

G.I.-30 SEPT. 1976

GEOCRES No. 30M11-161DIST. 6 REGION _____

W.P. No. _____

CONT. No. _____

W. O. No. 76-11008

STR. SITE No. _____

HWY. No. N/ALOCATION PROPOSED SHELTERS
PORT CREDIT GO STATIONNo. of PAGES -=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____



Ministry of
Transportation and
Communications

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

FOUNDATION INVESTIGATION & DESIGN REPORT

Proposed Shelters
Port Credit Go Station

W.O. 76-11008

DIST. 6

HWY. N/A

STR. SITE N/A

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INTRODUCTION

As requested by F.G. Pavelka (Project Engineer, Plant Division, TATO A) in his memo dated December 7, 1976, a subsurface investigation was carried out at the above mentioned site in order to assess subsoil conditions for the foundation support of the proposed new station building and the platform canopes.

DESCRIPTION OF THE SITE AND GEOLOGY

The site is located west of Hwy. 10 and North of Queen St., in the city of Mississauga, Regional Municipality of Peel.

The area is in physiographic region referred to as "Iroquois Plain". During the "pleistocene" period of glacial age the waters of "Lake Iroquois" covered the lowlands bordering the present Lake Ontario. In this area the surficial deposit is composed of silts and sands between 6 to 15 ft. in thickness. The granular deposit is generally underlain by a cohesive glacial till stratum.

FIELD INVESTIGATION

A subsurface investigation was initially carried out and the relevant data was contained in our report W.O. 72-11065 submitted June 6, 1976. During this investigation five sampled boreholes were put down along the present "GO Station" platform, by means of a portable washboring rig as well as a Winkie drill. An additional subsurface investigation, consisting of two sampled boreholes (BH 6 and 7) were carried out during February 3, 1977 by means of a truck mounted C.M.E. auger machine adapted for soil sampling purposes. These two boreholes were located at the entrance section of the existing "GO Station" for the proposed station building.

The locations and elevations of all the borings are shown on Drawing No. W.O. 76-11008 A. The stratigraphy encountered at the boring locations is shown on the Record of Borehole sheets. A stratigraphical section, inferred from this data is also plotted on Drawing No. 76-11008 A.

SUBSURFACE CONDITIONS

The five boreholes were put down through the existing platform, which was surfaced with a thin (1 inch thick) asphalt pavement. The pavement is underlain by fill, the thickness of which varies from 13.3 feet (B.H. #1) to 18.5 feet (B.H. #3); in general, it decreases in an easterly direction, i.e. towards Hwy. #10. The fill is primarily composed of sand and gravel with pieces of coal and wood throughout. Layers of clayey silt, up to 3 feet thick, are also present. In addition, occasional boulders up to 18 inches in size are located at random locations within the fill.

Standard penetration resistance testing carried out within the deposit, the results of which are plotted on the Borelog Sheets, gave 'N' values varying from 2 to 25 blows/ft. These results suggest that the relative density varies from compact in the upper and lower portions of the fill to very loose in the middle portion.

At the GO Station entrance, two boreholes, (B.H. #6 and #7) were put down for the station building. The ground was surfaced with a thin layer of concrete pavement. The pavement is underlain by fill material. In B.H. #6 the fill is a 2 foot thick layer of sub-base gravel material. In B.H. #7 a 3.5 foot thick layer of fill material composed of clayey silt, some sand and occasional gravel with trace of organics.

The fill is underlain, in places, by a stratum of compact to very dense ('N' values between 21 and 104 blows/ft.) granular material composed of brown to grey silty fine sand. The thickness of the sand varies from 5.5 feet at B.H. #1 to 7.5 feet at B.H. #6, although not fully penetrated at B.H. #3, it was proven to extend to a depth of at least 4.5 feet.

The granular material, where present, or the fill elsewhere, is underlain by a very stiff ('N' values between 19 and 29 blows/ft.) cohesive deposit composed of grey clayey silt. This cohesive deposit was fully penetrated at B.H. #2 only, where it has a thickness of 5 feet.

The granular deposit, where present, or the cohesive clayey silt stratum elsewhere, is underlain by a stratum of very stiff to hard ('N' value of 24 blows/ft. to over 100 blows/ft.) grey glacial till composed of clayey silt with sand and gravel. This stratum was not fully penetrated at any of the boring locations. It was proven to extend to a depth of at least 11 ft.

