



**Illinois Department
of Transportation**

District 4 • 401 Main Street • Peoria, IL 61602

Structure Geotechnical Report



Bridge Replacement Illinois Route 78 over Kickapoo Creek Knox County, Illinois

Region:	Three
District:	Four
Route:	FAP 22 (IL RTE. 78)
Section:	(48B-1) BR
Structure Number:	048-0095 (Proposed) 048-0018 (Existing)
Contract No.:	68758 - PTB 150/25
Date Prepared:	April 6, 2012
Proposed Letting:	November 2015

Prepared For: Illinois Department of Transportation
Bureau of Bridges and Structures
2300 S. Dirksen Parkway
Springfield, IL 62764
(217) 782-7820

Homer L. Chastain & Associates, LLP
Jeremy Buening, P.E., S.E.
5 North Country Club Road
Decatur, IL 62521
(217) 429-8800

Prepared By: Ray Seneca, P.E.



401 Main Street • Suite 1130 • Peoria, IL 61602
309.999.0123 • 309.999.0120 (fax)
www.terraengineering.com

TABLE OF CONTENTS

1.0	PROJECT DESCRIPTION	3
2.0	SUBSURFACE CONDITIONS	4
3.0	GEOTECHNICAL EVALUATIONS	5
3.1	Settlements	5
3.2	Slope Stability	5
3.3	Seismic Considerations	5
3.4	Scour	6
3.5	Mining Activities	6
3.6	Bridge Foundations	6
3.7	Lateral Pile Response	7
4.0	CONSTRUCTION CONSIDERATIONS	7

TABLES

Table 3.4.1 – 100 Year Design Scour Elevations	6
Table 3.4.2 – 500 Year Design Scour Elevations	6

APPENDICES

Appendix A – Site Investigation Photo Log and Vicinity and Quadrangle Map	8
Appendix B – Boring Location Site Plan	15
Appendix C – Boring Logs.....	17
Appendix D – Subsurface Data Profile.....	21
Appendix E – Stability Analysis.....	23
Appendix F – IDOT BBS Spreadsheet – Seismic Site Class Determination.....	35
Appendix G – IDOT Static Method of Estimating Pile Length.....	37
Part I – North Abutment	38
Part II – South Abutment	48
Part III – Pier 1	58
Part IV – Pier 2	68
Appendix H – Soil Modulus Parameters (k) for LPILE Analysis.....	78

Structure Geotechnical Report

**BRIDGE REPLACEMENT
IL 78 OVER KICKAPOO CREEK
KNOX COUNTY, ILLINOIS
FAP 22 (IL 78)
SECTION: (48B-1)BR
CONTRACT No.: 68758
STRUCTURE NO.: 048-0018(EXISTING)
048-0095(PROPOSED)**

SITE INVESTIGATION

A site investigation was done by TERRA Engineering, Ltd. personnel in March 2012 and there were no signs of distress or deformation in the existing substructure foundation, nor distress in the existing embankment and pavement. Appendix A includes a project location map and pictures taken at the time of the investigation.

1.0 PROJECT DESCRIPTION

The geotechnical study summarized in this report was performed for the proposed replacement of the bridge that carries FAP 22 (IL 78) over Kickapoo Creek at station 1440+89.93 in Knox County, Illinois. The purpose of our study was to explore the subsurface conditions and develop design and construction recommendations for the bridge replacement.

The existing structure is three spans consisting of a PPC deck beam superstructure on closed abutments and solid wall piers. The total surface length is 99.5 feet from back-to-back of the abutments and the width is 33.0 feet from out-to-out of the deck. The superstructure consists of 17 inch PPC deck beams with approximately 3 inches of bituminous overlay. The closed abutments are founded on spread footings that are supported by untreated timber piling. Abutment caps were added to the original closed abutments in 1977 to provide ample bearing surface for the new deck beams. The caps are longer than the existing abutment wall due to wider deck. The closed abutments are approximately 16 feet tall with 2.25 feet thick footings. The solid wall piers are supported by HP8 x 36 piles and were added in 1977 when the truss bridge was removed.

The proposed structure will be three spans consisting of structural steel beams and a reinforced concrete deck superstructure on integral abutments. The total surface length is 110.5 feet from back-to-back of abutments and the width is 35.17 feet from out-to-out of deck. The superstructure consists of W27 (Composite) beams with an 8.0 inch concrete slab.

2.0 SUBSURFACE CONDITIONS

The project site is located approximately one mile south of the Illinois Route 78 and Illinois Route 8 junction in Knox County. Physiographically the project is located in the Galesburg Plain. Three standard penetration test (SPT) borings were performed. The borings were taken at the south abutment (B-1), at pier 1 (B-2), and between pier 2 and the north abutment (B-3). See Appendix B for the Boring Location Site Plan. All borings were advanced into shale bedrock to approximate elevations of 563.82 (B-1), 562.83 (B-2), and 568.18 (B-3). Detailed information regarding the nature and thickness of the soil and rock layers encountered, and the results of the field sampling and laboratory testing are shown on the Boring Logs in Appendix C. The field exploration was performed in general accordance with the procedures outlined in the 1999 IDOT Geotechnical Manual. The borings were staked by the Illinois Department of Transportation (IDOT) and drilled by Terracon Consultants, Inc. as a Direct Cost to TERRA Engineering. An experienced technician from Terracon was with the drill rig to monitor drilling, log borings, and perform unconfined compressive strength tests.

A CME 550 ATV rig with hollow-stem augers and automatic hammer was used to advance the borings. SPT's were performed with a split spoon sampler at 2.5 foot intervals to a depth of 30 feet, and then at 5 foot intervals to the boring termination depths. Unconfined compression strengths of cohesive samples were measured with a Rimac testing apparatus.

The bridge site has three major soil layers. The first of these layers was a dark brown/gray-brown Clay with elevations ranging from 587.33 to 602.82 feet. Moisture content varied from 21 to 32 percent, unconfined compressive strength ranged from 0.30 to 2.30 tons per square foot, and 2 to 9 blows per foot were acquired during the sampling of the Clay layer.

The second layer consisted of a dark gray/dark brown-gray Sandy Loam with a trace of gravel at elevations between 579.18 and 590.32. The material in this layer had a blow count per foot ranging from 4 to 76 blows and a moisture content of 12 to 29 percent. Boring B-1 had a 3 foot layer of Sandy Clay Loam between the first and second major soil types from elevation 590.32 to 593.32. Moisture content was 21 percent with a blow count of 2 and friction angle of 27 degrees for the Sand Clay Loam.

Clayey Shale is the third major layer found in all three borings at elevations ranging from 562.83 to 582.33 with a range of 70 to well over 100 blows per foot. Moisture content varied between 13 to 18 percent. A Shaley Clay layer was present in boring B-1 between the Sandy Loam and Clayey Shale layers. Shaley Clay was encountered from elevations 578.32 to 583.32 with a blow count of 60 and moisture content around 19 percent.

Ground water elevations encountered during drilling and at completion are shown on the boring logs (Appendix C) and in the Subsurface Data Profile in Appendix D. Based on the boring log data, the expected ground water elevation for the bridge site is 589.3 ft.

The uppermost bedrock in Knox County consists of Pennsylvanian Carbondale, Shalburn, and Patoka formations.

3.0 GEOTECHNICAL EVALUATIONS

3.1 Settlement

The south abutment is being raised approximately 2.8 feet and the north abutment is being raised approximately 1.0 foot. Using the Geotechnical Manual's recommendation for settlement evaluation (Section 1.2.5.2), settlement should not be a concern at this site for the grade raise at either abutment.

3.2 Slope Stability

Slope stability analysis was performed on the end slope for both the north and the south abutment. Both end slopes have a proposed inclination of 2 horizontal to 1 vertical. Static and seismic conditions were both considered during the analysis. The results of the stability analysis (Appendix E) indicate that the new slopes should be stable under both static and seismic condition. The minimum safety factor for the north abutment under static conditions was 1.758 and the minimum for the south abutment was 1.836. Both static values meet the minimum allowable safety factor of 1.5. The minimum safety factor for the north abutment under seismic conditions was 1.623 and the minimum for the south abutment was 1.676. Both seismic values meet the minimum allowable safety factor of 1.0.

3.3 Seismic Considerations

According to the AASHTO LRFD Bridge Design Specifications (Fourth Edition), a site coefficient, which is a function of the soil profile types, is required for the calculation of minimum earthquake design forces. Based on the soils encountered and the depth to bedrock, the seismic performance zone is 1 and the soil site class is C. The global site class definition is based on the results of IDOT Bureau of Bridges and Structures Seismic Site Class Determination spreadsheet (Appendix F). The AASHTO specifications also indicate that the site has a Design Spectral Acceleration at 1.0 second (S_{D1}) of 0.077 g, and a Design Spectral Acceleration (S_{DS}) at 0.2 second of 0.124 g.

According to the USGS Earthquake Hazards Program website, the design earthquake at the site, which has a 5 percent probability of exceedance in 50 years, is 7.70 on the Richter scale with a peak horizontal ground acceleration of 0.03867 g. The peak seismic ground surface acceleration, A_s , is 0.053 g, since this is less than 0.15g (as stated in All Geotechnical Manual Uses Design Guide 10.1) and is in seismic performance zone 1 no liquefaction analysis is required.

3.4 Scour

A 100 year flood scour depth of 13.16 feet was estimated at each of the piers for this project. The scour depth was deducted from the elevation at which the ground elevation at the piers to get the scour elevation. Table 3.4.1 presents the design scour elevations for 100 year flood.

Table 3.4.1 – 100 Year Design Scour Elevation

Abutment/Pier	Design Scour Elevation (ft)
South Abutment	607.73
Pier 1	583.34
Pier 2	583.34
North Abutment	607.06

Scour for 500 year design at Pier 1 and Pier 2 is estimated to be 17.11 feet. Table 3.4.1 presents the 500 year scour elevations.

Table 3.4.2 – 500 Year Design Scour Elevation

Abutment/Pier	Design Scour Elevation (ft)
South Abutment	607.73
Pier 1	579.39
Pier 2	579.39
North Abutment	607.06

3.5 Mining Activity

According to the Directory of Coal Mines in Illinois – Knox County, dated July 20, 2011, the subject site was not undermined. There is abandoned strip mining activity within 0.5 miles of the project site and abandoned underground coal mining approximately 0.75 miles to the east of the project site. The listed disclaimer did indicate that the locations of some features on the mine map may be offset by 500 or more feet due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors.

3.6 Bridge Foundations

The foundation supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loads. Since an integral abutment design was selected for this bridge, the only foundation permitted by the IDOT Bridge Manual is a single row of vertical H-Piles or Metal Shell piles. Based upon the bridge length of 110.5 feet, the pile foundation is further restricted to only H-Pile and 14 inch Metal Shell pile.

The Modified IDOT Static Method of Estimating Pile Length spreadsheet (See Appendix G) was used to analyze the various pile types and their loading for the abutments and piers. The total factored

substructure load at each abutment was 890 kips and 1320 kips at each pier. The pile cut off elevations are 609.06 feet at the north abutment, 610.52 feet at pier 1, 610.26 feet at pier 2, and 609.73 feet at the south abutment.

H-Pile bearing capacity reductions due to negative skin friction, liquefaction, and scour have been considered at this bridge site. The anticipated affect of scour was incorporated into the calculations at the piers. Metal Shell pile is not recommended due the shallow hard driving conditions that do not allow sufficient skin friction to be achieved. H-pile is recommended for this site. See Appendix G for the pile capacities and lengths. Pile shoes should not be necessary for H-Piles. It is recommended that one test pile be driven at each abutment and each pier. The pile lengths used in construction should be longer than the estimated length to ensure sufficient depth is achieved.

3.7 Lateral Pile Response

A representation of the pile response under lateral loading is required for design of the bridge superstructure. The lateral pile response can be developed by modeling the soil/pile interaction with the computer program LPILE. Discrete elements are used in LPILE to represent the pile and non-linear soil springs. The non-linear soil springs are commonly referred to as P-Y curves.

Based on the encountered subsurface conditions, tables for B-1, B-2, and B-3 summarizing appropriate soil parameters ϕ , c , γ wet and saturated soil until weights for the LPILE analysis, are included in Appendix H (Reference: LPILE User's Manual, Ensoft, Inc., October 2000). When pile design details and load information are available LPILE analyses can be performed.

4.0 CONSTRUCTION CONSIDERATIONS

The road will be closed and the traffic will be detoured for the removal and replacement of this structure. The Estimated Water Surface Elevation (EWSE) is 598.02 feet. The elevation at the bottom of pier 1 and pier 2 is 590.50 feet. Both piers will require a Cofferdam (Type II) for construction due to the EWSE being 7.52 feet above the bottom of the pier (see ABD Memo 11.2). It is anticipated that a seal coat will be required. In general, stream related work should not occur during periods of flooding. The construction activities should be performed in accordance with the current IDOT Standard Specifications for Road and Bridge Construction and any pertinent special provisions or policies.

Appendix A



Photo 1- Looking North



Photo 2- Northwest Corner of Bridge



Photo 3- Southwest Corner of Bridge

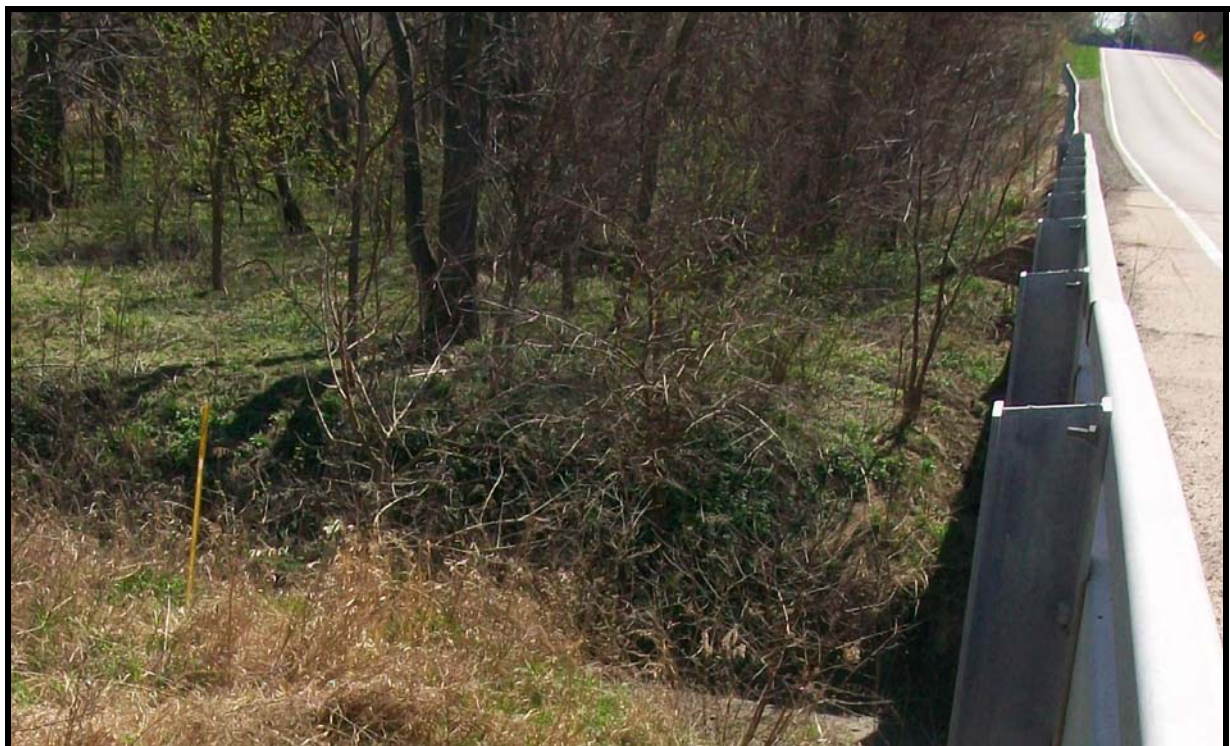


Photo 4- Southeast Corner of Bridge

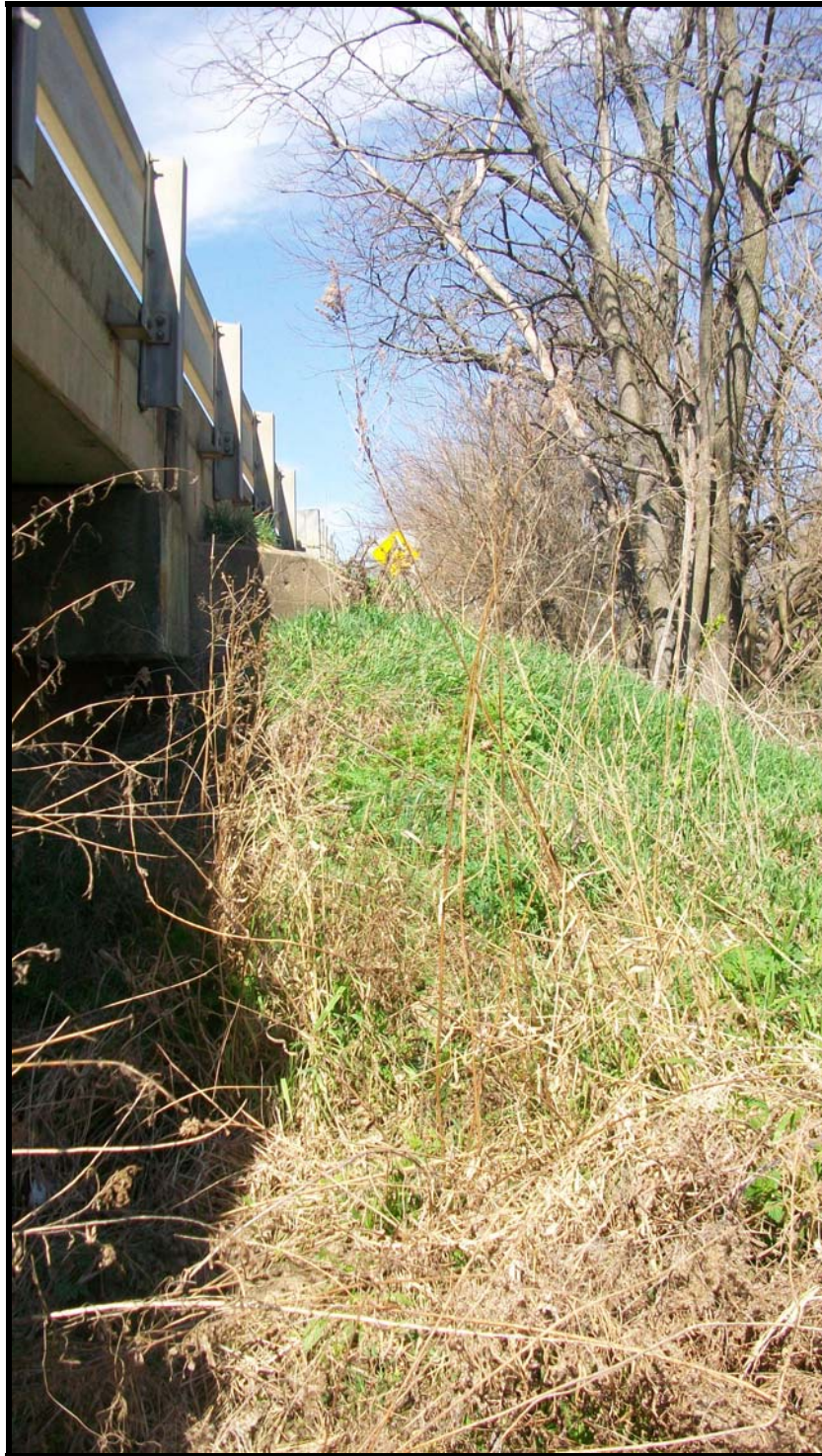
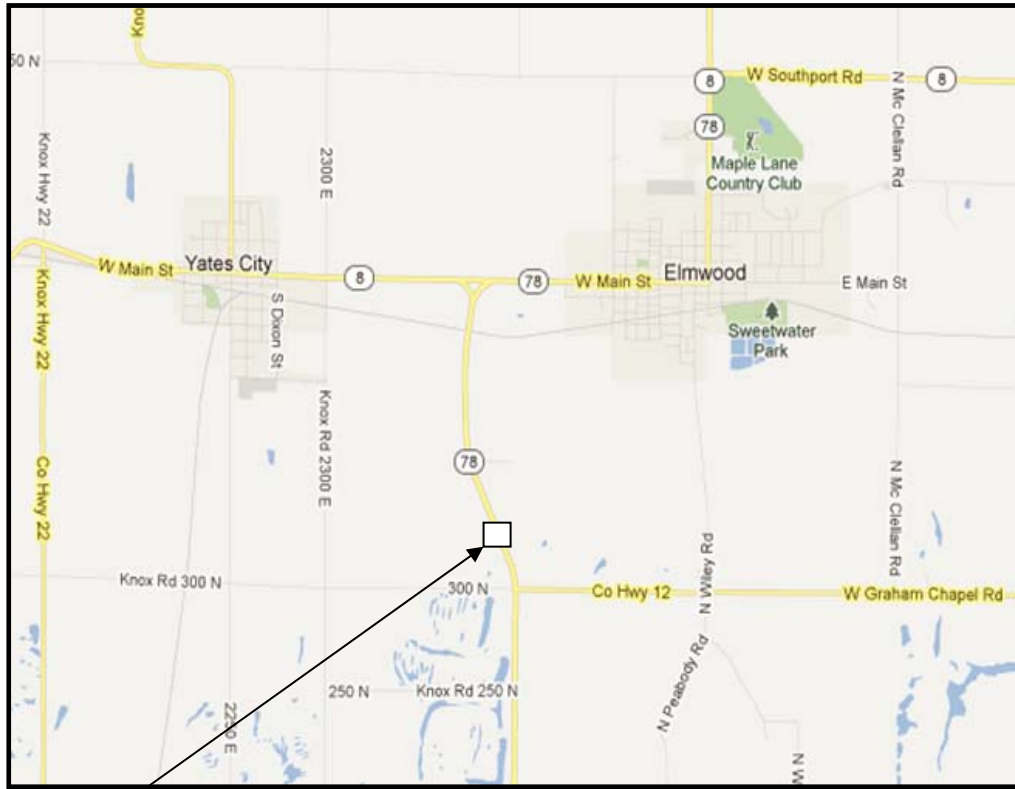


