

DOCUMENT, MICROFILMING IDENTIFICATION

GEOCRES No. 40P2-50

DIST. 2 REGION _____

W.P. No. 479-89-01

CONT. No. 92-06

W. O. No. _____

STR. SITE No. _____

HWY. No. 401

LOCATION Hwy 401 & Culboden Rd
H.M.L.

No of PAGES - 1

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS: _____

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ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 479-89-01 DIST 2
HWY 401 STR SITE N/A

High Mast Lighting
Highway 401 and Culloden Road Interchange

CONT 92-06

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FOUNDATION INVESTIGATION REPORT
For
High Mast Lighting
Highway 401 and Culloden Road Interchange
W.P. 479-89-01, Highway 401
District 2, London

INTRODUCTION

This report contains the results of a soil investigation carried out at the above mentioned site to provide information for the design and construction of the proposed high mast light poles.

The fieldwork for this project was carried out between 91 08 26 and 91 08 28, and comprised of eight sampled boreholes and Dynamic Cone Penetration Test adjacent to these holes.

All the boreholes, with the exception of BH 5, were advanced at the proposed pole locations. However, the boring for pole No. 5 was carried out 5 m northeast of the original location to avoid underground service. Boreholes were advanced to a maximum depth of 14.2 m (Elevation 272.2 m) below the existing ground level using a continuous flight hollow stem auger. However, Dynamic Cone Penetration Test was carried out to a maximum depth of 17.8 m.

SITE DESCRIPTION

The site under investigation is located at the crossing of Highway 401 and Culloden Road in the Township of Southwest Oxford.

The topography of the site, with the exception of the existing crossing (embankment fill) is generally undulating with ridges to the east and northwest.

The ridges are moraines of calcareous clay or silty clay while in the valley, it is common to find alluvium of gravel, sand or silt. Physiographically the area is located in the region known as the "Mount Elgin Ridges".

SUBSURFACE CONDITIONS

General

The extent of the area investigated covers more than 800 m in length and 500 m in width. The subsoil conditions encountered at this site varies from location to location and it is not practical to give detail description for the individual strata. Reference should be made to the Record of Borehole sheets where details of the stratification at a particular boring location are given. However, for classification purposes, the soils encountered at this site can be divided into seven different zones.

- a) Fill
- b) Silty Sand to Sandy Silt Trace/Some Gravel
- c) Gravelly Sand, Trace of Silt
- d) Organic Silt
- e) Clayey Silt to Silty Clay
- f) Sandy Gravel
- g) Sand, Trace of Silt

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. The Gradation Test results for sandy or silty material are shown on Figure No.s 1, 2, 3 & 4. The results of the Atterberg Limit Test carried out on clayey soils are shown on Figure No.'s 5 & 6. The location of the boreholes are shown on Drawing No. 4798901-A.

Groundwater Conditions

The groundwater level measurements were taken in open boreholes during investigation and was observed about 1.9 m to 6.0 m (Elevation 285.3 m to 281.7 m) below the existing ground level. The groundwater level at each borehole is as follows:

<u>Borehole No.</u>	<u>Elevation</u>	<u>Remarks</u>
1	283.3	Water level after 24 hours
2	284.5	Water level after 24 hours
3	-	Dry on Completion
4	285.3	Water level after 24 hours
5	282.4	Water level after 3 hours
6	281.7	Water level after 24 hours
7	283.1	Water level after 4 hours
8	282.8	Water level after 1 hour

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to construct eight high mast light poles within the Hwy. 401 and Culloden Road interchange. The location of poles are as follows:

High Mast Pole No.	Station	Location	Ground Elevation
1	14+017	42.0 m Rt. Hwy. 401	285.9
2	14+180	40.0 m Rt. Hwy. 401	286.4
3	10+228	24.0 m Rt. Culloden Rd.	291.1
4	14+328	50.0 m Rt. Hwy. 401	287.3
5	14+491	50.0 m Lt. Hwy. 401	287.0
6	9+754	20.0 m Lt. Culloden Rd.	287.7
7	14+647	43.0 m Lt. Hwy. 401	287.1
8	14+813	43.0 m Lt. Hwy. 401	287.7

Foundation Design

The design of the foundation for the high mast light poles (single concrete caisson) should be in accordance with the method as outlined in the following papers.

Broms, B.B. "Lateral Resistance of Piles in Cohesive soil" Journal of the Soil Mechanics and Foundation Division. ASCE Vol. 90 No. SM2, paper 3285, March 1964.

Broms, B.B. "Lateral Resistance of Piles in Cohesionless Soil" Journal of the Soil Mechanics and Foundation Division, ASCE Vol. 90 No. SM3, paper 3909, May 1964.

The design parameters are given in Table 1 appended to this report. The material located within the zone of frost penetration (1.2 m) should be neglected in the calculation of lateral resistance.

The "sand boiling" due to unbalanced hydrostatic condition was encountered at the following borehole locations. The borehole locations and the elevations at which sand boiling encountered are as follows:

<u>Borehole No.</u>	<u>Elevation</u>
1	277
2	274
5	279
6	278.5
7	279

The high groundwater level and the sandy material encountered at this site may impose greater construction difficulties. However, bentonite slurry could be used to counterbalance the hydrostatic forces and to prevent soil from caving.

Considering the construction difficulties, it is advisable, if the embedment length of the caissons at these locations are limited to the elevations indicated above and the diameter of the caissons may be increased to mobilize adequate lateral resistance. However, if the tip of the caissons are located above these depths, liner and tremie concreting may be required for the construction of the caissons. If the founding level of the caissons are proposed to be located below the elevations indicated above, bentonite slurry and tremie concreting may have to be utilized for the construction of the caissons.

