

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M5-102

W.P. No. —

CONT. No. —

W. O. No. —

STR. SITE No. —

HWY. No. —

LOCATION BEACH RD. & RED HILL  
CREEK, HAMILTON

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: \_\_\_\_\_

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B.D. 540

~~Rev. 1947~~

T.O. LAZARIDES, LOUNT AND PARTNERS  
CONSULTING ENGINEERS

30M5-102  
GEOCRENS No.

T.O. LAZARIDES, OR. ENG., U.I. LV., P. ENG.  
A.M. LOUNT, P. ENG., B.A. SC. M.E.I.C.

HEAD OFFICE  
79 SCOLLARD STREET  
TORONTO 5, ONT.  
WALNUT 4-2155

YOUR REF.  
OUR REF.

August 8, 1956

Mr. A.M. Toye,  
Bridge Engineer,  
Department of Highways of Ontario,  
Queens Park,  
Toronto 5, Ontario.

Dear Mr. Toye:

Re: Beach Road Bridge over Red Hill Creek.

We enclose herewith two (2) copies of the soil investigation report on the Leach Road Bridge over the Red Hill Creek WP 48 B - 56. This report has been prepared by Racey, MacCallum and Associates, 20 Carlton Street, Toronto.

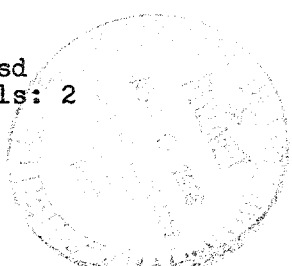
Yours sincerely,

T.O. LAZARIDES, LOUNT AND PARTNERS.

C. Visser

C. Visser.

CV/sd  
Encls: 2



B.A. 540

RACEY, MACCALLUM AND ASSOCIATES  
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers  
AND ASSOCIATED STAFF

30M5-102
GEOCREC No.

MONTREAL  VANCOUVER

TORONTO

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

H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.

GEORGE J. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION  
20 CARLTON STREET

Reference: S-500-501/T-390

Department of Highways of Ontario,  
Lazarides, Lount and Partners,  
79 Scollard Street,  
TORONTO, Ontario.

25 July 1956.

RE: FOUNDATION INVESTIGATION FOR  
BEACH ROAD BRIDGE, HAMILTON

Dear Sirs:

We have completed our foundation investigation for the proposed Beach Road Bridge, in Hamilton, Ontario, and are submitting our report which was prepared by Mr. B. F. Welsh, herewith.

The soil at the footing depth, which is approximately 14 feet below the ground surface, is basically a stiff blue grey silty clay which has a bearing capacity of 4000 p.s.f. for continuous spread footings. With an anticipated loading on the centre piers of the structure of approximately 43 kips per lineal foot, this bearing value will result in footings approximately 11 feet in width. Consideration should also be given to the use of piles. Piles driven to refusal in the underlying shale may result in some saving in the cost of foundations, as compared to spread footings. The design capacity of the piles would depend upon their structural strength in this instance. If spread footings are used, settlement of the structure should be minor, because the moisture contents of the clay are generally very close to the plastic limit, indicating that the clay cannot consolidate appreciably under the loading.

No difficulty should be anticipated in dewatering the excavation for the foundations. Pumping from sumps should be a satisfactory method of dewatering in the soil encountered.

We are happy to have had this opportunity to be of service to you and will be pleased to confer with you, at your convenience, should any further problems arise concerning this site.

Yours very truly,  
RACEY, MacCALLUM AND ASSOCIATES LIMITED

  
W. A. Trow,  
Divisional Soils Engineer

BEW/MD

Original and 3 copies - Lazarides, Lount and Partners, Toronto, Ontario.

FOUNDATION INVESTIGATION  
FOR BEACH ROAD BRIDGE,  
HAMILTON, ONTARIO.

Report No: S-500-501/T-390

Racey, MacCallum and Associates Limited

25 July 1956

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25 July 1956

FOUNDATION INVESTIGATION FOR BEACH ROAD  
BRIDGE, HAMILTON, ONTARIO.

INTRODUCTION

This report describes the foundation investigation carried out at the site of a proposed bridge on Beach Road in Hamilton, Ontario. The proposed structure will have three spans with a maximum loading of 43 kips per lineal foot on the centre piers. The anticipated foundation level is approximately 14 feet below the existing ground surface. Included in the report are a description of the subsoil conditions, along with recommendations for the foundation design.

