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DIST. _____ REGION _____

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CONT. No. 90-36

W. O. No. _____

STR. SITE No. _____

HWY. No. 416 / 417

LOCATION 417 W.B.L. Culvert 5

No. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

CONT. 90-36

WP 120-87-00B DIST 9
HWY 417 STR SITE

Culvert Structure Underneath the Proposed
Hwy. 417 Westbound Lane
Culvert No. ~~43~~ *5*

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FOUNDATION INVESTIGATION REPORT
For
Culvert Structure Underneath the Proposed
Hwy. 417 Westbound Lane
Culvert No. #3
W.P. 120-87-00B
District 9, Ottawa

INTRODUCTION

This report summarizes the information obtained from a foundation investigation carried out at the above-mentioned site during the period of 89 10 31 to 89 11 01. A 3.0 m span culvert structure is proposed to carry Hwy. 417 Westbound Lane (Culvert No. #3).

Two boreholes (BH #C3-1 and BH #C3-2) were advanced and sampled by means of hollow stem augers with a conventional Cone Penetration Tests. These boreholes extended down to depth of 11.9 metres below the existing ground surface.

This report contains factual information obtained from this investigation together with discussion and recommendations pertaining to structure foundations, approach embankments and related earthworks for the Culvert No. #3 as shown on Drawing No. 1208700B-A.

SITE DESCRIPTION AND GEOLOGY

The proposed structure site is located in the corn field and underneath the existing Hwy. 417 Eastbound Lane between the Acres Road and Moodie Drive in the City of Nepean, Ottawa-Carleton Municipality. The topography of the area is generally flat to gently undulating with the land in the immediately vicinity being used for agricultural and dairy farming purposes. A new municipal pumping station exists north of the site.

Physiographically, the site lies in the area known as the Ottawa Valley Clay Plains founded in the lowlands of the St. Lawrence. The subsoil consists of clay plains interrupted by ridges of rock or sand. Fault scarps are also evident within the area; an illustration of the numerous normal faults that dominate the region. It appears that the site is divided by a fault. The

bedrock in the area is of the March Formation west of the fault, and the Rockcliffe and Gull River Formation east of the fault which are of the middle Ordovician period. The March Formation consists of interbedded quartz sandstone and sandy dolostone, whereas the Rockcliffe and Gull River Formation consists of interbedded fine grained quartz sandstone, silty dolostone, and limestone. The site is transversed by a north-south trending fault which is a geologic structure reportedly common to the area. The overburden was deposited during and immediately following the Wisconsin glaciation at which time the area was depressed from the effect of the glaciation. Following the retreat of the glacier, the brackish waters of the Champlain Sea flooded the area and then gradually receded as the land rebounded with the deposition of sediments to its present level.

SUBSURFACE CONDITIONS

The subsoil conditions are generally consistent across the site. The surficial layer consists of a generally soft to stiff cohesive silty clay to clayey silt which extends to a maximum thickness of 4.8 m. Underlying this layer is a deposit of clayey silt interbedded with irregular layers or seams of sandy silt. The maximum thickness of this deposit is about 4.6 m. A deep deposit of silty sand is the subsequent underlying deposit. However, it should be noted that this deposit was not proven for the full depth. The proven thickness down to a depth of 11.9 m below the ground surface is about 4.1 m at BH #C3-1. It should be also noted that under the existing Hwy. 417 Eastbound lane, sand and gravel subgrade fill material was found. But no samples were taken from the site.

A detailed description of the subsurface conditions encountered is given below.

Silty Clay to Clayey Silt

This stratum was encountered in two boreholes (BH #C3-1 and BH #C3-2). This material consists of a silty clay to clayey silt ranging in thickness between 4.1 and 4.8 m. The material changes in colour from brown to grey at approximately elevation of 64.5 m.

Two Atterberg Limit tests were performed on these samples and the results are plotted on Figure 1 and summarized as follows:

<u>Property</u>	<u>Ranges (%)</u>	<u>Average (%)</u>
Natural Moisture Content (w)	43.5-45.0	44.3
Liquid Limit (w_L)	34.5-48.5	41.5
Plastic Limit (w_p)	15.0-20.5	17.8
Plasticity Index (I_p)	19.5-28.0	23.8

From the plasticity chart, it is evident that the layer can be classified as an inorganic silty clay to clayey silt with intermediate to low plasticity (CI or CL).

Grain size distribution tests were carried out on these material. Figure 2 in Appendix shows the results.

Undrained shear strength of the soil were determined by in situ vane tests. The results are plotted on the Record of Borehole sheets in the Appendix and summarized as follows:

<u>Test</u>	<u>Undrained Shear Strength (C_u, kPa)</u>	<u>Sensitivity</u>
Field Vane	70-72 (Avg. 71 kPa)	4.5-9

Recommended shear strength for this deposit can be estimated to be about 70 kPa. Based on this result, the soil has stiff consistency. The sensitivity of the soil is generally moderate to high.

Clayey Silt with Interbedded Sandy Silt

Underlying the surficial deposit of silty clay to clayey silt, a layer of grey clayey silt with interbedded sandy silt was encountered. This stratum extends to depths ranging from 7.8 m to 9.4 m below the ground surface. The thickness of the stratum varies between 3.7 and 4.6 m.

The results from the 4 Atterberg Limit test performed on this material are summarized as follows:

<u>Property</u>	<u>Ranges (%)</u>	<u>Average (%)</u>
Natural Moisture Content (w)	27.5-42.6	33.1
Liquid Limit (w_L)	21.0-30.5	26.8
Plastic Limit (w_p)	12.5-16.5	14.1
Plasticity Index (I_p)	6.5-15.0	12.6
Unit Weight (kN/m^3)	17.8-19.2	18.5

From the plasticity chart (Figure 3), it is evident that the layer can be classified as an inorganic clayey silt with interbedded sandy silt with low plasticity (CL or CL-ML).

Grain size distribution tests were carried out on these materials. Figure 4 in the Appendix shows the results in an envelope form.

Undrained shear strength of the soil was determined both by in situ vane tests and laboratory tests, namely unconfined compression tests. The results are plotted on the Record of Borehole sheets in the Appendix and summarized as follows:

<u>Undrained Shear Strength</u>	<u>kPa</u>	<u>Average (kPa)</u>	<u>Sensitivity</u>
Field Vane (5 tests)	52-80	64	4.3-7.0
Laboratory Results (2 tests)	35-63	50	

Due to the irregular nature of the deposit, that reveals numerous seams and layers of sandy silt interbedded within the clayey silt, the results provided in the above table are not necessarily indicative of the shear strength of the clayey silt portion. In view of this consideration, the consistency of the clayey silt portion can be described as firm to stiff. The sandy silt portion was generally very loose in denseness. For design purposes, an undrained shear strength of 65 kPa can be assumed for this stratum.

