

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30MR-173

DIST. 4 REGION                     

W.P. No. 197-77-05

CONT. No. 84-78

W. O. No.                     

STR. SITE No. 10-82-327

HWY. No. 403/407

LOCATION Ninth Line Underpass  
(Structure #3)

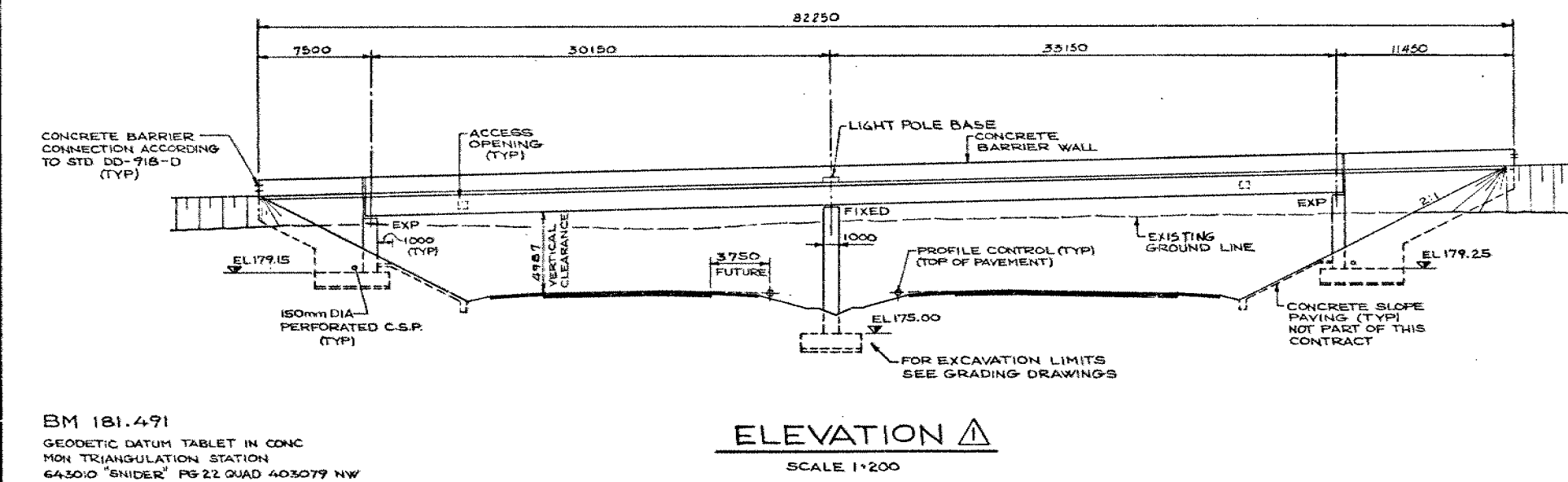
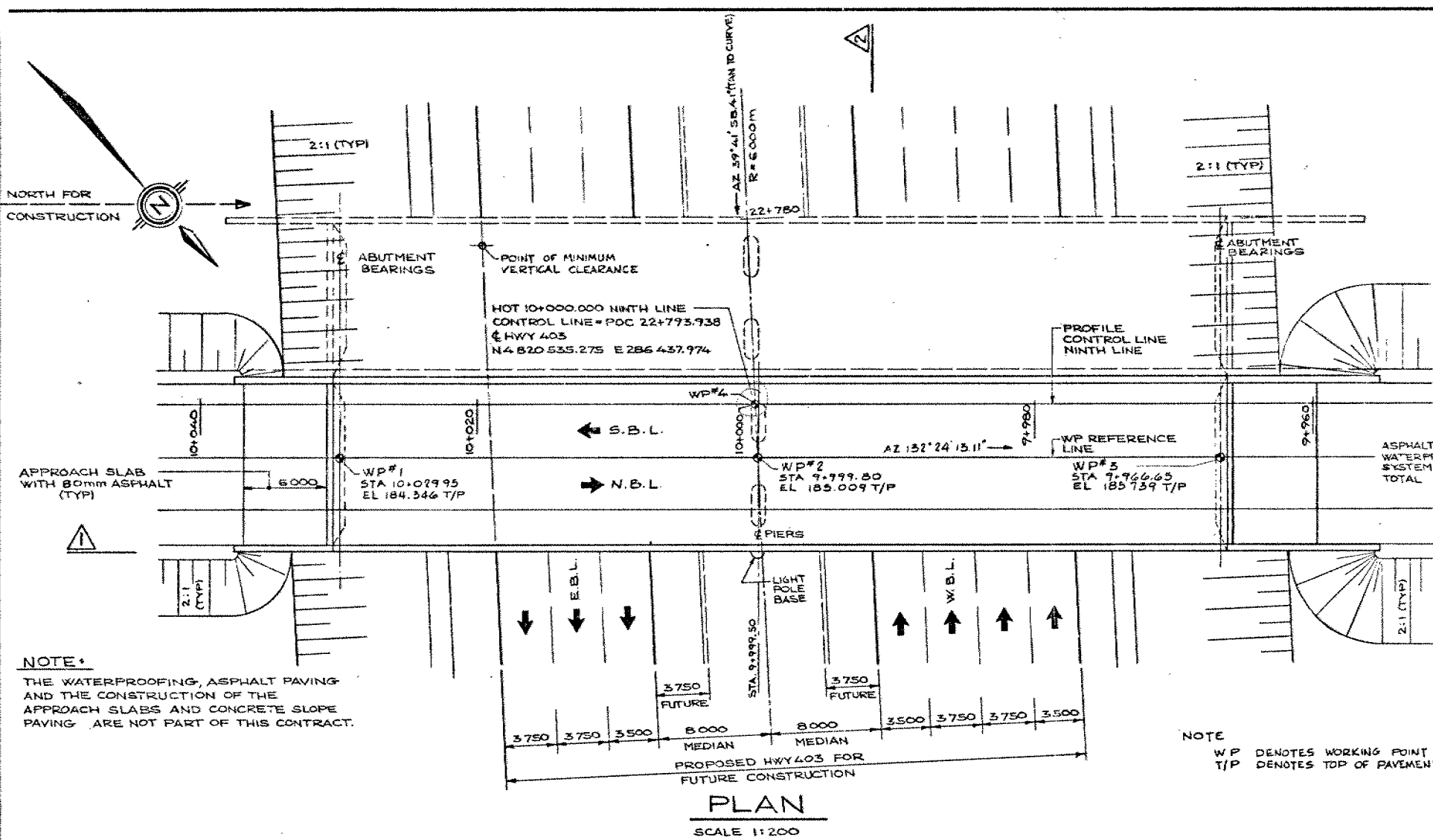
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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     

