G.I.-30 SEPT. 1976

GEOCRES No. 30M12-140

DIST. 6 REGION

W.P. No. 604-89-00 (49-11-02)

CONT. No.

W. O. No.

STR. SITE No. 37-1083

HWY. No. 427

LOCATION Hwy 427 / Morningstar Dr. Underpass

No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

604-89-01

Ontario

Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 49-71-02 DIST 6

HWY 427 STR SITE 37-1083

Morning Star Drive Underpass

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GEOCRES 30M12-140 DATE AUG 0 9 1979

FOUNDATION INVESTIGATION REPORT

For

Morning Star Drive Underpass
W.P. 49-71-02, Site 37-1083
Hwy. 427, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation performed at the above mentioned site. Fieldwork was carried out from July 9 to July 10, 1979, consisting of three sampled boreholes. Boring was achieved by means of an auger machine equipped with 3¼" I.D. hollow stem augers. The depth of boring ranged from 40 feet to 56 feet below ground surface.

SITE DESCRIPTION

The area is located at the intersection of Morning Star Drive and Indian Line, about two miles south of Steeles Avenue in the vicinity of the boundary between Metro Toronto and the City of Mississauga.

Other that a 14 foot deep cut recently excavated immediately east of Indian Line, the surrounding terrain is relatively flat. The area east of the cut is an open field. The land west of Indian Line is used primarily for residential development. The general area is drained by the Humber River and its tributaries.

Geologically, the site is situated in a bevelled till plain which is located in a physiographic region generally known as the 'Peel Plain'.

SUBSURFACE CONDITIONS

In general, subsoil at this site consists of two glacial till sheets separated by a silt stratum. The upper glacial till sheet is about 19 feet thick with a cohesive matrix. The lower glacial till sheet is about 25 feet thick which is basically granular in nature. The silt stratum sandwiched between the two glacial till

sheets is about 10 feet thick and is an inter-stadial deposit. Across the site the overburden is underlain by shale bedrock.

Factual borehole data is contained in the Borehole Record Sheets. The location and elevation of the boreholes, together with a subsoil profile estimated from the borehole data, are shown in Drawing No. 497102-A. A description of the subsurface conditions as revealed by our borings is as follows.

Glacial Till (Upper Deposit)

The upper deposit of glacial till encountered immediately below the ground surface generally has a thickness in the order of 19 feet. However, in the cut section immediately east of Indian Line, the upper portion of this glacial till deposit has been excavated resulting in a thickness of only about four feet. The glacial till is a heterogeneous mixture of clayey silt, sand and gravel. Laboratory tests performed on two representative samples from this deposit indicate that the glacial till has a liquid limit of 24 and 29%, a plastic limit of 11 and 12%, and a moisture content of 19 and 27%. The Atterberg Limits are also plotted on Figure 1 which indicates that the matrix of the glacial till has a plasticity in the low range (CL). According to the 'N' values which range from 6 to 35 blows per foot, it is estimated that the glacial till has a stiff to very stiff consistency.

Silt

Underlying the cohesive glacial till is a 10 foot thick stratum of silt. Typical grain size distribution curves for material from the silt stratum are shown in Figure 2. Within this stratum occasional isolated thin layers of clayey silt are also encountered. Based on 'N' values of 20 to 48 blows/foot, the silt is inferred to have a compact to dense relative density. The silt has a quick reaction to shaking (dilatency). In view of this, such material will lose its strength once it is disturbed either due to vibration or due to unbalanced hydrostatic head.

Glacial Till (Lower Deposit)

The silt is underlain by a further deposit of glacial till which has a thickness of about 25 feet. This lower deposit of glacial

till is granular in nature, composed of a heterogeneous mixture of sand, silt, clay and gravel. Grain size distribution curves obtained for representative samples from this deposit are shown in Figure 3 in an envelope form. The lower portion of this deposit contains shale fragments. In one particular location, a four foot thick layer of uniform fine sand was also intercepted immediately above bedrock. The 'N' values recorded in the glacial till deposit ranged from 54 blows/foot to generally over 100 blows/foot indicating that this glacial till has a very dense relative density. Across the site the lower glacial till is underlain by shale bedrock at an approximate elevation of 494.

Groundwater Conditions

Groundwater level was encountered at elevation 530±. In addition, all boreholes were found to cave in at the upper boundary of the silt deposit shortly after the withdrawal of the augers.

RECOMMENDATIONS

It is proposed to construct at this location a two span (114 foot-114 foot) underpass structure with closed type abutments to carry Morning Star Drive over Hwy. 427. The profile grade of Morning Star Drive and Hwy. 427 would be at elevation 554± and 533± respectively. This would require fills in the order of six feet high for Morning Star Drive and cuts up to 15 feet deep for Hwy. 427. During the time of field investigation, the cuts had been partially excavated. Our recommendations for the design and construction of the structure foundations and the approaches are as follows.

Structure Foundations

The closed type abutments and the centre pier can be supported on spread footings. In order to provide a minimum of four feet of earth cover for the underside of the footings for frost protection purposes, the footings should be founded at or below elevation 528. At this founding level, the footings would be located in the silt stratum. In its undisturbed state, the silt would be competent to provide a safe bearing capacity of 2.5 tsf. Resistance to lateral forces on the footings may be derived from friction between the underside of the concrete footings and the silt subsoil. This frictional resistance can be computed by assuming an angle of friction of 28°. If excavation for the spread footings is carried out below groundwater level, a positive dewatering scheme will be required to prevent the silt from 'boiling' caused by unbalanced hydrostatic head. Dewatering could be achieved by means of interlocking sheeting driven into the lower till deposit or by means of an oversized excavation incorporating a drainage ditch on the perimeter. Pertinent details of the oversized excavation dewatering method are shown in Figure A.

Since the silt is susceptible to disturbance, a six inch mass concrete working slab should be cast on the base of the excavation as soon as the founding level is reached and levelled.

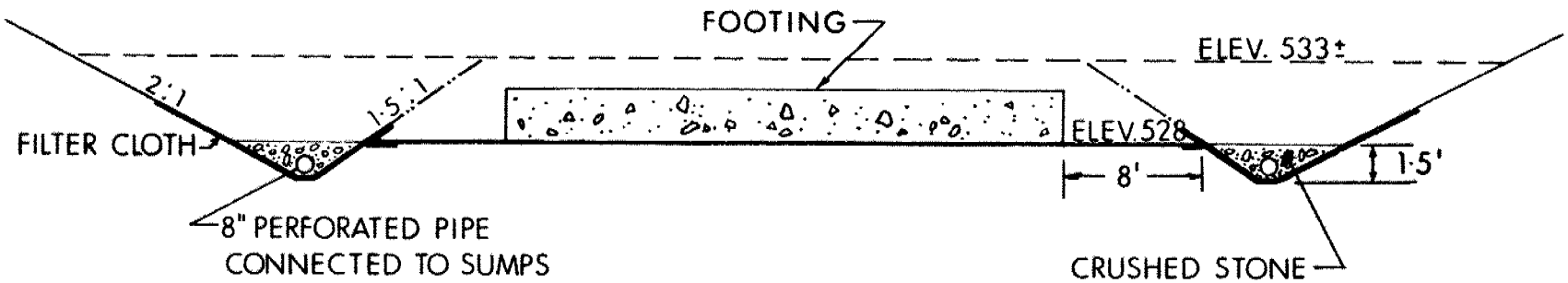
5.

Note 1. Complete excavation to Elev. 533±

2. Install drainage ditches as shown and start pumping

3. Excavate to footing foundation elevation, cast mass concrete working slab and construct footing

4. Keep pumping until the footing is backfilled



N. T. S.

FIG. A

Approaches

No stability problems for the fills and the cuts are anticipated provided they are constructed not steeper than a 2:1 slope.

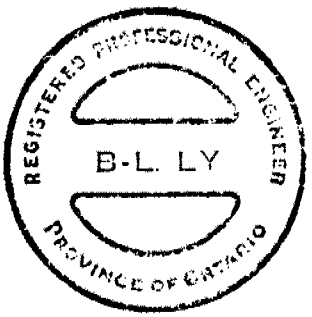
Other Considerations

Backfill to the abutment walls should be composed of free draining granular type of material placed and compacted according to current MTC practice. It should be noted that heavy vibratory compacting equipment should not be used within the zone drawn with a line from the heel of the retaining wall stem at an angle of 1H to 1½V. Compaction of backfill within this restricted zone should be done by means of light, hand operated equipment.

To estimate the lateral earth pressure imposed by the weight of the backfill material and the surcharge, a coefficient of lateral earth pressure equal to 0.35 and a unit weight of 135 pcf for the granular backfill should be assumed.

B. Ly

B. Ly, P. Eng.
Senior Engineer



M. Devata

M. Devata, P. Eng.
Supervising Engineer

August, 1979

APPENDIX

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

4 842 608.5 294 745.3

W P 49-71-02 LOCATION Coords. N 15 887 823; E 967 012 ORIGINATED BY BL

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BRL

DATUM Geodetic DATE July 9, 1979 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
1668 / 547.3	Ground Surface										
0.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel Very Stiff to Stiff — Brown / Grey		1	SS	23		540				
			2	SS	18						
161.3 / 529.3			3	SS	6		530				
18.0	Sandy Silt to Silt Dense		4	SS	37	(Hole Caved)					
158.1 / 518.8			5	SS	36		520				0 0 93 7
28.5	Glacial Till Heterogeneous Mixture of Sand, Silt, Some Gravel and Trace of Clay Very Dense		6	SS	120						11 35 42 12
			7	SS	60/ 6"		510				
			8	SS	90/ 4"						
			9	SS	97		500				31 48 16 5
151.1 / 495.8	Shale Fragments		10	SS	60/ 2"						
51.5	End of Borehole										

Note: Borehole Caved in at 18 Feet Upon Completion

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

4 842 634.4 294 775.

