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GEOCRES No. 40P1-78

DIST. 4 REGION

W.P. No. 66-67-06

CONT. No. 90-95

W. O. No.

STR. SITE No. 1-193

HWY. No. 403

LOCATION Johnson Rd. Underpass

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



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## **FOUNDATION DESIGN SECTION**

**foundation  
investigation and  
design report**

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

WP 66-67-06 DIST 4  
HWY 403 STR SITE 1-193

Johnson Road Underpass

*CONT 90-95*

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# FOUNDATION INVESTIGATION REPORT

for

Johnson Road Underpass

W.P. 66-67-06, Site 1-193

Hwy. 403, District 4 (Burlington)

## INTRODUCTION

This report contains the results of a foundation investigation carried out for the proposed structure at the junction of the existing Johnson Road and New Hwy. 403, during the periods of 76 03 05-11 and 79 07 23-24. The fieldwork consisted of three sampled boreholes and two dynamic cone penetration tests. The borings were advanced by employing continuous flight auger machines, mounted either on a muskeg vehicle or on an allterrain vehicle and equipped with 82 mm I.D. hollow stem augers. This report supersedes the original foundation report issued in December 1979.

## SITE DESCRIPTION

The structure site is located at the future junction of the existing Johnson Road and proposed New Hwy. 403, in the Township of Brantford.

The surrounding terrain is relatively flat, cultivated agricultural land.

## SUBSURFACE CONDITIONS

### General

Generally uniform subsoil conditions were found to exist across the site. The subsoil (apart from the existing roadway material) consists of a deep deposit (24 - 26 m) of stratified silty clay with trace of sand followed by dolomite type bedrock.

The boundary between the overburden and bedrock, together with the obtained field and laboratory tests results are shown on the Record of Borehole Sheets contained in the Appendix. The stratigraphical profile shown on Drawing No. 666706-A is based on this information. The drawing also shows the locations and elevations of the borings. A detailed description of the encountered subsurface conditions is given below.

### Silty Clay Trace of Sand

This stratum was intersected in all borings and extends from immediately below the ground surface to the bedrock for a depth about 24 - 26 m. The material in the deposit is stratified and classified as silty clay with trace of sand. The stratification is rather random and ranges in thickness from 5 mm to about 100 mm. The plasticity of the individual layers varies from low to high. Occasional silt seams were also observed throughout the stratum. The Atterberg Limit test results for the overall deposit are plotted on the

plasticity chart (Figure 1). The consistency of the stratum varies randomly from firm to very stiff. This assessment is based on a number of field vane and laboratory unconfined and quick triaxial tests, the results of which as plotted on Figure 2 and summarized below, together with other physical properties determined from field and laboratory tests.

	<u>Range</u>
Natural Moisture Content (W)	14 - 47%
Liquid Limit ( $W_L$ )	15 - 66%
Plastic Limit ( $W_P$ )	12 - 25%
Undrained Shear Strength ( $c_u$ )	
Unconfined	45 - 95 kPa
Quick Triaxial	45 - 58 kPa
Field Vane	55 - over 100 kPa
Unit Weight ( $\gamma$ )	18.4 - 22.9 kN/m <sup>3</sup>
Sensitivity (Based on field vane tests)	2 - 5

Grain size distribution curves are presented in an envelope form on Figure 3 of the Appendix.

Two consolidation tests were performed on samples obtained from this stratum. The test results are plotted on the void ratio versus pressure curves (Figure 4) in the Appendix. The tests indicate that the soil is overconsolidated with a preconsolidation pressure ranging from 550 to 620 kPa.

For design purposes in terms of total stresses an average undrained shear strength value of 65 kPa is recommended.

#### Bedrock

Bedrock was found at depths about 24 - 26 m below ground level (elevation 185 - 186) which consists of moderately fractured, hard, light grey to white dolomite.

#### Groundwater Conditions

The following groundwater levels were observed the boring locations:

B.H. #1 - Elevation 208.8

B.H. #2 - Elevation 209.1

B.H. #3 - Elevation 207.5

It is pointed out that the subsoil is relatively impermeable therefore, a considerable time is required for the water levels to stabilize.

For design and construction purposes, it should be assumed that the groundwater level at this site is probably at elevation 208.5±. Seasonal changes may also influence the groundwater level.

## DISCUSSION AND RECOMMENDATIONS

### General

It is proposed to construct a two span (25.5 m - 25.5 m) structure at the junction of future New Hwy. 403 and the existing Johnson Road. As per the present proposals, the profile grade of Hwy. 403 will be located at elevation 208.6 (H.O.T. 12 + 498.839 @ median of Hwy. 403) with a gradient of 1.13% increase from east to west. The profile grade of Johnson Road will be at elevation 214.8 (H.O.T. 10 + 000.000 @ Johnson Road). The average original ground level is at approx. elevation 211 +. The subsoil at this site was found to consist of a 24 - 26 m deep, firm to very stiff, stratified silty clay and followed by dolomite type bedrock.

### Structure Foundation

The encountered subsurface conditions (relatively low bearing capacity value and settlement considerations) do not favour spread footing type foundations. Therefore, piled foundations are recommended. End-bearing steel 'H' piles driven to bedrock (elevation 185 - 186 ±) appear to be the most practical solution.

The pile tips should be reinforced with pile driving shoes. The maximum allowable load for the particular section may be assumed for design purposes: 1150 kN (HP 310 x 110) and 900 kN (HP 310 X 79).



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

	<u>HP 310 X 110</u>	<u>HP 310 X 79</u>
Factored Capacity at U.L.S. =	1600	1150
Capacity at S.L.S. Type II =	1150	900

Earth pressures should be computed (assuming 'active' condition) as per subsection 6.6.1.2.2 of the code.

The granular 'A' or 'B' backfill should be in accordance with Special Provision No. 109F03 (latest revision). The following parameters are recommended for the granular backfill:

	<u>Granular 'A'</u>	<u>Granular 'B'</u>
Angle of Internal Friction =	$\phi = 35^\circ$	$\phi = 30^\circ$
Unit Weight ( $\text{kN/m}^3$ ) =	$\gamma = 22.8$	$\gamma = 21.2$

#### Approach Embankments

To accommodate the proposed profile grades of New Hwy. 403 and Johnson Road, up to 2.4 m deep cuts and up to 3.8 m high fills will be required respectively. No stability problems are anticipated for the approaches (cuts and fill) of this magnitude, constructed with 2:1 forward and side 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 have to be driven, and it is recommended that this portion of the fill

contain no larger grain sizes than 75 mm. Settlement of the silty clay subsoil induced by the construction of approach fills is estimated to be in the range of 75 - 100 mm and will take place over a long term period. In order to minimize the effect of these settlements on the performance of the pavement, it is recommended that the approach embankments be built in advance of the final grading and paving for as long a period as possible.

#### Other Considerations

The pile caps should be located not less than 1.2 m below finished ground level so as to provide for frost protection.

No major dewatering problems are anticipated due to the relatively impermeable nature of the subsoil. Topsoil and/or any soft surficial material should be removed in accordance with current M.T.O. practices.

