

BA 1234

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section,
(Foundations Office).
Attention: Mr. S. McCombie.

August 9, 1961.
D.H.O. FOUNDATION INVESTIGATION
REPORT.
W.J. 61-F-59 -- W.P. 205-61.

Re: Credit River & Hwy. #7, Revision
Line 'E' at Norval, Ontario,
District #4.

Accompanying this memo, is our detailed foundation report on the subsoil conditions existing at the above site.

We believe the conclusions and recommendations summarized in the report, are self-explanatory and should prove adequate for your future design work.

If we can be of further assistance in connection with this project, please do not hesitate to contact our Office.

AGS/MdeF
Attach.

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

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

Alfsterman
(A. G. Stermac,
SUPERVISING FOUNDATION ENGR.)

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Foundation Investigation

at

Credit River & Hwy. #7, Revision
Line 'E' at Norval, Ontario.
W.P. 205-61 -- W.J. 61-F-59,
District #4.

1. INTRODUCTION:

It is proposed to construct a one span or three span bridge where the proposed Revision Line 'E' of Kings Highway 7 crosses the West Branch of the Credit River at Norval. The site is on the western outskirts of Norval about 50 ft. southwest of the existing structure. At this location the river is 45 ft. wide with a maximum depth of 1 ft. at the time of the investigation.

In order to determine the subsoil properties and decide on the most suitable type of foundation for either a one span or three span structure, a field investigation was carried out. Results and the discussion of the field and laboratory investigations as well as conclusions and recommendations for the future design work and construction procedure, are contained in this report.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site of the proposed structure is located in the valley of the Credit River. The eastern bank is flat for about 50 ft. and then rises to 15 ft. then levels off. This plain,

2. DESCRIPTION OF SITE AND GEOLOGY: (Cont'd.) ...

about 50 ft. wide, could be called a flood plain and occasional flooding in spring might occur. The western bank rises gradually for the first 150 ft. and then steeply to a height of about 80 ft. These banks are composed of reddish brown gravelly till.

The underlying bedrock is Queenston Shale, an Ordovician rock. This shale formation is predominantly reddish brown with a few greenish grey bands of sandy structure. It is fairly homogeneous and contains a large percentage of clay. As a result it weathers easily and the weathered product is plastic.

This area was covered by glacial ice and the material was deposited during the Wisconsin glacial substage. The deposit is reddish brown gravelly till with large fragments of the underlying shale bedrock.

3. FIELD INVESTIGATION PROCEDURE:

In order to determine the subsoil conditions existing at the location of the proposed structure, six sampled boreholes and four dynamic cone penetration tests were carried out. The density of the cohesionless material was determined by the Standard Penetration Test. Samples recovered in the Split Spoon were used for classification purposes.

All boreholes were advanced at least 5 ft. into the

Cont'd. /3 ...

3. FIELD INVESTIGATION PROCEDURE: (Cont'd.) ...

bedrock to determine the bedrock profile and the depth of weathering.

Water level observations were taken in each hole after completion of boring and at the end of the investigation.

The locations and elevations of boreholes are shown on the site plan, Drawing 61-F-59A.

4. LABORATORY INVESTIGATION:

Samples were visually examined and classified at the site as well as in the laboratory.

Tests were carried out in the laboratory on a selection of disturbed samples to determine:-

- (a) Natural Moisture Content.
- (b) Atterberg Limits.
- (c) Grain Size Distribution. (Results are shown in the Appendix)
- (d) Organic Content.

5. SUBSOIL CONDITIONS:

5.1 General.

The stratigraphy of the soil at the site is a shallow bedrock of Queenston red shale with a reddish brown gravelly till overburden. Detailed descriptions of various soil types encountered in each borehole are shown in the appendix of this report. The estimated stratigraphical profile of Drawing 61-F-59A

5. SUBSOIL CONDITIONS: (Cont'd.) ...

5.1 General.

is based on this information.

The subsoil consists of the following strata:-

- (i) Sandy gravel with silt and clay (glacial till).
- (ii) Sandy silt with clay (glacial till).
- (iii) Silty clay with sand and gravel (glacial till).
- (iv) Red Queenston Shale.

5.2 Sandy Gravel with Silt and Clay (Glacial Till).

The sandy gravel found in B.H.'s 1, 3 & 4 contains a considerable amount of silt and clay. This material is reddish brown and it is medium dense. It extends to depths 2 to 4 ft. and lies on top of shale in B.H.'s Nos. 2, 3, 4 & 6 and on top of very dense sandy silt with clay in B.H. No. 1.

The ground water being located in the lower part of this stratum, has washed out some of the fines in the last foot of this material.

B.H.'s No. 4 & 3 have been stripped of top soil and B.H. No. 1 has $\frac{1}{2}$ ft. of topsoil.

B.H. No. 2 is located in a former river bed and is overlain by soft grey sandy organic material to a depth of 2 ft. This is a localized condition and is not shown in the soil profile.

B.H. No. 6 is located in the river bed and the fines have been washed out of this material.

5. SUBSOIL CONDITIONS: (Cont'd.) ...

5.3 Sandy silt with Clay (Glacial Till).

At B.H. No. 1, on the eastern bank of the river, the sandy gravel is underlain by a very dense red sandy silt with clay (glacial till). This stratum is 5 ft. thick extending from 4 to 9 ft. in depth. The material is mainly silt (57%) but being very dense and with natural moisture contents in the range of 12.1% - 14.3% it can carry a considerable load.

5.4 Silty Clay with Sand and Gravel (Glacial Till).

This stratum is 5 ft. thick in B.H. No. 5 with no topsoil and it overlies the Queenston Shale. It is a clay of intermediate plasticity, low natural moisture content (below 2 ft. depth) and high penetration resistance. Values of some of the physical properties are as follows:

Moisture Content Range	8.3% - 26.6%
Liquid Limit Range	20.5% - 41.6%
Plastic Limit Range	15.7% - 22.6%
Penetration Resistance (Standard)	18 - 28 blows/ft.
Organic Matter	1.5%

5.5 Bedrock.

The bedrock is red Queenston Shale an Ordovician formation. This shale is predominantly reddish brown with a few greenish grey bands of sandy texture. It contains a large percentage of clay and becomes plastic on weathering. It weathers very easily.

