

# 67-F-267 M

CTV. RD # 34

CULVERT C-95

LOTS 10/11, CON. 8

WESTMINSTER TWP.

# DOMINION SOIL INVESTIGATION LIMITED

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MIDDLESEX COUNTY ENGINEER,  
COUNTY BUILDINGS  
LONDON, ONTARIO.

REPORT ON

SOIL INVESTIGATION

FOR

SUBJECT 2-10, COUNTY ROAD NO. 34,

LOTS 10 & 11, CONCLUSION 1,

TOWNSHIP OF SCARBOROUGH.

67-5-2674

BY

DOMINION SOIL INVESTIGATION LIMITED  
363 QUEEN'S AVENUE,  
LONDON, ONTARIO

Reference No. 7-3-12  
August 25, 1967.

# DOMINION SOIL INVESTIGATION LIMITED

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DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

SUMMARY

The natural subsoil consists of very stiff to hard silty clay till which was penetrated to a depth of 13 feet below the creek bed.

It is recommended that the structure be supported on spread footing foundations at or below El. 71 using a maximum net soil pressure of 5000 p.s.f. Total settlement is estimated to be less than 1-inch.

No unusual construction problems are anticipated.

## 1 INTRODUCTION

In accordance with a letter of authorization, dated August 15, 1967, a soil investigation has been carried out in the Township of Westminster where it is proposed to replace an existing culvert with a new structure.

The existing 18 foot span concrete culvert is located on County Road No. 34 and is designated as C-95 on the County classification.

It is understood that the proposed structure is a standard D.H.O. type concrete culvert with a span of about 20 feet. Also, the longitudinal and transverse centre lines will be the same as the existing bridge. The requirements of the project were discussed with Mr. J.P. McIntyre, P. Eng., who supplied the foregoing information.

The purpose of this 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 August 22 & 23, 1967, at the locations shown on Enclosure 1. The holes were advanced to the sampling depths by washboring methods and were lined with 8x size casing.

Standard penetration tests were carried out at frequent intervals of depth, as detailed in Appendix 'A', and the results

are recorded on the Geotechnical Data Sheets as 'N' values.

Elevations were referred to a benchmark which was supplied by the client (B.M. No.2 of the County survey, El. 81.37 feet).

#### 111 SUBSURFACE CONDITIONS

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

##### Sandy clayey silt fill

This material is associated with the construction of the approaches to the existing bridge. The relative density of the fill is described as 'loose' to 'compact' as estimated from 'N' values of 9 and 14 blows per foot.

##### Silty clay with a trace of gravel (Glacial Till).

The upper zone of the clay till stratum has a brown colour, shows signs of weathering and was often found to be fissured. Below the creek bed level, the colour changes to grey, however there is no significant change in moisture content or shear strength.

Atterberg limit and moisture content tests were performed on 2 samples as a means of classification and as a guide to the probable behaviour of the soil. These gave values of Liquid Limit of 27% and 28%; Plastic Limit of 14% and 13%; and Plasticity Index of 13 and 15, indicating that the soil is a clay of low plasticity and compressibility. The Liquidity Indices which relate the natural moisture content of the clay to the Atterberg Limits were 0.1 and 0.2, confirming the 'very stiff' consistency obtained from visual and tactile examination.

#### IV GROUNDWATER CONDITIONS.

The groundwater in the boreholes reached equilibrium at an average El. 77.5, which was about 26 inches above the creek bed elevation.

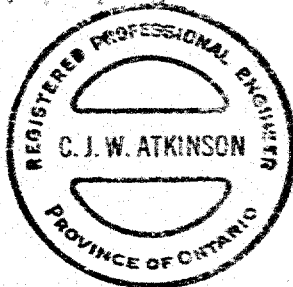
#### V DISCUSSION AND RECOMMENDATIONS

The natural subsoil consists of very stiff to hard silty clay till which will be suitable for the support of normal spread footing foundations.

The bed of the creek extends to El. 75.7 therefore allowing 4 feet of cover for frost protection, the footing grade will be established at about El. 71. This level lies within the stratum of hard silty clay till, and on the basis of the borehole results a maximum net soil pressure of 8000 pounds per square foot is appropriate for the design of footings. Furthermore the footings will have a factor of safety of 3 against shear failure of the underlying soil.

It is estimated that total settlement of footings mobilizing the above 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. and the factor of safety against horizontal sliding of the abutments should be at least 1.5. The very stiff to hard cohesive till will present no unusual construction problems. The sides of excavation will remain vertical for short periods of time which will be sufficient to pour the footings against undisturbed soil. Seepage into excavations will be very small and if necessary, it could be collected in sumps dug below the footing grade and removed by pumping.



Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED.

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

CJWA:/jc



## APPENDIX A

### STANDARD PENETRATION TESTS

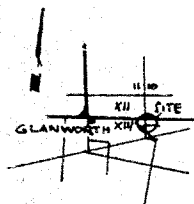
In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

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 in. 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 used is one originally developed by the 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:

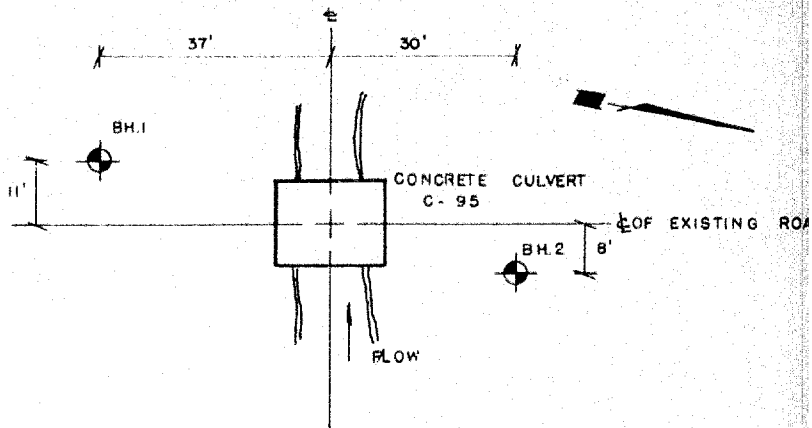
Values of N	Density
Less than 10	Loose
Between 10 and 30	Compact
Between 30 and 50	Dense
Greater than 50	Very dense

B.M. NO. 2 NAIL IN 24" TREE  
STUMP AT STA. 19 + 38  
EL. 81.37



KEYPLAN

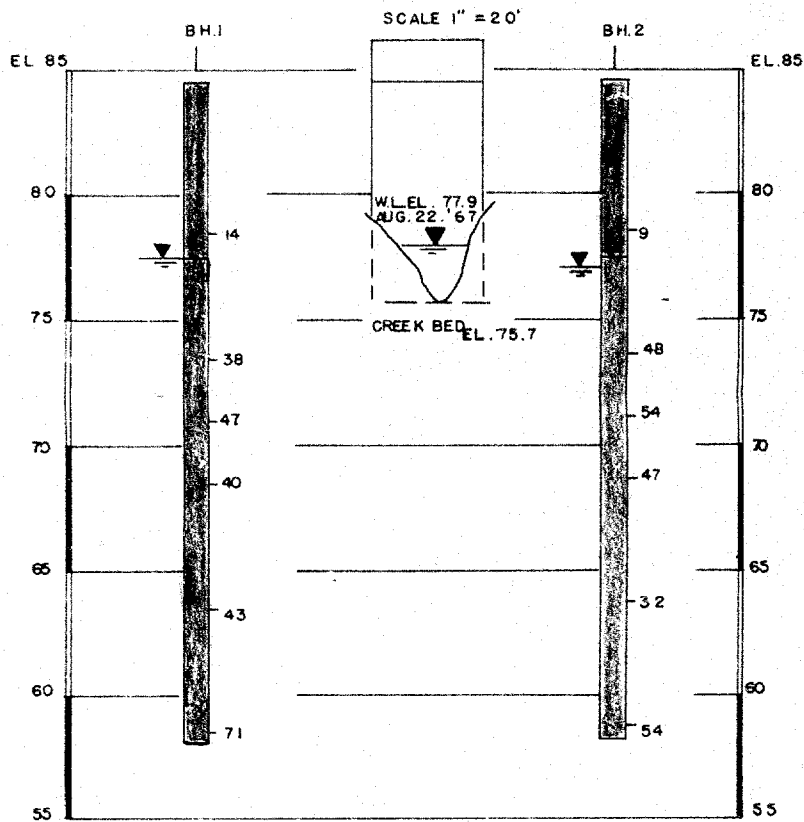
TWP  
OF  
WESTMINSTER



LOCATION OF BOREHOLES

● LOOSE TO COMPACT  
CLAYEY SILT FILL

● VERY STIFF TO HARD  
SILTY CLAY, TILL



SUBSURFACE PROFILE

VERT. SCALE 1" = 5'

OUR REFERENCE NO 7-8-L8

## GEOTECHNICAL DATA SHEET FOR BOREHOLE .12 . . .

CLIENT: County of Middlesex,  
PROJECT: Proposed Culvert C-95LOCATION: Lots 10 & 11, Conc. 8, Township of Westminster.  
DATUM ELEVATION: BM.2. El. 81.37 feet.METHOD OF BORING:  
DIAMETER OF BOREHOLE:Washboring  
BX (3-inch)  
August 23, 1967

ENCLOSURE NO. 2

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %				REMARKS
				NUMBER	TYPE	N <sub>60</sub> or Equivalent of SPT	20	40	60	80	100	FL	W	LI		
							SHEAR STRENGTH      lbs. sq. ft.					10   20   30   40				
85.5	0.0	Ground surface.														
85		Compact brown sand, clayey silt (Fill)	X	1	SS	14										
7.0		Very stiff to hard silty clay, trace of gravel (Glacial Till)	Brown Grey X	2	SS	38										
80			X	3	SS	47										
75			X	4	SS	40										
70			X	5	SS	43										
65			X	6	SS	71										
65		End of Borehole														
60																

W.L.  
El. 77.5

VERTICAL SCALE: 1 IN. TO

5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CHKD:

OUR REFERENCE NO 7-8-L8

## GEOTECHNICAL DATA SHEET FOR BOREHOLE 2

CLIENT County of Middlesex

PROJECT Proposed Culvert C-95

LOCATION Lots 10 &amp; 11, Concession 8, Twp. of Westminster.

DATUM ELEVATION BM. 2. El. 81.37 feet.

METHOD OF BORING Washboring

DIAMETER OF BOREHOLE Bx (3-inch)

DATE August 22, 1957.

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	NO. OF TESTS	20	40	60	80	100	PL	W	
							10 20 30 40							
							10 20 30 40							
85.6	0.0	Ground Surface.												
80	7.0	Loose to compact brown sandy clayey silt (Fill)	X	1	SS	9								
75		Very stiff to hard silty clay, trace of gravel (Glacial Till)	T	2	SS	48								
		Brown Grey	X	3	SS	54								
70			X	4	SS	47								
			T											
65			X	5	SS	32								
			T											
60	26.5		X	6	SS	54								
		End of borehole.												

W.L.  
 El. 77.1