

G.I.-30 SEPT. 1973

GEOCRES No. 40 P 10-26DIST. 3 REGION south western

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

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

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

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

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

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

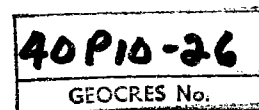
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: DOCUMENTS TO BE UNFOLDEDBEFORE MICRO FILM

40P10

BA1771

MR. V. R. ASTROP  
CONSULTING ENGINEER  
HAMILTON - ONTARIO



REPORT ON  
SOIL INVESTIGATION  
FOR  
ROAD BRIDGE  
LOT 14, CONCESSIONS II & III  
TOWNSHIP OF PEEL

Submitted by  
DOMINION SOIL INVESTIGATION LIMITED  
77 Crockford Boulevard  
SCARBOROUGH - ONTARIO

OUR REF: 4-1-7  
JANUARY 1964

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S U M M A R Y

Two boreholes were put down at the site of the proposed bridge indicating that the significant soil stratum at the foundation level (elevation 16.0) is a very dense gravel and boulder deposit with some silt and clay.

6 tons per square foot is the recommended safe bearing value of the stratum and it is estimated that settlement will not exceed 1.0 inch.

No major construction or dewatering problems are anticipated.

## I. INTRODUCTION

Subsequent to a letter of authorization received from Mr. V.R. Astrop, Consulting Engineer, a subsurface investigation was carried out at the site of a proposed bridge in Peel Township.

A plan of the site was supplied showing the location of the existing structure designated as Wellington Bridge No. 2 and the proposed location of the two boreholes requested by the Client.

The purpose of the investigation was to determine the soil and ground water conditions relevant to the foundation design of the proposed single span bridge and further to assess the possible difficulties during construction.

## II. FIELD WORK

Two boreholes were put down at the locations indicated on the attached site plan (encl. #2). The actual locations of the boreholes is different from the proposed locations due to difficulties of getting access to the site.

The field work was carried out on February 10th and 11th, 1964 using a diamond drill rig and standard washboring methods.

Samples were recovered at frequent intervals of depth by a 2 in. outside diameter split spoon sampler. The sampler was driven 18 ins. into the ground by 350 ft.-lbs. energy and the number of blows required for the last 12 ins. of penetration were recorded as the standard penetration resistance or "N" value.

All elevations mentioned in this report are referred to the temporary bench mark No. 3 as shown on Drawing No. 1 by Mr. V. R. Astrop, Consulting Engineer. The bench mark is described as a spike in the telephone pole 26 ft. left of station 15+00. The elevation of the bench mark is given as 36.14 ft.

### III. SITE AND GEOLOGY

The site is located on the Wellington County Road No. 93 between Concessions II and III in Lot No. 14 of Peel Township.

Geologically, the site lies within a large till plain known as the Oxford Till plain. It is an area of ground moraine consisting of a calcareous silty clay. Some of the silt and clay is a decomposed limestone.

### IV. SOIL CONDITIONS

Details of the soil stratification in the boreholes is given on the individual borehole logs presented on enclosures #3 and #4 and are described below:

#### (1) Silty Clay with Organic Matter

Under about 12 ins. of road fill in borehole #3 and about 3 ft. of topsoil in borehole #4, the first stratum encountered was a brown to grey silty clay and silt with some gravel and organic matter. As the composition of the stratum is similar to the silty clayey till characteristic of the area, the stratum may either be the weathered zone of the underlying till or could be a fill material as suggested by the organic content. The relative density of the stratum is loose to compact.

#### (2) Silty Clayey Till

A very hard brown silty clayey till stratum was encountered in both boreholes. The thickness of the stratum varied from 3.5 ft. in borehole #3 to only 6 ins. in borehole #4. The till consists of silt and clay particles with some gravel embedded into the fine textured matrix.

#### (3) Gravel and Boulders

The till is underlain by a very dense gravel and boulder deposit, consisting of coarse gravel, cobbles and larger boulders of limestone. Some silt with a trace of clay is also present. On account of the density of the stratum and the size of the boulders, the hole could only be advanced by diamond drilling. However, only 25 to 50% of the core was recovered indicating the above described composition.

The stratification and the elevations where the different strata were encountered are diagrammatically shown on the inferred soil profile (enclosure #2).

