

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 4076-889

DIST. 1 REGION

W.P. No. 260-66-13

CONT. No. 88-69

W. O. No.

STR. SITE No.

HWY. No. E.C. ROW EXPWY

LOCATION Matchette Rd & Malden Rd.

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 88-69



Ministry of
Transportation and
Communications

1

INDEX

<u>Page No.</u>	<u>Description</u>
1	Index
2	Soil Classification System
3	Abbreviations & Symbols
4 - 25	Foundation Investigation Reports
	* Matchette Road Overpass W.P. 260-66-02, Site 6-274
	* Malden Road Overpass W.P. 260-66-03, Site 6-275
	* 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 ^{E.B.L.} approaches have been built at both sites and ground conditions have changed accordingly.

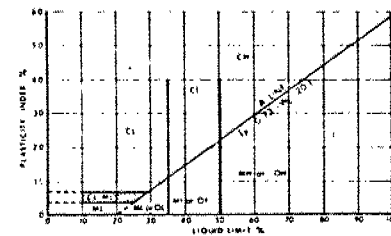
NOTE: For purposes of the contract these reports supercede other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.

*THIS REPORT WAS PREPARED
FOR THE E.B.L. ADVANCE APPROACHES*

EXTENDED CASAGRANDE SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 75 mm AND BASING FRACTIONS ON ESTIMATED MASS)		GROUP SYMBOL	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN 75 μm (SMALLEST PARTICLE VISIBLE TO THE NAKED EYE)	GRAVELS				
	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	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.	$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 8 $C_c = \frac{(D_{30})^2}{D_{10} \cdot D_{60}}$ BETWEEN ONE AND 3 NOT MEETING ALL GRADATION REQUIREMENTS FOR GW ATTERBERG LIMITS BELOW A-LINE, OR I_p LESS THAN 4 ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
	GRAVEL WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES; LITTLE OR NO FINES		
		GC	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES		
		GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES	FOR UNDISTURBED SOILS AND INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITIONS & DRAINAGE CHARACTERISTICS.	$C_u = \frac{D_{60}}{D_{10}}$ 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 ATTERBERG LIMITS BELOW A-LINE OR I_p LESS THAN 4 ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
	SANDS				
	CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES		
		SP	POORLY GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES		
	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES		
		SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES		
IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425 μm					
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN 75 μm (75 μm IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE)	LIQUID LIMIT LESS THAN 35%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	
		NONE	QUICK	NONE	ML INORGANIC SILTS & SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR
		MEDIUM TO HIGH	NONE TO VERY SLOW	MEDIUM	CL CLAYEY SILTS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS
	LIQUID LIMIT BETWEEN 35% AND 50%	SLIGHT TO MEDIUM	SLOW	SLIGHT	OL ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS
		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	CI SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY
	LIQUID LIMIT GREATER THAN 50%	SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	CI ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY
		SLIGHT TO MEDIUM	SLOW TO NONE	MEDIUM	ML 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
	HIGHLY ORGANIC SOILS	MEDIUM TO HIGH	NONE TO VERY SLOW	SLIGHT TO MEDIUM	OH ORGANIC CLAYS OF HIGH PLASTICITY
		READILY IDENTIFIED BY COLOUR, ODOR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE			PE PEAT & OTHER HIGHLY ORGANIC SOILS

USE GRAIN SIZE CURVE IN IDENTIFYING THE FUNCTIONS AS GIVEN UNDER FIELD IDENTIFICATION



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED 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: 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-SAMPER 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 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. $\bar{C}U$ = 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

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_0 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
 β ANGLE OF SLOPE
 N, N_q, N_c BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_0 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 = $w_L - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu\text{m Soil Fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_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
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 α, β STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 α_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_c OVERCONSOLIDATION RATIO (OCR)

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

FOUNDATION INVESTIGATION REPORT

For

Matchette Road Overpass
0.5 Miles East of Hwy. 18
W.P. 260-66-02 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 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.

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 _p) %	13- 23
Liquid Limit (W _L) %	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).

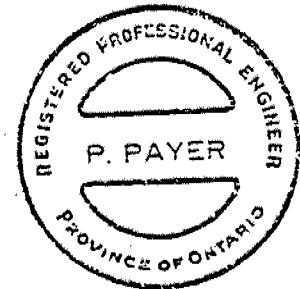
Groundwater Conditions

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 NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L			
								SHEAR STRENGTH PSF			WATER CONTENT (%)			
							○ UNCONFINED + FIELD VANE				PCF	GR SA SI CL		
							● QUICK TRIAXIAL × LAB VANE							
							500 1000 1500 2000 2500							
585.2	Ground Level													
0.0	Silty Sand													
581.2														
4.0			1	SS	8		580							
			2	TW	PH									
			3	SS	7									
	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm		4	TW	PH		570	~2.4				118	0 9 (91)	
			5	TW	PH		560	+3.5						
			6	TW	PH		550	~2.2				127		
			7	TW	PH			+3.2						
			8	TW	PH		540	+2.6				127.5		
			9	TW	PH			+2.1						
			10	TW	PH		530	+1.5				133	3 22 49 26	
			11	TW	PH			+1.6						
			12	TW	PH		520							
			13	AXT	REC		510					139	2 19 (79)	
512.2														
73.0	Sandy Silt													
508.5	Some Gravel													
76.7	Limestone													
503.1	Bedrock Sound													
52.1	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE



Ministry of
Transportation and
Communications

RECORD OF BOREHOLE No 2

W P 260-66-02 LOCATION Co-ords N 350,868 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 _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	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															

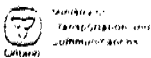
OFFICE REPORT ON SOIL EXPLORATION

W P 260-66-02 LOCATION Co-ords N 359.847 E 845.310 ORIGINATED BY AMS
DIST 1 HWY E.C. Row Expy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS
DATUM Geodetic DATE Feb. 28 & 29, 1968 CHECKED BY _____