REMARKS:

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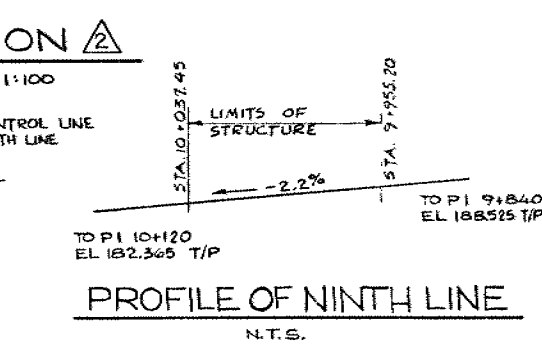
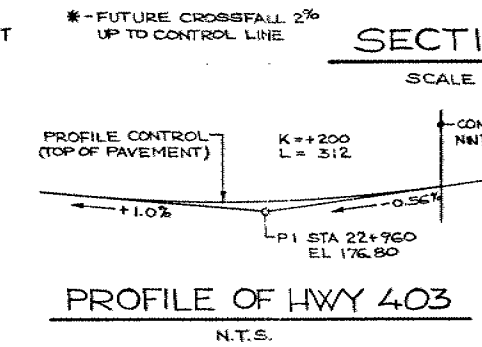
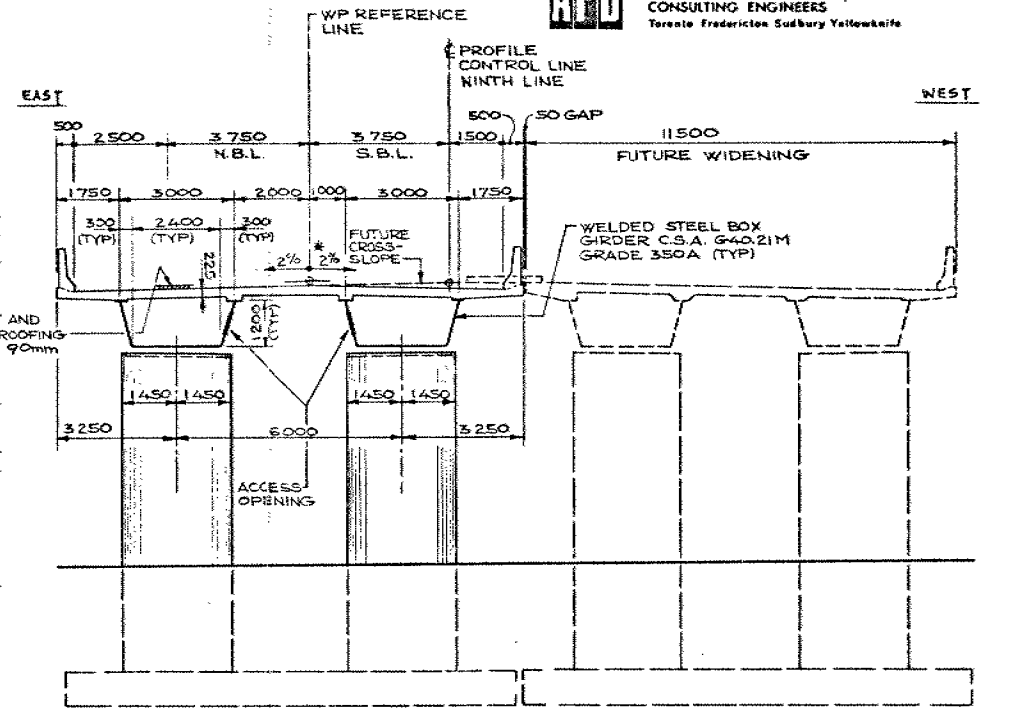
**METRIC**

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

**DIST. No 4**  
**CONT No**  
**WP No 197-77-05**

**NINTH LINE UNDERPASS**  
**HWY 403/407 INTERCHANGE**  
**GENERAL ARRANGEMENT**

**ALBERRY, PULLERITS, DICKSON & ASSOCIATES**  
CONSULTING ENGINEERS  
Toronto Fredericton Sudbury Yellowknife



**LIST OF DRAWINGS**

- 1) GENERAL ARRANGEMENT
- 2) BOREHOLE LOCATIONS & SOIL STRATA
- 3) FOUNDATION LAYOUT AND DETAILS
- 4) SOUTH ABUTMENT
- 5) NORTH ABUTMENT
- 6) PIER DETAILS
- 7) BOX GIRDERS - PLAN & ELEVATION
- 8) BOX GIRDERS - SECTIONS & DETAILS
- 9) BOX GIRDERS - SECTIONS & DETAILS
- 10) BOX GIRDERS - SECTIONS & DETAILS
- 11) DECK REINFORCING
- 12) DECK DETAILS & SCREED ELEVATIONS
- 13) BARRIER WALLS
- 14) 6000mm APPROACH SLABS
- 15) DETAILS OF CONC SLOPE PAVING
- 16) STANDARD DETAILS
- 17) BRIDGE DATA & SITE NUMBER DATA
- 18) AS CONSTRUCTED ELEVATIONS & DIMENSIONS
- 19) QUANTITIES - STRUCTURE

