DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M 16-28

DIST. 7 REGION

W.P. No. 167-80-04

CONT. No.

W. O. No.

STR. SITE No.

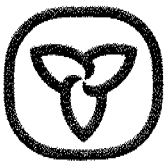
HWY. No. 2

LOCATION RETAINING WALL IN NEWTONVILLE

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FILE COPY



Ontario

Ministry of
Transportation and
Communications

foundation investigation and design report

F

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 167-80-04 DIST 7

HWY 2 STR SITE

Proposed Retaining Wall; Newtonville

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GEOCRES 30M16-28

DATE JUN 29 1984

FOUNDATION INVESTIGATION REPORT
For
Proposed Retaining Wall; Newtonville
W.P. 167-80-04
Hwy. #2, District 7, Port Hope

INTRODUCTION:

This report summarizes the factual information obtained from a foundation investigation carried out at the above-mentioned site between 84-05-14 and 84-05-18. The fieldwork consisted of 10 sample boreholes advanced by means of hollow stem augers and wash boring. The boreholes ranged in depth from 3.4 to 9.4 m below the ground surface. None of the boreholes were advanced to bedrock. Dynamic cone penetration tests were performed at three boreholes.

SITE DESCRIPTION AND GEOLOGY

The site is located on the north shoulder of the existing Hwy. 2; 350 m to the west of Newtonville Rd. South in the Town of Newcastle, Regional Municipality of Durham.

Land use in the vicinity of the site is predominantly agricultural. Topography around the site is generally level to the south towards Lake Ontario, with a steep sloped hill (approx. 30 m) to the immediate north of Hwy. 2.

The site is located in the physiographic region known as the "South Slope". The characteristic deposit in the area under investigation is composed of highly calcareous glacial till. The overburden is underlain by limestone bedrock with minor amounts of dolostone and shale, of the Trenton and Black River groups, Ordovician Period.

SURFACE CONDITIONS

General

The predominant soil deposit at this site is a glacial till composed of a heterogeneous mixture of silty clay, with sand, trace to some gravel. This cohesive deposit was not explored to it's full depth but extends for at least 9.4 m.

The subsoil types, insitu and laboratory test results, and groundwater levels are shown on the Record of Borehole Sheets in the Appendix. The location and ground elevation of each borehole and an estimated stratigraphical section based on the borehole data, are shown on Drawing No. 1678004-A.

The description of the glacial till is given below:

Glacial Till

This is the principal deposit in the area and is found in thickness over 9.4 m. The till has little or no topsoil cover in the area of investigation.

The results of Atterberg Limits tests carried out on samples from this cohesive deposit are plotted on Fig. 1 and indicate that the matrix of this glacial till is a silty clay of low plasticity (ML to CL-ML zone).

The result of grain size distribution tests conducted on 19 samples from this stratum indicate there are reasonably uniform gravel and clay contents with a considerable variance in the silt and sand contents. The results of these tests are plotted in envelope form on Fig. 2, and are summarized as follows:

	Range	Mean
Gravel	6-42%	14%
Sand	25-45%	36%
Silt	21-41%	30%
Clay	12-21%	17%

As a result of the grain size distribution of this cohesive stratum, the glacial till is described as a heterogeneous mixture of silty clay, with sand, trace to some gravel.

Groundwater Conditions

The groundwater level was established at the time of the investigation by measuring in the open boreholes. The measurements indicate that the groundwater level varies between elevation 157.6 to 160.0 m. However, due to the cemented nature of the till and the use of water in drilling, the water levels may not reflect a true stabilized condition.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to construct a retaining wall along the north side of Hwy. 2 from Sta. 20+707 to Sta. 20+994 excluding 11 m at the entrance at Sta. 20+835. The proposed structure will have a maximum height of approx. 1.0 m above the existing ground level.

Recommendations for the design and construction of the retaining walls foundations are as follows:

Wall Foundations

Option 1 - Gravity-type (Gabion) Retaining Wall

The full length of the wall can be supported within the original material at the elevations and design loads given below (O.H.B.D.C.).

