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DIST. 6 REGION

W.P. No. 127-66-76

CONT. No. 83-71

W. O. No.

STR. SITE No. 24-81-468

HWY. No. 401

LOCATION Bridge #63

EB Collector Bar Estweave

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



DATE _____

REMARKS

8/6/19

$$\begin{array}{r} 11 \\ 3 \overline{) 32} \\ \underline{30} \\ 20 \\ 3 \overline{) 20} \\ \underline{18} \\ 20 \\ 3 \overline{) 20} \\ \underline{18} \\ 20 \end{array}$$

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 83-71



Ministry of
Transportation and
Communications

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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 (R Q D), FOR MODIFIED RECOVERY, IS:

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
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

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_i	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

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

3

For

Bridge #63

Hwy. 401 E.B. Collector Basketweave

Structure and Retaining Walls

W.P. 127-66-76, Site 24-81-468

District 6, Toronto.

INTRODUCTION:

This report summarizes the factual information obtained from a foundation investigation program performed at the above-mentioned structural site and provides detailed recommendations pertaining to the structure foundations and related earthworks.

The fieldwork was carried out between 82 01 27 to 29 and 82 03 23, consisting of 6 sampled boreholes advanced using solid stem continuous flight augers with bedrock being cored in two of the borings. The depth of borings ranged from 3.5 metres to 12.2 metres terminating at or within the shale bedrock.

Site Description and Geology

The site is located along Hwy. 401 between Etobicoke Creek and the Fifth Line, immediately south of the Toronto International Airport, in the City of Mississauga, Regional Municipality of Peel.

Land use in the area is changing from predominately farming to industrial subdivision development. Topography across the site is generally flat to gently undulating with ground surface sloping gradually towards Lake Ontario.

The site is located in the physiographic region known as the "Peel Plain". The characteristic deposit, in the vicinity of the area under investigation, is composed of cohesive glacial till, whose thickness varies from nil to 15 metres. The overburden is underlain by shale bedrock of the Meaford-Dundas Formation, Ordovician Period.

Subsurface Conditions

Borings carried out at the structure site indicates generally uniform subsurface conditions. The overburden consists of a shallow deposit of cohesive glacial till underlain by shale bedrock. The upper portion of the shale was found to be weathered.

The boundaries between the various soil types, insitu and laboratory test results, as well as stabilized ground water levels, are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with a profile and two sections showing an estimated soil stratigraphy based on borehole data, are shown on Drawing No. 2.

The various soil types encountered are briefly described in the following paragraphs.

Silty Clay, Gravel and Sand (Glacial Till)

The surficial deposit overlying the site consists of a shallow deposit of glacial till composed of a silty clay of low plasticity with varying amounts of gravel and some sand. Typical grain size distribution curves for representative samples from this deposit are shown in envelope form on Figure 1. An increasing frequency of fragments, and detached slabs of weathered shale and limestone were encountered within the lower portion of this till.

Results of water content and Atterberg Limit testing are plotted on the Plasticity Chart (Figure 2) and summarized as follows:

		<u>Range</u>	<u>Average</u>
Water Content	(w) %	10-16	13
Liquid Limit	(W _L) %	27-35	31
Plastic Limit	(W _p) %	15-20	17
Plasticity Index (I _p) %		10-15	14

These results indicate the cohesive matrix of the glacial till consists of an inorganic silty clay of low plasticity (CL).

Based on interpretation of Standard Penetration Test 'N' values ranging from 13 to in excess of 100 blows per 0.3 metres, the consistency of this deposit is assessed to range from stiff to hard.

Bedrock

The shale bedrock was encountered immediately beneath the glacial till deposit across the site. The upper 0.7 to 1.3 metres of the bedrock is in a weathered condition. The bedrock surface varies between elevations 155.3 to 157.0 corresponding to depths of approximately 3.2 metres below natural ground surface.

Bedrock surface is sloping gently across the site, and can be expected to exhibit minor fluctuations across the footing locations.

The rock is described as a dark grey, fine textured, soft shale interbedded with thin layers of light grey, fine to medium texture, medium hard limestone. This formation is generally weathered in the upper layers and frequently transitional with the overlying till layer containing fragments and detached slabs of shale and limestone. The badly weathered zone of shale near the top of bedrock grades through a zone of moderate weathering into intact bedrock.

Groundwater Conditions

No natural groundwater level was encountered and/or established during augering operations in the borings. Upon completion of rock coring, the induced drill water remained perched within the borings, indicating a low permeability for both the till and shale strata. Perched ground water conditions can be expected within the glacial till deposit, depending on the time of year.



M. Devata
Murty Devata, P. Eng.
Senior Foundations Engineer

A P P E N D I X

RECORD OF BOREHOLE No 1

METRIC 7

W P 127-66-76 LOCATION Co-ords, N 4 835 170.0; E 295 505.6 ORIGINATED BY V.P.
 DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers & BXL Rock Core COMPILED BY V.P.
 DATUM Geodetic DATE 82 01 27 CHECKED BY OP.

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					
159.2	Ground Surface																
0.0	Grey brown (Glacial Till)		1	SS	13		158										
	Silty Clay, some Sand varying amounts of Gravel & Rock fragments Stiff to Hard		2	SS	113												
156.3			3	SS	101												
2.9	Grey		4	SS	100	10 cm	156										
	Weathered		5	SS	100	9 cm											
	Shale Bedrock with thin layers of Limestone		6	BXL RC	REC 100%		154										
			7	BXL RC	REC 100%		152										
			8	BXL RC	REC 98%												
			9	BXL RC	REC 100%		150										
149.7	End of Borehole																
	*Note: Water Level not Established																

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



METRIC 8

W P 127-66-76 LOCATION Co-ords N 4 835 143.6; E 295 478.2 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
DATUM Geodetic DATE 82 01 29 CHECKED BY [Signature]

[illegible]

OFFICE OF THE ATTORNEY GENERAL

+3, x5: Numbers refer to Sensitivity



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RECORD OF BOREHOLE No 3

METRIC 9

W P 127-66-76

LOCATION Co-ords. N 4 835 154.0;

E 295 468.3

ORIGINATED BY V.P.

DIST 6 HWY 401

BOREHOLE TYPE Solid Stem Augers

COMPILED BY V.P.

