

G.I.-30 SEPT. 1976

GEOCRES No. 40P2-44DIST. 2 REGION W.P. No. 481-89-04CONT. No. 92-18W. O. No. STR. SITE No. 23-169HWY. No. 401LOCATION Hwy 401 & Cedar CreekNo of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

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FOUNDATION DESIGN SECTION

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 481-89-04

DIST 2

HWY 401

STR SITE 23-169

Cedar Creek Bridge

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FOUNDATION INVESTIGATION REPORT

For

Cedar Creek Bridge

W.P. 481-89-04, Site 23-169

Hwy. 401, District 2, London

INTRODUCTION

This report contains the results of a site investigation carried out at the above mentioned site to provide information for the design and construction of the proposed widening of Hwy. 401.

The field work for this project was carried out between 1990 04 04 and 1990 04 16, and comprised of four sampled boreholes and Dynamic Cone Penetration Test adjacent to these boreholes.

Boreholes were advanced to a maximum depth of 19.2 m below the existing ground level (El. 266.2 m) using a continuous flight hollow stem auger and BW casing. Rock cores were obtained in two of the boreholes using BX size diamond bit.

SITE DESCRIPTION

The site under investigation is located about 300 m west of Hwy. 59 at the crossing of Hwy. 401 and Cedar Creek in the City of Woodstock.

The topography of the site with the exception of the existing crossing (embankment) and the flood plain of the creek is generally undulating with drumlins to the south. The site was modified to the present condition by the construction of the existing bridge and prior to the construction of this bridge, the creek was meandering at this location. Physiographically the area is located in the region known as the "Oxford Till Plain".

SUBSURFACE CONDITIONS

The underlying subsoil at this site consists of compact to dense alluvial sand underlain by firm to very stiff clayey silt with occasional sand and

silt seams. The clayey silt layer is underlain by dense to very dense sand and gravel which overlies the limestone bedrock. For classification purposes, the soils encountered at this site can be divided into four different zones.

- a) Sand, some to trace of Silt, some to trace of Gravel
- b) Clayey Silt with occasional Sand and Silt seams
- c) Sand and Gravel, some Silt
- d) Limestone Bedrock

The subsurface conditions encountered during the course of the investigation, together with the field and laboratory test results are shown on the Record of Borehole sheets contained in the Appendix of this report. Two stratigraphical sections are shown on Drawing No. 4818904-A. This drawing also shows the locations and elevations of the borings. Description of the strata encountered are given below.

Sand, some to trace of Silt, some to trace of Gravel

The alluvial sandy deposit was encountered immediately below the topsoil. The thickness of this deposit varies from 3.0 m to 7.6 m. The results of the gradation tests carried out on representative soil samples are shown on Figure 1 in an envelope form. These test results indicate that this deposit is predominantly composed of sand with varying proportions of gravel and silt (Gravel 0% to 45%, Sand 47% to 96%, Silt 4% to 14%). The Standard Penetration Test results were observed to vary over a wide range ('N' values 12 blows/30 cm to 61 blows/30 cm). These test results indicate that this stratum is in a compact to very dense state of compaction.

Clayey Silt with occasional Sand and Silt seams

This clayey silt deposit was encountered in all the boreholes immediately below the sandy deposit. The thickness of this layer varies from 1.0 m to 6.5 m. The natural moisture content was observed to vary from 15.5% to 23% with an average value of 20.5%. The results of the grain size distribution test are shown on Figure 2 in an envelope form. The Atterberg Limits

determined for the representative soil samples of this deposit are shown on Figure 3. The consistency of this stratum varies from location to location over a wide range (firm to very stiff). However, in BH 2, an isolated very soft layer was observed around El. 279.5 m. The Standard Penetration Test results were also observed to vary very widely ('N' values 6 blows/30 cm to 20 blows/30 cm).

Sand and Gravel, some Silt

The clayey silt is underlain by this deposit. The thickness of this deposit varies from 4.1 m to 5.1 m and extends to elevation 270.8 to 269.6 m. The grain size distribution test results are shown on Figure 4 in an envelope form. These results indicate 31% to 54% gravel, 35% to 55% sand and 10% to 19% silt. The Standard Penetration Test results indicate that this stratum is in dense to very dense state of compaction ('N' values 41 blows/30 cm to over 100 blows/30 cm).

Bedrock

The rock cores were examined by Mr. S.A. Senior, Geological Engineer and his description is included in the Appendix of this report.

The project area is underlain by limestone bedrock of the Detroit River Group. The thickness of the weathered rock was observed in the range of 30 cm to 35 cm and the elevation of the unweathered rock is expected to be in the depth range of El. 269.2 to 270.5 m.

The RQD values measured from BX size cores (0% to 9%) indicate that the bedrock up to the depth of drilling may be classified as very poor quality rock.

Groundwater Conditions

The groundwater level was observed at or near the creek water level (El. 284.3 to 284.8 m). Seasonal fluctuation of the groundwater level may be expected. The groundwater level at each borehole location is as follows:

<u>Borehole No.</u>	<u>Elevation</u>
1	284.8
2	284.5
3	284.3
4	284.3

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to widen the existing bridge at the crossing of Hwy. 401 and Cedar Creek to provide additional lane on both sides of Hwy. 401.