Photo 5- Northeast Corner of Bridge



Photo 6- East Side of Bridge

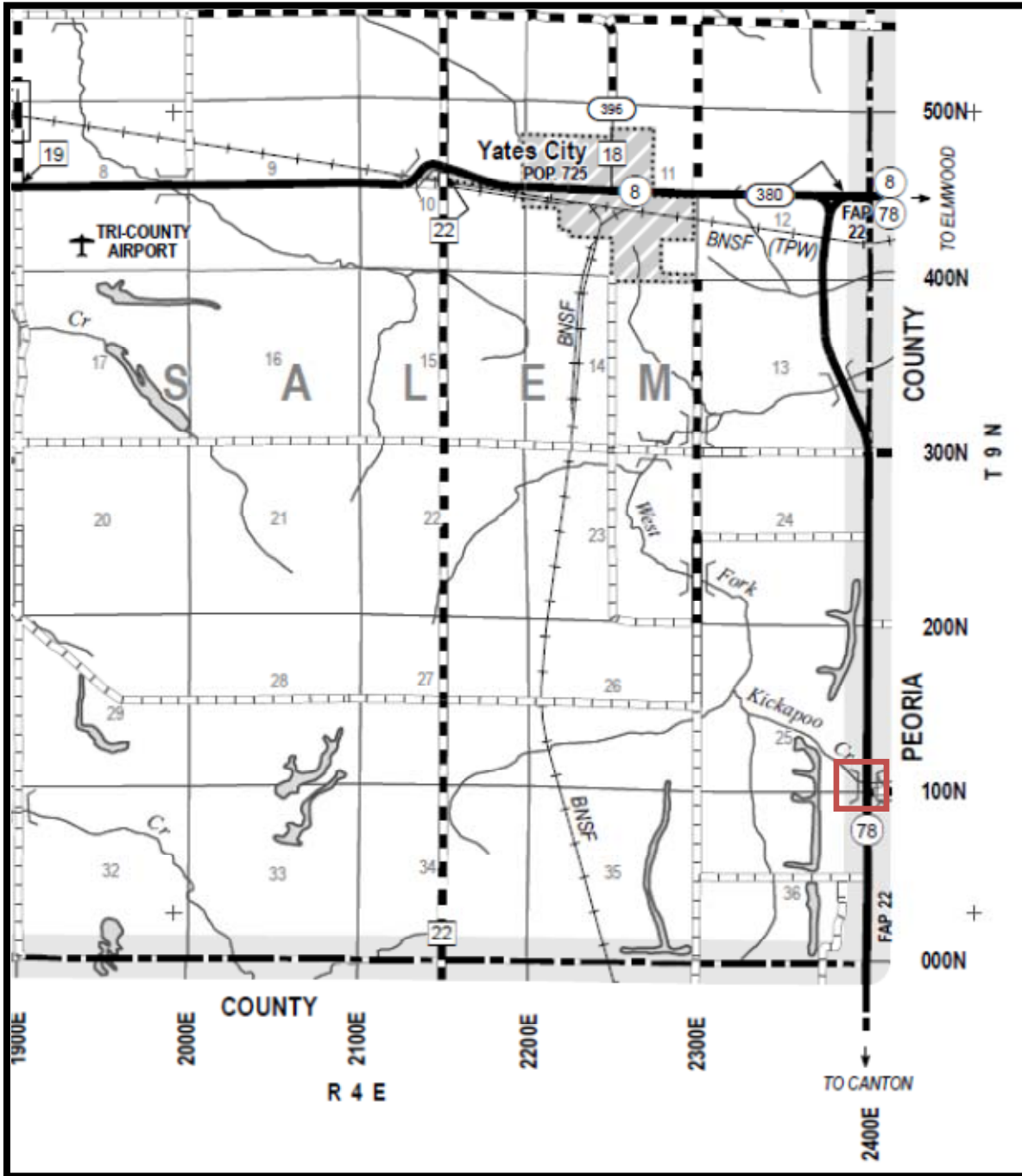
Location Map



Project Location



Quadrangle Map

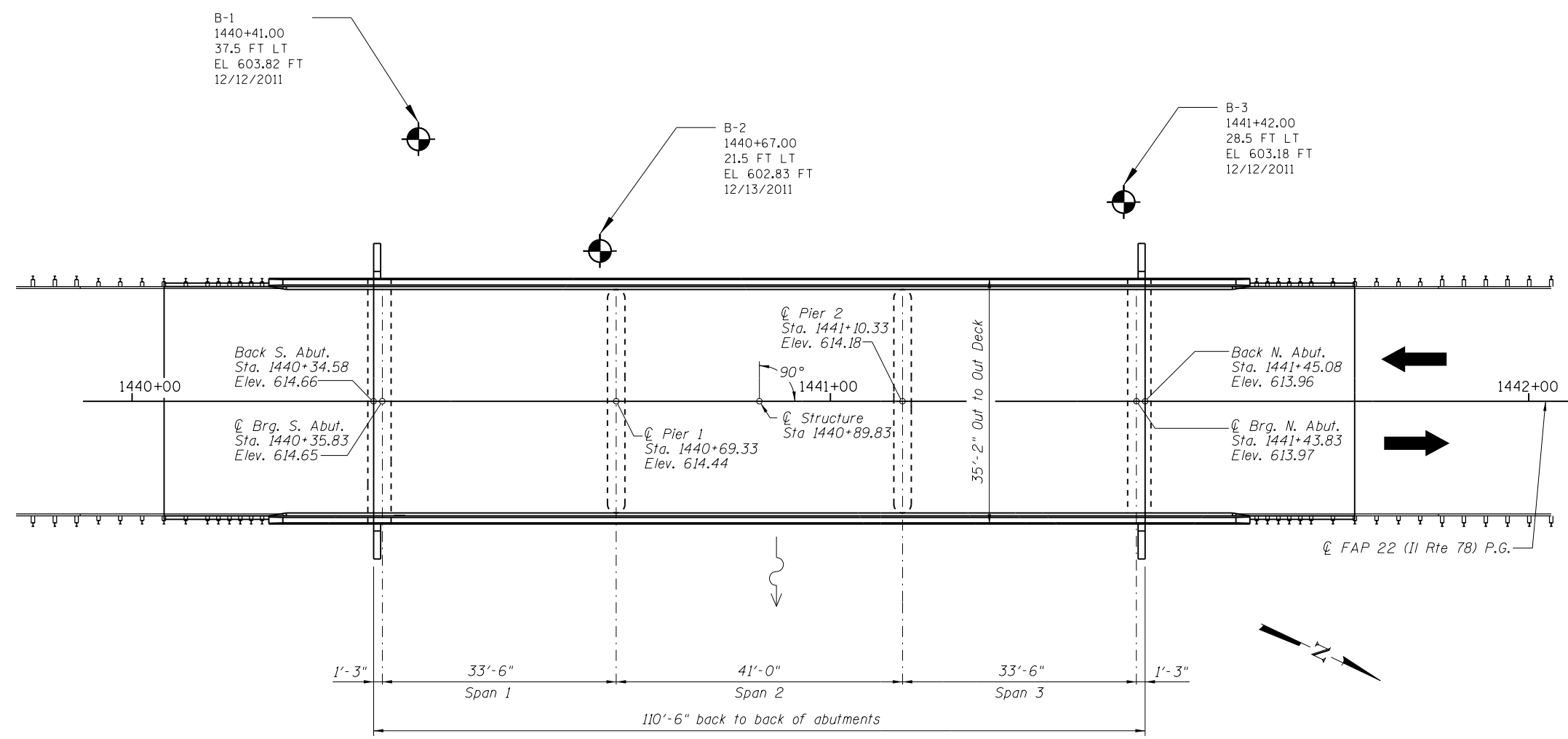


Appendix B

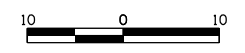
I:\Terra_Bentley\Bentley\Standards\LDOT\Std\Tables\pen\plotlabel.tbl

LDOT_PDFNLAVERS.BWplotcf

T:\Projects\99-128-04-1001_VV-HLC-PTB_150-25\Calculations\MO*1-IL78 over Kickapoo Creek\SGR\Boring Plots\IL78_PlanView_B1-B3.dgn



BORING LOCATION PLAN VIEW
 IL 78 OVER KICKAPOO CREEK
 FAP ROUTE 22
 SECTION (48B-1) BR
 KNOX COUNTY
 STATION 1440+89.93
 STRUCTURE NO. (EXISTING) 048-0018
 STRUCTURE NO. (PROPOSED) 048-0095



USER NAME = LNF	DESIGNED -	REVISED -
	DRAWN -	REVISED -
PLOT SCALE = 20.0000' / in.	CHECKED -	REVISED -
PLOT DATE = 2/15/2012	DATE -	REVISED -

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

BORING LOCATION PLAN VIEW	
IL 78 OVER KICKAPOO CREEK	
SCALE:	TO STA.
SHEET NO. 1 OF 1 SHEETS	

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
22	(48B-1)BR	KNOX		
CONTRACT NO. 68758				
ILLINOIS FED. AID PROJECT				

Appendix C



SOIL BORING LOG

ROUTE FAP22 (IL78) DESCRIPTION Illinois Route 78 over Kickapoo Creek LOGGED BY JM

SECTION (48B-1) BR LOCATION SEC. 13, TWP. 9N, RNG. 4E,

Latitude 40.7619, Longitude -89.9886

COUNTY Knox DRILLING METHOD HOLLOW STEM/WASH BORING HAMMER TYPE AUTO

STRUCT. NO. 048-0095 Existing
Station 1440+89.93

BORING NO. B-1
Station 1440+41
Offset 37.5 ft LT

Ground Surface Elev. 603.82 ft

D E P T H H	B L O W S	U C S Qu	M O I S T	Surface Water Elev. _____ ft	D E P T H H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)	Stream Bed Elev. _____ ft	(ft)	(/6")	(tsf)	(%)

Approx. 12 inches Topsoil				583.32				
602.82				Hard Gray				
M. Stiff	3		31	<u>SHALEY CLAY</u> trace sand	19			20
Dark Brown	2				26			
<u>CLAY</u> trace fine sand	2				34			
	1	1.0	24		15			18
	2				29			
	3				31			
	-5				-25			
				578.32				
Gray with Brown	2		29	Gray				
	2			<u>CLAYEY SHALE</u>	36			13
	2				50/2"			
M. Stiff to Soft	2	0.3	27		100/3"			15
	2							
	2							
	-10				-30			
593.32								
Soft								
Brown and Gray	1		21					
<u>SANDY CLAY LOAM</u> trace organics	1							
	1							
590.32								
Loose	1		26		50/4"			17
Dark Gray, fine to medium	2							
<u>SANDY LOAM</u>	2							
	-15				-35			
588.32								
M. Dense								
Dark Brown and Gray, Fine to Coarse	5		29					
<u>SANDY LOAM</u> with gravel and organics	6							
	7							
	13		19		50/1"			15
	39			Boring terminated at approximately 40 ft.				
	37			563.82	-40			
	-20							

End of Boring

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



SOIL BORING LOG

ROUTE FAP22 (IL78) DESCRIPTION Illinois Route 78 over Kickapoo Creek LOGGED BY JM

SECTION (48B-1) BR LOCATION SEC. 13, TWP. 9N, RNG. 4E,

Latitude 40.7618, Longitude -89.9885

COUNTY Knox DRILLING METHOD HOLLOW STEM/WASH BORING HAMMER TYPE AUTO

STRUCT. NO. 048-0095 Existing
 Station 1440+89.93

BORING NO. B-2
 Station 1440+67
 Offset 21.5 ft LT

Ground Surface Elev. 602.83 ft

Surface Water Elev. 12.00 ft
 Stream Bed Elev. _____ ft
 Groundwater Elev.:
 First Encounter 590.8 ft ▼
 Upon Completion 588.8 ft ▼
 After _____ Hrs. _____ ft

DEPTH (ft)	BLOWS (6")	UCS (tsf)	MOIST (%)	Soil Description	DEPTH (ft)	BLOWS (6")	UCS (tsf)	MOIST (%)
602.03				Approx. 10 inches Topsoil	582.33			
	3	2.3	21	M. Stiff to Stiff Dark Brown CLAY trace fine sand, gravel and organics		27		14
	2					39		
	2					47		
	2	2.0	25			19		15
	2					31		
-5	2				-25	39		
	3	2.0	24			50/5"		15
	4							
	4							
	2	0.5	29			50/4"		15
	3							
-10	2				-30			
592.33				Soft Dark Brown and Gray CLAY , with sand, trace gravel and organics				
	1	0.5	27					
	2							
	1							
	2	0.5	32			50/4"		17
	1							
-15	1				-35			
587.33				M. Dense Brown and Gray, Fine to Coarse SANDY LOAM trace gravel				
	9	0.3	15					
	8							
	12							
	8		12			50/2"		17
	10							
-20	13				-40			

Boring terminated at approximately 40 ft.

562.83

End of Boring

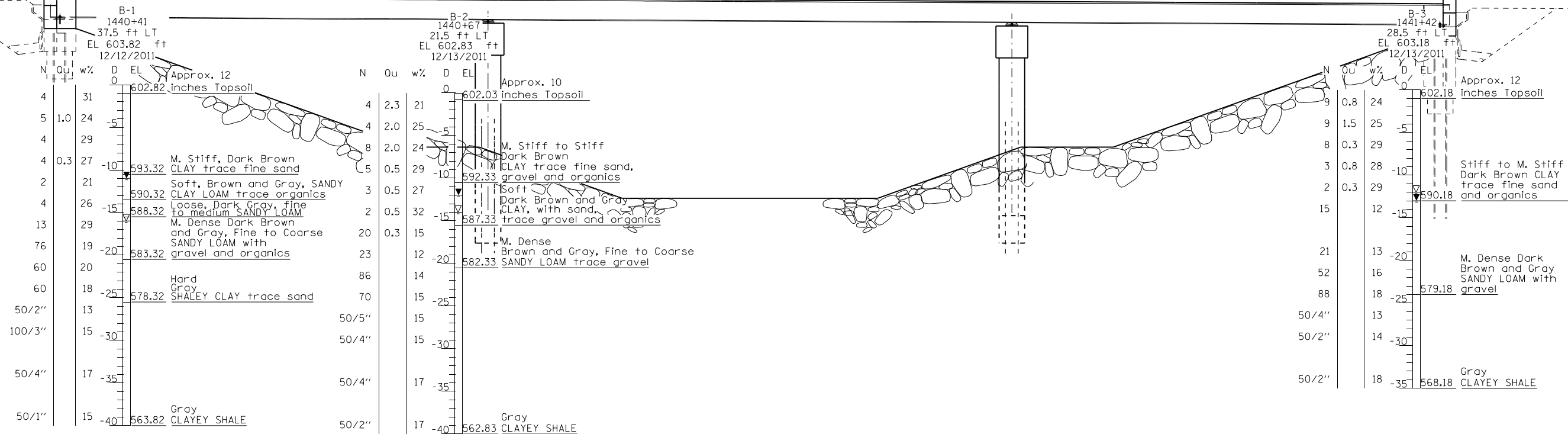
The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
 The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Appendix D

BRIDGE OMISSION STA 1440+34.58 TO STA 1441+45.08

PROPOSED GRADE

EXISTING GRADE



NOT TO SCALE

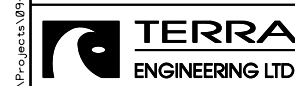
LEGEND

EL = Elevation (ft)
 D = Depth Below Existing Ground Surface (ft)
 N = SPT N-Value (AASHTO T206)
 Qu = Unconfined compressive Strength (tsf)
 Failure Mode (B= Bulge, S= shear, P= penetrometer)
 w% = Moisture Content Percentage

WATER TABLE LEGEND

▼ = Groundwater Level First Encountered
 ▽ = Groundwater Level Upon Completion
 ▾ = Groundwater Level After ... hours

SUBSURFACE DATA PROFILE
 IL78 OVER KICKAPOO CREEK
 FAP ROUTE 22
 SECTION (48B-1) BR
 KNOX COUNTY
 STATION 1440+89.93
 STRUCTURE NO. (EXISTING) 048-0018
 STRUCTURE NO. (PROPOSED) 048-0095



USER NAME = LNF	DESIGNED -	REVISED -
PLOT SCALE = 48.0000' / in.	DRAWN -	REVISED -
PLOT DATE = 2/15/2012	CHECKED -	REVISED -
	DATE -	REVISED -

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

SUBSURFACE DATA PROFILE
 IL 78 OVER KICKAPOO CREEK

SCALE: SHEET NO. 1 OF 1 SHEETS STA. TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
22	(48B-1)BR	KNOX		
CONTRACT NO. 68758				
ILLINOIS FED. AID PROJECT				

Appendix E

Slide Analysis Information

Document Name

File Name: IL 78_SLIDE_Seismic_North Abut..sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified
Janbu corrected

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.0387

Material Properties

Material: Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft³
Cohesion: 1000 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 112.8 lb/ft³
Saturated Unit Weight: 117.03 lb/ft³
Cohesion: 1150 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay-1

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 111.6 lb/ft³
Saturated Unit Weight: 119.97 lb/ft³
Cohesion: 300 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay-2

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 111.63 lb/ft³
Saturated Unit Weight: 119.04 lb/ft³
Cohesion: 800 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay-3

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 115.2 lb/ft³
Saturated Unit Weight: 123.84 lb/ft³
Cohesion: 300 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sandy Loam

Strength Type: Mohr-Coulomb
Unit Weight: 136.4 lb/ft³
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clayey Shale

Strength Type: Mohr-Coulomb
Unit Weight: 137.7 lb/ft³
Cohesion: 4500 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	603.180
121.560	603.180

Material Boundary

0.000	590.180
241.920	590.180

Material Boundary

0.000	579.180
241.920	579.180

Material Boundary

0.000	598.180
131.560	598.180

Material Boundary

0.000	594.680
138.560	594.680

Material Boundary

0.000	593.180
141.560	593.180

External Boundary

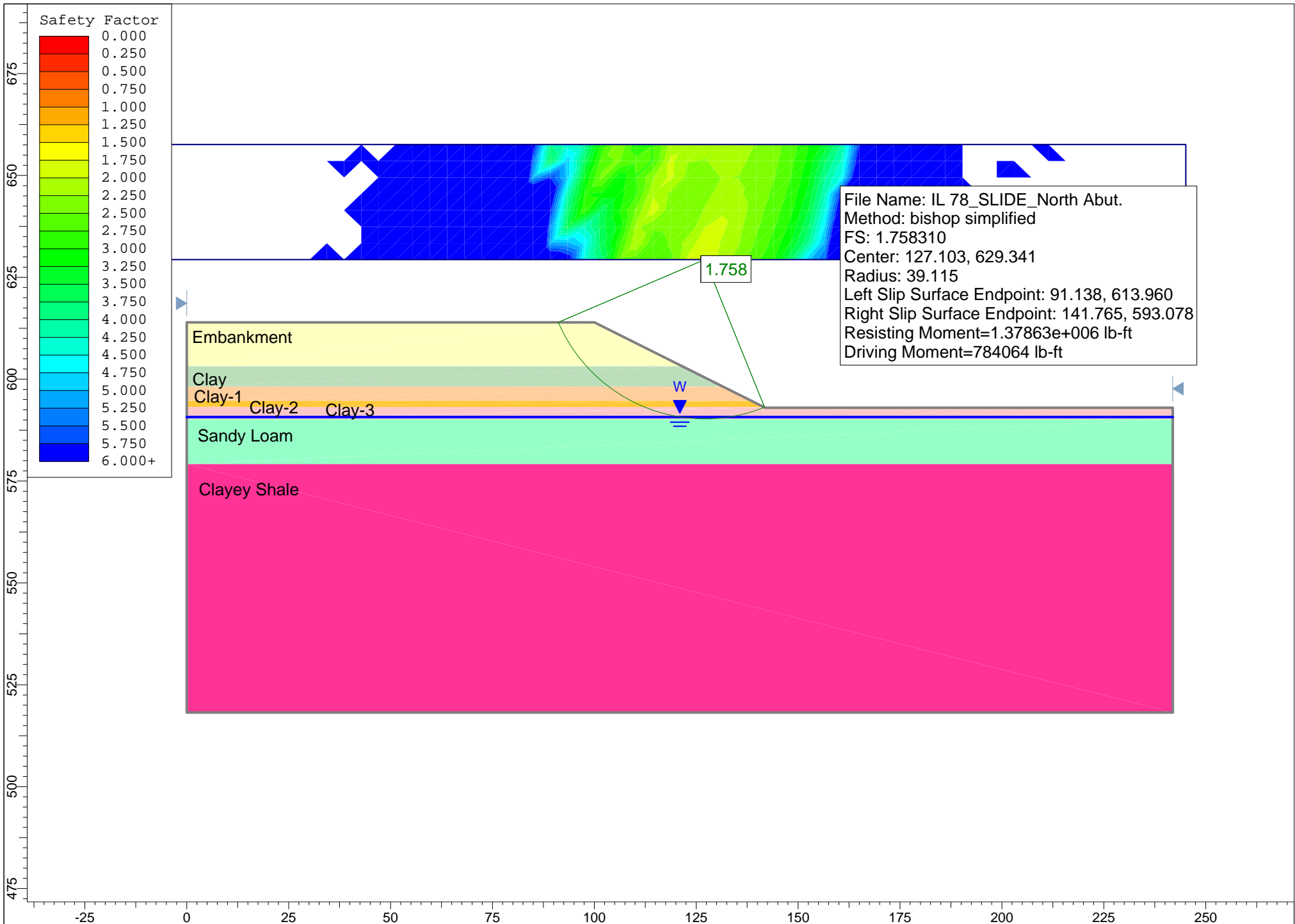
0.000	603.180
0.000	598.180
0.000	594.680
0.000	593.180
0.000	590.180
0.000	579.180
0.000	518.180
241.920	518.180
241.920	579.180
241.920	590.180
241.920	593.000
141.920	593.000
141.560	593.180
138.560	594.680
131.560	598.180
121.560	603.180
100.000	613.960
0.000	613.960