DATUM Geodetic

DATE 82 01 29

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 (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH									
								20	40	60	80	100					
160.2	Ground Surface																
0.0	Grey Brown (Glacial Till) Silty Clay, some sand varying am'ts. of Grav. and rock fragments Very Stiff to Hard		1	SS	28												
			2	SS	33												
			3	SS	38												
			4	SS	77												
156.7	Refusal to Augering Probable weathered bedrock surface End of Borehole *Note: Water Level not Encountered																


*³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

METRIC 10

W P 127-66-76 LOCATION Co-ords. N 4 835 125.0; E 295 437.6
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers & BXL Rock Core
DATUM Geodetic DATE 82 01 28
ORIGINATED BY V.P.
COMPILED BY V.P.
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				
160.1	Ground Surface															
0.0	Grey Brown (Glacial Till) Silty Clay, some Sand varying am'ts. of Gravel & rock fragments Very Stiff to Hard		1	SS	28	*	160									
			2	SS	26		158									4 21 50 25
			3	SS	39											
156.8			4	SS	107	17 cm										
3.3	Grey		5	SS	111		156									41 21 26 12
	Weathered		6	SS	100	9 cm										
	Shale Bedrock with thin layers of Limestone		7	BXL RC	REC 100%		154									
			8	BXL RC	REC 100%											
			9	BXL RC	REC 100%		152									
			10	BXL RC	REC 100%		150									
149.9	End of Borehole															
10.2	* Note: Water Level not Established															

+3, x5: Numbers refer to
Sensitivity

20
15 + 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 5

METRIC ¹¹

W P 127-66-76 LOCATION Co-ords. N 4 835 088.2; E 295 395.5 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
DATUM Geodetic DATE 82 03 23 CHECKED BY *CP*

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								
158.5	Ground Surface												
0.0	Gray Brown (Glacial Till)		1	SS	29	*	158						3 18 49 30
	Silty Clay, some Sand and varying am'ts. of Gravel and rock fragments		2	SS	34								
	Very Stiff to Hard		3	SS	72		156						
155.3			4	SS	83								
3.2	Gray Weathered Shale Bedrock with thin layers of Limestone		5	SS	50	20 cm							
			6	SS	55	5 cm	154						
152.4			7	SS	50	2 cm							
6.1	End of Borehole												
	*Note: Water Level not Established												

+3, x5: Numbers refer to Sensitivity

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



RECORD OF BOREHOLE No 6

METRIC ¹²

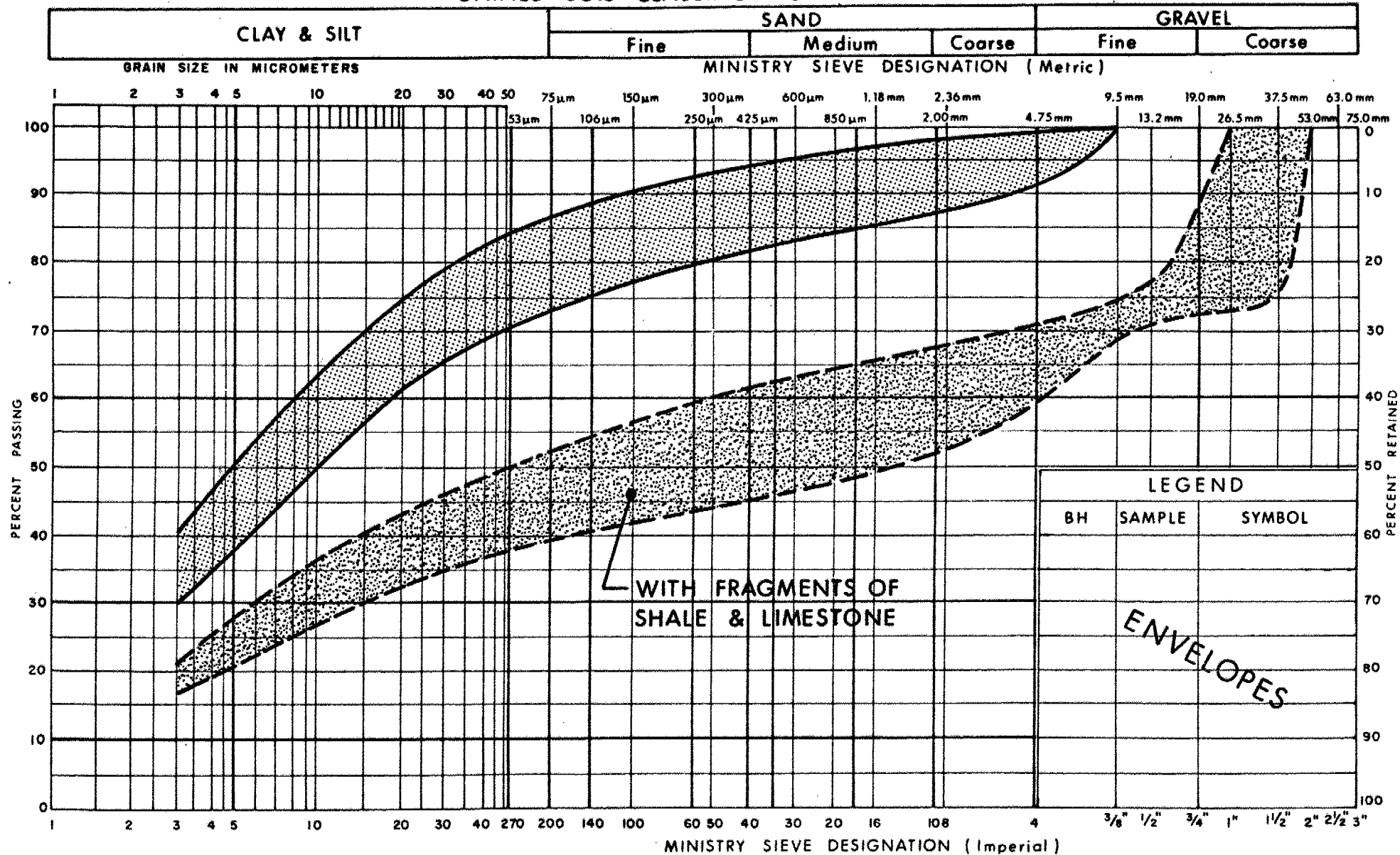
W P 127-66-76 LOCATION Co-ords. N 4 835 207.2; E 295 549.2 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
DATUM Geodetic DATE 82 03 23 CHECKED BY CP

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					
160.2	Ground Surface															GR SA SI CL
0.0	Gray Brown (Glacial Till)		1	SS	30	*										
	Silty Clay, some Sand & varying am'ts. of Gravel & Rock fragments		2	SS	32											2 17 53 28
	Hard		3	SS	55	15 cm										
157.0			4	SS	50	8 cm										
3.2	Weathered		5	SS	50	5 cm										34 17 23 26
	Gray Shale Bedrock with thin layers of Limestone		6	SS	50	2 cm										
			7	SS	50	3 cm										
			8	SS	60	1 cm										
			9	SS	50	1 cm										
148.0			10	SS	70	1 cm										
12.2	End of Borehole															
	* Note: Water Level not Established															

