

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40P5-8

W.P. No. \_\_\_\_\_

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. \_\_\_\_\_

LOCATION 120 FT. BR. ACROSS  
The AUSABLE Riv.,  
HURON CO.

=====  
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

NONE

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

\_\_\_\_\_

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-291

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RACEY, MacCALLUM AND ASSOCIATES  
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers  
AND ASSOCIATED STAFF

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.

A. ERIC RANKINE, B.SC., M.E.I.C., A.M.I.ELEC.E., P.ENG.



TORONTO DIVISION  
27 CARLTON STREET

Toronto 2.

Reference: S-763/T-1142.

14 November, 1958.

County of Huron,  
Highways Department,  
Court House,  
GODERICH - Ontario.

Attention: Mr. J. Britnell.

RE: FOUNDATION INVESTIGATION FOR A  
120 FOOT, TWO SPAN BRIDGE ACROSS THE  
AUSABLE RIVER, HURON COUNTY, ONTARIO.

Dear Sir,

The enclosed report presents the results of our soil investigation at the above location.

We hope the report is satisfactory to you; if you have any questions about it please do not hesitate to get in touch with us.

Thank you for this opportunity of being of service to you.

Yours very truly,  
RACEY, MacCALLUM AND ASSOCIATES LIMITED,

  
J. J. Schoustra, P.Eng.,  
Divisional Soil Engineer.

JJS:YDP

County of Huron,  
Highways Department,  
Court House,  
Goderich - Ontario.

FOUNDATION INVESTIGATION FOR A  
120 FOOT, TWO SPAN BRIDGE ACROSS THE  
AUSABLE RIVER, HURON COUNTY, ONTARIO.

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Racey, MacCallum and Associates  
Limited.

14 November, 1958.

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TORONTO DIVISION  
27 CARLTON STREET

Toronto 2.

Reference: S-763/T-1142.

14 November, 1958.

## FOUNDATION INVESTIGATION FOR A 120 FOOT, TWO SPAN BRIDGE ACROSS THE AUSABLE RIVER, HURON COUNTY, ONTARIO.

This investigation was carried out between 16th and 22nd October, 1958, and consisted of three borings with adjacent cone penetration tests and three separate cone penetration tests. This report presents a summary of the subsoil conditions encountered, and recommendations regarding the foundation design of the proposed structure.

### FIELD WORK :

The site is located just West of the village of Centralia. The Ausable River at this location is about 100 feet wide. In the Summer the water level is only about one to three feet, but in the Spring it may rise in a short period to about 15 feet. The existing one-span rectangular bridge is rather narrow. The footings appear to be in fairly good shape. The proposed new structure will have a 30-degree skew, and will be considerably wider.

The borings were carried out using a standard diamond drill equipped for soil sampling with a 2-inch outside diameter split spoon, and with 2-inch inside diameter thin-walled tubes. The number of blows of a 140 lb hammer falling a distance of 30 inches required to drive the split spoon sampler one foot, is called the standard penetration resistance. It bears an empirically established relationship to the relative density of the soil. The cone penetration tests, carried out with a 2-inch diameter, 60-degree point angle cone gives a continuous record of the changes in density with depth.

Locations of borings and penetration tests are indicated on a sketch, Enclosure No 1. The water level was very low at the time of the investigation, no difficulties were encountered in working in the river.

Reference: Report No:  
S-763/T-11112 - Continued.

14 November, 1958.

DISCUSSION OF RESULTS :

The subsoil profile at the site appears to be fairly consistent. From the ground surface down to approximate Elevation 73 feet, waterlain sand and silty clay were found, originating from fairly recent flooding. At Boring No 3 an approximately nine foot layer of granular fill covers the original ground surface. Below the river deposits and at the surface in the centre of the river, a layer of very compact glacial till was found to extend down to at least Elevation 58 feet. Where this till layer is at the surface, at the location of the proposed new centre pier, the top 3 - 4 feet is somewhat less dense, presumably because of exposure to water and to freezing and thawing. The tin-walled samples taken from this till layer were found to be too dense to be jacked out undisturbed for further testing, except one sample, T<sub>14</sub> of Borehole No 3, which had a shear strength of 4,000 psf. Although the gravel content was considerable, no large boulders were encountered.