5. SUBSOIL CONDITIONS: (Cont'd.) ...

5.5 Bedrock.

In boreholes 2, 3 and 4 seams of limestone were found. They were found predominantly in Boreholes 3 and 4, at depth 7 to 9 ft. These seams were up to 3 inches in thickness.

The weathered zone of shale was found to be 1 to 2 ft. in depth.

The elevation of bedrock and the weathered zone were established in each borehole and are shown in Drawing 61-F-59A.

6. GROUND WATER OBSERVATIONS:

Since all the boreholes were done adjacent to or in the existing river bed, the ground water level was found to coincide with the river water level. The river water level at the time of investigation was at elevation 666.5 ft.

7. DISCUSSION AND RECOMMENDATIONS:

The bedrock being at a shallow depth and a very dense till located on the eastern bank, it is recommended to use shallow spread footings on all abutments and piers.

In case of a three span structure, the westerly abutment and the two piers can be founded on unweathered shale at approximate depths of 7 ft., 6 ft., and 4 ft. at elevations 664.0', 662.0', and 662.0' respectively, and the easterly abutment can be founded on the very dense till at the depth of 5 ft. at an elevation of 665.0'. A safe load of 4 T.S.F. can be used on all abutments and piers.

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

The subsoil being a gravelly till, no stability problems are expected on the approach embankments.

Ground water was located at elevation 666.5. As the subsoil is relatively impermeable, however, no major problems are anticipated with regard to dewatering of the excavations.

8. SUMMARY:

The site of the proposed bridge is located on Queenston Shale overlain by glacial till varying from sandy gravel with silt and clay to silty clay with sand and gravel.

Because of the shallow overburden, shallow spread footings on sound shale are proposed in all cases except in case of a three span structure in which case the ^{east} westerly abutment should be placed on the very dense sandy silt with clay (glacial till).

A safe load of 4 T.S.F. can be used for all abutments and piers.

As the subsoil is relatively impermeable, no major dewatering problems are anticipated.

No stability problems for the approach fills are anticipated.

cont'd. /8 ...

9. MISCELLANEOUS:

The field work was carried out from June 30 to July 7, 1961, by the Dominion Soil Investigations, Ltd., using a diamond core drill adapted for soil testing. The work was supervised by I. Holubec for the Ontario Department of Highways.

August 1961. REPORT PREPARED BY:

I. Holubec
.....
I. Holubec,
PROJECT FOUNDATION ENGINEER.

REPORT APPROVED BY:

A. G. Stermac
.....
A. G. Stermac,
SUPERVISING FOUNDATION ENGINEER.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-59

W.P. 205-61

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	2'-3.5'	Sandy gravel with silt and clay (glacial till).	11	13.0	-	-	-	-	
	S2	5'-6.5'	Sandy silt with clay (glacial till).	79	14.3	-	-	-	-	
	S3	8'-9.5'	- " -	76	12.1	-	-	-	126.8	
	S4	10'-10.3'	- " -	50-3"	-	-	-	-	-	
	RC5	11.5'-15.5'	Red Queenston Shale.	-	-	-	-	-	-	
	RC6	15.5'-20'	- " -	-	-	-	-	-	-	
2	S1	2'-3.5'	Weathered shale.	94	-	-	-	-	-	
	RC2	4'-9'	Red Queenston Shale.	-	-	-	-	-	-	
	RC3	9'-13'	- " -	-	-	-	-	-	-	
3	S1	2'-3.5'	Sandy gravel with silt and clay (glacial till)	13	10.0	-	-	-	-	
	RC2	4.5'-7.8'	Red Queenston Shale.	-	-	-	-	-	-	
	RC3	7.8'-8.8'	Grey limestone and shale.	-	-	-	-	-	-	
	RC4	8.8'-9.3'	Red Queenston shale.	-	-	-	-	-	-	
	RC5	9.3'-10.0'	- " -	-	-	-	-	-	-	
	RC6	10'-13.5'	Red Queenston Shale.	-	-	-	-	-	-	
	RC7	13.5'-18.3'	- " -	-	-	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-59

W.P. 205-61

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETN RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
3	RC8	18.3'-19.5'	Red Queenston Shale.	-	-	-	-	-	-	
	RC9	19.5'-24.5'	- " -	-	-	-	-	-	-	
4	S1	2'-3.5'	Sandy gravel with silt and clay (glacial till).	16	9.8	-	-	-	-	
	S2	3.5'-4.0'	- " -	30	9.3	-	-	-	-	
	S3	5'-6'	Weathered shale.	100-5"	8.5	-	-	-	-	
	RC4	6'-6.5'	Grey limestone.	-	-	-	-	-	-	
	RC5	6.5'-8.5'	Red Queenston Shale.	-	-	-	-	-	-	
	RC6	8.5'-10'	- " -	-	-	-	-	-	-	
	RC7	10'-12'	- " -	-	-	-	-	-	-	
5	S1	2'-3.5'	Silty clay with sand and gravel (glacial till)	21	26.6	22.6	41.5	-	-	
	S2	3.5'-5'	- " -	18	9.3	15.7	20.5	-	-	
	S3	5'-6.5'	Weathered shale.	68	8.3	-	-	-	-	
	S4	6.5'-7.3'	- " -	120-9"	-	-	-	-	-	
	RC5	7.3'-8.7'	Red Queenston Shale.	-	-	-	-	-	-	
	S6	8.2'-8.9'	- " -	116-9"	-	-	-	-	-	
	RC7	8.9'-10.5'	- " -	-	-	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-59

W.P. 205-61

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
5	RC8	10.5'-14.8'	Red Queenston Shale.	-	-	-	-	-	-	
6	RC1	3.5'-7.5'	Red Queenston Shale.	-	-	-	-	-	-	
	RC2	7.5'-9.6'	- " -	-	-	-	-	-	-	
			S denotes split spoon sample RC " rock core							

