

Mr. A. M. Toye,  
Bridge Engineer.  
Materials & Research Section.

August 3, 1960.

D.H.O. FOUNDATION INVESTIGATION

W.J. 60-F-52 -- W.P. 183-60.

Attention: Mr. S. McCombie.

Re: -- Hostien Road and Highway No. 403 --  
(Approx. 4 Miles North-East of Ancaster,  
Twp. of Ancaster, County of Wentworth,  
District No. 4.

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

The conclusions and recommendations to be followed  
in your future design work, are summarized in the report, and  
are self-explanatory.

Should any questions arise in connection with this  
project that you would like to discuss, please feel free to  
contact our Office.

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

AS/MdeF  
Attach.

*Attenuated*  
(A. Sternac,  
FOUNDATIONS OFFICE ENGR.)

cc: Messrs. A. M. Toye (2)  
H. A. Tregaskes  
D. G. Ramsay  
I. Campbell  
B. E. Richardson  
T. Kovich  
A. Watt  
Foundations Office  
Gen. Files.

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## FOUNDATION INVESTIGATION

At

Hostien Road and Highway No. 403,  
(Approx. 4 Miles North-East of Ancaster,  
Twp. of Ancaster, County of Wentworth,  
W.J. 60-7-52 - W.P. 183-60 - Dist. No. 4.

### 1. INTRODUCTION:

It is intended to construct an underpass which would carry the Hostien Road over Highway No. 403. The site of the proposed underpass is located approx. 2 miles North-East of the Town of Ancaster, County of Wentworth. At this location, the chainage of Highway 403 is 153+95.41 and 0+00 for Hostien Road.

In order to determine the soil properties and decide on the type of foundation, an investigation was carried out by this Section. Results and the discussion of the field and laboratory investigations, as well as conclusions and recommendations for the future design work, are contained in the following paragraphs of this report.

### 2. DESCRIPTION OF SITE AND GEOLOGY:

The area in which the structure site is located is hilly, and at the present time, covered with clover.

Physiographically, the site is in the Norfolk Sand Plain.

### 3. FIELD AND LABORATORY WORK:

In order to obtain sufficient information on the types and properties of the subsoil, five sampled boreholes supplemented by the same number of dynamic cone penetration holes, were carried out at this particular site.

Samples were taken at depth intervals of 3, 5 and 10 feet. The granular nature of the soil precluded the taking of relatively undisturbed samples. The density of the cohesionless materials was determined with the Standard Penetration Test. Samples recovered in

### 3. FIELD AND LABORATORY WORK: (cont'd.) ...

the split spoon were used for classification purposes.

Boreholes 1, 2, 3 and 4 were terminated in the underlying dense, clayey-silt stratum at a depth of about 41.5 ft. below existing ground level. Borehole No. 5 was carried down to a depth of 66 ft. below existing ground level and terminated in the very dense sandy-clayey-silt stratum. The purpose of this borehole was to determine, if possible, the depth to bedrock, below ground level.

The elevations, as well as the location (chainage) of the boreholes, are given on Drawing No. 60-F-52A, attached to this report (Appendix I).

Under Appendix I, borehole logs with penetration results are also given.

Laboratory testing was confined to the determination of grain size distribution curves. All the curves are given under Appendix I.

### 4. SUBSOIL CONDITIONS:

#### 4.1 General:

The stratigraphy of the soil at the site was found to be quite uniform. Three main types of soil were encountered, and they are:-

#### 4.2 Silty Sand and Sandy Silt:

This material forms the top layer on the site and extends to about 25 - 30 feet below ground level. The silt percentage varies between 53 and 99%. In places, up to 47% of fine sand is also found. The layer is in a dense to very dense condition with an average 'N' value of about 96. The density of the layer increases with depth.

cont'd. /3 ...

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

4.3 Clayey, Sandy Silt:

Underlying the silty sand-sandy silt layer, is a layer of light grey clayey, sandy silt. In places, this clay was up to 45%. According to the Standard Penetration Test results, the density of this material varies from dense to very dense. Disregarding some very high values, an increase in density with depth is clearly distinguishable.

This layer was found in all boreholes. It is not easy to determine the exact depth to which this material extends, because the material which replaces it is quite similar. It seems as if this material extends to about 35 feet in Borehole No. 1 to about 42 feet in Borehole No. 2, very hardly distinguishable in Borehole No. 3, to about 32 feet in Borehole No. 4, and to about 50 feet in Borehole No. 5.

4.4 Sandy, Clayey Silt:

This material was encountered below the clayey, sandy silt stratum. The percentage of sand in this material is about 24%, and the percentage of clay around 16%.

In density, this material could be classified as very dense, 'N' being more than 60 blows/foot.

