

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 421-92-01

DIST 2

HWY -

STR SITE -

Sanitary Trunk Sewer and
Restoration of Interchange Ramps
Bradley Avenue/Highbury Avenue Interchange

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FOUNDATION INVESTIGATION REPORT
For
Sanitary Trunk Sewer and
Restoration of Interchange Ramps
Bradley Avenue/ Highbury Avenue Interchange
W.P. 421-92-01
District 2, London

INTRODUCTION

This report summarizes the information obtained from the foundation investigation carried out for the above-mentioned project during the period of March 29 to April 21, 1993.

Twelve boreholes (BH No.'s 93-1 to 93-12) were advanced and sampled by means of hollow stem augers with conventional cone penetration and MTO vane tests. These boreholes extended to depths between 11.1 and 23.3 metres below the existing ground surface.

This report contains factual information obtained from this investigation pertaining to sanitary sewer foundations, restoration of interchange ramps and related earthworks as shown on Drawing No. 4219201-A.

BACKGROUND

During the construction of the N-E/ W ramp at Bradley Avenue/ Highbury Avenue (formerly Hwy. 126) interchange (refer to Contract 90-13), a large settlement of the sanitary sewer near Manhole no. 33 and the failure of ramp fills occurred. Site investigations by the Foundation Design Section revealed insufficient removal of swamp material (Refer to our memos of September 18, 1991 and October 22, 1990). Twenty six boreholes (BH #401 to BH #424) were put down at locations shown on Figure 1 and 1A in our previous Report

No. W.P. 421-92-00 (September, 1992). Remedial work recommended by this section was carried out at that time.

Upon completion of the Bradley Avenue/Highbury Avenue interchange construction, the area was transferred to the City of London.

MTO Construction Office has been monitoring the settlement in this area over the past 2½ years. The monitoring results indicate some 260 mm of settlement of Manhole No. 33.

The City of London has conducted a video examination of the sanitary sewer between Manhole No. 32 and Manhole No. 38. The video shows some high water level in 750 mm sanitary sewer between Manhole No. 32 and Manhole No. 34, and between Manhole No. 36 and Manhole No. 37. Based on the above examination, the City of London expressed their concern regarding the on-going settlement of the ramp and potential failure of the sanitary sewer.

The Ministry of Transportation has retained Delcan to investigate the problem and devise alternative solutions for the repair of the sewer, along with a recommendation as to the most appropriate solution. Few meetings were held to review the alternatives proposed by Delcan.

In the meeting at Delcan Office in London on February 2, 1993, Mr. M. Devata, Chief Foundation Engineer, proposed an additional alternative with Caisson foundation or Steel 'H' pile foundation. Based on our analyses, it was recommended that the new alignment of the sewer be located not closer than 5 m away from the toe of the nearest embankment (our memo of March 2, 1993).

Regional Planning and Design Section has finalized the new sewer location based on the recommendation of the Foundation Design Section.

SITE DESCRIPTION AND GEOLOGY

The site is located in southeast London, west of the Bradley Avenue Overpass at Highbury Avenue and east of Pond Mills as shown on Drawing 4219201-A.

The majority of the site is gently rolling grassland with ground surface elevation at the borehole locations generally varying between elevation 269 m and 275 m. Several large wooded areas exist in the western portion of the site. In addition, several relatively extensive swampy areas are present on the site. It should be noted that significant amounts of sand fill and clayey silt fill have been placed as a part of roadway embankment on the site.

Physiographically, the site is located in the "Ingersoll Till Moraine" region (Ref. Chapman and Putnam, 1984). During the retreat of the last glacial ice sheet, many large blocks of ice were deposited in the surface of the tills and overlying alluvial outwash to form the present moraine. Subsequently, these ice blocks melted to form isolated deep waterfilled depressions. The lack of any continuous deep drainage of these depressions has resulted in the deposition of considerable depths of peat and organic silt.

SUBSURFACE CONDITIONS

The subsoil conditions encountered in the boreholes drilled at the site are complex and highly variable. The road embankment fill of the existing Bradley Avenue and their ramp consists of cohesive and granular fill. The embankment of fill was generally found to be underlain by peat and organic silt overlying layers of granular material and clayey silt till. Most of boreholes drilled at the site generally encountered varying amount of fill, often overlying relatively thick layers of peat and organic silt underlain by silty sand, silt and clayey silt till. The following paragraphs are intended to provide a summary of the surface conditions which have been simplified for the purpose of geotechnical design:

1) AREA 1: Between MH3A-A and 16.5 m south of MH3A-A

6.0 m : clayey silt till

11.5 m : silty sand

Below 17.5 m : clayey silt till

2) AREA 2: Between 16.5 m south of MH3A-A and 14 m south of MH3A-B

8.5 m : clayey silt till

15.0 m : silty sand

Below 23.5 m : clayey silt till

3) AREA 3: Between 14 m south of MH3A-B and 27 m south of MH3A-C

9.5 m : sand fill

Below 9.5 m : clayey silt till

4) AREA 4: Between 27 m south of MH3A-C and 17.5 m north of MH3A-D

3.0 m : peat

1.5 m : organic silt

6.0 m : clayey silt till

Below 10.5 m : silty sand

5) AREA 5: Between 17.5 m north of MH3A-D and 17.5 m south of MH3A-D

5.0 m : peat

1.5 m : organic silt

7.5 m : clayey silt till

Below 14.0 m : silty sand

6) AREA 6 : Between 17.5 m south of MH3A-D and MH37

3.0 m : sand fill

4.0 m : clayey silt fill

2.0 m : organic silt

1.5 m : silty sand

9.5 m : clayey silt till

Below 20.0 m : silty sand

The detailed soil and groundwater conditions encountered in the boreholes are shown on the attached Record of Borehole sheets and the inferred stratigraphic profile is shown on Drawing No. 4219201-A.

A detailed description of the subsoil conditions encountered at the site is given below.

Fill

Clayey Silt Fill

Four boreholes (BH No.'s 93-7, 93-8, 93-10 and 93-11) encountered layers of surficial clayey silt fill ranging in thickness from 1.4 m to 4.2 m. Through visual observation, the material can be classified as a clayey silt.

In this stratum, the 'N' values ranged from 3 to 7 blows/0.3 m indicating the consistency described as soft to firm.

Sand Fill

The sand fill was encountered in five boreholes (BH No.'s 93-3, 93-4, 93-5, 93-11 and 93-12). This material consists of a bedding sand (SSM) ranging in thickness from 2.9 m to 10.1 m.

In this stratum, the 'N' values ranged from 1 to 9 blows/0.3 m indicating a state of compaction described as very loose to loose.

Peat

Layers of peat ranging in thickness from 0.9 to 5.5 metres were encountered in five boreholes (BH No.'s 93-6 to 93-10), generally either at ground surface or beneath the surficial fill. The peat had in situ moisture contents ranging from about 535 to 600 percent. The 'N' values of the peat ranged from the weight of the sampling equipment to about 2 blows per 0.3 metres.

The undrained shear strength of the peat ranged from 14 to 40 kilopascals with the sensitivity of the peat ranged from 1 to 2. Based on this result, the consistency of the peat can be described as soft to firm. The organic content varies from 75 to 88 percent.

Organic Silt

Seven boreholes encountered layers of organic silt generally underlying the fill and peat layers (BH No.'s 93-3, 93-6, 93-7, 93-8, 93-9, 93-11 and 93-12). These layers ranged in thickness from 0.4 to 2.3 metres. The natural moisture content of the organic silt was found to be about 165 percent. The 'N' value of the organic silt ranged from 2 to about 7 blows per 0.3 metres.

An Atterberg Limit test was performed on this sample and the results is plotted on Figure 1 and summarized as follows:

<u>Index Property</u>	<u>Range (%)</u>
Natural Moisture Content (w)	165
Liquid Limit (w_L)	82
Plastic Limit (w_p)	48
Plasticity Index (I_p)	34

From the plasticity chart, it is evident that the layer can be classified as an organic silt with high plasticity (OH). Grain size distribution test was carried out on this sample. Figure 2 in Appendix shows the result.

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. The undrained shear strength ranged from 28 to over 100 kilopascals with the sensitivity ranged from 2 to 6. Based on this result, the consistency of the organic silt can be described as firm to very stiff. The organic content is about 12 percent.

Sandy Silt to Silt

Some of the boreholes encountered layers of sandy silt to silt ranging in thickness from 1.5 to 3.1 metres. These layers have natural moisture content ranging from 17 to 23 percent. The sandy silt to silt have plastic limit ranging from 16 to 18 percent with plasticity index varied from 2 to 5 percent. From the plasticity chart as shown on Figure 3, this material can be classified as sandy silt to silt (ML). Grain size distribution tests were carried out on this material. Figure 4 in Appendix shows the results.

The 'N' values varied from 7 to 28 blows per 0.3 metres indicating a state of compaction described as loose to compact.

