

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M15-53

DIST. 6 REGION

W.P. No. 2725-78-01

CONT. No. 82-400

W. O. No.

STR. SITE No.

HWY. No. 401

LOCATION N.W. QUADRANT

HWY 401 & NEWTONVILLE RD.

No of PAGES -

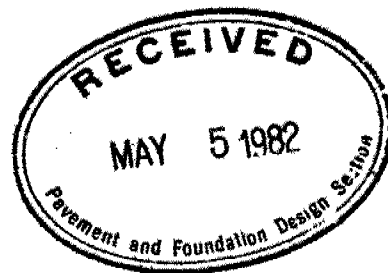
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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 82 - 400



Ministry of  
Transportation and  
Communications

## I N D E X

<u>Page Number</u>	<u>Description</u>
1	Index
2	Abbreviations and Symbols
3-11	Foundation Investigation Report for W. P. 2725-78-01 Patrol Yard Garage Newtonville Road

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

'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. CIU = 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  
 $k_o$  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 SURCHARGE   
 $w$  SLOPE ANGLE-BACKFACE OF WALL   
 $\beta$  ANGLE OF SLOPE   
 $N_q, N_q', N_c$  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  
 $e_o$  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 =  $w_L - w_p$   
 $I_L$  LIQUIDITY INDEX =  $\frac{w - w_p}{I_p}$   
 $I_c$  CONSISTENCY INDEX =  $\frac{w_L - w}{I_p}$   
 $A_c$  ACTIVITY =  $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ Soil Fraction}}$   
 $Om$  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  
 $\tau_f$  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  
 $s_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $k_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

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

##### 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  
 $m_v$  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  
 $O_c$  OVERCONSOLIDATION RATIO (OCR)

## FOUNDATION INVESTIGATION REPORT

For  
Patrol Yard Garage  
Newtonville Road  
Hwy. 401, District 6, Toronto  
W.P. 2725-78-01

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INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above project. Fieldwork was carried out on 80 03 04 and 80 03 05 and consisted of five sampled boreholes advanced to depths of up to 30 feet below the ground surface by means of solid stem augers.

SITE DESCRIPTION AND GEOLOGY

The site is located in the north west quadrant of the Hwy. 401 and Newtonville Road interchange in the Town of Newcastle, Regional Municipality of Durham.

Topographically the site is flat and grass covered. Some ditching work has been carried out across the northern limits of the proposed patrol yard. Physiographically the site is located in the Iroquois Plain Region. This region is characterized by undulating till plain bordering glacial Lake Iroquois.

SUBSURFACE CONDITIONS

Subsurface conditions across the site consist of an extensive deposit of glacial till encountered immediately below a thin veneer of topsoil. This stratum was not explored to its full depth, but proven to extend to at least 30 feet. The composition of the deposit is a silt and sand with a trace of clay and a trace of gravel. The results of grain size distribution testing on samples from this strata are shown in envelope form on Figure 1. Visual classification indicates that the deposit exhibits no plasticity or a very slight plasticity in some samples. This was confirmed by Atterberg Limit test carried out on

selected samples. These results are plotted on the Borehole Log Sheets as well as on the Plasticity Chart, Figure 2, and indicate that the matrix of the deposit is composed of inorganic silt of zero to low plasticity (ML zone). The visual examination and limit testing indicate that in the long term the material will behave as a granular type of deposit. Based on 'N' values ranging generally from 30 to over 100 blows per 0.3 metre, the deposit is estimated to have a dense to very dense relative density.

A brief description of the subsoil type and laboratory results are shown on the Record of Borehole Sheets. The locations and elevations of the boreholes as well as one stratigraphical profile is shown on Sheet No. 24-1

#### GROUNDWATER CONDITIONS

Groundwater levels were observed by measuring in the open borehole 24 hours after completion of the borings. The measurements indicate that the groundwater level is 4 to 5 feet below ground surface which corresponds to an elevation of 489.9 to 492.6.

M. Devata,  
Senior Foundations Engineer



RECORD OF BOREHOLE No 1

W P 2725-78-01 LOCATION Sta. 9484 126' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

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> WATER CONTENT (%) 10 20	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
495.1	Ground Level										
0.0	Heterogeneous Mixture Sand and Silt, Trace Clay, Trace Gravel Dense to V. Dense		1	SS	32						
			2	SS	64						
			3	SS	64						
485.1											
10.0	End of Borehole										

+3, x5: Numbers refer to Sensitivity  
20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 2

W P 2725-78-01 LOCATION Sta. 9+73 205' RT. ORIGINATED BY FL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY FL  
DATUM Geodetic DATE 80 03 04 CHECKED BY \_\_\_\_\_

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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
495.6	Ground Level														
0.0	Heterogeneous Mixture Silt and Sand Trace Clay Trace Gravel (Glacial Till)		1	SS	74		490							5 35 48 12	
			2	SS	26										
			3	SS	47										
			4	SS	78										
			5	SS	72/		6"								
	Dense to V. Dense		6	SS	100/		5"	480							
			7	SS	87/		5"								
			8	SS	75/		3"	470							
			9	SS	30/		3"								
465.1															
30.5	End of Borehole														

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

20  
15 5 (%) STRAIN AT FAILURE  
10





RECORD OF BOREHOLE No 3

W P 2725-78-01 LOCATION Sta. 9+23 158' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT		UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100		W <sub>p</sub>	W		
495.4	Ground Level											GR SA SI CL
0.0	Heterogeneous Mixture Silt and Sand, Trace Clay Trace Gravel (Glacial Till)  Dense to V. Dense		1	SS	33		Auger Through Frozen Ground					
			2	SS	38	490						2 45 46 7
			3	SS	80/	5"						
			4	SS	114/	5"						
			5	SS	74/	4"						
			6	SS	100/	5"	480					17 39 36 8
			7	SS	87/	4"						
			8	SS	80/	6"	470					
464.9			9	SS	100/	5"						
30.5	End of Borehole											

+3, x5: Numbers refer to  
Sensitivity

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



RECORD OF BOREHOLE No 4

W P 2725-78-01 LOCATION Sta. 7+98 170' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY \_\_\_\_\_