Elev. (m)	ULS (kPa)	SLS II (kPa)
159	700	300
158 (or lower)	1000	unyielding

In order to prevent washout of the fines from the backfill and the original soil, a filter medium should be installed between the back-face of the wall and the backfill.

Option 2 - Concrete Retaining Wall

The full length of the wall can be supported on spread footings at the elevations and design loads given above.

Other Considerations

1. No major dewatering problems are anticipated in view of the cohesive nature of the glacial till. Localized seepage into the excavation can be controlled by pumping from sumps.

2. Active conditions apply (ka) in all design.

3. All underside of concrete retaining wall footings should be protected by a minimum of 1.2 m earth cover.

4. Backfill to structures should conform to O.H.B.D.C. Section 6-9.6.1.

5. The adhesion between the founding soil and base can be taken as 100 kPa.

Construction Considerations

Note: Due to the cemented nature of the native material (below elev. 159 m) ordinary excavation methods may not be adequate.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. J. Alter, Student Engineer, utilizing equipment owned and operated by Dominion Soil Investigation, Toronto. This report was written by Mr. J. Alter and reviewed by Mr. B. Ruck, Project Foundations Engineer and Mr. M. Devata, Chief Foundations Engineer (East).

J. Alter
Student Engineer

B. Ruck
Project Foundations Engineer

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CIVIL
M. DEVATA
PROVINCE OF ONTARIO

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

APPENDIX

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

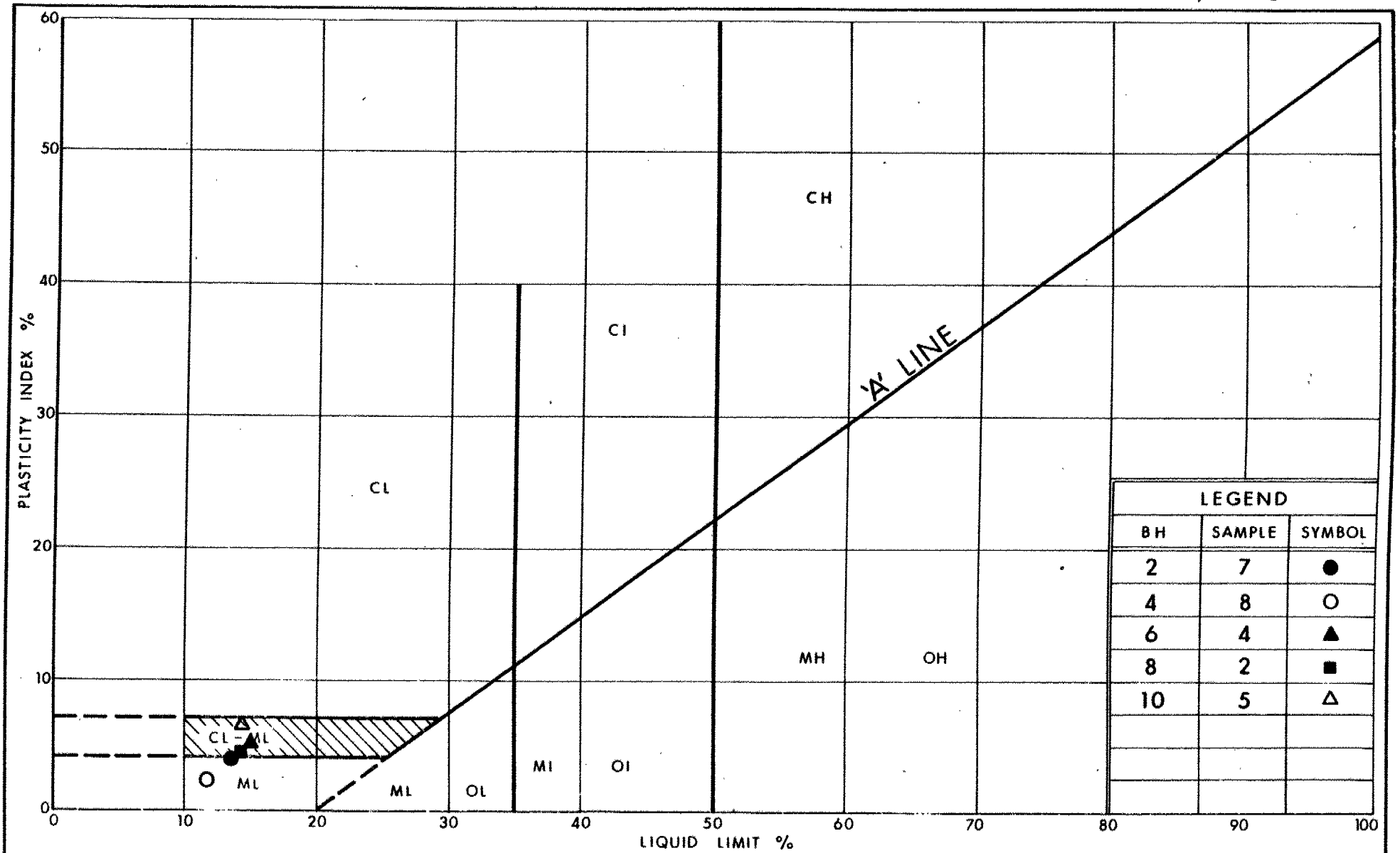
m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
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	1,%	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



