

CORRESPONDENCE/MEMORANDUM_____ **State of Wisconsin**

DATE: 29 May 2003

TO: Mike Perkins
District Soils Engineer
Transportation District #6

FROM: Jan G. Kinar, P.E.
Geotechnical Engineer

SUBJECT: *Site Investigation Report*
Project ID: 1559-08-01
Structure B-55-69
CTH K over WCL RR & STH 64
Houlton to New Richmond Road
St. Croix County

Attached is the Site Investigation Report for the above project.

JGK:u:\sir_brid\b55_69 STH 64 under CTH K
Attachments

cc: District 6
Bridge Office
Geotechnical Files

SITE INVESTIGATION REPORT
Project ID 1559-08-01
Structure B-55-69
CTH K over WCL RR & STH 64
Houlton to New Richmond Road
St. Croix County

1. GENERAL

The proposed structure will be located on CTH K at the Wisconsin Central Railroad, approximately 0.75 miles north of existing STH 64. The existing 3-span, 36" prestressed girder bridge will be lengthened to become a 6-span structure, with a total length of approximately 324 feet. Pier #3 will be at the location of the existing north abutment. New foundations will be needed for the proposed north abutment and Piers #4 and #5.

The site is located in gentle rolling terrain. Groundcover consists of farm fields, railroad tracks, and small woods. Exposed bedrock and boulders are not present.

2. SUBSURFACE CONDITIONS

Two borings conforming to AASHTO T-206, Standard Penetration Test, were made to determine subsurface conditions at the site. Soil textures in the boring logs are field identifications made by the drilling crew chief. In mid-February 2003, the elevation of groundwater fluctuated between 1024 and 1036 feet. A typical boring at this site consisted of fill, firm brown silty fine to medium sand with a trace of gravel, over firm fine to medium sand with a trace of silt and gravel over very dense sand and weathered limestone.

TABLE 1: Soil Borings for Structures B-55-69, CTH K Over WCL RR & STH 64					
B #2—Proposed Pier #4 Station 500+32, 12' RT of Existing CTH K CL			B #1—Proposed North Abutment Station 501+27, 23' LT of Existing CTH K CL		
Elevation	Soil Description	Blow Count	Elevation	Soil Description	Blow Count
1038-1037	6" Bituminous and 6" CABC	---	1046.2-1033	Fill: Brown Silty F/M Sand; Trace of Gravel	27, 13
1037-1025	Fill: Brown F/M Sand; Little Silt; Trace of Gravel	14, 10			
1025-1012.5	Red/Brown Sand; Some Silt & Gravel; Trace of Cobbles	32, 12	1033-1008	Red/Brown Silty Sand; Little Gravel; Trace of Silt Seams	10, 16, 11, 17, 16
1012.5-1009	Granite <i>Boulder</i>	---			
1009-1004.5	Red/Brown Sand; Some Silt; Little Gravel	19	1008-1004	Brown F/C Sand; Little Silt & Gravel	36
1004.5-999.5	Brn Medium Sand; Some Gravel	54	1004-995.7	Brn/Grn Sand; Some Gravel	100/5"
999.5-990.5	Brown F/M Sand; Little Gravel; Trace of Silt	29, 31	995.7-993.2	Very Hard Drilling; Possibly Limestone (EOB)	90/0"
990.5-983	Weathered Rock: Shale/Limestone (EOB)	100/3", 30/0"			

At the location of the current north abutment, i.e., the proposed Pier #3, the 1975 boring indicated that there was firm medium to coarse silty sand with a trace of gravel from elevation 1027 feet to 1005 feet, dense medium to coarse silty sand with a trace of gravel

from elevation 1005 feet to 977 feet, and weathered limestone bedrock below elevation 977 feet.

3. BEARING CAPACITY

The bearing capacity of the soil layers found at the elevation at the proposed footing bases is provided in Table 2. The values were calculated assuming a minimum footing dimension of 6 feet by 6 feet and embedment depth of 4 feet.