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

*3, x⁵: Numbers refer to Sensitivity



RECORD OF BOREHOLE No 4

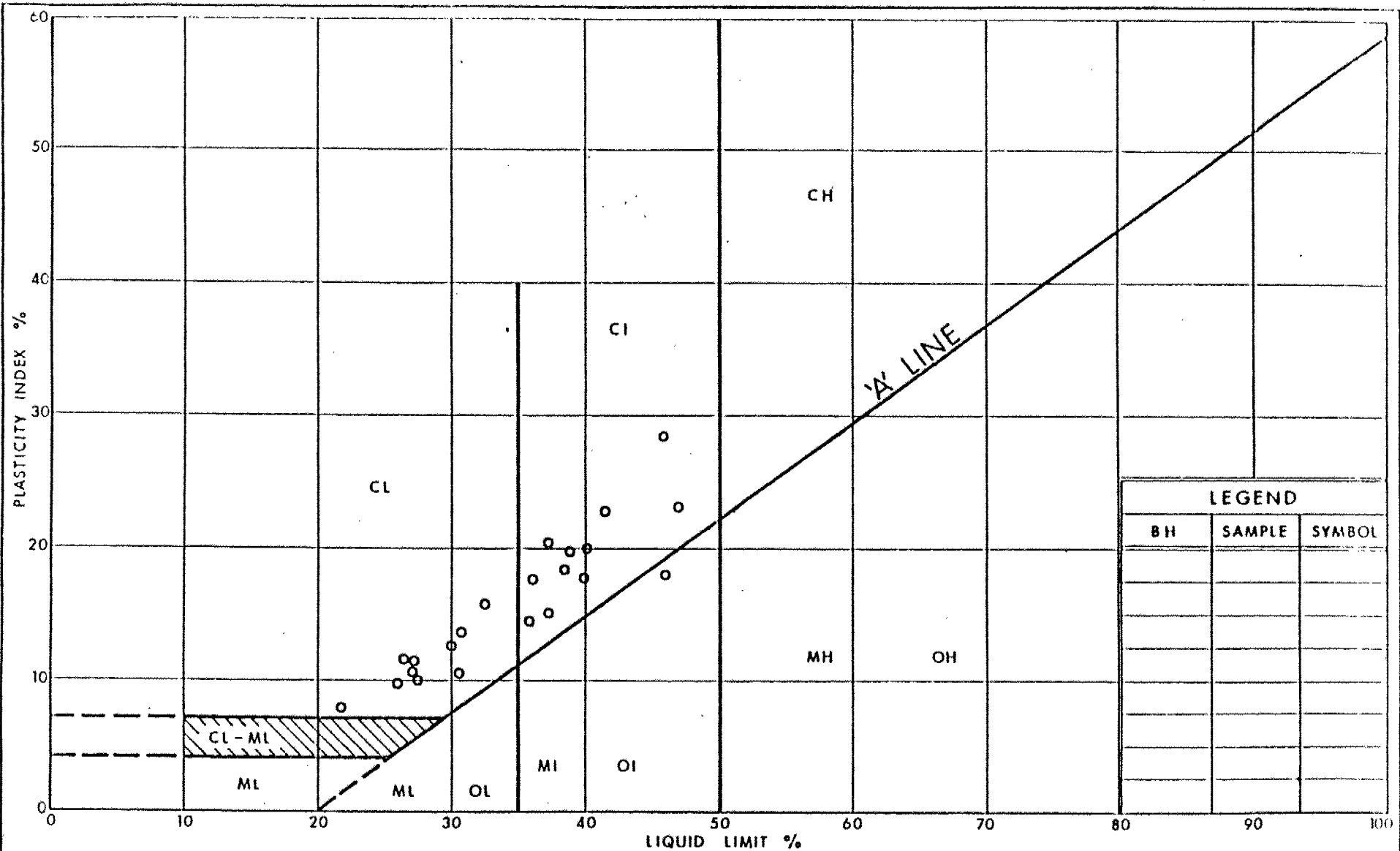
W P 260-66-02 LOCATION Co-ords N 359,742 E 845,277 ORIGINATED BY AMS
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS
DATUM Geodetic DATE Feb. 29, 1968 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ pcf	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
585.8	Ground Level													
581.8	Silty Sand	1	SS	6										
580.0		2	TW	PH										
570.0	Silty Clay to Clayey Silt. Some Sand, Trace of Gravel	3	SS	5										
560.0		4	TW	PH										
550.0	Firm	5	SS	6										
540.0		6	TW	PH										
537.8		7	SS	4										
530.0	End of Borehole	8	TW	PH										

OFFICE REPORT ON SOIL EXPLORATION

+3, x²: Numbers refer to
Sensitivity

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

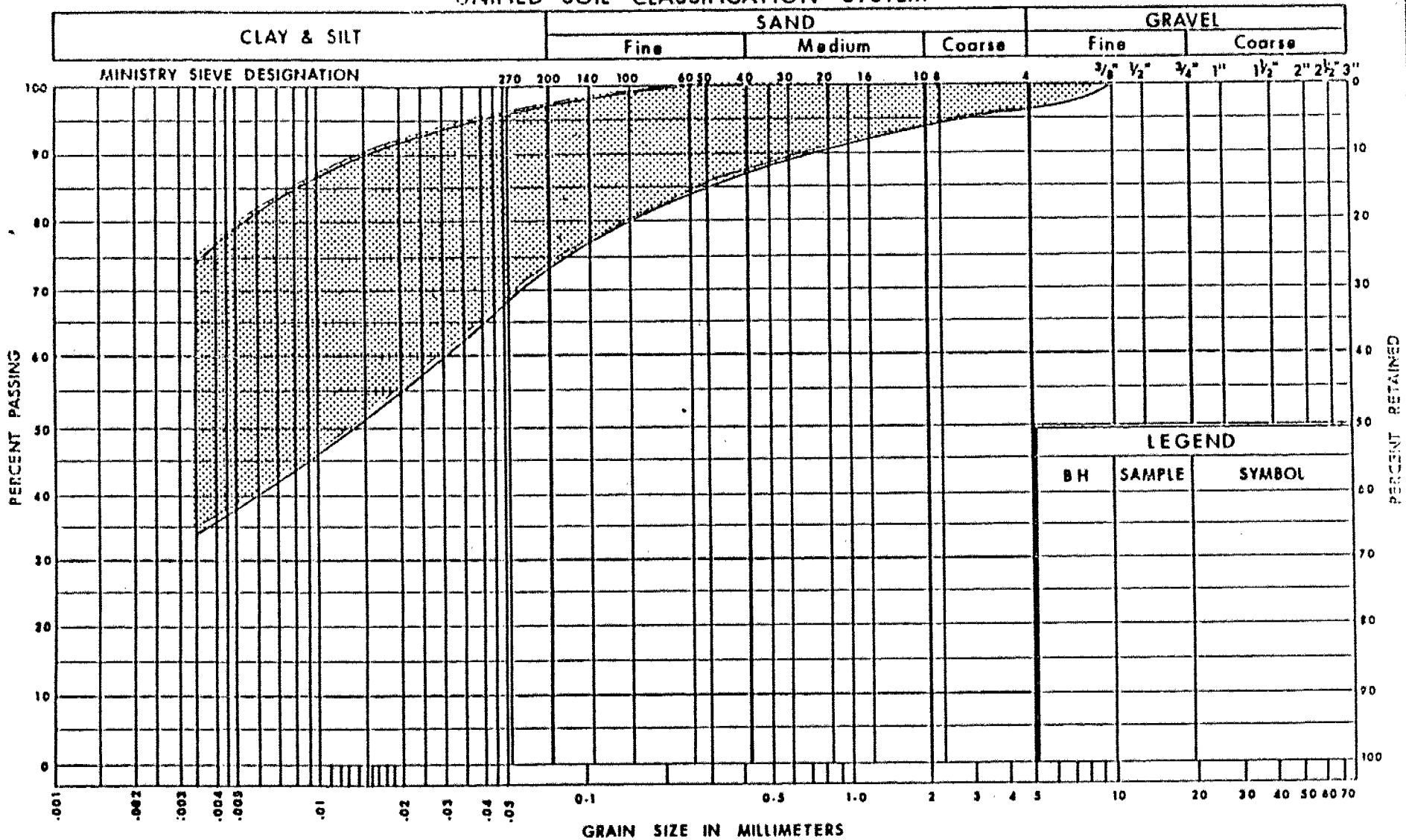
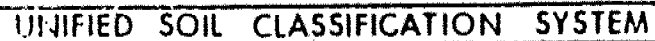


