

## DEPARTMENT OF HIGHWAYS, ONTARIO

## MEMORANDUM

To: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Office,  
Admin. Bldg.

FROM: Foundation Section,  
Materials & Testing Office,  
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: July 2, 1969

JUL - 8 1969

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Go Transit Parking Lot Extension  
Port Credit -- County of Peel  
District No. 6 (Toronto)

W.J. 69-F-46 -- W.P. 23-69-1

1. Introduction:

The Foundation Section was requested to carry out a subsurface investigation for the aforementioned extension. The request was contained in a memo from the Bridge Office - (Mr. W. S. Melnyshyn, Regional Bridge Location Engineer), dated June 18, 1969. Subsequently, an investigation was carried out by this Section at the above site in order to determine the subsoil conditions.

This memo contains the results of the investigation, together with our recommendations for the design of foundations for the two proposed structures, which will provide vehicular access to the C.N.R. and the extension to the existing parking lot.

2. Description of the Site and Geology:

The site is located west of Hwy. #10 and north of Queen Street, in the Town of Port Credit. The proposed structures will cross the existing concrete-lined drainage canal, which is approximately 70 feet wide and 12 feet in depth. This canal is located immediately north of the existing C.N.R. tracks. The area involved is flat lying at between elevation 270 to 275.

The lowland bordering Lake Ontario was inundated in late Pleistocene times by a body of water, known as Lake Iroquois; this region is physiographically spoken of as the "Iroquois Plain".

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2. Description of the Site and Geology: (cont'd.) ...

In this section of the "Plain" the surficial deposit is composed of silts and sands between 6 and 15 feet in thickness. The granular deposit is generally underlain by a cohesive glacial till stratum.

3. Subsoil Conditions:

Two sampled boreholes were put down to a depth of approximately 20 feet, during the course of the investigation, by means of a continuous flight power auger. In addition, two hand auger holes were put down south of the concrete-lined canal in an area which was inaccessible to the Penndrill.

The locations of the borings are shown in plan on Drawing No. 69-F-46A. The stratigraphy encountered at the boring locations is shown on the Record of Borelog sheets; stratigraphical sections, inferred from this data, are plotted on Drawing No. 69-F-46A. A brief review of the subsoil conditions encountered are presented in the following paragraphs.

Beneath a thin cover of topsoil, south of the canal, and asphalt and road fill in the existing parking lot area, is a deposit of brown to grey uniform silty fine sand. The thickness of the sand varies from 18 feet (B.H. #1) to 4 feet (B.H. #2); in general, it decreases in an easterly direction - i.e., towards Hwy. #10.

Standard penetration resistance testing carried out within the deposit, the results of which are plotted on the Borelog sheets, gave 'N' values varying from 15 to 98 blows/ft. Based on these results, it is estimated that the relative density varies from compact in the upper portion, increasing to very dense with depth.

The upper granular deposit is underlain by a very stiff to hard ('N' values between 29 and 98 blows/ft.) grey glacial till composed of clayey silt with some sand and gravel. This stratum was not penetrated at any of the boring locations; it was, however, proven to extend to a depth of at least 13 feet at B.H. #2.

The groundwater level across the site, at the time of the investigation, was between 6 and 9 feet below existing ground surface - i.e., at between elevation 266 and 269.

4. Recommendations:

It is proposed to construct two single-span structures, each approximately 30 feet in length, to provide access for vehicles over the drainage canal, to the proposed extension to the parking lot. It is understood that the approach fill heights will be nomina

Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Office, Admin. Bldg.  
Attn: Mr. S. McCombie

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4. Recommendations: (cont'd.) ...

The foundation subsoil on either side of the drainage canal is competent; this being the case, it is recommended that the abutments be founded on spread footings located at approximately elevations 269 and 271 at the west and east structure locations, respectively. The footings will have adequate cover for frost protection purposes. At these elevations the footings for the most westerly structure will be founded in the upper granular deposit (refer to B.H.'s #1 and #4), while the footings for the easterly structure will be located in the underlying competent glacial till deposit (refer to B.H.'s #2 and #3). In either case, an allowable bearing pressure of 2.0 t.s.f. can be used in design.

To reach foundation level, the footing excavations will extend some 6 feet below existing ground surface. If construction is carried out during dry periods of the year, such as when this investigation was carried out, the excavations should not present any problems with regard to dewatering. However, if excavations have to be carried out during a period of heavy precipitation, the groundwater level may have to be lowered by means of a suitable dewatering scheme. This is particularly the case at the location of the most westerly structure, where the footings will be situated in the granular deposit.

Settlement of the foundation subsoil will take place due to the applied footing loading. Because of the competence of the subsoil, this settlement will be elastic in nature - i.e., take place during, or immediately following the construction period; it will be well within tolerable limits for the type of structures contemplated.

