

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31E-92

DIST. 11 REGION

W.P. No. 33-77-02

CONT. No. 86-90

W. O. No.

STR. SITE No. 42-182

HWY. No. 11

LOCATION Taylor Rd. Interchange

No of PAGES -

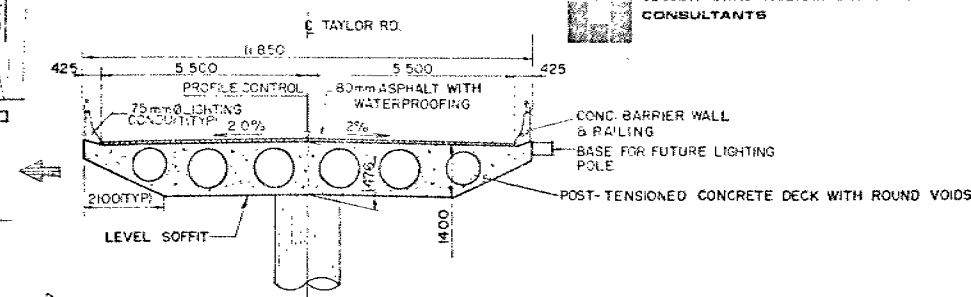
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

**METRIC**

DIMENSIONS ARE IN MILLIMETRES  
UNLESS OTHERWISE SHOWN.  
ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES.

totten sims hubicki associates limited  
CONSULTANTS



**TYPICAL DECK SECTION**

SCALE 1:100

**NOTES**

**CLASS OF CONCRETE**

- DECK, PIER & BARRIER WALLS. 35 MPa.
- FOOTINGS, ABUTMENTS & WINGWALLS. 25 MPa.
- REMAINDER. 20 MPa.

**CLEAR COVER TO REINFORCING STEEL**

- FOOTINGS, ABUTMENTS & WINGWALLS 75 mm
- DECK TOP- 50 mm  
BOT- 40 mm
- APPROACH SLABS 50 mm
- BARRIER WALLS AS NOTED
- PIER 60 mm

**CONSTRUCTION:**

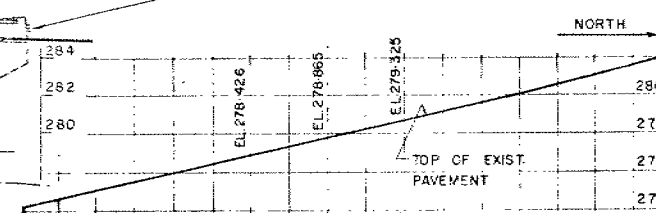
- THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF  $\pm 3$  mm.
- NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN DECK HAS BEEN PLACED, STRESSED AND GROUTED.
- REINFORCING STEEL SHALL BE GRADE 400 EXCEPT AS NOTED. REINFORCING BARS WITH THE DESIGNATION 'C' AT THE END OF BAR MARKS SHALL BE COATED BARS.
- TO ACHIEVE THE MINIMUM CLEAR COVER OF 50 mm SPECIFIED AT TOP OF DECK THE TOP LAYER OF REINFORCING STEEL SHALL BE PLACED PRIOR TO CONCRETING WITH A CLEAR COVER OF 65 mm TOLERANCE.

**LIST OF DRAWINGS**

- 4282-1 GENERAL ARRANGEMENT
- 2 BOREHOLE DATA & SOIL STRATA
- 3 FOOTINGS
- 4 ABUTMENTS
- 5 WINGWALLS
- 6 PIER
- 7 BEARINGS
- 8 DECK DETAILS
- 9 LONGITUDINAL CABLE DETAILS
- 10 TRANSVERSE CABLE DETAILS
- 11 DECK REINFORCEMENT
- 12 BARRIER WALL WITH RAILING
- 13 RAILING FOR BARRIER WALL
- 14 6000 APPROACH SLAB
- 15 BRIDGE ELECTRICAL DETAILS-TYPE 17
- 16 STANDARDS
- 17 STANDARDS
- 18 BRIDGE DATA & SITE NUMBER DATA
- 19 AS CONSTRUCTED ELEV. & DIM.

**PROFILE AT @ TAYLOR RD.**

N.T.S.



TAYLOR RD. INTERCHANGE  
HWY. NO. 11 AT THE NORTH ENTRANCE  
TO THE TOWN OF BRACEBRIDGE  
FOOTINGS

METRIC

DIMENSIONS ARE IN MILLIMETRES  
UNLESS OTHERWISE SHOWN.  
ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES.

A20025 TO A20034  
FANNED OUT EQUALLY  
300 MAX 75 MIN. TOP

14-A25022 AT 150 DWL'S

16 - A 20046AT 300 TOP

16 - A 20046AT 300 TOP

3 - A 30045 BOT.

40 - A 350047 DWLS.

CONSTRUCTION (TAYLOR RD.)

6 - A 30045 AT 114(TYP) BETWEEN PILES BOT.

3 - A 30045(TYP)

6 - A 30045 AT 114(TYP) BETWEEN PILES BOT.

3 - A 30045 BOT.

PIER FOOTING REINFORCEMENT  
SCALE 1:50

## NOTES

- SPACING OF PILES TO BE MEASURED AT UNDERSIDE OF FOOTINGS.

• PILE LENGTHS SHOWN ARE THEORETICAL LENGTHS BELOW CUT-OFF ELEVATIONS

LIST OF PILES				OSLO POINT
LOCATION	NO	LENGTH	TYPE	NO
EAST ABUT.	19	40000	HP 310x110	5
WESTABUT.	19	19 000	HP 310x110	4
PIER	25	23 000	HP 310x110	20

- reinforced typ on vest

SCALE AS NOTED

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS				SCALE AS NOTED	
DATE	BY	DESCRIPTION			
DESIGN RHP	CHECK T/M	LOADING 01800-879 DATE 2-8			
TRAINING RHP	CHECK SLS	SITE NO. 32-462 CHECK 1			

# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 86-90



Ministry of  
Transportation and  
Communications

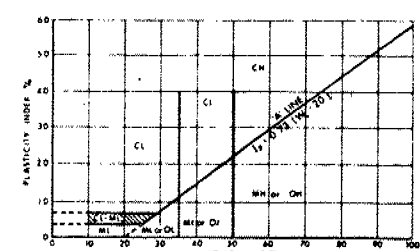
I N D E X

<u>PAGE NO.</u>	<u>DESCRIPTION</u>
1	Index
2	MTC Soil Classification System
3	Abbreviations and Symbols
4 - 24	Foundation Investigation Report Taylor Rd. Interchange Underpass W. P. 33-77-02, Site: 42-182 Hwy. #11, District #11 (Huntsville)

NOTE: FOR THE PURPOSE OF THIS CONTRACT THIS REPORT SUPERCEDES ALL OTHER FOUNDATION REPORTS PREPARED BY OR FOR THE MINISTRY IN CONNECTION WITH THE ABOVE-NOTED PROJECT.

# EXTENDED CASAGRANDE SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 75 mm AND BASING FRACTIONS ON ESTIMATED MASS)				GRP SYMB	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA		
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN 75 μm (LITTLE OR NO FINE FRACTION IS LARGER THAN 4.75 mm)	GRAVELS	CLEAN GRAVELS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZE		GM	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	GIVE TYPE, NAME, IF NECESSARY, INDICATE APPROX. % OF SAND & GRAVEL; MAX. SIZE; ANGULARITY, SURFACE CONDITION, & HARDNESS OF THE COARSE GRAINS; LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION; & SYMBOL IN PARENTHESES.  FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITIONS & DRAINAGE CHARACTERISTICS.  USE GRAIN SIZE CURVE IN IDENTIFYING THE FRACTIONS AS GIVEN UNDER FIELD IDENTIFICATION	$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4 $C_c = \frac{(D_{30})^2}{D_{10} \cdot D_{60}}$ BETWEEN ONE AND 3  NOT MEETING ALL GRADATION REQUIREMENTS FOR GM  ATTENBERG LIMITS BELOW A-LINE, OR $I_p$ LESS THAN 4  ATTENBERG LIMITS ABOVE A-LINE WITH $I_p$ GREATER THAN 7  $C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 6 $C_c = \frac{(D_{30})^2}{D_{10} \cdot D_{60}}$ BETWEEN ONE AND 3  NOT MEETING ALL GRADATION REQUIREMENTS FOR SM  ATTENBERG LIMITS BELOW A-LINE OR $I_p$ LESS THAN 4  ATTENBERG LIMITS ABOVE A-LINE WITH $I_p$ GREATER THAN 7	
			PREDOMINANTLY ONE SIZE OF A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES; LITTLE OR NO FINES			
		GRAVEL WITH FINES (APPRECIABLE AMOUNT OF FINES)	NON-PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES			
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES			
	SANDS	CLEAN SANDS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZES & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES		SW	WELL GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES			
			PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING		SP	POORLY GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES			
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	NON-PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES			
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES			
	FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN 75 μm (75 μm IS ABOUT THE SMALLEST PARTICLE SIZE VISIBLE TO THE NAKED EYE)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425 μm							
		SILTS AND CLAYS	LIQUID LIMIT LESS THAN 35%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)		ML	INORGANIC SILTS & SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR
NONE				QUICK	NONE	CL	CLAYEY SILTS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS		
MEDIUM TO HIGH				NONE TO VERY SLOW	MEDIUM	DL	ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS		
SLIGHT TO MEDIUM				NONE TO SLIGHT	SLOW TO QUICK	SLIGHT	ML	INORGANIC, COMPRESSIBLE FINE SANDY SILT WITH CLAY OF MEDIUM PLASTICITY, CLAYEY SILTS	
				HIGH	NONE	MEDIUM TO HIGH	CL	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY	
				SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	DL	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY	
LIQUID LIMIT BETWEEN 35% AND 50%			NONE TO SLIGHT	SLOW TO QUICK	SLIGHT	ML	INORGANIC, COMPRESSIBLE FINE SANDY SILT WITH CLAY OF MEDIUM PLASTICITY, CLAYEY SILTS		
			HIGH	NONE	MEDIUM TO HIGH	CL	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY		
			SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	DL	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY		
			LIQUID LIMIT GREATER THAN 50%	SLIGHT TO MEDIUM	SLOW TO NONE	MEDIUM	MH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMACEOUS FINE SANDY SILTS, ELASTIC SILTS	
HIGH TO VERY HIGH		NONE		HIGH	CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS			
MEDIUM TO HIGH		NONE TO VERY SLOW		SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY			
		SLIGHT TO MEDIUM		VERY SLOW	SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS		READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE			Pe	PEAT & OTHER HIGHLY ORGANIC SOILS			



BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS. FOR EXAMPLE GM-GC, WELL GRADED GRAVEL-SAND MIXTURE WITH CLAY BINDER

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

**JOINTING AND BEDDING:**

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

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

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

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	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
$C_\alpha$	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
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	$kg/m^3$	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	$kN/m^3$	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	$kg/m^3$	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	$kN/m^3$	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	$kg/m^3$	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	$kN/m^3$	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	$kg/m^3$	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	$m^3/s$	RATE OF DISCHARGE
$\gamma_d$	$kN/m^3$	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	$kg/m^3$	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	$kN/m^3$	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	$kg/m^3$	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	$kN/m^3$	SEEPAGE FORCE
$\gamma'$	$kN/m^3$	UNIT WEIGHT OF SUBMERGED SOIL						

## FOUNDATION INVESTIGATION REPORT

For

Taylor Rd. Interchange Underpass

W. P. 33-77-02; Site: 42-182

Hwy. #11, District #11 (Huntsville)INTRODUCTION

This report contains the results of a foundation investigation carried out for the proposed structure at the future junction of the realigned Taylor Road and existing Hwy. #11, during the period of 79 06 20 to 28. The field work consisted of three sampled boreholes and three dynamic cone penetration tests. In addition, seven probeholes were augered to refusal without sampling. The borings were advanced by employing a continuous flight auger machine, mounted on a muskeg vehicle and equipped with 82 mm I.D. hollow stem augers.

SITE DESCRIPTION

The site is located at the future junction of the proposed Taylor Road realignment and existing Hwy. #11. The existing Hwy. #11 is a four lane roadway divided by an approximately 15 m wide median. The proposed structure will be located within M.T.C.'s Right-of-Way. The surrounding terrain is sloping from west to east.

SUBSURFACE CONDITIONSGeneral

The overburden at this location was found to consist mainly of sands and silts (or the combinations of these two materials) with an approximately 3 m thick clayey silt layer sandwiched between the granular type deposits at the location of the pier and east abutment. Granite Gneiss type bedrock (sloping from west to east with an estimated gradient of 3.3:1) was encountered between El. 265± and El. 242±. The boundaries of the different soil types and bedrock, together with the obtained field and laboratory tests results are shown on the Record of Borehole Sheets contained in the Appendix. The stratigraphical profile and sections shown on Drawing No. 2 and 2A of the Contract Documents are based on this information.



Drawing #2 also shows the locations and elevations of the borings. A detailed description of the encountered subsurface conditions is given below.

#### Sand With Traces of Silt and Clay

This deposit was encountered in all of the borings from ground level to a maximum (observed) thickness of about 9 m. The material consists mainly of sand with traces of silt and clay. The colour of the stratum is yellow brown and red brown. An approx. 3 m thick of clayey silt with sand intrusion was also encountered within this deposit. Laboratory tests carried out on the sand samples revealed the natural moisture content to range from 4% to 20%. Grain size distribution curves are plotted in an envelope form on Figure 1 in the Appendix.

Standard Penetration Tests gave 'N' values to range from 7 to 38 blows/0.3 m, with an average of 25 blows/0.3 m, indicating a loose to dense denseness.

#### Clayey Silt With Sand

Boreholes #2 and #4 intersect this layer within the above described sand deposit but it appears to peter out before reaching B.H. #1. The thickness is about 3 m. The colour of the material is grey. Laboratory tests indicate the following physical properties:

	<u>Range</u>
Natural Moisture Content (w)	28-34%
Liquid Limit ( $w_L$ )	24-36%
Plastic Limit ( $w_p$ )	10-15%

The results of grain size distribution tests are shown on Figure 2. The consistency of this layer is estimated to range from stiff to very stiff. For design purposes an estimated undrained shear strength value ( $c_u$ ) of 85 kPa is recommended.

#### Sandy Silt to Silt with Traces of Clay

This deposit underlies the sand stratum at the boring locations with variable thickness (2 to 8 m).

The material in the deposit was found to consist of sandy silt to silt with traces of clay. The natural moisture content was found to be in the order of 23%.

Grain size distribution curves are plotted on Figure 3 of the Appendix. Standard Penetration Test 'N' values (12-36 blows/0.3 m) indicate that the denseness varies randomly from compact to dense.

#### Sand With Traces of Silt and Clay

Below the sandy silt to silt zone a second deposit of sand with traces of silt and clay was encountered down to the bedrock surface. The colour of the material is brown-grey to brown-yellow. The natural moisture content ranges from 18% to 27%. The results of the laboratory grain size distribution tests are plotted in an envelope form on Figure 4. Based on the Standard Penetration Tests 'N' values (17 to 50 blows/0.3 m) it is estimated that the denseness of the overall stratum ranges from compact to very dense. Occasionally, 'boiling' of the sand due to excess hydrostatic pressure was also observed.

#### Bedrock

Bedrock was proven in Boreholes #1 and #4 by obtaining BXL size cores at the following levels:

B.H. #1 El. 263.5

B.H. #4 El. 242.2

The bedrock as described by Mr. B. K. Glassford, Geologist, consists of pinkish-grey coloured Granite Gneiss bedrock.

#### Groundwater Conditions

The groundwater level was observed by measuring in the open sampled boreholes after completion of the investigation:

B.H. #1 El. 267.9

B.H. #2 El. 267.0

B.H. #4 El. 275.9



*P. Payer*  
P. Payer, P. Eng.,  
Senior Foundations Engineer

*K. G. Selby*  
K. G. Selby, P. Eng.,  
Chief Foundations Engineer  
(West)

## APPENDIX

# RECORD OF BOREHOLE No 1

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 083.4; E 321 352.3 ORIGINATED BY PRK  
 DIST 11 HWY 11 BOREHOLE TYPE Hollow Stem Auger, BXL Core COMPILED BY PRK  
 DATUM Geodetic DATE 1979 07 04 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
280.0	Ground Level																
0.0							280.0										
	Sand		1	SS	34												
	Traces of Silt and Clay		2	SS	34												0 94 (6)
			3	SS	32												0 91 (9)
			4	SS	33												0 97 (3)
	Compact to Dense		5	SS	34												
			6	SS	26		275.0										
			7	SS	24												
			8	SS	25												
			9	SS	28												0 96 (4)
272.1			10	SS	36												0 21 76 3
7.9	Sandy Silt to Silt																
	Traces of Clay																
	Compact		11	SS	23												
270.0							270.0										
10.0	Sand		12	SS	44												0 95 (5)
	Traces of Silt and Clay																
	Compact to Dense		13	SS	27												
			14	SS	27												0 98 (2)
265.1			15	SS	25/100 mm Bouncing		265.0										
14.9	Granite Gneiss		16	RC	98% REC												
263.5	Bedrock Sound																
16.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 2

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 114.4; E 321 373.2 ORIGINATED BY PRK  
 DIST 11 HWY 11 BOREHOLE TYPE Hollow Stem Auger, BX Casing COMPILED BY PRK  
 DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
277.7	Ground Level																GR SA SI CL
0.0	Sand Traces of Silt and Clay Compact		1	SS	18												0 93 (7)
275.5			2	SS	17												0 45 25 30
2.2	Clayey Silt with Sand <i>firm</i> to Stiff		3	SS	17		275.0										0 29 51 20
			4	SS	25												0 32 50 18
			5	SS	12												
			6	SS	12												
272.2			7	TW	PH												
5.5	Sand Traces of Silt and Clay Compact to Dense		8	SS	27												0 96 (4)
269.9			9	SS	42		270.0										0 96 (4)
7.8	Sandy Silt to Silt Traces of Clay Compact to Dense		10	SS	36												
267.6			11	SS	25												
10.1	Sand Traces of Silt and Clay		12	SS	41												0 86 (14)
			13	SS	25		265.0										
	Compact to Very Dense		14	SS	19												0 92 (8)
			15	SS	50												
							260.0										0 99 (1)
			16	SS	9												
255.9			17	SS	127												
21.8	End of Borehole																
	Note: Casing Bent and Broke at 15.3 m. Probable Bedrock with Steep Slope at Elev. 262.4.																

OFFICE REPORT ON SOIL EXPLORATION

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	 PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT W <sub>p</sub> W                  W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH			
277.8	Ground Level							20    40    60    80    100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 4

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 146.1; E 321 394.1 ORIGINATED BY PRK  
 DIST 11 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Casing, BXL Core COMPILED BY PRK  
 DATUM Geodetic DATE 79 06 25 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
277.7	Ground Level													
0.0	Sand		1	SS	14									
	Traces of Silt and Clay		2	SS	7									
			3	SS	9									
	Loose to Compact		4	SS	14									
273.3			5	SS	21									0 93 (7)
4.4	Clayey Silt With Sand		6	SS	15									0 96 (4)
	Stiff to Very Stiff		7	SS	15									0 38 26 36
270.7			8	TW	PH									
7.0	Sand													
	Traces of Gravel Silt and Clay		9	SS	22									2 86 (12)
268.7	Compact													
9.0	Sandy Silt to Silt		10	SS	28									0 21 75 4
	Traces of Clay		11	SS	17									
	Compact		12	SS	22									
			13	SS	12									0 21 76 3
			14	SS	16									0 5 92 3
260.7														
17.0	Sand		15	SS	30									0 86 (14)
	Traces of Silt and Clay		16	SS	50/	.77 mm								
			17	SS	θ									
			18	SS	35									
247.5	CONT.													