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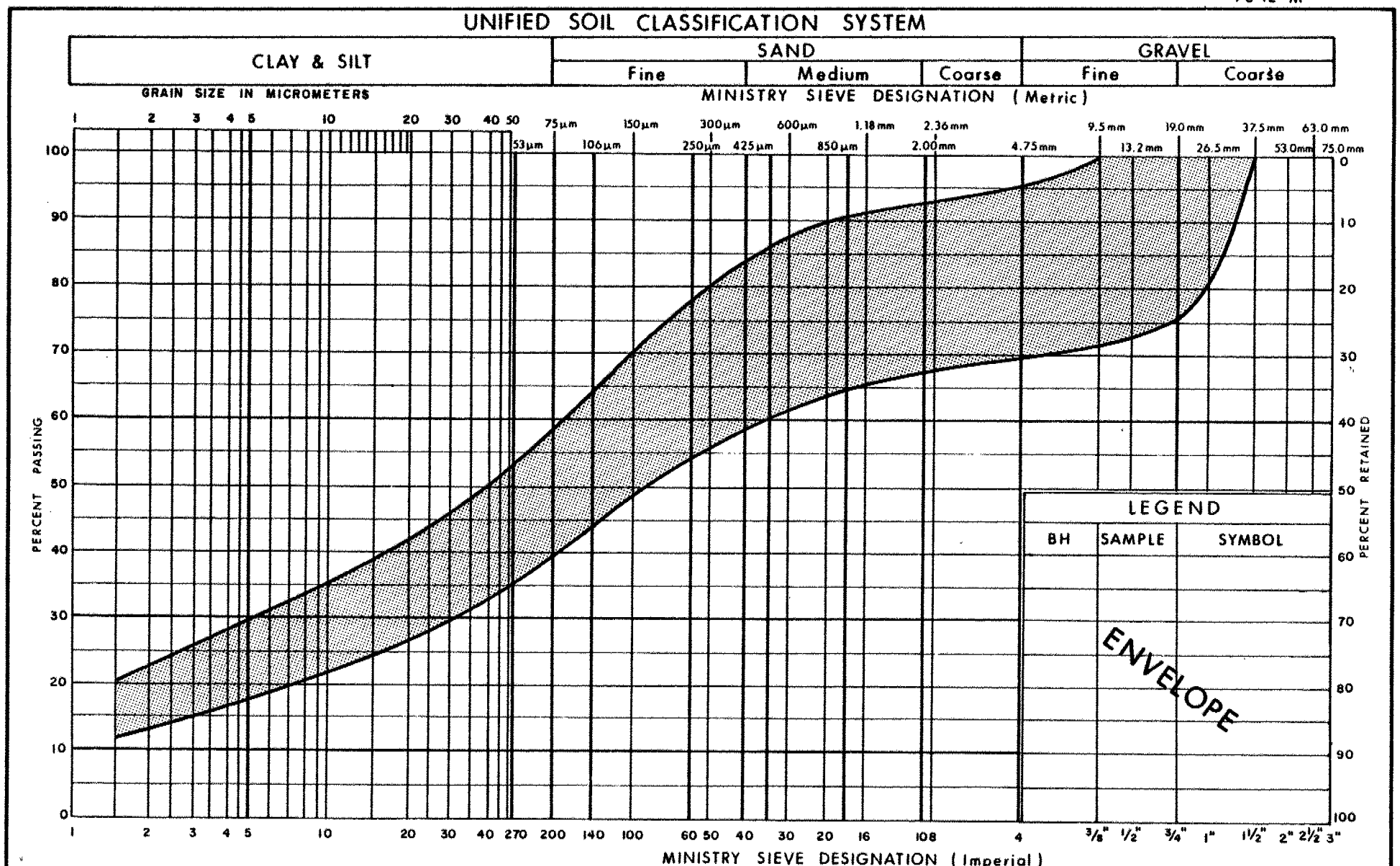
PLASTICITY CHART
HET MIXTURE OF SILTY CLAY, WITH SAND, TRACE TO SOME GRAVEL (Glacial Till)