The result (e-log P curves) of a consolidation test on a representative sample is shown on Figure 5. This test indicated that the clayey silt has been preconsolidated in the past to an effective pressure of 236 kPa (P_c-P_o) in excess of the existing effective overburden pressure. The detail of the result is as follows:

<u>Parameters</u>	<u>Results</u>
Preconsolidation pressure, P_c (kPa)	315
Initial Void Ratio (e_o)	1.009
Compression Index (C_c)	0.562

Silty Sand

This deposit was encountered below the clayey silt with interbedded sandy silt layer. The proven thickness of this layer ranges from 2.5 m at BH #C3-2 to 4.1 m at BH #C3-2.

This deposit contains a minor variation in gravel content throughout its thickness. Generally, the deposit contains trace of gravel, but at some locations, considerable gravel was encountered. Grain size distribution curve indicate that the soil can be classified to a silty sand. This layer is basically non-plastic. Figure 6 in the Appendix shows the result of Grain size distribution tests.

In this stratum, the 'N' values ranged from 19 to over 100 blows/0.3 m indicating a state of compaction described as compact to very dense. However, at certain locations low resistance (1 below/0.3 m) encountered. This may be attributed to 'boiling' of subsoil due to unbalanced hydrostatic head and consequently do not represent the undisturbed denseness of the soil.

GROUNDWATER CONDITIONS

Observation of the groundwater level was carried out by measuring the water level in the open boreholes and a piezometer installed in BH #C3-2. Groundwater levels in the boreholes were found to range between elevation 63.1 m at BH #C3-1 and elevation 63.7 m at BH #C3-2. This corresponds to depths of 2.6 m to 1.7 m below the existing ground surface.

DISCUSSION AND RECOMMENDATIONS

The recommendations in this report apply to the concrete culvert and related approaches.

It is proposed to construct a 3.0 m span culvert underneath the proposed Hwy. 417 Westbound (Culvert No. #3) at the base elevation of about 61.0 metres (approximately 4.5 m below the existing ground surface). The proposed culvert will be a 3.0 x 2.0 m box culvert with an approximate length of about 62 m. Fill height will be approximately 5.5 metres above the proposed culvert as shown on Drawing No. 1208700B-A.

Based on the site investigation, the foundation recommendations for the design of concrete box culvert are as follows:

STRUCTURE FOUNDATION FOR CONCRETE CULVERTS

The proposed concrete culvert structure may be founded on spread footings located within the native clayey silt layer at the southern portion of culvert and the native silty clay to clayey silt layer at the northern portion of culvert that predominate the site. For purposes of the O.H.B.D.C., the following design values are recommended at the invert elevation of culvert provided:

<u>Structure</u>	<u>Bearing Capacity at S.L.S. Type II (kPa)</u>	<u>Factored Bearing Capacity at U.L.S. (kPa)</u>	<u>Recommended Footing Elev. (m)</u>
Concrete Culvert	150	250	61.0-61.2

A footing width of 3.0 m was used in the calculation of the capacities.

To protect the footings against scour, a properly designed rip-rap meeting the filter design criteria and hydrological requirements at site, should be placed at the culvert channel inlet and outlet.

Settlement of the foundation subsoil as a result of the applied footing pressure will be time dependent in nature. The magnitude of the consolidation settlement is anticipated to be within 25 mm, provided the subsoil is not disturbed by

construction or related activities. It is recommended that a working slab be placed to protect the footing founding soil within 4 hours of exposure.

Resistance to sliding of the footings can be calculated assuming an adhesion of 75 kPa to apply between the underside of the concrete culvert and the founding soil in accordance with Section 6.6.1.2.1 of the O.H.B.D.C.

OTHER CONSIDERATIONS

Lateral Earth Pressures on Culvert Walls

Free draining material such as Granular 'A' or Granular 'B' is recommended as appropriate backfill to the culvert walls to prevent hydrostatic pressure build-up.

Design parameters of the soil are given below for purpose of the O.H.B.D.C.:

	<u>Granular 'A'</u>	<u>Granular 'B'</u>
Angle of Internal Friction (ϕ)	35°	30°
Unit Weight (kN/m^3) γ	22.8	21.2
Coefficient of Earth Pressure at Rest (K_0)*	0.43	0.50

*for horizontal backfill only.

The earth pressure coefficient at rest is to be used in design if the culvert structure is rigid and unyielding. Weep holes in the abutment walls should be designed to drain any accumulation of water in the backfill.

Dewatering

No major dewatering difficulties are anticipated for footing excavations in consideration of the relatively low permeability of the cohesive foundation soils. However, if localized seepage or surface water do accumulate in excavations, it can be controlled by perimeter ditches and pumping from sumps.

Frost Protection

The footings should be placed so as to have a minimum earth cover or 1.8 m to allow for frost protection.

Approach Fills

No stability problems are anticipated for the proposed height of permanent embankment constructed to a 2H:1V geometry.

Cut Slopes at Culvert Inlet and Outlet, and Drainage Channel

The critical condition for stability of the open cut slopes proposed at the culvert inlet and outlet, and drainage channel will be the long term condition and consequently an effective stress analysis was implemented incorporating a minimum factor of safety of 1.3.

Based on the analyses, the following conclusions have been derived:

- 1) Excavation down to 5.0 metres in depth will be stable provided they are maintained with 2H:1V slope, while deeper cuts to 7 metres will require a flatter slope of $2\frac{1}{2}$ H:1V.

CONSTRUCTION CONSIDERATIONS

- 1) Temporary excavation cuts for foundation elements should be at slopes no steeper than 2H:1V in view of the high water table.
- 2) In order to get a gravitational drainage system in the vicinity of the culvert excavation, it is recommended that the construction of drainage channel downstream of the Culvert #3 should be implemented prior to excavation for the culvert foundation.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Tae C. Kim, Foundation Design Engineer, and Dale Colquhoun, visiting Engineer from Jamaica. The equipment was owned and operated by Marathon Drilling Co. and Johnston Drilling Co., Ottawa.