The existing bridge is a single span reinforced concrete rigid frame structure. The clear span between the face of the abutments is about 18.3 m. The structure as well as the side slopes of the approach fill are in very good condition.

It appears from the structural drawings of the existing bridge that the abutments as well as the wing walls are supported on spread footings founded either on mass concrete or compacted granular backfill placed in shells made of steel sheet piles. However, the founding level of the backfill or mass concrete is not available.

Structure Foundations

Considering the subsoil conditions at this site and high water level, it is recommended that the abutments and wing walls be supported on steel H-piles driven to bedrock which will be encountered around elevation 269.5 to 270.5 m.

The maximum allowable load for the steel H-pile section selected may be used for the design purposes. For the purposes of the O.H.B.D.C., the following values are recommended:

	<u>HP 310x110</u>	<u>HP 310x79</u>
Factored Bearing Capacity at U.L.S.	1600 kN	1150 kN
Bearing Capacity at S.L.S. Type II	1150 kN	900 kN

Earth pressure should be computed as per Section 6.1.2.2 of the O.H.B.D.C. and unyielding foundation condition may be assumed for the computations.

The Granular 'A' or 'B' backfill should be in accordance with the Special Provision No. 109F03. The following parameters are recommended for the granular backfill.

	<u>Granular 'A'</u>	<u>Granular 'B'</u>
Angle of Internal Friction	$\phi = 35^\circ$	$\phi = 30^\circ$
Unit Weight (kN/m^3)	$\gamma = 22.8$	$\gamma = 21.2$

Approach Embankment

Considering the subsoil conditions at this site, no major stability problems are anticipated for the approach fill constructed with 2H:1V side slopes. The fill should consist of well compacted acceptable material. The topsoil as well as any spongy or soft areas observed within the base width of the embankment should be removed before placing the fill. The benching for the new approach fill should be in accordance with the OPSD 208.01 dated 88 12 01.

Other Considerations

The pile tips should be reinforced with pile driving shoe as per MTO Standard. The high ground water level may impose greater difficulty for the construction of the pile caps. Pile bents may be used to support the bridge deck instead of the caps. If pile caps are proposed, it should have a minimum of 1.2 m earth cover to protect against the frost penetration.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. M. Vasavithasan. The equipment used was owned and operated by London Soil Test. This report was prepared by Mr. M. Vasavithasan, reviewed by Mr. P. Payer, Senior Foundation Engineer, and approved by Mr. M. Devata, Chief Foundation Engineer.