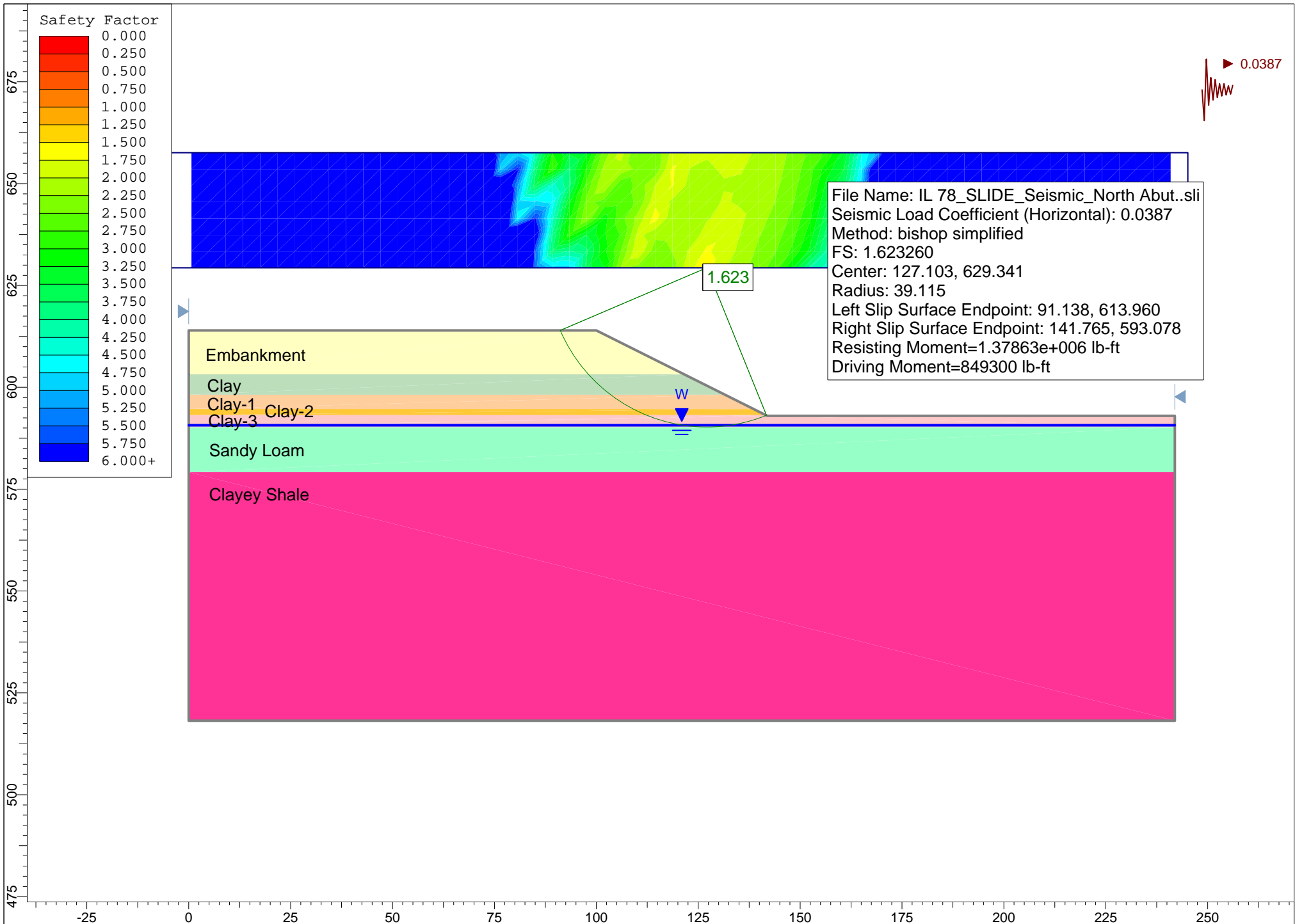
Water Table

0.000	590.700
241.920	590.700

Search Grid

-7.764	629.341
245.111	629.341
245.111	657.586
-7.764	657.586





Slide Analysis Information

Document Name

File Name: IL 78_SLIDE_Seismic_South Abut..sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.0387

Material Properties

Material: Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft³
Cohesion: 1000 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 112.8 lb/ft³
Saturated Unit Weight: 123.14 lb/ft³
Cohesion: 500 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay-1

Strength Type: Mohr-Coulomb
Unit Weight: 116.56 lb/ft³
Cohesion: 1000 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay-2

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 112.8 lb/ft³
Saturated Unit Weight: 121.26 lb/ft³
Cohesion: 500 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clay-3

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 112.8 lb/ft³
Saturated Unit Weight: 119.38 lb/ft³
Cohesion: 300 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sandy Clay Loam

Strength Type: Mohr-Coulomb
Unit Weight: 139.2 lb/ft³
Cohesion: 0 psf
Friction Angle: 27 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sandy Loam

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 144 lb/ft³
Saturated Unit Weight: 151.2 lb/ft³
Cohesion: 0 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sandy Loam-1

Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 142.8 lb/ft³
Saturated Unit Weight: 154.8 lb/ft³

Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Shaley Clay
Strength Type: Mohr-Coulomb
Unit Weight: 127.3 lb/ft3
Cohesion: 4000 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clayey Shale
Strength Type: Mohr-Coulomb
Unit Weight: 146.1 lb/ft3
Cohesion: 4500 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

List of All Coordinates

Material Boundary
0.000 603.820
121.680 603.820

Material Boundary
0.000 593.320
142.680 593.320

Material Boundary
0.000 590.320
243.320 590.320

Material Boundary
0.000 588.320
243.320 588.320

Material Boundary
0.000 583.320
243.320 583.320

Material Boundary
0.000 578.320
243.320 578.320

Material Boundary
0.000 601.320
126.680 601.320

Material Boundary
0.000 598.820
131.680 598.820

Material Boundary

0.000	596.320
136.680	596.320

External Boundary

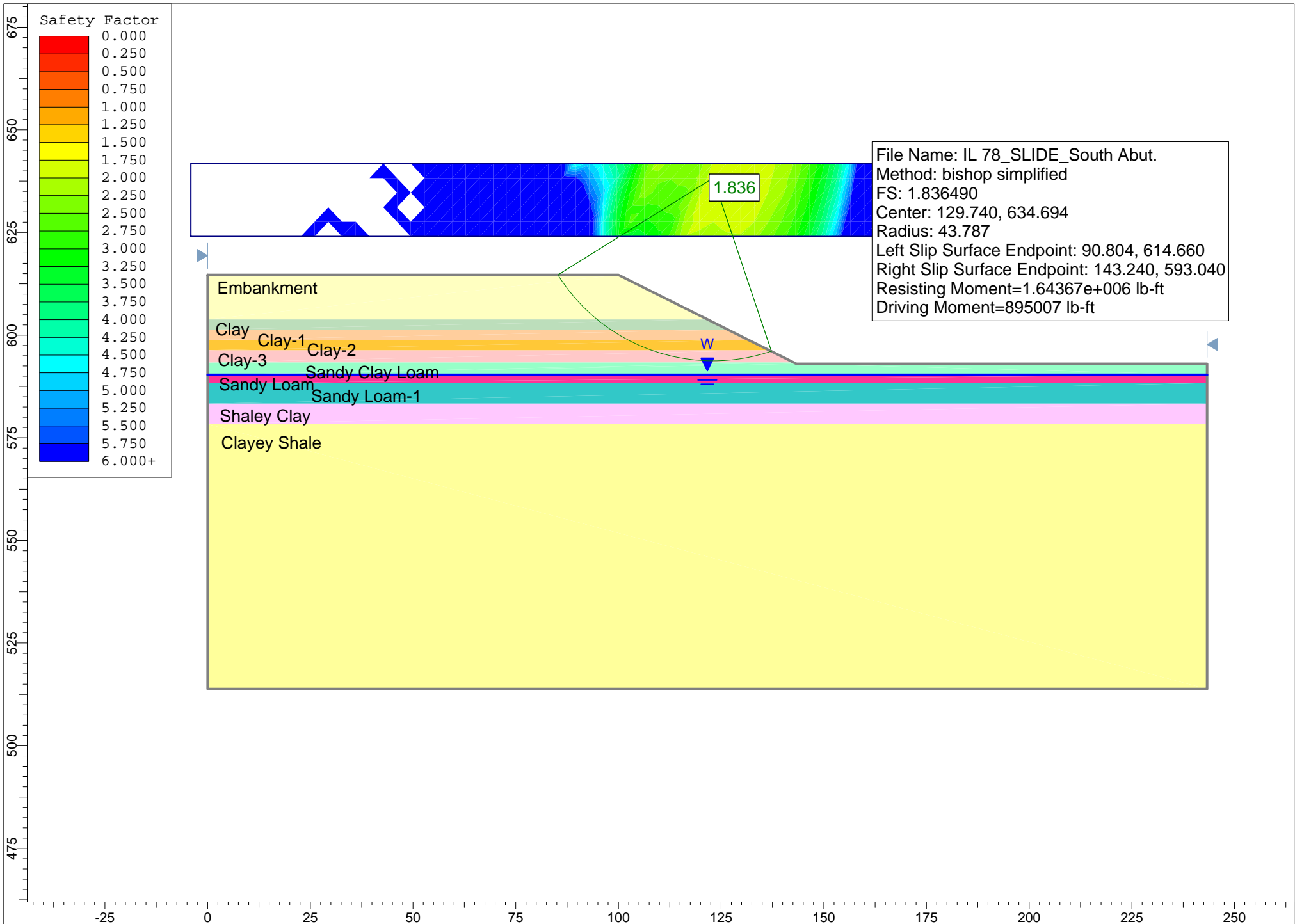
0.000	614.660
0.000	603.820
0.000	601.320
0.000	598.820
0.000	596.320
0.000	593.320
0.000	590.320
0.000	588.320
0.000	583.320
0.000	578.320
0.000	513.820
243.320	513.820
243.320	578.320
243.320	583.320
243.320	588.320
243.320	590.320
243.320	593.000
143.320	593.000
142.680	593.320
136.680	596.320
131.680	598.820
126.680	601.320
121.680	603.820
100.000	614.660

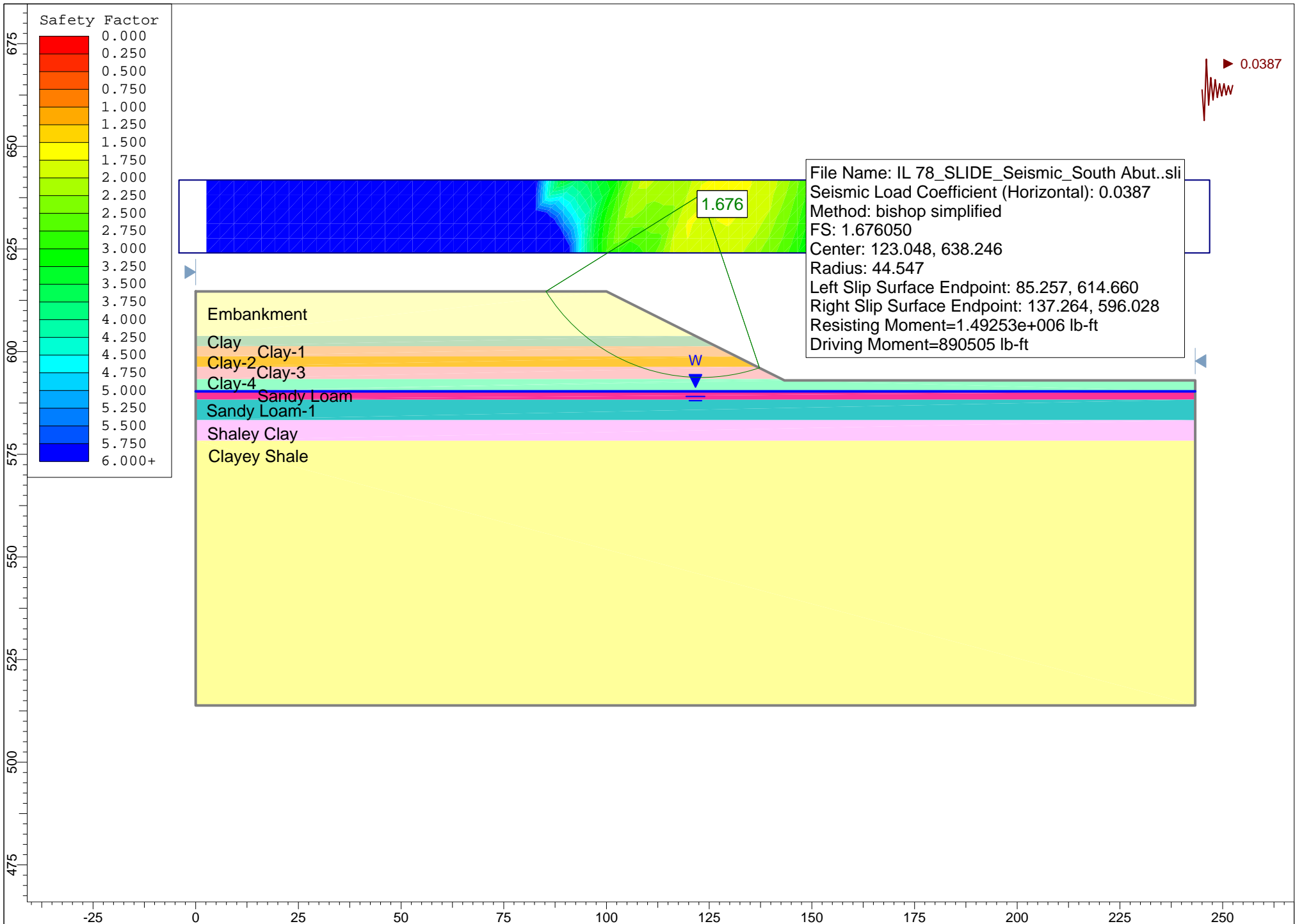
Water Table

0.000	590.320
243.320	590.320

Search Grid

-4.086	624.038
246.837	624.038
246.837	641.798
-4.086	641.798





Appendix F

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====**IL Route 78 over Kickapoo Creek**

Substructure 1

Base of Substruct. Elev. (or ground surf for bents) **607.73** ft.
 Pile or Shaft Dia. **12** inches
 Boring Number **B-1**
 Top of Boring Elev. **603.82** ft.
 Approximate Fixity Elev. **601.73** ft.

Individual Site Class Definition:

N (bar): 22 (Blows/ft.) Soil Site Class D
 N_{ch} (bar): 32 (Blows/ft.) Soil Site Class D <----Controls
 s_u (bar): 2.66 (ksf) Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	Sample Description		Layer Boundary
			N (tsf)	Qu (tsf)	
	602.3	1.50	4	0.50	B
1.9	599.8	2.50	5	1.00	B
4.4	597.3	2.50	4	0.50	B
6.9	594.8	2.50	4	0.30	B
9.4	592.3	2.50	2		B
11.9	589.8	2.50	4		B
14.4	587.3	2.50	13		
16.9	584.8	2.50	76		B
19.4	582.3	2.50	60	4.00	
21.9	579.8	2.50	60	4.00	B
24.4	577.3	2.50	300	4.50	
26.9	574.8	2.50	400	4.50	
31.9	569.8	5.00	150	4.50	
100.0	501.7	68.09	600	4.50	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents) **596.5** ft.
 Pile or Shaft Dia. **12** inches
 Boring Number **B-2**
 Top of Boring Elev. **602.83** ft.
 Approximate Fixity Elev. **590.5** ft.

Individual Site Class Definition:

N (bar): 48 (Blows/ft.) Soil Site Class D
 N_{ch} (bar): 93 (Blows/ft.) Soil Site Class C
 s_u (bar): 2.45 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	Sample Description		Layer Boundary
			N (tsf)	Qu (tsf)	
	601.3	1.50	4	2.30	
	598.8	2.50	4	2.00	
	596.3	2.50	8	2.00	B
	593.8	2.50	5	0.50	B
	591.3	2.50	3	0.50	
1.7	588.8	2.50	2	0.50	B
4.2	586.3	2.50	20	0.30	
6.7	583.8	2.50	23	0.30	B
9.2	581.3	2.50	86	4.50	
11.7	578.8	2.50	70	4.50	
14.2	576.3	2.50	120	4.50	
16.7	573.8	2.50	150	4.50	
21.7	568.8	5.00	150	4.50	
100.0	490.5	78.30	300	4.50	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents) **596.5** ft.
 Pile or Shaft Dia. **12** inches
 Boring Number **B-3**
 Top of Boring Elev. **603.18** ft.
 Approximate Fixity Elev. **590.5** ft.

Individual Site Class Definition:

N (bar): 80 (Blows/ft.) Soil Site Class C <----Controls
 N_{ch} (bar): 80 (Blows/ft.) Soil Site Class C
 s_u (bar): 4.5 (ksf) Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	Sample Description		Layer Boundary
			N (tsf)	Qu (tsf)	
	601.7	1.50	9	0.80	B
	599.2	2.50	9	1.50	B
	596.7	2.50	8	0.30	B
	594.2	2.50	3	0.80	B
	591.7	2.50	2	0.30	B
1.3	589.2	2.50	15		
6.3	584.2	5.00	21		
8.8	581.7	2.50	52		B
11.3	579.2	2.50	88	4.50	
13.8	576.7	2.50	150	4.50	
16.3	574.2	2.50	300	4.50	
100.0	490.5	83.70	300	4.50	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents) **607.06** ft.
 Pile or Shaft Dia. **12** inches
 Boring Number **B-3**
 Top of Boring Elev. **603.18** ft.
 Approximate Fixity Elev. **601.06** ft.

Individual Site Class Definition:

N (bar): 26 (Blows/ft.) Soil Site Class D
 N_{ch} (bar): 77 (Blows/ft.) Soil Site Class C
 s_u (bar): 2.31 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	Sample Description		Layer Boundary
			N (tsf)	Qu (tsf)	
	601.7	1.50	9	0.80	B
1.9	599.2	2.50	9	1.50	B
4.4	596.7	2.50	8	0.30	B
6.9	594.2	2.50	3	0.80	B
9.4	591.7	2.50	2	0.30	B
11.9	589.2	2.50	15		
16.9	584.2	5.00	21		
19.4	581.7	2.50	52		B
21.9	579.2	2.50	88	4.50	
24.4	576.7	2.50	150	4.50	
26.9	574.2	2.50	300	4.50	
100.0	501.1	73.10	300	4.50	R

Global Site Class Definition: Substructures 1 through 4

N (bar): 44 (Blows/ft.) Soil Site Class D
 N_{ch} (bar): 71 (Blows/ft.) Soil Site Class C
 s_u (bar): 2.97 (ksf) Soil Site Class C <----Controls

Appendix G

Appendix G

Part - I

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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
413 KIPS	413 KIPS	227 KIPS	17 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.25" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		2.3		5.8	6	0	0	3	2
604.14	2.50	0.30	8		3.5	3.5	15.2	15	0	0	8	5
601.64	2.50	0.80	3		8.5	9.4	17.8	18	0	0	10	7
599.14	2.50	0.30	2		3.5	3.5	107.9	108	0	0	59	10
596.64	2.50		15	Fine Sand	11.9	90.2	170.9	171	0	0	94	12
591.64	5.00		21	Fine Sand	33.3	141.3	412.9	413	0	0	227	17
589.14	2.50		52	Fine Sand	57.1	349.9	456.5	457	0	0	254	20
588.64	0.50			Shale	115.4	336.5	571.9	572	0	0	345	20.4
588.14	0.50			Shale	115.4	336.5	687.2	687	0	0	378	20.9
587.64	0.50			Shale	115.4	336.5	802.6	803	0	0	441	21.4
587.14	0.50			Shale	115.4	336.5	918.0	918	0	0	505	21.9
586.64	0.50			Shale	115.4	336.5	1033.3	1033	0	0	568	22.4
586.14	0.50			Shale	115.4	336.5	1148.7	1149	0	0	632	22.9
585.64	0.50			Shale	115.4	336.5	1264.1	1264	0	0	695	23.4
585.14	0.50			Shale	115.4	336.5	1379.4	1379	0	0	759	23.9
584.64	0.50			Shale	115.4	336.5	1494.8	1495	0	0	822	24.4
584.14	0.50			Shale	115.4	336.5	1610.1	1610	0	0	886	24.9
583.64	0.50			Shale	115.4	336.5	1725.5	1726	0	0	949	25.4
583.14	0.50			Shale	115.4	336.5	1840.9	1841	0	0	1012	25.9
582.64	0.50			Shale	115.4	336.5	1956.2	1956	0	0	1076	26.4
582.14	0.50			Shale	115.4	336.5	2071.6	2072	0	0	1139	26.9
581.64	0.50			Shale	115.4	336.5	2187.0	2187	0	0	1203	27.4
581.14	0.50			Shale	115.4	336.5	2302.3	2302	0	0	1266	27.9
580.64	0.50			Shale	115.4	336.5	2417.7	2418	0	0	1330	28.4
580.14	0.50			Shale	115.4	336.5	2533.0	2533	0	0	1393	28.9
579.64	0.50			Shale	115.4	336.5	2648.4	2648	0	0	1457	29.4
579.14	0.50			Shale	115.4	336.5	2763.8	2764	0	0	1520	29.9
578.64	0.50			Shale	115.4	336.5	2879.1	2879	0	0	1584	30.4
578.14	0.50			Shale	115.4	336.5	2994.5	2994	0	0	1647	30.9
577.64	0.50			Shale	115.4	336.5	3109.9	3110	0	0	1710	31.4
577.14	0.50			Shale	115.4	336.5	3225.2	3225	0	0	1774	31.9
576.64	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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
513 KIPS	457 KIPS	251 KIPS	20 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.312" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		2.3		5.8	6	0	0	3	2
604.14	2.50	0.30	8		3.5	3.5	15.2	15	0	0	8	5
601.64	2.50	0.80	3		8.5	9.4	17.8	18	0	0	10	7
599.14	2.50	0.30	2		3.5	3.5	107.9	108	0	0	59	10
596.64	2.50		15	Fine Sand	11.9	90.2	170.9	171	0	0	94	12
591.64	5.00		21	Fine Sand	33.3	141.3	412.9	413	0	0	227	17
589.14	2.50		52	Fine Sand	57.1	349.9	456.5	457	0	0	251	20
588.64	0.50			Shale	115.4	336.5	571.9	572	0	0	315	20.4
588.14	0.50			Shale	115.4	336.5	687.2	687	0	0	378	20.9
587.64	0.50			Shale	115.4	336.5	802.6	803	0	0	441	21.4
587.14	0.50			Shale	115.4	336.5	918.0	918	0	0	505	21.9
586.64	0.50			Shale	115.4	336.5	1033.3	1033	0	0	568	22.4
586.14	0.50			Shale	115.4	336.5	1148.7	1149	0	0	632	22.9
585.64	0.50			Shale	115.4	336.5	1264.1	1264	0	0	695	23.4
585.14	0.50			Shale	115.4	336.5	1379.4	1379	0	0	759	23.9
584.64	0.50			Shale	115.4	336.5	1494.8	1495	0	0	822	24.4
584.14	0.50			Shale	115.4	336.5	1610.1	1610	0	0	886	24.9
583.64	0.50			Shale	115.4	336.5	1725.5	1726	0	0	949	25.4
583.14	0.50			Shale	115.4	336.5	1840.9	1841	0	0	1012	25.9
582.64	0.50			Shale	115.4	336.5	1956.2	1956	0	0	1076	26.4
582.14	0.50			Shale	115.4	336.5	2071.6	2072	0	0	1139	26.9
581.64	0.50			Shale	115.4	336.5	2187.0	2187	0	0	1203	27.4
581.14	0.50			Shale	115.4	336.5	2302.3	2302	0	0	1266	27.9
580.64	0.50			Shale	115.4	336.5	2417.7	2418	0	0	1330	28.4
580.14	0.50			Shale	115.4	336.5	2533.0	2533	0	0	1393	28.9
579.64	0.50			Shale	115.4	336.5	2648.4	2648	0	0	1457	29.4
579.14	0.50			Shale	115.4	336.5	2763.8	2764	0	0	1520	29.9
578.64	0.50			Shale	115.4	336.5	2879.1	2879	0	0	1584	30.4
578.14	0.50			Shale	115.4	336.5	2994.5	2994	0	0	1647	30.9
577.64	0.50			Shale	115.4	336.5	3109.9	3110	0	0	1710	31.4
577.14	0.50			Shale	115.4	336.5	3225.2	3225	0	0	1774	31.9
576.64	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	319 KIPS	175 KIPS	25 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 10 X 42

