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G.I.-30 SEPT. 1976

GEOCRES No. 4076-8

DIST. 1 REGION

W.P. No. 260-66-02/

CONT. No. 81-05  
(see also 89-41)

W. O. No.

STR. SITE No. 6-274

HWY. No. ECR

LOCATION Matchette Rd. Overpass

No of PAGES - 1

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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NOTE: For purposes of the contract these reports supercede all other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.



'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS  $N_c$ .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON A 1" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

$S_u$ (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

#### ABBREVIATIONS & SYMBOLS

##### LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG.  $\bar{C}IU$  - CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

##### FIELD SAMPLING

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

##### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  ANGLE OF WALL FRICTION  
 $k_o$  COEFFICIENT OF EARTH PRESSURE AT REST  
 $k_a$  COEFFICIENT OF ACTIVE EARTH PRESSURE  
 $k_p$  COEFFICIENT OF PASSIVE EARTH PRESSURE  
 $i$  ANGLE OF INCLINATION OF SURCHARGE  
 $w$  SLOPE ANGLE-BACKFACE OF WALL  
 $\beta$  ANGLE OF SLOPE  
 $N_q, N_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

##### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  UNIT WEIGHT OF SUBMERGED SOIL  
 $G_s$  SPECIFIC GRAVITY OF SOLIDS  
 $e$  VOIDS RATIO  
 $e_o$  INITIAL VOIDS RATIO  
 $e_{max}$   $e$  IN LOOSEST STATE  
 $e_{min}$   $e$  IN DENSEST STATE  
 $D_r$  RELATIVE DENSITY =  $\frac{e_{max} - e}{e_{max} - e_{min}}$   
 $n$  POROSITY  
 $w$  WATER CONTENT  
 $w_L$  LIQUID LIMIT  
 $w_p$  PLASTIC LIMIT  
 $w_s$  SHRINKAGE LIMIT  
 $I_p$  PLASTICITY INDEX =  $w_L - w_p$   
 $L_L$  LIQUIDITY INDEX =  $\frac{w - w_p}{w_L - w_p}$   
 $I_c$  CONSISTENCY INDEX =  $\frac{w_L - w}{w_L - w_p}$   
 $A_c$  ACTIVITY =  $\frac{I_p \text{ of soil}}{I_p \text{ of } \mu m \text{ Soil Fraction}}$   
 $O_m$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

##### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  RESIDUAL SHEAR STRENGTH  
 $c$  COHESION INTERCEPT  
 $\sigma_1, \sigma_2, \sigma_3$  NORMAL PRINCIPAL STRESSES  
 $u$  PORE WATER PRESSURE  
 $u_e$  EXCESS  $u$   
 $r_u$  PORE PRESSURE RATIO  
 $q_u$  UNCONFINED COMPRESSIVE STRENGTH  
 $s_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $k_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

##### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  COEFFICIENT OF VISCOSITY  
 $k$  COEFFICIENT OF HYDRAULIC CONDUCTIVITY  
 $k_h$   $k$  IN HORIZONTAL DIRECTION  
 $k_v$   $k$  IN VERTICAL DIRECTION  
 $\alpha_v$  COEFFICIENT OF VOLUME CHANGE  
 $c_v$  COEFFICIENT OF CONSOLIDATION  
 $C_c$  COMPRESSION INDEX  
 $C_r$  RECOMPRESSION INDEX  
 $d$  DRAINAGE PATH DISTANCE  
 $T_v$  TIME FACTOR  
 $U$  DEGREE OF CONSOLIDATION  
 $O_r$  OVERCONSOLIDATION RATIO (OCR)

## FOUNDATION INVESTIGATION REPORT

For

Matchette Road Overpass W.B.L.  
0.5 Miles East of Hwy. 18  
W.P. 260-66-02, Site 6-274  
Hwy. ECR, District 1, Chatham

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INTRODUCTION

The following report contains the results of a foundation investigation carried out at the above site in the period from February 28 to March 4, 1968. A muskeg vehicle mounted power auger was used to advance four boreholes to depths ranging from 48 to 82 feet in depth. Bedrock was proven in one borehole by obtaining AXT size rock core. Dynamic penetration tests (cone tests) were carried out at each of the four boreholes.

SITE DESCRIPTION

The site is located 1.4 miles west of Hwy. 3 along the proposed E.C. Row Expressway alignment within the City of Windsor.

Several residential buildings are present to the east of Matchette Road. Overgrown agricultural land surrounds the site.

Physiographically, this area lies in the Essex Clay Plain which is a flat lying till plain of poor natural drainage. In this area clay and silt deposits from glacial Lakes Whittlesey and Warren and later Lake Saint Clair, caused a general levelling of the basic clay till.

SUBSURFACE CONDITIONSGeneral

Subsoil at the site consists of a shallow uniform layer of silty sand underlain by cohesive type deposits of silty clay to clayey silt, some sand, trace of gravel, followed by a sandy silt layer, some gravel and clay overlying the flat lying limestone bedrock.

The boundaries of the various deposits are shown in the appended Record of Borehole Sheets and an estimated stratigraphical profile is shown on Drawing # 102 of the contract drawings.

Soil types encountered from ground level downward are described in some detail below.

#### Silty Sand

This deposit is present in all boreholes to a 4 foot depth from ground surface downwards and is classified as silty sand with a loose to compact relative density.

#### Silty Clay to Clayey Silt

The silty sand is underlain by an extensive cohesive type stratum down to elevation 512±. The material in the deposit consists of silty clay to clayey silt some sand, trace of gravel. A plot of plasticity index versus liquid limit (Fig. 1) shows the points to fall within the CL and CI zones.

Field and laboratory tests indicate the following physical properties:

	<u>Range</u>
Natural Moisture Content (W) %	14- 39
Plastic Limit (W <sub>p</sub> ) %	13- 23
Liquid Limit (W <sub>L</sub> ) %	21- 47
Bulk Density (γ) PCF	115-133
Undrained Shear Strength (Su) PSF	
Unconfined Compression	372-1569
Field Vane	520-2000+
Sensitivity (S)	1.4-3.6

Grain size distribution curves are plotted on Figure 2.

The undrained shear strength of the deposit decreases with depth until a minimum value is reached, then increases again. For design purposes the following undrained shear strength values are suggested:

- Above Elev. 575: 2000 PSF
- Elev. 575-Elev. 550: 750 PSF
- Elev. 550-Elev. 535: 600 PSF
- Elev. 535-Elev. 512: 2500 PSF

The consistency of the overall deposit ranges from firm to very stiff.

#### Sandy Silt

An approximate 4 to 5 foot thick layer of sandy silt, some gravel and clay was encountered below the clayey silt to silty clay deposit. The relative density is estimated to be very dense.

Limestone Bedrock

Bedrock at this site was found to consist of generally sound limestone at elevation 508.5 (BH. #1).

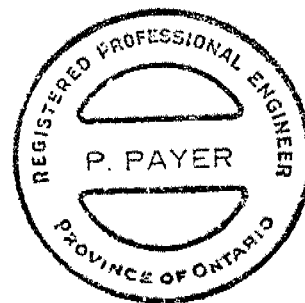
Groundwater Conditions

Groundwater level observations have been carried out during the course of fieldwork by recording the water levels in the open boreholes. The following groundwater levels were observed:

B.H. #1	Elev. 582.5
2	583.0
3	583.3
4	583.5

These figures indicate that the groundwater level is about 2-3 feet below the original ground level.

P. Payer, P. Eng.  
Foundations Engineer



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

## APPENDIX





# RECORD OF BOREHOLE No 1

W P 260-66-02 LOCATION Co-ords N 359,765 E 845,119 ORIGINATED BY AMS  
DIST 1 HWY E.C.Row Expwy BOREHOLE TYPE Cont. Flight Auger AXT Rock Core & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE March 4, 1968 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					
585.2	Ground Level													
0.0	Silty Sand													
581.2														
4.0			1	SS	8		580							
			2	TW	PH									
			3	SS	7									
			4	TW	PH									
			5	TW	PH									
			6	TW	PH									
			7	TW	PH									
			8	TW	PH									
			9	TW	PH									
			10	TW	PH									
			11	TW	PH									
			12	TW	PH									
512.2			13	AXT RC	REC 100%									
73.0	Sandy Silt													
508.5	Some Gravel													
76.7	Limestone													
503.1	Bedrock Sound													
82.1	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5  
0  
5  
10  
15  
20  
(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 2

W P 260-66-02 LOCATION Co-ords N 359,868 E 845,192 ORIGINATED BY AMS  
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE March 1, 1968 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					
585.5	Ground Level																
0.0	Silty Sand																
581.5																	
4.0																	
	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm		1	SS	6												
			2	TW	PH												
			3	TW	PH												
			4	TW	PH												
			5	TW	PH												
			6	TW	PH												
			7	TW	PH												
			8	TW	PH												
537.5																	
48.0	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



RECORD OF BOREHOLE No 3

W P 260-66-02 LOCATION Co-ords N 359,847 E 845,310 ORIGINATED BY AMS  
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE Feb. 28 & 29, 1968 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 PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 500 1000 1500 2000 2500												
585.5	Ground Level																			
0.0	Silty Sand																			
581.5																				
4.0	Silty Clay to Clayey Silt, Some Sand, Trace of Gravel Firm		1	SS	5		580								117					
			2	TW	PH															
			3	TW	PH		570								115					
			4	TW	PH										124					
			5	TW	PH		560													
			6	TW	PH										137					
			7	TW	PH		550								118					
			8	TW	PH										122					
			9	TW	PH		540													
			10	TW	PH										130.5	3 21 48 28				
			11	TW	PH		530								131					
513.5			12	TW	PH										144					
72.0	Sandy Silt, Some Gravel & Clay																			
508.5	Very Dense		13	SS	150		510									17 24 41 18				
77.0	Probable Bedrock																			

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10



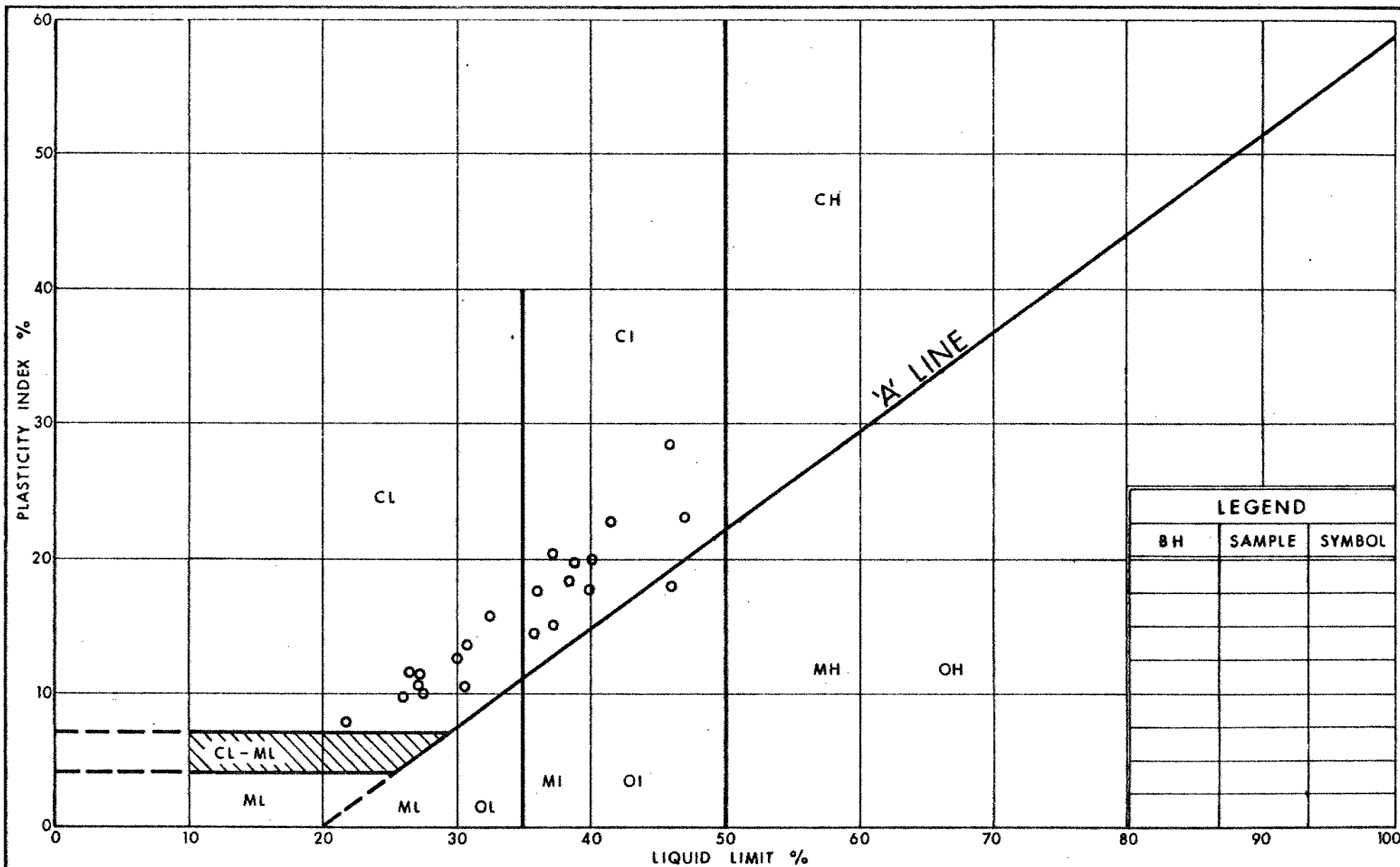
# RECORD OF BOREHOLE No 4

W P 260-66-02 LOCATION Co-ords N 359,742 E 845,277 ORIGINATED BY AMS  
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE Feb. 29, 1968 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			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
585.8	Ground Level							20 40 60 80 100							
0.0	Silty Sand							500 1000 1500 2000 2500							
581.8															
4.0			1	SS	6		580								
			2	TW	PH										
	Silty Clay to Clayey Silt, Some Sand, Trace of Gravel		3	SS	5		570								
	Firm		4	TW	PH										
			5	SS	6		560								
			6	TW	PH										
			7	SS	4		550								
			8	TW	PH		540								
537.8															
48.0	End of Borehole														