#### V. WATER CONDITIONS

The observed ground water levels in both boreholes are indicated on the geotechnical data sheets.

There was approximately 5 ft. difference between the observed water levels in the two boreholes which could only be explained by the low permeability of the strata, the fact that the holes were advanced by washing and the insufficient time available for the observations.

For the above reasons, it is most likely possible that none of these water levels indicate the true position of the ground water table but it might correspond to the water level in the creek. At the time of the investigation, the water level in the creek was at elevation 24.8 ft.

#### VI. DISCUSSION

It is understood that the existing 45 ft. span bridge will be replaced by a new structure. Although there is no detailed information available as to the size and nature of the proposed structure, it is assumed that the new bridge will be wider, will have a longer span and will be constructed of reinforced concrete.

The bottom of the existing creek bed is at elevation 21.0  $\pm$ . As the footings of the abutments must be protected against the frost action and/or scour, the foundations will have to be taken to or below elevation 16.0  $\pm$ . At this level, the footings will be resting on the very dense gravel and boulder stratum. Based on the estimated shear

strength of the stratum and adopting a safety factor of at least 3.0 against general shear failure of the soil, the use of an allowable bearing value of 6 tons per square foot is recommended.

The corresponding total and differential settlements are estimated not to exceed 1.0 inch and 0.75 inches respectively.

When considering the stability of the abutments against horizontal sliding, the coefficient of friction between the footings and the foundation material should be assumed to be 0.5.

To reach the foundation level, most of the excavation will be carried out below the ground water table. However, it is believed this will not present any major problems as the permeability of the encountered strata is sufficiently low to <sup>not</sup> yield excessive amount of water. The water should be collected in sumps dug below the proposed foundation level from where it could be removed by ordinary sump pumps.

The excavation through the predominantly cohesive strata will be easy and the walls of the excavation will require little or no support.

IPL/oed



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  
 " pressure : p  
 " tapping : t

OBSERVATIONS  
 MADE WHILE CORING

Steady pressure  
 No pressure  
 Intermittent pressure

Washwater returns  
 Washwater lost

## PENETRATION RESISTANCES.

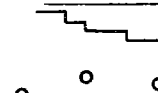
**DYNAMIC PENETRATION RESISTANCE** : to drive a 2"  $\phi$ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

**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 :



322

## SOIL PROPERTIES.

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

## UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL UNCONFINED

COMPRESSION TEST



St

LABORATORY

VANE TEST

X St

FIELD

+ St

POCKET PENETROMETER TEST  
 - St

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.