**GENERAL NOTES:**

- CLASS OF CONCRETE**  
ABUTMENTS, WINGWALLS, DECKS, PIERS AND BARRIER WALLS 30MPa  
REMAINDER 20MPa
- REINFORCING STEEL GRADE**  
GRADE 400 UNLESS OTHERWISE SPECIFIED.  
BARS MARKED WITH THE SUFFIX 'C' SHALL BE COATED BARS
- CLEAR COVER TO REINF STEEL**
- | FOOTINGS                           | 100±25 |
|------------------------------------|--------|
| ABUTMENTS - F-FACE                 | 80±20  |
| ABUTMENTS - B-FACE                 | 70±20  |
| PIERS                              | 80±20  |
| DECKS - TOP                        | 70±20  |
| DECKS - BOT                        | 40±10  |
| REMAINDER (UNLESS OTHERWISE NOTED) | 70±20  |

**CONSTRUCTION NOTE**

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

NOTES FOR STRUCTURAL STEEL SEE DWG NO. 10.



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISION	DATE	BY	CHECK	DESCRIPTION
DESIGN	7/2	7/2	7/2	LOADING OHBDC 479
DRAWING	7/2	7/2	7/2	SITE 10-82-327 DWG 1

CONT No  
WP No 197-77-05



NINTH LINE UNDERPASS  
HWY 403/407 INTERCHANGE  
FOUNDATION LAYOUT & DETAILS

SHEET



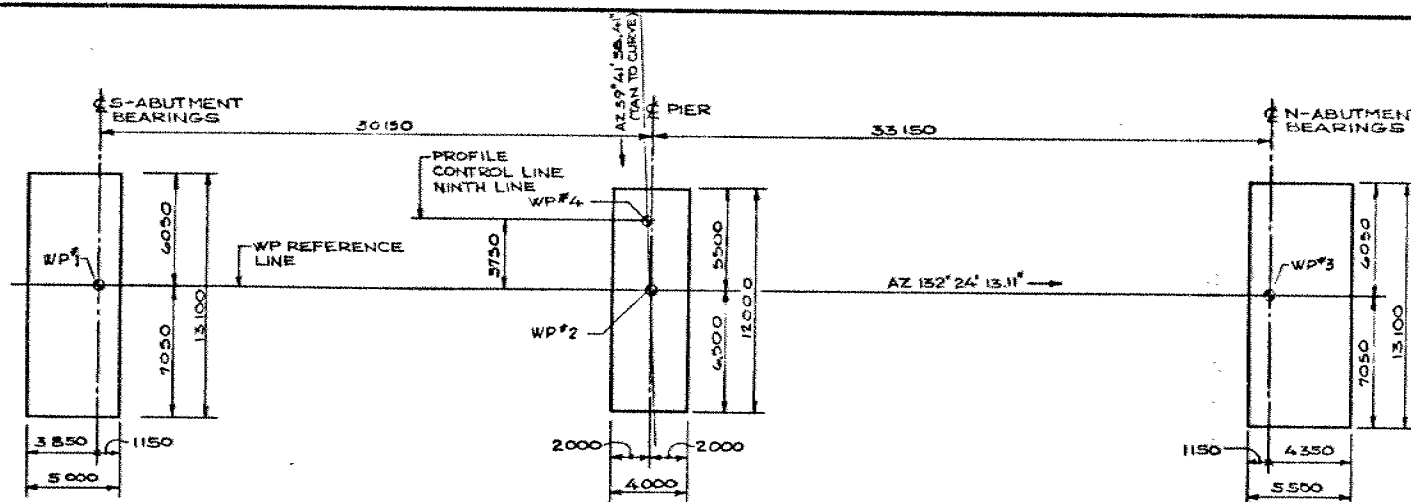
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METRIC

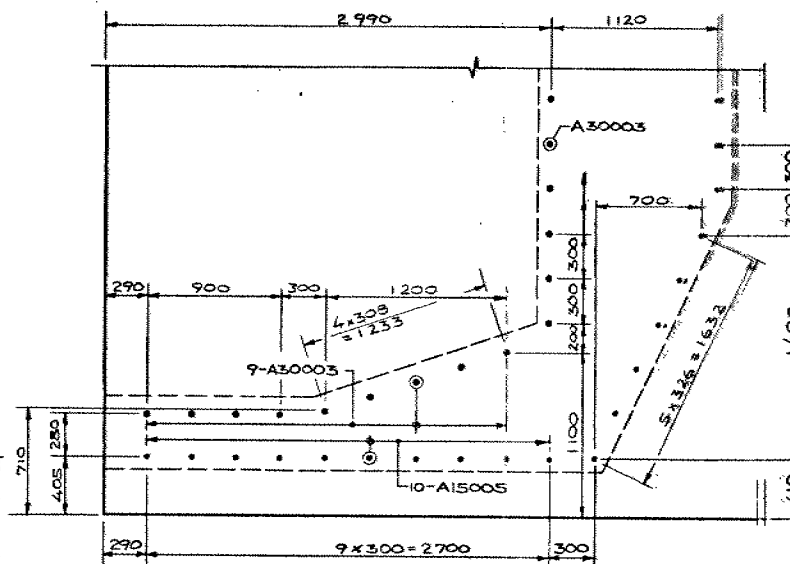
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ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES.