Two soil profiles, one along the East and one along the West side of the proposed site, have been prepared and are shown on Drawing No. 60-F-52A.

5. GROUND WATER CONDITIONS:

At the time of the investigation, there was considerable rain and, as a result, the water table, at the time, was higher than normal. No artesian water conditions were encountered during the investigation.

The water table, at the time of the investigation, was encountered at about 5'-6" to 6'-0" below existing ground level.

cont'd. /4 ...

## 6. DISCUSSION AND RECOMMENDATIONS:

As can be seen from the previously described soil stratigraphy, the soil consists mainly of dense to very dense silt with an admixture of sand and clay. It is quite logical to suggest that the structure should be founded on spread footings.

For footings founded in silt, the safe bearing pressure, based upon a shear failure is evaluated by the following equation:-

$$q_s = \frac{1}{2} \frac{B \gamma N_\gamma}{F} + \frac{\gamma D F N_q}{F}$$

Where - B is the width of the footing  
 $\gamma$  is the unit weight of subsoil  
 D is the depth of the surcharge  
 $N_\gamma$  and  $N_q$  are bearing capacity factors  
 F is the safety factor = 3.

Because the subsoil consists mainly of silt, the value of 'N' has to be reduced by the following equation:-

$$N = 15 + \frac{1}{2} (N' - 15)$$

As the bottom of the foundation will be founded at approx. Elev. 771.0' in the stratum of silty sand and sandy silt, with the lowest 'N' value of 58, the real design value of 'N' will be:-

$$N = 15 + \frac{1}{2} (58 - 15) = 37.$$

Hence -

$$q_s = \frac{1}{2} \frac{6 \times 115 \times 46}{3 \times 2000} + \frac{115 \times 6 \times 42}{3 \times 2000} = 7.4 \text{ Tons/sq. ft.}$$

Taking into account that the water table will be at the base of the footing, the amount of 7.4 tons/sq.ft. should be divided by 2 which gives us a safe bearing pressure of 3.7 tons/sq. ft.

In order to limit settlements to a generally accepted value of 1 to 1½ inches under the footings and to allow for possible variations in relative density of the silt layer, an allowable safe bearing pressure of 2.5 tons/sq. ft. would be recommended for the design.

cont'd. /5 ...

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

The footings for the falsework for the construction can be placed on the exposed sandy silt layer approx. 2'-6" to 3'-0" below ground level. Precaution should be taken that the ground on which these temporary footings will be placed is not softened by running or standing water, and that it is sound and does not contain decayed organic matter. The safe load that can be attributed to these footings should not exceed 1.5 tons/sq.ft.

Because of the granular, non-cohesive character of the subsoil, no stability problems for the approach embankment fill are anticipated, provided the surface vegetation layer is removed prior to fill placement.

7. SUMMARY:

1. The stratification of the soil is quite uniform. The upper 25 - 30 feet thick layer of dense sandy silt and silty sand is underlain by a very dense layer of silty clay which, in turn, is underlain by a dense layer of sandy, clayey silt. Because of their similarity, it is sometimes hard to distinguish which of the two layers was found.
2. Because of the dense character of the upper layer spread footings are proposed for the structure. The bottom of the footings should not be above Elev. 771.0'. The safe load can be taken as 2.5 Tons/sq.ft.
3. To select the suitable type of structure, is left to the Structural Engineer's discretion.
4. Problems due to water seeping into the excavation, are not likely to present too much difficulty as the material has a relatively low permeability.

cont'd. /6 ...

7. SUMMARY: (cont'd.) ...

5. Footings for the falsework can be placed on the exposed silty sand and sandy silt layer provided it is not softened by water and it is a sound material (no organic matter). The safe load should not be in excess of 1.5 Tons/sq. ft.
6. No stability problems of the approach embankment fills are anticipated. The top organic layer should be removed prior to the placing of the embankments.

8. MISCELLANEOUS:

The field work was carried out during the period of June 15 to June 20, 1960, by the D.H.O. skid-mounted core drills, adapted for soil sampling, under the supervision of Mr. W. Kulmatickas, Project Engineer, Foundation Section.

July 1960.

REPORT PREPARED BY:   
W. Kulmatickas  
Project Foundation Engr.

REPORT APPROVED BY:   
A. Stermac,  
Foundations Office Engr.



APPENDIX I.