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5  
(%) STRAIN AT FAILURE



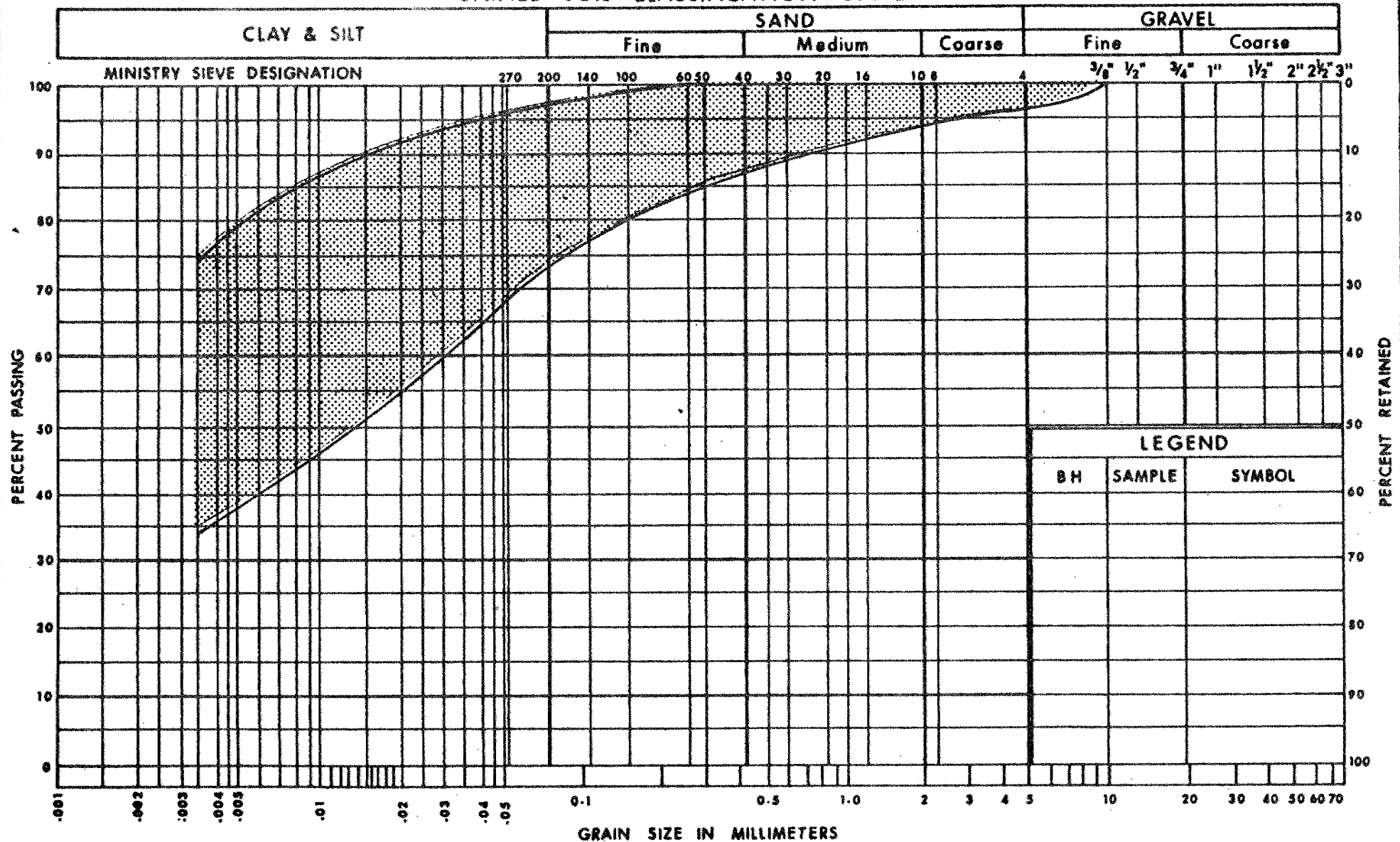
Ministry of  
Transportation and  
Communications

# PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260-66-02

# UNIFIED SOIL CLASSIFICATION SYSTEM



**Ministry of  
Transportation and  
Communications**

## GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT

FIG No 2

W P 260-66-02

## FOUNDATION INVESTIGATION REPORT

For

Malden Road Overpass W.B.L.  
1.2 Miles East of Hwy. 18 - Windsor  
Hwy. ECR, District 1, Chatham  
W.P. 260-66-03, Site 6-275

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INTRODUCTION

This report contains the results of our foundation investigation carried out for the proposed overpass structure. The fieldwork was carried out during the period of February 22-28, 1968, utilizing a continuous flight auger machine mounted on a muskeg vehicle and equipped with solid augers.

SITE DESCRIPTION

The site is located 1.2 miles east of Hwy. 18 along the proposed E.C. Row Expressway alignment within the City of Windsor. The surrounding terrain is flat residential area.

Physiographically the site is located in the region referred to as the St. Clair Clay Plain.

SUBSURFACE CONDITIONSGeneral

Generally uniform subsoil conditions were found to prevail over the site area. The subsoil consists of a shallow layer of silty sand, underlain by a deep deposit of silty clay to clayey silt, containing some sand and traces of gravel, followed by a sandy silt stratum which is in turn underlain by sound limestone bedrock. The boundaries of the different deposits are shown on the Record of Borehole Sheets attached to the Appendix. The estimated stratigraphical profiles of Drawing#120 of the contract drawings is based upon this information. Soil types encountered from ground level downward are described in some detail below.

Silty Sand

This deposit was intersected in all borings from immediately below the ground surface to a depth of about 4 feet. The material consists of silty sand. The

upper portion was found to be frozen at the time of the field investigation. The relative density is estimated to be compact.

#### Silty Clay to Clayey Silt

The silty sand is underlain by an extensive cohesive type stratum at each boring location. The lower boundary of the deposit was encountered between elevation 496 and elevation 500. It was penetrated fully only in B.H. 1 and 3. The material in the deposit consists of silty clay to clayey silt, some sand and traces of gravel. A plot of plasticity index versus liquid limit (Fig. 1) shows the points to fall within the CL and CI zones indicating a low to medium plasticity. Physical properties of the overall deposit as determined from field and laboratory tests are as follows:

Natural Moisture Content (%)	17- 29
Liquid Limit (%)	23- 41
Plastic Limit (%)	14- 21
Bulk Density (PCF)	115- 134
Unconfined Shear Strength (PSF)	600-4690
Field Vane Test (PSF)	1000-2000+
Sensitivity	1.6- 3.2

The results of mechanical analyses are shown in an envelope form on Figure 2.

The undrained shear strength of the deposit in general decreases with depth. For design purposes the following undrained shear strength values are suggested:

Above Elev. 580	- 2000 PSF
Elev. 580-Elev. 565	- 1500 PSF
Elev. 565-Elev. 500	- 1000 PSF

The consistency of the overall deposit ranges from firm to very stiff.

#### Sandy Silt

An approximate 5-10 foot thick sandy silt, some gravel zone was found to underlie the cohesive deposit. The relative density is estimated to be very dense.

#### Limestone Bedrock

The bedrock was proven at one borehole location (B.H. #1) by obtaining AXT size core. The bedrock was found to be sound limestone, the surface being at elevation 490±.



Groundwater Conditions

Groundwater level observations have been carried out during the course of fieldwork by recording the water levels in the open boreholes. The following groundwater levels were observed:

- B.H. #1 Elev. 591
- B.H. #2 Elev. 591
- B.H. #3 Elev. 590
- B.H. #4 Not observed

These figures indicate that the groundwater level is located some 2-3 feet below the existing ground level.

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



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

## APPENDIX



# RECORD OF BOREHOLE No 1

W P 260-66-03 LOCATION Co-ords. N 15,358,550; E 848,663 ORIGINATED BY AMS  
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger (Bombardier) AXT Rock Core & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE Feb., 21 & 22, 1968 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT			UNIT WEIGHT $\gamma$ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100	W <sub>p</sub>	W	W <sub>L</sub>		
592.8	Ground Level													
0.0	Silty Sand						590	Frozen Zone						
588.8	Compact													
4.0	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm to Very Stiff		1	SS	5									
			2	SS	20									
			3	SS	18									
			4	SS	9									
			5	TW	PH								130	
			6	TW	PH									
			7	TW	PH								128	
			8	TW	PH									
			9	TW	PH								128	1 21 48 30
			10	TW	PH									
			11	TW	PM								134	
			12	TW	PM									
			13	TW	PM								127	2 17 47 34
			14	TW	PM									
499.8	Sandy Silt Some Gravel						500							
93.0														
490.0	Very Dense													
102.8	Limestone Bedrock		15	AXT RC	REC 100%		490							
484.6	Sound													
108.2	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

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



## RECORD OF BOREHOLE No 2

W P 260-66-03 LOCATION Co-ords N 15,358,662; E 848,637 ORIGINATED BY AMS  
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger (Bombardier) & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE Feb., 23, 1968 CHECKED BY RS

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 PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80	100
								SHEAR STRENGTH P.S.F.									
593.0	Ground Level																
0.0	Silty Sand						590	Frozen Zone									
589.0	Compact																
4.0	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm to Very Stiff		1	SS	6												
			2	TW	PH												
			3	TW	PH												
			4	TW	PM												
			5	TW	PM												
			6	TW	PM												
		7	TW	PM													
551.5		8	TW	PM													
41.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 3

W P 260-66-03 LOCATION Co-ords N 15,358,707; E 848,504 ORIGINATED BY AMS  
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger (Bombardier) & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE Feb. 26 & 27, 1968 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>			
592.3	Ground Level							SHEAR STRENGTH P.S.F.		WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 500 1000 1500 2000 2500						
0.0	Silty Sand						590	Frozen Zone						
588.3	Compact							4690					125	0 9 31 60
4.0	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm To Stiff		1	SS	7									
			2	TW	PH									
			3	SS	11									
			4	TW	PM			+ 1.8						124
			5	TW	PM			b 2.4						
			6	TW	PM			+ 2.1						127
			7	TW	PM									
			8	TW	PM			+ 1.7						126
			9	TW	PM			q 2.0						
			10	TW	PM			+ 2.5						115
			11	TW	PM									
			12	TW	PM			+ 1.6						132
			13	TW	PM									
			14	TW	PM			+ 1.5						
496.3							500	+ 2.6						
96.0	Sandy Silt, Some Gravel													
491.0	Very Dense													
101.3	End of Borehole (Refusal)													

+3, x5: Numbers refer to  
Sensitivity

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



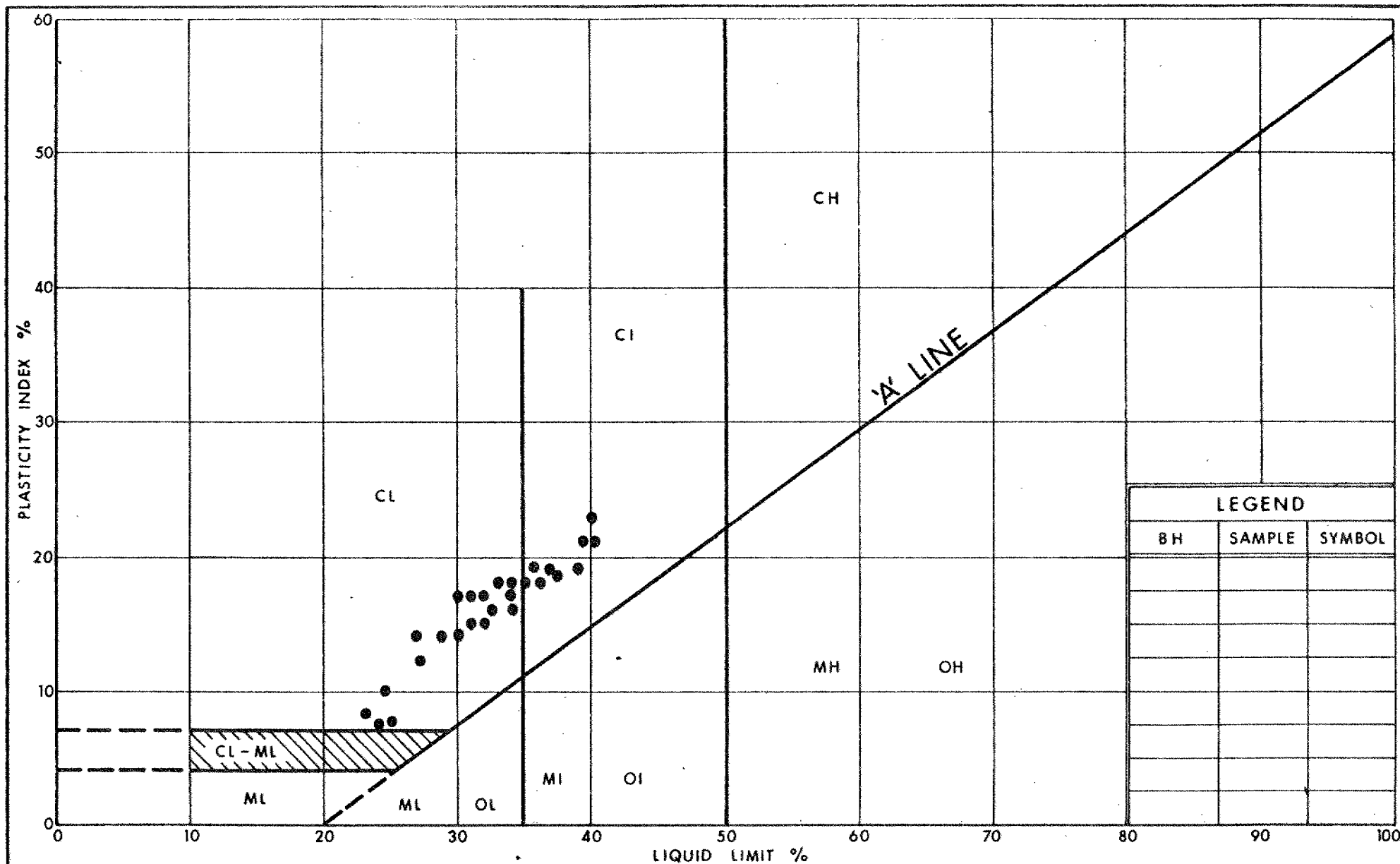
# RECORD OF BOREHOLE No 4

W P 260-66-03 LOCATION Co-ords N 15,358,594: E 848,573 ORIGINATED BY AMS  
DIST 1 HWY E.C.Row Expwy BOREHOLE TYPE Cont. Flight Auger (Bombardier) & Cone Test COMPILED BY AMS  
DATUM Geodetic DATE Feb. 27, 1968 CHECKED BY RS

