Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date: 10/09/2023	**Proposed SN:** 027-0105	**Route:**	F.A.P. Route 796
Revised Date: 06/18/24	**Existing SN:** 027-0074	**Section:**	(106BR-2)BR
Geotechnical Engineer: Rubino Engineering (Report No. G23.049)		**County:**	Ford
Structural Engineer: HDR		**Contract:**	66B58

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): The proposed bridge configuration of IL 115 over N Fork Vermillion Tributary consists of a single span IL36-2438 PPC Beam structure that spans 77 feet 10 and 1/4 inches, has an out-to-out deck width of 34 feet 10 inches, and a 26 degree skew. The approved TS&L drawing supplied by HDR dated 3/28/2024 indicates that the proposed bridge will contain integral abutments. Please reference the TS&L drawing attached herein.

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): The plans indicate that the existing structure (SN 027-0074) consists of a single span with 27" PPC deck beams resting on bearing pads. The structure is skewed 26 degrees and is 69'-0" long by 33'-0" wide. The substructure consists of concrete spill-thru abutments supported on concrete piles.

Two soil borings (Boring 1 at the South Abutment and Boring 2 at the North Abutment) were conducted by IDOT on October 27 and October 28 of 2009 and supplied to Rubino. Please reference the Boring Logs attached herein.

Beneath the augered shoulder stone and silty clay loam till fill, soil conditions within Boring 1 and Boring 2 generally consisted of stiff to very stiff cohesive fill, medium to hard silty clay/loam, very soft brown silt, hard silty clay loam till, stiff silty loam till, dense to very dense fine to coarse sand, soft to medium silty clay loess, and very stiff to hard silty/sandy clay loam/clay loam till. The soil profile generally consisted of cohesive soils with an interbedded layer of granular soils. Please see the Subsurface Soil Profile and Soil Boring Logs attached herein for more detailed information.

Rubino does not recommend additional subsurface exploration at this time for the proposed structure.

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 approved TS&L, significant fills are not proposed for this structure/project.

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: Based on the approved TS&L, cuts are proposed for the proposed abutment slopewalls. Rubino has conducted a slope stability analysis at the north abutment slopewall utilizing Boring 2. In slope stability analyses, the drained (long-term) conditions control over the undrained (short-term) conditions. Rubino used the slope stability program Stedwin Version 2.90 to run the Modified Biship Method. A factor of safety of 2.62 was achieved in the drained condition and a factor of safety of 3.17 was achieved in the undrained condition. These results meet the 2020 IDOT Geotechnical Manual requirement for a factor of safety greater than or equal to 1.7 when using field rimac test data. No additional analysis or treatment is recommended. Please reference the slope stability analyses results attached herein.

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: The approved TS&L depicts the abutment end slopes as riprapped with Class A4 riprap. Per the 2023 IDOT Bridge Manual, based on the abutment end slopes being riprapped, there is no scour loss at the abutments. Rubino recommends that the foundation scour elevations be the bottom of the abutments (elevation 652.68 feet for each substructure).

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: The seismic data is as follows: Seismic Site Class = D; Seismic Performance Zone = SPZ 1; Design Spectral Acceleration at 0.2 sec. (SDS) = 0.179; Design Spectral Acceleration a 1.0 sec. (SD1) = 0.11. Liquefaction is not applicable because the SPZ = 1.

Please see the Seismic Site Class Determination results attached herein. Due to the boring logs not extending to bedrock, Rubino estimated if bedrock would be encountered within 100 feet of the bottom of substructure elevations. The Illinois State Geology Survey does not have a bedrock quadrangle map for Ford County. Based on ILWATER

well logs in the vicinity of the project site, bedrock is not anticipated within 100 feet of the bottom of substructure elevations.

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: The approved TS&L depicts piles as the desired foundation option for the abutments. Based on the subsurface information in the supplied soil borings, Rubino recommends driven metal shell piles at each abutment. Rubino has provided pile design tables attached herein for various metal shell pile sizes. Per OSEH Inc. on April 28, 2023, preliminary pile loads at each abutment pile assuming six (6) piles per abutment are: Strength I = 201 kips; Service I = 146 kips.

Conical tips are recommended due to Rubino anticipating the piles being driven through hard, dense, and very dense strata of soil. This recommendation was made in reference to section 3.10.1.8 in the 2023 IDOT Bridge Manual.

Rubino recommends that at least one test pile be conducted for this project at either substructure due to metal shell piles being the recommended foundation type. This recommendation was made in reference to section 3.10.1.7 in the 2023 IDOT Bridge Manual.

The approved TS&L states that integral abutments are proposed for this structure. Please see the Integral Abutment Feasibility summary attached herein for a discussion regarding integral abutments.

The proposed pile locations need to be checked for conflict with the existing abutment and existing pile system.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: Per the approved TS&L, the Estimated Water Surface Elevation (E.W.S.E.) is 644.01 feet. The bottom of each abutment is elevation 652.68 feet. Due to the E.W.S.E. being below the elevation of each substructure, at this time cofferdams are not necessary.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: The approved TS&L states that traffic will be detoured during construction. No sheeting, soil retention, or temporary construction slope will be necessary.

Benchmark: BM 2 – R.R. Spike in Telephone Pole at N.E. quadrant of S.N. 027-0074. Elev. 655.348

Existing Structure: S.N. 027-0074 constructed as F.A. Route 796 in 1981 under Sec. 106BR-2 at Station 1665+79. The existing structure consists of a single span with 27" P.P.C. deck beams resting on bearing pads. A bituminous overlay with Waterproofing Membrane System is provided on top of the beams. The structure is skewed 26°00'00" and is 69'-0" back-to-back abutments with a 32'-4" width measured face-to-face of railing. Substructure consists of concrete spill-thru abutments supported on concrete piles. Resurfacing was completed in 2000 under Sec. 106-RS-2.

Traffic to be detoured during construction.

No salvage.

WATERWAY INFORMATION

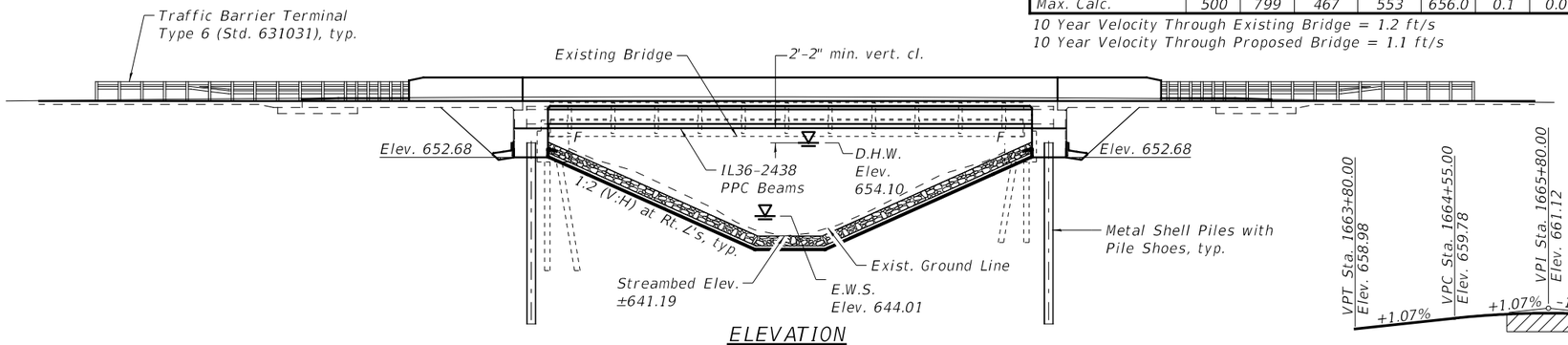
Existing Overtopping Elev. 657.40 @ Sta. 1661+00
Drainage Area = 11.4 sq. mi. Proposed Overtopping Elev. 657.40 @ Sta. 1661+00

