

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: May 1, 1997

TO: Richard Pauser
Construction and Materials Supervisor
Transportation District 6

FROM: Dennis G. Althaus
Geologist

SUBJECT: Site Investigation Report
Project I.D. 1550-00-04
Structure B-55-192
STH 35&64 under 150th Ave.
St. Croix River Bridge, East Approach
St. Croix County

Attached is the Site Investigation Report for the above project.

DGA:\
Attachments

cc: District 6 (5)
C.O. Bridge
C.O. Design
Geotechnical File

SITE INVESTIGATION REPORT
Project I.D. 1550-00-04
Structure B-55-192
STH 35&64 under 150th Ave.
St. Croix River Bridge, East Approach
St. Croix County

1. GENERAL

Three borings were taken for a proposed 2 span structure to carry STH 35 and STH 64 under 150th Avenue at about station 4+989. The proposed structure will be about 93.570 meters long by 11.680 meters wide. The site is located about 4800 meters east of Houlton. There is no structure presently at the site. Rolling hills with woods and farm fields for ground cover make up the surrounding terrain. The surface soil should be a sandy till. There are rock boulders near the site.

2. SUBSURFACE CONDITION

Three borings conforming to AASHTO Method T-206, Standard Penetration Test, to estimate relative density, fix presumptive bearing capacity, investigate soil properties to select suitable pile types with their support values, make a cursory review of alternative foundation possibilities, and recover samples for soil textural identification and classification. Soil textures in the borings logs are field identifications made by the drillers and were later verified in the C.O. Geotechnical Lab.

Boring 1 was taken at station 5+030.33, 8 meters right of the proposed centerline.

<u>Elevations</u>	<u>Soil Description</u>
270.26 to 269.65	brown sandy silt
269.65 to 268.95	black silt
268.95 to 268.00	loose brown sandy silt
268.00 to 261.10	firm brown sand with a little gravel and a boulder (El. 265)
261.10 to 253.95	loose brown clayey silt with layers of sand and a trace of gravel
253.95 to 249.75	very dense sand (weathered sandstone)

Boring 2 was taken at station 4+948.13, 8 meters left of the proposed centerline.

<u>Elevation</u>	<u>Soil Description</u>
275.10 to 274.90	topsoil
274.90 to 272.10	loose brown silty sand with a trace of gravel
272.10 to 265.30	firm grown sand with gravel layers and a trace of gravel
265.30 to 261.40	very dense brown sand gravel and boulders (weathered sandstone)
261.40 to 260.20	very dense weathered limestone

Boring 3 was taken at station 4+984.23, on the proposed centerline.

<u>Elevation</u>	<u>Soil Description</u>
272.96 to 272.75	topsoil
272.75 to 268.75	loose brown sandy silt
268.75 to 262.75	firm brown silty sand with clayey silt layers and a trace of gravel
262.75 to 254.45	firm to dense brown sand with silt and a trace of gravel
254.45 to 250.60	very dense sand with a trace of gravel (weathered sandstone)

Weathered Rock Elevations

<u>Structure Unit</u>	<u>Station</u>	<u>Ws. Rock Elevation</u>
West Abutment, Boring 2	4+948	265.3
Pier, Boring 3	4+984	254.5
East Abutment, Boring 1	5+030	253.9

The pond elevation was 269.803 at the time the boring were taken. The ground water was at 259.00, it was measured 5 days after the borings were taken. The topsoil thickness varied from 0.2 meters for borings 2 and 3 to 1.3 meters for boring 1.

3. BEARING CAPACITY

The subsurface soils within a practical footing depth have insufficient bearing capacity to support spread footings for this structure.

4. PILES

A cursory review indicates that the soils above rock/weathered rock would not be adequate to support friction/displacement piles at practical load levels.

H-piles or oil field pipe piles however could be driven to 62 MPa load in the steel section if driven to weathered rock / very dense sand at about The following elevations:

<u>Structure Unit</u>	<u>Station</u>	<u>Weathered Rock Elevation</u>
West Abutment	4+944	265.0
Pier	4+989	254.2
East Abutment	5+034	253.6

5. ALTERNATIVE FOUNDATION TYPE

Drilled caissons could be used here but the cost would be more. Dynamic and vibratory methods could not be used effectively here.

