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W. O. No.

STR. SITE No. 1-192

HWY. No. 403

LOCATION Fairchild Creek Twin Bridges

No. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976



Ministry of  
Transportation and  
Communications

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## FOUNDATION DESIGN SECTION

**foundation  
investigation and  
design report**

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

*CONT 90-95*

WP 66-67-05

DIST 4

HWY 403

STR SITE 1-192

Fairchild Creek Twin Structures

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# FOUNDATION INVESTIGATION REPORT

for

## FAIRCHILD CREEK TWIN STRUCTURES

W.P. 66-67-05; Site 1-192

Hwy. #403, District #4 (Burlington)

### INTRODUCTION

Foundation Investigation was carried out at the above mentioned site on March 18, 1976 and from January 24 to 29, 1979. A foundation investigation and design report was issued on April 12, 1979. Since that time, the location of the structures were moved some 60 m easterly on the same alignment. A review of the available subsurface information indicated that additional borings are required. The additional fieldwork was carried out from February 14 to 27, 1989. A total of eight sampled boreholes was drilled in the three different time periods using Auger Machines equipped with Hollow Stem Augers and BXL rock coring equipment. This report replaces the original report which should be discarded.

### SITE DESCRIPTION

The site is located on the proposed new alignment of Hwy. 403 approximately 60 metres west of Fairchild Creek in the Township of Brantford, Brant County.

The land at the site is generally gentle to moderately rolling and used for agricultural purposes.

The site lies in the physiographic region known as the Haldimand Clay Plain. This extensive plain consists of stratified clay, silts and sands deposited by glacial lakes Whittlesey and Warren. Streams have severely dissected the lake plain in some areas. Along these streams more recent surficial deposits of alluvium are present.

#### SUBSURFACE CONDITIONS

Generally, uniform subsurface conditions were found to exist across the site. The surficial deposit consists of up to 7 metres of silt containing some sand. Immediately below this deposit a stratum composed of alternating layers of clayey silt and silty clay exists. This stratum extends up to a depth of 16.3 metres below the ground surface. In some of the borings a .9 to 3.4 metre thick deposit of clayey silt was found over the dolostone bedrock. For a detailed description of the soil and rock types encountered in each borehole refer to the Record of Borehole Sheets. The estimated stratigraphical profile and sections are shown on Drawing No. 666705-A. The following is a summary of the soil types encountered from ground level downwards.

#### Silt of Slight Plasticity

Immediately below the ground surface a 2.3 to 7.0 metre thick deposit of silt of slight plasticity containing traces to some fine sand was encountered. The upper portion of this deposit

contains traces of clay and organics. Occasional silty clay to clayey silt layers were also observed.

Standard Penetration Tests carried out within this stratum yielded 'N' values ranging from 2 to 20 blows/0.3 metres. Therefore, the denseness can be described as ranging from very loose to compact.

The natural moisture content as determined by laboratory testing ranged from 19 to 23%. Figure 1 illustrates the grain size distribution for samples obtained from this stratum.

#### Alternating Layers of Clayey Silt and Silty Clay

Beneath the surficial silt deposit a stratum consisting of alternating layers of clayey silt and silty clay with occasional layers of silt and clay exists. Overall, the stratum ranged in thickness from 8.1 to 12.7 metres with the individual clayey silt and silty clay layers varying from 2 to 130 mm in thickness.

Field vanes carried out within this stratum yielded an undrained shear strength ranging from 30 to over 100 kPa with a sensitivity of 2 to 5. During examination and testing of the obtained samples it was noted that the consistency of the clayey silt layers is generally higher than the silty clay layers. Overall, the consistency of the stratum varied from firm to very stiff.

The natural moisture contents of the individual layers within the stratum were determined in the laboratory. For the clayey silt layers the moisture content ranged from 23 to 27% with an average of 25%. The moisture content of the silty clay portion of the stratum ranged between 31 and 41% with the average being 37%.

Four consolidation tests were performed on samples obtained from this stratum. The results are plotted on the void ratio versus pressure curves, Figures 2, 3, 4, 5. The tests generally indicate that the soil is overconsolidated with a preconsolidation pressure ranging from 375 to 536 kPa.

#### Clayey Silt

Underlying the layered stratum is a deposit of clayey silt containing occasional pockets of silt. This deposit was found to vary from .9 to 3.4 metres in thickness. The lower portion of the deposit immediately above the bedrock contains some sand and traces of gravel.

Field vanes carried out within this stratum yielded an undrained shear strength ranging from 60 to greater than 107 kPa, indicating a stiff to very stiff consistency.

### BEDROCK

Dolostone type bedrock was encountered at the following levels:

BH # 3            EL. 181.7

BH #102           EL. 182.8

BH #104           EL. 182.2

The upper surface of the bedrock in BH #102 and BH #3 is moderately weathered or fractured.

### GROUNDWATER CONDITIONS

The following groundwater levels were observed in the open boreholes:

<u>Borehole No.</u>	<u>Elevation</u>
3	195.5 (March 1976)
20	197.3 (January 1979)
21	188.0 (January 1979)
23	185.8 (January 1979)
102	193.2 (February 1989)
103	191.6 (February 1989)
104	Not Observed
106	186.3 (February 1989)



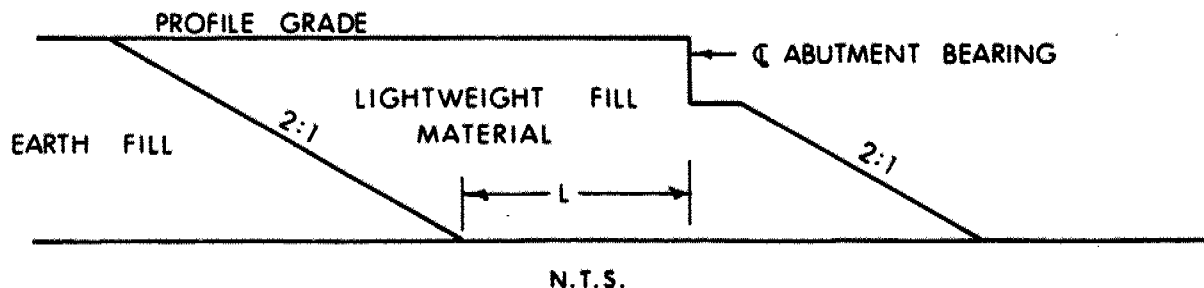
## DISCUSSION AND RECOMMENDATIONS

### General

As part of the construction of the proposed new Hwy. #403 between Ancaster and Brantford, twin structures will be required to cross Fairchild Creek. The present proposal is to construct twin structures consisting of three 27 m spans. The profile grade is proposed to be at EL. 205 (west abutment) and at EL. 204 (east abutment). The bed level of Fairchild Creek is set at EL. 193.

### APPROACH EMBANKMENTS

In order to realize the proposed profile grades, and ensure the stability of approaches multiple berms are required if regular earth fill is used. Consequently, the length of the structures would be about 91 m. It is the MTO opinion thus, this scheme is very costly. Therefore, we are recommending that the earth fill is replaced with lightweight material as indicated on the sketch below:



L = Horizontal limit of lightweight material behind abutment bearings.

L = 12 m (east approach)

L = 15 m (west approach)

The following parameters are suggested for the 'Old Clinker' (Pelletized blast furnace slag) type material:  $\phi = 35^\circ$ ;

$\gamma = 1.25$  tonnes/m<sup>3</sup>. The price is about \$18.00 per tonne, plus \$0.07 per tonne per km. In the transverse direction (outside the lightweight fill area) the berm requirements are as follows:

H = 6 m (or less) no berm

H = 7 m                      5 m wide berm constructed at half height

The material in fill (core and berm) should consist of well compacted granular material up-to the high water level and should be placed in accordance with special provision No. 120.17. The side slopes of the berm and core should not be steeper than 2:1. Settlements up to 200 mm are expected.

#### Structure Foundations

The abutments and piers should be supported on steel 'H' piles driven to bedrock. The pile tips should be reinforced with driving shoes. The maximum allowable load for the particular section chosen may be assumed for design purposes: 1150 kN (HP 310 x 110) and 900 kN (HP 310 x 79). It is assumed that the piles will reach bedrock between EL. 182 and EL. 183. 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 kN	1150 kN
Capacity at S.L.S. Type II	1150 kN	900 kN

Earth pressures should be computed as per subsection 6.6.1.2.1 of the code. Yielding foundation conditions should be considered to apply.

