

# 64-F-270m

BRIDGE BR. <sup>#</sup>139

LOT <sup>#</sup>21, CON VI

LOGAN

TWP.

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CONSULTING ENGINEER  
GODERICH ONTARIO

BR. 1962

25-1213

Report on  
SOIL INVESTIGATION  
for  
BRIDGE BR 139  
LOT 21, CONCESSION VI  
TOWNSHIP OF LOGAN

by  
DOMINION SOIL INVESTIGATION LIMITED  
363 Queens Avenue  
LONDON ONTARIO  
Reference No. 4-10-L9  
October 30th, 1964

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SUMMARY

The strata consist of very dense cohesive glacial deposits.

It is recommended that the structure should be supported on spread footings bearing at El. 1112 and using a maximum net soil pressure of 10,000 pounds per square foot. The estimated consolidation settlement is less than 1 inch and no appreciable differential settlement is expected.

No unusual construction problems are anticipated.

## I INTRODUCTION

Verbal authorization was received from Mr. B. M. Ross's office on the 16th of October, 1964 to carry out a soil investigation at a site in the Township of Logan where it is proposed to replace an existing road bridge with a new structure.

The existing structure, which has collapsed, has a clear span of 78.5 feet. It is understood that the new bridge will probably be a concrete rigid frame with a span of 60 to 65 feet with its north abutment located in the same position as the existing north abutment. The requirements of the project were discussed with Mr. K. G. Dunn 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 was done during the period 22nd to 27th of October, 1964 and consisted of two boreholes at the locations shown on enclosure 2. The holes were advanced by washboring and lined with Bx casing. The progress of the drilling was expedited by the use of diamond coring techniques to penetrate very dense glacial deposits below El. 1110.

Standard penetration tests were performed at frequent intervals of depth to determine the relative density or consistency of the soil and to recover representative samples. Dynamic cone penetration tests were performed adjacent to each borehole. Sections of core from boulders and cobbles were recovered during the process of diamond drilling described above.

The results of the field tests are recorded on enclosure 3. Elevations have been referred to a geodetic bench mark established by the client. (Nail in 2 foot elm 100 feet north of existing structure, El. 1127.02)

## III SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown on enclosure 3 and a general picture of the soil stratigraphy is given in the form of a subsurface profile on enclosure 2.

Both boreholes encountered a shallow deposit of fill which is associated with the construction of the existing bridge. This material, extending to depths of 4 to 5 feet, consists of *firm* to *stiff* brown clayey silt containing traces of organics and gravel.

Natural soil was encountered at an average level of El. 1119 feet. This is a *hard* glacial till deposit consisting mainly of grey silty clay with gravel, cobbles and boulders. In borehole 1 the material is very silty between depths of 4 to 8 feet and is classified as a clayey silt. The gravel content varies from about 5% to 20% and consists of all sizes of angular and sub-angular particles. Occasional very fine (+ 0.1 inch) seams of cohesionless sand and silt were encountered. Limestone cobbles and boulders were found below El. 1110.

The site is located in a wide shallow, glacial spillway now occupied by the North Branch of the River Thames. The soil deposits encountered in this investigation belong to the Stratford Till Plain.

#### IV GROUNDWATER CONDITIONS

Within the duration of the field work, the level of groundwater in the boreholes became established at an average elevation of 1117.9. The level of water in the river at this time was El. 1117.7.

#### V DISCUSSION

It has been shown that the subsoil is a dense cohesive glacial deposit which is suitable for the support of the proposed rigid frame structure.

The bed of the river extends to El. 1116.8 and allowing for scour it is recommended that the footings should bear at El. 1112. This level lies within the very hard till stratum, and on the basis of the field observations a maximum net soil pressure of 10,000 pounds per square foot is recommended for the design of footings. It is estimated that the settlement due to consolidation of the soil below a footing 4 feet wide loaded to 10,000 pounds per square foot will be less than 1.0 inch. In view of the very similar conditions at the two boreholes, no appreciable differential settlement is anticipated.

