

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section.

June 17, 1960.

D.H.C. FOUNDATION INVESTIGATION
W.P. 277-60 -- W.J. 60-F-42.

Attention: Mr. S. McCombie.

Re: - 20-Mile Creek and Highway No. 56 -
(Approx. 1.6 Miles North of Binbrook)
Twp. of Binbrook, County of Wentworth.
W.J. 60-F-42 -- W.P. 277-60 -- Dist. 4.

Attached to this memo, we are forwarding to you,
the Foundation Investigation Report for the above mentioned
location. The report has been prepared in our Section.

The conclusions and recommendations contained in this
report are self-explanatory and we believe, adequate and suf-
ficient for your future design work.

Should there be any other additional questions in con-
nection with this site that you would like to discuss, please
feel free to call on our Office.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.
Per:

AS/Ndef
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Raxsey
I. Campbell
D. E. Richardson
T. J. Kovich
A. Watt

(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

Foundations Office
Gen. Files.

FOUNDATION INVESTIGATION

At

20-Mile Creek and Highway No. 56,
(Approx. 1.6 Miles North of Binbrook)
Twp. of Binbrook, County of Wentworth.
W.J. 60-F-42 -- W.P. 277-60 -- Dist. 4.

DESCRIPTION OF SITE:

Presented in this report are the results of a foundation investigation carried out recently at the site of the proposed new structure to replace the existing concrete arch bridge carrying Hwy. No. 56 over Twenty-Mile Creek.

The site is located 300 feet North of the existing bridge. The area on the West side of Hwy. No. 56 is thickly wooded and rather swampy, on the East side, fairly flat, and grass covered.

Physiographically, the site forms the Western extremity of the St. Lawrence Lowlands.

DESCRIPTION OF FIELD WORK:

The field work was carried out during the period of May 9 to May 11, 1960, and consisted of 4 sampled boreholes, supplemented by dynamic cone penetration tests. This work was carried out by a wheel-mounted Pennsylvania Drill adapted for soil sampling. Borehole #5 was drilled with a hand auger.

Boreholes No. 1, 2, 3, & 4, were advanced using the Penn-Drill and samples were taken at depth intervals of 3 to 6 feet.

In both middle strata of the cohesive silty clays, 2" Ø thin-walled Undisturbed Shelby Tube samples were taken. In the cohesionless, lower sandy, clayey silt strata, a 2" O.D. split-barrelled spoon sampler was used. The dimensions of this sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test.

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cont'd. /2 ...

DESCRIPTION OF FIELD WORK: (cont'd.) ...

In Holes 1, 2, 3, & 4, insitu vane test results have been obtained in the middle strata; in the lower strata, the sandy, clayey silt was too stiff to obtain field shear strength values.

No rock cores were taken.

The results of the field and laboratory tests are presented in the Borehole Logs and are also detailed in tabular form.

Drawing No. 60-F-42 A, shows the borehole locations and the subsoil profile.

SUBSOIL CONDITIONS:

The subsoil consists of three main strata between ground level and bedrock:-

- a) From ground level (approx. 669'-0") to about 7 ft. - med. stiff, dark brown sandy, silty clay, with organic matter, some gravel and pebbles.
- b) From 7 ft. to 13 ft. - approx. med.-stiff, light brown sandy, silty clay with fine gravel and small pebbles.
- c) From 13 ft. to 17 ft., very stiff grey sandy silt with fine gravel - traces of red shale. These strata are underlain by red shale bedrock.

a) Sandy Silty Clay:

This material is predominantly dark brown in colour and varies in consistency from med.-stiff to stiff. Laboratory shear strength values range between 1000 p.s.f. to 1700 lbs. per sq. ft.

The average moisture content of this material was found to be 26.3% and Atterberg Limits test gave an average Liquid Limit of 40%, and an average Plastic Limit of 24%. The average Unit Weight is 123 lbs. per cu. ft.

cont'd. /3 ...

SUBSOIL CONDITIONS: (cont'd.) ...

b) Sandy Silty Clay:

Throughout the site the sandy silty clay described under (a), was found to be underlain by a layer approx. 6 ft. thick, of med.-stiff, light-brown, sandy, silty clay intermixed with fine gravel.

Laboratory shear strength values range between 930 to 965 lbs. per sq. ft.

The average moisture content of this material was found to be 25.3% and Atterberg Limit tests gave the average Liquid Limit of 33%, and an average Plastic Limit of 22%. The average Unit Weight is 127 lbs. per cu. ft.

c) Sandy Silt:

This material is predominantly dark grey in colour and consists mainly of sandy, clayey, silt. Standard Penetration Test results indicate the material to be dense. ('N' varies from 18 to 45).

d) Bedrock:

Bedrock was encountered at depths between 16'-8" and 19'-0" (between Elevations 652.3 and 649.8). Rock core was not taken, but fragments showed the material to be Red Shale.

WATER CONDITIONS:

At the time of the investigation, there was considerable rain and, as a result, the water table, at the time, was higher than normal. No artesian water conditions were encountered.

It should be noted that the ground water in this region contains a high percentage of sulphur and a special sulphur-resistant cement should be used in the construction of the bridge.

cont'd. /4 ...