If you have any queries with respect to any of the aforementioned discussion, or if we can be of any further assistance, please contact this Office.

MD/MGeF  
Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (2)  
F. G. Allen  
W. S. Melinyshyn  
T. J. Kovich  
B. A. Singh

Foundations Files  
Gen. Files

*M. Devata*  
M. Devata,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-46 LOCATION Port Credit (refer to Drawing 69-F-46A) ORIGINATED BY MRV  
W.P. 23-69-1 BORING DATE June 20, 1969 COMPILED BY BTD  
DATUM Geodetic BORE HOLE TYPE Penndrill - Power Auger CHECKED BY SR

SOIL PROFILE			S SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				$w_p$ — $w$ — $w_L$ WATER CONTENT %					
275.0	Ground Level															
1.5	0.4 Sand & Gravel (Fill)															
	Brown		1	SS	20	270										
	Silty fine sand		2	SS	16											
	Grey		3	SS	21											
	Compact to very dense		4	SS	76/9"	260										
257.0	Grey silt with some sand & gravel (Glac. Till)		5	SS	50											
255.5	Grey sand & gravel (Glac. Till)		6	SS	75											
19.5	End of Borehole					250										

$\nabla$  267.0  
WL in open  
BH  
June 20/69

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-46 LOCATION Port Credit (refer to Drawing 69-F-46A) ORIGINATED BY MRV  
W.P. 23-69-1 BORING DATE June 20, 1969 COMPILED BY BRD  
DATUM Geodetic BOREHOLE TYPE Penndrill - Power Auger CHECKED BY MR

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$				BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %						
							UNCONFINED		+ FIELD VANE		$w_p$ — $w$ — $w_L$						
						QUICK TRIAXIAL		x LAB. VANE									
277.0	Ground Level																
271.0	Silty fine sand . Brown. Dense.		1	SS	35												
271.0	Clayey silt with some sand and gravel (Glacial Till)		2	SS	35	270											
6.0	Grey		3	SS	54												
	Hard		4	SS	98												
257.5			5	SS	96	260											
19.5	End of Borehole		6	SS	82												
						250											

▽ 269  
WL in open  
hole  
June 20/69

MATERIALS &amp; TESTING OFFICE

## FOUNDATION SECTI

LOCATION Port Credit (Refer to Drawing 69-F-46A)

ORIGINATED BY MRV

BORING DATE      June 21, 1969

COMPILED BY / RTD

BOREHOLE TYPE Hand Auger

CHECKED BY *OK*

[illegible]

FOUNDATION SECTION

JOB 69-F-46 LOCATION Port Credit (Refer to Drawing 69-F-46A) ORIGINATED BY MRV  
 W.P. 23-69-1 BORING DATE June 20, 1969 COMPILED BY BTD  
 DATUM Geodetic BOREHOLE TYPE Hand Auger CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT ——— W <sub>P</sub> WATER CONTENT ——— W				REMARKS
ELEV. DEPTH	DESCRIPTION	SIRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.	W <sub>p</sub> ——— W ——— W <sub>L</sub> WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					
0.0	Ground Level											
275.0												
264.0	Brown Silty fine sand		1	SS	17	270						
	Grey		2	SS	11							
262.0	Dense		3	SS	45							
262.0	Clayey silt some sand gr. (Giac. Till) Grey		4	SS	29							
13.0	End of Borehole					260						



## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N': - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

### TYPE OF SAMPLE

SS	SPLIT SPOON	T.W.	THINWALL OPEN
WS	WASHED SAMPLE	T.P.	THINWALL PISTON
SB	SCRAPER BUCKET SAMPLE	OS	OESTERBERG SAMPLE
AS	AUGER SAMPLE	FS	FOIL SAMPLE
CS	CHUNK SAMPLE	RC	ROCK CORE
ST	SLOTTED TUBE SAMPLE		
	PH	SAMPLE ADVANCED HYDRAULICALLY	
	PM	SAMPLE ADVANCED MANUALLY	

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	LV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FV	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

## ABBREVIATIONS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
s	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_C$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$c_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

### GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

### STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

## MEMORANDUM

To: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Building

FROM: C.S. Grebski,  
Bridge Office

ATTENTION:

DATE: July 22, 1969

OUR FILE REF.

IN REPLY TO

SUBJECT: G.O. Transit Bridges  
at Port Credit Station  
W.P. 23-69-1  
Site Nos. 24-292(E) and 24-293(W)  
District No. 6

69-F-46

Attached herewith we are submitting the final  
bridge drawings which show the foundation design for  
this structure.

Kindly give us your comments at your earliest  
convenience.



