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G.I.-30 SEPT. 1976

GEOCRES No. 40P9-27

DIST. 3 REGION South western

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

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

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

STR. SITE No. 36254/255

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

LOCATION LOT 13 CON 5 E 6

PILKINGTON TWP.

=====

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

REMARKS: DOCUMENTS TO BE UNFOLDED  
BEFORE MICRO FILM

40 P9 map

TOWNSHIP OF PILKINGTON

c/o Mr. V. R. Astrop  
Consulting Engineer  
Hamilton - Ontario

STRUCTURE SITE No. 36-254

-255

40P9-27  
GEOCRES No.

SEILING BRIDGE

FOUNDATION CONDITIONS

Submitted by

DOMINION SOIL INVESTIGATION LIMITED  
77 Crockford Boulevard  
Scarborough, Ontario

OUR REFERENCE: 2-10-18

NOVEMBER 1962

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BRANCH  
33 QUEENS AVENUE  
LONDON, ONTARIO  
TELEPHONE GE. 3-3881



FOUNDATION ENGINEERS

P.O. BOX 933  
SAULT STE. MARIE  
ONTARIO  
TELEPHONE AL. 4-2615

### I N T R O D U C T I O N

A letter of authorization dated October 24th, 1962 was received from Mr. V. R. Astrop, Consulting Engineer, to conduct a foundation investigation at the site of a proposed bridge in the Township of Pilkington, Wellington County.

The proposed project will replace two small structures, thereby eliminating a bottleneck on the Township road and creating more favourable hydrological conditions for the flow of the water.

Number and location of the boreholes were as directed on a Drawing (site plan #1) supplied to us.

The purpose of the investigation was to reveal the subsurface conditions and determine the necessary soil properties for the design and construction of foundations.

S U M M A R Y

- (1) Densely packed glacial tills were encountered at the site which are capable of supporting the proposed bridge on spread footings.
- (2) Dewatering of the excavation should be made by pumping out the seepage water from a pit enclosed by sheet piles.
- (3) For details, see Section IV - "Discussion and Recommendation".

## I. DESCRIPTION OF SITE AND GEOLOGY

The proposed bridge will be located about  $3\frac{1}{2}$  miles south of Elora-Salem, on a gravel-surfaced township road. The past "Pentland Corners" was situated about  $\frac{1}{2}$  a mile east of the site. The area is generally flat and the creek flows in a shallow, broad valley.

Southern Ontario is a glaciated region. Vast masses of ice moved across it during several cold periods, meanwhile abrading the bedrock, breaking off big pieces, pulverizing the debris and finally depositing it into a non-stratified, compact mixture of all soil factions. The resulting sediment is the so-called till.

## II. FIELD AND LABORATORY WORK

Field work was carried out during the period October 29th to 31st, 1962 and comprised two boreholes and four dynamic cone penetration tests at the locations shown on Enclosure #2. The positions of the test holes were set out on the site with the assistance of the drawing referred to in the Introduction. Elevations were measured relative to benchmark #2 as indicated on the site plan (spike in 2' willow = elevation 58.77 ft.)

The boreholes were of  $2\frac{7}{8}$  in. diameter. They were lined or partly lined with Bx casing advanced to the required sampling depths by the repetitious procedure of alternately driving and washing.

Standard penetration tests were made at frequent intervals using a 2 in. outside diameter split spoon driven into the bottom of the clean borehole by a constant driving energy (140 pound hammer dropping 30 inches). The dynamic cone penetration test is one type of deep sounding in which the A rods with a 2 in. diameter 60 degree apex cone driving

point are driven into the subsoil without casing and applying the same driving energy as above. The former test provided disturbed samples of the substrata indicating their relative density and consistency and the latter a continuous record of soil density.

Where bedrock or boulder was encountered, the holes were advanced by diamond drilling. AxT size 1 1/8 in. diameter core was recovered.

The samples were shipped to our laboratory where they were thoroughly examined and classified. The results of this analysis together with all data obtained and observations made on the field comprise the basis on which the geotechnical properties of the substrata are being evaluated.

The stratification of the subsoil, sampling depths, the results of the penetration tests together with percentages of core recovery are recorded on geotechnical datasheets comprising Enclosures #3 to #5 inclusive.

### III. SUBSURFACE CONDITIONS

Below a relatively thick topsoil, layers of glacial tills were encountered. The cohesive strata (sandy, clayey silt) were deposited directly from the ice; the granular ones may have originated from the meltwaters and subsequently compressed by the enormous weight of the ice having lain above them for thousands of years. Numerous boulders, cobbles are scattered at random locations in the soil mass which is a frequent phenomenon in glacial tills.

