Structure Geotechnical Report

SN 038-0209
(Existing SN 038-0023)

Illinois Route 1 over Coon Creek, 5 miles North of Milford
Station 1151+70
F.A.P. Route 332
Section 15R-BR
Iroquois County

D-93-051-01
Contract No. 66932

Prepared by: Paul Guthrie
IDOT BBS
Central Geotechnical Unit
217-524-4681
Date: June 19, 2007

Approved by: Riyad Wahab
Updates Approved by: Brad Hessing

Revised/Updated by: Brad Hessing / Doris Gonzalez
Foundations and Geotechnical Unit
217-782-7773
Revised Date: April 14, 2021
July 1, 2021

Attachments: TSL
Location Map
Subsurface Profile
Boring Logs
Pile Length Estimate Spreadsheets

Project Description and Proposed Structure Information

The construction site is located in Iroquois County, 2nd Meridian, Range 12W and Township 26N. The structure carries IL 1 over Coon Creek. The existing bridge (SN 038-0023) is to be removed and replaced (SN 038-0209). Stage construction will be utilized to maintain traffic. The superstructure and substructures will be designed according to 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition.

The existing structure is SN 038-0023, built in 1953 as S.B.I. Route 1, Section 15-R-B, at Station 1151+70. The existing 3-span structure consists of continuous cast-in-place concrete T-girders supported on pile bent abutments and solid wall piers. The structure is 118'-0" back to back of abutments and 33'-8" out to out.

The proposed structure (SN 038-0209) will be 106'-4" back to back of abutments. The structure will have a single span. The skew angle is right forward 10 degrees. The structure will have integral abutments on Metal Shell Piles equipped with conical shoes.

The preliminary factored loads are 1,633 k at each abutment.

Subsurface Conditions

Subsurface Exploration

A total of two borings were done for this project. At the North Abutment, Boring 1 was drilled on 4/20/01, and Boring 2, at the South Abutment, was done on 1/25/01. Both borings ended at elevations between 593 ft and 592 ft which made the borings approximately 66.5 ft deep. Neither boring encountered bedrock. Boring 2 indicates a ground water elevation at first encounter of 642 .3 ft and, also gives an elevation of 634.3 ft but does not give the time this reading was taken. Boring 1 gives no groundwater information.

Geotechnical Evaluations

Settlement

Our analyses indicate settlement is not a concern at either abutment. There will be very little new fill at either abutment; downdrag on piles will not be an issue.

Slope Stability

Based on our analyses, slope stability is not a concern at either abutment.

Seismic Considerations

The values for the seismic data parameters are listed below:

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.112g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.178g
Soil Site Class = D

Liquefaction

Since this structure is in Seismic Performance Zone 1, liquefaction analysis was not done.

Scour

The design scour elevations are per the following table (taken at the bottom of the abutment caps):

Table 1 - Design Scour Elevation Table

Event/Limit State	Design Scour Elevations (ft.)		
	North Abutment	South Abutment	Item 113
Q100	650.90	650.78	8
Q200	650.90	650.78	
Design	650.90	650.78	
Check	650.90	650.78	

Foundation Recommendations

Spread Footings

Since the structure will have integral abutments, spread footings are not an option.

Drilled Shafts

Since the structure will have integral abutments, drilled shafts will not be an option.

Piles

Driven piles appear to be the only alternative since this is a single span structure with integral abutments. The assumed pile cutoff elevation is 652.9 at the North Abutment and 652.78 at the South Abutment.

Pile Types: 14" Diameter Metal Shell Piles with 0.312" Wall Thickness, equipped with Conical Pile Shoes are the recommended pile type. Tables 2 and 3 below list these piles along with estimated pile lengths for a variety of Nominal Required Bearings & Factored Resistances Available. Both tables list only metal shell piles as possible pile types; originally the structure was to use H-piles, however there are no " stopper" layers or rock to prevent H-piles from running on and on, requiring an unknown number of unplanned splices. In addition, the SGR originally stated that, due to Boring 1 (North Abut.) indicating silty clay till with a Qu of 6.1 tsf and a blow count of 16 (starting at an elevation of 634.58 to an elevation of approximately 629.58) and Boring 2 (South Abut.) showing Qu values ranging as high as 4.9 tsf with blow counts as high as 70, attempting to drive metal shell piles through these hard materials may cause damage to the metal shell piles. However, experience has since shown us over the last 20 years that thicker walled metal shell piles equipped with conical pile shoes are not only feasible but are typically the preferred pile type when borings do not go to rock.

It should be noted that these tables do not go up to the Maximum Nominal Required Bearing of the pile (570 k) to avoid the risk of damaging the piles while driving, since dense sands with high

blow counts were encountered on Boring 1. On Boring 2, the Maximum Nominal Required Bearing was not achieved within the boring's depth. Despite this, as explained above, Metal Shell Piles are the preferred pile type for this site.

Test Piles: One test pile at *each* abutment is recommended.