Clayey Silt (Glacial Till)

Layers of clayey silt till were encountered in most of the boreholes, ranging in thickness from 3.9 to greater than 10.9 metres. The material changes in colour from reddish brown to brown with depth.

Atterberg limit tests were performed on this material and the results are plotted on Figure 5 and summarized as follows:

<u>Index Property</u>	<u>Range (%)</u>
Natural Moisture Content (w)	10.5-17.5
Liquid Limit (w_L)	21.0-35.0
Plastic Limit (w_p)	11.0-17.0
Plasticity Index (I_p)	8.0-19.0

From the plasticity chart it is evident that the layer can be classified as a clayey silt, some sand and trace of gravel (Glacial Till, CL).

Grain Size Distribution tests were carried out on these samples. Figure 6 in the Appendix shows the results in an envelope form.

Standard Penetration Test 'N' values between 5 and 82 indicated that the soil can be interpreted as being firm to hard.

Silty Sand

Most of the boreholes encountered silty sand layers ranging in thickness from 1.5 to greater than 16.2 metres. The silty sand has natural moisture contents ranging from 17.5 to 19.0 percent.

The 'N' values of the silty sand ranged from 7 to 80 blows per 0.3 metres indicating a state of compaction described as loose to very dense. The grain size distribution curves for some sample of silty sand with occasional silty layers are shown on Figure 7.

GROUNDWATER

Groundwater conditions were observed by measurement of water level in the open boreholes. The groundwater level was found to be at approximate elevation between 268.0 m at BH 93-12 and 270.1 m at BH 93-2 which correspond to depths of 2.4 m and 1.5 m below the existing ground surface. However, it is likely that the groundwater level is subject to seasonal fluctuation.

DISCUSSION AND RECOMMENDATIONS

The recommendations in this report apply to the sanitary sewer foundation and restoration of Interchange Ramps.

It is proposed that the revised alignment of the sanitary sewers be located no closer than 5 m away from the toe of the nearest embankment. It should be also noted that for this alternative the restoration of the embankment be achieved before the construction of the sewer system by using lightweight material. This will reduce the magnitude of further settlements and embankment instabilities.

Sewer Foundations

AREA 1 : Between MH3A-A and 16.5 m south of MH 3A-A

In consideration of the competent nature of the subsoils at this area, sanitary sewers may be founded on native silty sand. For spread footings founded on native silty sand, the following design parameters are recommended:

Factored Bearing Capacity
at U.L.S. (kPa)

800 kPa

Bearing Capacity
at S.L.S. Type II

400 kPa

Other Areas

In view of the low shear strength and compressibility of the peat, organic silt and loose sand fill, conventional spread footing shallow foundations are not applicable at this site. In addition, to avoid the problems associated with deep excavation through weak overburden soils, it is recommended that structural loading for the sewers be transferred to the underlying very stiff to hard clayey silt till or dense to very dense silty sand by means of

Steel 'H' piles installed through the overburden. For cost estimating purposes, it is assumed that the pile lengths will be in the order of 15 m and 20 m.

If steel "H310 x 110" piles are used, the following design parameters are recommended for the purpose of the O.H.B.D.C.

<u>Location</u>	<u>Factored Axial Capacity at U.L.S. (kN)</u>		<u>Axial Capacity at S.L.S. Type II (kN)</u>	
	<u>15 m long</u>	<u>20 m long</u>	<u>15 m long</u>	<u>20 m long</u>
<u>Area 2</u>	680	850	450	550
<u>Area 3</u>	420	740	280	490
<u>Area 4</u>	780	1,210	520	810
<u>Area 5</u>	820	1,280	550	850
<u>Area 6</u>	530	1,050	350	700

The actual pile lengths and space between piles should be determined during the design stage. However, based on the above design parameters, it is recommended that the pile lengths be about 15 m in Areas 2, 4, 5 and 6 except Area 3 where 20 m piles would be required.

Other Considerations

Lateral Earth Pressures

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

	<u>Sand Fill</u>	<u>Clayey Silt Till</u>
Angle of International Friction (ϕ)	28°	30°
Unit Weight (kN/m^3), γ	20	21
Coefficient of Active Earth Pressure (K_a)	0.36	0.33
Coefficient of Earth Pressure at Rest (K_o)	0.53	0.5
Coefficient of Passive Earth Pressure (K_p)	2.77	3.0

Frost Protection

It should be noted that the footings for sanitary sewer be provided with a minimum of 1.2 m of earth cover for frost protection purposes.

Dewatering

The footings for the sewer should be constructed in dry condition. Since the sewer footing is located in a granular deposit and organic soils and the water level is at or above the footing founding level, it will be necessary to prevent the base of the footing from boiling due to an unbalanced excess hydrostatic head. In this case a dewatering scheme would be required at this site.

Slope Stabilization

It is believed that the existence of some compressible organic layers and very loose bedding sand might cause about 260 mm settlement of the Manhole No. 33 for the sanitary sewer system and jeopardized the slope stability.

Based on our analyses, it is recommended that the restoration of the embankment be achieved before the construction of the sewer system by using lightweight material in the upper 4 m portion of the fill. This will reduce the magnitude of further settlement and embankment instabilities. For the design purpose, schematic sections are provided on Figure 8.

Regarding the lightweight fill embankment, a draft non-standard specification, used by MTO, is enclosed in this report. It should be noted that a sub-drain at the base of lightweight fill be required to prevent a "bathtub effect".

Construction Considerations

All the failed and/or loosened material in the affected area be removed and replaced with proper backfill materials. The fill should be keyed into the existing slope in accordance with current MTO standards and practice.

The embankment should be re-built with 2H:1V side slope to the required level. After completion of the rehabilitation, the earth slope should be protected in accordance with OPSD 218.01.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Matt Mayers, Trainee Engineer from Northern Region, Martin Michalek, Junior Foundation Engineer, and Tae C. Kim, Senior Foundation Engineer. The equipment was owned and operated by Dominion Soil Investigation Inc., London.

This report was written by Tae C. Kim, Senior Foundation Engineer, and reviewed by M. Devata, Chief Foundation Engineer.



Tae C. Kim
Tae C. Kim, P.Eng.

Senior Foundation Engineer



M. Devata
M. Devata, P.Eng.

Chief Foundation Engineer

GENERAL

Details of location, volume, etc.

MATERIAL

The Lightweight Blast Furnace Slag is to be obtained from:

National Slag Limited
139 Windermere Road
Hamilton, Ontario
L8H 3Y2

under the designation of either Unprocessed Litex or 9.5 mm (3/8") Structural Coarse depending on the in-situ unit weight designated in the design.

Unprocessed Litex has range of grain size through the sand range. 9.5 mm (3/8") Structural Coarse has a relatively uniform grain size.

Properties of these materials are summarized below.

	Unprocessed Litex	9.5 mm (3/8") Structural Coarse
In-Situ Unit Weight (Design Value)	14.0 \pm kN/m ³	1.5 \pm kN/m ³
Loose Unit Weight (Actual Value)	< 12.5 \pm kN/m ³	< 10.0 \pm kN/m ³
Approximate Gradation		
<u>Sieve Size</u>	<u>% Passing</u>	<u>% Passing</u>
13.2 mm	95-100	100
9.5 mm	95-100	95-100
6.7 mm	85-95	70-90
4.75 mm	75-85	30-60
2.36 mm	40-60	10-30
1.18 mm	20-30	5-15
600 um	10-15	0-15
300 um	5-10	0-10
150 um	0-5	0-10
75 um	0-5	0-5

Equivalent materials and suppliers will be considered subject to review of physical and chemical material properties such as grain size, crushing characteristics and chemical composition.

CONSTRUCTION

The intention is to achieve adequate compaction without crushing the material since crushing would increase its unit weight. The Contractor is advised that lightweight blast furnace slag is susceptible to crushing if overcompacted and that careful construction supervision is required.

The lightweight fill shall be placed in accordance with OPSS 206.07 with the following amendments:

- Water shall be added to maintain saturation of the material during compaction.
- For embankments, the lightweight blast furnace slag shall be placed in lifts of 300 mm and compacted by 4 passes of a single-drum vibratory compactor such as a Bomag 142 D or equivalent.
- For backfill to structures, the light weight blast furnace slag shall be placed in lifts of 300 mm and compacted with 8 passes of a manually guided tamper such as a Bomag BPR 30/38 D or equivalent.

Compaction Equipment Technical Details

	Bomag 142 D	Bomag BPR 30/38 D
Weights		
- operating weight	4,691± kg	175±kg
- mass per square meter of base plate	N/A	1,439± kg/m ³
Dimensions		
- drum width	1,426± mm	N/A
- drum diameter	1,058± mm	N/A
- width of base plate	N/A	380± mm
- length of base plate	N/A	730± mm
Drive		
- performance DIN 6271 IFN	37± kW	3.7± kW
- performance SAE	39.5± kW	N/A
- speed	2300± rpm	3600± rpm
Vibratory System		
- frequency	32± Hz	68± Hz
- amplitude	1.24± mm	N/A
- centrifugal force	66.1± kN	30± kN

MEASURE OF PAYMENT

The unit measurement will be tonnes and the method of determining the weight of material for payment shall conform to OPSS 502.

