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DIST. 2 REGION

W.P. No. 480-89-03

CONT. No. 94-05

W. O. No.

STR. SITE No. 23-166

HWY. No. 401

LOCATION Hwy 401 & North Sweaburg
Mudspan Rd.

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ontario

Ministry of
Transportation and
Communications

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

CONT 94-05

WP 480-89-03 DIST 2

HWY 401 STR SITE 23-166

North Sweaburg Road Underpass

DISTRIBUTION

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Foundation Investigation Report
For
North Sweaburg Road Underpass
W.P. 480-89-03, Site 23-166
Highway 401, District 2, London

INTRODUCTION

This report contains the results of a foundation investigation carried out at the above mentioned site. The field work was carried out between 1991 11 25 and 1991 12 02, and comprised of four sampled boreholes and Dynamic Cone Penetration Test adjacent to these holes. However, the borings for the existing structure were put down in December 1957.

Boreholes were advanced to a maximum depth of 24.7 m (El: 301.9) below the existing ground level using an 82 mm I.D. continuous flight hollow stem auger.

SITE DESCRIPTION

The site under investigation is located at the crossing of Hwy. 401 and North Sweaburg Road in the Township of Southwest Oxford.

The site is located in an area where the surface is drumlinized. The topography of the site with the exception of the existing crossing (fills) is generally undulating with a group of kames to the northeast. Physiographically, the area is located in the region known as the "Oxford Till Plain".

SUBSURFACE CONDITIONS

The underlying subsoil at this site consists of 6.6 m to 7.8 m dense to very dense fill underlain by 10.5 m to 14.6 m compact to very dense silty sand to sandy silt with occasional gravelly sand seams. This granular deposit is underlain by hard heterogeneous mixture of clayey silt, sand and gravel (glacial till). For classification purposes, the soils encountered at this site can be

divided into four different zones.

- a) Gravelly Sand, Some Silt, Cobbles (Fill)
- b) Clayey Silt, Some Sand and Gravel (Fill)
- c) Silty Sand to Sandy Silt, Trace of Gravel
- d) Heterogeneous Mixture of Clayey Silt, Sand & Gravel (Glacial Till)

The soils 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. A stratigraphical section is shown on Drawing No. 4808903-A. This drawing also shows the locations and elevations of the borings. Description of the strata encountered are given below.

The record of borehole sheets as well as the information obtained from the site investigation carried out for the existing bridge are included in this report.

Gravelly Sand, Some Silt, Cobbles (Fill)

This fill which was placed to raise the finished grade of the North Sweaburg Road, consists of gravelly sand with varying proportions of silt and cobbles. The thickness of the fill varies from 6.6 m to 7.8 m and extends to elevation 319.8 to 318.8. The Standard Penetration Test results indicate that this fill is in dense to very dense state of denseness (N-Values 31 blows/0.3 m to over 100 blows/0.3 m).

Clayey Silt, Some Sand and Gravel (Fill)

The original boreholes (101 & 104) advanced for the existing bridge, indicate fill consists of clayey silt with varying proportions of sand and gravel. The thickness of the fill is about 3.0 m and extend to elevation 317.0. The Standard Penetration Test results in this fill varies over a wide range (N-values 5 blows/0.3 m to 54 blows/0.3 m).

Silty Sand to Sandy Silt, Trace of Gravel

This granular deposit was encountered immediately below the fill. The thickness of this deposit varies from 10.5 m to 14.6 m and extends to elevation 309.2 to 304.4. In this deposit, occasional gravelly sand seams varying in thickness from a few millimetres to a maximum of 4.2 m were encountered. The Gradation Test results are shown on Figure 2 in an envelope form. The results of the Gradation Test 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 (11% to 58%) and silt (41% to 88%). This deposit down to about elevation 316.0 was observed to be in compact to dense state of denseness (N-values 11 blows/0.3 m to 42 blows/0.3 m), however, below this elevation, it is in very dense state of denseness (47 blows/0.3 m to over 100 blows/0.3 m). The borings for the existing bridge (101, 102, 103 and 104) were terminated within this stratum.

Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)

The upper boundary of this deposit was encountered between El: 309.2 and El: 304.3. The Gradation Test results are shown on Figure 3 in an envelope form. These results indicate 13% to 40% gravel, 25% to 47% sand and 13% to 57% clayey silt. The Atterberg Limits determined for the representative soil samples of this deposit are shown on Figure 4. Refusal to Standard Penetration Test was observed in this stratum. The full extent of this deposit was not proven below El: 301.9.

Groundwater Conditions

The groundwater level measurements were taken in open boreholes during investigation and was observed around El: 313.4 and 311.4. However, the borings for the existing structure indicate water level at higher elevation (315.1 to 315.5). The groundwater level at each borehole location is as follows:

<u>Borehole No:</u>	<u>Elevation</u>
1	312.6
2	311.4
3	313.4
4	312.0
101	315.4
102	315.5
103	315.3
104	315.1

DISCUSSION AND RECOMMENDATION

General

It is proposed to replace the existing bridge at the crossing of Hwy. 401 and North Sweaburg Road to accommodate the widening of Highway 401 to six lanes. The new structure will be constructed along the same alignment as the existing bridge. The replacement bridge will be a two span concrete structure with a pier column along the Hwy. 401 median. Each span will be approximately 35 m. The proposed finished grade of North Sweaburg Road is set at El: 327.1± which is about 0.5 m higher than the existing grade.

The existing bridge is a single span rigid frame concrete structure. The clear span between the face of the abutments is about 29.0 m. The approach embankments as well as the bridge deck appear in very good condition. However, few cracks have been noticed on abutments as well as on toe walls.

Based on the information available in this office, the existing structure is supported on shallow foundation placed at about El: 315.8±.

Structure Foundations

Pier

Considering the subsoil conditions at this site, it is recommended that the pier be supported on spread footings placed at about elevation 316.0±. Alternatively, the soil down to elevation 316.0 may be removed and replaced with compacted granular material and the footing may be placed a minimum of 1.2 m below the proposed finished grade. The engineered fill should be constructed as outlined on Figure 5. The following bearing capacity values are recommended for the design of the footing placed on natural ground as well as on compacted granular material.