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-52

W.P. \_\_\_\_\_

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH P.S.I.	UNIT WEIGHT P.C.F.	REMARKS
1	S1	3'-4.5'	Sandy silt, medium dense.	16	-	-	-	-	-	
	S2	6'-7.5'	Sandy silt, dense.	58	-	-	-	-	-	
	S3	10'-11.5'	Sandy silt, dense.	59	-	-	-	-	-	
	S4	15'-16.5'	Sandy silt, very dense.	112	-	-	-	-	-	
	S5	20'-21.5'	Sandy, clayey silt, very dense.	155	-	-	-	-	-	
	S6	30'-31.3'	Sandy, clayey silt, very dense.	100	-	-	-	-	-	
	S7	40'-41.5'	Sandy silt, very dense.	76	-	-	-	-	-	
2	S1	3'-4.5'	Sandy silt, loose.	8	-	-	-	-	-	
	S2	6'-7.5'	Sandy silt, med. dense.	16	-	-	-	-	-	
	S3	10'-11.5'	Sandy silt, very dense.	92	-	-	-	-	-	
	S4	15'-16.5'	Sandy silt, dense.	44	-	-	-	-	-	
	S5	20'-21.5'	Silt, very dense.	219	-	-	-	-	-	
	S6	30'-31.5'	Clayey silt, very dense.	147	-	-	-	-	-	
	S7	40'-41.3'	Sandy, clayey silt, very dense.	110-9"	-	-	-	-	-	
3	S1	3'-4.5'	Sandy silt, loose.	10	-	-	-	-	-	
	S2	6'-7.5'	Sandy silt, very dense.	76	-	-	-	-	-	
	S3	10'-11.5'	Sandy silt, very dense.	98	-	-	-	-	-	

Cont. P. 2

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-52

W.P. \_\_\_\_\_

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
3	S4	15'-16.5'	Sandy silt, dense.	41	-	-	-	-	-	
	S5	20'-21.5'	Sandy silt, very dense.	97	-	-	-	-	-	
	S6	30'-31.5'	Sandy silt, very dense.	147	-	-	-	-	-	
	S7	40'-41.5'	Sandy silt, very dense.	74	-	-	-	-	-	
4	S1	3'-4.5'	Silty sand, med. dense.	27	-	-	-	-	-	
	S2	6'-7.5'	Sandy silt, dense.	44	-	-	-	-	-	
	S3	10'-11.5'	Sandy silt, very dense.	106	-	-	-	-	-	
	S4	15'-16.5'	Sandy silt, very dense.	79	-	-	-	-	-	
	S5	20'-21.5'	Sandy, clayey silt, dense.	50	-	-	-	-	-	
	S6	30'-31.5'	Silty, clayey sand, dense.	54	-	-	-	-	-	
	S7	40'-41.5'	Sandy, clayey silt, dense.	43	-	-	-	-	-	
5	S1	3'-4.5'	Sandy silt, loose.	10	-	-	-	-	-	
	S2	6'-7.5'	Sandy silt, loose.	9	-	-	-	-	-	
	S3	10'-11.5'	Sandy silt, very dense.	130	-	-	-	-	-	
	S4	15'-16.5'	Sandy silt, very dense.	83	-	-	-	-	-	
	S5	20'-21.5'	Sandy silt, very dense.	71	-	-	-	-	-	

# SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-52

W.P. \_\_\_\_\_

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	S6	30'-31.5'	Sandy silt, very dense.	102	-	-	-	-	-	
	S7	40'-41.5'	Clayey sandy silt, very dense.	70	-	-	-	-	-	
	S8	50'-51.5'	Clayey sandy silt, dense.	54	-	-	-	-	-	
	S9	60'-61.5'	Clayey sandy silt, dense.	64	-	-	-	-	-	
			S denotes split spoon sample.							

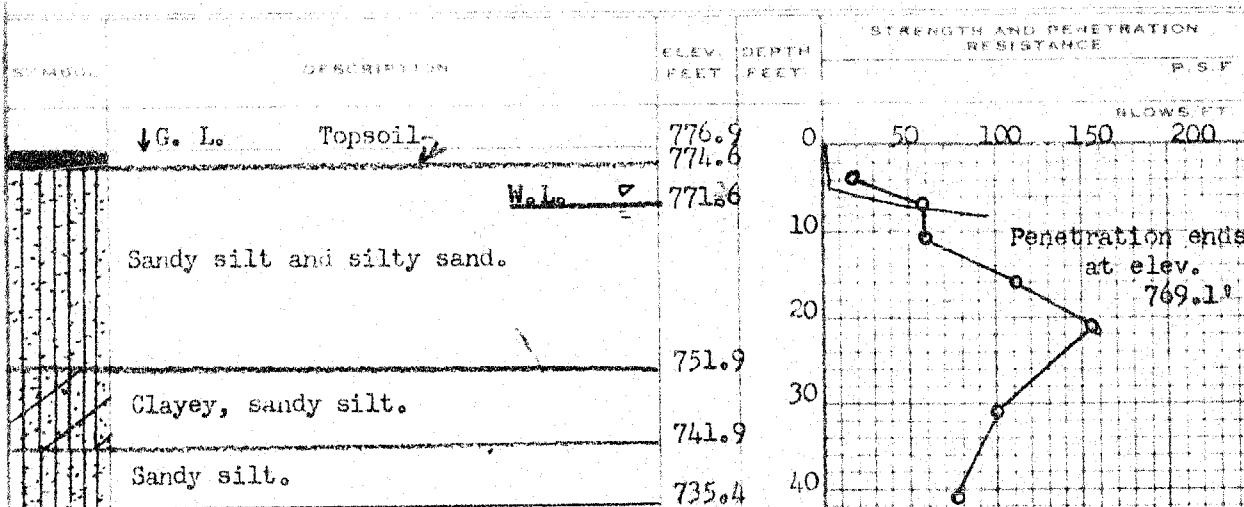
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. BORE HOLE NO. 1  
JOB 60-P-52 STATION \_\_\_\_\_  
DATUM 776.9' COMPILED BY B. K.  
BORING DATE June 15/60. CHECKED BY W. W. K.