OFFICE REPORT ON SOIL EXPLORATION

30.2

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity  
 20  
 15 5 (%) STRAIN AT FAILURE  
 10

RECORD OF BOREHOLE No 4 cont.

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 146.1; E 321 394.1 ORIGINATED BY PRK  
 DIST 11 HWY 11 BOREHOLE TYPE Drive Casing, BI-Cone Washboring BXL Core COMPILED BY PRK  
 DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
247.5	Cont'd		19	SS	8												
30.2			20	SS	17												0 98 (2)
	Compact to Very Dense						245.0										
242.2																	
35.5	Granite Gneiss Bedrock		21	RC BXL	71X REC												
241.0																	
36.7	End of Borehole						240.0										

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10



## RECORD OF PROBEHOLE No 1A

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 089.6; E 321 350.0 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY PPK  
DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

[illegible]

+3, x5 : Numbers refer to Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

# RECORD OF PROBEHOLE No 1B

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 076.0; E 321 355.6 ORIGINATED BY PPK  
 DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
 DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
280.0	Ground Level																
							275										
							270										
266.0																	
14.0	End of Probhole Augering to Refusal Probable Bedrock						265										


OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF PROBEHOLE No 1D

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 087.8; E 321 347.6 ORIGINATED BY PPK  
 DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
 DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
280.2	Ground Level						280										
							275										
							270										
266.6																	
13.4	End of Probehole Augering to Refusal Probable Bedrock						265										

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10

## RECORD OF PROBEHOLE No 3A

METRIC

W P 33-77-02 LOCATION N 4 990 128.0; E 321 370.0 ORIGINATED BY PRK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PRK  
DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

[illegible]

+3, x5: Numbers refer to Sensitivity

20  
15  $\phi$   
10

5 (%) STRAIN AT FAILURE

10

RECORD OF PROBEHOLE No 4A

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 142.0; E 321 399.0 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
277.3	Ground Level																
0.0																	
							275										
							270										
							265										
							260										
							255										
							250										
248.2																	
29.1	End of Probehole Augering to Refusal Probable Bedrock																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH		WATER CONTENT (%)			
278.0	Ground Level						<p>○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE</p>						GR SA SI CL

[illegible]

+<sup>3</sup>, x<sup>5</sup> : Numbers refer to Sensitivity

15 - 20  
5 (%) STRAIN AT FAILURE  
10

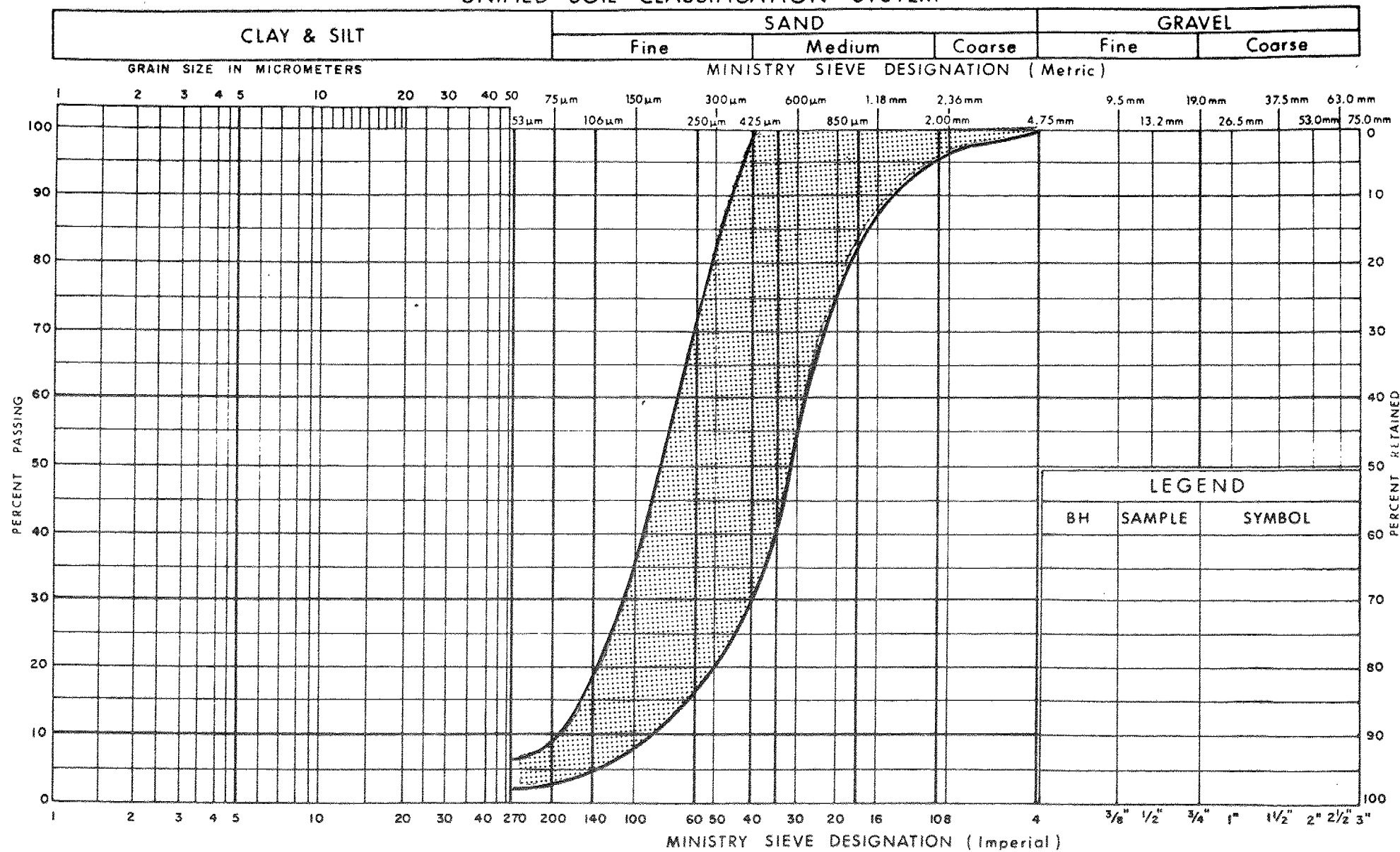
## METRIC

SOIL PROFILE	SAMPLES	B	III	DYNAMIC CONE PENETRATION
--------------	---------	---	-----	--------------------------

+3, x5: Numbers refer to Sensitivity



## UNIFIED SOIL CLASSIFICATION SYSTEM

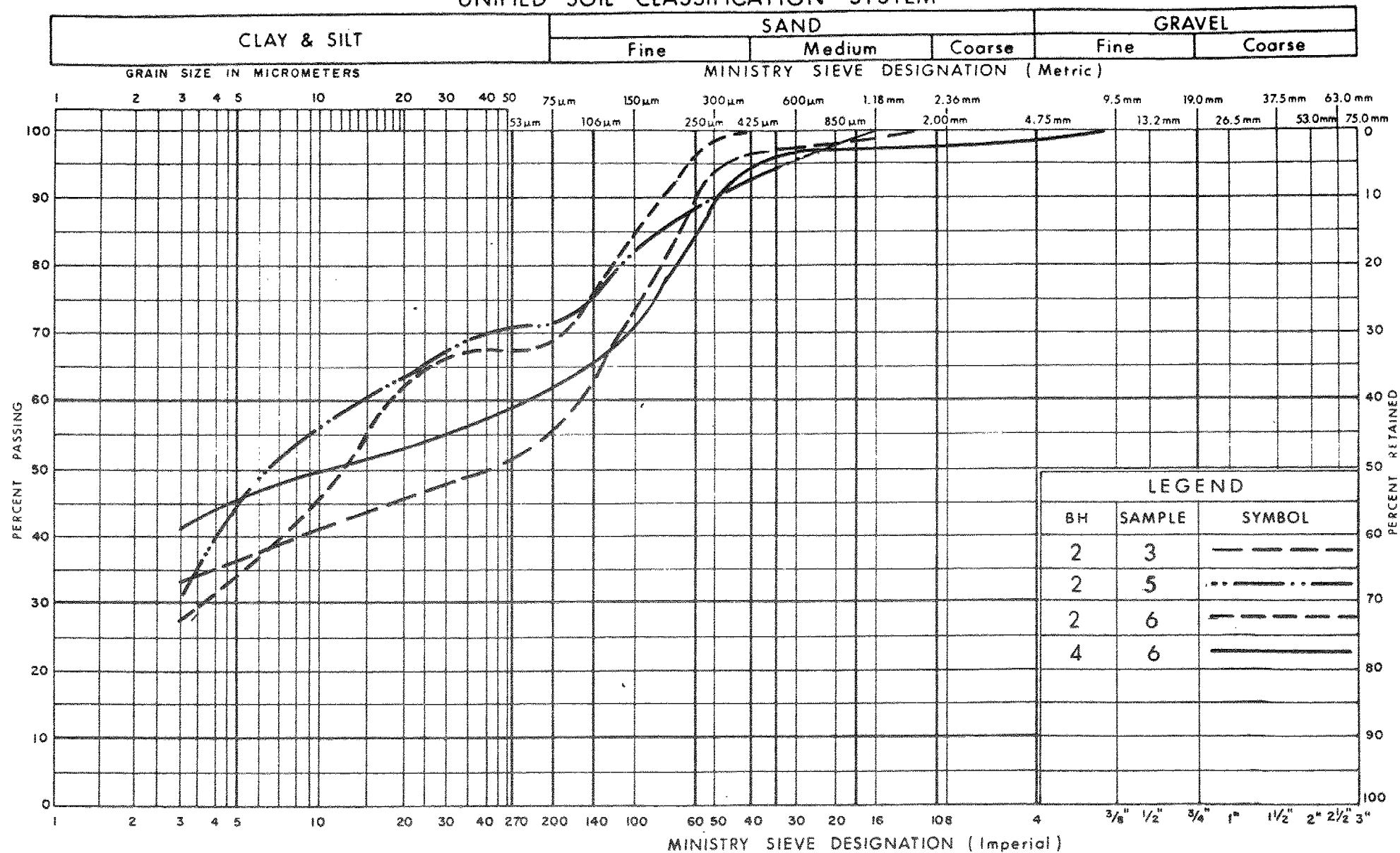
Ministry of  
Transportation and  
Communications