FOUNDATION CONSIDERATIONS:

The canal profile proposed by the Hydrological Section of the D.H.C., has a depth of 11 ft. - i.e., the canal bottom elevation is 658.0. To provide for scour and frost protection, the footings of the structure should be placed at least 5 ft. below the above mentioned bottom elevation. Thus, the footings would rest in the sandy, clayey silt layer only some 1 - 3 feet above bedrock. Therefore, it is natural that the footing excavations should be deepened and the footings placed on bedrock. In this case, a safe load of 6 T/sq.ft. can be used for the design, provided the bedrock (shale) is sound. If there is a weathered layer, it has to be stripped prior to the placement of concrete.

It has already been noted that, at the time of the foundation investigation, the water table was within 4- 6" of the grade surface throughout the site. Hence, with footing excavation down to Elev. 652.0, there may be some seepage of water during excavations, depending upon the seasonal variations in the water table. However, as the material to be excavated, is mainly stiff and relatively impervious, this seepage is not expected to create too much difficulty.

FOOTINGS FOR FORMWORK DURING CONSTRUCTION:

Footing plates for formwork can safely be placed on the exposed surface of the dark grey sandy, clayey silt. The footing plates for the formwork should preferably be square in shape, and sufficiently large in size such that the bearing capacity on the soil does not exceed a maximum value of 2 tons per sq. ft.

DIVERSION OF TWENTY-MILE CREEK:

In order to divert the Twenty-Mile Creek, from the present location, a canal will have to be dug. It has already been noted that the bottom of the canal should be at Elev. 658.0. This elevation is located in the med.-stiff light-brown sandy, silty clay stratum (shear strength 930-965 lbs. per sq. ft.). The materials in which the excavation will be done, have such properties that, with slopes of 2:1, no stability problems are anticipated.

cont'd. /5 ...

CONCLUSIONS AND RECOMMENDATIONS:

1. The soil at the site of the proposed structure consists of a surface layer of med.-stiff to stiff dark brown, sandy, silty clay about 7 ft. thick, underlain by med.-stiff, light-brown sandy, silty clay with fine gravel and small pebbles, approx. 6 ft. thick, followed by a very stiff layer of dark grey, sandy, clayey silt about 4 ft. thick. Hard, red shale was found at a depth from 17 to 19 feet below grade elevation.
2. The structure should be founded on spread footings resting on sound bedrock. All disintegrated shale must be removed before construction is started. The safe load can be taken as 6 T/sq.ft.
3. It is recommended that the structure should be of the rigid frame type, hinged at the bottom - rather than that of the arch type. (clear. span. 50 feet).
4. Problems due to water seeping into the excavation, are not likely to present too much difficulty, depending upon seasonal variations of the water table.
5. Footings for formwork during construction, should preferably be square in shape and may be designed to a maximum allowable bearing capacity of 2 tons per sq. ft. provided that they are placed on sound material which has not been unduly softened by standing or running water.
6. No slope stability problems in the diverting canal are anticipated, provided that the slopes are formed as 2 horizontally to 1 vertically.

June 1960

REPORT PREPARED BY: Walter Kulmatickas
Project Pdns. Engr.

REPORT APPROVED BY: A. Stermac,
Foundations Office Engr.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-42

W.P. 277-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	3'-4.5'	Med. stiff, dark brown sandy silty clay.	6	25.4	-	-	-	-	
	vane	5.5'		-	-	-	-	1040	-	Sens: 2.6
	T2	6'-7.5'	Stiff light brown sandy silty clay with fine gravel and small pebbles.	P	28.7	24.7	46.8	1700	123.0	
	vane	9'		-	-	-	-	1840	-	Sens: 2.9
	T3	10'-11.5'	Stiff light brown sandy silty clay, with fine gravel, organic matter and some red shale.	P	21.2	-	-	930	131.0	
2	S1	3'-4.5'	Medium stiff dark brown sandy silty clay.	8	24.8	-	-	-	-	
	vane	6'		-	-	-	-	1120	-	Sens: 2.7
	T2	6.5'-8'	Stiff light brown sandy silty clay with fine gravel and small pebbles.	P	27.1	22.5	29.7	1000	123.0	
	vane	9.5'		-	-	-	-	1280	-	Sens: 1.8
	T3	10'-11.5'	Stiff light brown sandy silty clay with organic matter fine gravel and pebbles.	15	33.2	24.8	40.8	1600	119.0	
	SL	13'-14.5'	Very stiff sandy clayey silt.	45	13.9	-	-	-	-	

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3	S1	3'-4.5'	Medium stiff dark brown sandy silty clay.	5	18.9	-	-	-	-	
	vane	6'		-	-	-	-	1040	-	Sens: 1.8
	T2	6.5'-8'	Stiff, light brown, sandy, silty clay with fine gravel and small pebbles.	8	24.1	22.8	35.4	1540	126.0	
	vane	9.5'		-	-	-	-	1440	-	Sens: 2.4
	T3	10'-11.5'	Stiff, light brown, sandy, silty clay with organic matter fine gravel and pebbles.	10-6"	22.6	-	-	-	128.0	
	S4	14'-15.5'	Very stiff sandy clayey silt.	18	16.6	-	-	-	-	
4	S1	3'-4.5'	Medium stiff dark brown sandy silty clay.	9	21.4	-	-	-	-	
	vane	6'		-	-	-	-	1120	-	Sens: 2.4
	T2	6.5'-8'	Stiff, light brown, sandy silty clay with fine gravel and small pebbles.	13	20.4 32.8	24.7	47.2	1700	123.0	
	vane	9.5'		-	-	-	-	2000	-	Sens: 2.5
	T3	10'-11.5'	Stiff, light brown, sandy silty clay with organic matter fine gravel and pebbles.	P	24.4	20.0	25.5	965	129.0	
	S4	14'-15.5'	Very stiff sandy clayey silt.	13	16.0	-	-	-	-	

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5	P1	3'-4'	Stiff, light brown sandy, silty clay.	-	24.5	-	-	-	-	
	P2	5'-6'	Stiff, light brown sandy, silty clay.	-	26.6	-	-	-	-	
			S denotes Split Spoon Sample T denotes Shelby Tube Sample P denotes Piston Samples.							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 277-60

BORE HOLE NO. 1

JOB 60-F-42

STATION 113+60

DATUM 669.0'

COMPILED BY B.K.

