

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 4076-849

DIST. 1 REGION

W.P. No. 260-66-13

CONT. No. 88-69

W. O. No.

STR. SITE No.

HWY. No. E.C. ROW EXPRWY

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.

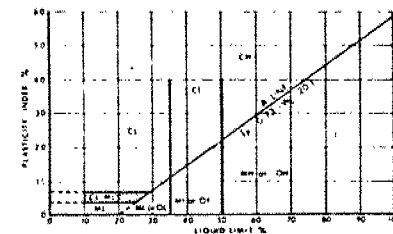
*THIS REPORT WAS PREPARED
FOR THE E.B.L. ADVANCE APPROACHES*

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 MORE THAN HALF OF COARSE FRACTION IS LARGER THAN 4.75 mm	CLEAN GRAVELS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZE			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.	DETERMINE PERCENTAGES OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDENT ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75 μm) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS: LESS THAN 5% GW, GP, SW, SP MORE THAN 12% GM, GC, SM, SC 5% TO 12% BORDERS LINE CASES REQ. USE OF DUAL SYMBOLS
		GRAVEL WITH FINES (APPRECIABLE AMOUNT OF FINES)	PREDOMINANTLY ONE SIZE OF A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES; LITTLE OR NO FINES		
		CLEAN SANDS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES			SW	WELL GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES		
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN 4.75 mm	CLEAN SANDS (LITTLE OR NO FINES)	PREDOMINANTLY ONE SIZE OF A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING			SP	POORLY GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES	FOR UNDISTURBED SOILS ADD 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 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 ATTERBERG LIMITS ABOVE A-LINE WITH I _p GREATER THAN 7
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	NON-PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)			SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES		
		PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES			
IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425 μm									
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN 75 μm (1.75 mm IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE)	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 35%	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	ML	INORGANIC SILTS & SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR	GIVE TYPE, NAME, IF NECESSARY, INDICATE DEGREE & CHARACTER OF PLASTICITY, AMOUNT & MAXIMUM SIZE OF COARSE GRAINS, COLOUR IN WET CONDITION, ODOR, IF ANY, LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION & SYMBOL IN PARENTHESES.	FOR UNDISTURBED SOILS AND INFORMATION ON STRUCTURE, STRATIFICATION, CONSISTENCY IN UNDISTURBED & REMOULDED STATES, MOISTURE & DRAINAGE CONDITIONS
			NONE	QUICK	NONE	CL	CLAYEY SILTS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS		
			MEDIUM TO HIGH	NONE TO VERY SLOW	MEDIUM	OL	ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS		
		LIQUID LIMIT BETWEEN 35% AND 50%	SLIGHT TO MEDIUM	SLOW	SLIGHT	ML	INORGANIC COMPRESSIBLE FINE SANDY SILT WITH CLAY OF MEDIUM PLASTICITY, CLAYEY SILTS		
			HIGH	NONE	MEDIUM TO HIGH	CL	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY		
			SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	OL	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY		
	LIQUID LIMIT GREATER THAN 50%	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			
		MEDIUM TO HIGH	NONE TO VERY SLOW	SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY			
	HIGHLY ORGANIC SOILS		READILY IDENTIFIED BY COLOUR, ODOR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE			PE	PEAT & OTHER HIGHLY ORGANIC SOILS		

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

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. $\bar{C}\bar{U}$ = 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 = $\frac{w - w_p}{w_L - w_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{w_L - w_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu\text{m Soil Fraction}}$
 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).

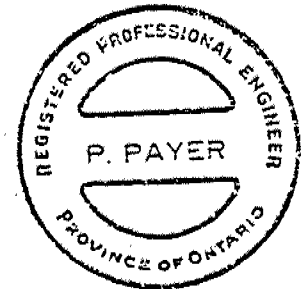
Groundwater Conditions

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

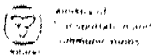
These figures indicate that the groundwater level is about 2-3 feet below the original ground level.

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 Y 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 (%)			
585.2	Ground Level												
0.0	Silty Sand												
581.2													
4.0			1	SS	8								
			2	TW	PH								
			3	SS	7								
	Silty Clay To Clayey Silt Some Sand Trace of Gravel Firm		4	TW	PH							118	0 9 (91)
			5	TW	PH								
			6	TW	PH							127	
			7	TW	PH								
			8	TW	PH							127.5	
			9	TW	PH								
			10	TW	PH							133	3 22 49 26
			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												
52.1	End of Borehole												

+3, x5: Numbers refer to
Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 2

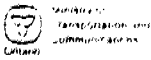
W P 260-66-02 LOCATION Co-ords N 350,868 E 845,192 ORIGINATED BY AMS
DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS
DATUM Geodetic DATE March 1, 1968 CHECKED BY _____

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			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

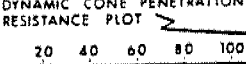
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DIST 1 HWY E.C. Row Expy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS
DATUM Geodetic DATE Feb. 28 & 29, 1968 CHECKED BY _____

