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NOTE: For purposes of the contract these reports
supercede 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

DENSITY: 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. CIE = 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

μ COEFFICIENT OF FRICTION
 δ 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
 β ANGLE OF SLOPE
 N_q, N_c, N_γ BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' 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 = $\frac{w - w_p}{p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu \text{ soil fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remolded)}}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_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
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν 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:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

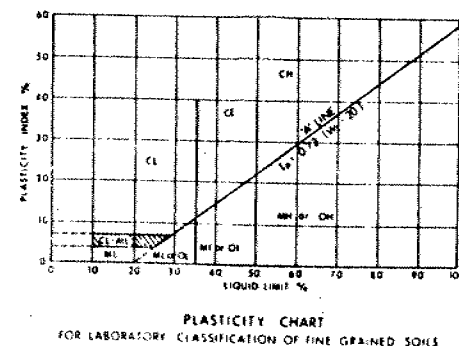
h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT 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)

EXTENDED CASAGRANDE SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 75mm (3 INCHES) AND BASING FRACTIONS ON ESTIMATED MASS)									
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN 75µm (No. 200 sieve size)		SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN 5mm (No. 4 sieve)		GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN 5mm (No. 4 sieve)		GRF SYMP	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA
IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425µm (No. 40 sieve size)		SANDS WITH APPRECIABLE AMOUNT OF FINES	CLEAN SANDS (LITTLE OR NO FINES)	GRAVEL WITH APPRECIABLE AMOUNT OF FINES	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.	GIVE TYPE, NAME, IF NECESSARY, INDICATE APPROX. % OF SAND & GRAVEL, MAX. SIZE, ANGULARITY, SURFACE CONDITION, & HARDNESS OF THE COARSE GRAINS; LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION, & SYMBOL IN PARENTHESIS. FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITIONS & DRAINAGE CHARACTERISTICS.	$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4 $C_c = \frac{(D_{30})^2}{D_{10} \cdot D_{60}}$ BETWEEN ONE AND 3 NOT MEETING ALL GRADATION REQUIREMENTS FOR GW ATTERBERG LIMITS BELOW A-LINE OR I_p LESS THAN 4 ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS $C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 6 $C_c = \frac{(D_{30})^2}{D_{10} \cdot D_{60}}$ BETWEEN ONE AND 3 NOT MEETING ALL GRADATION REQUIREMENTS FOR SW ATTERBERG LIMITS BELOW A-LINE OR I_p LESS THAN 4 ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
						GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES; LITTLE OR NO FINES		
						GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES		
						GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES		
IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425µm (No. 40 sieve size)		SANDS WITH APPRECIABLE AMOUNT OF FINES	CLEAN SANDS (LITTLE OR NO FINES)	GRAVEL WITH APPRECIABLE AMOUNT OF FINES	CLEAN GRAVELS (LITTLE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	GIVE TYPE, NAME, IF NECESSARY, INDICATE DEGREE & CHARACTER OF PLASTICITY, AMOUNT & MAXIMUM SIZE OF COARSE GRAINS, COLOUR IN WET CONDITION, ODOUR, IF ANY, LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION & SYMBOL IN PARENTHESIS. FOR UNDISTURBED SOILS ADD INFORMATION ON STRUCTURE, STRATIFICATION, CONSISTENCY IN UNDISTURBED & REMOULDED STATES, MOISTURE & DRAINAGE CONDITIONS.	USE GRAIN SIZE CURVE IN IDENTIFYING THE FRACTIONS AS GIVEN UNDER FIELD IDENTIFICATION DETERMINE PERCENTAGES OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75µm (No. 200 sieve) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS: LESS THAN 5% GW, GP, SM, SP MORE THAN 5% GM, GC, SM, SC 5% TO 12% BORDRELIN CASES REQ. USE OF DUAL SYMBOLS MORE THAN 12% BORDRELIN CASES REQ. USE OF DUAL SYMBOLS
						SP	POORLY GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES		
						SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES		
						SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES		
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN 75µm (No. 200 sieve size) (75µm IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE)		SILTS AND CLAYS	LIQUID LIMIT LESS THAN 35%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	ML	INORGANIC SILTS & SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR	GIVE TYPE, NAME, IF NECESSARY, INDICATE DEGREE & CHARACTER OF PLASTICITY, AMOUNT & MAXIMUM SIZE OF COARSE GRAINS, COLOUR IN WET CONDITION, ODOUR, IF ANY, LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION & SYMBOL IN PARENTHESIS. FOR UNDISTURBED SOILS ADD INFORMATION ON STRUCTURE, STRATIFICATION, CONSISTENCY IN UNDISTURBED & REMOULDED STATES, MOISTURE & DRAINAGE CONDITIONS.
							CL	CLAYEY SILTS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS	
							OL	ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS	
							MI	INORGANIC COMPRESSIBLE SILTS OR SILTY FINE SANDS WITH SOME CLAY OF MEDIUM PLASTICITY (BELOW A-LINE)	
							CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY	
							OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY	
			LIQUID LIMIT BETWEEN 35% AND 50%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	MH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
							CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS	
							OH	ORGANIC CLAYS OF HIGH PLASTICITY	
							ML	INORGANIC COMPRESSIBLE SILTS OR SILTY FINE SANDS WITH SOME CLAY OF MEDIUM PLASTICITY (BELOW A-LINE)	
							CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY	
							OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY	
LIQUID LIMIT GREATER THAN 50%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	PH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS				
				CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS				
				OH	ORGANIC CLAYS OF HIGH PLASTICITY				
				ML	INORGANIC COMPRESSIBLE SILTS OR SILTY FINE SANDS WITH SOME CLAY OF MEDIUM PLASTICITY (BELOW A-LINE)				
				CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY				
				OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY				
HIGHLY ORGANIC SOILS		READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE		PE	PEAT & OTHER HIGHLY ORGANIC SOILS				

BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY THE GROUP SYMBOLS OF BOTH GROUPS.

BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS. FOR EXAMPLE GW-GC, WELL GRADED GRAVEL-SAND MIXTURE WITH CLAY BINDER



FOUNDATION INVESTIGATION REPORT

For

Mississauga Road Underpass
W.P. 157-75-04, Site 24-387
Hwy. 403, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the period of June 17, 1977 to June 27, 1977.

The fieldwork consisted of six sampled boreholes advanced by means of a continuous flight auger machine equipped with solid and hollow stem ($3\frac{1}{2}$ " I.D.) augers. In addition, diamond drilling techniques were employed to obtain BXL size rock core samples of bedrock. The boreholes ranged in depths from 26.5 to 35 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located about 200 feet west of the Credit River and one mile south of Eglinton Avenue on Mississauga Road, in the City of Mississauga, Regional Municipality of Peel.

The topography of the area is gently sloping in a southerly to southwest direction. The land is developed for farming purposes. Physiographically the site is situated in the border regions of "Peel Plains" and "South Slope". The characteristic deposit in this area is a cohesive glacial till. The overburden is underlain by interbedded layers of shale and limestone bedrock of the Meaford-Dundas formation, Ordovician Period. This physiographic region is well drained by the Credit, Oakville and Etobicoke Creeks, which have cut deep valleys into the overburden. Although in many of the interstream areas drainage is still imperfect.

SUBSURFACE CONDITIONS

General

The subsurface conditions were found to be quite uniform over the site. Under a thin layer of topsoil is a stratum of cohesive glacial till which was explored to its full depth in all the boreholes. The overburden is underlain by interbedded layers of shale and limestone bedrock.

Detailed description of the various soil and rock types encountered in each borehole are given in the Record of Borehole Sheets. The estimated stratigraphical profile and sections shown on Contract Drawing No. 24-387-2 are based upon this information. From ground level downwards, the various soil types encountered are as follows:

Glacial Till

Underlying a thin (maximum 12") layer of topsoil, a deposit of cohesive glacial till was encountered at all locations over the site. The glacial till varies in thickness from 26 to 30 feet and forms the overburden in the area. The cohesive glacial till is comprised of a heterogeneous mixture of clayey silt, sand and gravel. The Standard Penetration Tests gave "N" values ranging from 20 blows to over 100 blows per foot, indicating that the glacial till has a very stiff to hard consistency, but generally hard. The physical properties of the glacial till as determined from laboratory testing are summarized below:

	<u>Range</u>
Liquid Limit (W_L)%	21-32
Plastic Limit (W_P)%	13-17
Moisture Content (W)%	9-15

The results of the Atterberg Limit Tests are shown on Plasticity chart (Fig. 1) and the typical Grain Size Distribution curves are presented in an envelope form in Fig. 2, which are included in the Appendix of this report.

The Atterberg Limits indicate that the cohesive stratum is inorganic and of low plasticity.

Bedrock

Bedrock was encountered immediately below the cohesive glacial till overburden. The bedrock was proven by obtaining BXL size rock core samples. It consists of interbedded layers of shale and limestone. A more detailed description of the core samples is given in the Diamond Drill Record Sheets provided in the Appendix.

The bedrock surface in the area investigated varies from elevations 436.3 to 431.8. The bedrock appears to be dipping slightly in a south to southwest direction. The bedrock was found to be generally sound. However, in certain locations, the upper 6" to 24" of the bedrock appeared to be slightly weathered.

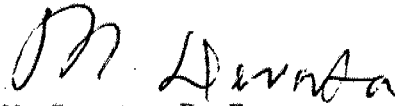
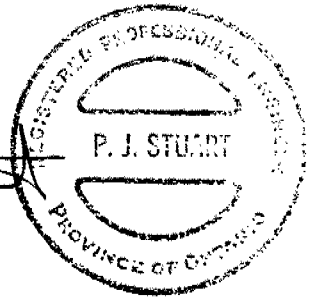
GROUNDWATER CONDITIONS

The groundwater levels were observed by measuring in the open boreholes during and after the completion of the foundation investigation. The groundwater levels were found to vary between elevations 449.5 (B.H. #3) and 432.5 (B.H. #4) which corresponds to depths of 13 feet to 30 feet below the existing ground surface.

The groundwater levels are shown on the Record of Borehole Sheets as well as on Contract Drawing No. 24-387-2.



