

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M 12-152

DIST. 6 REGION

W.P. No. 153-80-02

CONT. No. 88-30

W. O. No.

STR. SITE No. 37-1109

HWY. No.

LOCATION C.N.R. Overhead at

Hwy 427

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

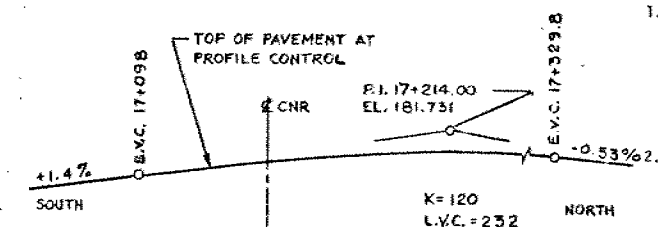
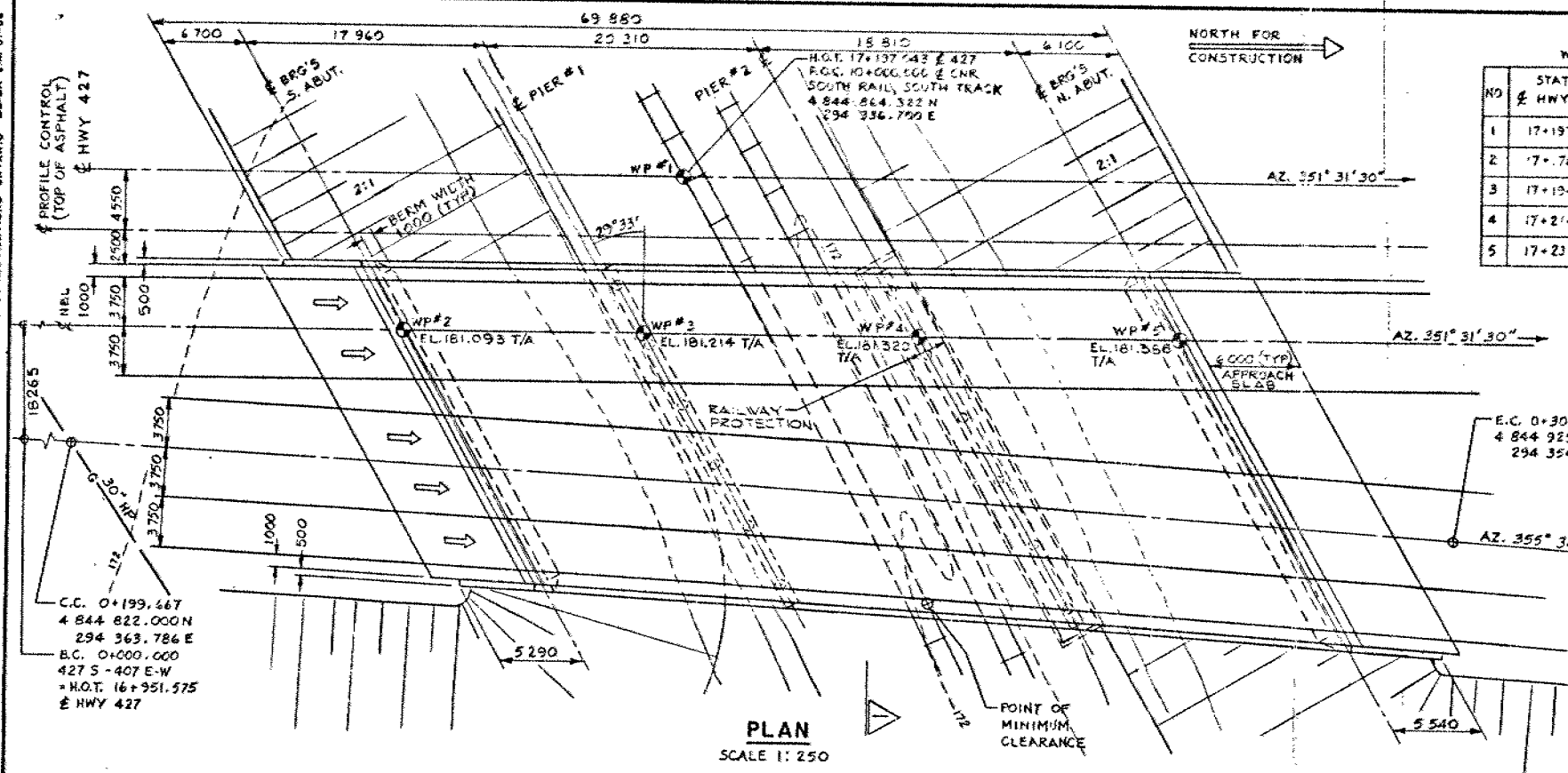


ALBURY, FULLERTON, DICKSON & ASSOCIATES
CONSULTING ENGINEERS
Toronto, Fredericton, Sudbury, Yellowknife

METRIC

DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

NO	STATION # HWY 427	COORDINATES	
		N	E
1	17+197.043	4,844,864.322	294,356.700
2	17+76.511	4,844,845.555	294,351.426
3	17+194.273	4,844,863.322	294,375.049
4	17+214.585	4,844,883.411	294,345.786
5	17+233.395	4,844,902.016	294,343.013

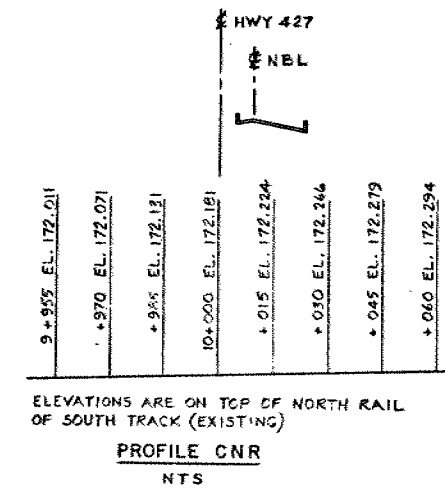
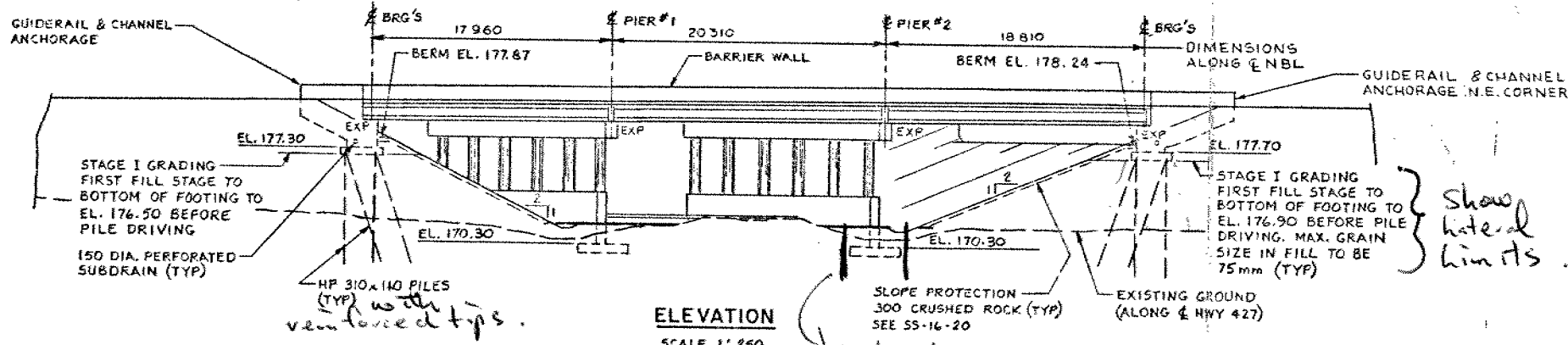


- NOTES:
- Class of Concrete

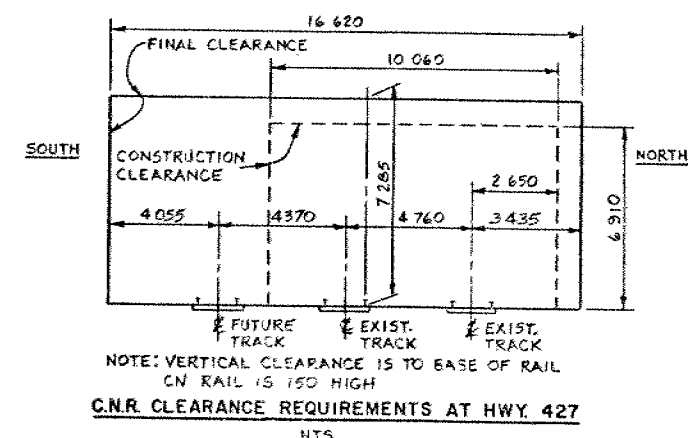
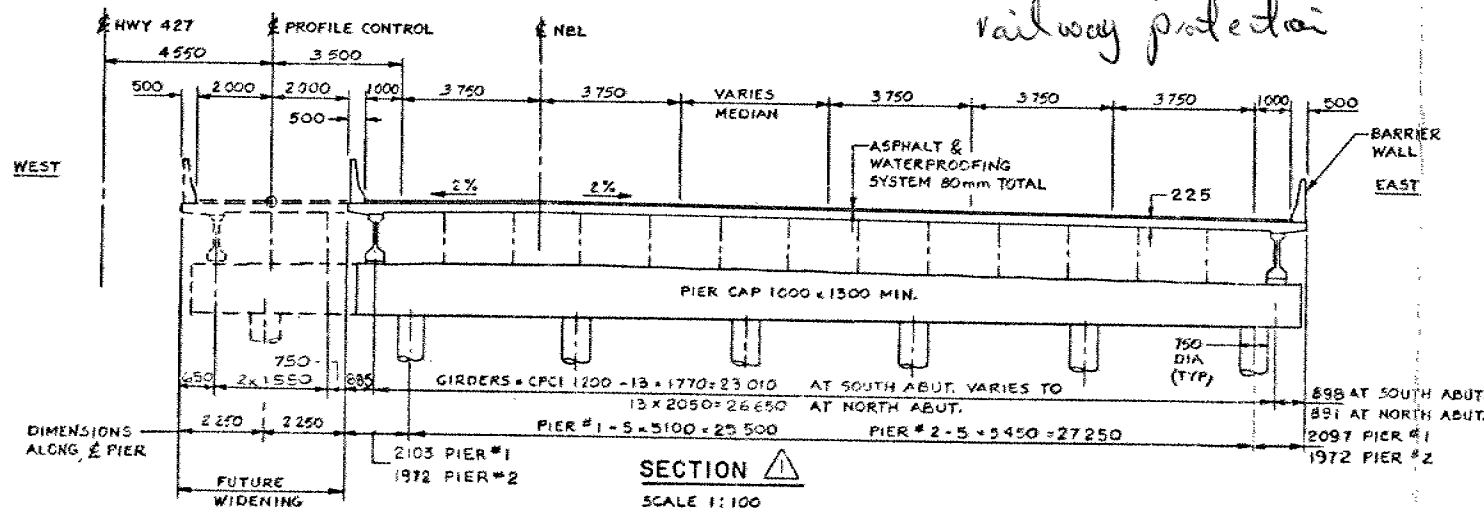
Deck & Barrier Walls	30 MPa
Columns & Abutments	30 MPa
Footings	20 MPa
Prestressed Girders	35 MPa
 - Clear Cover to Reinforcing Steel

Footings	100 ± 25 mm
Top of Deck,	70 ± 20 mm
Deck Bottom	40 ± 10 mm
Prestressed Girders	30 ± 5 mm
Piers, Abutments and Wing Wall	80 ± 20 mm
Front Surfaces	70 ± 20 mm
Remainder	70 ± 20 mm

 (Unless Otherwise Noted)
 - Reinforcing steel shall be Grade 400 unless otherwise specified. Bars marked with the Suffix C shall be coated Bars.



- LIST OF DRAWINGS
- GENERAL ARRANGEMENT
 - BOREHOLE LOCATION & SOIL STRATA
 - FOUNDATION LAYOUT, FOOTINGS
 - ABUTMENT FOOTINGS
 - SOUTH ABUTMENT, WINGWALLS
 - PIER #1
 - PIER #2
 - NORTH ABUTMENT, WINGWALLS
 - DECK REINFORCING
 - DECK DETAILS & SCREED ELEVATIONS
 - PRESTRESSED GIRDERS AND BEARINGS
 - BARRIER WALLS
 - EXPANSION JOINT DETAILS
 - 6000 mm APPROACH SLAB
 - PILE DRIVING - STEAM DIESEL HAMMERS
 - PILE DRIVING - DROP HAMMERS
 - BRIDGE DATA & SITE NUMBER DATA
 - AS CONSTRUCTED ELEV. & DIM.
 - QUANTITIES - STRUCTURE SHEET
 - QUANTITIES - STRUCTURE SHEET



	HORIZONTAL ALIGNMENT	
	CURVE 1	CURVE 2
Δ	3° 48' 48"	1° 29' 30"
R	3000.000	4000.000
T	39.870	52.072
L	199.667	104.136
E	0.339	0.339



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

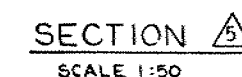
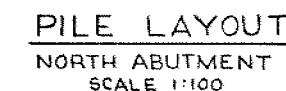
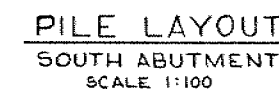
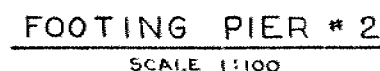
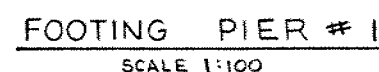
CONCRETE IN PIERS, ABUTMENTS & WINGWALLS	566 m³
CONCRETE IN DECK & DIAPHRAGMS	425 m³
CONCRETE IN BARRIER WALLS	43 m³
CONCRETE IN APPROACH SLABS	77 m³

REVISIONS	DATE	BY	DESCRIPTION
DESIGN		CHECK	LOADING: OHBDC A-79 DATE NOV. 82
DRAWING		CHECK	SITE 37-80-1109A DWG 1

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES

**ALBERRY, PULLERITS, DICKSON
& ASSOCIATES**
CONSULTING ENGINEERS
Toronto Fredericton Sudbury Yellowknife



Location	Section	Type	No	Length	Driving Shoe
N. Abut	HP 310x110	Vertical	8	22200	Flange Plate
	HP 310x110	Battered	21	23400	" "
S. Abut	HP 310x110	Vertical	8	22800	" "
	HP 310x110	Battered	24	24033	" "

Pile driving note: Piles to be driven in accordance with SS103-10 or SS103-11.

Design Load 850 ~~KN~~
Ultimate Capacity 2940 ~~KN~~

- Structural steel to be in accordance with C.S.A. G40.21 M 300W or equal.
- Welding to be in accordance with C.S.A. W59-77
- Sheet piles shall be driven to elevations shown on the drawings.
- After placing of concrete in footing and crash wall piles shall be cut at top of footing and left in place.

Solder
Piles

Difficultly may be encountered in driving sheeting due to presence of cobbles.



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REV			
	DATE	BY	DESCRIPTION
DESIGN	ES	CHECK	4-25 LOADING OH80C A-79 DATE NOV. 8
DRAWING	AMS	CHECK	4-25 SITE 37-80-1109A DWG 3

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 88-30



Ministry of
Transportation and
Communications

INDEX

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2	Symbols & Abbreviations
3 - 75	Foundation Investigation Reports for C.N.R. (Halton Subdivision) Overhead at Hwy. 427 N.B.L. & S.B.L. W.P. 153-80-02, Site 37-80-1109 A & B Hwy. 427, District 6, Toronto Albion Road Overpass W.P. 153-80-03, Site 37-80-1110 Hwy. 427, District 6, Toronto Steeles Avenue Overpass W.P. 153-80-04, Site 37-80-1111 Hwy. 427, District 6, Toronto Highway 427 over Ramp 427N-407E W.P. 153-80-05, Site 37-73-1112 Hwy. 427, District 6, Toronto

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

EXPLANATION OF TERMS USED IN REPORT

2

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

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_t	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
C.N.R. (Halton Subdivision) Overhead
at Highway 427 NBL and SBL
W.P. 153-80-02, Site: 37-80-1109 A & B
Highway 427, District 6, Toronto

INTRODUCTION:

This report summarizes the factual information obtained from a foundation investigation program performed at the above-mentioned structural site and provides detailed recommendations pertaining to the structure foundations and related earthworks. The fieldwork was carried out between 81-12-10 and 81-12-23, consisting of 8 sampled boreholes, 5 accompanied by dynamic cone penetration tests, advanced by means of hollow and solid stem continuous flight augers in addition to washboring techniques. Borings were advanced for depths ranging from 13.9 metres to 33.4 metres.

SITE DESCRIPTION AND GEOLOGY

The site is located at the crossing of the proposed Hwy. 427 and C.N.R. Halton Subdivision Tracks, some 0.3 kilometres east of Indian Line, 0.4 Kilometres west of Albion Road, and 0.7 kilometres south of Steeles Avenue in the Borough of Etobicoke, Municipality of Metropolitan Toronto.

The topography of the area is a flat to gently undulating till plain which is dissected in the immediate area by the West Branch of the Humber River. Generally, drainage is in a southerly to easterly direction. Land use in the area is rapidly changing from predominately farming to industrial subdivision development.

The site is located in the physiographic region known as the 'Peel Plain' characterized in this area by ground moraine till deposits of pleistocene origin. Generally, these silty clay till sheets are separated by beds of stratified clay, silt, or sand of variable thickness with occasional boulder concentrations present.

Bedrock, in excess of 30 metres depth at this location, consists of interbedded shale and limestone of the Dundas Formation, Ordovician Period.

SUBSURFACE CONDITIONS

In general, reasonably competent and uniform subsurface conditions were encountered across the site. The surficial deposit extending to a maximum depth of 11.9 metres is a stiff to hard cohesive glacial till consisting of silty clay with sand and a trace of gravel. Stratified silt and sand seams with occasional cobbles and boulders were encountered within this stratum.

Underlying the till deposit and explored for a maximum thickness of 23 metres is a dense to very dense silty sand grading to a sand of probable glaciolacustrine origin. Alternating seams and layers of silt, sand and gravel, with occasional cobbles and boulders were encountered throughout.

The boundaries between the various soil types, insitu and laboratory test results, as well as stabilized ground water levels, are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with a profile showing a simplified stratigraphical summary are shown on Sheet No. 33 and No. 54. Four sections showing estimated stratigraphical details based on borehole data are shown on Sheet No. 33A and No. 54A .

The various soil types encountered are briefly described in the following paragraph.

Silty Clay, Sand, and Gravel (Glacial Till)

The surficial deposit encountered across the site for depths ranging from 8.5 metres to 11.9 metres is a cohesive glacial till composed of silty clay with sand and a trace of gravel. Typical grain size distribution curves for representative samples of this deposit are plotted in envelope form on Figure 1 in the appendix. Stratified silt and sand seams with occasional cobbles and boulders were encountered within this deposit.

The results of Atterberg Limit and water content testing are plotted on the Plasticity Chart, Figure 2, and summarized as follows:

	<u>Range</u>	<u>Average</u>
Water Content (w) %	10-20	15
Liquid Limit (w_L) %	19-29	23
Plastic Limit (w_p) %	12-20	15
Plasticity Index (I_p) %	2-14	8

These results indicate the fine grained matrix of the glacial till to consist of an inorganic silty clay of low plasticity (CL to CL-ML).

Based on interpretation of Standard Penetration Test 'N' values and augering operations, the consistency of this silty clay till deposit is assessed as ranging from stiff to hard.