Ministry of
Transportation and
Communications

PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260-66-02

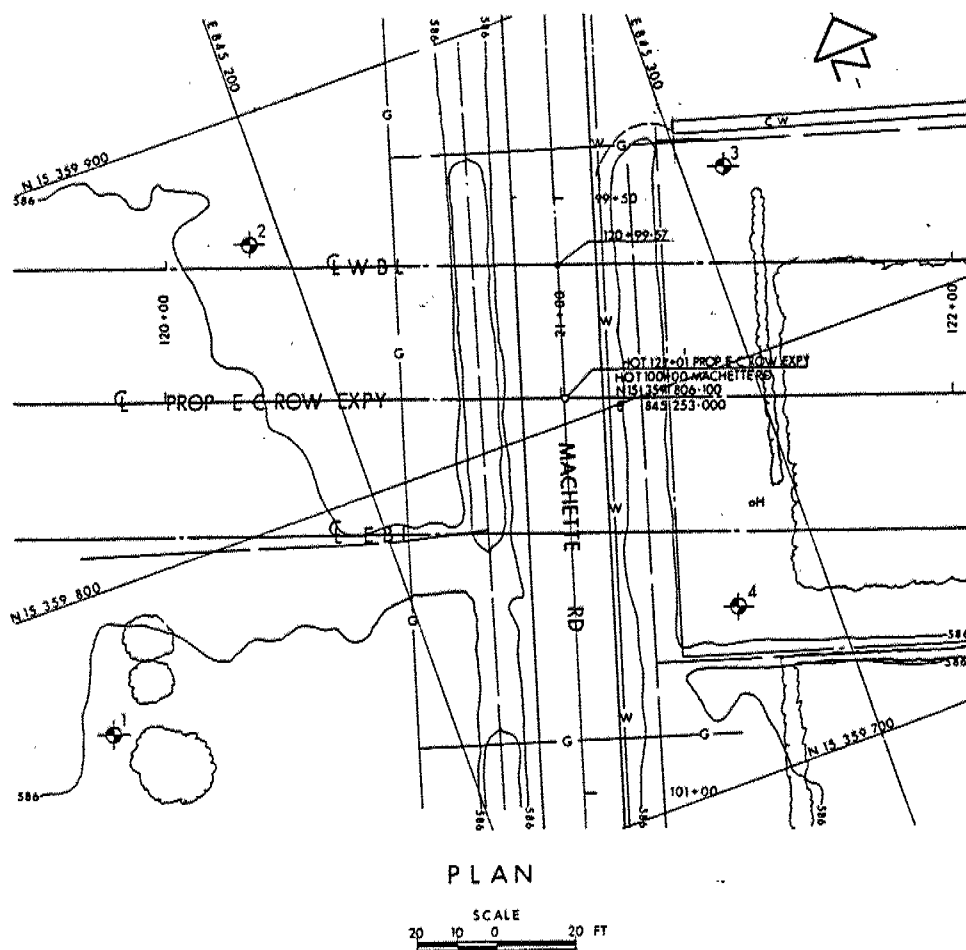


**Ministry of
Transportation and
Communications**

GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT

FIG No 2

W P 260-66-02



NOTE: SITE CONDITIONS AS OF FEB. & MAR. 1968

NOTES:
The complete foundation report for this project may be examined at the Engineer's District Office, Downsville. Information contained in this file and any other documents used is specifically excluded in accordance with the conditions of Section 102.2 of Form 104.

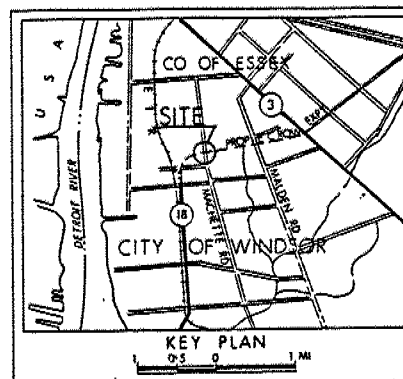
REF No E-5518-1 JUNE 1977

CONT No
WP No 260-66-02



MACHETTE RD O'PASS
CITY OF WINDSOR
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



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)
- ↓ W/L at time of investigation
FEB & MAR 1968

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	585-2	359 765	845 119
2	585-5	359 868	845 192
3	585-5	359 847	845 310
4	585-8	359 742	845 277

-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

HWY No E.C. ROW EXPY
SUBMIT P.P. CHECKED DATE 20 OCT 1977 SITE
DRAWN BY J. L. HARRIS

FOUNDATION INVESTIGATION REPORT

For

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

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. 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. Eng.
Foundations Engineer



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

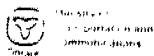
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20					
592.8	Ground Level												
0.0	Silty Sand												
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
			10	TW	PH								
			11	TW	PH								134
			12	TW	PH								
			13	TW	PH								127
			14	TW	PH								
499.3	Sandy Silt Some Gravel												
93.0													
490.0	Very Dense												
102.8	Limestone Bedrock		15	AXT RC	REC 100%								
484.6	Sound												
108.2	End of Borehole												

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (% STRAIN AT FAILURE)

RECORD OF BOREHOLE No 2													
W P <u>260-66-03</u>		LOCATION <u>Co-ords N 15,358.662; E 848.637</u>				ORIGINATED BY <u>AMS</u>							
DIST <u>1</u> HWY <u>E.C. Row Expwy</u>		BOREHOLE TYPE <u>Cont. Flight Auger (Bombardier) & Cone Test</u>				COMPILED BY <u>AMS</u>							
DATUM <u>Geodetic</u>		DATE <u>Feb., 23, 1968</u>				CHECKED BY <u>ES</u>							
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			VALUES	20 40 60 80 100	W _p	W	W _L		
593.0	Ground Level												
0.0	Silty Sand												
589.0	Compact												
4.0	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm to Very Stiff		1	SS	0								
			2	SW	PH								
			3	SW	PH								
			4	SW	PH								
			5	SW	PH								
			6	SW	PH								
			7	SW	PH								
			8	SW	PH								
551.5													
41.5	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION



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 NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			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	W _p W W _L	WATER CONTENT (%)				
592.3	Ground Level													
0.0	Silty Sand						590	Frozen Zone						
588.3	Compact													
4.0	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm To Stiff		1	SS	7							125	0 9 31 60	
			2	TW	PH									
			3	SS	11							124		
			4	TW	PM									
			5	TW	PM							127		
			6	TW	PM									
			7	TW	PM									
			8	TW	PM							126	3 15 40 42	
			9	TW	PM									
			10	TW	PM							115	1 19 55 25	
			11	TW	PM									
			12	TW	PM							132	3 20 38 39	
			13	TW	PM									
		14	TW	PM										
459.3														
96.0	Sandy Silt, Some Gravel													
491.0	Very Dense													
101.3	End of Borehole (Refusal)													