Table 2: Bearing Capacity of Underlying Soils			
Substructure Unit & Station	Closest Boring	Footing Elevation, feet	Allowable Bearing Capacity of Soils at Footing Elevation
Pier #4, 500+28	#2, 500+32	1006.7±	4500 psf
Pier #5, 501+02	#1, 501+27	1009.9±	4500 psf
North Abutment, 501+39	#1, 501+27	1027.8±	4500 psf

4. PILES

Table 3 provides design values for cast-in-place and H10x42 piles at each boring location.

TABLE 3a: PILE PARAMETERS for Pier #2 (B#1 taken in 1975)			
Elevation, feet	<u>Skin Friction, psf</u>	<u>End Bearing, psf w/FS = 2.0</u>	
	w/FS=2.0	10¾" CIP	H10x42
1028 – 1018	80	---	---
1018 – 1005	180	---	---
1005 – 995	360	32,000	16,000
995 – 983	500	45,000	22,500
983 – 977	770	92,000	46,000
977 – 975	1200	110,000+	110,000+

TABLE 3b: PILE PARAMETERS for Pier #4 (B#2)			
Elevation, feet	<u>Skin Friction, psf</u>	<u>End Bearing, psf w/FS = 2.0</u>	
	w/FS=2.0	10¾" CIP	H10x42
1038 – 1025	90	---	---
1025 – 1009	290	---	---
1009 – 1004.5	340	22,000	11,000
1004.5 – 990.5	450	30,000	15,000
990.5 – 982.5	1200	110,000+	87,200

TABLE 3c: PILE PARAMETERS for North Abutment (B#1)			
Elevation, feet	<u>Skin Friction, psf</u>	<u>End Bearing, psf w/FS = 2.0</u>	
	w/FS=2.0	10¾" CIP	H10x42
1046 – 1033	120	---	---
1033 – 1021	190	---	---

TABLE 3c: PILE PARAMETERS for North Abutment (B#1)			
Elevation, feet	<u>Skin Friction, psf</u>	<u>End Bearing, psf w/FS = 2.0</u>	
	w/FS=2.0	10¾" CIP	H10x42
1021 – 1008	300	---	---
1008 – 1001	490	43,400	21,700
1001 – 995.5	1050	110,000+	87,200
995.5 – 993	1200	110,000+	110,000+

5. ALTERNATE FOUNDATION TYPES

Drilled caissons do not offer any economic or engineering benefit at this site. Dynamic consolidation and vibratory techniques do not offer any economic or engineering benefits either at this site.

6. LATERAL EARTH PRESSURE

Grade 1 Granular Backfill is recommended behind the abutments. With proper drainage and compaction, clean granular backfill will exert an equivalent fluid pressure of about 33 psf. If drainage is provided, silt creates 50-55 psf of fluid pressure on structures. If drainage is not provided, use 65 psf for silt as a minimum.

7. CONSTRUCTION PROBLEMS ANTICIPATED

Boulders were encountered while drilling for this site, and may cause the piles to stop at erratic lengths. H-piles may drive better than cast-in-place piles through soil layers that contain boulders.

Borings were not taken at every substructure unit location. Hence, anticipated pile lengths are approximate.

No other unusual or difficult construction problems are anticipated.

8. RECOMMENDATIONS

We recommend that H10x42 piles driven to limestone bedrock be used to support structure B-55-69. Table 3, provided earlier in this report, provides the allowable skin friction and point resistance of the various soil layers encountered at this site. The allowable design stresses for H-piles should be limited to 9000 psi.