P.J. Stuart, P. Eng.
Foundations Engineer



M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 157-75-04

LOCATION Co-ords. N 15,827,865; E 950,796

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 17, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 3 1/2" Auger - BXL Core & Cone Test

CHECKED BY ES

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	WP	W	WL		
461.7	Ground Level															
0.0	Topsoil															
	Heterogeneous mixture of clayey silt, sand and gravel (Glacial Till)		1	SS	65	460										0 26 46 28
			2	SS	86											
			3	SS	130	450										1 22 49 28
			4	SS	51											
			5	SS	69											
	Hard		6	SS	100	440										26 21 32 21
433.7																
28.0	Weathered															
431.6	Shale Bedrock		7	SS	100/ 1"											
30.1	End of Borehole															

20
15 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 157-75-04

LOCATION Co-ords. N 15,827,912; E 950,843

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 27, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 3 1/2" Auger - BXL Core & Cone Test

CHECKED BY Ks

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	W_P	W	W_L		
461.8	Ground Level					460										GR SA SI CL
0.0	Topsoil		1	SS	38											
	Heterogeneous mixture of clayey silt, sand and gravel. (Glacial Till)		2	SS	48											2 21 47 30
			3	SS	62	450										
			4	SS	24											3 33 44 20
	Very Stiff to Hard		5	SS	60	440										
			6	SS	135	10"										7 22 45 26
431.8	Weathered															
30.0	Sound Shaly		7	BXL	90%	430										
426.8	Limestone Bedrock				Rec											
35.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 157-75-04

LOCATION Co-ords. N 15,827,915; E 950,743

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE July 6, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 3/4" Auger - BXL Core & Cone Test

CHECKED BY 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	W_P	W	W_L		
462.0	Ground Level															
0.0	Topsoil															
	Heterogeneous mixture of clayey silt, sand and gravel		1	SS	20	460										5 23 51 21
			2	SS	58											3 20 52 25
			3	SS	77											
	(Glacial Till)		4	SS	59											
			5	SS	28											
	Very stiff to hard		6	SS	70											7 29 44 20
435.0			7	SS	91											
27.0	Weathered Sound, Shaly Limestone Bedrock		8	BXL	70% Rec											
430.0																
32.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 157-75-04 LOCATION Co-ords. N 15,827,978; .E 950,778 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE June 24, 1977 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem 3 1/2" Auger - BXL Core & Cone Test CHECKED BY RS

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 % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
462.8	Ground Level															
0.0	Topsoil		1	SS	39	460										0 15 45 40
	Heterogeneous mixture of clayey silt, sand and gravel. (Glacial Till) Very stiff to hard		2	SS	45											5 20 49 26
			3	SS	46											10 21 49 20
			4	SS	31											
			5	SS	27											
			6	SS	67											
			7	SS	102											2 25 47 26
432.6																
30.2	Sound, Shaly		8	BXL	96% Rec	430										
428.9	Limestone Bedrock															
33.9	End of Borehole															

20
15 \diamond 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 157-75-04

LOCATION Co-ords. N 15,827,994; E 950,665

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 17, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 3 1/2" Auger - BXL Core & Cone Test

CHECKED BY RS

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	w_p	w	w_L		
464.3	Ground Level															
0.0	Topsoil		1	SS	56	460										1 21 48 30
	Heterogeneous mixture of clayey silt, sand and gravel. (Glacial Till)		2	SS	107											20 22 34 24
			3	SS	124											
			4	SS	73	450										
	Hard		5	SS	68											1 31 49 19
			6	SS	71	440										
436.3																
28.0	Weathered															
	Sound															
	Shaly Limestone		7	BXL	100% Rec	430										
429.3	Bedrock															
35.0	End of Borehole															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6

WP 157-75-04

LOCATION Co-ords. N 15,828,042; E 950,712

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 20, 1977

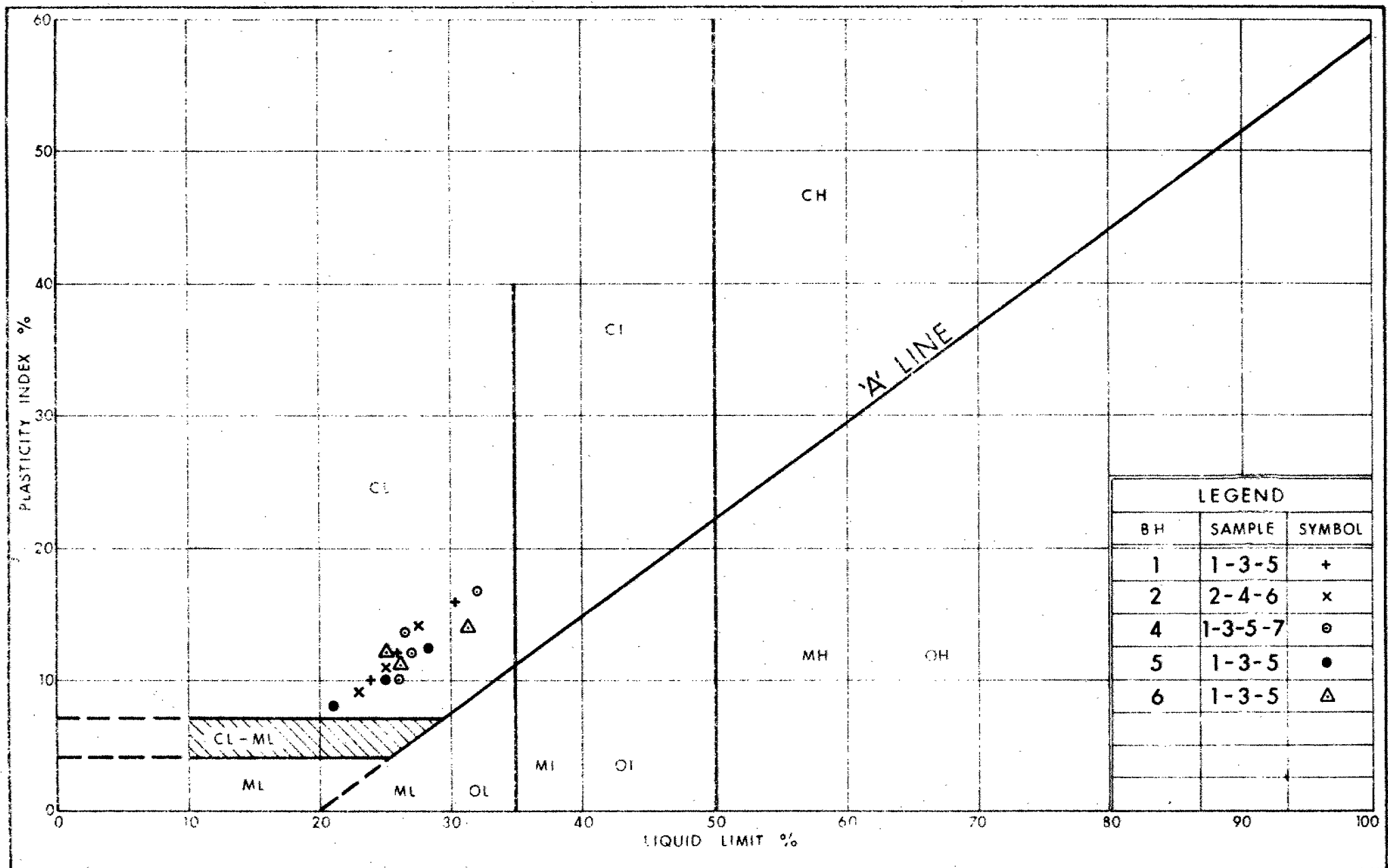
COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 3 1/2" Auger - BXL Core & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —w WP — w — WL WATER CONTENT % 10 20 30	UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
465.1	Ground Level									
0.0	Topsoil									
	Heterogeneous mixture of clayey silt, sand and gravel		1	SS	55	460				13 14 42 31
			2	SS	56					
			3	SS	64					11 23 41 25
	(Glacial Till)		4	SS	32	450				
	Hard		5	SS	51					1 19 49 31
438.6			6	SS	156/7"	440				
26.5	End of Borehole (Probable Bedrock)									

20
15 0.5 % STRAIN AT FAILURE
10



Ontario

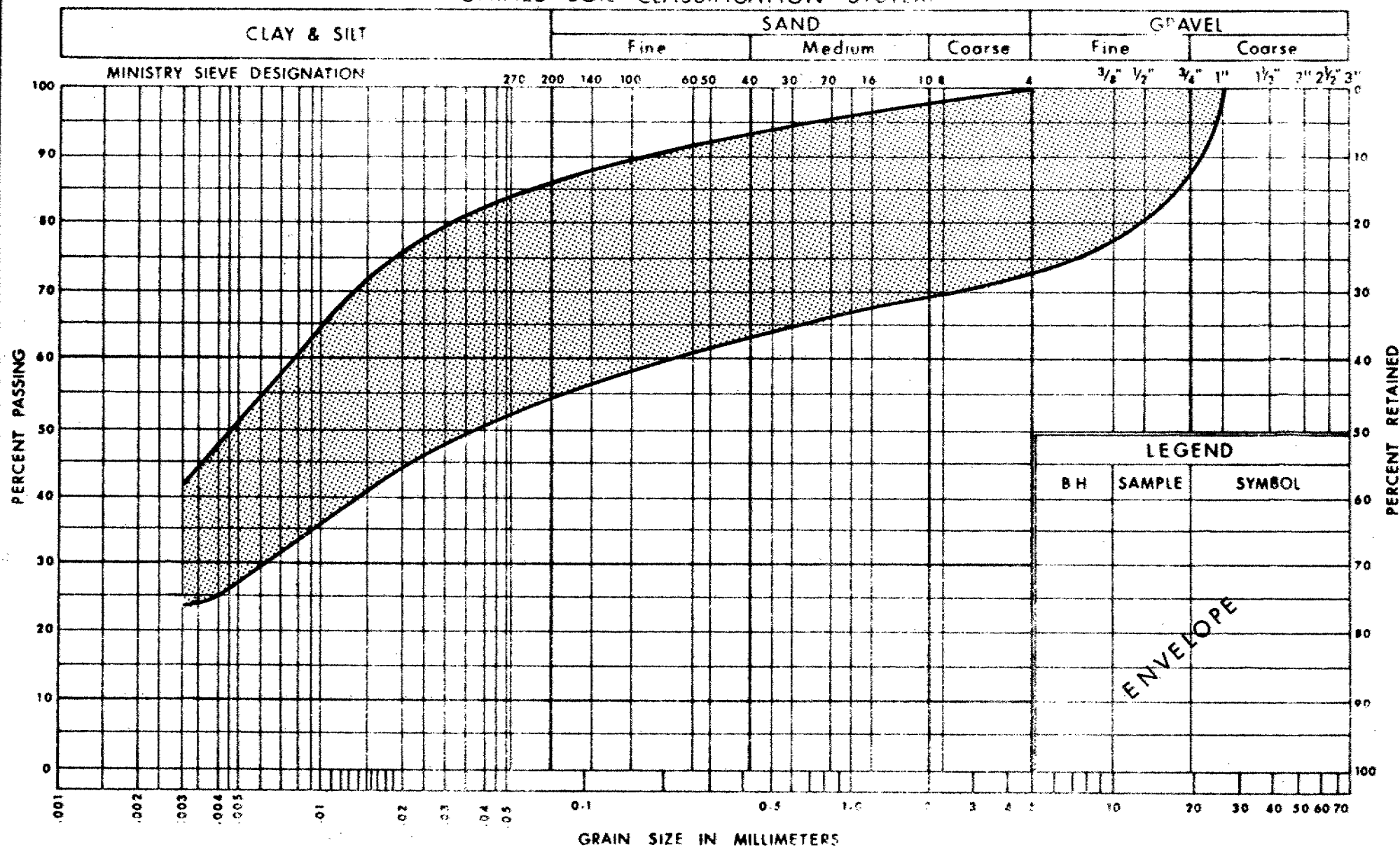
Ministry of
Transportation and
Communications

PLASTICITY CHART
COHESIVE GLACIAL TILL
HET MIX OF CLAYEY SILT, SAND & GRAVEL

FIG No 1

W P 157 - 75 - 04

UNIFIED SOIL CLASSIFICATION SYSTEM



**Ministry of
Transportation and
Communications**

Ontario

GRAIN SIZE DISTRIBUTION
COHESIVE GLACIAL TILL
HET MIX OF CLAYEY SILT, SAND & GRAVEL

FIG No 2

WP 157-75-04



Ministry of
Transportation and
Communications

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

DIP _____

PROPERTY W.P. 157-75-03
LOCATION Bay, Tanjong Pagar Road, Singapore
LATITUDE _____
DEPARTURE _____
BEARING _____

000

TOTAL FATHOM _____

ELEV. COLLECTED _____
DATE _____
DATE _____
DATE _____
DATE _____

FOOTAGE		FORMATION	SAMPLE NUMBER	DIP	REMARKS
FROM	TO				
0.00	0.10	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.10	0.20	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.20	0.30	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.30	0.40	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.40	0.50	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.50	0.60	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.60	0.70	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.70	0.80	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.80	0.90	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
0.90	1.00	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.00	1.10	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.10	1.20	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.20	1.30	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.30	1.40	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.40	1.50	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.50	1.60	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.60	1.70	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.70	1.80	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.80	1.90	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
1.90	2.00	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.00	2.10	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.10	2.20	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.20	2.30	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.30	2.40	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.40	2.50	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.50	2.60	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.60	2.70	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.70	2.80	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.80	2.90	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	
2.90	3.00	Formation, dark grey colour, fine texture, hard with few thin beds of shaly material. 1/2" zone is broken and		00%	

DATE OF EXAMINATION 10/10/77

DATE OF EXAMINATION 10/10/77



Ministry of
Natural Resources and
Environment

DIAMOND DRILL RECORD

DIP

00°

HOLE NO. _____ CORE NO. _____

PROPERTY W.D. 157-75-01
 LOCATION _____
 LATITUDE _____
 DEPARTURE _____
 BEARING _____

TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLER _____

FOOTAGE		FORMATION	DIP	DIP	REMARKS
FROM	TO				
0'00"	0'00"	1. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	2. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	3. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	4. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	5. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	6. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	7. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	8. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	9. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	10. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	11. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	12. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	13. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	14. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	15. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	16. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	17. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	18. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	19. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2
0'00"	0'00"	20. Unconsolidated, light-colored, silty sandstone, with chert nodules in the top 10'.	0°	0°	MASS = 1.2

DATE OF EXAMINATION July 10, 1967

By _____

FOUNDATION INVESTIGATION REPORT

For

Mullet Creek Bridge
W.P. 157-75-05, Site 24-386
Hwy. 403, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the period of June 21 and 22, 1977.