MISCELLANEOUS

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



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M. Devata
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Chief Foundation Engineer

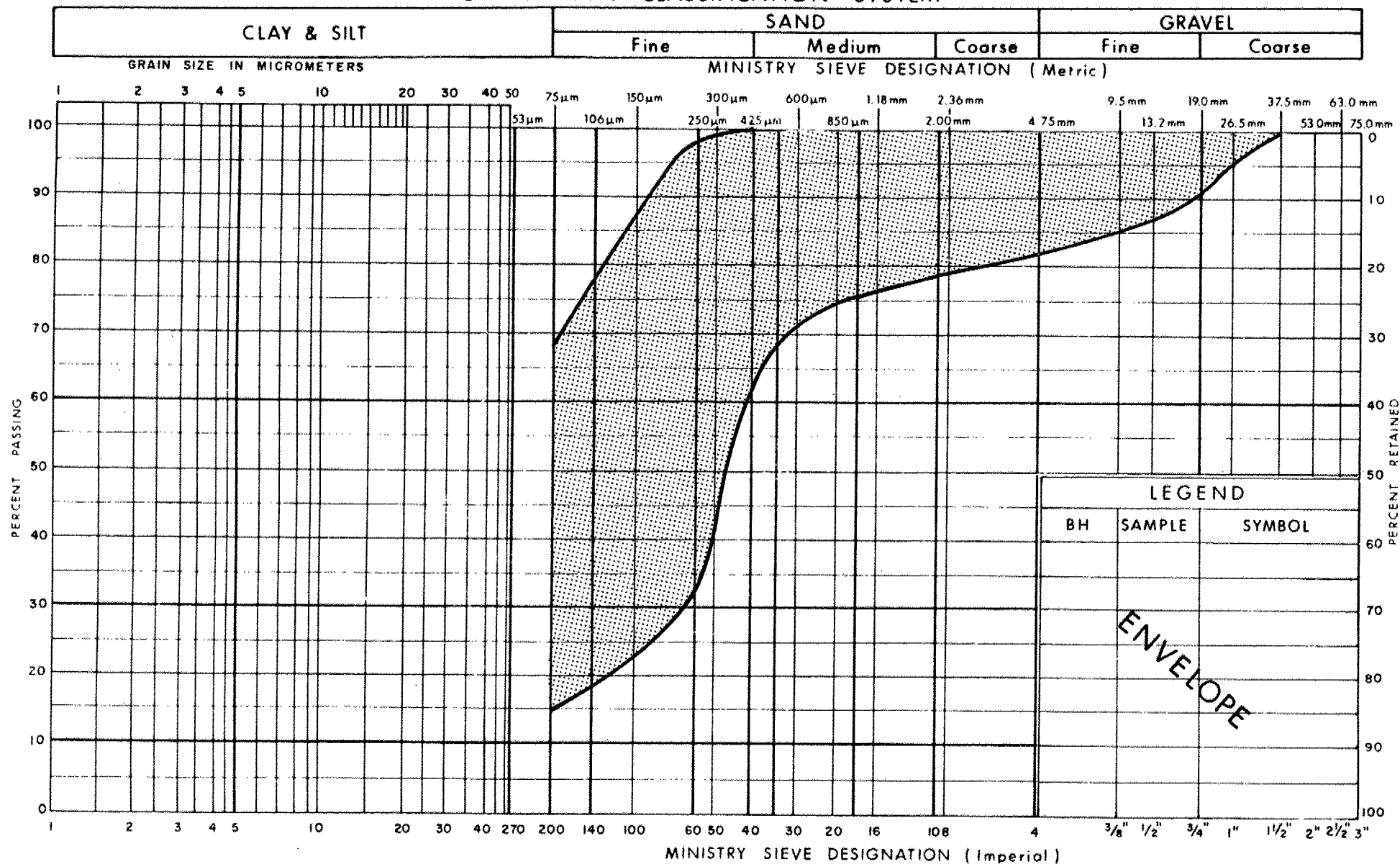
Table 1

High Mast Pole No.	Soil Boundary	Soil Type	Design Parameters		
			ϕ	q_u (kPa)	γ (kN/m ³)
1	285.9-284.5	Fill			
	284.5-278.4	Cohesionless	32°	-	18.5
	278.4-276.3	Cohesionless	30°	-	18.0
2	286.4-281.8	Organic Silt	-	-	-
	281.8-274.5	Cohesionless	30°	-	18.0
	274.5-272.2	Cohesionless	34°	-	19.0
3	291.1-290.4	Fill	-	-	-
	290.4-289.0	Cohesionless	28°	-	17.5
	289.0-281.9	Cohesionless	36°	-	21.0
4	287.3-286.5	Cohesionless	28°	-	17.5
	286.5-285.9	Cohesive	-	100	18.0
	285.9-277.7	Cohesionless	30°	-	18.0
5	287.0-285.9	Cohesionless	28°	-	17.5
	285.9-283.7	Cohesive	-	120	18.5
	283.7-279.5	Cohesionless	30°	-	18.5
	279.5-278.5	Cohesionless	36°	-	21.0
6	287.7-286.6	Cohesionless	28°	-	17.5
	286.6-278.3	Cohesionless	34°	-	19.0
7	287.1-285.0	Cohesionless	26°	-	17.0
	285.0-284.5	Cohesive	-	100	18.0
	284.5-280.9	Cohesionless	34°	-	19.0
	280.9-278.1	Cohesionless	36°	-	21.0
8	287.7-286.3	Cohesionless	26°	-	17.0
	286.3-284.3	Cohesive	-	100	18.0
	284.3-276.1	Cohesionless	32°	-	18.5