Table 4: Estimated Pile Tip Elevations for B-55-69

Substructure Unit & Station	Closest Boring	Footing Elevation, feet	<u>H10x42 Piles</u>	
			Length from bottom of footing, feet	Elevation, ft
Pier #3 (former North Abutment), 499+54	#1 taken in 1975	1008.6±	32±	977±
Pier #4, 500+28	#2, 500+32	1006.7±	17±	990±

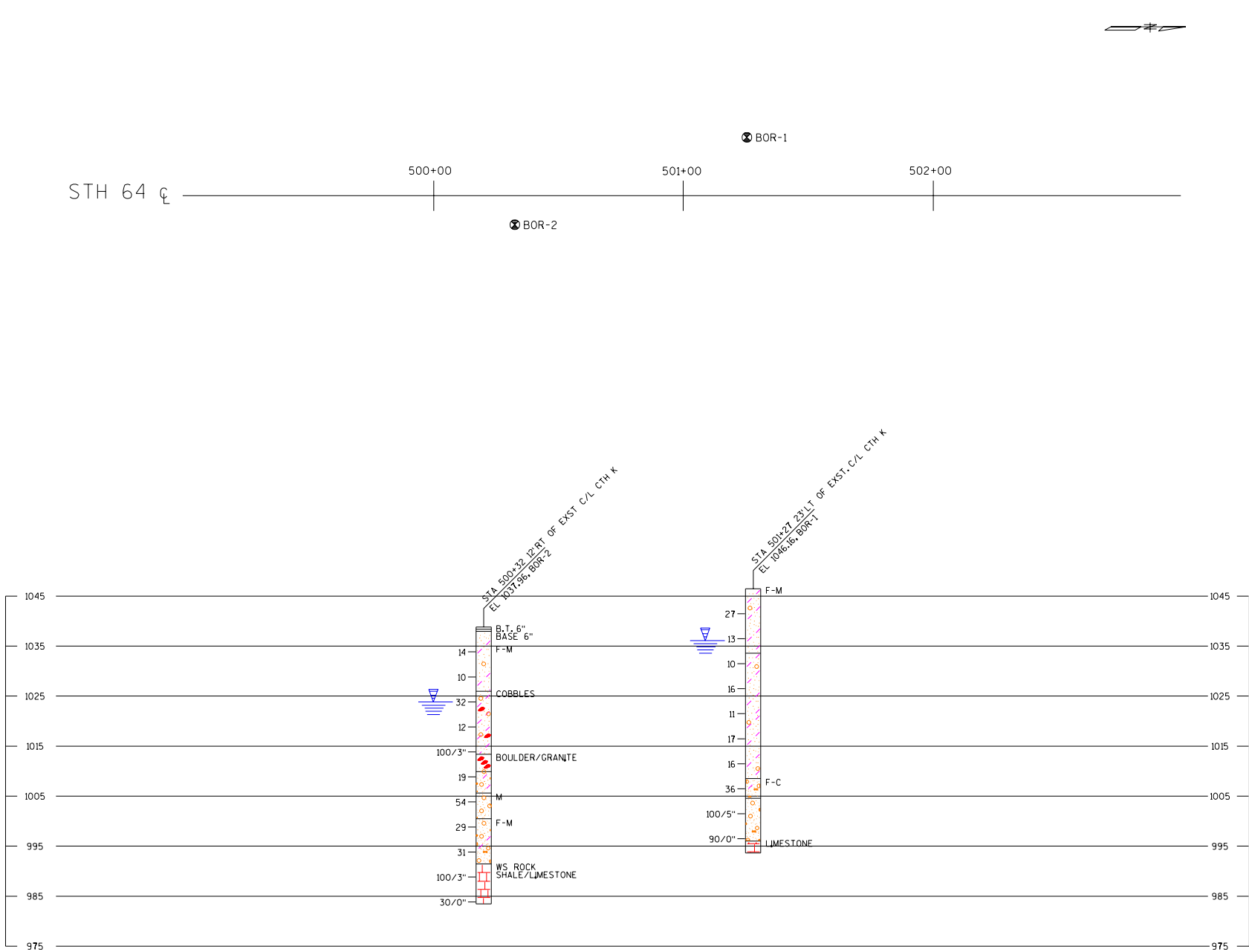
Table 4: Estimated Pile Tip Elevations for B-55-69

Substructure Unit & Station	Closest Boring	Footing Elevation, feet	<u>H10x42 Piles</u>	
			Length from bottom of footing, feet	Elevation, ft
Pier #5, 501+02	#1, 501+27	1009.9±	14±	996±
North Abutment, 501+39	#1, 501+27	1027.8±	27±	1001±

We recommend that Grade 1 Granular Backfill be used behind the abutments. If you have any questions, please contact the Geotechnical Section.