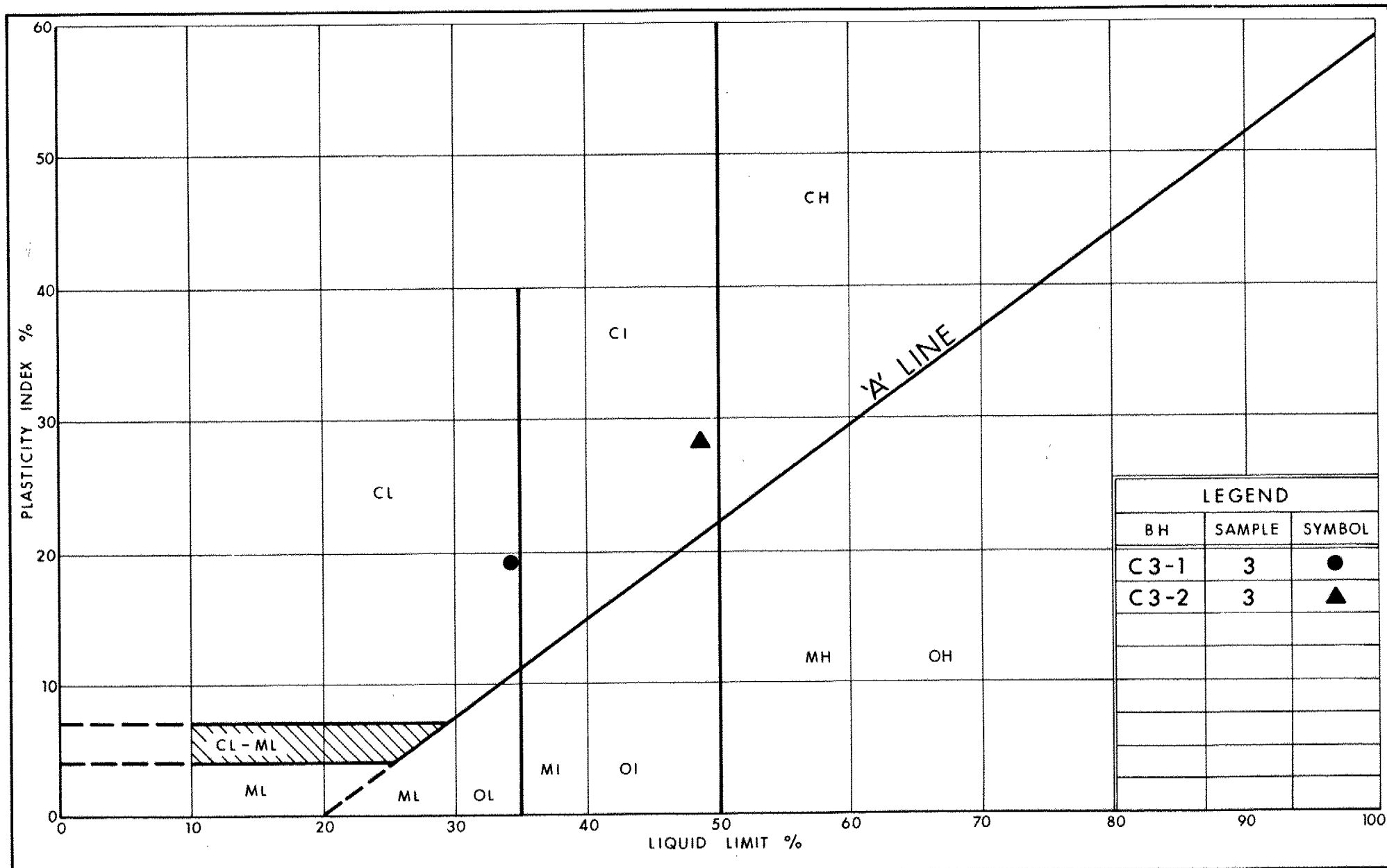
The project was carried out by Tae C. Kim under the general supervision of Dr. B. Iyer. This report was written by Tae C. Kim, Foundation Design Engineer, reviewed by Dr. B. Iyer, Sr. Foundation Engineer and approved by M. Devata, Chief Foundation Engineer.



Tae C. Kim
Tae C. Kim, P.Eng.
Foundation Design Engineer

M. Devata
M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX



Ontario

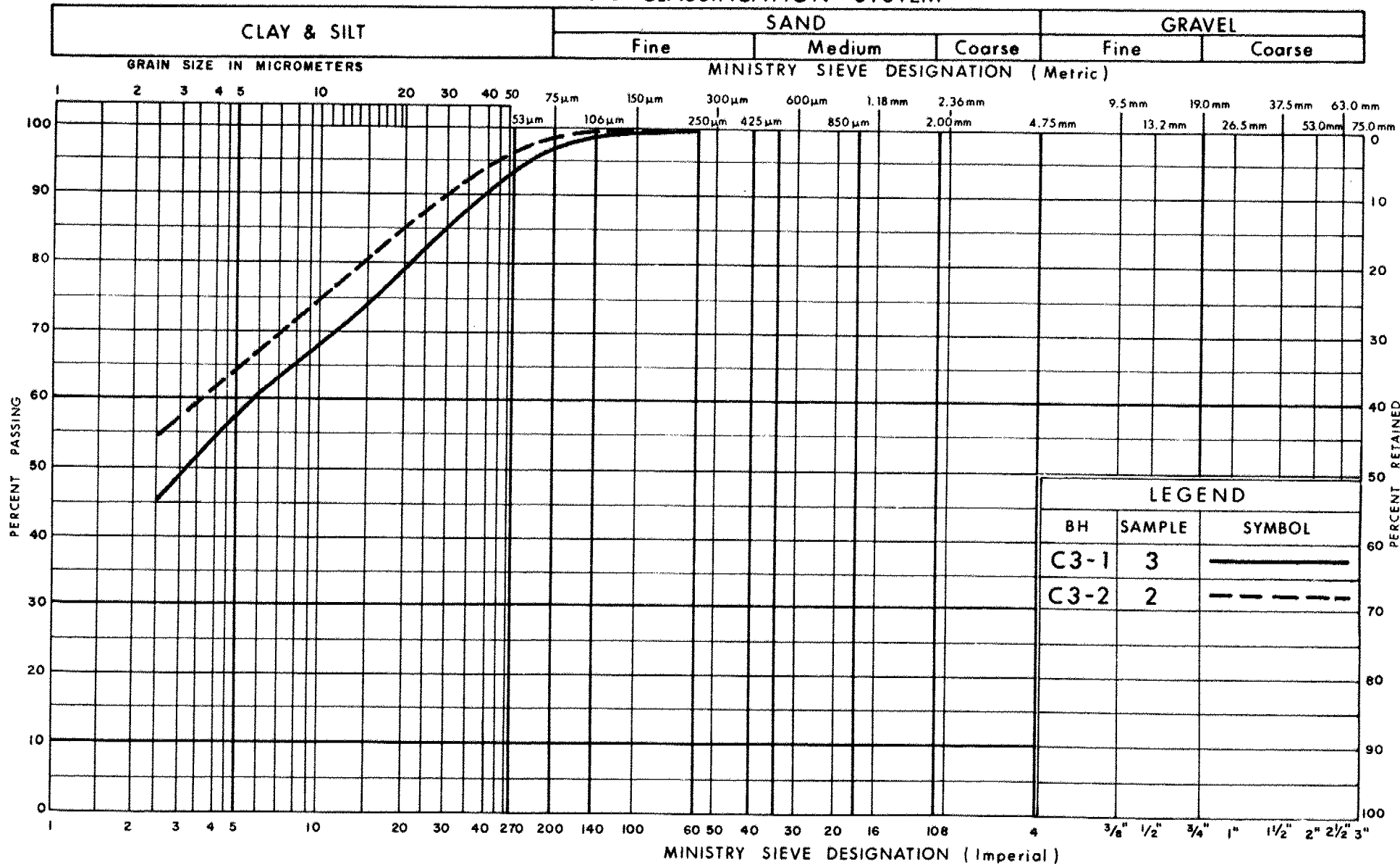
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PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 120-87-00B

