STRUCTURE GEOTECHNICAL REPORT (IN HOUSE)

IL 161 OVER CROOKED CREEK

FAP ROUTE 805/ ILLINOIS ROUTE 161

CLINTON COUNTY

EXISTING SN: 014-0025

PROPOSED SN: 014-0080

SECTION 7BR

JOB NUMBER: D-98-024-05

Date: 04/12/2018

Submitted by:

BBS Foundations and Geotechnical Unit

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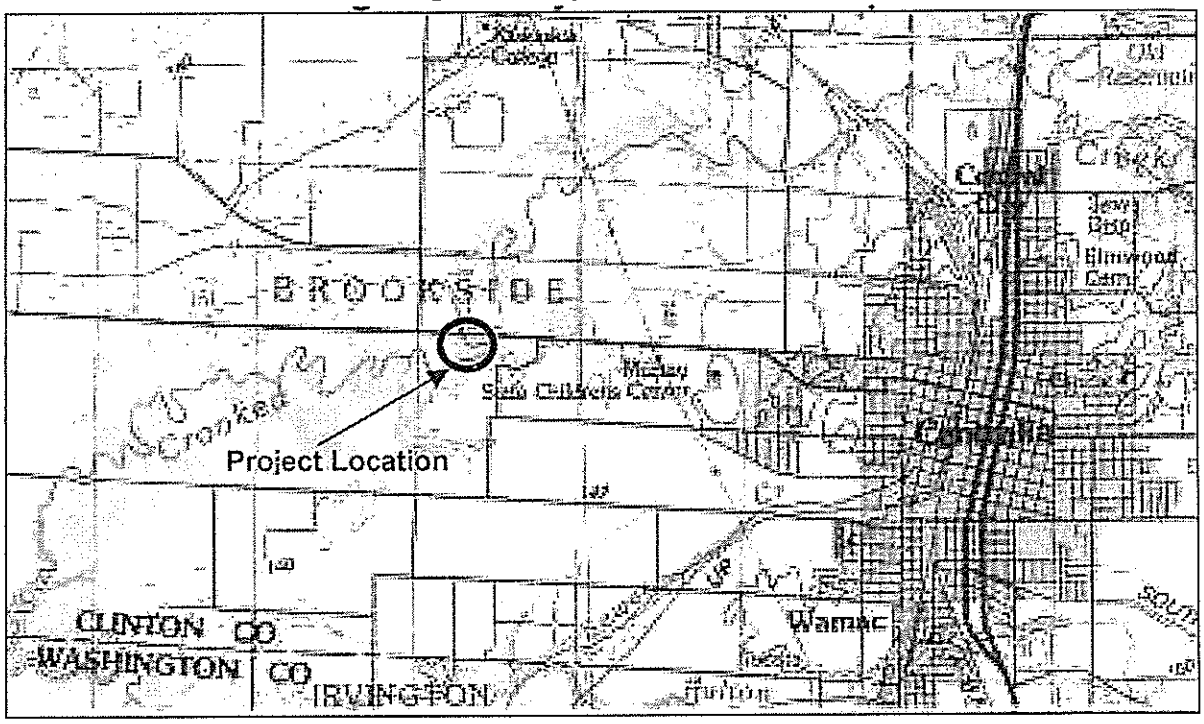
1 Project Description and Scope

This project consists of the complete replacement of existing structure 014-0025 with proposed structure 014-0080. The structure carries FAP 805 (IL 161) over Crooked Creek in Clinton County. Specifically, the structure is located in the Southwest quadrant of Section 10, Township 1 North, Range 1 West, 3rd Principal Meridian, 8.6 miles east of IL 127. See Figure 1 for Project Location Map. (Wiszkon, 2010)

Figure 1: Project Location Map



1.1 Existing and Proposed Structures

The existing structure consists of an 11-span cast-in-place concrete deck bridge on steel wide flange sections supported by open abutments on concrete piles and pile bent piers on concrete piles with a concrete cap. The existing structure is 644'-4" back-to-back abutments and 35'-8" out-to-out deck. It was originally constructed in 1937 as FA 150, Section 7BY, and was reconstructed and widened in 1963. The existing structure has been programmed for total replacement due to severe deteriorated conditions, the age of the structure, and hydraulic issues.

The proposed structure will consist of an 8-span, 2-Unit composite plate girder bridge with an overall planned length of 1073'-6" back-to-back. Unit 1 (620'-6½") will consist of a 70" web plate girder made up of 4 spans with lengths 130'-0", 164'-4", and 192'-0" (the main span over Crooked Creek), and 130'-2", encompassing the West Abutment and Piers 1, 2, 3, and 4. Unit 2 (452'-11½") will consist of a 48" web plate girder made up of 4 spans with lengths 119'-4", 126'-0", 126'-0", and 77'-7", encompassing and Piers 4, 5, 6, and 7 and the East Abutment. It is anticipated that the Abutments will be Open Abutments supported by drilled shafts socketed into

rock and that the Piers will also be supported by drilled shafts socketed into rock. The stationing for the substructure units are as follows:

- West Abutment Sta. 724+67.02
- Pier 1 Sta. 725+96.94
- Pier 2 Sta. 727+61.27
- Pier 3 Sta. 729+53.27
- Pier 4 Sta. 730+83.44
- Pier 5 Sta. 732+02.77
- Pier 6 Sta. 733+28.77
- Pier 7 Sta. 734+54.77
- East Abutment Sta. 735+40.52

2 Field Exploration

2.1 Area Geology

The proposed structure lies in the Springfield Plain physiographic province of Illinois and the Tills Plains Section of the Central Lowlands Province of the United States. The location consists of surficial materials from the Cahokia Formation. Bedrock is generally Clay Shale, Limestone, Sandstone, and Underclay of the Bond Formation, formed during the Pennsylvanian period. There is one coal layer in the Bond Formation. (Wiszkon, 2010)

Based on a review of the Clinton County Soil Survey, the primary soil type at the proposed structure is the Birds Silt Loam. This soil has a 0-2 percent slopes and is frequently flooded and poorly drained, and consists of alluvium formed on flood plains. (Wiszkon, 2010)

2.2 Subsurface Exploration

Five boring logs were conducted by District 8 in March and April 2010. The locations of the borings are as follows (Wiszkon, 2010):

- #1 – Station 727+00, Offset 15 feet Right
- #2 – Station 730+14, Offset 8.5 feet Left
- #3 – Station 731+28, Offset 8 feet Left
- #4 – Station 732+97, Offset 9 feet Left
- #5 – Station 735+94, Offset 15 feet Left; rock core w/ NO RQD & NO strengths

Since 2010, the proposed structure was lengthened for hydraulic concerns. As a result additional borings were gathered in May of 2017 and are as follows:

- SB A – Station 724+72, Offset 15 feet Right
- SB B – Station 725+63, Offset 15 feet Right; rock core w/ RQD, but NO strengths
- SB C – Station 726+37, Offset 15 feet Right
- SB D – Station 729+23, Offset 23 feet Left
- SB E – Station 731+00, Offset 23 feet Left; rock core w/ RQD, but NO strengths
- SB F – Station 732+00, Offset 23 feet Left
- SB G – Station 733+70, Offset 23 feet Left
- SB H – Station 734+43, Offset 10 feet Right
- SB I – Station 735+35, Offset 15 feet Right

During the early stages of writing the SGR the need for additional information regarding the strength of the shale was identified and the following additional borings and rock cores were taken in October of 2017 (note that the initial subsurface exploration did not provide adequate information about the shale bedrock and, if left as is, would have resulted in grossly overconservative foundation designs):

- P-2 – Station 724+49, Offset 15 feet Right; rock core with RQD and strengths
- P-3 – Station 729+43, Offset 10 feet Right. P-3 is an MSPT boring- no actual rock core was taken; the rock strengths were derived from the MSPT data
- P-6 – Station 733+18, Offset 10 feet Right; rock core with RQD and strengths

The following list shows the borings used in the analyses of each substructure:

- West Abutment – SB A, P-2
- Pier 1 – SB B, P-2
- Pier 2 – #1, SB C, P-3
- Pier 3 – P-3, SB D
- Pier 4 – #2, #3, P-3, SB E
- Pier 5 – Boring SB F, SB-E, P-6
- Pier 6 – P-6
- Pier 7 – SB H, P-6
- East Abutment – Boring SB I

2.3 Subsurface Conditions

2.3.1 Subsurface Profile

In general, the subsurface profile consists of an approximately 40' to 50' deep mixture of Loamy and Silty soils with layers of Sand and Clay mixed in, underlain by bedrock. Bedrock consists of shale with RQDs mostly above 70. In general, most of the profile has low blow counts and low Qu strengths. Due to the fluctuations of the elevations and general loam, silt, sand, and/or clay content of assorted layers, the Soil Profile is more accurately described by referring to Appendix B *Subsurface Data Profile* and Appendix C *Boring Logs* for further details.

2.3.2 Top of Bed Rock

See Table 2.3.2.1 on the following page for Estimated Top of Rock Elevations. These elevations represent the first encounter of rock (independent of quality and strength).

Table 2.3.2.1 Estimated Top of Rock Elevations	
Substructure	Estimated Top of Rock Elevation
W. Abut	400
Pier 1	406
Pier 2	403.2
Pier 3	406
Pier 4	408
Pier 5	408.5
Pier 6	415.5
Pier 7	423.7
E. Abut	414

2.3.3 Ground Water Elevation

The encountered range of Ground Water Elevations was 421.5 to 444.5, with an average of 433.0. It is more than likely that the Ground Water Elevation is closely related to the Water Surface Elevation of Crooked Creek. With this in mind, the water elevation used in the design of foundations and walls, either permanent or temporary, should be set to no lower than the Estimated Water Surface Elevation (E.W.S.E) of 440.4.

3 Geotechnical Evaluations

3.1 Settlement

Based off a Preliminary Plan and Profile dated 3/10/2017, it is estimated that the West Abutment will have approximately 6 feet of new fill placed at it and the East Abutment will have approximately 4.5 feet of new fill placed at it. As a result of the new fill and the soft clay in the soil profiles for both locations, the estimated settlement will be 2.2" at the West Abutment and 1.1" at the East Abutment. Settlements of this magnitude are high enough to induce downdrag forces on abutment piles. The downdrag can be mitigated in one of several different ways; see Section 4.3.1 *Driven H-Piles.* There will be no settlement at the Piers.

3.2 Slope Stability

Based on Slope Stability Analyses performed for this report using SLIDE software, we conclude that raising the grade will not cause a slope stability issue. All Factors of Safety are above the minimum required per Section 6.10.3 of the Geotechnical Manual. Results are in Table 3.2.1 below:

Table 3.2.1 Slope Stability Results			
Location	Case	Calculated Factor of Safety	Required Factor of Safety
West Abutment	Static (End of Construction)	2.0	1.7
West Abutment	Seismic	1.6	1.0
East Abutment	Static (End of Construction)	1.7	1.7
East Abutment	Seismic	1.3	1.0

3.3 Scour

Table 3.3.1 shows the raw unadjusted scour elevations based on the raw scour depths given in the Hydraulic Report. Table 3.3.2 contains the adjusted Scour Elevations. An analysis was completed for each Pier to adjust the scour elevation to account for the presence of cohesive soils in the borings. Note, however, that Piers 4-7 could not be adjusted due to the softness of the silty clays present. These adjusted scour elevations have in turn been incorporated into Table 3.3.3, the *Design Scour Elevation Table*.

Table 3.3.1 Raw Scour Elevations									
	W Abut	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7	E Abut
Q100	446.58	434.5	406.8	406.8	434.5	434.5	434.5	434.5	448.85
Q500	446.58	429.5	405.8	405.8	429.5	429.5	429.5	429.5	448.85

Table 3.3.2 Adjusted Scour Elevations									
	W Abut	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7	E Abut
Q100	446.58	436.50	409.20	416.90	434.50	434.50	434.50	434.50	448.85
Q500	446.58	432.00	408.20	416.10	429.50	429.50	429.50	429.50	448.85

	Table 3.3.3 Design Scour Elevation Table									
	W Abut	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7	E Abut	Item 113
Q100	446.58	436.50	409.20	416.90	434.50	434.50	434.50	434.50	448.85	
Q500	446.58	432.00	408.20	416.20	429.50	429.50	429.50	429.50	448.85	5
Design	446.58	436.50	409.20	416.90	434.50	434.50	434.50	434.50	448.85	
Check	446.58	432.00	408.20	416.20	429.50	429.50	429.50	429.50	448.85	

Scour will need to be accounted for in the design of driven H-pile foundations. See Section 4.3.1 *Driven H-Piles* for further details.

3.4 Seismic Considerations/Seismic Parameters and Site Class

Because the bridge is comprised of two Units, the procedures outlined in the *Foundations and Geotechnical Unit's* Design Guide for LFRD Seismic Site Class Definition were carried out each for Unit 1 and for Unit 2, rather than for the entire bridge. Based on the results, it has been determined that for both Unit 1 (West Abutment, Piers 1-4) and Unit 2 (Piers 4-7 and the East Abutment) the Site Class will be D (see Table 3.4.1). Based on the Site Class and the site's location, the Design Spectral Acceleration at 1.0 sec., SD1, is 0.271g and the Design Spectral Acceleration at 0.2 sec., SD_S, is 0.637g, for both Units. From Figure 2.3.10-4 in the Bridge Manual the Site Class places the bridge in Seismic Performance Zone (SPZ) 2. Seismic Data is summarized in Table 3.4.2. Due to the Soil Site Class and Seismic Performance Zone, a Liquefaction Analysis was completed as well. Please see the following section, Section 3.5 *Liquefaction.*

Table 3.4.1 Modified Site Class

Unit	Substructures in Unit	Site Class
1	W. Abut, Pier 1, Pier 2, Pier 3, and Pier 4	D
2	Pier 4, Pier 5, Pier 6, Pier 7, and E. Abut	D

Table 3.4.2. Seismic Data, Units 1 and 2
Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.271g
Design Spectral Acceleration at 0.2 sec. (SD_S) = 0.637g
Soil Site Class = D

3.5 Liquefaction

The Liquefaction Analysis shows a consistent layer of Loam, Silty Clay, and Soft Clay that has the potential to liquefy during a seismic event. The results of the analysis can be found in Table 3.5.1 below. The abutments do not show liquefaction potential due to the increase in confining pressure for the layer in question. However, the piers are in a cut and will have less confining pressure for this layer. Note that the Liquefaction Results for Pier 1 showed 2 separate layers of Liquefaction (from Elevations 430.00 to 427.50 and 421.00 to 416.00), the total height being .5'. For Lateral Analysis, these two separate layers will be considered as liquefied and the soils in-between as not liquefied.

Table 3.5.1 Liquefaction Results			
	Liquefaction Elevations		
Substructure	Top	Bottom	Total
W Abut	-	-	-
Pier 1	430.00	416.00	14.00
Pier 2	436.20	431.20	5.00
Pier 3	439.50	437.00	2.50
Pier 4	434.50	425.50	9.00
Pier 5	437.00	424.50	12.50
Pier 6	-	-	-
Pier 7	-	-	-
E Abut	-	-	-

3.6 Mining Activity

According to the Illinois Geological Survey's collection of County Coal Mine Maps and Directories, there has been no recorded mining activity in the effective area of the project (Wiszkon, 2010). However, mining activity is shown to be within 2 to 4 miles of the project location.

Boring SB E, located between Piers 4 and 5, indicates trace amount of coal in the shale bedrock. Boring SB F, located at Pier 5, indicated a seam of coal in the shale bedrock at approximately elevation 406.00. While it does not appear in the other borings, the possibility of pockets of coal deposits are possible at this site.

Due to the somewhat variable nature of coal strength we recommend that the tip elevation for Drilled Shafts or H-Piles Set in Rock at Pier 5 be lower than 405.00.

4 Foundation Recommendations

4.1 Foundation Feasibility

- Spread Footings. Spread footings are not recommended for this structure. Based on subsurface data provided in the borings, along with scour and liquefaction potential at this site, spread footings are not a feasible foundation treatment for any of the substructures.

- Metal Shell Piles. Metal shell piles are not recommended for any of the substructures because of the relatively short distance to rock and issues concerning scour and liquefaction.

- H-Piles: Driven to Rock. H-Piles driven to rock are feasible at both the East and West Abutments, and at Pier 1, Pier 4, and Pier 5. Due to scour issues they are *not* feasible at

Piers 2, 3, and 7. H-piles driven to rock at Pier 6 are questionable; due to a limited embedment in soft soil remaining after a scour event, coupled with the pier's bearing being fixed and large lateral loads, there is a concern that there may not be enough lateral stability, whereby the piles could be overstressed in flexure. Our preliminary analyses indicated that battering multiple rows of H-Piles may help withstand the preliminary estimated lateral loadings, however the batter will likely cause concerns for the seismic loading in the Extreme Event. If a battered driven pile foundation at Pier 6 cannot be successfully designed for, then H-piles set in rock or drilled shafts need to be considered.

- H-Piles: Set in Rock. H-Piles Set in Rock are feasible at Piers 6 and 7. For Pier 6, setting the piles in rock would be required based on the high lateral loads attributed to the Pier being fixed. At Pier 7, they would be needed due to the depth of scour. Rock socketed piles do *not* appear to be an appropriate choice at Piers 2 and 3 based, due to large unbraced lengths resulting from deep scour in conjunction with both piers having fixed bearings and undergoing high lateral loads. In this case drilled shafts would appear most appropriate.

- Drilled Shafts. Drilled Shafts are feasible at both abutments and at each pier. Although they are feasible everywhere, the locations where they will surely be needed are at Piers 2 and 3. They should also be used at Piers 6 and 7, if Piles Set in Rock are not chosen or if battered piles cannot be used at Pier 6. See Section 4.4 *Drilled Shafts*.

4.2 Preliminary Loads

Table 4.2.1 consists of Preliminary Factored Axial Loads for Strength 1 loading, as furnished to us by our Bridge Planning Unit.

Table 4.2.1 Preliminary Factored Axial Loads

Location	Preliminary Factored Axial Load to Substructure (k)
W. Abut	1889
Pier 1	5253
Pier 2	5793
Pier 3	5739
Pier 4	4259
Pier 5	4757
Pier 6	4437
Pier 7	4245
E. Abut	1397

Table 4.2.2 contains the Preliminary Estimated Seismic forces acting in the Longitudinal and Transverse Direction (of *structure*), also given to us by Bridge Planning. Note that the loads in Tables 4.2.1 and 4.2.2 both tables are only preliminary and are used only to aid the SGR author (not the Designer) in establishing foundation feasibility and in the development of foundation

treatment for the TSL and SGR; they are not to be representative of those to be determined by the Structural Designer in the Design Phase.

Table 4.2.2 Preliminary Estimated Lateral Seismic Loads		
	Preliminary Estimated Lateral Seismic Loads (k)	
Location	Transverse	Longitudinal
W Abut	846	0
Pier 1	615	0
Pier 2	615	1546
Pier 3	507	1546
Peir 4	615	0
Pier 5	332	0
Pier 6	568	2021
Pier 7	332	0
E Abut	457	0

4.3 H-Piles

Sections 4.3.1 and 4.3.2 below discuss Driven H-Piles and H-Piles Set in Rock, respectively. All pile supported footings should have two (2) feet of embedment up into the footing in order to create a fixed-head condition. This will help with respect to bending and deflection in the pile.

4.3.1 Driven H-Piles

Table 4.3.1.1 shows the axial resistances (corresponding to maximum nominal required bearing values for selected pile sizes) and the estimated lengths for both the Strength Limit Case and the Extreme Event Case at various locations where driven H-piles appear feasible. Note that the entries for both abutments for the Strength Case take into account the downdrag due to settlement under new embankment fill. As indicated above in Section 3.1 *Settlement*, the downdrag resulting from settlement of the new fill can be mitigated in several different ways:

- Accounting for it in the pile design, as represented in Table 4.3.1.1.
- Precoring the piles through the new embankment and below it so that the downdrag on the piles is fully mitigated. For the West Abutment a Precore Elevation of 423.5 (23 ft precore depth) would be required; for the East Abutment a Precore Elevation of 432.5 (16.5 ft precore). Tables 4.3.1.2 and 4.3.1.3 show the nominal bearings, factored resistances, and estimated lengths for this option for the Strength Case. This would allow for the full resistance of the pile to be used, but would be an added cost for the precore along with the inconvenience of precoring on a batter.
- Allow a waiting time for all but 0.4" or less of settlement to occur prior to driving the piles. However, no consolidation tests were ran at the abutments; without consolidation tests ran on undisturbed samples the expected waiting period cannot be accurately defined. This option is therefore not recommended.

For the Strength Case Table 4.3.1.1 not only includes downdraq allowance for the abutments, but also scour losses for the piers. For the Extreme Event Case the table includes losses due to liquefaction.

Table 4.3.1.1 Driven Piles

			Strength			Extreme Event			
Loaction	Pile Size	Nominal Bearing (kips)	Scour Loss (kips)	Downdrag Loss & Load (kips)	Factored Resistance (kips)	Liquefaction and DD Loss (kips)	DD Load (kips)	Seismic Resistance (kips)	Both Pile Length (feet)
W Abut. Cutoff EL=448.58 Load=1889	10x42	335	0	46	138	0	0	335	53
	12x53	418	0	56	174	0	0	418	53
	12x63	497	0	56	217	0	0	497	54
	14x73	578	0	66	252	0	0	578	54
	14x89	705	0	66	322	0	0	705	56
	14x117	929	0	68	443	0	0	929	59
Pier 1 Cutoff EL.=441.50 Load=5253k	10x42	335	3	0	181	23	14	298	45
	12x53	418	4	0	226	28	17	373	45
	12x63	497	4	0	270	28	17	452	47
	14x73	578	4	0	313	33	20	525	46
	14x89	705	4	0	383	33	20	652	48
	14x117	929	4	0	510	34	21	874	51
Pier 4 Cutoff EL.=441.50 Load=4259k	10x42	335	1	0	183	7	3	325	40
	12x53	418	2	0	228	8	4	406	40
	12x63	497	2	0	271	8	4	485	41
	14x73	578	2	0	316	10	4	564	41
	14x89	705	2	0	385	10	4	691	43
	14x117	929	2	0	509	10	4	915	46
Pier 5 Cutoff EL.=441.50 Load=4757	10x42	335	1	0	183	12	0	323	38
	12x53	418	1	0	229	15	0	403	38
	12x63	497	1	0	272	15	0	482	40
	14x73	578	2	0	316	17	0	561	39
	14x89	705	2	0	386	17	0	688	41
	14x117	929	2	0	509	18	0	911	45
Pier 6 Cuttoff EL.=441.50 Load=4437	10x42	335	2	0	182	0	0	335	33
	12x53	418	3	0	227	0	0	418	33
	12x63	497	3	0	270	0	0	497	34
	14x73	578	4	0	314	0	0	578	34
	14x89	705	4	0	384	0	0	705	36
	14x117	929	4	0	507	0	0	929	39
E. Abut Cutoff EL. 450.85 Load=1397	10x42	335	0	27	157	0	0	335	40
	12x53	418	0	33	197	0	0	418	40
	12x63	497	0	33	240	0	0	497	42
	14x73	578	0	39	279	0	0	578	41
	14x89	705	0	39	349	0	0	705	44
	14x117	929	0	40	471	0	0	929	47

Table 4.3.1.2 West Abutment Precore			
Pile Cut Off=448.58		Precore Elevation= 423.5	
Pile Size	Nominal Bearing (kips)	Factored Resistance (kips)	Estimated Length (feet)
10X42	335	184	53
12X53	419	230	53
12X63	497	273	55
14x73	578	318	54
14X89	705	388	56
14X117	929	511	60

Table 4.3.1.3 East Abutment Precore			
Pile Cut Off=450.85		Precore Elevation= 432.50	
Pile Size	Nominal Bearing (kips)	Factored Resistance (kips)	Estimated Length (feet)
10X42	335	184	42
12X53	419	230	42
12X63	497	273	44
14x73	578	318	43
14X89	705	388	45
14X117	929	511	49

4.3.1.1 Test Piles

We recommend one test pile at each substructure that calls for driven H-Piles. Due to the piles being driven into shale, pile shoes will not be required.

4.3.2 H-Piles Set in Rock

Preliminary Analysis of Pier 6 shows that if battered H-Piles are used then it could be a driven H-Pile Foundation. However, due to this being a seismically active area, it is unlikely that battered H-Piles will be used at this substructure. With that in mind, a foundation composed of H-Piles Set in Rock is feasible at this location. Pier 7 requires a foundation set in rock due to the fact the top of rock elevation is high at this substructure, meaning fixity will not be developed in the soils above the rock.

Table 4.3.2.1 Shows the Unit Resistances of Piles set in Rock. Table 4.3.2.2 shows the resistance factors used for design of the rock sockets. Please note that performing load tests would allow for a resistance factor of 0.7. Table 4.3.2.3 and 4.3.2.4 show the factored resistances for the strength limit cases for Piers 6 and 7. Tables 4.3.2.5 and 4.3.2.6 show the factored resistances for the extreme event (seismic). Capacity of the H-Piles set in rock should not account for the soil above the rock.

Table 4.3.2.1 Unit Resistance of Piles set in Rock

Pier 6			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
415.5	406	15	5.18	75
406	375	80	11.97	277.4
Pier 7			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
423.7	413.7	15	5.18	75
413.7	406	30	7.33	150
406	375	75	11.59	268.6

Table 4.3.2.2 Resistance Factors

Side Resistance in Rock	0.5
Tip Resistance in Rock	0.5

Table 4.3.2.3 Pier 6 Strength Limit

Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
		Side	Tip	Side	Tip	Total
410.5	5	162.65	235.50	81.33	117.75	199
405.5	10	346.62	871.04	173.31	435.52	609
400.5	15	722.48	871.04	361.24	435.52	797
395.5	20	1098.34	871.04	549.17	435.52	985
390.5	25	1474.20	871.04	737.10	435.52	1173
385.5	30	1850.06	871.04	925.03	435.52	1361
380.5	35	2225.91	871.04	1112.96	435.52	1548
375.5	40	2601.77	871.04	1300.89	435.52	1736

Table 4.3.2.4 Pier 7 Strength Limit						
Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
		Side	Tip	Side	Tip	Total
418.7	5	162.65	235.50	81.33	117.75	199
413.7	10	325.30	471.00	162.65	235.50	398
408.7	15	555.47	592.05	277.73	296.02	574
403.7	20	847.16	843.40	423.58	421.70	845
398.7	25	1211.09	843.40	605.54	421.70	1027
393.7	30	1575.01	843.40	787.51	421.70	1209
388.7	35	1938.94	843.40	969.47	421.70	1391
383.7	40	2302.86	843.40	1151.43	421.70	1573

Table 4.3.2.5 Pier 6 Extreme Event					
Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
		Side	Tip		
410.5	5	162.65	235.50	0	398
405.5	10	346.62	871.04	0	1218
400.5	15	722.48	871.04	0	1594
395.5	20	1098.34	871.04	0	1969
390.5	25	1474.20	871.04	0	2345
385.5	30	1850.06	871.04	0	2721
380.5	35	2225.91	871.04	0	3097
375.5	40	2601.77	871.04	0	3473

Table 4.3.2.6 Pier 7 Extreme Event					
Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
		Side	Tip		
418.7	5	162.65	235.50	0	398
413.7	10	325.30	471.00	0	796
408.7	15	555.47	592.05	0	1148
403.7	20	847.16	843.40	0	1691
398.7	25	1211.09	843.40	0	2054
393.7	30	1575.01	843.40	0	2418
388.7	35	1938.94	843.40	0	2782
383.7	40	2302.86	843.40	0	3146

4.3.3 Lateral Analyses of Piles

Lateral analyses of piles will be performed in Final Design.

4.4 Drilled Shafts

Based on the deep scour elevation and the high expected lateral loads, Piers 2 and 3 are recommended to be on drilled shaft foundations. Piers 6 and 7 should also use drilled shafts if rock sockets are not chosen for either and if driven piles cannot be used at Pier 6. Piers 1,4, and 5 can be founded on drilled shafts if driven piles are not chosen.

Tables 4.4.3 through 4.4.11 show the nominal and factored drilled shaft axial resistances for the East and West Abutments and for Piers 1 through 7 for the Strength Case. For the tables rock socket diameters are assumed 36", 42", and 48". These values were picked as we believe these are the most likely diameters to be used. The rock socket depth is referenced to the estimated top of rock elevation at the element in question. Note that for the Abutments, Tables 4.4.3 and 4.4.4 include an allowance for downdrag due to settlement. Table 4.4.1 can be used to acquire nominal side and tip resistances for shafts with differing diameters. The resistance factors in Table 4.4.2 can then be used to acquire factored resistances. Tables 4.4.12 through 4.4.20 show the axial resistances for the Extreme Event (Seismic). The downdrag for the Strength Limit State was applied to both Abutments and is incorporated into the Factored Resistance. Please note that downdrag due to liquefaction was applied at Piers 1, 2, 4, and 5. Pier 3 had liquefaction, but it was at the at the bottom of the footing; the layers above will not induce down drag on the shafts themselves. Note that the resistance factor for the extreme event is 1.0 instead of 0.5, meaning the Nominal Values shown in the table will be the same as the Factored Values.

