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DIST. 6 REGION

W.P. No. 157-75-03
(see also ~~802-93-01~~)

CONT. No. 81-39

W. O. No.

STR. SITE No. 24-222

HWY. No. 403

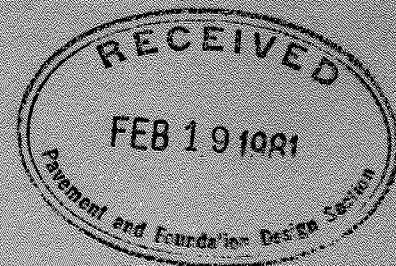
LOCATION Credit River

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



FOUNDATION INVESTIGATION REPORT

CONTRACT NO 81-39



Ministry of
Transportation and
Communications

1

INDEX

<u>Page No.</u>	<u>Description</u>
1	Index
2	Abbreviations & Symbols
3-44	Foundation Investigation Report For W.P. 157-75-03 602-93-01 Credit River Bridge

NOTE: For purposes of the contract this report supercedes all other foundation reports prepared by or for the Ministry in connection with the above mentioned project.

'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 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

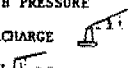

LABORATORY TESTING

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

μ COEFFICIENT OF FRICTION
 δ 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 
 β ANGLE OF SLOPE 
 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_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 = $w_L - w_P$
 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 = $\frac{I_p}{w_L - w_P}$ Soil Fraction
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(undisturbed)}{S_u(remoulded)}$

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
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = 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
 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_r OVERCONSOLIDATION RATIO (OCR)

FOUNDATION INVESTIGATION REPORT

For

Credit River Bridge
W.P. 157-75-03, Site 24-222
Hwy. 403, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during July 8, 1976 and during the periods of June 8 to 22, 1978, and April 16 to 18, 1980. The earliest investigation was done for feasibility purposes and consisted of one sampled borehole advanced by augering and diamond drilling techniques to a depth of 30 feet below the ground surface. In the 1978 investigation, a total of 16 sampled boreholes were put down by means of an auger machine equipped with hollow stem continuous flight augers and solid stem augers. The borings ranged in depth from 19 to 46 feet below the ground surface. In addition, bedrock was proven by obtaining BXL size rock core. The 1980 investigation consisted of an additional 8 boreholes put down by means of hollow stem continuous flight augers to depths of 20 to 30 feet below ground surface. Bedrock was proven by obtaining BXL size rock core samples.

SITE AND GEOLOGY

The site is located about 1½ miles south of Eglinton Avenue and about 250 feet east of Mississauga Road in the City of Mississauga, Regional Municipality of Peel.

At this site the Credit River is winding from north to south and has eroded a valley which is about 1100 feet wide from crest to crest and about 70 feet deep. The sides of the valley are found to be as steep as 1½:1 with the steep faces being on the concave side of the river. In certain locations subsoil strata and bedrock formations are exposed on the sides of the valley. The tabeland on either side of the valley is relatively flat, being gently sloping down towards the south.

Physiographically the site is situated in the border region of the "Peel Plain" and the "South Slope". The predominant deposit in this area is known to be a cohesive glacial till. The underlying bedrock is a shale of the Dundas-Meaford formation.

SUBSURFACE CONDITIONS

General

The overburden has a thickness of up to 32 feet in the tableland bordering the valley, but diminishes to 3 to 11 feet thick at the valley floor. The overburden at this site generally consists of a glacial till composed of clayey silt, some sand and gravel. However, in the valley floor the Credit River has eroded the glacial till and the upper portion of the bedrock and redeposited a sand and gravel with trace of silt and clay. Across the site, the overburden is underlain by shale bedrock.

Factual data on the subsoil conditions is shown on the Borehole Record Sheets. The locations and elevations of the borings, together with the estimated stratigraphical profile and sections, are shown on Contract Drawing Nos. 24-222-2 and 2A. A description of the subsoil and bedrock conditions is given below.

Glacial Till

This deposit is encountered on the tableland on either side of the valley and has a thickness of up to 32 feet. It is composed of a heterogeneous mixture of clayey silt, sand and gravel. Typical grain size distribution curves of the material from this deposit are shown in an envelope form on Figure 1. Geotechnical identity indices of the glacial till as determined from laboratory testing are summarized below.

		<u>Range</u>
Natural Moisture Content (W)%		9-12
Liquid Limit	(W _L)%	19-38
Plastic Limit	(W _p)%	13-23

The results of the Atterberg Limit Testing are also plotted on the Plasticity Chart, Figure 2, which indicate the glacial deposit is cohesive with a low to medium plasticity (CL TO CI zone).

The Standard Penetration Test 'N' values ranged from 10 blows to over 100 blows per foot, generally increasing with depth, indicating that the consistency of the glacial till varies from stiff to hard, but generally hard.

Sand and Gravel, Trace of Clay and Silt

This flood plain deposit was encountered in the river valley. It appears to be confined to areas below contour 392.0 and extends to bedrock for a thickness of 3 to 11 feet. This deposit is alluvial in origin and is composed of sand and gravel with a trace of clay and silt. Typical grain size distribution of the material in this deposit is shown in an envelope form on Figure 3. However, in certain locations the matrix (material passing sieve #40) exhibits slight plasticity. The Standard Penetration Test 'N' values varying randomly from 13 to 53 blows per foot indicate that this deposit has a compact to very dense relative density.

Bedrock (Shale Interbedded With Limestone)

Bedrock was encountered at elevation 437 on the west bank of the valley, at elevation 378 to 398 in the valley floor, and at elevation 420 to 425 on the east bank of the valley. Bedrock may be described as shale interbedded with limestone. The shale is soft to medium hard, somewhat fissile and weathered in the upper portion. The depth of weathering was found to be one to two feet on the west bank of the valley and up to 10 feet on the east bank of the valley. However, in the valley the weathered bedrock was up to 8 to 15 feet thick. The recovery ratio is high, generally close to 100%. However, the average RQD was found to be in the order of 30% to 50%, suggesting the shale is a poor quality rock.

Groundwater Conditions

The groundwater levels were observed by measuring in the open boreholes during and immediately after the field investigation. The groundwater levels were found to vary as high as elevation 454 (on the tableland) and as low as elevation 385 to elevation 390 (in the valley floor), generally constituting a hydraulic

gradient towards the river. Since the water level in the Credit River was at elevation 390, which was higher than some of the observed water levels in the boreholes, it is believed that the water levels in the boreholes probably were not stabilized during the period of observations.

M. MacLean

M. MacLean, P. Eng.
Project Foundations Engineer

M. Devata

M. Devata, P. Eng.
Sr. Foundations Engineer

APPENDIX



RECORD OF BOREHOLE No 9

8

W P 157-75-03 LOCATION Coords. N 15,828,140; E 950,880 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE H.S. Auger, NX Casing, BXL Rock Core and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE July 8, 1976 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								SHEAR STRENGTH			WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								W _p W W _L			10 20 30		
462.0	Ground Level														GR SA SI CL						
0.0	Heterogeneous Mixture of Clayey Silt With Sand and Occasional Gravel (Glacial Till) Hard Brown Grey		1	SS	38	↓	460								0 16 54 30						
			2	SS	47																
			3	SS	109																
			4	SS	49		450														
			5	SS	39																
			6	SS	74																
437.5	Sound Shale Interbedded With Limestone						440								2 20 52 26						
24.5			7	RC BXL	100% Rec																
431.7	End of Borehole																				
30.3																					

+³, x⁵ : Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 11

9

W P 157-75-03 LOCATION Coords. N 15,828,055; E 950,965 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE June 22, 1978 CHECKED BY ep

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
462.8	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt With Sand and Some Gravel		1	SS	10		460							7 23 45 25
			2	SS	48									
	Brown Grey (Glacial Till)		3	SS	20		450							15 24 42 19
	Stiff to Hard		4	SS	11									
			5	SS	25									
			6	SS	29									
			7	SS	85		440							7 21 45 27
437.0			8	SS	110	4"								
25.8	Weathered													
27.0	Sound Shale Interbedded With Limestone		9	RC BXL	100% Rec									RQD = 46%
431.5														
31.3	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 12

10

W P 157-75-03 LOCATION Coords. N 15,828,256; E 951,024 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 21, 1978 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
391.5	Ground Level													
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	35		390							47 41 10 2
384.0	Compact to Dense		2	SS	29									61 20 15 4
7.5	Weathered		3	SS	50		380							
376.5			4	SS	88									
15.0	Sound, Shale Interbedded With		5	RC	100%									RQD = 35%
371.3	Limestone			BXL	Rec									
20.2	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 13

11

W P 157-75-03 LOCATION Coords. N 15,828,192; E 951,085 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 22, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES						
390.9	Ground Level										
0.0	Sand and Gravel		1	SS	26		390				62 25 10 3
384.9	Trace of Clay and Silt Compact		2	SS	103						
6.0			3	SS	105	6"					
			4	SS	116	4"					
376.1	Weathered						380				
14.8	Sound, Shale		5	RC	100%						RQD = 44%
371.9	Interbedded With Limestone			BXL	Rec						
19.0	End of Borehole										

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 14

12

W P 157-75-03 LOCATION Coords. N 15,828,442; E 951,219 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE June 8, 1978 CHECKED BY *JP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y	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							
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	x LAB VANE						
393.7	Ground Level														GR SA SI CL
0.0	Sand and Gravel Trace of Clay and Silt Compact to Dense		1	SS	19		390								41 41 14 4
			2	SS	53										36 42 17 5
382.2			3	SS	13										
11.5			4	SS	100%	6"	380								
			6	RC BXL	50% Rec										RQD = 100%
373.2	Weathered		7	RC BXL	39% Rec										RQD = 0%
20.5	Sound Shale Interbedded With Limestone		8	RC BXL	100% Rec		370								RQD = 28%
			9	RC	100%										RQD = 21%
365.7			10	RC	100%										RQD = 71%
28.0	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 15

13

W P 157-75-03 LOCATION Coords. N 15,828,380; E 951,281 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE June 8, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
391.6	Ground Level													
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	19		390							48 27 19 6
	Compact to Dense		2	SS	22									43 34 16 7
379.6			3	SS	56									
12.0			4	SS	100%	4"	380							25 15 49 11
375.8	Weathered		5	BXL	70% Rec									
15.8	Sound Shale Interbedded With Limestone		6	RC BXL	100% Rec									RQD = 25%
370.9														
20.7	End of Borehole													

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



RECORD OF BOREHOLE No 16

14

W P 157-75-03 LOCATION Coords. N 15,828,584; E 951,332 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 12, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
404.4	Ground Level										
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	44		400				13 24 44 19
393.4			2	SS	100/	4"					
11.0			3	SS	100/	1"					
			4	SS	100/	5"					
			5	SS	100/	4"					
	Weathered		6	SS	150/	3"					
			7	SS	100/	3"					
378.4							380				
26.0	Sound, Shale		8	RC	100%						RQD = 40%
374.4	Interbedded With Limestone			BXL	Rec						
30.0	End of Borehole										

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 17

15

W P 157-75-03 LOCATION Coords. N 15,828,538; E 951,378 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 13, 1978 CHECKED BY *GP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L		
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT (%) 10 20 30			
398.6	Ground Level												
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Stiff to Hard		1	SS	12							0 9 66 25	
			2	SS	29								
388.6			3	SS	65								
10.0			4	SS	105		6"						
	Weathered		5	SS	100		5"						
			6	SS	140		3"						
374.6													
24.0	Sound, Shale Interbedded With Limestone		7	RC BXL	100% Rec							RQD = 55%	
369.6													
29.0	End of Borehole												

+³, x⁵: Numbers refer to
Sensitivity



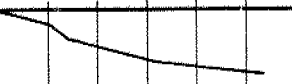


20
15 - 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 18

16

W P 157-75-03 LOCATION Coords. N 15,828,492; E 951,425 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone COMPILED BY C.P.
DATUM Geodetic DATE June 12, 1978 Test CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
389.7	Ground Level														
0.0	Sand and Gravel		1	SS	25		380		○						66 21 10 3
383.2	Trace of Silt and Clay, Compact		2	SS	124/										
6.5	Weathered		3	SS	100/	5"	370								RQD = 51%
374.7			4	RC BXL	75% Rec										RQD = 48%
15.0	Sound, Shale Interbedded With		5	RC	100%										
369.7	Limestone				BXL	Rec									
20.0	End of Borehole														

+3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 19

17

W P 157-75-03 LOCATION Coords. N 15,828,632; E 951,411 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 14, 1978 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						
404.8	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	100%	5"	400							32 34 27 7
394.3			2	SS	31									
10.5			3	SS	100%	5"								16 32 34 18
			4	SS	100%	5"								
	Weathered		5	SS	100%	4"	390							
384.8														
20.0	Sound, Shale Interbedded With Limestone		6	RC BXL	100% Rec		380							RQD = 68%
379.2														
25.6	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 20

18

W P 157-75-03 LOCATION Coords. N 15,828,572; E 951,472 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 13, 1978 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						
402.7	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	24		400							40 38 16 6
			2	SS	100/	5"								27 12 41 20
			3	SS	100/	6"								
390.2			4	SS	100/	6"								
12.5			5	SS	160/	4"								
	Weathered		6	SS	106/	5"								
377.7							380							
25.0	Sound, Shale Interbedded With		7	RC	100%									RQD = 71%
372.5	Limestone			BXL	Rec									
30.2	End of Borehole													

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 21

19

W P 157-75-03 LOCATION Coords. N 15,828,777; E 951,519 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 19, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
441.9	Ground Level												
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	28		440						4 19 49 28
			2	SS	30								
			3	SS	81								
			4	SS	61		430						12 28 40 20
424.9			5	SS	120/5"								
423.4	Weathered Sound, Shale Interbedded With Limestone												
18.5													
419.4			6	BXL	100% Rec		420						RQD = 0%
22.5	End of Borehole												

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 22

20

W P 157-75-03 LOCATION Coords. N 15,828,732; E 951,566 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 16, 1978 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						
441.1	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	37		440							23 16 41 20
			2	SS	46									0 28 52 20
			3	SS	66		430							
			4	SS	47									
	Boulders		5	SS	100	1"								
422.1			6	SS	123	6"								
19.0	Weathered						420							
416.4														
24.7	Sound, Shale Interbedded With		7	RC	100%									RQD = 59%
411.1	Limestone			BXL	Rec									
30.0	End of Borehole													

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 23

21

W P 157-75-03 LOCATION Coords. N 15,828,688; E 951,614 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone Test COMPILED BY C.P.
DATUM Geodetic DATE June 16, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
440.7	Ground Level										
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	33		440				15 18 46 21
			2	SS	48						
			3	SS	42		430				6 30 47 17
			4	SS	73						
			5	SS	116						
421.2			6	SS	100	4"	420				
19.5	Weathered										
415.7											
25.0	Sound, Shale Interbedded With Limestone		7	RC	100%						RQD = 41%
410.5				BXL	Rec						
30.2	End of Borehole										

+3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 24

22

W P 157-75-03 LOCATION Coords. N 15,828,887; E 951,622 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 21, 1978 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
454.2	Ground Level											
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	26							11 19 39 31
			2	SS	32							3 24 53 20
			3	SS	44							
			4	SS	41							
			5	SS	33							
	Very Stiff to Hard		6	SS	28							
			7	SS	50							10 31 50 19
422.2			8	SS	25							
32.0	Weathered		9	SS	130/6"							
415.2												
39.0	Sound, Shale Interbedded With Limestone		10	RC	100% Rec							RQD = 43%
410.2												
44.0	End of Borehole											

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



RECORD OF BOREHOLE No 25

23

W P 157-75-03 LOCATION Coords. N 15,828,850; E 951,676 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 19, 1978 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
451.4	Ground Level						450					
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	33							
			2	SS	36							
			3	SS	70							
	Hard		4	SS	50							
			5	SS	35							
			6	SS	54							
			7	SS	63							
419.4			8	SS	112							
32.0	Weathered		9	SS	100/2"							
410.4			10	SS	165/4"							
41.0	Sound, Shale Interbedded With Limestone		11	RC BXL	100% Rec							
405.2												RQD = 63%
46.2	End of Borehole											

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

RECORD OF BOREHOLE No 26

24

W P 157-75-03 LOCATION Coords. N 15,828,795; E 951,716 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core and Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 20, 1978 CHECKED BY *[Signature]*

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						
445.3	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	23		440							
			2	SS	22									
			3	SS	43									
			4	SS	31									
	Very Stiff to Hard		5	SS	31		430							9 34 42 15
422.3			6	SS	25									
23.0	Weathered		7	SS	100/6"		420							
415.3														
30.0	Sound, Shale Interbedded With		8	RC	100%									RQD = 45%
410.3	Limestone			BXL	Rec									
35.0	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 51

25

W P 157-75-03 LOCATION Co-ords. N 15 828 215; E 950 966 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 17, 1980 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
389.7	Ground Level																
0.0	Sand & Gravel Dense																
386.7	Trace of Silt		1	SS	125												
3.0	Weathered Shale		2	SS	125	6"											
382.7			3	SS	100	6"											
7.0																	
	Sound Shale with Limestone Layers		4	RC BXL	REC 20%		380										RQD 0%
			5	RC BXL	REC 100%												RQD 70%
			6	RC BXL	REC 67%												RQD 25%
368.9			7	RC BXL	REC 100%		370										RQD 75%
20.8	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 52

26

W P 157-75-03 LOCATION Co-ords N 15 828 145; E 951 023 ORIGINATED BY MM & GP
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY GP
 DATUM Geodetic DATE April 18, 1980 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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
390.0	Ground Level													GR SA SI CL
0.0	Glacial Till	Hard	1	SS	100/	5"								
387.0			2	SS	100/	5"								
3.0	Weathered Shale		3	SS	100/	2"								
383.0			4	SS	100/	2"								
7.0			5	SS	100/	1"								
	Sound Shale with Limestone Layers		6	RC	REC									RQD 35%
			7	BXL	70%									RQD 30%
			8	RC	100%	REC								RQD 100%
			9	RC	REC									
				9	BXL	90%								RQD 48%
366.0														
24.0	End of Borehole													

+³, x⁵: Numbers refer to
Sensitivity

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

RECORD OF BOREHOLE No 53

27

W P 157-75-03 LOCATION Co-ords. N 15 828 306; E 951 073 ORIGINATED BY MM & GP
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 17, 1980 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				
391.0	Ground Level															
0.0	Sand and Gravel Trace of Silt and Clay Compact		1	SS	25		390									50 26 20 4
384.0			2	SS	27											51 31 14 4
7.0	Glacial Till Hard		3	SS	48											
380.5			4	SS	101											
10.5	Weathered Shale		5	SS	100		380									
377.5			6	RC	25%											RQD = 0%
13.5	Sound Shale with Limestone Layers		7	RC	15%											RQD = 10%
			8	RC	20%											RQD = 60%
			9	BXL	90%		370									RQD = 80%
367.5																
23.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 54

28

W P 157-75-03 LOCATION Co-ords. N 15 828 235; E 951 140 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 17, 1980 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT Wp	NATURAL MOISTURE CONTENT W	LIQUID LIMIT Wl	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE
390.7	Ground Level																	
0.0	Sand and Gravel Trace of Silt and Clay		1	SS	21	↓	390											
			2	SS	20													
382.7	Compact		3	SS	44													
8.0	Weathered Shale		4	SS	100/		4"											
376.2			5	SS	100/		2"											
14.5	Sound Shale with Limestone Layers		6	RC	REC													
370.7				BXL	40%												RQD 25%	
20.0	End of Borehole																	

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



RECORD OF BOREHOLE No 55

29

W P 157-75-03 LOCATION Co-ords. N 15 828 420; E 951 192 ORIGINATED BY M.M.
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 16, 1980 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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80					
392.4	Ground Level															
0.0	Sand and Gravel		1	SS	36											
	Trace of Silt & Clay		2	SS	19											
	Compact to Dense		3	SS	33											
	Numerous Cobbles and		4	SS	22											
	Boulders		5	SS	79/											
378.2			6	SS	100/											
13.5	Weathered Shale															
374.4																
18.0	Sound Shale with		7	RC	REC											
	Limestone Seams			BXL	80%											RQD 45%
367.4																
25.0	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 56

30

W P 157-75-03 LOCATION Co-ords. N 15 828 350; E 951 254 ORIGINATED BY M.M.
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 16, 1980 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
389.1	Ground Level																
0.0	Sand and Gravel		1	SS	20												
	Trace of Silt and Clay		2	SS	39												
382.1	Compact to Dense Cobbles & Boulders		3	SS	32												
7.0	Glacial Till Hard		4	SS	100												
378.6			5	SS	100												
10.5	Weathered Shale		6	SS	100												
373.1																	
16.0	Sound Shale with Limestone Layers		7	RC BXL	REC 100%												RQD 80%
364.1	End of Borehole																
25.0																	

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 57

31

W P 157-75-03 LOCATION Co-ords. N 15 828 546; E 951 305 ORIGINATED BY M.M.
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 16, 1980 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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
404.9	Ground Level																GR SA SI CL
0.0	Heterogeneous Mixture Clayey Silt, Sand and Gravel Glacial Till		1	SS	23												
398.4	Hard		2	SS	90%												
6.5	Weathered Shale and Limestone Layers 4" - 6" Thick Alternating Layers of Glacial Till 5" - 24" Thick		3	BXL	30%	10"											
			4	RC	REC												
			5	BXL	80%												
			6	RC	90%	REC											
385.9			7	SS	30%	3"											
19.0	Sound Shale Bedrock with Limestone Layers		8	BXL	100%												RQD 80%
374.9																	
30.0	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

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



RECORD OF BOREHOLE No 58

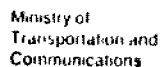
32

W P 157-75-03 LOCATION Co-ords. N 15 828 462; E 951 366 ORIGINATED BY M.M.
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 16, 1980 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH					WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE	W _p	W	W _L			
390.5	Ground Level																
0.0	Sand & Gravel		1	SS	24		390										
383.5	Trace of Silt & Clay Compact With Organic Inclusions		2	SS	15												
381.0	Glacial Till Hard		3	SS	45												
9.5	Weathered		4	SS	167/		9"	380									
			5	SS	100/		5"										
			6	SS	100/		3"										
371.0	Shale Bedrock with Limestone Layers																
19.5	Sound	7	RC BXL	REC 80%		370										RQD 50%	
365.5																	
25.0	End of Borehole																

+³, x⁵: Numbers refer to
Sensitivity

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



DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

Q1P

PROPERTY _____ W.P. 157-75-03
LOCATION _____ Hwy. 403 and Credit River

LATITUDE _____
DEPARTURE _____
BEARING _____

	90°
TOTAL FOOTAGE	

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY Z. Kuniuszy

[illegible]

DATE OF EXAMINATION _____

08 - MY - 113



□ □ □

ELEV. COLLAR

DATUM

DATE STARTED

DATE COMPLETED

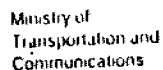
DRILLED BY

LOGGED BY

TOTAL FOOTAGE	

DATE OF EXAMINATION

UB - NT - 443



QEP

FILE NO. 100-441100-100

PROPERTY LOCATION W.P. 157-75-03
Hwy. 403 and Credit River

LATITUDE
DEPARTURE
BEARING

TOTAL FOOTAGE

ELEV. COLLAR
DATUM
DATE STARTED
DATE COMPLETED
DRILLED BY
LOGGED BY

[illegible]

DATE OF EXAMINATION

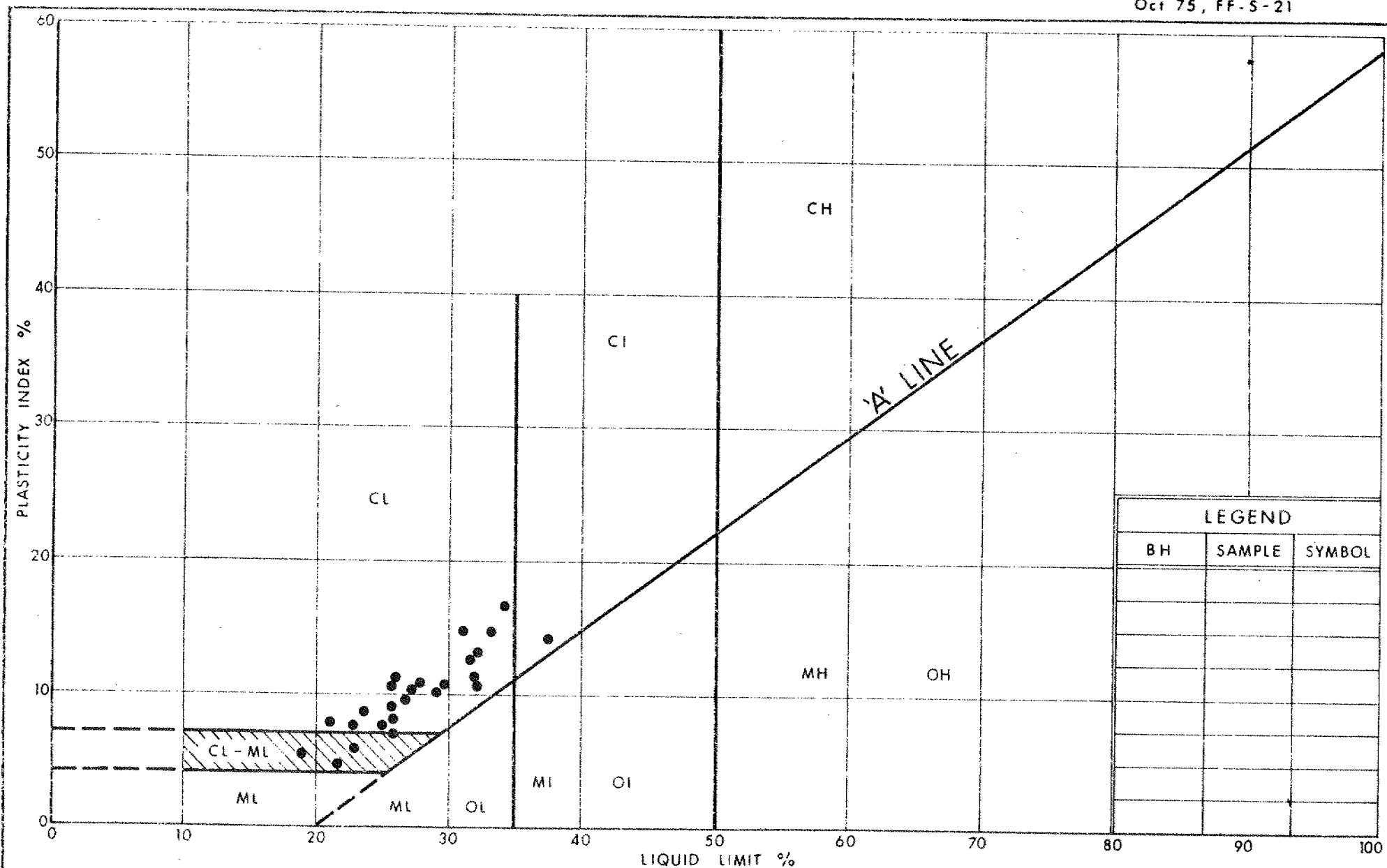
DB - 47 - 113



GRAIN SIZE DISTRIBUTION

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

W P 157-75-03



Ontario

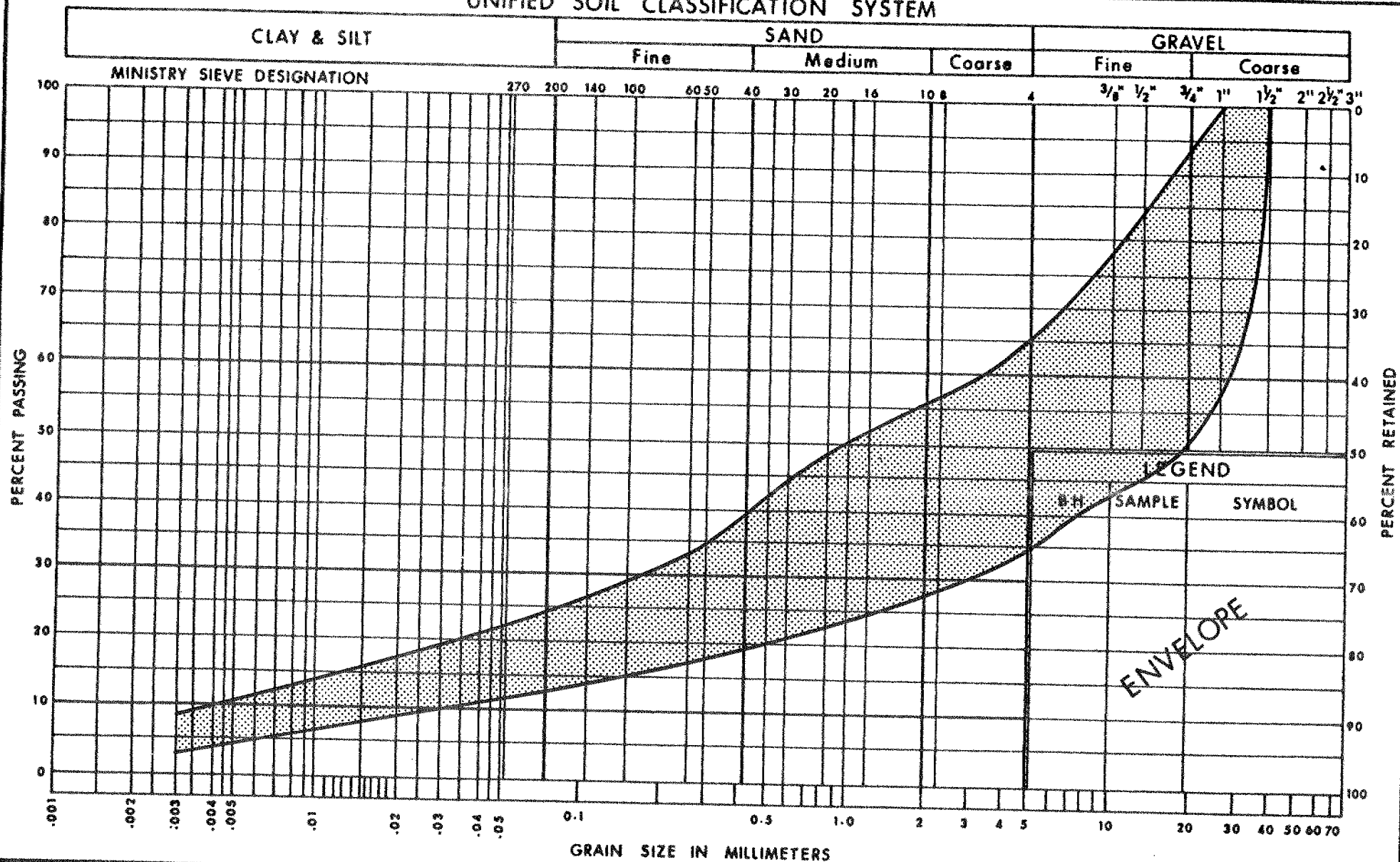
Ministry of
Transportation and
Communications

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

FIG No 2

W P 157-75-03

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SAND & GRAVEL, TRACE OF SILT & CLAY

FIG No 3

W P 157-75-03

9, 11
21, 23

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

COUT 81-39

WP 157-75-03

DIST 6

HWY 403

STR SITE 24-222

Credit River Bridge

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SAMPLE DISPOSITION NOTICE

TYPE	DISCARD AFTER	RECOMM. BY
JARS	28 D 15	MDA
TUBES	-	-
ROCK CORES	The remainder of 100%	MA

FOUNDATION INVESTIGATION REPORT

For

Credit River Bridge
W.P. 157-75-03, Site 24-222
Hwy. 403, District 6, Toronto

INTRODUCTION

This report contains the results of the foundation investigations carried out by the Soil Mechanics Section at the site of the above mentioned project on July 8, 1976 and also during the period of June 8, 1978 to June 22, 1978. The earlier investigation was done for feasibility study purposes and consisted of one sampled borehole advanced by augering and diamond drilling techniques to a depth of 30 feet below the ground surface. In the later investigation, a total of 16 sampled boreholes were put down by means of an auger machine equipped with hollow stem continuous flight augers and solid stem augers. The borings ranged in depth from 19 to 46 feet below the ground surface. In addition, bedrock was proven by obtaining BXL size rock core.