W P 49-71-02 LOCATION Coords. N 15 887 908; E 967 110 ORIGINATED BY BRL

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BRL

DATUM Geodetic DATE July 9, 1979 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
162.9 534.4	Ground Surface										
0.0 4.1 530.4	Glacial Till, Grey Very Stiff						530				
4.0	Silt, Grey, Compact to Dense With Occasional Thin Clay Layers Clayey Silt		1	SS	20	(Hole caved)					0 49 49 2
158.3 519.4			2	SS	35		520				
15.0	Glacial Till Heterogeneous Mixture of Silt, Sand, Clay and Gravel Very Dense		3	SS	60/ 5"						6 35 49 10
			4	SS	60/ 4"		510				
			5	SS	70						23 48 29 0
			6	SS	60/ 4"		500				
151.0 495.4	Shale Fragments		7	SS	111/ 9"						
39.0	Weathered Shale		8	SS	80/ 6"						
40.5	End of Borehole Note: Borehole Caved in at 4 Feet Shortly After Completion of Boring										

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

4 842 642.3 294 820.5

W P 49-71-02 LOCATION Coords. N 15 887 944; E 967 259 ORIGINATED BY BRL

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BRL

DATUM Geodetic DATE July 10, 1979 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1670 547.8	Ground Surface							
0.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Sand and Gravel Very Stiff		1	SS	18		540	
			2	SS	19			
161.2 528.8	Brown Grey		3	SS	13	▼	530	
19.0	Silt, Grey Dense		4	SS	48			
158.1 518.8			5	SS	40		520	0 0 (100)
29.0	Glacial Till Heterogeneous Mixture of Sand, Silt, Clay and Gravel Grey, Very Dense		6	SS	60/ 5"			6 38 45 11
			7	SS	97		510	
			8	SS	75/ 6"			
			9	SS	60/ 4"		500	
150.7 494.3	Uniform Fine Sand		10	SS	54			0 90 (10)
491.8	Weathered Shale		11	SS	70/ 3"			
56.0	End of Borehole							

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

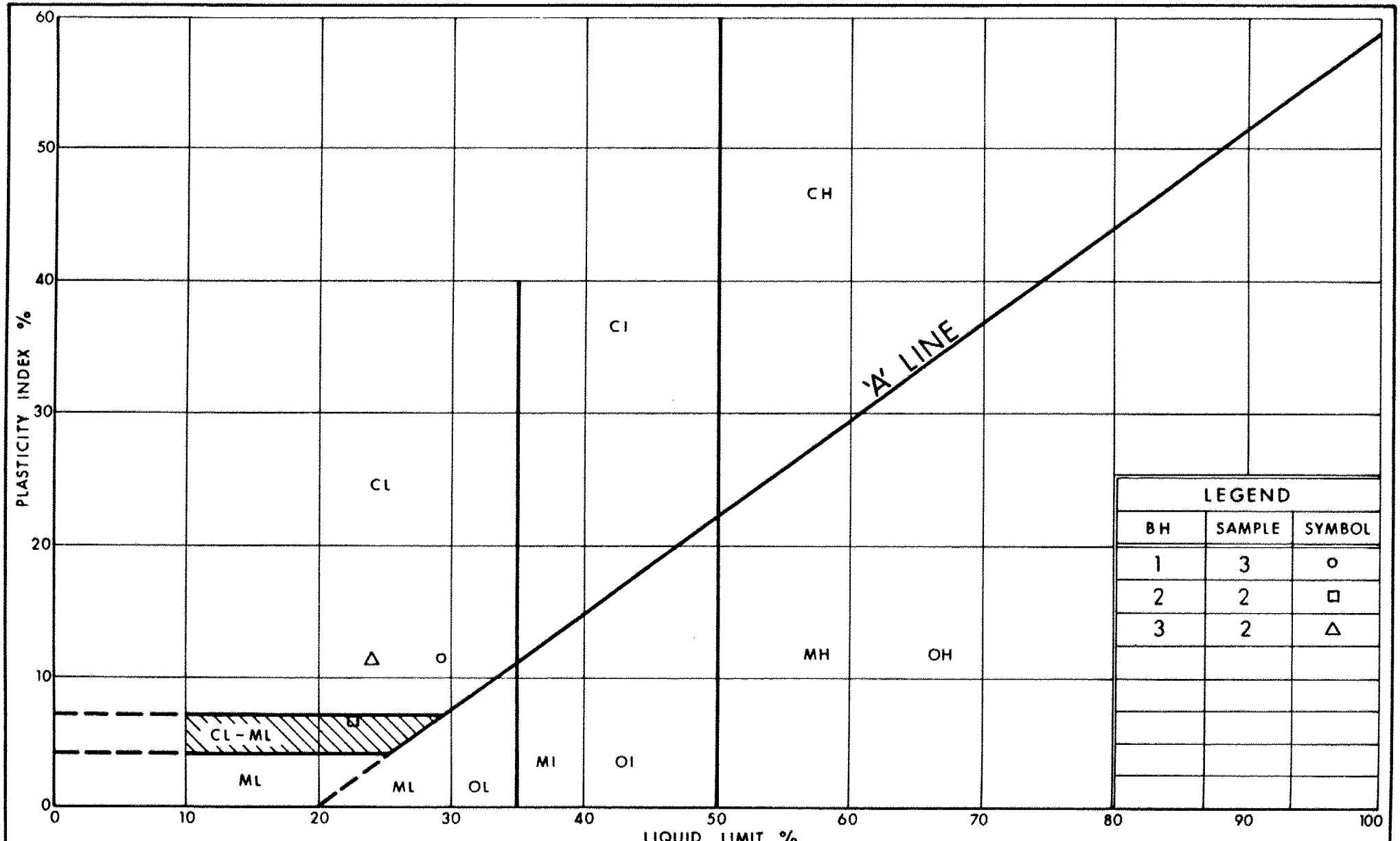
PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 15 ◇ 5 10 (%) STRAIN AT FAILURE



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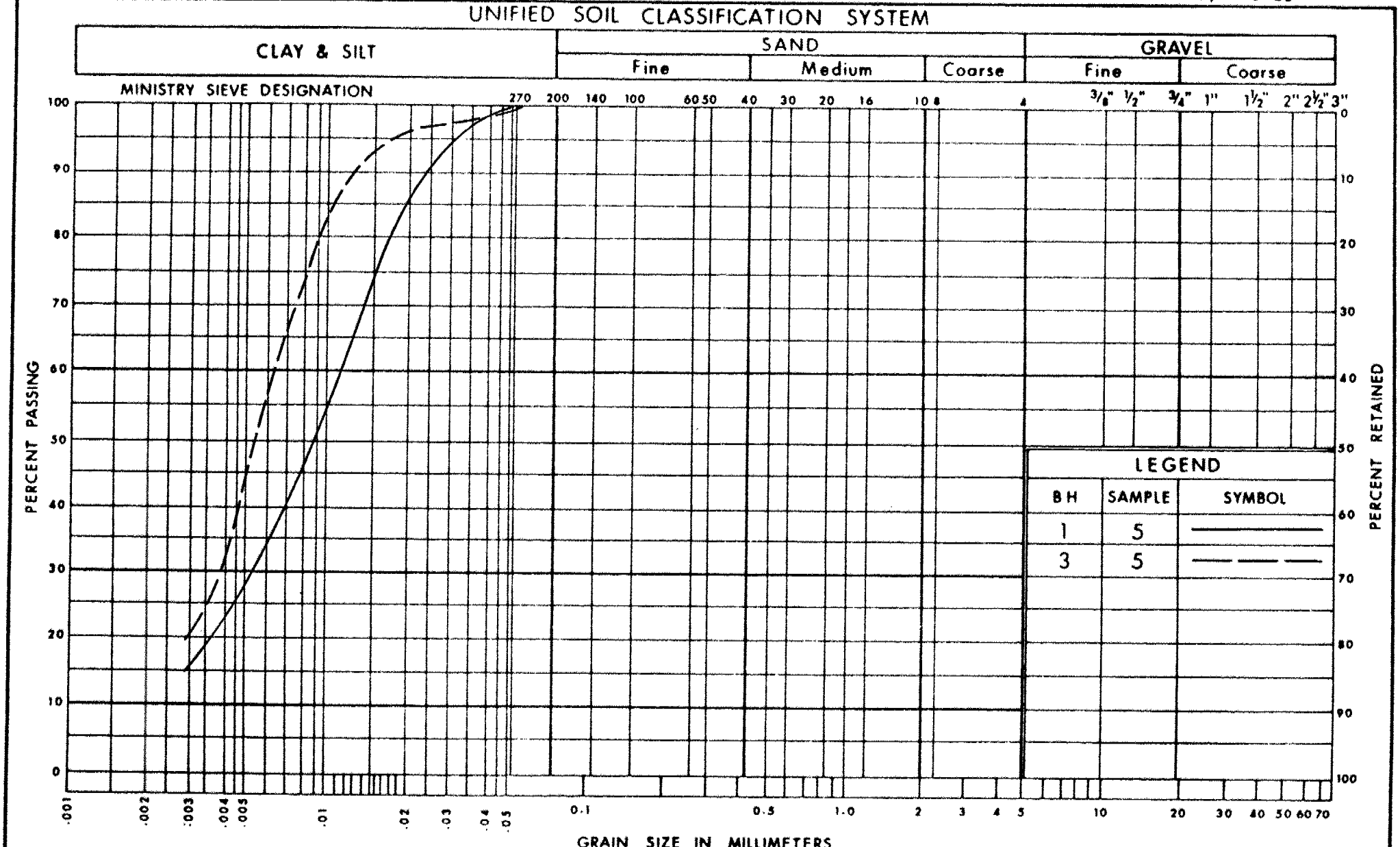
Ontario