# LOCATION OF WORKING POINTS

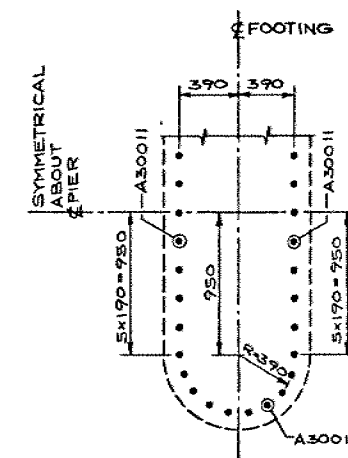
STA	NORTH	EAST	EL T/P
WP#1 10+029.75	4 820 517.847	286 462.6-8	84.346
WP#2 9+777.80	4 820 535.179	286 440.355	85.009
WP#3 9+966.65	4 820 560.534	286 415.877	85.739
WP#4 10+000.00	4 820 535.275	286 437.974	



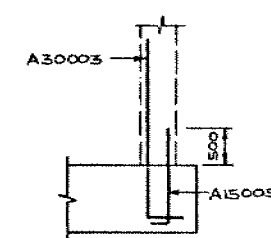
FOOTING LAYOUT  
SCALE 1:200



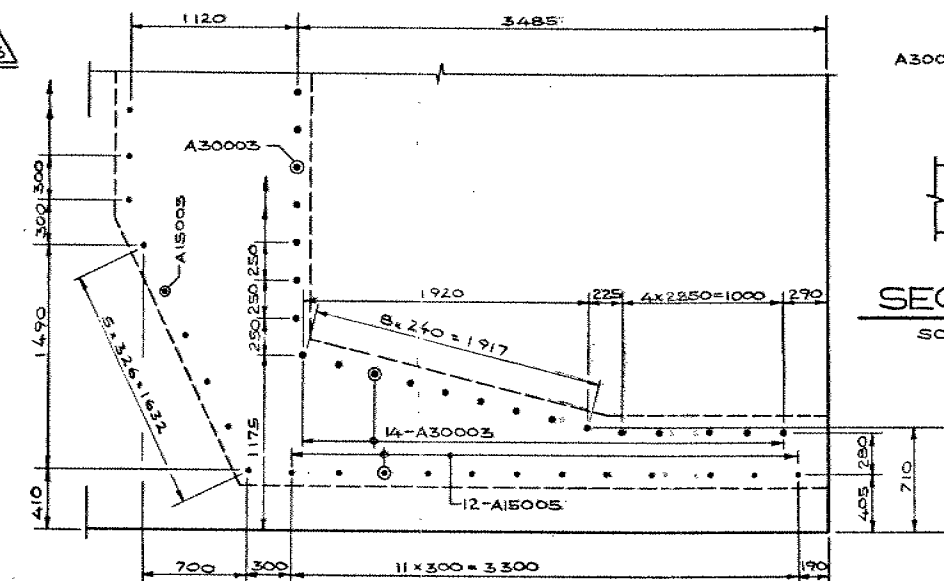
DETAIL A  
SCALE 1:25



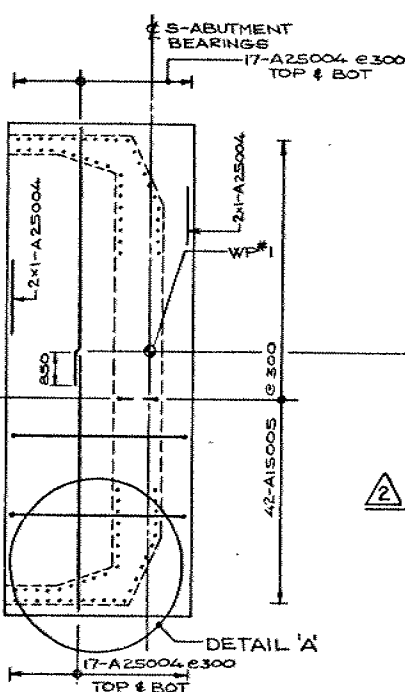
DETAIL B  
SCALE 1:25



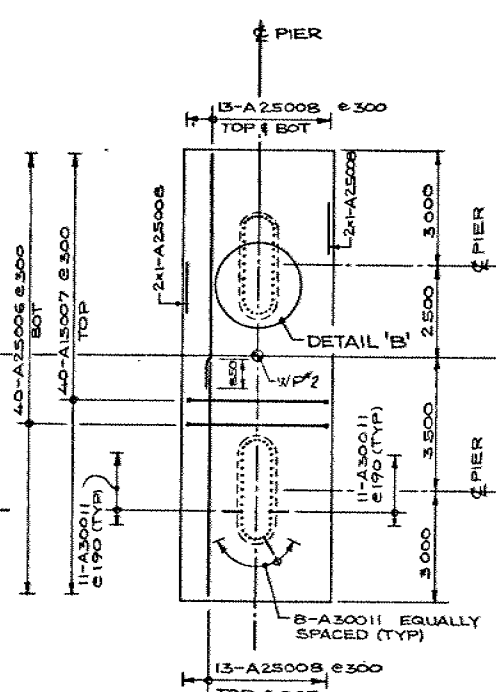
SECTION A  
SCALE 1:50



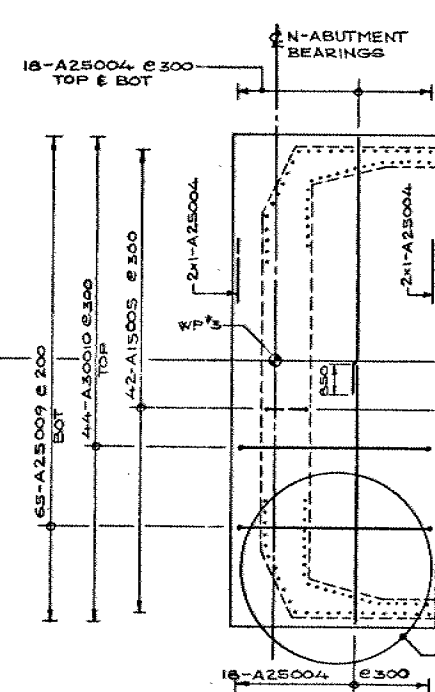
DETAIL C  
SCALE 1:25



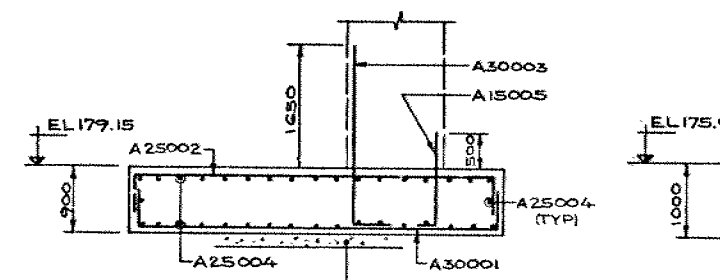
FOOTING SOUTH ABUTMENT  
SCALE 1:100



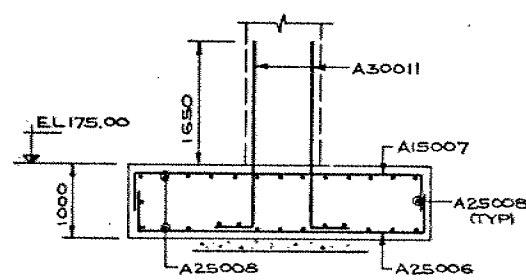
FOOTING PIER  
SCALE 1:100



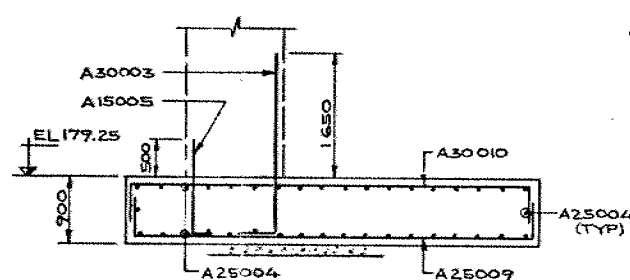
FOOTING NORTH ABUTMENT  
SCALE 1:100



SECTION 1  
SCALE 1:50



SECTION 2  
SCALE 1:50



SECTION 3  
SCALE 1:50

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN			LOADING ON BOX-CULVERTS
DRAWING			SITE 10-82-327 DWG 3



Ministry of  
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# foundation investigation and design report

ENGINEERING MATERIALS OFFICE  
PAVEMENT & FOUNDATION DESIGN SECTION

*CONT 84-78*

WP 197-77-05

DIST 4

HWY 403 & 407

STR SITE 10-82-327

Ninth Line Underpass, Hwy. #403 & 407  
Interchange Complex

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R. Fitzgibbon (Cover Only)

T.J. Kovich (Cover Only)

Files

# FOUNDATION INVESTIGATION REPORT

For

Ninth Line Underpass

Hwy. #403 & 407 Interchange Complex

W.P. 197-77-05; Site 10-82-327

District 4, Hamilton

BH No 12

ADDED 83/006

## INTRODUCTION:

This report contains the results of the foundation investigation carried out at the aforementioned site on 82 11 08. The fieldwork consisted of two sampled boreholes and one dynamic cone penetration tests adjacent to each boring. The borings were advanced by continuous flight auger machines mounted on muskeg vehicles and equipped with solid stem augers.

## SITE DESCRIPTION

The site is located in the vicinity of the existing Ninth Line Road, some 1.0 km north of Burnhamthorpe Rd. in the town of Milton, and town of Oakville. The surrounding terrain is relatively flat. Physiographically the site is located in the region referred to as the Peel Plain. The deposits in the vicinity of the area under investigation are composed of cohesive glacial till and granular deposits. The overburden is underlain by shale bedrock.

## SUBSURFACE CONDITIONS

### General

The subsoil at this location was found to consists of cohesive type glacial till, followed by sandy silt to silty sand deposit, followed by shale bedrock. The boundaries of the different strata, together with the obtained field and laboratory test results are shown on the Record of Borehole sheets contained in the Appendix of this report. A stratigraphical profile is shown on Drawing No. 1977705-A. A description of the different strata encountered is given below.