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

## LEGEND

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



CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT	FLUID WT.		
		S1	-
		S2	-
		S3	-
		S4	-
		S5	-
		S6	-
		S7	-

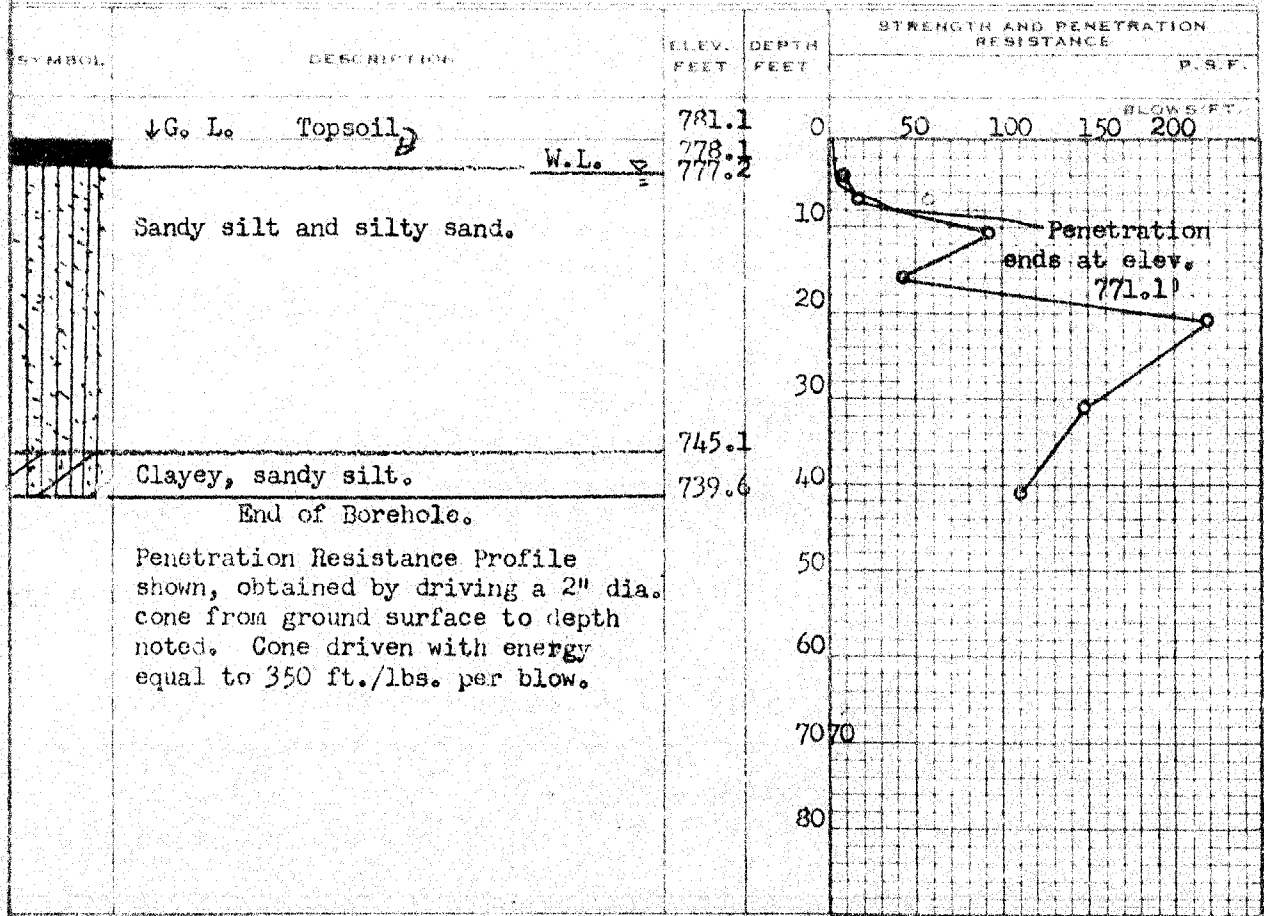
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. \_\_\_\_\_ BORE HOLE NO. 2  
JOB 60-F-52 STATION \_\_\_\_\_  
DATUM 781.1' COMPILED BY B. K.  
BORING DATE June 15/60. CHECKED BY W. W. K.