BASIS OF PAYMENT

Payment at the contract price for the above tender item shall be full compensation for all labour, equipment and material required to do the work.

APPENDIX

RECORD OF BOREHOLE No 93-1 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 850.7; E 411 955.8 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE Apr. 2, 1993 CHECKED BY T.K.

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	WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						
275.4	Ground Surface																	
0.0		Brown					275											
	Clayey Silt, trace of Gravel (Glacial Till) Stiff		1	SS	9		273											
271.3			2	SS	10		271											
4.1			3	SS	28		269											
	Silty Sand occasional Silt Layers Compact to Dense		4	SS	28		267											
	Silt		5	SS	41		265											
265.3			6	SS	39													
10.1	Clayey Silt, some Sand trace of Gravel (Glacial Till), Hard		7	SS	38													
264.3																		
11.1	End of Borehole																	

RECORD OF BOREHOLE No 93-2 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 833.1; E 411 944.3 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE Apr.5 and Apr.6, 1993 CHECKED BY T.K.

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					
271.6	Ground Surface													
0.0														
	Redish Brown		1	SS	8		271							
	Brown		2	SS	3		269							
	Clayey Silt, some Sand trace of Gravel (Glacial Till) Firm to Stiff		3	SS	9		267							
			4	TW	PM		265						20.8	2 10 47 41
264.5														
7.1			5	SS	24		263							
			6	SS	28		261							
			7	SS	36		259							
			8	SS	20		257							
	Silty Sand occasional Silt Layers Compact to Dense		9	SS	39		255							
			10	SS	29		253							
			11	SS	26		251							
			12	SS	25		249							
			13	SS	22									
			14	SS	14									
248.3			15	SS	15									
23.3	End of Borehole													

RECORD OF BOREHOLE No 93-3 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 813.5; E 411 937.5 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE Apr.2, 1993 CHECKED BY T.K.

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	WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						
269.7	Ground Surface																	
0.0	Sand (Fill) with mixture of Peat and Clayey Silt Very Loose		1	SS	5		269											
263.6		Brown					267											
263.2	Organic Silt	Grey	2	SS	2		265											
6.5		Grey					263											
		Brown	3	SS	13		261											
	Clayey Silt, some Sand trace of Gravel (Glacial Till) Stiff to Hard		4	TW	PM		259											
			5	SS	41		257											
			6	SS	26		255											
255.0			7	SS	42		253											
14.7	Silty Sand occ. Silt and Clayey Silt Layers Compact to Very Dense		8	SS	22		251											
			9	SS	24		249											
		Clayey Silt	10	SS	67													
249.9																		
19.8	Clayey Silt some Sand, trace of Gravel (Glacial Till) Hard																	
247.9			11	SS	29													
21.8	End of Borehole																	

RECORD OF BOREHOLE No 93-4 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 794.0; E 411 930.3 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE March 31, 1993 CHECKED BY T.K.

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa						
269.6	Ground Surface							20 40 60 80 100	20 40 60					
0.0		Brown	1	SS	7		269							
			2	SS	3		267							
	Sand (Fill) Loose		3	SS	6		265							
			4	SS	9		263							
			5	SS	7		261							
259.5			6	SS	3		259							
10.1			7	SS	5		257							
			8	TW	PM		255							
	Clayey Silt some Sand, trace of Gravel (Glacial Till) Stiff to Hard		9	SS	7		253							
			10	SS	12		251							
			11	SS	30									
			12	SS	33									
249.3			13	SS	34									
20.3	End of Borehole													

RECORD OF BOREHOLE No 93-5

1 OF 1

METRIC

W.P. 421-92-01

LOCATION coords: N 4 756 777.2; E 411 930.7

ORIGINATED BY M.M.

DIST 2 HWY 126

BOREHOLE TYPE Hollow Stem Augers, Wash Boring

COMPILED BY D.S.

DATUM Geodetic

DATE April 19 and April 20, 1993

CHECKED BY T.K.

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	WATER CONTENT (%)	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						
269.7	Ground Surface																	
0.0		Brown																
			1	SS	2		269											
			2	SS	2		267											
	Sand (Fill) Very Loose		3	SS	3		265											
			4	SS	3		263											
			5	SS	5		261											
261.1			6	SS	2		259											
8.6	Sandy Silt Very Loose to Loose		7	SS	7		257											
			8	SS	20		255											
			9	SS	10		253											
258.0			10	SS	25		251											
			11	SS	23		249											
11.7	Clayey Silt some Sand, trace of Gravel (Glacial Till) Stiff to Hard		12	SS	20													
			13	SS	37													
			14	SS	34													
247.9																		
21.8	End of Borehole																	

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 93-6

1 OF 1

METRIC

W.P. 421-92-01

LOCATION coords: N 4 756 760.2; E 411 931.0

ORIGINATED BY M.M.

DIST 2 HWY 126

BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test

COMPILED BY D.S.

DATUM Geodetic

DATE March 30 and March 31, 1993

CHECKED BY T.K.

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					
269.8	Ground Surface													
0.0	Pest		1	SS	2									
267.3	Dark Brown													
266.8	Organic Silt		2	SS	7									
3.2	Brown		3	SS	21									
	Silty Sand occ. Silt Layers Loose to Very Dense		4	SS	16									
			5	SS	7									
	Sandy Silt		6	SS	10									
			7	SS	10									
			8	SS	7									
			9	SS	18									
			10	SS	25									
			11	SS	20									
251.1			12	SS	49									
18.7	End of Borehole													
	• Water Level was not established during the drilling													

RECORD OF BOREHOLE No 93-7

1 OF 1

METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 727.0; E 411 931.5 ORIGINATED BY M.M.
DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
DATUM Geodetic DATE April 6 and April 7, 1993 CHECKED BY T.K.

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	20 40 60 80 100					
269.8	Ground Surface														
0.0	Clayey Silt (Fill)														
268.2															
1.6	Peat Firm		1	TW	PM										
267.3	Dark Brown														
2.5	Organic Silt with some Sand Layers, Stiff		2	SS	2										
266.4	Brown														
3.4	Clayey Silt some Sand, trace of Gravel (Glacial Till) Very Stiff to Hard		3	SS	17										
			4	SS	34										
262.5															
7.3	Silt		5	SS	45										
	Clayey Silt		6	SS	41										
			7	SS	34										
			8	SS	32										
	Silty Sand occ. Silt Layers Compact to Very Dense		9	SS	22										
			10	SS	39										
			11	SS	6										
			12	SS	51										
248.0			13	SS	39										
21.8	End of Borehole														
	• Low 'N' Value probably due to Belling														

RECORD OF BOREHOLE No 93-8 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 710.3; E 411 832.0 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring COMPILED BY D.S.
 DATUM Geodetic DATE April 15 and April 19, 1993 CHECKED BY T.K.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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									
					SHEAR STRENGTH kPa									
					20 40 60 80 100									
269.7	Ground Surface													
0.0	Clayey Silt (Fill) Soft	Brown	1	SS	3		269							
268.3		Dark Brown	2	SS	2		267	+2						
1.4	Peat Soft to Firm		3	SS	0		265	+1 +2						
265.9		Dark Brown	4	SS	2		263	+2						
3.8	Organic Silt Stiff	Grey					261							
264.5		Grey					259							
264.1	Silty Sand trace of Gravel	Brown	5	SS	10		257							
5.6			6	SS	18		255							
	Clayey Silt some Sand trace of Gravel (Glacial Till) Stiff to Hard		7	SS	31		253							
			8	SS	27		251							
259.6			9	SS	21		249							
10.1			10	SS	29									
	Silty Sand occasional Silt Layers Compact to Very Dense		11	SS	58									
			12	SS	80									
247.9			13	SS	49									
21.8	End of Borehole													

RECORD OF BOREHOLE No 93-9 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 693.8; E 411 932.5 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE April 8 and April 12, 1993 CHECKED BY T.K.