6. LATERAL EARTH PRESSURE

Grade 1 granular backfill will exert an equivalent fluid pressure of 1.4 to 1.7 kPa, silty sands 2.2 kPa, silts 3.2 kPa, silty clays and clays 4.1 kPa or more.

7. CONSTRUCTION PROBLEMS

There are no unique or especially difficult construction problems foreseen.

8. RECOMMENDATIONS

A) Remove all topsoil and black silt before placing any fill.

B) If any material (soil) other than a grade 1 granular is used as backfill behind the abutments or any other earth retaining structure, some sort of drainage system should be placed behind these structures to prevent water caused problems such as material wash out from behind these structures.

C) Use H-piles or oil field pipe piles driven to 62 MPa load in the steel section driven to weathered rock at about the following elevations:

<u>Structure Unit</u>	<u>Station</u>	<u>Weathered Rock Elevation</u>
West Abutment	4+944	265.0
Pier	4+989	254.2
East Abutment	5+034	253.6

Since boulders are on the surface as well as in the subsurface soils, it is recommended that tips be installed to help drive the piles through the boulders to get down to the weathered rock.

If you have any questions, please contact the Geotechnical Unit.

ABBREVIATIONS
F—Fine M—Medium C—Coarse
W—Weathered S—Sound

MATERIAL SYMBOLS
Topsoil Silt Sandstone
Sand Peat Limestone
Gravel Clay Igneous Rock

LEGEND OF PROBING

95/152=95 Blows for
152mm Penetration
7 Average Blows Per
151.1Kg Wt.
Falling 457mm on a
51mm O.D. Point.
Refusal 95/152

LEGEND OF BORING

Unconfined
Strength
kPa → 778 7
Blows Per 300mm
Using 63 Kg Wt.
Falling 762mm
Wash Sample
Shelby Tube—S.T.
Ground Water
Elevation
No Ground Water
Observed Above
This Elevation
Limestone
Silty Clay
Sand
Silty Gravel
Boulders or
Cobbles
Sand

SUBSURFACE EXPLORATION FOR FOUNDATION

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 of Division of Highways 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.

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STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

STRUCTURE B-55-192

CONSTR. SPEC. 1996

DESIGN BY M.J.P.

PLANS OCT.

SUBSURFACE
EXPLORATION

SHEET 1 OF 1

12 Meter Log

Boring No. 1 Structure B SS-1902 County ST CROIX Sheet V of 2
 Project 1550-00-04 Road STH 35/64 Under 150th AVE
 Station 5+030, 330 Offset 8 m RT of Proposed E Surface Elevation 270-266

GROUND WATER OBSERVATIONS of 150th Avenue

Streambed Elev. Pond Elev 269.803 Time After Drilling 5 days
 Water Elev. _____
 Top of Well Elev. _____ Depth to Water 11.3 m (cave-in)

MOISTURE

D = Damp
 M = Moist
 W = Wet

A = Auger
 C = Coring
 CA = Casing Advancer
 WA = Wash Ahead
 HS = Hollowstem

DRILLING METHOD

DM = Drilling Mud NW = Casing, 76.2mm I.D. (3")
 RB = Rockbit HW = Casing, 101.6mm I.D. (4")
 SS = Splitspoon BV = Corebarrel, 36.5mm Core Dia. (1 7/16")
 ST = Shelby Tube NV = Corebarrel, 47.6mm Core Dia. (1 7/8")
 E = Easy M = Medium H = Hard

