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DIST. 2 REGION SOUTHWESTERN

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

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

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

STR. SITE No. 19-354

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

LOCATION TWP RD.  $\frac{1}{2}$  SHARON CK.,

BRIDGE - 354, WESTMINSTER - DELAWARE

TOWNLINE

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: DOCUMENTS TO BE UNFOLDED BEFORE

MICROFILMED



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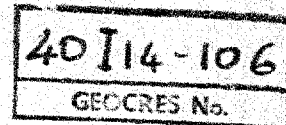
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KINGSTON 5, JAMAICA  
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**MIDDLESEX COUNTY ENGINEER**  
**COUNTY BUILDINGS**  
**LONDON ONTARIO**



STRUCTURE SITE N° 19-354

Report on

SOIL INVESTIGATION

for

BRIDGE 354

WESTMINSTER-DELAWARE TOWNLINE

by

DOMINION SOIL INVESTIGATION LIMITED

369 Queens Avenue

LONDON

Ref. No. 8-7-L4.

ONTARIO

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## ENCLOSURES.

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SUMMARY.

The natural subsoil consists of hard silty clay till which was penetrated to a depth of 19 feet below the creek bed.

It is recommended that the structure be supported on spread footing foundations at or below El. 89, using a maximum net soil pressure of 10,000 p.s.f. Total settlement is estimated to be less than 1-inch.

No unusual construction problems are anticipated.

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1. INTRODUCTION.

In accordance with a letter of authorization dated July 8, 1968, a soil investigation has been carried out on the Westminster-Delaware Townline where it is proposed to replace an existing road bridge with a new structure.

The existing 20 foot span structure is located on the road allowance between Lot 7 Gore Concession of Westminster Township and Lot 11 Concession 4 of Delaware Township where the road crosses Sharon Creek.

It is understood that the proposed structure is a 20 to 25 foot span concrete rigid frame and that it will be centered on the existing bridge. The requirements of the project were discussed with Mr. D.H. Husson P.Eng., who supplied the foregoing information.

The purpose of the investigation was to reveal the subsurface conditions at the site and to determine the relevant soil properties for the design and construction of the new foundations.

11. FIELD WORK.

The field work, consisting of 2 boreholes, was carried out on July 17 & 18, 1968, at the locations shown on Enclosure 1.

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The holes were advanced to the sampling depths by a continuous flight auger machine which was equipped for soil sampling.

Standard penetration tests were performed at frequent intervals of depth, as detailed in Appendix 'A', and the results are recorded on the borehole logs as 'N' values.

Dynamic cone penetration tests were performed adjacent to each borehole location to obtain an indication of soil density and strata changes with depth.

Elevations were referred to a nail in a power line pole at the location indicated on Enclosure 1. The benchmark was given the assumed value El.100 feet.

#### 111. SUBSURFACE CONDITIONS.

Detailed descriptions of the strata encountered in each borehole are given on the borehole logs, comprising Enclosures 2 and 3, and a general picture of the soil stratigraphy is presented in the form of a Subsurface Profile on Enclosure 1. The following notes are intended only to amplify this data.

rown silty clay (Fill).

This material is associated with the construction of the approaches to the existing bridge and was found to have a thickness of 7 feet in both boreholes.

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Silty clay with traces of sand and gravel (Glacial Till).

The upper zone of the clay till stratum is brown in colour and shows signs of weathering in the form of fissures. With increasing depth the colour of the till becomes grey however the change is not characterized by any significant change in shear strength.

Standard penetration test results range from 32 to 105 blows per foot, indicating that the clay has a generally 'hard' consistency, and based on a visual and tactile examination of the soil samples it is estimated that the moisture content of the clay is close to the Plastic Limit of the soil.

IV. GROUNDWATER CONDITIONS.

Due to the impervious nature of the subsoil, the boreholes remained dry throughout the boring operation, however for practical purposes when considering seepage into excavations, it may be assumed that the ground water level is the same as the water level in the creek.