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					
269.3	Ground Surface																
0.0			1	SS	1	*	269										
	Peat		2	TW	PM		267										
	Soft		3	SS	2		265										
			4	SS	2		263										
			5	SS	1		261										
263.8	Dark Brown		6	SS	1		259										
5.5	Organic Silt		7	SS	2		257										
262.7	Soft	Grey	8	TW	PM		255										
6.6		Brown	9	SS	15		253										
			10	SS	23		251										
	Clayey Silt some Sand, trace of Gravel (Glacial Till) Stiff to Hard		11	SS	16		249										
			12	SS	77												
255.4			13	SS	64												
13.9			14	SS	51												
			15	SS	53												
	Silty Sand occasional Silt Layers Compact to Very Dense		16	SS	21												
			17	SS	27												
247.5			18	SS	23												
21.8	End of Borehole																
	• Borehole driven in Swamp Water Level 269.9m (0.6m above Ground Surface)																

RECORD OF BOREHOLE No 93-10 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 676.8; E 411 933.0 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE April 12 and April 13, 1993 CHECKED BY T.K.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ 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		
269.5	Ground Surface													
0.0	Clayey Silt (Fill) Firm	Brown	1	SS	5		269							
268.1		Dark Brown	2	SS	2		267						601% o	
1.4	Peat occ. Sand Layers soft		3	SS	2		265							
			4	SS	2		263							
			5	SS	2		261							
264.3		Dark Brown	6	SS	2		259							
5.2		Brown	7	SS	3		257							
	Silty Sand occ. Silt Layers Loose		8	SS	5		255							
			9	SS	3		253							
260.3			10	SS	5		251							
8.2			11	SS	30		249							
			12	SS	33									
	Clayey Silt some Sand, trace of Gravel (Glacial Till) Very Stiff to Hard		13	SS	19									
			14	SS	31									
			15	SS	31									
			16	SS	82									
250.2			17	SS	57									
19.3	Silty Sand occ. Silt Layers Dense to Very Dense		18	SS	47									
247.7														
21.8	End of Borehole													

RECORD OF BOREHOLE No 93-11 1 OF 1 METRIC

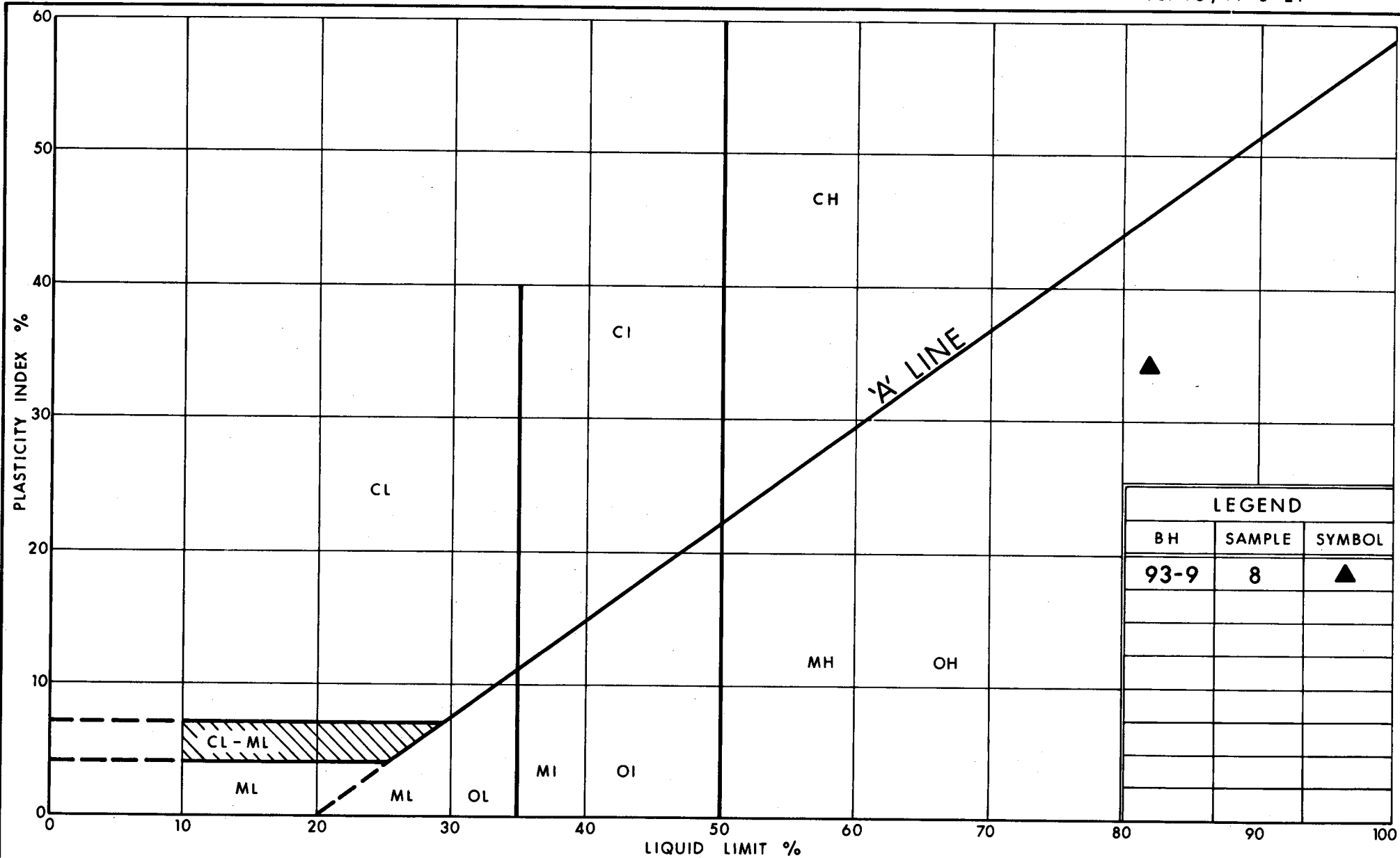
W.P. 421-92-01 LOCATION coords: N 4 756 643.3; E 411 934.0 ORIGINATED BY M.M.
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY D.S.
 DATUM Geodetic DATE April 14, 1993 CHECKED BY T.K.

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	20 40 60 80 100					
270.4	Ground Surface														
0.0	Sand (Fill) Loose to Compact		1	SS	6		270								
			2	SS	4										
267.5		Brown	3	SS	14		268								
2.9	Clayey Silt (Fill) Firm		4	SS	7										
			5	SS	4		266								
			6	SS	5										
			7	SS	4		264								
			8	SS	5										
263.3		Brown					262								
7.1	Organic Silt Firm	Gray	9	SS	4										
261.0		Gray	10	SS	2		260								
9.4	Silty Sand occ. Silt Layers Compact	Brown													
259.5			11	SS	16		258								
10.9	Clayey Silt some Sand, trace of Gravel occ. Silt and Silty Sand Layers (Glacial Till) Very Stiff to Hard		12	SS	23										
			13	SS	34		256								
			14	SS	37										
	Silty Sand		15	SS	32		254								
			16	SS	47		252								
			17	SS	75		250								
248.6			18	SS	68										
21.8	End of Borehole														

RECORD OF BOREHOLE No 93-12 1 OF 1 METRIC

W.P. 421-92-01 LOCATION coords: N 4 756 626.7; E 411 934.3 ORIGINATED BY MM
 DIST 2 HWY 126 BOREHOLE TYPE Hollow Stem Augers, Wash Boring and Cone Test COMPILED BY DS
 DATUM Geodetic DATE April 15, 1993 CHECKED BY TK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	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	w _p	w	w _L		
270.4	Ground Surface													
0.0														
	Sand (Fill) Very Loose		1	SS	4		270							
			2	SS	8		268							
			3	SS	0		266							
			4	SS	4									
			5	SS	1									
			6	SS	2									
			7	SS	3									
264.2		Brown												
6.2	Organic Silt Firm	Grey	8	SS	4		264							
263.3														
7.1		Brown												
	Clayey Silt some Sand trace of Gravel (Glacial Till) Very Stiff		9	SS	18		262							
			10	SS	23									
260.3														
10.1														
	Silt Compact		11	SS	24		260							
			12	SS	28									
257.2														
13.2														
	Clayey Silt some Sand and Gravel (Glacial Till) Hard		13	SS	24		256							
			14	SS	65									
			15	SS	45		254							
252.6														
17.8														
	Silty Sand occ. Silt Layers Dense		16	SS	32		252							
			17	SS	37		250							
248.6														
			18	SS	42									
21.8	End of Borehole													



