

MEMORANDUM

BA 1424

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107,
Lab. Building.

FROM: P. DeVisser,
Bridge Location Engineer.

DATE: December 7, 1962.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 211-61-1, Site #25-43
Humber River at Cedar Mills
2.5 miles south of Palgrave
Hwy. #50, District #6.

Attached is one print of preliminary plan
D 5173-F for the subject structure.

If you have any comments, please let us know.

P. DeVisser

FDv/rv

P. DeVisser,
Bridge Location Engineer.

Not Jan. 14th 1963.

Sheet piles not needed for river protection. (Hydraulic)
However because of the predominantly granular
nature of the subsoil an appropriate dewatering
scheme will be required, and a note to bidders
should therefore be put on the drawing or ~~sent~~
in the Contract
Francis DeVisser

Lefton

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)

May 10, 1962.

D.H.C. FOUNDATION INVESTIGATION
REPORT.
W.J. 62-F-33 -- W.P. 211-61-1.

Attention: Mr. S. McCombie.

Re: Proposed New Humber River Bridge on
Hwy. #50 - 2.4 Mi. South of Palgrave, (D. E. M.)
District #8.

We are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure location.

We believe the factual data and recommendations contained therein, will prove adequate for your future design work. Should further information be required, please feel free to contact our Office.

AGS/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
I. C. Campbell
C. Fraser
T. J. Kovich
J. Roy
J. E. Gruspier
E. R. Saint
P. Norman
A. Watt
Foundations Office.
Gen. Files.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF SITE.
 3. FIELD INVESTIGATION PROCEDURE.
 4. LABORATORY TESTS.
 5. SOIL TYPES AND SOIL CONDITIONS:
 - 5.1) General.
 - 5.2) Fine Sandy Peat.
 - 5.3) Silty Fine Sand with Some Gravel.
 - 5.4) Silty Fine Sand to Silt.
 - 5.5) Clayey Silt.
 6. GROUND WATER LEVEL.
 7. DISCUSSION AND RECOMMENDATIONS.
 - 7.1) General.
 - 7.2) Structure Foundation.
 8. SUMMARY.
 9. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION

For

Proposed New Humber River Bridge on
Hwy. #50 - 2.4 Mi. South of Palgrave,
District #6
W.J. 62-F-33 -- W.P. 211-61-1

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed new bridge on Hwy. #50 was received from the Bridge Location Section in a memo dated March 13th, 1962.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the location of the proposed structure. Presented in this report are the results of this investigation, together with recommendations pertaining to the design of the proposed foundation and approach embankments.

2. DESCRIPTION OF SITE:

The site is on Hwy. #50, 2.4 miles South of Palgrave. The proposed new Humber River Bridge is 70 ft. east of the existing bridge.

The highway-river crossing is situated in a valley surrounded by a rolling topography with a knob-and-basin relief. At the site the Humber River flows swiftly and is about 40 ft. wide and $1\frac{1}{2}$ ft. deep. Its northern and southern banks are relatively flat at the proposed structure location and are approximately 5 ft. and 10 ft. in height, respectively, above the

cont'd. /2 ...

2. DESCRIPTION OF SITE: (cont'd.) ...

river water level. The soil is predominantly fine sand with a grass cover and some cedar trees.

The site is located in the physiographic region of Oak Ridges. The Oak Ridges consist of an interlobate moraine built between two opposing lobes of a glacier. Much of this moraine is covered with sand hills and coarse outwash.

3. FIELD INVESTIGATION PROCEDURE:

A total of four boreholes and four dynamic cone penetration tests adjacent to the boreholes were carried out during the course of the field work. Boring was achieved by means of conventional diamond drilling equipment adapted for soil sampling purposes. Soil samples were obtained by means of a standard split spoon. The dimensions of the split spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Driving energy to advance the dynamic cone was 350 ft.-lbs. per blow.

The locations and elevations of all boreholes are shown on Drawing No. 62-F-33A which accompanies this report.

4. LABORATORY TESTS:

Some samples were tested in the laboratory primarily for classification purposes. These tests were Atterberg Limits and grain size analyses. The results of the latter are plotted on a grain size distribution chart and are included in Appendix #1.

5. SOIL TYPES AND SOIL CONDITIONS:

5.1) General:

The subsoil at the site consists of fluvial deposits varying in grain size from a silty fine sand with gravel to a clayey silt and a swamp deposit of fine sandy peat.

The boundaries of the deposits are shown on the accompanying bore log sheets. The estimated stratigraphical profiles and cross sections shown on Drawing #62-F-33A are based on information from the boreholes. From ground level downwards, the various soil types are as follows:-

5.2) Fine Sandy Peat:

This stratum is a swamp deposit. It was found in the northern bank in boreholes No's 3 and 4 to depths of 2.5 ft. and 7.5 ft., respectively. It extended from ground level to elevation 821.5'. The material is a very soft peat with some fine sand. It is highly compressible, has an organic odour and is black in colour.

