

G.I.-30 SEPT. 1976

GEOCRES No. 30L14-44DIST. 4 REGION W.P. No. 2706-76-02CONT. No. 78-418W. O. No. STR. SITE No. HWY. No. 140LOCATION Port ColborneNo. of PAGES -=====  
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 78-418



Ministry of  
Transportation and  
Communications



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NOTE: For purposes of the contract this report supercedes all other foundation reports prepared by or for the Ministry in connection with the above mentioned project.

# EXPLANATION OF TERMS USED IN REPORT

**'N' VALUE:** AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS  $N_c$ .

**DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3):** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

**SOIL QUALITY:** SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

**CONSISTENCY:** COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH AS FOLLOWS:

$S_u$ (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

**ROCK QUALITY:** ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH DRILLED IN THAT CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS & SYMBOLS

### LABORATORY TESTING

TRIAxIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG.  $\bar{C}U$  = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

### FIELD SAMPLING

S S SPLIT SPOON  
W S WASH SAMPLE  
S T SLOTTED TUBE SAMPLE  
B S BLOCK SAMPLE  
C S CHUNK SAMPLE  
T W THINWALL OPEN  
T P THINWALL PISTON  
O S OSTERBERG SAMPLE  
F S FOIL SAMPLE  
R C ROCK CORE  
P H T.W. ADVANCED HYDRAULICALLY  
P M T.W. ADVANCED MANUALLY

### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  ANGLE OF WALL FRICTION  
 $k_0$  COEFFICIENT OF EARTH PRESSURE AT REST  
 $k_A$  COEFFICIENT OF ACTIVE EARTH PRESSURE  
 $k_P$  COEFFICIENT OF PASSIVE EARTH PRESSURE  
 $i$  ANGLE OF INCLINATION OF SURFACE  
 $\omega$  SLOPE ANGLE-BACKFACE OF WALL  
 $\beta$  ANGLE OF SLOPE  
 $c, \gamma, \lambda, k_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  UNIT WEIGHT OF SUBMERGED SOIL  
 $G_s$  SPECIFIC GRAVITY OF SOLIDS  
 $e$  VOIDS RATIO  
 $e_n$  INITIAL VOIDS RATIO  
 $e_{max}$   $e$  IN LOOSEST STATE  
 $e_{min}$   $e$  IN DENSEST STATE  
 $D_r$  RELATIVE DENSITY =  $\frac{e_{max} - e}{e_{max} - e_{min}}$   
 $n$  POROSITY  
 $w$  WATER CONTENT  
 $w_L$  LIQUID LIMIT  
 $w_P$  PLASTIC LIMIT  
 $w_S$  SHRINKAGE LIMIT  
 $I_P$  PLASTICITY INDEX =  $w_P - w_L$   
 $I_L$  LIQUIDITY INDEX =  $\frac{w - w_P}{w_L - w_P}$   
 $I_c$  CONSISTENCY INDEX =  $\frac{w_L - w}{w_L - w_P}$   
 $A_c$  ACTIVITY =  $\frac{I_P}{I_c}$   
 $O_m$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_c$  PEAK SHEAR STRENGTH  
 $\tau_R$  RESIDUAL SHEAR STRENGTH  
 $c$  COHESION INTERCEPT  
 $\sigma_1, \sigma_2, \sigma_3$  NORMAL PRINCIPAL STRESSES  
 $u$  PORE WATER PRESSURE  
 $u_e$  EXCESS  $u$   
 $r_u$  PORE PRESSURE RATIO  
 $q_u$  UNCONFINED COMPRESSIVE STRENGTH  
 $c_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $E_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  COEFFICIENT OF VISCOSITY  
 $k$  COEFFICIENT OF HYDRAULIC CONDUCTIVITY  
 $k_h$   $k$  IN HORIZONTAL DIRECTION  
 $k_v$   $k$  IN VERTICAL DIRECTION  
 $\epsilon_v$  COEFFICIENT OF VOLUME CHANGE  
 $C_v$  COEFFICIENT OF CONSOLIDATION  
 $C_c$  COMPRESSION INDEX  
 $C_r$  RECOMPRESSION INDEX  
 $d$  DRAINAGE PATH DISTANCE  
 $T_v$  TIME FACTOR  
 $U$  DEGREE OF CONSOLIDATION  
 $O_r$  OVERCONSOLIDATION RATIO (OCR)