Start 4-16-97 Unit 1Finish _____ Chief STAVEN
AK

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0-15	15-30							
						30 cm <u>Br. Sandy Silt</u>				
						60 cm <u>Black Silt</u>				
						90 cm <u>Black Silt</u>				
						120 cm				
1	MW	4	2	15	5	1.5 m <u>Loose Br. SAND & Silt</u>				
		3				180 cm				
						210 cm				
						240 cm				
2	M	4	7	15	15	270 cm <u>Firm Br. Fine to Coarse SAND Little Gravel</u>				
		8				3 m				
						330 cm				
						360 cm				
						390 cm				
						420 cm <u>No Rec</u>				
						4.5 m				
						480 cm				
						510 cm				
						540 cm				
3	W	8	7	15	15	570 cm <u>tr of silt</u>				
						6 m				
						630 cm				
						660 cm				
						690 cm				
						720 cm				
						7.5 m <u>No Rec</u>				
						780 cm				
						810 cm				
						840 cm				
4	W	7	6	13	13	870 cm				
						9 m				
						930 cm <u>Loose Br. clayey</u>				
						960 cm				
						990 cm				
5	W	3	3	6	6	1020 cm <u>Silt Layer of SAND tr of Gravel</u>				
						10.5 m				
						1080 cm				
						1110 cm				
						1140 cm				
6	W	2	3	5	5	1170 cm				
						12 m				

Checked by _____

METRIC CONVERSION FACTORS

1 cm = 0.3937 inch
 1 inch = 2.54 cm
 1 m = 3.281 feet
 1 foot = 30.48 cm, 0.3048 m

Boring No. 1

GROUND WATER OBSERVATIONS

MOISTURE		DRILLING METHOD (Cave-in)		Start <u>1469</u> Unit <u>1</u>
D = Damp	A = Auger	DM = Drilling Mud	NW = Casing, 76.2mm I.D. (3")	Finish Chief <u>XP</u>
M = Moist	C = Coring	RB = Rockbit	HW = Casing, 101.6mm I.D. (4")	
W = Wet	CA = Casing Advancer	SS = Splittings	BV = Corebarrel, 36.5mm Core Dia. (1 7/16")	
	WA = Wash Ahead	ST = Shelby Tube	NV = Corebarrel, 47.6mm Core Dia. (1 7/8")	
	HS = Hollowstem	E = Easy	M = Medium H = Hard	

Checked by

METRIC CONVERSION FACTORS

Boring No.

1 cm = 0.3937 inches 1 inch = 2.54 cm
1 m = 3.281 feet 1 foot = 30.48 cm = 0.3048 m

Boring No. 2

Structure B 55-192

County ST CROIX

Sheet 1 of 2

Project 1550-00-04

Road STH 35/64 under KO AVE

Station 4+948.130

Offset 8m LT of proposed 275.103

Surface Elevation 275.103

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

A = Auger
C = Coring
CA = Casing Advancer
WA = Wash Ahead
HS = Hollowstem

DM = Drilling Mud
RB = Rockbit
SS = Splitspoon
ST = Shelby Tube
E = Easy

NW = Casing, 76.2mm I.D. (3")
HW = Casing, 101.6mm I.D. (4")
BV = Corebarrel, 36.5mm Core Dia. (1 7/16")
NV = Corebarrel, 47.6mm Core Dia. (1 7/8")
M = Medium
H = Hard

Start 4-21-97 Unit 1

Finish 4-22-97

Chief SHAVEN

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0-15	15-30							
						30 cm top soil				
						60 cm BR silty sand Tr GRAVEL				
						90 cm				
						120 cm				
						1.5 m 1.5 m				
1	M	4	4	9		180 cm				
						210 cm				
						240 cm				
						270 cm				
						3 m 3 m				
2		2	2	11		Firm BR Fine to med SAND			RB	
						330 cm EOL (Tr GRAVEL)			DM	
						360 cm (Layer GRAVEL)			WA	
						390 cm				
						420 cm				
3		11	11	25		4.5 m 4.5 m				
						480 cm				
						510 cm				
						540 cm				
4		8	8	17		570 cm Firm BR med to coarse SAND				
						6 m 6 m				
						630 cm Tr GRAVEL				
						660 cm				
						690 cm				
5		11	10	20		720 cm 7.5 m 7.5 m				
						780 cm				
						810 cm				
						840 cm				
6		9	12	21		870 cm 9 m 9 m				
						9 m Firm Fine to med SAND				
						930 cm Tr GRAVEL				
						960 cm				
						990 cm				
7		14	103	168		1020 cm Dense BR Fine SAND				
						10.5 m 10.5 m				
						1080 cm (Drove Shoe through Boulder)				H
						1140 cm				
						1140 cm				
8		22	23	45		1170 cm Very Dense weather sand stone				
						12 m 12 m				
						Little silt SAND (Shake layer in spoon)				
						Tr GRAVEL				