+3, x5: Numbers refer to
Sensitivity

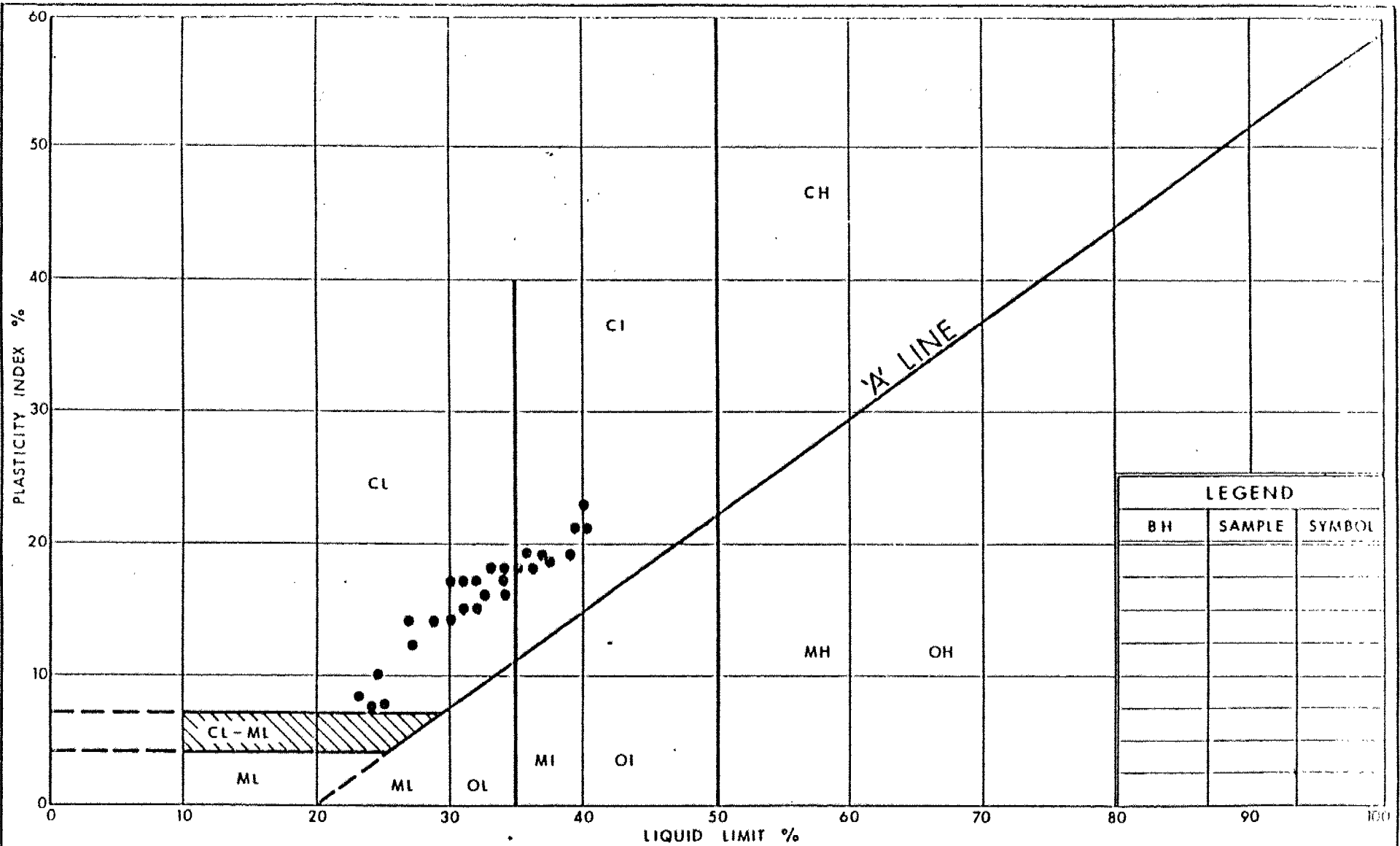
20
15 \div 5 (%) STRAIN AT FAILURE
10

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 Expy 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 _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
593.6	Ground Level													
0.0	Silty Sand					*	590	Frozen Zone						
589.6	Compact													
4.0			1	SS	4									
			2	TW	PH								129	
	Silty Clay		3	TW	PH									
	To		4	TW	PH									
	Clayey Silt		5	TW	PH									
	Some Sand		6	TW	PH									
	Trace of Gravel		7	TW	PH									
	Firm To Stiff		8	TW	PH									
550.6														
43.0	End of Borehole													
	* Note Water Level Not Established													

