Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date: 02-15-2022	**Proposed SN:** 046-0162	**Route:**	FAP 41 (IL 17)
Revised Date: 09-15-2023	**Existing SN:** 046-0031	**Section:**	(13)BR-2
Geotechnical Engineer: Rubino Engineering, Inc. (G21.171)		**County:**	Kankakee
Structural Engineer: DLZ Corporation		**Contract:**	#66L10

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): The proposed bridge configuration consists of a 100-foot, single-span, PPC I Beam bridge structure. The new bridge will utilize IL36-3838 PPC I Beams on integral abutments. The current TSL drawing 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): The plans indicate that the existing structure consists of a three-span concrete superstructure supported by stub concrete abutments and concrete wall piers. In September of 2021, two soil borings were taken at the abutments. The native soils encountered in the borings beneath the topsoil and undocumented fill are generally very soft to hard, black and gray silty clay, silt, and silty clay loam. Copies of these logs are attached. Need for additional exploration is not anticipated.

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: There is no fill proposed for this profile and, therefore, minimal settlement is anticipated under the proposed embankments. No additional testing or treatment for settlement is anticipated.

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 new profile of the bridge has approximately a 4.5-foot cut to accommodate the proposed Stone Riprap slope design beneath the bridge span. The proposed embankment slope below the bridge will be 1:2. In the slope stability analyses, the drained (long-term construction) conditions control over the undrained (short-term construction) conditions. Rubino used the slope stability program Stedwin Version 2.90 to run the Modified Bishop Method. A factor of safety of 2.20 was achieved in the drained condition and a factor of safety of 4.51 was achieved in the undrained condition. No additional analyses or treatment is recommended.

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 100-year and 200-year scour depths are 0 feet for the W. Abutment and the E. Abutment. The proposed ground surface elevations at the West and East Abutments are approximately 609.9 feet and 609.4 feet, respectively. The recommended foundation design scour elevation at the West and East Abutments are 609.9 feet and 609.4 feet, respectively. The countermeasure for scour proposed in this design is Stone RipRap for embankment protection.

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 Soil Site Class = C; Seismic Performance Zone = SPZ 1; Design Spectral Acceleration at 0.2 sec. (SDS) = 0.129; Design Specteral Acceleration at 1.0 sec. (SD1) = 0.074. Liquefaction is not applicable because the SPZ =1.

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 proposed foundation type (driven piles) is feasible. IDOT Static Method of Estimating Pile Length spreadsheet was used to calculate estimated pile lengths. The refusal was defined as apparent bedrock and projected deeper in the pile spreadsheets in order to obtain the capacities listed herein. Revised loads were provided by Quigg Engineering on September 13, 2023. Quigg Engineering requested Pile Type & Lengths for 100% of Strength-I and Extreme Event-I loads and also 120% of Strength-I and Extreme Event-I loads. Ground surface elevation against pile during driving, 609.9 feet (W. Abutment) and 609.4 feet (E. Abutment), and the pile cut off elevations, 611.9 feet (W. Abutment) and 611.4 feet (E. Abutment), were obtained from the TS&L dated December 12, 2022. Pile Design Tables are included in the attached supplemental information. Integral abutments are feasible for this project. See the attached supplemental information for details

Hard driving is expected due to very stiff soil layers and possible limestone bedrock was encountered at an estimated elevation of 565 feet, therefore H-piles with pile shoes are recommended. Please reference the included pile tables for recommended pile sizes and estimated lengths.

Rubino recommends the utilization of at least one test pile in either abutment in order to obtain site specific pile bearing and length data. This data can be used, in addition to the boring information, to supplement the estimated plan length. This recommendation has been made in accordance with the 2012 IDOT Bridge Manual Section 3.10.1.7.

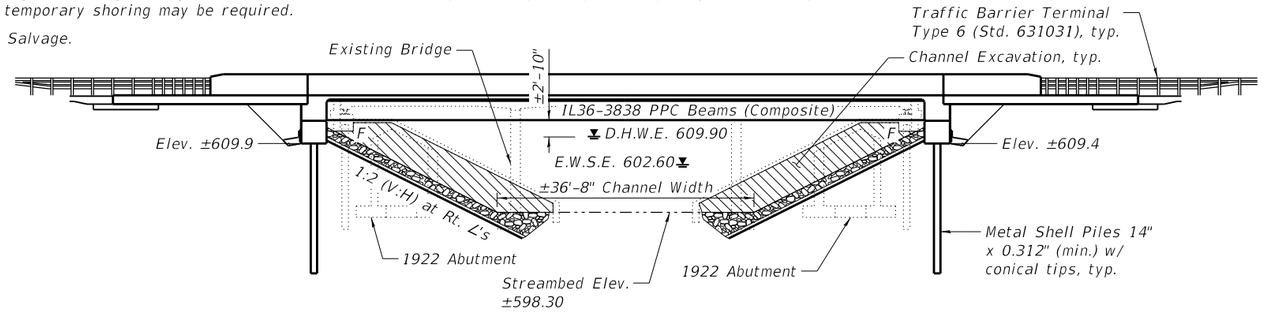
Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: The estimated water surface elevation (E.W.S.E.) is 602.6 feet. The bottom elevation of the proposed slope embankment is approximately 598.3 feet. Therefore, a Type 1 cofferdam will be needed for this project. This needs to be checked and confirmed by the designer.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: The proposed plans indicate that traffic will be maintained utilizing staged construction by removing the existing bridge and constructing the proposed bridge in two stages. Stage I will be the South side of the bridge and Stage II will be the North side of the bridge. Temporary sheet piling is proposed along the Stage Construction/Removal lines in the TSL.

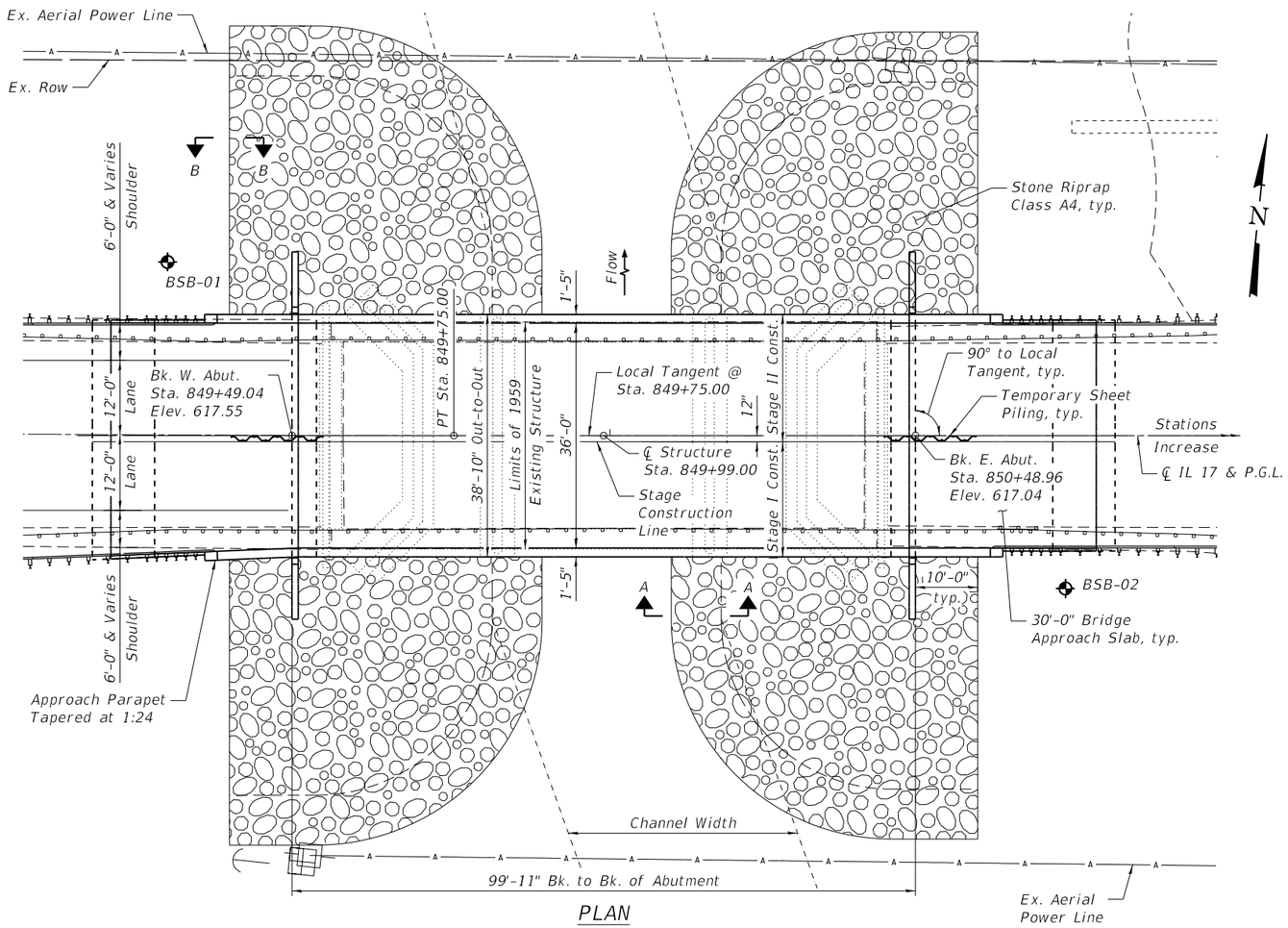
Benchmark: Cut ⊓ on SW Wing of SN 046-0031. Sta. 849+54.98, Offset 19.23' Rt., Elev. 617.04.

Existing Structure: SN 046-0031 Built in 1959 as S.B.I. Route 17, Section 13-BR at Sta. 849+99. Existing structure consists of 3-Span continuous cast in place reinforced concrete slab superstructure and supported by stub concrete abutments and solid wall concrete piers. Structure is 90'-0" long Bk. to Bk. abutments and 36'-4" Out to Out deck. Structure to be removed and replaced. Traffic to be maintained utilizing stage construction. Existing staging details are based on inspection data from 2019. The condition of the slab should be reevaluated during final design, using current inspection data to verify its acceptability to carry stage traffic. Adjustments or temporary shoring may be required.

No Salvage.



ELEVATION



PLAN

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

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

PRECAST PRESTRESSED UNITS

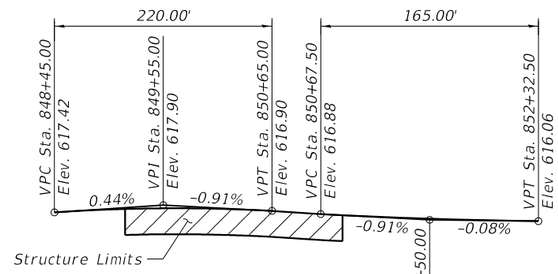
f'c = 8,500 psi
f'ci = 6,500 psi
fpu = 270,000 psi (0.6"ϕ low lax. strands)
fpbt = 202,300 psi (0.6"ϕ low lax. strands)

HIGHWAY CLASSIFICATION

FAP Route 41 – IL 17
Functional Class: Minor Arterial
ADT: 2,450 (2021); 2,499 (2046)
ADTT: 588 (2021); 600 (2046) (24%)
DHV: 225 (Two-way)
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

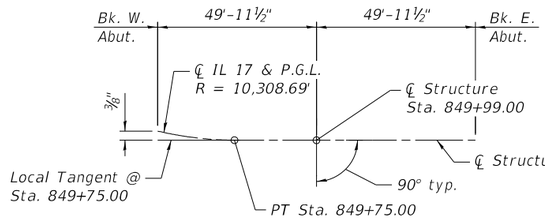
SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.074g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.129g
Soil Site Class = C

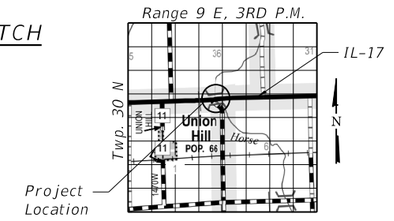


PROFILE GRADE

(Along ℄ IL 17)



OFFSET SKETCH



LOCATION SKETCH

CURVE DATA

EX CURVE EXCL
P.I. Sta. = 846+00.33
Δ = 4° 10' 00" (LT)
D = 0° 33' 21"
R = 10,308.69'
T = 375.00'
L = 749.67'
E = 6.82'
P.C. Sta. = 842+25.33
P.T. Sta. = 849+75.00

GENERAL PLAN & ELEVATION
IL ROUTE 17 OVER HORSE CREEK
FAP ROUTE 41 – SECTION (13)BR-2
KANKAKEE COUNTY
STATION 849+99.00
STRUCTURE NUMBER 046-0162

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN & ELEVATION
STRUCTURE NO. 046-0162
SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
41	13(BR)-2	KANKAKEE		
		CONTRACT NO. 66L10		
	ILLINOIS FED. AID PROJECT			

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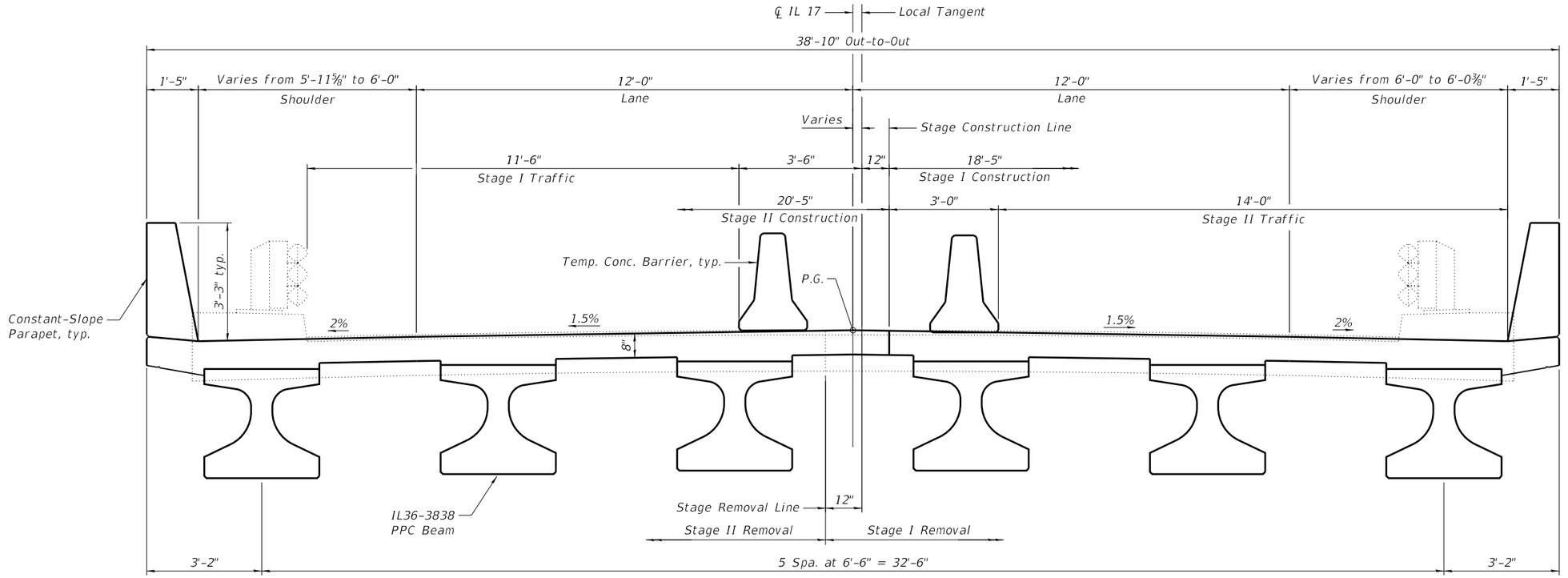
Rubino Report No: G21.171 REV1



CROSS SECTION

(Looking East)

(Shoulder widths measured at back of abutments and perpendicular to local tangent)

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.)		
	W. Abut.	E. Abut.	Item 113
Q100	±609.9	±609.4	8
Q200	±609.9	±609.4	
Design	±609.9	±609.4	
Check	±609.9	±609.4	

WATERWAY INFORMATION

Drainage Area = 26.7 sq. mi.

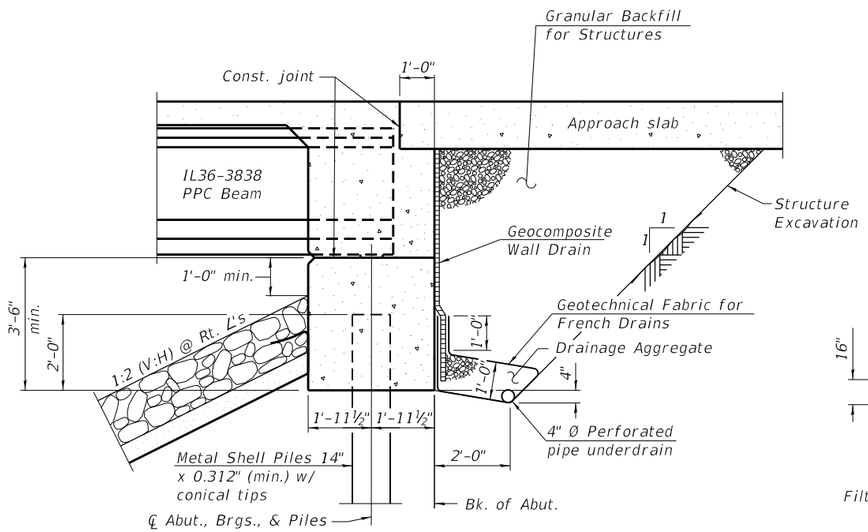
Existing Overtopping Elev. 616.49 @ Sta. 850+43

Proposed Overtopping Elev. 617.09 @ Sta. 850+44

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.
	10	1,230	269	439	608.3	0.0	0.0	608.3	608.3
Design	50	1,820	353	565	609.9	0.0	0.0	609.9	609.9
Base	100	2,090	376	608	610.3	0.2	0.1	610.5	610.4
Overtopping	200	2,350	394	633	610.6	0.3	0.2	610.9	610.8
Max. Calc.	500	2,700	413	659	610.9	0.4	0.3	611.3	611.2

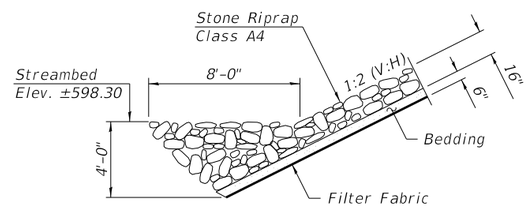
10-Year Velocity through Existing Structure = 4.6 fps

10-Year Velocity through Proposed Structure = 2.8 fps

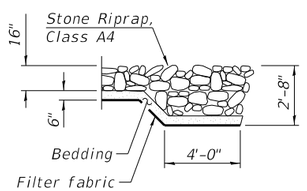


SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. ℄s)



SECTION A-A



SECTION B-B

DETAILS

IL ROUTE 17 OVER HORSE CREEK

FAP ROUTE 41 - SECTION (13)BR-2

KANKAKEE COUNTY

STATION 849+99.00

STRUCTURE NUMBER 046-0162

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

DETAILS
STRUCTURE NO. 046-0162
SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
41	13(BR)-2	KANKAKEE		
		CONTRACT NO. 66L10		
	ILLINOIS FED. AID PROJECT			

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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.:
Project & location: IL 17 over Horse Creek
Route: FAP 41 (IL 17)
County: Kankakee
Section: (13)BR-2

rubino ENGINEERING INC.

SOIL BORING LOG

Date 9/29/21

ROUTE FAP 41 (IL 17) **DESCRIPTION** IL 17 over Horse Creek, 0.7 mi. E of Union Hill Rd **LOGGED BY** M.K.

SECTION (13)BR-2 **LOCATION** SW 1/4

COUNTY Kankakee **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 046-0031 Existing
Station 849+99

BORING NO. BSB-01 (NW Quad.)
Station 849+29
Offset 27.7Lt
Ground Surface Elev. 615.88 ft

Surface Water Elev. 602.60 ft
Stream Bed Elev. 598.30 ft

Groundwater Elev.:
First Encounter N/A ft
Upon Completion N/A ft
After 18 **Hrs.** 13.5 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Approximately 8 inches of TOPSOIL
615.22				
	2 3 2	2.5 P	12	FILL: dark brown to black SILTY CLAY to SILTY CLAY LOAM
611.88	1 2 1		20	FILL: black SANDY LOAM
-5				
609.88	0 0 1	0.3 B	33	Very soft to soft, black SILTY CLAY, trace sand and gravel *A-7-6*
	0 0 1	0.3 P	30	*LL = 53* *PL = 27* *PI = 26*
-10				
	3 2 1		14	
602.38 ▽				
	3 4 6	2.0 B	14	Stiff, gray SILTY CLAY, trace to little sand and gravel
-15				
599.88	7 8 20	1.3 B	14	Very stiff to hard, gray SILTY CLAY, trace to little sand and gravel
	18 20 23	4.5 P	10	
-20				
				Very stiff to hard, gray SILTY CLAY, trace to little sand and gravel *(continued)*
	12 13 17	4.5 P	15	
592.38				
	10 13 15	4.5 P	16	Very stiff, SILTY LOAM, trace sand and gravel
-25				
589.88	10 13 21	5.5 B	10	Very stiff to hard, gray SILTY CLAY, trace sand and gravel
	12 13 16	4.5 P	9	
-30				
	12 13 15		15	
-35				
	10 13 17	4.5 P	13	
-40				

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

BBS, from 137 (Rev. 8-99)

SOIL BORING LOG

Date 9/29/21

ROUTE FAP 41 (IL 17) **DESCRIPTION** IL 17 over Horse Creek, 0.7 mi. E of Union Hill Rd **LOGGED BY** M.K.

SECTION (13)BR-2 **LOCATION** SW 1/4

COUNTY Kankakee **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 046-0031 Existing
Station 849+99

BORING NO. BSB-01 (NW Quad.)
Station 849+29
Offset 27.7Lt
Ground Surface Elev. 615.88 ft

Surface Water Elev. 602.60 ft
Stream Bed Elev. 598.30 ft

Groundwater Elev.:
First Encounter N/A ft
Upon Completion N/A ft
After 18 **Hrs.** 13.5 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Very stiff to hard, gray SILTY CLAY, trace sand and gravel *(continued)*
	48	4.5		
	31	P		
-45	22			
	8	1.6		
	9	B		
-50	16			
				565.22
				Possible WEATHERED LIMESTONE 565.05
	50/2"			**Auger and spoon refusal at approximately 50 feet 10 inches below existing grade due to possible limestone bedrock.**
				End of boring at approximately 50 feet 10 inches below existing grade.
-55				
-60				

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

BBS, from 137 (Rev. 8-99)

SOIL BORING LOG

Date 9/30/21

ROUTE FAP 41 (IL 17) **DESCRIPTION** IL 17 over Horse Creek, 0.7 mi. E of Union Hill Rd **LOGGED BY** M.K.

SECTION (13)BR-2 **LOCATION** SW 1/4

COUNTY Kankakee **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 046-0031 Existing
Station 849+99

BORING NO. BSB-02 (SE Quad.)
Station 850+73
Offset 24.5Rt
Ground Surface Elev. 615.27 ft

Surface Water Elev. 602.60 ft
Stream Bed Elev. 598.30 ft

Groundwater Elev.:
First Encounter 16 ft ▼
Upon Completion 22.5 ft ▽
After ____ **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Approximately 8 inches of TOPSOIL	614.61			
FILL: dark brown silty clay to silty clay loam, trace to little sand and gravel		2 3 6	0.8 B	25
		3 4 6	2.0 B	21
	609.27			
Stiff to very stiff, dark brown to black SILTY CLAY LOAM		11 13 13	2.3 P	23
		13 7 7		22
	604.27			
Medium stiff, brown and gray SILTY CLAY, trace sand and gravel		2 3 4	1.6 B	23
	601.77			
Stiff, gray SILT, trace sand and gravel	601.27	3 5 8	3.6 B	15
Stiff, gray CLAY, trace sand and gravel				
	599.27 ▼			
Hard, gray SILTY CLAY LOAM, little sand and gravel		11 12 21	2.5 S	12
	596.77			
Very stiff to hard, gray CLAY, trace to little sand and gravel		13 14 17	7.9 S	9
Very stiff to hard, gray CLAY, trace to little sand and gravel *(continued)*		7 10 13	5.8 S	12
		6 12 16	10.5 S	13
		13 20 22	6.2 S	11
	586.77			
Hard, gray SILTY CLAY, little sand and gravel		15 16 25		12
		33 28 20	3.0 B	
	576.77			
Very stiff to very hard, gray CLAY LOAM, trace gravel and rock chips		9 14 20		15

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)

rubino ENGINEERING INC.