Table 4.4.1 Nominal Unit Resistances of Rock Socketed Drilled Shafts				
West Abutment			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
400	395	3	2.32	15
395	375	75	11.59	268.6
375	360	45	8.98	208.1
East Abutment			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
414	406	30	7.33	150
406	375	75	11.59	268.6
Pier 1			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
406	402	3	2.32	15
402	375	75	11.59	268.6
Pier 2			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
403.2	402	3	2.32	15
402	396	30	7.33	150
396	375	60	10.37	240.4
Pier 3			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
406	396	30	7.33	150
396	375	60	10.37	240.4
Pier 4			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
408	406	3	2.32	15
406	400	30	7.33	150
400	383	50	9.46	219.3
383	375	75	11.59	268.6
Pier 5			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
408.5	403.5	3	2.32	15
403.5	400	30	7.33	150
400	383	50	9.46	219.3
383	375	75	11.59	268.6
Pier 6			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
415.5	406	15	5.18	75
406	375	80	11.97	277.4
Pier 7			Side	Tip
Top	Bottom	qu (tsf)	qs (ksf)	qt (ksf)
423.7	413.7	15	5.18	75
413.7	406	30	7.33	150
406	375	75	11.59	268.6

Table 4.4.2 Resistance Factors	
Side Resistance in Rock	0.5
Tip Resistance in Rock	0.5

Table 4.4.3 West Abutment Axial Capacities Strength Limit								
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance			
			Side	Tip	Side	Tip	Downdrag	Total
3	395	5	109.27	1899.00	54.64	949.50	72.54	932
	390	10	655.16	1899.00	327.58	949.50	72.54	1205
	385	15	1201.05	1899.00	600.53	949.50	72.54	1477
	380	20	1746.94	1827.60	873.47	913.80	72.54	1715
	375	25	2292.83	1471.27	1146.41	735.63	72.54	1810
3.5	395	5	127.48	2583.93	63.74	1291.97	84.63	1271
	390	10	764.35	2583.93	382.18	1291.97	84.63	1590
	385	15	1401.23	2583.93	700.61	1291.97	84.63	1908
	380	20	2038.10	2417.51	1019.05	1208.75	84.63	2143
	375	25	2674.97	2001.92	1337.48	1000.96	84.63	2254
4	395	5	145.70	3373.62	72.85	1686.81	96.72	1663
	390	10	873.55	3373.62	436.77	1686.81	96.72	2027
	385	15	1601.40	3373.62	800.70	1686.81	96.72	2391
	380	20	2329.25	3088.50	1164.63	1544.25	96.72	2612
	375	25	3057.10	2613.74	1528.55	1306.87	96.72	2739

Table 4.4.4 East Abutment Axial Capacities Strength Limit								
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance			
			Side	Tip	Side	Tip	Downdrag	Total
3	409	5	345.24	1479.75	172.62	739.88	94.68	818
	404	10	770.74	1899.00	385.37	949.50	94.68	1240
	399	15	1316.63	1899.00	658.32	949.50	94.68	1513
	394	20	1862.52	1899.00	931.26	949.50	94.68	1786
	389	25	2408.41	1899.00	1204.21	949.50	94.68	2059
3.5	409	5	402.78	2095.24	201.39	1047.62	110.46	1139
	404	10	899.20	2583.93	449.60	1291.97	110.46	1631
	399	15	1536.07	2583.93	768.04	1291.97	110.46	1950
	394	20	2172.94	2583.93	1086.47	1291.97	110.46	2268
	389	25	2809.81	2583.93	1404.91	1291.97	110.46	2586
4	409	5	460.32	2814.70	230.16	1407.35	126.24	1511
	404	10	1027.66	3373.62	513.83	1686.81	126.24	2074
	399	15	1755.51	3373.62	877.76	1686.81	126.24	2438
	394	20	2483.36	3373.62	1241.68	1686.81	126.24	2802
	389	25	3211.22	3373.62	1605.61	1686.81	126.24	3166

Table 4.4.5 Pier 1 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	401	5	196.60	1897.66	98.30	948.83	1047
	396	10	742.49	1897.66	371.25	948.83	1320
	391	15	1288.38	1897.66	644.19	948.83	1593
	386	20	1834.27	1897.66	917.14	948.83	1866
	381	25	2380.16	1897.66	1190.08	948.83	2139
	376	30	2926.05	1897.66	1463.03	948.83	2412
3.5	401	5	229.36	2583.93	114.68	1291.97	1407
	396	10	866.23	2583.93	433.12	1291.97	1725
	391	15	1503.10	2583.93	751.55	1291.97	2044
	386	20	2139.97	2583.93	1069.99	1291.97	2362
	381	25	2776.84	2583.93	1388.42	1291.97	2680
	376	30	3413.71	2583.93	1706.86	1291.97	2999
4	401	5	262.13	3373.61	131.07	1686.81	1818
	396	10	989.98	3373.61	494.99	1686.81	2182
	391	15	1717.83	3373.61	858.92	1686.81	2546
	386	20	2445.68	3373.61	1222.84	1686.81	2910
	381	25	3173.53	3373.61	1586.77	1686.81	3274
	376	30	3901.38	3373.61	1950.69	1686.81	3637

Table 4.4.6 Pier 2 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	398.2	5	288.61	1465.26	144.30	732.63	877
	393.2	10	714.04	1699.63	357.02	849.81	1207
	388.2	15	1202.46	1699.63	601.23	849.81	1451
	383.2	20	1690.89	1699.63	845.45	849.81	1695
	378.2	25	2179.32	1699.63	1089.66	849.81	1939
	373.2	30	2667.74	1699.63	1333.87	849.81	2184
3.5	398.2	5	336.71	2039.34	168.36	1019.67	1188
	393.2	10	833.04	2312.65	416.52	1156.32	1573
	388.2	15	1402.87	2312.65	701.44	1156.32	1858
	383.2	20	1972.71	2312.65	986.35	1156.32	2143
	378.2	25	2542.54	2312.65	1271.27	1156.32	2428
	373.2	30	3112.37	2312.65	1556.18	1156.32	2713
4	398.2	5	384.81	2707.18	192.41	1353.59	1546
	393.2	10	952.05	3019.42	476.02	1509.71	1986
	388.2	15	1603.28	3019.42	801.64	1509.71	2311
	383.2	20	2254.52	3019.42	1127.26	1509.71	2637
	378.2	25	2905.76	3019.42	1452.88	1509.71	2963
	373.2	30	3556.99	3019.42	1778.50	1509.71	3288

Table 4.4.7 Pier 3 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	401	5	345.24	1167.04	172.62	583.52	756
	396	10	690.49	1699.63	345.24	849.81	1195
	391	15	1178.91	1699.63	589.46	849.81	1439
	386	20	1667.34	1699.63	833.67	849.81	1683
	381	25	2155.77	1699.63	1077.88	849.81	1928
	376	30	2644.19	1699.63	1322.10	849.81	2172
3.5	401	5	402.78	1691.48	201.39	845.74	1047
	396	10	805.57	2312.65	402.78	1156.32	1559
	391	15	1375.40	2312.65	687.70	1156.32	1844
	386	20	1945.23	2312.65	972.62	1156.32	2129
	381	25	2515.06	2312.65	1257.53	1156.32	2414
	376	30	3084.89	2312.65	1542.45	1156.32	2699
4	401	5	460.32	2309.78	230.16	1154.89	1385
	396	10	920.65	3019.42	460.32	1509.71	1970
	391	15	1571.88	3019.42	785.94	1509.71	2296
	386	20	2223.12	3019.42	1111.56	1509.71	2621
	381	25	2874.36	3019.42	1437.18	1509.71	2947
	376	30	3525.59	3019.42	1762.80	1509.71	3273

Table 4.4.8 Pier 4 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	403	5	250.85	1305.48	125.43	652.74	778
	398	10	636.23	1550.45	318.11	775.23	1093
	393	15	1081.79	1550.45	540.90	775.23	1316
	388	20	1527.36	1608.64	763.68	804.32	1568
	383	25	1972.92	1899.00	986.46	949.50	1936
	378	30	2518.81	1899.00	1259.41	949.50	2209
3.5	403	5	292.66	1823.95	146.33	911.98	1058
	398	10	742.26	2109.67	371.13	1054.83	1426
	393	15	1262.09	2109.67	631.05	1054.83	1686
	388	20	1781.92	2245.21	890.96	1122.61	2014
	383	25	2301.75	2583.93	1150.87	1291.97	2443
	378	30	2938.62	2583.93	1469.31	1291.97	2761
4	403	5	334.47	2427.97	167.24	1213.99	1381
	398	10	848.30	2754.41	424.15	1377.20	1801
	393	15	1442.39	2754.41	721.20	1377.20	2098
	388	20	2036.48	2987.14	1018.24	1493.57	2512
	383	25	2630.57	3373.62	1315.28	1686.81	3002
	378	30	3358.42	3373.62	1679.21	1686.81	3366

Table 4.4.9 Pier 5 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	403.5	5	109.27	1264.68	54.64	632.34	687
	398.5	10	484.61	1550.45	242.31	775.23	1018
	393.5	15	930.18	1550.45	465.09	775.23	1240
	388.5	20	1375.74	1579.51	687.87	789.75	1478
	383.5	25	1821.31	1869.94	910.65	934.97	1846
	378.5	30	2357.17	1899.00	1178.58	949.50	2128
3.5	403.5	5	127.48	1776.33	63.74	888.17	952
	398.5	10	565.38	2109.67	282.69	1054.83	1338
	393.5	15	1085.21	2109.67	542.60	1054.83	1597
	388.5	20	1605.03	2211.25	802.52	1105.63	1908
	383.5	25	2124.86	2550.07	1062.43	1275.03	2337
	378.5	30	2750.03	2583.93	1375.01	1291.97	2667
4	403.5	5	145.70	2373.59	72.85	1186.79	1260
	398.5	10	646.15	2754.41	323.07	1377.20	1700
	393.5	15	1240.24	2754.41	620.12	1377.20	1997
	388.5	20	1834.33	2947.96	917.16	1473.98	2391
	383.5	25	2428.41	3334.93	1214.21	1667.47	2882
	378.5	30	3142.89	3373.62	1571.44	1686.81	3258

Table 4.4.10 Pier 6 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	410.5	5	243.98	887.99	121.99	444.00	566
	405.5	10	519.94	1961.22	259.97	980.61	1241
	400.5	15	1083.72	1961.22	541.86	980.61	1522
	395.5	20	1647.51	1961.22	823.76	980.61	1804
	390.5	25	2211.30	1961.22	1105.65	980.61	2086
	385.5	30	2775.08	1961.22	1387.54	980.61	2368
3.5	410.5	5	284.64	1416.93	142.32	708.46	851
	405.5	10	606.59	2668.59	303.30	1334.29	1638
	400.5	15	1264.34	2668.59	632.17	1334.29	1966
	395.5	20	1922.10	2668.59	961.05	1334.29	2295
	390.5	25	2579.85	2668.59	1289.92	1334.29	2624
	385.5	30	3237.60	2668.59	1618.80	1334.29	2953
4	410.5	5	325.30	2054.19	162.65	1027.09	1190
	405.5	10	693.25	3484.14	346.62	1742.07	2089
	400.5	15	1444.97	3484.14	722.48	1742.07	2465
	395.5	20	2196.68	3484.14	1098.34	1742.07	2840
	390.5	25	2948.40	3484.14	1474.20	1742.07	3216
	385.5	30	3700.11	3484.14	1850.06	1742.07	3592

Table 4.4.11 Pier 7 Axial Capacities Strength Limit							
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Factored Resistance		
			Side	Tip	Side	Tip	Total
3	418.7	5	243.98	618.63	121.99	309.31	431
	413.7	10	487.96	1060.50	243.98	530.25	774
	408.7	15	833.20	1522.10	416.60	761.05	1178
	403.7	20	1270.74	1899.00	635.37	949.50	1585
	398.7	25	1816.63	1899.00	908.31	949.50	1858
	393.7	30	2362.52	1899.00	1181.26	949.50	2131
3.5	418.7	5	284.64	927.66	142.32	463.83	606
	413.7	10	569.28	1443.00	284.64	721.50	1006
	408.7	15	972.07	2143.82	486.03	1071.91	1558
	403.7	20	1482.53	2583.93	741.26	1291.97	2033
	398.7	25	2119.40	2583.93	1059.70	1291.97	2352
	393.7	30	2756.27	2583.93	1378.14	1291.97	2670
4	418.7	5	325.30	1295.31	162.65	647.66	810
	413.7	10	650.61	1940.27	325.30	970.13	1295
	408.7	15	1110.93	2870.84	555.47	1435.42	1991
	403.7	20	1694.32	3373.62	847.16	1686.81	2534
	398.7	25	2422.17	3373.62	1211.09	1686.81	2898
	393.7	30	3150.02	3373.62	1575.01	1686.81	3262

Table 4.4.12 West Abutment Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	395	5	109.27	1899.00	0	2008
	390	10	655.16	1899.00	0	2554
	385	15	1201.05	1899.00	0	3100
	380	20	1746.94	1827.60	0	3575
	375	25	2292.83	1471.27	0	3764
3.5	395	5	127.48	2583.93	0	2711
	390	10	764.35	2583.93	0	3348
	385	15	1401.23	2583.93	0	3985
	380	20	2038.10	2417.51	0	4456
	375	25	2674.97	2001.92	0	4677
4	395	5	145.70	3373.62	0	3519
	390	10	873.55	3373.62	0	4247
	385	15	1601.40	3373.62	0	4975
	380	20	2329.25	3088.50	0	5418
	375	25	3057.10	2613.74	0	5671

Table 4.4.13 East Abutment Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	409	5	345.24	1479.75	0	1825
	404	10	770.74	1899.00	0	2670
	399	15	1316.63	1899.00	0	3216
	394	20	1862.52	1899.00	0	3762
	389	25	2408.41	1899.00	0	4307
3.5	409	5	402.78	2095.24	0	2498
	404	10	899.20	2583.93	0	3483
	399	15	1536.07	2583.93	0	4120
	394	20	2172.94	2583.93	0	4757
	389	25	2809.81	2583.93	0	5394
4	409	5	460.32	2814.70	0	3275
	404	10	1027.66	3373.62	0	4401
	399	15	1755.51	3386.18	0	5142
	394	20	2483.36	3398.74	0	5882
	389	25	3211.22	3411.30	0	6623

Table 4.4.14 Pier 1 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	401	5	196.60	1897.66	58	2036
	396	10	742.49	1897.66	58	2582
	391	15	1288.38	1897.66	58	3128
	386	20	1834.27	1897.66	58	3674
	381	25	2380.16	1897.66	58	4220
	376	30	2926.05	1897.66	58	4766
3.5	401	5	229.36	2583.93	67	2746
	396	10	866.23	2583.93	67	3383
	391	15	1503.10	2583.93	67	4020
	386	20	2139.97	2583.93	67	4657
	381	25	2776.84	2583.93	67	5294
	376	30	3413.71	2583.93	67	5931
4	401	5	262.13	3373.61	75	3561
	396	10	989.98	3373.61	75	4289
	391	15	1717.83	3373.61	75	5016
	386	20	2445.68	3373.61	75	5744
	381	25	3173.53	3373.61	75	6472
	376	30	3901.38	3373.61	75	7200

Table 4.4.15 Pier 2 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	398.2	5	288.61	1465.26	10	1744
	393.2	10	714.04	1699.63	10	2404
	388.2	15	1202.46	1699.63	10	2892
	383.2	20	1690.89	1699.63	10	3381
	378.2	25	2179.32	1699.63	10	3869
	373.2	30	2667.74	1699.63	10	4357
3.5	398.2	5	336.71	2039.34	11	2365
	393.2	10	833.04	2312.65	11	3135
	388.2	15	1402.87	2312.65	11	3705
	383.2	20	1972.71	2312.65	11	4274
	378.2	25	2542.54	2312.65	11	4844
	373.2	30	3112.37	2312.65	11	5414
4	398.2	5	384.81	2707.18	12	3080
	393.2	10	952.05	3019.42	12	3959
	388.2	15	1603.28	3019.42	12	4611
	383.2	20	2254.52	3019.42	12	5262
	378.2	25	2905.76	3019.42	12	5913
	373.2	30	3556.99	3019.42	12	6564

Table 4.4.16 Pier 3 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	401	5	345.24	1167.04	0	1512
	396	10	690.49	1699.63	0	2390
	391	15	1178.91	1699.63	0	2879
	386	20	1667.34	1699.63	0	3367
	381	25	2155.77	1699.63	0	3855
	376	30	2644.19	1699.63	0	4344
3.5	401	5	402.78	1691.48	0	2094
	396	10	805.57	2312.65	0	3118
	391	15	1375.40	2312.65	0	3688
	386	20	1945.23	2312.65	0	4258
	381	25	2515.06	2312.65	0	4828
	376	30	3084.89	2312.65	0	5398
4	401	5	460.32	2309.78	0	2770
	396	10	920.65	3019.42	0	3940
	391	15	1571.88	3019.42	0	4591
	386	20	2223.12	3019.42	0	5243
	381	25	2874.36	3019.42	0	5894
	376	30	3525.59	3019.42	0	6545

Table 4.4.17 Pier 4 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	403	5	250.85	1305.48	14	1542
	398	10	636.23	1550.45	14	2173
	393	15	1081.79	1550.45	14	2618
	388	20	1527.36	1608.64	14	3122
	383	25	1972.92	1899.00	14	3858
	378	30	2518.81	1899.00	14	4404
3.5	403	5	292.66	1823.95	16	2101
	398	10	742.26	2109.67	16	2836
	393	15	1262.09	2109.67	16	3356
	388	20	1781.92	2245.21	16	4011
	383	25	2301.75	2583.93	16	4870
	378	30	2938.62	2583.93	16	5507
4	403	5	334.47	2427.97	17	2745
	398	10	848.30	2754.41	17	3586
	393	15	1442.39	2754.41	17	4180
	388	20	2036.48	2987.14	17	5007
	383	25	2630.57	3373.62	17	5987
	378	30	3358.42	3373.62	17	6715

Table 4.4.18 Pier 5 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	403.5	5	109.27	1264.68	1	1373
	398.5	10	484.61	1550.45	1	2034
	393.5	15	930.18	1550.45	1	2480
	388.5	20	1375.74	1579.51	1	2954
	383.5	25	1821.31	1869.94	1	3690
	378.5	30	2357.17	1899.00	1	4255
3.5	403.5	5	127.48	1776.33	1	1903
	398.5	10	565.38	2109.67	1	2674
	393.5	15	1085.21	2109.67	1	3194
	388.5	20	1605.03	2211.25	1	3815
	383.5	25	2124.86	2550.07	1	4674
	378.5	30	2750.03	2583.93	1	5333
4	403.5	5	145.70	2373.59	1	2518
	398.5	10	646.15	2754.41	1	3400
	393.5	15	1240.24	2754.41	1	3994
	388.5	20	1834.33	2947.96	1	4781
	383.5	25	2428.41	3334.93	1	5762
	378.5	30	3142.89	3373.62	1	6516

Table 4.4.19 Pier 6 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	410.5	5	243.98	887.99	0	1132
	405.5	10	519.94	1961.22	0	2481
	400.5	15	1083.72	1961.22	0	3045
	395.5	20	1647.51	1961.22	0	3609
	390.5	25	2211.30	1961.22	0	4173
	385.5	30	2775.08	1961.22	0	4736
3.5	410.5	5	284.64	1416.93	0	1702
	405.5	10	606.59	2668.59	0	3275
	400.5	15	1264.34	2668.59	0	3933
	395.5	20	1922.10	2668.59	0	4591
	390.5	25	2579.85	2668.59	0	5248
	385.5	30	3237.60	2668.59	0	5906
4	410.5	5	325.30	2054.19	0	2379
	405.5	10	693.25	3484.14	0	4177
	400.5	15	1444.97	3484.14	0	4929
	395.5	20	2196.68	3484.14	0	5681
	390.5	25	2948.40	3484.14	0	6433
	385.5	30	3700.11	3484.14	0	7184

Table 4.4.20 Pier 7 Axial Capacities Extreme Event						
Diameter of Socket	Bottom Elevation	Socket Depth	Nominal Resistance		Down Drag Load	Seismic Resistance
			Side	Tip		
3	418.7	5	243.98	618.63	0	863
	413.7	10	487.96	1060.50	0	1548
	408.7	15	833.20	1522.10	0	2355
	403.7	20	1270.74	1899.00	0	3170
	398.7	25	1816.63	1899.00	0	3716
	393.7	30	2362.52	1899.00	0	4262
3.5	418.7	5	284.64	927.66	0	1212
	413.7	10	569.28	1443.00	0	2012
	408.7	15	972.07	2143.82	0	3116
	403.7	20	1482.53	2583.93	0	4066
	398.7	25	2119.40	2583.93	0	4703
	393.7	30	2756.27	2583.93	0	5340
4	418.7	5	325.30	1295.31	0	1621
	413.7	10	650.61	1940.27	0	2591
	408.7	15	1110.93	2870.84	0	3982
	403.7	20	1694.32	3373.62	0	5068
	398.7	25	2422.17	3373.62	0	5796
	393.7	30	3150.02	3373.62	0	6524

4.4.1 Lateral Analyses of Shafts

Lateral analyses of drilled shafts will be performed in Final Design. Please contact the SGR author.

5 Construction Considerations

5.1 Temporary Soil Retention

Construction of the new bridge will involve complete closure of the existing structure and detouring of IL 161. Temporary soil retention will not be required.

5.2 EWSE and Cofferdams

The EWSE for the site is 440.4; the proposed footing elevation of Piers 1 through 7 is 439.5. In addition to the difference between the EWSE and bottom of the footing being only less than 1.0 feet (0.9'), the existing ground at each substructure is well above the EWSE. The footings could all be excavated with enough earth left around them that would make cofferdams unnecessary. Even the proposed ground at each footing is 3 feet above the EWSE. Cofferdams will not be needed. If water is present in any of the excavations, it could be easily pumped out. If working conditions were to become sloppy and wet, a "mud slab" can be placed to provide a stable and dry working platform to construct the footing on.

5.3 Drilled Shafts

A detailed squeeze analysis did not show a squeeze issue, however there are several sand and silty and loamy layers beneath the water table. We recommend a temporary casing for these locations, but recognize that a contractor may be able to prevent caving of these layers through the wet method or through the use of slurry. Addressing these problem soils should be left to the contractor. Due to the possibility of caving we recommend a minimum of one Crosshole Sonic Logging (CSL) Test be performed at each substructure where drilled shafts are used. The Guide Bridge Special Provision (GBSP) No. 86 *Drilled Shafts* should be included in the contract.

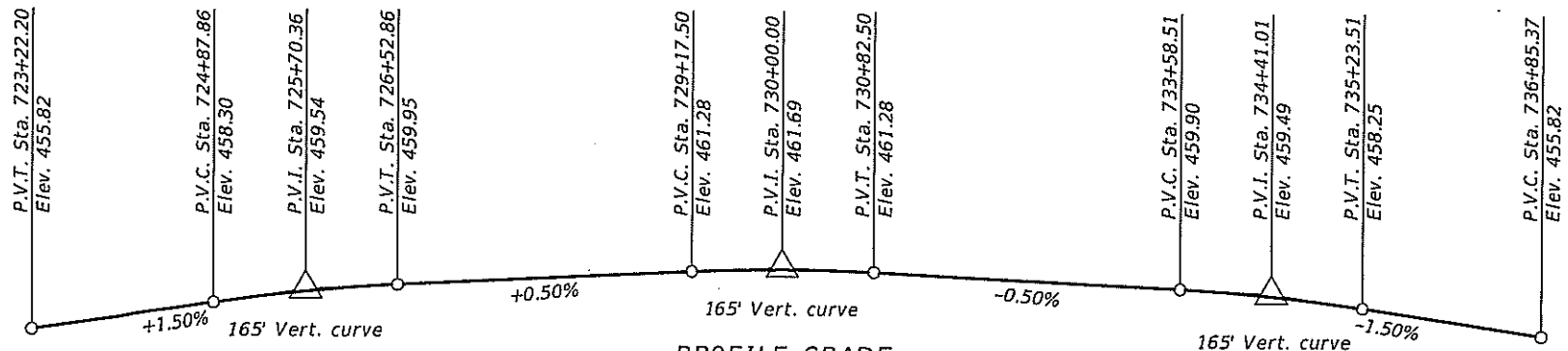
Appendix A TSL Plan with Boring Layout

Benchmark: BM Railroad Spike set in the south face of PP east of bridge at elevation 454.67.

Existing Structure: Structure number 014-0025, built in 1937 as F.A. Rte. 150, Section 7BY, reconstructured and widened in 1963 is an 11 span concrete deck on steel wide flange beams supported by pile stub abutments and pile bent piers. The existing structure length is 644'-4" back-to-back and 35'-8" out-to-out. The structure is to be removed and replaced. The existing structure will be replaced under road closure.

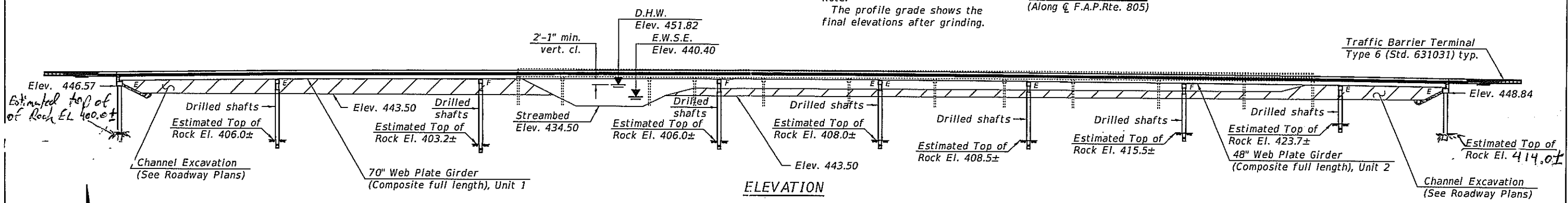
No salvage.

Note: Up to ¼" may be ground off the bridge deck and the bridge approach slabs.

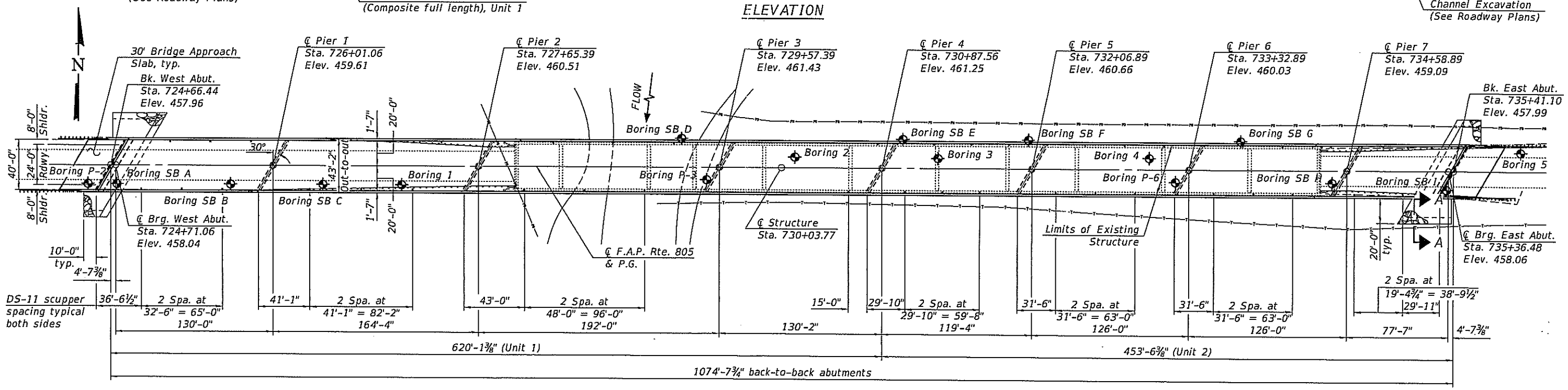


PROFILE GRADE
(Along ℄ F.A.P.Rte. 805)

Note:
The profile grade shows the final elevations after grinding.



ELEVATION



PLAN

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

f'c = 4,000 psi (Superstructure)
f'c = 3,500 psi (Substructure)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

DESIGN SPECIFICATIONS

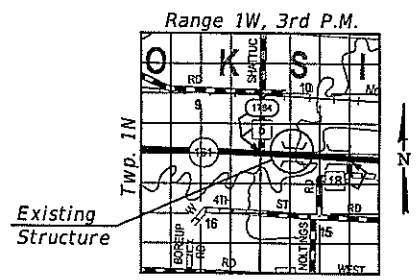
2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

SEISMIC DATA

Seismic Performance Zone (SPZ) = 2 ✓
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.271 g ✓
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.637 g ✓
Soil Site Class = D ✓

HIGHWAY CLASSIFICATION

IL Rte. 161 over Crooked Creek
F.A.P. Rte. 805
Functional Class: Minor Arterial
ADT: 4900 (2015); 6100 (2038)
ADTT: 665 (2015); 828 (2038)
DHV: 610 (2038)
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50



LOCATION SKETCH

GENERAL PLAN & ELEVATION
IL RTE. 161 OVER CROOKED CREEK
F.A.P. RTE. 805 - SEC. 7BR, 7BR-1
CLINTON COUNTY
STATION 730+03.77
STRUCTURE NO. 014-0080

DESIGNED	-	NICHOLAS R. BARNETT
CHECKED	-	VICTOR M MERCADO-VAZQUEZ
DRAWN	-	IAN J. ANDREWS
CHECKED	-	N.R.B. / V.M.V.

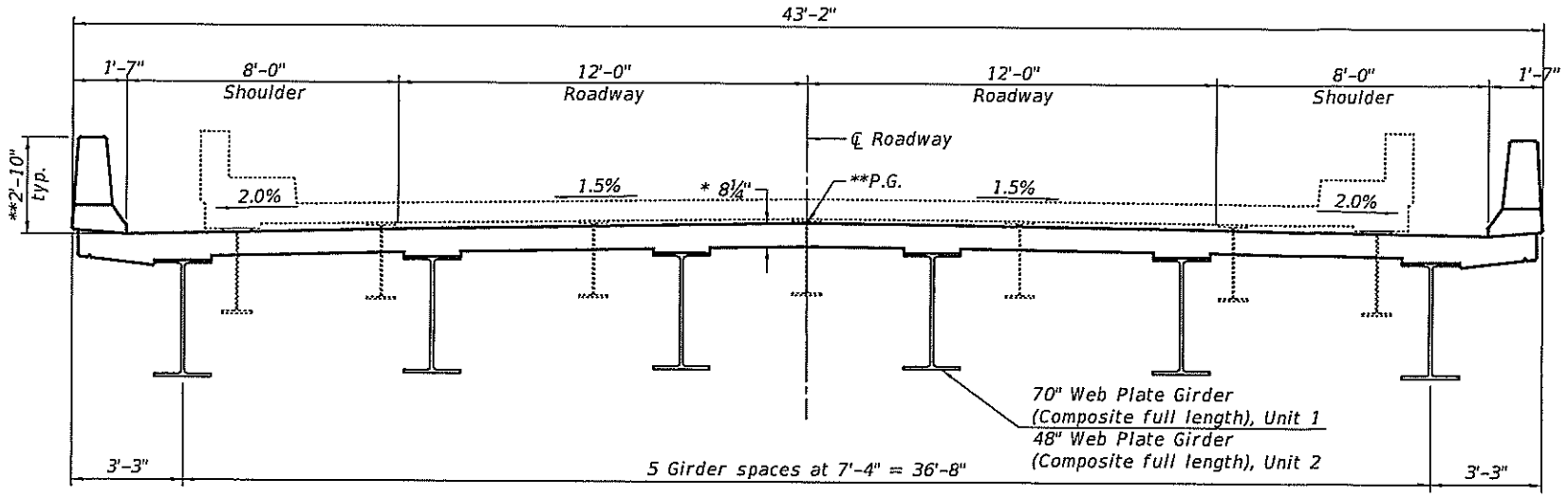
MARCH 13, 2018

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
805	7BR, 7BR-1	CLINTON	___	___

CONTRACT NO. 76887
ILLINOIS FED. AID PROJECT

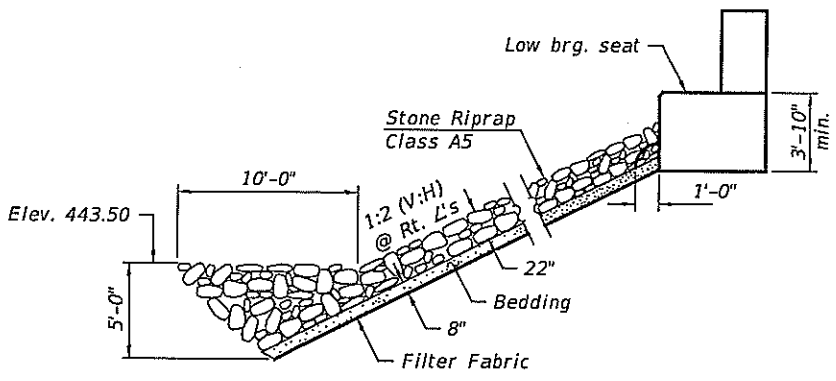


* Prior to Grinding
** After Grinding

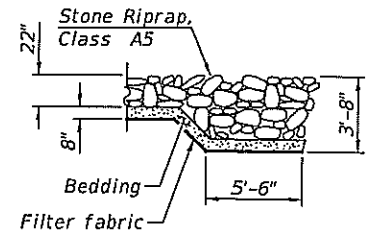
CROSS SECTION
(Looking East)

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.)									
	W. Abut.	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7	E. Abut.	Item 113
Q100	446.58	436.50	409.20	416.90	434.50	434.50	434.50	434.50	448.85	5
Q500	446.58	432.00	408.20	416.20	429.50	429.50	429.50	429.50	448.85	
Design	446.58	436.50	409.20	416.90	434.50	434.50	434.50	434.50	448.85	
Check	446.58	432.00	408.20	416.20	429.50	429.50	429.50	429.50	448.85	