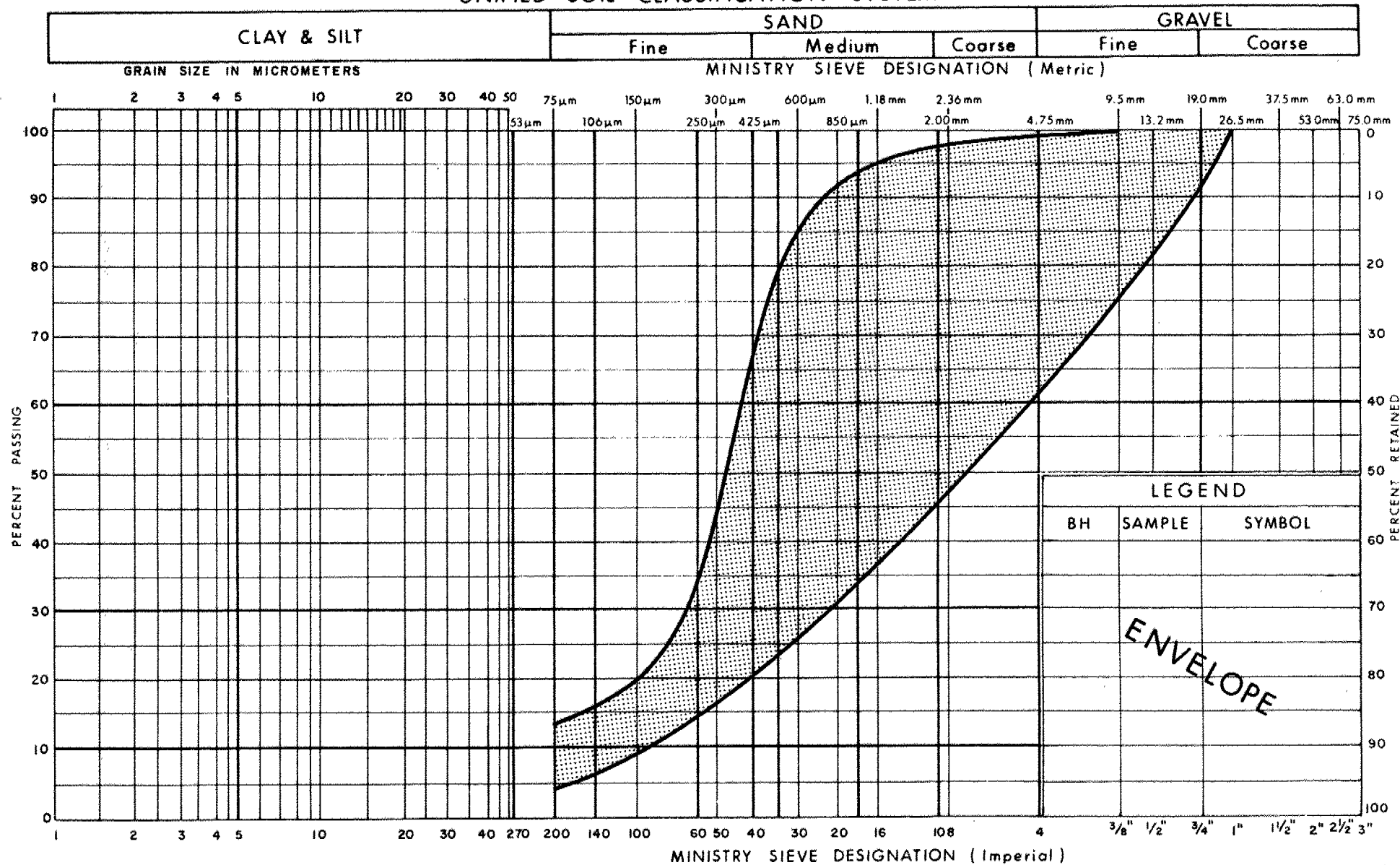


M. Vasavithasan
M. Vasavithasan, P.Eng.
Foundation Engineer

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

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



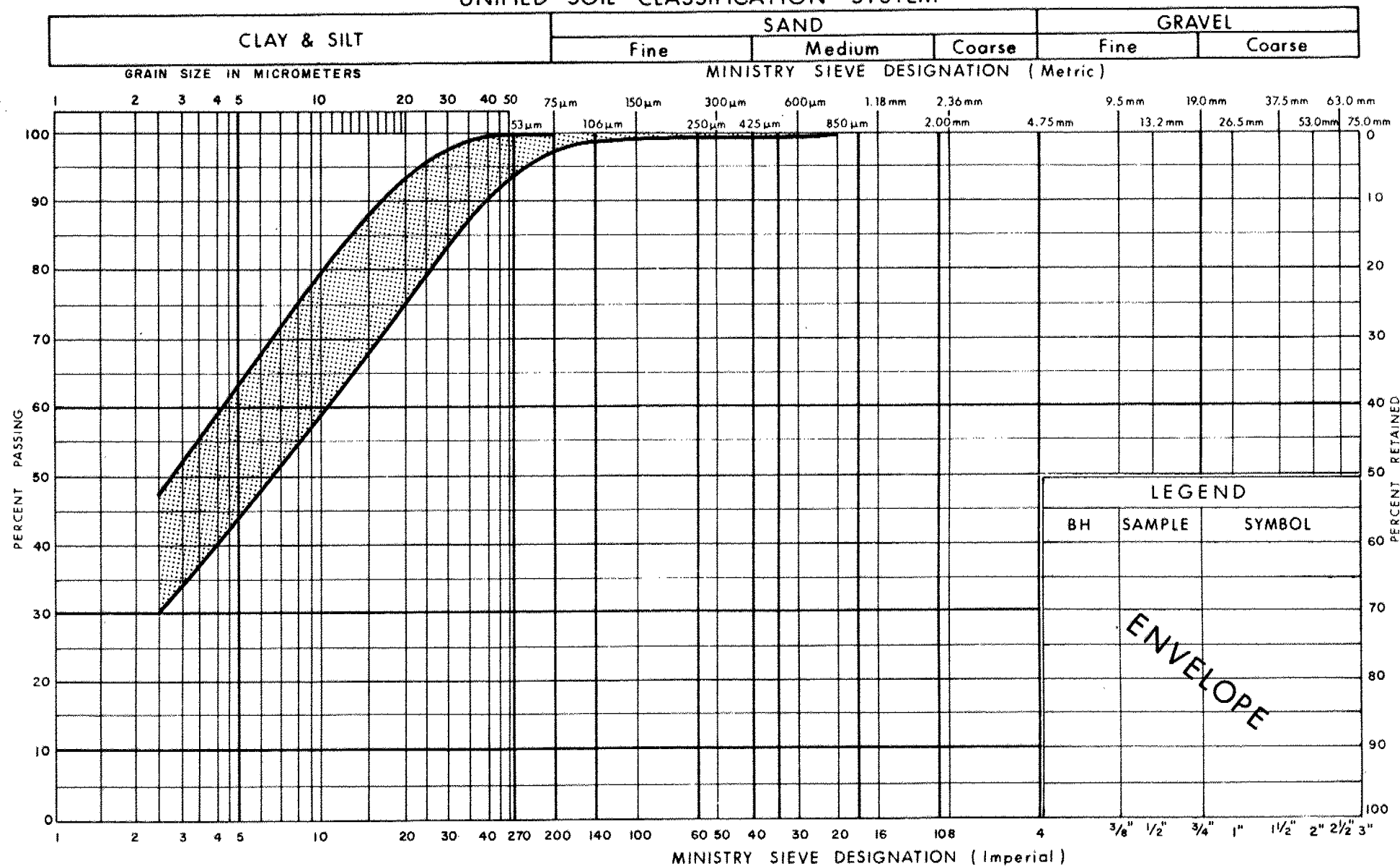
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GRAIN SIZE DISTRIBUTION
SAND, TRACE TO SOME SILT, TRACE TO SOME GRAVEL

FIG No 1

W P 481-89-04

UNIFIED SOIL CLASSIFICATION SYSTEM

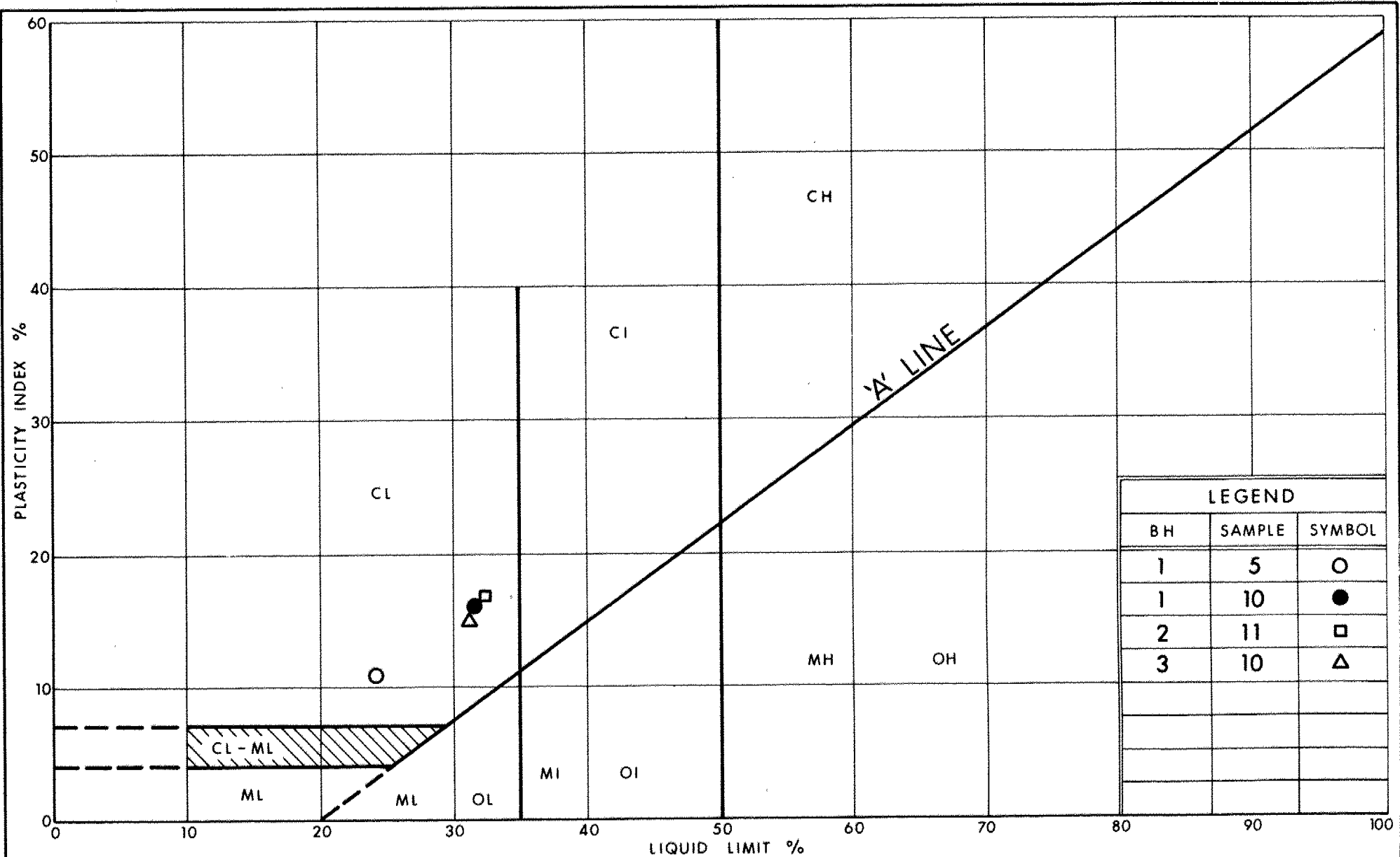


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GRAIN SIZE DISTRIBUTION
CLAYEY SILT, WITH OCC SAND & SILT SEAMS

FIG No 2

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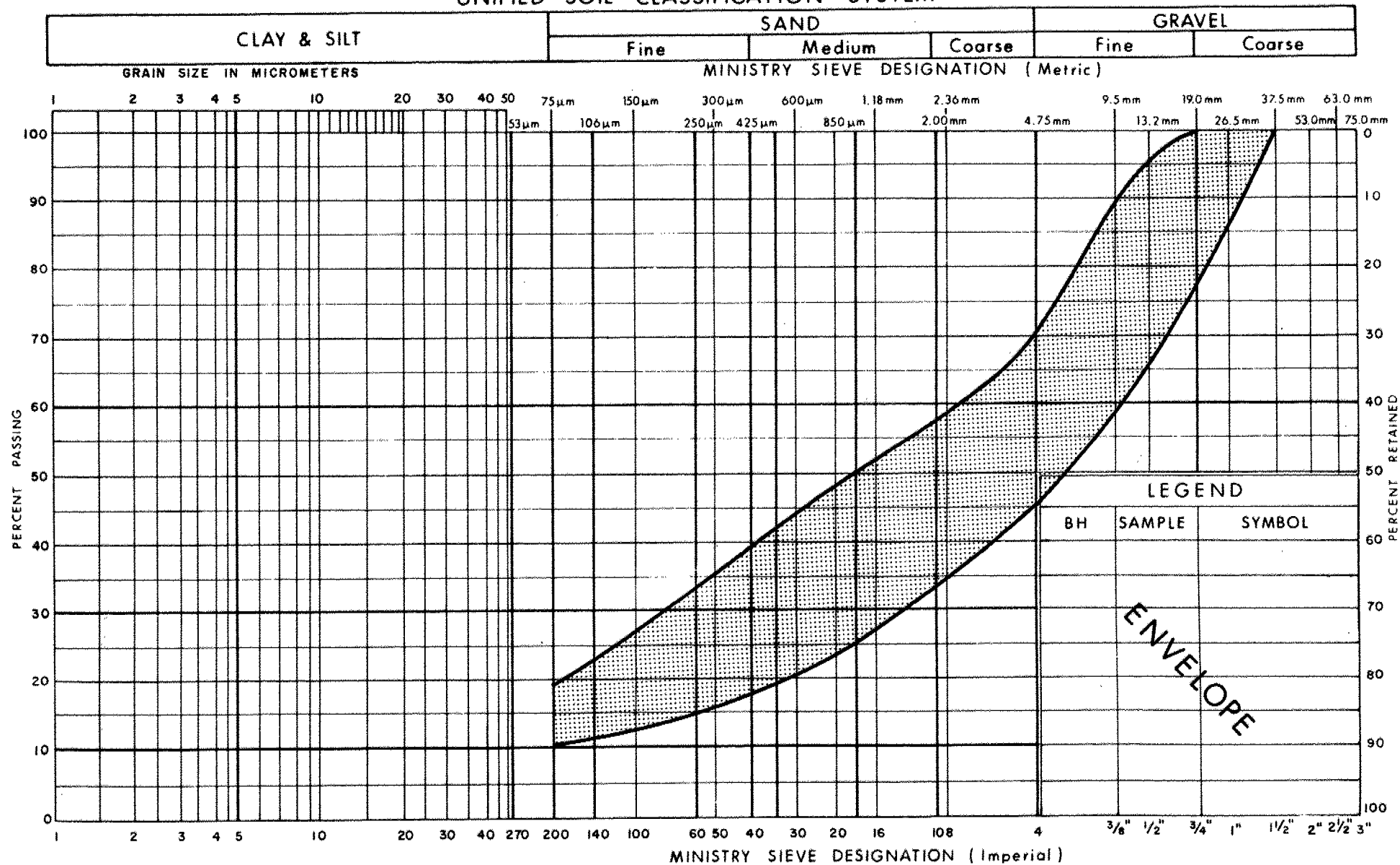
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PLASTICITY CHART CLAYEY SILT, WITH OCC SAND & SILT SEAMS

FIG No 3

W P 481-89-04

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION SAND & GRAVEL, SOME SILT

FIG No 4

W P 481-89-04

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 (RQD), FOR MODIFIED RECOVERY, IS:

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kn/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kn/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kn/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kn/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $\frac{w_L - w_p}{w - w_p}$	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						

ROCK CORE DESCRIPTION **WP 481-89-04**

Page 1 of .1

CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
2	15	14.17-15.70	-	-	14.17-15.70	OVERBURDEN, gravel, cobbles, weathered bedrock.
	16	15.70-17.22	86	0	15.70-17.22	LIMESTONE, light grey to light brownish grey, mottled white; very fine grained, argillaceous partings; weak to medium strong rock; slightly weathered to unweathered; very closely spaced fractures.
4	-	15.85-16.18	-	-	-	OVERBURDEN, weathered bedrock
	14	16.18-16.92	60	0	16.18-19.	LIMESTONE, light grey to light brownish grey, mottled white; very fine grained, argillaceous partings; weak to medium strong rock; slightly weathered to unweathered; very closely spaced fractures.
	15	16.92-18.29	99	9		
	16	18.29-19.20	100	0		

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%

Logged by: SAS, Soils and Aggregates Section.