V. DISCUSSION & RECOMMENDATIONS.

The natural subsoil consists of hard silty clay till which is suitable for the support of normal spread footing foundations. The bed of the creek extends down to El.93.0 therefore, allowing 4 feet of cover for frost protection the footing grade will be

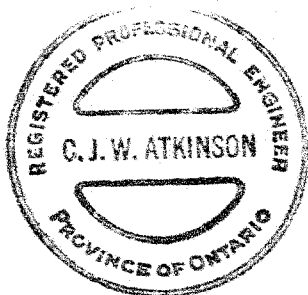
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established at or below El.89. On the basis of the borehole results a maximum net soil pressure of 10,000 p.s.f. is appropriate for the design of footings at this level and the soil pressure incorporates a factor of safety of 3 against shear failure of the underlying soil.

It is estimated that total settlement of footings mobilizing the maximum net soil pressure will not exceed 1-inch, and in view of the similar conditions encountered in the two boreholes, no appreciable differential settlement is anticipated.

The adhesion between the footings and the clay till may be taken as 2000 p.s.f. or 35% of the normal load, whichever is the lower value, and the factor of safety against horizontal sliding of the abutments should be at least 1.5.

The hard cohesive till will present no unusual construction problems. The sides of excavations will remain vertical for a short period of time, and seepage into excavations may be controlled by pumping from sumps dug below the footing grade.



CJWA.jb.

Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED.

*C.J.W. Atkinson*  
C.J.W. Atkinson M.Sc., P.Eng.  
Branch Manager.



APPENDIX 'A'.

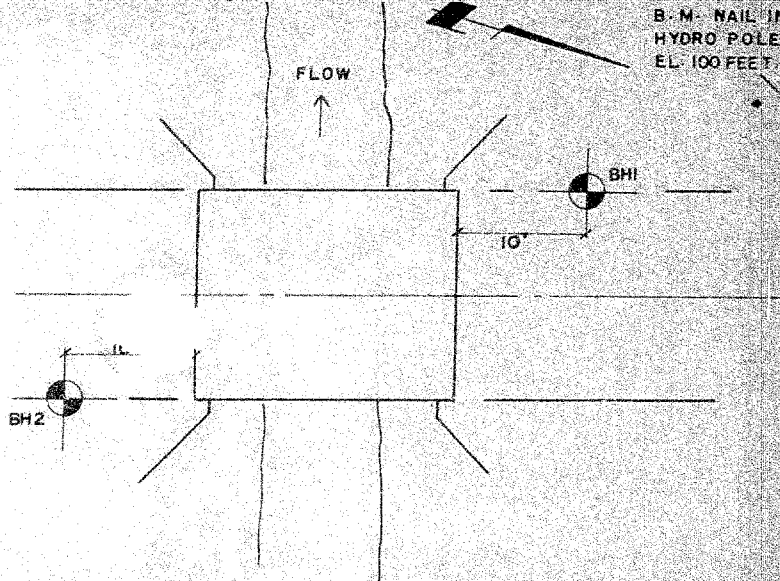
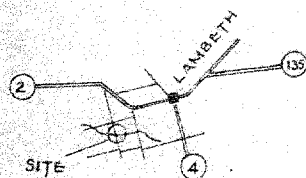
THE STANDARD PENETRATION TEST.