**NOTE:** EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\sigma'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'_1$  = EFFECTIVE NORMAL STRESS

## FOUNDATION INVESTIGATION REPORT

For

Port Colborne Patrol Yard  
Hwy. 140, Township of Humberstone  
W.P. 2706-76-02, District 4, Hamilton

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### INTRODUCTION

This report contains the results of a foundation investigation which was carried out at the site of the above mentioned project. Fieldwork was done during the period December 13-14, 1978, utilizing a continuous flight auger machine equipped with 3½ inch I.D. hollow stem augers.

### SITE DESCRIPTION

The proposed patrol yard is located on the west side of Hwy. 140 approximately 1.5 miles north of Hwy. 3. The surrounding terrain is relatively flat lying farmland with occasional mixed bush.

Physiographically, the site is located in the region referred to as the Haldiman Clay Plain.

### SUBSURFACE CONDITIONS

#### General

Reference should be made to the Record of Borehole Sheets for elevations and to Figure 1 for locations of the borings, contained in the Appendix of this report. Subsoil at the site consists of 6 to 7 feet of fill material overlying a deposit of silty clay to clay to the depth of exploration (maximum 24 feet).

#### Fill Material

This zone consists of a surficial layer (approximately 12-18 inches thick) of granular 'A' (well graded sand and gravel with traces of fines) followed by a locally obtained silty clay to clay material to approximate elevation 579+, having similar composition as the encountered native soil which properties are described as follows. The consistency varies from soft to very

stiff. The fill material for the garage apron and building was placed under Contract 77-433.

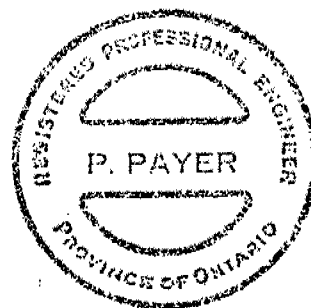
#### Silty Clay to Clay

This deposit was encountered immediately beneath the fill material and extends from there to the depth of exploration which was terminated at elevation 561 $\pm$  some 24 feet below the existing ground surface. The material in the deposit was found to consist of silty clay to clay, trace of sand. Occasional grey silt seams and pockets of clear gypsum crystals were also encountered. The extreme upper portion of the stratum contains undecayed and decayed organic substances. The material has an intermediate to high plasticity. The average natural moisture content is about 27%. Standard Penetration Tests 'N' values ranged from 11 to 40 blows per foot. The consistency of the portion of the deposit investigated varies from stiff to hard. The colour of the material changes from brown to reddish brown and to brown again below elevation 565 $\pm$ .