Silty Sand to Sand, Varying Amounts of Gravel

The cohesive surficial till deposit is underlain by a glaciolacustrine deposit consisting of silty sand to sand with varying amounts of gravel and a trace of clay-sized fractions. This deposit was explored for a maximum thickness of 23 metres corresponding to a maximum depth of 33.4 metres. Typical grain size distribution curves plotted in envelope form are shown on Figure 3a, 3b, and 3c, in the appendix, indicating the variable composition of this granular deposit. Alternating seams and layers of stratified silt, sand, and gravel were encountered within this deposit. In addition, based on augering operations, cobble and boulder sized fragments are well dispersed throughout this deposit probably accounting for refusal to advance augers at various depths within the borings.

Interpretation of Standard Penetration Test 'N' values generally in excess of 50 blows per 0.3 metres, suggests a denseness ranging from dense to very dense but consistently very dense below elevation 156.

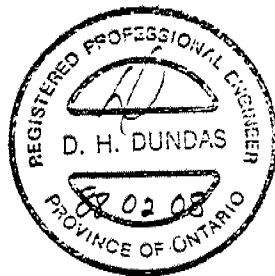
Groundwater Condition

Based on water level readings taken in open boreholes over a period of time, a perched water table exists within the relatively impermeable silty clay till deposit which approximates, within a metre, the ground surface. 'Ponded' water and marshy surface conditions are apparent over some of the site.

In addition, slight subartesian conditions can be assumed within the silty sand to sand deposit based on sand and silt 'boiling-up' within the augers during borehole advancement operations.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. H. Sturm, Engineer-in-Training, and Mr. V. Parker, Field Technician, utilizing equipment owned and operated by Atcost Soil Investigation, Toronto. This report was written by Mr. T.J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.



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

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 153-80-02 LOCATION Co-ords. N 4 844 821.2; E 294 328.3 ORIGINATED BY V.P.
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Augers and Cone Test COMPILED BY V.P.
 DATUM Geodetic DATE 81-12-10 to 81-12-11 CHECKED BY CP

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
171.9	Ground Surface													
0.0														
	Mottled		1	SS	9		170							2-20-45-33
			2	SS	13									
			3	SS	29									
	Brown Grey (Glacial Till)		4	SS	27									
	Silty Clay with Sand trace of Gravel		5	SS	21		168							3-20-57-20
			6	SS	35									
			7	SS	14		166							
	Stiff to Hard		8	SS	16		164							
			9	SS	53		162							
			10	SS	37		160							0-28-42-30
160.0														
11.9	Silty Sand Dense		11	SS	37									
158.0	Boulder		12	RC	-									
13.9	Break corebarrel in borehole Abandon hole End of Borehole													
	* Borehole caved at shallow depth. Perched water level at 0.5 metres.													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 153-80-02 LOCATION Co-ords. N 4 844 869.0; E 294 354.2 ORIGINATED BY V.P.
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Augers/Solid Stem Augers 24.4 m to 33.4 m COMPILED BY V.P.
 DATUM Geodetic DATE 81-12-16, 81-12-17 and Cone Test CHECKED BY GP

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
171.5	Ground Surface													GR SA SI CL
0.0	(Glacial Till)		1	SS	9		170							2-22-55-21
			2	SS	26									
			3	SS	49									
	Brown Grey		4	SS	50		168							
	Silty Clay with Sand trace of Gravel		5	SS	38									5-12-51-32
			6	SS	21		166							
	occ. Cobbles and Boulders		7	SS	26									
			8	SS	30		164							
	Stiff to Hard		9	SS	44		162							
161.1	boulder		10	SS	36		160							22-48-25-5
10.4	Grey		11	SS	105		158							
	Silty Sand to Sand Varying Amounts of Gravel		12	SS	58		156							2-71-25-2
	Occasional Cobbles and Boulders throughout		13	SS	58/15 cm		154							44-42-(14)
	Alternating Seams and Layers of Silt, Sand and Gravel		14	SS	105/13 cm		152							
	Dense to Very Dense						150							
							140							
138.1	Refusal to Solid Augers, Possible Boulder or Bedrock End of Borehole													
33.4	* Perched Water Table at 0.9 m Borehole Caved at 3.5 m													
	Note: This borehole is a combination of two borings the first meeting refusal at 10.7 metres on a probable boulder.													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

METRIC

W P 153-80-02 LOCATION Co-ords N 4 844 838.7; E 294 313.7 ORIGINATED BY V.P.
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY V.P.
 DATUM Geodetic DATE 81-12-18 to 81-12-21 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				
171.4	Ground Surface															GR SA SI CL
0.0	(Glacial Till)		1	SS	42	*	170									
	Brown Grey		2	SS	60		168									1-17-67-15
	Silty Sand		3	SS	46		166									
	Silty Clay some Sand trace of Gravel		4	SS	75		164									
	Hard		5	SS	33		162									5-15-60-20
			6	SS	83		160									
159.8			7	SS	45		158									
11.6	Cobbles		8	SS	20		156									15-53-30-2
	Grey Compact		9	SS	84		154									
	Silty Sand		10	SS	105/	15 cm	152									6-75-(19)
	to Gravel and Cobble layers		11	SS	115/	13 cm	150									12-51-33-4
	Sand		12	SS	120/	3 cm										
148.5	Varying Amounts of Gravel															
	occasional Cobbles and Boulders throughout															
	Very Dense															
22.9	End of Borehole															
	* Borehole caved at 9.3 metres.															
	Perched Water Table															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5

METRIC

W P 153-80-02 LOCATION Co-ords. N 4 844 920.5; E 294 356.5 ORIGINATED BY V.P.
 DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger/BW Casing and Cone Test COMPILED BY V.P.
 DATUM Geodetic DATE 81-12-16 to 81-12-17 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	NUMBER	TYPE			20 40 60 80 100						
171.5	Ground Surface												
0.0	(Glacial Till)												
	Silty Clay		1	SS	12								
			2	SS	15								
			3	SS	37								
	Brown Grey		4	SS	35								
	with Sand		5	SS	27								
	trace of Gravel		6	SS	15								
	Stiff to Hard		7	SS	20								
	Cobble		8	SS	41								
	Gravel												
	Cobbles & Boulders												
162.4			9	SS	124								
9.1	Grey Silty Sand to Sand		10	SS	77								
	Varying Amounts of Gravel		11	SS	53								
	occasional Cobbles and Boulders throughout		12	SS	145								
			13	SS	148/	23 cm							
	Very Dense												
146.5			14	SS	147/	23 cm							
21.7	End of Borehole												
	* Note: W.L. after 24 hours												
	Refusal to augering at 8.2 metres												
	Move BH 1.2 m south												
	Drive BW casing and run bi-cone 18.3 to 21.3 metres.												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

METRIC

W P 153-80-02 LOCATION Co-ords. N 4 844 864.4; E 294 316.3 ORIGINATED BY V.P.
DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger/Drive "B" Casing COMPILED BY V.P.
DATUM Geodetic DATE 81-12-21 CHECKED BY *CP*

SOIL PROFILE		STRAT PLOT	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		NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
170.6	Ground Surface															GR SA SI CL
0.0	(Glacial Till)		1	SS	31	*	170									4-26-52-18
			2	SS	44											
			3	SS	47		168									2-4-82-12
	Brown Grey		4	SS	35											
	Silty Clay with Sand trace of Gravel		5	SS	40											
			6	SS	100/	8 cm	166									
			7	SS	36		164									
	Hard		8	SS	40											
	Gravel & Cobbles		9	SS	31		162									2-10-56-32
160.5																
10.1	Grey		10	SS	36		160									24-47-25-4
	Silty Sand to		11	SS	74		158									3-56-35-6
	Cobbles															
	Sand						156									
	Varying Amounts of Gravel		12	SS	149/	23 cm	154									
	Occasional Cobbles and Boulders throughout		13	SS	168/	23 cm	152									
	Dense to Very Dense						150									
149.0			14	SS	145/	23 cm										15-47-32-6
21.6	End of Borehole															
	* Perched Water Level at Ground Surface. BH Caved at 6.9 m.															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 7

METRIC

W P 153-80-02 LOCATION Co-ords. N 4 844 880.0; E 294 310.4 ORIGINATED BY V.P.
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Augers and Cone Test COMPILED BY V.P.
 DATUM Geodetic DATE 81-12-22 CHECKED BY CP

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				
171.7	Ground Surface															
0.0	(Glacial Till)		1	SS	27	*	170									
	Brown Grey		2	SS	44		168									
	Silty Clay with Sand trace of Gravel occ. cobbles		3	SS	30		166									
			4	SS	75		164									
	Very Stiff to Hard		5	SS	122/	22 cm	162									
161.6			6	SS	40		160									
10.1	Grey Silty Sand to Sand		7	SS	107		158									
	Varying Amounts of Gravel		8	SS	79		156									
	occasional Cobbles and Boulders throughout		9	SS	103		154									
	Very Dense		10	SS	102		152									
151.5			11	SS	157/	20 cm										
20.2	End of Borehole															
	* Note: W.L. not established at time of investigation.															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 8

METRIC

W P 153-80-02 LOCATION Co-ords. N 4 844 895.5; E 294 357.7 ORIGINATED BY V.P.
DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger/"B" Casing COMPILED BY V.P.
DATUM Geodetic DATE 81-12-22 CHECKED BY [Signature]

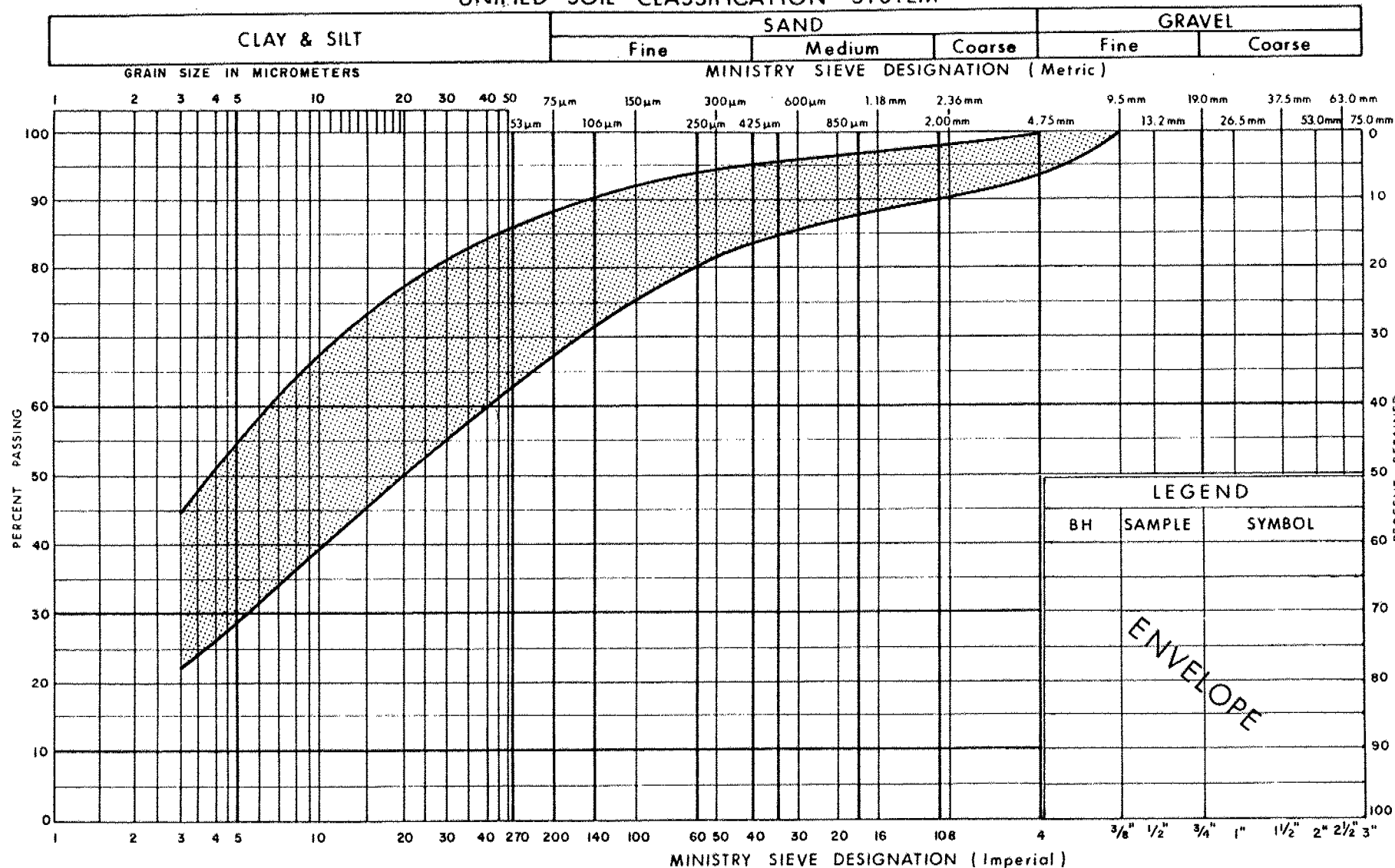
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <u>✓</u>				UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
170.8	Ground Surface												
0.0	(Glacial Till)		1	SS	31	*	170						
	<u>Brown</u> Grey		2	SS	25		168						
	Silty Clay with Sand trace of Gravel		3	SS	23		166						
	<u>Silty</u> <u>Sand</u>		4	SS	27		164						
	Very Stiff to Hard		5	SS	109		162						
162.0	8.8		6	SS	100		160						
	Grey		7	SS	118		158						
	Silty Sand to Sand		8	SS	11		156						
	Varying Amounts of Gravel		9	SS	156		154						
	occasional Cobbles and Boulders Throughout		10	SS	111		152						
	Very Dense		11	SS	100/	15 cm	150						
147.7	12		12	SS	100/	8 cm	148						
23.1	End of Borehole												
	* W.L. not established at time of investigation.												

+3, x5: Numbers refer to
Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM

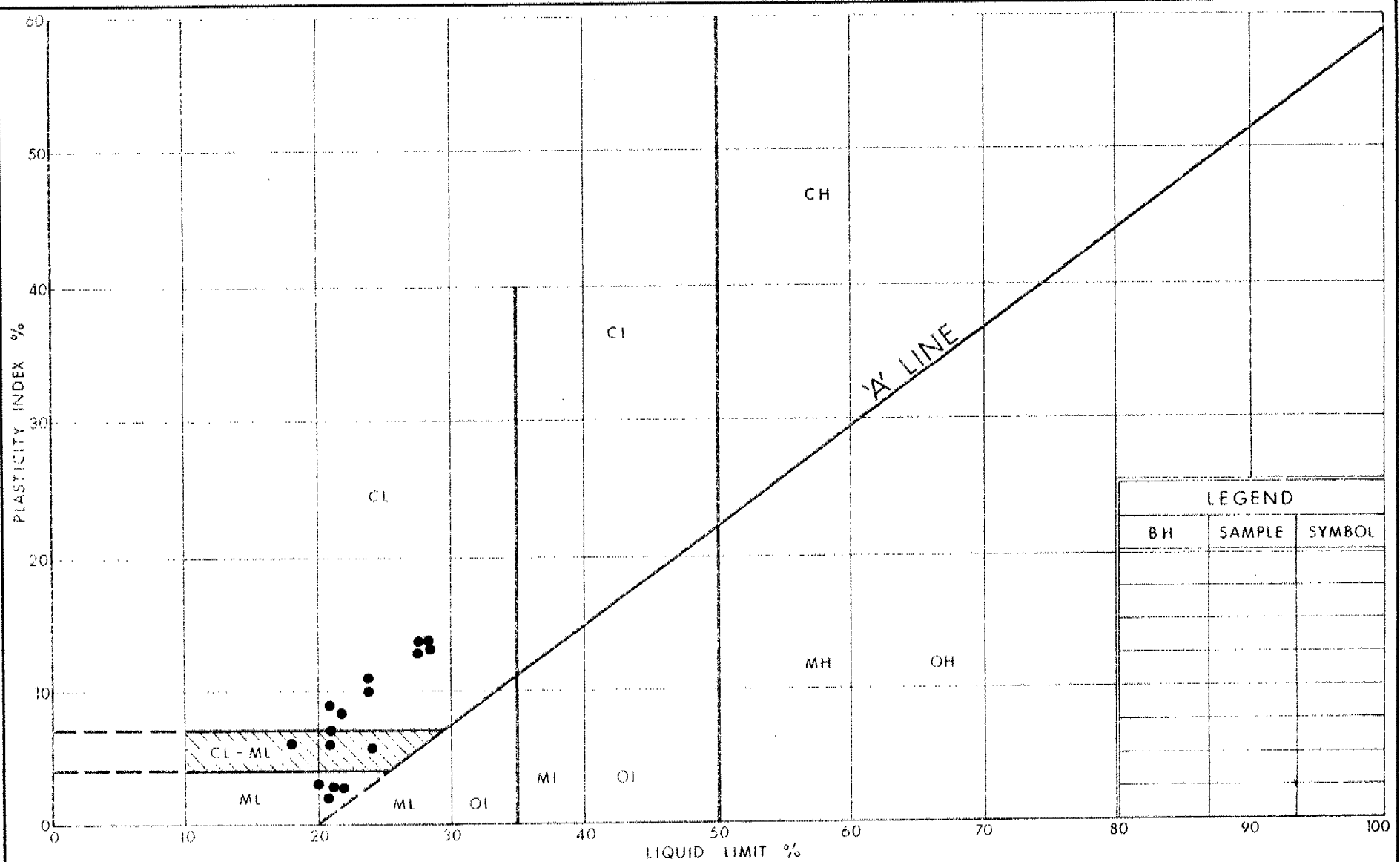


Ministry of
Transportation and
Communications

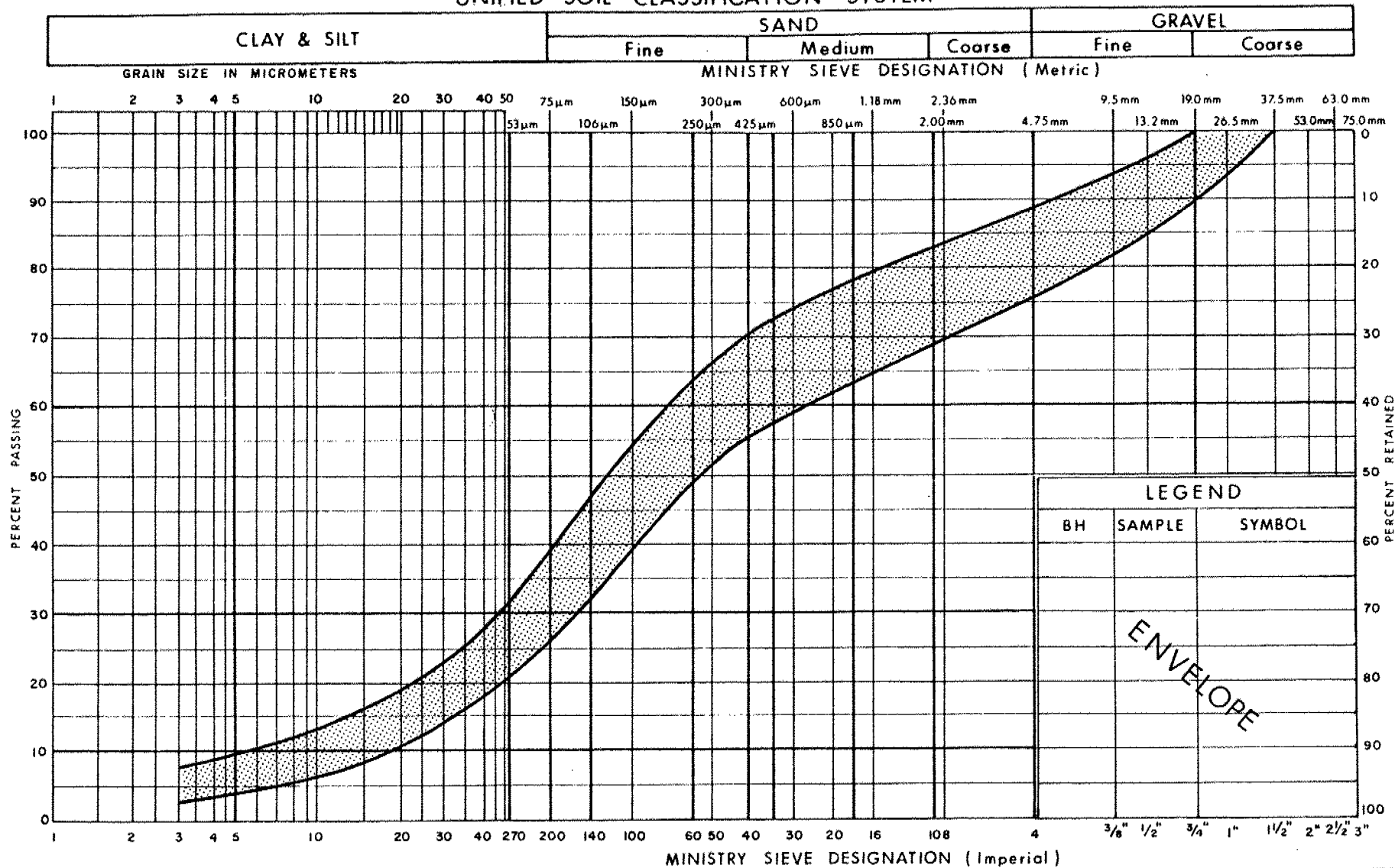
GRAIN SIZE DISTRIBUTION
SILTY CLAY, with SAND TRACE OF GRAVEL
 (Glacial Till)