RECOMMENDATIONS :

The relatively thin layer of waterlain clay and sand is of low to medium density, and cannot be considered a safe base for the footing foundations of the abutments. It is not felt, however, that this layer should settle appreciably under the weight of eventual additional fill for the approaches. The glacial till layer appears to be an ideal base for both abutment and pier foundations. Based on the penetration resistance and laboratory testing results, the safe bearing capacity for a footing foundation on this till layer can be taken as 6000 psf. The foundations for the two abutments could be built safely on the top of this till layer, at Elevation 72 feet. The abutments will be further away from the centre line of the river than those of the existing bridge, and it is felt that danger of scour damage is not very great. However, in view of the reputation of the Assable River and of the presence of a centre pier, which may affect the current velocity at high water, it may be advisable to build the abutment footings five feet below the river bed, or at Elevation 70 feet.

For the proposed rigid frame structure, the horizontal thrust on the abutment will be absorbed by the bending moment. Enclosure No 8 shows a safe method for calculating the earth pressure at rest without detailed knowledge about the properties of backfill material. It may be assumed that the glacial till can be excavated vertically, and no backfill will be required for footing excavations below the glacial till surface. For a complete picture the passive earth pressure that may develop in case of slight lateral movements of the abutment is shown on the same sketch. If the passive earth pressure is to be used for design purposes, a factor of safety of 2.0 should be applied to the determined value.

Reference: Report No.  
S-763/T-11112 - Continued.

11 November, 1958.

The footings for the centre pier would require more protection against scour damage. The most suitable methods of construction would be to drive sheet piling down to approximate Elevation 60 feet, and to excavate inside this cofferdam to a depth of about  $7\frac{1}{2}$  feet below the river bed, or Elevation 67 feet. Although the till layer is very compact, sheet pile driving should not be too difficult because of the moderate size of the gravel. The safe bearing capacity of 6000 psf may be adhered to at this level.

CONCLUSIONS :

Summarising the results of this investigation, the following conclusions may be drawn :

1. At the location of the proposed new abutments, not more than about seven feet of relatively recent, medium dense river deposits are found below the original ground surface.
2. At all borings, at approximate Elevations 74 to 72 feet, a very dense glacial till was encountered.
3. The safe bearing capacity for footing foundations on the till layer is of the order of 6000 psf. The settlements under such a load should not exceed one inch evenly, or  $\frac{3}{4}$  inch differentially.
4. For protection against scour damage it would be advisable to found both abutment footings at approximate Elevation 70 feet, and the pier foundations at approximate Elevation 67 feet; the latter with additional sheet piling protection down to Elevation 60 feet.
5. The additional weight of approach fill should not cause appreciable settlements of the top layer of waterlain sand and clay.