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM

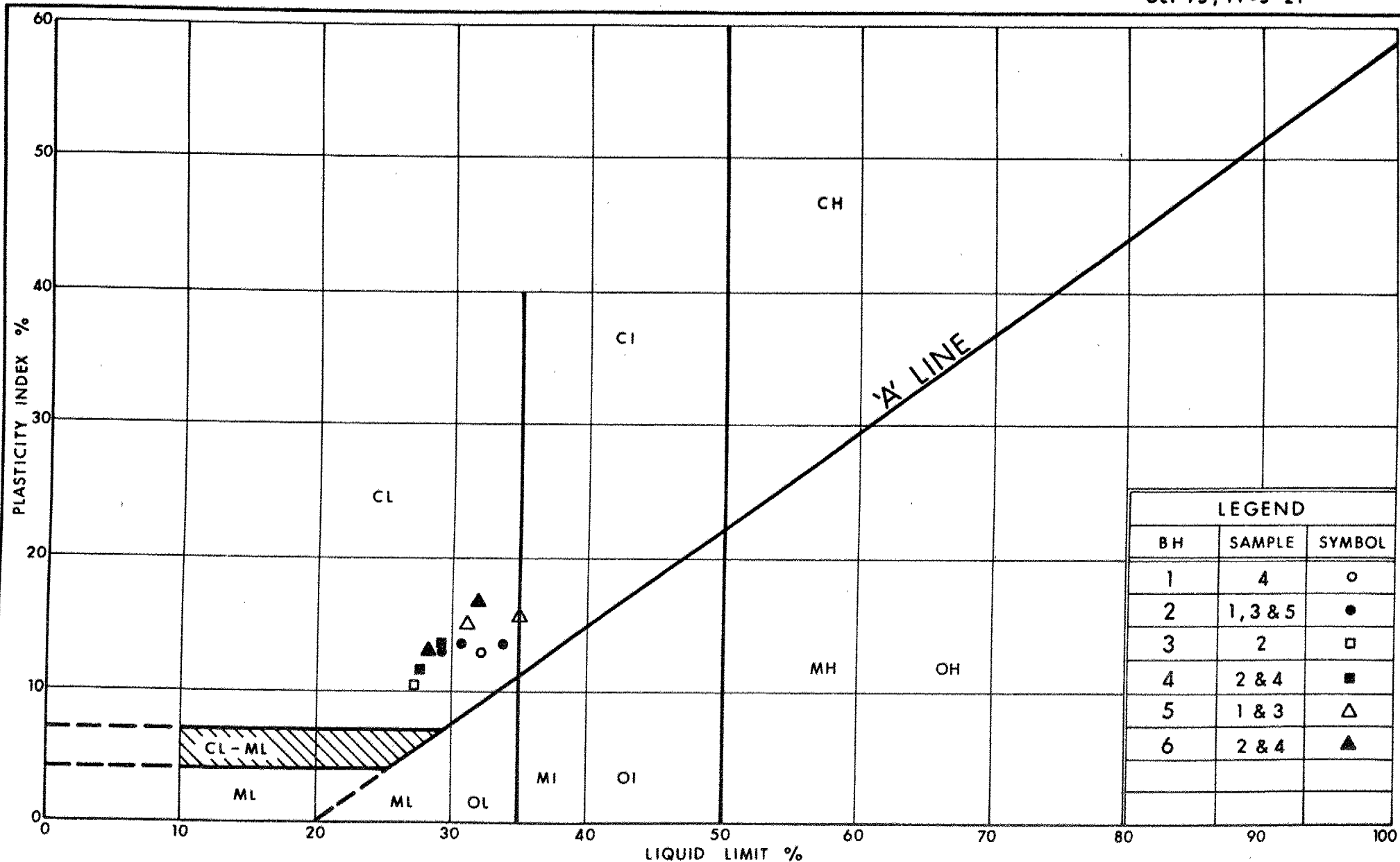


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GRAIN SIZE DISTRIBUTION
SILTY CLAY (OF LOW PLASTICITY) Glacial Till

FIG No 1

W P 127-66-76



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PLASTICITY CHART
(Glacial Till Matrix)
SILTY CLAY (OF LOW PLASTICITY)

FIG No 2

W P 127-66-76



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foundation investigation and design report

CONT 83-71

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 127-66-76

DIST 6

HWY 401

STR SITE 24-81-468

Bridge #63, Hwy. 401 E.B. Collector Basketweave
Structure and Retaining Walls

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FOUNDATION INVESTIGATION REPORT

For

Bridge #63

Hwy. 401 E.B. Collector Basketweave

Structure and Retaining Walls

W.P. 127-66-76, Site 24-81-468

District 6, Toronto.

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Borings carried out at the structure site indicates generally uniform subsurface conditions. The overburden consists of a shallow deposit of cohesive glacial till underlain by shale bedrock. The upper portion of the shale was found to be weathered.

The boundaries between the various soil types, insitu and laboratory test results, as well as stabilized ground water levels, are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with a profile and two sections showing an estimated soil stratigraphy based on borehole data, are shown on Drawing No. 1276676-A.

The various soil types encountered are briefly described in the following paragraphs.

Silty Clay, Gravel and Sand (Glacial Till)

The surficial deposit overlying the site consists of a shallow deposit of glacial till composed of a silty clay of low plasticity with varying amounts of gravel and some sand. Typical grain size distribution curves for representative samples from this deposit are shown in envelope form on Figure 1. An increasing frequency of fragments, and detached slabs of weathered shale and limestone were encountered within the lower portion of this till.

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Bedrock

The shale bedrock was encountered immediately beneath the glacial till deposit across the site. The upper 0.7 to 1.3 metres of the bedrock is in a weathered condition. The bedrock surface varies between elevations 155.3 to 157.0 corresponding to depths of approximately 3.2 metres below natural ground surface.

Bedrock surface is sloping gently across the site, and can be expected to exhibit minor fluctuations across the footing locations.

The rock is described as a dark grey, fine textured, soft shale interbedded with thin layers of light grey, fine to medium texture, medium hard limestone. This formation is generally weathered in the upper layers and frequently transitional with the overlying till layer containing fragments and detached slabs of shale and limestone. The badly weathered zone of shale near the top of bedrock grades through a zone of moderate weathering into intact bedrock.

Groundwater Conditions

No natural groundwater level was encountered and/or established during augering operations in the borings. Upon completion of rock coring, the induced drill water remained perched within the borings, indicating a low permeability for both the till and shale strata. Perched ground water conditions can be expected within the glacial till deposit, depending on the time of year.

DISCUSSION AND RECOMMENDATION

As part of the upgrading of Highway 401 to a collector/core network, from Renforth Dr. to Dixie Rd. a basketweave structure for the transfer roads between the East Bound Expressway and East Bound Collectors is planned. The proposed structure will consist of a single span 92 x 16 metre concrete box-type design with associated east and west retaining walls some 50 metres each in length.

Proposed profile grades of 160.1 for the Expressway-E.B. Collector and 153.2 for the E.B. Collector-Expressway and an average ground surface elevation 160 will necessitate cuts in the order of 7 metres and approach retaining walls ranging to a maximum height of 7 metres at the immediate structure location.

In consideration of the proximity of competent glacial till and shale bedrock to ground surface across the site, recommendations pertaining to the foundations of the new structure, retaining walls, and related earthworks are summarized as follows:

The design of shallow foundations founded on an unyielding medium such as shale bedrock will not be governed by settlement since the bearing capacity at the S.L.S. Type II is much larger than the factored capacity at U.L.S.

Full height abutments and retaining walls can be supported on shallow spread footings located within the intact shale at or below elevation 153.0 for a factored capacity at the U.L.S. of 1500 kPa.

A minimum earth cover of 1.25 metres should be provided to the underside of all footings, since the shale is considered susceptible to frost action.

The base of all footing excavations should be covered immediately upon exposure with a working slab of lean concrete to protect the exposed shale from weathering and softening.

Earth pressures against the abutment walls and retaining walls should be computed as per Subsection 6.6.1.2.2 of the O. H. B. D. C. Manual with provisions made for adequate drainage behind the abutment.