Note: q_u = Unconfined Compressive Strength (kPa)
 γ = Bulk Unit Weight (kN/m³)
 ϕ = Angle of Internal Friction

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



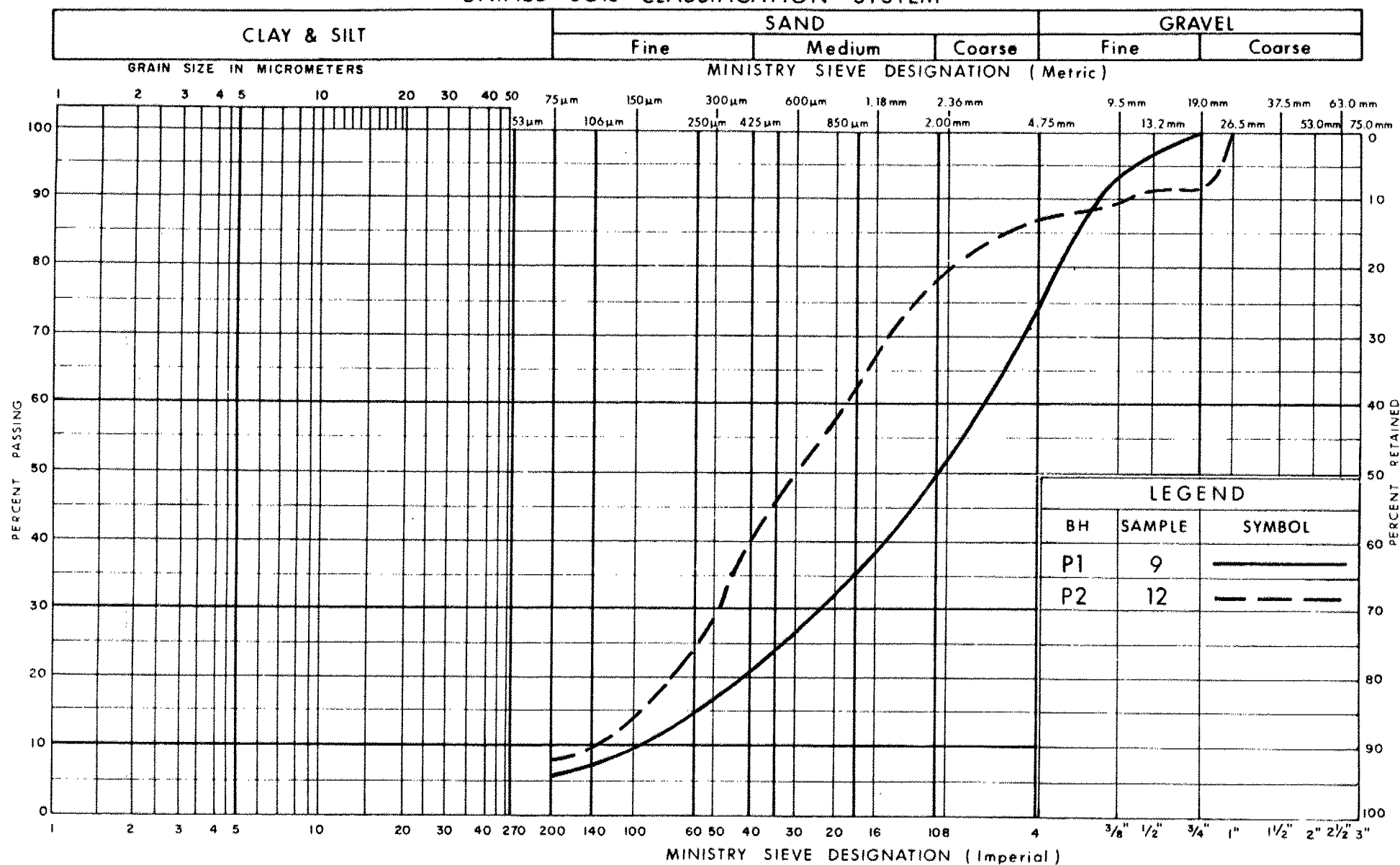
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Transportation