Table 2. North Abutment Piles (using Boring 1)

Metal Shell 14" with 0.312" walls		
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
184	101	25
192	106	26
361	198	27
381	209	29
389	214	30
393	216	31
525	289	32
544	299	33

Table 3. South Abutment Piles (using Boring 2)

Metal Shell 14" with 0.312" walls		
Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
295	162	31
308	169	32
467	257	33
477	262	35
456	251	36
463	254	37
523	288	38
547	301	42

Construction Considerations

Existing Piles

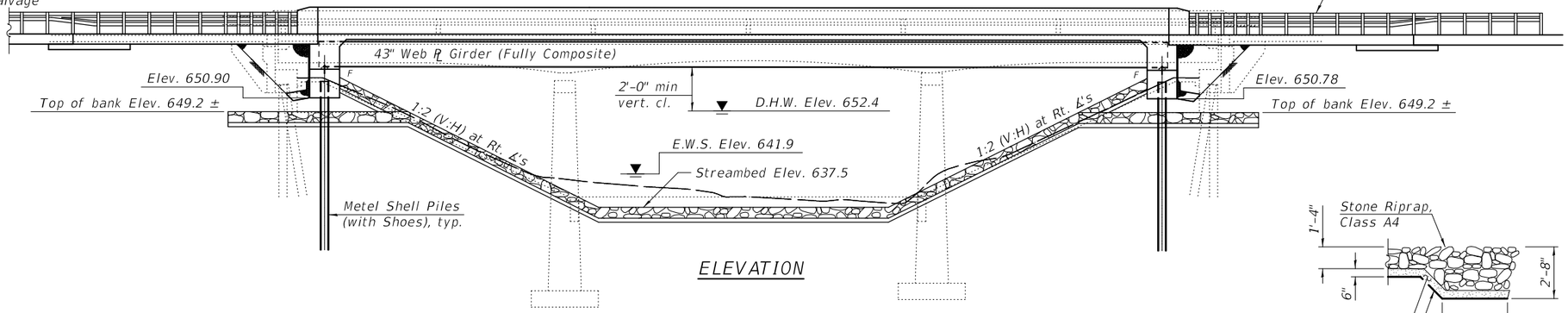
There are existing battered piles at both existing abutments which could interfere with the driving of the proposed piles. Therefore, to avoid this problem, the proposed piles should be spaced accordingly to miss the existing ones.

Stage Construction/ Soil Retention

Our analyses indicate Temporary Sheet Piling is feasible at both abutments.

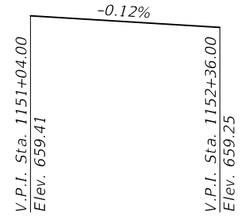
Attachments

Bench Mark: Chiseled "square" on S.E. wingwall ±Sta. 1152+25.75, ±18'-9" Lt., Elev. ±659.86
Existing Structure: S.N. 038-0023 was built in 1953 as S.B.I. Route 1, Section 15-R-B, at Station 1151+70. The existing three span structure consists of continuous cast-in-place concrete T-girders supported on pile bent abutments and solid wall piers. The structure is 118'-0" back to back of abutments and 33'-8" out to out of deck. The existing structure will be replaced. Stage construction will be utilized to maintain one lane of traffic at all times.
No salvage



ELEVATION

SECTION A-A



PROFILE GRADE
(℄ IL. Rte. 1)

HIGHWAY CLASSIFICATION

F.A.P. Rte. 332 - IL. Rte. 1
Functional Class: Principal Artierial
ADT: 2,781 (2022); 3,321 (2042)
ADTT: 355 (2022); 423 (2042)
DHV: 300 (2042)
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

DESIGN STRESSES

FIELD UNITS

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

LOADING HL-93

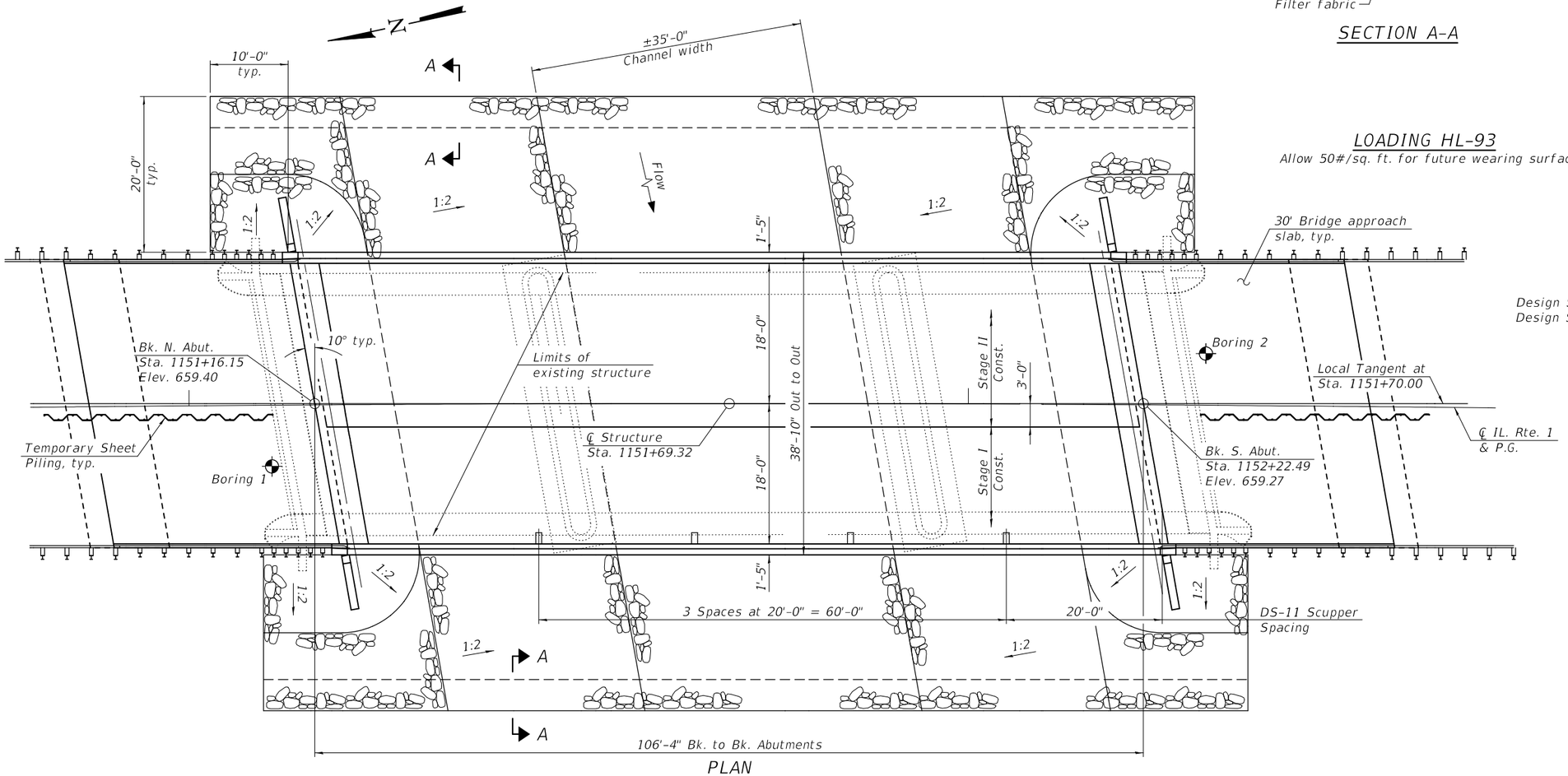
Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