PLASTICITY CHART
GLACIAL TILL
HETEROGENEOUS MIXTURE OF CLAYEY SILT SAND & GRAVEL

FIG No 1
W P 49-71-02
SITE 37-1083



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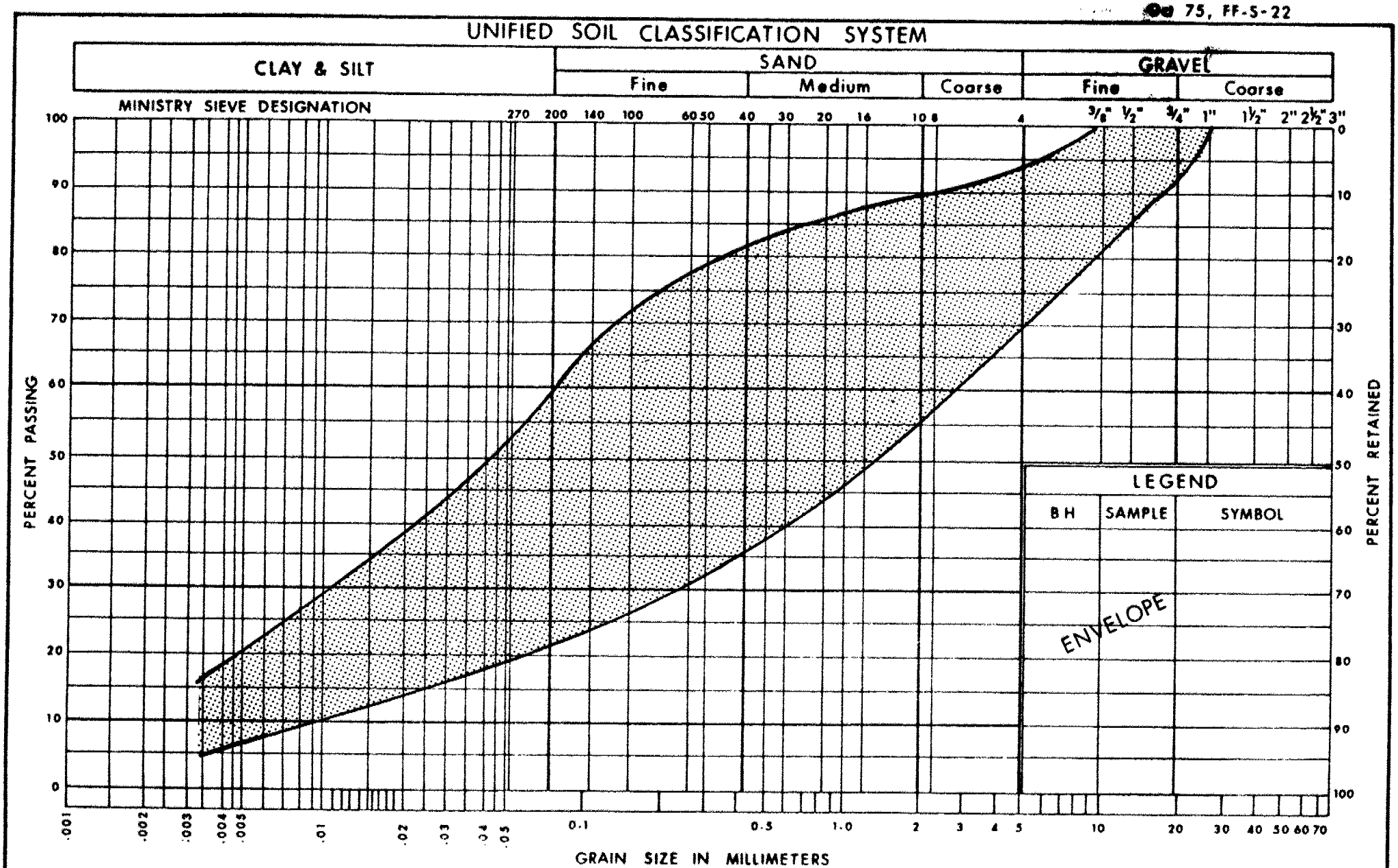
Ontario

GRAIN SIZE DISTRIBUTION
SILT

FIG No 2
W P 49-71-02
SITE 37-1083



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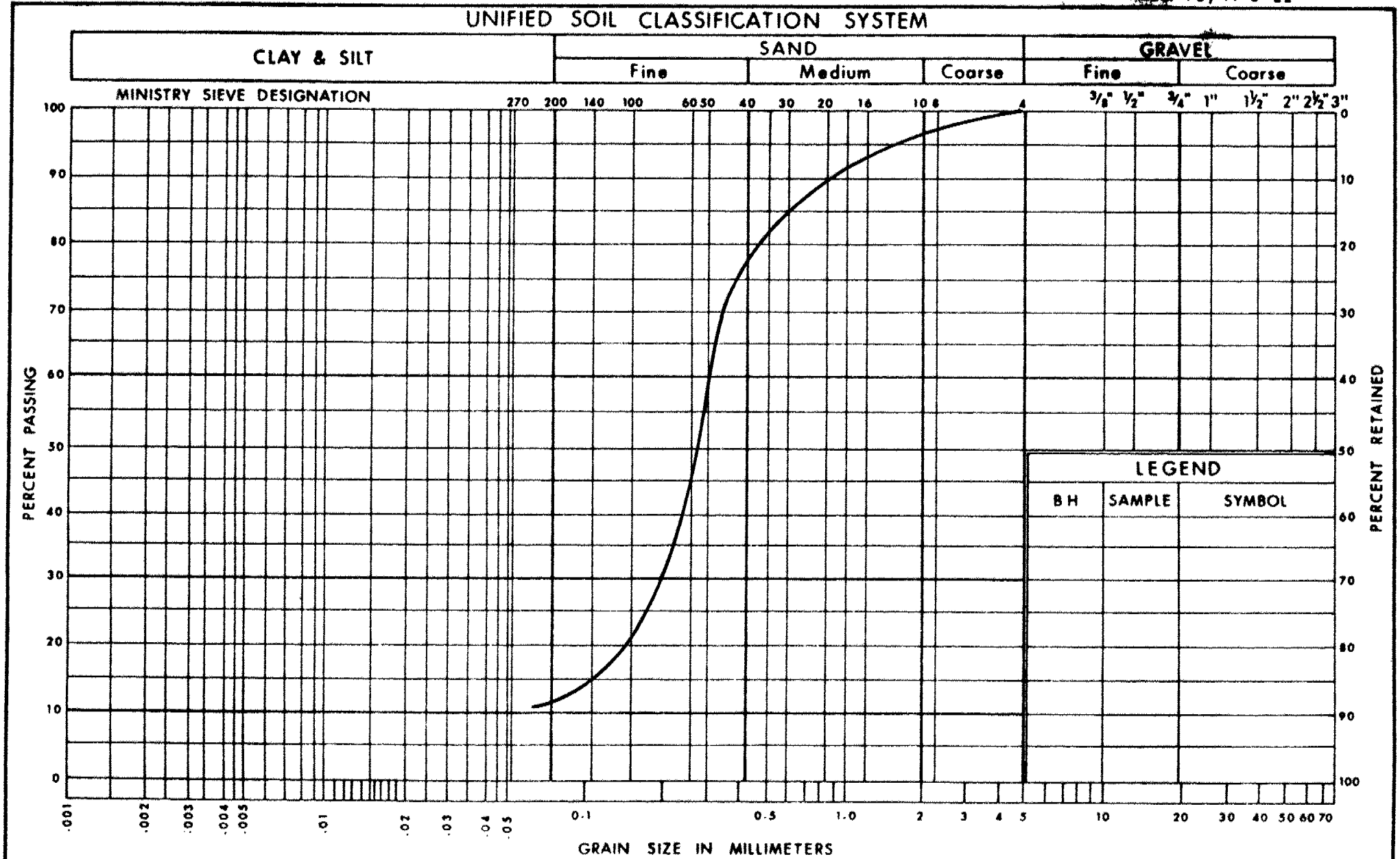
Ontario

GRAIN SIZE DISTRIBUTION
GLACIAL TILL (LOWER DEPOSIT)
HETEROGENEOUS MIXTURE OF SAND SILT CLAY & GRAVEL

FIG No 3
W P 49-71-02
SITE 37-1083



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Ontario

GRAIN SIZE DISTRIBUTION
FINE SAND
UNIFORM

FIG No 4
W P 49-71-02
SITE 37-1083

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH AS FOLLOWS:

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCK QUALITY: ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U)
ISOTROPICALLY (I) OR NOT (A)
AND SHEARED DRAINED (D) OR UNDRAINED (U)
WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS)
EG. $\bar{C}\bar{I}\bar{U}$ = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT
UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ	COEFFICIENT OF FRICTION
δ	ANGLE OF WALL FRICTION
k_o	COEFFICIENT OF EARTH PRESSURE AT REST
k_A	COEFFICIENT OF ACTIVE EARTH PRESSURE
k_p	COEFFICIENT OF PASSIVE EARTH PRESSURE
i	ANGLE OF INCLINATION OF SURCHARGE
ω	SLOPE ANGLE-BACKFACE OF WALL
β	ANGLE OF SLOPE
N_γ, N_q, N_c	BEARING CAPACITY FACTORS
D_f	DEPTH OF FOOTING
B,L	FOOTING DIMENSIONS

INDEX PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G_s	SPECIFIC GRAVITY OF SOLIDS
e	VOIDS RATIO
e_o	INITIAL VOIDS RATIO
e_{max}	e IN LOOSEST STATE
e_{min}	e IN DENSEST STATE
D_r	RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
n	POROSITY
w	WATER CONTENT
w_L	LIQUID LIMIT
w_P	PLASTIC LIMIT
w_S	SHRINKAGE LIMIT
I_p	PLASTICITY INDEX = $w_L - w_P$
I_L	LIQUIDITY INDEX = $\frac{w - w_P}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{\% < 2\mu m \text{ Soil Fraction}}$
Om	ORGANIC MATTER CONTENT
S_r	DEGREE OF SATURATION
S	SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

ϕ	ANGLE OF SHEARING RESISTANCE
τ_f	PEAK SHEAR STRENGTH
τ_R	RESIDUAL SHEAR STRENGTH
c	COHESION INTERCEPT
$\sigma_1, \sigma_2, \sigma_3$	NORMAL PRINCIPAL STRESSES
u	PORE WATER PRESSURE
u_e	EXCESS u
r_u	PORE PRESSURE RATIO
q_u	UNCONFINED COMPRESSIVE STRENGTH
s_u	UNDRAINED SHEAR STRENGTH
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO
E	MODULUS OF ELASTICITY
G	MODULUS OF SHEAR DEFORMATION
k_s	MODULUS OF SUBGRADE REACTION
m,n	STABILITY COEFFICIENTS
A,B	PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