The fieldwork consisted of 12 sampled boreholes advanced by means of a continuous flight auger machine equipped with solid and hollow stem ($3\frac{1}{4}$ " I.D.) augers. In addition, diamond drilling techniques were employed to obtain BXL size rockcore samples of bedrock. The boreholes ranged in depths from 6.5 to 11 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located about half mile west of Credit River or immediately west of Mississauga Road and one mile south of Eglinton Avenue, in the City of Mississauga, Regional Municipality of Peel.

The topography of the general area is gently sloping in a southerly direction. The site is located in the Mullet Creek Valley whose width is approximately 250 feet. The valley floor is at approximate elevation 448 and the valley banks are at elevation 465. The creek meanders in a southerly direction. The clear width of the creek is about 20 feet and the water level in the creek is about elevation 445. The land is developed for farming purposes. Physiographically the site is situated in the border regions of "Peel Plains" and "South Slope". The characteristic deposit in the area under investigation is a cohesive glacial till. The overburden is underlain by interbedded layers of shale and limestone of the Meaford-Dundas Formation.

This physiographic region is well drained by the Credit, Oakville and Etobicoke Creeks, which have cut deep valleys into the overburden, although in many of the interstream areas drainage is still imperfect.

SUBSURFACE CONDITIONS

General

The subsurface conditions were found to be quite uniform over the site. Under a thin layer of topsoil is a stratum of cohesive glacial till, a heterogeneous mixture of clayey silt, sand and gravel. The overburden is underlain by interbedded layers of shale and limestone bedrock which was proven in all the boreholes. Detailed descriptions of the soil and rock types encountered in each borehole are given in the Record of Borehole Sheets. The estimated stratigraphical profile and sections shown on Contract Drawing No. 24-386-2 are based upon this information.

Glacial Till (Heterogeneous Mixture of Clayey Silt, Sand and Gravel)

Underlying a thin layer up to 12 inches of topsoil, is a deposit of cohesive glacial till comprised of a heterogeneous mixture of clayey silt, sand and gravel. The cohesive glacial till material was encountered at all locations except at B.H. No's 8, 9 and 11, which are located in the stream channel. The glacial till varied in thickness from 3.5 to 6.0 feet. The Standard Penetration Tests gave 'N' values ranging from 13 to over 100 blows per foot indicating that the cohesive stratum has stiff to hard consistency.

The physical properties of the clayey silt layer, as determined from laboratory testing, are summarized below:

	<u>Range</u>
Liquid Limit (W_L) %	25-34
Plastic Limit (W_P) %	16-20
Moisture Content (W) %	7-21

The results of the Atterberg Limit Tests are shown on Plasticity Chart (Fig. 1) and the typical grain size distribution curves are presented in an envelope form in Fig. 2 which are included in the Appendix of this report.

The Atterberg Limits indicate that the cohesive stratum is inorganic and of low plasticity.


The borehole numbers 8, 9 and 11 were put in the creek through 6 inches of water. Under the water a deposit of 1.5 to 2.5 ft. thick alluvial silty sand and gravel was found overlying the bedrock.

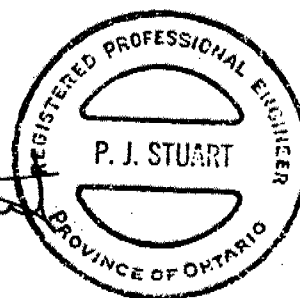
Bedrock

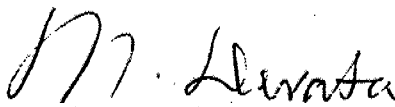
Bedrock was encountered immediately below the cohesive glacial till overburden, or immediately beneath the alluvial deposit in the creek floor. It consists of interbedded layers of shale and limestone. The surface of the bedrock in the area investigated varies from elevation 442.0 to 445.0 and appears to be dipping slightly in a westerly direction. The bedrock was found to be generally sound. However, in certain locations, the upper 6" to 18" of the bedrock appeared to be slightly weathered.

Groundwater

The groundwater levels were observed by measuring in the open boreholes during and after the completion of the foundation investigation. The groundwater levels were found to vary between elevations 445.8 and 444.1 which corresponds to depths of 3.0 to 3.5 feet below the existing ground surface. The water level in the Mullet Creek during the time of investigation (June 22, 1977) was 445.0. The groundwater levels are shown on the Record of Borehole Sheets, as well as on Contract Drawing No. 24-386-2.


P.J. Stuart, P. Eng.
Foundations Engineer




M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 157-75-05

LOCATION Co-ords. N 15,827,211; E 950,002

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY

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	w_p	w	w_L		
447.6	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sand & gravel (Glacial Till) Stiff		1	SS	28											GR SA SI CL
442.1																31 33 24 12
5.5	Weathered Sound Shaly limestone Bedrock		2	BXL	Rec 70%	440										RQD 9%
437.1																
10.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 5'5" to 5'11" Limestone, grey, medium textured, medium hard, fossiliferous with sandy sections.															
	From 5'11" to 10'5" Shale, grey, soft fissile with shaly sections.															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 157-75-05

LOCATION Co-ords. N 15,827,282; E 949,964

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY KS

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	W_P	W	W_L		
448.3	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, ss and gravel.															
444.3	(Glacial till) Stiff		1	SS	13											11 36 37 16
4.0	Shaly Limestone		2	BXL	Rec 100											RQD 40%
439.3	Bedrock Sound					440										
9.0	End of Borehole															
<p><u>Bedrock Description</u></p> <p>From 4'0" to 6'0" Limestone, grey, medium textured, medium hard to hard, fossiliferous.</p> <p>From 6'0" to 10'5" Shale, grey, soft, fissile with shaly sections.</p>																

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 157-75-05

LOCATION Co-ords. N 15,827,355; E 949,932

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY

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	W_p	W	W_L		
448.4	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sand, & gravel. (Glacial Till)		1	SS	45											
442.4	Hard weathered		2	SS	100	5"										7 28 51 14
6.0	Sound Shaly Limestone Bedrock		3	BXL	Rec 90%	440										RQD 7%
437.4																
11.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 6' to 7' Limestone, grey, medium textured, hard.															
	From 7' to 9'3" Shale, grey, soft, fissile with shaly sections.															
	From 9'3" to 9'9" Limestone, light grey, medium textured, hard, fossiliferous.															
	From 9'9" to 11' Shale, grey, soft, fissile with shaly sections.															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 157-75-05

LOCATION Co-ords. N 15,827,230; E 950,025

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p w w_L				
							SHEAR STRENGTH					WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					10 20 30				
446.9	Ground Level															
0.0	Topsoil															
443.4	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	38	↓									28 31 31 10	
3.5	Shaly Limestone															
438.4	Sound Bedrock		2	BXL	Rec 100%	440									RQD 38%	
8.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 3'5" to 5'5" Limestone, grey, medium textured, medium hard to hard, fossiliferous.															
	From 5'5" to 7'5" Shale, grey, soft, fissile with shaly sections.															
	From 7'5" to 8'5" Limestone, light grey, medium to coarse textured, medium hard, fossiliferous.															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 157-75-05

LOCATION Co-ords. N 15,827,301; E 949,986

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY L.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 Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
447.7	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, ss, & gr															
443.7	(Glacial Till) Hard		1	SS	45										13 15 55 17	
4.0	Shaly Limestone		2	BXL	Rec											
438.7	Bedrock Sound				100%	440									RQD 45%	
9.0	End of Borehole															
	<u>Bedrock Description</u> From 4'0" to 6'4" Limestone, grey, medium textured, medium hard, fossiliferous. From 6'4" to 8'5" Shale, grey, soft, fissile with shaly sections. From 8'5" to 9' Limestone, grey, medium textured, medium hard, fossiliferous.															

 20
 15 ϕ 5 % STRAIN AT FAILURE
 10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6

WP 157-75-05

LOCATION Co-ords. N 15,827,376; E 949,961

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY Z

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	w_p	w	w_L		
448.0	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) V. Stiff		1	SS	16											
444.0																
4.0	Shaly Limestone		2	BXL	Rec											
439.0	Bedrock Sound				100	% 440										
9.0	End of Borehole															
	<u>Bedrock Description</u>															
	From 4' to 6'3"															
	Limestone, grey,															
	medium textured,															
	hard, fossiliferous.															
	From 6'3" to 9'															
	Shale, grey, soft,															
	fissile, with shaly															
	sections.															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 7

WP 157-75-05

LOCATION Co-ords. N 15,827,333; E 950,024

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY

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	w_p	w	w_L		
447.9	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sa. & gr. (Glacial till) V. Stiff		1	SS	22											
443.4																
4.5	Shaly Limestone		2	BXL	Rec											
438.4	Bedrock Sound				100	440										RQD 7%
9.5	End of Borehole															
	<u>Bedrock Description</u> From 4'5" to 6'6" Limestone, grey, medium textured, medium hard, fossiliferous. From 6'6" to 8'7" Shale, grey, soft, fissile with shaly sections. From 8'7" to 9'2" Limestone, grey, medium textured, medium hard, fossiliferous From 9'2" to 9'5" Shale, grey, soft, fissile.															

