

Original Report Date: 10-15-19 Proposed SN: 038-0226 Route: FAP 332 (IL 1)
 Revised Date: _____ Existing SN: 038-0020 Section: 4 BR
 Geotechnical Engineer: Terry McCleary of McCleary Engineering County: Iroquois
 Structural Engineer: Michael Haley of Lin Engineering, Ltd. Contract: 66959

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): Proposed SN 038-0226 is a 3 span structure replacing SN 038-0020 on the same alignment that carries IL Route 1 over Pike Creek at sta. 273+22.00. There is no existing or proposed skew. The 15 inch reinforced concrete deck will be supported by integral abutments and pile bent piers encased with a solid wall. The out to out superstructure width is 34.83 ft. and the back to back abutment length is 91.0 ft. The factored loading is 540.0 kips for the abutments and 1250.0 kips for the piers. The vertical profile of the roadway at the bridge will be raised a maximum of about 1.9 ft. See the attached TS&L drawing for further information.

Discuss the existing boring data, existing plans foundation information, new subsurface exploration and need for any additional exploration to be provided with SGR Technical Memo (attach all data and subsurface profile plot): Two borings were taken in October 2006 on the north and south sides of the side of the structure, Both borings reported a very similar profile. Below approximately 7 ft. of loose to medium loamy Sand fill, both borings show 2 to 3 ft. of loose to medium alluvial Sand. Below the Sand layer was approximately 55 ft. of stiff to very stiff Silty Clay, Clay, and Silty Clay Till. Seams and ribbons of Silt were present. Below Elevations 562.63 in Boring #1 on the south side and 565.04 in Boring #2 on the north side was hard gray brittle Silty Clay Loam Till and Sandy Clay Loam Till. Boring #2 reported Cobble and Boulder sized rocks in the till. Boring #2 reported auger refusal at 69 ft. due to Boulder obstruction. See attached 2006 borings and the Subsurface Profile Plot.

The existing 3 span structure, SN 038-0020, was built in 1955. Both abutments are supported on spread footings bearing on soil. Both piers are supported on concrete pile bents; the 1955 plans show 35 ft. long tapered concrete piles. The previous 3 span structure, built in 1921, was supported by spread footings. A general plan and elevation drawing provided by the 2006 BCR consultant shows a profile of the of the proposed structure, SN 038-0226, superimposed over the profiles of the previous 2 structures. It shows a conflict at Pier 2--the 1921 footing conflicts with the proposed pile bent, requiring either footing removal or coring through the spread footing. The current TS&L also shows near conflicts with both proposed piers and may require mitigation.

Provide the location and maximum height of any new soil fill or magnitude of footing bearing pressure. Estimate the amount and time of the expected settlement. Indicate if further testing, analysis, and/or ground improvement/treatment is necessary: The rise in the profile at the abutments is expected to be a little less than 1.9 ft. and will consist of a thicker pavement structure plus some additional aggregate fill. The existing embankment is over 60 years old and show no signs of any settlement problems. There is expected to be little or no settlement;

Identify any new cuts or fill slope angles and heights. Estimate the factor of safety against slope failure. Indicate if further testing, analysis or ground improvement/treatment is necessary: The proposed roadway maintains the same horizontal alignment. There will be no new cuts or fill slopes; the re-graded ditch height will vary from 6 ft. to 10 ft.. A worst case scenario was analyzed for the temporary 2:1 end slope: the factor of safety against a slope failure is 1.578. Some flattening (2:1 is recommended) of the temporary slope behind the abutment may be required because of the sandy soils. See attached slope stability analysis. No further testing is necessary.

Indicate at each substructure, the 100-year and 200-year total scour depths in the Hydraulics report, the non-granular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations: No scour was accounted for at the abutments per IDOT policy. The Thalweg elevation at the structure is 613.8. The maximum design scour depth (4.81 ft.) was caused by the Q200 flood. A 25% reduction (1.2 ft.) in the scour depth for cohesive soils was allowed for soft to stiff cohesive soils (Qu between 0.5 to 1.5 tsf). An adjusted scour depth of 3.6 ft. was used to determine the design scour elevations in the table below.

Event/Limit	Design Scour Elevations (ft.)				Item
	S. Abut	Pier 1	Pier 2	N. Abut.	
State	-	610.2	610.2	-	113
Q100	-	610.2	610.2	-	8
Q200	-	610.2	610.2	-	
Design	622.93	610.2	610.2	623.03	
Check	622.93	610.2	610.2	623.03	

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if that the soils are liquefiable: This site has a soil site class of "C", the seismic performance zone, SPZ = 1. The SDS = 0.127 g and the SD1 = 0.076 g. Because the SD1 is less than 0.15 g, a liquefaction analysis is NOT required.

Confirm feasibility of the proposed foundation or wall type and provide design parameters. Attach a pile design table indicating feasible pile types, various nominal required bearings, factored resistances available and corresponding estimated lengths at locations where piles will be used. Provide factored bearing resistance and unit sliding resistance at various elevations and confirm no ground improvement/treatment is necessary where spread footings are proposed. Estimated top of rock elevations as well as preliminary factored unit side and tip resistance values shall be indicated when drilled shafts are proposed: Data from two October 2016 borings, Boring #1: SE Quad: S Abut and Boring #2: NW Quad: N Abut were used to populate the data fields in the Estimated Pile Length spreadsheets. These 2 borings satisfactorily represent soil layers at the proposed substructure locations.

We recommend the use of metal shell piles with a wall thickness of 0.312 Inches or greater driven to bearing. Boring #1 shows a layer with high unconfined compressive strengths between the elevations of 595 and 586. Although the soils ranged from very stiff to hard, blow counts were less than 14. MS 14 w/ 0.312 walls or larger metal shell piling should be used; care should be taken to not damage them while driving. Metal shoes are recommended. Pile length spreadsheets for all the applicable sizes and wall thicknesses of metal shell piles are included in the appendix. The calculated settlement is negligible, therefore, down drag was not used in the analysis. Also, the site is in a SPZ 1, therefore, liquefaction was not considered. Two test piles are recommended, one should be driven at an abutment and the other at the pier farthest from the abutment.

Integral Abutments – The updated draft version of the Integral Abutment Spreadsheet was used for this analysis. We used the information from Boring 01 (N.E. Quad.) and Boring 02 (S.W. Quad.) to populate the fields in the integral abutment worksheet. The results show the abutment soils would allow the required movement for integral abutments and no remediation is required.

Assumptions used for the pile length analysis include:

- Bottom of North and South Abutment Elevation = 623.03 ft. and 622.93 ft. (respectively)
- The factored loading for the Abutments is 540 kips and 1250 kips for the pier.
- The bottom of the Pier footing is 610.20
- The pile cutoff elevation allows for a 2 ft. embedment into concrete for the abutments, 1 ft. for the pier.
- A 25% geotechnical reduction (1.2 ft.) in the scour depth of 4.8 ft. is allowed. Therefore the bottom elevation of the encasement can be raised to an elevation of 610.20 ft.
- No other geotechnical losses were accounted for in the analysis.

PILE LENGTH/RESISTANCE TABLES USING SOIL DATA for Abutments and Piers

South Abutment, Using Boring #1: SE Quad			South Pier, Using Boring #1: SE Quad		
Nominal Required Bearing (KIPS)	Factored Resistance Available (KIPS)	Estimated Pile Length (Ft.)	Nominal Required Bearing (KIPS)	Factored Resistance Available (KIPS)	Estimated Pile Length (Ft.)
MS 14 with 0.312" wall			MS 14 with 0.312" wall		
91	50	15	209	115	35
113	62	20	202	111	40
144	79	25	231	127	45
216	119	30	250	137	50
262	144	38	281	155	55
570	313	58	570	313	58
MS 16 with 0.312" wall			MS 16 with 0.312" wall		
107	59	15	176	97	30
131	72	20	249	137	35
167	92	25	233	128	40
256	141	30	267	147	45
328	181	35	288	158	50
654	360	58	654	360	58
MS 16 with 0.375" wall			MS 16 with 0.375" wall		
107	59	15	176	97	30
131	72	20	249	137	35
167	92	25	233	128	40
256	141	30	267	147	45
328	181	35	288	158	50
782	430	58	782	430	58
North Pier, Using Boring #2: NW Quad			North Abutment, Using Boring #2: NW Quad		
MS 14 with 0.312" wall			MS 14 with 0.312" wall		
166	91	38	80	44	15
172	95	40	98	54	21
204	112	45	127	70	26
229	126	50	202	111	33
257	141	55	230	126	39
570	313	58	570	313	58
MS 16 with 0.312" wall			MS 16 with 0.312" wall		
194	107	38	94	52	15
199	109	40	114	62	21
237	130	45	147	81	26
265	145	50	238	131	33
296	163	55	265	146	39
654	360	58	654	360	58
MS 16 with 0.375" wall			MS 16 with 0.375" wall		
194	107	38	94	52	15
199	109	40	114	62	21
237	130	45	147	81	26
265	145	50	238	131	33
296	163	55	265	146	39
782	430	60	782	430	58

Estimated Lateral Load Soil Parameters

Soil Type	Angle of Internal Friction (degrees)	Average Undrained Cohesion (ksf)	Static Soil Modulus k (pci)	Soil Strain Parameter E50	Total Unit Wt. (pcf)	Effective Unit Wt. (pcf)
Loose loamy sand	28	-	25	-	100	37.6
Very Stiff Silty Clay	-	2.1	1000	0.005	125	62.6
Stiff Clay and Silty Clay	-	1.5	500	0.007	120	57.6
Hard gray Silty Clay and Sandy Loam Till	-	4.3	2000	0.004	130	67.6

See attached Pile Length Estimating Spreadsheets, 2016 Boring logs, selected 1955 as-built plan sheets, loading documentation, and integral abutment spreadsheet.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: The E.W.S.E. is 618.04, the bottom of encasement is 610.2, therefore type 2 cofferdams are required. The soils are not permeable and seal coat should not be required.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: At this time we anticipate the structure to be built under staged construction conditions, therefore, Temporary Sheet Piling will be required at the stage line. From the data shown in the boring logs the author does not anticipate any problems driving the sheets to the design depth. The substructures shall be removed as per Section 501 if the 2016 IDOT Standard Specifications for Road and Bridge Construction.

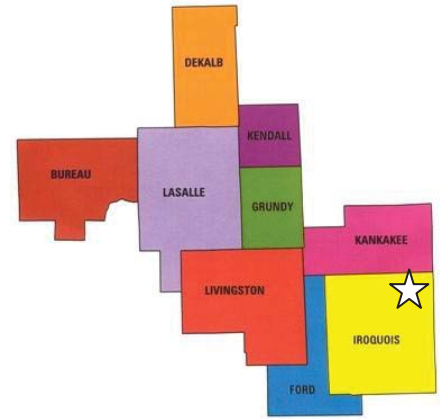
Prepared by: McCleary Engineering
 Author: Terrence L. McCleary, P.E.
 Email: terry@mcclearyengineering.com
 Phone: (815) 780-8486



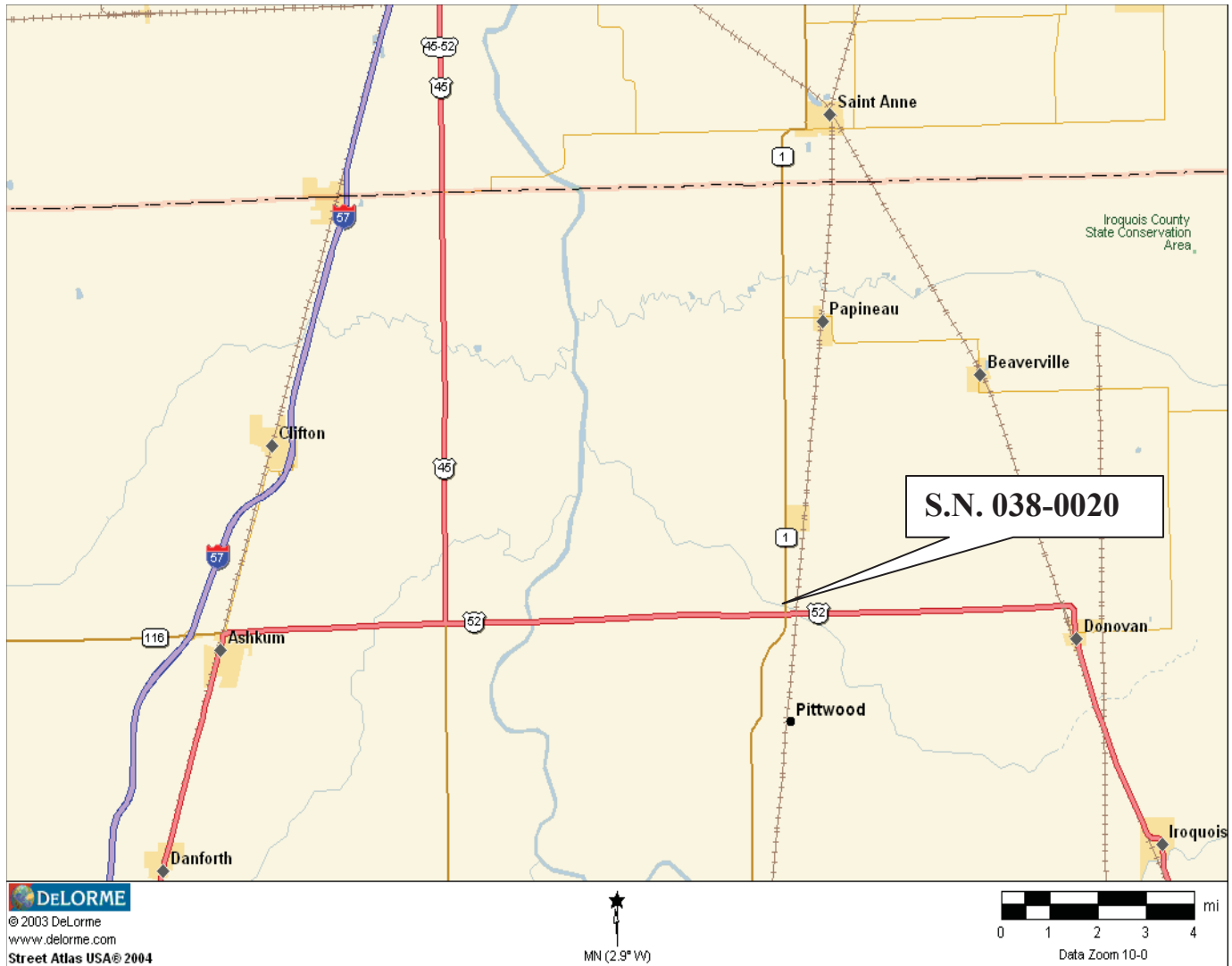
Terrence L. McCleary
 Illinois Professional Engineer
 License No. 062.050019 Exp. 11/2021

Project Location Map

FAP 332 (IL 1)
Section 4 BR
Iroquois County
Removal and replacement of S.N. 038-0020
carrying IL 1 over Pike Creek located 0.2
mi. north of U.S. 52
D3 No. 1134
P-93-044-00
Contract No. 66959



Project Area = ☆



Benchmarks: BM #1 - Railroad Spike in Power Pole, Sta. 267+39.37
82.04 Lt., Elev. 626.56

BM #3 - Chiseled "□" in N.E. Wing Wall, Sta. 273+62.00,
39.00 Rt., Elev. 626.55

Existing Structure: S.N. 038-0020 originally constructed in 1918, replaced in 1954 as a cast-in-place three-span slab bridge with gravity abutments and solid wall encased pile bent piers supported on concrete piles. Back-to-Back abutment length is 81'-2" and out-to-out width of deck is 34'-4". The wearing surface was replaced in 1970 and a new thrie beam bridge rail was installed in 1984. The bridge is to be fully replaced.

Stage construction will be utilized to maintain one signalized lane of traffic.

Salvage: None

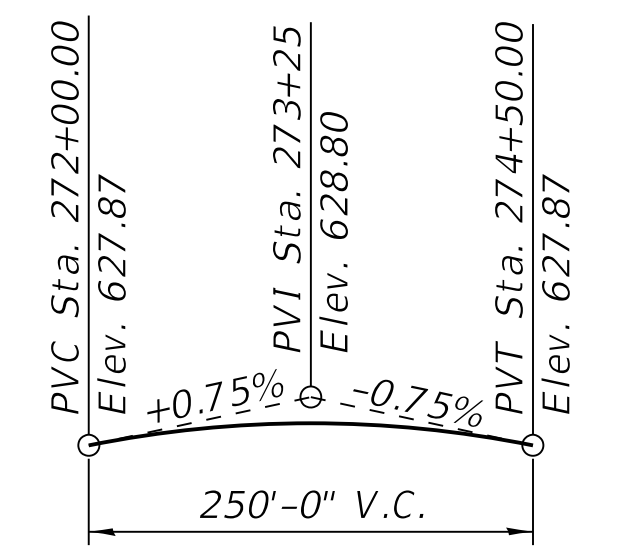
WATERWAY INFORMATION

Drainage Area = 21 sq. mi.		Low Grade Elev. 624.99 @ Sta. 281+50							
Flood	Freq. Yr.	Q	Opening Ft ²		Nat. H.W.E.	Head - Ft.		Headwater El.	
			Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
Design	10	1120	360	469	623.6	0.2	0.0	623.7	623.6
Ex. Overtopping	50	1750	436	547	624.6	0.3	0.1	624.9	624.7
Base/Scour Des.	65	1870	449	560	624.8	0.5	0.1	625.3	624.9
Scour Check	100	2030	457	588	625.1	0.5	0.2	625.6	625.4
Max. Calc.	200	2320	457	625	625.6	0.5	0.3	626.1	625.9
	500	2710	457	646	625.8	0.5	0.3	626.4	626.1

10-Yr. Velocity through Existing Structure = 3.2 fps
10-Yr. Velocity through Proposed Structure = 2.4 fps

DESIGN SCOUR ELEVATION TABLE

Event / Limit	Design Scour Elevations (ft.)					
	State	S. Abut.	Pier 1	Pier 2	N. Abut.	Item 113
Q100	-	610.20	610.20	-	-	8
Q200	-	610.20	610.20	-	-	
Design	622.93	610.20	610.20	623.03	-	
Check	622.93	610.20	610.20	623.03	-	



PROFILE GRADE
(Along \bar{C} Roadway)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.076 g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.127 g
Soil Site Class = C

DESIGN SPECIFICATIONS
2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

DESIGN STRESSES

FIELD UNITS
f'c = 3,500 psi
f'c = 4,000 psi (Superstructure)
fy = 60,000 psi (Reinforcement)

LOADING HL-93

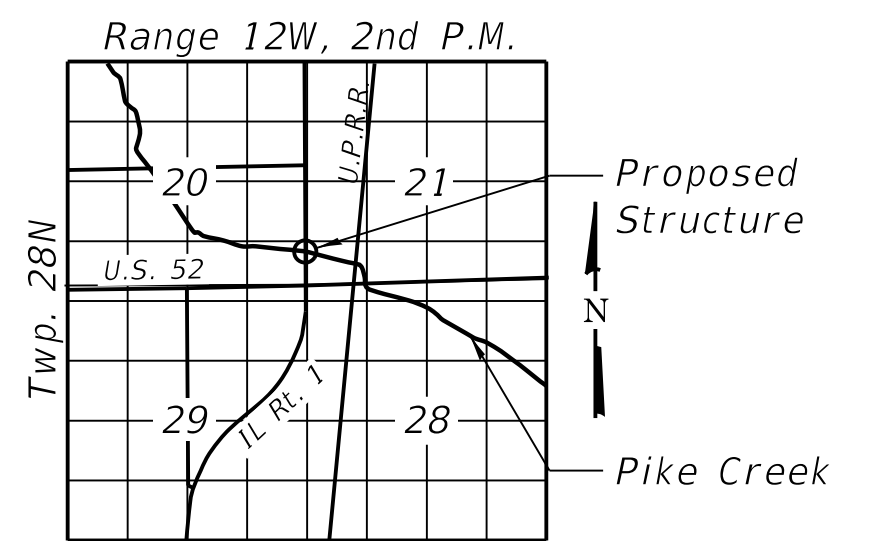
Allow 50#/sq. ft. for future wearing surface.