C.S. Grebski,  
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Section

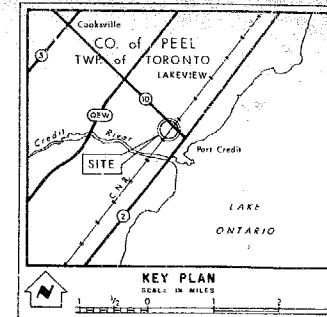
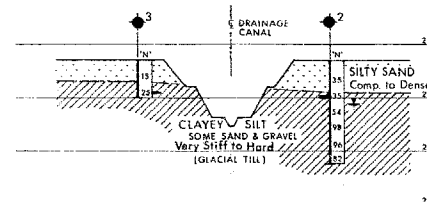
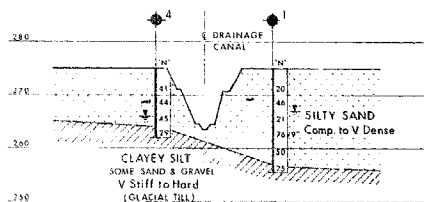
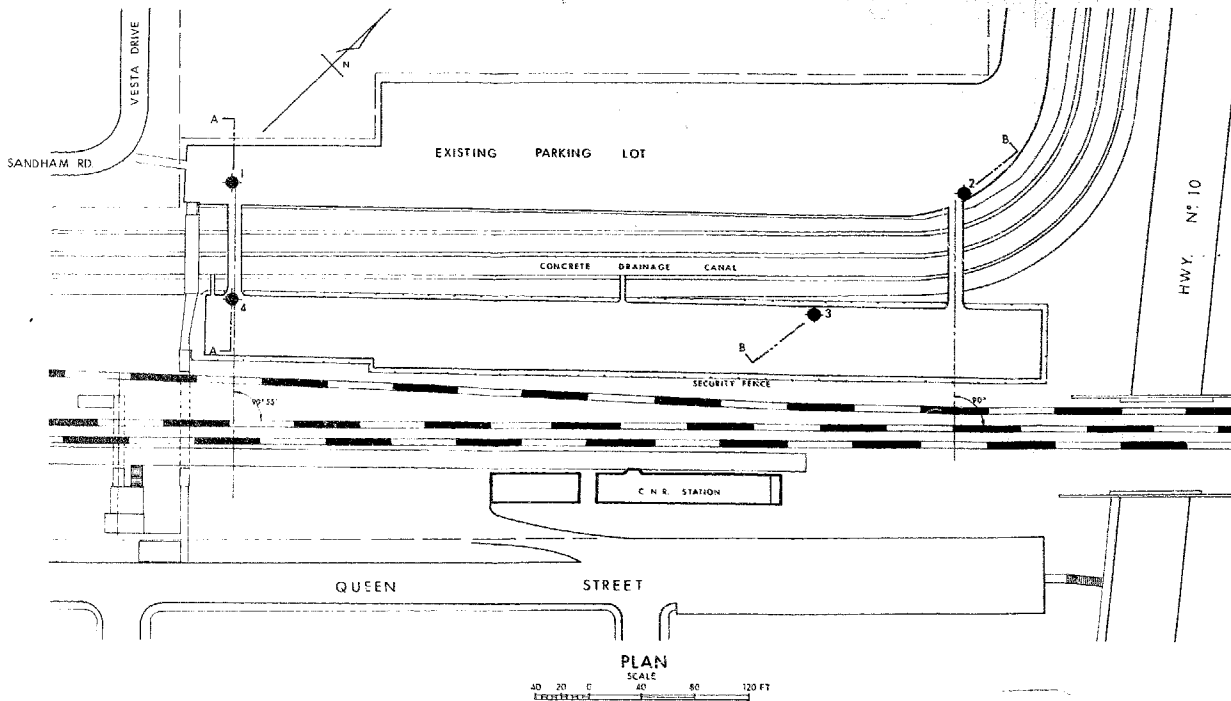
A.K.

Tak

no comments  
M. Devata  
July 29/69

no comments  
B.T.P.

- all abutments & footings  
are above the groundwater  
level recorded during the  
period of the investigation (June 20, 1969)



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation, 20 JUNE 69		
NO.	ELEVATION	STATION	OFFSET
1	275.0		
2	277.0		
3	277.0		
4	275.0		

**NOTE**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

NO.	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

**GO TRANSIT PARKING LOT EXTENSION**

HWY. 10 HIGHWAY NO. PORT CREDIT DIST. NO. 6  
CO. PEEL  
TWP. TORONTO LOT COM.

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBM. S.I.D. CHECKED 27/7/69 M.P. NO. 23-69-1 N.S.T. DRAWING NO. 69-F-46A  
DRAWN 27/7/69 JOB NO. 69-F-46  
DATE 2 JULY 1969 SITE NO. BRIDGE DRAWING NO.  
APPROVED 27/7/69 CONT. NO.