OFFICE REPORT ON SOIL EXPLORATION

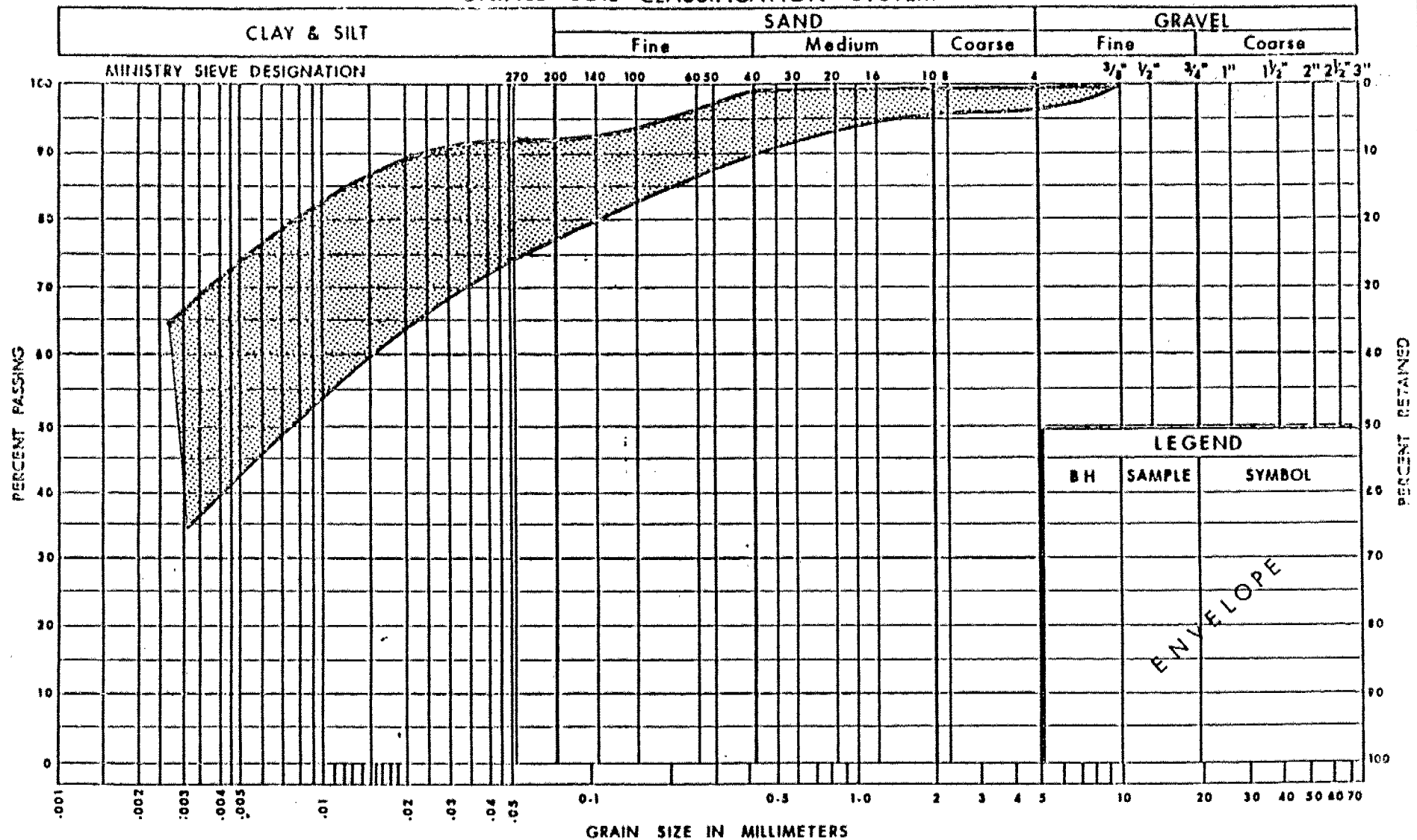


Ministry of
Transportation and
Communications

PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260 - 66 - 03

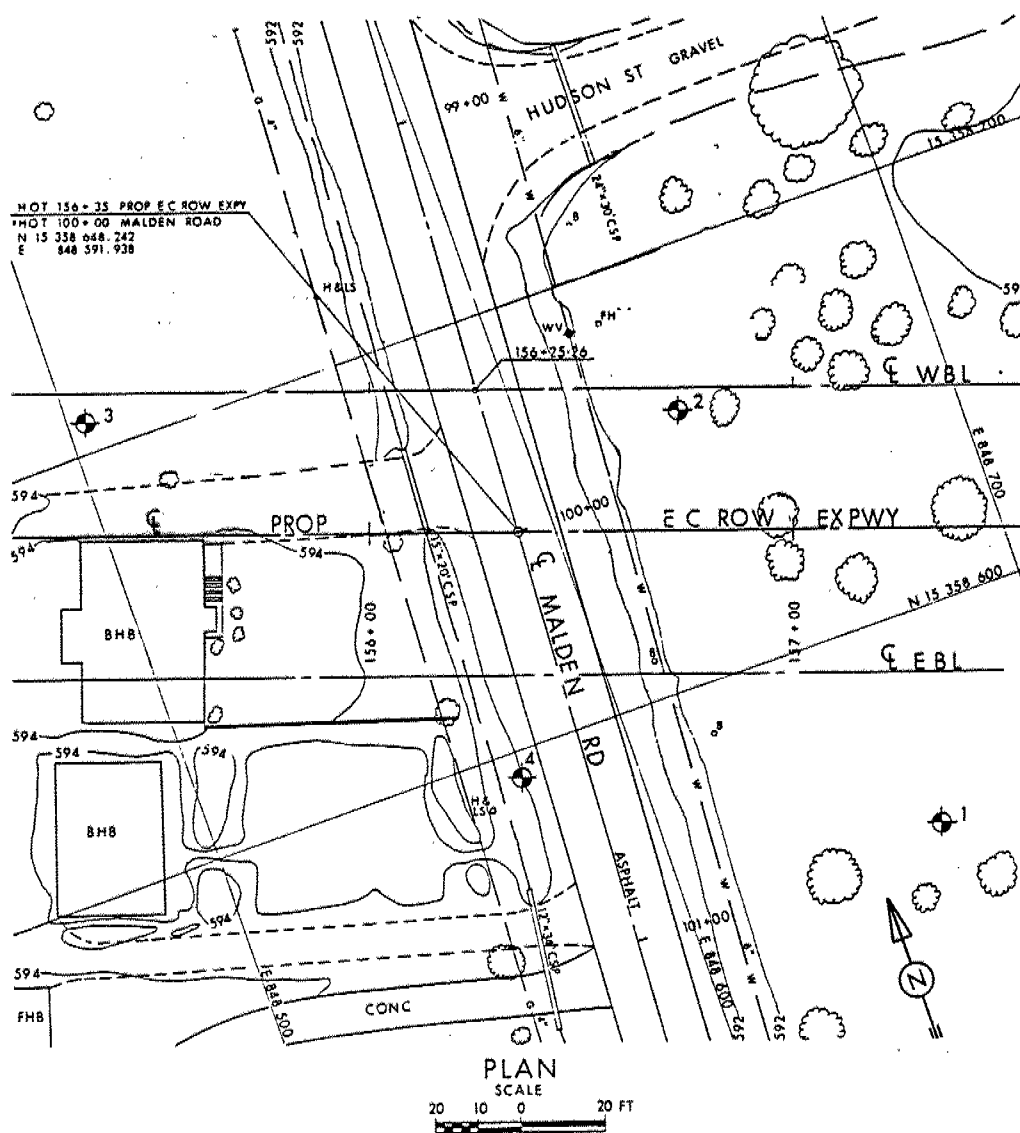


**Ministry of
Transportation and
Communications**

GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAYEY SILT

FIG No 2

WP 260 - 66 - 03



NOTE: SITE CONDITIONS AS OF FEB. 1968

The sponsor's foundation investigation file for this project may be obtained at the Engineering Materials Office, Cranview. Information contained in this file and any supplementary data is strictly confidential in accordance with the conditions of Section 102-2 of Part 102.

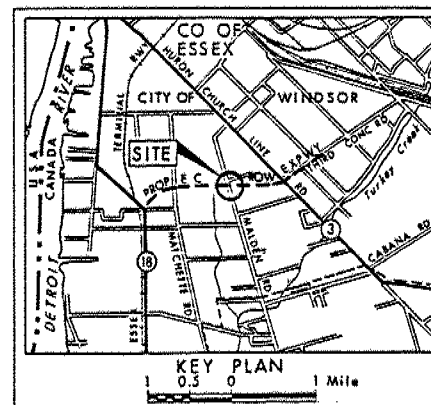
REF ID: A67512, June 1977

CONT No
WP No 260-66-03



MALDEN RD O'PASS
(1.2 Miles E of Hwy 18)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- | | |
|------|--|
| | Bore Hole |
| | Dynamic Cone Penetration Test (Cone) |
| | Bore Hole & Cone |
| 'N' | Blows/ft (Std Pen Test, 350ft lbs energy) |
| CONE | Blows/ft (60° Cone, 350ft lbs energy) |
| | WL at time of investigation FEB 1968
WL NOT Established for Bore Hole 4 |

No	ELEVATION	CO - ORDINATES	
		NORTH	EAST
1	592.8	15 358 550	848 663
2	593.0	15 358 662	848 637
3	592.3	15 358 707	848 504
4	593.6	15 358 594	848 573

-NOTE-

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

[illegible]

HWY No. 200W 200Y DIST 1
SUBNO P.P. CHECKED ☒ DATE Oct 20, 1977 SITE
COUNT 4 = 275

memorandum



To: E. Stevenson
Senior Project Manager
Planning & Design
Southwestern Region

Date: 1988 04 12

From: Foundation Design Section
Room 315, Central Building

RE: Review of Advanced Grading Documents
Matchette Rd. & Malden Rd.
E.C. Row Expressway, City of Windsor
W.P. 260-66-13; Contract No. 88-69
District #1 (Chatham)

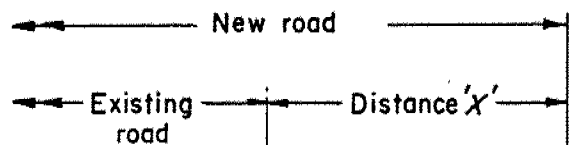
We have reviewed sheets 3 to 14 and 16 to 17 for the above project.
We have no comments to offer from our point of view.

The Foundation Investigation Reports (W.P. 260-66-02 and W.P. 260-66-03)
will be forwarded to you for inclusion in the Contract Package at a
later date.

