

28-4

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

September 28, 1959.

Re: FOUNDATION REPORT - D.H.O.

W.J. F 59-70. - Dist. 4.

Attention: Mr. S. McCombie.

WP 195-55-2

Re: Canadian National Rwy.  
& Aldershot Road Crossing,  
Wentworth Cty., E. Flamborough Twp.,  
Lots 6 & 7, Con. 1, 0.5 Mi. North to  
Aldershot.

This memo accompanies our foundation report for the proposed overhead at the above noted site. Reference to the contents of this report shows that the subsoil consists of a layer of fill, and a stratum of clay silt with a combined thickness varying from 14 to 20 feet. These strata overlie Queenston shale bedrock.

The footings for this structure must be either pile-supported or placed directly upon the underlying bedrock formation. In view of the fact that excavation to place the footings on bedrock will require detailed shoring design to ensure stability of the railway fill, it is our recommendation that small displacement type 'H' piles be driven to refusal in the underlying shale bedrock. 'H' piles are preferred to sonotube sections because of the apparent slope of the bedrock. With 'H' piles, a positive fixity of the pile tip in the shale will be assured.

The strength characteristics of the underlying clay are such that embankments can be designed with side slopes of 2:1.

If any queries arise with respect to the contents of this report, please contact our office.

LGS/ndef  
Encl.

L. G. Goderman,  
PRINCIPAL SOILS & FOUNDATIONS ENGINEER

cc: Messrs. A. M. Toye D. W. Farren

B. A. Fregaskes  
D. G. Ramsay  
R. E. Richardson  
P. F. Weber  
A. Watt

Foundation Section -- Gen. File

FOUNDATION REPORT  
on  
Canadian National Railway  
and  
Aldershot Road Crossing  
Wentworth Cty., E. Flamborough Twp.  
Lots 6 & 7, Con. I, 0.5 Mi. North  
to Aldershot.

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Plan No: F 2407-26.

Prof.No: F 2407-27.

Distribution:

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Mr. H. A. Tregaskes, Construction Engineer.	(1)
Mr. D. G. Ramsay, Road Design Engineer.	(1)
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Mr. R. E. Richardson, District Engr., Hamilton.	(1)
Mr. P. F. Weber, Regional Soils Engineer.	(1)
Mr. A. Watt, Ont. Water Resources Commission.	(1)
Foundation Section.	(1)
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W.J. F 59-70

W.P. 125-18-2

## INTRODUCTION:

Presented in this report are the results of an investigation carried out to determine the competence of the subsoil material at the site of a proposed overhead located approximately 1/2 mile N.W. of Aldershot. At this location the C.N.R. crosses the existing paved road between lots of 6 & 7 in Con. I, Twp. of East Flamborough, Sta. 19+87 - Profile No. F 2407-27.

The field work commenced on July 1st, 1959 and was completed on July 7th, 1959.

## DESCRIPTION OF THE SITE & GEOLOGY:

The site is on the Niagara Escarpment which extends from the Niagara River to the tip of Bruce Peninsula. In this section the escarpment is cut by numerous small creeks. On the N.E. side of the site a rather broad belt of shale is exposed and the long, lower slopes of the escarpment are highly eroded. According to the available geological information, it is the valley of the pre-glacial river which joined the basins of Lake Erie and Lake Ontario.

The topography of the site is generally level. The area in the vicinity of the site is mainly pasture with a few scattered fruit trees.

This site is generally covered by shallow deposits of clay, underlain by shale bedrock.

## DESCRIPTION OF FIELD & LABORATORY WORK:

The investigation consisted of 4 sampled boreholes. Borings 1, 3 & 4 were carried out by means of a continuous flight auger; Boring 2 by a skid-mounted core-drill machine adapted for

cont'd. /2 ...

DESCRIPTION OF FIELD & LABORATORY WORK: (cont'd.) ...

soil sampling. Samples were recovered at depths required by means of a 2" O.D. split spoon sampler. The dimensions of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Disturbed samples were recovered at depths required, in Borings 1, 3 & 4.

Rock samples were obtained from each borehole by rotary drilling, using an AXT corebit and retained in a 5-ft. double tube core-barrel.

In addition to the sampled boreholes, dynamic cone penetration tests were carried out adjacent to each borehole, except Borehole 1.

Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were carried out on selected representative samples. Rock core samples were carefully examined to determine the quality and soundness of the rock.

Laboratory and field test results have been summarized in Table No. 1 and are included in this report under Appendix I.

Drawing No. F 59-70A shows the borehole locations and the estimated subsoil stratigraphy.

SUBSOIL CONDITIONS:

In each of the sampled boreholes, the topsoil was found to be underlain by fill material consisting of sandy clay with gravel. This fill material extends approximately 5 to 10 ft. below the existing surface. Underlying this material and immediately overlying the shale bedrock, a layer of medium red-brown silty clay approximately 10 to 15 ft. was encountered.

cont'd. /3 ...

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

Bedrock was drilled and cored in order to determine its quality and soundness.

In the order of stratigraphic succession, the following soil types are defined:-

1. Fill Material.
2. Medium Red & Brown Silty Clay.

The layer of silty clay was found to be continuous over the site. The upper zone has been subjected to oxidation, resulting in its present brownish colour. Below the oxidized zone, the colour is predominantly red. The silty clay contains 39% silt, 22% sand, and 19% gravel. Its consistency is defined by a moisture content of 15%, liquid and plastic limits of 27% and 16%, respectively. The bedrock was encountered below the silty clay stratum.

3. Bedrock.

The bedrock consists of Queenston shale of upper Ordovician age. The formation consists of interbedded red and grey shale. The top one foot of the bedrock is medium soft; below this depth the shale is in sound condition with no signs of weathering or fracture. Bedrock was contacted at Elevation 318.3' in Boring 1, Elev. 328.1' in Boring 2, Elev. 327.4' in Boring 3, and at Elev. 322.1' in Boring 4.

From the elevations of bedrock surface encountered in the four borings, it appears that the rock surface is sloping in a South-Easterly direction.

WATER CONDITIONS:

Observations and measurements carried out during boring and sampling operations, indicate that the water table is at approximately Elev. 328'. In view of the fact that no water-bearing sand seams of any significance, or artesian water conditions were encountered during the exploration programme, seepage into footing excavations will be local and of minor quantities.

FOUNDATION CONSIDERATIONS:

Reference to the borehole logs appended to the report, shows that the subsoil conditions at the site consist of shale bedrock overlain by medium clay and fill material; the combined thickness of these strata vary from 14 to 20 ft. The soft nature of the upper layers of the clay and fill material will not enable the use of spread footings for the foundations of the proposed structure. Spread footings can be used directly on the bedrock formation, and a bearing capacity of at least 10 tons/sq.ft. can be used. Excavation to place footings directly upon the underlying shale formation will require a detailed shoring design to ensure that the railway fill does not become unstable. An alternate means of footing support eliminating excavation, would be to use short end-bearing piles. Small displacement type 'H' piles are recommended in preference to either timber or steel monotube piling.

No approach fill stability problems are anticipated. The top soil layer should be stripped prior to placing fill material. Side slopes of 2:1 are adequate.

CONCLUSIONS & RECOMMENDATIONS:

- (1) The site is underlain by red Queenston shale covered by a shallow layer of silty clay.
- (2) Subsoil conditions are such that satisfactory foundation support cannot be obtained in the overburden above bedrock.
- (3) As such, end-bearing piles driven to refusal into the shale bedrock, appear to be the obvious means of obtaining satisfactory footing support. Bedrock is at approximately Elev. 328' to 319.0'.
- (4) No approach fill stability problems are anticipated. Prior to the embankment fill, all top soil shall be removed. Standard 2:1 side slopes are considered adequate.

*L. G. Soderman*  
for  
M. Devata,  
Project Foundation Engr.

APPENDIX I.








DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

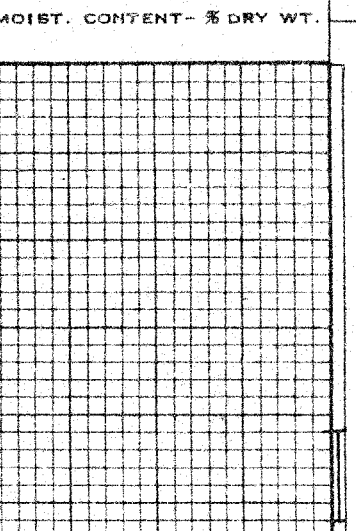
W.P. - - - - - BORE HOLE NO. 1 - - - - -  
JOB F 59-70 - - - - - STATION 19+42 (47' Rt) - - - - -  
DATUM 339.3' - - - - - COMPILED BY B.K. - - - - -  
BORING DATE July 1/59 - - - - - CHECKED BY M.D. - - - - -