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

LEGEND

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



CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT			
		S1	-
		S2	-
		S3	-
		S4	-
		S5	-
		S6	-
		S7	-

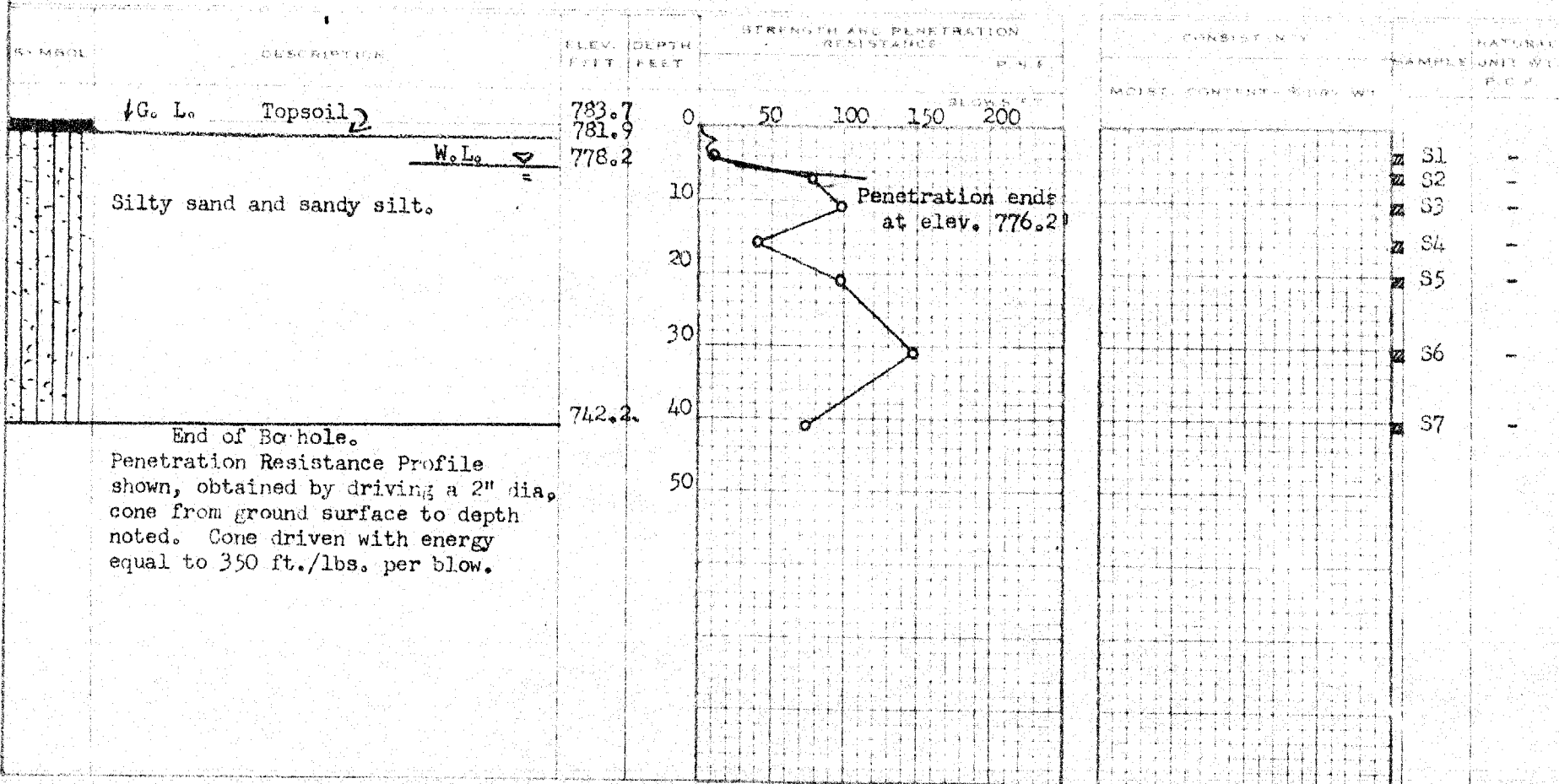
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. BORE HOLE NO. 3  
JOB 60-F-52 STATION  
DATUM 783.7' COMPILED BY B. K.  
BORING DATE June 16/60. CHECKED BY W. W. K.