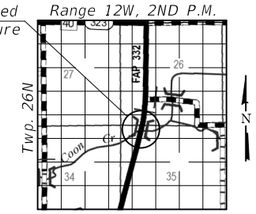
2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.112 g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.178 g
Soil Site Class = D



PLAN



LOCATION SKETCH

GENERAL PLAN & ELEVATION
IL. RTE. 1 OVER COON CREEK
F.A.P. RTE. 332 - SECTION 15R-BR
IROQUOIS COUNTY
STATION 1151+69.32
STRUCTURE NO. 038-0209

DESIGNED	-	JOSUE D. ORTIZ-VARELA
CHECKED	-	RICHARD J. CHAPUT
DRAWN	-	DENNIS A. POP
CHECKED	-	J.O.V. / R.J.C.

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 of 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	15R-BR	IROQUOIS		
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

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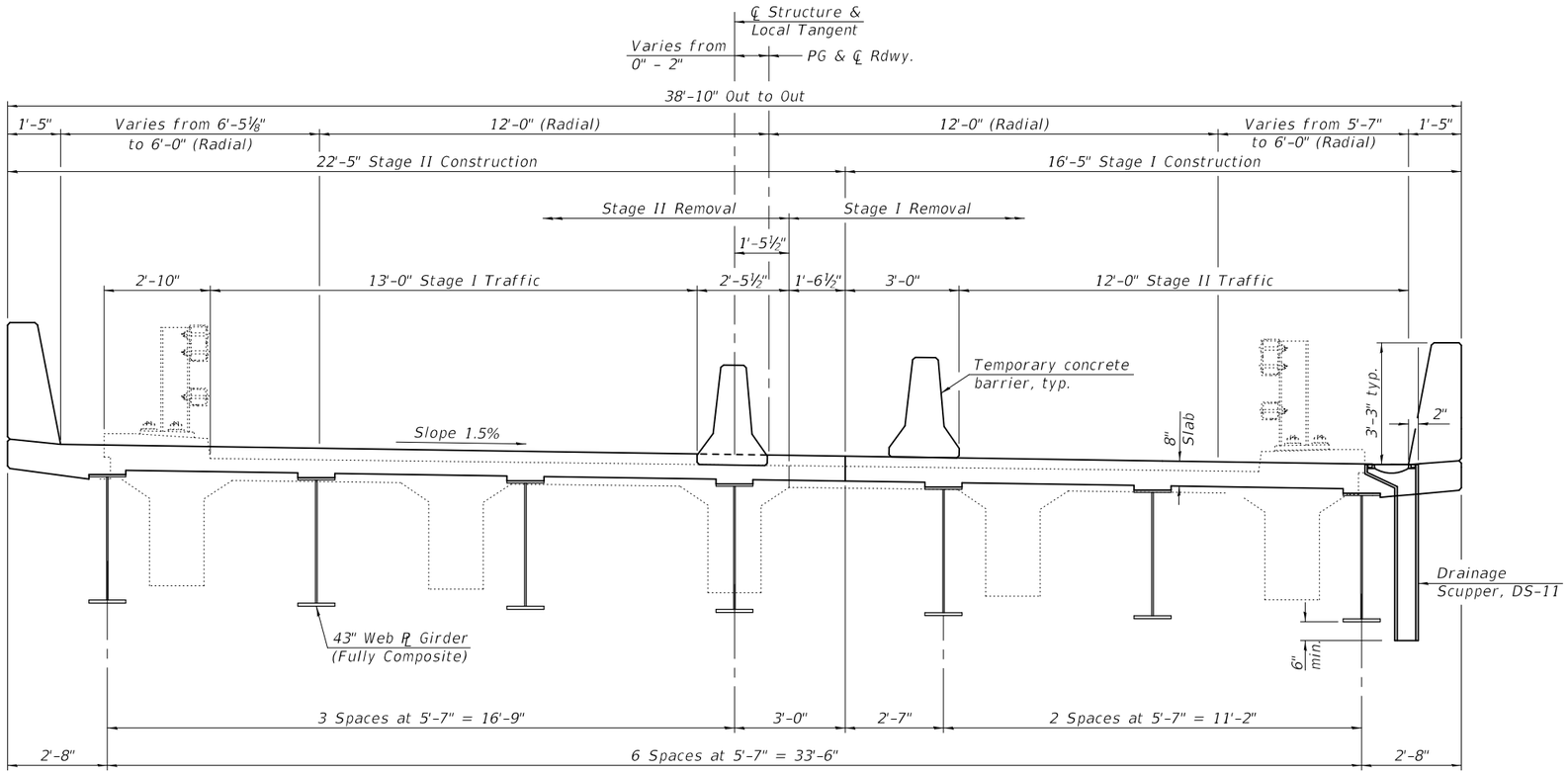
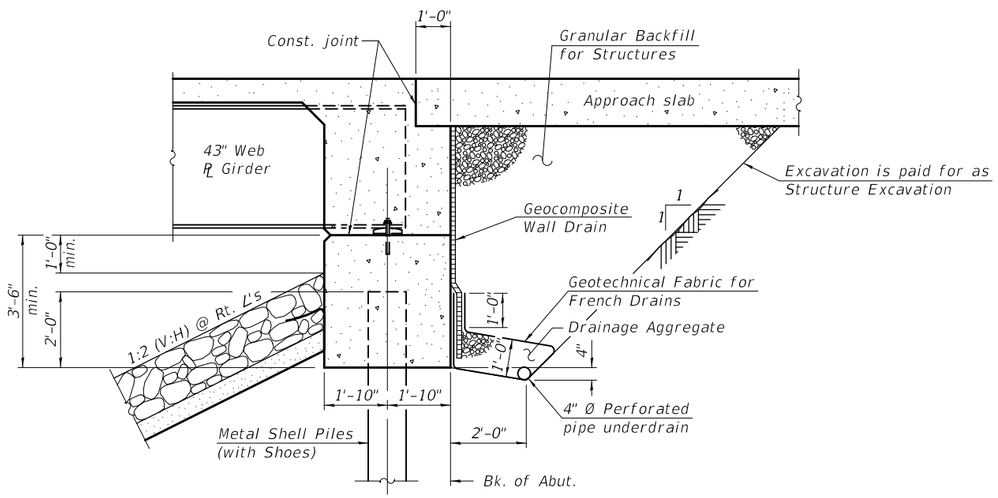
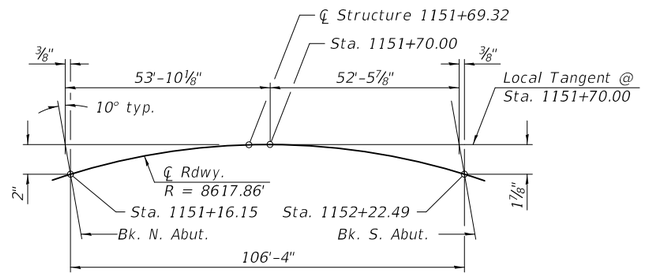


CROSS SECTION
(Looking South)



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. ℄'s)



OFFSET SKETCH

WATERWAY INFORMATION

Drainage Area = 40.4 sq. mi. Low Grade Elev. 658.64 @ Sta. 1156+00