STONE RIPRAP ANCHOR DETAIL



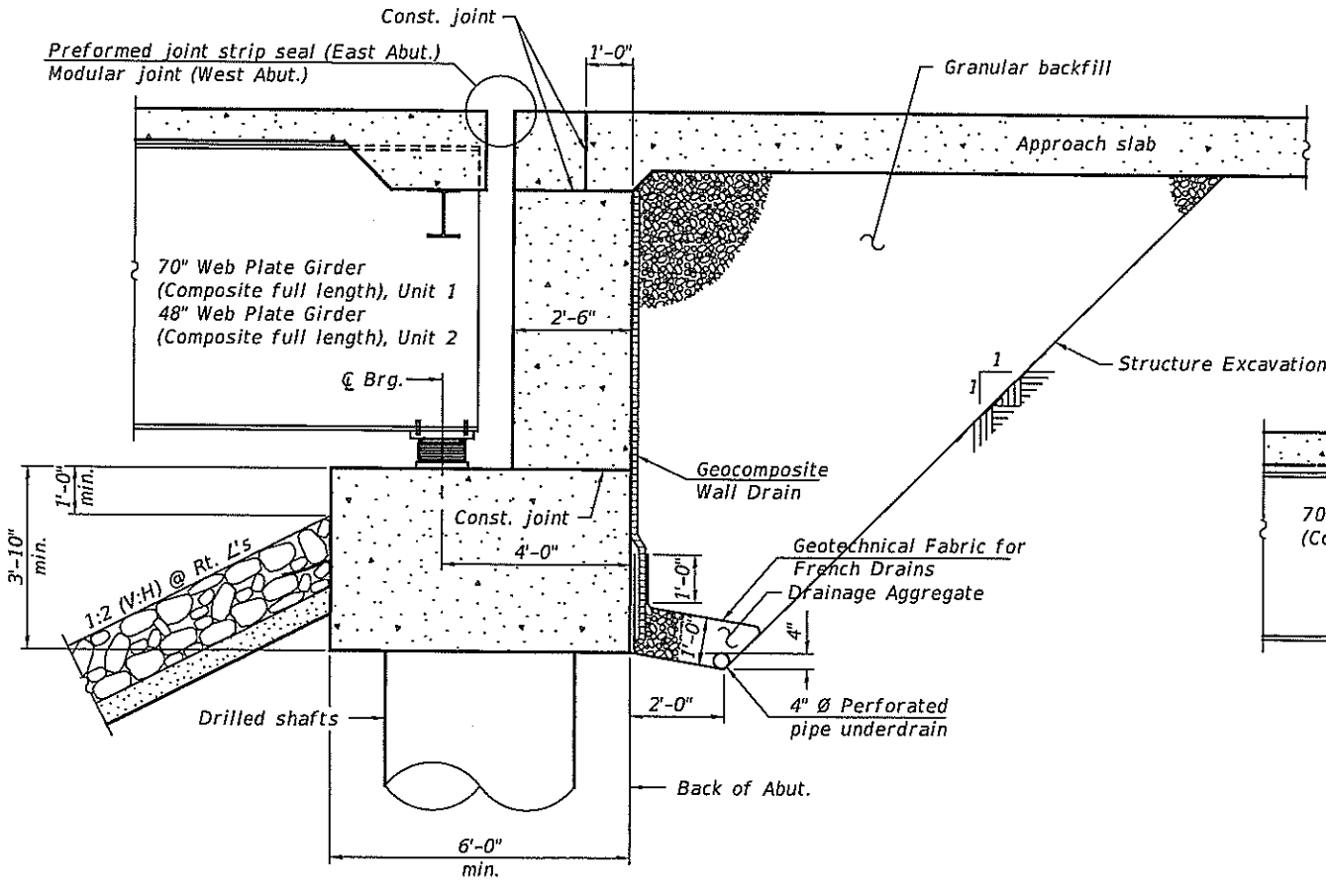
SECTION A-A

WATERWAY INFORMATION

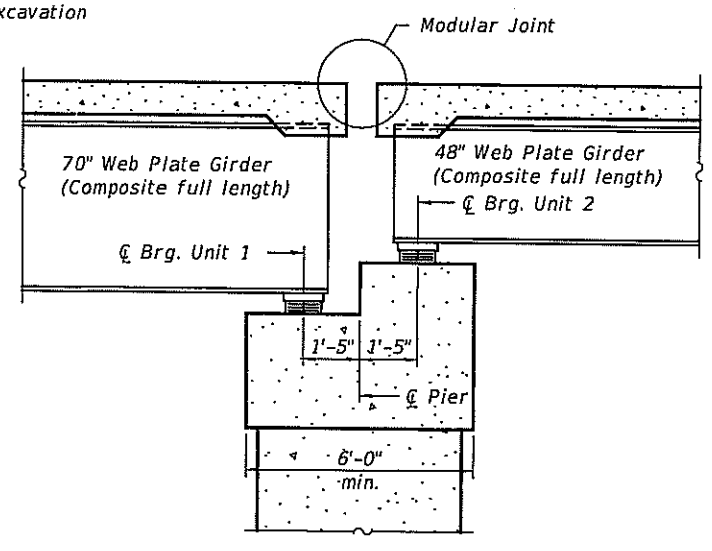
Drainage Area = 178.247 sq. mi.
Existing Overtopping Elev. 451.04 @ Sta. 741+32.84
Proposed Overtopping Elev. 454.32 @ Sta. 695+20.48 to 721+22.20 & 738+85.37 to 764+03.26

Flood Event	Freq. Yr.	Discharge Ft³/s	Opening Ft²		Natural H.W.E.	Head - Ft.		Headwater El.	
			Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
	10	12,752	2564	6812	450.80	1.52	1.24	452.32	452.04
Design	50	20,006	2564	8013	451.82	1.84	1.70	453.66	453.52
Base	100	23,200	2564	8465	452.20	2.24	1.88	454.44	454.08
Scour Design Check	500	31,149	2564	10755	456.47	0.23	0.15	456.70	456.62
Overtop Existing	2	5,000	2564	5900	450.51	0.35	0.29	450.86	450.80
Overtop Proposed	100	23,200	2564	8465	452.20	2.24	1.88	454.44	454.08

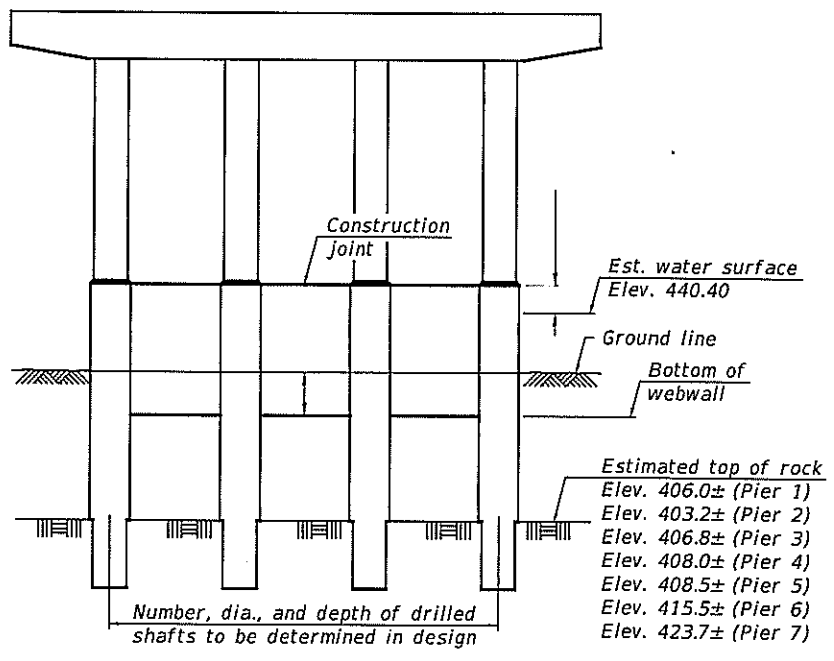
10 Year Velocity Through Existing Bridge = 3.3 ft/s
10 Year Velocity Through Proposed Bridge = 1.87 ft/s



SECTION THRU PILE SUPPORTED STUB ABUTMENT
(Horiz. dim. @ Rt. ℄s)



PIER 4 CROSS SECTION
(Horiz. dim. @ Rt. ℄s)



PIER SKETCH

DETAILS
IL RTE. 161 OVER CROOKED CREEK
F.A.P. RTE. 805-SEC 7BR, 7BR-1
CLINTON COUNTY
STATION 730+03.77
STRUCTURE NO. 014-0080

DESIGNED	NICHOLAS R. BARNETT
CHECKED	VICTOR M MERCADO-VAZQUEZ
DRAWN	IAN J. ANDREWS / M.B.M.
CHECKED	N.R.B. / V.M.V.

MARCH 13, 2018

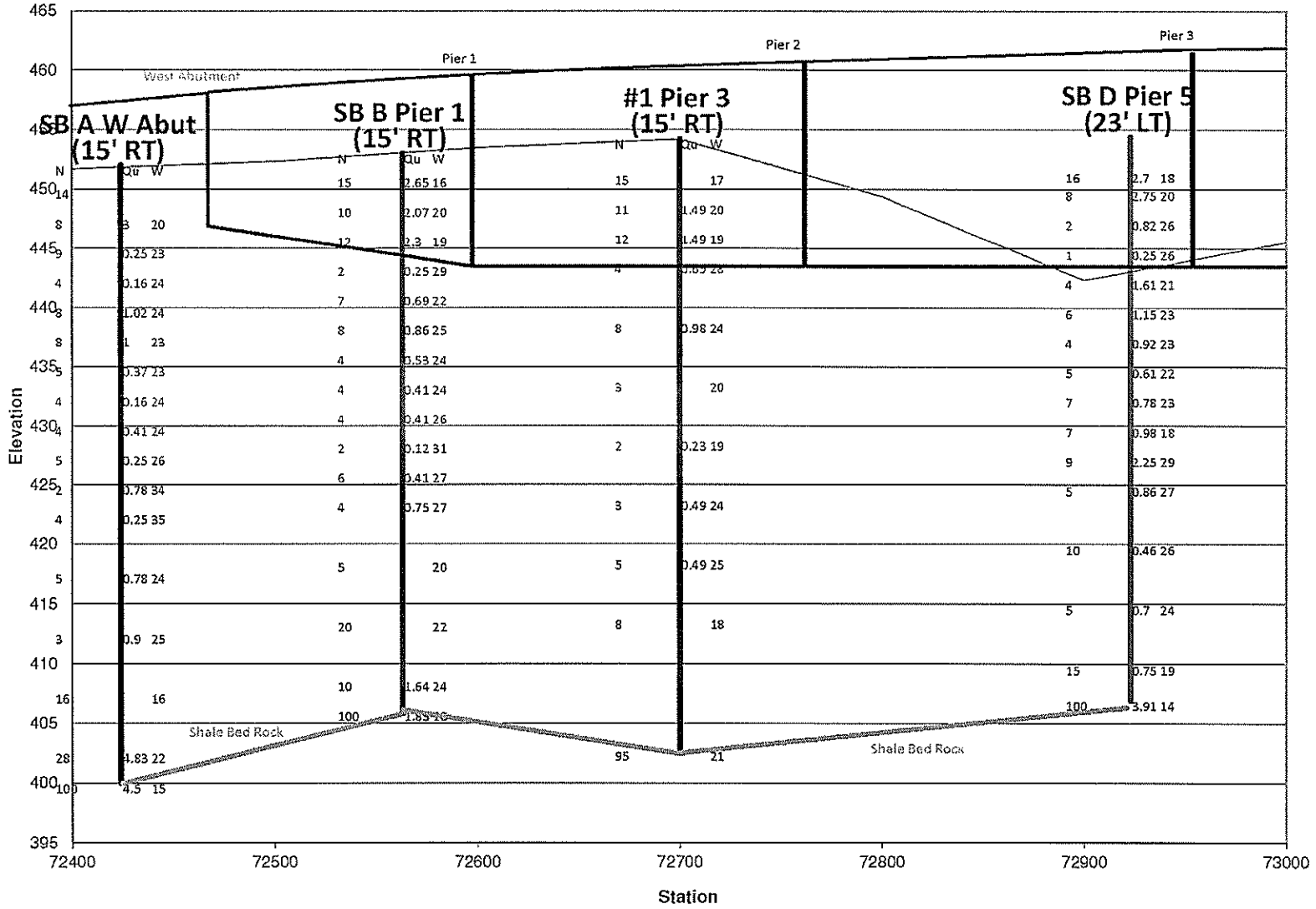
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
805	7BR, 7BR-1	CLINTON	___	___
		CONTRACT NO. 76887		

Appendix B Subsurface Data Profile

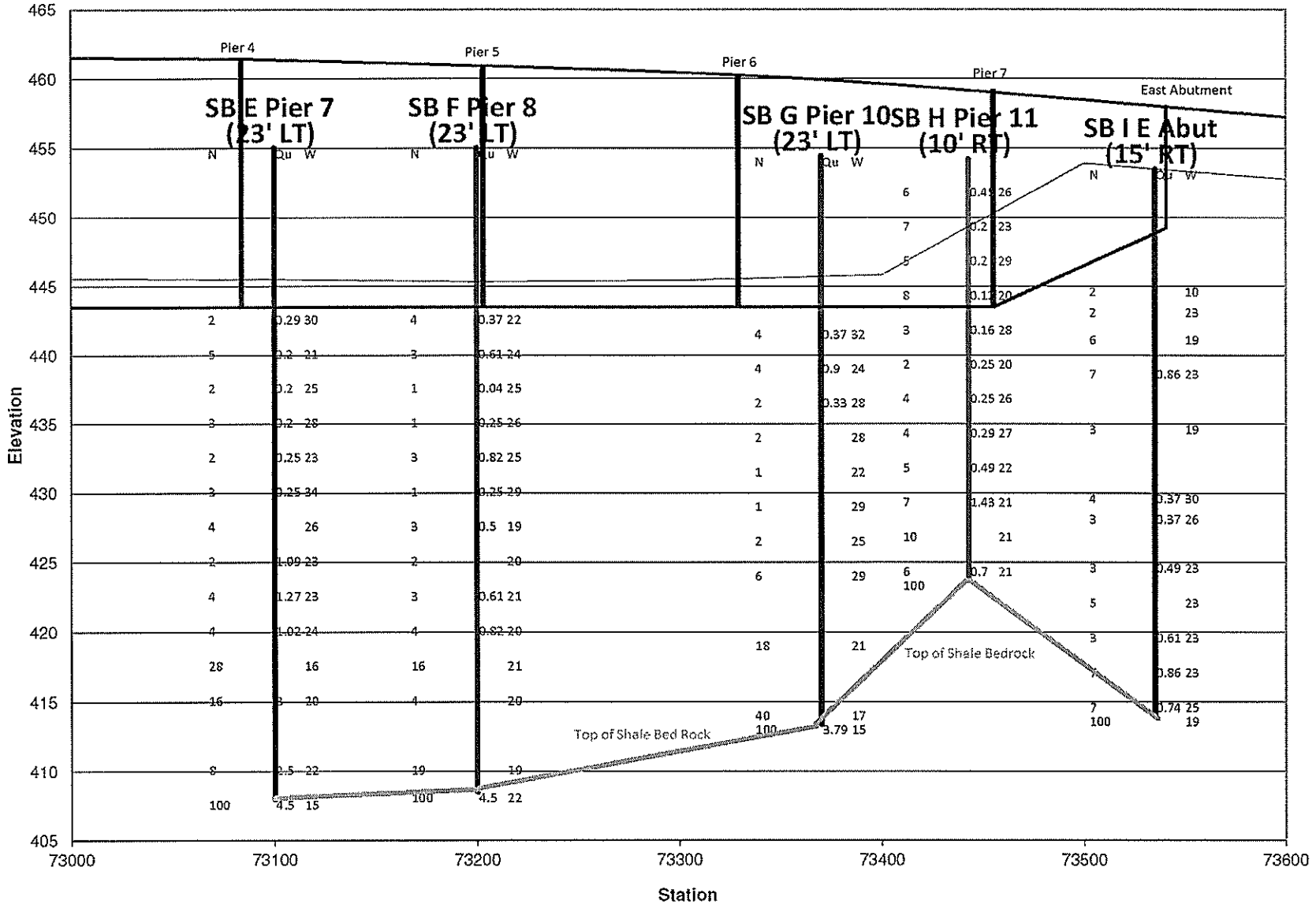
SN 014-0080 IL 161 over Crooked Creek



8/21/2017

Log Plot.xls

SN 014-0080 IL 161 over Crooked Creek



Appendix C Boring Logs

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 3/11/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY J. Houston

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #1
Station 727+00
Offset 15.00ft Right
Ground Surface Elev. 454.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 435.7 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Silty Clay LOAM with Bituminous, Concrete, Sand, and Rock			
	5		
	6	NC	17
	9		
450.2			
-5	4		
Gray Silty LOAM A-4(8) See Classification @ 10 ft	5	1.49	20
	6	B/15	
	3		
	6	1.49	19
	6	S/15	
-10	2		
	2	0.65	28
	2	B/20	
-15	2		
	3	0.98	24
	5	S/20	
436.2			
Gray SAND			
-20	1		
Gray SAND *(continued)*	1	NC	20
	2		
431.2			
Brown and Gray LOAM A-4(6) See Classification @ 30 ft			
-25	1		
	1	0.23	19
	1	B/20	
-30	1		
	2	0.49	24
	1	B/20	
-35	0		
	0	0.49	25
	5	B/20	
416.2			
Gray Medium to Fine SAND See Gradation @ 40 ft			
-40	0		

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
Illinois Department of Transportation

SOIL BORING LOG

Date 3/11/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY J. Houston

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #1
Station 727+00
Offset 15.00ft Right
Ground Surface Elev. 454.2 ft

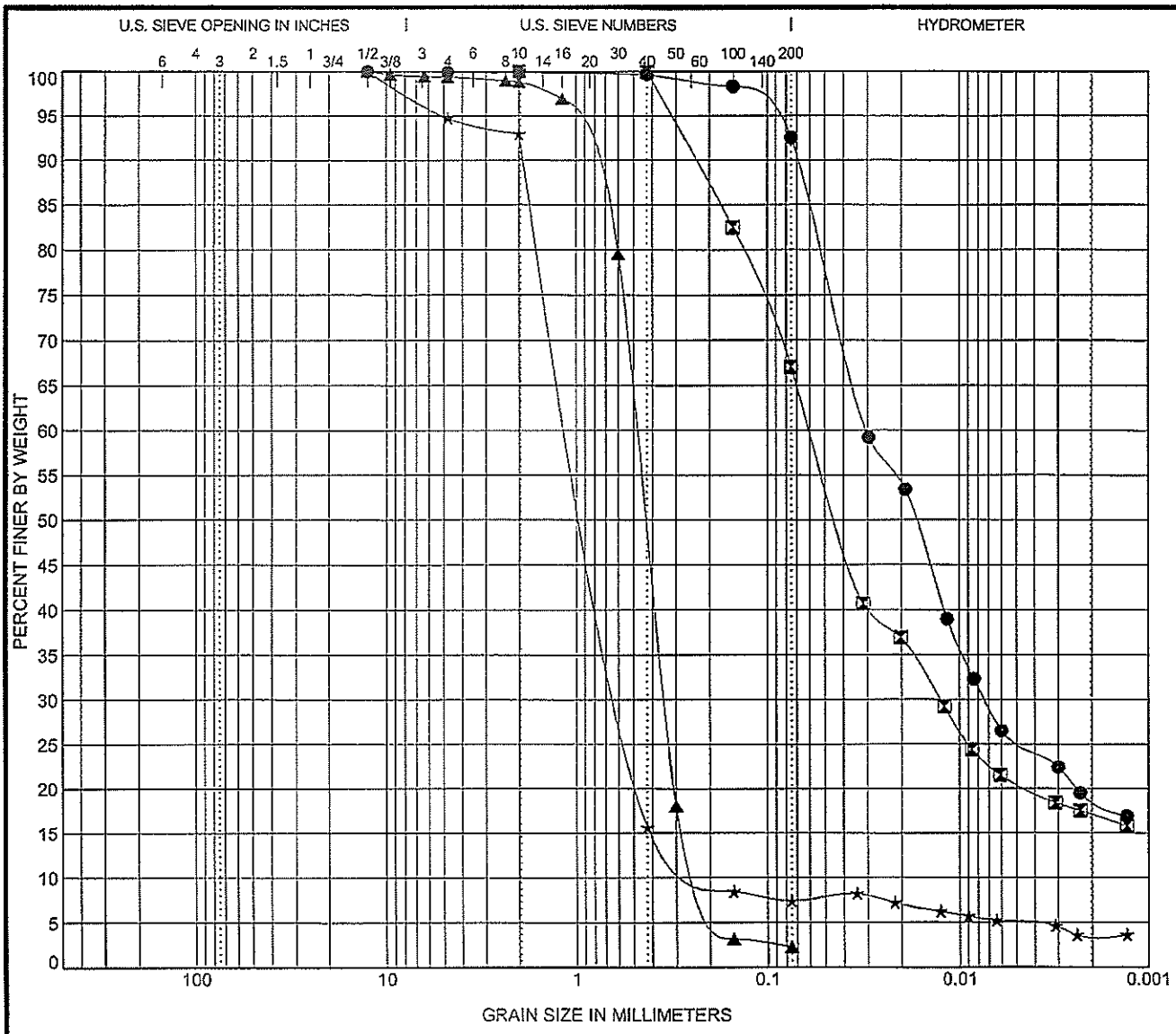
Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 435.7 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Medium to Fine SAND See Gradation @ 40 ft *(continued)*		3 5	NC	18
	-45			
	-50			
	403.2	0	NC	
Gray Very Weathered SHALE A-1-b(0)		57		
	402.2	38	NC	21
See Classification @ 50 ft				
END OF BORING ** Hole Filled Upon Completion	-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)

BBS, from 137 (Rev. 8-99)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	#1	10.00	A-4 (6) SILTY LOAM	27.9	20.9	7.0		
⊠	#1	30.00	A-4 (1) LOAM	22.7	18.3	4.4		
▲	#1	40.00	SAND				1.19	2.33
★	#1	50.00	A-1-b (0) SAND	19.9	16.3	3.6	1.65	5.50

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	#1	10.00	12.5	0.03	0.007		0.2	7.3	73.7	18.9
⊠	#1	30.00	2	0.06	0.013		0.0	33.0	49.9	17.1
▲	#1	40.00	12.5	0.481	0.343	0.206	1.2	96.5	2.3	
★	#1	50.00	12.5	1.034	0.567	0.188	7.1	85.5	3.8	3.6

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 4/19/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #2
Station 730+14
Offset 8.50ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Suspended Augers			
-5			
-10			
444.5			
Gray Silt LOAM			
	1		
	3 4	0.43 S/20	26
-15	2		
	4 2	0.65 S/20	27
	1		
▼	0 3	0.62 S/20	25
436.0			
Gray SAND			
-20	1		
Gray SAND *(continued)*			
	1 2	NC	19
433.0			
	0		
Brown Sandy Clay LOAM			
	2 2	0.18 S/10	35
431.5			
Gray SAND			
430.5			
-25	1		
Brown and Gray LOAM			
	1 1	0.59 S/15	23
-30	1		
	3 2	0.42 S/15	21
-35	3		
	5 27	0.26 S/20	25
418.5			
Gray SAND			
-40	8		

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, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 4/19/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #2
Station 730+14
Offset 8.50ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray SAND *(continued)*		25 30	NC	20
	-45	50		
		53 -	NC	19
408.0		61/4"		
Gray Very Weathered SHALE		- -	NC	28
406.5				
END OF BORING				
** Hole Filled Upon Completion	-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)

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 4/7/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #3
Station 731+28
Offset 8.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 436.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Suspended Augers
-5				
445.5				
-10				Gray Silt LOAM
	2			
	4	0.49	25	
	2	S/20		
-15	1			
	3	0.49	27	
	2	S/20		
	2			
	1	0.59	26	
	2	S/20		
436.0 ▼				
-20	0			Gray SAND
	2		21	Gray SAND *(continued)*
	1	NC		
433.5				
	WH			Brown Sandy Clay LOAM
	1	0.48	39	
	3	S/10		
431.0				
	1	NC	--	Gray SAND
430.0 -25	0			
	2	0.48	27	Brown and Gray LOAM
		S/15		
-30	2			
	1	0.40	22	
	5	S/10		
-35	4			
	7	0.49	24	
	22	S/20		
418.5				
				Gray SAND
-40	50			

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, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 4/7/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #3
Station 731+28
Offset 8.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 436.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray SAND *(continued)*		45		21
		50	NC	
	-45	60		
	409.5	50	NC	27
		50/2"	NC	--
Gray Very Weathered SHALE				
	-50	50/4"		
		-		31
		-	NC	
	402.5	68/3"	NC	--
END OF BORING				
** Hole Filled Upon Completion	-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
Illinois Department of Transportation

SOIL BORING LOG

Date 4/6/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #4
Station 732+97
Offset 9.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Suspended Augers			
-5			
-10			
444.5			
Gray Silt LOAM			
	3		
	1	0.51	24
	5	S/10	
-15	2		
	1	0.40	28
	3	S/10	
	1		
▼	2	0.55	25
	2	S/20	
436.0			
Gray SAND			
-20	1		
Gray SAND *(continued)* 434.5	1	NC	--
	1	0.38	24
Brown Sandy Clay LOAM		S/15	
	1		
	2	0.39	41
	2	S/20	
431.0			
Gray SAND			
430.0 -25	2	NC	--
	1		
Gray and Brown LOAM	1	0.43	36
		S/20	
-30	3		
	3	0.39	21
	3	S/20	
420.0 -35	50	--	--
	60/2"		
Gray SAND	-	NC	23
418.0			
Auger Refusal - END OF BORING			
** Hole Filled Upon Completion			
-40			

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

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 3/23/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #5
Station 735+94
Offset 15.00ft Left
Ground Surface Elev. 452.8 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 433.8 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	3			Brown Silty Clay LOAM
	5	2.17	15	
	5	S/20		
-5	2			
	3	1.12	21	
	4	S/20		
445.8				
	3			Gray Silty Clay LOAM
	5	1.96	24	
	6	B/20		
443.8				
-10	2			Gray Silt LOAM
	1	0.13	29	
	2	B/20		Soft
	2			
	3	0.52	25	Mottled
	3	S/20		
438.8				
-15	2			Gray/Brown Silty Clay LOAM
	2	0.33	27	
	2	B/20		
	2			
	1	0.52	25	
	2	S/20		Wet
433.8 ▼				
-20	WH			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	2	0.04	27	Brown Sandy LOAM
	1	B/10		A-4(2)
				See Classification @ 20 ft
				(continued)
	WH			
	3	0.29	43	
	1	S/10		
428.8				
-25	1			Gray Fine SAND
	1	NC	30	See Gradation @ 25 ft
427.3				
	1	0.37	51	Gray Sandy LOAM
		S/10		A-4(0)
				See Classification @ 30 ft
-30	2			
	3	0.37	22	
	4	S/10		
419.8				
				Gray Loamy SAND
				See Gradation @ 35 ft
-35	5			
	10	NC	19	
	17			
414.8				
				Gray Coarse SAND
-40	50/1"			

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, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 3/23/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE 140# Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. #5
Station 735+94
Offset 15.00ft Left
Ground Surface Elev. 452.8 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 433.8 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Coarse SAND *(continued)*		- -	NC	22
408.3	-45	103		
Gray Very Weathered SHALE		- -	NC	34
		60/2"		
402.8	-50	- -	NC	
Borehole continued with rock coring.	-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)

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 3/23/10

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY S. Wiszkon

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD Tri-Cone Roller Bit

STRUCT. NO. 014-0025 (E) / 014-0080 (P) CORING BARREL TYPE & SIZE

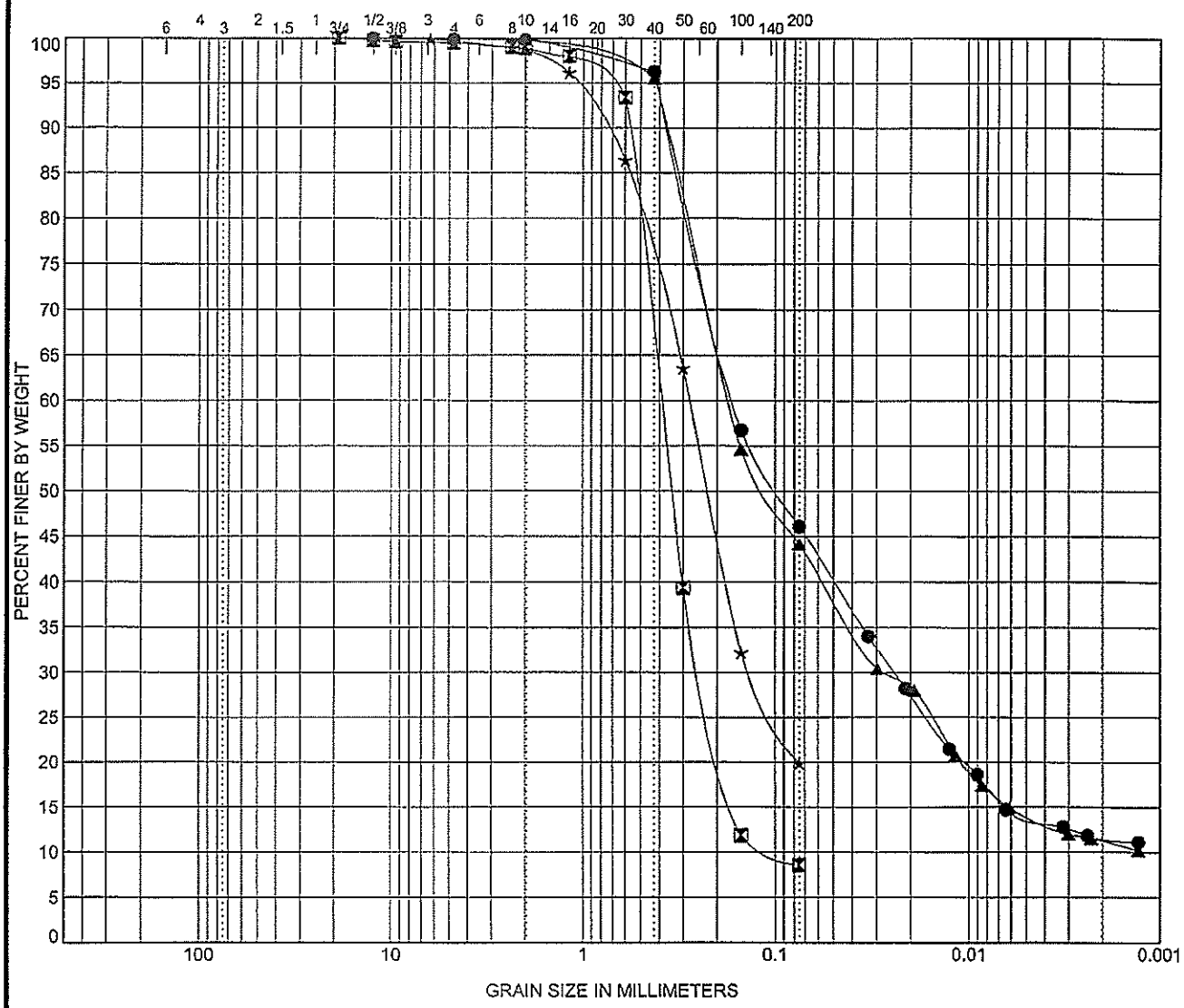
Station

Core Diameter 2 in
Top of Rock Elev. 402.80 ft
Begin Core Elev. 402.80 ft

BORING NO. #5
Station 735+94
Offset 15.00ft Left
Ground Surface Elev. 452.8 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
402.80						
Gray SHALE					3.33	
					4.08	
					4.42	
					3.75	
397.80	-55				2.08	
END OF BORING						
** Hole Filled Upon Completion	-60					
	-65					
	-70					