SITE AND GEOLOGY

The site is located about 1½ miles south of Eglinton Avenue and about 250 feet east of Mississauga Road in the City of Mississauga, Regional Municipality of Peel.

At this site the Credit River is winding from north to south and has eroded a valley which is about 1100 feet wide from crest to crest and about 70 feet deep. The sides of the valley are found to be as steep as 1½:1 with the steep faces being on the concave side of the river. In certain locations subsoil strata and bedrock formations are exposed on the sides of the valley. The tableland on either side of the valley is relatively flat, being gently sloping down towards the south.

Physiographically the site is situated in the border region of "Peel Plains" and "South Slope". The predominant deposit in this area is known to be a cohesive glacial till. The underlying bedrock is a shale of the Dundas-Meaford formation.

SUBSURFACE CONDITIONS

General

The overburden has a thickness of up to 32 feet in the tableland bordering the valley, but it diminishes to 6 to 11 feet thick at the valley floor. The overburden at this site generally consists of a glacial till composed of clayey silt, some sand and gravel. However, in the valley floor the Credit River has eroded the glacial till and the upper portion of the bedrock and redeposited a sand and gravel with trace of silt and clay. Across the site, the overburden is underlain by shale bedrock.

Factual data on the subsoil conditions is shown on the Borehole Record Sheets. The locations and elevations of the borings, together with the estimated stratigraphical profile and sections, are shown on Drawing No. 1577503-A. A description of the subsoil and bedrock conditions is given below.

Glacial Till

This deposit is encountered on the tableland on either side of the valley and has a thickness of up to 32 feet. It is composed of a heterogeneous mixture of clayey silt, sand and gravel. Typical grain size distribution curves of the material from this deposit are shown in an envelope form on Figure 1. Geotechnical identity indices of the glacial till as determined from laboratory testing are summarized below.

		<u>Range</u>
Natural Moisture Content (W)	%	9-12
Liquid Limit	(W _L) %	19-38
Plastic Limit	(W _p) %	13-23

The results of the Atterberg Limit Testing are also plotted on the Plasticity Chart, Figure 2, which indicate the glacial deposit is cohesive with a low to medium plasticity.

The Standard Penetration Test 'N' values ranged from 10 blows to over 100 blows per foot, generally increasing with depth, indicating that the consistency of the glacial till varies from stiff to hard, but generally hard.

Sand and Gravel, Trace of Clay and Silt

This flood plain deposit was encountered in the river valley. It appears to be confined to areas below contour 392.0 and extends to bedrock for a thickness of 6 to 11 feet. This deposit is alluvial in origin and is composed of sand and gravel with a trace of clay and silt. Typical grain size distribution of the material in this deposit is shown in an envelope form on Figure 3. However, in certain locations the matrix (material passing sieve #40) exhibits slight plasticity. The Standard Penetration Test 'N' values varying randomly from 13 to 53 blows per foot indicate that this deposit has a compact to very dense relative density.

Bedrock (Shale Interbedded With Limestone)

Bedrock was encountered at elevation 437 on the west bank of the valley, at elevation 380 to 395 in the valley floor, and at elevation 420 to 425 on the east bank of the valley. Bedrock may be described as shale interbedded with limestone. The shale is soft to medium hard, somewhat fissile and weathered in the upper portion. The depth of weathering was found to be one to two feet on the west bank of the valley and up to 10 feet on the east bank of the valley. However, in the valley the weathered bedrock was up to 8 to 15 feet thick. The recovery ratio is high, generally close to 100%. However, the average RQD was found to be in the order of 30% to 50%, suggesting the shale is a poor quality rock.

Groundwater Conditions

The groundwater levels were observed by measuring in the open boreholes during and immediately after the field investigation. The groundwater levels were found to vary as high as elevation 454 (on the tableland) and as low as elevation 385 to elevation 388 (in the valley floor), generally constituting a hydraulic gradient towards the river. Since the water level in the Credit River was at elevation 390, which was higher than some of the observed water levels in the boreholes, it is believed that the water levels in the boreholes probably were not stabilized during the period of observation.

DISCUSSION AND RECOMMENDATIONS

The proposed Hwy. 403 crosses the Credit River approximately $1\frac{1}{2}$ miles south of Eglinton Avenue in the City of Mississauga. At this location, the Credit River has eroded a valley some 1100 feet wide and 70 feet deep. Four structural schemes have been proposed to span Hwy. 403 over this valley. The four alternative schemes will have the same profile grade which has been set at about elevation 460 at the river crossing.

Our recommendations for the respective structure foundations and related approaches are as shown on the following pages.

It should be noted that if the six span twin structure scheme is adopted, a supplementary investigation will be required. This investigation can only be initiated once the preliminary design drawings with the exact location of the footings are available. In all cases for footings and pile caps there should be a minimum of 4 feet of earth cover for frost protection purposes. The lateral forces on the foundations can be resisted either by batter piles in the case of piled foundations or by frictional resistance on the underside of the spread footings. To estimate the frictional force a coefficient of friction of 0.5 can be assumed if the footing is founded on shale bedrock, or an adhesion of 2000 psf. if the footing is founded on the cohesive glacial till stratum.

Temporary dewatering measures may be required for the construction of the pier footings within the valley floor in order to place the concrete in a relatively dry condition. However, for the construction of the abutment footings no dewatering problems are anticipated since these footings will be situated in a cohesive subsoil above the prevailing groundwater level.

As an alternative the entire structure elements for any of the above schemes can be supported on caissons into the sound shale bedrock. The capacity of such caisson foundations can only be determined depending upon the diameter of the caisson, depth of embedment in the overburden and the extent of socketing into the bedrock. It may be necessary to install temporary protective steel liners within the overburden and below the rock surface in order to eliminate seepage into the caissons. For preliminary estimating purposes it can be assumed that a 48" ϕ concrete

A

THREE SPAN TWIN STRUCTURES

<u>Footing Element</u>	<u>Station Approximate ϕ Bearing</u>	<u>Reference Boreholes</u>	<u>Recommendations</u>
West Abutment	1018+60	9, 11	Spread footings in glacial till at or below elev. 450 with an allowable bearing pressure up to 3 tsf or alternately on end-bearing steel 'H' piles driven into the weathered bedrock (estimated tip elevation 435)
West Pier	1020+40	12, 13	Spread footings within the bedrock. Allowable bearing pressure up to 5 tsf at or below elev. 384 and 10 tsf at or below elev. 377
East Pier	1023+10	14, 15	Spread footings within the bedrock. Allowable bearing pressure up to 5 tsf at or below elev. 380 and 10 tsf at or below elev. 373
East Abutment	1024+90	16, 17, 18	Abutment perched in the approach fills supported on end-bearing steel 'H' piles driven into the shale bedrock (estimated tip elev. 392 at the north limits and 383 at the south limits) Pile capacity depends on the particular section chosen.

B
FOUR SPAN TWIN STRUCTURE

<u>Footings Element</u>	<u>Approximate Footing Ø Bearing</u>	<u>Reference Boreholes</u>	<u>Recommendations</u>
West Abutment	1018+60	9, 11	Same as for the three span scheme
West Pier	1020+40	12, 13	Same as for the three span scheme
Center Pier	1023+10	14, 15	Same as for the east pier in the three span scheme
East Pier	1025+80	19, 20	Spread footings in the glacial till at or below elev. 398 with an allowable bearing pressure up to 4 tsf or spread footings within the bedrock with an allowable bearing pressure up to 5 tsf at or below elev. 393 at the north limits and elev. 390 at the south limits.
East Abutment	1027+60	21, 22, 23	Spread footings within the glacial till at or below elev. 435 with an allowable bearing pressure up to 3 tsf or on end-bearing steel 'H' piles driven into bedrock (estimated tip elev. 421)

C
FIVE SPAN TWIN STRUCTURE

<u>Footing Element</u>	<u>Approximate Footing Ø Bearing</u>	<u>Reference Boreholes</u>	<u>Recommendations</u>
West Abutment	1018+60	9, 11	Same as for four span scheme
Pier #1	1020+40	12, 13	Same as for west pier in the four span scheme
Pier #2	1023+10	14, 15	Same as for center pier in the four span scheme
Pier #3	1025+80	19, 20	Same as for east pier in the four span scheme
Pier #4	1027+60	21, 22, 23	Same as for east abutment in the four span scheme
East Abutment	1029+10	24, 25, 26	Spread footings within the glacial till at or below elev. 451 at the north limits and elev. 441 at the south limits with an allowable bearing pressure up to 3 tsf. Alternatively on end-bearing steel 'H' piles driven into bedrock (estimated tip elev. 420)

D

SIX SPAN TWIN STRUCTURE

<u>Footing Element</u>	<u>Approximate Footing Ø Bearing</u>	<u>Recommendations</u>
West Abutment	1018+30	Same as for five span scheme
Pier #1	1019+50	Same as for pier #1 in the five span scheme
Pier #2	1021+10	Same as for pier #1 in the five span scheme
Pier #3	1022+70	Same as for pier #2 in the five span scheme
Pier #4	1024+30	Same as for east abutment in the three span scheme
Pier #5	1025+90	Same as for pier #3 in the five span scheme
East Abutment	1027+10	Same as for pier #4 in the five span scheme

caisson extended at least 3 feet into the sound shale bedrock should provide a safe design load of 400 tons per caisson. It should be noted that the depth of the embedment into the bedrock should be based on the magnitude of the vertical uplift and also the lateral resistance requirements. These aspects can only be discussed in detail once the design details become available. To minimize dewatering requirements for pier footings in the river valley, it may be advantageous to extend these large diameter concrete caissons to the underside of the deck of the high level bridge.

Approaches

The west approach will require fills up to 8 feet in height, whichever scheme is adopted. The overall slope of the valley, including this additional fill, will be stable provided the new fill is constructed with 2:1 slopes.

Depending on which alternative scheme is chosen, the east approach may require fills up to 60 feet in height. In order to ensure stability these fills should be constructed in accordance with the following recommendations:

- Fills up to 30 feet in height can be constructed with a 2:1 slope
- Fills in excess of 30 feet and up to 60 feet in height should be constructed with mid-height counter-balancing berms. The berming requirement is shown below in Figure A.

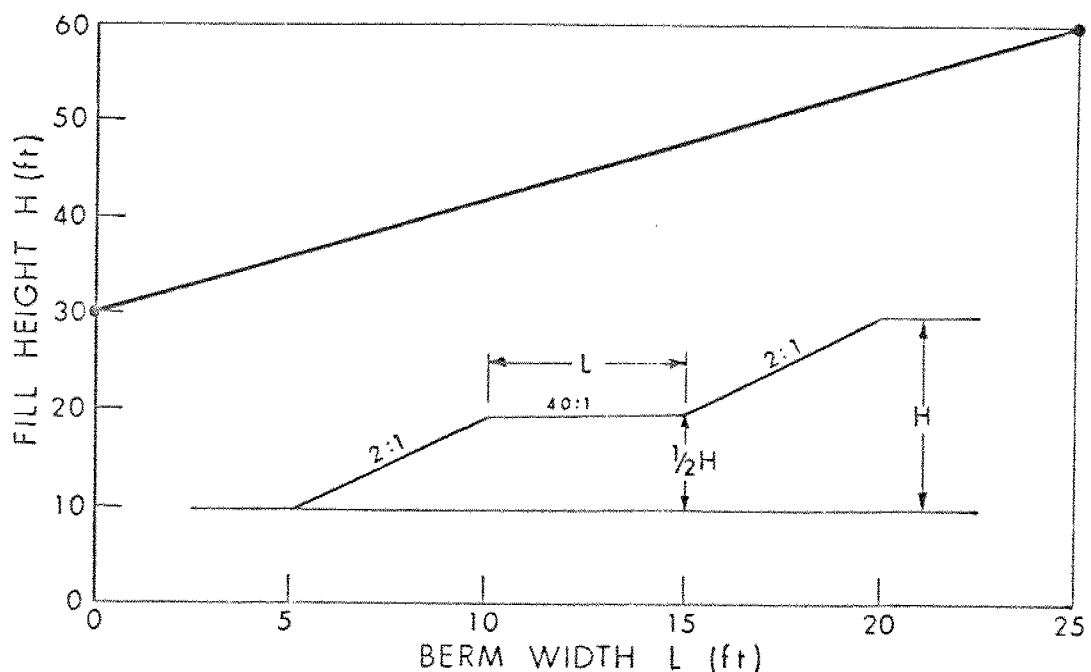


Figure A

- Prior to placing the fills, the existing slopes should be benched and the topsoil should be stripped as per current MTC practices.

It should be noted that the above mentioned recommendations were based on the assumption that locally available glacial till material (bulk unit weight $\gamma = 140$ pcf) will be used for embankment construction.

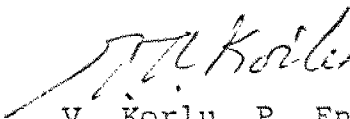
It is estimated that settlements in the order of 7 to 10 inches can be estimated within the embankment due to its own weight. In order to minimize post construction maintenance problems due to settlements within the fill material, it is desirable to place these high fills well in advance of the paving operations. To prevent negative skin frictional forces on the east abutment piles it is recommended that these high fills should be constructed and left in place for a minimum period of 3 months.

Related Considerations


If the abutments are relatively rigid then a coefficient of earth pressure at rest (k_0) of 0.5 should be assumed to estimate the earth pressure. However, if some movement at the top of the abutment wall is permitted, then a coefficient of active pressure (K_a) of 0.33 can be used. In order to relieve the build-up of excess hydrostatic pressure behind the abutment wall, free draining granular material should be used as backfill and suitable drainage measures should be provided.

MISCELLANEOUS

The fieldwork was carried out under the supervision of Mr. V. Korlu. This report was prepared by Mr. V. Korlu and Mr. B. Ly and was reviewed by Mr. M. Devata.


V. Korlu, P. Eng.
Project Engineer




M. Devata, p. Eng.
Supervising Engineer

September, 1978

FIELD AND LABORATORY WORK

The subsoil investigation was performed at this site in two stages by carrying out 17 sampled boreholes. Wherever possible, the boreholes were accompanied by a dynamic cone penetration test. The borings were advanced by a continuous flight auger machine (commercially known as C.M.E. 55, H.S.M.V.) adapted for soil sampling purposes.

Samples of the overburden were obtained in a 2" O.D. split-spoon sampler at required depths. The samples were hammered into the soil according to the specifications of the Standard Penetration Test. Bedrock was proven in boreholes by obtaining BXL size rock core samples.

Groundwater level observations were carried out during the time of the investigation in the open boreholes. The soil, bedrock and groundwater conditions encountered at the borehole locations are presented in the Record of Borehole Sheets. The locations and elevations of the various boreholes were provided by personnel from Construction Office, Central Region. The elevations in this report are referred to a geodetic datum. Boring locations and elevations are shown on Drawing No. 1577503-A. All samples were subjected to careful visual examinations in the field and subsequently in the laboratory. Following this examination, laboratory tests were carried out on selected representative samples to determine the physical properties of the various soil types encountered, namely:

- Natural Moisture Content

- Atterberg Limit

- Grain Size Distribution

The results of this testing are plotted on the Record of Borehole Sheets and summarized on Figure 1 to 3, all contained in the Appendix of this report.

APPENDIX



Highway Engineering Division
Materials Office - Soil Mechanics Section

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9

W P 157-75-03 LOCATION Coords. N 15,828,140; E 950,880 ORIGINATED BY V.K.
 DIST 6 HWY 403 BOREHOLE TYPE H.S. Auger, NX Casing, BXL Rock Core and COMPILED BY V.K.
 DATUM Geodetic DATE July 8, 1976 Cone Test CHECKED BY CP.

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					
462.0	Ground Level																GR SA SI CL
0.0	Heterogeneous Mixture of Clayey Silt With Sand and Occasional Gravel (Glacial Till) Hard	Brown Grey	1	SS	38		460										0 16 54 30
			2	SS	47												
			3	SS	109												
			4	SS	49		450										2 20 52 26
			5	SS	39												
			6	SS	74		440										
437.5																	
24.5	Sound Shale Interbedded With		7	RC	100%												
431.7	Limestone			BXL	Rec												
30.3	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



Highway Engineering Division
Materials Office - Soil Mechanics Section

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 11

W P 157-75-03 LOCATION Coords. N 15,828,055; E 950,965 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core COMPILED BY G.E.
DATUM Geodetic DATE June 22, 1978 CHECKED BY *ep*

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					
462.8	Ground Level																GR SA SI CL
0.0	Heterogeneous Mixture of Clayey Silt With Sand and Some Gravel		1	SS	10		460										7 23 45 25
			2	SS	48												15 24 42 19
	Brown Grey (Glacial Till)		3	SS	20												7 21 45 27
			4	SS	11		450										
	Stiff to Hard		5	SS	25												
			6	SS	29												
			7	SS	85		440										
437.0			8	SS	100												
25.8	Weathered																
27.0	Sound		9	RC	100%												RQD = 46%
431.5	Shale Interbedded With Limestone			BXL	Rec												
31.3	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION



Highway Engineering
Division - Engineering Materials Office - Soil Mechanics Section

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 12

W P 157-75-03 LOCATION Coords. N 15,828,256; E 951,024 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone COMPILED BY G.P.
DATUM Geodetic DATE June 21, 1978 Test CHECKED BY [Signature]

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			SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										WATER CONTENT (%) 10 20 30
391.5	Ground Level																	
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	35		390											47 41 10 2
384.0	Compact to Dense		2	SS	29												61 20 15 4	
7.5	Weathered		3	SS	50													
376.5			4	SS	88													
15.0			Sound, Shale Interbedded With Limestone	5	RC BXL		100% Rec											RQD = 35%
371.3																		
20.2	End of Borehole																	

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



Highway Engineering Division
and
Subdivisions

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 13

W.P. 257-75-03 LOCATION Coords. N 15,828,192; E 951,085 ORIGINATED BY V.K.
 DIST. 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone Test COMPILED BY G.P.
 DATUM Geodetic DATE June 22, 1978 CHECKED BY JP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
390.9	Ground Level															
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	26											
384.9	Compact		2	SS	103											
6.0			3	SS	105	6"										
			4	SS	116	4"										
376.1	Weathered															
14.8	Sound, Shale		5	RC	100%											
371.9	Interbedded With Limestone			BXL	Rec											RQD = 44%
19.0	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 14

W P 157-75-03 LOCATION Coords. N 15,828,442; E 951,219 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE June 8, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT γ					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
393.7	Ground Level																
0.0	Sand and Gravel Trace of Clay and Silt Compact to Dense		1	SS	19		390										41 41 14 4
			2	SS	53												
			3	SS	13												36 42 17 5
382.2			4	SS	100%												
11.5			5	SS	110%		380										RQD = 100%
			6	RC BXL	50% Rec												RQD = 0%
373.2	Weathered		7	RC BXL	39% Rec												RQD = 28%
20.5	Sound Shale Interbedded With Limestone		8	RC BXL	100% Rec		370										RQD = 21%
			9	RC	100%												RQD = 71%
365.7			10	RC	100%												
28.0	End of Borehole																



Highway Engineering Division
Transportation and
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 15

W P 157-75-03 LOCATION Coords. N 15,828,380; E 951,281 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE June 8, 1978 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
391.6	Ground Level																
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	19		390										48 27 19 6
	Compact to Dense		2	SS	22												43 34 16 7
379.6			3	SS	56												
12.0			4	SS	100%	4"	380										25 15 49 11
375.8	Weathered		5	BXL	70% Rec												
15.8	Sound Shale Interbedded With Limestone		6	RC BXL	100% Rec												RQD = 25%
370.9																	
20.7	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 16

W P 157-75-03 LOCATION Coords. N 15,828,584; E 951,332 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY C.P.
DATUM Geodetic DATE June 12, 1978 CHECKED BY SP.

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					
404.4	Ground Level																GR SA SI CL
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	44		400										13 24 44 19
393.4			2	SS	100/	4"											
			3	SS	100/	1"											
11.0			4	SS	100/	5"											
	Weathered		5	SS	100/	4"	390										
			6	SS	150/	3"											
378.4			7	SS	100/	3"	380										
26.0	Sound, Shale		8	RC	100%												RQD = 40%
374.4	Interbedded With Limestone			BXL	Rec												
30.0	End of Borehole																



Ministry of
Transportation and
Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 17

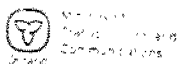
W P 157-75-03 LOCATION Coords. N 15,828,538; E 951,378 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 13, 1978 CHECKED BY [Signature]

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
398.6	Ground Level																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Stiff to Hard		1	SS	12												0 9 66 25
			2	SS	29												
388.6			3	SS	65												
10.0			4	SS	105	6"											
	Weathered		5	SS	100	5"											
			6	SS	140	3"											
374.6																	
24.0	Sound, Shale Interbedded With Limestone		7	RC	100%												RQD = 55%
369.6				BXL	Rec												
29.0	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 18

W P 157-75-03 LOCATION Coords. N 15,828,492; E 951,425 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone COMPILED BY G.P.
DATUM Geodetic DATE June 12, 1978 Test CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT Σ					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
389.7	Ground Level																
0.0	Sand and Gravel		1	SS	25												
383.2	Trace of Silt and Clay, Compact		2	SS	124	11"											66 21 10 3
6.5	Weathered		3	SS	100	5"											10 10 55 25
374.7			4	RC BXL	75% Rec		380										RQD = 51%
15.0	Sound, Shale		5	RC	100%												
369.7	Interbedded With Limestone			BXL	Rec		370										RQD = 48%
20.0	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

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15 \diamond 5 (%) STRAIN AT FAILURE



Ministry of
Transportation and
Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 19

W P 157-75-03 LOCATION Coords. N 15,828,632; E 951,411 ORIGINATED BY V.E.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 14, 1978 CHECKED BY [Signature]

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					
404.8	Ground Level																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	100/	5"	400							o			32 34 27 7
394.3			2	SS	31												
10.5			3	SS	100/	5"							o				16 32 34 18
384.8	Weathered		4	SS	100/	5"	390										
20.0			5	SS	100/	4"											
379.2	Sound, Shale Interbedded With Limestone		6	RC BXL	100% Rec		380										RQD = 68%
25.6	End of Borehole																

*3, *5: Numbers refer to
Sensitivity

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15 *5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



Ministry of
Transportation and
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 20

W P 157-75-03 LOCATION Coords. N 15,828,572; E 951,472 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 13, 1978 CHECKED BY [Signature]

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
402.7	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	24		400							40 38 16 6
			2	SS	100/	5"								
			3	SS	100/	6"								27 12 41 20
390.2			4	SS	100/	6"	390							
12.5			5	SS	160/	4"								
	Weathered		6	SS	106/	5"								
377.7							380							
25.0	Sound, Shale Interbedded With Limestone		7	RC BXL	100% Rec									RQD = 71%
372.5														
30.2	End of Borehole													

+3, x5; Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
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OFFICE REPORT ON SOIL EXPLORATION



Highway Engineering Division
Soil Investigation and
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 21

W P 157-75-03 LOCATION Coords. N 15,828,777; E 951,519 ORIGINATED BY V.K.
 DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
 DATUM Geodetic DATE June 19, 1978 CHECKED BY [Signature]

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					
441.9	Ground Level																GR SA SI CL
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	28		440										4 19 49 28
			2	SS	30												12 28 40 20
			3	SS	81												
			4	SS	61												
424.9			5	SS	120	5"											
423.4	Weathered																
18.5	Sound, Shale																
419.4	Interbedded With Limestone		6	RC BXL	100% Rec		420										RQD = 0%
22.5	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

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S (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



Highway Engineering Division
Engineering Materials Office - Soil Mechanics Section

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 22

W P 157-75-03 LOCATION Coords. N 15,828,732; E 951,566 ORIGINATED BY Y.K.
 DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY C.P.
 DATUM Geodetic DATE June 16, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
441.1	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	37		440							23 16 41 20
			2	SS	46									0 28 52 20
			3	SS	66		430							
			4	SS	47									
			5	SS	100	1"								
422.1	Boulders		6	SS	125	6"	420							
19.0	Weathered													
416.4														
24.7	Sound, Shale Interbedded With Limestone		7	RC	100%									RQD = 59%
411.1				BXL	Rec									
30.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION



Measurement
Transmittal and
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 23

W P 157-75-03 LOCATION Coords. N 15,828,688; E 951,614 ORIGINATED BY V.R.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 16, 1978 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					
440.7	Ground Level																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	33		440										15 18 46 21
			2	SS	48												6 30 47 17
			3	SS	42												
			4	SS	73												
			5	SS	116												
421.2			6	SS	100/	4"	420										
19.5	Weathered																
415.7																	
25.0	Sound, Shale		7	RC	100%												RQD = 41%
410.5	Interbedded With Limestone			BXL	Rec												
30.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
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Virginia Department of
Transportation
Communications

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 24

W P 157-75-03 LOCATION Coords. N 15,828,887; E 951,622 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 21, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
454.2	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	26		450							11 19 39 31
			2	SS	32									
			3	SS	44									
			4	SS	41									
	Very Stiff to Hard		5	SS	33		440							3 24 53 20
			6	SS	28									
			7	SS	50		430							
422.2			8	SS	25									10 31 50 10
32.0	Weathered		9	SS	110	6"	420							
415.2														
39.0	Sound, Shale Interbedded With Limestone		10	RC BXL	100% Rec									RQD = 43%
410.2														
44.0	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

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15 ϕ 5 (%) STRAIN AT FAILURE
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OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 25

W P 157-75-03 LOCATION Coords. N 15,828,850; E 951,676
 DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test
 DATUM Geodetic DATE June 19, 1978
 ORIGINATED BY V.K.
 COMPILED BY G.F.
 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		NUMBER	TYPE	VALUES			20	40	60					
451.4	Ground Level														
0.0	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		1	SS	33		450								
			2	SS	36										
			3	SS	70										
	Hard		4	SS	50		440								
			5	SS	35										
			6	SS	54										
			7	SS	63		430								
			8	SS	112										
419.4			9	SS	100/2"		420								
32.0	Weathered		10	SS	165/4"										
410.4															
41.0	Sound, Shale Interbedded with Limestone		11	RC BXL	100% Rec		410								
405.2															RQD = 63%
46.2	End of Borehole														



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HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

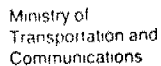
RECORD OF BOREHOLE No 26

W P 157-75-03 LOCATION Coords. N 15,828,795; E 951,716 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core and Cone COMPILED BY G.P.
DATUM Geodetic DATE June 20, 1978 Test 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					
445.3	Ground Level																GR SA SI CL
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	23		440										
			2	SS	22												
			3	SS	43												
			4	SS	31												
	Very Stiff to Hard		5	SS	31		430										9 34 42 15
			6	SS	25												
422.3			7	SS	100/6"		420										
23.0	Weathered																
415.3																	
30.0	Sound, Shale Interbedded With		8	RC	100%												RQD = 45%
410.3	Limestone			BXL	Rec												
35.0	End of Borehole																

+3, x5 : Numbers refer to
Sensitivity

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DIP

HOLE NO. _____ SHEET NO. _____

TOTAL FOOTAGE _____

ELEV. COLLAR _____

DATUM _____

DATE STARTED _____

DATE COMPLETED _____

DRILLED BY _____

LOGGED BY _____

DATE OF EXAMINATION _____



DIP

HOLE NO. _____ SHEET NO. 11

TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____



Communications

DIAMOND DRILL RECORD

01 户

HOLE NO. _____ SHEET NO. _____ 7

PROPERTY W.P. 157-75-03
LOCATION Hwy. 403 and Credit River

LATITUDE
DEPARTURE
BEARING

TOTAL FOOTAGE _____

ELEV. COLLAR _____

DATUM _____

DATE STARTED _____

DATE COMPLETED _____

DRILLED BY _____

LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____



PROPERTY
LOCATION

PROPERTY LOCATION Hwy. 403 and Credit River

L A T I T U D E

DEPARTURE

BEARING

BEARING

BEARING

DIP

TOTAL FOOTAGE

HOLE NO. _____ SHEET NO. _____

ELEV. COLLAR

DATUM

DATE STARTED

DATE COMPLETED

DRILLED BY

LOGGED BY

DATE OF EXAMINATION



Ministry of
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Communications

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

DIP

PROPERTY W.P. 157-75-03
LOCATION Hwy. 403 and Credit River

LATITUDE _____
DEPARTURE _____
BEARING _____

TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
Hole No. 22						
24'4"	29'1"	Shale dark grey, medium hard, partly fissile with two 2" limestone seams and numerous limestone lenses.				4" of core missing.
29'1"	30'0"	Limestone, light to grey, medium to coarse textured, hard, fossiliferous with thin seams of shale.				
Hole No. 23						
25'0"	25'6"	Shale, dark grey, medium hard				Core broken
25'6"	27'0"	Shale, dark grey, medium hard interbedded with grey, fine textured hard limestone.				
27'0"	27'9"	Shale, dark grey, medium hard, partly fissile.				
27'9"	29'0"	Shale, dark grey, medium hard, interbedded with grey, fine textured, medium hard shaly limestone.				
29'0"	32'2"	Limestone, light grey, coarse textured, hard fossiliferous with 2½" seam of dark grey shale.				28'7"-29'-11" - vertical fracture.