5.3) Silty Fine Sand with Some Gravel:

This stratum was established in all boreholes. It formed the ground surface in the southern bank and was found under the swamp deposit in the northern bank. The stratum thickness varied from 2.5 to 5.0 ft. with its lower boundary at elevation 819' approximately, except at B.H. #1 where it was 829'. The material is a silty fine sand with some fine to coarse gravel. The gravel is predominantly fine and sub-rounded. The coarse gravel was found in B.H. #1 and its maximum size, as observed at the

cont'd. /4 ...

5. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

5.3) Silty Fine Sand with Some Gravel: (cont'd.) ...

eroded slope of the bank, was 4 inches. The relative density of the material is loose to compact with an average 'N' value of 18 blows/ft.

5.4) Silty Fine Sand to Silt:

This is the main stratum at the proposed site and it controls the footing design. This stratum underlies the silty fine sand layer and extends throughout a depth of 85 ft. in B.H. No. 3 down to elevation 739'. The grain sizes of the material vary both vertically and horizontally from a silty fine sand to silt. The relative density varies from loose to very dense, with the higher relative density being encountered in the silt layers. An average penetration resistance 'N' value of 17 blows/ft. has been chosen for design purposes.

5.5) Clayey Silt:

This material was found in B.H. #2 and it represents a pocket in the silty fine sand to silt. It is 12 ft. thick extending from elev. 819' to elev. 807'. The clayey silt is stiff with average values of: LL - 20.7, P.L. - 14.4; M.C. - 14.7 and 'N' value of 15 blows/ft.

6. GROUND WATER LEVEL:

Ground water levels were observed in the boreholes during the time of field investigation. The water level was observed to be the same as the river water level in B.H. No's. 2 and 3, elev. 823', and at elevations 830.5' and 829' in B.H. No's 1 and 4, respectively.

cont'd. /5 ...

7. DISCUSSION AND RECOMMENDATIONS:

7.1) General:

It is recommended to construct a new three span bridge to replace the existing one span bridge on Hwy. #50 crossing Humber River, 2.4 mi. south of Palgrave. The centreline of the new bridge is located approx. 65 ft. west of the present centreline of Hwy. #50.

7.2) Structure Foundation:

Pier Foundations -

Three alternative recommendations are suggested:

(1) Spread Footings - Spread footings placed at elevation 816' with a safe bearing load of 2 T.S.F. may be employed. Due to the permeable nature of the stratum, sheet piles driven to elev. 811' will be required during construction to prevent a "quick" condition in the sand stratum. The sheet piles should be left in place permanently. With this design, a maximum theoretical settlement of 2 inches may occur. Most of the settlement will occur during construction, and should virtually be completed when the deck is poured.

(2) Wooden Piles - The footings may be placed at elevation 816' on wooden piles. The wooden piles should be 40 ft. long and driven to approximate elev. 780'. A safe load of 20 Tons/pile is recommended. Driving in the field should be controlled by the Hiley Formula. Sheet piles driven to twice the depth of the base of the footing below the prevailing river water level should prevent quick conditions during excavation.

7. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

7.2) Structure Foundation: (cont'd.) ...

(3) Tubular Piles - Tubular steel piles driven to approx. elevation of 760' may be employed. With 1 ft. diam. tubular steel piles, it is estimated that a safe load of 45 Tons/pile will be reached at elevation 760 '. Driving should be controlled by means of the Hiley Formula.

Abutment Foundations:

It is recommended to place the abutment footings in the approach fills on wooden piles or steel tubular piles. The bases of the south and north abutment footings should be placed at elevations 838' and 839', respectively. It is estimated that 40 ft. long wooden piles will develop a safe load of 20 Tons/pile.

Timber piles should be treated if not completely below the lowest water level. As an alternative, 12 $\frac{1}{4}$ " Ø steel tube piles driven to approximate elevation 875.0 should provide a design load of 45 tons/pile. All pile driving in the field should be controlled by means of the Hiley Formula according to the relevant D.H.C. Standards.

The sandy peat in the north bank will have to be excavated before any fill is placed.

No stability problems are anticipated in the approach embankments. Rip-rap should be placed to protect the slopes against scour action.

cont'd. /7 ...

8. SUMMARY:

- (1) It is proposed to construct a new three span structure to replace the existing single span bridge over the Humber River 2.4 miles south of Palgrave on Hwy. #50.
- (2) Subsoil at the site consists mainly of granular deposits of loose to compact silty fine sand.
- (3) It is recommended to found the piers either on spread footings encased in permanent steel sheeting with a design load of 2 tons/sq.ft. or on timber or steel tube piles. Design loads recommended for timber and steel piles are 20 and 45 tons, respectively. Driving should be controlled by the Hiley Formula.
- (4) It is recommended to found the abutments in the approach fills, either on timber or steel tube piles with design loads of 20 and 45 tons, respectively. Driving should be controlled by means of the Hiley Formula.
- (5) No stability problems are anticipated for the approach embankments provided 2:1 slopes are used. Rip-rap should be used to protect the sides of the slopes against scour action.