Flood	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 Yr.	10	2980	683	846	651.0	0.2	0.1	651.3	651.2
Design	50	4770	791	974	652.4	0.6	0.4	653.0	652.8
Base	100	5560	831	1021	652.9	0.8	0.5	653.7	653.4
Scour Check	200	6400	868	1065	653.4	1.0	0.6	654.4	654.0
Max. Calc.	500	7490	914	1118	653.9	1.3	0.8	655.2	654.7

Existing 10 Year Average Velocity - 4.6 ft/s
Proposed 10 Year Average Velocity - 3.6 ft/s

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.) N. Abut.	Design Scour Elevations (ft.) S. Abut.	Item 113
Q100	650.90	650.78	
Q200	650.90	650.78	8
Design	650.90	650.78	
Check	650.90	650.78	

HORIZONTAL CURVE DATA

PI Sta. = 1144+19.85
Δ = 14°-07'-42" (RT)
R = 8617.86'
T = 1067.94'
L = 2125.05'
E = 65.92'
P.C. Sta. = 1133+51.91
P.T. Sta. = 1154+76.96
S.E. = 1.5%
S.E. attained from Sta. 1131+91.91 to Sta. 1134+31.91
S.E. removed from Sta. 1153+96.91 to Sta. 1156+36.91

DETAILS
IL. RTE. 1 OVER COON CREEK
F.A.P. RTE. 332 - SECTION 15R-BR
IROQUOIS COUNTY
STATION 1151+69.32
STRUCTURE NO. 038-0209

DESIGNED -	JOSUE D. ORTIZ-VARELA
CHECKED -	RICHARD J. CHAPUT
DRAWN -	DENNIS A. POP
CHECKED -	J.O.V. / R.J.C.

