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DIST. B REGION

W.P. No. 72-74-06/07

CONT. No. 85-36

W. O. No.

STR. SITE No. 44-213

HWY. No. 11 N

LOCATION Asterville Rd. Interchange

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry of
Transportation and
Communications

Ontario

*Maps are in attached
file.*

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 72-74-06/07

DIST #13

HWY #11 N

STR SITE 44-213

Astorville Rd. Interchange Overpass
4.8 km South of Hwy. #94

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FOUNDATION INVESTIGATION REPORT

For

North and Southbound Lanes
Astorville Rd. Interchange Overpass
4.8 km South of Hwy. #94
W.P. 72-74-06/07, Site: 44-213
Hwy. #11N; District #13, North Bay

INTRODUCTION

This report contains the results of a foundation investigation carried out at this location during the period of 79-08-07 to 22. The field work was carried out with a continuous flight auger machine mounted on a muskeg vehicle. The borings were advanced by employing 82 mm I.D. hollow stem augers and conventional wash-boring and diamond drilling techniques.

SITE DESCRIPTION

The site is located some 350 metres east of the existing junction of Astorville Road and Hwy. #11 along Astorville Rd. At this location, Astorville Rd. runs approximately parallel to Wistiwasung River and some 15 m north. The river is a 15 m wide, slow flowing and meandering waterway. The flood plain on the southern side of the river is about 30 m in width. This flood plain is covered by forest, underlain with dense brush and at certain areas with marshy areas. Immediately south of the flood plain, the land rises steeply in an irregular fashion. Rock outcrops are frequent on the slopes. On the northern side of Wistiwasung River the ground gradually rises to the north. The Astorville Rd. is a two lane paved roadway.

SUBSURFACE CONDITIONS

General

The predominant soil types encountered at this site are as follows: silty clay to clay, sand and gravel (with bouldery zones) and Gneiss bedrock. On the south side of Wistiwasung River a silt

layer was found to be between the silty clay to clay and the sand and gravel deposit. In addition, silty sand and organic silt zones were also observed at the location of B.H. #1A. The extent of the deposits vary from location to location, therefore any quotation in this regard within the text of this report could be misinterpreted. Consequently, references should be made to the Record of Borehole Sheets contained in the Appendix for boundary elevations of the different deposits. These sheets also contain the descriptions of the soil and bedrock types encountered and in summarized form, the results of all field and laboratory tests performed. The stratigraphical sections (A-A, B-B and C-C) shown on Drawing No. 727406/07-A are based on this information. This drawing also shows the locations and elevations of the borings. A description of the encountered main strata are given below.

Silty Clay to Clay (Stratified)

This deposit was encountered at every boring location. The thickness varies from 1.7 to 5 m. The material in the stratum consists of layers or zones of silty clay (of low to medium plasticity) and clay in somewhat random fashion. Irregular lenses and seams (up to 10 mm) of inorganic silt were also observed throughout the deposit. A plot of liquid limit versus plasticity index is shown on Figure 1 of the appendix.

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

	<u>Range</u>	<u>Average</u>
Natural Moisture Content (%)	18-73	46
Liquid Limit (%)	25-66	47
Plastic Limit (%)	11-22	17
Bulk Density (t/m^3)	1.59-1.97	1.90
Undrained Shear Strength (kPa)		
Unconfined	9.2-30.7	18.9
Field Vane	11.4-38.0	23.7
Sensitivity	2-10	-

Grain-size distribution curves are presented in an envelope form on Figure 2. The consistency of the overall deposit may be described as very soft to firm. For design purposes an undrained shear strength value (cu) of 17 kPa is recommended.

Silt Trace of Sand, Silty Clay Seams

Beneath the stratified silty clay and clay deposit a layer of silt was encountered at the south side of the river (B.H.'s #1A, 7 and 8). The material in the stratum consists of mainly inorganic silt with trace of sand and occasional seams of silty clay. The natural moisture content was found to be between 9 to 30%. Based on the obtained 'N' values (1 to 19 blows/0.3 m) the denseness may be described as very loose to compact.

Sand and Gravel, Some Silt and Trace of Clay and Bouldery Zones

Immediately below the above described strata (silty clay and silt) a granular type deposit consisting of sand and gravel with some silt and trace of clay was encountered. The natural moisture content is in the order of 10%. The obtained standard penetration tests 'N' values (1 to over 100 blows/0.3 m) indicate a very loose to very dense denseness. Below certain elevations (see Record of Borehole Sheets for Reference) cobbles and boulders were encountered. Diamond Drilling techniques were required to advance the borings through the bouldery zones. Grain size distribution curves are plotted in an envelope form on Figure 3 of the appendix.

Bedrock

The bedrock at this location as described by Mr. B.K. Glassford, Geologist consists of pink-grey coloured, hard to medium and coarse textured Gneiss. For bedrock surface elevations references should be made to the Record of Borehole Sheets or the Drawing No. 727406/07-A.

