

#69-F-227M

SITE 5-90

BRIDGE #31



DOMINION SOIL INVESTIGATION LIMITED
CONSULTING SOIL & FOUNDATION ENGINEERS

HEAD OFFICE

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SCARBOROUGH, ONT.
CANADA
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ASSOCIATED COMPANY

SOIL TESTING AND ENGINEERING LTD.
39 BRENTFORD ROAD
KINGSTON 3, JAMAICA
WEST INDIES

69-F-227 M

A. M. SPRIET & ASSOCIATES LIMITED
CONSULTING ENGINEERS
LONDON ONTARIO

20-69

Report on
SOIL INVESTIGATION
for
BRIDGE NO 31
TOWNSHIP OF YARMOUTH

by

DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON 14, ONTARIO

Our Reference 9-9-L11
October 22, 1969.

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SUMMARY

The natural soil profile consists of a dense to very dense silt stratum, which extends to a depth of about 4 feet below the creek, overlying hard sandy clayey silt till.

It is recommended that the footing grade be established within the sandy clayey silt till stratum at or below El. 137, using a maximum allowable soil pressure of 5 tons per square foot. Total settlement of the footings is estimated to be 0.5 inch or less.

No unusual construction problems are anticipated.



I INTRODUCTION

In accordance with verbal authorization from A. M. Spriet & Associates Limited, Consulting Engineers, a soil investigation has been carried out in the Township of Yarmouth, where it is proposed to replace an existing road bridge with a new structure.

The site is located on the Edgeware Road at Lots 18 and 19 of the Township where the road crosses the East Catfish Creek.

It is understood that the new structure will be a 30 foot span rigid frame, and that it will be centered on the existing bridge. The requirements of the project were discussed with Mr. W. E. Kelley, 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.

II FIELD WORK

The field work, consisting of two boreholes and two dynamic cone penetration tests, was carried out on October 2, 3 and 6, 1969, at the locations shown on Enclosure 1. The boreholes were advanced by wash-boring techniques and were lined with Bx size casing.

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.

The dynamic cone penetration tests were performed adjacent to the borehole locations to obtain an indication of soil density and strata changes with depth.

The field work was supervised by a soils engineer who also determined the ground surface elevations. These were referred to a nail in a tree, 40 feet north of station 7+20, which was taken as El. 156.9 feet.

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata, which were 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:

Brown/grey Silt with traces of clay and gravel

This stratum extends down to El. 139.5 at borehole 1 location and to El. 137.7 at borehole 2 location. The relative density of the silt is described as 'dense' to 'very dense' based on 'N' values ranging from 43 blows per foot to 100 blows for less than 1 foot penetration of the sampler.

Both the dynamic cone penetration tests were terminated in this stratum.

Grey sandy clayey Silt with some gravel

Due to the clay content this material is regarded as being plastic and cohesive, and the consistency is described as 'hard' based on 'N' values ranging from



43 blows per foot to 100 blows for less than 1 foot penetration of the sampler.

Atterberg Limit tests were performed on two samples of the clayey silt, giving values of Liquid Limit of 14% and 19%, Plastic Limit of 11%, and Plasticity Index of 3% and 8%. The corresponding Liquidity Indices were -0.7 and -0.3, confirming the 'hard' consistency obtained from visual and tactile examination. The moisture content within the clayey silt stratum ranges from 7% to 11%.

IV GROUNDWATER CONDITIONS

The water levels in the boreholes reached equilibrium at an average El. 144.9, which is slightly above the level of the water in the adjacent creek.

V DISCUSSION AND RECOMMENDATIONS

The natural soil profile consists of 'dense' to 'very dense' silt and hard sandy clayey silt strata, which are suitable for the support of normal spread footing foundations. It is recommended that the footing grade be established within the clayey silt stratum

at or below El. 137 to minimize possible disturbance at the footing grade, and on the basis of the borehole results a maximum allowable soil pressure of 5 tons per square foot is appropriate for the design of the footings. This soil pressure incorporates a factor of safety of 3 against shear failure of the underlying soil.

Total settlement of a 5 foot wide footing mobilizing the above soil pressure is estimated to be 0.5 inch, and in view of the similar conditions encountered in the two boreholes no appreciable differential settlement is anticipated.

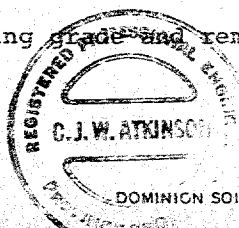
The adhesion between the footings and the clayey silt till may be taken at 0.35 times the vertical loading of the footing or 2,000 p.s.f., whichever is the lower value, and the factor of safety against sliding of the abutments should be at least 1.5.

Dewatering of excavations should not be especially difficult due to the impervious nature of the subsoil. Seepage should 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



APPENDIX 'A'.

