

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-124DIST. 6 REGION                     W.P. No. 157-75-04CONT. No. 80-71W. O. No.                     STR. SITE No. 24-387HWY. No. 403LOCATION Minisnanga Rd.UnderpassNo of PAGES -                     

---

---

---

  
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     REMARKS:

157-75-05 - July 29/77

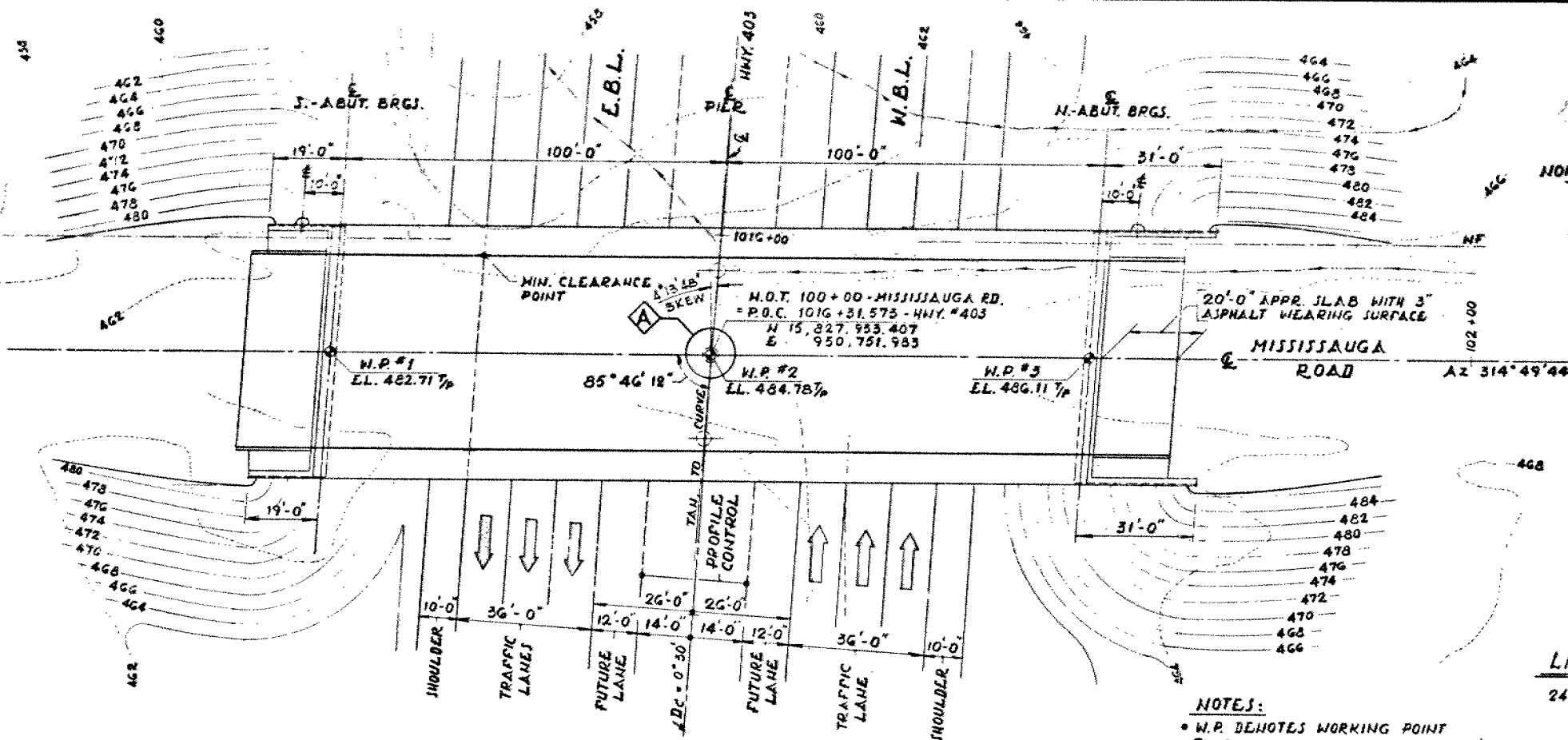
159-75-03 - Aug. 29/77

158-75-03 - Oct. 26-/77

158-75-04 - Oct. 12/77



CS COLE  
SHERMAN



4°13'48" SKEW	
SIN. 0.073760379	
COS 0.997275003	
TAN 0.073961852	

WP #	N	E
WP #1	N 15.827.882.908	E 950.822.905
WP #2	N 15.827.953.407	E 950.751.283
WP #3	N 15.828.023.906	E 957.981.061

# LIST OF DRAWINGS

- 24-387-1. GENERAL LAYOUT
2. BOREHOLE LOCATIONS & SOIL STRATA
3. FOOTING DETAILS
4. SOUTH ABUTMENT
5. NORTH ABUTMENT
6. PIER DETAILS
7. DECK LAYOUT
8. LONGITUDINAL CABLE DETAILS
9. DECK REINFORCEMENT & TRANSVERSE CABLES
10. DECK SECTIONS & DETAILS
11. BARRIER WALL WITH SIDEWALK
12. STEEL RAILING (SINGLE TUBE)
13. 20 FT. APPROACH SLAB
14. DETAILS OF CONC. SLOPE PAVING
15. STANDARD DETAILS I
16. STANDARD DETAILS II
17. STANDARD DETAILS III
18. AS CONSTRUCTED ELEV. & DIM.

# NOTES

**CLASS OF CONCRETE**  
DECK & PIER COLUMNS ..... 5,000 P.S.I.  
BARRIER WALLS ..... 4,000 P.S.I.  
REMAINDER ..... 3,000 P.S.I.  
OR AS NOTED ON THE DRAWINGS

**CLEAR COVER TO REINFORCING**  
FOOTINGS ABUTMENTS PIER COLUMNS  
3" 2" 2"  
DECK TOP BOT 2 1 1/2" APPROACH SLAB 2"  
OR AS NOTED ON THE DRAWINGS

**REINFORCING STEEL**  
GRADE 400 BARS WITH THE DESIGNATION  
C SHALL BE COATED BARS.

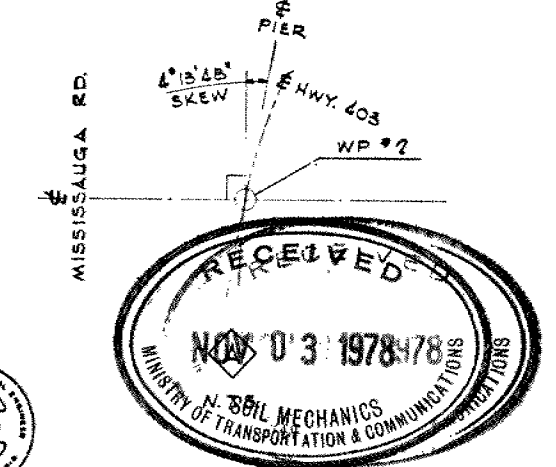
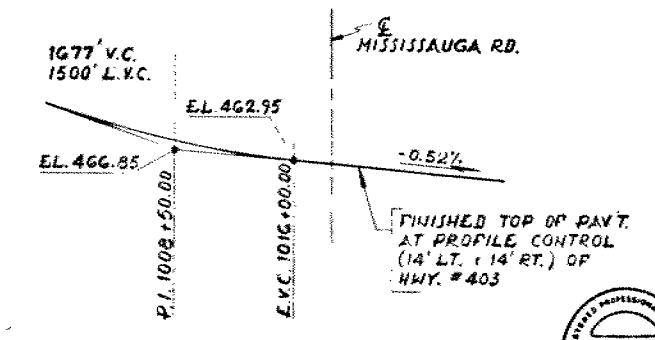
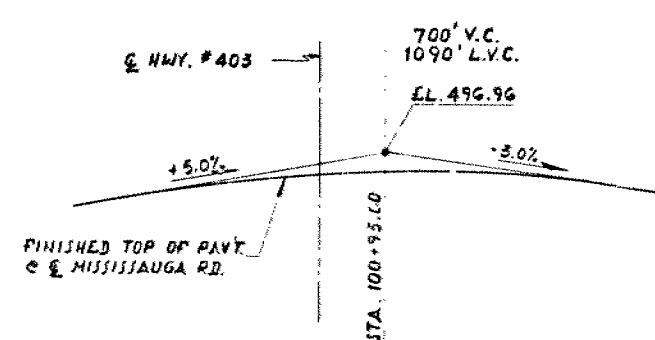
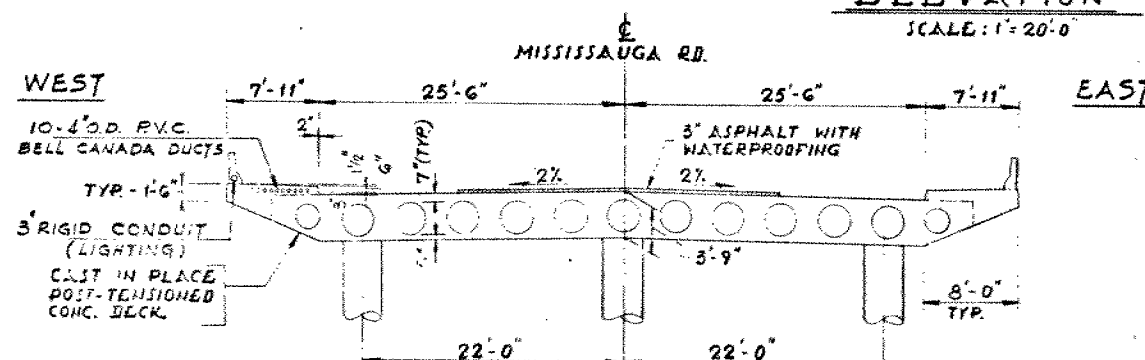
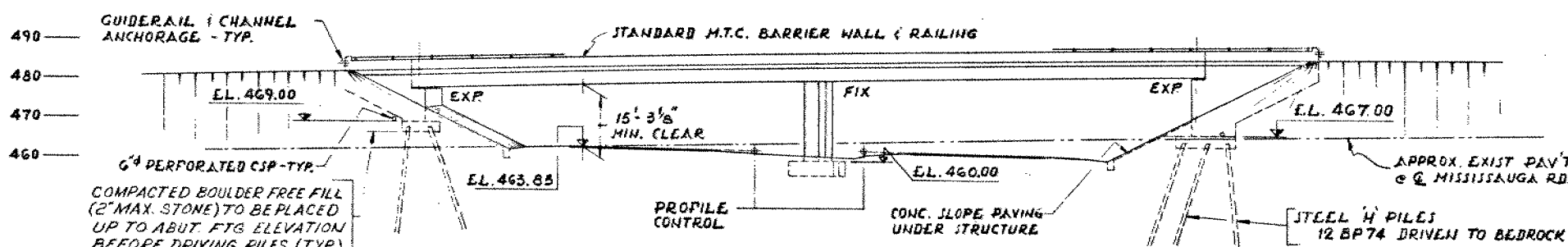
**CONSTRUCTION NOTES**  
THE CONTRACTOR IS RESPONSIBLE FOR  
FINISHING THE BEARING SEATS DEAD LEVEL  
TO THE SPECIFIED ELEVATIONS WITH A  
TOLERANCE OF ± 1/2".  
TO ACHIEVE THE MINIMUM CLEAR COVER OF 2"  
AS SPECIFIED, THE TOP LAYER OF DECK REINFORC-  
ING STEEL SHALL BE PLACED PRIOR TO CONCRETING  
WITH A CLEAR COVER OF 2" ± 1/2" TOLERANCE

NO CONCRETE SHALL BE PLACED ABOVE THE  
ABUTMENT BEARING SEATS UNTIL THE  
CONCRETE IN THE DECK HAS BEEN PLACED,  
STRESSED & GROUTED.

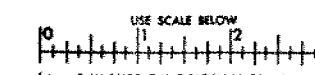
# CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW  
FOR THE APPROPRIATE CONCRETE LUMP  
SUM TENDER ITEMS

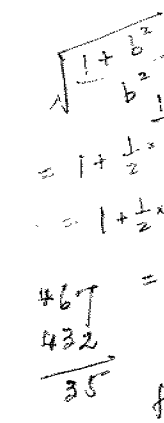
1. CONCRETE IN PIERS, ABUTMENTS AND WING WALLS 5,000 P.S.I. 3,000 P.S.I.	16 CU. YDS. 281 CU. YDS.
2. PRESTRESSED CONC. BRIDGE DECK	1327 CU. YDS.
3. CONCRETE IN BARRIER WALLS	38 CU. YDS.
4. CONCRETE IN APPROACH SLABS	72 CU. YDS.
5. CONCRETE IN SLOPE PAVING	57 CU. YDS.



FOR REDUCED PLAN



REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			



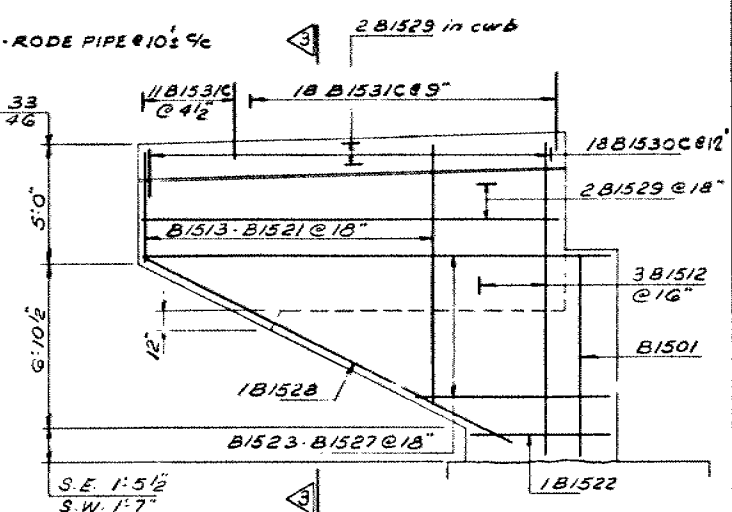
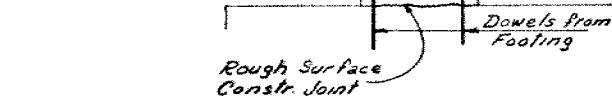
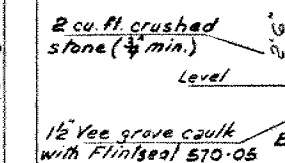

REVISIONS

DATE BY DESCRIPTION

DESIGN C.E. CHECK G.R. LOADING Y.S. DATE A.G.

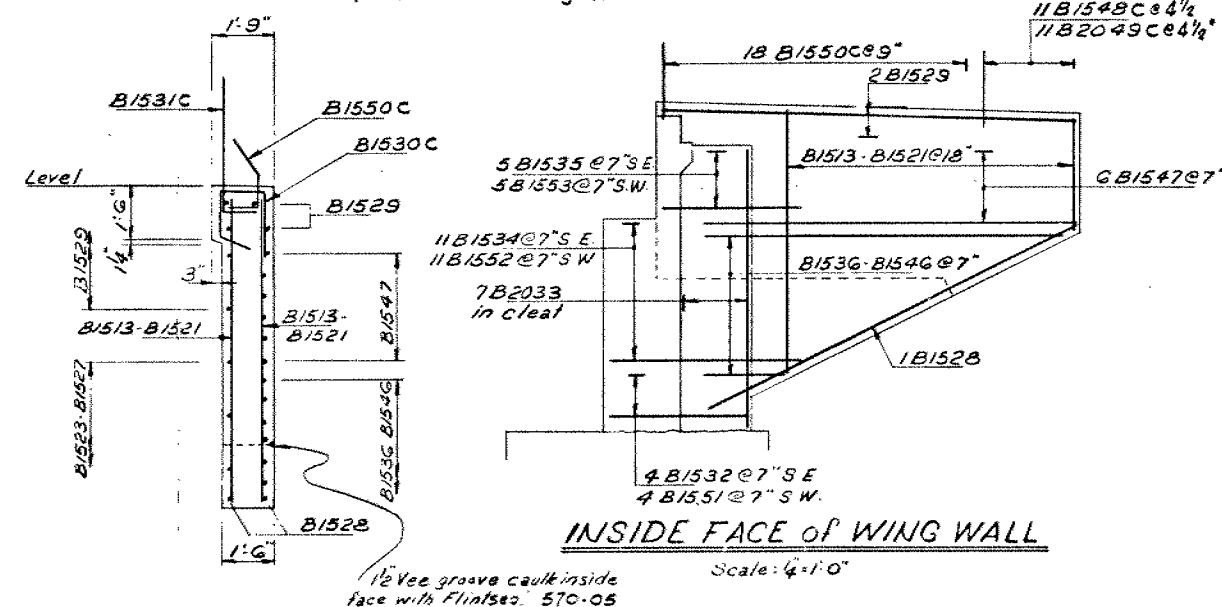
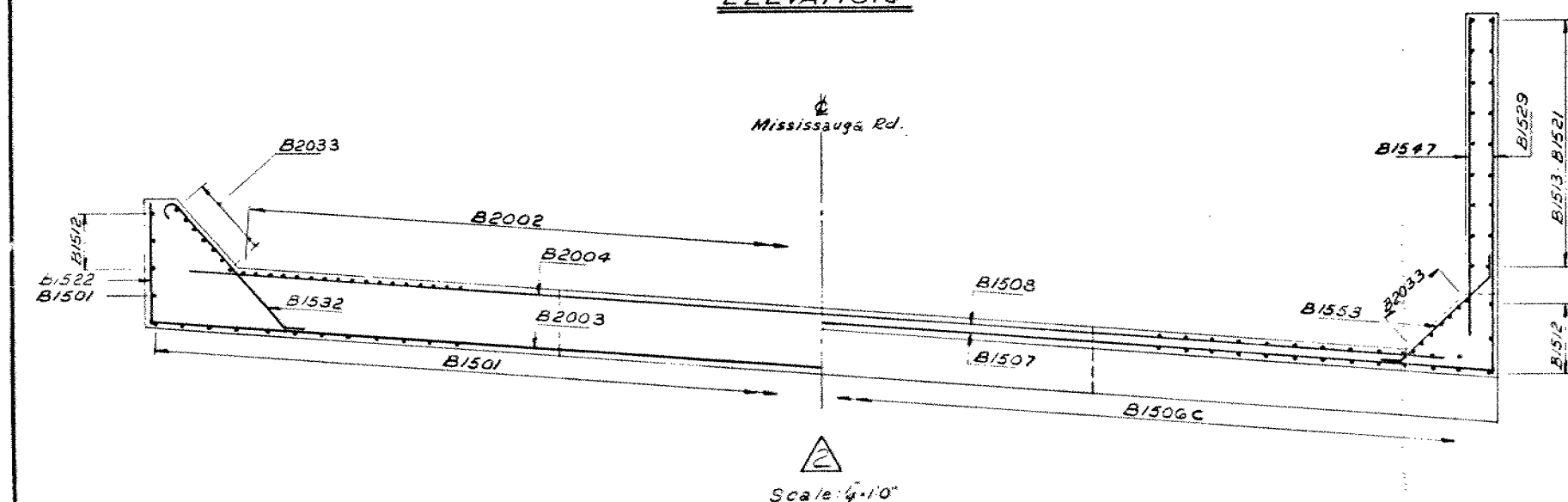
DRAWING E.C. CHECK J.L. SITE No. 62-527 DWG. B

**CS** COLE,  
SHERMAN



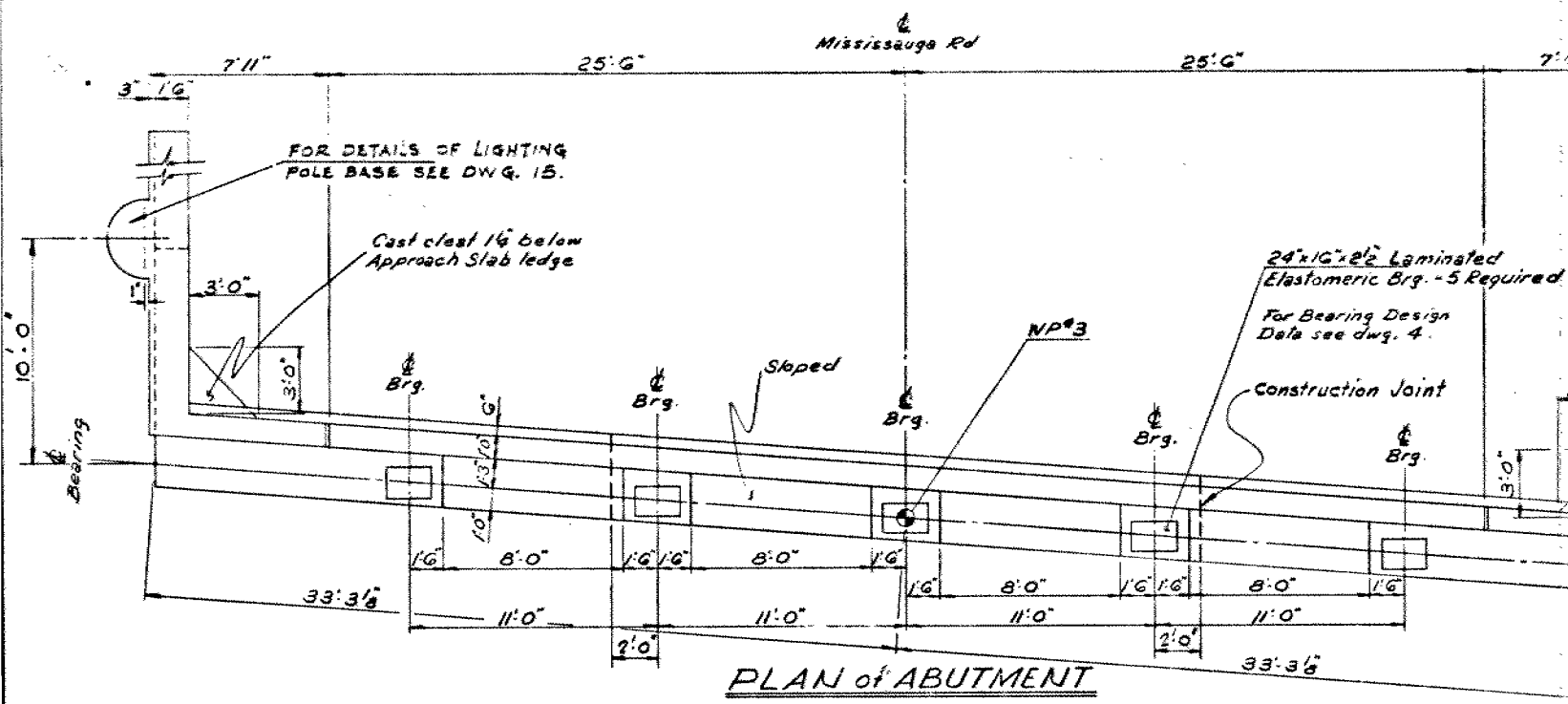
Scale:  $1'' = 1'-0''$

NOTE:  
For bars B1531C, B1548C, B2049C  
# B1550C see dwg. 11.

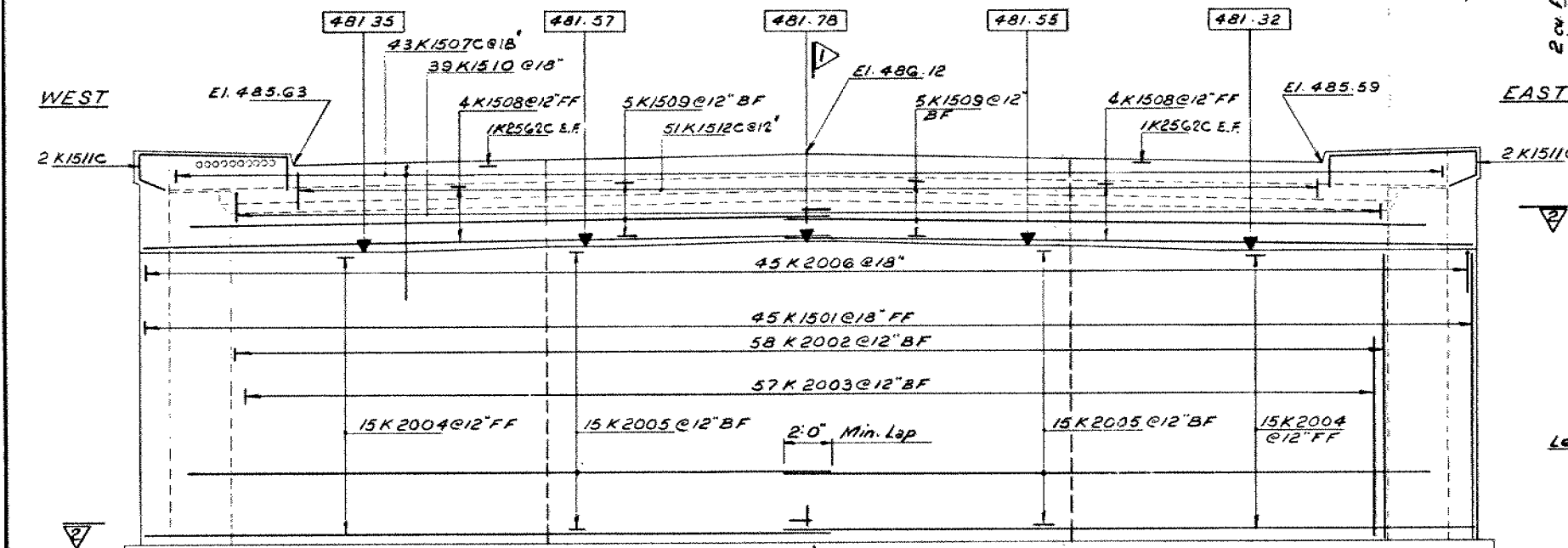
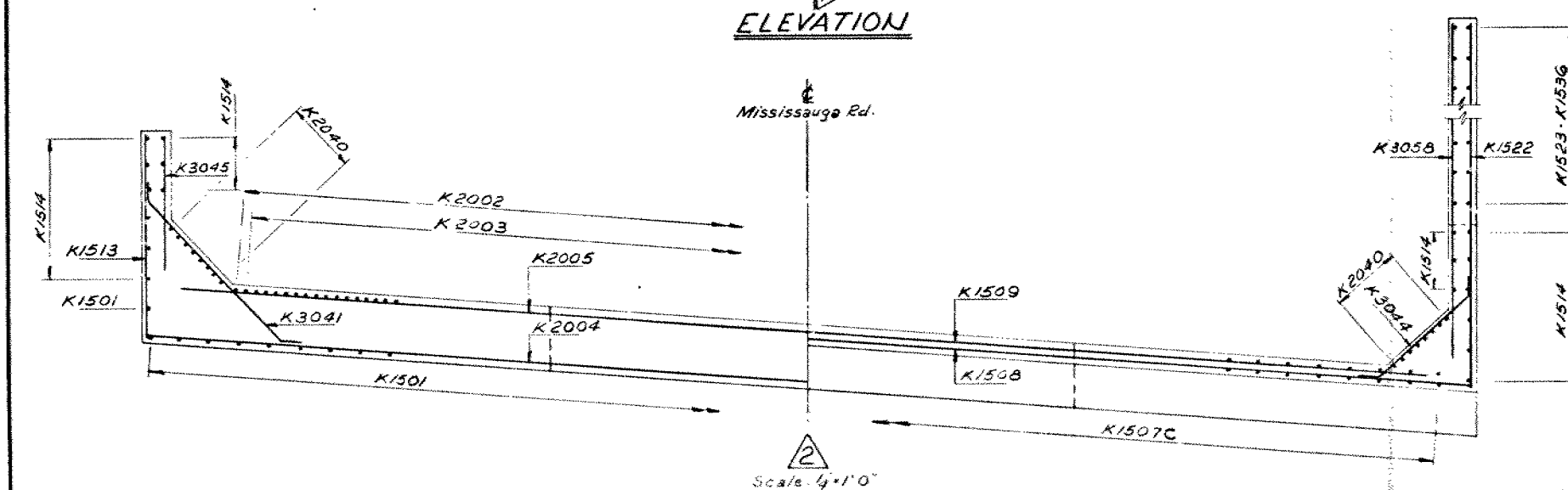
ELEVATION

Scale:  $1'' = 1.0'$

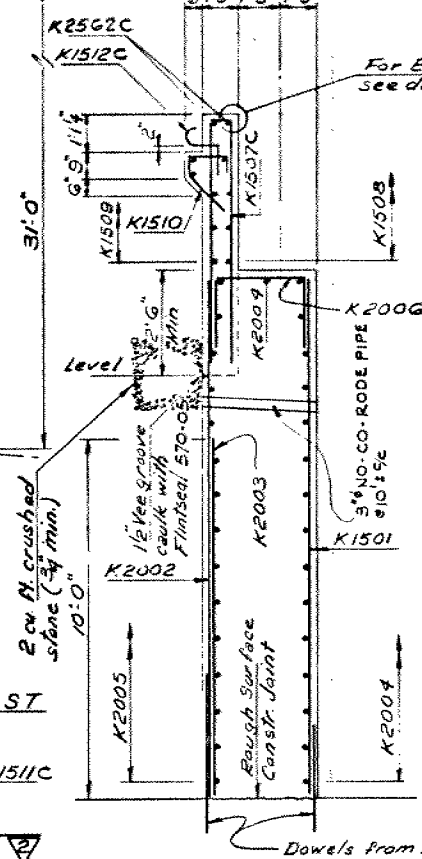
[illegible]



### PLAN of ABUTMENT

ELEVATION

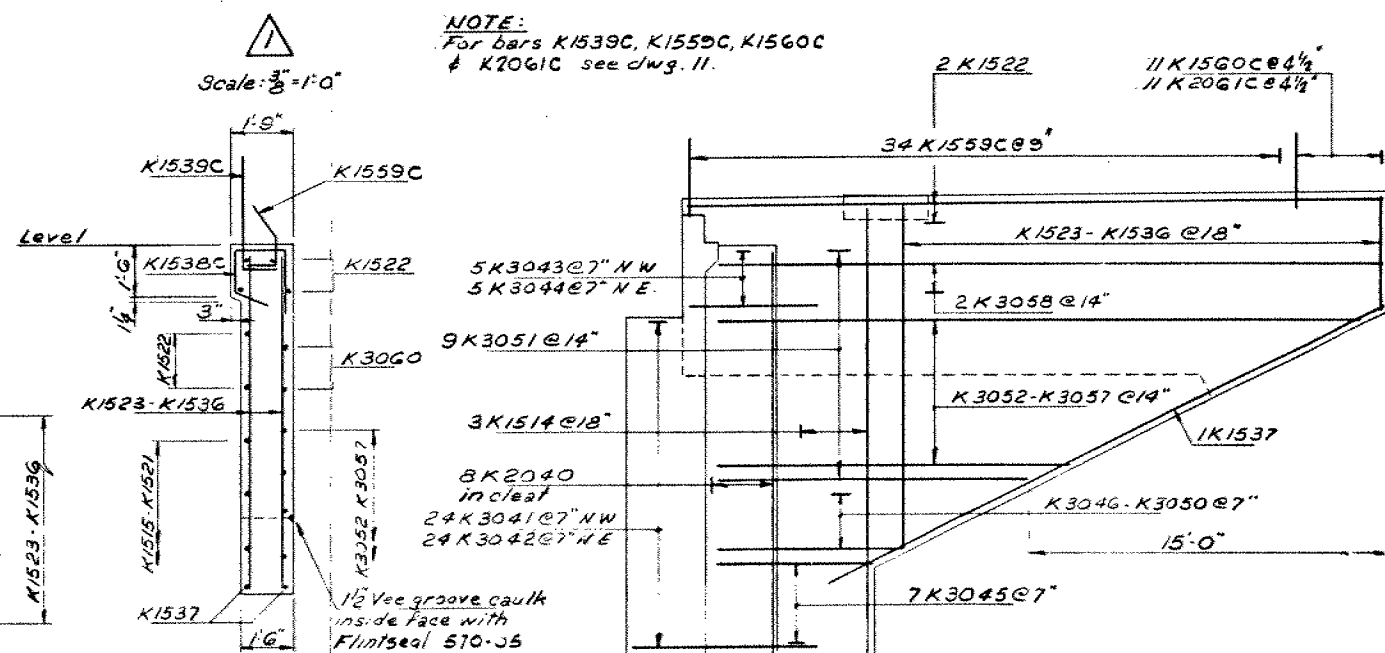
Scale: 1/4" = 1' 0"



OUTSIDE FACE of WING WALL

Scale:  $\frac{1}{4}'' = 1'-0''$

NOTE:  
For bars K1539C, K1559C, K1560C  
& K2061C see dwg. 11.

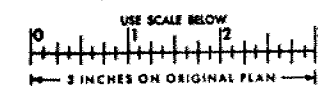


INSIDE FACE OF WING WALL

Scale:  $\frac{1}{4} = 1:0''$



FOR REDUCED PLAN



REVISES						
	DATE	BY	DESCRIPTION			
DESIGN	31		CHECKER	LOADING	AS 20-44	DATE 4/67
DRAWING	31		CHECKER	SITE No	20-337	DWG 3

## INDEX

<u>Page No.</u>	<u>Description</u>
1	Index
2	Abbreviations & Symbols
3	M.T.C. Soil Classification System
4- 57	Foundation Investigation Reports For W.P. 157-75-04 Mississauga Road Underpass  W.P. 157-75-05 Mullet Creek Bridge  W.P. 157-75-06 Erin Mills Parkway Underpass

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 &amp; 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

$\mu$  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   
 $\omega$  SLOPE ANGLE-BACKFACE OF WALL   
 $\beta$  ANGLE OF SLOPE   
 $N_q, N_c, N_{\gamma}$  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 =  $\frac{w - w_p}{p}$   
 $I_c$  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 =  $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

## 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)

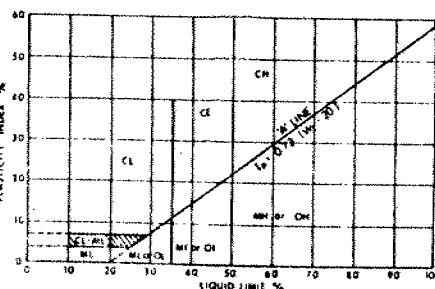


# EXTENDED CASAGRANDE SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 75mm (3 INCHES) AND BASING FRACTIONS ON ESTIMATED MASS)										GRP SYMP	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA															
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN 75µm (No. 200 sieve size)															GRAVELS		MORE THAN HALF OF COARSE FRACTION IS LARGER THAN 5mm (No. 4 sieve)	CLEAN GRAVELS	(LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZE	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.	DETERMINE PERCENTAGES OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75 µm (No. 200 sieve)) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS:  LESS THAN 5% GW, GP, SW, SP MORE THAN 12% GM, GC, SM, SC 5% TO 12%  BORDERLINE CASES REQ. USE OF DUAL SYMBOLS	$C_u = \frac{D_{60}}{D_{10}}$ 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	
															SANDS		MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN 5mm (No. 4 sieve)	CLEAN SANDS	(LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZES & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES			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	
										ATTERBERG LIMITS ABOVE A-LINE WITH $I_p$ GREATER THAN 7																		
										$C_u = \frac{D_{60}}{D_{10}}$ 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																
										ATTERBERG LIMITS ABOVE A-LINE WITH $I_p$ GREATER THAN 7																		
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN 75µm (No. 200 sieve size) (75 µm IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE)															IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425µm (No. 40 sieve size)							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.						
SILTS AND CLAYS		LIQUID LIMIT LESS THAN 50%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	ML	INORGANIC SILTS & SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR		USE GRAIN SIZE CURVE IN IDENTIFYING THE FRACTIONS AS GIVEN UNDER FIELD IDENTIFICATION																			
			MEDIUM TO HIGH	NONE TO VERY SLOW	MEDIUM	CL	CLAYEY SILTS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS																					
			SLIGHT TO MEDIUM	SLOW	SLIGHT	OL	ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS																					
			NONE TO SLIGHT	SLOW TO QUICK	SLIGHT	MI	INORGANIC COMPRESSIBLE SILTS OR SILTY FINE SANDS WITH SOME CLAY OF MEDIUM PLASTICITY (BELOW A-LINE)																					
			HIGH	NONE	MEDIUM TO HIGH	CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY																					
			SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY																					
		LIQUID LIMIT BETWEEN 50% AND 50%	SLIGHT TO MEDIUM	SLOW TO NONE	MEDIUM	MH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS																					
			HIGH TO VERY HIGH	NONE	HIGH	CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS																					
			MEDIUM TO HIGH	NONE TO VERY SLOW	SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY																					
			HIGHLY ORGANIC SOILS			READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE	PI				PEAT & OTHER HIGHLY ORGANIC SOILS																	
			BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY THE LETTERS OF BOTH GROUPS																									

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 75  $\mu$ m (No. 200 sieve) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS:



PLASTICITY CHART  
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

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

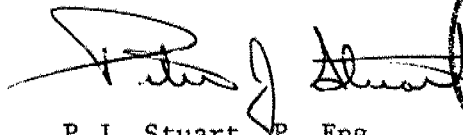
Bedrock was encountered immediately below the cohesive glacial till overburden. The bedrock was proven by obtaining BXL size rock core samples. It consists of interbedded layers of shale and limestone. A more detailed description of the core samples is given in the Diamond Drill Record Sheets provided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

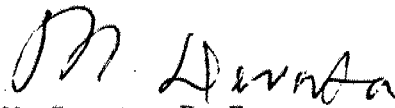
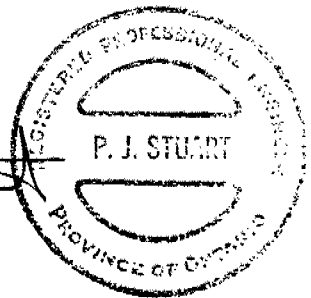
GROUNDWATER CONDITIONS

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 &amp; 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					460										
	Heterogeneous mixture of clayey silt, sand and gravel		1	SS	65											0 26 46 28
			2	SS	86											
			3	SS	130	450										1 22 49 28
	(Glacial Till)		4	SS	51											
	Hard		5	SS	69	440										26 21 32 21
433.7			6	SS	100											
28.0	Weathered		7	SS	100/ 1"											
431.6	Shale Bedrock															
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 $\gamma$	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  $\phi$  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 1/4" Auger - BXL Core &amp; Cone Test

CHECKED BY S

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
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 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 &amp; 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 $\gamma$	REMARKS
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											
			4	SS	31	450										10 21 49 20
			5	SS	27											
			6	SS	67	440										2 25 47 26
			7	SS	102											
432.6	Sound, Shaly															
30.2	Limestone Bedrock		8	BXL	96% Rec	430										
428.9																
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 &amp; 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 $\gamma$	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										1 31 49 19
	Hard		5	SS	68											
			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															

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

## 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

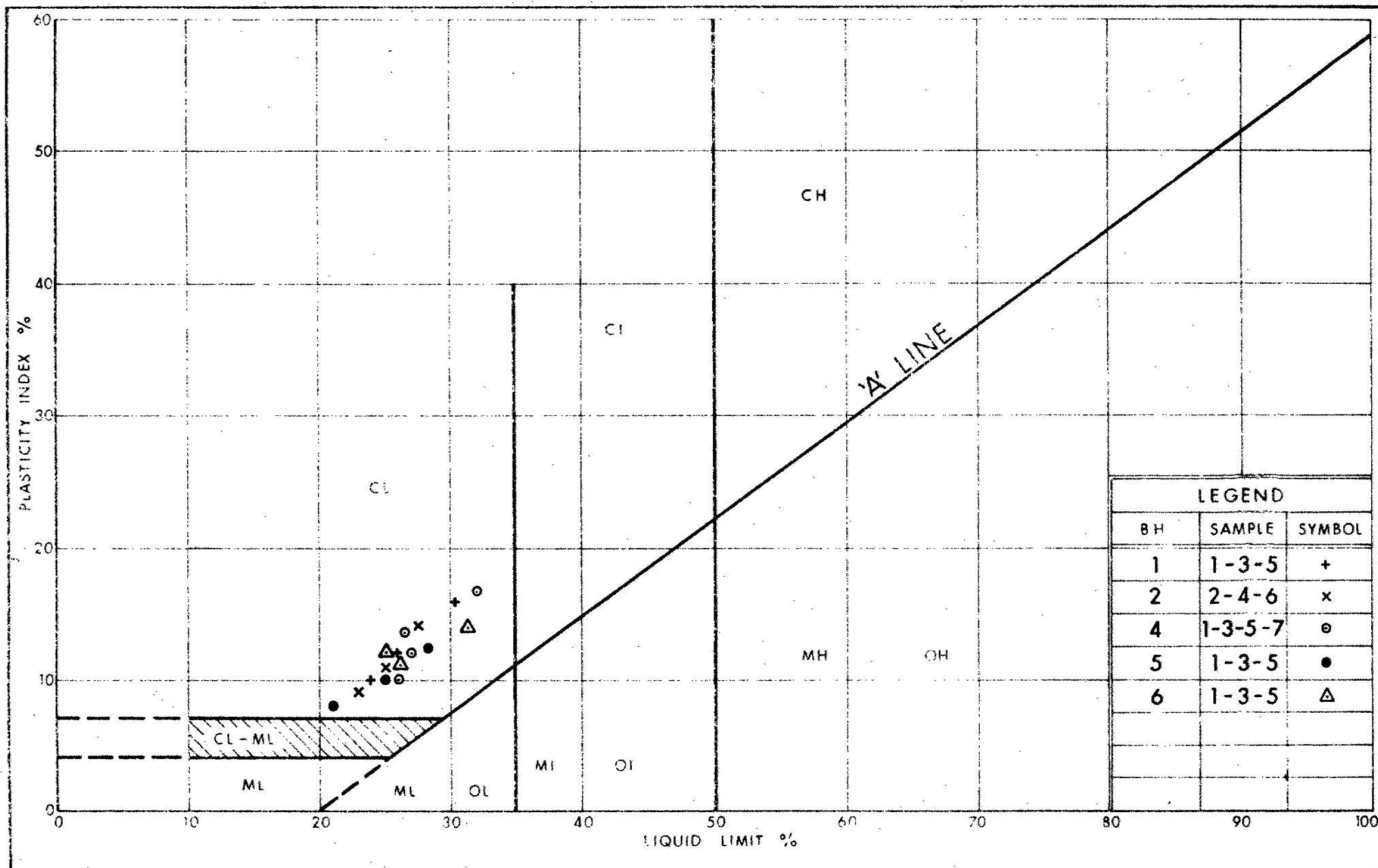
BORING DATE June 20, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 3 1/2" Auger - BXL Core &amp; 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		1	SS	55	460				13 14 42 31
	Heterogeneous mixture of clayey silt, sand and gravel		2	SS	56					11 23 41 25
	(Glacial Till)		3	SS	64					
	Hard		4	SS	32	450				1 19 49 31
			5	SS	51					
438.6			6	SS	156/7"	440				
26.5	End of Borehole (Probable Bedrock)									



Ontario

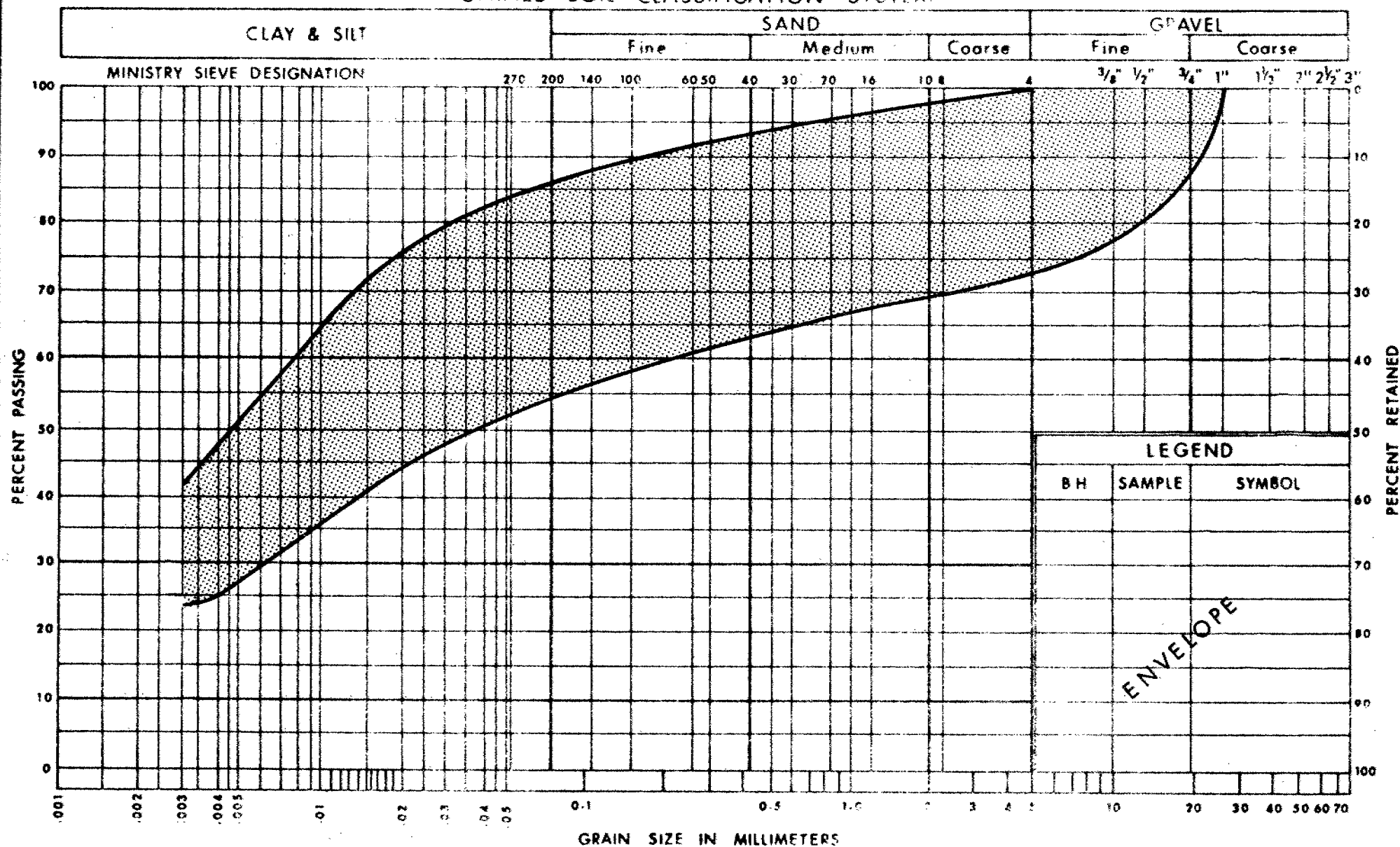
Ministry of  
Transportation and  
Communications

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

W P 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 FUSTAIN \_\_\_\_\_

ELEV. COLLECT \_\_\_\_\_  
DATE \_\_\_\_\_  
DATE \_\_\_\_\_  
DATE \_\_\_\_\_  
DATE \_\_\_\_\_

FOOTAGE		FORMATION	SAMPLE NUMBER	DIP	REMARKS
FROM	TO				
0.00	0.05	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.05	0.10	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.10	0.15	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.15	0.20	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.20	0.25	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.25	0.30	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.30	0.35	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.35	0.40	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.40	0.45	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.45	0.50	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.50	0.55	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.55	0.60	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.60	0.65	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.65	0.70	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.70	0.75	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.75	0.80	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.80	0.85	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.85	0.90	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.90	0.95	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 1/2" zone is broken and		00%	
0.95	1.00	Formation, dark grey colour, fine texture, hard with few thin beds of shale, 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

HOLE NO. \_\_\_\_\_ CORE NO. \_\_\_\_\_

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

DIP  
00°  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 TOTAL FOOTAGE \_\_\_\_\_

ELEV. COLLAR \_\_\_\_\_  
 DATUM \_\_\_\_\_  
 DATE STARTED \_\_\_\_\_  
 DATE COMPLETED \_\_\_\_\_  
 DRILLER \_\_\_\_\_  
 \_\_\_\_\_

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

DATE OF EXAMINATION July 10, 1960

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.

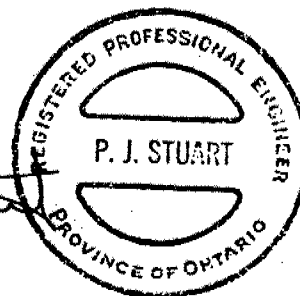
### Bedrock

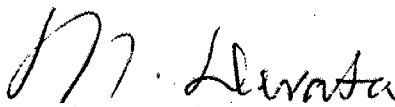
Bedrock was encountered immediately below the cohesive glacial till overburden, or immediately beneath the alluvial deposit in the creek floor. It consists of interbedded layers of shale and limestone. The surface of the bedrock in the area investigated varies from elevation 442.0 to 445.0 and appears 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 $\gamma$	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  $\phi$  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 $\gamma$	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 $\gamma$	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 $\gamma$	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										GR SA SI CL	
3.5	Shaly Limestone														28 31 31 10	
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  $\phi$  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											RQD 45%
438.7	Bedrock Sound				100%	440										
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  $\phi$  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 $\gamma$	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															
	Bedrock Description															
	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  $\phi$  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 $\gamma$	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										
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  $\phi$  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 $\gamma$	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 $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
445.0	Water Level															
0.0	Water															
442.0	Silty sand & gravel (alluvial)															GR SA SI CL
3.0	Weathered															
437.0	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 $\gamma$	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 R<sub>3</sub>

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100					WATER CONTENT %				
							SHEAR STRENGTH									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
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.															

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

## 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

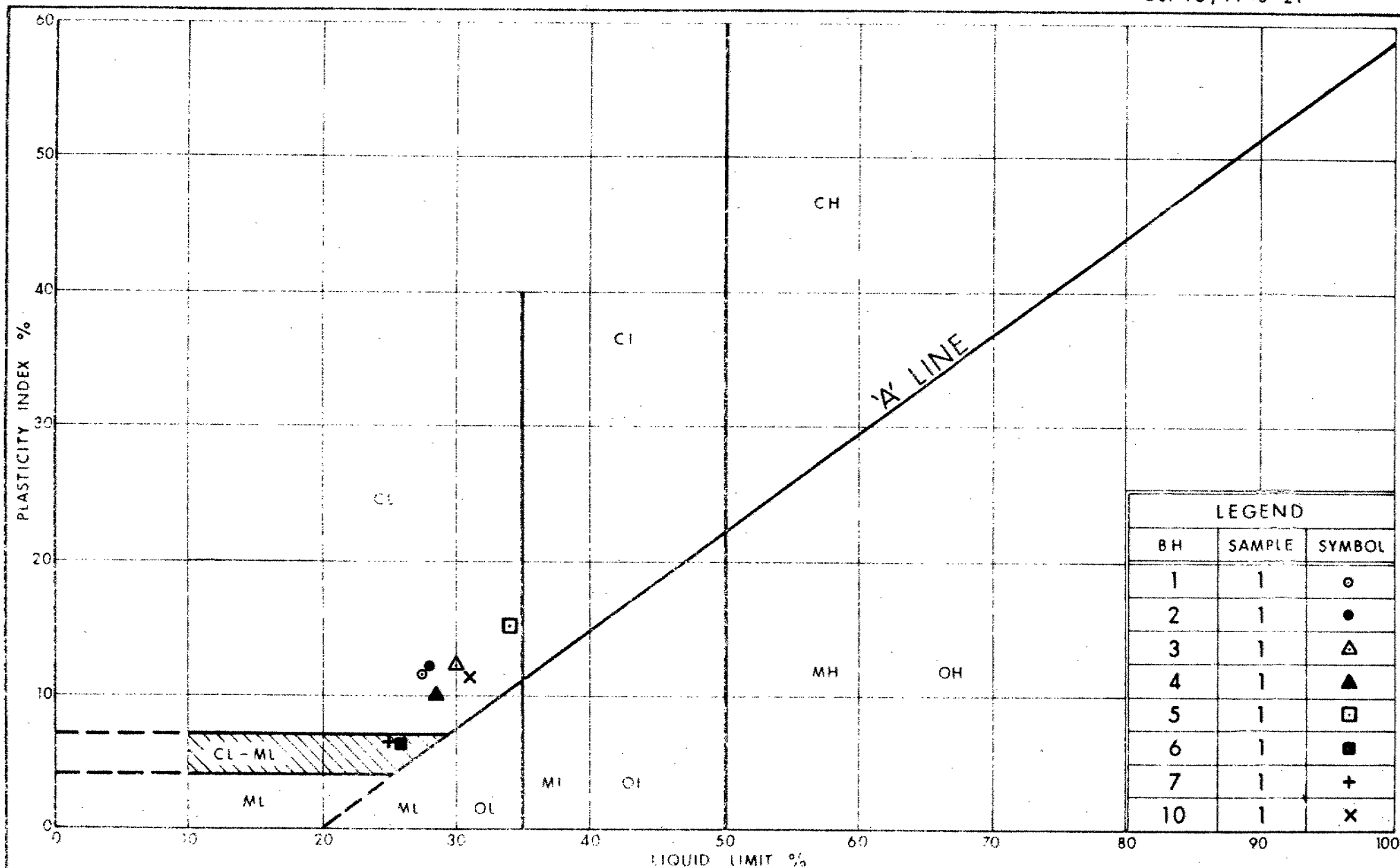
DATUM Geodetic

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 $\gamma$	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  $\phi$  5 % STRAIN AT FAILURE  
10



Ontario

 Ministry of  
Transportation and  
Communications

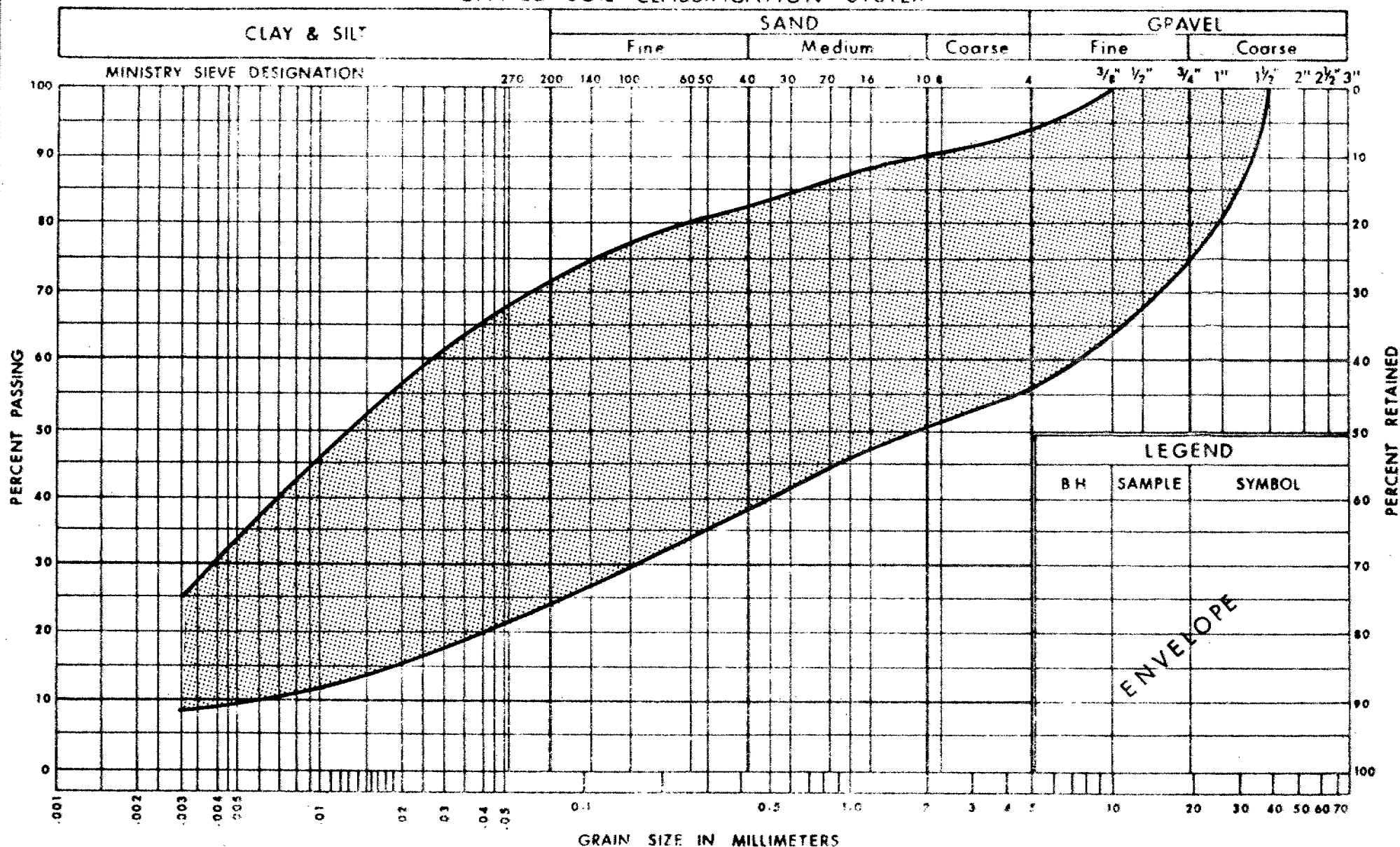
PLASTICITY CHART  
GLACIAL TILL  
HET MIX OF CLAYEY SILT WITH SAND & GRAVEL

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 <sub>L</sub> )%	26-33
Plastic Limit (W <sub>p</sub> )%	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.

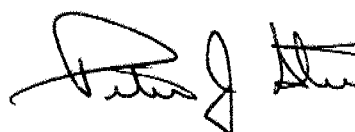
Bedrock

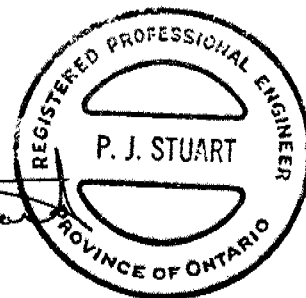
The elevation of the bedrock surface varies dramatically over the site. It was proven by the recovery of BXL size rockcore at depths varying from 24 to 97 feet. In the southwest quadrant of the interchange in the area of borehole #5A the bedrock is closest to the surface. At this location the precise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

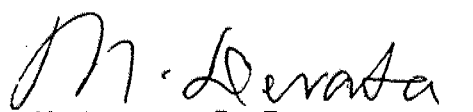
and the weathered shale is variable and difficult to define. The zone between the depths of 6 and 23 feet is a transition zone consisting of either weathered shale or fragments of shale compressed into a breccia or shale till. Bedrock found at the higher elevations is red Queenston Shale. At lower elevations 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 $\gamma$	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											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											0- 3-94- 3
14.5	Silt to sandy silt with occasional seams of clayey silt.		5	SS	71											
	Clayey Silt		6	SS	80											0-32-58-10
	Very Dense		7	SS	165											
500.7																
36.0	Silty sand with gravel and occasional boulders		8	SS	136											17-50-31-2
	Very Dense															
457.7																
79.0	Shaly limestone Bedrock		9	BXL	100% Rec											
452.7																
84.0	End of Borehole															

20  
15  $\phi$  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 $\gamma$	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															
452.0	Bedrock		10	BXL	100% Rec											
82.0	End of Borehole															

20  
15  $\phi$  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 $\gamma$	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									

## 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 $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100					$w_p$ — $w$ — $w_L$				
							SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT %				
											10 20 30			GR SA SI CL		
532.5	Ground Level					530										0-12-61-27
0.0	Heterogeneous Mixture of clayey silt sand and few gravel (Glacial fill) Hard		1	SS	79							○ —				0-0- 89-11
527.0			2	SS	104							○				
5.5	Silt to silty sand with occasional gravel and boulders		3	SS	110											
			4	SS	85	520										
			5	SS	46											
			6	SS	141	7"										
	20" boulders			BXL	20"	510						○ ○ —				0-50- 41-9
	clayey silt		7	SS	130											
	random clayey silt layers		8	SS	100	6"										
	Dense to Very Dense					500										
494.5																
38.0	Silty sand and gravel and boulders Very Dense		9	SS	159	490						○				50-35-13-2
			10	SS	100	2"										
477.5						480										
55.0	Shaly limestone Bedrock		11	BXL	Rec											
			12	BXL	Rec											
470.5			13	BXL	Rec											
62.0	End of Borehole															

20  
15  $\phi$  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 <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
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 24%		7	SS	15074"											
24.7	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

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

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



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 $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
534.0	Ground Level													
0.0	Clayey Silt With Trace of Sand		1	SS	23		530							0 4 80 16
528.0	(Glacial Till) Boulders Very Stiff		2	SS	103									
6.0	Reddish Clayey Silt With Fragments of Weathered Shale or Weathered Shale (Transition Zone)		3	SS	165									0 14 56 30
			4	SS	147									
			5	SS	100.6"		520							
	Hard		6	SS	100.5"									
510.7														
23.3	Bedrock - Sound		7	BXL	100% Rec.		510							
505.6	Shaley Limestone													
28.4	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\phi$  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

OFFICE REPORT ON SOIL EXPLORATION

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 (%)
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																
447.4	Shaley Limestone		13	BXL	90% Rec.												
84.2	End of Borehole																

+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 <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
531.4	Ice Level													
529.4	Water													
2.0	Clayey Silt and		1	SS	4		530							Organics 0.36%
526.4	Organics													
5.0	Heterogeneous Mixture of Clayey Silt With Some Sand & Trace of Gravel (Glacial Till)		2	SS	34									0 6 74 20
			3	SS	42									1 7 57 35
518.9	Hard Brown		4	SS	35		520							8 16 49 27
12.5	Grey		5	SS	50									0 0 87 13
			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													
44.0			11	SS	41		480							1 71 23 5
	Occasional Seams of Clayey Silt		12	SS	35		470							0 27 49 24
							460							
	Boulders		13	BXL	8" Rec.		450							
							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

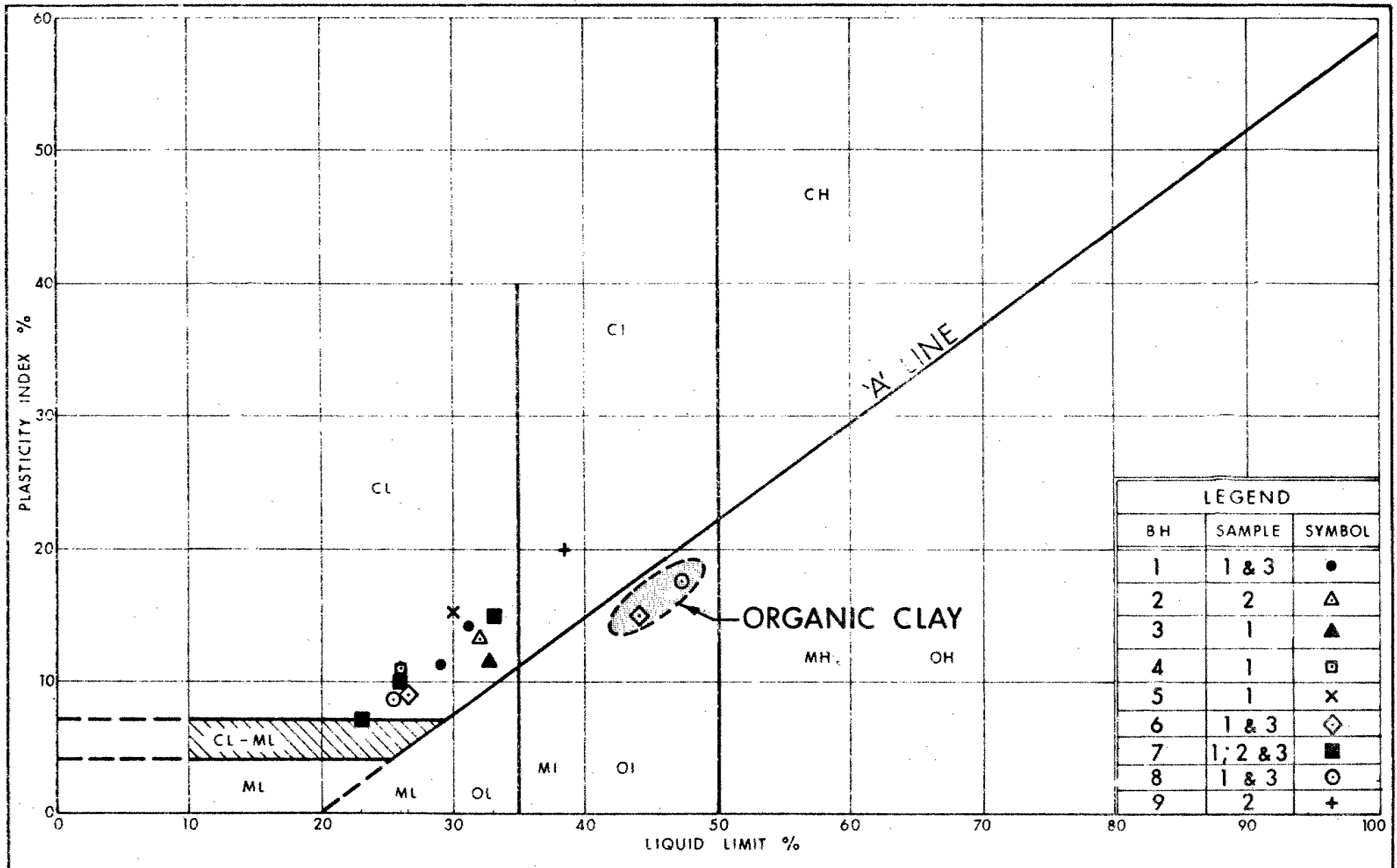
DATUM Geodetic

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 $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
538.0	Ground Level															
0.0	Fill Material clayey silt with some sand and traces of gravel and organics		1	SS	21											
530.0			2	SS	45	530										
8.0	Heterogeneous Mixture of clayey silt, sand and gravel (glacial till)		3	SS	112	8"										0-12-54-34
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  $\phi$  5 % STRAIN AT FAILURE  
10



Ministry of  
Transportation and  
Communications

# PLASTICITY CHART GLACIAL TILL

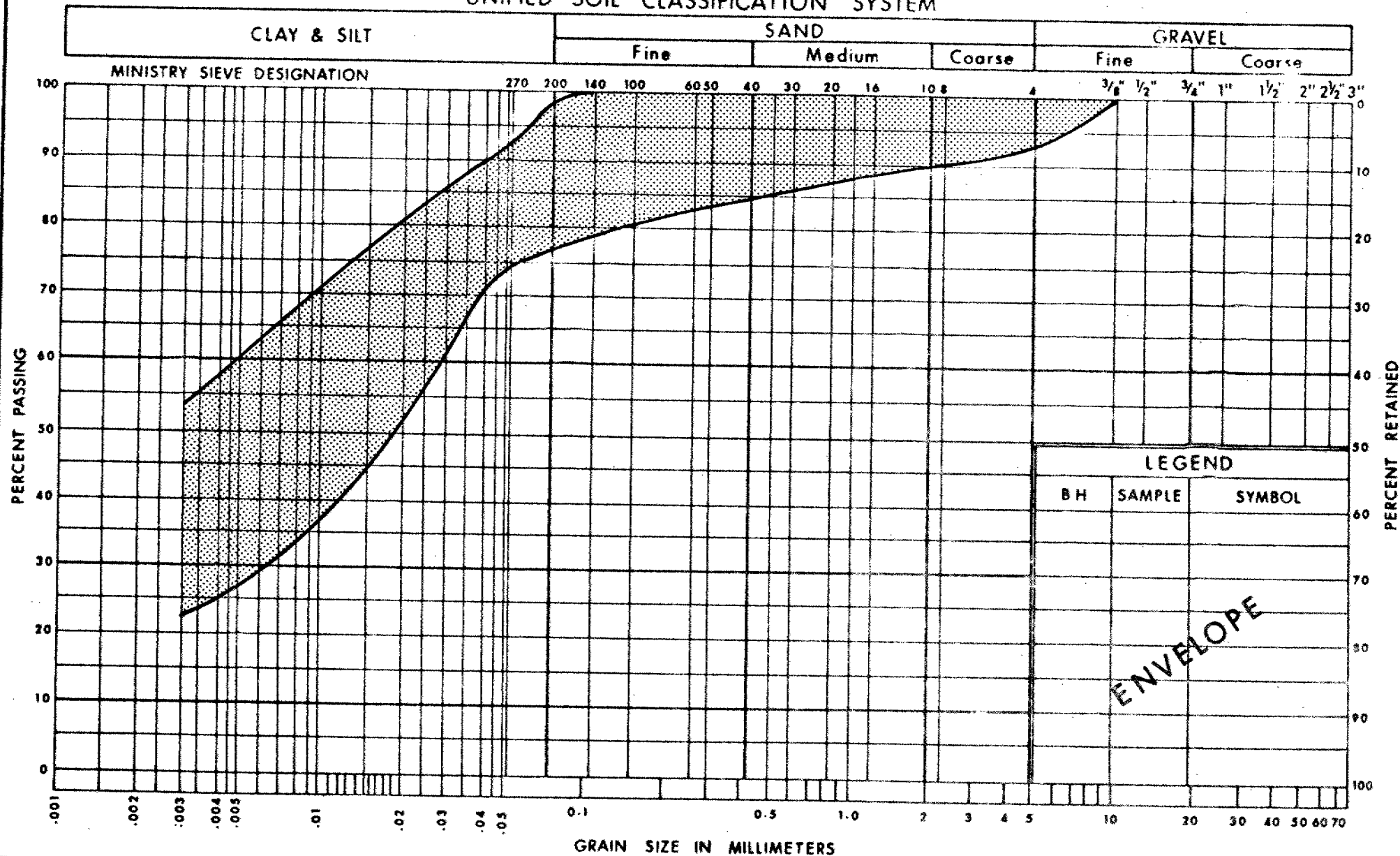
HET MIX OF CLAYEY SILT, SAND & GRAVEL

FIG No 1

W P 157-75-06



## UNIFIED SOIL CLASSIFICATION SYSTEM



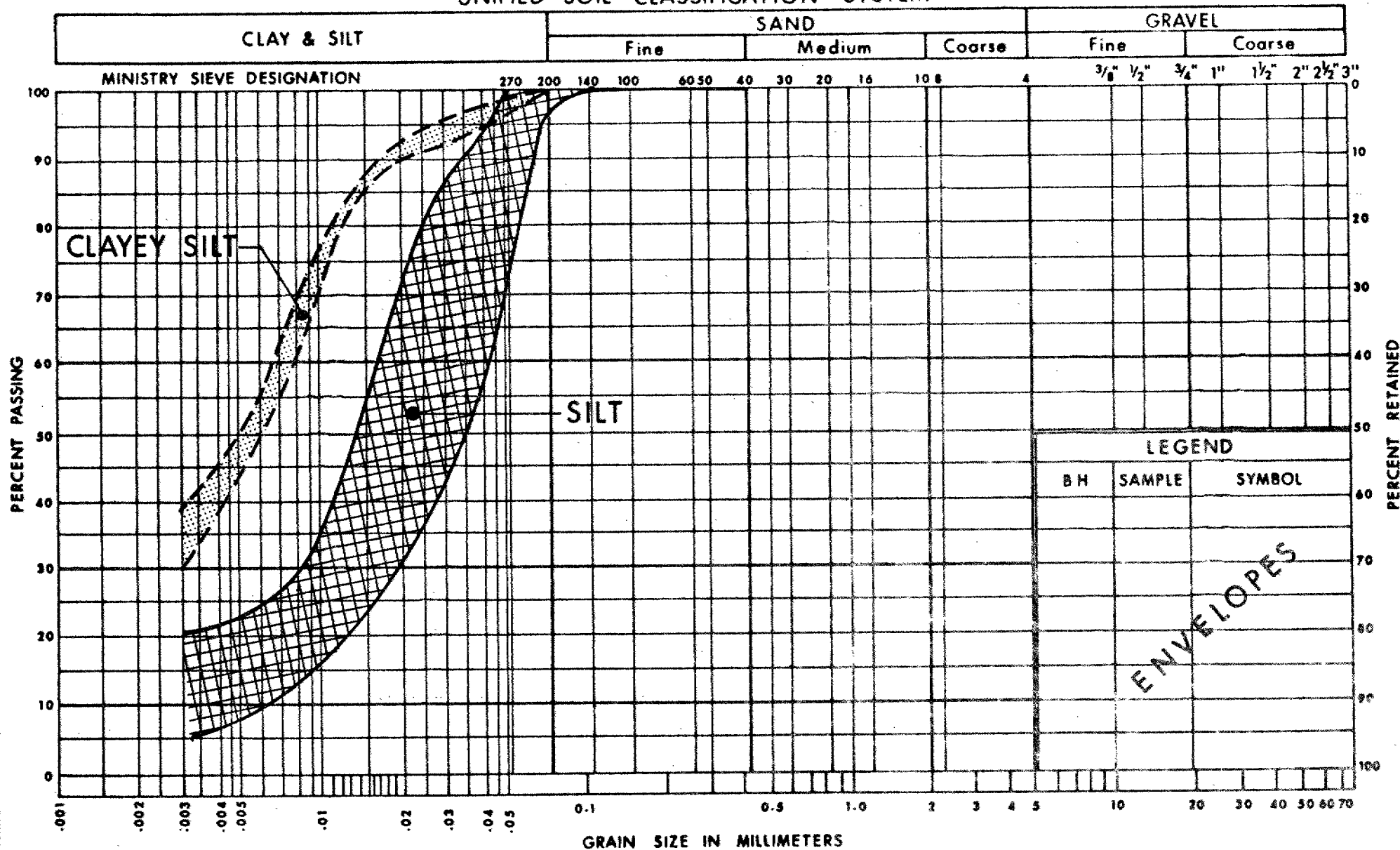
Ministry of  
Transportation and  
Communications

# GRAIN SIZE DISTRIBUTION GLACIAL TILL

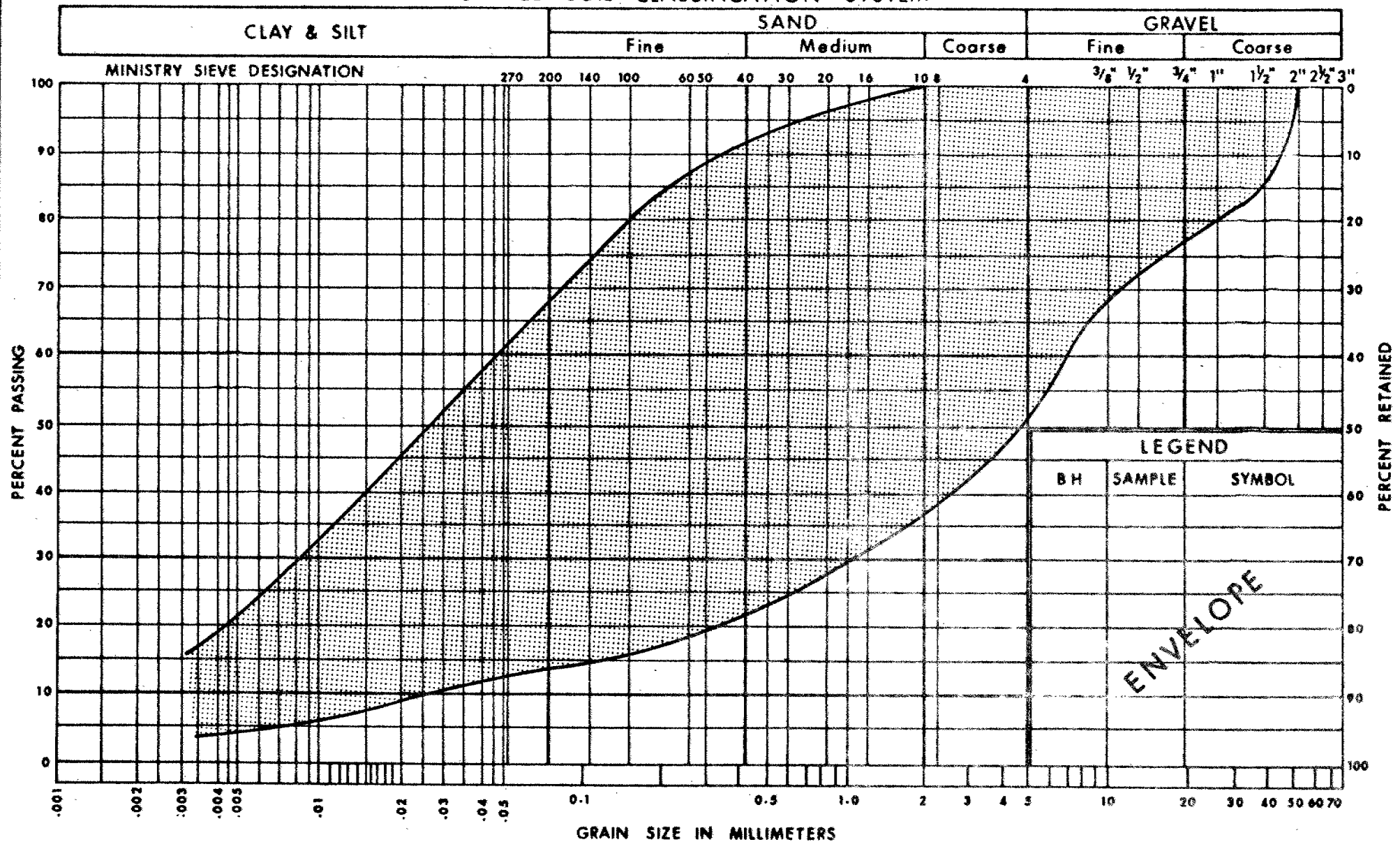
HET MIX OF CLAYEY SILT WITH SOME SAND & TRACE OF GRAVEL

FIG No 2

WP 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

QIP

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

990

LEV. COLLAR

DATUM

DATE STARTED

DATE COMPLETED

DRILLED BY

LOGGED BY

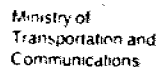
**TOTAL FOOTAGE**

FOOTAGE		FORMATION	SAMPLE NUMBER	SHALE %		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%		Possible boulders and loose rock
37'6"	38'5"	Shale, red colour, fine texture, soft, broken core		100%		Possible boulders and loose rock
		2 feet missing core				

DATE OF EXAMINATION 07 08 77

B. K. Glassford

DE - MT - 113



Q: P

NO. F. NO. \_\_\_\_\_ SHEET NO. 3 of 3

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

900	
TOTAL FOOTAGE	

ELEV. COLLAR \_\_\_\_\_  
 DATUM \_\_\_\_\_  
 DATE STARTED \_\_\_\_\_  
 DATE COMPLETED \_\_\_\_\_  
 DRILLED BY \_\_\_\_\_  
 LOGGED BY \_\_\_\_\_

[illegible]

DATE OF EXAMINATION 07 08 77

OB-44-115

B. K. Glassford

ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

WP 157-75-04

DIST 6

CONT 80-71

HWY 403

STR SITE

24-387

Mississauga Road Underpass  
at Proposed Hwy. 403

DISTRIBUTION

G.C.E. Burkhardt (3)  
R.D. Gunter  
M.R. Ernesaks  
D.E. Thrasher (2)

C. Grebski  
G.A. Wrong  
B.J. Giroux  
R.S. Pillar

R. Hore

R. Fitzgibbon  
J. Andreson  
G. Sloan

} cover only

Files ✓

SAMPLE DISPOSITION NOTICE

TYPE	DISCARD AFTER	RECOMM. BY
JARS		
TUBES		
ROCK CORES		

GEOCRES 3012-124

DATE JUL 25 1977

# FOUNDATION INVESTIGATION REPORT

For

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

## 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 (3¼" 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 the vicinity of the area under investigation, is composed of cohesive glacial till and granular deposits. The overburden is underlain by shale bedrock of 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 shaly 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 Drawing No. 1577504A 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 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 (Shale to Shaly Limestone)

Bedrock was encountered immediately below the cohesive glacial till overburden. The bedrock was proven at all locations, except in B.H. #6 by obtaining BXL size rock core samples.

The dominant type of bedrock encountered across the site is shaly limestone, except in one location the bedrock may be described as shale. 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 in general 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 Drawing No. 1577504A.

## DISCUSSIONS AND RECOMMENDATIONS

As part of the new Hwy. 403 construction, an underpass structure has been proposed at the crossing of the new Hwy. 403 and the existing Mississauga road. It is understood that the Mississauga Road will be widened to a 4 lane road in this area.

In the vicinity of the proposed structure the existing grade of the Mississauga Road varies from 466.5 (north side) to 463 (south side). The revised grade of the Mississauga road will be at elevations 487 (north side) and 484 (south side). The proposed grade of Hwy. 403 will be at elevation 461.5. This will necessitate fills of up to 21.5 feet and cuts of about 5 feet.

A two span structure (92'-92') consisting of closed type abutments with a center pier are presently being considered at this crossing.

### Pier Foundations

The pier may be founded on spread footings located within compact glacial till stratum at or below elevation 457.0 with an allowable load of up to 4 t.s.f. A minimum earth cover of 4 feet from the base of the footings should be provided for frost protection requirements.

No dewatering problems are anticipated for the construction of the foundations since the subsoil is relatively impervious and furthermore, the ground water level during the time of field investigation was found to be well below the footing foundation level. Any minor seepage or surface run-off into the excavation could be controlled by pumping from the sumps. It should be noted that the foundation excavation base should be kept dry at all times prior to the placing of concrete.

If higher loads are required, the pier could be supported on end bearing piles driven to the bedrock surface. For example an allowable load of up to 100 tons per pile may be used for a 12BP74 steel "H" pile driven to bedrock.

### Abutment Foundations

Since closed type of abutments are contemplated, the recommendations will be similar to those for pier foundations. However, if for any reason, perched abutments are contemplated, they should be supported

on a core of well compacted granular "A" material above the natural subsoil as per our current practices. An allowable load of  $2\frac{1}{2}$  t.s.f. may be used for design purposes. All the topsoil should be removed to the full base width of the granular core. Alternately, these perched abutments can be supported on end bearing piles driven to the bedrock, surface as given below:

	<u>Estimated tip location</u>
North Abutment (Ref B.H. #5 and #6)	435-438
South Abutment (Ref B.H. #1 and #2)	431-433

An allowable load of up to 100 tons per pile may be used for a 12BP74 steel "H" piles driven to the bedrock.

#### Approaches

No stability problems are anticipated for the proposed approach fills and cuts if constructed with 2:1 slopes.

#### Related Conditions

The abutments should be designed to withstand a lateral earth pressure exerted by the backfill and this pressure is dependant on the deformation characteristics of the retaining structure. If some movement of the top of the wall is permitted, then a coefficient of active earth pressure ( $K_a$ ) of 0.35 can be used. On the otherhand, if the structures are designed as rigid frames, then a coefficient of earth pressure at rest ( $K_o$ ) of 0.5 should be used. To compute the sliding resistance between the rough concrete footing base and cohesive subsoil, an adhesion value of 2000 p.s.f. should be used.

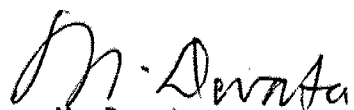
#### MISCELLANEOUS

The filed work was carried out during June 17, 1977 to June 27, 1977 under the supervision of Mr. V. Korlu, Project Engineer, who also prepared this report.

The drilling equipment was owned and operated by F.E. Johnston Drilling Co. Ltd. of Toronto. This report was reviewed by Mr. M. Devata, Supervising Engineer.

  
V. Korlu  
Project Engineer



  
M. Devata  
Supervising Engineer

VK/MD/kr  
July 1977

## APPENDIX

## FIELD AND LABORATORY WORK

Six sampled boreholes each accompanied by a dynamic cone penetration test, were carried out at this site. The borings were advanced by continuous flight auger machine (commercially know as C.M.E. 55, H.S.M.V.) adapted for soil sampling purposes.

Samples of the overburden were obtained in a 2" O.D. split spoon sampler at required depths. The samples were hammered into the soil according to the specifications of Standard Penetration Tests. Bedrock was proven in boreholes by obtaining BXL size rock core samples.

Groundwater level observations were carried out, during the time of investigation, in the open boreholes. The soil, bedrock and groundwater conditions encountered at the boring locations are presented in the Record of Borehole sheets. The locations and elevations of the various boreholes were provided by personnel from the Construction Office, Central Region. The elevations in this report are referred to a geodetic datum. Boring locations and elevations are shown on drawing No. W.P. 1577504A. All samples were subjected to careful visual examinations in the field and subsequently in the laboratory. Following this examination, laboratory tests were carried out on selected representative samples to determine the physical properties of the various soil types encountered, namely:

- Natural Moisture Content

- Atterberg Limit

- Grain Size Distribution

The results of this testing are plotted on the Record of Borehole Sheets and summarized on Fig. 1 and 2 all contained in Appendix 1 of this report.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

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 RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P \quad W \quad W_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
461.7	Ground Level					460								
0.0	Topsoil		1	SS	65									0 26 46 28
	Heterogeneous mixture of clayey silt, sand and gravel		2	SS	86									1 22 49 28
	(Glacial Till)		3	SS	130	450								
	Hard		4	SS	51									
			5	SS	69	440								26 21 32 21
433.7			6	SS	100									
28.0	Weathered		7	SS	100/	1"								
431.6	Shale Bedrock													
30.1	End of Borehole													

20  
15 5 % STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

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 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 $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
461.8	Ground Level															
0.0	Topsoil															
	Heterogeneous mixture of clayey silt, sand and gravel.  (Glacial Till)		1	SS	38	460										
			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															

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

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 RS

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 $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES					
462.0	Ground Level									
0.0	Topsoil		1	SS	20	460				5 23 51 21
	Heterogeneous mixture of clayey silt, sand and gravel		2	SS	58					
	(Glacial Till)		3	SS	77	450				3 20 52 25
	Very stiff to hard		4	SS	59					
			5	SS	28					
			6	SS	70	440				7 29 44 20
435.0			7	SS	91					
27.0	Weathered		8	BXL	70% Rec					
430.0	Sound, Shaly Limestone Bedrock									
32.0	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

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 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT <u>W<sub>L</sub></u> PLASTIC LIMIT <u>W<sub>P</sub></u> WATER CONTENT <u>W</u> <u>W<sub>P</sub></u> — <u>W</u> — <u>W<sub>L</sub></u> WATER CONTENT % 10 20 30	UNIT WEIGHT <u>γ</u>	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
462.8	Ground Level									
0.0	Topsoil									
	Heterogeneous mixture of clayey silt, sand and gravel.  (Glacial Till)  Very stiff to hard		1	SS	39					0 15 45 40
			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	Sound, Shaly									
30.2	Limestone Bedrock		8	BXL	96%					
428.9										
33.9	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

W.P. 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 $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100			
464.3	Ground Level													
0.0	Topsoil													
	Heterogeneous mixture of clayey silt, sand and gravel. (Glacial Till)		1	SS	56	460								1 21 48 30
			2	SS	107									
			3	SS	124									20 22 34 24
	Hard		4	SS	73	450								
			5	SS	68									1 31 49 19
			6	SS	71	440								
436.3	Weathered													
28.0	Sound Shaly Limestone		7	BXL	100% Rec	430								
429.3	Bedrock													
35.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

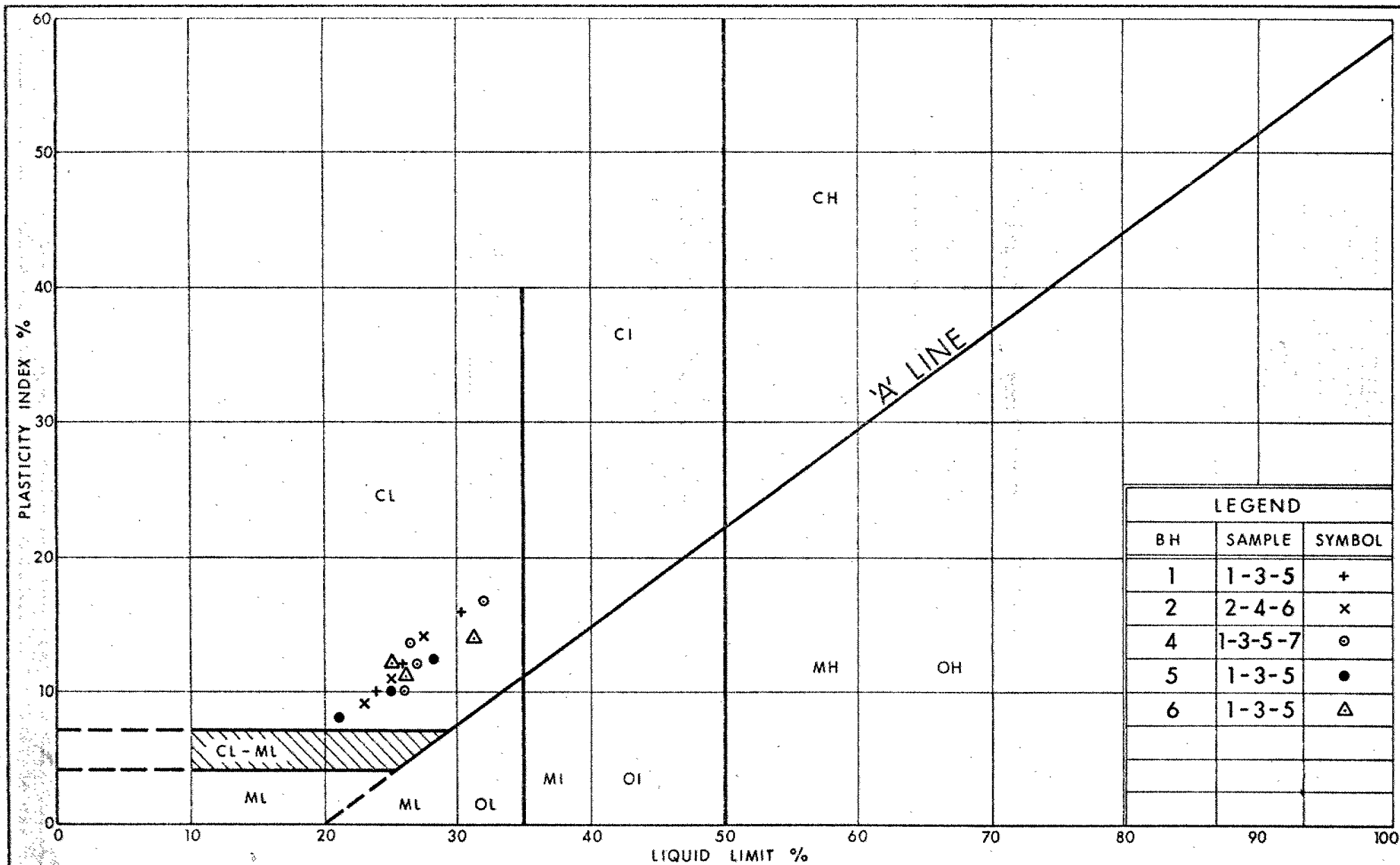
HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

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 ES

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 <u>W<sub>L</sub></u> PLASTIC LIMIT <u>W<sub>P</sub></u> WATER CONTENT <u>W</u> <u>W<sub>P</sub></u> — <u>W</u> — <u>W<sub>L</sub></u> WATER CONTENT % 10 20 30	UNIT WEIGHT <u>γ</u>	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
465.1	Ground Level									
0.0	Topsoil		1	SS	55					13 14 42 31
	Heterogeneous mixture of clayey silt, sand and gravel		2	SS	56					11 23 41 25
	(Glacial Till)		3	SS	64					
	Hard		4	SS	32					
			5	SS	51					1 19 49 31
438.6			6	SS	156					
26.5	End of Borehole (Probable Bedrock)									

OFFICE REPORT ON SOIL EXPLORATION



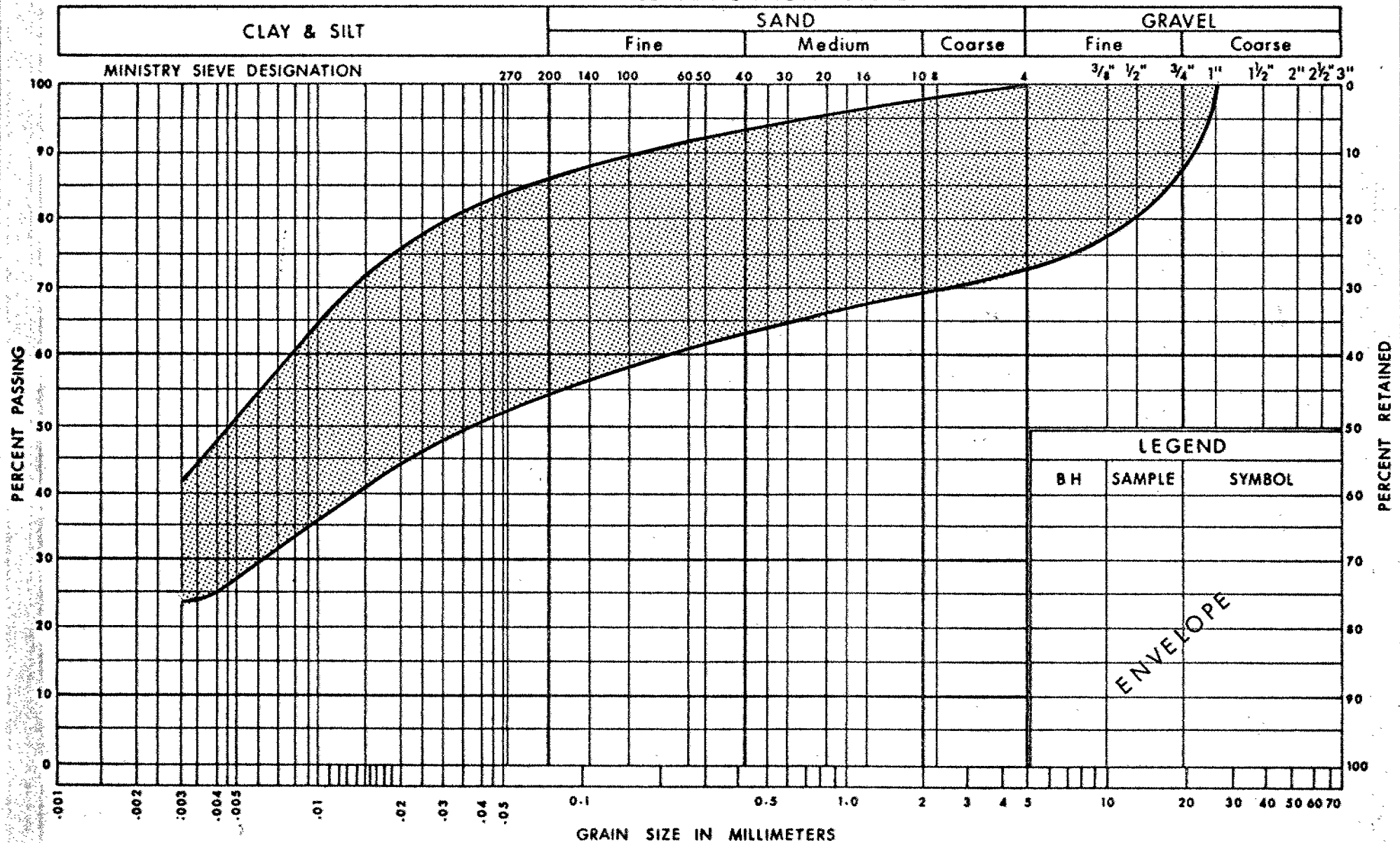
Ministry of  
Transportation and  
Communications

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

FIG No 1

W P 157 - 75 - 04

## UNIFIED SOIL CLASSIFICATION SYSTEM



## Ontario

Ministry of  
Transportation and  
Communications

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

FIG No 2

WP 157-75-04



## HOLE NO. \_\_\_\_\_ SHEET NO. \_\_\_\_\_

**DIP**

PROPERTY W.P. 157-75-04  
LOCATION Hwy. 403 and Mississauga Road Underpass  
\_\_\_\_\_  
\_\_\_\_\_  
LATITUDE \_\_\_\_\_  
DEPARTURE \_\_\_\_\_  
BEARING \_\_\_\_\_

90°

ELEV. COLLAR \_\_\_\_\_  
 DATUM \_\_\_\_\_  
 DATE STARTED \_\_\_\_\_  
 DATE COMPLETED \_\_\_\_\_  
 DRILLED BY \_\_\_\_\_  
 LOGGED BY \_\_\_\_\_

TOTAL FOOTAGE \_\_\_\_\_

[illegible]

DATE OF EXAMINATION July 13, 1977

B. K. Glassford





Ministry of  
Transportation and  
Communications

### DIAMOND DRILL RECORD

HOLE NO. \_\_\_\_\_ SHEET NO. \_\_\_\_\_

DIP

90°

PROPERTY W.P. 157-75-04  
LOCATION Hwy. 403 and Mississauga Road Underpass  
LATITUDE \_\_\_\_\_  
DEPARTURE \_\_\_\_\_  
BEARING \_\_\_\_\_

ELEV. COLLAR \_\_\_\_\_  
DATUM \_\_\_\_\_  
DATE STARTED \_\_\_\_\_  
DATE COMPLETED \_\_\_\_\_  
DRILLED BY \_\_\_\_\_  
LOGGED BY \_\_\_\_\_

TOTAL FOOTAGE \_\_\_\_\_

FOOTAGE		FORMATION	SAMPLE NUMBER	%	Shale	REMARKS
FROM	TO					
HOLE #4						
30'2"	33'9"	Limestone, shaly limestone with thin shale beds up to 1" thick, limestone is a light grey colour, med. texture and hard, partly fossiliferous. Shale is black, soft and fissile.		5%		RQD - 40%
HOLE #5						
30'	30'6"	Limestone, light grey colour, med. texture, med. hard, core is broken.		0%		RQD - 0%
30'6"	31'6"	Shale, dark grey, fine texture, soft and fissile, core is broken.		100%		RQD - 0%
31'6"	32'0"	Limestone, light grey colour, med. texture, med. hard, core is broken.		1%		RQD - 0%
32'0"	32'10"	Shaly limestone, med. grey colour, soft.		30%		RQD - 65%
32'10"	34'6"	Limestone, light grey colour, med. texture, med. hard, with thin shale beds up to 1" thick and partly fossiliferous.		5%		RQD - 75%
34'6"	35'0"	Shaly limestone, med. grey colour, soft and partly fossiliferous.		60%		RQD - 0%

DATE OF EXAMINATION July 13, 1977

B. K. Glassford

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### PENETRATION RESISTANCE

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

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

### DESCRIPTION OF SOIL

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

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

TERMS TO BE USED IN DESCRIBING SOILS:-

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

### TYPE OF SAMPLE

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

P.H SAMPLE ADVANCED HYDRAULICALLY

P.M SAMPLE ADVANCED MANUALLY

### SOIL TESTS

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

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### SOIL PROPERTIES

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

### GENERAL

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

### STRESS AND STRAIN

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

### EARTH PRESSURE

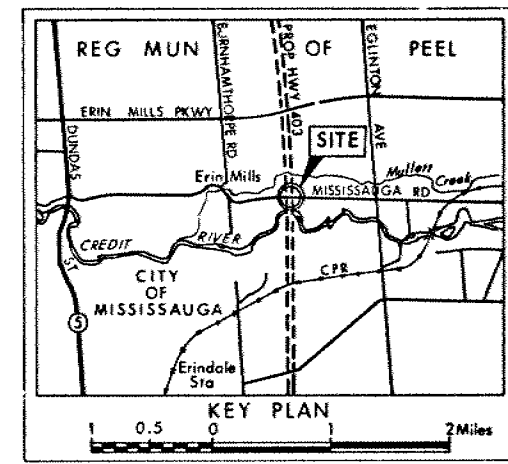
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

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

### SLOPES

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



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)
- W L at time of investigation June 1977

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	461.7	15 827 865	950 790
2	461.8	15 827 912	950 843
3	462.0	15 827 915	950 743
4	462.8	15 827 978	950 778
5	464.3	15 827 994	950 665
6	465.1	15 828 042	950 712

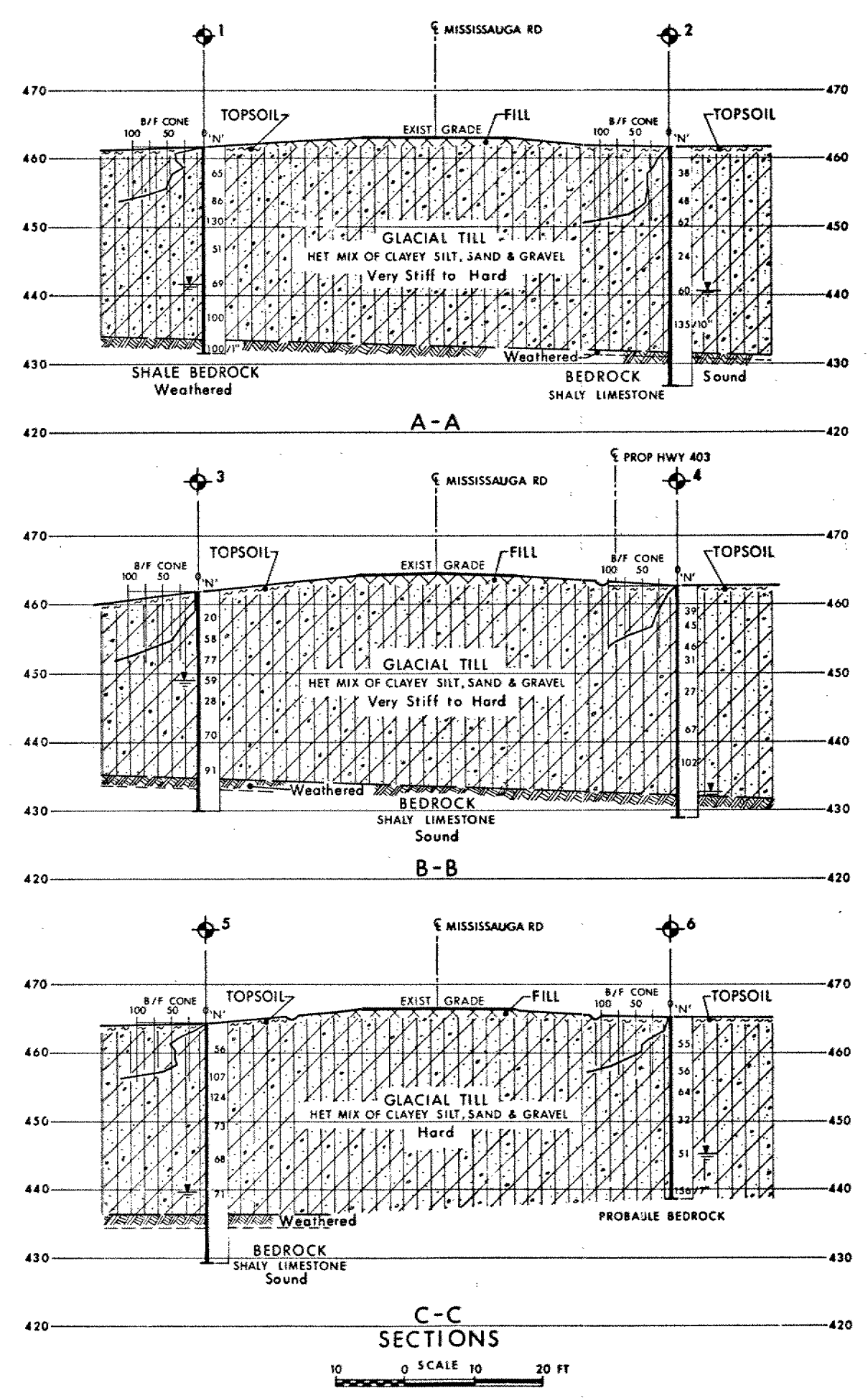
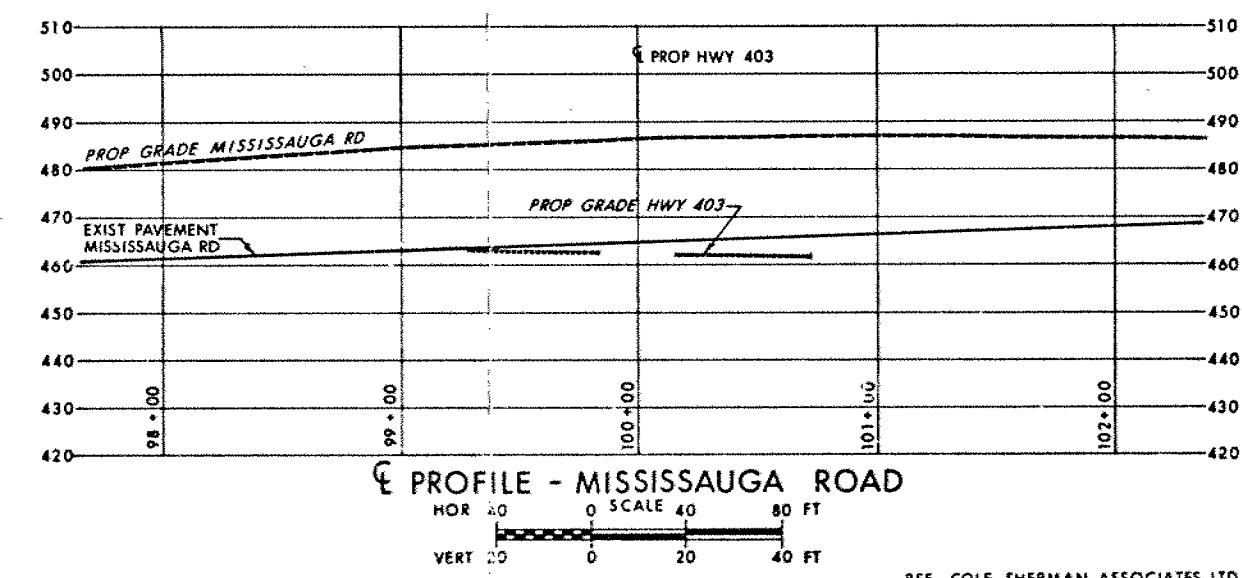
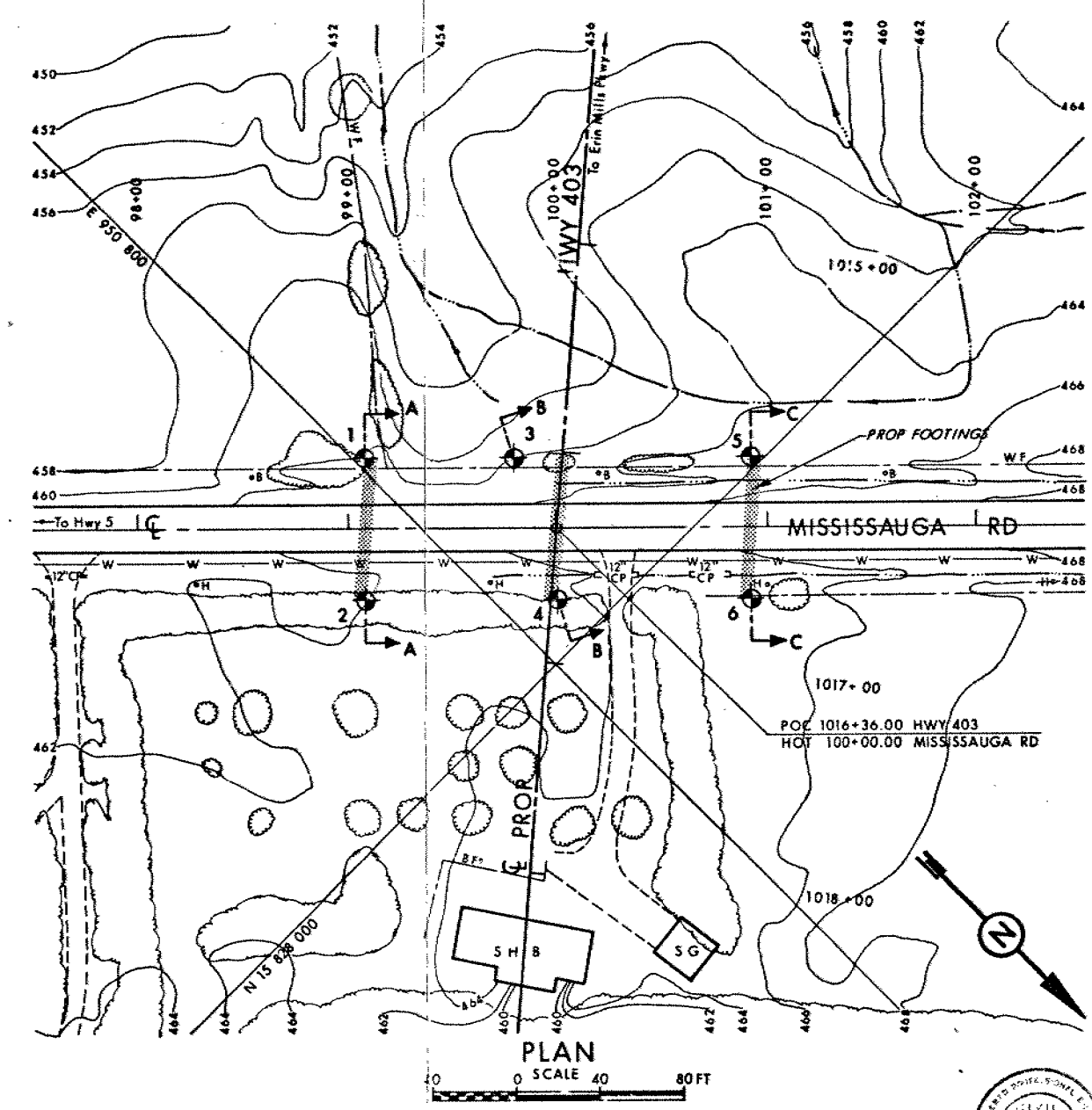
NOTE-  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

HWY No PROP 403  
SUBMD V.K. CHECKED  
DRAWN RS. CHECKED

DATE July 20-1977  
SITE 24-387  
DWG 1577304-A

DIST 6  
REF: COLE, SHERMAN ASSOCIATES LTD



Mr. C.S. Grebski  
Structural Design Engineer  
Structural Office  
West Building, Downsview

Soil Mechanics Section  
Engineering Materials Office  
West Building, Downsview

77 11 18

RE: Mississauga Road Underpass  
W.P. 157-75-04, Site 24-387  
District #6

---

We have reviewed the Preliminary Bridge Plan Drawing 24-387-P1 dated 77 10 21, for the above mentioned structure.

The foundation design follows the recommendations in our report. No problems are anticipated.

V. Korlu  
Project Engineer

For: M. Devata  
Supervising Engineer

VK/ND/bh

cc: Files ✓

G.I.-30 SEPT. 1976

GEOCRES No. \_\_\_\_\_

DIST. 6 REGION \_\_\_\_\_W.P. No. 157-75-01CONT. No. 80-71

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. 403

LOCATION From E. LTD. Winston  
Churchill Blvd. Int. E'ly to  
No 00 PAGES - Credit River

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



# COLE, SHERMAN & ASSOCIATES LIMITED

CONSULTING ENGINEERS AND PLANNERS

Our Ref: 6476

W.P. 157-75-01, HIGHWAY 403

OIL PIPELINES - MEETING 78-U-04

DATE: Friday, April 14, 1978

PLACE: Cole, Sherman & Associates Offices

PRESENT: Sarnia Products Pipeline Sun Canadian Pipeline

Mr. J. Creighton  
Mr. B. Stark  
Mr. T. Canning

Mr. B. MacRae  
Mr. J. Lynch

MTC

Mr. N. Sen - Planning & Design  
Mr. K. Cameron - " "  
Mr. N. Johnston - District 6 Utilities  
Mr. D. Bye - Structural Planning  
Mr. M. Devata - Soils Mechanics Office  
✓ Mr. B. Ly - " " "

CSA

Mr. R.L. Sinkus  
Mr. B. Hurd

ACTION

This meeting was called by MTC Structural Planning and Soils Mechanics Sections to express their concern for the safety of the oil pipelines in the vicinity of the Mullet Creek bridge.

Mr. Devata outlined the problems of differential settlement in the area of the high (25') approach fills to the bridge and under the northwest abutment. It was suggested that the pipes be lowered to the level of the shale bedrock and encased in concrete through this section.

Mr. Creighton stated that until the pipes are uncovered and the slack in the line is known, the amount of lowering cannot be determined. Lowering to the level of bedrock may place the pipe in tension, an unacceptable condition to the pipelines.

It was agreed that Sarnia Products and Sun Canadian will review the relocations through Mullet Creek with respect to providing additional protection against settlement problems.

J. Creighton  
B. MacRae

/ 2.....

ACTION

Mr. Sen requested the Pipelines to submit costs as follows:

J. Creighton  
B. MacRae

- 1) Revised estimates for lowering pipes at Mullet Creek.
- 2) Local relocation of pipelines to cross Hwy. 403 west of Mullet Creek at 90°.
- 3) Relocation of pipelines to run within utility easement along the north side of Hwy 403, between Winston Churchill Blvd. and Mississauga Road.

Mr. D. Bye will supply copies of the structural plan for the Mullet Creek bridge to the Pipelines.

D. Bye

Other Business

- The consultant supplied the Pipelines with prints of plans showing the new positions of the 8" SCPL valve and 10" SPPL valve at Mississauga Road. Sun Canadian will supply cost of relocating their existing 12" valve outside the future Mississauga Road right-of-way.
- Existing casing pipes under Mississauga Road will be removed during the MTC contract when the detour road is in operation. SPPL estimate for this work will be revised.
- Special measures to protect pipelines during MTC contract:
  - (i) Ensure pipeline locations are staked out in advance of construction.
  - (ii) Construct "granular ramps" to provide a minimum cover of 4.5' over pipes at locations of haul road crossings.
  - (iii) Exercise care when stripping topsoil over pipelines - possibly use a grader rather than a scraper.

B. MacRae

J. Creighton

Submitted by:

T. H. Hurd  
Bram Hurd

BHH:jt

cc: Those present  
W. Roters  
D. Thrasher