Groundwater Conditions

The following groundwater levels were observed during the field investigation:

<u>B.H. No.</u>	<u>Elevation</u>
1A	222.5
3A	221.8
4	222.6
5	223.2

<u>B.H. No.</u>	<u>Elevation</u>
6	223.3
7	222.4
8	222.5
10	222.2
12	223.2
13	222.0

The water level in Wistiwasing River was found to be at elevation 221.9 in March 1978 at the time of the original survey. Seasonal fluctuation of river water level is expected.

DISCUSSION AND RECOMMENDATIONS

It is proposed to build a twin two span structure at this location. The new Hwy. #11 (Line G) will overpass Astorville Road and Wistiwasing River at the following elevations:

S.B.L.

South Abutment El. 235.1

North Abutment El. 234.0

N.B.L.

South Abutment El. 235.9

North Abutment El. 234.7

The heights of the proposed approaches will vary between 9.5+ and 12.5+ m. The length of the north bound structure will be about 78 m while the south bound structure only 67 m as presently proposed. The piers will be located between the river and existing road.

The borings at the proposed footing locations indicate that the subsoil in general consists of very soft to firm clays to a maximum depth of about 6 m followed by silts and sands down to various depths. Frequent boulders and cobbles were also encountered within the lower portion of this latter deposit. In many instances, diamond drilling techniques were required to advance the borings. Granite Gneiss type bedrock was encountered between elevation 206 and elevation 219.

Structure Foundations

The encountered subsurface conditions do not favour spread footing type foundations within an economical level. Therefore, it is recommended that the footings (abutments and pier) for both structures be founded on end-bearing steel 'H' piles driven to refusal within the bouldery zone or to bedrock.

1600 x 53
74

1145

53
74

The following refusal levels to pile penetration are assumed:

	<u>N.B.L.</u>	<u>S.B.L.</u>
South Abutment	Elevation 214	Elevation 210 ✓
Centre Pier	Elevation 210 ✓	Elevation 210 212
North Abutment	Elevation 217	Elevation 218 ✓

12 BP @ 74

12 BP @ 53

GIVEN TO

F.C. @ ULS

180 T (1600 kN)

130 T (1150 kN)

C.S. @ L.S.

100 T (900 kN)

75 T (650/16 kN)

A. KOWSKI

81-03-24

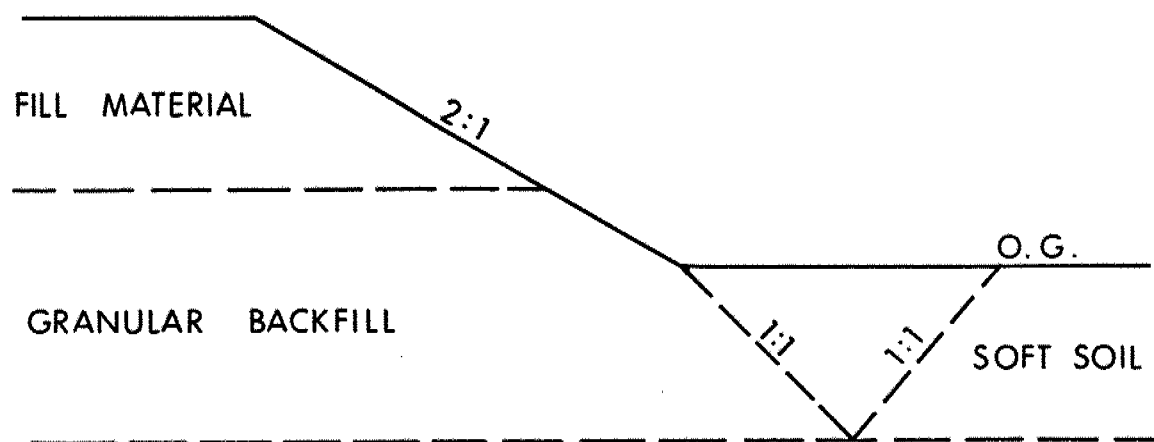
1487

Since it is not certain that the piles will reach the bedrock, we recommend that the design load should not exceed 885 kN if HP 310 x 110 steel 'H' piles with reinforced tips are to be used. The pile caps should be protected against frost action with a minimum of 1.8 m cover.

If excavations are below water level, a dewatering scheme will be required to form the pile caps in the dry.

Approaches Embankments

The shear strength of encountered very soft to firm silty clay and clay is such that it would not support fills more than 3 m without berms. In order to achieve the proposed profile grade up to 13.5 m high fills will be required. Consequently, the construction of series of berms will be needed in both the forward and the transverse directions. This requirement in our opinion is rather uneconomical (a much longer structure(s), additional property, excess amount of fill material). The best solution appears to be the removal of the soft soil to its full horizontal and vertical extent within the approaches. It is recommended that the sub-excavation be carried out as illustrated below.