GROUNDWATER

The groundwater level across the site was obtained by recording the water levels in the open boreholes. The groundwater level observed during the time of field investigations is at about elevation 267 which corresponds to a depth of 13.5 ft. below the existing station platform surface or 3.0 ft. below the existing street pavement surface.

DISCUSSION AND RECOMMENDATIONS

It is planned to construct a station building at the entrance and platform canopes on the platform of the existing Port Credit 'GO' station in the city of Mississauga, Regional Municipality of Peel.

Station Building

The subsoil at the station building location is generally favorable. A safe bearing pressure up to 3 t.s.f. can be used to support the spread footing foundations for the proposed structure. In order to satisfy the frost protection requirements in the area a minimum of 4 ft. earth cover above the base of the footings should be provided. It is recommended to place the footings at or below elevation 266.0. A dewatering scheme will be required since excavations for the foundation will be carried out below the water level in granular subsoil.

Platform Canopy

It is proposed to support the platform canopy columns on concrete filled augered caissons.

- (a) To evaluate the allowable bearing capacity of the caissons for vertical loads, the following formula can be used:

$$Q_{\text{safe}} = \left[\frac{\pi D^2}{4} p_s + \frac{K \pi D L^2}{2} \gamma \tan \alpha \right] \times \frac{1}{F}$$

where F = 2.0 (Factor of safety)

D = Caisson Diameter

L = Embedded Length

p_s = End-bearing capacity, 2 tsf for fill material & 3 tsf for natural deposit.

K = Earth pressure coefficient, 0.4 for fill material & 0.6 for natural deposit

α = Shaft friction angle, 28° for fill material & 32° for natural deposit

γ = Bulk density, 120 p.c.f. for both fill material and natural deposit.

- (b) To design against overturning the parameters $c = 0$ and $\phi = 28^\circ$ (32° in natural soil) and unit weight of 120 p.c.f. can be used if the Texas Highway Department method is adopted.
- (c) Alternately, a horizontal subgrade modulus of $K_h = 25 \text{ tons/ft.}^2/\text{ft.}$ may be assumed.

MISCELLANEOUS

The field investigation carried out during February 3, 1977 was supervised by Mr. V. Korlu, Project Engineer, who also prepared this report.

The equipment in the field was owned and operated by the Geocon Ltd. of Toronto.

This report was reviewed by Mr. M. Devata, Supervising Engineer.



V. Korlu
V. Korlu, P. Eng.
Project Engineer

M. Devata
M. Devata, P. Eng.
Supervising Engineer

MD/VK/bp
February/77

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

WO 76-11008 LOCATION Port Credit Co Station Platform ORIGINATED BY ECB
 W.P. BORING DATE May 25, 1972 COMPILED BY ECB
 DATUM Geodetic BOREHOLE TYPE Portable Winkie Drill-Washboring CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE						LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.						WATER CONTENT %				
280.6	Ground Level																
0.0	Asphalt Top 1"	X	1	SS	13	280											
		X															
	Sand and Gravel (occ. pieces of coal and wood) (Fill)	X	2	SS	5												
		X															
		X	3	SS	14												
		X															
	Loose to Compact	X	4	SS	13	270											
		X															
267.3		X	5	SS	12												
13.3	Boulder																
	Silty Fine Sand Brown		6	SS	81												
261.6	Very Dense																
261.1	Glacial Till Hard		7	SS	104												
19.5	End of Borehole					260											





267.3
 on May 26/72

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

WO 76-11008 LOCATION Port Credit Go Station Platform ORIGINATED BY ECB
 W.P. BORING DATE May 26, 1972 COMPILED BY ECB
 DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY SL

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE						LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.						WATER CONTENT %					
							○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL		x LAB. VANE		w_p ——— w ——— w_L			
280.7	Ground Level																	
0.0	Asphalt top 1½"		1	SS	17	280												
	Sand & gravel, trace of silt		2	SS	7													
	(trace of organic matter throughout)																	
	Fill		3	SS	2													
			4	SS	5/6"													
	Compact to Very Loose		5	SS	9	270												
265.2			6	SS	10													
15.5	Clayey Silt		7	SS	19													
	Grey		8	SS	29													
	Very Stiff																	
259.6	Het. mix. of clayey silt					260												
258.2	sa. & gr. (Glac. Till) V. Stiff		9	SS	24													
22.5	End of Borehole																	

No W.L.
Hole Caved in.