*3, x⁵: Numbers refer to Sensitivity



RECORD OF BOREHOLE No 4

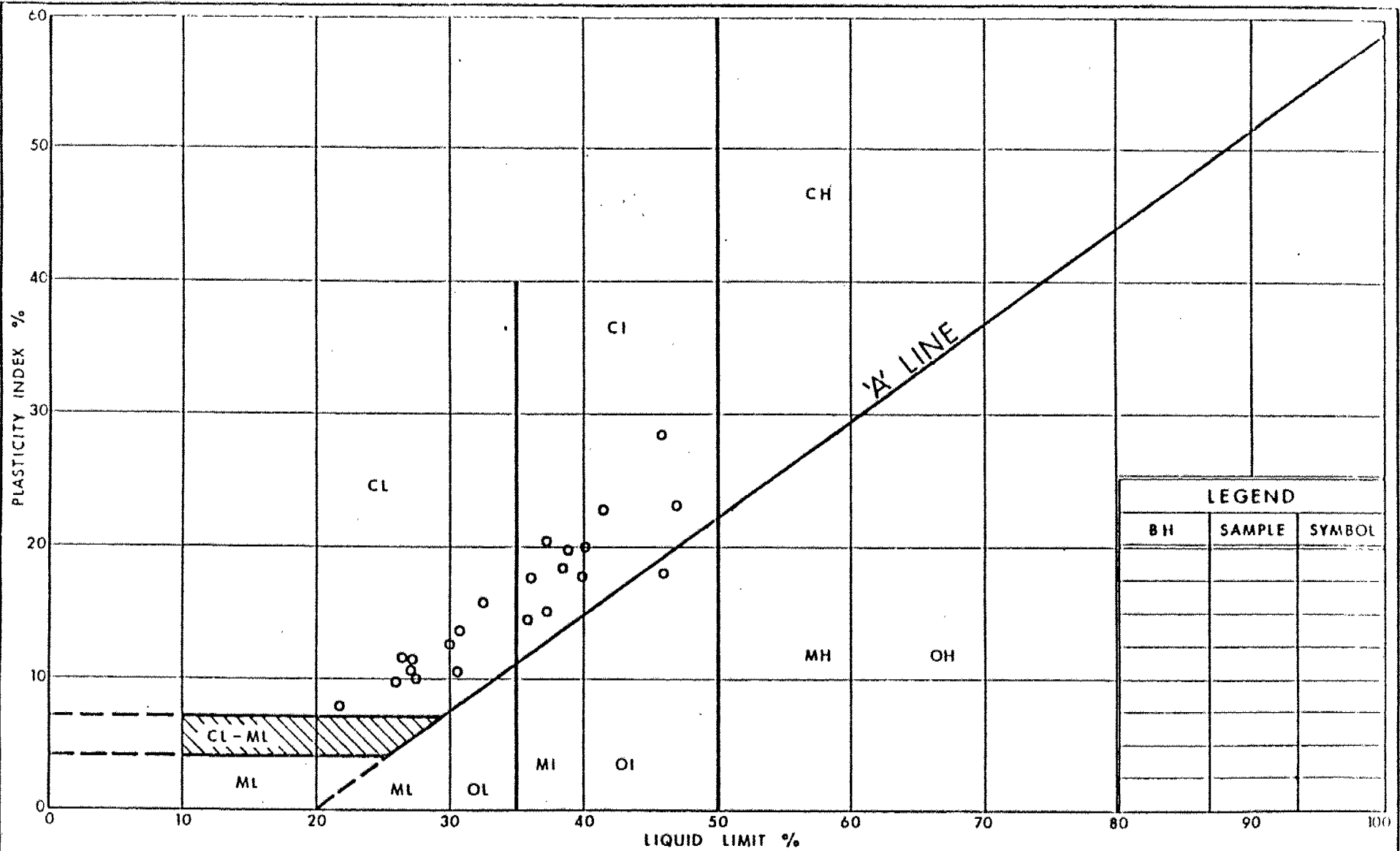
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DIST 1 HWY E.C. Row Expwy BOREHOLE TYPE Cont. Flight Auger & Cone Test COMPILED BY AMS
DATUM Geodetic DATE Feb. 29, 1968 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
585.8	Ground Level																
581.8	Silty Sand																
580	Silty Clay to Clayey Silt. Some Sand, Trace of Gravel Firm		1	SS	6											117.5	1 9 38 52
			2	TW	PH												
570			3	SS	5											121	
			4	TW	PH												
560			5	SS	6												
			6	TW	PH											122	
550			7	SS	4												
			8	TW	PH												
540																130.5	3 23 49 25
537.8																	
530.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x²: Numbers refer to
Sensitivity

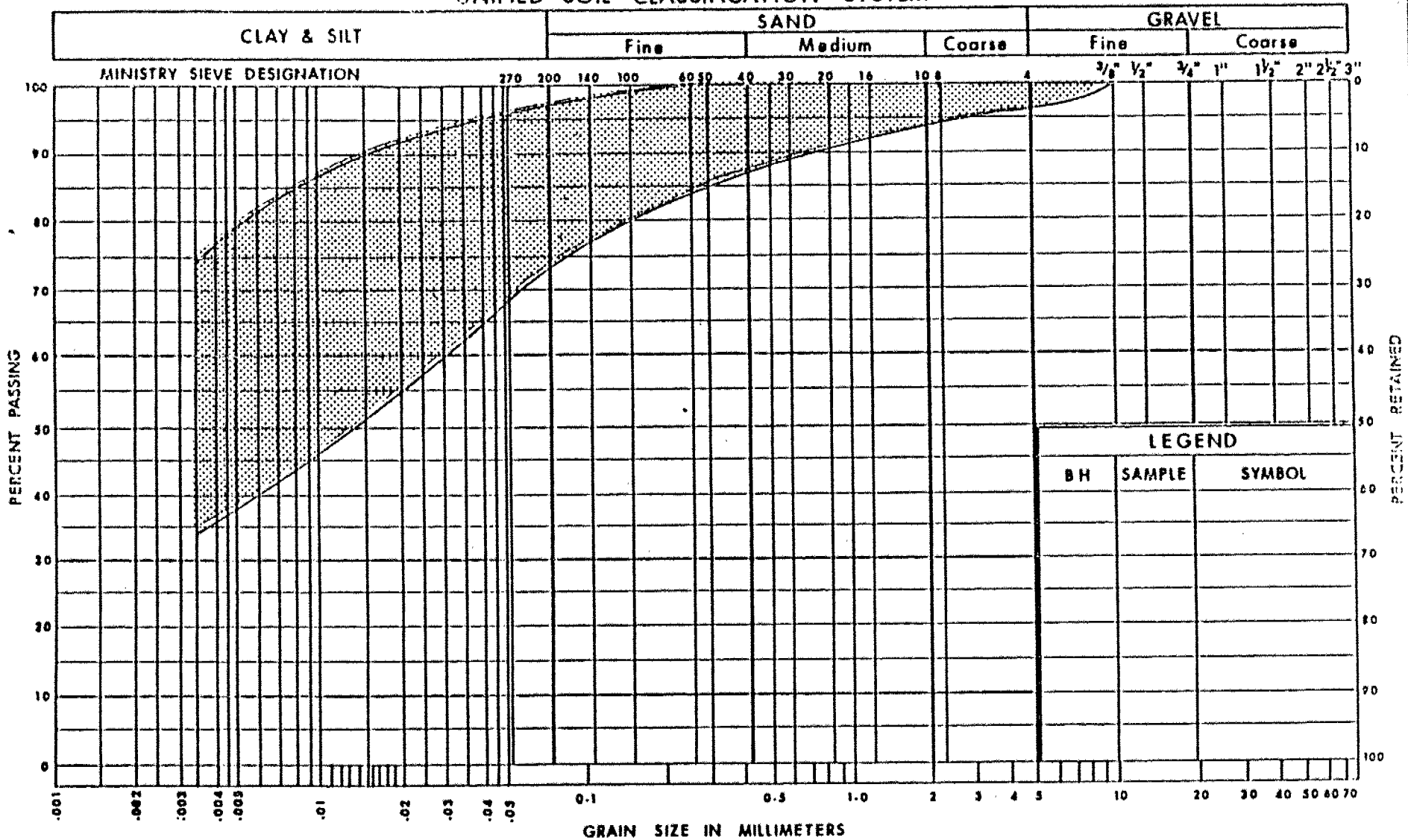
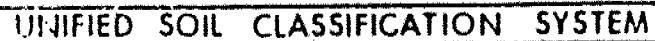
20
15 10 5 (%) STRAIN AT FAILURE
10

