

G.I.-30 SEPT. 1976

GEOCRES No. 40 P 10 - 24DIST. 3 REGION south western

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

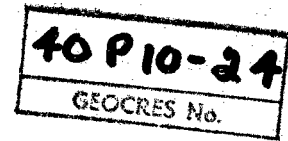
HWY. No. _____

LOCATION LOT 1 CONCESSION 4WELLESLEY TWP

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: DOCUMENTS TO BE UNFOLDED BEFOREMICROFILMED

McCARGAR FILER & HACHBORN
CONSULTING ENGINEERS
KITCHENER ONTARIO



Report on
SOIL INVESTIGATION
for
ROAD BRIDGE #33-14
LOT 1, CONCESSION 4
TOWNSHIP OF WELLESLEY

by
DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO
Reference No. 5-5-L12
July 13th, 1965

CONTENTS

	<u>Page</u>
SUMMARY.....	1
I INTRODUCTION.....	2
II FIELD WORK.....	2
III SUBSURFACE CONDITIONS.....	3
IV GROUNDWATER CONDITIONS.....	4
V LABORATORY TESTS.....	4
VI DISCUSSION.....	4 & 5

ENCLOSURES

	<u>No.</u>
SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.....	1
LOCATION OF BOREHOLES AND SUBSURFACE PROFILE.....	2
GEOTECHNICAL DATA SHEETS.....	3 & 4

SUMMARY

The two borings showed the following ground succession: stiff to very stiff clay strata (extending down to El. 91 at borehole 1 location and El. 88 at borehole 2 location), silty fine sand containing numerous thin layers of clayey silt (4 feet thick), hard silty clay (maximum 15 feet 6 inches penetrated).

It is recommended that the structure should be supported on spread footings at or below El. 83 using a maximum net soil pressure of 8000 pounds per square foot. The estimated total settlement is less than 1 inch.

I INTRODUCTION

In accordance with your letters dated May 19th, 28th 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 on Lot 1, Concession 4 of the Township in the vicinity of Kingwood Village, and the bridge site is numbered 35-14.

It is understood that the proposed structure is a single span of prestressed concrete girders with a skew of 20° and the centre line will be the same as the centre line of the existing bridge. 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 depths of 26 feet 6 inches and 31 feet 6 inches, was carried out on June 17th and 18th, 1965 at the locations shown on Enclosure 2. The locations were indicated on a sketch plan provided by the client. The boreholes were advanced by washboring methods and were lined with Bx casing, using a diamond drill machine equipped for soil sampling.

Standard Penetration Tests using a 2 inch outside diameter split-spoon sampler were performed at frequent intervals of depth. 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.

A dynamic cone penetration test was performed adjacent to each borehole location to obtain an indication of the soil density changes with depth.

A falling head permeability test was carried out in borehole 1 when the hole was advanced to a depth of 16 feet to determine the permeability for the soil at this depth.

Elevations were referred to a site benchmark which was indicated by the client (centre of roadway surface at centre of bridge El. 101.7 feet).

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered in each borehole are given in the 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" to 4'-0"
(b) Brown/dark brown silty clay with some gravel. In borehole 1 organic matter was found. The consistency of this stratum is described as 'stiff' to 'very stiff' as estimated from standard penetration test results ranging from 13 to 22 blows per foot.	4'-6" to 8'-6"
(c) Grey silty clay with organic matter. (Borehole 2 only). The consistency of this stratum is described as 'very stiff' as indicated by the standard penetration test result of 21 blows per foot.	3'-6"
(d) Grey/brown silty fine sand, with thin layers of clayey silt, traces of coarse sand and gravel were found in borehole 1. The relative density of this stratum is described as 'dense' to 'very dense' as estimated from standard penetration test results of 45 and 59 blows per foot.	4'-0" to 4'-3"

- (e) Silty clay with traces of sand and gravel (Glacial Till). The colour is generally grey and the consistency is described as 'hard' as indicated by standard penetration test results ranging from 41 to 58 blows per foot. penetrated 15'-6" in borehole 1

IV GROUNDWATER CONDITIONS

The water level in the creek at the time the field work was carried out was at El. 90.1. Upon completion of the field work the water level in borehole 1 was at El. 97.9' and in borehole 2 at El. 94.1'. Due to the impermeable nature of the subsoil and the presence of washwater used in the boring it is assumed that the observed water levels in the boreholes were not the true ground water level.