# GRAIN SIZE DISTRIBUTION SAND WITH TRACES OF SILT & CLAY

FIG No 1

W P 33-77-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



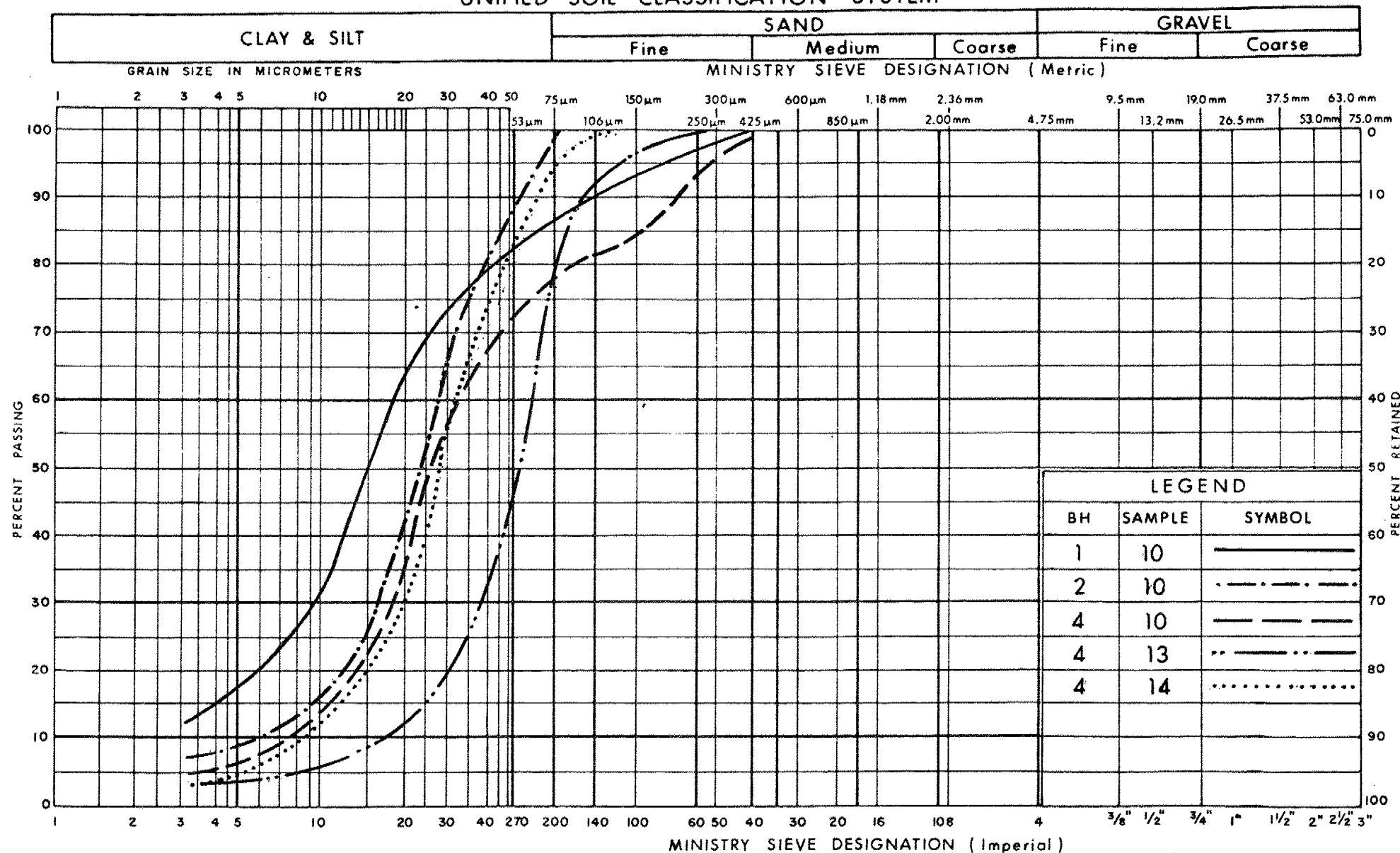
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Communications

GRAIN SIZE DISTRIBUTION  
CLAYEY SILT WITH SAND

FIG No 2

W P 33-77-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



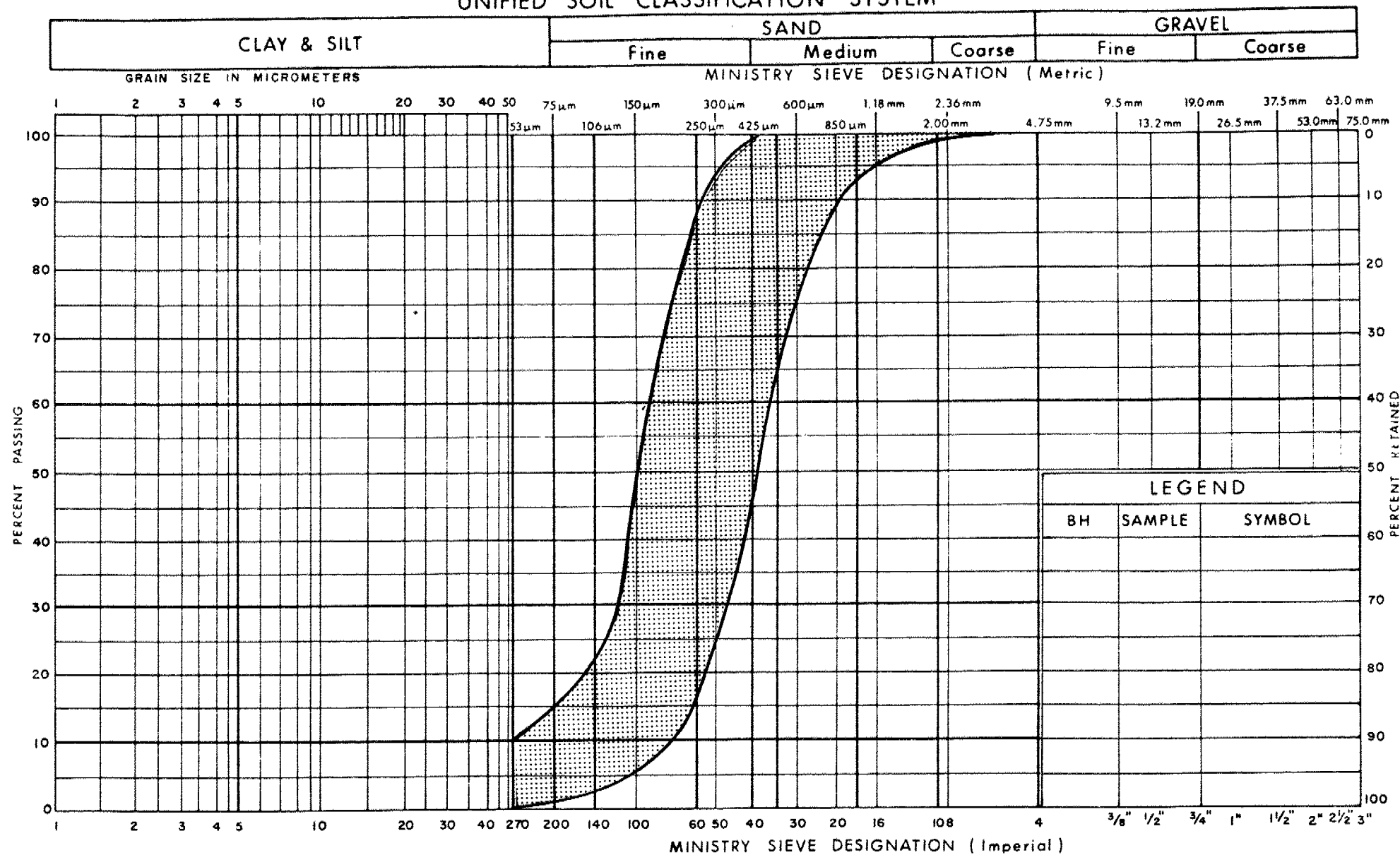
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GRAIN SIZE DISTRIBUTION  
SANDY SILT TO SILT  
WITH TRACE OF CLAY

FIG No 3

W P 33-77-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

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Communications

# GRAIN SIZE DISTRIBUTION SAND WITH TRACES OF SILT & CLAY

FIG No 4

W P 33-77-02

ENGINEERING MATERIALS OFFICE  
PAVEMENT & FOUNDATION DESIGN SECTION

WP 33-77-02

DIST #11

HWY #11

STR SITE 42-182

Taylor Rd. Interchange Underpass

DISTRIBUTION

J.C. McAllister (2)

B. MacKinnon

S. McCombie

J.M. Bernhardt (2)

E. Van Beilen

B.J. Giroux

R. Hore

L. Argo )

J. Anderson ) Cover only

T.J. Kovich )

Files

## FOUNDATION INVESTIGATION REPORT

For

Taylor Rd. Interchange Underpass  
W.P. 33-77-02; Site 42-182  
Hwy. #11, District #11 (Huntsville)

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### INTRODUCTION

This report contains the results of a foundation investigation carried out for the proposed structure at the future junction of the realigned Taylor Road and existing Hwy. #11, during the period of 1979-06-20 to 28. The field work consisted of three sampled boreholes and three dynamic cone penetration tests. In addition, seven probeholes were augered to refusal without sampling. The borings were advanced by employing continuous flight auger machine, mounted on a muskeg vehicle and equipped with 82 mm I.D. hollow stem augers.