Provided backfill to the abutments and retaining walls consists of free draining granular material and adequate provisions are made for an appropriate drainage scheme, the following equivalent fluid pressures may be assumed for computation of earth pressures.

a) At ultimate limit state

- | | |
|---------------------|------------|
| - active condition | 8.0 kPa/m |
| - at rest condition | 10.0 kPa/m |

b) At serviceability limit state

- | | |
|---------------------|-----------|
| - active condition | 6.5 kPa/m |
| - at rest condition | 8.5 kPa/m |

A constraint on the use of heavy vibratory equipment within a restricted distance to the back of all walls should be included as per current MTC directives.

Resistance to sliding of all the footings can be calculated assuming a coefficient of friction of 0.8 between the underside of the concrete footing and the rough shale surface.

No major dewatering difficulties are anticipated for footing excavations in consideration of the relatively low permeability of the shale bedrock and overlying fill deposit. Localized seepage into excavations can be controlled by perimeter ditches and pumping from corner sumps.

No stability problems are anticipated for permanent cut slopes constructed to a 2:1 geometry. Exposed shale in cut slopes should be protected with adequate earth/topsoil cover and sodded.

Temporary cut slopes will stand at a 1:1 geometry or steeper, however, these slopes will weather rapidly and show signs of surficial distress if not protected in a reasonable length of time.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. V. Parker, Field Technician, utilizing equipment owned and operated by Atcost Drilling Co., Toronto. This report was written by Mr. T. J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.



A handwritten signature in black ink, appearing to read "Tom Kazmierowski".

T. J. Kazmierowski, P. Eng.
Foundation Engineer

A handwritten signature in black ink, appearing to read "M. Devata".

M. Devata, P. Eng.
Senior Foundations Engineer

APPENDIX



Ministry of
Transportation and
Communications
Ontario

RECORD OF BOREHOLE No 1

METRIC

W P 127-66-76 LOCATION Co-ords. N 4 835 170.0: E 295 505.6 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers & BXL Rock Core COMPILED BY V.P.
DATUM Geodetic DATE 82 01 27 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							
								SHEAR STRENGTH							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
159.2	Ground Surface														
0.0	Grey brown (Glacial Till) Silty Clay, some Sand varying amounts of Gravel & Rock fragments Stiff to Hard		1	SS	13	10 cm	158								
			2	SS	113										
156.3			3	SS	101										
2.9	Grey		4	SS	100	9 cm	156								
	Weathered		5	SS	100										
	Shale Bedrock with thin layers of Limestone		6	BXL RC	REC 100%		154								
			7	BXL RC	REC 100%		152								
			8	BXL RC	REC 98%										
149.7			9	BXL RC	REC 100%		150								
9.5	End of Borehole														
	*Note: Water Level not Established														

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

RECORD OF BOREHOLE No 2

METRIC

W P 127-66-76 LOCATION Co-ords N 4 835 143.6; E 295 478.2 ORIGINATED BY V.P.
 DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
 DATUM Geodetic DATE 82 01 29 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 (%) 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											
159.9	Ground Surface																		
0.0	(Glacial Till)					*													
	Silty Clay, some Sand		1	SS	24											1 13 54 32			
	varying amounts of		2	SS	24														
	Gravel & rock fragments		3	SS	52											28 19 38 15			
	Brown		4	SS	74														
	Grey		5	SS	106														
155.8	Very Stiff to Hard																		
155.5	Weathered Shale Bedrock					19 cm	156												
4.4	End of Borehole																		
	*Note: Water Level not Encountered																		

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 3

METRIC

W P 127-66-76 LOCATION Co-ords. N 4 835 154.0; E 295 468.3 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
DATUM Gendetic DATE 82 01 29 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
160.2	Ground Surface																
0.0	Grey Brown (Glacial Till) Silty Clay, some sand varying am'ts. of Grav. and rock fragments Very Stiff to Hard		1	SS	28												
			2	SS	33												
			3	SS	38												
156.7			4	SS	77	18 cm											
3.5	Refusal to Augering Probable weathered bedrock surface End of Borehole *Note: Water Level not Encountered																

+3, x5: Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 4

METRIC

W P 127-66-76 LOCATION Co-ords. N 4 835 125.0; E 295 437.6 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers & BXL Rock Core COMPILED BY V.P.
DATUM Geodetic DATE 82 01 28 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	100				
160.1	Ground Surface														
0.0	Gray Brown (Glacial Till) Silty Clay, some Sand varying am'ts. of Gravel & rock fragments Very Stiff to Hard		1	SS	28	*									
			2	SS	26										4 21 50 25
			3	SS	39										
156.8			4	SS	107	17 cm									41 21 26 12
3.3	Gray		5	SS	111										
	Weathered		6	SS	100	9 cm									
	Shale Bedrock with thin layers of Limestone		7	BXL RC	REC 100%										
			8	BXL RC	REC 100%										
			9	BXL RC	REC 100%										
			10	BXL RC	REC 100%										
149.9															
10.2	End of Borehole														
	* Note: Water Level not Established														

+3, x5: Numbers refer to
Sensitivity

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



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RECORD OF BOREHOLE No 5

METRIC

W P 127-66-76 LOCATION Co-ords. N 4 835 088.2; E 295 395.5 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
DATUM Geodetic DATE 82 03 23 CHECKED BY CP.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE 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	W _L		
158.5	Ground Surface															
0.0	Gray Brown (Glacial Till) Silty Clay, some Sand and varying am'ts. of Gravel and rock fragments Very Stiff to Hard		1	SS	29	*										3 18 49 30
			2	SS	34											
			3	SS	72											
155.3			4	SS	83	20 cm										
3.2	Gray Weathered Shale Bedrock with thin layers of Limestone		5	SS	50	8 cm										
			6	SS	55	5 cm										
152.4																
6.1	End of Borehole		7	SS	50	2 cm										
	*Note: Water Level not Established															