Flood Event	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	368	317	328	652.1	0.0	0.0	652.1	652.1
Design	50	548	427	442	654.1	0.0	0.0	654.1	654.1
Base	100	623	466	486	654.9	0.0	0.0	654.9	654.9
Scour Check	200	699	467	526	655.5	0.0	0.0	655.5	655.5
Max. Calc.	500	799	467	553	656.0	0.1	0.0	656.0	656.0

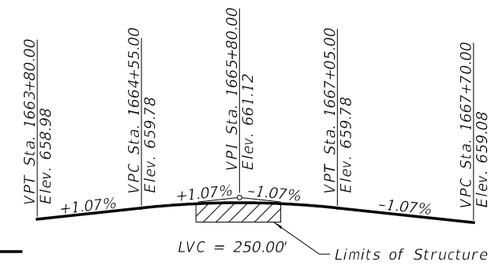
10 Year Velocity Through Existing Bridge = 1.2 ft/s
10 Year Velocity Through Proposed Bridge = 1.1 ft/s

DESIGN SCOUR ELEVATION TABLE

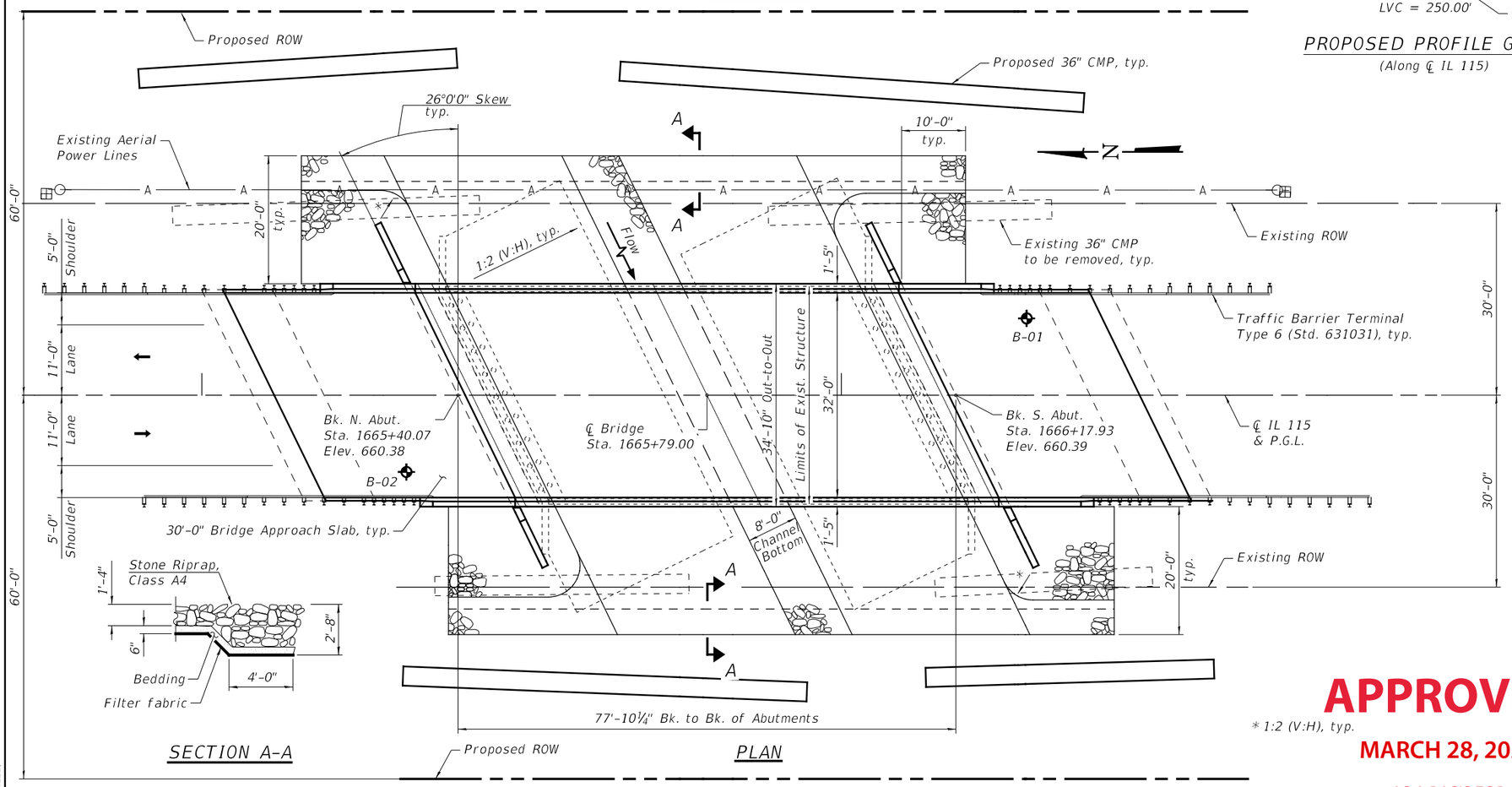
Event / Limit State	Design Scour Elevations (ft.) N. Abut.	Design Scour Elevations (ft.) S. Abut.	Item 113
Q100	652.68	652.68	8
Q200	652.68	652.68	
Design	652.68	652.68	
Check	652.68	652.68	



ELEVATION



PROPOSED PROFILE GRADE
(Along ℄ IL 115)



SECTION A-A

PLAN

* 1:2 (V:H), typ.

HIGHWAY CLASSIFICATION

F.A.P. 796 – IL Rte. 115
Functional Class: Major Collector
ADT: 550 (2021) 585 (2032)
ADTT: 55 (2021) 59 (2032)
DHV: 55
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.