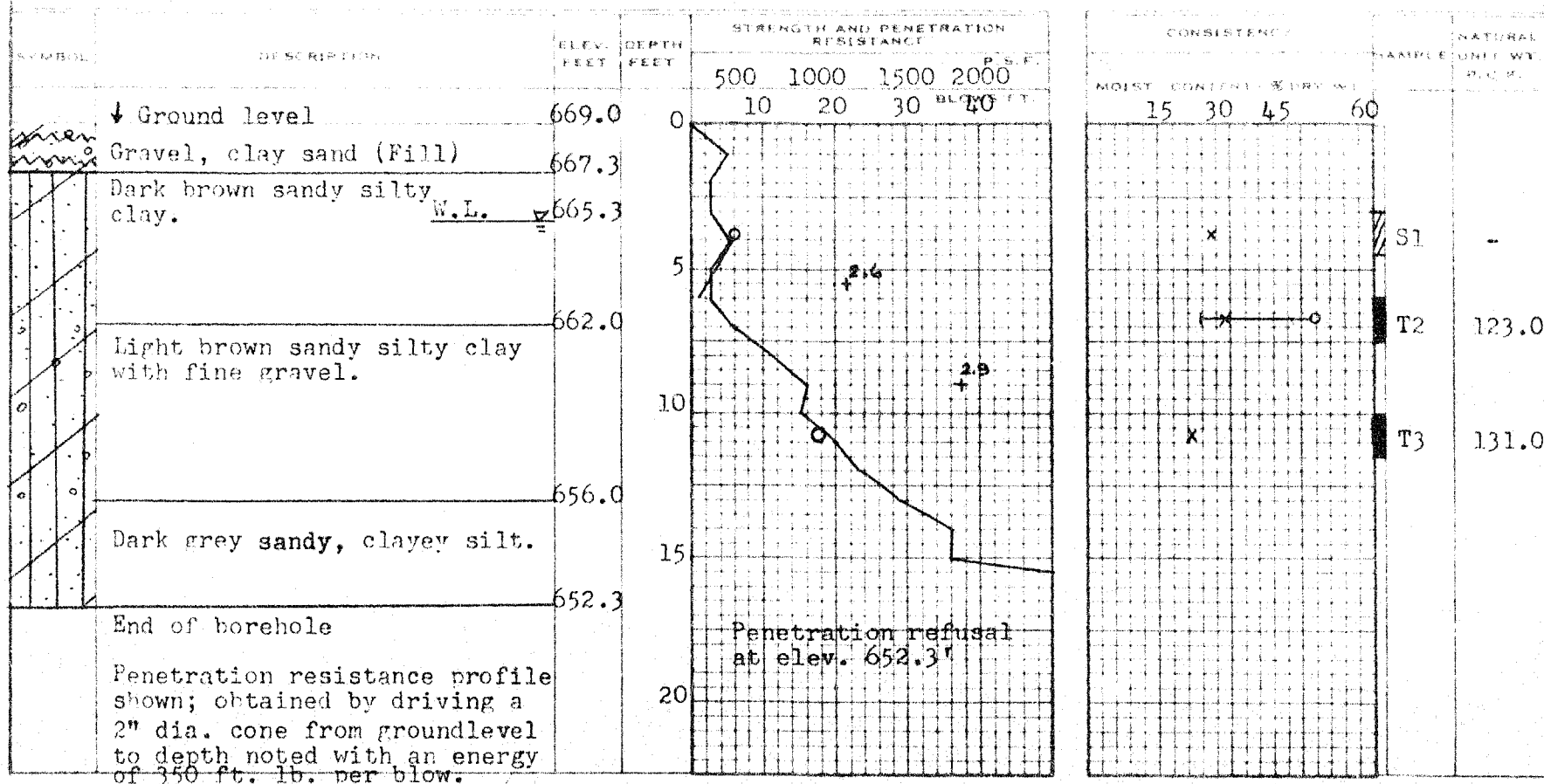
BORING DATE May 10/60

CHECKED BY W.K.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CON.
 2" SHELBY
 CASING

LEGEND

UNSATURATED COMPRESSION (Q_u)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO

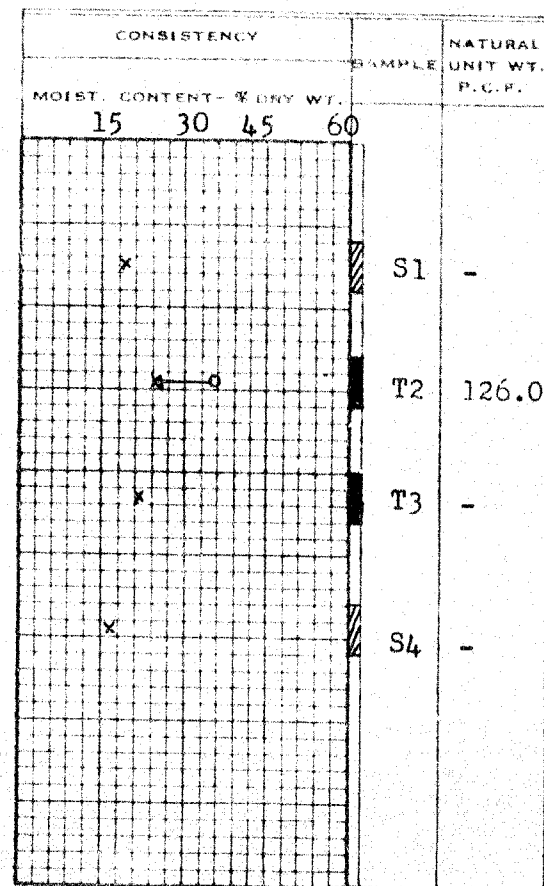
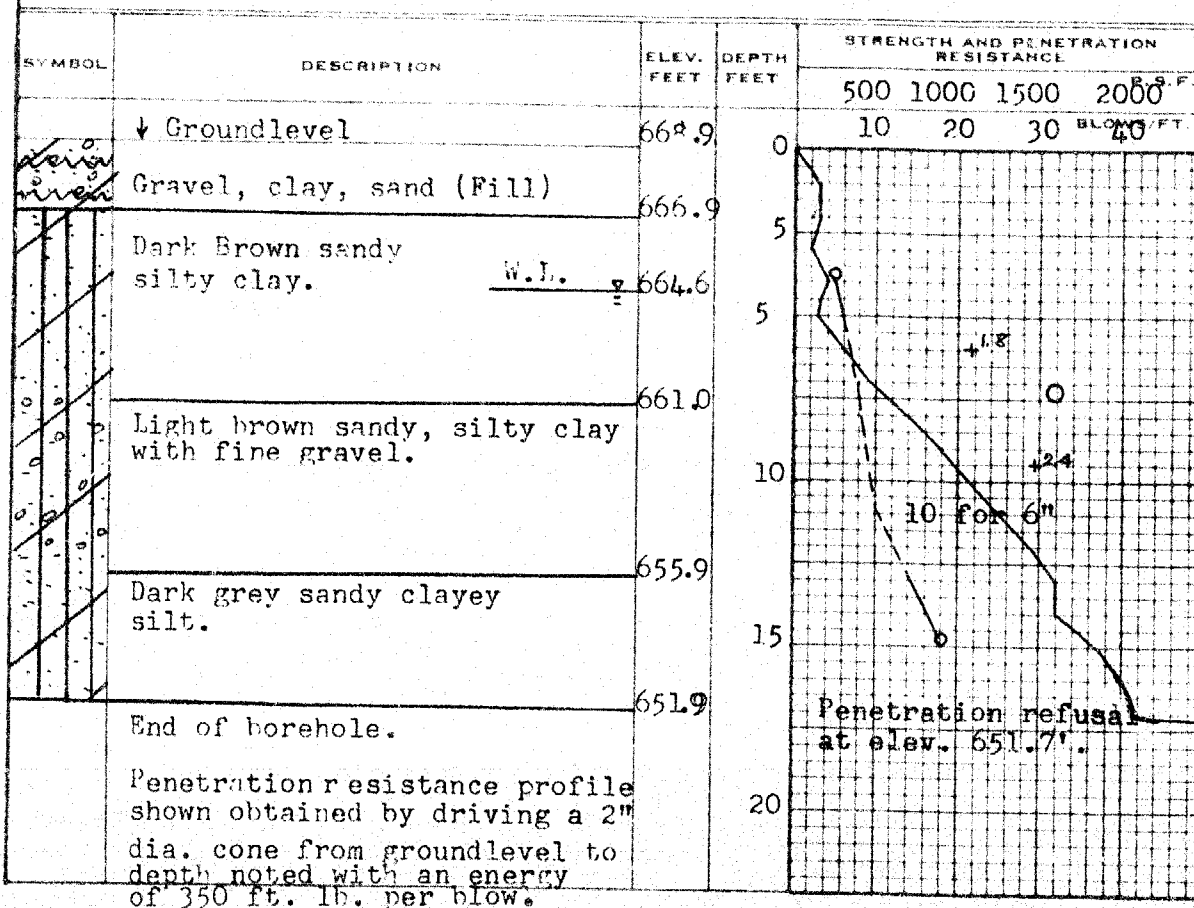
MATERIALS AND RESEARCH SECTION

W.P. 277-60 BORE HOLE NO. 3
 JOB 60-F-42 STATION 113/68
 DATUM 661.9' COMPILED BY B.K.
 BORING DATE May 11/60 CHECKED BY W.K.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 277-60 BORE HOLE NO. 5
 JOB 60-F-42 STATION
 DATUM 669.71 COMPILED BY B.K.
 BORING DATE May 11/60 CHECKED BY W.K.