FIG No 1
W P 167-80-04



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GRAIN SIZE DISTRIBUTION
HET MIXTURE OF SILTY CLAY, WITH SAND, TRACE TO SOME GRAVEL (Glacial Till)

FIG No 2
W P 167-80-04

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RECORD OF BOREHOLE No 1 METRIC

W P 167-80-04 LOCATION Sta. 20 + 711.0; 0/s 5.6 m LT ℄ Hwy. 2 ORIGINATED BY JA
DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JA
DATUM Geodetic DATE 1984 05 14 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 (%) 5 10 15	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
159.1	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, with sand, trace gravel Occasional Boulders (Glacial Till) Brown Hard		1	SS	17/1 cm	▼	159				
			2	SS	80		158				6 39 37 18
			3	SS	100/23 cm		157				
155.7			4	SS	100/23 cm		156		○		
3.4	Augered to Refusal End of Borehole										

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

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
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RECORD OF BOREHOLE No 2

METRIC

W P 167-80-04 LOCATION Sta. 20 + 741.5; O/S 4.7 m LT ℄ Hwy. 2 ORIGINATED BY JA

DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger and Washboring COMPILED BY JA

DATUM Geodetic DATE 1984 05 14 and 15 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, x LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) (5 10 15)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.1	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, with sand Trace to some gravel Occasional Boulders Very Stiff to Hard		1	SS	26		160				
			2	SS	60	▽	159				
			3	SS	100/10 cm		158				
	Brown Grey		4	SS	100/10 cm		157		o		8 36 36 20
			5	SS	100/15 cm		156				
			6	SS	100/17 cm		155				12 35 33 20
			7	SS	100/20 cm		154		o —		
150.7			8	SS	100/25 cm		153				
9.4	End of Borehole						152				
							151				

$+^{3}$, x^{5} : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 3

METRIC

W P 167-80-04 LOCATION Sta. 20 + 770.0; 0/S 4.3 m LT ℄ Hwy. 2 ORIGINATED BY JA

DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger, Washboring and Cone Test COMPILED BY JA

DATUM Geodetic DATE 84 05 15 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 W_p / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 5 10 15	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
160.2	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, with sand, trace gravel Occasional Boulders (Glacial Till) Very Stiff to Hard		1	SS	26		160				
			2	SS	38	▼	159	100/23 cm	○		
			3	SS	100/28 cm		158		○		
			4	SS	100/8 cm		157				
	Brown Grey		5	SS	100/10 cm		156				9 39 32 20
			6	SS	100/3 cm		155				
							154				
152.3			7	SS	100/15 cm		153				8 38 33 21
7.9	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 4