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 of 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
332	15R-BR	IROQUOIS		
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

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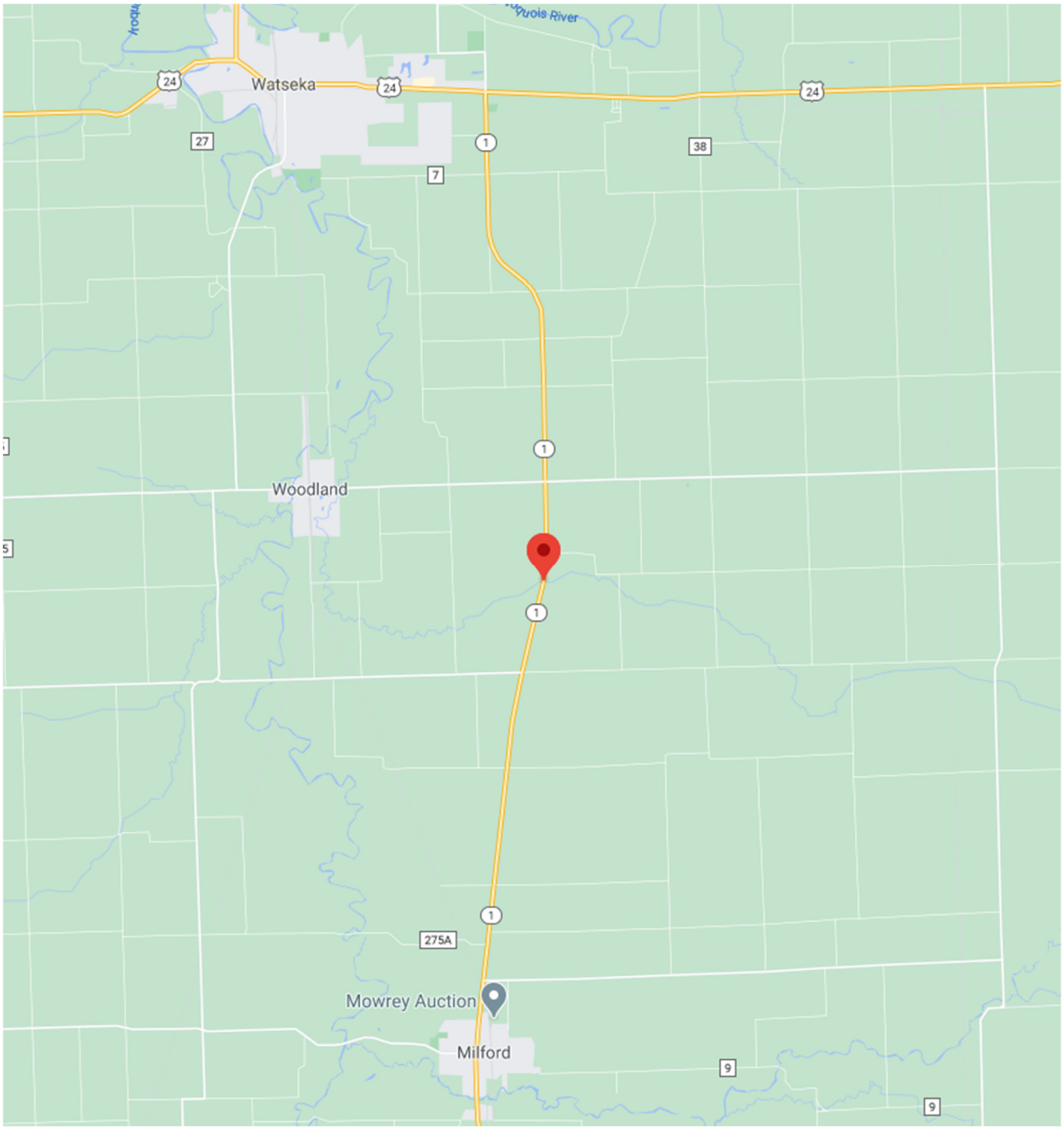
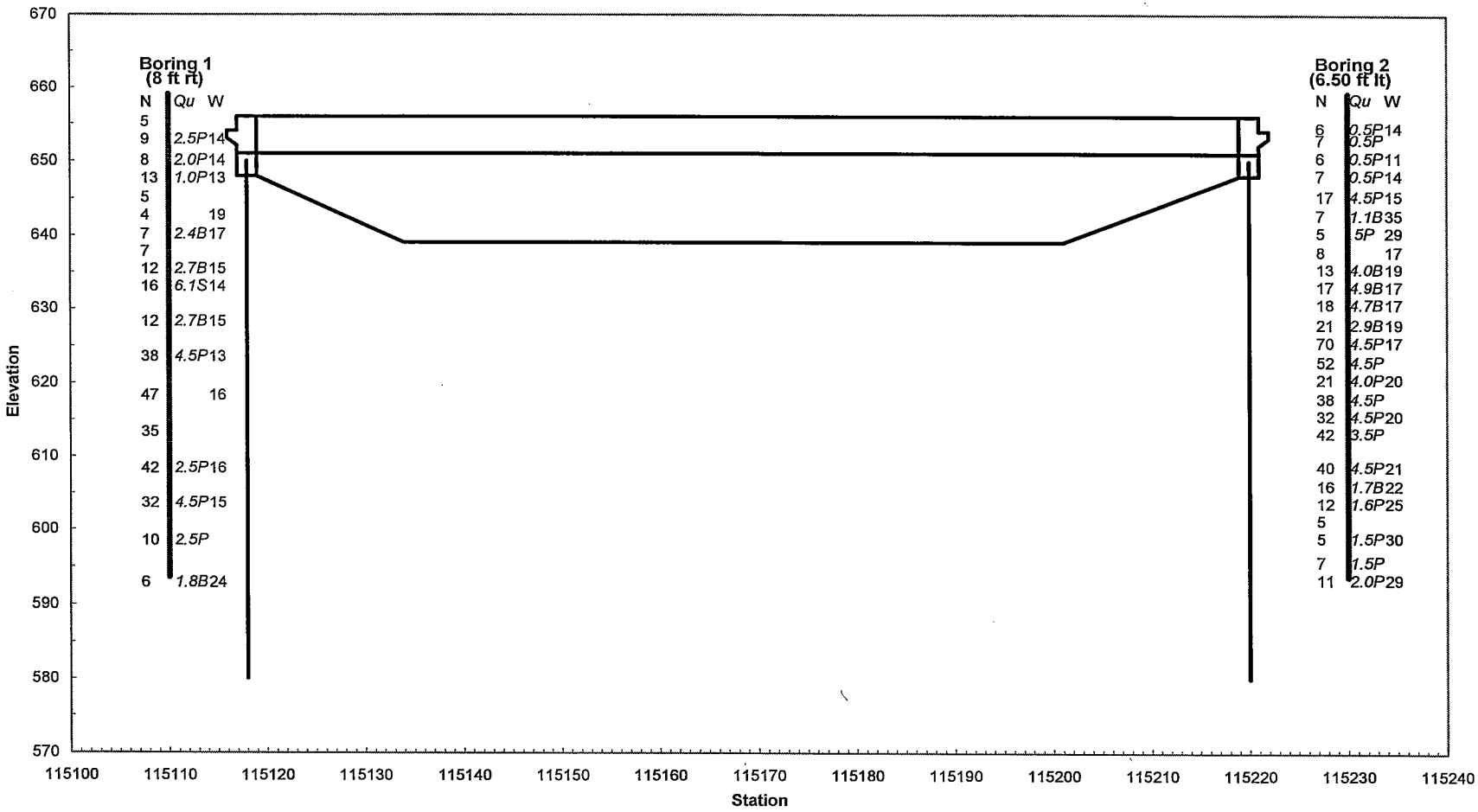
Location Map