The engineering properties of the tills are generally favourable. They combine high shear strength with low compressibility, resulting in a substantial bearing capacity coupled with practically no settlement.

The difference between the two main types of tills (cohesive and granular) found at the site lies mainly in the degree of permeability to water, which is an important factor to be considered when the construction procedure is being planned.

The ground water level corresponds to that in the creek.

#### IV. DISCUSSION AND RECOMMENDATIONS

Our recommendations are based on the findings in the boreholes and on the known geological history of the area. They take the requirements of the proposed project into full account.

The subsoil is capable of supporting the bridge on spread footings. The foundations should be placed at elevation 47 ft. or lower and a gross allowable bearing pressure of 8,000 psf is recommended. This value might be increased with increasing depth but it is believed that the above capacity is more than sufficient for the needs of the proposed structure.

The dewatering of the excavation should be carefully planned to avoid the danger of hydraulic failure of the subgrade. The excavation area should be enclosed by sheet piles driven to a sufficient depth below the proposed footing grade. (It is suggested that the distance between the bottom of sheet piles and the bottom of the excavation should be equal or greater than the distance between the ground water table outside the enclosed area and the bottom of excavation.) This measure will prevent the loosening of the subsoil by the upward seeping water and seal the walls of the pit. The water still seeping into the excavation can be collected in a temporary sump and removed by pumping. The bottom of the subgrade should be covered with a lean concrete



blanket which will provide an even, clean working area and prevent the further seepage of the ground water from below.

DOMINION SOIL INVESTIGATION LIMITED

*L. S. Rolko*

L. S. Rolko, P.Eng.,  
Senior Soils Engineer.

LSR/oed

V. REFERENCES

- (1) Procedures for Testing Soils, ASTM, April 1958, pp 186 to 198 (Unified Soil Classification System - by A. A. Wagner).
- (2) Terzaghi and Peck: Soil Mechanics in Engineering Practice, John Wiley and Sons, New York 1948.
- (3) The Physiography of Southern Ontario by L.J. Chapman and D.F. Putnam of the Ontario Research Foundation - University of Toronto Press 1951.
- (4) Strength and Deformation Characteristics of Various Tills in New England, by Kenneth A. Linell and H.F. Shea - Proc. Research Conference on the Shear Strength of Cohesive Soils, Boulder, Colorado, June 1960.

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

CS Sample from casing

ChS Chunk sample

RC Rock core

% Recovery

SS Split spoon sample

TP Piston, thin walled tube sample

TW Open, thin walled tube 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

LL % Liquid limit

PL % Plastic limit

PI % Plasticity index

LI Liquidity index

 $\gamma_s$ 

Natural bulk density (unit weight)

e

Void ratio

RD

Relative density

C<sub>v</sub>

Coeff. of consolidation

m<sub>v</sub>

Coeff. of volume compressibility

k Coeff. of permeability

C Shear strength in terms of total stress

 $\phi$ 

Angle of int. friction

C'

Cohesion

 $\phi'$ 

Angle of int. friction in terms of effective stress

## UNDRAINED SHEAR STRENGTH.

- DERIVED FROM -

TRIAXIAL

UNCONFINED

LABORATORY

FIELD

COMPRESSION TEST

VANE TEST

POCKET PENETROMETER TEST

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 :

RD :

Very loose

0 - 15 %

Loose

15 - 35 %

Compact

35 - 65 %

Dense

65 - 85 %

Very dense

85 - 100 %

COHESIVE SOILS :

C lbs/sq.ft.