JGK:u:\sir_brid\b55_69 STH 64 under CTH K

CTH "K" OVER W.C.L. RAIL ROAD AND STH 64
HOULTON- NEW RICHMOND ROAD, ST CROIX COUNTY



STATE PROJECT NUMBER			

ABBREVIATIONS			
F — FINE	M — MEDIUM	C — COARSE	
WS — WEATHERED	SO — SOUND		
MATERIAL SYMBOLS			
TOPSOIL	SILT	SANDSTONE	
SAND	PEAT	LIMESTONE	
GRAVEL	CLAY	IGNEOUS ROCK	
LEGEND OF PROBING			
PROBING NO. STA. ELEVATION 7 AVERAGE BLOWS PER FOOT REFUSAL 95/6			
95/6=95 BLOWS FOR 6" PENETRATION PROBING TAKEN WITH A 350# WT. FALLING 18" ON A 2" O.D. POINT.			
LEGEND OF BORING			
BORING NO. STA. ELEV. UNCONFINED STRENGTH → T. 7 BLOWS PER FT. USING 140# WT. FALLING 30" WASH SAMPLE SHELBY TUBE — S.T. GROUND WATER ELEVATION NO. GROUND WATER OBSERVED ABOVE THIS ELEVATION SANDY GRAVEL F. BOULDERS OR COBBLES SAND SILTY CLAY SO LIMESTONE			
UNLESS OTHERWISE SPECIFIED, THE BLOWS PER FOOT AT THE LOCATIONS INDICATED ARE BASED ON DRIVING A 2" O.D. X 1.4" I.D. SPLIT SPOON SAMPLER WITH A 140# HAMMER HAVING A FREE FALL OF 30". THE BLOW COUNT IS TAKEN IN UNDISTURBED SOIL IMMEDIATELY BELOW A CASED OR OPEN HOLE ELIMINATING SIDE FRICTION ON THE DRIVE PIPE.			
SUBSURFACE EXPLORATION FOR FOUNDATION DESIGN AND BIDDERS INFORMATION			
TO OBTAIN RELATIVE DATA CONCERNING THE CHARACTER OF MATERIAL IN AND UPON WHICH THE FOUNDATION MIGHT BE BUILT, BORINGS AND/OR SOUNDINGS WERE MADE AT POINTS APPROXIMATELY AS INDICATED ON THIS DRAWING. THE DATA PRESENTED HEREIN REPRESENTS THE FINDINGS OF THE SUBSURFACE EXPLORATIONS MADE. HOWEVER, BECAUSE THE DEPTHS INVESTIGATED ARE LIMITED AND THE AREA OF THE BORINGS AND/OR SOUNDINGS IS VERY SMALL IN RELATION TO THE ENTIRE AREA, THE WISCONSIN DEPARTMENT OF TRANSPORTATION DOES NOT WARRANT CONDITIONS BELOW THE DEPTHS INVESTIGATED OR THAT THE CLASSIFICATION OF MATERIAL ENCOUNTERED IN THESE INVESTIGATIONS IS NECESSARILY TYPICAL OF THE ENTIRE SITE.			
NO.	DATE	REVISION	BY
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION STRUCTURES DESIGN SECTION			
STRUCTURE 8-55-69			
CONST. SPEC.	1996	DRAWN BY	PLANS CKD.
SJJ			
SUBSURFACE EXPLORATION			SHEET 01

Boring No.1

StructureB-55-69

CountyST CLAIR

Sheet1 of

Project1559-08-02

RoadSTH 67 under CTH K

Station501+27

Offset23' LT. E+ST. 2 CTH K

Surface Elevation1046.16

GROUND WATER OBSERVATIONS

Streambed Elev. _____

Time After Drilling _____

Water Elev. _____

Top of Well Elev. _____

Depth to Water _____

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit

ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud

A = Auger
C = Coring
W = Wash

E = Easy
M = Medium
H = Hard

Start2/19/08

Unit3

Finish

ChiefByrka

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0/6	6/12							
	FM					(Firm) SAND BR SILTY F-M TH OF gravel			DM	
1	D	8	15	13	27	5 Firm	5		SS	
2	W	6	7	13	19	10 Firm	10			
3	W	4	5	10	14	15 Loose SAND Red / BK SILTY LITTLE gravel TH. OF SILT seems	15		WB RB DM	
4	W	6	7	16	22	20 Firm	20			
5	W	6	6	12	18	25 Firm	25			
6	m-w	5	8	17	22	30 Firm	30			
7	m-w	4	7	16	20	35 Firm	35			
8	m-w	20	15	21	35	40 Dense SAND BR F-C LITTLE gravel LITTLE SILT layers	40			

Streambed Elev. _____ Time After Drilling 14 hrs
 Water Elev. _____
 Top of Well Elev. _____ Depth to Water (6.5 - cave in)

GROUND WATER OBSERVATIONS

Streambed Elev. _____ Time After Drilling 14 hrs
 Water Elev. _____
 Top of Well Elev. _____ Depth to Water (6.5 - cave in)

MOISTURE

DRILLING METHOD

D = Damp
M = Moist
W = Wet

HS = Hollowstem
WA = Wash Ahead
BB Rockbit

ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud

A = Auger
C = Coring
W = Wash

E = Easy
M = Medium
H = Hard

Start 2/19/03 Unit 3
Finish 2/19/03 Chief By...

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0/6	6/12							
						SAND BL F-C little silt & gravel			MA	
						SAND Br/green some gravel			RB	
9	m-w	52	100/5"			54.5 V-Dense	5			
		90/				40 50	10			
						LIMESTONE ? (Drilled with roller bit - very hard)				
						15 55 EOB # 1 53.0	15			
						20 60	20			
						25 65	25			
						30 70	30			
						35 75	35			
						40 80	40			

Checked by

Final

Boring No.	
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Boring No. 2

Structure B-55-69

County St. Croix

Sheet of 2

Project 1559-08-02

Road STH 64 under CTN K

Station 500+32

Offset 12 R of Exst. E of CTN K

Surface Elevation 1037.96

SE ABT

GROUND WATER OBSERVATIONS

Streambed Elev. _____

Time After Drilling _____

Water Elev. _____

Top of Well Elev. _____

Depth to Water _____

MOISTURE

D = Damp
M = Moist
W = Wet

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit

DRILLING METHOD

ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud

A = Auger
C = Coring
W = Wash

E = Easy
M = Medium
H = Hard

Start 2/20/13

Unit 3

Finish

Chief Byr

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0/6	6/12							
1	D	6	8	14	5	(Fill) SAND Bt. F-M Little same slit th of gravel			AM	
2	M	6	4	10	10	LOOSE			SS NW	
3	M-W	6	20	32	15	SAND Red Bt some slit gravel T.F. OF COBBLE			WA RB DM	
4	M	9	6	12	20	Firm				
5		100/3			25					
6	M	11	9	19	30	SAND Bt Red same slit Little gravel			Boulder (Granite?)	
7	M	15	26	54	35	SAND Bt med. some gravel				
8	M-W	10	12	29	40	SAND Bt F-M Little gravel th of slit				

GROUND WATER OBSERVATIONS

MOISTURE

DRILLING METHOD

Start 2/20/03 Unit 3

E = Easy
M = Medium
H = Hard

Finish Chief *Byrne*

Checked by	Final	Boring No.
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