

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M5-149

DIST. 4 REGION                     

W.P. No. 83-74-31

CONT. No. 89-26

W. O. No.                     

STR. SITE No. 10-1337-138

HWY. No. QEW

LOCATION QEW / Brant St. Coespan

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     

REMARKS:                     

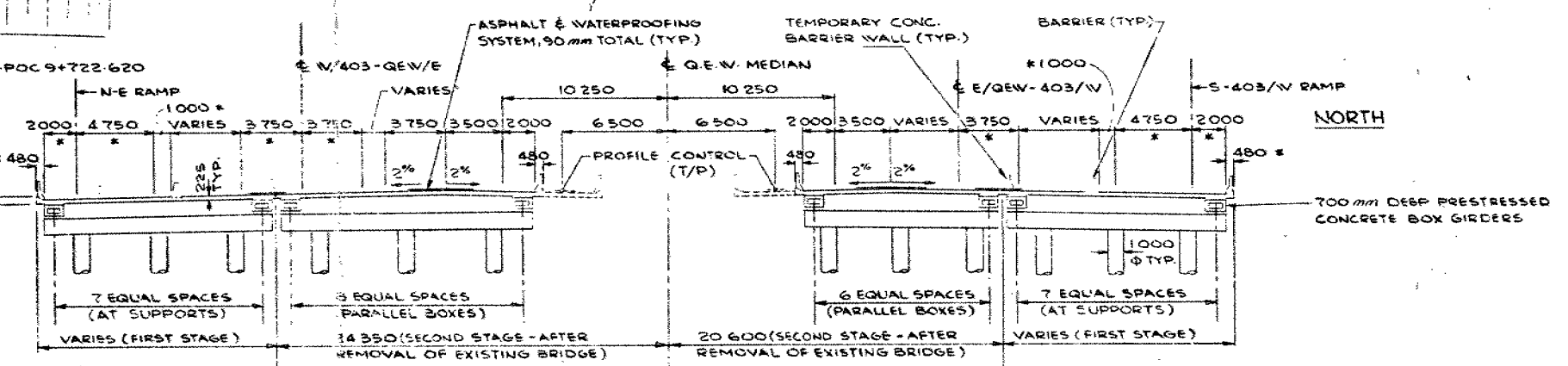
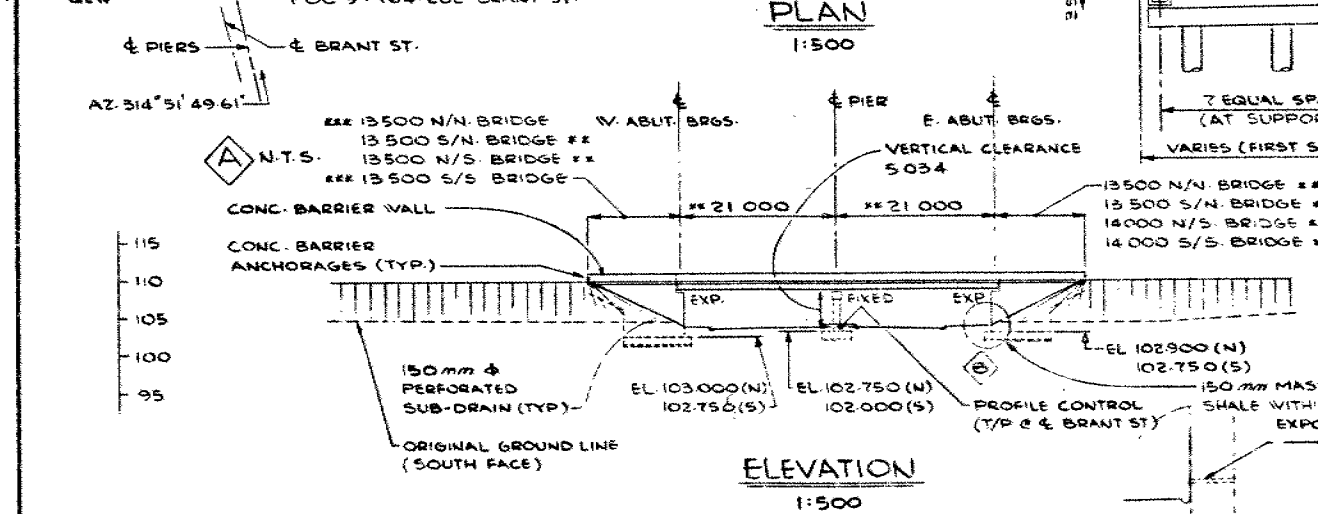
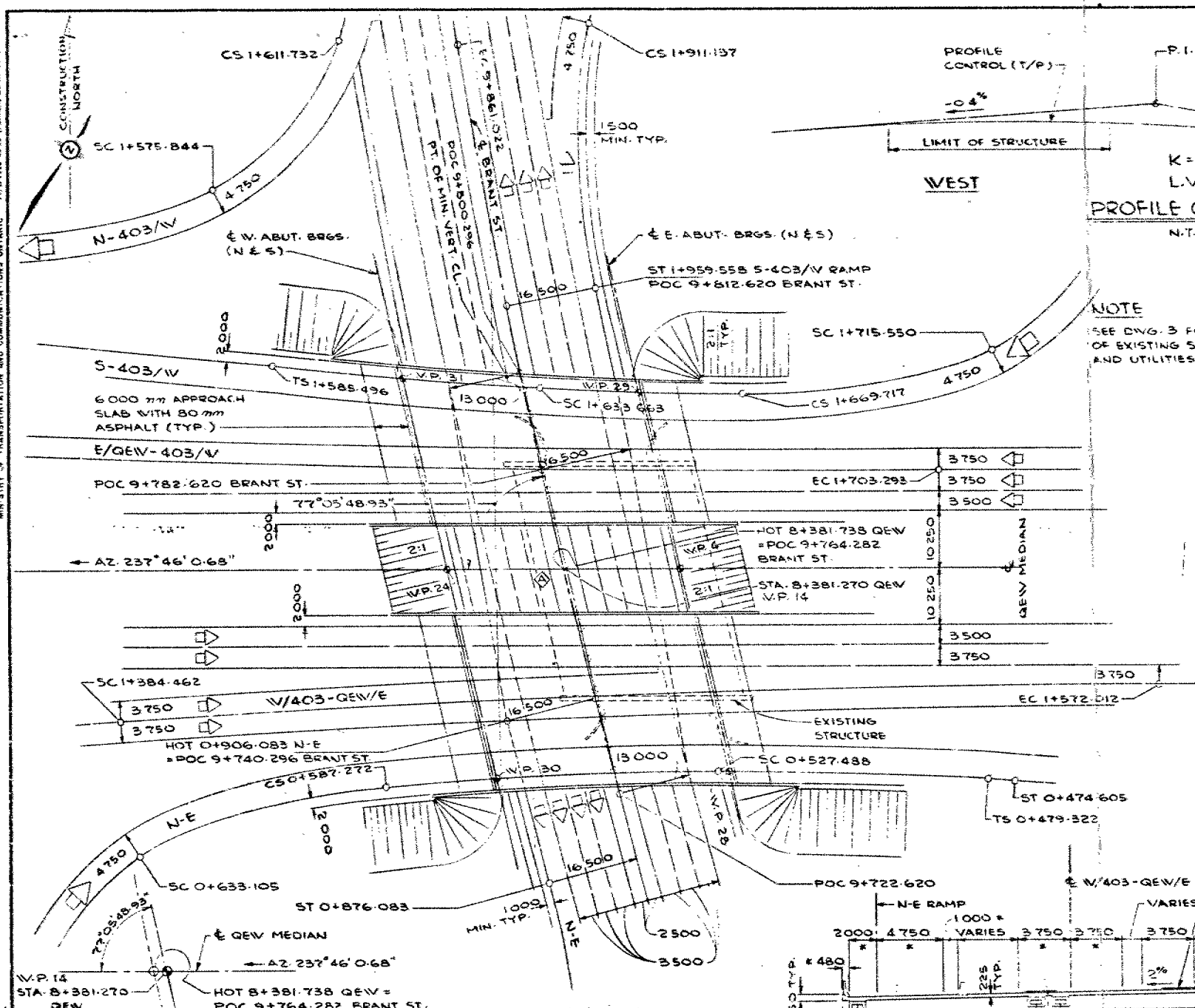
                    