#### Groundwater

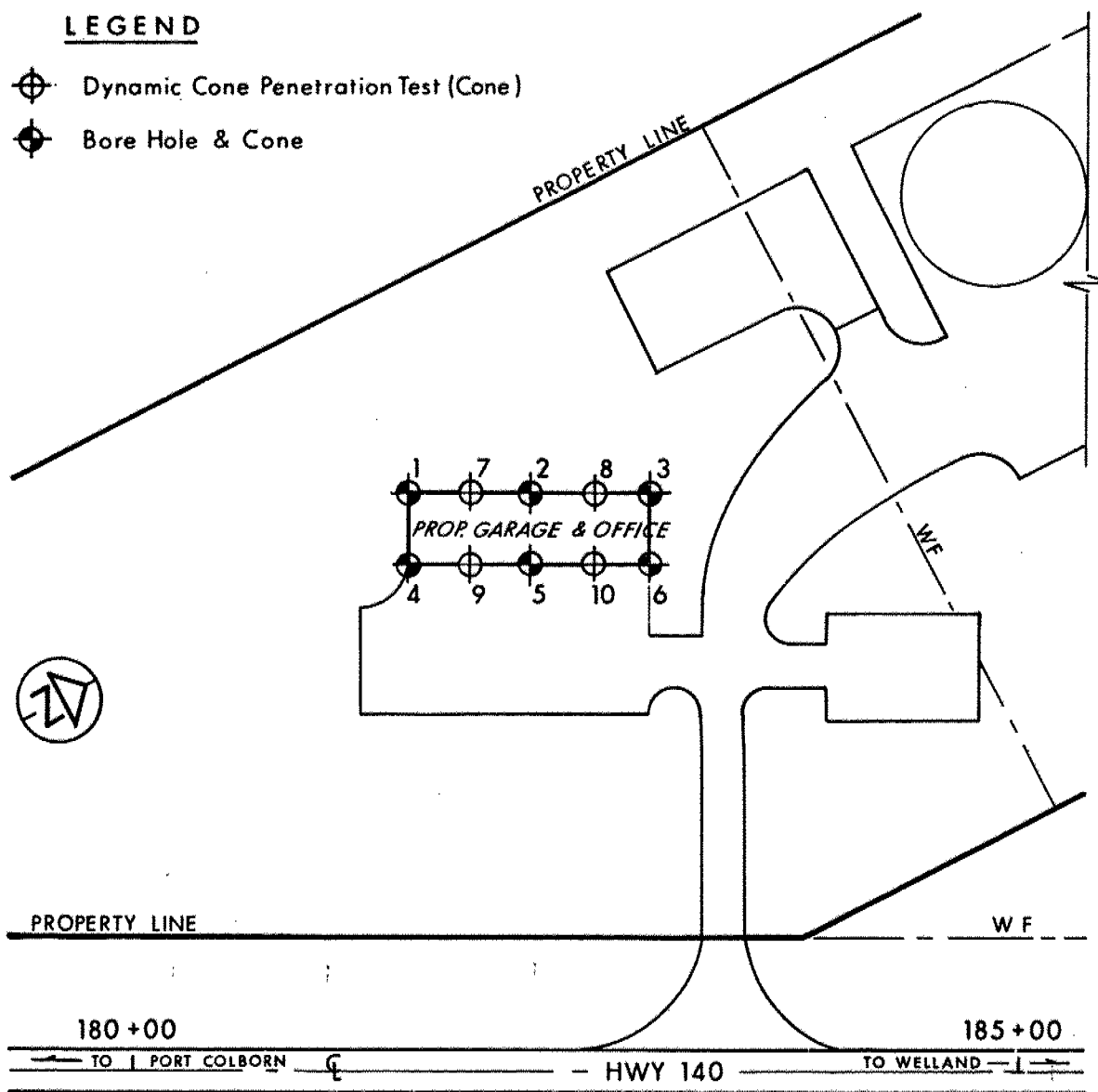
With the exception of Borehole #5 (west wall, mid-point) no water was observed in the borings. In Borehole #5, the groundwater level was found to be at elevation 573 $\pm$ , some 12 feet below the top of the embankment.

*P. Payer*  
P. Payer, P. Eng.  
Senior Engineer



*K.G. Selby*  
K.G. Selby, P. Eng.  
Supervising Engineer

## APPENDIX



**PLAN**

SCALE: 1 in. = 100 ft

**PATROL GARAGE & OFFICE**  
PORT COLBORNE PATROL YARD  
(1.5 Miles North of Hwy 3)

W.P. 2706-76-02

FIG 1



# RECORD OF BOREHOLE No 1

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
 DIST 4 HWY - BOREHOLE TYPE Continuous Flight Auger (H.S.) and Cone Test COMPILED BY PP  
 DATUM Geodetic DATE December 13, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
585.1	Ground Level																
0.0	Granular 'A' --- Silty Clay to Clay Occasional Organics Soft to Very Stiff Fill Material		1	SS	3		580										
579.0			2	SS	19												
6.1	Silty Clay to Clay Trace of Sand Occasional Grey Silt Seams and Pockets of Gypsum Crystals Brown to Reddish Brown		3	SS	19	Dry											
			4	SS	40												
			5	SS	39												
	Stiff to Hard		6	SS	14		570										
			7	SS	19												
563.6			8	SS	11												
21.5	End of Borehole						560										