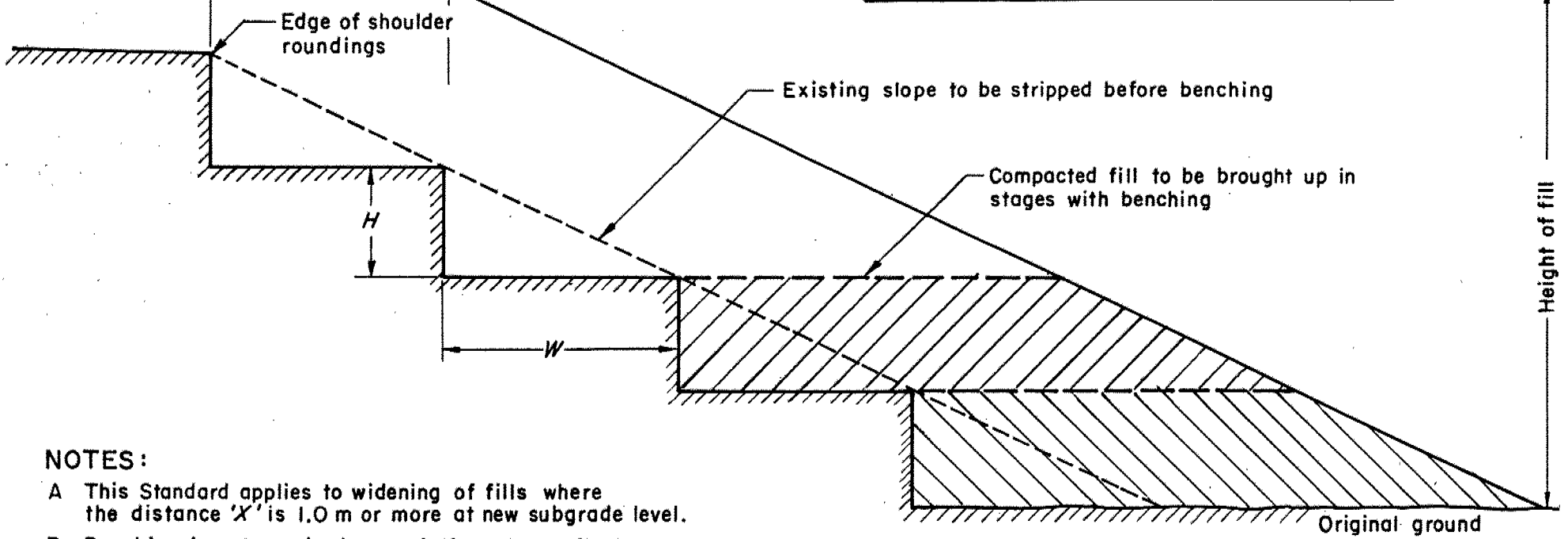
A handwritten signature in dark ink, appearing to read "P. Payer", with a checkmark at the end.

P. Payer, P. Eng.
Sr. Foundations Engineer

PP/mj



MAX HEIGHT AND WIDTH OF BENCHES <i>H</i> = Height, <i>W</i> = Width				
Existing slopes	Fills 3.5m or more		Fills under 3.5m	
	<i>W</i>	<i>H</i>	<i>W</i>	<i>H</i>
3:1 to 2:1	2.50	Var	1.25	Var
2:1	1.25	Var	600	Var



NOTES:

- A This Standard applies to widening of fills where the distance 'X' is 1.0 m or more at new subgrade level.
- B Benching is not required on existing slopes flatter than 3:1 or where specified.
- C Benches are to be excavated one level at a time and the compacted fill brought up before the next benching level is excavated.
- D All dimensions are in millimetres or metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING		Date	1983 12 01	Rev	
BENCHING OF EARTH SLOPES		Date _____			
		OPSD-208.01			

64-F-242M

LOTS 25³, 26, CON. IV

US BORNE

BA 1781
MR. B. M. ROSS
CONSULTING ENGINEER
GODERICH ONTARIO

DIST 3

64-F-242 M

STRUCTURE SITE No. 12-251

Report on
SOIL INVESTIGATION
for
ROAD BRIDGE
LOTS 25 & 26, CONCESSION IV
TOWNSHIP OF USBORNE

by

DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO
Reference No. 4-2-L8
March 5, 1964

CONTENTS

	<u>Page</u>
SUMMARY.....	1
I INTRODUCTION.....	2
II FIELD WORK.....	2
III SUBSURFACE CONDITIONS.....	2
IV FOUNDATIONS.....	3
V REFERENCES.....	4

ENCLOSURES

	<u>No.</u>
SYMBOLS, ABBREVIATIONS AND NOMENCLATURE	1
LOCATION OF BOREHOLES AND SUBSURFACE PROFILE	2
GEOTECHNICAL DATA SHEETS	3 and 4

SUMMARY

The soil stratification is approximately as follows: stiff silty fill to 10 feet, dense or stiff silt to 11 feet, dense sandy gravel to 15 feet, and thereafter a very stiff to hard silty clay till.

It is recommended that the structure should be supported on spread footings bearing in the till layer at El.923. The maximum gross soil pressure should not exceed 5000 p.s.f. Alternatively, footings bearing at El.920 may be designed for a soil pressure of 8000 p.s.f. The predicted total and differential settlements in either case are 1.0 and 0.5 inch respectively.

No unusual construction problems are anticipated.

I INTRODUCTION

In accordance with a letter of authorization dated 21 January 1964 from Mr. B. M. Ross, a soil investigation has been carried out at a site in the Township of Usborne where it is proposed to replace an existing road bridge with a new structure.

It is understood that the new bridge will be of approximately the same span and in the same position as the existing one.

The purpose of this investigation has been to reveal the subsurface conditions and to determine the necessary soil properties for the design and construction of the new foundations.

II FIELD WORK

Field work was carried out on the 13th and 14th of February 1964, and consisted of 2 boreholes at the locations shown on enclosure 2. The holes were advanced for part of their depth by wash-boring and lined with Bx (3-inch) casing. Progress through a hard till stratum, containing gravel, cobbles and boulders, was expedited by diamond drilling.

Standard Penetration tests were performed at frequent intervals of depth and a dynamic cone penetration test was performed adjacent to borehole 2 only.

The results of the field tests are shown on geotechnical data sheets comprising enclosures 3 and 4. Elevations have been referred to the centre of the deck of the existing bridge taken as 940.0 feet.

III SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown on the data sheets and a general picture of the subsurface conditions is given by the profile on enclosure 2. The principal strata are as follows:

- (i) clayey sandy silt fill. Below the gravel road bed this material extends to a total depth of 10 feet (+) and comprises the road embankment. It has a stiff consistency and is dark brown in colour owing to the presence of finely divided organic matter. Below the fill there is a thin layer of cohesive silt which is a natural deposit, and may be the original formation from which the fill has been taken.
- (ii) sandy gravel. This stratum is 3 to 5 feet in depth and lies immediately below the bed of the stream. The site is located in a spillway valley which lies against the east flank of the Seaforth Moraine. The gravel is probably an alluvial deposit of the former glacial river.

(iii) grey silty clay till. This is a very stiff to hard glacial deposit extending from about El.925 to the bottom of the boreholes. In general it consists of a matrix of silty clay with a moisture content higher than the plastic limit, and up to 5% of small sub-angular granular particles 1/2-inch or less in diameter. A few coarse gravel particles were found scattered at random in both boreholes, and particles of cobble and boulder size were found below El.915 in borehole 2. Although the maximum length of core recovered did not exceed 4 inches, the pressure at the drilling head indicated particle sizes in excess of 12 inches.

The level of water in the stream at the time of the investigation was El.930.4 feet.

IV FOUNDATIONS

The elevation of the bottom of the stream is 928.25. The soil conditions below this level are sufficiently good for the support of spread footing foundations. To allow for scour, the footings should bear at El.923 feet which lies within the very stiff to hard clay till. The 'N'-values at this level are 25 and 49 in boreholes 1 and 2 respectively (ignoring the high extrapolated figures which appear to be caused by the presence of large granular particles). It is recommended that the footings should be designed for a gross soil pressure not exceeding 5900 p.s.f. Notwithstanding the difference in stiffness between the two boreholes, the total settlement below the abutments is expected to be about one inch, and the differential settlement about 0.5 inch.

If the footings are lowered to El.920 a soil pressure of 8000 p.s.f. may be used, with a similar prediction of settlement. Settlement in either case will take place over a period of several months as the clay till consolidates.

The preparation of the footing grade in the very stiff or hard till stratum is unlikely to present any special problems. The material is generally impervious and not susceptible to disturbance. The seam of clayey sand between 17.5 and 20.0 feet in borehole 2 may or may not be waterbearing. Its absence in borehole 1 suggests that it is an isolated pocket. If it is encountered during the excavation and causes disturbance, it should be dug out until the grade reaches hard till again.