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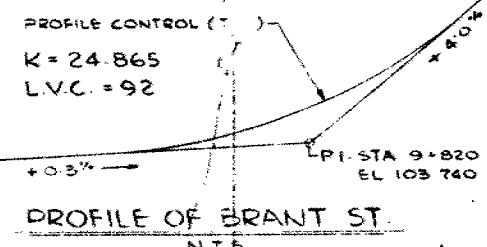
**METRIC**  
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UNLESS OTHERWISE SHOWN

DIST. 4  
CONT No  
WP No 83-74-31  
Q.E.W.  
BRANT ST. OVERPASS  
GENERAL ARRANGEMENT

SHEET



\* RADIAL DIMENSIONS.  
\*\* PARALLEL WITH Q.E.W. MEDIAN.  
\*\*\* ALONG FRONT FACE OF WALL.



NOTE  
SEE DWG. 3 FOR LOCATION  
OF EXISTING STRUCTURE  
AND UTILITIES.

**LIST OF DRAWINGS**

- 1 GENERAL ARRANGEMENT
- 2 BORE HOLE LOCATIONS & SOIL STRATA
- 3 CONSTRUCTION STAGES
- 4 TEMP. ROADWAY PROTECTION
- 5 FOOTING LAYOUT
- 6 FOOTING DETAILS & REINF. - N. BRIDGE
- 7 FOOTING DETAILS & REINF. - S. BRIDGE
- 8 EAST ABUTMENT - NORTH BRIDGE
- 9 WEST ABUTMENT - NORTH BRIDGE
- 10 EAST ABUTMENT - SOUTH BRIDGE
- 11 WEST ABUTMENT - SOUTH BRIDGE
- 12 PIER - NORTH BRIDGE
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- 22 AS CONSTRUCTED ELEV. & DIM.
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- 24 ELECTRICAL EMBEDDED WORK
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**GENERAL NOTES**

**CLASS OF CONCRETE**

MASS CONCRETE	20 MPa
ABUTMENT FOOTINGS	20 MPa
PIER FOOTINGS	30 MPa
PIERS	35 MPa
ABUTMENTS AND WINGWALLS	30 MPa
DECKS	30 MPa
PRESTRESSED GIRDERS	40 MPa
BARRIER WALLS	30 MPa
APPROACH SLABS	30 MPa
AND AS NOTED	

**CLEAR COVER TO REINFORCING STEEL**

FOOTINGS	100 ± 25
ABUTMENTS AND WINGWALLS F. FACE	80 ± 20
B. FACE	70 ± 20
PIERS	80 ± 20
DECKS TOP	70 ± 20
BOTTOM	40 ± 20
BARRIER WALLS	70 ± 20
APPROACH SLABS	70 ± 20
AND AS NOTED	

**REINFORCING STEEL**

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

**CONSTRUCTION NOTES**

THE CONTRACTOR SHALL FINISH THE BEARING  
SEATS DEAD LEVEL TO THE SPECIFIED  
ELEVATIONS TO A TOLERANCE OF ± 3 mm.

W.P. NO.	STATION	ELEVATION
28	0+525.004	109.802
29	1+652.055	109.914
30	0+566.776	109.794
31	1+609.325	109.835

DATE	BY	DESCRIPTION
DESIGN	C.R.G.	CHECK
LOADING	C.H.E.D.C.	A-83
DATE	NOV 85	
DRAWING	R.V.	CHECK D.R.G.
SITE	NO 10-1237-135	DWG