Plugged Pile Perimeter===== 3.300 FT. Unplugged Pile Perimeter===== 4.858 FT.
 Plugged Pile End Bearing Area===== 0.680 SQFT. Unplugged Pile End Bearing Area===== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		1.3		4.2	2.0		2.3	2	0	0	1	2
604.14	2.50	0.30	8		2.0	2.9	11.0	2.9	0.4	5.9	6	0	0	3	5
601.64	2.50	0.80	3		4.9	7.6	11.1	7.2	1.0	12.4	11	0	0	6	7
599.14	2.50	0.30	2		2.0	2.9	35.6	2.9	0.4	18.2	18	0	0	10	10
596.64	2.50		15	Fine Sand	2.1	25.4	47.9	3.1	3.2	22.6	23	0	0	12	12
591.64	5.00		21	Fine Sand	5.9	35.6	106.4	8.7	4.5	38.0	38	0	0	21	17
589.14	2.50		52	Fine Sand	10.2	88.1	113.2	15.0	11.2	52.6	53	0	0	29	20
588.64	0.50			Shale	20.6	84.8	133.7	30.3	10.7	82.8	83	0	0	46	20.4
588.14	0.50			Shale	20.6	84.8	154.3	30.3	10.7	113.1	113	0	0	62	20.9
587.64	0.50			Shale	20.6	84.8	174.8	30.3	10.7	143.4	143	0	0	79	21.4
587.14	0.50			Shale	20.6	84.8	195.4	30.3	10.7	173.6	174	0	0	95	21.9
586.64	0.50			Shale	20.6	84.8	216.0	30.3	10.7	203.9	204	0	0	112	22.4
586.14	0.50			Shale	20.6	84.8	236.5	30.3	10.7	234.1	234	0	0	129	22.9
585.64	0.50			Shale	20.6	84.8	257.1	30.3	10.7	264.4	257	0	0	141	23.4
585.14	0.50			Shale	20.6	84.8	277.6	30.3	10.7	294.7	278	0	0	153	23.9
584.64	0.50			Shale	20.6	84.8	298.2	30.3	10.7	324.9	298	0	0	164	24.4
584.14	0.50			Shale	20.6	84.8	318.7	30.3	10.7	355.2	319	0	0	175	24.9
583.64	0.50			Shale	20.6	84.8	339.3	30.3	10.7	385.4	339	0	0	187	25.4
583.14	0.50			Shale	20.6	84.8	359.8	30.3	10.7	415.7	360	0	0	198	25.9
582.64	0.50			Shale	20.6	84.8	380.4	30.3	10.7	446.0	380	0	0	209	26.4
582.14	0.50			Shale	20.6	84.8	400.9	30.3	10.7	476.2	401	0	0	221	26.9
581.64	0.50			Shale	20.6	84.8	421.5	30.3	10.7	506.5	421	0	0	232	27.4
581.14	0.50			Shale	20.6	84.8	442.1	30.3	10.7	536.8	442	0	0	243	27.9
580.64	0.50			Shale	20.6	84.8	462.6	30.3	10.7	567.0	463	0	0	254	28.4
580.14	0.50			Shale	20.6	84.8	483.2	30.3	10.7	597.3	483	0	0	266	28.9
579.64	0.50			Shale	20.6	84.8	503.7	30.3	10.7	627.5	504	0	0	277	29.4
579.14	0.50			Shale	20.6	84.8	524.3	30.3	10.7	657.8	524	0	0	288	29.9
578.64	0.50			Shale	20.6	84.8	544.8	30.3	10.7	688.1	545	0	0	300	30.4
578.14	0.50			Shale	20.6	84.8	565.4	30.3	10.7	718.3	566	0	0	311	30.9
577.64	0.50			Shale	20.6	84.8	585.9	30.3	10.7	748.6	586	0	0	322	31.4
577.14	0.50			Shale	20.6	84.8	606.5	30.3	10.7	778.8	606	0	0	334	31.9
576.64	0.50			Shale		84.8									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	404 KIPS	222 KIPS	25 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 12 X 53

Plugged Pile Perimeter===== 3.967 FT. Unplugged Pile Perimeter===== 5.800 FT.
 Plugged Pile End Bearing Area===== 0.983 SQFT. Unplugged Pile End Bearing Area===== 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		1.6		5.7	2.3		2.8	3	0	0	2	2
604.14	2.50	0.30	8		2.4	4.1	15.0	3.5	0.5	7.1	7	0	0	4	5
601.64	2.50	0.80	3		5.9	11.0	14.0	8.6	1.2	14.9	14	0	0	8	7
599.14	2.50	0.30	2		2.4	4.1	49.0	3.5	0.5	22.0	22	0	0	12	10
596.64	2.50		15	Fine Sand	2.5	36.7	66.3	3.7	4.0	27.3	27	0	0	15	12
591.64	5.00		21	Fine Sand	7.1	51.4	149.3	10.4	5.6	46.0	46	0	0	25	17
589.14	2.50		52	Fine Sand	12.2	127.4	156.7	17.9	13.9	63.4	63	0	0	35	20
588.64	0.50			Shale	24.7	122.5	181.4	36.1	13.4	99.5	100	0	0	55	20.4
588.14	0.50			Shale	24.7	122.5	206.1	36.1	13.4	135.6	136	0	0	75	20.9
587.64	0.50			Shale	24.7	122.5	230.8	36.1	13.4	171.8	172	0	0	94	21.4
587.14	0.50			Shale	24.7	122.5	255.5	36.1	13.4	207.9	208	0	0	114	21.9
586.64	0.50			Shale	24.7	122.5	280.2	36.1	13.4	244.0	244	0	0	134	22.4
586.14	0.50			Shale	24.7	122.5	304.9	36.1	13.4	280.1	280	0	0	154	22.9
585.64	0.50			Shale	24.7	122.5	329.6	36.1	13.4	316.3	316	0	0	174	23.4
585.14	0.50			Shale	24.7	122.5	354.3	36.1	13.4	352.4	352	0	0	194	23.9
584.64	0.50			Shale	24.7	122.5	379.0	36.1	13.4	388.5	379	0	0	208	24.4
584.14	0.50			Shale	24.7	122.5	403.7	36.1	13.4	424.6	404	0	0	222	24.9
583.64	0.50			Shale	24.7	122.5	428.4	36.1	13.4	460.8	428	0	0	236	25.4
583.14	0.50			Shale	24.7	122.5	453.2	36.1	13.4	496.9	453	0	0	249	25.9
582.64	0.50			Shale	24.7	122.5	477.9	36.1	13.4	533.0	478	0	0	263	26.4
582.14	0.50			Shale	24.7	122.5	502.6	36.1	13.4	569.1	503	0	0	276	26.9
581.64	0.50			Shale	24.7	122.5	527.3	36.1	13.4	605.3	527	0	0	290	27.4
581.14	0.50			Shale	24.7	122.5	552.0	36.1	13.4	641.4	552	0	0	304	27.9
580.64	0.50			Shale	24.7	122.5	576.7	36.1	13.4	677.5	577	0	0	317	28.4
580.14	0.50			Shale	24.7	122.5	601.4	36.1	13.4	713.6	604	0	0	331	28.9
579.64	0.50			Shale	24.7	122.5	626.1	36.1	13.4	749.8	626	0	0	344	29.4
579.14	0.50			Shale	24.7	122.5	650.8	36.1	13.4	785.9	654	0	0	358	29.9
578.64	0.50			Shale	24.7	122.5	675.5	36.1	13.4	822.0	676	0	0	372	30.4
578.14	0.50			Shale	24.7	122.5	700.2	36.1	13.4	858.1	700	0	0	385	30.9
577.64	0.50			Shale	24.7	122.5	724.9	36.1	13.4	894.3	725	0	0	399	31.4
577.14	0.50			Shale	24.7	122.5	749.6	36.1	13.4	930.4	750	0	0	412	31.9
576.64	0.50			Shale		122.5									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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
497 KIPS	483 KIPS	266 KIPS	26 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 12 X 63

Plugged Pile Perimeter===== 4.000 FT. Unplugged Pile Perimeter===== 5.883 FT.
 Plugged Pile End Bearing Area===== 1.000 SQFT. Unplugged Pile End Bearing Area===== 0.128 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		1.6		5.8	2.4		2.9	3	0	0	2	2
604.14	2.50	0.30	8		2.4	4.2	15.2	3.6	0.5	7.4	7	0	0	4	5
601.64	2.50	0.80	3		5.9	11.2	14.1	8.7	1.4	15.2	14	0	0	8	7
599.14	2.50	0.30	2		2.4	4.2	49.7	3.6	0.5	23.0	23	0	0	13	10
596.64	2.50		15	Fine Sand	2.6	37.4	67.3	3.8	4.8	28.7	29	0	0	16	12
591.64	5.00		21	Fine Sand	7.2	52.3	151.7	10.6	6.7	49.1	49	0	0	27	17
589.14	2.50		52	Fine Sand	12.3	129.5	159.0	18.1	16.6	66.6	67	0	0	37	20
588.64	0.50			Shale	24.9	124.6	183.9	36.6	15.9	103.3	103	0	0	57	20.4
588.14	0.50			Shale	24.9	124.6	208.9	36.6	15.9	139.9	140	0	0	77	20.9
587.64	0.50			Shale	24.9	124.6	233.8	36.6	15.9	176.5	177	0	0	97	21.4
587.14	0.50			Shale	24.9	124.6	258.7	36.6	15.9	213.2	213	0	0	117	21.9
586.64	0.50			Shale	24.9	124.6	283.6	36.6	15.9	249.8	250	0	0	137	22.4
586.14	0.50			Shale	24.9	124.6	308.5	36.6	15.9	286.5	286	0	0	158	22.9
585.64	0.50			Shale	24.9	124.6	333.4	36.6	15.9	323.1	323	0	0	178	23.4
585.14	0.50			Shale	24.9	124.6	358.3	36.6	15.9	359.8	358	0	0	197	23.9
584.64	0.50			Shale	24.9	124.6	383.3	36.6	15.9	396.4	383	0	0	211	24.4
584.14	0.50			Shale	24.9	124.6	408.2	36.6	15.9	433.1	408	0	0	224	24.9
583.64	0.50			Shale	24.9	124.6	433.1	36.6	15.9	469.7	433	0	0	238	25.4
583.14	0.50			Shale	24.9	124.6	458.0	36.6	15.9	506.3	458	0	0	252	25.9
582.64	0.50			Shale	24.9	124.6	482.9	36.6	15.9	543.0	483	0	0	266	26.4
582.14	0.50			Shale	24.9	124.6	507.8	36.6	15.9	579.6	508	0	0	279	26.9
581.64	0.50			Shale	24.9	124.6	532.7	36.6	15.9	616.3	533	0	0	293	27.4
581.14	0.50			Shale	24.9	124.6	557.7	36.6	15.9	652.9	558	0	0	307	27.9
580.64	0.50			Shale	24.9	124.6	582.6	36.6	15.9	689.6	583	0	0	320	28.4
580.14	0.50			Shale	24.9	124.6	607.5	36.6	15.9	726.2	607	0	0	334	28.9
579.64	0.50			Shale	24.9	124.6	632.4	36.6	15.9	762.9	632	0	0	348	29.4
579.14	0.50			Shale	24.9	124.6	657.3	36.6	15.9	799.5	657	0	0	362	29.9
578.64	0.50			Shale	24.9	124.6	682.2	36.6	15.9	836.1	682	0	0	375	30.4
578.14	0.50			Shale	24.9	124.6	707.1	36.6	15.9	872.8	707	0	0	389	30.9
577.64	0.50			Shale	24.9	124.6	732.1	36.6	15.9	909.4	732	0	0	403	31.4
577.14	0.50			Shale	24.9	124.6	757.0	36.6	15.9	946.1	757	0	0	416	31.9
576.64	0.50			Shale		124.6									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

TOTAL FACTORED SUBSTRUCTURE LOAD =====890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)=====35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE =====1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 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
578 KIPS	564 KIPS	310 KIPS	26 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		1.9		7.7	2.8		3.4	3	0	0	2	2
604.14	2.50	0.30	8		2.8	5.8	20.2	4.2	0.6	8.7	9	0	0	5	5
601.64	2.50	0.80	3		6.9	15.5	17.5	10.3	1.7	18.0	17	0	0	10	7
599.14	2.50	0.30	2		2.8	5.8	60.6	4.2	0.6	26.5	27	0	0	15	10
596.64	2.50		15	Fine Sand	3.0	46.0	89.7	4.5	5.0	33.8	34	0	0	19	12
591.64	5.00		21	Fine Sand	8.5	72.1	204.6	12.5	7.8	57.8	58	0	0	32	17
589.14	2.50		52	Fine Sand	14.5	178.6	212.3	21.5	19.3	78.6	79	0	0	43	20
588.64	0.50			Shale	29.3	171.8	241.5	43.4	18.5	122.1	122	0	0	67	20.4
588.14	0.50			Shale	29.3	171.8	270.8	43.4	18.5	165.5	165	0	0	91	20.9
587.64	0.50			Shale	29.3	171.8	300.1	43.4	18.5	208.9	209	0	0	115	21.4
587.14	0.50			Shale	29.3	171.8	329.4	43.4	18.5	252.4	252	0	0	139	21.9
586.64	0.50			Shale	29.3	171.8	358.6	43.4	18.5	295.8	296	0	0	163	22.4
586.14	0.50			Shale	29.3	171.8	387.9	43.4	18.5	339.3	339	0	0	187	22.9
585.64	0.50			Shale	29.3	171.8	417.2	43.4	18.5	382.7	383	0	0	210	23.4
585.14	0.50			Shale	29.3	171.8	446.5	43.4	18.5	426.2	426	0	0	234	23.9
584.64	0.50			Shale	29.3	171.8	475.7	43.4	18.5	469.6	470	0	0	258	24.4
584.14	0.50			Shale	29.3	171.8	505.0	43.4	18.5	513.0	505	0	0	278	24.9
583.64	0.50			Shale	29.3	171.8	534.3	43.4	18.5	556.5	534	0	0	294	25.4
583.14	0.50			Shale	29.3	171.8	563.6	43.4	18.5	599.9	564	0	0	310	25.9
582.64	0.50			Shale	29.3	171.8	592.8	43.4	18.5	643.4	593	0	0	326	26.4
582.14	0.50			Shale	29.3	171.8	622.1	43.4	18.5	686.8	622	0	0	342	26.9
581.64	0.50			Shale	29.3	171.8	651.4	43.4	18.5	730.3	654	0	0	358	27.4
581.14	0.50			Shale	29.3	171.8	680.7	43.4	18.5	773.7	684	0	0	374	27.9
580.64	0.50			Shale	29.3	171.8	709.9	43.4	18.5	817.2	740	0	0	390	28.4
580.14	0.50			Shale	29.3	171.8	739.2	43.4	18.5	860.6	739	0	0	407	28.9
579.64	0.50			Shale	29.3	171.8	768.5	43.4	18.5	904.0	768	0	0	423	29.4
579.14	0.50			Shale	29.3	171.8	797.7	43.4	18.5	947.5	798	0	0	439	29.9
578.64	0.50			Shale	29.3	171.8	827.0	43.4	18.5	990.9	827	0	0	455	30.4
578.14	0.50			Shale	29.3	171.8	856.3	43.4	18.5	1034.4	856	0	0	471	30.9
577.64	0.50			Shale	29.3	171.8	885.6	43.4	18.5	1077.8	886	0	0	487	31.4
577.14	0.50			Shale	29.3	171.8	914.8	43.4	18.5	1121.3	945	0	0	503	31.9
576.64	0.50			Shale		171.8									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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	690 KIPS	379 KIPS	28 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

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			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		1.9		7.8	2.8		3.6	4	0	0	2	2
604.14	2.50	0.30	8		2.9	5.9	20.6	4.3	0.8	9.1	9	0	0	5	5
601.64	2.50	0.80	3		7.0	15.8	17.7	10.4	2.0	18.2	18	0	0	10	7
599.14	2.50	0.30	2		2.9	5.9	61.7	4.3	0.8	27.8	28	0	0	15	10
596.64	2.50		15	Fine Sand	3.1	47.0	91.4	4.5	6.1	35.7	36	0	0	20	12
591.64	5.00		21	Fine Sand	8.5	73.7	208.8	12.6	9.5	62.4	62	0	0	34	17
589.14	2.50		52	Fine Sand	14.6	182.5	216.4	21.7	23.5	83.2	83	0	0	46	20
588.64	0.50			Shale	29.6	175.5	246.0	43.8	22.6	127.0	127	0	0	70	20.4
588.14	0.50			Shale	29.6	175.5	275.6	43.8	22.6	170.8	171	0	0	94	20.9
587.64	0.50			Shale	29.6	175.5	305.2	43.8	22.6	214.6	215	0	0	118	21.4
587.14	0.50			Shale	29.6	175.5	334.8	43.8	22.6	258.4	258	0	0	142	21.9
586.64	0.50			Shale	29.6	175.5	364.3	43.8	22.6	302.2	302	0	0	166	22.4
586.14	0.50			Shale	29.6	175.5	393.9	43.8	22.6	346.0	346	0	0	190	22.9
585.64	0.50			Shale	29.6	175.5	423.5	43.8	22.6	389.8	390	0	0	214	23.4
585.14	0.50			Shale	29.6	175.5	453.1	43.8	22.6	433.6	434	0	0	239	23.9
584.64	0.50			Shale	29.6	175.5	482.7	43.8	22.6	477.5	477	0	0	263	24.4
584.14	0.50			Shale	29.6	175.5	512.3	43.8	22.6	521.3	512	0	0	282	24.9
583.64	0.50			Shale	29.6	175.5	541.9	43.8	22.6	565.1	542	0	0	298	25.4
583.14	0.50			Shale	29.6	175.5	571.4	43.8	22.6	608.9	571	0	0	314	25.9
582.64	0.50			Shale	29.6	175.5	601.0	43.8	22.6	652.7	601	0	0	331	26.4
582.14	0.50			Shale	29.6	175.5	630.6	43.8	22.6	696.5	631	0	0	347	26.9
581.64	0.50			Shale	29.6	175.5	660.2	43.8	22.6	740.3	660	0	0	363	27.4
581.14	0.50			Shale	29.6	175.5	689.8	43.8	22.6	784.1	690	0	0	379	27.9
580.64	0.50			Shale	29.6	175.5	719.4	43.8	22.6	827.9	749	0	0	396	28.4
580.14	0.50			Shale	29.6	175.5	749.0	43.8	22.6	871.7	749	0	0	412	28.9
579.64	0.50			Shale	29.6	175.5	778.5	43.8	22.6	915.5	779	0	0	428	29.4
579.14	0.50			Shale	29.6	175.5	808.1	43.8	22.6	959.3	808	0	0	444	29.9
578.64	0.50			Shale	29.6	175.5	837.7	43.8	22.6	1003.1	838	0	0	461	30.4
578.14	0.50			Shale	29.6	175.5	867.3	43.8	22.6	1046.9	867	0	0	477	30.9
577.64	0.50			Shale	29.6	175.5	896.9	43.8	22.6	1090.8	897	0	0	493	31.4
577.14	0.50			Shale	29.6	175.5	926.5	43.8	22.6	1134.6	926	0	0	510	31.9
576.64	0.50			Shale		175.5									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====North Abut
 REFERENCE BORING =====B-3
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.06 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.06 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	920 KIPS	506 KIPS	31 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 14 X 117

Plugged Pile Perimeter===== 4.850 FT. Unplugged Pile Perimeter===== 7.117 FT.
 Plugged Pile End Bearing Area===== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
606.64	0.42	1.50	9		2.0		8.1	2.9		3.9	4	0	0	2	2
604.14	2.50	0.30	8		2.9	6.2	21.4	4.3	1.0	9.9	10	0	0	5	5
601.64	2.50	0.80	3		7.2	16.5	18.2	10.5	2.7	18.7	18	0	0	10	7
599.14	2.50	0.30	2		2.9	6.2	64.0	4.3	1.0	30.0	30	0	0	16	10
596.64	2.50		15	Fine Sand	3.1	49.0	95.0	4.6	8.0	39.1	39	0	0	21	12
591.64	5.00		21	Fine Sand	8.7	76.9	217.2	12.8	12.5	70.3	70	0	0	39	17
589.14	2.50		52	Fine Sand	15.0	190.4	224.8	21.9	31.0	91.1	91	0	0	50	20
588.64	0.50			Shale	30.2	183.0	255.0	44.3	29.8	135.4	135	0	0	74	20.4
588.14	0.50			Shale	30.2	183.0	285.2	44.3	29.8	179.7	180	0	0	99	20.9
587.64	0.50			Shale	30.2	183.0	315.4	44.3	29.8	224.1	224	0	0	123	21.4
587.14	0.50			Shale	30.2	183.0	345.7	44.3	29.8	268.4	268	0	0	148	21.9
586.64	0.50			Shale	30.2	183.0	375.9	44.3	29.8	312.7	313	0	0	172	22.4
586.14	0.50			Shale	30.2	183.0	406.1	44.3	29.8	357.0	357	0	0	196	22.9
585.64	0.50			Shale	30.2	183.0	436.3	44.3	29.8	401.4	401	0	0	221	23.4
585.14	0.50			Shale	30.2	183.0	466.5	44.3	29.8	445.7	446	0	0	245	23.9
584.64	0.50			Shale	30.2	183.0	496.7	44.3	29.8	490.0	490	0	0	270	24.4
584.14	0.50			Shale	30.2	183.0	526.9	44.3	29.8	534.3	527	0	0	290	24.9
583.64	0.50			Shale	30.2	183.0	557.1	44.3	29.8	578.7	557	0	0	306	25.4
583.14	0.50			Shale	30.2	183.0	587.3	44.3	29.8	623.0	587	0	0	323	25.9
582.64	0.50			Shale	30.2	183.0	617.5	44.3	29.8	667.3	618	0	0	340	26.4
582.14	0.50			Shale	30.2	183.0	647.7	44.3	29.8	711.6	648	0	0	356	26.9
581.64	0.50			Shale	30.2	183.0	677.9	44.3	29.8	756.0	678	0	0	373	27.4
581.14	0.50			Shale	30.2	183.0	708.2	44.3	29.8	800.3	708	0	0	389	27.9
580.64	0.50			Shale	30.2	183.0	738.4	44.3	29.8	844.6	738	0	0	406	28.4
580.14	0.50			Shale	30.2	183.0	768.6	44.3	29.8	889.0	769	0	0	423	28.9
579.64	0.50			Shale	30.2	183.0	798.8	44.3	29.8	933.3	799	0	0	439	29.4
579.14	0.50			Shale	30.2	183.0	829.0	44.3	29.8	977.6	829	0	0	456	29.9
578.64	0.50			Shale	30.2	183.0	859.2	44.3	29.8	1021.9	859	0	0	473	30.4
578.14	0.50			Shale	30.2	183.0	889.4	44.3	29.8	1066.3	889	0	0	489	30.9
577.64	0.50			Shale	30.2	183.0	919.6	44.3	29.8	1110.6	920	0	0	506	31.4
577.14	0.50			Shale	30.2	183.0	949.8	44.3	29.8	1154.9	959	0	0	522	31.9
576.64	0.50			Shale		183.0			29.8						

Pile Design Table for North Abut utilizing Boring #B-3

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)		
Metal Shell 12"Φ w/.179" walls			Steel HP 10 X 57			Steel HP 14 X 73				
129	71	12	452	249	28	564	310	26		
Metal Shell 12"Φ w/.25" walls			Steel HP 12 X 53			Steel HP 14 X 89				
129	71	12	404	222	25	690	379	28		
311	171	17	Steel HP 12 X 63			Steel HP 14 X 102				
350	193	20	483	266	26	789	434	29		
Metal Shell 14"Φ w/.25" walls			Steel HP 12 X 74			Steel HP 14 X 117				
108	59	10	566	311	28	920	506	31		
171	94	12	Steel HP 12 X 84			Precast 14"x 14"				
413	227	17	651	358	29	137	76	10		
Metal Shell 14"Φ w/.312" walls						218			120	12
108	59	10				Timber Pile				
171	94	12				61			33	12
413	227	17				141			78	17
457	251	20								
Steel HP 8 X 36										
281	155	26								
Steel HP 10 X 42										
319	175	25								