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 6

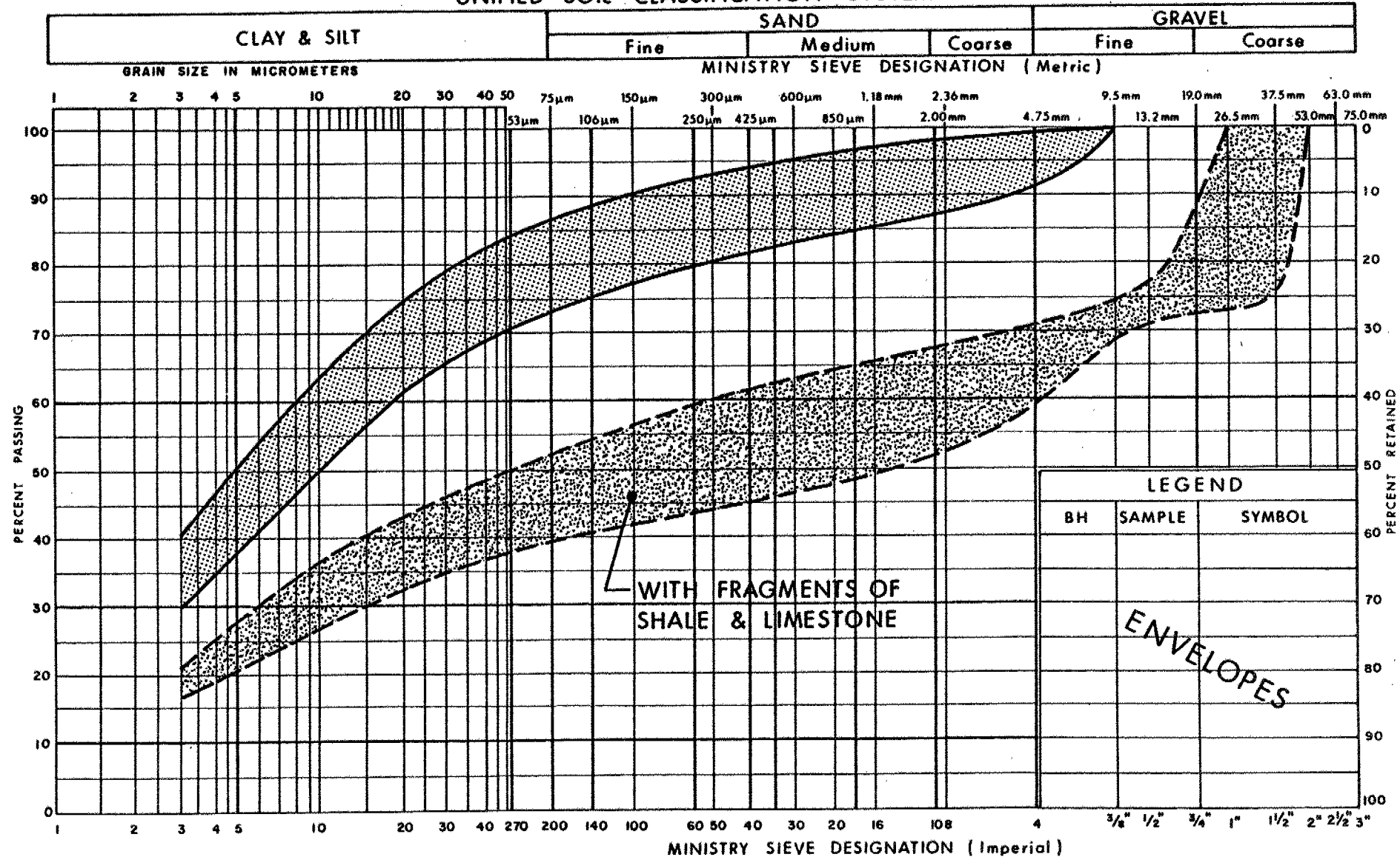
METRIC

W P 127-66-76 LOCATION Co-ords. N 4 835 207.2; E 295 549.2 ORIGINATED BY V.P.
DIST 6 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY V.P.
DATUM Geodetic DATE 82 03 23 CHECKED BY CP.

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 (%) 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						
160.2	Ground Surface													
0.0	Gray Brown (Glacial Till) Silty Clay, some Sand & varying am'ts. of Gravel & Rock fragments Hard		1	SS	30	*	160							
			2	SS	32		158						2 17 53 28	
			3	SS	55	15 cm								
157.0			4	SS	50	8 cm								
3.2	Weathered		5	SS	50	5 cm	156						34 17 23 26	
	Gray Shale Bedrock with thin layers of Limestone		6	SS	50	2 cm								
			7	SS	50	3 cm	154							
			8	SS	60	1 cm	152							
			9	SS	50	1 cm	150							
148.0			10	SS	70	1 cm								
12.2	End of Borehole													
	* Note: Water Level not Established													

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

UNIFIED SOIL CLASSIFICATION SYSTEM

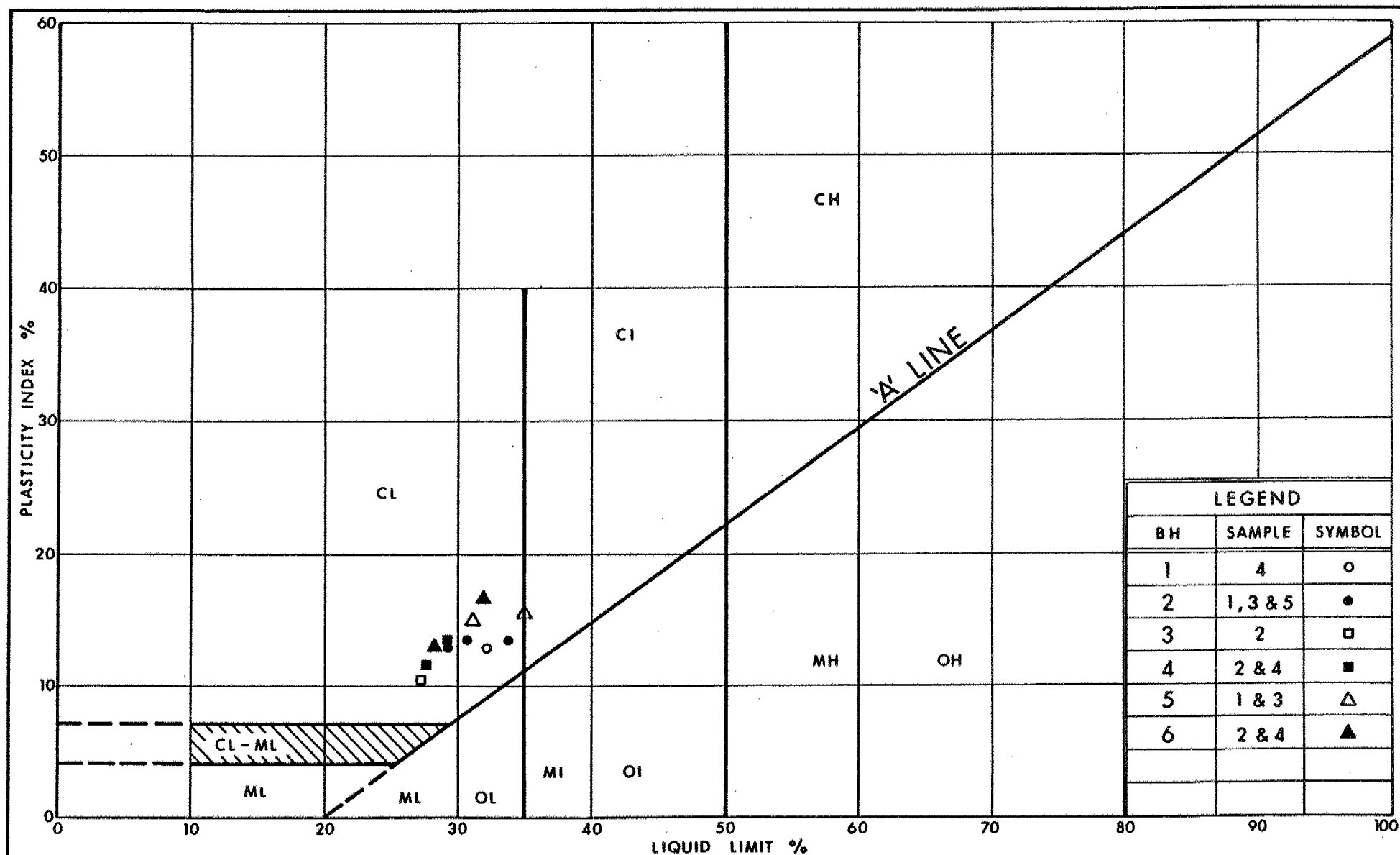


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GRAIN SIZE DISTRIBUTION
SILTY CLAY (OF LOW PLASTICITY) Glacial Till