The bottom of the soft soil varies between elevation 218 and elevation 220 at the boring locations. The limit of the sub-excavation should be determined by the Regional Geotechnical Section. The sub-excavation should be backfilled fully with granular type material.

This granular type backfill should extend for a minimum distance of 0.7 m over the observed high river water level at the south approaches. The remainder of the fill should consist of well compacted

acceptable material. No bouldery material should be placed at locations where piles have to be driven. It is recommended that this portion of the fill contains sizes larger than 75 mm.

2:1 forward and side slopes are recommended for the approaches.

OTHER CONSIDERATIONS

A temporary roadway protection will be required for Astorville Road during construction.

In order to estimate the earth pressures on the abutment walls, the following values are recommended:

Unit Weight of Granular Backfill: 21.2 kN/m^3
Coefficient of Active Earth Pressure: $K_a = 0.35$
Coefficient of Earth Pressure at Rest: $K_o = 0.50$

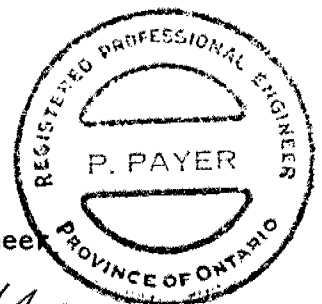
A suitable drainage system should be provided to relieve the build-up of excess hydrostatic pressure behind the abutment walls.

Any previously existed building foundations and driveways should be removed within the footing locations.

MISCELLANEOUS

The field work for this project was supervised by Mr. H. Szymanski and Mr. P.R. Karpol. This report was written by Mr. P. Payer and reviewed by Mr. K.G. Selby. The equipment used was owned and operated by Master Soil Investigation Ltd.

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



September 2, 1980

APPENDIX



METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 173.2; E 315 888.0 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Cone Test COMPILED BY PRK
DATUM Geodetic DATE 1979 08 13 CHECKED BY _____

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					
223.4	Ground Level												
0.0													

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 1A

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 168.0; E 315 893.1 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing, B1-Cone COMPILED BY PRK
DATUM Geodetic DATE 1989 08 13 & 14 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
223.4	Ground Level																
0.0	Silty Sand		1	SS	9												
	Trace of Clay																
221.4	Loose		2	SS	8												0 73 25 2
2.0	Organic Silt		3	SS	1												
220.5	Very Soft																
2.9	Silty Clay to Clay (Stratified)		4	SS	1/												
218.8	Very Soft to Soft		5	TW	PM												
			6	SS	PM												
4.6	Silt		7	TW	PM												
	Occasional Seams of Silty Clay, Trace of Sand		8	SS	1/												
	Very Loose to Loose		9	SS	5												
			10	SS	9												
215.2			11	SS	7												0 5.93 2
8.2	Sand & Gravel																
	Some Silt		12	SS	16												35 48 17
	Trace of Clay																
	Compact		13	SS	21												
	Boulders		14	RC													
			15	BXL													
			16	BXL													
			17	RC													
			18	BXL													
			19	BXL													
			20	BXL													
			21	RC	100% BXL REC												
206.0																	
17.4	Gneiss - Bedrock																
204.6	Sound																
18.8	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 - 5 (%) STRAIN AT FAILURE
10

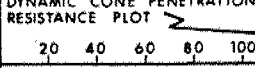
OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 2

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 162.8; E 315 898.4 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Cone Test COMPILED BY PRK
DATUM Geodetic DATE 1979 08 13 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80					
223.4 0.0	Ground Level															
210.6 12.8	End of Cone Test															

+³, x⁵: Numbers refer to Sensitivity

20
15
10

5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 203.8; E 315 901.2 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Cone Test COMPILED BY RS
DATUM Geodetic DATE 1979 08 17 CHECKED BY _____

[illegible]

+3, x⁵: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 3A

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 201.7; E 315 903.5 ORIGINATED BY HS
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing COMPILED BY HS
DATUM Geodetic DATE 1979 08 17 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
222.7	Ground Level																
0.0	Silty Clay to Clay (Stratified) Occasional Seams of Silt Soft to Firm		1	SS	5		222										
			2	SS	5												
			3	SS	-		220										
219.0			4	TW	PM												
3.7	Sand & Gravel Some Silt Trace of Clay Loose to Compact		5	SS	6												
			6	SS	23		218										
			7	SS	28												
			8	SS	11		216										
			9	SS	29												
			10	SS	20												
			11	SS	138		214										
			12	RC													
212.1			12A	BXL		0.20 m											
10.6	Gneiss - Bedrock		12B	RC	100%		212										
211.5				BXL	REC												
11.2	End of Borehole																