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES

FIELD UNITS

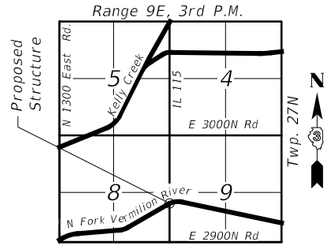
f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)

PRECAST PRESTRESSED UNITS

f'c = 8,500 psi
f'ci = 6,500 psi
fpu = 270,000 psi (0.6"∅ low lax. strands)
fpbt = 202,300 psi (0.6"∅ low lax. strands)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.110g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.179g
Soil Site Class = D



LOCATION SKETCH

APPROVED
MARCH 28, 2024
AS A BASIS FOR
PREPARATION OF DETAILED PLANS

GENERAL PLAN AND ELEVATION
IL RTE. 115 OVER NORTH FORK OF VERMILION RIVER TRIBUTARY
F.A.P. 796
SEC. (106BR-2) BR
FORD COUNTY
STATION 1665+79.00
STRUCTURE NO. 027-0105

HDR
9450 W. BRYN MAWR AVE.
ROSEMONT, IL 60018

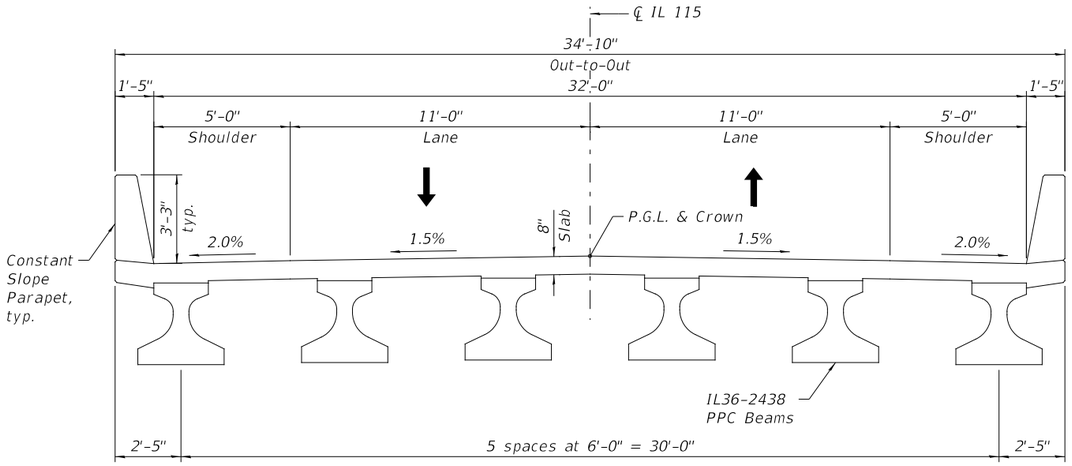
USER NAME = anagy		DESIGNED – MR		REVISED –	
		CHECKED – BHS		REVISED –	
PLOT SCALE = $SCALE$		DRAWN – AMN		REVISED –	
PLOT DATE = $DATE$		CHECKED – BHS		REVISED –	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

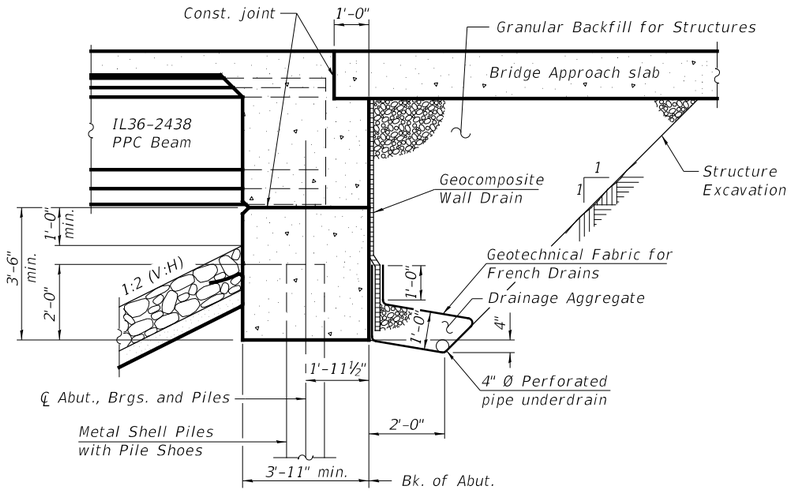
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
796	(106BR-2)BR	FORD	2	1
		CONTRACT NO. 66B58		
	ILLINOIS FED. AID PROJECT			

MODEL: $MODELNAME$
FILE NAME: $FILE$
$DATE$ $TIME$



CROSS SECTION

(Looking South)



SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. ℄'s)

APPROVED

MARCH 28, 2024

AS A BASIS FOR
PREPARATION OF DETAILED PLANS

DETAILS
IL RTE. 115 OVER NORTH FORK OF VERMILION RIVER TRIBUTARY
F.A.P. 796
SEC. (106BR-2) BR
FORD COUNTY
STATION 1665+79.00
STRUCTURE NO. 027-0105

MODEL: $MODELNAME$
FILE NAME: $FILE$

HDR
9450 W. BRYN MAWR AVE.
ROSEMONT, IL 60018

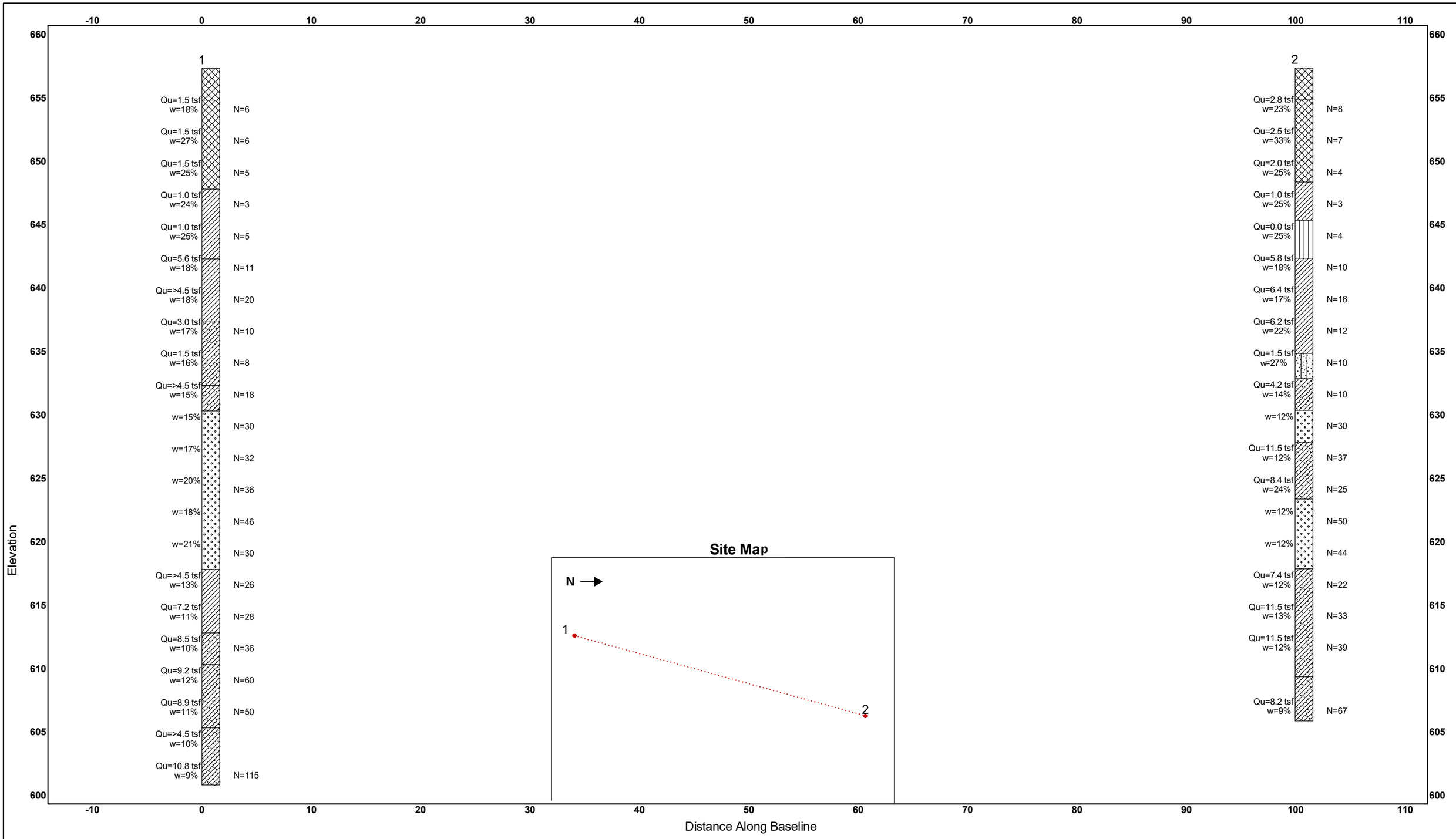
USER NAME = anagy	DESIGNED – MR	REVISED – _____	
	CHECKED – BHS	REVISED – _____	
PLOT SCALE = $SCALE$	DRAWN – AMN	REVISED – _____	
PLOT DATE = $DATE$	CHECKED – BHS	REVISED – _____	