9. MISCELLANEOUS:

The field work was undertaken during the period from March 27th to April 3rd, 1962, by Mr. I. Holubec, who also prepared the report under the supervision of Mr. K. G. Selby.

cont'd. /B ..

9. MISCELLANEOUS: (cont'd.) ...

Equipment used was owned by Johnston Drilling Co. of
Ottawa.

TH/MdeP

May 1962.



K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

APPENDIX 1.

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

<u>CONSISTENCY</u>	<u>'N' BLOWS/FT.</u>	<u>C. LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS/FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H.	SAMPLE ADVANCED HYDRAULICALLY	
	P.M.	SAMPLE ADVANCED MANUALLY	

SOIL TESTS

CU	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CCU	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX $= \frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR $= \frac{C_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_s	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_c	SENSITIVITY

GENERAL

π	$= 3.1416$
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 62-F-33 LOCATION Sta. 393+80, 17' Lt. of E ORIGINATED BY I.H.
W.P. 211-61 BORING DATE March 27, 1962. COMPILED BY H.S.
DATUM 834.0' BOREHOLE TYPE Washboring, BX Casing. CHECKED BY I.H.

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	WP	W	WL			
834.0	Groundlevel															
0.0	Silty fine sand with some gravel.															
829.0	Compact.															
5.0	silty fine sand to silt, loose to very dense.		1	SS	34											
			2	SS	24											
			3	SS	14											
			4	SS	13											
			5	SS	17											
			6	SS	19											
			7	SS	39											
			8	SS	20											
			9	SS	37											
			10	SS	27											
			11	SS	23											
			12	SS	13											
			13	SS	9											
			14	SS	64											
758.0																
76.0	End of borehole.															

Gr.l.
830.5
From borehole observation.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 62-F-33 LOCATION Sta. 394+38, 18' Rt. of E ORIGINATED BY I.H.
W.P. 211-61 BORING DATE March 29, 1962 COMPILED BY H.S.
DATUM 824.0' BOREHOLE TYPE Washboring, BX Casing. CHECKED BY I.H.

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	WP	W	WL		
							SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							1000	2000	3000	4000	5000	20	40	60		
824.0	Groundlevel															
0.0	Silty fine sand with some gravel.		1	SS	9	820										721 821 From borehole observation.
819.0	Loose.		2	SS	10											
5.0	Clayey silt.		3	TH	19											
	Stiff to very stiff.		4	TH	9	810										
807.0			5	TH	21											
17.0			6	SS	21	800										
	Silt,		7	SS	25											
	Compact.		8	SS	18	790										
			9	SS	21											
			10	SS	24	780										
782.5	End of borehole.															
41.5																

Note: % Strain 15 $\frac{0}{10}$ 5

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & RESEARCH DIVISION			RECORD OF BOREHOLE NO. 3				FOUNDATION SECTION			
JOB <u>62-F-33</u>		LOCATION <u>Sta. 394+75, 17' Lt. of E</u>		ORIGINATED BY <u>I.H.</u>						
W.P. <u>211-61</u>		BORING DATE <u>April 2, 1962.</u>		COMPILED BY <u>H.S.</u>						
DATUM <u>824.0'</u>		BOREHOLE TYPE <u>Wash Borehole, BX Casing.</u>		CHECKED BY <u>I.H.</u>						
SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F.	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W wp — w — WL WATER CONTENT %	BULK DENSITY P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER TYPE BLOWS / FOOT							
824.0	Groundlevel									
0.0	Sand with organics.									
821.5	Loose.									
819.0	Sand with gravel.									
5.0	Compact.									
			1 SS 18	820						
			2 SS 12							
			3 SS 12	810						
			4 SS 17							
	Fine sandy silt to silt.		5 SS 9	800						
			6 SS 14							
			7 SS 21							
	Loose to very dense.		8 SS 8	790						
			9 SS 21							
				780						
			10 SS 15							
				770						
			11 SS 6							
				760						
			12 WS							
				750						
			13 SS 100 for 4"							
			14 WS							
				740						
739.0										
85.0	End of borehole.									

▽ W.L.
= 823
From borehole observation.