UNIFIED SOIL CLASSIFICATION SYSTEM



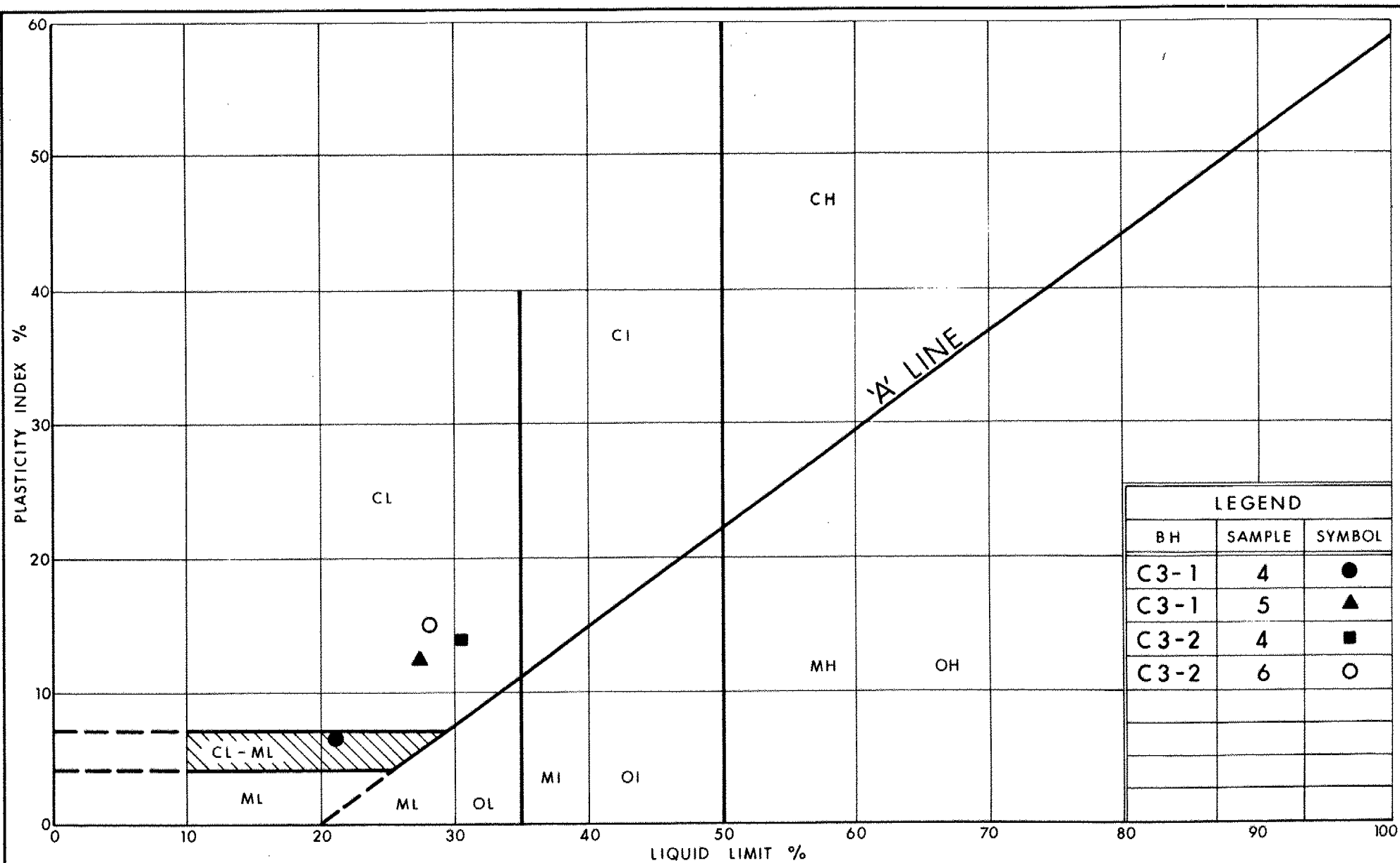
GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAYEY SILT