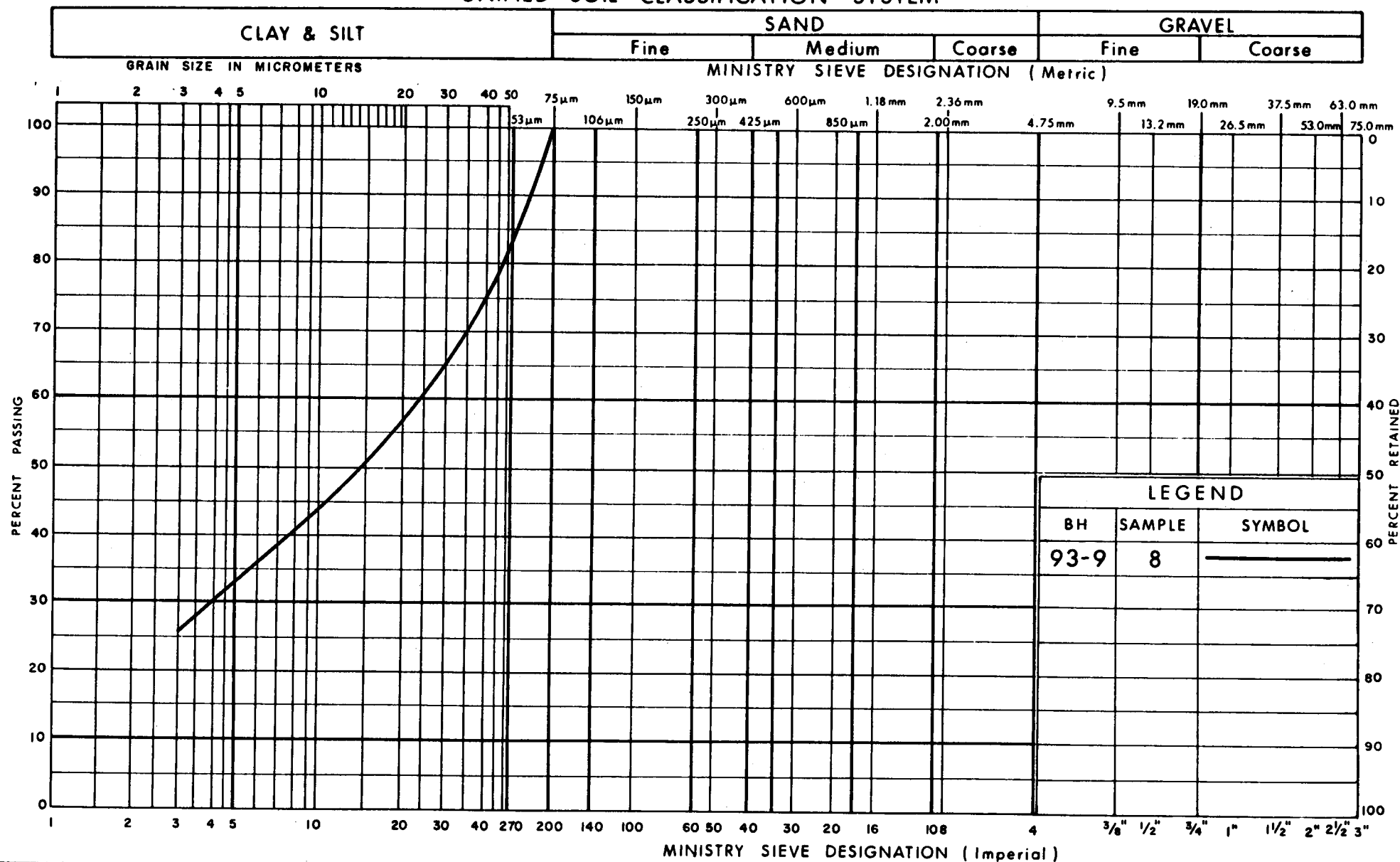
Ministry of
Transportation

PLASTICITY CHART ORGANIC SILT

FIG No 1

W P 421-92-01

UNIFIED SOIL CLASSIFICATION SYSTEM

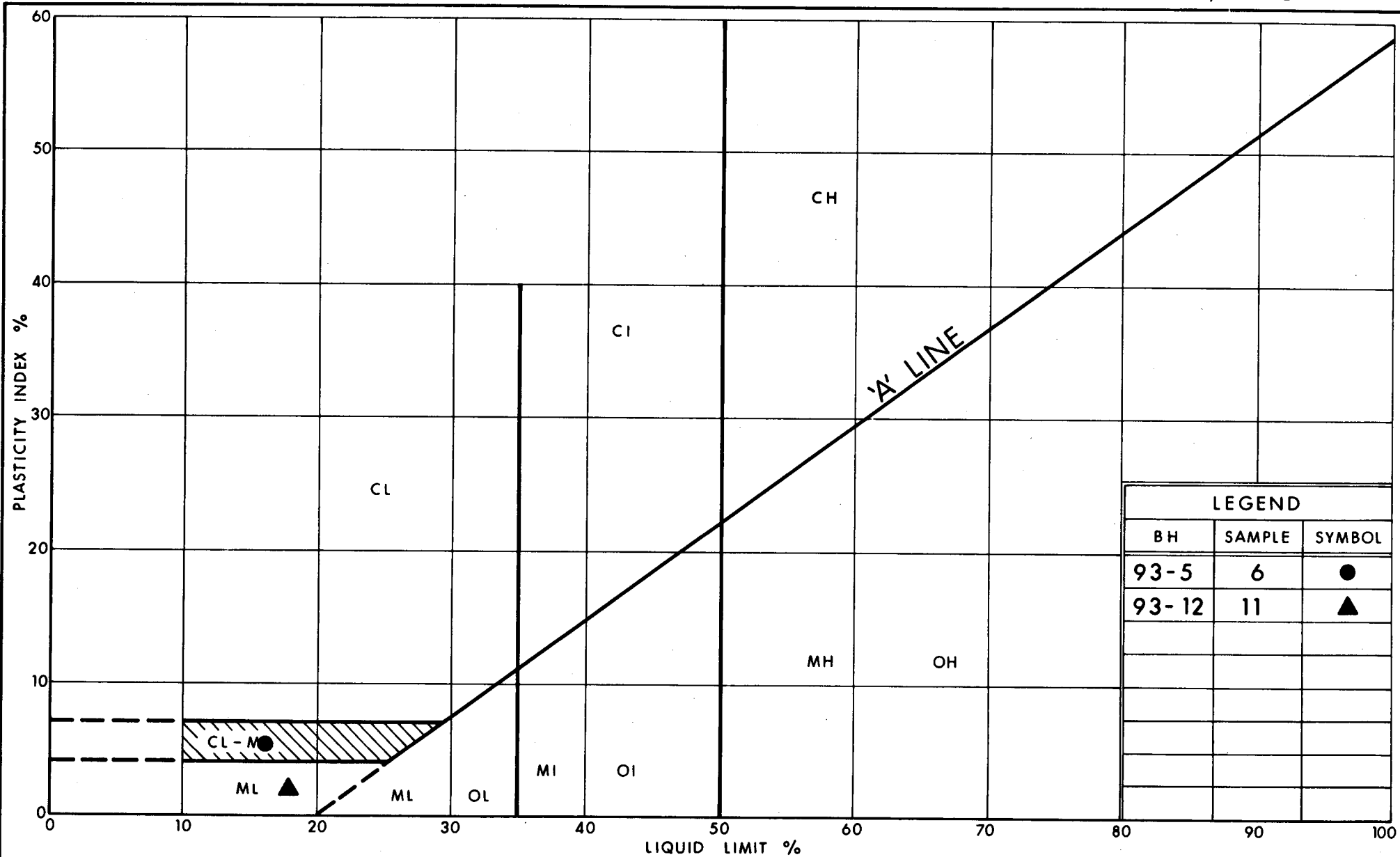


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Transportation

GRAIN SIZE DISTRIBUTION
ORGANIC SILT

FIG No 2

WP 421-92-01



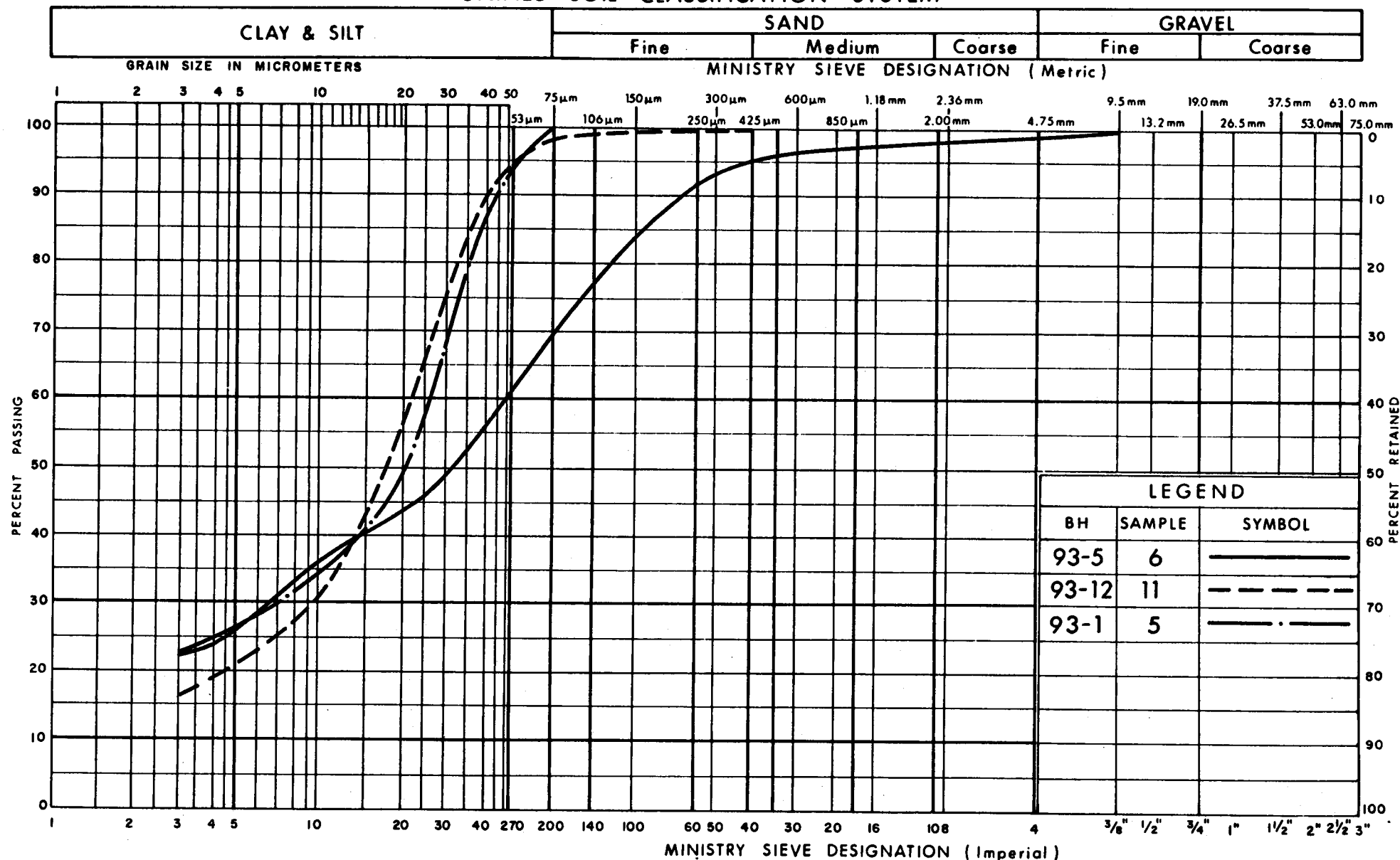
Ministry of
Transportation