HIGHWAY CLASSIFICATION

F.A.P. Rte. 332 - TL Rte. 1
Functional Class: Other Principal Arterial
ADT: 2,450 (2017); 2,295 (2032)
ADTT: 270 (2017); 253 (2032)
DHV: 302
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic

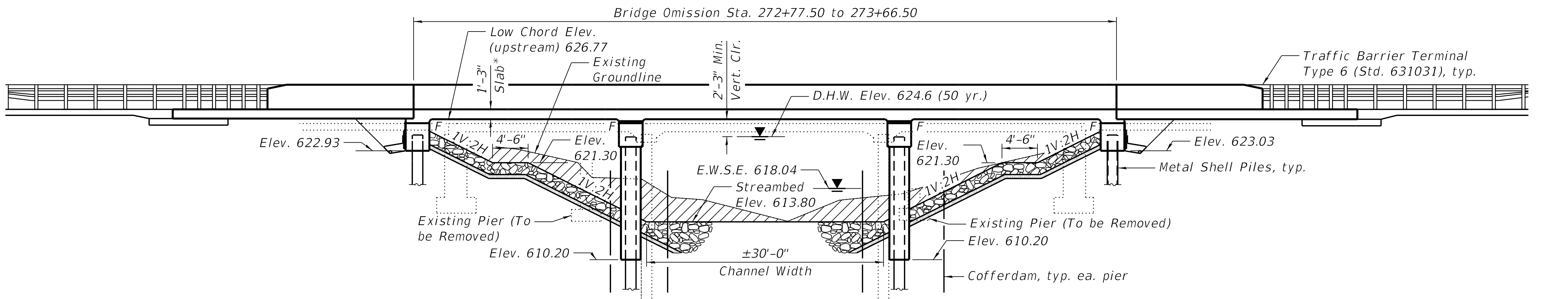
LEGEND

- Channel Excavation
- Soil Boring



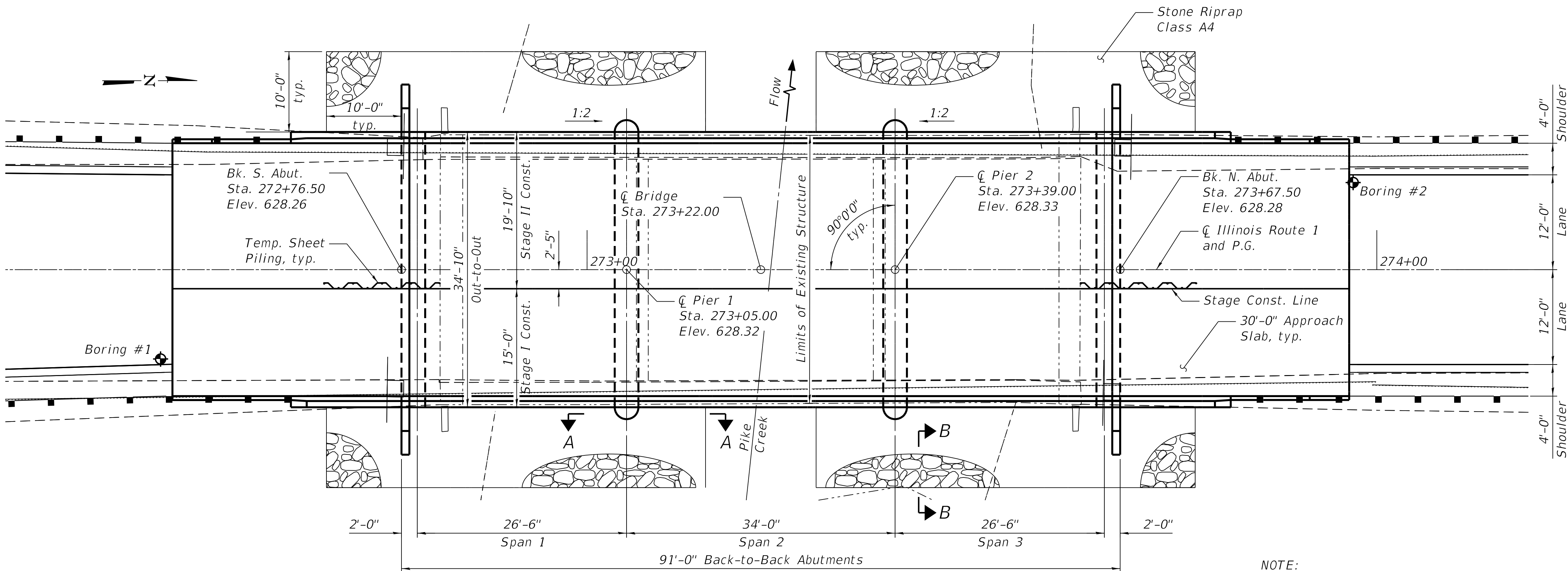
LOCATION SKETCH

GENERAL PLAN
ILLINOIS ROUTE 1 OVER PIKE CREEK
F.A.P. RTE. 332 - SEC. 4-BR
IROQUOIS COUNTY
STA. 273+22.00
STRUCTURE NO. 038-0226



ELEVATION

* Subject to refinement during the design phase



PLAN

NOTE:
1. See Sheet 2 for Sections A-A and B-B

MODEL: GPE
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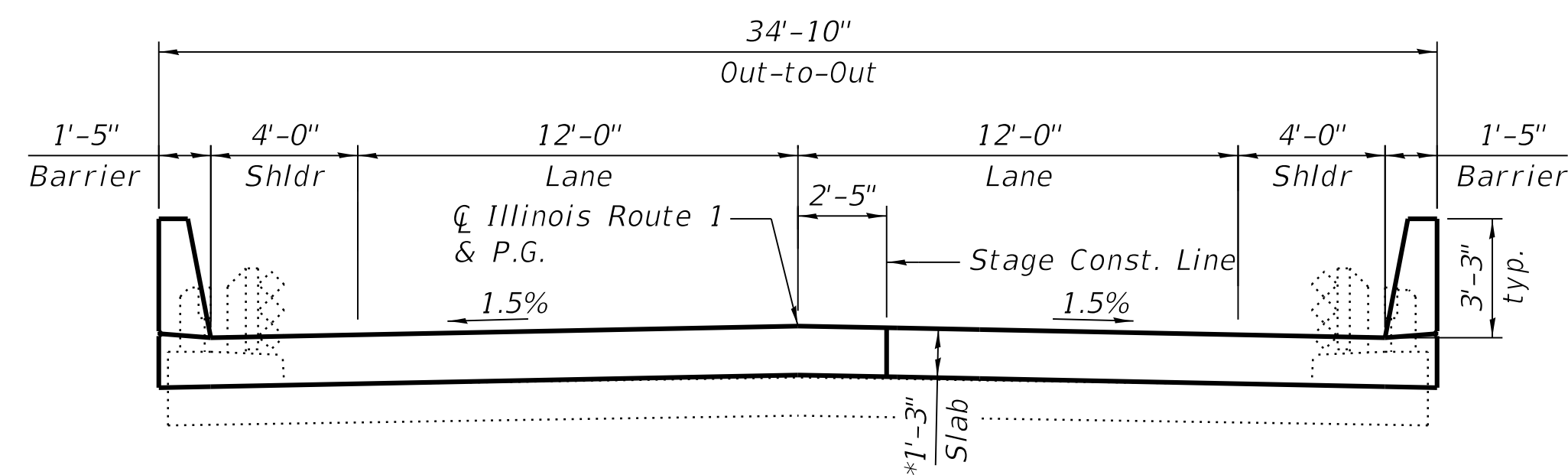
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CHECKED - JRM	REVISIONS -	
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PLOT DATE = 11/13/2019	CHECKED - JRM	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	4-BR	IROQUOIS	2	1
CONTRACT NO. 66959				

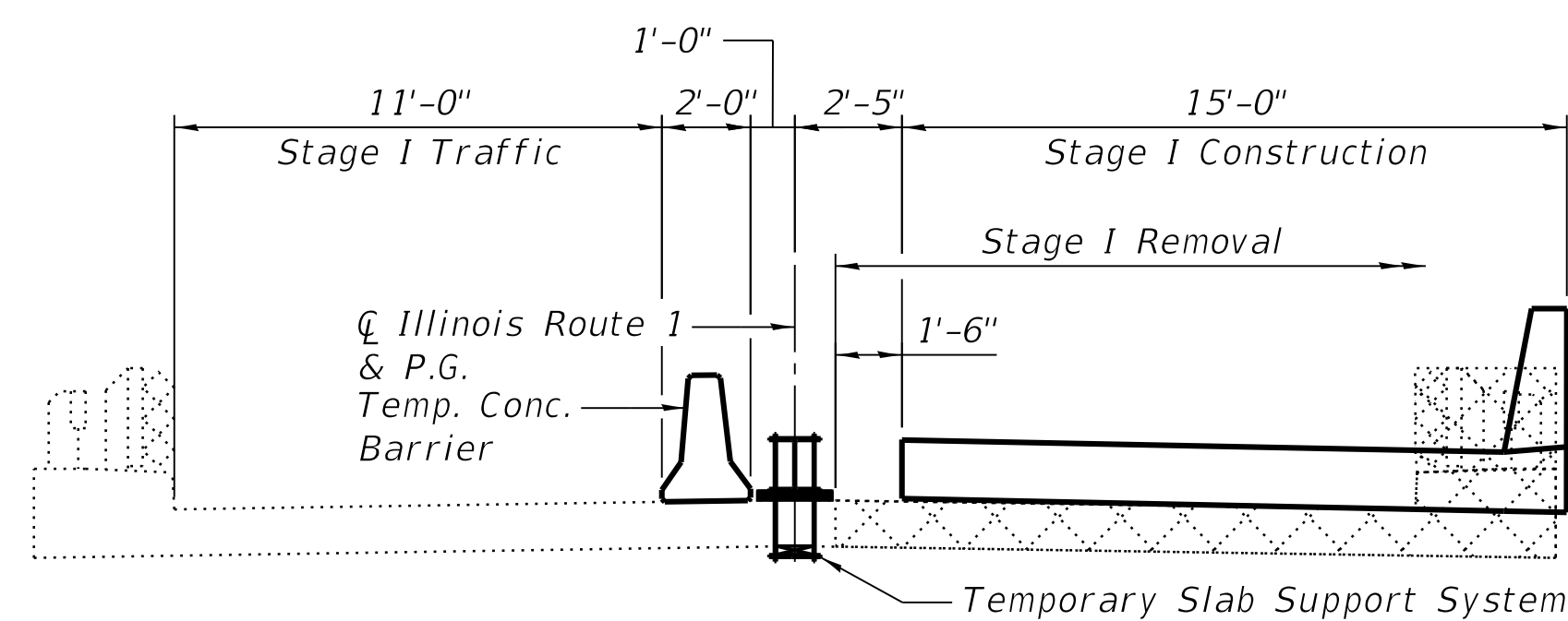
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CROSS SECTION

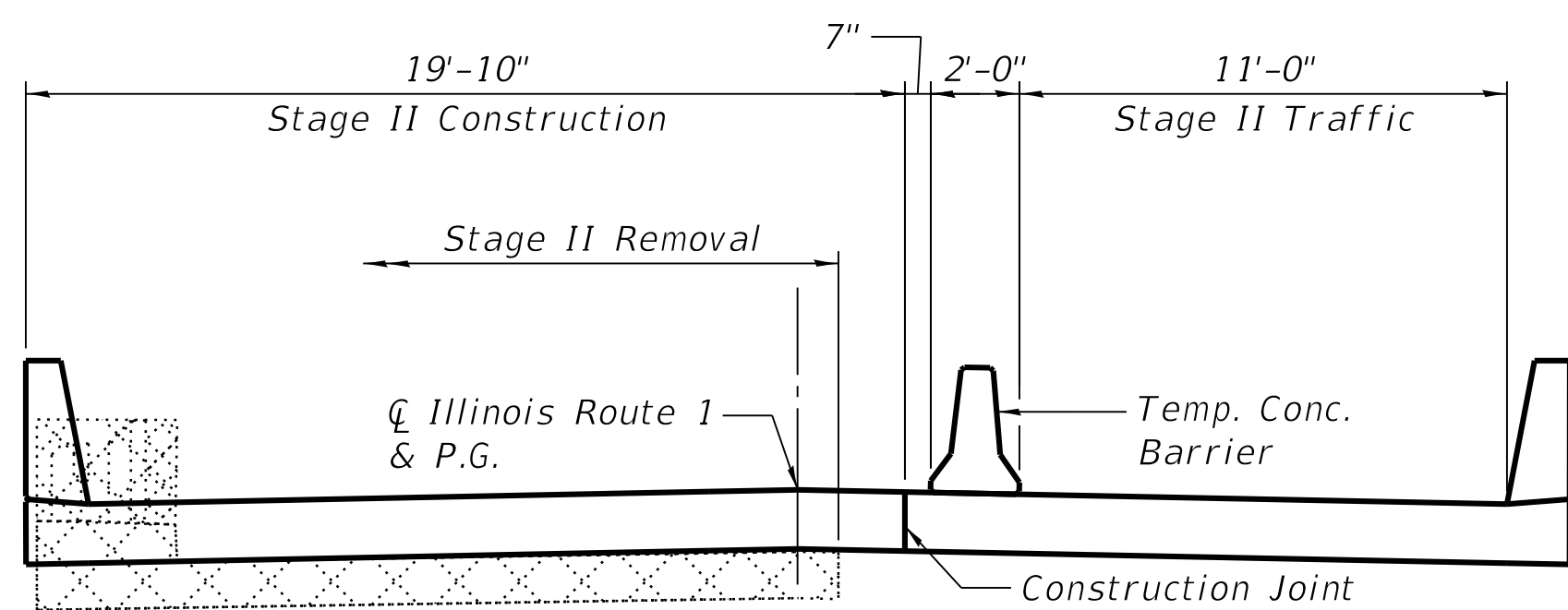
(Looking North)

*Subject to refinement during the design phase.



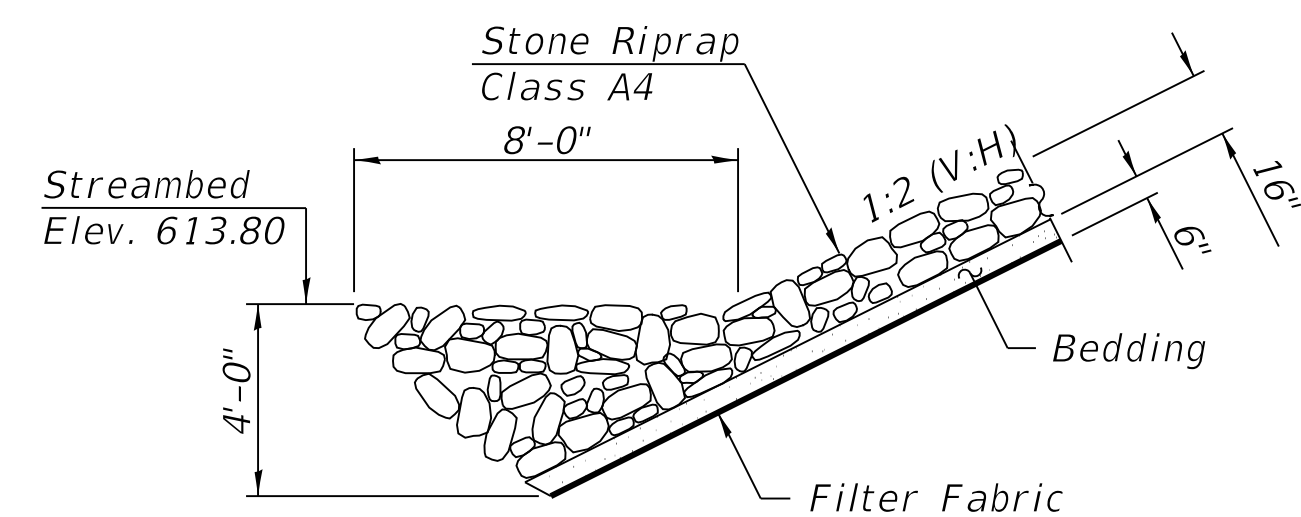
STAGE I CONSTRUCTION

(Looking North)