FIG No 2

W P 120-87-00B



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Ontario

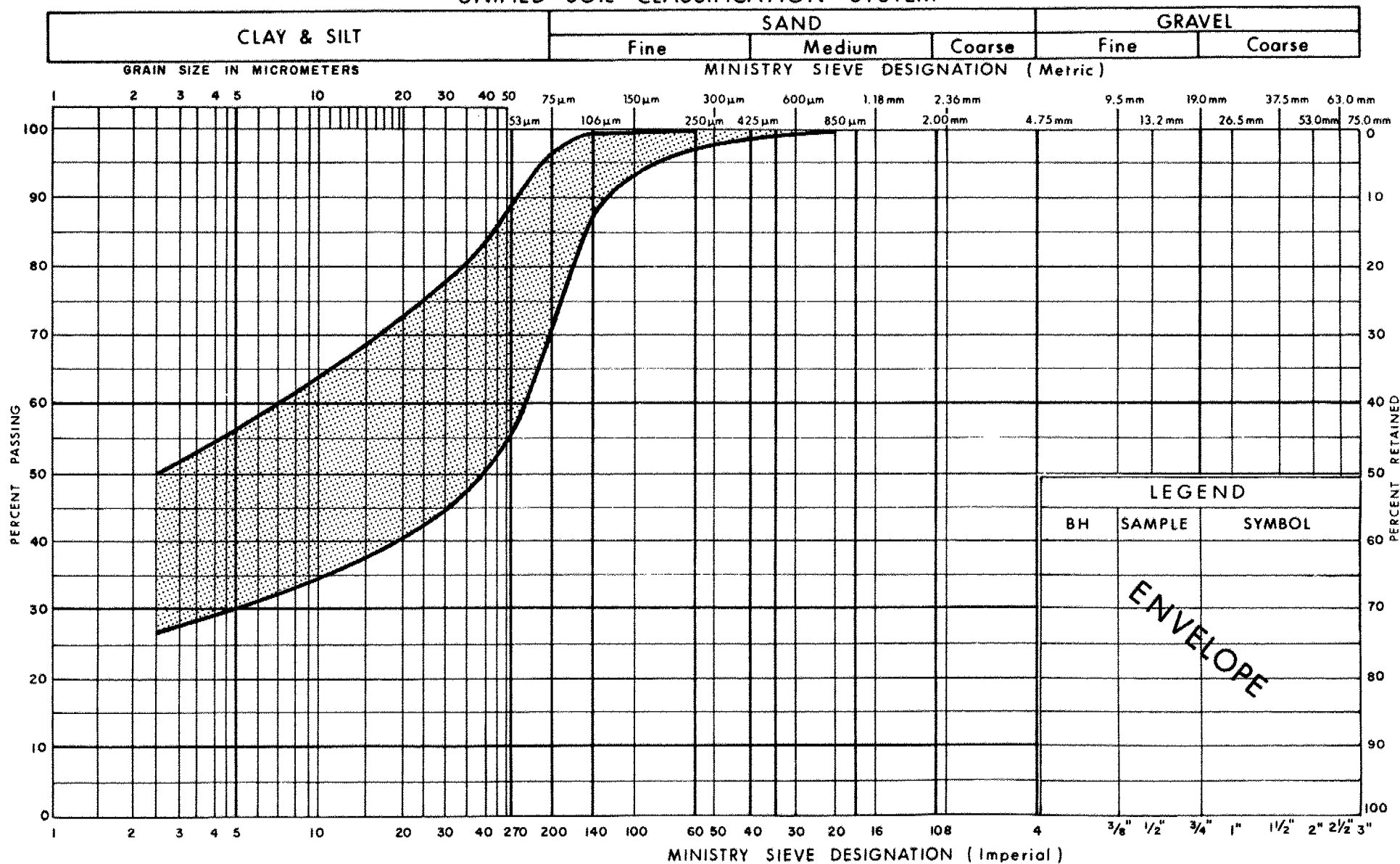
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PLASTICITY CHART CLAYEY SILT WITH INTERBEDDED SANDY SILT

FIG No 3

W P 120-87-00B

UNIFIED SOIL CLASSIFICATION SYSTEM



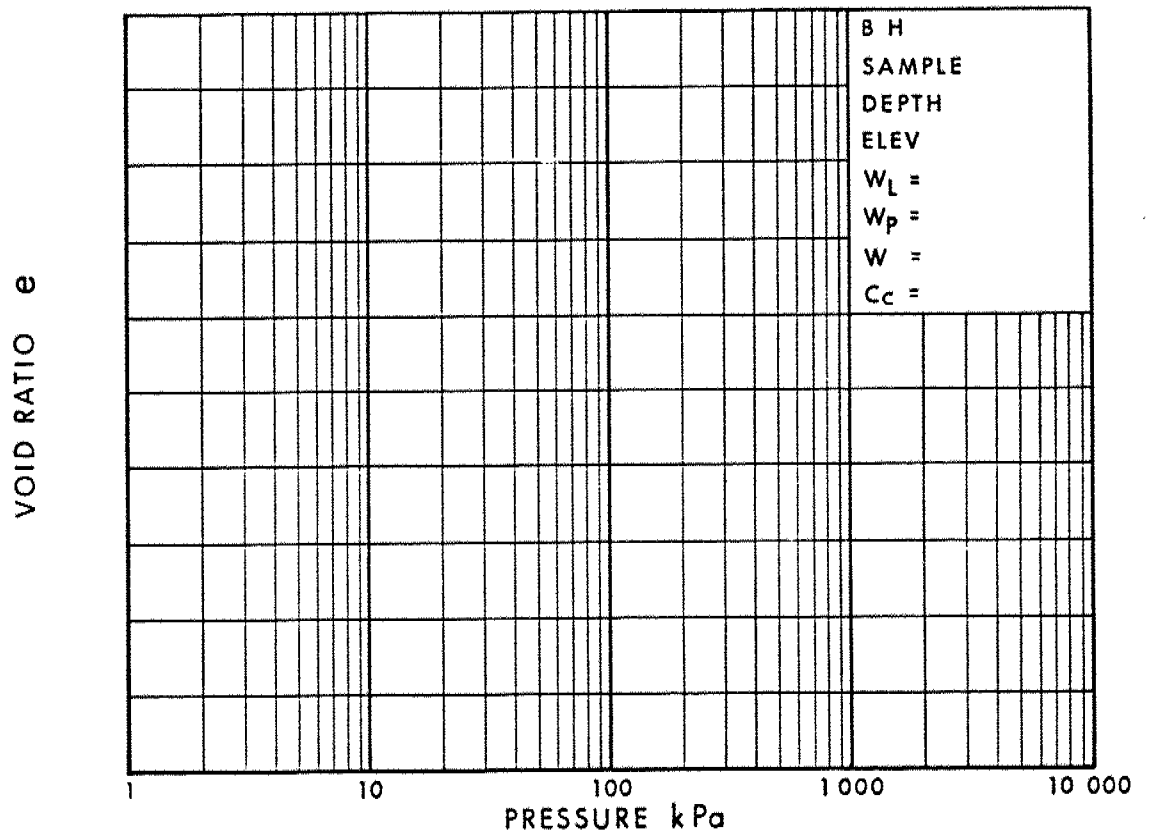
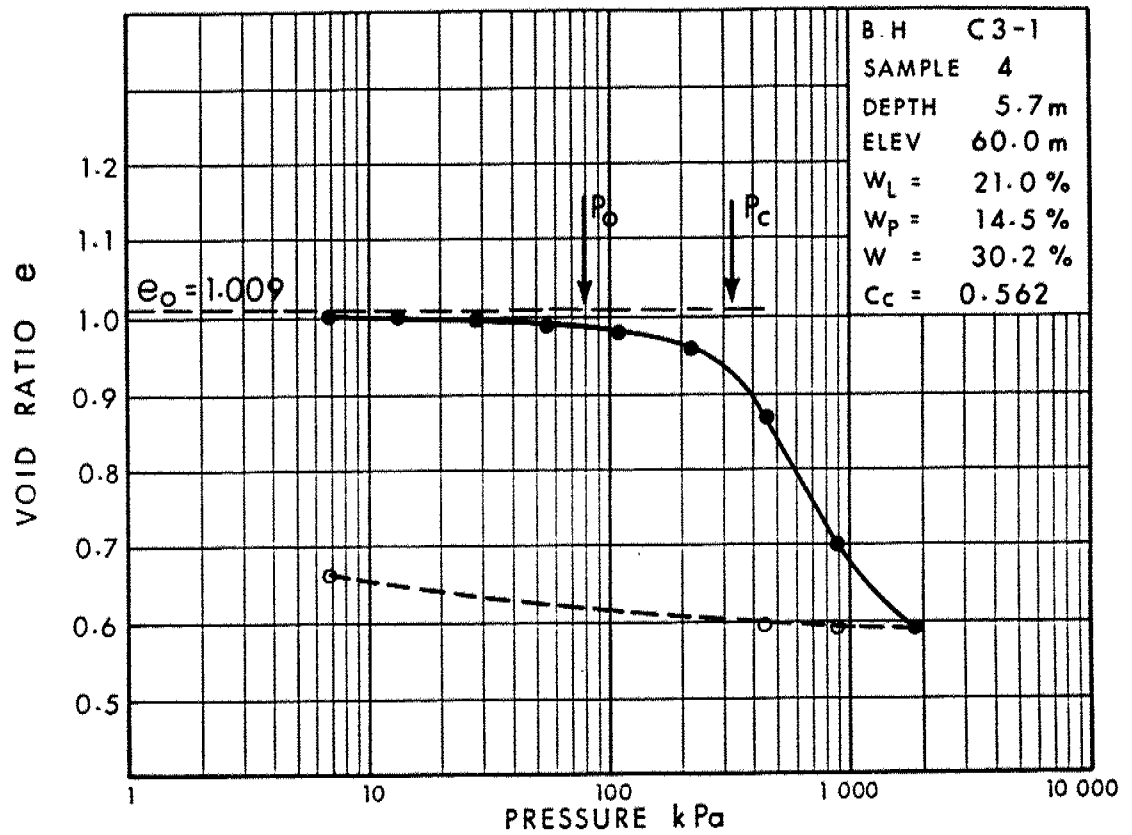
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GRAIN SIZE DISTRIBUTION
CLAYEY SILT WITH INTERBEDDED SANDY SILT