 20
 15 ϕ 5 % STRAIN AT FAILURE
 10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 8

WP 157-75-05

LOCATION Co-ords. N 15,827,263; E 950,063

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY A

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	w_p	w	w_L		
444.8	Water Level															
442.8	Si. sa. & gr. (alluvial)															
2.0	Shaly Limestone		1	BXL	Rec	440										
437.8	Bedrock Sound				100	%										RQD 51%
7.0	End of Borehole															
	Bedrock Description															
	From 2' to 3' Limestone, grey, medium to coarse textured, medium hard, fossiliferous.															
	From 3' to 5' Shale, grey, soft, fissile with shaly sections.															
	From 5' to 5'10" Limestone, grey, medium to coarse textured, medium hard, fossiliferous.															
	From 5'10" to 6'4" Shale, grey, soft, fissile.															
	From 6'4" to 6'7" Limestone, grey, medium to coarse textured, medium hard, fossiliferous.															
	From 6'7" to 7' Shale, grey, soft, fissile.															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 9

WP 157-75-05

LOCATION Co-ords. N 15,827,404; E 949,986

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY A.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. PLT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
445.0	Water Level															
442.0	Silty sand & gravel (alluvial)															GR SA SI CL
3.0	Sound Shaly Limestone Bedrock		1	BXL	Rec 96%	440										RQD 53%
8.0	End of Borehole															
	Bedrock Description															
	From 3' to 3'6" Limestone, grey, fine to medium textured, hard.															
	From 3'6" to 6'2" Shale, grey, soft, fissile.															
	From 6'2" to 6'9" Limestone, grey, fine textured, hard, fossiliferous with thin seams of shale.															
	From 6'9" to 8' Shale, grey, soft, fissile, interbedded with shaly sections.															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 10

WP 157-75-05 LOCATION Co-ords. N 15,827,281; E 950,084 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE June 21, 1977 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Auger - BXL Core CHECKED BY K.C.

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	w_p	w	w_L		
448.5	Ground Level															
0.0	Topsoil															
445.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	55											34 7 47 12
3.5	Shaly Limestone															
440.0	Bedrock Sound		2	BXL	Rec 100											RQD 40%
8.5	End of Borehole															
	Bedrock Description															
	From 3'5" to 5'1" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 5'1" to 7'3" Shale, grey, soft, fissile, with shaly sections.															
	From 7'3" to 8'5" Limestone, grey, medium textured, medium hard, inter- bedded with grey shale. Fossiliferous.															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 11

WP 157-75-05

LOCATION Co-ords. N 15,827,353; E 950,047

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY R₃

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	w_p	w	w_L		
445.1	Water Level															
443.6	Sl. Sa. & Gr. (Alluvial)		1	wash												GR SA SI CL
1.5	Shaly Limestone		2	BXL	Rec											RQD 49%
438.6	Bedrock Sound				100	% 440										
6.5	End of Borehole															
	Bedrock Description															
	From 1'5" to 2'11"															
	Limestone, grey,															
	medium textured,															
	medium hard,															
	fossiliferous.															
	From 2'11" to 5'0"															
	Shale, grey, reddish,															
	soft, fissile with															
	shaly sections.															
	From 5'0" to 5'11"															
	Limestone, light															
	grey, medium															
	textured, medium															
	hard, fossiliferous.															
	From 5'11" to 6'5"															
	Shale, grey, reddish,															
	soft, fissile.															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 12

WP 157-75-05

LOCATION Co-ords. N 15,827,422; E 950,008

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

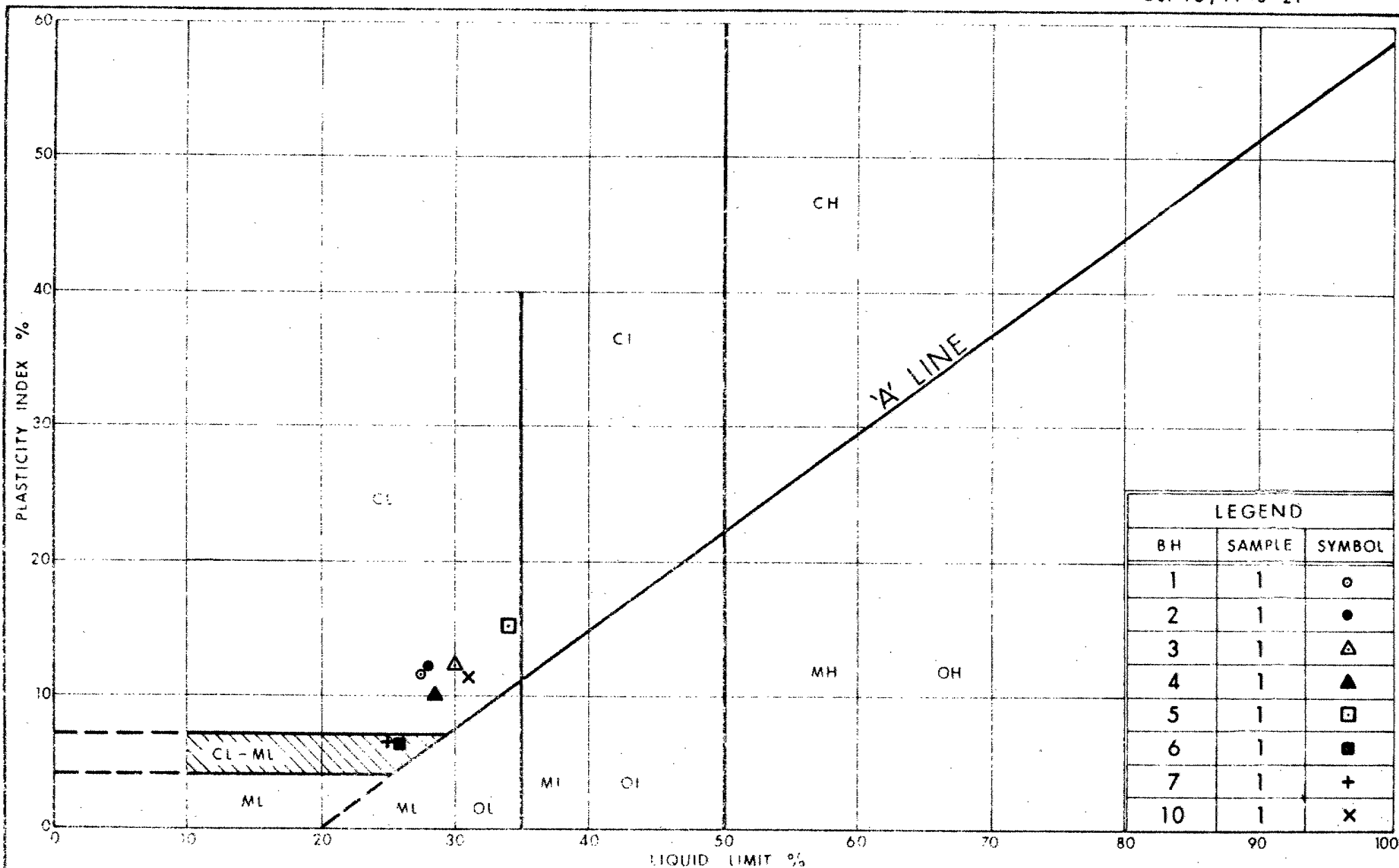
DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY

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	W_P	W	W_L		
447.4	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	118, 94											43 22 25 10
443.4																
4.0	Shaly Limestone		2	BXL	Rec 100%	440										RQD 16%
438.4	Bedrock Sound															
9.0	End of Borehole															
	<u>Bedrock Description</u> From 4' to 6' Limestone, grey, med. textured, med. hard fossiliferous. From 6' to 6'7" Shaly limestone. From 6'7" to 7'3" Limestone, grey, medium textured, medium hard, fossiliferous. From 7'3" to 7'10" Shale with thin seams of limestone. From 7'10" to 9' Limestone, grey to pink, medium textured, medium hard, fossiliferous.															

20
15 ϕ 5 % STRAIN AT FAILURE
10



Ontario

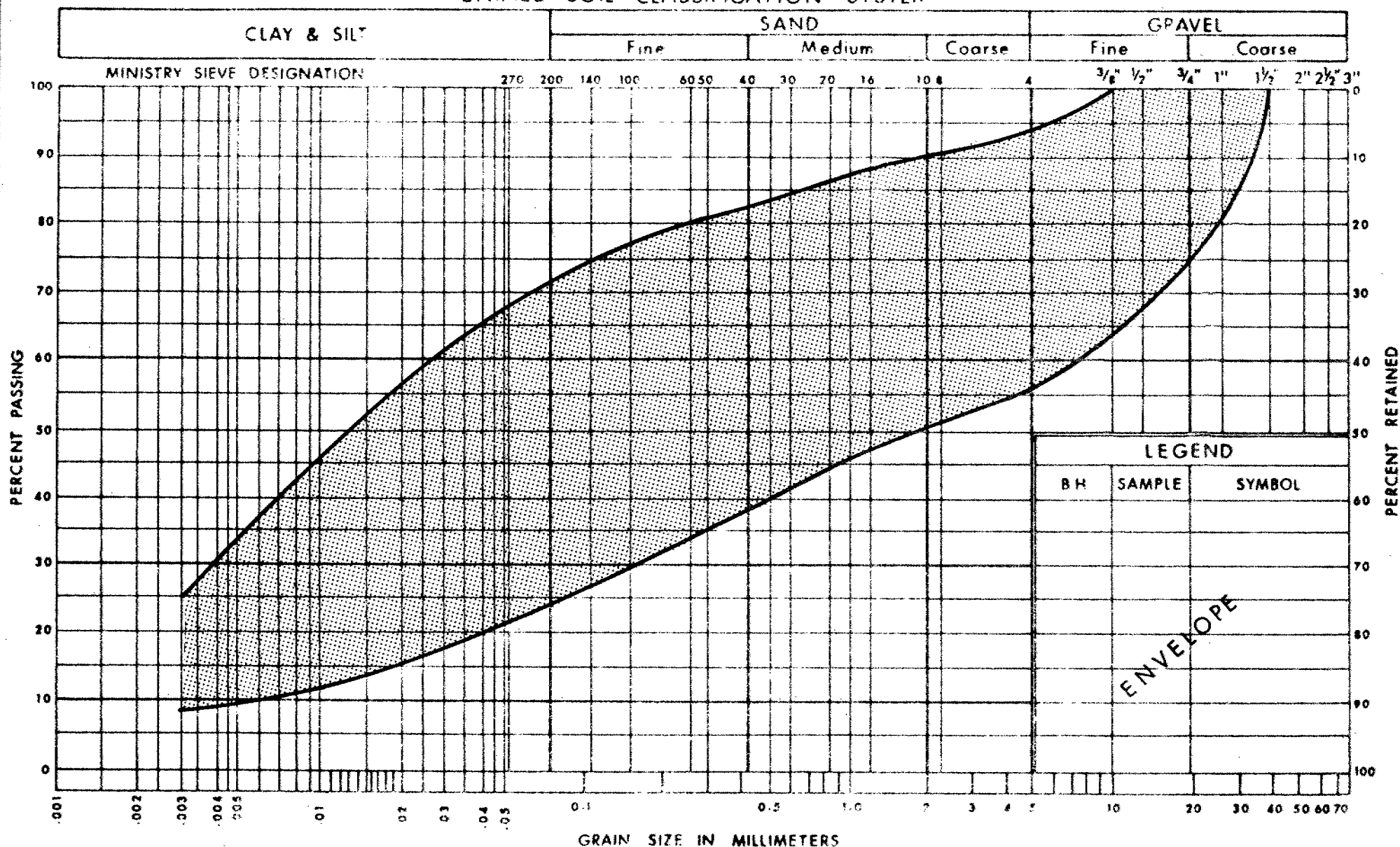
Ministry of
Transportation and
Communications

PLASTICITY CHART
GLACIAL TILL
HET MIX OF CLAYEY SILT WITH SAND & GRAVEL

FIG No 1

W P 157-75-05

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIX OF CLAYEY SILT WITH SAND & GRAVEL

FIG No 2

W P 157-75-05

FOUNDATION INVESTIGATION REPORT

For

Erin Mills Parkway Underpass
W.P. 157-75-06, Site 24-385
Hwy. 403, District 6, Toronto

INTRODUCTION

This report contains the results of foundation investigations carried out at the site of the above mentioned project during the periods of May 24 to June 2, 1977 and February 21 to 28, 1978. The fieldwork consisted of ten sampled boreholes advanced by means of a continuous flight auger machine equipped with solid and hollow stem augers. In addition, diamond drilling techniques were employed to obtain BXL size core samples of bedrock. The boreholes ranged in depth from 24.7 to 103.5 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located about one mile southeast of Eglinton Avenue on Erin Mills Parkway in the City of Mississauga, Regional Municipality of Peel.