It is anticipated that the ground water level will be slightly above the water level in the stream at any particular time. The falling head permeability test carried out in borehole 1 indicates that the average coefficient of permeability of the soil between 10 feet and 16 feet depth is about 1×10^{-5} cm/sec.

V LABORATORY TESTS

Natural moisture content and Atterberg limit tests were carried out on two samples of the silty clay which underlies the silty fine sand stratum. The results of the tests, which are presented graphically on the Geotechnical Data Sheets, classify the material as an inorganic clay of low plasticity. The natural moisture content of the soil varies from slightly higher to slightly lower than the plastic limit.

VI DISCUSSION

The soil profile beneath the sand and gravel road ballast, consists of stiff to very stiff clay strata extending down to El. 91 at borehole 1 location and El. 88 at borehole 2 location. These strata are underlain by about a 4 foot thick stratum of silty fine sand containing numerous thin layers of clayey silt, which overlies a stratum of hard silty clay of glacial origin.

The bed of the stream extends to El. 87.1 and allowing for scour it is recommended that the bridge should be supported on spread footings at El. 83'. This point should be confirmed by carrying out a scour study. 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 8000 pounds per square foot will be appropriate for the

design of footings. It is estimated that total settlement will not exceed 1 inch and in view of the similar conditions encountered in the borehole, no appreciable differential settlement is anticipated.

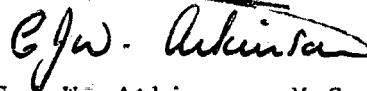
The footings will have a factor of safety at least 3 against shear failure of the underlying soil.

The permeabilities of the strata are generally low, therefore it is anticipated that seepage into excavation will be controlled by pumping. Due to the presence of water in the stratum of silty fine sand, it is probable that this stratum will require lateral support to obtain stability of the sides of the excavation, and prevent the soil and water flowing into the excavation. This can be most economically achieved by using timber sheeting.

The cohesion between the footings and the silty clay till should be taken as 2000 pounds per square foot 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, M.Sc., P.Eng.,
Branch Manager




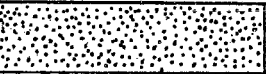








CJWA:jms

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
$\phi > 8"$	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	Washwater returns
"	pressure : p	MADE WHILE CORING	No pressure	Washwater lost
"	tapping : t		Intermittent pressure	

PENETRATION RESISTANCES.

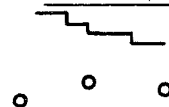
DYNAMIC PENETRATION RESISTANCE : to drive a 2" ϕ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

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 :