The future abutments in part, will be located over the existing roadway. To avoid damages to the piles during driving, it is recommended that the entire roadbed (pavement and base coarse) be excavated to its full vertical and horizontal extent.

A suitable drainage system should be provided to relieve the build-up of excess hydrostatic pressure behind the abutment walls.

To provide a smooth transition between the structure and the approaches which will undergo settling for a long period of time, it is recommended that the structure be designed with approach slabs.

The exposed cut and fill slopes should be protected against erosion according to M.T.O. standards.

#### MISCELLANEOUS

The fieldwork for this project was supervised by Mr. R. Van Veen, Project Engineer and Mr. P.R. Korpel, Trainee Engineer. The equipment used, was owned and operated by Atcost Soil Drilling Inc., and Dominion Soil Investigation Ltd. The original report was written by Mr. P. Payer, Foundations Engineer and reviewed by Mr. K.G. Selby, Senior Foundation Engineer.

In order to comply with the Ontario Highway Bridge Design Code and with some minor changes, Mr. P. Payer prepared the updated version of the original Foundation Investigation and Design Report.



*P. Payer*  
P. Payer, P. Eng.  
Senior Foundation Engineer

*M. Devata*  
M. Devata, P. Eng.  
Chief Foundation Engineer

## **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 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:

R Q D (%)	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
$u$	l	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
$\mu$	l	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	l	COMPRESSION INDEX
$C_s$	l	SWELLING INDEX
$C_\alpha$	l	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	l	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
$S_t$	l	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	l, %	VOID RATIO	$e_{min}$	l, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kn/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	l, %	POROSITY	$I_D$	l	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	l, %	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	$C_u$	l	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	$I_L$	l	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	l	HYDRAULIC GRADIENT
$\gamma_{sat}$	kn/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	l	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	l, %	VOID RATIO IN LOOSEST STATE	j	kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kn/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1										METRIC	
W P 66-67-06		Co-ords. LOCATION N 4 780 951.0; E 248 672.0				ORIGINATED BY PRK					
DIST 4 HWY 403		BOREHOLE TYPE Hollow Stem Auger and Cone Test				COMPILED BY PRK					
DATUM Geodetic		DATE 1979 07 23				CHECKED BY <i>GP</i>					
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE							'N' VALUES
210.6	Ground Level										
0.0	Silty clay Stratified		1	SS	14						
	Trace of sand		2	SS	11						
			3	SS	10						
			4	SS	20						
	Brown Grey		5	SS	21						
			6	SS	6						
	Occasional layers and seams of silt		7	SS	8						
			8	TW	PH						
	Firm to stiff		9	SS	11						
			10	SS	5						
			11	TW	PH						
197.9			12	SS	11						
12.4	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 2

METRIC

W P 66-67-06 LOCATION Co-ords. N 4 780 898.8; E 248 671.5 ORIGINATED BY PRK  
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger and BXL Rock Core COMPILED BY PRK  
 DATUM Geodetic DATE 1979 07 24 CHECKED BY JP

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
210.8	Ground Level																
0.0	Silty clay Stratified		1	SS	12		210										
	Trace of sand		2	SS	7												0 0 65 35
			3	SS	7		208										0 0 95 5
			4	TW	PH												
			5	SS	8		206										
			6	SS	6												
			7	TW	PH		204									20.1	0 0 68 32
	Occasional layers and seams of silt		8	SS	5		202									19.6	0 0 55 45
			9	TW	PH		200										
			10	SS	6		198									19.8	
	Stiff to very stiff		11	TW	PH		196										
			12	SS	21		194										
			13	TW	PH		192										
			14	TW	PH		190										
			15	SS	50		188										
186.4	Dolomite bedrock Moderately fractured		16	RC BXL	90% REC		186										
184.6																	
26.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 3 (Formerly B.H.#2 METRIC

W.P.66-67-01)

W P 66-67-06 LOCATION Co-ords. N 4780 933.2; E 248 671.6 ORIGINATED BY BVV  
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger, BX Core and Cone Test COMPILED BY PRK  
 DATUM Geodetic DATE 1976 03 05 - 11 CHECKED BY PRK

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100	W <sub>p</sub>	W	W <sub>L</sub>		
211.1	Ground Level													
0.0	Silty clay Stratified		1	SS	19		210							0 6 62 32
			2	SS	14									
			3	SS	11									
			4	SS	17		208							0 0 88 12
			5	SS	8									0 0 74 26
			6	TW	PH		206						19.0	0 2 (98)
			7	SS	8									
			8	TW	PH		204							0 0 66 34
			9	TW	PH		202							
			10	SS	8		200							
			11	TW	PH		198						18.8	
			12	SS	16		196							
			13	TW	PH		194						18.4	
			14	TW	PH		192							
			15	TW	PH		190							
			16	SS	25		188						22.9	
			17	RC	REC		186							2 0 66 32
185.0							184							
26.1	Dolomite bedrock Moderately fractured													
183.5														
27.6	End of Borehole													

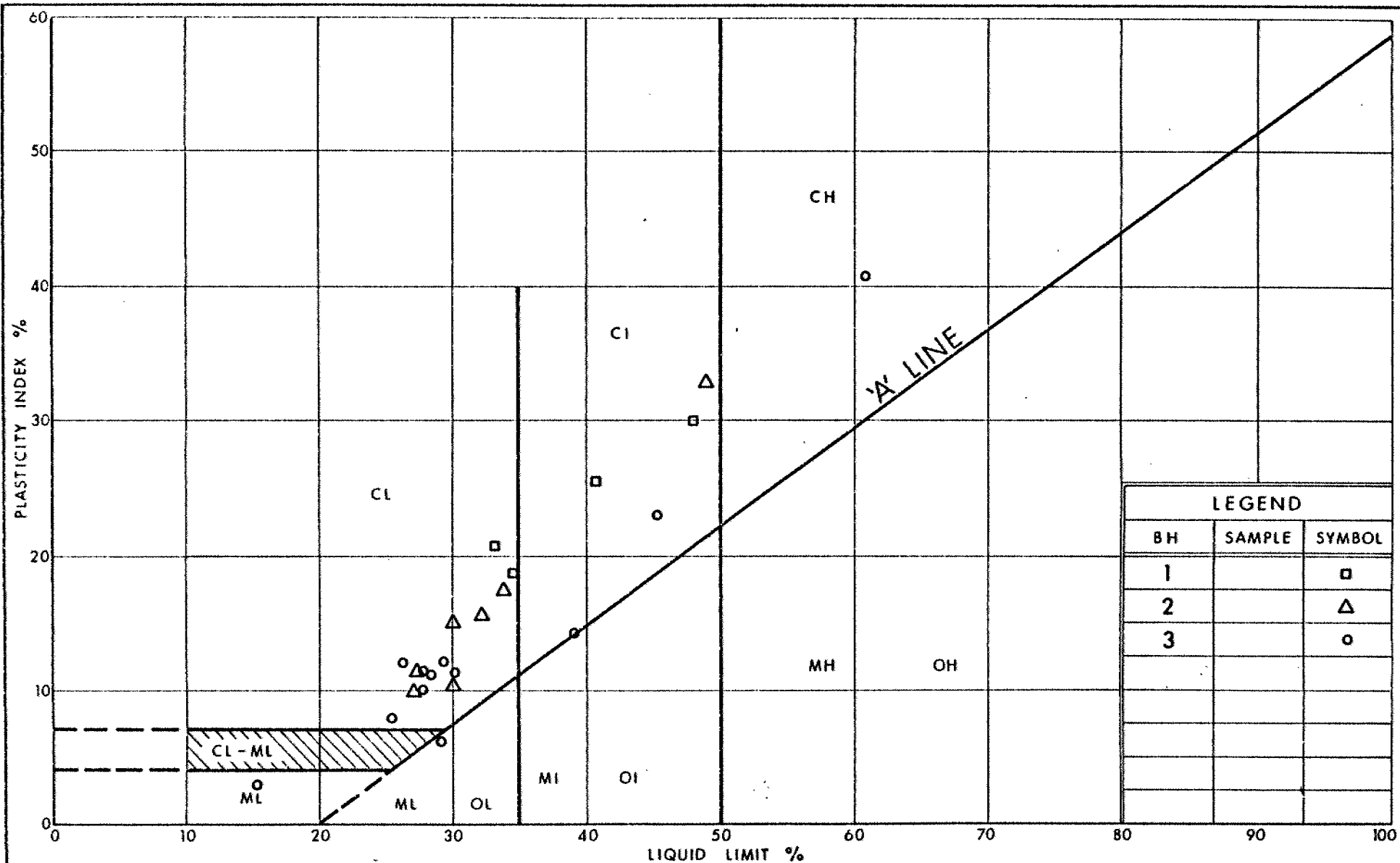
OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE





Ontario

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Transportation

PLASTICITY CHART  
 SILTY CLAY STRATIFIED, TRACE OF SAND  
 OCC LAYERS AND SEAMS OF SILT

FIG No 1

W P 66-67-06

# SHEAR STRENGTH Vs ELEVATION

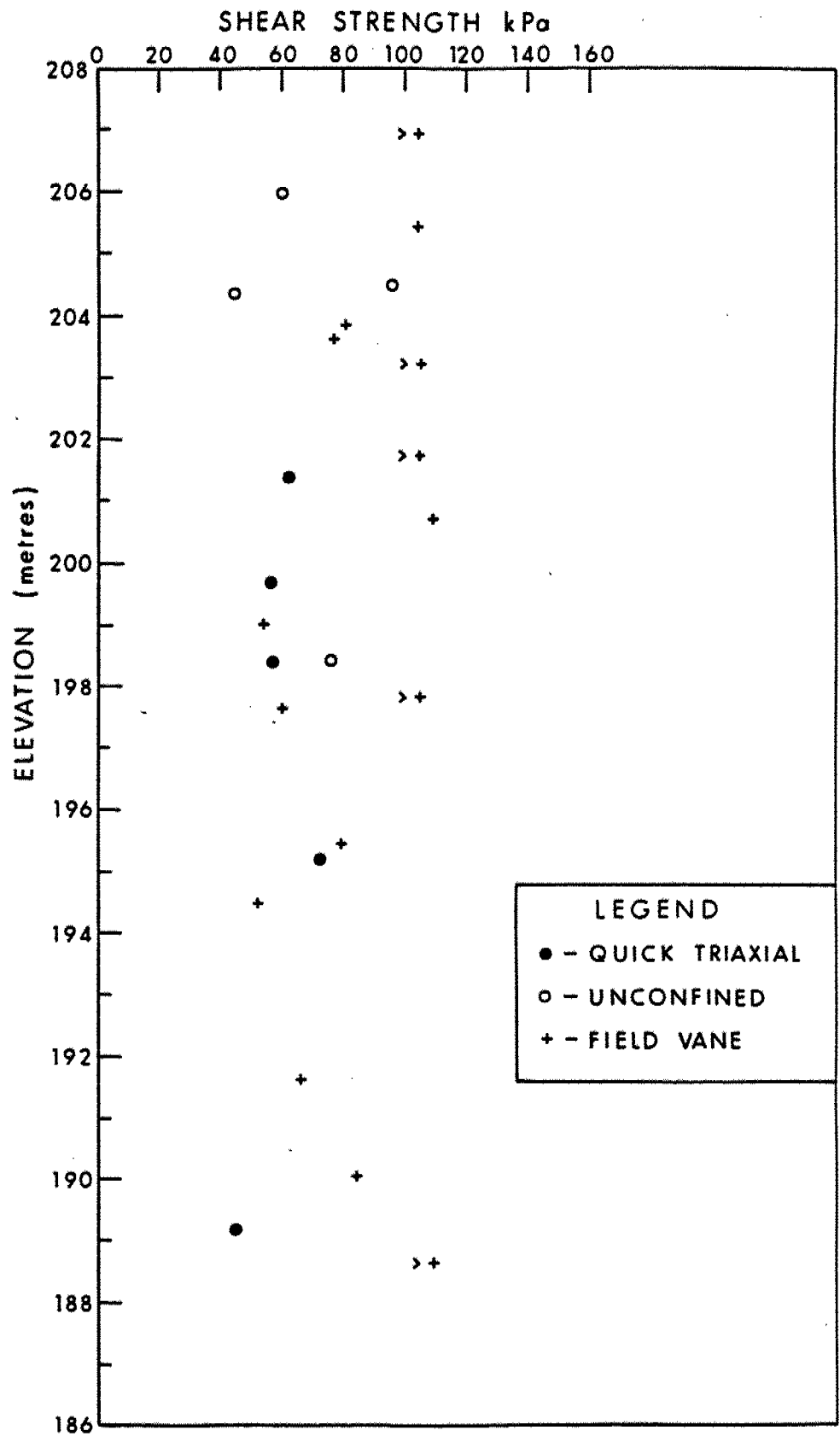


Fig 2

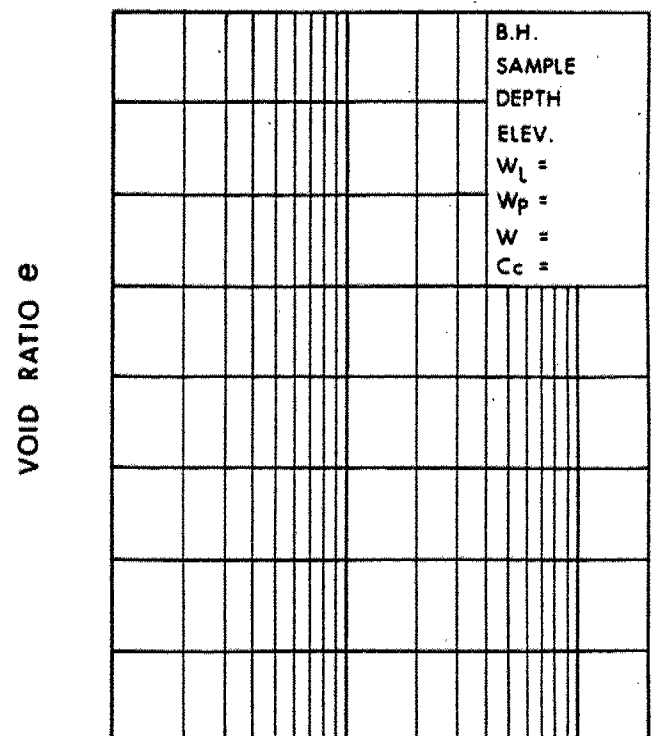
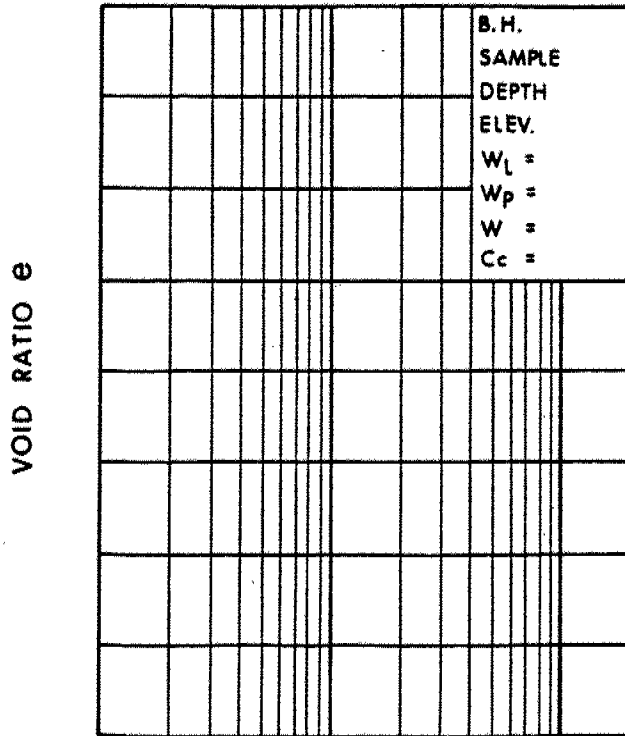
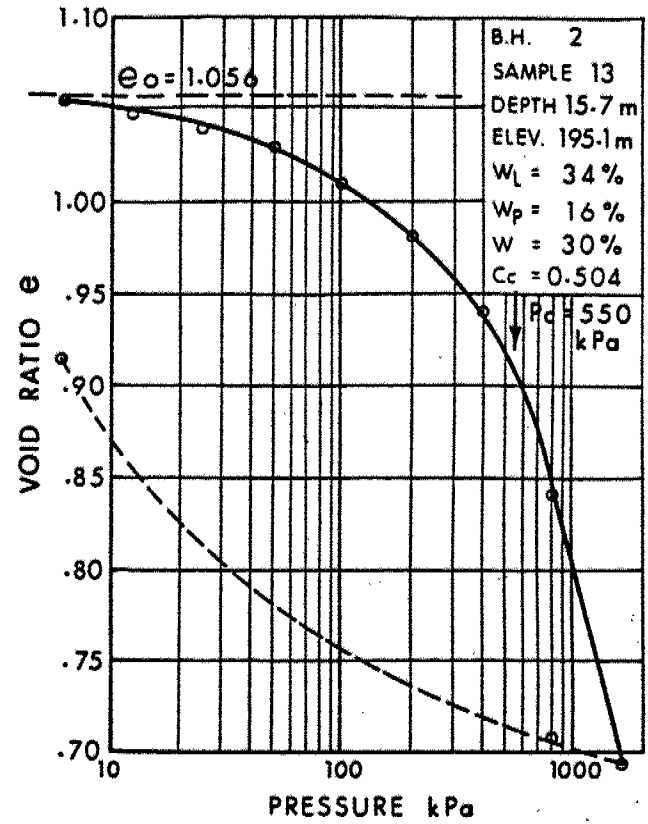
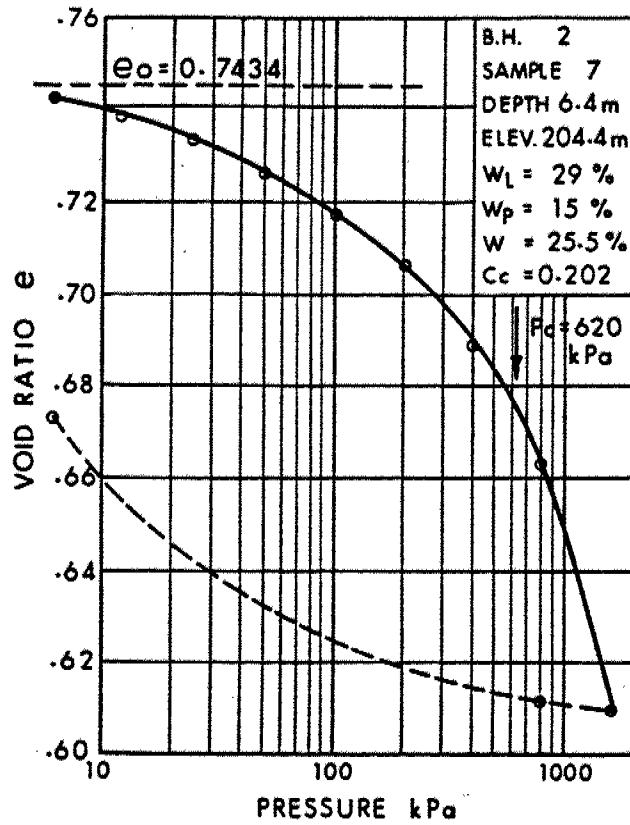
WP 66-67-06