GRAIN SIZE DISTRIBUTION
SILTY SAND TO SANDY SILT
TRACE / SOME GRAVEL

FIG No 1

W P 479 - 89 - 01

UNIFIED SOIL CLASSIFICATION SYSTEM



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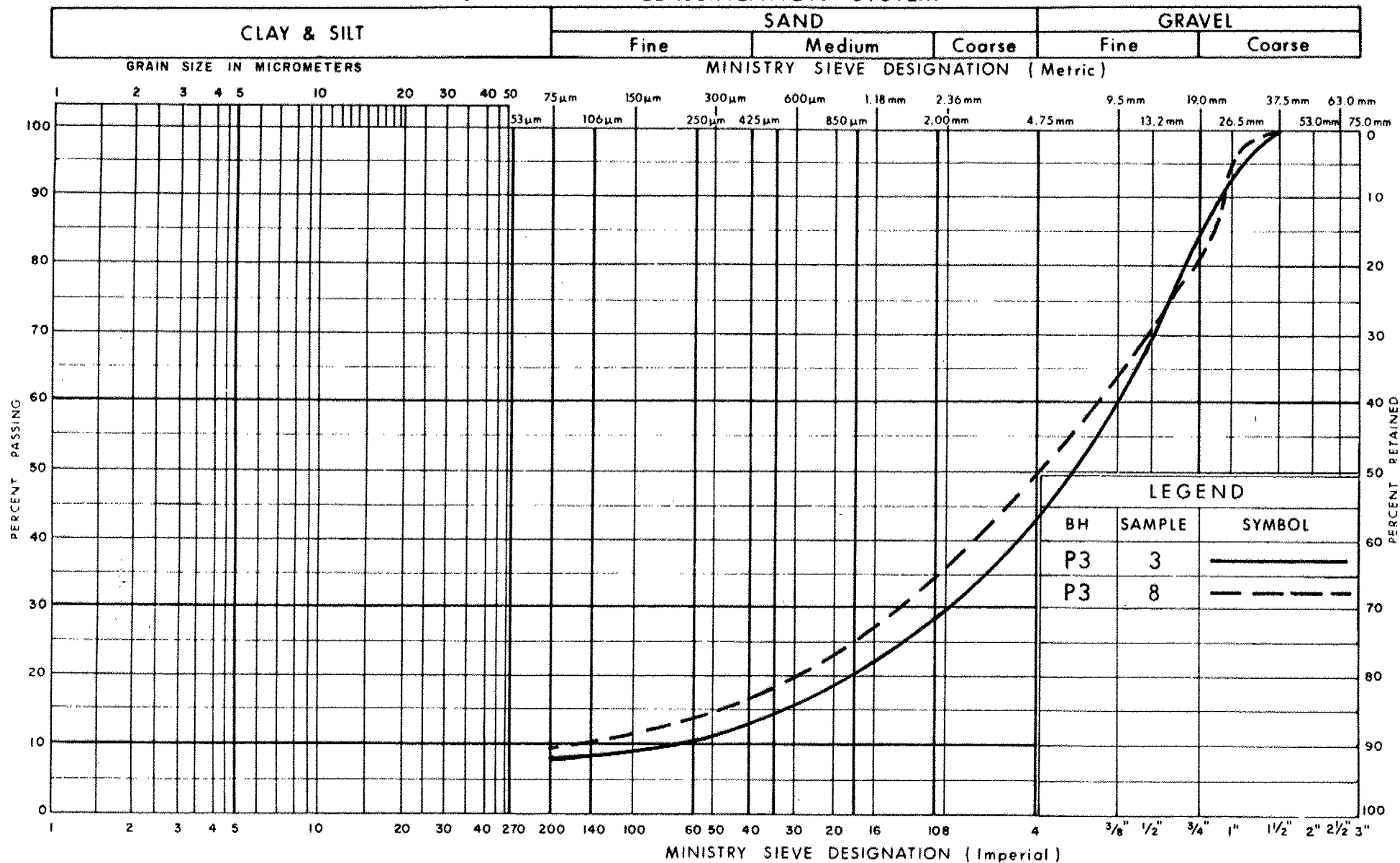
GRAIN SIZE DISTRIBUTION

GRAVELLY SAND, TRACE OF SILT

FIG No 2

W P 479-89-01

UNIFIED SOIL CLASSIFICATION SYSTEM



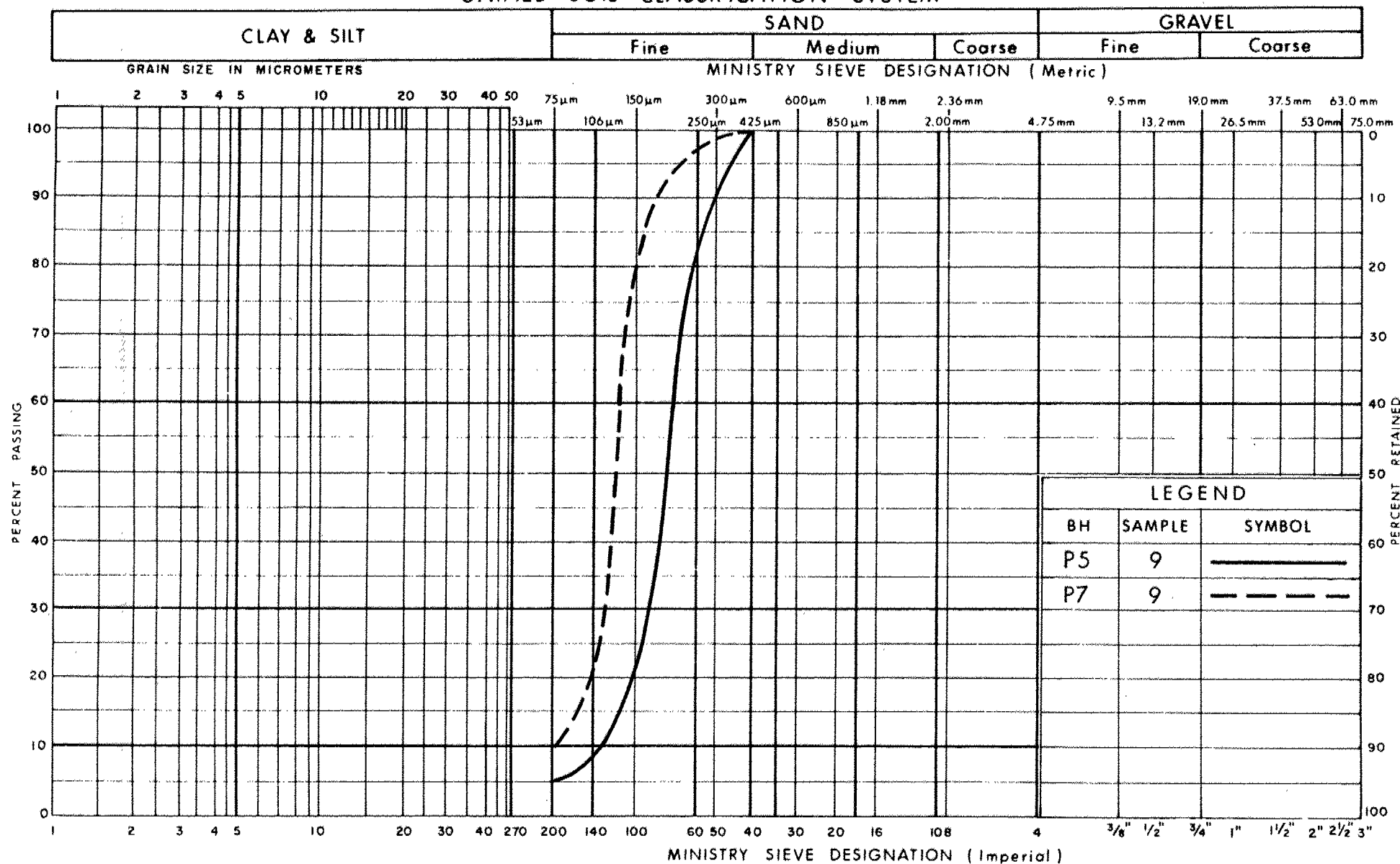
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SANDY GRAVEL, TRACE OF SILT, COBBLES

FIG No 3

W P 479 - 89 - 01

UNIFIED SOIL CLASSIFICATION SYSTEM



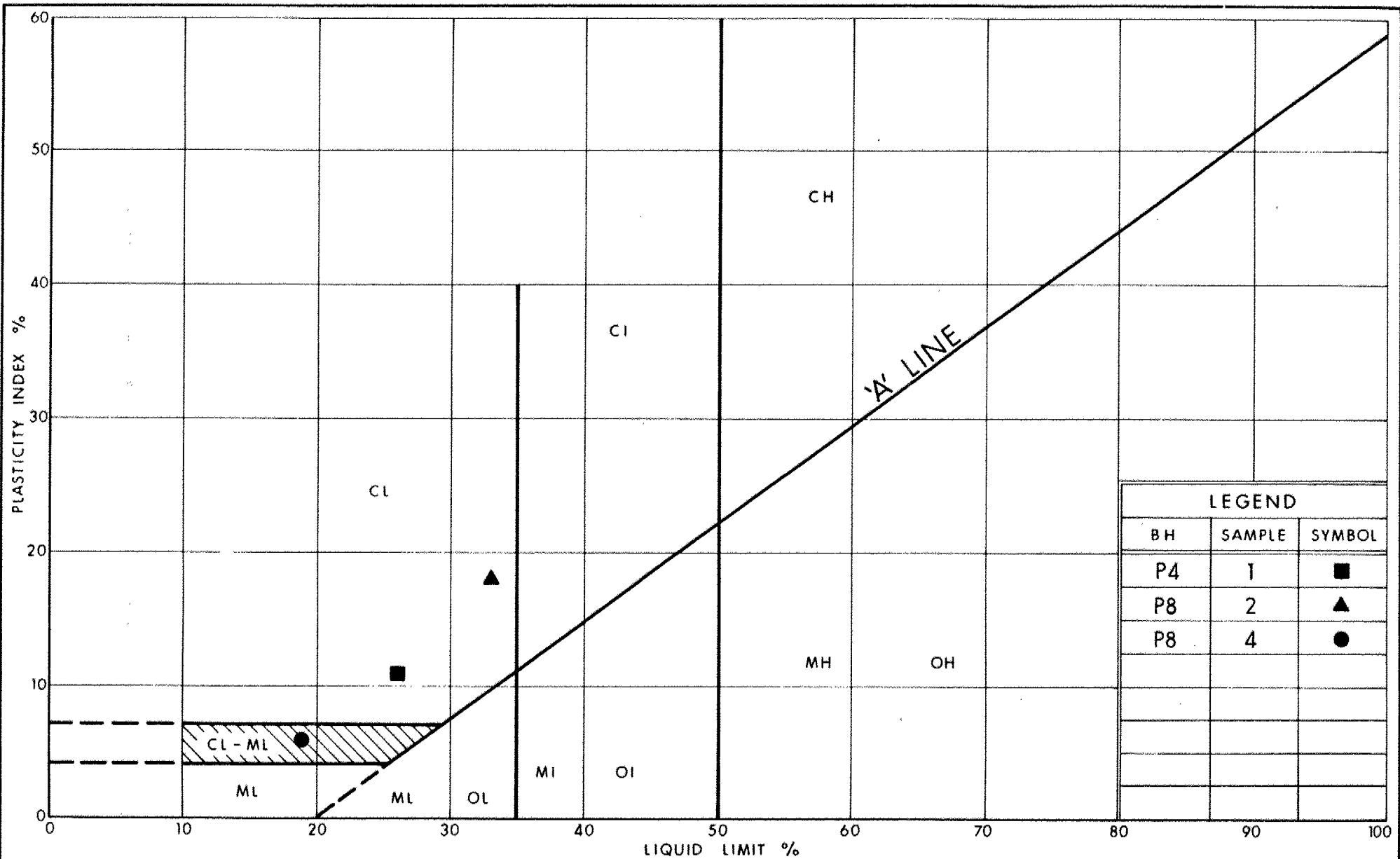
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

SAND, TRACE OF SILT

FIG No 4

W P 479 - 89 - 01



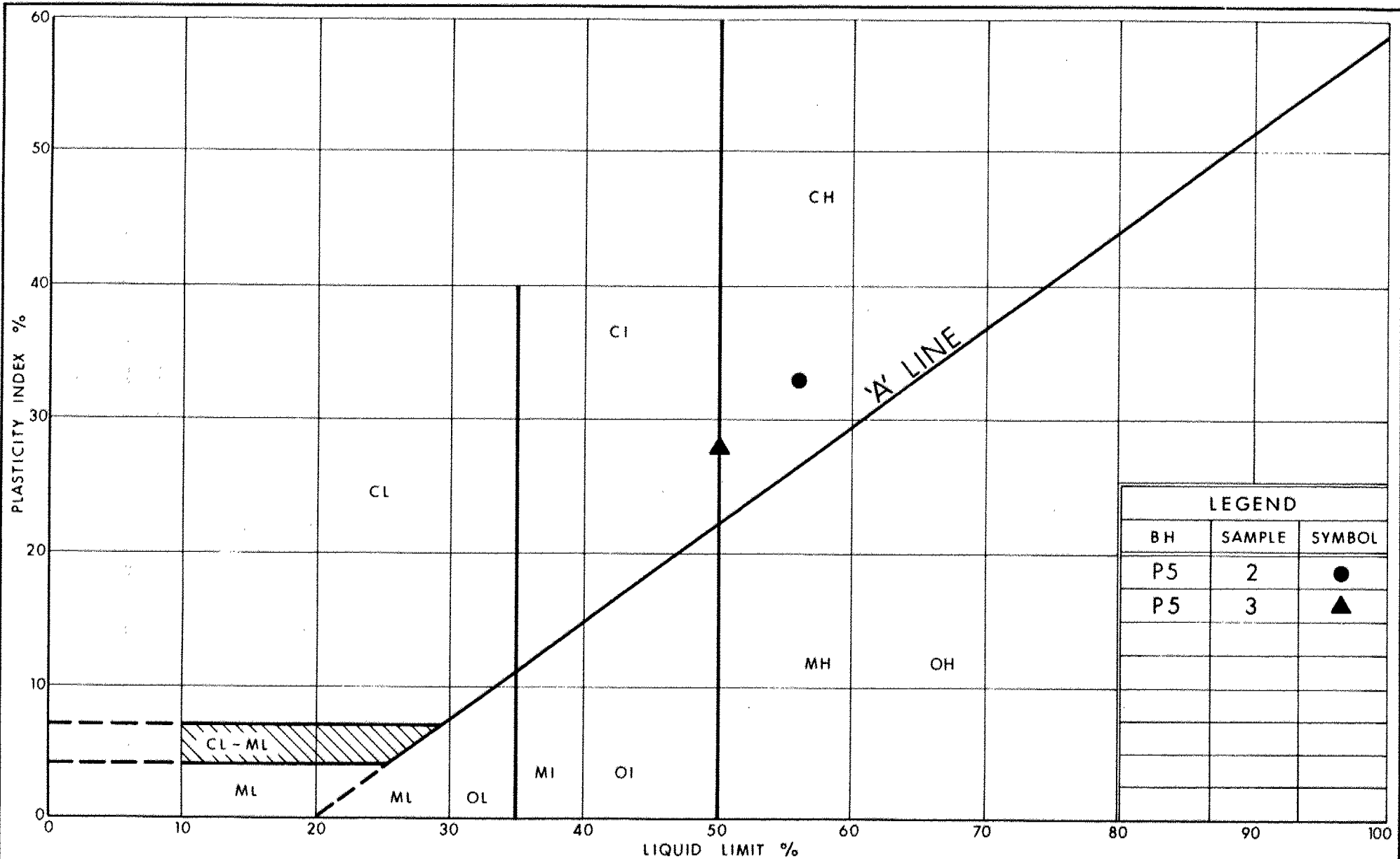
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Transportation

Ontario

PLASTICITY CHART CLAYEY SILT

FIG No 5

W P 479-89-01

Ministry of
Transportation

Ontario

PLASTICITY CHART
CLAY TO SILTY CLAY

FIG No 6

W P 479-89-01

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	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'_{v0}	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_f	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 = $w_L - w_p$	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						

RECORD OF BOREHOLE No P1

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 028; E 192 213 ORIGINATED BY M V

DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V

DATUM GEODETIC DATE 91 08 27 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
285.9	Ground Surface													
0.0	SANDY SILT, Some Gravel, Trace of Organics, Compact, (Fill)		1	SS	11									
284.5			2	SS	8									
1.4			3	SS	11									
			4	SS	18									
	SILTY SAND to SANDY SILT, trace of Gravel, Loose to Compact		5	SS	22									
			6	SS	21									
			7	SS	24									
			8	SS	22									
278.4														
7.5			9	SS	12									
	GRAVELLY SAND, Trace of Silt, Compact													
276.3			10	SS	1									
9.6	End of Borehole													
	Probable GRAVELLY SAND, Trace of Silt													
273.1														
12.8	End of Cone Test													
	Note: Water Level 24 Hours After Completion of Drilling													

RECORD OF BOREHOLE No P2

1 OF 2

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 134; E 192 337 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
DATUM GEODETIC DATE 91.08.27 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
285.4	Ground Surface													
0.0	ORGANIC SILT, Some Sand, Trace of Gravel, Occasional Layers of Peat and Partially Decomposed Timber, Soft to Very Soft		1	SS	7		286							
			2	SS	4		285							
			3	SS	4		284							
			4	SS	3		283							
			5	SS	2		282							
281.8	SANDY SILT to SILTY SAND, Trace of Gravel, Loose to Compact		6	SS	3		281							6 44 (50)
4.6			7	SS	10		280							
			8	SS	6		279							
			9	SS	22		278							
			10	SS	30		277							
			11	SS	21		276							0 3 (97)
274.5	GRAVELLY SAND, Trace of Silt, Compact		12	SS	-		275							13 79 (8)
11.9			13	SS	-		274							
							273							
272.2	End of Borehole						272							
14.2														
271.2														