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						
593.6	Ground Level													
0.0	Silty Sand													
589.6	Compact					*								
4.0			1	SS	4									
	Silty Clay		2	TW	PH								129	
	To		3	TW	PH									
	Clayey Silt		4	TW	PH								123	0 13 41 46
	Some Sand		5	TW	PH									
	Trace of Gravel		6	TW	PH								124	
	Firm To Stiff		7	TW	PH									
			8	TW	PH								127.5	1 16 44 39
550.6	End of Borehole													
43.0	* Note Water Level Not Established													

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



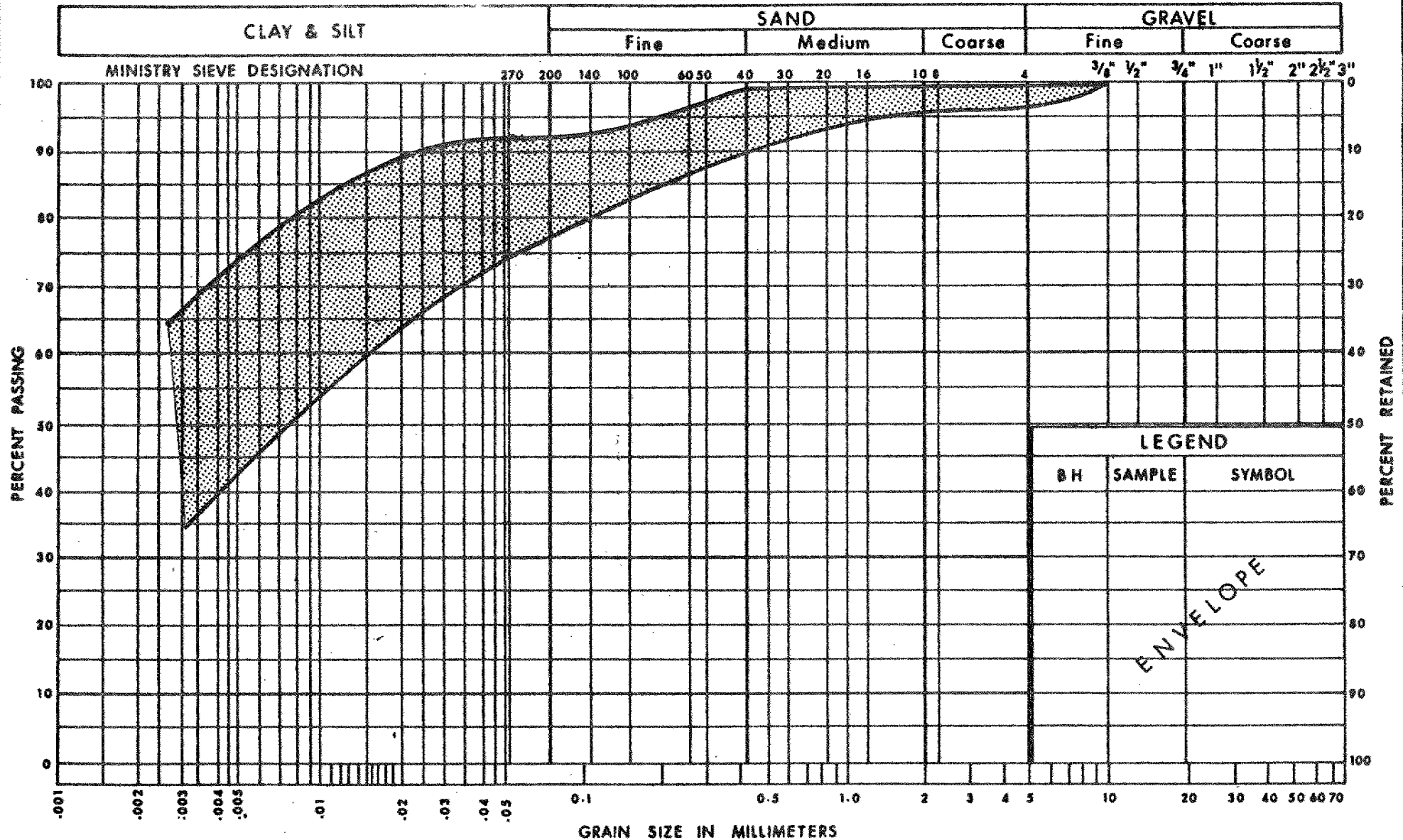
Ministry of  
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# PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260 - 66 - 03

# UNIFIED SOIL CLASSIFICATION SYSTEM



**Ministry of  
Transportation and  
Communications**

GRAIN SIZE DISTRIBUTION  
SILTY CLAY TO CLAYEY SILT

FIG No 2

WP 260 - 66 - 03



ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

W.P. 260-66-02

DIST 1

HWY ECR

STR SITE 6-274

Windsor-Matchette Road Overpass  
0.5 Miles East of Hwy. 18

DISTRIBUTION

A.P. Watt (2)  
J.R. Roy  
A. Wittenberg  
J.H. Blevins (2)

J.L. Keen  
G.A. Wrong  
B.J. Giroux  
R.S. Pillar

R. Hore

A. Crowley )  
J. Anderson } cover only  
G. Sloan )

.Files

# FOUNDATION INVESTIGATION REPORT

For

Windsor-Matchette Road Overpass  
0.5 Miles East of Hwy. 18  
W.P. 260-66-02, Site 6-274  
Hwy. ECR, District 1, Chatham

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## INTRODUCTION

The following report contains the results of a foundation investigation carried out at the above site in the period from February 28 to March 4, 1968. A muskeg vehicle mounted power auger was used to advance four boreholes to depths ranging from 48 to 82 feet in depth. Bedrock was proven in one borehole by obtaining AXT size rock core. Dynamic penetration tests (cone tests) were carried out at each of the four boreholes. The report also contains recommendations relating to the design and construction of the proposed structure and approaches.

## SITE DESCRIPTION

The site is located 1.4 miles west of Hwy. 3 along the proposed E.C. Row Expressway alignment within the City of Windsor.

Several residential buildings are present to the east of Matchette Road. Overgrown agricultural land surrounds the site.

Physiographically, this area lies in the Essex Clay Plain which is a flat lying till plain of poor natural drainage. In this area clay and silt deposits from glacial Lakes Whittlesey and Warren and later Lake Saint Clair, caused a general levelling of the basic clay till.

## SUBSURFACE CONDITIONS

### General

Subsoil at the site consists of a shallow uniform layer of silty sand underlain by cohesive type deposits of silty clay to clayey silt, some sand, trace of gravel, followed by a sandy silt layer, some gravel and clay overlying the flat lying limestone bedrock.

The boundaries of the various deposits are shown in the appended Record of Borehole Sheets and an estimated stratigraphical profile is shown on Drawing 2606602-A.

Soil types encountered from ground level downward are described in some detail below.

### Silty Sand

This deposit is present in all boreholes to a 4 foot depth from ground surface downwards and is classified as silty sand with a loose to compact relative density.

### Silty Clay to Clayey Silt

The silty sand is underlain by an extensive cohesive type stratum down to elevation 512±. The material in the deposit consists of silty clay to clayey silt some sand, trace of gravel. A plot of plasticity index versus liquid limit (Fig. 1) shows the points to fall within the CL and CI zones.

Field and laboratory tests indicate the following physical properties:

	<u>Range</u>
Natural Moisture Content (W) %	14- 39
Plastic Limit (W <sub>p</sub> ) %	13- 23
Liquid Limit (W <sub>L</sub> ) %	21- 47
Bulk Density (γ) PCF	115-133
Undrained Shear Strength (Su) PSF	
Unconfined Compression	372-1569
Field Vane	520-2000+
Sensitivity (S)	1.4-3.6

Grain size distribution curves are plotted on Figure 2.

The undrained shear strength of the deposit decreases with depth until a minimum value is reached, then increases again. For design purposes the following undrained shear strength values are suggested:

Above Elev. 575: 2000 PSF  
 Elev. 575-Elev. 550: 750 PSF  
 Elev. 550-Elev. 535: 600 PSF  
 Elev. 535-Elev. 512: 2500 PSF

The consistency of the overall deposit ranges from firm to very stiff.

### Sandy Silt

An approximate 4 to 5 foot thick layer of sandy silt, some gravel and clay was encountered below the clayey silt to silty clay deposit. The relative density is estimated to be very dense.

Limestone Bedrock

Bedrock at this site was found to consist of generally sound limestone at elevation 508.5 (BH. #1).

Groundwater Conditions

Groundwater level observations have been carried out during the course of fieldwork by recording the water levels in the open boreholes. The following groundwater levels were observed:

B.H. #1	Elev. 582.5
2	583.0
3	583.3
4	583.5

These figures indicate that the groundwater level is about 2-3 feet below the original ground level.

## DISCUSSION AND RECOMMENDATIONS

### General

It is proposed to build a three span (35'-63'-35') twin overpass structure at this location. The profile grade of E.C. Row Expressway is set at elevation 608 some 21 feet above Matchette Road surface. The existing ground surface adjacent to the proposed structure site is at about elevation 586±.

### Structure Foundations

It is recommended that the entire structure (abutments and piers) be founded on end bearing piles driven to bedrock. The bedrock surface is located some 77 feet below ground level. These piles could be either steel 'H' piles or concrete filled steel tube piles. Design loads may be as high as 130 tons/pile for either 12 3/4" x 1/4" steel tubes, or 12 BP @ 74 steel H sections. If tube piling is selected the driving energy should not exceed 30,000 ft.lbs per blow below elevation <sup>513</sup>503 to avoid damage to the pile tips when contact with the rock is made. All foundations should be protected against frostaction by at least 4 feet of earth cover.

No major dewatering problems are anticipated.


### Approach Embankments

The shear strength of the subsoil is such that it will be able to support the 21 foot high approach embankments constructed with 2:1 slopes. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven and it is recommended that this portion of the fill contain no larger grain sizes than 2 inches.

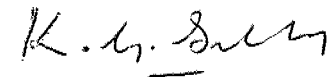
It is estimated that a maximum settlement of 5-6 inches will take place over a long period of time under the 21 foot high fill at the abutment locations. To minimize the effect of the settlement on the performance of the structure it is recommended that the approaches be built in advance of the structure for as long a period as possible.

MISCELLANEOUS

The field investigation was carried out under the supervision of Mr. A.M. Seppala, Project Engineer. The equipment used was owned and operated by Canadian Longyear Ltd. This report was written by Mr. P. Payer with the assistance of Mr. J. Murray, Student Technician.

  
P. Payer, P. Eng.  
Senior Engineer



  
K.G. Selby, P. Eng.  
Supervising Engineer

KGS/PP/gs  
October, 1977

## APPENDIX

# RECORD OF BOREHOLE No (Formerly B.H. 12 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,765 E 845,119 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger AXT Rock Core & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE March 4, 1968 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			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
585.2	Ground Level							20 40 60 80 100	500 1000 1500 2000 2500	10 20 30				GR SA SI CL	
0.0	Silty Sand														
581.2															
4.0			1	SS	8		580								
			2	TW	PH										
			3	SS	7		570								
			4	TW	PH										
			5	TW	PH										
			6	TW	PH										
			7	TW	PH										
			8	TW	PH										
			9	TW	PH										
			10	TW	PH										
			11	TW	PH										
			12	TW	PH										
512.2															
73.0	Sandy Silt														
508.5	Some Gravel														
76.7	Limestone		13	AXT RC	REC 100%										
503.1	Bedrock Sound														
82.1	End of Borehole														

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



# RECORD OF BOREHOLE No 2 (Formerly B.H. 11 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,868 E 845,192 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE March 1, 1968 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					
585.5	Ground Level																
0.0	Silty Sand																
581.5																	
4.0																	
	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm		1	SS	6		580									117	0 6 23 71
			2	TW	PH		570									121	
			3	TW	PH												
			4	TW	PH												
			5	TW	PH		560										
			6	TW	PH											127	
			7	TW	PH		550										
			8	TW	PH		540									132	4 22 51 23
537.5																	
48.0	End of Borehole																

# RECORD OF BOREHOLE No 3 (Formerly B.H. 9 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,847 E 845,310 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE Feb. 28 & 29, 1968 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 PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
585.5	Ground Level														
0.0	Silty Sand	1.													
581.5															
4.0			1	SS	5		580	+2.1							
			2	TW	PH			+2.9					117		
	Silty Clay to Clayey Silt, Some Sand, Trace of Gravel Firm		3	TW	PH		570	+2.1					115		
			4	TW	PH			+2.5					124		
			5	TW	PH		560	+1.8							
			6	TW	PH			+2.0					137		
			7	TW	PH		550	+5.1					118		
			8	TW	PH			+3.6					122		
			9	TW	PH		540	+2.0							
			10	TW	PH			+1.4					130.5	3 21 48 28	
							530								
			11	TW	PH			+1.6					131		
							520								
513.5			12	TW	PH								144		
72.0	Sandy Silt, Some Gravel & Clay							+*							
508.5	Very Dense		13	SS	150		510							17 24 41 18	
77.0	Probable Bedrock														