Subsurface Profile
(Log Plot)

SN 038-0209



Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 4/20/01

ROUTE FAP 332(IL1) DESCRIPTION IL 1 OVER COON CREEK SOUTH OF WATSEKA LOGGED BY B.S.

SECTION 15R-B LOCATION NW 1/4, SEC. 35, TWP. 26N, RNG. ~~2E, 3rd~~ 12W, 2nd PM

COUNTY IROQUOIS DRILLING METHOD HOLLOW STEM AUGER HAMMER TYPE AUTOMATIC

STRUCT. NO. 038-0023 EXISTING / 0380209 NEW
Station 1151+70

BORING NO. 1 NORTH ABUT.
Station 1151+10
Offset 8.00ft RT
Ground Surface Elev. 659.08 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ Hrs. ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
				PAVEMENT Over Brown SAND
656.58				
	1			Loose Brown Fine-grained SAND
	1	-	-	
	4	-		
-5				
	4	-	-	
	4		12.0	
653.08				
	5	2.5P	14.0	Very Stiff Black SANDY LOAM
	3			
	4	2.0	14.0	
	4	P		
649.58				
-10				Medium Black SAND (Coarsing with depth)
	3			
	6	1.0	13.0	
	7	P		
	2			
	3		-	
	2			
644.58				
-15				Loose Black to Gray SAND
	2			
	2		19.0	
	2			
642.08				
	2			Very Stiff Gray SILT with Interbedded Clay
	2	2.4	17.0	
	5	B		
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	2			Very Stiff Gray SILT with Interbedded Clay *(continued)*
	3		-	
	4			
637.08				
	3			Very Stiff Gray SILTY CLAY TILL
	4	2.7	15.0	
	8	B		
634.58				
-25				Hard Gray SILTY CLAY TILL
	5			
	6	6.1	14.0	
	10	S		
-30				
	3			
	4	2.7	15.0	
	8	B		
626.08				
				Dense Gray SILT
-35				
	8			
	23	4.5	13.0	
	15	P		
621.08				
				Dense Gray Fine-grained SAND
-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
Illinois Department of Transportation

SOIL BORING LOG

Date 4/20/01

ROUTE FAP 332(IL1) DESCRIPTION IL 1 OVER COON CREEK SOUTH OF WATSEKA LOGGED BY B.S.