### SITE DESCRIPTION

The site is located at the future junction of the proposed Taylor Road realignment and existing Hwy. #11. The existing Hwy. #11 is a four lane roadway divided by an approximately 15 m wide median. The proposed structure will be located within M.T.C.'s Right-of-Way. The surrounding terrain is sloping from west to east.

### SUBSURFACE CONDITIONS

#### General

The overburden at this location was found to consist mainly of sands and silts (or the combinations of these two materials) with an approximately 3 m thick clayey silt layer to be sandwiched between the granular type deposits at the location of the pier and east abutment. Granite Gneiss type bedrock (sloping from west to east with an estimated gradient of 3:3:1) between El. 265 $\pm$  and El. 242 $\pm$ . The boundaries of the different soil types and bedrock, together with the obtained field and laboratory tests results are shown on the Record of Borehole Sheets contained in the Appendix. The

stratigraphical profile and sections shown on Drawing No. 337202-A and 337202-B are based on this information. One of the Drawings (No. 337202-A) also shows the locations and elevations of the borings. A detailed description of the encountered subsurface conditions is given below.

#### Sand With Traces of Silt and Clay

This deposit was encountered in all of the borings from ground level to a maximum (observed) thickness of about 9 m. The material consists mainly of sand with traces of silt and clay. The colour of the stratum is yellow brown and red brown. An approx. 3 m thick of clayey silt with sand intrusion was also encountered within this deposit. Laboratory tests carried out on the sand samples revealed the natural moisture content to range from 4% to 20%. Grain size distribution curves are plotted in an envelope form on Figure 1 on the Appendix.

Standard Penetration Tests gave 'N' values to range from 7 to 38 blows/0.3 m, with an average of 25 blows/0.3 m, indicating a loose to dense denseness.

#### Clayey Silt With Sand

Boreholes #2 and #4 intersect this layer within the above described sand deposit but it appears to peter out before reaching B.H. #1. The thickness is about 3 m. The colour of the material is grey. Laboratory tests indicate the following physical properties:

	Range
Natural Moisture Content (w)	28-34%
Liquid Limit ( $w_L$ )	24-36%
Plastic Limit ( $w_p$ )	10-15%

The results of grain size distribution tests are shown on Figure 2. The consistency of this layer is estimated to range from stiff to very stiff. For design purposes an estimated undrained shear strength value ( $c_u$ ) of 85 kPa is recommended.

#### Sandy Silt to Silt with Traces of Clay

This deposit underlies the sand stratum at the boring locations with variable thickness (2 to 8 m).

The material in the deposit was found to consist of sandy silt to silt with trace of clay. The natural moisture content was found to be in the order of 23%. Grain size distribution curves are plotted on Figure 3 of the Appendix. Standard Penetration Test 'N' values (12-36 blows/0.3 m) that the denseness varies randomly from compact to dense.

#### Sand With Traces of Silt and Clay

Below the sandy silt to silt zone a second deposit of sand with traces of silt and clay was encountered down to the bedrock surface. The colour of the material is brown-grey to brown-yellow. The natural moisture content ranges from 18% to 27%. The results of the laboratory grain size distribution tests are plotted in an envelope form on Figure 4. Based on the Standard Penetration Tests 'N' values (17 to 50 blows/0.3 m) it is estimated that the denseness of the overall stratum ranges from compact to very dense. Occasionally, 'boiling' of the sand due to excess hydrostatic pressure was also observed.

#### Bedrock

Bedrock was proven in boreholes #1 and #4 by obtaining BXL size cores at the following levels:

B.H. #1	El. 263.5
B.H. #4	El. 242.2

The bedrock as described by Mr. B.K. Glassford, Geologist, consists of pinkish-grey coloured granite Gneiss bedrock. Refer to the Diamond Drill Record Sheet for a complete description of the rock cores obtained.

#### Groundwater Conditions

The groundwater level was observed by measuring in the open sampled boreholes after completion of the investigation:

B.H. #1	El. 267.9
B.H. #2	El. 267.0
B.H. #4	El. 275.9



## DISCUSSION AND RECOMMENDATIONS

### General

It is proposed to build a two-span underpass structure at the future junction of the realigned Taylor Road and the existing Hwy. #11. The following profile grades are proposed at the abutment locations:

West Abutment: El. 287<sub>±</sub>

East Abutment: El. 285<sub>±</sub>

Up to 7.5 m high approach embankments will be required.

The subsoil in general, consists of 15 to 36 m deep deposits of loose to very dense granular type materials (sands and sandy silts) followed by granite Gneiss bedrock.

### Structure Foundations

In view of the encountered subsoil conditions, it is recommended that the entire (abutments and piers) be founded on end-bearing steel 'H' piles driven to bedrock. It is estimated that the piles will meet the bedrock surface at the following levels

West Abutment: El. 264 - El. 267

Pier : El. 254 - El. 256

East Abutment: El. 242 - El. 248

~120 tons

12BP74

Design loads up to 1100 kN per pile may be assumed for HP 310-110 steel 'H' piles. The pile tips should be reinforced to prevent damage during driving. Due to the sloping nature of the bedrock surface, some keying is necessary. It is therefore recommended that the piles be fitted with Oslo Points (rock points) and driven in accordance with 903.07.05 of the M.T.C. specifications (metric).

### Approach Embankments

The maximum height of the proposed approaches is in the order of 7-8 m. Fills of this height will be stable with respect to failure within the foundation subsoil, provided the fill is properly placed and compacted and 2:1 side and forward slopes are employed. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery material is placed within the approaches through which piles have to be driven and it is recommended that this portion of the fill contain grain sizes not

larger than 75 mm. The granular subsoil will settle due to the induced embankment loading. This settlement will be elastic in nature; i.e. will take place during or immediately following the construction period. Additional settlements (up to 40 mm) are also anticipated to take place within the clayey silt layer.

#### OTHER CONSIDERATIONS

The pile caps should be protected against frost action with a minimum of 1.8 m of earth cover.

The granular type subsoil (sands and silts) is susceptible to 'boiling' when subjected to unbalanced hydrostatic pressure. The magnitude of this pressure should be determined during construction. Should the excavation base be located below the prevailing groundwater level a dewatering scheme will be required. If closed, interlocking steel sheet piling is incorporated into the scheme it should be driven to a depth below the excavation base equal to the prevailing groundwater pressure head existing above this level.

#### MISCELLANEOUS

The field work for this report was carried out under the supervision of Mr. P.R. Karpol, Student Technician. This report was written by Mr. P. Payer and reviewed by Mr. K.G. Selby. The equipment used was owned and operated by Atcost Soil Drilling Inc.

*P. Payer*  
P. Payer, P. Eng.  
Foundations Engineer

*K.G. Selby*  
K.G. Selby, P. Eng.  
Senior Foundations Engineer



September 4, 1980.

## APPENDIX



Ministry of  
Transportation and  
Communications  
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 083.4; E 321 352.3 ORIGINATED BY FRK  
DIST 11 HWY 11 BOREHOLE TYPE Hollow Stem Auger, EXL Core COMPILED BY FRK  
DATUM Geodetic DATE 1979 07 04 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
280.0	Ground Level						280.0										
0.0	Sand		1	SS	34												0 94 (6)
	Traces of Silt and Clay		2	SS	34												0 91 (9)
			3	SS	32												0 97 (3)
	Compact to Dense		4	SS	33												
			5	SS	34												
			6	SS	26		275.0										
			7	SS	24												
			8	SS	25												
			9	SS	28												0 96 (4)
272.1			10	SS	36												0 21 76 3
7.9	Sandy Silt to Silt Traces of Clay Compact		11	SS	23												
270.0							270.0										
10.0	Sand		12	SS	44												0 95 (5)
	Traces of Silt and Clay																
	Compact to Dense		13	SS	27												
			14	SS	27												0 98 (2)
265.1			15	SS	25/100												
14.9	Granite Gneiss Bedrock Sound		16	RC EXL REC	98% REC		265.0										
263.5																	
16.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 2

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 114.4; E 321 373.2 ORIGINATED BY PRK  
DIST. 11 HWY 11 BOREHOLE TYPE Hollow Stem Auger, BX Casing COMPILED BY PRK  
DATUM Geodetic DATE 79 06 28 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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										SHEAR STRENGTH			WATER CONTENT (%)		
																		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					
277.7	Ground Level																						
0.0	Sand Traces of Silt and Clay Compact		1	SS	18												0 93 (7)						
275.5			2	SS	17												0 45 25 30						
2.2	Clayey Silt with Sand  Firm to Stiff		3	SS	17		275.0										0 29 51 20						
			4	SS	25												0 32 50 18						
			5	SS	12																		
272.2			6	SS	12																		
			7	TW	PH																		
5.5	Sand Traces of Silt and Clay Compact to Dense		8	SS	27												0 96 (4)						
269.9			9	SS	42		270.0										0 96 (4)						
7.8	Sandy Silt to Silt Traces of Clay Compact to Dense		10	SS	36																		
267.6			11	SS	25																		
10.1	Sand Traces of Silt and Clay  Compact to Very Dense		12	SS	41												0 86 (14)						
			13	SS	25		265.0										0 92 (8)						
			14	SS	19																		
			15	SS	50																		
							260.0										0 99 (1)						
			16	SS	0																		
255.9			17	SS	127																		
21.8	End of Borehole  Note: Casing Bent and Broke at 15.3 m, Probable Bedrock with Steep Slope at Elev. 262.4.																						