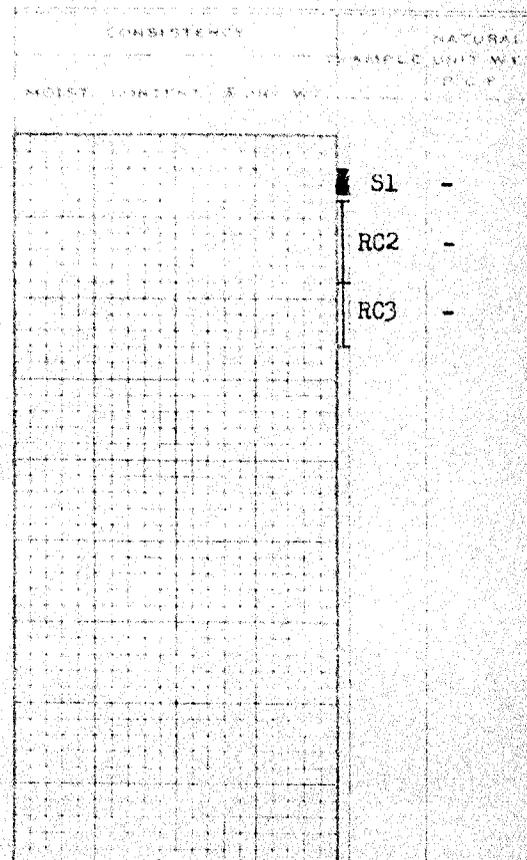
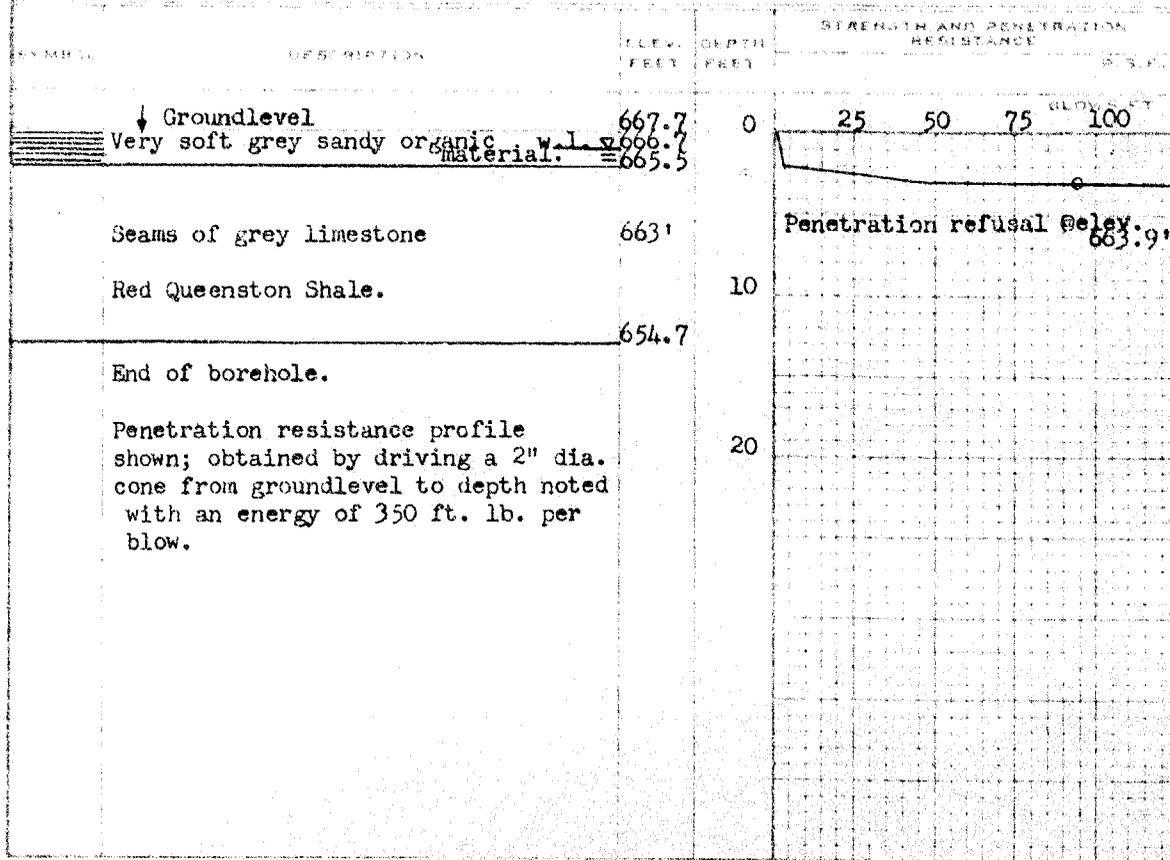
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 205-61 BORE HOLE NO. 2
 JOB 61-F-59 STATION 38/38 (18' Rt.)
 DATUM 667.7' COMPILED BY B.K.
 BORING DATE July 6/61 CHECKED BY I.H.