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PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260-66-02

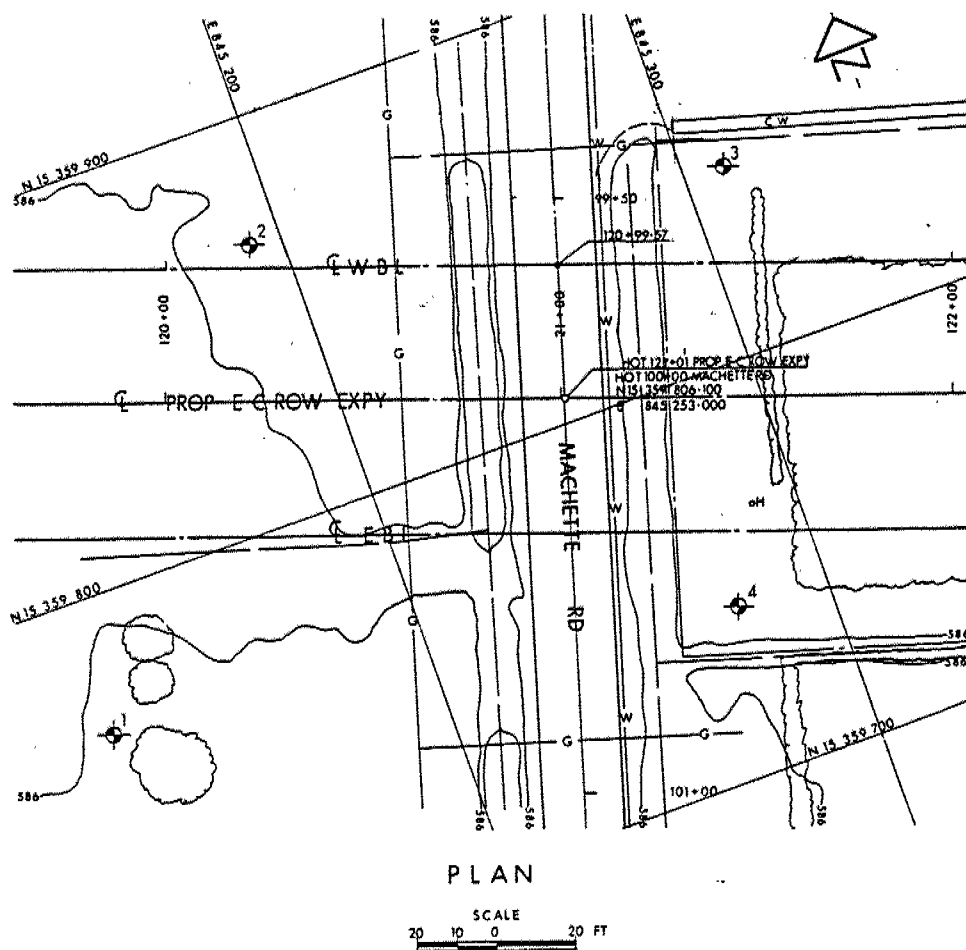


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GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT

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 in the Engineer's District Office, Downsview. Information contained in this file and any other documents used is specifically excluded in accordance with the conditions of Section 1.02(2) of Form 104.

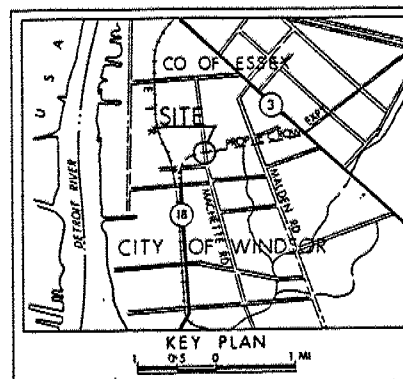
REF No E-5518-1 JUNE 1977

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. CHAPMAN

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

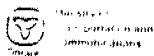
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100					
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			+2.5					
			6	TW	PH			b +2.4				130	
			7	TW	PH			b +2.1				128	
			8	TW	PH			+2.1					
			9	TW	PH			+2.3				128	.1 21 48 30
			10	TW	PH			+2.8					
			11	TW	PH			+3.2					
			12	TW	PH			b +2.0				134	
			13	TW	PH			b +1.6				127	2 17 47 34
			14	TW	PH			+2.7					
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 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					
592.3	Ground Level										
0.0	Silty Sand										
588.3	Compact										
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						
			5	TW	PM						
			6	TW	PM						
			7	TW	PM						
			8	TW	PM						
			9	TW	PM						
			10	TW	PM						
			11	TW	PM						
			12	TW	PM						
			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
10

