DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40P10-27

DIST. 3 REGION South western

W.P. No.

CONT. No.

W. O. No.

STR. SITE No.

HWY. No.

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

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS: DOCUMENTS TO BE UNFOLDED BEFORE MICROFILM

G.I.-30 SEPT. 1976

Plot for 40P10

Mr. V. R. ASTROP

CONSULTING ENGINEER

HAMILTON, ONTARIO

REPORT ON

SOIL INVESTIGATION

FOR

WELLINGTON ROAD BRIDGE NO. 3

LOT 14, CONCESSIONS II & III

TOWNSHIP OF PEEL

SUBMITTED BY

DOMINION SOIL INVESTIGATION LIMITED
77 Crockford Boulevard
SCARBOROUGH - ONTARIO

OUR REFERENCE: 4-1-8

JANUARY 1 9 6 4

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SUMMARY

The site of the proposed bridge is underlain by hard, cohesive strata suitable to support normal strip footing foundations.

5 tons per square foot is the recommended maximum design value for continuous footings. The estimated total and differential settlement is 0.8 and 0.5 inches respectively.

No construction problems are anticipated.

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I. INTRODUCTION

On January 17th, 1964, Dominion Soil Investigation Limited was authorized by Mr. V. R. Astrop, Consulting Engineer, to carry out a soil investigation at the site of the proposed Wellington Bridge No. 3 located in the Township of Peel.

A drawing accompanying the letter of authorization showed the location of two boreholes in relation to the existing structure and the bench mark to be used for levelling.

The purpose of the investigation was to explore the subsurface conditions at the location of the proposed bridge and to give recommendations for the design of the foundations.

II. PROCEDURES

The boreholes were located as shown on the attached site plan (Encl. #2) using the centre line of the existing bridge as a reference line. All elevations were referred to a temporary bench mark located on the south side of the road at station 24 and 25. The bench mark was described as a spike in an elm tree and its elevation was given as 49.92 ft.

The work on the field was carried out on February 11th and 12th, 1964 using a diamond drill rig and standard washboring methods. Samples were recovered at frequent intervals of depth by means of a 2 in. outside diameter split spoon sampler. When taking the samples, the penetration resistances were recorded in blows per foot. The samples were then visually classified in the field and later in the laboratory.

The results of the field work are shown on the geotechnical data sheets comprising enclosures #3 and #4.

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III. SOIL CONDITIONS

The site is located in an area of a large ground moraine consisting of a calcareous silty clayey till deposited by the Wisconsin glacier. It was the last of the four glaciers invading this part of the Continent.

The soils encountered during the present investigation were all very dense, fine textured soils belonging to the above described geological environment.

In both boreholes, covered only by a thin layer of road fill or topsoil, a very hard brown silty clayey till was encountered. The silt and clay contents varied within certain limits but by visual inspection, it is estimated that silt is the predominant particle size with about 20% clay, 10% sand and 15% gravel. Partly due to the clay content and partly due to the cemented nature of the silt, the stratum had a distinctly cohesive appearance and could be regarded as such. The apparent cohesion of the stratum is estimated to be over 5,000 pounds per square foot.

The natural moisture content of the stratum is at or below the plastic limit. This, and the high "N" values obtained in the standard penetration tests (37 to 95 blows per foot) indicate that the consistency of the till is hard.

IV. GROUND WATER CONDITIONS

After the boreholes were completed, the water levels in the holes were observed and are indicated on the geotechnical data sheets. In borehole #5, the water level was at the ground surface (elevation 31.3 ft.) and in borehole #6, it was recorded at elevation 32.9 ft. At the same time, the water level in the river was at elevation 31.1 ft.

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V. DISCUSSION

It is understood that the existing bridge, which is a single span, reinforced concrete structure, will be replaced by a new and presumably larger structure of similar construction. The bridge will carry normal highway traffic.

The soil investigation indicated that the site is underlain by hard silty and clayey glacial deposits suitable to support normal spread and strip footing foundations. Based on the estimated shear strength of the till, 5 tons per square foot is the recommended bearing value for strip footings regardless of the elevation the footings are placed. The actual foundation elevation should be determined by hydraulic considerations but it is recommended that the footings be placed at least 4 ft. below the lowest bottom elevation of the creek. As the till is not unduly susceptible to either frost or scour, this is considered to be adequate under normal flow conditions.