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

LEADS

UNCONFINED COMPRESSION (QU)	C
PLANE TEST (C) AND SENSITIVITY (S)	1
NATURAL MOISTURE AND	1
LIQUIDITY INDEX	X
LEAD LIMIT	
PLASTIC LIMIT	



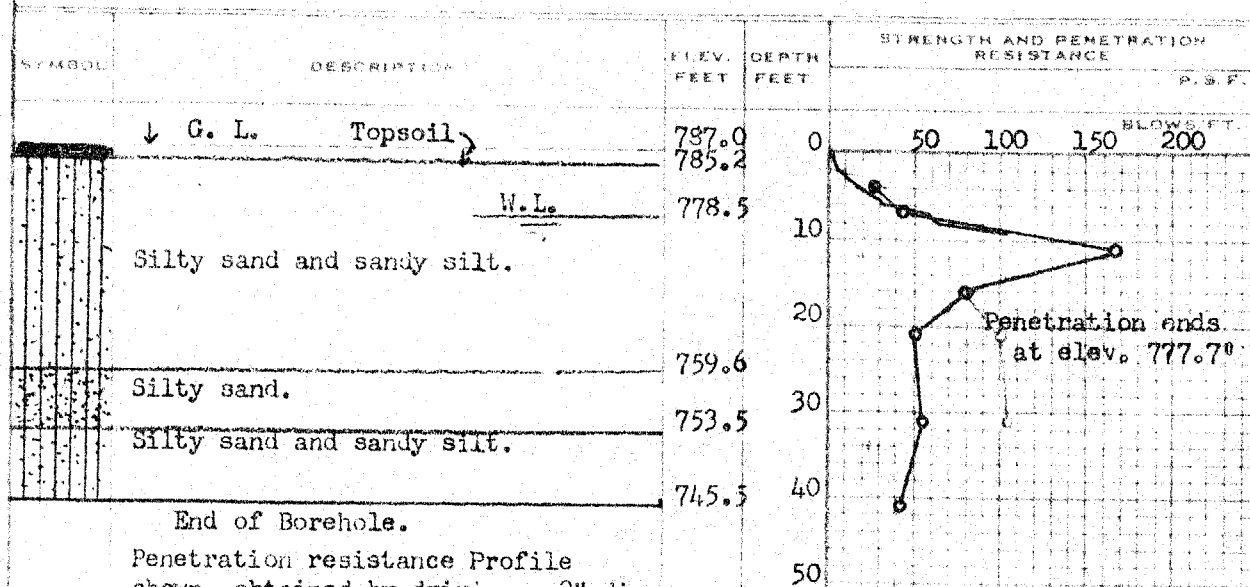
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. \_\_\_\_\_ BORE HOLE NO. 4JOB 60-F-52 STATION \_\_\_\_\_DATUM 787.0' COMPILED BY B. K.BORING DATE June 17/60. CHECKED BY W. W. K.

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 \_\_\_\_\_



CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY W.			
		S1	-
		S2	-
		S3	-
		S4	-
		S5	-
		S6	-
		S7	-