FIG No 1

W P 153-80-02



UNIFIED SOIL CLASSIFICATION SYSTEM



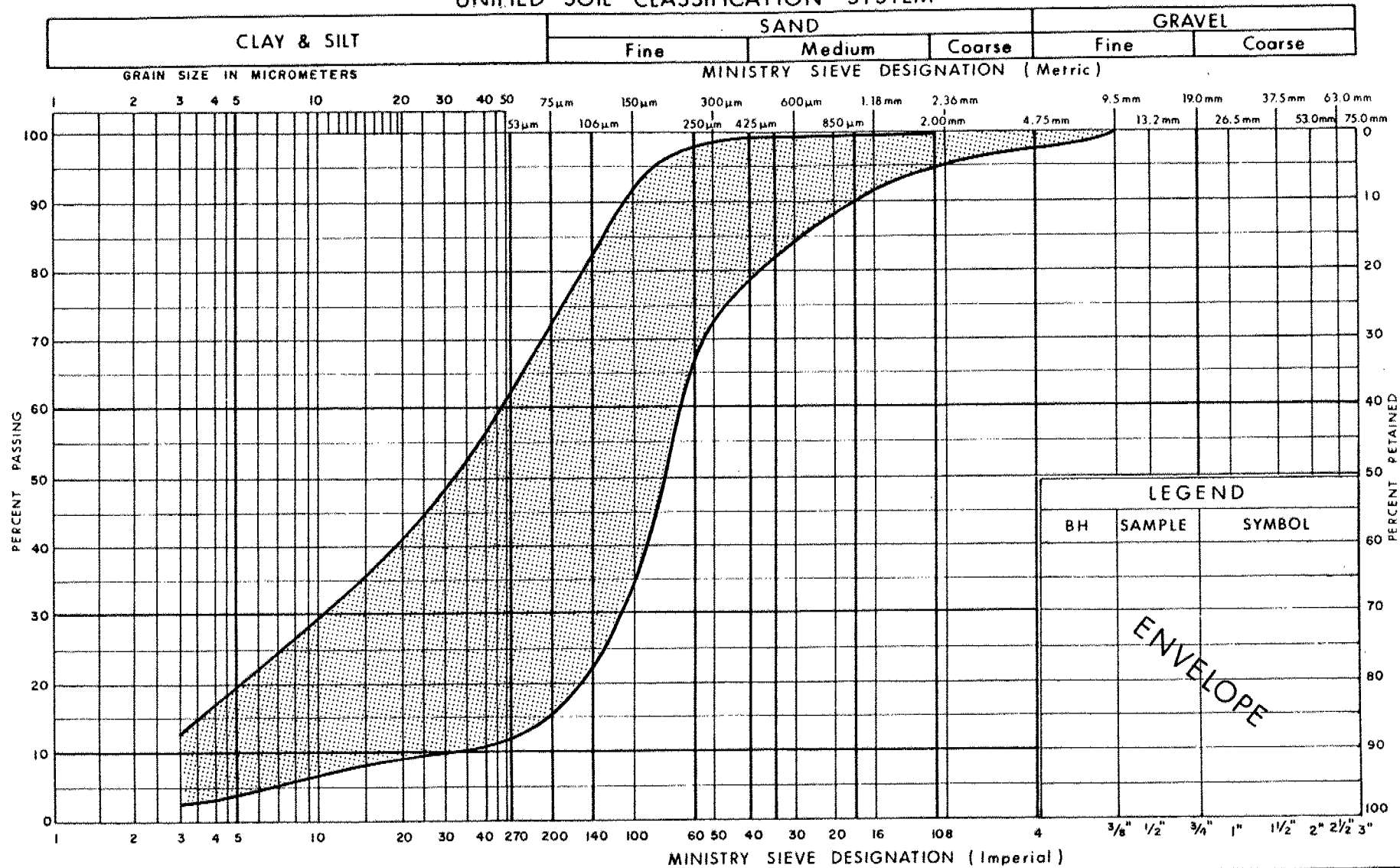
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SAND WITH SILT SOME GRAVEL

FIG No 3A

W P 153-80-02

UNIFIED SOIL CLASSIFICATION SYSTEM



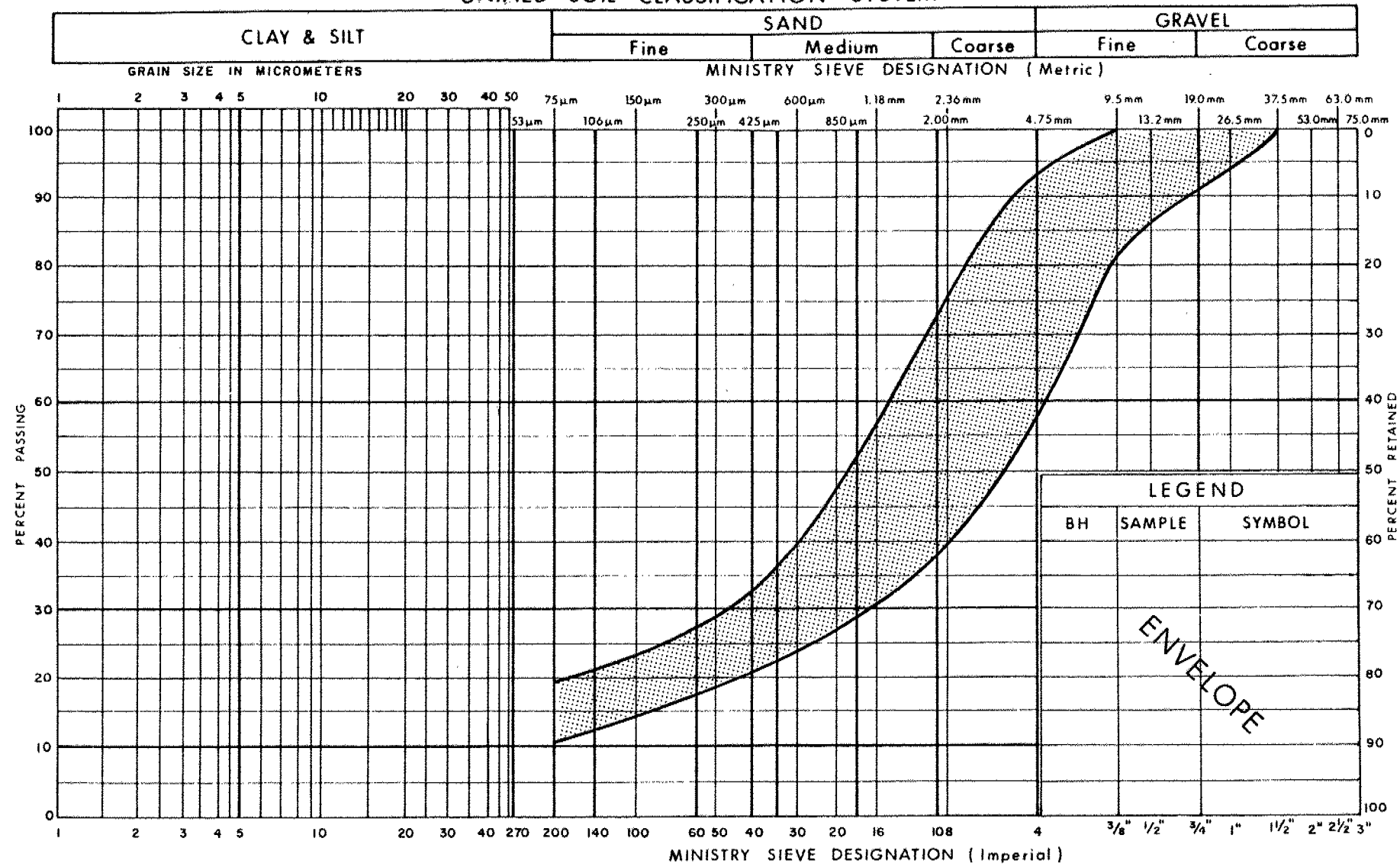
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Communications

GRAIN SIZE DISTRIBUTION
SILTY SAND

FIG No 3 B

W P 153-80-02

UNIFIED SOIL CLASSIFICATION SYSTEM



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Communications

GRAIN SIZE DISTRIBUTION
SAND WITH VARYING AMOUNTS OF GRAVEL TRACE OF SILT

FIG No 3C

W P 153-80-02

FOUNDATION INVESTIGATION REPORT
FOR

Albion Road Overpass

W.P. 153-80-03, Site 37-80-1110

Highway 427, District 6, Toronto

1. INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation required for the above-noted project. The investigation was carried out by Peto MacCallum Ltd. (geotechnical consultants for this project), under the technical supervision of the Ministry of Transportation Foundation Design Section.

2. FIELD WORK

The scope of the present investigation was established based on the subsurface information available in the general area, particularly from MTC investigations for other structures in the Highway 427 proposed extension, and generally competent glacial till soils were anticipated.

A total of six (6) boreholes were scheduled for the proposed underpass structure, two along each of the pier and abutment lines. Two deep and four relatively shallow boreholes were planned.

The field work was carried out during the period of February 17 to 19, 1982, at the locations shown on the appended plan. The holes were extended to a depth of 9.39 to 18.57 m below existing grade using a CME-75 Nodwell mounted drillrig equipped with continuous flight hollow stem augers, supplied and operated by a specialist drilling contractor.

Representative samples of the overburden were obtained at frequent intervals using a conventional split spoon sampler in conjunction with standard penetration tests. Relatively undisturbed samples of the cohesive soils encountered at the site were recovered in thin walled Shelby tubes. Dynamic cone penetration tests were carried out from the ground surface in two (2) boreholes.

The groundwater conditions in the open boreholes were closely monitored during and on completion of drilling. Piezometers were installed in two (2) boreholes and monitored

to determine the stabilized groundwater conditions. Details of the piezometer installations are described on the appended Record of Borehole sheets 1 and 5.

The field work was supervised throughout by a member of our engineering staff who directed the drilling and sampling operations, documented the soil stratigraphy encountered, monitored the groundwater condition in the open boreholes, detailed the piezometer installations and cared for the recovered samples.

The location and ground surface elevation at the boreholes were established in the field by Peto MacCallum Ltd. The following geodetic benchmark, provided by The Ministry of Transportation and Communications was used as a reference for vertical control:

E-BM 1010 - elevation 173.217 (metric);
Tablet in centre at north end of
west concrete pier of bridge over
CNR tracks on Albion Road, 1.16 m
above ground level. (benchmark
elevation has been adjusted per
information from MTC).

3. LABORATORY TESTING PROGRAMME

All the recovered samples were brought to our laboratory for detailed visual examination and routine testing to confirm field classifications.

The following tests were conducted:

Moisture content on all samples	Record of Borehole Sheets
Six (6) Atterberg Limits	Table I
Three (3) "Quick" Triaxial Compression tests	Table II
One (1) pH and Sulphate Content on Groundwater Sample	Table III
Five (5) Grain Size Analyses tests	Figures 1 to 4

4. SITE DESCRIPTION, SUBSURFACE SOILS AND GROUNDWATER CONDITIONS

The site comprises relatively flat open fields and slopes gently down in a north to south direction. The site was snow covered at the time of drilling. Existing Albion Road is raised about 0.5 m above the surrounding area.

Reference is made to the appended Record of Borehole sheets for details of the field work including soil classifications, inferred stratigraphy, standard penetration 'N' values, dynamic cone penetration tests, the results of laboratory undrained shear strength testing, groundwater observations in the open boreholes and installed piezometers, laboratory moisture content determinations and Atterberg Limit test results. Summarized subsurface profile conditions are shown on Sheet No. 73.

The stratigraphy at the bridge site generally comprises surficial topsoil overlying a major glacial till deposit comprising shallow silty clay of intermediate plasticity grading to silty clay of low plasticity and then to silty sand with depth. The deepest borehole encountered very dense sand at a depth of 16.15 m.

4.1 TOPSOIL

Surficial topsoil, described as dark brown silty clay with relatively low organic content, was found to a depth ranging from 310 to 760 mm in all the boreholes.

4.2 SILTY CLAY OF INTERMEDIATE PLASTICITY (GLACIAL TILL)

Silty clay glacial till of intermediate plasticity was contacted in all the boreholes under the topsoil, and extended to depths of 2.13 to 3.66 m below ground surface, about elevation 169 to 170. This stratum was typically described as very stiff brown silty clay with sand, trace of gravel, fissured, thin fine sand layers. Based on the standard penetration test 'N' values the consistency, locally, ranged from firm to hard.

The results of three (3) "Quick" triaxial compression tests on this stratum are shown in Table II and on Records of Borehole 3 and 6, and indicated shear strengths of 99, 154, and 204 kPa, a very stiff consistency. Wet unit weights of the triaxial test specimens ranged from 20.1 to 20.9 kN/m³.

Atterberg limits on four (4) samples of the silty clay are shown on Table I, and indicate liquid limits ranging from 32 to 49, plastic limits from 16 to 22 and plasticity indices from 15 to 27, all typical of a plastic clay soil of intermediate plasticity (CI). Natural moisture contents were as high as 26% directly under the topsoil, but generally the silty clay stratum showed moisture contents of 18 to 22%, about the plastic limit, typical for over-consolidated clays.

A grain size distribution curve of the silty clay is shown on Figure 1.

4.3 SILTY CLAY OF LOW PLASTICITY (GLACIAL TILL)

The silty clay till of intermediate plasticity graded to a silty clay glacial till of low plasticity in all the boreholes at depths ranging from 2.13 to 3.66 m, and extended to depths of 4.88 to 7.01 m, about elevation 168.04 to 165.31, sloping down in a north to south direction.

This stratum was typically described as brown to grey silty clay with sand, trace gravel; fissured, thin fine sand layers. Based on the standard penetration test 'N' values, the consistency ranged from hard to very stiff.

Atterberg limits are shown in Table I and indicate a liquid limit of 23, a plastic limit of 16, and a plasticity index of 7. Natural moisture contents for this stratum were typically 10 to 12%, well below the plastic limit indicative of the over-consolidated state of this stratum.

A unit weight determination on a silty clay specimen showed a wet unit weight of 22.2 kN/m^3 , typical for hard glacial till soils. A grain size distribution curve is shown on Figure 2.

4.4 SILTY SAND (GLACIAL TILL)

Silty sand glacial till underlay the silty clay in all the boreholes, at depths from 4.88 to 7.01 m, and was not fully penetrated except in borehole 1, at a depth of 16.15 m, elevation 156.17.

This stratum was described as grey silty sand, fine to coarse, with gravel. Based on the standard penetration test 'N' values, the relative density was very dense throughout.

A unit weight determination showed a value of 22.4 kN/m^3 , typical for dense glacial till soils. An Atterberg Limit determination confirmed the non-plastic nature of this silty sand glacial till soil. Natural moisture contents were typically 7 to 10% in the upper part of the stratum and as high as 12%, at depth, below the groundwater level.

Typical silty sand glacial till grain size distribution curves (2) are shown on Figure 3.

4.5 SAND

The deepest borehole 1, contacted sand at a depth of 16.15 m, elevation 156.17 and this stratum was not fully penetrated at the termination depth of the borehole, 18.57 m.

This stratum was described as grey sand, fine with silt; occasional thin layers of silty clay. Based on the standard penetration test 'N' values, the relative density was very dense throughout.

A typical sand grain size distribution curve is shown on Figure 4.

4.6 GROUNDWATER

The groundwater conditions observed in the boreholes during and on completion of drilling, and the piezometer readings afterward, are shown on the individual Record of Borehole sheets. Generally, on completion of drilling most of the boreholes indicated a depth of groundwater below about 8 m.

Subsequent readings in the piezometer installed at 18.0 m depth in borehole 1 indicated a groundwater level at 5.3 m (elevation 167.0). The piezometer in borehole 5, at a depth of about 9.0 m, indicated a groundwater level at 2.38 m; however, it is suspected that this may be due to perched water infiltration.

NOTE:

The preceding report is a copy of the factual information from the Foundation Report prepared by Peto MacCallum Ltd. (consulting geotechnical engineers for this project), under the technical supervision of the Ministry of Transportation Foundation Design Section.



D. H. Dundas

D. H. Dundas, P. Eng.

Sr. Foundations Engineer

APPENDIX

RECORD OF BOREHOLE No 1

Metric

W P 153-20-03 LOCATION Co-ords: 4,845, 115N; 294, 281E ORIGINATED BY M.R.
 DIST 5 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
 DATUM Geodetic DATE February 17, 1982 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 kN/m ³	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														
										WATER CONTENT (%)												
										10	20	30										
172.32	Ground Level																					
172.00	Topsoil, silty clay, low organic, dark brown						172						44									
0.31	Silty clay with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till)		1	SS	10								19.1	0 17 38 45								
170.13	Intermediate plasticity		2	SS	7																	
2.13	Stiff to Firm, Brown		3	SS	37		170															
	Silty clay with sand, trace gravel, fissured, thin sand layers (Glacial Till) Low plasticity		4	SS	51								22.2	1 19 52 23								
			5	SS	30																	
167.75	Hard Brown		6	SS	26		168															
4.57	becoming very stiff, Grey		7	SS	17		166															
165.31			8	SS	91		164						22.4	28 40 29 3								
7.01	Silty sand fine to coarse with gravel, (Glacial Till)		9	SS	100/280 mm		162															
	Very Dense Grey		10	SS	100/200 mm		160							14 44 37 5								
			11	SS	100/280 mm		158															
			12	SS	100		156															
			13	SS	100/200 mm		154															
16.15	Sand, fine with silt, occasional thin layers of silty clay		14	SS	80/180 mm									0 65 22 13								
13.75	Very Dense Grey		15	SS	100/280 mm																	
18.57	End of Borehole																					
Note: 4 hr. after sample 11, water at elevation 160.42 inside augers Upon completion of augering, water at elevation 161.42 inside augers Piezometer installed at elevation 154.03 seal at elevation 163.48 <table><tr><th>Date</th><th>Water Elevation</th></tr><tr><td>Feb. 13/82</td><td>165.02</td></tr><tr><td>Feb. 19/82</td><td>165.42</td></tr><tr><td>Feb. 26/82</td><td>167.02</td></tr></table>															Date	Water Elevation	Feb. 13/82	165.02	Feb. 19/82	165.42	Feb. 26/82	167.02
Date	Water Elevation																					
Feb. 13/82	165.02																					
Feb. 19/82	165.42																					
Feb. 26/82	167.02																					

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

Metric

W P 153-80-03 LOCATION Co-ords. 4,845, 119N; 294, 317E ORIGINATED BY B.T.K.
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
DATUM Geodetic DATE February 19, 1982 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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAI PLOT	NUMBER	TYPE			20	40	60	80	100					
173.70	Ground Level															
172.00	Topsoil, silty clay, low plasticity															
0.61	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till)		1	SS	18											
	Intermediate plasticity		2	SS	28											
169.65	Very Dense Brown		3	SS	28											
3.05	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till)		4	SS	42											
	Low plasticity		5	SS	32											
			6	SS	35											
	Hard Brown to Grey		7	SS	41											
165.80																
7.01	Silty sand fine to coarse with gravel (Glacial Till)		8	SS	100											
163.28	Very Dense Gray		9	SS	100											
9.42	End of Borehole															
<p>Note: After removal of augers upon completion of drilling, borehole caved at elevation 164.24, no free water</p>																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

Metric

W P 153-90-03 LOCATION Co-ords. 4, 845, 141 N; 294, 277E ORIGINATED BY B.L.K.
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
DATUM Geodetic DATE February 18, 1982 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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
172.57	Gravel																
171.8	Topsoil, silty clay, low organic, Dark Brown																
170.76	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till)		1	SS	30		172										
	Intermediate plasticity		2	TV	PH												
169.52	Very Stiff to Hard Brown		3	SS	34		170										
169.05	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till)		4	SS	55												
	Low plasticity		5	SS	48		168										
	Hard to Brown		6	SS	25												
166.1	Very Stiff to Grey		7	SS	44		166										
164.40	Silty sand fine to coarse with gravel (Glacial Till)		8	SS	100/250 mm												
161.12	Very Dense Grey						164										
9.39	End of Borehole																
<p>Note: After removal of augers upon completion of drilling, water level at elevation 163.89 Borehole caved at elevation 164.04</p>																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

Metric

W P 153-30-03 LOCATION Co-ords. 4, 845, 145 N. 294, 313E ORIGINATED BY B.T.V.
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
 DATUM Geodetic DATE February 19, 1982 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	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100					
172.59	Ground Level																
172.29	Topsoil, silty clay, low organic Dark Brown						172										
0.31	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity		1	SS	16												
			2	SS	21												
			3	SS	22		170										
168.93	Very Stiff Brown		4	SS	24												
3.66	Silty clay with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till) Low plasticity		5	SS	20												
			6	SS	45		168										
166.49	Hard Gray																
6.10	Silty sand fine to coarse with gravel (Glacial Till)		7	SS	91		166										
			8	SS	86												
163.09	Very Dense Gray		9	SS	100, 200		164										
9.50	End of Borehole																
Note: After removal of augers on completion of drilling, water level and elevation 165.78 and borehole caved at elevation 165.68																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5

Metric

W P 153-80-03 LOCATION Co-ords. 4, 845, 161N; 294, 274E ORIGINATED BY B.L.K.
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
 DATUM Geodetic DATE February 18, 1982 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	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														
							WATER CONTENT (%)															
172.89	Ground Level																					
172.29	Topsoil, silty clay, low organic Dark Brown																					
0.61	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till) Intermediate plasticity Very Stiff		1	SS	26		172															
			2	SS	27																	
			3	SS	31		170															
3.05	Silty Clay with sand, trace gravel, fissured, thin fine sand layers, (Glacial Till) low plasticity		4	SS	49																	
			5	SS	50																	
163.01	Hard Brown		6	SS	43		168															
4.88	Silty sand, fine to coarse with gravel (Glacial Till)		7	SS	53																	
			8	SS	97		166															
			9	SS	100/230		164															
163.36	Very Dense Gray																					
9.53	End of Borehole																					
<p>Note: After removal of augers upon completion of drilling, water level at elevation 164.97 and borehole caved at elevation 165.57 Piezometer installed at elevation 163.44 seal at elevation 171.06</p> <table><tr><th>Date</th><th>Water Elevation</th></tr><tr><td>Feb. 19/82</td><td>169.92</td></tr><tr><td>Feb. 26/82</td><td>170.51</td></tr></table> <p>(possible perched water infiltration)</p>																	Date	Water Elevation	Feb. 19/82	169.92	Feb. 26/82	170.51
Date	Water Elevation																					
Feb. 19/82	169.92																					
Feb. 26/82	170.51																					

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

Metric

W P 151-20-01 LOCATION Co-ords. 4, 845, 168N; 294, 309E ORIGINATED BY R.L.K.
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.P.
DATUM Geodetic DATE February 17/18, 1982 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				
172.20	Ground Level															
172.60	Topsoil, silty clay, low plasticity															
0.61	Silty clay with sand, trace gravel, fissured, thin fine sand layers (Glacial Till)		1	SS	15		172									
170.40	Intermediate plasticity		2	SS	21											
2.74	Silty clay, with sand, trace gravel, fissured, thin fine sand layers. (Glacial Till)		3	SS	28											
	Low plasticity		4	SS	49											
	Hard		5	SS	52											
	Brown to Grey		6	SS	27											
5.18	Silty sand, fine to coarse with gravel (Glacial Till)		7	SS	98	250 mm										
			8	SS	100	200 mm										
	Very Dense	Grey	9	SS	120	200 mm										
			10	SS	100	180 mm										
			11	SS	94											
			12	SS	100	150 mm										
			13	SS	100	250 mm										
15.64	End of Borehole															
<p>Note: After removal of auger upon completion of drilling, water level at elevation 163.47 and borehole caved at elevation 167.43</p>																

OFFICE REPORT ON SOIL EXPLORATION

*3, *5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

JOB NO. 82 F 18
MARCH, 1982

TABLE I
ATTERBERG LIMIT TEST RESULTS

Albion Road Underpass
at Highway 427

<u>BOREHOLE NO.</u>	<u>SAMPLE NO.</u>	<u>DEPTH (m)</u>	<u>NATURAL WATER CONTENT (w) %</u>	<u>LIQUID LIMIT (^wL)</u>	<u>PLASTIC LIMIT (^wp)</u>	<u>PLASTICITY INDEX (^Ip)</u>	<u>REMARKS</u>
1	1	0.76-1.22	25	44	22	22	silty clay (CI)
3	2	1.52-1.98	22	49	22	27	silty clay (CI)
3	2	1.52-1.98	18	32	17	15	silty clay (CI)
6	3	2.29-2.74	21	32	16	16	silty clay (CI)
1	4	3.05-3.50	12	23	16	7	silty clay (CL)
1	8	7.62-8.07	9	Non-Plastic			silty sand

JOB NO. 82 F 18
MARCH, 1982

TABLE II
"QUICK" TRIAXIAL COMPRESSION TEST RESULTS

Albion Road Underpass
at Highway 427

BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	NATURAL WATER CONTENT (w) (%)	UNIT WEIGHT WET (γ) (kN/m ³)	DRY (γ_d) (kN/m ³)	VOID RATIO (e)	DEGREE OF SATURATION (S_r) (%)	CELL PRESSURE (σ_3) (kPa)	FAILURE STRAIN (ϵ_f) (%)	SHEAR STRENGTH (τ_f) (kPa)	REMARKS
3	2	1.52-1.98	22.1	20.9	17.1	0.55	100	37.2	5.0	154	silty clay (CI)
			17.9	20.6	17.4	0.51	94	37.2	5.8	204	silty clay (CI)
6	3	2.29-2.74	20.6	20.1	16.6	0.59	94	49.6	5.2	99	silty clay (CI)

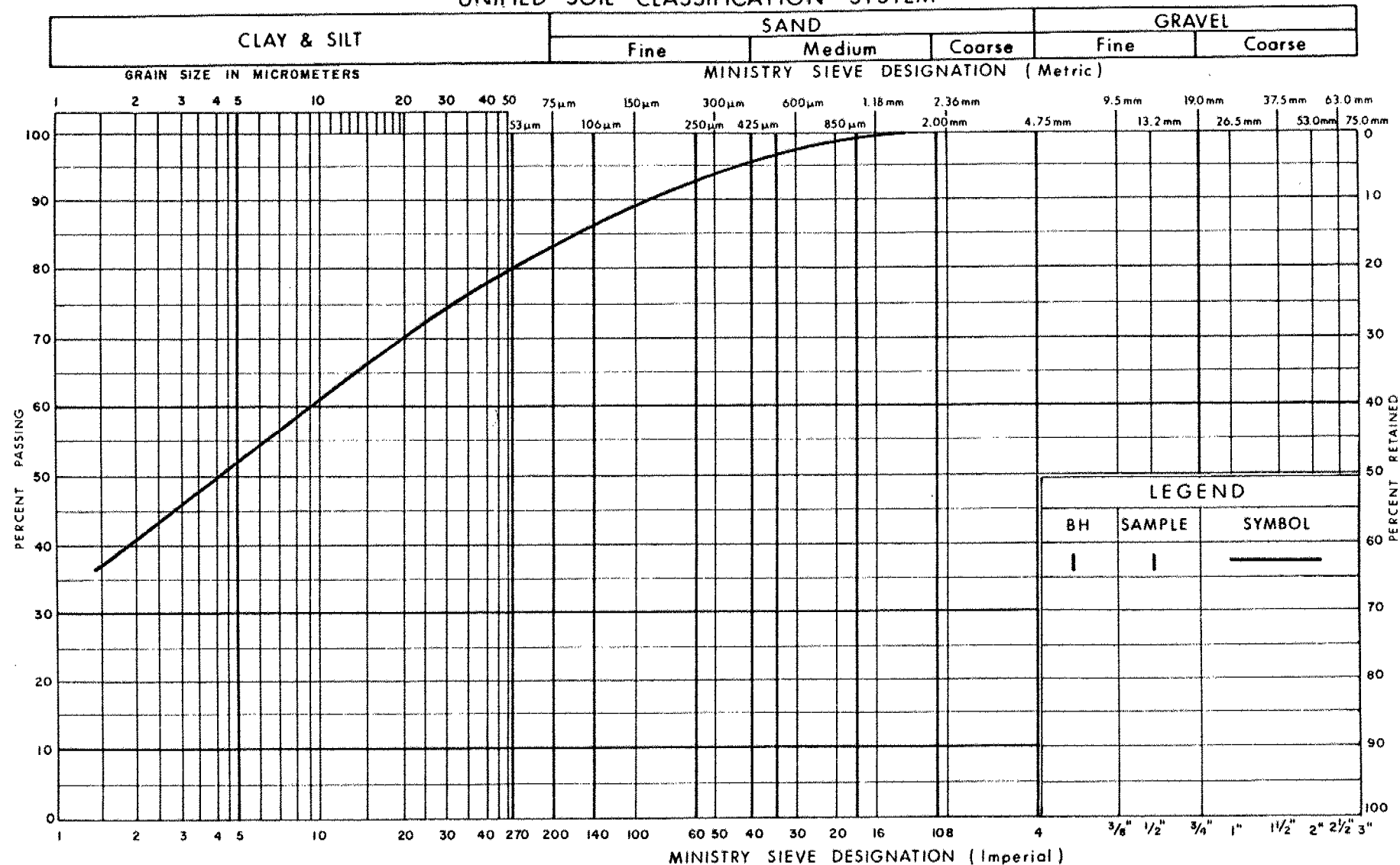
JOB NO. 82 F 18
MARCH, 1982

TABLE III
pH VALUE AND SULPHATE CONTENT OF WATER SAMPLES

Albion Road Underpass
at Highway 427

<u>BOREHOLE NO.</u>	<u>DEPTH (m)</u>	<u>pH VALUE</u>	<u>SULPHATE CONTENT ppm as SO₄</u>	<u>RELATIVE DEGREE SULPHATE ATTACK ON CONCRETE</u>
1	12.0	7.8	70	'negligible'

UNIFIED SOIL CLASSIFICATION SYSTEM



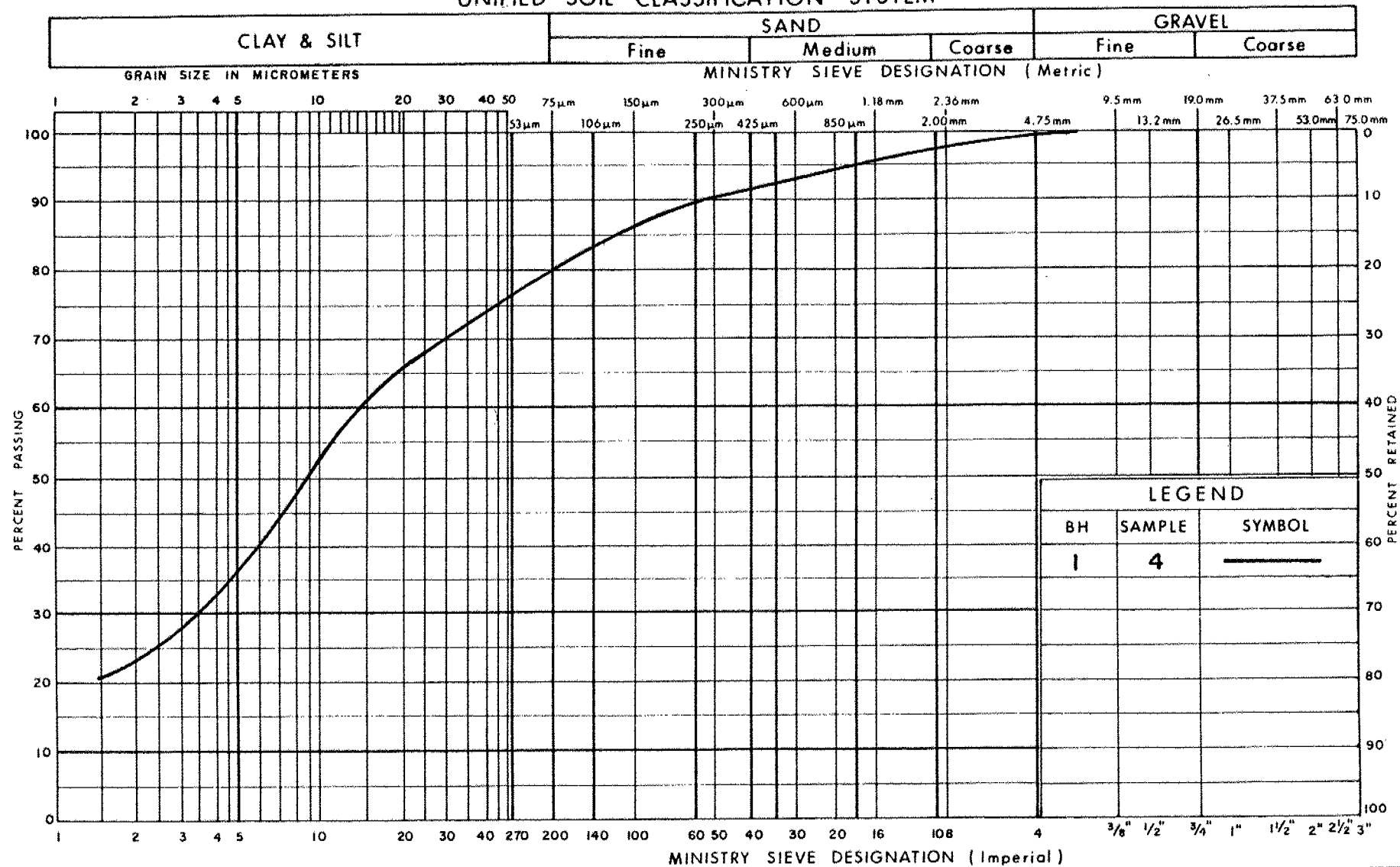
Ministry of
Transportation and
Communications

**GRAIN SIZE DISTRIBUTION
SILTY CLAY (GLACIAL TILL)
WITH SAND**

FIG No 1

W P 153-80-03

UNIFIED SOIL CLASSIFICATION SYSTEM



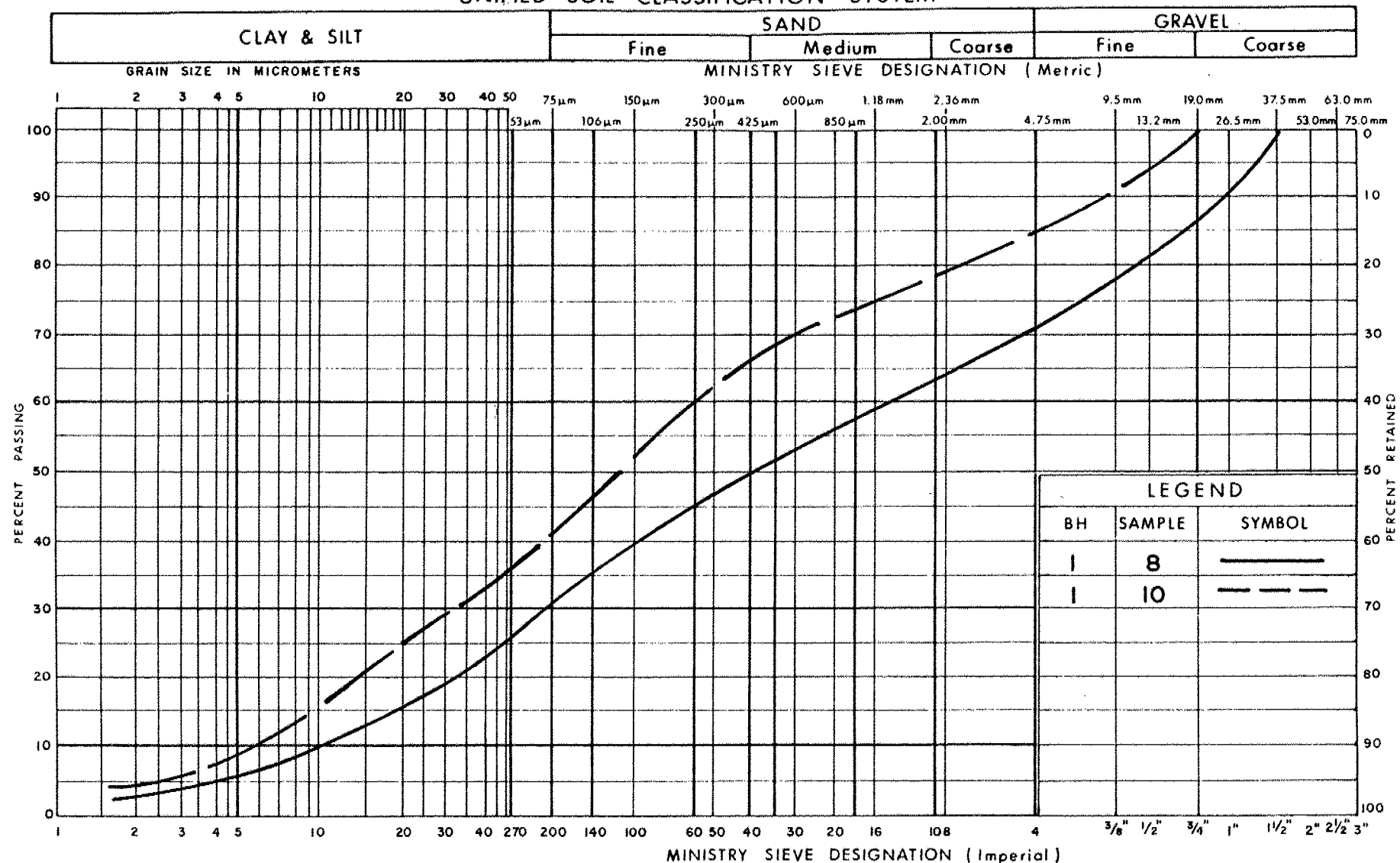
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY CLAY (GLACIAL TILL)
WITH SAND