LOCATION OF THE SITE AND OF THE BOREHOLES

The site of the proposed bridge is located on Beach Road, approximately 600 feet west of the Queen Elizabeth Way, in the City of Hamilton, on fairly low and level ground. The proposed bridge will cross a diversion of the creek which flows into one of the reaches of Hamilton Bay. The boreholes were located as shown on enclosure no.1. Borehole no.1 lies 25 feet north of the centreline of Beach Road, and 44 feet west of the centreline of the proposed structure. Borehole no.2 is 65 feet south of the centreline of Beach Road and 20 feet west of the centreline of the proposed structure. Borehole no.3 was moved slightly from its original location and placed 15 feet south of the centreline of Beach Road and 50 feet east of the proposed structure's centreline, in order to clear the pavement on Beach Road and the road running south from Beach Road. The elevation of the boreholes was determined by referring them to the water level in the Bay, and subsequently obtaining the water level from the Hamilton Harbour Commissioners. The elevations were then converted from the hydrographic datum used by the Harbour Authorities to the more commonly used geodetic datum, for presentation in this report.

THE SUBSOIL CONDITIONS

With the exception of the top 15 feet, the soil profile in the three boreholes is similar. As can be seen from enclosure no. 2, the engineering data sheet for borehole no.1, the soil profile consists of 16 feet of very stiff brown silty clay, with some fine gravel, underlain by stiff blue grey silty clay with fine gravel. In borehole no.2, as shown on enclosure no.3, the upper layer consists of brown silty clay with fine sand and some root fibres, changing at 7.5 feet to a very dense sandy brown silt with a trace of clay. At 12 feet the stiff blue grey silty clay with some fine gravel, encountered in borehole no.1, was also found in this hole. In borehole no.3, as shown on enclosure no.4, brown silty clay, which is probably fill, was found to a depth of 4.0 feet. A layer of soft organic silty clay, approximately one foot thick, was found below this and is probably the original topsoil on which the fill has been placed. Below the organic layer is hard brown silty clay

24 July 1956.

with some fine gravel, changing to stiff blue grey silty clay with some fine gravel at approximately 15 feet.

Refusal in borehole no.1 was encountered at 31 feet or El.218.7 feet. The borehole was inadvertently advanced to 36.3 feet in soft red shale, before drilling was commenced, due to the soft nature of the rock. The drilling was carried down to approximately 46.0 feet, with good core recovery. The shale was interbedded with layers of soft limestone, up to approximately six inches thick. Refusal with the split spoon sampler was encountered at 30 feet, or El.221.8 ft. in borehole no.2 and soft red shale was found in the nose of the sampler. Borehole no.3 was ended at approximately 26.0 feet and was not carried to refusal.

The very stiff to hard brown silty clay extended to elevations 233.7 and 232.2 feet in boreholes 1 and 3 respectively. This layer is similar to the underlying blue grey clay, except that it has been weathered and dessicated. This accounts for the definite and very pronounced decrease in strength in the lower layer. The upper layer has strengths ranging up to 6690 p.s.f., from the unconfined compressive strength test, although the underlying blue grey silty clay has strengths ranging from approximately 2100 p.s.f. to 1350 p.s.f. In borehole no.2 the stiff blue grey silty clay was encountered at El. 239.8 feet, underlying a four and a half foot thick layer of very dense sandy brown silt, with a trace of clay. The very dense silt layer had an N value, from the standard penetration test, of 62 blows per foot. The stiff blue grey silty clay in this borehole resembled, in strength and other properties, the clay encountered in the first two boreholes. In borehole no.2 the strength of the clay, as measured by the field vane, was 1900 p.s.f. and compares with the shear strength of 1420 p.s.f. as measured by the unconfined compression test. Since the cohesive strength as measured by the field vane is generally more accurate than that measured by the unconfined compression test, it is reasonable to assume that the lowest cohesive strength of the clay stratum is in the order of 1900 p.s.f.