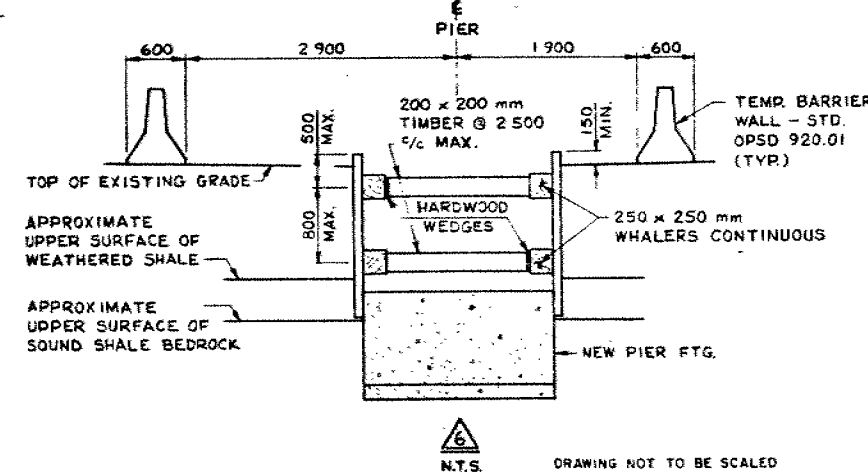
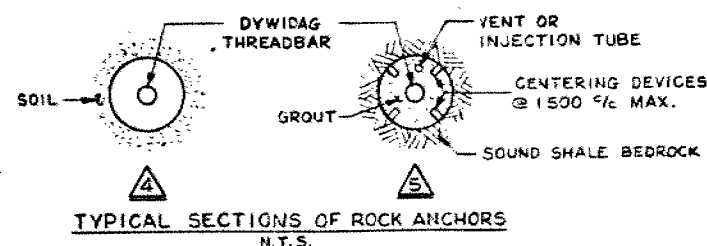
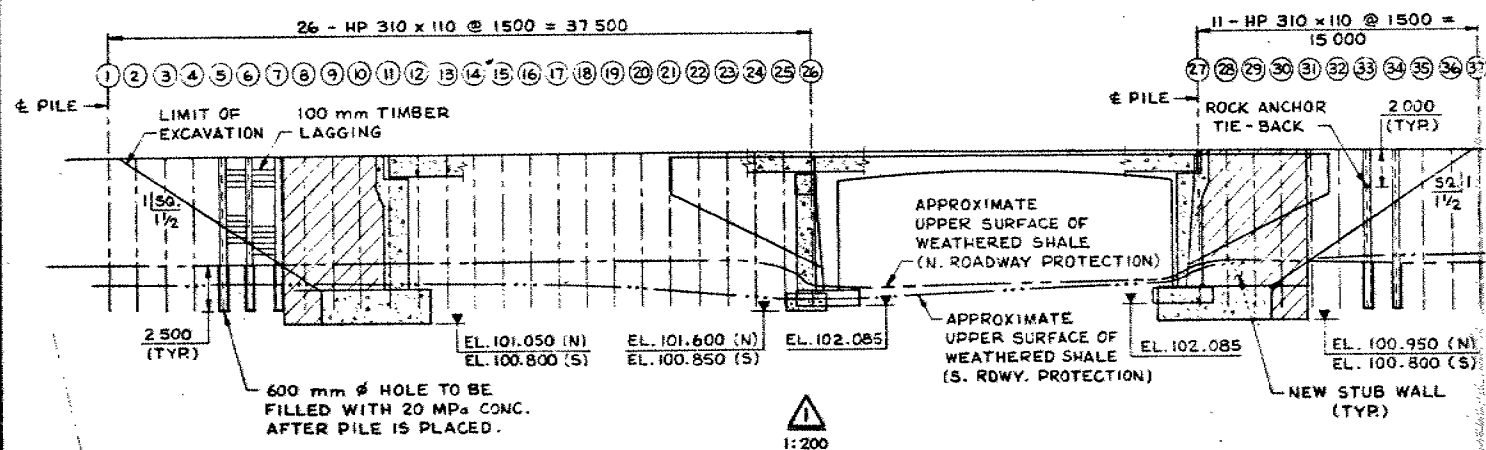
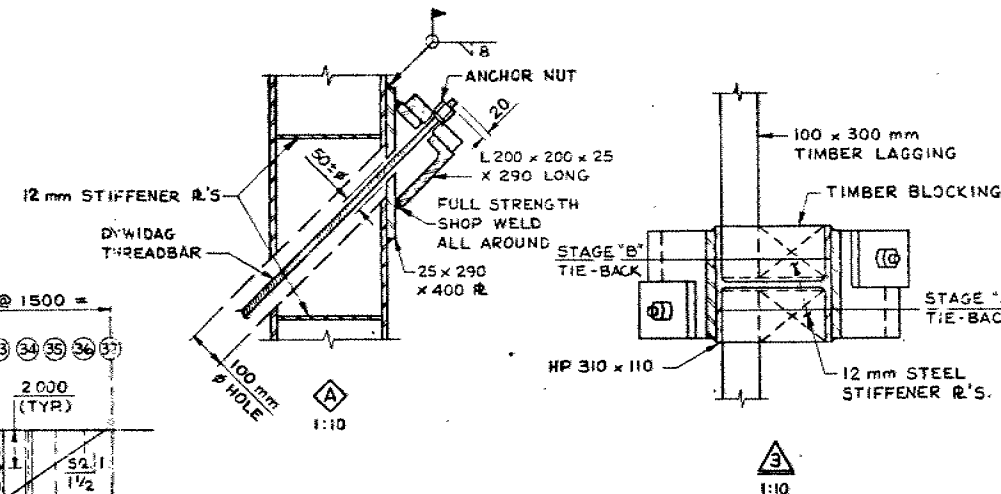
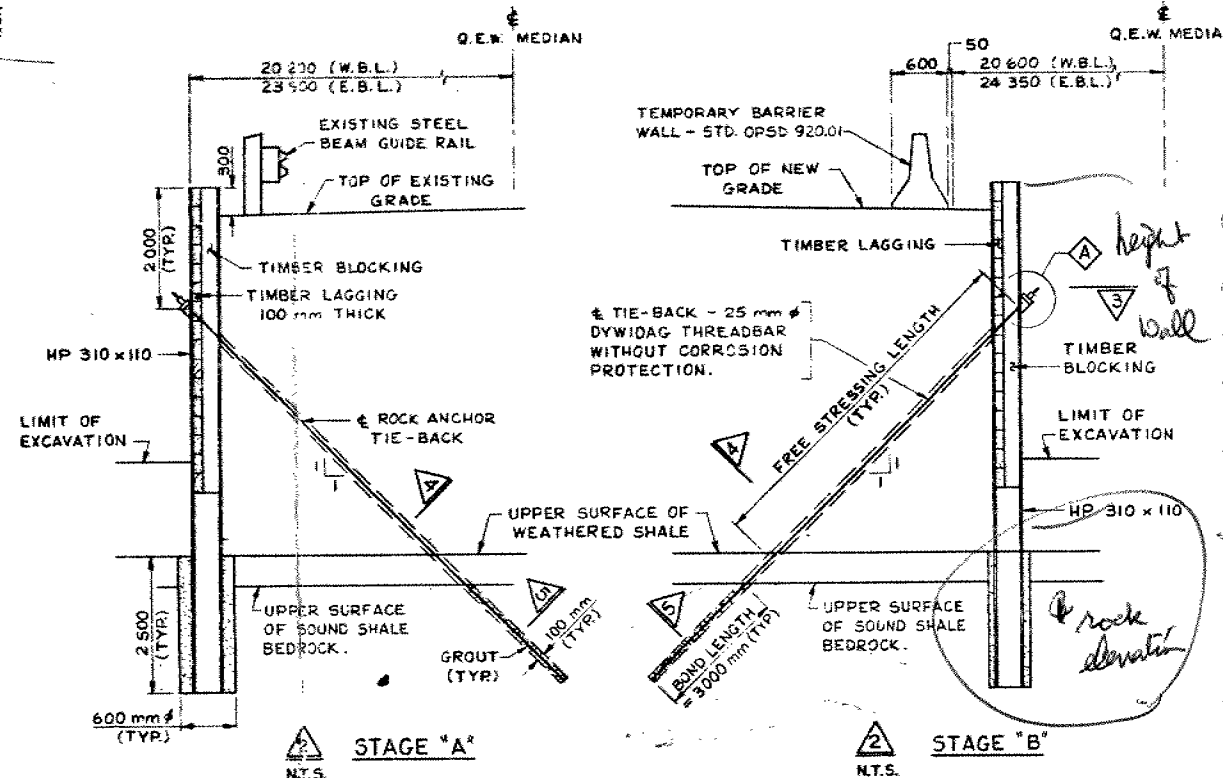
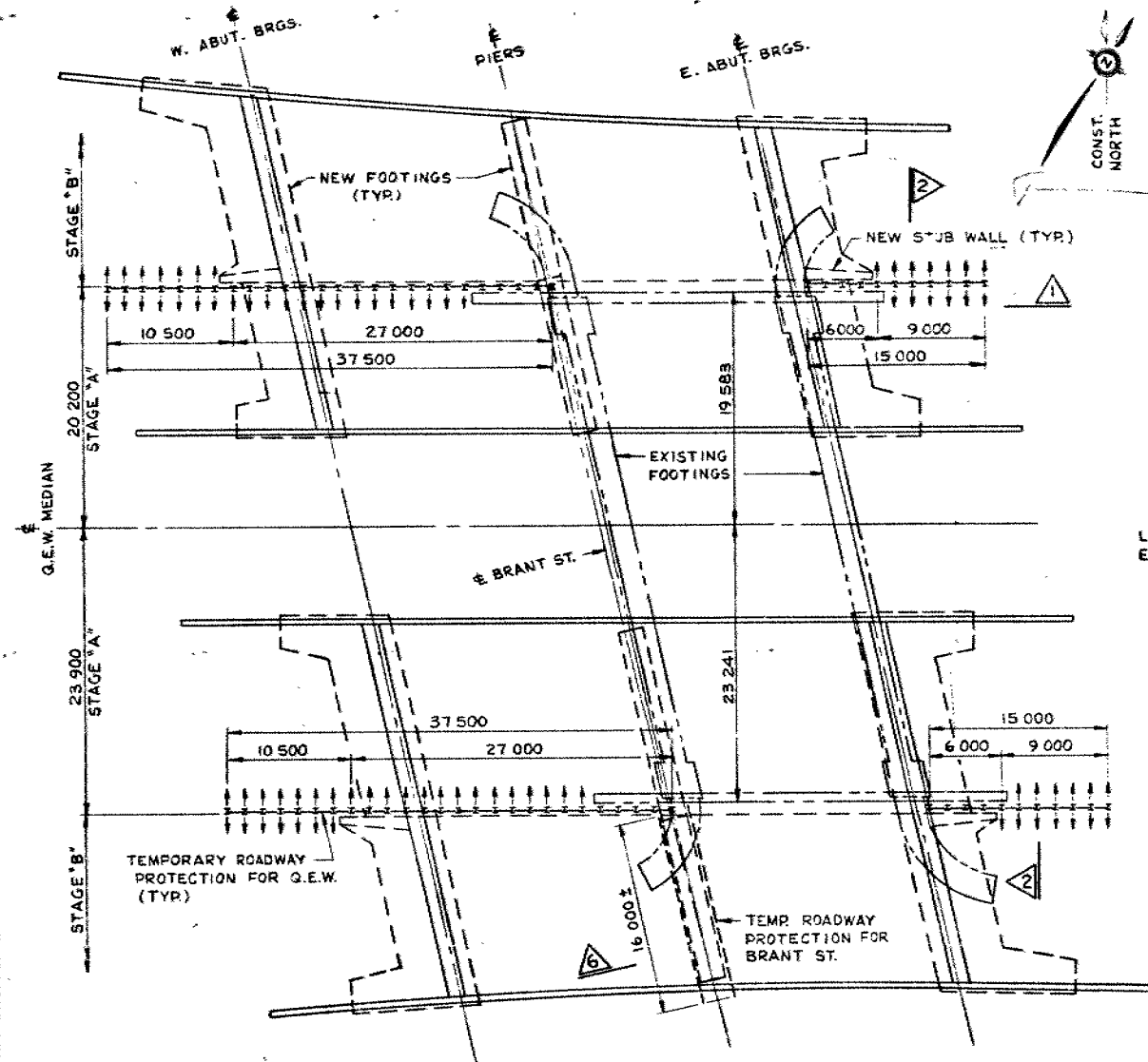
DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