The coefficient of friction between the footings and the clay till should be taken as 0.35 and the factor of safety against horizontal sliding of the abutments should be at least 1.5. If this can not be achieved by friction alone, the footings should be lowered below the assumed

level of scour. The passive resistance of the soil can then be utilized. The coefficient of passive earth pressure can be taken as 3.0 and the submerged unit weight of the soil as 70 pounds per cubic foot.

The permeability of the strata is generally low with the possible exception of occasional fine seams of sand and silt. The latter may cause some seepage into the excavation, but this will be easily controllable by pumping, and the strata are not unduly susceptible to disturbance. It is anticipated that the sides of the excavation will stand almost vertically without support.



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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 76mm	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	OBSERVATIONS	Steady pressure
"	pressure	p	MADE WHILE	No pressure
"	tapping	t	CORING	Intermittent pressure

Washwater returns	Washwater lost
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## PENETRATION RESISTANCES.

**DYNAMIC PENETRATION RESISTANCE** : to drive a 2" Ø, 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 :



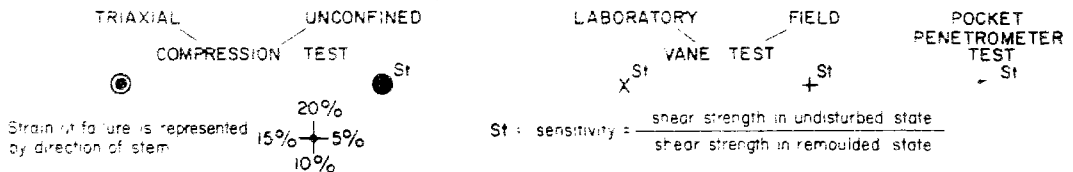
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## SOIL PROPERTIES.

W %	Water content	γ	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	φ	Angle of int. friction in terms of total stress
PI %	Plasticity index	C <sub>v</sub>	Coeff. of consolidation	C'	Cohesion in terms of effective stress
LI	Liquidity index	m <sub>v</sub>	Coeff. of volume compressibility	φ'	Angle of int. friction in terms of effective stress