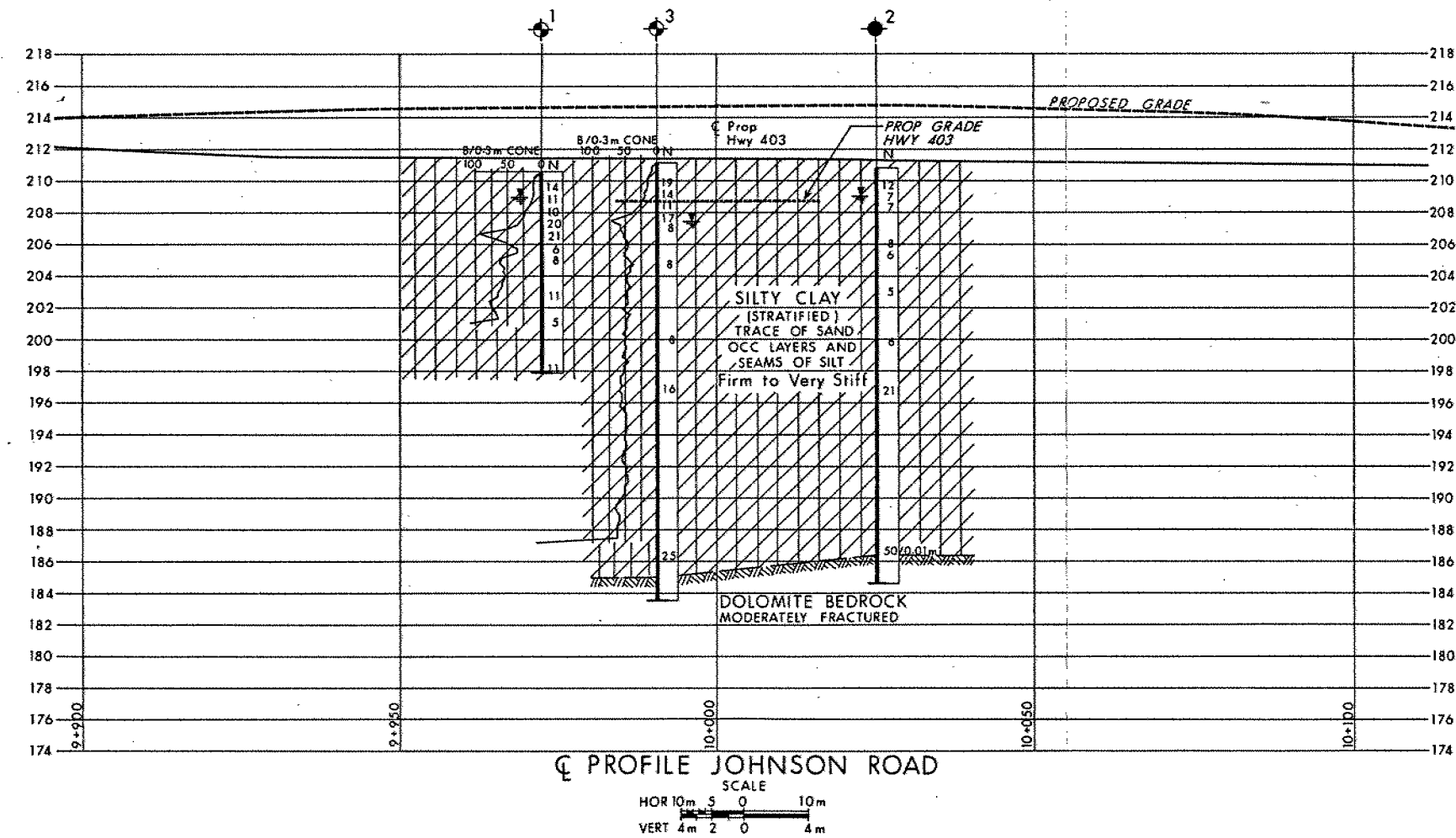
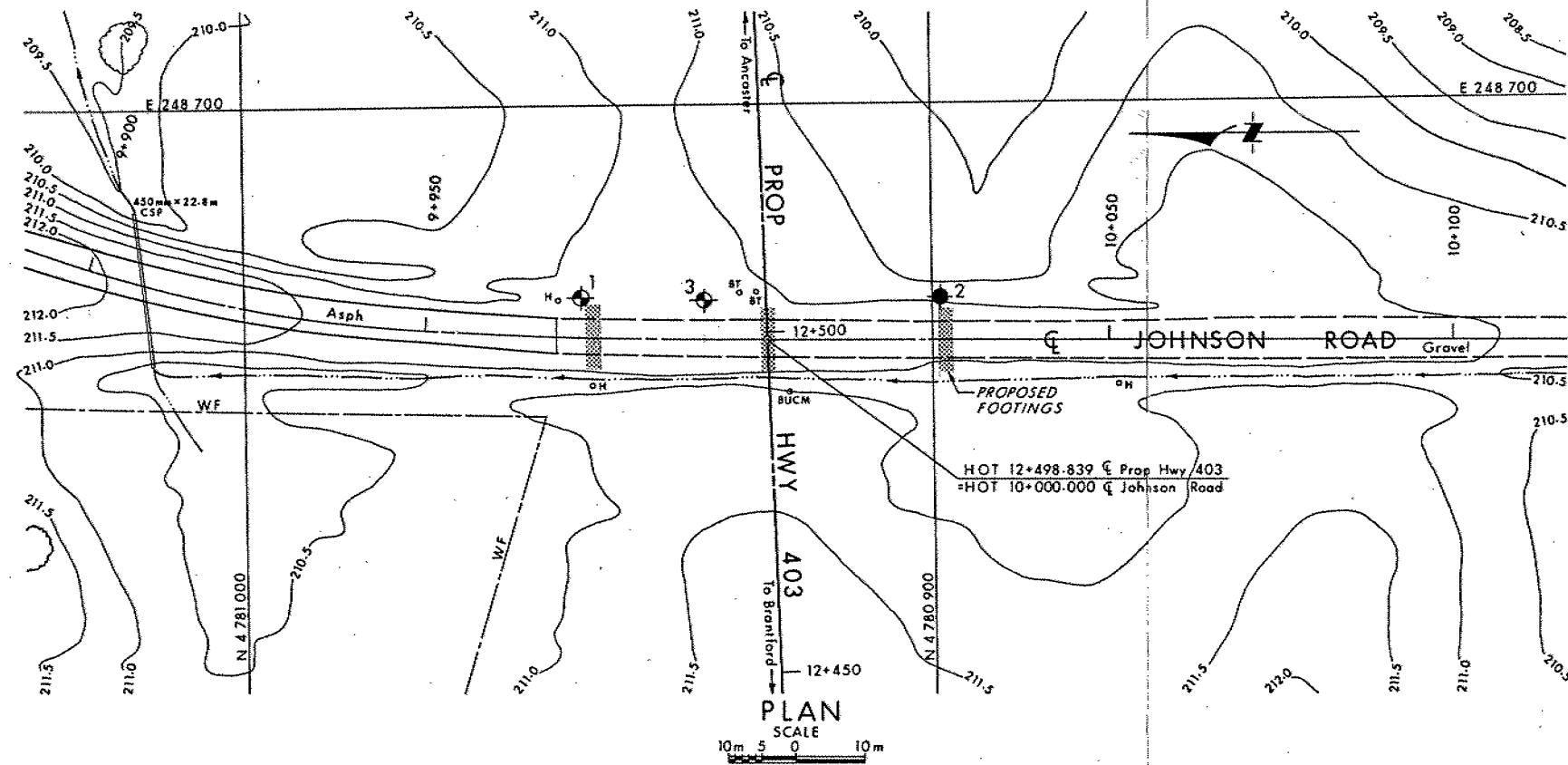


W P 66-67-06

Ministry of  
Transportation

# VOID RATIO - PRESSURE CURVES





**METRIC**

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

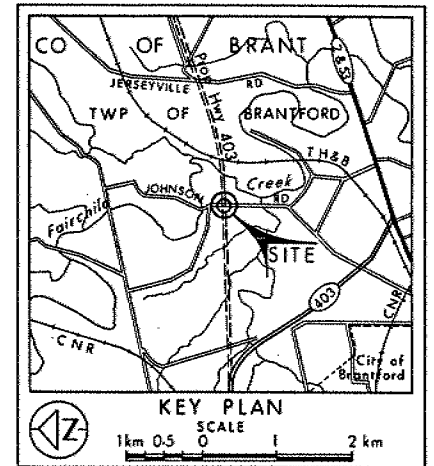
CONT No  
WP No 66-67-06

JOHNSON ROAD UNDERPASS

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	WL at time of investigation 1979 07		
W	WL for BH#3 1976 03		

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	210.6	4 780 951.0	248 672.0
2	210.8	4 780 898.8	248 671.5
3	211.1	4 780 933.2	248 671.6

