

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M13-54

DIST. 6 REGION

W.P. No. 88-78-24

CONT. No. 89-62

W. O. No.

STR. SITE No. 37-80-1117

HWY. No. 407

LOCATION Ramp 407 E to 427 S

Overpass @ Steeles Ave

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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

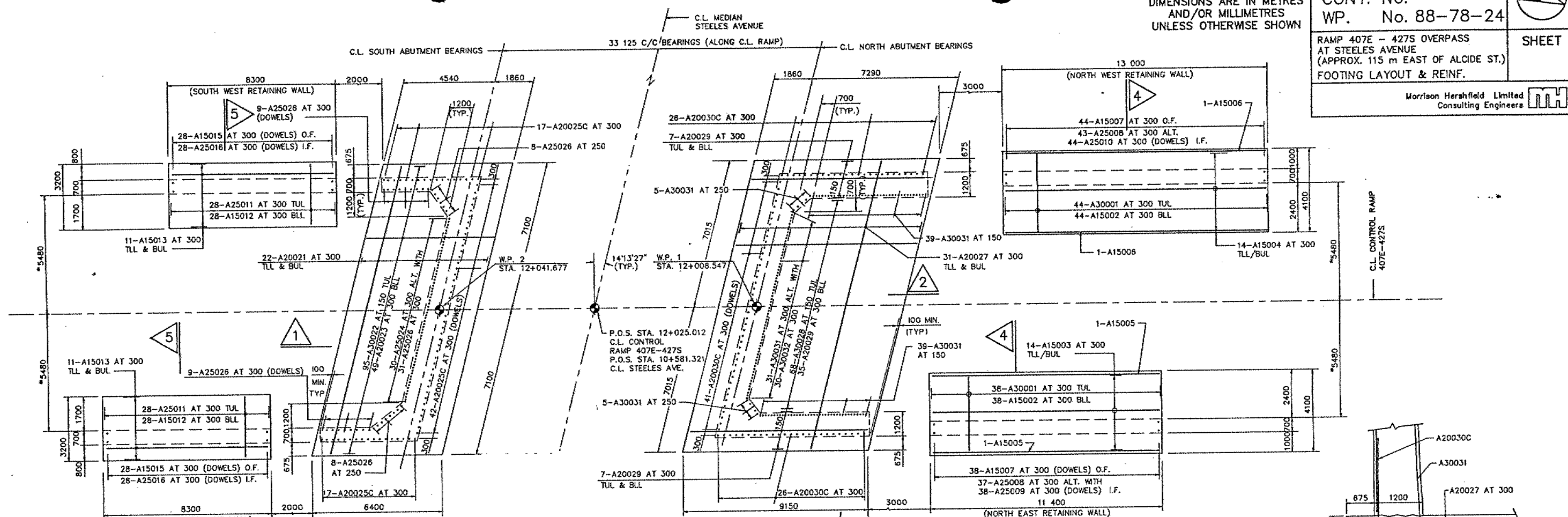
DIST. No. 6
CONT. No.
WP. No. 88-78-24



RAMP 407E - 427S OVERPASS
AT STEELES AVENUE
(APPROX. 115 m EAST OF ALCLIDE ST.)
FOOTING LAYOUT & REINF.

Morrison Hershfield Limited
Consulting Engineers

SHEET

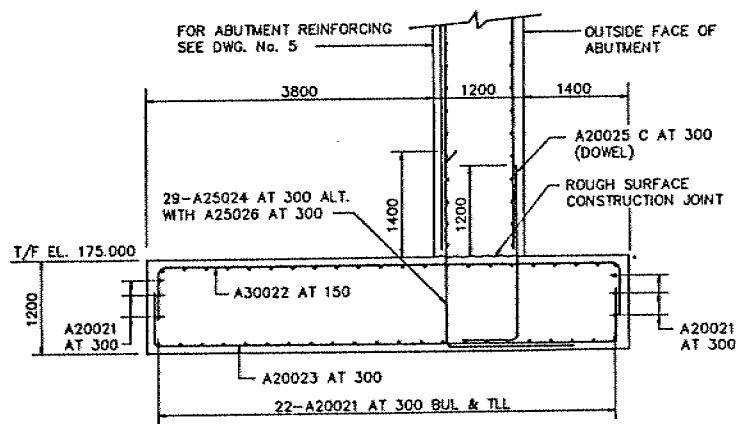


FOUNDATION PLAN
1 : 100

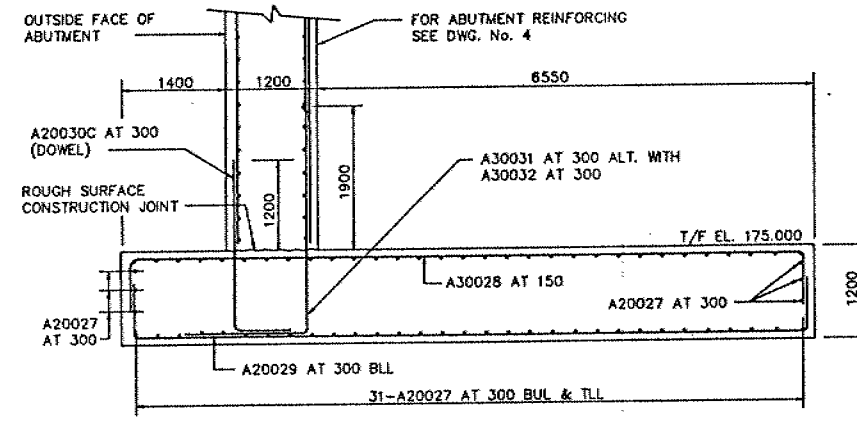
* DENOTES RADIAL DIMENSION

NOTES :

