

G.I.-30 SEPT. 1973

GEOCRES No. 40P10-25DIST. 3 REGION SOUTH WESTERN

W.P. No. \_\_\_\_\_

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. \_\_\_\_\_

LOCATION BRIDGE 1 LOT 14CON. 2 & 3 PEEL TWP.

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: DOCUMENTS TO BE UNFOLDEDBEFORE MICROFILMED.

40P10

BA1770

V. R. ASTROP  
SULTING ENGINEER  
ILTON - ONTARIO

40P10-25
GEOCRES No.

REPORT ON  
SOIL INVESTIGATION  
FOR  
WELLINGTON BRIDGE NO. 1  
LOT NO. 14, CONCESSIONS II & III  
TOWNSHIP OF PEEL

Submitted by  
DOMINION SOIL INVESTIGATION LIMITED  
77 Crockford Boulevard  
SCARBOROUGH ONTARIO

OUR REFERENCE: 4-1-5  
JANUARY 1964

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## S U M M A R Y

Two boreholes were put down at the site of the proposed Wellington Bridge No. 1 to determine the subsurface stratigraphy. The results of the investigation indicate that the soil conditions are favourable from the foundation point of view. Footings taken below the maximum depth of scour could be designed for bearing pressures up to 5 tons per square foot. No harmful settlements are anticipated.

The excavation through the dense strata and its dewatering during construction will present some problems.

## I. INTRODUCTION

Written authorization was received from Mr. V. R. Astrop, Consulting Engineer, to carry out a soil investigation in Peel Township at a site where it is proposed to replace three existing bridges with new structures. The construction of the bridges is part of a larger project which includes the reconstruction of the road and the realignment of the riverbed.

A site plan was provided showing the existing structures, the temporary bench marks and the approximate location of the boreholes proposed by the Client.

This report deals with the soil conditions encountered at the site of the proposed Wellington Bridge No. 1 and contains the recommendations for the design and construction of foundations.

## II. PROCEDURES

The boreholes were set out in the field using the centre line of the existing structure as reference line and their position is shown on enclosure #2. A temporary bench mark located 27 feet right of Sta. 7 + 77 was used as reference for elevations. The datum elevation of the bench mark was given as 37.69 feet.

The field work consisting of two boreholes was carried out on February 6th and 7th, 1964. The holes were advanced by washboring technique and were lined with 3 inch diameter casings. Disturbed samples were taken at frequent intervals of depth by means of a 2 inch outside diameter split spoon sampler driven into the ground by 350 ft./lbs. constant energy. The blows required for 12 inches of penetration are recorded as the "N" values which are used to assess the relative density or consistency of the encountered strata.

The results of the field tests are shown on the geotechnical data sheets (enclosures #3 and #4).

### III. SUBSURFACE CONDITIONS

The characteristic soil type in this region is a pale brown, calcareous silty-clayey till forming part of a huge ground moraine. The thickness of the drift over the limestone and dolomite bedrock is not great and most of the stones and boulders found in the overburden are carbonates.

The two boreholes, penetrating to a maximum depth of 25 feet below existing ground surface, indicated the following stratification:

- (a) Below the ground surface and extending to elevation approximately 21.0, a dark brown, silty-clayey fill was encountered. The presence of some organic matter, gravel and even boulders was also indicated. As the composition of the fill resembles in many respects the underlying natural soil, the boundary between the two could only be established approximately.
- (b) The natural soil underlying the fill is a brown, silty clayey till with fine gravel embedded into a fine textured matrix. The proportion of the silt and clay particles varies but silt remains the dominant particle size throughout the stratum. The clay sizes and possibly the calcareous rock flour impart considerable cohesion to the till. By tactile methods, the natural water content of the stratum is estimated to be close to its plastic limit. The standard penetration resistances indicate a hard consistency.
- (c) The above silty-clayey till is underlain by another glacial deposit: a stratum of pale brown silt, sand and gravel with several boulders and traces of clay. The relative density of the material is so high and the boulders so numerous that the holes could only be advanced by diamond drilling. The recovered cores indicated limestone boulders, and sand, gravel and silt were brought up by the wash water.

The water level in borehole #1 was observed at elevation 14.3 feet and in borehole #2 at elevation 23.0 feet. However, in view of the insufficient time available for observation and the relatively low permeability of the strata, it is believed that they do not reflect the true position of the ground water table. It is reasonable to assume that it would rather correspond to the river level which at the time of the investigation was at elevation 20.5 feet.