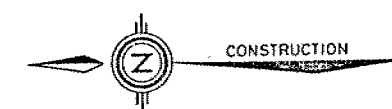
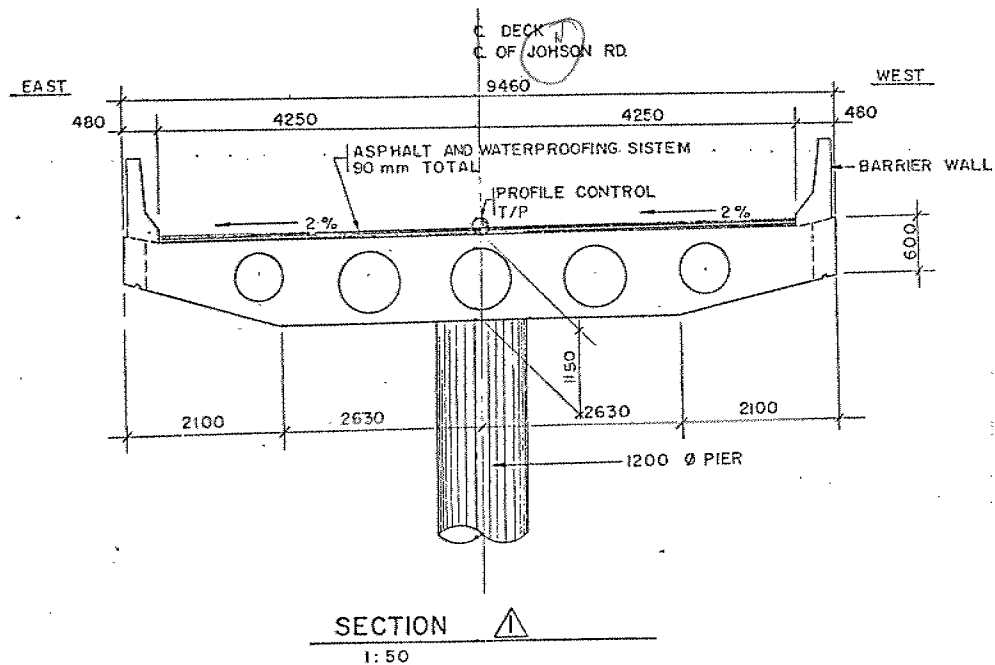
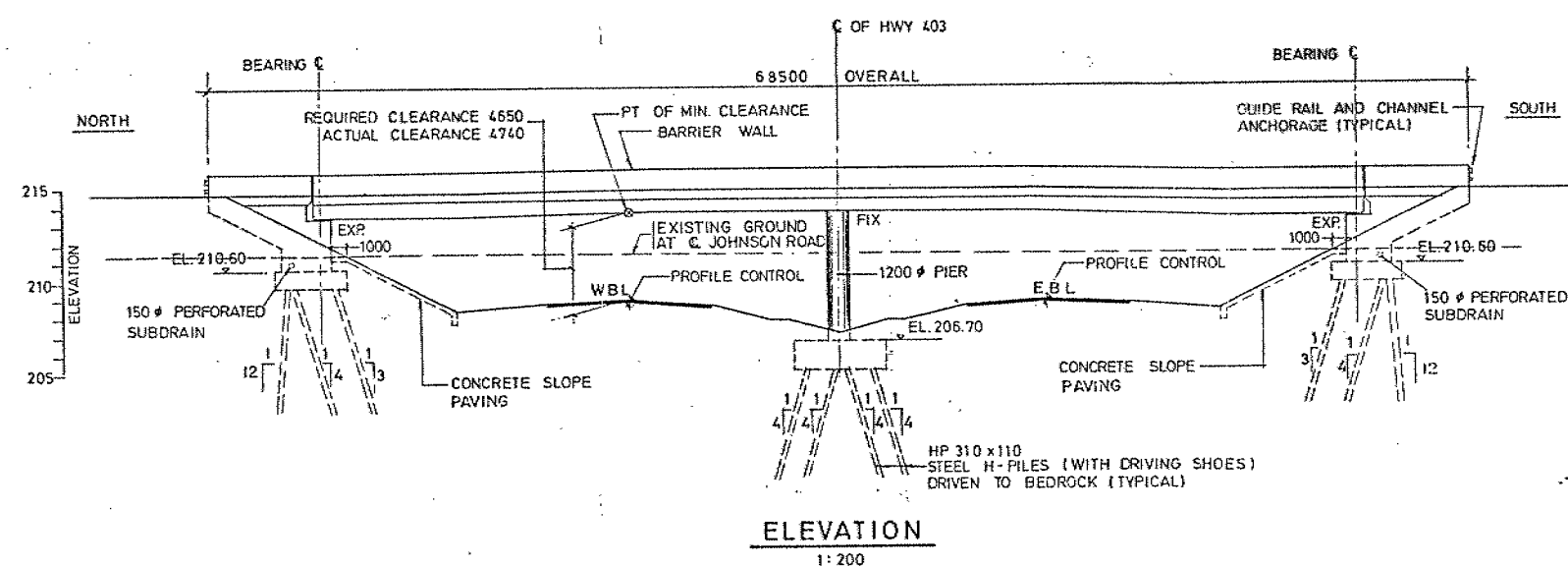
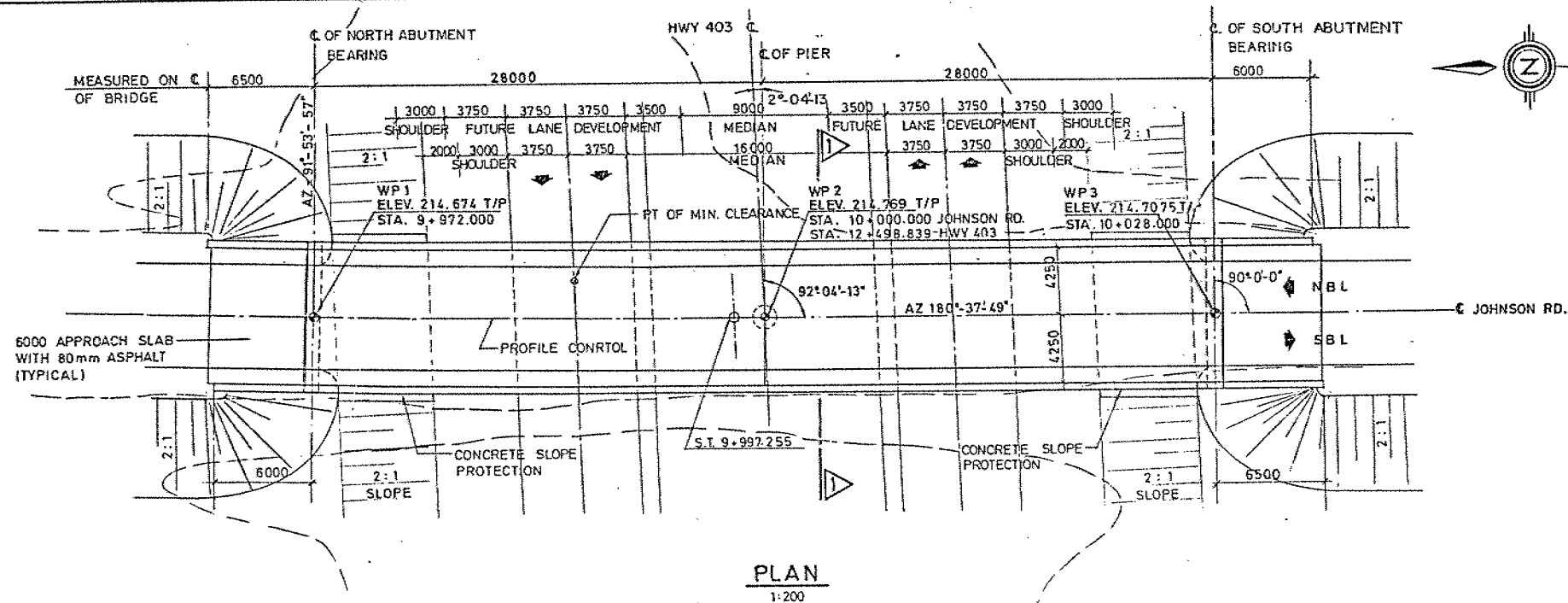
NOTE  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