METRIC

W P 167- 80-04 LOCATION Sta.20 + 800.0; O/S 4.5 m LT ℄ Hwy. 2 ORIGINATED BY JA
DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger, and Washboring COMPILED BY JA
DATUM Geodetic DATE 84 05 16 CHECKED BY GP

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (5 10 15)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.4	Ground Surface										
0.0	Heterogeneous Mixture of Silty Clay, with sand, some to with gravel Occasional Boulders (Glacial Till) Very Stiff to Hard		1	SS	27	▼	160				
			2	SS	100/18 cm		159				
			3	SS	100/20 cm		158				
	Brown / Grey		4	SS	100/20 cm		157				30 32 24 14
			5	SS	100/10 cm		156		○		
			6	SS	100/5 cm		155				12 35 37 16
			7	SS	100/17 cm		154				
151.0			8	SS	100/15 cm		153		○ ⊢		
9.4	End of Borehole						152				

+3, ×5 : Numbers refer to Sensitivity

20
15 ⊹ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 5

METRIC

W P 167-80-04 LOCATION Sta. 20 + 830.5; O/S 4.9 m LT ℄ Hwy. 2 ORIGINATED BY JA

DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger and Washboring COMPILED BY JA

DATUM Geodetic DATE 84 05 16 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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (5 10 15)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.7	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, with sand, trace to some gravel Occasional Boulders (Glacial Till) Hard		1	SS	51	▽	160				
			2	AS					○		
			3	SS	100/23 cm		159				
			4	SS	100/18 cm		158				
	Brown / Grey		5	SS	100/23 cm		157				11 40 29 20
							156		○		
			6	SS	100/10 cm		155				
			7	SS	100/ 8 cm		154				
			8	SS	100/15 cm		153				7 37 41 15
151.3			9	SS	100/15 cm		152				
9.4	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 6 METRIC

W P 167-80-04 LOCATION Sta. 20 + 865.0; O/S 3.8 m LT ℄ Hwy. 2 ORIGINATED BY JA
DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger, Washboring and Cone Test COMPILED BY JA
DATUM Geodetic DATE 1984 05 17 CHECKED BY

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)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 5 10 15	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.5	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, with sand, trace to with gravel Occasional Boulders (Glacial Till) Very Stiff to Hard		1	SS	23		160				
			2	SS	80		159	100/ 25 cm			
			3	SS	100/ 28 cm		158				28 34 25 13
			4	SS	100/ 20 cm		157		o		
	Brown Grey		5	SS	100/ 8 cm		156				
			6	SS	100/ 13 cm		155		o		5 38 36 21
			7	SS	100/ 13 cm		154				
							153				
151.1			8	SS	100/ 15 cm		152				
9.4	End of Borehole										

SHEAR STRENGTH: o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 7

METRIC

W P 167-80-04 LOCATION Sta. 20 + 900.5; O/S 3.8 m LT ℄ Hwy. 2 ORIGINATED BY JA

DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger and Washboring COMPILED BY JA

DATUM Geodetic DATE 84 05 17 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 ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L / WATER CONTENT (%) 5 10 15	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.6	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, and sand trace gravel Occasional Boulders (Glacial Till) stiff		1	SS	15	▼	160				
			2	SS	100		159				
	Very Stiff to Hard		3	SS	100/ 23 cm		158				6 45 38 11
			4	SS	100/ 13 cm		157				
	Brown Grey		5	SS	100/ 13 cm		156				
			6	SS	100/ 13 cm		155				
							154				
			7	SS	100/ 15 cm		153				8 34 38 20
							152				
151.2			8	SS	100/ 15 cm						
9.4	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