The land immediately adjacent to the site has a gentle topography sloping down to the south and is developed for farming purposes. Physiographically the site is situated in the border region of "Peel Plains" and "South Slope". The overburden is underlain by interbedded layers of limestone and shale bedrock of the Queenston and Meaford-Dundas Formations. This physiographic region is well drained by the Credit, Oakville and Etobicoke Creeks, which have cut deep valleys into the overburden, although in many of the interstream areas drainage is still imperfect.

SUBSURFACE CONDITIONS

The site is situated on the edge of a buried valley in the bedrock with widely varying depths of overburden. Underlying the roadway fill material and a shallow surficial organic deposit (swampy area) on the east side of the centreline, is a stratum of cohesive glacial till.

The glacial till is underlain by an extensive granular deposit which in the upper portion consists of silt to sandy silt or clayey silt and gradually changes to silty sand with gravel and boulders. The overburden is underlain by interbedded layers of shale and limestone bedrock. Detailed descriptions of the various soil and rock types encountered in each borehole are given in the Record of Borehole Sheets and the Diamond Drill Record Sheets. The estimated stratigraphical profile and sections shown on Contract Drawing No. 24-385-2 are based upon this information. From ground level downwards, the various soil types encountered are as follows.

Fill Material

In certain locations where boreholes (B.H. #1, #2, #5 and #9) were put down in the shoulders of the existing Erin Mills Parkway, a surficial layer of 3.5 to 8.0 feet of fill material was encountered.

The fill material is cohesive and is comprised of clayey silt with some sand and traces of organics. The 'N' values ranging from 8 to 21 blows per foot, obtained during sampling, indicate that the fill material is well compacted.

Surficial Organic Deposits

At this site on the east side of the Erin Mills Parkway centreline the surficial organic deposits in the swamp area were investigated in the three boreholes (B.H. #6, #7 and #8). The swampy area is covered with 2 to 2.5 feet of water followed by 1.5 to 3.0 foot thick surficial layers of firm organic clay or clayey silt with traces of sand and organics (mostly decayed vegetation).

Glacial Till

Underlying the fill material or beneath the surficial organic deposit a stratum of cohesive glacial till was encountered. This glacial deposit varies in thickness from 4.5 to 18.0 feet and is comprised of a heterogeneous mixture of clayey silt, sand and gravel. The Standard Penetration Tests gave 'N' values ranging from 16 blows to over 100 blows per foot generally increasing with depth indicating that the glacial till has a very stiff to hard consistency. The physical properties of the glacial till as determined from laboratory testing are summarized below:

	<u>Range</u>
Liquid Limit (W _L)%	26-33
Plastic Limit (W _p)%	15-21
Moisture Content (W)%	11-16

The results of the Atterberg Limit Tests are shown on the Plasticity Chart (Figure 1) and the typical grain size distribution curves are presented in Figure 2 which are included in the Appendix of this report.

The Atterberg Limits indicate that the cohesive stratum is inorganic and of low plasticity.

Silt to Silty Sand With Layers of Clayey Silt
(Upper Granular Deposit)

Underlying the cohesive glacial till is a granular deposit which varies in thickness from zero at B.H. #5A to a maximum of 32 feet. The material is mainly composed of silt with some sand changing to silty sand with random seams of clayey silt up to 2 feet thick. The Standard Penetration Tests gave an 'N' value range of 22 to over 100 blows per foot which indicates that the relative density of the deposit is compact to very dense but generally in the dense to very dense range.

Silty Sand With Gravel and Occasional
Boulders (Lower Granular Deposit)

The upper granular stratum is underlain by a deposit of silty sand with gravel and occasional boulders up to 18 inches in size. The lower granular deposit varies in thickness from zero at B.H. #5A to a maximum of 53 feet. The material in this stratum is generally silty sand with gravel and occasional boulders (up to 18 inches in size), the boulders becoming more frequent with depth. At one location (B.H. #9), the lower granular deposit at approximate elevation 512.0 was subjected to an excess hydrostatic head of 2 feet. Due to this unbalanced hydrostatic head, the silty sand continuously kept pushing into the hollow stem augers and the BX casing and consequently rendered further investigation impossible.

Standard Penetration Tests performed gave 'N' values ranging from 37 to over 100 blows per foot with an exception of 18 blows per foot at one location. Based on these values it is estimated that the relative density of the lower granular deposit varies from dense to very dense with the exception of one location where it may be described as compact.

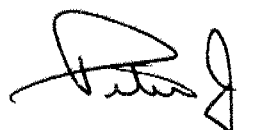
Bedrock

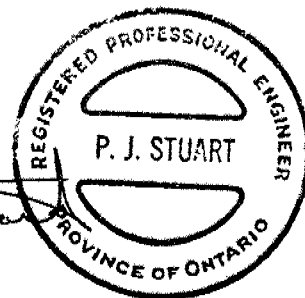
The elevation of the bedrock surface varies dramatically over the site. It was proven by the recovery of BXL size rockcore at depths varying from 24 to 97 feet. In the southwest quadrant of the interchange in the area of borehole #5A the bedrock is closest to the surface. At this location the precise boundary between the overlying glacial till

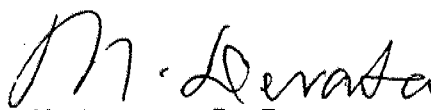
and the weathered shale is variable and difficult to define. The zone between the depths of 6 and 23 feet is a transition zone consisting of either weathered shale or fragments of shale compressed into a breccia or shale till. Bedrock found at the higher elevations is red Queenston Shale. At lower elevations it consists of interbedded layers of limestone and grey shale of the Meaford-Dundas Formation.

Groundwater

Groundwater conditions were observed by measurements in the open boreholes during and after the foundation investigation. During the investigation an artesian head of 2 feet was encountered in B.H. #9 at approximate elevation 512. Groundwater elevations observed following completion of the field investigation varied from 519 (B.H. #5) to elevation 531 which corresponded to the water surface elevation in the swampy area east of Erin Mills Parkway.


P.J. Stuart, P. Eng.
Foundations Engineer




M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 157-75-06 LOCATION Co-ords N 15,825,402 ; E 947,811 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE May 31, 1977 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE 3/4" Hollow Stem auger; Bx casing; BXL Core CHECKED BY _____

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	w_p	w	w_L		
536.7	Ground Level															
0.0	Fill Material (clayey silt with some sand and traces of organics)		1	SS	12	530										0-19-60-21
528.7			2	SS	20											
8.0	Heterogeneous Mixture of clayey silt, sand and gravel (Glacial till) Hard		3	SS	75											
522.2			4	SS	71	520										0- 3-94- 3
14.5	Silt to sandy silt with occasional seams of clayey silt.		5	SS	71											
	Clayey Silt		6	SS	80	510										0-32-58-10
	Very Dense		7	SS	165											
500.7						500										
36.0	Silty sand with gravel and occasional boulders		8	SS	136	490										17-50-31-2
	Very Dense					480										
						470										
457.7						460										
79.0	Shaly limestone Bedrock		9	BXL	100% Rec											
452.7																
84.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 157-75-06

LOCATION Co-ords N 15,825,468 ; E 947,725

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 2 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE 3 1/2" Hollow Stem auger; BX casing; BXL core

CHECKED BY

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	W_p	W	W_L		
534.0	Ground Level															GR SA SI CL
0.0	Fill Material															
	Clayey silt with some sand and traces of organics		1	SS	14	530										
526.5																
7.5	Heterogeneous Mixture of clayey silt, sand and gravel (Glacial Till) Hard		2	SS	62											0-13-58-29
522.0																
12.0			3	SS	85											
	clayey silt					520										
	silt to sandy silt with occasional seams of clayey silt		4	SS	54											0-0-88-12
	Very Dense		5	SS	69											
						510										0-0- 95-5
			6	SS	65											
504.0																
30.0			7	SS	109											
	Silty sand with gravel and occasional boulders					500										
	random clayey silt layers clayey silt		8	SS	160/11"											17-35-36-12
	Very Dense					490										
						480										
						470										
			9	SS	142/11"											18-69--(13)
						460										
457.0																
77.0	Shaly limestone															
	Bedrock		10	BXL	100% Rec											
452.0																
82.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 157-75-06 LOCATION Co-ords N 15,825,423 :E 947,678 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE May 26, 1977 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem auger; BX casing; BXL core and CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	cone test LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES					
531.8	Ground Level									
0.0	Heterogeneous Mixture of clayey silt, sand and few gravel. (Glacial fill) Hard		1	SS	36					0-10-60-30
526.3			2	SS	59					
5.5	Silt to silty sand with occasional gravel and seams of clayey silt Very Dense		3	SS	74					0-0- 81-19
			4	SS	84					
516.8			5	SS	55					10-61-23-6
15.0	Silty sand with gravel and Boulders		6	SS	170					
			7	SS	37					
			8	SS	93					
	Dense to Very Dense									
	Boulders		BXL		24" Rec					
			BXL		6" Rec					
488.3			9	SS	116					
43.5	End of Borehole									

20
15 ϕ 5 % STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 157-75-06 LOCATION Co.ords N 15,825,362 ;E 947,771 ORIGINATED BY VK
 DIST 6 HWY 403 BORING DATE May 24, 1977 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE 3 1/2" Hollow Stem auger; BX casing; BXL core and cone test CHECKED BY

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					w_p — w — w_L				
							SHEAR STRENGTH					WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
532.5	Ground Level					ELEV									GR SA SI CL	
0.0	Heterogeneous Mixture of clayey silt sand and few gravel (Glacial fill) Hard		1	SS	79	530									0-12-61-27	
527.0			2	SS	104											
5.5	Silt to silty sand with occasional gravel and boulders		3	SS	110										0-0- 89-11	
			4	SS	85	520										
			5	SS	46											
			6	SS	141	7"										
	20" boulders			BXL	20"	510										
	clayey silt		7	SS	130										0-50- 41-9	
	random clayey silt layers		8	SS	100	6"										
	Dense to Very Dense					500										
494.5			9	SS	159	490									50-35-13-2	
38.0	Silty sand and gravel and boulders Very Dense		10	SS	100	480										
477.5																
55.0	Shaly limestone Bedrock		11	BXL	Rec											
			12	BXL	Rec											
470.5			13	BXL	Rec											
62.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 5

W P 157-75-06 LOCATION Co-ords N 15,825,316; E 947,875 ORIGINATED BY VK
DIST 6 HWY 403 BOREHOLE TYPE H.S. 3 1/2" Ø Auger - CME 55 and Cone Test COMPILED BY VK
DATUM Geodetic DATE July 2, 1976 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
538.0	Ground Level															
0.0	Fill Material (mix. of clayey silt with sand, trace of gravel & organics)		1	SS	8										Org. 1.70%	5 19 52 24
531.5			2	SS	60											
6.5	Silty Sand with Occasional Gravel		3	SS	70		530									0 88 (12)
	Very Dense		4	SS	41											
			5	SS	123		520									2 65 (33)
	occasional layers of clayey silt below elev. 520		6	SS	136											4 65 25 6
513.3	Shale Fragments		7	SS	150											
24.7	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5A