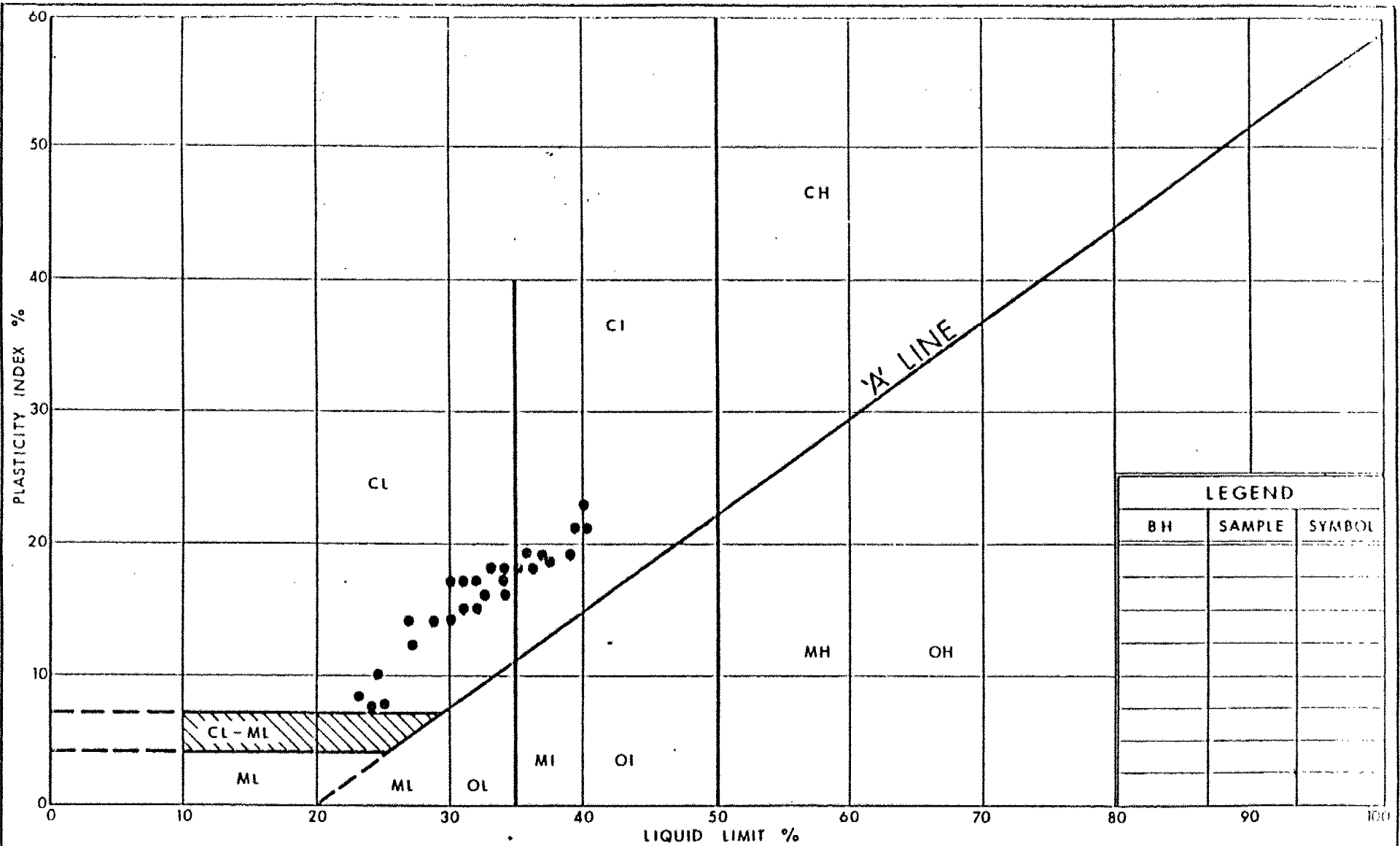
5 (% STRAIN AT FAILURE)

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	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			20 40 60 80 100		W _p	W	W _L		
593.6	Ground Level						SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 500 1000 1500 2000 2500		WATER CONTENT (%) 10 20 30				
0.0	Silty Sand				*	590	Frozen Zone						
589.6	Compact												
4.0			1	SS									
			2	TW PH								129	
	Silty Clay To Clayey Silt Some Sand Trace of Gravel		3	TW PH									
			4	TW PH				+2.5				123	0 13 41 46
	Firm To Stiff		5	TW PH				+2.2					
			6	TW PH				+2.0				124	
			7	TW PH				+2.6					
			8	TW PH				+2.1					
550.6						560		+2.2				127.5	1 16 44 39
43.0	End of Borehole												
	* Note Water Level Not Established												

OFFICE REPORT ON SOIL EXPLORATION



LEGEND		
BH	SAMPLE	SYMBOL



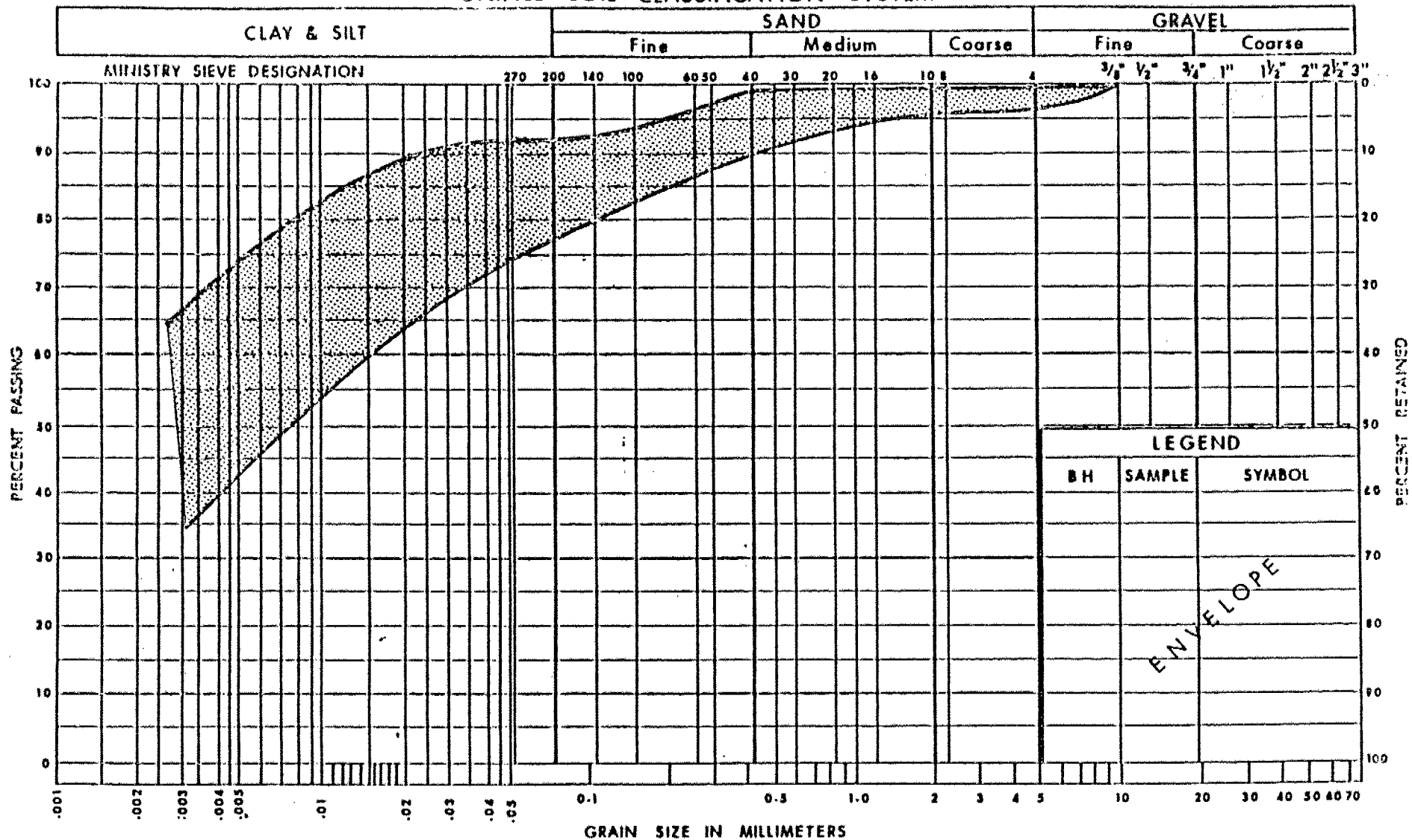
Ministry of
Transportation and
Communications

PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No 1

W P 260 - 66 - 03

UNIFIED SOIL CLASSIFICATION SYSTEM

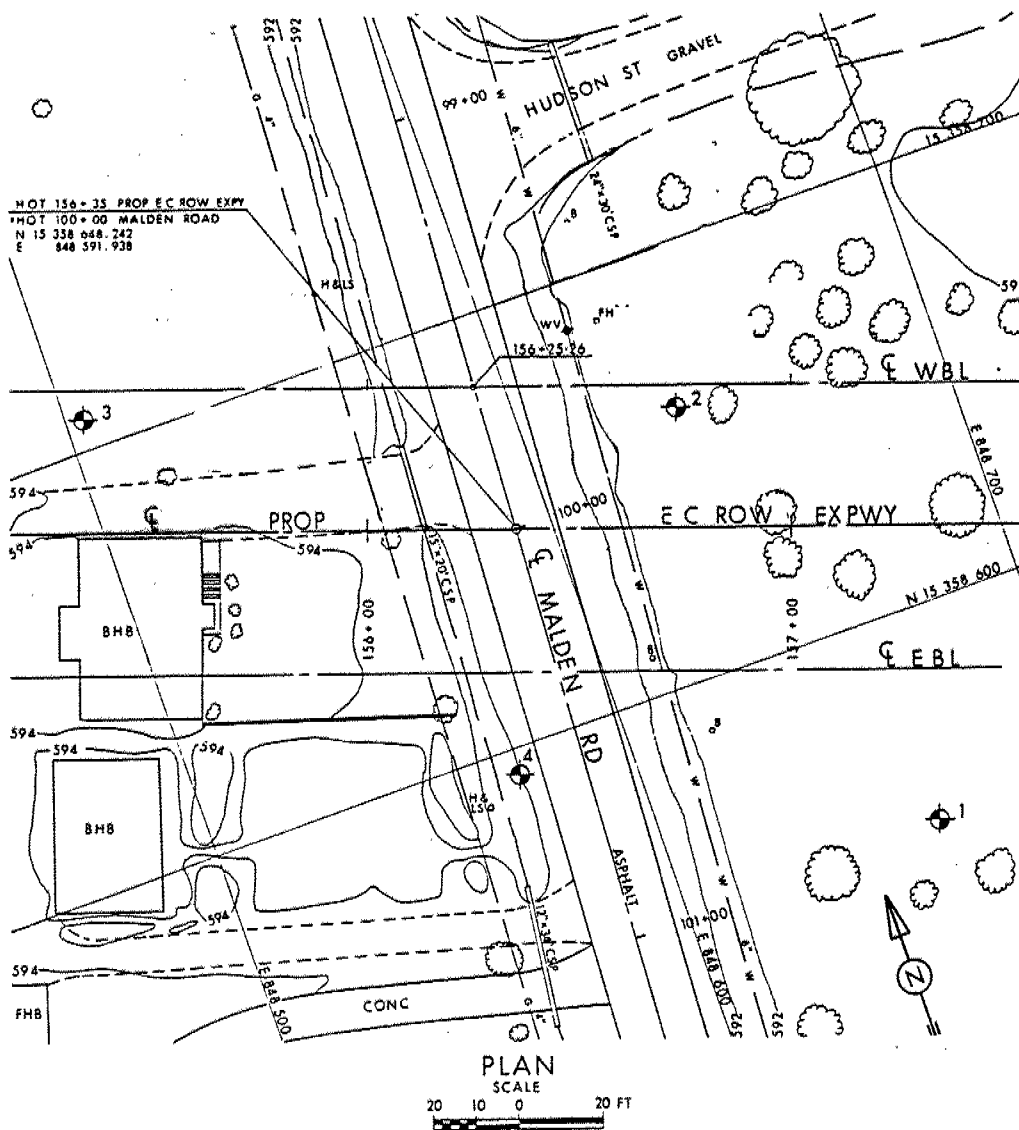


Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAYEY SILT

FIG No 2
WP 260 - 66 - 03

HOT 156+35 PROP EC ROW EXPY
 PHOTO 100+00 MALDEN ROAD
 N 15 338 648.242
 E 848 591.938



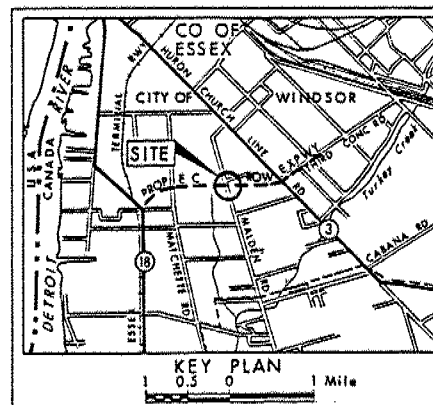
NOTE: SITE CONDITIONS AS OF FEB. 1968

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 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft 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.

REVISIONS	DATE	BY	DESCRIPTION

The complete foundation investigation file for this project may be examined at the Engineering Materials Lab, Cranview. Information contained in this file and any supplementary data is confidential and shall be maintained in accordance with the provisions of Section 102 of the R.S.A. 1977.