The concrete for the pile caps should be poured 'in the dry'. The base of all pile caps should be provided with a minimum earth cover of 1.2 m for frost protection purposes.

#### MISCELLANEOUS

The fieldwork was carried out under the supervision of Mr. R. Van Veen, Mr. C. T. Johnson and Mr. L. Simolote.

The original report was written by Mr. C. T. Johnson, Project Engineer and reviewed by Mr. K. G. Selby, Supervising Engineer in April 1979. The updated and revised report was written by Mr. P. Payer, and reviewed by Mr. M. Devata.



*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 (RQD), FOR MODIFIED RECOVERY, IS:

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

**JOINTING AND BEDDING:**

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

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

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

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	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

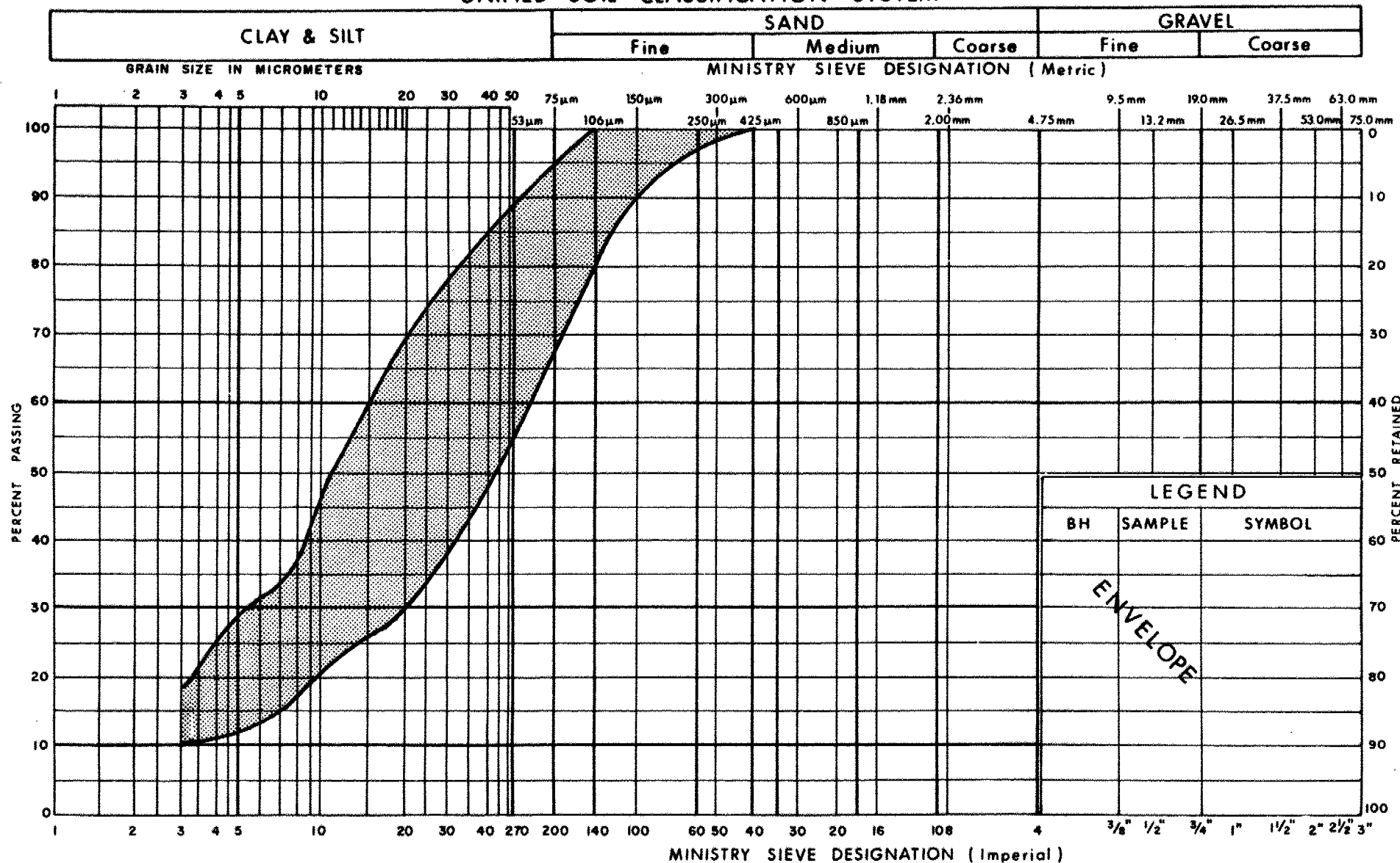
### MECHANICAL PROPERTIES OF SOIL

$m_v$	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
$\sigma'_{v0}$	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
$S_t$	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	j	kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kn/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

## UNIFIED SOIL CLASSIFICATION SYSTEM



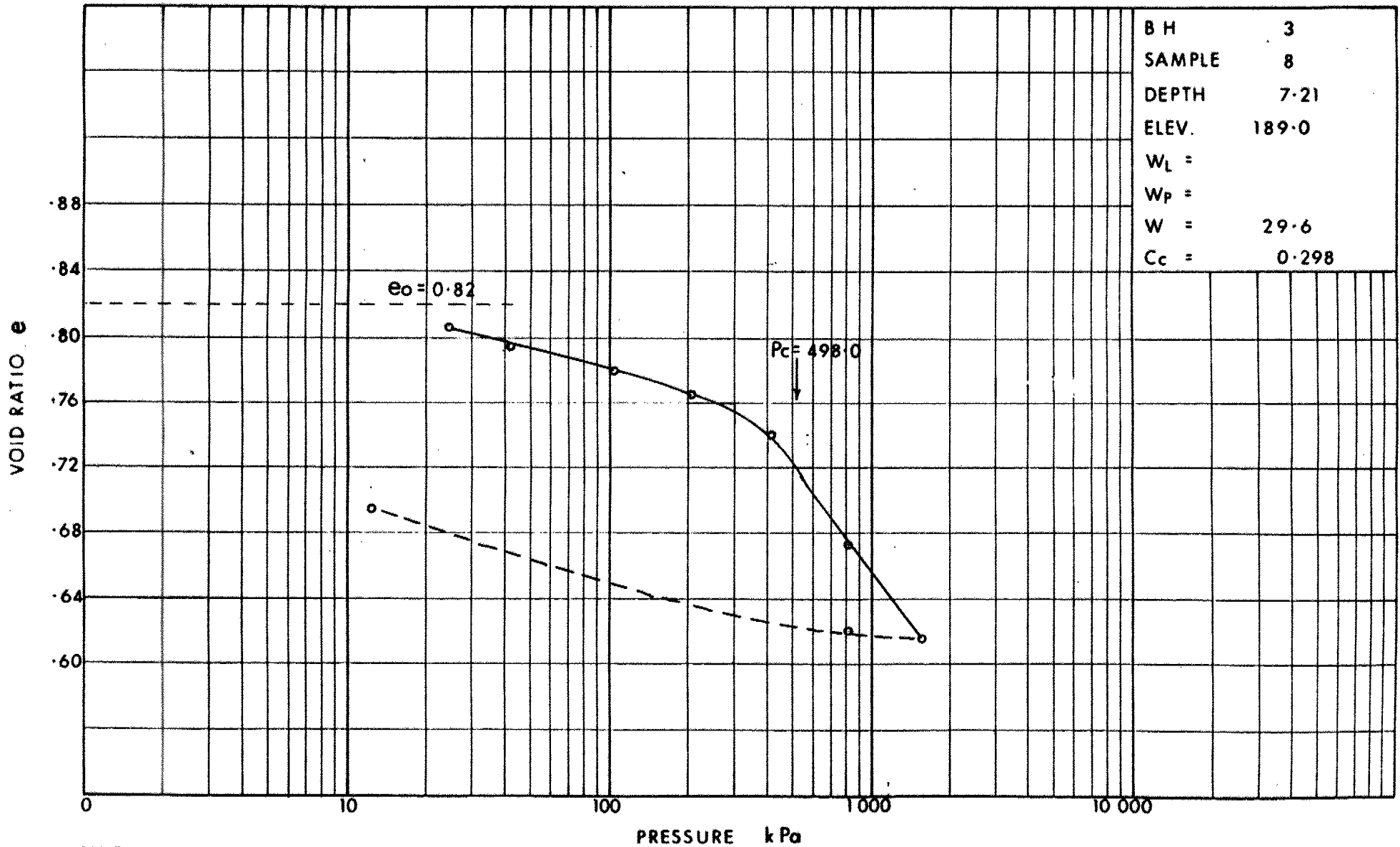
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GRAIN SIZE DISTRIBUTION  
SILT  
SOME SAND