FIG No 1

W P 127-66-76



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PLASTICITY CHART
(Glacial Till Matrix)
SILTY CLAY (OF LOW PLASTICITY)

FIG No 2

W P 127-66-76

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

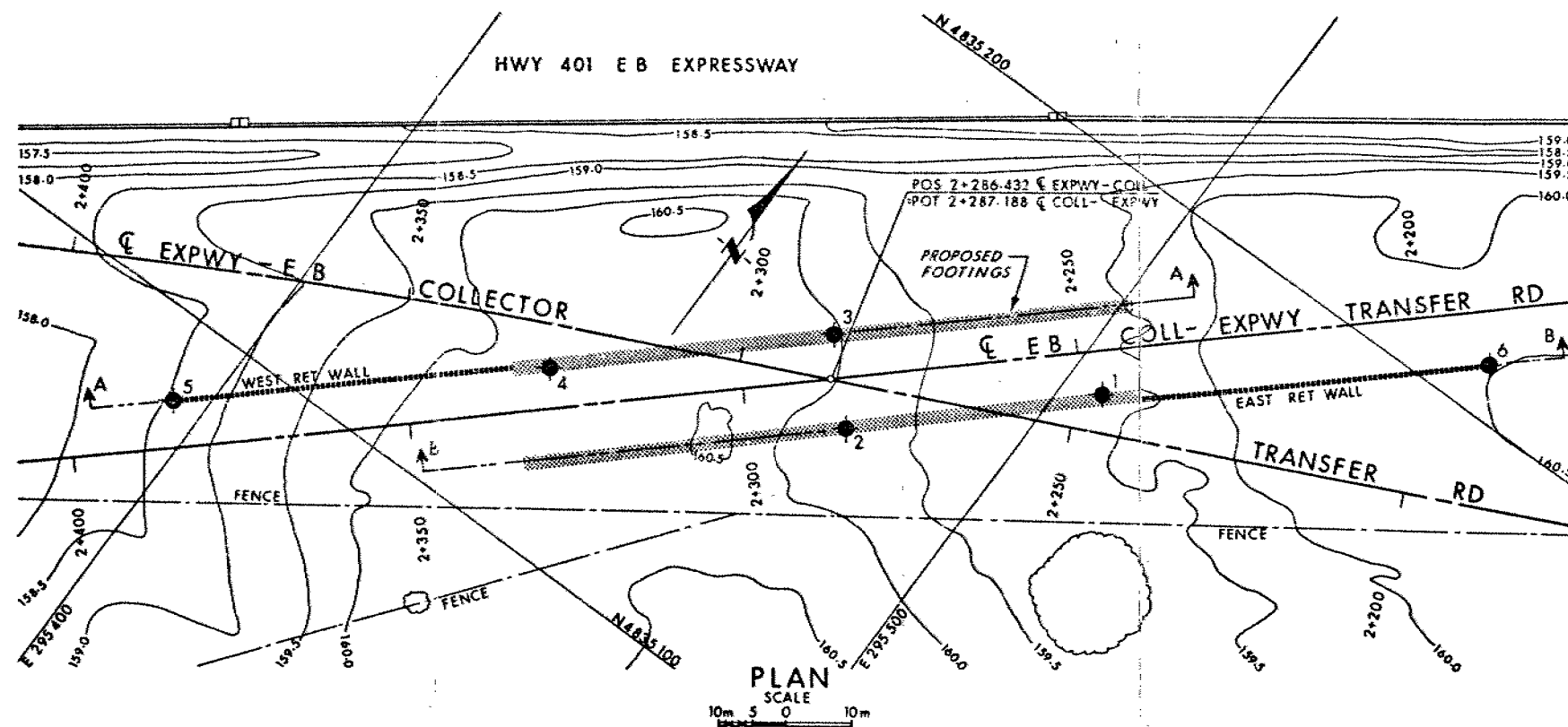
u_w	kPa	PORE WATER PRESSURE
u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS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

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 = $\frac{c_u}{\tau_r}$

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^2	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						



METRIC

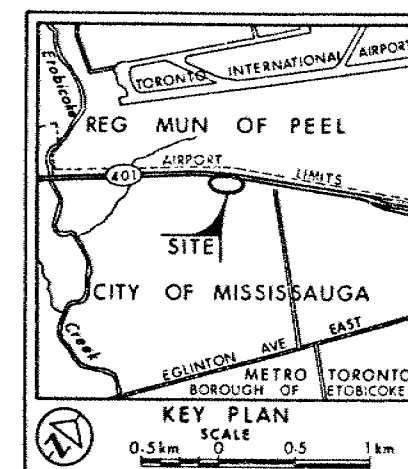
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN.
STATIONS ARE IN
KILOMETRES + METRES.