Very soft

less than 250

Soft

250 - 500

Firm

500 - 1000

Stiff

1000 - 2000

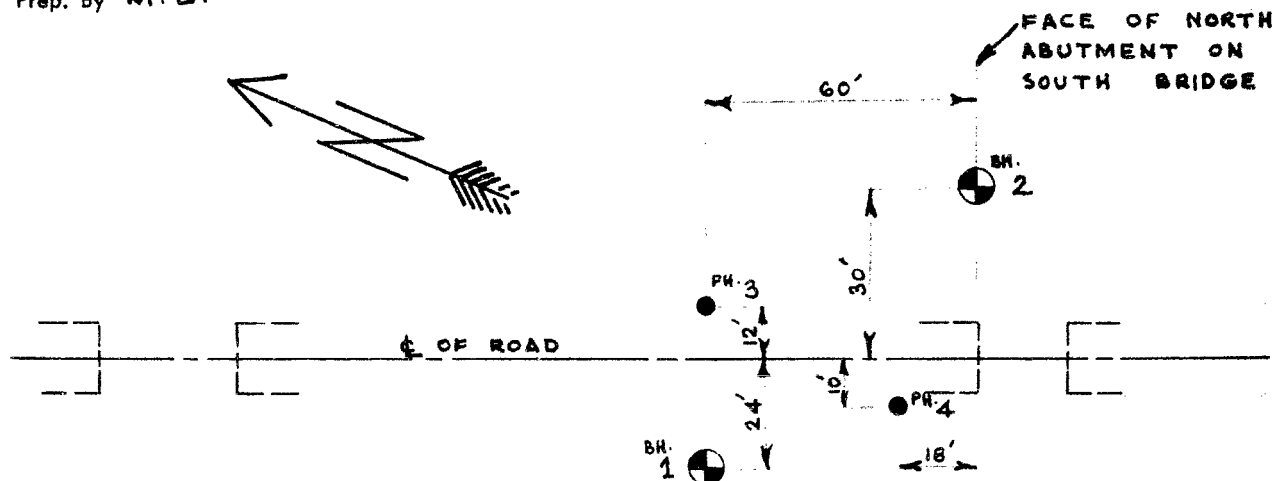
Very stiff

2000 - 4000

Hard

over 4000

Prep. By M.B.



## LOCATION OF BOREHOLES

SCALE: 1" TO 40'

### LEGEND:



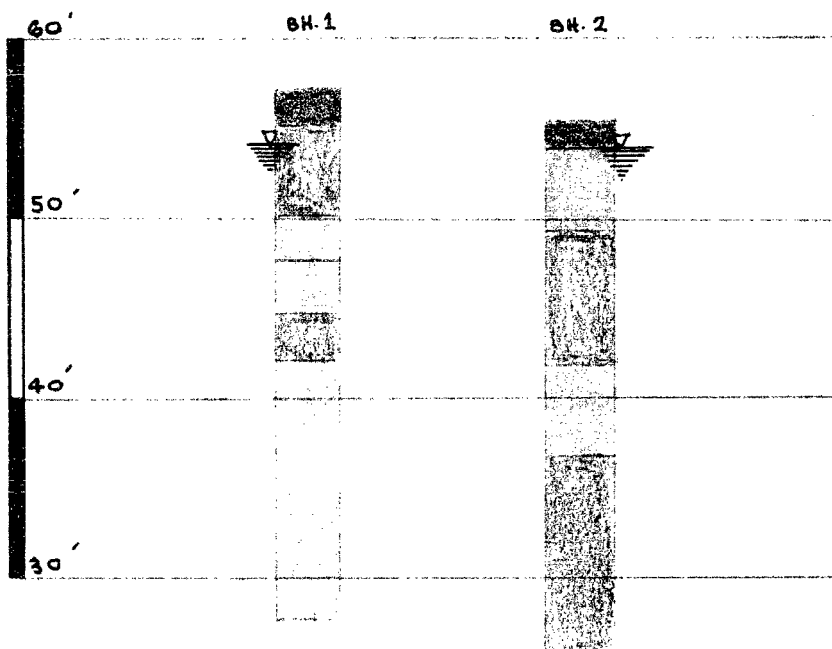
TOPSOIL



SANDY CLAYEY  
SILT



FINE SAND AND  
SILTY FINE SAND  
WITH GRAVEL



## SUBSURFACE PROFILE

SCALE: 1" TO 10'

OUR REFERENCE NO. 2-10-18

# GEOTECHNICAL DATA SHEET FOR BOREHOLE CONE 3 & 4

40P9-27

GEOCRE No.