Color pictures of the cores No
Cores will be stored for examination until N/A
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	#5	20.00	A-4 (0) SANDY LOAM	20.0	14.2	5.8		
⊠	#5	25.00	SAND				1.41	3.84
▲	#5	30.00	A-4 (0) SANDY LOAM	NP	NP	NP		
★	#5	35.00	SAND					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	#5	20.00	12.5	0.163	0.024		0.2	53.7	34.5	11.6
⊠	#5	25.00	19	0.391	0.237	0.102	1.1	90.3	8.5	
▲	#5	30.00	4.75	0.172	0.028		0.1	55.8	33.0	11.2
★	#5	35.00	9.5	0.277	0.133		1.3	78.8	19.9	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/10/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CWG (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. P-2
Station 724+49
Offset 15.00ft Right
Ground Surface Elev. 454.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 430.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				Asphalt (4") and Concrete (8")
453.0				
	5			
	7	2.83	18	Brown and Gray Silt LOAM
	7	S		A-4(2)
				See Class @ 1.5 ft
	4			
	6	0.87	17	Gray
-5	6	B		
	4			
	5	2.50	17	
	5	P		
	3			
	3	1.25	21	Trace Wood and Gravel
-10	2	P		
	3			
	4	1.09	21	Trace Gravel
	5	S		
	3.			
	3	0.61	19	
-15	4	S		
438.5				
	3			Brown and Gray Silty CLAY
	3	0.41	22	
	4	B		
436.0				
	2			Brown and Gray CLAY
	2	0.44	23	
-20	2	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				Brown and Gray CLAY *(continued)*
	2			
	2	0.25	23	
	3	P		
▼	2			
	2	0.20	22	Trace Fine Sand
-25	1	B		
428.5				
	1			Gray Sandy LOAM
	3	0.75	21	A-2-4(0)
	3	P		See Class @ 26.5 ft
426.0				
	1			Gray CLAY with Trace Sand
	1	0.61	24	
-30	2	B		
	2			
	3	0.61	22	
-35	3	S		
	0			
	1	0.61	22	
-40	3	B		

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
Illinois Department of Transportation

SOIL BORING LOG

Date 10/10/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CWG (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. P-2
Station 724+49
Offset 15.00ft Right
Ground Surface Elev. 454.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 430.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray CLAY with Trace Sand *(continued)*				
412.5				
Gray and Brown Fine to Coarse SAND with Some Gravel See Gradation @ 44 ft		7		
		3	NC	18
	-45	4		
		12		
		12	NC	17
	-50	4		
		9		
Gray		7	NC	15
		6		
399.5				
Gray SHALE	-55			
395.0		50/3"	–	–
Borehole continued with rock coring.	-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
Illinois Department of Transportation

ROCK CORE LOG

Date 10/10/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CWG (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD

STRUCT. NO. 014-0025 (E) / 014-0080 (P) CORING BARREL TYPE & SIZE

Station

Core Diameter 2 in
Top of Rock Elev. 395.00 ft
Begin Core Elev. 395.00 ft

BORING NO. P-2
Station 724+49
Offset 15.00ft Right
Ground Surface Elev. 454.0 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
395.00						
Gray (Soft, Very Fine, Laminated, Cross Bedded) SHALE	-60	1	100	75	3	
		2	100	97	1	
		2	100	97	1	
		2	100	97	1	132.48
		2	100	97	1	
		2	100	97	1	
	-65	3	100	93	2	
		3	100	93	2	
		3	100	93	1	
		3	100	93	2	72.72
384.00	-70	3	100	93	3	
Gray to Dark Gray (Soft to Moderately Hard, Slightly Weathered, Aphanitic to Very Finely Crystalline, Banded to Medium Bedded) SHALE		4	92	68	2	
		4	92	68	1	150.48
		4	92	68	1	
		4	92	68	1	
	-75	4	92	68	1	
		5	100	77	1	
		5	100	77	1	
		5	100	77	2	
		5	100	77	1	

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 10/10/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CWG (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD

STRUCT. NO. 014-0025 (E) / 014-0080 (P) CORING BARREL TYPE & SIZE

Station

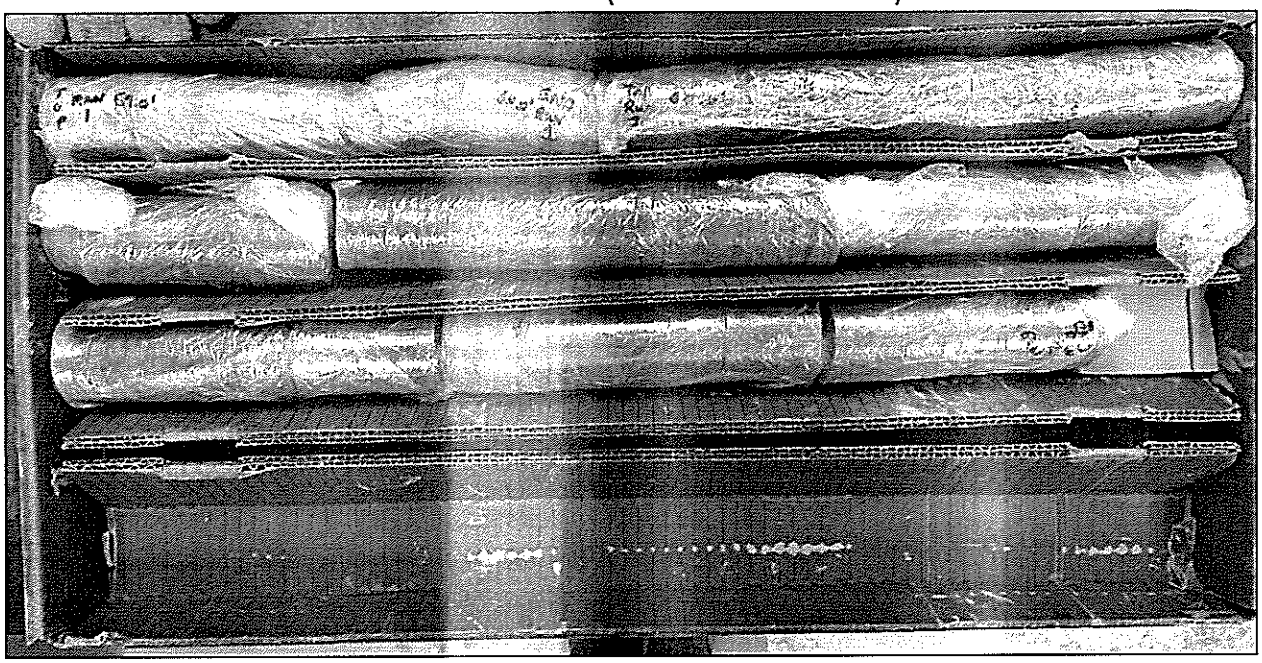
Core Diameter 2 in
Top of Rock Elev. 395.00 ft
Begin Core Elev. 395.00 ft

BORING NO. P-2
Station 724+49
Offset 15.00ft Right
Ground Surface Elev. 454.0 ft

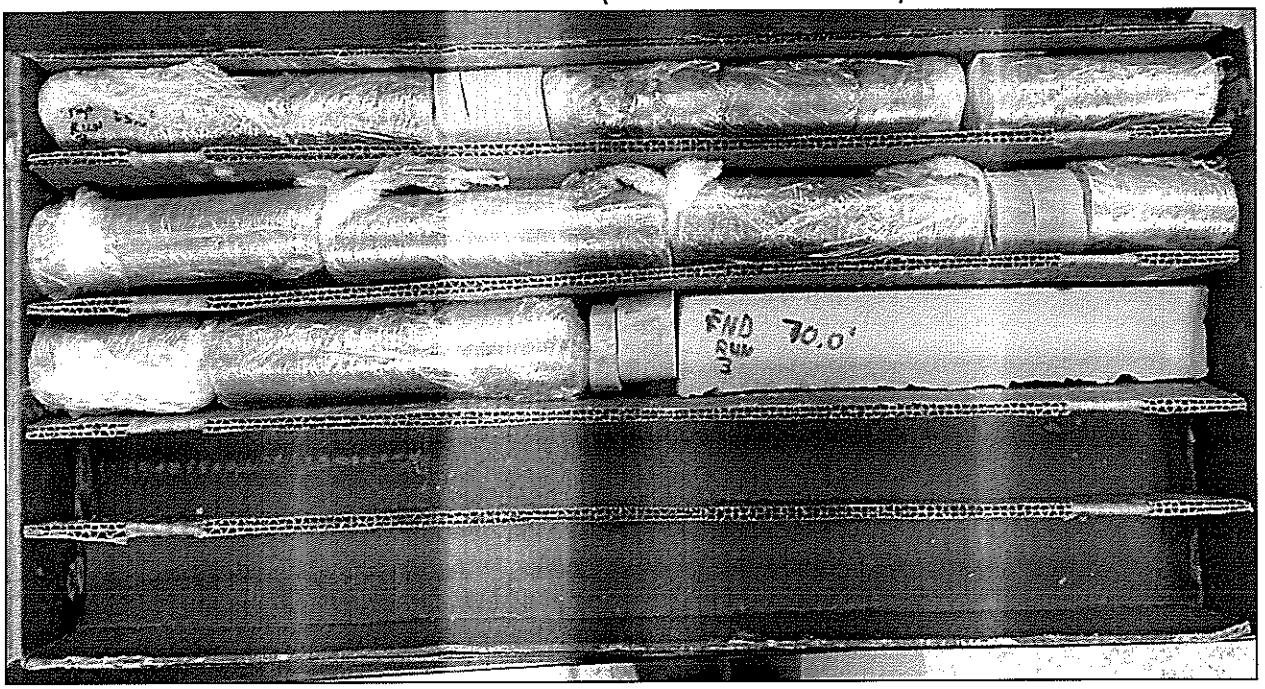
	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray to Dark Gray (Soft to Moderately Hard, Slightly Weathered, Aphanitic to Very Finely Crystalline, Banded to Medium Bedded) SHALE *(continued)*	-80	5	100	77	1	
		6	100	70	1	42.48
		6	100	70	1	
		6	100	70	1	
		6	100	70	1	
		6	100	70	1	
	369.00 -85					
END OF BORING AND ROCK CORE ** Hole Filled Upon Completion	-90					
	-95					

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

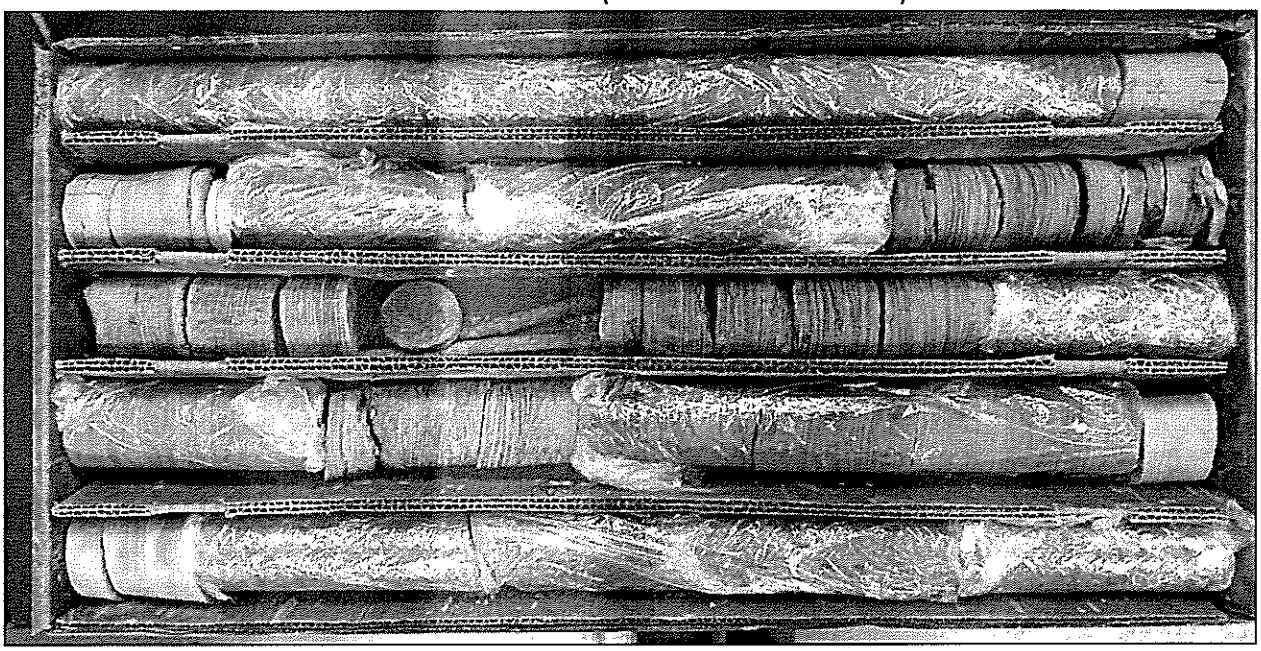
P-2 Pier 2: Station 724+49, 15 ft Right
Run 1: 59 – 60 ft (Elev 395.0 – 394.0)
Run 2: 60 – 65 ft (Elev 394.0 – 389.0)



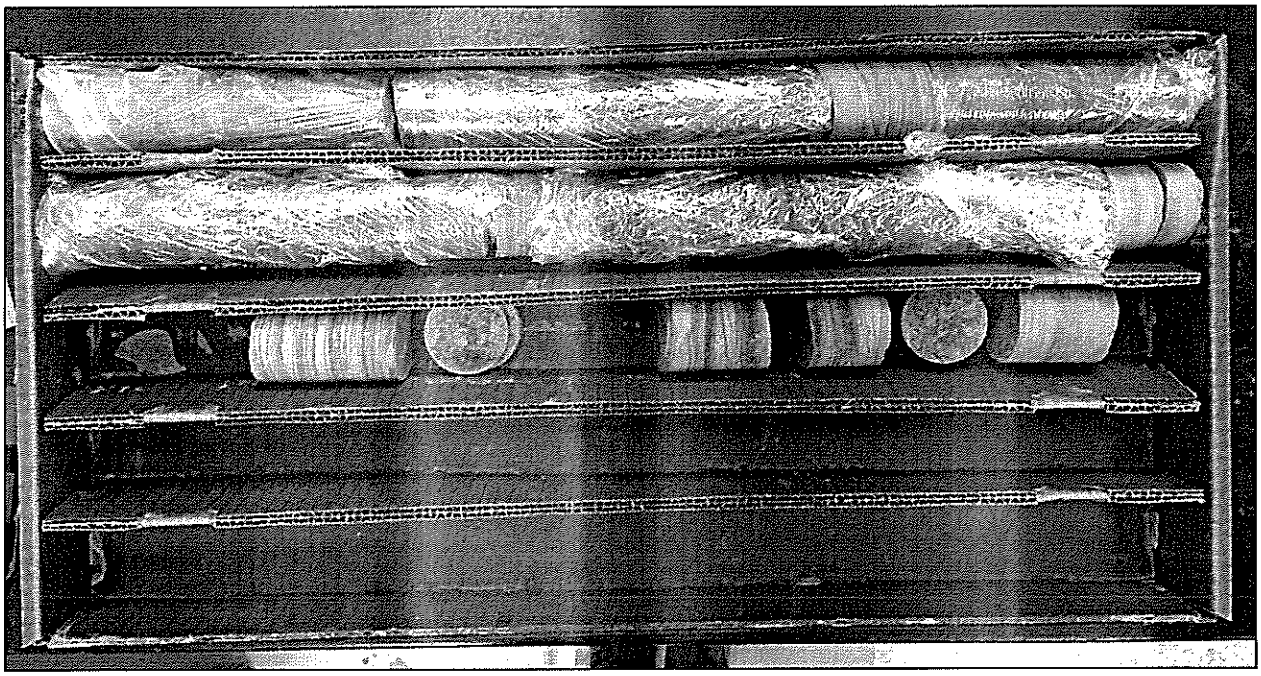
P-2 Pier 2: Station 724+49, 15 ft Right
Run 3: 65 – 70 ft (Elev. 389.0 – 384.0)

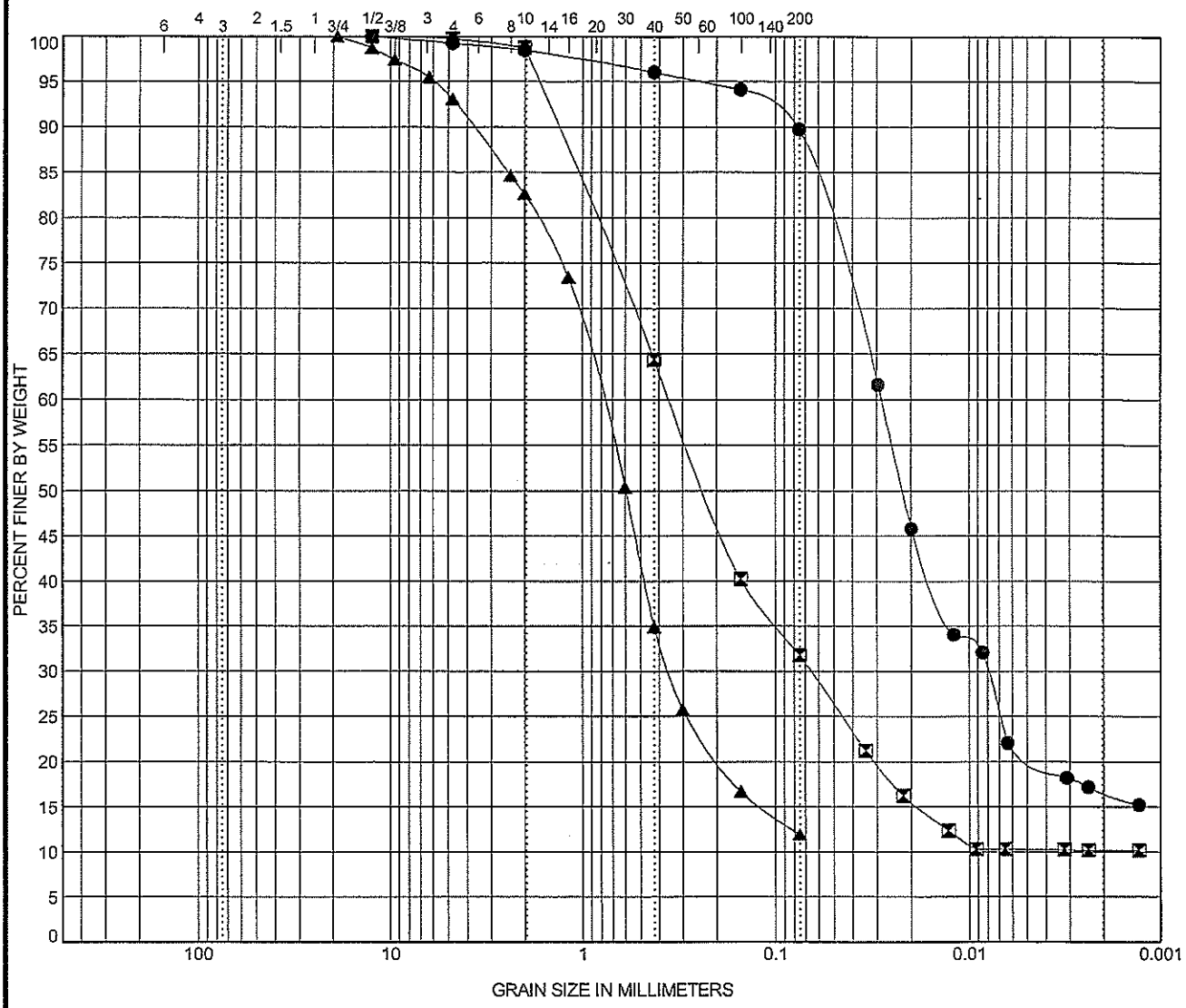


P-2 Pier 2: Station 724+49, 15 ft Right
Run 4: 70 – 75 ft (Elev. 384.0 – 379.0)
Run 5: 75 – 80 ft (Elev. 379-0 – 374.0)



P-2 Pier 2: Station 724+49, 15 ft Right
Run 6: 80 – 85 ft (Elev. 374.0 – 369.0)





COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	P-2	1.50	A-4 (2) SILTY LOAM	24.5	19.8	4.7		
⊠	P-2	26.50	A-2-4 (0) SANDY LOAM	16.9	15.9	1.0		
▲	P-2	44.00	SAND				2.77	14.10

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	P-2	1.50	12.5	0.028	0.008		1.5	8.7	73.1	16.6
⊠	P-2	26.50	12.5	0.352	0.066		1.2	67.0	21.6	10.2
▲	P-2	44.00	19	0.796	0.353		17.4	70.7	11.9	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR, 7BR-1
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 10/30/17

10/30/2017 1:39:53 PM
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Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-2, 1.5

Reading	Soil Tare	Percent Finer
12.5	0	100
4.75	3.8	99.27975
2	4.2	98.4837
0.425	1.237	96.04964
0.15	0.98	94.12129
0.075	2.227	89.73921

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INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-2, 26.5

Reading	Soil Tare	Percent Finer
12.5	0	100
4.75	1	99.77216
2	4.4	98.76965
0.425	17.648	64.38178
0.15	12.401	40.21791
0.075	4.343	31.75539

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EV0000
Illinois Department of Transportation
Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-2, 44

Reading	Soil Tare	Percent Finer
19	0	100
12.5	6.1	98.71063
9.5	6	97.4424
6.3	9.3	95.47665
4.75	11.4	93.067
2.36	39.8	84.6544
2	9.6	82.62524
1.18	43.5	73.43056
0.6	109.1	50.3699
0.425	73.4	34.85521
0.3	43.1	25.74508
0.15	42.9	16.67723
0.075	22.4	11.94251

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/16/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ZTV (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. P-3
Station 729+43
Offset 10.00ft Right
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 421.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Concrete 454.3
				Open Space - Suspended Augers
-5				
-10				Ground Surface 442.0
	3			Brown Silty CLAY with Trace Gravel
	3	--	15	
-15	2			
				439.5
	1			Brown Silt LOAM
	2	--	21	A-4(3)
	1			See Class @ 16.5 ft
	1			
	1	0.41	25	Brown and Gray
-20	1	B		
				Brown Silt LOAM *(continued)* 434.5
	Wh			Gray Sandy CLAY
	1	0.49	41	
	1	B		
				432.0
	2			Gray Clay LOAM with Organics
	1	0.57	35	
-25	2	B		
				429.5
	1			Gray LOAM
	1	--	20	A-4(0)
	1			See Class @ 26.5 ft
	2			
	1	0.86	29	
-30	2	B		
	1			
	4	--	22	
-35	5			
	2			
	4	0.74	22	
-40	3	B		

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, from 137 (Rev. 8-99)

P-3

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/16/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ZTV (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. P-3 Pier 3
Station 729+43
Offset 10.00ft Right
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 421.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Gray LOAM A-4(0) See Class @ 26.5 ft *(continued)*
	4			
-45	4 6	0.78 B	21	
408.0				
				Gray SAND
406.0	24			
	41 50	–	20	Gray Limey SHALE
405.0 -50				
		+	18	Gray SHALE (Modified SPT Sampling) *q_u = 38.2 ksf
403.0				
		+	17	q_u = 30.4 ksf
401.0				
-55				
		+	15	q_u = 89.7 ksf
398.5				
		+	14	q_u = 30.9 ksf
396.0				
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
		+	12	Gray SHALE (Modified SPT Sampling) *(continued)* q_u = 55.5 ksf
393.5				
		+	11	q_u = 63.7 ksf
391.0				
-65				
		+	12	q_u = 71.3 ksf
388.5				
		+	13	q_u = 47.2 ksf
386.0				
-70				
		+	13	q_u = 49.6 ksf
383.5				
		+	11	q_u = 111 ksf
381.0				
-75				
379.5		+	10	q_u = 71.8 ksf
				END OF BORING
				** Hole Filled Upon Completion
				+ SEE MODIFIED SPT SHEET
-80				

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

BBS, from 137 (Rev. 8-99)

* q_u values are from Modified SPT Log on Next Page

Illinois Department of Transportation

Modified SPT Log

Route: FAP 805 Structure No.: 014-0025 (Exist.) 014-0080 (Prop.) Date: 11/7/17 Page: 1 of

Section: 7BR, 7BR-1 Description: IL 161 over Crooked Creek

County: Putnam / Bureau Logged by: TLM / MS Sampler Tube Length: 18 in.

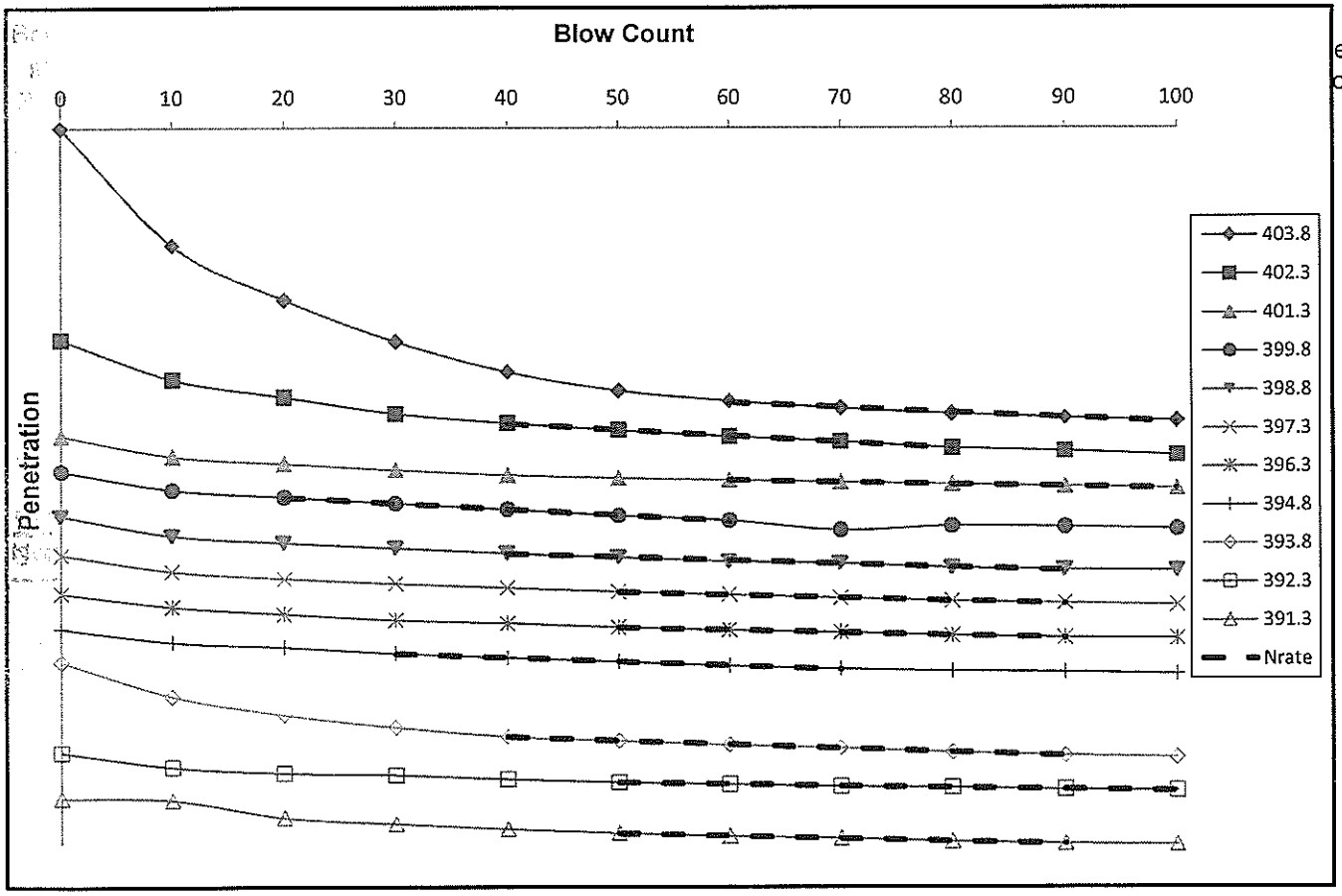
Boring No.: P-3 Pier 3 Station: 729+43 Offset: 10' RT Latitude: Longitude:

Drill Rig: Hammer Type: Auto Hammer Efficiency (%): 73 Surface Elevation: 455.00

Borehole Diameter. (in.): 8 Split-barrel Sampler Description: 1.5-in. I.D. w/o Liner

Measured Rod Length (in.)	Blows where exposed rod length is measured (blows)											$N_{rate,90}$	q_u	Young's Modulus
Test Elevation	0	10	20	30	40	50	60	70	80	90	100	(bpf)	(ksf)	(ksi)
403.75	51.31	44.31	41.06	38.56	36.75	35.63	***35***	***34.6***	***34.3***	***34***	***33.8***	397.6	38.2	8.97
402.25	46.44	44.06	43	42	***41.4***	***41***	***40.6***	***40.3***	***39.9***	39.75	39.5	316.7	30.4	6.90
401.25	52.06	50.81	50.38	50	49.69	49.5	***49.4***	***49.3***	***49.1***	***49***	***48.9***	934.4	89.7	27.94
399.75	46.56	45.44	***45***	***44.6***	***44.3***	***43.88***	***43.6***	43	43.25	43.19	43.06	322.2	30.9	7.02
398.75	50.88	49.69	49.25	48.94	***48.6***	***48.38***	48.13	***48***	***47.8***	***47.6***	47.56	578.1	55.5	14.39
397.25	46.56	45.56	45.13	44.81	44.56	***44.31***	***44.1***	***43.9***	***43.8***	***43.6***	43.5	663.6	63.7	17.30
396.25	47.31	46.5	46.06	45.69	45.5	***45.25***	***45.1***	***44.9***	***44.8***	***44.6***	44.56	742.8	71.3	20.17
394.75	41.31	40.5	40.19	***39.8***	***39.6***	***39.31***	***39.1***	***38.9***	38.75	38.69	38.56	491.8	47.2	11.66
393.75	49.13	47.06	45.94	45.19	***44.6***	***44.38***	44.13	***43.9***	***43.7***	***43.5***	43.38	516.8	49.6	12.42
392.25	41.75	40.87	40.5	40.38	40.13	***39.94***	***39.8***	39.69	***39.6***	***39.5***	***39.4***	1156	111	40.19
391.25	48.81	48.69	47.63	47.25	46.94	***46.69***	***46.5***	***46.4***	***46.2***	***46.1***	46	747.5	71.8	20.37

Note: ***"Values"*** indicates data used to calculate $N_{rate,90}$.