J. J. Schoustra, P.Eng.,  
Divisional Soil Engineer.

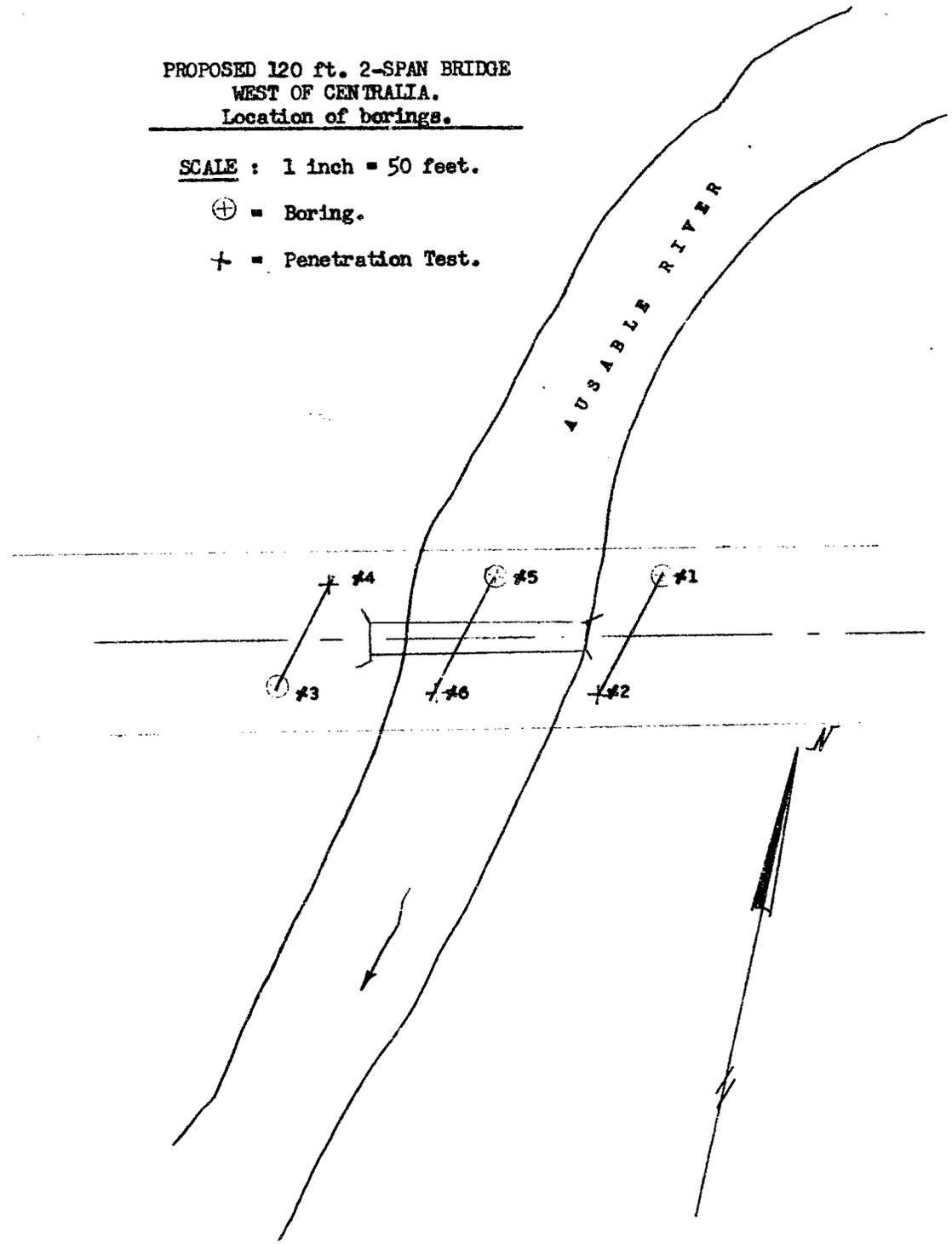
Prep. By J.J.S.

PROPOSED 120 ft. 2-SPAN BRIDGE  
WEST OF CENTRALIA.  
Location of borings.

SCALE : 1 inch = 50 feet.

⊕ = Boring.

+ = Penetration Test.



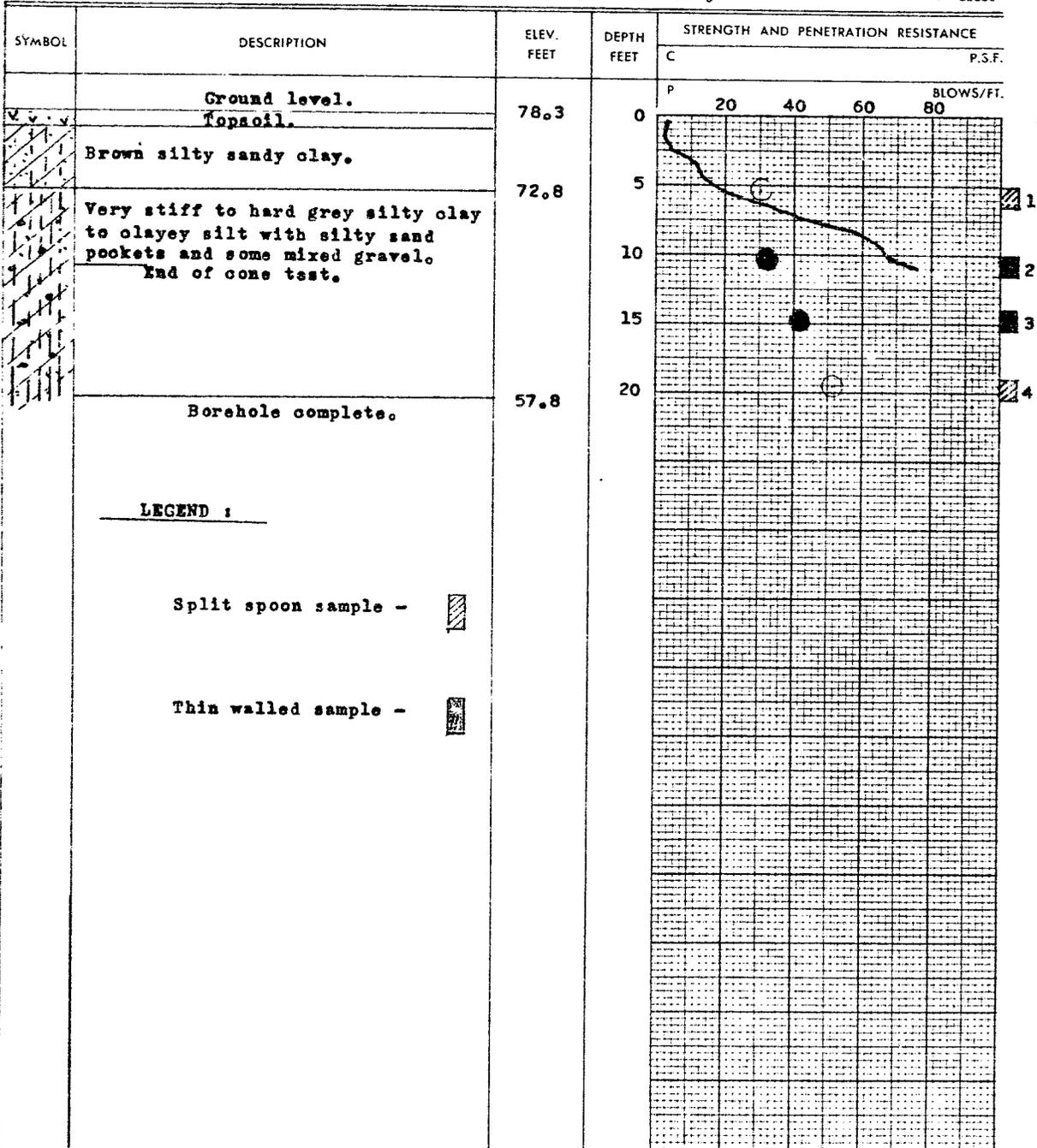
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Foundation Engineering Division