W P 157-75-06 LOCATION Coords. N 15,825,302: E 947,864 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE 3 1/2" H.S. Auger COMPILED BY V.K.
DATUM Geodetic DATE February 28, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100				
								SHEAR STRENGTH				
534.0	Ground Level		1	SS	23							GR SA SI CL
0.0	Clayey Silt With Trace of Sand		2	SS	103							0 4 80 16
528.0	(Glacial Till) Boulders Very Stiff		3	SS	165							
6.0	Reddish Clayey Silt With Fragments of Weathered Shale or Weathered Shale (Transition Zone)		4	SS	147							0 14 56 30
			5	SS	100.6"							
	Hard		6	SS	100.5"							
510.7												
23.3	Bedrock - Sound		7	BXL	100% Rec.							
505.6	Shaley Limestone											
28.4	End of Borehole											

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 6

W P 157-75-06 LOCATION Coords. N 15,825,523; E 947,780 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE 3/4" H.S. Auger COMPILED BY V.K.
DATUM Geodetic DATE February 23, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
531.6	Ice Surface																
530.0	Water																
529.3																	
528.2	Organic Clay		1	SS	4												Organic 3.27%
5.0	Heterogeneous Mixture of Clayey Silt With Some Sand and Trace of Gravel (Glacial Till) Brown Grey Very Stiff to Hard		2	SS	16												46%
			3	SS	38												
			4	SS	49												
			5	SS	104												
			6	SS	49												
508.6																	
23.0	Silt With Trace of Clay		7	SS	22												
			8	SS	30												
			9	SS	30												
493.6	Compact to Dense																
38.0	Silty Sand With Gravel and Occasional Seams of Clayey Silt		10	SS	37												
			11	SS	147												
	Dense to Very Dense																
			12	SS	95												
450.7																	
80.9	Bedrock		13	BXL	90% Rec.												
447.4	Shaley Limestone																
84.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

W P 157-75-06 LOCATION Coords. N 15,825,463; E 947,873 ORIGINATED BY V.K.
 DIST 6 HWY 403 BOREHOLE TYPE 3 1/2" H.S. Auger COMPILED BY V.K.
 DATUM Geodetic DATE February 21, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%) 10 20 30	GR SA SI CL

531.4	Ice Level													
529.4	Water						530						Organics 0.36%	
2.0	Clayey Silt and Organics		1	SS	4									0 6 74 20
526.4			2	SS	34									1 7 57 35
5.0	Heterogeneous Mixture of Clayey Silt With Some Sand & Trace of Gravel (Glacial Till)		3	SS	42									8 16 49 27
518.9	Hard Brown		4	SS	35		520							0 0 87 13
12.5	Grey		5	SS	50									
			6	SS	35									
	Silt With Layers of Clayey Silt		7	SS	30		510							0 2 81 17
	Compact to Dense		8	SS	29		500							0 1 68 31
			9	SS	28									
			10	SS	28		490							
487.4	Silty Sand With Trace of Gravel		11	SS	41		480							1 71 23 5
44.0			12	SS	35		470							0 27 49 24
	Occasional Seams of Clayey Silt						460							
			13	BXL	8" Rec.		450							
	Boulders						440							
434.0	Dense													
97.4	Bedrock Weathered Shaley Sound Limestone		14	BXL	100% Rec.		430							
427.9														
103.5	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 9

WP 157-65-06

LOCATION Co-ords N 15,825,341 ; E 947,902

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE May 27, 1977

COMPILED BY VK

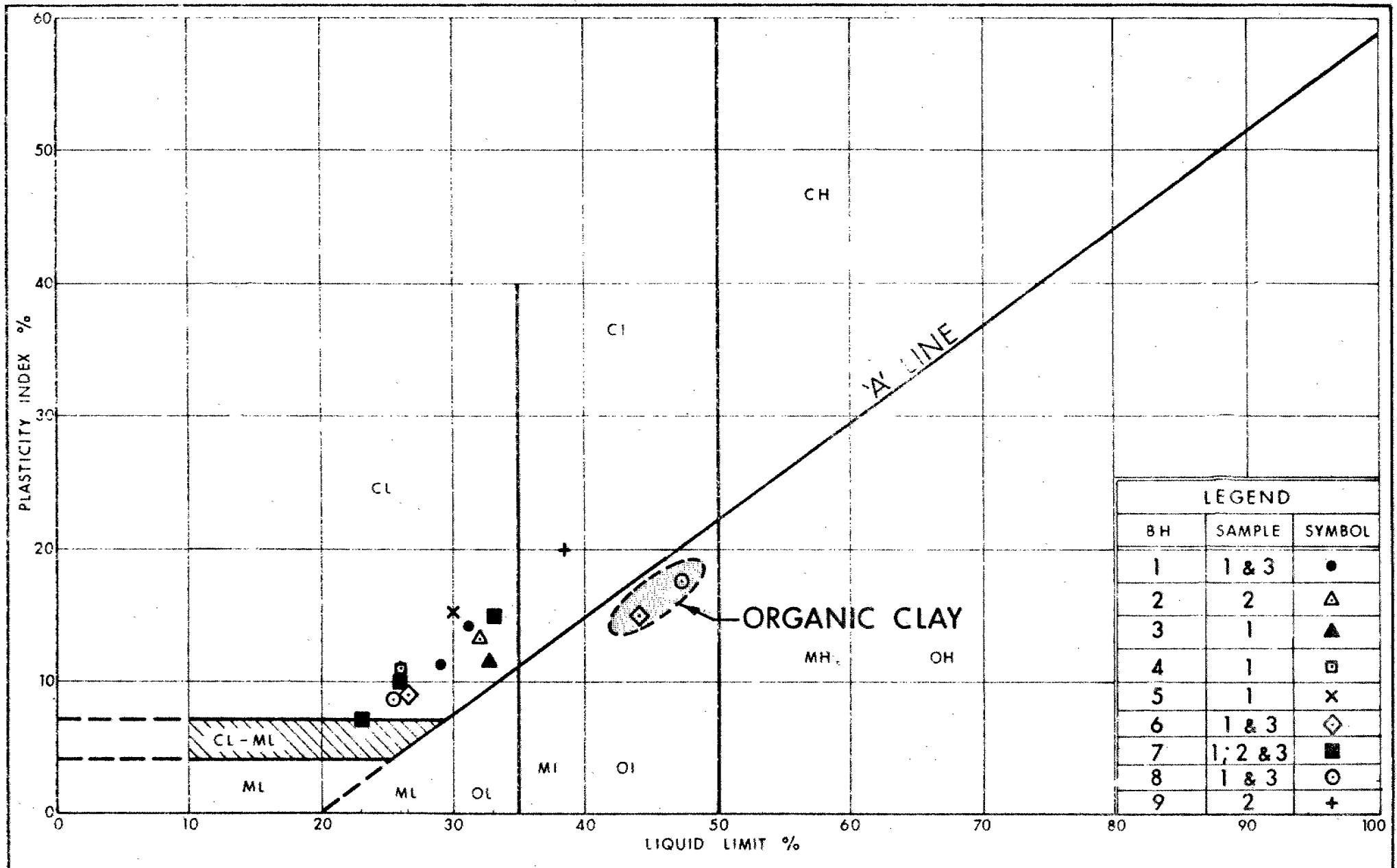
DATUM Geodetic

BOREHOLE TYPE 3" Hollow Stem auger; BX casing; BXL core

CHECKED BY ES

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	w_p	w	w_L		
538.0	Ground Level															GR SA SI CL
0.0	Fill Material clayey silt with some sand and traces of gravel and organics		1	SS	21											
530.0			2	SS	45	530										0-12-54-34
8.0	Heterogeneous Mixture of clayey silt, sand and gravel (glacial till)		3	SS	112	8"										
523.0	Hard		4	SS	135											
15.0	Silty sand with gravel and occasional Boulders random clayey silt layers		5	SS	90	520										0-91- (9)
	Very Dense		6	SS	68	510										
						500										
						490										
	Boulder or Bedrock		7	BXL	4"											
481.5	End of Borehole															
56.5	(The core barrel and the BX Casing jammed, could not continue drilling)															