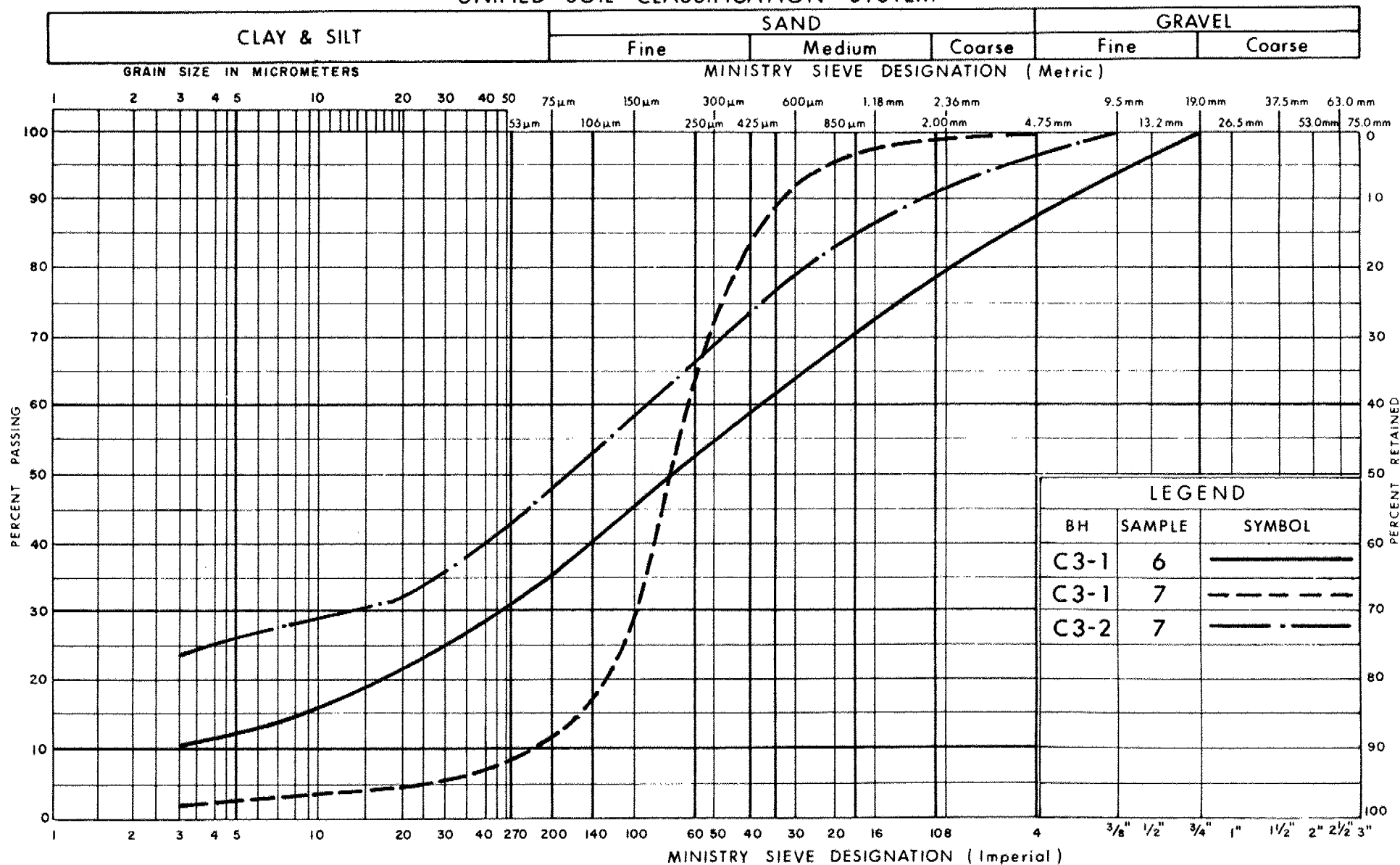
FIG No 4

W P 120-87-00B

VOID RATIO - PRESSURE CURVES



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SILTY SAND

FIG No 6

W P 120-87-00B



Ontario

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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 1" 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/0.3 m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