**METRIC**  
DIMENSIONS ARE IN METRES  
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CONT No  
WP No 83-74-31

O.E.W.  
BRANT ST. OVERPASS  
TEMP ROADWAY PROTECTION

SHEET



# NOTES FOR Q.E.W. ROADWAY PROTECTION

## STAGE "A"

- 1 AUGER INTO FILL AND DRILL INTO BEDROCK FOR A DEPTH OF 2 500 mm BELOW TOP OF WEATHERED BEDROCK, AT ALL SOLDIER PILE LOCATIONS.
- 2 INSTALL SOLDIER PILES AND FILL 600 mm DIA. ROCK CAVITY WITH CONCRETE (CLASS = 20 MPa)
- 3 INSTALL TIMBER LAGGING TO ELEVATION OF TIE-BACKS.
- 4 INSTALL TIE-BACKS WITH ROCK ANCHORS LOCATED BENEATH THE EXISTING RETAINED FILLS, FOR ALL SOLDIER PILES AS SHOWN EXCEPT AT WINGWALLS.
- 5 COMPLETE INSTALLATION OF LAGGING (AND BLOCKING) AS EXCAVATION CONTINUES.

## STAGE "B"

- 1 INSTALL TIE-BACKS WITH ROCK ANCHORS LOCATED BENEATH THE NEW RETAINED FILLS FOR SOLDIER PILES 1 TO 7 INCLUSIVE AND 31 TO 37 INCLUSIVE.
- 2 ADEQUATELY SECURE SOLDIER PILES 8 AND 30 TO THEIR ADJACENT SUB WALLS.
- 3 COMPLETE NEW EXCAVATION TO THE LIMITS SHOWN.
- 4 REMOVE PILES 9 TO 29 INCLUSIVE AS WELL AS THEIR ASSOCIATED LAGGING INCLUDING ROCK ANCHOR TENDONS TO THE LEVEL OF BOTTOM OF NEW STRUCTURE FOOTINGS.
- 5 CUT OFF AND REMOVE REMAINDER OF PILES AND LAGGING TO A DEPTH OF 1000 mm BELOW FINISHED GRADE.

## NOTES

- STEEL SHALL BE IN ACCORDANCE WITH C.S.A. G 40.21 M GRADE 350 W.
- TIMBER LAGGING SHALL BE NEW, DOUGLAS FIR CONSTRUCTION GRADE. DIMENSION GIVEN IS ACTUAL SIZE REQUIRED.
- ROCK ANCHORS SHALL BE DYWIDAG ROCK ANCHORS OR EQUAL, WITH A MINIMUM WORKING LOAD CAPACITY OF 200 kN AT S.L.S. II LOADING. (BASED ON 45° INCLINATION)
- MACHINE EXCAVATION SHALL NOT BE CARRIED OUT CLOSER THAN 300 mm FROM THE FACE OF SOLDIER PILES.
- GRADE OF STEEL FOR 25 mm DIA. DYWIDAG THREADBAR SHALL BE 1030 MPa.
- THE DIAMETER AND LENGTH OF EACH ROCK ANCHOR SHALL BE 100 mm x 3000 mm RESPECTIVELY IN THE UNWEATHERED SHALE, EMBEDMENT LENGTH WITHIN THE WEATHERED SHALE IS NOT CONSIDERED PART OF THE ANCHOR LENGTH REQUIRED.
- ALL MATERIALS FOR ROADWAY PROTECTION TO BE SUPPLIED, PLACED, FABRICATED, AND REMOVED BY THE CONTRACTOR.



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	10-13-87	CHD/C	CHD/C-A-83
CHECK	10-13-87	CHD/C	CHD/C-A-83
DRAWING	10-13-87	CHD/C	CHD/C-A-83

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING



Ontario

Ministry of  
Transportation and  
Communications

# foundation investigation and design report

**ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION**

**WP 83-74-31**

**DIST 4**

**HWY**

**STR SITE 10-1337-138**

**Q.E.W. - Brant Street Overpass**

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FOUNDATION INVESTIGATION REPORT  
For

Q.E.W. - Brant Street Overpass  
W.P. 83-74-31, Site 10-1337-138  
District 4, Hamilton

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INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation carried out at the above-mentioned location between 85 01 31 and 85 02 07. The fieldwork consisted of six boreholes and six accompanying dynamic cone penetration tests. The borings were advanced by a continuous flight auger machine mounted on a muskeg vehicle equipped with solid stem augers and BX size rock coring equipment.

SITE DESCRIPTION

The site is located at the intersection of Q.E.W. and Brant Street, in the City of Burlington, Regional Municipality of Halton.

This area is located in the physiographic region referred to as the Iroquois Plain, characterized by red shale bedrock covered by a shallow layer of soil. The surrounding terrain is relatively flat, with the exception of man made earthworks (Highways).

SUBSURFACE CONDITIONS

General

Two types of deposit were encountered at this location. The overburden, ranging in thickness from 0.3 m to 1.8 m is a heterogeneous mixture of silty clay, sand and gravel (glacial till). The second deposit is red shale bedrock. The top 0.4 m to 2.9 m of the bedrock is in a highly weathered state.

The boundaries of the various strata together with the field and laboratory tests are plotted on the Record of Borehole Sheets located in the Appendix. The borings locations and elevations, along with the estimated stratigraphical profiles based on borehole data are shown on Drawing 837431-A, in the Appendix. A description of the different strata encountered is given below.

### Heterogeneous Mixture of Silty Clay, Sand and Gravel (Glacial Till)

Immediately below a thin layer of top soil a material identified as till (glacial till) was encountered at all borehole locations. The thickness of this zone ranged from 0.3 m to 1.8 m. The material composing this strata consists of a heterogeneous mixture of silty clay, sand and gravel. The matrix of this deposit is basically cohesive in nature - i.e. silty clay binding coarser particles.

A plot of the Liquid Limit versus Plastic Index, (see Figure No. 1), shows the majority of the points to fall within the CL zone. The physical properties of this material as determined by laboratory tests are as follows:

		Range	Average
Natural Moisture Content	(w) %	7 - 14	12
Liquid Limit	(w <sub>L</sub> ) %	25 - 41	32
Plastic Limit	(w <sub>p</sub> ) %	17 - 22	19
Plastic Index	(I <sub>p</sub> ) %	9 - 20	13

The results of the grain size distribution test are shown in an envelope form, on Figure No. 2, of the Appendix.

Standard Penetration Tests carried out within the deposit gave 'N' values from 22 to over 100 blows per 30 cm. The consistency of the deposit ranges from very stiff to hard.

### Bedrock

Bedrock was proven in all six boreholes by obtaining up to 3.1 m of BX rock cores. The top of the bedrock ranged from elevation 104.5 to 102.2. The bedrock is a red shale with green siltstone (approximately 80% shale, 20% siltstone) of the Queenston formation. The upper 0.4 m to 2.9 m is in a highly weathered state, with layers of broken shale and red clay. In each of the borings, split spoon samples of the weathered portion of the bedrock were recovered before augering was terminated.

The core recovery attained varied from 8 1/2% to 100%.

Rock Quantity Designation (RQD) for the coring ranged from 52% to 95% with the mean being 75%.

A detailed description of the rock core was prepared by Mr. E. Magni, M.T.C. Geologist, and his report is located in the Appendix.