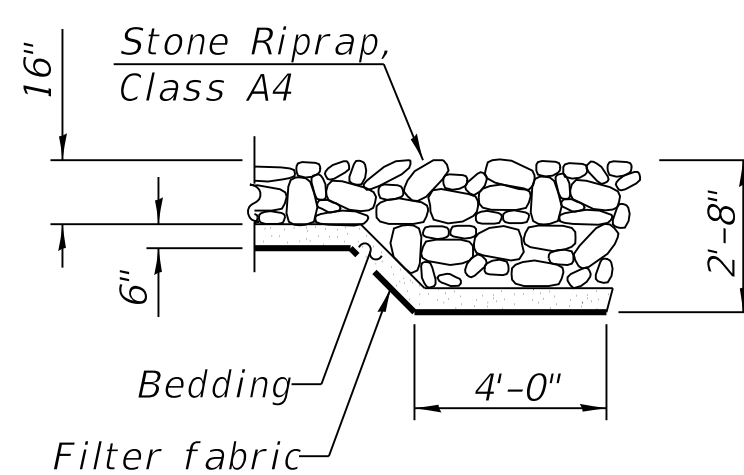


STAGE II CONSTRUCTION

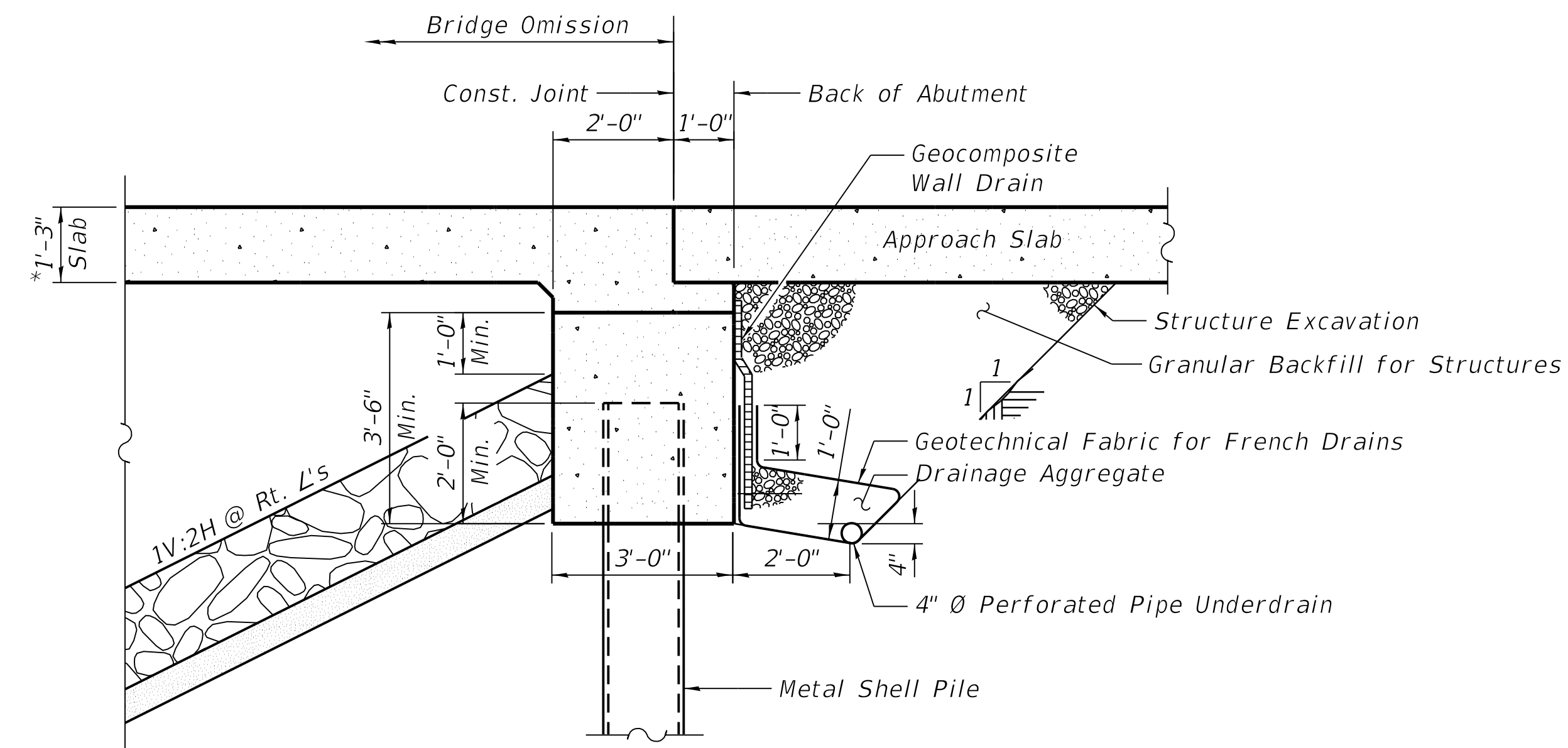
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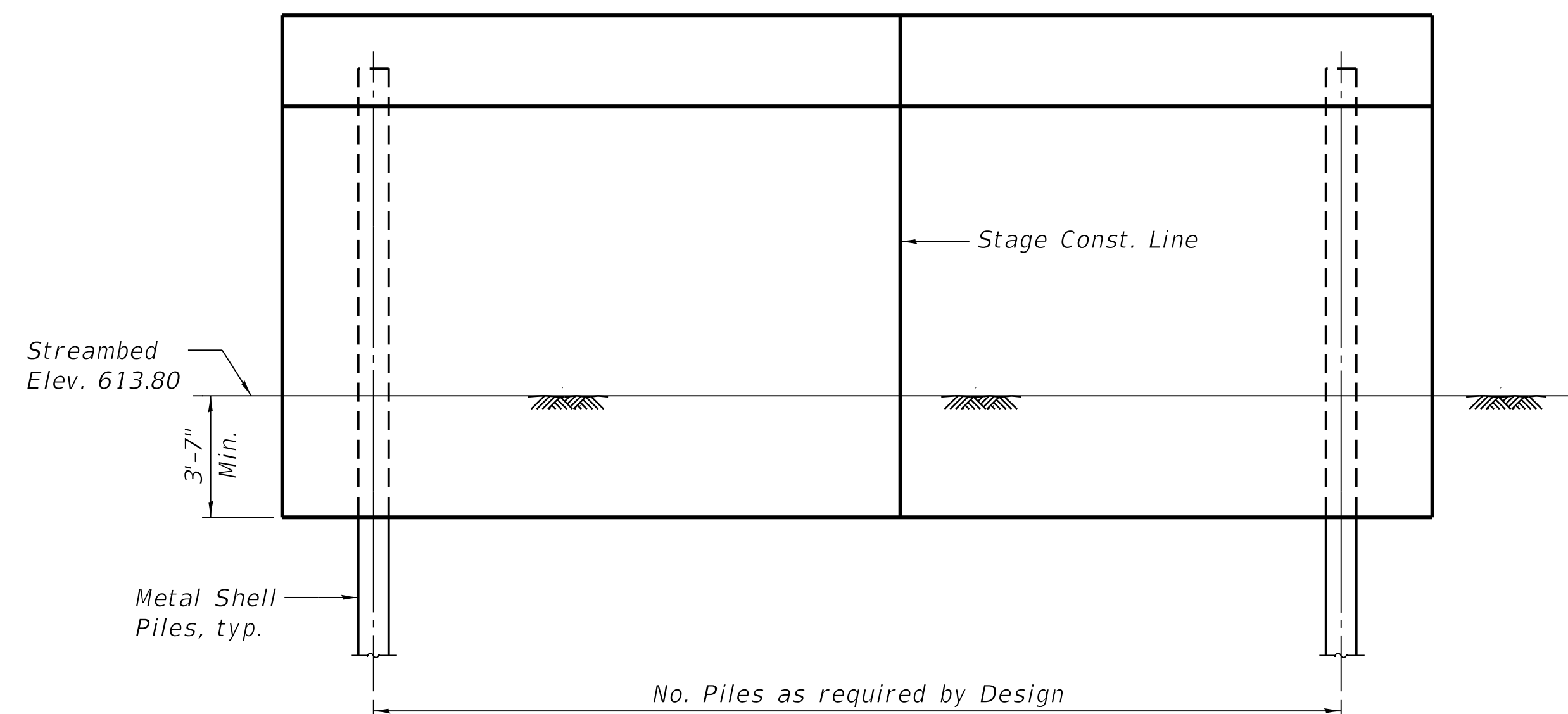
SECTION A-A



SECTION B-B



SECTION THRU ABUTMENT



PIER SKETCH

LEGEND

- Existing Structure Removal

DETAILS
 ILLINOIS ROUTE 1 OVER PIKE CREEK
 F.A.P. RTE. 332 - SEC. 4-BR
 IROQUOIS COUNTY
 STA. 273+22.00
 STRUCTURE NO. 038-0226



USER NAME = jmpattison	DESIGNED - JMP	REVISED - _____
PLOT SCALE = 0:1.000'"/in.	CHECKED - JRM	REVISED - _____
PLOT DATE = 11/11/2019	DRAWN - JMP	REVISED - _____
	CHECKED - JRM	REVISED - _____

**STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION**

SHEET 2 OF 2 SHEETS

F.A.P. RTE. 332	SECTION 4-BR	COUNTY IROQUOIS	TOTAL SHEETS 2	SHEET NO. 2
CONTRACT NO. 66959				
ILLINOIS FED. AID PROJECT				



SOIL BORING LOG

ROUTE SBI-1 (IL 1) DESCRIPTION IL 1 over Pike Creek LOGGED BY Larry Myers

SECTION 4-BR LOCATION SE 1/4, SEC. 20, TWP. 28N, RNG. 12W, 2nd PM

COUNTY Iroquois DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO.	DEPT H	BLOW S	UCS Qu	MOIST (%)	Surface Water Elev.	DEPT H	BLOW S	UCS Qu	MOIST (%)
Station	(ft)	(/6")	(tsf)	(%)	ft	(ft)	(/6")	(tsf)	(%)
038-0020					618.31				
273+22									
BORING NO. #1: SE Quad: S Abut					Groundwater Elev.:				
Station 272+46					First Encounter				
Offset 10.00ft Right					Upon Completion	604.6			
Ground Surface Elev. 628.63 ft					After _____ Hrs.				
Augered, bituminous pavement, white CA06					Stiff, gray, Clay with layers of gray, Silty Clay with thin Silt seams @ 30.5' (somewhat varved) (continued)	2	1.5	27.1	
626.63						3	B		
Loose, brown and black, very loamy, fine to coarse, Sand - fill (borderline loam)	5			12.4		wh			
	5					2	1.2	31.6	
	5					3	B		
	-5	2				wh			
	2			19.1		3	1.2	29.4	
	3					3	B		
621.63									
Loose to medium, brown gray, fine, Sand, Silt, Clay layers (alluvial)	2					wh			
	2	1.0		23.8		3	1.6	32.2	
	3	P				3	B		
619.63									
Very stiff, gray, Silty Clay									
	-10	2				2			
	3	2.1		23.0		2	1.6	35.0	
	5	B				3	B		
					597.13				
	3				Very stiff, dark gray, Silty Clay, Clay and Silt pockets- some small scale varved, Clay 1-2" thick	3			
	4	2.3		22.9		5	2.9	23.0	
	5	B				7	S		
					594.63				
	-15	3			Hard, gray, Silty Clay, Clay, Silt seams - varved, Clay layers	4			
	3	2.1		23.3		6	4.7	23.4	
	5	B				8	S		
612.13									
Stiff, gray, Clay with layers of gray, Silty Clay with thin Silt seams @ 30.5' (somewhat varved)	1					5			
	3	1.7		26.2		6	4.0	24.7	
	5	S				7	S		
					589.63				
	-20	1			Stiff, gray, Clay with minor, Silt ribbons	4			

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 SBI-1 (IL 1) DESCRIPTION IL 1 over Pike Creek LOGGED BY Larry Myers

SECTION 4-BR LOCATION SE 1/4, SEC. 20, TWP. 28N, RNG. 12W, 2nd PM

COUNTY Iroquois DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 038-0020
 Station 273+22
 BORING NO. #1: SE Quad: S Abut
 Station 272+46
 Offset 10.00ft Right
 Ground Surface Elev. 628.63 ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
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Surface Water Elev. 618.31 ft
 Stream Bed Elev. _____ ft
 Groundwater Elev.:
 First Encounter _____ ft
 Upon Completion 604.6 ft ∇
 After _____ Hrs. _____ ft

D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
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Stiff, gray, Clay with minor, Silt ribbons (continued)	6	5.2	21.7	Stiff, gray, Clay to Silty Clay Till	2	1.8	23.6	
	8	S			4	B		
	2				3			
	3	1.2	36.8		4	1.8	26.7	
	3	B			4	B		
	wh				3			
	-45				-65	3		
	2	1.1	36.3		5	2.0	13.6	
	3	S			90	B		
					562.63			
Stiff, grayish brown to gray Clay	1			Hard, gray, Sandy Clay Loam Till (brittle)	18			
	2	1.2	35.7		29	7.6	8.6	
	3	S			50	S		
	579.63							
	1				55			
	-50				-70	100/5"	>4.5	6.4
	3	1.6	27.0			P		
	1							
2	1.0	42.3						
2	B							
wh				70				
-55			-75	80	>4.5	5.4		
2	1.1	37.9		50	P			
3	B							
wh								
2	1.3	29.8						
3	B							
569.63								
-60	1			-80	60			

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



SOIL BORING LOG

ROUTE SBI-1 (IL 1) DESCRIPTION IL 1 over Pike Creek LOGGED BY Larry Myers

SECTION 4-BR LOCATION SE 1/4, SEC. 20, TWP. 28N, RNG. 12W, 2nd PM

COUNTY Iroquois DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

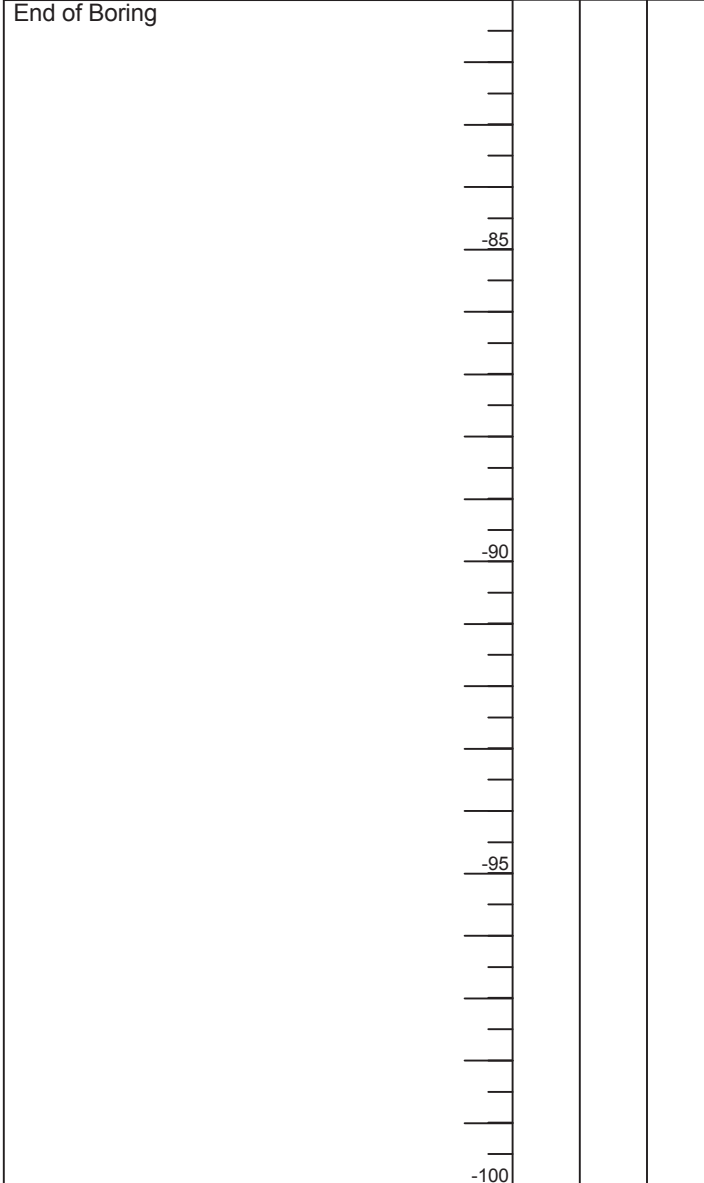
STRUCT. NO. 038-0020
 Station 273+22

BORING NO. #1: SE Quad: S Abut
 Station 272+46
 Offset 10.00ft Right
 Ground Surface Elev. 628.63 ft

DEPTH H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev. 618.31 ft
 Stream Bed Elev. _____ ft
 Groundwater Elev.:
 First Encounter _____ ft
 Upon Completion 604.6 ft ▽
 After _____ Hrs. _____ ft

Hard, gray, Sandy Clay Loam Till (brittle) (continued)	90	>4.5	7.1
547.63	100/3"	P	



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



SOIL BORING LOG

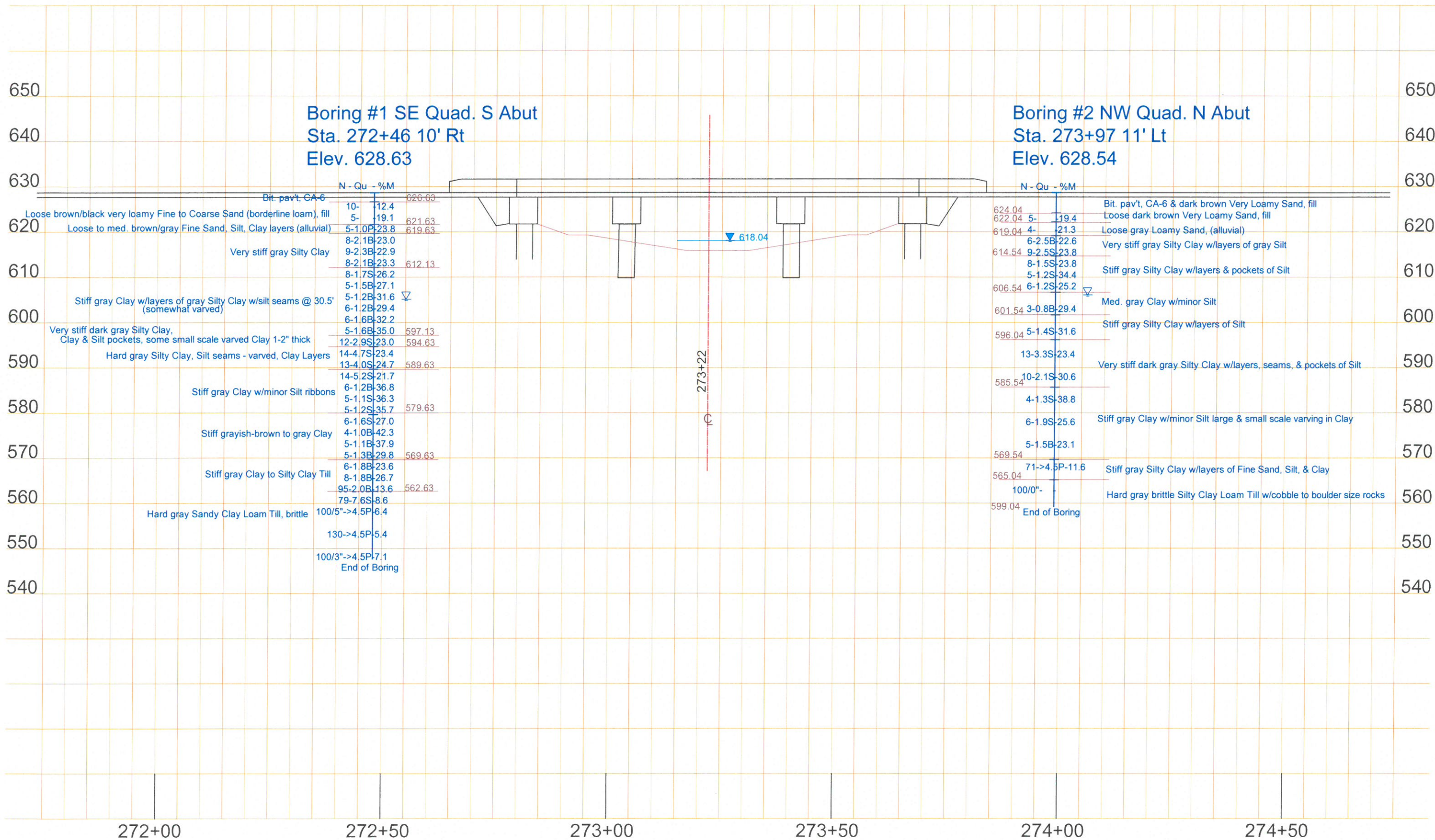
ROUTE SBI-1 (IL 1) DESCRIPTION IL 1 over Pike Creek LOGGED BY Larry Myers

SECTION 4-BR LOCATION SE 1/4, SEC. 20, TWP. 28N, RNG. 12W, 2nd PM

COUNTY Iroquois DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO.	Station	BORING NO.	Station	Offset	Ground Surface Elev.	D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)	Surface Water Elev.	Stream Bed Elev.	D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
038-0020	273+22	#2: NW Quad: N Abut	273+97	11.00ft Left	628.54					618.31					
Augered bituminous pavement, white CA06, dark brown, very loamy, Sand- fill															
											606.54				
624.04															
Loose, dark brown, very loamy, Sand- fill						-5	4		19.4			-25	wh		
							2						1	0.8	29.4
							3						2	B	
622.04															
Loose, gray, loamy, Sand- (alluvial)							3								
							2		21.3						
							2								
619.04															
Very stiff, gray, Silty Clay with layers of gray, Silt						-10	1					-30	1		
							2	2.5	22.6				2	1.4	31.6
							4	B					3	S	
							2								
							3	2.5	23.8						
							6	S							
614.54															
Stiff, gray, Silty Clay with layers and pockets of Silt						-15	1					-35	4		
							3	1.5	23.8				6	3.3	23.4
							5	S					7	S	
							1								
							2	1.2	34.4						
							3	S							
							1								
							2								
							3								
							1						4		
						-20						-40			

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



Boring #1 SE Quad. S Abut
Sta. 272+46 10' Rt
Elev. 628.63

Boring #2 NW Quad. N Abut
Sta. 273+97 11' Lt
Elev. 628.54

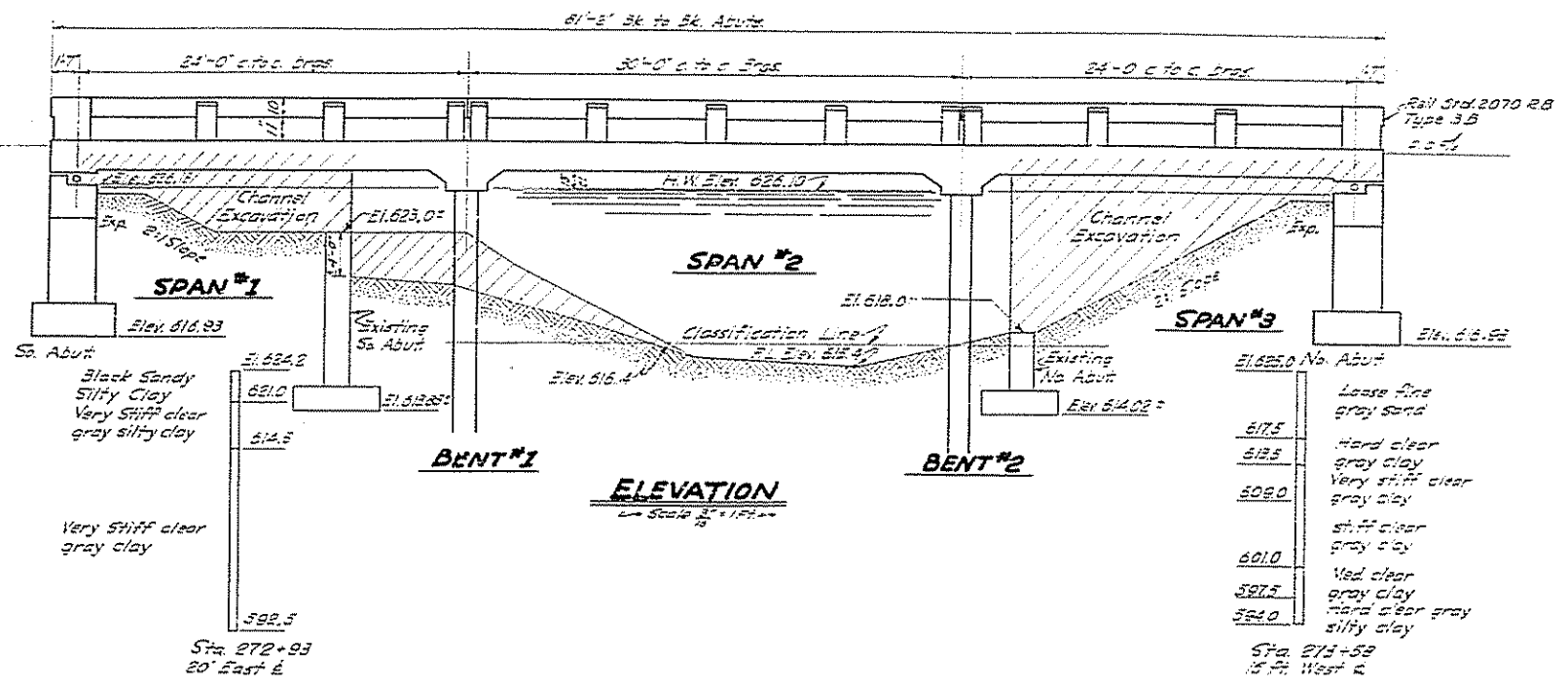
273+22

618.04

B.M. Top N.W. Wing Existing Bridge Elev 629.02
Existing Structure: 40' R.C. thru Girder and portions of R.C. closed Abutments to be removed by Bridge Contractor.