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

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

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

ROD (%)	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		MECHANICAL PROPERTIES OF SOIL	
S S	SPLIT SPOON	T P	THINWALL PISTON
WS	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	
σ_v	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	
ρ_s	kg/m ³	UNIT WEIGHT OF SOLID PARTICLES	
ρ_w	kg/m ³	DENSITY OF WATER	
γ_w	kg/m ³	UNIT WEIGHT OF WATER	
ρ	kg/m ³	DENSITY OF SOIL	
γ	kg/m ³	UNIT WEIGHT OF SOIL	
ρ_d	kg/m ³	DENSITY OF DRY SOIL	
γ_d	kg/m ³	UNIT WEIGHT OF DRY SOIL	
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	
γ_{sat}	kg/m ³	UNIT WEIGHT OF SATURATED SOIL	
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	
γ'	kg/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 = $\frac{w_L - w_p}{w - w_p}$	
I_L	1	LIQUIDITY INDEX = $\frac{I_p}{w - w_p}$	
I_c	1	CONSISTENCY INDEX = $\frac{I_p}{I_L}$	
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	kg/m ³	SEEPAGE FORCE	



RECORD OF BOREHOLE No C3-1

METRIC

W P 120-87-00B LOCATION Co-ords: N 5 022 603.0; E 358 242.2 ORIGINATED BY DC
DIST 9 HWY 416/417 BOREHOLE TYPE H.S. Auger and Cone Test COMPILED BY TCK
DATUM Geodetic DATE 89 10 31 CHECKED BY TCK

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x 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/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
65.7	Ground Surface										
0.0	Grey		1	SS	8						
	Silty Clay to Clayey Silt		2	SS	2						
	Soft to Stiff		3	SS	4						
61.6			4	TW	PM						
4.1	Clayey Silt With Interbedded Sandy Silt Layers		5	SS	16						
	Firm to Stiff		6	SS	1						
57.9			7	SS	1						
7.8	Silty Sand, Some Gravel, Trace Clay		8	SS	70						
	Loose to V. Dense										
53.8											
11.9	End of Borehole										



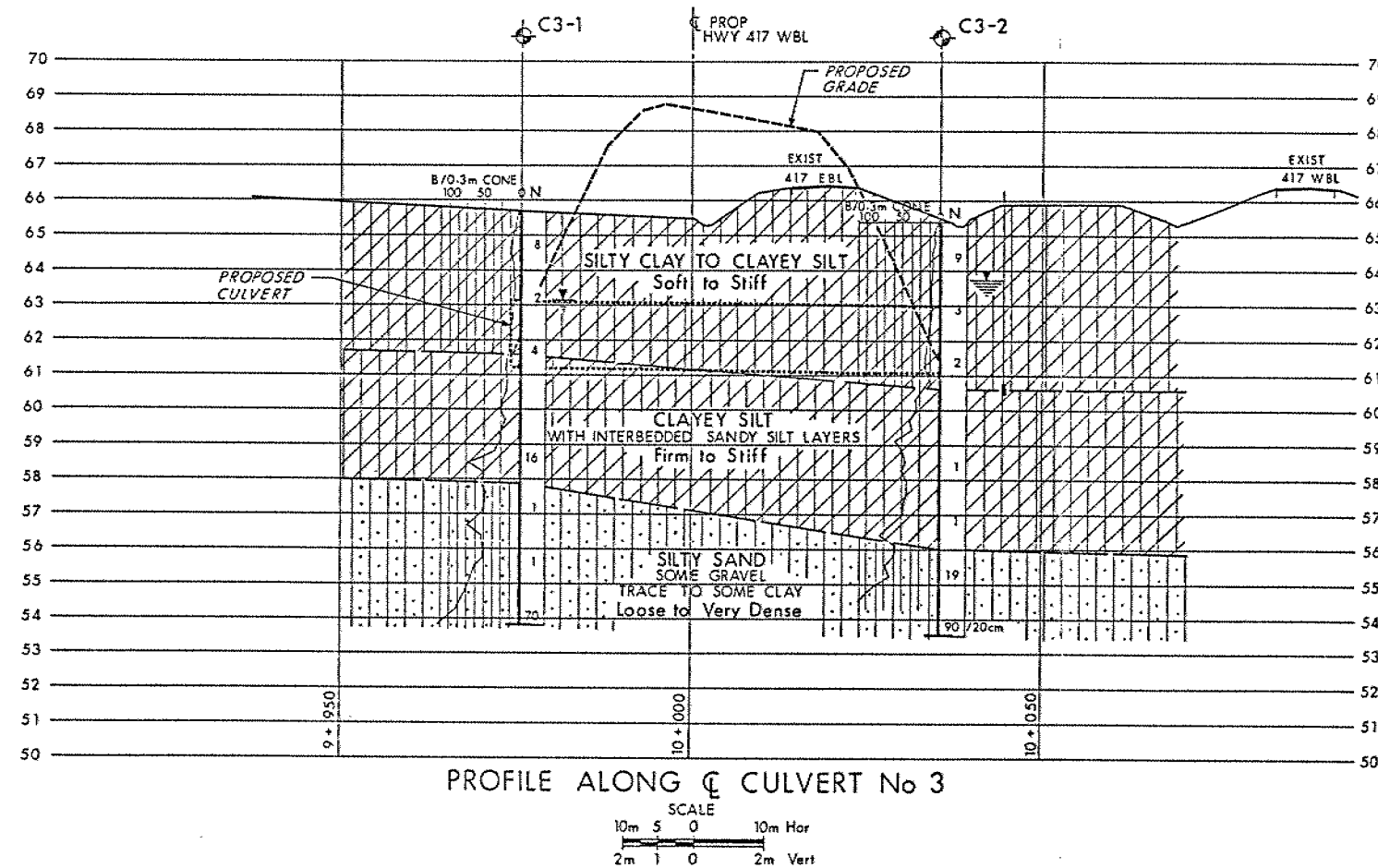
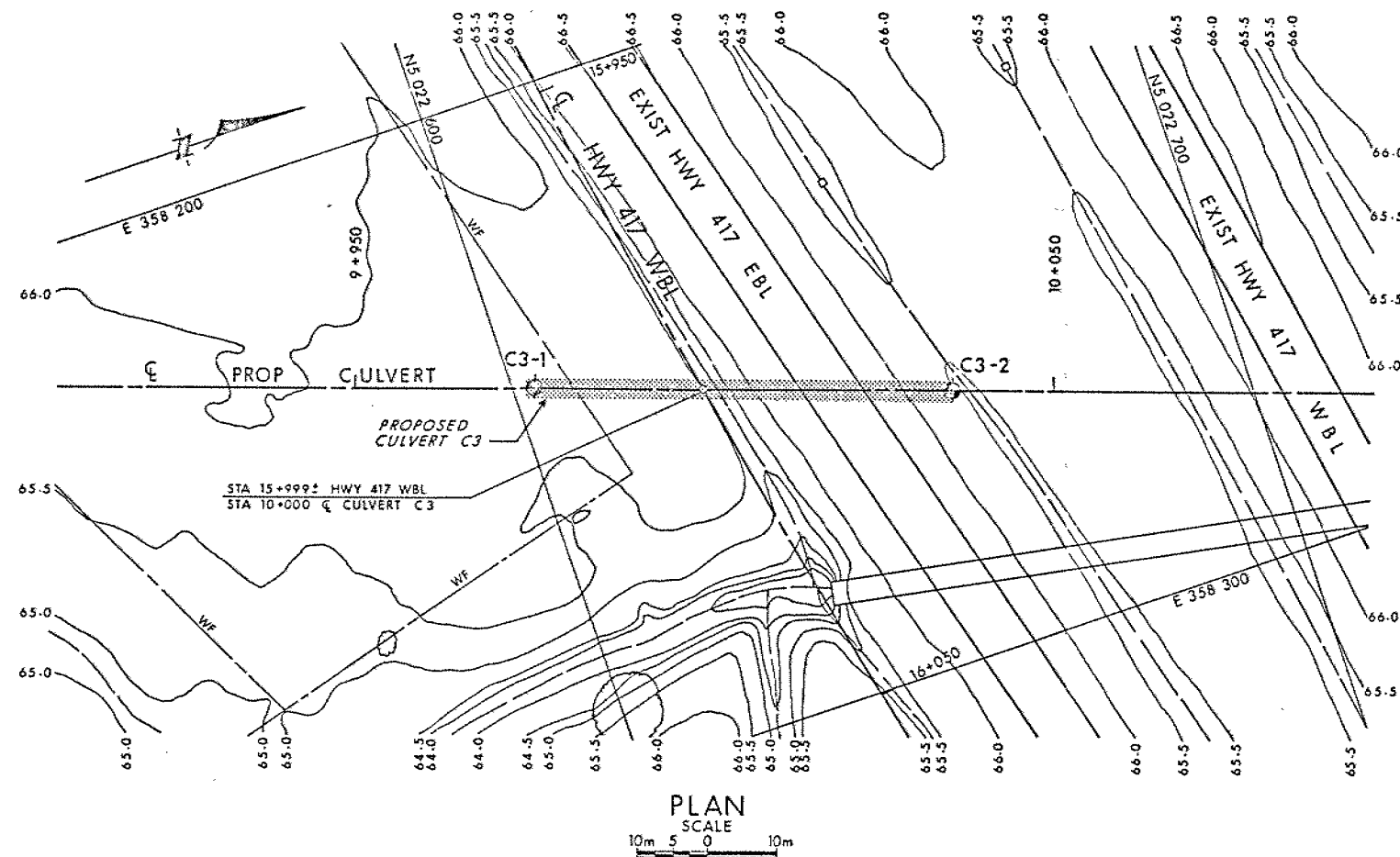
RECORD OF BOREHOLE No C3-2