#### Groundwater Conditions

No groundwater levels were observed during the field investigations. However, an additional borehole was augered (adjacent to borehole 6) to elevation 102 and no groundwater was observed.



## DISCUSSION AND RECOMMENDATIONS

### General

Presently the Q.E.W. - Brant Street overpass is a simple span rigid frame structure. There is no existing access from the Q.E.W. to Brant Street or visa versa.

As part of the proposed 403/Q.E.W. reconstruction it is proposed to construct a Q.E.W./Brant Street interchange. It is intended to replace the existing structure with two-span (20<sup>±</sup> m, 20<sup>±</sup> m) twin trapazodal steel box girder bridges. To accommodate these structures the profile of the Q.E.W. will be slightly raised from elevation 109.8<sup>±</sup> to elevation 110.1<sup>±</sup>. The Brant Street grade will be lowered from elevation 104.0<sup>±</sup> to elevation 103.5<sup>±</sup>.

### Structure Foundation

Since the bedrock is close to the ground level it is recommended that the entire structure be supported on spread footings.

Design details for spread footings founded on weathered shale and sound shale are given below.

All abutments and piers founded on weathered shale will have an allowable bearing capacity of 500 kPa.

For the purpose of the O.H.B.D.C. the following values are recommended:

Factored Capacity at U.L.S.: 750 kPa

Bearing Capacity at S.L.S. Type II: 500 kPa

### Footings Founded on Sound Shale Bedrock

Structural Component	Foundation Elevation	Factored Capacity at U.L.S. (kPa)	Capacity at S.L.S. Type II (kPa)
North Structure East Abutment	102.1 (100.95)	1500 (BH.#1)	N.A.
North Structure Pier	102.4 (101.6)	1500 (BH.#2)	N.A.
North Structure West Abutment	101.9 (101.05)	1500 (BH.#3)	N.A.
South Structure West Abutment	101.2 (100.80)	1500 (BH.#4)	N.A.
South Structure Pier	101.8 (100.85)	1500 (BH.#5)	N.A.
South Structure East Abutment	101.6 (100.80)	1500 (BH.#6)	N.A.

### General Foundation Requirements

- 1) The following unfactored friction coefficients may be used for design of sliding resistance between the base of the footing and the shale bedrock.

Weathered Shale Bedrock	$\tan 22^\circ$
Sound Shale Bedrock	$\tan 25^\circ$

- 2) Backfill to the structure should consist of Granular 'A' or Granular 'B'. Earth pressure acting on the abutment walls may be computed in accordance with the O.H.B.D.C., Section 6.6.1.2.1 assuming a non-yielding foundation in which case the "at rest" ( $K_0$ ) condition applies. The physical properties assumed for the backfill are as follows:

Granular 'A'	$35^\circ$	22.8 kN/m <sup>3</sup>
Granular 'B'	$30^\circ$	21.2 kN/m <sup>3</sup>

- 3) A 150 mm thin pad of lean concrete should be placed on exposed shale within twelve hours of exposure.
- 4) Minimum frost protection in this area is 1.2 m of cover.
- 5) No dewatering problems are anticipated for the footing excavation. Seepage into the excavation can be controlled by sump pumps.

### Approach Embankments

The grade at Brant Street will be lowered from elevation 104.0<sup>+</sup> to elevation 103.5<sup>+</sup> and the Q.E.W. profile must be raised from elevation 109.8<sup>+</sup> to elevation 110.1<sup>+</sup>. It is recommended that the embankments be constructed with 2:1 slopes.

### MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. M.J. Kelly, Trainee Engineer and Mr. D. Graham, Engineering Student. The equipment utilized was owned and operated by Dominion Soil Investigation Ltd. This report was written by Mr. M.J. Kelly, with assistance from Mr. P. Payer, Foundations Engineer and reviewed by Mr. K.G. Selby, Chief Foundations Engineer (West.)

*M.J. Kelly*

M.J. Kelly  
Trainee Engineer

*P. Payer*

P. Payer, P. Eng.  
Foundations Engineer



*K. G. Selby*

K.G. Selby, P. Eng.  
Chief Foundations Engineer  
(West)

## APPENDIX

## 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 UN-DRAINED 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

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

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_r$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

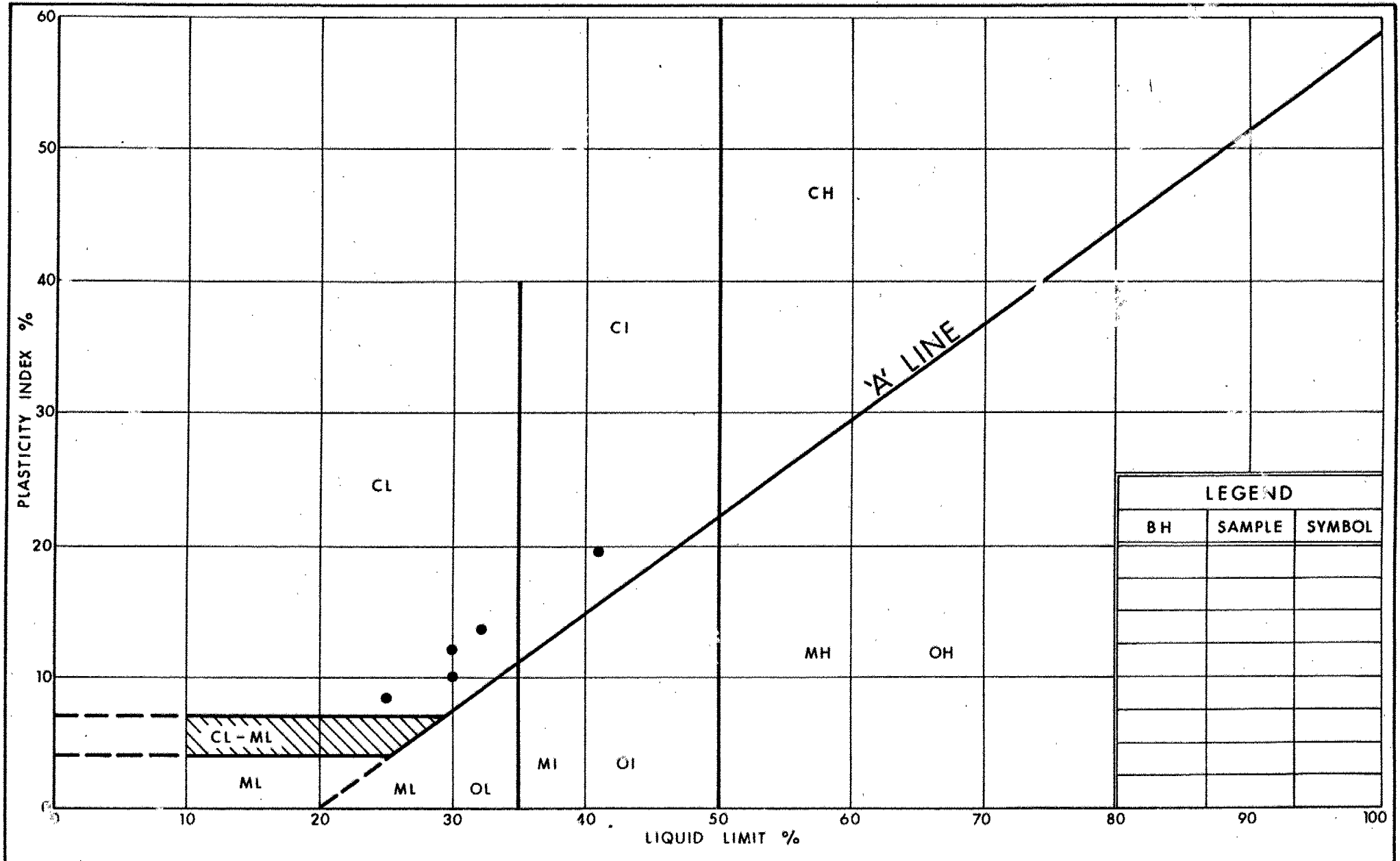
### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kn/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	kn/m <sup>3</sup>	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$d_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	kn/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	kn/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	kn/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE		kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kn/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