The liquid limit for the clay ranged from 25.9 percent to 38.6 percent with an average of approximately 30 percent. The plastic limit for this material ranged from 13.4 percent to 18.1 percent, with an average of approximately 16 percent. The penetration resistance of the clay to the driving of a Shelby tube one foot, was indicative of changes in cohesive strength, but no numerical values can be assigned from this. The unconfined compressive strength test and the vane test are far more reliable than the penetration resistance, in determining the cohesive strength of clays. The ground water level measured in the boreholes corresponded roughly to the water level in Hamilton Bay, which was approximately El.247.0 feet at the time the drilling was carried out.

25 July 1956.

DISCUSSION OF THE RESULTS

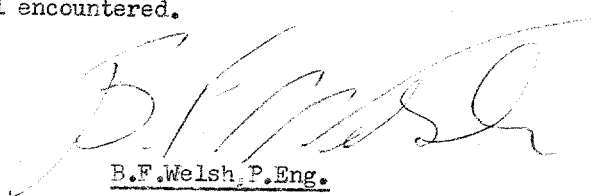
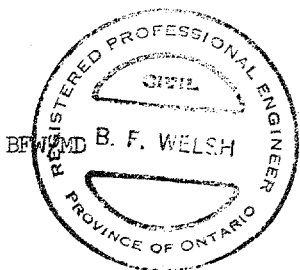
Since the structure is to be founded 14 feet below the ground surface, or at approximate El.235.0 feet, the foundation will rest on the stiff blue grey clay, which can be taken as having a cohesive strength of approximately 1900 p.s.f. This will result in a permissible bearing value of approximately 4000 p.s.f. With this bearing value, if continuous spread footings are used, the width of the footings will have to be approximately 11 feet. Also, some settlement can be anticipated, although this should be of a minor character since generally the natural moisture contents are very close to the plastic limit, indicating that the clay is in a fairly incompressible state.

It may, however, be more economical to found the structure on piles, driven to refusal in the soft red shale which was found at approximately El.220.0 feet. These piles would probably meet refusal after three or four feet penetration into the soft shale and the resulting pile lengths would, therefore, be approximately 20 feet. The permissible bearing capacity of the piles will depend upon their structural strength in this case.

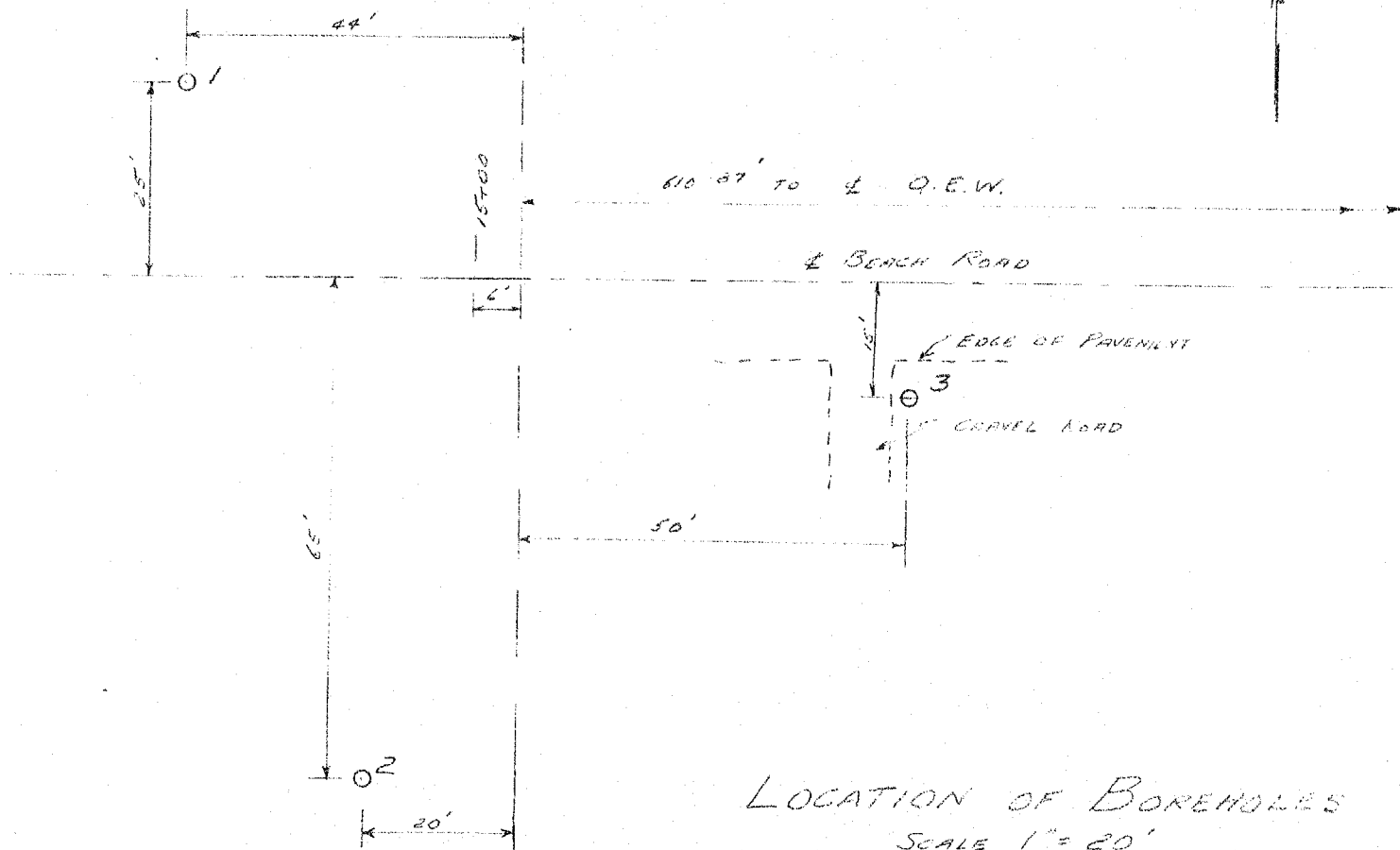
Because of the impermeable nature of the soil encountered, the excavations for the foundations will probably be able to be dewatered without difficulty.