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 ◇ 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 2

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
 DIST. 4 HWY - BOREHOLE TYPE Continuous Flight Auger (H.S.) and Cone Test COMPILED BY PP  
 DATUM Geodetic DATE December 13, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							WATER CONTENT (%)					
								SHEAR STRENGTH							Wp — W — WL					
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE													
585.5	Ground Level																			
0.0	Granular 'A'																			
	Silty Clay to Clay Trace of Sand and Occasional Organics Soft to Stiff		1	SS	2															
579.0	Fill Material		2	SS	11		580													
6.5	Occasional Organics		3	SS	12															
	Silty Clay to Clay Trace of Sand Occasional Grey Silt Seams		4	SS	30	Dry														
	Brown to Reddish Brown		5	SS	35															
	Stiff to Hard		6	SS	19		570													
564.0			7	SS	12															
21.5	End of Borehole						560													

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 3

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY BOREHOLE TYPE Continuous Flight Auger (H.S.) and Cone Test COMPILED BY PP  
DATUM Geodetic DATE December 13, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
585.5	Ground Level																
0.0	Granular 'A'																
	Silty Clay to Clay Occasional Sand Pockets Very Stiff Fill Material		1	SS	24												
579.0			2	SS	22												
6.5	Silty Clay to Clay Trace of Sand Occasional Grey Silt Seams Brown to Reddish Brown Stiff to Hard		3	SS	16												
			4	SS	31	Dry											
			5	SS	19												
			6	SS	15												
564.0			7	SS	11												
21.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 4

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY - BOREHOLE TYPE Continuous Flight Auger (H.S.) and Cone Test COMPILED BY PP  
DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
584.9	Ground Level																
0.0	Granular 'A'																
	Silty Clay to Clay		1	SS	3												
	Occasional Organics																
	Soft to Very Stiff																
	Fill Material																
579.0			2	SS	18		580										
5.9	Silty Clay to Clay		3	SS	15												
	Trace of Sand																
	Occasional Grey Silt		4	SS	36												
	Seams																
	Brown to Reddish		5	SS	21												
	Brown																
	Very Stiff to Hard		6	SS	17		570										
			7	SS	18												
560.9			8	SS	15												
24.0	End of Borehole						560										

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

## RECORD OF BOREHOLE No 5

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY - BOREHOLE TYPE Continuous Flight Auger (H.S.) and Cone Test COMPILED BY PP  
DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						SHEAR STRENGTH	WATER CONTENT (%)		
								○ UNCONFINED ● QUICK TRIAXIAL						+ FIELD VANE x LAB VANE			
585.7	Ground Level																
0.0	Granular 'A'																
	Silty Clay to Clay Some Sand Traces of Organics Very Stiff Fill Material																
579.0			1	SS	18		580										
6.7	Trace of Organics		2	SS	16												
	Silty Clay to Clay Trace of Sand Occasional Grey Silt Seams and Pockets of Gypsum Crystals Brown to Reddish Brown		3	SS	13												
			4	SS	17												
			5	SS	21												
	Stiff to Very Stiff		6	SS	18		570										
564.2			7	SS	16												
21.5	End of Borehole						560										

+3, x5: Numbers refer to Sensitivity

15  $\phi$  5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 6

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY - BOREHOLE TYPE Continuous Flight Auger (H.S.) and Cone Test COMPILED BY PP  
DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
585.4	Ground Level																
0.0	Silty Clay to Clay Trace of Sand Very Stiff Fill Material																
279.0			1	SS	17		580										
6.4	Occasional Organics		2	SS	13												
	Silty Clay to Clay Trace of Sand Occasional Grey Silt Seams		3	SS	26	Dry											
	Brown to Reddish Brown		4	SS	21												
	Stiff to Very Stiff		5	SS	14		570										
563.9			6	SS	12												
21.5	End of Borehole						560										