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Ontario

RECORD OF BOREHOLE No 8 METRIC

W P 167-80-04 LOCATION Sta. 20 + 920.0; 0/S 4.0 m LT ℄ Hwy. 2 ORIGINATED BY JA
DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger and Washboring COMPILED BY JA
DATUM Geodetic DATE 84 05 17 & 18 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 WL / WATER CONTENT (%) (5 10 15)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
160.5 / 0.0	Ground Surface										
	Heterogeneous Mixture		1	SS	73	▼	160				16 37 32 15
	Silty Clay, with sand, some gravel		2	SS	100/23 cm		159				
	Occasional Boulders (Glacial Till)		3	SS	100/15 cm		158				
	Hard		4	SS	100/17 cm		157				
	Brown Grey		5	SS	100/13 cm		156				16 35 34 15
			6	SS	100/10 cm		155				
152.6 / 7.9	End of Borehole		7	SS	100/18 cm		154				
							153				

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 9

METRIC

W P 167-80-04 LOCATION Sta. 20 + 955.0; O/S 3.5 m LT ℄ Hwy. 2 ORIGINATED BY BR

DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger, Washboring and Cone Test COMPILED BY JA

DATUM Geodetic DATE 84 05 18 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	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 WL / WATER CONTENT (%) (5 10 15)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.5	Ground Surface										
0.0	Heterogenous Mixture Silty Clay with sand some gravel stiff Occasional Boulders (Glacial Till) Very Stiff to Hard Brown Grey		1	SS	9		160				
			2	SS	34		159	100/28 cm			
			3	SS	100/ 20 cm		158				
			4	SS	100/ 10 cm		157				41 25 21 13
			5	SS	100/ 11 cm		156				
			6	SS	100/ 14 cm		155				16 36 30 18
							154				
152.6			7	SS	100/ 13 cm		153		○		
7.9	End of Borehole										
	* Note: Water Level Not Established										

+3, ×5 : Numbers refer to Sensitivity

1S 20 / 10 ⊹ 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No 10

METRIC

W P 167-80-04 LOCATION Sta. 20 + 986.0; O/S 4.4 m LT ℄ Hwy. 2 ORIGINATED BY BR

DIST 7 HWY 2 BOREHOLE TYPE Hollow Stem Auger and Washboring COMPILED BY JA

DATUM Geodetic DATE 84 05 18 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	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 W_p / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (5 10 15)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
160.2	Ground Surface										
0.0	Heterogeneous Mixture Silty Clay, with sand, trace to some gravel Occasional Boulders (Glacial Till) Very Stiff to Hard Brown / Grey		1	SS	27		160				
			2	SS	100/28 cm		159		○		
			3	SS	100/13 cm		158				24 32 27 17
			4	SS	100/ 8 cm		157				
			5	SS	100/17 cm		156		○ ⊢		
							155				
			6	SS	100/18 cm		154				9 38 32 21
							153				
152.2			7	SS	100/14 cm						
8.0	End of Borehole * Note: Water Level Not Established										