DATE OF EXAMINATION _____



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Ontario

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

DIP

PROPERTY LOCATION W.P. 157-75-03
Hwy. 403 and Credit River

LATITUDE _____
DEPARTURE _____
BEARING _____

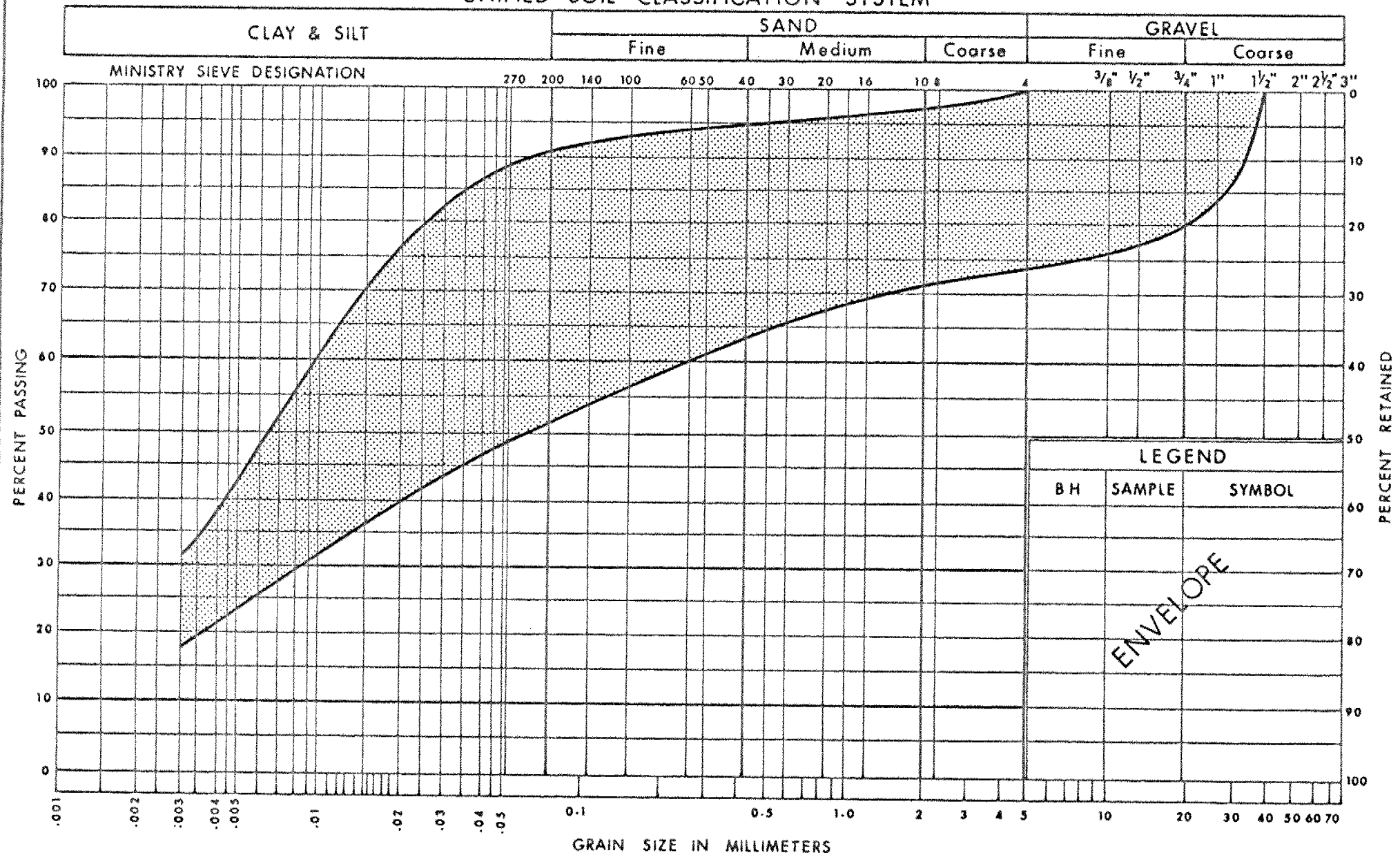
TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
		Hole No 25				
41'0"	45'5"	Shale, dark grey with reddish sections, medium hard with thin lenses of fine textured, hard limestone.				
45'5"	46'3"	Limestone, grey with reddish tint, fine textured, hard with 3" seam of reddish shale.				Vertical fracture through out limestone.
		Hole No 26				
30'0"	32'9"	Shale, dark grey, partly fissile with thin lenses of fine to medium textured grey shaly limestone.				
32'9"	33'2"	Limestone, grey, hard fossiliferous				
33'5"	33'11"	Limestone, grey, hard, fossiliferous				Core broken
33'11"	35'0"	Shale, dark grey, medium hard				

DATE OF EXAMINATION _____

UNIFIED SOIL CLASSIFICATION SYSTEM



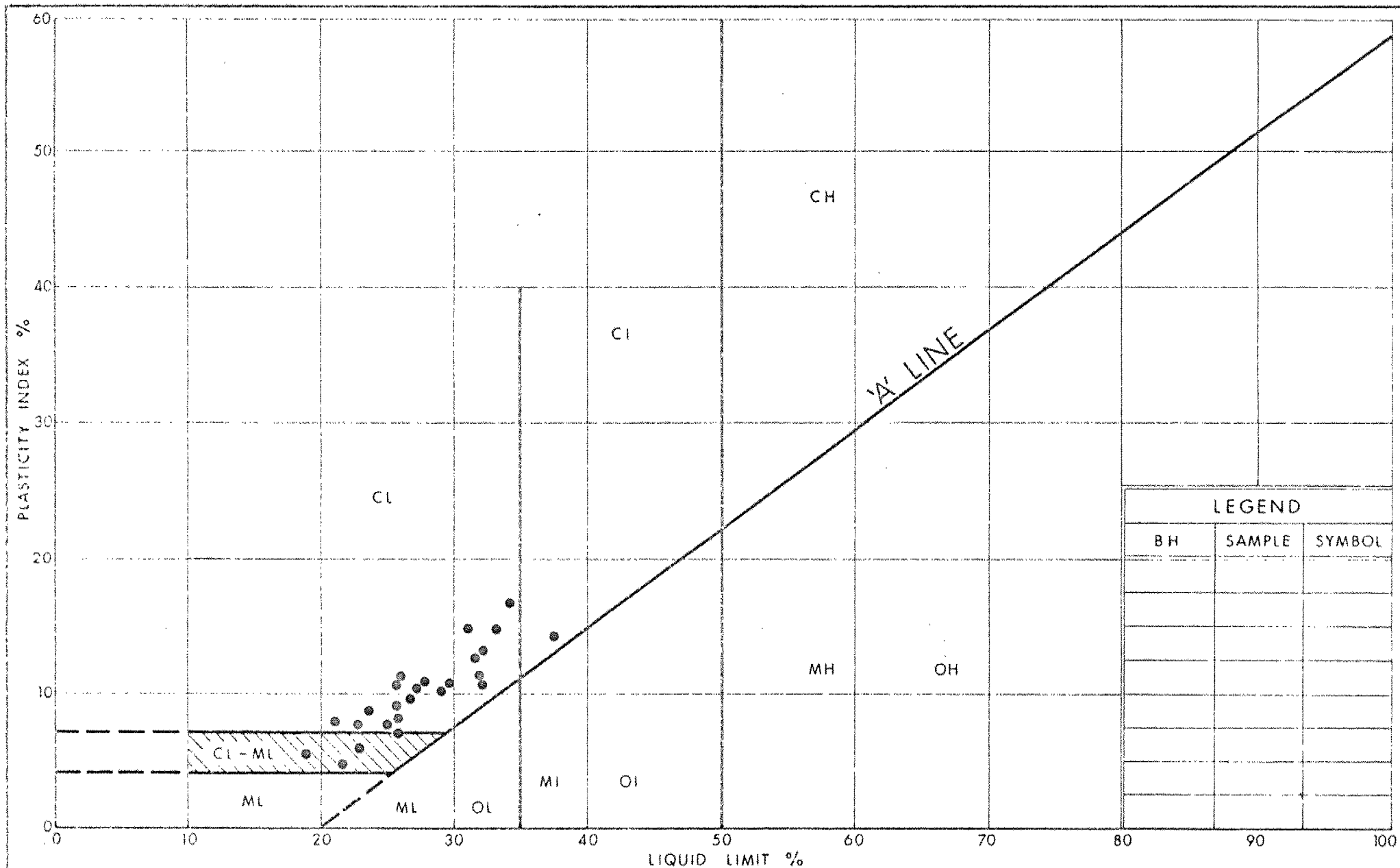
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

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

FIG No 1

W P 157-75-03



Ontario

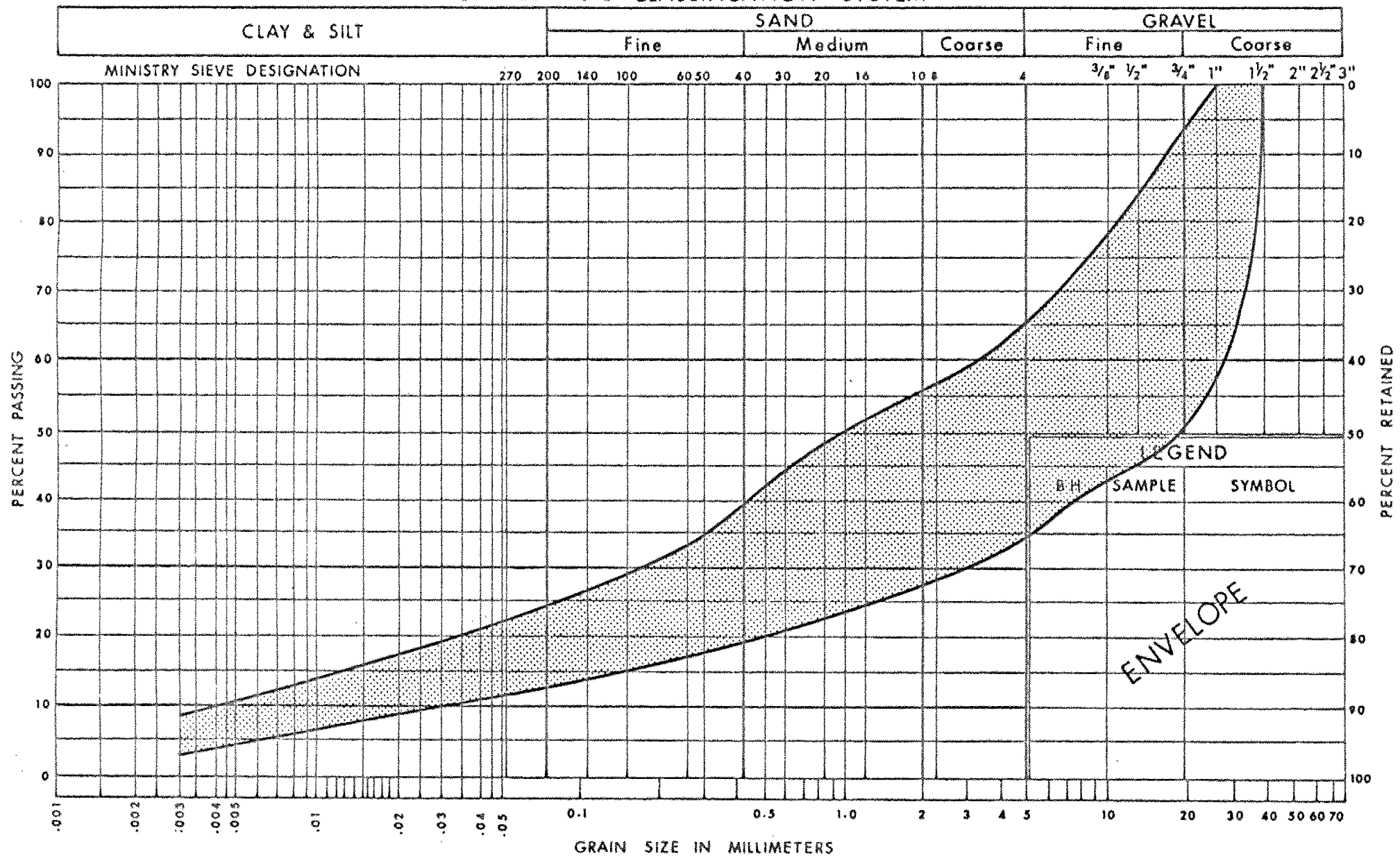
Ministry of
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Communications

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

FIG No 2

W P 157-75-03

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

 Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

SAND & GRAVEL, TRACE OF SILT & CLAY

FIG No 3

W P 157-75-03

EXPLANATION OF TERMS USED IN REPORT

'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" 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. CUU = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

SS SPLIT SPOON
WS WASH SAMPLE
ST SLOTTED TUBE SAMPLE
BS BLOCK SAMPLE
CS CHUNK SAMPLE
TW THINWALL OPEN
TP THINWALL PISTON
OS OSTERBERG SAMPLE
FS FOIL SAMPLE
RC ROCK CORE
PH T.W. ADVANCED HYDRAULICALLY
PM T.W. ADVANCED MANUALLY

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ 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-REARFACE OF WALL
 β ANGLE OF SLOPE
 N_c, N_q, N_γ 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_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 = $w_L - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{w_L - w_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w_p}{w_L - w_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ Soil Fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

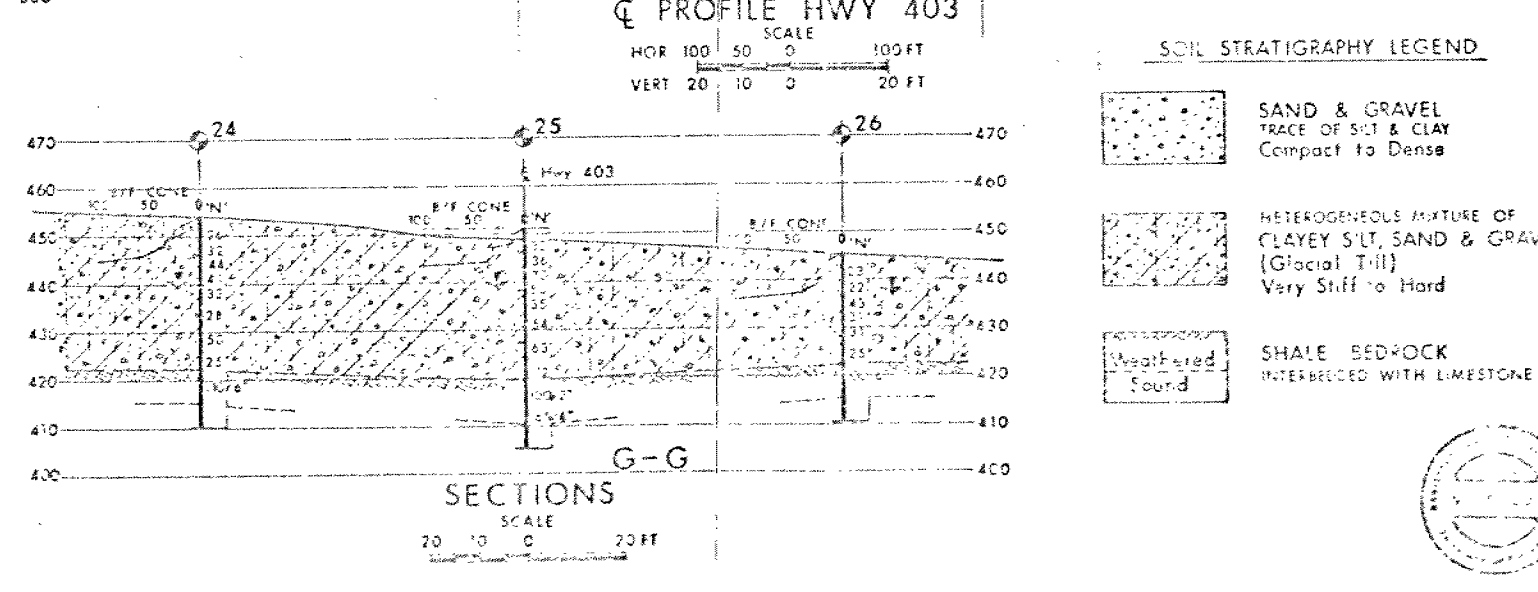
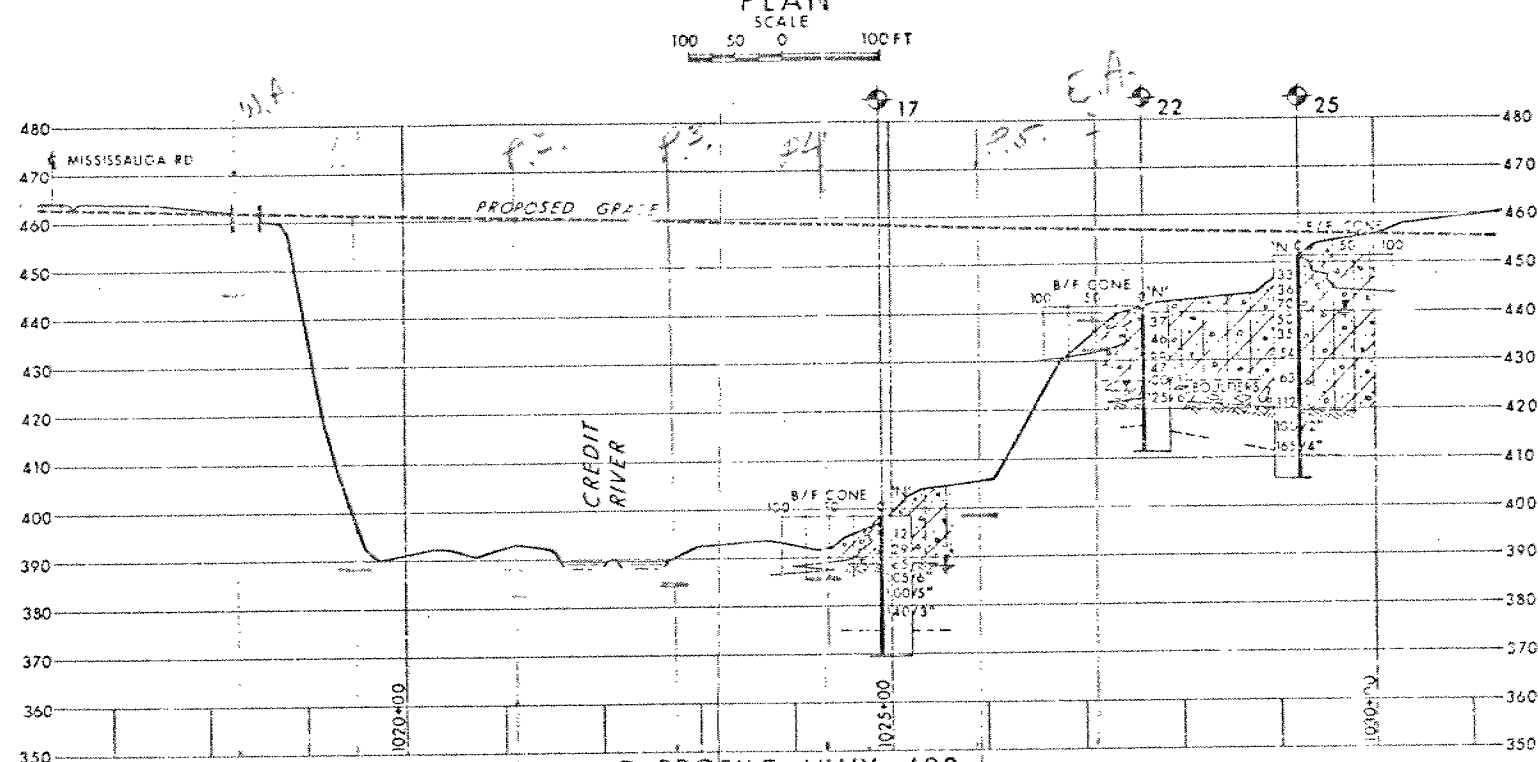
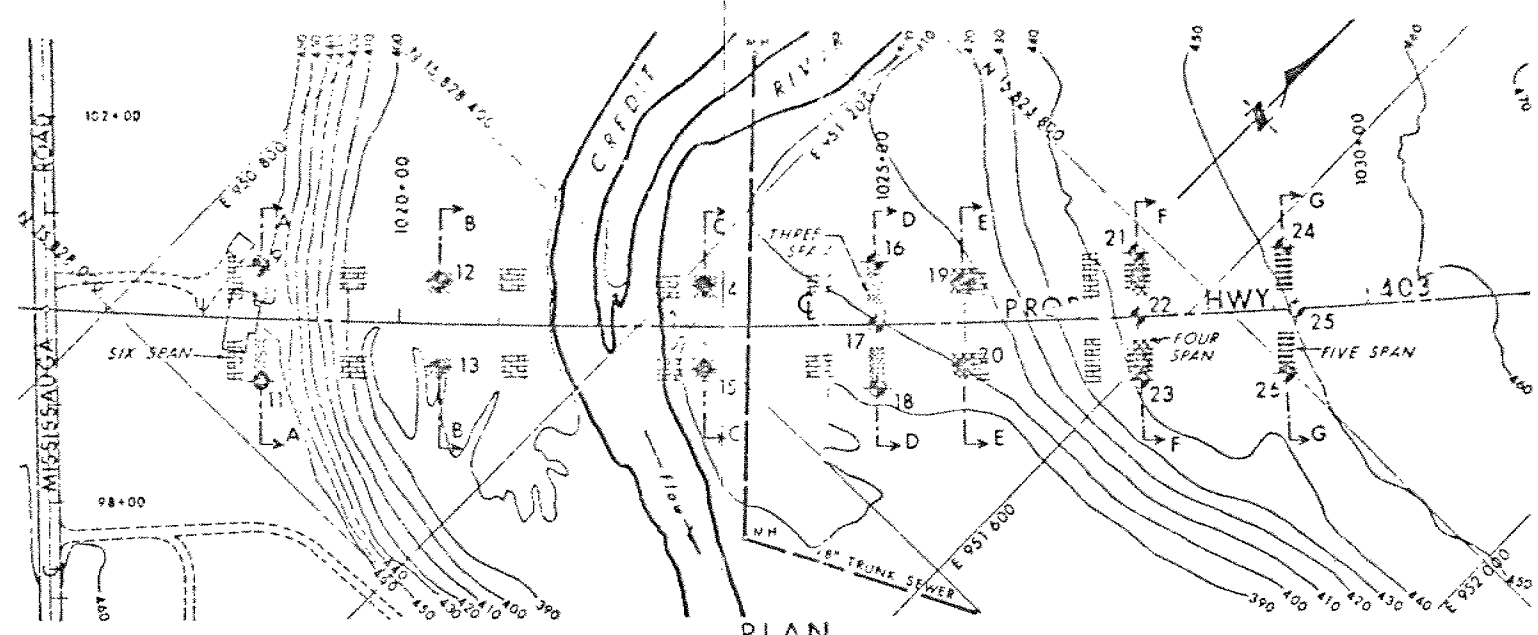
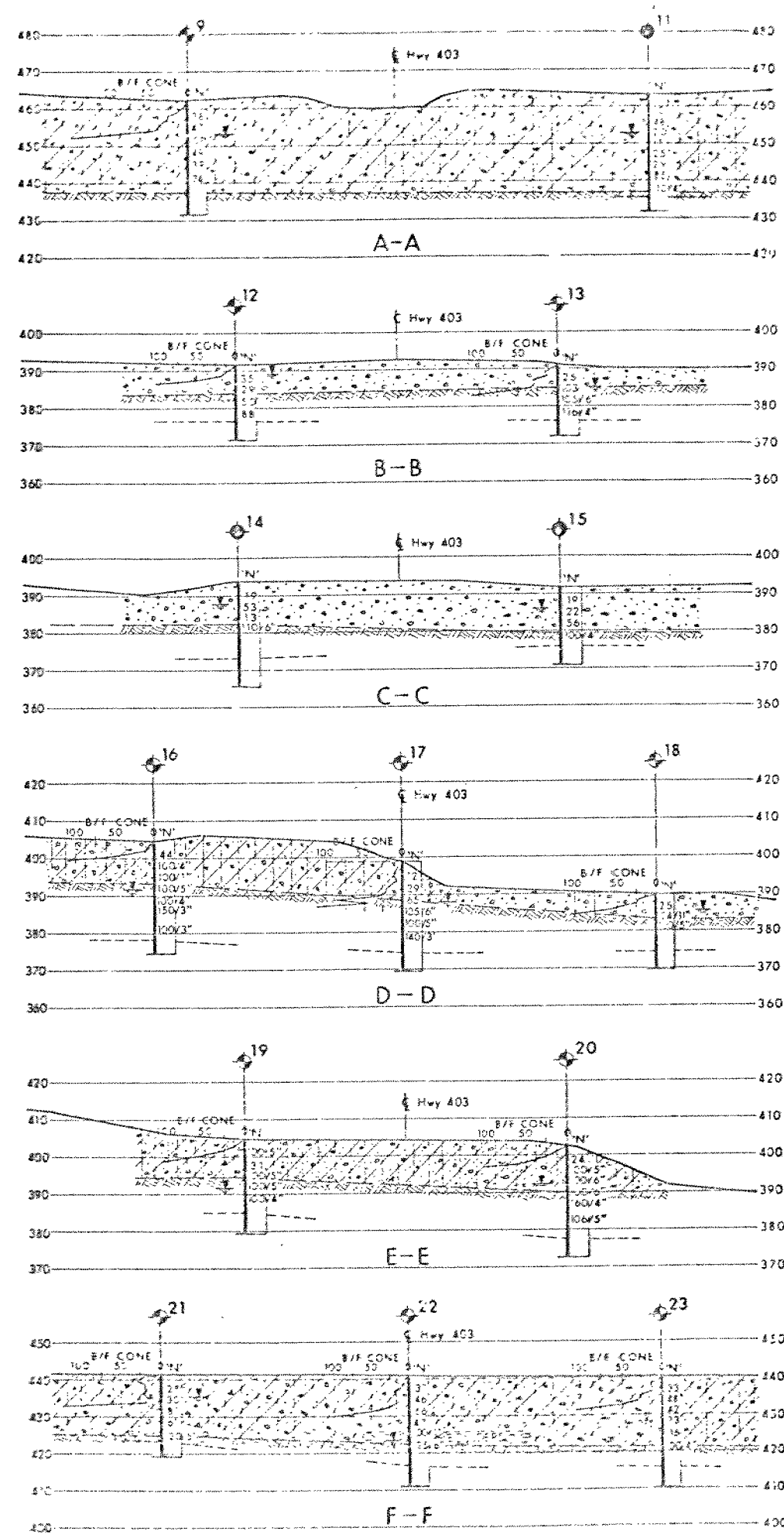
STRENGTH PARAMETERS

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 COMPRESSION STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR INFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

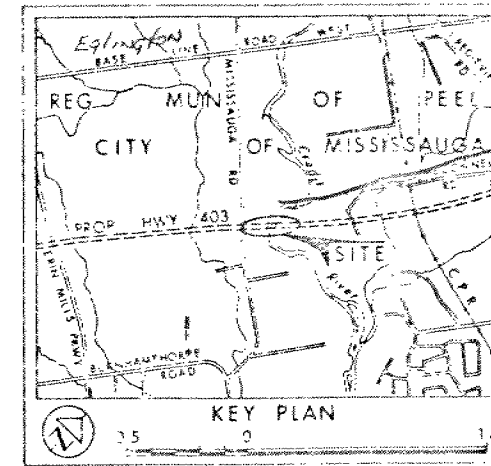
HYDRAULIC TERMS

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
 m_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
 OCR OVERCONSOLIDATION RATIO (OCR)

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



CONT No
WP No 157-75-03
CREDIT RIVER
(3.3 Miles West of Hwy 101)
BORE HOLE LOCATIONS & SOIL STRATA



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/ft (Std Pen Test, 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation June 1976
- WL for BH #9, July 1976

No	ELEVATION	CO. OF. NORTH	EAST
9	462.0	15 828 140	950 880
11	462.8	15 828 055	950 965
12	391.5	15 828 256	951 024
13	290.9	15 828 192	951 035
14	393.7	15 828 442	951 219
15	391.6	15 828 380	951 281
16	404.4	15 828 584	951 332
17	398.6	15 828 538	951 378
18	387.7	15 828 492	951 425
19	404.8	15 828 632	951 411
20	402.7	15 828 572	951 472
21	441.9	15 828 777	951 519
22	441.1	15 828 732	951 566
23	440.7	15 828 688	951 614
24	454.2	15 828 857	951 622
25	451.4	15 828 850	951 676
26	445.3	15 828 795	951 716

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

NO	DATE	BY	REVISION

Geopress No 30M12-131
Drawn by Prop. 403
Checked by Prop. 403
Scale 1" = 100'

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

CONT 81-39

WP 157-75-03

DIST 6

HWY 403

STR SITE 24-222

Addendum to
Credit River Bridge

DISTRIBUTION

G.C.E. Burkhardt (3)

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R. Fitzgibbon)

J. Anderson) Cover only

T.J. Kovich)

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ADDENDUM TO FOUNDATION INVESTIGATION REPORT

For

Credit River Bridge
W.P. 157-75-03, Site 24-222
Hwy. 403, Dist. 6, Toronto

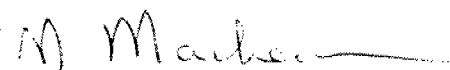
This addendum contains the results of fieldwork carried out on 80-04-16 to 80-04-18 at the above mentioned project. The original Foundation Investigation Report for this project was issued on 78-09-21. The scope of that investigation included an assessment for four different structural schemes incorporating three to six span concepts. On 79-09-14 our office received the final structural drawings showing a six span concept with span ratios somewhat different than originally anticipated. In view of the variation in subsurface and bedrock conditions at this site, it was deemed necessary to carry out eight additional borings in the immediate area of the proposed piers for design and construction purposes. Because of property and access problems it was not possible to carry out the required borings until the spring of 1980. These borings have now been completed as well as the laboratory testing and drafting. The results of the additional fieldwork is appended to this addendum by means of eight Borehole Log Sheets and two Stratigraphical Drawings.