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on: 42.9425

FAP 805 (IL 161)
Section 7BR, 7BR-1
Clinton County

MODIFIED SPT DATA P-3

DEPTH = 50.0 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	51.3125	0.00
10	44.3125	7.00
20	41.0625	10.25
30	38.5625	12.75
40	36.7500	14.56
50	35.6250	15.69
60	35.0000	16.31
70	34.5625	16.75
80	34.2500	17.06
90	34.0000	17.31
100	33.8125	17.50

DEPTH = 52.5 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	46.4375	0.00
10	44.0625	2.38
20	43.0000	3.44
30	42.0000	4.44
40	41.4375	5.00
50	41.0000	5.44
60	40.6250	5.81
70	40.3125	6.13
80	39.9375	6.50
90	39.7500	6.69
100	39.5000	6.94

DEPTH = 55.0 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	52.0625	0.00
10	50.8125	1.25
20	50.3750	1.69
30	50.0000	2.06
40	49.6875	2.38
50	49.5000	2.56
60	49.3750	2.69
70	49.2500	2.81
80	49.1250	2.94
90	49.0000	3.06
100	48.8750	3.19

DEPTH = 57.5 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	46.5625	0.00
10	45.4375	1.13
20	45.0000	1.56
30	44.6250	1.94
40	44.2500	2.31
50	43.8750	2.69
60	43.5625	3.00
70	43.3750	3.19
80	43.2500	3.31
90	43.1875	3.38
100	43.0625	3.50

DEPTH = 60.0 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	50.8750	0.00
10	49.6875	1.19
20	49.2500	1.63
30	48.9375	1.94
40	48.6250	2.25
50	48.3750	2.50
60	48.1250	2.75
70	48.0000	2.88
80	47.7500	3.13
90	47.6250	3.25
100	47.5625	3.31

DEPTH = 62.5 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	46.5625	0.00
10	45.5625	1.00
20	45.1250	1.44
30	44.8125	1.75
40	44.5625	2.00
50	44.3125	2.25
60	44.1250	2.44
70	43.9375	2.63
80	43.7500	2.81
90	43.6250	2.94
100	43.5000	3.06

FAP 805 (IL 161)
Section 7BR, 7BR-1
Clinton County

MODIFIED SPT DATA P-3

DEPTH = 65.0 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	47.3125	0.00
10	46.5000	0.81
20	46.0625	1.25
30	45.6875	1.63
40	45.5000	1.81
50	45.2500	2.06
60	45.0625	2.25
70	44.9375	2.38
80	44.7500	2.56
90	44.6250	2.69
100	44.5625	2.75

DEPTH = 67.5 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	41.3125	0.00
10	40.5000	0.81
20	40.1875	1.13
30	39.8125	1.50
40	39.5625	1.75
50	39.3125	2.00
60	39.0625	2.25
70	38.8750	2.44
80	38.7500	2.56
90	38.6875	2.63
100	38.5625	2.75

DEPTH = 70.0 FT

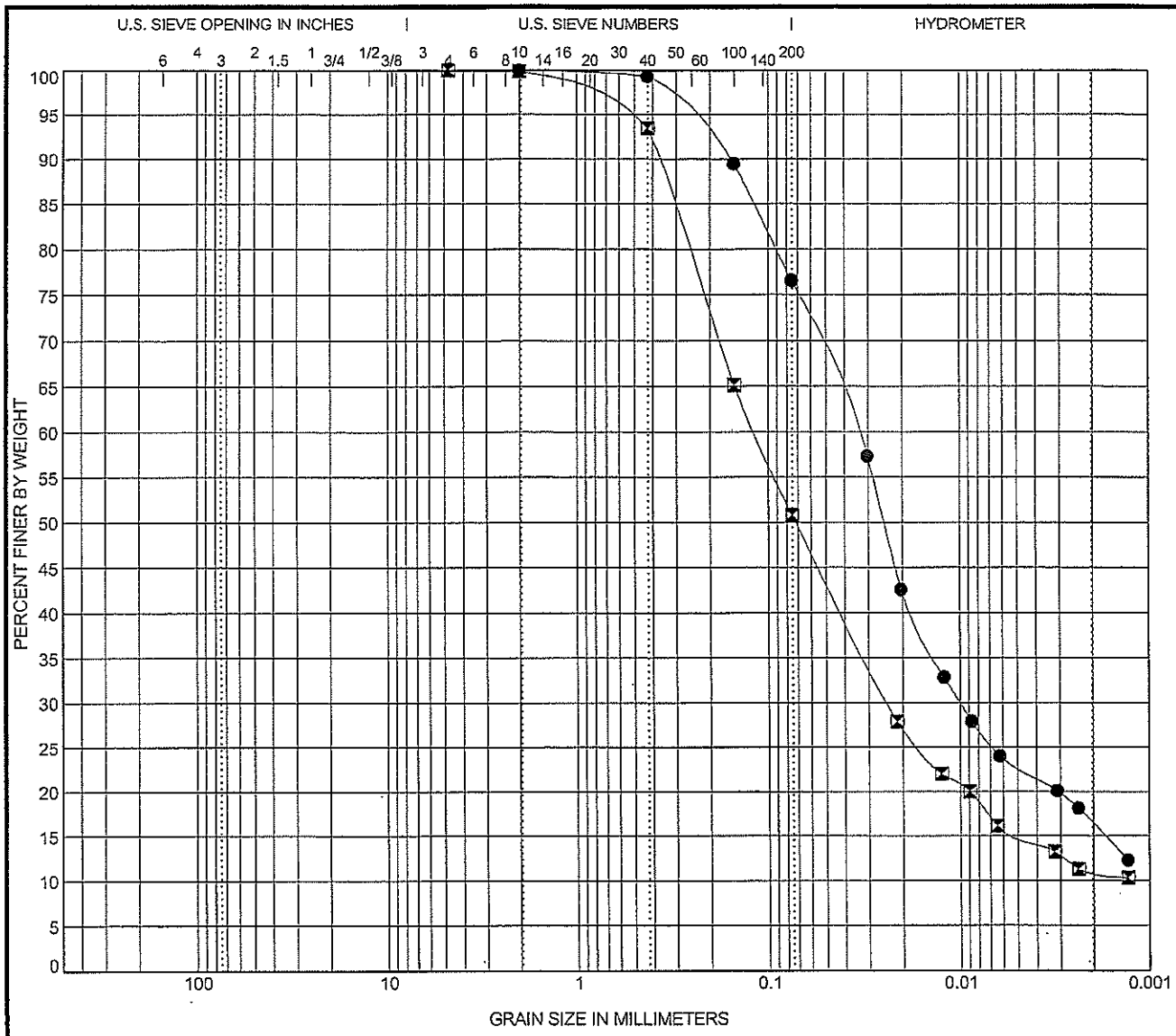
Blow Counts	Measured Rod Length (in)	Penetration (in)
0	49.1250	0.00
10	47.0625	2.06
20	45.9375	3.19
30	45.1875	3.94
40	44.6250	4.50
50	44.3750	4.75
60	44.1250	5.00
70	43.9375	5.19
80	43.6875	5.44
90	43.5000	5.63
100	43.3750	5.75

DEPTH = 72.5 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	41.7500	0.00
10	40.8750	0.88
20	40.5000	1.25
30	40.3750	1.38
40	40.1250	1.63
50	39.9375	1.81
60	39.8125	1.94
70	39.6875	2.06
80	39.6250	2.13
90	39.5000	2.25
100	39.4375	2.31

DEPTH = 75.0 FT

Blow Counts	Measured Rod Length (in)	Penetration (in)
0	48.8125	0.00
10	48.6875	0.13
20	47.6250	1.19
30	47.2500	1.56
40	46.9375	1.88
50	46.6875	2.13
60	46.5000	2.31
70	46.3750	2.44
80	46.1875	2.63
90	46.0625	2.75
100	46.0000	2.81



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	P-3	16.50	A-4 (3) SILTY LOAM	24.3	18.4	5.9		
⊠	P-3	26.50	A-4 (0) LOAM	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	P-3	16.50	2	0.034	0.01		0.0	23.4	60.2	16.4
⊠	P-3	26.50	4.75	0.117	0.024		0.1	49.1	39.8	11.0

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR, 7BR-1
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 10/30/17

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Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-3, 16.5

Reading	Soil Tare	Percent Finer
2	0	100
0.425	0.34	99.32146
0.15	4.934	89.47473
0.075	6.473	76.55664

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EV0000
Illinois Department of Transportation
Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-3, 26.5

Reading	Soil Tare	Percent Finer
4.75	0	100
2	0.6	99.86702
0.425	3.235	93.43816
0.15	14.227	65.16505
0.075	7.235	50.78705

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/11/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. P-6
Station 733+18
Offset 10.00ft Right
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 429.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Concrete 454.3
				Open Space - Suspended Augers
-5				
-10				Ground Surface 444.7
	1			Brown and Gray Silt LOAM A-4(0) See Class @ 11.5 ft
	2 4	1.00 P	22	
	2			
	3 3	0.75 P	18	Brown
-15	1			
	2 2	0.61 B	20	
	WH			
-20	- 18	0.25 P	24	
				Brown and Gray Silt LOAM A-4(0) See Class @ 11.5 ft *(continued)*
	WH			
	3 2	0.25 P	23	Trace Sand
				432.0
	2			Fine to Coarse SAND with Some Clay 431.0
	2 1	0.44 S	30	
-25				Brown and Gray LOAM with Trace Organic Material A-4(0) See Class @ 26.5 ft
	WH			
	WH 1	0.50 P	36	Gray, Trace Gravel
	WH			
-30	WH 3	0.49 B	22	
	1			
-35	2 2	0.25 P	20	
	3			
	3 10	0.23 S	21	415.5 Gray SHALE
-40				

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

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/11/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. P-6
Station 733+18
Offset 10.00ft Right
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 429.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray SHALE *(continued)*				
		24		
		50 -	4.50 P	12
	-45			
	406.0	50	4.00 P	19
Borehole continued with rock coring.	-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
Illinois Department of Transportation

ROCK CORE LOG

Date 10/11/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD

STRUCT. NO. 014-0025 (E) / 014-0080 (P) CORING BARREL TYPE & SIZE

Station

Core Diameter 2 in
Top of Rock Elev. 406.00 ft
Begin Core Elev. 406.00 ft

BORING NO. P-6
Station 733+18
Offset 10.00ft Right
Ground Surface Elev. 455.0 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
	406.00	1	89	76	0	
Gray (Soft, Fresh to Moderate Weathering, Very Fine to Fine Grained, Laminated to Thinly Bedded, 10 Degree Cross Bedding) SHALE	-50	1	89	76	1	224.64
		1	89	76	1	
		1	89	76	1	
Planar Joint, No Fill		1	89	76	1	
	401.00	1	89	76	1	
Gray (Medium Soft, Fine Grained, Thinly Bedded) SANDSTONE with Shale Partings Throughout	-55	2	73	73	1	442.8
	399.00	2	73	73	1	
Gray to Dark Gray (Medium Soft to Soft, Fresh to Slightly Weathered, Laminated, Very Fine Grained, 10-15 Degree Bedding) SHALE		2	73	73	1	
		2	73	73	1	
		2	73	73	2	
	395.00 -60	3	75	62	2	
Gray (Soft, Moderately Weathered, Very Fine Grained, Laminated to Thinly Bedded, Some Cross Bedding) SHALE		3	75	62	3	
		3	75	62	2	96.48
		3	75	62	3	
	-65	3	75	62	2	
		4	100	90	2	
		4	100	90	2	
		4	100	90	2	
		4	100	90	3	143.28

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 10/11/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD

STRUCT. NO. 014-0025 (E) / 014-0080 (P) CORING BARREL TYPE & SIZE

Station

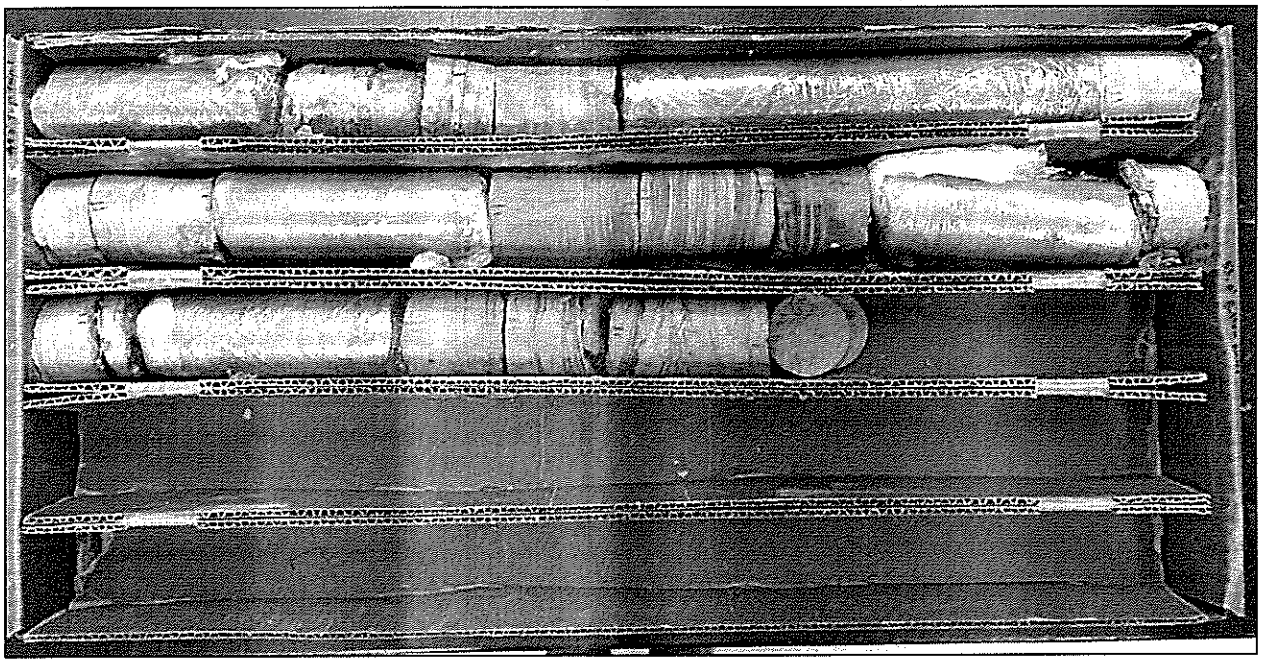
BORING NO. P-6
Station 733+18
Offset 10.00ft Right
Ground Surface Elev. 455.0 ft

Core Diameter 2 in
Top of Rock Elev. 406.00 ft
Begin Core Elev. 406.00 ft

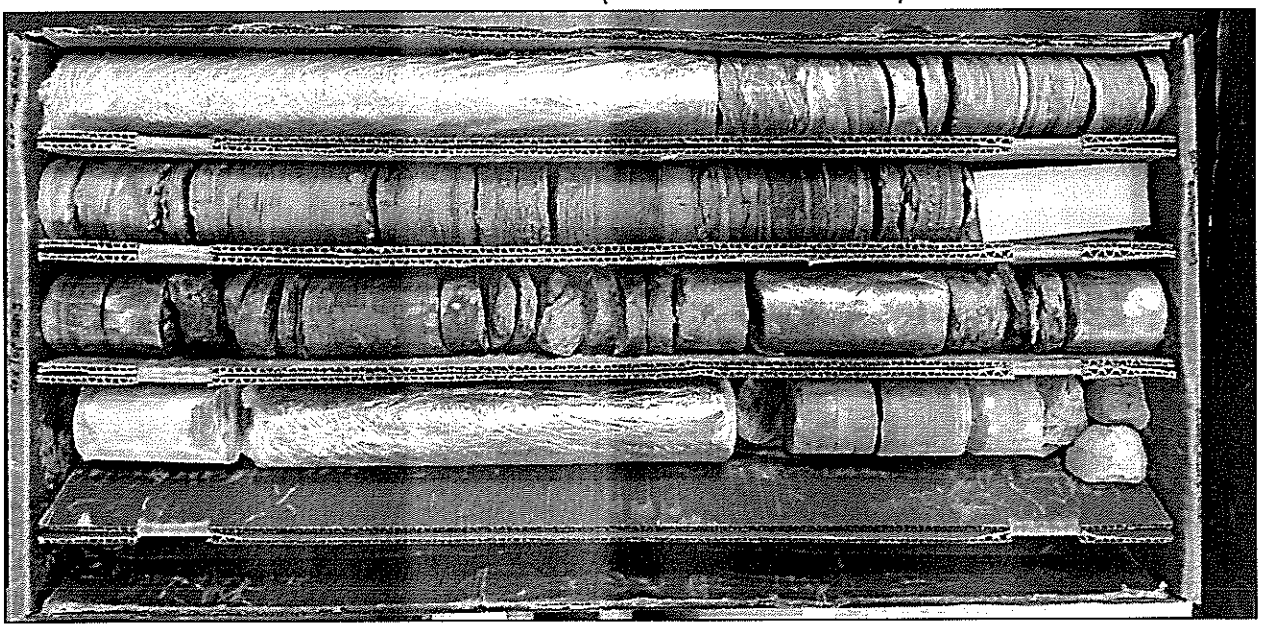
	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray (Soft, Moderately Weathered, Very Fine Grained, Laminated to Thinly Bedded, Some Cross Bedding) SHALE *(continued)*	-70	4	100	90	2	
		5	100	100	2	
		5	100	100	2	187.92
		5	100	100	2	
		5	100	100	1	
	-75	5	100	100	1	
		6	100	100	2	80.64
		6	100	100	2	
		6	100	100	2	
		6	100	100	2	
	375.00 -80	6	100	100	2	
END OF BORING AND ROCK CORE						
** Hole Filled Upon Completion	-85					

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

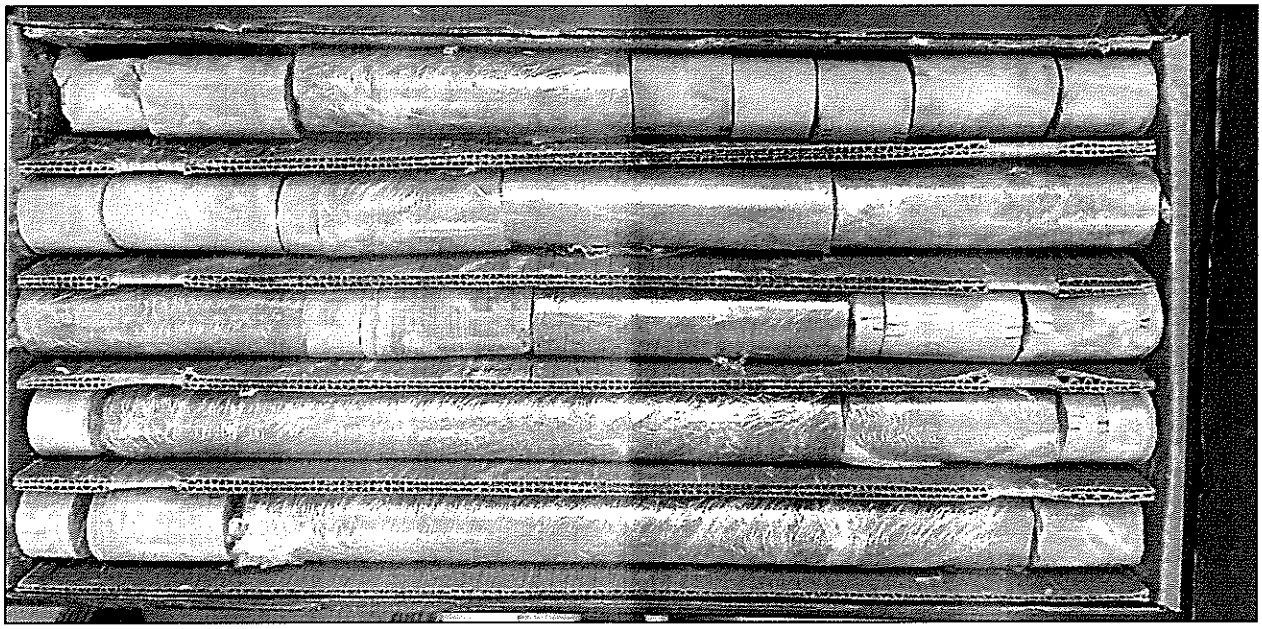
P-6 Pier 6: Station 733+18, 10 ft Right
Run 1: 49 – 55 ft (Elev. 406.0 – 400.0)



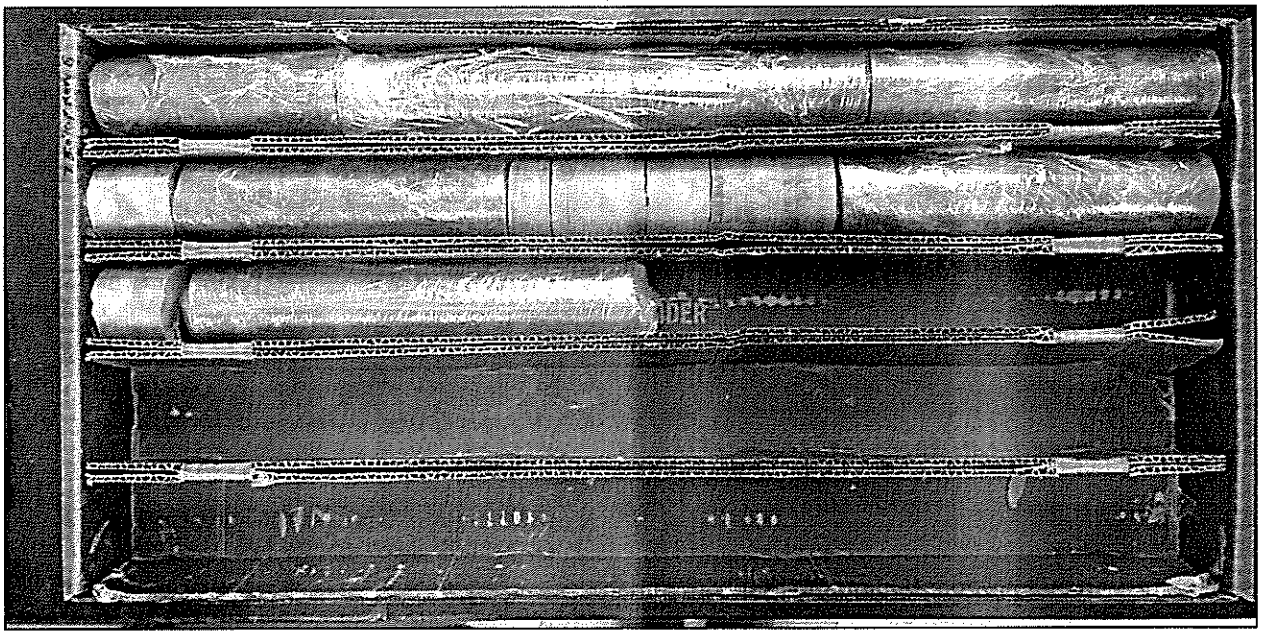
P-6 Pier 6: Station 733+18, 10 ft Right
Run 2: 55 – 60 ft (Elev. 400.0 – 395.0)
Run 3: 60 – 65 ft (Elev. 395.0 – 390.0)

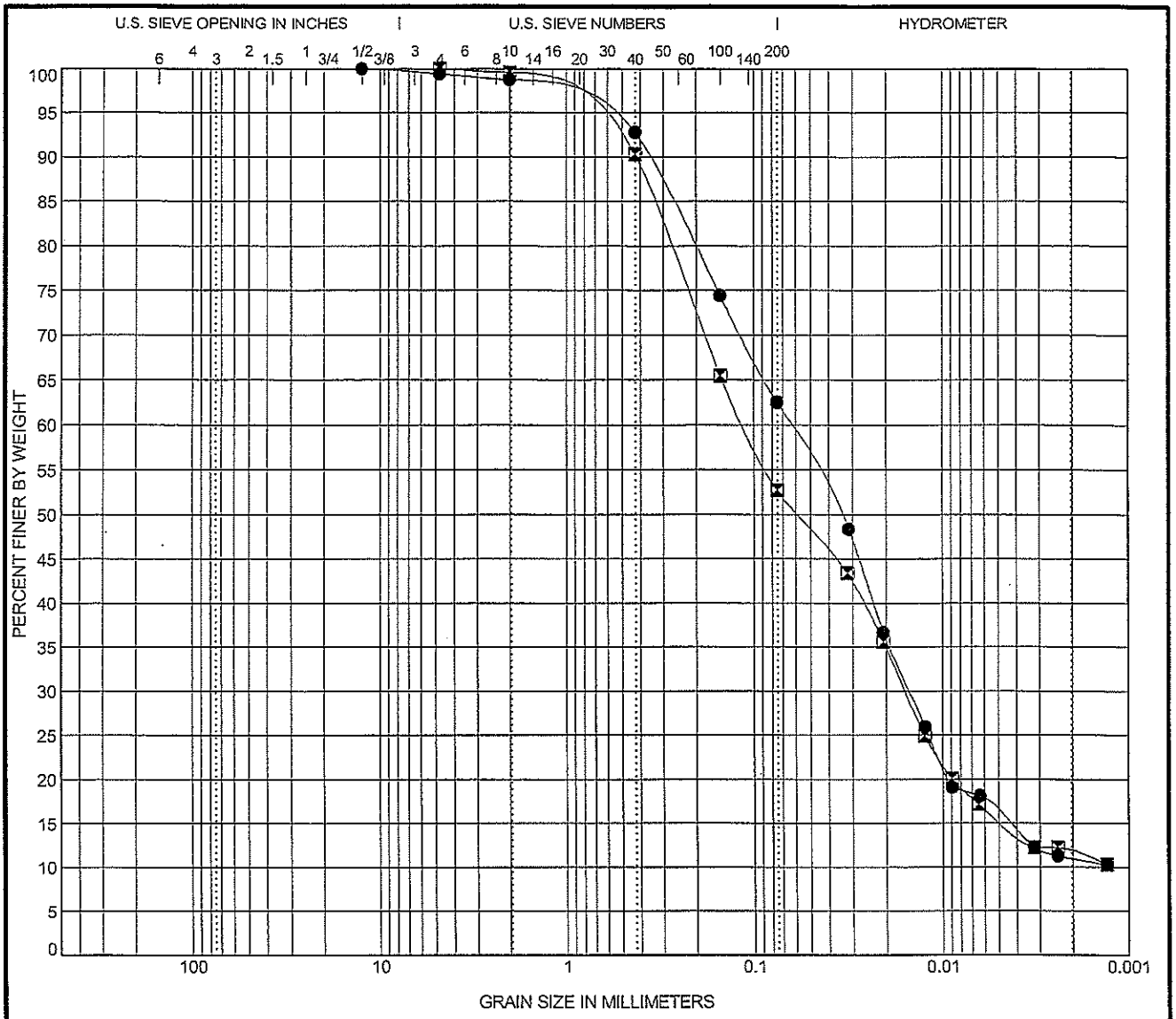


P-6 Pier 6: Station 733+18, 10 ft Right
Run 4: 65 – 70 ft (Elev. 390.0 – 385.0)
Run 5: 70 – 75 ft (Elev. 385.0 – 380.0)



Pier 6 Pier 6: Station 733+18, 10 ft Right
Run 6: 75 – 80 ft (Elev. 380.0 – 375.0)





COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	P-6	11.50	A-4 (0) SILTY LOAM	19.9	17.4	2.5		
⊠	P-6	26.50	A-4 (0) LOAM	20.4	17.2	3.2		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	P-6	11.50	12.5	0.064	0.015		1.2	36.2	51.5	11.0
⊠	P-6	26.50	4.75	0.111	0.016		0.4	46.9	41.1	11.6

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR, 7BR-1
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 10/30/17

10/30/2017 1:40:17 PM
EV0000
Illinois Department of Transportation
Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-6, 11.5

Reading	Soil Tare	Percent Finer
12.5	0	100
4.75	2.2	99.46433
2	2.9	98.75822
0.425	3.035	92.78403
0.15	9.328	74.42249
0.075	6.05	62.51347

10/30/2017 1:40:22 PM
EV0000
Illinois Department of Transportation
Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\clinton\structures\014-0025.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID,Depth, P-6, 26.5

Reading	Soil Tare	Percent Finer
4.75	0	100
?	1.7	99.59753
.425	4.707	90.27753
.15	12.542	65.44398
.075	6.422	52.72823

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/16/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB A
Station 724+72
Offset 15.00ft Right
Ground Surface Elev. 452.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 431.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	5			Brown CLAY with Trace Asphalt Fragments
	6	--	--	
	8			
449.0				
	3			Brown and Gray Silt LOAM A-4(4) See Class @ 4 ft
	3	3.00	20	
-5	5	P		
	3			Gray
	5	0.25	23	
	4	B		
	1			
	2	0.16	24	
-10	2	B		
	3			
	3	1.02	24	
	5	B		
	3			
	3	1.00	23	
-15	5	S		
	2			
	3	0.37	23	
	2	B		
	1			
	2	0.16	24	
-20	2	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	3			Brown and Gray Silt LOAM A-4(4) See Class @ 4 ft *(continued)* Brown
430.0				
	2	0.41	24	Gray Loamy SAND
	2	B		
429.0				
	1			Brown and Gray Sandy CLAY
	2	0.25	26	
-25	3	P		
	WH			Gray
	WH	0.78	34	
	2	B		Trace Gravel
424.0				
	WH			Gray Sandy LOAM
	2	0.25	35	
-30	2	P		
420.0				
	2			Gray Sandy Clay LOAM
	3	0.78	24	
-35	2	B		
	WH			
	WH	0.90	25	
-40	3	B		

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, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/16/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB A
Station 724+72
Offset 15.00ft Right
Ground Surface Elev. 452.0 ft

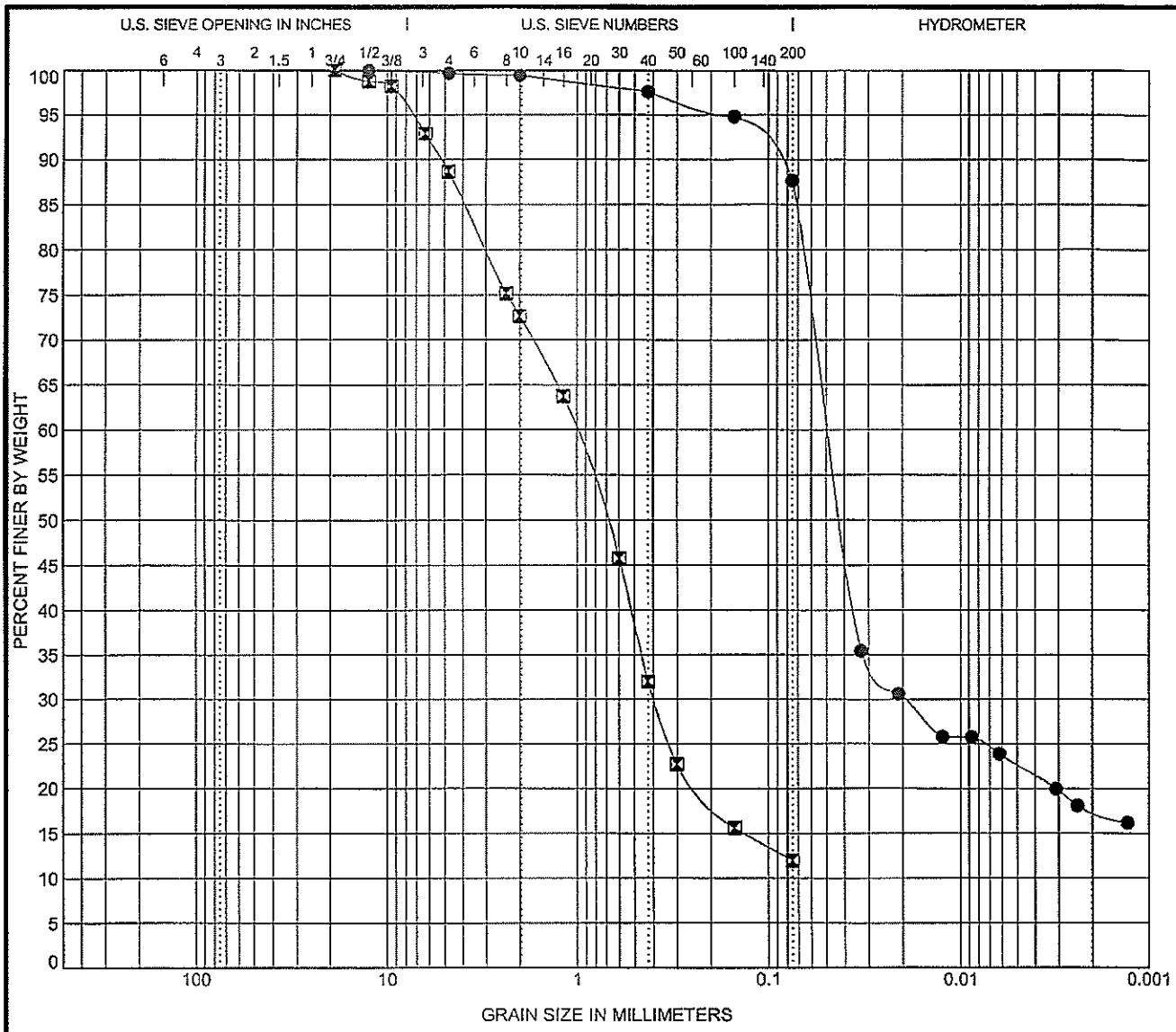
Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 431.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Sandy Clay LOAM *(continued)*			
410.0			
Dark Gray SAND with Some Gravel See Gradation @ 44 ft	8		
	8	NC	16
-45	8		
405.0			
Brown and Gray CLAY with Trace Gravel	7		
	13	4.83	22
-50	15	B	
400.0			
Dark Gray SHALE	50/4"		
	-	4.50	15
-55	-	P	
	50/2"		
	-	–	21
-60	-		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Dark Gray SHALE *(continued)*			
388.3	50/2"	3.50 P	19
END OF BORING			
-65			
** Hole Filled Upon Completion			
-70			
-75			
-80			

