

#

61-F-72

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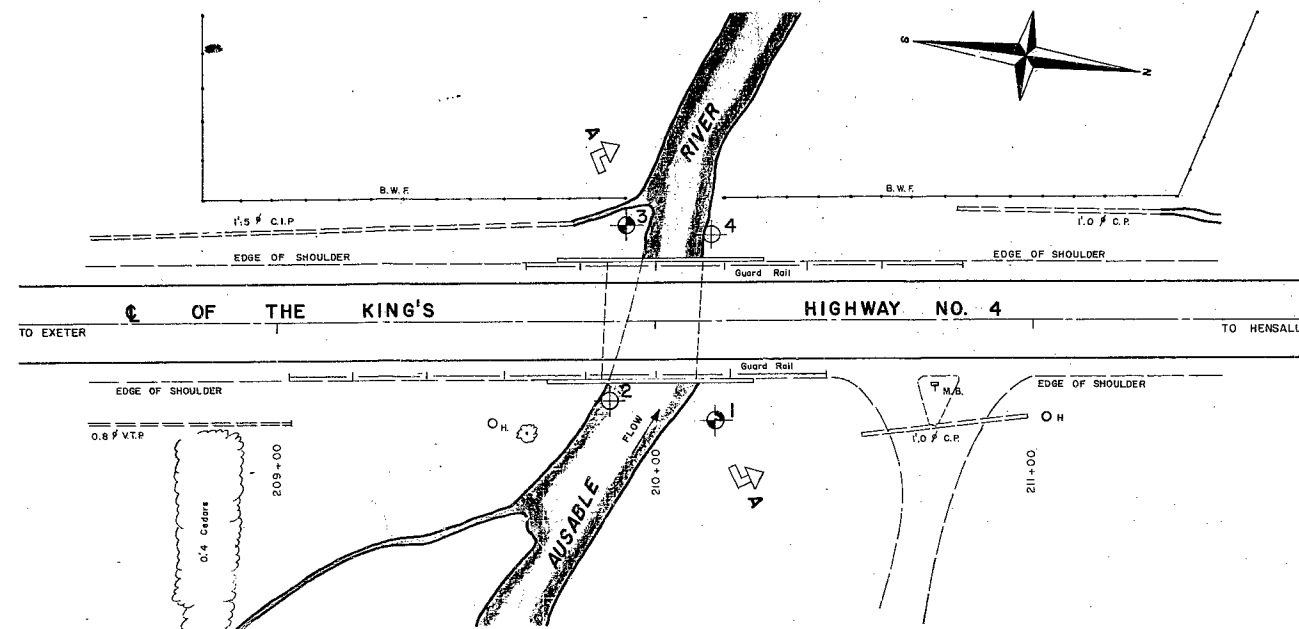
W.P. 185-61

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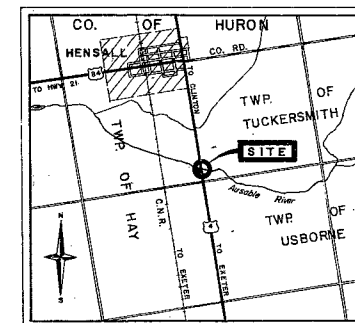
HWY. 4

AUSABLER.