The subsurface conditions revealed by the additional boreholes reflect those encountered in the original foundation investigation and for a more complete description of subsurface conditions than given on the additional eight Borehole Log Sheets, reference should be made to the original Foundation Investigation and Design Report.

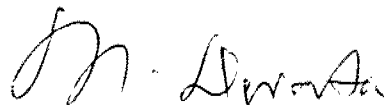
On the sheet following are summarized the complete foundation design and construction requirements as indicated by the recent completed borings.

It is important to note that our input to the structural contract package will include two stratigraphical drawings.

If you have any questions please do not hesitate to contact this office.



M. MacLean
Project Foundations Engineer



M. Devata
Senior Foundations Engineer

ELEMENT	STATION	REFERENCE B.H.	GROUND ELEVATION	OVERBURDEN TYPE	WEATHERED BEDROCK ELEVATION	SOUND BEDROCK ELEVATION	*FOOTING ELEVATION	RECOMMENDED DESIGN LOAD **	DEWATERING SCHEME REQUIRED
W Abut. WBL	1018+30	9	462.0	Glacial Till	437.5	437.5	434.5	Up to	NO
EBL		11	462.8	Glacial Till	437.0	436.7	434.5	10 TSF	
Pier 1 WBL	1019+50	51	389.7	Sand & Gravel	386.7	382.7	371.5	Up to	YES
EBL		52	390.0	Glacial Till	387.0	383.0	371.5	10 TSF	
Pier 2 WBL	1021+10	53	391.0	Sand & Till	380.5	377.5	371.5	Up to	YES
EBL		54	390.7	Sand & Gravel	382.7	376.2	371.5	10 TSF	
Pier 3 WBL	1022+70	55	392.4	Sand & Gravel	378.2	374.4	368.5	Up to	YES
EBL		56	389.1	Sand & Till	378.6	373.1	371.5	10 TSF	
Pier 4 WBL	1024+30	57	404.9	Till & Weathered Rock	385.9	385.9	371.0	Up to	YES
EBL		58	390.5	Sand & Till	381.0	371.0	370.0	10 TSF	
Pier 5 WBL	1025+90	19	404.8	Glacial Till	394.3	384.8	381.5	Up to	YES
EBL		20	402.7	Glacial Till	390.2	377.7	374.5	10 TSF	
E Abut. WBL	1027+10	21	441.9	Glacial Till	424.9	423.4	432.0	3 TSF	NO
EBL		23	441.1	Glacial Till	421.2	415.7	426.0	3 TSF	

* Refers to structural steel scheme. In some instances concrete scheme has a lower F.T.G. elevation.

** Recommended design load in sound bedrock.



RECORD OF BOREHOLE No 51

W P 157-75-03 LOCATION Co-ords. N 15 828 215; E 950 966 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 17, 1980 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				
389.7	Ground Level														
0.0	Sand & Gravel Dense														
386.7	Trace of Silt		1	SS	125										
3.0	Weathered Shale		2	SS	125	6"									
382.7			3	SS	100	6"									
7.0	Sound Shale with Limestone Layers		4	RC BXL	REC 20%										ROD 0%
			5	RC BXL	REC 100%										RQD 70%
			6	RC BXL	REC 67%										RQD 25%
368.9			7	RC BXL	REC 100%										RQD 75%
20.8	End of Borehole														

+3, x5: Numbers refer to
Sensitivity


20
15
10

(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 52

W P 157-75-03 LOCATION Co-ords N 15 828 145; E 951 023 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY GP
DATUM Geodetic DATE April 18, 1980 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					
390.0	Ground Level																
0.0	Glacial Till	Hard	1	SS	100/	5"											
387.0			2	SS	100/	5"											
3.0	Weathered Shale		3	SS	100/	2"											
383.0			4	SS	100/	2"											
7.0			5	SS	100/	1"											
	Sound Shale with Limestone Layers		6	RC	REC												
			7	BXL	70%												RQD 35%
			8	RC	100%	REC											RQD 30%
			9	RC	REC												RQD 100%
				BXL	90%												RQD 48%
366.0																	
24.0	End of Borehole																

+3, x5 : Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 53

W P 157-75-03 LOCATION Co-ords. N 15 828 306; E 951 073 ORIGINATED BY MM & GP
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 17, 1980 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					
391.0	Ground Level															
0.0	Sand and Gravel Trace of Silt and Clay Compact		1	SS	25											50 26 20 4
384.0			2	SS	27											
7.0	Glacial Till Hard		3	SS	48											51 31 14 4
380.5			4	SS	101											
10.5	Weathered Shale		5	SS	100											
377.3			6	RC	25%											RQD = 0%
13.5	Sound Shale with Limestone Layers		7	RC	REC											RQD = 10%
			8	BXL	15%											RQD = 60%
			9	RC	50%											RQD = 80%
367.5																
23.5	End of Borehole															

+³, x⁵: Numbers refer to
Sensitivity

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



RECORD OF BOREHOLE No 54

W P 157-75-03 LOCATION Co-ords. N 15 828 235; E 951 140 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 17, 1980 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
390.7	Ground Level															
0.0	Sand and Gravel Trace of Silt and Clay		1	SS	21											
			2	SS	20											
382.7	Compact		3	SS	44											
8.0	Weathered Shale		4	SS	100/	4"										
376.2			5	SS	100/	2"										
14.5	Sound Shale with Limestone Layers		6	RC BXL	REC 40%											RQD 25%
370.7																
20.0	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (% STRAIN AT FAILURE)

RECORD OF BOREHOLE No 55

W P 157-75-03 LOCATION Co-ords. N 15 828 420; E 951 192 ORIGINATED BY M.M.
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 16, 1980 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100	W _p	W	W _L		
392.4	Ground Level															GR SA SI CL
0.0	Sand and Gravel		1	SS	36											
	Trace of Silt & Clay		2	SS	19											
	Compact to Dense		3	SS	33											
	Numerous Cobbles and		4	SS	22											
	Boulders		5	SS	79/	10"										
378.2			6	SS	100/	4"										
13.5	Weathered Shale															
374.4																
18.0	Sound Shale with		7	RC	REC											
	Limestone Seams			BXL	80%											RQD 45%
367.4																
25.0	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 56

W P 157-75-03 LOCATION Co-ords. N 15 828 350; E 951 254 ORIGINATED BY M.M.
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 16, 1980 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
389.1	Ground Level																
0.0	Sand and Gravel		1	SS	20												
	Trace of Silt and Clay		2	SS	39												
382.1	Compact to Dense Cobbles & Boulders		3	SS	32												
7.0	Glacial Till Hard		4	SS	100												
378.6			5	SS	100												
10.5	Weathered Shale		6	SS	100												
373.1			7	RC	REC												
16.0	Sound Shale with Limestone Layers			BXL	100%												
364.1																	RQD 80%
25.0	End of Borehole																

+³, x⁵ : Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 57

W P 157-75-03 LOCATION Co-ords. N 15 828 546; E 951 305 ORIGINATED BY M.M.
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 16, 1980 CHECKED BY

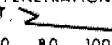


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							SHEAR STRENGTH
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
404.9	Ground Level														
0.0	Heterogeneous Mixture Clayey Silt, Sand and Gravel Glacial Till Hard		1	SS	23	10" 	400								
398.4			2	SS	90										
6.5	Weathered Shale and Limestone Layers 4" - 6" Thick Alternating Layers of Glacial Till 5" - 24" Thick		3	RC	REC										
			4	BXL	50										
			5	RC	REC										
			6	BXL	80										
385.9			7	RC	90		REC	390							
19.0	Sound Shale Bedrock with Limestone Layers		8	SS	30		3"	380							
374.9															
30.0	End of Borehole													RQD 80%	

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 58

W P 157-75-03 LOCATION Co-ords. N 15 828 462; E 951 366 ORIGINATED BY M.M.
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 16, 1980 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							SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%)
390.5	Ground Level													GR SA SI CL		
0.0	Sand & Gravel		1	SS	24		390									
383.5	Trace of Silt & Clay Compact With Organic Inclusions		2	SS	15											
381.0	Glacial Till Hard		3	SS	45											
9.5	Weathered Shale Bedrock with Limestone Layers		4	SS	1677		9"	380								
			5	SS	1007		5"									
			6	SS	1007		3"									
371.0																
19.5	Sound		7	RC BXL	REC 80%		370							RQD 50%		
365.5																
25.0	End of Borehole															

+3, x⁵: Numbers refer to
Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

EXPLANATION OF TERMS USED IN REPORT

'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' 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

μ COEFFICIENT OF FRICTION
 δ 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
 β ANGLE OF SLOPE
 N_c, N_q, N_γ 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_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 = $w_L - w_P$
 I_L LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$
 A_c ACTIVITY = $\frac{I_P \text{ of soil}}{I_P \text{ of } 2\mu m \text{ Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

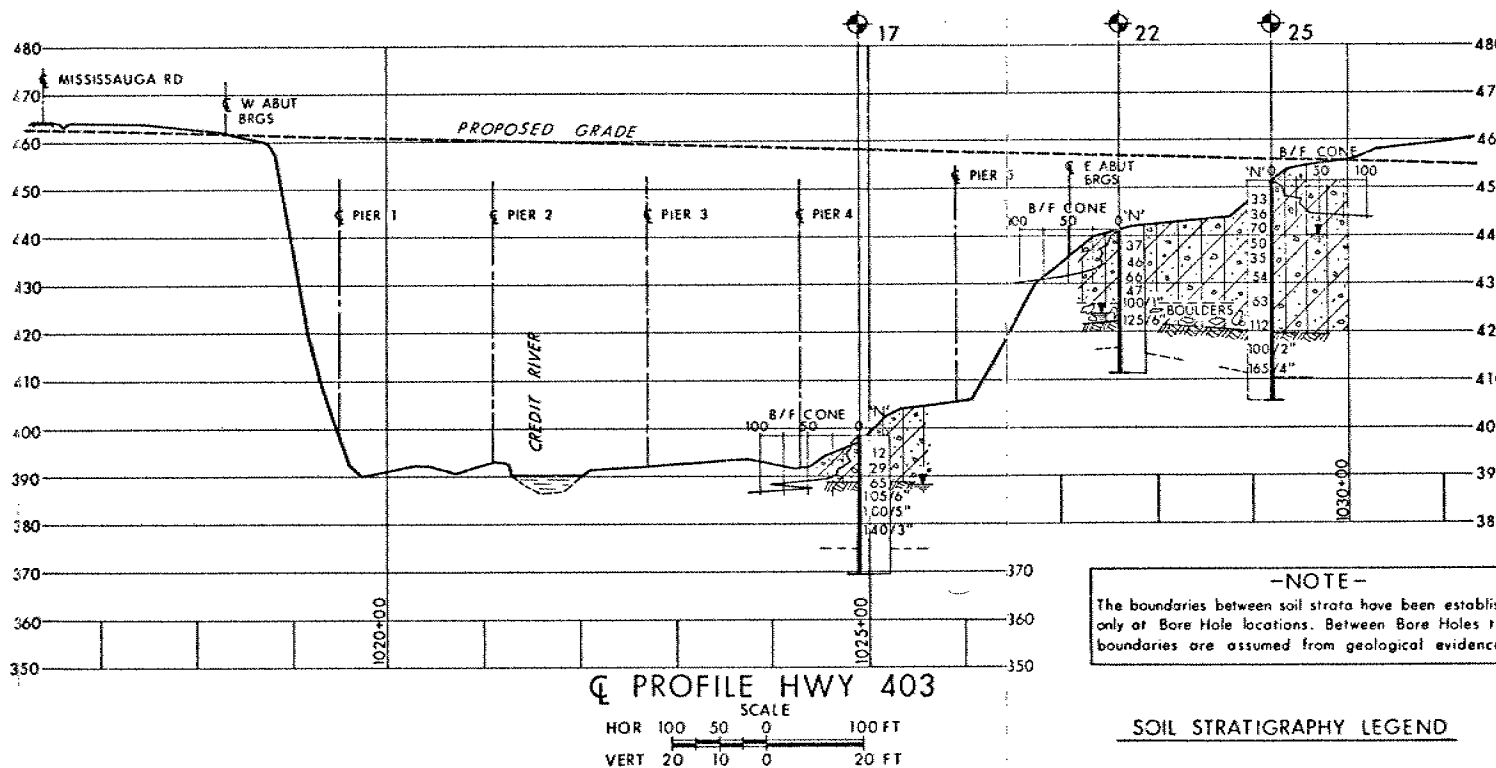
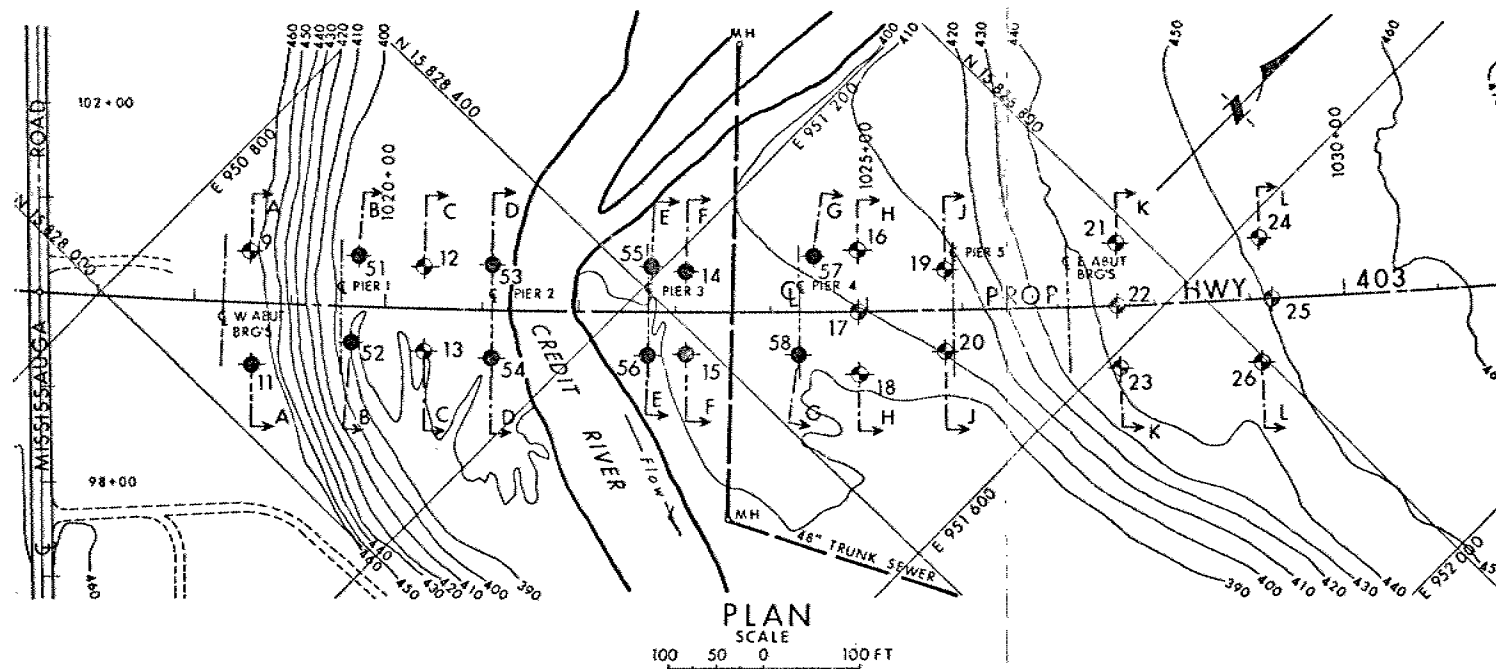
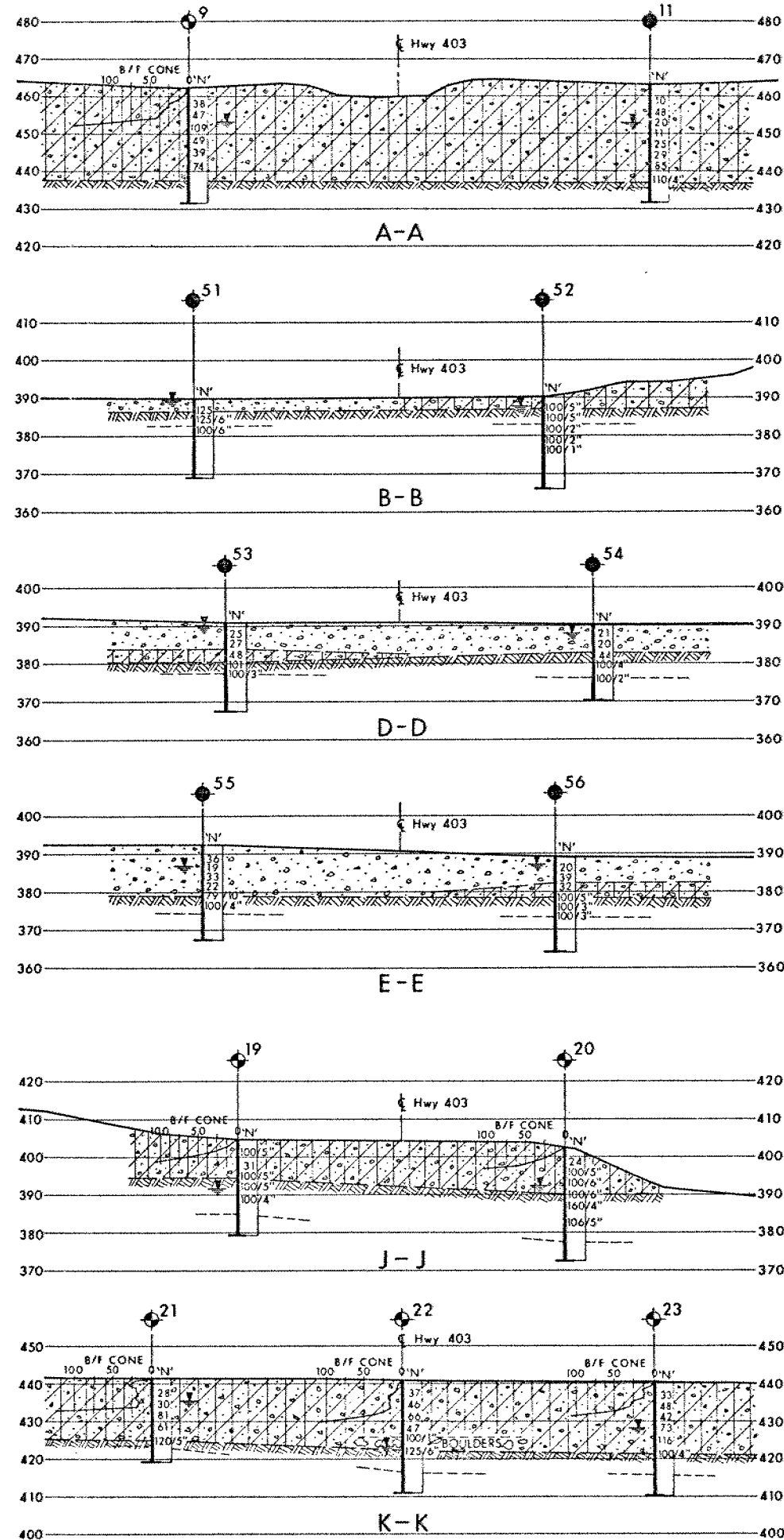
STRENGTH PARAMETERS

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
 m, n 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
 m_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
 U_r OVERCONSOLIDATION RATIO (OCR)

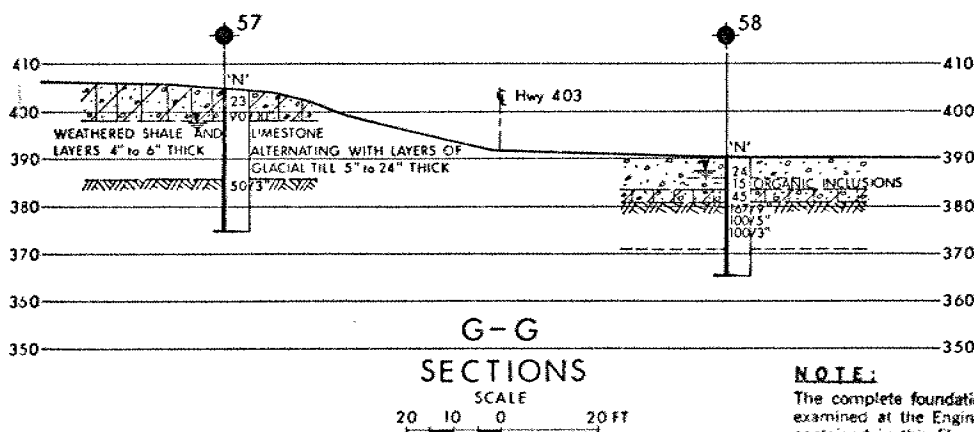
NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS



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

SOIL STRATIGRAPHY LEGEND

	SAND & GRAVEL TRACE OF SILT & CLAY Compact to Dense
	HETEROGENEOUS MIXTURE OF CLAYEY SILT, SAND & GRAVEL (Glacial Till) Very Stiff to Hard
	WEATHERED SOUND
	SHALE BEDROCK INTERBEDDED WITH LIMESTONE



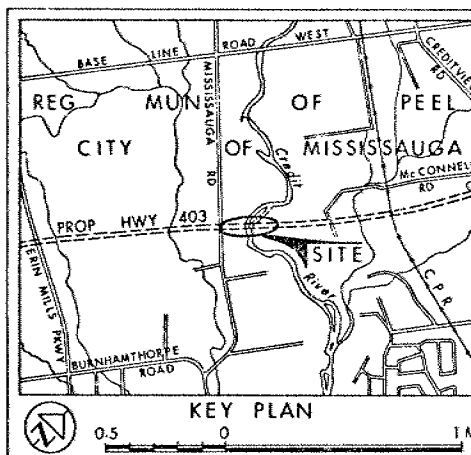
NOTE:
The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102.2 of Form 100.

CONT No
WP No 157-75-03

CREDIT RIVER
(3.3 Miles West of Hwy 10)
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 June 1978
- WL for BH# 9; July 1976
- WL for BH 51 to 58: April 1980

No	ELEVATION	CO ORDINATES NORTH	EAST
9	462.0	15 828 140	950 880
11	462.8	15 828 055	950 965
12	391.5	15 828 256	951 024
13	390.9	15 828 192	951 085
14	393.7	15 828 442	951 219
15	391.6	15 828 380	951 281
16	404.4	15 828 584	951 332
17	398.6	15 828 538	951 378
18	389.7	15 828 492	951 425
19	404.8	15 828 632	951 411
20	402.7	15 828 572	951 472
21	441.9	15 828 777	951 519
22	441.1	15 828 732	951 566
23	440.7	15 828 688	951 614
24	454.2	15 828 887	951 622
25	451.4	15 828 850	951 676
26	445.3	15 828 795	951 716
51	389.7	15 828 215	950 966
52	390.0	15 828 145	951 023
53	391.0	15 828 306	951 073
54	390.7	15 828 235	951 140
55	392.4	15 828 420	951 192
56	389.1	15 828 350	951 254
57	404.9	15 828 546	951 305
58	390.5	15 828 462	951 366

REVISIONS

NO	DATE	BY	DESCRIPTION
1	May/80	GP	Bore Holes 51 to 58 Added

Geocres No 30M12-131

HWY No	Prop	403	DIST	6
SUBMIT	V.K.	CHECKED	DATE	Sept 14, 1978
DRAWN	GP	CHECKED	DATE	Sept 14, 1978

SITE 24-222
DWG 2

CONT No
WP No 157-75-03

CREDIT RIVER
[3.3 Miles West of Hwy 10]
SECTIONS & SOIL STRATIGRAPHY

SHEET

SEE DWG 24-222-2

KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation June 1978

No	ELEVATION		

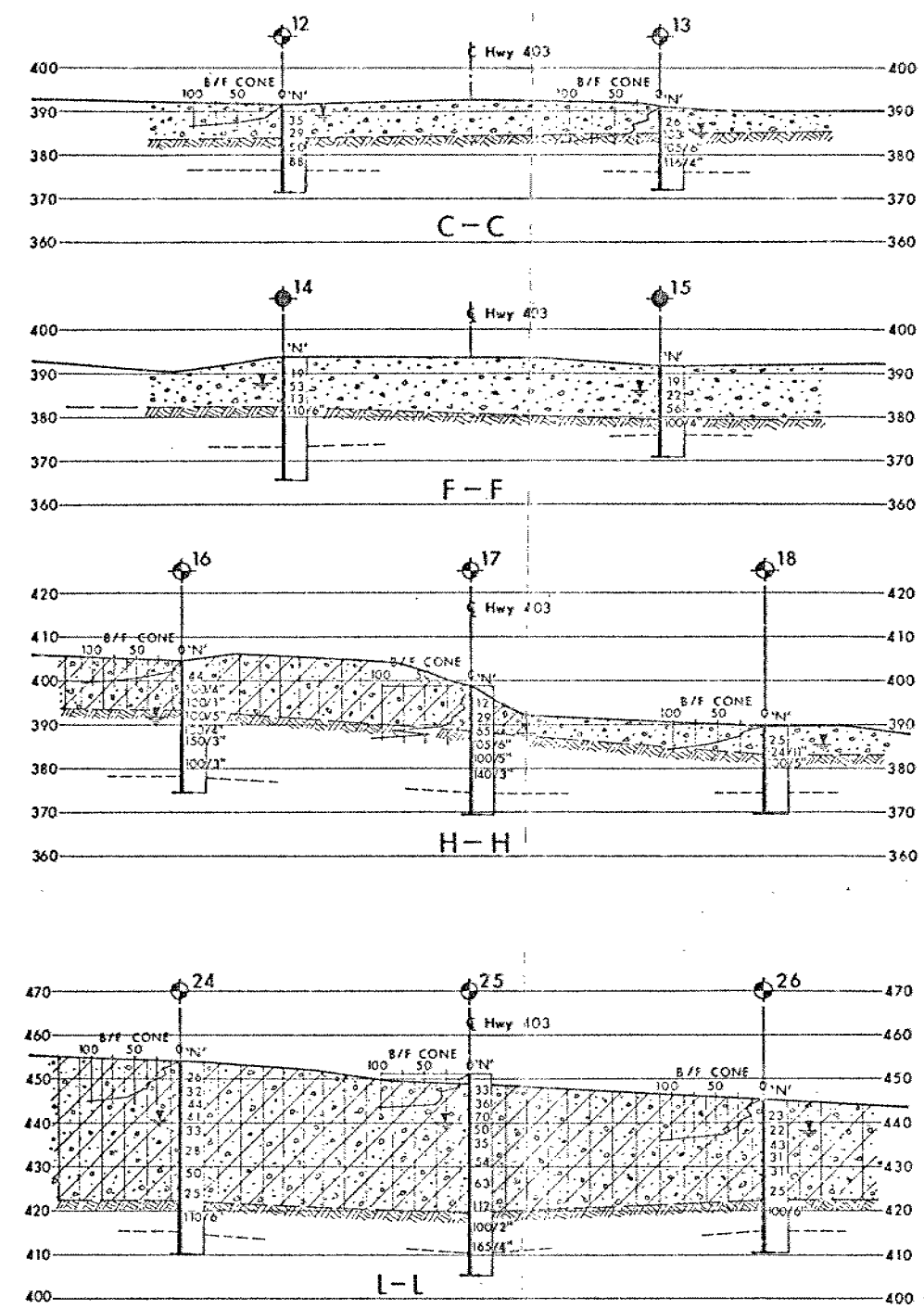
NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 30M12-131

HWY No 403	DATE May 28, 1980	DIST 6
SUBMITTAL CHECKED	DATE May 28, 1980	SITE 24-222
DRAWN	CHECKED	DWG 2A



SOIL STRATIGRAPHY LEGEND

- SAND & GRAVEL
TRACE OF SILT & CLAY
Compact to Dense
- HETEROGENEOUS MIXTURE OF
CLAYEY SILT, SAND & GRAVEL
(Glacial Till)
Very Stiff to Hard
- Weathered
Sound
SHALE BEDROCK
INTERBEDDED WITH LIMESTONE

SECTIONS
SCALE
20 10 0 20 FT

NOTE

The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

SHEET

LIST OF DRAWINGS

GENERAL DRAWING

- 1 GENERAL DRAWING
- 2 BORE HOLE LOCATIONS & SOIL STRATA
- 3 FOOTING LAYOUT
- 4 NORTH STRUCTURE - FTG. DETAILS
- 5 SOUTH STRUCTURE - FTG. DETAILS
- 6 NORTH STRUCTURE - WEST ABUTM.
- 7 NORTH STRUCTURE - EAST ABUTM.
- 8 SOUTH STRUCTURE - WEST ABUTM.
- 9 SOUTH STRUCTURE - EAST ABUTM.
- 10 PIER DETAILS
- 11 RETAINING WALL
- 12 GIRDER LAYOUT & DETAILS
- 13 GIRDER DETAILS - SPANS I & II
- 14 GIRDER DETAILS SPANS 2, 3, 4 & 5
- 15 GIRDER REIN. SPANS 2, 3, 4 & 5
- 16 DECK DETAILS
- 17 DECK REINFORCING
- 18 BARRIER WALL I
- 19 BARRIER WALL II
- 20 EXPANSION JOINT
- 21 AS CONSTRUCTED ELEV. & DIM.
- 22 20 FT. APPROACH SLAB
- 23 STANDARD DETAILS I
- 24 STANDARD DETAILS II
- 25 STANDARD DETAILS III
- 26 EMBEDDED WORK (LIGHTING) I
- 27 EMBEDDED WORK (LIGHTING) II
- 28 EMBEDDED WORK (LIGHTING) III

CLASS OF CONCRETE

GIRDERS	:	50 MPa
DIAPHRAGMS & PIERS	:	35 MPa
DECK SLABS & BARRIER WALLS	:	30 MPa
REMAINDER	:	20 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTINGS, ABUTMENTS & RETAINING WALL - 3"
PIERS: 3" TO MAIN STEEL
DECK SLAB: TOP = 2"; BOTTOM = 1 1/2"
APPR. SLAB: 2"; DIAPHRAGMS: 1 1/2"
BARRIER WALLS: 1 1/2" EXCEPT AS NOTED

GRADE OF REINFORCING STEEL-400 & 400W

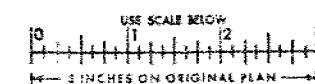
REINFORCING BARS WITH THE DESIGNATION 'C' AT THE END OF BAR MARKS SHALL BE COATED BARS.