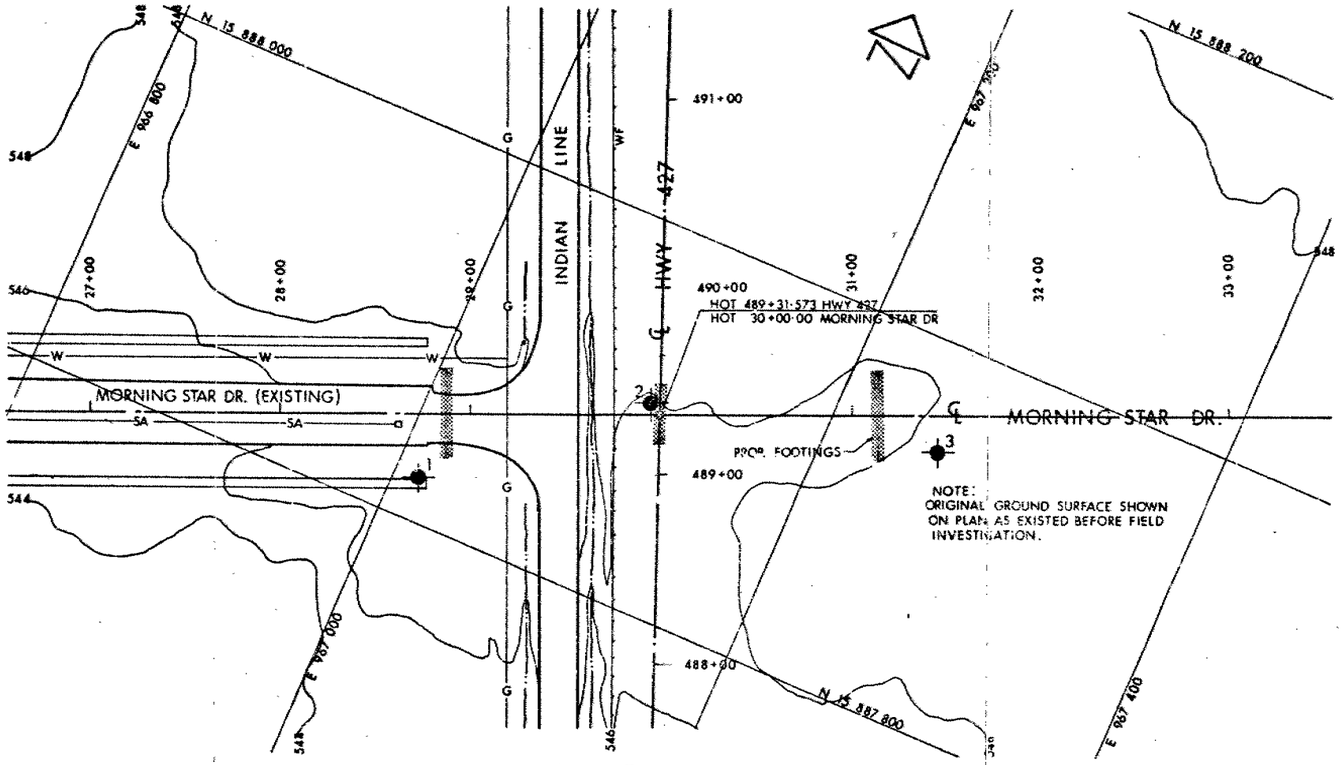
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
j	SEEPAGE FORCE PER UNIT VOLUME
η	COEFFICIENT OF VISCOSITY
k	COEFFICIENT OF HYDRAULIC CONDUCTIVITY
k_h	k IN HORIZONTAL DIRECTION
k_v	k IN VERTICAL DIRECTION
m_v	COEFFICIENT OF VOLUME CHANGE
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX
C_r	RECOMPRESSION INDEX
d	DRAINAGE PATH DISTANCE
T_v	TIME FACTOR
U	DEGREE OF CONSOLIDATION
O_r	OVERCONSOLIDATION RATIO (OCR)

CONT No
WP No 49-71-02

MORNING STAR DR UNDERPASS AT HWY 427

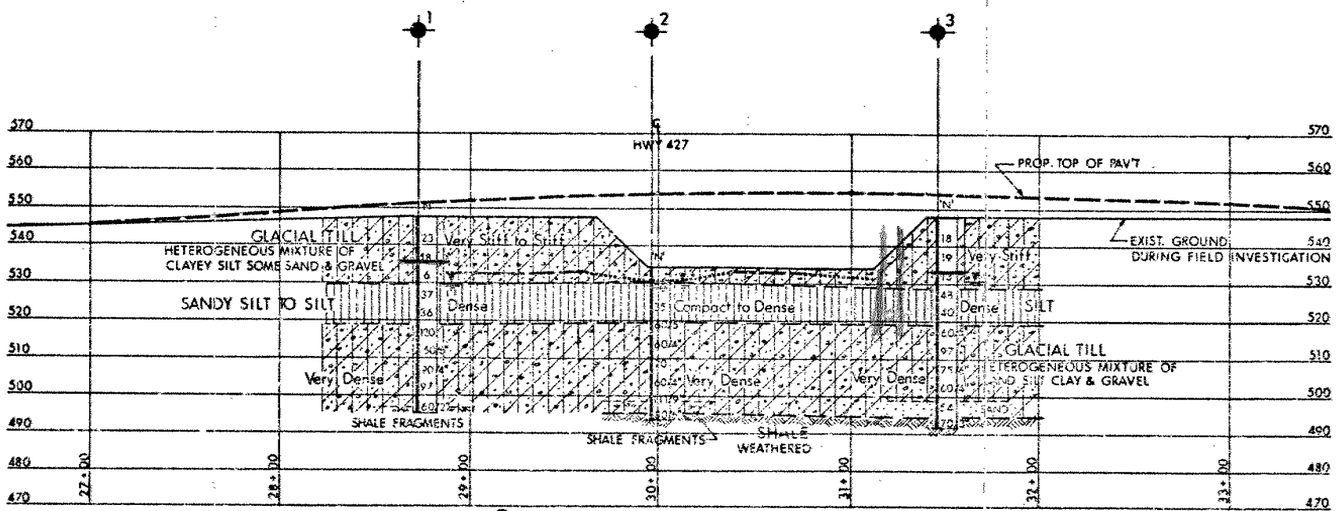
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



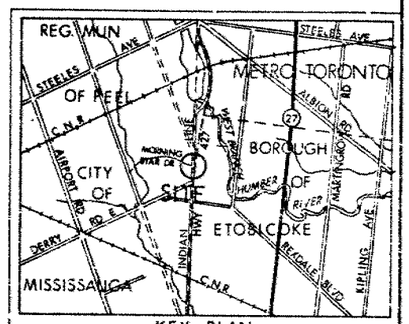
PLAN

SCALE 40 20 0 40 FT



℄ PROFILE MORNING STAR DR.

SCALE
HOR 40 20 0 40 FT
VERT 20 10 0 20



KEY PLAN

1 0 5 0 1 MI.

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- W.L at time of investigation JULY 1979

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	547·3	15 887 823	967 012
2	534·4	15 887 908	967 110
3	547·8	15 887 944	967 259

-NOTE-

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

REVISIONS

DATE	BY	DESCRIPTION

REF. No. PROCTOR & REDFERN LTD.
DWG No. X-78462-G1 APR. 1979

GEOCRES No 30M12-140

HWY No. 427			DIST 6
SUBM'D B. L.	CHECKED -	DATE 79 07 31	SITE 37-1083
DRAWN O. J.	CHECKED - APPROVED		DWG 497102-A

Cole Sherman

FAX (905)
882-4399

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 604-89-01 DIST 6

HWY 427 STR SITE 37-1083

Morning Star Drive Underpass

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GEOCRES 30M12-140

DATE DEC 2 1 1992

FOUNDATION INVESTIGATION REPORT

For

Morning Star Drive Underpass
W.P. 604-89-01, Site 37-1083
Hwy 427, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation performed at the above site between 1979 07 09 and 1979 07 10.

The fieldwork consisted of three sampled boreholes put down by means of a drill rig equipped with hollow stem augers. The depths of borings ranged from 12.2 m to 17.1 m (40 ft to 56 ft) below original ground surface.

SITE DESCRIPTION

The area is located at the intersection of Morning Star Drive and Hwy 427, about 3 km south of Steeles Avenue.

At the time of the fieldwork, a 4.3 m (14 ft) deep cut had been excavated within the present limits of the Hwy 427 NBL. Beyond the limits of existing Hwy 427, the terrain is relatively flat. The area to the east of Hwy 427 is an open field and the area to the west is used primarily for residential development. The general area is drained by the Humber River and its tributaries, located to the east of the site.

Geologically, the site is situated in a bevelled till plain which is located in a physiographic region generally known as the 'Peel Plain'.

SUBSURFACE CONDITIONS

In general, subsoil at this site consists of two glacial till sheets separated by a silt stratum. The upper glacial till sheet is about 5.8 m (19 ft) thick with a cohesive matrix. The lower glacial till sheet is about 7.6 m (25 ft) thick which is basically granular in nature. The silt stratum is sandwiched between the two glacial till sheets, is about 3.0 m (10 ft) thick and is an inter-stadial deposit. Across the site the overburden is underlain by shale bedrock.

Factual borehole data is contained in the Borehole Record Sheets. The location and elevation of the boreholes, together with a subsoil profile estimated from the borehole data, are shown in Drawing No. 6048901-A. A description of the subsurface conditions as revealed by the borings is as follows.

Heterogeneous Mixture of Clayey Silt, some sand and gravel (Glacial Till) (Upper Deposit)

A deposit of heterogeneous mixture of clayey silt, some sand and gravel (cohesive glacial till) was encountered from the ground surface for a maximum depth of 5.8 m (19 ft). The thickness of this stratum was about 1.2 m (4 ft) in the borehole located within the 4.3 m (14 ft) cut.

Laboratory tests performed on two representative samples from this deposit indicate that the glacial till has a liquid limit of 24 and 29, a plastic limit of 11 and 12 and a natural moisture content of 19% and 27%. The Atterburg limits are also plotted on Figure 1 which indicates that the matrix of the glacial till has a plasticity in the low range (CL).

Based on Standard Penetration Resistance (N) values of 6 to 35 blows per 0.3 m obtained within this deposit, the upper glacial till has a stiff to very stiff consistency.

Silt

Underlying the upper cohesive glacial till deposit is a 3.0 m (10 ft) thick stratum of silt. Typical grain size distribution curves for material from the silt stratum are shown on Figure 2. Within this stratum, occasional isolated thin layers of clayey silt are also encountered.