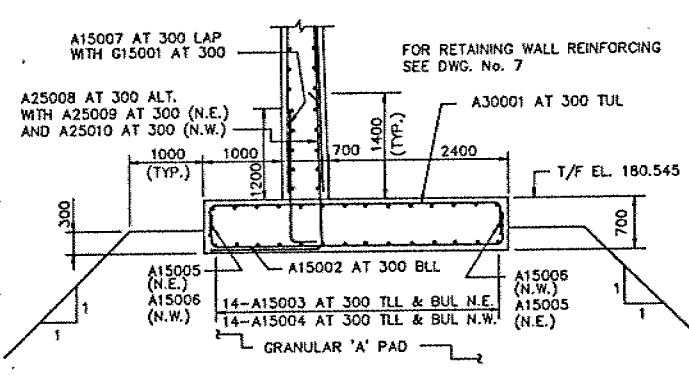
- NORTH/SOUTH DIMENSIONS ARE GIVEN PARALLEL TO THE C.L. CONTROL OF 407E-427S RAMP.
- C.L. NORTH AND SOUTH ABUTMENT BEARINGS ARE PARALLEL TO TANGENT AT P.O.C. STA. 10+581.321 C.L. STEELES AVE.



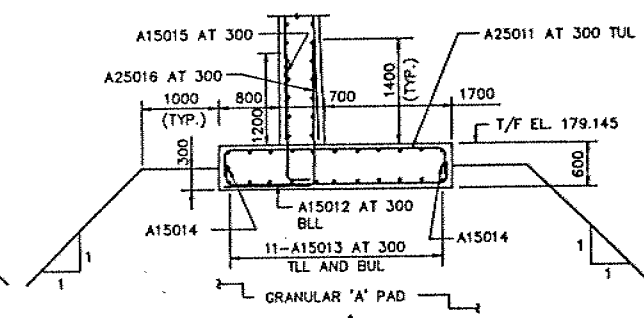
1
1 : 50



2
1 : 50



4
1 : 50



5
1 : 50

LOCATION OF WORKING POINTS

W.P.	STATION	CO-ORDINATES	
		NORTHING	EASTING
1	12+008.489	4845513.165	294103.573
2	12+041.613	4845482.978	294117.198

LEGEND :

- N.E. - NORTH EAST
- N.W. - NORTH WEST
- S.E. - SOUTH EAST
- S.W. - SOUTH WEST
- T/F - TOP OF FOOTING
- I.F. - INSIDE FACE
- O.F. - OUTSIDE FACE
- TUL - TOP UPPER LAYER
- TLL - TOP LOWER LAYER
- BUL - BOTTOM UPPER LAYER
- BLL - BOTTOM LOWER LAYER
- W.P. - WORKING POINT



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN D.D.	CHK. ATC	CODE OHBDC-83	LOAD CLASS A
DRAWN H.T.	CHK. ATC	SITE 37-1117	STRUCT. SCHEME
			DATE AUG/88
			DWG. 3

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 88-78-24

DIST 6

HWY 427/407

STR SITE 37-80-1117

Ramp Structure 407E - 427S Over Steeles
Avenue, Bridge #17

DISTRIBUTION

G.C.E. Burkhardt (3)

R.D. Gunter

F. Norman

J. Smrcka (2)

K. Bassi

B.J. Giroux

R. Hore

R. Fitzgibbon (Cover Only)

T.J. Kovich (Cover Only)

Files

GEOCRES

30M13-54

~~30M13-54~~

DATE 820922

FOUNDATION INVESTIGATION REPORT

For

Ramp Structure 407E - 427S

Over Steeles Avenue

Bridge #17

W.P. 88-78-24 Site: 37-80-1117

Hwy. 427/407, 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 82 06 28 and 82 07 01 consisting of 3 sampled boreholes, 2 accompanied by dynamic cone penetration tests, advanced by means of hollow and solid stem continuous flight augers. Borings were advanced for depths ranging from 13.9 metres to 15.3 metres.

Site Description and Geology

The site is located at the crossing of the proposed Hwy. 407E off-ramp to Hwy. 427S over widened Steeles Ave. in the Borough of Etobicoke, Municipality of Metropolitan Toronto.

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 Ave. is a 2 lane paved roadway with narrow gravel shoulders and side ditch drainage.

Physiographically, 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 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 which appears sandier than the surficial till. Bedrock has been found in the area at depths of 25 to 30 metres below ground surface, and 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 3.7 metres is a very stiff to hard cohesive deposit consisting of silty clay with sand and a trace of gravel.