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

LOCATION	Port Credit Go Station Platform
----------	---------------------------------

ORIGINATED BY ECB

BORING DATE May 29, 1972

COMPILED BY ECB

BOREHOLE TYPE Washboring-BX Casing

CHECKED BY 

[illegible]

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

WO 76-11008

LOCATION Port Credit Go Station Platform

ORIGINATED BY ECB

W.P.

BORING DATE May 29, 1972

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Washboring-BX Casing

CHECKED BY AK

[illegible]

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

WO 76-11008 LOCATION Port Credit Go Station Platform ORIGINATED BY ECB
 W.P. BORING DATE May 30, 1972 COMPILED BY ECB
 DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY alk.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE		WATER CONTENT % w_p — w — w_L			
280.7	Ground Level											
0.0	Asphalt Top 1"	X	1	SS	17	280						
	Sand and gravel, trace of silt	X	2	SS	20							
	(occ. pieces of wood & brick)	X	3	SS	10							
	Fill	X										
270.2	Loose to Compact	X	4	SS	7							Hole Dry
10.5	End of Borehole					270						

NOTE:
Met practical refusal to driving at 5' (probably boulder). Moved 2½' west and resumed sampling at 6'.

RECORD OF BOREHOLE NO 6

WO 76-11008

LOCATION 'GO' Station Port Credit

ORIGINATED BY VK

DIST 6 HWY

BORING DATE Feb. 3, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Augers

CHECKED BY R.S.

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	WP	W	WL		
270.0	Ground Level															
268.0	Concrete pavement & sand & Gravel fill															
2.0	Silty fine sand compact. (Brown)		1	SS	29											0 2 89 3
260.5			2	SS	24											
9.5	(Grey) Het. Mix. of clayey silt, sand & gravel (Glacial Till) Very stiff to hard.		3	SS	23											
			4	SS	52											
			5	SS	51											
250.0			6	SS	100											
20.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 7

WO. 76-11008 LOCATION 'GO' Station, Port Credit ORIGINATED BY VK
 DIST 6 HWY BORING DATE Feb. 3, 1977 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Augers CHECKED BY R.S.

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				
270.0	Ground Level															
0.0	Clayey silt, sand & few gravel, traces of organics - fill		1	SS	10											
266.5			2	SS	68											
3.5	Silty fine sand Compact to very dense.		3	SS	21											
261.0			4	SS	39											
9.0	Het. Mix. of clayey silt, sand & gravel. (Glacial Till)		5	SS	47											
250.0	Very stiff to hard.		6	SS	90											
20.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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
w_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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	$= 3.1416$
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
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	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
β	ANGLE OF SLOPE TO HORIZONTAL

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

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

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S	OESTERBERG SAMPLE
A.S	AUGER SAMPLE	F.S	FOIL SAMPLE
C.S	CHUNK SAMPLE	R.C	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

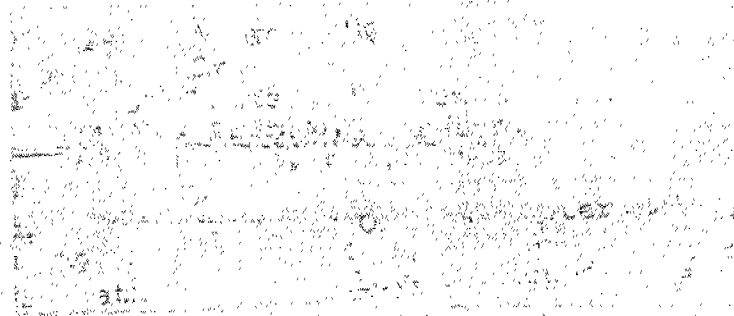
P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

OVERSIZE DRAWING

FILE COPY



FOUNDATION FILE COPY

MINISTRY
OF
TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

30M11-161

TO: Mr. H. W. Clelland,
Manager, Project Development
Go Transit Branch,
Central Building.

FROM: Foundations Office,
Design Services Branch,
Downsview, Ontario.

ATTENTION:

DATE: June 6, 1972.

OUR FILE REF.