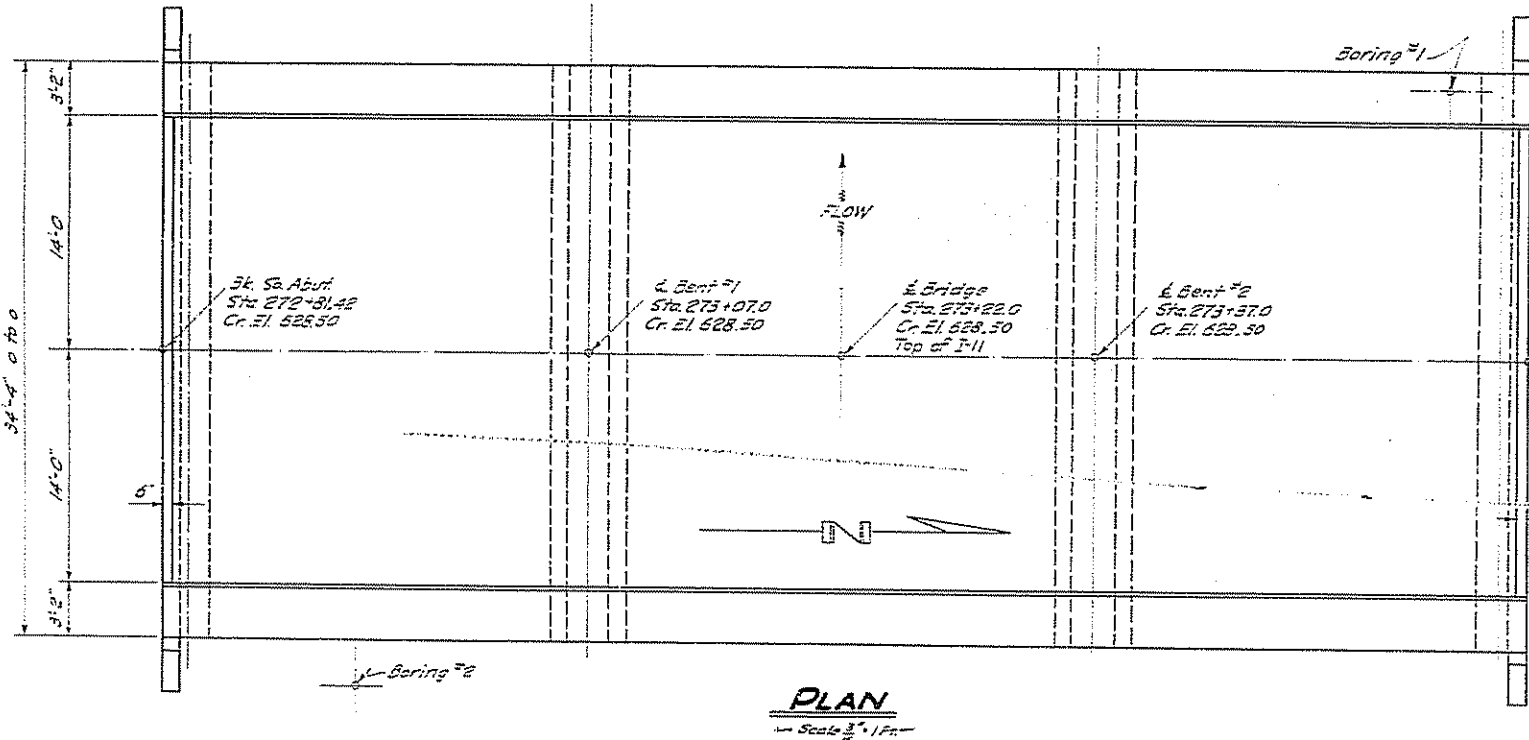
STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF HIGHWAYS

DATE	REVISION	BY	NO.



GENERAL NOTES

Class X Concrete shall be used throughout except as noted. Handrail Concrete shall be used in Falls & Piers. The concrete floor slab shall be finished in accordance with the provisions of Article 500 and the Sp. 5000. All bearing plates, rollers, rockers, anchor bolts, and end plates shall be included for payment as Structural Steel and shall be set in accordance with Art. 5, Sec. 2550 of Structural Steel included in bill of material. Structural steel shall receive one shop coat of red lead paint and two field coats of aluminum paint. All reinforcement bars shall conform to A.S.T.M. designation A-305 and the bar number is the number of 3/8 inches in the nominal diameter. The boring data are given on the plans only as a guide to bidders in estimating the types of soil which may be encountered. One test pile shall be driven in a permanent pile location, before casting remainder of piles.



NOTE: All crown elevations are referred to top of 3-11 surface.

TOTAL BILL OF MATERIAL

Item	Units	Quantity	Cost	Total
Class X Concrete	Cu.Yds.	1,353	5.5	7,441.5
Handrail Concrete	Cu.Yds.	2.0	4.0	8.0
Reinforcement Bars	Lbs.	25,120	4.00	100,480.00
Structural Steel	Lbs.	6,590	3.30	21,753.00
Precast Concrete Piles (24")	Lin. Ft.	1	355	355
Name Plates	Sq.	1		
Bit. Concrete Surface Course (2")	Tons	21.0		21.0
Bit. Material - Prime Coat	Gal.	25		25
Channel Excavation	Cu.Yds.			236
Removal of existing Structure	Sq.			1
Test Piles	Sq.			1
Class "A" Excavation for Structure	Cu.Yds.			253

STATION 273+22
BUILT 195 BY
STATE OF ILLINOIS
S.B.I.R.T. 1 SEC. 4-BR
F.A. PROJECT F-2(23)
LOADING H20-S16

LETTERING FOR NAME PLATE
See Sta. 213

WATERWAY INFORMATION

Drainage Area 3,200 Acres
Character Level, Cultivated
Present Opening 315"
Req'd. Opening (2' Falber's + 02) 315"
Proposed Opening 457"

STRESSES

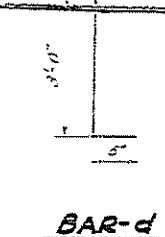
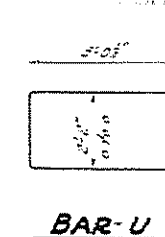
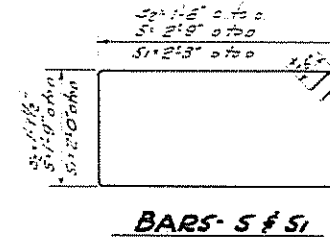
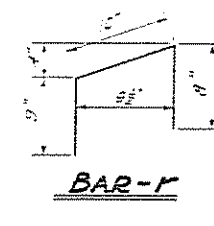
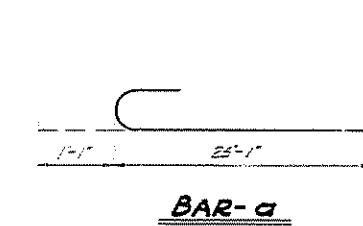
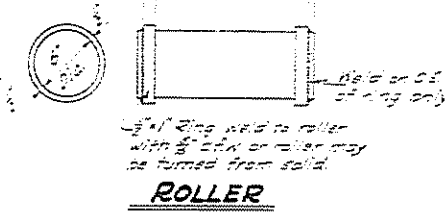
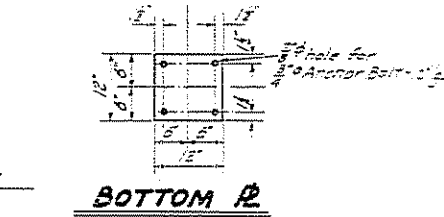
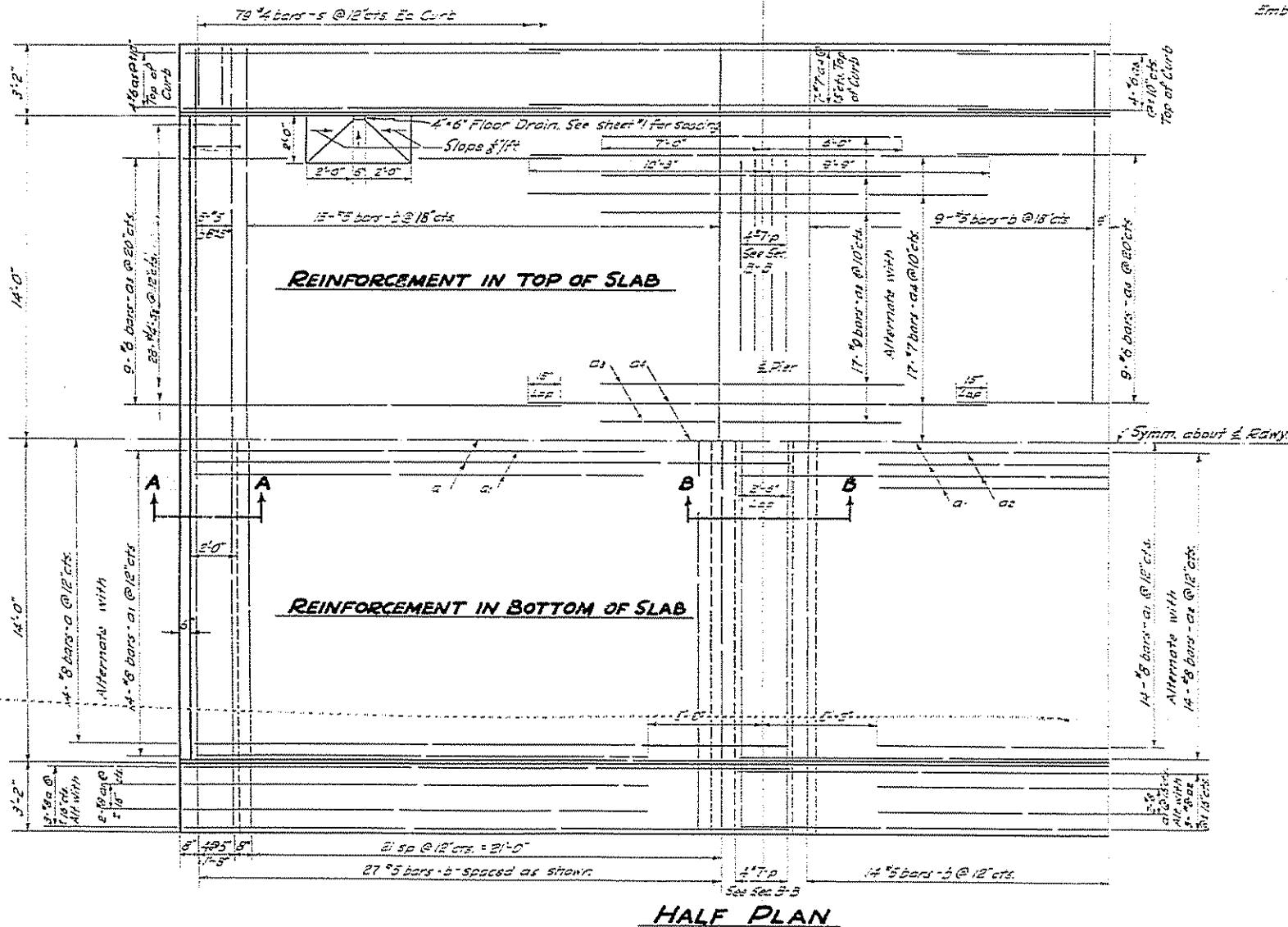
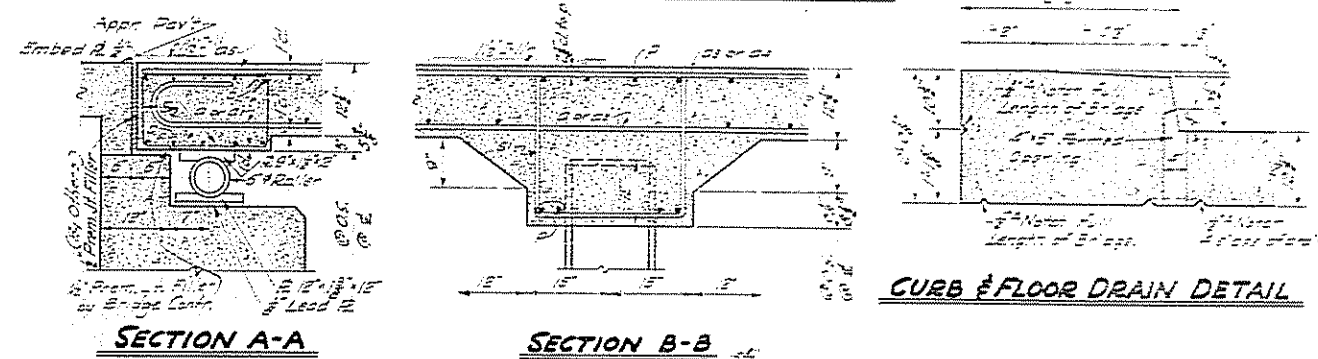
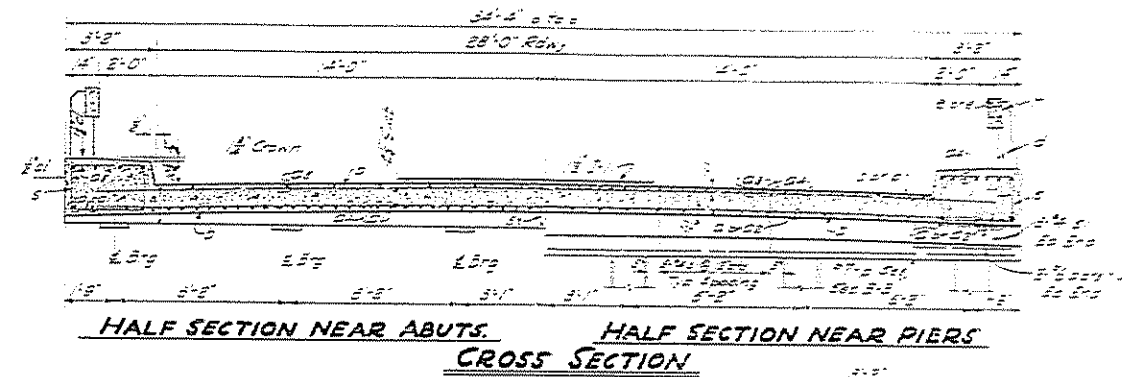
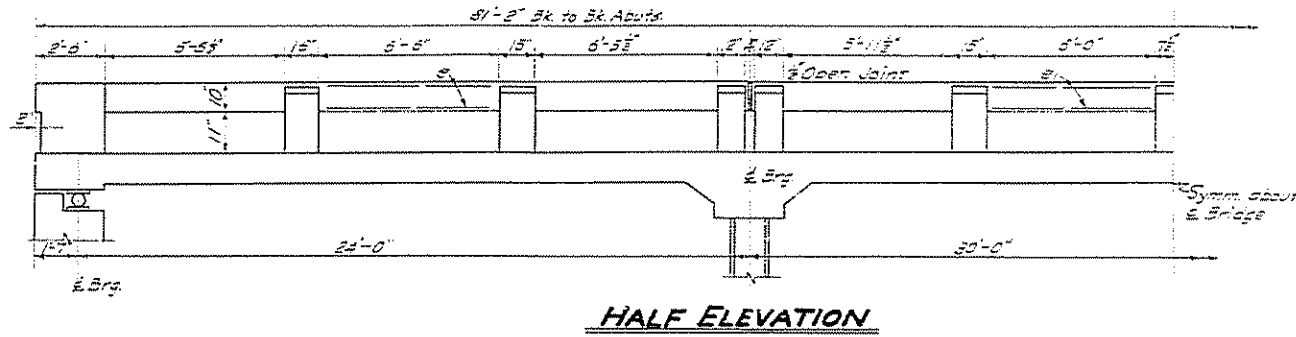
$f_s = 15,000 \text{ psi}$ struct
 $f_c = 20,000 \text{ psi}$ reinf
 $f_r = 1,400 \text{ psi}$ superst
 $f_t = 800 \text{ psi}$ subst
 $n = 10$
Loading H20 S-16-44

DESIGNED	Henry P. Schaefer	DATE	Nov 7 1952
DRAWN	W.E. Hanson	CHECKED	Amelita Orsini
APPROVED	R.M. Zinke		

PROJECT F-2(23)
GENERAL PLAN & ELEVATION
S.B.I.R.T. 1 SECTION 4-BR
IROQUOIS COUNTY
STA. 273+22

NO.	DATE	REVISION	BY	CHKD.
1		ISSUED FOR BIDDING		

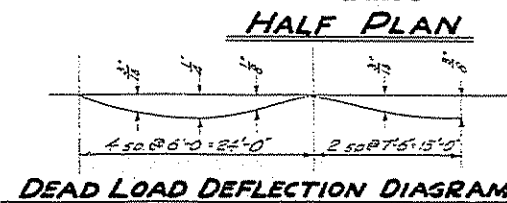
See Sp. 2070-25
Type 3B for details
of Handrails



BILL OF MATERIAL-SUPER

BAR	NO.	SIZE	LENGTH	SHAPE
a	66	#5	27'-0"	C
a1	35	#5	24'-0"	
a2	35	#5	22'-0"	
a3	66	#5	5'-0"	
a4	66	#5	20'-0"	
a5	35	#5	16'-0"	
a6	35	#5	9'-0"	
b	35	#5	22'-0"	
c	22	#5	3'-0"	
d	5	#5	24'-0"	
e	8	#5	22'-6"	
f	32	#4	2'-3"	F
g	5	#7	5'-0"	
h	125	#2	5'-0"	
i	25	#4	5'-0"	
j	8	#5	5'-0"	

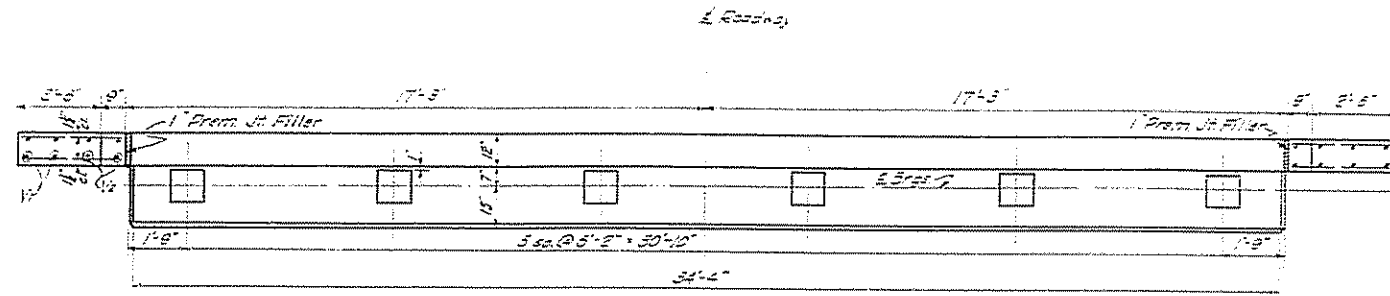
CLASS X CONCRETE CURB & RAIL
HANDRAIL CONCRETE CURB & RAIL
REINFORCEMENT BARS CURB & RAIL
STRUCTURAL STEEL CURB & RAIL
3" CONC. SURFACE CURB & RAIL
5" MATERIAL (DRIVE CURB) CURB & RAIL



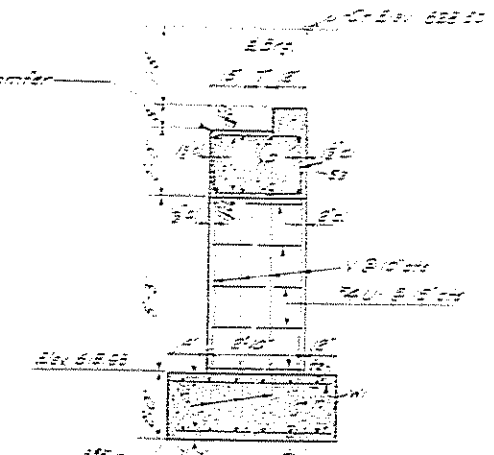
In addition to D.L. Deflection the contractor shall make allowance for shrinkage & settlement of falsework.