Underlying the surficial deposit and explored for a maximum thickness of 9.9 metres is a dense to very dense silty sand interbedded with silt layers to gravelly sand with some cobbles. A hard cohesive glacial till was encountered below this granular deposit.

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 Drawing No. 887824-A.

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

Silty Clay With Sand

The surficial deposit encountered across the site for depths ranging from 2.3 metres to 3.7 metres is composed of silty clay with sand and a trace of gravel, probably of glacial origins. Towards this deposit's base, a higher proportion of sand as well as occasional cobbles and boulders were encountered. Typical grain size distribution curves for representative samples from this deposit are plotted on Figure 1 in the appendix.

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) %	15-22	18
Liquid Limit (w_L) %	25-38	31
Plastic Limit (w_p) %	15-16	16
Plasticity Index (I_p) %	9-22	15

These results indicate the fine grained matrix of this deposit to consist predominately of an inorganic silty clay of low plasticity (CL).

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

Silty Sand to Gravelly Sand

The surficial cohesive deposit is underlain by a granular stratum ranging from a silty sand with interbedded silt layers in the upper portion to a coarser gravelly sand with some cobbles and occasional boulders towards the lower portion. In addition, alternating layers of silt clay were encountered at the transition between the surficial cohesive deposit and this stratum. Grain size distribution curves illustrating the finer gradation of the upper portion of this deposit are shown in envelope form on Figure 3. Thicknesses encountered for this deposit range from 8.4 to 9.9 metres.

Interpretation of Standard Penetration Test 'N' values ranging from 16 to in excess of 100 blows/0.3 metres, indicates a denseness for this deposit ranging from compact to very dense but generally dense to very dense throughout.

Silty Clay, Sand and Gravel (Glacial Till)

Underlying the granular deposit and explored for a maximum thickness of 3.2 metres is a glacial till deposit composed of a silty clay matrix with high percentages of sand and gravel.

Based on interpretation of 'N' values in excess of 100 blows per foot and very difficult augering operations, the consistency for this deposit is assessed as hard.

Groundwater Condition

Although no stabilized borehole water level readings taken at the time of investigation were established, additional subsurface data obtained from previous investigations in the immediate area indicate the groundwater level should approximate elevation 171.0, ie. some 5.0 metres below ground surface. Seasonal fluctuations of the groundwater level are anticipated.

DISCUSSION AND RECOMMENDATIONS

As part of the planned Hwy. 427/407 interchange, it is proposed to construct a 30 x 12 metre single span ramp structure to carry 407E-427S alignment over the widened Steeles Ave. A proposed maximum ramp elevation of 186.0 and average ground surface elevation of 176.0 will necessitate approach fill heights in the order of 10.0 metres.

In consideration of the reasonably competent cohesive deposit overlying the dense silty sand to gravelly sand deposit across the site, recommendations pertaining to the foundations of the new structure and related earthworks are summarized as follows:

Structure Foundations

Major consideration should be given to founding abutments on spread footings located on a well compacted Granular 'A' core beneath the embankment approaches as per current M.T.C. Standards. All surficial softened and/or organic material within the planned limits of the granular core must be subexcavated prior to placement of the granular core. For spread footings founded on a Granular 'A' core and constructed to current M.T.C. Standards, an allowable capacity at the S.L.S. Type II of 280 kPa and a factored capacity at the U.L.S. of 850 kPa may be used for design purposes.

Resistance to sliding of the abutment footings can be calculated assuming a coefficient of friction of 0.7 between the underside of the concrete footing and the Granular 'A' core.

Alternatively, abutment elements can be founded on shallow spread footings located within the competent silty clay deposit. For footings located at or below elevation 174.0, the following O.H.B.D.C. parameters are applicable.

Factored capacity at U.L.S.	800 kPa
Allowable capacity at S.L.S. Type II	350 kPa

An adhesional value of 95 kPa can be used in calculating resistance to sliding between the base of the footing and the founding soil.

Other Considerations

All softened and/or organic material within the planned limits of the immediate approaches should be excavated for their full depth and backfilled prior to fill placement.

The underside of all abutment footings should be provided with a minimum 1.25 metres of earth cover for frost protection purposes.

Earth pressures against the back of the abutment wall should be computed as per Subsection 6.6.1.2.2 of the O.H.B.D.C. Manual, with provisions made for adequate drainage.

Vibratory compaction equipment for use behind abutment walls must be restricted in size as per current MTC specifications.

No major dewatering difficulties are anticipated for footing excavations in consideration of the relatively low permeability of the cohesive surficial deposit. Localized seepage into excavations can be controlled by perimeter ditches and pumping from corner sumps.

No stability problems are anticipated for permanent embankment slopes constructed to a 2:1 geometry.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. Dave Wismath, Student Technician, utilizing equipment owned and operated by Master Soil Drilling, Toronto. This report was written by Mr. T. J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.