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

Immediately below a thin layer of topsoil a till-like zone was encountered at every boring location. The thickness varies from 13.7 m. to 14.5 m. The material in the deposit was found to consist of a heterogeneous mixture of silty clay, sand and gravel. The matrix of this till is basically cohesive in nature - i.e., silty clay binding coarser particles. Standard Penetration Tests carried out within the deposit gave 'N' values to range from 18 to over 100 blows per 30 cm.

Physical properties of the material as determined from laboratory tests are summarized as follows:

	<u>Range</u>
Natural Moisture Content (%)	7-14
Liquid Limit (%)	20-27
Plastic Limit (%)	12-17

The results of the grain-size distribution tests are shown in an envelope form on Figure #1 of the Appendix.

The consistency of the overall deposit varies from very stiff to hard.

### Sandy Silt to Silty Sand, Traces of Gravel & Clay

This stratum was encountered in each boring below the above described glacial till. The thickness varied from 5.3 m to 6.1 m at the boring locations. The material in the deposit consists of sands and silts with varying proportions, with traces of gravel and clay. Occasional layers of silty clay were also intercepted in the lower part of the deposit.

Standard Penetration Tests, carried out within the deposit, gave 'N' values to range from 13 to over 100 blows per 30 cm. Based on this value, the overall deposit may be classified as being compact to very dense. The natural moisture content ranges from 12 to 13%. The results of the grain-size analyses performed on two samples are as follows: Gravel: 3-13%, Sand: 41-48%, Silt: 34-48% and Clay: 5-8%.

Shale Bedrock

Shale-type bedrock was encountered below the sandy silt to silty sand deposits, at EL. 162.9 and at EL. 162.4. The shale is badly weathered. No core samples were obtained.

Groundwater Conditions

The groundwater levels were observed to be at ground surface during the field investigation.



## DISCUSSION AND RECOMMENDATIONS

### General

It is proposed to construct a single span (68 m in length) over the future Hwy. #403. The profile grade of Ninth Line is set at EL. 185.8 (north end) and EL. 184.4 (south end). The bottom of Hwy. #403 median ditch will be at EL 176±. The level of the natural ground surface varies between EL. 182± and EL. 182.6±. In order to realize the proposed grades, up to 6 m deep cuts and up to 3 m high fills will be required.