SOIL BORING LOG

Date 9/30/21

ROUTE FAP 41 (IL 17) **DESCRIPTION** IL 17 over Horse Creek, 0.7 mi. E of Union Hill Rd **LOGGED BY** M.K.

SECTION (13)BR-2 **LOCATION** SW 1/4

COUNTY Kankakee **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Automatic

STRUCT. NO. 046-0031 Existing
Station 849+99

BORING NO. BSB-02 (SE Quad.)
Station 850+73
Offset 24.5Rt
Ground Surface Elev. 615.27 ft

Surface Water Elev. 602.60 ft
Stream Bed Elev. 598.30 ft

Groundwater Elev.:
First Encounter 16 ft ▼
Upon Completion 22.5 ft ▽
After ____ **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very stiff to very hard, gray CLAY LOAM, trace gravel and rock chips *(continued)*				
		34		13
		30		
	-45	38		
	566.77			
Dense, light gray SANDY LOAM, some gravel and rock chips		20		12
		14		
	565.27 -50	31		
Auger and spoon refusal at approximately 50 feet below existing grade due to possible limestone bedrock. End of boring at approximately 50 feet below existing grade.		50/0"		
	-55			
	-60			

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

BBS, from 137 (Rev. 8-99)

G21.171 IDOT WO#8

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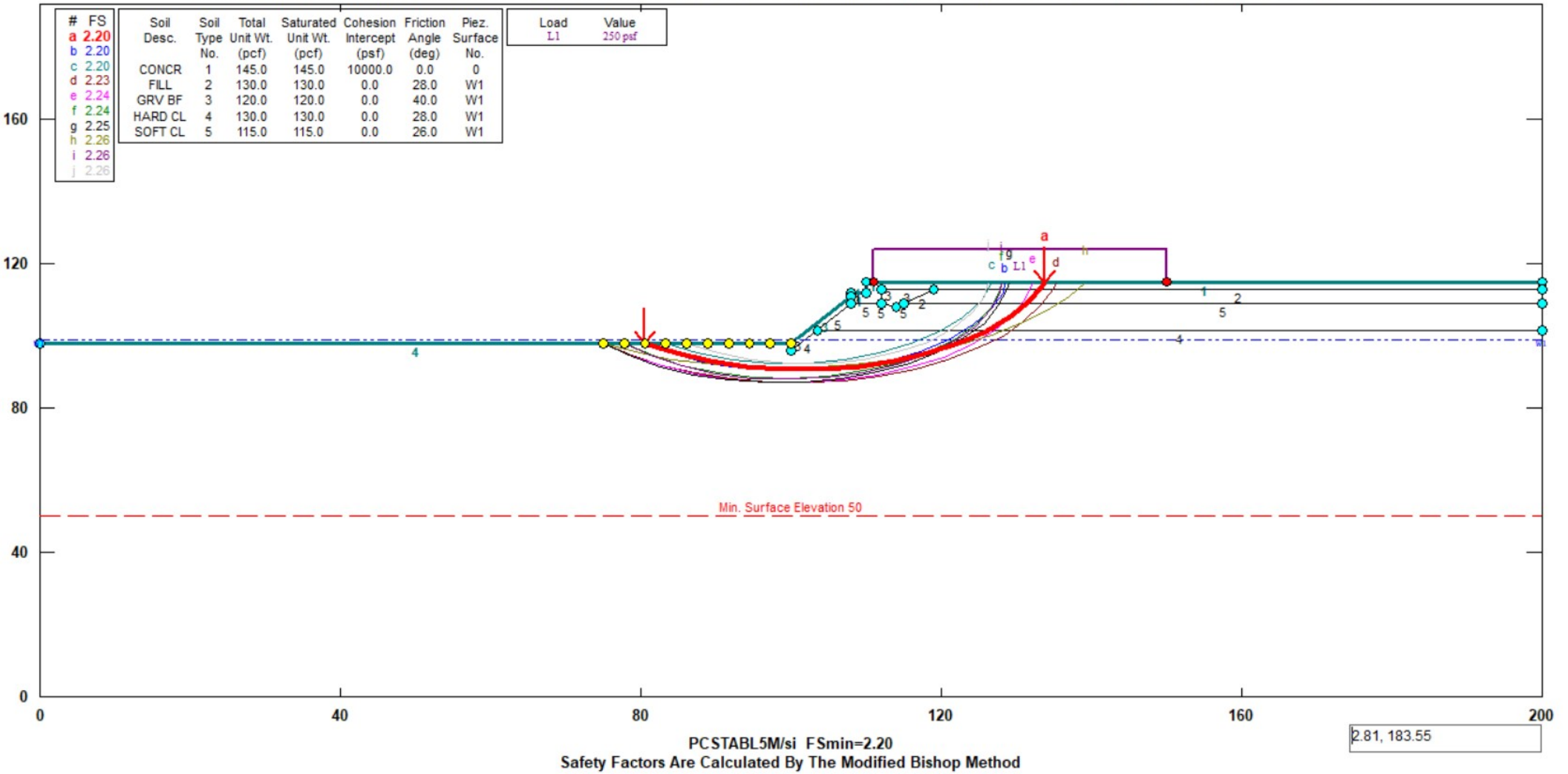

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Safety Factors Are Calculated By The Modified Bishop Method

G21.171 IDOT WO#8

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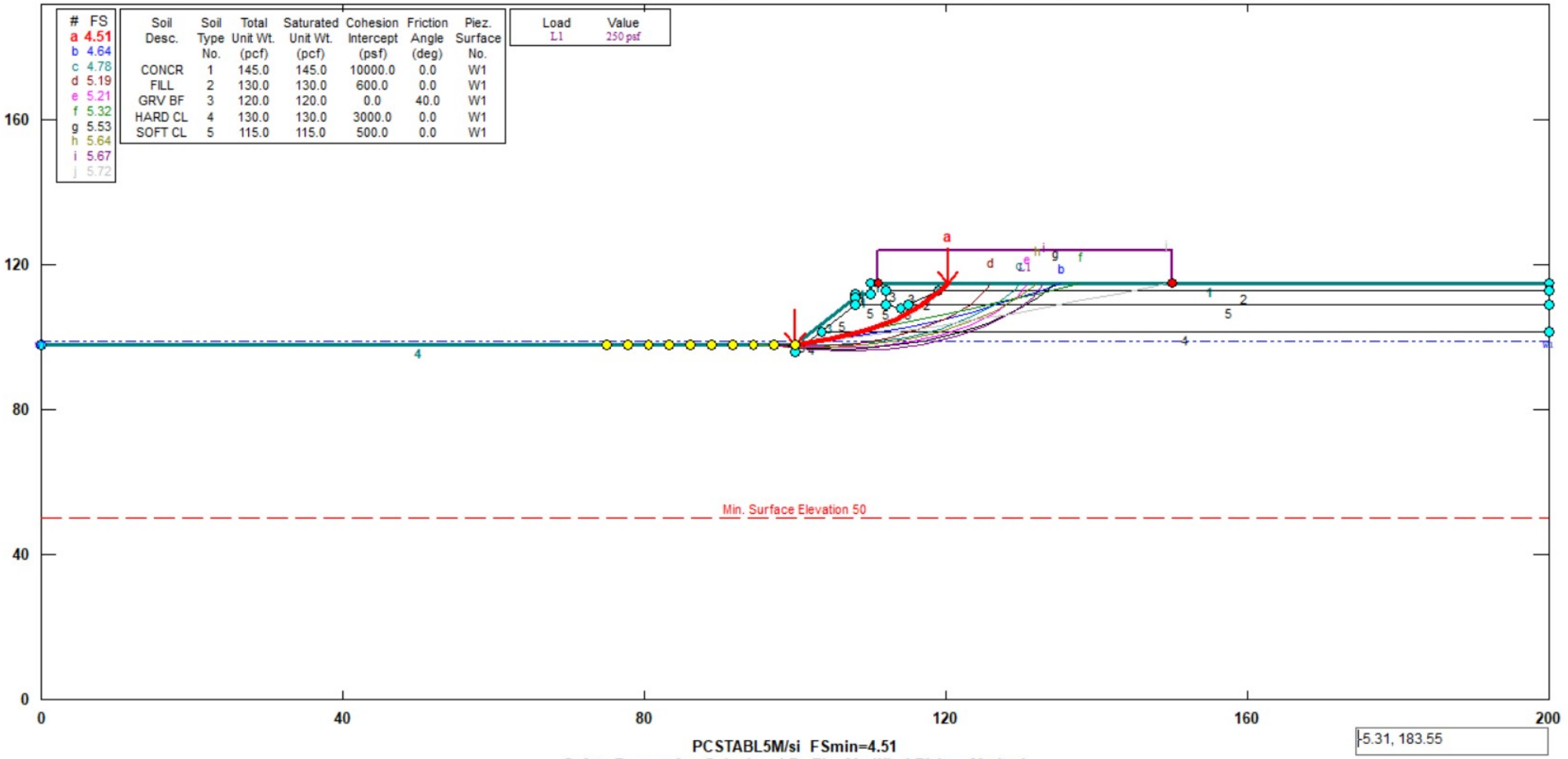