CONCLUSIONS AND RECOMMENDATIONS

1. The allowable bearing value of the clay at approximately El.235.0 feet is in the order of 4000 p.s.f. for continuous spread footings. This will result in footings approximately 11 feet in width for the centre piers.
2. The settlement of the structure, if it is founded on spread footings, should be minor because the moisture contents of the clay are generally very close to the plastic limit, indicating that the clay cannot consolidate appreciably under the loading.
3. Consideration should also be given to the use of piles. Piles driven to refusal in the underlying red shale may result in some saving in the cost of the foundations, as compared with spread footings. The bearing capacity of the piles would depend upon the structural strength in this case.
4. No difficulty should be anticipated in dewatering the foundations. Pumping from sumps should be a satisfactory method of dewatering in the soil encountered.

  
B.F. Welsh, P.Eng.





Order No. S-500-501/T-390

Enclosure No. 2

**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: /

Project: PROPOSED LARK RD. BRIDGE, HAMILTON

Field Supervision: *E. C.*

Location: HAMILTON, Ont.

Driller: *W. L.*

Hole Location *SHE ATTACHED PLAN*

Prep.: B.F.M.

Hole Elevation and Datum: 245.7 (GEODETIC)












Checked:

Field Work Begun ..... Ended.

Date:

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				
				1500	2000	3000	4000	5000
				P.S.F.				
				BLOWS/FT				
	GROUND SURFACE	243.7	0	10	20	30	40	50
	VERY STIFF BROWN CLAY WITH SOME FINE GRAVEL	243.7	3.0					
		233.7	16.15					
	STIFF BLUE GREY SILTY CLAY WITH FINE GRAVEL	233.7	20					
		219.7	30.0					
	REFUSAL ON SOFT RED SHALE ADVANCED PILE WITH P.X. LACING CARRYING CONTINUOUS PRESSURE	219.7	31.0					
		211.9	35					
	SOFT RED SHALE WITH LIM. COAR. INCL. LBS 1" TO 2" THICK.	208.7	40					
	END OF PILE/SHOULDER	203.7	46.0					

**LEGEND**

<u>Sampling Method</u>	
2" Dia. split tube	
2" Shelby tube	
<u>Penetration Resistance</u>	
2" Split tube	
2" Dia. Cone	
Casing	
<u>Strength</u>	
Unconfined compression	
Vane test and sensitivity	
<u>Consistency</u>	
Natural moisture	
Liquid limit	
Plastic limit	
Natural Unit Weight	

CONSISTENCY AND UNIT WEIGHT

	100	110	120	130	140	% DR
0	10	20	30	40		
10						
20						
30						
40						
50						
60						
70						
80						
90						
100						

