Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date: 5/11/2023 **Proposed SN:** 038-0231 **Route:** FAP 332 (IL 1)
Revised Date: **Existing SN:** 038-0017 **Section:** (4 BR-4)ES
Geotechnical Engineer: Jeremy Brown, P.E. (IDOT D3) **County:** Iroquois
Structural Engineer: **Contract:** 66K94

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): The proposed structure will be a 3-span slab bridge on integral abutments, have a back-to-back length of 98 feet, and have an out-to-out width of 32 feet with no skew. Load information provided by the Bureau of Bridges and Structures indicates factored loads of 715.7 kips at the abutments and 857.2 kips at the two piers. Staged construction will be utilized for construction of the new bridge. A draft copy of the TS&L is attached.

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): There was little subsurface information available from construction of the existing structure. Soil borings were conducted at the abutments in 2020 by IDOT. The existing structure is on closed abutments with spread footings and has one precast concrete pile bent pier. Copies of the boring logs are attached.

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: Based on the draft TS&L, cuts and fills are proposed to be minimal for the approach pavement areas. Settlement of the approach pavement is little concern due to the minimal fills proposed. A site visit showed no signs of settlement. No further settlement analysis is warranted.

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: Minimal grade change is expected. The end slope on the creek side of the abutment will be a 1:2(V:H) slope with a slope height near 8 feet to the bottom of the proposed abutment. The short term FOS is estimated to be 1.62 and the long term FOS is 1.528. These factors of safety were estimated using the Slide 2 software using Boring 01 for the south abutment. No further analysis is warranted.

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 design scour elevations and bottom of abutment elevations are 618.73 and 618.25 for the south abutment and north abutment respectively. Per the Hydraulic Report, the total pier scour depths for Q100 and Q200 are 14.20 ft and 15.54 ft respectively. The following scour depths were calculated using the IDOT Scour Analysis spreadsheet. Copies of the spreadsheets are attached.

Event/Limit State	Design Scour Elevations (ft.)				Item 113
	S. Abut	Pier 1	Pier 2	N. Abut.	
Q100	618.73	598.50	598.50	618.25	5
Q200	618.73	597.80	597.80	618.25	
Design	618.73	598.50	598.50	618.25	
Check	618.73	597.80	597.80	618.25	

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: Seismic Soil Site Class = C. The SDS = 0.111 g. The SD1 = 0.074 g. The Seismic Performance Zone (SPZ) for this bridge = 1, therefore a liquefaction analysis was not performed.

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: Soil borings 01 (S.E. Quad.) and 02 (N.E. Quad) were used to design the foundations for the proposed structure. Use 576.58 for the top of rock elevation for the south abutment and south pier foundation designs and 576.29 for the top of rock elevation for the north abutment and north pier foundation designs.

Integral abutments are feasible for the proposed structure. The abutments and piers should utilize conventional construction methods to drive piles to refusal into the limestone. H-piles with pile shoes are recommended for both abutments and both piers because of the need to drive through the hard till layers and weathered limestone and set the piles one foot deeper into the denser limestone below. Metal shell piles are not recommended because of the risk of damage when driving to the limestone bedrock. See the attached integral abutment feasibility analysis and pile tables for the recommended pile lengths. The top of rock elevation is consistent through the location of the proposed structure, therefore only one test pile at each abutment is recommended. Pile design tables and lateral loading soil parameters are attached.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: From the hydraulic report, the estimated water surface elevation is 616.80. There will be two solid wall piers that will require in stream work. Because the EWSE of 616.80 is greater than 6 ft. above the base of the concrete of the piers, type II cofferdams are recommended. From the data shown in the soil boring logs, it should not be an issue driving the sheet piling to the design depth at this location.

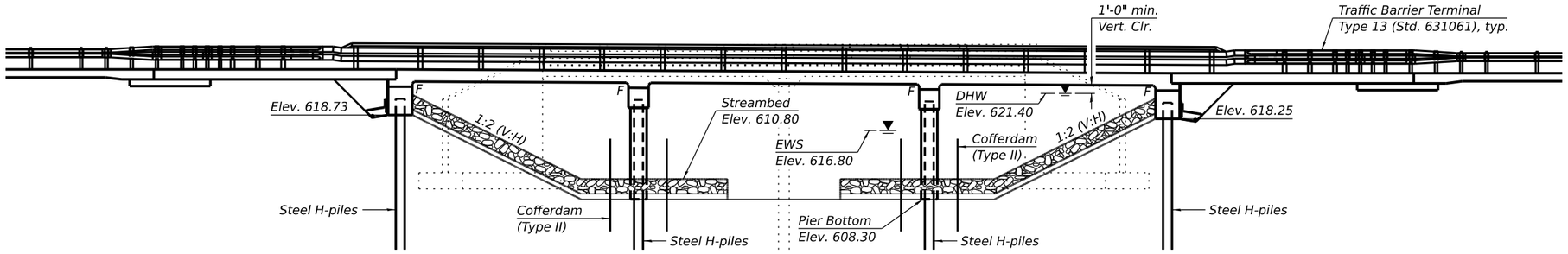
Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: Temporary sheet piling will be necessary for staged construction. The soils within the embedment depth do not exceed 4.5 tsf, therefore temporary sheet piling is feasible and the pay item TEMPORARY SHEET PILING should be used.

Benchmarks: BM: Cut square on top of SE abutment of S.N. 038-0017, Station 619+93.71, 16.89' Right of ℄ Route SBI-1, Elevation = 624.04

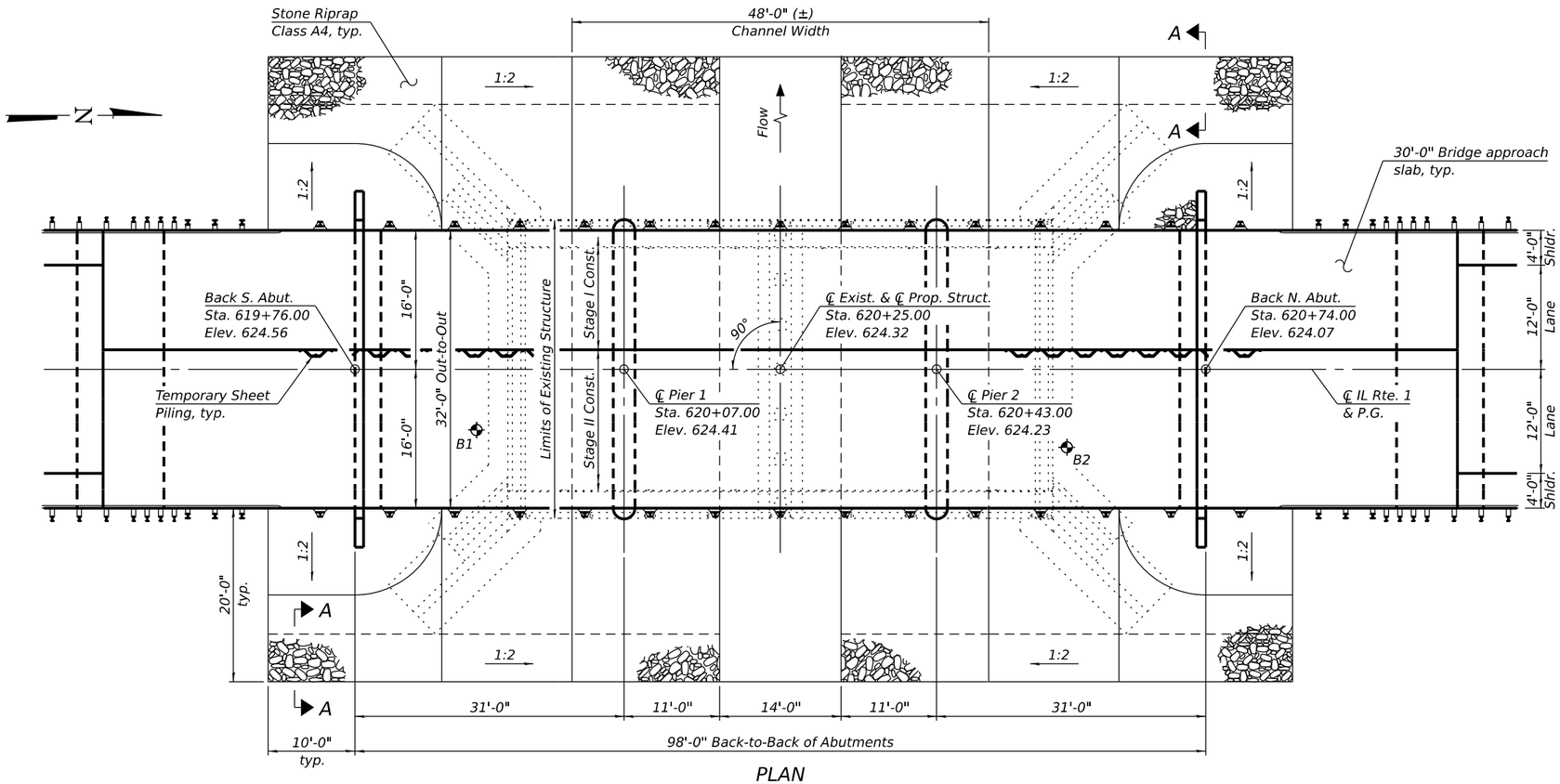
Existing Structure: S.N. 038-0017 was originally constructed in 1918 as part of Route SBI-1, Section F.15d at Station 620+25.00. The single-span structure was reconstructed in 1954 as Section J-15d-BY with a new reinforced concrete slab superstructure supported on the existing closed abutments with spread footings. The existing abutments were widened in-kind and a new pile bent pier consisting of precast concrete piles was built as part of the reconstruction. The two-span bridge has an out-to-out width of 34'-4" and a back-to-back abutments length of 62'-9" with no skew. Existing structure to be removed and replaced.