# DESCRIPTION OF ROCK CORE - W.P. 83-74-31

BOREHOLE NUMBER				CORE DESCRIPTION	
	DEPTH (m)	% CR *	% RQD *	DEPTH (m)	DESCRIPTION
1	3.28-4.70	88	63	3.28-3.45	Assumed zone of core loss
	4.70-6.12	100	64	3.45-6.12	Shale (80%), red, unweathered, medium spaced joints, with siltstone (20%), green, unweathered; 5.46 m to 5.57 m highly weathered zone in shale
2	3.15-4.50	98	77	3.15-5.84	Shale (75%), red, unweathered, medium spaced joints, with siltstone (25%), green, unweathered
	4.50-5.84	87	68		
3	3.53-4.95	96	79	3.53-6.4	Shale (80%), red, unweathered, medium spaced joints, with siltstone (20%), green, unweathered; 5.54 m to 5.56 m highly weathered shale zone
	4.95-6.40	100	98		
4	3.25-4.75	93	59	3.25-3.56	Shale (100%), red, slightly weathered, very closely spaced joints
	5.75-6.22	100	95	3.56-6.22	Shale (80%), red, unweathered, medium spaced joints, with siltstone (20%), green, unweathered
5	1.98-3.45	91	52	1.98-2.21	Assumed zone of core loss
	3.45-4.95	100	88	2.21-4.95	Shale (80%), red, unweathered, medium spaced joints, with siltstone (20%), green, unweathered
6	3.15-4.57	100	71	3.15-6.07	Shale (90%), red, unweathered, medium spaced joints, with siltstone (10%), green, unweathered
	4.57-6.07	100	86		

\* CR = CORE RECOVERY ; RQD = ROCK QUALITY DESIGNATION

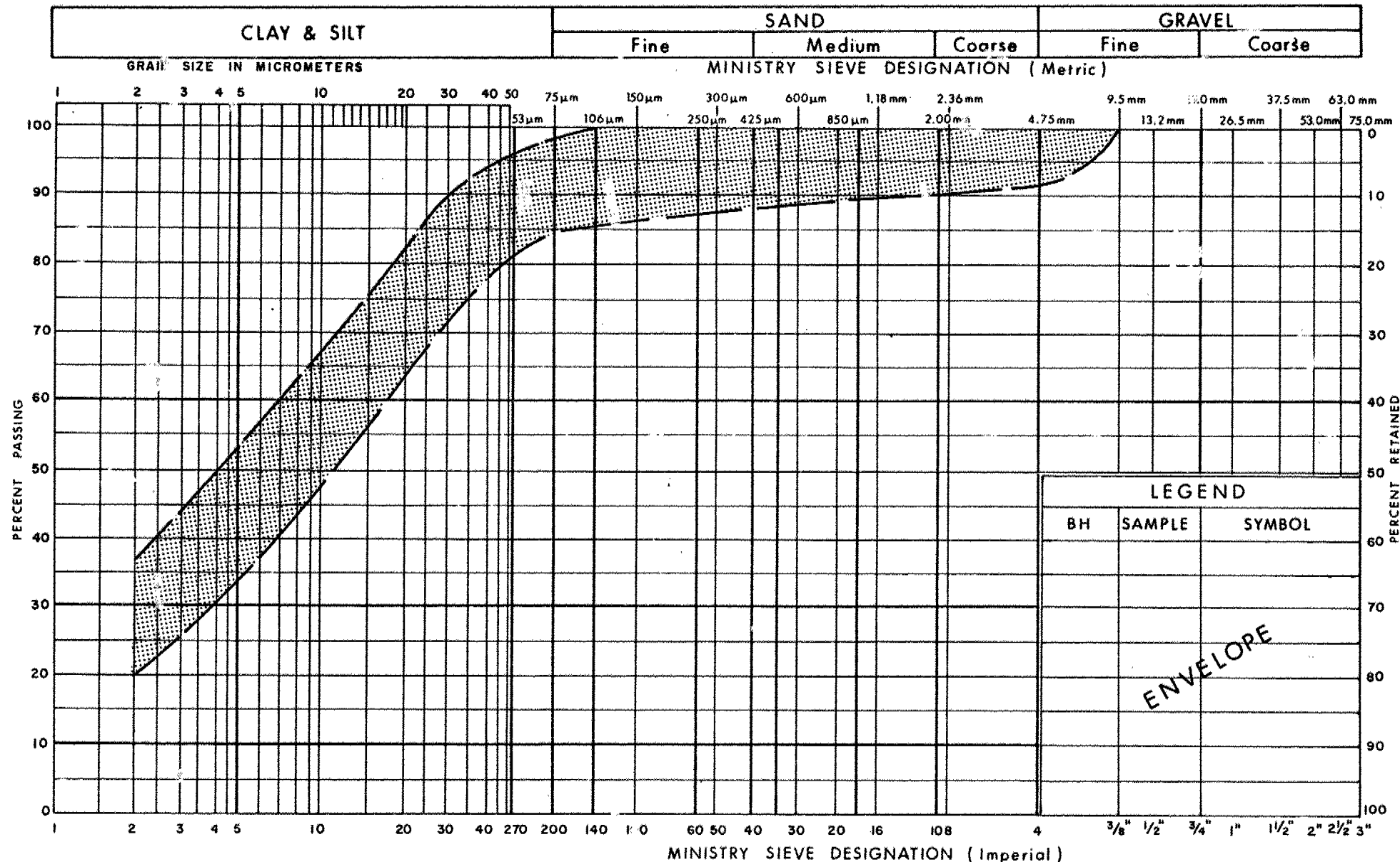


Ministry of  
Transportation and  
Communications

**PLASTICITY CHART**  
**HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND & GRAVEL**  
 ( Glacial Till )

FIG No 1  
 W P 83-74-31

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation and  
Communications

**GRAIN SIZE DISTRIBUTION**  
HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND & GRAVEL  
(Glacial Till)

FIG No 2

W P 83-74-31





# RECORD OF BOREHOLE No 1

METRIC

W P 83-74-31 LOCATION Co-ords. N 4 800 072.5 E 278 647.0 ORIGINATED BY DG  
DIST 4 HWY G.E.W. BOREHOLE TYPE Cont. Flight Auger (S.A.), Coring BX, Cone Test COMPILED BY MJK  
DATUM Geodetic DATE 85 01 31 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UN- WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELFV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
105.7	Ground Level															
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel															
104.3	Hard Glacial Till		1	SS	39											0 8 72 20
1.4	Bedrock		2	SS	100/	28 cm										
	Red Shale		3	SS	100/	14 cm										
	Weathered Sound		4	SS	100/	10 cm										
			5	RC BX	REC 88%											RQD 63%
			6	RC BX	REC 100%											RQD 64%
99.6																
6.1	End of Borehole															
	* Groundwater Level Not Observed															

+3, x5: Numbers refer to  
Sensitivity.