$DATE$ $TIME$

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
796	(106BR-2)BR	FORD	2	2
		CONTRACT NO. 66B58		
	ILLINOIS	FED. AID PROJECT		



rubino ENGINEERING INC.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

Soil Profile

Rubino Job No.: G23.049
Project: PTB 197-022 WO21
Location: Station 1665+79.00
City, State: Ford County, IL
Client: IDOT District 3

Illinois Department of Transportation
Division of Highways
District #3, Ottawa

SOIL BORING LOG

Date 10/27/09

ROUTE FAP-796 (IL 115) **DESCRIPTION** IL 115 over Drainage Ditch, 3.7 miles South of IL 116 **LOGGED BY** Larry Myers

SECTION (106 BR-2)BR **LOCATION** S.E. 1/4, **SEC.** 8, **TWP.** 27N, **RNG.** 9E

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

STRUCT. NO. 027-0074 (Existing)
Station 1665+79

BORING NO. 1 (South Abut.)
Station 1666+29
Offset 12.00ft Lt.
Ground Surface Elev. 657.30 ft

Surface Water Elev. 644.50 ft
Stream Bed Elev. 641.22 ft

Groundwater Elev.:
First Encounter 627.3 ft ▼
Upon Completion 627.3 ft ▽
After ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Augered White Shoulder Stone & Gray Silty Clay Loam Till Fill
654.80				
	3			Stiff Gray Silty Clay Loam/Sandy Clay Loam Till Fill
	3 3	1.5 P	17.9	
-5				
	2			
	3 3	1.5 P	27.4	
	2			
	2 3	1.5 P	25.4	
647.80				
-10				Soft to Medium Gray & Brown Silty Clay Loess
	1			
	1 2	1.0 P	24.2	
	1			
	2 3	1.0 P	24.8	
642.30 -15				
	4			Hard Gray Silty Clay Loam Till
	4 7	5.6 S	17.6	
	7			
	10 10	>4.5 P	17.6	
637.30 -20				
	4			Very Stiff to Stiff Brownish Gray Silty Clay Loam/Clay Loam Till
	3 7	3.0 P	17.1	
	3			
	3 5	1.5 B	15.9	
632.30 -25				
	3			Hard Gray Silty Clay Loam/Silty Loam Till
	7 11	>4.5 P	14.6	
630.30				
	7			Dense Gray Fine to Coarse Sand with Minor Fine Gravel & Silt Layers & Silty Clay Loam Till Layers (washed sample 35'-36.5')
	14 16		15.2	
▼ -30				
	9			
	14 18		17.1	
	10			
	18 18		19.9	
-35				
	15			
	20 26		17.6	
	10			
	10 20		21.3	
617.80				
-40				Hard Gray Silty Clay Loam Till

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

BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
District #3, Ottawa

SOIL BORING LOG

Date 10/27/09

ROUTE FAP-796 (IL 115) **DESCRIPTION** IL 115 over Drainage Ditch, 3.7 miles South of IL 116 **LOGGED BY** Larry Myers

SECTION (106 BR-2)BR **LOCATION** S.E. 1/4, **SEC.** 8, **TWP.** 27N, **RNG.** 9E

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

STRUCT. NO. 027-0074 (Existing)
Station 1665+79

BORING NO. 1 (South Abut.)
Station 1666+29
Offset 12.00ft Lt.
Ground Surface Elev. 657.30 ft

Surface Water Elev. 644.50 ft
Stream Bed Elev. 641.22 ft

Groundwater Elev.:
First Encounter 627.3 ft ▼
Upon Completion 627.3 ft ▽
After ____ **Hrs.** ____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Hard Gray Silty Clay Loam Till *(continued)*		7		
		11	>4.5	12.6
		15	P	
		7		
		10	7.2	11.3
		18	S	
612.80				
Hard Brown Sandy Clay Loam Till	-45	10		
		18	8.5	10.4
		18	S	
610.30				
Hard Green Sandy Clay Loam Till with Large Gravel Pieces		10		
		22	9.2	12.2
		38	S	
	-50	12		
		20	8.9	11.3
		30	S	
605.30				
Hard Gray/Brown Sandy Clay Loam Till with Sand & Silt Pockets, Very Dense & Brittle		17		
		69	>4.5	10.2
		100/3"	P	
	-55	38		
		43	10.8	9.4
		72	S	
600.80				
End of Boring	-60			

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

Illinois Department of Transportation
Division of Highways
District #3, Ottawa

SOIL BORING LOG

Date 10/28/09

ROUTE FAP-796 (IL 115) **DESCRIPTION** IL 115 over Drainage Ditch, 3.7 miles South of IL 116 **LOGGED BY** Larry Myers

SECTION (106 BR-2)BR **LOCATION** S.E. 1/4, **SEC.** 8, **TWP.** 27N, **RNG.** 9E

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

STRUCT. NO. 027-0074 (Existing)
Station 1665+79

BORING NO. 2 (North Abut.)
Station 1665+32
Offset 12.00ft Rt.
Ground Surface Elev. 657.34 ft