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

20
15 ⊹ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

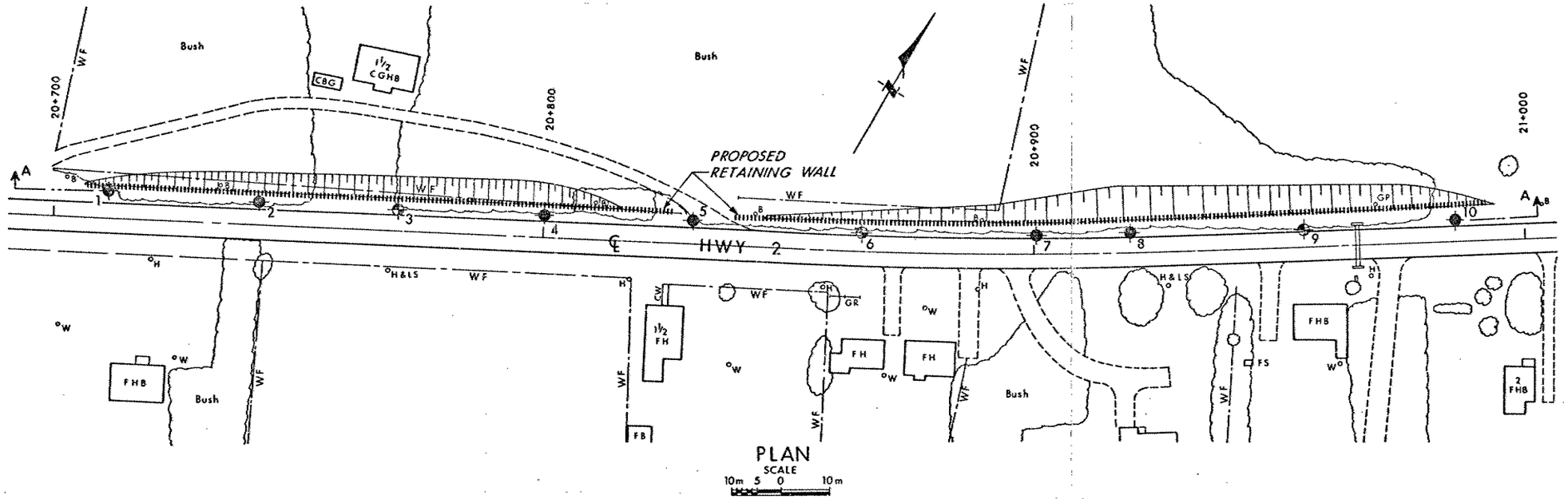
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO FH-O-207 82 04

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

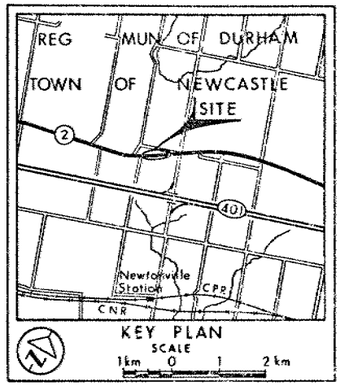
CONT No
WP No 167-80-04

PROPOSED RETAINING WALL
(NEWTONVILLE)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