CONT No
WP No 127-66-76

HWY 401 E B COLL BASKETWEAVE BRIDGE
AND RETAINING WALLS (BRIDGE 63)
BORE HOLE LOCATIONS & SOIL STRATA



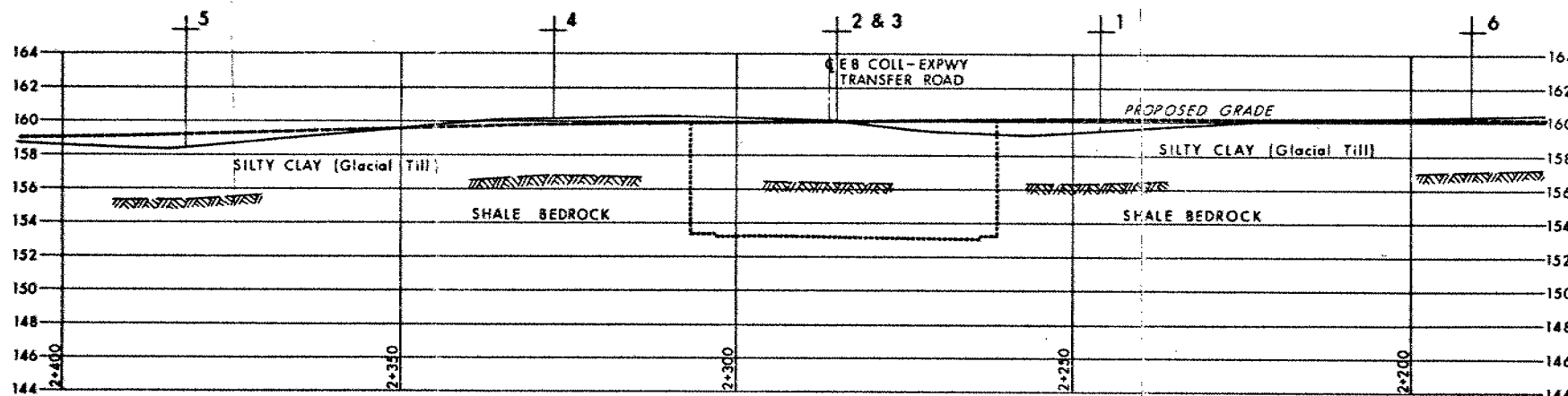
SHEET



LEGEND

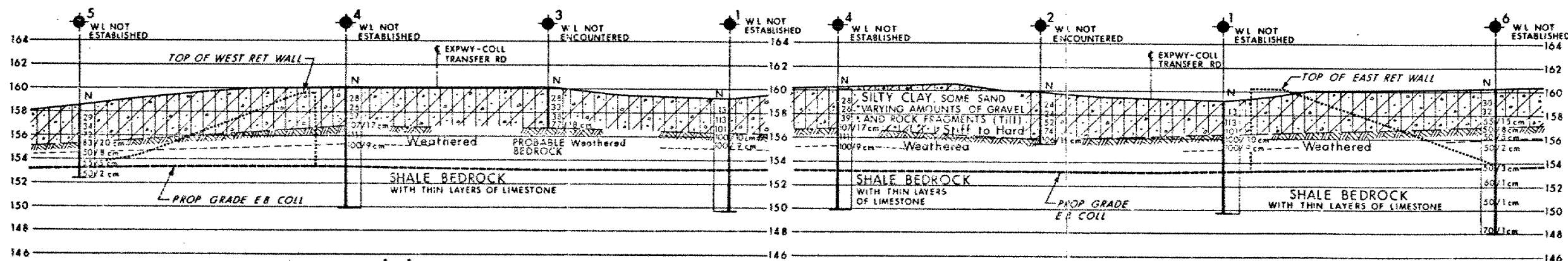
- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- ⬇ WL at time of investigation
- WL Not Established

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	159.2	4 835 170.0	295 505.6
2	159.9	4 835 143.6	295 478.2
3	160.2	4 835 154.0	295 468.3
4	160.1	4 835 125.0	295 437.6
5	158.5	4 835 088.2	295 395.5
6	160.2	4 835 207.2	295 549.2



PROFILE EXPRESSWAY-E B COLL TRANSFER RD

HOR 10m 5 0 10m
VERT 4m 2 0 4m



A-A

SECTIONS

B-B

HOR 10m 5 0 10m
VERT 4m 2 0 4m

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 30M12-161

HWY No 401	DATE 1982 05 05	SITE 24-81-46R
SUBMITTAL CHECKED	APPROVED	DWG 1276676-A



OVERSIZE DRAWING

memorandum



To: Mr. G.C.E. Burkhardt
Head, Structural Planning
Central (5000 Yonge St.) Region

Date: 83 02 08

From: Pavement & Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Bridge #63
Hwy. 401 E.B. Collector Basketweave
W.P. 127-66-76, Site 24-468
District 6, Toronto

We have reviewed the final general arrangement and foundation layout drawings for the above-mentioned, and provide the following comments:

- 1) The use of a working slab of lean concrete (mass concrete) beneath the footing is only required to protect exposed shale from weathering. Since the footings are founded in the overlying glacial till, there is no need for this treatment.
- 2) Earth pressures against the abutment and retaining walls should be computed according to the latest revised earth pressure values as per Subsection 6.6.1.2.2. of the O.H.B.D.C.



Tom Kazmierowski, P. Eng.
Foundations Engineer

TK:syc

cc: W. Lin

memorandum



To: Mr. G.C.E. Burkhardt
Head, Structural Planning
Central (5000 Yonge St.) Region

Date: 82 10 12

From: Pavement & Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Hwy. 401 E.B. Basketweave Structure
Bridge #63
W.P. 127-66-76, Site 24-81-468
District 6, Toronto

We have reviewed the revised bridge site plan for the above-mentioned structure and provide the following additional recommendation for the structure/retaining wall foundation and earthworks, in light of the complete change in structure geometry since our original report was issued.

- 1) Full height abutments and 1st. level retaining wall footings can be founded on shallow spread footings at or below elevation 158 to the following O.H.B.D.C. parameters:

Factored Capacity at U.L.S.	750 kPa
Capacity at S.L.S. Type II	350 kPa

- 2) Second level retaining wall segments can be founded on shallow spread footings at or below elevation 159 for the following design parameters:

Factored Capacity at U.L.S.	600 kPa
Capacity at S.L.S. Type II	250 kPa

Any localized softened material within the planned area of the footing excavation should be excavated for their full depth and replaced with well compacted granular 'A'.

- 3) The remaining 3 levels of retaining wall segments can be founded on spread footings located on a minimum one metre thick compacted granular 'A' core constructed to current M.T.C. specifications. The following parameters are applicable for retaining wall footings founded on a properly constructed granular 'A' core:

Factored Capacity at U.L.S.	850 kPa
Capacity at S.L.S. Type II	350 kPa

All softened and/or organic material within the planned limits of the granular core must be excavated prior to placement of any compacted granular 'A' material.

.../2

- 4) Resistance to sliding for the various footings can be calculated using the following parameters:

Founded on natural glacial till - adhesive value of 95 kPa

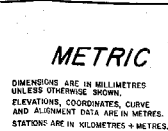
Founded on compacted granular 'A' - coefficient of friction of 0.7

All other recommendations contained within the original foundation investigation and design report are still considered applicable to the revised structural scheme. We trust the information provided is sufficient for your design requirements, if additional discussion is warranted, please contact this section.

A handwritten signature in dark ink, appearing to read 'Tom Kazmierowski', with a stylized, cursive script.

Tom Kazmierowski, P. Eng.
Foundations Engineer

CAW:syc



METRIC

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

DISTRICT No 6
CONT No
WP No 127-66-76



BRIDGE No. 63
DI EASTBOUND COLLECTOR
SKETWEAVE STRUCTURE
GENERAL ARRANGEMENT

McCORMICK RANKIN
CONSULTING ENGINEERS

GENERAL NOTES

CLASS OF CONCRETE

MASS CONCRETE AND FOOTINGS	20 MPa
FRAME, RETAINING WALLS, BARRIER WALLS AND APPROACH SLABS	30 MPa

REINFORCING STEEL

GRADE 400
REINFORCING BAR MARKS WITH SUFFIX 'C'
TO BE COATED BARS

COVER TO REINFORCING STEEL

FOOTINGS		100 ± 25 mm
RIGID FRAME	TOP	70 ± 20 mm
	BOTTOM	50 ± 10 mm
RETAINING WALLS	FRONT FACE	80 ± 20 mm
	BACK FACE	70 ± 20 mm
BARRIER WALLS		70 ± 20 mm
REMAINDER	70 ± 20 mm OR AS NOTED ON DWG'S.	

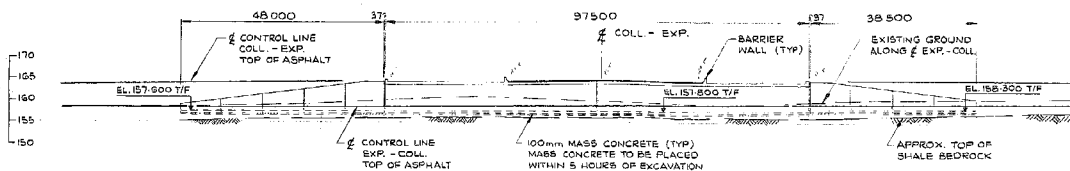
LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATION & SOIL STRATA
3. FOUNDATION LAYOUT
4. RETAINING WALL LAYOUT
5. S.W. RETAINING WALL REINFORCING
6. N.E. RETAINING WALL REINFORCING
7. RIGID FRAME DETAILS I
8. RIGID FRAME DETAILS II
9. SCREED ELEVATIONS
10. BARRIER WALL
11. APPROACH SLAB
12. AS CONSTRUCTED ELEV. & DIM.
13. BRIDGE DATA & SITE NUMBER DATA
14. STANDARDS
15. ELECTRICAL EMBEDDED WORK
16. ELECTRICAL STANDARDS