Surface Water Elev. 644.5 ft
Stream Bed Elev. 641.22 ft

Groundwater Elev.:
First Encounter 627.3 ft ▼
Upon Completion 627.3 ft ▽
After ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Augered White Shoulder Stone & Black/Gray Silty Clay Loam Till Fill			
654.84			
Very Stiff Black & Gray Silty Clay/Silty Clay Loam Topsoil & Till Fill	3		
	4 4	2.8 P	22.5
-5			
	2		
	3 4	2.5 P	33.0
	1		
	2 2	2.0 P	25.3
648.34			
Medium to Stiff Gray Silty Clay/Loam			
-10			
	wh		
	1 2	1.0 P	24.5
645.34			
Very Soft Brown Silt with Minor Clay			
	wh		
	2 2	0 P	24.8
642.34 -15			
Hard Gray Silty Clay Loam Till	2		
	4 6	5.8 S	18.3
	5		
	7 9	6.4 S	17.3
-20			
Hard Gray Silty Clay Loam Till *(continued)*	4		
	5 7	6.2 S	22.2
634.84			
Stiff Gray Silty Loam Till with Heavy Silt Layers	2		
	4 6	1.5 P	26.7
632.84			
Hard Gray Silty Clay Loam Till -25	2		
	4 6	4.2 B	13.7
630.34			
Dense Gray Loamy Fine to Coarse Sand with Minor Till Seams	7		
	13 17		11.9
627.84			
Hard Gray Silty Clay Loam Till with ▼-30 Layers of Silt @ 34' & Free Water (sample 30'-31.5' max Rimac @ 5.0%)	9		
	13 24	11.5 S	11.9
	3		
	9 16	8.4 S	24.0
623.34			
Very Dense Gray Fine to Coarse Sand (washed sample 35'-36.5') -35	15		
	25 25		12.2
	10		
	20 24		12.4
617.84			
-40			

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

Illinois Department of Transportation
Division of Highways
District #3, Ottawa

SOIL BORING LOG

Date 10/28/09

ROUTE FAP-796 (IL 115) **DESCRIPTION** IL 115 over Drainage Ditch, 3.7 miles South of IL 116 **LOGGED BY** Larry Myers

SECTION (106 BR-2)BR **LOCATION** S.E. 1/4, **SEC.** 8, **TWP.** 27N, **RNG.** 9E

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

STRUCT. NO. 027-0074 (Existing)
Station 1665+79

BORING NO. 2 (North Abut.)
Station 1665+32
Offset 12.00ft Rt.
Ground Surface Elev. 657.34 ft

Surface Water Elev. 644.5 ft
Stream Bed Elev. 641.22 ft

Groundwater Elev.:
First Encounter 627.3 ft ▼
Upon Completion 627.3 ft ▽
After ____ **Hrs.** ____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Hard Gray Silty Clay Loam Till (sample 42.5'-46.5' max Rimac @ 5.0%) *(continued)*		7		
		9 13	7.4 S	11.5
		9		
		15 18	11.5 S	13.2
	-45	10		
		16 23	11.5 S	12.0
609.34				
Hard Brittle Gray Silty Clay Loam/Silty Loam Till	-50	18		
		28 39	8.2 S	9.3
605.84				
End of Boring	-55			
	-60			

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

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====G23.049 PTB 197-022 WO21 IL-115 over N Fork Vermillion Tributary

Substructure 1 - South Abutment

Base of Substruct. Elev. (or ground surf for bents)	654.11	ft.
Pile or Shaft Dia.	12	inches
Boring Number	Boring 1	
Top of Boring Elev.	657.3	ft.
Approximate Fixity Elev.	648.11	ft.

Individual Site Class Definition:

N (bar):	27 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	35 (Blows/ft.)	Soil Site Class D	<----Controls
s_u (bar):	3.8 (ksf)	Soil Site Class C	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	654.8	2.50	6	1.50	
	652.3	2.50	6	1.50	
	649.8	2.50	6	1.50	
0.3	647.8	2.00	5	1.50	B
2.8	645.3	2.50	3	1.00	
4.3	643.8	1.50	5	1.00	
5.8	642.3	1.50	5	1.00	B
8.3	639.8	2.50	11	5.60	
10.8	637.3	2.50	20	4.50	
13.3	634.8	2.50	10	3.00	
15.8	632.3	2.50	8	1.50	B
17.8	630.3	2.00	18	4.50	B
20.3	627.8	2.50	30		
22.8	625.3	2.50	32		
25.3	622.8	2.50	36		
27.8	620.3	2.50	46		
30.3	617.8	2.50	30		B
32.8	615.3	2.50	26	4.50	
35.3	612.8	2.50	28	7.20	B
37.8	610.3	2.50	36	8.50	B
40.3	607.8	2.50	60	9.20	
42.8	605.3	2.50	50	8.90	B
45.3	602.8	2.50	169	4.50	
47.3	600.8	2.00	115	10.80	B
100.0	548.1	52.69	115	10.80	B

Substructure 2 - North Abutment

Base of Substruct. Elev. (or ground surf for bents)	654.11	ft.
Pile or Shaft Dia.	12	inches
Boring Number	Boring 2	
Top of Boring Elev.	657.34	ft.
Approximate Fixity Elev.	648.11	ft.

Individual Site Class Definition:

N (bar):	25 (Blows/ft.)	Soil Site Class D	<----Controls
N_{ch} (bar):	NA (Blows/ft.)	NA	
s_u (bar):	0.29 (ksf)	Soil Site Class E	

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	654.8	2.50	8	2.80	
	652.3	2.50	8	2.80	
	649.8	2.50	7	2.50	
	648.3	1.50	4	2.00	B
1.3	646.8	1.50	3	1.00	
2.8	645.3	1.50	3	1.00	B
4.3	643.8	1.50	6	0.01	
5.8	642.3	1.50	4	0.01	B
8.3	639.8	2.50	10	5.80	
10.8	637.3	2.50	16	6.40	
13.3	634.8	2.50	12	6.20	B
15.3	632.8	2.00	10	1.50	B
17.8	630.3	2.50	10	4.20	B
20.3	627.8	2.50	30		B
22.8	625.3	2.50	37	11.50	
24.8	623.3	2.00	25	8.40	B
26.3	621.8	1.50	50		
27.8	620.3	1.50	50		
30.3	617.8	2.50	44		B
32.8	615.3	2.50	22	7.40	
35.3	612.8	2.50	33	11.50	
37.0	611.1	1.75	39	11.50	
38.8	609.3	1.75	39	11.50	B
40.5	607.6	1.75	67	8.20	
42.3	605.8	1.75	67	8.20	B
100.0	548.1	57.73	67	8.20	B

Substructure 3

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

Individual Site Class Definition:

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

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

Substructure 4

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

Individual Site Class Definition:

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

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

Global Site Class Definition: Substructures 1 through 2

N (bar):	26 (Blows/ft.)	Soil Site Class D	
N_{ch} (bar):	37 (Blows/ft.)	Soil Site Class D	<----Controls
s_u (bar):	2 (ksf)	Soil Site Class D	

Integral Abutment Feasibility

Integral abutments are the preferred end bent type due to elimination of the joints in the bridge decks, decreasing maintenance costs, and increasing service life. The proposed structure length typically fits in the range of applicability for integral abutments. The bottom abutment elevations at each substructure are 652.11 feet. Critical depth for integral abutment analysis is 10 feet below the bottom of the abutment elevation.

Abutment	Soil Strengths at Critical Depth	Recommendation
North Abutment	Qu between 0 – 5.8 tsf Weighted Average Qu ≈ 1.30 tsf	No Pre-Coring
South Abutment	Qu between 1.0 – 5.6 tsf Weighted Average Qu ≈ 1.30 tsf	No Pre-Coring

According to the IDOT ABD Memo 19.8, the integral abutment study only pertains to soils with an average Qu of less than 3.0 tsf. See the attached IDOT BBS 145 spreadsheet for in-situ Integral Abutment Feasibility Analysis.