Proposed structure to be built using stage construction.

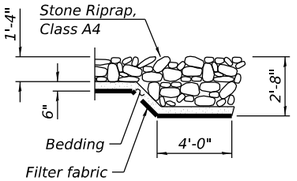
No salvage



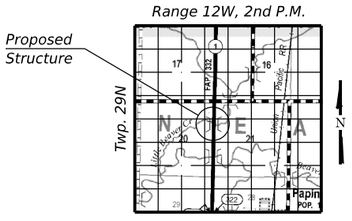
ELEVATION



PLAN



SECTION A-A



LOCATION SKETCH

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES

FIELD UNITS

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

HIGHWAY CLASSIFICATION

F.A.P. Rte. 332 (IL 1)
Functional Class: Other Principal Arterial
ADT: 2,014 (2025); 2,584 (2045)
ADTT: 318 (2025); 408 (2045)
DHV: 181 (2025)
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

LOADING HL-93

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

SEISMIC DATA

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

GENERAL PLAN & ELEVATION
IL 1 OVER LITTLE BEAVER CREEK
F.A.P. ROUTE 332 (IL 1) - SEC. (4BR-4)ES
IROQUOIS COUNTY
STA. 620+25.00
STRUCTURE NO. 038-0231

DESIGNED	-	MICHAEL A. PAULIONIS
CHECKED	-	NEPHTALI RIVERA-MARTINEZ
DRAWN	-	ANTHONY J. NOVELLO
CHECKED	-	____

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

5/5/2023 - 9:28:29 AM

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	(4BR-4)ES	IROQUOIS	__	__
		CONTRACT NO. 66K94		
		ILLINOIS	FED. AID PROJECT	

MODEL: 038O231-66K94-TSL-001
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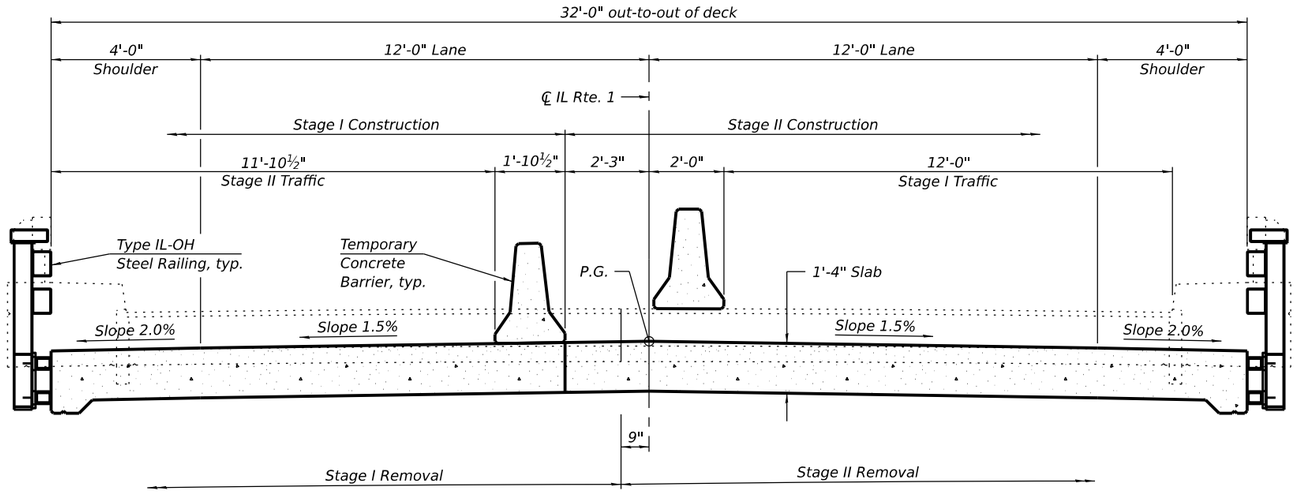
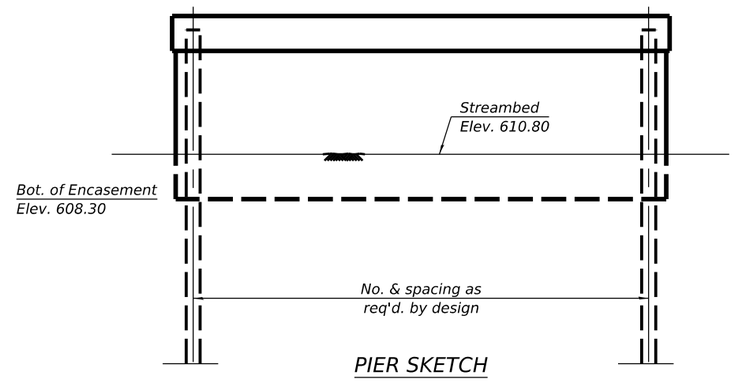
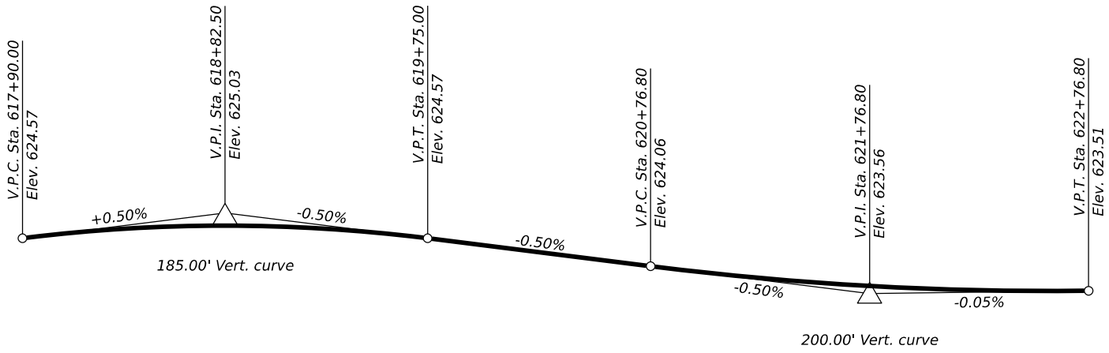