CLIENT: V. R. ASTROP

PROJECT: SEILING BRIDGE

LOCATION: TOWNSHIP OF PILKINGTON ONTARIO

DATUM ELEVATION: CONE 3 - 61.07 CONE 4 - 61.47

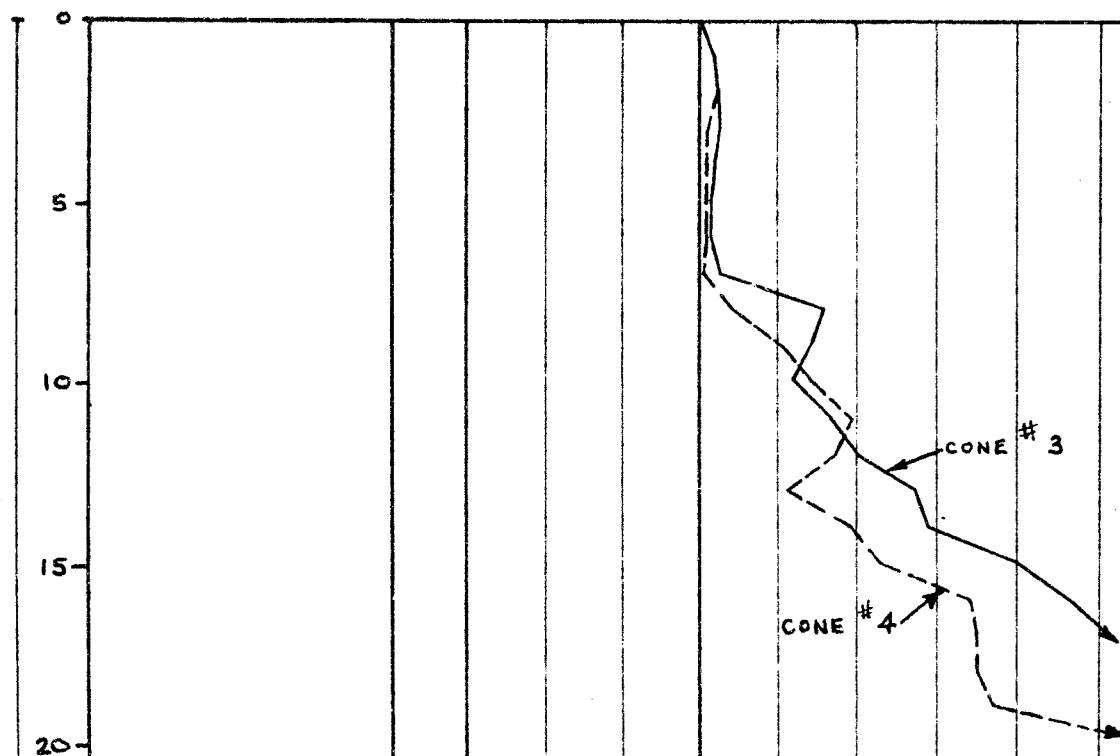
METHOD OF BORING: WASHBORING

DIAMETER OF BOREHOLE: 2 7/8"

DATE: NOV. 30, 1962.

ENCLOSURE NO. 5

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content % PL W LI	REMARKS
				NUMBER	TYPE	N- or Adjustment of Sampler	0 20 40 60 80 100	SHEAR STRENGTH lbs./sq ft		



OUR REFERENCE NO. 2-10-18

# GEOTECHNICAL DATA SHEET FOR BOREHOLE 2...

40P9-27

GEOCRETS No.

CLIENT: V. R. ASTROP  
PROJECT: SEILING BRIDGE

METHODE OF BORING: WASHBORING

DIAMETER OF BOREHOLE: 2 7/8"

ENCLOSURE NO. 4

LOCATION: TOWNSHIP OF PILKINGTON ONTARIO

DATE: OCT. 30-31, 1962

DATUM ELEVATION: 55.27

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	N- or Advance- ment of Sampler	SHEAR STRENGTH lbs/sq ft		PL	W	
55.27	0	TOPSOIL									
		BROWN DENSE SANDY SILT AND GRAVEL		1	SS	32					
50	5			2	SS	20					
		GREY HARD SANDY CLAYEY SILT		3	SS	43					
45	10			4	SS	36					
		BROWN LAYER		5	SS	160					
40	15	GREY VERY DENSE SILTY SAND		6	SS	95					
				7	SS	150					
35	20	BROWN HARD GRAVELLY SANDY CLAYEY SILT		7A	R.C 19%						
30	25			8	SS	196					
				8A	WS						
25	30	GREY LAYER		9	SS	240					

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE	CONSISTENCY	REMARKS
				NUMBER	TYPE	N <sub>60</sub> Advancement of Sampler	blows per foot	water content % PL W LI	
57.17	0	TOPSOIL				2			
55	5	SANDY CLAYEY SILT FIRM BROWN GREY STIFF		1	SS	6			
				2	SS	21			
50		GREY COMPACT FINE SAND (silt lumps)		3	SS	23			
45	10	BROWN DENSE SILTY FINE SAND		4	SS	46			
		GREY HARD SANDY CLAYEY SILT		5	SS	4			
40	15	BROWN VERY DENSE SILTY SAND AND GRAVEL		6	SS	240			
35	20			7	SS	400			
30	25			8	R.C.	33.6%			
				8A	WS				
25	30			9	SS	240			