IN REPLY TO

JUN 15 1972

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Commuter Platform Shelter Enclosures -

Port Credit Go Station

District No. 6 (Toronto)

W.O. ~~72-11065~~W.P. ~~46-72-01~~

76-11008

76-11008

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation for the aforementioned proposed shelter enclosures. The request was contained in a memo from the Transportation Operations Branch, M.T.C. (Mr. H. W. Clelland, Project Development Manager), dated May 18, 1972. Subsequently, an investigation was carried out by this Office 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 three proposed enclosures, which will provide shelter for Go Train commuters.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located west of Hwy. #10 and north of Queen St., in the town of Port Credit. The proposed shelter enclosures will be erected on the Go Station platform, which extends in an east-west direction parallel to and separating the existing C.N.R. tracks. Immediately to the north of these tracks is an east-west concrete-lined drainage canal which is approximately 50 feet wide and 12 feet deep. The platform area involved is flat, lying between elevation 280 and 281.

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". 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:

Five sampled boreholes were put down to depths ranging from 10.5 to 23 feet, during the course of the investigation by means of a portable washboring rig as well as a Winkie drill.

The locations and elevations of the borings are shown on Drawing No. 72-11065A. The stratigraphy encountered at the boring locations is shown on the Record of Borelog sheets; a stratigraphical section, inferred from this data, is plotted on Drawing No. 72-11065A. A brief review of the subsoil conditions encountered are presented in the following paragraphs.

The borings were put down through the existing platform, which was surfaced with a thin (1 inch thick) asphalt pavement. The pavement is underlain by fill, the thickness of which varies from 13.3 feet (B.H. #1) to 18.5 feet (B.H. #3); in general, it decreases in an easterly direction - i.e. towards Hwy. #10. The fill is primarily composed of sand and gravel with pieces of coal and wood throughout. Layers of clayey silt, up to 3 feet thick, are also present. In addition, occasional boulders, up to 18 inches in size are located at random locations within the fill.

Standard penetration resistance testing, carried out within the deposit, the results of which are plotted on the Borelog sheets, gave 'N' values varying from 2 to 25 blows/ft. These results suggest that the relative density varies from compact in the upper and lower portions of the fill to very loose in the middle portion.

The fill is underlain, in places, by a stratum of dense to very dense ('N' values between 44 and 104 blows/ft.) granular material composed of brown to grey silty fine sand. The thickness of the sand is 5.5 feet at B.H. #1, and, although not fully penetrated at B.H. #3, it was proven to extend to a depth of at least 4.5 feet.

The granular material, where present, or the fill elsewhere is underlain by a very stiff ('N' values between 19 and 29 blows/ft.) cohesive deposit composed of grey clayey

silt. This cohesive deposit was fully penetrated at B.H. #2 only, where it has a thickness of 5 feet.

The clayey silt deposit is underlain by a stratum of very stiff ('N' value of 24 blows/ft.) grey glacial till composed of clayey silt with sand and gravel. This stratum was not fully penetrated at any of the boring locations.

The groundwater level across the site was obtained by recording the water levels in the open boreholes. Based on these observations it is estimated that the groundwater level is at about elevation 267, which corresponds to a depth of 13.5 feet below the existing ground surface. This groundwater level was similar to that recorded during a previous investigation in this area (W.O. 69-F-46, July 2, 1969).

4. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct three aluminum frame platform shelter enclosures at the Port Credit Go Station, in the town of Port Credit. It is understood that each enclosure will be founded on eight cylindrical, reinforced concrete column footings, each approximately 1 foot in diameter.

In order to satisfy the frost protection requirements in the area a minimum of 4 feet of earth cover should be provided above the base of the cylindrical footings. This would place the footings within the relatively loose zone of the fill - i.e., at about elevation 276. With respect to static dead loads, such footings could be designed using an allowable bearing pressure of 1,000 p.s.f.. Further, when considering the case of transient live loads, such as wind loads, the maximum edge pressure should be limited to 1,500 p.s.f..

As the footings will be located above the groundwater level recorded during the period of investigation, no major dewatering problems are anticipated. Any minor seepage or surface run-off could be controlled using conventional techniques such as pumping from sumps.

Settlement will be induced in the foundation subsoil by the applied footing pressure. This settlement should not exceed 1 inch. Further, it will be elastic in nature - i.e., take place during or immediately following the construction period.