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\div$  5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF BOREHOLE No 2 A

**METRIC**

W P 33-77-02 LOCATION Co-ords. N 4 990 109.0; E 321 377.0 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Cone Only COMPILED BY PPK  
DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

+3, x5: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 4

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 146.1; E 321 394.1 ORIGINATED BY PRK  
DIST 11 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Casing, BXL Core COMPILED BY PRK  
DATUM Geodetic DATE 79 06 25 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							WATER CONTENT (%)
							20	40	60	80	100	10	20	30	
277.7	Ground Level														
0.0	Sand		1	SS	14										
	Traces of Silt and Clay		2	SS	7										
			3	SS	9										
	Loose to Compact		4	SS	14										
273.3			5	SS	21										
4.4	Clayey Silt		6	SS	15										
	With Sand		7	SS	15										
	Firm to Very Stiff		8	TW	PH										
270.7															
7.0	Sand		9	SS	22										
	Traces of Gravel														
	Silt and Clay														
268.7	Compact														
9.0	Sandy Silt		10	SS	28										
	to Silt		11	SS	17										
			12	SS	22										
	Traces of Clay		13	SS	12										
			14	SS	16										
	Compact														
260.7															
17.0	Sand		15	SS	30										
	Traces of Silt and Clay														
			16	SS	50/	.77 mm									
			17	SS	9										
			18	SS	35										
247.5	CONT.														

30.2

+3, x5: Numbers refer to Sensitivity  
20  
15 → 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 4 cont.

METRIC

W P 33-77-02 LOCATION Co-ords. N 4 990 146.1; E 321 394.1 ORIGINATED BY PRK  
DIST 11 HWY 11 BOREHOLE TYPE Drive Casing, BI-Cone Washboring BXL Core COMPILED BY PRK  
DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
247.5	Cont'd		19	SS	8												
30.2			20	SS	17												
	Compact to  Very Dense						245.0										0 98 (2)
242.2																	
35.5	Granite Gneiss Bedrock		21	RC BXL	712 REC												
241.0																	
36.7	End of Borehole						240.0										

+3, x5: Numbers refer to  
Sensitivity


20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



**METRIC**

W P 33-77-02 LOCATION Co-ords. N 4 990 089.6; E 321 350.0 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY PPK  
DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

SOIL PROFILE				SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
280.0	Ground Level													
							275							
							270							
265.0														
15.0	End of Probhole Augering to Refusal Probable Bedrock						265							

**+3, x5 : Numbers refer to Sensitivity**

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

LIFE REPORT ON SOIL EXPLORATION



## RECORD OF PROBEHOLE No 1B

**METRIC**

W P 33-77-02

LOCATION Co-ords. N 4 990 076.0; E 321 355.6

ORIGINATED BY PPK

DIST 11 HWY 11

BOREHOLE TYPE Solid Stem Auger

COMPILED BY PPK

DATUM Geodetic

DATE 79 06 29

CHECKED BY \_\_\_\_\_

[illegible]

**+3, x5 : Numbers refer to Sensitivity**

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

# UNITED NATIONS DEVELOPMENT PROGRAM



## RECORD OF PROBEHOLE No 1C

**METRIC**

W P 33-77-02 LOCATION Co-ords. N 4 990 078.2; E 321 359.1 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100									
								SHEAR STRENGTH									
279.5	Ground Level																
							275										
							270										
266.2																	
13.3	End of Probhole  Augering to Refusal Probable Bedrock						265										
						</											

\*3, \*5 : Numbers refer to Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF PROBEHOLE No 1D

METRIC

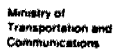
W P 33-77-02 LOCATION Co-ords. N 4 990 087.8; E 321 347.6 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
DATUM Geodetic DATE 79 06 29 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
280.2	Ground Level					280										
						275										
						270										
266.6																
13.4	End of Probbhole Augering to Refusal Probable Bedrock					265										

+3, x5 : Numbers refer to  
Sensitivity

20  
15  $\pm$  5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF PROBEHOLE No 3A

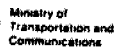
**METRIC**

W P 33-77-02 LOCATION N 4 990 128.0; E 321 370.0 ORIGINATED BY PRK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PRK  
DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

[illegible]

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF PROBEHOLE No 4A

**METRIC**

W P 33-77-02 LOCATION Co-ords. N 4 990 142.0; E 321 399.0 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

[illegible]

+3, x5: Numbers refer to Sensitivity

**METRIC**

W P 33-77-02 LOCATION Co-ords. N 4 990 151.0; E 321 388.8 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
DATUM Geodetic DATE 79 06 28 CHECKED BY \_\_\_\_\_

[illegible]

+3, x5: Numbers refer to Sensitivity


OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF PROBEHOLE No 4B cont.

**METRIC**

W P 33-77-02 LOCATION Co-ords. N 4 990 151.0; E 321 388.8 ORIGINATED BY PPK  
DIST 11 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY PPK  
DATUM Geodetic DATE 79 06 29 CHECKED BY \_\_\_\_\_

SOIL PROFILE					DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>		
248.0	Cont'd.										
242.6							245				
35.4	End of Probhole Augering to Refusal Probable Bedrock						240				

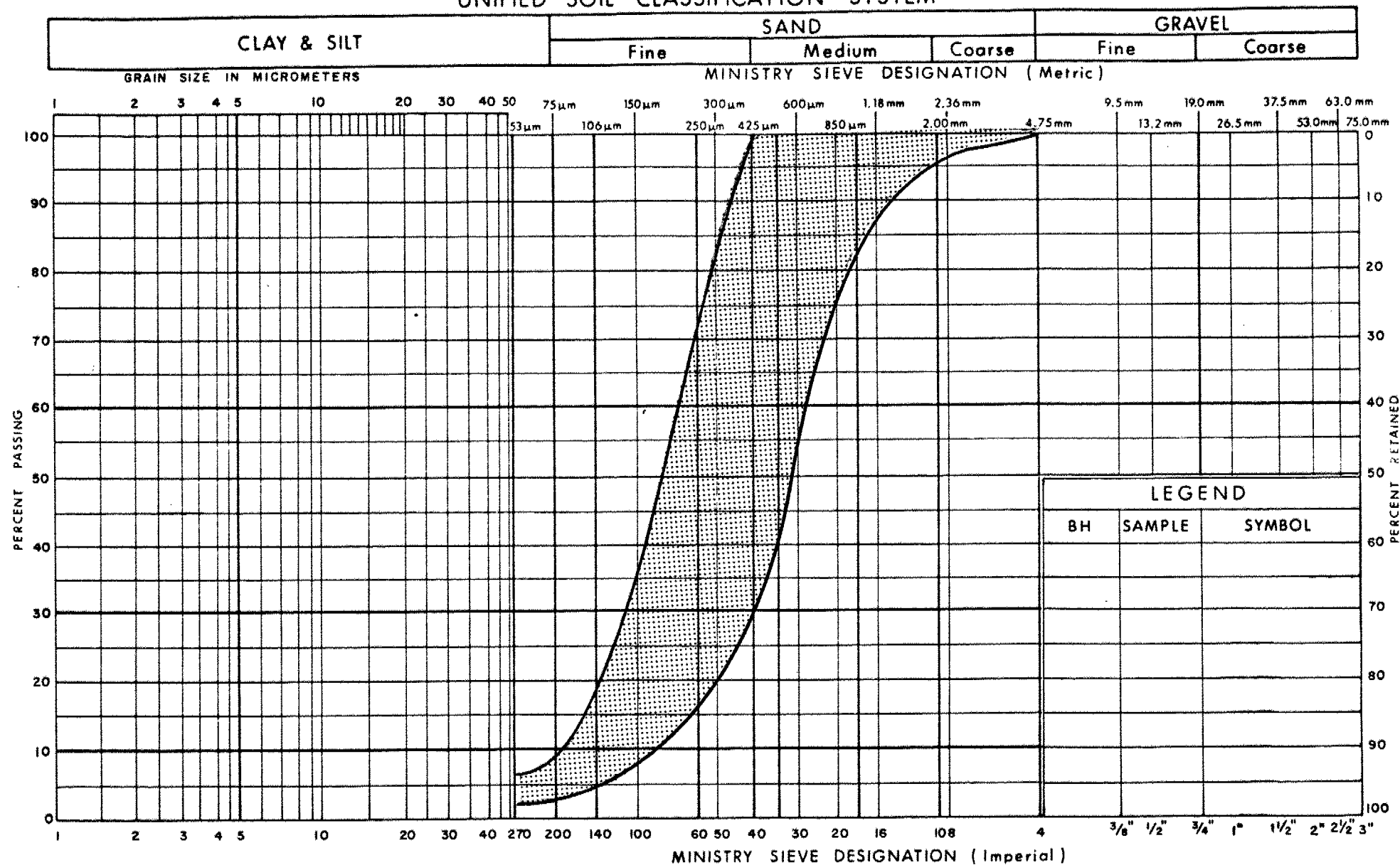
**+3, x5: Numbers refer to Sensitivity**