Factored Bearing Capacity at U.L.S. = 900 kPa

Bearing Capacity at S.L.S. Type II = 350 kPa

The allowable bearing pressure (S.L.S. Type II) recommended are based on the assumption that the footing will not be less than 4.0 m wide and on natural ground, it will not be placed at a level higher than El: 316.0. In addition, the footings will be founded on compacted granular material placed on competent ground. The total settlement for this bearing pressure is expected to be within 25 mm.

Abutments

The foundation for the abutments may be founded on Granular "A" core placed on competent ground. The soil down to elevation 318.0± should be removed before placing the engineered fill. The engineered fill for the abutment foundations should be placed as per Figure 6 attached to this report. The following bearing capacity values are recommended for the design of the abutment foundations.

Factored Bearing Capacity at U.L.S. = 900 kPa

Bearing Capacity at S.L.S. Type II = 350 kPa

Alternatively, the pier and abutments may be supported on driven piles. Since high bearing capacity values are recommended, the aspect of deep foundation is not discussed.

Earth pressure should be computed as per Section 6.1.2.2 of the O.H.B.D.C., and an 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)	$\gamma = 22.8$	$\gamma = 21.2$

If the structure is placed on spread footings, an unfactored coefficient of friction value of $\tan 30^{\circ}$ may be assumed for the estimate of the sliding resistance.

Approach Embankment

The proposed finished grade of North Sweaburg Road is set at El: 327.1 which is about 0.5 m higher than the existing grade. However, the maximum height of approach fill is expected to be about 7.9 m. No major stability problems are anticipated for the approach embankments constructed with 2 horizontal to 1 vertical 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.

Other Considerations

The spread footings should have minimum of 1.2 m earth cover for frost protection.

The ground water level was encountered well below the recommended founding level for the pier foundation. No major dewatering problems are anticipated, however, if any minor seepage or surface run-off into the excavation, it may be readily handled by pumping from the sump.

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, Foundation Engineer, reviewed by Mr. P. Payer, Senior Foundation Engineer and approved by Mr. M. Devata, Chief Foundation Engineer.