PLASTICITY CHART SANDY SILT TO SILT

FIG No 3

W P 421-92-01

UNIFIED SOIL CLASSIFICATION SYSTEM

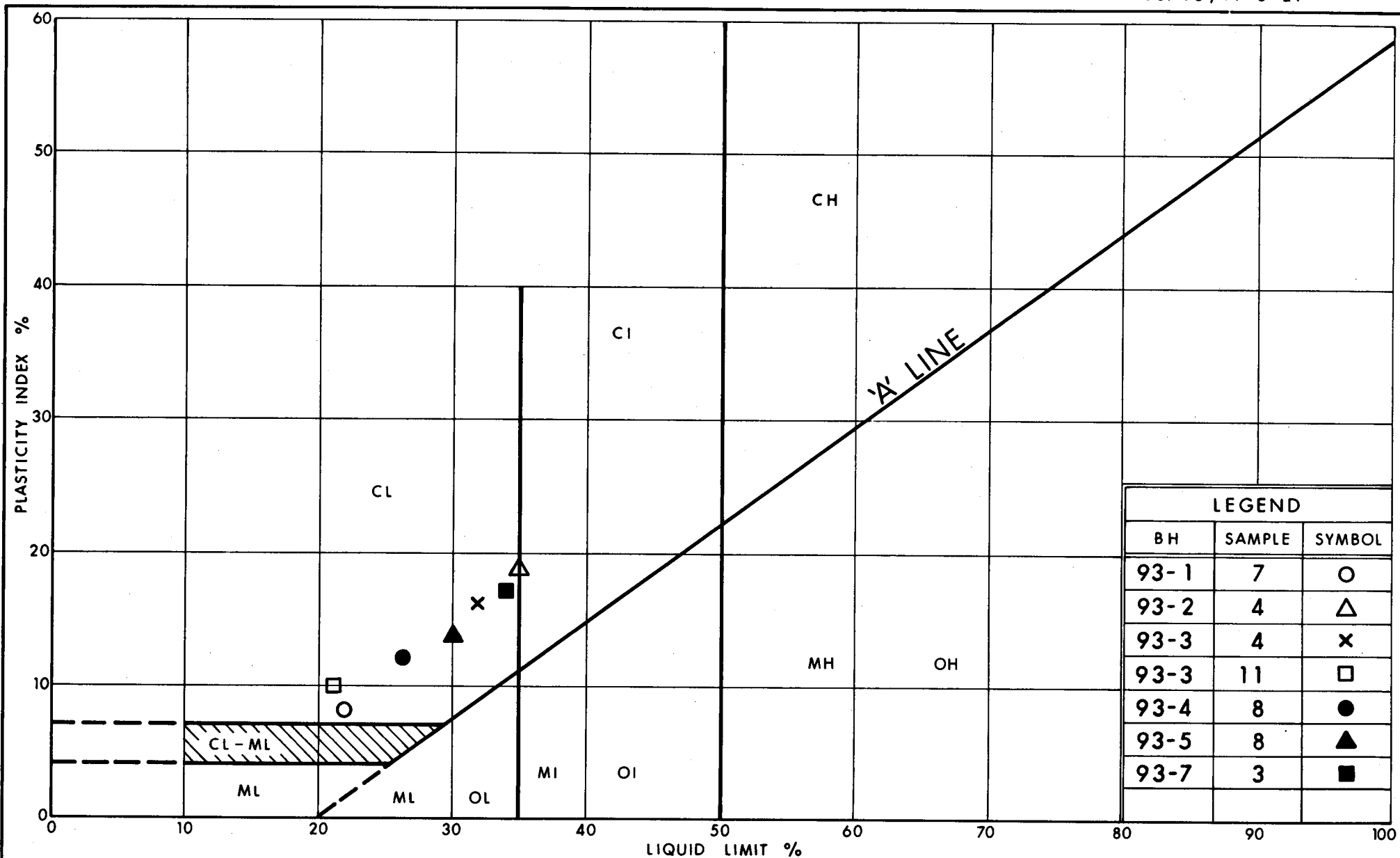


Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SANDY SILT TO SILT

FIG No 4

W P 421-92-01



Ministry of
Transportation

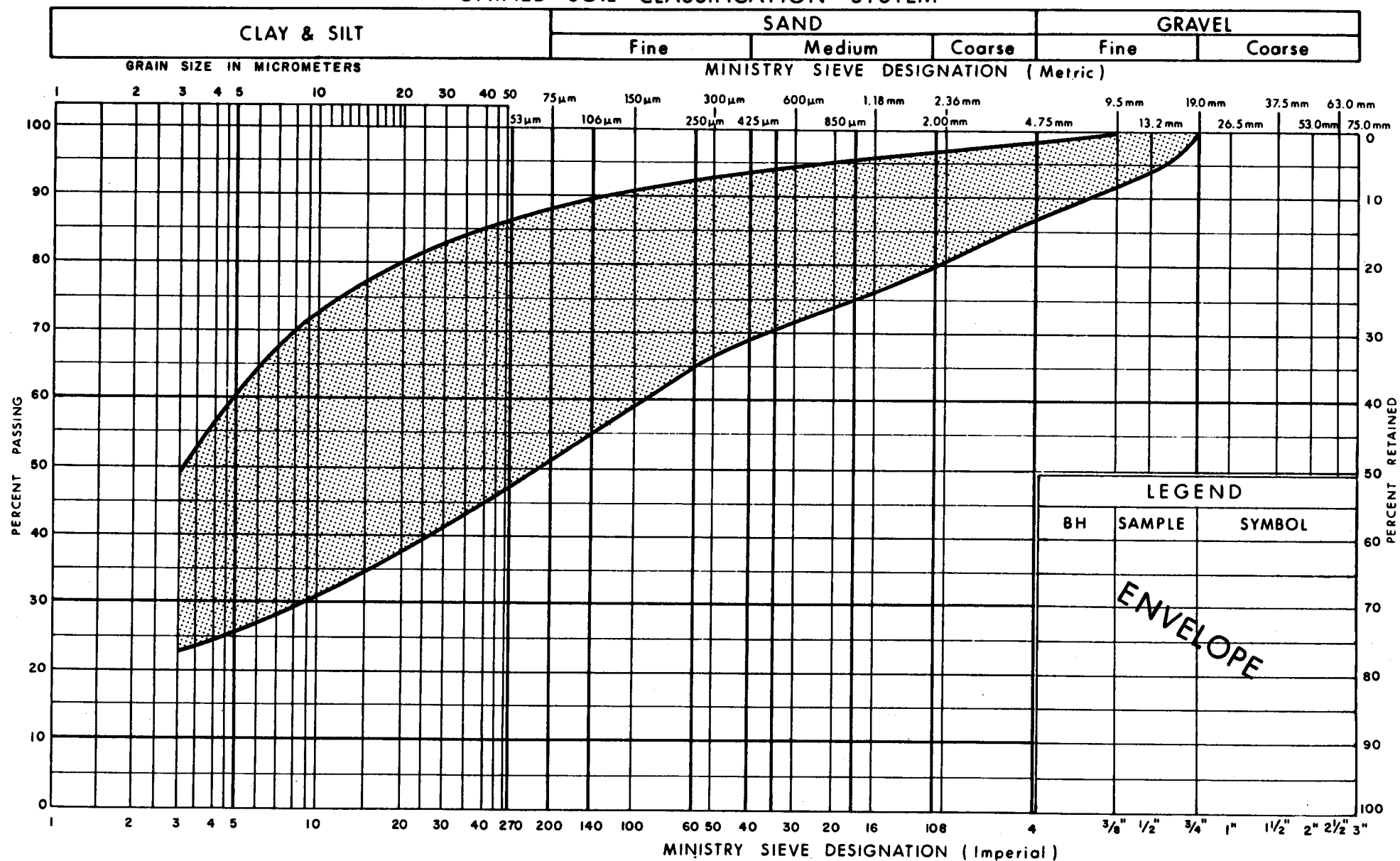
Ontario

PLASTICITY CHART
CLAYEY SILT, SOME SAND TRACE OF GRAVEL
(Glacial Till)