+³, *⁵: Numbers refer to
Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 195.8; E 315 913.2 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY HS
DATUM Geodetic DATE 1979 08 17 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
223.4	Ground Level													
0.0	Clayey Silt to Clay (Stratified) With Occasional Seams of Silt Very Soft to Firm		1	SS	5								1.97	0 0 36 64 0 6 54 40
			2	TW	PH									
			3	SS	-									
			4	SS	-									
218.8			5	TW	PM									
4.6	End of Borehole													
212.1														
11.3	End of Cone Test													

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 5

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 235.0; E 315 9 14.2 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing & Cone Test COMPILED BY PRK
DATUM Geodetic DATE 1979 08 08 to 09 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
224.3	Ground Level													
0.0	Silty Clay to Clay (Stratified) With Seams of Silt Very Soft to Firm		1	SS	9		224							
			2	SS	5		222						1.68	0 1 44 54
221.3			3	TW	PM									
3.0	Compact to Very Dense		4	SS	3/	0.15 m	220							28 60 12
			5	SS	11									
			6	SS	70	0.10 m								25 61 14
	Cobbles and Boulders		7	SS	27/	0.22 m	218							25 54 21
			8	SS	108/	0.10 m								
			9	SS	100/	0.15 m	216							31 67 9
			10	SS	100/	0.80 m								
			11	SS	100/	0.15 m	214							51 40 9
			12	RC										
			13	BXL										
			14	BXL										
			15	SS	112/	0.08 m	212							
			16	RC										
			17	BXL										
			18	SS	120/	0.13 m	210							19 55 26
210.0														
14.3	Gneiss - Bedrock (Shattered)		19	RC	100X									
208.9				BXL	REC									
15.4	End of Borehole													

+3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 6

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 223.7; E 315 925.7 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing & Cone Test COMPILED BY PRK
DATUM Geodetic DATE 1979 08 07 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
224.4	Ground Level																
0.0	Silty Clay to Clay (Stratified) Very Soft to Firm		1	SS	10		224										
			2	SS	9		222										
			3	SS	1												
220.7			4	SS	0												
3.7	Sand & Gravel Some Silt Trace of Clay and Occasional Boulders Loose to Very Dense		5	TW	PM		220										
			6	SS	8												
			7	SS	76												
			8	SS	150/	0.28 m	218										
			9	RC													
216.3			10	SS	170/	0.28 m											
8.1	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 7

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 137.2; E 315 917.1 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing & Cone Test COMPILED BY BS
DATUM Geodetic DATE 1979 08 15 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION [%] GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								20 40 60 80 100										
223.3	Ground Level							○ UNCONFINED	+ FIELD VANE									
0.0	Silty Clay to Clay Very Soft to Firm (Stratified)		1	SS	15		222							0 68 32				
			2	SS	9		220								0 8 87 5			
			3	SS	0													
			4	TW	PM													
219.5	Silt Occasional Clayey Silt Seams, Trace of Sand Loose to Compact		5	TW	PM			218										
3.8			6	SS	6													
217.5			7	SS	19													
5.8	Sand & Gravel Some Silt and Boulders Compact to Very Dense		8	SS	517		0.18 m Bouncing	216							31 53 16			
			9	RC BX														
			10	SS	28											44 46 10		
213.9	Gneiss - Bedrock							214										
9.4			11	RC BXL REC														
212.4	End of Borehole																	
10.9																		

+3, x5: Numbers refer to
Sensitivity



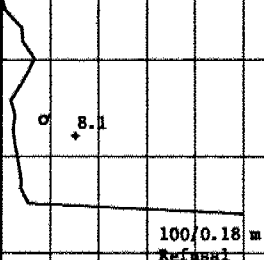


20
15
10
5
0
5
10
15
20
(%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 8

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 126.5; E 315 927.7 ORIGINATED BY FRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY BS
DATUM Geodetic DATE 1979 08 13 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
223.3	Ground Level							20 40 60 80 100							
0.0	Clayey Silt to Clay (Stratified) Very Soft to Soft		1	SS	10							1.62	0 3 40 57		
2			SS	1											
3			TW	PM											
4			SS	3											
219.5			218.9	5	SS									0	
3.8	Silt, Very Loose		6	RC BXL	100% REC		100/0.18 m Refusal								
4.4	Gneiss - Bedrock Sound														
217.7															
5.6	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

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



METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 172.2; E 315 932.7 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Cone Test COMPILED BY HS
DATUM Geodetic DATE 1979 08 17 CHECKED BY _____

[illegible]

+3, x5: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 10

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 161.1; E 315 944.0 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing & Cone Test COMPILED BY HS
DATUM Geodetic DATE 1979 08 16 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	WATER CONTENT (%)	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						
222.9	Ground Level																	
0.0	Silty Clay to Clay (Stratified) Trace of Sand Very Soft to Soft		1	SS	5		222										1.63	
			2	SS	0		220											0 9 91
			3	TW	FM													
219.1			4	SS	0													
3.8	Sand & Gravel Some Silt Trace of Clay Compact Occasional Boulders		5	TW	FM													13 27 59 1
			6	SS	20		218											37 48 15
			7	SS	11		216											37 47 -16
			8	SS	12													
			8A	SS	13		214											34 53 13
			9	SS	24													5 90 5
			10	SS	30													
			11	SS	33/	0.15 m	212											
							210											
			12	RC														
			13	RC														
207.7			14	RC			208											
15.2	Gneiss - Bedrock		15	RC	95% REC													
206.7				BX														
16.2	End of Borehole																	