CROSS SECTION

(Looking North)

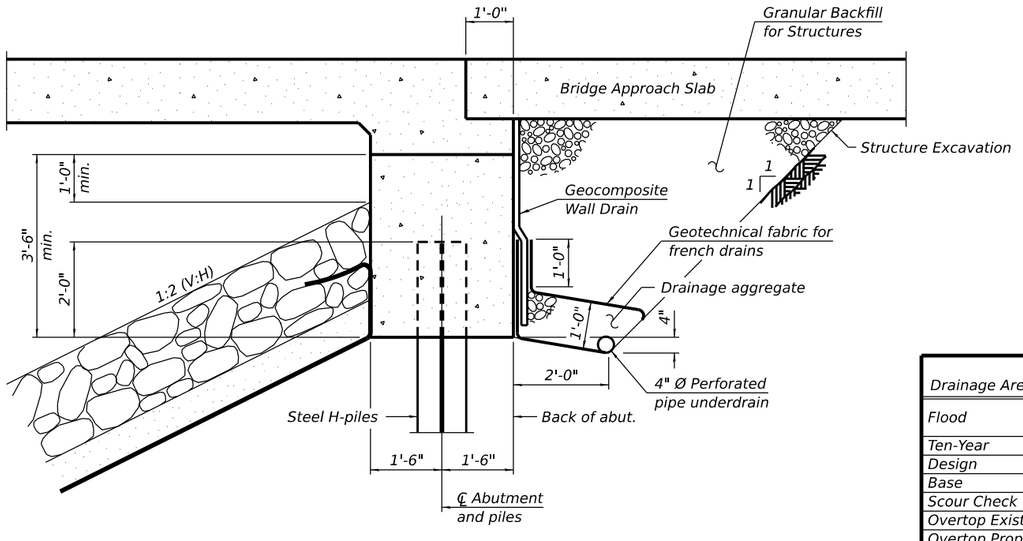


PIER SKETCH



PROFILE GRADE

(along ℄ of FAP 332 (IL 1))



SECTION THRU INTEGRAL ABUTMENT

WATERWAY INFORMATION

Drainage Area = 57.9 sq. mi.

Existing Overtopping Elev. = 623.45 @ Sta. 624+00.00
Proposed Overtopping Elev. = 623.38 @ Sta. 623+25.00

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
Ten-Year	10	1820	494	622	620.4	0.8	0.7	621.2	621.1
Design	50	2810	552	707	621.4	1.2	0.9	622.6	622.3
Base	100	3250	575	741	621.8	1.2	1.0	622.9	622.8
Scour Check	200	3710	578	775	622.1	1.4	1.2	623.5	623.4
Overtop Exist.	257	3870	578	---	622.3	1.5	---	623.7	---
Overtop Prop.	375	4110	---	798	622.5	---	1.2	---	623.7
Max. Calc.	500	4310	578	816	622.6	1.6	1.3	624.2	623.9

10 Year Velocity through Existing Bridge = 3.7 ft/sec.
10 Year Velocity through Proposed Bridge = 2.9 ft/sec.

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.) -. Abut.	Pier -	Pier -	-. Abut.	Item 113
Q100					
Q200					
Design					
Check					

DETAILS
IL 1 OVER LITTLE BEAVER CREEK
F.A.P. ROUTE 332 (IL 1) - SEC. (4BR-4)ES
IROQUOIS COUNTY
STA. 620+25.00
STRUCTURE NO. 038-0231

DESIGNED	-	MICHAEL A. PAULIONIS
CHECKED	-	NEPHTALI RIVERA-MARTINEZ
DRAWN	-	ANTHONY J. NOVELLO
CHECKED	-	____

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

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SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	(4BR-4)ES	IROQUOIS	__	__
		CONTRACT NO. 66K94		
	ILLINOIS	FED. AID PROJECT		

MODEL: 0380231-66K94-TSL-402
FILE NAME: pw:\\Bureau of Bridges and Structures\Projects\0380231_OBM\CADD Plans\0380231-66K94-TSL.dgn

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 8/25/20

ROUTE SBI-1 (IL 1) **DESCRIPTION** IL 1 over Little Beaver Creek, 1.2 miles North of Papineau Road **LOGGED BY** Larry Myers

SECTION J-15D-B-Y **LOCATION** NW 1/4, **SEC.** 21, **TWP.** 29N, **RNG.** 12W, 2nd **PM**,
Latitude 40.98718, **Longitude** -87.73216

COUNTY Iroquois **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 038-0017 (Exist.)
Station 620+25

BORING NO. 01 (S.E. Quad.)
Station 619+90
Offset 7.0 ft Rt.
Ground Surface Elev. 623.58 ft

Surface Water Elev. 614.54 ft
Stream Bed Elev. 612.19 ft

Groundwater Elev.:
First Encounter 614.1 ft ▼
Upon Completion 613.6 ft ▽
After ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Augered Bituminous, CA-6, Black Silty Clay Loam			
621.08			
Stiff Black Silty Clay Loam Fill			
-5	2		
	2 4	1.5 P	18
	1		
	2 4	1.8 P	23
614.08 ▼ ▽			
-10 Wood, Gravel, Construction Debris	18		
	6 5		42
611.58			
Stiff Gray Silty Clay	2		
	3 2	1.5 P	31
609.08			
-15 Loose Black & Gray Fine to Medium Angular Gravel - Loamy with Clay Pieces	2		
	1 2		34
	2		
	3 4		19
-20			
	2		
	3 4		17
Loose Black & Gray Fine to Medium Angular Gravel - Loamy with Clay Pieces *(continued)*			
	4		
	4 4		18
598.58 -25			
Very Stiff to Stiff Gray Clay	4		
	2 2	2.5 P	39
	3		
	4 5	2.7 S	30
-30			
	2		
	2 2	1.4 S	34
	2		
	3 2	1.4 S	33
-35			
	2		
	2 2	1.2 S	32
	2		
	2 2	1.2 S	33
584.08			
-40			

SOIL BORING 038-0017.GPJ IL_DOT.GDT 4/10/23

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 8/25/20

ROUTE SBI-1 (IL 1) **DESCRIPTION** IL 1 over Little Beaver Creek, 1.2 miles North of Papineau Road **LOGGED BY** Larry Myers

SECTION J-15D-B-Y **LOCATION** NW 1/4, **SEC.** 21, **TWP.** 29N, **RNG.** 12W, 2nd **PM**,
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STRUCT. NO. 038-0017 (Exist.)
Station 620+25

BORING NO. 01 (S.E. Quad.)
Station 619+90
Offset 7.0 ft Rt.
Ground Surface Elev. 623.58 ft

Surface Water Elev. 614.54 ft
Stream Bed Elev. 612.19 ft

Groundwater Elev.:
First Encounter 614.1 ft ▼
Upon Completion 613.6 ft ▽
After ____ **Hrs.** ____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Hard Gray Silty Clay Loam Till with Limestone Gravel Pieces		7		
		10	5.1	13
		12	S	
* Max Rimac @ 10% *(continued)*				
		70		
		38	11.5	12
		47	S*	
	578.58 -45			
Weathered & Reworked Limestone		44		
		100/5"		18
	576.58			
Auger Refusal at 47.0 Ft. End of Boring				
	-50			
	-55			
	-60			