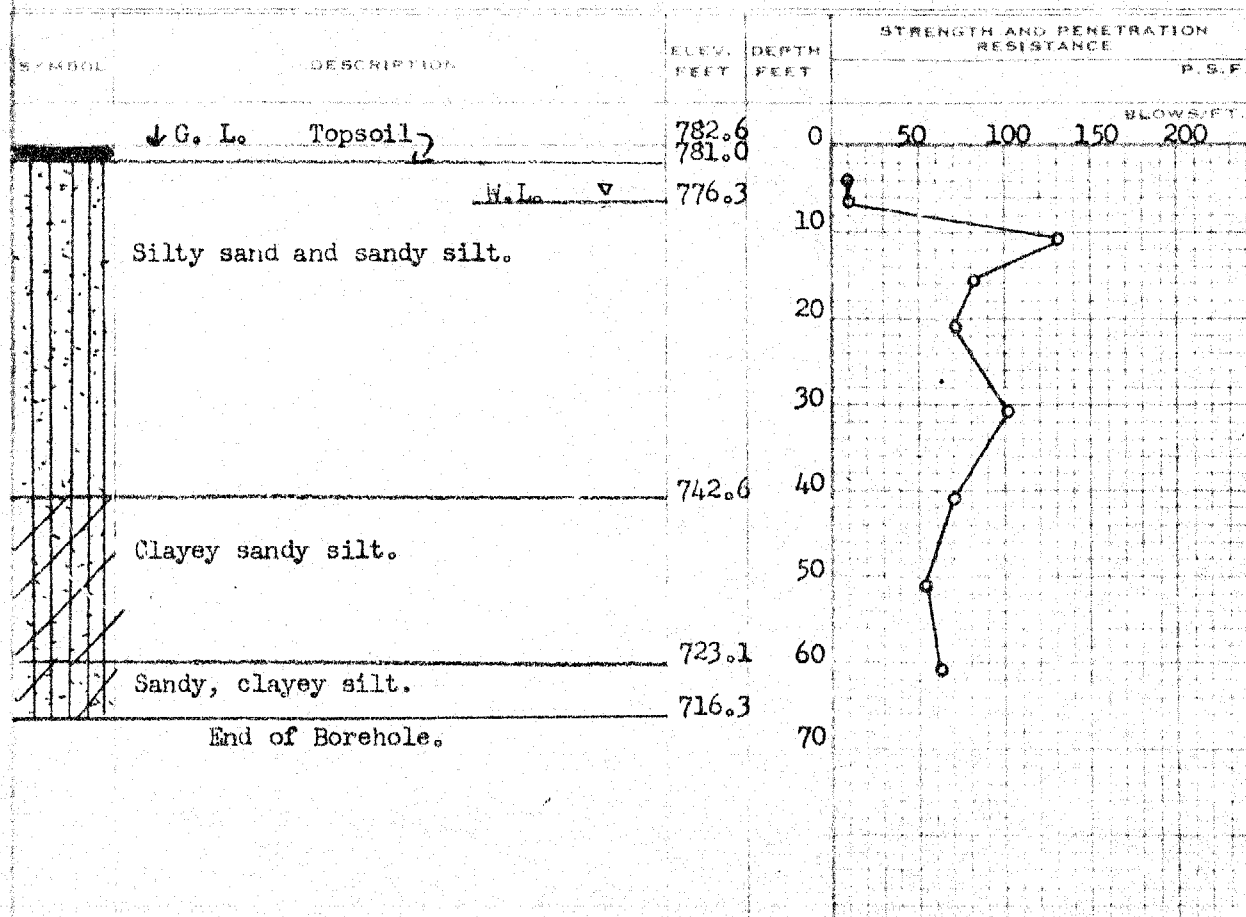
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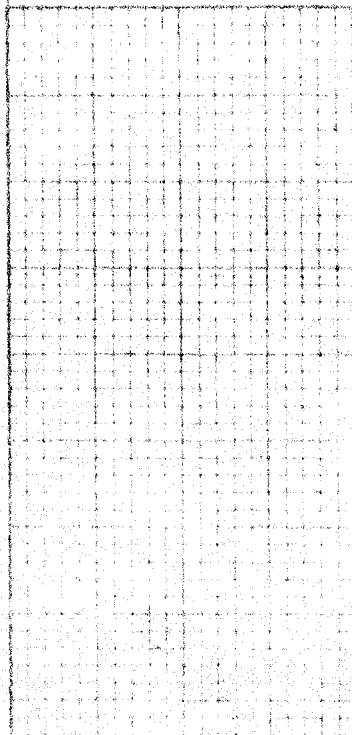
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2" DIA. SPLIT TUBE \_\_\_\_\_  
 2" SHELBY TUBE \_\_\_\_\_  
 2" SPLIT TUBE \_\_\_\_\_  
 2" DIA. CONE \_\_\_\_\_  
 2" SHELBY \_\_\_\_\_  
 CASING \_\_\_\_\_

## LEGEND

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



CONSISTENCY		SAMPLE	NATURAL
MOIST. CONTENT - % DRY WT.			UNIT WT.
		S1	-
		S2	-
		S3	-
		S4	-
		S5	-
		S6	-
		S7	-
		S8	-
		S9	-

*Hostein Road Bridge*

Mr. W. S. Melinyshyn,  
Regional Bridge Location Engr.,  
Bridge Division.

Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

September 23, 1964

Your Memo - Sept. 21/64

Hostein Road Bridge and Hwy. #403,  
W.P. 183-60 -- W.J. 60-F-52, Dist. #4.

We have reviewed the Preliminary Drawing No. D-5521-P1 for the above-mentioned bridge, and submit our comments for your consideration:

At the abutment locations the natural ground is only 2 to 3 feet below the designed footing elevation. It is our recommendation that piles be dispensed with and the footings be placed on well-compacted granular material. A relatively small quantity will be required because the rest of the approach embankment can be built of any acceptable fill material.

According to the findings of the investigation carried out at this site in July 1960, the ground water appears to be above the designed pier footing elevations and therefore, dewatering of the excavations may prove necessary. Due to the granular nature of the subsoil, boiling could occur if proper dewatering procedures are not applied.

Should there be any queries, please feel free to contact our Office.