# RECORD OF BOREHOLE No 7

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
 DIST 4 HWY - BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY PP  
 DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
585.3	Ground Level							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
0.0	Fill Material (Silty Clay to Clay)													
	Native Material (Silty Clay to Clay)													
570.3														
15.0	End of Cone Test													

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

## RECORD OF BOREHOLE No 8

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY - BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY PP  
DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES					
585.5	Ground Level											
0.0	Fill Material (Silt / Clay to Clay)											
	Native Material (Silty Clay to Clay)											
572.7												
12.8	End of Cone Test						120/10"					

+3, x5 : Numbers refer to Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION





# RECORD OF BOREHOLE No 9

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY - BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY PP  
DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
585.3	Ground Level												
0.0	Fill Material (Silty Clay to Clay)												
	Native Material (Silty Clay to Clay)												
572.6													
12.7	End of Cone Test												

+3, x5: Numbers refer to Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 10

W P 2706-76-02 LOCATION See Figure 1 ORIGINATED BY PP  
DIST 4 HWY - BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY PP  
DATUM Geodetic DATE December 14, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>	WATER CONTENT (%)					
585.6	Ground Level																
0.0	Fill Material (Silty Clay to Clay)																
	-----																
	Native Material (Silty Clay to Clay)																
572.6																	
13.0	End of Cone Test																

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10

Mr. E. Shedler  
Special Services Officer  
Regional Maintenance Office  
Central Region, 3501 Dufferin St.

Soil Mechanics Section  
Engineering Materials Office  
Room 315, Central Building

78 12 19

Re: Port Colborne Patrol Yard  
W.P. 2706-76-02, Hwy. 140  
District 4, Hamilton

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Following your request of 78 11 27 a field investigation was carried out at the proposed patrol yard. Due to the urgency of this project we are submitting our summarized findings and recommendations. A more detailed report will be prepared for contract purposes in the very near future.

#### SUBSURFACE CONDITIONS

##### Fill Material

Approximately 6 feet of fill consisting of silty clay to clay with traces of sand was placed up to elevation 585.7 under grading contract 77-433 at this location. The field tests indicate that the consistency of the fill material varies from soft to very stiff along the proposed footing location. It is estimated that the undrained shear strength ( $c_u$ ) ranges from about 350 psf to 3500 psf.

##### Silty Clay to Clay, Traces of Sand

The original deposit was found to be similar in composition to that of the fill material: reddish-brown coloured silty clay to clay, traces of sand. The lower boundary of the stratum was not determined since the borings were terminated at or above elevation 555+. A desiccated zone with a thickness ranging from 10 to 12 feet was found at all borehole locations, the upper boundary being at approximate elevation 576+. This zone is brown in colour and has a stiff to hard consistency. Above and below the desiccated zone the consistency ranges from stiff to very stiff.

##### Groundwater

With the exception of Borehole #5 (west wall, mid-point) no water was observed in the borings. In Borehole #5 the groundwater level was found to be at elevation 573+ some 12 feet below the top of the embankment.

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Recommendations

It is proposed to construct a masonry building (garage and office) at this location. According to the present proposals the design loads will vary from 2.0 to 3.6 kips/sq. foot along the wall foundations. Due to the encountered great variations of consistency within the fill material, it is not recommended that the footings be placed within this zone. Differential settlements of the foundation subsoil could greatly effect the appearance and structural performance of such a building. Therefore, it is recommended that the footings be placed within the desiccated portion of the original subsoil at elevation 576+. For design purposes, uniformly applied loads up to 2.0 tsf. are recommended. Care should be taken that the foundation subsoil is not softened by surface run-off water.

It is estimated that differential settlements will be of negligible order due to the imposed loading if the above recommendations are followed.

Should the above recommendations require further clarification, please contact this office.

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