

#56-F-204C

HWY # 10

CREDIT RIVER

BRIDGE

BA 553

RACEY, MacCALLUM AND ASSOCIATES  
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers  
AND ASSOCIATED STAFF

MONTREAL



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TORONTO

DONALD C. MACCALLUM, B.ENG., M.E.I.C., P.ENG.

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TORONTO DIVISION  
20 CARLTON STREET

Reference: S-500-629/T-488

Toronto, Ontario  
November 13, 1961

A. M. Toye, Esq.,  
Bridge Engineer,  
Department of Highways of Ontario,  
280 Lavenport Road,  
Toronto, Ontario.

Attention Mr. S. McCombie

Dear Sirs:

Further to your recent request, we have pleasure in enclosing herewith two additional copies of our report on the foundation investigation for the proposed Credit River Bridge, Station 555+70, Highway 10, Ontario. This investigation was performed at the request of A. W. Dickinson & Associates.

We trust that these will meet your requirements.

Yours very truly,

RACEY, MacCALLUM AND ASSOCIATES LIMITED

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**Consulting Engineers**  
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DONALD C. MacCALLUM, B.ENG., M.E.I.C., P.ENG.  
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TORONTO DIVISION  
20 CARLTON STREET

26 October 1956.

Reference: S-500-629/T-486

Department of Highways of Ontario,  
A.W. Dickinson and Associates,  
38 Irwin Avenue,  
TORONTO, Ontario.

Attention: Dr. A. W. Dickinson

FOUNDATION INVESTIGATION FOR THE  
PROPOSED CREDIT RIVER BRIDGE,  
STATION 555+70, HIGHWAY 10, ONTARIO

Dear Sirs:

We have completed our investigation of the subsoil conditions at the above noted site and our report on the subject is attached hereto. For your convenience, the conclusions of this report are repeated, as follows:-

1. The subsoil at the present bridge site consists of a surface layer of compressible peaty topsoil, underlain by saturated silt. The desirable load bearing level is at, or below El. 1311 feet, where a stratum of dense gravel, sand, and small boulders was encountered.
2. The recommended safe bearing value for this coarse granular stratum is of the order of 5000 p.s.f., for a limiting settlement of one inch.
3. Piles should encounter refusal in this granular material, although the exact depth at which this occurs may vary somewhat, due to the random nature of the small boulders. Ultimate refusal depth however, should not extend below El. 1288 feet.
4. Excavation difficulties below river level, in the upper silt layer, should be anticipated.

We thank you for this opportunity to be of service to you, and shall be pleased to discuss any matters not specifically covered in this report, at your convenience.

Yours very truly,  
RACEY, MacCALLUM AND ASSOCIATES LIMITED

W. A. Trow, F. Eng.  
Divisional Soils Engineer

FOUNDATION INVESTIGATION FOR THE  
PROPOSED CREDIT RIVER BRIDGE,  
STATION 555+70, HIGHWAY 10, ONTARIO.

Reference: S-500-629/T-488

Racey, MacCallum and Associates Limited

26 October, 1956.

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26 October 1956.

FOUNDATION INVESTIGATION FOR  
THE PROPOSED CREDIT RIVER  
BRIDGE, STATION 555+70,  
HIGHWAY 10, ONTARIO

This report contains the results of a foundation investigation consisting of two borings, carried to a depth of thirty-five to forty feet, near the abutments of the present bridge at the above noted site. This work was carried out during the period from 17 October to 23 October 1956. The location of the borings is indicated on enclosure No. 1.

DESCRIPTION OF THE SITE AND SUBSOIL CONDITIONS

The site of the proposed bridge and of the existing highway bridge lies in a relatively flat valley, approximately one mile wide. The valley is bounded to the north and south by steep hills which appear to consist of dense glacial till deposits, with random limestone boulders at the surface. Conversation with a local well-driller indicates that limestone bedrock was encountered at a depth of about fifty feet in these hills, although much greater bedrock depths were noted near Mournahan's Snack Bar, just south east of Orangeville. In the vicinity of the river itself, a wide flat alluvial plain has been developed, suggesting that the river has progressed across it in geologically recent times. The present bridge shows evidence of concrete deterioration, and occasional chunks of concrete were noted to fall into the river upon the passage of heavy trucks.

The subsoil at the site is shown in the profiles for borings 1 and 2, enclosures 2 and 3. Briefly, the profile consists of very peaty topsoil to El. 1321.5, underlain by approximately nine feet of loose, slightly cohesive silt which, in turn, changes at about El. 1311 feet to dense fine to coarse gravel with some boulders, which continued to El. 1280 feet, the ultimate depth of the borings. This granular material was very difficult to penetrate and sampling in it was very unsatisfactory. In hole No. 1 this material was broken near El. 1304 feet, by approximately seven feet of dense silt with some gravel. The water table at both locations coincided with river level.