Detailed borehole log sheets and a drawing #72-11065A showing the location of boreholes, together with the stratigraphical sections, inferred from the borehole data will be submitted within the next two weeks after the completion of our draughting work.

June 6, 1972

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/ht

M. Devata
SUPERVISING FOUNDATIONS ENGINEER

c.c. H.W. Clelland (2)
B.R. Davis
W.M. McFarland
D.W. Farren
H. Greenland
A. Rutka
G.A. Wrong
P.J. Harvey
T.J. Kovich
B.A. Singh

Foundations Files
Documents

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 72-11065 LOCATION Port Credit Go Station Platform ORIGINATED BY ECB
 W.P. 46-72-01 BORING DATE May 25, 1972 COMPILED BY ECB
 DATUM Geodetic BOREHOLE TYPE Portable Winkie Drill-Washboring CHECKED BY dl

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT						LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w				BULK DENSITY γ P.C.F.	REMARKS
LEV. EPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.						w_p — w — w_L WATER CONTENT %					
							○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL		x LAB. VANE					
30.6	Ground Level																	
0.0	Asphalt Top 1"	X	1	SS	13	280												
	Sand and Gravel (occ. pieces of coal and wood) (Fill)	X	2	SS	5													
	Loose to Compact	X	3	SS	14													
		X	4	SS	13	270												
57.3		X	5	SS	12													
13.3	Boulder	X																
	Silty Fine Sand Brown	X	6	SS	81													
61.6	Very Dense	X																
91.1	Clayey silt. Hard	X	7	SS	104													
99.5	End of Borehole					260												

267.3
on May 26/7

267.3
on May 26/72

CHECKED BY

FOUNDATION SECTION

[illegible]

CHECKED BY

FOUNDATION SECTION

[illegible]

FOUNDATION SECTION

CHECKED BY [Signature]

[illegible]

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 72-11065 LOCATION Port Credit Go Station Platform ORIGINATED BY ECB
W.P. 46-72-01 BORING DATE May 30, 1972 COMPILED BY ECB
DATUM Geodetic BOREHOLE TYPE Washboring-BX Casing CHECKED BY *g/f*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w <div>w_p — w — w_L</div> WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
LEV. EPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
80.7	Ground Level															
0.0	Asphalt Top 1"		1	SS	17	280										
	Sand and gravel, trace of silt		2	SS	20											
	(occ. pieces of wood & brick)		3	SS	10											
	Fill															
70.2	Loose to Compact		4	SS	7										Hole Dry	
10.5	End of Borehole					270										

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

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	$= 3.1416$
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
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

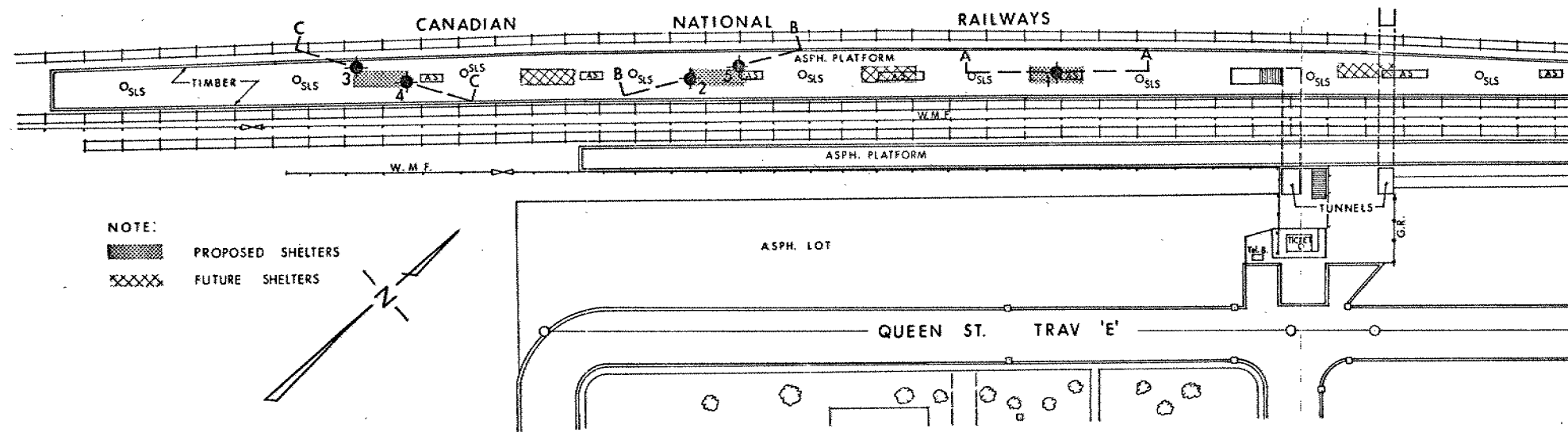
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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