The sides of the excavation through the fill should be braced or sloped at 1 to 1, the gravel stratum should be braced, and the till will stand vertically without support. The gravel layer is the only highly pervious stratum below the water table. If the diversion channel for the stream cuts into this layer the volume of seepage may be high. It should be collected in sumps dug below the footing grade level and removed by pumping.

V

REFERENCES

1. The Physiography of Southern Ontario by L. J. Chapman and D. F. Putnam of the Ontario Research Foundation - University of Toronto Press 1951.
2. Procedures for Testing Soils, ASTM, April 1958. pp.186 to 198. (Unified Soil Classification System - by A. A. Wagner).
3. Terzaghi and Peck: Soil Mechanics in Engineering Practice. John Wiley and Sons, New York 1948.



DOMINION SOIL INVESTIGATION LIMITED

James Park

James Park, M.Sc., P.Eng.

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
$\phi > 8"$	$3" - 3\frac{1}{2}"$	COARSE	FINE	COARSE	MEDIUM	FINE	0.074	0.002	>	NO SIZE LIMIT		
U.S. Standard Sieve Size :		No. 4	No. 10	No. 40	No. 200							

SAMPLE TYPES.

AS Auger sample
CS Sample from casing
ChS Chunk sample

RC Rock core
% Recovery
SS Split spoon sample

TP Piston, thin walled tube sample
TW Open, thin walled tube sample
WS Wash sample

SAMPLER ADVANCED BY static weight : w
" pressure : p
" tapping : t

OBSERVATIONS
MADE WHILE
CORING

Steady pressure
 No pressure
 Intermittent pressure

Washwater returns
 Washwater lost

PENETRATION RESISTANCES.

DYNAMIC PENETRATION RESISTANCE : to drive a 2" ϕ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot.

EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SYMBOL :



322

SOIL PROPERTIES.

W% Water content
LL% Liquid limit
PL% Plastic limit
PI% Plasticity index
LI Liquidity index

γ Natural bulk density (unit weight)
e Void ratio
RD Relative density
 C_v Coeff. of consolidation
 m_v Coeff. of volume compressibility

k Coeff. of permeability
C Shear strength — in terms of total stress
 ϕ Angle of int. friction —
C' Cohesion — in terms of effective stress
 ϕ' Angle of int. friction —

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL COMPRESSION TEST

UNCONFINED TEST

LABORATORY

FIELD

VANE TEST

POCKET PENETROMETER TEST

Strain at failure is represented by direction of stem

20%
15% — 5%
10%

St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

SOIL DESCRIPTION.

COHESIONLESS SOILS :

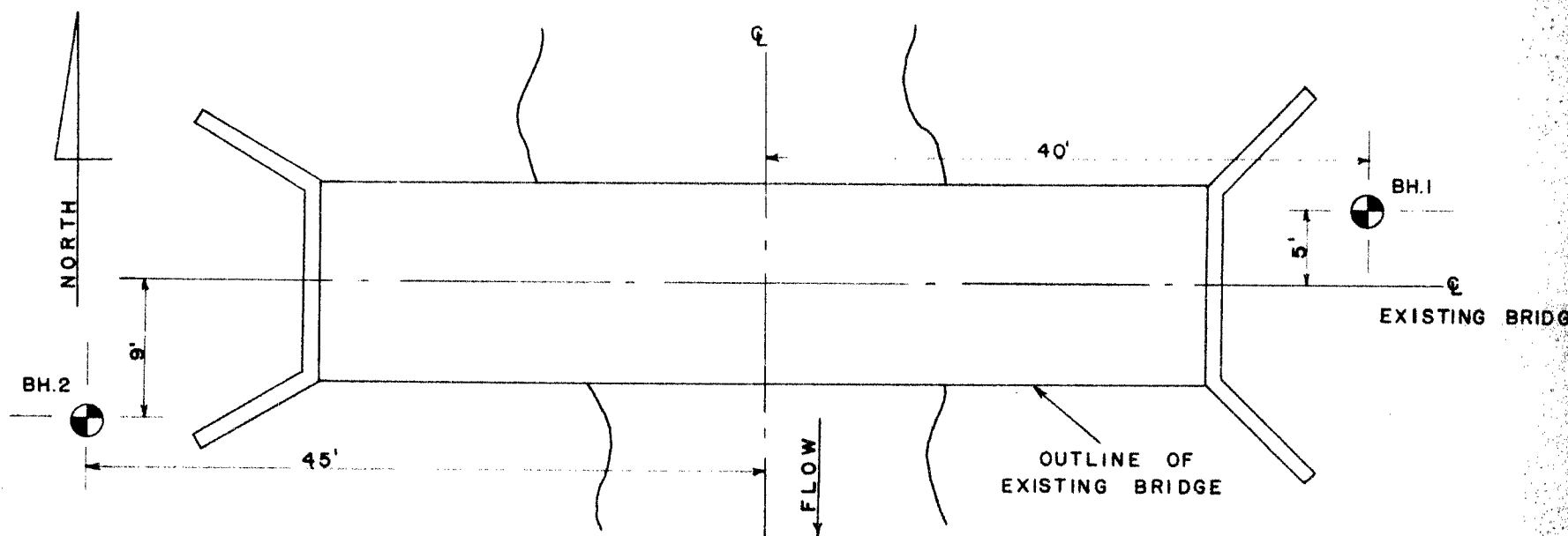
RD :

COHESIVE SOILS :

C lbs/sq.ft.

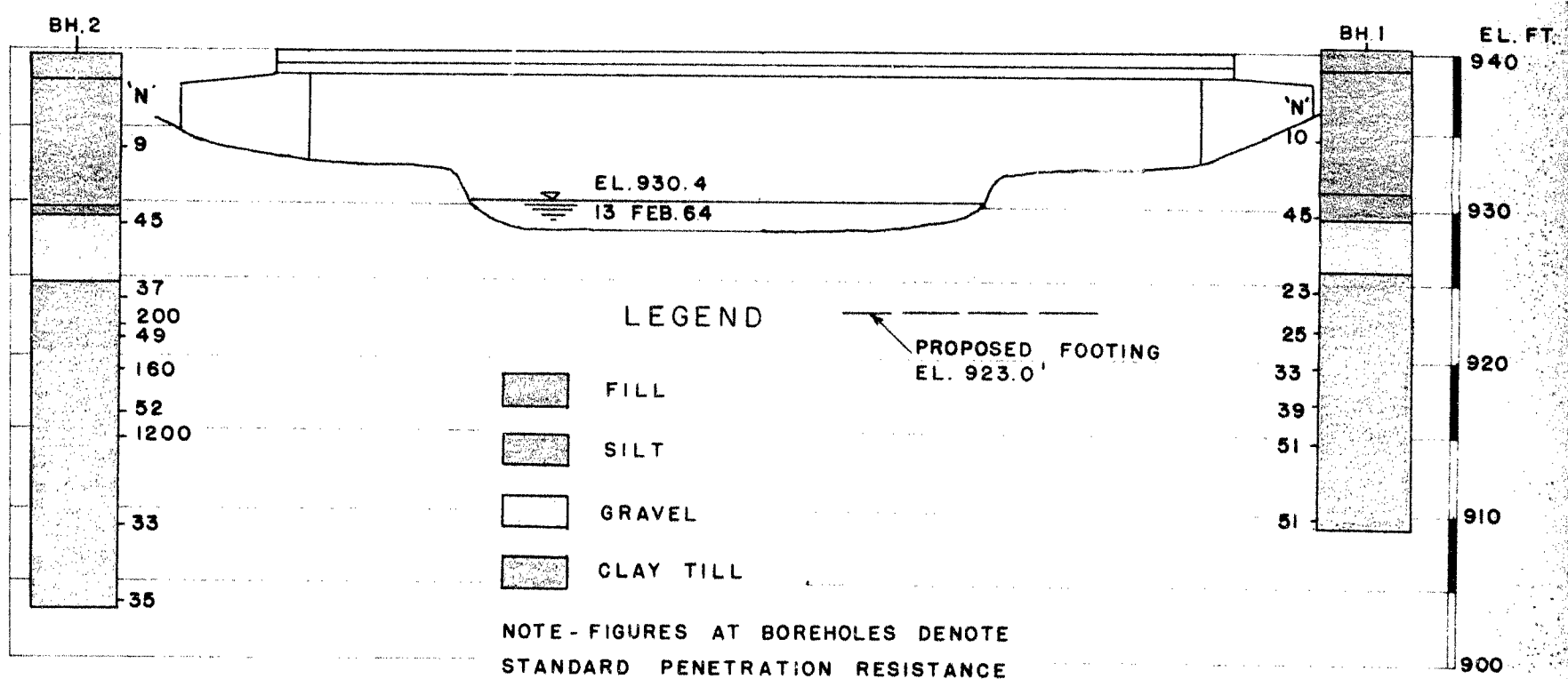
Very loose 0 - 15 %
Loose 15 - 35 %
Compact 35 - 65 %
Dense 65 - 85 %
Very dense 85 - 100 %