CONSTRUCTION NOTES

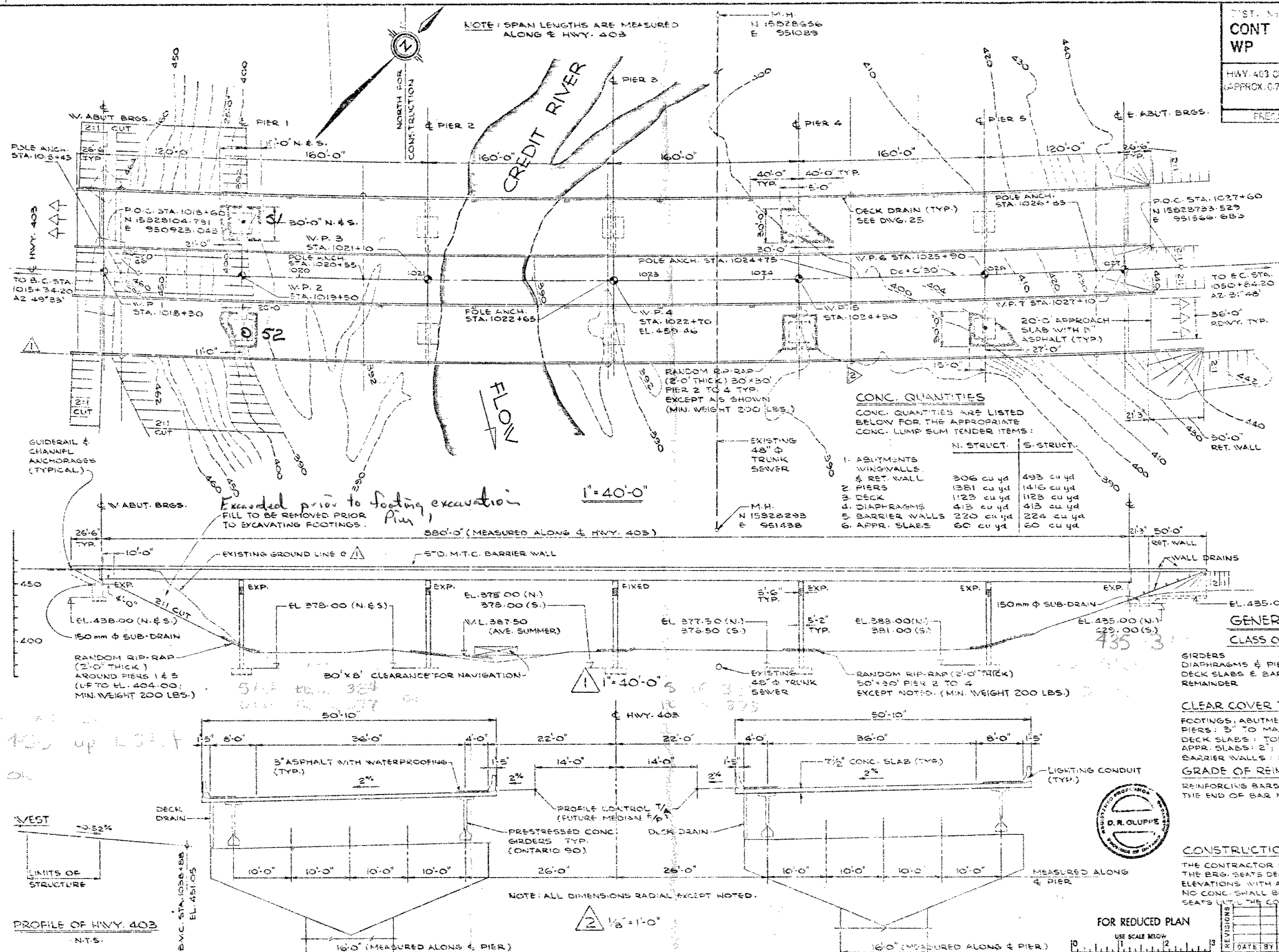
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BRG. SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF $\pm 1/8"$. NO CONC. SHALL BE PLACED ABOVE THE ABUT. BRG. SEATS UNTIL THE CONC. IN THE DECK HAS BEEN PLACED.



FOR REDUCED PLAN



REVISION	DATE	BY	DESCRIPTION
DESIGN	CHECK	LOADING	DATE
DRAWING	CHECK	SITE NO.	DWG



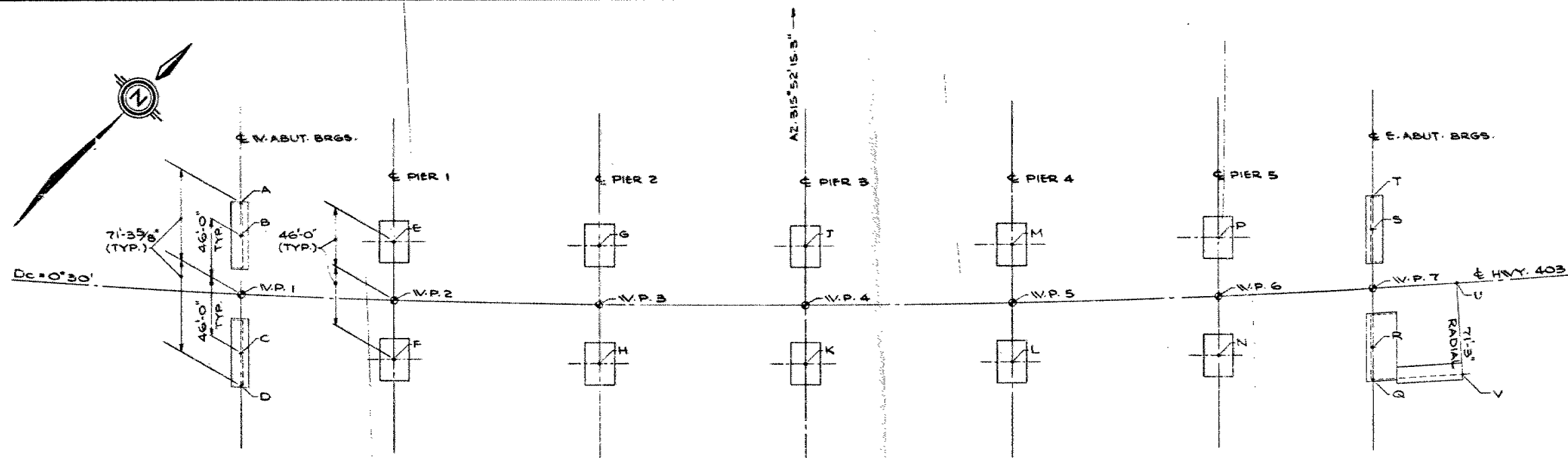
CONT No
WP No 157-75-03

H.WY. 403 CREDIT RIVER CROSSING
(APPROX. 0.7 MI. N. OF BURNHAM, RD.)
FOOTING LAYOUT

SHEET

PRECAST GIRDER SCHEME

NOTES:
ALL CENTRE LINES ARE PARALLEL.

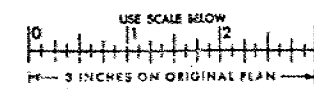


FOOTING LAYOUT

N.T.S.

POINT	STATION	CO-ORDINATES	
		N	E
A	1018+27.24	15828135.89	950851.10
B	—	15828117.73	950868.72
V.P. 1	1018+30	15828084.71	950900.75
C	—	15828051.69	950932.78
D	1018+32.72	15828033.54	950950.38
E	—	15828198.39	950957.57
V.P. 2	1019+50	15828165.37	950989.60
F	—	15828132.30	951021.63
G	—	15828307.36	951074.72
V.P. 3	1021+10	15828274.34	951106.75
H	—	15828241.32	951138.78
J	1022+70	15828417.96	951190.34
V.P. 4	1022+70	15828384.94	951222.37
K	1022+70	15828351.92	951254.40
L	—	15828464.12	951368.46
V.P. 5	1024+30	15828497.14	951336.43
M	—	15828530.16	951304.40
N	—	15828577.91	951480.95
V.P. 6	1025+90	15828610.93	951448.92
P	—	15828643.95	951416.89
Q	1027+07.28	15828646.11	951381.88
R	—	15828664.27	951364.26
V.P. 7	1027+10	15828697.29	951332.23
S	—	15828730.31	951500.20
T	1027+12.75	15828748.47	951482.59
U	1027+78.09	15828746.68	951579.10
V	1027+78.09	15828697.79	951630.93

FOR REDUCED PLAN



REVISIONS		DATE		BY		DESCRIPTION	
DESIGN	CHECK	LOADING	DATE	DESIGN	CHECK	LOADING	DATE
DRAWING	CHECK	SITE No	14-222	1966			



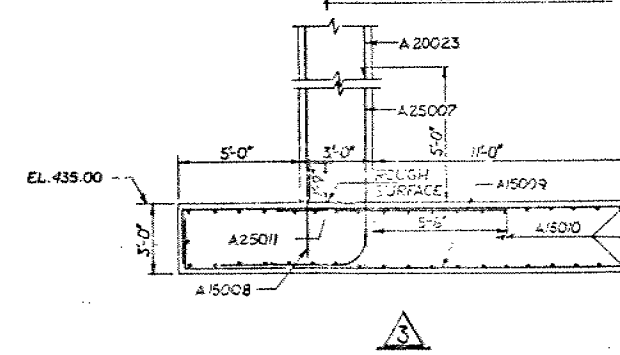
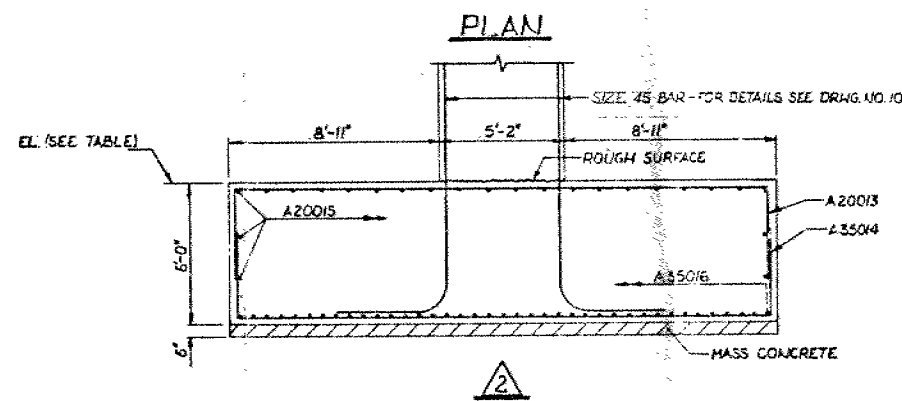
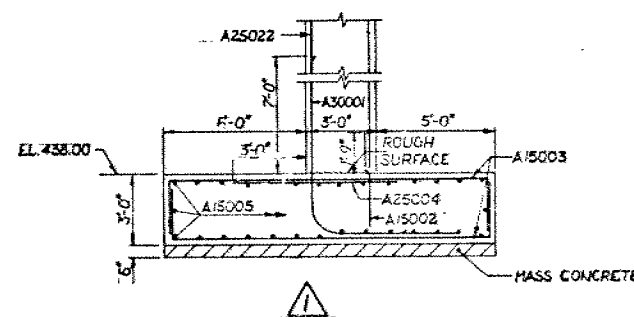
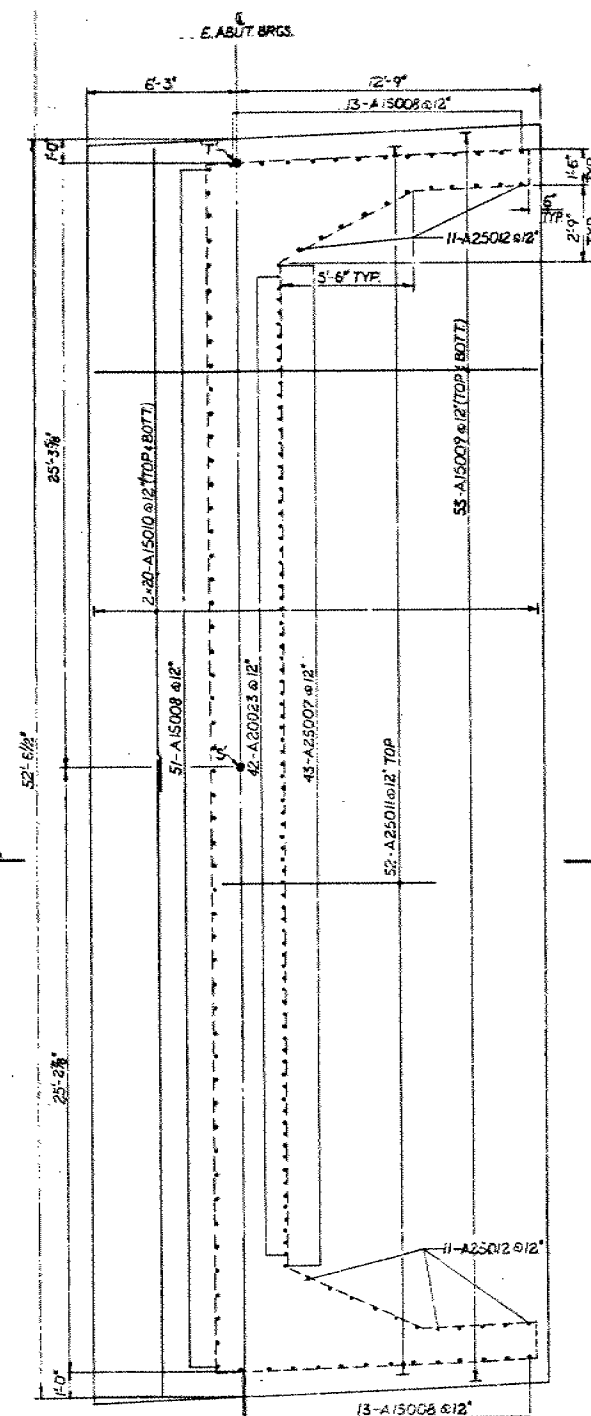
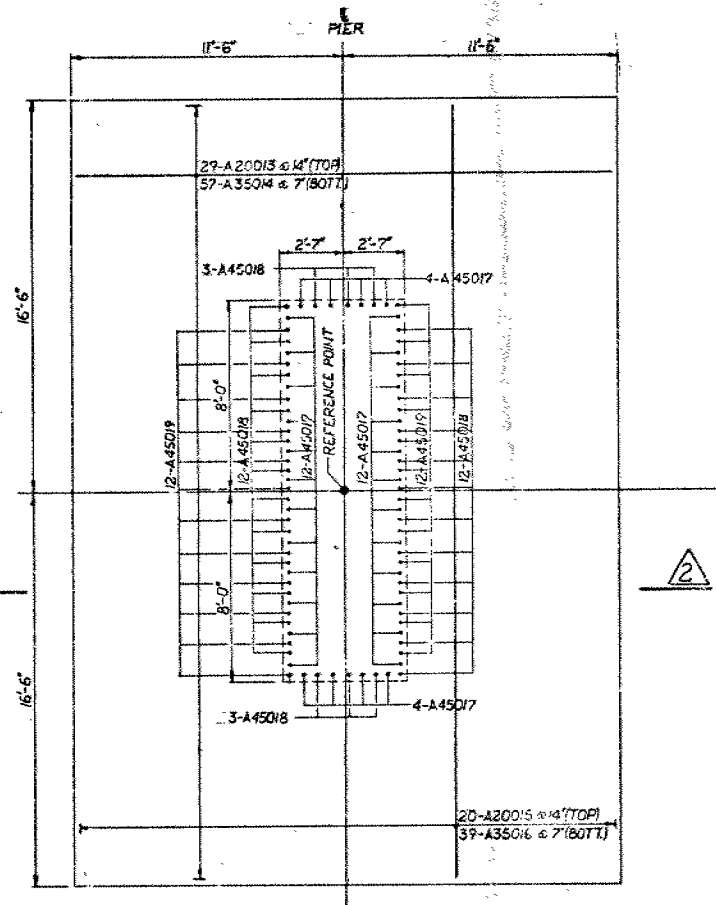
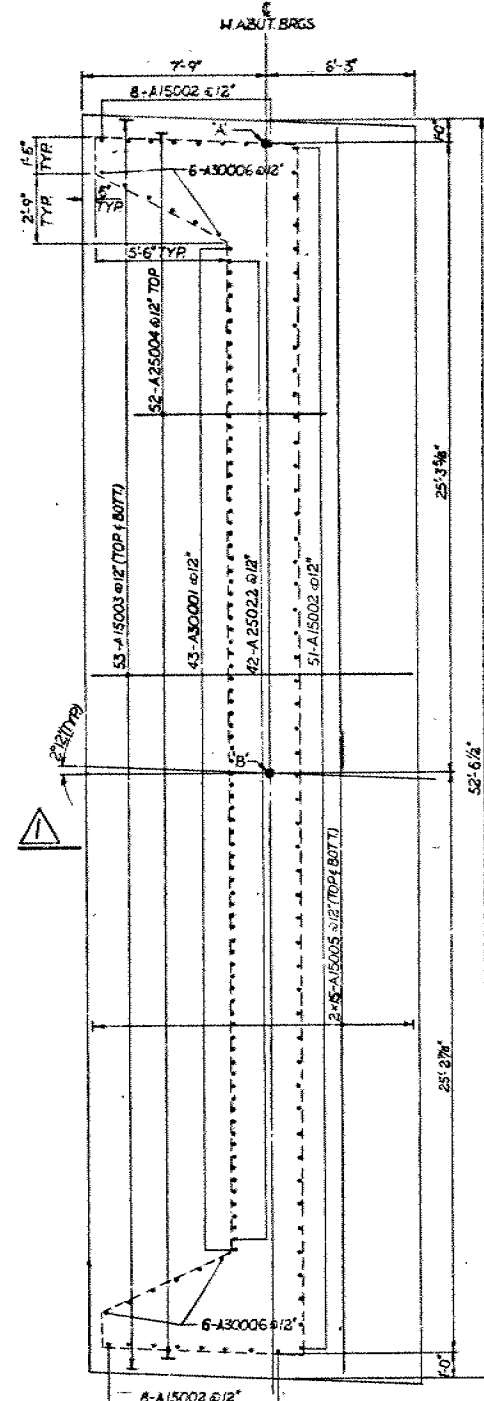
CONT No
WP No 157-75-03

HWY 403 CREDIT RIVER CROSSING
(APPROX 0.7 MI N OF BURNHAM RD.)
NORTH STRUCTURE-FTG. DETAILS
PRECAST GIRDER SCHEME

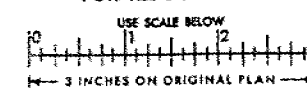
SHEET

PIER	T/F ELEV
#1	378.00
#2	378.00
#3	375.00
#4	377.50
#5	388.00

NOTES:
• ALL PIER FOOTINGS ARE SIMILAR.
• MASS CONCRETE TO BE PLACED WITHIN 3 HOURS AFTER EXCAVATION.
• FOR REFERENCE POINTS SEE DRAWG. NO. 3
• T/F = TOP OF FOOTING.



FOR REDUCED PLAN



SCALE 1/4" = 1'-0"



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	CHECK	LOADING	DATE
DRAWING	CHECK	SITE No	DWG

Mr. C.S. Grebski
Head, Central Section
Structural Office
2nd Floor, West Building

1979 06 05

From: Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

Re: Hwy. 403, Credit River Crossing
W.P. 157-75-03, Site 24-222
District 6, Toronto

We have reviewed the Preliminary Bridge Plan Drawing 24-222-P2 which depicts a steel girder scheme as an alternative to the prestressed concrete girder scheme shown earlier in Drawing 24-222-P1. Both schemes have the same footing arrangements.

As mentioned in our memorandum dated 79 01 16, an additional investigation will be required because most of the footings have been relocated some distance from our boring and the sub-surface conditions are known to be quite variable across the site. The fieldwork will commence this summer. The results, together with our comments, will be submitted immediately to the Structural Office for any necessary modifications in the design.

B. Ly
Senior Engineer

For: M. Devata
Supervising Engineer

BL/MD/gs

cc: G.C.E. Burkhardt
Files /



Memorandum

To: Mr. M. Devata,
Supervising Engineer,
Soil Mechanics Section,
Central Building, Downsview.

From: Structural Office,
West Building, Downsview.

Attention: Mr. V. Korlu,
Project Engineer.

Date: 79 01 18

Our File Ref. 24-222

In Reply to


Subject: Hwy. 403, Credit River Crossing,
W. P. 157-75-03, Site 24-222,
District 6.

This will acknowledge receipt of your memo regarding the above subject.

The only item we do not agree with is in the last paragraph. As we stated at the meeting, we will leave the 2:1 slope at the west approach. There are two reasons for this. The reasoning for the 1 1/2:1 change is as you stated for erosion control. In our opinion a 2:1 slope is better than 1 1/2:1 for erosion control. Also, the preliminary plan has been approved by the Credit River Conservation Authority and hence we do not wish to submit a second plan with the indicated changes for their approval. Obtaining approval for the existing plan required several office meetings and a field meeting by G. Burkhardt.

If you feel strongly about this point please let us know and we will meet with you again.

CSG/cf


C. S. Grebski,
Head, Central Section.

c.c. G. Burkhardt
W. Lin



Mr. C.S. Grebski
Head, Central Section
Structural Office
2nd Floor, West Building

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

79 01 16

Re: Hwy. 403, Credit River Crossing
W.P. 157-75-03, Site 24-222
District 6, Toronto

We have reviewed the Preliminary Bridge Plan Drawing 24-222-P1 for the above mentioned structure and submit the following comments.

According to your drawing a new 6 span structure concept has been proposed. This scheme suggests that the new footings in some cases will be located 40 to 80 feet away from the locations shown on our foundation investigation report.

The subsoil conditions at the Credit River Valley are quite variable. The overburden has a thickness of up to 32 feet in the tableland bordering the valley but it diminishes to 6 to 11 feet thick at the valley floor. The predominant overburden at this site generally consists of a glacial till. However, in the valley floor, the Credit River has eroded this glacial till and also the upper portion of the weathered shale bedrock. The eroded valley floor is covered with recent flood plain deposits such as sand and gravel.

Since the subsoil and bedrock conditions are quite variable across the site, a meeting was held on 79 01 15 at the Soil Mechanics Section office to discuss the foundation requirements for the new 6 span structure scheme. This meeting was attended by Messrs. C.S. Grebski, W. Lin, M. Devata and V. Korlu. It was concluded that due to the size of the structure and loading requirements for the foundations, an additional subsurface investigation will be necessary for the new scheme. This Section will initiate necessary fieldwork during early summer of this year and the results will be submitted immediately to the Structural Office for necessary modifications of the footing elevations for the piers and pile lengths for the abutments. It was also agreed that the final drawings will be issued after the submission of this new information. For preliminary purposes the discussions and recommendations contained in our

cont'd.....

foundation report can be used except for the abutment foundations. It is understood that the Structural Office will carry out a cost analysis between the deep spread footings and pile foundation alternatives at the east and west abutment supports.

In our opinion the west approach slope of the rock cut should be $1\frac{1}{2}$:1 with a mid-height berm rather than a continuous slope of 2:1.

V. Korlu
Project Engineer

For: M. Devata
Supervising Engineer

VK/MD/gs

cc: G.C.E. Burkhardt
M.R. Ernesaks
D.A. MacDonald
Files /

G.I.-30 SEPT. 1976

GEOCRES No. SOMR-131DIST. 6 REGION W.P. No. 802-98-01CONT. No. 94-57W. O. No. STR. SITE No. 24-222HWY. No. 403LOCATION Hwy 403 & Credit
riverNo of PAGES - OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO. 94-57



Ministry of
Transportation

INDEX

<u>Page No:</u>	<u>DESCRIPTION</u>
1	Index
2	Abbreviations & Symbols
3 - 63	Foundation Investigation Report for Credit River Bridge W.P. 802-93-01, Site 24-222 Hwy. 403, District 6, Toronto Mullet Creek Bridge W.P. 803-93-01, Site 24-386 Hwy. 403, District 6, Toronto

Note: For purposes of the contract, this report supersedes all other Foundation Reports prepared by, or for the Ministry in connection with the above mentioned project.

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

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

STRESS AND STRAIN

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	KN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	KN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	KN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	KN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	KN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	KN/m^3	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

FOUNDATION INVESTIGATION REPORT
for
Credit River Bridge
W.P. 802-93-01, Site 24-222
Hwy. 403, District 6, Toronto

NOTE: All measurements are in imperial units. The foundation drawings (Contract Dwgs. No. 2 & 3) are in imperial units. Imperial stations cannot be directly converted to metric stations. The surface conditions and contours shown on the drawing may not reflect existing surface conditions.

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during July 8, 1976 and during the periods of June 8 to 22, 1978, and April 16 to 18, 1980. The earliest investigation was done for feasibility purposes and consisted of one sampled borehole advanced by augering and diamond drilling techniques to a depth of 30 feet below the ground surface. In the 1978 investigation, a total of 16 sampled boreholes were put down by means of an auger machine equipped with hollow stem continuous flight augers and solid stem augers. The borings ranged in depth from 19 to 46 feet below the ground surface. In addition, bedrock was proven by obtaining BXL size rock core. The 1980 investigation consisted of an additional 8 boreholes put down by means of hollow stem continuous flight augers to depths of 20 to 30 feet below ground surface. Bedrock was proven by obtaining BXL size rock core samples.

SITE AND GEOLOGY

The site is located about 1½ miles south of Eglinton Avenue and about 250 feet east of Mississauga Road in the City of Mississauga, Regional Municipality of Peel.

At this site the Credit River is winding from north to south and has eroded a valley which is about 1100 feet wide from crest to crest and about 70 feet deep. The sides of the valley are found to be as steep as 1½:1 with the steep faces being on the concave side of the river. In certain locations subsoil strata and bedrock formations are exposed on the sides of the valley. The tableland on either side of the valley is relatively flat, being gently sloping down towards the south.

Physiographically the site is situated in the border region of the "Peel Plain" and the "South Slope". The predominant deposit in this area is known to be a cohesive glacial till. The underlying bedrock is a shale of the Dundas-Meaford formation.

SUBSURFACE CONDITIONS

General

The overburden has a thickness of up to 32 feet in the tableland bordering the valley, but diminishes to 3 to 11 feet thick at the valley floor. The overburden at this site generally consists of a glacial till composed of clayey silt, some sand and gravel. However, in the valley floor the Credit River has eroded the glacial till and the upper portion of the bedrock and redeposited a sand and gravel with trace of silt and clay. Across the site, the overburden is underlain by shale bedrock.

Factual data on the subsoil conditions is shown on the Borehole Record Sheets. The locations and elevations of the borings, together with the estimated stratigraphical profile and sections, are shown on Contract Drawing Nos. 2 and 3. A description of the subsoil and bedrock conditions is given below.

Glacial Till

This deposit is encountered on the tableland on either side of the valley and has a thickness of up to 32 feet. It is composed of a heterogeneous mixture of clayey silt, sand and gravel. Typical grain size distribution curves of the material from this deposit are shown in an envelope form on Figure 1. Geotechnical identity indices of the glacial till as determined from laboratory testing are summarized below.

		<u>Range</u>
Natural Moisture Content	(W) %	9 - 12
Liquid Limit	(W _L) %	19 - 38
Plastic Limit	(W _p) %	13 - 23

The results of the Atterberg Limit Testing are also plotted on the Plasticity Chart, Figure 2, which indicate the glacial deposit is cohesive with a low to medium plasticity (CL to CI zone).

The Standard Penetration Test 'N' values ranged from 10 blows to over 100 blows per foot, generally increasing with depth, indicating that the consistency of the glacial till varies from stiff to hard, but generally hard.

Sand and Gravel, Trace of Clay and Silt

This flood plain deposit was encountered in the river valley. It appears to be confined to areas below contour 392.0 and extends to bedrock for a thickness of 3 to 11 feet. This deposit is alluvial in origin and is composed of sand and gravel with a trace of clay and silt. Typical grain size distribution of the material in this deposit is shown in an envelope form on Figure 3. However, in certain locations the matrix (material passing sieve #40) exhibits slight plasticity. The Standard Penetration Test 'N' values varying randomly from 13 to 53 blows per foot indicate that this deposit has a compact to very dense relative density.

Bedrock (Shale Interbedded with Limestone)

Bedrock was encountered at elevation 437 on the west bank of the valley, at elevation 378 to 398 in the valley floor, and at elevation 420 to 425 on the east bank of the valley. Bedrock may be described as shale interbedded with limestone. The shale is soft to medium hard, somewhat fissile and weathered in the upper portion. The depth of weathering was found to be one to two feet on the west bank of the valley and up to 10 feet on the east bank of the valley. However, in the valley the weathered bedrock was up to 8 to 15 feet thick. The recovery ratio is high, generally close to 100%. However, the average RQD was found to be in the order of 30% to 50%, suggesting the shale is a poor quality rock.