20
15 ϕ 5 % STRAIN AT FAILURE
10



Ministry of
Transportation and
Communications

PLASTICITY CHART GLACIAL TILL HET MIX OF CLAYEY SILT, SAND & GRAVEL

FIG No 1

W P 157-75-06



Ministry of
Transportation and
Communications

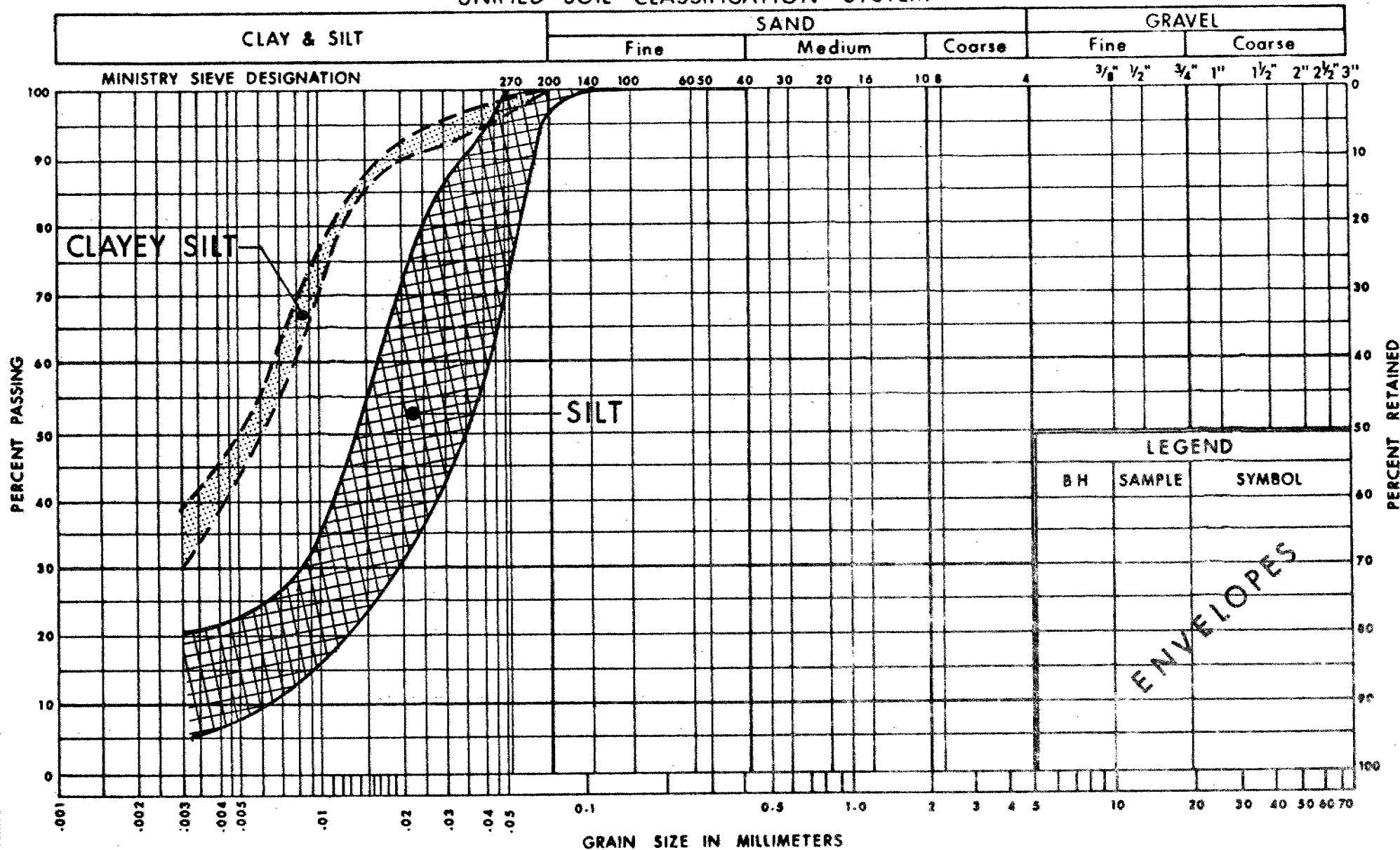
GRAIN SIZE DISTRIBUTION GLACIAL TILL

HET MIX OF CLAYEY SILT WITH SOME SAND & TRACE OF GRAVEL

FIG No 2

W P 157 - 75 - 06

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

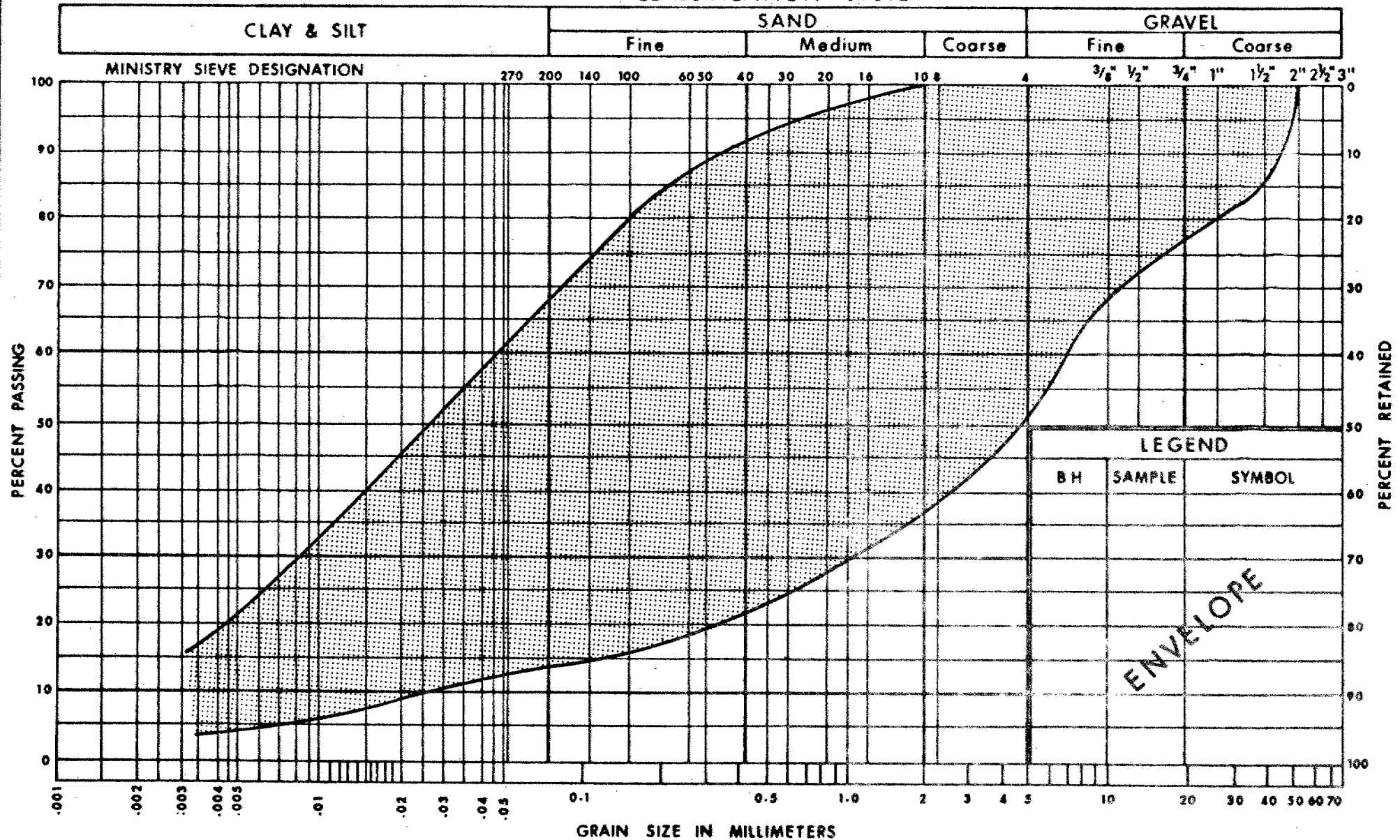
**Ministry of
Transportation and
Communications**

GRAIN SIZE DISTRIBUTION
SILT TO SILTY SAND
WITH OCC SEAMS OF CLAYEY SILT

FIG No 3

W P 157 - 75 - 06

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

**Ministry of
Transportation and
Communications**

GRAIN SIZE DISTRIBUTION
SILTY SAND

WITH OCC GRAVEL & SEAMS OF CLAYEY SILT

FIG No 4

WP 157-75-06

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. 1 of 3

PROPERTY W.P. 157-75-06
LOCATION 403 Hwy. and Erin Mills Pkwy.

LATITUDE _____
DEPARTURE _____
BEARING _____

DIP
90°

TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER	SHALE %		REMARKS
FROM	TO					
HOLE #1						
79'0"	79'10"	Limestone, grey colour, med. texture, hard, fossiliferous		2%		Core broken, sections weathered
79'10"	80'8"	Shaly limestone, grey colour, fine texture, soft		50%		
80'8"	81'0"	Limestone, grey colour, med. texture, hard, fossiliferous		1%		
81'0"	83'0"	Shaly limestone, grey colour, fine texture, soft & fossiliferous		60%		
83'0"	84'0"	Limestone, grey colour, med. texture, hard, fossiliferous		2%		
HOLE #2						
77'0"	77'6"	Limestone, grey colour, med. texture, hard		1%		
77'6"	79'0"	Shaly limestone, grey colour, fine texture, soft fossiliferous, partly fissile		60%		

DATE OF EXAMINATION 07 08 77

B.K. Glassford

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. 2 of 3

PROPERTY W.P. 157-75-06
LOCATION 403 Hwy. and Erin Mills Pkwy.
LATITUDE _____
DEPARTURE _____
BEARING _____

DIP
90°

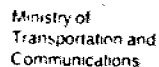
TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER	SHALE or %	REMARKS
FROM	TO				
		HOLE # 2 cont'd			
79'0"	79'8"	Limestone, grey colour, med. texture, hard		1%	
79'8"	80'2"	Shaly limestone, grey colour, fine texture, soft fossiliferous, partly fissile		60%	
80'2"	81'6"	Limestone, grey colour, med. texture, hard and fossiliferous		1%	
81'6"	82'0"	Shaly limestone, grey colour, fine texture, soft fossiliferous, partly fissile		60%	
		HOLE #3			
34'0"	37'6"	Limestone, grey colour, fine texture, hard, top 12" weathered		2%	
37'6"	38'5"	Shale, red colour, fine texture, soft, broken core		100%	Possible boulders and loose rock
		2 feet missing core			Possible boulders and loose rock

DATE OF EXAMINATION 07.08.77

B.K. Glassford



Q: P

NO. 1. NO. _____, SHEET NO. 3 of 3

PROPERTY W. P. 157-75-06
LOCATION 403 and Erin Mills Pkwy.

LATITUDE _____
DEPARTURE _____
BEARING _____

	90°
TOTAL FOOTAGE	

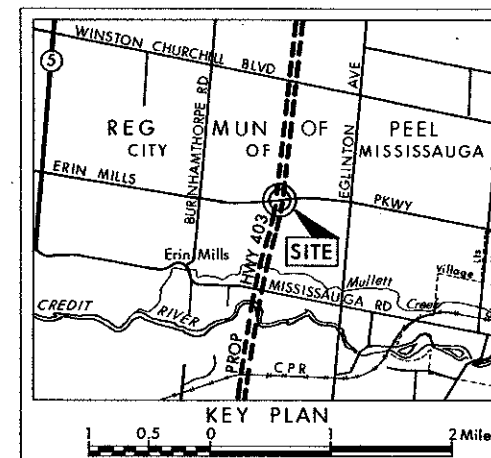
ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION 07 08 77