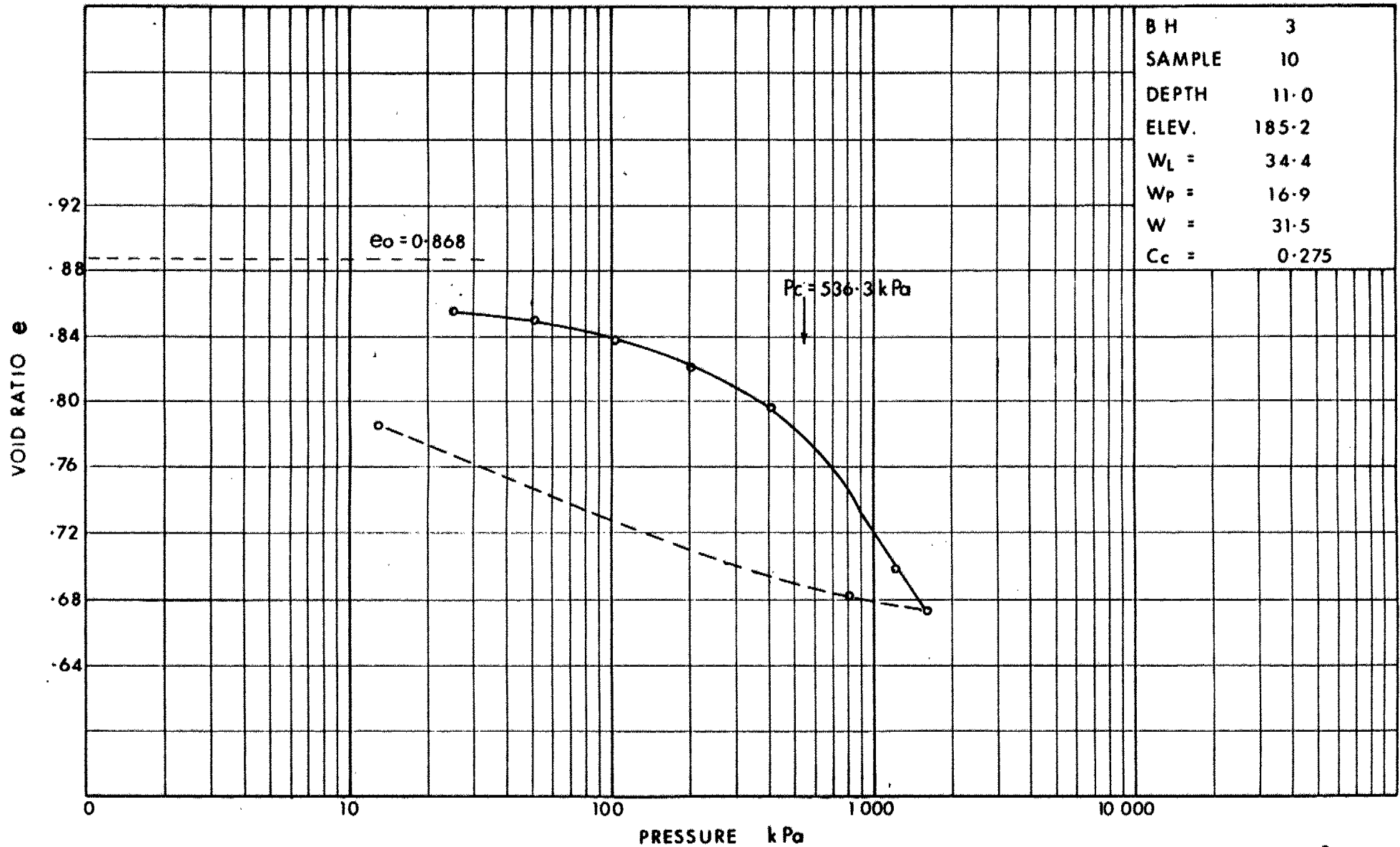
FIG No 1

W P 66-67-05

# VOID RATIO - PRESSURE CURVE



# VOID RATIO - PRESSURE CURVE





# VOID RATIO - PRESSURE CURVE

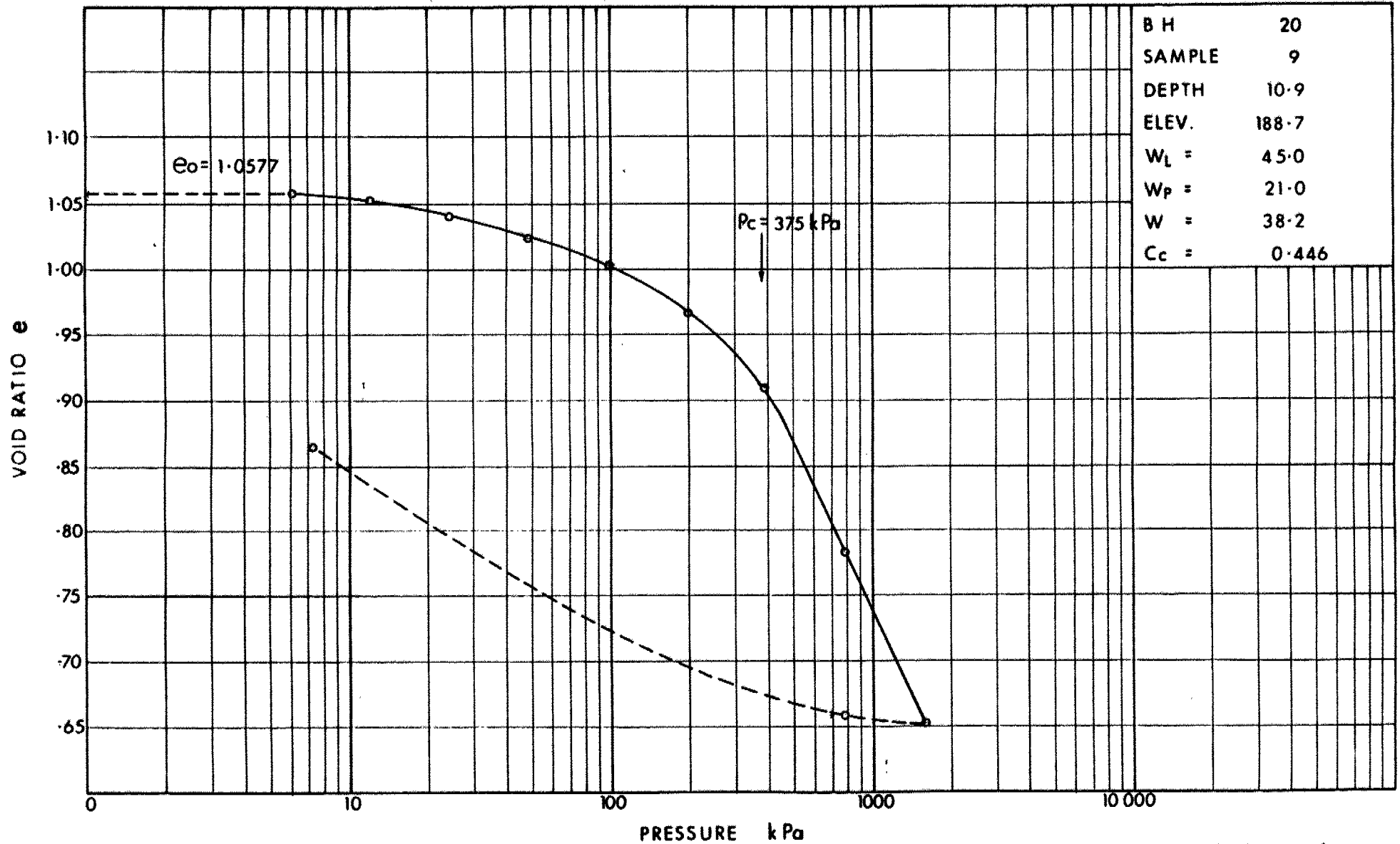
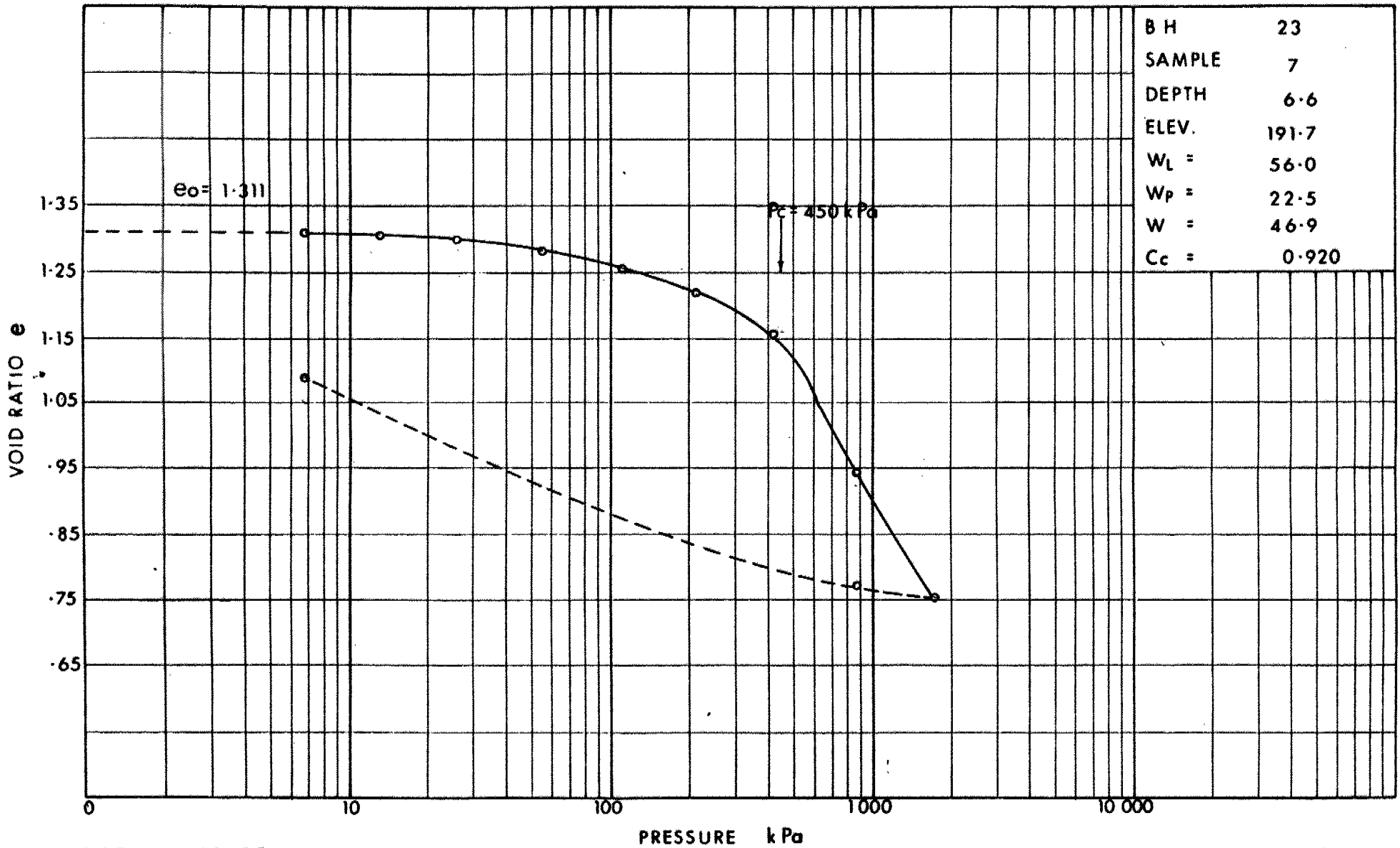