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

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 11

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 207.2; E 315 948.3 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Cone Test COMPILED BY BS
DATUM Geodetic DATE 1979 08 09 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
224.6	Ground Level									
0.0										
217.8										
6.8	End of Cone Test									

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 12

METRIC

W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 195.1; E 315 960.7 ORIGINATED BY PRK
DIST 13 HWY 11 Line 'G' BOREHOLE TYPE Hollow Stem Auger, BX Casing & Cone Test COMPILED BY HS
DATUM Geodetic DATE 1979 08 09 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
224.4	Ground Level																
0.0	Silty Clay to Clay (Stratified) Trace of Sand Soft to Firm		1	SS	11		224										
			2	SS	7		222										
			3	TW	PM												
			4	SS	2												
220.4	Sand & Gravel Traces of Silt and Clay Boulders Very Dense		5	SS	84		220										
4.0			6	BC EXL													
218.0			7	SS	64	0.15 m											
6.4	End of Borehole																

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 13

METRIC

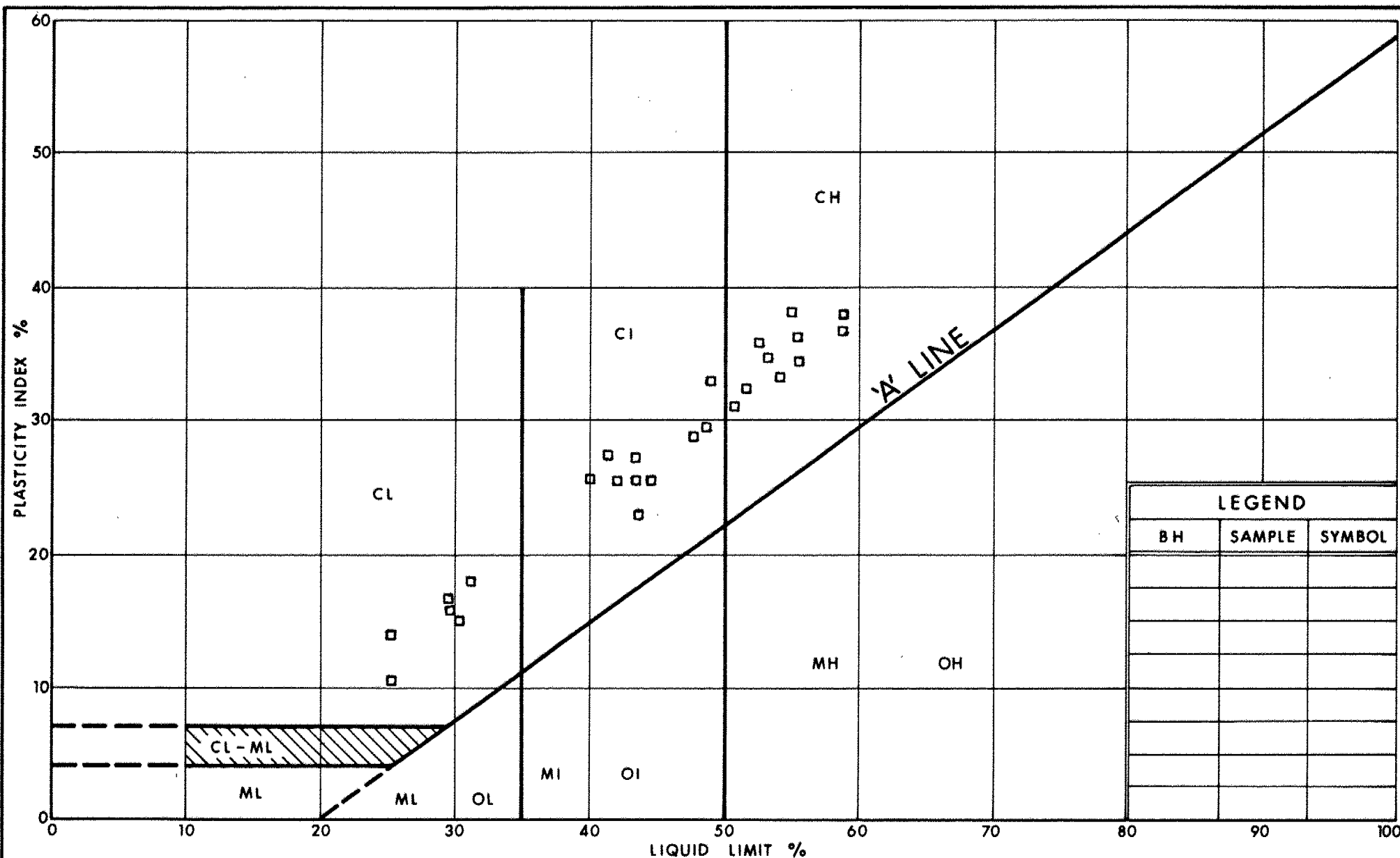
W P 72-74-06 & 07 LOCATION Co-ords. N 5 117 183.6; E 315 926.0 ORIGINATED BY HS
DIST 13 HWY 11 BOREHOLE TYPE Hollow Stem Auger, BX Casing & Cone Test COMPILED BY HS
DATUM Geodetic DATE 1979 08 21 to 22 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ t/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
222.8	Ground Level													
0.0	Silty Clay to Clay (Stratified) Some Sand Very Soft to Firm		1	SS	10		222						1.73	0 0 41 59
			2	SS	6		220							0 19 26 55
			3	TW	PH									
			4	TW	PH									
			5	SS	0									
217.9			6	TW	PM		218							
4.9	Sandy Silt to Silty Sand		7	SS	8									1 46 52 1
	Trace of Gravel and Clay Loose		8	SS	4									
215.4			9	SS	9		216							17 57 22 4
7.4	Sand and Gravel Some Silt Trace of Clay Very Loose to Dense		10	SS	31		214							34 47 17 2
			11	SS	18									
			12	SS	2		212							
			12A	SS	1									
			13	BXL			210							
	Boulders		13A	BXL										
			14	SS	181		208							
			15	BXL										
206.5														
206.0	Gneiss-Assumed Bedrock		16	BXL										
16.8	End of Borehole													