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

LEGEND

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



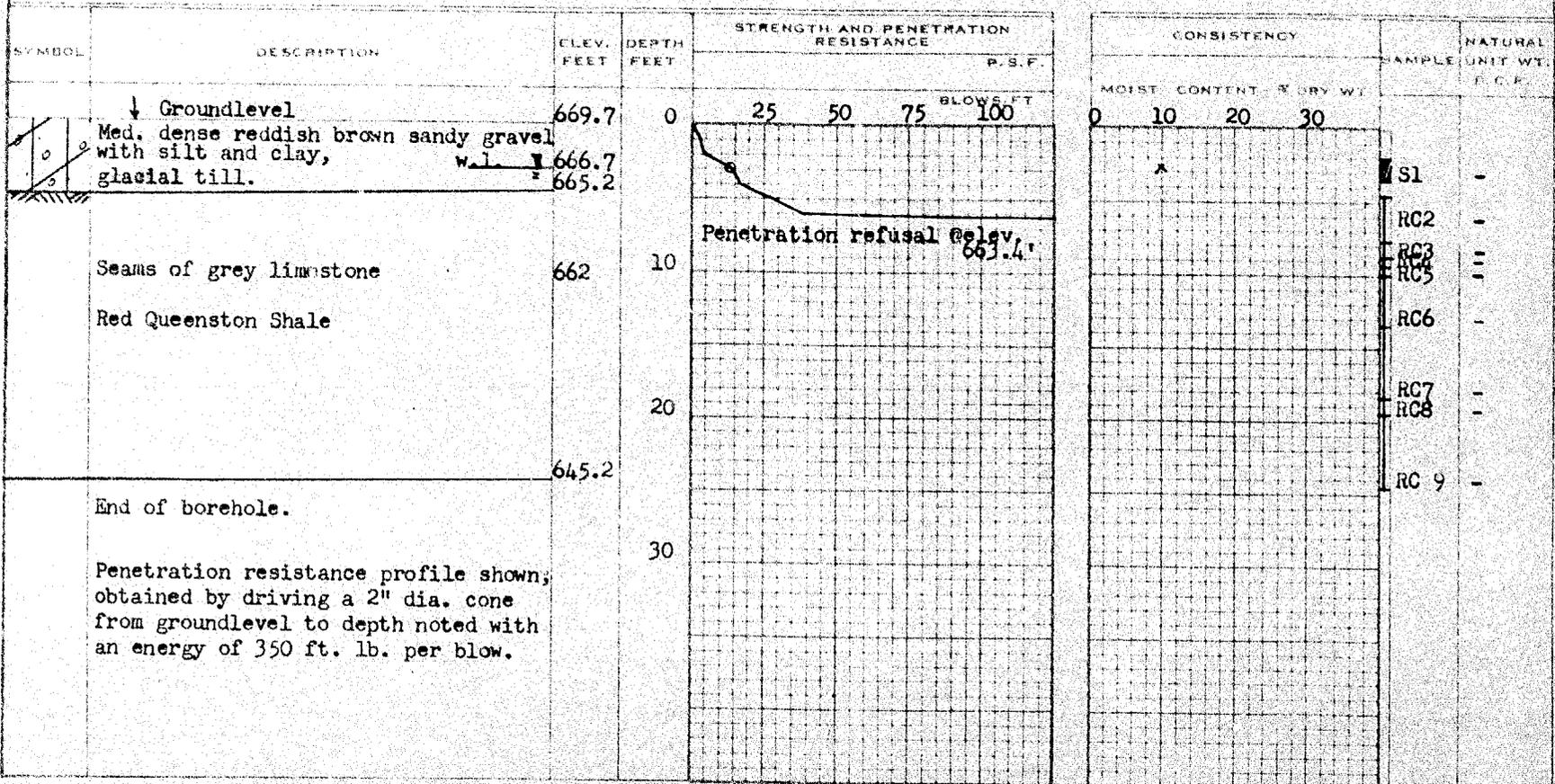
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 205-61 BORE HOLE NO. 3
 JOB 61-F-59 STATION 38+83 (18' Lt.)
 DATUM 669.7' COMPILED BY B.K.
 BORING DATE July 4/61 CHECKED BY I.H.

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

LEGEND

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



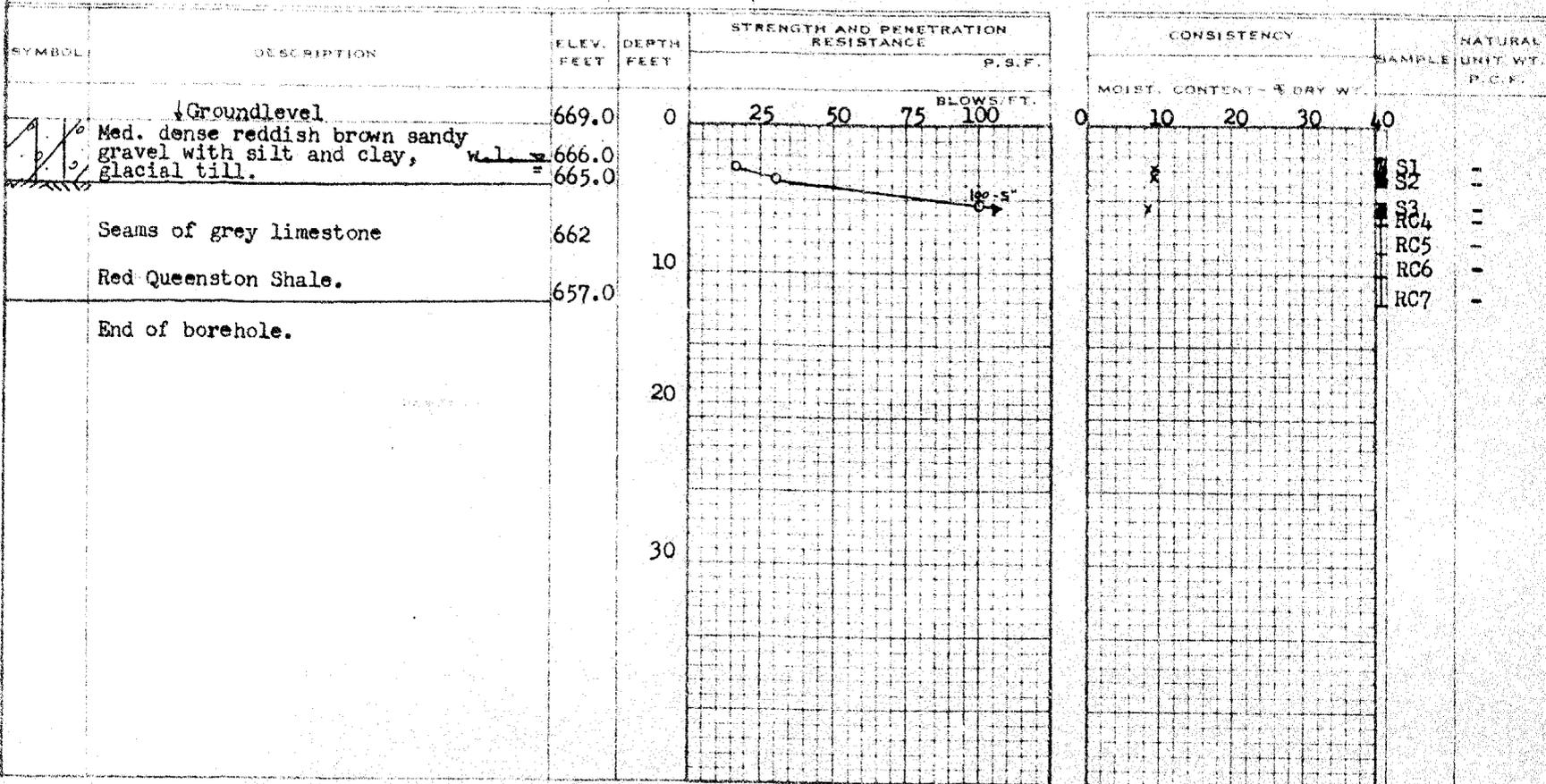
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 205-61 BORE HOLE NO. 4
 JOB 61-F-59 STATION 38/86 (15' Rt.)
 DATUM 669.0' COMPILED BY B.K.
 BORING DATE July 5/61 CHECKED BY I.H.