Groundwater Conditions

The groundwater levels were observed by measuring in the open boreholes during and immediately after the field investigation. The groundwater levels were found to vary as high as elevation 454 (on the tableland) and as low as elevation 385 to elevation 390 (in the valley floor), generally constituting a hydraulic gradient towards the river. Since the water level in the Credit River was at elevation 390, which was higher than some of the observed water levels in the boreholes, it is believed that the water levels in the boreholes probably were not stabilized during the period of observations.



P. Payer

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



D. Dundas

D. Dundas, P. Eng.
Chief Foundation Engineer
(Acting)

APPENDIX



WP 802-93-01

RECORD OF BOREHOLE No 9

IMPERIAL

W P ~~157-75-03~~ LOCATION Coords. N 15,828,140; E 950,880 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE H.S. Auger, NX Casing, BXL Rock Core and Cone Test COMPILED BY V.K.
DATUM Geodetic DATE July 8, 1976 CHECKED BY *P.*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
462.0	Ground Level													GR SA SI CL
0.0	Heterogeneous Mixture of Clayey Silt With Sand and Occasional Gravel (Glacial Till) Hard Brown Grey		1	SS	38		460							0 16 54 30
			2	SS	47									
			3	SS	109									
			4	SS	49									
			5	SS	35									
			6	SS	74									
437.5	Sound Shale Interbedded With Limestone						440							
24.5			7	RC BXL	100% Rec									
431.7	End of Borehole													
30.3														

+3, x5: Numbers refer to
Sensitivity

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



RECORD OF BOREHOLE No 11										IMPERIAL					
WP 802-93-01		LOCATION		Coords. N 15,828,055; E 950,965		ORIGINATED BY V.K.									
W P 157-75-03		DIST 6 HWY 403		BOREHOLE TYPE Solid Auger, BX Casing and BXL Rock Core		COMPILED BY G.P.									
DATUM Geodetic		DATE June 22, 1978				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	20 40 60 80 100	20 40 60 80 100					
462.8	Ground Level														
0.0	Heterogeneous Mixture of Clayey Silt With Sand and Some Gravel		1	SS	10		460								7 23 45 25
			2	SS	48										
	Brown Grey (Glacial Till)		3	SS	20		450								15 24 42 19
			4	SS	11										
	Stiff to Hard		5	SS	25										
			6	SS	29										
			7	SS	85		440								7 21 45 27
437.0			8	SS	110	4"									
25.8	Wearhered														
27.0	Sound Shale Interbedded With Limestone		9	RC	100%										RQD = 46%
431.5				BXL	Rec										
31.3	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION



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	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	20	40	60	80	100	SHEAR STRENGTH				WATER CONTENT (%)										
391.5	Ground Level																								
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	35																				47 41 10 2
384.0	Compact to Dense		2	SS	29																				61 20 15 4
7.5	Weathered		3	SS	50																				
376.5			4	SS	88																				
15.0	Sound, Shale Interbedded With Limestone		5	RC BXL	100% Rec																				RQD = 35%
171.3	End of Borehole																								
20.2																									

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



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	SHEAR STRENGTH				WATER CONTENT (%)						
390.9	Ground Level																				
0.0	Sand and Gravel		1	SS	26															62 25 10 3	
384.9	Trace of Clay and Silt Compact		2	SS	103																
6.0			3	SS	105																
			4	SS	116																
376.1	Weathered																				
14.8	Sound, Shale																				
371.9	Interbedded With Limestone		5	RC BXL	100% Rec															RQD = 44%	
19.0	End of Borehole																				

OFFICE REPORT ON SOIL EXPLORATION



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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH								
							20	40	60	80	100					
							<input type="radio"/> UNCONFINED + FIELD VANE <input checked="" type="radio"/> QUICK TRIAXIAL x LAB VANE									
393.7	Ground Level															GR SA S _i CL
0.0	Sand and Gravel Trace of Clay and Silt Compact to Dense		1	SS	19		390									41 41 14 4
			2	SS	53											
382.2			3	SS	13											36 42 17 5
11.5			4	SS	100%		380									RQD = 100%
			5	SS	100%											RQD = 0%
373.2	Weathered		6	RC BXL	50% Rec											RQD = 28%
20.5	Sound Shale Interbedded With Limestone		7	RC	39%		370									RQD = 21%
			8	BXL	Rec											RQD = 71%
			9	RC	100%											
365.7			10	RC	100%											
28.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80					
391.6	Ground Level															
0.0	Sand and Gravel Trace of Clay and Silt		1	SS	19											48 27 19 6
	Compact to Dense		2	SS	22											43 34 16 7
379.6			3	SS	56											
12.0			4	SS	1007											25 15 49 11
375.8	Weathered		5	BXL	70% Rec											
15.8	Sound Shale Interbedded With Limestone		6	RC BXL	100% Rec											RQD = 25%
370.9																
20.7	End of Borehole															

WP 802-93-01

RECORD OF BOREHOLE No 16

IMPERIAL

W P ~~157-75-03~~ LOCATION Coords. N 15,828,584; E 951,332 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 12, 1978 CHECKED BY P.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
404.4	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	44		400							13 24 44 19
393.4			2	SS	100%	4"								
			3	SS	100%	1"								
11.0			4	SS	100%	5"								
			5	SS	100%	4"	390							
	Weathered		6	SS	150%	3"								
			7	SS	100%	3"	380							
378.4														
26.0	Sound, Shale		8	RC	100%									
374.4	Interbedded With Limestone			BXL	Rec									RQD = 40%
30.0	End of Borehole													

+3, x5 : Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

WP 802-93-01 RECORD OF BOREHOLE No 17 **IMPERIAL**

W P 157-75-03 LOCATION Coords. N 15,828,538; E 951,378 ORIGINATED BY V.K.

DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.

DATUM Geodetic DATE June 13, 1978 CHECKED BY JP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
398.6	Ground Level							SHEAR STRENGTH						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL x LAB VANE						
								WATER CONTENT (%)						
								10 20 30						
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Stiff to Hard		1	SS	12		390							0 9 66 25
388.6			2	SS	29									
10.0			3	SS	65									
			4	SS	103	6"								
			5	SS	100	5"								
	Weathered		6	SS	140	3"								
374.6							380							
24.0	Sound, Shale Interbedded With Limestone		7	RC	100%		370							RQD = 55%
369.6														
29.0	End of Borehole													

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					
389.7	Ground Level													
0.0	Sand and Gravel		1	SS	25									
383.2	Trace of Silt and Clay, Compact		2	SS	124	11"								66 21 10 3
6.5	Weathered		3	SS	100	5"								10 10 55 25
374.7			4	RC BXL	75% Rec									RQD = 51%
15.0	Sound, Shale		5	RC	100%									RQD = 48%
369.7	Interbedded With Limestone			BXL	Rec									
20.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION



WP 802-93-01

RECORD OF BOREHOLE No 19

IMPERIAL

W P 157-75-03 LOCATION Coords. N 15,828,632; E 951,411 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 14, 1978 CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
404.8	Ground Level												
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	100/	5"	400			o			32 34 27 7
394.3			2	SS	31								
10.5			3	SS	100/	5"				o			16 32 34 18
384.8	Weathered		4	SS	100/	5"	390						
20.0	Sound, Shale Interbedded With Limestone		5	SS	100/	4"							
379.2			6	RC BXL	100% Rec		380						RQD = 68%
25.6	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 20										IMPERIAL				
WP 802-93-01		LOCATION		Coords. N 15,828,572; E 951,472		ORIGINATED BY V.K.								
W P 157-75-03		DIST 6 HWY 403		BOREHOLE TYPE Solid Auger, NX Casing, BXL Rock Core & Cone Test		COMPILED BY G.P.								
DATUM Geodetic		DATE June 13, 1978				CHECKED BY								
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	Wp	W	WL	Y	GR SA SI CL	
402.7	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	24		400						40 38 16 6	
			2	SS	1007	5"								
			3	SS	1007	6"							27 12 41 20	
390.2			4	SS	1007	6"								
12.5			5	SS	1807	4"								
	Weathered		6	SS	1067	5"								
372.7							380							
25.0	Sound, Shale Interbedded With Limestone		7	RC BXL	100% Rec									RQD = 71%
372.5														
30.2	End of Borehole													



SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
441.9	Ground Level									
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	28					4 19.49 28
			2	SS	30					
			3	SS	81					12 28 40 20
			4	SS	61					
424.9			5	SS	120	5"				
423.4	Weathered									
18.5	Sound, Shale									
419.4	Interbedded With Limestone		6	RC	100%					RQD = 0%
				BXL	Rec					
22.5	End of Borehole									

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

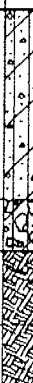
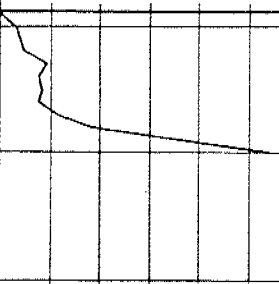

OFFICE REPORT ON SOIL EXPLORATION

WP 802-93-01

RECORD OF BOREHOLE No 22

IMPERIAL

W P 157-75-83 LOCATION Coords. N 15,828,732; E 951,566 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 16, 1978 CHECKED BY [Signature]

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							WATER CONTENT (%)	10 20 30	GR SA SI CL
								SHEAR STRENGTH									
								○ UNCONFINED	+ FIELD VANE								
441.1	Ground Level																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	37	1" 6"							23 16 41 20				
			2	SS	46									0 28 52 20			
			3	SS	66												
			4	SS	47												
	Boulders		5	SS	100												
422.1			6	SS	125												
19.0	Weathered																
416.4																	
24.7	Sound, Shale Interbedded With		7	RC	100												
411.1	Limestone		BXL	Rec									RQD = 59%				
30.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION



WP 802-93-01										RECORD OF BOREHOLE No 23										IMPERIAL									
W P 157-75-03										LOCATION Coords. N 15,828,688; E 951,614										ORIGINATED BY V.K.									
DIST 6 HWY 403										BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core and Cone Test										COMPILED BY G.P.									
DATUM Geodetic										DATE June 16, 1978										CHECKED BY									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL													
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W			W _L												
440.7	Ground Level																												
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	33											15 18 46 21													
			2	SS	48																								
			3	SS	42																								
			4	SS	73											6 30 47 17													
			5	SS	116																								
421.2			6	SS	100/	4"																							
19.5	Weathered																												
415.7																													
25.0	Sound, Shale		7	RC	100%																								
410.5	Interbedded With Limestone			BXL	Rec											RQD = 41%													
30.2	End of Borehole																												

OFFICE REPORT ON SOIL EXPLORATION



WP 802-93-01

RECORD OF BOREHOLE No 24

IMPERIAL

W P ~~157-75-03~~ LOCATION Coords. N 15,828,887; E 951,622 ORIGINATED BY V.K.
DIST 6 HWY 403 BOREHOLE TYPE Solid Auger, BX Casing, BXL Rock Core & Cone Test COMPILED BY G.P.
DATUM Geodetic DATE June 21, 1978 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				
454.2	Ground Level															
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	26		450									11 19 39 31
			2	SS	32											
			3	SS	44											3 24 53 20
			4	SS	41											
			5	SS	33											
			6	SS	28											
			7	SS	50											
			8	SS	25											10 31 50 19
422.2			9	SS	110/											
32.0	Weathered															
415.2																
39.0	Sound, Shale Interbedded With Limestone		10	RC	100%											RQD = 43%
410.2				BXL	Rec											
44.0	End of Borehole															

*3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100	W _p	W	W _L		
451.4	Ground Level												
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	33								
			2	SS	36								
			3	SS	70								
	Hard		4	SS	50								
			5	SS	35								
			6	SS	54								
			7	SS	63								
			8	SS	112								
419.4													
32.0	Weathered		9	SS	100	2"							
410.4			10	SS	165	4"							
41.0	Sound, Shale Interbedded With Limestone		11	RC EXL	100% Rec								
405.2													
46.2	End of Borehole												

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	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
445.3	Ground Level													
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	23									
			2	SS	22									
			3	SS	43									
			4	SS	31									
	Very Stiff to Hard		5	SS	31									
			6	SS	25									
422.3			7	SS	100/ 6"									
23.0	Weathered													
415.3														
30.0	Sound, Shale Interbedded With		8	RC	100%									
410.3	Limestone			BXL	Rec									
35.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION




WP 802-93-01

RECORD OF BOREHOLE No 51

IMPERIAL

W P 157 75 03 LOCATION Co-ords. N 15 828 215; E 950 966 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 17, 1980 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
389.7	Ground Level																
0.0	Sand & Gravel Dense																
386.7	Trace of Silt		1	SS	125												
3.0	Weathered Shale		2	SS	125	6"											
382.7			3	SS	100	6"											
7.0	Sound Shale with Limestone Layers		4	RC	REC		380										RQD 0%
			5	BXL	REC												RQD 70%
			6	RC	REC												RQD 25%
368.9			7	BXL	67%		370										RQD 75%
20.8	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15  5 (%) STRAIN AT FAILURE
10

WP 802-93-01

RECORD OF BOREHOLE No 52

IMPERIAL

W P 157-75-03 LOCATION Co-ords N 15 828 145; E 951 023 ORIGINATED BY MM & GP
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY GP
DATUM Geodetic DATE April 18, 1980 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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
390.0	Ground Level																
0.0	Glacial Till	Hard	1	SS	100%	5"											
387.0			2	SS	100%	5"											
3.0	Weathered Shale		3	SS	100%	2"											
383.0			4	SS	100%	2"											
7.0			5	SS	100%	1"											
	Sound Shale with Limestone Layers		6	RC	REC												
			7	BXL	70%												
			8	RC	100%	REC											
			9	RC	100%	REC											
366.0																	
24.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

WP 802-93-01

RECORD OF BOREHOLE No 53

IMPERIAL

W P 157-75-03 LOCATION Co-ords. N 15 828 306; E 951 073 ORIGINATED BY MM & GP
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 17, 1980 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
391.0	Ground Level													
0.0	Sand and Gravel Trace of Silt and Clay Compact		1	SS	25		390							50 26 20 4
384.0			2	SS	27									
7.0	Glacial Till Hard		3	SS	48									51 31 14 4
380.5			4	SS	101									
10.5	Weathered Shale		5	SE	100		380							
377.5			6	RC	65	REC								
13.5	Sound Shale with Limestone Layers		7	RC	REC									RQD = 0%
			8	BXL	15%									RQD = 10%
			9	RC	50%	REC								RQD = 60%
367.5							370							RQD = 80%
23.5	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

WP 802-93-01

RECORD OF BOREHOLE No 54

IMPERIAL

W P 157 75 93 LOCATION Co-ords. N 15 828 235; E 951 140 ORIGINATED BY MM & GP
 DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY G.P.
 DATUM Geodetic DATE April 17, 1980 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
390.7	Ground Level													
0.0	Sand and Gravel Trace of Silt and Clay		1	SS	21									
382.7	Compact		2	SS	20									
8.0	Weathered Shale		3	SS	44									
376.2			4	SS	1007	4"								
14.5			5	SS	1067	2"								
370.7	Sound Shale with Limestone Layers		6	RC BXL	REC 40%									RQD 25%
20.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

WP 802-93-01		RECORD OF BOREHOLE No 55				IMPERIAL							
W P 157-75-09		LOCATION Co-ords. N 15 828 420; E 951 192				ORIGINATED BY M.M.							
DIST 6 HWY 403		BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core				COMPILED BY G.P.							
DATUM Geodetic		DATE April 16, 1980				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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20					
392.4	Ground Level												
0.0	Sand and Gravel		1	SS	36								
	Trace of Silt & Clay		2	SS	19								
	Compact to Dense		3	SS	33								
	Numerous Cobbles and		4	SS	22								
	Boulders		5	SS	79/								
378.2			6	SS	100/	10"							
13.5	Weathered Shale					4"							
374.4													
18.0	Sound Shale with												
	Limestone Seams		7	RC	REC								
367.4				BXL	80%								RQD 45%
25.0	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

WP 802-93-01

RECORD OF BOREHOLE No 56

IMPERIAL

W P 157-75-03 LOCATION Co-ords. N 15 828 350; E 951 254 ORIGINATED BY M.M.
DIST 6 HWY 403 BOREHOLE TYPE Hollow Stem Auger & BXL Rock Core COMPILED BY G.P.
DATUM Geodetic DATE April 16, 1980 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
389.1	Ground Level																
0.0	Sand and Gravel		1	SS	20												
	Trace of Silt and Clay		2	SS	39												
382.1	Compact to Dense Cobbles & Boulders		3	SS	32												
7.0	Glacial Till Hard		4	SS	100												
378.6			5	SS	100	5"	380										
10.5	Weathered Shale		6	SS	100	3"											
373.1			7	RC	REC	3"											
16.0	Sound Shale with Limestone Layers						370										
364.1																	
25.0	End of Borehole																RQD 80%

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L	WATER CONTENT (%)				
404.9	Ground Level															
0.0	Heterogeneous Mixture Clayey Silt, Sand and Gravel Glacial Till		1	SS	23											
398.4	Hard		2	SS	90%											
6.5	Weathered Shale and Limestone Layers 4" - 6" Thick		3	RC	REC											
	Alternating Layers of Glacial Till 5" - 24" Thick		4	BXL	80%											
			5	RC	REC											
385.9			6	RC	90%	REC										
19.0	Sound Shale Bedrock with Limestone Layers		7	SS	30%	3"										
374.9			8	BXL	100%										RQD 80%	
30.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

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					
390.5	Ground Level														
0.0	Sand & Gravel		1	SS	24										
	Trace of Silt & Clay Compact		2	SS	15										
383.5	With Organic Inclusions		3	SS	45										
381.0	Glacial Till Hard		4	SS	167	9"									
9.5	Weathered		5	SS	100	5"									
	Shale Bedrock with Limestone Layers		6	SS	100	3"									
371.0															
19.5	Sound		7	RC BXL	REC 80%										RQD 50%
365.5															
25.0	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION



HOLE NO. _____ SHEET NO. _____

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900

PROPERTY W.P. 157-75-03
LOCATION Hwy. 403 and Credit River

LATITUDE
DEPARTURE
BEARING

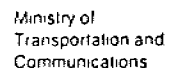
TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY Z. Koniuszy

[illegible]

DATE OF EXAMINATION _____

OB-NY-113



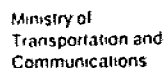
HOLE NO. _____ SHEET NO. _____

TOTAL FOOTAGE _____	

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
		Hole No. 13				
14'6"	15'0"	Limestone - dolomitic, silty light grey with reddish tint, fine textured, hard with 1" seam of dark grey shale.				
15'0"	19'0"	Shale, reddish-grey, medium hard, partly fissile, with numerous thin lenses of grey limestone.				core broken and ground.
		Hole No. 14				
14'0"	14'10"	Limestone, grey, mottled, medium to coarse textured, fossiliferous, vuggy.				
14' 10"	23'5"	Shale, dark grey, partly fissile with thin lenses of limestone.				4' of core missing core badly broken and ground.

DATE OF EXAMINATION _____



NOTE NO. _____ SHEET NO. _____

DEP

PROPERTY W.P. 157-75-03
LOCATION Hwy. 403 and Credit River

LATITUDE _____
DEPARTURE _____
BEARING _____

TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____



Communications

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

Q1 P

PROPERTY	W.P. 157-75-03
LOCATION	Hwy. 403 and Credit River
LATITUDE	
DEPARTURE	
BEARING	

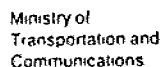
TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____

DB - 47-113



HOLE NO. _____ SHEET NO. _____

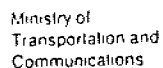
DIP

TOTAL FOOTAGE _____

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 GRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____



HOLE NO. _____ SHEET NO. _____

515

TOTAL FOOTAGE	

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____



Ministry of
Transportation and
Communications

Ontario

DIAMOND DRILL RECORD

DIP

HOLE NO. _____ SHEET NO. _____

PROPERTY W.P. 157-75-03
LOCATION Hwy. 403 and Credit River

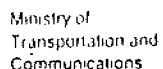
LATITUDE _____
DEPARTURE _____
BEARING _____

TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
Hole No. 22						
24'4"	29'1"	Shale dark grey, medium hard, partly fissile with two 2" limestone seams and numerous limestone lenses.				4" of core missing.
29'1"	30'0"	Limestone, light to grey, medium to coarse textured, hard, fossiliferous with thin seams of shale.				
Hole No. 23						
25'0"	25'6"	Shale, dark grey, medium hard				Core broken
25'6"	27'0"	Shale, dark grey, medium hard interbedded with grey, fine textured hard limestone.				
27'0"	27'9"	Shale, dark grey, medium hard, partly fissile.				
27'9"	29'0"	Shale, dark grey, medium hard, interbedded with grey, fine textured, medium hard shaly limestone.				
29'0"	32'2"	Limestone, light grey, coarse textured, hard fossiliferous with 2½" seam of dark grey shale.				28'7"-29'-11" - vertical fracture.

DATE OF EXAMINATION _____



FILE NO. _____ DATE OF INFO. _____

018

[illegible]

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

[illegible]

DATE OF EXAMINATION _____



Ministry of
Transportation and
Communications

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

DIP _____

PROPERTY LOCATION W.P. 157-75-03
Hwy. 403 and Credit River

LATITUDE _____
DEPARTURE _____
BEARING _____

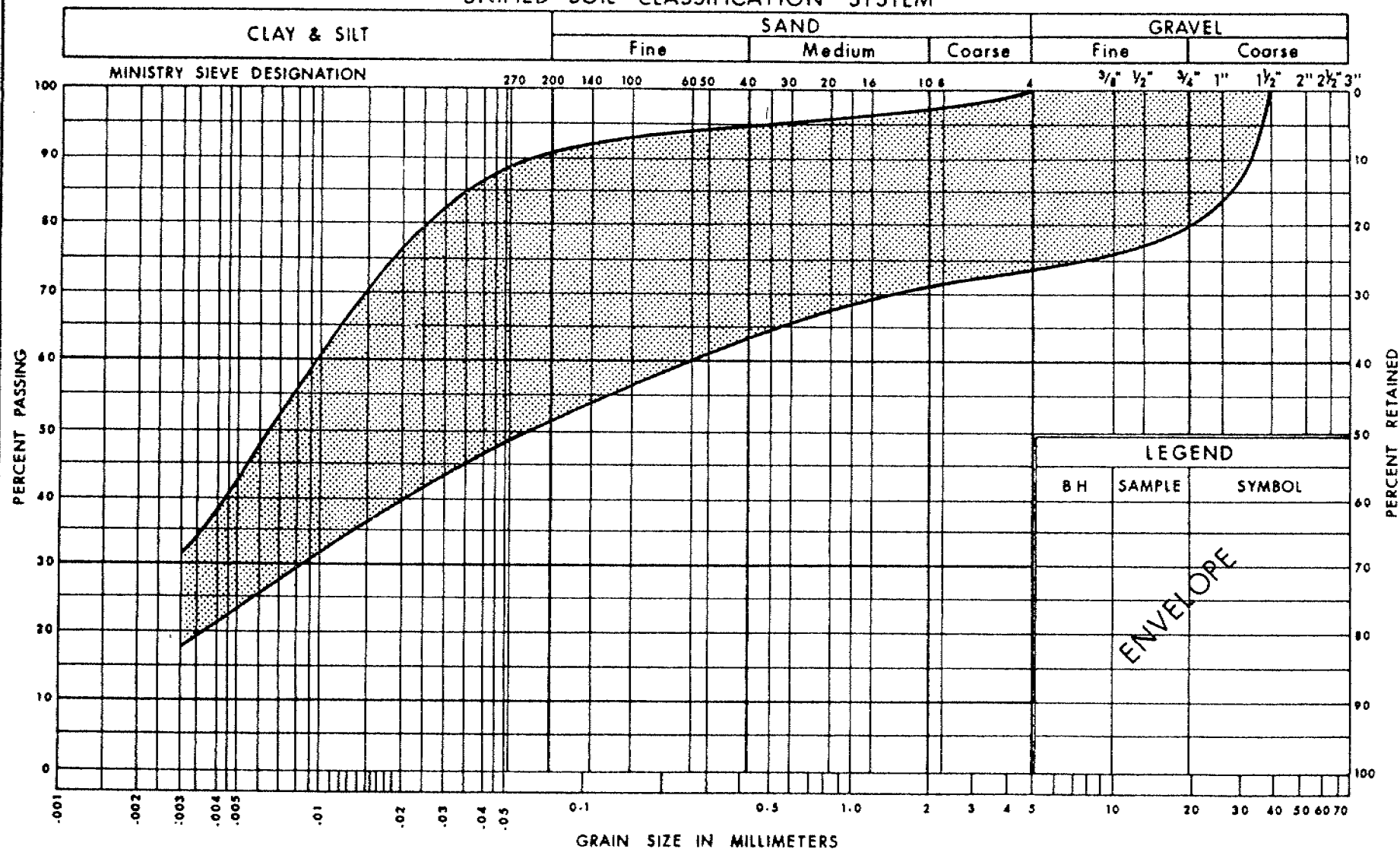
TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
		Hole No 25				
41'0"	45'5"	Shale, dark grey with reddish sections, medium hard with thin lenses of fine textured, hard limestone.				
45'5"	46'3"	Limestone, grey with reddish tint, fine textured, hard with 3" seam of reddish shale.				Vertical fracture through out limestone.
		Hole No 26				
30'0"	32'9"	Shale, dark grey, partly fissile with thin lenses of fine to medium textured grey shaly limestone.				
32'9"	33'2"	Limestone, grey, hard fossiliferous				
33'5"	33'11"	Limestone, grey, hard, fossiliferous				Core broken
33'11"	35'0"	Shale, dark grey, medium hard				

DATE OF EXAMINATION _____

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

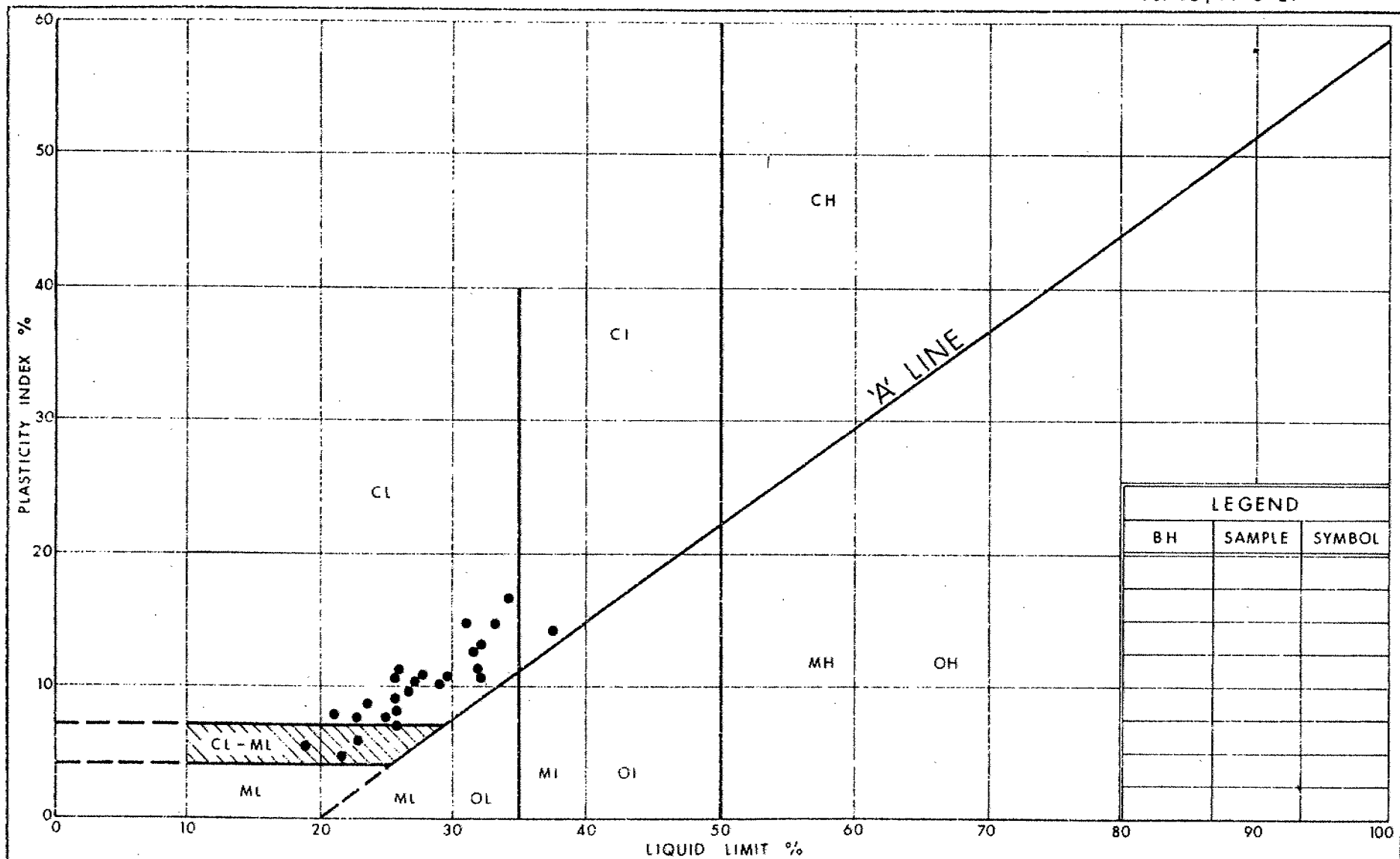
GRAIN SIZE DISTRIBUTION

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

FIG No 1

WP ~~157-75-03~~

WP 802-93-01



Ministry of
Transportation and
Communications

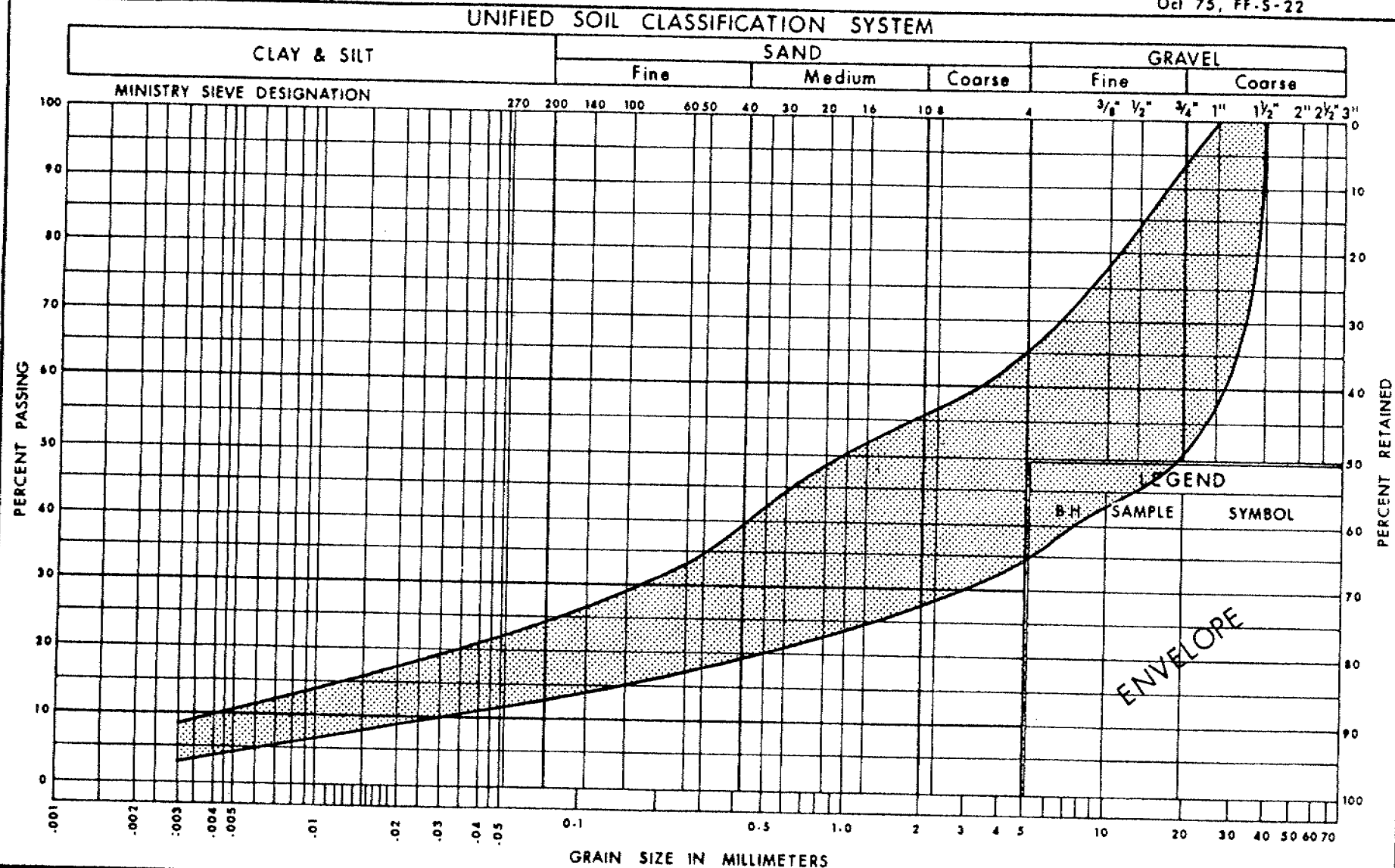
PLASTICITY CHART HET MIXTURE OF CLAYEY SILT, SAND & GRAVEL (Glacial Till)

FIG No 2

W P ~~157-75-03~~

WP 802-93-01

2



Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION

SAND & GRAVEL, TRACE OF SILT & CLAY

FIG No 3

WP ~~157-75-03~~

WP 802-93-01

FOUNDATION INVESTIGATION REPORT

For

Proposed Structure Over

Mullet Creek and Hwy. 403

W.P. 803-93-01, Site 24-386

District 6, Toronto

NOTE: All measurements are in imperial units. The foundation drawing (Contract Dwg No. 2) is in imperial units. Imperial stations cannot be directly converted to metric stations. The surface conditions and contours shown on the drawing may not reflect existing surface conditions.