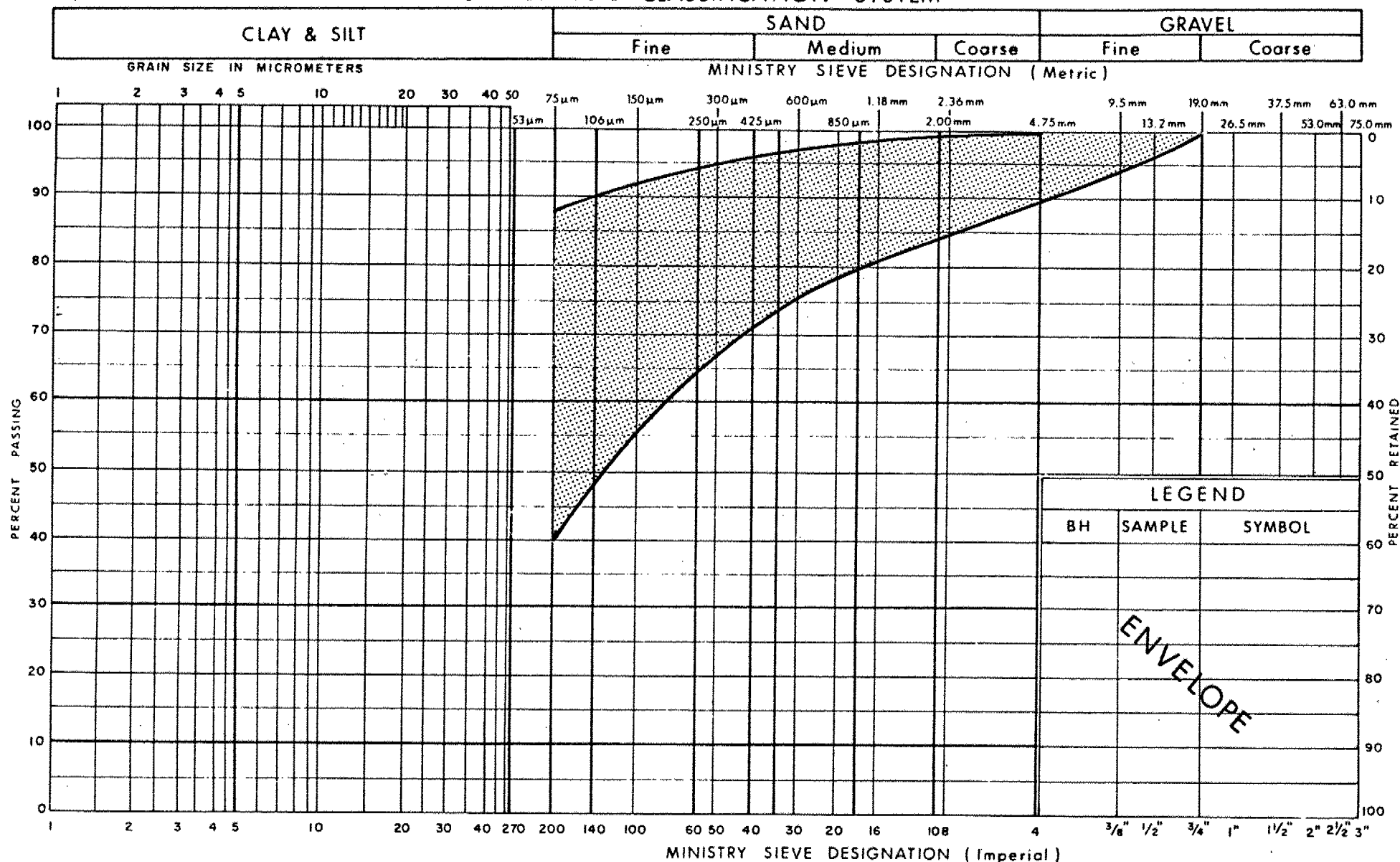


M. Vasavithasan
M. Vasavithasan, P. Eng.
Foundation Engineer

M. Devata
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Chief Foundation Engineer

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM

Ministry of
Transportation

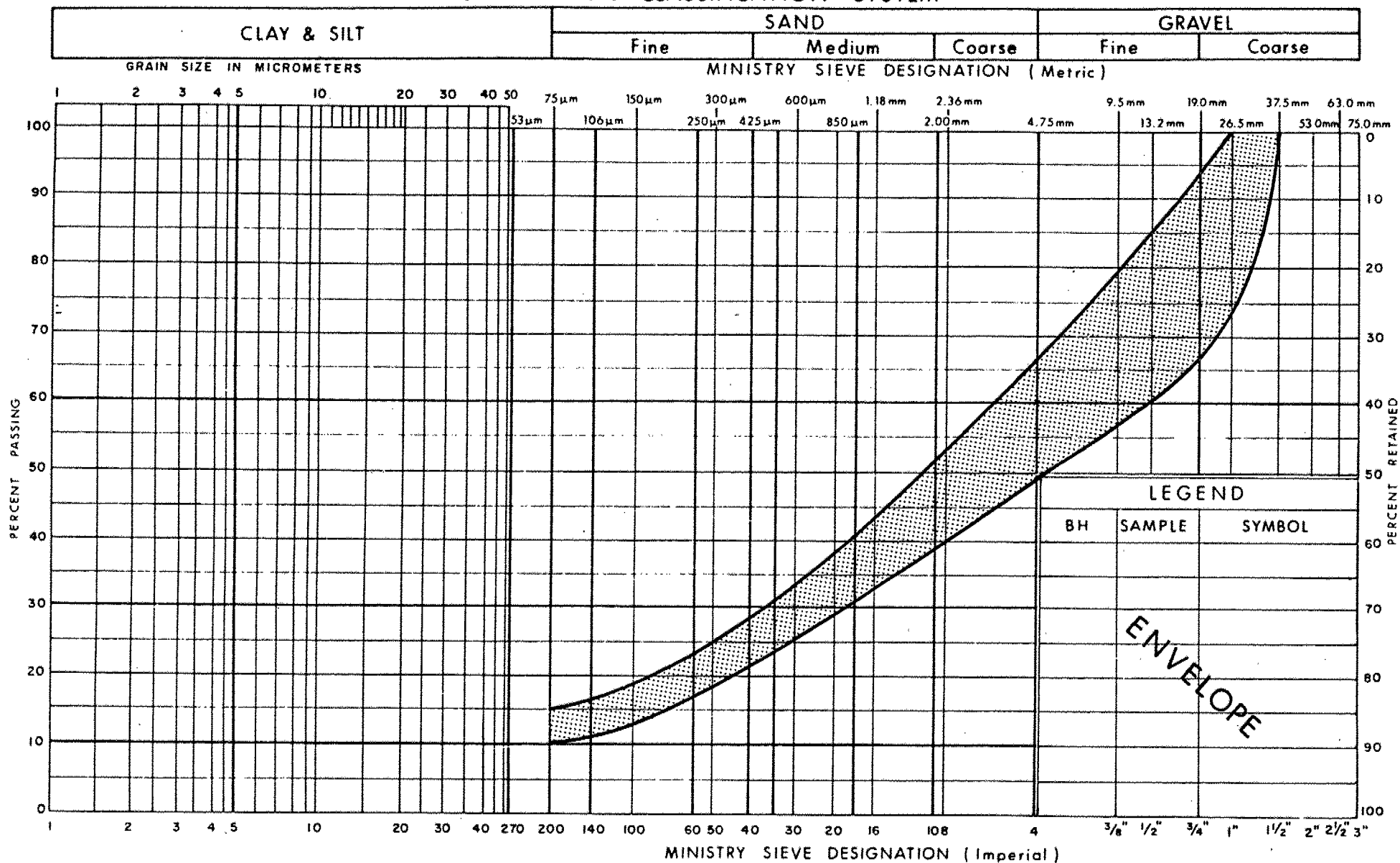
Ontario

GRAIN SIZE DISTRIBUTION
SILTY SAND TO SANDY SILT
TRACE OF GRAVEL

FIG No 1