Utilizing the available Qu data for both embankment conditions, the results show integral abutments are applicable for the pile types recommended in the Pile Design Tables attached to this report. Please reference the Integral Abutment Feasibility spreadsheet included in this report.

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========	027-0105		TOTAL STRUCTURE LENGTH==========	76.14 FT
STRUCTURE TYPE ==========	SIMPLE-SPAN			
STRUCTURE SKEW==========	26	DEGREES		
SUPER. DATA IN REFERENCE TO SUB. DATA ====	ABUT 1			

SUPERSTRUCTURE DATA (END OR MAIN SPAN)

BEAM TYPE ==========	CONCRETE BEAM	
CONCRETE BEAM ==========	IL36-2438	
BEAM F'C ==========	8.5	KSI
BEAM SPACING PERP. TO CL ==========	6.25	FT
SLAB THICKNESS ==========	8.00	IN
SLAB F'C ==========	4.00	KSI

SUPERSTRUCTURE DATA (ADJACENT SPAN)

KSI	
BEAM SPACING PERP. TO CL ==========	FT

ABUTMENT #1 DATA

ABUTMENT NAME ==========	South Abutment	
ABUTMENT REFERENCE BORING ==========	Boring 1	
BOTTOM OF ABUTMENT ELEVATION ==========	652.11	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	6	
PILE SPACING PERP. TO CL ==========	5	FT

ABUTMENT #2 DATA

ABUTMENT NAME ==========	North Abutment	
ABUTMENT REFERENCE BORING==========	Boring 2	
BOTTOM OF ABUTMENT ELEVATION==========	652.11	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	
PILE SPACING PERP. TO CL ==========	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)*
650.30	1.81	1.5		
647.80	2.50	1.5		
645.30	2.50	1.0		
643.80	1.50	1.0		
642.30	1.50	1.0		
642.11	0.19	5.60		

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)*
649.84	2.27	2.5		
648.34	1.50	2.0		
645.34	3.00	1.0		
642.34	3.00	0.00		
642.11	0.23	5.80		

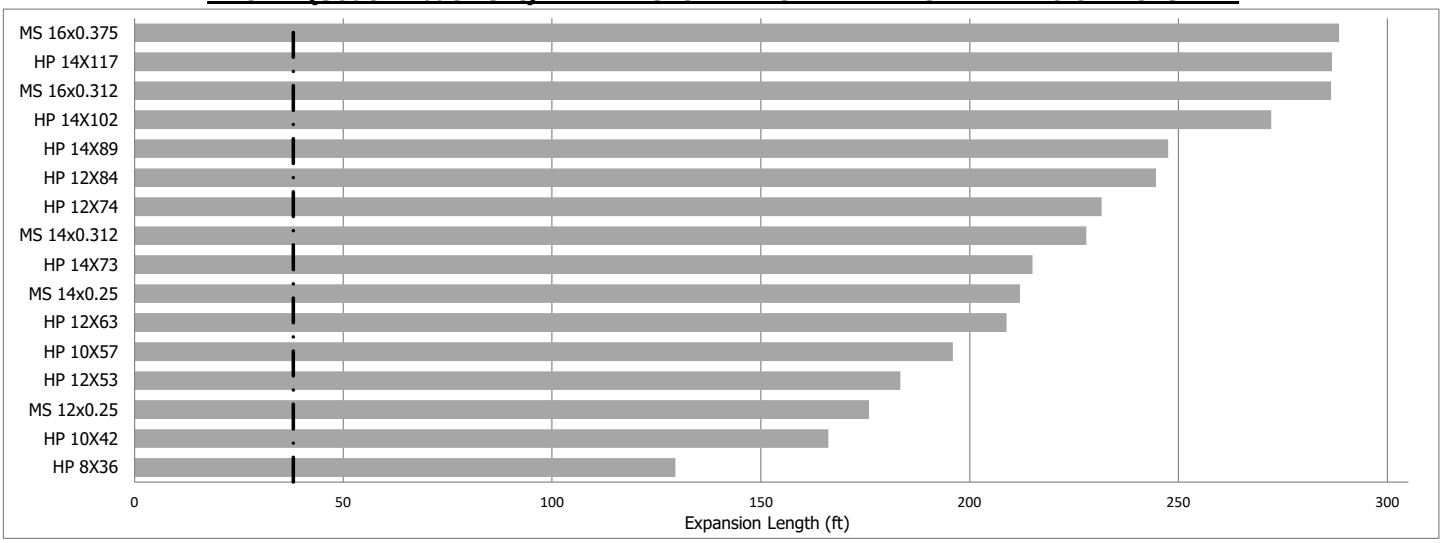
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1======	1.30	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2======	1.30 TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.3])==========	0.94		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*1.3])==========	0.94

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [0.94*6*0+0.94*6*76.14]/[0.94*6+0.94*6]========== 38.06 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [0.94*6*0+0.94*6*76.14]/[0.94*6+0.94*6]========== 38.08 FT

ABUT 1 (South Abutment) - EXPANSION LENGTH LIMIT CHART - 26.0 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.)

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========	027-0105		TOTAL STRUCTURE LENGTH==========	76.14 FT
STRUCTURE TYPE ==========	SIMPLE-SPAN			
STRUCTURE SKEW==========	26	DEGREES		
SUPER. DATA IN REFERENCE TO SUB. DATA ====	ABUT 2			

SUPERSTRUCTURE DATA (END OR MAIN SPAN)

BEAM TYPE ==========	CONCRETE BEAM	
CONCRETE BEAM ==========	IL36-2438	
BEAM F'C ==========	8.5	KSI
BEAM SPACING PERP. TO CL ==========	6.25	FT
SLAB THICKNESS ==========	8.00	IN
SLAB F'C ==========	4.00	KSI

SUPERSTRUCTURE DATA (ADJACENT SPAN)

	KSI
BEAM SPACING PERP. TO CL ==========	FT

ABUTMENT #1 DATA

ABUTMENT NAME ==========	South Abutment	
ABUTMENT REFERENCE BORING ==========	Boring 1	
BOTTOM OF ABUTMENT ELEVATION ==========	652.11	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	6	
PILE SPACING PERP. TO CL ==========	5	FT

ABUTMENT #2 DATA

ABUTMENT NAME ==========	North Abutment	
ABUTMENT REFERENCE BORING==========	Boring 2	
BOTTOM OF ABUTMENT ELEVATION==========	652.11	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	6	
PILE SPACING PERP. TO CL ==========	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)*
650.30	1.81	1.5		
647.80	2.50	1.5		
645.30	2.50	1.0		
643.80	1.50	1.0		
642.30	1.50	1.0		
642.11	0.19	5.60		

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)*
649.84	2.27	2.5		
648.34	1.50	2.0		
645.34	3.00	1.0		
642.34	3.00	0.00		
642.11	0.23	5.80		