Appendix G

Part- II

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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
413 KIPS	131 KIPS	72 KIPS	20 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE : 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.25" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		15.9		21.8	22	0	0	12	6
602.32	1.50	0.50	4		3.4	5.9	31.0	31	0	0	17	7
599.82	2.50	1.00	5		10.2	11.7	35.3	35	0	0	19	10
597.32	2.50	0.50	4		5.6	5.9	38.6	39	0	0	21	12
594.82	2.50	0.30	4		3.5	3.5	52.0	52	0	0	29	15
592.32	2.50		2	Fine Sand	1.6	13.5	67.1	67	0	0	37	17
589.82	2.50		4	Fine Sand	3.2	26.9	130.8	131	0	0	72	20
587.32	2.50		13	Fine Sand	10.3	87.5	565.1	565	0	0	311	22
584.82	2.50		76	Fine Sand	108.8	511.4	465.3	465	0	0	256	25
582.32	2.50		60	Hard Till	39.6	302.8	504.9	505	0	0	278	27
579.82	2.50		60	Hard Till	39.6	302.8	578.1	578	0	0	318	30
579.32	0.50			Shale	115.4	336.5	693.5	693	0	0	381	30.4
578.82	0.50			Shale	115.4	336.5	808.9	809	0	0	445	30.9
578.32	0.50			Shale	115.4	336.5	924.2	924	0	0	508	31.4
577.82	0.50			Shale	115.4	336.5	1039.6	1040	0	0	572	31.9
577.32	0.50			Shale	115.4	336.5	1154.9	1155	0	0	635	32.4
576.82	0.50			Shale	115.4	336.5	1270.3	1270	0	0	699	32.9
576.32	0.50			Shale	115.4	336.5	1385.7	1386	0	0	762	33.4
575.82	0.50			Shale	115.4	336.5	1501.0	1501	0	0	826	33.9
575.32	0.50			Shale	115.4	336.5	1616.4	1616	0	0	889	34.4
574.82	0.50			Shale	115.4	336.5	1731.8	1732	0	0	952	34.9
574.32	0.50			Shale	115.4	336.5	1847.1	1847	0	0	1016	35.4
573.82	0.50			Shale	115.4	336.5	1962.5	1962	0	0	1079	35.9
573.32	0.50			Shale	115.4	336.5	2077.8	2078	0	0	1143	36.4
572.82	0.50			Shale	115.4	336.5	2193.2	2193	0	0	1206	36.9
572.32	0.50			Shale	115.4	336.5	2308.6	2309	0	0	1270	37.4
571.82	0.50			Shale	115.4	336.5	2423.9	2424	0	0	1333	37.9
571.32	0.50			Shale	115.4	336.5	2539.3	2539	0	0	1397	38.4
570.82	0.50			Shale	115.4	336.5	2654.6	2655	0	0	1460	38.9
570.32	0.50			Shale	115.4	336.5	2770.0	2770	0	0	1524	39.4
569.82	0.50			Shale	115.4	336.5	2885.4	2885	0	0	1587	39.9
569.32	0.50			Shale	115.4	336.5	3000.7	3001	0	0	1650	40.4
568.82	0.50			Shale	115.4	336.5	3116.1	3116	0	0	1714	40.9
568.32	0.50			Shale	115.4	336.5	3231.5	3231	0	0	1777	41.4
567.82	0.50			Shale	115.4	336.5	3346.8	3347	0	0	1841	41.9
567.32	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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
513 KIPS	131 KIPS	72 KIPS	20 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE =====Metal Shell 14"Φ w/.312" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		15.9		21.8	22	0	0	12	6
602.32	1.50	0.50	4		3.4	5.9	31.0	31	0	0	17	7
599.82	2.50	1.00	5		10.2	11.7	35.3	35	0	0	19	10
597.32	2.50	0.50	4		5.6	5.9	38.6	39	0	0	21	12
594.82	2.50	0.30	4		3.5	3.5	52.0	52	0	0	29	15
592.32	2.50		2	Fine Sand	1.6	13.5	67.1	67	0	0	37	17
589.82	2.50		4	Fine Sand	3.2	26.9	130.8	131	0	0	72	20
587.32	2.50		13	Fine Sand	10.3	87.5	565.1	565	0	0	311	22
584.82	2.50		76	Fine Sand	108.8	511.4	465.3	465	0	0	256	25
582.32	2.50		60	Hard Till	39.6	302.8	504.9	505	0	0	278	27
579.82	2.50		60	Hard Till	39.6	302.8	578.1	578	0	0	318	30
579.32	0.50			Shale	115.4	336.5	693.5	693	0	0	381	30.4
578.82	0.50			Shale	115.4	336.5	808.9	809	0	0	445	30.9
578.32	0.50			Shale	115.4	336.5	924.2	924	0	0	508	31.4
577.82	0.50			Shale	115.4	336.5	1039.6	1040	0	0	572	31.9
577.32	0.50			Shale	115.4	336.5	1154.9	1155	0	0	635	32.4
576.82	0.50			Shale	115.4	336.5	1270.3	1270	0	0	699	32.9
576.32	0.50			Shale	115.4	336.5	1385.7	1386	0	0	762	33.4
575.82	0.50			Shale	115.4	336.5	1501.0	1501	0	0	826	33.9
575.32	0.50			Shale	115.4	336.5	1616.4	1616	0	0	889	34.4
574.82	0.50			Shale	115.4	336.5	1731.8	1732	0	0	952	34.9
574.32	0.50			Shale	115.4	336.5	1847.1	1847	0	0	1016	35.4
573.82	0.50			Shale	115.4	336.5	1962.5	1962	0	0	1079	35.9
573.32	0.50			Shale	115.4	336.5	2077.8	2078	0	0	1143	36.4
572.82	0.50			Shale	115.4	336.5	2193.2	2193	0	0	1206	36.9
572.32	0.50			Shale	115.4	336.5	2308.6	2309	0	0	1270	37.4
571.82	0.50			Shale	115.4	336.5	2423.9	2424	0	0	1333	37.9
571.32	0.50			Shale	115.4	336.5	2539.3	2539	0	0	1397	38.4
570.82	0.50			Shale	115.4	336.5	2654.6	2655	0	0	1460	38.9
570.32	0.50			Shale	115.4	336.5	2770.0	2770	0	0	1524	39.4
569.82	0.50			Shale	115.4	336.5	2885.4	2885	0	0	1587	39.9
569.32	0.50			Shale	115.4	336.5	3000.7	3001	0	0	1650	40.4
568.82	0.50			Shale	115.4	336.5	3116.1	3116	0	0	1714	40.9
568.32	0.50			Shale	115.4	336.5	3231.5	3231	0	0	1777	41.4
567.82	0.50			Shale	115.4	336.5	3346.8	3347	0	0	1841	41.9
567.32	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	328 KIPS	180 KIPS	34 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 10 X 42

Plugged Pile Perimeter===== 3.300 FT. Unplugged Pile Perimeter===== 4.858 FT.
 Plugged Pile End Bearing Area===== 0.680 SQFT. Unplugged Pile End Bearing Area===== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		9.2		13.9	13.5		14.1	14	0	0	8	6
602.32	1.50	0.50	4		1.9	4.8	20.6	2.8	0.6	17.5	18	0	0	10	7
599.82	2.50	1.00	5		5.9	9.5	21.7	8.6	1.2	25.6	22	0	0	12	10
597.32	2.50	0.50	4		3.2	4.8	23.0	4.7	0.6	30.1	23	0	0	13	12
594.82	2.50	0.30	4		2.0	2.9	25.6	2.9	0.4	33.1	26	0	0	14	15
592.32	2.50		2	Fine Sand	0.3	3.4	29.2	0.4	0.4	33.9	29	0	0	16	17
589.82	2.50		4	Fine Sand	0.6	6.8	45.1	0.8	0.9	36.7	37	0	0	20	20
587.32	2.50		13	Fine Sand	1.8	22.0	153.7	2.7	2.8	52.9	53	0	0	29	22
584.82	2.50		76	Fine Sand	19.4	128.8	120.5	28.5	16.3	74.8	75	0	0	41	25
582.32	2.50		60	Hard Till	7.1	76.3	127.6	10.4	9.7	85.2	85	0	0	47	27
579.82	2.50		60	Hard Till	7.1	76.3	143.1	10.4	9.7	96.6	97	0	0	53	30
579.32	0.50			Shale	20.6	84.8	163.7	30.3	10.7	126.9	127	0	0	70	30.4
578.82	0.50			Shale	20.6	84.8	184.2	30.3	10.7	157.2	157	0	0	86	30.9
578.32	0.50			Shale	20.6	84.8	204.8	30.3	10.7	187.4	187	0	0	103	31.4
577.82	0.50			Shale	20.6	84.8	225.3	30.3	10.7	217.7	218	0	0	120	31.9
577.32	0.50			Shale	20.6	84.8	245.9	30.3	10.7	248.0	246	0	0	135	32.4
576.82	0.50			Shale	20.6	84.8	266.4	30.3	10.7	278.2	266	0	0	147	32.9
576.32	0.50			Shale	20.6	84.8	287.0	30.3	10.7	308.5	287	0	0	158	33.4
575.82	0.50			Shale	20.6	84.8	307.5	30.3	10.7	338.7	308	0	0	169	33.9
575.32	0.50			Shale	20.6	84.8	328.1	30.3	10.7	369.0	328	0	0	180	34.4
574.82	0.50			Shale	20.6	84.8	348.7	30.3	10.7	399.3	349	0	0	192	34.9
574.32	0.50			Shale	20.6	84.8	369.2	30.3	10.7	429.5	369	0	0	203	35.4
573.82	0.50			Shale	20.6	84.8	389.8	30.3	10.7	459.8	390	0	0	214	35.9
573.32	0.50			Shale	20.6	84.8	410.3	30.3	10.7	490.0	410	0	0	226	36.4
572.82	0.50			Shale	20.6	84.8	430.9	30.3	10.7	520.3	431	0	0	237	36.9
572.32	0.50			Shale	20.6	84.8	451.4	30.3	10.7	550.6	451	0	0	248	37.4
571.82	0.50			Shale	20.6	84.8	472.0	30.3	10.7	580.8	472	0	0	260	37.9
571.32	0.50			Shale	20.6	84.8	492.5	30.3	10.7	611.1	493	0	0	271	38.4
570.82	0.50			Shale	20.6	84.8	513.1	30.3	10.7	641.3	513	0	0	282	38.9
570.32	0.50			Shale	20.6	84.8	533.6	30.3	10.7	671.6	534	0	0	294	39.4
569.82	0.50			Shale	20.6	84.8	554.2	30.3	10.7	701.9	554	0	0	305	39.9
569.32	0.50			Shale	20.6	84.8	574.8	30.3	10.7	732.1	575	0	0	316	40.4
568.82	0.50			Shale	20.6	84.8	595.3	30.3	10.7	762.4	595	0	0	327	40.9
568.32	0.50			Shale	20.6	84.8	615.9	30.3	10.7	792.6	616	0	0	339	41.4
567.82	0.50			Shale	20.6	84.8	636.4	30.3	10.7	822.9	636	0	0	350	41.9
567.32	0.50			Shale											

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	415 KIPS	228 KIPS	34 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 12 X 53

Plugged Pile Perimeter===== 3.967 FT. Unplugged Pile Perimeter===== 5.800 FT.
 Plugged Pile End Bearing Area===== 0.983 SQFT. Unplugged Pile End Bearing Area===== 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		11.0		17.9	16.1		16.9	17	0	0	9	6
602.32	1.50	0.50	4		2.3	6.9	27.1	3.4	0.8	21.0	21	0	0	12	7
599.82	2.50	1.00	5		7.0	13.8	27.3	10.3	1.5	30.6	27	0	0	15	10
597.32	2.50	0.50	4		3.9	6.9	28.4	5.7	0.8	35.9	28	0	0	16	12
594.82	2.50	0.30	4		2.4	4.1	31.6	3.5	0.5	39.5	32	0	0	17	15
592.32	2.50		2	Fine Sand	0.3	4.9	36.8	0.5	0.5	40.5	37	0	0	20	17
589.82	2.50		4	Fine Sand	0.7	9.8	59.5	1.0	1.1	43.9	44	0	0	24	20
587.32	2.50		13	Fine Sand	2.2	31.8	216.1	3.2	3.5	64.1	64	0	0	35	22
584.82	2.50		76	Fine Sand	23.3	186.2	163.4	34.1	20.4	89.8	90	0	0	49	25
582.32	2.50		60	Hard Till	8.5	110.2	171.9	12.4	12.1	102.2	102	0	0	56	27
579.82	2.50		60	Hard Till	8.5	110.2	192.6	12.4	12.1	116.0	116	0	0	64	30
579.32	0.50			Shale	24.7	122.5	217.4	36.1	13.4	152.1	152	0	0	84	30.4
578.82	0.50			Shale	24.7	122.5	242.1	36.1	13.4	188.2	188	0	0	104	30.9
578.32	0.50			Shale	24.7	122.5	266.8	36.1	13.4	224.4	224	0	0	123	31.4
577.82	0.50			Shale	24.7	122.5	291.5	36.1	13.4	260.5	260	0	0	143	31.9
577.32	0.50			Shale	24.7	122.5	316.2	36.1	13.4	296.6	297	0	0	163	32.4
576.82	0.50			Shale	24.7	122.5	340.9	36.1	13.4	332.7	333	0	0	183	32.9
576.32	0.50			Shale	24.7	122.5	365.6	36.1	13.4	368.9	366	0	0	201	33.4
575.82	0.50			Shale	24.7	122.5	390.3	36.1	13.4	405.0	390	0	0	215	33.9
575.32	0.50			Shale	24.7	122.5	415.0	36.1	13.4	441.1	415	0	0	228	34.4
574.82	0.50			Shale	24.7	122.5	439.7	36.1	13.4	477.2	440	0	0	242	34.9
574.32	0.50			Shale	24.7	122.5	464.4	36.1	13.4	513.4	464	0	0	255	35.4
573.82	0.50			Shale	24.7	122.5	489.1	36.1	13.4	549.5	489	0	0	269	35.9
573.32	0.50			Shale	24.7	122.5	513.8	36.1	13.4	585.6	514	0	0	283	36.4
572.82	0.50			Shale	24.7	122.5	538.5	36.1	13.4	621.7	539	0	0	296	36.9
572.32	0.50			Shale	24.7	122.5	563.2	36.1	13.4	657.9	563	0	0	310	37.4
571.82	0.50			Shale	24.7	122.5	588.0	36.1	13.4	694.0	588	0	0	323	37.9
571.32	0.50			Shale	24.7	122.5	612.7	36.1	13.4	730.1	613	0	0	337	38.4
570.82	0.50			Shale	24.7	122.5	637.4	36.1	13.4	766.2	637	0	0	351	38.9
570.32	0.50			Shale	24.7	122.5	662.1	36.1	13.4	802.4	662	0	0	364	39.4
569.82	0.50			Shale	24.7	122.5	686.8	36.1	13.4	838.5	687	0	0	378	39.9
569.32	0.50			Shale	24.7	122.5	711.5	36.1	13.4	874.6	711	0	0	391	40.4
568.82	0.50			Shale	24.7	122.5	736.2	36.1	13.4	910.7	736	0	0	405	40.9
568.32	0.50			Shale	24.7	122.5	760.9	36.1	13.4	946.9	761	0	0	418	41.4
567.82	0.50			Shale	24.7	122.5	785.6	36.1	13.4	983.0	786	0	0	432	41.9
567.32	0.50			Shale		122.5			13.4						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====607.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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
497 KIPS	494 KIPS	272 KIPS	36 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 12 X 63

Plugged Pile Perimeter===== 4.000 FT. Unplugged Pile Perimeter===== 5.883 FT.
 Plugged Pile End Bearing Area===== 1.000 SQFT. Unplugged Pile End Bearing Area===== 0.128 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		11.1		18.1	16.3		17.2	17	0	0	9	6
602.32	1.50	0.50	4		2.3	7.0	27.5	3.4	0.9	21.6	22	0	0	12	7
599.82	2.50	1.00	5		7.1	14.0	27.6	10.5	1.8	31.1	28	0	0	15	10
597.32	2.50	0.50	4		3.9	7.0	28.7	5.7	0.9	36.5	29	0	0	16	12
594.82	2.50	0.30	4		2.4	4.2	31.9	3.6	0.5	40.2	32	0	0	18	15
592.32	2.50		2	Fine Sand	0.3	5.0	37.2	0.5	0.6	41.3	37	0	0	20	17
589.82	2.50		4	Fine Sand	0.7	10.0	60.3	1.0	1.3	45.2	45	0	0	25	20
587.32	2.50		13	Fine Sand	2.2	32.4	219.5	3.3	4.1	68.5	69	0	0	38	22
584.82	2.50		76	Fine Sand	23.5	189.3	165.7	34.6	24.2	93.2	93	0	0	51	25
582.32	2.50		60	Hard Till	8.6	112.1	174.3	12.6	14.3	105.8	106	0	0	58	27
579.82	2.50		60	Hard Till	8.6	112.1	195.3	12.6	14.3	120.0	120	0	0	66	30
579.32	0.50			Shale	24.9	124.6	220.2	36.6	15.9	156.6	157	0	0	86	30.4
578.82	0.50			Shale	24.9	124.6	245.1	36.6	15.9	193.3	193	0	0	106	30.9
578.32	0.50			Shale	24.9	124.6	270.0	36.6	15.9	229.9	230	0	0	126	31.4
577.82	0.50			Shale	24.9	124.6	295.0	36.6	15.9	266.5	267	0	0	147	31.9
577.32	0.50			Shale	24.9	124.6	319.9	36.6	15.9	303.2	303	0	0	167	32.4
576.82	0.50			Shale	24.9	124.6	344.8	36.6	15.9	339.8	340	0	0	187	32.9
576.32	0.50			Shale	24.9	124.6	369.7	36.6	15.9	376.5	370	0	0	203	33.4
575.82	0.50			Shale	24.9	124.6	394.6	36.6	15.9	413.1	395	0	0	217	33.9
575.32	0.50			Shale	24.9	124.6	419.5	36.6	15.9	449.8	420	0	0	231	34.4
574.82	0.50			Shale	24.9	124.6	444.4	36.6	15.9	486.4	444	0	0	244	34.9
574.32	0.50			Shale	24.9	124.6	469.4	36.6	15.9	523.1	469	0	0	258	35.4
573.82	0.50			Shale	24.9	124.6	494.3	36.6	15.9	559.7	494	0	0	272	35.9
573.32	0.50			Shale	24.9	124.6	519.2	36.6	15.9	596.4	519	0	0	286	36.4
572.82	0.50			Shale	24.9	124.6	544.1	36.6	15.9	633.0	544	0	0	299	36.9
572.32	0.50			Shale	24.9	124.6	569.0	36.6	15.9	669.6	569	0	0	313	37.4
571.82	0.50			Shale	24.9	124.6	593.9	36.6	15.9	706.3	594	0	0	327	37.9
571.32	0.50			Shale	24.9	124.6	618.8	36.6	15.9	742.9	619	0	0	340	38.4
570.82	0.50			Shale	24.9	124.6	643.8	36.6	15.9	779.6	644	0	0	354	38.9
570.32	0.50			Shale	24.9	124.6	668.7	36.6	15.9	816.2	669	0	0	368	39.4
569.82	0.50			Shale	24.9	124.6	693.6	36.6	15.9	852.9	694	0	0	381	39.9
569.32	0.50			Shale	24.9	124.6	718.5	36.6	15.9	889.5	719	0	0	395	40.4
568.82	0.50			Shale	24.9	124.6	743.4	36.6	15.9	926.2	743	0	0	409	40.9
568.32	0.50			Shale	24.9	124.6	768.3	36.6	15.9	962.8	768	0	0	423	41.4
567.82	0.50			Shale	24.9	124.6	793.2	36.6	15.9	999.4	793	0	0	436	41.9
567.32	0.50			Shale			124.6		15.9						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
578 KIPS	578 KIPS	318 KIPS	36 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 14 X 73

Plugged Pile Perimeter===== 4.700 FT. Unplugged Pile Perimeter===== 6.975 FT.
 Plugged Pile End Bearing Area===== 1.379 SQFT. Unplugged Pile End Bearing Area===== 0.149 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		13.1		22.7	19.4		20.4	20	0	0	11	6
602.32	1.50	0.50	4		2.7	9.7	35.1	4.1	1.0	25.5	26	0	0	14	7
599.82	2.50	1.00	5		8.3	19.3	33.8	12.4	2.1	36.9	34	0	0	19	10
597.32	2.50	0.50	4		4.6	9.7	34.5	6.8	1.0	43.3	35	0	0	19	12
594.82	2.50	0.30	4		2.8	5.8	38.5	4.2	0.6	47.6	38	0	0	21	15
592.32	2.50		2	Fine Sand	0.4	6.9	45.7	0.6	0.7	48.9	46	0	0	25	17
589.82	2.50		4	Fine Sand	0.8	13.7	77.4	1.2	1.5	53.5	53	0	0	29	20
587.32	2.50		13	Fine Sand	2.6	44.7	296.5	3.9	4.8	80.7	81	0	0	44	22
584.82	2.50		76	Fine Sand	27.6	261.1	217.6	41.0	28.1	110.2	110	0	0	61	25
582.32	2.50		60	Hard Till	10.1	154.6	227.7	14.9	16.7	125.1	125	0	0	69	27
579.82	2.50		60	Hard Till	10.1	154.6	254.9	14.9	16.7	141.9	142	0	0	78	30
579.32	0.50			Shale	29.3	171.8	284.2	43.4	18.5	185.3	185	0	0	102	30.4
578.82	0.50			Shale	29.3	171.8	313.4	43.4	18.5	228.8	229	0	0	126	30.9
578.32	0.50			Shale	29.3	171.8	342.7	43.4	18.5	272.2	272	0	0	150	31.4
577.82	0.50			Shale	29.3	171.8	372.0	43.4	18.5	315.6	316	0	0	174	31.9
577.32	0.50			Shale	29.3	171.8	401.3	43.4	18.5	359.1	359	0	0	197	32.4
576.82	0.50			Shale	29.3	171.8	430.5	43.4	18.5	402.5	403	0	0	221	32.9
576.32	0.50			Shale	29.3	171.8	459.8	43.4	18.5	446.0	446	0	0	245	33.4
575.82	0.50			Shale	29.3	171.8	489.1	43.4	18.5	489.4	489	0	0	269	33.9
575.32	0.50			Shale	29.3	171.8	518.4	43.4	18.5	532.9	518	0	0	285	34.4
574.82	0.50			Shale	29.3	171.8	547.6	43.4	18.5	576.3	548	0	0	301	34.9
574.32	0.50			Shale	29.3	171.8	576.9	43.4	18.5	619.8	577	0	0	317	35.4
573.82	0.50			Shale	29.3	171.8	606.2	43.4	18.5	663.2	606	0	0	333	35.9
573.32	0.50			Shale	29.3	171.8	635.5	43.4	18.5	706.6	635	0	0	350	36.4
572.82	0.50			Shale	29.3	171.8	664.7	43.4	18.5	750.1	665	0	0	366	36.9
572.32	0.50			Shale	29.3	171.8	694.0	43.4	18.5	793.5	694	0	0	382	37.4
571.82	0.50			Shale	29.3	171.8	723.3	43.4	18.5	837.0	723	0	0	398	37.9
571.32	0.50			Shale	29.3	171.8	752.6	43.4	18.5	880.4	753	0	0	414	38.4
570.82	0.50			Shale	29.3	171.8	781.8	43.4	18.5	923.9	782	0	0	430	38.9
570.32	0.50			Shale	29.3	171.8	811.1	43.4	18.5	967.3	811	0	0	446	39.4
569.82	0.50			Shale	29.3	171.8	840.4	43.4	18.5	1010.8	840	0	0	462	39.9
569.32	0.50			Shale	29.3	171.8	869.7	43.4	18.5	1054.2	870	0	0	478	40.4
568.82	0.50			Shale	29.3	171.8	898.9	43.4	18.5	1097.6	899	0	0	494	40.9
568.32	0.50			Shale	29.3	171.8	928.2	43.4	18.5	1141.1	928	0	0	511	41.4
567.82	0.50			Shale	29.3	171.8	957.5	43.4	18.5	1184.5	957	0	0	527	41.9
567.32	0.50			Shale			171.8			18.5					