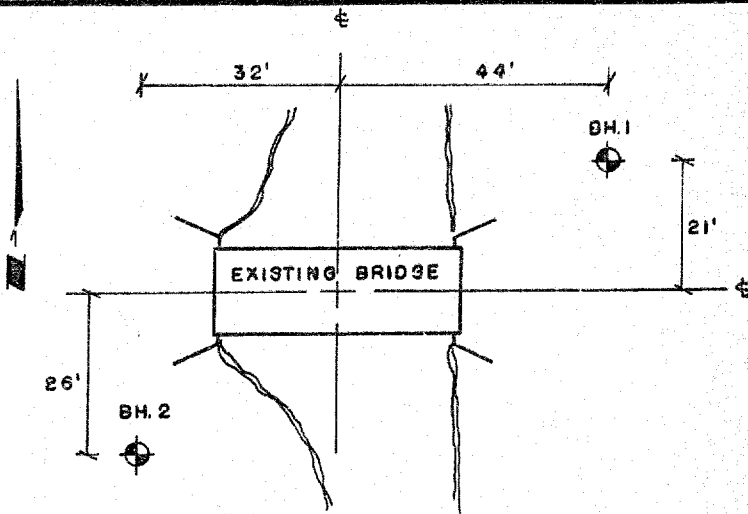
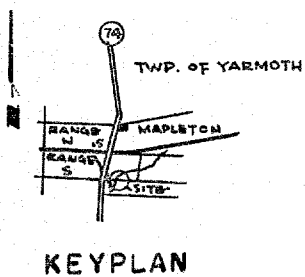
THE STANDARD PENETRATION TEST.

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-ins. 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:-

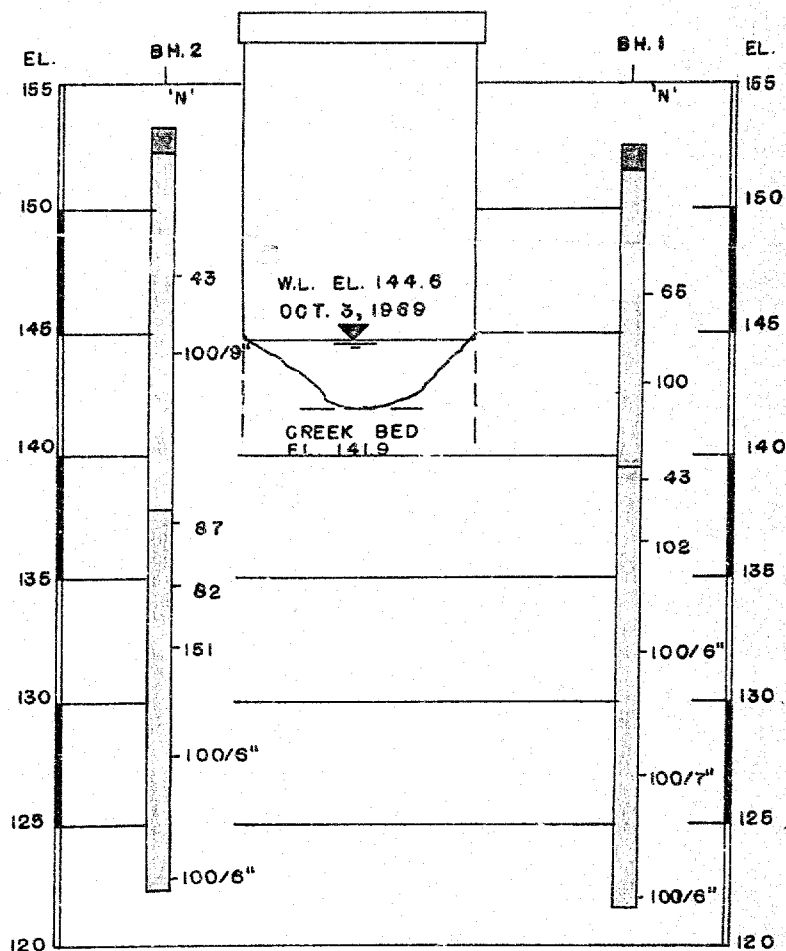
Values of 'N'.	Density.
Less than 10	Loose
Between 10 and 30	Compact
Between 30 and 50	Dense
Greater than 50	Very dense.



LOCATION OF BOREHOLES
SCALE 1" = 20'

LEGEND

- TOPSOIL
- VERY DENSE SILT
- HARD CLAYEY SILT, TILL



SUBSURFACE PROFILE
VERT. SCALE 1" = 5'

LOG OF BOREHOLE.....1.....

Our Reference No. 9-9-L11.....

Enclosure No. 2.....