FIELD BORING LOG
12 Meter Log

Boring No. 2 Structure B 65-192 County ST CROIX Sheet 2 of 2
Project 1550-00-04 Road STH 35/STH 64 under 150 Ave
Station 4498.130 Offset 8m LT of proposed LF 150 Ave Surface Elevation 275.103

GROUND WATER OBSERVATIONS

Streambed Elev. _____ Time After Drilling _____
Water Elev. _____
Top of Well Elev. _____ Depth to Water _____

MOISTURE

D = Damp
M = Moist
W = Wet

A = Auger
C = Coring
CA = Casing Advancer
WA = Wash Ahead
HS = Hollowstem

DRILLING METHOD

DM = Drilling Mud
RB = Rockbit
SS = Splitspoon
ST = Shelby Tube
E = Easy
NW = Casing, 76.2mm I.D. (3")
HW = Casing, 101.6mm I.D. (4")
BV = Corebarrel, 36.5mm Core Dia. (1 7/16")
NV = Corebarrel, 47.6mm Core Dia. (1 7/8")
M = Medium
H = Hard

Start 42197 Unit 1Finish 42297 Chief STADEN
AC

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0-15	15-30							
						40 cm				
						60 cm				
						90 cm				
9		34	40	74		120 cm				
						150 cm				
						180 cm				
						210 cm				
						240 cm				
10		18	100			270 cm				
						3 m				
						330 cm				
						360 cm				
						390 cm				
						420 cm				
						4.5 m				
						480 cm				
						510 cm				
						540 cm				
						570 cm				
						6 m				
						630 cm				
						660 cm				
						690 cm				
						720 cm				
						7.5 m				
						780 cm				
						810 cm				
						840 cm				
						870 cm				
						9 m				
						930 cm				
						960 cm				
						990 cm				
						1020 cm				
						10.5 m				
						1080 cm				
						1110 cm				
						1140 cm				
						1170 cm				
						12 m				

Checked by _____

METRIC CONVERSION FACTORS

1 cm = 0.3937 inches
1 m = 3.281 feet
1 inch = 2.54 cm
1 foot = 30.48 cm, 0.3048 m

Boring No. 2

FIELD BORING LOG

12 Meter Log

Boring No. 3 Structure B55-192 County ST CROIX Sheet 1 of 1
 Project 1550-00-04 Road STH 35/STH 64 Under 150 Ave
 Station 47984.230 Offset P Propose 4 of 150 Ave Surface Elevation 272.963

GROUND WATER OBSERVATIONS

Streambed Elev. _____ Time After Drilling _____
 Water Elev. _____
 Top of Well Elev. _____ Depth to Water _____

MOISTURE

DRILLING METHOD

Start 4:22:97 Unit 1

D = Damp
 M = Moist
 W = Wet

A = Auger
 C = Coring
 CA = Casing Advancer
 WA = Wash Ahead
 HS = Hollowstem

DM = Drilling Mud
 RB = Rockbit
 SS = Splitspoon
 ST = Shelby Tube
 E = Easy

NW = Casing, 76.2mm I.D. (3")
 HW = Casing, 101.6mm I.D. (4")
 BV = Corebarrel, 36.5mm Core Dia. (1 7/16")
 NV = Corebarrel, 47.6mm Core Dia. (1 7/8")
 M = Medium
 H = Hard