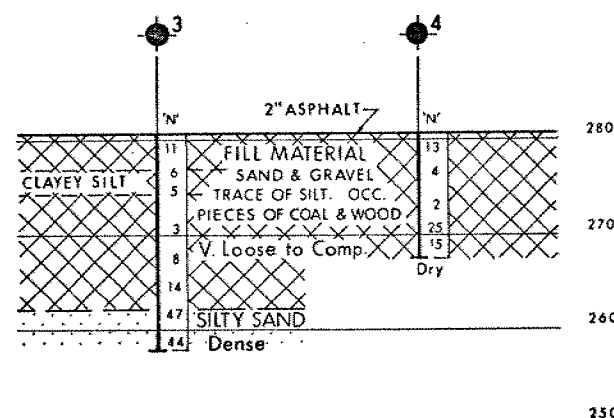
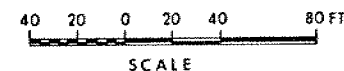
SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

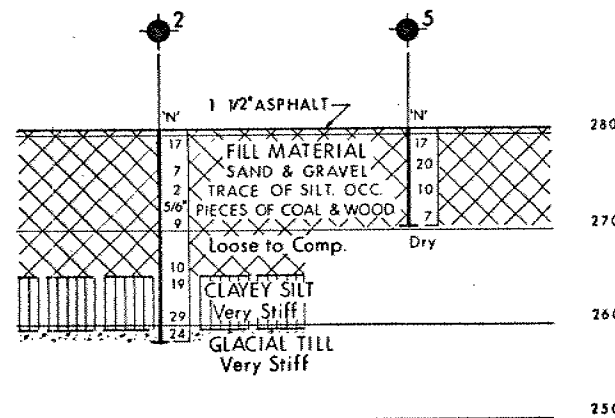


NOTE:
 PROPOSED SHELTERS
 FUTURE SHELTERS

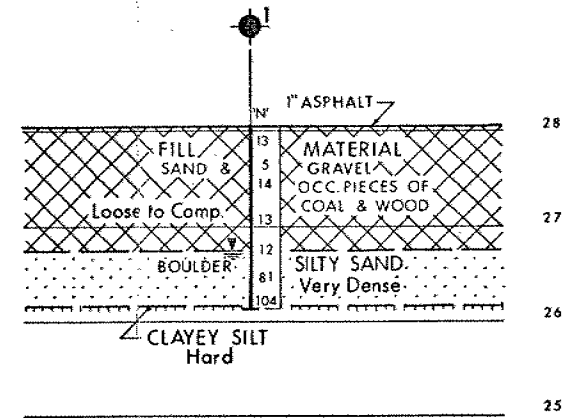
PLAN



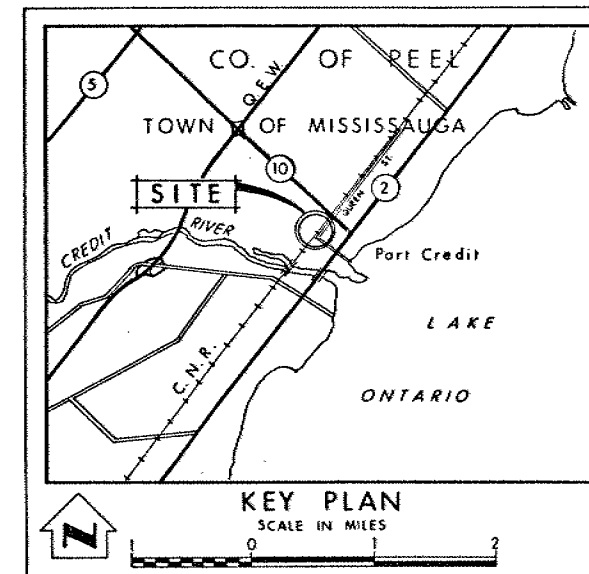
C - C



SECTIONS
B - B



A - A



LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, May 1972
No W.L. Observed in Boreholes 2 & 3. Holes Caved In

NO.	ELEVATION	STATION	OFFSET
1	280.6		
2	280.7		
3	280.7		
4	280.7		
5	280.7		

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.