FIG No 4

# VOID RATIO - PRESSURE CURVE



RECORD OF BOREHOLE No 3

METRIC

W P 66-67-05 LOCATION Coords. N 780 934.3; E 249 055.1 ORIGINATED BY BVV  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger, Cone Test & BXL Rock Core COMPILED BY BVV  
DATUM Geodetic DATE 1976 03 18 CHECKED BY *W.J.*

OFFICE REPORT ON SOIL EXPLORATION

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 25 50 75 100 125	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
196.2	Ground Level									
0.0	Silt of Slight Plasticity, Some Very Fine Sand Trace of Clay and Organics (Wood Chips) Very Loose		1	SS	3				Org. 1.83%	0 9 79 12
			2	SS	2					
			3	SS	3					
			4	SS	4					
192.0			5	SS	4				Org. 1.38%	0 18 67 15
4.0	Alternating Layers of Clayey Silt and Silty Clay Occasional Seams of Silt Firm to Stiff		6	SS	3					1 2 73 24
			7	TW	PH					
			8	TW	PH					
			9	SS	10					
			10	TW	PH					
			11	SS	5					
			12	SS	4					
182.6										
13.6	Clayey Silt, Some Sand & Gravel, Firm		13	SS	5					
181.7										
14.5	Dolostone Bedrock Moderately Fractured		14	RC BXL	Rec. 87%					24 12 26 28
180.2										
16.0	End of Borehole									

RECORD OF BOREHOLE No 20

METRIC

W P 66-67-05 LOCATION Coords. N 4 780 922.0; E 248 043.0 ORIGINATED BY CTJ  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger COMPILED BY CTJ  
DATUM Geodetic DATE 1979 01 29 CHECKED BY *WJ*

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					
199.6	Ground Level																
0.0	Trace of Organics and Clay		1	SS	14		198										
197.3	Silt of Slight Plasticity, Trace to Some Sand, Compact		2	SS	11												
2.3	Alternating Layers of Clayey Silt and Silty Clay Layers Vary in Thickness from 2 mm to 130 mm Brown Occasional Layers of Silt Firm to Stiff		3	SS	6		196										
			4	SS	5												
			5	TW	PH												
			6	TW	PH		194										
			7	TW	PH		192										
			8	SS	5		190										
			9	TW	PH		188										
			10	SS	7												
			11	TW	PH		186										
185.4	Clayey Silt Occasional Pockets of Silt Grey Firm to Stiff		12	SS	8		184										
14.2	Traces of Gravel & Sand Refusal to Augering		13	SS	25												
182.1	End of Borehole Probable Bedrock																
17.5																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 21

METRIC

W P 66-67-05 LOCATION Coords. N 4 780 943.3; E 248 072.0 ORIGINATED BY CTJ  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY CTJ  
DATUM Geodetic DATE 1979 01 24 and 1979 01 25 CHECKED BY *CTJ*

OFFICE REPORT ON SOIL EXPLORATION

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	100					
199.2	Ground Level													
0.0	Trace of Organics and Clay		1	SS	8		198							0 12 78 10
	Silt of Slight Plasticity		2	SS	7									0 14 77 9
	Some Fine Sand Loose		3	SS	5									0 29 60 11
195.2			4	SS	8		196							
4.0	Alternating Layers of Clayey Silt and Silty Clay		5	SS	5									0 0 78 22
	Brown		6	SS	5		194							
	Firm to Stiff		7	SS	6									
			8	SS	7		192							
			9	SS	5		190							
189.1														
10.1	End of Borehole						188							
							186							
							184							
182.7														
16.5	End of Cone Test Probable Bedrock													

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



## METRIC

W P 66-67-05 LOCATION Coords. N 4 780 942.5; E 249 022.0 ORIGINATED BY CTJ  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger COMPILED BY CTJ  
DATUM Geodetic DATE 1979 01 25 CHECKED BY al./

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 101

METRIC

W P 66-67-05 LOCATION Co-ords: N 4 780 946.1; E 249 060.5 ORIGINATED BY LNS  
 DIST 4 HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test Only COMPILED BY LNS  
 DATUM Geodetic DATE 89 02 20 CHECKED BY DT

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> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
196.5 0.0	Ground Level										
							196	Frozen			
							194				
							192				
							190				
							188				
							186				
							184				
182.2											
14.3	End of Cone Test										

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 102

METRIC

W P 66-67-05 LOCATION Co-ords: N 4 780 947.5; E 249 087.3 ORIGINATED BY LNS  
 DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Auger (H.S.) COMPILED BY PP  
 DATUM Geodetic DATE 89 02 17 CHECKED BY XX