#### IV. DISCUSSION

It is understood that the new structure will be located approximately 100 feet to the west of the existing one. The proposed bridge will likely be wider and will also have a larger span.

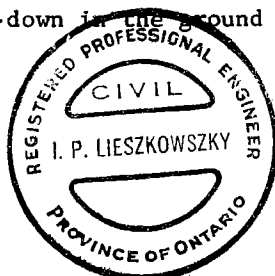
The dense strata indicated in the boreholes provide adequate support for spread footing foundations. As the creek bed lies at elevation  $14.0 \pm$  and to protect the footings against scour, it is proposed to take the foundations at least 5 feet below this level - i.e. to elevation 9.0. In view of the high relative density and the consequently low compressibility of the stratum encountered at and below this level, 5 tons per square foot is the allowable bearing pressure for strip and spread footings. Any settlement which will be experienced will not only be negligible but also instantaneous.

For the stability calculations against horizontal sliding, the coefficient of friction between the concrete footings and the subsoil could be assumed as 0.5.

Some difficulties during the construction can be expected. The excavation through the hard and dense strata will probably be difficult and slow. Dewatering of the working area might also present some problems. Although the sandy-gravelly till is relatively impervious by virtue of its high density and the fine particles present in the stratum, with time, these particles will be washed out, allowing a free passage of water through the coarse grained skeleton. It is difficult to forecast the rate of flow into the excavation but it is believed the sump pumps will be able to cope with the water conditions. However, should the influx of water be high for normal working conditions, the dewatering problem could likely be overcome by installing one or two deep wells between the stream and the excavation. By pumping out the water from these wells, a sufficient draw-down in the ground water level can be obtained.

IPL/oed

Encls.



DOMINION SOIL INVESTIGATION LIMITED,

*I. P. Lieszkowsky*  
I. P. Lieszkowsky, P.Eng.

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	OBSERVATIONS	Steady pressure	Washwater returns
"	pressure : p	MADE WHILE CORING	No pressure		
"	tapping : t		Intermittent pressure		Washwater lost

## PENETRATION RESISTANCES.

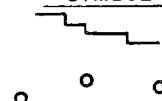
**DYNAMIC PENETRATION RESISTANCE :** to drive a 2"  $\phi$ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

**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 :



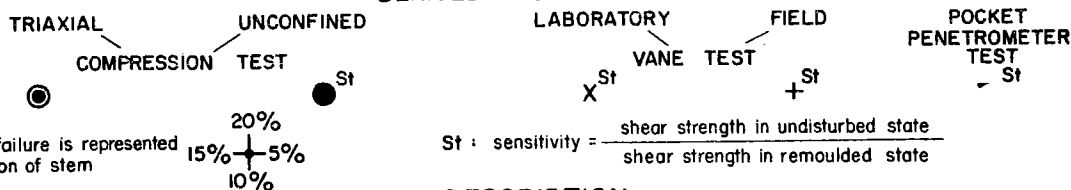
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## SOIL PROPERTIES.