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>s</sup>
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	---
PLASTIC LIMIT	---	---

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F. BLOWS/FT.	
	↓Ground level	339.3	0		
	Fill (Sandy clay)	329.3	10		
	Red silty clay with gravel	318.3	20		
	Bedrock Red & grey shale	313.3	30		
	End of borehole		40		

CONSISTENCY		NATURAL UNIT WT.
	SAMPLE	P.C.F.
MOIST. CONTENT - % DRY WT.		
	RC1	

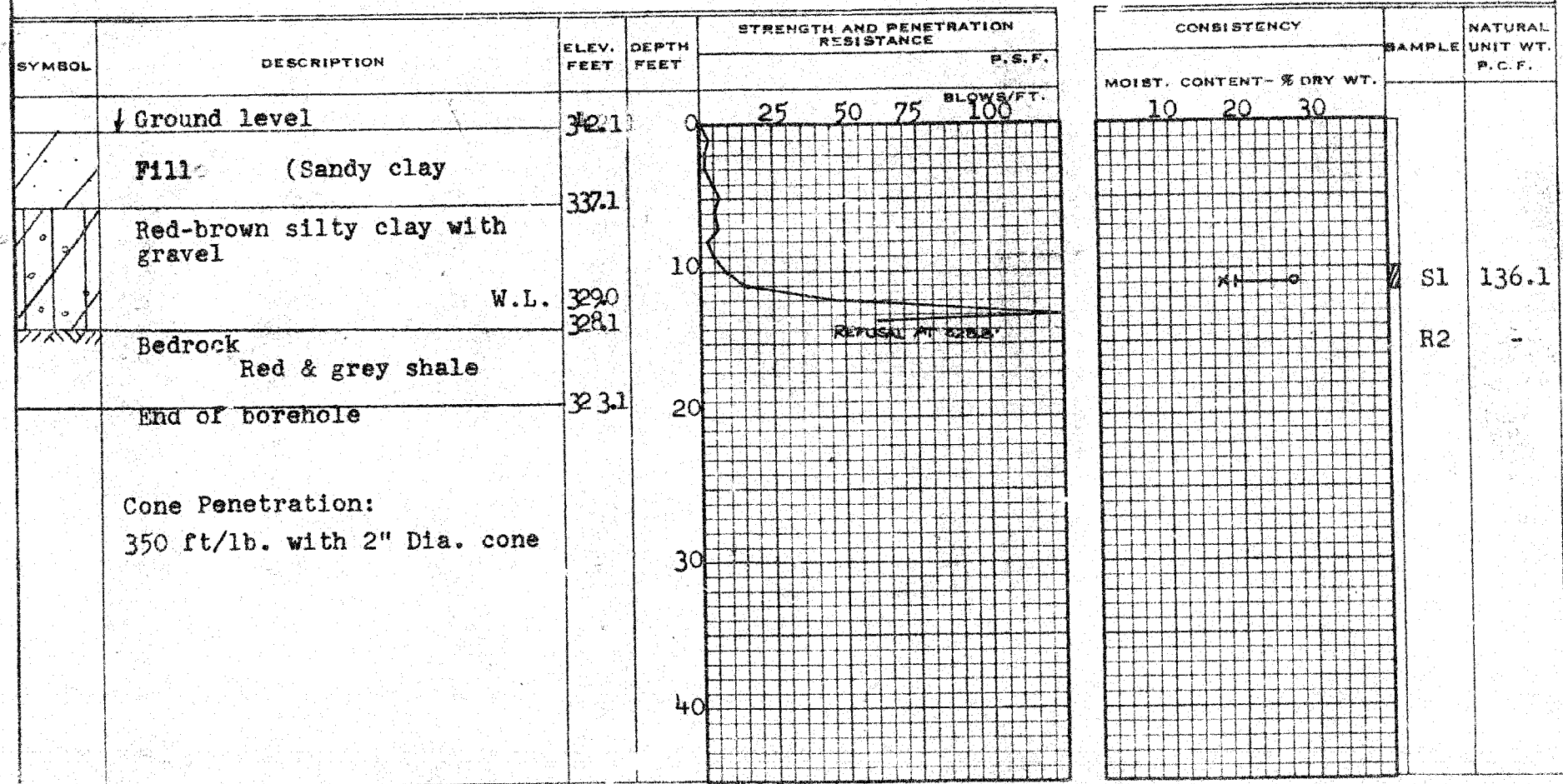
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. \_\_\_\_\_ BORE HOLE NO. 2  
 JOB F 59-70 STATION 19+63 (52' Rt.)  
 DATUM 342.1' COMPILED BY B.K.  
 BORING DATE July 2/59 CHECKED BY M.D.