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

LEGEND

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



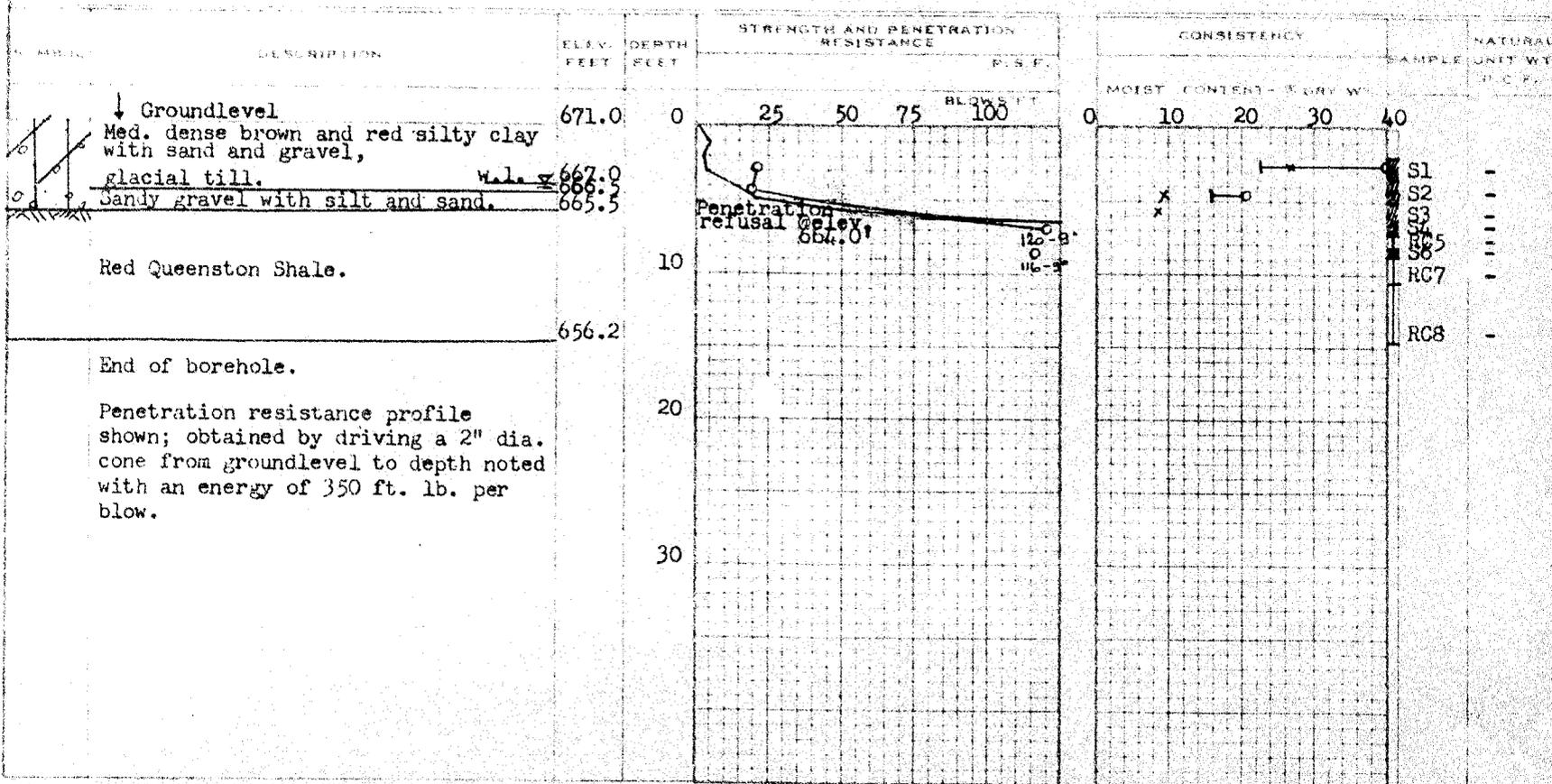
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 205-61 BORE HOLE NO. 5
 JOB 61-F-59 STATION 39+27 E
 DATUM 671.0' COMPILED BY B.K.
 BORING DATE July 5/61 CHECKED BY I.H.