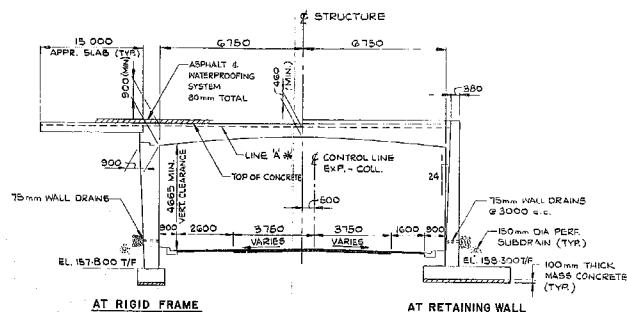
CONCRETE QUANTITIES

(FOR LUMP SUM TENDER ITEMS)

- CONCRETE IN BRIDGE AND RETAINING WALLS - 2175 m³
- CONCRETE IN BARRIER WALLS - 58 m³
- CONCRETE IN APPROACH SLABS - 245 m³

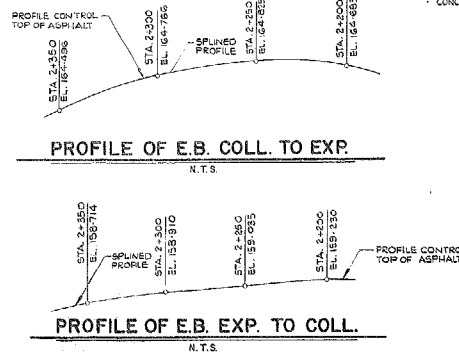


A
1:500



AT RIGID FRAME

AT RETAINING WALL



PROFILE OF E.B. COLL. TO EXP.

N.T.S.

PROFILE OF E.B. EXP. TO COLL

N.T.S.

Reviewed
by T.K.
on 03-02-09
Memo sent



REVISIONS				
DATE	BY	DESCRIPTION		
DESIGN J.L.	CHECK R.S.	LOADING CHBDC-A-79		DATE JAN. 8
DRAWING J.A.D.	CHECK C.C.	SITE 04 - BL. ABB	DWG.	

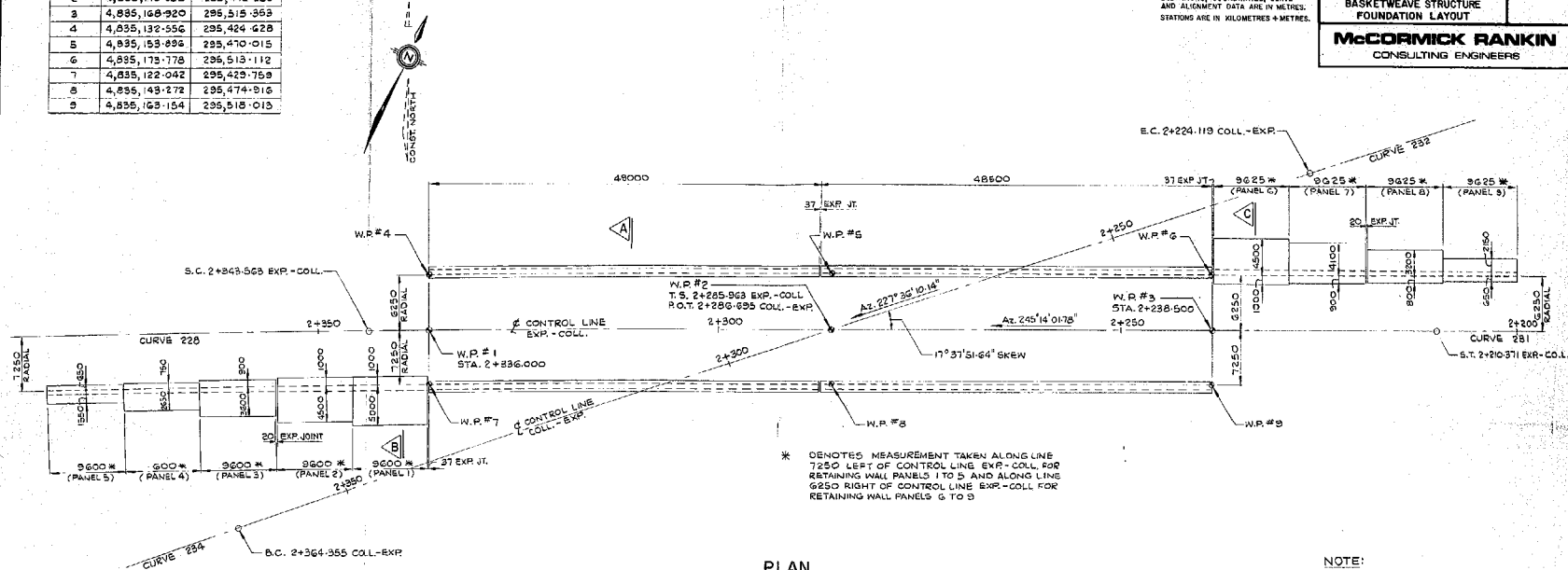
DRAWING NOT TO BE SCALED
IOD IN IN ON ORIGINAL DRAWING

* LINE 'A' DENOTES CONTROL LINE FOR PLACING REINFORCING

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

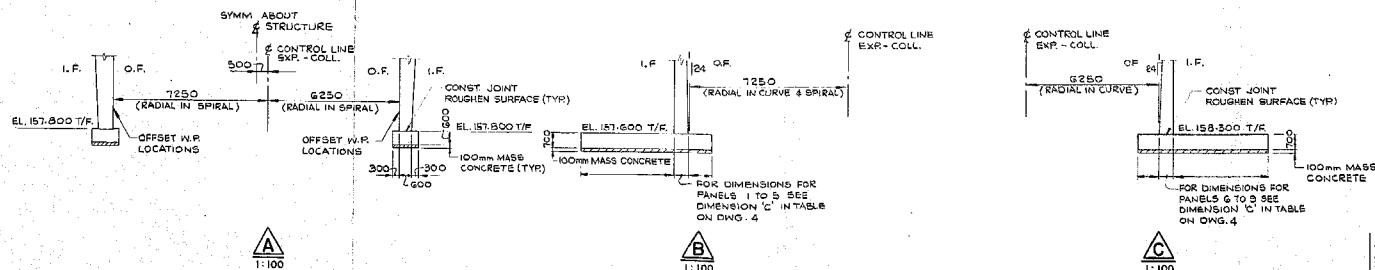
BRIDGE No. 63
HWY. 401 EASTBOUND COLLECTOR
BASKETWEAVE STRUCTURE
FOUNDATION LAYOUT

McCORMICK RANKIN
CONSULTING ENGINEERS



1:250

- A 100 mm THICK MASS CONCRETE SEAL SLAB SHALL BE CAST WITHIN 5 HRS. AFTER COMPLETION OF FOOTING EXCAVATION.



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS				
	DATE	BY	DESCRIPTION	
	DESIGN	J. L.	CHECK A.S.W.	LOADING HOB-C-A-79 DATE JAN. 83
	DRAWING	J.W.R.	CHECK J.I.	SITE 24-BI-468 DWS 3