W P 480 - 89 - 03

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
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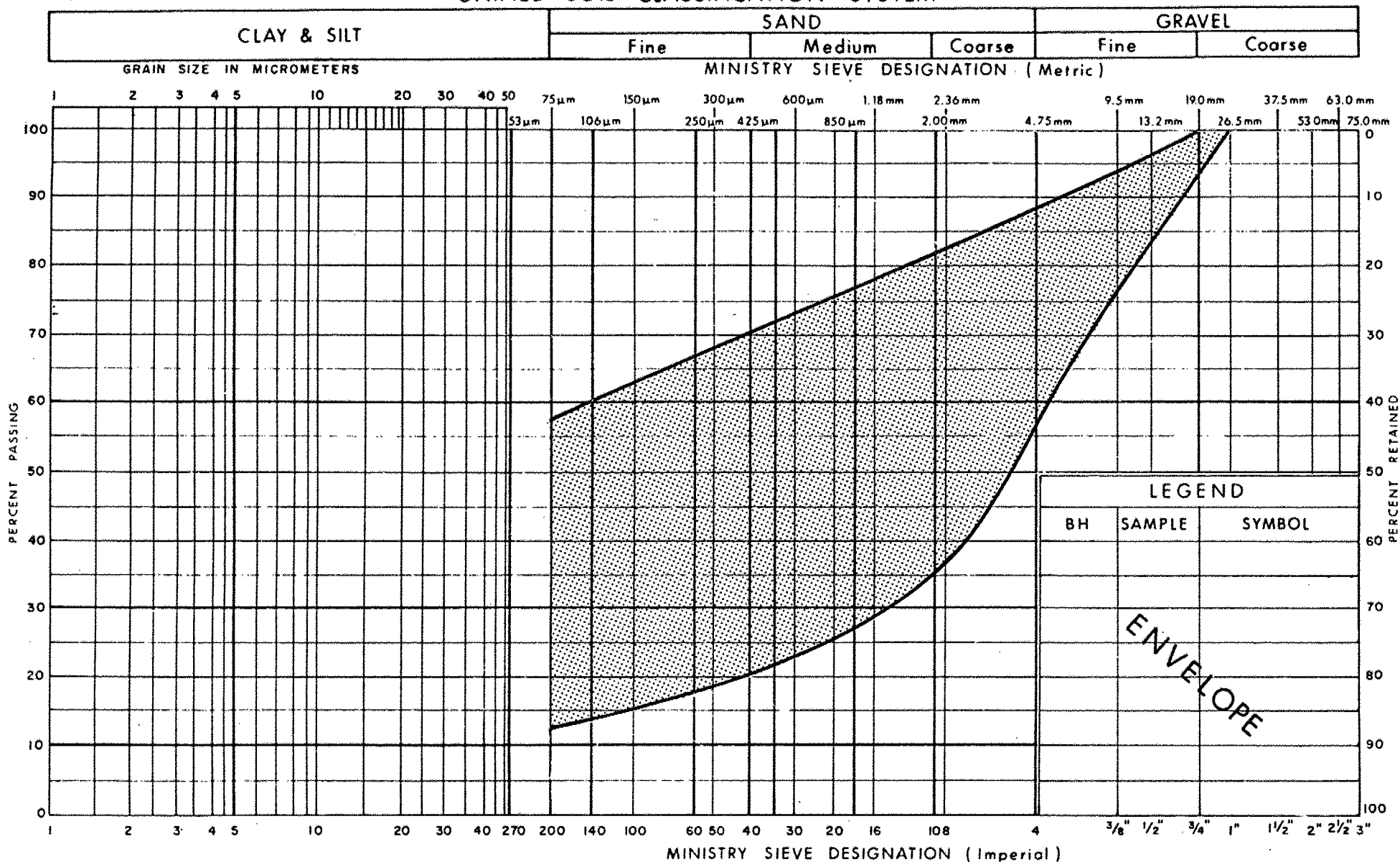
Ontario

GRAIN SIZE DISTRIBUTION
GRAVELLY SAND, SOME SILT

FIG No 2

W P 480 - 89 - 03

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

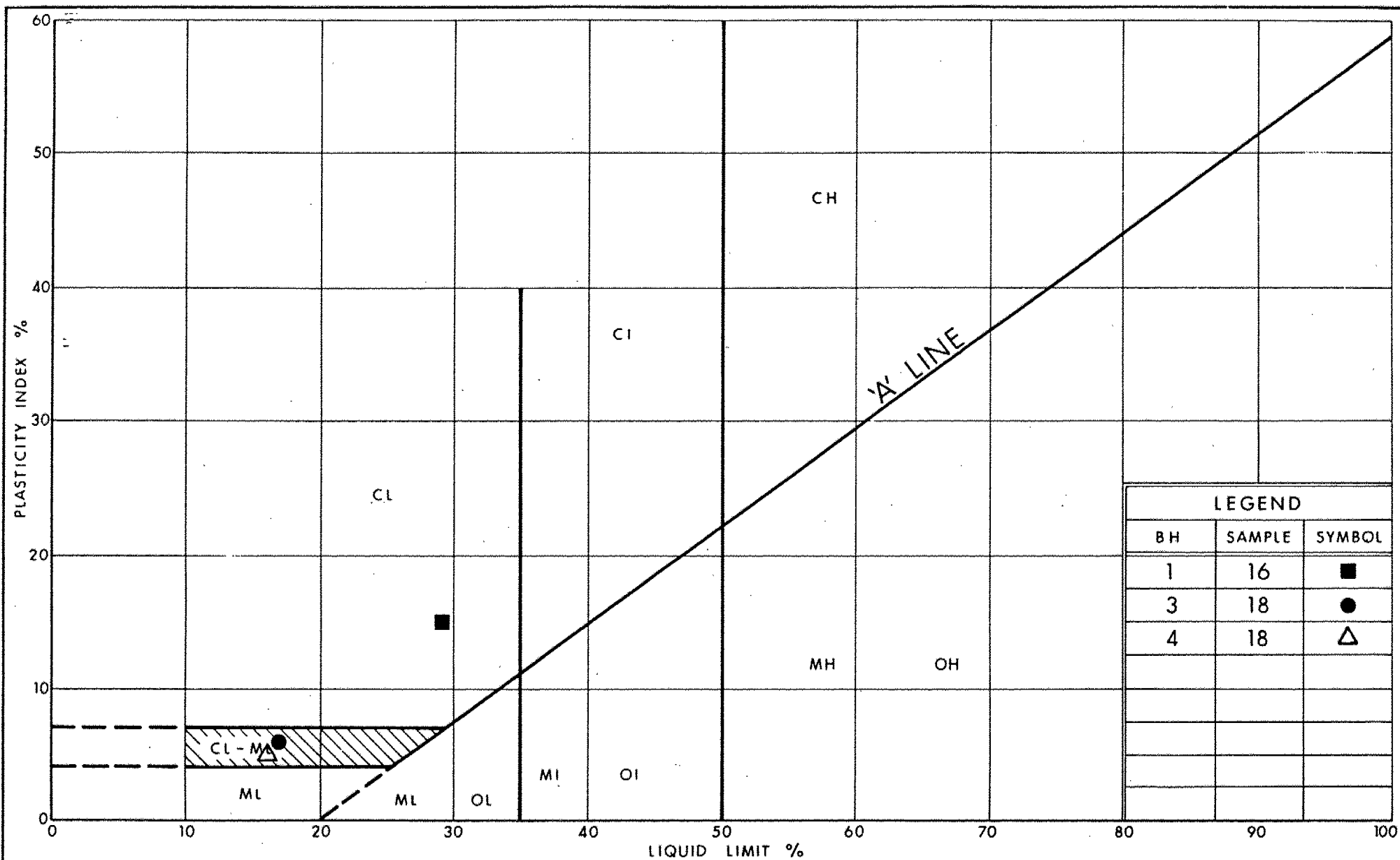
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