15.2

Continued

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No P2

2 OF 2

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 134; E 192 337 ORIGINATED BY M V
 DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
 DATUM GEODETIC DATE 91 08 27 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80	100
271.2	Continued	[Strat Plot]					271										
15.2							270										
268.6							269										
17.8	End of Cone Test																
	* Note: Water Level 24 Hours After Completion of Drilling																

RECORD OF BOREHOLE No P3

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 090; E 192 493 ORIGINATED BY M V
 DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
 DATUM GEODETIC DATE 91 08 26 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
291.1	Ground Surface													
0.0	SAND, With Gravel, Some Silt, Compact, (Fill)					DRY *								
290.4	Organics													
0.7	SILTY SAND, Trace of Gravel, Compact		1	SS	14		290							
			2	SS	12									
289.0							289							
2.1			3	SS	57									
			4	SS	88									
			5	SS	71	/15cm	288							
			6	SS	80	/13cm								
			7	SS	76	/10cm	286							
	SANDY GRAVEL, Trace of Silt, Cobbles, Very Dense		8	SS	107		285							56 36 (8)
			9	SS	81		284							
							283							
281.8							282							50 41 (9)
9.2	End of Borehole													
	Note: Borehole Dry on Completion													

RECORD OF BOREHOLE No P4

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 220; E 192 458 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
DATUM GEODETIC DATE 91 08 26 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
287.3	Ground Surface												
0.0	Topsoil												
286.5	SANDY SILT, Trace of Gravel, Loose												
0.8	CLAYEY SILT, Tr. of Sand, Tr. of Gravel, Stiff		1	SS	10								
285.9													
1.4			2	SS	22								
			3	SS	12								
			4	SS	31								
			5	SS	16								
			6	SS	16								
			7	SS	21								
			8	SS	25								
			9	SS	26								
			10	SS	17								
277.7													
9.6	End of Borehole												
	Note: Water Level 24 Hours After Completion of Drilling												

RECORD OF BOREHOLE No P5

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 402; E 192 519 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
DATUM GEODETIC DATE 91 08 28 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
287.0	Ground Surface												
0.0	SANDY SILT, Some Gravel, Trace of Organics, Loose to Compact		1	SS	16								
285.9			2	SS	16								
1.1	CLAY to SILTY CLAY, Some Sand, Trace of Gravel, Stiff to Very Stiff		3	SS	10								
283.7			4	SS	9								
3.3	SILTY SAND to SANDY SILT, Trace of Gravel, Compact		5	SS	13								
			6	SS	20								
			7	SS	2								
			8	SS	24								
279.5													
7.5	SAND, Trace of Silt, Very Dense		9	SS	90								
278.9													
8.1	End of Borehole												
278.5													
8.5	End of Cone Test												
	Note: Water Level 3 Hours After Completion of Drilling												

RECORD OF BOREHOLE No P6

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 562; E 192 475 ORIGINATED BY M V
 DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
 DATUM GEODETIC DATE 91 08 27 CHECKED BY P P

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 × 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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
287.7	Ground Surface											
0.0	SANDY SILT, Some Gravel, Trace of Organics, Compact		1	SS	14		287					
266.6			2	SS	19		286					7 56 (37)
1.1			3	SS	18		285					
			4	SS	37		284					
			5	SS	44		283					
	SILTY SAND, Some Gravel, Compact to Dense		6	SS	44		282					
			7	SS	46		281					
			8	SS	24		280					18 67 (15)
			9	SS	85		279					
278.6												
9.1	End of Borehole											
278.3												
9.4	End of Cone Test							120/25cm				
	Note: Water Level 24 Hours After Completion of Drilling											

RECORD OF BOREHOLE No P7

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 496; E 192 643
 DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER
 DATUM GEODETIC DATE 91 08 28

ORIGINATED BY M V

COMPILED BY M V

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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
287.1	Ground Surface													
0.0	SAND With Gravel, Some Silt, Loose to Very Loose (Fill)		1	SS	10									
285.0			2	SS	3									
2.1 284.5	CLAYEY SILT, Some Sand, Stiff		3	SS	10									
2.6			4	SS	25									
	SILTY SAND, Some Gravel, Compact to Dense		5	SS	42									
			6	SS	36									
			7	SS	28									
280.9			8	SS	30									
6.2	SAND, Trace of Silt, Dense to Very Dense		9	SS	61									
279.0														0 90 (10)
8.1	End of Borehole Probable SAND													
278.1														
9.0	End of Cone Test													
	Note: Water Level 4 Hours After Completion of Drilling													

RECORD OF BOREHOLE No P8

1 OF 1

METRIC

W.P. 479 - 89 - 01 LOCATION CO - ORDS. N 4 764 602; E 192 771 ORIGINATED BY M.V.
DIST 2 HWY 401 BOREHOLE TYPE CONE TEST & CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M.V.
DATUM GEODETIC DATE 91 08 28 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	20 40 60 80 100					
287.7	Ground Surface													
0.0	SANDY SILT, Trace of Gravel, Loose		1	SS	6		287							
286.3			2	SS	10		286							
1.4	CLAYEY SILT, Occasional Silt & Sand Seams, Stiff to Very Stiff		3	SS	16		285							
284.3			4	SS	15		284							
3.4			5	SS	22		283							
			6	SS	11		282							
			7	SS	9		281							
			8	SS	16		280							
	SILTY SAND to SANDY SILT, Trace of Gravel, Loose to Compact		9	SS	18		279							
			10	SS	32		278							
			11	SS	25		277							
276.6														
11.1	End of Borehole													
276.1														
11.6	End of Cone Test													
	Note: Water Level 1 Hour After Completion of Drilling													

METRIC

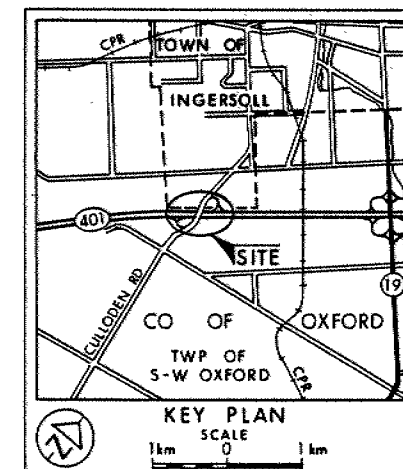
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES.