Very soft less than 250
Soft 250 - 500
Firm 500 - 1000
Stiff 1000 - 2000
Very stiff 2000 - 4000
Hard over 4000



LOCATION OF BOREHOLES

SCALE: 1 INCH TO 10 FEET



SUBSURFACE PROFILE

SCALE: 1 INCH TO 10 FEET

OUR REFERENCE NO. 4-2-18

GEOTECHNICAL DATA SHEET FOR BOREHOLE

CLIENT: Mr. B. M. Ross

PROJECT: Road Bridge

LOCATION: Township of Usborne

DATUM ELEVATION: 940.0' (centre of existing bridge deck)

METHOD OF BORING:

DIAMETER OF BOREHOLE

See remarks

ENCLOSURE NO.

3

DATE: February 14, 1964

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	N- or Advancement of Sampler	20	40	60	80	100	PL	W	
940.0	0	Ground Surface												
		Brown gravelly sandy road fill.												
935	5	Brown, moist, stiff clayey sandy silt fill (trace of organics).		1	SS	10								
930	10	Dense grey silt (slight cohesion)		2	SS	45								
		Dense sandy gravel.		3	AX Casing Core									
925	15			4	SS	25								
		very stiff hard		5	SS	25								
920	20	Grey, silty clay till.		6	SS	55								
				7	SS	59								
915	25	very silty		8	SS	51								
910	30			9	SS	51								
		End of borehole												

WL. on completion of borehole
El. 932.8'
14 Feb. 64.

WL. in creek
El. 930.4'
13 Feb. 64.

The borehole was advanced by diamond drilling with Ax (2-1/4" casing and partially lined with Bx(3") casing.

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: SB

CH'D: JP

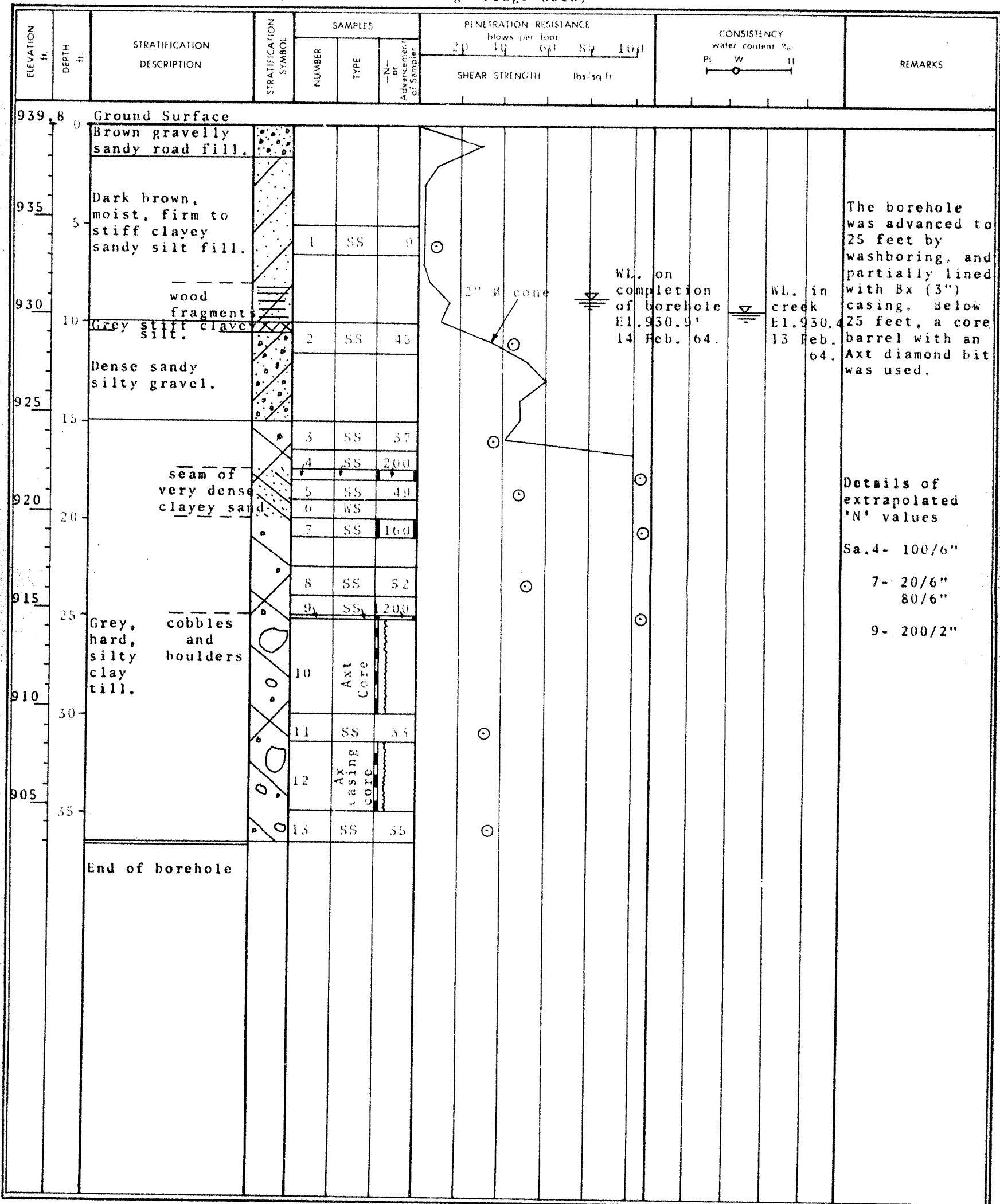
OUR REFERENCE NO 4-2-18

GEOTECHNICAL DATA SHEET FOR BOREHOLE

CLIENT: Mr. B. M. Ross
 PROJECT: Road Bridge
 LOCATION: Township of Usborne
 DATUM ELEVATION: 940.0' (centre of existing bridge deck)

METHOD OF BORING: See remarks
 DIAMETER OF BOREHOLE: See remarks
 DATE: February 13-14, 1964.

ENCLOSURE NO. 4



VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: SB

CH'D: JP