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10

# UNIT 10: THE FUTURE



## UNIFIED SOIL CLASSIFICATION SYSTEM

Ministry of  
Transportation and  
Communications

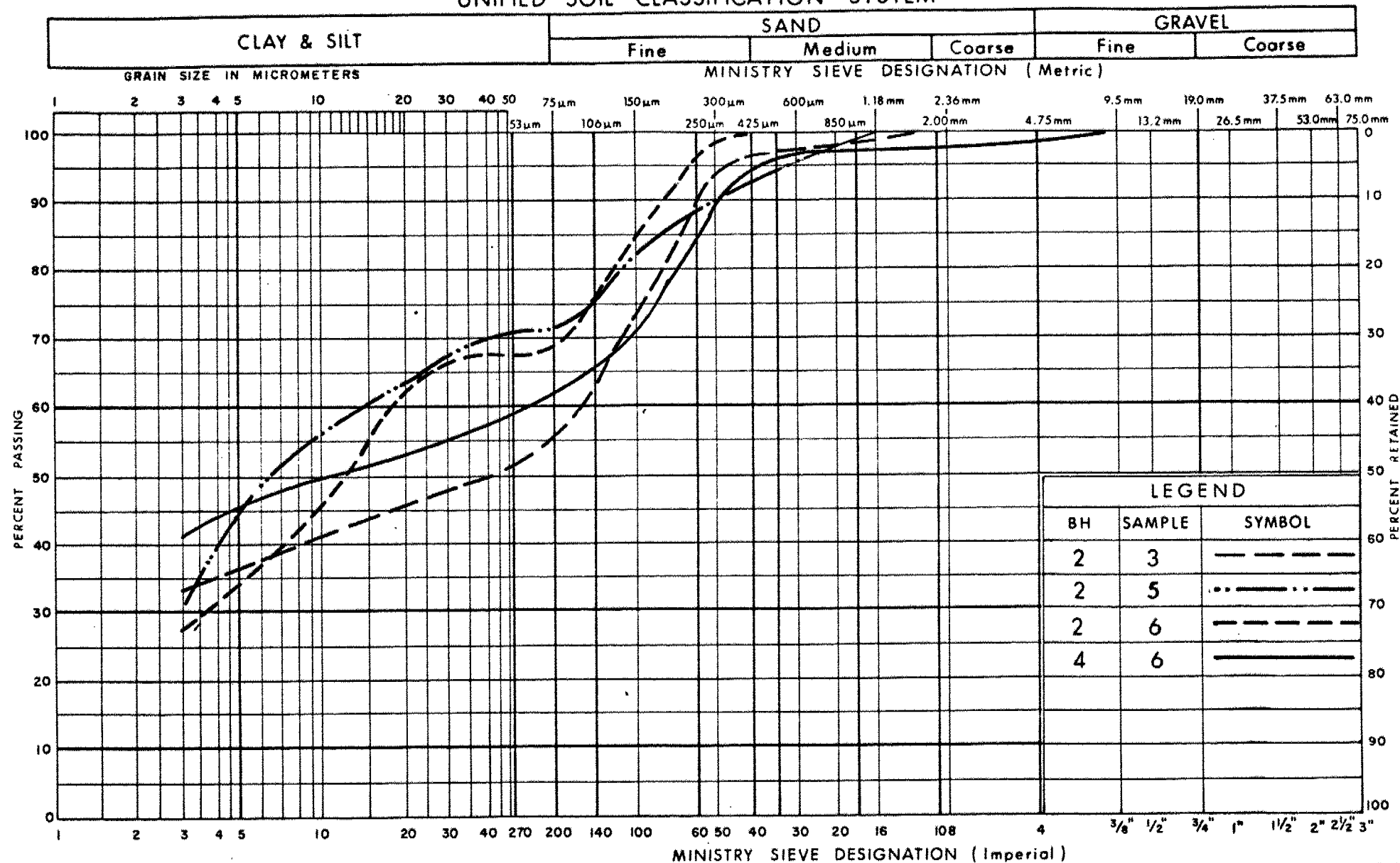
**Ontario**

# GRAIN SIZE DISTRIBUTION SAND WITH TRACES OF SILT & CLAY

FIG No 1

W P 33-77-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



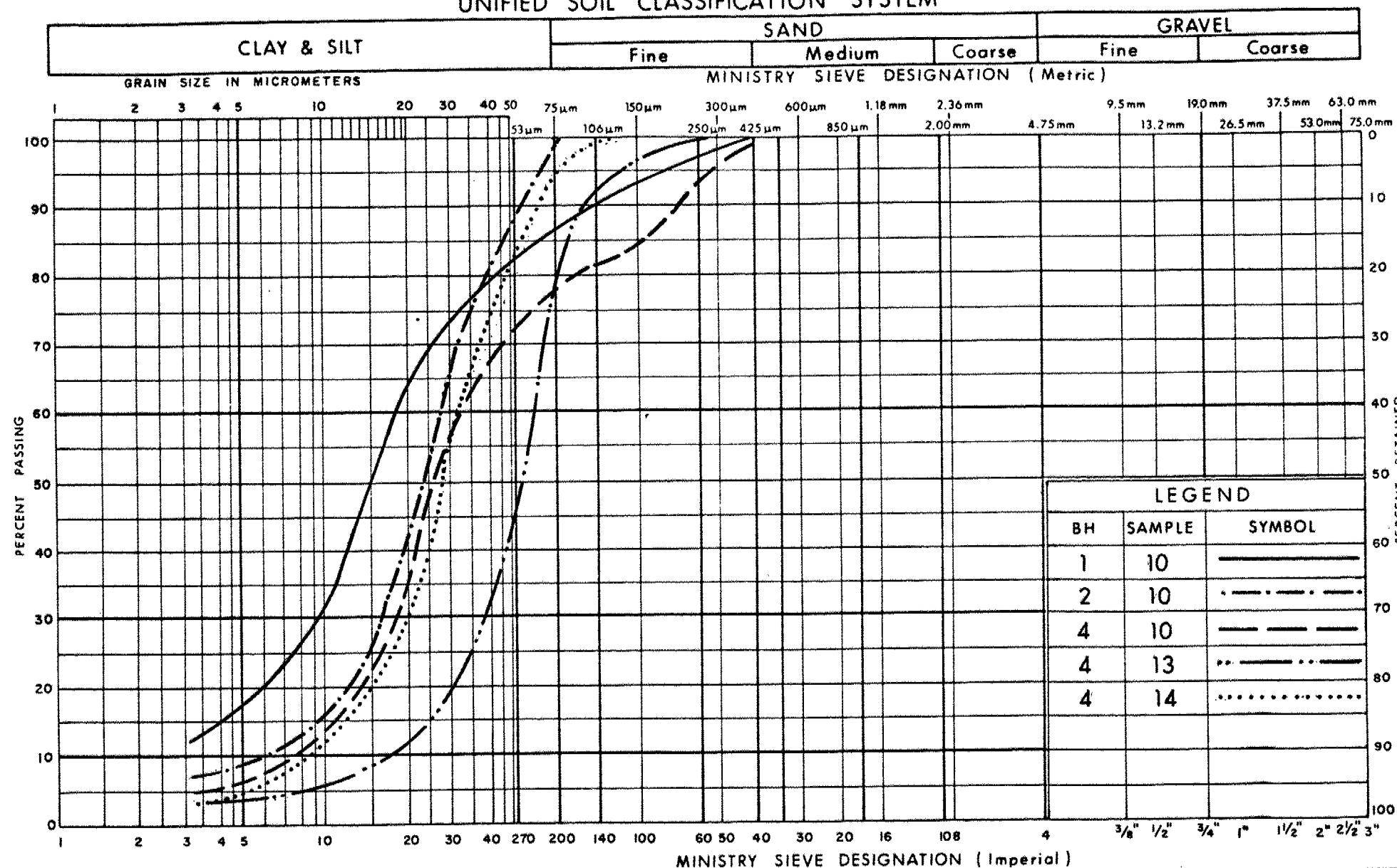
Ministry of  
Transportation and  
Communications

GRAIN SIZE DISTRIBUTION  
CLAYEY SILT WITH SAND

FIG No 2

W P 33-77-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



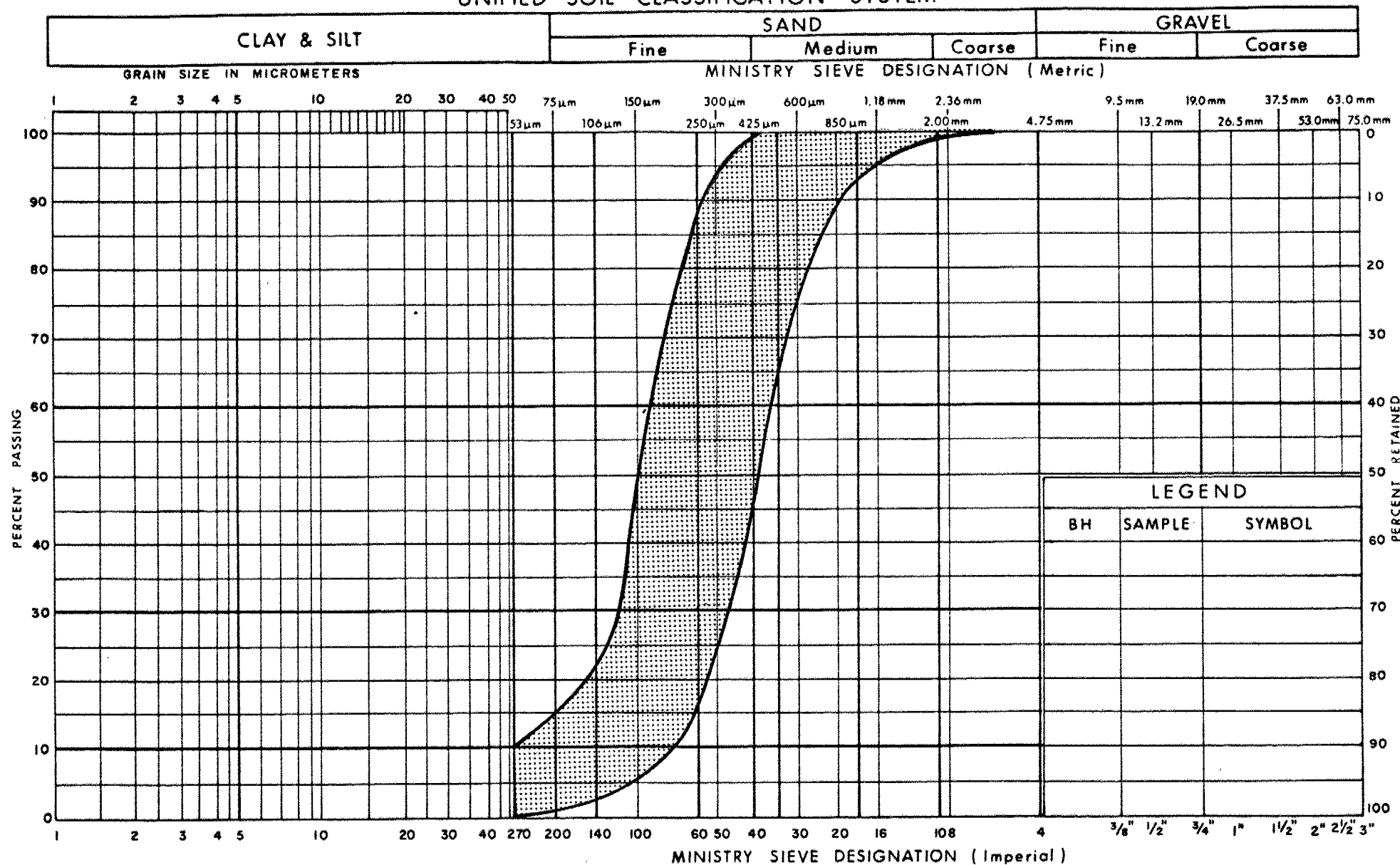
Ministry of  
Transportation and  
Communications