DESIGNED	Harry P. Gunkler	DATE	Nov. 7 1922
CHECKED	Amelia W. Gunkler	EXAMINED	J. E. Hartman
DRAWN	S. J. Gunkler	APPROVED	J. M. Gunkler

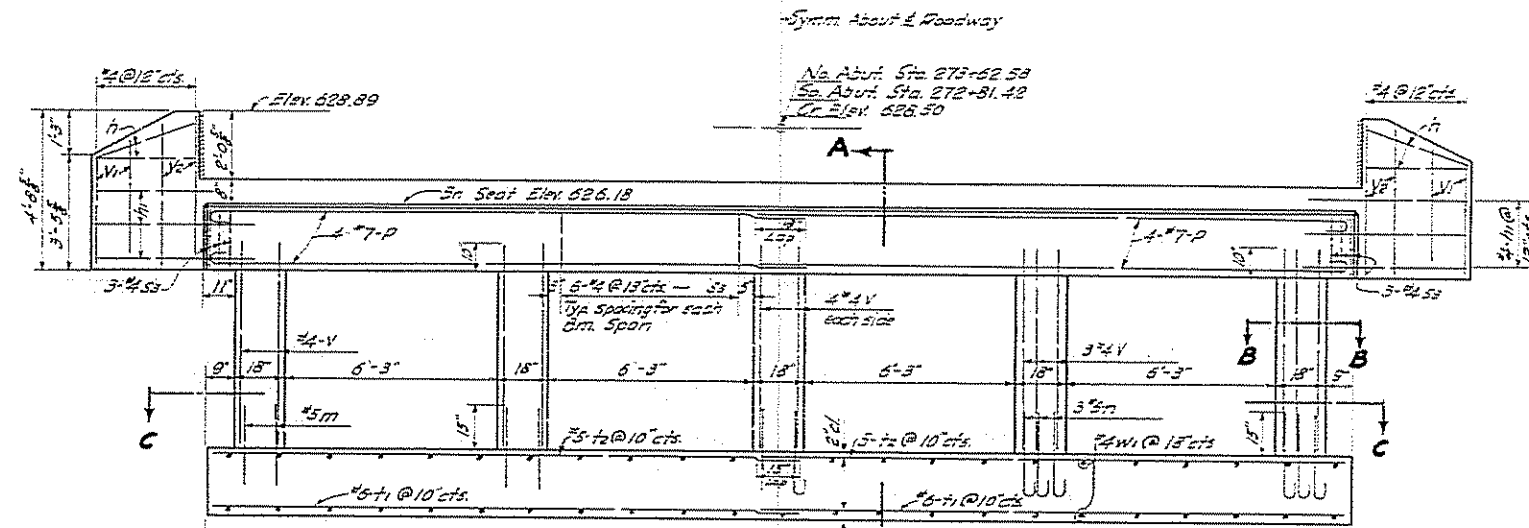
PROJECT	NO.	DATE	BY
IRROQUOIS COUNTY	12	1911	



ABUT. PLAN

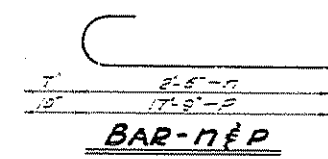


SECTION A-A

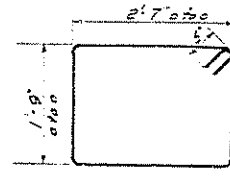


SHOWING REINF. IN FRONT FACE
SHOWING REINF. IN BACK FACE
ELEVATION

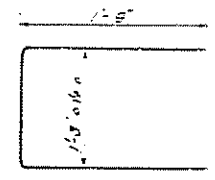
SECTION B-B



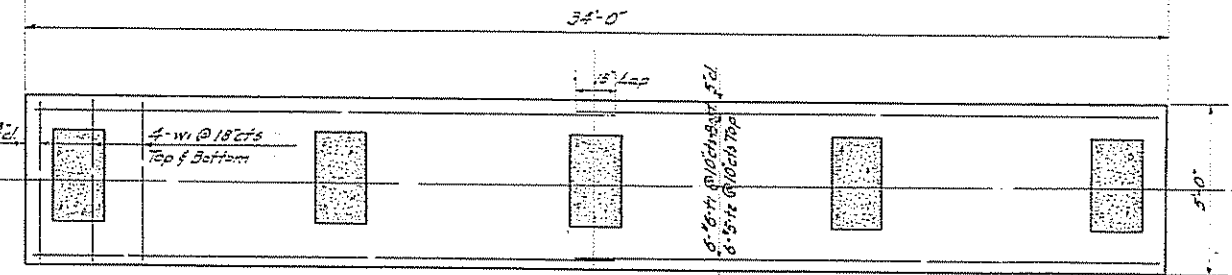
BAR-N&P



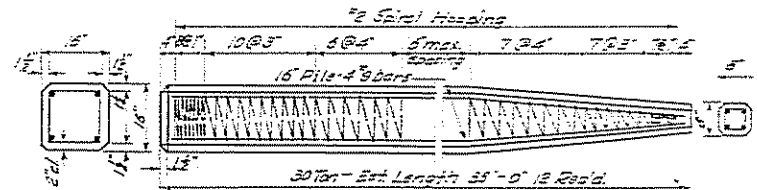
BAR-S3



BAR-U1



SECTION C-C



DETAIL OF PRECAST CONCRETE PILES

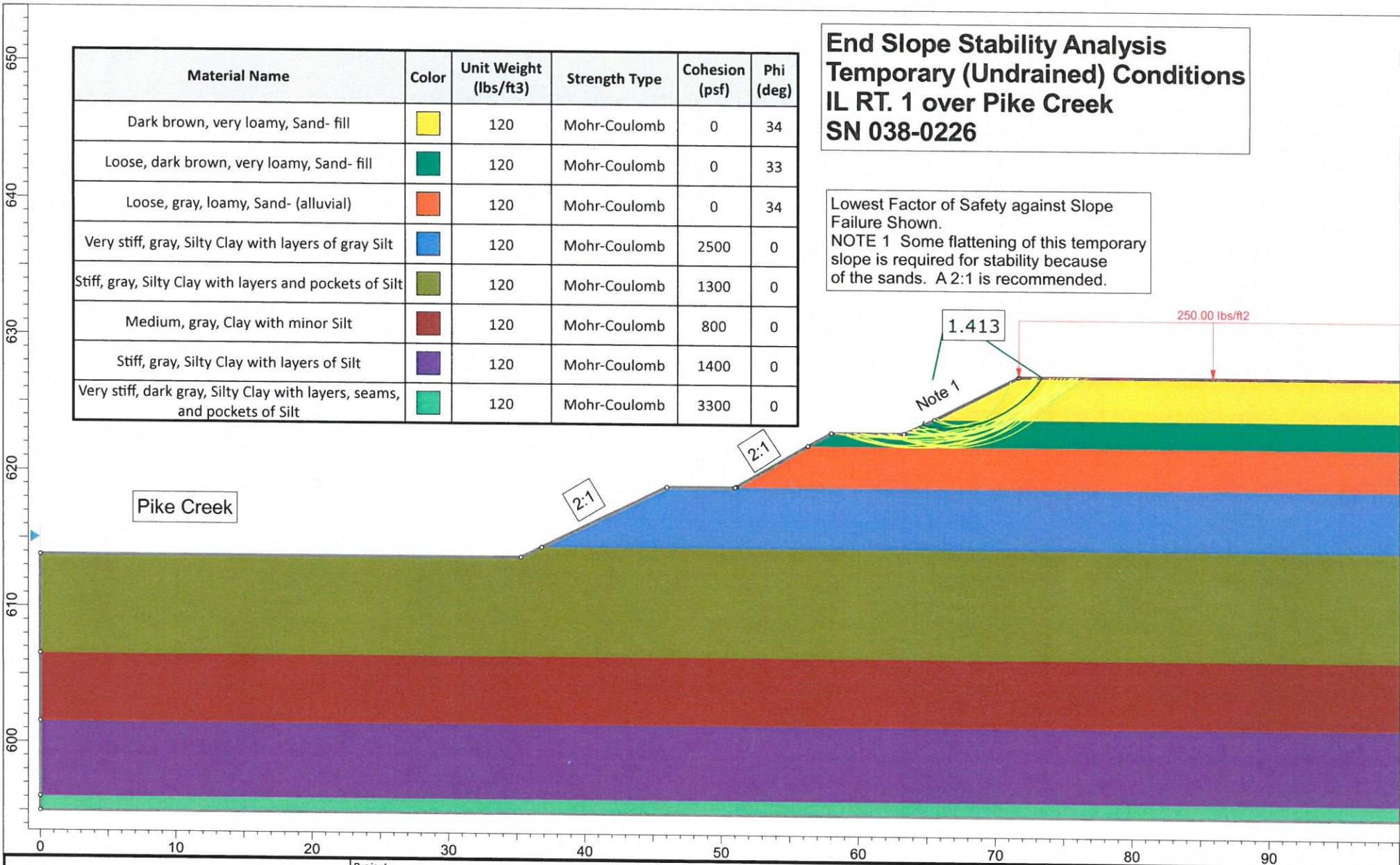
BILL OF MATERIAL-SUBSTR.

BAR	NO.	SIZE	LENGTH	GRADE
V	82	12	3'-0"	
W	12	12	3'-0"	
X	12	12	2'-5"	
Y	12	12	3'-0"	
Z	84	12	3'-5"	
AA	82	12	18'-0"	
AB	60	12	8'-5"	
AC	50	12	3'-0"	
AD	50	12	8'-5"	
AE	84	12	17'-5"	
AF	84	12	17'-5"	
AG	82	12	4'-5"	
AH	100	12	4'-5"	

Class X Concrete 515
 Reinforcement Bars 115 4-20
 Test Piles 200
 Precast Concrete Piles 150 11-25

DESIGNED: *Inhibition*
 CHECKED: *Harry P. Sullivan*
 DRAWN: *S.P.S.*
 APPROVED: *H.P.V.*
 EXAMINED: *W.E. Franzen*
 PASSED: *E.H. Franzen*
 APPROVED: *J.P. Parker*

SUBSTRUCTURE
S.B.I.R.1 SECTION 4-BR
IRROQUOIS COUNTY
STA. 273+22



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Dark brown, very loamy, Sand- fill	Yellow	120	Mohr-Coulomb	0	34
Loose, dark brown, very loamy, Sand- fill	Green	120	Mohr-Coulomb	0	33
Loose, gray, loamy, Sand- (alluvial)	Orange	120	Mohr-Coulomb	0	34
Very stiff, gray, Silty Clay with layers of gray Silt	Blue	120	Mohr-Coulomb	2500	0
Stiff, gray, Silty Clay with layers and pockets of Silt	Olive Green	120	Mohr-Coulomb	1300	0
Medium, gray, Clay with minor Silt	Red	120	Mohr-Coulomb	800	0
Stiff, gray, Silty Clay with layers of Silt	Purple	120	Mohr-Coulomb	1400	0
Very stiff, dark gray, Silty Clay with layers, seams, and pockets of Silt	Teal	120	Mohr-Coulomb	3300	0

**End Slope Stability Analysis
Temporary (Undrained) Conditions
IL RT. 1 over Pike Creek
SN 038-0226**

Lowest Factor of Safety against Slope Failure Shown.
NOTE 1 Some flattening of this temporary slope is required for stability because of the sands. A 2:1 is recommended.

1.413
Note 1
250.00 lbs/ft2

Pike Creek

2:1

2:1

	Project			IL 1 over Pike Creek (SN 038-0226) Slope Stability Analysis		
	Analysis Method			SLIDEINTERPRET 8.028 Bishop simplified		
	Drawn By	MEJ	Scale	1:117	Company	McCleary Engineering
	Date	10/10/2019		File Name	Pike Creek Temporary (Undrained) Conditions.slmd	
	SLIDEINTERPRET 8.028					

Final Scour Results - SN 038-0020

	Existing											
	50 yr			100 yr			200 yr			500 yr		
	LT	Channel	RT	LT	Channel	RT	LT	Channel	RT	LT	Channel	RT
Abutment	0		1.9	0		3.55	3.52		4.46	3.83		5.03
Pier		4.38			4.23			3.89			3.84	
Contraction	0	0	0	0	1.2	0.01	0	1.19	0.25	0	0.56	0.6
Pressure		2.52			4.51			4.91			4.66	
TOTAL Pier + Contraction*		6.90			8.74			8.80			8.50	
TOTAL Abut. + Contraction	0		1.9	0		3.56	3.52		4.71	3.83		5.63
D50 Used	0.2 mm Sand											

	Proposed											
	50 yr			100 yr			200 yr			500 yr		
	LT	Channel	RT	LT	Channel	RT	LT	Channel	RT	LT	Channel	RT
Abutment	0		0	0		0	0		0.59	1.25		1.67
Pier		4.8			4.8			4.8			4.8	
Contraction	0	0	0	0	0	0	0	0.01	0	0	0.01	0
Pressure		0			0			0			0	
TOTAL Pier + Contraction*		4.8			4.8			4.81			4.81	
TOTAL Abut. + Contraction	0		0	0		0	0		0.59	1.25		1.67
D50 Used	0.2 mm Sand											

*Pier scour used is greater of pier or pressure scour

Characteristic Soil D50 Sizes		
Sand	0.074 - 2.0	mm
Silt	0.002 - 0.074	mm
Clay	< 0.002	mm

Common D50 sizes			
RipRap	lbs	cube	mm
RR 1		1.5"	38
RR 2		2"	50
RR 3	10-12	4-5"	127
RR 4	40-50	7-8"	200
RR 5	90-170	10-12"	300
RR 6	300	15"	381
RR 7	400-1000	16-22"	457

1. Largest stone in mix no greater than 1.5 x D50
2. Thickness of layer 2.25 x D50

JSON Raw Data Headers

Save Copy Collapse All Expand All

Filter JSON

SEISMIC DETERMINATION

request:

date: "2019-10-04T17:06:20.344Z"
 referenceDocument: "AASHTO-2009"
 status: "success"
 url: "https://earthquake.usgs.gov/ws/designmaps/aashto-2009.json?Latitude=40.892&Longitude=-87.7318&siteClass=C&title=SN0380226proposed"

parameters:

latitude: 40.892
 longitude: -87.731

siteClass: "C"

title: "SN0380226proposed"

SN 038-0226 (PROP)

response:

data:

pga: 0.046

fpga: 1.2

as: 0.055

ss: 0.106

fa: 1.2

sds: 0.127

s1: 0.044

fv: 1.7

sd1: 0.076

sdc: "A"

ts: 0.594

t0: 0.119

sdSpectrum:

0:

0: 0

1: 0.055

1:

0: 0.025

1: 0.07

2:

0: 0.05

1: 0.085

3:

0: 0.1

1: 0.116

4:

0: 0.119

1: 0.127

5:

0: 0.15

1: 0.127

6:

0: 0.2

1: 0.127

7:

0: 0.25

1: 0.127

8:

0: 0.3

1: 0.127

9:

0: 0.35

1: 0.127

PROJECT TITLE=====IL 1 over Pike Creek SN 038-0226 (Prop)

Substructure 1

Base of Substruct. Elev. (or ground surf for bents) 622.93 ft.
 Pile or Shaft Dia. 12 inches
 Boring Number #1: SE Quad: S Abut
 Top of Boring Elev. 628.63 ft.
 Approximate Fixity Elev. 616.93 ft.

Individual Site Class Definition:
 N (bar): 13 (Blows/ft.) Soil Site Class E
 N₆₀ (bar): (Blows/ft.) NA
 s_v (bar): 2.46 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation (ft)	Sample Thick. (ft)	Layer Description		
			N	Qu	Boundary
	626.6	2.00			B
	624.1	2.50	10		
	621.6	2.50	5		B
	619.6	2.00	5	1.00	B
	617.1	2.50	8	2.10	
2.3	614.6	2.50	9	2.30	
4.8	612.1	2.50	8	2.10	B
7.3	609.6	2.50	8	1.70	
9.8	607.1	2.50	5	1.50	
12.3	604.6	2.50	5	1.20	
14.8	602.1	2.50	6	1.20	
17.3	599.6	2.50	6	1.60	
19.8	597.1	2.50	5	1.60	B
22.3	594.6	2.50	12	2.90	B
24.8	592.1	2.50	14	4.70	
27.3	589.6	2.50	13	4.00	B
29.8	587.1	2.50	14	5.20	
32.3	584.6	2.50	6	1.20	
34.8	582.1	2.50	5	1.10	
37.3	579.6	2.50	5	1.20	B
39.8	577.1	2.50	6	1.60	
42.3	574.6	2.50	4	1.00	
44.8	572.1	2.50	5	1.10	
47.3	569.6	2.50	5	1.30	B
49.8	567.1	2.50	6	1.80	
52.3	564.6	2.50	8	1.80	
54.3	562.6	2.00	95	2.00	B
56.8	560.1	2.50	79	7.60	
59.3	557.6	2.50	240	4.60	
61.8	555.1	2.50	240	4.60	
64.3	552.6	2.50	130	4.60	
66.8	550.1	2.50	130	4.60	
69.3	547.6	2.50	400	4.60	
100.0	516.9	30.70	220	4.60	

Substructure 2

Base of Substruct. Elev. (or ground surf for bents) 610.2 ft.
 Pile or Shaft Dia. 12 inches
 Boring Number #1: SE Quad: S Abut
 Top of Boring Elev. 628.63 ft.
 Approximate Fixity Elev. 604.2 ft.