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		STRAT. PLOT	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		NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100					
197.4	Ground Level													
0.0	Silt of Slight Plasticity Some Sand Occ. Clay Seams		1	SS	6		196							0 22 (78)
			2	SS	5		194							0 49 (51)
			3	SS	4		192							
			4	SS	4		190							
193.0	Loose		5	SS	6		188							
4.4	Alternating Layers of Silty Clay and Clayey Silt Trace of Sand Occ. Silt and Clay Seams		6	SS	5		186							
			7	SS	7		184							
			8	TW	PH		182							
			9	TW	PH									
			10	TW	PH									
	Firm to V. Stiff		11	SS	18									
			12	TW	PH									
184.0	Clayey Silt Some Sand & Gravel V. Stiff		13	SS	24									
182.8	Weathered Dolostone		14	RC BXL	Rec 92%									
14.6	Unweathered Bedrock													
181.2	End of Borehole													
16.2														



# RECORD OF BOREHOLE No 103

METRIC

W P 66-67-05 LOCATION Co-ords: N 4 780 937.0; E 250 011.6 ORIGINATED BY LNS  
 DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Augers (H.S.) COMPILED BY PP  
 DATUM Geodetic DATE 89 02 16 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

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					
197.4	Ground Level																
0.0	Silt of Slight Plasticity Some Sand		1	SS	6		196										
			2	SS	5												
	Occ. Clayey		3	SS	4												
	Silt Layers		4	TW	PH		194									19.0	0 29 (71)
			5	SS	4												
	Loose		6	SS	7		192										
190.4																	
7.0			7	TW	PH		190										
	Alternating Layers of Silty Clay and Clayey Silt Trace of Sand Occ. Clay and Silt Seams		8	SS	8		188									19.8	
			9	SS	10												
			10	SS	23		186										
			11	TW	PH		184										
	Firm to V. Stiff															20.1	
181.9							182										
5.5	End of Borehole Probable Bedrock																

# RECORD OF BOREHOLE No 104

METRIC

W P 66-67-05 LOCATION Co-ords: N 4 780 923.5; E 249 082.5 ORIGINATED BY LNS  
 DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Auger (H.S.) COMPILED BY PP  
 DATUM Geodetic DATE 89 02 14-15 CHECKED BY DK

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y 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		
197.4 0.0	Ground Level												
	Silt of Slight Plasticity  Some Sand Occ. Organic Silty Clay Layers  Loose		1	SS	7								0 15 (85)
			2	SS	5								
			3	SS	5								
			4	TW	PH							W <sub>p</sub> = 58% W <sub>L</sub> = 41% W <sub>p</sub> = 33%	15.1 0 30 (70)
			5	SS	9								
190.7 6.7	Alternating Layers of Silty Clay and Clayey Silt Trace of Sand Occ. Clay and Silt Seams  Firm to Stiff		6	TW	PH								18.4
			7	SS	8								
			8	SS	10								
			9	TW	PH								
			10	SS	12								0 0 (100)
182.2 15.2	Dolostone Sound Bedrock		11	RC EXL	Rec 100%								
180.7 16.7	End of Borehole  *Groundwater Level not Observed												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 105

METRIC

W P 66-67-05 LOCATION Co-ords: N 4 780 922.5; E 249 055.0 ORIGINATED BY LNS  
 DIST 4 HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test Only COMPILED BY LNS  
 DATUM Geodetic DATE 89 02 24 CHECKED BY DT

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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
196.5	Ground Level													
0.0														
							196							
							194							
							192							
							190							
							188							
							186							
							184							
182.5														
14.0	End of Cone Test													

OFFICE REPORT ON SOIL EXPLORATION

## METRIC

W P 66-67-05 LOCATION Co-ords: N 4 780 915.5; E 249 008.0 ORIGINATED BY LNS  
DIST 4 HWY 403 BOREHOLE TYPE Cont. Flight Auger (H.S.) COMPILED BY LNS  
DATUM Geodetic DATE 89 02 27 CHECKED BY JK

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							WATER CONTENT (%)			
								SHEAR STRENGTH kPa										
								○ UNCONFINED	+ FIELD VANE									
								● QUICK TRIAXIAL	× LAB VANE									
								25 50 75 100 125										
198.5	Ground Level																	
0.0	Silt of Slight Plasticity Some Sand Occ. Clayey Silt Zones Compact																	
			1	SS	16									0 18 (82)				
			2	SS	16													
			3	SS	20													
194.8			4	SS	14													
3.7			5	SS	5													
			6	SS	6													
			7	TW	PH								19.5	0 1 (99)				
	Alternating Layers of Clayey Silt and Silty Clay		8	SS	4													
	Trace of Sand Occ. Clay and Silt Seams		9	TW	PH								18.9	0 1 (99)				
			10	SS	9													
	Firm to V. Stiff		11	TW	PH								19.8					
			12	SS	9													
			13	TW	PH													
182.2	Refusal to Auger																	
16.3	End of Borehole												120 Blows/150 mm					

+3, x5: Numbers refer to Sensitivity

CONT No  
WP No 66-67-05

FAIRCHILD CREEK TWIN BRIDGE

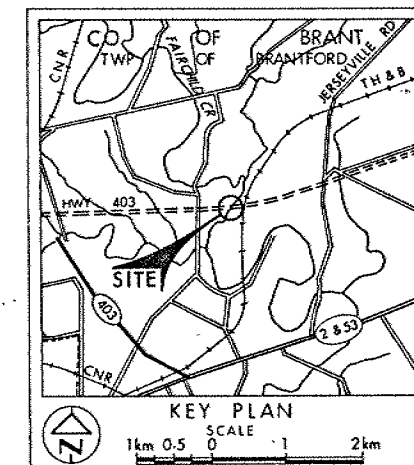
BORE HOLE LOCATIONS & SOIL STRATA



SHEET

METRIC

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



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  
76 03, 79 01 and 89 02

No	ELEVATION	CO-ORDINATES NORTH	EAST
76 03	3	196.2	4 780 934.3
	20	199.6	4 780 922.0
79 01	21	199.2	4 780 943.3
	23	198.3	4 780 942.5
	101	196.5	4 780 946.1
	102	197.4	4 780 947.5
89 02	103	197.4	4 780 937.0
	104	197.4	4 780 923.5
	105	196.5	4 780 922.5
	106	198.5	4 780 915.5

NOTE

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

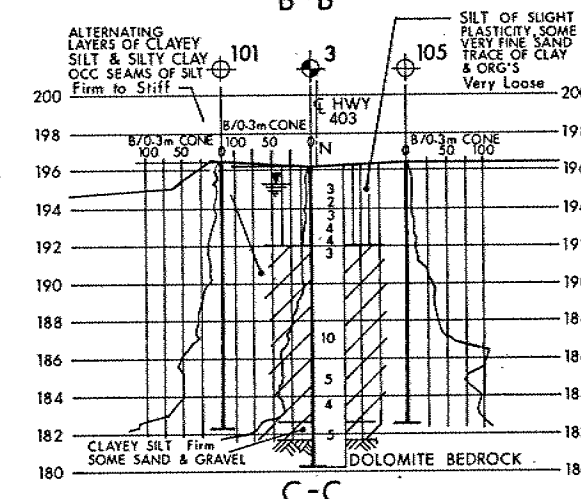
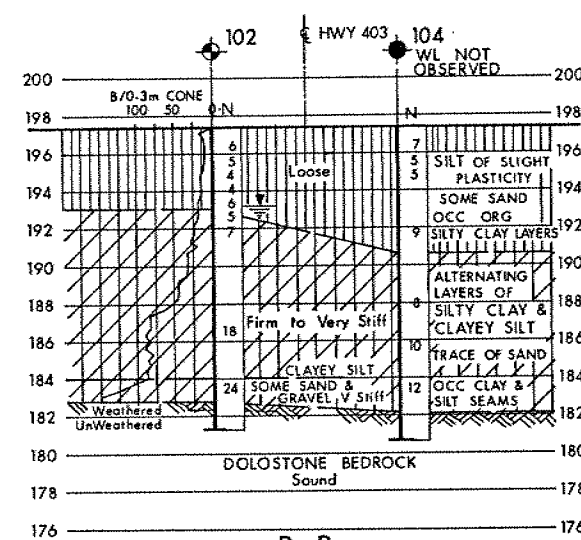
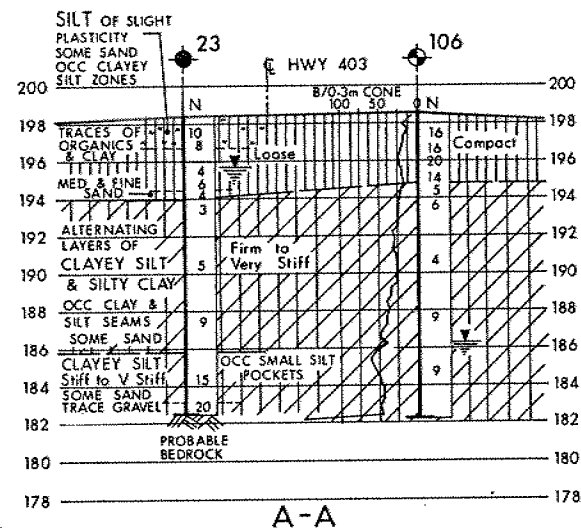
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2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

