

67-F-237M

ELGIN COUNTY BRIDGE #62

COUNTY ROAD 52

BA 2515

Site 5-92

DOMINION SOIL INVESTIGATION LIMITED

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LONDON ONTARIO

67-F-237.17

Report on
SOIL INVESTIGATION
for
ELGIN COUNTY BRIDGE NO. 62
COUNTY ROAD 52

by
DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO

Reference No. 6-11-L19
January 9th, 1967.

DOMINION SOIL INVESTIGATION LIMITED

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SUMMARY

The two boreholes revealed the following general ground succession:- topsoil or road ballast (1'-0" thick); sandy or silty clay (2'-0" to 8'-6" thick); and hard silty clay till (maximum penetrated 18'-6").

It is recommended that the structure be supported on spread footing foundations at or below El. 86, using a maximum net soil pressure of 10,000 p.s.f. Total settlement is estimated to be less than 1/2 inch.

No unusual construction problems are anticipated.

I INTRODUCTION

Verbal authorization was received from A. M. Spriet and Associates, Consulting Engineers, to carry out a soil investigation at a site in the County of Elgin where it is proposed to replace an existing road bridge with a new structure.

The existing structure is located on Lot 18 of the road allowance between Concession 10 of ~~Westminster~~ ^{York} Township and Range 2 North of the Edgeware Road.

It is understood that the proposed structure is a concrete rigid frame and that the centre line will be the same as the existing bridge. The requirements of the project were discussed with Mr. A. M. Spriet, 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.

II FIELD WORK

The field work, consisting of 2 boreholes, was carried out on December 28 and 30, 1966, at the locations shown on Enclosure 2. The holes were advanced to the sampling depths by washboring methods and were lined with Bx size casing.

Cont'd over....

Standard Penetration Tests using a 2-inch outside diameter split-spoon sampler were performed at frequent intervals of depth, using a driving force of a 140 lb. hammer falling freely through 30-inches. 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 required to drive the sampler a further 12-inches was recorded as the standard penetration resistance (or 'N' value). This test determines the relative density of granular strata and gives an indication of the consistency of cohesive strata. It also enables samples to be obtained for classification purposes.

The results of the field tests are presented on the Geotechnical Data Sheet, Enclosure 3. Elevations were referred to the deck of the existing bridge, which was given the arbitrary value, El. 100 feet.

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered in each borehole are given on the Geotechnical Data Sheet, comprising Enclosure 3, and a general picture of the soil stratigraphy is given in the form of a Subsurface Profile on Enclosure 2.

The boreholes revealed the following general ground succession:-

Cont'd over....

	<u>Thickness</u>	
	<u>Borehole 1</u>	<u>Borehole 2</u>
(a) Topsoil or Road Ballast	1'- 0"	1'- 0"
(b) Brown sandy or silty clay fill, associated with the construction of the approaches to the existing bridge.	2'- 0"	8'- 6"
(c) Grey silty clay containing traces of sand and fine gravel (Glacial Till). Due to the clay content the till should be regarded as a cohesive and plastic material. The consistency is described as 'hard' as indicated by standard penetration test results ranging from 34 to 94 blows per foot.	18'- 6" Penetrated	17'- 0"

IV GROUNDWATER CONDITIONS

Due to the impervious nature of the subsoil it was not possible to observe the groundwater table during the drilling operation. However for dewatering purposes it can be assumed that seepage into excavations will be very small, and may be controlled by pumping from sumps dug below the footing grade.

V LABORATORY TESTS

A series of laboratory tests were performed on samples of the silty clay till stratum in which spread footings will bear, if such a design is used.

Cont'd over....

Atterberg Limit and moisture content tests were carried out 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 16% and 22%; Plastic Limit of 9% and 11% and Plasticity Index of 7 and 11 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 -0.3 and 0.0 indicating a 'very stiff' consistency.

The results of the Atterberg Limit and moisture content tests are plotted graphically on the Geotechnical Data Sheet for each borehole.

VI DISCUSSION

The natural subsoil consists of 'hard' silty clay till which will be suitable for the use of normal spread footing foundations.