Engineering Data Sheet for Borehole: 1

Project: PROPOSED BRIDGE ACROSS AUSABLE RIVER  
 Location: NEAR CENTRALIA, HURON COUNTY, ONTARIO.  
 Hole Location: See Enclosure No 1.  
 Hole Elevation and Datum: 78.3 Ft. BM = 84.15 Ft.  
 Field Supervisor: P.F. Prep.: B.A.G.  
 Driller: M.G. Checked: J.S. Date: 31.10.'58

**LEGEND**  
 Shear Strength (C)   
 Unconfined compression  
 Vane test and sensitivity (S)   
 Penetration Resistance (P)   
 2" Split tube  
 2" Dia. Cone  
 Casing 



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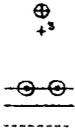
Foundation Engineering Division

Engineering Data Sheet for ~~36602~~ **Penetration test 2.**

Project: **PROPOSED BRIDGE ACROSS AUSABLE RIVER**  
 Location: **NEAR CENTRALIA, HURON COUNTY, ONTARIO.**  
 Hole Location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **81.0 Ft. BM = 84.15 Ft.**  
 Field Supervisor: **P.F.** Prep.: **B.A.G.**  
 Driller: **M.G.** Checked: **J.S.** Date: **31.10.'58**

**LEGEND**

Shear Strength (C)  
 Unconfined compression  
 Vane test and sensitivity (S)  
 Penetration Resistance (P)  
 2" Split tube  
 2" Dia. Cone  
 Casing



SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				C	P.S.F.
	<b>Ground level.</b>	<b>81.0</b>	<b>0</b>		
	<b>Refusal at 12 feet.</b>	<b>69.0</b>	<b>12</b>		

DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
	P BLOWS/FT.			
	20	40	60	80
0				
5				
10				
15				

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Foundation Engineering Division

Engineering Data Sheet for Borehole: 3

Project: **PROPOSED BRIDGE ACROSS AUSABLE RIVER**  
 Location: **NEAR CENTRALIA, HURON COUNTY, ONTARIO.**  
 Hole Location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **88.7 Ft. BM = 84.15 Ft.**  
 Field Supervisor: **P.F. Prep.: B.A.G.**  
 Driller: **M.G. Checked: J.S. Date: 31.10.58**