DATE	BY	DESCRIPTION

Geocres No 40P1-75

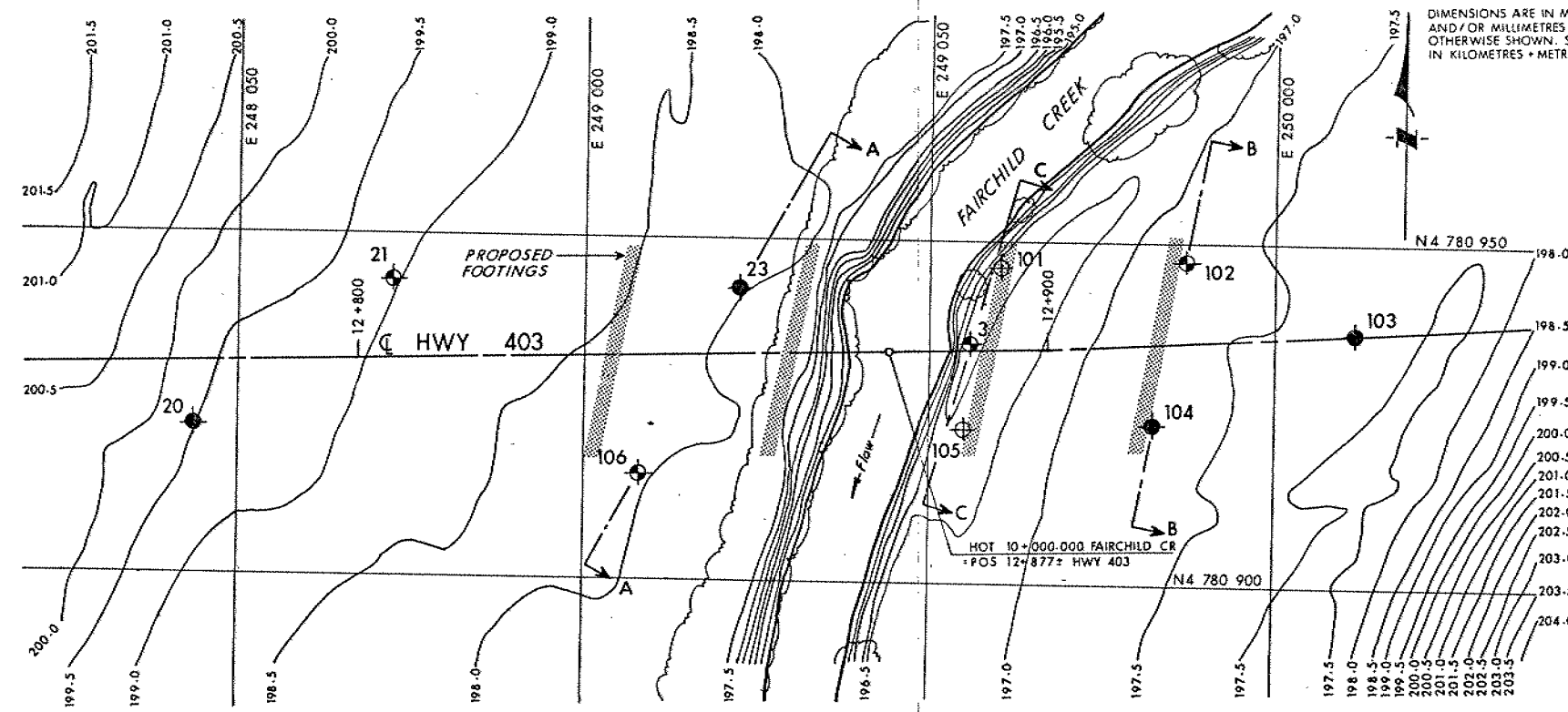
HWY No 403	DIST 4
SUBM'D PP CHECKED	DATE 89 06 12
DRAWN DT CHECKED	DATE 89 06 12
	SITE 1-192
	DWG 666705-A