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 2

METRIC

W P 83-74-31 LOCATION Co-ords. N 4 800 054.5 E 278 618.5 ORIGINATED BY DG  
DIST 4 HWY Q.E.W. BOREHOLE TYPE Cont. Flight Auger (S.A.) Coring BX, Cone Test COMPILED BY MJK  
DATUM Geodetic DATE 85 02 01-05 CHECKED BY LM

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
ELLV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100	100	Wp	W	WL		
105.9													
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel Very Stiff Glacial Till		1	SS	22	*							5 9 54 32
104.5			2	SS	78								
1.4	Bedrock		3	SS	100/	23 cm							
	Red Shale		4	SS	100/	5 cm							
	Weathered Sound		5	RC BX	REC 98%								RQD 77%
			6	RC BX	REC 87%								RQD 88%
100.0													
5.9	End of Borehole												
	* Groundwater Level Not Observed												

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 3

METRIC

W P 83-74-31 LOCATION Co-ords. N 4 800 046.5 E 278 605.0 ORIGINATED BY DG  
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Cont. Flight Auger (S.A.), Coring BX, Cone Test COMPILED BY JK  
 DATUM Geodetic DATE 85 02 01-04 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80	SHEAR STRENGTH					
105.8	Ground Level							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel Very Stiff Glacial Till		1	SS	22	*								5 9 52 34
104.4														
1.4	Bedrock  Red Shale		2	SS	80		104							
			3	SS	100	15 cm								
			4	SS	100	18 cm								
	Weathered Sound		5	RC BX	REC 96%		102							RQD 79%
			6	RC BX	REC 100%		100							RQD 98%
99.4	End of Borehole													
3.4	* Groundwater Level Not Observed													

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 4

METRIC

W P 83-74-31 LOCATION Co-ords. N 4 799 994.5 E 278 658.5 ORIGINATED BY DG  
DIST 4 HWY Q.E.W. BOREHOLE TYPE Cont. Flight Auger (S.A.) Coring BX, Cone Test COMPILED BY MJK  
DATUM Geodetic DATE 85 02 05-06 CHECKED BY 20

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	SHEAR STRENGTH			
104.8	Ground Level											
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel Very Stiff Glacial Till		1	SS	26	*						0 3 61 36
103.4			2	SS	100/	30 cm						
1.4	Bedrock  Red Shale		3	SS	100/	14 cm						
	Weathered Sound		4	RC BX	REC 93%							RQD 59%
			5	RC BX	REC 100%							RQD 95%
98.6	End of Borehole											
6.2	* Groundwater Level Not Observed											

+3, x5 : Numbers refer to  
Sensitivity

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



# RECORD OF BOREHOLE No 5

METRIC

W P 83-74-31 LOCATION Co-ords. N 4 800 004.5 E 278 674.5 ORIGINATED BY DG  
DIST 4 HWY QEW BOREHOLE TYPE Cont. Flight Auger (S.A.) Coring BX, Cone Test COMPILED BY 1006  
DATUM Geodetic DATE 85 01 06 CHECKED BY 1006

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80
104.0	Ground Level															
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel Hard Glacial Till		1	SS	64									8 7 64 21		
102.2			2	SS	100/	23 cm										
1.8	Bedrock Weathered Sound		3	RC	REC 91%									RQD 52%		
	Red Shale		4	RC	100%									RQD 86%		
99.0	End of Borehole															
5.0	* Groundwater Level Not Observed															

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10



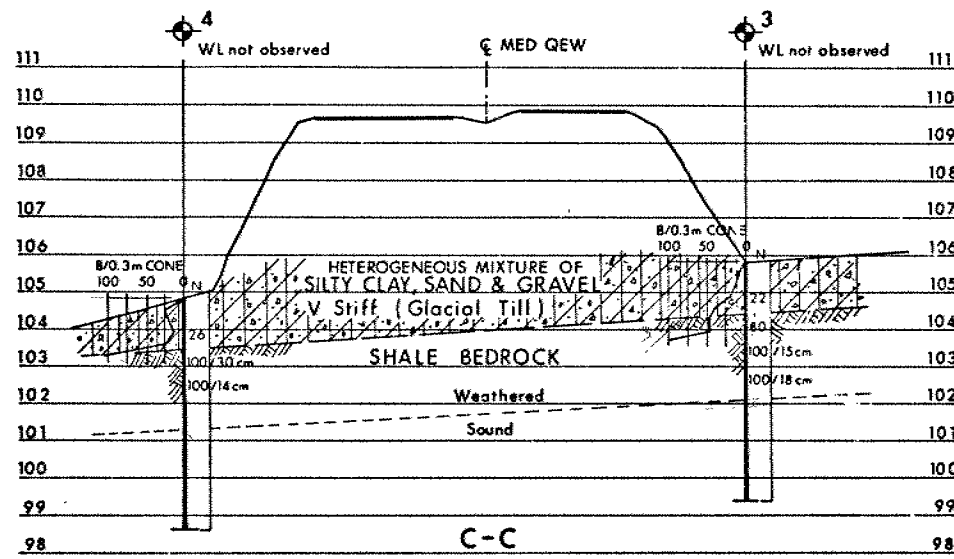
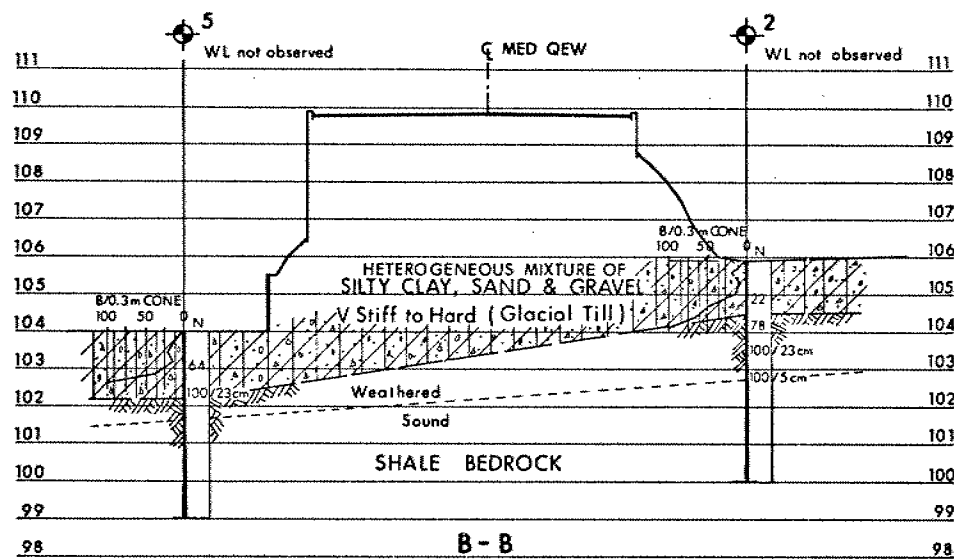
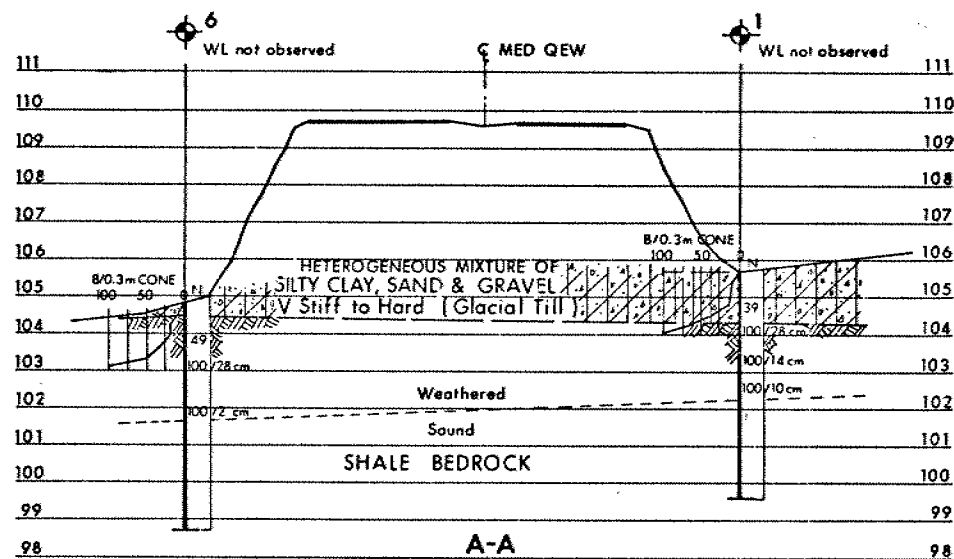
# RECORD OF BOREHOLE No 6