T. J. Kazmierowski

T. J. Kazmierowski, P. Eng.,
Foundations Engineer

M. Devata

M. Devata, P. Eng.,
Senior Foundations Engineer

APPENDIX



Ministry of
Transportation and
Communications
Ontario

RECORD OF BOREHOLE No 1

METRIC

W P 88-78-24 LOCATION Co-ords. N.4845 511.7; E.294097.8 ORIGINATED BY D.W.
DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY D.W.
DATUM Geodetic DATE 82 06 28 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	SHEAR STRENGTH						WATER CONTENT (%)	
176.3	Ground Surface							○ UNCONFINED + FIELD VANE						GR SA SI CL		
0.0	Brown Silty Clay with Sand Trace of Gravel Very Stiff to Hard		1	SS	28	*	176							1 25 38 36		
			2	SS	17		174								2 22 61 15	
			3	SS	68											4 65 26 5
			4	SS	97	25cm										0 26 72 2
172.6	Silty Sand with Interbedded Silt Layers to		5	SS	80	15cm	172							0 54 44 2		
3.7			6	SS	58	15cm										
			7	SS	96		170									
			8	SS	35		168									
			9	SS	67		166									
			10	SS	—		164									
			11	SS	90	13cm	164								36 62 (2)	
163.5			Gravelly Sand with cobbles and occ. Boulders Dense to Very Dense		12	SS	105	15cm	162							
12.8	Grey (Glacial Till) Silty Clay with excess of sand and Gravel Hard		13	AS												
161.1	End of Borehole															
15.2	* Note: Borehole caved at a depth of 6.7m															

+3, x5: Numbers refer to
Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 2

METRIC

W P 88-78-24 LOCATION Co-ords. N.4845 498.6; E.294116.5 ORIGINATED BY D.W.
DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger COMPILED BY D.W.
DATUM Geodetic DATE 82 06 29 CHECKED BY *GP*

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					
175.7	Ground Surface																
0.0	Brown Silty Clay with Sand Trace of Gravel Very stiff		1	SS	23	*	174										7 27 48 18
173.4			2	SS	24												
2.3			3	SS	76												
	Interbedded Layers of Silty Clay		4	SS	95	23cm	172										6 46 45 3
			5	SS	87												
			6	SS	87	28cm											
	Silty Sand with Silt Layers		7	SS	88		170										
			8	SS	62		168										
	to Gravelly sand with cobbles and occ. boulders		9	SS	55		166										
165.0	Very Dense		10	SS	105	15cm	164										
10.7	Grey (Glacial Till) Silty Clay with excess of sand and gravel		11	SS	105	13cm											
161.8	Hard		12	SS	100	10cm	162										
13.9	End of Borehole																
	* Note: Water table not established																

+3, x5 : Numbers refer to
Sensitivity

20
15 10 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 3

METRIC

W P 88-78-24 LOCATION Co-ords N.4845 481.0; E.294 111.6 ORIGINATED BY D.W.
 DIST 6 HWY 427 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY D.W.
 DATUM Geodetic DATE 82 07 01 CHECKED BY GP