REF No E-86-403-4, 79 02



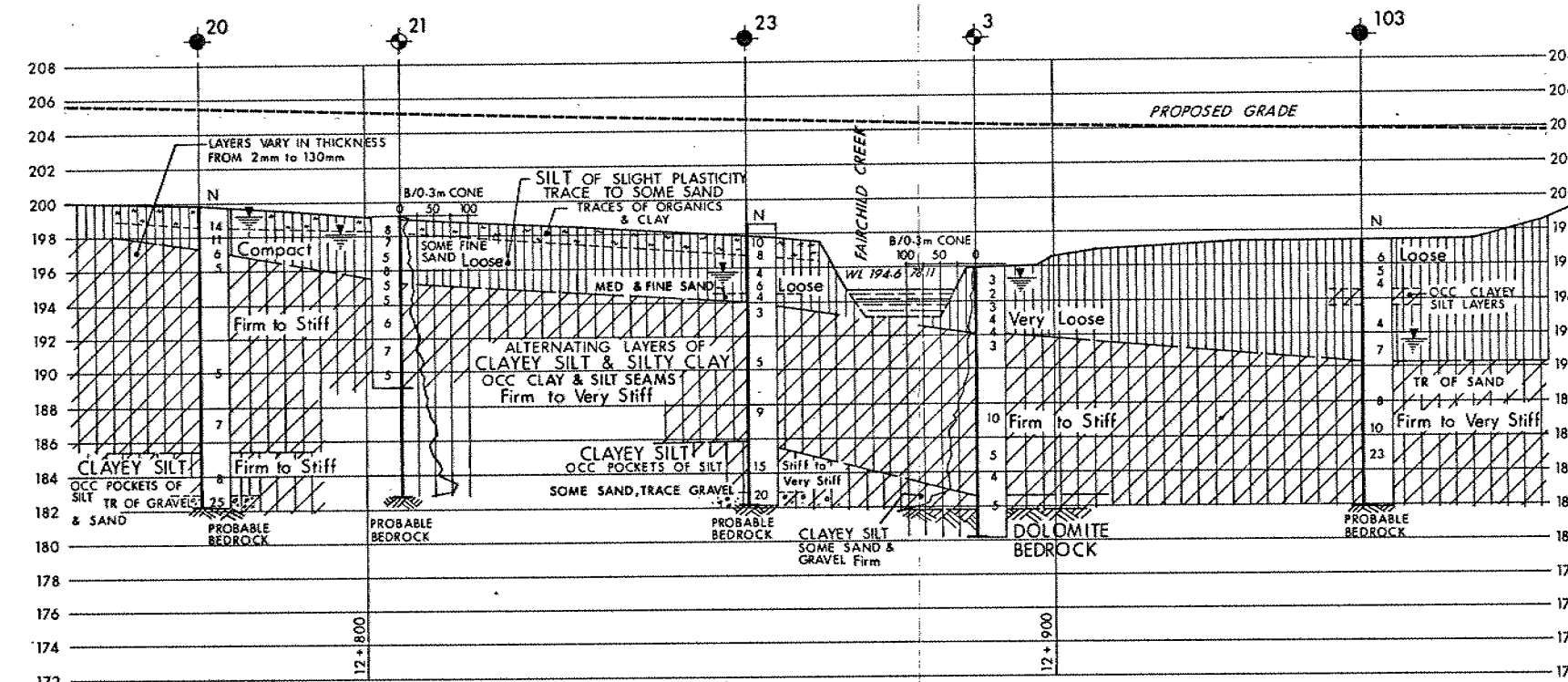
SECTIONS

SCALE  
10m 5 0 10m Hor  
4m 2 0 4m Vert



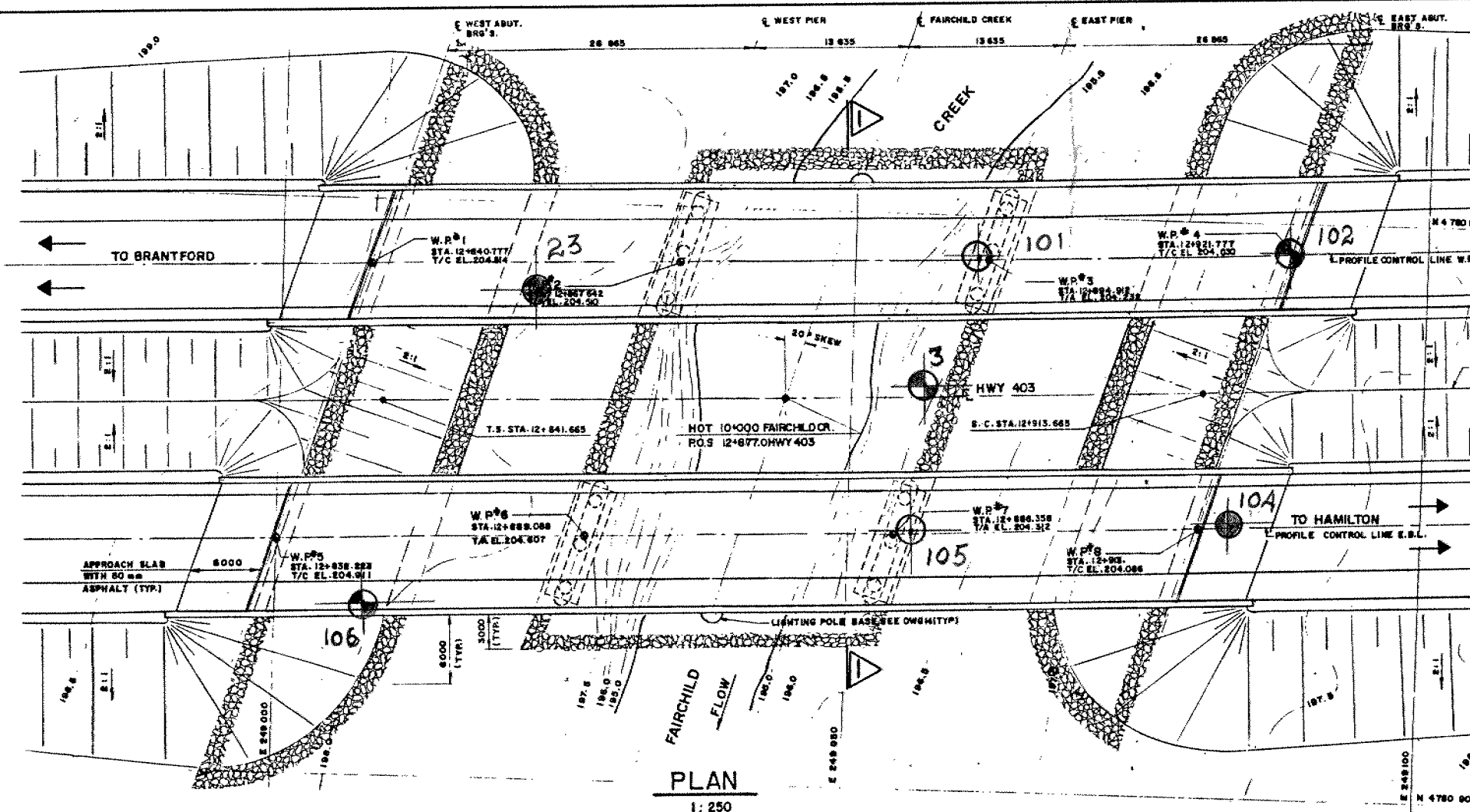
PLAN

SCALE  
10m 5 0 10m



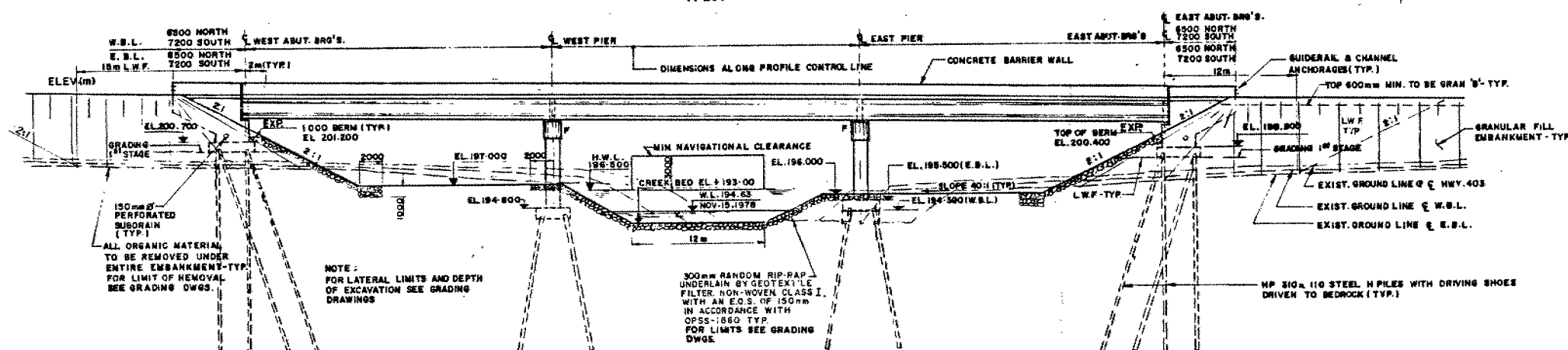
PROFILE HWY 403

SCALE  
10m 5 0 10m Hor  
4m 2 0 4m Vert



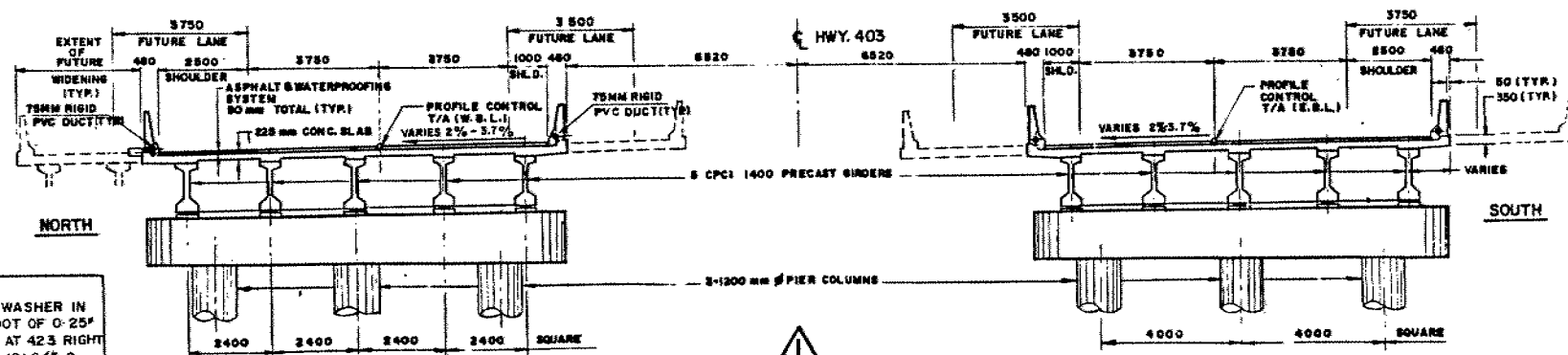
PLAN

1:250



ELEVATION

1:250



1:100

B.M.  
NAIL & WASHER IN  
EAST FOOT OF 0-25'  
POPLAR AT 423 RIGHT  
OF STA 12+845.0  
EL. 198.035m

## METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST. 4  
CONT No  
WP No 66-67-05

FAIRCHILD CREEK/403  
TWIN BRIDGES  
GENERAL ARRANGEMENT

PLANMAC CONSULTANTS LTD.  
CONSULTING ENGINEERS & PLANNERS



SHEET

## GENERAL NOTES

## CLASS OF CONCRETE:

PRESTRESSED GIRDERS 40 MPa  
REMAINDER 30 MPa

## REINFORCING STEEL:

REINFORCING STEEL SHALL BE GRADE 400  
UNLESS OTHERWISE NOTED.  
BAR MARKS WITH SUFFIX "C" DENOTE COATED  
BARS.