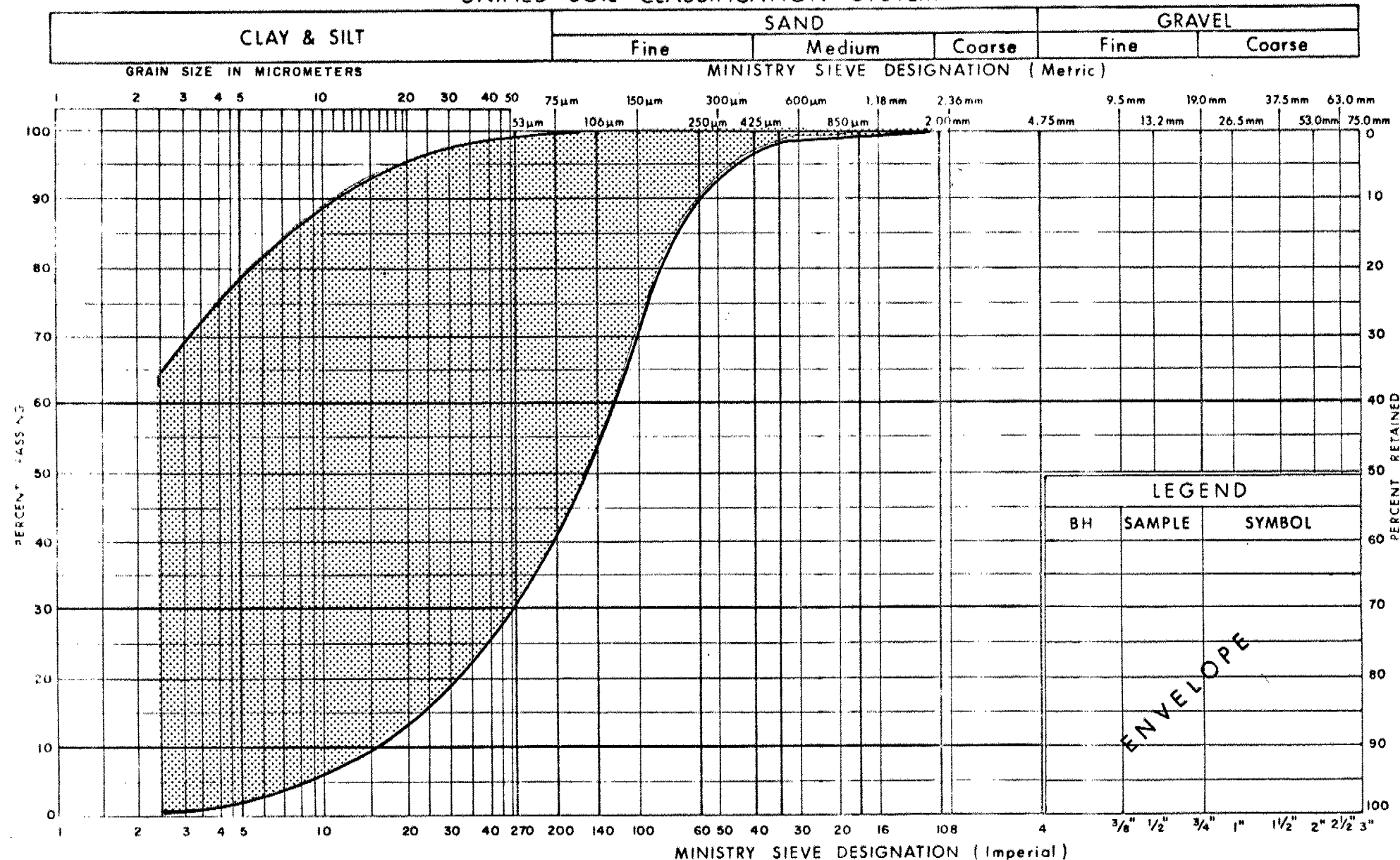
+³, x⁵: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