The amount of total settlement under a 2 ft. wide continuous footing carrying 10 tons per linear foot is estimated to be in the order of 0.8 inches. Part of this will be caused by the immediate elastic compression of the stratum but most of it will be due to the long term consolidation of the till. Similarly, the differential settlement is estimated to be less than 0.5 inches.

The stability of the footings against horizontal sliding should be checked both for the short (immediately after construction) and the long term cases. In the short term case, the adhesion between the poured concrete footings and the cohesive till should be taken as 4,000 pounds per square foot. Furthermore, it is recommended that the surface of the clay be roughened prior to the pouring of the concrete. When considering the long term case, the design should be based on the assumption that the coefficient of friction is equal to 0.4.

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No major problems are anticipated during the excavation and construction of the foundations. The excavation through the hard, silty clay will not present undue difficulties and the vertical walls of the excavation will be temporarily stable without any support.

Even though the ground water table is higher than the bottom elevation of the excavation, the dewatering of the working area will cause no problems. Owing to the low permeability of the soil, the rate of flow of water into the excavation will be low and could be removed by ordinary sump pumps.

DOMINION SOIL INVESTIGATION LIMITED

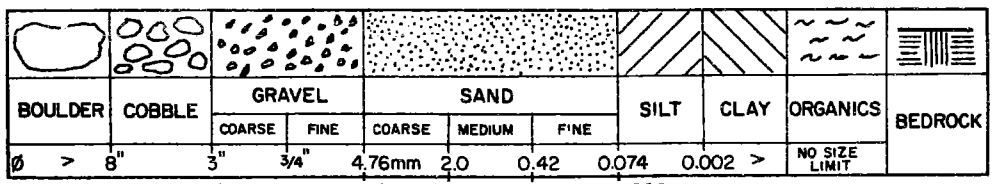
IPL/oed

I.P. Lieszkowszky, P.Eng.

Enclosures

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.



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

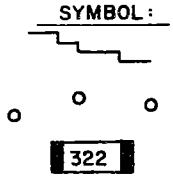
Washwater returns; Washwater lost

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.

SYMBOL :



EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

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 total stress
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 — in terms of effective stress

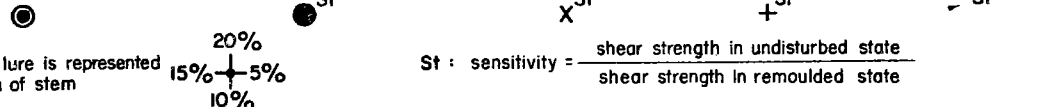
UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL COMPRESSION TEST — UNCONFINED