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									
496.0	Ground Level													
0.0														
	Heterogeneous Mixture		1	SS	23									
	Silt and Sand,		2	SS	44									
	Trace Clay,		3	SS	87									
	Trace Gravel		4	SS	44									
	(Glacial Till)		5	SS	131									
	Dense to V. Dense		6	SS	367	3"								
			7	SS	1407	3"								
			8	SS	1007	4"								
465.5			9	SS	1007	6"								
30.5	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



## RECORD OF BOREHOLE No 5

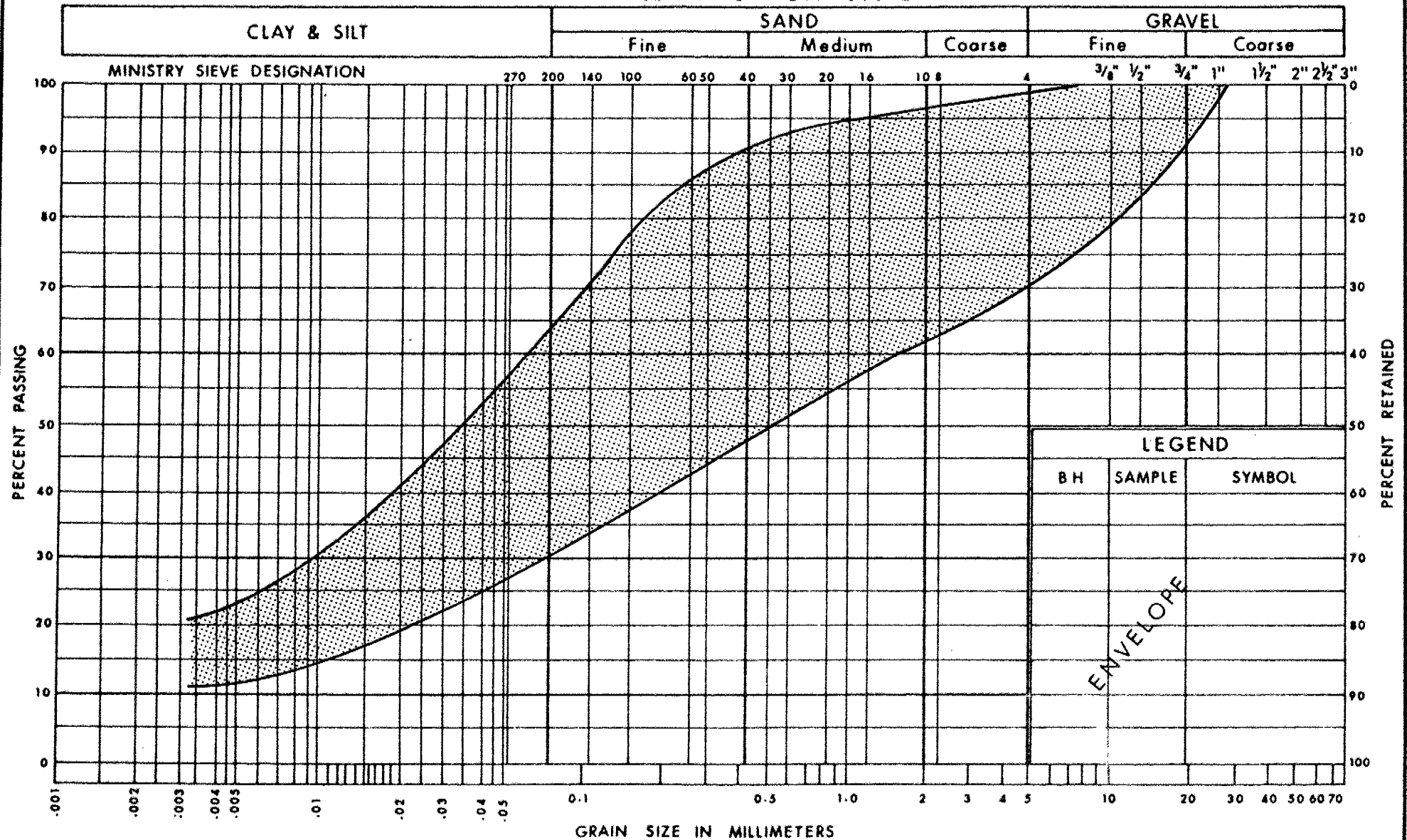
W P 2725-78-01 LOCATION Sta. 7+57 191' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
494.9	Ground Level															
0.0	Heterogeneous Mixture Silt and Sand, Trace Clay, Trace Gravel (Glacial Till)  Dense to V. Dense		1	SS	39		490	Auger Through Frozen Ground								35 42 18 S
			2	SS	54											
			3	SS	907	6"										
			4	SS	1007	5"										
			5	SS	1807	4"	480									
			6	SS	707	4"										
			7	SS	857	5"										
			8	SS	807	5"	470									
464.4			9	SS	1007	2"										
30.5	End of Borehole															
	Note: Water Level Not Established.															