AGS/MdeF

cc: Foundations Office  
Gen. Files ✓

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER

*uf*

# 60-F-52

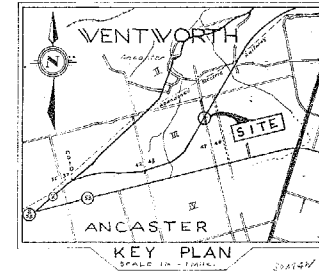
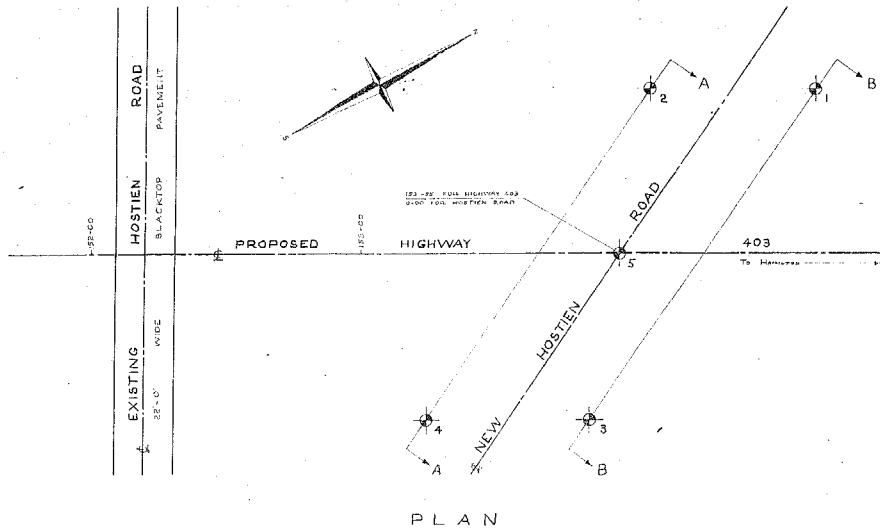
W.P. # 183-60

Hwy. # 403

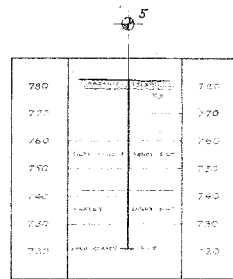
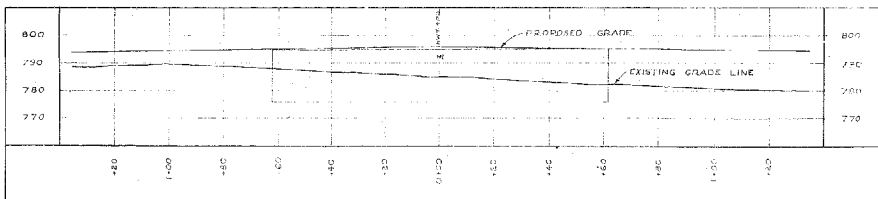
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4 MILES N.E. OF

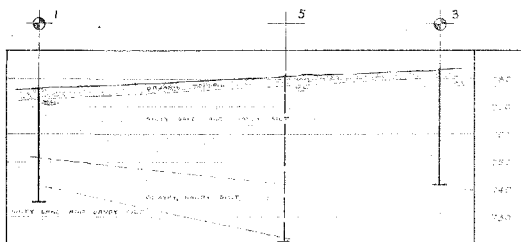
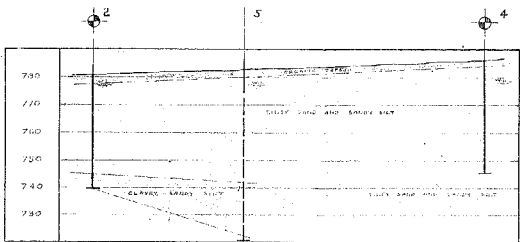
ANCASTER



32414W  
5 476110  
2 473180  
2 17



LEGEND			
BORE & PENETRATION			
ELEVATION STATION DISTANCE FROM A			
1	774.0	154+00	60' LT
2	781.1	154+00	60' LT
3	783.7	152+85	60' RT
4	787.0	153+25	60' RT
5	782.0	153+25	2



NOTE  
THE PROFILES SHOWN ARE BASED ON THE DATA  
OBTAINED AT THE BORE LOCATIONS SHOWN HERE  
UNLESS THE ROADWAY HAS BEEN RECENTLY  
CONSTRUCTED AND MAY BE SUBJECT TO CONSTRUCTION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MINISTRY OF TRANSPORTATION

HOSTIEN ROAD REVISION

PROJECT NO. 103-60  
SHEET NO. 103-60  
DATE: AUG. 1, 1982  
BY: [Signature]

REVISIONS  
1. [Description]  
2. [Description]  
3. [Description]