UNIFIED SOIL CLASSIFICATION SYSTEM



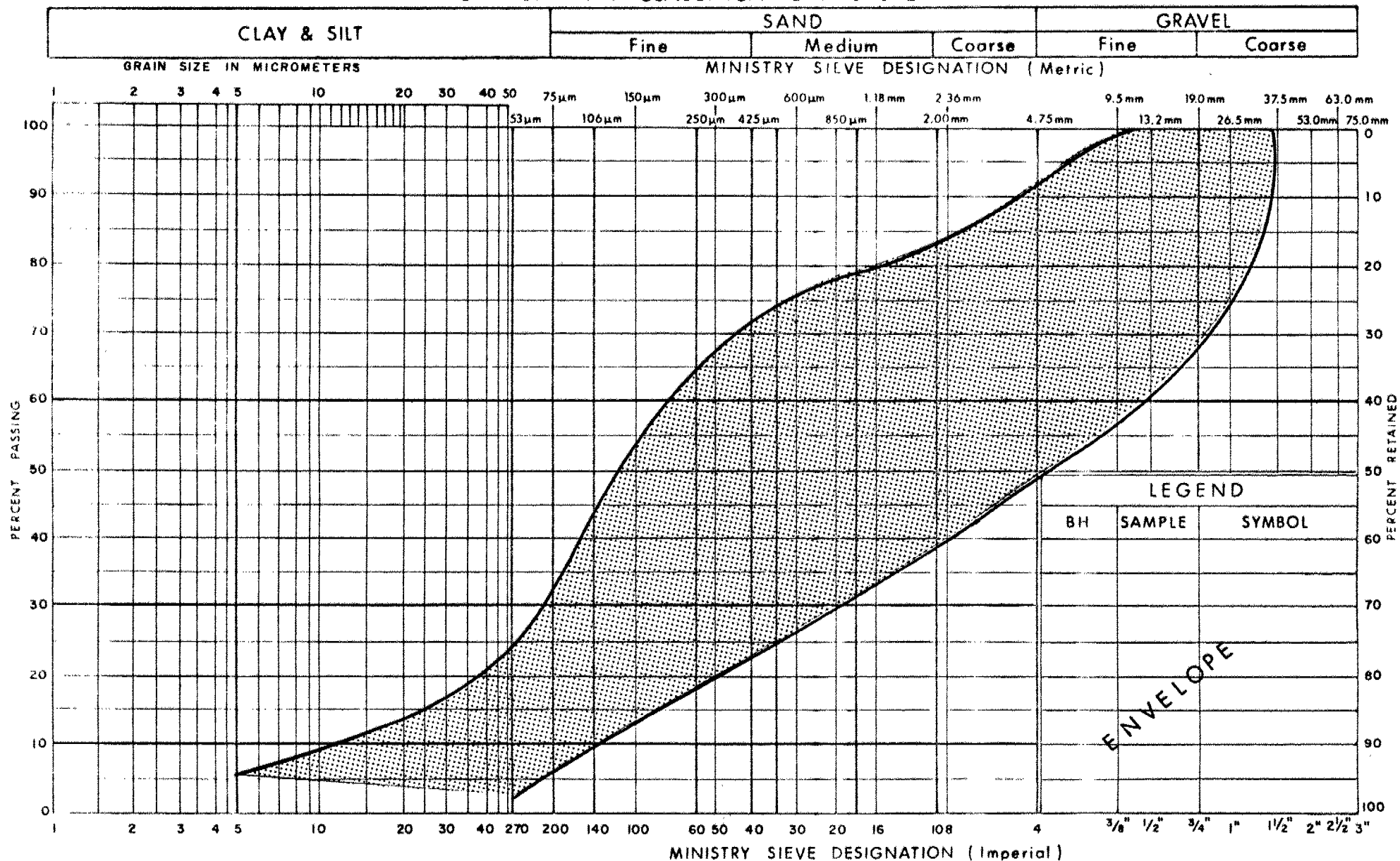
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAY (STRATIFIED)