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

## UNIFIED SOIL CLASSIFICATION SYSTEM

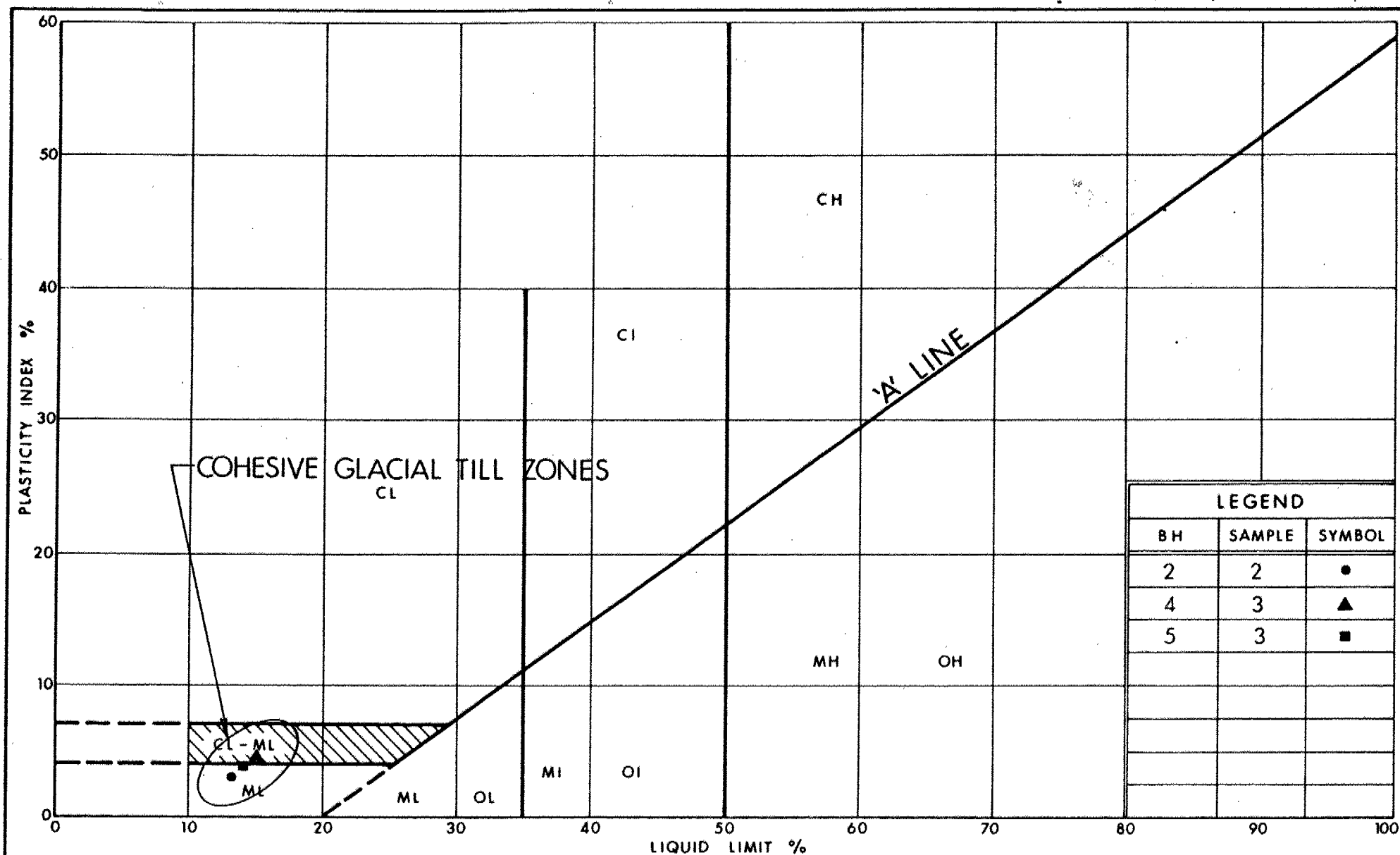


Ministry of  
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**GRAIN SIZE DISTRIBUTION**  
SILT TO SILTY CLAY  
WITH SAND SOME GRAVEL (GLACIAL TILL)

FIG No 1

W P 2725-78-01



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PLASTICITY CHART  
SILT TO SILTY CLAY  
WITH SAND SOME GRAVEL (GLACIAL TILL)

FIG No 2

W P 2725-78-01

ENGINEERING MATERIALS OFFICE  
PAVEMENT & FOUNDATION DESIGN SECTION

WP 2725-78-01

DIST #6

HWY #401

STR SITE

Patrol Yard Garage  
Newtonville Road

DISTRIBUTION

E. Shedler (3)  
R.D. Gunter  
I.V. Oliver  
D.E. Thrasher (2)  
B. Richardson

R. Fitzgibbon )  
J. Anderson ) Cover only.  
T.J. Kovich )

Files

## FOUNDATION INVESTIGATION REPORT

For  
Patrol Yard Garage  
Newtonville Road  
Hwy. 401, District 6, Toronto  
W.P. 2725-78-01

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### INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above project. Fieldwork was carried out on 80 03 04 and 80 03 05 and consisted of five sampled boreholes advanced to depths of up to 30 feet below the ground surface by means of solid stem augers.

### SITE DESCRIPTION AND GEOLOGY

The site is located in the north west quadrant of the Hwy. 401 and Newtonville Road interchange in the Town of Newcastle, Regional Municipality of Durham.

Topographically the site is flat and grass covered. Some ditching work has been carried out across the northern limits of the proposed patrol yard. Physiographically the site is located in the Iroquois Plain Region. This region is characterized by undulating till plain bordering glacial Lake Iroquois.

### SUBSURFACE CONDITIONS

Subsurface conditions across the site consist of an extensive deposit of glacial till encountered immediately below a thin veneer of topsoil. This stratum was not explored to its full depth, but proven to extend to at least 30 feet. The composition of the deposit is a silt and sand with a trace of clay and a trace of gravel. The results of grain size distribution testing on samples from this strata are shown in envelope form on Figure 1. Visual classification indicates that the deposit exhibits no plasticity or a very slight plasticity in some samples. This was confirmed by Atterberg Limit test carried out on

selected samples. These results are plotted on the Borehole Log Sheets as well as on the Plasticity Chart, Figure 2, and indicate that the matrix of the deposit is composed of inorganic silt of zero to low plasticity (ML zone). The visual examination and limit testing indicate that in the long term the material will behave as a granular type of deposit. Based on 'N' values ranging generally from 30 to over 100 blows per 0.3 metre, the deposit is estimated to have a dense to very dense relative density.

A brief description of the subsoil type and laboratory results are shown on the Record of Borehole Sheets. The locations and elevations of the boreholes as well as one stratigraphical profile is shown on Drawing No. 27257801-A.

#### GROUNDWATER CONDITIONS

Groundwater levels were observed by measuring in the open borehole 24 hours after completion of the borings. The measurements indicate that the groundwater level is 4 to 5 feet below ground surface which corresponds to an elevation of 489.9 to 492.6.




### DISCUSSION AND RECOMMENDATIONS

It is proposed to construct a new patrol yard and garage at the north west quadrant of the Newtonville and Hwy. 401 interchange. Current proposals call for garage bays and offices to be housed in a building some 135 feet long x 40 feet deep. It is understood that the type of building design contemplated is a concrete masonry with strip footings, and steel roof joists. Our comments for the design and construction of the garage building are as follows.

The structure can be founded on strip footings located in the parent glacial till deposit. Based on frost protection requirements of a minimum of 4 feet of earth cover, the strip footings would be located at approximately elevation 491. Spread footings located at or below this elevation can be designed for an allowable load of 3 t.s.f. in order to limit the differential settlements to less than 1/2 inch. Notwithstanding the above, the strip footing should be at least 2 times the width of the concrete block used.