METRIC

W P 120-87-00B LOCATION Co-ords: N 5 022 659.5; E 358 262.0 ORIGINATED BY DC
DIST 9 HWY 416/417 BOREHOLE TYPE H.S. Auger and Cone Test COMPILED BY TCK
DATUM Geodetic DATE 89 11 01 CHECKED BY TCK

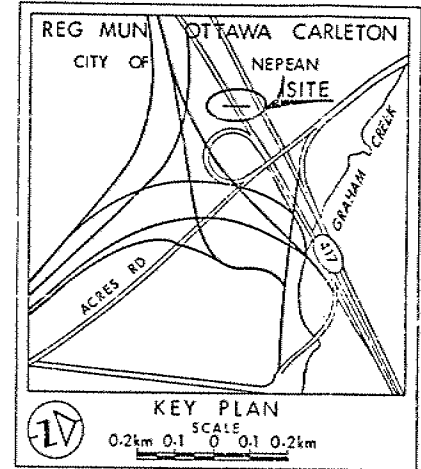
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
65.4	Ground Surface															
0.0	Brown Grey Silty Clay to Clayey Silt Soft to Stiff		1	SS	9		64									
			2	SS	3		62		4.5						W=43.5% W _L =48.5%	0 2 48 50
60.6			3	SS	2	Seal										
4.8	Clayey Silt With Interbedded Sandy Silt Layers Stiff		4	TW	PM	P-1 Seal	60		4.5						W=17.8% W _L =42.6%	0 4 49 47
			5	SS	1		58		7							
			6	SS	1		56		1.7							0 30 43 27
56.0							54									
9.4	Silty Sand, Some Gravel, Trace to Some Clay Compact to V. Dense		7	SS	19											6 48 26 20
53.5			8	SS	90/	20cm										
11.9	End of Borehole															
	Piezometer Installation P-1 (Tip at 5.0m BGS)															
	0 - 4.08m Backfill															
	4.08 - 4.42m Bentonite	Seal														
	4.42 - 5.12m Pea Gravel															
	5.12 - 5.24m Bentonite	Seal														
	5.24 - 11.90m Backfill															

OFFICE REPORT ON SOIL EXPLORATION



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

CONT No
WP No 120-87-00B
HWY 417 WESTBOUND LANE
CULVERT No 3
BORE HOLE LOCATIONS & SOIL STRATA



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		
	89 10 and 89 11		
	Piezometer		
No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
C3-1	65.7	5 022 603.0	358 242.2
C3-2	65.4	5 022 659.5	358 262.0

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, 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
1			

Geocres No 31G5-172

HWY No 417/417 DIST 9

SUEMO ICK CHECKED T. KEATE 90 02 05 SITE

ERAWN DT CHECKED 92 APPROVED 10WG1208700B-A