+3, x5 : Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

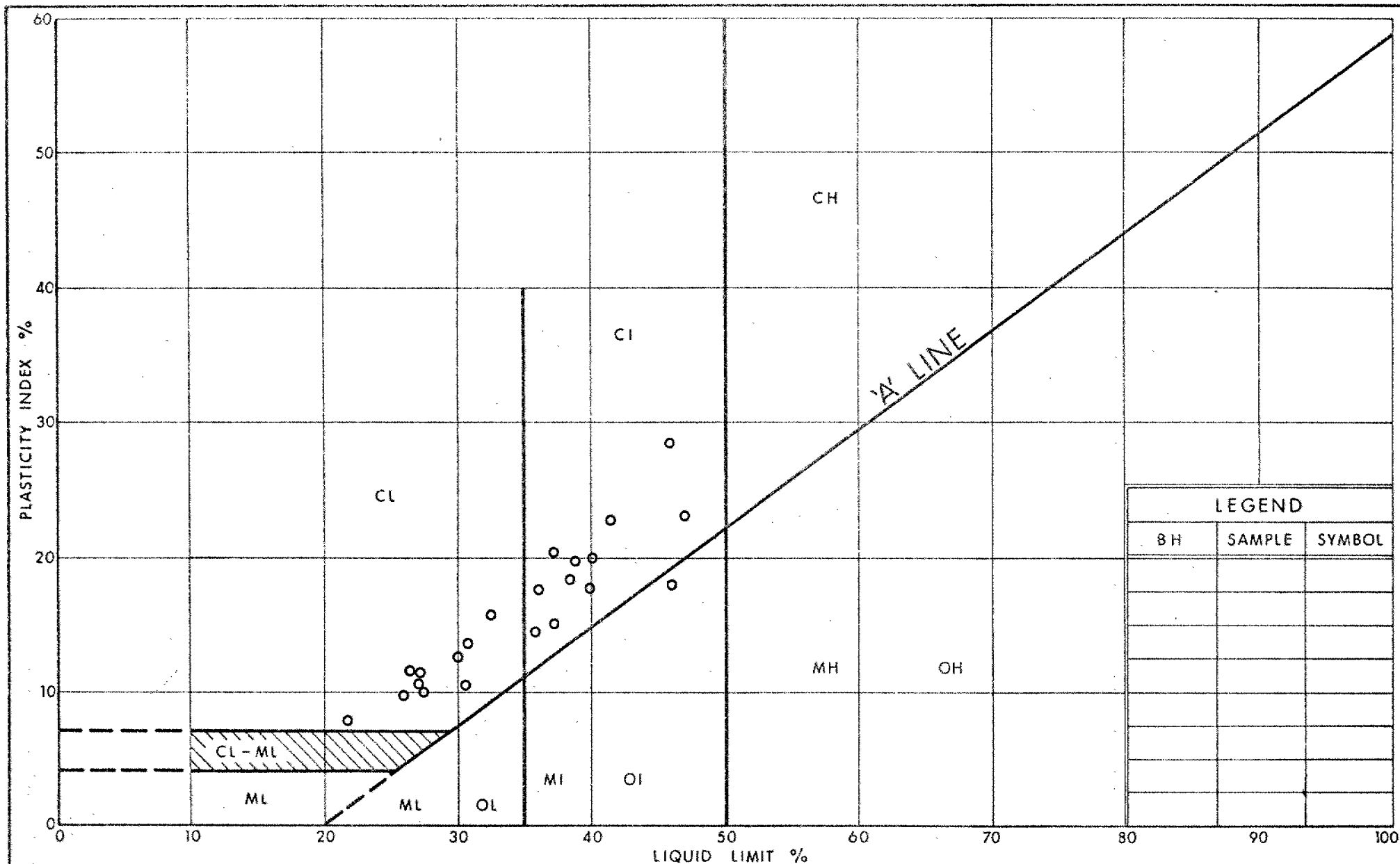
## RECORD OF BOREHOLE No 4 (Formerly B.H. 10 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,742 E 845,277 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE Feb. 29, 1968 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					
585.8	Ground Level																
0.0																	
581.8	Silty Sand																
4.0																	
			1	SS	6		580										
			2	TW	PH												
	Silty Clay to Clayey Silt, Some Sand, Trace of Gravel		3	SS	5		570										
			4	TW	PH												
	Firm		5	SS	6		560										
			6	TW	PH												
			7	SS	4		550										
			8	TW	PH		540										
537.8	End of Borehole																
48.0																	

+3, x5 : Numbers refer to Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10



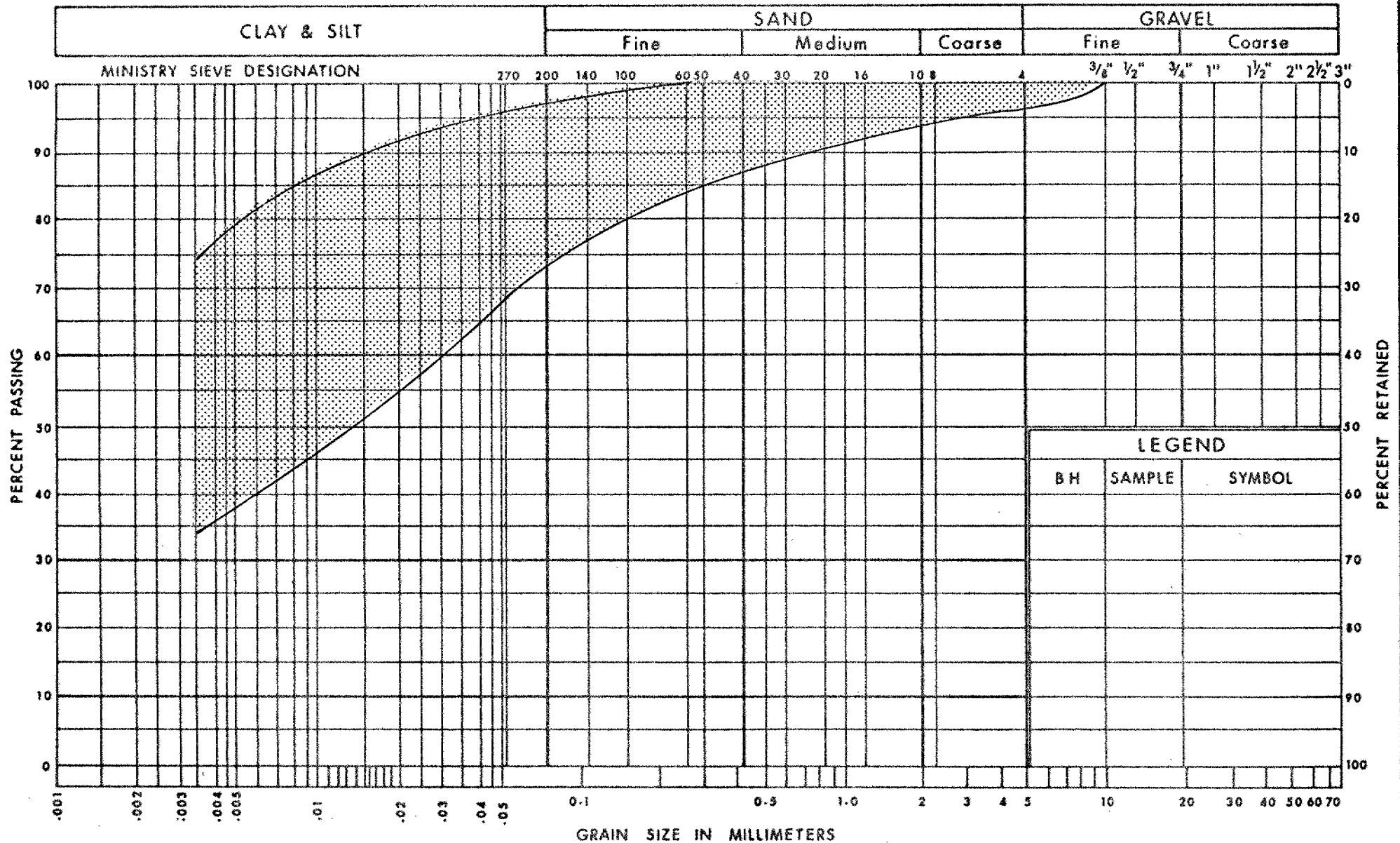
Ministry of  
Transportation and  
Communications

# PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260-66-02

## UNIFIED SOIL CLASSIFICATION SYSTEM



**Ministry of  
Transportation and  
Communications**

# GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT

FIG No 2

W P 260-66-02

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
$w_s$	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_C$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$c_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_i$	SENSITIVITY

### GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

### STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

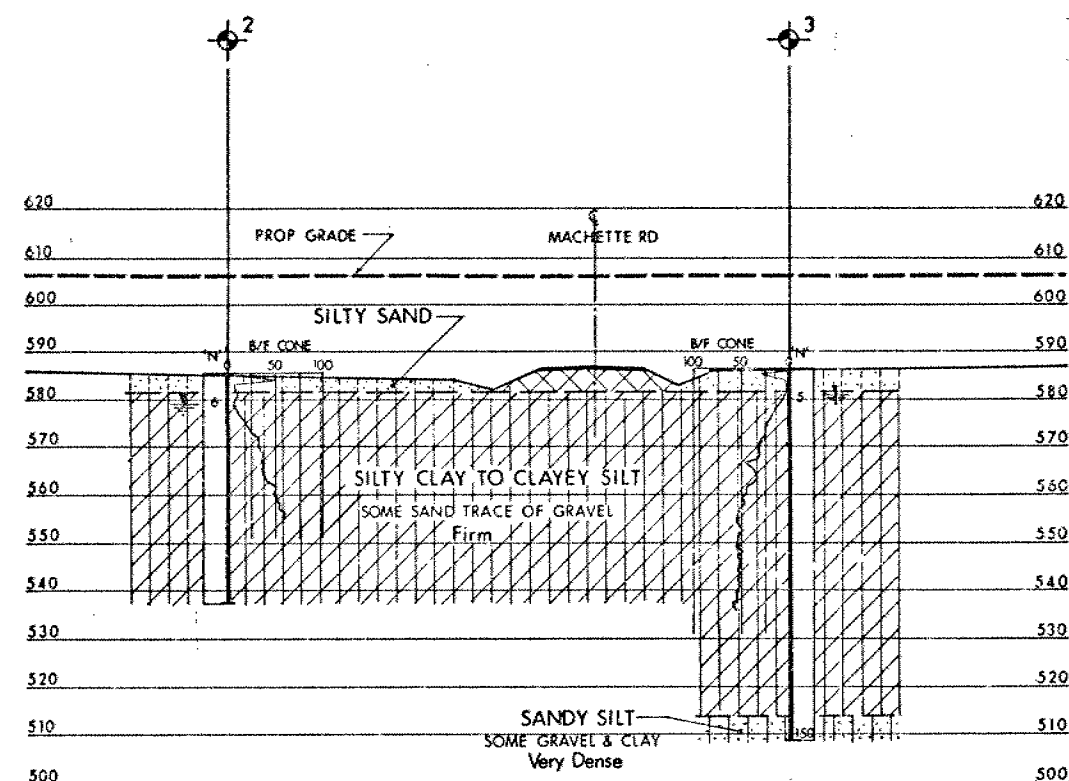
CONT No  
WP No 260-66-02

MACHETTE RD. O'PASS

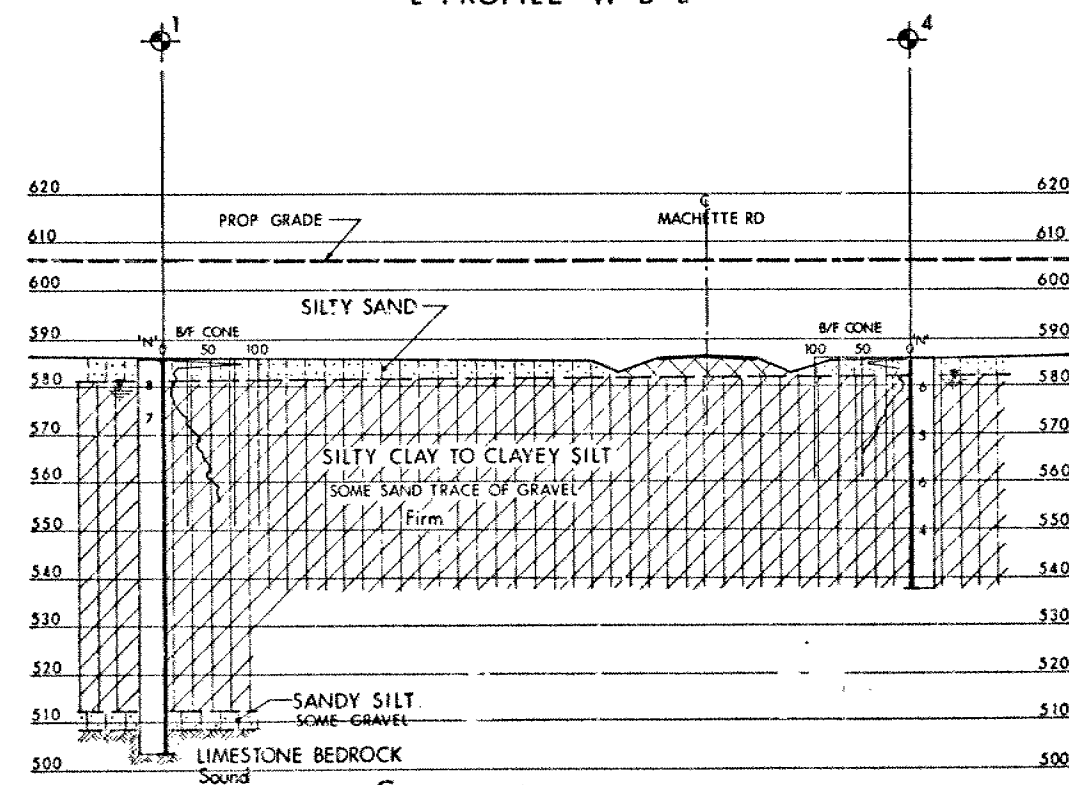
BORE HOLE LOCATIONS & SOIL STRATA



SHEET

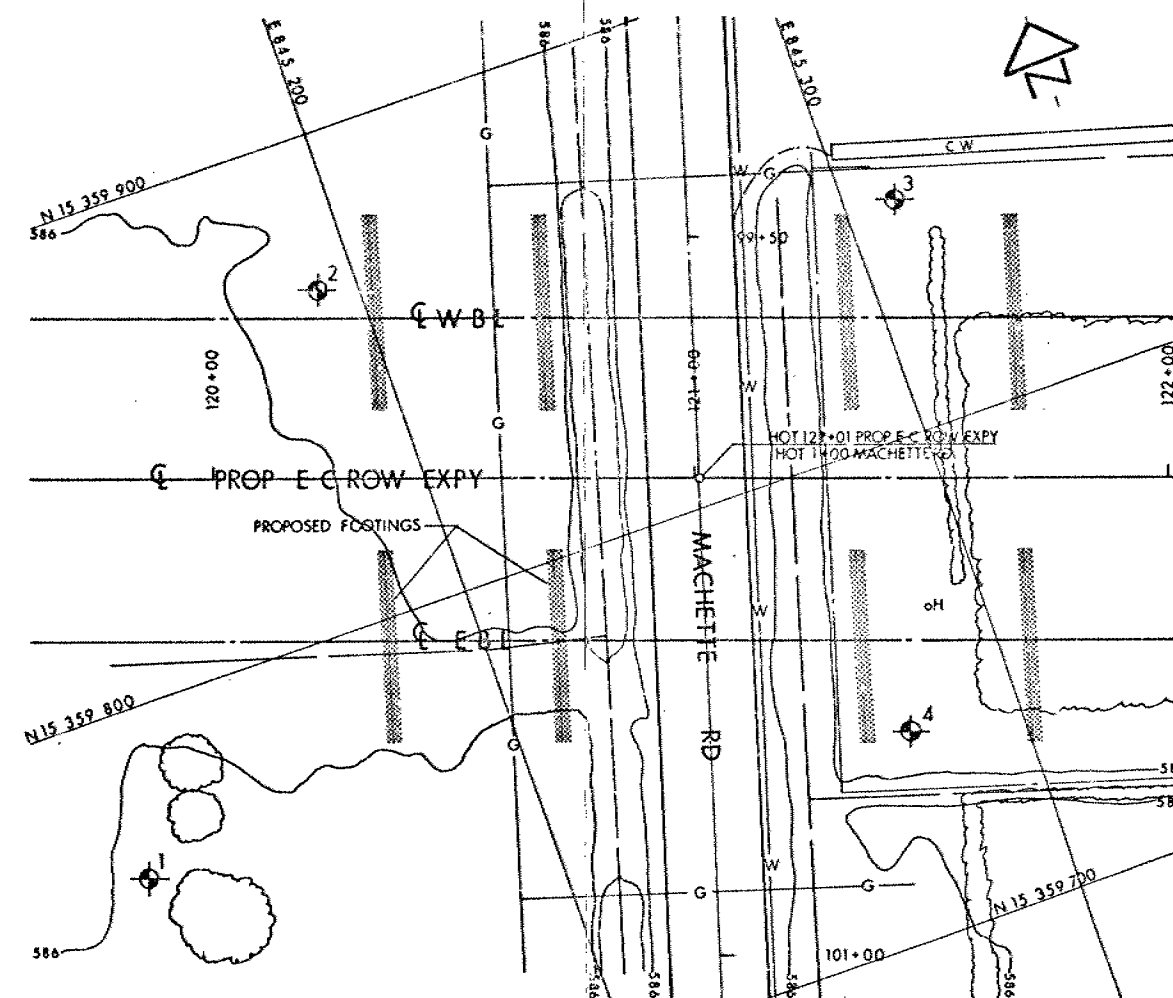


PROFILE W B L



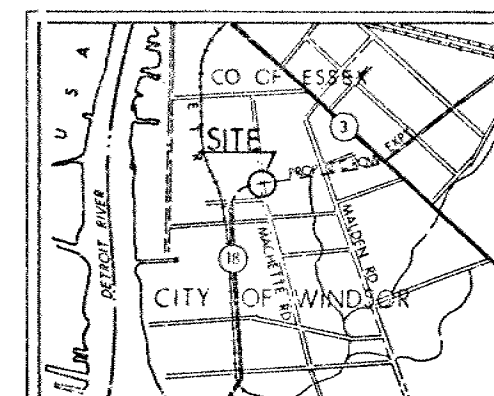
PROFILE E B L

SCALE  
20 10 0 20 FT



PLAN

SCALE  
20 10 0 20 FT



# LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation  
FEB & MAR 1968

No	ELEVATION	CO-ORDINATES		FORMERLY WG 68-F-15-1
		NORTH	EAST	
1	585-2	359 765	845 119	12
2	585-5	359 868	845 192	11
3	585-5	359 847	845 310	9
4	585-8	359 742	845 277	10

# 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

REF No E-5518-1 JUNE 1977

HWY No. 1 E C ROW EXPY  
SUBMITTAL CHECKED DATE 20 OCT 1977 SITE 6-278  
DRAWN BY J. CHECKED BY J. DATE 6/20/77

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40 J 6-8

DIST. 1 REGION

W.P. No. 260-66-06

CONT. No. 89-41

W. O. No.

STR. SITE No. 6-274

HWY. No. E.C. ROW

LOCATION Matchette Rd.

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



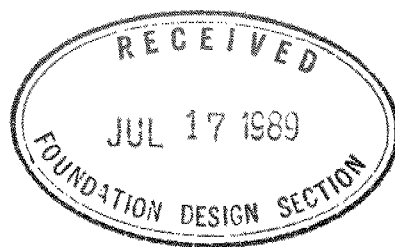
# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 89-41



Ontario

Ministry of  
Transportation and  
Communications



## INDEX

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	* These foundation reports were prepared in 1968 and reflect the subsurface and topographical conditions which prevailed at that time. Since then the W.B.L. structures and the E.B.L. approaches have been built at both sites and ground conditions have changed accordingly.

NOTE: For purposes of the contract these reports supercede all other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.

# EXPLANATION OF TERMS USED IN REPORT

2

**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
$\sigma'_{vo}$	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
$S_i$	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						

FOUNDATION INVESTIGATION REPORT  
For  
Matchette Road Overpass E.B.L.  
0.8 km East of Hwy. 18  
W.P. 260-66-06, Site 6-274  
Hwy. ECR, District 1, Chatham

## INTRODUCTION

The following report contains the results of a foundation investigation carried out at the above site in the period from February 28 to March 4, 1968. A muskeg vehicle mounted power auger was used to advance 2 boreholes to depths ranging from 14.6 to 25.0 m in depth. Bedrock was proven in one borehole by obtaining AXT size rock core. Dynamic penetration tests (cone tests) were carried out at each of the 2 boreholes.

## SITE DESCRIPTION

The site is located 2.2 km west of Hwy. 3 along the proposed E.C. Row Expressway alignment within the City of Windsor.

Several residential buildings are present to the east of Matchette Road. Overgrown agricultural land surrounds the site.

Phsiographically, this area lies in the Essex Clay Plain which is a flat lying till plain of poor natural drainage. In this area clay and silt deposits from glacial Lakes Whittlesey and Warren and later Lake Saint Clair, caused a general levelling of the basic clay till.

## SUBSURFACE CONDITIONS

### General

Subsoil at the site consists of a shallow uniform layer of silty sand underlain by cohesive type deposits of silty clay to clayey silt, some sand, trace of gravel, followed by a sandy silt layer, some gravel and clay overlying the flat lying limestrone bedrock.

The boundaries of the various deposits are shown in the appended Record of Borehole Sheets and an estimated stratigraphical profile is shown on Drawing #2 of the contract drawings.

Soil types encountered from ground level downward are described in some detail below.

### Silty Sand

This deposit is present in all boreholes to a 1.3 m depth from ground surface downwards and is classified as silty sand with a loose to compact relative density.

### Silty Clay to Clayey Silt

The silty sand is underlain by an extensive cohesive type stratum down to elevation 156.0. The material in the deposit consists of silty clay to clayey silt some sand, trace of gravel.

Field and laboratory tests indicate the following physical properties:

Natural Moisture Content (W) %		21 - 34
Plastic Limit	(W <sub>p</sub> ) %	12 - 22
Liquid Limit	(W <sub>L</sub> ) %	24 - 43
Bulk Density	( $\gamma$ ) kN/m <sup>3</sup>	18.4 - 21.8
Undrained Shear Strength	kPa	
Unconfined Compression		12 - 40
Field Vane		22 - 108
Sensitivity	(S)	1.5 - 3.5

The undrained shear strength of the deposit decreased with depth until a minimum value is reached, then increased again. For design purposes the following undrained shear strength values are suggested:

Above Elev. 175: 95.7 kPa

Elev. 175 - Elev. 167: 35.9 kPa

Elev. 167 - Elev. 163: 28.7 kPa

Elev. 163 - Elev. 156: 119.7 kPa

The consistency of the overall deposit ranged from firm to very stiff.

### Sandy Silt

An approximate 1 m thick layer of sandy silt, some gravel and clay was encountered below the clayey silt to silty clay deposit. The relative density is estimated to be very dense.

### Limestone Bedrock

Bedrock at this site was found to consist of generally sound limestone at elevation 156.0 (B.H. #1).

Sandy Silt

An approximate 3 m thick sandy silt, some gravel zone was found to underlie the cohesive deposit. The relative density is estimated to be very dense.

Limestone Bedrock

The bedrock was proven at one borehole location (B.H. #1) by obtaining AXT size core. The bedrock was found to be sound limestone, the surface being at elevation 149.3.

Groundwater Conditions

Groundwater level observations have been carried out during the course of fieldwork by recording the water levels in the open boreholes. The following groundwater levels were observed:

B.H. #1 Elev. 180.1

B.H. #4 Not Observed

These figures indicate that the groundwater level is located some 0.5 m below the existing ground level.



*P. Payer*

P. Payer, P. Eng.  
Sr. Foundation Engineer

*M. Devata*

M. Devata, P. Eng.  
Chief Foundation Engineer

**APPENDIX**

# RECORD OF BOREHOLE No 1

METRIC 7

W P 260-66-06 LOCATION Sta. 13 + 652.8 15.0 m Rt. C E.B.L. E.C. Row Expwy. ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy. BOREHOLE TYPE Cont. Flight Auger, AXT Rock Core & Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1968 03 04 CHECKED BY *AD*

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
178.3	Ground Level																
0.0	Silty Sand						178										
177.2																	
1.1			1	SS	8												
			2	TW	PH												
			3	SS	7												
	Silty Clay to Clayey Silt		4	TW	PH		172									18.5	0 9 (91)
	Some Sand		5	TW	PH												
	Trace Gravel		6	TW	PH		170									20.0	
	Firm		7	TW	PH												
			8	TW	PH		168										
			9	TW	PH		166									20.0	
			10	TW	PH		164									20.9	3 22 49 26
			11	TW	PH		160										
			12	TW	PH		158										
156.0	Sandy Silt						156									21.8	2 19 (79)
22.3	Some Gravel																
155.0																	
23.3	Limestone Bedrock Sound		13	AXT RC	REC 100%		154										
153.3																	
25.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

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



# RECORD OF BOREHOLE No 4

METRIC 8

W P 260-66-06 LOCATION Sta. 13 + 701.6 5.9 m Rt. E E.B.L. E.C. Row Expwy. ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy. BOREHOLE TYPE Cont. Flight Auger and Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1968 02 29 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT	WATER CONTENT (%)	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W		
178.6	Ground Level															
0.0	Silty Sand															
177.3																
1.3			1	SS	6											
			2	TW	PH											
			3	SS	5											
			4	TW	PH											
	Silty Clay to Clayey Silt		5	SS	6											
	Some Sand		6	TW	PH											
	Trace Gravel		7	SS	4											
	Firm		8	TW	PH											
164.0																
14.6	End of Borehole															

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

FOUNDATION INVESTIGATION REPORT  
For  
Malden Road Overpass E.B.L.  
1.9 km East of Hwy. 18 - Windsor  
Hwy. ECR, District 1, Chatham  
W.P. 260-66-07, Site 6-275

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## INTRODUCTION

This report contains the results of our foundation investigation carried out for the proposed overpass structure. The fieldwork was carried out during the period of February 22-28, 1968, utilizing a continuous flight auger machine mounted on a muskeg vehicle and equipped with solid augers.

## SITE DESCRIPTION

The site is located 1.9 km east of Hwy. 18 along the proposed E.C. Row Expressway alignment within the City of Windsor. The surrounding terrain is flat residential area.

Physiographically the site is located in the region referred to as the St. Clair Clay Plain.

## SUBSURFACE CONDITIONS

### General

General uniform subsoil conditions were found to prevail over the site area. The subsoil consists of a shallow layer of silty sand, underlain by a deep deposit of silty clay to clayey silt, containing some sand and traces of gravel, followed by a sandy silt stratum which is in turn underlain by sound limestone bedrock. The boundaries of the different deposits are shown on the Record of Borehole Sheets attached to the Appendix. The estimated stratigraphical profile of Drawing #2 of the contract drawings is based upon this information. Soil types encountered from ground level downward are described in some detail below.

### Silty Sand

This deposit was intersected in all borings from immediately below the ground surface to a depth of about 1.2 m. The material consists of silty sand. The upper portion was found to be frozen at the time of the field investigation. The relative density is estimated to be compact.

### Silty Clay to Clayey Silt

The silty sand is underlain by an extensive cohesive type stratum at each boring location. The lower boundary of the deposit was encountered at Elevation 152.3. It was penetrated fully only in B.H. 1. The material in the deposit consists of silty clay to clayey silt, some sand and traces of gravel. Physical properties of the overall deposit as determined from field and laboratory tests are as follows:

Natural Moisture Content	(%)	17 - 28
Liquid Limit	(%)	23 - 41
Plastic Limit	(%)	12 - 20
Bulk Density	(kN/m <sup>3</sup> )	19.3 - 20.4
Unconfined Shear Strength	(kPa)	26 - 75
Field Vane Test	(kPa)	43 - 105
Sensitivity		1.6 - 3.2

The undrained shear strength of the deposit in general decreases with depth. For design purposes the following undrained shear strength values are suggested:

Above Elev. 176	- 95.7 kPa
Elev. 176 - Elev. 565	- 71.8 kPa
Elev. 172 - Elev. 152	- 47.8 kPa

The consistency of the overall deposit ranges from firm to very stiff.

Groundwater Conditions

Groundwater level observations have been carried out during the course of fieldwork by recording the water levels in the open boreholes. The following groundwater levels were observed:

B.H. #1 Elev. 177.5

B.H. #4 177.8

These figures indicate that the groundwater level is about 0.8 m below the original ground level.