The base of the footing excavation will be approximately at the groundwater level and because the material is susceptible to boiling it may be necessary to employ a temporary dewatering scheme depending on groundwater level at the time of construction. This can be accomplished by constructing oversize perimeter drains and pumping from sumps.

M. MacLean  
M. MacLean  
Project Foundations Engineer



M. Devata  
M. Devata  
Senior Foundations Engineer

April 10, 1980.

RECORD OF BOREHOLE No 1

W P 2725-78-01 LOCATION Sta. 9+84 126' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

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					
495.1	Ground Level													
0.0	Heterogeneous Mixture Sand and Silt, Trace Clay, Trace Gravel Dense to V. Dense		1	SS	32		490	Auger Through Frozen Ground						7 42 46 5
485.1			2	SS	64									
			3	SS	64									
10.0	End of Borehole						480							

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



Ministry of  
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Communications  
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 2725-78-01 LOCATION Sta. 9473 205' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

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								
495.6	Ground Level											
0.0												
	Heterogeneous Mixture Silt and Sand Trace Clay Trace Gravel (Glacial Till)		1	SS	74							
			2	SS	26							
			3	SS	47							
			4	SS	78							
			5	SS	72	6"						
			6	SS	100	5"						
	Dense to V. Dense		7	SS	87	5"						
			8	SS	75	3"						
			9	SS	30	3"						
465.1												
30.5	End of Borehole											

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

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

OFFICE REPORT ON SOIL EXPLORATION



Ministry of  
Transportation and  
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No. 3

W P 2725-78-01 LOCATION Sta. 9+23 158' RT. ORIGINATED BY FL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY FL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

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					
495.4	Ground Level												GR SA SI CL
0.0													
	Heterogeneous Mixture	1	SS	33									2 45 46 7
	Silt and Sand,	2	SS	38									
	Trace Clay	3	SS	80/	5"								
	Trace Gravel	4	SS	114/	5"								
	(Glacial Till)	5	SS	74/	4"								
	Dense to V. Dense	6	SS	100/	5"								17 39 36 8
		7	SS	87/	4"								
		8	SS	80/	6"								
464.9		9	SS	100/	5"								
30.5	End of Borehole												

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



Ministry of  
Transportation and  
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

W P 2725-78-01 LOCATION Sta. 7+98 170' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY \_\_\_\_\_

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									
496.0	Ground Level													
0.0	Heterogeneous Mixture Silt and Sand, Trace Clay, Trace Gravel (Glacial Till)  Dense to V. Dense		1	SS	23									
			2	SS	44									
			3	SS	87									
			4	SS	44									
			5	SS	131									
			6	SS	367	3"								
			7	SS	1487	3"								
			8	SS	1007	4"								
			9	SS	1007	6"								
465.5	End of Borehole													
30.5														

Auger Through Frozen Ground

8 34 51 7

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



Ministry of  
Transportation and  
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

W P 2725-78-01 LOCATION Sta. 7+57 191' RT. ORIGINATED BY PL  
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers & Cone Test COMPILED BY PL  
DATUM Geodetic DATE 80 03 04 CHECKED BY

SOIL PROFILE		STRAT PLOT	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		NUMBER	TYPE						
494.9	Ground Level							110 20 30		
0.0	Heterogeneous Mixture Silt and Sand, Trace Clay, Trace Gravel (Glacial Till)  Dense to V. Dense		1	SS	39					
			2	SS	54					
			3	SS	90/	6"				
			4	SS	100/	5"				
			5	SS	180/	4"				
			6	SS	70/	4"				
			7	SS	85/	5"				
			8	SS	80/	5"				
464.4			9	SS	100/	2"				
30.5	End of Borehole									
	Note: Water Level Not Established.									

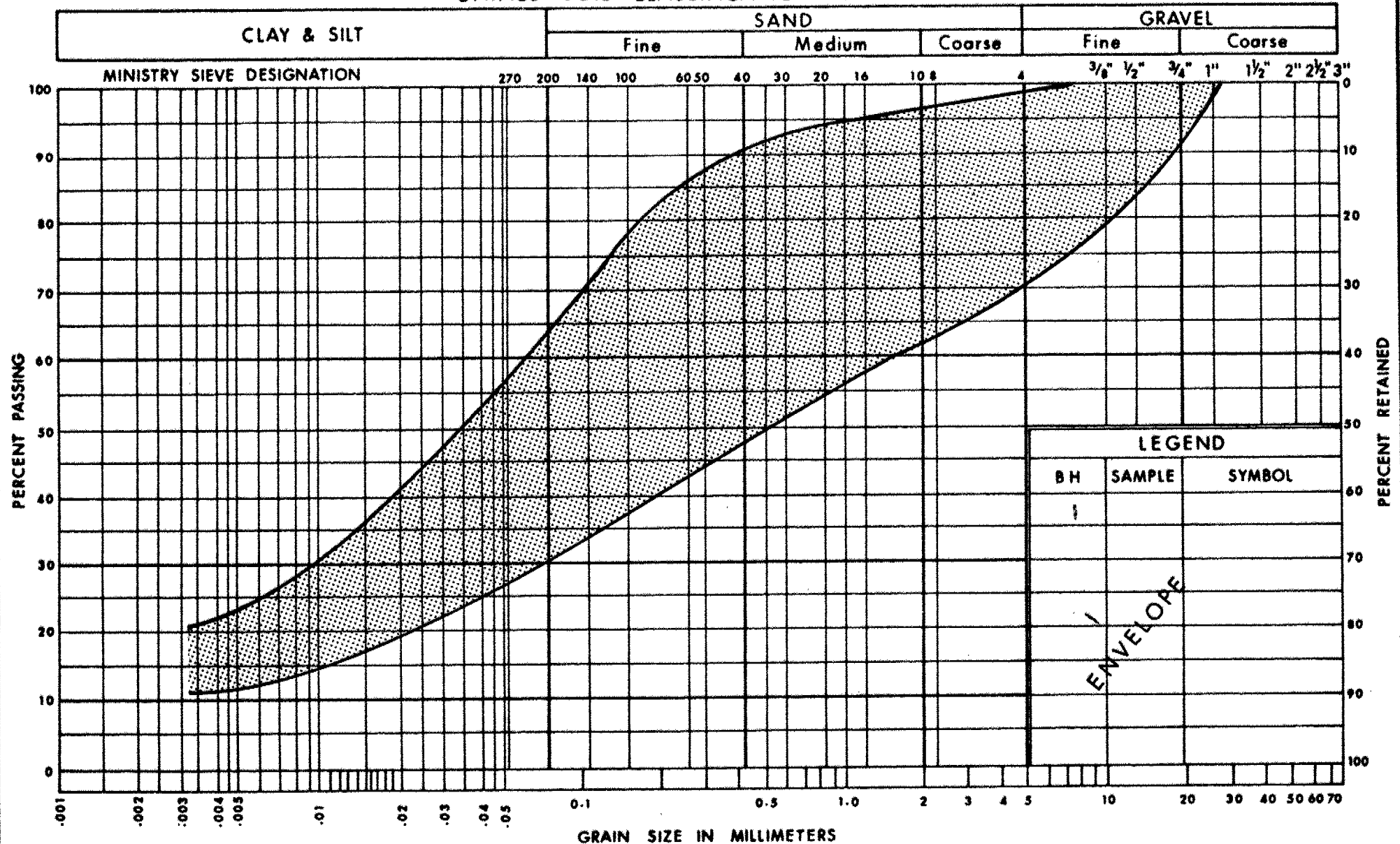
+3, x5 : Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