10/11/54  
ESF

X

X

X ———— O X

X

X

X ———— O X

E-500-Sa/T-320

Enclosure No. 6

# RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: /

## LEGEND

Sampling Method  
2" Dia. split tube  
2" Shelby tube

Penetration Resistance  
2" Split tube  
2" Dia. Cone  
Casing

Strength  
Unconfined compression  
Vane test and sensitivity

Consistency  
Natural moisture  
Liquid limit  
Plastic limit

Natural Unit Weight



PROPOSED BEACH RD. BRIDGE HAMILTON  
HAMILTON, ONT.  
on S.D. ATTACHED PLAN  
Location and Datum: 243.7 (GEODETIK)  
Begun ..... Ended .....

Field Supervision: E. C.  
Driller: W. L.  
Prep.: B. P. W.  
Checked:  
Date:

DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				
			1000	2000	3000	4000	5000
			P.S.F. BLOWS/FT.				
GROUND SURFACE	243.7	0	10	20	30	40	50
STIFF BROWN CLAY SOME FINE GRAVEL	246.7	3.0					
	233.7	16.15					
BLUE GREY SILTY WITH FINE GRAVEL		20					
		25					
REFUSAL ON SOFT RED SHALE WELL HOLE WITH BX CASING AND CONTINUOUS PRESSURE	218.7	31.0					
	211.9	36.5					
RED SHALE WITH COARSE INTERFILLS 10" C" THICK	202.7	41.0					
END OF BOREHOLE	203.7	46.0					

CONSISTENCY AND UNIT WEIGHT						SAMPLE NO.
100	110	120	130	140	150	P.C.F.
% DRY WEIGHT						
0	10	20	30	40	50	
<div>FINED 5%   &lt;</div>						

Order No. S-500-501/7-30Enclosure No. 3**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: 2Project: PROPOSED BEACH ROAD BRIDGE, HAMILTON Field Supervision: E. C.Location: HAMILTON, ONT.Driller: W. L.Hole Location SEE ATTACHED PLANPrep.: E. F. W.Hole Elevation and Datum: 251.8 GEODETIC

Checked:

Field Work Begun ..... Ended ..... Date:

**LEGEND**Sampling Method  
2" Dia. split tube  
2" Shelby tubePenetration Resistance  
2" Split tube  
2" Dia. Cone  
Casing

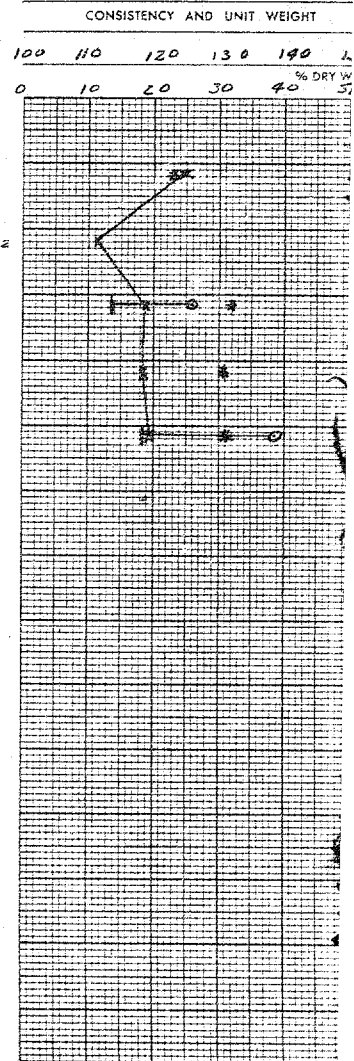
Strength

Unconfined compression  
Vane test and sensitivityConsistency  
Natural moisture  
Liquid limit  
Plastic limit

Natural Unit Weight



SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE					
				P.S.F.					
				1000	2000	3000	4000	5000	BLOWS/FT.
	<u>GROUND SURFACE</u>	<u>251.8</u>	<u>0</u>	<u>10</u>	<u>20</u>	<u>30</u>	<u>40</u>	<u>50</u>	
	<u>BROWN SILTY CLAY WITH FINE SAND AND SOME ROOT FIBRES.</u>		<u>5</u>						
	<u>VERY DENSE SANDY BROWN SILT WITH A TRACE OF CLAY</u>	<u>247.3</u>	<u>7.5</u>						
		<u>232.8</u>	<u>12.0</u>						
	<u>STIFF BLUE GREY SILTY CLAY WITH SOME FINE GRAVEL</u>		<u>15</u>						
			<u>20</u>						
			<u>25</u>						
	<u>REFUSAL WITH SAMPLER ON SOFT RED SHALE</u>	<u>221.8</u>	<u>30</u>						
			<u>35</u>						



**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: 62

Field Supervision: *EE*

Driller: *W. L.*

Prep.: *E. F. W.*

Checked:

Date:

### LEGEND

### Sampling Method

2" Dia. split tube

2" Shelby tube

### Penetration Resistance

2" Split tube

2" Dia. Cone

## Casing

### Strength

☒ Ur confined compression

### Vane test and sensitivity

### Consistency

Natural moisture

Liquid limit

Plastic limit

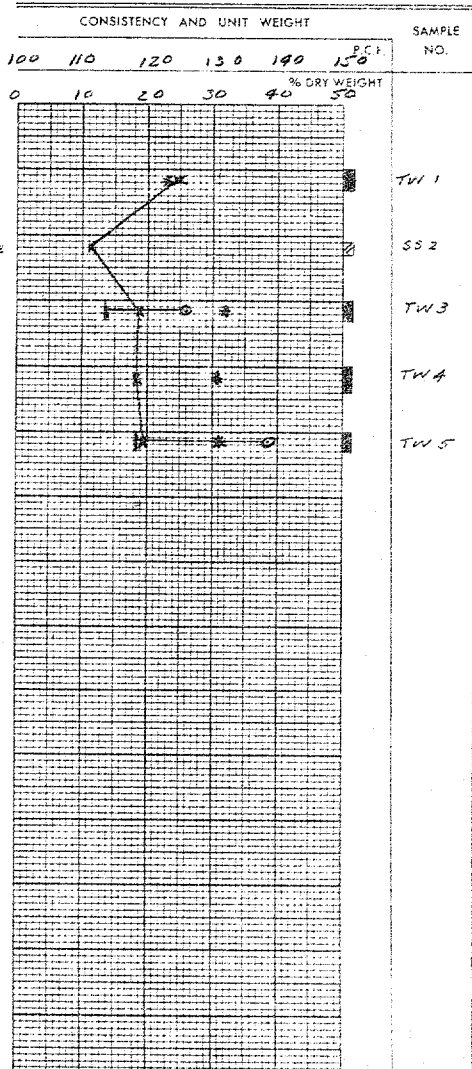
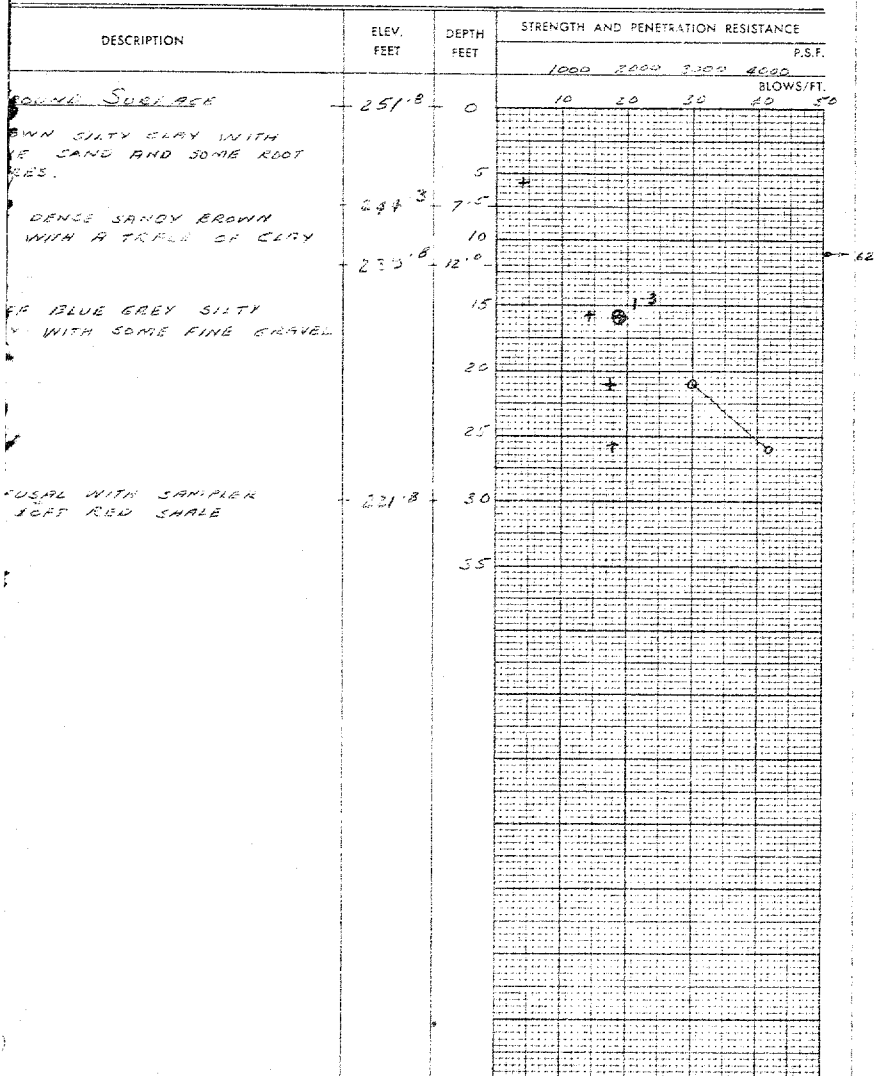
Natural Unit Weight