REVISIONS	DATE	BY	DESCRIPTION
1	89 06 30	DT	PROPOSED GRADES REVISED

Geocres No 40P1-78	
HWY No Prop 403	DIST 4
SUBM'D PP	CHECKED DATE 1979 12 14 SITE 1-193
DRAWN	CHECKED APPROVED DWG 666706-A

REFER MCCORMICK RANKIN CONSULTING ENG  
DWG No 1012-9321; 1979 06



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

DISTRICT No. 4  
CONT No  
WP No 66-67-06



JOHNSON ROAD UNDERPASS  
GENERAL ARRANGEMENT

SHEET



MARSHALL MACKLIN MONAGHAN LIMITED  
CONSULTING ENGINEERS SURVEYORS PLANNERS

### GENERAL NOTES

1. CLASS OF CONCRETE  
DECK AND PIER 35 mPa  
REMAINDER 30 mPa
2. CLEAR COVER TO REINFORCING STEEL  
FOOTINGS 100 ± 25  
ABUTMENTS : WINGWALLS AND RETAINING WALLS  
FRONT FACE 80 ± 20  
BACK FACE 70 ± 20  
PIER 80 ± 20  
DECK TOP 70 ± 20  
BOTTOM AND SIDES 50 ± 10  
REMAINDER 70 ± 20 UNLESS  
OTHERWISE SPECIFIED
3. REINFORCING STEEL SHALL BE GRADE 400 UNLESS  
OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX C  
DENOTE COATED BARS.
4. CONSTRUCTION NOTES  
IF THE ACTUAL BEARING HEIGHTS ARE DIFFERENT  
FROM THE ASSUMED HEIGHTS GIVEN WITH THE  
BEARING DESIGN DATA, THE CONTRACTOR SHALL  
ADJUST THE BEARING SEAT ELEVATIONS AND THE  
REINFORCING STEEL TO SUIT THE ACTUAL HEIGHTS.

WP DENOTES WORKING POINT  
T/P DENOTES TOP OF PAVEMENT

## LIST OF DRAWINGS

1. GENERAL ARRANGEMENT.
2. BOREHOLE LOCATIONS & SOIL STRATA.
3. FOOTING DETAILS.
4. ABUTMENTS AND WINGWALLS.
5. BEARING AND PIER DETAILS.
6. DECK DETAILS.
7. DECK REINFORCING I.
8. DECK REINFORCING II.
9. TRANSVERSE CABLE DETAILS.
10. LONGITUDINAL CABLE DETAILS.
11. JOINT ANCHORAGE AND ARMOURING.
12. BARRIER WALL.
13. 6000 mm APPROACH SLAB.
14. DETAILS OF CONCRETE SLOPE PAVING.
15. STANDARD DETAILS.
16. AS CONSTRUCTED ELEV. AND DIM.
17. QUANTITIES STRUCTURE 1.
18. QUANTITIES STRUCTURE 2.



APPLICABLE STANDARD DRAWINGS

DD 3502 BACKFILL TO STRUCTURE

WP No.	CO - ORDINATES	
	NORTHING	EASTING
1	4 780 951.622	248 566.154
2	4 780 923.627	248 565.660
3	4 780 895.629	248 565.352

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

[illegible]

# METRIC

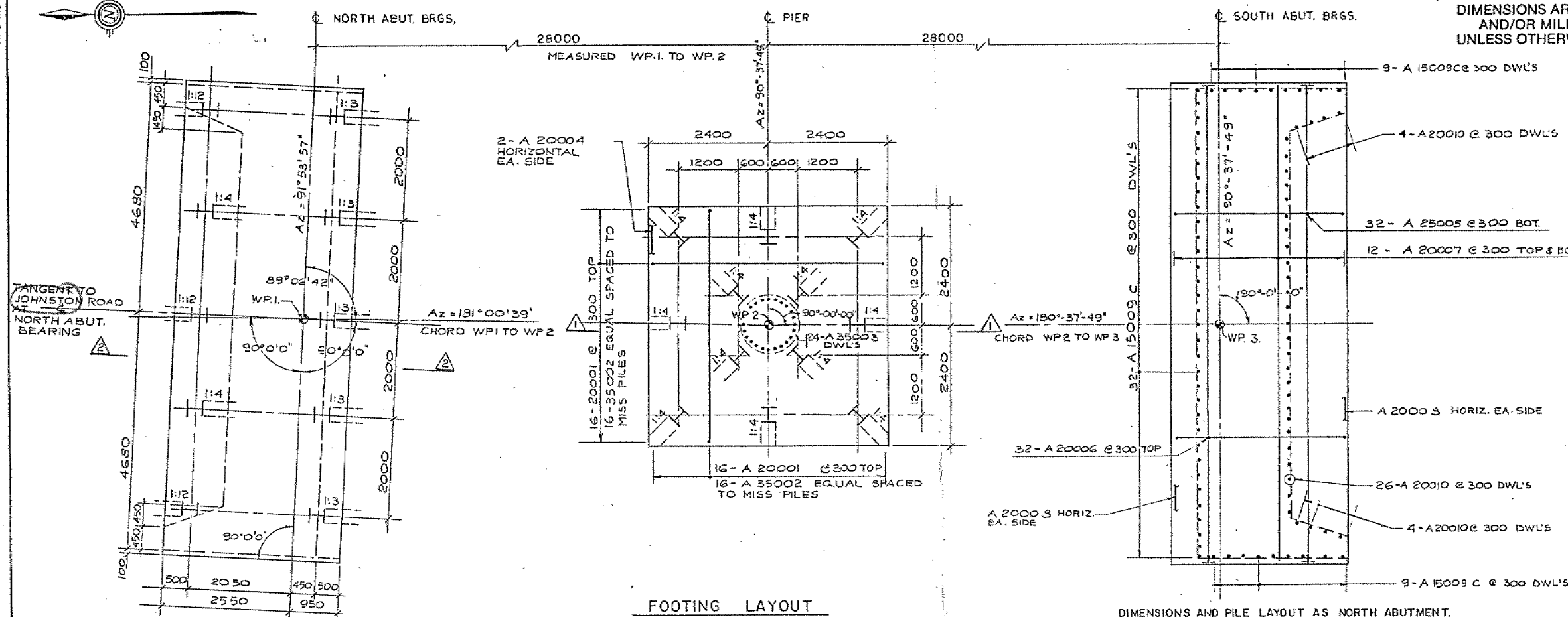
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