The bed of the creek extends to El. 90.0, therefore allowing 4 feet of cover for frost protection it is recommended that footings should bear at or below El. 86.0. The footing depth should be decided after a hydrological study has been made to determine the maximum depth of scour. 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 10,000 pounds per square foot is appropriate for the

Cont'd over....

design of footings. Furthermore the footings will have a factor of safety of at least 3 against shear failure of the underlying soil.

It is estimated that total settlement will not exceed 1/2 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 'hard' cohesive till will present no unusual construction problems. The volume of seepage into excavations will be very small and 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

CJWA:jms

Enclosures

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø	> 8"	3"	3/4"	4.75mm	2.0	0.42	0.074	0.002	>	NO SIZE LIMIT		
U.S. Standard Sieve Size :		No. 4		No. 10		No. 40		No. 200				

SAMPLE TYPES.

AS Auger sample

CS Sample from casing

ChS Chunk sample

RC Rock core

% Recovery

SS Split spoon sample

TP Piston, thin walled tube sample

TW Open, thin walled tube sample

WS Wash sample

SAMPLER ADVANCED BY static weight : w
 " pressure : p
 " tapping : t

OBSERVATIONS
 MADE WHILE
 CORING

Steady pressure
 No pressure
 Intermittent pressure

Washwater returns
 Washwater lost

PENETRATION RESISTANCES.

DYNAMIC PENETRATION RESISTANCE : to drive a 2", 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia. split spoon sampler 1 foot into the ground, expressed in blows per foot.

SYMBOL:



322

EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SOIL PROPERTIES.

W% Water content

LL% Liquid limit

PL% Plastic limit

PI% Plasticity index

LI Liquidity index

 γ

Natural bulk density (unit weight)

e

Void ratio

RD

Relative density

C_v

Coeff. of consolidation

m_v

Coeff. of volume compressibility

k Coeff. of permeability

C Shear strength in terms of total stress

 ϕ

Angle of int. friction

C'

Cohesion in terms of effective stress

 ϕ'

Angle of int. friction

UNDRAINED SHEAR STRENGTH.

- DERIVED FROM -

TRIAXIAL

UNCONFINED

LABORATORY

FIELD

COMPRESSION TEST

VANE TEST

POCKET PENETROMETER TEST



Strain at failure is represented
 by direction of stem

20%
 15% + 5%
 10%

St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

SOIL DESCRIPTION.

COHESIONLESS SOILS :

RD :

Very loose

Loose

Compact

Dense

Very dense

0 - 15 %

15 - 35 %

35 - 65 %

65 - 85 %

85 - 100 %

COHESIVE SOILS :

C lbs./sq ft.