### Structure Foundations

The following foundation alternatives are recommended:

#### 1.) Spread Footings within Original Ground

The abutments may be supported on spread footing type foundations at or below EL. 180. The frost protection criteria is 1.4 m of earth cover in this area. An allowable bearing value of up to 300 kPa can be used in design.

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

Factored Bearing Capacity at U.L.S. = 450 kPa

Bearing Capacity at S.L.S. Type II = 300 kPa

Earth pressures should be computed as per subsection 6.6.1.2.2 of the code. For the granular backfill a non-yielding foundation condition should be assumed, in which case a value of  $K_0 = 0.43$  is recommended. The base of the footing excavations should be protected by 15 cm of mass concrete within 8 hours of exposure. Settlements of the foundation subsoil, due to the surcharge loading of the footings will be negligible (Approx. 25 mm) in magnitude.

No dewatering problems are anticipated due to the relatively impervious nature of the subsoil.

## 2.) Perched Abutments on Short Piles

As an alternative, footings may be constructed within the original subsoil or within the approach fills and supported on short piles driven to a minimum elevation 172±. In the case of steel 'H' piles (310 HP 79), design loads up to 890 KN may be assumed. The piles should be driven in accordance with SS103-10 or SS103-11. The driving energy should not be less than 50 kJ.

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

Factored Capacity at U.L.S. = 1160 KN

Capacity at S.L.S. Type II = 890 KN

The pile caps should have a minimum of 1.4 m earth cover for frost protection purposes.

## Approach Embankments

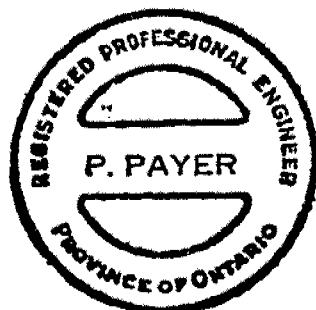
Fills up to 3 m will be required at this location adjacent to the proposed structure. No stability problems are anticipated for the approaches of this height constructed with 2:1 slopes. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles may have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 75 mm. It is estimated that the total settlement caused by the embankment loading will be in the order of 25 mm or less.

## Cut Sections

Cuts up to 6 m in depth will also be required. The groundwater level was found to be at the ground surface. It is assumed that the slopes will drain in time as the excavation is carried downward. Possible softening of the bottom of the slope, due to seepage, should be prevented by providing adequate drainage and/or filter blankets. The final slopes should not be steeper than 2:1.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. J. Hayward, Student Field Technician. The equipment used was owned and operated by Master Soil Investigation Ltd. This report was written by Mr. P. Payer, and reviewed by Mr. K. G. Selby.



*P. Payer*  
P. Payer, P. Eng.  
Foundations Engineer

*K. G. Selby*  
K. G. Selby, P. Eng.  
Senior Foundations Engineer

## APPENDIX

# RECORD OF BOREHOLE No 10

METRIC

W P 197-77-05 LOCATION Co-ords. N 4 820 518.2; E 286 466.6 ORIGINATED BY JH  
DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Auger (S.A.) & Cone COMPILED BY JB  
DATUM Geodetic DATE 82 11 08 CHECKED BY JB

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	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					
182.2	Ground Surface						182							
0.0	Heterogeneous Mixture of Silty Clay, Sand & Gravel (Glacial Till) Very Stiff to Hard		1	SS	40		180							8 22 51 19
			2	SS	78		178							6 31 44 19
			3	SS	45		178							7 31 42 20
			4	SS	18		176							3 31 45 21
			5	SS	42		174							6 38 43 13
			6	SS	41		172							
			7	SS	33		170							6 31 45 18
			8	SS	23		168							
			9	SS	67	23 cm	166							
			10	SS	60	5 cm	164							3 41 48 8
			11	SS	68		162							
			12	SS	90	25 cm	160							
168.5							168							
13.7	Sandy Silt to Silty Sand, Traces of Gravel & Clay Compact to Very Dense		13	SS	13		166							
			14	SS	60	8 cm	164							
162.4							162							
19.8	Weathered Red Shale		15	SS	110	5 cm	160							
			16	SS	100	10 cm	158							
157.7														
24.5	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 11

METRIC

W P 197-77-05 LOCATION Co-ords. N 4 820 560.3; E 286 415.4 ORIGINATED BY JR  
DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Auger (S.A.) & Cone COMPILED BY JR  
DATUM Geodetic DATE 82 11 08 CHECKED BY JR

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	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
182.7	Ground Surface															
0.0	Heterogeneous Mixture of Silty Clay, Sand & Gravel (Glacial Till) Very Stiff to Hard	1	SS	37		182										
		2	SS	88		180										
		3	SS	79		178										
		4	SS	47		176										
		5	SS	29		174										
		6	SS	24		172										
		7	SS	28		170										
		8	SS	28		168										
		9	SS	40	23 cm	166										
		10	SS	60	10 cm	164										
		11	SS	50	8 cm	162										
		12	SS	70	15 cm											
168.2	Sandy Silt to Silty Sand, Some Gravel, Trace Clay Very Dense	13	SS	60												
14.5		14	SS	30	3 cm											
162.9	Weathered Red Shale	15	SS	100	8 cm											
19.8																
161.3	End of Borehole															
21.4																