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Safety Factors Are Calculated By The Modified Bishop Method

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE=====G21.171 REV 1 IL17 over Horse Creek

Substructure 1

Base of Substruct. Elev. (or ground surf for bents	609.9	ft.
Pile or Shaft Dia.	12	inches
Boring Number	BSB-01	
Top of Boring Elev.	615.88	ft.
Approximate Fixity Elev.	603.9	ft.

Individual Site Class Definition:

N (bar): 40 (Blows/ft.) Soil Site Class D
N_{ch} (bar): NA (Blows/ft.) NA
s_u (bar): 4.36 (ksf) Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	611.9	4.00	5	2.50	B
	609.9	2.00	3		B
	607.4	2.50	1	0.25	
	604.9	2.50	1	0.25	B
1.5	602.4	2.50	3		B
4.0	599.9	2.50	10	2.00	
6.5	597.4	2.50	28	1.25	
9.0	594.9	2.50	43	4.50	
11.5	592.4	2.50	30	4.50	B
14.0	589.9	2.50	28	4.50	B
16.5	587.4	2.50	34	5.50	
21.5	582.4	5.00	29	4.50	
26.5	577.4	5.00	28		
31.5	572.4	5.00	30	4.50	
36.5	567.4	5.00	54	4.50	
38.7	565.2	2.20	25	1.60	B
88.0	515.9	49.30	100	5.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents	609.4	ft.
Pile or Shaft Dia.	12	inches
Boring Number	BSB-02	
Top of Boring Elev.	615.27	ft.
Approximate Fixity Elev.	603.4	ft.

Individual Site Class Definition:

N (bar): 50 (Blows/ft.) Soil Site Class D
N_{ch} (bar): 83 (Blows/ft.) Soil Site Class C <----Controls
s_u (bar): 4.25 (ksf) Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	611.8	3.50	9	0.80	
	609.3	2.50	10	2.00	B
	606.8	2.50	26	2.30	
	604.3	2.50	14		B
1.6	601.8	2.50	7	1.60	B
2.1	601.3	0.50	13		B
4.1	599.3	2.00	13	3.60	B
6.6	596.8	2.50	33	2.50	B
9.1	594.3	2.50	31	7.90	
11.6	591.8	2.50	23	5.80	
14.1	589.3	2.50	28	9.90	
16.6	586.8	2.50	42	6.20	B
21.6	581.8	5.00	41		
26.6	576.8	5.00	48	3.00	B
31.6	571.8	5.00	44		
36.6	566.8	5.00	68		B
38.1	565.3	1.50	45		B
88.1	515.3	50.00	100	5.00	R

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): 45 (Blows/ft.) Soil Site Class D
N_{ch} (bar): 69 (Blows/ft.) Soil Site Class C <----Controls
s_u (bar): 4.31 (ksf) Soil Site Class C

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 soil at critical depth of 10 feet below the abutments is very soft to stiff. The bottom abutment elevation is 609.9 feet at the West abutment and 609.4 feet at the East abutment. Critical depth for intergral abutment analysis is 10 feet below the bottom of the abutment elevation.

Abutment	Soil Strengths at Critical Depth	Estimated Expansion Length*
West Abutment	Qu between 0.3 – 2.0 tsf	62 feet
East Abutment	Qu between 1.6 – 3.6 tsf	38 feet

*Piles with an expansion length greater than this are suitable for consideration

The IDOT BBS 145 spreadsheet for Integral Abutment Feasibility Analysis shows that the integral abutment option is feasible for both abutments. See the attached spreadsheet for more details.

Abutment Pile Discussion

Metal shell piles and H-piles were both considered for integral abutment applications; however, H-piles are recommended over metal shell piles due to possible bedrock encountered in both borings near elevation 565 feet. Tables of estimated pile lengths are attached for 100% proposed loading and 120% of proposed loading for the Strength I case and the Extreme Event I case at each abutment. If the anticipated load per pile in the 100% cases was acceptable but the 120% loads exceeded the maximum factored resistance available for a particular pile type, the pile was still included as an option and is noted on the attached Pile Design Tables. Pile shoes are recommended for H-piles in very stiff or dense soils. The proposed pile locations need to be checked for conflict with the existing piling. Existing piles should be cut off to an appropriate elevation to not interfere with the new abutment and pile system.

Laboratory Testing

An Atterberg Limit test (AASHTO T89/AASHTO T90) was run on boring BSB-01 at approximately 8 ½ feet below existing grade (607.38 feet) where very soft black silty clay was observed. The result of the Atterberg showed that the soil at this depth is classified as an A-7-6 material. Two Hydrometer tests (AASHTO T88) were run on boring BSB-01. One hydrometer was done at 6 feet below existing grade (609.88, near scour depth) and one at approximately 23 ½ below existing grade (592.38). See the attached lab results and boring logs for more details.

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========	PTB 197-022		TOTAL STRUCTURE LENGTH==========	99.92	FT
STRUCTURE TYPE ==========	SIMPLE-SPAN				
STRUCTURE SKEW==========	0	DEGREES			
SUPER. DATA IN REFERENCE TO SUB. DATA ====	ABUT 1				

SUPERSTRUCTURE DATA (END OR MAIN SPAN)

BEAM TYPE ==========	CONCRETE BEAM	
CONCRETE BEAM ==========	IL36-3838	
BEAM F'C ==========	8.5	KSI
BEAM SPACING PERP. TO CL ==========	6.50	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 ==========	N.W. Quad	
ABUTMENT REFERENCE BORING ==========	BSB-1	
BOTTOM OF ABUTMENT ELEVATION ==========	609.9	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	14	
PILE SPACING PERP. TO CL ==========	3	FT

ABUTMENT #2 DATA

ABUTMENT NAME ==========	S.E. Quad	
ABUTMENT REFERENCE BORING==========	BSB-2	
BOTTOM OF ABUTMENT ELEVATION==========	609.4	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	14	
PILE SPACING PERP. TO CL ==========	3	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)*
607.40	2.50	0.3		
604.90	2.50	0.3		
602.40	2.50		3	1.5
599.90	2.50	2.0		

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)*
606.90	2.50	2.3		
604.40	2.50		14	2.7
601.90	2.50	1.6		
599.40	2.50	3.6		

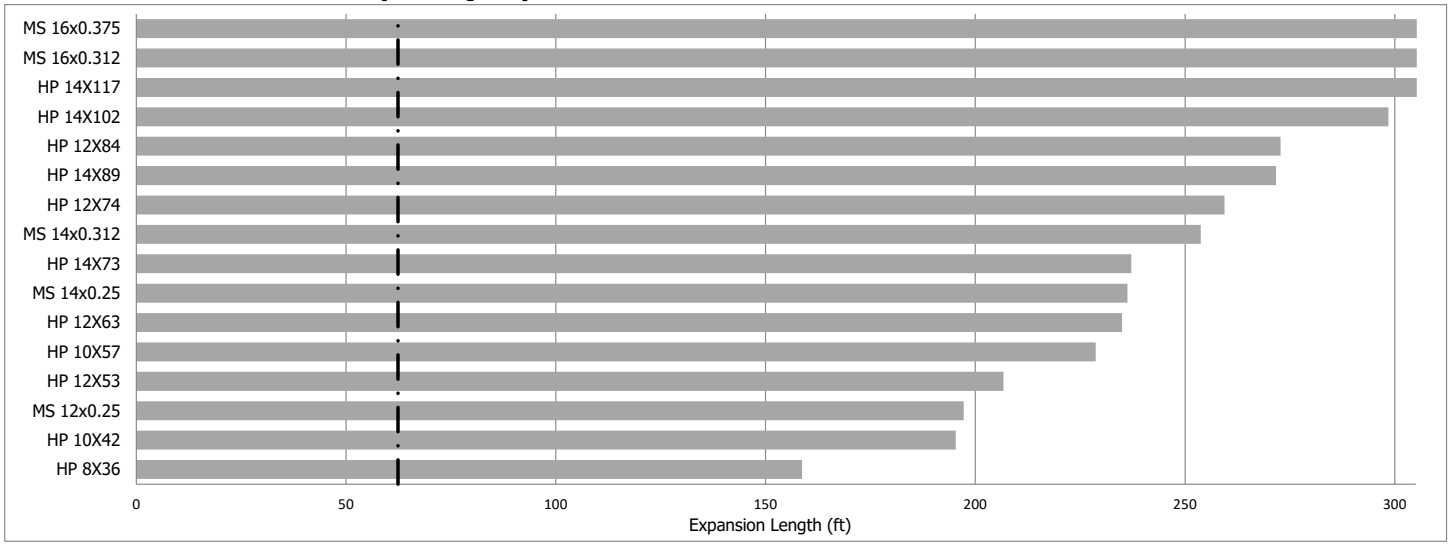
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1=======	1.03	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2=======	2.54	TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.03])==========	0.88		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*2.54])==========	1.46	

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [0.88*14*0+1.46*14*99.92]/[0.88*14+1.46*14]========== 62.38 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1.46*14*0+0.88*14*99.92]/[1.46*14+0.88*14]========== 37.54 FT

ABUT 1 (N.W. Quad) - 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.)

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER==========	PTB 197-022		TOTAL STRUCTURE LENGTH==========	99.92	FT
STRUCTURE TYPE ==========	SIMPLE-SPAN				
STRUCTURE SKEW==========	0	DEGREES			
SUPER. DATA IN REFERENCE TO SUB. DATA ====	ABUT 2				

SUPERSTRUCTURE DATA (END OR MAIN SPAN)

BEAM TYPE ==========	CONCRETE BEAM	
CONCRETE BEAM ==========	IL36-3838	
BEAM F'C ==========	8.5	KSI
BEAM SPACING PERP. TO CL ==========	6.50	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 ==========	N.W. Quad	
ABUTMENT REFERENCE BORING ==========	BSB-1	
BOTTOM OF ABUTMENT ELEVATION ==========	609.9	FT
ESTIMATED NUMBER OF PILES AT ABUT. =======	14	
PILE SPACING PERP. TO CL ==========	3	FT

ABUTMENT #2 DATA

ABUTMENT NAME ==========	S.E. Quad	
ABUTMENT REFERENCE BORING==========	BSB-2	
BOTTOM OF ABUTMENT ELEVATION==========	609.4	FT
ESTIMATED NUMBER OF PILES AT ABUT.=======	14	
PILE SPACING PERP. TO CL ==========	3	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)*
607.40	2.50	0.3		
604.90	2.50	0.3		
602.40	2.50		3	1.5
599.90	2.50	2.0		

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)*
606.90	2.50	2.3		
604.40	2.50		14	2.7
601.90	2.50	1.6		
599.40	2.50	3.6		

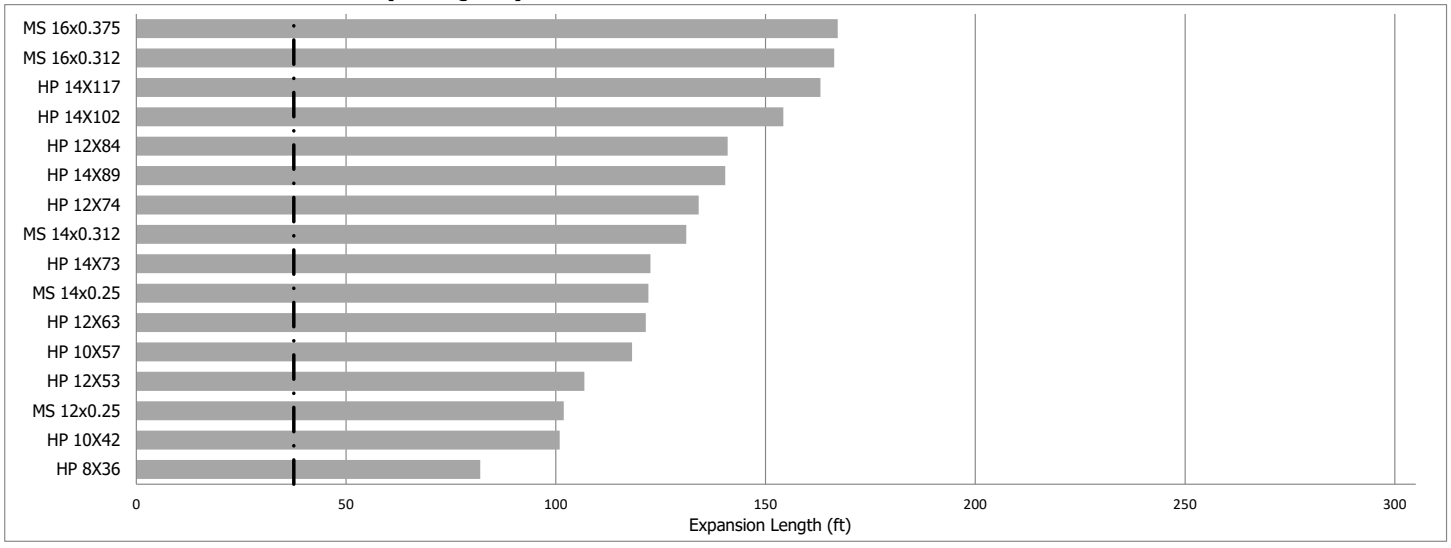
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1=======	1.03	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2=======	2.54	TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.03])==========	0.88		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*2.54])==========	1.46	

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [0.88*14*0+1.46*14*99.92]/[0.88*14+1.46*14]========== 62.38 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1.46*14*0+0.88*14*99.92]/[1.46*14+0.88*14]========== 37.54 FT

ABUT 2 (S.E. Quad) - 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.)

West Abutment Pile Design Table - Boring BSB-01

100% Extreme Event: 179 kips/pile
120% Extreme Event: 215 kips/pile
100% Strength: 267 kips/pile
120% Strength: 321 kips/pile

	Maximum Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (kips)
Steel HP 12 x 63	497	273*	49
Steel HP 12 x 84	664	365	50
Steel HP 14 x 89	705	388	49
Steel HP 14 x 102	810	445	50
Steel HP 14 x 117	929	511	50

*120% Strength case exceeds factored resistance available, however 100% Strength case does not

East Abutment Pile Design Table - Boring BSB-02

100% Extreme Event: 179 kips/pile
120% Extreme Event: 215 kips/pile
100% Strength: 267 kips/pile
120% Strength: 321 kips/pile

	Maximum Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (kips)
Steel HP 12 x 63	497	273*	48
Steel HP 12 x 84	664	365	49
Steel HP 14 x 89	705	388	49
Steel HP 14 x 102	810	445	49
Steel HP 14 x 117	929	511	50

*120% Strength case exceeds factored resistance available, however 100% Strength case does not

Job No.:	21IL082-08
SN:	046-0162
Designed:	KWB
Date:	9/12/2023
Checked:	CFS
Date:	9/12/2023
Page:	1 of 1

Note: The Longitudinal and Transverse Loads shown below do not act concurrently.

INITIAL ESTIMATED PILE LOADS: (AASHTO LRFD)

Total Load per Abutment: Impact = 1.33

	SERVICE LOADS:		STRENGTH-I LOADS:		EXT. EVENT-I LOADS:	
Abutment DL =	128.3	k	160.3	k	160.3	k
Approach Slab =	125.0	k	156.2	k	156.2	k
DC =	504.7	k	630.8	k	630.8	k
DW =	86.4	k	129.6	k	129.6	k
LL Lane =	78.3	k	137.1	k	0.0	k
LL Vehicle =	165.8	k	385.8	k	0.0	k
Long. Lat. Load =		k		k		k
Trans. Lat. Load =		k		k		k
Total Axial Load =	1088.4	k	1599.8	k	1077.0	k
Est. # Piles/Abut. =	6	piles				
Axial Load/Pile =	**181**	**k/pile**	**267**	**k/pile**	**179**	**k/pile**

Total Load per Pier: Impact = 1.00

	SERVICE LOADS:		STRENGTH-I LOADS:		EXT. EVENT-I LOADS:	
Pier DL =		k	0.0	k	0.0	k
DC =		k	0.0	k	0.0	k
DW =		k	0.0	k	0.0	k
LL Lane =		k	0.0	k	0.0	k
LL Vehicle =		k	0.0	k	0.0	k
Long. Lat. Load =		k		k		k
Trans. Lat. Load =		k		k		k
Total Axial Load =	0.0	k	0.0	k	0.0	k
Est. # Piles/Abut. =	0	piles				
Axial Load/Pile =	**#DIV/0!**	**k/pile**	**#DIV/0!**	**k/pile**	**#DIV/0!**	**k/pile**

Total Load per Pier: Impact = 1.00

	SERVICE LOADS:		STRENGTH-I LOADS:		EXT. EVENT-I LOADS:	
Pier DL =		k	0.0	k	0.0	k
DC =		k	0.0	k	0.0	k
DW =		k	0.0	k	0.0	k
LL Lane =		k	0.0	k	0.0	k
LL Vehicle =		k	0.0	k	0.0	k
Long. Lat. Load =		k		k		k
Trans. Lat. Load =		k		k		k
Total Axial Load =	0.0	k	0.0	k	0.0	k
Est. # Piles/Abut. =	0	piles				
Axial Load/Pile =	**#DIV/0!**	**k/pile**	**#DIV/0!**	**k/pile**	**#DIV/0!**	**k/pile**

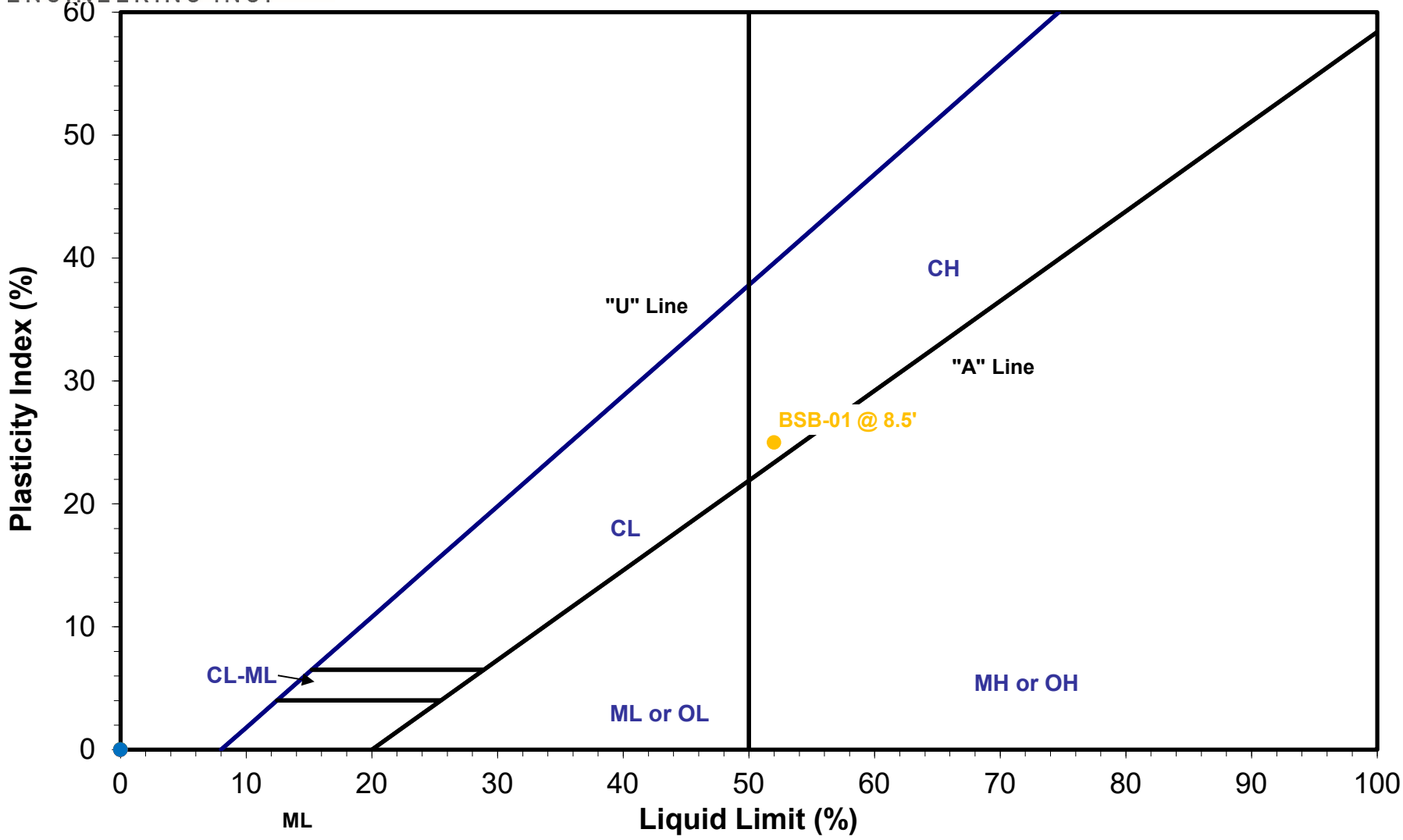
In the SGR provide at each substructure location the Pile Type & Lengths for the following loads:

+/- 100% of Strength-I & Extreme Event-I Loads shown above

+/- 120% of Strength-I & Extreme Event-I Loads shown above

rubino ENGINEERING INC.

Report of Atterberg Limits Test (ASTM D4318 / AASHTO T89 / AASHTO T90)

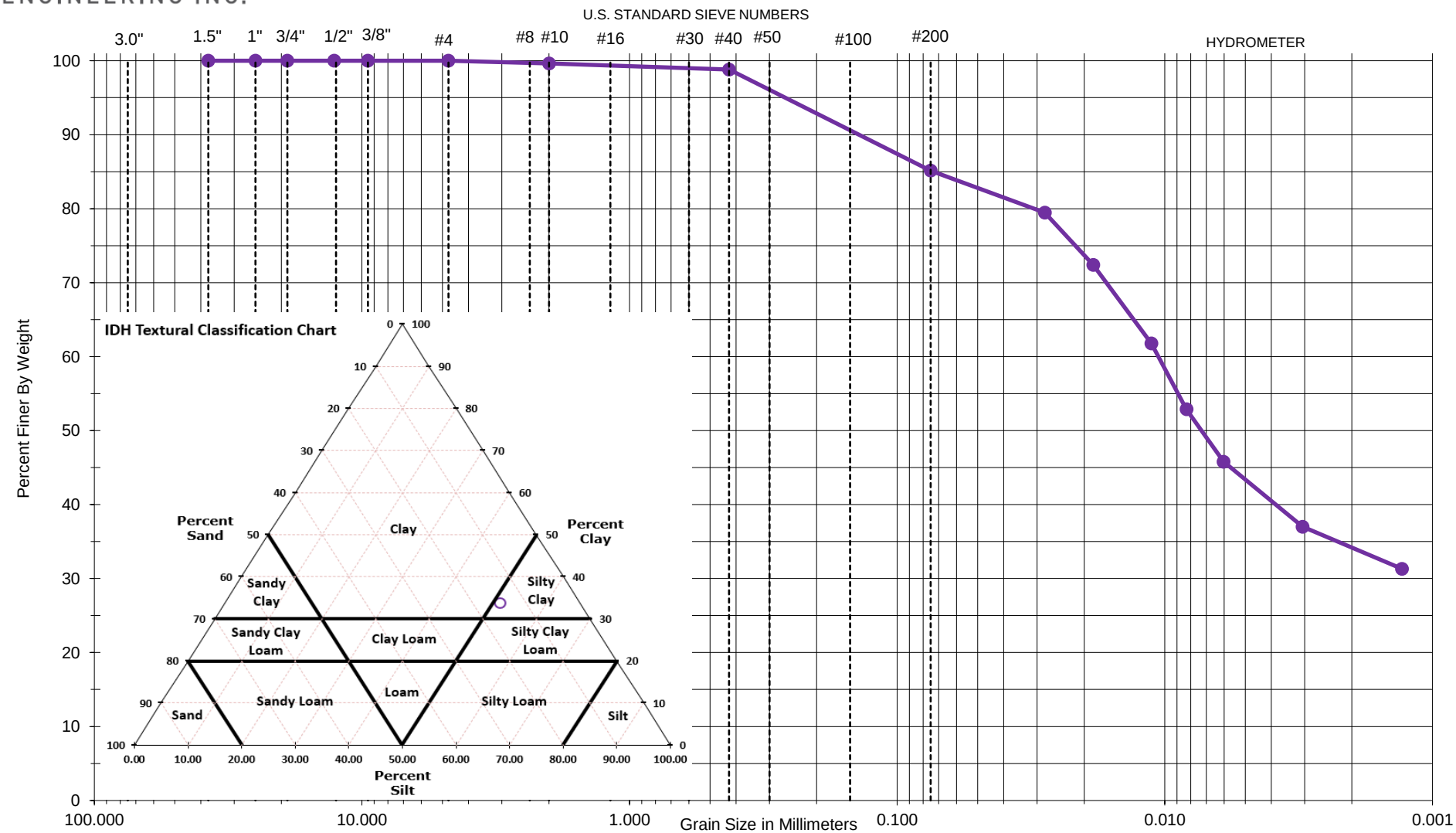


Boring #	BSB-01 @ 8.5'					
LL	52					
PL	27					
PI	25					

Project: PTB 197-022 WO 8
Location: IL 17 over Horse Creek, Kankakee Cty
Client: IDOT District 3
Project #: G21.171

rubino ENGINEERING INC.

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL



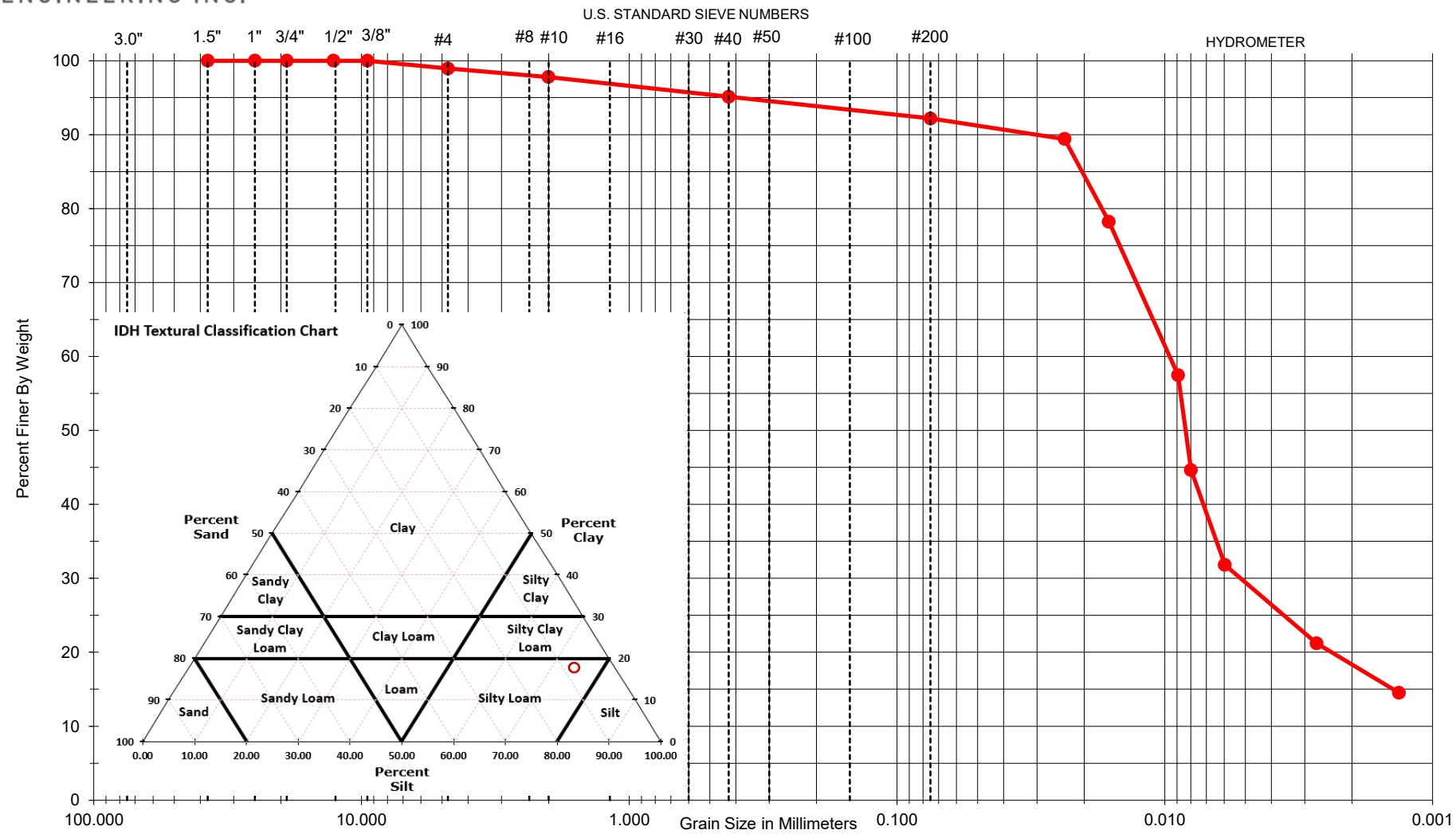
Key	Boring No.	Depth	IDH Textural Classification	WC%	ORG%	Cc	Cu	%Gravel	%Sand	%Silt	%Clay	D60	D90	D50
●	BSB-01	6	SILTY CLAY	33	4	N/A	N/A	0.4	14.6	51.6	33.5	0.011	0.199	0.007

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL	PTB 197-022 WO 8 IL-17 Over Horse Creek	File No. G21.171

Rubino Engineering Inc 425 Shepard Drive● Elgin, IL 60123 ● 847-931-1555 ● 847-931-1560 (Fax)

rubino ENGINEERING INC.

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL



Key	Boring No.	Depth	IDH Textural Classification	WC%	ORG%	Cc	Cu	%Gravel	%Sand	%Silt	%Clay	D60	D30	D10
●	BSB-01	23.5	Silty LOAM	16	N/A			2.2	5.7	74.4	17.7	0.010	0.005	

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL	PTB 197-022 WO 8 IL-17 Over Horse Creek	File No. G21.171

Rubino Engineering Inc 425 Shepard Drive● Elgin, IL 60123 ● 847-931-1555 ● 847-931-1560 (Fax)