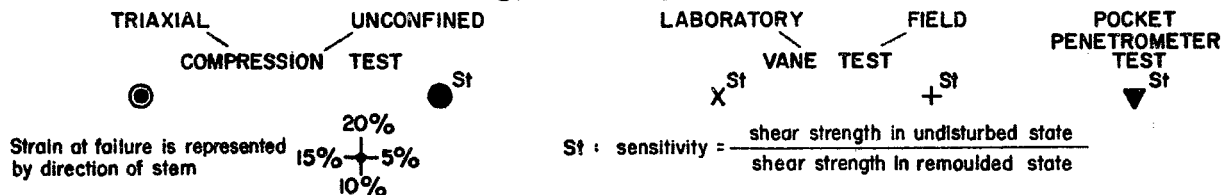
322

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

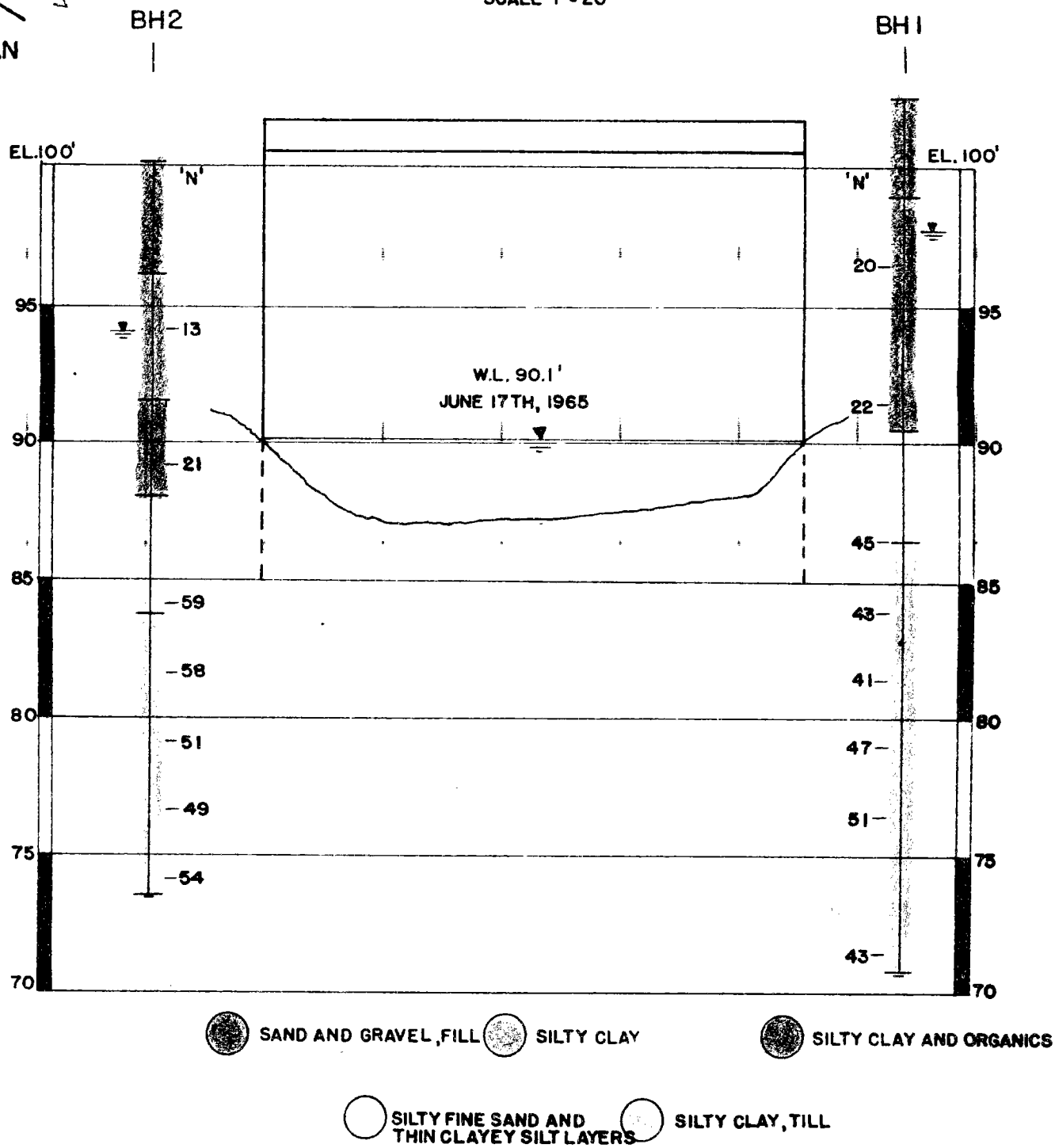
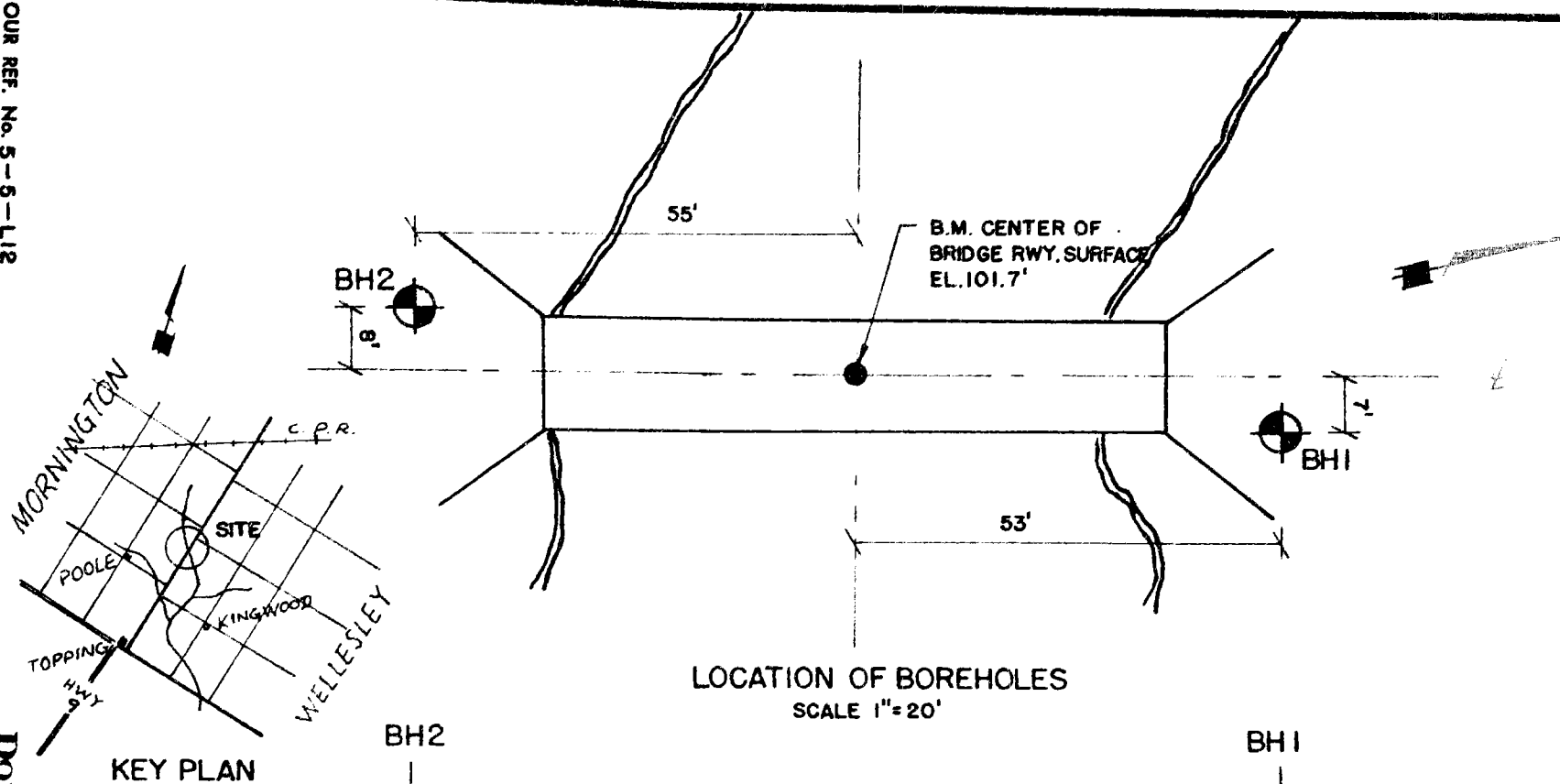
UNDRAINED SHEAR STRENGTH.