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

## UNDRAINED SHEAR STRENGTH.

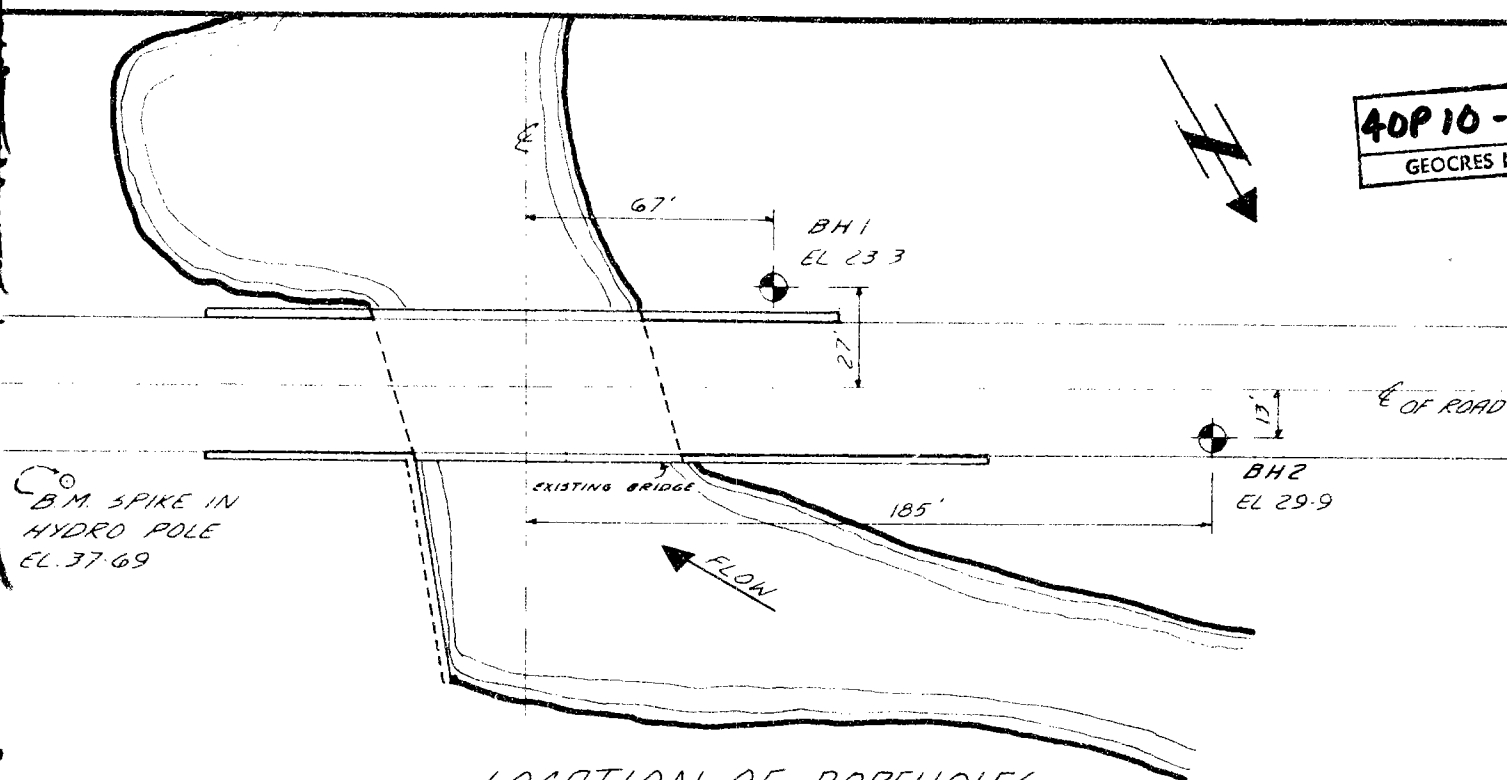
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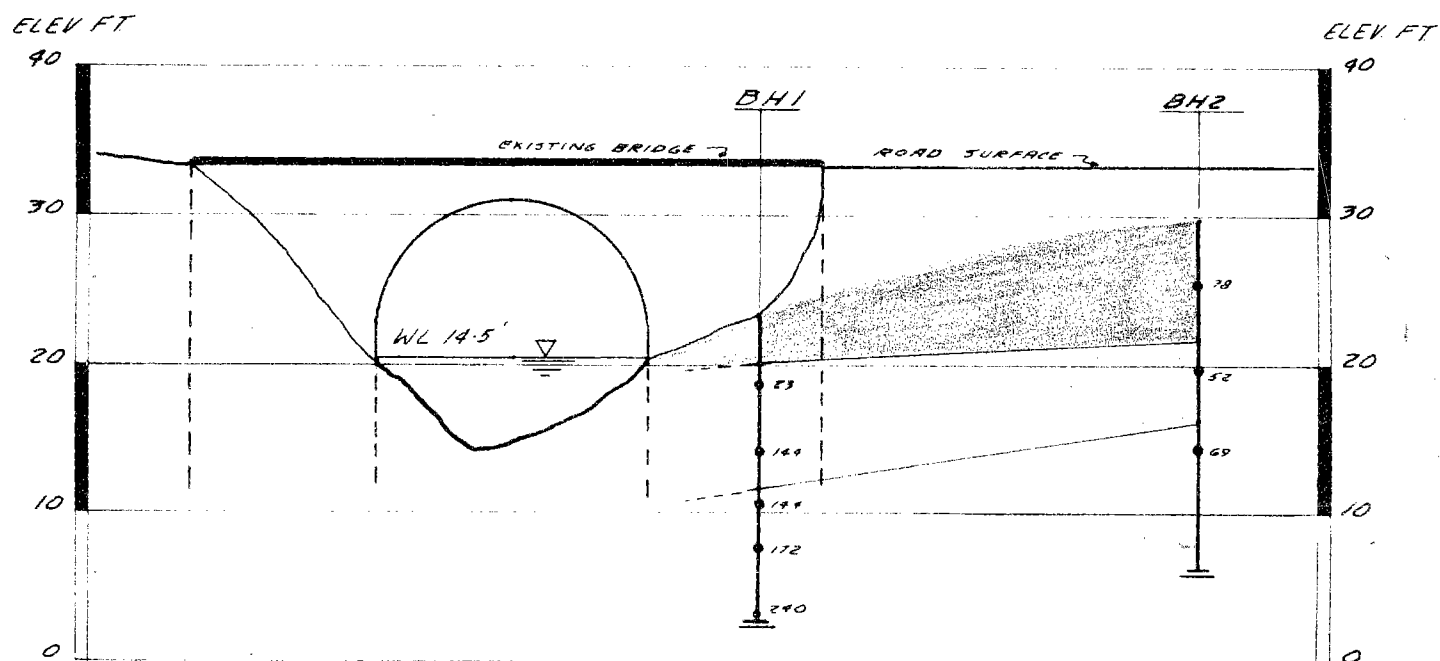
## SOIL DESCRIPTION.