HET MIXTURE OF CLAYEY SILT, SAND & GRAVEL (Glacial Till)

FIG. No 3

W P 480-89-03

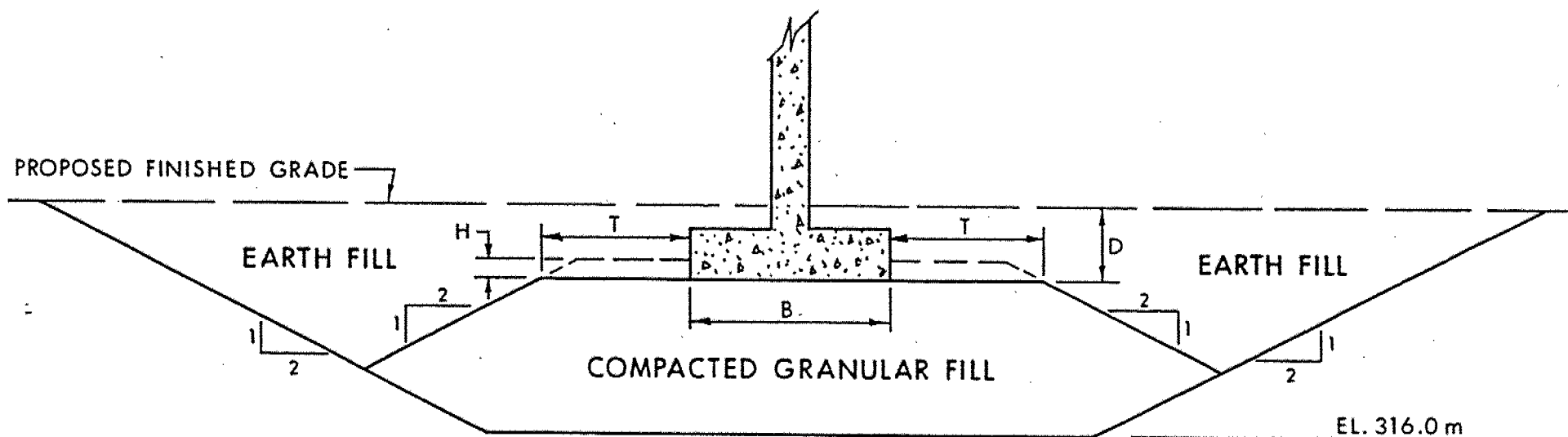


Ministry of
Transportation

PLASTICITY CHART
HET MIXTURE OF
CLAYEY SILT, SAND & GRAVEL (Glacial Till)

FIG No 4

W P 480 - 89 - 03



NOTES:

- 1) SUB-EXCAVATE UP TO EL. 316.0m UNDER AREA OF COMPACTED GRANULAR FILL.
- 2) PLACE GRANULAR FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT MTO STANDARDS.
- 3) CONSTRUCT CONCRETE FOOTING.
- 4) PLACE REMAINDER OF EARTH FILL.

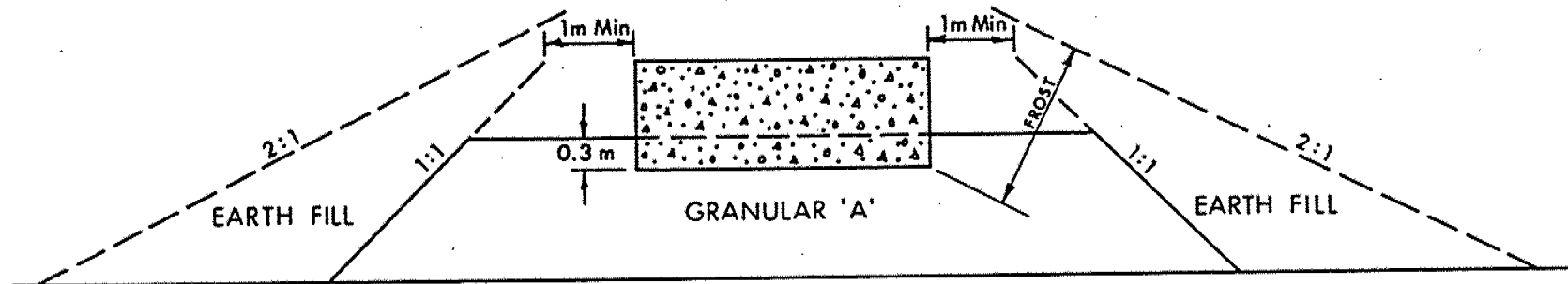
LEGEND:

- H = 0.3m
- T = 3.0m Minimum
- D = 1.2m Minimum
- B = Footing Width

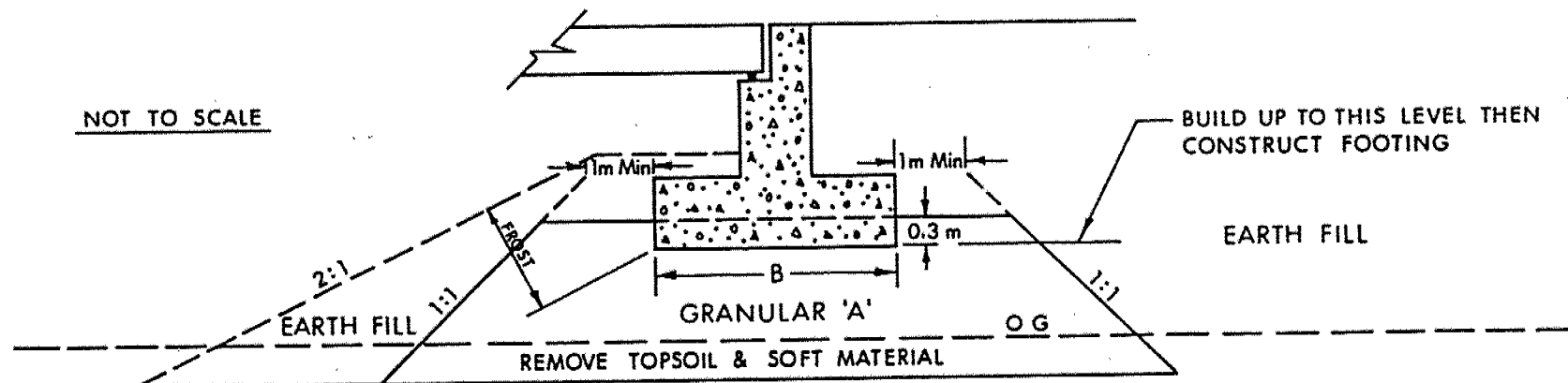
FIG No 5

WP 480-89-03

PIER ON COMPACTED GRANULAR FILL



X SECTION



LONGITUDINAL SECTION

NOTES:

- 1- REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.
- 2- PLACE GRANULAR 'A' & EARTH FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M T O STANDARDS.
- 3- CONSTRUCT CONCRETE FOOTING.
- 4- PLACE REMAINDER OF GRANULAR 'A' & EARTH FILL AS REQUIRED.



Ministry of
Transportation

ABUTMENT ON COMPACTED FILL
SHOWING GRANULAR 'A' CORE

FIG No 6

W P 480 - 89 - 03

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_a	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_f	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
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

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^2	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 879.6; E 200 676.3 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER & CONE TEST COMPILED BY M V
DATUM GEODETIC DATE 91 11 25 & 91 11 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 (%) 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					
326.3	Asphalt Surface													
0.0	100 mm Asphalt													
	GRAVELLY SAND, Some Silt, Cobbles, Dense to Very Dense (Fill)													
			1	SS	100	/3cm								
			2	SS	76									
			3	SS	34									
			4	SS	100	/10cm								
319.7			5	SS	131									
6.6	Trace of Organics		6	SS	28									1 58 (41)
	Loose to Compact		7	SS	7									8 26 (66)
			8	SS	14									
			9	SS	11									
	SILTY SAND to SANDY SILT, Trace of Gravel, Very Dense		10	SS	52									1 11 (88)
			11	SS	81									
			12	SS	99									
	Gravelly Sand, Some Silt		13	SS	87									
			14	SS	116									
309.2														
17.1	Heterogeneous Mixture of CLAYEY SILT, SAND and GRAVEL, Hard (Glacial Till)		15	SS	102	/15cm								
			16	SS	102	/15cm								13 30 30 27
304.7														
21.6	End of Borehole													

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 889.0; E 200 660.5 ORIGINATED BY M V
 DIST 2 HWY 401 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER & CONE TEST COMPILED BY M V
 DATUM GEODETIC DATE 91 11 29 TO 91 12 02 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 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					
326.6	Asphalt Surface													
0.0	180 mm Asphalt													
	GRAVELLY SAND, Some Silt, Cobbles; Dense to Very Dense (Fill)		1	SS	31									
			2	SS	119									
			3	SS	96									
320.7														
5.9	Trace of Organics		4	SS	51									
			5	SS	21									
			6	SS	11									0 22 (78)
	Compact		7	SS	18									2 20 (78)
			8	SS	14									11 38 (51)
			9	SS	14									
			10	SS	134									
	SILTY SAND to SANDY SILT, Trace of Gravel, Very Dense		11	SS	108									
			12	SS	104									3 22 (75)
			13	SS	113									
			14	SS	104									
309.2			15	SS	153									
17.4	Gravelly Sand, Some Silt													
	Heterogeneous Mixture of CLAYEY SILT, SAND and GRAVEL Hard (Glacial Till)		16	SS	107	/8cm								
305.0														
			17	SS	107	/15cm								40 47 (13)
21.6	End of Borehole													

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 926.7; E 200 631.7 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER & CONE TEST COMPILED BY M V
DATUM GEODETIC DATE 91 11 28 & 91 11 29 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			
326.6	Asphalt Surface													
0.0	190 mm Asphalt													
	GRAVELLY SAND, Some Silt, Cobbles, Dense to Very Dense (Fill)		1	SS	47									
			2	SS	49									
			3	SS	33									
			4	SS	59									
			5	SS	28									
318.8			6	SS	27									
7.8	Trace of Organics Compact		7	SS	14									
			8	SS	42									
	Gravelly Sand, Some Silt		9	SS	118									37 53 (10)
			10	SS	104	/15cm								52 37 (11)
			11	SS	131	/25cm								
			12	SS	66									
			13	SS	106									
			14	SS	103	/8cm								
	SILTY SAND to SANDY SILT, Trace of Gravel, Dense to Very Dense		15	SS	104	/15cm								5 29 (66)
			16	SS	117									
304.4			17	SS	131	/15cm								
22.2	Heterogeneous Mixture of CLAYEY SILT, SAND and GRAVEL, Hard													
301.9	(Glacial Till)		18	SS	143	/15cm								20 25 39 16
24.7	End of Borehole													

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 936.3; E 200 615.8 ORIGINATED BY M V
DIST 2 HWY 401 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER & CONE TEST COMPILED BY M V
DATUM GEODETIC DATE 91 11 26 & 91 11 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 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			
326.3	Asphalt Surface													
0.0	100 mm Asphalt													
	GRAVELLY SAND, Some Silt, Cobbles, Dense to Very Dense (Fill)		1	SS	48									
			2	SS	42									
			3	SS	60									
			4	SS	100	/5cm								
318.9			5	SS	57									
7.4	Trace of Organics		6	SS	20									
	Compact		7	SS	11									3 40 (57)
			8	SS	58									38 48 (14)
			9	SS	100	/14cm								
	Gravelly Sand, Some Silt		10	SS	101									
			11	SS	59									41 45 (14)
			12	SS	47									
			13	SS	95									5 22 (73)
	SILTY SAND to SANDY SILT, Trace of Gravel, Dense to Very Dense		14	SS	130									
			15	SS	153									
			16	SS	133									
304.3			17	SS	101									1 49 (50)
22.0	Heterogeneous Mixture of CLAYEY SILT, SAND and GRAVEL, Hard													
301.8	(Glacial Till)		18	SS	161	/15cm								13 38 (49)
24.5	End of Borehole													