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the period of June 21 and 22, 1977.

The fieldwork consisted of 12 sampled boreholes advanced by means of a continuous flight auger equipped with solid and hollow stem (3-1/4" I.D.) augers. In addition, diamond drilling techniques were employed to obtain BXL size rock core samples of bedrock. The boreholes ranged in depths from 6.5 to 11 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located about a half mile west of Credit River or immediately west of Mississauga Road and one mile south of Eglinton Avenue, in the City of Mississauga, Regional Municipality of Peel.

The topography of the general area is gently sloping in a southerly direction. The site is located in the Mullet Creek Valley whose width is approximately 250 feet. The valley floor is at approximate

elevation 448 and the valley banks are at elevation 465. The creek meanders in a southerly direction. The clear width of the creek is about 20 feet and the water level in the creek is about elevation 445. The land is developed for farming purposes. Physiographically, the site is situated in the border regions of "Peel Plains" and "South Slope". The characteristic deposit in the vicinity of the area under investigation is composed of cohesive glacial till and granular deposits. The overburden is underlain by shale bedrock of Meaford, Dundas formation, Ordovician Period.

This physiographic region is well drained by the Credit, Oakville and Etobicoke Creeks, which have cut deep valleys into the overburden, although in many of the interstream areas drainage is still imperfect.

SUBSURFACE CONDITIONS

General

The subsurface conditions were found to be quite uniform over the site. Under a thin layer of topsoil is a stratum of cohesive glacial till, a heterogeneous mixture of clayey silt, sand and gravel. The overburden is underlain by interbedded layers of shale and limestone bedrock which was proven in all boreholes. Detailed descriptions of the soil and rock types encountered in each borehole are given in the Record of Borehole Sheets. The estimated stratigraphical profile and sections shown on Drawing No. 2 of the Contract Drawings are based upon this information.

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

Underlying a thin layer up to 12 inches of topsoil, is a deposit of cohesive glacial till comprised of a heterogeneous mixture of clayey silt, sand and gravel. The cohesive glacial till material was encountered at all locations except in B.H. No's 8, 9 and 11. The glacial till varied in thickness from 3.5 to 6.0 feet. The Standard Penetration Tests gave "N" values ranging from 13 to over 100 blows per foot indicating that the cohesive stratum has stiff to hard consistency.

The physical properties of the clayey silt layer, as determined from laboratory testing, are summarized below:

	<u>Range</u>
Liquid Limit (w_L) %	25 - 34
Plastic Limit (w_P) %	16 - 20
Moisture Content (w) %	7 - 21

The results of the Atterberg Limit Tests are shown on Plasticity Chart (Fig. 1) and the typical grain size distribution curves are presented in an envelope form in Fig. 2 which are included in the Appendix of this report.

The Atterberg Limits indicate that the cohesive stratum is inorganic and of low plasticity.

The boreholes No. 8, 9 and 11 were put in the creek through 6 inches of water. Under the water a deposit of 1.5 to 2.5 ft. thick alluvial silty sand and gravel was found overlying the bedrock.

Bedrock (Shale to Shaley Limestone)

Bedrock was encountered immediately below the cohesive glacial till overburden, or immediately beneath the alluvial deposit in the creek floor. It consists of interbedded layers of shale and limestone. The surface of the bedrock in the area investigated varies from elevation 442.0 to 445.0 and appears to be dipping slightly in a westerly direction. The bedrock was found to be generally sound. However, in certain locations, the upper 6" to 18" of the bedrock appeared to be slightly weathered.

Groundwater

The groundwater levels were observed by measuring in the open boreholes during and after the completion of the foundation investigation. The groundwater levels were found to vary between

elevations 445.8 and 444.1 which corresponds to depths of 3.0 to 3.5 feet below the existing ground surface. The water level in the Mullet Creek during the time of investigation (June 22, 1977) was 445.0.

The groundwater levels are shown on the record of Borehole Sheets, as well as on Contract Drawing No. 2.

MISCELLANEOUS

The fieldwork was carried out during June 21 and 22, 1977 under the supervision of Mr. V. Korlu, Project Engineer, who also prepared this report.

The drilling equipment was owned and operated by Dominion Soil Ltd. of Toronto. This report was reviewed by Mr. M. Devata, Supervising Engineer.



B. Bennett
B. Bennett, P. Eng.
Sr. Foundation Engineer
(Acting)



D. Dundas
D. Dundas, P. Eng.
Chief Foundation Engineer
(Acting)

APPENDIX

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 1

IMPERIAL

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,211; E 950,002

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
447.6	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sand & gravel (Glacial till) Stiff		1	SS	28											
442.1	Weathered															
5.5	Sound Shaly limestone Bedrock		2	BXL	Rec 70%	440										
437.1	End of Borehole															
10.5	Bedrock Description															
	From 5'5" to 5'11" Limestone, grey, medium textured, medium hard, fossiliferous with sandy sections.															
	From 5'11" to 10'5" Shale, grey, soft fissile with shaly sections.															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION													
RECORD OF BOREHOLE NO 2										IMPERIAL			
WP 803-93-01		LOCATION Co-ords. N 15,827,282; E 949,964				ORIGINATED BY VK							
WP 157-75-05		BORING DATE June 22, 1977				COMPILED BY VK							
DIST 6 HWY 403		BOREHOLE TYPE Auger - BXL Core				CHECKED BY RS							
DATUM Geodetic													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	20 40 60 80 100	WATER CONTENT % w_p — w — w_L	10 20 30	% GR SA SI CL			
448.3	Ground Level												
0.0	Topsoil												
1.0	Heterogeneous mixture of clayey silt, sand, gravel.												
444.3	(Glacial till) Stiff		1	SS	13								11 36 37 16
4.0	Shaly Limestone												
439.3	Bedrock Sound		2	BXL	Rec 100	% 440							RQD 40%
9.0	End of Borehole												
<p><u>Bedrock Description</u></p> <p>From 4'0" to 6'0" Limestone, grey, medium textured, medium hard to hard, fossiliferous.</p> <p>From 6'0" to 10'5" Shale, grey, soft, fissile with shaly sections.</p>													

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 3

IMPERIAL

WP 157-75-05

LOCATION Co-ords. N 15,827,355; E 949,932

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W _P	W	W _L	
448.4	Ground Level														
0.0	Topsoil														GR SA SI CL
1.0	Heterogeneous mixture of clayey silt, sand, & gravel. (Glacial Till), Hard		1	SS	45										7 28 51 14
442.4	Weathered		2	SS	100	5"									
6.0	Sound Shaly Limestone Bedrock		3	BXL	Rec 90%	440									RQD 7%
437.4															
11.0	End of Borehole														
	Bedrock Description														
	From 6' to 7' Limestone, grey, medium textured, hard.														
	From 7' to 9'3" Shale, grey, soft, fissile with shaly sections.														
	From 9'3" to 9'9" Limestone, light grey, medium textured, hard, fossiliferous.														
	From 9'9" to 11' Shale, grey, soft, fissile with shaly sections.														

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 4

IMPERIAL

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,230; E 950,025

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P W W_L			
446.9	Ground Level														
0.0	Topsoil														
1.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	38										
443.4															
3.5	Shaly Limestone				Rec										
438.4	Sound Bedrock		2	BXL	100%	440									RQD 38%
8.5	End of Borehole														
	Bedrock Description														
	From 3'5" to 5'5" Limestone, grey, medium textured, medium hard to hard, fossiliferous.														
	From 5'5" to 7'5" Shale, grey, soft, fissile with shaly sections.														
	From 7'5" to 8'5" Limestone, light grey, medium to coarse textured, medium hard, fossiliferous.														

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

IMPERIAL

WP 803-93-01

WP 157-75-05

LOCATION Co-ords. N 15,827,301; E 949,986

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p	w	w_L		
447.7	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, ss. & gr.															
443.7	(Glacial till) Hard		1	SS	45											13 15 55 17
4.0	Shaly Limestone															
438.7	Bedrock Sound		2	BXL	Rec 100%	440										RQD 45%
9.0	End of Borehole															
	Bedrock Description															
	From 4'0" to 6'4" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 6'4" to 8'5" Shale, grey, soft, fissile with shaly sections.															
	From 8'5" to 9' Limestone, grey, medium textured, medium hard, fossiliferous.															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 6

IMPERIAL

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,376; E 949,961

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY R S

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
448.0	Ground Level															
0.0	TOPSOIL															
1.0	Het. mix. of cl. si. sa. & s. l.															
444.0	gr. (Gl. Till) V. Stiff		1	SS	16											7 50 35 8
4.0	Shaly Limestone															
439.0	Bedrock Sound		2	BXL	Rec 100	440										RQD 28%
9.0	End of Borehole															
	Bedrock Description															
	From 4' to 6'3"															
	Limestone, grey,															
	medium textured,															
	hard, fossiliferous.															
	From 6'3" to 9'															
	Shale, grey, soft,															
	fissile, with shaly															
	sections.															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE No 7

IMPERIAL

WP 157-75-05

LOCATION Co-ords. N 15,827,333; E 950,024

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p — w — w_L				
							SHEAR STRENGTH					WATER CONTENT %				
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
447.9	Ground Level															
0.0	Topsoil															
1.0	Heterogeneous mixture of clayey silt, sa. & gr. (Glacial till) V. Stiff		1	SS	22											
443.4																
4.5	Shaly Limestone		2	BXL	Rec											
438.4	Bedrock Sound				100	440									GR SA SI CL 45 31 16 8 RQD 7%	
9.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 4'5" to 6'6" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 6'6" to 8'7" Shale, grey, soft, fissile with shaly sections.															
	From 8'7" to 9'2" Limestone, grey, medium textured, medium hard, fossiliferous															
	From 9'2" to 9'5" Shale, grey, soft, fissile.															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 8

IMPERIAL

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,263; E 950,063

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 22, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY PS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
444.8	Water Level															
442.8	Sl. sa. sgr. (alluvial)															
2.0	Shaly Limestone		1	BXL	Rec	440										
437.8	Bedrock Sound				100 %											
7.0	End of Borehole															
	<p><u>Bedrock Description</u></p> <p>From 2' to 3' Limestone, grey, medium to coarse textured, medium hard, fossiliferous.</p> <p>From 3' to 5' Shale, grey, soft, fissile with shaly sections.</p> <p>From 5' to 5'10" Limestone, grey, medium to coarse textured, medium hard, fossiliferous.</p> <p>From 5'10" to 6'4" Shale, grey, soft, fissile.</p> <p>From 6'4" to 6'7" Limestone, grey, medium to coarse textured, medium hard, fossiliferous.</p> <p>From 6'7" to 7' Shale, grey, soft, fissile.</p>															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 9

IMPERIAL

WP 157-75-05

LOCATION Co-ords. N 15,827,404; E 949,986

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		UNIT WEIGHT γ	REMARKS		
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80			100	w_p
445.0	Water Level													
0.0	Silty sand & gravel (alluvial)													
442.0	Weathered													
3.0	Sound Shaly Limestone Bedrock		1	BXL	Rec 96%	440								
437.0														
8.0	End of Borehole													
	Bedrock Description													
	From 3' to 3'6" Limestone, grey, fine to medium textured, hard.													
	From 3'6" to 6'2" Shale, grey, soft, fissile.													
	From 6'2" to 6'9" Limestone, grey, fine textured, hard, fossiliferous with thin seams of shale.													
	From 6'9" to 8' Shale, grey, soft, fissile, interbedded with shaly sections.													

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 10

IMPERIAL

WP 803-93-01

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,281; E 950,084

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
448.5	Ground Level															
0.0	Topsoil															
445.0	Het. mix. of cl. si. sa. sgr. (Cl. Till) Hard		1	SS	55											34 7 47 12
3.5	Shaly Limestone															
440.0	Bedrock Sound		2	BXL	Rec 100 %											RQD 40%
8.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 3'5" to 5'1" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 5'1" to 7'3" Shale, grey, soft, fissile, with shaly sections.															
	From 7'3" to 8'5" Limestone, grey, medium textured, medium hard, inter- bedded with grey shale. Fossiliferous.															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 11

IMPERIAL

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,353; E 950,047

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	SHEAR STRENGTH O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				
445.1	Water Level															
443.6	St. Sa. & Gr. (Alluvial)		1	Wash												GR SA SI CL
1.5	Shaly Limestone		2	BXL	Rec											
438.6	Bedrock Sound				100	% 440										RQD 49%
6.5	End of Borehole															
	<u>Bedrock Description</u>															
	From 1'5" to 2'11" Limestone, grey, medium textured, medium hard, fossiliferous.															
	From 2'11" to 5'0" Shale, grey, reddish, soft, fissile with shaly sections.															
	From 5'0" to 5'11" Limestone, light grey, medium textured, medium hard, fossiliferous.															
	From 5'11" to 6'5" Shale, grey, reddish, soft, fissile.															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

WP 803-93-01

RECORD OF BOREHOLE NO 12

IMPERIAL

WP ~~157-75-05~~

LOCATION Co-ords. N 15,827,422; E 950,008

ORIGINATED BY VK

DIST 6 HWY 403

BORING DATE June 21, 1977

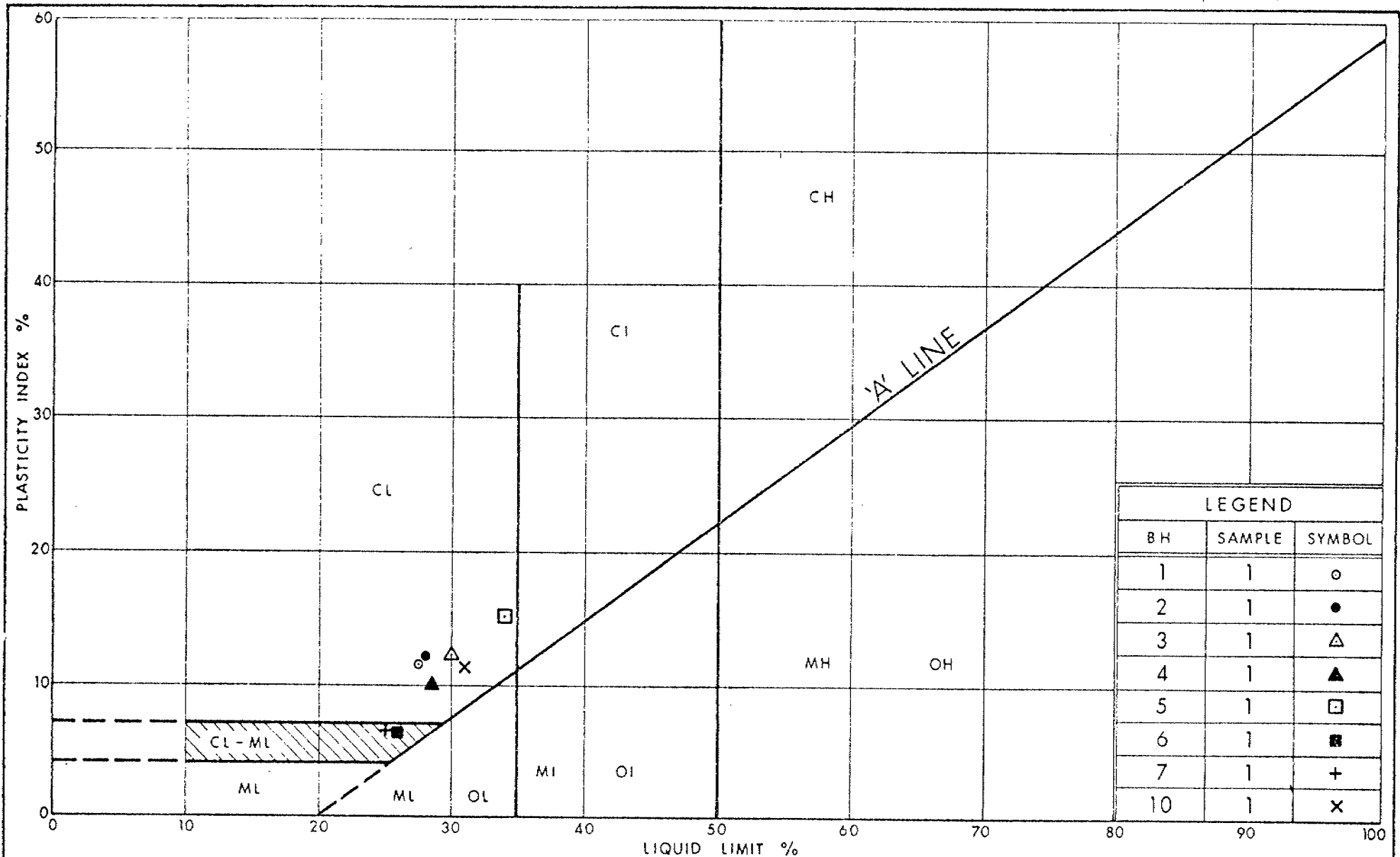
COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger - BXL Core

CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
447.4	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of cl. si. sa. & gr. (Gl. Till) Hard		1	SS	118, 94											43 22 25 10
443.4																
4.0	Shaly Limestone		2	BXL	Rec 100%	440										RQD 16%
438.4	Bedrock Sound															
9.0	End of Borehole															
	<u>Bedrock Description</u> From 4' to 6' Limestone, grey, med. textured, med. hard fossiliferous. From 6' to 6'7" Shaly limestone. From 6'7" to 7'3" Limestone, grey, medium textured, medium hard, fossiliferous. From 7'3" to 7'10" Shale with thin seams of limestone. From 7'10" to 9' Limestone, grey to pink, medium textured, medium hard, fossiliferous.															



Ministry of
Transportation and
Communications

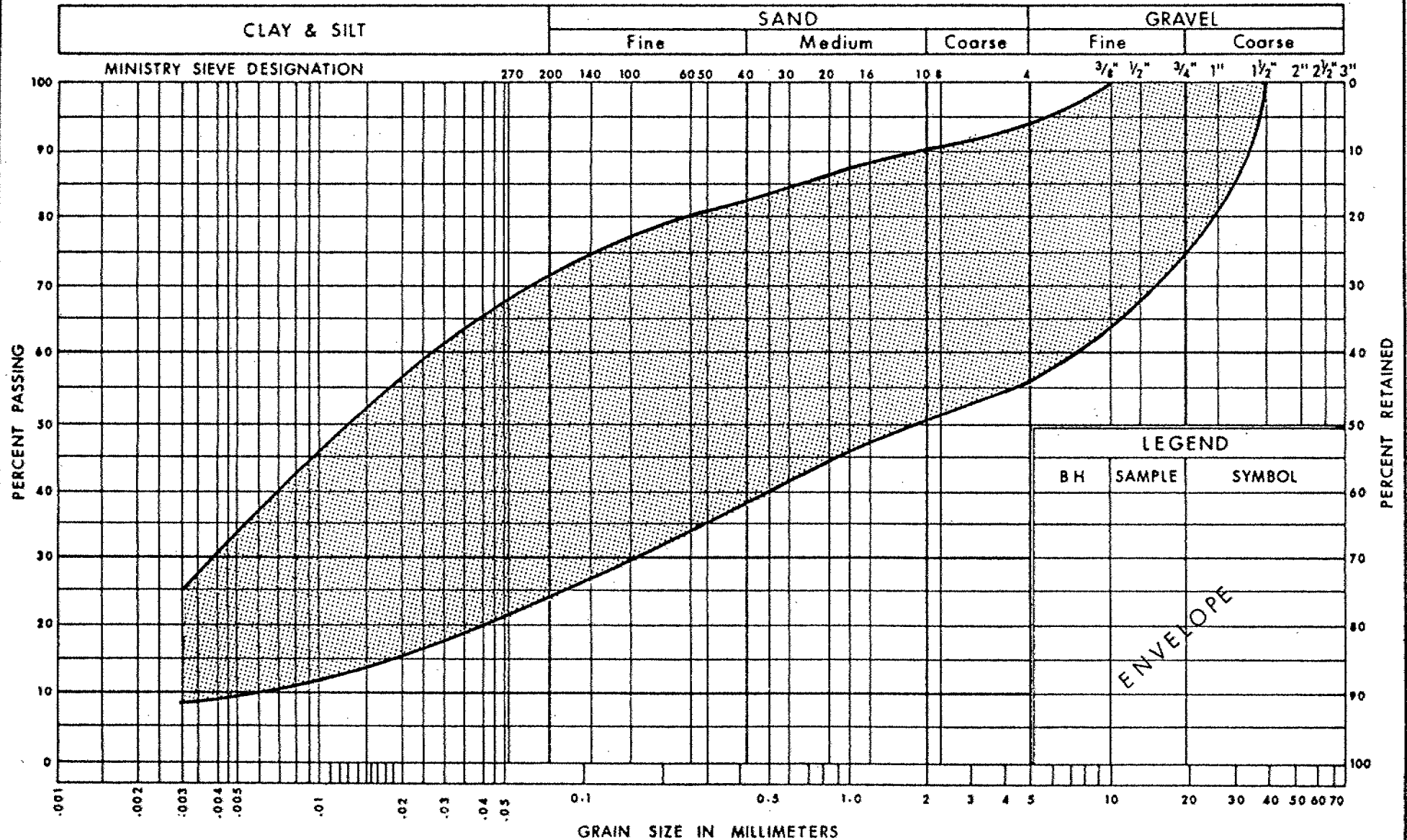
PLASTICITY CHART
GLACIAL TILL
HET MIX OF CLAYEY SILT WITH SAND & GRAVEL

FIG No 1

W P ~~157-75-05~~

WP 803-93-01

UNIFIED SOIL CLASSIFICATION SYSTEM



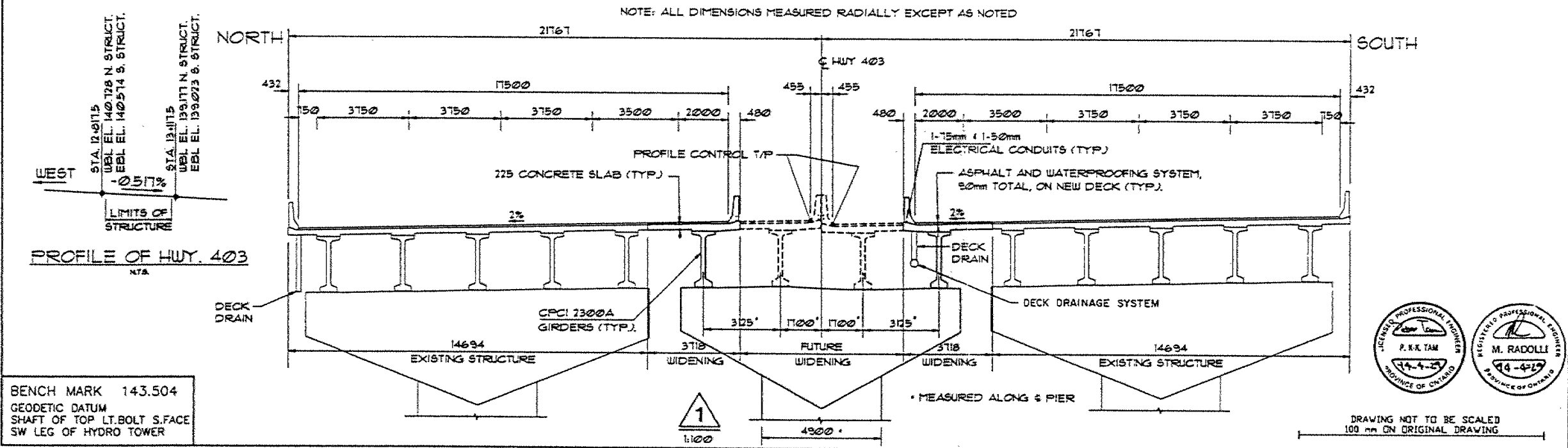
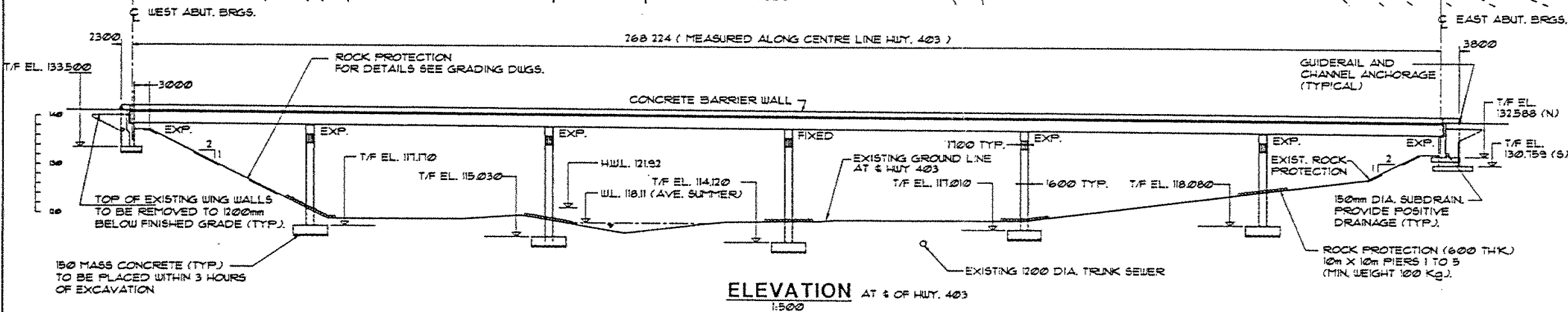
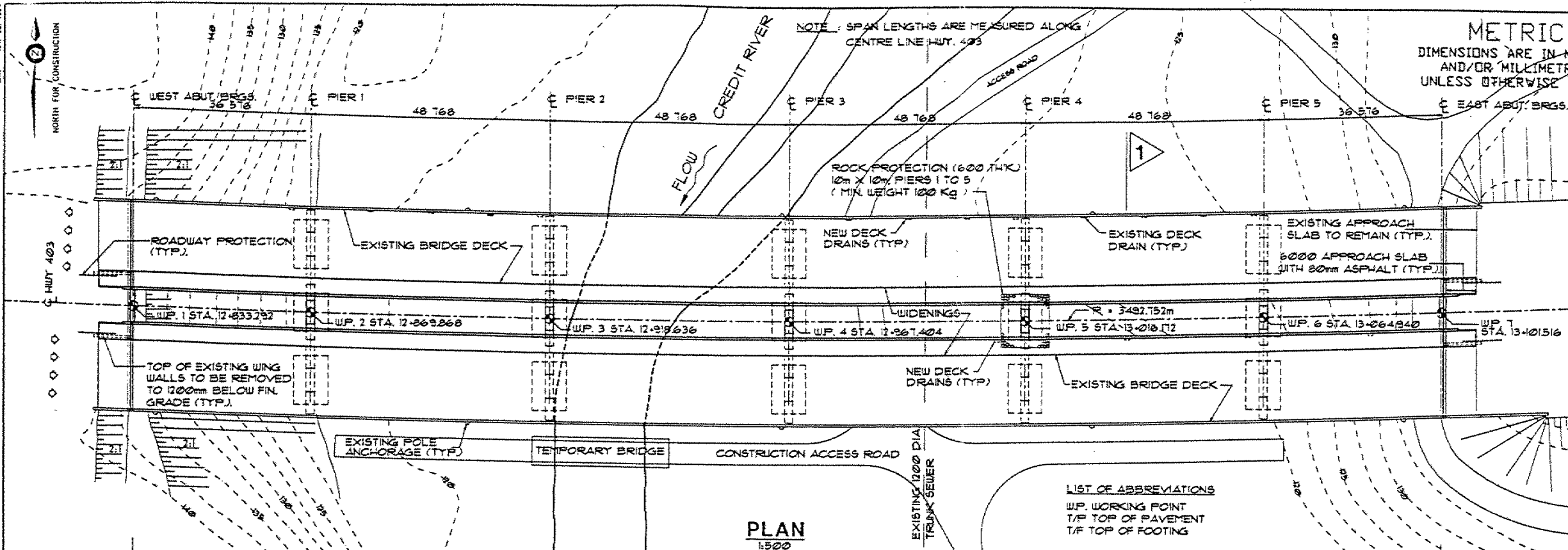
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIX OF CLAYEY SILT WITH SAND & GRAVEL

FIG No 2

WP ~~157-75-05~~

WP 803-93-01



DIST. No. 6
 CONT. No. 94-57
 WP. No. 802-93-01

HWY 403 - CREDIT RIVER
 BRIDGE WIDENING
 GENERAL ARRANGEMENT

SHEET
 128

DILLON
 Consulting Engineers - Planners
 Environmental Scientists

GENERAL NOTES

CLASS OF CONCRETE

PRECAST GIRDERS AND PIER DIAPHRAGMS 45 MPa.
 PIERS 35 MPa.
 REMAINDER 30 MPa.