2" DIA SPLIT TUBE _____
 2" SHELBY TUBE _____
 2" SPLIT TUBE _____
 2" DIA CONE _____
 2" SHELBY _____
 CASING _____

LEGEND

UNCONFINED COMPRESSION (Q_u) _____
 VANE TEST (C) AND SENSITIVITY (S) _____
 NATURAL MOISTURE AND LIQUIDITY INDEX _____
 LIQUID LIMIT _____
 PLASTIC LIMIT _____

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY			NATURAL MOISTURE CONTENT % DRY WT	SAMPLE UNIT WT. P.C.F.
				P.S.F.		BLOWS/FT.				
	↓ Groundlevel	W.L. 664.5	0					15 30 45		
	Tonsoil	662.5								
	Light brown sandy silty clay.		5							
		658.5								
	End of borehole		10							
			15							
			20							

MEMORANDUM

TO: Mr. A. Stermac
Principal Foundation Eng.
Room 107, Lab. Bldg.

FROM: F. DeVisser,
Br. Location Eng.

DATE: March 5, 1963.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 277-60
Site #37-114
Twenty Mile Creek
Hwy. #56, Dist. #4

Enclosed is one (1) print of our preliminary
plan D 4704-P for the subject structure.

If you have any comments please let us know.

FDev/m

F. DeVisser
F. DeVisser,
Bridge Location Engineer

*No comment - footings founded
on bedrock
March 7, 1963. A. Stermac*

General Files

Mr. C. S. Grebski
Bridge Design Engineer
Bridge Office
Admin. Building

Foundation Section
Materials and Testing Office
Laboratory Building
Downsview, Ontario
January 5, 1971

Proposed Structure at the Crossing of Twenty Mile
Creek Diversion and Hwy. #56 - Township of Binbrook
County of Wentworth - District No. 4 (Hamilton)
W. O. 60-11042 W.P. 277-60

This Section has reviewed the Bridge Drawings
(Nos. D-6956-1, 2 and 3) , dated December 1970 for the afore-
mentioned structure; the following comment is submitted.

The groundwater in this area contains a high sulphate
concentration, which would have a detrimental effect on the
concrete in the abutment foundations. A sulphate resistant
cement should, therefore, be employed as per enclosed memo from
Mr. A. Rutka, Materials and Testing Engineer, dated June 4, 1963.
This provision should be contained in the "Special Provisions"
section of this contract. A copy of this letter is appended to
this memo.

We trust that the aforementioned is sufficient for
your immediate requirements, if further clarification is necessary
please contact this office.

B.T.D.

B. T. Darch,
Senior Foundation Engineer

For

BTD/jt
encl.

A. G. Stermac
Principal Foundation Engineer

MEMORANDUM

W.P. 277-60
MSB
Principal Foundation Engineer
Room 107, Lab. Bldg.
C.S. Grebski
Bridge Office

TO: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: December 22, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: Twenty Mile Creek Bridge
1.5 Miles North of Binbrook
W.P. 277-60, Site No. 36-114
Highway 56, District No. 4

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

C.S. Grebski
C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

60-F-24

*Comments given in a memo
dated January 4, 1971*

R.T.D.

HR

#60-F-42

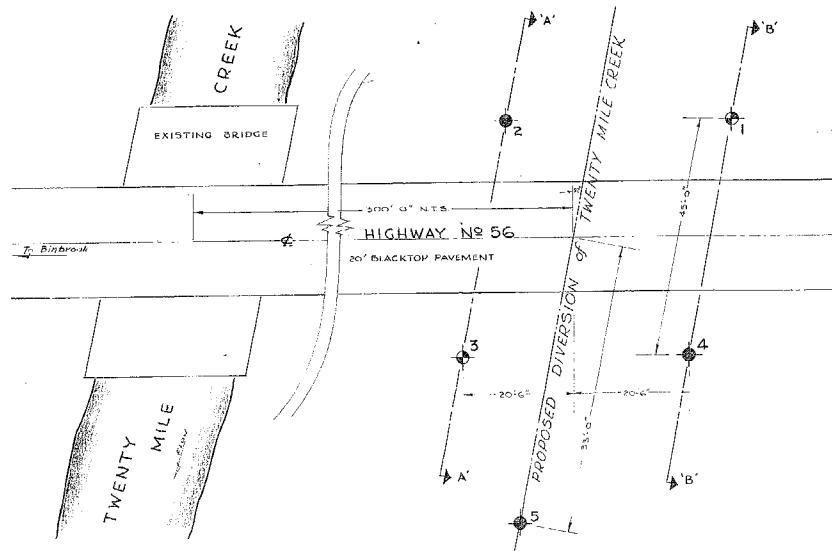
W.P. #277-60

TWENTY MILE

CREEK & HWY #56

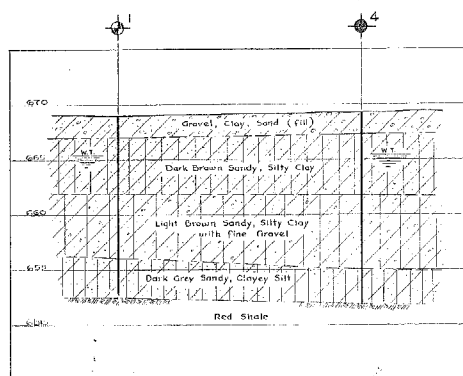
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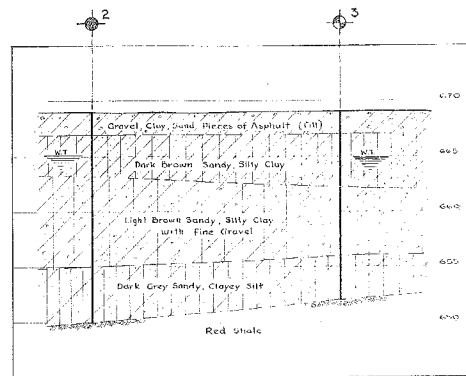