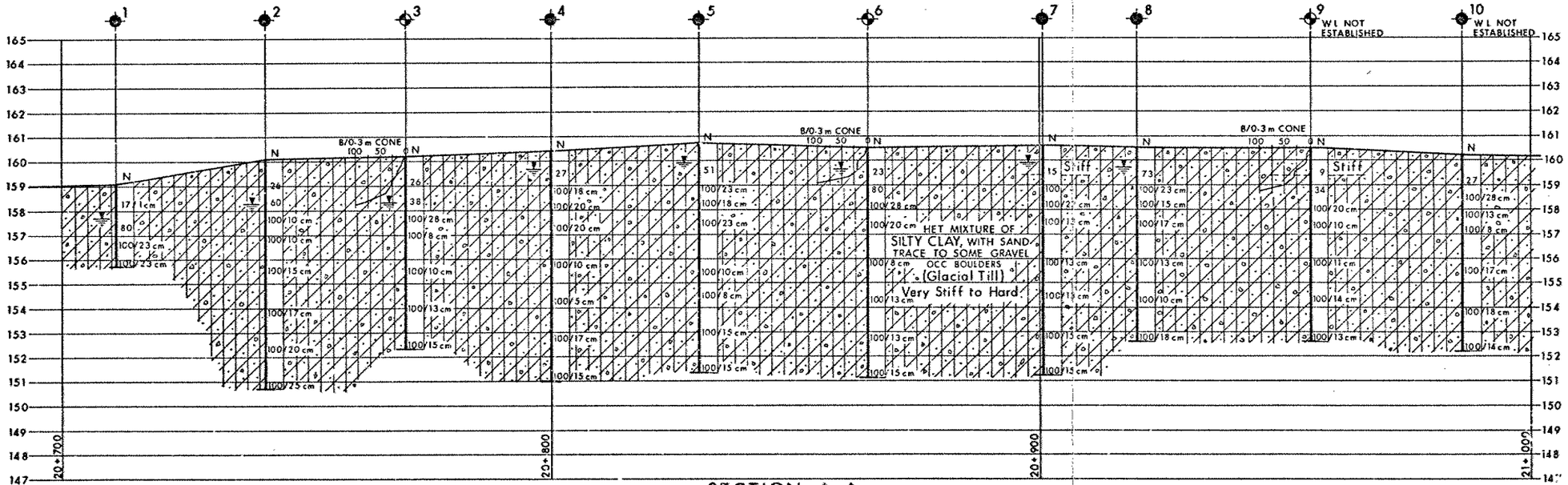
PLAN
SCALE
10m 5 0 10m



KEY PLAN
SCALE
1km 0 1 2 km

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 1984 05
- W L Not Established in BH 9 and 10



SECTION A-A
SCALE
HOR 10m 5 0 10m
VERT 2m 1 0 2m

No	ELEVATION	STATION	OFFSET
1	159·1	20+711·0	5·6m Lt
2	160·1	20+741·5	4·7m Lt
3	160·2	20+770·0	4·3m Lt
4	160·4	20+800·0	4·5m Lt
5	160·7	20+830·5	4·9m Lt
6	160·5	20+865·0	3·8 m Lt
7	160·6	20+900·5	3·8m Lt
8	160·5	20+920·0	4·0m Lt
9	160·5	20+955·0	3·5m Lt
10	160·2	20+986·0	4·4m Lt

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

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

REV	DATE	BY	DESCRIPTION

Geocres No 30M16-28

HWY No 2			DIST 7
SUBM'D B R	CHECKED	DATE 1984 06 28	SITE
DRAWN	CHECKED	APPROVED	DWG 167 8004-A

memorandum

F.

Ontario

To: Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region
5000 Yonge Street

Date: 1984 06 12

ATTENTION: F. Chan

From: Foundation Design Section
Room 315, Central Building

Re: Foundation Investigation
Preliminary Recommendations
W.P. 167-80-04
Hwy. 2 Urban Section in Newtonville
Proposed Retaining Wall
District 7, Port Hope

In response to your Foundation Investigation request for the proposed retaining wall on Highway 2 in Newtonville, the following are our preliminary recommendations. The final report for this project will be issued in late June.

Subsurface Conditions

A foundation investigation consisting of 10 boreholes advanced by means of hollow stem auger and wash boring at the above-mentioned site, indicates that the overburden consists of at least 9.4 m of cohesive glacial till varying in consistency from stiff to hard. The boreholes were not advanced to bedrock.

At the time of the field investigation, the groundwater level varied between elevations 157.6 and 160.0 m. However, this may not represent the stabilized condition due to the cemented nature of the till and the use of water in drilling.

Discussion and Recommendations

It is proposed to construct a retaining wall along the north side of Hwy. 2 from Station 20+707 to Station 20+994 excluding 11 m at the entrance at Station 20+835. Our recommendations for design and construction are as follows:

Wall Foundations

Option 1 - Gravity type (Gabion) Retaining Wall

The full length of the wall can be supported within the original material at the elevations and design loads given below (O.H.B.D.C.).

Elev. (m)	ULS (kPa)	SLSII (kPa)
159	700	300
158 (or lower)	1000	unyielding

In order to prevent washout of the fines from the granular backfill and original soil, a filter medium should be installed between the backface of the wall and the backfill.

Option 2 - Concrete Retaining Wall

The full length of the wall can be supported on spread footings at the elevations and design loads given above.

Additional Remarks:

1. Backfill to structures should conform to M.T.C. standards.

2. All underside of the Concrete Retaining Wall footings should be protected by a minimum 1.2 m frost cover.

3. No dewatering problems are anticipated in view of the cohesive nature of the glacial till.

J.S. Alter

for

B. Ruck
Project Foundation Engineer

JSA/mb

cc: S. Killaire
R. Fitzgibbon
D. Gunter
K.G. Bassi