## LEGEND

1/2 UNCONFINED COMPRESSION (Qu)      O  
 VANE TEST (G) AND SENSITIVITY (S)      +  
 NATURAL MOISTURE AND LIQUIDITY INDEX      LI  
 LIQUID LIMIT      X  
 PLASTIC LIMIT      —

2" DIA. SPLIT TUBE      [Symbol]  
 2" SHELBY TUBE      [Symbol]  
 2" SPLIT TUBE      [Symbol]  
 2" DIA. CONE      [Symbol]  
 2" SHELBY      [Symbol]  
 CASING      [Symbol]



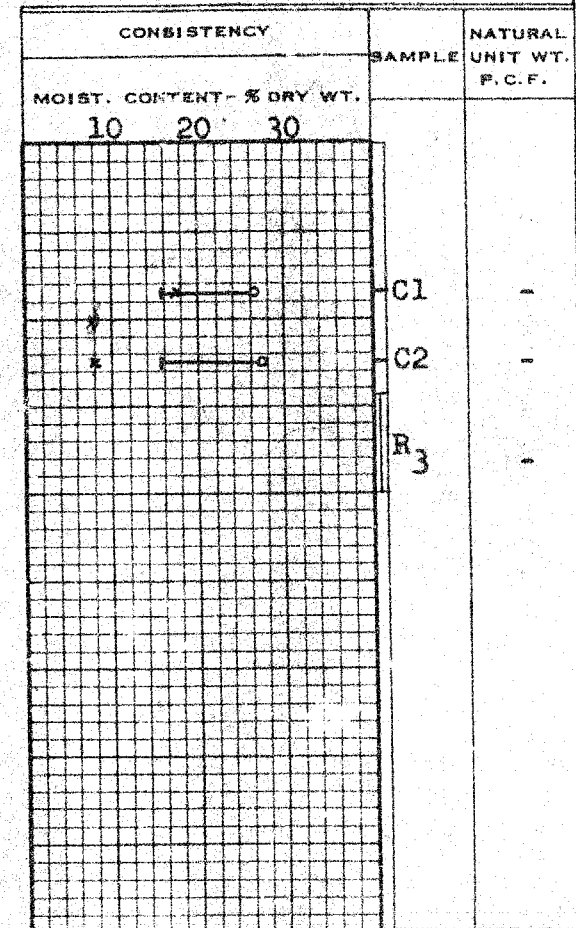
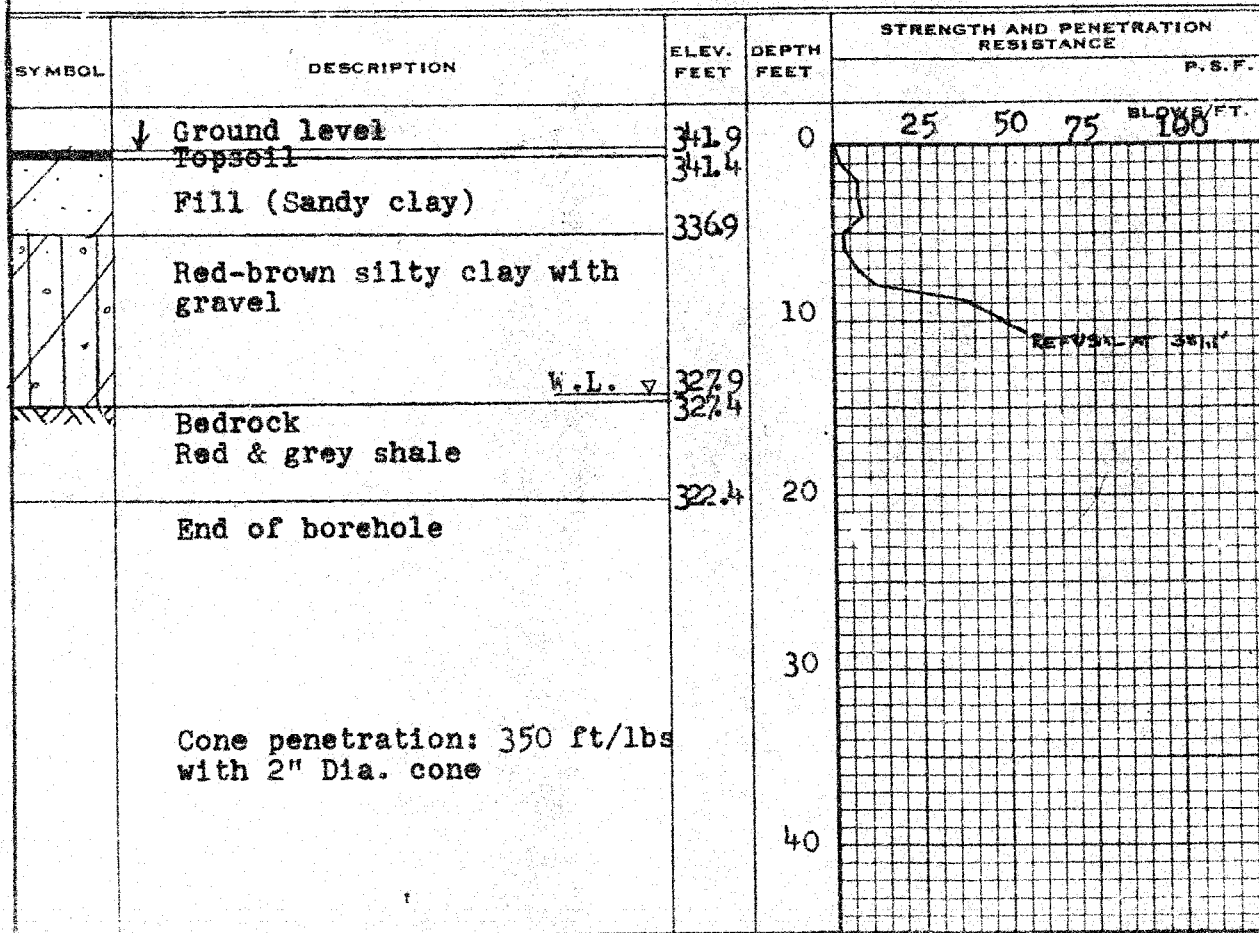
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. \_\_\_\_\_ BORE HOLE NO. 3  
 JOB F59-70 STATION 20+06(53' Rte.)  
 DATUM 341.9' COMPILED BY B.K.  
 BORING DATE July 7/59 CHECKED BY M.D.