*P. Payer*  
P. Payer, P. Eng.  
Foundation Engineer

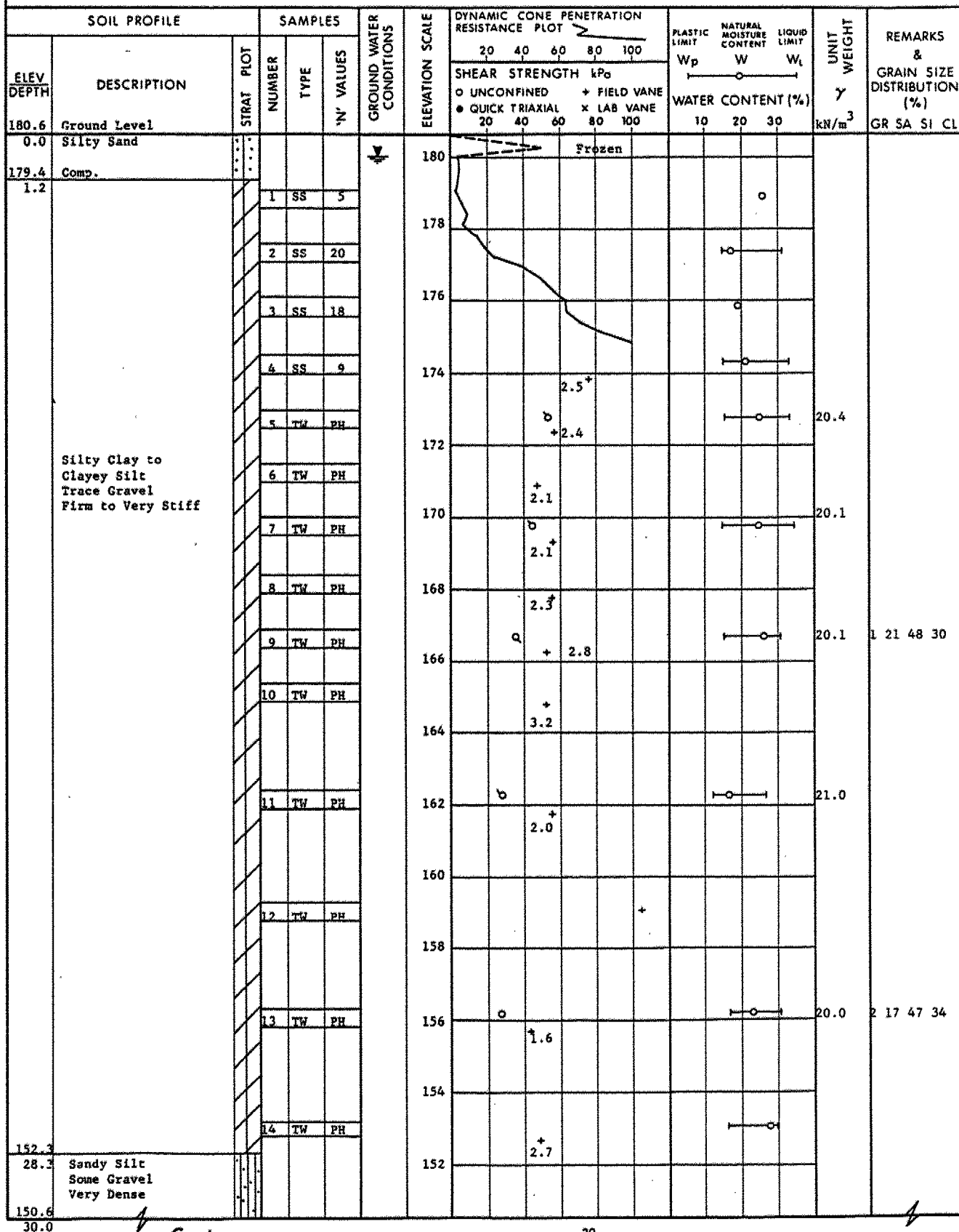
*M. Devata*  
M. Devata, P. Eng.  
Chief Foundation Engineer

**APPENDIX**

# RECORD OF BOREHOLE No 1

METRIC

W P 260-66-07 LOCATION Sta. 14+795.8 10.8m Rt. EBL EC Row Expwy. ORIGINATED BY AMS  
 DIST 1 HWY EC Row Expwy. BOREHOLE TYPE Cont. Flight Auger AXT Rock Core & Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1968 02 21 & 22 CHECKED BY LS



## METRIC

DATUM Geodetic DATE 1968 02 21 & 22 CHECKED BY [Signature]

+3, x5: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 4

METRIC

W P 260-66-07 LOCATION Sta 14 + 765.6 7.2m Rt C EBL EC Row Expwy ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont Flight Auger Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1968 02 27 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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 <sub>p</sub>	W	W <sub>L</sub>		
180.8	Ground Level													
0.0	Silty Sand Compact					*	180							
179.6														
1.2			1	SS	4									
			2	TW	PH		178						20.3	
	Silty Clay to Clayey Silt		3	TW	PH		176							
	Some Sand Trace Gravel		4	TW	PH		174						19.3	0 13 41 46
	Firm to Stiff		5	TW	PH		172							
			6	TW	PH		170						19.5	
			7	TW	PH									
			8	TW	PH		168						20.0	1 16 44 39
167.7														
13.1	END OF BOREHOLE * Water Level Not Established													

OFFICE REPORT ON SOIL EXPLORATION



*EBL 260-66-06*  
*Done 12/1/76*

ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

WP 260-66-02

DIST 1

HWY ECR

STR SITE 6-274

Windsor-Matchette Road Overpass  
0.5 Miles East of Hwy. 18

*WBL DONE UNDER 81-05*

DISTRIBUTION

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# FOUNDATION INVESTIGATION REPORT

For

Windsor-Matchette Road Overpass

0.5 Miles East of Hwy. 18

W.P. 260-66-02, Site 6-274

Hwy. ECR, District 1, Chatham

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## INTRODUCTION

The following report contains the results of a foundation investigation carried out at the above site in the period from February 28 to March 4, 1968. A muskeg vehicle mounted power auger was used to advance four boreholes to depths ranging from 48 to 82 feet in depth. Bedrock was proven in one borehole by obtaining AXT size rock core. Dynamic penetration tests (cone tests) were carried out at each of the four boreholes. The report also contains recommendations relating to the design and construction of the proposed structure and approaches.

## SITE DESCRIPTION

The site is located 1.4 miles west of Hwy. 3 along the proposed E.C. Row Expressway alignment within the City of Windsor.

Several residential buildings are present to the east of Matchette Road. Overgrown agricultural land surrounds the site.

Physiographically, this area lies in the Essex Clay Plain which is a flat lying till plain of poor natural drainage. In this area clay and silt deposits from glacial Lakes Whittlesey and Warren and later Lake Saint Clair, caused a general levelling of the basic clay till.

## SUBSURFACE CONDITIONS

### General

Subsoil at the site consists of a shallow uniform layer of silty sand underlain by cohesive type deposits of silty clay to clayey silt, some sand, trace of gravel, followed by a sandy silt layer, some gravel and clay overlying the flat lying limestone bedrock.

The boundaries of the various deposits are shown in the appended Record of Borehole Sheets and an estimated stratigraphical profile is shown on Drawing 2606602-A.

Soil types encountered from ground level downward are described in some detail below.

### Silty Sand

This deposit is present in all boreholes to a 4 foot depth from ground surface downwards and is classified as silty sand with a loose to compact relative density.

### Silty Clay to Clayey Silt

The silty sand is underlain by an extensive cohesive type stratum down to elevation 512±. The material in the deposit consists of silty clay to clayey silt some sand, trace of gravel. A plot of plasticity index versus liquid limit (Fig. 1) shows the points to fall within the CL and CI zones.

Field and laboratory tests indicate the following physical properties:

	<u>Range</u>
Natural Moisture Content (W) %	14- 39
Plastic Limit (W <sub>p</sub> ) %	13- 23
Liquid Limit (W <sub>L</sub> ) %	21- 47
Bulk Density (γ) PCF	115-133
Undrained Shear Strength (Su) PSF	
Unconfined Compression	372-1569
Field Vane	520-2000+
Sensitivity (S)	1.4-3.6

Grain size distribution curves are plotted on Figure 2.

The undrained shear strength of the deposit decreases with depth until a minimum value is reached, then increases again. For design purposes the following undrained shear strength values are suggested:

Above Elev. 575: 2000 PSF  
 Elev. 575-Elev. 550: 750 PSF  
 Elev. 550-Elev. 535: 600 PSF  
 Elev. 535-Elev. 512: 2500 PSF

The consistency of the overall deposit ranges from firm to very stiff.

### Sandy Silt

An approximate 4 to 5 foot thick layer of sandy silt, some gravel and clay was encountered below the clayey silt to silty clay deposit. The relative density is estimated to be very dense.

Limestone Bedrock

Bedrock at this site was found to consist of generally sound limestone at elevation 508.5 (BH. #1).

Groundwater Conditions

Groundwater level observations have been carried out during the course of fieldwork by recording the water levels in the open boreholes. The following groundwater levels were observed:

B.H. #1	Elev. 582.5
2	583.0
3	583.3
4	583.5

These figures indicate that the groundwater level is about 2-3 feet below the original ground level.

## DISCUSSION AND RECOMMENDATIONS

### General

It is proposed to build a three span (35'-63'-35') twin overpass structure at this location. The profile grade of E.C. Row Expressway is set at elevation 608 some 21 feet above Matchette Road surface. The existing ground surface adjacent to the proposed structure site is at about elevation 586±.

### Structure Foundations

It is recommended that the entire structure (abutments and piers) be founded on end bearing piles driven to bedrock. The bedrock surface is located some 77 feet below ground level. These piles could be either steel 'H' piles or concrete filled steel tube piles. Design loads may be as high as 130 tons/pile for either 12 3/4" x 1/4" steel tubes, or 12 BP @ 74 steel H sections. If tube piling is selected the driving energy should not exceed 30,000 ft.lbs per blow below elevation <sup>513</sup>503 to avoid damage to the pile tips when contact with the rock is made. All foundations should be protected against frost action by at least 4 feet of earth cover.

No major dewatering problems are anticipated.

### Approach Embankments

The shear strength of the subsoil is such that it will be able to support the 21 foot high approach embankments constructed with 2:1 slopes. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven and it is recommended that this portion of the fill contain no larger grain sizes than 2 inches.

It is estimated that a maximum settlement of 5-6 inches will take place over a long period of time under the 21 foot high fill at the abutment locations. To minimize the effect of the settlement on the performance of the structure it is recommended that the approaches be built in advance of the structure for as long a period as possible.

MISCELLANEOUS

The field investigation was carried out under the supervision of Mr. A.M. Seppala, Project Engineer. The equipment used was owned and operated by Canadian Longyear Ltd. This report was written by Mr. P. Payer with the assistance of Mr. J. Murray, Student Technician.

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



*K.G. Selby*  
K.G. Selby, P. Eng.  
Supervising Engineer

KGS/PP/gs  
October, 1977

## APPENDIX

## RECORD OF BOREHOLE No (Formerly B.H. 12 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,765 E 845,119 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger AXT Rock Core & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE March 4, 1968 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			SHEAR STRENGTH						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE	500 1000 1500 2000 2500	10 20 30			
585.2	Ground Level												PCF	GR SA SI CL
0.0	Silty Sand													
581.2														
4.0			1	SS	8		580							
			2	TW	PH									
			3	SS	7		570							
			4	TW	PH									
			5	TW	PH		560							
			6	TW	PH									
			7	TW	PH		550							
			8	TW	PH									
			9	TW	PH		540							
			10	TW	PH									
			11	TW	PH		530							
			12	TW	PH		520							
512.2														
73.0	Sandy Silt						510							
508.5	Some Gravel													
76.7	Limestone		13	AXT RC	REC 100%									
503.1	Bedrock Sound													
82.1	End of Borehole													

+3, x5: Numbers refer to Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



## RECORD OF BOREHOLE No 2(Formerly B.H. 11 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,868 E 845,192 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE March 1, 1968 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					
585.5	Ground Level																
0.0	Silty Sand																
581.5																	
4.0	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm		1	SS	6		580									117	0 6 23 71
			2	TW	PH		570									121	
			3	TW	PH												
			4	TW	PH												
			5	TW	PH												
			6	TW	PH												
			7	TW	PH												
			8	TW	PH												
537.5							540									132	4 22 51 23
48.0	End of Borehole																

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

20  
15-5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 3 (Formerly B.H. 9 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,847 E 845,310 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE Feb. 28 & 29, 1968 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 PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
585.5	Ground Level							20 40 60 80 100							
0.0	Silty Sand														
581.5															
4.0															
	Silty Clay to Clayey Silt, Some Sand, Trace of Gravel Firm		1	SS	5		580		+2.1						
			2	TW	PH				+2.9				117		
			3	TW	PH		570		+2.1				115		
			4	TW	PH				+2.5				124		
			5	TW	PH		560		+1.8						
			6	TW	PH				+2.0				137		
			7	TW	PH		550		+5.1				118		
			8	TW	PH				+3.6				122		
			9	TW	PH		540		+2.0						
			10	TW	PH				+1.4				130.5	3 21 48 28	
			11	TW	PH		530						131		
513.5			12	TW	PH							144			
72.0	Sandy Silt, Some Gravel & Clay						510		+>					17 24 41 18	
508.5	Very Dense		13	SS	150										
77.0	Probable Bedrock														

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

20  
15  
10

5 (% ) STRAIN AT FAILURE

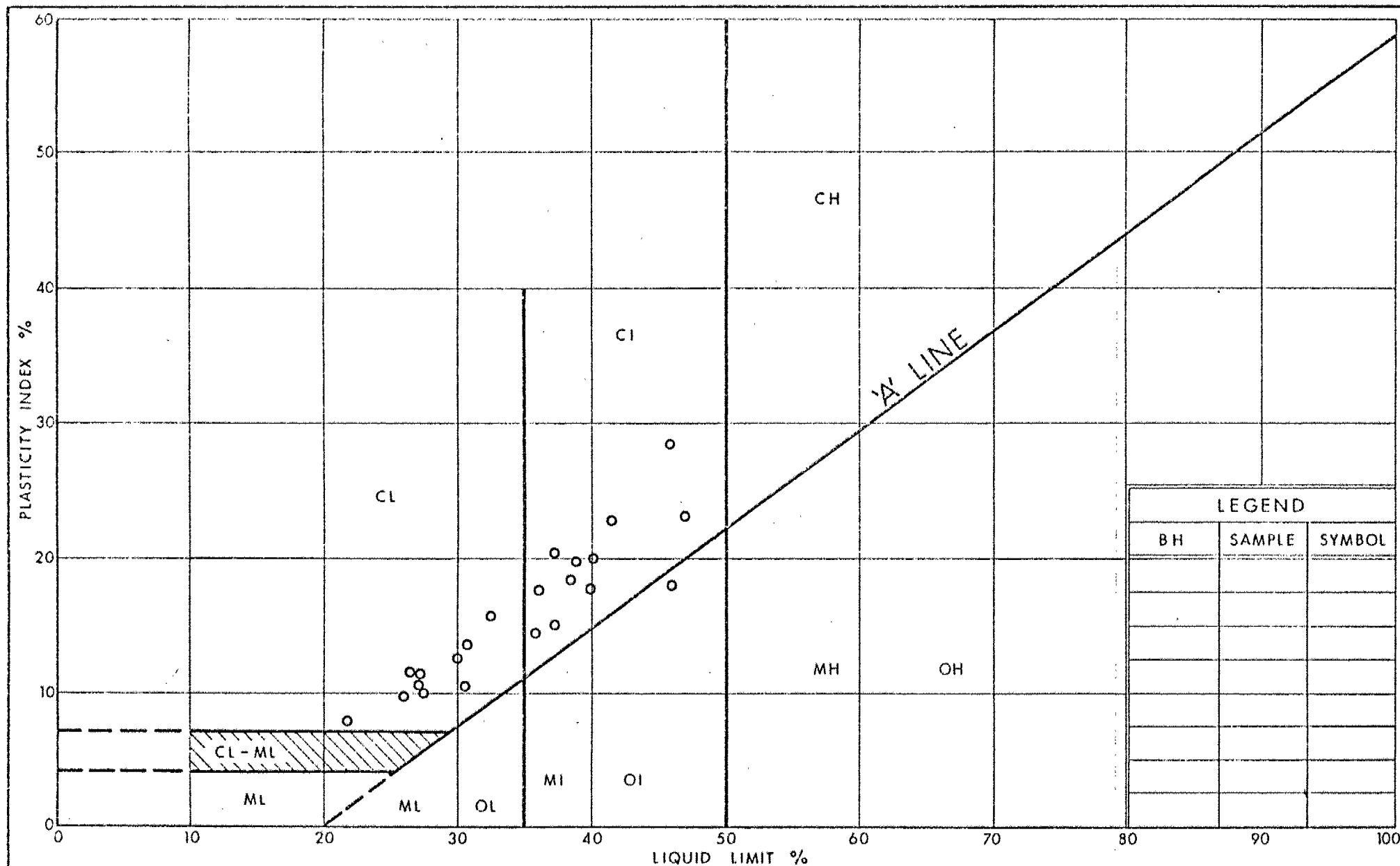
## RECORD OF BOREHOLE No 4 (Formerly B.H. 10 W.O. 68-F-15-1)