FIG No 2

W P 153-80-03

UNIFIED SOIL CLASSIFICATION SYSTEM



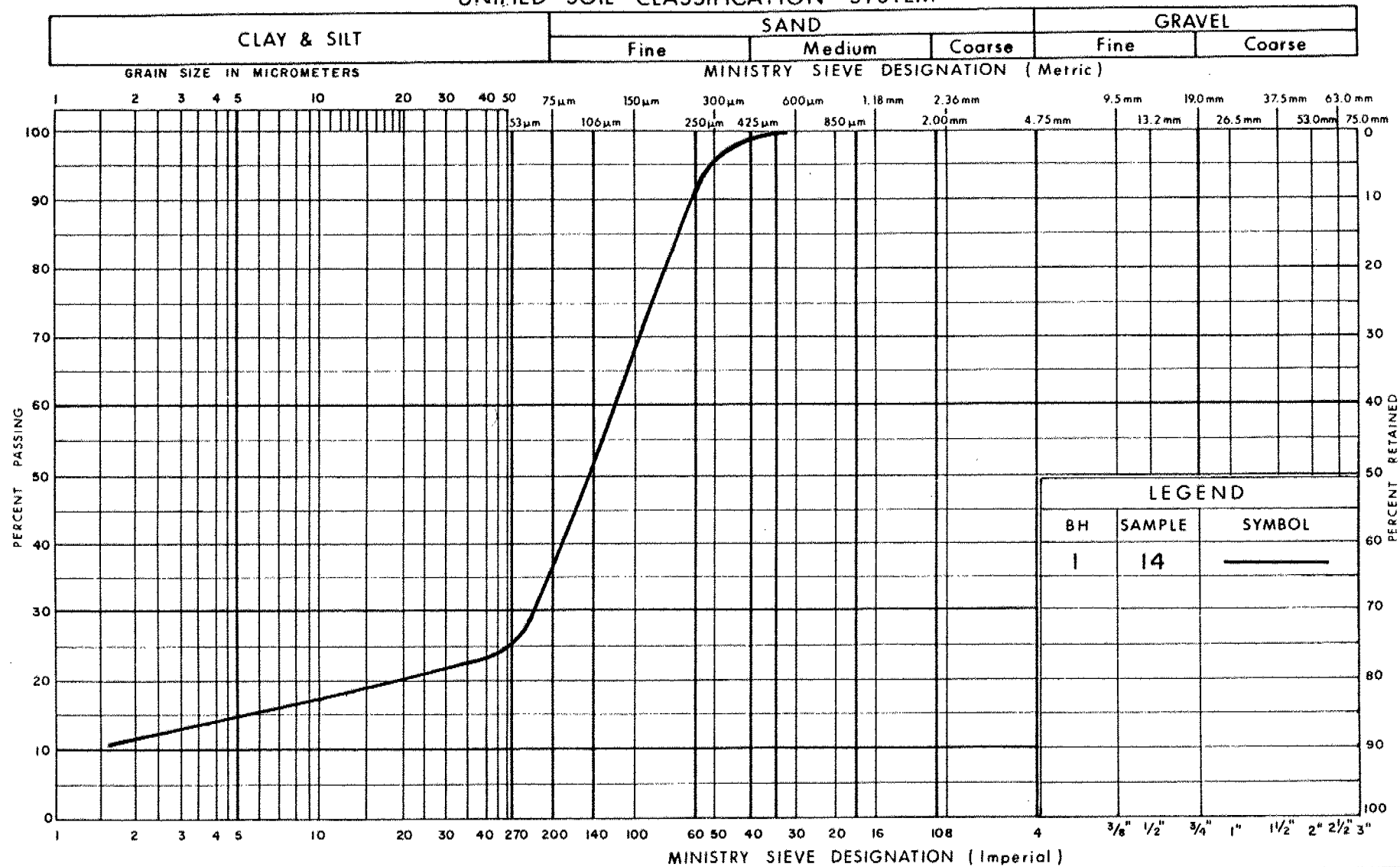
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY SAND (GLACIAL TILL)
FINE TO COARSE WITH GRAVEL

FIG No 3

W P 153-80-03

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SAND
FINE WITH SILT, OCCASIONAL THIN LAYERS OF SILTY CLAY

FIG No 4

W P 153-80- 03

FOUNDATION INVESTIGATION REPORT
FOR

Steeles Avenue Overpass
W.P. 153-80-04, Site 37-80-111
Highway 427, District 6, Toronto

1.0 INTRODUCTION

Golder Associates have been retained by the Ontario Ministry of Transportation and Communications to carry out a foundation investigation at the site of a proposed overpass bridge at Highway 427 and Steeles Avenue in Etobicoke, Ontario. Authorization for the investigation was received in a letter dated February 2, 1982 from the Hon. James Snow, Minister of Transportation and Communications.

The purpose of the investigation was to determine the subsurface conditions at the site and based on an assessment and interpretation of these data, to provide engineering recommendations for the geotechnical aspects of the design of the foundations for the proposed structure and the approach embankments.

The field investigation was carried out and this report was prepared in accordance with the terms of reference outlined in Golder Associates proposal letter dated February 2, 1982 to Mr. M. S. Devata, P. Eng., Supervisory Engineer in the Soil Mechanics Section, Ministry of Transportation and Communications, Downsview, Ontario.

FIELD WORK

The present boring program consisted of six boreholes (numbered 1 to 6) which were put down between February 12 and 16, 1982 at the locations shown on Sheet 93. A bombardier-mounted CME-75 power auger (supplied by Atcost Soil Drilling Inc.) was used with 175 mm diam. hollow-stem augers for all boreholes. A total of 70 metres of sampled borings were put down to depths of between 9 and 21 metres.

Soil samples were taken at 0.75 to 1.5 metre intervals of depth, using a standard 50 mm O.D. split-barrel sampler advanced by a 63.5 kg weight falling freely over 0.75 metre to determine 'N' values (blows per 0.3 metre penetration). Details of the drilling and sampling operations are summarized on the Record of Borehole sheets.

Piezometers were sealed into 5 of the 6 boreholes to allow monitoring of groundwater levels across the site. The remaining borehole was backfilled to the ground surface.

The field work was supervised throughout by a member of our engineering staff who located the borings in the field, cleared the site for buried services, directed the drilling and sampling operations, and logged the boreholes.

The borehole locations and ground elevations at the boreholes were surveyed by Golder Associates. The elevations were referred to Geodetic datum using BM E-1010 (Elev. 173.217 m) located at the north end of the west concrete pier of the bridge structure on Albion Road over the C.N.R. railway tracks.

All soil samples were shipped to our laboratory for detailed examination. Selected representative samples were tested for grain size distribution while all samples were subjected to a water content determination. The test results are summarized on the Record of Borehole sheets and on Figures 1 to 6.

2.0 SITE AND PROJECT DESCRIPTION

The details and requirements of the project were provided during a meeting between Messrs. M. Devata and T. Kazmierowski of the Ministry of Transportation and Communications, and Messrs. F. Heffernan and M. Tanos of Golder Associates on January 27, 1982. Additional details were provided on a drawing titled "Highway No. 427 Over Steeles Ave., Preliminary Site Plan" dated November, 1981 (Dwg. No. X-81197-G3 by Proctor & Redfern Limited).

The project site is located on Steeles Avenue between Highway No. 27 and Highway No. 50 on the boundary between the Borough of Etobicoke and the Town of Vaughan (refer to Sheet No.-93) . The existing topography around the site is flat and level. The land is clear of vegetation and is currently in use as farm land. At present, Steeles Avenue is a 2 lane paved roadway with narrow gravel shoulders and side ditch drainage.

3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

From a review of available geological references*, the site is located in the Halton-Peel till plain which was spread over the area by the advance and retreat of the Wisconsin ice sheet during the Pleistocene epoch (over 5,000 years ago). The till plain occupies the area east of the Niagara Escarpment and north of the Lake Iroquois shoreline. It consists mainly of a bevelled till plain with a gently undulating rolling surface and limited relief. In places the till is overlain by thin deposits of varved clay.

Indications are that there are four till sheets present. The uppermost material is described as a stony clay. The till sheets are usually separated from one another by a bed of stratified silt or sand of variable thickness. The middle till is a grey to brown, dense sandy till up to 6 m thick. The lowest till is a grey silty till which appears sandier than the surficial till. Grey shale bedrock has been found in the area at depths of 25 to 30 metres below ground surface.

3.2 Soil Stratigraphy

The detailed stratigraphy encountered in each of the boreholes put down during this investigation is given on the attached Record of Borehole sheets. It should be noted that the soil boundaries indicated on the Record of Borehole sheets are not exact planes of geological change but represent transitions

* Watt, A.K., "Pleistocene Geology and Groundwater Resources, Township of Etobicoke", O.D.M. Geological Report 59, 1968.

Hewitt, D.F., "Industrial Mineral Resources of the Brampton Area", O.D.M. Industrial Mineral Report 23, 1969.

Chapman, L.J., and Putnam, D.F., "The Physiography of Southern Ontario", Ontario Research Foundation, 1966.

Hewitt, D.F., White, O.L., "Industrial Mineral Resources of the Bolton Area", O.D.M. Industrial Mineral Report 30, 1969.

from one soil type to another. Conditions will change between boreholes. The locations of the boreholes and stratigraphic sections showing the inferred subsurface conditions are given on Sheet No. 93. The results of laboratory testing carried out on representative samples are given on the Record of Borehole sheets and on Figures 1 to 5 inclusive.

3.2.1 Silty Clay Till

Beneath about 150 mm of topsoil, a mottled brown and gray silty clay till was encountered in all the borings, to depths of 2.9 to 4.3 metres below ground surface. The till is generally well-graded and contains sand as well as inclusions of rounded medium to fine gravel (see Figure 1). Towards its base, the stratum contains a higher proportion of sand. 'N'* values of 21 to 57 were measured in the till indicating the soil to be very stiff to hard.

The measured water content of the clayey silty clay till ranged from about 20 percent near the ground surface to about 10 percent at depth. Based on the 'N' values obtained and the correlations quoted by Terzaghi (1948)** and Hough (1969)***, it is estimated that the undrained shear strength of the soil is at least 200 kPa. The measured liquid limit of the material varied between 30 and 21 percent and the plastic limit varied between 18 and 16 percent. The plasticity index was found to be between 5 and 12 percent. These values classify the soil as inorganic clay and silt of low plasticity.

3.2.2 Interbedded Silty Sand and Sandy Silt

In all the boreholes, the silty clay till stratum is underlain by a 2 to 3 metre thick deposit of brown interbedded silty sand

* 'N' - Standard Penetration Resistance - Refer to Explanation of Terms.

** Terzaghi, K. and Peck, R.B., "Soil Mechanics in Engineering Practice", J. Wiley & Sons, 1948.

*** Hough, B.K., "Basic Soils Engineering", Ronald Press Co., 1967.

and sandy silt layers extending to depths of 5.2 to 6.7 metres below ground surface. The layers are horizontal and their thickness varies from 10 to 55 mm. The results of grain size analyses carried out on samples of this deposit are shown on Figure 2. 'N' values measured in this deposit ranged from 59 to 120 which indicate it to be very dense.

The measured water content of the sand and silt layers ranges from about 2 to 19 percent. In boreholes 1, 3 and 4 the static water level is below the base of the deposit and the average water content is about 8 percent. In boreholes 2, 5 and 6, the static water level is within the deposit and the average water content is about 16.5 percent.

3.2.3 Silty Fine Sand and Sand with some Gravel

Beneath the interbedded silt and sand, a silty fine sand stratum was encountered in all the boreholes. In boreholes 2 to 6, the fine sand extended to the bottom of the boreholes at depths of about 9.5 and 11 metres below ground surface. In borehole 1 the silty fine sand was found to be about 8 metres thick, extending to a depth of about 13 metres below ground surface. In boreholes 4 and 6, a well graded sand deposit with gravel was encountered below the fine sand and this extended to the bottom of the boreholes. In borehole 3 a similar material was present as a 1 metre thick seam within the fine sand. The grain size distributions of this fine sand and the sand with gravel are given on Figures 3 and 4 respectively. The 'N' values recorded during sampling were similar for both the fine sand and the sand with gravel and ranged from 35 to more than 125 with an average value of about 70. Several of the lower 'N' values are considered to have resulted from disturbance caused by upward seepage during sampling operations.

The measured water content of this very dense sand strata ranged from 10 to 20 percent with an average of about 16 percent.

3.2.4 Hard Grey Till

Beneath the silty fine sand stratum in Borehole 1, a very hard, grey silty clay till with some gravel and sand was encountered to a depth of at least 21.5 metres below ground surface. The grain size distribution of this soil is shown on Figure 1. A 400 mm thick seam of silty fine sand was found within the hard till at a depth of about 20 metres below ground surface. The 'N' values recorded for this stratum were all greater than 100 per 225 mm of penetration, and the deposit can be described as very hard.

The measured water content of the till was between 7 and 9 percent. The measured liquid limit and plastic limit was 24 and 15 percent respectively, for a plasticity index of 9. The till can be classified as a clay of low plasticity.

3.3 Groundwater Conditions

Following completion of each borehole, piezometers were installed in all boreholes except No. 5, to allow monitoring of groundwater levels across the site. The details of piezometer installation are given on the Record of Borehole sheets.

The water levels in the piezometers were monitored on February 16 and 17 and March 1, 1982. The individual readings are given on the attached Table 1. The stabilized groundwater level within the confined sand strata was found to be at about elevation 170 metres which is 5 to 6 metres below ground surface. The piezometer in Borehole 1 was installed within the hard grey till beneath the sand strata and the measured water level was at about elevation 169.8 metres. Seasonal fluctuations of the groundwater level should be anticipated.

NOTE:

The preceding report is a copy of the factual information from the Foundation Investigation Report prepared by Golder Associates (consulting geotechnical engineers for this project), under the technical supervision of the Ministry of Transportation Foundation Design Section.



A handwritten signature in cursive script that reads "D. H. Dundas".

D. H. Dundas, P. Eng.

Sr. Foundations Engineer

APPENDIX

RECORD OF BOREHOLE No 1

W.P. 151-80-04 LOCATION Co-ords. 4, 845, 498 N; 294, 227.5 E. ORIGINATED BY NE
DIST 6 HWY 427 BOREHOLE TYPE Hollow-stem auger COMPILED BY RR
DATUM Geodetic DATE February 12, 1982 CHECKED BY LRB

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	NUMBER	TYPE			20	40	60					
175.63	Ground Level													
0.00	Topsoil 150 mm thick				Seal									
	Till, Silty Clay with some sand & gravel		1	SS	38	174								5 18 49 28
	Very Stiff to Hard Brown		2	SS	29									
172.73			3	SS	35									
2.90	Interbedded Silty Sand and Sandy Silt, 10 to 50 mm thick layers		4	SS	108	172								
	Very Dense Brown		5	SS	59									
170.45			6	SS	115									
5.18	Fine Sand, silty		7	SS	78	170								
			8	SS	65	Water Mar. 1/82								
			9	SS	73									
			10	SS	125	168								
			11	SS	73									
	Very Dense Brown to Grey		12	SS	35	166								
			13	SS	79									
			14	SS	72	164								
			15	SS	80/150	162								
162.52			16	SS	125/25	160								
13.11	Till, Silty Clay with some sand and gravel		17	SS	100/25	158								9 20 40 20
			18	SS	100/50									
	Very Hard Grey		19	SS	100/5	156								
19.81	Fine Sand, silty		20	SS	W.H.	Seal								
20.42	Dense Grey				Piezometer									
154.08			21	SS	100/200	152								
21.53	End of Borehole													



RECORD OF BOREHOLE No 2

W P 153-80-04 LOCATION Co-ords. 4, 845, 540 N; 294, 253 E. ORIGINATED BY MT
DIST 6 HWY 427 BOREHOLE TYPE Hollow-stem auger COMPILED BY RR
DATUM Geodetic DATE February 15, 1982 CHECKED BY JNS

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 (%)
MATRES ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
175.41	Ground Level																
0.00	Topsoil 150 mm thick					Seal											
	Till, silty clay, with some sand and gravel		1	SS	21		174										
	Very stiff to hard		2	SS	31												
	Brown		3	SS	53	Seal											
171.75	Interbedded silty sand and sandy silt		4	SS	100/225		172										
3.00	Very Dense Brown		5	SS	100	Water Level											
			6	SS	101	Mar. 1/82											
169.47	Fine Sand, Silty		7	SS	86		170										
5.94	Very Dense Brown		8	SS	47												
			9	SS	71												
			10	SS	113												
165.82			11	SS	100												
			12	SS	71												
9.60	End of Borehole																

*3, x5: Numbers refer to
Sensitivity

20
15-20-5 (%) STRAIN AT FAILURE
10

UPPER REMAINING WITH TABLET

RECORD OF BOREHOLE No 3

W P 153-80-04 LOCATION Co-ords. 4,845,559 N; 294,213.5 E ORIGINATED BY RF
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR
DATUM Canadian DATE February 16, 1982 CHECKED BY JNS

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					
176.28	Ground Level																
0.00	Topsoil, 150 mm thick		1	SS	23		176 Seal										
	Till, silty clay, with some sand and gravel		2	SS	18												
	Very Stiff to Hard Brown		3	SS	41		174 Seal										
173.08	Interbedded Silty Sand and Sandy Silt		4	SS	80												
	Very Dense Brown		5	SS	88		172										
			6	SS	85												
170.34	Fine Sand, Silty		7	SS	60		Water Level Mar. 1/82										
	Very Dense Brown		8	SS	46		170 Piezometer										
168.31	Sand, with some Gravel and trace Silt		9	SS	50												
			10	SS	72												
166.33	Very Dense Brown						168										10 70 9 0
9.45	End of Borehole						166										
							164										

OFFICE RECORD FOR SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15-25 (% STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4

W P 153-90-0- LOCATION Co-ords. 4,845,572 N; 294,247 E. ORIGINATED BY MT
DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR
DATUM Geodetic DATE February 16, 1982 CHECKED BY JRB

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
Mettres ELEV DEPTH	DESCRIPTION	STRAT	PLOT	NUMBER	TYPE			'N' VALUES		20 40 60 80 100			
										SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			
175.98	Ground Level												
0.00	Topsail, 150 mm thick						Seal						
	Till, silty clay, with some sand and gravel			1	SS	28							
	Vary Stiff to Hard			2	SS	39							
172.78	Brown			3	SS	42							
3.20	Interbedded Silty Sand and Sandy Silt			4	SS	57	50 mm Seal						
170.30	Very Dense Brown			5	SS	120							
	Fine Sand, Silty			6	SS	81							
	Very Dense Brown			7	SS	56	Water Level Mar. /82						
				8	SS	48	170						
				9	SS	61							
163.06	Sand, seam, some gravel			10	SS	92	168 Piezometer						
166.99	Very Dense --- Brown			11	SS	118							
166.38				12	SS	50							
9.60	End of Borehole						166						
							164						

NO. 104X5-003 NC ANDERSON REPORT ON 500 EXPLORATION

*3, x5: Numbers refer to Sensitivity

20
15 25 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 5

W P 153-80-04 LOCATION Co-ords. 4,845.933 N; 294,223 E. ORIGINATED BY MT
 DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR
 DATUM Geodetic DATE February 16, 1982 CHECKED BY MT