SECTION 15R-B LOCATION NW 1/4, SEC. 35, TWP. 26N, RNG. ~~2E, 3rd~~ 12W 2nd PM

COUNTY IROQUOIS DRILLING METHOD HOLLOW STEM AUGER HAMMER TYPE AUTOMATIC

STRUCT. NO. 038-0023 EXISTING / 0380209 NEW
Station 1151+70

BORING NO. 1 NORTH ABUT.
Station 1151+10
Offset 8.00ft RT
Ground Surface Elev. 659.08 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ Hrs. _____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Soil Description
	14			Dense Gray Fine-grained SAND *(continued)*
	20		16.0	
	27			
-45	7			
	16		-	
	19			
-50	11			
	20	2.5	16.0	
	22	P		
606.08				Dense to Medium Gray SILT
-55	6			
	14	4.5	15.0	
	18	P		
-60				
	3			Dense to Medium Gray SILT *(continued)*
	5	2.5	-	
	5	P		
596.08				Stiff Gray CLAY
-65	3			
	3	1.8	24.0	
592.58	3	B		End of Boring
-70				
-75				
-80				

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 1/25/01

ROUTE FAP 332(IL1) DESCRIPTION IL 1 OVER COON CREEK SOUTH OF WATSEKA LOGGED BY B.S.

SECTION 15R-B LOCATION NW 1/4, SEC. 35, TWP. 26N, RNG. ~~2E, 3rd~~ 12W, 2nd PM

COUNTY IROQUOIS DRILLING METHOD HOLLOW STEM AUGER HAMMER TYPE AUTOMATIC

STRUCT. NO. 038-0023 EXISTING / 038-0209 NEW
Station 1151+70

BORING NO. 2 SOUTH ABUT.
Station 1152+30
Offset 6.50ft LT
Ground Surface Elev. 659.25 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter 642.3 ft ▼
Upon Completion ____ ft
After ____ Hrs. 634.3 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				4" BITIMINOUS Over 12" CONCRETE
				657.95
				Loose Fine to Medium Grained Brown SAND
	3			
	3	0.5	14.0	
	3	P		
-5				
	4			
	4	0.5	-	
	3	P		
	2			
	2	0.5	11.0	
	4	P		
				649.75
-10				Loose Fine to Medium grained Dark Gray SAND
	4			
	4	0.5	14.0	
	3	P		
				647.25
				Hard Gray SILTY LOAM TILL
	4			
	7	4.5	15.0	
	10	P		
				644.75
-15				Medium Black CLAY
	3			
	3	1.1	35.0	
	4	B		
				642.25 ▼
				Loose Gray Coarse Grained SAND with Shell Fragments
	1			
	2	0.5	29.0	
	3	P		
				639.75
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	6			Loose Gray Coarse SAND to Angular GRAVEL *(continued)*
	4	-	17.0	
	4	-		
				637.25
				Hard Gray SANDY CLAY
	1			
	5	4.0	19.0	
	8	B		
				634.75
-25 ▽				Hard Gray CLAY TILL
	4			
	6	4.9	17.0	
	11	B		
				632.25
				Hard Gray SILTY CLAY TILL
	4			
	8	4.7	17.0	
	10	B		
				629.75
-30				Very Stiff Gray SILTY CLAY LOAM TILL
	3			
	6	2.9	19.0	
	15	B		
				627.25
				Dense (Hard)Gray SILT
	17			
	20	4.5	17.0	
	50	P		
-35				
	16			
	22	4.5	-	
	30	P		
	6			
	9	4.0	20.0	
	12	P		
-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
Illinois Department of Transportation

SOIL BORING LOG

Date 1/25/01

ROUTE FAP 332(IL1) DESCRIPTION IL 1 OVER COON CREEK SOUTH OF WATSEKA LOGGED BY B.S.

SECTION 15R-B LOCATION NW 1/4, SEC. 35, TWP. 26N, RNG. ~~2E, 3rd~~ 12W, 2nd PM

COUNTY IROQUOIS DRILLING METHOD HOLLOW STEM AUGER HAMMER TYPE AUTOMATIC

STRUCT. NO. 038-0023 EXISTING / 038-0209 NEW
Station 1151+70

BORING NO. 2 SOUTH ABUT.
Station 1152+30
Offset 6.50ft LT
Ground Surface Elev. 659.25 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

Groundwater Elev.:
First Encounter 642.3 ft ▼
Upon Completion _____ ft
After _____ Hrs. 634.3 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	10			Dense (Hard)Gray SILT *(continued)*
	16	4.5	-	
	22	P		
	8			
	15	4.5	20.0	
	17	P		
-45	10			
	19	3.5	-	
	23	P		
-50	12			
	18	4.5	21.0	
	22	P		
607.25				Stiff Gray SILTY CLAY
	5			
	7	1.7	22.0	
	9	B		
604.75				Stiff Gray CLAY
-55	6			
	5	1.6	25.0	
	7	P		
	2			
	2	-	-	
	3	-		
-60				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material
	2			Stiff Gray CLAY *(continued)*
	2	1.5	30.0	
	3	P		
	WOH			
	3	1.5	-	
	4	P		
-65	4			
	5	2.0	29.0	
592.75	6	P		
				End of Boring
-70				
-75				
-80				