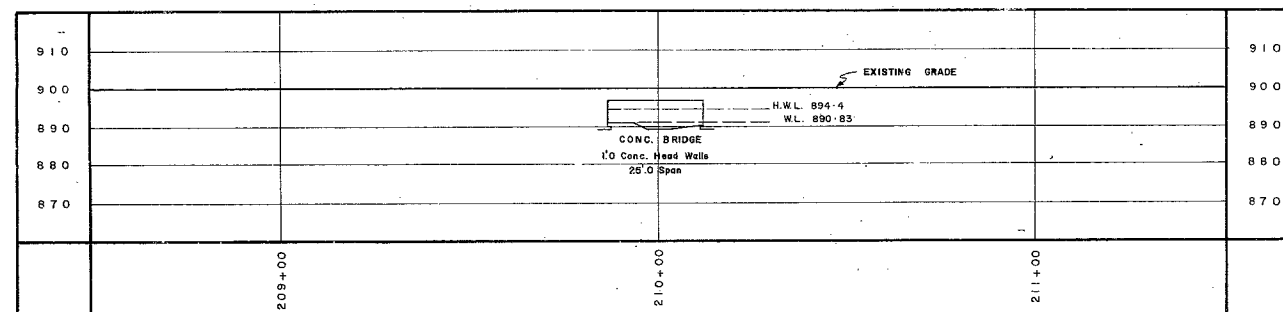
BRIDGE



PLAN

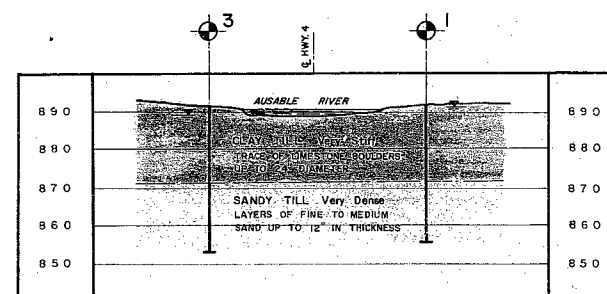


KEY PLAN  
SCALE: 1 in. = 0.8 mi.



PROFILE

LEGEND			
	BORE & PENETRATION HOLE		
	PENETRATION HOLE		
HOLE	ELEVATION	STATION	OFFSET
1	891.5	210+16	27' RT.
2	891.0	209+88	21' RT.
3	891.2	209+93	25' LT.
4	891.5	210+15	22' LT.



A - A

DEPARTMENT OF HIGHWAYS - ONTARIO		
MATERIALS & RESEARCH SECTION		
<b>AUSABLE RIVER BRIDGE</b>		
<b>AND</b>		
<b>HIGHWAY NO. 4</b>		
ORIGINATED T. WIDDIS	DISTRICT NO. 3	DATE 16 AUGUST 1961
DRAWN D. MUMFORD	W.P. NO. (85-61)	JOB NO. 61-F-72
CHECKED <i>[Signature]</i>	SCALE	DRAWING NO.
APPROVED <i>[Signature]</i>	1 inch = 20 feet	<b>61-F-72 A</b>

REF. NO. E-3998

23-62 147-6

Mr. A. H. Toye,  
Bridge Engineer.  
Materials & Research Section,  
(Foundations Office).  
Attention: Mr. E. McCasbie.

August 14, 1961.

D.H.C. FOUNDATION INVESTIGATION  
REPORT.  
W.J. 61-F-72 --(W.P. 185-61.)

Re: Anasable River Bridge,  
1 1/2 Miles South of Hensall  
on Hwy. #4, Bridge Office  
Plan A-3998, District #1.

Accompanying this memo, is our detailed foundation  
report on the subsail 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 feel free to contact our Office.

AGL/MSG:  
attach.

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

cc: Messrs. A. H. Toye (2)  
H. A. Tregaskes  
H. D. McMillan  
A. Gater  
L. D. Barrett  
J. Roy  
T. J. Kovich  
J. M. Graspier  
E. R. Saint  
P. Norman  
A. Watt  
Foundations Office  
Gen. Files. ✓

*AGL/MSG*  
(A. G. Sternac,  
SUPERVISING FOUNDATION ENGR.)

## TABLE OF CONTENTS

1. INTRODUCTION
  2. DESCRIPTION OF THE SITE AND GEOLOGY
  3. FIELD AND LABORATORY INVESTIGATIONS
  4. SUBSOIL CONDITIONS
    - 4.1 General
    - 4.2 Clay Till
    - 4.3 Sandy Till containing layers of Fine to Medium Sand
  5. GROUND WATER CONDITIONS
  6. DISCUSSIONS AND RECOMMENDATIONS
  7. SUMMARY
  8. MISCELLANEOUS
-

# Foundation Investigation

at

Ausable River Bridge,  
1 1/2 Miles South of Hensall  
on Hwy. #4, Bridge Office  
Plan E-3998.  
W.P.185-61 - W.J.61-F-72  
District #3.

## 1. INTRODUCTION:

A soils investigation has been carried out at a bridge site where Hwy. #4 crosses the Ausable River 1 1/2 miles south of Hensall, to determine the soils conditions and to provide information for the foundation design of the proposed structure. The existing structure is a steel girder bridge having a 25.0' span. Extensive spalling has taken place on the wing walls and head walls exposing the steel reinforcing bars. The new structure is to be realigned to coincide with the existing course of the Ausable River and will be 40.0 feet wide with a 25.0' span. Its centre line will conform with the existing Hwy. #4 centre line.