PLAN

Scale: 1 inch = 10 feet



B - B



A - A

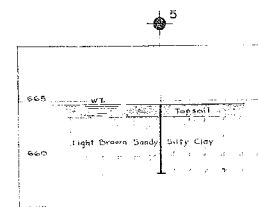
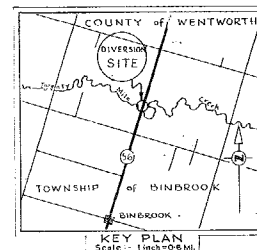
SECTIONS

Vert.: 1 inch = 5 feet
Horiz.: 1 inch = 10 feet

LEGEND

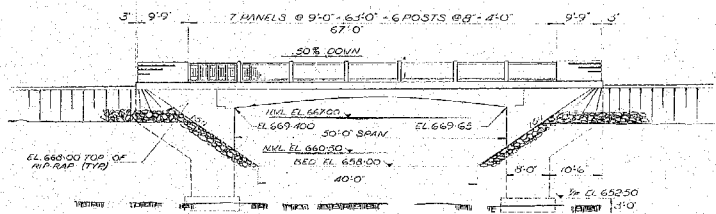
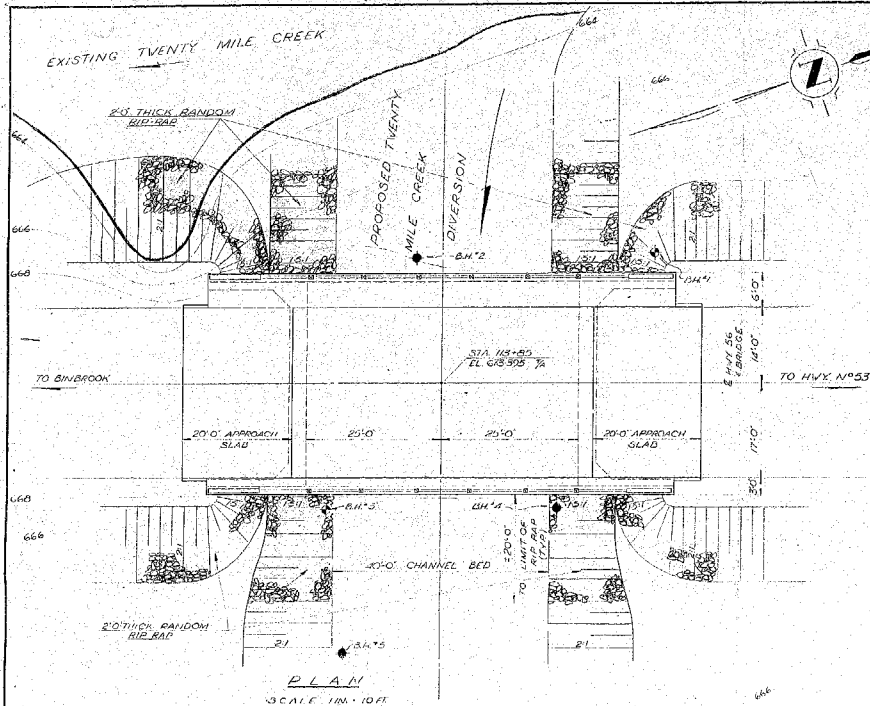
● BORE HOLE

○ BORE & PENETRATION HOLE



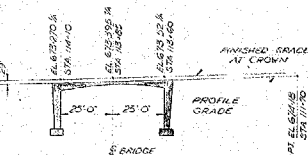
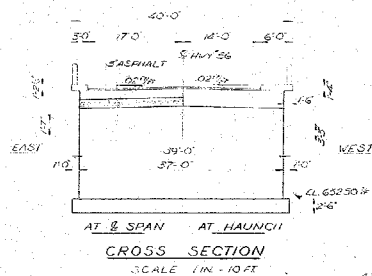
NOTE
THE INFORMATION CONTAINED HEREIN HAS BEEN PREPARED ONLY AT THE REQUEST OF THE CLIENT. THE ENGINEER HAS ASSURED THAT THE INFORMATION HAS BEEN PREPARED IN ACCORDANCE WITH THE STANDARDS OF THE PROFESSIONAL ENGINEER.

DEPARTMENT OF HIGHWAYS - ONTARIO			
WATERWAYS & A. 1072 (REV. 10-1-60)			
TWENTY MILE CREEK			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
DAY 86	DATE 4	SCALE 1/2" = 1'	PROJECT KENTWORTH
LOCATION 2 MILES NORTH OF BINBROOK	SP 12.5	NO. 443	
DRAWN BY H. B. S.	APPROVED BY	DATE 7 JUNE 1960	NO. 277-60
BY AS. SHOWN	APPROVED BY		60-F-42A