— 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



OUR REFERENCE NO 5-5-L12

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

CLIENT: McCargar Filer & Hachborn

METHOD OF BORING Washboring

PROJECT: Kingwood Bridge #33-14

DIAMETER OF BOREHOLE Bx (3-inch)

ENCLOSURE NO. 3

LOCATION: Con IV, Lot 1, Twp. of Wellesley, Ont.

DATE: June 17th, 1965

DATUM ELEVATION: See Encl 2.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %				REMARKS
				NUMBER	TYPE	N or Advancement of Sampler	20	40	60	80	100	PL	W	LI		
102.6	0.0	Ground Surface														
100	3.5	Sand and gravel (fill)														
95		Very stiff dark brown silty clay and some gravel and organics.		1	SS	20										
90	12.0			2	SS	22										
85	16.0	Dense brown silty fine sand traces coarse sand & fine gravel, thin clayey silt layers.		3	SS	45										
				4	SS	43										
				5	SS	41										
80		Hard grey silty clay traces of sand and gravel		6	SS	47										
75				7	SS	51										
70	31.5	(Glacial Till) End of borehole		8	SS	43										

W.L.
EL. 97.9'
June 18th,
1965.

OUR REFERENCE NO. 5-5-L12

ENCLOSURE NO. 4

DATE: June 17th, 1965

DATUM ELEVATION: See Encl 2.

[illegible]