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 (%)
METRES ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
173.49	Ground Level															
0.00	Topsoil, 150 mm thick		1	SS	32		174									
	Till, silty clay, with some sand and gravel		2	SS	31											
	Hard Brown		3	SS	37											
			4	SS	57		172									
171.22			5	SS	53											
169.22	Interbedded Silty Sand and Sandy Silt		6	SS	64											
	Very Dense Brown		7	SS	71		170									
169.22			8	SS	58											
6.25	Fine Sand, Silty		9	SS	16											
	Dense to Very Dense		10	SS	37		168									
	Brown															
165.39			11	SS	78		166									
9.00	End of Borehole						164									

COPY OF RECORD ON FILE EXP-101

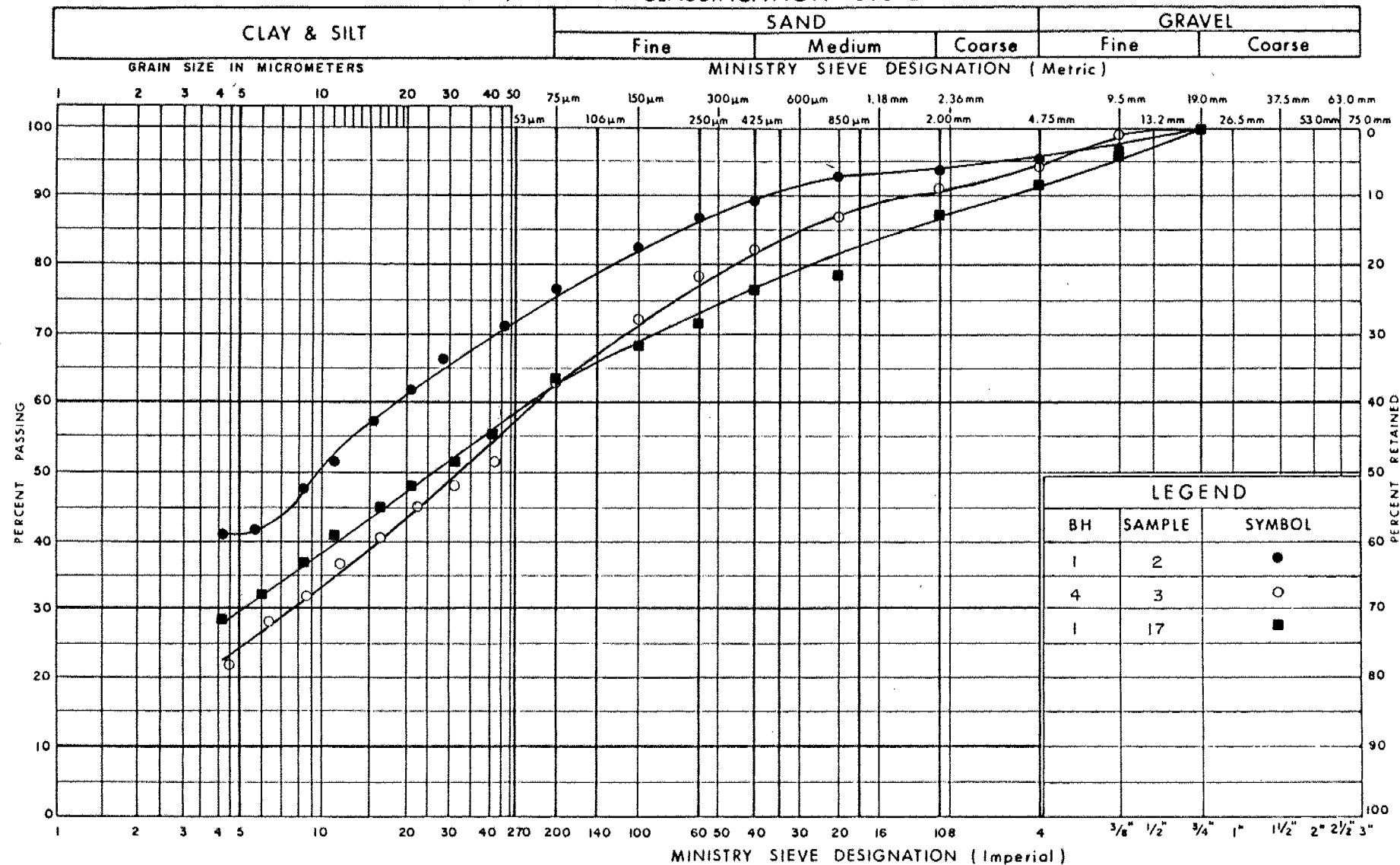
RECORD OF BOREHOLE No 6

W P 153-90-01 LOCATION Co-ords. 4, 845, 510 N: 194, 250 E. ORIGINATED BY NE
DIST 6 HWY 427 BOREHOLE TYPE Hollow-stem auger COMPILED BY RR
DATUM Geodetic DATE February 15, 1982 CHECKED BY JRG

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
Metres ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
75.33	Ground Level																
0.00	Topsail, 150 mm thick						Seal										
	Till, silty clay, with some sand and gravel		1	SS	32		170										
	Very Stiff to Hard		2	SS	30												
	Brown		3	SS	45		Seal										
171.67			4	SS	35		172										
3.00	Interbedded Silty Sand and Sandy Silt		5	SS	73												
	Very Dense Brown		6	SS	55		Water Level Mar. 1/82										
			7	SS	39		170										0 35 62 3
163.62			8	SS	82												
6.71	Fine Sand, Silty		9	SS	76		160										
167.10	Very Dense Brown		10	SS	69												
8.23	Sand, with some Gravel		11	SS	69												
	Very Dense Grey		12	SS	34		166										
164.20			13	SS	76		Piezometer										
			14	SS	39												
11.13	End of Borehole						164										
							162										

ON EXPL ON REF

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
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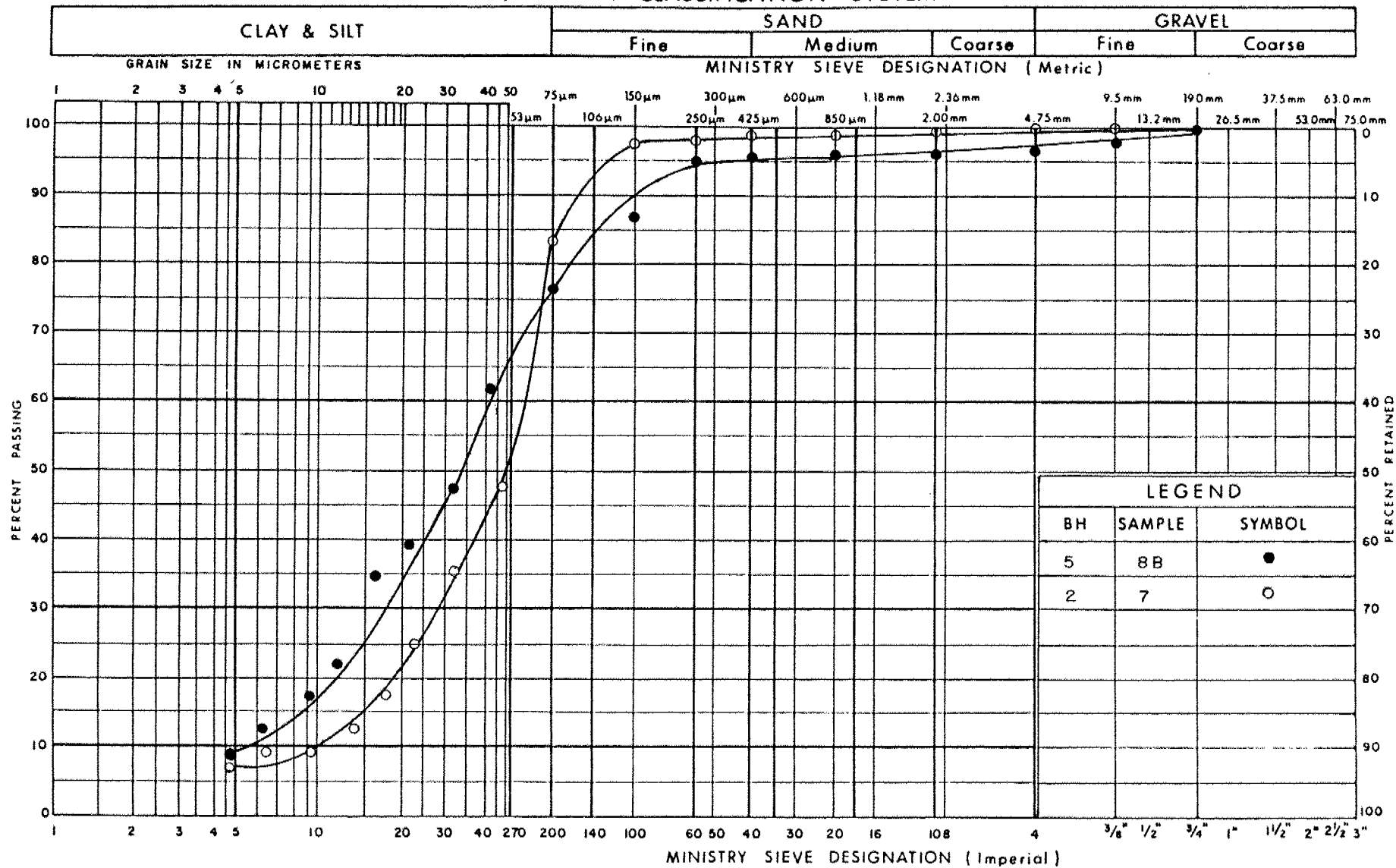
GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL

FIG No 1

W P 153-80-04

UNIFIED SOIL CLASSIFICATION SYSTEM



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Communications

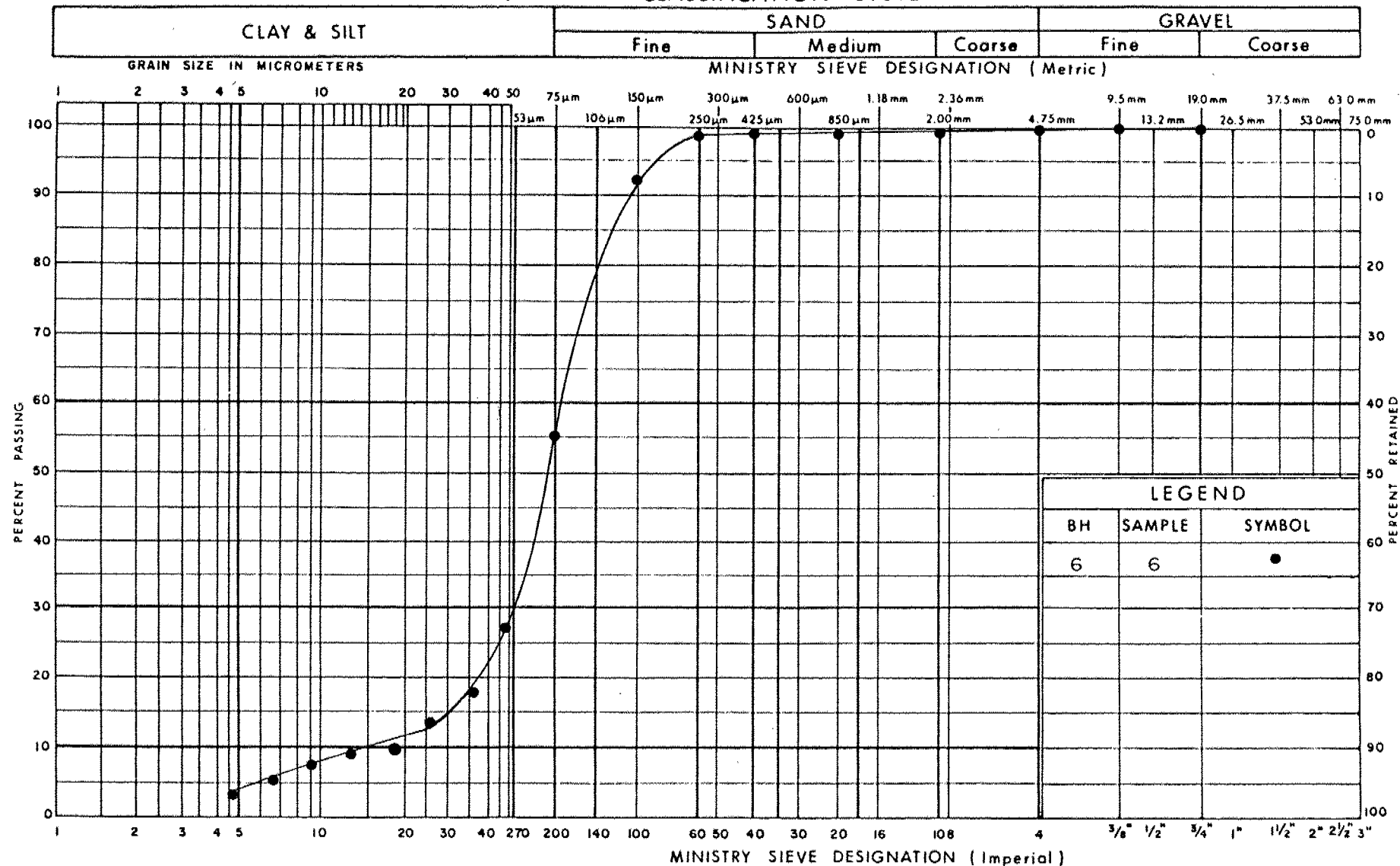
GRAIN SIZE DISTRIBUTION

SANDY SILT SEAM

FIG No 2

W P 153-80-04

UNIFIED SOIL CLASSIFICATION SYSTEM



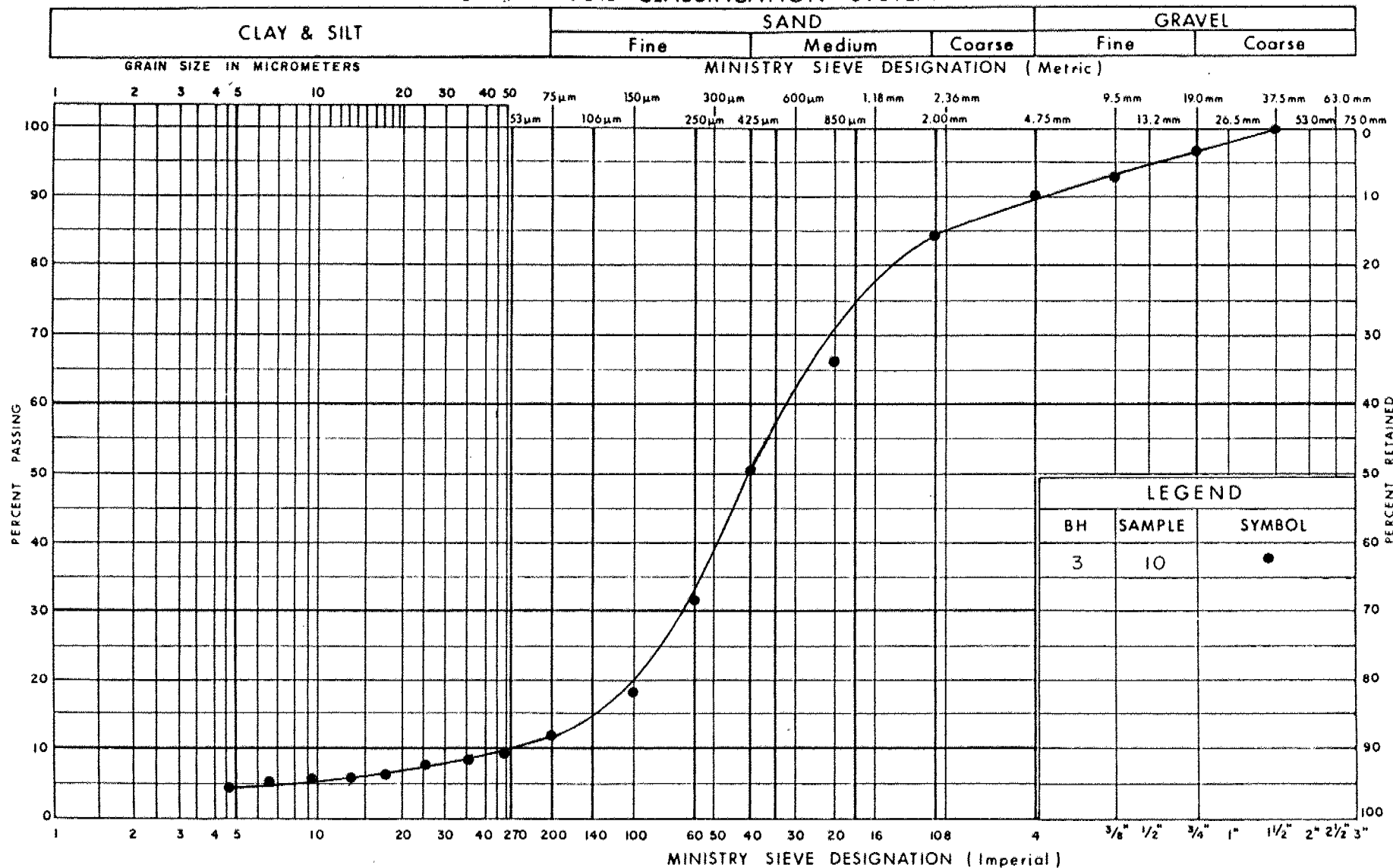
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Communications

GRAIN SIZE DISTRIBUTION
SILTY FINE SAND

FIG No 3

W P 153-80-04

UNIFIED SOIL CLASSIFICATION SYSTEM



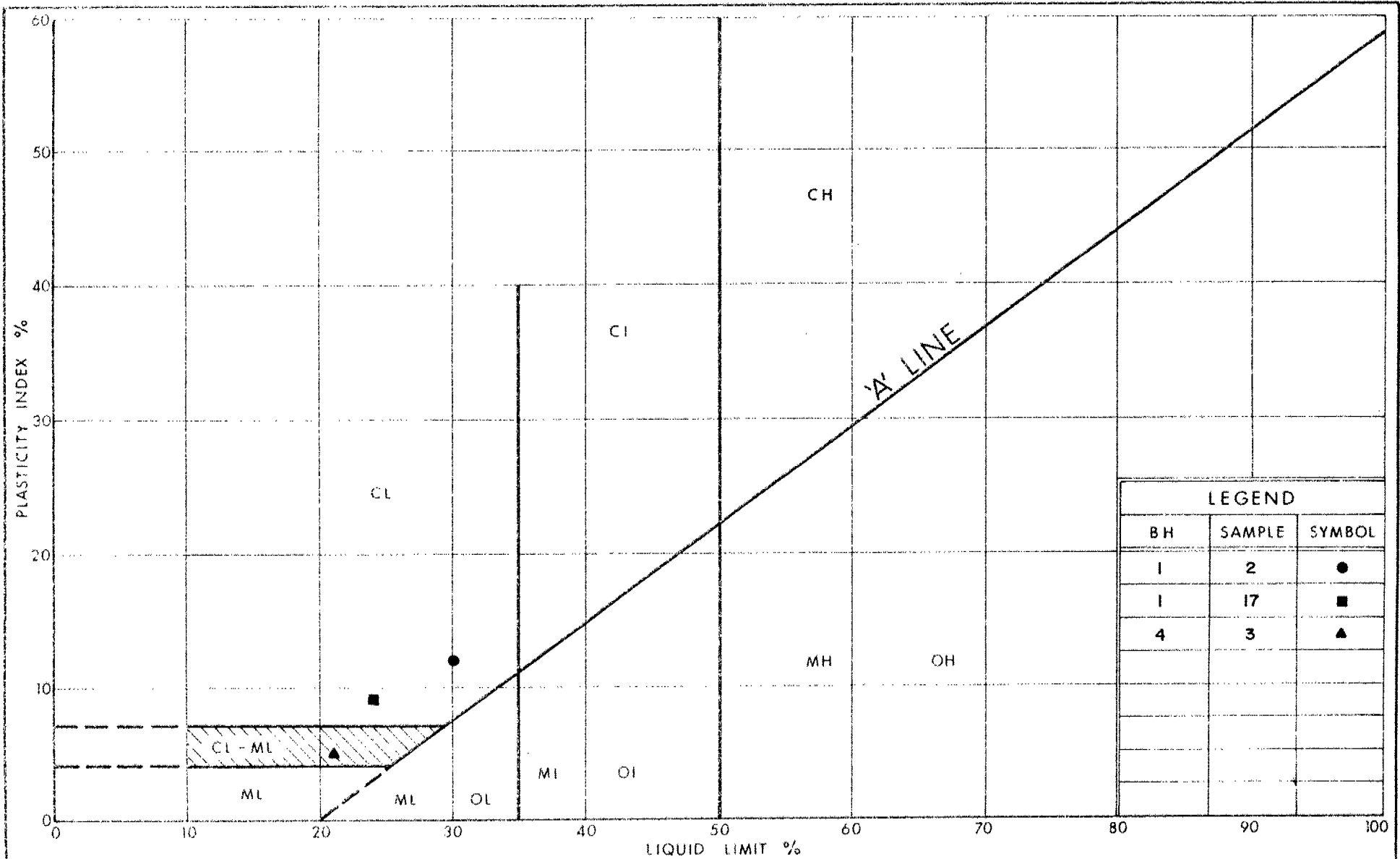
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GRAIN SIZE DISTRIBUTION