LABORATORY VANE TEST — FIELD

POCKET PENETROMETER TEST



Strain at failure is represented by direction of stem

St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

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

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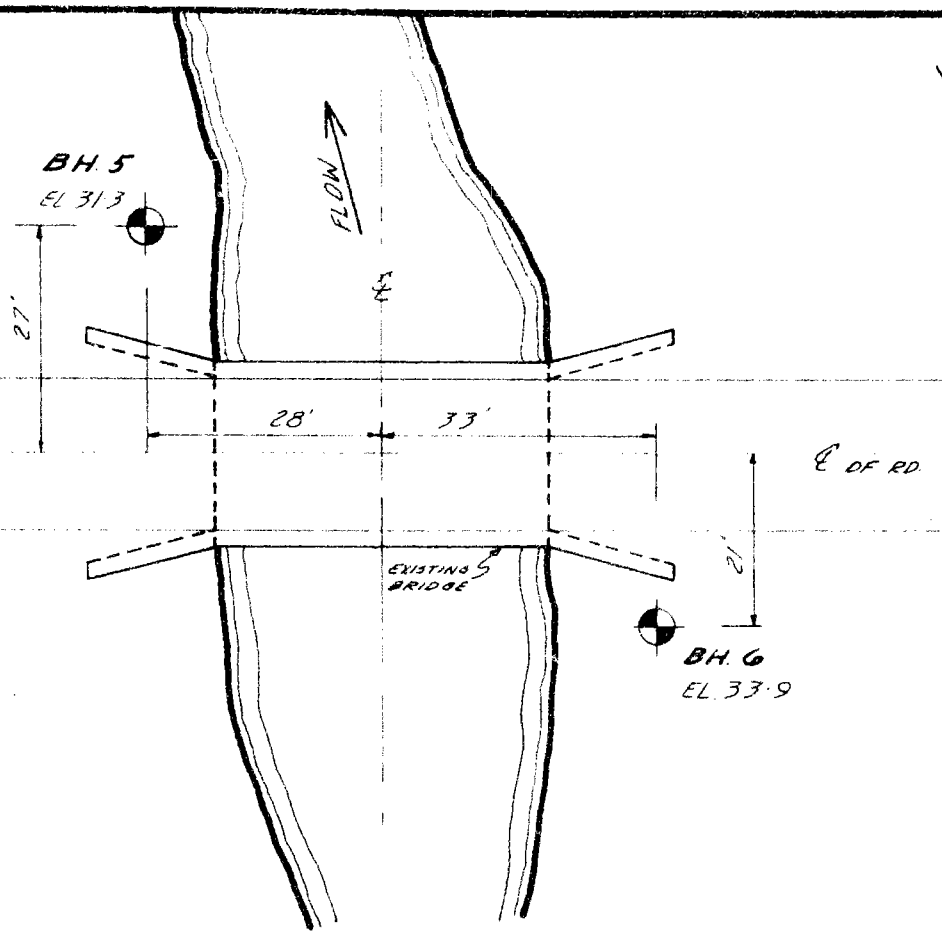
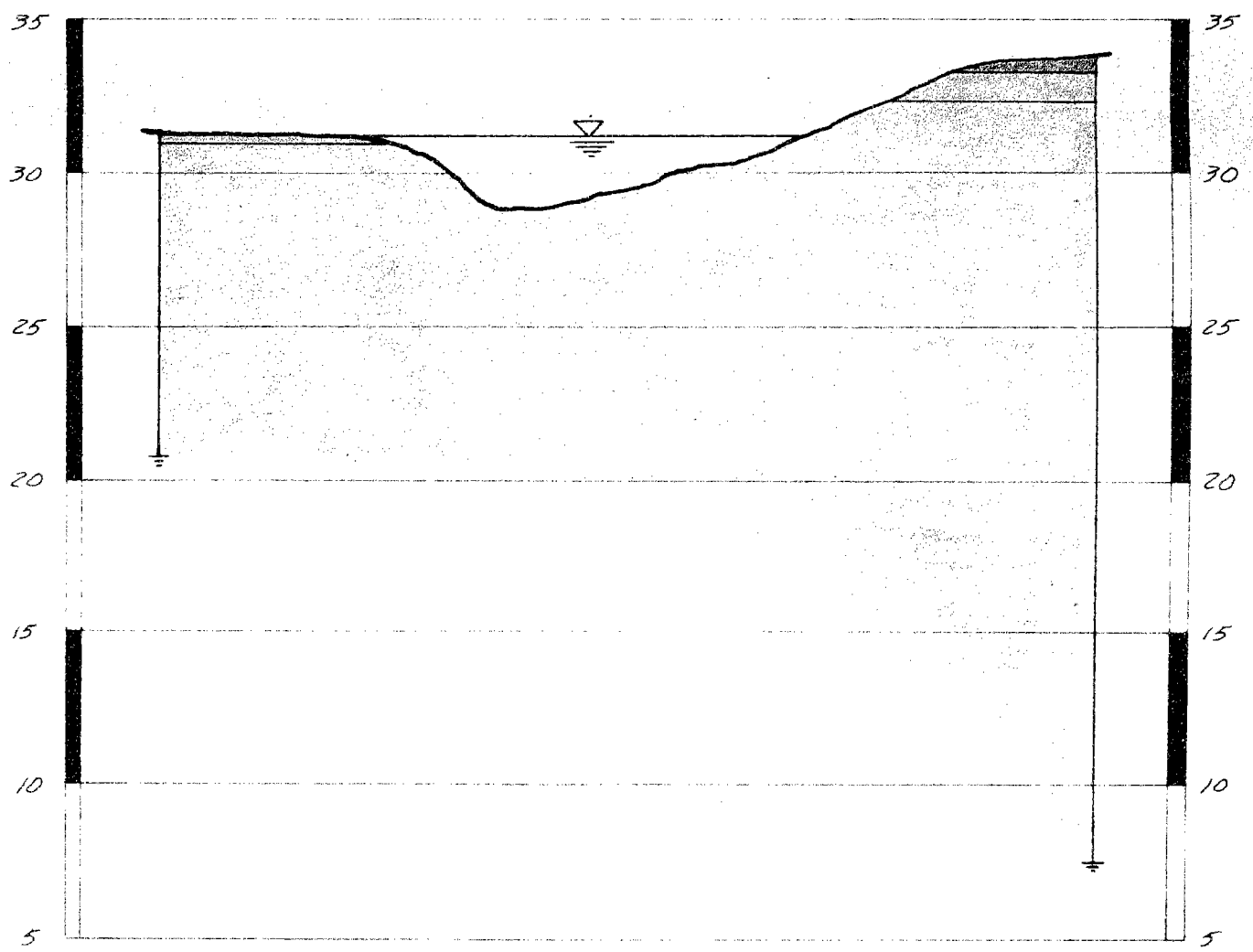
GEOCRES No.