SOIL BORING 038-0017.GPJ IL_DOT.GDT 4/10/23

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Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 9/1/20

ROUTE SBI-1 (IL 1) **DESCRIPTION** IL 1 over Little Beaver Creek, 1.2 miles North of Papineau Road **LOGGED BY** Larry Myers

SECTION J-15D-B-Y **LOCATION** NW 1/4, **SEC.** 21, **TWP.** 29N, **RNG.** 12W, 2nd **PM**, **Latitude** 40.98736, **Longitude** -87.73216

COUNTY Iroquois **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. 038-0017 (Exist.)
Station 620+25

BORING NO. 02 (N.E. Quad.)
Station 620+58
Offset 9.0 ft Rt.
Ground Surface Elev. 623.29 ft

Surface Water Elev. 614.54 ft
Stream Bed Elev. 612.19 ft

Groundwater Elev.:
First Encounter 581.3 ft ▼
Upon Completion 609.3 ft ▽
After ____ **Hrs.** ____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Augered Bituminous Pavement, CA-6 Fill, Brown Silty Clay Loam Fill				
	618.29 -5			
Stiff Gray to Black Silty Clay Fill		3		
		2 3	1.5 P	18
		1		
		2 3	1.5 P	26
	-10	1		
		1 2	1.0 P	26
	611.29			
Stiff to Medium Gray & Black Silty Clay with Sand & Gravel Layers (Alluvial Deposits)		WH		
	▽	2 1	1.0 P	25
WH = Weight of Hammer	-15	WH		
		1 1	0.8 P	28
	606.29			
Very Stiff Brownish Gray Clay with Minor Silt		3		
		6 7	3.7 S	26
	-20			
Very Stiff Brownish Gray Clay with Minor Silt *(continued)*		4		
		5 6	3.9 S	24
	601.29			
Hard Brownish Gray Clay with Silt Seams & Pockets		5		
		6 8	4.4 S	25
	-25	4		
		4 5	4.9 S	23
	596.29			
Stiff Gray Clay with some Silt Pockets / Layers		3		
		2 3	1.6 B	33
	-30	1		
		2 2	1.8 B	29
		1		
		1 2	1.6 B	33
WH = Weight of Hammer	-35	WH		
		1 2	1.4 B	32
		1		
		1 2	1.4 B	32
	583.79 -40			

SOIL BORING 038-0017.GPJ IL_DOT.GDT 4/10/23

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Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 9/1/20

ROUTE SBI-1 (IL 1) **DESCRIPTION** IL 1 over Little Beaver Creek, 1.2 miles North of Papineau Road **LOGGED BY** Larry Myers

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Latitude 40.98736, **Longitude** -87.73216

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STRUCT. NO. 038-0017 (Exist.)
Station 620+25

BORING NO. 02 (N.E. Quad.)
Station 620+58
Offset 9.0 ft Rt.
Ground Surface Elev. 623.29 ft

Surface Water Elev. 614.54 ft
Stream Bed Elev. 612.19 ft

Groundwater Elev.:
First Encounter 581.3 ft ▼
Upon Completion 609.3 ft ▽
After ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	6			Hard Gray Silty Clay Loam Till with Heavy Sand & Gravel Pieces and some Loamy Sand Layers *(continued)*
	12	6.4	10	
	18	S		
▼				
	19			
	25	>4.5	10	
	20	P		
578.29 -45				
	51			Weathered & Reworked Limestone with some Clay Matrix
	100/5"		13	
576.29				
				Auger Refusal at 47.0 Ft. End of Boring
-50				
-55				
-60				

SOIL BORING 038-0017.GPJ IL_DOT.GDT 4/10/23

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

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====038-0231

South Abutment

Base of Substruct. Elev. (or ground surf for bents	618.72	ft.
Pile or Shaft Dia.	12	inches
Boring Number	Boring 01	
Top of Boring Elev.	623.58	ft.
Approximate Fixity Elev.	612.72	ft.

Individual Site Class Definition:

N (bar):	17	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	31	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	3.64	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	621.1	2.50	5	1.00	B
	616.6	4.50	6	1.50	
	614.1	2.50	6	1.80	B
1.1	611.6	2.50	11		B
3.6	609.1	2.50	5	1.50	B
6.1	606.6	2.50	3		
8.6	604.1	2.50	7		
11.1	601.6	2.50	7		
14.1	598.6	3.00	8		B
16.1	596.6	2.00	4	2.50	
18.6	594.1	2.50	9	2.70	
21.1	591.6	2.50	4	1.40	
23.6	589.1	2.50	5	1.40	
26.1	586.6	2.50	4	1.20	
28.6	584.1	2.50	4	1.20	B
31.1	581.6	2.50	22	5.10	
34.1	578.6	3.00	85	11.50	B
100.0	512.7	65.90	100	50.00	R

South Pier

Base of Substruct. Elev. (or ground surf for bents	610.8	ft.
Pile or Shaft Dia.	12	inches
Boring Number	Boring 01	
Top of Boring Elev.	623.58	ft.
Approximate Fixity Elev.	604.8	ft.

Individual Site Class Definition:

N (bar):	22	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	49	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	3.87	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	621.1	2.50	5	1.00	B
	616.6	4.50	6	1.50	
	614.1	2.50	6	1.80	B
	611.6	2.50	11		B
	609.1	2.50	5	1.50	B
	606.6	2.50	3		
0.7	604.1	2.50	7		
3.2	601.6	2.50	7		
6.2	598.6	3.00	8		B
8.2	596.6	2.00	4	2.50	
10.7	594.1	2.50	9	2.70	
13.2	591.6	2.50	4	1.40	
15.7	589.1	2.50	5	1.40	
18.2	586.6	2.50	4	1.20	
20.7	584.1	2.50	4	1.20	B
23.2	581.6	2.50	22	5.10	
26.2	578.6	3.00	85	11.50	B
100.0	504.8	73.80	100	50.00	R

North Pier

Base of Substruct. Elev. (or ground surf for bents	610.8	ft.
Pile or Shaft Dia.	12	inches
Boring Number	Boring 02	
Top of Boring Elev.	623.29	ft.
Approximate Fixity Elev.	604.8	ft.

Individual Site Class Definition:

N (bar):	21	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	NA	(Blows/ft.)	NA
s_u (bar):	3.87	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	618.3	5.00	5	1.00	B
	616.3	2.00	5	1.50	
	613.8	2.50	5	1.50	
	611.3	2.50	3	1.00	B
	608.8	2.50	3	1.00	
	606.3	2.50	2	0.75	B
1.0	603.8	2.50	13	3.70	
3.5	601.3	2.50	11	3.90	B
6.0	598.8	2.50	14	4.40	
8.5	596.3	2.50	9	4.90	B
11.0	593.8	2.50	5	1.60	
13.5	591.3	2.50	4	1.80	
16.0	588.8	2.50	3	1.60	
18.5	586.3	2.50	3	1.40	
21.0	583.8	2.50	3	1.40	B
23.5	581.3	2.50	30	6.40	
26.5	578.3	3.00	45	4.50	B
100.0	504.8	73.50	100	50.00	R

North Abutment

Base of Substruct. Elev. (or ground surf for bents	618.24	ft.
Pile or Shaft Dia.	12	inches
Boring Number	Boring 02	
Top of Boring Elev.	623.29	ft.
Approximate Fixity Elev.	612.24	ft.

Individual Site Class Definition:

N (bar):	15	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	NA	(Blows/ft.)	NA
s_u (bar):	3	(ksf)	Soil Site Class C <----Controls

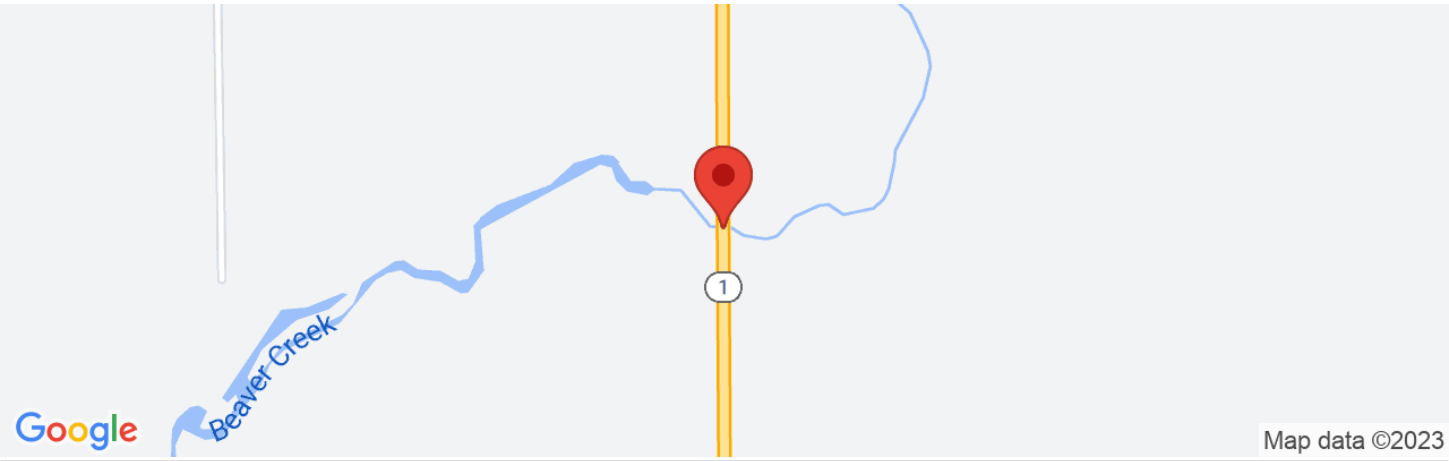
Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	618.3	5.00	5	1.00	B
	616.3	2.00	5	1.50	
	613.8	2.50	5	1.50	
1.0	611.3	2.50	3	1.00	B
3.5	608.8	2.50	3	1.00	
6.0	606.3	2.50	2	0.75	B
8.5	603.8	2.50	13	3.70	
11.0	601.3	2.50	11	3.90	B
13.5	598.8	2.50	14	4.40	
16.0	596.3	2.50	9	4.90	B
18.5	593.8	2.50	5	1.60	
21.0	591.3	2.50	4	1.80	
23.5	588.8	2.50	3	1.60	
26.0	586.3	2.50	3	1.40	
28.5	583.8	2.50	3	1.40	B
31.0	581.3	2.50	30	6.40	
34.0	578.3	3.00	45	4.50	B
100.0	512.3	66.00	100	50.00	R

Global Site Class Definition: Substructures 1 through 4

N (bar):	19	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	68	(Blows/ft.)	Soil Site Class C <----Controls
s_u (bar):	3.59	(ksf)	Soil Site Class C

038-0231

Latitude, Longitude: 40.98723570, -87.73219691



Date	5/9/2023, 1:31:42 PM
Design Code Reference Document	ASCE7-16
Risk Category	I
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	0.128	MCE_R ground motion. (for 0.2 second period)
S_1	0.074	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.167	Site-modified spectral acceleration value
S_{M1}	0.111	Site-modified spectral acceleration value
S_{DS}	0.111	Numeric seismic design value at 0.2 second SA
S_{D1}	0.074	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.3	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.062	MCE_G peak ground acceleration
F_{PGA}	1.3	Site amplification factor at PGA
PGA_M	0.081	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.128	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.137	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.074	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.085	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.062	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.936	Mapped value of the risk coefficient at short periods

Type	Value	Description
C_{R1}	0.871	Mapped value of the risk coefficient at a period of 1 s
C_V	0.7	Vertical coefficient

Pile Design Table for S. Abutment – Boring B-01 (S.E. Quad.) SN: 038-0231			
Pile Size	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	*Estimated Pile Length (Ft.)
Steel HP 8x36	286	157	45
Steel HP 10x42	335	184	45
Steel HP 10x57	454	250	45
Steel HP 12x53	418	230	45
Steel HP 12x63	497	273	45
Steel HP 12x74	589	324	45
Steel HP 12x84	664	365	45
Steel HP 14x73	578	318	45
Steel HP 14x89	705	388	45
* Estimated pile length is calculated from 1 foot below the top of rock elevation (576.58) to the pile cutoff elevation.			

Pile Design Table for S. Pier – Boring B-01 (S.E. Quad.) SN: 038-0231			
Pile Size	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	*Estimated Pile Length (Ft.)
Steel HP 8x36	286	157	45
Steel HP 10x42	335	184	45
Steel HP 10x57	454	250	45
Steel HP 12x53	418	230	45
Steel HP 12x63	497	273	45
Steel HP 12x74	589	324	45
Steel HP 12x84	664	365	45
Steel HP 14x73	578	318	45
Steel HP 14x89	705	388	45
* Estimated pile length is calculated from 1 foot below the top of rock elevation (576.58) to the pile cutoff elevation.			

Pile Design Table for N. Abutment – Boring B-02 (N.E. Quad.) SN: 038-0231			
Pile Size	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	*Estimated Pile Length (Ft.)
Steel HP 8x36	286	157	45
Steel HP 10x42	335	184	45
Steel HP 10x57	454	250	45
Steel HP 12x53	418	230	45
Steel HP 12x63	497	273	45
Steel HP 12x74	589	324	45
Steel HP 12x84	664	365	45
Steel HP 14x73	578	318	45
Steel HP 14x89	705	388	45
* Estimated pile length is calculated from 1 foot below the top of rock elevation (576.29) to the pile cutoff elevation.			

Pile Design Table for N. Pier – Boring B-02 (N.E. Quad.) SN: 038-0231			
Pile Size	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	*Estimated Pile Length (Ft.)
Steel HP 8x36	286	157	45
Steel HP 10x42	335	184	45
Steel HP 10x57	454	250	45
Steel HP 12x53	418	230	45
Steel HP 12x63	497	273	45
Steel HP 12x74	589	324	45
Steel HP 12x84	664	365	45
Steel HP 14x73	578	318	45
Steel HP 14x89	705	388	45
* Estimated pile length is calculated from 1 foot below the top of rock elevation (576.29) to the pile cutoff elevation.			

Soil Type	Elevation	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)
Brown Silty Clay Loam Fill	623.29 - 618.29	-	1	100	0.01	118	55.6
Stiff Gray to Black Silty Clay Fill	618.29 - 611.29	-	1	500	0.007	120	57.6
Stiff to Medium Gray and Black Silty Clay	611.29 - 606.29	-	0.8	100	0.01	120	57.6
Very Stiff Brownish Gray Clay	606.29 - 601.29	-	3.7	1000	0.005	120	57.6
Hard Brownish ray Clay with Silt Seams	601.29 - 596.29	-	4.4	2000	0.004	120	57.6
Stiff Gray Clay with Silt Layers	596.29 - 583.79	-	1.4	500	0.007	120	57.6
Hard Gray Silty Clay Loam Till	583.79 - 578.29	-	4.5	2000	0.007	120	57.6

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========	038-0231		TOTAL STRUCTURE LENGTH==========	98.00	FT
STRUCTURE TYPE ==========	MULTI-SPAN		NUMBER OF SPANS ==========	3	
STRUCTURE SKEW==========	0	DEGREES	END SPAN LENGTH ==========	31.00	FT
SUPER. DATA IN REFERENCE TO SUB. DATA ====	ABUT 1		ADJACENT INTERIOR SPAN LENGTH ==========	36.00	FT

SUPERSTRUCTURE DATA (END OR MAIN SPAN)

BEAM TYPE ==========	SLAB BRIDGE	
SLAB THICKNESS ==========	16.00	IN
SLAB F'C ==========	4.00	KSI

SUPERSTRUCTURE DATA (ADJACENT SPAN)

SLAB THICKNESS ==========	16.00	IN
SLAB F'C ==========	4.00	KSI

ABUTMENT #1 DATA

ABUTMENT NAME ==========	South	
ABUTMENT REFERENCE BORING ==========	B-1	
BOTTOM OF ABUTMENT ELEVATION ==========	618.73	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	6	
PILE SPACING PERP. TO CL ==========	5.5	FT

ABUTMENT #2 DATA

ABUTMENT NAME ==========	North	
ABUTMENT REFERENCE BORING==========	B-2	
BOTTOM OF ABUTMENT ELEVATION==========	618.25	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	
PILE SPACING PERP. TO CL ==========	5.5	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)*
616.58	2.15	1.5		
614.08	2.50	1.8		
611.58	2.50		11	2.5
609.08	2.50	1.5		
608.73	0.35	1.5		

10.00 FT = TOTAL DEPTH ENTERED

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)*
616.29	1.96	1.5		
613.79	2.50	1.5		
611.29	2.50	1.0		
608.79	2.50	1.00		
608.25	0.54	0.80		

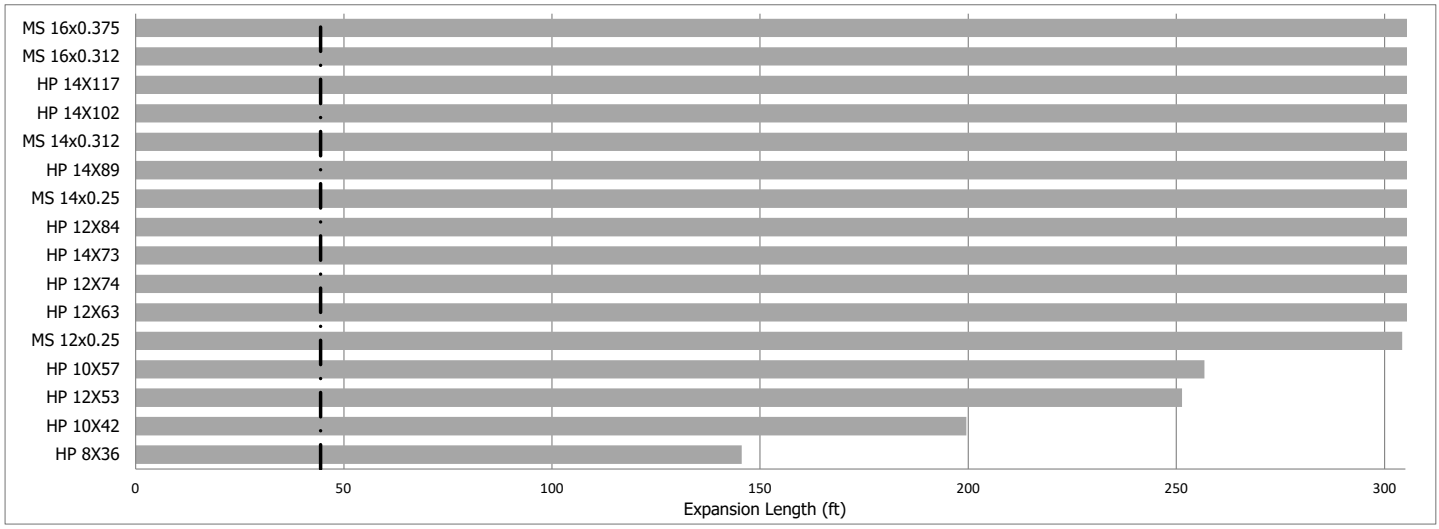
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1=======	1.82	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2=======	1.21	TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.82])==========	1.11		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*1.21])==========	0.92	

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1.11*6*0+0.92*6*98]/[1.11*6+0.92*6]========== 44.47 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [0.92*6*0+1.11*6*98]/[0.92*6+1.11*6]========== 53.53 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.)

SCOUR ANALYSIS FOR NON-GRANULAR CONDITIONS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/28/2015

STRUCTURE NUMBER ========== 038-0231 (0017 Exist.)
SUBSTRUCTURE UNIT ========== Pier 1 (South)
BORING LOCATION RELATIVE TO SUBSTRUCURE UNIT========== NEAR
BOTTOM OF SUBSTRUCTURE ELEVATION ========== 608.3
GROUND SURFACE ELEVATION AT SUBSTRUCTURE ========== 610.8
Q100 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q100) ======= 14.20 FT
Q200 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q200) ======= 15.54 FT

LAYER NO.	BOTTOM OF LAYER ELEV. (FT)	DEPTH BELOW SURFACE (FT)	LAYER THICK. (FT)	Qu VALUE (TSF)	ROCK TYPE (IF APPLICABLE)	SCOUR REDUCTION (%)	SCOUR RESISTANCE OF LAYER (FT)	REMAINING Q100 SCOUR BELOW LAYER (FT)	REMAINING Q200 SCOUR BELOW LAYER (FT)
1	609.1	1.7	1.7	1.50		50%	3.44	10.76	12.10
2	598.6	12.2	10.5	0.00		0%	10.50	0.26	1.60
3	596.6	14.2	2.0	2.50		50%	4.00	0.00	0.00
4	594.1	16.7	2.5	2.70		50%	5.00		
5	591.6	19.2	2.5	1.40		25%	3.33		
6	589.1	21.7	2.5	1.40		25%	3.33		
7	586.6	24.2	2.5	1.20		25%	3.33		
8	584.1	26.7	2.5	1.50		50%	5.00		
9	581.6	29.2	2.5	5.10		50%	5.00		
10	578.6	32.2	3.0	11.50		50%	6.00		
					LIMESTONE	100%	INFINITE		

STRENGTH LIMIT STATE ADJUSTED SCOUR (ADJ. Q100)

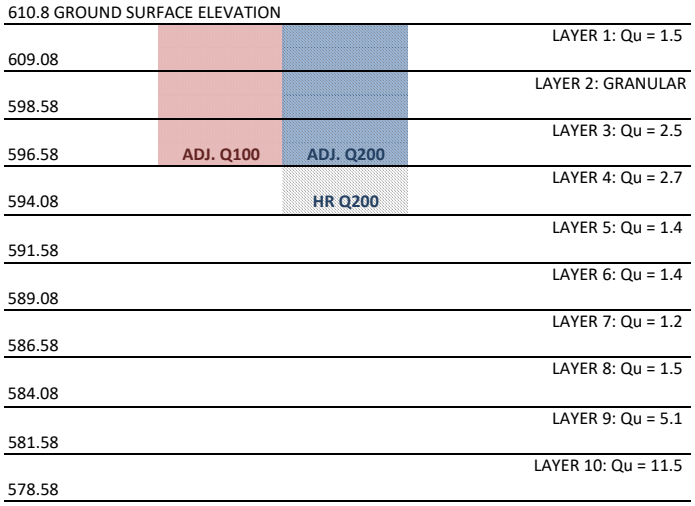
UNADJUSTED Q100 SCOUR DEPTH ==========	596.6	FT
LAYER IN WHICH ADJUSTED Q100 SCOUR STOPS ==========	LAYER 3	
DEPTH INTO LAYER 3 AT WHICH SCOUR STOPS ==========	0.1	FT
DEPTH BELOW GROUND SURFACE TO ADJUSTED Q100 SCOUR =====	12.4	FT
TOTAL % ADJUSTMENT OF Q100 SCOUR = [1-(12.35/14.2)]*100====	13.0%	
Q100 SCOUR ELEVATION ==========	**598.5**	FT

EXTREME EVENT II ADJUSTED SCOUR (ADJ. Q200)

UNADJUSTED Q200 SCOUR DEPTH ==========	595.3	FT
LAYER IN WHICH ADJUSTED Q200 SCOUR STOPS ==========	LAYER 3	
DEPTH INTO LAYER 3 AT WHICH SCOUR STOPS ==========	0.8	FT
DEPTH BELOW GROUND SURFACE OF ADJUSTED Q200 SCOUR =====	13.0	FT
TOTAL % ADJUSTMENT OF Q200 SCOUR = [1-(13.02/15.54)]*100===	16.2%	
Q200 SCOUR ELEVATION ==========	**597.8**	FT

LEGEND FOR SCOUR FIGURE
- ADJUSTED Q100 SCOUR
- RAW Q100 SCOUR PER APPROVED HYDRAULIC REPORT
- ADJUSTED Q200 SCOUR
- RAW Q200 SCOUR PER APPROVED HYDRAULIC REPORT

SCOUR FIGURE



SCOUR ANALYSIS FOR NON-GRANULAR CONDITIONS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 5/28/2015

STRUCTURE NUMBER	038-0231 (0017 Exist.)	
SUBSTRUCTURE UNIT	Pier 2 (North)	
BORING LOCATION RELATIVE TO SUBSTRUCURE UNIT	NEAR	
BOTTOM OF SUBSTRUCTURE ELEVATION	608.3	
GROUND SURFACE ELEVATION AT SUBSTRUCTURE	610.8	
Q100 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q100)	14.20	FT
Q200 SCOUR DEPTH AT SUBSTRUCTURE PER APPROVED HYDRAULIC REPORT (HR Q200)	15.54	FT

LAYER NO.	BOTTOM OF LAYER ELEV. (FT)	DEPTH BELOW SURFACE (FT)	LAYER THICK. (FT)	Qu VALUE (TSF)	ROCK TYPE (IF APPLICABLE)	SCOUR REDUCTION (%)	SCOUR RESISTANCE OF LAYER (FT)	REMAINING Q100 SCOUR BELOW LAYER (FT)	REMAINING Q200 SCOUR BELOW LAYER (FT)
1	608.8	2.0	2.0	1.00		25%	2.68	11.52	12.86
2	606.3	4.5	2.5	0.80		25%	3.33	8.19	9.53
3	603.8	7.0	2.5	3.70		50%	5.00	3.19	4.53
4	601.3	9.5	2.5	3.90		50%	5.00	0.00	0.00
5	598.8	12.0	2.5	4.40		50%	5.00		
6	596.3	14.5	2.5	4.90		50%	5.00		
7	593.8	17.0	2.5	1.60		50%	5.00		
8	591.3	19.5	2.5	1.80		50%	5.00		
9	588.8	22.0	2.5	1.60		50%	5.00		
10	586.3	24.5	2.5	1.40		25%	3.33		

STRENGTH LIMIT STATE ADJUSTED SCOUR (ADJ. Q100)

UNADJUSTED Q100 SCOUR DEPTH	596.6	FT
LAYER IN WHICH ADJUSTED Q100 SCOUR STOPS	LAYER 4	
DEPTH INTO LAYER 4 AT WHICH SCOUR STOPS	1.6	FT
DEPTH BELOW GROUND SURFACE TO ADJUSTED Q100 SCOUR	8.6	FT
TOTAL % ADJUSTMENT OF Q100 SCOUR = [1-(8.6/14.2)]*100	39.4%	
Q100 SCOUR ELEVATION	**602.2**	FT

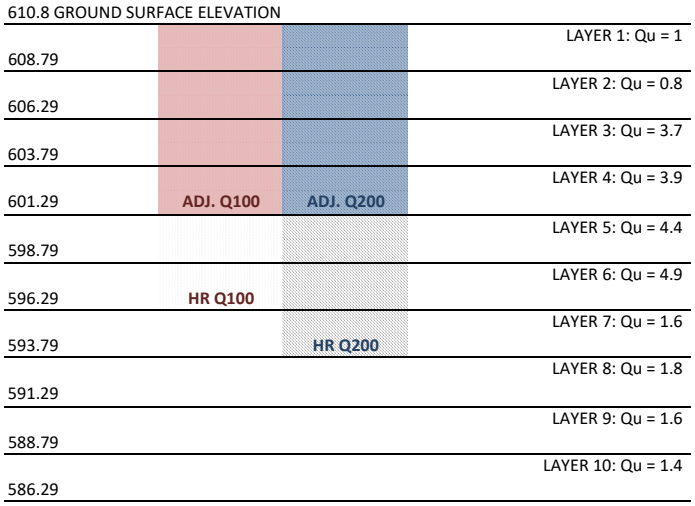
EXTREME EVENT II ADJUSTED SCOUR (ADJ. Q200)

UNADJUSTED Q200 SCOUR DEPTH	595.3	FT
LAYER IN WHICH ADJUSTED Q200 SCOUR STOPS	LAYER 4	
DEPTH INTO LAYER 4 AT WHICH SCOUR STOPS	2.3	FT
DEPTH BELOW GROUND SURFACE OF ADJUSTED Q200 SCOUR	9.3	FT
TOTAL % ADJUSTMENT OF Q200 SCOUR = [1-(9.27/15.54)]*100	40.3%	
Q200 SCOUR ELEVATION	**601.5**	FT

LEGEND FOR SCOUR FIGURE

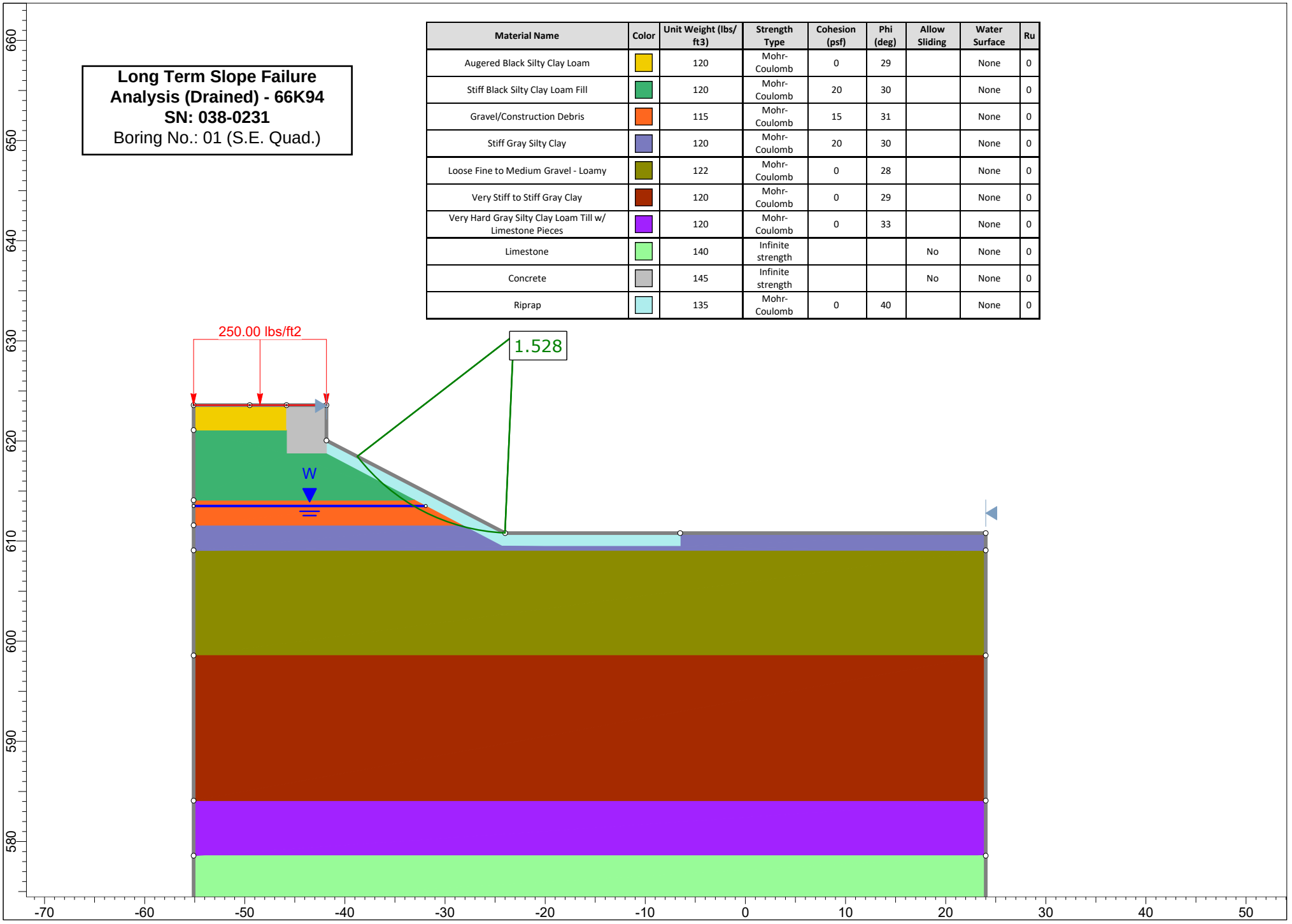
- ADJUSTED Q100 SCOUR
- RAW Q100 SCOUR PER APPROVED HYDRAULIC REPORT
- ADJUSTED Q200 SCOUR
- RAW Q200 SCOUR PER APPROVED HYDRAULIC REPORT