## UNIFIED SOIL CLASSIFICATION SYSTEM

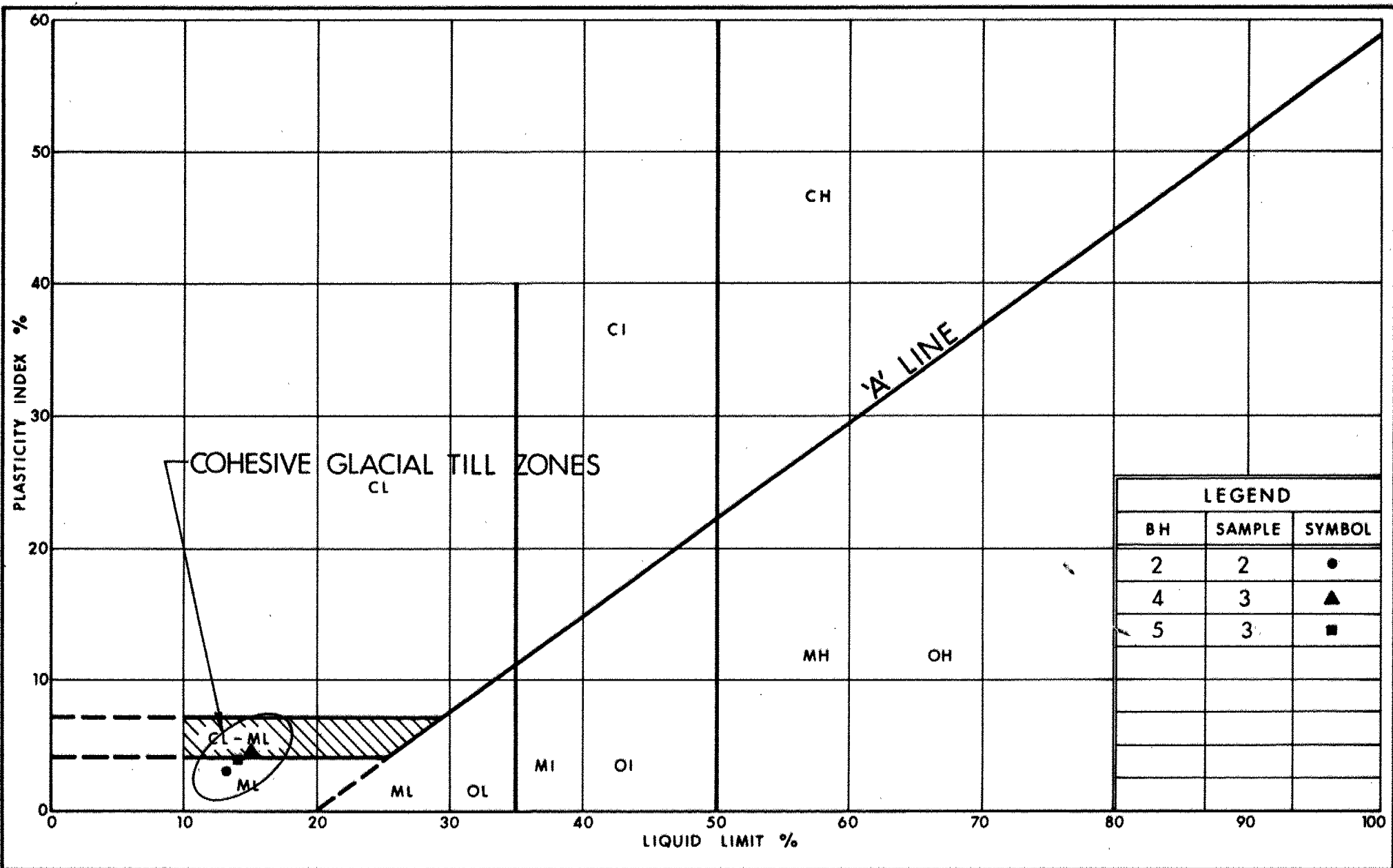


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**GRAIN SIZE DISTRIBUTION**  
**SILT TO SILTY CLAY**  
**WITH SAND SOME GRAVEL (GLACIAL TILL)**

FIG No 1

W P 2725-78-01



Ministry of  
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Ontario  
ENGINEERING SERVICES BRANCH

PLASTICITY CHART  
SILT TO SILTY CLAY  
WITH SAND SOME GRAVEL (GLACIAL TILL)

FIG No 2  
W P 2725-78-01



# 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. CIU = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

### FIELD SAMPLING

SS SPLIT SPOON  
WS WASH SAMPLE  
ST SLOTTED TUBE SAMPLE  
BS BLOCK SAMPLE  
CS CHUNK SAMPLE  
TW THINWALL OPEN  
TP THINWALL PISTON  
OS OSTERBERG SAMPLE  
FS FOIL SAMPLE  
RC ROCK CORE  
FH T.W. ADVANCED HYDRAULICALLY  
FM T.W. ADVANCED MANUALLY

### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  ANGLE OF WALL FRICTION  
 $k_o$  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 SURCHARGE  
 $w$  SLOPE ANGLE-BACKFACE OF WALL  
 $\beta$  ANGLE OF SLOPE  
 $N_q, N_c$  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  
 $e_o$  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 =  $w_L - w_P$   
 $I_L$  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 =  $\frac{I_P \text{ of soil}}{2 \mu m \text{ Soil Fraction}}$   
 $Om$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

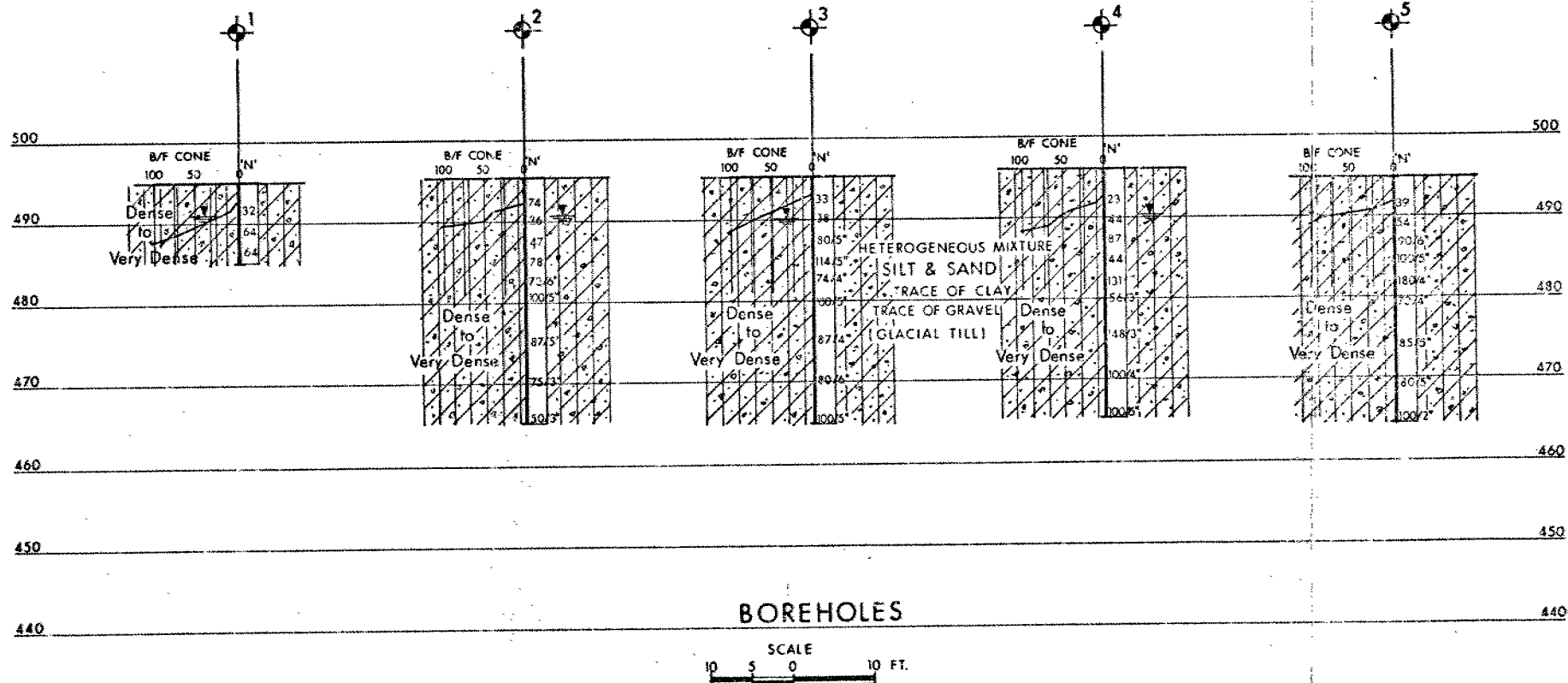
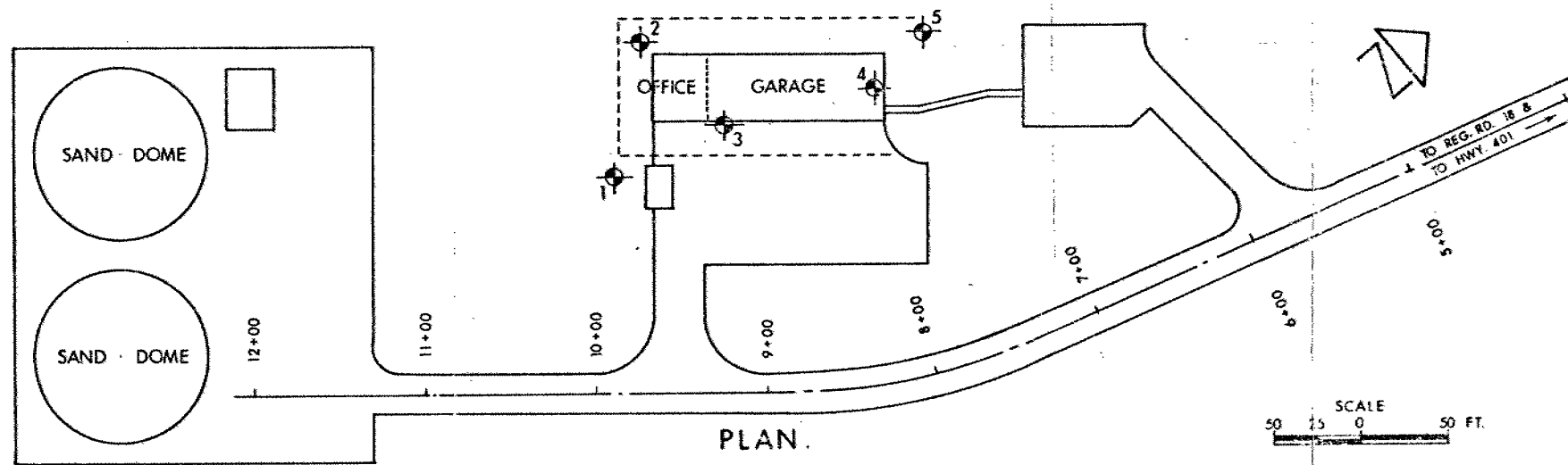
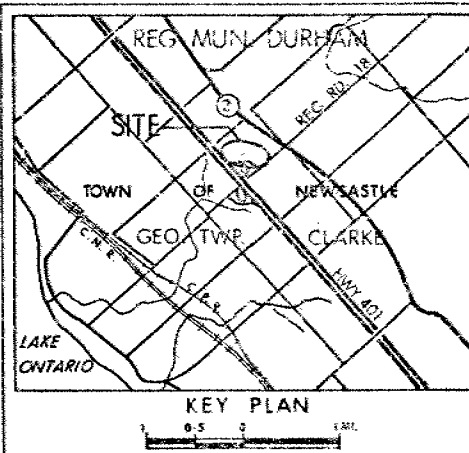
### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  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  
 $e_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $k_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