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

**40P10-25**  
GEOCRE No.



LOCATION OF BOREHOLES  
SCALE 1" TO 40'



INFERRED SOIL PROFILE  
SCALE VERT. 1" TO 10'  
HOR 1" TO 40'

LEGEND

- |   |  |   |
|---|--|---|
|  SILTY CLAYEY FILL |  SILTY TILL |  SANDY GRAVELLY TILL |
| • N VALUES blows/ft   |  |   |
| — DENOTES END OF BOREHOLE   |  |   |

# GEOTECHNICAL DATA SHEET FOR BOREHOLE . . . / . . .

**40P10-25**  
 GEOCREs No.

CLIENT: **U. R. ASTROP**  
 PROJECT: **WELLINGTON BRIDGE NO. 1**  
 LOCATION: **WELLINGTON COUNTY Rd 93**  
 DATUM ELEVATION: **SPIKE IN HYDRO POLE EL. 37.69**

METHOD OF BORING: **WASHBORING**  
 DIAMETER OF BOREHOLE: **2 7/8"**  
 DATE: **FEB. 7, 1969**

ENCLOSURE NO. **3**

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	
23.3	0	dark brown <b>SILTY CLAYEY SAND</b> with some gravel and organic matter (fill)		1	CS	—									
20.0	5	compact brown hard <b>SILT</b> with some clay and gravel		2	SS	23									
15.0	10	(TILL)		3	CS	—									
				4	SS	144									
10.0	15	very dense light brown <b>SILTY SAND AND GRAVEL</b> with some boulders		5	SS	144									
5.0	20	(TILL)		6	SS	172									
0.0		END OF BOREHOLE		7	SS	290									

FEB 7, 1969

EL 143'

DETAILS OF  
EXTRAPOLATED  
N-VALUES

So*	Blows
4	60/5"
5	60/5"
6	100/7"
7	100/5"

FEB. 7, 1969

EL. 14.3'

DETAILS OF  
 EXTRAPOLATED  
 N-VALUES

Sa*	Blows
4	60/5"
5	60/5"
6	100/7"
7	100/5"

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

40 P10-25

GEOCREs No.

PROJECT U.R. ASTROP  
 WELLINGTON BRIDGE NO 1  
 LOCATION WELLINGTON COUNTY RD 93  
 LOCATION ELEVATION SPIKE IN HYDRO POLE EL 37.69

METHOD OF BORING WASHBORING  
 DIAMETER OF BOREHOLE 2 7/8"  
 DATE FEB. 6, 1969

ENCLOSURE NO. 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	No. or Advancement of Sampler	20	40	60	80	100	PL	W	
29.9	0													
		dark brown SILTY CLAY with organic matter, some gravel and boulders (fill)		1	SS	78								
25.0	5													
		hard brown CLAYEY SILT with some fine gravel (TILL)		2A	CS	—								
20.0	10			2	SS	52								
15.0	15	very dense brown SAND AND GRAVEL with some silt clay and boulders (TILL)		3	RC 12%									
				4	SS	60								
				5	WS									
				6	RC 69%									
				7	WS RC 10%									
10.0	20			8	WS RC 48%									
5.0	25	END OF BOREHOLE												

DETAILS OF  
 EXTRAPOLATED  
 N-VALUES

Sa"      Blows  
 4      23/4"