OB-447-215

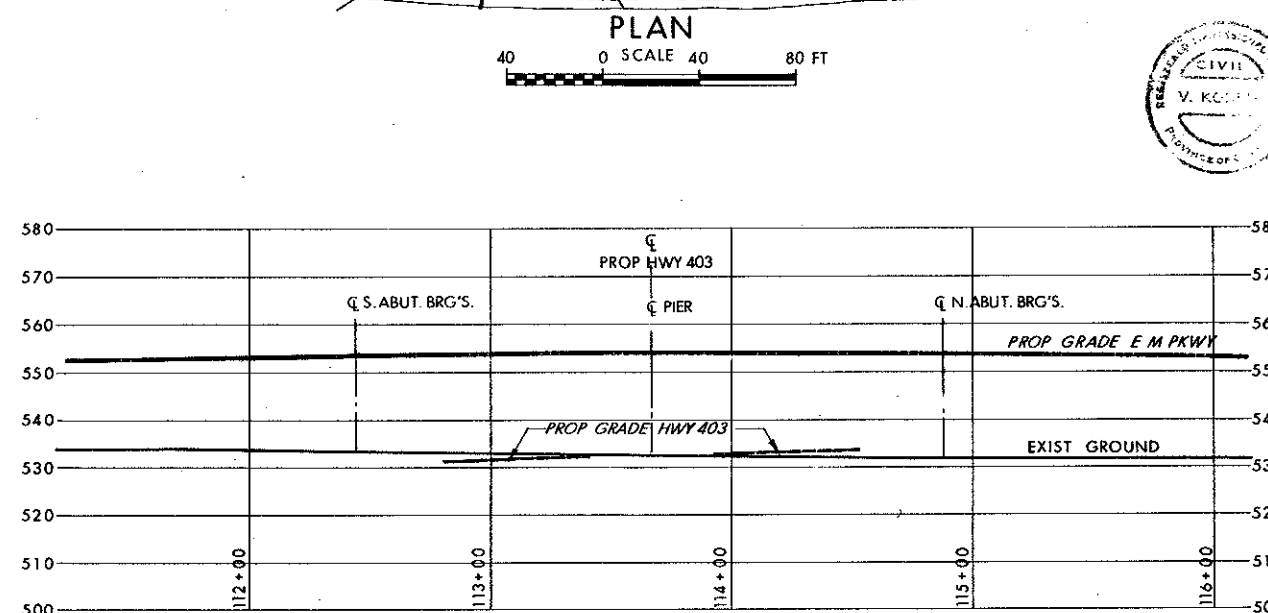
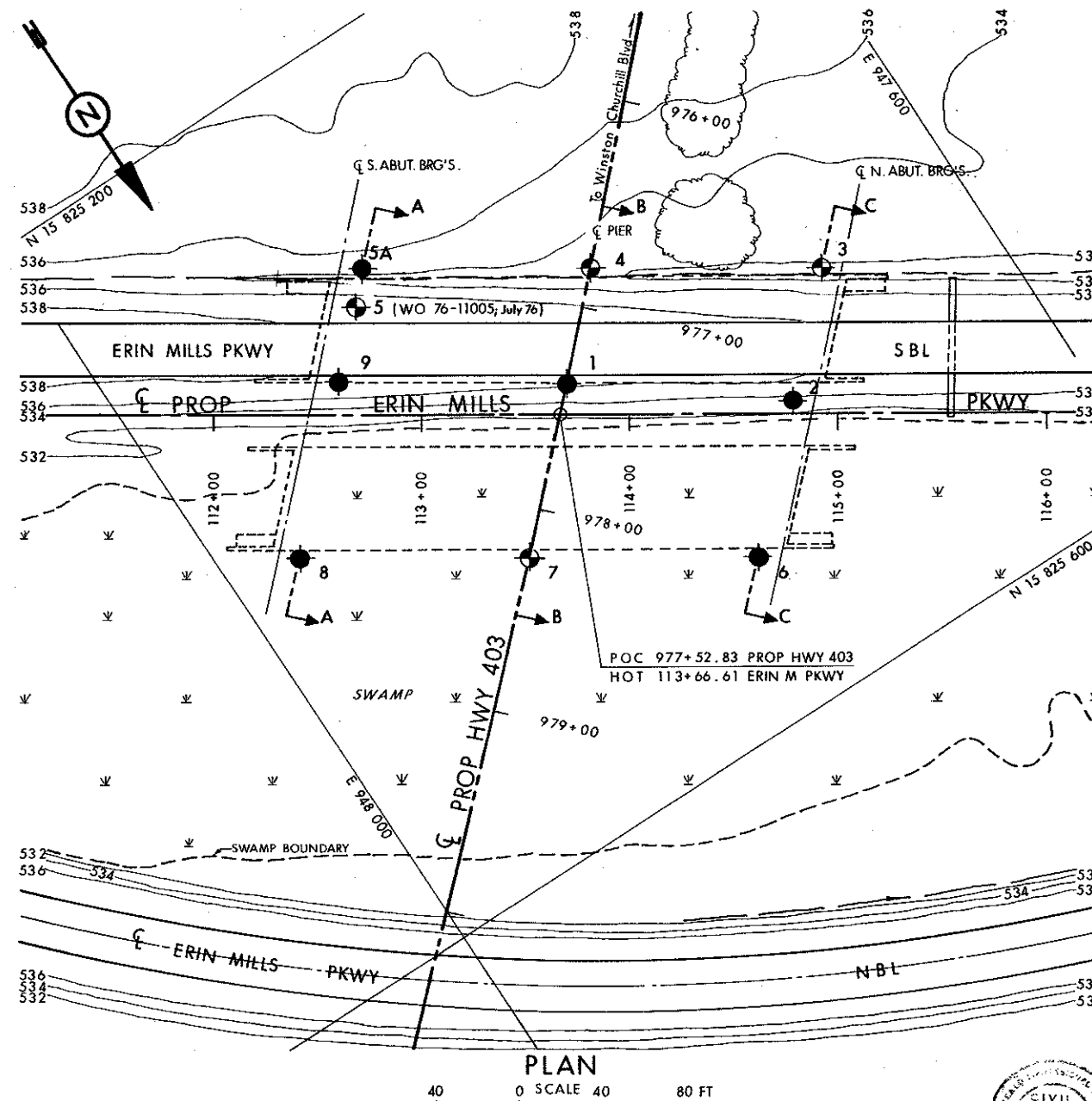
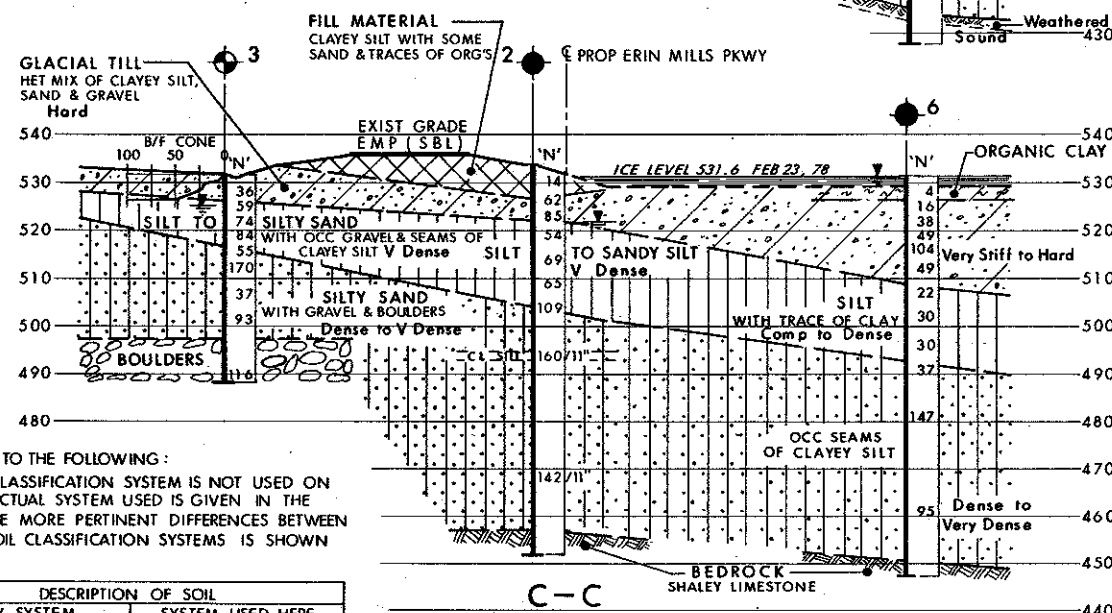
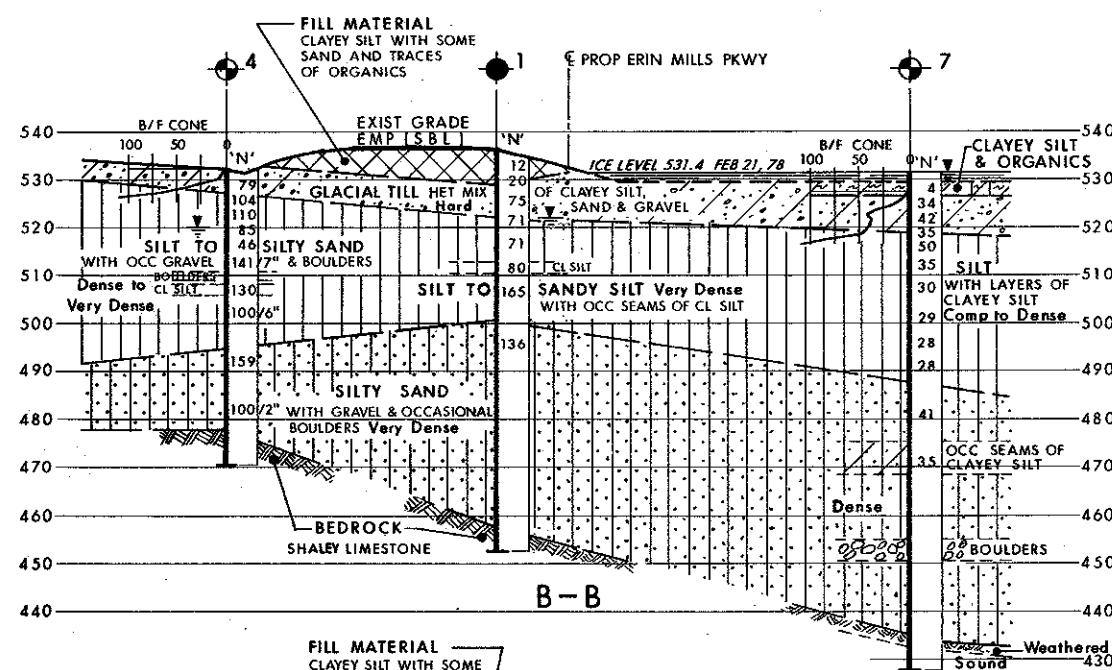
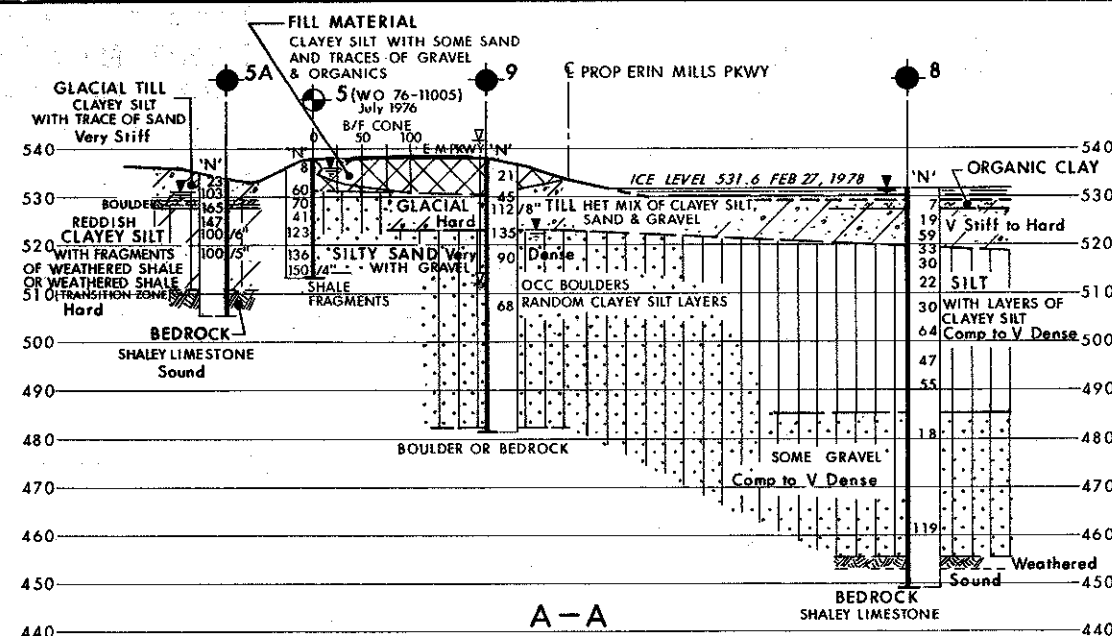
B.K. Glassford



LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Test (Cone)		
	Bore Hole & Cone		
N'	Blows/ft (Std Pen Test 350ft lbs energy)		
	CONE Blows/ft (60° Cone, 350ft lbs energy)		
	WL at time of investigation May & June 1977; Bore Hole 5 July 1976; Bore Holes 5A, 6, 7 & 8, Feb 1978		
	ARTESIAN WATER		
No	ELEVATION	CO-ORDINATES NORTH	EAST
1	536.7	15 825 402	947 811
2	534.0	15 825 468	947 725
3	531.8	15 825 423	947 678
4	532.5	15 825 362	947 771
5	538.0	15 825 316	947 875
5A	534.0	15 825 302	947 864
6	531.6	15 825 523	947 780
7	531.4	15 825 463	947 873
8	531.6	15 825 402	947 965
9	538.0	15 825 341	947 902

-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			
15 Jun 78	R.S.	SECTION A-A	REVISED
DATE	BY	DESCRIPTION	
GEOCRE No 30M12-123			
HWY No PROPOSED 403			
SUBM'D V.K. CHECKED DATE July 14-1977			
DRAWN R.S. CHECKED			
DIST 6			
SITE 24-385			
DWG 24-385-2			



ATTENTION IS DRAWN TO THE FOLLOWING:
THE NEW MTC SOIL CLASSIFICATION SYSTEM IS NOT USED ON THIS DRAWING. THE ACTUAL SYSTEM USED IS GIVEN IN THE CONTRACT REPORT. THE MORE PERTINENT DIFFERENCES BETWEEN THE OLD AND NEW SOIL CLASSIFICATION SYSTEMS IS SHOWN IN THE TABLE BELOW.

SYMBOL	NEW SYSTEM	DESCRIPTION OF SOIL	SYSTEM USED HERE
ML	SILT, CLAYEY SILT, SANDY SILT	SILT, SANDY SILT	
CL	SILTY CLAY	CLAYEY SILT	
CI	SILTY CLAY	SILTY CLAY	
CH	CLAY	CLAY	

SECTIONS

20 0 SCALE 20 40 FT

NOTE:
This complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102.2 of Form 100.