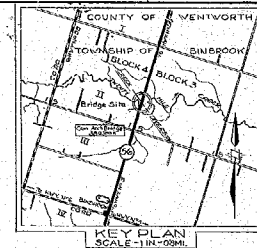
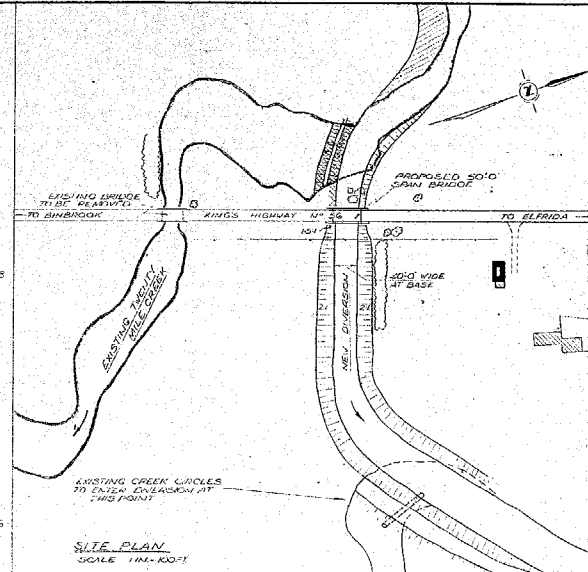


EAST ELEVATION
SCALE 1/4" = 10'

NOTE: GRADE RAISED 0.75'
BY BRIDGE DESIGN
FEB. 1963

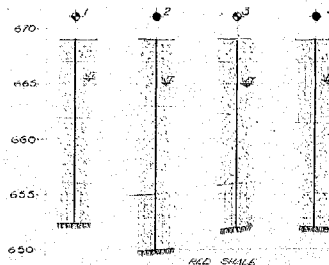


PROFILE OF HWY. NO. 56
NOT TO SCALE



- GRAVEL, CLAY & SAND (FILL)
- CHALK BROWN SANDY SILTY CLAY
- LIGHT BROWN SANDY SILTY CLAY WITH FINE GRAVEL
- CHALK GRAY SANDY CLAY & SILT

- BORE & PENETRATION HOLE
- DRIFT HOLE



BOREHOLE DATA

GEOTECH. B.N. NO. 204 ELEV. 371.236
SUBWAY UNDER BRIDGE AT STATION, NORTH FACE OF WEST CHAIN STONE AT NORTH END OF SUBWAY. ROLL SET HORIZONTALLY.

DATE	BY	DESCRIPTION

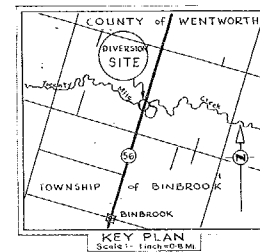
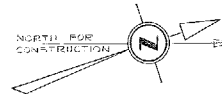
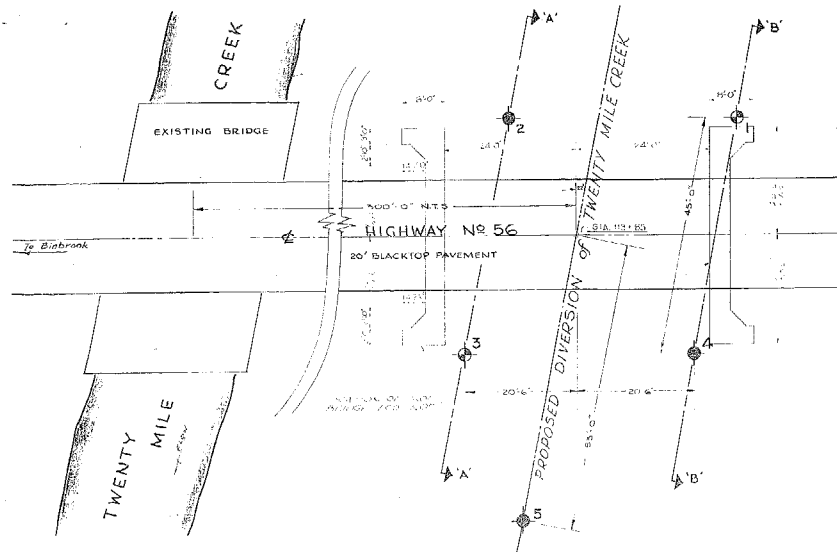
DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

TWENTY MILE CREEK

KINGS HIGHWAY No. 56 DIST. No. 1
CO. VENTWORTH
TWP. BAINBROOK 101-5-BLOCK 3 CON. II

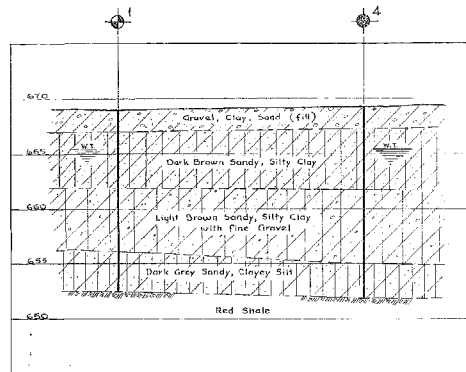
PRELIMINARY

APPROVED	DATE	BY	CONTRACT	NO.	W.P. No.
DESIGN	A.R.S.	CHECK	W.J.O.	37-114	277-60
DRAWING	W.J.O.	CHECK	W.J.O.		
DATE	FEB. 63	LOADING	1/20 S-6	DRAWING	D-2704-P