Individual Site Class Definition:
 N (bar): 17 (Blows/ft.) Soil Site Class D
 N₆₀ (bar): (Blows/ft.) NA
 s_v (bar): 2.79 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation (ft)	Sample Thick. (ft)	Layer Description		
			N	Qu	Boundary
	626.6	2.00			B
	624.1	2.50	10		
	621.6	2.50	5		B
	619.6	2.00	5	1.00	B
	617.1	2.50	8	2.10	
	614.6	2.50	9	2.30	
	612.1	2.50	8	2.10	B
	609.6	2.50	8	1.70	
	607.1	2.50	5	1.50	
	604.6	2.50	5	1.20	
2.1	602.1	2.50	6	1.20	
4.7	599.6	2.58	6	1.60	
7.2	597.1	2.50	5	1.60	B
9.7	594.6	2.50	12	2.90	B
12.2	592.1	2.50	14	4.70	
14.7	589.6	2.50	13	4.00	B
17.2	587.1	2.50	14	5.20	
19.7	584.6	2.50	6	1.20	
22.2	582.1	2.50	5	1.10	
24.7	579.6	2.50	5	1.20	B
27.2	577.1	2.50	6	1.60	
29.7	574.6	2.50	4	1.00	
32.2	572.1	2.50	5	1.10	
34.7	569.6	2.50	5	1.30	B
37.2	567.1	2.50	6	1.80	
39.7	564.6	2.50	8	1.80	
41.7	562.6	2.00	95	2.00	B
44.2	560.1	2.50	79	7.60	
46.7	557.6	2.50	240	4.60	
49.2	555.1	2.50	240	4.60	
51.7	552.6	2.50	130	4.60	
54.2	550.1	2.50	130	4.60	
56.7	547.6	2.50	400	4.60	
100.0	504.3	43.30	220	4.60	

Substructure 3

Base of Substruct. Elev. (or ground surf for bents) 610.2 ft.
 Pile or Shaft Dia. 12 inches
 Boring Number #2: NW Quad: N Abut
 Top of Boring Elev. 628.54 ft.
 Approximate Fixity Elev. 604.2 ft.

Individual Site Class Definition:
 N (bar): 13 (Blows/ft.) Soil Site Class E
 N₆₀ (bar): (Blows/ft.) NA
 s_v (bar): 2.63 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation (ft)	Sample Thick. (ft)	Layer Description		
			N	Qu	Boundary
	626.0	2.50			
	624.0	2.00			B
	622.0	2.00	5		
	620.5	1.50	4		
	619.0	1.50	4		B
	616.5	2.50	6	2.50	
	614.5	2.00	9	2.50	B
	612.0	2.50	8	1.50	
	609.5	2.50	5	1.20	
	606.5	3.00	6	1.20	B
0.2	604.0	2.50	3	0.80	
2.7	601.5	2.50	3	0.80	B
5.2	599.0	2.50	5	1.40	
8.2	596.0	3.00	5	1.40	B
9.7	594.5	1.50	13	3.30	
12.2	592.0	2.50	13	3.30	
14.7	589.5	2.50	13	3.30	
17.2	587.0	2.50	10	2.10	
18.7	585.5	1.50	10	2.10	B
19.7	584.5	1.00	4	1.30	
22.2	582.0	2.50	4	1.30	
24.7	579.5	2.50	4	1.30	
27.2	577.0	2.50	6	1.90	
29.7	574.5	2.50	6	1.90	
32.2	572.0	2.50	5	1.30	
34.7	569.5	2.50	5	1.30	B
37.2	567.0	2.50	5	1.50	
39.2	565.0	2.00	5	1.50	B
41.7	562.5	2.50	71	4.80	
44.2	560.0	2.50	71	4.60	
45.2	559.0	1.00	71	4.60	
100.0	504.2	54.80	71	4.80	

Substructure 4

Base of Substruct. Elev. (or ground surf for bents) 623.03 ft.
 Pile or Shaft Dia. 12 inches
 Boring Number #2: NW Quad: N Abut
 Top of Boring Elev. 628.54 ft.
 Approximate Fixity Elev. 617.03 ft.

Individual Site Class Definition:
 N (bar): 10 (Blows/ft.) Soil Site Class E
 N₆₀ (bar): (Blows/ft.) NA
 s_v (bar): 2.2 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation (ft)	Sample Thick. (ft)	Layer Description		
			N	Qu	Boundary
	626.0	2.50			
	624.0	2.00			B
	622.0	2.00	5		
	620.5	1.50	4		
	619.0	1.50	4		B
0.5	616.5	2.50	6	2.50	
2.5	614.5	2.00	9	2.50	B
5.0	612.0	2.50	8	1.50	
7.5	609.5	2.50	5	1.20	
10.5	606.5	3.00	6	1.20	B
13.0	604.0	2.50	3	0.80	
15.5	601.5	2.50	3	0.80	B
18.0	599.0	2.50	5	1.40	
21.0	596.0	3.00	5	1.40	B
22.5	594.5	1.50	13	3.30	
25.0	592.0	2.50	13	3.30	
27.5	589.5	2.50	13	3.30	
30.0	587.0	2.50	10	2.10	
31.5	585.5	1.50	10	2.10	B
32.5	584.5	1.00	4	1.30	
35.0	582.0	2.50	4	1.30	
37.5	579.5	2.50	4	1.30	
40.0	577.0	2.50	6	1.90	
42.5	574.5	2.50	6	1.90	
45.0	572.0	2.50	5	1.30	
47.5	569.5	2.50	5	1.30	B
50.0	567.0	2.50	5	1.50	
52.0	565.0	2.00	5	1.50	B
54.5	562.5	2.50	71	4.80	
57.0	560.0	2.50	71	4.60	
58.0	559.0	1.00	71	4.60	
100.0	517.0	42.00	71	4.60	

Global Site Class Definition: Substructures 1 through 4

N (bar): 13 (Blows/ft.) Soil Site Class E
 N₆₀ (bar): (Blows/ft.) NA
 s_v (bar): 2.52 (ksf) Soil Site Class C <----Controls

GENERAL DATA

STRUCTURE NUMBER===== 038-0226
 STRUCTURE TYPE ===== MULTI-SPAN
 STRUCTURE SKEW===== 0 DEGREES
 SUPER. DATA IN REFERENCE TO SUB. DATA ===== ABUT 1

TOTAL STRUCTURE LENGTH===== 91.00 FT
 NUMBER OF SPANS ===== 3
 END SPAN LENGTH ===== 26.50 FT
 ADJACENT INTERIOR SPAN LENGTH ===== 34.00 FT

SUPERSTRUCTURE DATA (END OR MAIN SPAN)	
BEAM TYPE =====	SLAB BRIDGE
SLAB THICKNESS =====	15.00 IN
SLAB F'C =====	4.00 KSI

SUPERSTRUCTURE DATA (ADJACENT SPAN)	
SLAB THICKNESS =====	15.00 IN
SLAB F'C =====	4.00 KSI

ABUTMENT #1 DATA	
ABUTMENT NAME =====	South
ABUTMENT REFERENCE BORING =====	#1: SE Quad: S Abut
BOTTOM OF ABUTMENT ELEVATION =====	622.93 FT
ESTIMATED NUMBER OF PILES AT ABUT. =====	10
PILE SPACING PERP. TO CL =====	3.5 FT

ABUTMENT #2 DATA	
ABUTMENT NAME =====	East
ABUTMENT REFERENCE BORING =====	#2: NW Quad: N Abut
BOTTOM OF ABUTMENT ELEVATION =====	623.03 FT
ESTIMATED NUMBER OF PILES AT ABUT. =====	10
PILE SPACING PERP. TO CL =====	3.5 FT

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1				
BOT. OF LAYER ELEV. (FT)	LAYER THICKNESS (FT)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	N S.P.T. VALUE (BLOWS/12 IN.)	Qu EQUIV. FOR N VALUE (TSF)
621.63	1.30	1.5		
619.63	2.00	1.0		
617.13	2.50	2.1		
614.63	2.50	2.3		
612.93	1.70	2.1		

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2				
BOT. OF LAYER ELEV. (FT)	LAYER THICKNESS (FT)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	N S.P.T. VALUE (BLOWS/12 IN.)	Qu EQUIV. FOR N VALUE (TSF)
622.04	0.99		5	1.9
620.04	2.00		5	1.9
618.54	1.50		4	1.7
617.04	1.50		4	1.7
614.54	2.50	2.50		
613.03	1.51	2.50		

10.00 FT = TOTAL DEPTH ENTERED

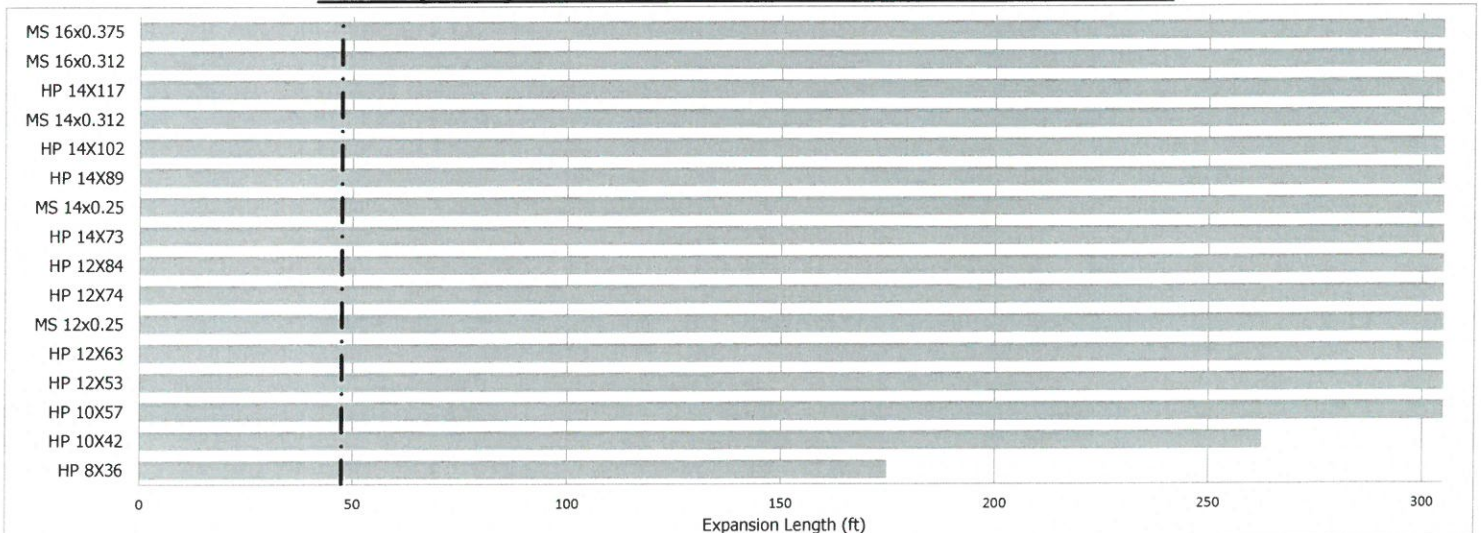
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1===== 1.85 TSF
 PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.85])===== 1.12


WEIGHTED AVERAGE Qu FOR ABUTMENT #2===== 2.09 TSF
 PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*2.09])===== 1.22

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1.12*10*0+1.22*10*91]/[1.12*10+1.22*10]===== 47.43 FT
 DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1.22*10*0+1.12*10*91]/[1.22*10+1.12*10]===== 43.57 FT

ABUT 1 (South) - EXPANSION LENGTH LIMIT CHART - 0 DEG. SKEW



----- = Estimated expansion length for the indicated abutment. Piles with an expansion length greater than this are suitable for consideration. (Note: The same size pile should be used at both abutments.)

	CLIENT:	IDOT - District 3	MADE BY:	CHK'D BY:	PROJ. NO.
	PROJECT:	IL 1 over Pike Creek - Bridge Replacement	JMP	JRM	P401190086
	SUBJECT:	Preliminary Foundation Loads	DATE:	DATE:	REV. NO.
			8/22/2019	8/22/2019	0

SUMMARY - PRELIMINARY FOUNDATION LOADS

Table 1 - Service Loads

	Abutment	Pier
LL	180.0 k	280.0 k
DC	160.0 k	530.0 k
DW	20.0 k	70.0 k
Total	360.0 k	880.0 k

Table 2 - Factored Loads

	Abutment	Pier
LL	310.0 k	490.0 k
DC	200.0 k	660.0 k
DW	30.0 k	100.0 k
Total	540.0 k	1250.0 k

Loads Reflect Bridge Width = 32ft
Assumes use of Integral Abutments

Pile Design Table for south abut. SN 038-0226 utilizing Boring #1: SE Quad: S Abut

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.)
			Steel HP 10 X 42			Steel HP 12 X 84		
			77	42	23	77	42	18
			85	47	25	86	47	20
			106	58	28	100	55	23
			135	74	30	110	61	25
			146	80	33	140	77	28
			152	83	38	174	96	30
			157	87	40	192	106	38
			165	91	43	199	109	40
			175	96	45	208	114	43
			178	98	48	222	122	45
			185	102	50	224	123	48
			193	106	53	233	128	50
			205	113	55	243	134	53
			214	118	58	260	143	55
			318	175	60	271	149	58
			319	175	62	401	220	60
			Steel HP 10 X 57			419	230	62
			78	43	23	491	270	65
			87	48	25	Steel HP 14 X 73		
			108	60	28	70	38	13
			139	76	30	86	47	15
			149	82	33	91	50	18
			155	85	38	101	56	20
			161	88	40	118	65	23
			168	93	43	130	72	25
			179	98	45	167	92	28
			182	100	48	201	110	30
			189	104	50	223	123	38
			197	108	53	231	127	40
			209	115	55	242	133	43
			218	120	58	259	142	45
			325	179	60	259	143	48
			327	180	62	269	148	50
			363	216	65	282	155	53
			Steel HP 12 X 53			302	166	55
			82	45	20	315	173	58
			96	53	23	461	254	60
			106	58	25	484	266	62
			134	74	28	553	304	65
			166	91	30	Steel HP 14 X 89		
			184	101	33	71	39	13
			185	102	38	87	48	15
			192	106	40	93	51	18
			201	110	43	102	56	20
			214	118	45	120	66	23
			216	119	48	132	73	25
			225	124	50	169	93	28
			235	129	53	204	112	30
			250	138	55	226	124	38
			261	144	58	233	128	40
			381	209	60	244	134	43
			400	220	62	262	144	45
			Steel HP 12 X 63			262	144	48
			83	46	20	272	150	50
			97	53	23	286	157	53
			107	59	25	306	168	55
			135	74	28	319	175	58
			169	93	30	470	259	60
			186	102	33	493	271	62
			187	103	38	572	314	65
			194	106	40	Steel HP 14 X 102		
			203	111	43	72	40	13
			216	119	45	88	49	15
			218	120	48	94	52	18
			227	125	50	104	57	20
			237	130	53	122	67	23
			253	139	55	134	73	25
			264	145	58	172	95	28
			389	214	60	207	114	30
			409	225	62	228	125	38
			467	257	65	236	130	40
			Steel HP 12 X 74			247	136	43
			84	46	20	265	146	48
			98	54	23	276	152	50
			108	60	25	289	159	53
			137	76	28	309	170	55
			172	94	30	322	177	58
			189	104	33	477	262	60
			189	104	38	498	274	62
			196	108	40	585	322	65
			205	113	43	798	439	67
			219	121	45	Steel HP 14 X 117		
			221	122	48	73	40	13
			230	126	50	90	49	15
			240	132	53	95	52	18
			256	141	55	105	58	20
			267	147	58	123	68	23
			395	217	60	135	74	25
			414	228	62	174	96	28
			480	264	65	210	116	30
						231	127	38
						239	131	40
						250	138	43
						268	147	48
						279	153	50
						292	161	53
						313	172	55
						326	179	58
						486	267	60
						507	279	62
						603	332	65
						817	450	67
						Precast 14"x 14"		
						83	46	10
						99	55	13
						115	64	15
						129	71	18
						144	79	20
						164	90	23
						183	101	25
						221	121	28

Pile Design Table for Pier 1 SN 038-0226 utilizing Boring #1: SE Quad: S Abut

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 14"Φ w/.312" walls			Steel HP 10 X 42			Steel HP 12 X 84		
192	106	38	176	97	58	186	102	50
202	111	40	262	144	60	196	108	53
215	118	43	279	153	62	213	117	55
231	127	45	321	177	65	224	123	58
238	131	48	Steel HP 10 X 57			332	183	60
250	137	50	180	99	58	350	193	62
263	145	53	269	148	60	422	232	65
281	155	55	285	156	62	601	331	67
297	163	58	337	185	65	Steel HP 14 X 73		
Metal Shell 16"Φ w/.312" walls			Steel HP 12 X 53			187	103	43
176	97	30	189	104	53	205	113	45
199	110	33	205	113	55	205	113	48
222	122	38	216	119	58	215	118	50
233	128	40	314	173	60	228	126	53
248	136	43	333	183	62	248	136	55
267	147	45	386	212	65	261	143	58
274	151	48	Steel HP 12 X 63			381	209	60
288	158	50	191	105	53	404	222	62
303	167	53	207	114	55	473	260	65
325	179	55	218	120	58	Steel HP 14 X 89		
343	189	58	322	177	60	190	104	43
Metal Shell 16"Φ w/.375" walls			341	187	62	207	114	45
176	97	30	400	220	65	207	114	48
199	110	33	Steel HP 12 X 74			218	120	50
222	122	38	194	107	53	231	127	53
233	128	40	210	115	55	251	138	55
248	136	43	221	121	58	264	145	58
267	147	45	327	180	60	390	214	60
274	151	48	346	190	62	412	226	62
288	158	50	412	226	65	491	270	65
303	167	53				702	386	67
325	179	55				Steel HP 14 X 102		
343	189	58				192	106	43
Steel HP 8 X 36						210	115	48
141	78	58				220	121	50
211	116	60				234	128	53
215	118	62				254	140	55
260	143	65				267	147	58
						396	218	60
						417	229	62
						504	277	65
						717	394	67
						Steel HP 14 X 117		
						194	107	43
						212	117	48
						223	123	50
						236	130	53
						257	141	55
						270	149	58
						404	222	60
						425	234	62
						521	287	65
						736	405	67
						901	495	70
						Precast 14"x 14"		
						186	102	30
						214	117	33

Pile Design Table for Pier 2 SN 038-0226 utilizing Boring ##2: NW Quad: N Abut

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.)
			Steel HP 10 X 42			Steel HP 12 X 84		
			160	88	58	193	106	55
			235	129	60	203	112	58
			249	137	62	296	163	60
			261	143	65	313	172	62
			265	146	66	330	181	65
			274	151	68	337	185	66
			284	156	71	354	195	68
			293	161	73	371	204	71
			302	166	76	388	213	73
			312	172	78	403	222	76
			321	177	81	415	228	78
			331	182	83	427	235	81
			Steel HP 10 X 57			438	241	83
			163	90	58	450	248	86
			240	132	60	Steel HP 14 X 73		
			254	140	62	186	102	45
			268	147	65	199	109	48
			272	149	66	200	110	50
			281	155	68	211	116	53
			291	160	71	225	124	55
			301	165	73	236	130	58
			310	171	76	340	187	60
			320	176	78	360	198	62
			330	181	81	380	209	65
			339	187	83	388	214	66
			349	192	86	408	225	68
			Steel HP 12 X 53			428	236	71
			195	107	58	448	247	73
			281	155	60	468	258	76
			298	164	62	488	269	78
			314	173	65	508	280	81
			321	176	66	526	289	83
			337	186	68	539	296	86
			354	195	71	Steel HP 14 X 89		
			371	204	73	188	103	45
			386	212	76	201	111	48
			397	218	78	203	112	50
			408	225	81	213	117	53
			Steel HP 12 X 63			227	125	55
			188	103	55	239	131	58
			197	108	58	347	191	60
			287	158	60	368	202	62
			304	167	62	388	213	65
			321	177	65	396	218	66
			328	180	66	416	229	68
			345	190	68	436	240	71
			362	199	71	456	251	73
			378	208	73	476	262	76
			390	214	76	496	273	78
			401	221	78	517	284	81
			413	227	81	533	293	83
			424	233	83	547	301	86
			436	240	86	Steel HP 14 X 102		
			Steel HP 12 X 74			190	105	45
			190	105	55	204	112	48
			200	110	58	205	113	50
			292	160	60	216	119	53
			309	170	62	230	127	55
			326	179	65	242	133	58
			332	183	66	352	194	60
			349	192	68	372	205	62
			366	201	71	393	216	65
			383	211	73	401	220	66
			396	218	76	421	232	68
			408	224	78	441	243	71
			420	231	81	461	254	73
			431	237	83	482	265	76
			443	244	86	502	276	78
						522	287	81
						541	297	83
						555	305	86
						Steel HP 14 X 117		
						193	106	45
						206	114	48
						208	114	50
						218	120	53
						233	128	55
						245	135	58
						359	197	60
						379	209	62
						400	220	65
						408	224	66
						428	236	68
						449	247	71
						469	258	73
						489	269	76
						510	280	78
						530	292	81
						548	302	83
						562	309	86
						Precast 14"x 14"		
						190	104	35
						211	116	38
						213	117	39
						219	120	40
						235	129	43
						260	143	45