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

BBS, from 137 (Rev. 8-99)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB A	4.00	A-4 (4) SILTY LOAM	25.5	20.3	5.2		
⊠	SB A	44.00	SAND				2.95	19.99

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB A	4.00	12.5	0.048	0.02		0.6	11.8	70.1	17.5
⊠	SB A	44.00	19	1.027	0.394		27.4	60.7	12.0	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/18/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB B
Station 725+63
Offset 15.00ft Right
Ground Surface Elev. 453.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	4			Brown and Gray Silt LOAM A-4(2) See Class @ 4 ft
	7 8	2.65 S	16	
	3			
	4 6	2.07 S	20	
-5				
	3			Gray
	6 6	2.30 S	19	
445.0				
	1			Gray Silty CLAY
	1 1	0.25 B	29	
-10				
442.5				
	3			Brown and Gray CLAY
	3 4	0.69 S	22	
440.0				
	2			Brown and Gray Silty CLAY
	3 5	0.86 B	25	
-15				
▼	2			
	2 2	0.53 B	24	
	2			
	2 2	0.41 B	24	
-20				
432.5				Brown and Gray Silty CLAY *(continued)*
	1			Brown and Gray Clay LOAM
	2 2	0.41 B	26	
	WH			
	WH WH	0.12 B	31	
-25				
427.5				
	3			Gray Sandy Clay LOAM
	3 3	0.41 B	27	
	WH			
	2 2	0.75 P	27	
-30				
421.0				
				Gray SAND See Gradation @ 34 ft
	WH			
	1 4	NC	20	
-35				
	7			
	1 19	NC	22	
-40				

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/18/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB B
Station 725+63
Offset 15.00ft Right
Ground Surface Elev. 453.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray SAND See Gradation @ 34 ft *(continued)*				
411.0				
Gray Sandy CLAY with Trace Gravel		2		
		4 6	1.64 B	24
	-45			
406.0				
Gray SHALE		34		
		50/3" -	1.83 S	18
	-50			
402.0				
Borehole continued with rock coring.				
	-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
Illinois Department of Transportation

ROCK CORE LOG

Date 5/18/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD

STRUCT. NO. 014-0025 (E) / 014-0080 (P) CORING BARREL TYPE & SIZE

Station

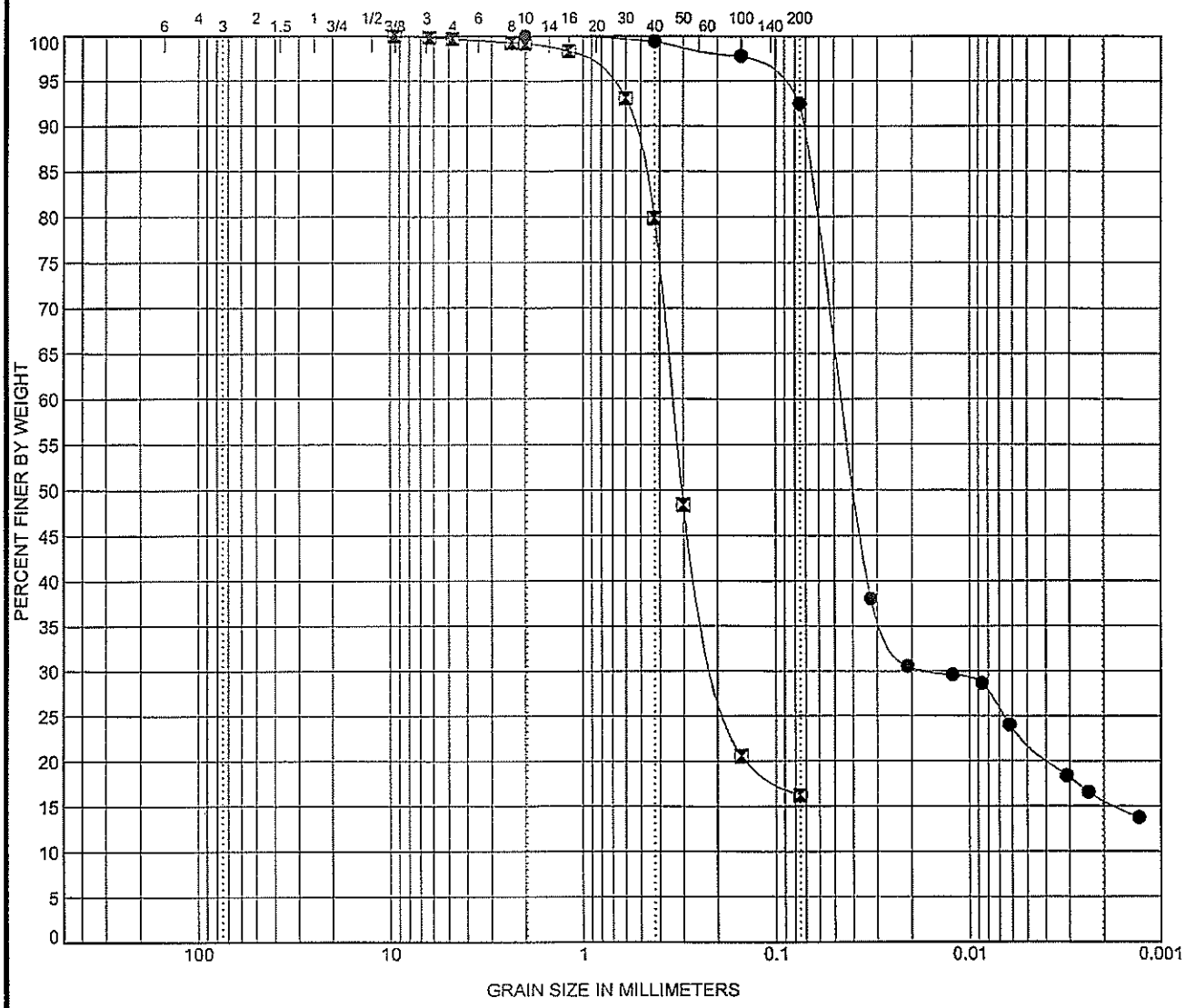
Core Diameter 2 in
Top of Rock Elev. 402.00 ft
Begin Core Elev. 402.00 ft

BORING NO. SB B
Station 725+63
Offset 15.00ft Right
Ground Surface Elev. 453.0 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
402.00					
Gray to Dark Gray, Soft, Slightly to Moderately Weathered, Aphanitic to Finely Crystalline, Banded to Medium Beddded, SHALE	1	100	70	2	
	1	100	70	2	
	1	100	70	2	
	1	100	70	1	
-55					
	1	100	70	1	
Soft to Moderately Hard, Slightly Weathered	2	90	73	2	
	2	90	73	2	
	2	90	73	2	
	2	90	73	1	
-60					
	2	90	73	2	
392.00					
END OF BORING AND ROCK CORE					
** Hole Filled Upon Completion					
-65					
-70					

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

BBS, form 138 (Rev. 8-99)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB B	4.00	A-4 (2) SILTY LOAM	24.6	21.7	2.9		
⊠	SB B	34.00	SAND					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB B	4.00	2	0.045	0.015		0.0	7.5	76.7	15.7
⊠	SB B	34.00	9.5	0.341	0.19		0.8	83.0	16.2	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/18/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB C
Station 726+37
Offset 15.00ft Right
Ground Surface Elev. 453.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				Brown CLAY with Asphalt Fragments
452.0	4			
	6	2.44	17	Brown and Gray Silt LOAM
	8	S		A-4(1)
				See Class @ 4 ft
	4			
	6	3.50	18	Gray
-5	6	P		
448.0				
	2			Gray Silt LOAM
	3	1.42	19	A-4(2)
	4	B		See Class @ 6.5 ft
	3			
	4	1.57	21	
-10	4	S		
442.0	2			
	2	0.65	25	Gray Silt LOAM
	3	B		
440.5				
	2			Gray Silty CLAY
	2	0.86	26	
-15	2	B		
438.0				
▼	1			Brown and Gray Silt LOAM
	2	0.41	27	
	2	B		
	WH			
	1	1.25	29	
-20	3	P		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
				Brown and Gray Silt LOAM *(continued)*
	2			
	2	0.82	23	
	4	B		Trace Gravel
430.5				
	2			Brown and Gray Loamy SAND
	3	NC	21	See Gradation @ 24 ft
-25	3			
428.0				
	2			Brown and Gray Sandy Clay LOAM
	1	0.45	25	
	2	B		
425.5				
	1			Brown and Gray Clay LOAM
	2	0.41	26	
-30	1	B		
421.5				
	2			Gray Loamy SAND
	1	0.50	21	See Gradation @ 34 ft
-35	4	P		
416.5				
	5			Gray Sandy Clay LOAM
	5	0.86	28	
-40	5	B		

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
Illinois Department of Transportation

SOIL BORING LOG

Date 5/18/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB C
Station 726+37
Offset 15.00ft Right
Ground Surface Elev. 453.5 ft

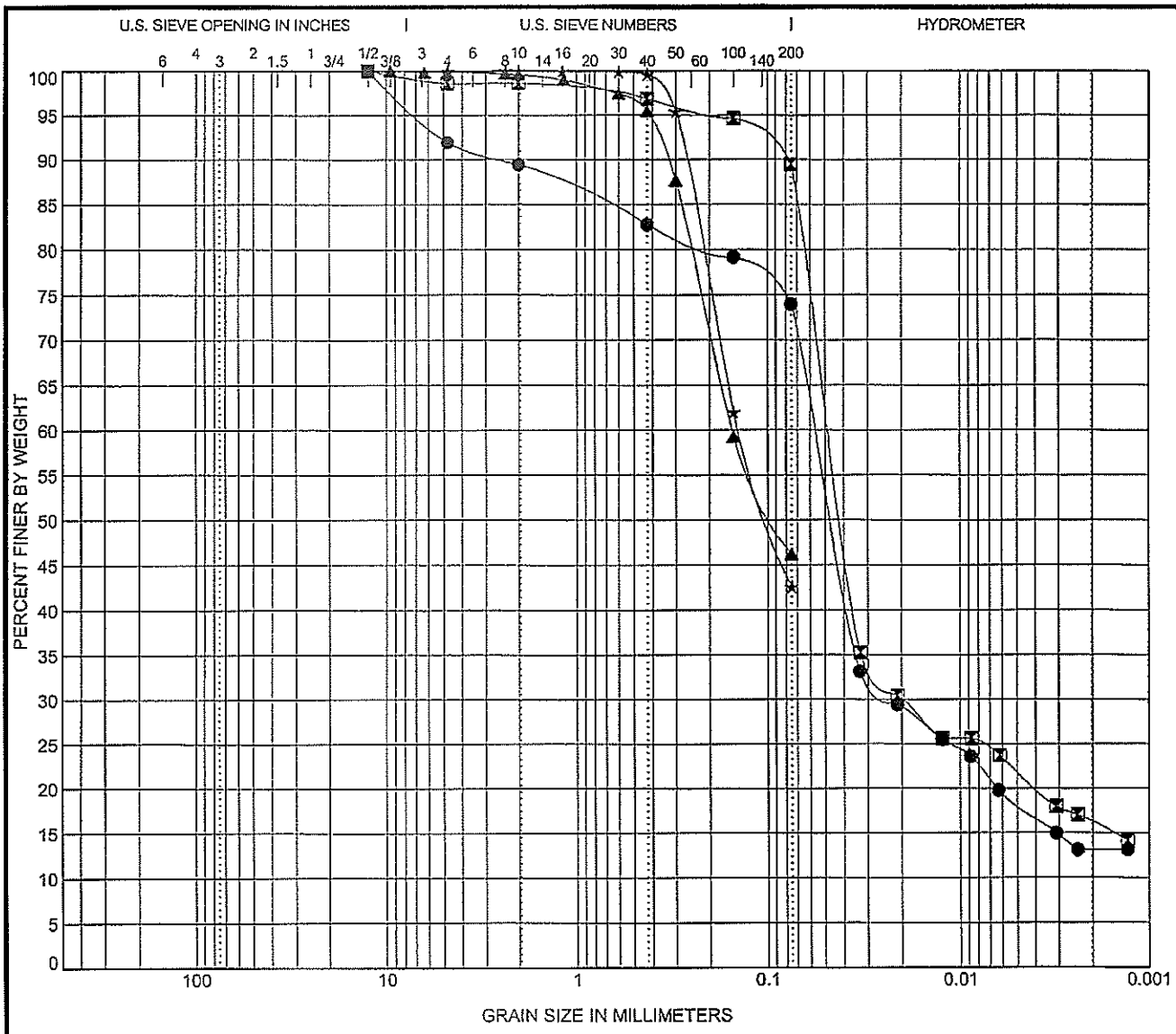
Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 437.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	Gray Sandy Clay LOAM *(continued)*		
	4		
	3	0.70	23
-45	6	B	
407.0			
	Gray SHALE		
	50/4"		
	-	4.50	13
-50	-	P	
	50/3"		
	-	1.60	15
-55	-	S	
394.8	50/2"	–	20
	END OF BORING		
	** Hole Filled Upon Completion		
-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)

BBS, from 137 (Rev. 8-99)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB C	4.00	A-4 (1) SILTY LOAM	23.7	19.6	4.1		
⊠	SB C	6.50	A-4 (2) SILTY LOAM	25.2	21.9	3.3		
▲	SB C	24.00						
★	SB C	34.00						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB C	4.00	12.5	0.057	0.023		10.6	15.5	60.8	13.1
⊠	SB C	6.50	12.5	0.048	0.02		1.4	9.1	73.3	16.2
▲	SB C	24.00	9.5	0.153			0.4	53.3	46.2	
★	SB C	34.00	4.75	0.14			0.0	57.4	42.5	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/22/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station
BORING NO. SB D
Station 729+23
Offset 23.00ft Left
Ground Surface Elev. 454.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 439.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Asphalt 454.0
				Concrete PCC 453.0
	6			Brown and Gray Silt LOAM
	7	2.70	18	A-4(5)
	9	S		See Class @ 4 ft
	4			
	5	2.75	20	Gray
-5	3	P		
				449.0
	1			Gray Silty CLAY
	1	0.82	26	
	1	B		
	WH			
	WH	0.25	26	
-10	WH	B		
				444.0
	2			Brown and Gray CLAY
	2	1.61	21	
	2	S		
	2			
	3	1.15	23	
-15	3	B		
▼				
	2			
	2	0.92	23	
	2	S		
				436.5
	2			Brown and Gray Silty CLAY
	2	0.61	22	
-20	3	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				Brown and Gray Silty CLAY 434.0 *(continued)*
	5			Brown and Gray Clay LOAM
	4	0.78	23	
	3	B		
	2			
	3	0.98	18	
-25	4	B		
				429.0
	4			Brown and Gray CLAY with Trace Gravel
	5	2.25	29	
	4	B		
				426.5
	2			Brown and Gray Clay LOAM
	2	0.86	27	
-30	3	B		
				423.0
				Gray Sandy Clay LOAM
	3			
	4	0.46	26	
-35	6	S		
	2			
	2	0.70	24	
-40	3	B		

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
Illinois Department of Transportation

SOIL BORING LOG

Date 5/22/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB D
Station 729+23
Offset 23.00ft Left
Ground Surface Elev. 454.5 ft

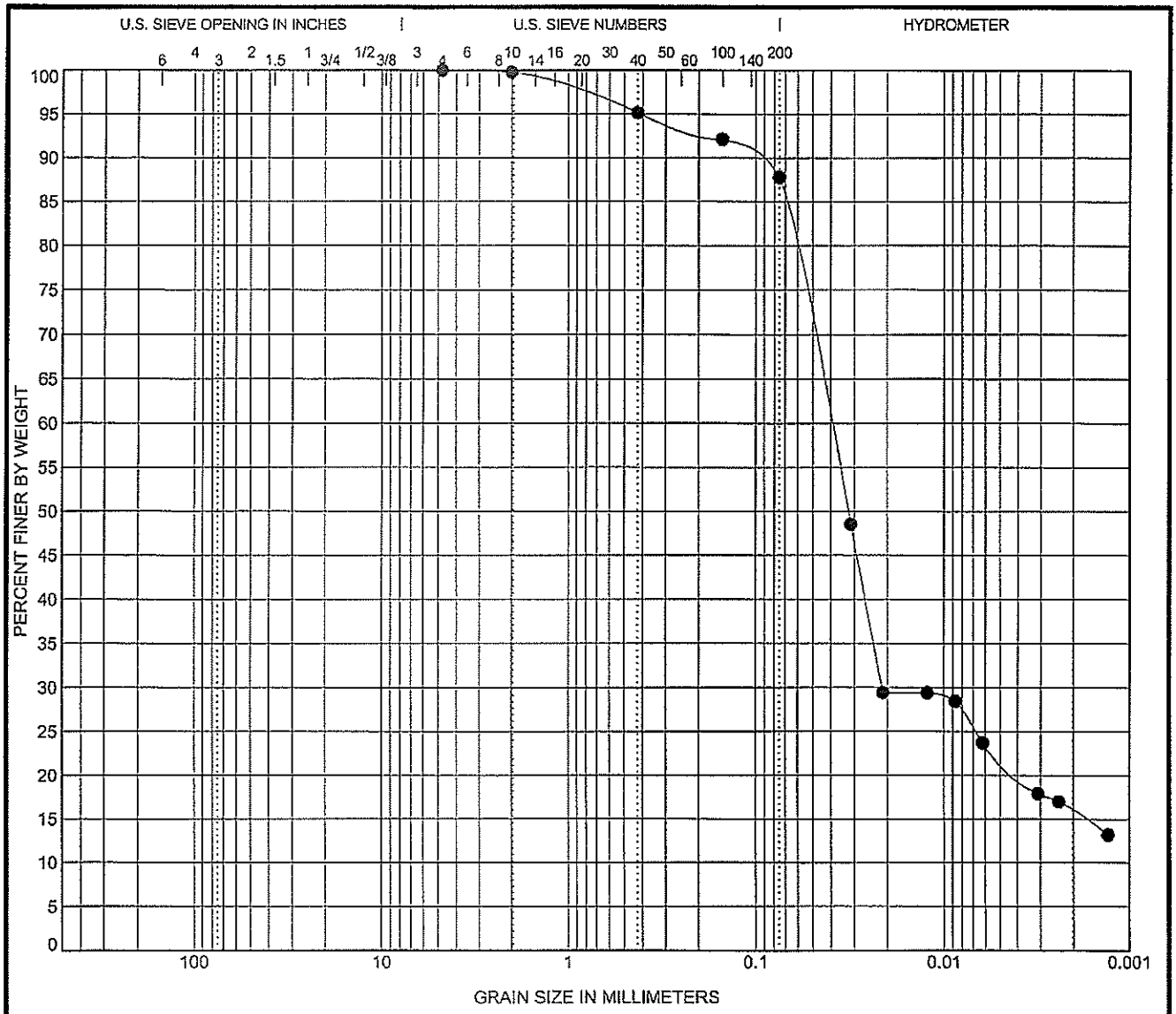
Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 439.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Sandy Clay LOAM *(continued)*			
413.0			
Gray Loamy SAND with Trace Gravel			
	7		
	7	0.75	19
-45	8	P	
407.0			
Gray SHALE			
	35		
	50/3"	3.91	14
-50	-	S	
400.7	50/4"	3.00	21
		P	
END OF BORING			
-55			
** Hole Filled Upon Completion			
-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)

BBS, from 137 (Rev. 8-99)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB D	4.00	A-4 (5) SILTY LOAM	27.5	20.1	7.4		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB D	4.00	4.75	0.04	0.021		0.2	12.0	71.9	15.9

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-16-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 6/5/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB E
Station 731+00
Offset 23.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 435.3 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Concrete PCC 454.5			
Suspended Augers			
-5			
445.3			
-10 Brown and Gray Silt LOAM A-4(7) See Class @ 11.5 ft	1		
	1	0.29	30
	1	B	
442.0			
Brown and Gray Silt Loam A-4(3) See Class @ 14 ft	2		
	2	0.20	21
-15	3	B	
439.5			
Brown and Gray Clay LOAM	2		
	1	0.20	25
	1	B	
437.0			
Brown and Gray CLAY with Trace Gravel	1		
	1	0.20	28
▼ -20	2	B	
434.5			
Brown and Gray Sandy Clay LOAM with Trace Gravel	1		
	1	0.25	23
	1	P	
432.0			
Gray Sandy LOAM with Trace Gravel	3		
	2	0.25	24
-25	1	P	
429.5			
Gray Loamy SAND with Trace Coal	3		
	1	NC	26
	3		
	2		
425.5	1	1.09	23
-30	1	B	
Gray Clay LOAM with Trace Gravel	2		
	1	1.27	23
	3	B	
422.0			
Gray Sandy CLAY	3		
	2	1.02	24
-35	2	B	
419.5			
Gray SAND with Trace Gravel See Gradation @ 36.5 ft	10		
	13	NC	16
	15		
417.0			
Gray Sandy Clay LOAM	6		
	7	3.00	20
-40	9	P	

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
Illinois Department of Transportation

SOIL BORING LOG

Date 6/5/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB E
Station 731+00
Offset 23.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 435.3 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Sandy Clay LOAM *(continued)*			
	3		
	4	2.50	22
-45	4	P	
408.0			
Gray SHALE			
406.0	50/5"	4.50	15
		P	
Borehole continued with rock coring.			
-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)

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 6/5/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton CORING METHOD

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

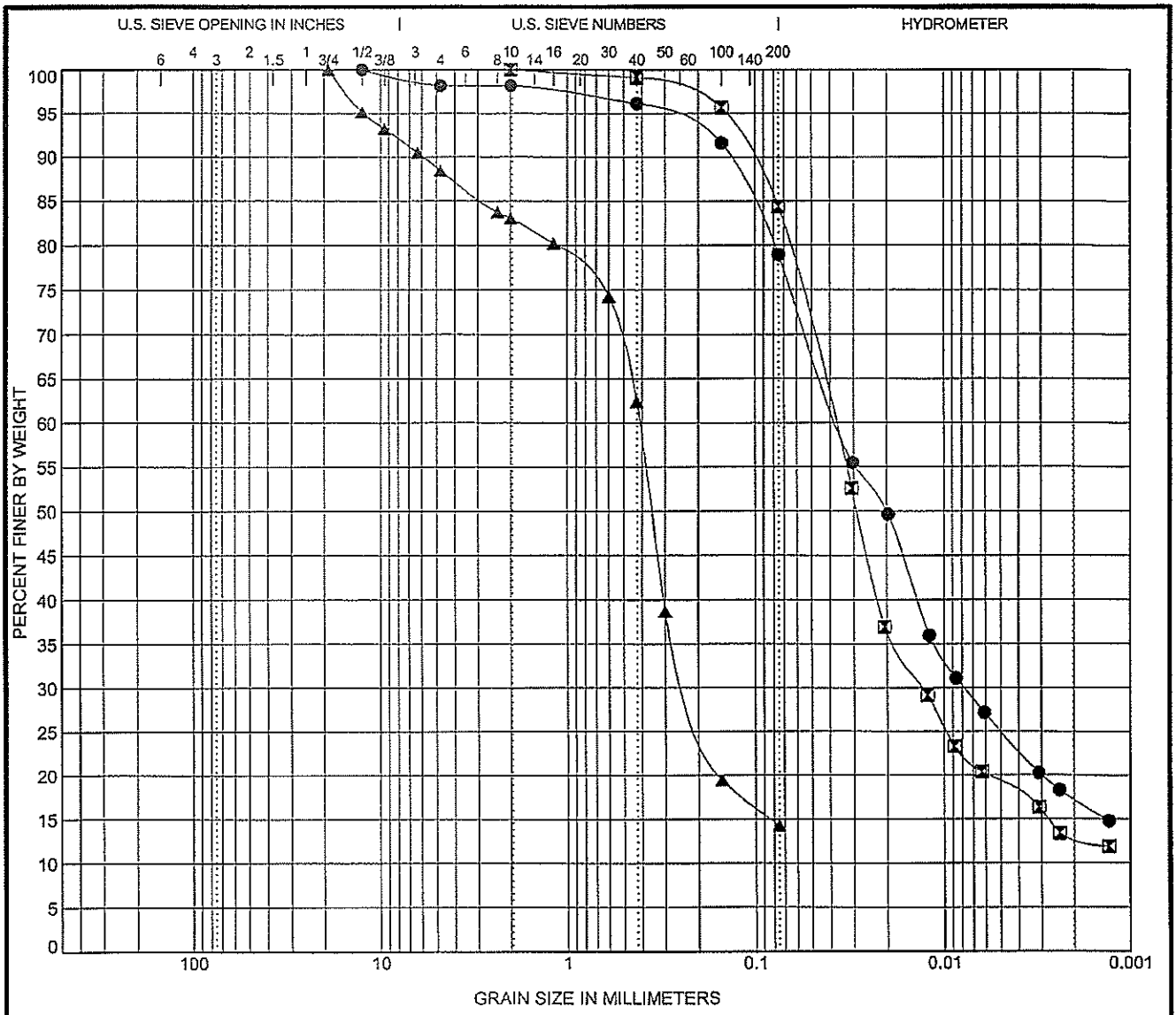
CORING BARREL TYPE & SIZE

Core Diameter 2 in
Top of Rock Elev. 406.00 ft
Begin Core Elev. 406.00 ft

BORING NO. SB E
Station 731+00
Offset 23.00ft Left
Ground Surface Elev. 455.0 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
406.00						
No Recovery - Possible Shale Washout	-50	1	20	0	18	
402.00						
Dark Gray and White LIMESTONE Fragments and Gravel - Likely Fall In	401.50					
Dark Gray, Very Soft to Soft, Slightly to Moderately Weathered, Aphanitic, Banded to Medium Bedded, Dense to Pitted, SHALE	-55	2	93	65	12	
Trace Coal and Pyrite Fragments						
Banded to Thick Bedded	-60	3	86	57	10	
392.50						
END OF BORING AND ROCK CORE						
** Hole Filled Upon Completion	-65					

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



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB E	11.50	A-4 (7) SILTY LOAM	29.8	20.5	9.3		
⊠	SB E	14.00	A-4 (3) SILTY LOAM	26.0	20.7	5.3		
▲	SB E	36.50	SAND					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB E	11.50	12.5	0.036	0.008		1.8	19.2	61.7	17.3
⊠	SB E	14.00	2	0.038	0.013		0.0	15.6	71.4	12.9
▲	SB E	36.50	19	0.41	0.22		17.0	68.8	14.3	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/24/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB F
Station 732+00
Offset 23.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 444.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
454.5				Concrete PCC
				Suspended Augers
-5				
445.0				
-10				
				Brown and Gray Silt LOAM A-4(4) See Class @ 11.5 ft
	1			
	2	0.37	22	
	2	B		
	1			
	1	0.61	24	
-15	2	B		
439.5				
				Brown and Gray Silt LOAM A-4(1) See Class @ 16.5 ft
	WH			
	WH	0.04	25	
	1	B		
	WH			
	WH	0.25	26	
-20	WH	P		
				Brown and Gray Silt LOAM A-4(1) See Class @ 16.5 ft *(continued)*
	WH			
433.0				
	2	0.82	25	
	1	B		
432.0				Gray Loamy SAND
				Brown and Gray Sandy Clay LOAM
	WH			
	WH	0.25	29	
-25	WH	P		
429.5				
	1			Gray Loamy SAND with Trace Gravel See Gradation @ 26.5 ft
	1	0.50	19	
	2	P		
	1			
	1	NC	20	
-30	1			
424.5				
	3			Gray Sandy LOAM
	1	0.61	21	
	2	B		
	WH			
	2	0.82	20	
-35	2	B		
419.5				
	WH			Gray SAND with Some Gravel See Gradation @ 36.5 ft
	8	NC	21	
	8			
	3			
	3	NC	20	
-40	1			

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
Illinois Department of Transportation

SOIL BORING LOG

Date 5/24/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY ACE (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

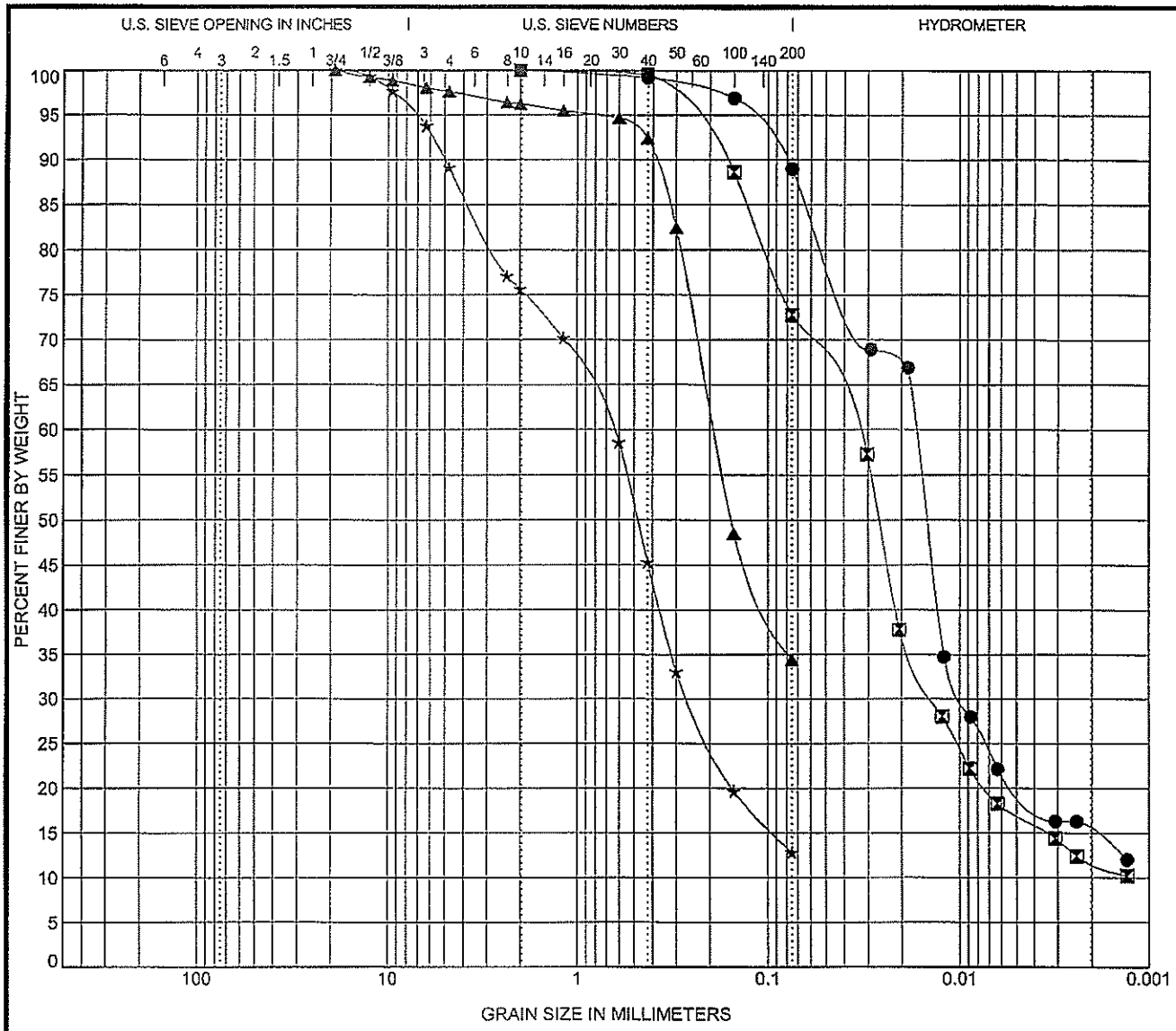
BORING NO. SB F
Station 732+00
Offset 23.00ft Left
Ground Surface Elev. 455.0 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 444.0 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray SAND with Some Gravel See Gradation @ 36.5 ft *(continued)*			
	9		
	7	NC	19
-45	12		
408.5			
Dark Gray SHALE			
Black Coal	50		
	-	4.50	22
-50	-	P	
401.3	50/2"	4.50 P	18
END OF BORING ** Hole Filled Upon Completion			
-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)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB F	11.50	A-4 (4) SILTY LOAM	25.9	20.3	5.6		
⊠	SB F	16.50	A-4 (1) SILTY LOAM	22.0	18.3	3.7		
▲	SB F	26.50						
★	SB F	36.50	SAND					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB F	11.50	2	0.017	0.01		0.0	11.0	74.0	15.0
⊠	SB F	16.50	2	0.036	0.014		0.0	27.2	61.0	11.8
▲	SB F	26.50	19	0.19			3.8	61.8	34.4	
★	SB F	36.50	19	0.651	0.256		24.4	62.8	12.8	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-16-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/31/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CLM (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB G
Station 733+70
Offset 23.00ft Left
Ground Surface Elev. 454.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 444.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
454.0				Concrete PCC
				Suspended Augers
-5				
-10				
444.0				
	2			Brown Silt LOAM A-4(4)
	2 2	0.37 B	32	See Class @ 14.5 ft Some Gravel
	3			
-15	2 2	0.90 B	24	
	WH			Brown and Gray
	1 1	0.33 B	28	
436.0				
	1			Brown and Gray Silt LOAM
-20	1	--	28	
	1			Brown and Gray Silt LOAM *(continued)*
433.5				
	WH			Gray Loamy SAND
	WH WH	NC	22	
431.0				
	WR			Brown and Gray Silt LOAM with Some Gravel
-25	WR WR	--	29	
428.5				
	1			Gray Sandy LOAM
427.0	1 1	--	25	
426.0				Gray Sandy CLAY
	WH			Gray Sandy LOAM
-30	3 3	--	29	
422.0				
	4			Gray Loamy SAND See Gradation @ 34.5 ft
-35	5 13	NC	21	
	6			
414.5 -40	10	NC	17	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
Illinois Department of Transportation