OFFICE REPORT ON SOIL EXPLORATION



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# RECORD OF BOREHOLE No 12

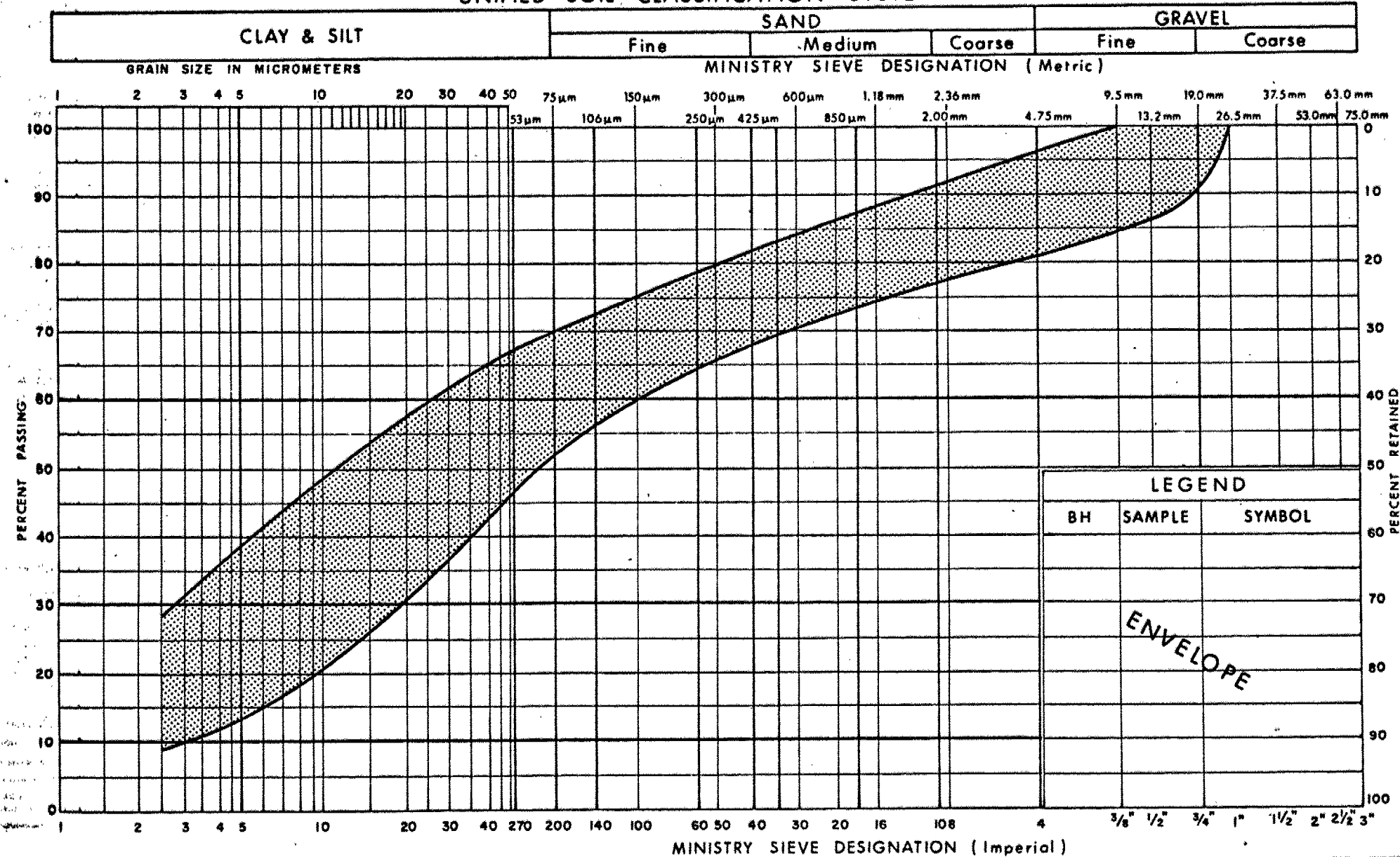
METRIC

W P 197-77-05 LOCATION Co-ords. N 4 820 539.2; E 286 441.2 ORIGINATED BY SO  
DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Auger COMPILED BY SO  
DATUM Geodetic DATE 83 02 16 CHECKED BY SO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>		
182.1	Ground Level						182		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
0.0			1	SS	55									
			2	SS	68									
			3	SS	98		180							
			4	SS	106									
			5	SS	93		178							
			6	SS	74									
			7	SS	77									
			8	SS	44		176							
			9	SS	32									
			10	SS	46		174							
			11	SS	81									
172.9			12	SS	120	10 cm								
9.2														

T ON SOIL EXPLORATION

## UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION  
HET MIXTURE OF  
SILTY CLAY SAND & GRAVEL  
(GLACIAL TILL)

FIG No 1

W P 197-77-05



# 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 (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
$\sigma_u$	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
$\tau_f$	kPa	REMOULDED SHEAR STRENGTH
$S_f$	1	SENSITIVITY = $\frac{c_u}{\tau_f}$

### 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	j	kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kn/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