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

### 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  
 $m_v$  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  
 $O_c$  OVERCONSOLIDATION RATIO (OCR)



NOTE:  
THE DYNAMIC CONE  
PENETRATION TESTS  
WERE CARRIED OUT  
AFTER AUGERING THROUGH  
THE UPPER 3 TO 4 FOOT  
THICK FROZEN LAYER

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N' Blows/ft (Std Pen Test, 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- ↓ WL at time of investigation 80 03 04  
NO WL Established in BH No 5

No	ELEVATION	STATIONS	OFFSET
1	495.1	9+84	125' RT.
2	495.6	9+73	205' RT.
3	495.4	9+23	158' RT.
4	496.0	7+98	170' RT.
5	494.9	7+37	191' RT.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



REVISIONS	DATE	BY	DESCRIPTION

GEOCRETS No 20M15-53

DIST No 401  
SUBMOM M CHECKED DATE 80 04 09  
DRAWNOL J CHECKED DATE 80 04 09  
SITE DIST 7  
DWG 27257801-A



## Memorandum

To: Mr. G. Celmins  
Area Manager  
Planning and Design  
Central Region

Attention:  
Mr. Peter Hobbs

Our File Ref.

From: Regional Geotechnical Section  
Central Region

Date: 79 07 20

In Reply to

Subject:

Re: W.P. 2747-76-01, Hwy 401  
Proposed Patrol Yard Newtonville  
\*District 7, Port Hope

The proposed yard site lies along the ramp in the NW quadrant of the Newtonville-Hwy 401 interchange approximately 5 miles east of Newcastle. It is  $2\frac{1}{2}$  miles from Lake Ontario and within the area known as Iroquois Plain. The indented shoreline of the former Lake Iroquois lies just north of Hwy #2 against till ridges. There are also several drumlinised uplands, which were islands in the former lake. The lowlands (most of them still about 200' above the present lake level) form undulating plains in between and chiefly contain a reworked sandy loam till, derived by wave action from the uplands.

The yard site occupies a relatively flat area of the lowlands. The slightly irregular surface of the till is covered by a thin mantle of fine sandy loam and topsoil. Although the general direction of the drainage is to Lake Ontario towards the south (via a series of rather deeply eroded creeks), the local drainage of the site is chiefly to the north. The lands north of the patrol yard have a very faint slope to the south resulting in a faint dish at about the R.O.W. line, in particular on the east portion (east of Station 6+75 approximately). Here also, the vegetation is indicative of poor drainage during long periods of the year; low willow bushes and cattails within high grasses.

A soils investigation by power auger was made on July 10th, at which time the soils were dry to moist. However, early in June several locations were still soggy. This is explained by the thin mantle of permeable topsoil and sandy loam over the irregular surface of the rather impervious sandy loam till.

RECEIVED

JUL 23 1979

Central Region Maint.  
Office

The borings found:

9" - 18" sandy loam topsoil over  
6" - 12" fine sandy loam over a light grey  
brown sandy loam till

The till is low in stone content (estimated 5-10%) with occasional cobbles and boulders up to 18". The till is also exposed in the backslopes of the up to 7' deep road cut for the ramp adjacent to the site. The log of the borings and a sketch of the location of the borings are attached.

A prime concern for the development of the site will be the drainage, as there is a light depression along the north R.O.W. fence where much of the precipitation accumulates both from the north and the south. The water in the topsoil and the sandy loam is perched on top of the till without having an adequate outlet. A shallow ditch along the north R.O.W. would appreciably improve this drainage and if dug prior to the site development permit an earlier access to the site in spring and at the same time reduce the quantity of topsoil stripping.

From the layout of the site, we conclude that it is the intention that the runoff will be towards the south and away from the garage building. For this purpose, either earth borrow could be imported to raise the north portion of the site or the grade of the south portion along the ramp could be lowered and the excavated material used to raise the grade on the north portion.

The recommendations for the site are:

1. Drainage

Provide a shallow (36") perimeter ditch along the north R.O.W. fence well ahead of the award of the grading contract.

2. Topsoil

For the design and estimate the topsoil depth should be taken as 12".

(continued)

### 3. Granular Depths

Total granular depth for entrance flares along Newtonville Road and yard roadways to be 24". Start excavation for full granular depth along Newtonville Road 5' from edge of pavement.

For paved aprons at domes and garage and also for parking provide for 21" granular. Of the total granular depth the upper 6" should be Granular 'A', the remainder Granular 'C'.

### 4. Pavement Depths

for roadways	4½" H.L.4 (3 x 1½")
for aprons	3½" H.L.4 (2" + 1½")
for parking	2" H.L.4

### 5. Cross-fall

The cross-fall of the paved aprons should be not less than 3%. The cross-fall of the earth grade should be 1% more than that for the pavement.

### 6. Garage Foundation

The fine sandy loam till found at about 2' below ground level all over the site makes for a good and competent foundation soil. If the surface drainage is under control, no dewatering problems for the footing excavation are anticipated.

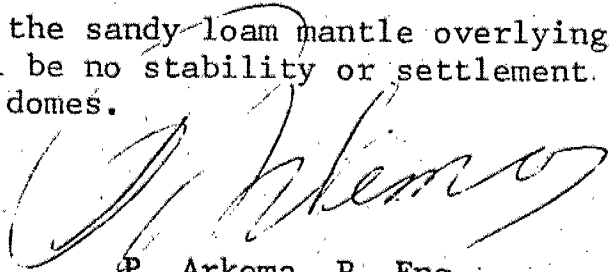
Strip footing with up to 350 p.s.f. bearing are recommended. The foundation depth should provide for a minimum of 4' of frost protection and also be a minimum of 12" into the "native" till.