## 2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site of the new structure lies in flat country some 10 miles east of Lake Huron. The Ausable River some eleven feet wide and one foot deep flows sluggishly except in time of flood when the water level may rise some 3.5 feet. The approach embankments are 7.0 feet

Cont'd. /2 ...

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

high on both sides of the existing bridge.

The site lies in the Huron slope clay plain. The deposits normally consist of a layer of lacustrine clay on top of a loam clay till, beneath which is a stratified clay of the same colour. In this area however, the deposit consists of a clay till at the surface overriding a dense sandy till.

3. FIELD AND LABORATORY INVESTIGATIONS:

The field work consisted of two boreholes and four dynamic cone penetration tests. The boreholes were put down in BI size casing to depths of 36.0 and 38.0 feet respectively using a skid-mounted machine drillrig. The dynamic penetration tests were put down to practical refusal obtained at depths varying from 11.0' in B.H. #1, to 15.0' in the other three boreholes.

A standard split spoon sampler was used to obtain disturbed samples and 'N' values in the very stiff clay till and dense sandy till. The samples so obtained were visually identified in the field and returned to the laboratory for testing. The results of these tests are plotted in the borehole log sheets of this report. A plan of the site, 61-F-72A, showing the position of the boreholes and the inferred soil stratigraphy is found at the back of this report.

Cont'd. /3 ...

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

4.1 General.

The subsoil at the site consists of a 20.0' layer of very stiff clay till overriding a stratum of very dense sandy till containing layers of fine to medium sand up to 12" in thickness.

4.2 Clay Till.

This clay till was found in each borehole to a depth of 20.0'. The 'N' values for this material vary from 9 at 3.0' to 39 at 20.0' below the surface and an 'N' value of 20 has been chosen as representative. Average Atterberg limits for the clay matrix are L.L. 24.1%, P.L. 13.7% and the average M/C is 14.1%. An average density for the material is 145 lbs./cu. ft.

4.3 Sandy Till containing layers of Fine to Medium Sand.

Beneath the clay till is a sandy till containing layers of fine to medium sand up to 12" in thickness. This material was proved to a depth of 36.0' in B.H. 1 and 38.0' in B.H. 3. An 'N' value of 55 has been chosen as representative of this material indicating a relative density which is very dense.

Cont'd. /4 ...

5. GROUND WATER CONDITIONS:

At the time of the investigation the water level in the Ausable River was placed at an elevation of 891.0' on the east side, and 889.75 on the west side of the existing structure. The exact locations of the water levels as found in the boreholes are found in the plan 61-F-72A of this report. In time of flood the water level rises to an elevation of 894.4.

6. DISCUSSIONS AND RECOMMENDATIONS:

It is understood that the existing bridge is to be replaced and that the profile grade is to be raised to 900.70 feet. The soil conditions at the site are favourable for the use of spread footings which may be placed in the very stiff clay till at an elevation of 883.00 or lower with a safe design load of 2 Tons/sq. ft. using a factor of safety of 3.

The settlement of the structure due to the consolidation of the subsoil should be small and within tolerable limits.

Before beginning the excavation it is suggested that a cofferdam be built to such a height as to prevent flash flood water from entering the excavation. Any seepage water that may enter the cutting may be removed by the use of a sump pump.

Cont'd. /5 ...



6. DISCUSSIONS AND RECOMMENDATIONS: (Cont'd.) ...

The excavation may be made with vertical sides and when brought down to the required grade a working slab should be poured immediately to prevent softening of the clay till.

7. SUMMARY:

7.1 The subsoil at the site consists of a 20.0' layer of very stiff clay till overriding a dense sandy till.

7.2 The clay till is capable of supporting the structure on spread footings at an elevation of 883.0 with a safe design load of 2.0 Tons/sq. ft. using a safety factor of 3.

7.3 Settlement should be within tolerable limits.

7.4 The river water may be prevented from entering the footing excavation by using a cofferdam. A sump pump may be used to keep the excavation free from seepage water.

8. MISCELLANEOUS:

The field work was carried out from Wed. 26th of July to Tuesday 1st of August, 1961, by the Johnston Drilling Co. Ltd., using a Boyles Diamond Core Drill adapted for soil sampling purposes. The work was supervised for the D.W.O. by T. P. Widdis.

REPORT PREPARED BY:

*T. P. Widdis*  
.....  
T. P. Widdis,  
Project Pdn. Engr.

August 1961.

REPORT APPROVED BY:

*A. G. Stemas*  
.....  
A. G. Stemas,  
Supervising Pdn. Engr.

APPENDIX I.

# SUMMARY OF FIELD & LABORATORY TESTS

 JOB 61-F-72

 W.P. 185-61

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	3'-4.5'	Clay till, stiff, grey. Gravel is angular to subangular. Clay is of low compressibility.	9	12.4	13.6	23.4	-	141.8	
	S2	6'-7.5'	Clay till, very stiff, grey. Gravel is angular to subangular.	18	14.4	14.1	24.6	-	149.0	
	S3	9'-10.3'	Same as S. 2. 27" limestone boulder at 10.5'	21	14.3	14.3	26.0	-	143.6	
	S4	13.5'-15'	Same as S. 2.	22	16.9	14.5	28.5	-	-	
	S5	20'-20.75' 20.76-21.50	Same as S. 2. Silty fine sand. Dense. Grey.	39	13.5 13.2	12.6 13.9	21.3 23.5	- -	149.0 -	
	S6	25'-26.3'	Sandy till. Dense, Grey. 3. 6 contains 6" layer of fine sand and silt at 25.75'	45-10"	12.1	-	-	-	-	
	S7	31'-32.0' 32.0-32.5	Medium sand. Dense Grey. Sandy till, very dense, grey.	53-11"	18.3 12.5	- 11.3	- 18.0	- -	- -	
	S8	35'-36'	Sandy till very dense grey.	47	10.5	-	-	-	-	
2	cone penetration only									
3	S1	4.5'-6.0'	Clay till, very stiff. Grey. Gravel is angular to subangular. Clay is of low compressibility.	22	14.5	14.8	25.5	-	136.0	
	S2	7'-8.5'	Same as S. 1.	20	13.2	13.7	24.8	-	-	
	S3	10'-11.5'	Same as S. 1.	20	15.7	14.0	26.3	-	-	

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-72

W.P. 185-61

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	S4	15'-16.5'	Same as S. 1.	29	10.8	12.0	19.0	-	-	
	S5	20'-21.5'	Silty clay of low compressibility, Hard grey.	39	14.6	13.5	23.3	-	146.8	
	S6	25'-26.5'	Fine to medium sandy till, very dense. Grey. Gravel is angular.	32-11"	12.5	-	-	-	-	
	S7	30'-31'	10" of medium sand. Very dense brown. 2" silt grey.	60	25.6	-	-	-	-	
	S8	35'-35.5'	Sandy till. 12" limestone boulder at 35.75'	11-6"	-	-	-	-	-	
	S9	37'-37.7'	Sandy till.	63-8"	11.1	-	-	-	-	
4	cone	penetration	only							
			S denotes split spoon sample.							

# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 185-61

BORE HOLE NO. 1

JOB 61-F-72

STATION 210+16 (27' Rt.)

DATUM 891.5'

COMPILED BY B.K.

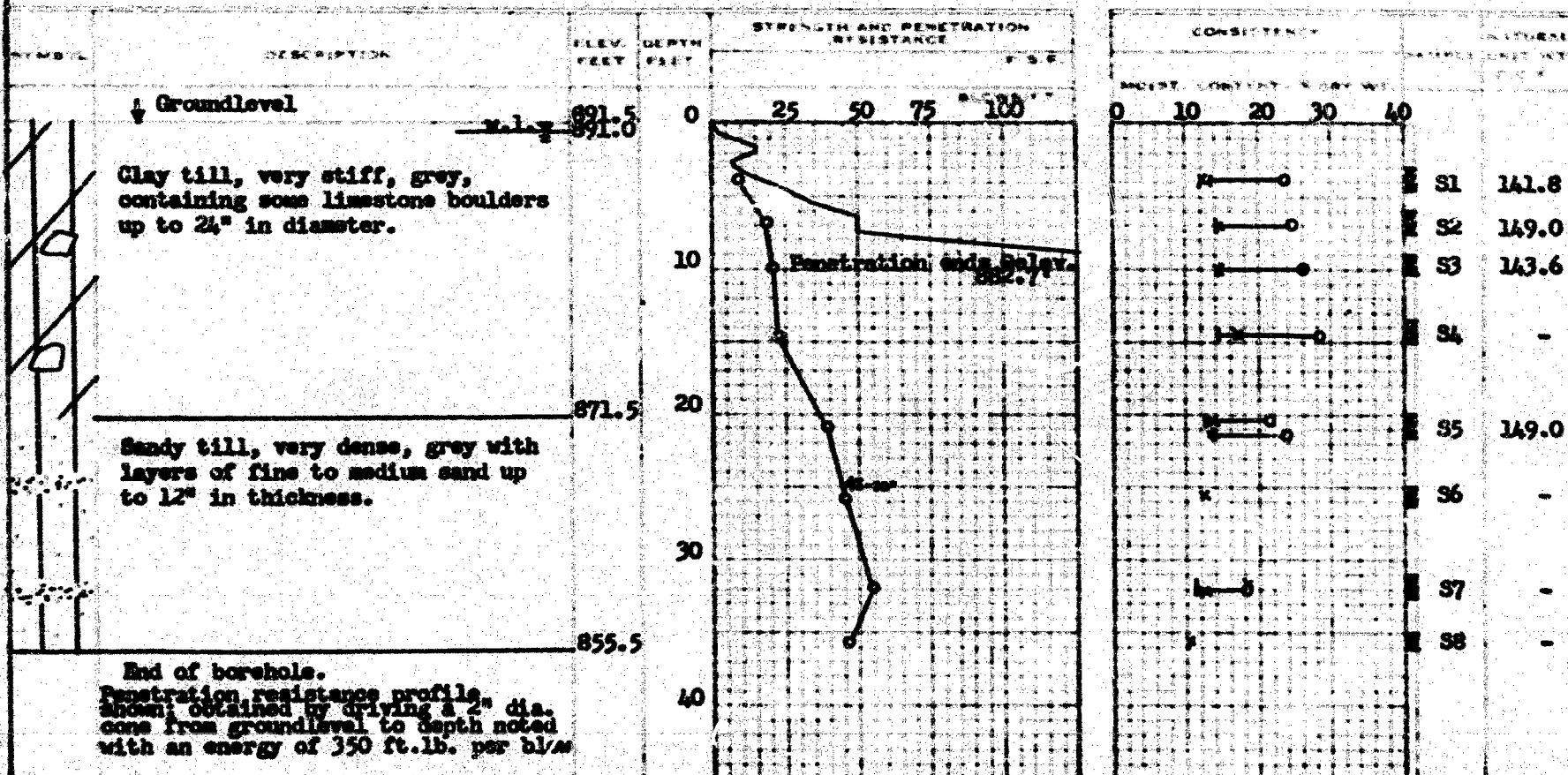
BORING DATE July 27/61.

CHECKED BY T.F.W.

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

## LEGEND

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



## MATERIALS AND RESEARCH SECTION

W.P. 185-61 BORE HOLE NO. 2  
JOB 61-F-72 STATION 209/88 (21' Rt.)  
DATUM 891.0' COMPILED BY B.K.  
BORING DATE: July 28/61. CHECKED BY T.F.W.

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

## LEGEND

UNCONFINED COMPRESSION (Qu) -----	0
VANE TEST (C) AND SENSITIVITY (S) -----	+6
NATURAL MOISTURE AND LIQUIDITY INDEX -----	11
LIQUID LIMIT -----	2
PLASTIC LIMIT -----	

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE
↓	Waterlevel	891.0	0	
---	Water	890.0		
				<div> <div> 2550 75 100 </div> <div> BLOW FT. </div> </div> <div> <div> 16.0' </div> <div> Penetration ends here </div> </div>
			30	
			40	

Penetration resistance profile shown;  
obtained by driving a 2" dia. cone  
from groundlevel to depth noted with  
an energy of 350 ft. lb. per blow.

<b>CONSISTENCY</b>	<b>NATURAL</b>
MOIST. CONTENT - <u>5.5</u> % WT.	SAMPLE UNIT WT. <u>100</u> G.

# DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS AND RESEARCH SECTION

W.P. 185-61

BORE HOLE NO. 3

JOB 61-P-72

STATION 209+93 (25' It.)

DATUM 891.2'

COMPILED BY B.K.

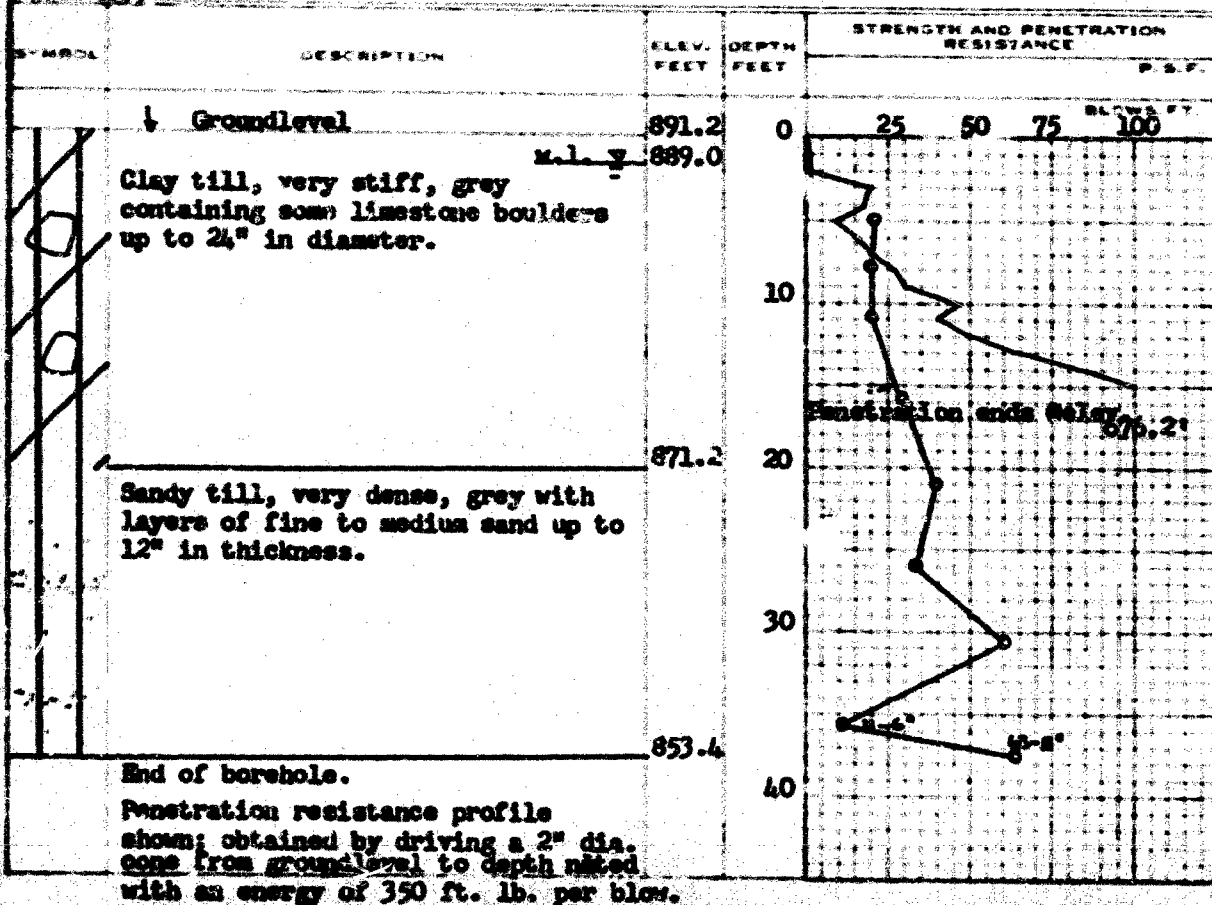
BORING D. E July 31/61.

CHECKED BY T.P.W.