METRIC

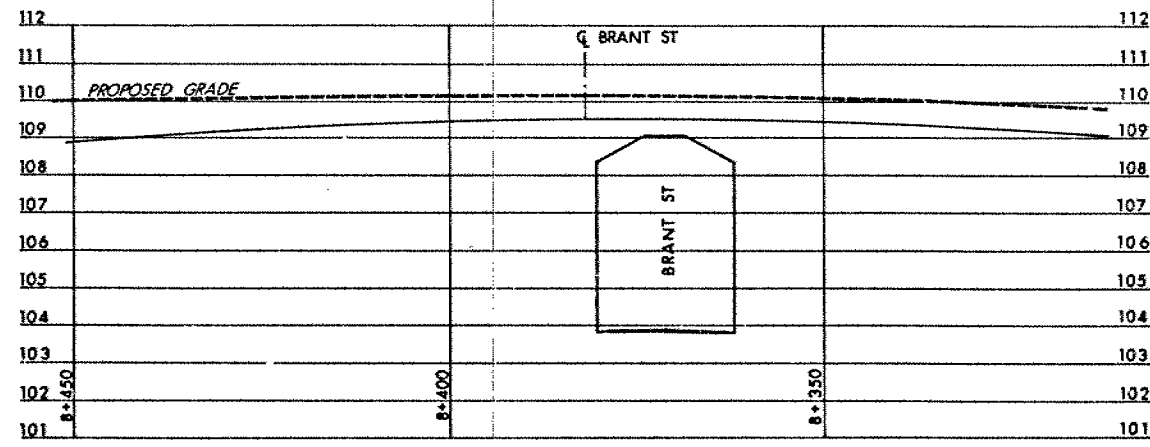
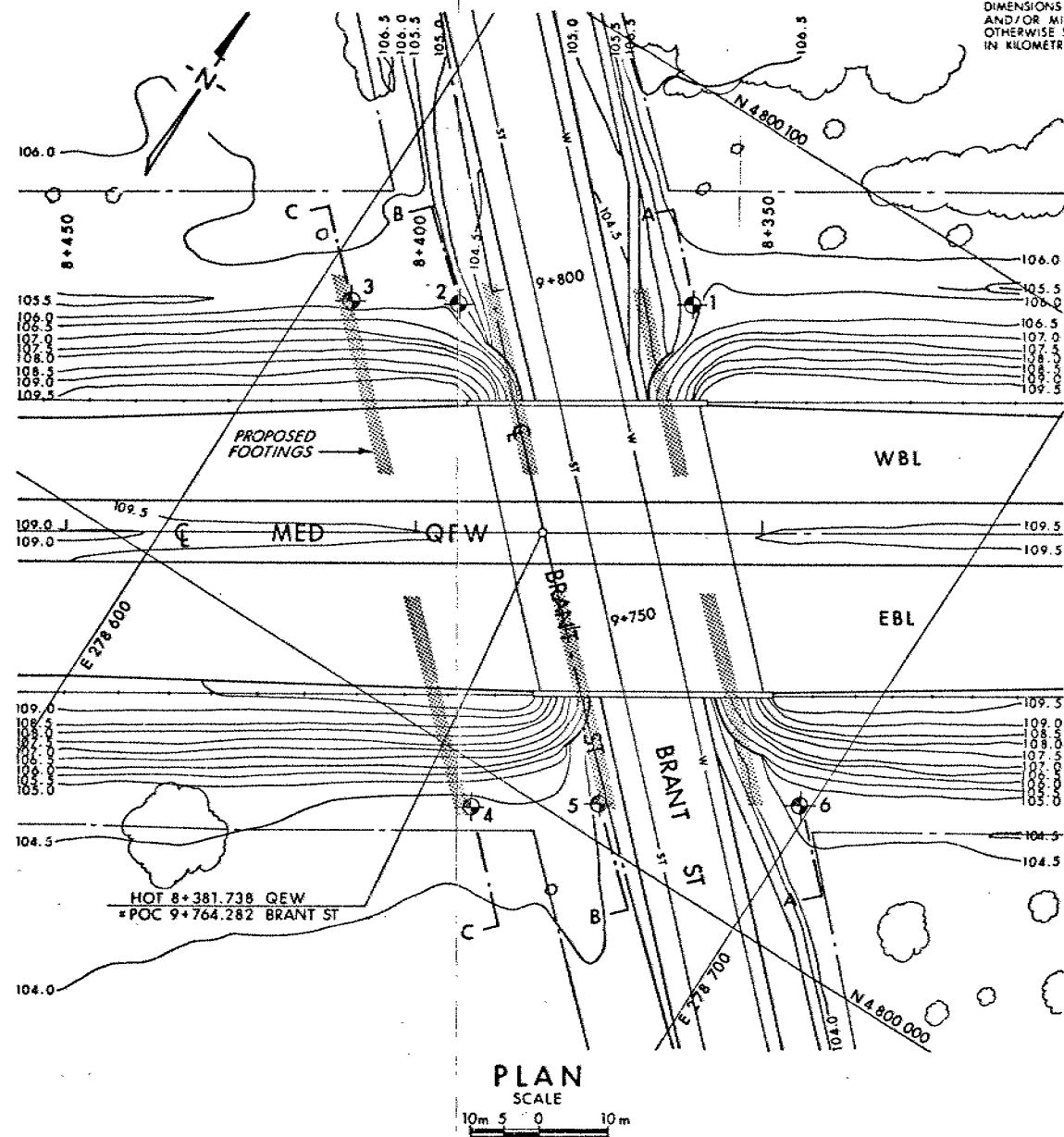
W P 83-74-31 LOCATION Co-ords. N 4 800 020.0 E 278 698.5 ORIGINATED BY DG  
DIST 4 HWY Q.E.W. BOREHOLE TYPE Cont. Flight Auger (S.A.) Coring BX, Cone Test COMPILED BY MJK  
DATUM Geodetic DATE 85 01 07 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
104.8	Ground Level															
0.0	Het. Mix. of Silty Clay															
104.5	Sand & Grav. V. Stiff Till															
0.3																
	Bedrock		1	SS	49											0 3 74 23
	Red Shale		2	SS	100/	28 cm										
	Weathered Sound		3	SS	100/	2 cm										
			4	RC BX	REC 100%											RQD 71 %
			5	RC BX	REC 100%											RQD 86 %
98.7																
6.1	End of Borehole															
	* Groundwater Level Not Observed															

OFFICE REPORT ON SOIL EXPLORATION



SECTIONS



Q PROFILE QEW

METRIC

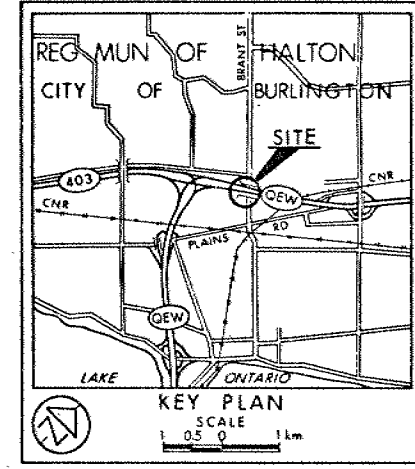
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN  
IN KILOMETRES + METRES.

CONT No  
WP No 83-74-31

BRANT ST

BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (CONE)
- Bore Hole & Cone
- N Blows/0.3m (5rd Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	105.7	4800 072.5	278 647.0
2	105.9	4800 054.5	278 618.5
3	105.8	4800 046.5	278 605.0
4	104.8	4799 994.5	278 658.5
5	104.0	4800 004.5	278 674.5
6	104.8	4800 020.0	278 698.5

NOTE

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

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

DATE	BY	DESCRIPTION
1985 04 02	10-1337-138	DWG 837431-A

Geocret No 30M5-149

HWY No QEW	CHECKED	DATE 1985 04 02	DIST 4
SUBMD PP	CHECKED	DATE 1985 04 02	SITE 10-1337-138
DRAWN SO	CHECKED	DATE 1985 04 02	DWG 837431-A