The relative density of the various strata was determined by penetration measurements, using the standard split spoon, the two inch diameter cone and by recording the blows per foot required to drive the three inch casing. Undisturbed Shelby tube samples of the silt were also taken, for determinations of relative density. The relative density of the upper silt was found to be of the order of 77 percent, which indicates a dense state of compaction and conflicts with the standard penetration measurements. This paradox has been noted on other occasions and gives evidence of the conservativeness of the empirical standard penetration test under certain circumstances.

26 October 1956

DISCUSSION OF THE RESULTS

In view of the subsoil conditions observed at the site, the alternatives for the support of the proposed highway bridge would appear to be somewhat limited. Because of the flood conditions on record for this part of the river, and the probable low resistance to scour of the upper stratum of silt, it would appear desirable to carry any foundation down to the gravel deposits encountered in the vicinity of El. 1311 feet. This could be done either by excavating to this depth and installing the required abutment footings, or by driving short piles to refusal in the gravel stratum. The former method of construction would involve the usual difficulties associated with excavating below the water table in silt, and well-shored sheet piling, driven into the gravel, would be required to contain this unstable material. A free flow of water from the underlying gravel should also be anticipated.

According to the standard penetration measurements in the gravel, sand and boulders, the empirical safe bearing value for an abutment footing founded at El. 1311 feet is of the order of 5000 p.s.f. This value allows for the effect of submergence of the gravel, and also for the fact that large abutment footings, because of their rigid nature, undergo less settlement than ordinary footings for similar soil conditions. It does not allow for the fact that granular deposits adjust instantaneously to any load application and, therefore, that a considerable amount of the total one inch settlement will take place as the abutment is being constructed.

If driven to refusal, the ultimate bearing capacity of piles will be governed by structural considerations. A factor of safety of three should be applied to this ultimate capacity. As a check on this capacity, current soil mechanics literature indicates an ultimate capacity for the granular material with the penetration resistances noted at this site, of the order of one hundred times the tip area of the pile. Although wood piles would appear to be an economic method of abutment support, some danger of pile brooming on some of the small boulders should be anticipated.

CONCLUSIONS

On the basis of the foregoing comments, the following conclusions regarding subsoil conditions, can be drawn.

1. The subsoil at the present bridge site consists of a surface layer of compressible peaty topsoil, underlain by saturated silt. The desirable load bearing level is at, or below, El. 1311 feet, where a stratum of dense gravel, sand, and small boulders was encountered.

26 October 1956.

2. The recommended safe bearing value for this coarse granular stratum is of the order of 5000 p.s.f., for a limiting settlement of one inch.

3. Piles should encounter refusal in this granular material, although the exact depth at which this occurs may vary somewhat, due to the random nature of the small boulders. Ultimate refusal depth however, should not extend below El. 1288 feet.

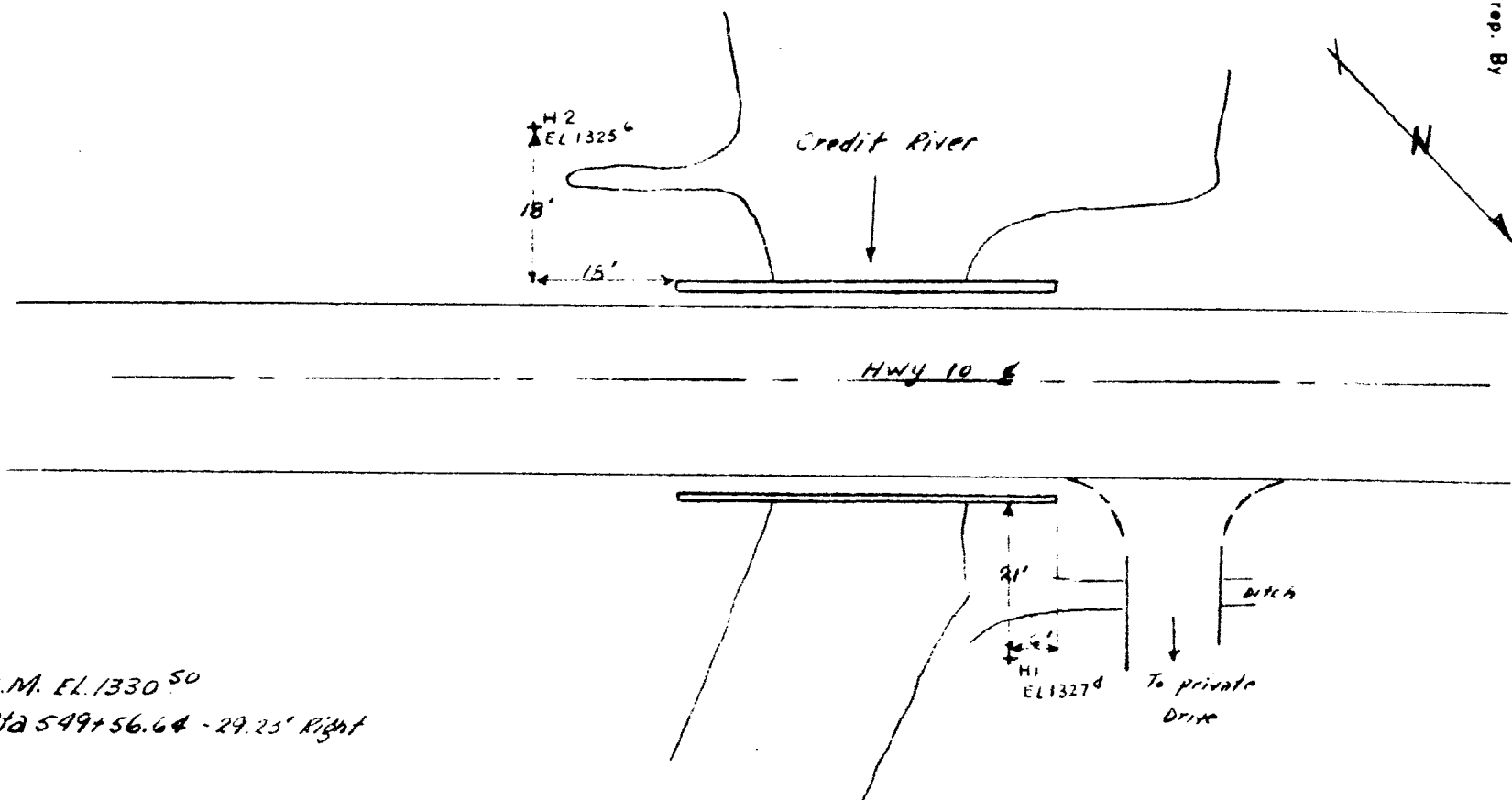
4. Excavation difficulties below river level, in the upper silt layer, should be anticipated.