LOCATION OF BOREHOLES
SCALE 1" TO 20'



SUBSURFACE PROFILE
SCALE: VERT. & HOR 1" TO 10'

LEGEND

TOPSOIL | SAND AND GRAVEL | SILTY CLAYEY TILL

OUR REF. No. 4-1-8

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ENCLOSURE No. 2

GEOTECHNICAL DATA SHEET FOR BOREHOLE ..5...

40 P 10-27
GEOCRES No.

REFERENCE NO. 4-1-8

CLIENT V. R ASTROP
PROJECT WELLINGTON BRIDGE NO 3
LOCATION WELLINGTON COUNTY RD 93
DATUM ELEVATION SPIKE IN TREE EL. 49.92'

METHOD OF BORING WASHBORING
DIAMETER OF BOREHOLE 2 7/8"
DATE FEB. 11, 1964

ENCLOSURE NO 3

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N or Advancement of Sampler	PENETRATION RESISTANCE blows per foot 20 40 60 80 100 / SHEAR STRENGTH lbs sq ft	CONSISTENCY water content % PL W LL	REMARKS
31.3	0								▽ FEB 11, 1964 EL. 31.3
		2" SAND AND GRAVEL							
30.0		hard brown							
	5	SILTY CLAYEY TILL		1	SS	37	○		
25.0		with some sand and gravel		2	SS	48	○		
	10			3	SS	86	○		
20.0		END OF BOREHOLE							
	15								
15.0									

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . 6 . . .

40 P 10-27
GEOCRES No.

CLIENT V.R. ASTROP
PROJECT WELLINGTON BRIDGE NO 3
LOCATION WELLINGTON COUNTY RD 93
DATUM ELEVATION SPIKE IN TREE EL 99.92'

METHOD OF BORING WASHBORING
DIAMETER OF BOREHOLE 2 7/8"
DATE FEB. 12, 1964

ENCLOSURE NO. 9

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N or Advancement of Sampler	PENETRATION RESISTANCE blows per foot 20 40 60 80 100 / SHEAR STRENGTH lbs sq ft	CONSISTENCY water content % PL W LL	REMARKS
99.9	0								
		6" TOPSOIL							
		SANDY GRAVEL							
									FEB 12, 1964 ▽ EL. 32.9
30.0	5			1	SS	50			
		hard brown SILTY CLAYEY TILL with some sand and gravel		2	SS	97			
25.0	10			3	SS	52			
				4	SS	95			
20.0	15			5	SS	62			
15.0	20			6	SS	78			
10.0	25			7	SS	76			
		END OF BOREHOLE							
5.0	30								