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

## LEGEND

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



CONSISTENCY	NATURAL UNIT WT. P.C.
MOIST. CONTENT - % DRY WT.	
0 10 20 30 40	
S1	136.0
S2	-
S3	-
S4	-
S5	146.8
S6	-
S7	-
S8	-
S9	-

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

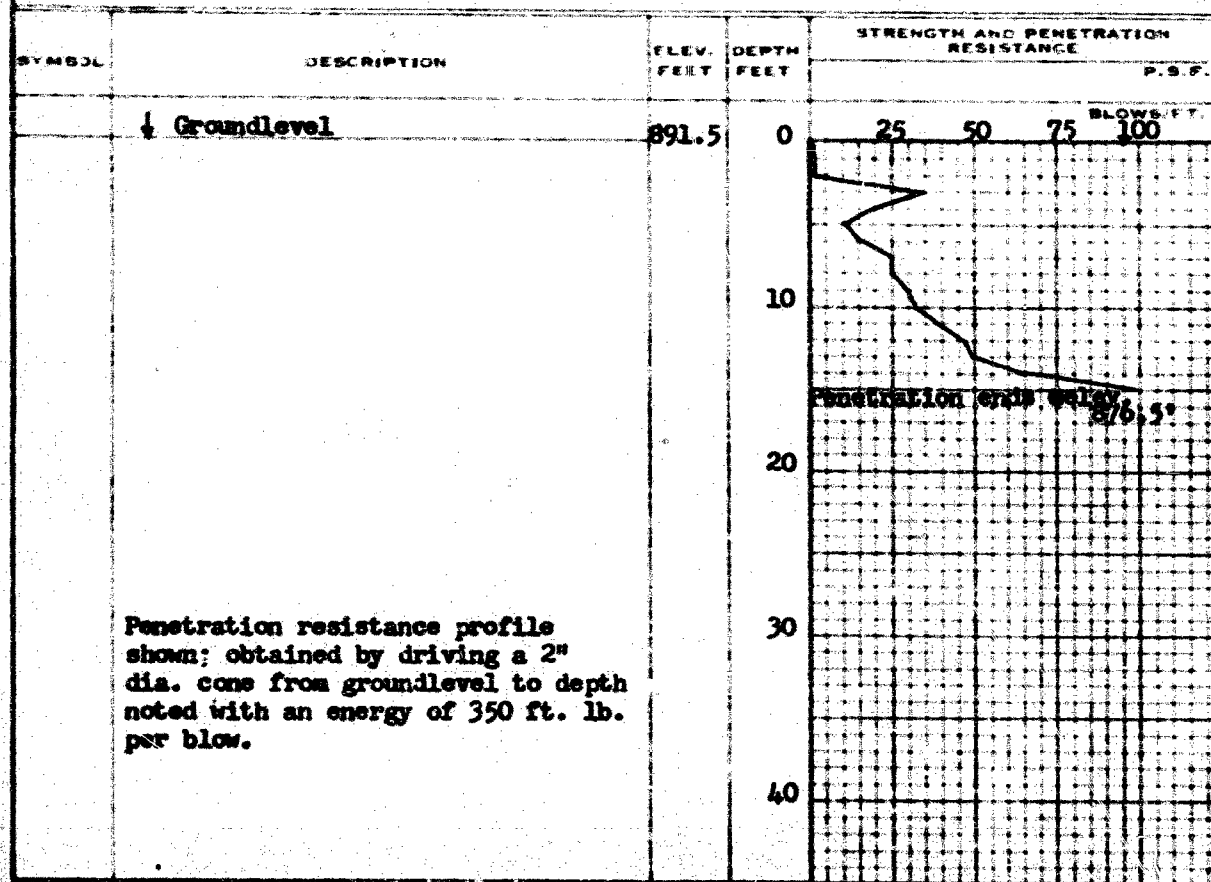
W.P. 185-61  
JOB 61-P-72  
DATUM 891.5'  
BORING DATE Aug. 1/61.

BORE HOLE NO. 4  
STATION 210/15 (22' It.)  
COMPILED BY B.K.  
CHECKED BY T.P.W.

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

## LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	0
VANE TEST (C) AND SENSITIVITY (S)	+ <sup>2</sup>
NATURAL MOISTURE AND	LI
LIQUIDITY INDEX	X
LIQUID LIMIT	0
PLASTIC LIMIT	

[illegible]