W. A. Trow, P. Eng.,  
Divisional Soils Engineer.

WAT/AD  
Copy /PW

Original and 3 copies - Department of Highways of Ontario,  
A. W. Dickinson & Associates, Toronto.





Sketch of site showing location of Boreholes

Order No. 5500-629/488 RACEY, MACCALLUM AND ASSOCIATES  
LIMITED

Hole Begun \_\_\_\_\_

Foundation Engineering Division

Driller \_\_\_\_\_

Hole Ended \_\_\_\_\_

Engineering Data Sheet for Borehole: \_\_\_\_\_

Helper \_\_\_\_\_

Job Name: Credit River Bridge Hwy No 10 Sta 555+70Job Located: Approx. 2 mi. South Orangeville Ont

Checked by \_\_\_\_\_

Hole Located: See Encl. No 1Hole Elevation: 1327.4 Datum: Geodetic

DEPTH	EL.	THICK- NESS	SYMBOL	DESCRIPTION	TABULAR VALUES Blows/Ft.				SAMPLING METHOD
					25	50	75	100	
	1327.4			Ground surface					
6'				black peaty topsoil					
				Uniform loose grey silt (slightly cohesion)					SS.1
16'	1311								SS.2
				Fine to coarse gravel					SS.3
23'				Uniform dense grey silt with gravel					SS.4
				Coarse gravel & small stones (wash water clear)					SS.5
40'				Drilled with AXT bit through small boulders & gravel to 40' End of bore					SS.6
Note water level coincides with river level									
Legend									
SS = 2" split spoon									
TW = 2" Shelby tube									
Blows /ft. 140" hammer 30" drop									

Order No.: ~~5522-629/1400~~ RACEY, MACCALLUM AND ASSOCIATES  
LIMITED

L.B.

# Driller

Hole Begun \_\_\_\_\_ Foundation Engineering Division

Hole Ended \_\_\_\_\_ Engineering Data Sheet for Borehole: 2

## Helper

Job Name: Credit River Bridge Hwy 10 Sta 555 + 70

Job Located: Approx 2 mi. South Orangeville Ont.

Checked by

Hole Located: See ENCL. No 1

Hole Elevation: 1325<sup>6</sup> Datum: Crest of TIC

Day Month Year

DEPTH	EL.	THICK- NESS	SYMBOL	DESCRIPTION	TABULAR VALUES Blows/Ft.	SAMPLING METHOD
0	1325.6			Ground surface	25 50 75 100	
4				Black topsoil		T.W. 1
6				Loose medium sand		SS. 2
				Loose slightly cohesive silt		T.W. 3
13.5	1312			Dense gravel & boulders and coarse sand (sampling impossible)		SS. 4.
				Some silt in evidence at 23 ft.		135
30				Drill with AXT bit through dense gravel & boulders to 35'		159
36	1289			End of Bore		180
				Note: Water table coincides with river level		184
				Legend		120
				SS. = 2" Split Spoon		170
				TW = 2" Shelby tube		145
				Blows/Ft. 140# hammer 30" drop		106