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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	388 KIPS	38 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

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			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		13.2		23.1	19.5		20.8	21	0	0	11	6
602.32	1.50	0.50	4		2.8	9.9	35.7	4.1	1.3	26.2	26	0	0	14	7
599.82	2.50	1.00	5		8.4	19.7	34.3	12.5	2.5	37.4	34	0	0	19	10
597.32	2.50	0.50	4		4.6	9.9	35.0	6.9	1.3	43.8	35	0	0	19	12
594.82	2.50	0.30	4		2.9	5.9	38.9	4.3	0.8	48.2	39	0	0	21	15
592.32	2.50		2	Fine Sand	0.4	7.0	46.4	0.6	0.9	49.7	46	0	0	25	17
589.82	2.50		4	Fine Sand	0.8	14.0	78.8	1.2	1.8	54.9	55	0	0	30	20
587.32	2.50		13	Fine Sand	2.6	45.6	302.5	3.9	5.9	87.3	87	0	0	48	22
584.82	2.50		76	Fine Sand	27.9	266.7	221.6	41.3	34.3	114.6	115	0	0	63	25
582.32	2.50		60	Hard Till	10.2	157.9	231.8	15.0	20.3	129.7	130	0	0	71	27
579.82	2.50		60	Hard Till	10.2	157.9	259.5	15.0	20.3	147.0	147	0	0	81	30
579.32	0.50			Shale	29.6	175.5	289.1	43.8	22.6	190.8	191	0	0	105	30.4
578.82	0.50			Shale	29.6	175.5	318.7	43.8	22.6	234.6	235	0	0	129	30.9
578.32	0.50			Shale	29.6	175.5	348.3	43.8	22.6	278.4	278	0	0	153	31.4
577.82	0.50			Shale	29.6	175.5	377.8	43.8	22.6	322.2	322	0	0	177	31.9
577.32	0.50			Shale	29.6	175.5	407.4	43.8	22.6	366.0	366	0	0	201	32.4
576.82	0.50			Shale	29.6	175.5	437.0	43.8	22.6	409.8	410	0	0	225	32.9
576.32	0.50			Shale	29.6	175.5	466.6	43.8	22.6	453.6	454	0	0	249	33.4
575.82	0.50			Shale	29.6	175.5	496.2	43.8	22.6	497.4	496	0	0	273	33.9
575.32	0.50			Shale	29.6	175.5	525.8	43.8	22.6	541.2	526	0	0	289	34.4
574.82	0.50			Shale	29.6	175.5	555.4	43.8	22.6	585.0	555	0	0	305	34.9
574.32	0.50			Shale	29.6	175.5	584.9	43.8	22.6	628.9	585	0	0	322	35.4
573.82	0.50			Shale	29.6	175.5	614.5	43.8	22.6	672.7	615	0	0	338	35.9
573.32	0.50			Shale	29.6	175.5	644.1	43.8	22.6	716.5	644	0	0	354	36.4
572.82	0.50			Shale	29.6	175.5	673.7	43.8	22.6	760.3	674	0	0	371	36.9
572.32	0.50			Shale	29.6	175.5	703.3	43.8	22.6	804.1	703	0	0	387	37.4
571.82	0.50			Shale	29.6	175.5	732.9	43.8	22.6	847.9	733	0	0	403	37.9
571.32	0.50			Shale	29.6	175.5	762.5	43.8	22.6	891.7	762	0	0	419	38.4
570.82	0.50			Shale	29.6	175.5	792.0	43.8	22.6	935.5	792	0	0	436	38.9
570.32	0.50			Shale	29.6	175.5	821.6	43.8	22.6	979.3	822	0	0	452	39.4
569.82	0.50			Shale	29.6	175.5	851.2	43.8	22.6	1023.1	851	0	0	468	39.9
569.32	0.50			Shale	29.6	175.5	880.8	43.8	22.6	1066.9	881	0	0	484	40.4
568.82	0.50			Shale	29.6	175.5	910.4	43.8	22.6	1110.7	910	0	0	501	40.9
568.32	0.50			Shale	29.6	175.5	940.0	43.8	22.6	1154.5	940	0	0	517	41.4
567.82	0.50			Shale	29.6	175.5	969.6	43.8	22.6	1198.4	970	0	0	533	41.9
567.32	0.50			Shale		175.5			22.6						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE=====South Abut
 REFERENCE BORING =====B-1
 LRFD or ASD or SEISMIC =====LRFD
 PILE CUTOFF ELEV. =====609.73 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR =====607.73 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) =====None
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD =====ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) =====ft

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	929 KIPS	511 KIPS	41 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 890 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 202.45 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 75.92 KIPS

PILE TYPE AND SIZE ===== Steel HP 14 X 117

Plugged Pile Perimeter===== 4.850 FT. Unplugged Pile Perimeter===== 7.117 FT.
 Plugged Pile End Bearing Area===== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
603.82	3.91	1.00	8		13.5		23.8	19.8		21.4	21	0	0	12	6
602.32	1.50	0.50	4		2.8	10.3	36.9	4.2	1.7	27.3	27	0	0	15	7
599.82	2.50	1.00	5		8.6	20.6	35.2	12.6	3.3	38.2	35	0	0	19	10
597.32	2.50	0.50	4		4.7	10.3	35.8	6.9	1.7	44.5	36	0	0	20	12
594.82	2.50	0.30	4		2.9	6.2	39.9	4.3	1.0	49.0	40	0	0	22	15
592.32	2.50		2	Fine Sand	0.4	7.3	47.6	0.6	1.2	50.8	48	0	0	26	17
589.82	2.50		4	Fine Sand	0.8	14.6	81.4	1.2	2.4	57.4	57	0	0	32	20
587.32	2.50		13	Fine Sand	2.7	47.6	314.7	4.0	7.7	98.8	99	0	0	54	22
584.82	2.50		76	Fine Sand	28.5	278.2	229.8	41.8	45.2	122.2	122	0	0	67	25
582.32	2.50		60	Hard Till	10.4	164.7	240.1	15.2	26.8	137.4	137	0	0	76	27
579.82	2.50		60	Hard Till	10.4	164.7	268.8	15.2	26.8	155.6	156	0	0	86	30
579.32	0.50			Shale	30.2	183.0	299.0	44.3	29.8	199.9	200	0	0	110	30.4
578.82	0.50			Shale	30.2	183.0	329.2	44.3	29.8	244.3	244	0	0	134	30.9
578.32	0.50			Shale	30.2	183.0	359.4	44.3	29.8	288.6	289	0	0	159	31.4
577.82	0.50			Shale	30.2	183.0	389.6	44.3	29.8	332.9	333	0	0	183	31.9
577.32	0.50			Shale	30.2	183.0	419.9	44.3	29.8	377.3	377	0	0	207	32.4
576.82	0.50			Shale	30.2	183.0	450.1	44.3	29.8	421.6	422	0	0	232	32.9
576.32	0.50			Shale	30.2	183.0	480.3	44.3	29.8	465.9	466	0	0	256	33.4
575.82	0.50			Shale	30.2	183.0	510.5	44.3	29.8	510.2	510	0	0	281	33.9
575.32	0.50			Shale	30.2	183.0	540.7	44.3	29.8	554.6	541	0	0	297	34.4
574.82	0.50			Shale	30.2	183.0	570.9	44.3	29.8	598.9	571	0	0	314	34.9
574.32	0.50			Shale	30.2	183.0	601.1	44.3	29.8	643.2	601	0	0	331	35.4
573.82	0.50			Shale	30.2	183.0	631.3	44.3	29.8	687.5	631	0	0	347	35.9
573.32	0.50			Shale	30.2	183.0	661.5	44.3	29.8	731.9	662	0	0	364	36.4
572.82	0.50			Shale	30.2	183.0	691.7	44.3	29.8	776.2	692	0	0	380	36.9
572.32	0.50			Shale	30.2	183.0	721.9	44.3	29.8	820.5	722	0	0	397	37.4
571.82	0.50			Shale	30.2	183.0	752.1	44.3	29.8	864.8	752	0	0	414	37.9
571.32	0.50			Shale	30.2	183.0	782.4	44.3	29.8	909.2	782	0	0	430	38.4
570.82	0.50			Shale	30.2	183.0	812.6	44.3	29.8	953.5	813	0	0	447	38.9
570.32	0.50			Shale	30.2	183.0	842.8	44.3	29.8	997.8	843	0	0	464	39.4
569.82	0.50			Shale	30.2	183.0	873.0	44.3	29.8	1042.2	873	0	0	480	39.9
569.32	0.50			Shale	30.2	183.0	903.2	44.3	29.8	1086.5	903	0	0	497	40.4
568.82	0.50			Shale	30.2	183.0	933.4	44.3	29.8	1130.8	933	0	0	513	40.9
568.32	0.50			Shale	30.2	183.0	963.6	44.3	29.8	1175.1	964	0	0	530	41.4
567.82	0.50			Shale	30.2	183.0	993.8	44.3	29.8	1219.5	994	0	0	547	41.9
567.32	0.50			Shale		183.0									

Pile Design Table for South Abut utilizing Boring #B-1

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			Steel HP 10 X 57			Steel HP 14 X 73		
101	56	20	441	243	37	125	69	27
Metal Shell 12"Φ w/.25" walls			Steel HP 12 X 53			142 78 30		
101	56	20	415	228	34	578 318 36		
Metal Shell 14"Φ w/.25" walls			Steel HP 12 X 63			Steel HP 14 X 89		
131	72	20	494	272	36	130 71 27		
Metal Shell 14"Φ w/.312" walls			Steel HP 12 X 74			147 81 30		
131	72	20	578	318	37	705 388 38		
Steel HP 8 X 36			Steel HP 12 X 84			Steel HP 14 X 102		
272	150	35	663	365	39	133 73 27		
Steel HP 10 X 42						151 83 30		
328	180	34				810 445 39		
						Steel HP 14 X 117		
						137 76 27		
						156 86 30		
						929 511 41		
						Precast 14"x 14"		
						85 47 17		
						167 92 20		
						Timber Pile		
						59 32 20		

Appendix G

Part- III

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

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
413 KIPS	347 KIPS	185 KIPS	27 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 KIPS

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.25" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		3.7		7.3	7	2	0	2	22
586.33	2.50	0.30	20		3.5	3.5	10.7	11	4	0	2	24
583.83	2.50	0.30	23		3.5	3.5	347.2	347	6	0	185	27
583.33	0.50			Shale	115.4	336.5	462.5	463	6	0	249	27.2
582.83	0.50			Shale	115.4	336.5	577.9	578	6	0	342	27.7
582.33	0.50			Shale	115.4	336.5	693.2	693	6	0	375	28.2
581.83	0.50			Shale	115.4	336.5	808.6	809	6	0	439	28.7
581.33	0.50			Shale	115.4	336.5	924.0	924	6	0	502	29.2
580.83	0.50			Shale	115.4	336.5	1039.3	1039	6	0	566	29.7
580.33	0.50			Shale	115.4	336.5	1154.7	1155	6	0	629	30.2
579.83	0.50			Shale	115.4	336.5	1270.0	1270	6	0	693	30.7
579.33	0.50			Shale	115.4	336.5	1385.4	1385	6	0	756	31.2
578.83	0.50			Shale	115.4	336.5	1500.8	1501	6	0	820	31.7
578.33	0.50			Shale	115.4	336.5	1616.1	1616	6	0	883	32.2
577.83	0.50			Shale	115.4	336.5	1731.5	1731	6	0	946	32.7
577.33	0.50			Shale	115.4	336.5	1846.9	1847	6	0	1010	33.2
576.83	0.50			Shale	115.4	336.5	1962.2	1962	6	0	1073	33.7
576.33	0.50			Shale	115.4	336.5	2077.6	2078	6	0	1137	34.2
575.83	0.50			Shale	115.4	336.5	2192.9	2193	6	0	1200	34.7
575.33	0.50			Shale	115.4	336.5	2308.3	2308	6	0	1264	35.2
574.83	0.50			Shale	115.4	336.5	2423.7	2424	6	0	1327	35.7
574.33	0.50			Shale	115.4	336.5	2539.0	2539	6	0	1391	36.2
573.83	0.50			Shale	115.4	336.5	2654.4	2654	6	0	1454	36.7
573.33	0.50			Shale	115.4	336.5	2769.8	2770	6	0	1517	37.2
572.83	0.50			Shale	115.4	336.5	2885.1	2885	6	0	1581	37.7
572.33	0.50			Shale	115.4	336.5	3000.5	3000	6	0	1644	38.2
571.83	0.50			Shale	115.4	336.5	3115.8	3116	6	0	1708	38.7
571.33	0.50			Shale	115.4	336.5	3231.2	3231	6	0	1771	39.2
570.83	0.50			Shale	115.4	336.5	3346.6	3347	6	0	1835	39.7
570.33	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

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
513 KIPS	347 KIPS	185 KIPS	27 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 KIPS

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.312" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		3.7		7.3	7	2	0	2	22
586.33	2.50	0.30	20		3.5	3.5	10.7	11	4	0	2	24
583.83	2.50	0.30	23		3.5	3.5	347.2	347	6	0	185	27
583.33	0.50			Shale	115.4	336.5	462.5	463	6	0	249	27.2
582.83	0.50			Shale	115.4	336.5	577.9	578	6	0	342	27.7
582.33	0.50			Shale	115.4	336.5	693.2	693	6	0	375	28.2
581.83	0.50			Shale	115.4	336.5	808.6	809	6	0	439	28.7
581.33	0.50			Shale	115.4	336.5	924.0	924	6	0	502	29.2
580.83	0.50			Shale	115.4	336.5	1039.3	1039	6	0	566	29.7
580.33	0.50			Shale	115.4	336.5	1154.7	1155	6	0	629	30.2
579.83	0.50			Shale	115.4	336.5	1270.0	1270	6	0	693	30.7
579.33	0.50			Shale	115.4	336.5	1385.4	1385	6	0	756	31.2
578.83	0.50			Shale	115.4	336.5	1500.8	1501	6	0	820	31.7
578.33	0.50			Shale	115.4	336.5	1616.1	1616	6	0	883	32.2
577.83	0.50			Shale	115.4	336.5	1731.5	1731	6	0	946	32.7
577.33	0.50			Shale	115.4	336.5	1846.9	1847	6	0	1010	33.2
576.83	0.50			Shale	115.4	336.5	1962.2	1962	6	0	1073	33.7
576.33	0.50			Shale	115.4	336.5	2077.6	2078	6	0	1137	34.2
575.83	0.50			Shale	115.4	336.5	2192.9	2193	6	0	1200	34.7
575.33	0.50			Shale	115.4	336.5	2308.3	2308	6	0	1264	35.2
574.83	0.50			Shale	115.4	336.5	2423.7	2424	6	0	1327	35.7
574.33	0.50			Shale	115.4	336.5	2539.0	2539	6	0	1391	36.2
573.83	0.50			Shale	115.4	336.5	2654.4	2654	6	0	1454	36.7
573.33	0.50			Shale	115.4	336.5	2769.8	2770	6	0	1517	37.2
572.83	0.50			Shale	115.4	336.5	2885.1	2885	6	0	1581	37.7
572.33	0.50			Shale	115.4	336.5	3000.5	3000	6	0	1644	38.2
571.83	0.50			Shale	115.4	336.5	3115.8	3116	6	0	1708	38.7
571.33	0.50			Shale	115.4	336.5	3231.2	3231	6	0	1771	39.2
570.83	0.50			Shale	115.4	336.5	3346.6	3347	6	0	1835	39.7
570.33	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	317 KIPS	171 KIPS	32 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		2.1		5.0	3.2		3.5	4	1	0	1	22
586.33	2.50	0.30	20		2.0	2.9	7.0	2.9	0.4	6.5	6	2	0	1	24
583.83	2.50	0.30	23		2.0	2.9	90.9	2.9	0.4	19.8	20	3	0	7	27
583.33	0.50			Shale	20.6	84.8	111.5	30.3	10.7	50.0	50	3	0	24	27.2
582.83	0.50			Shale	20.6	84.8	132.0	30.3	10.7	80.3	80	3	0	41	27.7
582.33	0.50			Shale	20.6	84.8	152.6	30.3	10.7	110.6	111	3	0	57	28.2
581.83	0.50			Shale	20.6	84.8	173.1	30.3	10.7	140.8	141	3	0	74	28.7
581.33	0.50			Shale	20.6	84.8	193.7	30.3	10.7	171.1	171	3	0	91	29.2
580.83	0.50			Shale	20.6	84.8	214.2	30.3	10.7	201.3	201	3	0	107	29.7
580.33	0.50			Shale	20.6	84.8	234.8	30.3	10.7	231.6	232	3	0	124	30.2
579.83	0.50			Shale	20.6	84.8	255.3	30.3	10.7	261.9	255	3	0	137	30.7
579.33	0.50			Shale	20.6	84.8	275.9	30.3	10.7	292.1	276	3	0	148	31.2
578.83	0.50			Shale	20.6	84.8	296.4	30.3	10.7	322.4	296	3	0	160	31.7
578.33	0.50			Shale	20.6	84.8	317.0	30.3	10.7	352.6	317	3	0	171	32.2
577.83	0.50			Shale	20.6	84.8	337.5	30.3	10.7	382.9	338	3	0	182	32.7
577.33	0.50			Shale	20.6	84.8	358.1	30.3	10.7	413.2	358	3	0	194	33.2
576.83	0.50			Shale	20.6	84.8	378.7	30.3	10.7	443.4	379	3	0	205	33.7
576.33	0.50			Shale	20.6	84.8	399.2	30.3	10.7	473.7	399	3	0	216	34.2
575.83	0.50			Shale	20.6	84.8	419.8	30.3	10.7	503.9	420	3	0	227	34.7
575.33	0.50			Shale	20.6	84.8	440.3	30.3	10.7	534.2	440	3	0	239	35.2
574.83	0.50			Shale	20.6	84.8	460.9	30.3	10.7	564.5	461	3	0	250	35.7
574.33	0.50			Shale	20.6	84.8	481.4	30.3	10.7	594.7	481	3	0	261	36.2
573.83	0.50			Shale	20.6	84.8	502.0	30.3	10.7	625.0	502	3	0	273	36.7
573.33	0.50			Shale	20.6	84.8	522.5	30.3	10.7	655.2	523	3	0	284	37.2
572.83	0.50			Shale	20.6	84.8	543.1	30.3	10.7	685.5	543	3	0	295	37.7
572.33	0.50			Shale	20.6	84.8	563.6	30.3	10.7	715.8	564	3	0	307	38.2
571.83	0.50			Shale	20.6	84.8	584.2	30.3	10.7	746.0	584	3	0	318	38.7
571.33	0.50			Shale	20.6	84.8	604.8	30.3	10.7	776.3	605	3	0	329	39.2
570.83	0.50			Shale	20.6	84.8	625.3	30.3	10.7	806.5	625	3	0	341	39.7
570.33	0.50			Shale		84.8			10.7						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

 TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	402 KIPS	217 KIPS	32 FT.

PILE TYPE AND SIZE ===== Steel HP 12 X 53
 Plugged Pile Perimeter===== 3.967 FT. Unplugged Pile Perimeter===== 5.800 FT.
 Plugged Pile End Bearing Area===== 0.983 SQFT. Unplugged Pile End Bearing Area===== 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		2.6		6.7	3.8		4.2	4	1	0	1	22
586.33	2.50	0.30	20		2.4	4.1	9.1	3.5	0.5	7.7	8	3	0	2	24
583.83	2.50	0.30	23		2.4	4.1	129.9	3.5	0.5	24.2	24	4	0	9	27
583.33	0.50			Shale	24.7	122.5	154.6	36.1	13.4	60.3	60	4	0	29	27.2
582.83	0.50			Shale	24.7	122.5	179.3	36.1	13.4	96.5	96	4	0	49	27.7
582.33	0.50			Shale	24.7	122.5	204.0	36.1	13.4	132.6	133	4	0	69	28.2
581.83	0.50			Shale	24.7	122.5	228.7	36.1	13.4	168.7	169	4	0	89	28.7
581.33	0.50			Shale	24.7	122.5	253.4	36.1	13.4	204.8	205	4	0	109	29.2
580.83	0.50			Shale	24.7	122.5	278.1	36.1	13.4	241.0	241	4	0	128	29.7
580.33	0.50			Shale	24.7	122.5	302.8	36.1	13.4	277.1	277	4	0	148	30.2
579.83	0.50			Shale	24.7	122.5	327.5	36.1	13.4	313.2	313	4	0	168	30.7
579.33	0.50			Shale	24.7	122.5	352.2	36.1	13.4	349.3	349	4	0	188	31.2
578.83	0.50			Shale	24.7	122.5	376.9	36.1	13.4	385.5	377	4	0	203	31.7
578.33	0.50			Shale	24.7	122.5	401.7	36.1	13.4	421.6	402	4	0	217	32.2
577.83	0.50			Shale	24.7	122.5	426.4	36.1	13.4	457.7	426	4	0	230	32.7
577.33	0.50			Shale	24.7	122.5	451.1	36.1	13.4	493.8	454	4	0	244	33.2
576.83	0.50			Shale	24.7	122.5	475.8	36.1	13.4	530.0	476	4	0	258	33.7
576.33	0.50			Shale	24.7	122.5	500.5	36.1	13.4	566.1	500	4	0	271	34.2
575.83	0.50			Shale	24.7	122.5	525.2	36.1	13.4	602.2	525	4	0	285	34.7
575.33	0.50			Shale	24.7	122.5	549.9	36.1	13.4	638.3	550	4	0	298	35.2
574.83	0.50			Shale	24.7	122.5	574.6	36.1	13.4	674.5	575	4	0	312	35.7
574.33	0.50			Shale	24.7	122.5	599.3	36.1	13.4	710.6	599	4	0	326	36.2
573.83	0.50			Shale	24.7	122.5	624.0	36.1	13.4	746.7	624	4	0	339	36.7
573.33	0.50			Shale	24.7	122.5	648.7	36.1	13.4	782.8	649	4	0	353	37.2
572.83	0.50			Shale	24.7	122.5	673.4	36.1	13.4	819.0	673	4	0	366	37.7
572.33	0.50			Shale	24.7	122.5	698.1	36.1	13.4	855.1	698	4	0	380	38.2
571.83	0.50			Shale	24.7	122.5	722.8	36.1	13.4	891.2	723	4	0	394	38.7
571.33	0.50			Shale	24.7	122.5	747.5	36.1	13.4	927.3	748	4	0	407	39.2
570.83	0.50			Shale	24.7	122.5	772.3	36.1	13.4	963.5	772	4	0	421	39.7
570.33	0.50			Shale		122.5									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

 TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 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
497 KIPS	481 KIPS	260 KIPS	34 FT.

PILE TYPE AND SIZE ===== Steel HP 12 X 63
 Plugged Pile Perimeter===== 4.000 FT. Unplugged Pile Perimeter===== 5.883 FT.
 Plugged Pile End Bearing Area===== 1.000 SQFT. Unplugged Pile End Bearing Area===== 0.128 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		2.6		6.8	3.8		4.4	4	1	0	1	22
586.33	2.50	0.30	20		2.4	4.2	9.2	3.6	0.5	7.9	8	3	0	2	24
583.83	2.50	0.30	23		2.4	4.2	132.0	3.6	0.5	26.9	27	4	0	11	27
583.33	0.50			Shale	24.9	124.6	156.9	36.6	15.9	63.5	64	4	0	31	27.2
582.83	0.50			Shale	24.9	124.6	181.8	36.6	15.9	100.2	100	4	0	51	27.7
582.33	0.50			Shale	24.9	124.6	206.8	36.6	15.9	136.8	137	4	0	71	28.2
581.83	0.50			Shale	24.9	124.6	231.7	36.6	15.9	173.5	173	4	0	91	28.7
581.33	0.50			Shale	24.9	124.6	256.6	36.6	15.9	210.1	210	4	0	111	29.2
580.83	0.50			Shale	24.9	124.6	281.5	36.6	15.9	246.7	247	4	0	132	29.7
580.33	0.50			Shale	24.9	124.6	306.4	36.6	15.9	283.4	283	4	0	152	30.2
579.83	0.50			Shale	24.9	124.6	331.3	36.6	15.9	320.0	320	4	0	172	30.7
579.33	0.50			Shale	24.9	124.6	356.2	36.6	15.9	356.7	356	4	0	192	31.2
578.83	0.50			Shale	24.9	124.6	381.2	36.6	15.9	393.3	381	4	0	206	31.7
578.33	0.50			Shale	24.9	124.6	406.1	36.6	15.9	430.0	406	4	0	219	32.2
577.83	0.50			Shale	24.9	124.6	431.0	36.6	15.9	466.6	431	4	0	233	32.7
577.33	0.50			Shale	24.9	124.6	455.9	36.6	15.9	503.3	456	4	0	247	33.2
576.83	0.50			Shale	24.9	124.6	480.8	36.6	15.9	539.9	481	4	0	260	33.7
576.33	0.50			Shale	24.9	124.6	505.7	36.6	15.9	576.5	506	4	0	274	34.2
575.83	0.50			Shale	24.9	124.6	530.6	36.6	15.9	613.2	534	4	0	288	34.7
575.33	0.50			Shale	24.9	124.6	555.6	36.6	15.9	649.8	556	4	0	304	35.2
574.83	0.50			Shale	24.9	124.6	580.5	36.6	15.9	686.5	580	4	0	315	35.7
574.33	0.50			Shale	24.9	124.6	605.4	36.6	15.9	723.1	605	4	0	329	36.2
573.83	0.50			Shale	24.9	124.6	630.3	36.6	15.9	759.8	630	4	0	343	36.7
573.33	0.50			Shale	24.9	124.6	655.2	36.6	15.9	796.4	655	4	0	356	37.2
572.83	0.50			Shale	24.9	124.6	680.1	36.6	15.9	833.1	680	4	0	370	37.7
572.33	0.50			Shale	24.9	124.6	705.0	36.6	15.9	869.7	705	4	0	384	38.2
571.83	0.50			Shale	24.9	124.6	730.0	36.6	15.9	906.3	730	4	0	397	38.7
571.33	0.50			Shale	24.9	124.6	754.9	36.6	15.9	943.0	755	4	0	411	39.2
570.83	0.50			Shale	24.9	124.6	779.8	36.6	15.9	979.6	780	4	0	425	39.7
570.33	0.50			Shale		124.6			15.9						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 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
578 KIPS	561 KIPS	304 KIPS	33 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		3.1		8.9	4.5		5.2	5	2	0	1	22
586.33	2.50	0.30	20		2.8	5.8	11.7	4.2	0.6	9.4	9	3	0	2	24
583.83	2.50	0.30	23		2.8	5.8	180.5	4.2	0.6	31.5	31	5	0	13	27
583.33	0.50			Shale	29.3	171.8	209.8	43.4	18.5	74.9	75	5	0	36	27.2
582.83	0.50			Shale	29.3	171.8	239.1	43.4	18.5	118.4	118	5	0	60	27.7
582.33	0.50			Shale	29.3	171.8	268.3	43.4	18.5	161.8	162	5	0	84	28.2
581.83	0.50			Shale	29.3	171.8	297.6	43.4	18.5	205.3	205	5	0	108	28.7
581.33	0.50			Shale	29.3	171.8	326.9	43.4	18.5	248.7	249	5	0	132	29.2
580.83	0.50			Shale	29.3	171.8	356.2	43.4	18.5	292.2	292	5	0	156	29.7
580.33	0.50			Shale	29.3	171.8	385.4	43.4	18.5	335.6	336	5	0	180	30.2
579.83	0.50			Shale	29.3	171.8	414.7	43.4	18.5	379.1	379	5	0	204	30.7
579.33	0.50			Shale	29.3	171.8	444.0	43.4	18.5	422.5	422	5	0	228	31.2
578.83	0.50			Shale	29.3	171.8	473.3	43.4	18.5	465.9	466	5	0	251	31.7
578.33	0.50			Shale	29.3	171.8	502.5	43.4	18.5	509.4	503	5	0	272	32.2
577.83	0.50			Shale	29.3	171.8	531.8	43.4	18.5	552.8	532	5	0	288	32.7
577.33	0.50			Shale	29.3	171.8	561.1	43.4	18.5	596.3	561	5	0	304	33.2
576.83	0.50			Shale	29.3	171.8	590.4	43.4	18.5	639.7	590	5	0	320	33.7
576.33	0.50			Shale	29.3	171.8	619.6	43.4	18.5	683.2	620	5	0	336	34.2
575.83	0.50			Shale	29.3	171.8	648.9	43.4	18.5	726.6	649	5	0	352	34.7
575.33	0.50			Shale	29.3	171.8	678.2	43.4	18.5	770.1	678	5	0	368	35.2
574.83	0.50			Shale	29.3	171.8	707.5	43.4	18.5	813.5	707	5	0	384	35.7
574.33	0.50			Shale	29.3	171.8	736.7	43.4	18.5	856.9	737	5	0	400	36.2
573.83	0.50			Shale	29.3	171.8	766.0	43.4	18.5	900.4	766	5	0	416	36.7
573.33	0.50			Shale	29.3	171.8	795.3	43.4	18.5	943.8	795	5	0	433	37.2
572.83	0.50			Shale	29.3	171.8	824.6	43.4	18.5	987.3	825	5	0	449	37.7
572.33	0.50			Shale	29.3	171.8	853.8	43.4	18.5	1030.7	854	5	0	465	38.2
571.83	0.50			Shale	29.3	171.8	883.1	43.4	18.5	1074.2	883	5	0	481	38.7
571.33	0.50			Shale	29.3	171.8	912.4	43.4	18.5	1117.6	912	5	0	497	39.2
570.83	0.50			Shale	29.3	171.8	941.7	43.4	18.5	1161.0	942	5	0	513	39.7
570.33	0.50			Shale		171.8			18.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 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	687 KIPS	373 KIPS	35 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			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		3.1		9.0	4.6		5.3	5	2	0	1	22
586.33	2.50	0.30	20		2.9	5.9	11.9	4.3	0.8	9.6	10	3	0	2	24
583.83	2.50	0.30	23		2.9	5.9	184.3	4.3	0.8	35.7	36	5	0	15	27
583.33	0.50			Shale	29.6	175.5	213.9	43.8	22.6	79.5	79	5	0	39	27.2
582.83	0.50			Shale	29.6	175.5	243.5	43.8	22.6	123.3	123	5	0	63	27.7
582.33	0.50			Shale	29.6	175.5	273.1	43.8	22.6	167.1	167	5	0	87	28.2
581.83	0.50			Shale	29.6	175.5	302.7	43.8	22.6	210.9	211	5	0	111	28.7
581.33	0.50			Shale	29.6	175.5	332.3	43.8	22.6	254.7	255	5	0	135	29.2
580.83	0.50			Shale	29.6	175.5	361.8	43.8	22.6	298.5	299	5	0	159	29.7
580.33	0.50			Shale	29.6	175.5	391.4	43.8	22.6	342.3	342	5	0	183	30.2
579.83	0.50			Shale	29.6	175.5	421.0	43.8	22.6	386.1	386	5	0	208	30.7
579.33	0.50			Shale	29.6	175.5	450.6	43.8	22.6	429.9	430	5	0	232	31.2
578.83	0.50			Shale	29.6	175.5	480.2	43.8	22.6	473.8	474	5	0	256	31.7
578.33	0.50			Shale	29.6	175.5	509.8	43.8	22.6	517.6	510	5	0	276	32.2
577.83	0.50			Shale	29.6	175.5	539.4	43.8	22.6	561.4	539	5	0	292	32.7
577.33	0.50			Shale	29.6	175.5	568.9	43.8	22.6	605.2	569	5	0	308	33.2
576.83	0.50			Shale	29.6	175.5	598.5	43.8	22.6	649.0	599	5	0	324	33.7
576.33	0.50			Shale	29.6	175.5	628.1	43.8	22.6	692.8	628	5	0	341	34.2
575.83	0.50			Shale	29.6	175.5	657.7	43.8	22.6	736.6	658	5	0	357	34.7
575.33	0.50			Shale	29.6	175.5	687.3	43.8	22.6	780.4	687	5	0	373	35.2
574.83	0.50			Shale	29.6	175.5	716.9	43.8	22.6	824.2	717	5	0	389	35.7
574.33	0.50			Shale	29.6	175.5	746.5	43.8	22.6	868.0	746	5	0	406	36.2
573.83	0.50			Shale	29.6	175.5	776.0	43.8	22.6	911.8	776	5	0	422	36.7
573.33	0.50			Shale	29.6	175.5	805.6	43.8	22.6	955.6	806	5	0	438	37.2
572.83	0.50			Shale	29.6	175.5	835.2	43.8	22.6	999.4	835	5	0	455	37.7
572.33	0.50			Shale	29.6	175.5	864.8	43.8	22.6	1043.3	865	5	0	471	38.2
571.83	0.50			Shale	29.6	175.5	894.4	43.8	22.6	1087.1	894	5	0	487	38.7
571.33	0.50			Shale	29.6	175.5	924.0	43.8	22.6	1130.9	924	5	0	503	39.2
570.83	0.50			Shale	29.6	175.5	953.6	43.8	22.6	1174.7	954	5	0	520	39.7
570.33	0.50			Shale		175.5			22.6						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 1
 REFERENCE BORING ===== B-2
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.52 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 32.00 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 330.00 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 123.75 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
929 KIPS	917 KIPS	499 KIPS	39 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
588.83	1.67	0.50	2		3.2		9.3	4.6		5.6	6	2	0	1	22
586.33	2.50	0.30	20		2.9	6.2	12.3	4.3	1.0	9.9	10	3	0	2	24
583.83	2.50	0.30	23		2.9	6.2	192.1	4.3	1.0	43.0	43	5	0	19	27
583.33	0.50			Shale	30.2	183.0	222.3	44.3	29.8	87.3	87	5	0	43	27.2
582.83	0.50			Shale	30.2	183.0	252.5	44.3	29.8	131.7	132	5	0	67	27.7
582.33	0.50			Shale	30.2	183.0	282.7	44.3	29.8	176.0	176	5	0	92	28.2
581.83	0.50			Shale	30.2	183.0	312.9	44.3	29.8	220.3	220	5	0	116	28.7
581.33	0.50			Shale	30.2	183.0	343.1	44.3	29.8	264.6	265	5	0	141	29.2
580.83	0.50			Shale	30.2	183.0	373.3	44.3	29.8	309.0	309	5	0	165	29.7
580.33	0.50			Shale	30.2	183.0	403.5	44.3	29.8	353.3	353	5	0	189	30.2
579.83	0.50			Shale	30.2	183.0	433.7	44.3	29.8	397.6	398	5	0	214	30.7
579.33	0.50			Shale	30.2	183.0	463.9	44.3	29.8	442.0	442	5	0	238	31.2
578.83	0.50			Shale	30.2	183.0	494.1	44.3	29.8	486.3	486	5	0	262	31.7
578.33	0.50			Shale	30.2	183.0	524.4	44.3	29.8	530.6	524	5	0	283	32.2
577.83	0.50			Shale	30.2	183.0	554.6	44.3	29.8	574.9	555	5	0	300	32.7
577.33	0.50			Shale	30.2	183.0	584.8	44.3	29.8	619.3	585	5	0	317	33.2
576.83	0.50			Shale	30.2	183.0	615.0	44.3	29.8	663.6	615	5	0	333	33.7
576.33	0.50			Shale	30.2	183.0	645.2	44.3	29.8	707.9	645	5	0	350	34.2
575.83	0.50			Shale	30.2	183.0	675.4	44.3	29.8	752.2	675	5	0	367	34.7
575.33	0.50			Shale	30.2	183.0	705.6	44.3	29.8	796.6	706	5	0	383	35.2
574.83	0.50			Shale	30.2	183.0	735.8	44.3	29.8	840.9	736	5	0	400	35.7
574.33	0.50			Shale	30.2	183.0	766.0	44.3	29.8	885.2	766	5	0	416	36.2
573.83	0.50			Shale	30.2	183.0	796.2	44.3	29.8	929.5	796	5	0	433	36.7
573.33	0.50			Shale	30.2	183.0	826.4	44.3	29.8	973.9	826	5	0	450	37.2
572.83	0.50			Shale	30.2	183.0	856.7	44.3	29.8	1018.2	857	5	0	466	37.7
572.33	0.50			Shale	30.2	183.0	886.9	44.3	29.8	1062.5	887	5	0	483	38.2
571.83	0.50			Shale	30.2	183.0	917.1	44.3	29.8	1106.9	917	5	0	499	38.7
571.33	0.50			Shale	30.2	183.0	947.3	44.3	29.8	1151.2	947	5	0	516	39.2
570.83	0.50			Shale	30.2	183.0	977.5	44.3	29.8	1195.5	977	5	0	533	39.7
570.33	0.50			Shale		183.0			29.8						

Pile Design Table for Pier 1 utilizing Boring #B-2

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			Steel HP 10 X 57			Steel HP 14 X 73		
9	1	24	451	244	35	561	304	33
Metal Shell 12"Φ w/.25" walls			Steel HP 12 X 53			Steel HP 14 X 89		
9	1	24	402	217	32	687	373	35
256	136	27	Steel HP 12 X 63			Steel HP 14 X 102		
Metal Shell 14"Φ w/.25" walls			481	260	34	786	427	37
11	2	24	Steel HP 12 X 74			Steel HP 14 X 117		
347	185	27	564	306	35	917	499	39
Metal Shell 14"Φ w/.312" walls			Steel HP 12 X 84			Precast 14"x 14"		
11	2	24	649	353	37	14	2	24
347	185	27				Timber Pile		
Steel HP 8 X 36						93	46	27
280	151	33						
Steel HP 10 X 42								
317	171	32						

Appendix G

Part- IV

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

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
413 KIPS	379 KIPS	187 KIPS	26 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE : 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.25" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	6.3		82.8	83	3	0	42	21
584.18	5.00		21	Fine Sand	33.3	76.6	379.1	379	22	0	187	26
579.18	5.00		52	Fine Sand	114.2	339.5	490.3	490	22	0	248	34
578.68	0.50			Shale	115.4	336.5	605.6	606	22	0	311	34.6
578.18	0.50			Shale	115.4	336.5	721.0	721	22	0	375	32.4
577.68	0.50			Shale	115.4	336.5	836.4	836	22	0	438	32.6
577.18	0.50			Shale	115.4	336.5	951.7	952	22	0	502	33.4
576.68	0.50			Shale	115.4	336.5	1067.1	1067	22	0	565	33.6
576.18	0.50			Shale	115.4	336.5	1182.5	1182	22	0	629	34.4
575.68	0.50			Shale	115.4	336.5	1297.8	1298	22	0	692	34.6
575.18	0.50			Shale	115.4	336.5	1413.2	1413	22	0	755	35.4
574.68	0.50			Shale	115.4	336.5	1528.5	1529	22	0	819	35.6
574.18	0.50			Shale	115.4	336.5	1643.9	1644	22	0	882	36.4
573.68	0.50			Shale	115.4	336.5	1759.3	1759	22	0	946	36.6
573.18	0.50			Shale	115.4	336.5	1874.6	1875	22	0	1009	37.4
572.68	0.50			Shale	115.4	336.5	1990.0	1990	22	0	1073	37.6
572.18	0.50			Shale	115.4	336.5	2105.4	2105	22	0	1136	38.4
571.68	0.50			Shale	115.4	336.5	2220.7	2221	22	0	1200	38.6
571.18	0.50			Shale	115.4	336.5	2336.1	2336	22	0	1263	39.4
570.68	0.50			Shale	115.4	336.5	2451.4	2451	22	0	1327	39.6
570.18	0.50			Shale	115.4	336.5	2566.8	2567	22	0	1390	40.4
569.68	0.50			Shale	115.4	336.5	2682.2	2682	22	0	1453	40.6
569.18	0.50			Shale	115.4	336.5	2797.5	2798	22	0	1517	41.4
568.68	0.50			Shale	115.4	336.5	2912.9	2913	22	0	1580	41.6
568.18	0.50			Shale	115.4	336.5	3028.3	3028	22	0	1644	42.4
567.68	0.50			Shale	115.4	336.5	3143.6	3144	22	0	1707	42.6
567.18	0.50			Shale	115.4	336.5	3259.0	3259	22	0	1771	43.4
566.68	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

 TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE : 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
513 KIPS	490 KIPS	248 KIPS	31 FT.

PILE TYPE AND SIZE ===== Metal Shell 14"Φ w/.312" walls
 Pile Perimeter===== 3.665 FT.
 Pile End Bearing Area===== 1.069 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			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	6.3		82.8	83	3	0	42	21
584.18	5.00		21	Fine Sand	33.3	76.6	379.1	379	22	0	187	26
579.18	5.00		52	Fine Sand	114.2	339.5	490.3	490	22	0	248	31
578.68	0.50			Shale	115.4	336.5	605.6	606	22	0	311	34.6
578.18	0.50			Shale	115.4	336.5	721.0	721	22	0	375	32.4
577.68	0.50			Shale	115.4	336.5	836.4	836	22	0	438	32.6
577.18	0.50			Shale	115.4	336.5	951.7	952	22	0	502	33.4
576.68	0.50			Shale	115.4	336.5	1067.1	1067	22	0	565	33.6
576.18	0.50			Shale	115.4	336.5	1182.5	1182	22	0	629	34.4
575.68	0.50			Shale	115.4	336.5	1297.8	1298	22	0	692	34.6
575.18	0.50			Shale	115.4	336.5	1413.2	1413	22	0	755	35.4
574.68	0.50			Shale	115.4	336.5	1528.5	1529	22	0	819	35.6
574.18	0.50			Shale	115.4	336.5	1643.9	1644	22	0	882	36.4
573.68	0.50			Shale	115.4	336.5	1759.3	1759	22	0	946	36.6
573.18	0.50			Shale	115.4	336.5	1874.6	1875	22	0	1009	37.4
572.68	0.50			Shale	115.4	336.5	1990.0	1990	22	0	1073	37.6
572.18	0.50			Shale	115.4	336.5	2105.4	2105	22	0	1136	38.4
571.68	0.50			Shale	115.4	336.5	2220.7	2221	22	0	1200	38.6
571.18	0.50			Shale	115.4	336.5	2336.1	2336	22	0	1263	39.4
570.68	0.50			Shale	115.4	336.5	2451.4	2451	22	0	1327	39.6
570.18	0.50			Shale	115.4	336.5	2566.8	2567	22	0	1390	40.4
569.68	0.50			Shale	115.4	336.5	2682.2	2682	22	0	1453	40.6
569.18	0.50			Shale	115.4	336.5	2797.5	2798	22	0	1517	41.4
568.68	0.50			Shale	115.4	336.5	2912.9	2913	22	0	1580	41.6
568.18	0.50			Shale	115.4	336.5	3028.3	3028	22	0	1644	42.4
567.68	0.50			Shale	115.4	336.5	3143.6	3144	22	0	1707	42.6
567.18	0.50			Shale	115.4	336.5	3259.0	3259	22	0	1771	43.4
566.68	0.50			Shale		336.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	318 KIPS	171 KIPS	36 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	1.1		28.1	1.6		5.1	5	1	0	2	21
584.18	5.00		21	Fine Sand	5.9	27.0	95.2	8.7	3.4	21.5	22	4	0	8	26
579.18	5.00		52	Fine Sand	20.4	88.1	112.2	30.0	11.2	51.1	51	4	0	24	31
578.68	0.50			Shale	20.6	84.8	132.7	30.3	10.7	81.3	81	4	0	41	31.6
578.18	0.50			Shale	20.6	84.8	153.3	30.3	10.7	111.6	112	4	0	57	32.1
577.68	0.50			Shale	20.6	84.8	173.8	30.3	10.7	141.9	142	4	0	74	32.6
577.18	0.50			Shale	20.6	84.8	194.4	30.3	10.7	172.1	172	4	0	91	33.1
576.68	0.50			Shale	20.6	84.8	214.9	30.3	10.7	202.4	202	4	0	107	33.6
576.18	0.50			Shale	20.6	84.8	235.5	30.3	10.7	232.6	233	4	0	124	34.1
575.68	0.50			Shale	20.6	84.8	256.0	30.3	10.7	262.9	256	4	0	137	34.6
575.18	0.50			Shale	20.6	84.8	276.6	30.3	10.7	293.2	277	4	0	148	35.1
574.68	0.50			Shale	20.6	84.8	297.1	30.3	10.7	323.4	297	4	0	160	35.6
574.18	0.50			Shale	20.6	84.8	317.7	30.3	10.7	353.7	318	4	0	171	36.1
573.68	0.50			Shale	20.6	84.8	338.3	30.3	10.7	383.9	338	4	0	182	36.6
573.18	0.50			Shale	20.6	84.8	358.8	30.3	10.7	414.2	359	4	0	193	37.1
572.68	0.50			Shale	20.6	84.8	379.4	30.3	10.7	444.5	379	4	0	205	37.6
572.18	0.50			Shale	20.6	84.8	399.9	30.3	10.7	474.7	400	4	0	216	38.1
571.68	0.50			Shale	20.6	84.8	420.5	30.3	10.7	505.0	420	4	0	227	38.6
571.18	0.50			Shale	20.6	84.8	441.0	30.3	10.7	535.2	441	4	0	239	39.1
570.68	0.50			Shale	20.6	84.8	461.6	30.3	10.7	565.5	462	4	0	250	39.6
570.18	0.50			Shale	20.6	84.8	482.1	30.3	10.7	595.8	482	4	0	261	40.1
569.68	0.50			Shale	20.6	84.8	502.7	30.3	10.7	626.0	503	4	0	273	40.6
569.18	0.50			Shale	20.6	84.8	523.2	30.3	10.7	656.3	523	4	0	284	41.1
568.68	0.50			Shale	20.6	84.8	543.8	30.3	10.7	686.5	544	4	0	295	41.6
568.18	0.50			Shale	20.6	84.8	564.4	30.3	10.7	716.8	564	4	0	307	42.1
567.68	0.50			Shale	20.6	84.8	584.9	30.3	10.7	747.1	585	4	0	318	42.6
567.18	0.50			Shale	20.6	84.8	605.5	30.3	10.7	777.3	605	4	0	329	43.1
566.68	0.50			Shale		84.8			10.7						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
418 KIPS	403 KIPS	217 KIPS	36 FT.

PILE TYPE AND SIZE ===== Steel HP 12 X 53
 Plugged Pile Perimeter===== 3.967 FT. Unplugged Pile Perimeter===== 5.800 FT.
 Plugged Pile End Bearing Area===== 0.983 SQFT. Unplugged Pile End Bearing Area===== 0.108 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	1.3		33.9	2.0		5.5	6	1	0	2	21
584.18	5.00		21	Fine Sand	7.1	32.5	135.9	10.4	3.6	26.3	26	5	0	10	26
579.18	5.00		52	Fine Sand	24.5	127.4	155.4	35.8	13.9	61.6	62	5	0	29	31
578.68	0.50			Shale	24.7	122.5	180.1	36.1	13.4	97.7	98	5	0	49	31.6
578.18	0.50			Shale	24.7	122.5	204.9	36.1	13.4	133.8	134	5	0	69	32.1
577.68	0.50			Shale	24.7	122.5	229.6	36.1	13.4	169.9	170	5	0	89	32.6
577.18	0.50			Shale	24.7	122.5	254.3	36.1	13.4	206.1	206	5	0	109	33.1
576.68	0.50			Shale	24.7	122.5	279.0	36.1	13.4	242.2	242	5	0	129	33.6
576.18	0.50			Shale	24.7	122.5	303.7	36.1	13.4	278.3	278	5	0	148	34.1
575.68	0.50			Shale	24.7	122.5	328.4	36.1	13.4	314.5	314	5	0	168	34.6
575.18	0.50			Shale	24.7	122.5	353.1	36.1	13.4	350.6	351	5	0	188	35.1
574.68	0.50			Shale	24.7	122.5	377.8	36.1	13.4	386.7	378	5	0	203	35.6
574.18	0.50			Shale	24.7	122.5	402.5	36.1	13.4	422.8	403	5	0	217	36.1
573.68	0.50			Shale	24.7	122.5	427.2	36.1	13.4	459.0	427	5	0	230	36.6
573.18	0.50			Shale	24.7	122.5	451.9	36.1	13.4	495.1	452	5	0	244	37.1
572.68	0.50			Shale	24.7	122.5	476.6	36.1	13.4	531.2	477	5	0	257	37.6
572.18	0.50			Shale	24.7	122.5	501.3	36.1	13.4	567.3	504	5	0	271	38.1
571.68	0.50			Shale	24.7	122.5	526.0	36.1	13.4	603.5	526	5	0	285	38.6
571.18	0.50			Shale	24.7	122.5	550.7	36.1	13.4	639.6	554	5	0	298	39.1
570.68	0.50			Shale	24.7	122.5	575.5	36.1	13.4	675.7	575	5	0	312	39.6
570.18	0.50			Shale	24.7	122.5	600.2	36.1	13.4	711.8	600	5	0	325	40.1
569.68	0.50			Shale	24.7	122.5	624.9	36.1	13.4	748.0	625	5	0	339	40.6
569.18	0.50			Shale	24.7	122.5	649.6	36.1	13.4	784.1	650	5	0	353	41.1
568.68	0.50			Shale	24.7	122.5	674.3	36.1	13.4	820.2	674	5	0	366	41.6
568.18	0.50			Shale	24.7	122.5	699.0	36.1	13.4	856.3	699	5	0	380	42.1
567.68	0.50			Shale	24.7	122.5	723.7	36.1	13.4	892.5	724	5	0	393	42.6
567.18	0.50			Shale	24.7	122.5	748.4	36.1	13.4	928.6	748	5	0	407	43.1
566.68	0.50			Shale		122.5									

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
497 KIPS	482 KIPS	260 KIPS	38 FT.

PILE TYPE AND SIZE ===== Steel HP 12 X 63
 Plugged Pile Perimeter===== 4.000 FT. Unplugged Pile Perimeter===== 5.883 FT.
 Plugged Pile End Bearing Area===== 1.000 SQFT. Unplugged Pile End Bearing Area===== 0.128 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	1.4		34.4	2.0		6.2	6	1	0	3	21
584.18	5.00		21	Fine Sand	7.2	33.1	138.1	10.6	4.2	29.1	29	5	0	11	26
579.18	5.00		52	Fine Sand	24.7	129.5	157.8	36.3	16.6	64.8	65	5	0	31	31
578.68	0.50			Shale	24.9	124.6	182.7	36.6	15.9	101.4	101	5	0	51	31.6
578.18	0.50			Shale	24.9	124.6	207.6	36.6	15.9	138.1	138	5	0	71	32.1
577.68	0.50			Shale	24.9	124.6	232.5	36.6	15.9	174.7	175	5	0	91	32.6
577.18	0.50			Shale	24.9	124.6	257.4	36.6	15.9	211.4	211	5	0	112	33.1
576.68	0.50			Shale	24.9	124.6	282.4	36.6	15.9	248.0	248	5	0	132	33.6
576.18	0.50			Shale	24.9	124.6	307.3	36.6	15.9	284.6	285	5	0	152	34.1
575.68	0.50			Shale	24.9	124.6	332.2	36.6	15.9	321.3	321	5	0	172	34.6
575.18	0.50			Shale	24.9	124.6	357.1	36.6	15.9	357.9	357	5	0	192	35.1
574.68	0.50			Shale	24.9	124.6	382.0	36.6	15.9	394.6	382	5	0	205	35.6
574.18	0.50			Shale	24.9	124.6	406.9	36.6	15.9	431.2	407	5	0	219	36.1
573.68	0.50			Shale	24.9	124.6	431.8	36.6	15.9	467.9	432	5	0	233	36.6
573.18	0.50			Shale	24.9	124.6	456.8	36.6	15.9	504.5	457	5	0	247	37.1
572.68	0.50			Shale	24.9	124.6	481.7	36.6	15.9	541.2	482	5	0	260	37.6
572.18	0.50			Shale	24.9	124.6	506.6	36.6	15.9	577.8	507	5	0	274	38.1
571.68	0.50			Shale	24.9	124.6	531.5	36.6	15.9	614.5	534	5	0	288	38.6
571.18	0.50			Shale	24.9	124.6	556.4	36.6	15.9	651.1	556	5	0	304	39.1
570.68	0.50			Shale	24.9	124.6	581.3	36.6	15.9	687.7	584	5	0	315	39.6
570.18	0.50			Shale	24.9	124.6	606.2	36.6	15.9	724.4	606	5	0	329	40.1
569.68	0.50			Shale	24.9	124.6	631.2	36.6	15.9	761.0	634	5	0	342	40.6
569.18	0.50			Shale	24.9	124.6	656.1	36.6	15.9	797.7	656	5	0	356	41.1
568.68	0.50			Shale	24.9	124.6	681.0	36.6	15.9	834.3	684	5	0	370	41.6
568.18	0.50			Shale	24.9	124.6	705.9	36.6	15.9	871.0	706	5	0	384	42.1
567.68	0.50			Shale	24.9	124.6	730.8	36.6	15.9	907.6	734	5	0	397	42.6
567.18	0.50			Shale	24.9	124.6	755.7	36.6	15.9	944.3	756	5	0	411	43.1
566.68	0.50			Shale		124.6			15.9						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
578 KIPS	562 KIPS	304 KIPS	37 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	1.6		40.7	2.4		6.6	7	1	0	3	21
584.18	5.00		21	Fine Sand	8.5	39.1	183.4	12.5	4.2	33.6	34	6	0	13	26
579.18	5.00		52	Fine Sand	29.0	173.3	210.8	43.0	18.7	76.4	76	6	0	37	31
578.68	0.50			Shale	29.3	171.8	240.1	43.4	18.5	119.9	120	6	0	60	31.6
578.18	0.50			Shale	29.3	171.8	269.4	43.4	18.5	163.3	163	6	0	84	32.1
577.68	0.50			Shale	29.3	171.8	298.6	43.4	18.5	206.8	207	6	0	108	32.6
577.18	0.50			Shale	29.3	171.8	327.9	43.4	18.5	250.2	250	6	0	132	33.1
576.68	0.50			Shale	29.3	171.8	357.2	43.4	18.5	293.7	294	6	0	156	33.6
576.18	0.50			Shale	29.3	171.8	386.4	43.4	18.5	337.1	337	6	0	180	34.1
575.68	0.50			Shale	29.3	171.8	415.7	43.4	18.5	380.5	381	6	0	204	34.6
575.18	0.50			Shale	29.3	171.8	445.0	43.4	18.5	424.0	424	6	0	228	35.1
574.68	0.50			Shale	29.3	171.8	474.3	43.4	18.5	467.4	467	6	0	252	35.6
574.18	0.50			Shale	29.3	171.8	503.5	43.4	18.5	510.9	504	6	0	271	36.1
573.68	0.50			Shale	29.3	171.8	532.8	43.4	18.5	554.3	533	6	0	288	36.6
573.18	0.50			Shale	29.3	171.8	562.1	43.4	18.5	597.8	562	6	0	304	37.1
572.68	0.50			Shale	29.3	171.8	591.4	43.4	18.5	641.2	594	6	0	320	37.6
572.18	0.50			Shale	29.3	171.8	620.6	43.4	18.5	684.7	624	6	0	336	38.1
571.68	0.50			Shale	29.3	171.8	649.9	43.4	18.5	728.1	650	6	0	352	38.6
571.18	0.50			Shale	29.3	171.8	679.2	43.4	18.5	771.5	679	6	0	368	39.1
570.68	0.50			Shale	29.3	171.8	708.5	43.4	18.5	815.0	708	6	0	384	39.6
570.18	0.50			Shale	29.3	171.8	737.7	43.4	18.5	858.4	738	6	0	400	40.1
569.68	0.50			Shale	29.3	171.8	767.0	43.4	18.5	901.9	767	6	0	416	40.6
569.18	0.50			Shale	29.3	171.8	796.3	43.4	18.5	945.3	796	6	0	432	41.1
568.68	0.50			Shale	29.3	171.8	825.6	43.4	18.5	988.8	826	6	0	449	41.6
568.18	0.50			Shale	29.3	171.8	854.8	43.4	18.5	1032.2	855	6	0	465	42.1
567.68	0.50			Shale	29.3	171.8	884.1	43.4	18.5	1075.7	884	6	0	481	42.6
567.18	0.50			Shale	29.3	171.8	913.4	43.4	18.5	1119.1	943	6	0	497	43.1
566.68	0.50			Shale		171.8			18.5						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
705 KIPS	688 KIPS	373 KIPS	39 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			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	1.6		41.5	2.4		7.5	8	1	0	3	21
584.18	5.00		21	Fine Sand	8.5	39.9	187.2	12.6	5.1	37.8	38	6	0	15	26
579.18	5.00		52	Fine Sand	29.3	177.1	214.9	43.4	22.8	81.0	81	6	0	39	31
578.68	0.50			Shale	29.6	175.5	244.5	43.8	22.6	124.8	125	6	0	63	31.6
578.18	0.50			Shale	29.6	175.5	274.1	43.8	22.6	168.6	169	6	0	87	32.1
577.68	0.50			Shale	29.6	175.5	303.7	43.8	22.6	212.4	212	6	0	111	32.6
577.18	0.50			Shale	29.6	175.5	333.3	43.8	22.6	256.2	256	6	0	135	33.1
576.68	0.50			Shale	29.6	175.5	362.9	43.8	22.6	300.0	300	6	0	159	33.6
576.18	0.50			Shale	29.6	175.5	392.5	43.8	22.6	343.8	344	6	0	184	34.1
575.68	0.50			Shale	29.6	175.5	422.0	43.8	22.6	387.6	388	6	0	208	34.6
575.18	0.50			Shale	29.6	175.5	451.6	43.8	22.6	431.5	431	6	0	232	35.1
574.68	0.50			Shale	29.6	175.5	481.2	43.8	22.6	475.3	475	6	0	256	35.6
574.18	0.50			Shale	29.6	175.5	510.8	43.8	22.6	519.1	511	6	0	275	36.1
573.68	0.50			Shale	29.6	175.5	540.4	43.8	22.6	562.9	540	6	0	292	36.6
573.18	0.50			Shale	29.6	175.5	570.0	43.8	22.6	606.7	570	6	0	308	37.1
572.68	0.50			Shale	29.6	175.5	599.6	43.8	22.6	650.5	600	6	0	324	37.6
572.18	0.50			Shale	29.6	175.5	629.1	43.8	22.6	694.3	629	6	0	340	38.1
571.68	0.50			Shale	29.6	175.5	658.7	43.8	22.6	738.1	659	6	0	357	38.6
571.18	0.50			Shale	29.6	175.5	688.3	43.8	22.6	781.9	688	6	0	373	39.1
570.68	0.50			Shale	29.6	175.5	717.9	43.8	22.6	825.7	718	6	0	389	39.6
570.18	0.50			Shale	29.6	175.5	747.5	43.8	22.6	869.5	747	6	0	406	40.1
569.68	0.50			Shale	29.6	175.5	777.1	43.8	22.6	913.3	777	6	0	422	40.6
569.18	0.50			Shale	29.6	175.5	806.7	43.8	22.6	957.1	807	6	0	438	41.1
568.68	0.50			Shale	29.6	175.5	836.2	43.8	22.6	1001.0	836	6	0	454	41.6
568.18	0.50			Shale	29.6	175.5	865.8	43.8	22.6	1044.8	866	6	0	471	42.1
567.68	0.50			Shale	29.6	175.5	895.4	43.8	22.6	1088.6	895	6	0	487	42.6
567.18	0.50			Shale	29.6	175.5	925.0	43.8	22.6	1132.4	925	6	0	503	43.1
566.68	0.50			Shale		175.5			22.6						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

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

Modified 10/18/2011

SUBSTRUCTURE===== Pier 2
 REFERENCE BORING ===== B-3
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 610.26 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DR ===== 590.50 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 583.34 ft
 TOP ELEV. OF LIQUEF. (so layers above apply DD) ===== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1320 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 35.17 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 300.26 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 112.60 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req'd Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	918 KIPS	499 KIPS	43 FT.

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

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			NOMINAL UNPLUG'D			NOMINAL REQ'D BEARING (KIPS)	FACTORED LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
					SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)	SIDE RESIST. (KIPS)	END BRG. RESIST. (KIPS)	TOTAL RESIST. (KIPS)					
589.18	1.32		15	Fine Sand	1.6		43.3	2.4		9.2	9	1	0	4	21
584.18	5.00		21	Fine Sand	8.7	41.6	195.1	12.8	6.8	45.2	45	6	0	19	26
579.18	5.00		52	Fine Sand	29.9	184.7	223.3	43.9	30.0	88.9	89	6	0	43	31
578.68	0.50			Shale	30.2	183.0	253.5	44.3	29.8	133.2	133	6	0	68	31.6
578.18	0.50			Shale	30.2	183.0	283.7	44.3	29.8	177.5	178	6	0	92	32.1
577.68	0.50			Shale	30.2	183.0	313.9	44.3	29.8	221.8	222	6	0	116	32.6
577.18	0.50			Shale	30.2	183.0	344.1	44.3	29.8	266.2	266	6	0	141	33.1
576.68	0.50			Shale	30.2	183.0	374.4	44.3	29.8	310.5	310	6	0	165	33.6
576.18	0.50			Shale	30.2	183.0	404.6	44.3	29.8	354.8	355	6	0	189	34.1
575.68	0.50			Shale	30.2	183.0	434.8	44.3	29.8	399.1	399	6	0	214	34.6
575.18	0.50			Shale	30.2	183.0	465.0	44.3	29.8	443.5	443	6	0	238	35.1
574.68	0.50			Shale	30.2	183.0	495.2	44.3	29.8	487.8	488	6	0	263	35.6
574.18	0.50			Shale	30.2	183.0	525.4	44.3	29.8	532.1	525	6	0	283	36.1
573.68	0.50			Shale	30.2	183.0	555.6	44.3	29.8	576.5	556	6	0	300	36.6
573.18	0.50			Shale	30.2	183.0	585.8	44.3	29.8	620.8	586	6	0	316	37.1
572.68	0.50			Shale	30.2	183.0	616.0	44.3	29.8	665.1	616	6	0	333	37.6
572.18	0.50			Shale	30.2	183.0	646.2	44.3	29.8	709.4	646	6	0	350	38.1
571.68	0.50			Shale	30.2	183.0	676.4	44.3	29.8	753.8	676	6	0	366	38.6
571.18	0.50			Shale	30.2	183.0	706.6	44.3	29.8	798.1	707	6	0	383	39.1
570.68	0.50			Shale	30.2	183.0	736.9	44.3	29.8	842.4	737	6	0	400	39.6
570.18	0.50			Shale	30.2	183.0	767.1	44.3	29.8	886.7	767	6	0	416	40.1
569.68	0.50			Shale	30.2	183.0	797.3	44.3	29.8	931.1	797	6	0	433	40.6
569.18	0.50			Shale	30.2	183.0	827.5	44.3	29.8	975.4	827	6	0	449	41.1
568.68	0.50			Shale	30.2	183.0	857.7	44.3	29.8	1019.7	858	6	0	466	41.6
568.18	0.50			Shale	30.2	183.0	887.9	44.3	29.8	1064.0	888	6	0	483	42.1
567.68	0.50			Shale	30.2	183.0	918.1	44.3	29.8	1108.4	918	6	0	499	42.6
567.18	0.50			Shale	30.2	183.0	948.3	44.3	29.8	1152.7	948	6	0	516	43.1
566.68	0.50			Shale		183.0			29.8						

Pile Design Table for Pier 2 utilizing Boring #B-3

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			Steel HP 10 X 57			Steel HP 14 X 73		
71	36	21	451	244	39	562	304	37
Metal Shell 12"Φ w/.25" walls			Steel HP 12 X 53			Steel HP 14 X 89		
71	36	21	403	217	36	688	373	39
291	141	26	Steel HP 12 X 63			Steel HP 14 X 102		
Metal Shell 14"Φ w/.25" walls			Steel HP 12 X 74			Steel HP 14 X 117		
83	42	21	482	260	38	787	427	41
379	187	26	Steel HP 12 X 84			Precast 14"x 14"		
Metal Shell 14"Φ w/.312" walls			Steel HP 12 X 84			Timber Pile		
83	42	21	650	353	41	105	54	21
379	187	26						
490	248	31						
Steel HP 8 X 36								
280	151	37						
Steel HP 10 X 42								
318	171	36						

Appendix H

Boring B-1 (South Abutment)
 STA. 1440+41
 Offset 37.5 ft LT
 Water Table Elevation 590.32 ft

Depth (Ft)	Elevation (Ft)	Abbreviated Soil Description	Friction (ϕ)	Cohesion (tsf) (c)	Unit Weight (pcf)	
					γ_{wet}	γ_{sat}
3.9	607.73 to 603.82	Embankment		1.00	120.00	
6.4	603.82 to 601.32	Clay		0.25		123.14
8.9	601.32 to 598.82	Clay		0.50	116.56	
11.4	598.82 to 596.32	Clay		0.25		121.26
14.4	596.32 to 593.32	Clay		0.15		119.38
17.4	593.32 to 590.32	Sandy Clay Loam	27		139.20	
19.4	590.32 to 588.32	Sandy Loam	28			151.20
24.4	588.32 to 583.32	Sandy Loam	35			154.80
29.4	583.32 to 578.32	Shaley Clay		2.00	127.30	
43.9	578.32 to 563.82	Clayey Shale		2.25	146.10	

Boring B-2 (Pier 1)
 STA. 1440+67
 Offset 21.5 ft LT
 Water Table Elevation 588.8 ft

Depth (Ft)	Elevation (Ft)	Abbreviated Soil Description	Friction (ϕ)	Cohesion (tsf) (c)	Unit Weight (pcf)	
					γ_{wet}	γ_{sat}
8.5	602.83 to 594.33	Clay		1.05	115.90	
10.5	594.33 to 592.33	Clay		0.25		121.26
15.5	592.33 to 587.33	Clay		0.25		121.73
20.5	587.33 to 582.33	Sandy Loam		0.15	136.20	
40.0	582.33 to 562.83	Clayey Shale		2.25	146.70	

Boring B-3 (Pier 2)
 STA. 1442+42
 Offset 28.5 ft LT
 Water Table Elevation 590.7 ft

Depth (Ft)	Elevation (Ft)	Abbreviated Soil Description	Friction (ϕ)	Cohesion (tsf) (c)	Unit Weight (pcf)	
					γ_{wet}	γ_{sat}
5.0	603.18 to 598.18	Clay		0.58		117.03
8.5	598.18 to 594.68	Clay		0.15		119.97
10.0	594.68 to 593.18	Clay		0.40		119.04
13.0	593.18 to 590.18	Clay		0.15		123.84
24.0	590.18 to 579.18	Sandy Loam	35			136.40
35.0	579.18 to 568.18	Clayey Shale		2.25		137.70

Boring B-3 (North Abutment)
 STA. 1442+42
 Offset 28.5 ft LT
 Water Table Elevation 590.7 ft

Depth (Ft)	Elevation (Ft)	Abbreviated Soil Description	Friction (ϕ)	Cohesion (tsf) (c)	Unit Weight (pcf)	
					γ_{wet}	γ_{sat}
3.9	607.06 to 603.18	Embankment		1.00		120.00
8.9	603.18 to 598.18	Clay		0.58		117.03
12.4	598.18 to 594.68	Clay		0.15		119.97
13.9	594.68 to 593.18	Clay		0.40		119.04
16.9	593.18 to 590.18	Clay		0.15		123.84
27.9	590.18 to 579.18	Sandy Loam	35			136.40
38.9	579.18 to 568.18	Clayey Shale		2.25		137.70