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 481 - 89 - 04 LOCATION CO-ORDS. N 4 774 818.2; E 203 958.5 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & HOLLOW STEM AUGER COMPILED BY M V
DATUM GEODETIC DATE 90 04 04 & 90 04 05 CHECKED BY P P

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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
285.3	Ground Surface															
284.8	Organic Silt & Clay, Soft															
0.7	Sand And Gravel, Some Silt, Trace of Organics, Compact to Dense		1	SS	13											45 47 (8)
			2	SS	25											
			3	SS	49											
			4	SS	27											33 53 (14)
281.6	Clayey Silt With Intermittent Sand And Silt Seams, Stiff to Very Stiff		5	SS	20											0 2 71 27
			6	SS	12											
			7	SS	17											
			8	SS	10											
			9	SS	12											
			10	SS	17											0 0 62 38
275.1			11	SS	44											
			12	SS	59											38 43 (19)
10.2	Sand And Gravel, Some Silt, Dense to Very Dense		13	SS	96	/15cm										
270.5	Limestone Bedrock															
14.8	Limestone Bedrock															
267.0	Limestone Bedrock															
18.3	End of Borehole															
	Note: Below El: 270.5 Borehole Was Advanced With Bi-Cone															

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 481 - 89 - 04 LOCATION CO-ORDS. N 4 774 830.5; E 203 973.4 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONE TEST, HOLLOW STEM AUGER & BW CASING COMPILED BY M V
DATUM GEODETIC DATE 90 04 05 TO 90 04 09 CHECKED BY P P

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT		UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
285.0	Ground Surface							20 40 60 80 100		W _P W W _L				
0.0	Sand, Some Silt, Some Gravel, Trace of Organics, Compact		1	SS	22		284						24 62 (14)	
			2	SS	20		282							
			3	SS	14									
			4	SS	26									
281.0			5	SS	23									
4.0	Clayey Silt With Intermittent Sand And Silt Seams, Soft to Firm		6	SS	6		280							
			7	SS	1									
			8	SS	7									
			9	SS	7									
			10	SS	11									
			11	SS	8									
274.8	Sand And Gravel, Some Silt, Dense to Very Dense		12	SS	41		274		120/25cm					0 1 57 42
10.1														
			13	SS	80									51 39 (10)
			14	SS	100									
270.8	Boulder & Weathered Bedrock		15	RC	REC		/11cm		272					
14.2													RQD 0%	
	Limestone Bedrock Unweathered		BX	98	270									
													RQD 0%	
267.8			16	RC	REC	268								
			BX	87										
17.2	End of Borehole													

RECORD OF BOREHOLE No 3

1 OF 1 METRIC

W.P. 481 - 89 - 04 LOCATION CO-ORDS. N 4 774 873.6; E 203 947.6 ORIGINATED BY M.V.
 DIST 2 HWY 401 BOREHOLE TYPE CONE TEST, HOLLOW STEM AUGER & BW CASING COMPILED BY M.V.
 DATUM GEODETIC DATE 90 04 09 TO 90 04 11 CHECKED BY P.P.

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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
284.8	Ground Surface																
0.0	Sandy Silt to Clayey Silt Some Gravel, Trace of Organics, Compact/Stiff		1	SS	12		284										
283.4			2	SS	29		282										0 93 (7)
1.4	Sandy Gravel, Some Silt		3	SS	16		280										0 96 (4)
			4	SS	22		278										
			5	SS	24		276										
			6	SS	32		274										
	Sand, Trace of Silt, Compact to Dense		7	SS	32		272										
			8	SS	61												
			9	SS	28												
275.8			10	SS	10												0 0 60 40
9.0	Clayey Silt, Stiff		11	SS	100												54 35 (11)
274.8			12	SS	90												
10.0	Sand And Gravel, Some Silt, Very Dense																
270.6																	
14.2	End of Borehole Probable Bedrock																