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)

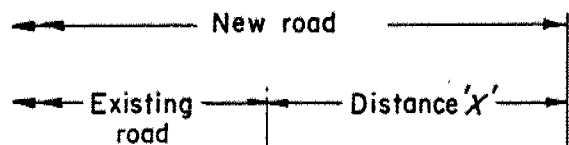
We have reviewed sheets 3 to 14 and 16 to 17 for the above project.
We have no comments to offer from our point of view.

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.

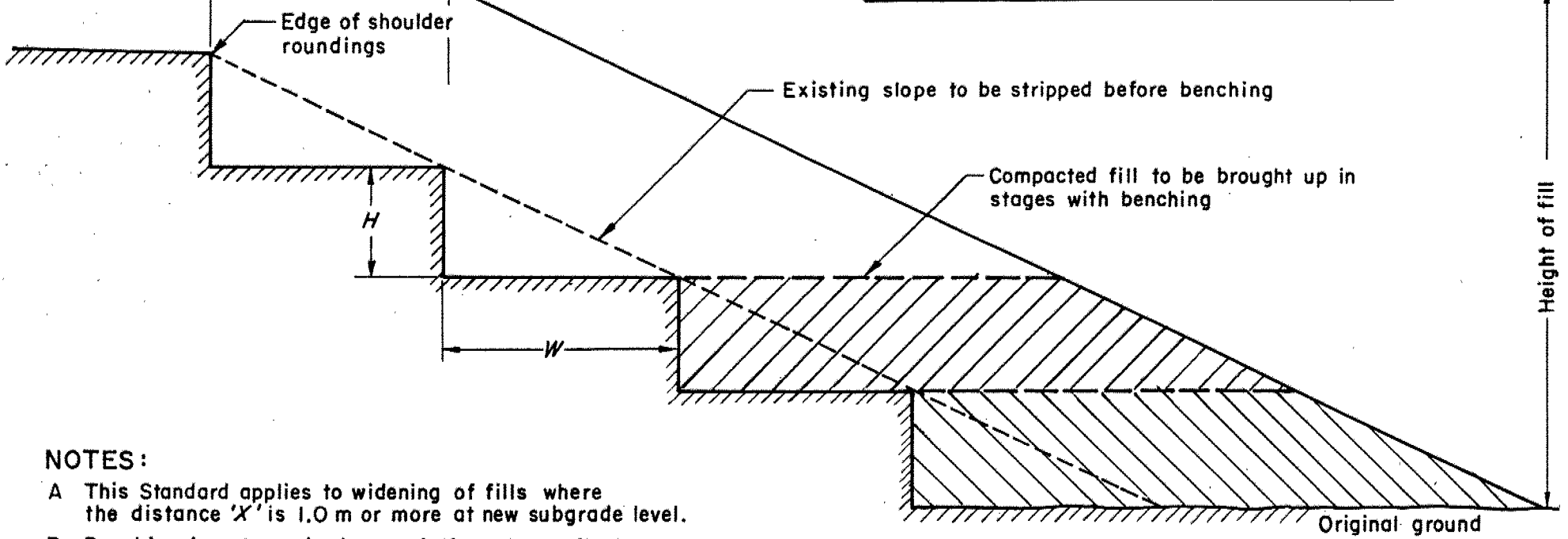
A handwritten signature in dark ink, appearing to read "P. Payer", with a checkmark at the end.

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			

63 - F - 258 M

BAY FIELD RIVER

BRIDGE

CON. 3, LOTS 15/16

HIBBERT TWP.

BA 1609

25-116

MR. T.B. COLLINGS
PERTH COUNTY ENGINEER
Court House
STRATFORD ONTARIO

Report on
SOIL INVESTIGATION
for
BAYFIELD RIVER BRIDGE
CONCESSION 3, LOTS 15 to 16
TOWNSHIP OF HIBBERT
COUNTY OF PERTH

63-116 258M

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 3-1-L7
January
1963

CONTENTS

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

ENCLOSURES

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

INTRODUCTION

In accordance with a letter of authorization dated the 18th of January 1963 from the Perth County Engineer's office, a soil investigation has been carried out at the site of a proposed new bridge on County Road No. 10.

The new bridge will carry a gravel road across the realigned Bayfield River. The structure is intended to be a 50 to 60 foot span rigid frame carried on spread footings at El. 77.5 feet. The site was located with the aid of drawing No. 8/10/III/B, supplied by the County Engineer's office.

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

I PHYSIOGRAPHY

The site lies in an area of low relief 1-1/2 miles southwest of the Village of Dublin. It is located in a wide shallow spillway valley flanking the Lucan Moraine to the west, and the soil deposits are apparently of fluvio-glacial origin. Several streams converging in the vicinity form the headwaters of the Bayfield River.

II FIELD WORK

Field work was carried out on the 25th and 28th of January 1963, and consisted of 2 boreholes at the locations shown on enclosure 2. The holes were advanced by dry boring methods and lined with Bx (3-inch) casing.

Standard Penetration tests were made at frequent intervals of depth and dynamic cone penetration tests were performed adjacent to each borehole. The former test gave a measure of the relative density or consistency of the soil and provided disturbed samples, while the latter test gave a continuous record of soil density.

The results of the field tests are recorded on geotechnical data sheets comprising enclosures 3 and 4. Elevations and chainages are referred to the data used on the County drawing No. 8/10/III/B.

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.

At borehole 1 the gravelly silt till layer is almost cohesionless and contains about 50% of material in the fine sand - coarse gravel range. The grey till is cohesive and contains only a few percent of fine gravel particles. The clayey gravel and sand stratum in which the footings will bear contains approximately 10% of clay and all sizes of sand and gravel. The lower gravel and sand layer is almost cohesionless.

At borehole 2 the strata contains no gravel above El. 73.3 feet and the upper clay layer is much deeper. The grey-brown sandy

silt has no cohesion and the hard grey silt layer on which the footings will bear contains alternating layers of cohesive and non-cohesive material. The lower gravel and sand layer contains all sizes of material from fine sand to coarse gravel with approximately 5% of clay.

The water table was located between Els. 80 and 83 feet.

IV FOUNDATIONS

Only small settlements are expected in the dense strata at and below the proposed footing level, so that a rigid-frame type of structure is suitable. It is recommended that footings should be designed for a gross soil pressure (including the weight of overburden) not exceeding 4 t.s.f. at or below El. 80 for the conditions at borehole 1, and at or below El. 77.5 for the conditions at borehole 2. Provided that the footings are poured on a firm undisturbed grade, the total settlement associated with the recommended pressure is not expected to exceed one inch.

