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G.I.-30 SEPT. 1976

GEOCRES No. 40 P7-44

DIST. 3 REGION South western

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION LOT 13 CONCESSION

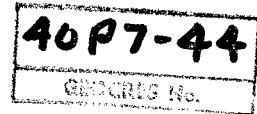
12 WELLESLEY TW?

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: DOCUMENTS TO BE UNFOLDED BEFORE

MICROFILMED

McCARGAR FILER & HACHBORN
CONSULTING ENGINEERS
KITCHENER ONTARIO



Report on
SOIL INVESTIGATION
for
ROAD BRIDGE #33-21
LOT 13, CONCESSION 2
TOWNSHIP OF WELLESLEY

by
DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO
Reference No. 5-5-L11
July 7th, 1965

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SUMMARY

The two borings show that the soil profile consists of firm to stiff clayey silty sand at borehole 1 location (extending down to El. 85) and firm silty clay at borehole 2 location (extending down to El. 83) overlying very dense sandy silt of glacial origin.

It is recommended that the structure should be supported on spread footings at or below El. 82 using a maximum net soil pressure of 8000 pounds per square foot. The estimated total settlement is less than 1 inch.

Construction problems are discussed.

I INTRODUCTION

In accordance with your letters dated May 19th and June 9th, 1965, a soil investigation has been carried out in the Township of Wellesley where it is proposed to replace an existing road bridge with a new structure.

The existing structure is located in Wellesley Village on Lot 13, Concession 2 of the Township, and the bridge site is numbered 33-21. The requirements of the project were discussed with Mr. E. G. Hachborn, 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 to a depth of 26 feet 6 inches was carried out during the period June 10th to 16th, 1965, at the locations shown on Enclosure 2. Borehole 1 was advanced by washboring and diamond drilling techniques and borehole 2 was advanced by washboring methods only. Both holes were lined with Bx casing.

Standard Penetration Tests, using a 2" outside diameter split-spoon sampler were performed at frequent intervals of depth in borehole 2. In borehole 1 penetration of the sampler was not possible due to the density of the subsoil and also probably due to the presence of material exceeding coarse gravel size. The number of blows required to drive the sampler one foot, after initial penetration of 6 inches using an energy of 350 foot pounds per blow, were 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 are presented on the Geotechnical Data Sheets, Enclosures 3 and 4.

Dynamic cone penetration tests were performed adjacent to borehole 1 and 2 locations to compare relative properties of the soil at each location.

Elevations were referred to a site benchmark which was indicated by the client (centre of road surface at centre of bridge El. 100 feet).

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered in each borehole are given on the Geotechnical Data Sheets, comprising Enclosures 3 and 4 and a general picture of the soil stratigraphy is given in the form of a Subsurface Profile on Enclosure 2.

The borings revealed the following general ground succession:-

	<u>Thickness</u>
(a) Sand and gravel Fill.	3'-6"
(b) Brown clayey silty sand with fine gravel, organics (borehole 1 only).	11'-6"
(c) Grey/brown silty clay with sand and fine gravel, organics (borehole 2 only).	13'-0"
(d) Grey sandy silt with fine gravel, (Glacial Till). The relative density of this stratum is described as 'very dense' based on Standard Penetration test results ranging from 82 to 146 blows per foot.	penetrated 10'-6" in borehole 1

IV GROUNDWATER CONDITIONS

The water level in the pond at the time the field work was carried out was at El. 95.1. In borehole 1 the water level was recorded at El. 94.8 and in borehole 2 at El. 95.9, indicating that the ground water table is closely related to the level of the water in the pond at any particular time.

A falling head permeability test carried out in borehole 2 when the casing was at 15 feet depth indicates a coefficient of permeability of 2×10^{-4} cm/sec for the soil.

V DISCUSSION

Below the sand and gravel road ballast, the natural ground consists of firm to stiff clayey silty sand at borehole 1 location extending down to El. 85 and silty clay at borehole 2 location extending down to about El. 83. Both these strata contain some fine gravel and also organic material. Underlying these strata there is a stratum of very dense sandy silt of Glacial origin which appears to extend to a considerable depth.

The bed of the pond extends to El. 87.5 and allowing for scour it is recommended that the bridge should be supported on spread footings at or below El. 82. This level lies within the stratum of very dense sandy silt Till and on the basis of the borehole results a maximum net soil pressure of 8000 pounds per square foot will be appropriate for the design of footings. It is estimated that the total settlement will not exceed 1 inch and in view of the similar conditions encountered in the boreholes, no appreciable differential settlement is anticipated. Furthermore, the footings will have a factor of safety at least 3 against shear failure of the underlying soil.

The permeabilities of the strata are generally low therefore it is anticipated that seepage into excavations will be controlled by pumping. However due to the firm consistency and presence of organic matter in the upper strata, the sides of excavations will require lateral support to prevent them "sloughing-in" and it is suggested that excavation should be carried out inside an interlocking steel sheet pile enclosure which should penetrate to the very dense sandy silt till stratum.

The coefficient of friction between the footings and the sandy silt till may be taken as 0.45 and the factor of safety against horizontal sliding of the abutments should be at least 1.5.

Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED

C.J.W. Atkinson

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

CJWA:jms



E n c l o s u r e s

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
 " 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" ϕ , 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 :



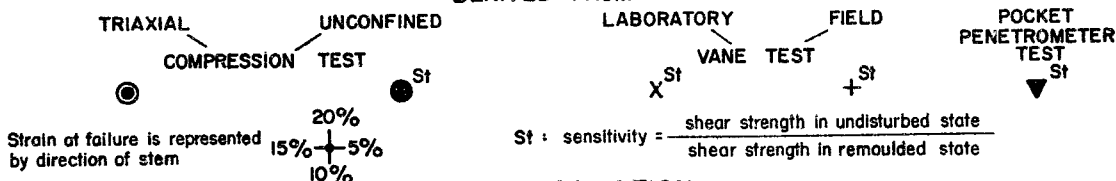
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SOIL PROPERTIES.

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
PI % Plasticity index	C_v Coeff. of consolidation	C' Cohesion in terms of effective stress
LI Liquidity index	m_v Coeff. of volume compressibility	ϕ' Angle of int. friction

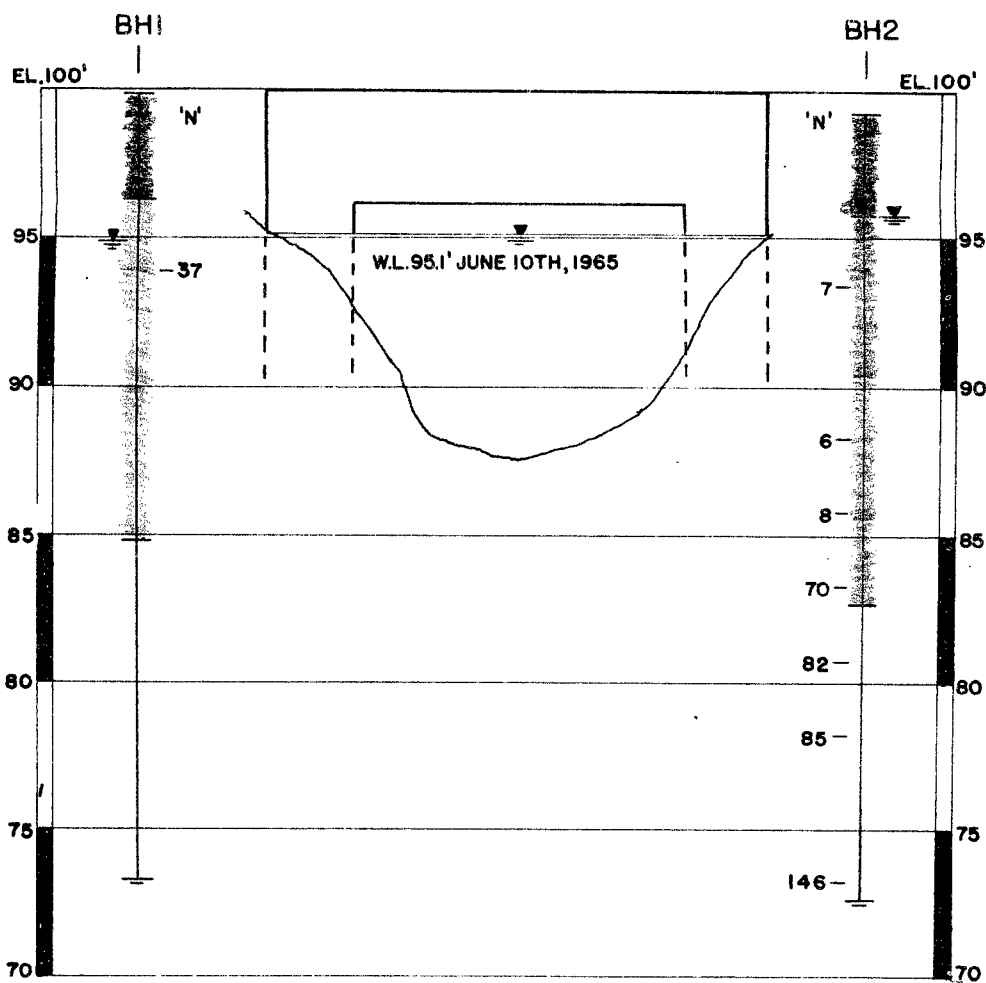
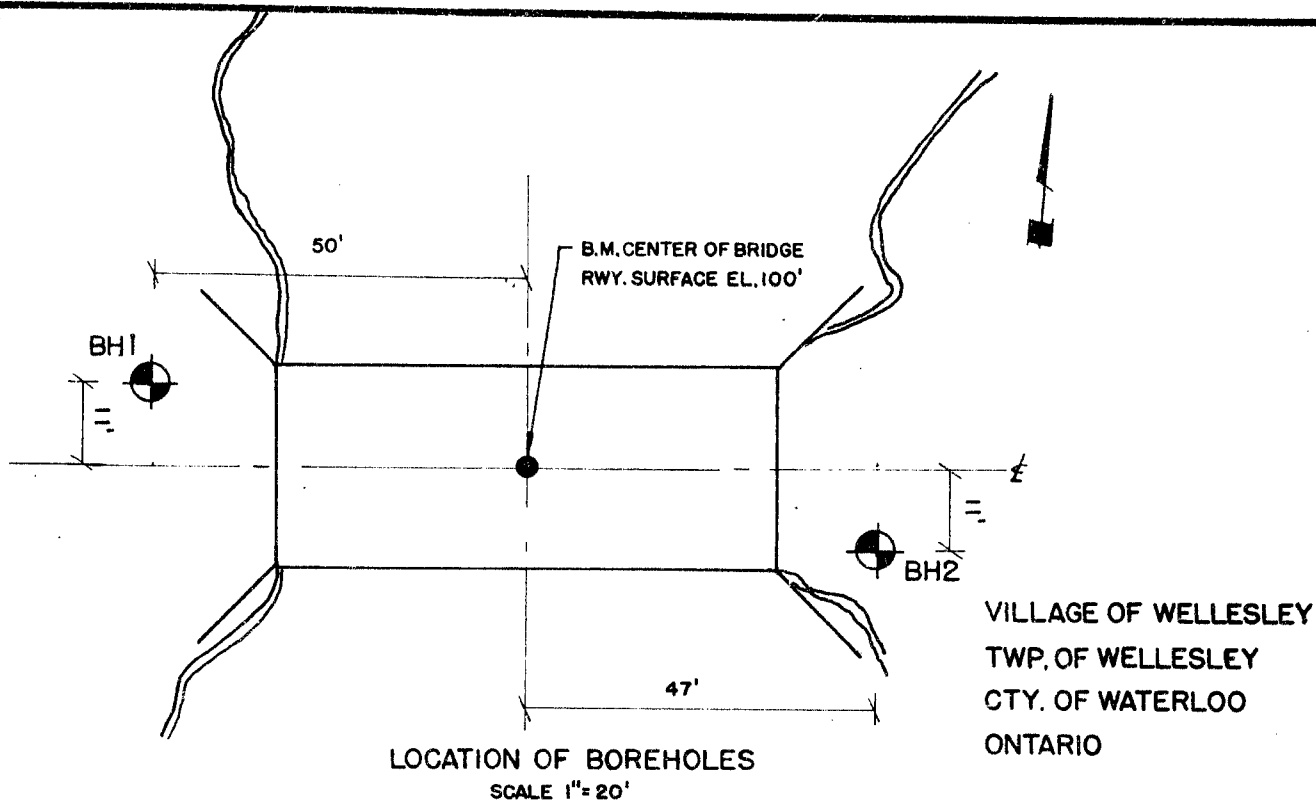
UNDRAINED SHEAR STRENGTH.