**LEGEND**

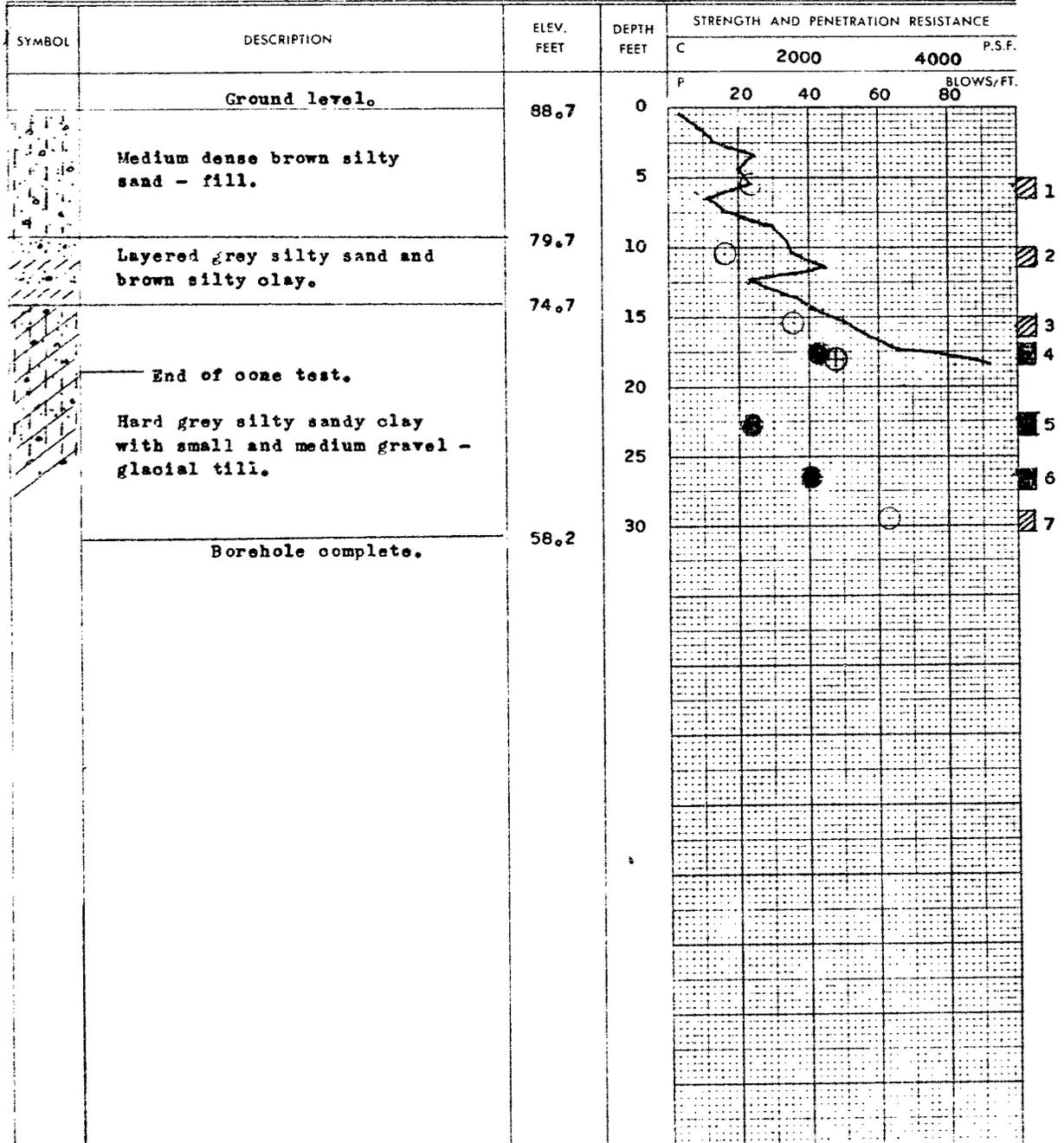
Shear Strength (C):

Unconfined compression  
 Vane test and sensitivity (S)



Penetration Resistance (P):

2" Split tube  
 2" Dia. Cone  
 Casing



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Engineering Data Sheet for ~~Barabola~~ Penetration test 4.