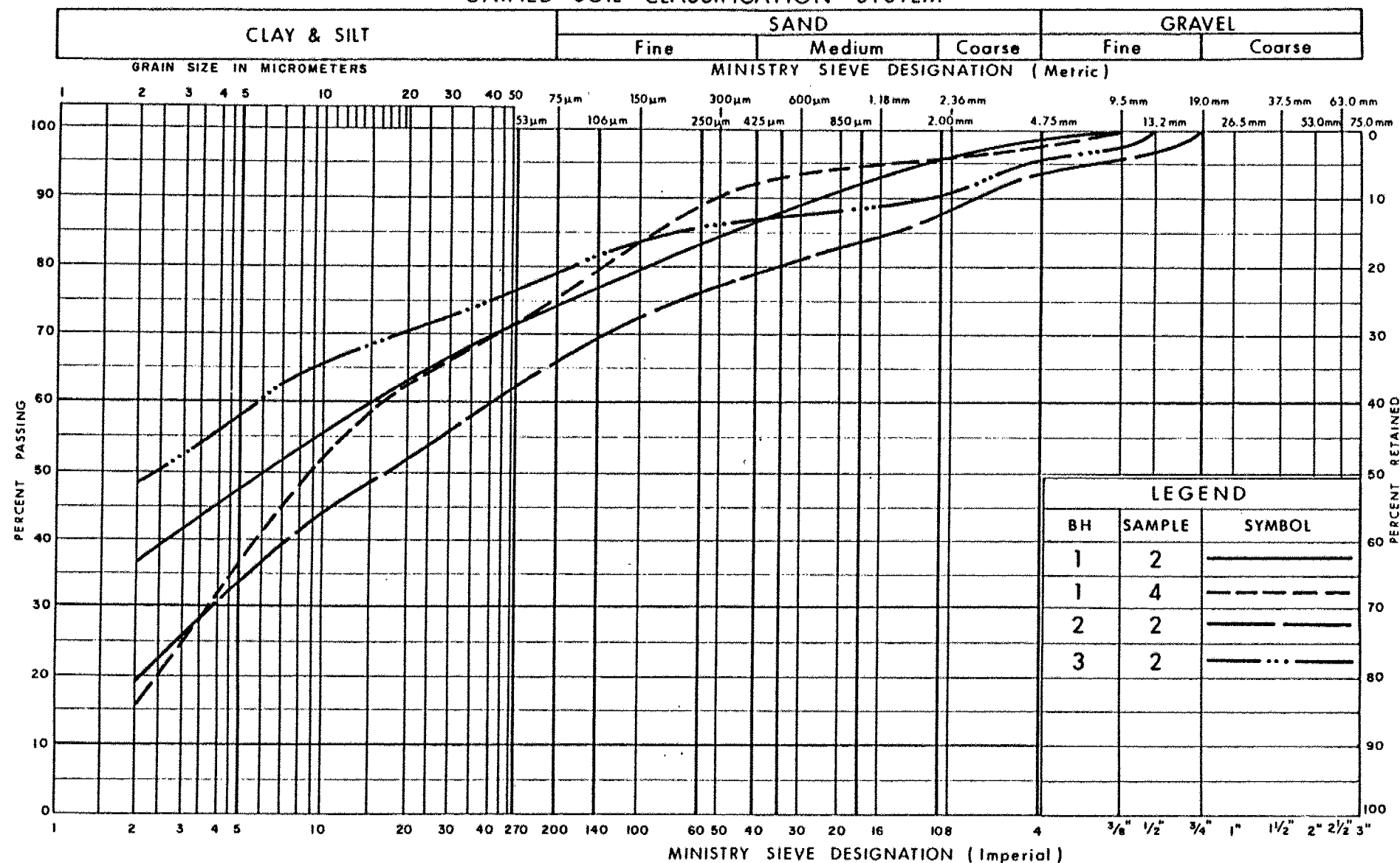
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100					
175.9	Ground Surface													GR SA SI CL
0.0	Brown Silty Clay with Sand Trace of Gravel Very Stiff to Hard		1	SS	28	*								4 18 30 48
			2	SS	27		174							
173.0			3	SS	107									
2.9	Silty Clay Layers		4	SS	60	13cm								22 38 33 7
			5	SS	85	20cm	172							
	Silty Sand with Silt Layers		6	SS	111	20cm								6 50 42 2
	Brown Grey		7	SS	84	23cm	170							
	to		8	SS	44		168							1 7 89 3
	Gravelly Sand with Cobbles occ. Boulders Compact to Very Dense		9	SS	16		166							0 85 (15)
			10	SS	41									
163.1			11	SS	120	15cm	164							
12.8	Grey (Glacial Till) Silty Clay with Excess of Sand and gravel		12	SS	50	3cm	162							
160.6	Hard		13	SS	75	5cm								
15.3	End of Borehole * Water Table not established													

