

# 66-F-270 M

CULVERT

LOTS  $7/8$ , CONS.  $2/3$

NORTH DORCHESTER TWP.

DOMINION SOIL INVESTIGATION LIMITED  
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FOUNDATION ENGINEERS

ASSOCIATED COMPANY  
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KINGSTON 5, JAMAICA, WEST INDIES  
TELEPHONE: 68989

London  
October 13, 1966

Report  
6-9-L3

A. M. Spriet & Associates Ltd.,  
264 Wellington Street,  
LONDON, Ontario.

Gentlemen:

Soil Investigation for Proposed  
Culvert, Lots 7 & 8, Concs. 2 & 3  
Township of North Dorchester.

REPORT

We have completed this project in accordance with your verbal authorization of September 21, 1966. This report contains a record of our findings and presents our recommendations for the foundation design of the proposed structure.

FIELD WORK

The field work, consisting of one borehole was carried out on September 20, 1966 at the location shown on Enclosure 2. The hole was advanced by washboring methods, and was lined with Bx casing.

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 a spike in a hydro pole, southwest of the existing structure, which was given the arbitrary value, El. 100 feet.

Cont'd over....

SUBSURFACE CONDITIONS

The borehole penetrated a 1 foot thick layer of road ballast overlying a 5 foot thick layer of clay fill which constitutes the existing road embankment.

Natural soil consisting of glacial sandy silty clay containing a trace of gravel was encountered at El. 92, and the borehole was terminated in a stratum of silty fine sand at El. 77 $\frac{1}{2}$ .

The consistency of the clay till is described as 'very stiff' to 'hard' as indicated by 'N' values ranging from 59 to 66 blows per foot. Atterberg Limit tests carried out on a sample of the clay till gave a Liquid Limit value of 17%; Plastic Limit of 9% and Plasticity Index of 8, indicating that the soil is a clay of low plasticity and compressibility. The Liquidity Index which relates the natural moisture content of the Atterberg Limits was -0.1 confirming the very stiff consistency obtained from visual and tactile examination.

The relative density of the silty fine sand stratum is described as 'very dense' based on an 'N' value of 75 blows per foot.

The water level observed in the borehole was at El. 90.8 feet, while the water level in the adjacent creek was at El. 91.3 feet.

DISCUSSION

The bed of the creek extends to El. 91.0 therefore allowing 4 feet of cover for frost protection it is recommended that footings should bear at or below El. 87. 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 very stiff to hard 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 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 of footings mobilizing the above soil pressure will not exceed 1/2 inch.

The very stiff cohesive soil will present no unusual construction problems. The volume of seepage into excavations will probably be very small and should be collected in sumps dug below the footing level 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

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

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 7/8mm	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	RC Rock core	TP Piston, thin walled tube sample
CS Sample from casing	% Recovery	TW Open, thin walled tube sample
CHS Chunk sample	SS Split spoon 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" dia, 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.

EXTRAPOLATED -N- VALUE

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

SYMBOL :



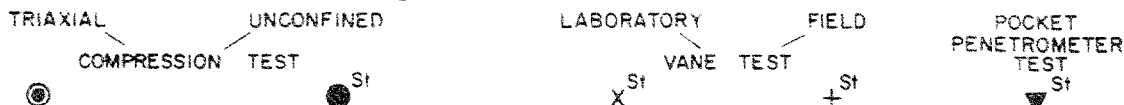
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## SOIL PROPERTIES.

W % Water content	$\gamma^*$ Natural bulk density (unit weight)	k Coeff of permeability
LL % Liquid limit	e Void ratio	C Shear strength in terms of total stress
PL % Plastic limit	RD Relative density	$\phi$ Angle of int friction in terms of effective stress
PI % Plasticity index	$C_v$ Coeff of consolidation	$C'$ Cohesion
LI Liquidity index	$m_v$ Coeff of volume compressibility	$\phi'$ Angle of int friction

## UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —



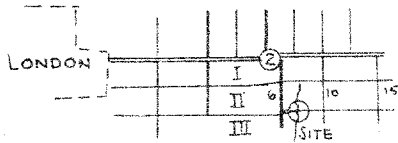
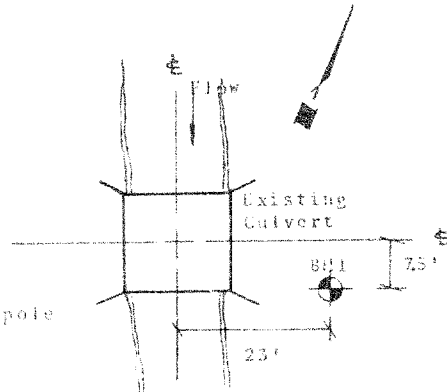
Strain at failure is represented by direction of stem  
 20%  
 15% + 5%  
 10%

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

## SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	COHESIVE SOILS :	C lbs./sq ft
Very loose	0 - 15 %	Very soft	less than 250
Loose	15 - 35 %	Soft	250 - 500
Compact	35 - 65 %	Firm	500 - 1000
Dense	65 - 85 %	Stiff	1000 - 2000
Very dense	85 - 100 %	Very stiff	2000 - 4000
		Hard	over 4000

B.M. Spike in Hydro pole  
El. 100 feet

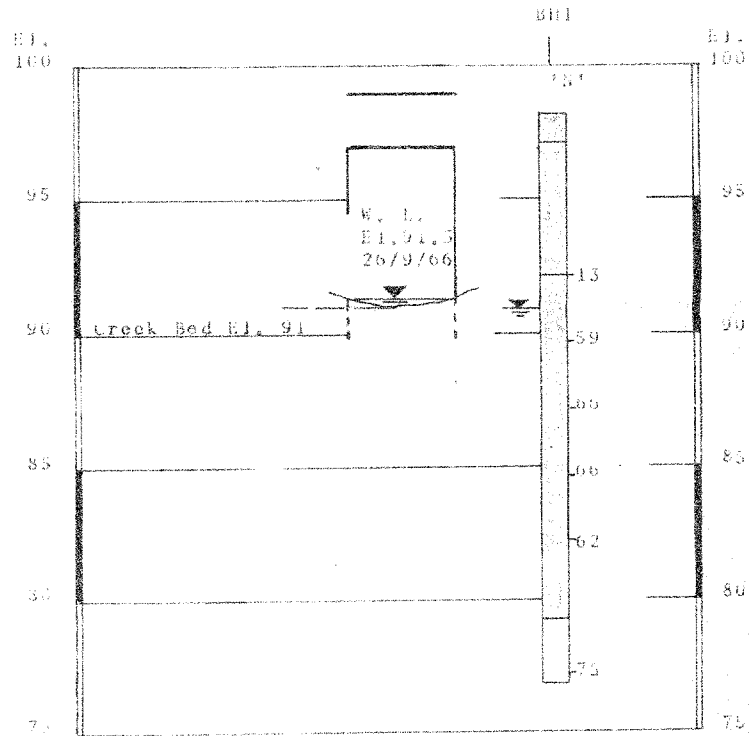


KEYPLAN

LOCATION OF BOREHOLE  
Scale 1-inch to 20 feet

LEGEND

- Ballast
- Clayey Fill
- Very Stiff to Hard Sandy Silty Clay, 1111.
- Very Loose Silty Fine Sand.



SUBSURFACE PROFILE

Vert. Scale 1-inch to 5 feet

# GEOTECHNICAL DATA SHEET FOR BOREHOLE 1

OUR REFERENCE NO. 6-9-L8

CLIENT: A. M. Spriet & Associates

PROJECT: Proposed Bridge

LOCATION: Lots 7 & 8, Conc. 2 & 3, Twp. of  
DATUM ELEVATION: 100 feet (See Incl. 2, Dorchester)

METHOD OF BORING: Washboring  
DIAMETER OF BOREHOLE: 8x (3-inch)

ENCLOSURE NO. 3

DATE: September 26 & 27, 1966

ELEVATION F.	DEPTH F.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %				REMARKS
				NUMBER	TYPE	28 Days Strength	20	40	60	80	100	PL	W	LI	
98.1	0.0	Ground Surface													
	1.0	Ballast													
95		Brown clayey													
	6.0	Fill		1	SS	13									
90		Very stiff to hard sandy		2	SS	59									
		silty clay, traces of		3	SS	66									
85		gravel.		4	SS	66									
		(Glacial Till)		5	SS	62									
80															
	19.0	Very dense grey silty fine sand		6	SS	75									
	21.5														
75		End of Borehole													

W. L.  
11. 90.8  
September  
27, 1966.