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

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== N Abutment
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 652.90 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 650.90 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1633 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 39.43 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 331.32 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 124.25 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.312" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
570 KIPS	**393** KIPS	**216** KIPS	**31** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
649.58	1.32	2.00			8.8		***20.5***				21	0	0	11	3
647.08	2.50	1.00			10.2	11.7	***37.2***				37	0	0	20	6
644.58	2.50		5	Medium Sand	4.2	18.2	***43.6***				44	0	0	24	8
642.08	2.50		4	Medium Sand	3.4	20.3	***54.7***				55	0	0	30	11
639.58	2.50	2.40			18.8	28.1	***73.5***				74	0	0	40	13
637.08	2.50	2.40			18.8	28.1	***95.8***				96	0	0	53	16
634.58	2.50	2.70			20.4	31.7	***156.1***				156	0	0	86	18
633.08	1.50	6.10	16		17.9	71.5	***174.0***				174	0	0	96	20
630.58	2.50	6.10	16		29.8	71.5	***163.9***				164	0	0	90	22
628.08	2.50	2.70			20.4	31.7	***184.3***				184	0	0	101	25
627.08	1.00	2.70			8.1	31.7	***192.4***				192	0	0	106	26
626.08	1.00	2.70			8.1	31.7	***360.7***				361	0	0	198	27
623.58	2.50		38	Hard Till	19.9	191.8	***380.6***				381	0	0	209	29
622.58	1.00		38	Hard Till	7.9	191.8	***388.5***				389	0	0	214	30
622.08	0.50		38	Hard Till	4.0	191.8	***392.5***				393	0	0	216	31
621.08	1.00		38	Hard Till	7.9	191.8	***525.0***				525	0	0	289	32
620.08	1.00		47	Fine Sand	19.2	316.3	***544.2***				544	0	0	299	33
619.08	1.00		47	Fine Sand	19.2	316.3	***563.4***				563	0	0	310	34
615.58	3.50		47	Fine Sand	67.3	316.3	***549.9***				550	0	0	302	37
613.08	2.50		35	Fine Sand	29.5	235.5	***579.4***				~~579~~	~~0~~	~~0~~	~~319~~	~~40~~
610.58	2.50		35	Fine Sand	29.5	235.5	***656.0***				~~656~~	~~0~~	~~0~~	~~361~~	~~42~~
608.08	2.50		42	Fine Sand	39.6	282.6	***695.6***				~~696~~	~~0~~	~~0~~	~~383~~	~~45~~
606.08	2.00		42	Fine Sand	31.7	282.6	***606.2***				~~606~~	~~0~~	~~0~~	~~333~~	~~47~~
603.58	2.50		32	Hard Till	16.1	161.5	***622.3***				~~622~~	~~0~~	~~0~~	~~342~~	~~49~~
600.58	3.00		32	Hard Till	19.4	161.5	***509.5***				510	0	0	280	52
596.08	4.50	2.50			34.8	29.3	***536.1***				536	0	0	295	57
594.58	1.50	1.80			9.4	21.1	***545.4***				545	0	0	300	58
593.58	1.00	1.80			6.2	21.1	***551.7***				552	0	0	303	59
592.58	1.00	1.80				21.1									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== S Abutment
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 652.78 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 650.78 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 1633 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 39.43 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 331.32 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 124.25 KIPS

PILE TYPE AND SIZE ========== Metal Shell 14"Φ w/.312" walls
Pile Perimeter========== 3.665 FT.
Pile End Bearing Area========== 1.069 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
570 KIPS	**470** KIPS	**259** KIPS	*** Below Boring

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
649.75	1.03	0.50			2.3		***8.2***				8	0	0	4	3
647.25	2.50	0.50			5.6	5.9	***34.3***				34	0	0	19	6
644.75	2.50	2.25			18.0	26.4	***38.8***				39	0	0	21	8
642.25	2.50	1.10			11.0	12.9	***42.8***				43	0	0	24	11
639.75	2.50	0.50			5.6	5.9	***96.3***				96	0	0	53	13
637.25	2.50		8	Sandy Gravel	8.7	53.8	***98.0***				98	0	0	54	16
634.75	2.50	4.00	13		27.2	46.9	***135.8***				136	0	0	75	18
632.25	2.50	4.90	17		29.8	57.5	***163.3***				163	0	0	90	21
629.75	2.50	4.70	18		29.8	55.1	***172.0***				172	0	0	95	23
627.25	2.50	2.90			21.4	34.0	***512.7***				513	0	0	282	26
624.50	2.75		70	Hard Till	56.9	353.3	***478.7***				479	0	0	263	28
622.00	2.50		52	Hard Till	31.3	262.4	***294.5***				295	0	0	162	31
620.75	1.25	4.00	21		13.6	46.9	***308.1***				308	0	0	169	32
619.50	1.25	4.00	21		13.6	46.9	***466.6***				467	0	0	257	33
618.25	1.25		38	Hard Till	9.9	191.8	***476.5***				477	0	0	262	35
617.00	1.25		38	Hard Till	9.9	191.8	***456.2***				456	0	0	251	36
616.00	1.00		32	Hard Till	6.5	161.5	***462.6***				463	0	0	254	37
614.50	1.50		32	Hard Till	9.7	161.5	***522.8***				523	0	0	288	38
610.75	3.75		42	Hard Till	34.1	212.0	***546.8***				547	0	0	301	42
607.25	3.50		40	Hard Till	29.8	201.9	***394.7***				395	0	0	217	46
604.75	2.50	1.70			15.0	19.9	***408.5***				409	0	0	225	48
602.00	2.75	1.60			15.9	18.8	***423.2***				423	0	0	233	51
599.50	2.50	1.50			13.8	17.6	***437.0***				437	0	0	240	53
597.00	2.50	1.50			13.8	17.6	***450.8***				451	0	0	248	56
594.50	2.50	1.50			13.8	17.6	***470.4***				470	0	0	259	58
592.75	1.75	2.00				23.5									