CONT No
WP No 479-89-01

HWY 401 & CULLODEN ROAD
HIGH MAST LIGHTING
BORE HOLE LOCATIONS



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)
- W L at time of investigation 1991 08

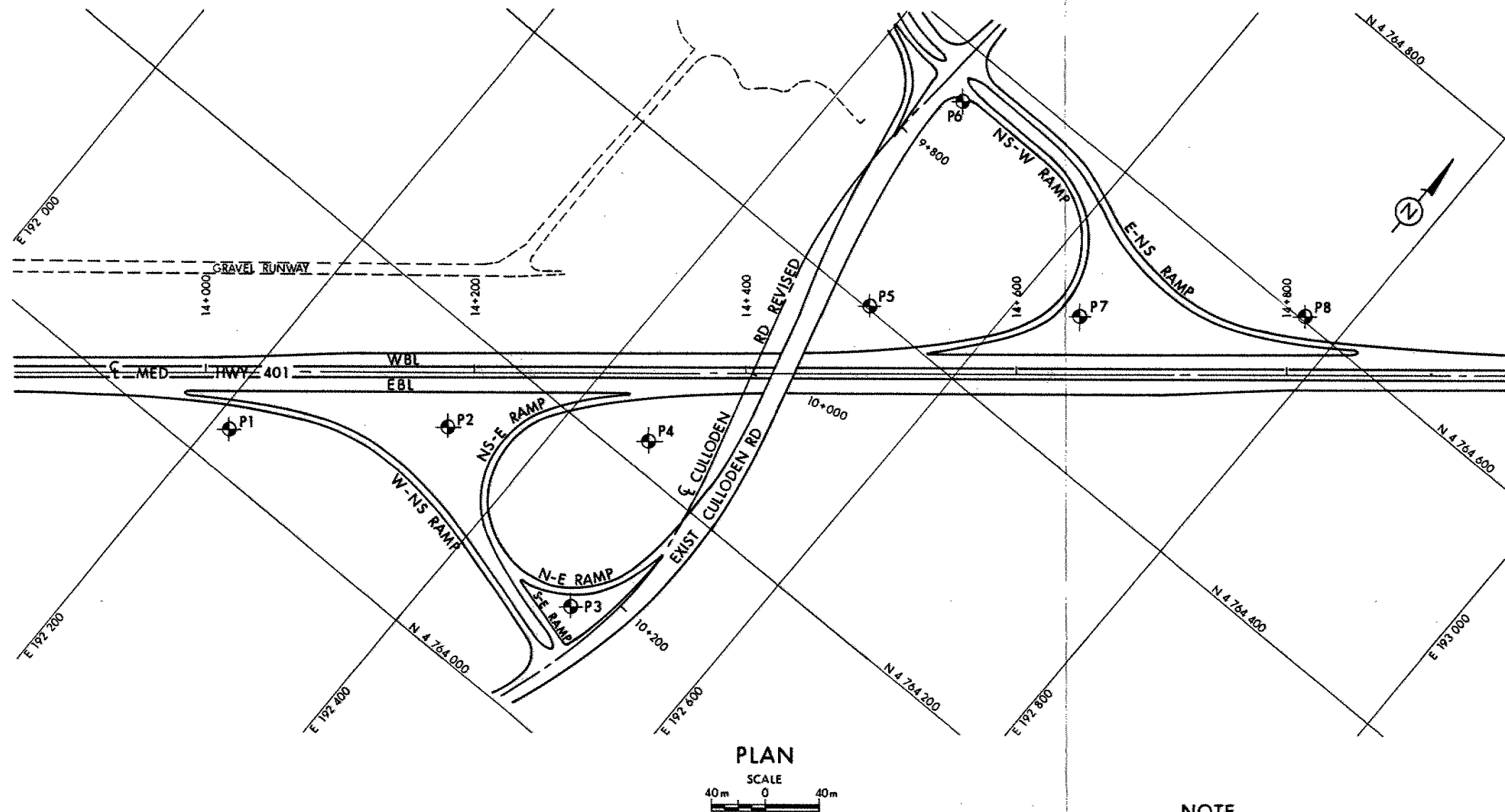
No	ELEVATION	CO-ORDINATES NORTH	EAST
P1	285.9	4 764 028	192 213
P2	286.4	4 764 134	192 337
P3	291.1	4 764 090	192 493
P4	287.3	4 764 220	192 458
P5	287.0	4 764 402	192 519
P6	287.7	4 764 562	192 475
P7	287.1	4 764 496	192 643
P8	287.7	4 764 602	192 771

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 40P2-50			
HWY No	401	DIST	2
SUBMD	MY	CHECKED	9
DATE	1991 09 19	SITE	
DRAWN	RS	CHECKED	01
APPROVED		DWG	4798901-A



NOTE

For Soil details refer to
Record of Borehole Sheets.