SOIL BORING LOG

Date 5/31/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CLM (TSi)

SECTION 7BR, 7BR-1 LOCATION SW 1/4, SEC. 10, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB G
Station 733+70
Offset 23.00ft Left
Ground Surface Elev. 454.5 ft

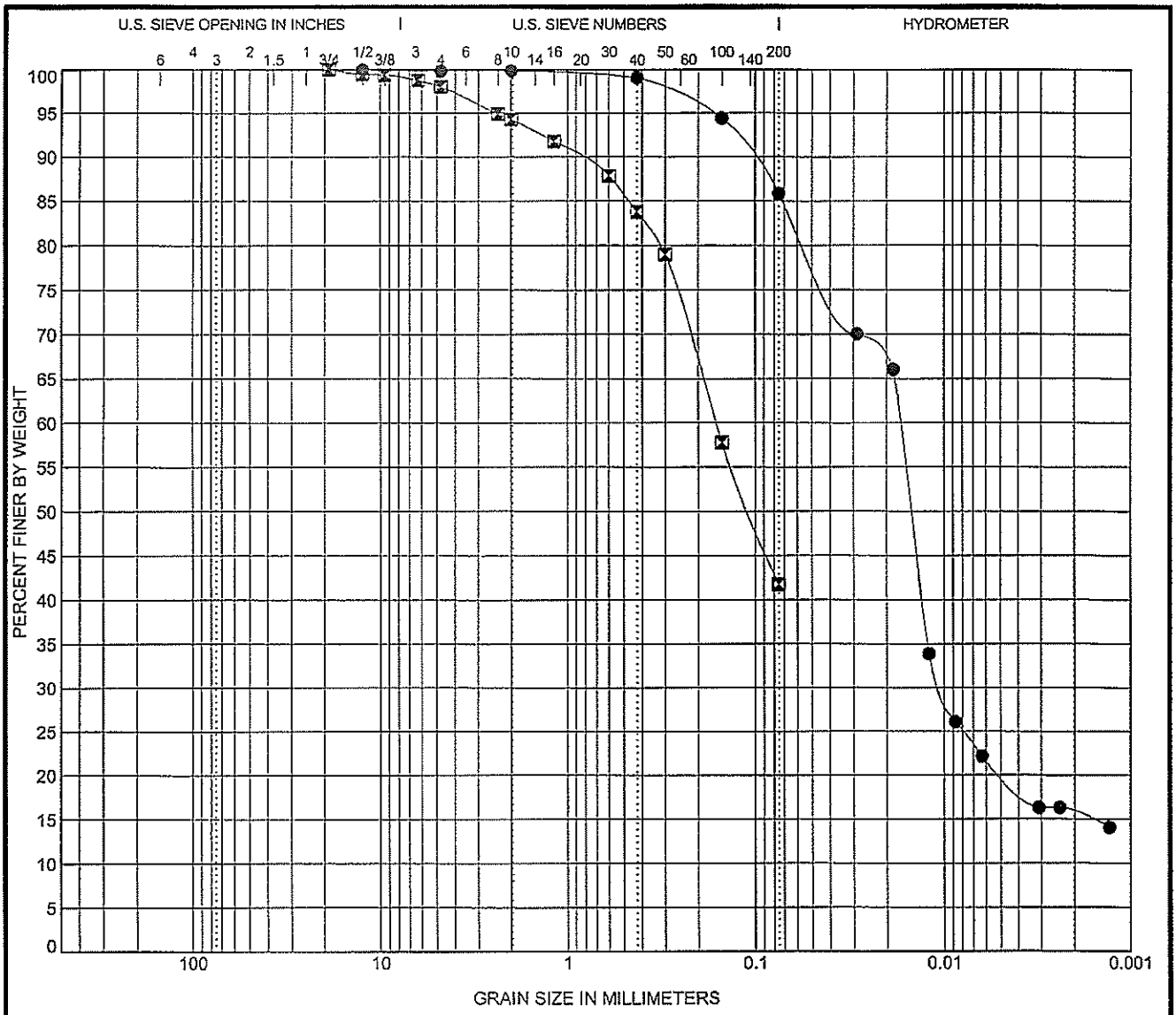
Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 444.5 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	30		
Gray SHALE			
	50		
-45	- -	3.79 S	15
405.4	50/1"	–	19
END OF BORING			
** Hole Filled Upon Completion			
-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)

BBS, from 137 (Rev. 8-99)



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● SB G	14.50	A-4 (4) SILTY LOAM	27.3	20.9	6.4		
⊠ SB G	34.50						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● SB G	14.50	12.5	0.017	0.01		0.2	14.0	70.2	15.6
⊠ SB G	34.50	19	0.162			5.7	52.5	41.7	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-16-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 6/2/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY FH (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB H
Station 734+43
Offset 10.00ft Right
Ground Surface Elev. 454.2 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 443.7 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray CLAY		1		
452.7		2	0.45	26
Brown and Gray Silt LOAM A-4(3) See Class @ 4 ft		4	B	
		4		
	-5	4	0.20	23
		3	B	
448.7				
Gray CLAY		3		
447.7		3	0.20	29
Brown Silt LOAM		2	B	
446.2				
Brown and Gray LOAM A-4(0) See Class @ 9 ft		2		
		3	0.12	20
	-10	5		
▼				
		2		
Brown		2	0.16	28
		1	B	
		1		
		1	0.25	20
Gray	-15	1	B	
438.7				
Brown and Gray Silty CLAY		2		
		2	0.25	26
		2	B	
436.2				
Gray CLAY		2		
		2	0.29	27
434.2	-20	2	B	

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Silty Clay LOAM		2		
		2	0.49	22
		3		
		2		
		3	1.43	21
	-25	4		
428.7				
Gray Sandy LOAM		5		
427.7		5	NC	21
Gray Sandy LOAM See Gradation @ 26.5 ft		5		
426.2				
Gray Sandy Clay LOAM		4		
		3	0.70	21
	-30	3	B	
423.7				
Gray Fissle SHALE				
		50/1"		
		-	--	--
	-35	-		
		50/1"		
	-40	-	--	--

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 6/2/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY FH (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

BORING NO. SB H
Station 734+43
Offset 10.00ft Right
Ground Surface Elev. 454.2 ft

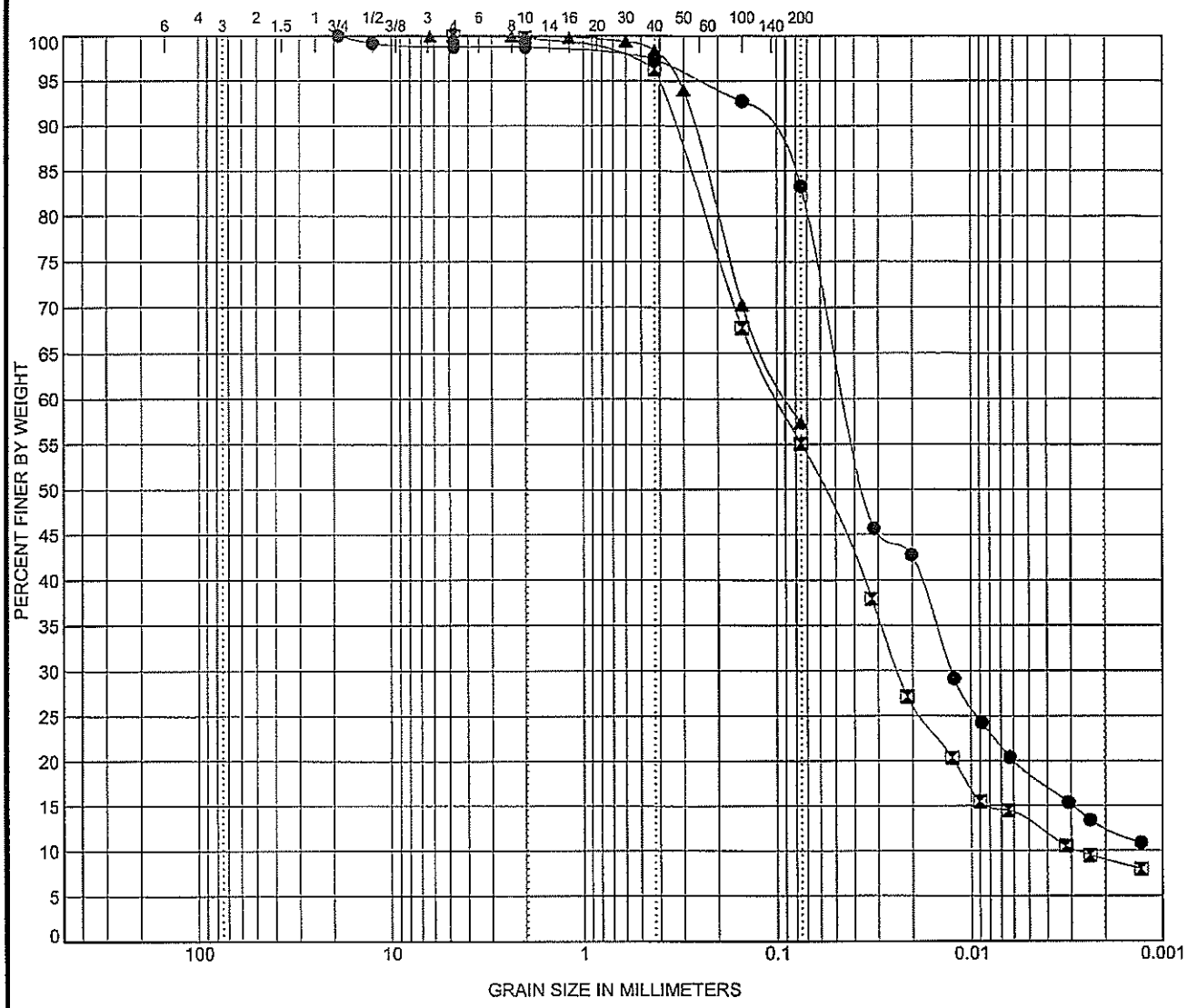
Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 443.7 ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Fissle SHALE *(continued)* 413.7		-		
END OF BORING				
** Hole Filled Upon Completion	-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)

BBS, from 137 (Rev. 8-99)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB H	4.00	A-4 (3) SILTY LOAM	24.0	18.5	5.5		
⊠	SB H	9.00	A-4 (0) LOAM	19.5	16.7	2.8	2.09	35.45
▲	SB H	26.50						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB H	4.00	19	0.044	0.013		1.3	15.5	70.6	12.7
⊠	SB H	9.00	4.75	0.098	0.024	0.003	0.2	44.7	46.0	9.0
▲	SB H	26.50	6.3	0.086			0.1	42.5	57.4	

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 805
Section: 7BR
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 6/1/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CLM (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station
BORING NO. SB I
Station 735+35
Offset 15.00ft Right
Ground Surface Elev. 453.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter None Recorded ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Concrete PCC 453.0			
No Samples Taken			
-5			
446.0	WH		
GRAVEL	1	NC	10
444.5	1		
	1		
Brown LOAM with Trace Gravel	1	–	23
-10 A-4(2)	1		
See Class @ 11.5 ft			
	2		
Brown and Gray	3	–	19
	3		
	2		
	3	0.86	23
-15	4	B	
	3		
	1	–	19
	2		
-20			
Brown LOAM with Trace Gravel (continued) 432.5			
Gray Silt LOAM			
430.5	2		
	1	0.37	30
Gray SAND	3	B	
429.0	2		
-25	1	0.37	26
Gray Silty Clay LOAM with Some Organic Material	2	B	
426.5			
Gray Silt LOAM	2		
	1	0.49	23
	2	B	
-30			
	1		
	2	–	23
	3		
421.5			
Gray CLAY	2		
	1	0.61	23
	2	B	
419.0			
-35			
Gray Sandy CLAY	2		
	3	0.86	23
	4	B	
	2		
	3	0.74	25
	4	B	
414.0			
Gray SHALE with Clay -40			

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 6/1/17

ROUTE FAP 805 DESCRIPTION IL 161 over Crooked Creek LOGGED BY CLM (TSi)

SECTION 7BR, 7BR-1 LOCATION NW 1/4, SEC. 15, TWP. 1N, RNG. 1W, 3 PM

COUNTY Clinton DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 014-0025 (E) / 014-0080 (P)
Station

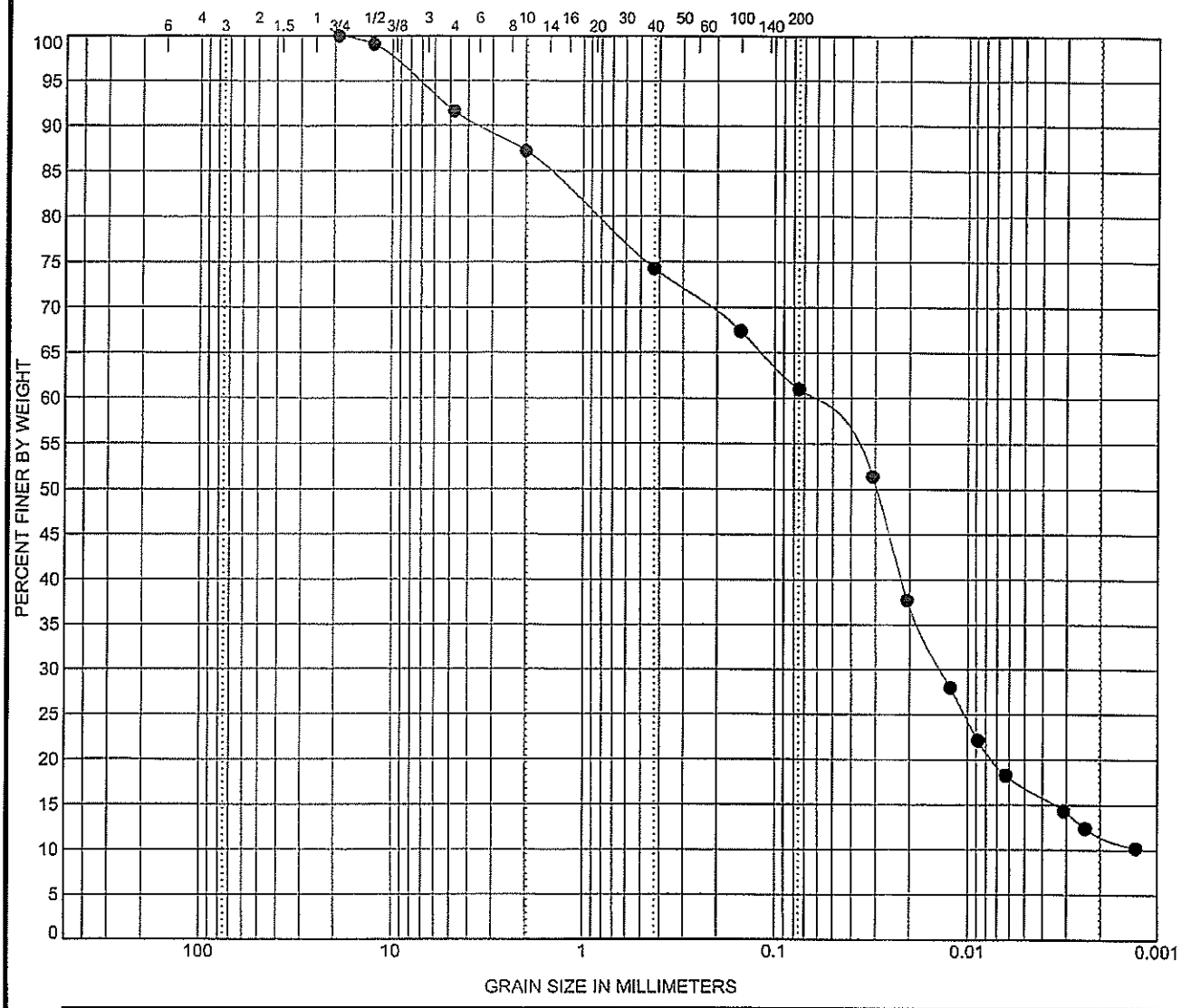
BORING NO. SB I
Station 735+35
Offset 15.00ft Right
Ground Surface Elev. 453.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter None Recorded ft
Upon Completion Not Taken ft
After ** Hrs. Not Taken ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray SHALE with Clay *(continued)*			
	50/1"		
	- -	---	19
-45			
407.4	50/1"	–	17
END OF BORING			
** Hole Filled Upon Completion			
-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)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB I	11.50	A-4 (2) LOAM	27.3	20.4	6.9		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB I	11.50	19	0.069	0.014		12.8	26.2	49.2	11.7

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

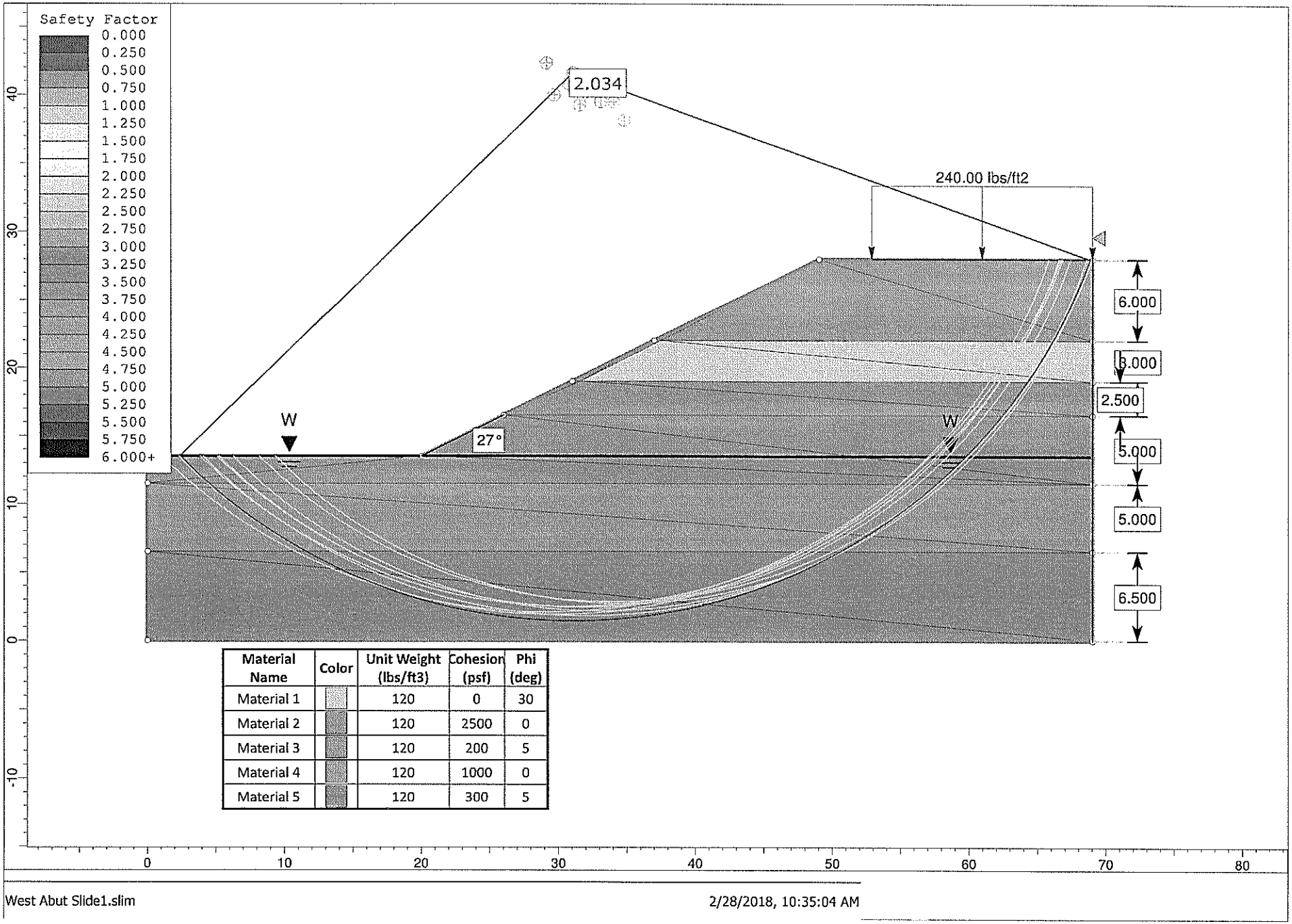
Route: FAP 805

Section: 7BR

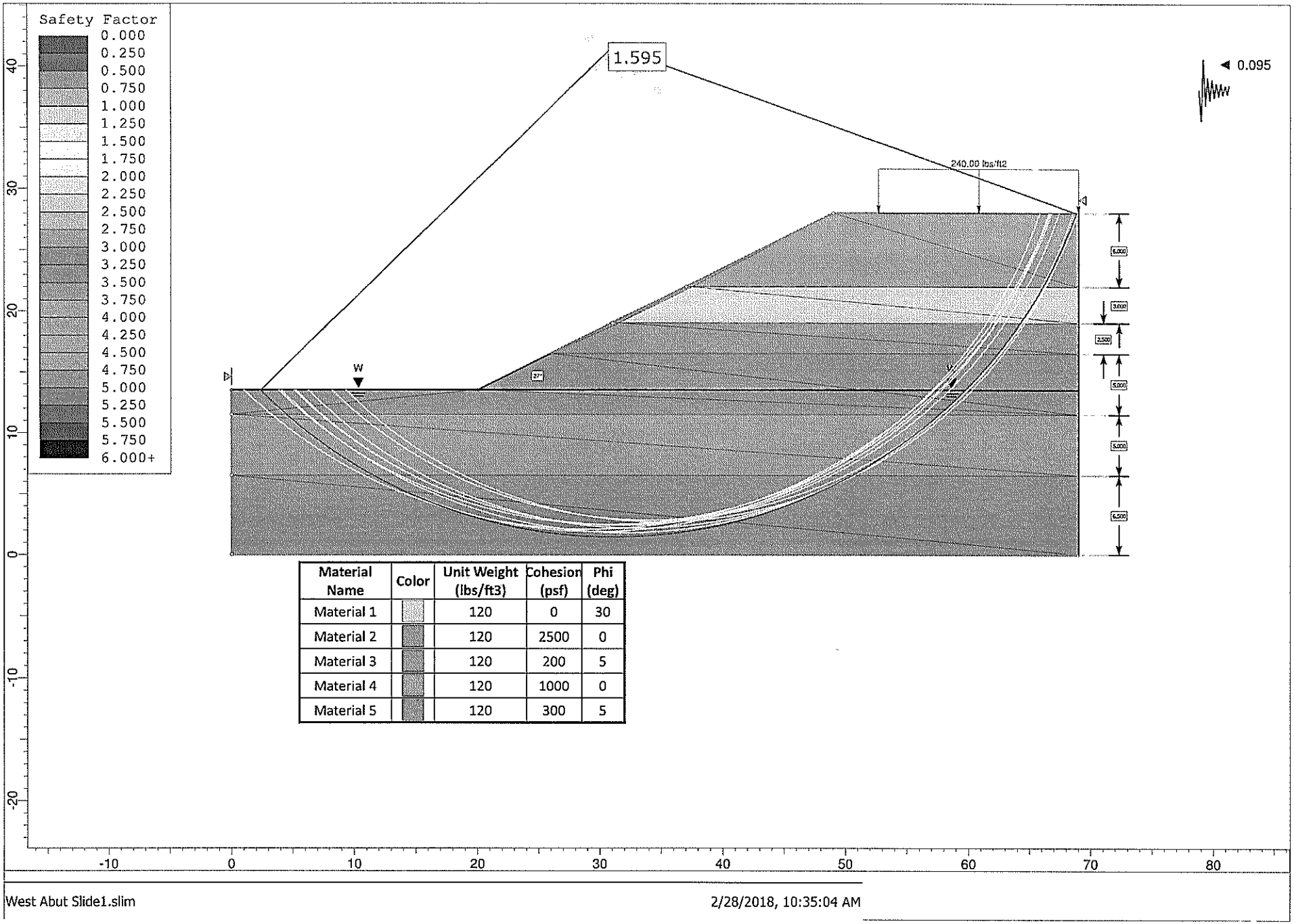
County: Clinton

GRAIN_SIZE_IDH_3-18-11 014-0025.GPJ IL_DOT.GDT 6/19/17

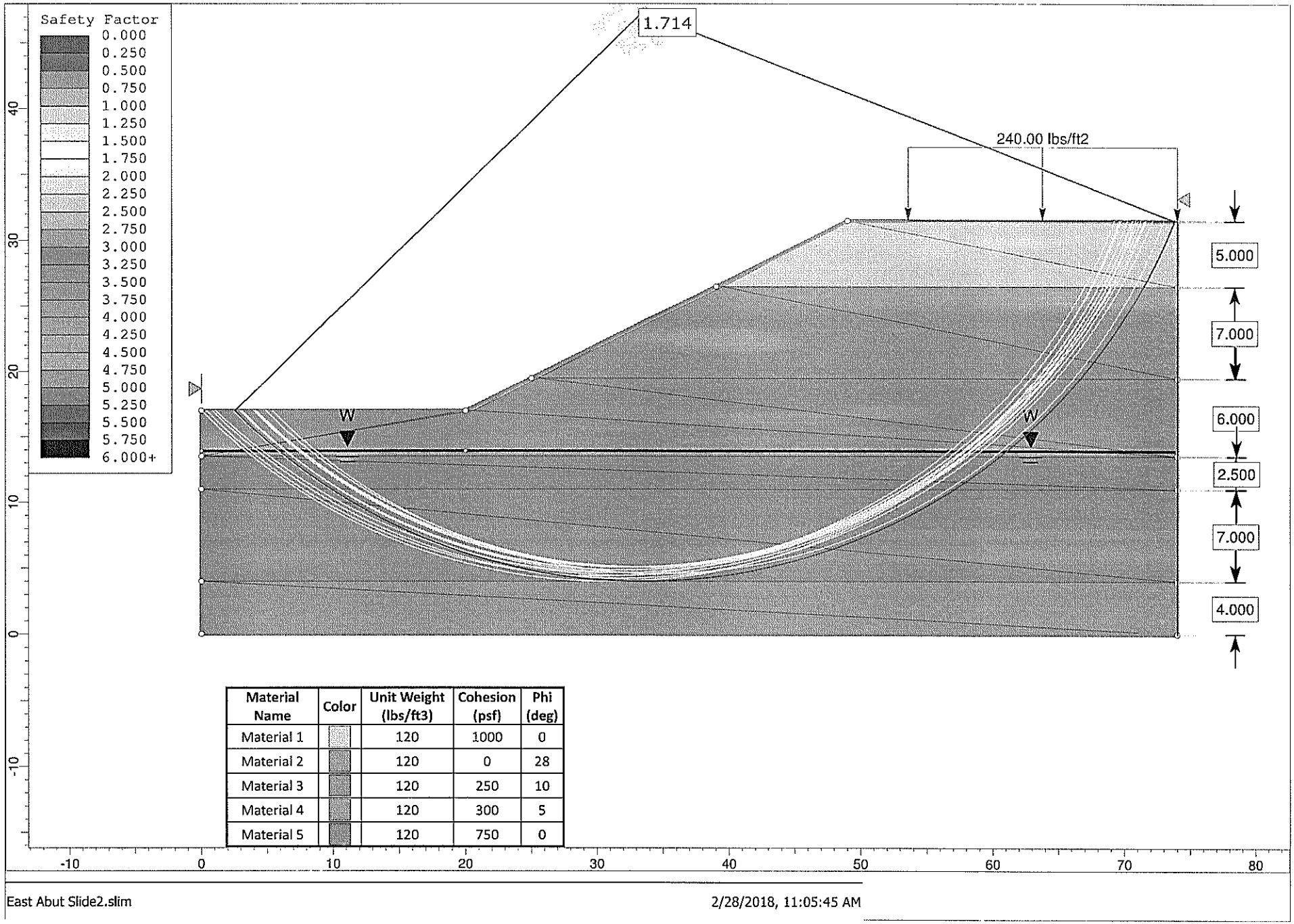
Appendix D Slope Stability Results



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Material 1		120	0	30
Material 2		120	2500	0
Material 3		120	200	5
Material 4		120	1000	0
Material 5		120	300	5