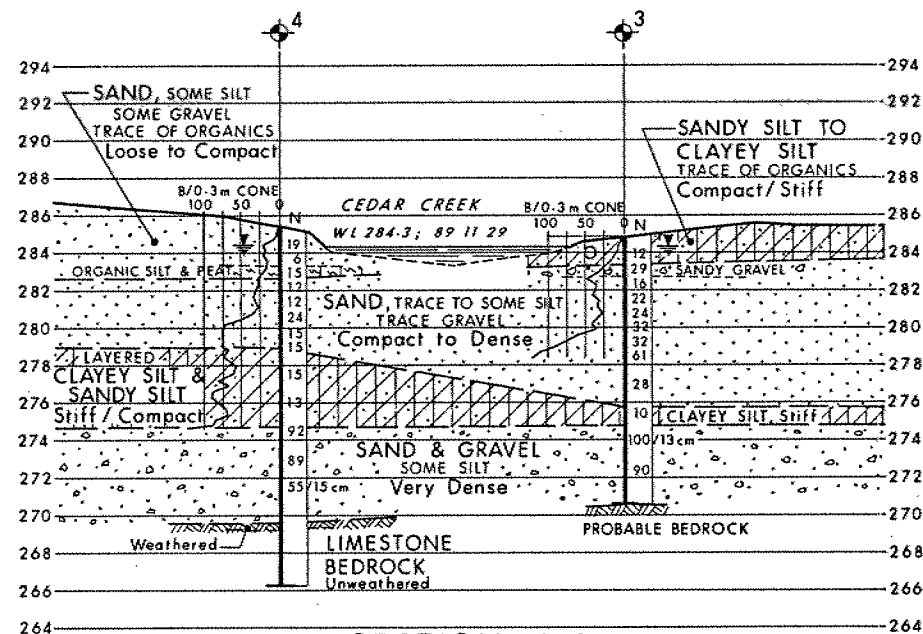
RECORD OF BOREHOLE No 4

1 OF 1

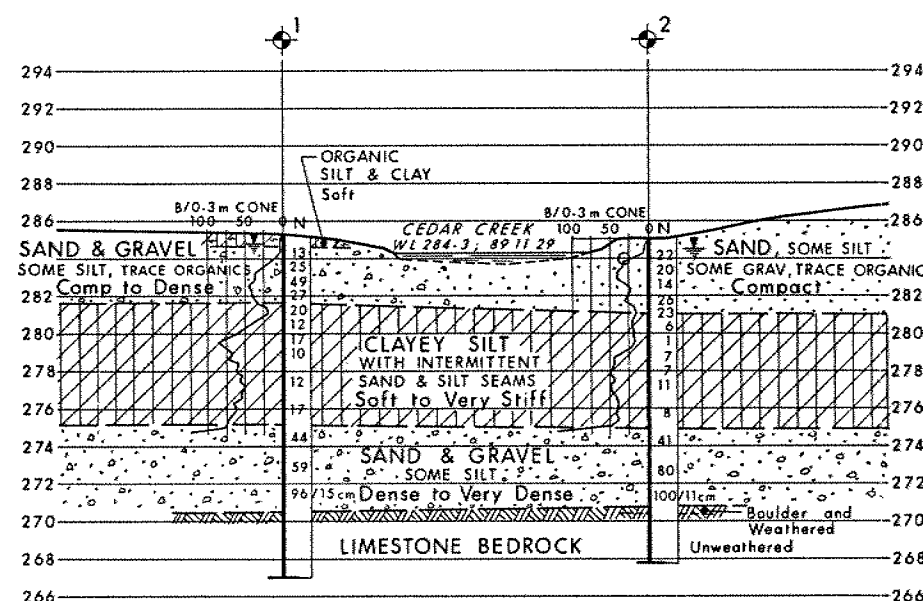
METRIC

W.P. 481 - 89 - 04 LOCATION CO-ORDS. N 4 774 862.6; E 203 933.2 ORIGINATED BY M.V.
 DIST 2 HWY 401 BOREHOLE TYPE CONE TEST, HOLLOW STEM AUGER & BW CASING COMPILED BY M.V.
 DATUM GEODETIC DATE 90 04 11 & 90 04 16 CHECKED BY P.P.

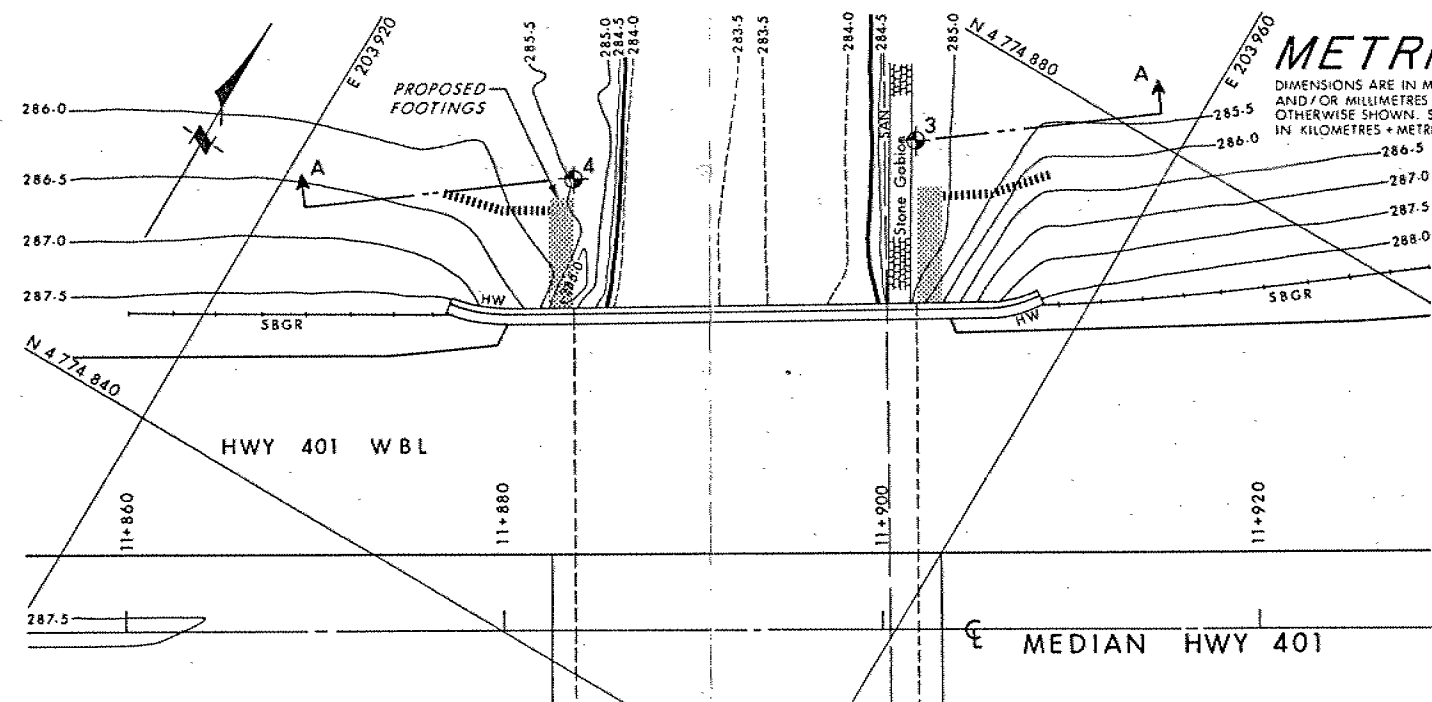
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIMIT MOISTURE CONTENT		UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	
285.4	Ground Surface												
0.0	Topsoil		1	SS	19		284						
	Sand, Some Silt, Some Gravel, Trace of Organics, Loose to Compact		2	SS	6								
282.6	Organic Silt & Peat		3	SS	15								
2.8			4	SS	12		282						
	Sand, Some Silt, Trace of Gravel, Compact		5	SS	12								
			6	SS	24								
			7	SS	15		280						
278.9			8	SS	15								
6.5			9	SS	15		278						
	Layered Clayey Silt And Sandy Silt, Stiff/Compact		10	SS	13		276						
274.7			11	SS	92								
10.7			12	SS	89		274						
	Sand And Gravel, Some Silt, Very Dense		13	SS	55	/15cm	272						31 55 (14)
269.6							270						
15.8	Weathered		14	RC BX	REC 62		268						RQD 0%
	Limestone Bedrock Unweathered		15	RC BX	REC 96								RQD 9%
266.2			16	RC BX	REC 100								RQD 0%
19.2	End of Borehole												