CLEAR COVER TO REINFORCING STEEL

FOOTINGS 100±25mm
 ABUTMENTS AND WINGWALLS
 FRONT FACE: 70±20mm
 BACK FACE: 70±20mm
 PIERS 70±20mm
 DECK TOP 70±20mm
 BOTTOM 40±10mm
 REMAINDER UNLESS OTHERWISE NOTED 70±20mm

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.
 BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.
 WHERE SPLICES ARE NOT SHOWN ON THE DRAWINGS, SPLICES SHALL BE AT LEAST:-

15M	650mm
20M	800mm
25M	1000mm
30M	1250mm
35M	1500mm

CONSTRUCTION NOTES:-

THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.

CONTRACTOR SHALL VERIFY ALL RELEVANT DIMENSIONS AND ELEVATIONS OF EXISTING STRUCTURE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR.

SAUCUTS IN CONCRETE SHALL BE 25mm DEEP OR TO TOP OF FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.

LIST OF DRAWINGS

- GENERAL ARRANGEMENT
- BORE HOLE LOCATION AND SOIL STRATA
- SECTIONS AND SOIL STATIGRAPHY
- ROADWAY PROTECTION
- FOOTING LAYOUT
- FOOTING REINFORCEMENT
- EAST ABUTMENT
- WEST ABUTMENT
- ABUTMENT DETAILS
- PIER
- GIRDER LAYOUT AND DETAILS
- GIRDER DETAILS - SPANS 1 & 6
- GIRDER DETAILS - SPANS 2 & 5
- GIRDER DETAILS - SPANS 3 & 4
- MISCELLANEOUS GIRDER DETAILS
- DECK LAYOUT & SCREED ELEVATIONS
- DECK REINFORCEMENT - I
- DECK REINFORCEMENT - II
- DECK DRAIN MODIFICATIONS
- EXPANSION JOINT
- BARRIER WALL W/O RAILING
- 6000mm APPROACH SLAB
- AS CONSTRUCTED ELEVATION & DIMENSION
- METHOD OF GIRDER ERECTION
- STANDARDS
- DRAINAGE DETAILS
- ELECTRICAL EMBEDDED WORK
- QUANTITIES - STRUCTURE I
- QUANTITIES - STRUCTURE II

APPLICABLE STANDARD DRAWINGS

CPSD 350120 GRANULAR BACKFILL REQUIREMENTS
 CPD 350622 BRIDGE DECK WATERPROOFING
 CPD 401020 GUIDERAIL AND CHANNEL ANCHORAGE

REVISIONS

NO.	DATE	BY	DESCRIPTION
1			

DESIGN P.T. CHK. M.R. [CODE 0900-91] LOAD CLASS A DATE APR 94
 DRAWN M.A.S. CHK. P.T. [SITE 24-222] STRUCT. SCHEME 13VG. 1

DRAWING NOT TO BE SCALED
 100 mm ON ORIGINAL DRAWING

REGISTERED PROFESSIONAL ENGINEER
 P. K. K. TAM
 PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER
 M. RADOLLI
 PROVINCE OF ONTARIO

P.E. PROJ. NO. 94-57
DATE: APR 1994

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

CONT. No. 94-57
WP. No. 802-93-01

HWY 403 - CREDIT RIVER
BRIDGE WIDENING
ROADWAY PROTECTION

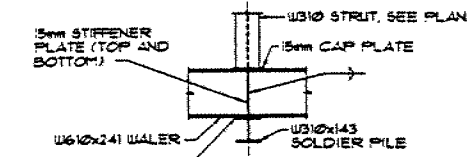
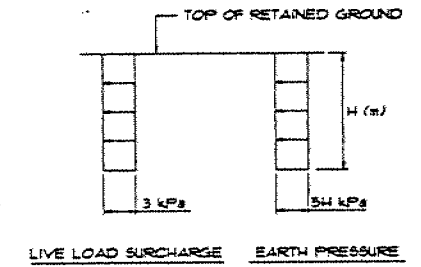


SHEET
131

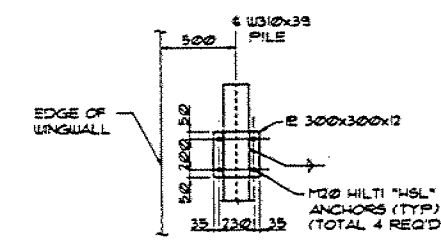
DILLON
Consulting Engineers & Planners
Environmental Scientists

NOTES:

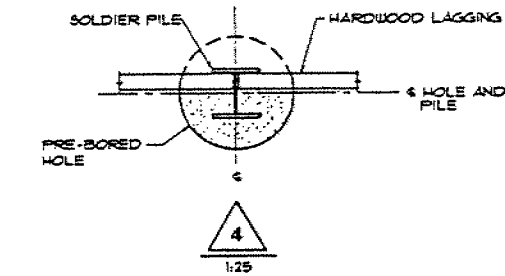
1. ALL STRUCTURAL STEEL FOR PILES, WALERS, STRUTS AND CONNECTIONS, ETC. SHALL CONFORM TO C.S.A. G40.21 - GRADE 300UL.
2. ALL WELDING OF STRUCTURAL STEEL SHALL CONFORM TO C.S.A. W59 AND BE PERFORMED BY QUALIFIED WELDERS.
3. LAGGING SHALL BE HARDWOOD OF FULL THICKNESS OF 100mm, UNLESS NOTED ON DRAWING.
4. CONCRETE ENCASMENT FOR PILES SHALL BE CAST AGAINST UNDISTURBED GROUND.
5. AFTER CONSTRUCTION IS COMPLETED, ALL SHORING TO BE CUT OFF ONE METER BELOW GRADE.
6. ALL WALER BEAMS TO BE W610x241.
7. ALL WELDS SHOWN OR IMPLIED TO BE 6mm FILLET.
8. LATERAL PRESSURE DIAGRAM:



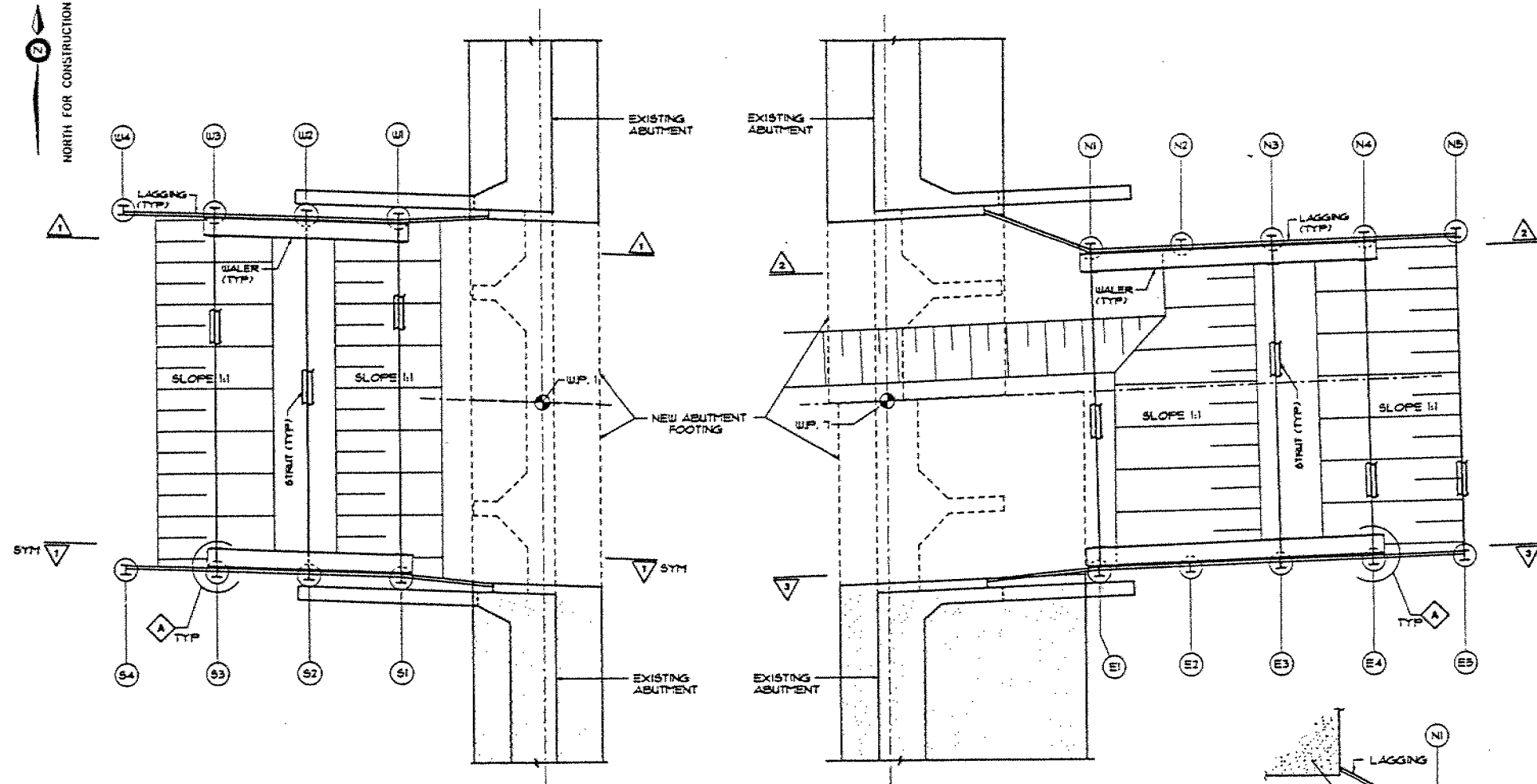
A DETAIL
1:50



B DETAIL
1:25



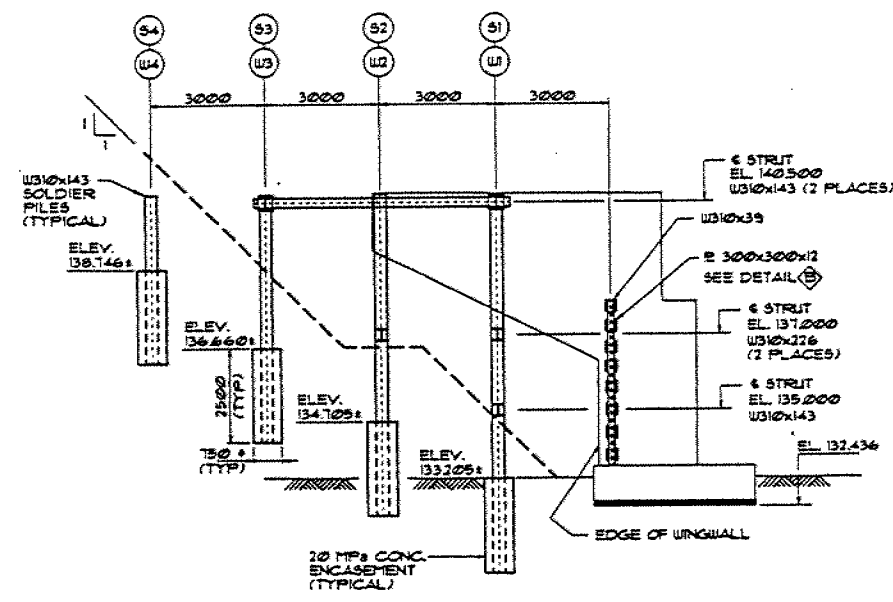
4
1:25



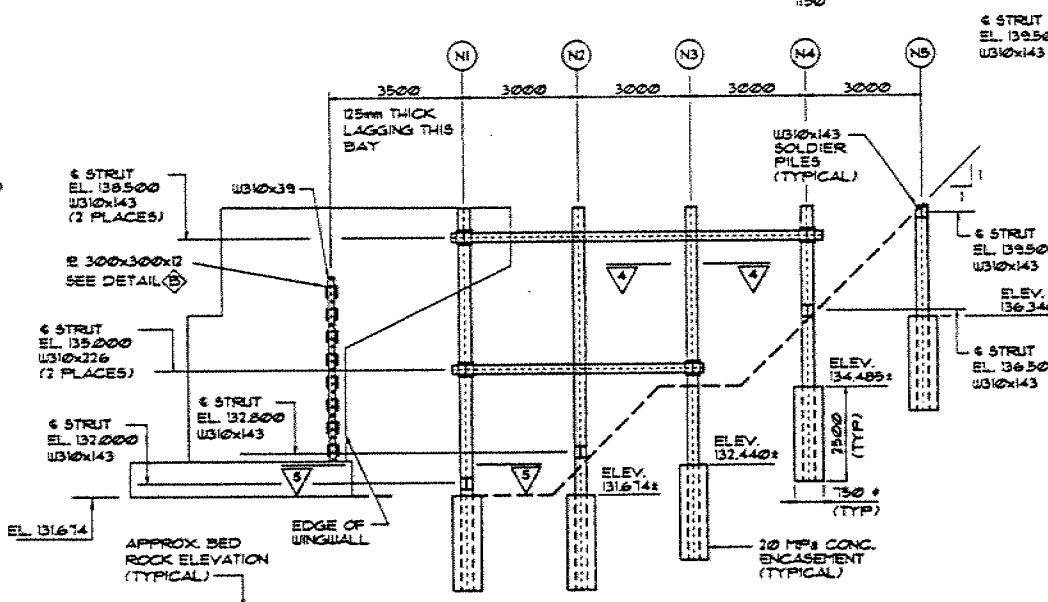
ROADWAY PROTECTION SHORING PLAN
1:100

JAM LAGGING AGAINST EXISTING FOOTING
AND WEDGE AT PILE AS NECESSARY

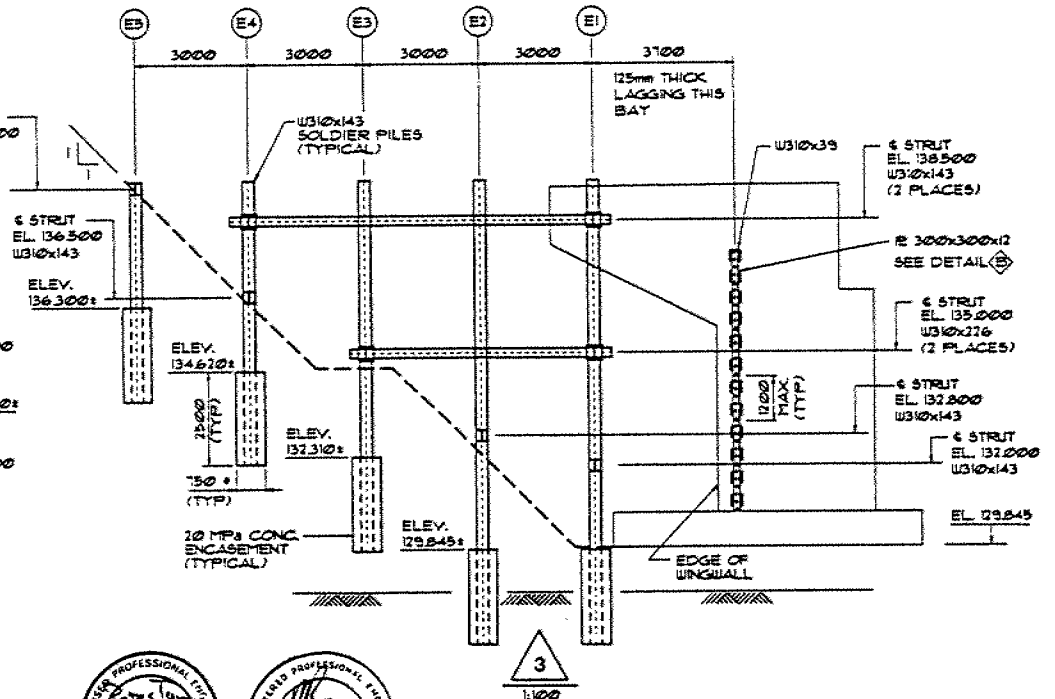
5
1:50



1
1:100



2
1:100



3
1:100



100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	APR 1994	CHK. M.R.	CODE C-400-91
DRAWN	APR 1994	CHK. P.T.	SITE 24-222
			STRUCT. SCHEME
			1 DWG. 4

memorandum



To: V. Boehnke
Head, Structural Section
Central Region

Date: 1994 03 28

Atten: R. Jeffries

From: Foundation Design Section
Room 315, Central Bldg.

Re: Shoring Design Scheme
Credit River Structure Widening
Hwy. #403
W.P. 802-93-01, Site 24-222
District #6 (Toronto)

As per your request the following design parameters are recommended for the proposed shoring scheme:

$$\begin{array}{lcl} \phi & = & 32.5^{\circ} \\ \gamma & = & 22.4 \text{ kN/m}^3 \end{array}$$

These average figures (glacial till and shale bedrock) were given to Mr. R. Radolli by telephone on March 18, 1994.

A handwritten signature in dark ink, appearing to read "P. Payer".

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

PP/mmj

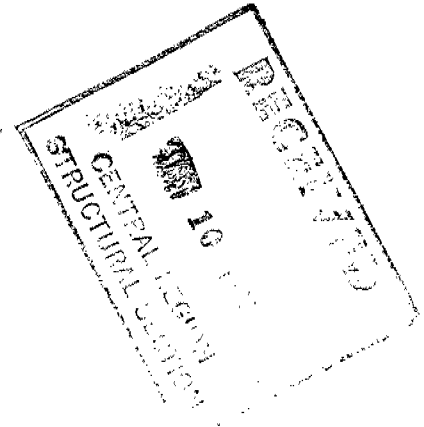


Consulting Engineers • Planners
Environmental Scientists

Our File: 93-1428-01

January 6, 1994

Ministry of Transportation
Structural Section
Atrium Tower, 4th Floor
1201 Wilson Avenue
DOWNSVIEW, Ontario
M3M 1J8



ATTENTION: Mr. R.A. Jeffries, P.Eng.

Highway 403 — Credit River Bridge Widening
Site 24-222 W.P. 801-93-00

Dear Sirs:

At our December 13, 1993 meeting with Foundation Design Section, we identified some inconsistencies between the founding levels recommended by the Foundation Design Section and the top of footing elevation shown on the General Arrangement drawing of the existing bridge (W.P. 157-75-03). Additionally, we requested clarification of some pier and abutment footing levels, since the existing north and south structures are, in some instances, founded at different elevations. The inconsistencies/clarifications to be resolved are summarized as follows:

East Abutment

Recommended bottom of footing elevations are:

WBL (north structure)	432.0 (ft.) ✓
EBL (south structure)	426.0 (ft.) ✓

This is consistent with what is shown on the General Arrangement of the existing structure.

In widening the bridge in the centre, we must decide which elevations to use for the new footing, and where the transition should occur.

WBL, EL. 432.0
EBL, EL. 426.0

... continued

Ministry of Transportation
Mr. R.A. Jeffries, P.Eng.

- 2 -

January 6, 1994

Figure 1 attached shows our proposal for the east abutment. Because of the 6 ft. difference in abutment heights, we have separated the two abutments with an expansion joint. The 6 ft. variation is made in one step, at the joint. This is consistent with what has been done previously at the southeast wingwall of the south structure. The joint in the abutment mirrors the longitudinal joint in the superstructures.

Pier 5

Recommended bottom of footing elevations are:

WBL (north structure)	381.5 (ft.)
EBL (south structure)	374.5 (ft.)

At first, this appears to be inconsistent with elevations given on the General Arrangement. Bottom of footing elevations on the General Arrangement of the existing structure are:

WBL (north structure)	382.0 (ft.)
EBL (south structure)	375.0 (ft.)

In each case, the General Arrangement elevations are 0.5 ft. higher than recommended by Foundation Design Section. However, when the thickness of the mass concrete is considered, there is agreement between the two sets of elevations.

In determining the elevation for the new pier, we must interpolate between the values given. Given the slope of the sound bedrock, and the variation in the weathered bedrock layer, we are proposing an elevation for the bottom of footing at 375.0 (ft.). This is consistent with the lower elevation given on the General Arrangement, and is shown on Figure 2, attached.

Pier 4

Recommended bottom of footing elevations are:

WBL (north structure)	371.0 (ft.)
EBL (south structure)	370.0 (ft.)

This is inconsistent with elevations given on the General Arrangement of the existing structure. Bottom of footing elevations on the General Arrangement are:

WBL (north structure)	378.5 (ft.)
EBL (south structure)	367.5 (ft.)

... continued

The situation at Pier 4 is somewhat confusing. At the north structure the General Arrangement elevations are 7.5 ft. higher than the Foundation Design Section recommendations, while at the south structure, the General Arrangement elevations are 2.5 ft. lower.

From the original Foundation Design Report, sound bedrock is reported at elevations 385.9 (ft.) - WBL and 371.0 (ft.) - EBL. Additionally, there is a 10 ft. variation from north to south, in the thickness of the weathered rock. We cannot explain why the founding level recommended for the north structure is 14.9 ft. below sound bedrock, while that recommended for the south footing is only 1 ft. below sound bedrock.

In determining the elevation for the new pier, we have assumed the worst case scenario, i.e. bottom of footing elevation consistent with the south structure, 367.5 ft. This appears to be more consistent with the top of sound bedrock elevation at the south side of the bridge, and takes into account the large variability in the thickness of weathered bedrock. See Figure 3. Undermining of adjacent footings should not occur, since the excavation will be in sound bedrock.

Pier 3

Recommended bottom of footing elevations are:

WBL (north structure)	368.5 (ft.)
EBL (south structure)	371.5 (ft.)

This is inconsistent with elevation given on the General Arrangement of the existing structure. Bottom of footing elevations on the General Arrangement are:

WBL (north structure)	369.0 (ft.)
EBL (south structure)	369.0 (ft.)

We can only assume that the original designer decided to place both footings at the same elevation. The 369.0 (ft.) elevation is well below the reported sound bedrock elevations (374.4 (ft.) - WBL; 373.1 (ft.) - EBL).

We therefore propose to use 369.0 (ft.) as the bottom of footing elevation at Pier 3.

Pier 2

If the mass concrete below the footing is considered, then there is agreement at Pier 2 between the General Arrangement of the existing structure and the Foundation Design Section recommendations. Therefore, we proposed to use 372 (ft.) as the bottom of footing elevation at Pier 2.

... continued

Ministry of Transportation
Mr. R.A. Jeffries, P.Eng.

- 4 -

January 6, 1994

Pier 1

Recommended bottom of footing elevations are:

For both WBL and EBL 371.5 (ft.)

The General Arrangement of the existing structure indicates both footings were to be placed at Elev. 379.0 (ft.) *EL. 378.5*

The original Foundation Design Report indicates sound bedrock at 382.7 (ft.) - WBL and 383.0 (ft.) - EBL.

We are not certain why the Foundation Design Section recommendations are in excess of 10 ft. below sound bedrock. It appears that the original structural design, although well above recommended levels, is still founded well into the sound bedrock.

Based on the uniformity of both the sound bedrock elevation and in the thickness of weathered bedrock, we propose that we use Elev. 379.0 (ft.) as the founding elevation for Pier 1 (similar to General Arrangement).

West Abutment

There is agreement between the Foundation Design Section recommendations and the existing General Arrangement.

We are requesting that you review our proposed foundation levels with Foundation Design Section, so that a consensus can be reached regarding the bottom of footing elevations. *EL. 434.5*

Given the uncertainty that exists with respect to footing elevations, we suggest that a note be added to the drawings that indicates that foundation levels shown are approximate, and will be confirmed in the field. Additionally, we suggest that a Non-Standard Special Provision be incorporated into the contract that does not permit the placement of any footing concrete or mass concrete, until the founding bedrock has been inspected by a representative of the Foundation Design Section.

For design purposes, we will be using the worst case scenario in the design of the bridge piers. This may result in some nominal over design, but without an extensive field investigation, we feel this is the prudent course of action, given the project schedule.

At our December 13, 1993 meeting, we discussed some other aspects which we wish to confirm.

... continued

Ministry of Transportation
Mr. R.A. Jeffries, P.Eng.

- 5 -

January 6, 1994

Foundation Drawings

The Soil Stratigraphy drawings that normally form part of the structural drawing package will be prepared by Foundation Design Section.

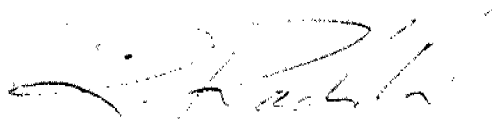
Sliding Friction Coefficients

The design of the abutments will require the sliding friction coefficients for both rock and till in Limit States format. The values given in the original report are based on the old working stress philosophy. It is our understanding that Foundation Design Section will be providing these values.

We trust the above clarifies the additional information which we will require to complete our design. Should another meeting be necessary to clarify any of the issues described above, we are available at your convenience.

Yours truly,

M.M. DILLON LIMITED



RR:ms
Encls.

Reno Radolli, P.Eng.
Project Manager

cc: B. Iyer — MTO, Foundation Design Section
K. Schipper — City of Mississauga
P. Tam — Dillon

MEMORANDUM



To: V. Boehnke
Head, Structural Section
Central Region

Date: November 3, 1993

Attn: R. Jeffries

From: Foundation Design Section
Room 315, Central Bldg.

Tel: 235-3731
Fax: 235-5240

Re: Foundation Recommendations
Credit River Bridge Widening, Hwy 403
W.P. 157-75-03, Site 24-222
District 6, Toronto

This memo is in response to your query regarding design recommendations as per OHBDC for the proposed Credit River Bridge widening along Hwy 403.

The existing six-span twin structure is supported on spread footings founded on sound bedrock or very stiff to hard cohesive glacial till stratum immediately overlying bedrock. Factored ULS capacities and the existing footing elevations as per contract drawings are given in the attached table. Due to the unyielding nature of the founding soil/bedrock, SLS type II bearing capacities will not control the design.

General Comments

The design shall take into account the influence of new footings on the adjacent existing footings.

At Pier 3, Pier 5 and east abutment locations, the design of the new footings should take into account differential founding elevations of the existing WBL and EBL structure footings.

Depending upon the groundwater level and the river water level at the time of construction, some advance dewatering may be required during construction of the new footings.

All foundations shall be provided with a minimum of 4 ft (1.2 m) of earth cover for frost protection purposes.

We trust that the above information is sufficient for your immediate needs. Please call this office if you need additional input from us.

A handwritten signature in dark ink, appearing to read "B. Iyer", with a horizontal line drawn underneath it.

B. Iyer, P. Eng.
Senior Foundation Engineer

BI/jb

Recommended Design Capacities

Element	Existing Footing Elevation (Ft.)*	Factored ULS Capacity (kPa)	Founding Stratum
W. Abutment WBL EBL	434.5 434.5	3000 3000	Sound Bedrock Sound Bedrock
Pier 1 WBL EBL	371.5 371.5	3000 3000	Sound Bedrock Sound Bedrock
Pier 2 WBL EBL	371.5 371.5	3000 3000	Sound Bedrock Sound Bedrock
Pier 3 WBL EBL	368.5 371.5	3000 3000	Sound Bedrock Sound Bedrock
Pier 4 WBL EBL	371.0 370.0	3000 3000	Sound Bedrock Sound Bedrock
Pier 5 WBL EBL	381.5 374.5	3000 3000	Sound Bedrock Sound Bedrock
E. Abutment WBL EBL	432.0 426.0	1000 1000	Glacial Till Glacial Till

* Existing footing elevations are in imperial units and are as per contract drawings.