## CLEAR COVER TO REINFORCING STEEL:

FOOTINGS 100±25  
ABUTMENTS - FRONT FACE 80±20  
- BACK FACE 70±20  
PIERS 80±20  
DECK - TOP 70±20  
- BOTTOM 40±10  
REMAINDER 70±20

(UNLESS OTHERWISE NOTED)

## CONSTRUCTION NOTE:

IF THE ACTUAL BEARING HEIGHTS  
DIFFER FROM THE ASSUMED HEIGHTS GIVEN WITH THE  
BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST  
THE BEARING SEAT ELEVATIONS AND REINFORCING  
STEEL TO SUIT THE ACTUAL HEIGHTS.

## LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BORE HOLE LOCATIONS & SOIL STRATA
3. FOUNDATION LAYOUT
4. WEST ABUTMENTS
5. EAST ABUTMENTS
6. PIERS
7. PRESTRESSED GIRDERS & BEARINGS
8. DECK
9. SCREED ELEVATIONS & MISCELLANEOUS DETAILS
10. BARRIER WALLS
11. 600mm APPROACH SLAB
12. JOINT ANCHORAGE AND ARMOURING
13. AS CONSTRUCTED ELEV. & DIM.
14. STANDARD DETAILS
15. ELECTRICAL EMBEDDED WORK
16. QUANTITIES - STRUCTURE

APPLICABLE STANDARD DRAWINGS:  
SS 9-20 BRIDGE DECK WATERPROOFING

## NOTES:

- W.P. DENOTES WORKING POINT
- T/C DENOTES TOP OF CONCRETE
- T/A DENOTES TOP OF ASPHALT WEARING SURFACE
- L.W.F. DENOTES LIGHTWEIGHT FILL MAT

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

DESIGN N.S.K.D. CHECK E.S. CODE 0880C-63/LOAD CLASS A DATE FEB. 1990  
DRAWING J.P. CHECK G.R. SITE No 1-192 DWG 1

# PILE DATA

LOCATION	NO. REQD.	TYPE	EST. LENGTH EA PILE	CUT OFF ELEV.
WEST BOUND LANES	6	VERTICAL	18.00	200.00
	8	BATTER 1:3	18.00	200.00
	12		12.10	194.10
	12		11.60	193.60
EAST BOUND LANES	6	VERTICAL	17.20	199.20
	8	BATTER 1:3	17.20	199.20
	12		12.10	194.10
	12		12.80	194.80

## ANGLE $\beta$ BETWEEN $\hat{C}$ FTGS AND LINES CONNECTING W.P.S.

LOCATION	W.P. #1	W.P. #2	W.P. #3	W.P. #4	W.P. #5	W.P. #6	W.P. #7
ANGLE $\beta$	70°13'48"	69°54'57"	69°16'42"	70°15'44"	70°02'59"	69°31'10"	

## W.P. DATA

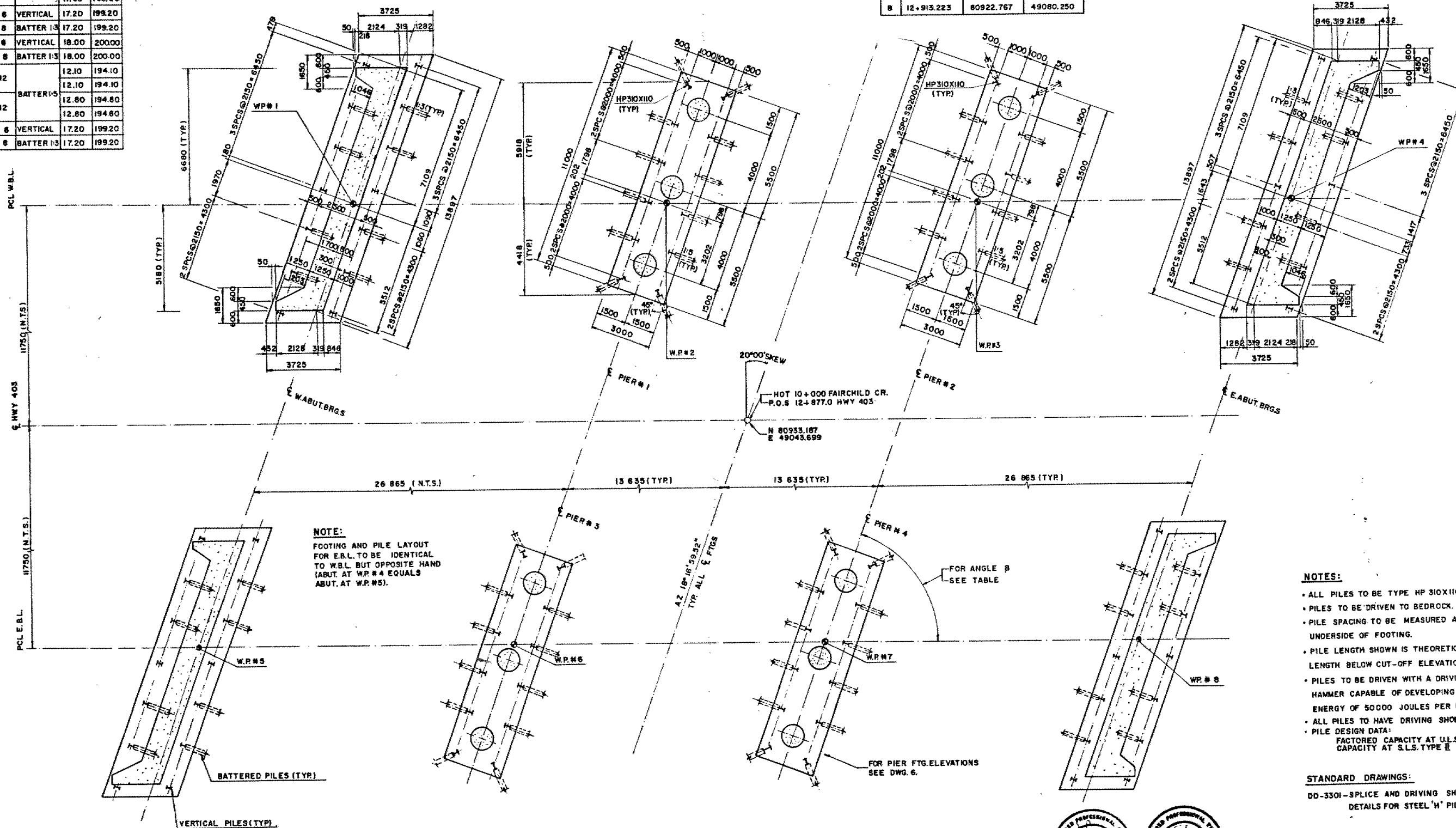
W.P.S.	STATIONS	COORDINATES (IN METRES)	
		NORTH	EAST
1	12+840.777	80943.967	49007.138
2	12+867.642	80944.664	49033.994
3	12+894.912	80945.521	49061.251
4	12+921.777	80946.664	49088.091
5	12+832.223	80920.262	48999.291
6	12+859.088	80920.944	49026.147
7	12+886.358	80921.737	49053.405
8	12+913.223	80922.767	49080.250

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

**DIST 4**  
**CONT No**  
**WP No 66-67-05**  
**FAIRCHILD CREEK/403**  
**TWIN BRIDGES**  
**FOUNDATION LAYOUT**



**PLANMAC CONSULTANTS LTD.**  
CONSULTING ENGINEERS & PLANNERS



## NOTES:

- ALL PILES TO BE TYPE HP 310X110.
- PILES TO BE DRIVEN TO BEDROCK.
- PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTING.
- PILE LENGTH SHOWN IS THEORETICAL LENGTH BELOW CUT-OFF ELEVATION.
- PILES TO BE DRIVEN WITH A DRIVING HAMMER CAPABLE OF DEVELOPING A MIN. ENERGY OF 50000 JOULES PER BLOW.
- ALL PILES TO HAVE DRIVING SHOES.
- PILE DESIGN DATA:  
FACTORED CAPACITY AT U.L.S. 1800KN  
CAPACITY AT S.L.S. TYPE II 1150KN

## STANDARD DRAWINGS:

DD-3301-SPLICE AND DRIVING SHOE DETAILS FOR STEEL 'H' PILES.

## FOUNDATION LAYOUT

1:100



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN E.S.	CHK J.F.	CODE 08DC-83	LOAD CLASS A [DATE FEB.90]
DRAWN B.H.	CHK E.S.	SITE 1-192	STRUCT SCHEME DWG. 3