REVISIONS	DATE	BY	DESCRIPTION

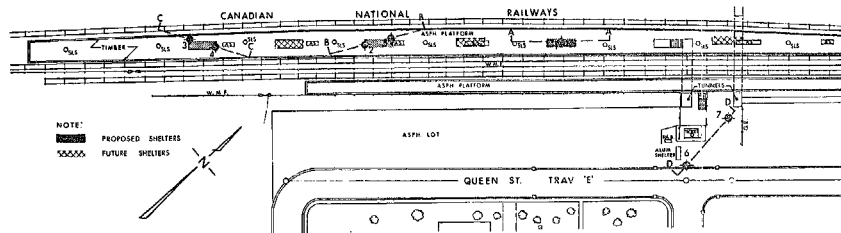
MINISTRY OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

PROPOSED SHELTERS PORT CREDIT GO STATION

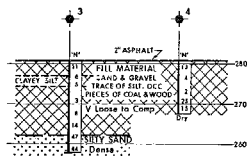
HIGHWAY NO. _____ DIST. NO. 6
CO. PEEL TOWN OF MISSISSAUGA
TWP. _____ LOT _____ CON. _____

BORE HOLE LOCATIONS & SOIL STRATA

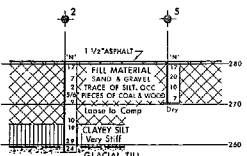
SUBMD E.C.B. CHECKED <input checked="" type="checkbox"/>	W.P. NO. 46-72-01	DRAWING NO. 72-11065A
DRAWN O.L.J. CHECKED <input checked="" type="checkbox"/>	JOB NO. 72-11065	BRIDGE DRAWING NO. _____
DATE 13 JUNE 72	SITE NO. _____	CONT. NO. _____
APPROVED PRINCIPAL FOUNDATION ENGINEER		



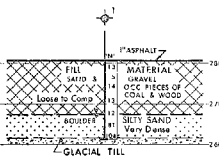
PLAN
40 30 0 30 40 50 FT
SCALE



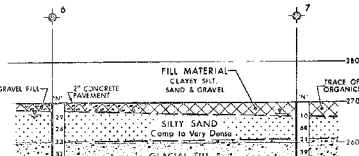
C - C



B - B



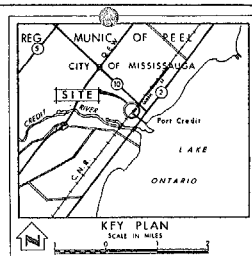
A - A



D - D

SECTIONS

10 5 0 SCALE 10 20 FT
DISTANCE



LEGEND

- ◆ Bore Hole
- ◆ Core Penetration Test
- ◆ Bore Hole & Core Test
- ◆ Water Levels established at time of field investigation May 1972
- ◆ No WL Observed in Boreholes
- ◆ 2 A.S. Holes Closed in
- ◆ 3110.6.7 February 1977

NO	ELEVATION	STATION	OFFSET
1	280.6		
2	280.7		
3	280.7		
4	280.7	AS SHOWN ON PLAN	
5	280.7		
6	270.0		
7	270.0		

NOTE

The boundaries between the bore holes 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	DESCRIPTION
1	1. FILL MATERIAL
2	2. SAND & GRAVEL
3	3. TRACE OF SILT
4	4. COAL WOOD
5	5. LOOSE TO COMP
6	6. SILTY SAND
7	7. DENSE

MINISTRY OF TRANSPORTATION & COMMUNICATIONS
ROADWAY DESIGN DIVISION (INCLUDING MATERIALS OFFICE, SOIL MECHANICS SECTION)

PROPOSED SHELTERS
PORT CREDIT GO STATION

HIGHWAY NO. _____ DIST. NO. 6
REG. MUN. OF PEEL CITY OF MISSISSAUGA

LOT _____ CON. _____

BORE HOLE LOCATIONS & SOIL STRATA

DRAWN BY C.B. CHECKED BY _____

DATE 13 JUNE 72 SHEET NO. _____

APPROVED _____

761008-A