Based on Standard Penetration Resistance (N) values of 20 to 48 blows per 0.3 m, the silt is inferred to have a compact to dense relative density. The silt has a quick reaction to shaking (dilatancy). In view of this, such material will lose its strength once it is disturbed either due to vibration or due to unbalanced hydrostatic head.

Heterogeneous Mixture of Sand, Silt, Clay and Gravel (Glacial Till) (Lower Deposit)

The silt is underlain by a deposit of heterogeneous mixture of sand, clay and gravel for a thickness of about 7.6 m (25 ft). Grain size distribution curves obtained for representative samples from this deposit are shown in Figure 3 in an envelope form. The lower portion of this deposit contains shale fragments. In one particular location, a 1.2 m (4 ft) thick layer of uniform fine sand was also intercepted immediately above

bedrock.

The Standard Penetration Resistance (N) values recorded in this stratum ranged from 54 blows per 0.3 m to generally over 100 blows per 0.3 m, indicating a very dense relative density for this deposit. Across the site, the lower glacial stratum is underlain by bedrock at an approximate elevation of 150.5 m (494 ft).

GROUNDWATER CONDITIONS

Groundwater level was encountered at elevation 161.5 m +/- (530 ft +/-). In addition, all boreholes were found to cave in at the upper boundary of the silt deposit shortly after the withdrawal of the augers.

Because of the various construction activities that have taken place at this site, the groundwater level should be expected to be slightly above the invert of the median ditch running along Hwy 427.

RECOMMENDATIONS

It is proposed to construct at this location a two span (34.5 m + 34.5 m) underpass structure with closed type abutments to carry Morning Star Drive over Hwy 427. The profile grades of Morning Star Drive and Hwy 427 would be at approximate elevation 169.8 m and 162.6 m respectively. The fill heights above existing grade will be about 3 m.

Recommendations for the design and construction of structure foundations and approach embankments are as follows.

STRUCTURE FOUNDATIONS

It is considered that the upper cohesive glacial till stratum is not suitable for the support of shallow spread footings. The underlying silt layer is susceptible to disturbance due to vibration during excavation and other construction activities. Hence, it is recommended that the abutment footings shall be designed as perched footing on compacted granular A pad, as shown on Figure 4. To avoid softening of the underlying silt layer, it is recommended that the excavation of the upper cohesive glacial till layer be restricted to El 162 m or above. Footings resting on 1 m thick compacted granular pad shall be designed using an SLS Type II capacity of 350 kPa and factored ULS capacity of 900 kPa.

The central pier shall be founded on steel H piles, end bearing on bedrock surface, expected at about El 150 m. The design axial capacities of the steel H piles are as follows:

Pile Type	Factored Capacity at U.L.S.	Capacity at S.L.S. Type II
HP310X79	1150 kN	890 kN
HP310X110	1600 kN	1150 kN

To facilitate driving of piles through the overburden, it is recommended that they be provided with standard MTO tip reinforcement as per OPSD 3301.

It is possible that some of the piles may reach refusal within the lower glacial till stratum. In such cases, pile installation shall be controlled by Hiley formula as per MTO Standards SS 103-10 or SS 103-11. The ultimate capacity of the driven piles shall be as follows.

Pile Type	Ultimate Capacity
HP310X79	2670 kN
HP310X110	3450 kN

All shallow spread footings and pile caps shall be provided with minimum 1.2 m of earth cover for frost protection purposes.

APPROACH EMBANKMENT

The approach fills will be about 3 m high. These shall be constructed using 2H to 1V slopes from existing grade. Any organic soil or soft layers should be excavated before constructing new embankment.

It is understood that due to space limitation, it will be necessary to construct a conventional concrete retaining wall or a reinforced earth wall on one side of the approach embankment to the east of Hwy 427. Such retaining walls may be supported on shallow spread footings founded on 300 mm thick granular pad on existing cohesive glacial till and designed using a factored ULS capacity of 350 kPa and an SLS Type II capacity of 200 kPa.

Backfill pressures on retaining walls shall be calculated using the following coefficients.

	Granular A	Granular B
Angle of internal friction	35°	30°
Unit weight (kN/m^3)	22.8	21.2
Active earth pressure coefficient	0.27	0.33

GENERAL

For calculation of sliding resistance of footings resting on compacted granular A pad, an unfactored angle of internal friction of 35° shall be used.

Excavation for pile caps at the pier location would extend below groundwater level and into the silt layer. Advance dewatering, by means of oversized excavation, wellpoint system or other means will be required to facilitate construction of the pile caps in the dry.

MISCELLANEOUS

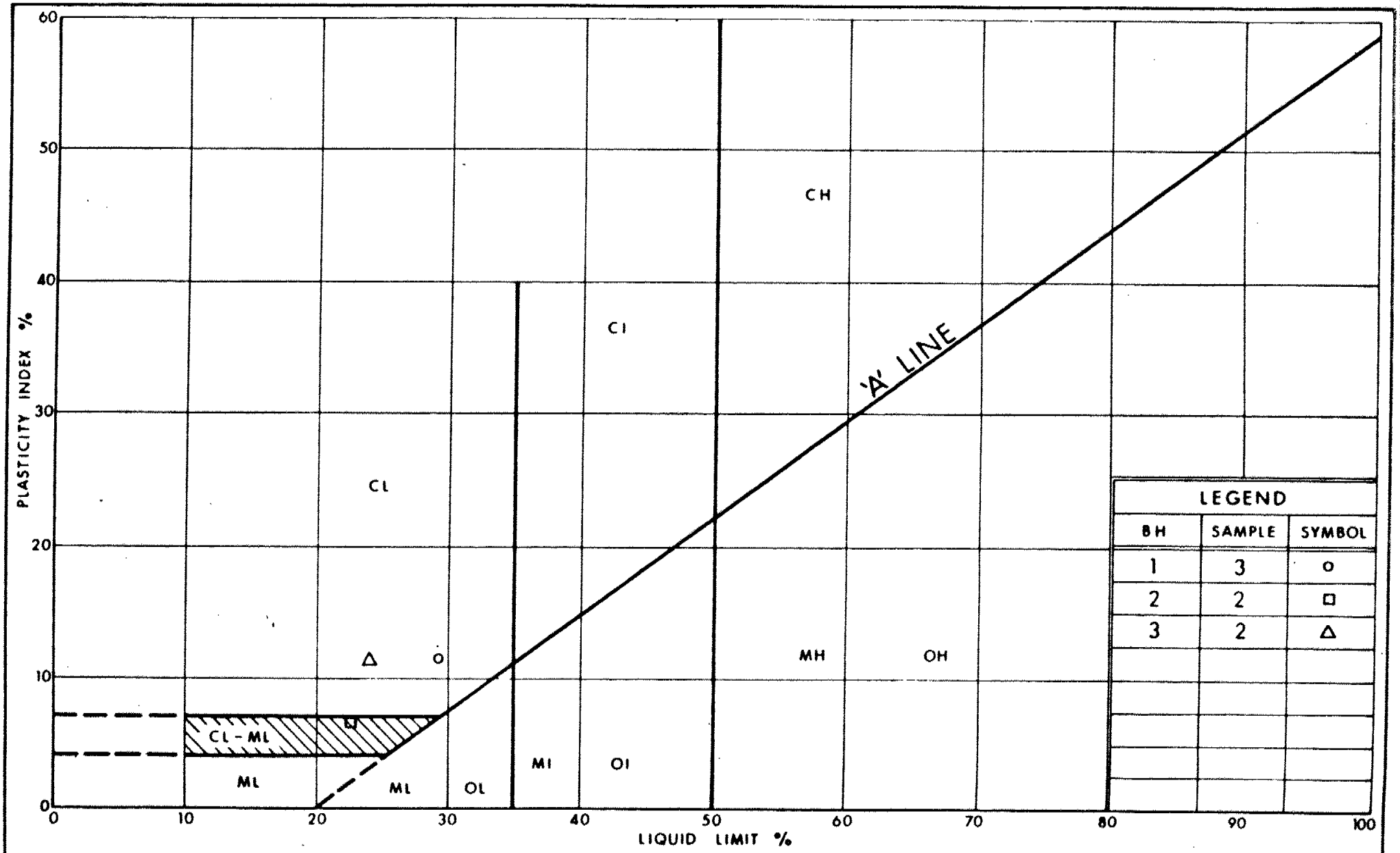
The original report was prepared by B. Ly, P.Eng., Senior Engineer and reviewed by M. Devata, P.Eng., Supervising Engineer.

In order to comply with the Ontario Highway Bridge Design Code and provide soft conversion from imperial units to metric units, Balu Iyer, P.Eng., Senior Foundation Engineer prepared this updated version of the original report. This report was approved by M. Devata, P.Eng., Chief Foundation Engineer.