— 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



SAND AND GRAVEL, FILL
 SILTY CLAY
 CLAYEY SILTY SAND
 SANDY SILT, TILL

SUBSURFACE PROFILE
VERT. SCALE 1"=5'

40P7-44
GEOCRES No.

GEOTECHNICAL DATA SHEET FOR BOREHOLE...1...

OUR REFERENCE NO. 5-5-L11

CLIENT: McCargar Filer & Hachborn
PROJECT: Wellesley Bridge #33-21
LOCATION: Wellesley, Ontario.
DATUM ELEVATION: 100 feet.

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: June 10th to 16th, 1965.
ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content % PL W LI	REMARKS
				NUMBER	TYPE	N- Advancement of Sampler	20	40		
99.8	0.0	Ground Surface								
	3.5	Sand and gravel Fill.								
95		Firm to stiff brown clayey silty sand with fine gravel, organics		1	SS	37				
90		5.1/2" slightly decomposed wood.		2	Bx					
85	15.0	Very dense grey sandy silt with fine gravel.		3	Bx					
		(Glacial Till)		4	Bx					
80				5	Bx					
75				6	Bx					
25.5		End of Borehole		7	Bx					
70										

W.L.
El. 94.8
June 16th, 1965.

GEOTECHNICAL DATA SHEET FOR BOREHOLE...2...

OUR REFERENCE NO. 5-5-L11

CLIENT: McCargar Filer & Hachborn
 PROJECT: Wellesley Bridge #33-21
 LOCATION: Wellesley, Ontario.
 DATUM ELEVATION: 100 feet.

METHOD OF BORING: Washboring
 DIAMETER OF BOREHOLE: Bx (3-inch)
 DATE: June 15th, & 16th, 1965

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	N - C Advancement of Sampler	20	40	60	80	100	PL	W	LI	
99.3	0.0	Ground Surface													
95	3.5	Sand and gravel Fill													
90		Firm, grey/brown silty clay with sand and fine gravel.		1	SS	7									
85		organics		2	SS	6									
80	16.5			3	SS	8									
75		Very dense grey sandy silt with fine gravel.		4	SS	70									
70		(Glacial Till)		5	SS	82									
				6	SS	35									
	25.5	End of Borehole		7	SS	146									

W.L.
 El. 95.8
 June 16th,
 1965.