PROPOSED BEACH ROAD BRIDGE, HAMILTON  
HAMILTON, ONT.

ation SEE ATTACHED PLAN

Location and Datum: 251'8 GEOGRAPHIC

Work Begun ..... Entered .....



Order No. 5-500-50.1/F-300Enclosure No. 7**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

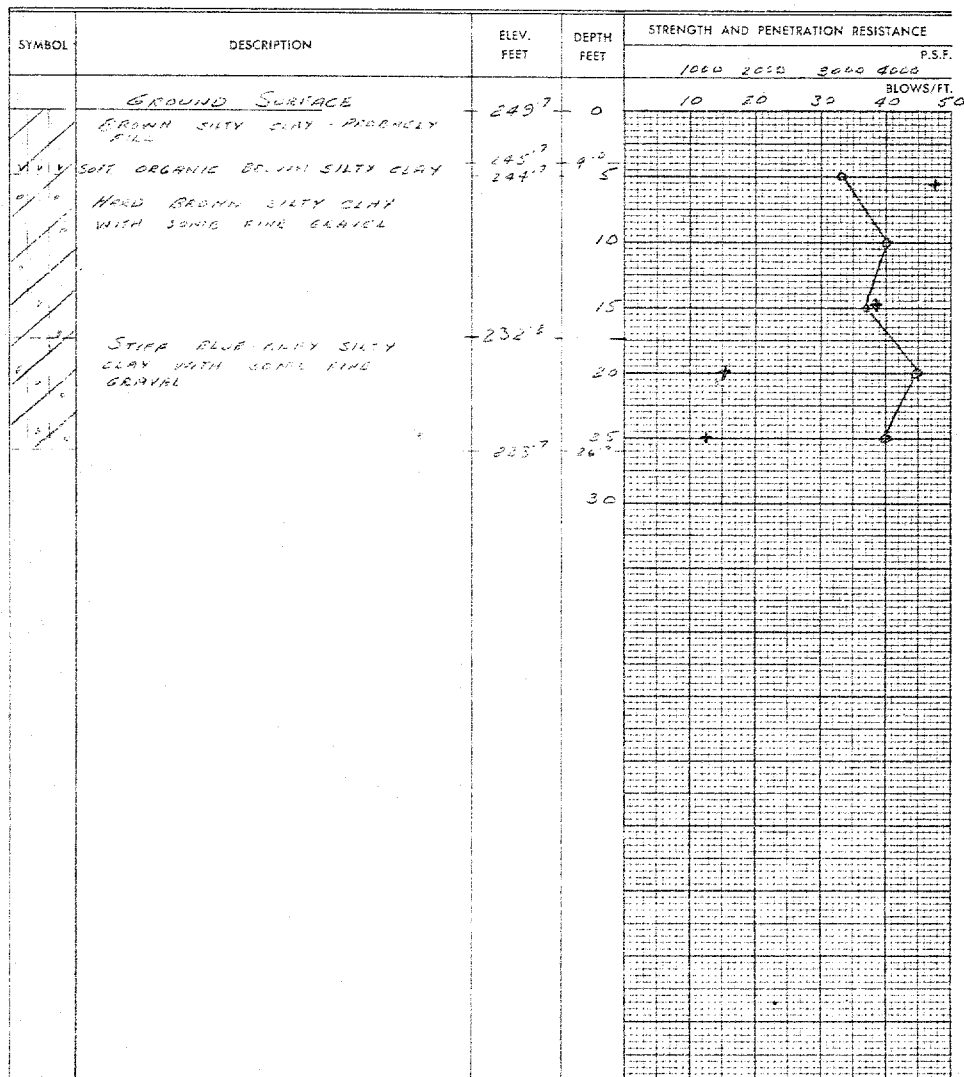
Engineering Data Sheet for Borehole: 3Project: PROPOSED BEACH ROAD BRIDGE, HAMILTON Field Supervision: E.C.Location: H. WILTON, ONT.Driller: W.L.Hole Location SEE ATTACHED PLANPrep.: B.F.W.Hole Elevation and Datum: 243.7 GEODETIC