+3, x5: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM

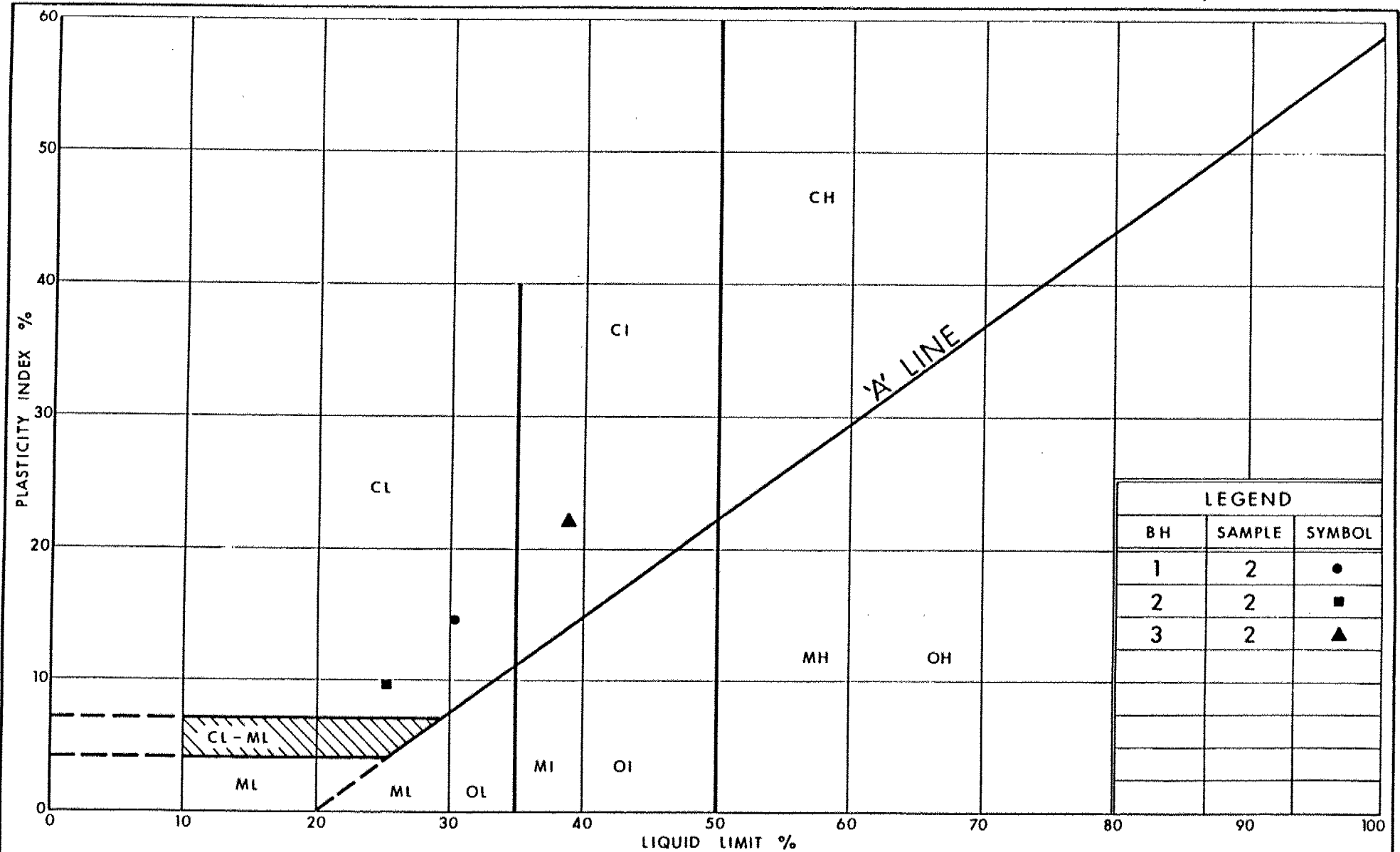


Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY CLAY, WITH SAND TRACE OF GRAVEL

FIG No 1

W P 88-78-24



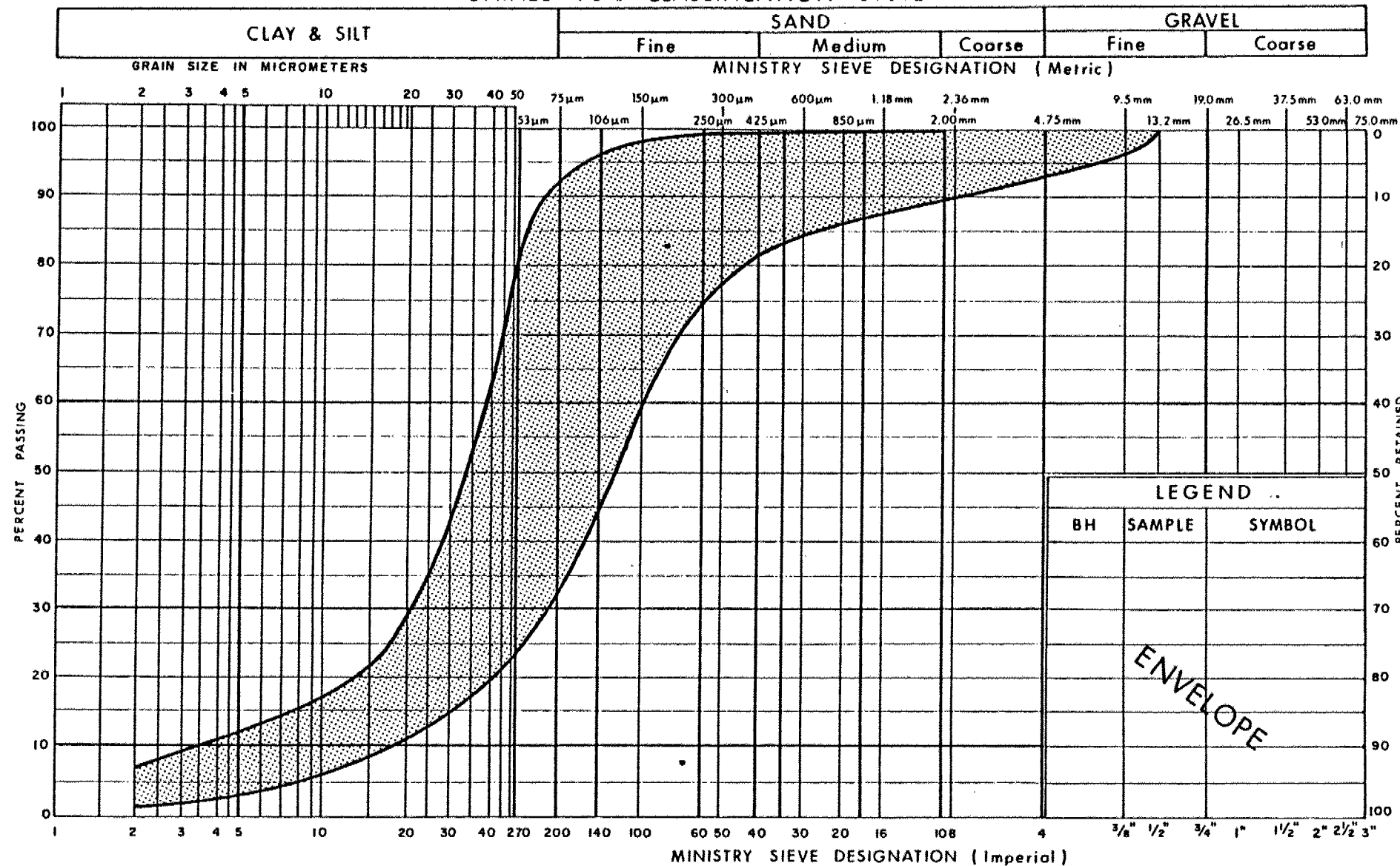
Ministry of
Transportation and
Communications