GRAIN SIZE DISTRIBUTION  
SANDY SILT TO SILT  
WITH TRACE OF CLAY

FIG No 3

W P 33-77-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation and  
Communications

**GRAIN SIZE DISTRIBUTION**  
**SAND**  
WITH TRACES OF SILT & CLAY

FIG No 4

W P 33-77-02

## EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

**JOINTING AND BEDDING:**

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

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

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

### STRESS AND STRAIN

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

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{v0}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_f$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$i_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	kN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$s_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	kN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	kN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

METRIC

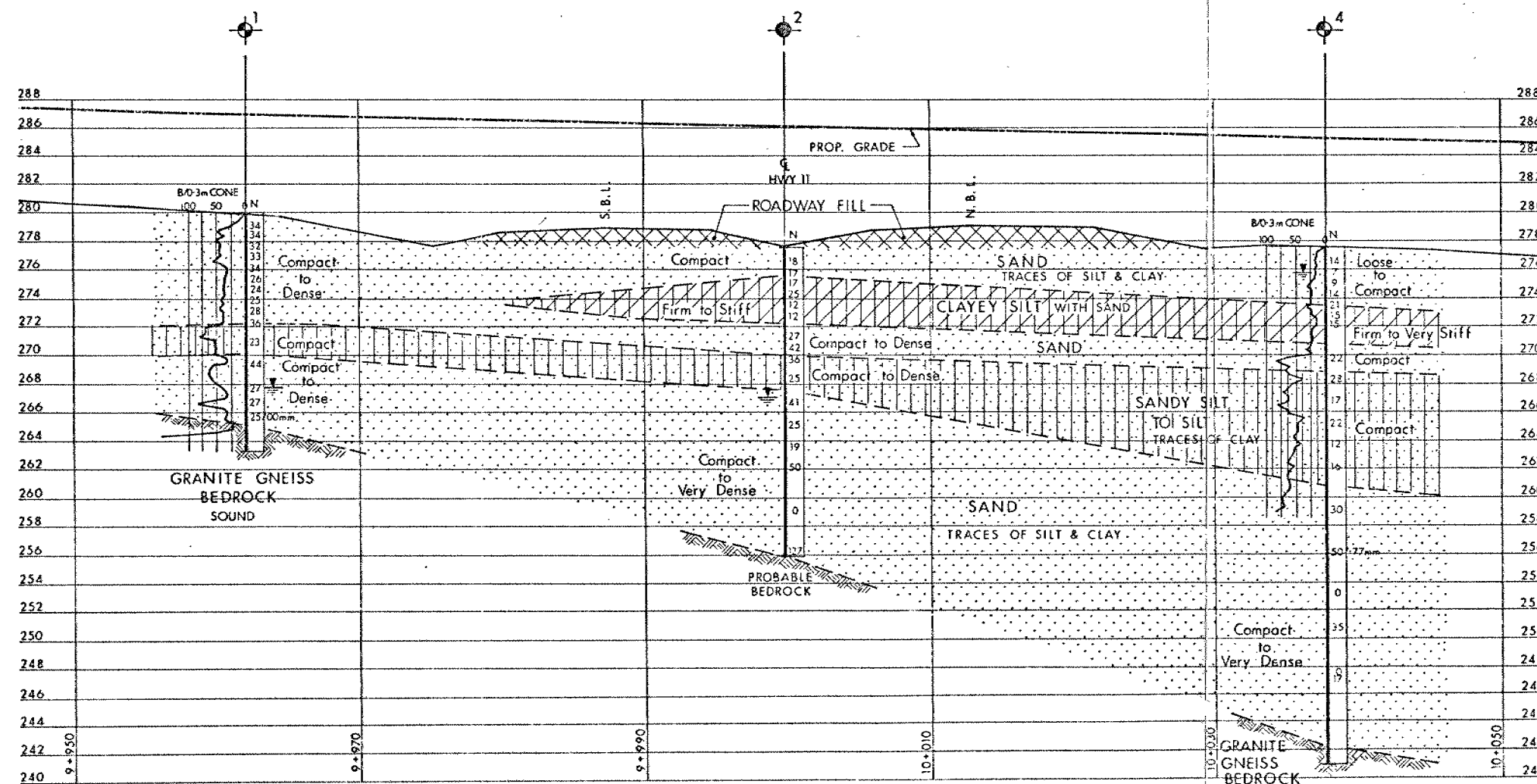
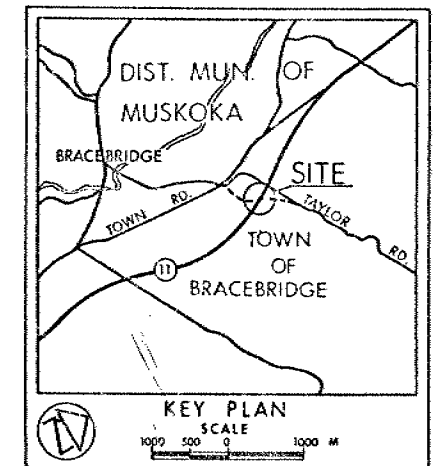
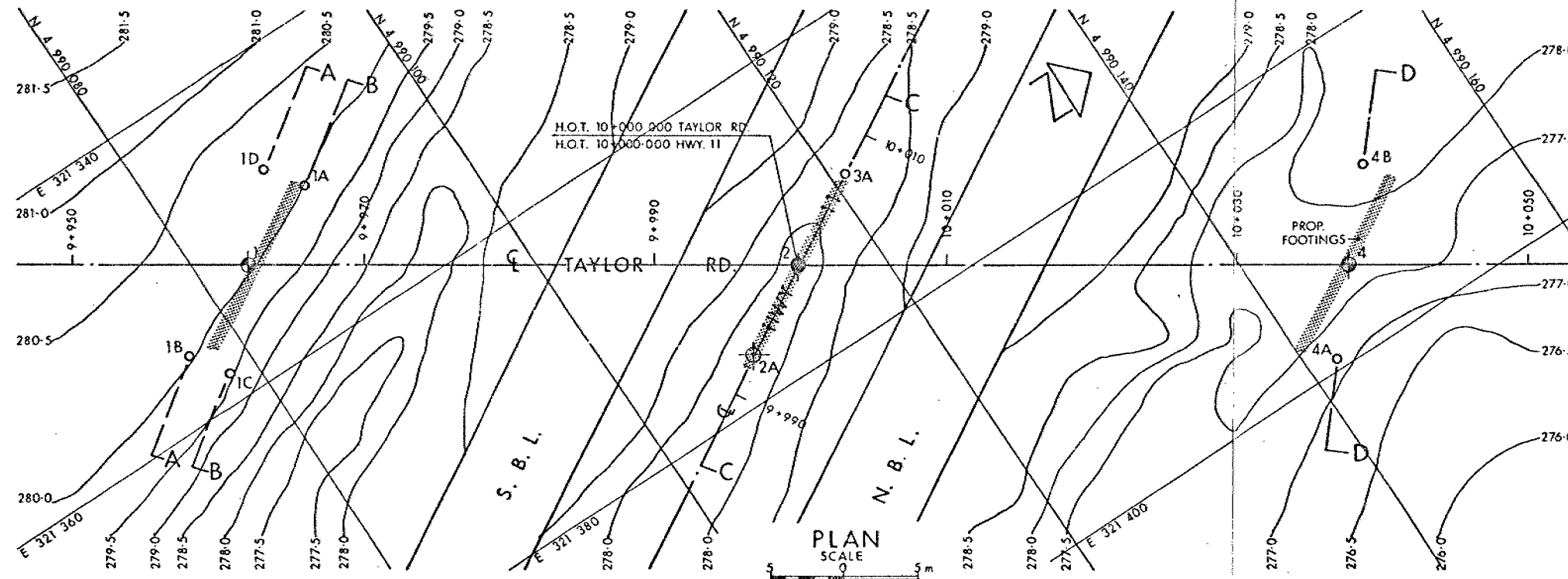
CONT No  
WP No 33-77-02

HWY. 11 & TAYLOR RD.  
INTERCHANGE  
BORE HOLE LOCATIONS & SOIL STRATA



SHEET

NOTE:  
DIMENSIONS ARE IN  
METERS AND/OR  
MILLIMETERS, UNLESS  
OTHERWISE SHOWN.  
STATIONS IN KILOMETERS  
+ METERS



PROFILE TAYLOR RD.

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 79 06 28
- PROBE HOLES

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	280.0	4 990 083.4	321 352.3
2	277.7	4 990 114.4	321 373.2
2A	277.8	4 990 109.0	321 377.0
4	277.7	4 990 146.1	321 394.1
PROBE HOLES			
1A	280.0	4 990 089.6	321 350.0
1B	280.0	4 990 076.6	321 355.6
1C	279.5	4 990 078.2	321 359.1
1D	280.2	4 990 087.8	321 347.6
3A	278.2	4 990 128.0	321 370.0
4A	277.3	4 990 142.0	321 399.0
4B	278.0	4 990 151.0	321 388.8

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 31E-92	HWY No. TAYLOR RD.	DIST. 11
SUBMD P.P. CHECKED	DATE 80 03 10	SITE 42-182
DRAWN O.L. CHECKED	DATE 80 03 10	DWG 337702-A