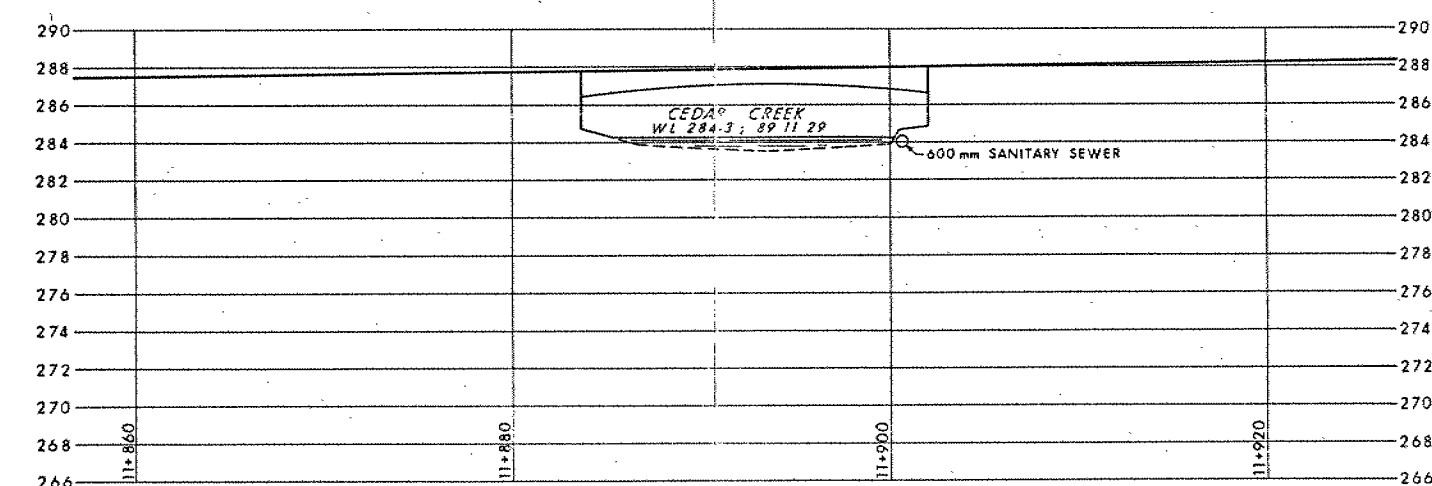
SECTION A-A



SECTION B-B



PLAN



PROFILE HWY 401 MEDIAN

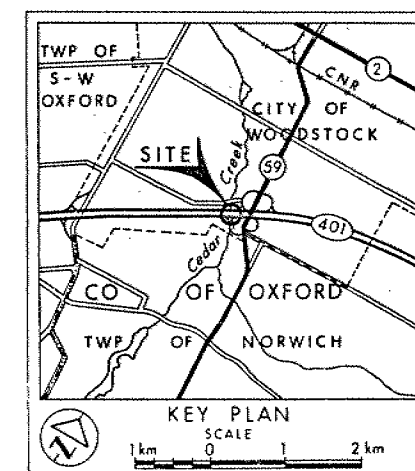
CONT No
WP No 481-89-04

CEDAR CREEK

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 1990 04

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	285.3	4774818.2	203958.5
2	285.0	4774830.5	203973.4
3	284.8	4774873.6	203947.6
4	285.4	4774862.6	203933.2

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			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Geocres No 40P2-44

HWY No 401	DIST 2
SUBMDM V CHECKED BY DATE 1990 06 07	SITE 23-169
DRAWN BY CHECKED BY	DWG 4818904-A