Project: PROPOSED BRIDGE ACROSS AUSABLE RIVER  
 Location: NEAR CENTRALIA, HURON COUNTY, ONTARIO.  
 Hole Location: See Enclosure No 1.  
 Hole Elevation and Datum: 86.0 Ft. BM = 84.15 Ft.  
 Field Supervisor: P.F. Prep: B.A.G.  
 Driller: M.G. Checked: J.S. Date: 31.10.1958

LEGEND  
 Shear Strength (C)  
 Unconfined compression  
 Vane test and sensitivity (S) ⊕  
 Penetration Resistance (P) ⊕  
 2" Split tube  
 2" Dia. Cone  
 Casing

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				C	P.S.F.
	Ground level.	86.0	0		
	Refusal at 12 feet.	74.0	12		

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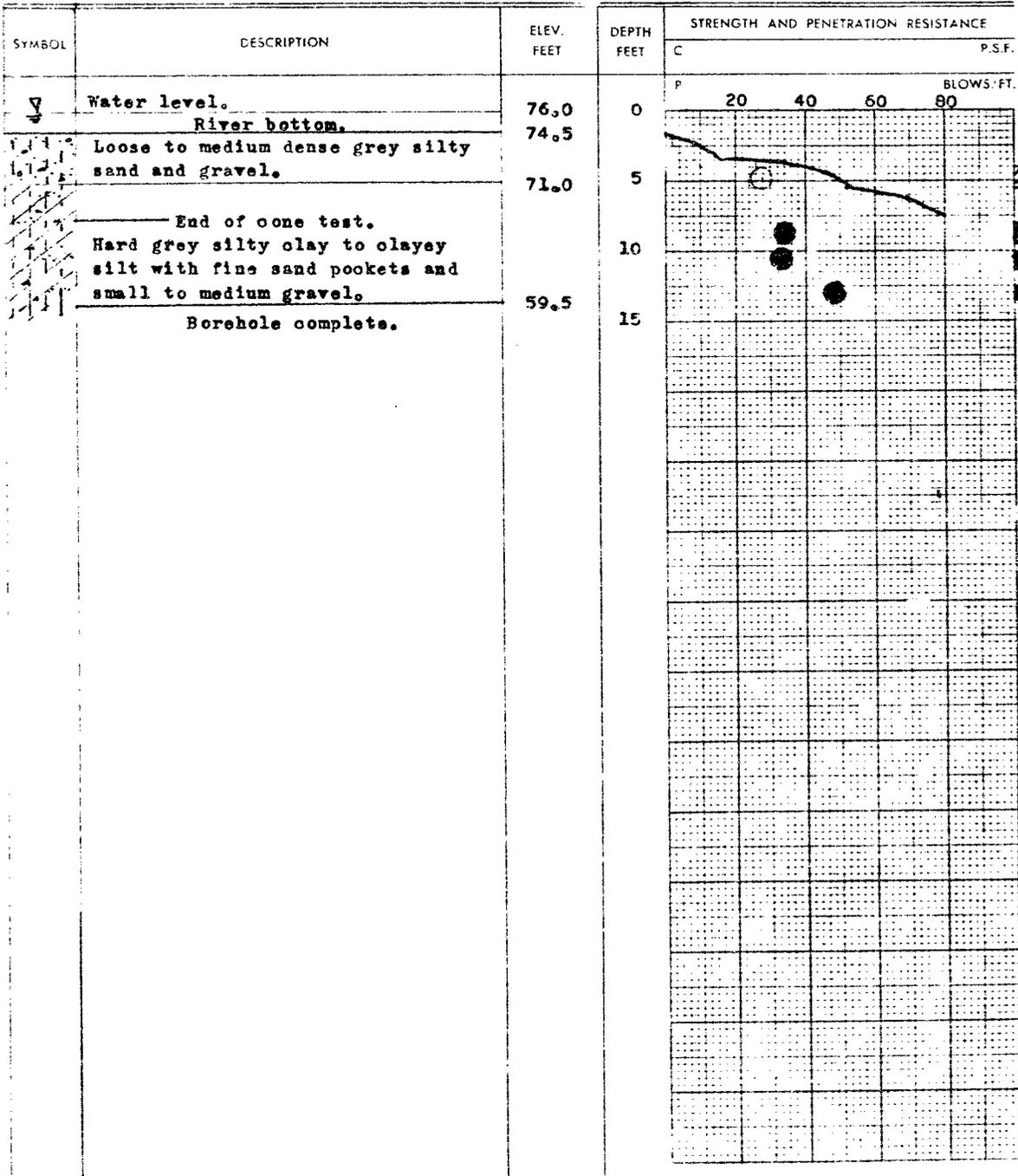
Foundation Engineering Division

Engineering Data Sheet for Borehole: 5

Project: PROPOSED BRIDGE ACROSS AUSABLE RIVER  
 Location: NEAR CENTRALIA, HURON COUNTY, ONTARIO.  
 Hole Location: See Enclosure No 1.  
 Hole Elevation and Datum: 76.0 Ft. BM = 84.15 Ft.  
 Field Supervisor: P.F. Prep.: B.A.G.  
 Driller: M.G. Checked: J.S. Date: 31.10.'58.