W P 260-66-02 LOCATION Co-ords N 359,742 E. 845,277 ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS  
 DATUM Geodetic DATE Feb. 29, 1968 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					
585.8	Ground Level																
0.0																	
581.8	Silty Sand																
4.0																	
	Silty Clay to Clayey Silt, Some Sand, Trace of Gravel		1	SS	6		580									117.5	1 9 38 52
			2	TW	PH												
			3	SS	5		570									121	
	Firm		4	TW	PH												
			5	SS	6		560										
			6	TW	PH											122	
			7	SS	4		550										
			8	TW	PH		540									130.5	3 23 49 25
537.8	End of Borehole																
48.0																	

+3, x5: Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



Ontario

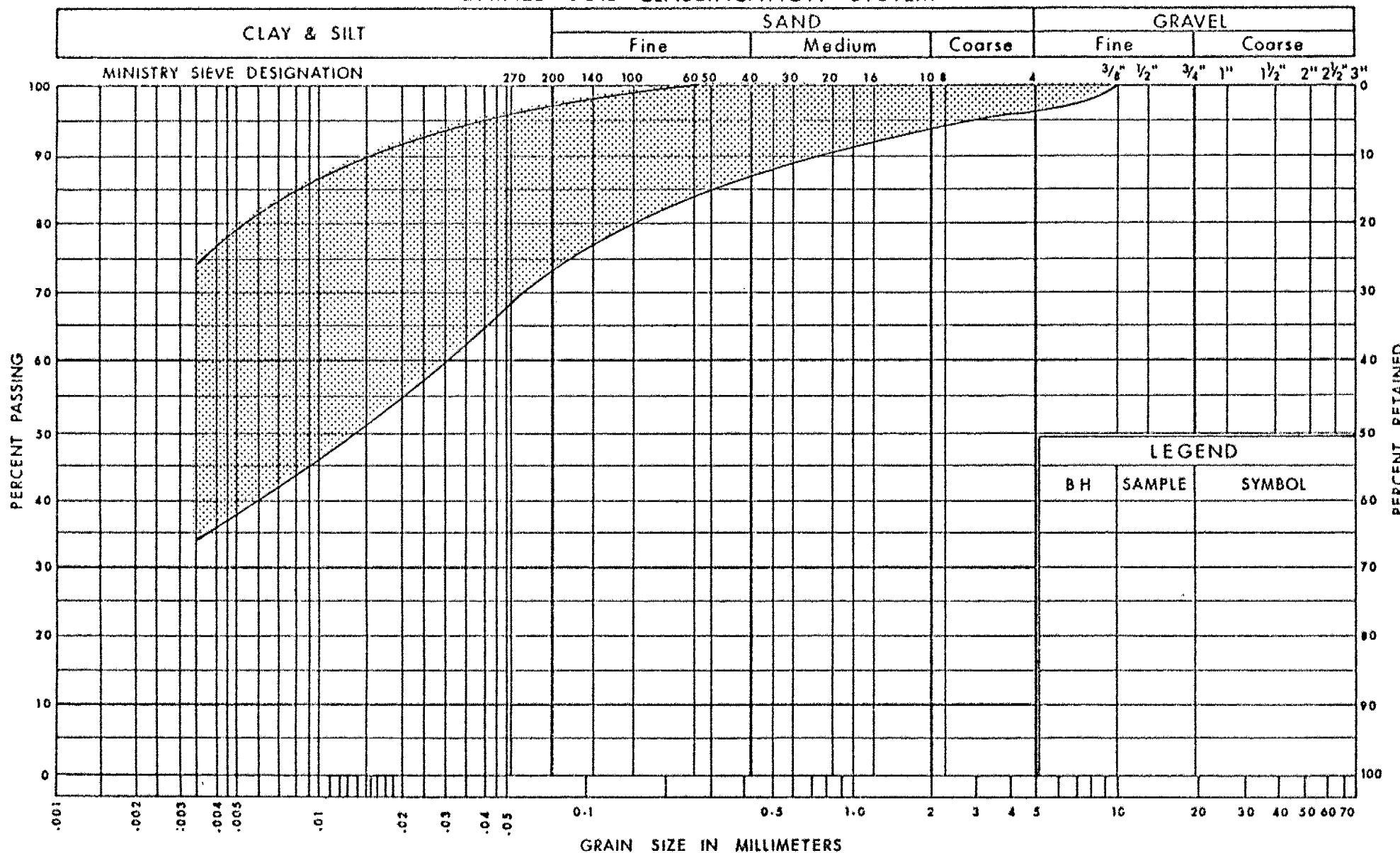
Ministry of  
Transportation and  
Communications

# PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260-66-02

# UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation and  
Communications

GRAIN SIZE DISTRIBUTION  
SILTY CLAY TO CLAYEY SILT

FIG No 2

W P 260-66-02

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
$w_s$	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_C$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$c_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

### GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

### STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



# RECORD OF BOREHOLE No 1

METRIC

W P 260-66-06 LOCATION Sta. 13 + 652.8 15.0 m Rt. C E.B.L. E.C. Row Expwy. ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy. BOREHOLE TYPE Cont. Flight Auger, AXT Rock Core & Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1968 03 04 CHECKED BY SD

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	20 40 60 80 100					
178.3	Ground Level													
0.0														
177.2	Silty Sand													
1.1														
			1	SS	8									
			2	TW	PH									
			3	SS	7									
			4	TW	PH									
			5	TW	PH									
			6	TW	PH									
			7	TW	PH									
			8	TW	PH									
			9	TW	PH									
			10	TW	PH									
			11	TW	PH									
			12	TW	PH									
156.0														
22.3	Sandy Silt													
155.0	Some Gravel													
23.3	Limestone Bedrock Sound		13	AXT RC	REC 100%									
153.3														
25.0	End of Borehole													

+3, x5: Numbers refer to Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 4

METRIC

W P 260-66-06 LOCATION Sta. 13 + 701.6 5.9 m Rt. E.C. Row Expwy. ORIGINATED BY AMS  
 DIST 1 HWY E.C. Row Expwy. BOREHOLE TYPE Cont. Flight Auger and Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1968 02 29 CHECKED BY [Signature]

OFFICE REPORT ON SOIL EXPLORATION

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 kN/m <sup>3</sup>	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					
178.6	Ground Level													
0.0														
177.3	Silty Sand													
1.3			1	SS	6									
			2	TW	PH									
			3	SS	5									
			4	TW	PH									
	Silty Clay to Clayey Silt		5	SS	6									
	Some Sand		6	TW	PH									
	Trace Gravel		7	SS	4									
	Firm		8	TW	PH									
164.0														
14.6	End of Borehole													

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

**METRIC**

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

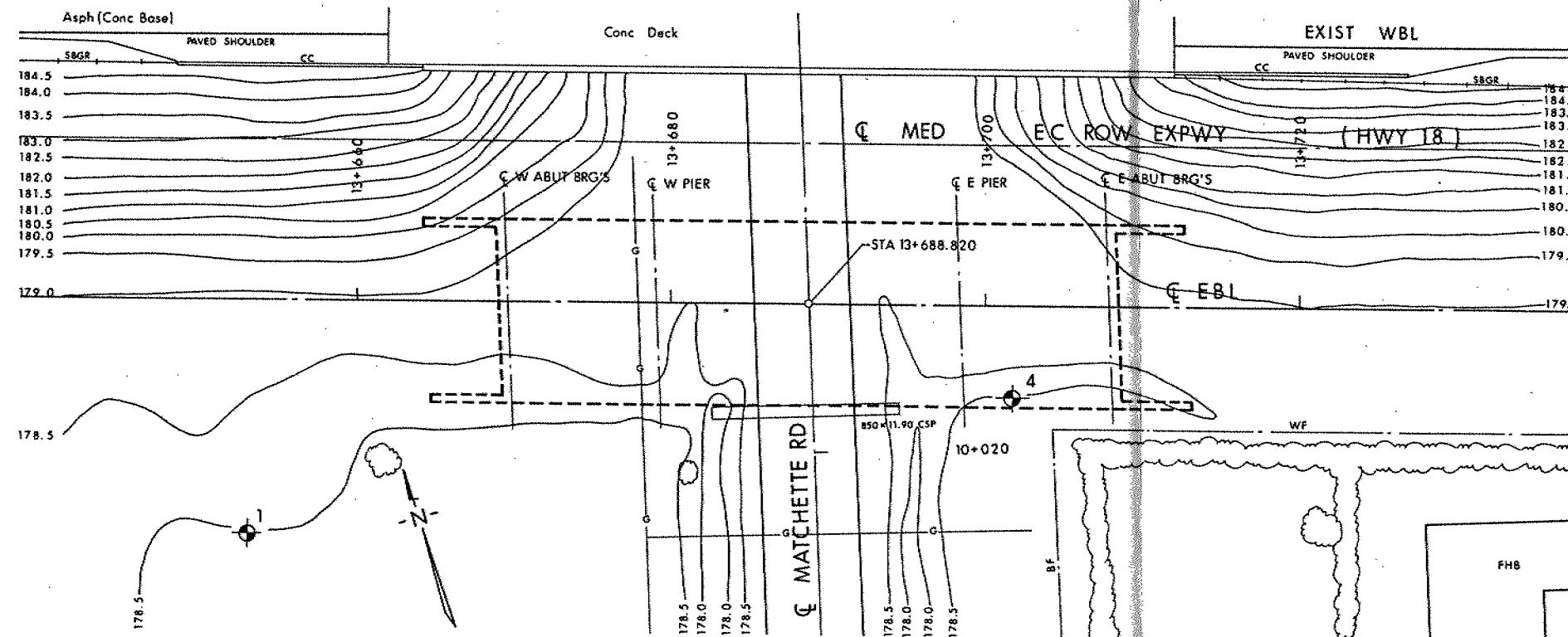
CONT No  
WP No 260-66-06

MATCHETTE RD EBL

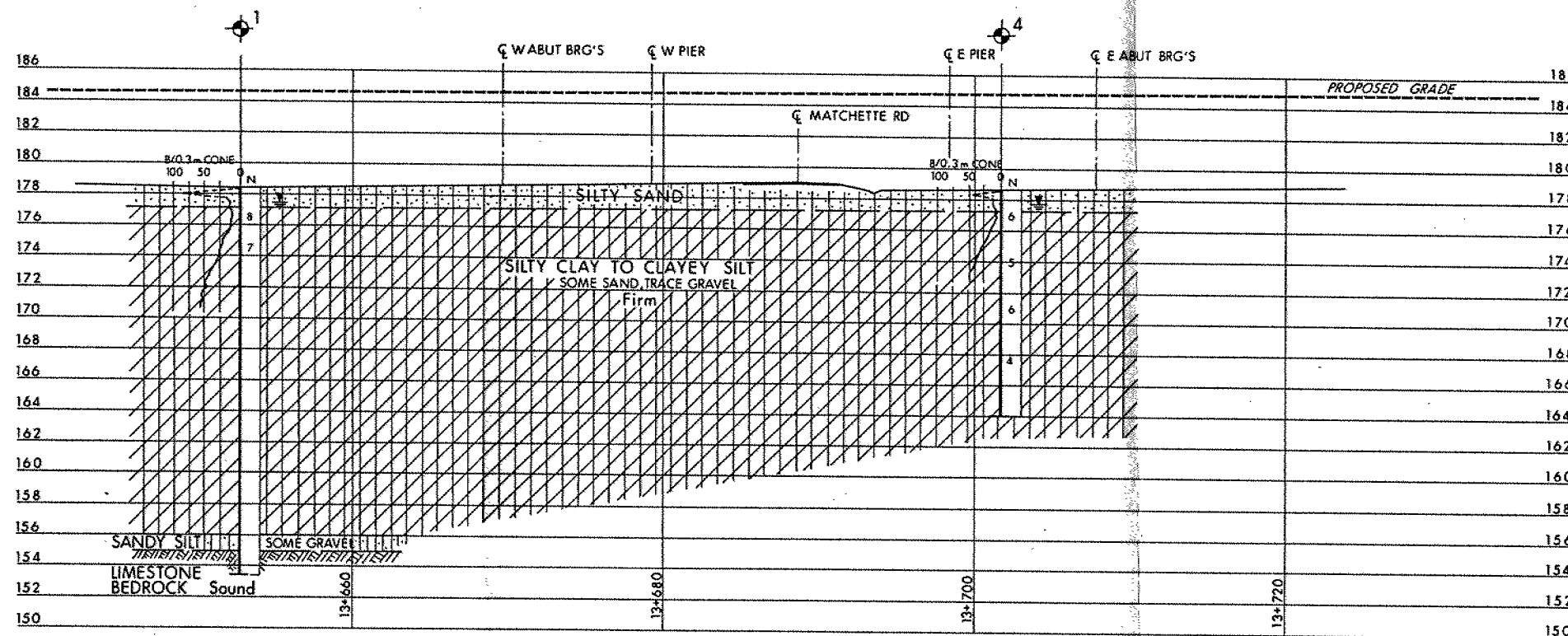
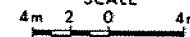
BORE HOLE LOCATIONS & SOIL STRATA



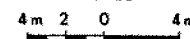
SHEET



PLAN  
SCALE



PROFILE EBL  
SCALE



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 68 02&03

No	ELEVATION	STATION	OFFSET
1	178.3	13+652.8	15.0 m RT
4	178.6	13+701.6	5.9 m RT

NOTE

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION
------	------	----	-------------