FIG No 5

W P 421-92-01

UNIFIED SOIL CLASSIFICATION SYSTEM



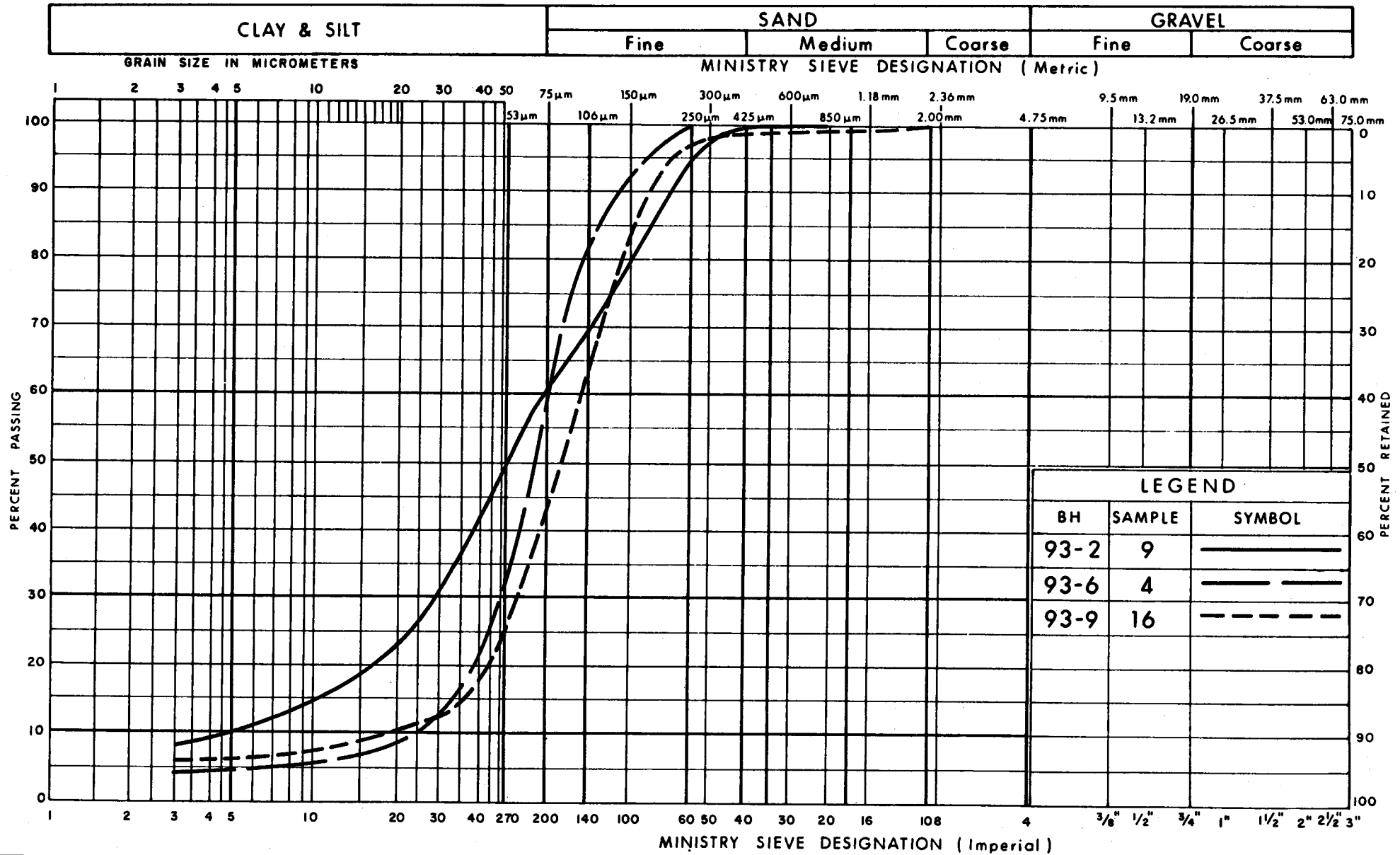
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
CLAYEY SILT, SOME SAND TRACE OF GRAVEL
(Glacial Till)

FIG No 6

W P 421-92-01

UNIFIED SOIL CLASSIFICATION SYSTEM

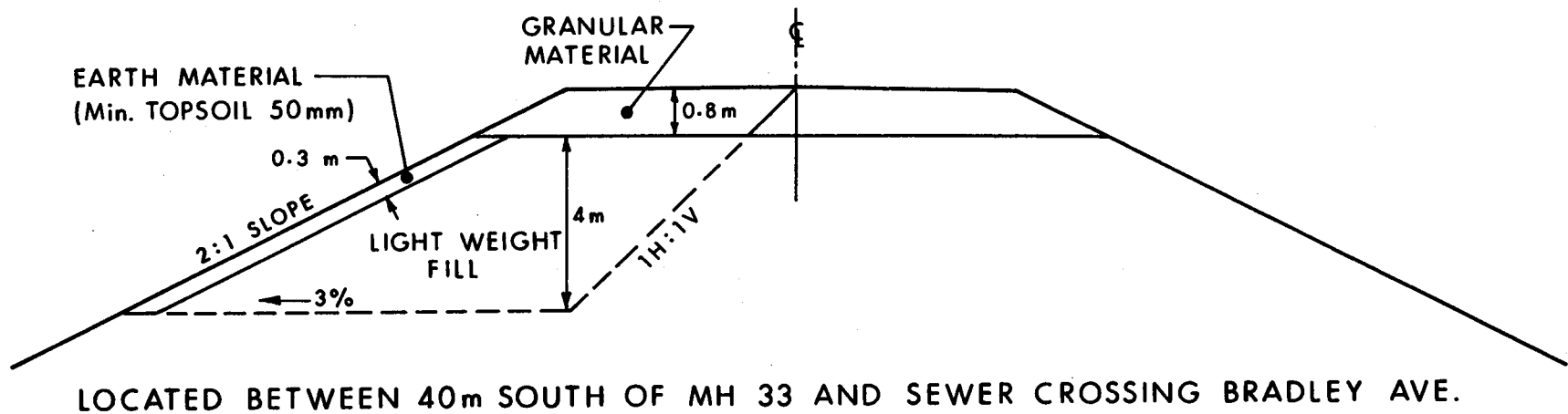
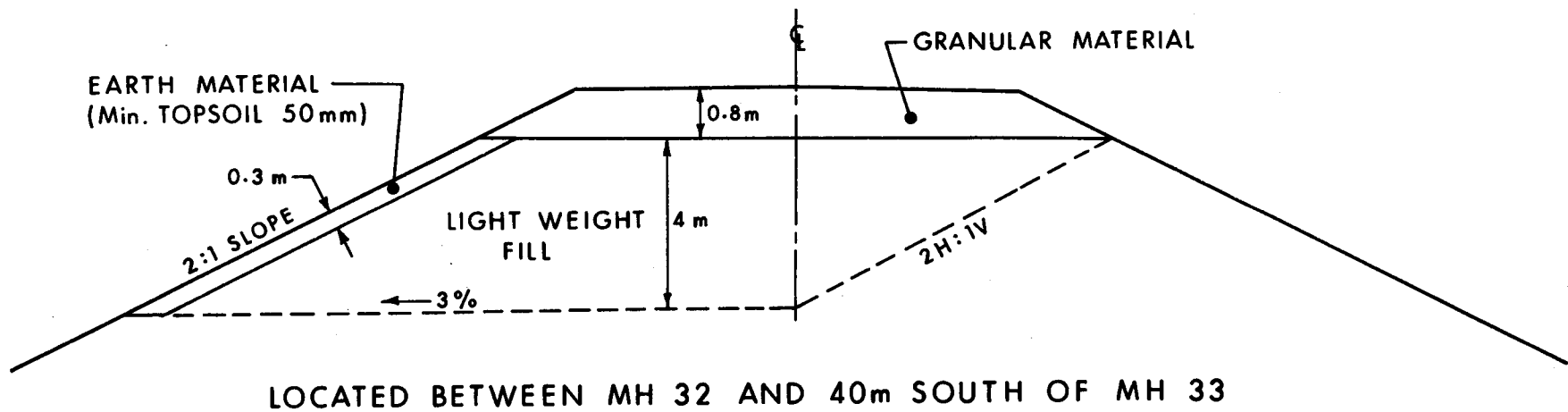


Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY SAND

FIG No 7

W P 421-92-01



BRADLEY AVENUE N-E/W RAMP LIMITS OF EXCAVATION FOR LIGHT WEIGHT FILL

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 T W ADVANCED HYDRAULICALLY
CS CHUNK SAMPLE	PM T W ADVANCED MANUALLY
TW THINWALL OPEN	FS FOIL SAMPLE

STRESS AND STRAIN

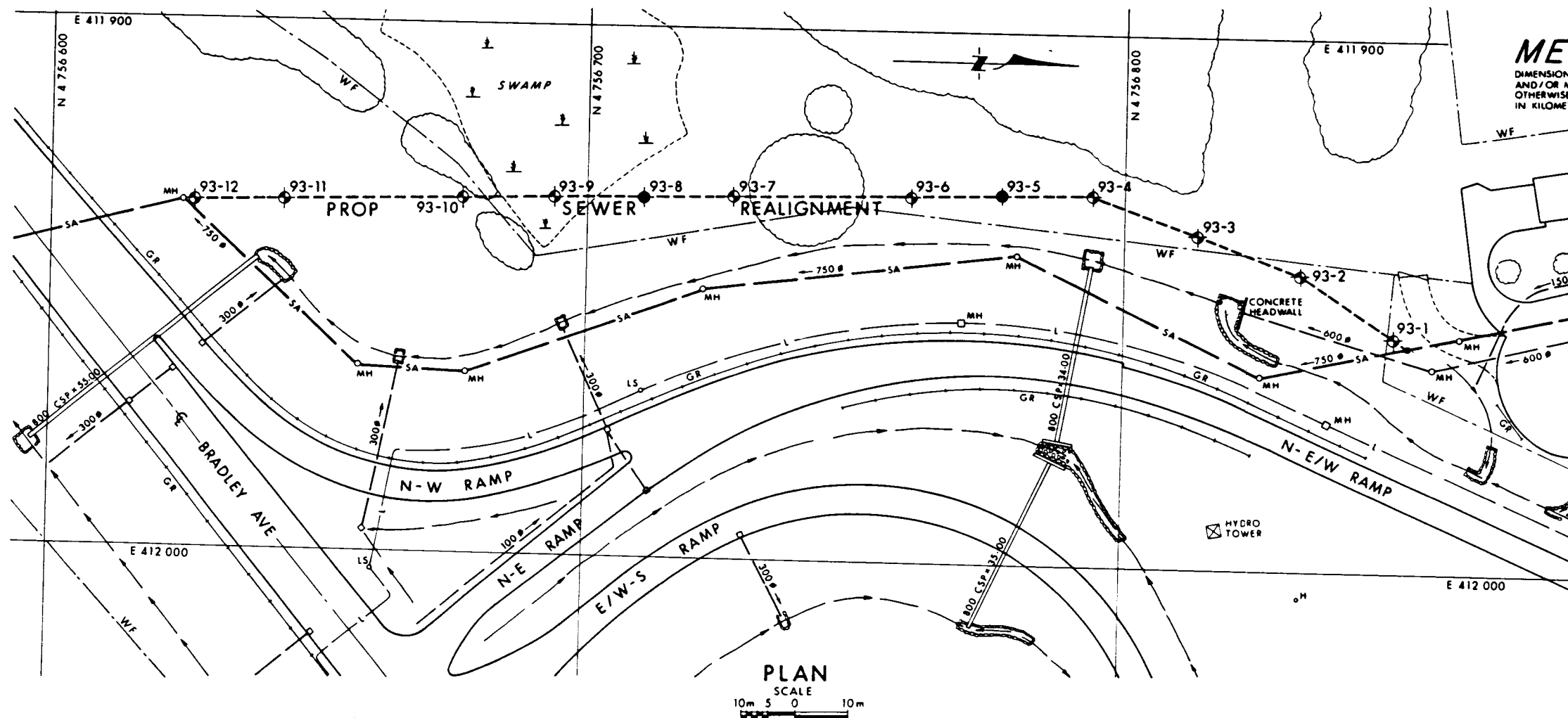
u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	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'_{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 = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						



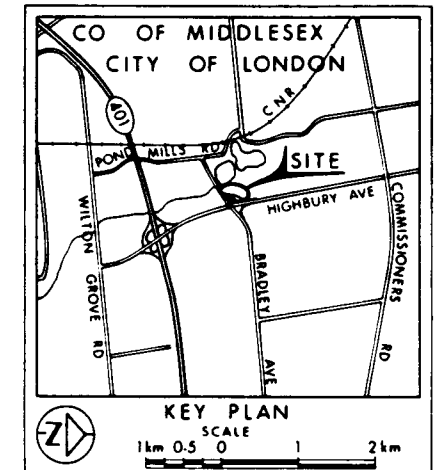
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES.

CONT No
WP No 421-92-01

SANITARY TRUNK SEWER
BRADLEY AVE/HIGHBURY AVE 1c
BORE HOLE LOCATIONS & SOIL STRATA

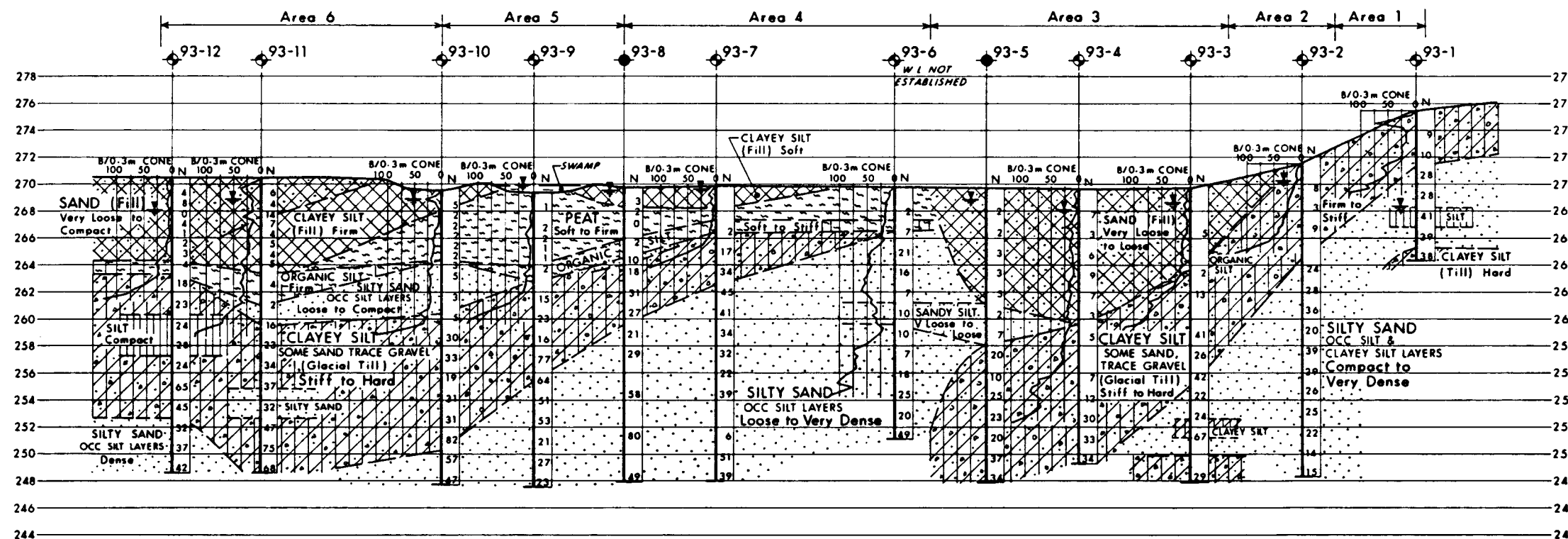


SHEET



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)
- W.L. at time of investigation 1993 03 and 04



No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
93-1	275.4	4756850.7	411955.8
93-2	271.6	4756833.1	411944.3
93-3	269.7	4756813.5	411937.5
93-4	269.6	4756794.0	411930.3
93-5	269.7	4756777.2	411930.7
93-6	269.8	4756760.2	411931.0
93-7	269.8	4756727.0	411931.5
93-8	269.7	4756710.3	411932.0
93-9	269.3	4756693.8	411932.5
93-10	269.5	4756676.8	411933.0
93-11	270.4	4756643.3	411934.0
93-12	270.4	4756626.7	411934.3

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 included in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV	DATE	BY	DESCRIPTION

Geacres No 40114-123

HWY No 126 (HIGHBURY AVE)	DIST 2
SUBMITTAL CHECKED/DATE 1993 07 05	SITE
DRAWN/DATE 1993 07 05	DWG 4219201-A