SAND WITH SOME GRAVEL

FIG No 4

W P 153-80-04

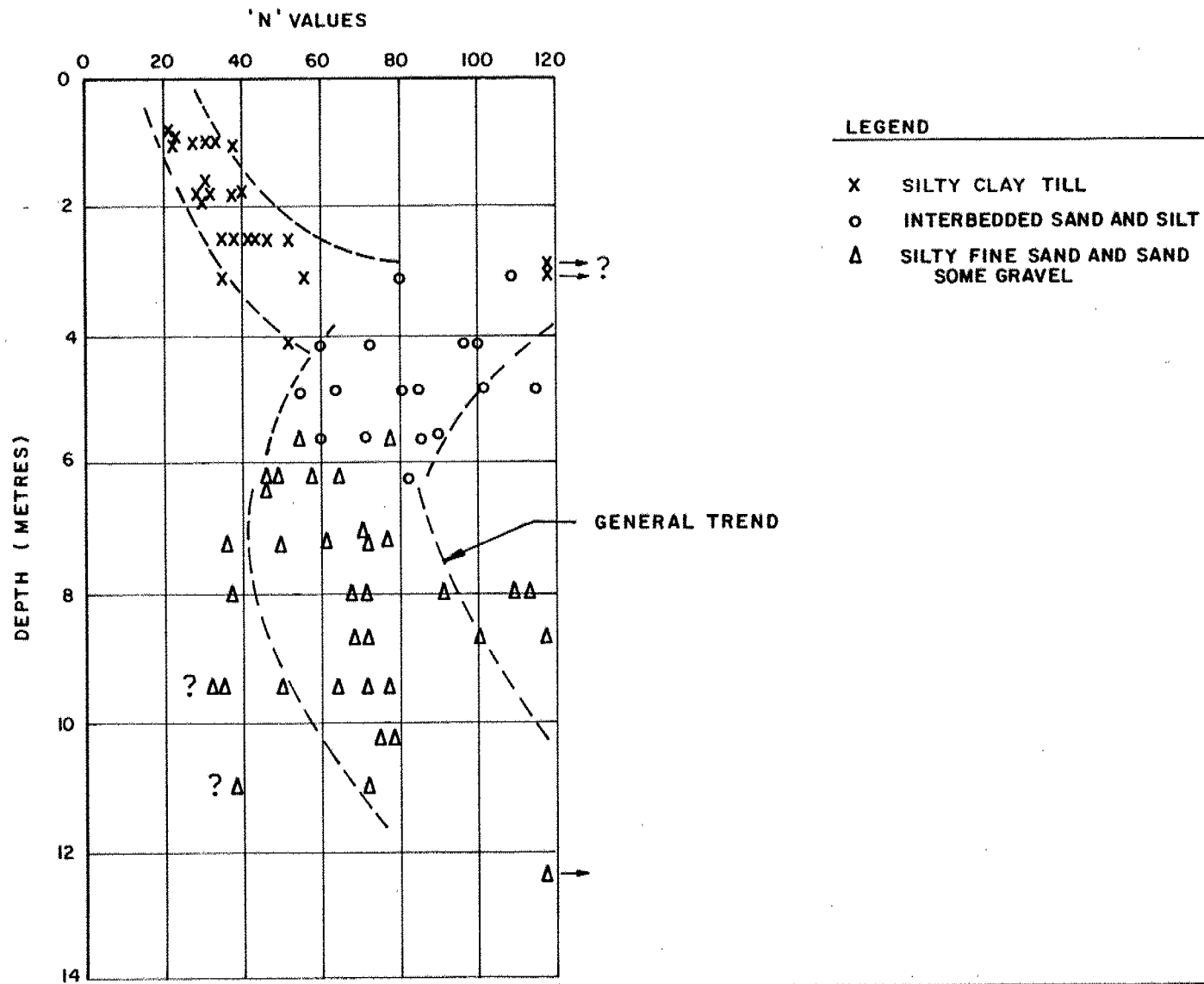


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PLASTICITY CHART

FIG No 5

W P 153-80-04



FOUNDATION INVESTIGATION REPORT
FOR
Highway 427 over Ramp 427N-407E
W.P. 153-80-05, Site 37-73-1112
Highway 427, District 6, Toronto

1.0 INTRODUCTION

Morton & Partners Limited has been retained by the Ministry of Transportation and Communications to carry out a foundation investigation for a proposed underpass structure designated as Highway 427 over Ramp 427 N - 407 E.

2.0 SITE

The site is located in the proposed alignment of Highway 427, about 160 m north of Steeles Avenue, in the Borough of Etobicoke. At the present time, the site is part of a ploughed field and is approximately level at about elevation 177.

3.0 FIELD WORK

The field work for this investigation was carried out in the period of January 29 to February 6, 1982 and consisted of three boreholes accompanied by dynamic cone penetration tests and two additional dynamic cone penetration tests at the locations shown on Sheet No. 113. The work was carried out using a track-mounted CME-55 drilling machine, supplied and operated by Master Soil Investigations Limited.

Soil samples were taken using the Standard Penetration Test method and brought to our laboratory for further examination and testing. Samples remaining after testing will normally be stored for a period of three months following the date of this report and then discarded, unless other instructions are received.

The elevations of the ground surface at the borehole locations were determined using Borough of Etobicoke Benchmark No. E1010, described as "tablet in centre at north end of west concrete pier of bridge over CNR tracks on Albion Road, 1.16 m above ground level" having a geodetic elevation of (initially 173.317 m and subsequently revised to) 173.217 m.

4.0 SOIL CONDITIONS

The soil conditions encountered at the borehole locations are shown on the Borehole Records attached and are briefly described below.

NOTE: REFER TO FIGURES 1, 2, 3 FOR GRAIN SIZE DISTRIBUTION CURVES.

4.1 Topsoil

All boreholes encountered dark brown to black silty to clayey topsoil, extending to a depth of about 200 mm.

4.2 Silty Clay (Till)

The topsoil covers a layer of brown silty clay, ranging in thickness from 2600 to 3500 mm. The upper 300 to 500 mm are somewhat organic and contain roots. The upper part of the stratum tends to be more clayey and locally appears to have a layered structure. The sand content increases with depth and a trace to some gravel is dispersed throughout. The silty clay is generally considered to be of late glacial origin, although the upper (more clayey and sometimes layered) part may be post glacial representing waterlain sedimentation to temporary pro-glacial lake pondings. The till layer is identified as the Halton Till, while the vaguely layered upper part comprises the Lacustrine-Wildfield Till complex formed in the pro-glacial Peel Pondings.*

On the basis of standard penetration tests, the silty clay stratum is stiff to very stiff in the upper part, increasing rapidly to hard with depth.

The natural moisture content of the stratum ranges from 11 to 22 percent with a median value of 17 percent. The unit weight, as determined from suitable samples, ranged from 20.7 to 22.3 kN/m³ with a median value of 21.4 kN/m³.

4.3 Sand

The silty clay (Halton Till) is underlain by a stratum of brown sand. In Borehole 1 the stratum is about 6500 mm in thickness

* O.L. White - "Quaternary Geology of the Bolton Area, Southern Ontario".
OGS Geological Report 117; 1975

4.3 Sand (Cont'd)

and extends to elevation 168.3. In Boreholes 2 and 3 it is about 2000 mm in thickness and extends to about elevation 171.5.

The sand is generally fine and silty to very silty, but layers or pockets of coarser sand mixed with gravel and rock fragments were encountered. These layers occasionally exhibit a till-like structure and may be part of the Halton Till unit of late Wisconsinan age.

The stratum is very dense as indicated by the results of the standard penetration tests. The natural moisture content of the sand ranges from 6 to 21 percent with a median value of about 10 percent. The unit weight could only be determined on the more silty samples and ranged from 19.8 to 22.2 kN/m³ with a median value of 20.9 kN/m³.

4.4 Sand (Till)

In Boreholes 1 and 3, the brown sand is underlain by grey and grey-brown sand, extending to about elevation 165.5. The sand is generally fine and silty to very silty. It contains scattered gravel and rock fragments and appears to be a glacial till (possibly the Wentworth Till member, see publication by O.L. White).

The natural moisture content ranges from 10 to 20 percent with a median value of 14 percent. The unit weight is of the order of 22.5 kN/m³.

4.5 Silt (Till)

The sand till overlies a stratum of grey silt, extending to the depths explored. The silt contains some sand and a trace of clay. Rock fragments are erratically dispersed throughout the stratum. A layer of what appeared to be a varved silty clay was encountered at about elevation 166. The overall structure of the stratum, however, suggests that it is a till deposit which has been tentatively identified as York Till.

The silt is very dense. Its natural moisture content ranges from 6 to 11 percent with a median value of 8 percent. The unit weight ranged from 21.8 to 23.7 kN/m³ with a median value of 23.6 kN/m³. The clay layer encountered at about elevation 166 had a moisture content of 18 percent and a unit weight of 20.7 kN/m³.

5.0 GROUNDWATER

Stand pipes with piezometer tips were installed at depths of 10.97 m, 10.06 m and 11.43 m in Boreholes 1, 2 and 3 respectively. The groundwater level observations and other relevant information are summarized below:

<u>BH</u>	<u>DRILLING DATE</u>	<u>OBSERVATIONS AT TIME OF DRILLING</u>	<u>GROUNDWATER LEVEL FEB. 10, 1982</u>
1	Feb. 3/82	Borehole caving at depth of ± 7.50 m.	7.55 m
2	Jan. 29/82	Borehole dry during drilling. Borehole open and dry to 18.3 m on Feb. 2, 1982.	dry to 10 m
3	Feb. 2/82	Borehole caving at depth of ± 6.1 m.	7.00 m

On the basis of the above observations, it is concluded that the groundwater level at the time of the investigation was at about elevation 170.

NOTE:

The preceding report is a copy of the factual information from the Foundation Investigation Report prepared by Morton & Partners Limited (consulting geotechnical engineers for this project) under the technical supervision of the Ministry of Transportation Foundation Design Section.



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

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 151-80-05 LOCATION Co-ords. 4 845 667 N; 294 187 E. ORIGINATED BY _____
 DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger COMPILED BY _____
 DATUM Geodetic DATE 82-02-03 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					
177.6	Ground Level																
0.2	Silty clay, sandy, trace of gravel (Till)		1	SS	23											20.9	
	Very stiff to hard, brown		2	SS	37											21.8	2 24 49 25
174.9			3	SS	61											20.9	1 35 50 14
2.8	Sand, fine, silty to very silty, occasional coarser layers with some gravel		4	SS	96											19.8	14 83 3
	Very dense, brown		5	SS	117												
			6	SS	165/180mm											22.2	
			7	SS	121/250mm											20.6	
168.3			8	SS	175/150mm												
9.3	Sand, fine, with silt and some gravel. (Till)		9	SS	171/280mm											22.6	
165.9	Very dense, grey																
11.7	Silt, some sand, trace of clay, occasional rock fragments (Till)															22.9	
	Very dense, grey															23.9	
																23.1	
																21.8	
159.1			14	SS	56/0mm											23.7	
18.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

*3, *5: Numbers refer to
Sensitivity

20
15 + 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 2										METRIC				
W P 153-80-05		LOCATION Co-ords. 4 845 713 N; 294 232 E.				ORIGINATED BY _____								
DIST 6 HWY 427		BOREHOLE TYPE Solid Stem Auger				COMPILED BY _____								
DATUM Canadian		DATE 82-01-29				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					
176.3	Ground Level													
0.2	Silty clay, sandy, trace of gravel (Till) Hard, brown		1	SS	33		176						21.4	
			2	SS	45								21.4	
			3	SS	57								22.3	27 52 21
			4	AS	-	*	174							3 24 45 28
173.1														
1.7	Sand, fine, silty, some gravel, (possibly Till lenses in part) Very dense, brown		5	SS	70/150mm		172							4 53 38 5
171.7														
5.5	Silt, some sand, trace of clay, occasional rock fragments and gravel Very dense, grey		6	SS	100/230mm		170							
			7	SS	72/150mm		168						23.7	
			8	SS	159/30mm		166						23.6	
			9	SS	74		164						20.7	
	Hard grey varved silty clay layer at ± elev. 166		10	SS	100/230mm		162						22.6	
			11	SS	129/150mm		160						23.6	
			12	SS	87/150mm								23.6	
			13	SS	62/150mm								23.7	
158.4			14	SS	140/50mm								23.4	
18.4	End of Borehole													
<p>* Note: sampler refusal at elev. 173.9. Augered through and took auger sample</p>														

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 153-80-05 LOCATION Co-ords. 4 845 689 N; 294 212 E. ORIGINATED BY _____
DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger COMPILED BY _____
DATUM Canadian DATE 82-02-02 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	SIRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
177.1	Ground Level															
0.2	Silty clay, sandy, trace to some gravel (Till) Stiff to hard, brown		1	SS	20										20.7	
			2	SS	43										21.2	16 47 37
			3	SS	43										21.7	6 36 38 20
174.1																
3.0	Sand, fine to coarse, silty to very silty, trace to some gravel. Very dense, brown		4	SS	73										21.2	28 60 12
			5	SS	56											
171.6																
5.5	Sand, fine, silty to very silty, occasional coarser layers with some gravel and rock fragments Very dense, brown to grey-brown		6	SS	93										22.3	
			7	SS	115											
			8	SS	50											
			9	SS	73											
165.0																
12.1	Silt, sandy, trace of clay, trace of gravel (Till) Very dense, grey		10	SS	107/50mm										23.3	
161.0			11	SS	100/270mm										23.4	
14.1	End of Borehole															

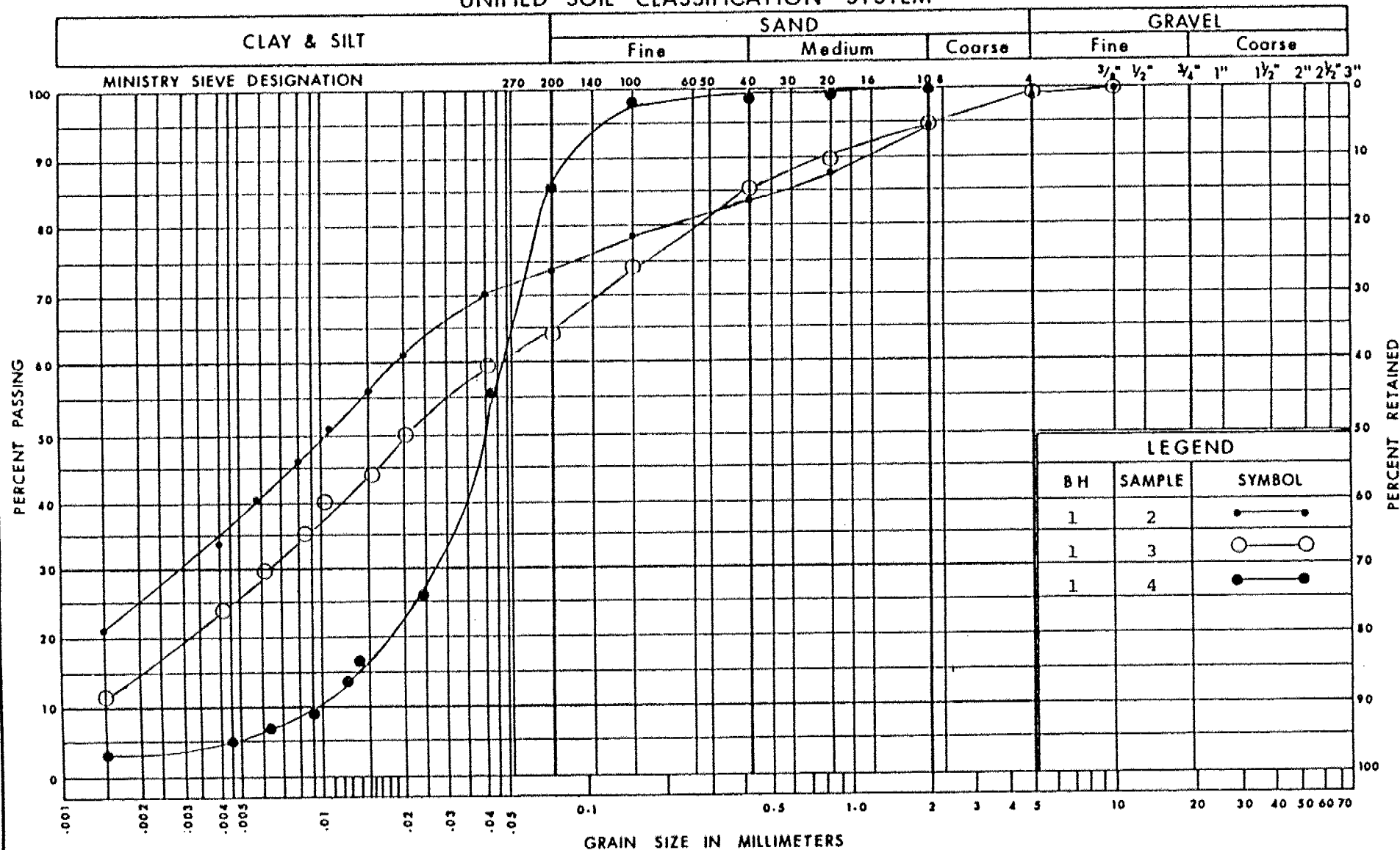
* 3, * 5 : Numbers refer to Sensitivity 20
15 * 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF CONE No 4										METRIC		
W P 153-80-05		LOCATION Co-ords. 4 845 692 N; 294 240 E.				ORIGINATED BY						
DIST 6 HWY 427		BOREHOLE TYPE Dynamic Cone Penetration Test				COMPILED BY						
DATUM Geodetic		DATE (Cone 4 82-01-29) (Cone 5 82-02-02)				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	VALUES					
176.9	Ground Level											
176												
174												
173.6	End of Dynamic Cone 4 Penetration Test											
<p align="center">RECORD OF CONE No 5</p> <p align="center">Co-ords. 4 845 687 N; 294 179 E.</p>												
177.6	Ground Level											
177												
175.2	End of Dynamic Cone 5 Penetration Test											