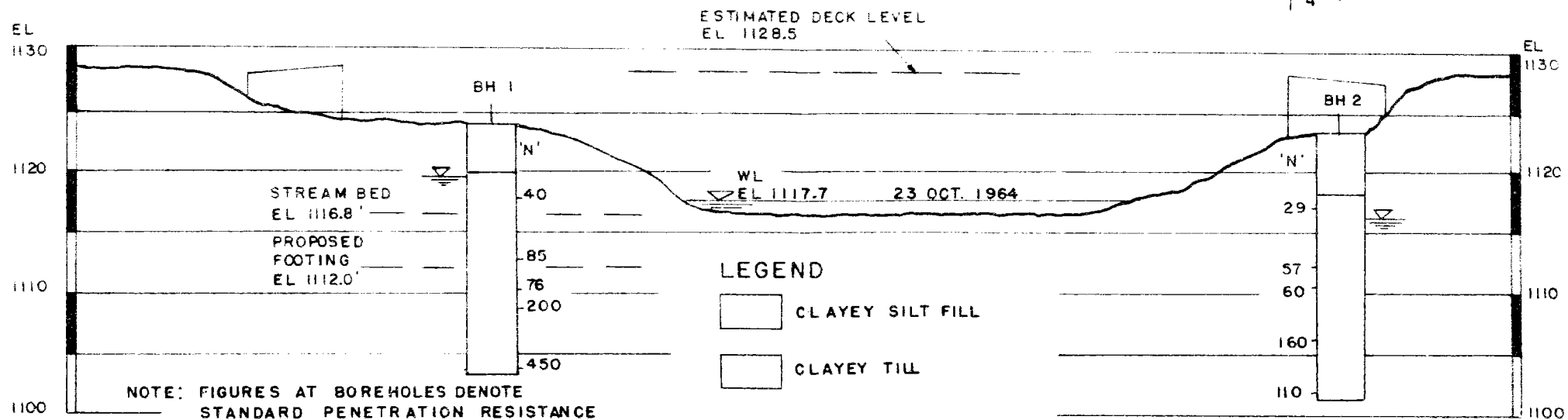
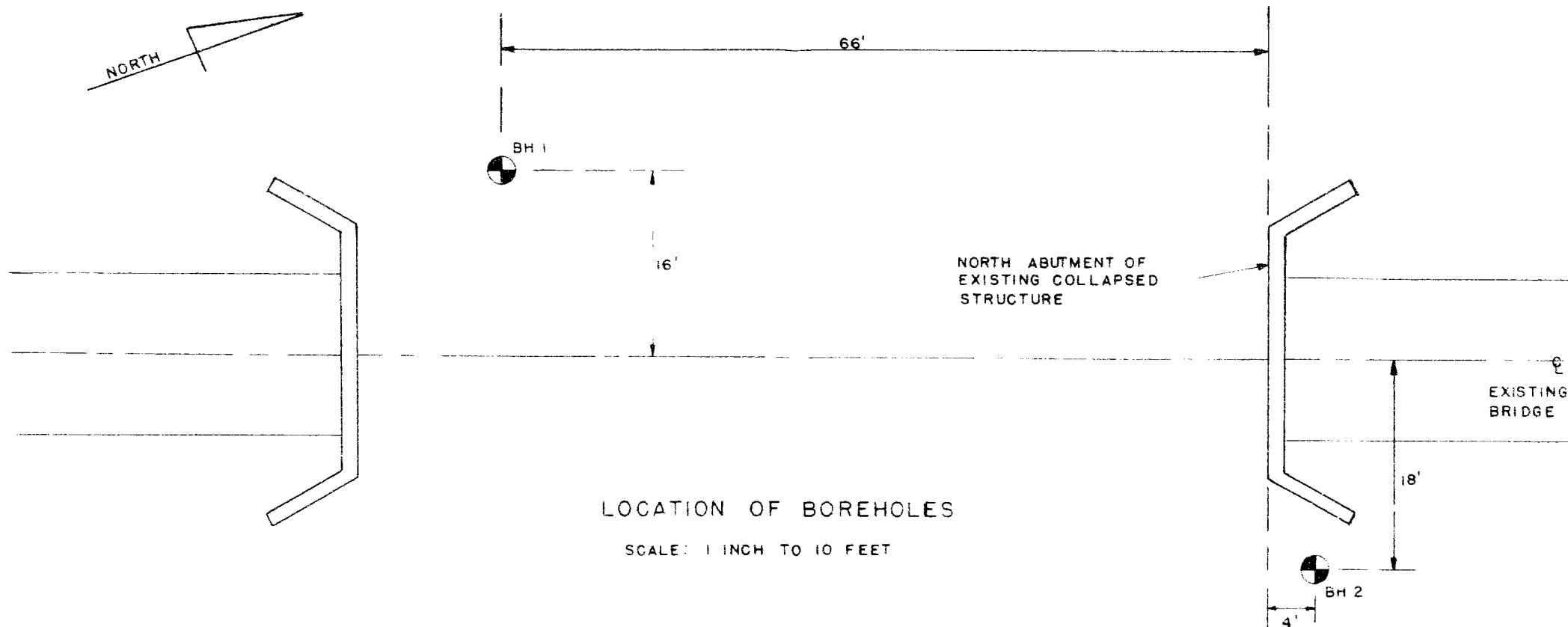
## UNDRAINED SHEAR STRENGTH.

- DERIVED FROM -



## 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



OUR REFERENCE NO. 4-10-19

## GEOTECHNICAL DATA SHEET FOR BOREHOLE 1 and 2

CLIENT: Mr. B. M. Ross  
 PROJECT: Bridge No. RR-139  
 LOCATION: Township of Logan  
 DATUM ELEVATION: Geodetic

METHOD OF BORING: Washboring  
 DIAMETER OF BOREHOLE: Bx (3-inch)  
 DATE: October 22nd and 23rd, 1964  
 ENCLOSURE NO. 3