SCOUR FIGURE

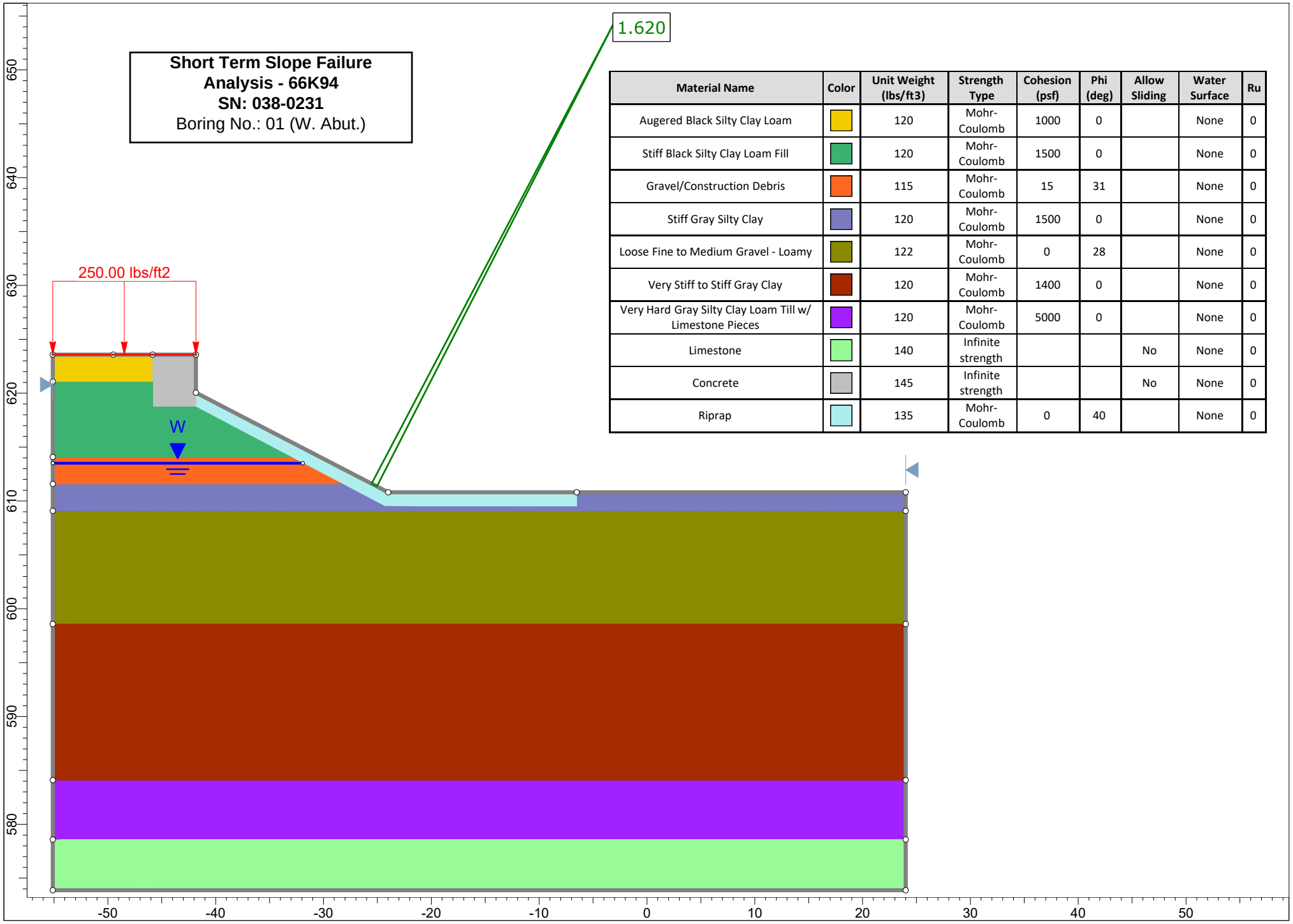


Long Term Slope Failure Analysis (Drained) - 66K94
SN: 038-0231
Boring No.: 01 (S.E. Quad.)

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
Augered Black Silty Clay Loam		120	Mohr-Coulomb	0	29		None	0
Stiff Black Silty Clay Loam Fill		120	Mohr-Coulomb	20	30		None	0
Gravel/Construction Debris		115	Mohr-Coulomb	15	31		None	0
Stiff Gray Silty Clay		120	Mohr-Coulomb	20	30		None	0
Loose Fine to Medium Gravel - Loamy		122	Mohr-Coulomb	0	28		None	0
Very Stiff to Stiff Gray Clay		120	Mohr-Coulomb	0	29		None	0
Very Hard Gray Silty Clay Loam Till w/ Limestone Pieces		120	Mohr-Coulomb	0	33		None	0
Limestone		140	Infinite strength			No	None	0
Concrete		145	Infinite strength			No	None	0
Riprap		135	Mohr-Coulomb	0	40		None	0



Short Term Slope Failure
Analysis - 66K94
SN: 038-0231
Boring No.: 01 (W. Abut.)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
Augered Black Silty Clay Loam		120	Mohr-Coulomb	1000	0		None	0
Stiff Black Silty Clay Loam Fill		120	Mohr-Coulomb	1500	0		None	0
Gravel/Construction Debris		115	Mohr-Coulomb	15	31		None	0
Stiff Gray Silty Clay		120	Mohr-Coulomb	1500	0		None	0
Loose Fine to Medium Gravel - Loamy		122	Mohr-Coulomb	0	28		None	0
Very Stiff to Stiff Gray Clay		120	Mohr-Coulomb	1400	0		None	0
Very Hard Gray Silty Clay Loam Till w/ Limestone Pieces		120	Mohr-Coulomb	5000	0		None	0
Limestone		140	Infinite strength			No	None	0
Concrete		145	Infinite strength			No	None	0
Riprap		135	Mohr-Coulomb	0	40		None	0