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

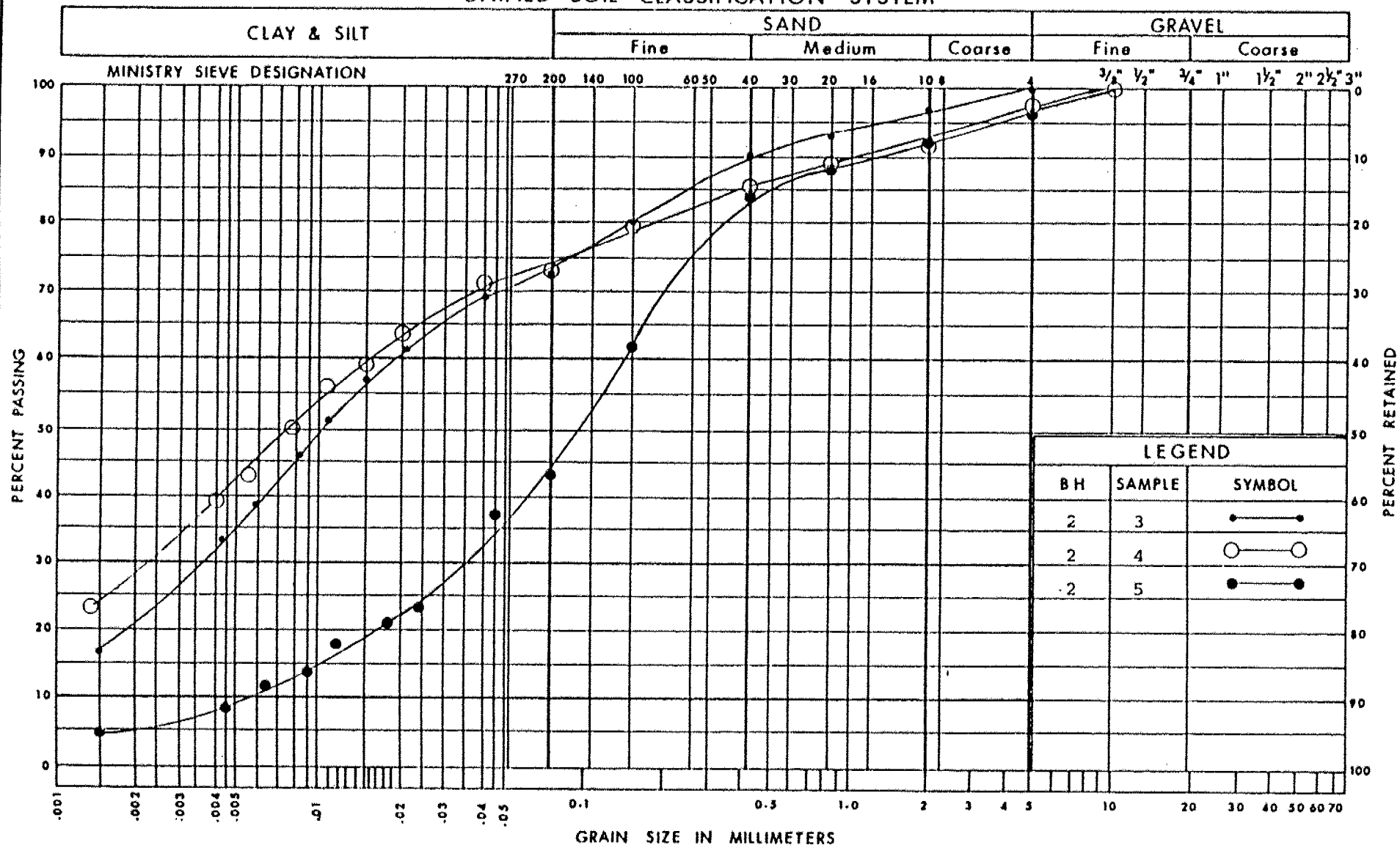
Silty clay (Till) (Sa. 2 & 3)
Silty sand (Sa. 4)

FIG No 1

W P 153-80-05

73

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

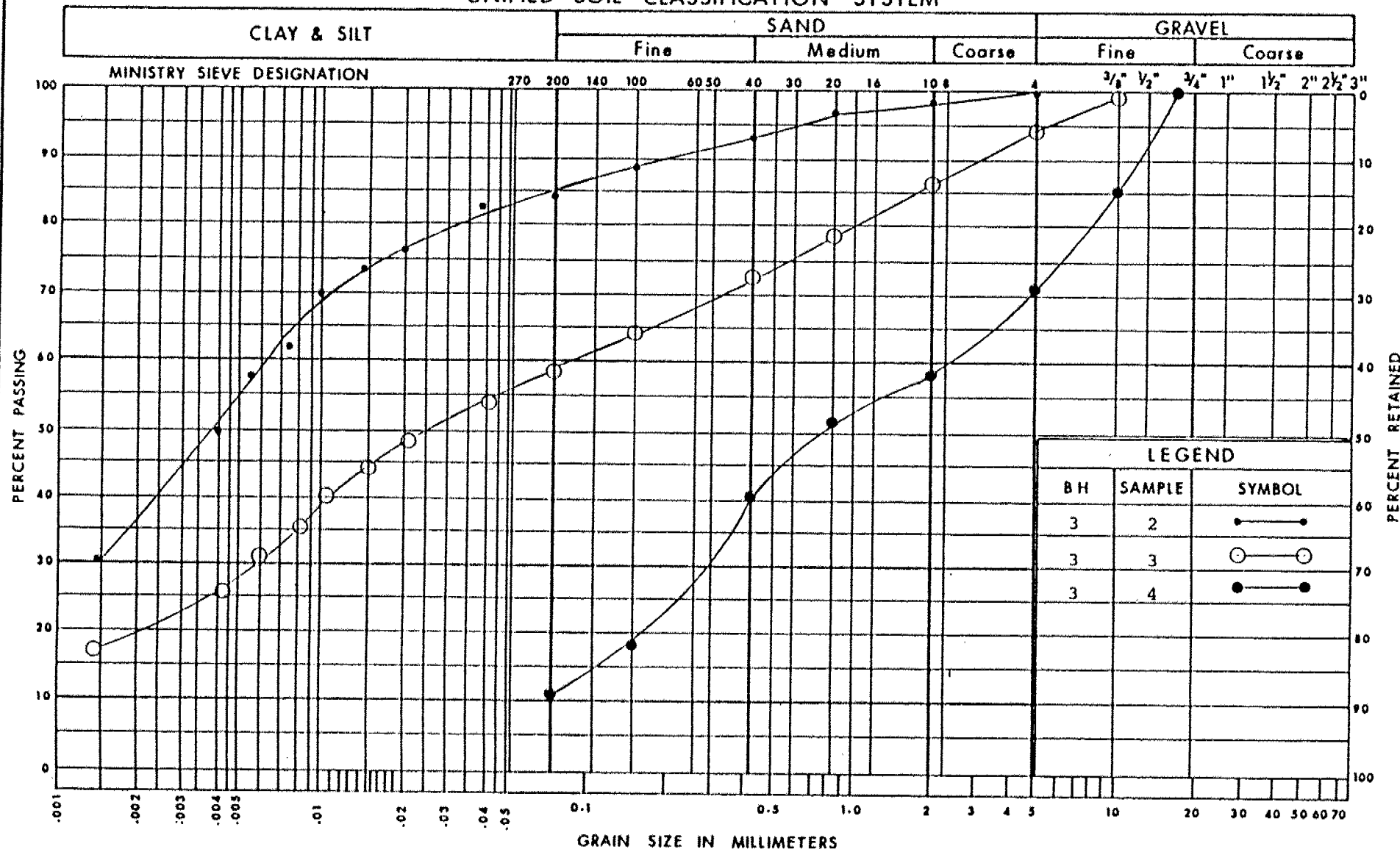
Silty clay (Till) (Sa. 3 & 4)
Silty sand (Sa. 5)

FIG No 2

W P 153-80-05

74

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

Silty clay (Till) (Sa. 2 & 3)
Sand with gravel (Sa. 4)

FIG No 3

W P 153-80-05

75

memorandum



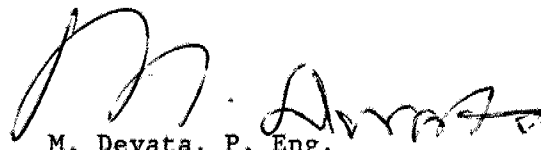
To: J.P. Cullen
Area Construction Engineer
Construction Office
5000 Yonge Street

Date: 1988 07 18

From: Foundation Design Section
Room 315, Central Building

RE: Obstruction to Pile Driving
Contract 88-30
Highway 427

During pile driving operations for the above-mentioned project all piles penetrated to the required tip elevation, however it was not possible to advance five piles for the southbound structure (south abutment). This was brought to our attention by your field staff and after consultation with Mr. G. Al-Bazi of the Structural Office, it was initially agreed to drive these five piles at a different batter in an attempt to avoid the obstruction. This method proved to be unsuccessful. Finally it was agreed that the best method would be to pre-drill through the obstruction and then drive the pile from the bottom of the pre-drilled hole to the required tip and design capacity. In addition, the preaugered hole should be backfilled with lean concrete. It is understood that this method was proven successful in resolving this problem and the obstruction encountered was an abandoned 30" steel gas main.


M. Devata, P. Eng.
Chief Foundation Engineer

MD/mmj

c.c. - G. Al-Bazi
M. Holowka
G. Henderson
R. Kant
D. Lang

memorandum



Central Region, Construction Office, 5000 Yonge Street 224-7614

To: Mr. M. Devata
Chief Foundation Engineer
Foundation Design Section

Date: 88 07 13

RE: Obstruction to Pile Driving
Contract 88-30
Highway 427

This will confirm that due to an obstruction, it was not possible to advance five piles for the southbound structure (south abutment).

Initially it was agreed to drive the piles at a different batter in an attempt to miss the obstruction. This proved to be unsuccessful. The next option was to drill through the obstruction and then drive the piles. Drilling through the obstruction resolved the problem. Please note that the obstruction encountered was an abandoned 30" steel gas main.

Your assistance in resolving this problem is appreciated.

A handwritten signature in cursive script, appearing to read "J. P. Cullen".

J. P. Cullen
Area Construction Engineer

JPC:ek
c.c. M. Holowka
G. Henderson
R. Kant
D. Lang



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

Copy for the information of

M. Devata

Mr. W. Lin
Design Engineer
Structural Office
3501 Dufferin Street

1987-06-30

RE: CNR O'Head, Site 37-80-1109
Highway 427, District 6, Toronto

WP 153-80-02

Enclosed please find the revised tracings for the northbound and southbound (original design) structures as follows:

- a/ Northbound structure - Dwg. 1, 3 to 20, and copy of dwg. 21.
- b/ Southbound structure - Dwg. 1, 3 to 18 and copy of dwg. 19.

We have kept the original Quantities Structure sheets for inclusion in the contract package.

As you know, the revised design which did not provide for the future highway 407 ramps is to be scrapped. Kindly have these tracings removed from your files for destruction as soon as this contract is awarded.

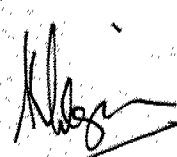
Due to the recent decision by the Transportation Capital Branch to build the original design, and the urgency of getting the revisions made on time in order to meet our program delivery date, we have retained the original pile foundation design. The drawings have therefore, not been revised to show the spread footing foundation design on the granular A pad per the revised (or narrower) design. It should be kept in mind that the original design had to be quickly pulled "off-the-shelf" to get it ready to meet our delivery dates. Please let us know if there are serious concerns about the pile foundation design.

We are forwarding one print of the two General Arrangement drawings to the Foundation Design Section. This corresponds to the copies of the D4, Special Provisions and half size prints circulated in your memo of 83-02-07 to A. Wittenberg.



KP/jf
attachment

c.c. M. Devata ✓
G. Smolskis


K. Pilgrim
Senior Structural Engineer
for:
G.C.E. Burkhardt
Head, Structural Section

memorandum



To: Mr. W. L. Lin
Design Engineer
Structural Office (Central)
3501 Dufferin St.

Date: 83 05 06

From: Pavement & Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Hwy. 427, CNR Overhead
North & Southbound Structures
W.P. 153-80-02, Site 37-80-1107
District 6

We have reviewed the preliminary general arrangement drawing 37-80-1109-P1 for the above mentioned project and provide the following comments:

- a) A note should be placed on Section 1 indicating that all softened and/or organic material within the limits of the granular 'A' pad must be subexcavated and backfilled with granular 'A'.
- b) We recommend that the approach fills adjacent to the granular 'A' pad be constructed simultaneously with construction of the pad to prevent erosion of the granular 'A'.

A handwritten signature in cursive script, appearing to read "Harry Sturm".

H. Sturm,
Project Foundations Engineer.

HS:gm

memorandum



To: Mr. W.L. Lin
Design Engineer (Central)
Structural Office
3501 Dufferin St., 4th Floor

Date: 83 02 22

From: Pavement & Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Highway 427 C.N.R. Overhead
N.B. and S.B. Structures
W.P. 153-80-02, Sites 37-1109 A & B
District 6, Toronto

We have reviewed the final bridge drawings and documentation for the above-mentioned twin structures and provide the following comments:

- 1) The lateral limits (1:1 from edges of abutment pile cap) for the fill with restricted gradation should be shown on Dwgs. 1.
- 2) The note "equipped with reinforced tips" should be included on the pile type (typ.) note on Dwgs. 1.
- 3) The railway protection scheme should be indicated and labelled on the elevation skematic, Dwgs. 1, with the appropriate vertical lines.
- 4) Under pile design data on Dwgs. 3, kN (kilonewtons), not KM, should be used for pile loadings.
- 5) Tip elevations for sheet piling should be 166.5 rather than 166.75, as specified on Dwgs. 3.
- 6) A note should be added to Dwgs. 3 stating "Difficulty may be encountered in driving sheet piling and steel 'H' piles due to the presence of cobbles and boulders".
- 7) As per foundation report and preliminary design review recommendations, we strongly feel that the abutment should be founded on a well compacted Granular 'A' core rather than steel 'H' piles which may become damaged or meet refusal on the numerous cobbles and boulders across the site.

A handwritten signature in dark ink, appearing to read "Tom Kazmierowski".

Tom Kazmierowski, P. Eng.
Foundations Engineer

TK:syc

cc: G.C.E. Burkhardt

memorandum



To: Mr. W.L. Lin
Design Engineer (Central)
Operating Section

Date: 82 08 25

From: Pavement and Foundation Design
Room 315, Central Building
Downsview, Ontario

Re: Hwy. 427 C.N.R. Overhead
N.B. and S.B. Structures
W.P. 153-80-02, Site 37-1109A
and 37-1109B
District 6, Toronto

We have reviewed the preliminary bridge plan drawings for the above-mentioned structures and provide the following comments:

1. In consideration of the probability of piles meeting shallow refusal to driving on the numerous boulders across the site and the economy of design, the abutments should be founded on a well compacted granular "A" core as per foundation report recommendations.
2. Alternatively piles should be equipped with reinforced tips and the contractor informed of difficult driving conditions due to the presence of boulders.
3. Fill material placed beneath the pile cap should be restricted to a maximum gradation of 75 mm to facilitate pile penetration.

A handwritten signature in black ink, appearing to read "T. Kazmierowski".

T. Kazmierowski, P. Eng.
Foundations Engineer

TK/jb

SEND
TO

Mr. M. Devata

Senior Foundation Engineer

Part of Foundation Design Room 313 Central Bldg. Attn Mr. T. Kazmierowski

FROM

K. Pilgrimi

Structural Section

DATE

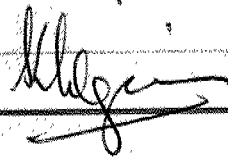
82-03-05

SUBJECT

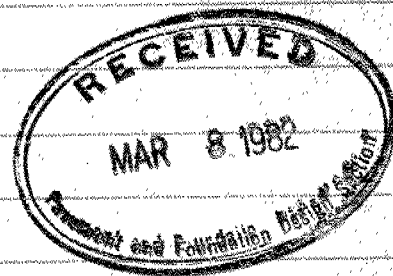
CNR. O'Head at Hwy 427 H.P. 153-80-02 Site 37-1109

Further to our memo of 81-11-19, the final Site Geometrics plan shows no revisions to the profiles of the proposed Hwy 427.

A 1000 mm of CSL will be placed below the fill at the north approach to the structure and its invert elevation will be adjusted to suit the locations for the north abutment footings. We will provide information on this once the foundation Investigation report is ready.



REPLY

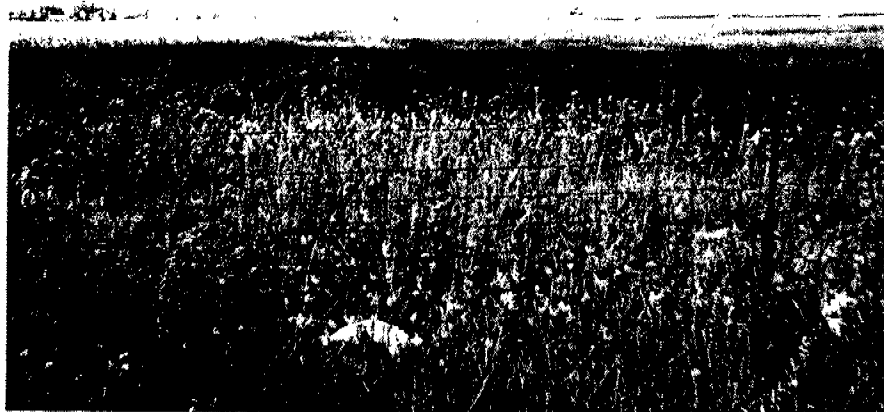


REPLY FROM

REPLY DATE



SOUTH ALONG HWY 427

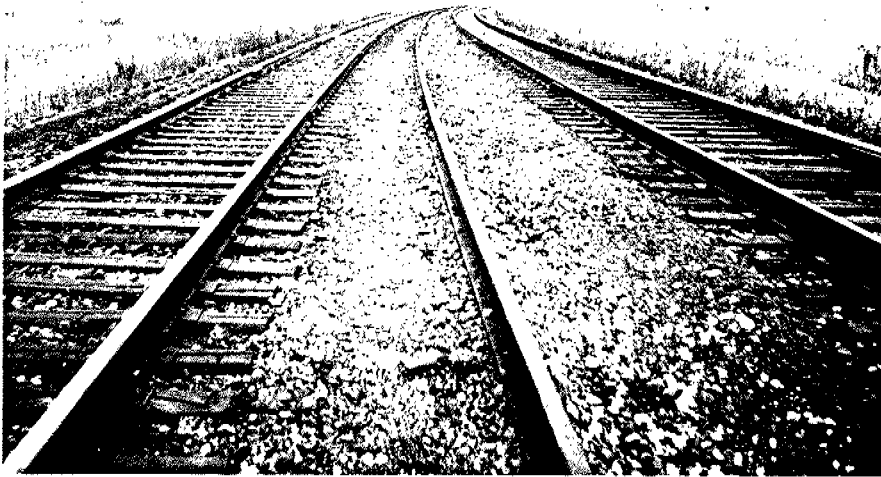


NORTH ALONG HWY 427



NORTH DITCH LOOKING EAST

CNR 6'HEAD (2)
11/14 427
SITE 37/109



EAST ALONG ϕ TRACKS



WEST ALONG ϕ TRACKS