RECORD OF BOREHOLE No 101*

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 922.1; E 200 638.0 ORIGINATED BY L B
DIST 2 HWY 401 BOREHOLE TYPE BW CASING COMPILED BY M V
DATUM GEODETIC DATE 57 12 05 TO 57 12 14 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					
320.0	Ground Surface												
0.0	CLAYEY SILT, Some Sand and Gravel, Occasional Brick Fragments and Ashes, Firm to Stiff (Fill)		1	SS	54								
			2	SS	13								
317.0			3	SS	5								
3.0	Gravelly Sand, Some Silt Compact		4	SS	14								
			5	SS	27								
			6	SS	76								
	SILTY SAND to SANDY SILT, Trace of Gravel, Very Dense		7	SS	48								
312.2			8	SS	64								
7.8	End of Borehole * Formerly BH# 1 of W. P. 151 - 57												

RECORD OF BOREHOLE No 102*

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 900.5; E 200 658.2 ORIGINATED BY L B
DIST 2 HWY 401 BOREHOLE TYPE BW CASING COMPILED BY M V
DATUM GEODETIC DATE 57 12 05 TO 57 12 14 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			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20 40 60 80 100										10 20 30		
319.7	Ground Surface																			
0.0	SILTY SAND, Some Gravel, Some Organics, Compact, (Fill)		1	SS	18															
318.3			2	SS	15															
1.4	Compact		3	SS	10															
			4	SS	33	/23cm														
			5	SS	30	/23cm														
	SILTY SAND to SANDY SILT, Trace of Gravel, Dense to Very Dense		6	SS	34															
			7	SS	33	/23cm														
			8	SS	35	/23cm														
311.9			9	SS	37	/23cm														
7.8	End of Borehole * Formerly BH# 2 of W. P. 151 - 57																			

RECORD OF BOREHOLE No 103*

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 893.7; E 200 654.5 ORIGINATED BY L B
 DIST 2 HWY 401 BOREHOLE TYPE BW CASING COMPILED BY M V
 DATUM GEODETIC DATE 57 12 05 TO 57 12 14 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 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					
318.7	Ground Surface																
0.0	SILTY SAND, Some Gravel, Some Organics, Dense (Fill)		1	SS	35												
318.3			2	SS	21												
1.4	Compact		3	SS	7												
			4	SS	78												
			5	SS	78												
	SILTY SAND to SANDY SILT, Trace of Gravel, Very Dense to Dense		6	SS	60												
			7	SS	61												
			8	SS	36												
310.3			9	SS	38												
9.4	End of Borehole																
	* Formerly BH# 3 of W. P. 151 - 57																

RECORD OF BOREHOLE No 104*

1 OF 1

METRIC

W.P. 480 - 89 - 03 LOCATION Co-ords: N 4 771 916.0; E 200 630.7 ORIGINATED BY L.B.
DIST 2 HWY 401 BOREHOLE TYPE BW CASING COMPILED BY M.V.
DATUM GEODETIC DATE 57 12 05 TO 57 12 14 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					
319.8	Ground Surface																
0.0	CLAYEY SILT, Some Sand and Gravel, Occasional Brick Fragments and Ashes, Firm to Stiff (Fill)		1	SS	14		318										
			2	SS	14												
316.9			3	SS	7												
2.9	Compact		4	SS	10		316										
			5	SS	18												
			6	SS	49												
	SILTY SAND to SANDY SILT, Trace of Gravel, Very Dense		7	SS	69	/23cm	314										
			8	SS	80	/23cm	312										
310.5			9	SS	40	/15cm											
9.3	End of Borehole																
	* Formerly BH# 4 of W. P. 151 - 57																

