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GEOCRES No. 30M13-87

DIST. 6 REGION

W.P. No. 164-79-06

CONT. No. 88-79

W. O. No.

STR. SITE No. N/A

HWY. No. 400

LOCATION HWY 400 DETOUR N.B.L.

CULVERT EXTENSION STA. 10+777.5

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry  
of  
Transportation

FILE  
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## FOUNDATION DESIGN SECTION

**foundation  
investigation and  
design report**

RPN

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

WP 164-79-06

DIST 6

HWY 400

STR SITE

Culvert Extension Under Hwy. 400 N.B. Detour

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FOUNDATION INVESTIGATION REPORT  
For  
Culvert Extension Under Hwy 400 N.B. Detour  
WP 164-79-06, Site No.  
District 6, Toronto

INTRODUCTION

A request, dated July 20, 1988, to conduct a foundation investigation, for the culvert extension under the Hwy 400 NB Detour, was received from the Central Region Structural Section (Mr. D. Wong - Toronto).

It is proposed to extend the existing culvert under the Hwy 400 easterly underneath the proposed Hwy 400 NB Detour. Subsequently, a foundation investigation was conducted at the proposed site to determine the subsoil conditions during the period of August 8 to August 11, 1988.

Three boreholes (Boreholes #101 to #103) were advanced and sampled as part of this project by means of hollow stem augers and washboring techniques. These boreholes extended down to depths between 9.6 and 15.7 metres below the ground surface.

Samples were visually examined and identified in the field and subsequently, in the laboratory. Laboratory tests were conducted on selected representative samples to determine, Atterberg Limits, grain-size distribution, and natural moisture content. Results of the laboratory tests are presented in the Record of Borehole Logs (see Appendix).

This report contains factual information together with recommendations pertaining to the culvert extension underneath the proposed Hwy 400 NB Detour as shown on Drawing No. 1647906-A1.

SITE DESCRIPTION AND GEOLOGY

The site is located about 200 metres north of the Steeles Avenue and east of the existing Hwy 400 NB. The existing culvert is a 1.22 x 1.22 m box culvert underneath the Hwy 400 and will be extended easterly to accommodate the proposed Hwy 400 NB Detour.

The site is located in the physiographic region known as the "Peel Plain" as described by the physiography of Southern Ontario (Chapman and Putnam, 1984). The region is characterized by a level to gently undulating topography sloping gradually towards south. The underlying soil consists of a hard layer of glacial till overlying very dense sand. Land use in the vicinity of the site is mainly for industrial purposes.

### SUBSURFACE CONDITIONS

#### General

The subsoil conditions encountered across the site were generally uniform consisting primarily of two distinct deposits. The upper layer consists of a clayey silt to silt with sand and a trace of gravel which extends down to the elevation 175.4 metres at BH #101 and 177.5 metres at BH #103 as shown on the sections (Drawing No. 1647906-A1). The thickness of this layer varies between 7.2 metres at BH #103 location and 9.5 metres at BH #101 location. Underneath this clayey silt to silt deposit, very dense sand with some gravel is present and proven to a maximum depth of 5.6 metres.

It should be noted that a thin layer of topsoil was encountered at each borehole location. Topsoil consists of organic clayey silt as shown on The Record of Borehole Logs.

More detailed description of the two distinct deposits will be given below.

#### Clayey silt to silt (Glacial Till)

A deposit of clayey silt to silt with sand and a trace of gravel extends from immediately below the topsoil to depths between 7.8 and 10.1 metres. The material changes in colour from brown to grey at approximately elevation 184.1 metres at BH #101 location and 182.3 metres in the vicinity of BH #103 location.

The results from laboratory tests performed on this material are summarized as follows:

<u>Property</u>	<u>Range (%)</u>
Natural Moisture Content (w)	6.5-19
Liquid Limit (w <sub>L</sub> )	13.5-25
Plastic Limit (w <sub>p</sub> )	11.5-15
Plasticity Index (I <sub>p</sub> )	1-11

The Atterberg Limit Test results are illustrated on the plasticity chart (Figure 1). From the chart it is evident that the layer can be classified as an inorganic clayey silt to silt with low plasticity (CL or CL-ML).

Grain size distribution tests were carried out on these materials. Figure 2 in the Appendix shows the results in an envelope form.

Standard Penetration Test 'N' values ranged between 5 and over 100 blows/0.3 m generally increasing with depth indicated that the soil can be interpreted as being firm to hard.

#### Sand

Sand with some gravel was encountered below the clayey silt to silt layer. The proven thickness of this layers ranges from 1.1 metres at BH #102 to 5.6 metres at BH #101.

This deposit contains minor variations in gravel content throughout its thickness. Generally, the deposit contains some gravel, but at some locations, considerable gravel (in excess of 30%) was encountered. Grain size distribution analyses indicate that the soil can be classified as a sand with some gravel with trace of silt. This layer is basically non-plastic. Figure 3 in the Appendix shows the results of grain size distribution tests in an envelope form.

In this stratum, the 'N' values ranged from 20 to over 100 blows/0.3 m indicating a state of compaction described as compact to very dense.

#### GROUNDWATER CONDITIONS

Groundwater conditions were observed through the measurements of water level in the open boreholes. Groundwater level in the boreholes was found to range between elevation 184.6 metres at BH #102 and elevation 185.3 metres at BH #103 which corresponds to depths of 1.1 metres to 0 metres below the existing ground surface.

## DISCUSSION AND RECOMMENDATIONS

The recommendations in this report apply to the concrete culvert and related approaches.

It is proposed to extend the existing culvert underneath the Hwy 400 easterly under the proposed Hwy 400 NB Detour. The existing culvert is a 1.22 x 1.22 metres box culvert with an approximate length of 110 metres and will be extended easterly by about 60 metres.

Based on the site investigation, our foundation recommendations for the design of concrete box culvert are as follows:

### Foundation for Concrete Culvert

In consideration of the weak nature of the upper layer of clayey silt, this material may be excavated and replaced by competent material. Three stepped excavations are recommended to remove this soft material down to the elevations of 184.0, 183.5 and 182.8 metres, respectively as shown on section in Drawing No. 1647906-A1. The excavated area should be backfill with well compacted Granular 'A' material to the base elevation of proposed culvert at an approximate elevation of 185.0 metres. The proposed concrete box culvert may be constructed on a Granular 'A' pad and the following design values are recommended for the purpose of the O.H.B.D.C.:

	Factored Capacity at U.L.S. (kPa)	Allowable Capacity at S.L.S. Type II (kPa)	Approx. Base Elev. of Culvert (m)
Footings	900	350	184.8-185.2

Resistance to sliding of the footings can be calculated assuming a coefficient of friction of 0.7 between the underside of the concrete footings and the Granular 'A' core if it is required.

### Earth Pressures

The Granular 'A' or 'B' backfill to the culvert should be in accordance with Special Provision No. 109F03 (dated March, 1988).

The following parameters are recommended for the granular backfill:

	<u>Granular 'A'</u>	<u>Granular 'B'</u>
Angle of Internal Friction ( $\phi$ )	35°	30°
Unit Weight ( $\text{kN/m}^3$ ) $\gamma$	22.8	21.2
Coefficient of Active Earth Pressure ( $K_A$ ) (Horizontal Ground behind wall)	0.27	0.33
Coefficient of Active Earth Pressure ( $K_A$ ) (Sloping Ground behind wall, 2H to 1V slope)	0.43	0.6
Coefficient of Passive Earth Pressure ( $K_p$ )	6	5
Coefficient of Earth Pressure at Rest ( $K_0$ )	0.43	0.5

Computation of earth pressure should be in accordance with Section 6.6.1.2 of the O.H.B.D.C.

### Construction

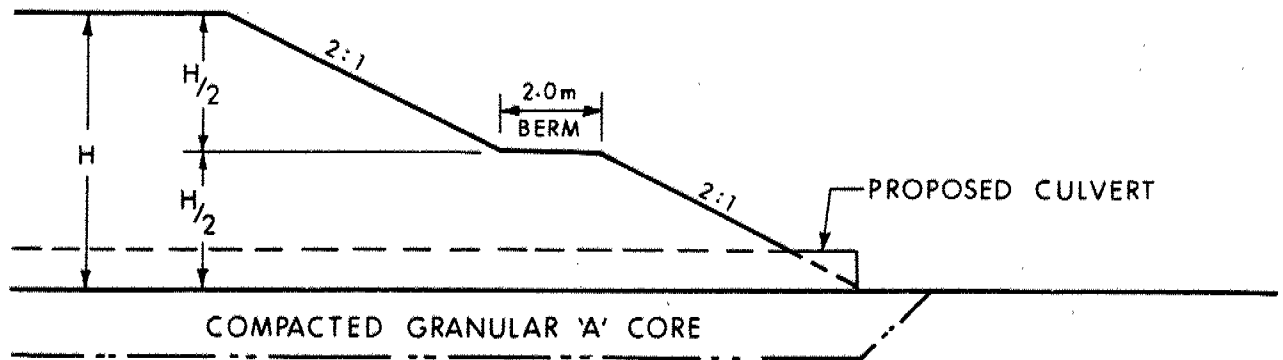
During excavation, care should be exercised by not leaving any weak material underneath the proposed culvert. Sub-excavation of the weak material will be carried out below the prevailing water level. Since the subsoil essentially consists of cohesive material of glacial origin, no major dewatering problems are anticipated. However any seepage from silt layers or due to accumulation surface water can be readily controlled by pumping from sumps as well ditches on either side of the sub-excavation.

### Slope Stability

For fill height in the order of 12 metres, stability problems are anticipated. Stability analyses were carried out to evaluate the effect of the approach fills to the overall stability of concrete culvert and it's embankment.



Based on the stability analyses, it is recommended that the approach embankment on the proposed concrete box culvert to be constructed with a 2.0 m wide berm to the midheight of the slope, incorporating side slopes with 2H:1V (see detail below):



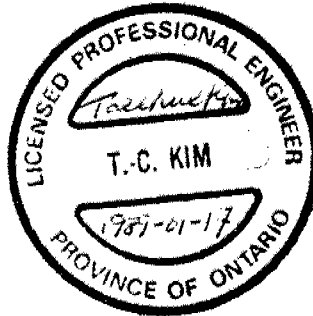
BERM DESIGN

Berm should be constructed as an integral part of the main embankment up to the berm height. It should be noted that erosion protection for the toe of the slope would be required in the vicinity of the channel up to H.H.W.L. Armor stones or Gabion stones would be appropriate for this purpose.

#### MISCELLANEOUS

The fieldwork for this investigation was carried out during the period of 88 08 08 to 88 08 11 under the supervision of J. Fellenius, Student Engineer. The equipment was owned and operated by Malones Soil Samples, Toronto.

This report was written by Tae C. Kim, Foundation Engineer and reviewed by Murty Devata, Chief Foundation Engineer.

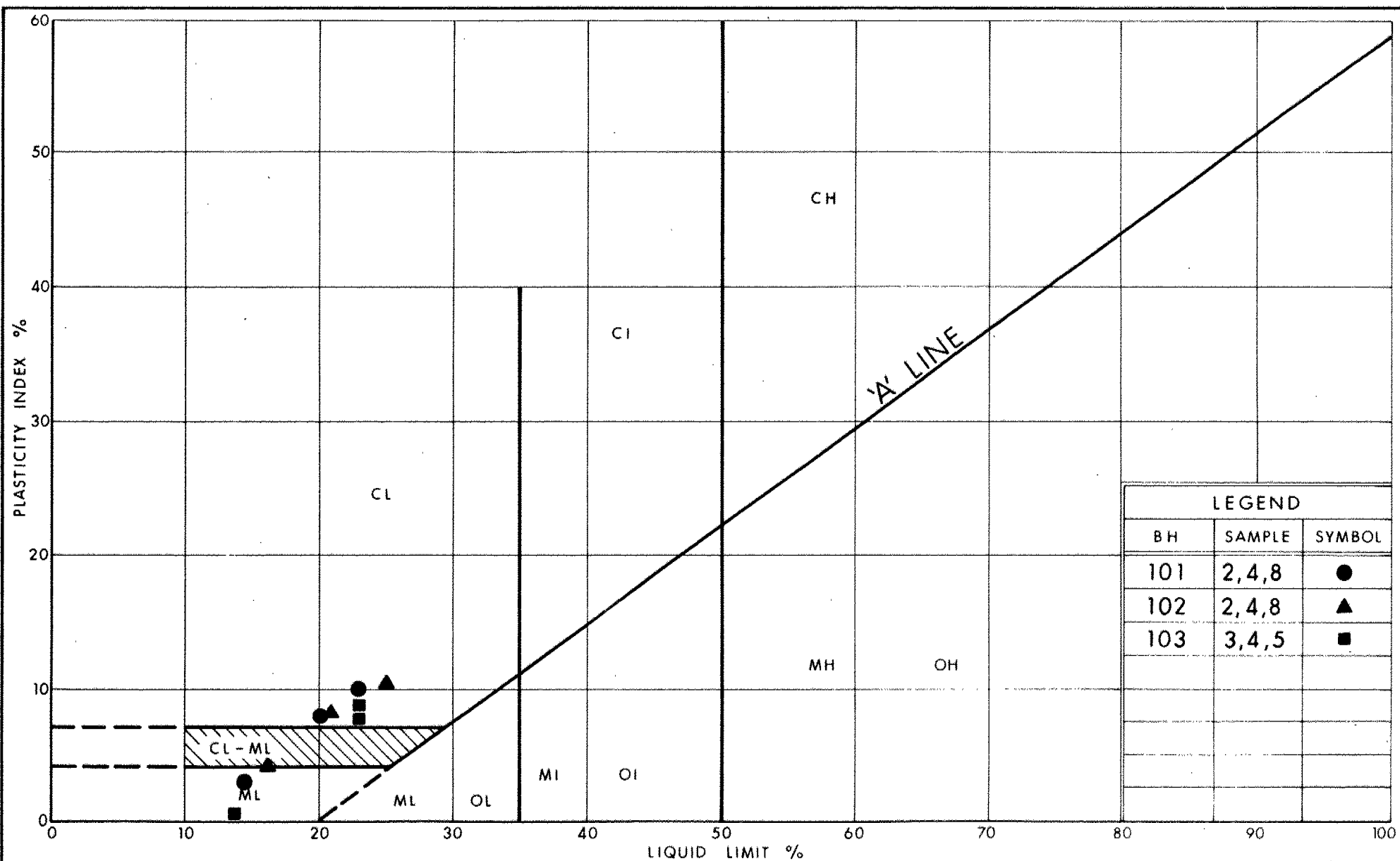


*Tae C. Kim*  
Tae C. Kim, P.Eng.  
Foundation Engineer

*Murty Devata*

Murty Devata, P.Eng.  
Chief Foundation Engineer

## APPENDIX



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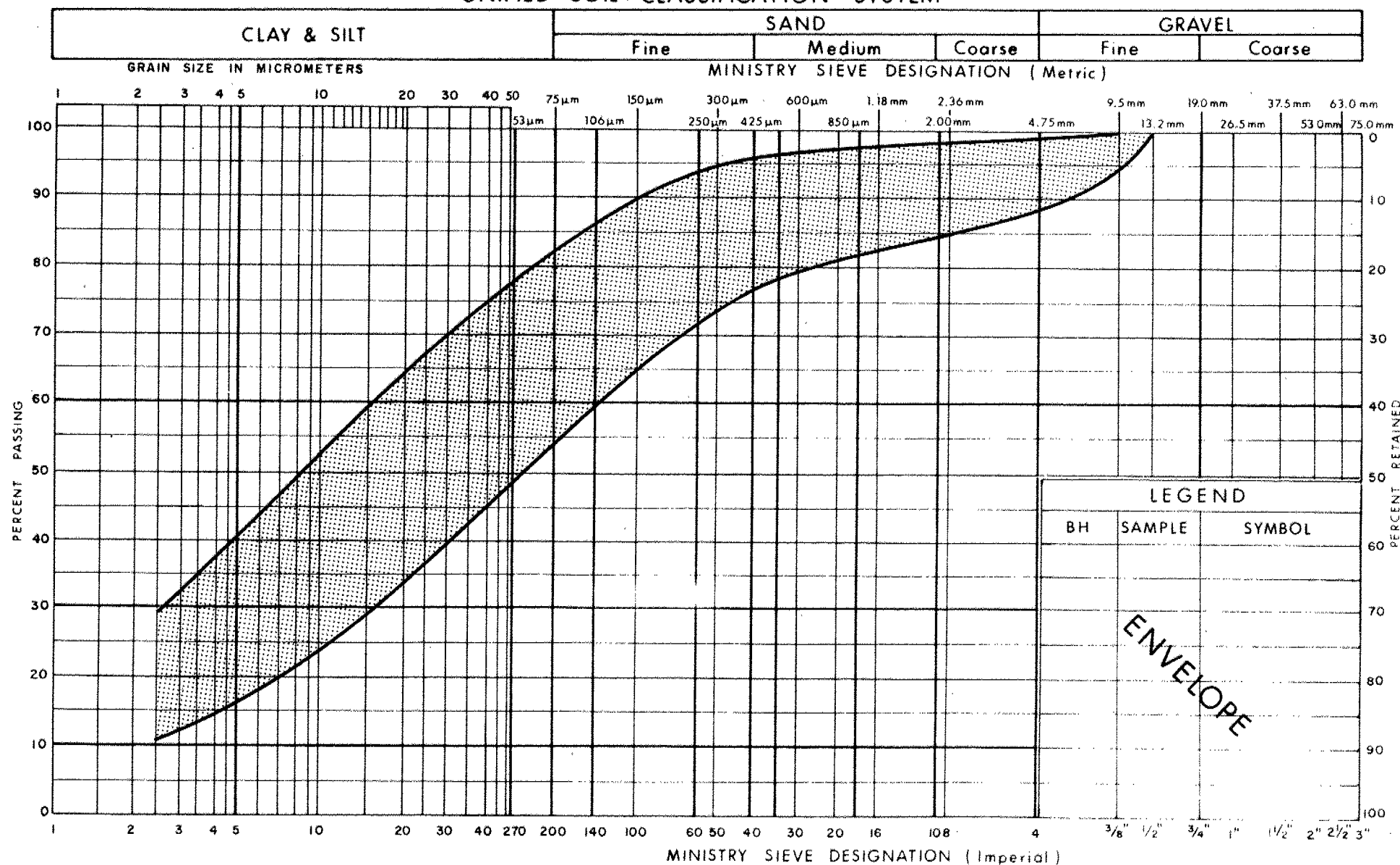
Ontario

# PLASTICITY CHART CLAYEY SILT TO SILT (Glacial Till)

FIG No 1

W P 164-79-06

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

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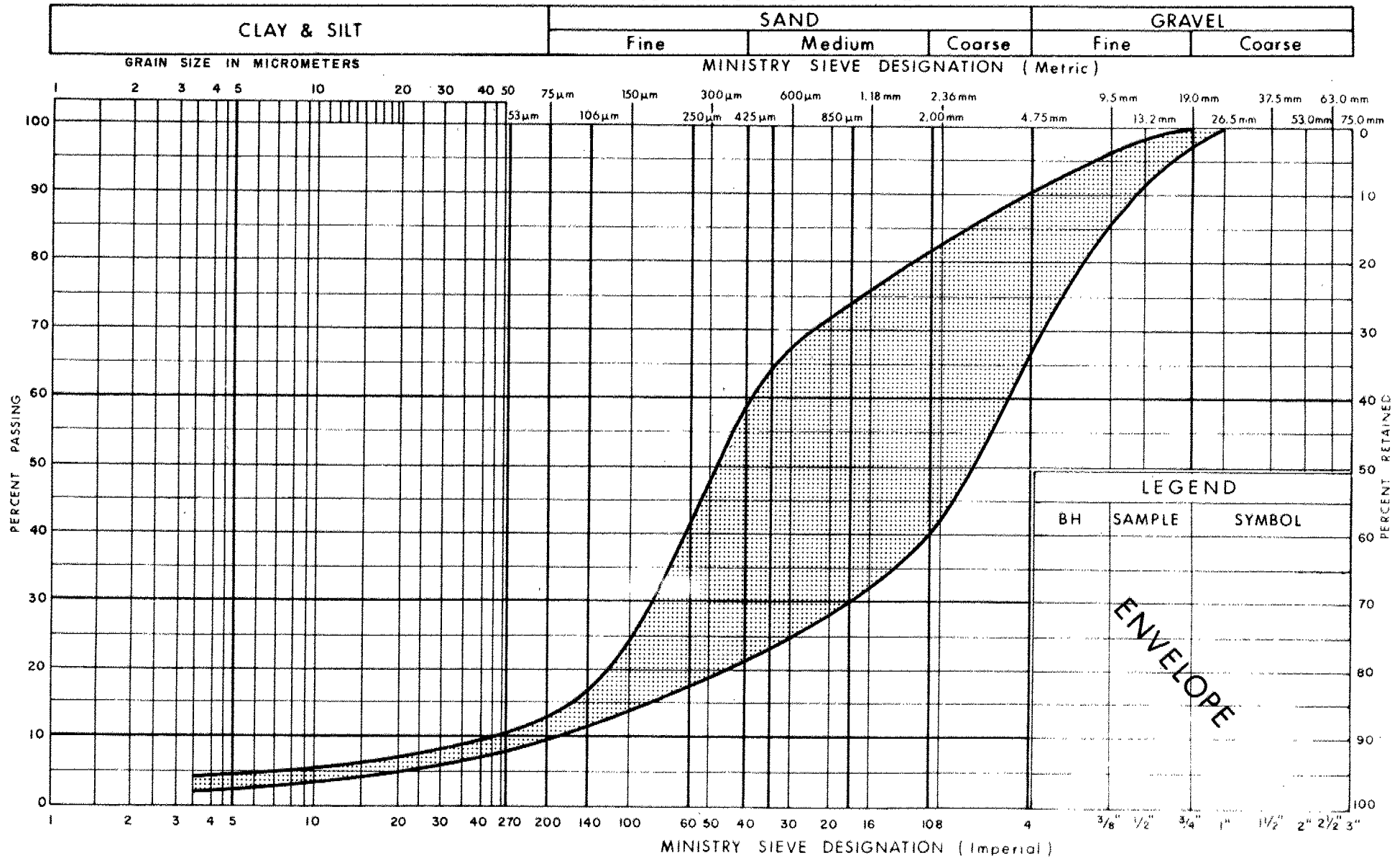
## GRAIN SIZE DISTRIBUTION

### CLAYEY SILT TO SILT (Glacial Till)

FIG No 2

W P 164-79-06

## UNIFIED SOIL CLASSIFICATION SYSTEM



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**GRAIN SIZE DISTRIBUTION**  
**SAND, SOME / WITH GRAVEL, TRACE OF SILT**

FIG No 3

W P 164-79-06

## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 41% IMPACT ENERGY ON 1" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

$c_u$ (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

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 OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ 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	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

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

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_a$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	KN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	KN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	KN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	KN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	KN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	KN/m <sup>2</sup>	SEEPAGE FORCE
$\gamma'$	KN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

# RECORD OF BOREHOLE No 101

METRIC

W P 164-79-06 LOCATION Co-ords. N 4 848 111.5; 301 987.5 ORIGINATED BY JBF  
 DIST 6 HWY 400 BOREHOLE TYPE Hollow Stem Augers, Washboring & Cone Test COMPILED BY JBF  
 DATUM Geodetic DATE 88 08 08 - 09 CHECKED BY TCK

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH $kPa$ ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT $W_p$ NATURAL MOISTURE CONTENT $W$ LIQUID LIMIT $W_L$ WATER CONTENT (%) 10 20 30	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
185.5	Ground Surface										
0.0	Organic Clayey Silt (Topsoil)		1	SS	5						
184.9			2	SS	11						
0.6	Brown Grey		3	SS	12						
			4	SS	5						
	Clayey Silt to Silt		5	SS	85/	15 cm					
	With/Some Sand		6	SS	159						
	Trace/Some Gravel		7	SS	134						
	Occasional Silty Sand Layers		8	SS	103						
	Firm to Hard (Glacial Till)		9	SS	70/	15 cm					
175.4			10	SS	73						
10.1			11	SS	33						
	Sand Some/With Gravel		12	SS	105						
	Trace of Silt		13	SS	20						
	Compact to Very Dense		14	SS	69						
169.8											
15.7	End of Borehole										



# RECORD OF BOREHOLE No 102

METRIC

W P 164-79-06 LOCATION Co-ords. N 4 848 109.0; E 302 003.5  
 DIST 6 HWY 400 BOREHOLE TYPE Hollow Stem Augers, Washboring & Cone Test  
 DATUM Geodetic DATE 88 08 09 ~ 10.  
 ORIGINATED BY JBF  
 COMPILED BY JBF  
 CHECKED BY TCK

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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
185.7	Ground Surface													
185.4 0.3	Organic Clayey Silt (Topsoil)		1	SS	3									GR SA SI CL
			2	SS	8									
			3	SS	11									
	Brown Grey		4	SS	64									
	Clayey Silt to Silt		5	SS	136	23 cm								
	With/Some Sand		6	SS	98	15 cm								
	Trace/Some Gravel		7	SS	29									
	Occasional Silty Sand Layers		8	SS	132	23 cm								
	Stiff to Hard (Glacial Till)		9	SS	73	15 cm								
177.2 8.5	Sand, Some/With Gravel, Trace of Silt													
176.1	Very Dense		10	SS	147									
9.6	End of Borehole													

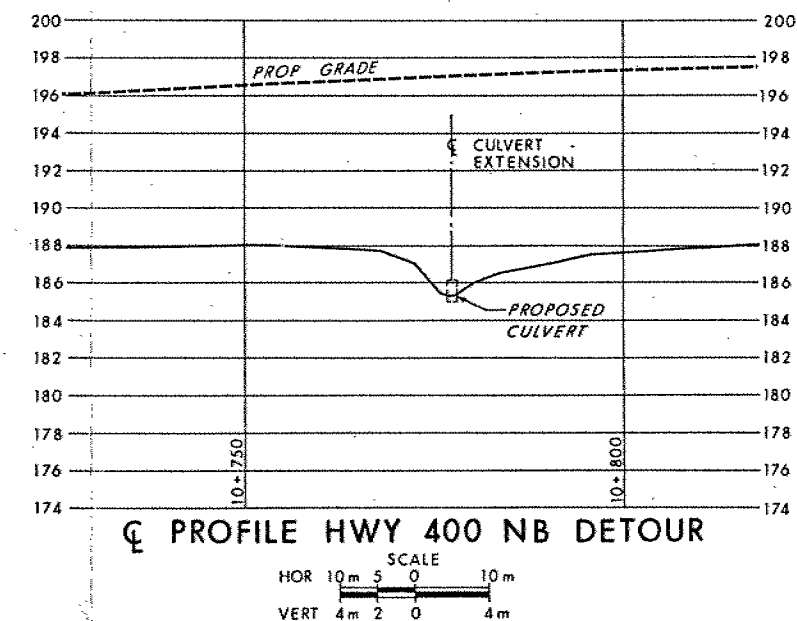
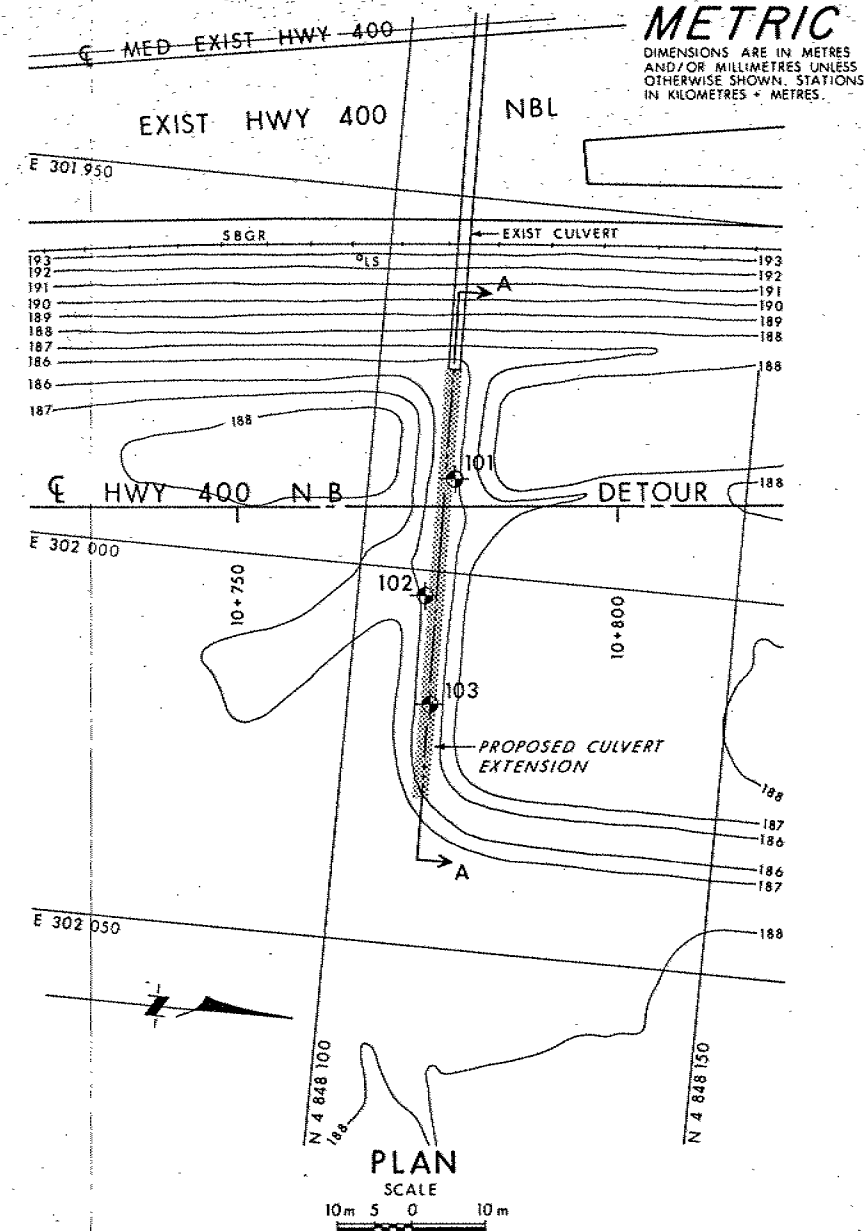
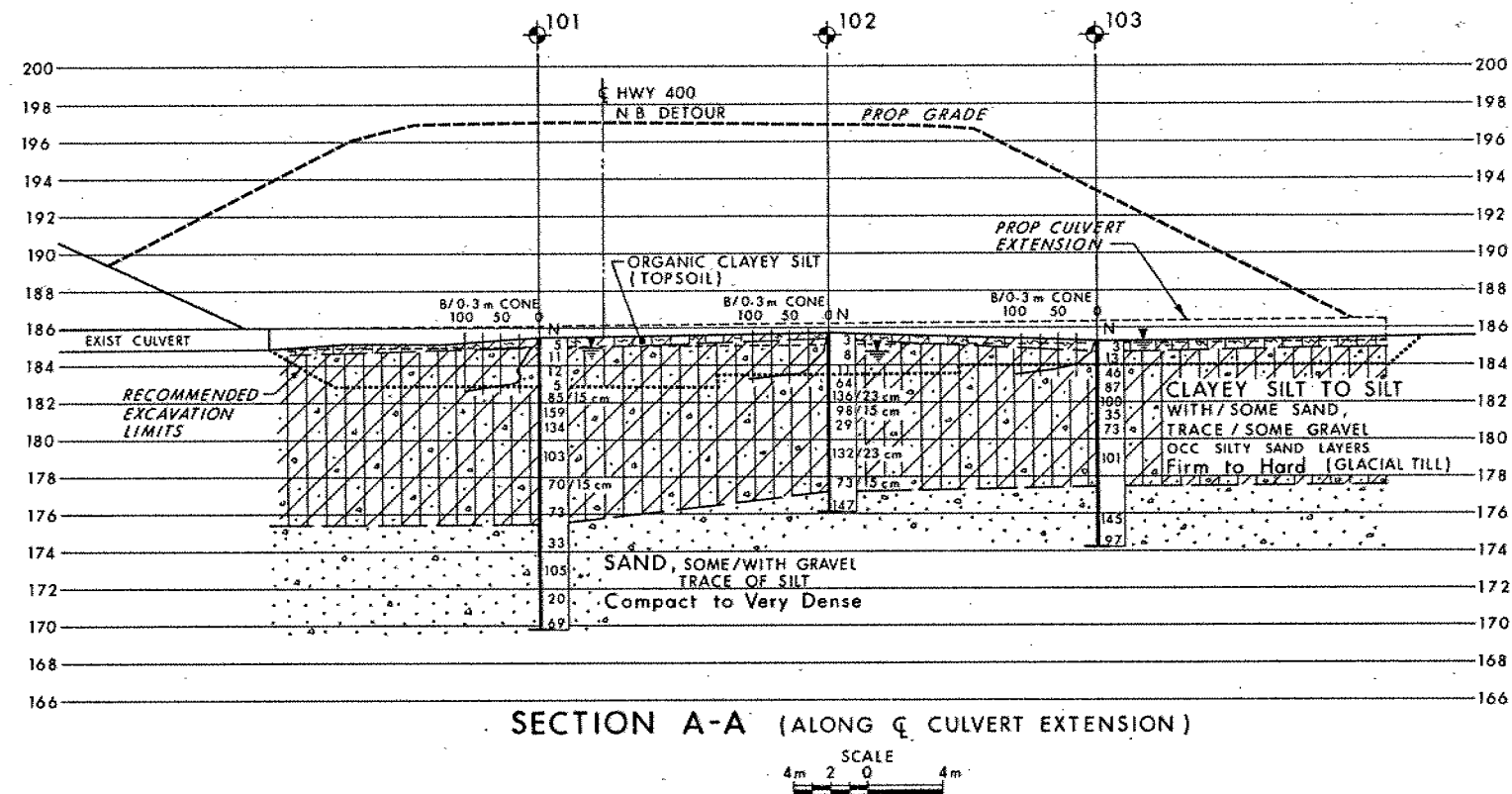
# RECORD OF BOREHOLE No 103

METRIC

W P 164-79-06 LOCATION Co-ords. N 4 848 111.0; E 302 017.5 ORIGINATED BY JBF  
 DIST 6 HWY 400 BOREHOLE TYPE Hollow Stem Augers, Washboring & Cone Test COMPILED BY JBF  
 DATUM Geodetic DATE 88 08 10 - 11 CHECKED BY TCK

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100	Wp W WL	WATER CONTENT (%)	10 20 30		
185.3	Ground Surface (Ditch)												
0.0	Organic Clayey Silt (Topsoil)		1	SS	3								
184.7			2	SS	13								
0.6			3	SS	46								
	Clayey Silt to Silt		4	SS	87								
			5	SS	100								
	With/Some Sand		6	SS	35								
	Trace/Some Gravel		7	SS	73								
	Occasional Silty Sand Layers		8	SS	101								
	Stiff to Hard (glacial Till)												
177.5													
7.8	Sand, Some/With Gravel		9	SS	145								
	Trace of Silt												
	Very Dense												
174.2			10	SS	97								
11.1	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

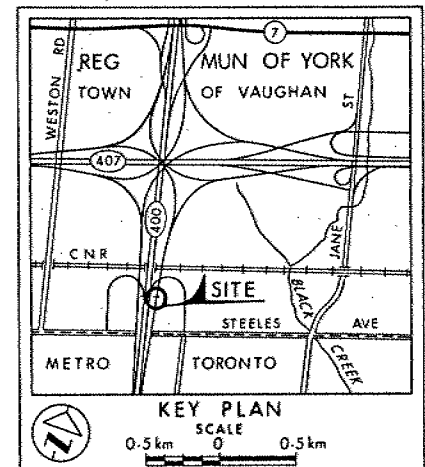


CONT No  
WP No 164-79-06

CULVERT EXTENSION  
UNDER HWY 400 N B DETOUR  
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



# LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation 88.08

No	ELEVATION	CO-ORDINATES NORTH	EAST
101	185.5	4 848 111.5	301 987.5
102	185.7	4 848 109.0	302 003.5
103	185.3	4 848 111.0	302 017.5

# NOTE

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Geocres No 30M13-87

HWY No 400	DIST 6
SUBAND TK CHECKED	DATE 1989 01 30
DRAWN 00 CHECKED	SITE
	DWG 1647906-A1

M E M O R A N D U M

Geotechnical Section, Central Region

Telephone: 224-7417



To: Mr. J. Cullen  
Area Construction Eng.  
(District 6)  
Construction Office  
Central Region

Date: 89-01-26

Attention: R. Kant,  
Construction Supervisor

Re: Contract 88-79, Hwy. 400 Detour  
Proposed Berm Construction

WP 164-79-86

To allow for the construction of a 2.5 m berm 8.0 m below profile grade between Sta. 10+700 Rt Hwy. 400 and Sta. 10+325 Rt Ramp 400S - Steeles E,W, the following additions/changes are recommended:

1. Additional property will be required. The property line between Sta. 10+750 Rt and Sta. 10+870 Rt (Hwy. 400 NBL) should be shifted 2.5 m east of the present location.
2. Culvert #1, Sta. 10+777.50 should be increased in length by 2.5 m.
3. The present ditch should be adjusted to the following location and as per attached typical (Appendix I):

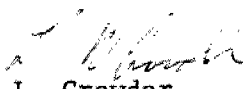
STATION	O/S FROM CENTRELINE	BOTTOM OF DITCH ELEVATION
10+777.50	44.5 - 49.0 m	85.20
10+791.30 Hwy. 400 =		
10+236.49 Ramp	30.7 - 32.7 m	85.34
10+250	28.5 - 30.5 m	85.39
10+275	27.5 - 29.5 m	85.43
10+300	26.0 - 28.0 m	85.45
10+325	Match Existing	

4. Earth excavated from the relocated ditch will be used to fill in the old ditch.
5. The proposed berm should be constructed using acceptable earth fill material.

6. The relocated ditch should be lined with rip-rap, Sta. 10+770 to Sta. 10+790.

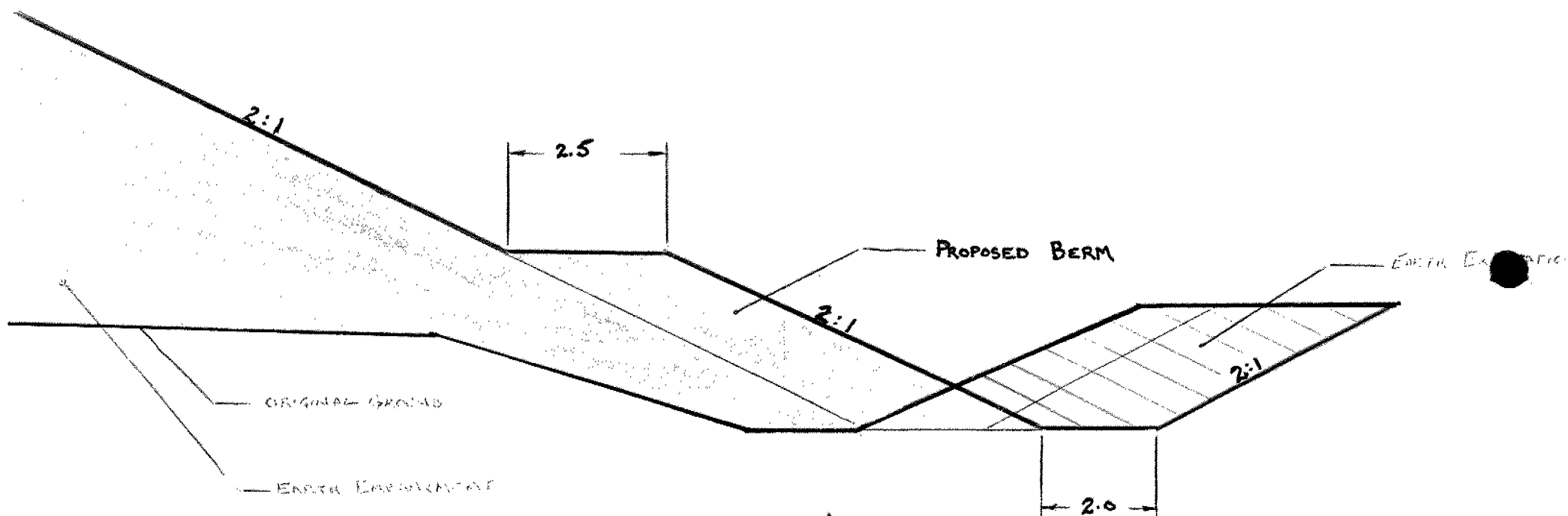
Adjustments to the plotted cross-sections within these limits have been carried out and will be discussed with the Construction Project Supervisor.

LC/GC/rb  
Attach.

  
L. Crowder  
for:  
G. Cautillo  
Head, Geotechnical Section

c.c. J. Castator  
J. Clark  
D. Wong  
M. Devata  
W. Sippola

Appendix I



TYPICAL SECTION

N.T.S. N

Sta 10+236

to

10+325

RAMP

4005 - STEELES E, W