B. Iyer, P.Eng.
Senior Foundation Engineer

M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

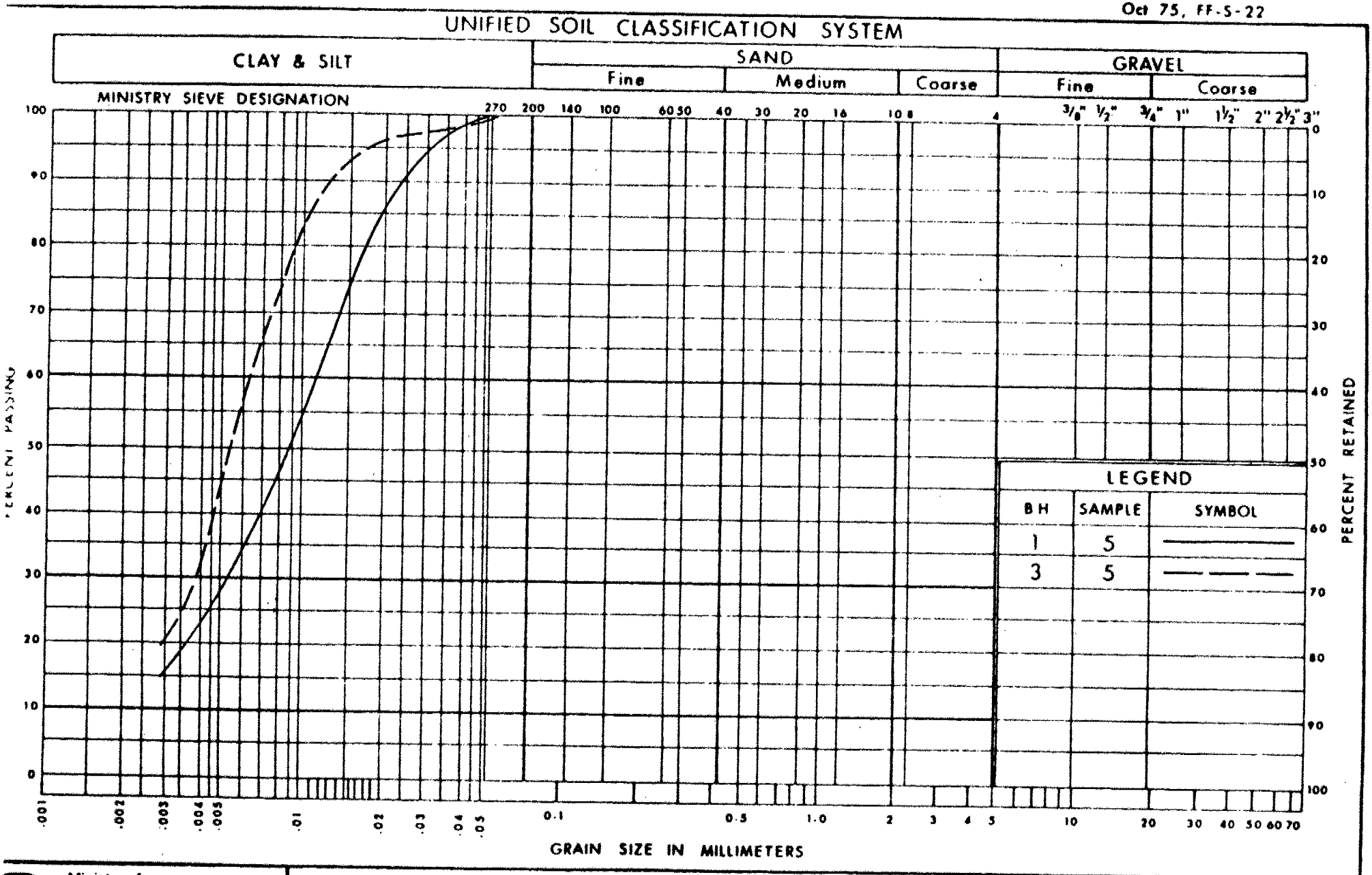


Ministry of Transportation and Communications
Ontario

PLASTICITY CHART
GLACIAL TILL
HETEROGENEOUS MIXTURE OF CLAYEY SILT SAND & GRAVEL

FIG No 1
W P 604-89-01
SITE 37-1083

Oct 75, FF-S-22



Ministry of Transportation and Communications

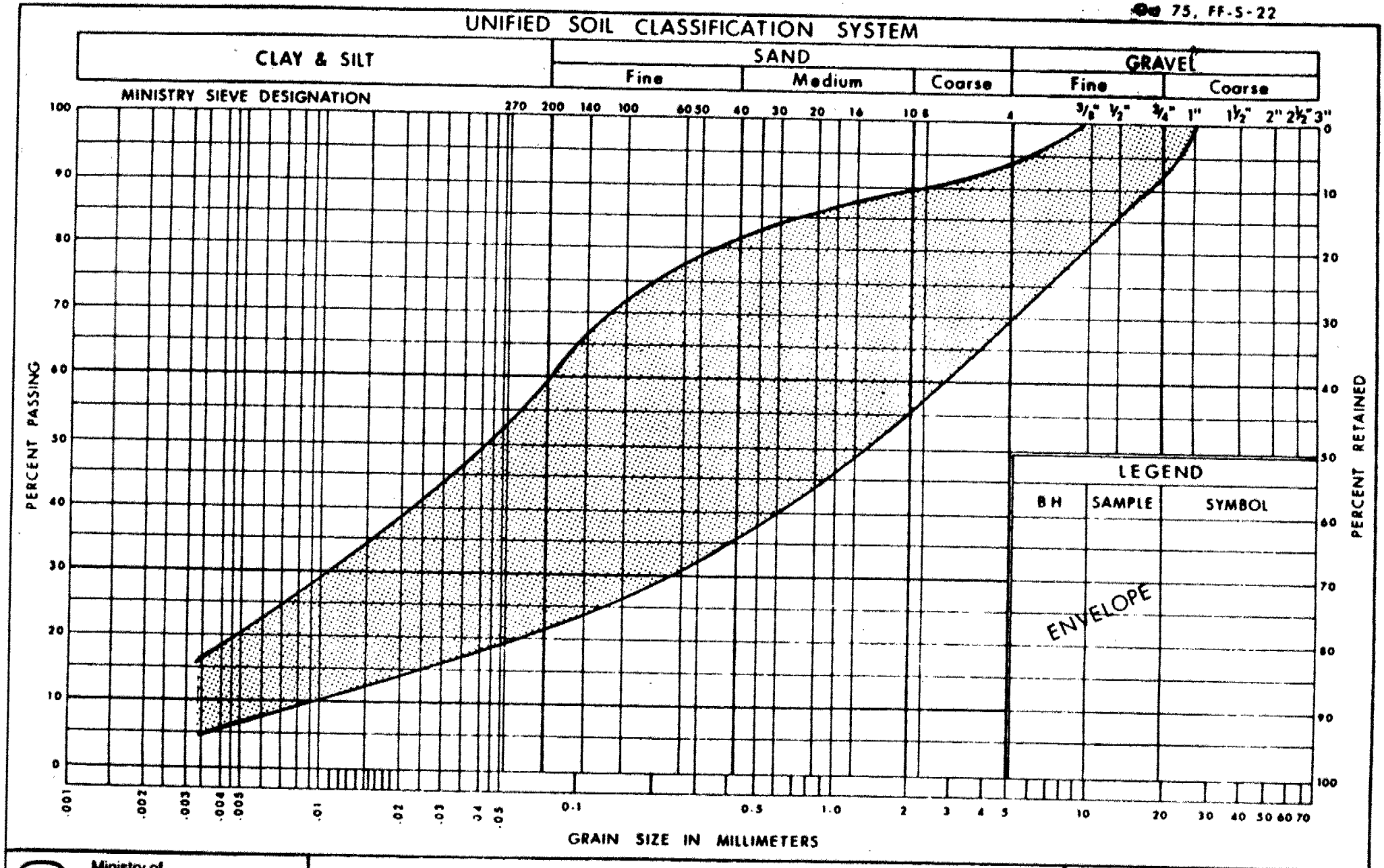
Ontario

GRAIN SIZE DISTRIBUTION
SILT

FIG No 2

W P 604-89-01

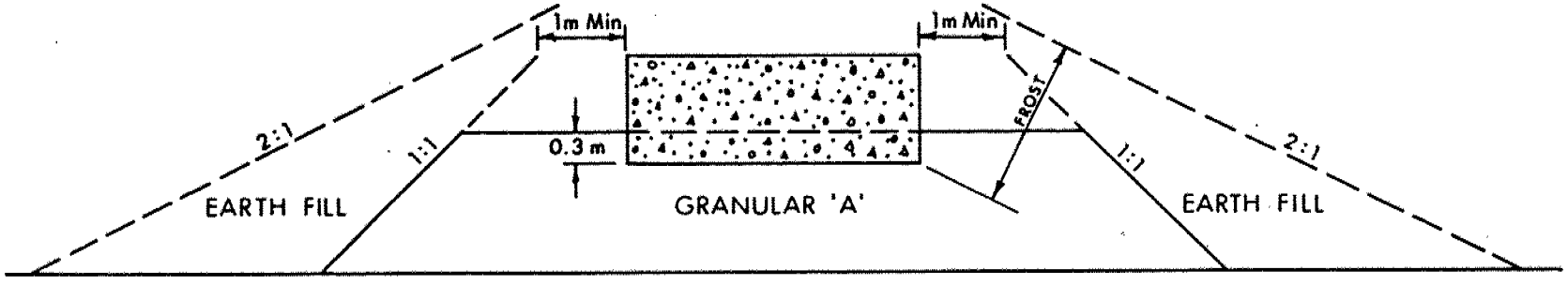
SITE 37-1083



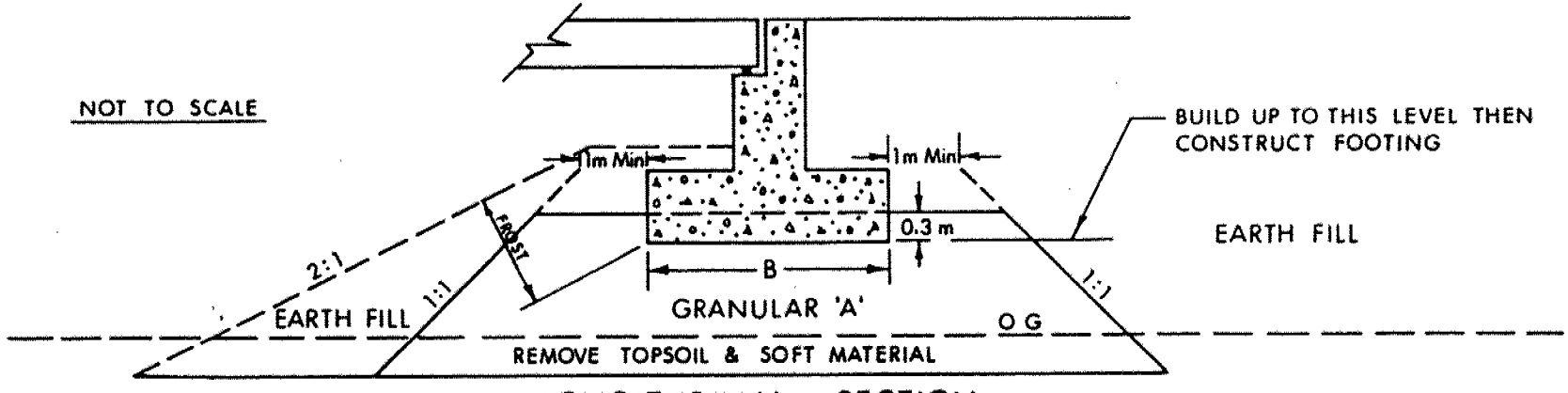
Ministry of Transportation and Communications
Ontario

GRAIN SIZE DISTRIBUTION
GLACIAL TILL (LOWER DEPOSIT)
HETEROGENEOUS MIXTURE OF SAND SILT CLAY & GRAVEL

FIG No 3
W P 604-89-01
SITE 37-1083



X SECTION



LONGITUDINAL SECTION

NOTES:

1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.