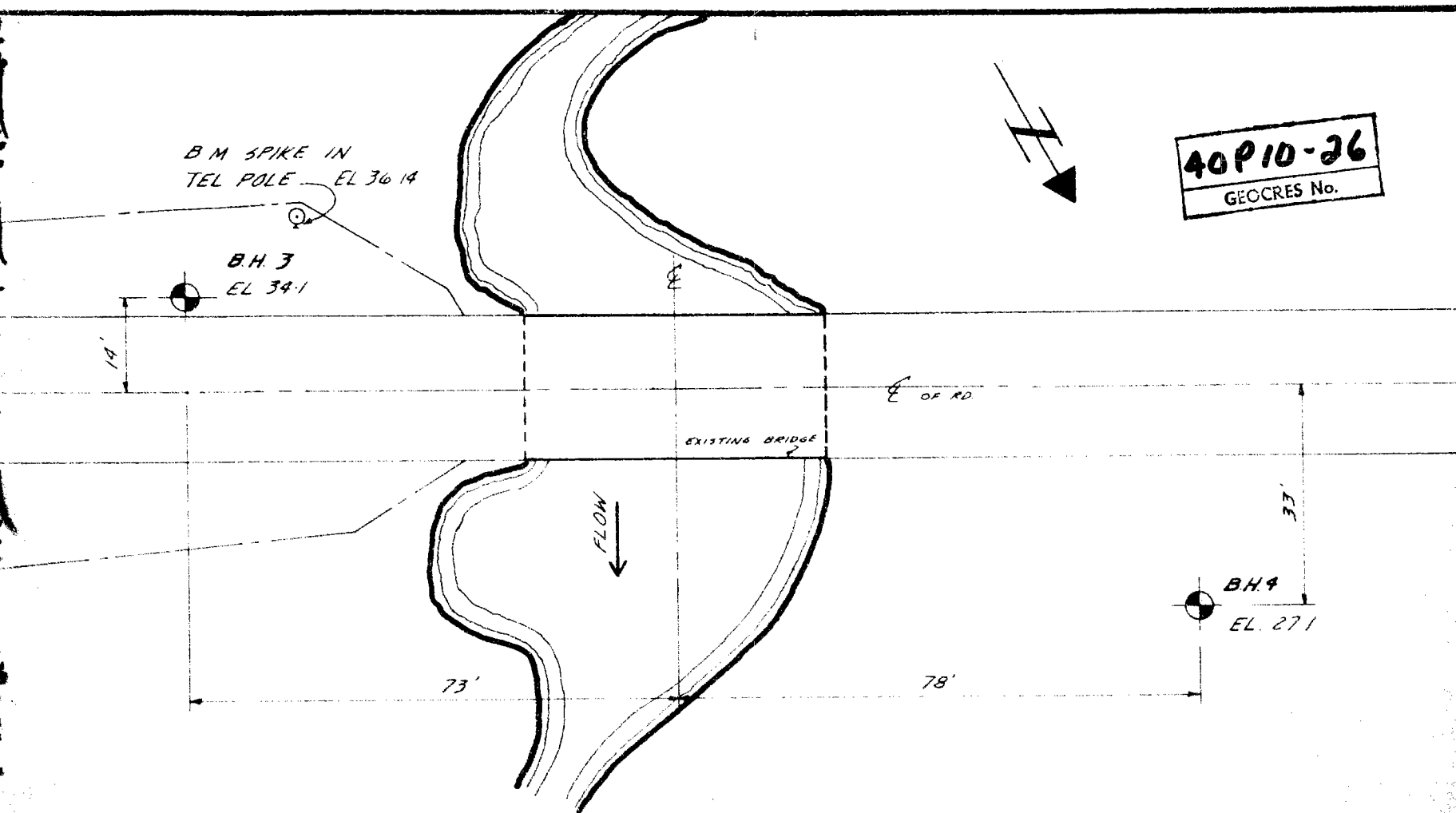
COHESIONLESS SOILS :

Very loose	0 - 15 %
Loose	15 - 35 %
Compact	35 - 65 %
Dense	65 - 85 %
Very dense	85 - 100 %

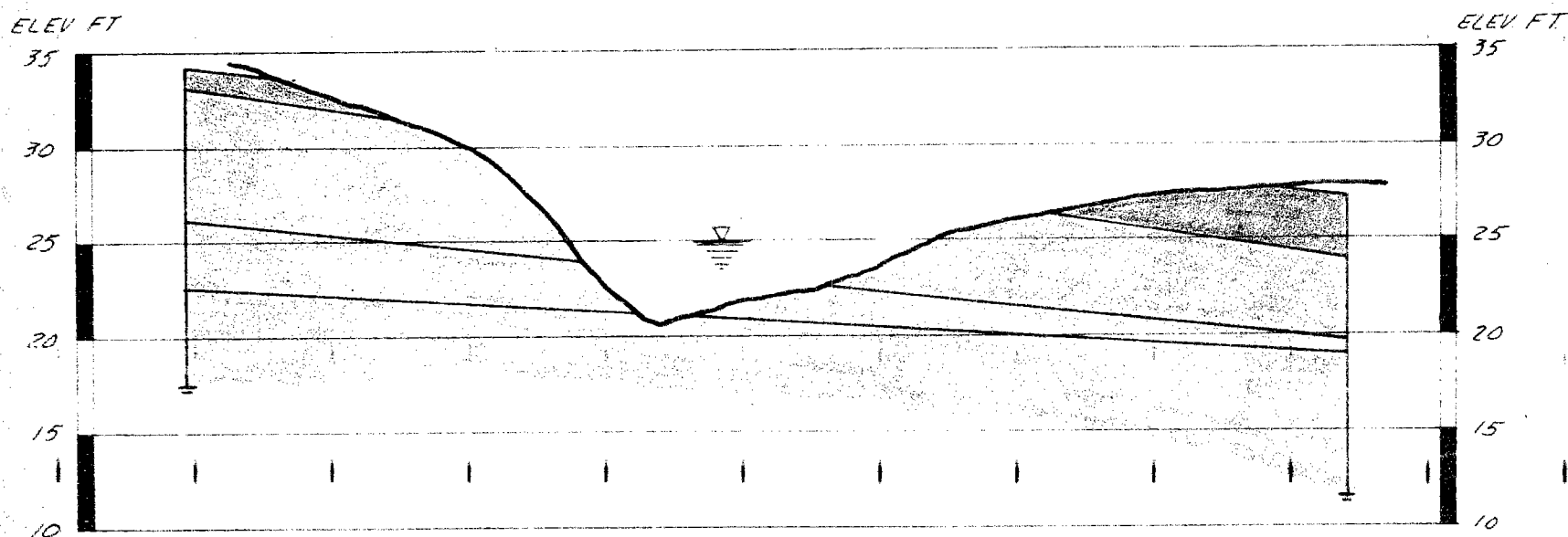
RD :