SUBSTRUCTURE===== south abut. SN 038-0226
 REFERENCE BORING ===== #1: SE Quad: S Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 624.93 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 622.93 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
570 KIPS	367 KIPS	202 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 540 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 124.03 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 46.51 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)					
621.63	1.30		5	Medium Sand	2.2		11.7	12	0	0	6	3
619.63	2.00		5	Fine Sand	3.2	9.5	30.0	30	0	0	16	5
617.13	2.50	2.10	8		17.2	24.6	49.6	50	0	0	27	8
614.63	2.50	2.30	9		18.3	27.0	65.5	65	0	0	36	10
612.13	2.50	2.10	8		17.2	24.6	78.0	78	0	0	43	13
609.63	2.50	1.70	8		15.0	19.9	90.7	91	0	0	50	15
607.13	2.50	1.50	5		13.8	17.6	101.0	101	0	0	56	18
604.63	2.50	1.20	5		11.8	14.1	112.7	113	0	0	62	20
602.13	2.50	1.20	6		11.8	14.1	129.2	129	0	0	71	23
599.63	2.50	1.60	6		14.4	18.8	143.6	144	0	0	79	25
597.13	2.50	1.60	5		14.4	18.8	173.2	173	0	0	95	28
594.63	2.50	2.90	12		21.4	34.0	215.8	216	0	0	119	30
592.13	2.50	4.70	14		29.8	55.1	237.4	237	0	0	131	33
589.63	2.50	4.00	13		27.2	46.9	278.6	279	0	0	153	35
587.13	2.50	5.20	14		29.8	61.0	261.5	262	0	0	144	38
584.63	2.50	1.20	6		11.8	14.1	272.1	272	0	0	150	40
582.13	2.50	1.10	5		11.0	12.9	284.3	284	0	0	156	43
579.63	2.50	1.20	5		11.8	14.1	300.7	301	0	0	165	45
577.13	2.50	1.60	6		14.4	18.8	308.1	308	0	0	169	48
574.63	2.50	1.00	4		10.2	11.7	319.5	319	0	0	176	50
572.13	2.50	1.10	5		11.0	12.9	332.8	333	0	0	183	53
569.63	2.50	1.30	5		12.5	15.2	351.2	351	0	0	193	55
567.13	2.50	1.80	6		15.6	21.1	366.8	367	0	0	202	58
564.63	2.50	1.80	8		15.6	21.1	840.7	841	0	0	462	60
562.63	2.00		95	Hard Till	72.4	479.5	832.4	832	0	0	458	62
560.13	2.50		79	Hard Till	64.3	398.7	1709.3	1709	0	0	940	65
557.63	2.50		240	Hard Till	557.6	1211.3	2266.9	2267	0	0	1247	67
555.13	2.50		240	Hard Till	557.6	1211.3	2269.3	2269	0	0	1248	70
552.63	2.50		130	Hard Till	165.5	656.1	2434.8	2435	0	0	1339	72
550.13	2.50		130	Hard Till	165.5	656.1	3963.1	3963	0	0	2180	75
547.63	2.50		400	Hard Till		2018.8						

SUBSTRUCTURE===== south abut. SN 038-0226
 REFERENCE BORING ===== #1: SE Quad: S Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 624.93 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 622.93 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
654 KIPS	423 KIPS	232 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 540 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 124.03 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 46.51 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"Φ w/.312" walls
 Pile Perimeter===== 4.189 FT.
 Pile End Bearing Area===== 1.396 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)					
621.63	1.30		5	Medium Sand	2.5		14.9	15	0	0	8	3
619.63	2.00		5	Fine Sand	3.6	12.4	38.3	38	0	0	21	5
617.13	2.50	2.10	8		19.7	32.2	61.0	61	0	0	34	8
614.63	2.50	2.30	9		20.9	35.2	78.9	79	0	0	43	10
612.13	2.50	2.10	8		19.7	32.2	92.4	92	0	0	51	13
609.63	2.50	1.70	8		17.2	26.0	106.5	107	0	0	59	15
607.13	2.50	1.50	5		15.8	23.0	117.7	118	0	0	65	18
604.63	2.50	1.20	5		13.4	18.4	131.1	131	0	0	72	20
602.13	2.50	1.20	6		13.4	18.4	150.7	151	0	0	83	23
599.63	2.50	1.60	6		16.5	24.5	167.1	167	0	0	92	25
597.13	2.50	1.60	5		16.5	24.5	203.5	204	0	0	112	28
594.63	2.50	2.90	12		24.5	44.4	255.6	256	0	0	141	30
592.13	2.50	4.70	14		34.1	72.0	278.9	279	0	0	153	33
589.63	2.50	4.00	13		31.1	61.3	328.4	328	0	0	181	35
587.13	2.50	5.20	14		34.1	79.6	301.2	301	0	0	166	38
584.63	2.50	1.20	6		13.4	18.4	313.1	313	0	0	172	40
582.13	2.50	1.10	5		12.6	16.8	327.2	327	0	0	180	43
579.63	2.50	1.20	5		13.4	18.4	346.8	347	0	0	191	45
577.13	2.50	1.60	6		16.5	24.5	354.1	354	0	0	195	48
574.63	2.50	1.00	4		11.6	15.3	367.2	367	0	0	202	50
572.13	2.50	1.10	5		12.6	16.8	382.9	383	0	0	211	53
569.63	2.50	1.30	5		14.3	19.9	404.8	405	0	0	223	55
567.13	2.50	1.80	6		17.8	27.6	422.6	423	0	0	232	58
564.63	2.50	1.80	8		17.8	27.6	1039.1	1039	0	0	572	60
562.63	2.00		95	Hard Till	82.8	626.3	1016.4	1016	0	0	569	62
560.13	2.50		79	Hard Till	73.5	520.8	2151.2	2151	0	0	1183	65
557.63	2.50		240	Hard Till	637.3	1582.1	2788.5	2788	0	0	1534	67
555.13	2.50		240	Hard Till	637.3	1582.1	2700.6	2701	0	0	1485	70
552.63	2.50		130	Hard Till	189.2	857.0	2889.8	2890	0	0	1589	72
550.13	2.50		130	Hard Till	189.2	857.0	4858.9	4859	0	0	2672	75
547.63	2.50		400	Hard Till		2636.8						

SUBSTRUCTURE===== south abut. SN 038-0226
 REFERENCE BORING ===== #1: SE Quad: S Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 624.93 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 622.93 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
782 KIPS	423 KIPS	232 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 540 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 124.03 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 46.51 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"φ w/.375" walls
 Plugged Pile Perimeter===== 4.189 FT.
 Plugged Pile End Bearing Area===== 1.396 SQFT.

BOT. OF LAYER ELEV. (FT.)	UNCONF. COMPR. STRENGTH (TSF)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED			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)					
621.63	1.30	5	Medium Sand	2.5		14.9	15	0	0	8	3
619.63	2.00	5	Fine Sand	3.6	12.4	38.3	38	0	0	21	5
617.13	2.50	8		19.7	32.2	61.0	61	0	0	34	8
614.63	2.50	2.30		20.9	35.2	78.9	79	0	0	43	10
612.13	2.50	2.10		19.7	32.2	92.4	92	0	0	51	13
609.63	2.50	1.70		17.2	26.0	106.5	107	0	0	59	15
607.13	2.50	1.50		15.8	23.0	117.7	118	0	0	65	18
604.63	2.50	1.20		13.4	18.4	131.1	131	0	0	72	20
602.13	2.50	1.20		13.4	18.4	150.7	151	0	0	83	23
599.63	2.50	1.60		16.5	24.5	167.1	167	0	0	92	25
597.13	2.50	1.60		16.5	24.5	203.5	204	0	0	112	28
594.63	2.50	2.90		24.5	44.4	255.6	256	0	0	141	30
592.13	2.50	4.70		34.1	72.0	278.9	279	0	0	153	33
589.63	2.50	4.00		31.1	61.3	328.4	328	0	0	181	35
587.13	2.50	5.20		34.1	79.6	301.2	301	0	0	166	38
584.63	2.50	1.20		13.4	18.4	313.1	313	0	0	172	40
582.13	2.50	1.10		12.6	16.8	327.2	327	0	0	180	43
579.63	2.50	1.20		13.4	18.4	346.8	347	0	0	191	45
577.13	2.50	1.60		16.5	24.5	354.1	354	0	0	195	48
574.63	2.50	1.00		11.6	15.3	367.2	367	0	0	202	50
572.13	2.50	1.10		12.6	16.8	382.9	383	0	0	211	53
569.63	2.50	1.30		14.3	19.9	404.8	405	0	0	223	55
567.13	2.50	1.80		17.8	27.6	422.6	423	0	0	232	58
564.63	2.50	1.80		17.8	27.6	1039.1	1039	0	0	572	60
562.63	2.00	95	Hard Till	82.8	626.3	1016.4	1016	0	0	559	62
560.13	2.50	79	Hard Till	73.5	520.8	2151.2	2151	0	0	1183	65
557.63	2.50	240	Hard Till	637.3	1582.1	2788.5	2788	0	0	1534	67
555.13	2.50	240	Hard Till	637.3	1582.1	2700.6	2701	0	0	1485	70
552.63	2.50	130	Hard Till	189.2	857.0	2889.8	2890	0	0	1589	72
550.13	2.50	130	Hard Till	189.2	857.0	4858.9	4859	0	0	2672	75
547.63	2.50	400	Hard Till		2636.8						

SUBSTRUCTURE===== Pier 1 SN 038-0226
 REFERENCE BORING ===== #1: SE Quad: S Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 624.96 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.20 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 610.20 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
570 KIPS	297 KIPS	163 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1250 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 287.11 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.67 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)					
609.63	0.57	1.70	8		3.4		21.0	21	0	0	12	15
607.13	2.50	1.50	5		13.8	17.6	31.3	31	0	0	17	18
604.63	2.50	1.20	5		11.8	14.1	43.0	43	0	0	24	20
602.13	2.50	1.20	6		11.8	14.1	59.5	59	0	0	33	23
599.63	2.50	1.60	6		14.4	18.8	73.9	74	0	0	41	25
597.13	2.50	1.60	5		14.4	18.8	103.6	104	0	0	57	28
594.63	2.50	2.90	12		21.4	34.0	146.1	146	0	0	80	30
592.13	2.50	4.70	14		29.8	55.1	167.7	168	0	0	92	33
589.63	2.50	4.00	13		27.2	46.9	209.0	209	0	0	115	35
587.13	2.50	5.20	14		29.8	61.0	191.9	192	0	0	106	38
584.63	2.50	1.20	6		11.8	14.1	202.5	202	0	0	111	40
582.13	2.50	1.10	5		11.0	12.9	214.6	215	0	0	118	43
579.63	2.50	1.20	5		11.8	14.1	231.1	231	0	0	127	45
577.13	2.50	1.60	6		14.4	18.8	238.4	238	0	0	131	48
574.63	2.50	1.00	4		10.2	11.7	249.8	250	0	0	137	50
572.13	2.50	1.10	5		11.0	12.9	263.1	263	0	0	145	53
569.63	2.50	1.30	5		12.5	15.2	281.5	281	0	0	155	55
567.13	2.50	1.80	6		15.6	21.1	297.1	297	0	0	163	58
564.63	2.50	1.80	8		15.6	21.1	771.0	771	0	0	424	60
562.63	2.00		95	Hard Till	72.4	479.5	762.7	763	0	0	420	62
560.13	2.50		79	Hard Till	64.3	398.7	1639.6	1640	0	0	902	65
557.63	2.50		240	Hard Till	557.6	1211.3	2197.2	2197	0	0	1208	67
555.13	2.50		240	Hard Till	557.6	1211.3	2199.6	2200	0	0	1210	70
552.63	2.50		130	Hard Till	165.5	656.1	2365.2	2365	0	0	1301	72
550.13	2.50		130	Hard Till	165.5	656.1	3893.4	3893	0	0	2141	75
547.63	2.50		400	Hard Till		2018.8						

SUBSTRUCTURE===== Pier 1 SN 038-0226
 REFERENCE BORING ===== #1: SE Quad: S Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 624.96 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.20 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 610.20 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
654 KIPS	343 KIPS	189 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1250 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 287.11 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.67 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"φ w/.312" walls
 Pile Perimeter===== 4.189 FT.
 Pile End Bearing Area===== 1.396 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)					
609.63	0.57	1.70	8		3.9		26.9	27	0	0	15	15
607.13	2.50	1.50	5		15.8	23.0	38.1	38	0	0	21	18
604.63	2.50	1.20	5		13.4	18.4	51.5	51	0	0	28	20
602.13	2.50	1.20	6		13.4	18.4	71.0	71	0	0	39	23
599.63	2.50	1.60	6		16.5	24.5	87.5	88	0	0	48	25
597.13	2.50	1.60	5		16.5	24.5	123.9	124	0	0	68	28
594.63	2.50	2.90	12		24.5	44.4	176.0	176	0	0	97	30
592.13	2.50	4.70	14		34.1	72.0	199.3	199	0	0	110	33
589.63	2.50	4.00	13		31.1	61.3	248.8	249	0	0	137	35
587.13	2.50	5.20	14		34.1	79.6	221.6	222	0	0	122	38
584.63	2.50	1.20	6		13.4	18.4	233.5	233	0	0	128	40
582.13	2.50	1.10	5		12.6	16.8	247.6	248	0	0	136	43
579.63	2.50	1.20	5		13.4	18.4	267.1	267	0	0	147	45
577.13	2.50	1.60	6		16.5	24.5	274.4	274	0	0	151	48
574.63	2.50	1.00	4		11.6	15.3	287.6	288	0	0	158	50
572.13	2.50	1.10	5		12.6	16.8	303.2	303	0	0	167	53
569.63	2.50	1.30	5		14.3	19.9	325.1	325	0	0	179	55
567.13	2.50	1.80	6		17.8	27.6	343.0	343	0	0	189	58
564.63	2.50	1.80	8		17.8	27.6	959.5	959	0	0	528	60
562.63	2.00		95	Hard Till	82.8	626.3	936.8	937	0	0	515	62
560.13	2.50		79	Hard Till	73.5	520.8	2071.6	2072	0	0	1139	65
557.63	2.50		240	Hard Till	637.3	1582.1	2708.9	2709	0	0	1490	67
555.13	2.50		240	Hard Till	637.3	1582.1	2621.0	2621	0	0	1442	70
552.63	2.50		130	Hard Till	189.2	857.0	2810.2	2810	0	0	1546	72
550.13	2.50		130	Hard Till	189.2	857.0	4779.2	4779	0	0	2629	75
547.63	2.50		400	Hard Till		2636.8						

SUBSTRUCTURE===== Pier 1 SN 038-0226
 REFERENCE BORING ===== #1: SE Quad: S Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 624.96 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.20 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 610.20 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
782 KIPS	343 KIPS	189 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1250 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 287.11 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.67 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"Φ w/.375" walls
 Plugged Pile Perimeter===== 4.189 FT.
 Plugged Pile End Bearing Area===== 1.396 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 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)					
609.63	0.57	1.70	8		3.9		26.9	27	0	0	15	15
607.13	2.50	1.50	5		15.8	23.0	38.1	38	0	0	21	18
604.63	2.50	1.20	5		13.4	18.4	51.5	51	0	0	28	20
602.13	2.50	1.20	6		13.4	18.4	71.0	71	0	0	39	23
599.63	2.50	1.60	6		16.5	24.5	87.5	88	0	0	48	25
597.13	2.50	1.60	5		16.5	24.5	123.9	124	0	0	68	28
594.63	2.50	2.90	12		24.5	44.4	176.0	176	0	0	97	30
592.13	2.50	4.70	14		34.1	72.0	199.3	199	0	0	110	33
589.63	2.50	4.00	13		31.1	61.3	248.8	249	0	0	137	35
587.13	2.50	5.20	14		34.1	79.6	221.6	222	0	0	122	38
584.63	2.50	1.20	6		13.4	18.4	233.5	233	0	0	128	40
582.13	2.50	1.10	5		12.6	16.8	247.6	248	0	0	136	43
579.63	2.50	1.20	5		13.4	18.4	267.1	267	0	0	147	45
577.13	2.50	1.60	6		16.5	24.5	274.4	274	0	0	151	48
574.63	2.50	1.00	4		11.6	15.3	287.6	288	0	0	158	50
572.13	2.50	1.10	5		12.6	16.8	303.2	303	0	0	167	53
569.63	2.50	1.30	5		14.3	19.9	325.1	325	0	0	179	55
567.13	2.50	1.80	6		17.8	27.6	343.0	343	0	0	189	58
564.63	2.50	1.80	8		17.8	27.6	959.5	959	0	0	528	60
562.63	2.00		95	Hard Till	82.8	626.3	936.8	937	0	0	545	62
560.13	2.50		79	Hard Till	73.5	520.8	2071.6	2072	0	0	1139	65
557.63	2.50		240	Hard Till	637.3	1582.1	2708.9	2709	0	0	1490	67
555.13	2.50		240	Hard Till	637.3	1582.1	2621.0	2621	0	0	1442	70
552.63	2.50		130	Hard Till	189.2	857.0	2810.2	2810	0	0	1546	72
550.13	2.50		130	Hard Till	189.2	857.0	4779.2	4779	0	0	2629	75
547.63	2.50		400	Hard Till		2636.8						