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

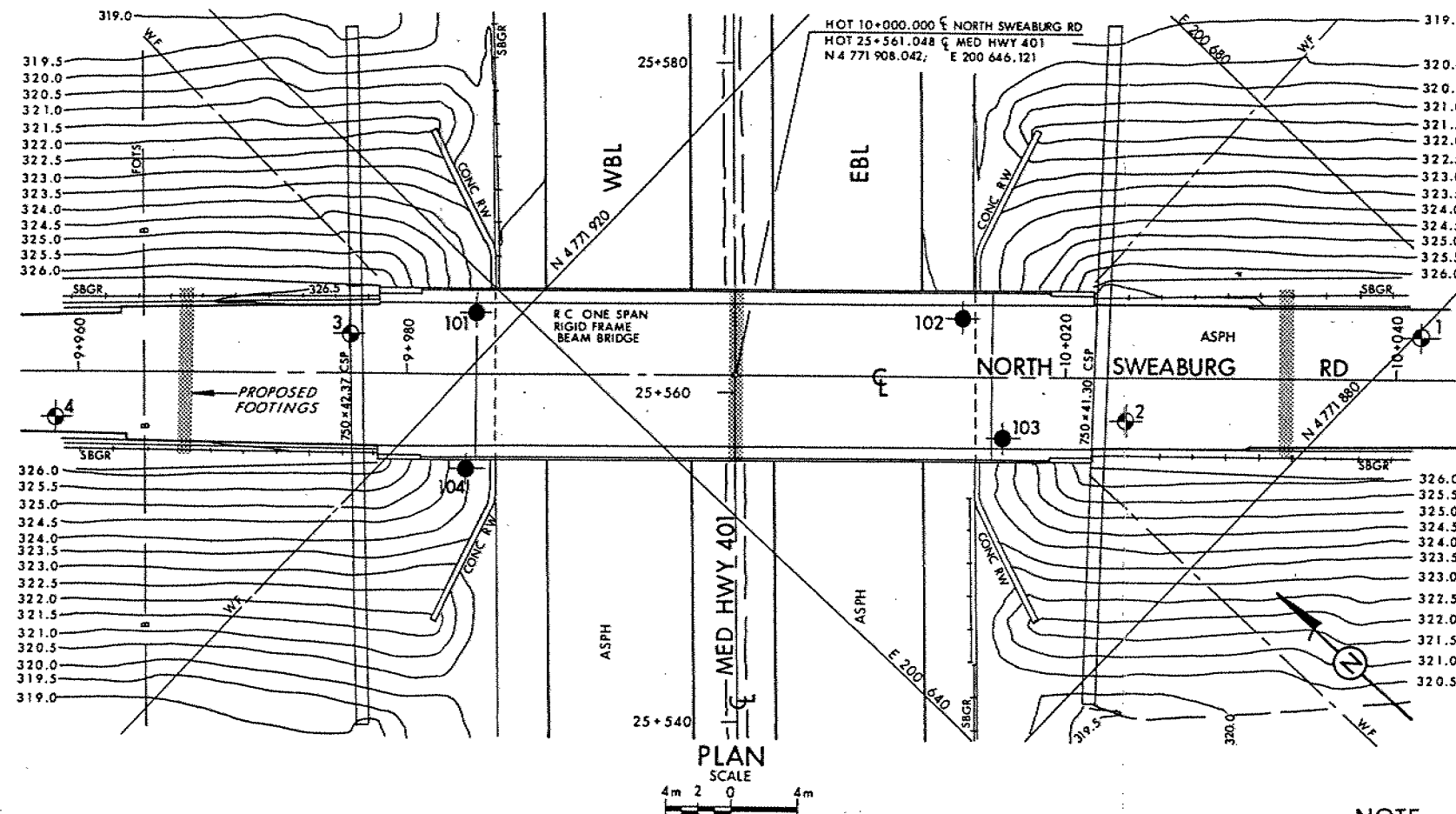
CONT No
WP No 480-89-03

NORTH SWEABURG ROAD

BORE HOLE LOCATIONS & SOIL STRATA

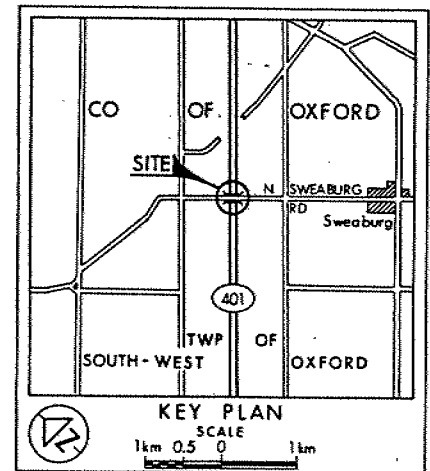


SHEET



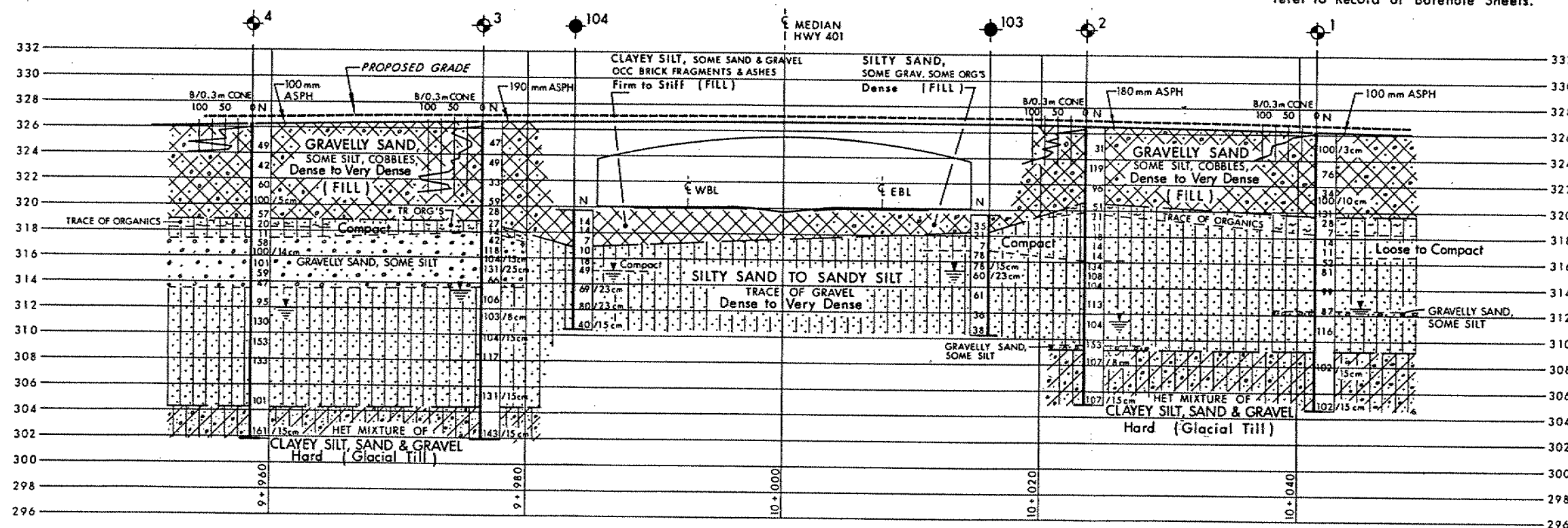
NOTE

For Subsoil information of B.H's 101 & 102
refer to Record of Borehole Sheets.



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
1957 12, 1991 11 and 12



PROFILE NORTH SWEABURG ROAD

FORMERLY
WP 151-57

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.

DATE	BY	DESCRIPTION
1992 05 20	DATE	1992 05 20
1992 05 20	DATE	1992 05 20
1992 05 20	DATE	1992 05 20

Geocres No 40P2-51

HWY No 401	SUBM'D M.V. CHECKED	DATE 1992 05 20	DIST 2
DRAWN R.S. CHECKED	DATE 1992 05 20	SITE 23-166	DWG 4808903-A