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 \_\_\_\_\_



# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. \_\_\_\_\_ BORE HOLE NO. 4  
 JOB F59-70 STATION 20+09 (55' Lt.)  
 DATUM 341.61/59 COMPILED BY BK  
 BORING DATE July 1/59 CHECKED BY M.D.

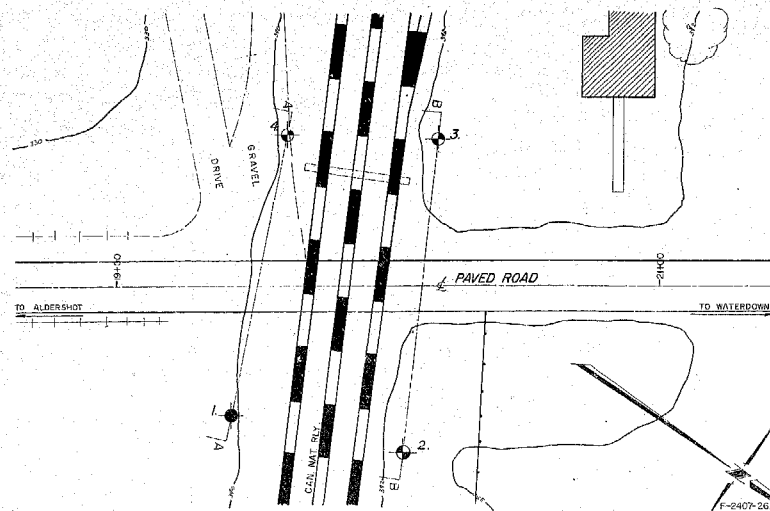
2" DIA. SPLIT TUBE \_\_\_\_\_  
 2" SHELBY TUBE \_\_\_\_\_  
 2" SPLIT TUBE \_\_\_\_\_  
 2" DIA. CONE \_\_\_\_\_  
 2" SHELBY \_\_\_\_\_  
 CASING \_\_\_\_\_