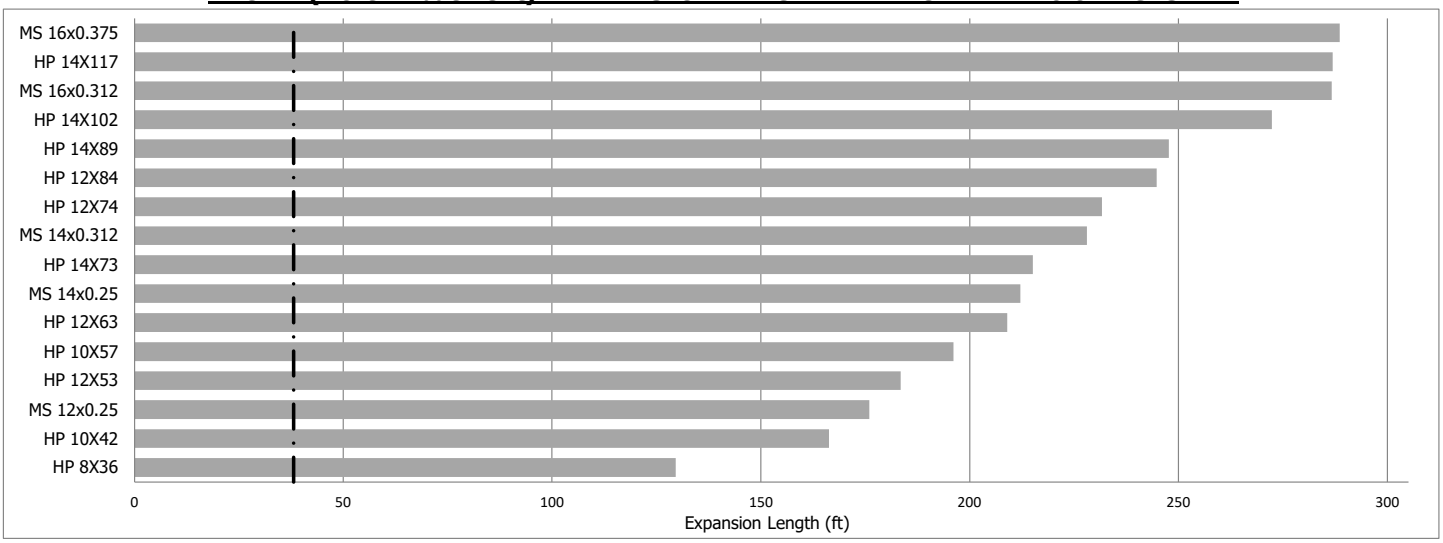
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1======	1.30	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2======	1.30 TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.3])==========	0.94		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*1.3])==========	0.94

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [0.94*6*0+0.94*6*76.14]/[0.94*6+0.94*6]========== 38.06 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [0.94*6*0+0.94*6*76.14]/[0.94*6+0.94*6]========== 38.08 FT

ABUT 2 (North Abutment) - EXPANSION LENGTH LIMIT CHART - 26.0 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.)

South Abutment Pile Design Table - Boring 1

Estimated Pile Cutoff Elevation of 654.11 feet	**Nominal Required Bearing** (kips)	**Factored Resistance Available** (kips)	**Estimated Pile Length** (feet)
Metal Shell 12" ϕ w/ 0.25" Walls	290	160	24
	323	177	26
	367	202	29
	392*	216	31
Metal Shell 14" ϕ w/ 0.25" Walls	367	202	24
	407	224	26
	459*	252	29
Metal Shell 14" ϕ w/ 0.312" Walls	367	202	24
	407	224	26
	463	255	29
	512	281	34
	570*	313	41
Metal Shell 16" ϕ w/ 0.312" Walls	453	249	24
	501	275	26
	569	313	29
	618	340	34
	654*	360	40
Metal Shell 16" ϕ w/ 0.375" Walls	453	249	24
	501	275	26
	569	313	29
	618	340	34
	690	379	41
	782*	430	43

***Maximum nominal required bearing of the pile.**

North Abutment Pile Design Table - Boring 2

Estimated Pile Cutoff Elevation of 654.11 feet	**Nominal Required Bearing** (kips)	**Factored Resistance Available** (kips)	**Estimated Pile Length** (feet)
Metal Shell 12" ϕ w/ 0.25" Walls	293	161	24
	302	166	26
	392*	216	31
Metal Shell 14" ϕ w/ 0.25" Walls	370	204	24
	379	208	26
	459*	252	31
Metal Shell 14" ϕ w/ 0.312" Walls	370	204	24
	379	208	26
	570*	313	31
Metal Shell 16" ϕ w/ 0.312" Walls	224	123	21
	456	251	24
	464	255	26
	654*	360	31
Metal Shell 16" ϕ w/ 0.375" Walls	456	251	24
	464	255	26
	715	393	31
	715	393	41
	731	402	43
	782*	430	44

***Maximum nominal required bearing of the pile.**

G23.049 IDOT PTB 197-022 WO21 IL115 overN Fork Vermillion Tributary (UNDRAINED)

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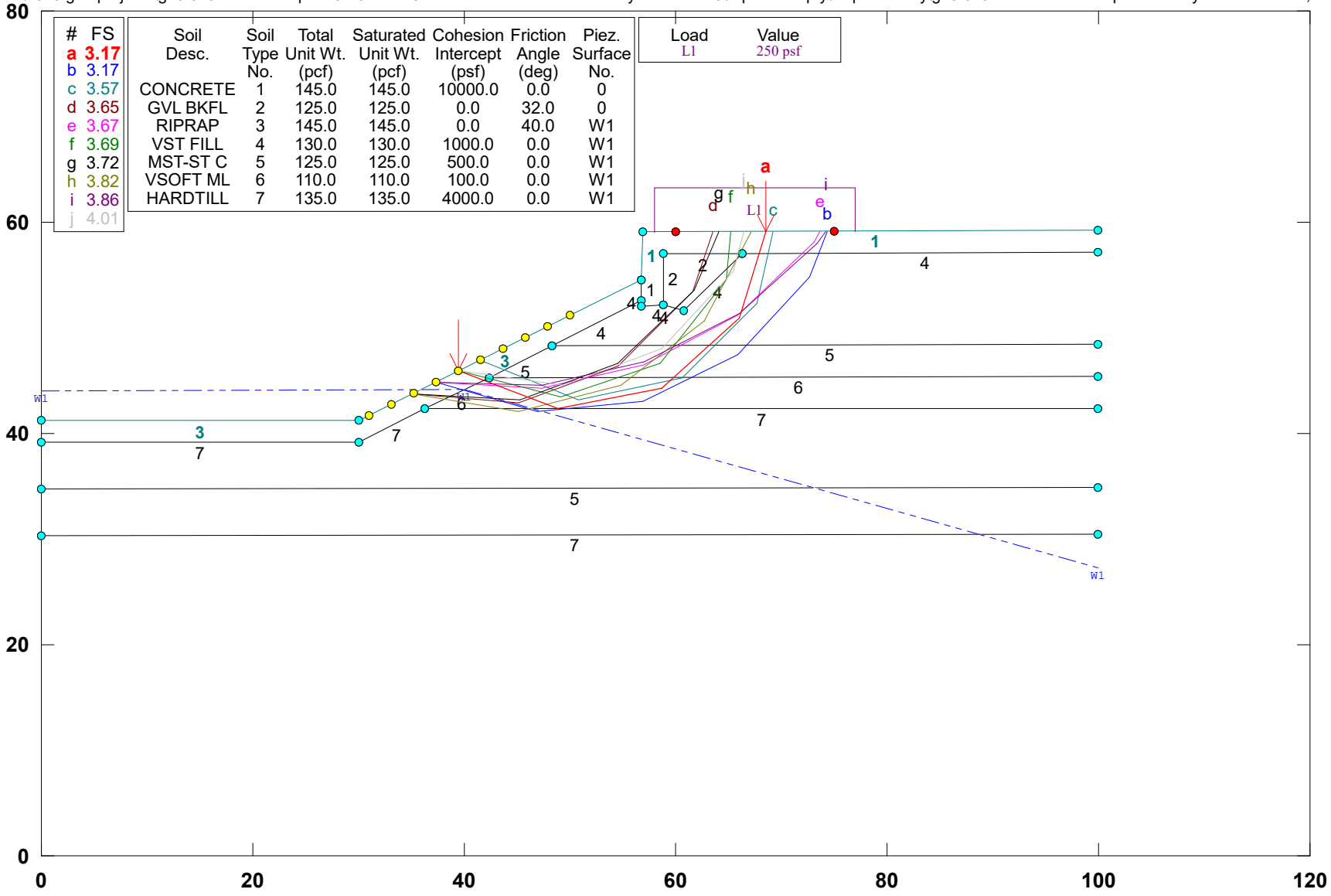