**LEGEND**

Shear Strength C  
 Unconfined compression  
 Vane test and sensitivity S  
 Penetration Resistance P  
 2" Sp. S.S.  
 2" Dia.  
 Casing



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Foundation Engineering Division

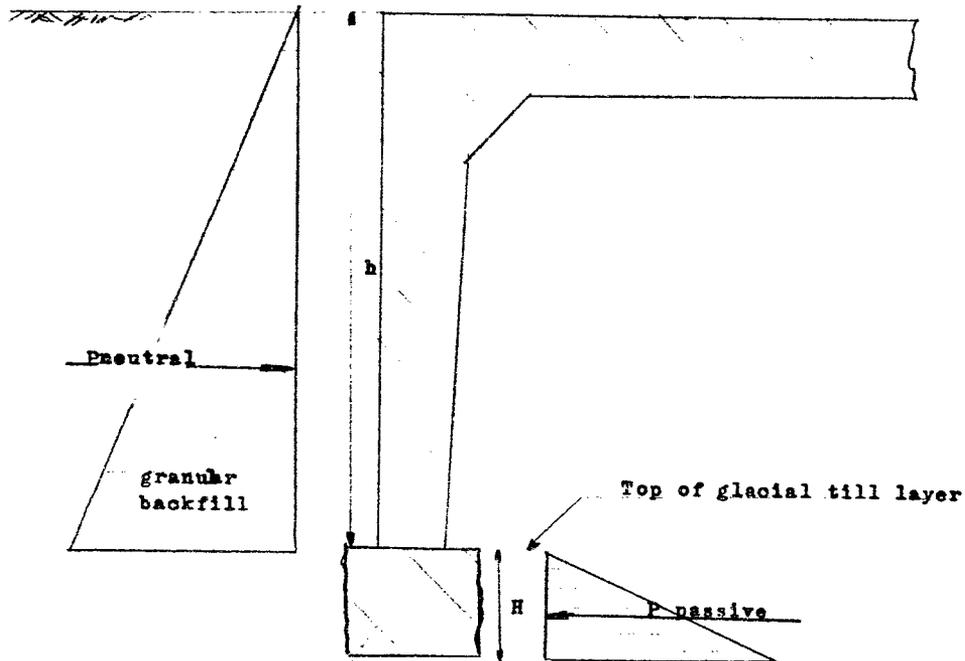
Engineering Data Sheet for ~~Penetration~~ Penetration test 6.

Project: **PROPOSED BRIDGE ACROSS AUSABLE RIVER**  
 Location: **NEAR CENTRALIA, HURON COUNTY, ONTARIO.**  
 Hole Location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **76.0 Ft. BM = 84.15 Ft.**  
 Field Supervisor: **P.F.** Prep.: **B.A.G.**  
 Driller: **M.G.** Checked: **J.S.** Date: **31.10.1958.**

**LEGEND**  
 Shear Strength (C) ⊕  
 Unconfined compression ⊕  
 Vane test and sensitivity (S) ⊕  
 Penetration Resistance (P) ⊕  
 2" Split tube ⊕ ⊖  
 2" Dia. Cone ⊕ ⊖  
 Casing ⊕ ⊖

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				C	P.S.F.
▽	Water level.	76.0	0		
⊕	River bottom.	74.5	5		
	Refusal at 8 feet.	68.0	10		

Drawn by J.S.



Poured in vertically excavated glacial till

### EARTH PRESSURES ON ABUTMENT

Per longitudinal foot of abutment wall:

$$P_{\text{neutral}} = 0.4 \times \frac{1}{2} \cdot \gamma \cdot h^2 ; \quad \gamma = 130 \text{ lbs/cu. ft.}$$

$$P_{\text{passive}} = \frac{1}{2} \cdot \gamma \cdot H^2 + 2.0 \cdot c \cdot H ; \quad \gamma = (130 - 62.4) \text{ lbs/cu. ft.} \quad c = 4000 \text{ psf}$$