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FOOTING DETAILS

SHEET

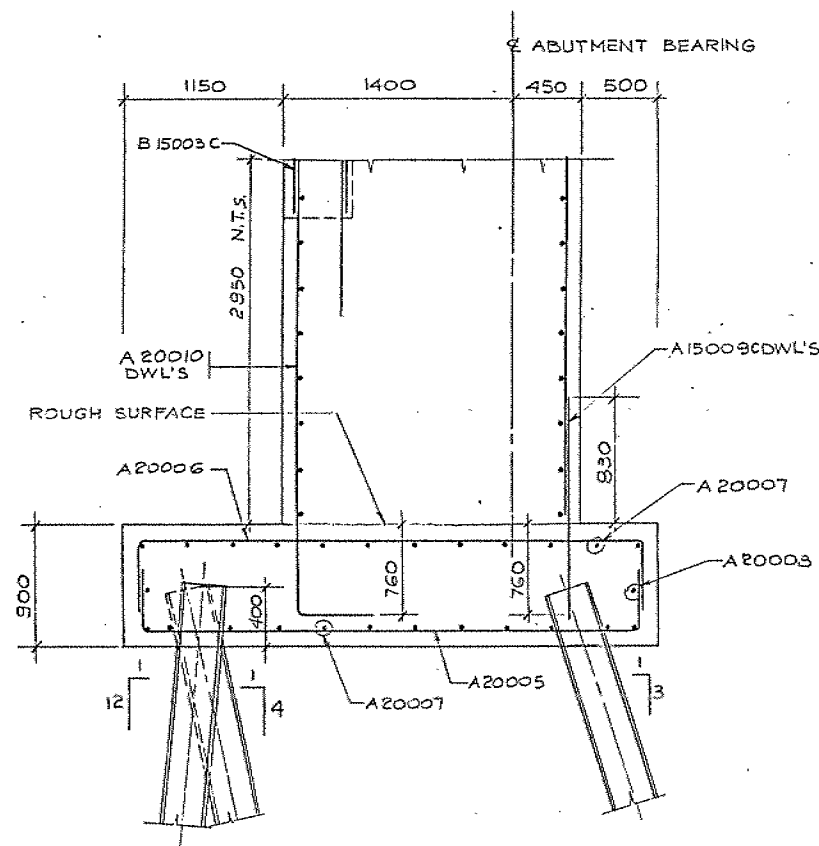
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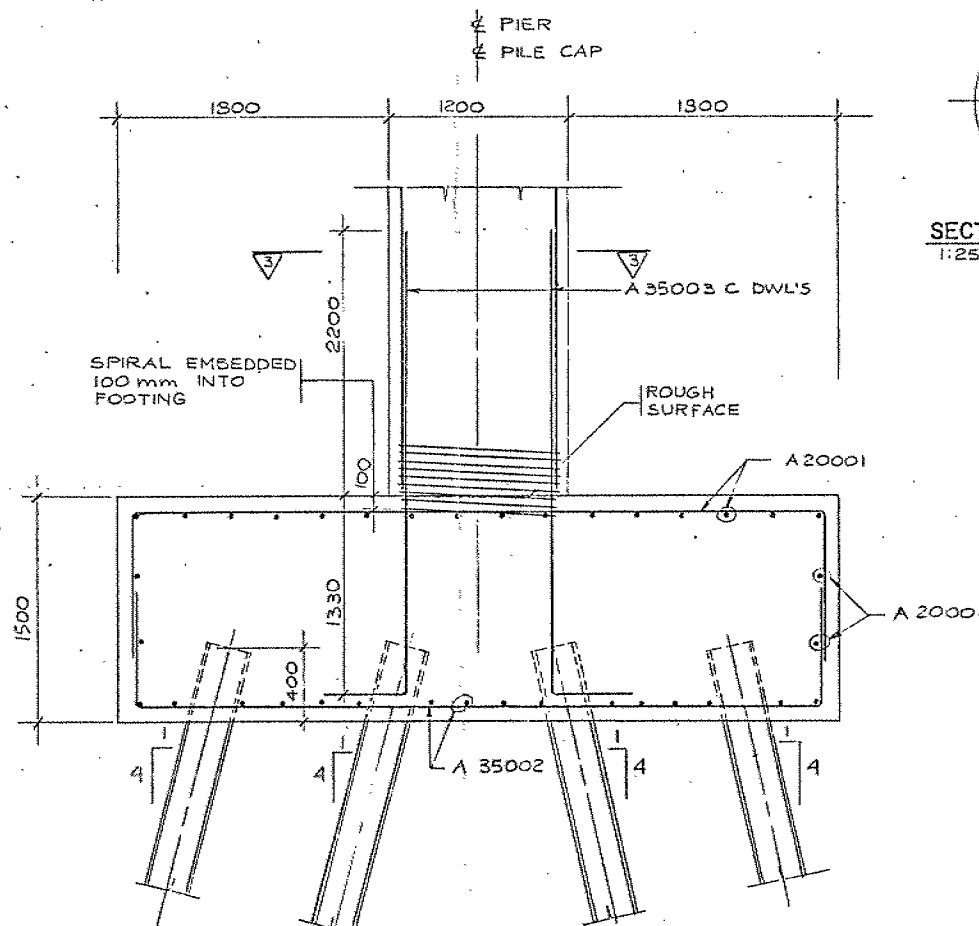
FOOTING LAYOUT  
1:50

DIMENSIONS AND PILE LAYOUT AS NORTH ABUTMENT.

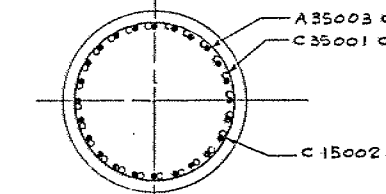
FOOTING REINFORCING AS SOUTH ABUTMENT



SECTION 2  
1:25



SECTION 1  
1:25



SECTION 3  
1:25

PILE DATA HP 310 x 110				
LOCATION	No.	APPROXIMATE LENGTH (m)	CUT OFF ELEV.	BATTER
PIER	12	21.3	205.6	1:4
NORTH ABUTMENT	5	26.5	210.1	1:3
	2	26.2	210.1	1:4
	3	24.6	210.1	1:12
SOUTH ABUTMENT	5	26.5	210.1	1:3
	2	25.2	210.1	1:4
	3	24.6	210.1	1:12

## PILE DESIGN DATA

MAX. COMBINED FACTORED LOAD:

AT ULS 1600 kN

AT SLS II, 1150 kN

## APPLICABLE STANDARD DRAWINGS

DD 3301 SPLICE AND DRIVING SHOE DETAILS



REVISIONS	DATE	BY	DESCRIPTION
DESIGN S.B.	CHK T.S.	LOADING	CH3DC A-83
DRAWN I.R.	CHK S.B.	SITE 1-193	STRUCT SCHEME DWG. 3
			DATE MAY, 90