PLASTICITY CHART SILTY CLAY, WITH SAND TRACE OF GRAVEL

FIG No 2

W P 88-78-24

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

 Ministry of
Transportation and
Communications

 GRAIN SIZE DISTRIBUTION
SILTY SAND, WITH SILT LAYERS

FIG No 3

W P 88-78-24

EXPLANATION OF TERMS USED IN REPORT

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

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

MECHANICAL PROPERTIES OF SOIL

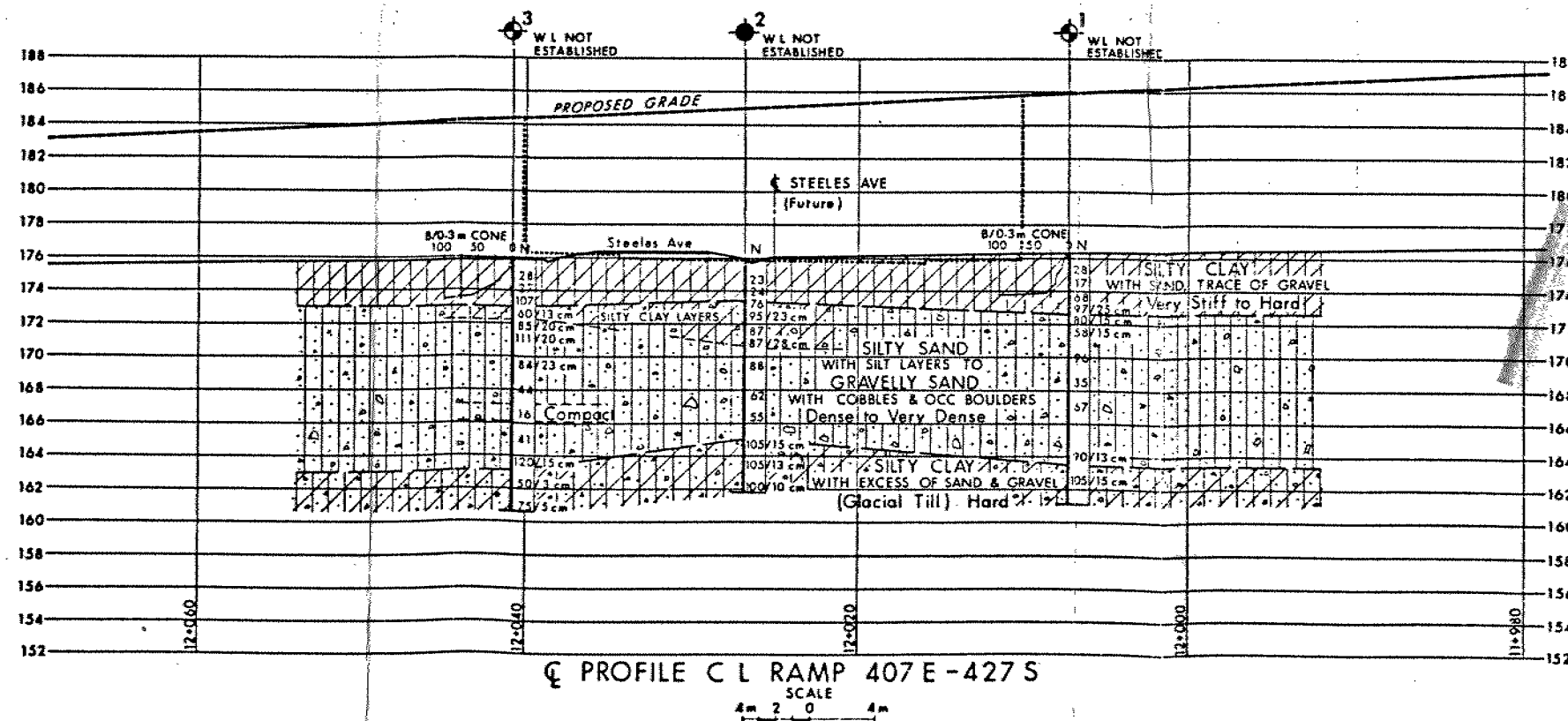
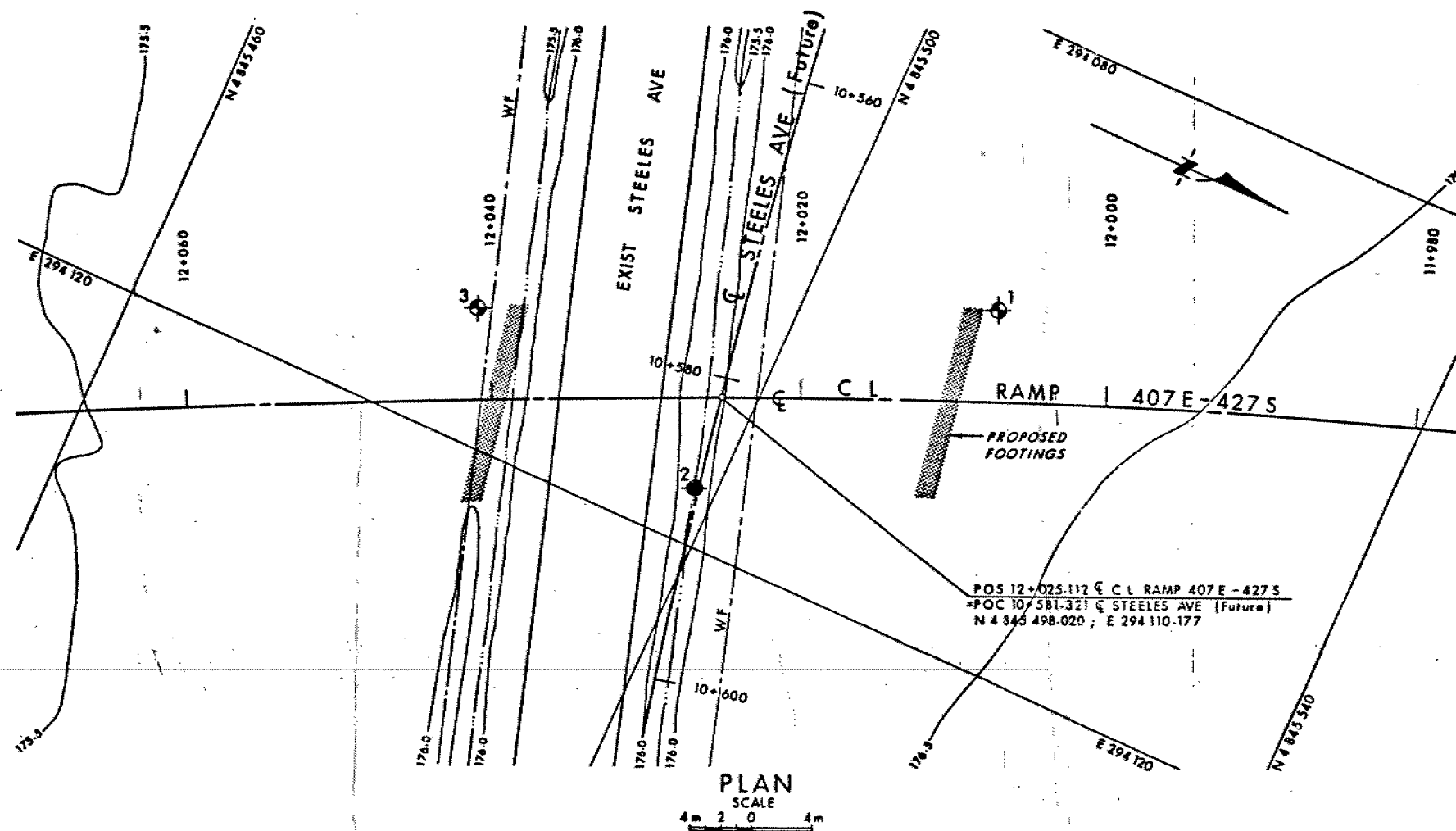
m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
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_f	kPa	REMOULDED SHEAR STRENGTH
S_f	1	SENSITIVITY = $\frac{c_u}{\tau_f}$