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

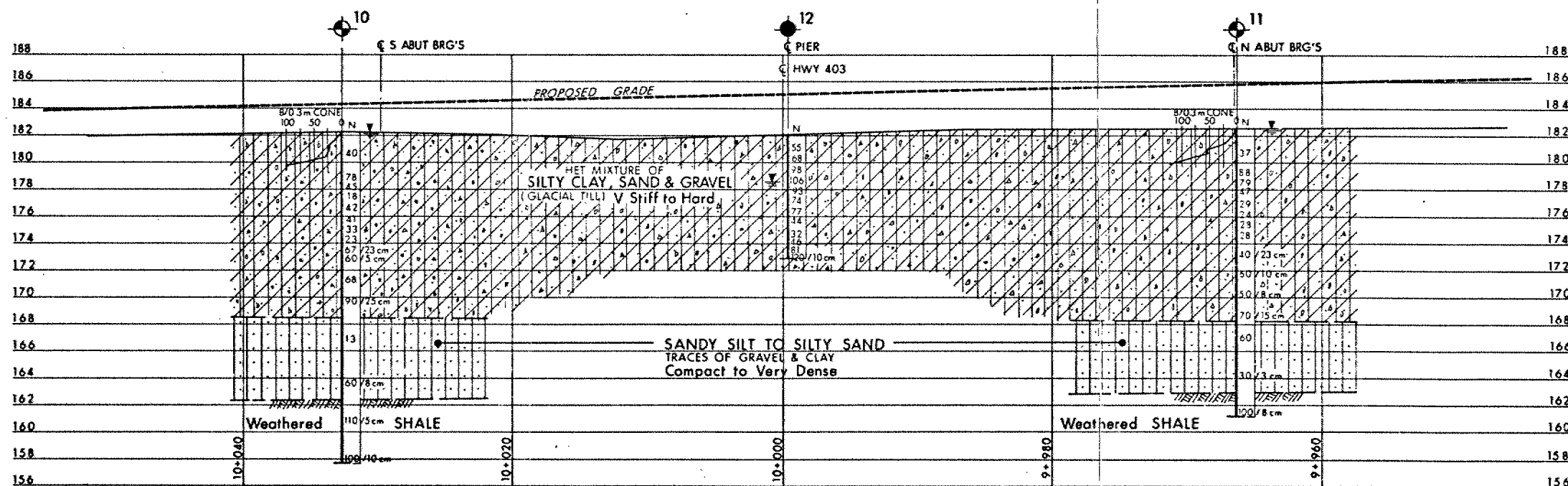
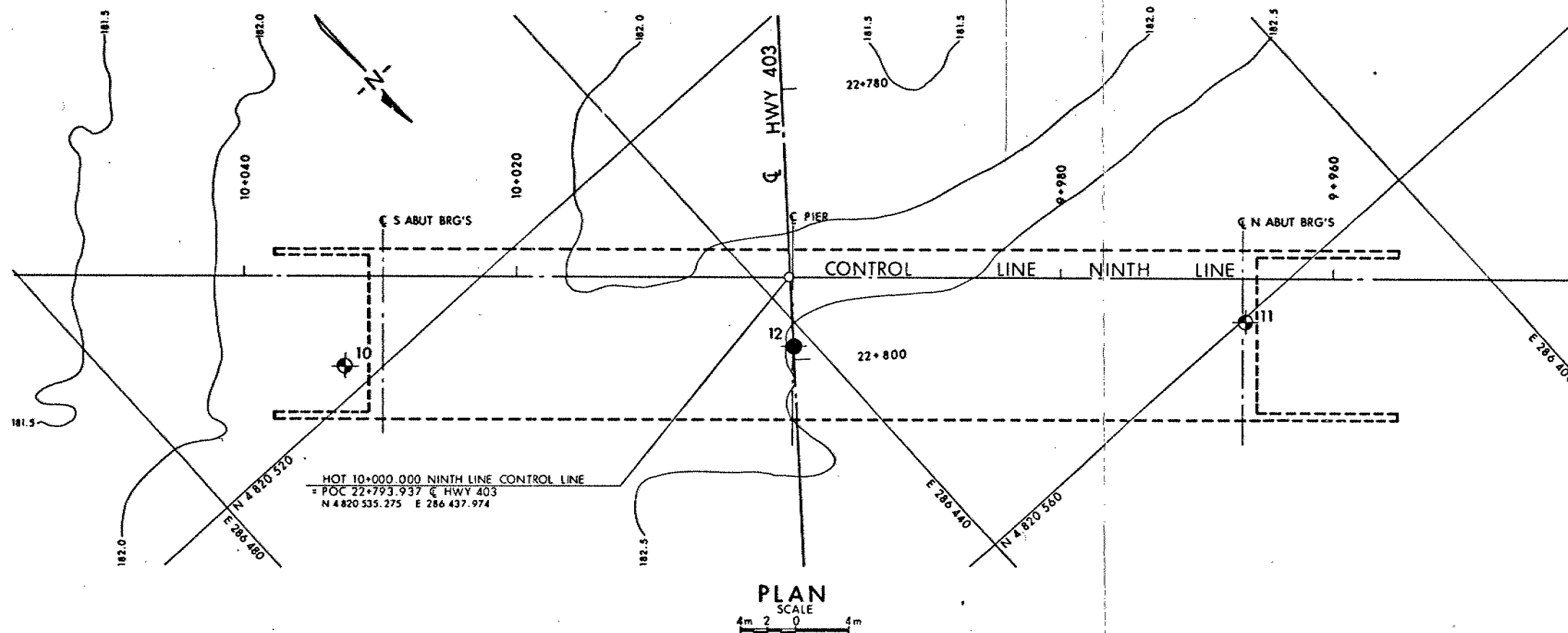
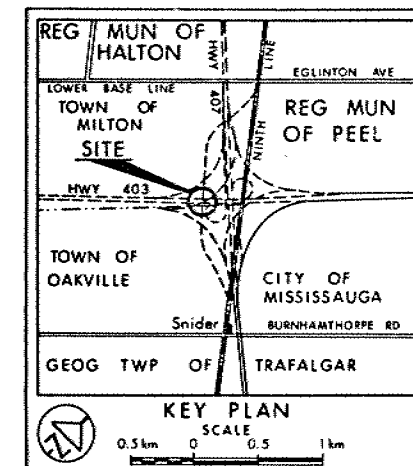
CONT No  
WP No 197-77-05

NINTH LINE

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)
- W/L at time of investigation 82 11 & 83 02

No	ELEVATION	CO ORDINATES	
		NORTH	EAST
10	182.2	4820518.2	286466.6
11	182.7	4820560.3	286415.4
12	182.1	4820539.2	286441.2

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.

83 10	SO	BORE HOLE 12 ADDED	
DATE	BY	DESCRIPTION	
Geocres No 30M12-173			
HWY No 403			DIST 4
SLURRY PP	CHECKED	DATE 82 12 21	SITE 10-82-327
DRAWN SO	CHECKED	DATE	DWG 2

# memorandum



To: W.L. Lin  
Design Engineer  
Structural Office  
3501 Dufferin Street

Date: 1983 10 12

From: Foundation Design Section  
Room 315, Central Building

Re: Ninth Line Overpass  
Highway 403/407 Interchange  
W.P. 197-77-05; Site 10-82-327  
District #4 (Hamilton)

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We have reviewed the final bridge drawings (Dwg. #1, and #3)  
for the above mentioned project, and have no comments.

A handwritten signature in cursive script, appearing to read "K.G. Selby".

K.G. Selby, P. Eng.  
Sr. Foundations Engineer

KGS/mmj