The coefficient of friction against sliding will depend upon the material in which the footings are located. From the results of the borings it appears that the character of the soil may vary widely over the footing area. For this reason it is recommended that a coefficient of 0.35 should be used over the entire area.

V CONSTRUCTION

It may be necessary to slope the sides of the excavation to prevent spalling, especially in the cohesionless till found at borehole 1, but no special bracing should be necessary.

The water table may be close to or above the proposed footing elevation depending on the time at which construction is carried out. Dewatering, if necessary, can be done by pumping from sumps dug below the footing grade level. Pumping should not be done from the floor of the excavation because this would tend to draw water up through the grade and so loosen the soil.

The strata at the two boreholes differ in several respects, and other conditions may be expected in the intervening area. For this reason it is particularly important, when inspecting the footing grade, to ensure that the condition of the soil at all

points is no less favourable than in the vicinity of the boreholes.

It is suggested that a thin layer of lean concrete should be spread on the footing grade as soon as it has been exposed and inspected. This will help to prevent disturbance by water or by construction personnel or equipment.

VI SUMMARY

1. The strata consist of various types of fluvio-glacial deposits which, below the proposed footing grade level, are in a dense to very dense condition.
2. It is recommended that footings should be designed for a gross soil pressure not exceeding 4 t.s.f.
3. The coefficient of friction should be taken as 0.35.
4. No unusual construction problems are anticipated.

VII REFERENCES

1. The Physiography of Southern Ontario by L.J. Chapman and D.F. Putman 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. Proceedings of the 4th International Conference on Soil Mechanics and Foundation Engineering (Research on Determining the Density of Sands by Spoon Penetration Testing, by H.J. Gibbs and W.G. Holtz of the United States Bureau of Reclamation), London, 1957.
4. Terzaghi and Peck, Soil Mechanics in Engineering Practice, John Wiley and Sons, New York, 1948.

DOMINION SOIL INVESTIGATION LIMITED

Encl.
JP/mc



A handwritten signature in cursive script, appearing to read "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
$\emptyset > 8"$	$3" - 3\frac{3}{4}"$	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	RC Rock core	TP Piston, thin walled tube sample
CS Sample from casing	% Recovery	TW Open, thin walled tube sample
ChS Chunk sample	SS Split spoon sample	WS Wash sample

SAMPLER ADVANCED BY	static weight : w	OBSERVATIONS	Steady pressure
"	pressure : p	MADE WHILE	No pressure
"	tapping : t	CORING	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 :



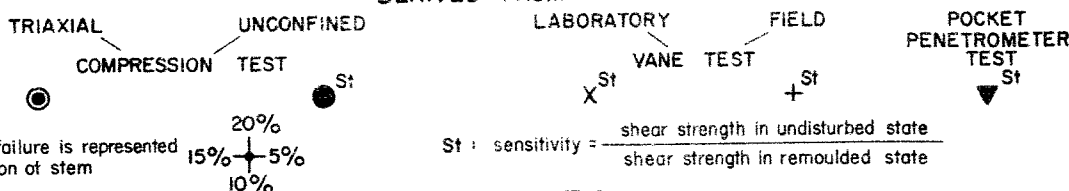
322

SOIL PROPERTIES.

W % Water content	γ^* Natural bulk density (unit weight)	k Coeff. of permeability
LL % Liquid limit	e Void ratio	C Shear strength
PL % Plastic limit	RD Relative density	ϕ Angle of int. friction
PI % Plasticity index	C _v Coeff. of consolidation	C' Cohesion
LI Liquidity index	m _v Coeff. of volume compressibility	ϕ' Angle of int. friction

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

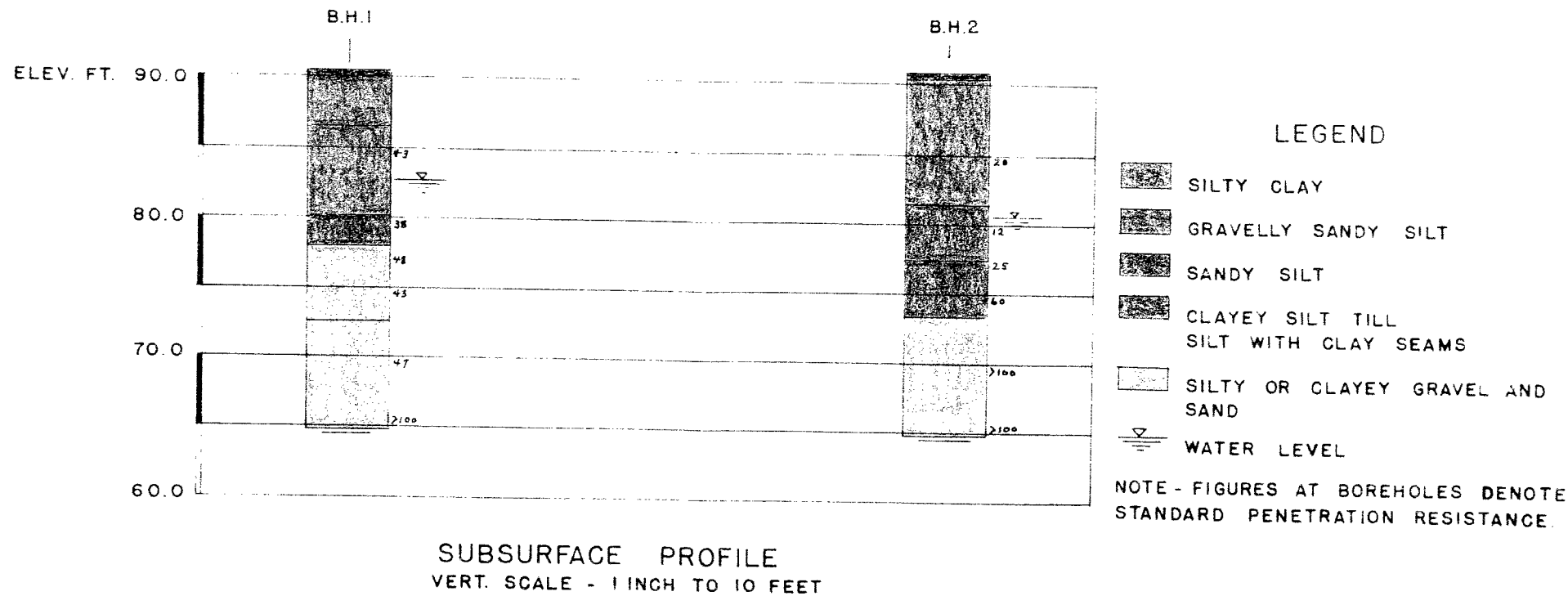
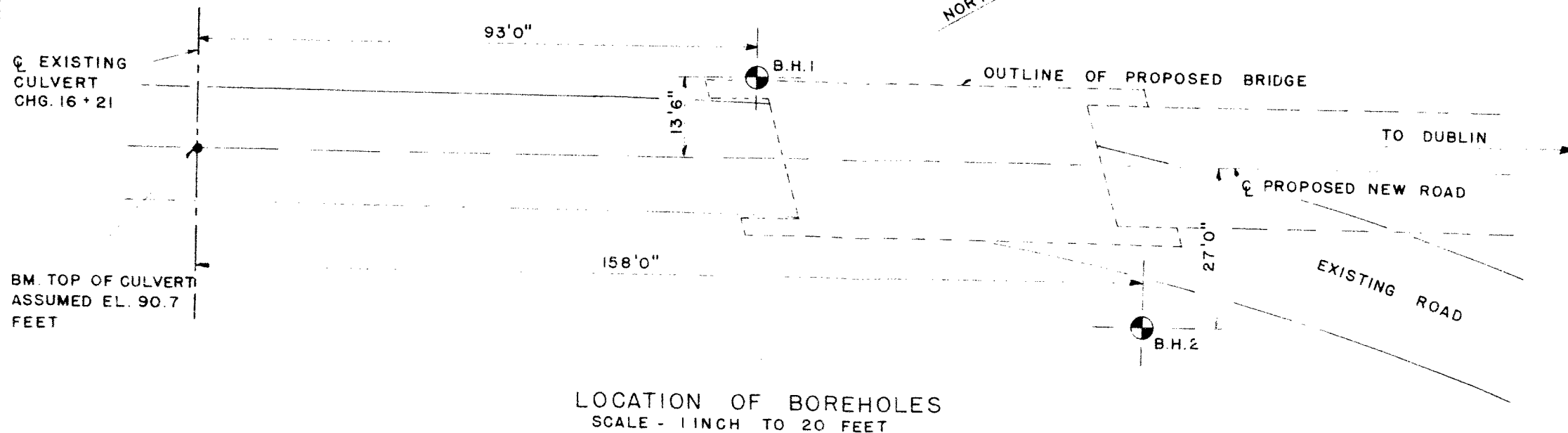


SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	COHESIVE SOILS :	C lbs/sq.ft.
Very loose	0 - 15 %	Very soft	less than 250
Loose	15 - 35 %	Soft	250 - 500
Compact	35 - 65 %	Firm	500 - 1000
Dense	65 - 85 %	Stiff	1000 - 2000
Very dense	85 - 100 %	Very stiff	2000 - 4000
		Hard	over 4000

JOB NO. 3-1-L7
PREP. BY M.C.

ENCLOSURE 2



DOMINION SOIL INVESTIGATION LIMITED

OUR REFERENCE NO. 3-1-17

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1

CLIENT: County of Perth
PROJECT: Bayfield River Bridge
Borehole LOCATION: See enclosure 2
DATUM ELEVATION: See enclosure 2

METHOD OF BORING: Dry boring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: 25 Jan 63

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE Blow count per foot					CONSISTENCY water content % P _L W U	REMARKS
				NUMBER	TYPE	NO. OF LAYER, THICK OF SAMPLE	20	40	60	80	100		
90.5	0	Ground surface											
		Organic topsoil											
		Brown silty clay											
86.5	5	Brown gravelly sandy silt till (dense)		1	SS	43							
80.0	10	Very stiff grey clayey silt till		2	SS	38							
78.0				3	SS	48							
	15	Grey-brown clayey gravel and sand (very dense)		4	SS	43							
72.5	20	Silty gravel and sand (very dense)		5	SS	47							
	25			6	SS	105							
64.7		End of borehole											

Cone

WL E1.82.8
28 Jan 63

Details of
Extrapolated
N-values

Sa.#6 18/6"
58/4"

GEOTECHNICAL DATA SHEET FOR BOREHOLE ... 2 ...

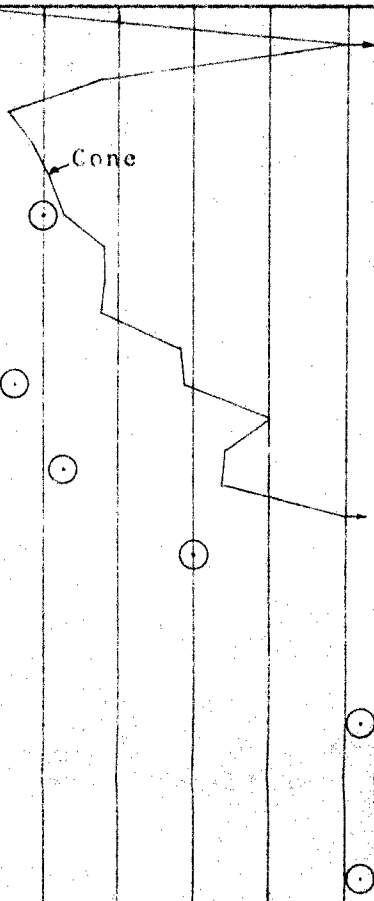
OUR REFERENCE NO. 3-1-1.7

CLIENT: County of Perth
PROJECT: Bayfield River Bridge
Borehole LOCATION: See enclosure 2
DATUM ELEVATION: See enclosure 2

METHOD OF BORING: Dry boring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: 28 Jan 63

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	N- value per sample	20	40	60	80	100	PL	W	LI	
90.8	0	Ground surface													
		Organic topsoil													
85.0	5	Brown silty clay (very stiff)		1	SS	20									
81.3	10	Grey-brown sandy silt (compact to dense)		2	SS	12									
77.3	15	Grey silt with clay seams (hard)		3	SS	25									
73.3				4	SS	60									
70.0	20	Silty clayey gravel and sand (very dense)		5	SS	142									
64.8	25			6	SS	202									
		End of borehole													



WL E1.80.6
28 Jan 63

Details of
Extrapolated
N-values

Sa.#5 42/6"
52/6" 30/2"
Sa.#6 46/6"
52/2"