Checked:

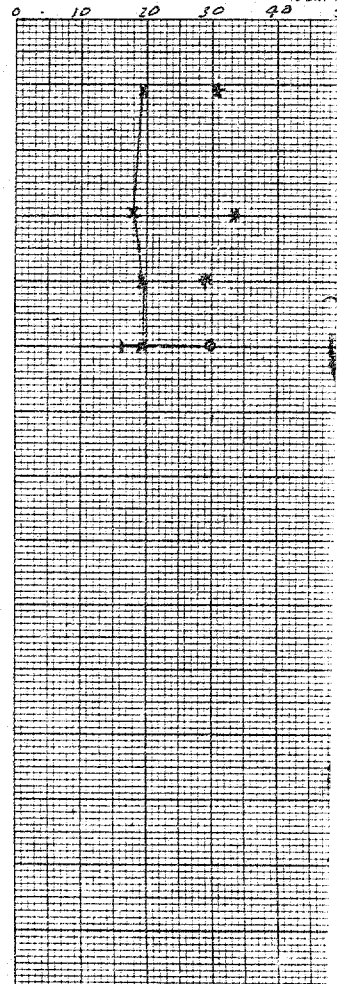
Field Work Begun ..... Ended ..... Date:

**LEGEND**Sampling Method  
2" Dia. split tube  
2" Shelby tubePenetration Resistance  
2" Split tube  
2" Dia. Cone  
Casing**Strength**Unconfined compression  
Vane test and sensitivity**Consistency**Natural moisture  
Liquid limit  
Plastic limit

Natural Unit Weight

**CONSISTENCY AND UNIT WEIGHT**

100	110	120	130	140
0	10	20	30	40
% DRY				



0.5-500-101/7-200

Enclosure No. 7

# RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 3

PROPOSED BEACH ROAD BRIDGE, HAMILTON, ONT. Field Supervision: E.C.  
 HAMILTON, ONT. Driller: W.L.  
 Location SEE ATTACHED PLAN Prep.: B.F.W.  
 Station and Datum: 243.7 GEDOLTA Checked:  
 Work Begun: Ended: Date:

## LEGEND

Sampling Method  
 2" Dia. split tube  
 2" Shelby tube

Penetration Resistance  
 2" Split tube  
 2" Dia. Cone  
 Casing

Strength  
 Unconfined compression  
 Vane test and sensitivity

Consistency  
 Natural moisture  
 Liquid limit  
 Plastic limit

Natural Unit Weight



DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				
			1000	2000	3000	4000	P.S.F.
GROUND SURFACE	249.7	0	10	20	30	40	50
BROWN SILTY CLAY - PROBABLY	245.7	4.0					
ORGANIC BROWN SILTY CLAY	244.7	5.0					
BROWN SILTY CLAY		10					
WITH SOME FINE GRAVEL		15					
	232.7	20					
THIN BLUE GRAY SILTY		25					
CLAY WITH SOME FINE	225.7	26					
GRAVEL		30					

CONSISTENCY AND UNIT WEIGHT						SAMPLE NO.
100	110	120	130	140	150	
P.C.F.						
% DRY WEIGHT						
0	10	20	30	40	50	