2 - PLACE GRANULAR 'A' & EARTH FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M T O STANDARDS.

3 - CONSTRUCT CONCRETE FOOTING.

4 - PLACE REMAINDER OF GRANULAR 'A' & EARTH FILL AS REQUIRED.

Ministry of Transportation Ontario	ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE	FIG No 4 W P 604-89-01

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O D SPLIT BARREL SAMPLER TO PENETRATE 0 3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63 5kg, FALLING FREELY A DISTANCE OF 0 76m FOR PENETRATIONS OF LESS THAN 0 3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED AVERAGE N VALUE IS DENOTED THUS $\bar{N}$

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O D 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0 3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS

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

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

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

N (BLOWS/0 3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

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

RECORD OF BOREHOLE No 1 — 1 OF 1 — METRIC

W.P. 604-89-00 FORMERLY 49-71-02 LOCATION Coords: N 4 842 608.5, E 294 745.3 ORIGINATED BY BL

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BRL

DATUM Geodetic DATE 79/07/09 CHECKED BY

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
166.8	Ground Surface										
0.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel Very Stiff to Stiff		1	SS	23		166				
	Brown / Grey		2	SS	18		164		o		
161.3			3	SS	6		162			o	
5.5	Sandy Silt to Silt Dense		4	SS	37	(Hole Caved)	160				
158.1			5	SS	36						0 0 93 7
8.7	Glacial Till Heterogeneous Mixture of Sand, Silt, Some Gravel and Trace of Clay Very Dense		6	SS	120		158				11 35 42 12
			7	SS	60	/15cm	156		o H		
			8	SS	90	/10cm	154				
			9	SS	97						31 48 16 5
151.1	Shale Fragments		10	SS	60	/5cm	152				
15.7	End of Borehole										
	Note: Borehole Caved in at 5.5 m Upon Completion										

$+^3$, $\times^5$: Numbers refer to Sensitivity

$\frac{20}{15 \diamond 5}$ (%) STRAIN AT FAILURE
$\frac{}{10}$

RECORD OF BOREHOLE No 2 1 OF 1 METRIC

W.P. 604-89-00 FORMERLY 49-71-02 LOCATION Coords: N 4 842 634.4, E 294 775.1 ORIGINATED BY BRL

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BRL

DATUM Geodetic DATE 79/07/09 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; 20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
162.9	Ground Surface										
0.0 / 161.7	Glacial Till, Grey Very Stiff										
1.2	Silt, Grey, Compact to Dense With Occasional Thin Clay Layers		1	SS	20	▼	162				0 49 49 2
	Clayey Silt		2	SS	35		160				
158.3											
4.6	Glacial Till Heterogeneous Mixture of Silt, Sand, Clay and Gravel Very Dense		3	SS	60	/13cm	158				6 35 49 10
			4	SS	60	/10cm					
							156				
			5	SS	70						23 48 29 0
			6	SS	60	/10cm	154				
	Shale Fragments		7	SS	111	/23cm	152				
151.0											
150.6	Weathered Shale		8	SS	80	/15cm					
12.3	End of Borehole										

Note: Borehole Caved in at 1.2 m Shortly After Completion of Boring

+³, ×⁵: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 3 — 1 OF 1 — METRIC

W.P. 604-89-00 FORMERLY 49-71-02 LOCATION Coords: N 4 842 645.3, E 294 820.5 ORIGINATED BY BRL

DIST 6 HWY 427 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BRL

DATUM Geodetic DATE 79/07/10 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
167.0	Ground Surface							
0.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Sand and Gravel Very Stiff		1	SS	18		166	
			2	SS	19		164	
	Brown / Grey		3	SS	13	▼	162	
161.2								
5.8	Silt, Grey Dense		4	SS	48		160	
			5	SS	40			0 0 (100)
158.2							158	
8.8	Glacial Till Heterogeneous Mixture of Sand, Silt, Clay and Gravel Grey, Very Dense		6	SS	60	/13cm		6 38 45 11
			7	SS	97		156	
			8	SS	75	/15cm		
			9	SS	60	/10cm	154	
			10	SS	54		152	0 90 (10)
150.7	Uniform Fine Sand							
16.3 / 149.9	Weathered Shale		11	SS	70	/8cm	150	
17.1	End of Borehole							

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION, ONTARIO PH-0-207 88 10

METRIC

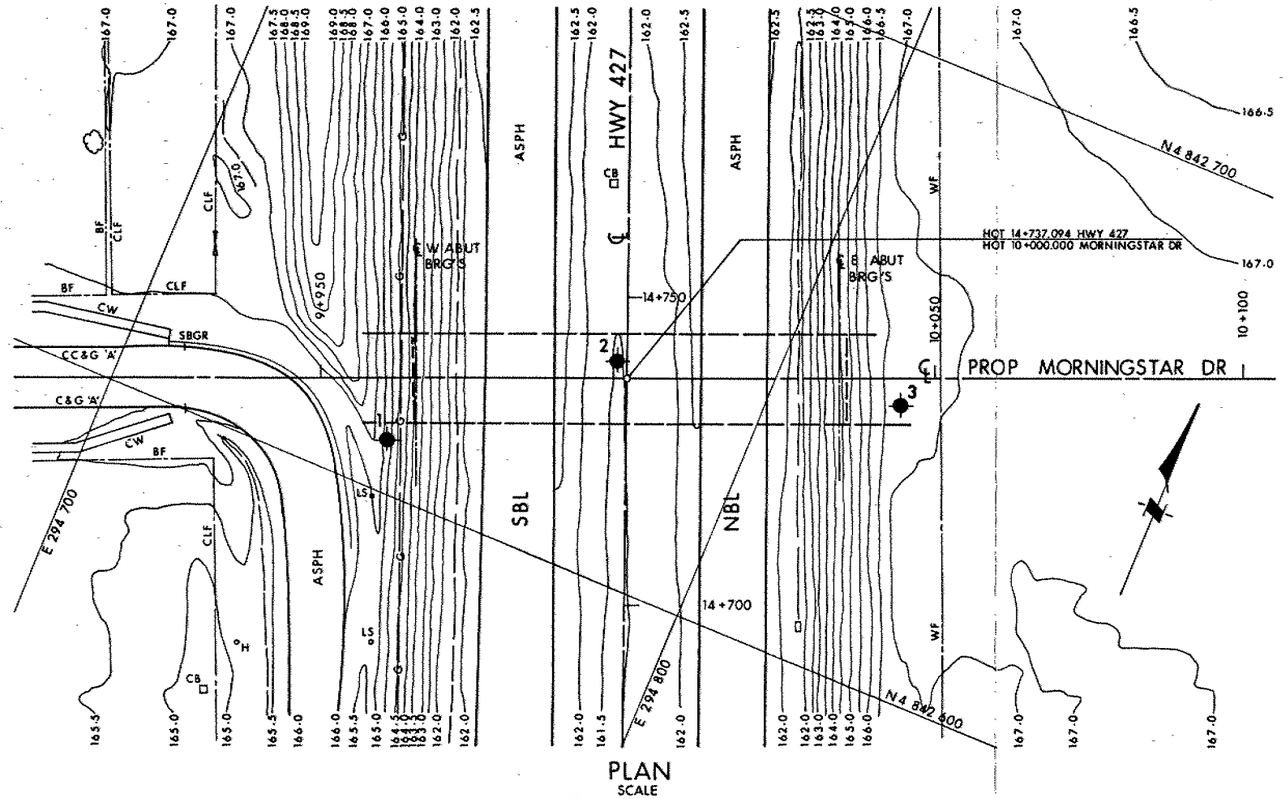
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No
WP No 604-89-01

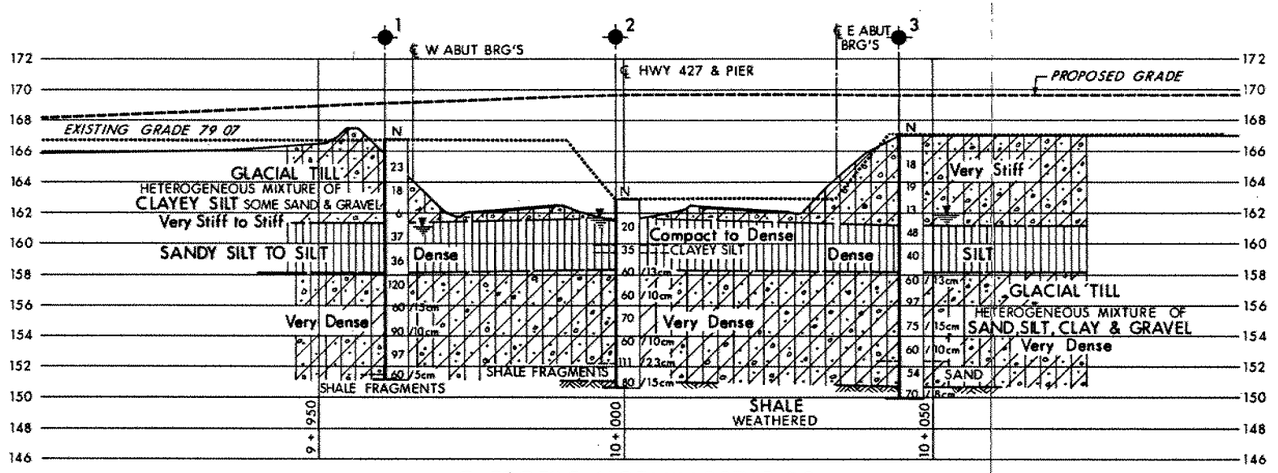
MORNINGSTAR DR UNDERPASS AT HWY 427

BORE HOLE LOCATIONS & SOIL STRATA

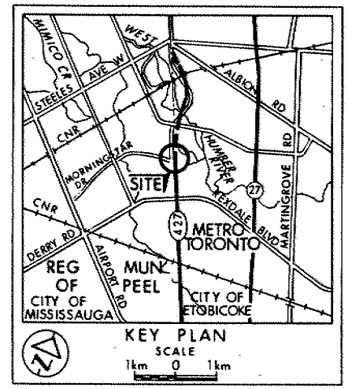
SHEET



PLAN
SCALE
10m 5 0 10m



℄ PROFILE MORNINGSTAR DR
SCALE
10m 5 0 10m Hor
4m 2 0 4m Vert



KEY PLAN
SCALE
1km 0 1km

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0·3m (Std Pen Test, 475 J/blow)
- CONE Blows/0·3m (60° Cone, 475 J/blow)
- W L at time of investigation 79 07