LEGEND

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

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

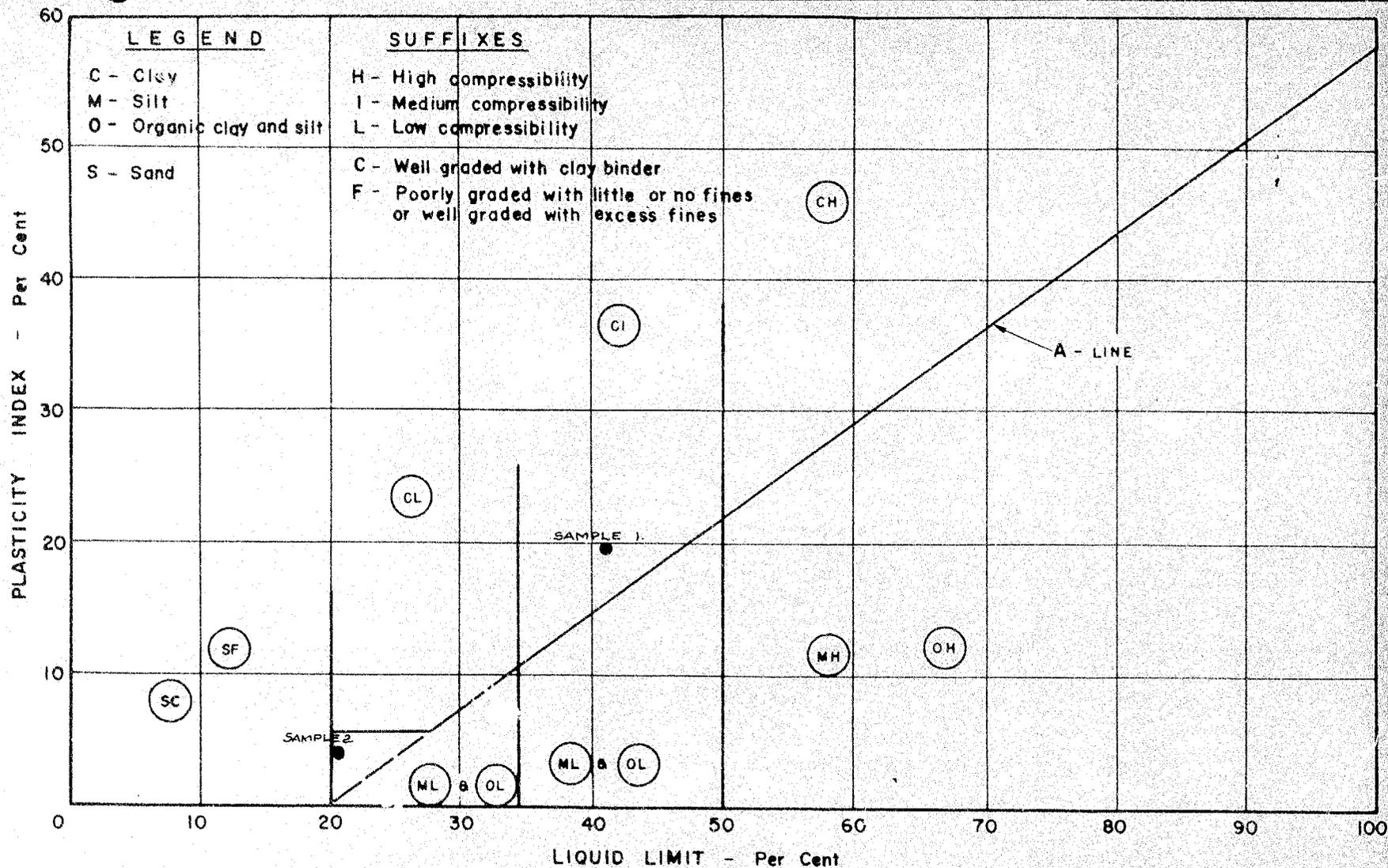
W.P. 205-61 BORE HOLE NO. 6
 JOB 61-F-59 STATION 38+32 (25' Lt.)
 DATUM 667.5' COMPILED BY B.K.
 BORING DATE CHECKED BY I.H.

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

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
 VANE TEST (C) AND SENSITIVITY (S) +
 NATURAL MOISTURE AND LIQUIDITY INDEX LI
 LIQUID LIMIT X
 PLASTIC LIMIT

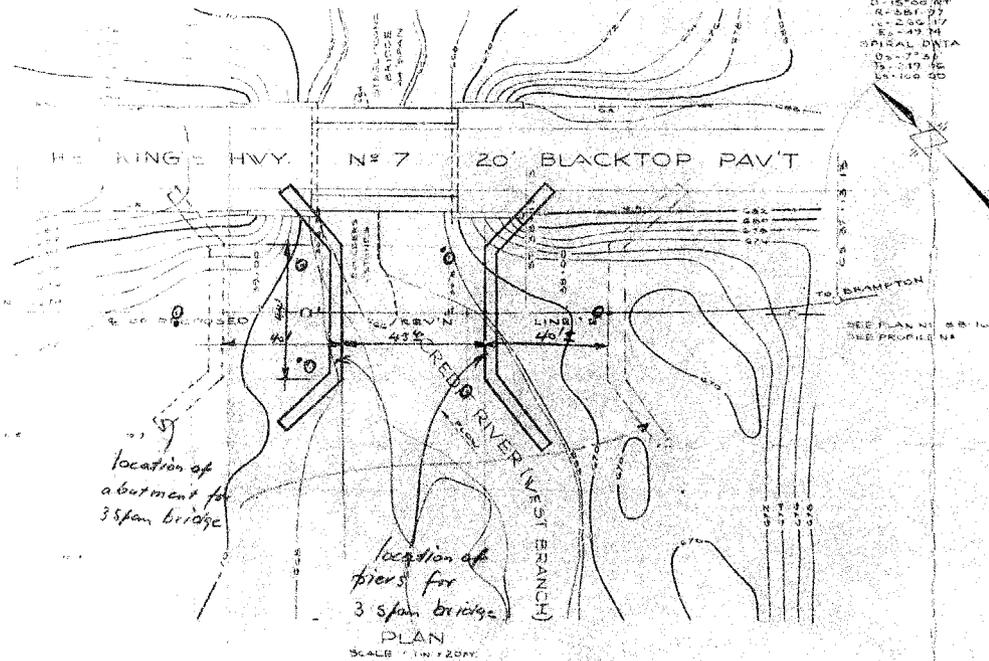
SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH / PENETRATION RESISTANCE		CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.W.
				P.S.F.	BLOW/FT	MOIST. CONTENT - % DRY WT.			
	↓ Groundlevel	668.0	0						
	Red Queenston Shale.	657.9	10						RC1 -
	End of borehole.		20						RC2 -



NOTES BORE HOLE 5 SAMPLE 1 & 2

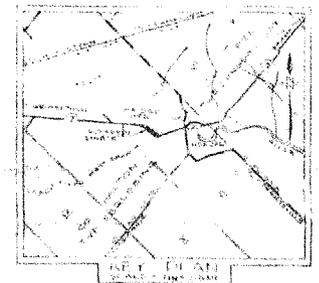
DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & RESEARCH SECTION
PLASTICITY CHART
 Job No. 61-F-59 W.P. No. 205-61
 Location NORVAL HIGHWAY No. 7

COUNTY OF HALTON
TOWNSHIP of ESQUESING
CON XI
LOT 12

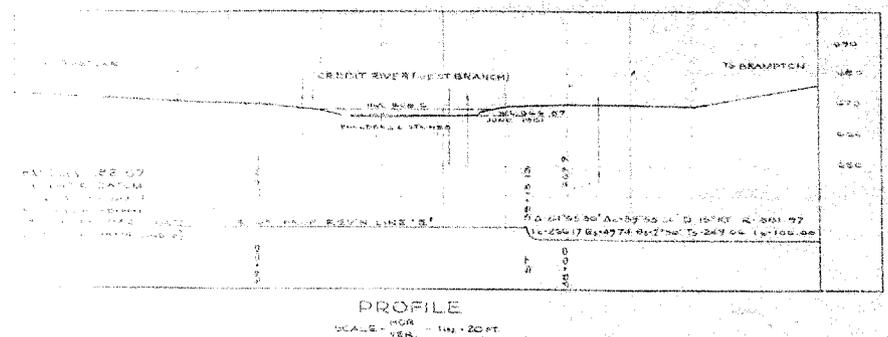


CURVE DATA
LINE 8
A=247.00 30°
B=37.85 30°
C=150.00 90°
R=281.37
E=47.14
SPIRAL DATA
O=7.5
S=19.45
L=100.00

7-1073-113-12

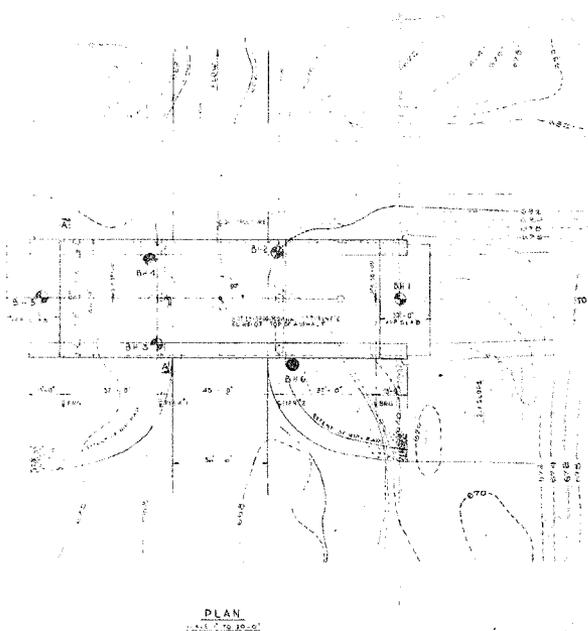


GBM No 595-F ELEV 809.670
GEORGETOWN: Centre of gravity of the B. Township
Three dimensional tie to datum, east of the Kings Highway
Towers. Ties to north meridian, 1983. 1:25000 scale
original, original, original, original, original
before, before, before, before, before

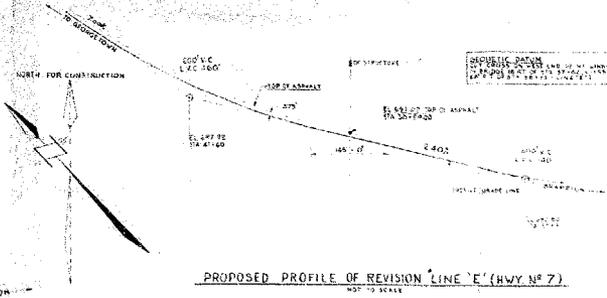


DEPARTMENT OF HIGHWAYS - ONTARIO
PLANNING & DESIGN BRANCH
DISTRICT OFFICE
PROPOSED BRIDGING
AT
CREDIT RIVER (WEST BRANCH)
AND
THE KINGS HWY #7 - CREDIT RIVER
AT TIERVAL
LOT 12
TOWNSHIP OF ESQUESING - COUNTY OF HALTON
BRIDGE SITE
DESIGNED BY: [Name]
CHECKED BY: [Name]
APPROVED: [Name]

WB 105.01



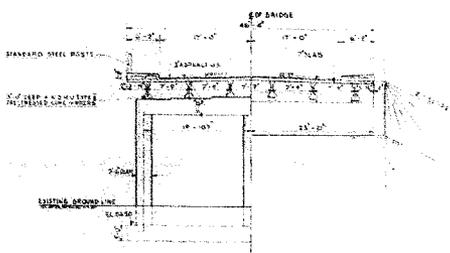
PLAN
SCALE 1" = 20'-0"



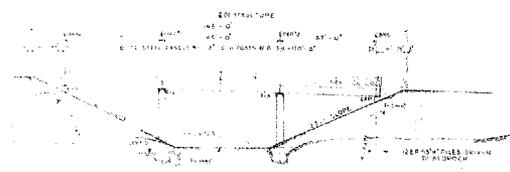
PROPOSED PROFILE OF REVISION LINE 'E' (HWY. NO. 7)
NOT TO SCALE



KEY PLAN
SCALE AS SHOWN



SECTION A-A
SCALE 1" = 10'-0"



ELEVATION
SCALE 1" = 20'-0"

BORE HOLE 1	BORE HOLE 2	BORE HOLE 3	BORE HOLE 4	BORE HOLE 5	BORE HOLE 6
ALL SOILS OR CLAY					
GRAVEL	GRAVEL	GRAVEL	GRAVEL	GRAVEL	GRAVEL
SAND	SAND	SAND	SAND	SAND	SAND
CLAY	CLAY	CLAY	CLAY	CLAY	CLAY
ROCK	ROCK	ROCK	ROCK	ROCK	ROCK
DEPTH OF BORE HOLE					

BORE HOLE DATA
SCALE 1" = 10'-0"

NOTE

TO DISTRICT ENGINEER
CONCRETE WORK OF THIS STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN SET AND CHECKED BY THE DISTRICT ENGINEER/A.

TO CONTRACTOR

STRUCTURE TO BE BUILT IN ACCORDANCE WITH FORM S.C.S. AND THE SPECIAL PROVISIONS, EXTRA COPIES OF WHICH MAY BE OBTAINED FROM THE DISTRICT ENGINEER/A.