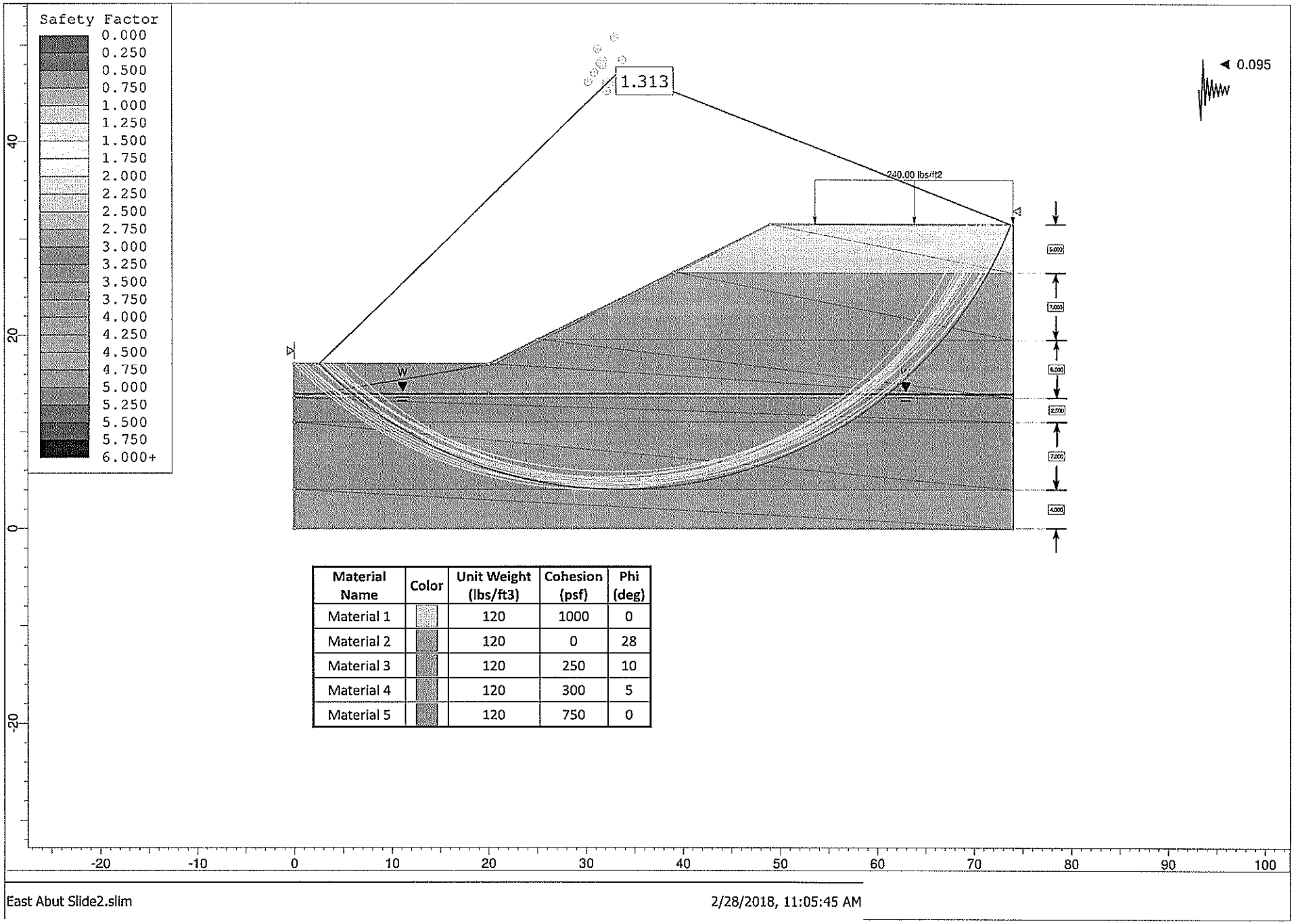
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Material 1		120	0	30
Material 2		120	2500	0
Material 3		120	200	5
Material 4		120	1000	0
Material 5		120	300	5



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Material 1		120	1000	0
Material 2		120	0	28
Material 3		120	250	10
Material 4		120	300	5
Material 5		120	750	0

East Abut Slide2.slim

2/28/2018, 11:05:45 AM



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Material 1		120	1000	0
Material 2		120	0	28
Material 3		120	250	10
Material 4		120	300	5
Material 5		120	750	0

Appendix E FGU Seismic Site Class Spreadsheet

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	E	
Top of Boring Elev.	445.3	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	19 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	44 (Blows/ft.)	Soil Site Class D	<—Controls
s_u (bar):	2.63 (ksf)	Soil Site Class C	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	442.0	3.30	2	0.29	B
	439.5	2.50	5	0.20	B
	437.0	2.50	2	0.20	B
	434.5	2.50	3	0.20	B
0.5	432.0	2.50	2	0.25	B
3.0	429.5	2.50	3	0.25	B
7.0	425.5	4.00	4		B
10.5	422.0	3.50	4	1.27	B
13.0	419.5	2.50	4	1.02	B
15.5	417.0	2.50	28		B
20.0	412.5	4.50	16	3.00	
24.5	408.0	4.50	8	2.50	B
100.0	332.5	75.50	100	5.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	F	
Top of Boring Elev.	445	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	14 (Blows/ft.)	Soil Site Class E	
N_{ch} (bar):	52 (Blows/ft.)	Soil Site Class C	
s_u (bar):	2.07 (ksf)	Soil Site Class C	<—Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	442.0	3.00	4	0.37	
	439.5	2.50	3	0.61	B
	437.0	2.50	1	0.04	
	434.5	2.50	1	0.25	B
0.5	432.0	2.50	3	0.82	B
3.0	429.5	2.50	1	0.25	B
5.5	427.0	2.50	3	0.50	
8.0	424.5	2.50	2		B
10.5	422.0	2.50	3	0.61	
13.0	419.5	2.50	4	0.82	B
15.5	417.0	2.50	16		
19.0	413.5	3.50	4		
24.0	408.5	5.00	19		B
31.2	401.3	7.20	75	4.50	B
100.0	332.5	68.80	100	5.00	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	G	
Top of Boring Elev.	444	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	19 (Blows/ft.)	Soil Site Class D	<—Controls
N_{ch} (bar):	19 (Blows/ft.)	Soil Site Class D	
s_u (bar):	(ksf)	NA, H < 0.1*H (Soil)	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	441.0	3.00	4	0.37	
	438.5	2.50	4	0.90	
	436.0	2.50	2	0.33	B
	433.5	2.50	2		B
1.5	431.0	2.50	2		B
4.0	428.5	2.50	2		B
6.5	426.0	2.50	2		B
10.5	422.0	4.00	6		B
18.0	414.5	7.50	18		B
100.0	332.5	82.00	100	5.00	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	H	
Top of Boring Elev.	454.2	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	45 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	79 (Blows/ft.)	Soil Site Class C	
s_u (bar):	3.26 (ksf)	Soil Site Class C	<—Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	451.2	3.00	6	0.45	
	448.7	2.50	7	0.20	B
	446.2	2.50	5	0.20	B
	443.7	2.50	8	0.12	
	441.2	2.50	3	0.16	
	438.7	2.50	2	0.25	B
	436.2	2.50	4	0.25	
	433.7	2.50	4	0.29	
1.3	431.2	2.50	5	0.49	
3.8	428.7	2.50	7	1.43	B
6.3	426.2	2.50	10		B
8.8	423.7	2.50	6	0.70	B
18.8	413.7	10.00	75	4.50	B
100.0	332.5	81.20	100	5.00	R

Global Site Class Definition: Substructures 1 through 5

N (bar):	22 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	56 (Blows/ft.)	Soil Site Class C	<—Controls
s_u (bar):	2.6 (ksf)	Soil Site Class C	

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====

Substructure 5

Base of Substruct. Elev. (or ground surf for bents)	449.2	ft.
Pile or Shaft Dia.	14	inches
Boring Number	I	
Top of Boring Elev.	446	ft.
Approximate Fixity Elev.	442.2	ft.

Individual Site Class Definition:

N (bar): 14 (Blows/ft.) Soil Site Class E

N_{ch} (bar): NA (Blows/ft.) NA

s_u (bar): 1.37 (ksf) Soil Site Class D <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	444.5	1.50	2		B
	442.5	2.00	2		
2.2	440.0	2.50	6		
6.2	436.0	4.00	7	0.86	
11.7	430.5	5.50	3		B
13.2	429.0	1.50	4	0.37	B
15.7	426.5	2.50	3	0.37	B
18.2	424.0	2.50	3	0.49	
20.7	421.5	2.50	5		B
23.2	419.0	2.50	3	0.61	B
25.7	416.5	2.50	7	0.86	
28.2	414.0	2.50	7	0.74	B
100.0	342.2	71.80	100	5.00	R

Substructure 6

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA

N_{ch} (bar): (Blows/ft.) NA

s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Substructure 7

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA

N_{ch} (bar): (Blows/ft.) NA

s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Substructure 8

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA

N_{ch} (bar): (Blows/ft.) NA

s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	446.91	ft.
Pile or Shaft Dia.	14	inches
Boring Number	A	
Top of Boring Elev.	452	ft.
Approximate Fixity Elev.	439.91	ft.

Individual Site Class Definition:

N (bar):	13 (Blows/ft.)	Soil Site Class E	
N_{ch} (bar):	71 (Blows/ft.)	Soil Site Class C	
s_u (bar):	1.38 (ksf)	Soil Site Class D	<—Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	449.0	3.00	14		B
	446.5	2.50	8	3.00	
	444.0	2.50	9	0.25	
	441.5	2.50	4	0.16	
0.9	439.0	2.50	8	1.02	
3.4	436.5	2.50	8	1.00	
5.9	434.0	2.50	5	0.37	
8.4	431.5	2.50	4	0.16	
10.9	429.0	2.50	4	0.41	B
13.4	426.5	2.50	5	0.25	
15.9	424.0	2.50	2	0.78	B
19.9	420.0	4.00	4	0.25	B
24.9	415.0	5.00	5	0.78	
29.9	410.0	5.00	3	0.90	B
34.9	405.0	5.00	16		B
39.9	400.0	5.00	28	4.83	B
100.0	339.9	60.10	100	5.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	B	
Top of Boring Elev.	453	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	20 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	56 (Blows/ft.)	Soil Site Class C	
s_u (bar):	1.88 (ksf)	Soil Site Class D	<—Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	450.0	3.00	15	2.65	
	447.5	2.50	10	2.07	
	445.0	2.50	12	2.30	B
	442.5	2.50	2	0.25	B
	440.0	2.50	7	0.69	B
	437.5	2.50	8	0.86	
	435.0	2.50	4	0.53	
	432.5	2.50	4	0.41	B
2.5	430.0	2.50	4	0.41	
5.0	427.5	2.50	2	0.12	B
7.5	425.0	2.50	6	0.41	
11.5	421.0	4.00	4	0.75	B
16.5	416.0	5.00	5		
21.5	411.0	5.00	20		B
26.5	406.0	5.00	10	1.64	B
100.0	332.5	73.50	100	5.00	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	#1	
Top of Boring Elev.	454.2	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	13 (Blows/ft.)	Soil Site Class E	
N_{ch} (bar):	31 (Blows/ft.)	Soil Site Class D	<—Controls
s_u (bar):	1.67 (ksf)	Soil Site Class D	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	450.2	4.00	15		B
	447.7	2.50	11	1.49	
	445.2	2.50	12	1.49	
	440.2	5.00	4	0.65	
	436.2	4.00	8	0.98	B
1.3	431.2	5.00	3		B
6.3	426.2	5.00	2	0.23	
11.3	421.2	5.00	3	0.49	
16.3	416.2	5.00	5	0.49	B
29.3	403.2	13.00	8		B
100.0	332.5	70.70	100	5.00	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	D	
Top of Boring Elev.	454.5	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar):	26 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	NA (Blows/ft.)	NA	
s_u (bar):	2.03 (ksf)	Soil Site Class C	<—Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	453.0	1.50	7		B
	451.0	2.00	16	2.70	
	449.0	2.00	8	2.75	B
	446.5	2.50	2	0.82	
	444.0	2.50	1	0.25	B
	441.5	2.50	4	1.61	
	439.0	2.50	6	1.15	
	436.5	2.50	4	0.92	B
	434.0	2.50	5	0.61	B
1.0	431.5	2.50	7	0.78	
3.5	429.0	2.50	7	0.98	B
6.0	426.5	2.50	9	2.25	B
9.5	423.0	3.50	5	0.86	B
14.5	418.0	5.00	10	0.46	
19.5	413.0	5.00	5	0.70	B
25.5	407.0	6.00	15	0.75	B
100.0	332.5	74.50	100	5.00	R

Global Site Class Definition: Substructures 1 through 5

N (bar):	18 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	59 (Blows/ft.)	Soil Site Class C	
s_u (bar):	1.92 (ksf)	Soil Site Class D	<—Controls

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====

Substructure 5

Base of Substruct. Elev. (or ground surf for bents)	439.5	ft.
Pile or Shaft Dia.	14	inches
Boring Number	E	
Top of Boring Elev.	445.3	ft.
Approximate Fixity Elev.	432.5	ft.

Individual Site Class Definition:

N (bar): 19 (Blows/ft.) Soil Site Class D

N_{ch} (bar): 44 (Blows/ft.) Soil Site Class D <—Controls

s_u (bar): 2.63 (ksf) Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	442.0	3.30	2	0.29	B
	439.5	2.50	5	0.20	B
	437.0	2.50	2	0.20	B
	434.5	2.50	3	0.20	B
0.5	432.0	2.50	2	0.25	B
3.0	429.5	2.50	3	0.25	B
7.0	425.5	4.00	4		B
10.5	422.0	3.50	4	1.27	B
13.0	419.5	2.50	4	1.02	B
15.5	417.0	2.50	28		B
20.0	412.5	4.50	16	3.00	
24.5	408.0	4.50	8	2.50	B
100.0	332.5	75.50	100	5.00	R

Substructure 6

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA

N_{ch} (bar): (Blows/ft.) NA

s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Substructure 7

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA

N_{ch} (bar): (Blows/ft.) NA

s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Substructure 8

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.
Approximate Fixity Elev.		ft.

Individual Site Class Definition:

N (bar): (Blows/ft.) NA

N_{ch} (bar): (Blows/ft.) NA

s_u (bar): (ksf) NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Appendix F Sample Liquefaction Results

LIQUEFACTION ANALYSIS

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER	B Pier 1	
ELEVATION OF BORING GROUND SURFACE	453.00	FT.
DEPTH TO GROUNDWATER - DURING DRILLING	12.60	FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE	3.10	FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As)	0.312	
EARTHQUAKE MOMENT MAGNITUDE	5.6	
FINISHED GRADE FILL OR CUT FROM BORING SURFACE	-9.50	FT. (Cut Depth)
HAMMER EFFICIENCY	73	%
BOREHOLE DIAMETER	8	IN.
SAMPLING METHOD	Sampler w/out Liners	

EQ MAGNITUDE SCALING FACTOR
(MSF) = 1.912

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = 417 FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.61
Source-To-Site Distance, R (km) = 17.4
Ground Motion Prediction Equations = CEUS
PGA = 0.240

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
450.5	2.5	15	2.65					0.133	0.333	31.729	31.729	0.671								
448	5	10	2.07					0.130	0.658	17.515	17.515	0.186								
446	7	12	2.3					0.132	0.922	19.684	19.684	0.212								
443.75	9.25	2	0.25					0.107	1.162	3.094	3.094	0.059								
441.25	11.75	7	0.69					0.117	1.455	10.654	10.654	0.119	0.117	0.263	0.263	1.500	0.341	0.971	0.197	N.L. (1)
440.4	12.6	8	0.86					0.120	1.557	12.064	12.064	0.132	0.120	0.365	0.365	1.500	0.378	0.959	0.195	N.L. (1)
438.75	14.25	8	0.86		12	25	25	0.057	1.651	12.105	12.105	0.132	0.057	0.459	0.562	1.454	0.367	0.934	0.232	N.L. (2)
436.25	16.75	4	0.53		12	24	24	0.052	1.781	6.047	6.047	0.080	0.052	0.589	0.848	1.303	0.200	0.892	0.260	N.L. (2)
433.75	19.25	4	0.41	30	10	24	24	0.049	1.903	6.004	11.637	0.128	0.049	0.712	1.127	1.302	0.318	0.846	0.271	1.173 (C)
431.25	21.75	4	0.41	30	10	26	26	0.049	2.026	5.930	11.551	0.127	0.049	0.834	1.405	1.252	0.304	0.795	0.272	1.118 (C)
428.75	24.25	2	0.12	30	10	31	31	0.037	2.118	2.936	8.096	0.097	0.037	0.927	1.654	1.199	0.222	0.743	0.269	0.825 (C)
426.25	26.75	6	0.41	30	10	27	27	0.049	2.241	8.648	14.689	0.157	0.049	1.049	1.932	1.201	0.361	0.690	0.258	1.399 (C)
423.75	29.25	4	0.75	30	10	27	27	0.056	2.381	5.633	11.208	0.124	0.056	1.189	2.228	1.148	0.272	0.639	0.243	1.119 (C)
418.75	34.25	5						0.055	2.656	6.723	6.723	0.085	0.055	1.464	2.815	1.081	0.177	0.545	0.213	0.831 (C)
413.75	39.25	20						0.067	2.991	27.012	27.012	0.339	0.067	1.799	3.462	1.057	0.685	0.471	0.184	N.L. (3)
408.75	44.25	10	1.64		10	24	24	0.065	3.316	12.077	12.077	0.132	0.065	2.124	4.099	1.000	0.252	0.418	0.164	1.537 (D)

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

LIQUEFACTION ANALYSIS

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/24/10

REFERENCE BORING NUMBER ========== P-3 Pier 3
ELEVATION OF BORING GROUND SURFACE ========== 455.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 14.60 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 3.10 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.312
EARTHQUAKE MOMENT MAGNITUDE ========== 5.6
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== -11.50 FT. (Cut Depth)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 8 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = 1.912

AVG. SHEAR WAVE VELOCITY (top 40')
$V'_{s,40'}$ = 354 FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.61
Source-To-Site Distance, R (km) = 17.4
Ground Motion Prediction Equations = CEUS
PGA = 0.240

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
440.5	14.5	5						0.111	1.610	7.667	7.667	0.093	0.111	0.333	0.333	1.494	0.266	0.938	0.190	N.L. (1)
438	17	3						0.051	1.737	4.593	4.593	0.069	0.051	0.461	0.610	1.357	0.179	0.881	0.237	0.755 (C)
435.5	19.5	2	0.41	35	5.9	24.3	25	0.049	1.860	3.037	8.645	0.101	0.049	0.583	0.889	1.334	0.259	0.821	0.254	1.020 (C)
433	22	2	0.49	35	10	40	41	0.051	1.987	2.994	8.593	0.101	0.051	0.711	1.172	1.276	0.246	0.758	0.254	0.969 (C)
430.5	24.5	3	0.57	35	10	40	35	0.053	2.120	4.407	10.269	0.116	0.053	0.843	1.461	1.240	0.274	0.695	0.244	1.123 (C)
428	27	2	0.86	50	10	20	20	0.057	2.262	2.872	8.446	0.100	0.057	0.986	1.759	1.185	0.226	0.635	0.230	0.983 (C)
425.5	29.5	3	0.86	50	10	29	29	0.057	2.405	4.206	10.048	0.114	0.057	1.128	2.058	1.157	0.251	0.578	0.214	1.173 (C)
420.5	34.5	9	0.86	50	10	22	22	0.057	2.690	12.028	19.434	0.208	0.057	1.413	2.655	1.125	0.449	0.481	0.183	2.454 (D)
415.5	39.5	7	0.74		10	22	22	0.056	2.970	8.937	8.937	0.104	0.056	1.693	3.247	1.052	0.209	0.409	0.159	1.314 (C)
410.5	44.5	10	0.78		10	22	22	0.056	3.250	12.219	12.219	0.133	0.056	1.973	3.839	1.018	0.259	0.359	0.142	1.824 (D)

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR $w_c/LL \leq 0.85$
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

LIQUEFACTION ANALYSIS

I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 5/24/10

REFERENCE BORING NUMBER ========== E. Abut
ELEVATION OF BORING GROUND SURFACE ========== 453.50 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ========== 13.10 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ========== 17.10 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.312
EARTHQUAKE MOMENT MAGNITUDE ========== 5.6
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ========== 4.00 FT. (Fill Height)
HAMMER EFFICIENCY========== 73 %
BOREHOLE DIAMETER========== 8 IN.
SAMPLING METHOD========== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = 1.912

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = 325 FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.61
Source-To-Site Distance, R (km) = 17.4
Ground Motion Prediction Equations = CEUS
PGA = 0.240

	BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
449.25	4.25	2						0.101	0.429	3.621	3.621	0.062	0.101	0.909	0.909	1.184	0.141	0.784	0.159	N.L. (1)
443.5	10	2						0.101	1.010	3.292	3.292	0.060	0.101	1.490	1.490	1.073	0.124	0.630	0.128	N.L. (1)
441.5	12	6						0.113	1.236	9.708	9.708	0.111	0.113	1.716	1.716	1.050	0.222	0.581	0.118	N.L. (1)
440.4	13.1	7	0.86					0.120	1.368	11.160	11.160	0.123	0.120	1.848	1.848	1.033	0.244	0.555	0.113	N.L. (1)
439	14.5	7	0.86		6.9	27.3	23	0.057	1.448	11.169	11 169	0.124	0.057	1.928	2.015	1.023	0.242	0.525	0.111	N.L. (2)
435	18.5	3						0.051	1.652	4.747	4.747	0.070	0.051	2.132	2.469	0.999	0.134	0.450	0.106	1.264 (C)
430	23.5	4	0.37		10	30	30	0.048	1.892	6.156	6.156	0.081	0.048	2.372	3.021	0.977	0.151	0.380	0.098	1.541 (C)
428.5	25	3	0.37		10	26	26	0.048	1.964	4.567	4.567	0.069	0.048	2.444	3.186	0.972	0.128	0.363	0.096	1.333 (C)
425	28.5	3	0.49		10	23	23	0.051	2.142	4.433	4.433	0.068	0.051	2.622	3.583	0.958	0.124	0.332	0.092	1.348 (C)
422.5	31	5						0.055	2.280	7.211	7.211	0.089	0.055	2.760	3.877	0.945	0.162	0.315	0.090	1.800 (C)
420	33.5	3	0.61		10	23	23	0.054	2.415	4.225	4.225	0.066	0.054	2.895	4.168	0.940	0.119	0.302	0.088	1.352 (C)
417.5	36	7	0.86		10	23	23	0.057	2.557	9.617	9.617	0.110	0.057	3.037	4.466	0.921	0.193	0.291	0.087	2.218 (C)
415	38.5	7	0.74		10	25	25	0.056	2.697	9.389	9.389	0.108	0.056	3.177	4.762	0.912	0.188	0.283	0.086	2.186 (C)

* FACTOR OF SAFETY DESCRIPTIONS

N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR w_c/LL $\leq$ 0.85
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60} > 25$
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

Appendix G Sample Pile Capacity Spreadsheet

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== B
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 441.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 439.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 436.60 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== 439.50 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 5253 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 49.85 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 421.50 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 158.06 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
705 KIPS	**705** KIPS	**383** KIPS	**48** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 89
Plugged Pile Perimeter========== 4.750 FT. Unplugged Pile Perimeter========== 7.033 FT.
Plugged Pile End Bearing Area========== 1.409 SQFT. Unplugged Pile End Bearing Area========= 0.181 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
437.50	2.00	0.86			6.0		16.4	8.8		***10.2***	10	3	0	2	4
436.50	0.90	0.53			1.8	10.5	18.2	2.6	1.3	***12.8***	13	4	0	3	5
435.00	1.60	0.53			3.1	10.5	18.9	4.6	1.3	***17.1***	17	4	0	5	7
432.50	2.50	0.41			3.9	8.1	***22.8***	5.7	1.0	22.8	23	4	0	8	9
430.00	2.50	0.41			3.9	8.1	***20.9***	5.7	1.0	27.8	21	4	0	7	12
427.50	2.50	0.12			1.2	2.4	***27.8***	1.8	0.3	30.3	28	4	0	11	14
425.00	2.50	0.41			3.9	8.1	***33.5***	5.7	1.0	36.2	33	4	0	14	17
420.00	5.00	0.50			9.3	9.9	***50.4***	13.7	1.3	50.9	50	4	0	23	22
415.00	5.00		5	Medium Sand	2.2	17.5	105.2	3.2	2.3	***60.9***	61	4	0	29	27
410.00	5.00		20	Medium Sand	8.7	70.2	76.1	12.8	9.0	***68.8***	69	4	0	34	32
405.00	5.00	1.64			24.3	32.4	***104.1***	35.9	4.2	105.3	104	4	0	53	37
401.00	4.00	1.83			20.9	36.1	264.3	30.9	4.6	***154.1***	154	4	0	81	41
400.00	1.00			Shale	59.2	175.5	323.5	87.6	22.6	***241.7***	242	4	0	129	41.5
399.00	1.00			Shale	59.2	175.5	382.7	87.6	22.6	***329.4***	329	4	0	177	42.5
398.00	1.00			Shale	59.2	175.5	441.8	87.6	22.6	***417.0***	417	4	0	225	43.5
397.00	1.00			Shale	59.2	175.5	***501.0***	87.6	22.6	504.6	501	4	0	271	44.5
396.00	1.00			Shale	59.2	175.5	***560.2***	87.6	22.6	592.2	560	4	0	304	45.5
395.00	1.00			Shale	59.2	175.5	***619.4***	87.6	22.6	679.8	619	4	0	336	46.5
394.00	1.00			Shale	59.2	175.5	***678.5***	87.6	22.6	767.4	679	4	0	369	47.5
393.56	0.45			Shale	26.3	175.5	***704.9***	39.0	22.6	806.4	705	4	0	383	47.9
392.56	1.00			Shale	59.2	175.5	***764.0***	87.6	22.6	894.0	~~764~~	~~4~~	~~0~~	~~446~~	~~48.3~~
391.56	1.00			Shale	59.2	175.5	***823.2***	87.6	22.6	981.7	~~823~~	~~4~~	~~0~~	~~449~~	~~48.6~~
390.56	1.00			Shale	59.2	175.5	***882.4***	87.6	22.6	1069.3	~~882~~	~~4~~	~~0~~	~~491~~	~~50.6~~
389.56	1.00			Shale	59.2	175.5	***941.5***	87.6	22.6	1156.9	~~942~~	~~4~~	~~0~~	~~514~~	~~51.9~~
388.56	1.00			Shale	59.2	175.5	***1000.7***	87.6	22.6	1244.5	~~1001~~	~~4~~	~~0~~	~~546~~	~~52.9~~
387.56	1.00			Shale		175.5			22.6						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== E. Abut
REFERENCE BORING ========== A
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 451.20 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 449.20 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ====== DD
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 427.20 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD========== 1397 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 49.85 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 224.19 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 84.07 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
705 KIPS	**705** KIPS	**353** KIPS	**45** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 89
Plugged Pile Perimeter========== 4.750 FT. Unplugged Pile Perimeter========== 7.033 FT.
Plugged Pile End Bearing Area========== 1.409 SQFT. Unplugged Pile End Bearing Area========== 0.181 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUGD SIDE RESIST. (KIPS)	NOMINAL UNPLUGD END BRG. RESIST. (KIPS)	NOMINAL UNPLUGD 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.)
444.50	4.70		2	Sandy Gravel	1.0		5.1	1.5		*2.1*	2	1	1	-1	7
442.50	2.00		2	Fine Sand	0.3	4.0	18.0	0.5	0.5	*4.2*	4	1	2	0	9
440.00	2.50		6	Fine Sand	1.2	16.6	19.6	1.8	2.1	*6.0*	6	1	3	-1	11
436.00	4.00	0.86			11.9	17.0	25.0	17.7	2.2	*22.8*	23	8	16	-11	15
431.00	5.00		3	Fine Sand	1.2	10.5	*23.0*	1.8	1.4	24.2	23	9	17	-13	20
429.50	1.50	0.37			2.1	7.3	*25.1*	3.1	0.9	27.4	25	10	20	-16	22
427.20	2.30	0.37			3.2	7.3	*28.4*	4.8	0.9	32.1	28	12	23	-19	24
426.50	0.70	0.37			1.0	7.3	*31.7*	1.5	0.9	33.9	32	12	23	-17	25
424.00	2.50	0.49			4.5	9.7	44.1	6.7	1.2	*41.6*	42	12	23	-12	27
421.50	2.50		5	Fine Sand	1.0	17.5	*39.6*	1.5	2.3	42.4	40	12	23	-13	30
419.00	2.50	0.61			5.5	12.0	*50.1*	8.2	1.5	51.3	50	12	23	-7	32
416.50	2.50	0.86			7.5	17.0	*55.2*	11.0	2.2	62.0	55	12	23	-4	35
414.00	2.50	0.74			6.6	14.6	222.6	9.7	1.9	*92.4*	92	12	23	16	37
413.00	1.00			Shale	59.2	175.5	281.8	87.6	22.6	*180.0*	180	12	23	64	38.2
412.00	1.00			Shale	59.2	175.5	341.0	87.6	22.6	*267.6*	268	12	23	112	39.2
411.00	1.00			Shale	59.2	175.5	400.2	87.6	22.6	*355.3*	355	12	23	161	40.2
410.00	1.00			Shale	59.2	175.5	459.3	87.6	22.6	*442.9*	443	12	23	209	41.2
409.00	1.00			Shale	59.2	175.5	*518.5*	87.6	22.6	530.5	519	12	23	250	42.2
408.00	1.00			Shale	59.2	175.5	*577.7*	87.6	22.6	618.1	578	12	23	283	43.2
407.00	1.00			Shale	59.2	175.5	*636.8*	87.6	22.6	705.7	637	12	23	315	44.2
406.00	1.00			Shale	59.2	175.5	*696.0*	87.6	22.6	793.3	696	12	23	348	45.2
405.85	0.15			Shale	8.9	175.5	*704.9*	13.1	22.6	806.5	705	12	23	353	45.4
404.85	1.00			Shale	59.2	175.5	*764.1*	87.6	22.6	894.1	~~764~~	~~12~~	~~23~~	~~385~~	~~45.4~~
403.85	1.00			Shale	59.2	175.5	*823.2*	87.6	22.6	981.7	~~823~~	~~12~~	~~23~~	~~418~~	~~42.4~~
403.31	0.55			Shale	32.2	175.5	*855.5*	47.8	22.6	1029.5	~~855~~	~~12~~	~~23~~	~~436~~	~~42.9~~
402.31	1.00			Shale	59.2	175.5	*914.7*	87.6	22.6	1117.1	~~915~~	~~12~~	~~23~~	~~458~~	~~46.9~~
401.31	1.00			Shale	59.2	175.5	*973.8*	87.6	22.6	1204.7	~~974~~	~~12~~	~~23~~	~~491~~	~~48.9~~
400.31	1.00			Shale	59.2	175.5	*1033.0*	87.6	22.6	1292.3	1033	*12*	*23*	*533*	*50.9*
399.31	1.00			Shale	59.2	175.5	*1092.2*	87.6	22.6	1379.9	~~1092~~	~~12~~	~~23~~	~~566~~	~~51.9~~
398.31	1.00			Shale	59.2	175.5	*1151.3*	87.6	22.6	1467.5	~~1151~~	~~12~~	~~23~~	~~593~~	~~52.9~~
397.31	1.00			Shale	59.2	175.5	*1210.5*	87.6	22.6	1555.1	~~1211~~	~~12~~	~~23~~	~~631~~	~~53.9~~
396.31	1.00			Shale	59.2	175.5	*1269.7*	87.6	22.6	1642.8	~~1270~~	~~12~~	~~23~~	~~664~~	~~54.9~~
395.31	1.00			Shale	59.2	175.5	*1328.9*	87.6	22.6	1730.4	~~1329~~	~~12~~	~~23~~	~~696~~	~~55.9~~
394.31	1.00			Shale	59.2	175.5	*1388.0*	87.6	22.6	1818.0	~~1388~~	~~12~~	~~23~~	~~729~~	~~56.9~~
393.31	1.00			Shale	59.2	175.5	*1447.2*	87.6	22.6	1905.6	~~1442~~	~~12~~	~~23~~	~~764~~	~~57.9~~
392.31	1.00			Shale	59.2	175.5	*1506.4*	87.6	22.6	1993.2	~~1506~~	~~12~~	~~23~~	~~794~~	~~58.9~~
391.31	1.00			Shale	59.2	175.5	*1565.5*	87.6	22.6	2080.8	~~1565~~	~~12~~	~~23~~	~~826~~	~~59.9~~
390.31	1.00			Shale		175.5			22.6						