SUBSTRUCTURE===== Pier 2 SN 038-0226
 REFERENCE BORING ===== #2: NW Quad: N Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 625.00 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.20 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 610.20 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
570 KIPS	270 KIPS	149 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1250 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 287.11 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.67 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)					
609.54	0.66	1.20	5		3.1		17.2	17	0	0	9	15
606.54	3.00	1.20	6		14.1	14.1	26.6	27	0	0	15	18
604.04	2.50	0.80	3		8.5	9.4	35.1	35	0	0	19	21
601.54	2.50	0.80	3		8.5	9.4	50.6	51	0	0	28	23
599.04	2.50	1.40	5		13.2	16.4	63.7	64	0	0	35	26
596.04	3.00	1.40	5		15.8	16.4	101.8	102	0	0	56	29
594.54	1.50	3.30	13		14.1	38.7	115.9	116	0	0	64	30
592.04	2.50	3.30	13		23.5	38.7	139.4	139	0	0	77	33
589.54	2.50	3.30	13		23.5	38.7	148.9	149	0	0	82	35
587.04	2.50	2.10	10		17.2	24.6	166.1	166	0	0	91	38
585.54	1.50	2.10	10		10.3	24.6	167.0	167	0	0	92	39
584.54	1.00	1.30	4		5.0	15.2	172.0	172	0	0	95	40
582.04	2.50	1.30	4		12.5	15.2	184.5	184	0	0	101	43
579.54	2.50	1.30	4		12.5	15.2	204.0	204	0	0	112	45
577.04	2.50	1.90	6		16.2	22.3	220.2	220	0	0	121	48
574.54	2.50	1.90	6		16.2	22.3	229.3	229	0	0	126	50
572.04	2.50	1.30	5		12.5	15.2	241.8	242	0	0	133	53
569.54	2.50	1.30	5		12.5	15.2	256.6	257	0	0	141	55
567.04	2.50	1.50	5		13.8	17.6	270.4	270	0	0	149	58
565.04	2.00	1.50	5		11.0	17.6	622.2	622	0	0	342	60
562.54	2.50		71	Hard Till	53.0	358.3	675.2	675	0	0	371	62
560.04	2.50		71	Hard Till	53.0	358.3	728.2	728	0	0	401	65
559.04	1.00		71	Hard Till	21.2	358.3	749.4	749	0	0	412	66
556.54	2.50		71	Hard Till	53.0	358.3	802.5	802	0	0	441	68
554.04	2.50		71	Hard Till	53.0	358.3	855.5	856	0	0	471	71
551.54	2.50		71	Hard Till	53.0	358.3	908.5	909	0	0	500	73
549.04	2.50		71	Hard Till	53.0	358.3	961.6	962	0	0	529	76
546.54	2.50		71	Hard Till	53.0	358.3	1014.6	1015	0	0	558	78
544.04	2.50		71	Hard Till	53.0	358.3	1067.6	1068	0	0	587	81
541.54	2.50		71	Hard Till	53.0	358.3	1120.7	1121	0	0	616	83
539.04	2.50		71	Hard Till	53.0	358.3	1173.7	1174	0	0	646	86
536.54	2.50		71	Hard Till		358.3						

SUBSTRUCTURE===== Pier 2 SN 038-0226
 REFERENCE BORING ===== #2: NW Quad: N Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 625.00 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.20 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 610.20 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
654 KIPS	312 KIPS	172 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1250 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 287.11 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.67 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"Φ w/.312" walls
 Pile Perimeter===== 4,189 FT.
 Pile End Bearing Area===== 1,396 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)					
609.54	0.66	1.20	5		3.5		21.9	22	0	0	12	15
606.54	3.00	1.20	6		16.1	18.4	31.9	32	0	0	18	18
604.04	2.50	0.80	3		9.7	12.3	41.6	42	0	0	23	21
601.54	2.50	0.80	3		9.7	12.3	60.5	60	0	0	33	23
599.04	2.50	1.40	5		15.0	21.4	75.5	75	0	0	42	26
596.04	3.00	1.40	5		18.0	21.4	122.6	123	0	0	67	29
594.54	1.50	3.30	13		16.1	50.5	138.8	139	0	0	76	30
592.04	2.50	3.30	13		26.9	50.5	165.6	166	0	0	91	33
589.54	2.50	3.30	13		26.9	50.5	174.1	174	0	0	96	35
587.04	2.50	2.10	10		19.7	32.2	193.8	194	0	0	107	38
585.54	1.50	2.10	10		11.8	32.2	193.4	193	0	0	106	39
584.54	1.00	1.30	4		5.7	19.9	199.1	199	0	0	109	40
582.04	2.50	1.30	4		14.3	19.9	213.3	213	0	0	117	43
579.54	2.50	1.30	4		14.3	19.9	236.8	237	0	0	130	45
577.04	2.50	1.90	6		18.5	29.1	255.2	255	0	0	140	48
574.54	2.50	1.90	6		18.5	29.1	264.5	265	0	0	145	50
572.04	2.50	1.30	5		14.3	19.9	278.8	279	0	0	153	53
569.54	2.50	1.30	5		14.3	19.9	296.1	296	0	0	163	55
567.04	2.50	1.50	5		15.8	23.0	311.9	312	0	0	172	58
565.04	2.00	1.50	5		12.6	23.0	769.5	770	0	0	423	60
562.54	2.50		71	Hard Till	60.6	468.0	830.2	830	0	0	452	62
560.04	2.50		71	Hard Till	60.6	468.0	890.8	891	0	0	490	65
559.04	1.00		71	Hard Till	24.2	468.0	915.0	915	0	0	503	66
556.54	2.50		71	Hard Till	60.6	468.0	975.6	976	0	0	537	68
554.04	2.50		71	Hard Till	60.6	468.0	1036.2	1036	0	0	570	71
551.54	2.50		71	Hard Till	60.6	468.0	1096.8	1097	0	0	603	73
549.04	2.50		71	Hard Till	60.6	468.0	1157.4	1157	0	0	637	76
546.54	2.50		71	Hard Till	60.6	468.0	1218.1	1218	0	0	670	78
544.04	2.50		71	Hard Till	60.6	468.0	1278.7	1279	0	0	703	81
541.54	2.50		71	Hard Till	60.6	468.0	1339.3	1339	0	0	737	83
539.04	2.50		71	Hard Till	60.6	468.0	1399.9	1400	0	0	770	86
536.54	2.50		71	Hard Till		468.0						

SUBSTRUCTURE===== Pier 2 SN 038-0226
 REFERENCE BORING ===== #2: NW Quad: N Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 625.00 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 610.20 ft
 GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== Scour
 BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ===== 610.20 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
782 KIPS	770 KIPS	423 KIPS	60 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 1250 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1

Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 287.11 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 107.67 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"Φ w/.375" walls
 Plugged Pile Perimeter===== 4.189 FT.
 Plugged Pile End Bearing Area===== 1.396 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 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)					
609.54	0.66	1.20	5		3.5		21.9	22	0	0	12	15
606.54	3.00	1.20	6		16.1	18.4	31.9	32	0	0	18	18
604.04	2.50	0.80	3		9.7	12.3	41.6	42	0	0	23	21
601.54	2.50	0.80	3		9.7	12.3	60.5	60	0	0	33	23
599.04	2.50	1.40	5		15.0	21.4	75.5	75	0	0	42	26
596.04	3.00	1.40	5		18.0	21.4	122.6	123	0	0	67	29
594.54	1.50	3.30	13		16.1	50.5	138.8	139	0	0	76	30
592.04	2.50	3.30	13		26.9	50.5	165.6	166	0	0	91	33
589.54	2.50	3.30	13		26.9	50.5	174.1	174	0	0	96	35
587.04	2.50	2.10	10		19.7	32.2	193.8	194	0	0	107	38
585.54	1.50	2.10	10		11.8	32.2	193.4	193	0	0	106	39
584.54	1.00	1.30	4		5.7	19.9	199.1	199	0	0	109	40
582.04	2.50	1.30	4		14.3	19.9	213.3	213	0	0	117	43
579.54	2.50	1.30	4		14.3	19.9	236.8	237	0	0	130	45
577.04	2.50	1.90	6		18.5	29.1	255.2	255	0	0	140	48
574.54	2.50	1.90	6		18.5	29.1	264.5	265	0	0	145	50
572.04	2.50	1.30	5		14.3	19.9	278.8	279	0	0	153	53
569.54	2.50	1.30	5		14.3	19.9	296.1	296	0	0	163	55
567.04	2.50	1.50	5		15.8	23.0	311.9	312	0	0	172	58
565.04	2.00	1.50	5		12.6	23.0	769.5	770	0	0	423	60
562.54	2.50		71	Hard Till	60.6	468.0	830.2	830	0	0	452	62
560.04	2.50		71	Hard Till	60.6	468.0	890.8	891	0	0	490	65
559.04	1.00		71	Hard Till	24.2	468.0	915.0	915	0	0	503	66
556.54	2.50		71	Hard Till	60.6	468.0	975.6	976	0	0	537	68
554.04	2.50		71	Hard Till	60.6	468.0	1036.2	1036	0	0	570	71
551.54	2.50		71	Hard Till	60.6	468.0	1096.8	1097	0	0	603	73
549.04	2.50		71	Hard Till	60.6	468.0	1157.4	1157	0	0	637	76
546.54	2.50		71	Hard Till	60.6	468.0	1218.1	1218	0	0	670	78
544.04	2.50		71	Hard Till	60.6	468.0	1278.7	1279	0	0	703	81
541.54	2.50		71	Hard Till	60.6	468.0	1339.3	1339	0	0	737	83
539.04	2.50		71	Hard Till	60.6	468.0	1399.9	1400	0	0	770	86
536.54	2.50		71	Hard Till		468.0						

SUBSTRUCTURE===== N Abut SN 038-0226
 REFERENCE BORING ===== #2: NW Quad: N Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 625.03 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 623.03 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
570 KIPS	333 KIPS	183 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 540 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 124.03 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 46.51 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)					
622.04	0.99		5	Medium Sand	1.7		7.4	7	0	0	4	3
620.54	1.50		4	Medium Sand	2.0	5.7	12.9	13	0	0	7	4
619.04	1.50		4	Medium Sand	2.0	9.2	35.0	35	0	0	19	6
616.54	2.50	2.50	6		19.3	29.3	54.4	54	0	0	30	8
614.54	2.00	2.50	9		15.5	29.3	58.1	58	0	0	32	10
612.04	2.50	1.50	8		13.8	17.6	68.4	68	0	0	38	13
609.54	2.50	1.20	5		11.8	14.1	80.1	80	0	0	44	15
606.54	3.00	1.20	6		14.1	14.1	89.5	90	0	0	49	18
604.04	2.50	0.80	3		8.5	9.4	98.0	98	0	0	54	21
601.54	2.50	0.80	3		8.5	9.4	113.5	114	0	0	62	23
599.04	2.50	1.40	5		13.2	16.4	126.7	127	0	0	70	26
596.04	3.00	1.40	5		15.8	16.4	164.7	165	0	0	91	29
594.54	1.50	3.30	13		14.1	38.7	178.8	179	0	0	98	30
592.04	2.50	3.30	13		23.5	38.7	202.3	202	0	0	111	33
589.54	2.50	3.30	13		23.5	38.7	211.8	212	0	0	116	35
587.04	2.50	2.10	10		17.2	24.6	229.0	229	0	0	126	38
585.54	1.50	2.10	10		10.3	24.6	230.0	230	0	0	126	39
584.54	1.00	1.30	4		5.0	15.2	235.0	235	0	0	129	40
582.04	2.50	1.30	4		12.5	15.2	247.4	247	0	0	136	43
579.54	2.50	1.30	4		12.5	15.2	266.9	267	0	0	147	45
577.04	2.50	1.90	6		16.2	22.3	283.1	283	0	0	156	48
574.54	2.50	1.90	6		16.2	22.3	292.2	292	0	0	161	50
572.04	2.50	1.30	5		12.5	15.2	304.7	305	0	0	168	53
569.54	2.50	1.30	5		12.5	15.2	319.5	320	0	0	176	55
567.04	2.50	1.50	5		13.8	17.6	333.3	333	0	0	183	58
565.04	2.00	1.50	5		11.0	17.6	685.1	685	0	0	372	60
562.54	2.50		71	Hard Till	53.0	358.3	738.1	738	0	0	406	62
560.04	2.50		71	Hard Till	53.0	358.3	791.2	791	0	0	435	65
559.04	1.00		71	Hard Till	21.2	358.3	812.4	812	0	0	447	66
556.54	2.50		71	Hard Till	53.0	358.3	865.4	865	0	0	476	68
554.04	2.50		71	Hard Till	53.0	358.3	918.4	918	0	0	505	71
551.54	2.50		71	Hard Till	53.0	358.3	971.5	971	0	0	534	73
549.04	2.50		71	Hard Till	53.0	358.3	1024.5	1025	0	0	563	76
546.54	2.50		71	Hard Till	53.0	358.3	1077.5	1078	0	0	593	78
544.04	2.50		71	Hard Till	53.0	358.3	1130.6	1131	0	0	622	81
541.54	2.50		71	Hard Till	53.0	358.3	1183.6	1184	0	0	651	83
539.04	2.50		71	Hard Till	53.0	358.3	1236.6	1237	0	0	680	86
536.54	2.50		71	Hard Till		358.3						

SUBSTRUCTURE===== N Abut SN 038-0226
 REFERENCE BORING ===== #2: NW Quad: N Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 625.03 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 623.03 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
654 KIPS	384 KIPS	211 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 540 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 124.03 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 46.51 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"Φ w/.312" walls
 Pile Perimeter===== 4.189 FT.
 Pile End Bearing Area===== 1.396 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)					
622.04	0.99		5	Medium Sand	1.9		9.4	9	0	0	5	3
620.54	1.50		4	Medium Sand	2.3	7.5	16.2	16	0	0	9	4
619.04	1.50		4	Medium Sand	2.3	12.0	44.8	45	0	0	25	6
616.54	2.50	2.50	6		22.1	38.3	66.9	67	0	0	37	8
614.54	2.00	2.50	9		17.7	38.3	69.3	69	0	0	38	10
612.04	2.50	1.50	8		15.8	23.0	80.4	80	0	0	44	13
609.54	2.50	1.20	5		13.4	18.4	93.9	94	0	0	52	15
606.54	3.00	1.20	6		16.1	18.4	103.8	104	0	0	57	18
604.04	2.50	0.80	3		9.7	12.3	113.5	114	0	0	62	21
601.54	2.50	0.80	3		9.7	12.3	132.4	132	0	0	73	23
599.04	2.50	1.40	5		15.0	21.4	147.4	147	0	0	81	26
596.04	3.00	1.40	5		18.0	21.4	194.6	195	0	0	107	29
594.54	1.50	3.30	13		16.1	50.5	210.7	211	0	0	116	30
592.04	2.50	3.30	13		26.9	50.5	237.6	238	0	0	131	33
589.54	2.50	3.30	13		26.9	50.5	246.1	246	0	0	135	35
587.04	2.50	2.10	10		19.7	32.2	265.8	266	0	0	146	38
585.54	1.50	2.10	10		11.8	32.2	265.3	265	0	0	146	39
584.54	1.00	1.30	4		5.7	19.9	271.0	271	0	0	149	40
582.04	2.50	1.30	4		14.3	19.9	285.3	285	0	0	157	43
579.54	2.50	1.30	4		14.3	19.9	308.7	309	0	0	170	45
577.04	2.50	1.90	6		18.5	29.1	327.2	327	0	0	180	48
574.54	2.50	1.90	6		18.5	29.1	336.5	336	0	0	185	50
572.04	2.50	1.30	5		14.3	19.9	350.7	351	0	0	193	53
569.54	2.50	1.30	5		14.3	19.9	368.0	368	0	0	202	55
567.04	2.50	1.50	5		15.8	23.0	383.8	384	0	0	211	58
565.04	2.00	1.50	5		12.6	23.0	841.5	841	0	0	463	60
562.54	2.50		71	Hard Till	60.6	468.0	902.1	902	0	0	496	62
560.04	2.50		71	Hard Till	60.6	468.0	962.7	963	0	0	529	65
559.04	1.00		71	Hard Till	24.2	468.0	986.9	987	0	0	543	66
556.54	2.50		71	Hard Till	60.6	468.0	1047.6	1048	0	0	576	68
554.04	2.50		71	Hard Till	60.6	468.0	1108.2	1108	0	0	609	71
551.54	2.50		71	Hard Till	60.6	468.0	1168.8	1169	0	0	643	73
549.04	2.50		71	Hard Till	60.6	468.0	1229.4	1229	0	0	676	76
546.54	2.50		71	Hard Till	60.6	468.0	1290.0	1290	0	0	709	78
544.04	2.50		71	Hard Till	60.6	468.0	1350.6	1351	0	0	743	81
541.54	2.50		71	Hard Till	60.6	468.0	1411.2	1411	0	0	776	83
539.04	2.50		71	Hard Till	60.6	468.0	1471.8	1472	0	0	809	86
536.54	2.50		71	Hard Till		468.0						

SUBSTRUCTURE===== N Abut SN 038-0226
 REFERENCE BORING ===== #2: NW Quad: N Abut
 LRFD or ASD or SEISMIC ===== LRFD
 PILE CUTOFF ELEV. ===== 625.03 ft
 GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 623.03 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
782 KIPS	384 KIPS	211 KIPS	58 FT.

TOTAL FACTORED SUBSTRUCTURE LOAD ===== 540 kips
 TOTAL LENGTH OF SUBSTRUCTURE (along skew)===== 34.83 ft
 NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ===== 1
 Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 124.03 KIPS
 Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 46.51 KIPS

PILE TYPE AND SIZE ===== Metal Shell 16"Φ w/.375" walls
 Plugged Pile Perimeter===== 4.189 FT.
 Plugged Pile End Bearing Area===== 1.396 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 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)					
622.04	0.99		5	Medium Sand	1.9		9.4	9	0	0	5	3
620.54	1.50		4	Medium Sand	2.3	7.5	16.2	16	0	0	9	4
619.04	1.50		4	Medium Sand	2.3	12.0	44.8	45	0	0	25	6
616.54	2.50	2.50	6		22.1	38.3	66.9	67	0	0	37	8
614.54	2.00	2.50	9		17.7	38.3	69.3	69	0	0	38	10
612.04	2.50	1.50	8		15.8	23.0	80.4	80	0	0	44	13
609.54	2.50	1.20	5		13.4	18.4	93.9	94	0	0	52	15
606.54	3.00	1.20	6		16.1	18.4	103.8	104	0	0	57	18
604.04	2.50	0.80	3		9.7	12.3	113.5	114	0	0	62	21
601.54	2.50	0.80	3		9.7	12.3	132.4	132	0	0	73	23
599.04	2.50	1.40	5		15.0	21.4	147.4	147	0	0	81	26
596.04	3.00	1.40	5		18.0	21.4	194.6	195	0	0	107	29
594.54	1.50	3.30	13		16.1	50.5	210.7	211	0	0	116	30
592.04	2.50	3.30	13		26.9	50.5	237.6	238	0	0	131	33
589.54	2.50	3.30	13		26.9	50.5	246.1	246	0	0	135	35
587.04	2.50	2.10	10		19.7	32.2	265.8	266	0	0	146	38
585.54	1.50	2.10	10		11.8	32.2	265.3	265	0	0	146	39
584.54	1.00	1.30	4		5.7	19.9	271.0	271	0	0	149	40
582.04	2.50	1.30	4		14.3	19.9	285.3	285	0	0	157	43
579.54	2.50	1.30	4		14.3	19.9	308.7	309	0	0	170	45
577.04	2.50	1.90	6		18.5	29.1	327.2	327	0	0	180	48
574.54	2.50	1.90	6		18.5	29.1	336.5	336	0	0	185	50
572.04	2.50	1.30	5		14.3	19.9	350.7	351	0	0	193	53
569.54	2.50	1.30	5		14.3	19.9	368.0	368	0	0	202	55
567.04	2.50	1.50	5		15.8	23.0	383.8	384	0	0	211	58
565.04	2.00	1.50	5		12.6	23.0	841.5	841	0	0	463	60
562.54	2.50		71	Hard Till	60.6	468.0	902.1	902	0	0	496	62
560.04	2.50		71	Hard Till	60.6	468.0	962.7	963	0	0	529	65
559.04	1.00		71	Hard Till	24.2	468.0	986.9	987	0	0	543	66
556.54	2.50		71	Hard Till	60.6	468.0	1047.6	1048	0	0	576	68
554.04	2.50		71	Hard Till	60.6	468.0	1108.2	1108	0	0	609	71
551.54	2.50		71	Hard Till	60.6	468.0	1168.8	1169	0	0	643	73
549.04	2.50		71	Hard Till	60.6	468.0	1229.4	1229	0	0	676	76
546.54	2.50		71	Hard Till	60.6	468.0	1290.0	1290	0	0	709	78
544.04	2.50		71	Hard Till	60.6	468.0	1350.6	1351	0	0	743	81
541.54	2.50		71	Hard Till	60.6	468.0	1411.2	1411	0	0	776	83
539.04	2.50		71	Hard Till	60.6	468.0	1471.8	1472	0	0	809	86
536.54	2.50		71	Hard Till	60.6	468.0						