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	166·8	4 842 608·5	294 745·3
2	162·9	4 842 634·4	294 775·1
3	167·0	4 842 645·3	294 820·5

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

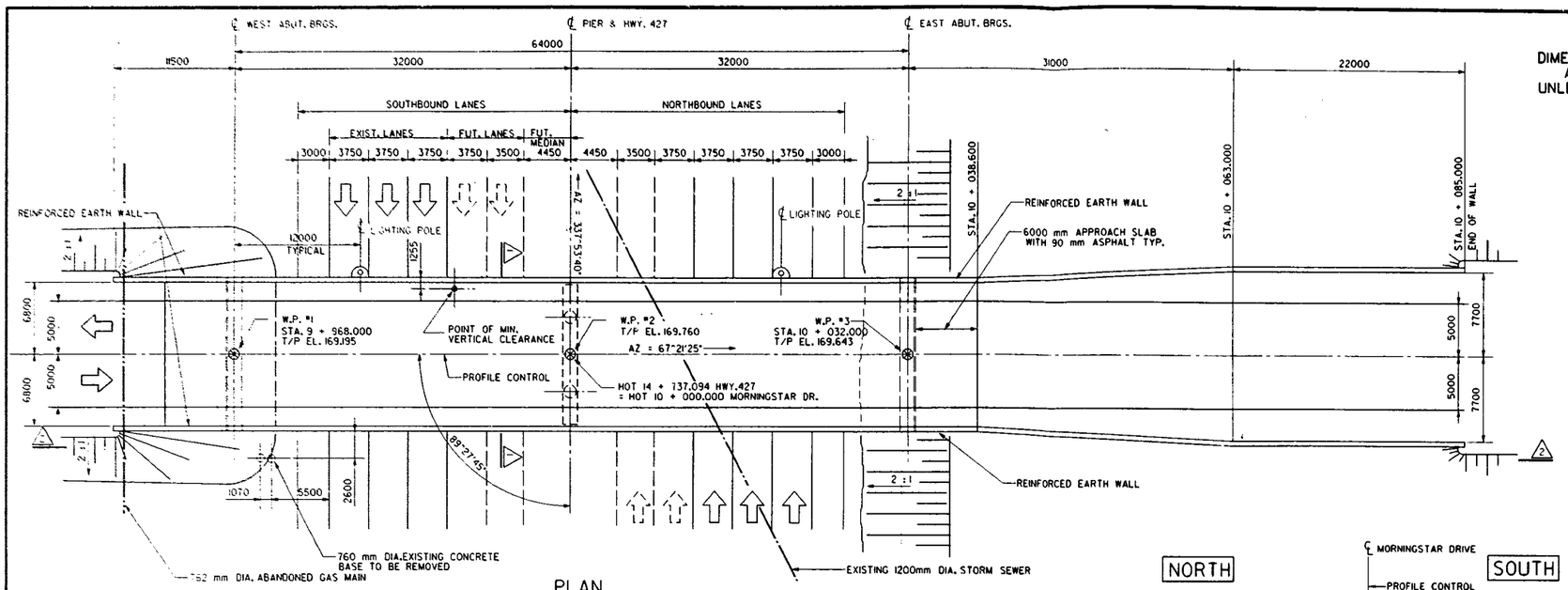
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 201 of OPS Gen Cond

REV.	DATE	BY	DESCRIPTION

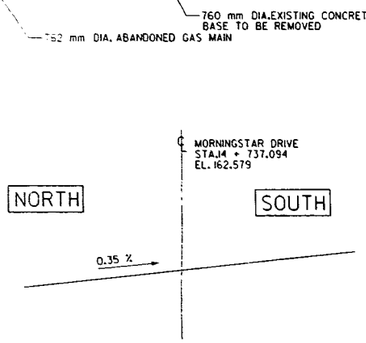
Geocres No 30M12-140

HWY No 427			DIST 6
SUBM'D BI	CHECKED	DATE 92 07 03	SITE 37-1083
DRAWN DT	CHECKED	APPROVED	DWG 6048901-A

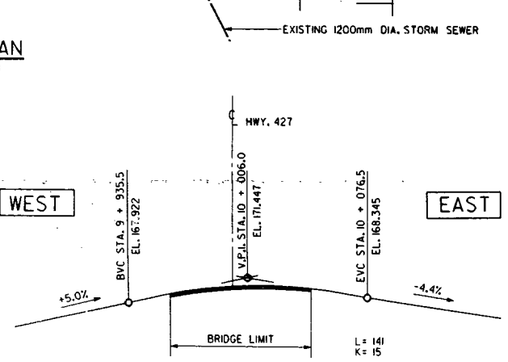
REF No E-80-427-1, 1991 11



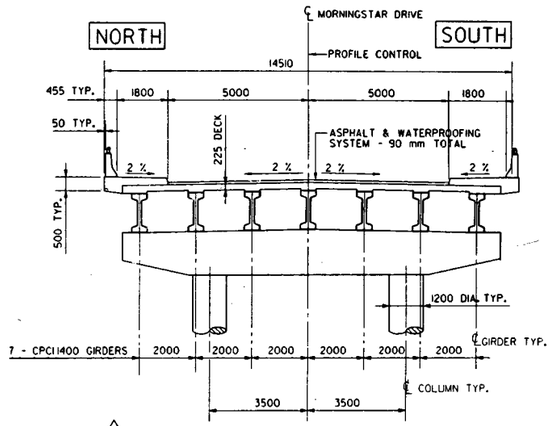
PLAN
1:100



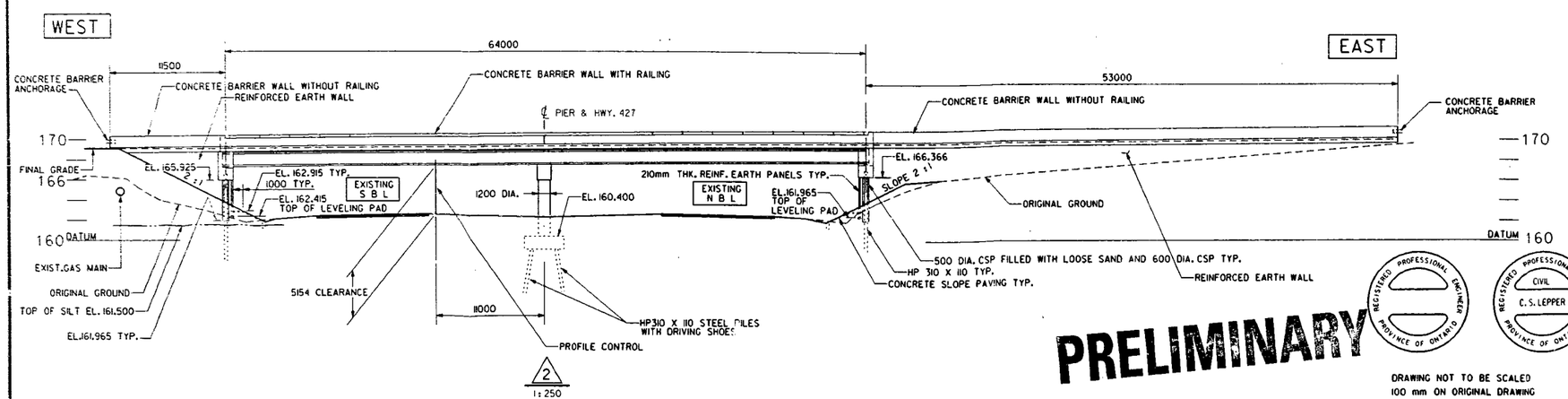
PROFILE HIGHWAY 427
N.T.S.



PROFILE MORNINGSTAR DR.
N.T.S.



1 TYPICAL DECK CROSS SECTION
1:100



2
1:250

PRELIMINARY

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DIST 6 HWY 427
CONT No 93-54
WP No 604-89-01

HIGHWAY 427
MORNINGSTAR DRIVE
UNDERPASS
GENERAL ARRANGEMENT

SHEET

COLE, SHERMAN
CONSULTING ENGINEERS · PLANNERS

GENERAL NOTES

CLASS OF CONCRETE

PRESTRESSED GIRDERS ..... 45 MPa
REMAINDER ..... 30 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTINGS..... 100 ± 25
ABUTMENTS ..... 70 ± 20
DECK TOP..... 70 ± 20
BOTTOM..... 40 ± 10
REMAINDER..... 70 ± 20
(UNLESS OTHERWISE NOTED)

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX -C- DENOTE COATED BARS.

CONSTRUCTION NOTES

THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.

NO BACKFILL SHALL BE PLACED UNTIL DECK CONCRETE HAS REACHED 75% OF ITS SPECIFIED STRENGTH

BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm

LIST OF DRAWINGS

APPLICABLE STANDARD DRAWINGS

OPSD 3501.00 GRANULAT BACKFILL REQUIREMENTS - ABUT.
OPSD 3906.03 BRIDGE DECK WATERPROOFING DETAILS
OPSD 3912.00 LIGHTING POLE BASE DETAILS
OPSD 918.01 CONCRETE BARRIER, TRANSITION TO STRUCTURE
SS 16-1 LOCATION OF SITE NUMBER & DATE FIGURES

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER CIVIL C. S. LEPPER PROVINCE OF ONTARIO

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	CSL	CHK		CODE	OHBDC-83	LOAD	CLASS "C"	DATE	DEC. 1996
DRAWN	JB	CHK		SITE	37-1083	STRUCT		SCHEME	DWG 1