Finish _____ Chief STAVEN

Sample No.	Moisture	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
		0-15	15-30							
						30 cm <u>Top soil</u>				
						60 cm				
						90 cm				
						120 cm				
						1.5 m <u>Loose BR Sandy silt</u>	1.5 m			
1		1	2	4		180 cm				
						210 cm				
						240 cm				
						270 cm				
						3 m	3 m			
						330 cm				
						360 cm				
						390 cm				
2		4	5	13		420 cm <u>Firm BR Silty Sand to GRAVEL</u>	4.5 m			
						450 cm				
						480 cm				
						510 cm				
						540 cm				
						570 cm				
B		4	4	8		6 m <u>BR med coarse Sand (with clayer silt layers) TR GRAVEL</u>	6 m			
						630 cm				
						660 cm				
						690 cm				
						720 cm				
4		5	5	12		7.5 m	7.5 m			
						780 cm				
						810 cm				
						840 cm				
						870 cm				
5		4	5	10		9 m	9 m			
						930 cm				
						960 cm				
						990 cm				
6		4	6	13		10.5 m <u>Firm BR med coarse Sand TR GRAVEL</u>	10.5 m			
						1020 cm				
						1050 cm				
						1080 cm				
						1110 cm				
						1140 cm				
						1170 cm				
						12 m <u>(no recovery)</u>	12 m			

Checked by _____

METRIC CONVERSION FACTORS

1 cm = 0.3937 inches
 1 m = 3.281 feet
 1 inch = 2.54 cm
 1 foot = 30.48 cm, 0.3048 m

Boring No. 3

FIELD BORING LOG
12 Meter Log

Boring No. 3 Structure B55-192 County ST CROIX Sheet 2 of 2
Project 1550-00-04 Road 5TH 35/5TH 61 Under 150 Ave
Station 4+784.23 Offset Propose E of 150 Ave Surface Elevation 222.963

GROUND WATER OBSERVATIONS

Streambed Elev. _____ Time After Drilling _____
Water Elev. _____
Top of Well Elev. _____ Depth to Water _____

MOISTURE

D = Dry
M = Moist
W = Wet

DRILLING METHOD

A = Auger
C = Coring
CA = Casing Advancer
WA = Wash Ahead
HS = Hollowstem

DM = Drilling Mud
RB = Rockbit
SS = Spillspoon
ST = Shelby Tube
E = Easy

NW = Casing, 76.2mm I.D. (3")
HW = Casing, 101.6mm I.D. (4")
BV = Corebarrel, 36.5mm Core Dia. (1 7/16")
NV = Corebarrel, 47.6mm Core Dia. (1 7/8")
M = Medium H = Hard

Start 422.97 Unit 1Finish _____ Chief STAYEN
AC

Sample No.	Blows on Sampler		Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method	Probe Blows
	0-15	15-30							
					40				
					30 cm				
					60 cm				
					90 cm				
					120 cm				
	5	4	9	45	(no recovery)				
					150 cm				
					180 cm				
					210 cm				
					240 cm				
					270 cm				
	17	6	12	60	(no recovery)				
					300 cm				
	6				330 cm				
					360 cm				
					390 cm				
					420 cm				
7	6	18	24	55	BR Silty SAND TR GRAVEL				
					480 cm				
					510 cm				
					540 cm				
					570 cm				
8	12	20	30	60					
					630 cm				
					660 cm				
					690 cm				
					720 cm				
9	40	57	100	197	VERY Dense Fine to Med SAND				
					750 cm				
					780 cm				
					810 cm				
					840 cm				
10	156	156	312	624	VERY Dense Fine SAND TR GRAVEL (Weathered Sandstone)				
					930 cm				
					960 cm				
					990 cm				
					1020 cm				
11	160	160	320	640	VERY Dense Fine SAND TR GRAVEL (Weathered Sandstone)				
					1080 cm				
					1110 cm				
					1140 cm				
					1170 cm				
					12 m				

Checked by _____

METRIC CONVERSION FACTORS

1 cm = 0.3937 inches
1 m = 3.281 feet

1 inch = 2.54 cm
1 foot = 30.48 cm, 0.3048 m

Boring No. 3