CONCRETE MIX

	MINIMUM STRENGTH AT 28 DAYS	MINIMUM SIZE OF AGGREGATE
BEAMS	5000 PSI	3/4"
ELSE WHERE	5500 PSI	3/4"

APPROVED QUANTITIES SUPPLIED BY THE CONTRACTOR WILL BE SUBJECT TO ALL CONCRETE AS ORDERED BY THE ENGINEER.

BORE HOLE

THE COMPLETE SOIL INVESTIGATION REPORT SA 1224 MAY BE EXAMINED AT THE ENGINEER'S OFFICE, DOWNVIEW, ONTARIO. THE DISTRICT ENGINEER WILL GUARANTEE THE ACCURACY OF THIS REPORT OR THE APPROVED VERSION SHOWN ON THESE PLANS.

CLEAR UNDER OR OVERPASS CLEARANCE

EXISTING: 8'

ADJUSTMENTS WITH WALLS: 8'

NO.	DATE BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO

CREDIT RIVER BRIDGE (WEST BRANCH)
AT WEST LIMITS OF NORVAL

ENGINEER: HIGHWAY No. 7 DIST. No. 3
CD. MALLON
TEMP. REQUESTING: 101 12 CORR. 41

PRELIMINARY - GENERAL PLAN

APPROVED	DATE	BY	DATE	BY
DESIGN	12/15/51	CHRY.	12/15/51	CHRY.
DRAWING	12/15/51	CHRY.	12/15/51	CHRY.
DATE	12/15/51	12/15/51	12/15/51	12/15/51

DRAWING NO. D 4924 - P1

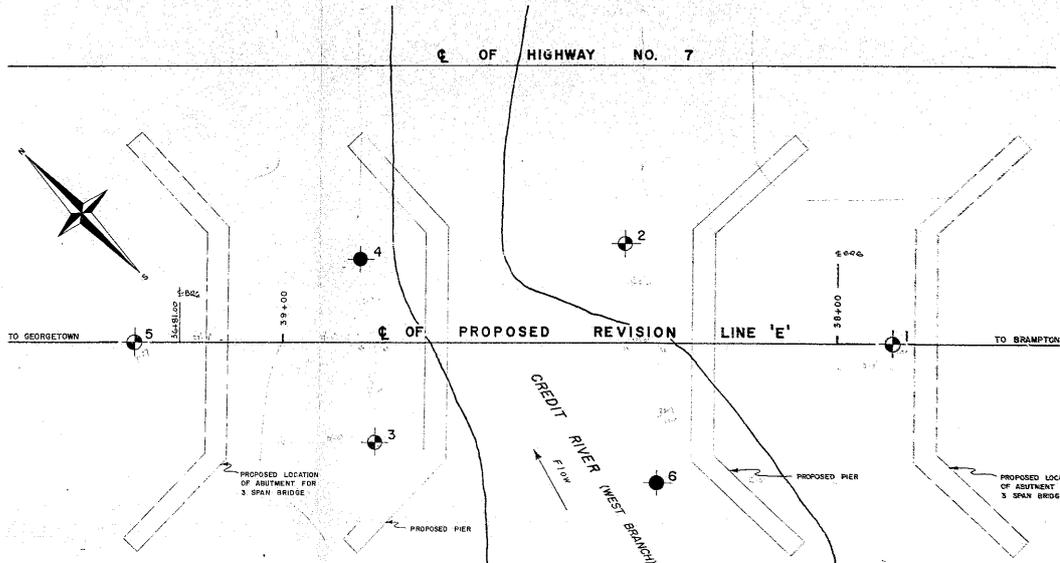
#61-F-59

W.P.# 205-61

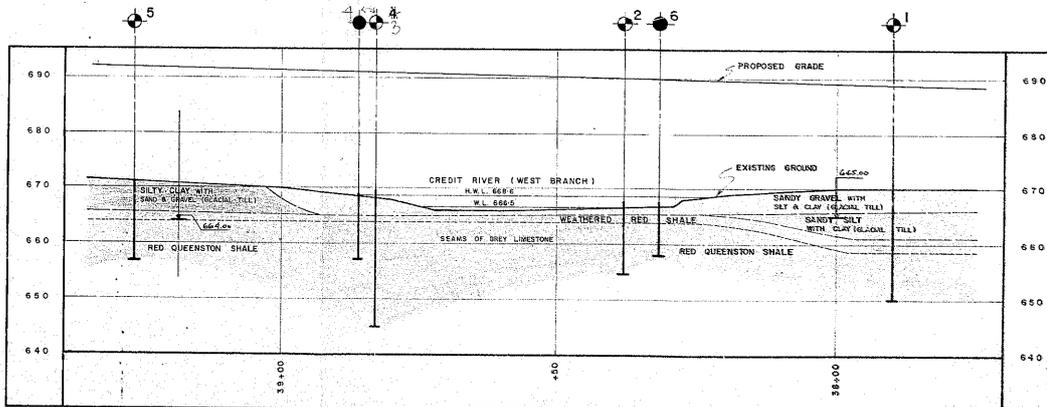
Hwy. #7 Rev.

5' CREDIT RIVER

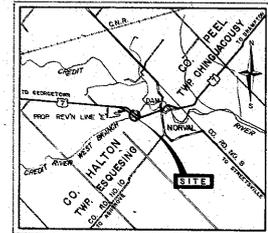
AT NORVAL



PLAN



PROFILE



KEY PLAN
SCALE: 1 inch = 0.8 miles

591400
4953300
591400
17

LEGEND			
	BORE & PENETRATION HOLE		
	BORE HOLE		
NO.	ELEVATION	STATION	OFFSET
1	670.0	37+90	℄
2	667.7	38+38	16' RT.
3	669.7	38+83	16' LT.
4	669.0	38+86	15' RT.
5	671.0	39+27	℄
6	667.5	38+32	25' LT.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

**CREDIT RIVER WEST BRANCH
AND
HIGHWAY NO. 7 LINE 'E'**

NORVAL REVISION

DESIGNATED L. HOLBEC	DISTRICT NO. 4	DATE 31 JULY 1961
DESIGNED D. MUMFORD	DIST. NO. 205 (E1)	JOB NO. 817-7-39
CHECKED	SCALE	DRAWING NO.
APPROVED	1 inch = 10 feet	61 - F - 59 A

REF. NO. E-4001-1