#	FS
a	3.17
b	3.17
c	3.57
d	3.65
e	3.67
f	3.69
g	3.72
h	3.82
i	3.86
j	4.01

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
CONCRETE	1	145.0	145.0	10000.0	0.0	0
GVL BKFL	2	125.0	125.0	0.0	32.0	0
RIPRAP	3	145.0	145.0	0.0	40.0	W1
VST FILL	4	130.0	130.0	1000.0	0.0	W1
MST-ST C	5	125.0	125.0	500.0	0.0	W1
VSOFT ML	6	110.0	110.0	100.0	0.0	W1
HARDTILL	7	135.0	135.0	4000.0	0.0	W1

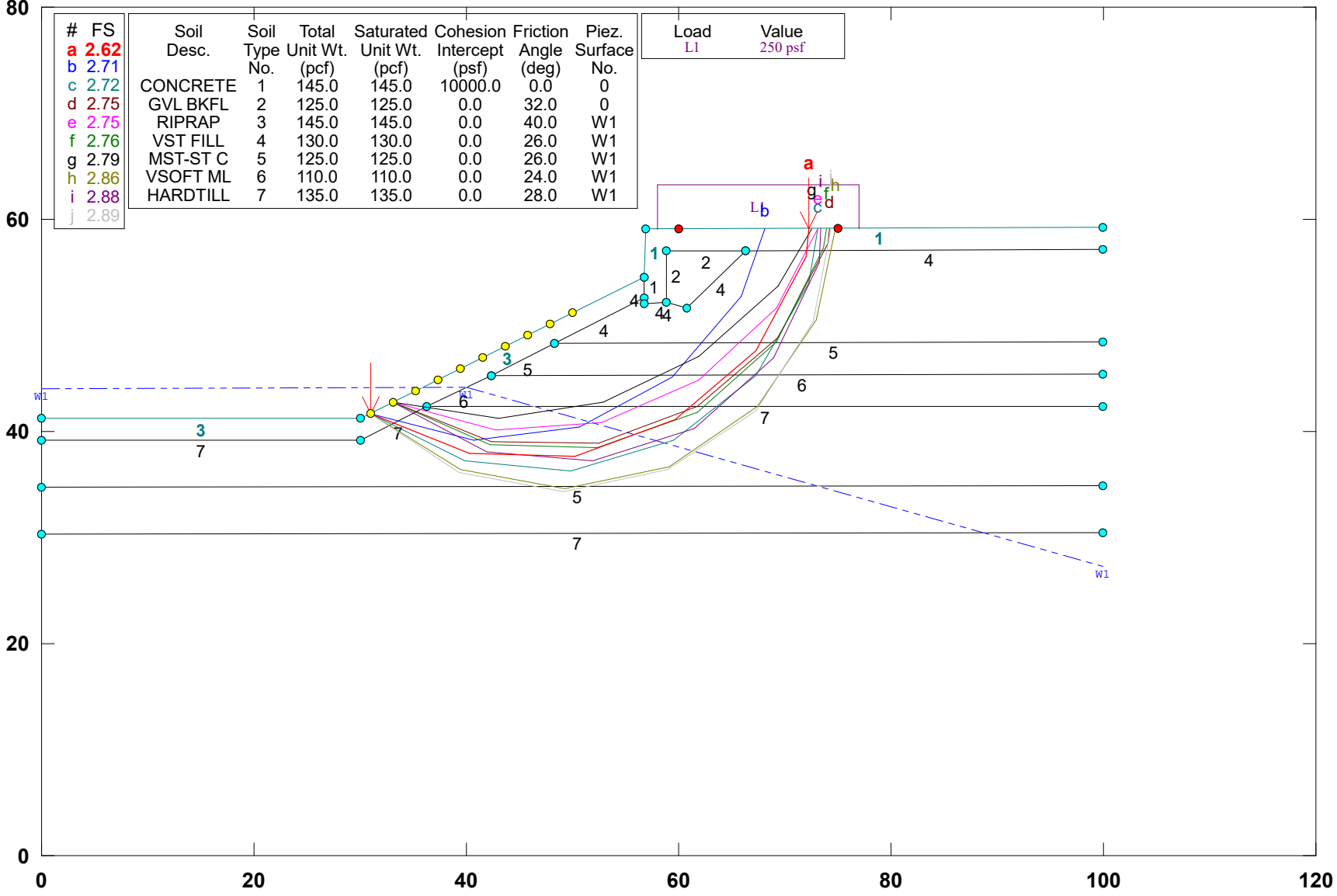
Load	Value
L1	250 psf

PCSTABL5M/si FSmin=3.17

Safety Factors Are Calculated By The Modified Bishop Method

G23.049 IDOT PTB 197-022 WO21 IL115 overN Fork Vermillion Tributary (DRAINED)

z:\rubino eng projects\2023 geo projects\g23.049 wo 21 idot ptb 197-022 il115 over n fork vermillion tributary for district 3\report - empty\slope stability\g23.049 wo21 drained.pl2 Run By: Matthew Kurz, EI 6/2/2023 09:3



#	FS
a	2.62
b	2.71
c	2.72
d	2.75
e	2.75
f	2.76
g	2.79
h	2.86
i	2.88
j	2.89

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
CONCRETE	1	145.0	145.0	10000.0	0.0	0
GVL BKFL	2	125.0	125.0	0.0	32.0	0
RIPRAP	3	145.0	145.0	0.0	40.0	W1
VST FILL	4	130.0	130.0	0.0	26.0	W1
MST-ST C	5	125.0	125.0	0.0	26.0	W1
VSOFT ML	6	110.0	110.0	0.0	24.0	W1
HARDTILL	7	135.0	135.0	0.0	28.0	W1

Load	Value
L1	250 psf

PCSTABL5M/si FSmin=2.62

Safety Factors Are Calculated By The Modified Bishop Method