Geocres No 40J6-8

HWY No EC ROW EXPWY (18)	DIST 1
SUBM'D PP CHECKED DATE 1988 10 13	SITE 6-274
DRAWN SO CHECKED APPROVED	DWG 2

**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST 1 HWY 18 (E.C.R.)  
CONT No  
WP No 260-66-07



MATCHETTE RD. OVERPASS  
EAST BOUND LANE  
GENERAL ARRANGEMENT

SHEET

COLE  
SHERMAN

# NOTES

## CLASS OF CONCRETE

- FOOTINGS ..... 20 MPa
- PRESTRESSED GIRDERS ..... 40 MPa
- REMAINDER ..... 30 MPa

## CLEAR COVER TO REINFORCING STEEL

- FOOTINGS ..... 100 ± 25
- ABUTMENTS, WINGWALLS
- FRONT FACE ..... 80 ± 20
- BACK FACE ..... 70 ± 20
- PIERS ..... 80 ± 20
- DECK
- TOP ..... 70 ± 20
- BOTTOM ..... 40 ± 10
- REMAINDER
- UNLESS OTHERWISE SPECIFIED 70 ± 20

## REINFORCING STEEL

- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED
- BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS

## CONSTRUCTION NOTES

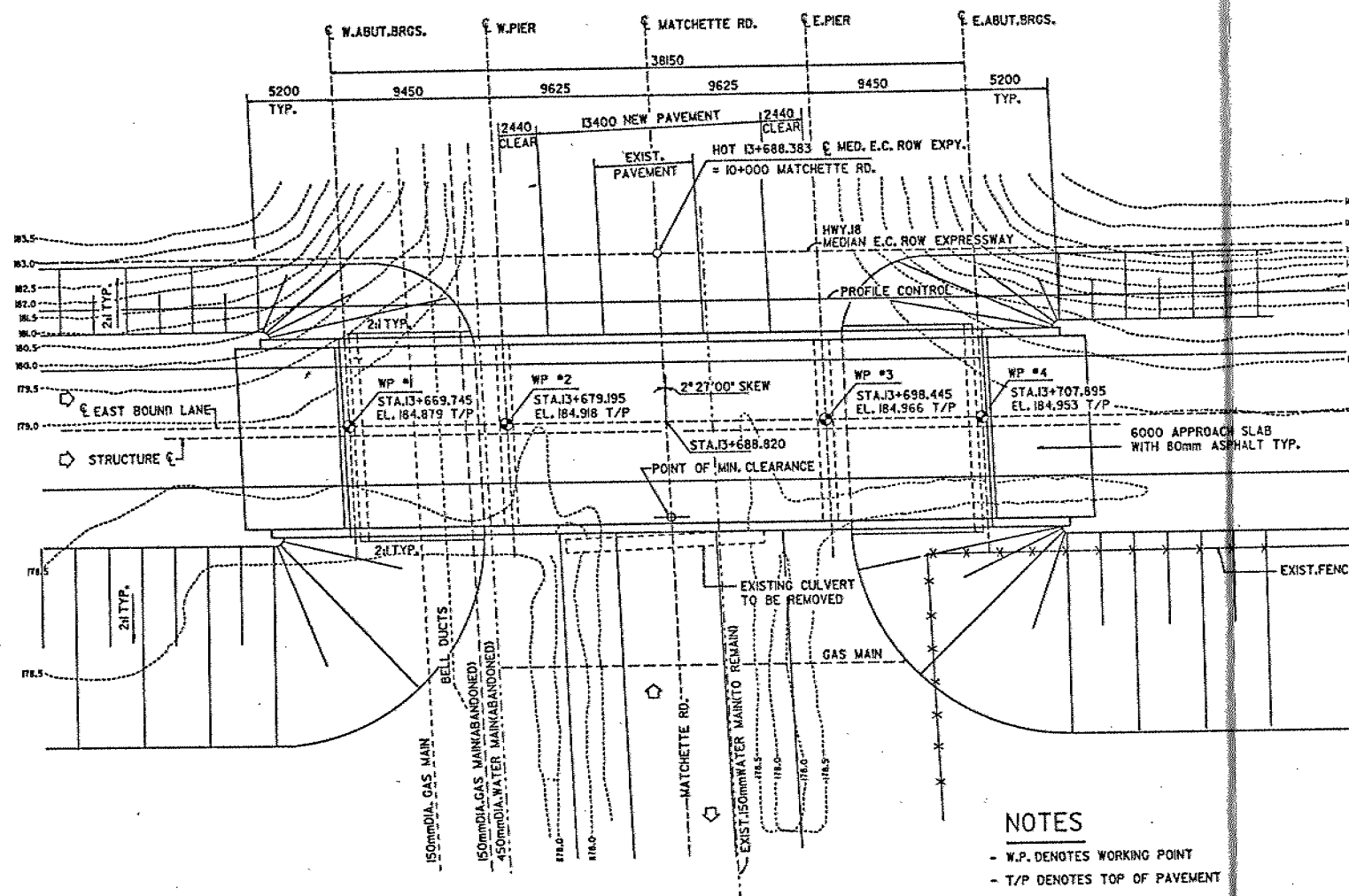
- THE CONTRACTOR SHALL FINISH THE BEARING SEATS LEVEL AND TO THE SPECIFIED ELEVATIONS

## LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BORE HOLE LOCATIONS & SOIL DATA
3. FOOTING LAYOUT & DETAILS
4. PILE DRIVING-STEAM & DIESEL HAMMERS
5. WEST ABUTMENT
6. EAST ABUTMENT
7. PIERS
8. PRESTRESSED GIRDERS & BEARINGS
9. DECK LAYOUT & DETAILS
10. SCREED ELEVATIONS
11. 6000 APPROACH SLAB
12. BARRIER WALL
13. DETAIL OF CONC. SLOPE PAVING
14. JOINT ANCHORAGE & ARMOURING
15. BRIDGE DATE & SITE NO. DATA
16. AS CONSTRUCTED ELEV. & DIM.
17. ELECTRICAL LAYOUT
18. QUANTITIES STRUCTURE
19. QUANTITIES STRUCTURE

## LIST OF STANDARD DRAWINGS

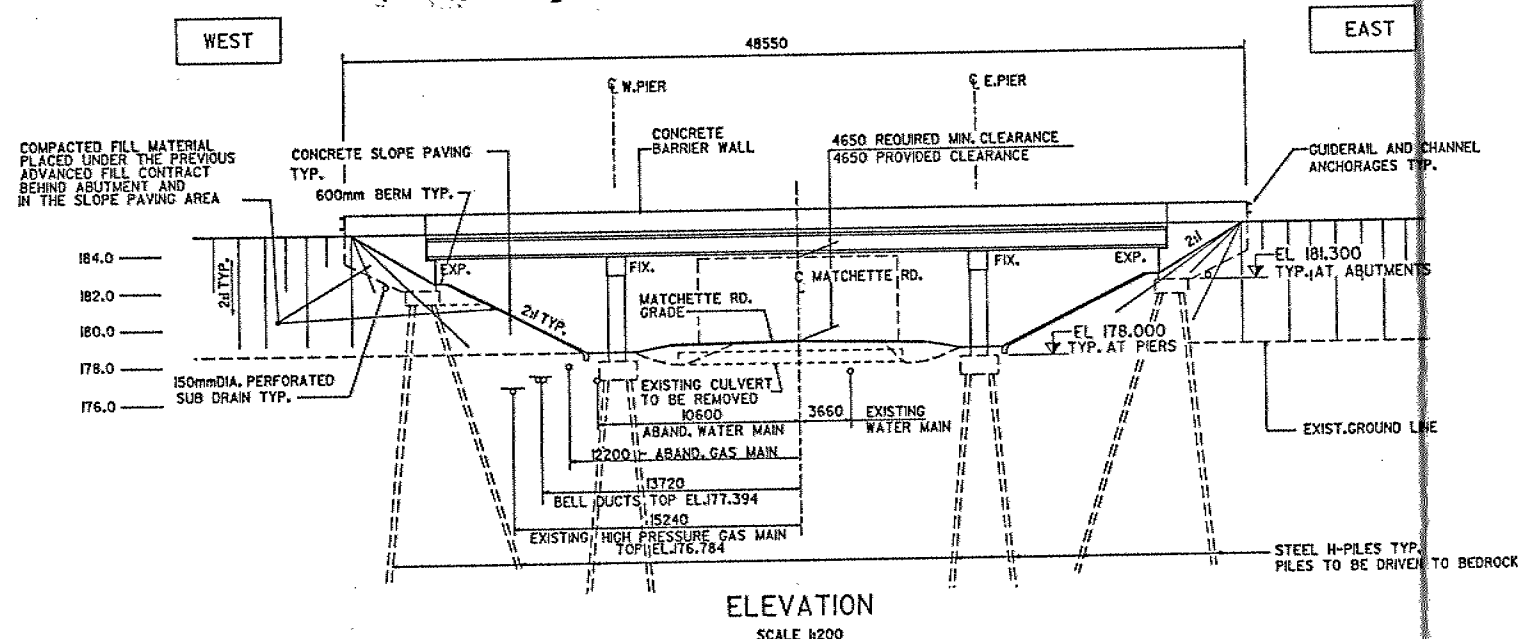
- DD-3503 REV. NO. 3 MINIMUM GRANULAR BACKFILL REQUIREMENT PERCHED ABUTMENT
- OPSD-508.02 BRIDGE DECK WATERPROOFING
- DD-4602 FALSEWORK CLEARANCES



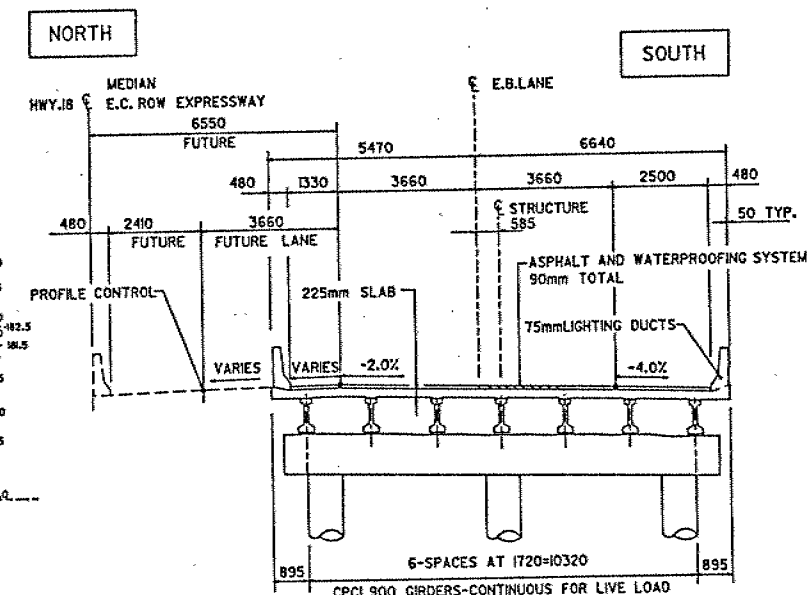
PLAN  
SCALE 1:200

# NOTES

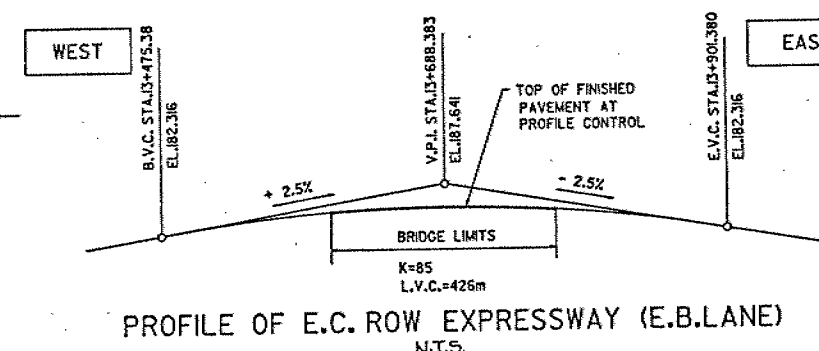
- W.P. DENOTES WORKING POINT
- T/P DENOTES TOP OF PAVEMENT



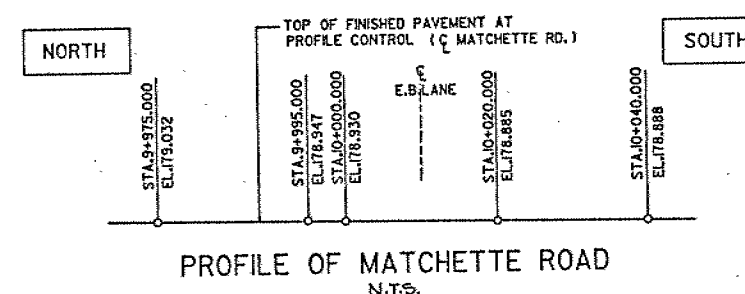
ELEVATION  
SCALE 1:200



TYPICAL DECK CROSS SECTION  
SCALE 1:400



PROFILE OF E.C. ROW EXPRESSWAY (E.B. LANE)  
N.T.S.



PROFILE OF MATCHETTE ROAD  
N.T.S.



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
1	12/12/20	CHK A.H.N.	CODE CHOC
2	12/12/20	CHK G.L.R.	LOAD A-B3
3	12/12/20	CHK G.L.R.	DATE 12/12/20
4	12/12/20	CHK G.L.R.	ISCHME
5	12/12/20	CHK G.L.R.	DWG 1

## METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST 1 HWY 18 (E.C.R.)  
CONT No  
WP No 260-66-06



MATCHETTE RD. OVERPASS  
EASTBOUND LANE  
FOOTING LAYOUT

SHEET

CS COLE  
SHERMAN

## NOTES

1. All pile spacing to be measured at underside of footing.
2. All piles are HP 310 x 110 steel "H" sections.
3. Design load per pile is 143 tonnes.
4. The tops of steel H-Piles to be reinforced in accordance with DD-3301 Rev. 0.
5. DWLS - Denotes Dowels

## PILE DATA

Location	Face	No. Req'd.	Batter	Length
W. Abut	Front	4	1:4	31.4 m
	Front	1	1:11	30.6 m
	Rear	1	Vertical	30.5 m
	Rear	2	1:6	30.9 m
W. Pier		10	1:3	27.8 m
E. Pier		10	1:3	27.8 m
E. Abut	Front	4	1:4	31.4 m
	Front	1	1:11	30.6 m
	Rear	1	Vertical	30.5 m
	Rear	2	1:6	30.9 m

\* NOTE: Pile lengths shown in table above are theoretical lengths below cut-off elevation.