COHESIVE SOILS :

	c lbs./sq.ft.
Very soft	less than 250
Soft	250 - 500
Firm	500 - 1000
Stiff	1000 - 2000
Very stiff	2000 - 4000
Hard	over 4000



LOCATION OF BOREHOLES  
SCALE: 1" TO 20'



INFERRED SOIL PROFILE  
SCALE: HOR 1" TO 20'  
VERT. 1/8" TO 1'

LEGEND

- TOPSOIL, FILL
- ORGANIC SILTY CLAY
- SILTY CLAYEY TILL
- GRAVEL AND BOULDERS

# GEOTECHNICAL DATA SHEET FOR BOREHOLE ... 3 ...

OUR REFERENCE NO. 4-1-7

40P10-26

GEOCRETS No.

CLIENT V.R. ASTROP

PROJECT WELLINGTON BRIDGE NO 2

LOCATION WELLINGTON COUNTY RD. 93

DATUM ELEVATION SPIKE IN TELEPHONE POLE EL. 36.14

METHOD OF BORING WASHBORING

DIAMETER OF BOREHOLE 27.8"

DATE FEB. 10, 1964

ENCLOSURE NO.

3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	N <sub>60</sub> or Advancement of Sampler	20	40	60	100	PL	W	
34.1	0	SANDY GRAVELLY FILL											
		loose brown											
30.0	5	SILTY CLAY with some gravel and organic matter		1	SS	6							
25.0	10	hard brown SILTY CLAYEY TILL		2	SS	40							
20.0	15	very dense GRAVEL with some sand, silt and traces of clay fragments of limestone		3	SS	300							
				4	RL	48%							
				5	SS	300							
		END OF BOREHOLE											
15.0													

 DETAILS OF  
EXTRAPOLATED  
N-VALUES

S <sub>a</sub> <sup>max</sup>	Blows
3	100/4"
5	150/6"

 FEB. 10, 1964  
EL. 21.6

# GEOTECHNICAL DATA SHEET FOR BOREHOLE ... 4 ...

40P10-26

GEGCKES No.

CLIENT *VR ASTROP*  
PROJECT *WELLINGTON BRIDGE NO. 2*

METHOD OF BORING *WASHBORING*  
DIAMETER OF BOREHOLE *27/8*  
DATE *FEB 11, 1969*

ENCLOSURE

LOCATION *WELLINGTON COUNTY RD. 93*  
DATUM ELEVATION *SPIKE IN TELEPHONE POLE EL 36.14*

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	30	40	50		60
27.1	0	ORGANIC TOPSOIL										
25.0	5	<i>brown compact grey</i> SILTY CLAY AND SILT with some gravel and organic matter		1	SS	18						
20.0		hard SILTY CLAYEY TILL		2	SS	112						
10		very dense pale brown LIMESTONE BOULDERS AND GRAVEL with some silt		3	RC	70%						
150				4	SS	110						
15				5	RC	28%						
10.0		END OF BOREHOLE		6	SS	98						

FEB. 11, 1969  
EL. 26.8

DETAILS OF  
EXTRAPOLATED  
N-VALUES

3a"	Blows
4	55/6"
6	49/6"
	30/1"