FOUNDATION SECTION

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.	WL	WP	W			
829.0	Ground level					830							▽ 829' From borehole observation.
0.0	Fine sandy peat, very soft.		1	SS	2	820							
821.5	Sand with gravel.		2	SS	18								
7.5	Compact.		3	SS	18								
818.5			4A	SS	23								
10.5			4B	SS	15								
	Fine sandy silt to silt.		5	SS	17								
			6	SS	12								
	Loose to dense.		7	SS	10								
			8	SS	6								
			9	SS	46								
740.0						740							

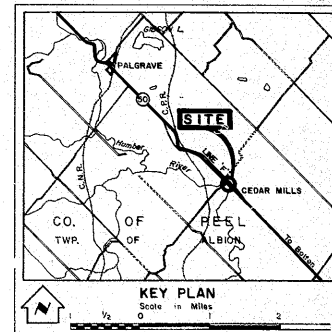
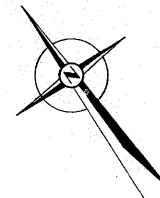
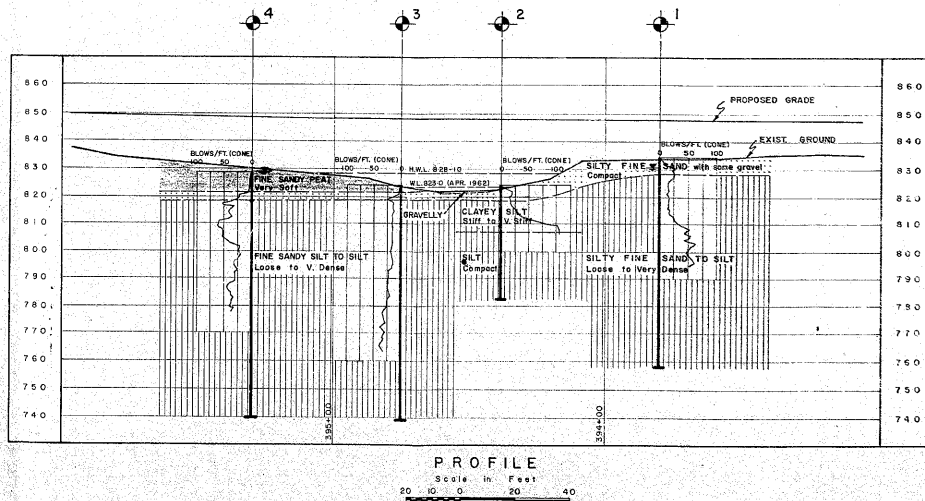
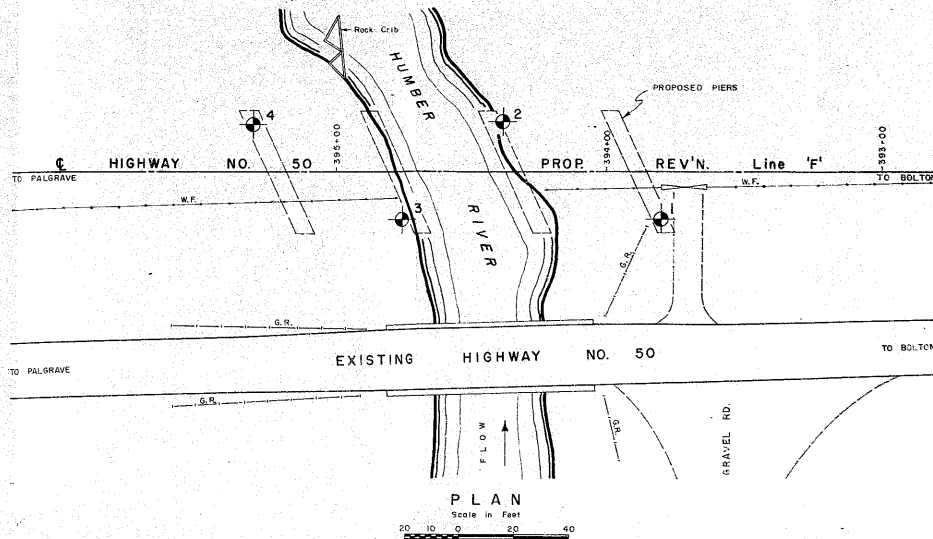
62-F-33

W.P. # 211-61-1

Hwy. # 50 E

HUMBER R. BR.

(PROP.)



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.

NO.	ELEVATION	STATION	OFFSET
1	834.0	393+80	17' LT.
2	824.0	394+38	16' RT.
3	824.0	394+75	17' LT.
4	829.0	395+30	17' RT.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

HUMBER RIVER AND HIGHWAY NO. 50 REVISION Line 'F'

ORIGINATED I. HOLLUBEC	DISTRICT NO. 6	DATE 26 APRIL 1962
DRAWN D. MUMFORD	W.P. NO. 211-61-1	JOB NO. 62-F-33
CHECKED <i>[Signature]</i>	CONTRACT NO.	DRAWING NO.
APPROVED <i>[Signature]</i>		62-F-33A