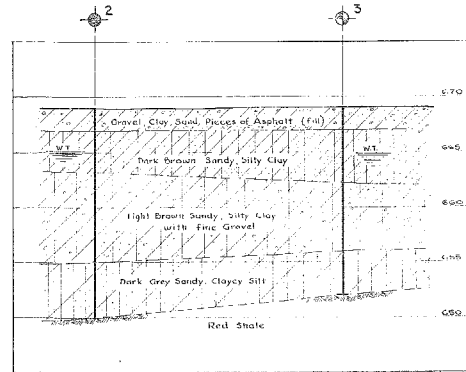


- LEGEND**
- BORE HOLE
 - BORE & PENETRATION HOLE

PLAN
Scale: 1 inch = 10 feet

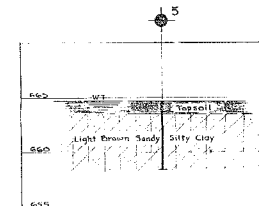


B - B



A - A

SECTIONS
Scale: - Vert.: 1 inch = 5 feet
- Horiz.: 1 inch = 10 feet

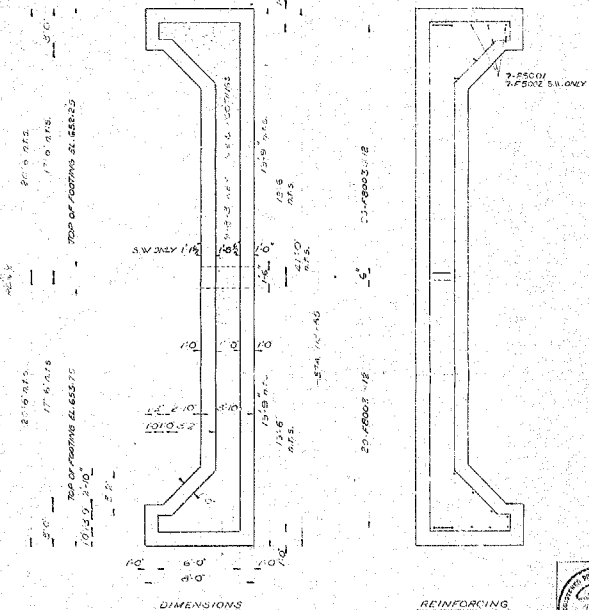
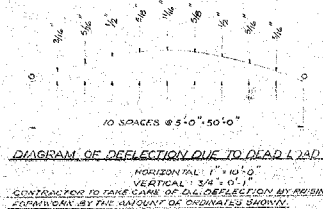
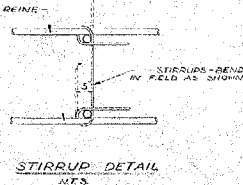
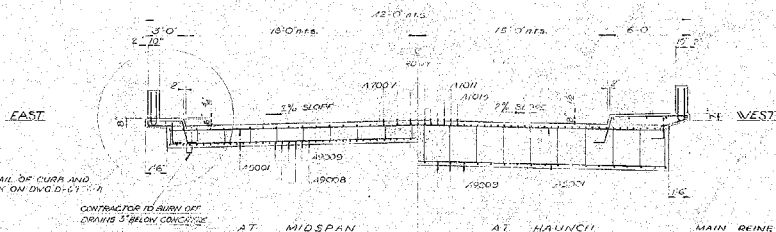


NOTE
THE FOUNDATION DETAILS, SOIL SAMPLES, AND BORE LOGS WERE OBTAINED ONLY AT THE BORE HOLE LOCATIONS SHOWN. BORE LOGS THE FOUNDATIONS ARE ASSUMED TO BE THE SAME AS THE FOUNDATIONS AND MAY BE SUBJECT TO CONTINUOUS MONITORING.

60-5-92

PRINT RECORD	NO.	FOR	DATE
	1	2	3
	4	5	6
	7	8	9
	10	11	12
	13	14	15
	16	17	18
	19	20	21
	22	23	24
	25	26	27
	28	29	30
	31	32	33
	34	35	36
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	40	41	42
	43	44	45
	46	47	48
	49	50	51
	52	53	54
	55	56	57
	58	59	60
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	64	65	66
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	70	71	72
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	79	80	81
	82	83	84
	85	86	87
	88	89	90
	91	92	93
	94	95	96
	97	98	99
	100	101	102

DEPARTMENT OF HIGHWAYS, ONTARIO			
BRIDGE DIVISION			
TWENTY MILE CREEK BRIDGE			
BINBROOK, ONT.			
KIND'S HIGHWAY No.	56	OSL No.	4
CD	CONSTRUCTION	LOT	277-60
TWP.	BINBROOK	CON.	
APPROVED	DATE	BY	DATE
DESIGN	20-44	20-44	20-44
CHECK	20-44	20-44	20-44
DATE	20-44	20-44	20-44
LOADING	20-44	20-44	20-44
DESCRIPTION	20-44	20-44	20-44

[illegible]

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

TWENTY MILE CREEK BRIDGE

16 MILES NORTH OF BIRNBOURNE

KING'S HIGHWAY No. 56 DIST

CO. IVENTWORTH
CALOGE 7

TWP. BIRNBROOK 1015. BLOCK 5 CON.

FOOTING & FRAME DETAILS

APPROVED	SITE No.	36-114	W.F.
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DESIGN	APB	CHECK	<i>[Signature]</i>	CONTRACT	
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DRAWING	11/20	CHECK	<i>[Signature]</i>	DATE	
	11/20/78		11/20/78	DRAWING	11/20/78

DATE	DEC 10	LOADING	HS 2044	NO	U-6756
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