In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

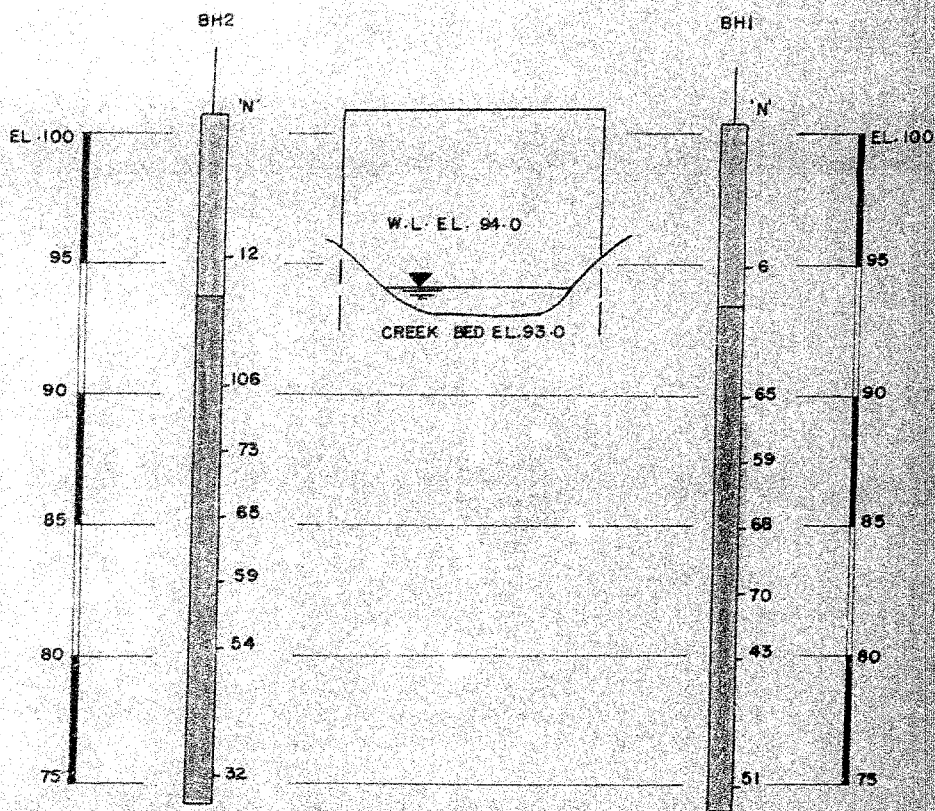
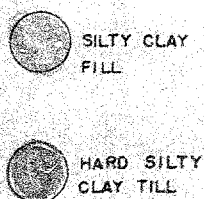
A two inch external diameter thick-walled sample tube is driven into the ground at the bottom of the borehole by means of a 140 lb. hammer falling freely through 30 in. The tube is first driven an initial 6-inches to allow for the presence of disturbed material at the bottom of the borehole. The number of standard blows (N) required to drive the sampler a further 12-in. is recorded. The sample tube is one originally developed by Raymond Concrete Pile Company in the United States, where a sufficient number of tests have been made in conjunction with field investigations to show that the results, although essentially empirical, may be applied to foundation design.

For Sands:-

Values of N.	Density.
Less than 10	Loose
Between 10 and 30	Compact
Between 30 and 50	Dense
Greater than 50	Very dense



# LEGEND





## LOG OF BOREHOLE ... 2. ....

Our Reference No 8-7-L4

Enclosure № 3.

CLIENT: County of Middlesex.  
PROJECT: Bridge 354  
LOCATION: Westminster Delaware Townline.  
DATUM ELEVATION: Nail in hydro pole, El. 100 feet.

## DRILLING DATA

Method: Auger  
Diameter: 4-inch  
Date: July 17, 1968.

SUBSURFACE PROFILE			SAMPLES			PENETRATION RESISTANCE		Blows / Foot		WATER CONTENT %			REMARKS
ELEVATION FT.	DEPTH FEET	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	IN'	UNDRAINED SHEAR STRENGTH		PLASTIC LIMIT	NATURAL	LIQUID LIMIT	
								+ FIELD VANE TEST	COMPRESSION TEST				
97.0	0.0	Ground Surface.											
		6" gravel											
		Brown silty clay containing pieces of wood (Fill).			1	SS	12						
95.0	7.0												
		Hard silty clay brown grey			2	SS	106						
90.0													
		with traces of sand and gravel (Glacial Till)			3	SS	73						
85.0													
					4	SS	65						
					5	SS	59						
80.0					6	SS	54						
75.0	25.5	End of Borehole			7	SS	32						