Very soft

Soft

Firm

Stiff

Very stiff

Hard

less than 250

250 - 500

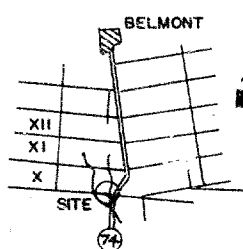
500 - 1000

1000 - 2000

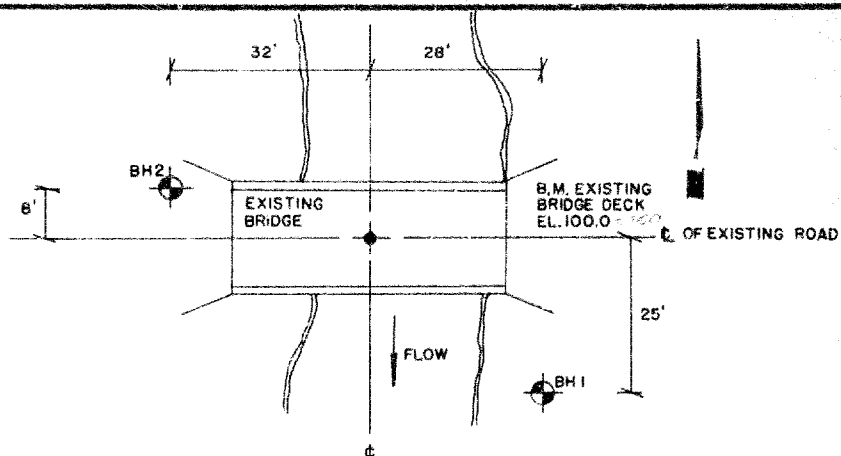
2000 - 4000

over 4000

COUNTY
OF
ELGIN








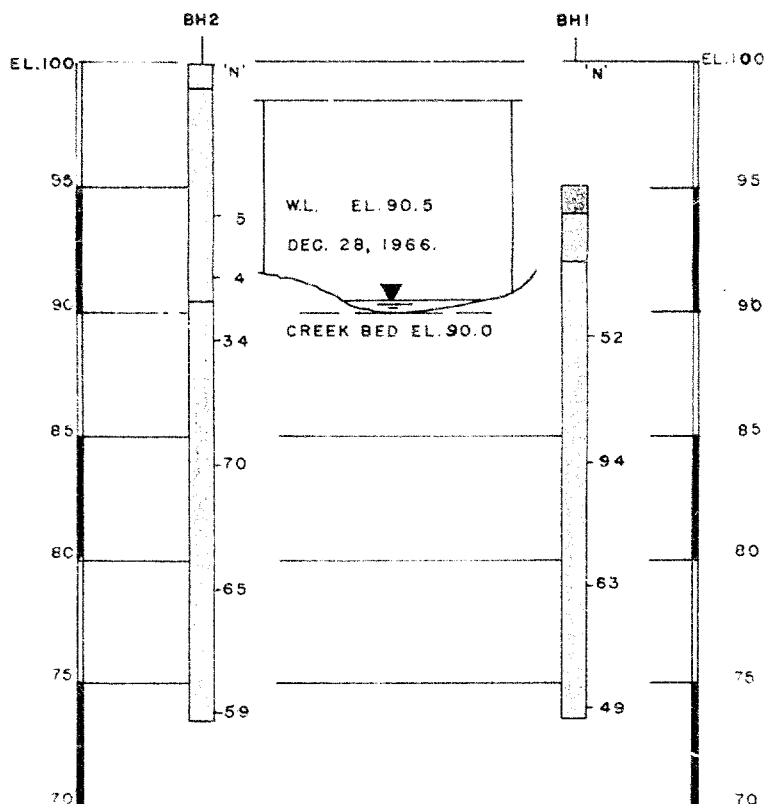
KEY PLAN



LOCATION OF BOREHOLES
SCALE 1" = 20'

LEGEND

-  TOPSOIL
-  SAND & GRAVEL
-  SANDY CLAY
-  CLAY FILL
-  HARD SILTY CLAY TILL



SUBSURFACE PROFILE

VERT. SCALE 1" = 5'

GEOTECHNICAL DATA SHEET FOR BOREHOLES 1 & 2.

OUR REFERENCE NO 6-11-119

CLIENT A. M. Spriet & Associates

PROJECT Bridge 62

LOCATION County of Elgin

DAIUM ELEVATION 100 feet, existing bridge deck.

METHOD OF BORING Washboring

DIAMETER OF BOREHOLE Bx (3-inch)

DATE December 28 & 30, 1966

ENCLOSURE NO 3

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE Blows per foot					CONSISTENCY Water content %			REMARKS
				NUMBER	TYPE	WATER CONTENT	20	40	60	80	100	PL	W	LL	
Borehole 1															
95.1	0.0	Ground Surface													
	1.0	Topsoil	~ ~ ~												
	3.0	Brown sandy clay.	~ ~ ~												Impervious soil
90		Hard grey silty clay, traces of sand and fine gravel	~ ~ ~	1	SS	52									
85			~ ~ ~	2	SS	94									
80			~ ~ ~	3	SS	63									
75			~ ~ ~	4	SS	49									
	21.5	(Glacial Till)	~ ~ ~												
		End of Borehole													
Borehole 2															
99.9	0.0	Ground Surface													
	1.0	Sand & gravel	~ ~ ~												Impervious soil
		Brown silty clay, trace of gravel (Fill)	~ ~ ~	1	SS	5									
95			~ ~ ~	2	SS	4									
90	9.5	decomposed wood fragments	~ ~ ~	3	SS	34									
		Hard grey silty clay, traces of sand and fine gravel.	~ ~ ~	4	SS	70									
85			~ ~ ~	5	SS	65									
80			~ ~ ~												
75		(Glacial Till)	~ ~ ~	6	SS	59									
	26.5	End of Borehole													

VERTICAL SCALE: 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE

CHD: