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W.P. No. 103-69-15

CONT. No. 87-75

W. O. No.

STR. SITE No. 24-81-495

HWY. No. 410

LOCATION Derry Rd. Underpass

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

W.P. 103-69-15
W.P. 103-69-16
W.P. 103-69-17

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 87-75



Ministry of
Transportation and
Communications

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NOTE: For purposes of this contract, these reports supercede all other reports prepared by or for the Ministry in connection with the above-noted projects.

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 475 J IMPACT ENERGY ON 'A' 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

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_f	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kn/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kn/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kn/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kn/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $\frac{w_L - w_p}{w_p}$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kn/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m ³	SEEPAGE FORCE
γ'	kn/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

FOUNDATION INVESTIGATION REPORT

FOR

Derry Road Underpass
W.P. 103-69-15, Site 24-81-495
Hwy. 410, District 6, Toronto

1.0 INTRODUCTION

Geocon Inc. has been retained by the Ontario Ministry of Transportation and Communications to carry out a geotechnical investigation at the site of the proposed interchange for Highway 410 at Derry Road as part of the continuing programme of construction of Highway 410. At the present time the Derry Road Underpass is proposed as a two span structure. The investigation for the structure has been carried out under the technical direction of Mr. M.S. Devata, Chief Foundations Engineer, Ministry of Transportation and Communications. The work was carried out in accordance with our proposal, dated December 4, 1985.

The purpose of the investigation was to obtain subsurface information for use in design and construction of foundations for abutments and piers to support the proposed Highway 410 and Derry Road structure and approach fills.

2.0 PROCEDURE AND EQUIPMENT

A total of 13 boreholes were put down during this investigation. Three of the 13 boreholes, numbered BH1, BH2 and BH13, were located in the area of the approach fills and the remaining 10 boreholes were located in the proposed abutments and piers.

The field work for this investigation was carried out between December 4 and 11, 1985. A Bombardier mounted B-57 mobile power auger drill, equipped with hollow stem augers and BX rock coring equipment, was used to put down the boreholes. The drill equipment and two operators were provided by Master Soil Investigations Limited.

Boreholes BH5, BH8, BH11 and BH13 were terminated at depths of 9.6 to 15.2 metres, after penetrating shale bedrock for lengths of 0.5 to 3.0 metres. The remaining boreholes were terminated within the overburden at depths of 9.3 to 11.7 metres below existing grade.

Samples were recovered within the overburden and weathered shale bedrock in conjunction with the Standard Penetration Test, at intervals of not greater than 1.5 metres.

The underlying bedrock was cored in BX nominal size for a depth of 1.5 metres in Borehole 8. The recovered core was examined to determine percent recovery, Rock Quality Designation (R.Q.D.) and bedrock condition.

Perforated plastic standpipes were installed within the bedrock stratum in Boreholes 5 and 8 and within the till stratum in Borehole 11. Water levels were monitored from ground surface throughout the period of the field programme with final water levels taken on December 17, 1985.

The recovered samples were transported to our Toronto Soil Mechanics Laboratory for detailed examination and testing. The samples remaining after testing will be stored until December, 1986 at which time they will be disposed of unless instructed otherwise.

The borings were located in the field by Geocon personnel by chaining from the centreline stakes placed in the field for the proposed structure. The borings of this investigation were put down from 0 to 18 metres from the proposed new Derry Road centreline alignment. Boring elevations were determined by an elevation survey utilizing a local bench mark (HCP No. 661029). All borehole locations and elevations are indicated on the drawing included in this report.

3.0 SITE AND GEOLOGY

The proposed Derry Road underpass is located within the City of Mississauga in the Municipality of Peel. The site is located just north of the present Highway 410 and Derry Road interchange.

The area under investigation is drained by Etobicoke Creek and its tributaries.

The site is located in the physiographic region known as the "Peel Plain". The deposits characterizing the area consist of cohesive glacial till underlain by shale bedrock of the Meaford-Dundas formation, Ordovician Period.

4.0 SUBSURFACE CONDITIONS

The site is generally covered with 9.1 to 12.3 metres of overburden overlying weathered shale and sound shale of the Meaford-Dundas Formation.

Reference should be made to the Records of Boreholes included in Appendix I of this report as well as to the drawing (Dwg. No. 1036915-A)**located at the rear of this report.

The subsurface groundwater and soil conditions are described in detail in the following sections.

4.1 Glacial Till - Silty Clay, some Sand and a Trace of Gravel

Underlying a 300 mm thick fill zone in Borehole 10 and a 50 to 460 mm thick topsoil zone in the remainder of the borings, a stratum consisting of a heterogeneous mixture of brown to grey silty clay, sand and gravel, was encountered in all locations. The thickness of this glacial till deposit where penetrated fully ranged from 8.8 to 12.2 metres.

Standard Penetration Tests carried out within the stratum yielded "N" values ranging from 19 to over 100 blows per 0.30 metres. The "N" values were generally all over 30 except for those near the ground surface, which indicates the soil is generally of a very stiff to hard consistency.

Grain size distribution analyses, carried out on six samples of the stratum, yielded the following results.

**NOTE: Refer to Drawing No. 2 of the Contract Drawings.

<u>Borehole Number</u>	<u>Sample Number</u>	<u>% Gravel</u>	<u>% Sand</u>	<u>% Silt</u>	<u>% Clay</u>
3	4	2	20	56	22
3	7	5	29	46	20
8	5	5	33	44	18
8	8	7	39	50	4
11	3	1	21	57	21
11	7	10	38	40	12

The results of these tests are shown as an envelope on Figure 1 in Appendix II.

The grain size distribution varies throughout the stratum however in general the soil is described as a silty clay, some sand with a trace of gravel.

Two Atterberg Limit Tests carried out on the minus 425 μ portion of representative samples of the stratum yielded the following results:

<u>Borehole Number</u>	<u>Sample Number</u>	<u>Liquid Limit % w_L</u>	<u>Plastic Limit % w_p</u>	<u>Plasticity Index % I_p</u>	<u>Natural Moisture Content % w</u>
8	4	25.8	16.8	9.0	10.4
8	9	17.7	11.8	5.9	12.0

The results of these tests are plotted on the Plasticity Chart on Figure 3 in Appendix II. The soil is described as an inorganic silty clay of low plasticity.

Twenty six natural moisture content tests were carried out on representative samples yielding values ranging from 4.9 to 17.6 percent with an average of 10.0 percent.

A zone within the glacial till stratum containing a non-cohesive sand, gravel and silt was encountered in Boreholes 5, 9, 11 and 12. This stratum was found to be water bearing with a thickness up to 3.1 metres. Some low standard penetration test values were recorded in this zone, however this is believed to be caused by boiling sands from within this zone.

One grain size distribution analysis carried out on a representative sample from this stratum yielded the following results. :

<u>Borehole</u> <u>Number</u>	<u>Sample</u> <u>Number</u>	<u>% Gravel</u>	<u>% Sand</u>	<u>% Silt</u>	<u>% Clay</u>
9	8	28	68	4	0

The results of this test are plotted on Figure 2 in Appendix II of this report.

One natural moisture content test was carried out on a representative sample yielding a value of 20.5 percent.

4.2 Weathered Shale

Weathered dark grey shale was encountered underlying the silty clay, some sand and gravel in Boreholes 5, 8, 11 and 13. All other borings were terminated within the glacial till. The shale was penetrated to 1.6, 0.9 and 0.5 metres in Boreholes 5, 11 and 13 respectively and to a maximum depth of 3.0 metres in Borehole 8. The weathered shale was encountered at elevation 173.2 to 175.3 metres and was generally easily auger drilled. The rock quality improved with depth and was core drilled from elevation 172.9 to 171.4 metres in Borehole 8.

Standard Penetration Tests carried out within the stratum yielded "N" values generally greater than 100.

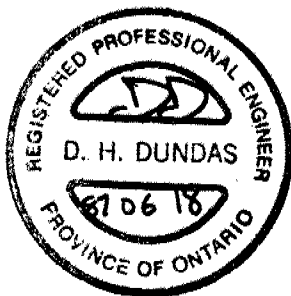
4.3 Groundwater Conditions

Groundwater levels determined during the investigation ranged from about elevation 184.6 to 185.7 metres and in some instances may not represent the stabilized groundwater level due to the relatively impermeable nature of the shale bedrock and glacial till. Groundwater levels should be expected to vary seasonally.

CLOSURE

The field work for this investigation was carried out under the direction of Mr. I. Wislesky, P.Eng. This report was written by Mr. I. Wislesky, P.Eng. and reviewed by Dr. B. Iyer, P.Eng.

NOTE: The preceding report is a copy of the factual information from the Foundation Investigation Report prepared by Geocon Inc. (consulting geotechnical engineers for this project), under the technical supervision of the MTC Foundation Design Section.



D. H. Dundas
 D.H. Dundas, P. Eng.
 Sr. Foundations Engineer

M. Devata
 M. Devata, P.Eng.
 Chief Foundations Engineer
 (East)

A P P E N D I X



RECORD OF BOREHOLE No 1

METRIC

W P 103-69-15

LOCATION Co-ords 4 835 300 N; 289 302 E.

ORIGINATED BY JW

DIST 6 HWY 410

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY AEL

DATUM Geodetic

DATE 1985 12 05

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L	WATER CONTENT (%)					
185.2	Ground Level																
0.0	Clayey silt, sand & organics. Soft to firm		1	SS	2	*	185										
184.1	Brown		2	SS	6		184										
1.1	Very stiff Heterogeneous mixture of silty clay, sand & gravel (Glacial till)		3	SS	27		183										
			4	SS	35		182										
	Hard		5	SS	83		181										
			6	SS	92		180										
	Brown		7	SS	80		179										
	Grey		8	SS	76		178										
			9	SS	46		177										
175.6							176										
9.6	End of Borehole																
	* Groundwater level not established																

RECORD OF BOREHOLE No 2

METRIC

W P 103-69-15 LOCATION Co-ords: 4 835 400 N; 289 365 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 05 CHECKED BY J4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH										WATER CONTENT (%)
								20 40 60 80 100										
189.0	Ground Level																	
0.0 188.7 0.3	Topsoil		1	SS	8	*												
	Stiff to very stiff		2	SS	20		188											
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		3	SS	41		187											
	Hard		4	SS	46		186											
			5	SS	50		185											
	Brown Grey		6	SS	28		184											
	Very stiff		7	SS	25		183											
	Hard		8	SS	89		182											
			9	SS	117/0.23		181											
179.6 9.4	End of Borehole						180											
	* Groundwater level not established																	

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

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

RECORD OF BOREHOLE No 3

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 448 N: 289 413.5 E ORIGINATED BY TW
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEI
 DATUM Geodetic DATE 1985 12 04 CHECKED BY /

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100					
188.0	Ground Level															
0.0	Topsoil															
187.7			1	SS	13											
0.3																
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		2	SS	35											
	Hard		3	SS	36											
			4	SS	48											
			5	SS	62											
	Brown Grey		6	SS	59											
			7	SS	52											
			8	SS	71											
			9	SS	90/0.15											
178.7	End of Borehole															
9.3	* Groundwater level not established															

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 4

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 470 N; 289 392 E.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers
DATUM Geodetic DATE 1985 12 06

ORIGINATED BY IW
COMPILED BY AEL
CHECKED BY 16

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.8	Ground Level																
0.0	Topsoil		1	SS	9	*											
187.3	Very stiff		2	SS	26		187										
0.5	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till)		3	SS	30		186										
	Hard		4	SS	56		185										
			5	SS	77		184										
							183										
	Brown Grey		6	SS	64		182										
			7	SS	59		181										
			8	SS	77		180										
							179										
							178										
							177										
	Frequent shale fragments		10	SS	107												
176.1			11	SS	88												
11.7	End of Borehole																
	* Groundwater level not established																

RECORD OF BOREHOLE No 5

METRIC

W P 103-69-15

LOCATION Co-ords. 4 835 470.5 N; 289 434 E.

ORIGINATED BY IW

DIST 6 HWY 410

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY AEL

DATUM Geodetic

DATE 1985 12 04

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.5	Ground Level																
187.0	Topsoil		1	SS	5		187										
0.3	Stiff to very stiff																
			2	SS	22		186										
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		3	SS	41												
	Hard		4	SS	62		185										
			5	SS	101		184										
	Brown																
	Grey		6	SS	75/0.23		183										
							182										
			7	SS	71		181										
			8	SS	93/0.15		180										
							179										
178.4																	
9.1	Silty sand and gravel		9	SS	115/0.25		178										
	Very dense																
			10	SS	60/0.08		177										
							176										
175.3																	
12.2	Shale bedrock		11	SS	95/0.25		175										
	Weathered																
173.7							174										
13.8	End of Borehole		12	SS	100/0.08												

+3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 6

METRIC

W P 103-69-15

LOCATION Co-ords. 4 835 489 N; 289 416 E

ORIGINATED BY IW

DIST 6 HWY 410

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY AET

DATUM Geodetic

DATE 1985 12 04

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.5	Ground Level																
0.0	Topsoil (0.1)		1	SS	5	*	187										
	Soft to very stiff		2	SS	19		186										
	Heterogeneous mixture of silty clay, sand & gravel		3	SS	36		185										
	(Glacial Till)		4	SS	41		184										
	Hard		5	SS	60		183										
			6	SS	60		182										
	Brown Grey		7	SS	50		181										
			8	SS	70/0.08		180										
			9	SS	105/0.18		179										
178.1	End of Borehole																
9.4	* Groundwater level not established																

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 502.5 N; 289 456 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 06 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.0	Ground Level																
0.0																	
186.5	Topsoil		1	SS	5	*	187										
0.5			2	SS	23		186										
	Very stiff		3	SS	22		185										
	Hard		4	SS	40		184										
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		5	SS	66		183										
			6	SS	36		182										
	Brown Grey		7	SS	70/ 0.20		181										
			8	SS	78/ 0.15		180										
			9	SS	76		179										
177.4							178										
9.6	End of Borehole * Groundwater level not established																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 8

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 522.5 N; 289 437.5 E. ORIGINATED BY IW
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers: BX Rock Core COMPILED BY AEL
 DATUM Geodetic DATE 1985 12 06-09 CHECKED BY /

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
186.6	Ground Level																
0.0	Topsoil		1	SS	8		186										
186.3			2	SS	28												
0.3	Very stiff																
	Hard		3	SS	45		185										
	Heterogeneous mixture of silty clay, sand & gravel		4	SS	68												
	(Glacial Till)		5	SS	64		184										
							183										5 33 44 18
	Brown Grey		6	SS	74		182										
							181										
			7	SS	100/ 0.15		180										
			8	SS	74		179										7 39 50 4
							178										
			9	SS	83		177										
							176										
			10	SS	70		175										
174.3																	
12.3	Shale bedrock		11	SS	80/ 0.1		174										
	Weathered						173										
	Dark Grey		12	RC BX	94%		172										RQD 25%
171.4			13	RC BX	92%												0%
15.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 9

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 533 N; 289 482 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 09 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
185.9	Ground Level																
0.0	Topsoil (0.1)		1	SS	10	*											
	Stiff to very stiff		2	SS	25		185										
	Hard		3	SS	34		184										
	Heterogeneous mixture of silty clay, sand & gravel		4	SS	66		183										
	(Glacial Till)		5	SS	66		182										
							181										
	Brown Grey		6	SS	63		180										
			7	SS	60/ 0.0		179										
179.5	Gravelly sand trace silt						178										
6.4	Very dense		8	SS	94		177										
178.0	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till)		9	SS	100/ 0.20												
7.9	Hard																
176.5	End of Borehole																
9.4	* Groundwater level not established																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 10

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 550 N; 289 463.5 E. ORIGINATED BY IW
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
 DATUM Geodetic DATE 1985 12 10 CHECKED BY 16

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										WATER CONTENT (%)
								SHEAR STRENGTH										
186.3	Ground Level																	
0.0	Silty sand, trace		1	SS	8	*	186											
186.0	organics (Fill)																	
0.3																		
	Heterogeneous mixture		2	SS	38		185											
	of silty clay, sand																	
	and gravel		3	SS	44		184											
	(Glacial Till)																	
	Hard		4	SS	64		183											
			5	SS	70		182											

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 11

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 553 N; 289 501.5 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 10-11 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100					
185.7	Ground Level																
185.4	Topsoil																GR SA SI CL
0.3	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till) Hard		1	SS	10		185										1 21 57 21
			2	SS	31		184										
			3	SS	39		183										
			4	SS	112		182										
			5	SS	88		181										
			6	SS	110		180										
179.2			7	SS	91		179										10 38 40 12
6.5	Silty sand Dense						178										
177.9			8	SS	36		177										
7.8	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till) Hard						176										
			9	SS	72		175										
			10	SS	118/ 0.20		174										
173.2							173										
12.5	Shale bedrock Weathered Dark Grey																
172.3			11	SS	139/ 0.23												
13.4	End of Borehole		12	SS	90/ 0												

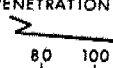
+³, x⁵: Numbers refer to
Sensitivity

20
15 ± 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12

METRIC

W P 102-69-15 LOCATION Co-ords 4 835 571 N; 289 484 5 E ORIGINATED BY IW
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
 DATUM Geodetic DATE 1985 12 10 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
185.6	Ground Level																
0.0	Topsoil		1	SS	13	*	185										
185.3																	
0.3	Very stiff		2	SS	24		184										
	Hard		3	SS	37		183										
	Heterogeneous mixture of silty clay, sand and gravel		4	SS	52		182										
	(Glacial Till)		5	SS	110		181										
			6	SS	53		180										
180.0																	
5.6	Silty sand Compact		7	SS	21		179										
179.2																	
6.4	Heterogeneous mixture of silty clay, sand and gravel		8	SS	62		178										
	(Glacial Till)						177										
	Hard																
176.0			9	SS	101		176										
9.6	End of Borehole * Groundwater level not established																

OFFICE REPORT ON 'SOIL EXPLORATION

RECORD OF BOREHOLE No 13

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 641 N: 289 540 E. ORIGINATED BY TW
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
 DATUM Ganderic DATE 1985 12 11 CHECKED BY

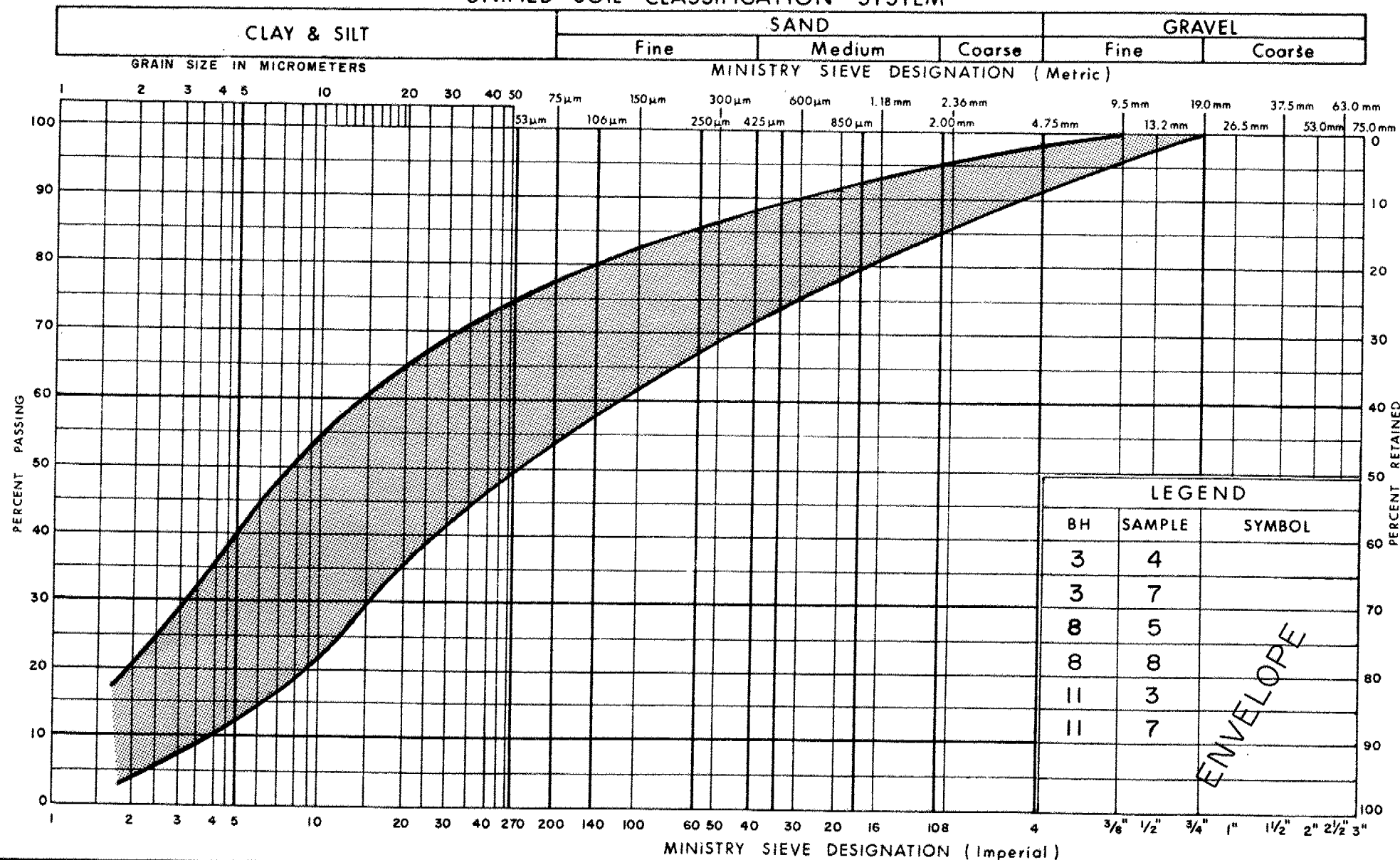
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
184.0	Ground Level																
0.0	Topsoil		1	SS	3	*											
0.3	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till) Hard		2	SS	40		183										
			3	SS	73		182										
			4	SS	93		181										
			5	SS	101		180										
							179										
			6	SS	93		178										
							177										
			7	SS	105		176										
							175										
			8	SS	112												
174.9																	
9.1	Shale bedrock		9	SS	107												
174.4	Weathered																
9.6	End of Borehole * Groundwater level not established																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

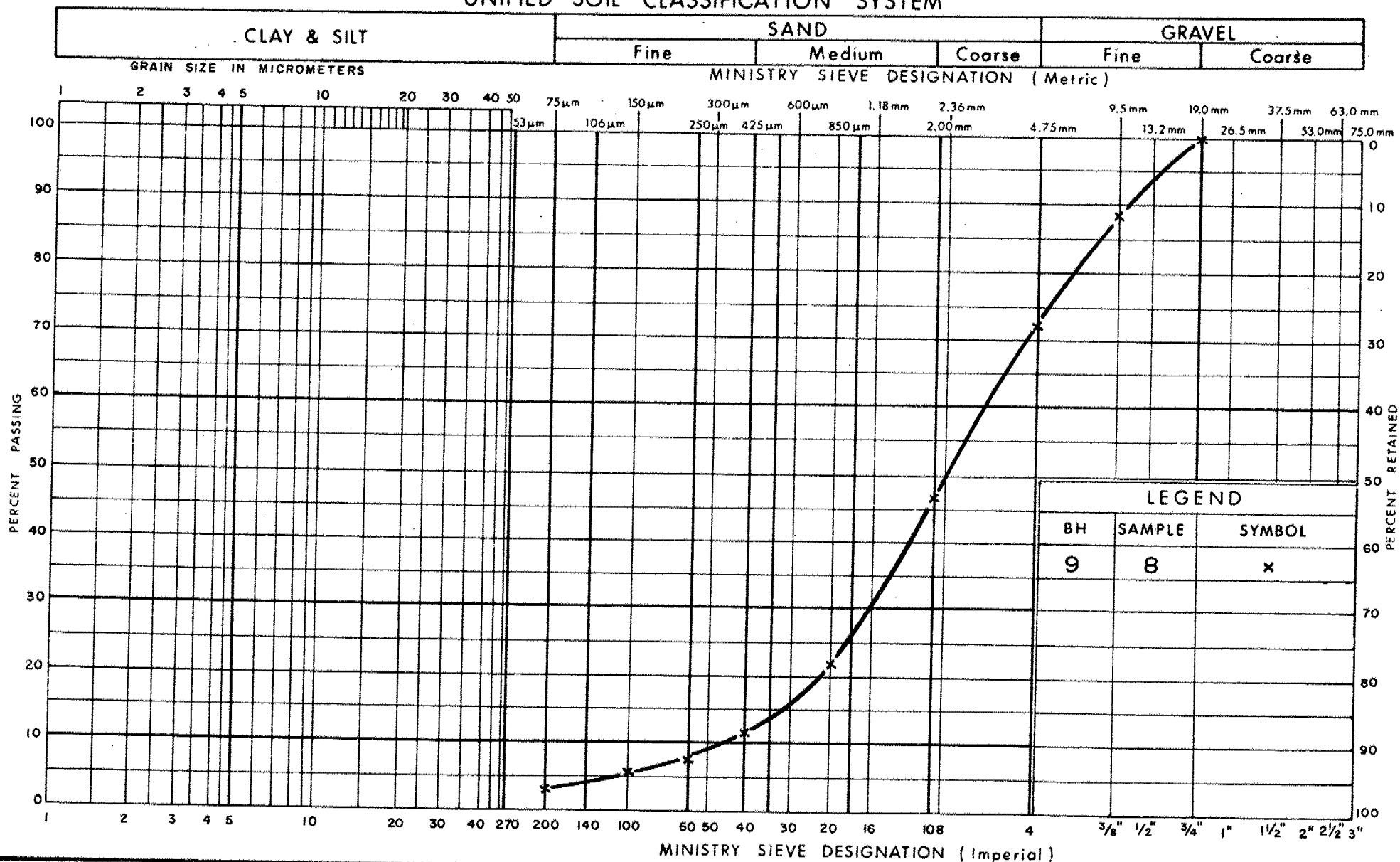
Ministry of
Transportation and
Communications

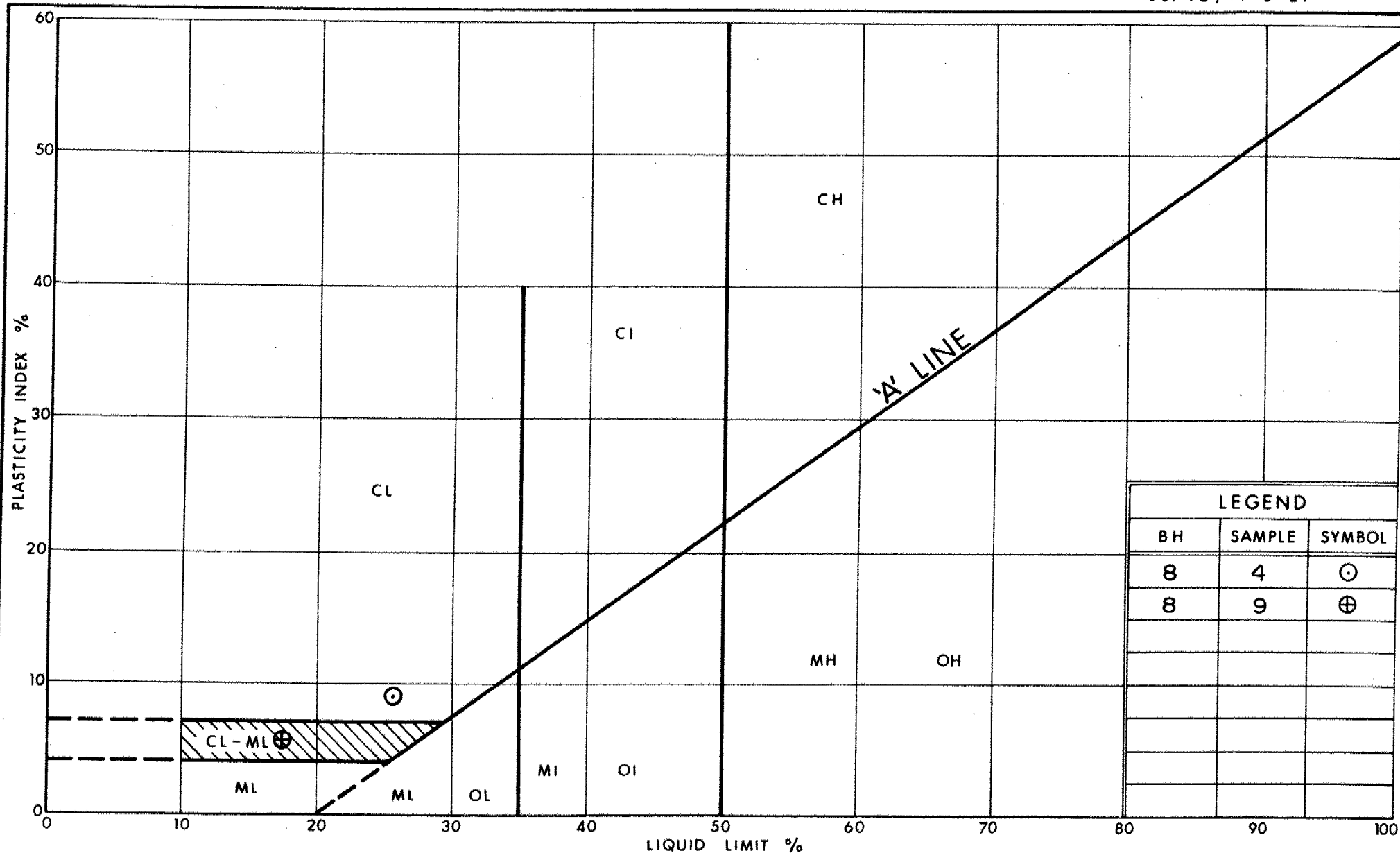
GRAIN SIZE DISTRIBUTION
HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND
& GRAVEL (GLACIAL TILL)

FIG No 1

W P 103-69-15

UNIFIED SOIL CLASSIFICATION SYSTEM





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Transportation and
Communications

PLASTICITY CHART HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND & GRAVEL (GLACIAL TILL)

FIG No 3

W P 103-69-15

FOUNDATION INVESTIGATION REPORT
for
S.B.L. Etobicoke Creek Structure
Hwy. #410
W.P. 103-69-16; Site No. 24-81-313
District 6, Toronto

INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation carried out at the above-mentioned site between 85 12 05 and 85 12 11. The fieldwork consisted of 8 sampled boreholes (BH 101 - BH 108) advanced by hollow or solid stem augers and by BXL rock coring equipment. One of the boreholes (BH 103) was also accompanied by a dynamic cone penetration test. The depth of the boreholes ranged from 4.9 m to 10.7 m in depth below the existing ground surface. Bedrock was proven in 4 boreholes (BH 103 - 106) by obtaining up to 4.0 m of BXL rock core in each.

In 1976 a foundation investigation was carried out for the now-constructed N.B.L. This investigation consisted of 12 sampled boreholes (BH 1 - BH 12). The location of the boreholes pertinent to this specific project (BH 7, 8, 9, 10) are shown on DWG 1036916-A.**The log sheets for these boreholes are also included in the Appendix. The information on these log sheets is provided for reference only and is not used in the description of the subsurface conditions at this site.

SITE DESCRIPTION

The site is located on Hwy. 410 approximately 1.5 km south of Steeles Ave. at Etobicoke Creek. The site is situated in the City of Brampton, Regional Municipality of Peel.

Land use in the vicinity of the site is predominantly agricultural.

The site is located in the physiographic region known as the "Peel Plain" as described in The Physiography of Southern Ontario (Chapman and Putman, 1984). The deposit characterizing this area consists of a cohesive glacial till deposit underlain by shale bedrock of the Georgian Bay Formation (formerly known as the Meaford-Dundas formation), Ordovician Period. The area under investigation is drained by Etobicoke Creek.

**NOTE: Refer to Drawing No. 2 of the Contract Drawings.

SUBSURFACE CONDITIONS

General

The predominant material across this site is a glacial deposit described as a heterogeneous mixture of silty clay, sand, gravel. This cohesive deposit is underlain by the Shale bedrock of the Georgian Bay formation. Other deposits such as silty clay, sand with silt, and sand and gravel were, however, encountered within this river valley.

The boundaries of the subsoil types, insitu and laboratory test results, as well as groundwater levels are shown on the Record of Borehole Sheets in the Appendix. The location of each borehole is shown in plan on DWG No. 1036916-A* together with a longitudinal stratigraphical section.

The various soils encountered at this site are described as follows:

Fill

Fill material was encountered in BH 107 and 108 extending from the ground surface down to a depth of 2.1 m and 2.9 m respectively. Four Atterberg Limits test were carried out on samples of this cohesive material with the following results:

	<u>Range</u>	<u>Average</u>
Moisture Content (W)	11.5 - 16%	14.5%
Liquid Limit (W _L)	25.5 - 30%	28%
Plastic Limit (W _p)	15.5 - 17.5%	16%
Plasticity Index (I _p)	9.5 - 14.5%	12%

The results are also shown in the Plasticity chart in Figure 1 in the Appendix.

Three grain size distribution tests were carried out on samples of this fill. The results are shown on Figure 2 and are summarized as follows:

	<u>Range</u>
Gravel	2 - 9%
Sand	20 - 27%
Silt	46 - 51%
Clay	20 - 25%

*NOTE: Refer to Drawing No. 2 of the Contract Drawings.

Based on the results of the Atterberg Limits tests and the grain size distribution tests, the fill can be described as a silty clay of low plasticity, some sand, trace gravel.

Standard Penetration Test 'N' values ranging from 9-25 blows/0.3m were obtained within this material.

Topsoil

The site is covered in a veneer of topsoil generally in the order of 250 mm in thickness. The thickness may vary across the site. No sampling or testing of this organic material was carried out with the exception of BH 108, Sample #4.

In BH 108, the original topsoil was encountered under 2.9 m of fill. A grain size distribution test carried out on a sample of this material resulted in 0% gravel, 31% sand, 54% silt, and 15% clay. The results of one Atterberg Limits test were as follows; $W=26\%$, $W_L=42\%$, $W_P=31\%$, $I_P=11\%$. This original topsoil can therefore be described as an organic silty clay of medium plasticity. The particular sample had a organic content of 6.3%.

Silty Clay

A silty clay deposit was encountered in BH 101, 103, 104 and 107 at depths ranging from 0.2 m \pm to 2.1 m below the existing ground surface. The thickness of this deposit varies from 0.8 m (BH 107) to 3.3 m (BH 101).

In BH 103 and 104, this material was found immediately below the surficial topsoil. In BH 107 the silty clay stratum was found under the fill material previously described. In BH 101, the silty clay was found under a sand with silt deposit.

Figure 3 in the Appendix shows the results of Atterberg Limits tests carried out as two samples of this material. It is evident that this cohesive material is a silty clay of low plasticity (CL group). The results of the Limits tests are summarized as follows:

	<u>BH 101, #5</u>	<u>BH 104, #1</u>
Moisture Content (W)	24.5%	30%
Liquid Limit (W_L)	30%	28.5%
Plastic Limit (W_P)	14%	21%
Plasticity Index (I_P)	16%	7.5%

Figure 4 shows the results of grain size distribution tests carried out on 4 samples of this cohesive material. The results are summarized as follows:

	<u>Range</u>
Gravel	0%
Sand	5 - 37%
Silt	48 - 56%
Clay	15 - 39%

Based on these results, the deposit can be described as having trace to with sand.

Values ranging from 7 to 16 blows/0.3 m were obtained with the Standard Penetration Test, indicating that this material has a consistency ranging from firm to very stiff.

Sand with Silt

Sand with silt was encountered in BH 101, 102, 106, and 108. In BH 101, 102, and 106, this non-cohesive deposit was encountered at the ground surface (or immediately below the topsoil) and with a thickness of 2.1 m. In BH 108, this material was encountered 3.2 m below the existing ground surface and immediately below the original topsoil at Elev. 187.2.

A grain size distribution test was out on one sample of this material (BH 102, #2). The test showed that this particular sample was composed of 0% gravel, 61% sand, 31% silt, and 8% clay.

'N' values ranging from 4 to 30 blows/0.3 m indicate that this material is in a very loose to compact state.

It should be noted that when this material is subjected to an unbalanced hydrostatic pressure, "boiling" may be experienced.

Sand and Gravel

Sand and gravel was encountered in BH 106, 107 and 108. The thickness of this deposit ranged from 0.6 m (BH 108) to 1.5 m (BH 107). Based on the interpretation of Standard Penetration Test 'N' values ranging between 10 blows/0.3 m and 30 blows/0.05 m, this non-cohesive material can be considered to be in a compact to very dense state.

As with the sand with silt deposit previously described, "boiling" may be experienced when this material is subjected to an unbalanced hydrostatic pressure.

Glacial Till

The predominant deposit across this site is a glacial till described as a heterogeneous mixture of silty clay, sand and gravel.

This material was encountered in BH 101, 102, 103, 105, 107 and 108 at depths ranging from the ground surface (BH 105) down to 5 m (BH 108). The thickness of this cohesive deposit ranges from 1 m (BH 107) to 5.3 m (BH 103).

The results of 9 Atterberg Limits tests are shown on Figure 5 in the Appendix and are summarized as follows:

	<u>Range</u>	<u>Average</u>
	%	%
Moisture Content (W)	8.5 - 22	14.7
Liquid Limit (W_L)	20.5 - 36	26.5
Plastic Limit (W_p)	12 - 20	16.1
Plasticity Index (I_p)	7 - 12.5	10.3

Based on the results of this test, the matrix of this heterogeneous mixture can be described as a silty clay of low plasticity (CL group)

Figure 6 in the Appendix shows, in envelope form, the results of 8 grain size distribution tests carried out on samples of this material. The results can be summarized as follows:

	<u>Range %</u>	<u>Average %</u>
Gravel	1 - 28	12.5
Sand	10 - 31	24.5
Silt	42 - 48	45
Clay	11 - 25	18

Based on the interpretation of Standard Penetration Test 'N' values ranging from 15 blows/0.3 m to 49 blows/0.3 m, this cohesive desposit is considered to have a consistency ranging from stiff to hard.

Shale Bedrock

Bedrock was encountered and proven in BH 103, 104, 105, and 106. In the other boreholes, bedrock was inferred. Bedrock across this site is found at elevations ranging from Elev. 184.2 (BH 108) to Elev. 191.0 (BH 102). The surface of the bedrock slopes towards the south.

The extent of the weathered zones, core recovery, and Rock Quality Designation (RQD) values are shown on the log sheets and are also presented in the Appendix, together with a detailed core description prepared by M.T.C. geologist E. Magni.

The bedrock across this site consists of shale of the Georgian Bay formation. The bedrock includes between 10 and 25% limestone in the form of interbedded layers ranging between 2.5 cm and 15 cm in thickness.

The surface of the bedrock is generally weathered. In BH 103-106, it was possible to penetrate the weathered zone with the augers. In BH 104 it was possible to obtain a split-spoon sample of the bedrock.

Groundwater Conditions

The groundwater levels were determined by measuring in the open boreholes 24 hours after the boreholes were opened. The following levels were determined:

<u>BH</u>	<u>GWL Elev.</u>
103	193.8
104	186.6
105	187.0
106	187.0
107	186.5
108	186.5

On 85 12 03 the water level in the creek at this site was found at Elev. 186.2. On 85 05 06 the water level in the creek at this site was found to be at Elev. 185.6.

Miscellaneous

The fieldwork for this investigation was carried out under the supervision of B. Dolinar and D. Yeo, Project Engineers, utilizing equipment owned and operated by Archer Drilling Inc., of Barrie Ontario. This report was prepared by L. Politano, Project Foundations Engineer and reviewed by M. Devata, Chief Foundations Engineer (East).



D. H. Dundas

D. H. Dundas, P. Eng.
Sr. Foundations Engineer

M. Devata

M. Devata, P. Eng.
Chief Foundations Engineer
(East)

A P P E N D I X



RECORD OF BOREHOLE No 7

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 890.1; E 288 325.6 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core and COMPILED BY V.K.
DATUM Geodetic DATE 76 04 30 Cone Test
CHECKED BY SP.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
187.5	Ground Level												
0.0	Silty Sand with Gravel and Trace Clay												
	Compact to Dense		1	SS	15								27 35 34 4
185.3			2	SS	30								46 22 26 6
2.2	--- weathered BEDROCK		3	BXL	REC 40%								
	Grey Shale with occasional layers of Limestone		4	BXL	REC 100%								
182.9	Sound												
4.6	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 8

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 880.6; E 288 296.9 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core and COMPILED BY V.K.
DATUM Geodetic DATE 76 05 03 Cone Test CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
187.7	Ground Level										
0.0	Gravel with Silty Sand trace Clay		1	SS	33		187				53 32 (15)
	Dense		2	SS	39		186				49 27 21 3
185.3	_____ weathered		3	BXL	REC 45%		185	Refusal			
2.4	BEDROCK		4	BXL	REC 100%		184				
	Grey Shale with occasional layers of Limestone		5	BXL	REC 100%		183				
	Sound										
182.0	End of Borehole										
5.7											

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 9

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 914.7; E 288 317.3 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem, BX Casing; BXL Rock Core and COMPILED BY V.K.
DATUM Geodetic DATE 76 05 07 Cone Test
CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
187.3	Ground Level										
0.0	Silty Clay, Some Sand and Gravel (Glacial Till)										
186.0	Hard		1	SS	56						
1.3	weathered										
	Bedrock-Grey Shale with occasional layers of Limestone		2	BXL	REC 90%						
	Sound		3	BXL	REC 100%						
182.9	End of Borehole										
4.4											

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



RECORD OF BOREHOLE No 10

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 905.3; E 288 288.4 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core and COMPILED BY V.K.
DATUM Geodetic DATE 76 05 07 Cone Test CHECKED BY EP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
187.1	Ground Level						187					
0.0	Gravel with Shale fragments											
	Very Dense		1	SS	100	15 cm	186					
185.9	--- weathered											
1.2	Bedrock-Grey Shale with occasional layers of Limestone		2	BXL	REC 95%		185					
	Sound		3	BXL	REC 100%		184					
182.7	End of Borehole						183					
4.4												

+³, x⁵: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 101

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 970.8; E 288 281.7 ORIGINATED BY DY
 DIST 6 HWY 410 BOREHOLE TYPE Solid Stem Auger COMPILED BY DY
 DATUM Geodetic DATE 85 12 11 CHECKED BY OP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
197.2	Ground Surface													
0.0	Topsoil					*	197							
	Sand with Silt, Changing to Silt with depth		1	SS	8		196							
195.1	Loose to Compact		2	SS	19		195							
2.1	Silty Clay, Trace Sand		3	SS	14		194							
			4	SS	11		193							
192.8	Firm to Stiff		5	SS	5		192							
4.4	Heterogeneous Mixture Silty Clay, Sand Gravel (Glacial Till)		6	SS	68/23 cm		191							
	Hard		7	SS	65/18 cm									
			8	SS	78/13 cm									
190.0	Auger Grinding Probable Bedrock End of Borehole													
	* Groundwater Level not established													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 102

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 948.0; E 288 289.1 ORIGINATED BY BD
DIST 6 HWY 410 BOREHOLE TYPE Solid, Hollow Stem Auger COMPILED BY DY
DATUM Geodetic DATE 85 12 10 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
197.1	Ground Surface																
0.0	Topsoil					*	197										
	Sand with Silt Trace Clay, Gravel		1	SS	4		196										
195.0	Loose to Compact		2	SS	30		195										0 61 31 8
2.1	Heterogeneous Mixture Silty Clay, Sand Gravel (Glacial Till)		3	SS	19		194										
			4	SS	15		193										4 29 48 19
			5	SS	28		192										10 29 43 18
			6	SS	29												
			7	SS	115												
191.0	Very Stiff to Hard Auger Grinding Probable Bedrock End of Borehole																
6.1	* Groundwater level not established																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 103

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 928.1; E 288 295.5 ORIGINATED BY BD
 DIST 6 HWY 410 BOREHOLE TYPE H. S. Auger, BXL Rock Core & Cone Test COMPILED BY DY
 DATUM Geodetic DATE 85 12 09 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ ORG. CON.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
196.5	Ground Surface										
0.0	Topsoil										
	Silty Clay, Trace Sand, Gravel		1	SS	8						
			2	SS	15						
194.0	Stiff		3	SS	33						1 26 48 25
2.5	Heterogeneous Mixture of Silty Clay, Sand, Gravel (Glacial Till)		4	SS	24						
			5	SS	23						
			6	SS	55						5 31 46 18
			7	SS	90/28 cm						
188.7	Very Stiff to Hard										
7.8	Shale Bedrock										
	Weathered Slightly Weathered to Unweathered		8	RC BXL	REC 100%						R.Q.D.=58%
185.8											
10.7	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

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

RECORD OF BOREHOLE No 104

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 911.8; E 288 300.9 ORIGINATED BY BD
 DIST 6 HWY 410 BOREHOLE TYPE H. S. Auger, BXL Rock Core COMPILED BY DY
 DATUM Geodetic DATE 85 12 09 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80					
187.6	Ground Surface															
0.0	Topsoil															
	Silty Clay, with Sand, Trace Organics		1	SS	7											0 37 48 15
186.1	Firm															
1.5	Shale Bedrock		2	SS	60	13 cm										
	Weathered															
	Slightly to Moderately Weathered		3	RC BXL	REC 93%											R.Q.D.=53%
	Slightly Weathered		4	RC BXL	REC 100%											R.Q.D.=80%
182.6	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

*³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 105

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 893.8; E 288 306.8 ORIGINATED BY BD
DIST 6 HWY 410 BOREHOLE TYPE H. S. Auger, BXL Rock Core COMPILED BY DY
DATUM Geodetic DATE 85 12 06 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
187.2	Ground Surface													
0.0	— Topsoil — Heterogeneous Mixture of Silty Clay, Sand Gravel (Glacial Till) Hard						187							
			1	SS	30	/4 cm	186							28 10 44 18
			2	SS	60	/15 cm	185							
184.5	Shale Bedrock						184							
2.7	Weathered Slightly Weathered		3	RC BXL	REC 92%		183							R.Q.D.=45%
182.3	End of Borehole													
4.9														

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 106

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 883.0; E 288 312.4 ORIGINATED BY BD
DIST 6 HWY 410 BOREHOLE TYPE H. S. Auger & BXL Rock Core COMPILED BY DY
DATUM Geodetic DATE 85 12 05 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80					
188.0	Ground Surface															
0.0	Sand with Silt, Trace Clay, Gravel		1	SS	13											
185.9	Loose to Compact Sand and Gravel		2	SS	5											
2.1	Very Dense		3	SS	60	/13 cm										
185.0	— weathered — Shale Bedrock		4	BXL	100%	REC										R.Q.D. = 0%
3.0	Slightly Weathered to Unweathered		5	RC BXL	REC 100%											R.Q.D. = 48%
181.9			6	RC BXL	REC 90%											R.Q.D. = 57%
6.1	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 107

METRIC

W P 103-69-16 LOCATION CO-ORDS: N 4 836 868.7; E 288 317.1 ORIGINATED BY BD
DIST 6 HWY 410 BOREHOLE TYPE H. S. Auger COMPILED BY DY
DATUM Geodetic DATE 85 12 05 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y ORG. CONT.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
189.8	Ground Surface																
0.0	Topsoil																
	Fill																
	Silty Clay, some Sand, Trace Gravel		1	SS	25		189										2 27 47 24
187.7	Stiff to Very Stiff		2	SS	12		188										8 21 46 25
2.1	Silty Clay, with Sand		3	SS	16		187										0 29 49 22
186.9	Very Stiff		4	SS	10		186									1.5	20 41 31 8
2.9	Sand and Gravel Mixture, with Silt Trace Clay		5	SS	45		185										46 28 21 5
185.4	Compact to Dense		6	SS	60	15 cm											
4.4	Heterogeneous Mixture of Silty Clay, Sand, Gravel (Glacial Till)		7	SS	50	10 cm											
184.4	Hard																
5.4	Spoon Bouncing Probable Bedrock End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 108

METRIC

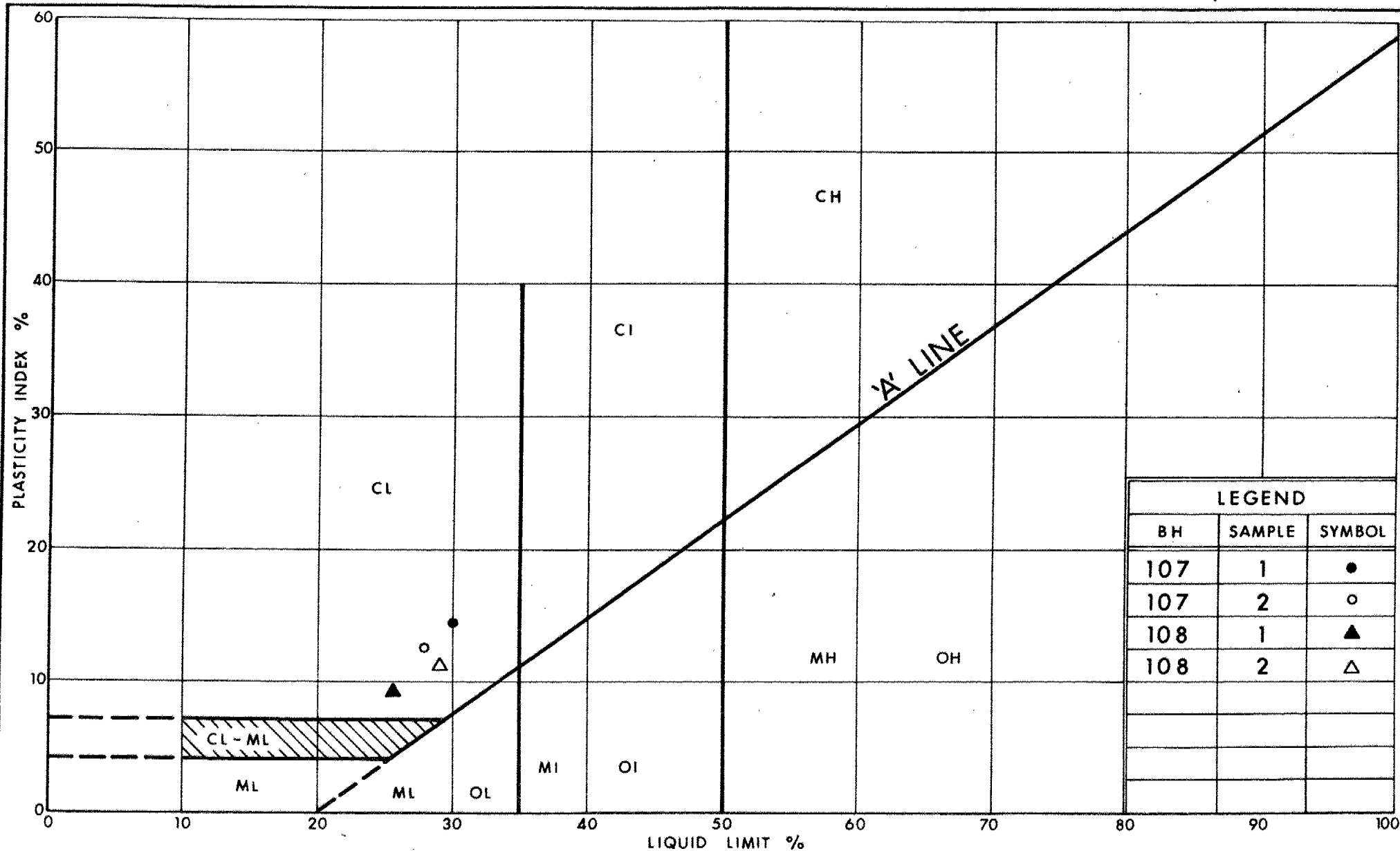
W P 103-69-16 LOCATION CO-ORDS. N 4 836 854.5; E 288 321.7 ORIGINATED BY BD
DIST 6 HWY 410 BOREHOLE TYPE H. S. Auger COMPILED BY BD
DATUM Geodetic DATE 85 12 05 CHECKED BY *SP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ ORG. CONT.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
190.4	Ground Surface															
0.0	Fill						190									
	Silty Clay, some Sand, Trace Gravel		1	SS	20											9 20 51 20
			2	SS	14		189									
			3	SS	9		188									
187.5	Silty Clay, with Sand															
2.9	Trace Organics		4	SS	15		187								6.3	0 31 54 15
187.2	Sand with Silt, Trace Clay, Gravel															
3.2			5	SS	16		186									
186.0	Compact															
4.4	Sand and Gravel		6	SS	30	/5 cm	185									
185.4	Very Dense															
5.0	Heterogeneous Mixture of Silty Clay, Sand and Gravel (Glacial Till)		7	SS	49	/3 cm										22 22 42 14
184.2	Hard		8	SS	20	/5 cm										25 22 42 11
6.2	Spoon Bouncing Probable Bedrock End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



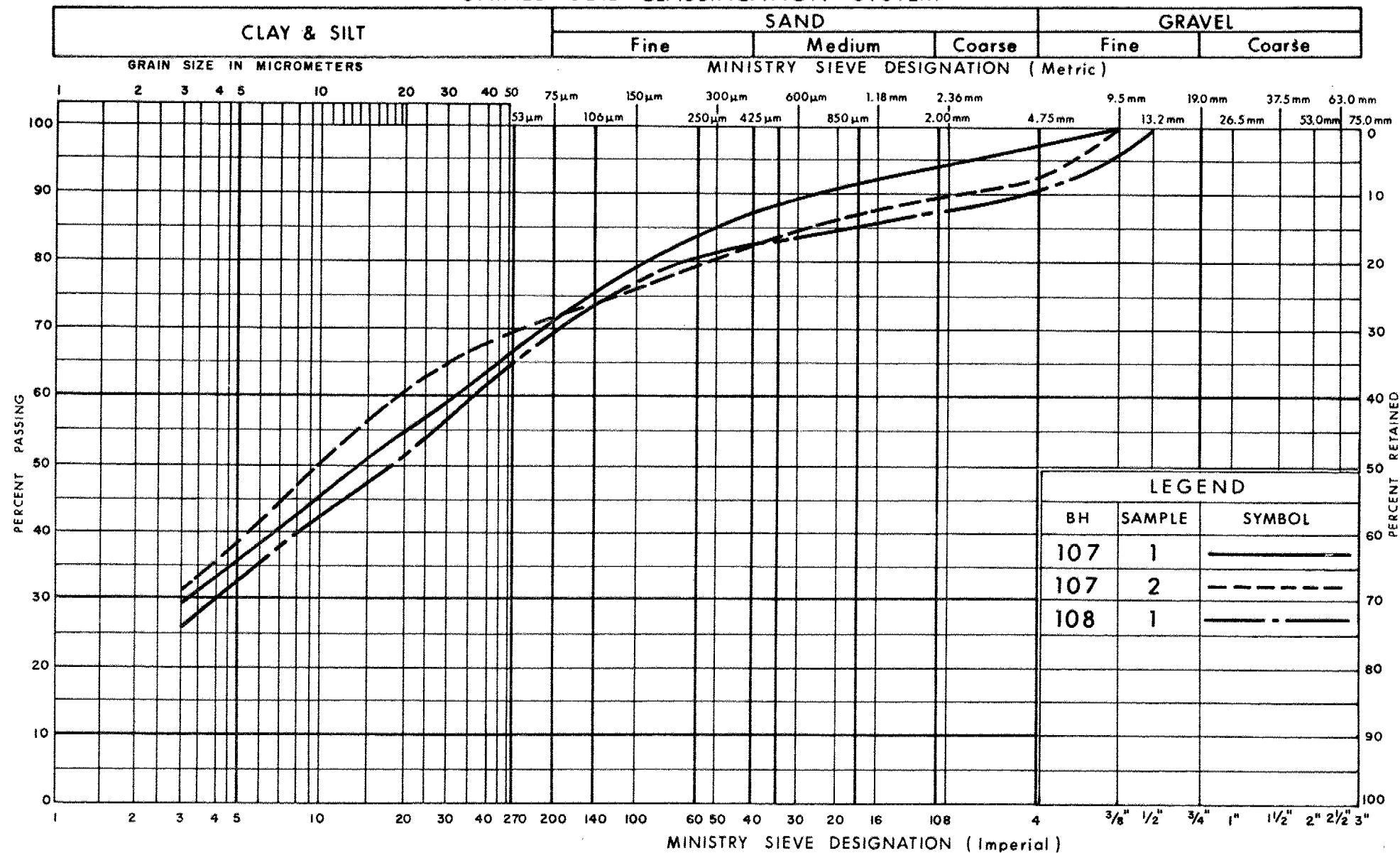
Ministry of
Transportation and
Communications

PLASTICITY CHART
FILL
SILTY CLAY, WITH SAND, TRACE GRAVEL

FIG No 1

W P 103-69-16

UNIFIED SOIL CLASSIFICATION SYSTEM



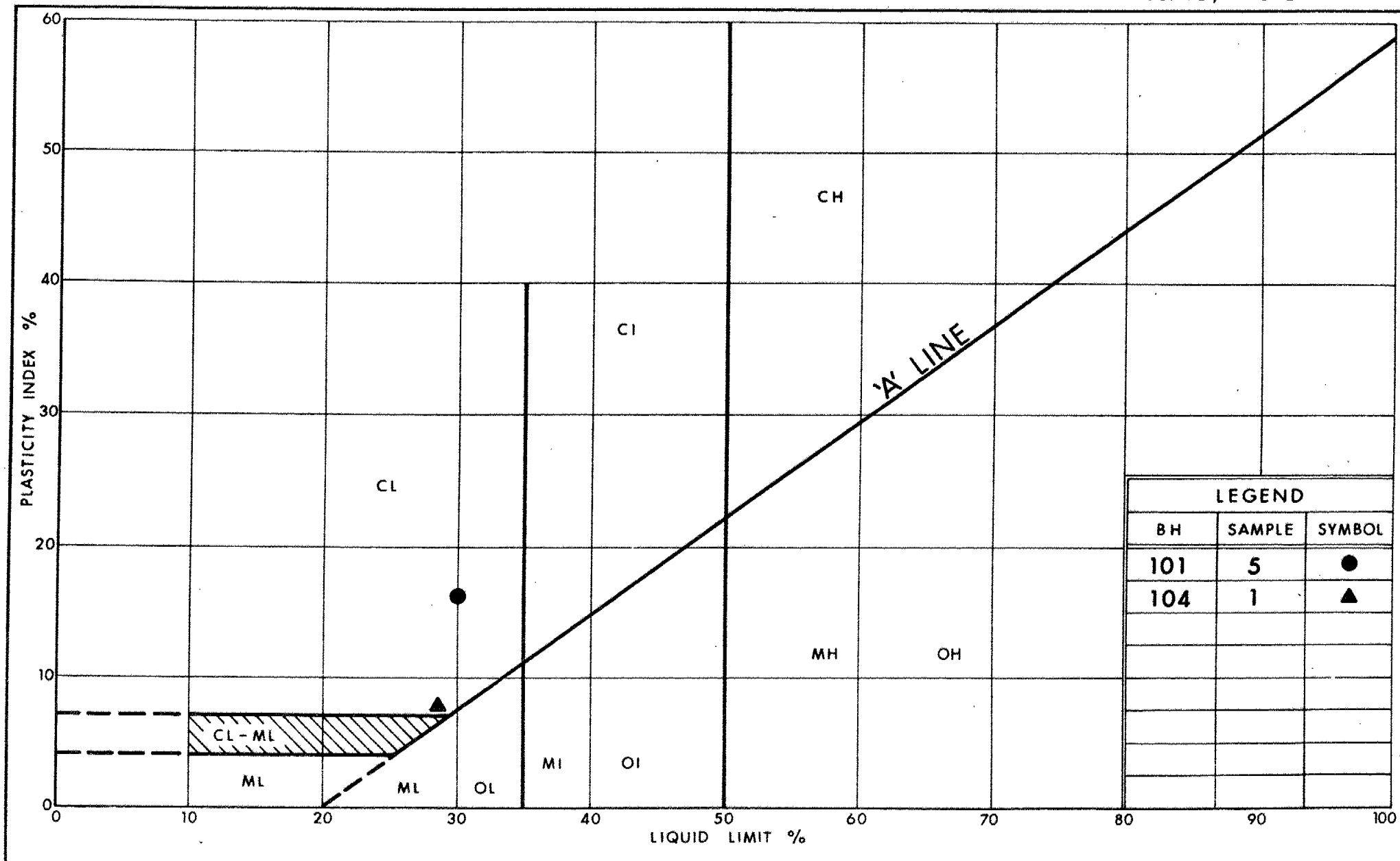
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION FILL

SILTY CLAY, SOME SAND, TRACE GRAVEL

FIG No 2

W P 103-69-16



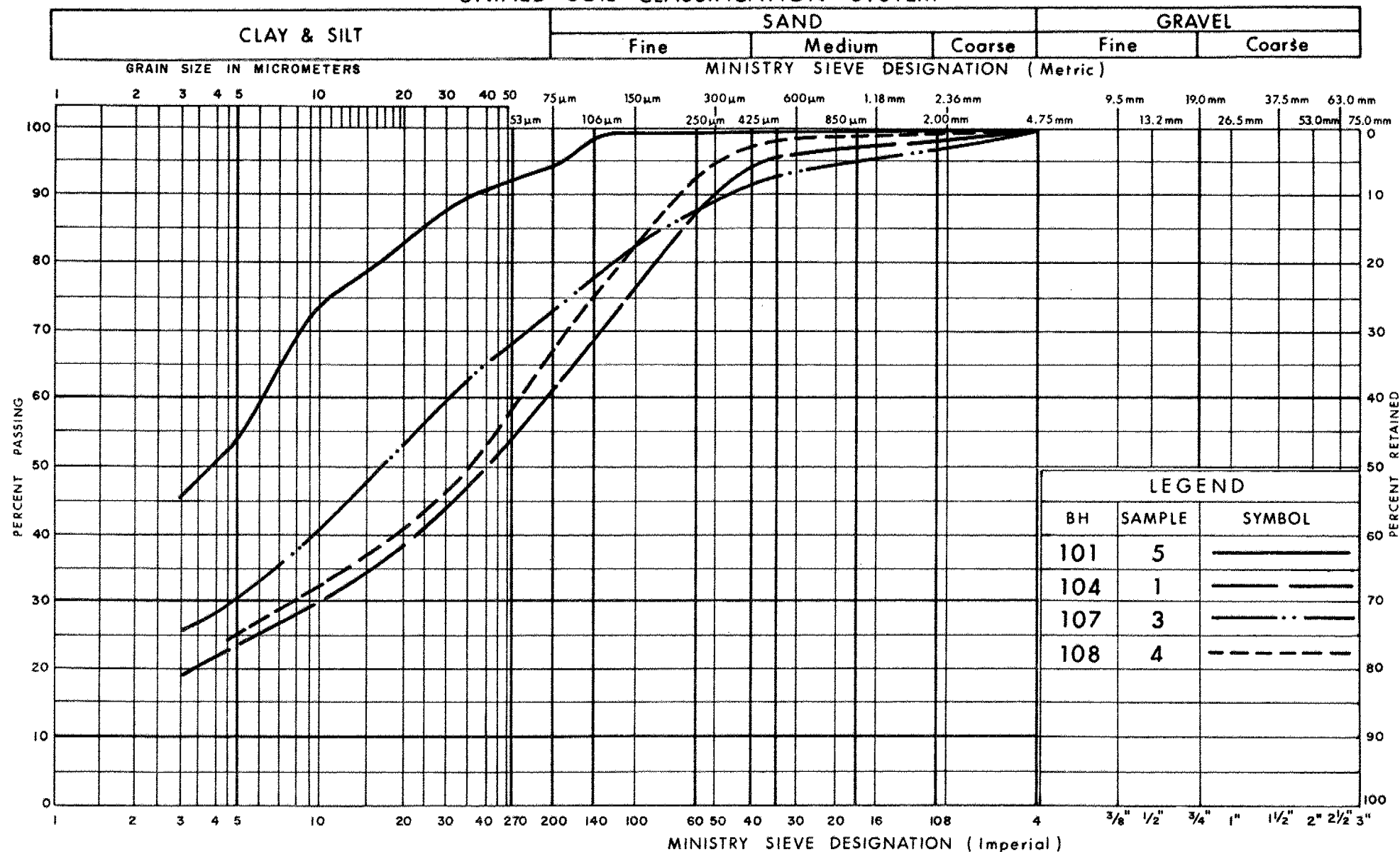
Ministry of
Transportation and
Communications

PLASTICITY CHART SILTY CLAY, TRACE TO WITH SAND

FIG No 3

W P 103-69-16

UNIFIED SOIL CLASSIFICATION SYSTEM



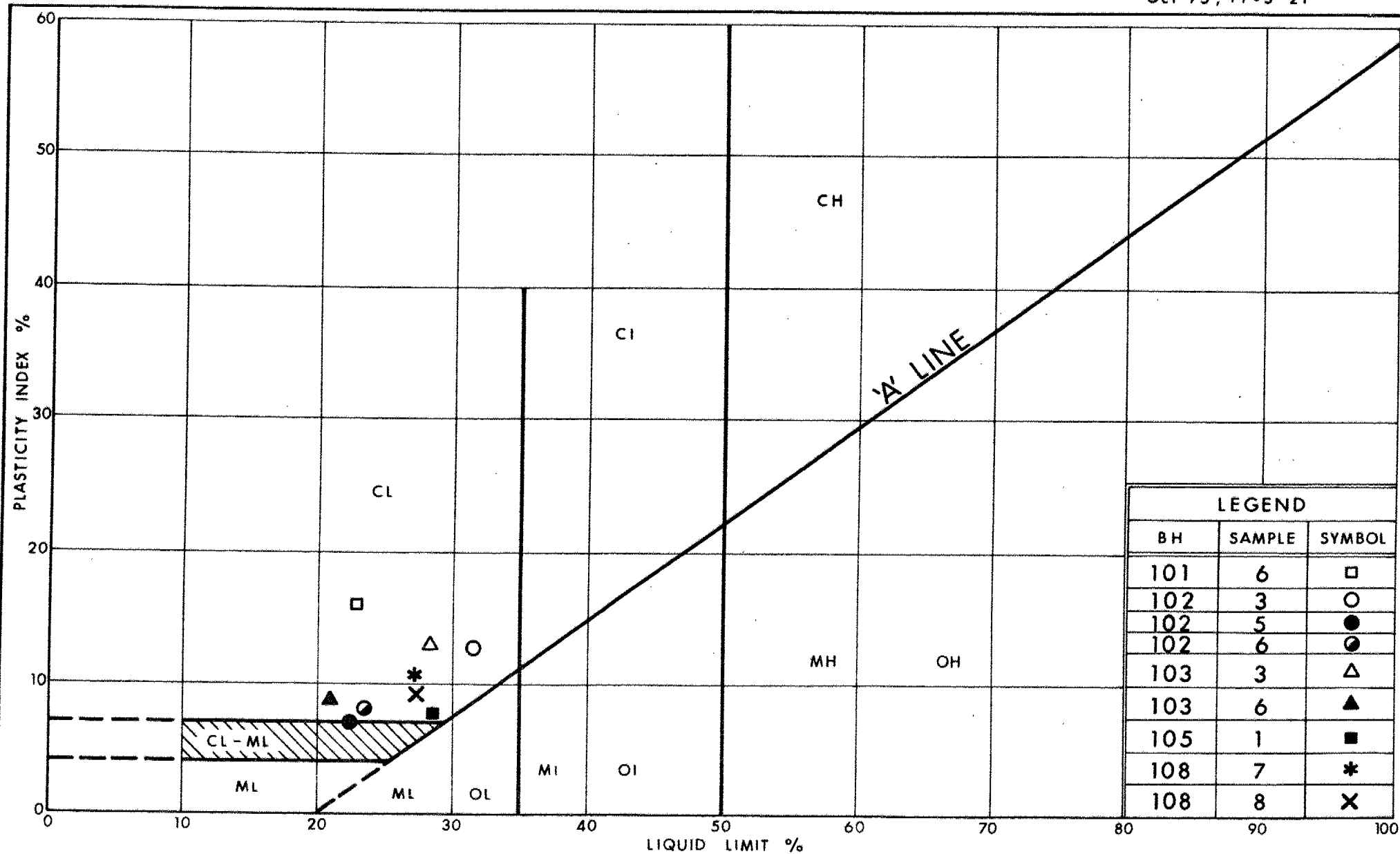
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

SILTY CLAY, TRACE TO WITH SAND

FIG No 4

W P 103-69-16



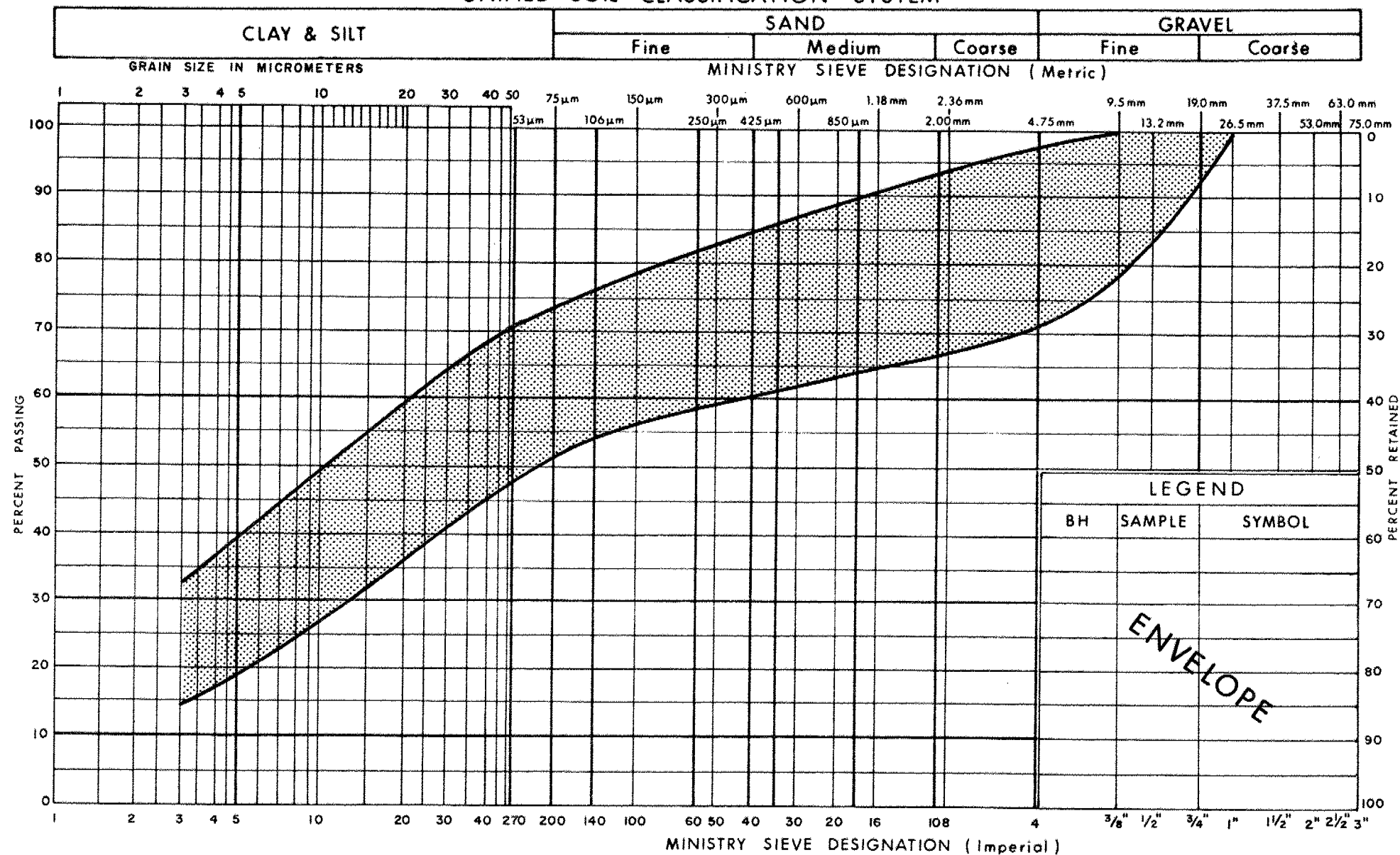
Ministry of
Transportation and
Communications

PLASTICITY CHART
HET MIXTURE OF
SILTY CLAY, SAND, GRAVEL (Glacial Till)

FIG No 5

W P 103-69-16

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
 HET MIXTURE OF
 SILTY CLAY, SAND, GRAVEL (Glacial Till)

FIG No 6

W P 103-69-16

DESCRIPTION OF ROCK CORE - W.P. 103-69-16

BOREHOLE NUMBER				CORE DESCRIPTION	
	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
103	9.1 -10.67	100	58	9.14-10.67	SHALE (75%), grey, slightly weathered to unweathered, closely spaced joints, with LIMESTONE (25%) layers 2.5 to 15 cm thick
104	2.04- 3.54	93	53	2.04- 2.29	SHALE (75%), grey, slightly to moderately weathered, very closely spaced joints, with LIMESTONE (25%) layer 7.5 cm thick
	3.54- 5.03	100	80	2.29- 5.03	SHALE (90%) grey, slightly weathered, closely spaced joints, with LIMESTONE (10%) layers 2.5 to 10 cm thick
105	3.26- 4.92	92	45	3.26- 4.91	SHALE (80%), grey, slightly weathered, closely spaced joints, with LIMESTONE (20%) layers 2.5 to 5 cm thick
106	3.32- 3.47	100	0	3.32- 6.08	SHALE (75%), grey, slightly weathered to unweathered, closely to medium spaced joints, with LIMESTONE (25%) 2.5 to 15 cm thick
	3.47- 5.00	100	48		
	5.00- 6.08	90	57		

* CR= CORE RECOVERY ; RQD = ROCK QUALITY DESIGNATION

FOUNDATION INVESTIGATION REPORT
for
N.B.L. Structure Widening
Hwy. #410
W.P. 103-69-17; Site No. 24-81-313
District 6, Toronto

INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation carried out at the above-mentioned site on 86 02 01. The fieldwork consisted of 1 borehole (BH 109) advanced by means of B-casing and augering from a portable tripod drill machine. The depth of this borehole extended 2.7 m below the existing ground surface.

In 1976 a foundation investigation was carried out for the existing NBL structure. The investigation consisted of 12 sampled boreholes (BH 1 - BH 12). The location of the boreholes pertinent to this specific project (BH 1-6, 11, 12) are shown on DWG 1036917-A.**The log sheets for these boreholes are also included in the Appendix. The information on these log sheets is provided for reference only and is not used in the description of the subsurface conditions at this site.

SITE DESCRIPTION

The site is located on Hwy. 410 approximately 1.5 km south of Steeles Ave. at Etobicoke Creek. The site is situated in the City of Brampton, Regional Municipality of Peel.

Land use in the vicinity of the site is predominantly agricultural.

The site is located in the physiographic region known as the "Peel Plain", as described in The Physiography of Southern Ontario (Chapman and Putnam, 1984). The deposit characterizing this area consists of a cohesive glacial till deposit underlain by shale bedrock of the Georgian Bay Formation (formerly known as the Meaford-Dundas formation), Ordovician Period. The area under investigation is drained by Etobicoke Creek.

**NOTE: Refer to Drawing No. 2 of the Contract Drawings.

SUBSURFACE CONDITIONS

General

The predominant material across this site is a glacial deposit described as a heterogeneous mixture of silty clay, sand, gravel. This cohesive deposit is underlain by Shale bedrock of the Georgian Bay formation. Other deposits such as silty clay, sand with silt, and sand and gravel were, however, encountered within this river valley.

The boundaries between the subsoil types, insitu and laboratory test results, as well as groundwater levels are shown on the Record of Borehole Sheets in the Appendix. The location of each borehole is shown in plan on DWG No. 1036917-A* together with a longitudinal stratigraphical section.

The various soils encountered at this site, and specifically at BH 109 are described as follows:

Borehole BH 109

Extending from the ground surface (Elev. 191.2) down to a depth of 1.4 m is a deposit of silty clay, some sand, trace gravel. Based on visual observation, this cohesive material can be described as a silty clay of low plasticity (CL group on the Atterberg chart). Based on the interpretation of a 'N' value of 9 blows/0.3 m, this material can be considered to have a stiff consistency.

Underlying this material is a 0.7 m thick deposit characteristic of this site: hard glacial till composed of a heterogeneous mixture of silty clay, sand, gravel. The cohesive silty clay matrix of this material can be described as a silty clay of low plasticity (CL group on the Atterberg chart). Based on visual observation, this material is composed of approximately 15% gravel, 25% sand, and 60% silt and clay. The thickness of this deposit varies appreciably across the site.

* NOTE: Refer to Drawing No. 2 of the Contract Drawings.

At approximately Elev. 189.1, bedrock was encountered at this location. The bedrock was highly weathered in the upper 0.6 m as evidenced by the fact that it was easily augered, and split-spoon samples were obtained.

Other

- . Subsequent to the investigation of 1976, fill material was placed at the south end of this site to form the approach fill. The fill material which is encountered is in the order of 3 m high and consists of a silty clay of low plasticity, some sand, trace gravel. In addition, the site is covered with a veneer of organic topsoil in the order of 150 mm or more.
- . It should be noted that all non-cohesive soils across this site will experience "boiling" when subjected to an unbalanced hydrostatic pressure.
- . For additional information on the soils across this site reference should be made to the various Record of Borehole sheets in the Appendix.

Groundwater Conditions

The groundwater level was not established in BH 109. However, in the 1976 investigation the following levels were obtained:

<u>BH #</u>	<u>GWL Elev.</u>
1	186.5
2	186.3
3	186.4
4	186.3
5	186.2
6	186.3
11	185.7

On 85 12 03 the water level in the creek at this site was found at Elev. 186.2. On 85 05 06 the water level in the creek at this site was found to be at Elev. 185.6.

Miscellaneous

The fieldwork for this investigation was carried out under the supervision of F. Saccon, Project Foundations Engineer, utilizing equipment owned and operated by Atcost Drilling Inc., of Concord, Ontario. This report was prepared by L. Politano, Project Foundations Engineer and reviewed by M. Devata, Chief Foundations Engineer (East).



D. H. Dundas

D. H. Dundas, P. Eng
Sr. Foundations Engineer

M. Devata

M. Devata, P. Eng.
Chief Foundations Engineer
East

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 885.2; E 288 337.5 ORIGINATED BY V.K.
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and COMPILED BY V.K.
 DATUM Geodetic DATE 76 04 30 Cone Test Checked CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
186.8	Ground Level											
0.0	Silty Clay with Sand and Gravel (Glacial Till)											
185.9	Gravel with Silty Sand and trace Clay		1	SS	19							61 28 (11)
185.3	Compact		2	BXL	REC 6%							
1.5	weathered		3	BXL	REC 8%							
	Bedrock		4	BXL	REC 10%							
	Grey Shale with occ. layers of Limestone											
	Sound											
182.0	End of Borehole											
4.8												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 890.7; E 288 354.5 ORIGINATED BY V.K.
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and COMPILED BY V.K.
 DATUM Geodetic DATE 76 04 29 Cone Test ✓ CHECKED BY EP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
187.0	Ground Level										
0.0	Silty Sand with Gravel Trace Clay Compact		1	SS	19		186				37 46 (17)
185.6	1.4 <u>weathered</u> BEDROCK Grey Shale with occ. layers of Limestone		2	BXL	REC 50%		185				
183.5	Sound		3	BXL	REC 100%		184				
3.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

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

RECORD OF BOREHOLE No 3

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 915.7; E 288 346.0 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and BXL Rock Core COMPILED BY V.K.
DATUM Geodetic DATE 76 05 05 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
186.5	Ground Level																
0.0	Gravel with Shale fragments																
185.5																	
1.0																	
	BEDROCK																
	Grey Shale with occ. layers of Limestone		1	BXL	REC	100%											
			2	BXL	REC	100%											
182.5	Sound																
4.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 911.4; E 288 331.7 ORIGINATED BY V.K.
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and BXL Rock Core COMPILED BY V.K.
 DATUM Geodetic DATE 76 05 04 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60					
186.3	Ground Level														
0.0	Gravel with Shale fragments														
185.5															
0.8	BEDROCK Grey Shale with occasional layers of Limestone		1	BXL	REC 100%										
	Sound		2	BXL	REC 100%										
182.6															
3.7	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 5

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 888.5; E 288 371.6 ORIGINATED BY V.K.
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core and COMPILED BY V.K.
 DATUM Geodetic DATE 76 04 29 Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
187.4	Ground Level												
0.0	Silty Sand with traces of Gravel, Clay Loose		1	SS	8								10 40 43 7
185.7	--- weathered		2	BXL	REC 80%								
1.7	BEDROCK												
	Grey Shale with occasional layers of Limestone		3	BXL	REC 90%								
	Sound		4	BXL	REC 100%								
182.4	End of Borehole												
5.0													

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 6

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 836 914.4; E 288 363.1 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing and NXL Rock Core COMPILED BY V.K.
DATUM Geodetic DATE 76 05 04 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT Wp W WL			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%)				
186.3	Ground Level						186										
0.0	Gravel with Shale fragments																
185.5																	
0.8																	
	BEDROCK																
	Grey Shale with occasional layers of Limestone		1	NXL	REC 100%		185										
	Sound		2	NXL	REC 100%		184										
182.5							183										
3.8	End of Borehole																

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

RECORD OF BOREHOLE No 11

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 851.3; E 288 343.8 ORIGINATED BY V.K.
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core and COMPILED BY O.Y.
 DATUM Geodetic DATE 76 06 25 Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES								
187.7	Ground Level												
0.0	Silty Sand with Gravel, Trace Clay												
	Compact												
185.8			1	SS	14								38 24 28 10
1.8	Silty Clay, Sand and Gravel (Glacial Till)												
	Stiff to Hard												
184.5			2	SS	100	15 cm							
3.2	--- weathered												
	Bedrock-Grey Shale with occasional layers of Limestone												
	Stone		3	BXL	REC 100%								
182.6													
5.1	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 12

METRIC

W P 103-69-09 LOCATION CO-ORDS. N 4 836 941.9; E 288 335.6 ORIGINATED BY V.K.
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE 76 07 30 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ ORG. CONT.	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES						
196.9	Ground Level					*					
0.0	Silty Sand, Trace Organics										
	Loose		1	SS	5					1.2%	0 68 31 1
195.4	Silty Clay, Sand and Gravel (Glacial Till)		2	SS	21						0 10 57 33
1.5			3	SS	26						0 13 47 40
			4	SS	20						2 15 41 42
			5	SS	23						
			6	SS	125						18 24 40 18
	Brown Grey										
	Very Stiff										
188.8			7	SS	100/	15 cm					
8.1	Shale Bedrock		8	BXL	REC 85%						
187.8											
9.1	End of Borehole										
	* Ground water level not established										

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 109

METRIC

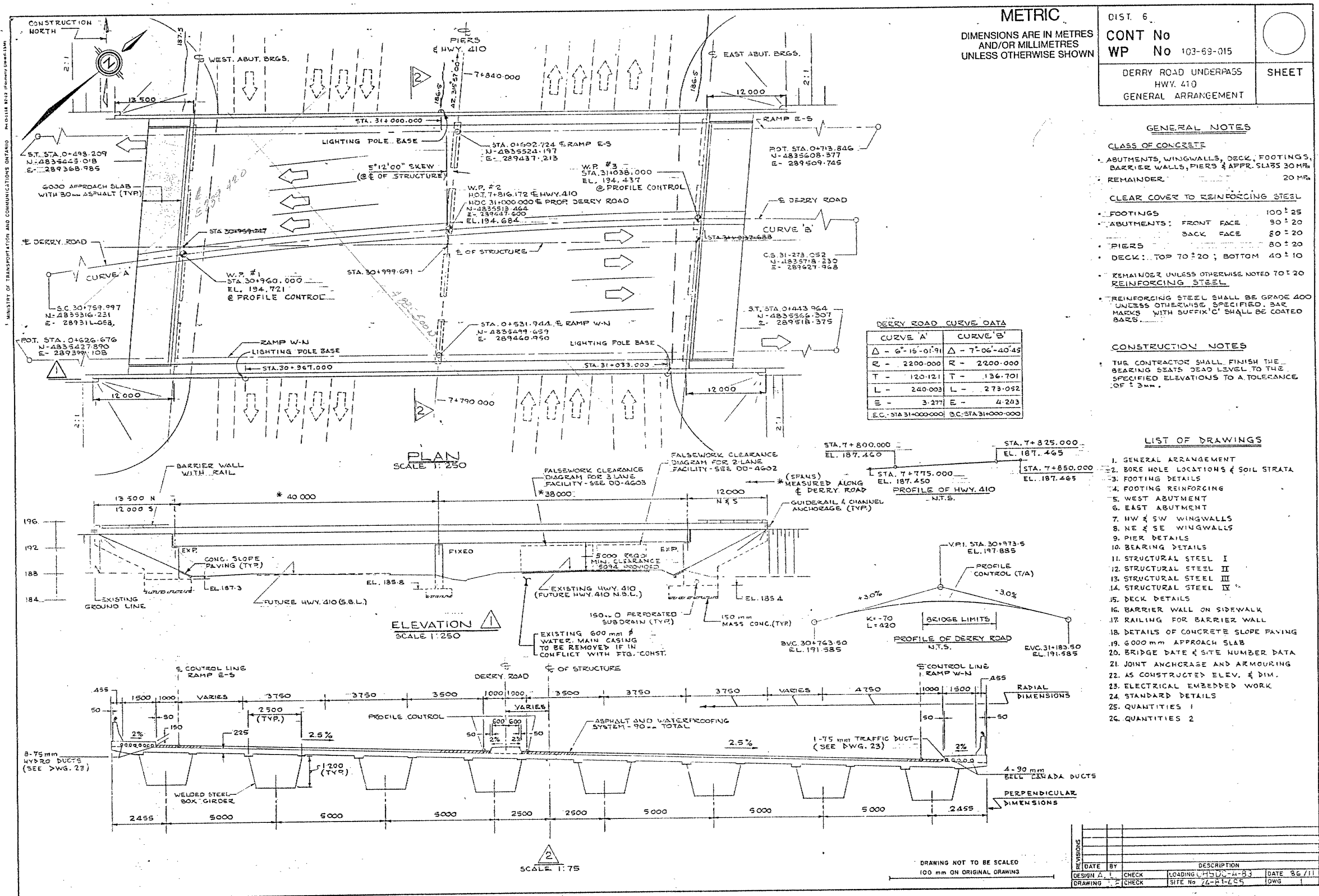
W P 103-69-17 LOCATION CO-ORDS: N 4 836 927.8; E 288 349.2 ORIGINATED BY F.S.
 DIST 6 HWY 410 BOREHOLE TYPE (Portable Tripod) B Casing COMPILED BY L.P.
 DATUM Geodetic DATE 86 02 01 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
191.2	Ground Surface																
0.0	Topsoil					*	191										
	Silty Clay, Trace Sand, Gravel																
189.8	Stiff		1	SS	9		190										
1.4	Heterogeneous Mixture of Silty Clay, Sand, Gravel		2	SS	46												
189.1	(Glacial Till) Hard																
2.1	Shale Bedrock		3	SS	90/15 cm		189										
188.5	Weathered		4	SS	100/10 cm												
2.7	End of Borehole																
	* Groundwater level not established																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DIST. 6	CONT No	SHEET
WP	No 103-69-015	
DERRY ROAD UNDERPASS HWY. 410 GENERAL ARRANGEMENT		

GENERAL NOTES

- CLASS OF CONCRETE
- ABUTMENTS, WINGWALLS, DECK, FOOTINGS, BARRIER WALLS, PIERS & APPRO. SLABS 30 MPa
 - REMAINDER 20 MPa
- CLEAR COVER TO REINFORCING STEEL
- FOOTINGS 100 ± 25
 - ABUTMENTS: FRONT FACE 90 ± 20
BACK FACE 80 ± 20
 - PIERS 80 ± 20
 - DECK: TOP 70 ± 20; BOTTOM 40 ± 10
- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BARS MARKS WITH SUFFIX 'C' SHALL BE COATED BARS.

CONSTRUCTION NOTES

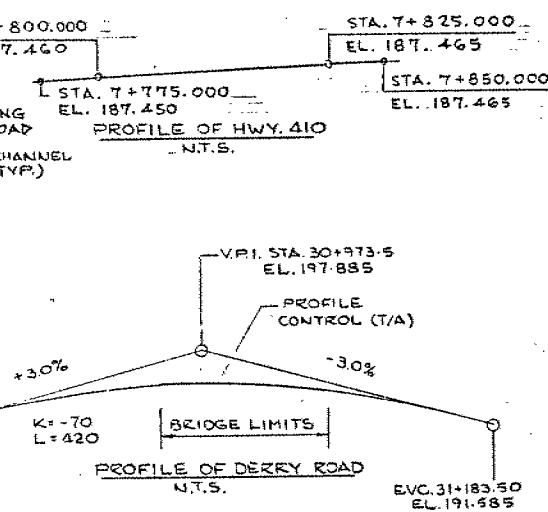
- THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3mm.

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BORE HOLE LOCATIONS & SOIL STRATA
3. FOOTING DETAILS
4. FOOTING REINFORCING
5. WEST ABUTMENT
6. EAST ABUTMENT
7. NW & SW WINGWALLS
8. NE & SE WINGWALLS
9. PIER DETAILS
10. BEARING DETAILS
11. STRUCTURAL STEEL I
12. STRUCTURAL STEEL II
13. STRUCTURAL STEEL III
14. STRUCTURAL STEEL IV
15. DECK DETAILS
16. BARRIER WALL ON SIDEWALK
17. RAILING FOR BARRIER WALL
18. DETAILS OF CONCRETE SLOPE PAVING
19. 6000 mm APPROACH SLAB
20. BRIDGE DATA & SITE NUMBER DATA
21. JOINT ANCHORAGE AND ARMOURING
22. AS CONSTRUCTED ELEV. & DIM.
23. ELECTRICAL EMBEDDED WORK
24. STANDARD DETAILS
25. QUANTITIES 1
26. QUANTITIES 2

DERRY ROAD CURVE DATA

CURVE A	CURVE B
$\Delta = 6^{\circ}15'01.91''$	$\Delta = 7^{\circ}06'40.45''$
$R = 2200.000$	$R = 2200.000$
$T = 120.121$	$T = 136.701$
$L = 240.003$	$L = 273.052$
$E = 3.277$	$E = 4.243$
E.C. STA 31+000.000	B.C. STA 31+000.000



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN A	CHECK	LOADING HSDC-A-83	DATE 86/11
DRAWING	CHECK	SITE No 76-A1-LCS	OWG

METRIC

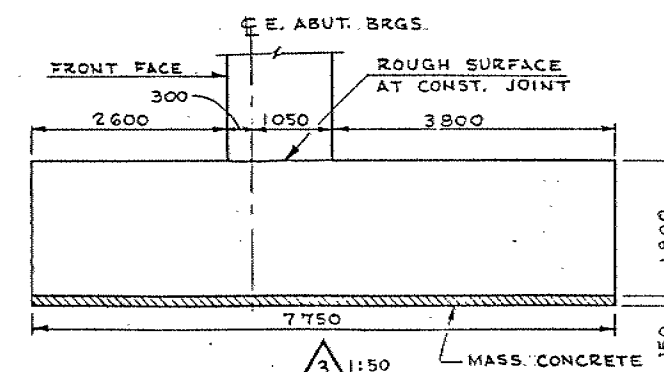
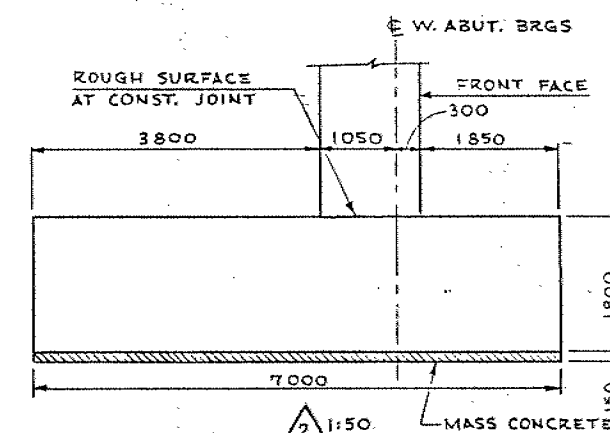
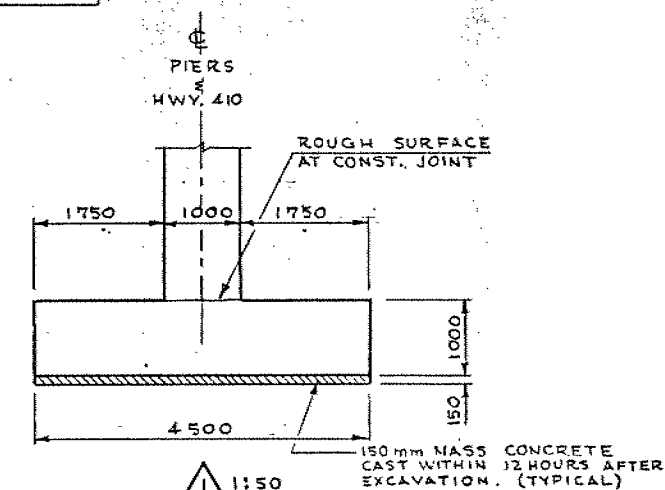
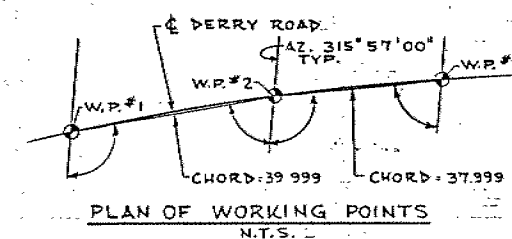
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
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DIST. 6
CONT No
WP No 103-69-015
DERRY ROAD UNDERPASS
HWY. 410
FOOTING DETAILS



SHEET

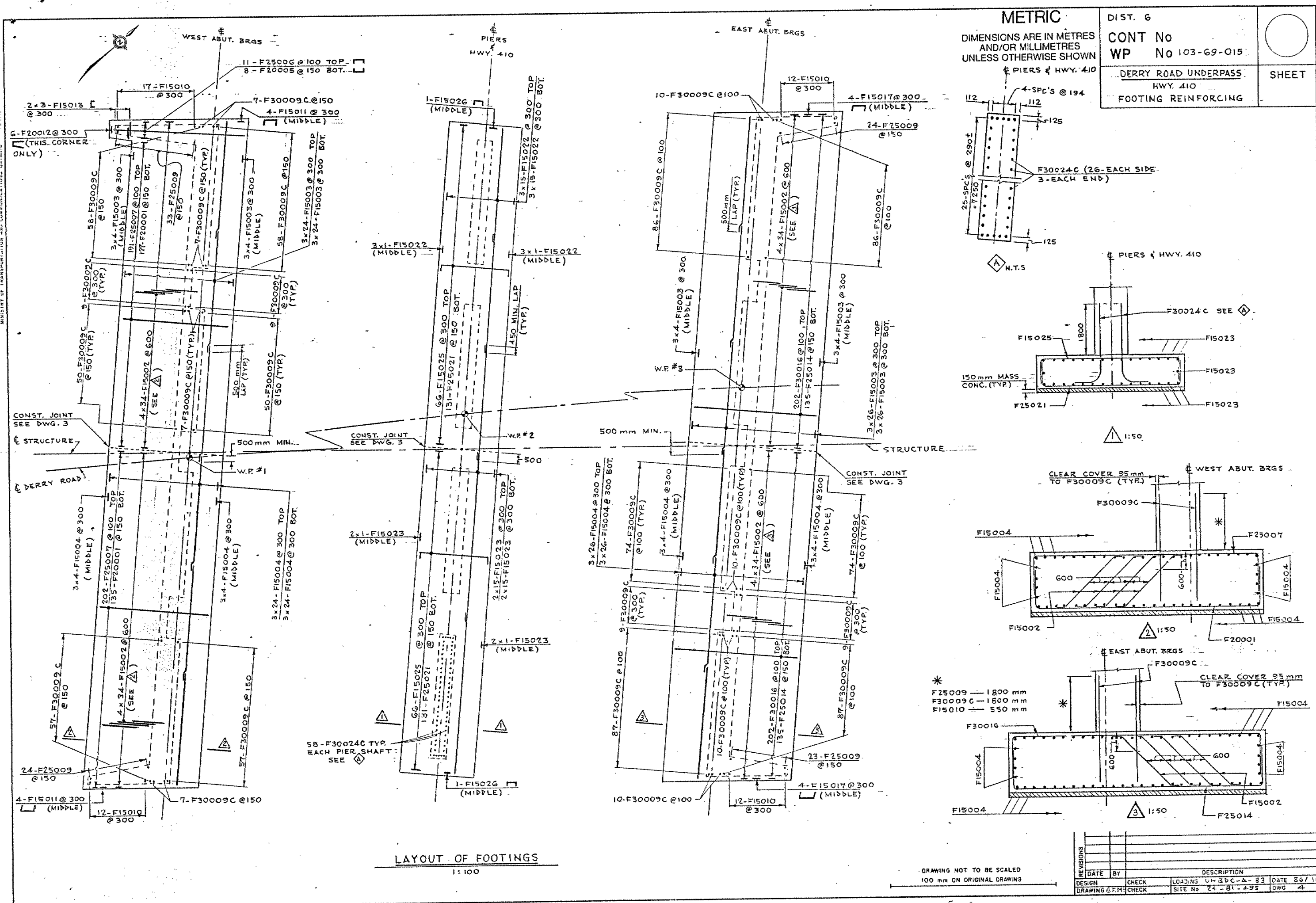
TABLE OF CO-ORDINATES		
	NORTH	EAST
①	4835 496.221	289 409.271
②	4835	289
③	4835 467.480	289 437.054
④	4835 525.457	289 436.006
⑤	4835	289
⑥	4835 498.405	289 482.158
⑦	4835 554.951	289 459.776
⑧	4835	289
⑨	4835 526.211	289 487.659
W.P. #1	4835 481.645	289 423.361
W.P. #2	4835 513.464	289 447.600
W.P. #3	4835 543.279	289 471.159



LAYOUT OF FOOTINGS
1:100

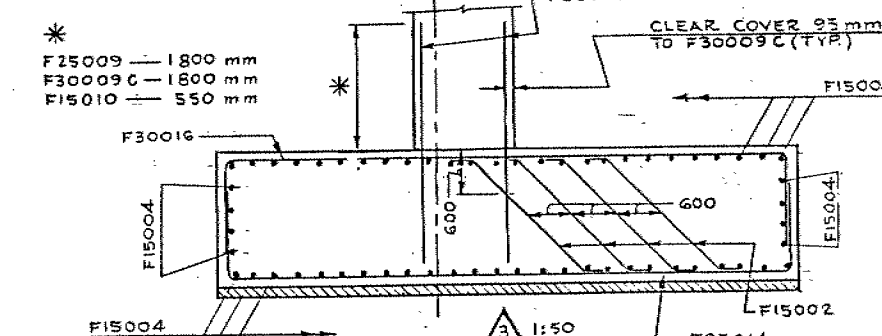
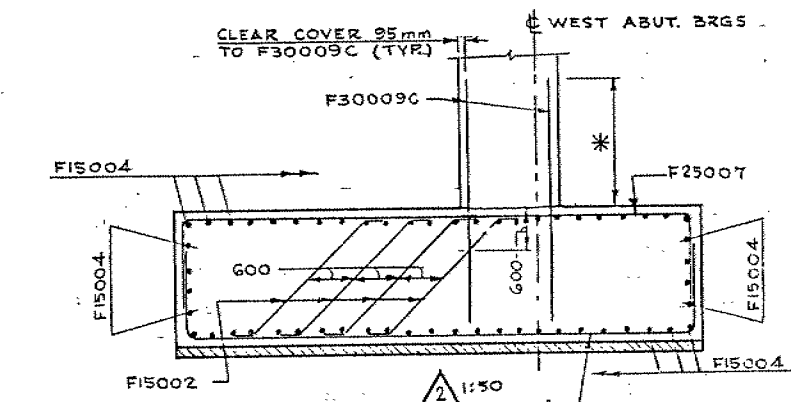
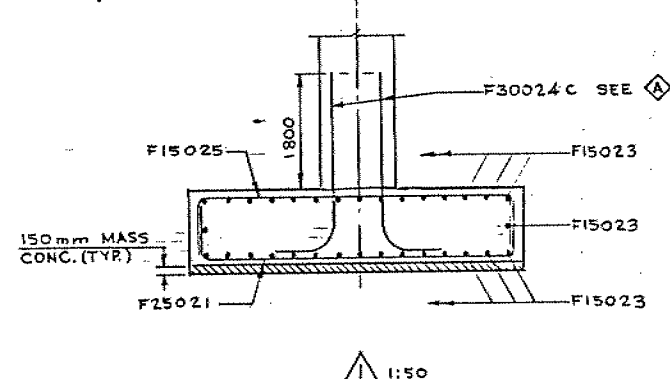
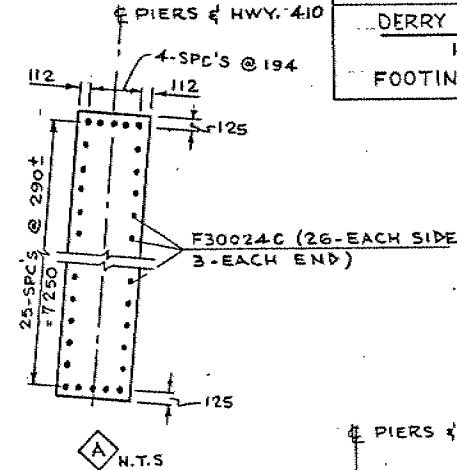
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN			LOADING CHS-C-A-B3 DATE 86/11
DRAWING			SITE No 24-81-495 DWG 3



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DIST. 6	CONT No	DERRY ROAD UNDERPASS HWY. 410 FOOTING REINFORCING	SHEET
	WP No 103-69-015		



- * F25009 - 1800 mm
- * F30009C - 1800 mm
- * F15010 - 550 mm

LAYOUT OF FOOTINGS
1:100

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	CHECK	LOADING	CH-3DC-A-83
DRAWING	CHECK	SITE No	24-81-495

T11038

CONT. #
87-75

REPORT TO

MINISTRY OF TRANSPORTATION
AND COMMUNICATIONS
DOWNSVIEW ONTARIO

FOUNDATION INVESTIGATION
PROPOSED HIGHWAY 410-DERRY ROAD UNDERPASS
MISSISSAUGA ONTARIO
W.P. 103-69-15

Distribution:

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January, 1986

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ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

W.P. 103-69-15 DIST 6

PROPOSED HIGHWAY 410-DERRY ROAD UNDERPASS
FOUNDATION INVESTIGATION AND DESIGN REPORT

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DATE

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APPENDIX I

Record of Boreholes

APPENDIX II

- Figure 1 Grain Size Distribution
Heterogeneous Mixture of Silty Clay,
Sand and Gravel (Glacial Till)
- Figure 2 Grain Size Distribution
Gravelly Sand, Trace Silt
- Figure 3 Plasticity Chart
Heterogeneous Mixture of Silty Clay,
Sand and Gravel (Glacial Till)
- Figure 4 Abutment on Compacted Fill
Showing Granular "A" Core

DRAWING (At rear of report)
1036915-A

1.0 INTRODUCTION

Geocon Inc. has been retained by the Ontario Ministry of Transportation and Communications to carry out a geotechnical investigation at the site of the proposed interchange for Highway 410 at Derry Road as part of the continuing programme of construction of Highway 410. At the present time the Derry Road Underpass is proposed as a two span structure. The investigation for the structure has been carried out under the technical direction of Mr. M.S. Devata, Chief Foundations Engineer, Ministry of Transportation and Communications. The work was carried out in accordance with our proposal, dated December 4, 1985.

The purpose of the investigation was to obtain subsurface information for use in design and construction of foundations for abutments and piers to support the proposed Highway 410 and Derry Road structure and approach fills.

2.0 PROCEDURE AND EQUIPMENT

A total of 13 boreholes were put down during this investigation. Three of the 13 boreholes, numbered BH1, BH2 and BH13, were located in the area of the approach fills and the remaining 10 boreholes were located in the proposed abutments and piers.

The field work for this investigation was carried out between December 4 and 11, 1985. A Bombardier mounted B-57 mobile power auger drill, equipped with hollow stem augers and BX rock coring equipment, was used to put down the boreholes. The drill equipment and two operators were provided by Master Soil Investigations Limited.

Boreholes BH5, BH8, BH11 and BH13 were terminated at depths of 9.6 to 15.2 metres, after penetrating shale bedrock for lengths of 0.5 to 3.0 metres. The remaining boreholes were terminated within the overburden at depths of 9.3 to 11.7 metres below existing grade.

Samples were recovered within the overburden and weathered shale bedrock in conjunction with the Standard Penetration Test, at intervals of not greater than 1.5 metres.

The underlying bedrock was cored in BX nominal size for a depth of 1.5 metres in Borehole 8. The recovered core was examined to determine percent recovery, Rock Quality Designation (R.Q.D.) and bedrock condition.

Perforated plastic standpipes were installed within the bedrock stratum in Boreholes 5 and 8 and within the till stratum in Borehole 11. Water levels were monitored from ground surface throughout the period of the field programme with final water levels taken on December 17, 1985.

The recovered samples were transported to our Toronto Soil Mechanics Laboratory for detailed examination and testing. The samples remaining after testing will be stored until December, 1986 at which time they will be disposed of unless instructed otherwise.

The borings were located in the field by Geocon personnel by chaining from the centreline stakes placed in the field for the proposed structure. The borings of this investigation were put down from 0 to 18 metres from the proposed new Derry Road centreline alignment. Boring elevations were determined by an elevation survey utilizing a local bench mark (HCP No. 661029). All borehole locations and elevations are indicated on the drawing included in this report.

3.0 SITE AND GEOLOGY

The proposed Derry Road underpass is located within the City of Mississauga in the Municipality of Peel. The site is located just north of the present Highway 410 and Derry Road interchange.

The area under investigation is drained by Etobicoke Creek and its tributaries.

The site is located in the physiographic region known as the "Peel Plain". The deposits characterizing the area consist of cohesive glacial till underlain by shale bedrock of the Meaford-Dundas formation, Ordovician Period.

4.0 SUBSURFACE CONDITIONS

The site is generally covered with 9.1 to 12.3 metres of overburden overlying weathered shale and sound shale of the Meaford-Dundas Formation.

Reference should be made to the Records of Boreholes included in Appendix I of this report as well as to the drawing (Dwg. No. 1036915-A) located at the rear of this report.

The subsurface groundwater and soil conditions are described in detail in the following sections.

4.1 Glacial Till - Silty Clay, some Sand and a Trace of Gravel

Underlying a 300 mm thick fill zone in Borehole 10 and a 50 to 460 mm thick topsoil zone in the remainder of the borings, a stratum consisting of a heterogeneous mixture of brown to grey silty clay, sand and gravel, was encountered in all locations. The thickness of this glacial till deposit where penetrated fully ranged from 8.8 to 12.2 metres.

Standard Penetration Tests carried out within the stratum yielded "N" values ranging from 19 to over 100 blows per 0.30 metres. The "N" values were generally all over 30 except for those near the ground surface, which indicates the soil is generally of a very stiff to hard consistency.

Grain size distribution analyses, carried out on six samples of the stratum, yielded the following results.

<u>Borehole Number</u>	<u>Sample Number</u>	<u>% Gravel</u>	<u>% Sand</u>	<u>% Silt</u>	<u>% Clay</u>
3	4	2	20	56	22
3	7	5	29	46	20
8	5	5	33	44	18
8	8	7	39	50	4
11	3	1	21	57	21
11	7	10	38	40	12

The results of these tests are shown as an envelope on Figure 1 in Appendix II.

The grain size distribution varies throughout the stratum however in general the soil is described as a silty clay, some sand with a trace of gravel.

Two Atterberg Limit Tests carried out on the minus 425 μ portion of representative samples of the stratum yielded the following results:

<u>Borehole Number</u>	<u>Sample Number</u>	<u>Liquid Limit % w_L</u>	<u>Plastic Limit % w_p</u>	<u>Plasticity Index % I_p</u>	<u>Natural Moisture Content % w</u>
8	4	25.8	16.8	9.0	10.4
8	9	17.7	11.8	5.9	12.0

The results of these tests are plotted on the Plasticity Chart on Figure 3 in Appendix II. The soil is described as an inorganic silty clay of low plasticity.

Twenty six natural moisture content tests were carried out on representative samples yielding values ranging from 4.9 to 17.6 percent with an average of 10.0 percent.

A zone within the glacial till stratum containing a non-cohesive sand, gravel and silt was encountered in Boreholes 5, 9, 11 and 12. This stratum was found to be water bearing with a thickness up to 3.1 metres. Some low standard penetration test values were recorded in this zone, however this is believed to be caused by boiling sands from within this zone.

One grain size distribution analysis carried out on a representative sample from this stratum yielded the following results.

Borehole	Sample				
<u>Number</u>	<u>Number</u>	<u>% Gravel</u>	<u>% Sand</u>	<u>% Silt</u>	<u>% Clay</u>
9	8	28	68	4	0

The results of this test are plotted on Figure 2 in Appendix II of this report.

One natural moisture content test was carried out on a representative sample yielding a value of 20.5 percent.

4.2 Weathered Shale

Weathered dark grey shale was encountered underlying the silty clay, some sand and gravel in Boreholes 5, 8, 11 and 13. All other borings were terminated within the glacial till. The shale was penetrated to 1.6, 0.9 and 0.5 metres in Boreholes 5, 11 and 13 respectively and to a maximum depth of 3.0 metres in Borehole 8. The weathered shale was encountered at elevation 173.2 to 175.3 metres and was generally easily auger drilled. The rock quality improved with depth and was core drilled from elevation 172.9 to 171.4 metres in Borehole 8.

Standard Penetration Tests carried out within the stratum yielded "N" values generally greater than 100.

4.3 Groundwater Conditions

Groundwater levels determined during the investigation ranged from about elevation 184.6 to 185.7 metres and in some instances may not represent the stabilized groundwater level due to the relatively impermeable nature of the shale bedrock and glacial till. Groundwater levels should be expected to vary seasonally.

5.0 DISCUSSION AND RECOMMENDATIONS

It is understood that the Derry Road Underpass is proposed as a two span structure, with temporary abutments, which ultimately would be extended into a four span structure in the future. The proposed structure's spans range in width from about 30 to 40 metres and will be located slightly to the north of the existing Highway 410-Derry Road intersection. The earth fill approach ramps will rise to a maximum height of about 8 metres.

5.1 Proposed Bridge Structure

The silty clay glacial till at the site is a competent subsoil and thus the proposed piers can be supported on conventional spread footings founded within this stratum at or below the elevations indicated below. As discussed later, the founding level should be selected to provide sufficient earth cover for frost protection purposes. The spread foundations may be designed using a bearing capacity at the U.L.S. of 600 kPa. The bearing capacity at the S.L.S. Type II should be taken as 300 kPa for an estimated maximum differential settlement of 25 mm.

The foundation for the proposed abutments may be founded on undisturbed till using spread footings or on piles as discussed later. Spread footings should be founded at or below the elevations indicated below. For purposes of design, bearing capacities may be taken to be the same as those given above for pier foundations, with due consideration being given to the effects of eccentric loading.

<u>Location</u>	<u>Maximum Footing Elevation</u>	<u>Approximate Bedrock Elevation</u>	
West abutment	186.3 metres	176.0 m	
Pier 1	186.8 "	175.2 m	} STAGE I CONSTRUCTION
Pier 2	185.1 "	175.3 m	
Pier 3	184.4 "	173.5 m	
East abutment	184.16 "	173.2 m	

The permanent abutments could also be constructed within the approach fill and founded on piles deriving their support from the underlying glacial till. Spread foundations placed on compacted Granular "A" may be designed using a bearing capacity at the U.L.S. of 900 kPa and a bearing capacity at the S.L.S. of 350 kPa (see Figure 4 in Appendix II for typical foundation details).

A number of alternative types of end bearing piles could be considered such as steel H or tube piles equipped with standard M.T.C. reinforcement. Typical steel H type piles driven to positive end bearing in the weathered shale bedrock are tabulated below for purposes of illustrating pile bearing capacities. The approximate bedrock elevation is given in the preceding table at each pier and abutment location.

Pile Type	U.L.S. kN	S.L.S. kN
HP 310 x 110	1600	1150
HP 310 x 79	1150	800

If the abutments are supported on piles, consideration could be given to supporting the piers on piles using the above criteria. However the use of spread foundations for the piers and piles for the abutments is considered to be a satisfactory foundation alternative from a geotechnical standpoint. It is recommended that all lateral loads on the abutments be resisted by battered piles.

5.2 Approach Fill

The approach fills to the east and west abutments of the proposed structure may be constructed following removal of the surficial topsoil and fill of about 0.1 to 1.1 metres in thickness. It is recommended that the surface

of the till exposed after topsoil stripping be proofrolled and that weak zones identified during proofrolling be removed and replaced with well compacted granular fill. If scheduling permits the embankment should be constructed 6 months prior to completion of the roadbed to allow for initial consolidation of the underlying soil to take place thereby minimizing differential settlement between the structure and the roadbed.

The structure approach fills will settle up to about 40 mm as consolidation of the underlying strata takes place. About 90 percent of this settlement would be expected to occur during the first six months following construction of the embankment.

The very stiff to hard till is considered a suitable subsoil on which to construct embankments of non frost susceptible granular materials with side slopes of up to 2H:1V. The overall stability of the embankments of up to 8 metres in height, constructed with the above side slopes, is considered to be acceptable.

5.3 General Design and Construction Considerations

Spread footings and pile caps subject to frost action should be provided with at least 1.2 metres of earth cover or equivalent for frost protection.

All topsoil and fill within the limits of the approach fills should be removed.

The pattern of penetration resistance should be recorded particularly during final set to confirm positive end bearing in the bedrock.

It is also recommended that the allowable pile load be confirmed by load testing.

Backfill to structures should consist of granular material in accordance with MTC Standard Special Provision #121 (83-10). Computation of earth pressures should be in accordance with Section 6.6.1.2. of the O.H.B.D.C. For design purposes, the physical properties of the backfill are as follows:

<u>Material</u>	<u>ϕ</u>	<u>γ</u>
Gran. "A"	35 degrees	22.0 kN/m ³
Gran. "B"	30 degrees	21.2 kN/m ³

Active conditions (k_A) apply

Construction of spread footings will require excavation of the fill and till strata below the groundwater level. The till stratum is considered susceptible to disturbance under the effects of seepage pressures, ponded water and construction traffic. It is therefore recommended that filter equipped sumps be provided to maintain the water level below excavation level. It is also recommended that a 150 mm mud mat of lean concrete be placed on the surface of the till within 6 hours of exposure of the final excavation level. The maximum anticipated footing excavation is less than 2 metres. Considering the depth and nature of the till, temporary slopes of the excavation can be cut at near vertical.

Sliding resistance between the concrete and hard glacial till can be taken as 75 kPa.

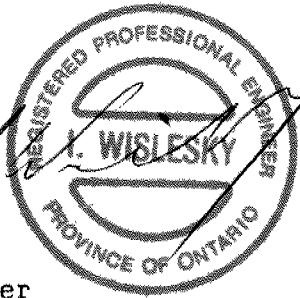
Backfill around pier foundations and for abutment construction should consist of well compacted, non-frost susceptible free draining granular fill. In the case of the abutments, suitable drainage measures should be incorporated in the backfill.

6.0 CLOSURE

The field work for this investigation was carried out under the direction of Mr. I. Wislesky, P.Eng. This report was written by Mr. I. Wislesky, P.Eng. and reviewed by Dr. B. Iyer, P.Eng.

We trust this report contains sufficient detail for your purposes. Should you require elaboration on any of the above please do not hesitate to contact us.

Yours very truly,
GEOCON INC.



I. Wislesky, P.Eng.
Geotechnical Engineer

A handwritten signature in cursive script, appearing to read "B. Iyer", written over a horizontal line.

Dr. B. Iyer, P.Eng.
Project Manager

IW:bg
T11038/43278

APPENDIX I

RECORD OF BOREHOLES

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 475 J IMPACT ENERGY ON 'A' 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 (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_f	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

METRIC

W P 103-69-15 LOCATION Co-ords 4 835 300 N; 289 302 E. ORIGINATED BY IW
 DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
 DATUM Geodetic DATE 1985 12 05 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							WATER CONTENT (%)		
185.2	Ground Level																
0.0	Clayey silt, sand & organics. Soft to firm		1	SS	2	*	185										
184.1	Brown		2	SS	6		184										
1.1	Very stiff Heterogeneous mixture of silty clay, sand & gravel (Glacial till)		3	SS	27		183										
			4	SS	35		182										
	Hard		5	SS	83		181										
			6	SS	92		180										
	Brown		7	SS	80		179										
	Grey		8	SS	76		178										
			9	SS	46		177										
175.6							176										
9.6	End of Borehole																
	* Groundwater level not established																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 400 N; 289 365 E. ORIGINATED BY TW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 05 CHECKED BY *[Signature]*

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT	NUMBER	TYPE			20	40	60	80	100					
189.0	Ground Level															
0.0 188.7 0.3	Topsoil		1	SS	8	*										
	Stiff to very stiff		2	SS	20											
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		3	SS	41											
	Hard		4	SS	46											
			5	SS	50											
	Brown Grey		6	SS	28											
	Very stiff		7	SS	25											
	Hard		8	SS	89											
179.6 9.4	End of Borehole		9	SS	117/0.23											
	* Groundwater level not established															

+3, x5 : Numbers refer to
Sensitivity

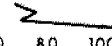
20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 3

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 448 N: 289 413.5 E ORIGINATED BY TW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEI
DATUM Geodetic DATE 1985 12 04 CHECKED BY /

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
188.0	Ground Level																
0.0	Topsoil																
187.7																	
0.3			1	SS	13		188										
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		2	SS	35		187										
	Hard		3	SS	36		186										
			4	SS	48		185										2 20 56 22
			5	SS	62		184										
			6	SS	59		183										
			7	SS	52		182										5 29 46 20
			8	SS	71		181										
							180										
178.7			9	SS	90/0.15		179										
9.3	End of Borehole * Groundwater level not established																



RECORD OF BOREHOLE No 4

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 470 N; 289 392 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 06 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.8	Ground Level																
0.0	Topsoil		1	SS	9	*											
187.3	Very stiff		2	SS	26		187										
0.5	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till)		3	SS	30		186										
	Hard		4	SS	56		185										
			5	SS	77		184										
	Brown Grey		6	SS	64		183										
			7	SS	59		182										
			8	SS	77		181										
			9	SS	100/0.10		180										
			10	SS	107		179										
	Frequent shale fragments		11	SS	88		178										
176.1	End of Borehole						177										
11.7	* Groundwater level not established																

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 5

METRIC

W P 103-69-15

LOCATION Co-ords. 4 835 470.5 N; 289 434 E.

ORIGINATED BY IW

DIST 6 HWY 410

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY AEL

DATUM Geodetic

DATE 1985 12 04

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
187.5	Ground Level																
0.0	Topsoil		1	SS	5		187										
187.2	Stiff to very stiff																
0.3			2	SS	22												
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		3	SS	41		186										
	Hard		4	SS	62		185										
			5	SS	101		184										
	Brown						183										
	Grey		6	SS	75/0.23		182										
			7	SS	71		181										
			8	SS	93/0.15		180										
							179										
178.4			9	SS	115/0.25		178										
9.1	Silty sand and gravel						177										
	Very dense		10	SS	60/0.08		176										
							175										
175.3			11	SS	95/0.25		174										
12.2	Shale bedrock																
	Weathered																
173.7			12	SS	100/0.08												
13.8	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 6

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 489 N; 289 416 E ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 04 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.5	Ground Level																
0.0	Topsoil (0.1)		1	SS	5	*	187										
	Soft to very stiff		2	SS	19		186										
	Heterogeneous mixture of silty clay, sand & gravel		3	SS	36		185										
	(Glacial Till)		4	SS	41		184										
	Hard		5	SS	60		183										
	Brown		6	SS	60		182										
	Grey		7	SS	50		181										
			8	SS	70/ 0.08		180										
			9	SS	105/ 0.28		179										
178.1	End of Borehole																
9.4	* Groundwater level not established																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 7

METRIC

W P 103-69-15

LOCATION Co-ords. 4 835 502.5 N; 289 456 E.

ORIGINATED BY IW

DIST 6 HWY 410

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY AEL

DATUM Geodetic

DATE 1985 12 06

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.0	Ground Level																
0.0																	
186.5	Topsoil		1	SS	5	*	187										
0.5																	
			2	SS	23		186										
	Very stiff		3	SS	22		185										
	Hard		4	SS	40		184										
	Heterogeneous mixture of silty clay, sand & gravel (Glacial Till)		5	SS	66		183										
			6	SS	36		182										
	Brown		7	SS	70/0.20		181										
	Grey		8	SS	78/0.15		180										
			9	SS	76		179										
							178										
177.4																	
9.6	End of Borehole																
	* Groundwater level not established																

RECORD OF BOREHOLE No 8

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 522.5 N; 289 437.5 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers; BX Rock Core COMPILED BY AEL
DATUM Geodetic DATE 1985 12 06-09 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							WATER CONTENT (%)
								SHEAR STRENGTH							
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
186.6	Ground Level													GR SA SI CL	
0.0	Topsoil		1	SS	8		186								
186.3			2	SS	28										
0.3	Very stiff														
	Hard		3	SS	45		185								
	Heterogeneous mixture of silty clay, sand & gravel		4	SS	68										
	(Glacial Till)		5	SS	64		184							5 33 44 18	
							183								
	Brown Grey		6	SS	74		182								
							181								
			7	SS	100/ 0.15		180								
			8	SS	74		179							7 39 50 4	
			9	SS	83		177								
			10	SS	70		176								
			11	SS	80/ 0.15		174								
174.3	Shale bedrock		12	RC BX	94%		173							RQD 25%	
12.3	Weathered		13	RC BX	92%		172							0%	
171.4	Dark Grey														
15.2	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 9

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 533 N; 289 482 E.

ORIGINATED BY IW

DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers

COMPILED BY AEL

DATUM Geodetic DATE 1985 12 09

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
185.9	Ground Level																
0.0	Topsoil (0.1)		1	SS	10	*											
	Stiff to very stiff		2	SS	25		185										
	Hard		3	SS	34		184										
	Heterogeneous mixture of silty clay, sand & gravel		4	SS	66		183										
	(Glacial Till)		5	SS	66		182										
							181										
	Brown Grey		6	SS	63		180										
			7	SS	60/ 0.0		179										
179.5	Gravelly sand trace silt						178										
6.4	Very dense		8	SS	94		177										
178.0	Heterogeneous mixture of silty clay, sand and gravel																
7.9	(Glacial Till) Hard		9	SS	100/ 0.2												
176.5	End of Borehole																
9.4	* Groundwater level not established																

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 10

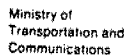
METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 550 N; 289 463.5 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 10 CHECKED BY 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
186.3	Ground Level																
0.0 186.0	Silty sand, trace organics (Fill)		1	SS	8	*	186										
0.3																	
	Heterogeneous mixture of silty clay, sand and gravel		2	SS	38		185										
	(Glacial Till)		3	SS	44												
	Hard		4	SS	64		184										
			5	SS	70		183										
							182										
	Brown Grey		6	SS	44		181										
			7	SS	89		180										
							179										
			8	SS	58		178										
							177										
176.8			9	SS	98												
9.5	End of Borehole																
	* Groundwater level not established																

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



METRIC

W P 103-69-15 LOCATION Co-ords.4 835 553 N; 289 501.5 E. ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEI
DATUM Geodetic DATE 1985 12 10-11 CHECKED BY [Signature]

+3, x5: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 12

METRIC

W P 102-69-15 LOCATION Co-ords. 4 835 571 N; 289 484 5 E ORIGINATED BY IW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 10 CHECKED BY /

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
185.6	Ground Level																
0.0 185.3 0.3	Topsoil		1	SS	13	*	185										
	Very stiff		2	SS	24		184										
	Hard		3	SS	37		183										
	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till)		4	SS	52		182										
			5	SS	110		181										
	Brown Grey		6	SS	53		180										
180.0 5.6	Silty sand Compact		7	SS	21		179										
179.2 6.4	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till) Hard		8	SS	62		178										
			9	SS	101		177										
176.0	End of Borehole * Groundwater level not established						176										

+³, x⁵: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 13

METRIC

W P 103-69-15 LOCATION Co-ords. 4 835 641 N; 289 540 E. ORIGINATED BY TW
DIST 6 HWY 410 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AEL
DATUM Geodetic DATE 1985 12 11 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
184.0	Ground Level																
183.9	Topsoil		1	SS	3	*											
0.3	Heterogeneous mixture of silty clay, sand and gravel (Glacial Till) Hard		2	SS	40		183										
			3	SS	73		182										
			4	SS	93		181										
			5	SS	101		180										
							179										
			6	SS	93		178										
							177										
			7	SS	105		176										
							175										
174.9			8	SS	112												
9.1																	
174.4	Shale bedrock Weathered		9	SS	107												
9.6	End of Borehole * Groundwater level not established																

+3, x5: Numbers refer to
Sensitivity

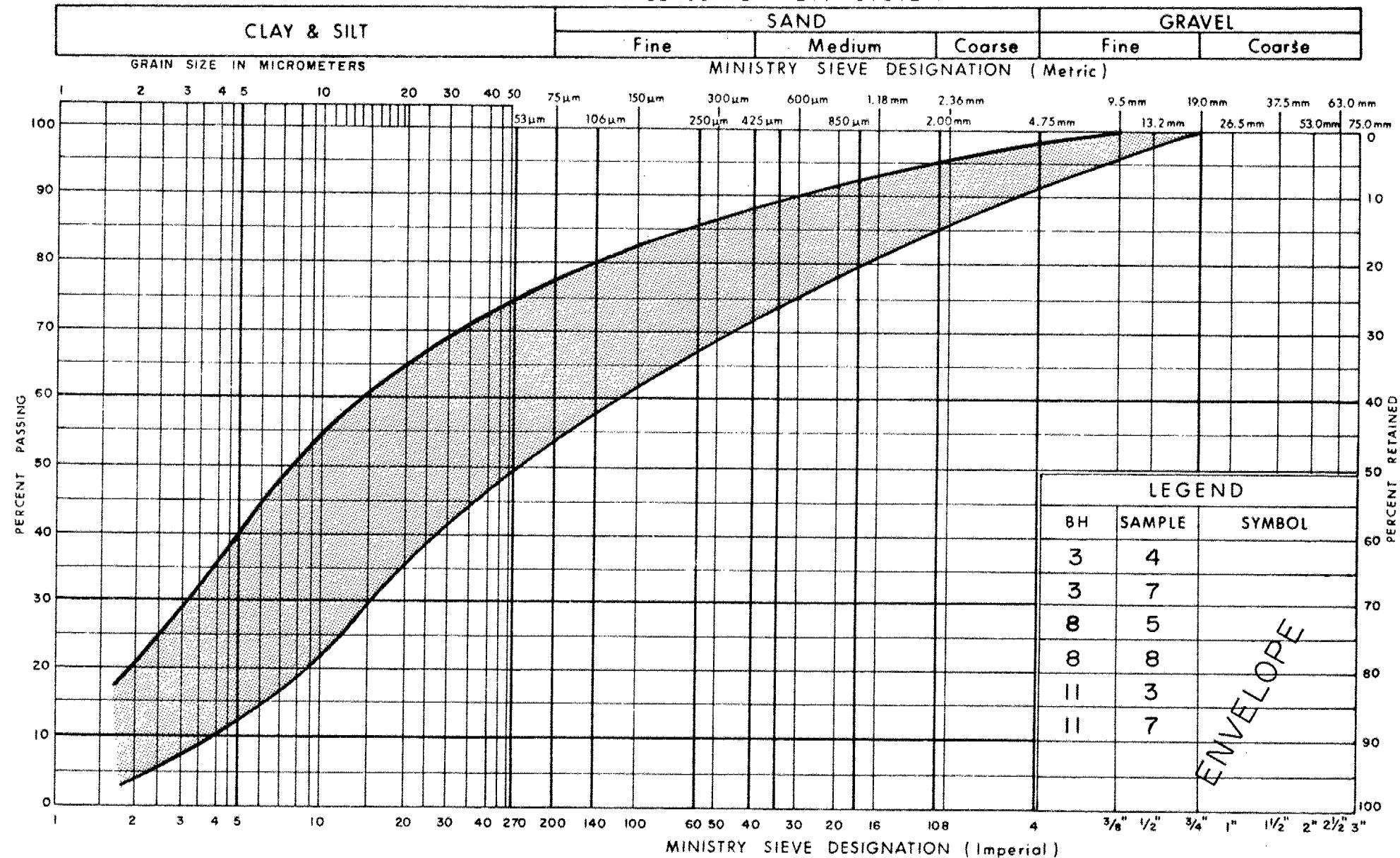
20
15 5 (%) STRAIN AT FAILURE
10

APPENDIX II

FIGURES

- Figure 1 Grain Size Distribution
 Heterogeneous Mixture of Silty Clay,
 Sand and Gravel (Glacial Till)
- Figure 2 Grain Size Distribution
 Gravelly Sand, Trace Silt
- Figure 3 Plasticity Chart
 Heterogeneous Mixture of Silty Clay,
- Figure 4 Abutment on Compacted Fill
 Showing Granular "A" Core

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

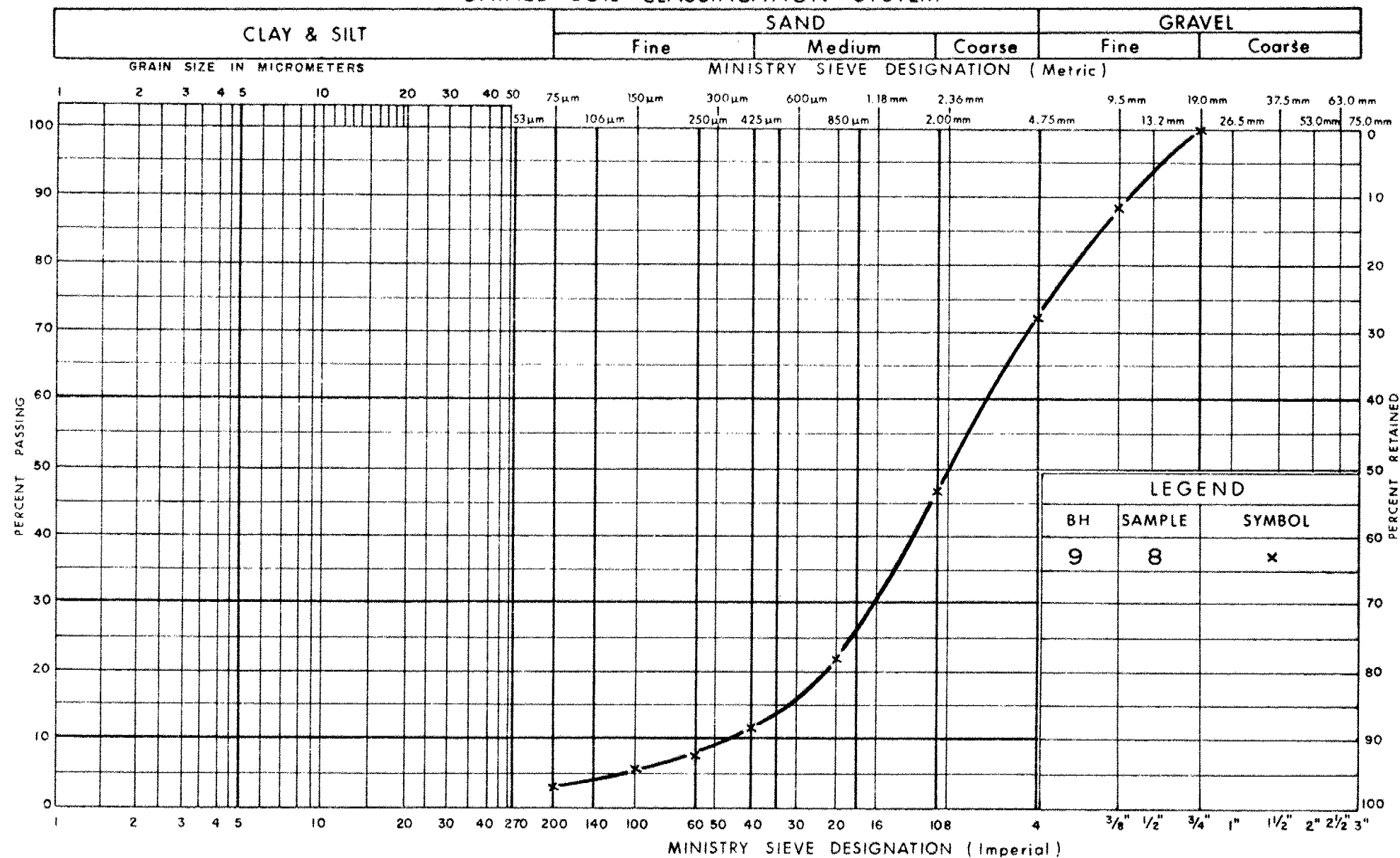
 Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
 HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND
 & GRAVEL (GLACIAL TILL)

FIG No 1

W P 103-69-15

UNIFIED SOIL CLASSIFICATION SYSTEM

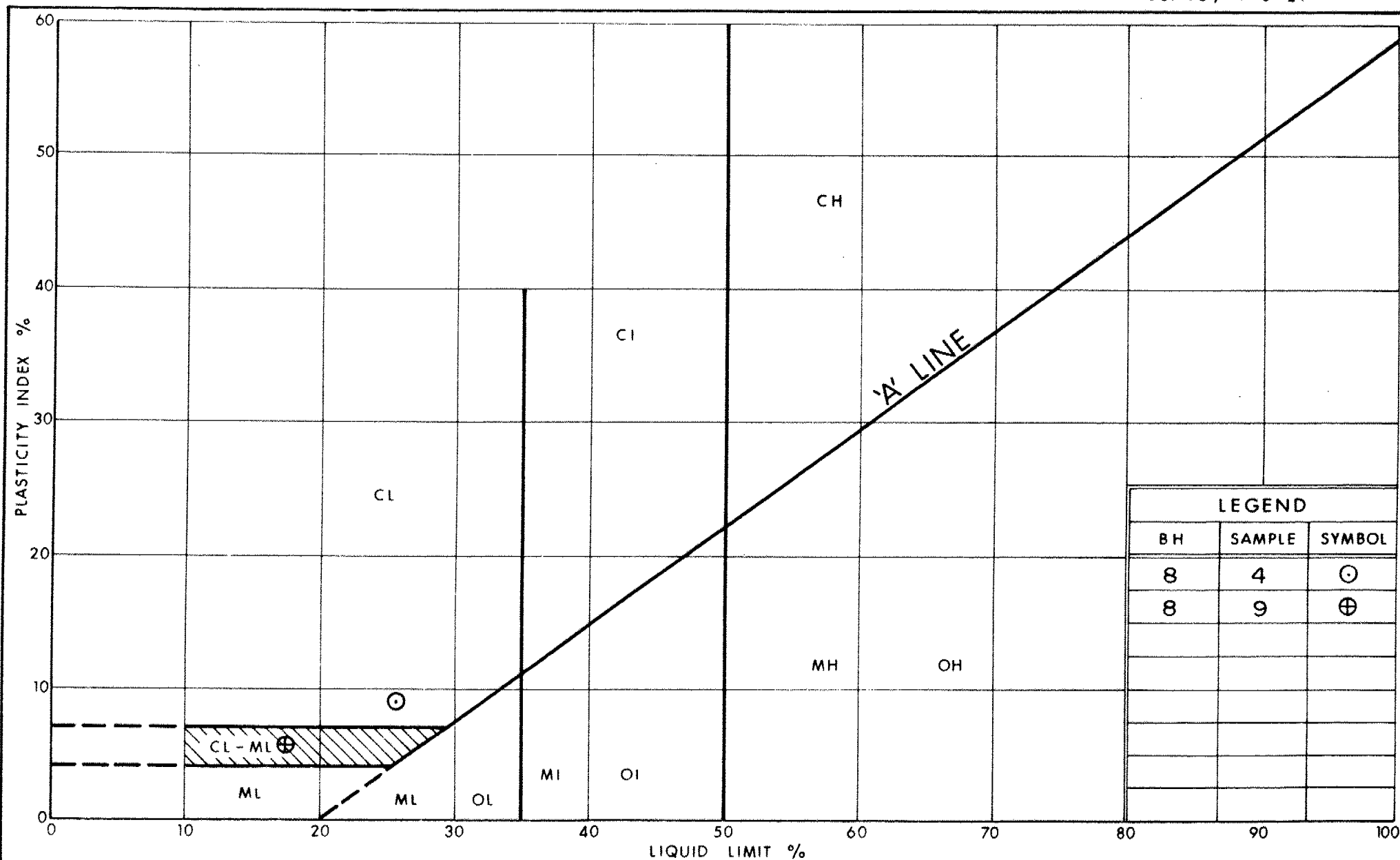


Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
GRAVELLY SAND, TRACE SILT

FIG No 2

W P 103 - 69 - 15



Ministry of
Transportation and
Communications

PLASTICITY CHART
HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND
& GRAVEL (GLACIAL TILL)

FIG No 3

W P 103-69-15

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO PR-D-207 (formerly DB-MT-308M 78-06)

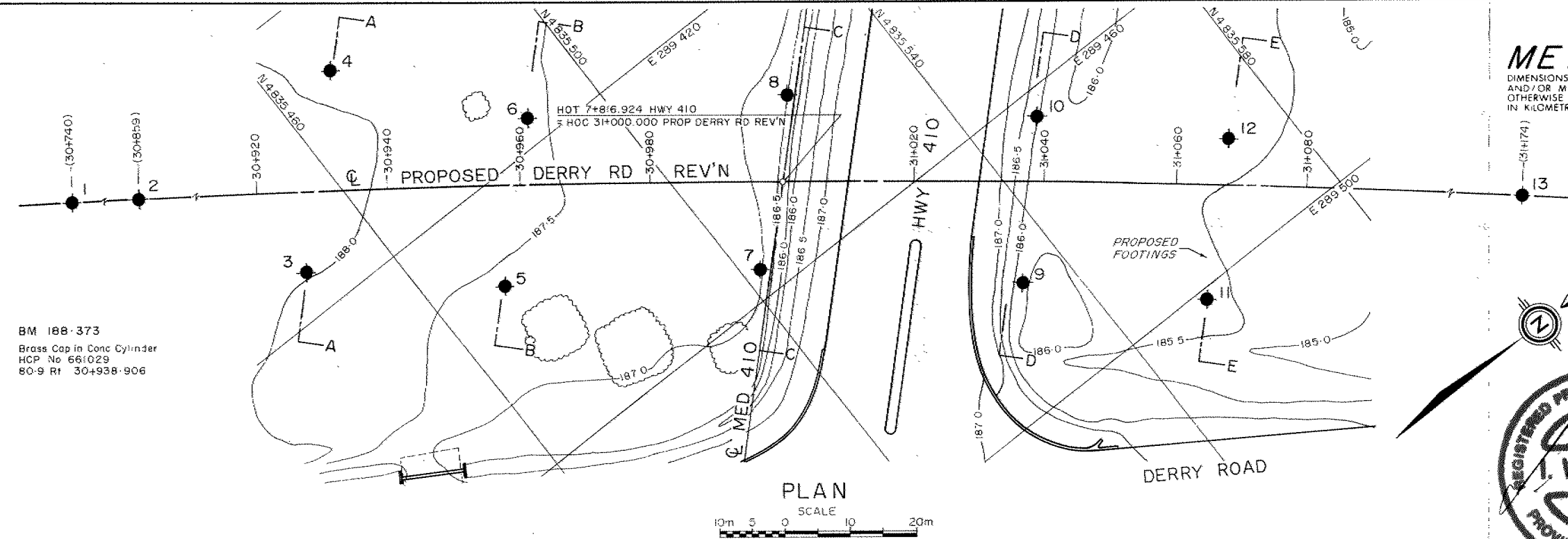
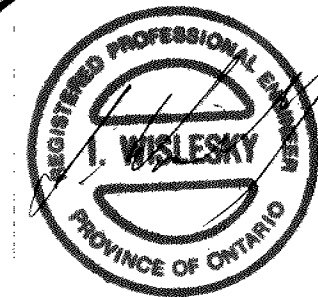
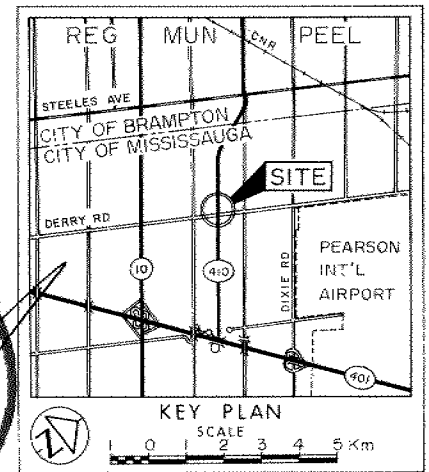
CONT No
WP No 103-69-15

HIGHWAY 410
DERRY ROAD UNDERPASS
BORE HOLE LOCATIONS & SOIL STRATA



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES.

GEOCON INC.



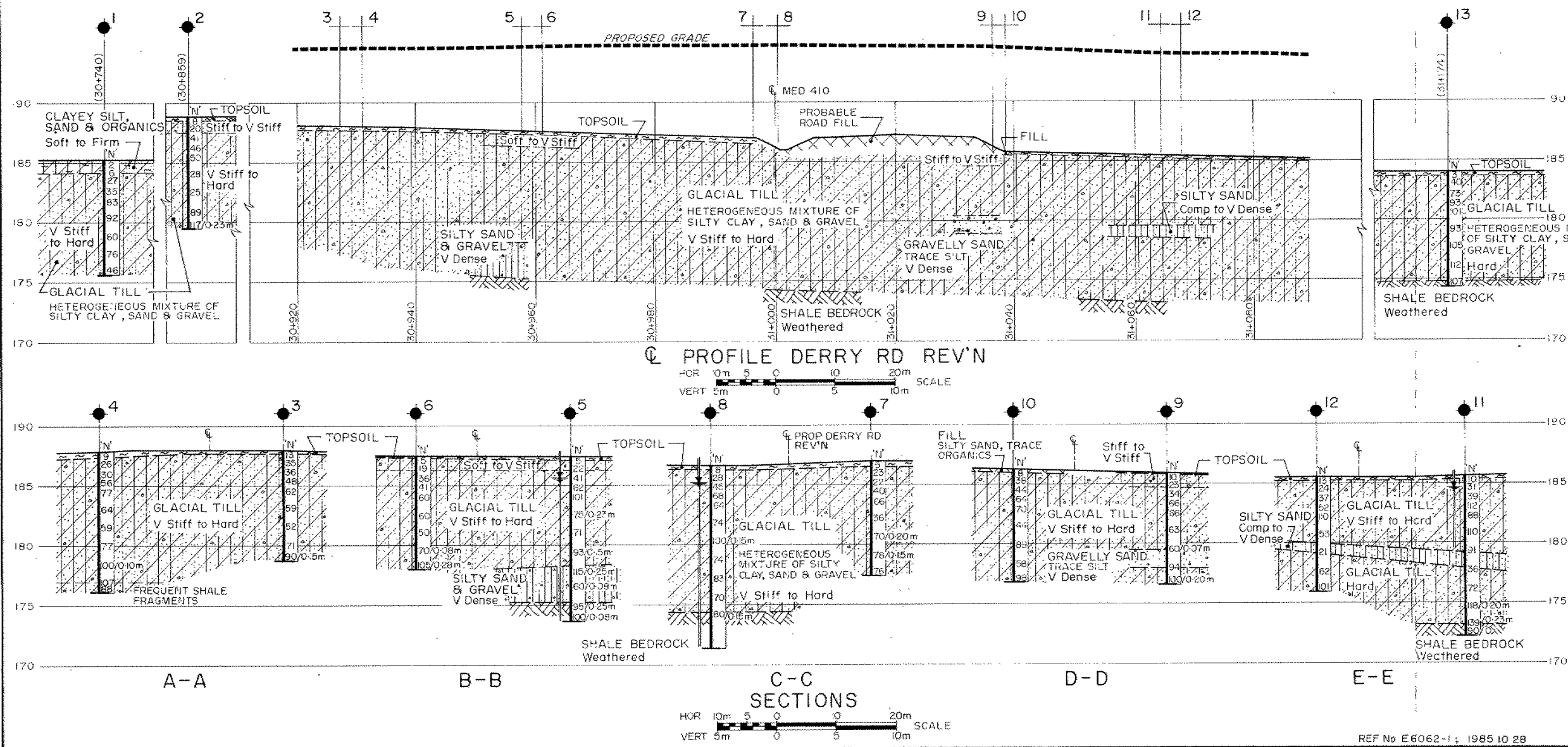
BM 188-373
Brass Cap in Conc Cylinder
HCP No 661029
80-9 Rt 30+938-906

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]			
W.L.	W.L. at time of investigation 1985 12			
—	STANDPIPE			

CO-ORDINATES			
No	ELEVATION	NORTH	EAST
1	185.2	4835 300.0	289 302.0
2	189.0	4835 400.0	289 365.0
3	188.0	4835 448.0	289 413.5
4	187.8	4835 470.0	289 392.0
5	187.5	4835 470.5	289 434.0
6	187.5	4835 489.0	289 416.0
7	187.0	4835 502.5	289 456.0
8	196.6	4835 522.5	289 437.5
9	185.9	4835 533.0	289 482.0
10	186.3	4835 550.0	289 463.5
11	185.7	4835 553.0	289 501.5
12	185.6	4835 571.0	289 484.5
13	184.0	4835 641.0	289 540.0

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. 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			

Geocres No 30M12-193

HWY No 410 - DERRY RD. REV'N	DIST	6
SUB'D I.W. CHECKED	DATE 1986 01 10	SITE 24-81-495
DRAWN AEL CHECKED w	APPROVED [Signature]	DWG 1036915-A

REF No E6062-1; 1985 10 28

memorandum



Tel: 3282

To: W.L. Lin
Design Engineer
Structural Office
3501 Dufferin Street

From: Foundation Design Section
Room 315, Central Building

RE: Derry Road Underpass, Hwy. 410
W.P. 103-69-015, Site 24-81-495
District 6 - Toronto

Date: 1986 12 23

We have reviewed the final General Arrangement Drawing and Footing Detail Drawing with relation to the foundation design. We have no comments.

A handwritten signature in dark ink, appearing to read "L. Politano", followed by a horizontal line.

L. Politano
Project Foundations Engineer
for

M. Devata
Chief Foundations Engineer
(East)

LP/MD/mmj

memorandum



To: Mr. W. L. Lin,
Design Engineer [Central]
Structural Office,
3501 Dufferin Street

Date: 86 05 06

From: Engineering Materials Office,
Foundation Design Section,
Central Building, Room 315

Re: Derry Road Underpass
W. P. 103-69-15, Site: 24-81-495
Hwy. 410, District #6, Toronto

We have reviewed the preliminary General Arrangement Drawing
Pl (not dated) for the above-noted project and make the following comments:

1. The West Abutment should be founded at or below Elevation 186.
Since a mud-mat is required, it is recommended that the excavation extend down to Elevation 186, and then be brought up to your current founding elevation of 186.3 by means of mass concrete. The mass concrete should be placed as soon as possible after the excavation is opened.
2. For the Pier and East Abutment, a 150 mm mud-mat should be provided on the excavation base as soon as possible after the excavation is opened.
3. We do not anticipate any dewatering problems. However, any local seepage or surface run-off can be controlled by pumping from sumps.
4. The Foundation Investigation Report for this project indicates that temporary slopes could be cut near vertical. However, in view of the time required for construction of the footings, we suggest that all temporary slopes be cut at 1H:1V or shallower.

If you require clarification or additional information, please contact this section.

A handwritten signature in black ink, appearing to read "L. Politano", with a long horizontal line extending to the right.

L. Politano,
Project Foundations Engineer

for

M. Devata,
Chief Foundations Engineer
(East)



Ontario

Telephone: (416) 248-3282

Ministry of
Transportation and
Communications

Engineering Materials Office
Foundation Design Section
Central Building, Room 315
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

April 15, 1986

DeLCan
133 Wynford Drive
North York, Ontario
M3C 1K1

Dear Mr. Smith:

Re: Hwy 410/Derry Rd. Interchange
W.P. 103-69-15
Consumers' Gas Main

Further to your letter of 86 03 26 and our telephone conversation of 86 04 14, this is to inform you that the MTC Foundation Design Section is not in a position to comment on the effects of the anticipated ground settlement on the gas main which is encountered across this site.

In the Foudation Investigation Report, an estimate of the settlement which can be anticipated as a result of additional stresses imposed by the approach fills is given. In our opinion, it is the responsibility of Consumers' Gas to determine if the anticipated settlement will have any intolerable effects on the gas main.

If you have any questions or wish to discuss this further please contact the undersigned.

Yours very truly

L. Politano, P. Eng.
Project Foundations Engineer

for M. Devata, P. Eng.
Chief Foundations Engineer
(East)

LP:gp

cc: B. Dickey

March 26, 1986

Our Ref: 01-0266A

Mr. J. Medeiros, C.P.T.
Supervisor System Design
Mississauga Office
Consumers' Gas
950 Burnhamthorpe Road West
Mississauga, Ontario
L5C 3B4

Dear Mr. Medeiros:

Re: Derry Road - Hwy. 410 Interchange
MTC W.P. 103-69-14
Consumers' Gas Ref: JM-037-86

Further to your February 3, 1986 letter and its attachments, we have reviewed the statements and have the following comments:

Paragraph 1

The total fill over the gas main will not exceed 7 m.

Paragraph 2

You request that compaction around the pipe (from the 3 o'clock position to the 9 o'clock position) be field checked to confirm that it is at least 90% standard Proctor Density. We can see no reason why this should be a problem, since it was a condition of the installation under the Region of Peel permit that compaction be 100% Standard Compaction. If Consumers' Gas feels that there is a possibility that its installation was incorrectly made, the Ministry has no objections to the gas company checking this, but it would of course be at Consumers' Gas' expense.



DeLCan

Mr. J. Medeiros, C.P.T.
March 26, 1986
Page Two

Paragraph 3

No excavation close to the pipe is expected to be needed except perhaps for localized surface drainage. If this is the case, it will be reviewed with you prior to finalization of the designs.

Yours very truly,



D.H. Smith, P.Eng.
Project Manager

DHS:dm

cc: B. Dickey
F. Conforti
M. Devata

Smith
Del Can

FROM

DEPT.

DATE

SUBJECT

WP 103-69-14 Highway 410 - 401 to Elobuoke Ck

Attached is correspondence from Creumers Gas concerning their gas main at Derry Rd.
Relocation is not required providing their conditions are met.

Please ensure that Ports 1 & 3 will be met by our design. Port 2 should be discussed with Construction & Protect at our Progress Reviews.

Bluckey

REPLY

DeLCan	
Don Mills Ontario	
RECEIVED	
FEB 18 1986	
Copy to:	
Action by:	
File:	

REPLY FROM

REPLY DATE

TO WRITE: HANDWRITE OR TYPE, REMOVE AND RETAIN YELLOW COPY. FORWARD BALANCE OF SET.

TO REPLY: WRITE REPLY IN BOTTOM AREA. SNAP SET APART.

FOLD AT MARKS FOR USE IN #9 OR #10 WINDOW ENVELOPE

RETAIN ORIGINAL AND RETURN PINK COPY



Consumers' Gas
950 Burnhamthorpe Road West
Mississauga, Ontario
L5C 3B4

Mississauga and Brampton:
Tel. (416) 276-3400
Orangeville:
Tel. (519) 941-1560



Consumers' Gas

February 3, 1986



The Ministry of Transportation
and Communications
5000 Yonge Street
WILLOWDALE, Ontario
M2N 6E9

Attention: B.W. Dickey, P. Eng.

Dear Mr. Dickey:

Re: Derry Road - Hwy. 410 Interchange
W.P. 103-69-14 / Our Ref: JM-037-86

Our Engineering office has made their recommendations regarding the fill loading on our NPS 30 gas main that will be encountered with this contract. I am enclosing a copy of same for your review.

I would invite any comments or questions you may have regarding the attached recommendations.

Yours truly,

J. Medeiros, C.P.T.
Supervisor System Design
Mississauga Office
276-3529

/gcm

Encl. ~

cc: Mr. F.M. Conforti,
District #6

Inter-Office Memorandum

File Number:

To: Clive Tomkins

Copies for: R. Ashby

From: Mike Banducci

Dept./Region: Engineering

Phone: 5416

Date: 1985-10-31

Follow-up:

Subject: HWY #410 - DERRY RD - CHECK FILL LOADING ON NPS 30 ☐ Return to Sender:

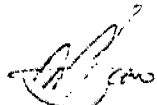
Comments:

The impact of the proposed interchange ramps crossing over the NPS 30 gas main has been investigated.

The pipe's ability to resist deflection under the imposed soil load of the ramps depends upon composite action of the pipe and the soil ring which surrounds it. Allowable pipe deflection may be exceeded if poorly compacted soil is in place around the pipe. To prevent any possible damage to the pipe, the following is recommended.

1. The total height of fill above the top of the gas main should not exceed 7 m.
2. Soil compaction around the gas main, within the proposed fill area, should be checked through field tests. Soil within a width of at least 1 m measured radially from the pipe, from the 3 o'clock to the 9 o'clock position, shall have a minimum Standard Proctor Density of 90%. If this level of compaction is not available in the existing soil, the fill must be excavated and recompacted.
3. No excavation of native soil shall be permitted during construction, within 7 m on either side of the main in the vicinity of the proposed fill. Disturbance of the soil could cause lateral movements which may jeopardize the composite strength of the soil and pipe acting together.

Should you have any questions, please call me.



RECEIVED

NOV 5 1985

WESTERN REGION
PLANNING & TECHNICAL DEPT.

RECEIVED

NOV 4 1985

WESTERN REGION
PLANNING & TECHNICAL DEPT.

memorandum



To: See Distribution

Date: 86 01 27

From: Engineering Materials Office,
Foundation Design Section,
Central Building, Room 315

Re: Foundation Investigation Report for
Proposed Hwy. #410 - Derry Road Underpass
Hwy. #410, District #6, Toronto
W. P. 103-69-15

The Geotechnical Consulting Engineering firm Geocon Inc. was retained by this section to carry out a foundation investigation at the above-noted site and provide recommendations for the design and construction of the structure and associated approach fills.

During the progress of the project, this section reviewed the draft version of the report and comments on the technical contents were made. The attached final report satisfactorily addresses our concerns.

If you require additional information or clarification, please contact this section.

A handwritten signature in dark ink, appearing to read "M. Devata".

M. Devata,
Chief Foundations Engineer
(East)

MD:ma

cc: Distribution
G. C. E. Burkhardt
T. J. Kazmierowski (acting)
A. Wittenberg
J. Smrcka
K. Bassi
J. H. Peer
T. Yakutchuk

memorandum



To: B. Dickey
Planning and Design Section
Central Region
5000 Yonge Street

Date: 1985 10 29

From: Foundation Design Section
Room 315, Central Building

Re: Consumer's Gas Trench
Hwy. 410 at Derry Road
WP. 103-69-14

Further to your request, enclosed is a report prepared by F. Saccon of this section, regarding his observations at the above-noted trench excavation.

If there are any questions, please contact this office.

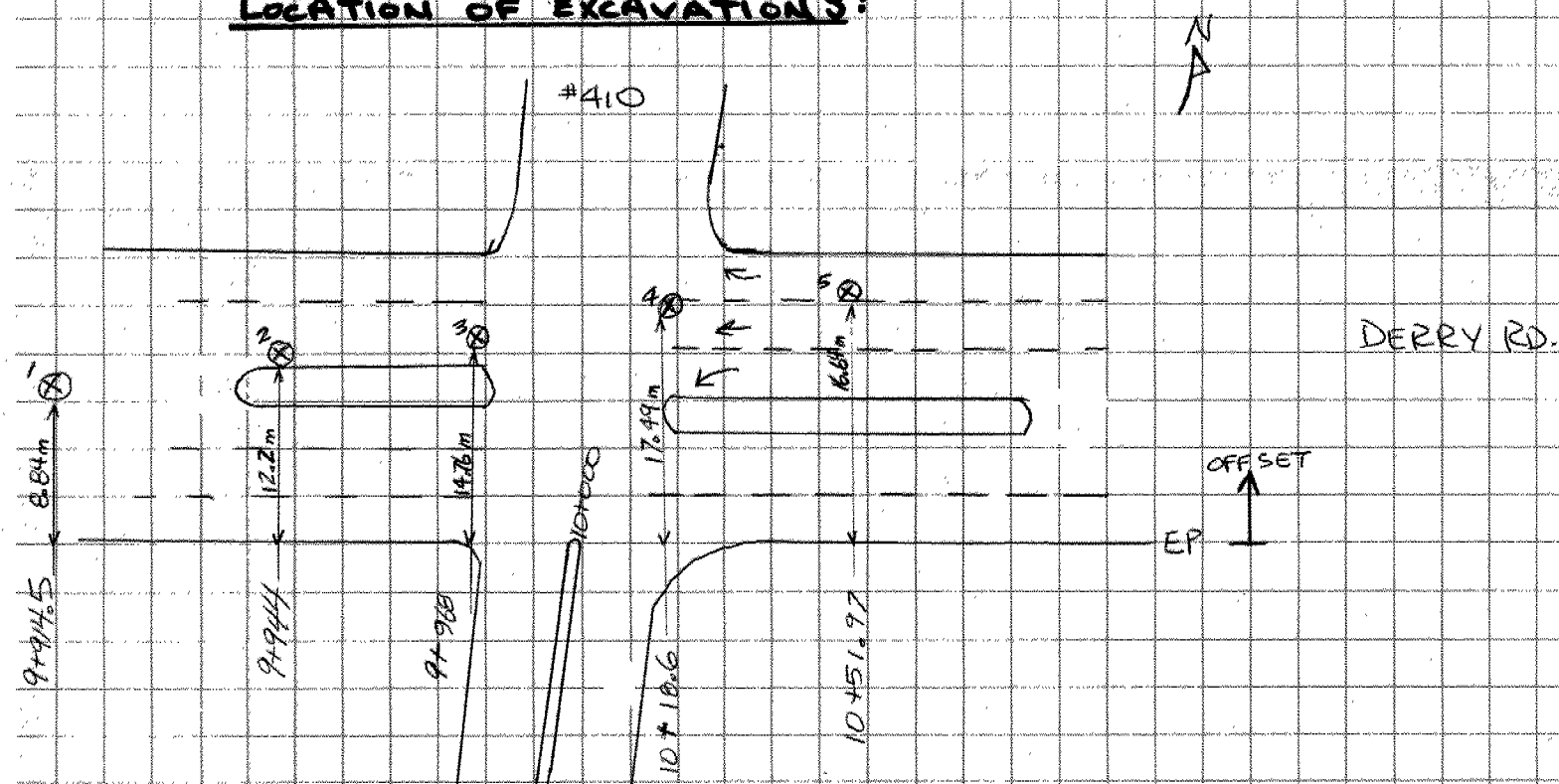
D. H. Dundas

D.H. Dundas
Senior Foundations Engineer

DHD/ta

Re: Derry Rd + Hwy 410 future construction (Drilling operations)

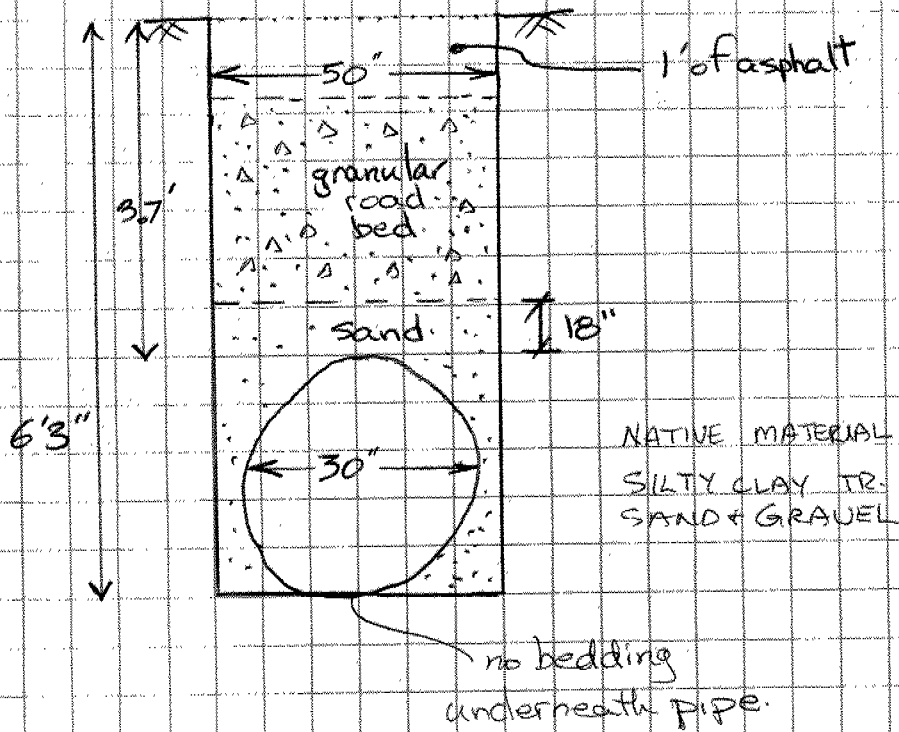
LOCATION OF EXCAVATIONS:



<u>EXCAVATION #</u>	<u>SURFACE ELEVATION</u>	<u>TOP OF PIPE</u>	<u>DEPTH TO TOP OF PIPE</u>
1	187.813	186.679	1.134 m (3.7')
2	187.318	186.358	0.96 m (3.1')
3	187.116	185.988	1.128 m (3.7')
4	187.051	185.084	1.967 (6.5')
5	186.372	184.546	1.826 (6')

EXCAVATION

1 + #3



SEND TO

Dave Hunter

Foundation Design Section

3rd Floor, Central Bldg. Courtyard

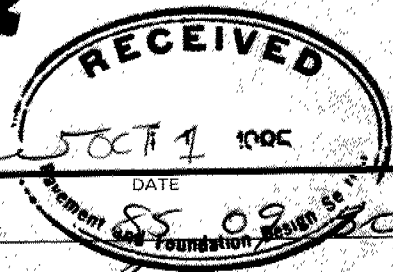
DEPT.

FROM

Bruce Bluker P+O Central Leg.

SUBJECT

WP 103-69-14 Highway 410 @ Curry Rd.



As discussed, we require a copy of any information or notes which you have available from the uncovering of the Consumers Gas pipeline at the above location. Consumers' Gas requires the information to determine if the trench fill material, etc., is sufficient to handle our proposed interchange fills or if pipeline relocation is necessary.

Please forward whatever you have to me. Thanks
Bluker

REPLY

cc R. Jeffries
D. Conforti

REPLY FROM

REPLY DATE

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-173DIST. 6 REGION _____

W.P. No. _____

CONT. No. _____

W. O. No. 95-11003

STR. SITE No. _____

HWY. No. 410LOCATION Hwy 410 & Derry Rd.No of PAGES -OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS: _____



memorandum

To: Ranko Mihaljevic, P. Eng.
Head, Construction Reviews
Approvals Section
Structural Office
7th Floor, Atrium Tower

1995 07 11

Attn.: Magdy Meleka, P. Eng.

From: Pavements & Foundations Section
Room 315, Central Building
Downsview, Ontario

W.O.95-11003

Re: Shoring Design By John Otter Engineering Services Ltd
Hwy 407 Project, Structure No. C81W, Derry Rd

This is in response to your memo of July 05, 1995, along with the shoring design by John Otter Engineering Services Ltd at the above captioned site dated June 29, 1995 and the geotechnical parameters provided by G.D. Prassad, P. Eng. of CHIC to John Otter Engineering Services Ltd dated June 28, 1995. We have reviewed the geotechnical parameters used by the consultant for the design of shoring at the above mentioned site. The consultant's assumption of the geotechnical parameters for the design of the shoring appears to be reasonable.

The overall design of the shoring system remains the responsibility of the consultant. We suggest that the design/calculation should be signed and sealed by a professional engineer.

A handwritten signature in cursive script, appearing to read "K.S.Q. Ahmad".

K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

D.H. Dundas, P. Eng.
Senior Foundation Engineer