CLIENT: A.M. Spriet & Associates Limited,
PROJECT: Proposed Bridge No. 31,
LOCATION: Township of Yarmouth
DATUM ELEVATION: Nail in tree, El. 156.9 feet

DRILLING DATA

Method: Washboring
Diameter: Bx (3-inch)
Date: October 2nd & 3rd, 1969

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE					WATER CONTENT %			REMARKS	
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows / Foot	Blows / Foot					PLASTIC LIMIT	NATURAL		LIQUID LIMIT
								20	40	60	80	100				
								UNDRAINED SHEAR STRENGTH + FIELD VANE TEST								
								lbs./sq. ft.					W _p W W _L			
								10 20 30 40 50								
152.50.0		Ground Surface														
	1.0	Topsoil														
150.0		Very dense brown silt, with traces of clay and gravel			1	SS	65									
145.0					2	SS	100									
140.0	13.0	Hard grey sandy clayey silt, with a trace of gravel (Glacial Till)			3	SS	43									
135.0					4	SS	102									
130.0					5	SS	100	6"								
					6	SS	100	7"								
125.0					7	SS	100	6"								
120.0		End of Borehole														

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CHECKED:

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

Our Reference No. 9-9-L11

Enclosure No. 3

CLIENT: A.M. Spriet & Associates Limited,
PROJECT: Proposed Bridge No. 31,
LOCATION: Township of Yarmouth
DATUM ELEVATION: Nail in tree, El. 156.9 feet

DRILLING DATA

Method: Washboring
Diameter: Bx (3-inch)
Date: October 3rd & 6th, 1969

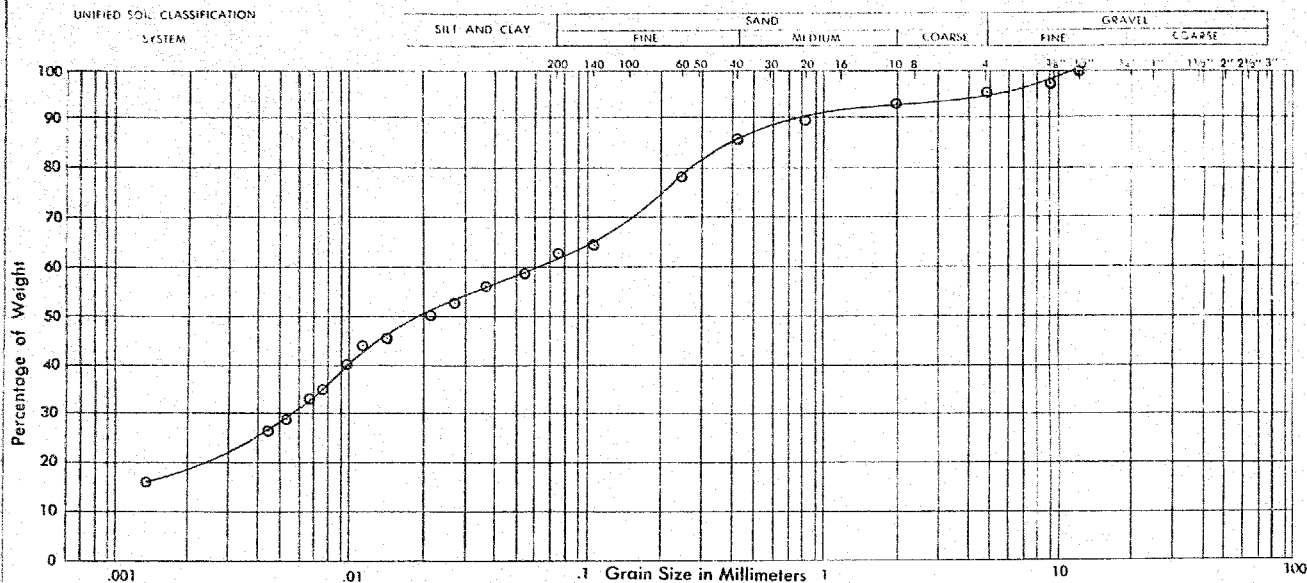
SUBSURFACE PROFILE				SAMPLES				PENETRATION RESISTANCE					WATER CONTENT %			REMARKS	
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TY:	'N' Blows / Foot	Blows / Foot					PLASTIC LIMIT W _p	NATURAL W	LIQUID LIMIT W _L		
								20	40	60	80	100					
								UNDRAINED SHEAR STRENGTH + FIELD VANE TEST									COMPRESSION TEST lbs/sq. ft.
								10					20 30 40 50				

53.2	0.0	Ground Surface																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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DOMINION SOIL INVESTIGATION LIMITED

GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 9-9-111



PROJECT: Proposed Bridge No.31

LOCATION: Township of Yarmouth

BOREHOLE NO.: 1

SAMPLE NO.: 4

DEPTH OF SAMPLE: 17½ feet

ELEVATION OF SAMPLE: 137 feet

COEFFICIENT OF UNIFORMITY

COEFFICIENT OF CURVATURE

PLASTIC PROPERTIES:

LIQUID LIMIT % =

PLASTIC LIMIT % =

PLASTICITY INDEX % =

MOISTURE CONTENT % =

ACTIVITY % =

Classification of Sample and Group Symbol:

SANDY CLAYEY SILT WITH A TRACE OF GRAVEL.

Enclosure No. 4