## LEGEND

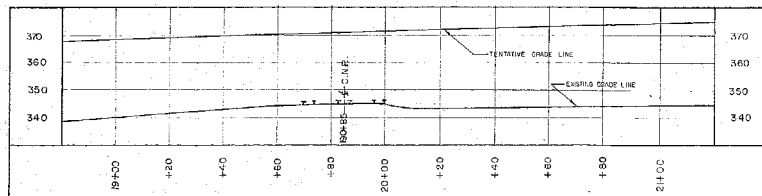
1/2 UNCONFINED COMPRESSION ( $Q_u$ ) \_\_\_\_\_ ○  
 VANE TEST (C) AND SENSITIVITY (S) \_\_\_\_\_ +  
 NATURAL MOISTURE AND LIQUIDITY INDEX \_\_\_\_\_ LI  
 LIQUID LIMIT \_\_\_\_\_ X  
 PLASTIC LIMIT \_\_\_\_\_

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE
				P. S. F. BLOWS/FT.
	↓ Ground level	341.6	0	25 50 75 100
	Fill (Sandy clay)	337.8	10	
	Red-brown silty clay		10	
	W.L. ∇ 327.6			
	A X T core bedrock, red & grey shale	322.1	20	
	End of borehole	317.1		
	Cone penetration, 350 ft/lb. with 2" Dia. cone.		30	
			40	

CONSISTENCY		SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT - % DRY WT. 10      20      30			

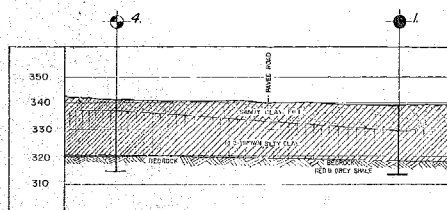


PLAN

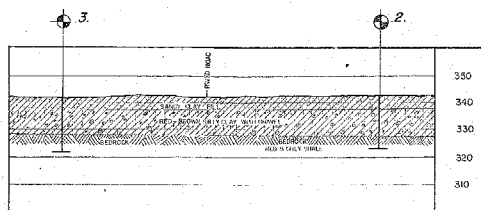


PROFILE

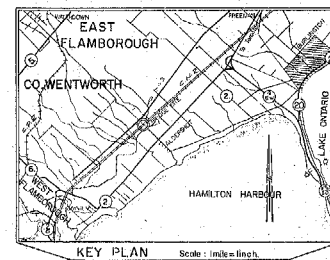
F 2407 27



A - A



B - B



KEY PLAN

# LEGEND

BORE HOLE

BORE & PENETRATION HOLE

HOLE No.	ELEVATION	STATION	DISTANCE FROM #1
1.	339.3	19+42	47 RT.
2.	342.1	19+63	52 RT.
3.	341.9	20+06	53 LT.
4.	341.6	20+09	55 LT.

NOTE

THE INDICATED BORE HOLE LOCATIONS HAVE BEEN RECORDED ONLY AS BEST AVAILABLE LOCATIONS BETWEEN ADJACENT BORE HOLES. THE BORE HOLES ARE ATTACHED FROM AERIAL PHOTOGRAPHS AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO  
TRAFFIC & HIGHWAY SAFETY DIVISION

## COUNTY ROAD & C.N.R. CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

PROJ.	EAST FLAMBOROUGH	DISTRICT	5-7	COUNTY	WENTWORTH
CONTRACT	0-5 MILE N.W. of ALDERSHOT	CON.	1.		
DESIGNED BY	F. Hargrave	DATE	19 SEPT. 1959	BY	NONE
CHECKED BY		DATE		BY	
SCALE	1 in = 20 Feet	APPROVED BY		DATE	

F-59-70A