### 7. Winter Sand Domes

With the drainage of the sandy loam mantle overlying the till remedied, there will be no stability or settlement problems for the winter sand domes.

(Attach: sketch & boreholes)

PA/RDG:ld

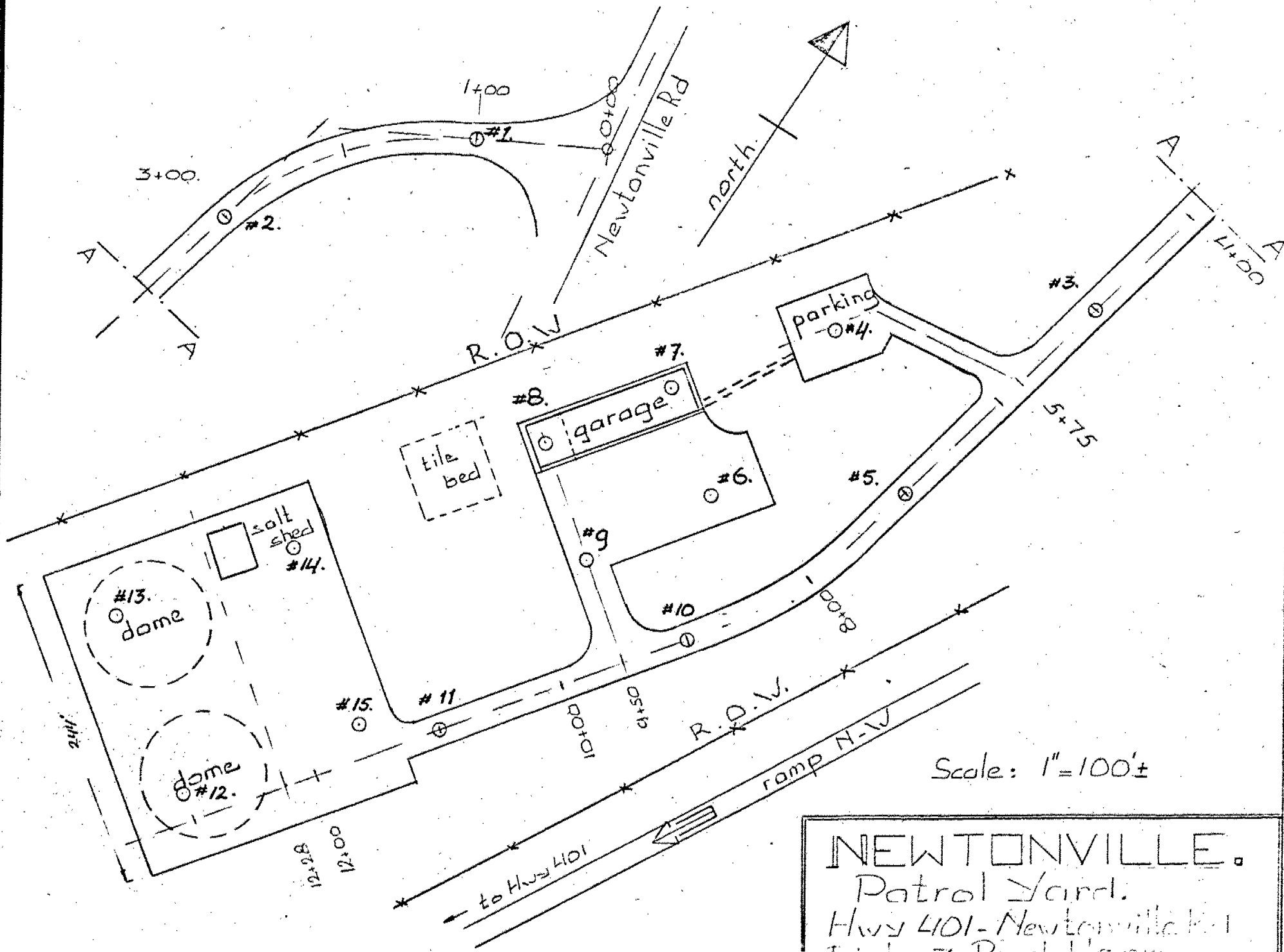


P. Arkema, P. Eng.

cc

A. Argue  
M. Sinclair /  
M. MacMaster  
G. Wrong  
R. Minaker

For: R.D. Gunter  
Head, Geotechnical Section



BH 1.

0-8" dk br sato tpsl.  
8"-17" br f sato  
17"-4' br f-vf sato till (moist)  
4'-4½' f-me sato (wet)  
4½"-5' br vf sato (wet).

BH 2.

0-15" dk br sato tpsl.  
15"-26" br f sato  
26"-6' br f-vf sato till (moist)

BH 3.

0-12" dk br sato tpsl.  
12"-17" br f sato  
17"-5' br f-vf sato till 79WB60  
M.P.H.

BH 4.

0-13" dk br sato tpsl.  
13"-5' br f-vf sato till

BH 5.

0-9" dk br sato tpsl.  
9"-5' br f sato till.

BH 6.

0-14" dk br sato tpsl.  
14"-19" br f sato  
19"-5½' br f-vf sato till (moist)

BH 7.

0-12" dk br sato tpsl.  
12"-24" br f sato  
24"-8' br f-vf sato-sactlo till  
6" max.

BH 8.

0-8" dk br sato tpsl.  
8"-16" br f sato  
16"-8½' br f-vf sato till

BH 9.

0-18" dk br sato tpsl.  
18"-29" br f sato  
29"-5' br vf sato

BH 10.

0-16" dk br sato tpsl.  
16"-27" br f sato  
27"-5' br f-vf sato till.

BH 11.

0-16" dk br sato tpsl.  
16"-26" br f sato  
26"-5' br f-vf sato till

BH 12.

0-8" dk br sato tpsl.  
8"-19" br f sato  
19"-9½' br f-vf sato till

BH 13.

0-15" dk br sato tpsl.  
15"-18" br f sato  
18"-10' br f-vf sato till

BH 14.

0-8" dk br sato tpsl.  
8"-19" br f sato  
19"-5' br f-vf sato till.

BH 15.

0-12" dk br sato tpsl.  
12"-22" br f sato  
22"-5' br f-vf sato till

Soils borings.

July 10/79.

NEWTONVILLE.

Patrol Yard.

Hwy 4101-Newtonville Rd

Dist. 7 Port Hope.