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

PHYSICAL PROPERTIES OF SOIL

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



METRIC

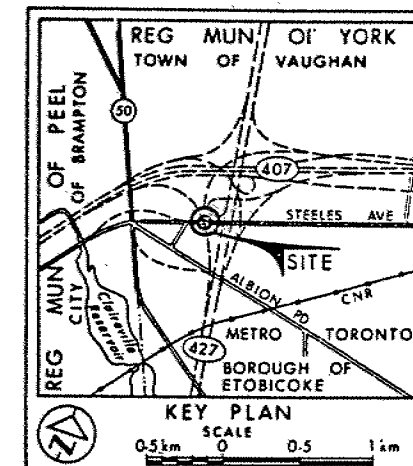
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES.

CONT No
WP No 88-78-24

RAMP 407 E-427 S
OVER STEELES AVE (BRIDGE 17)
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- ✦ WL at time of investigation
- WL Not Established

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	176.3	4 845 511.7	294 097.8
2	175.7	4 845 498.6	294 116.5
3	175.9	4 845 481.0	294 111.6

NOTE

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

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



DATE	BY	DESCRIPTION
Geocres No 30M13-54		
MWY No 427	DIST 6	
SUBMITTAL CHECKED	DATE 1982 09 10	SITE 37-80-1117
DRAWN	CHECKED	APPROVED
		DWG 837824-A