FIG No 2

W P 72-74-06/07

UNIFIED SOIL CLASSIFICATION SYSTEM

Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SAND & GRAVEL
SOME SILT TRACE OF CLAY

FIG No	3
W P	72-74-06/07

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

MECHANICAL PROPERTIES OF SOIL

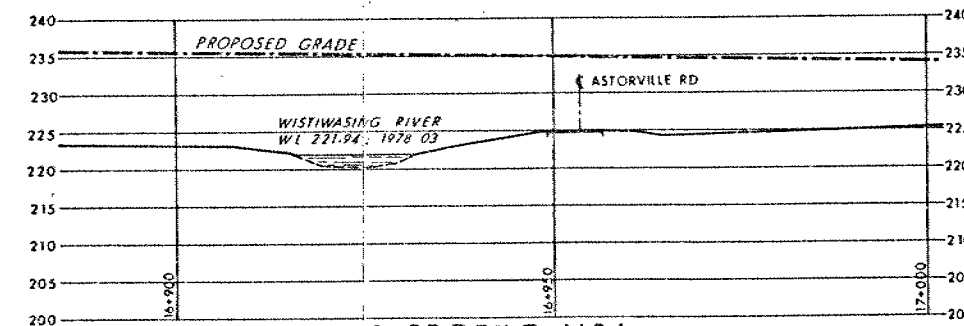
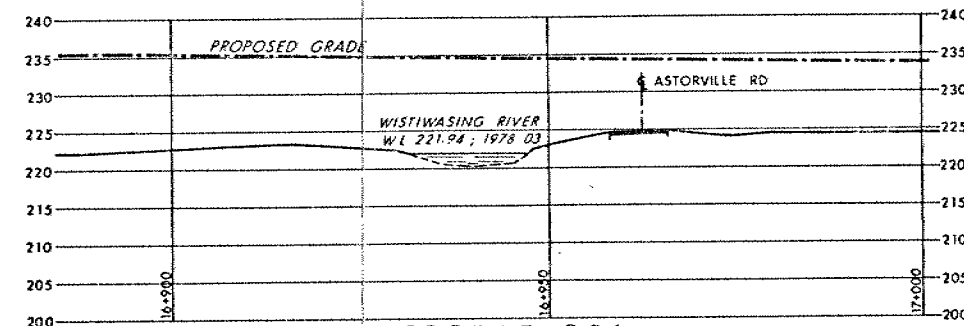
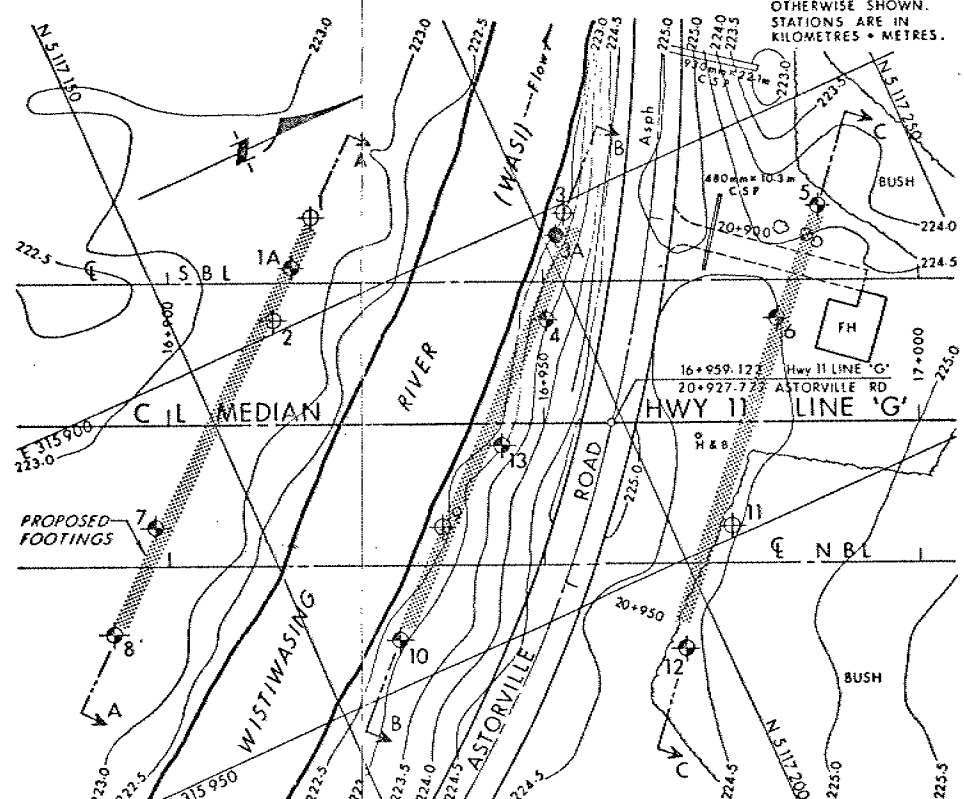
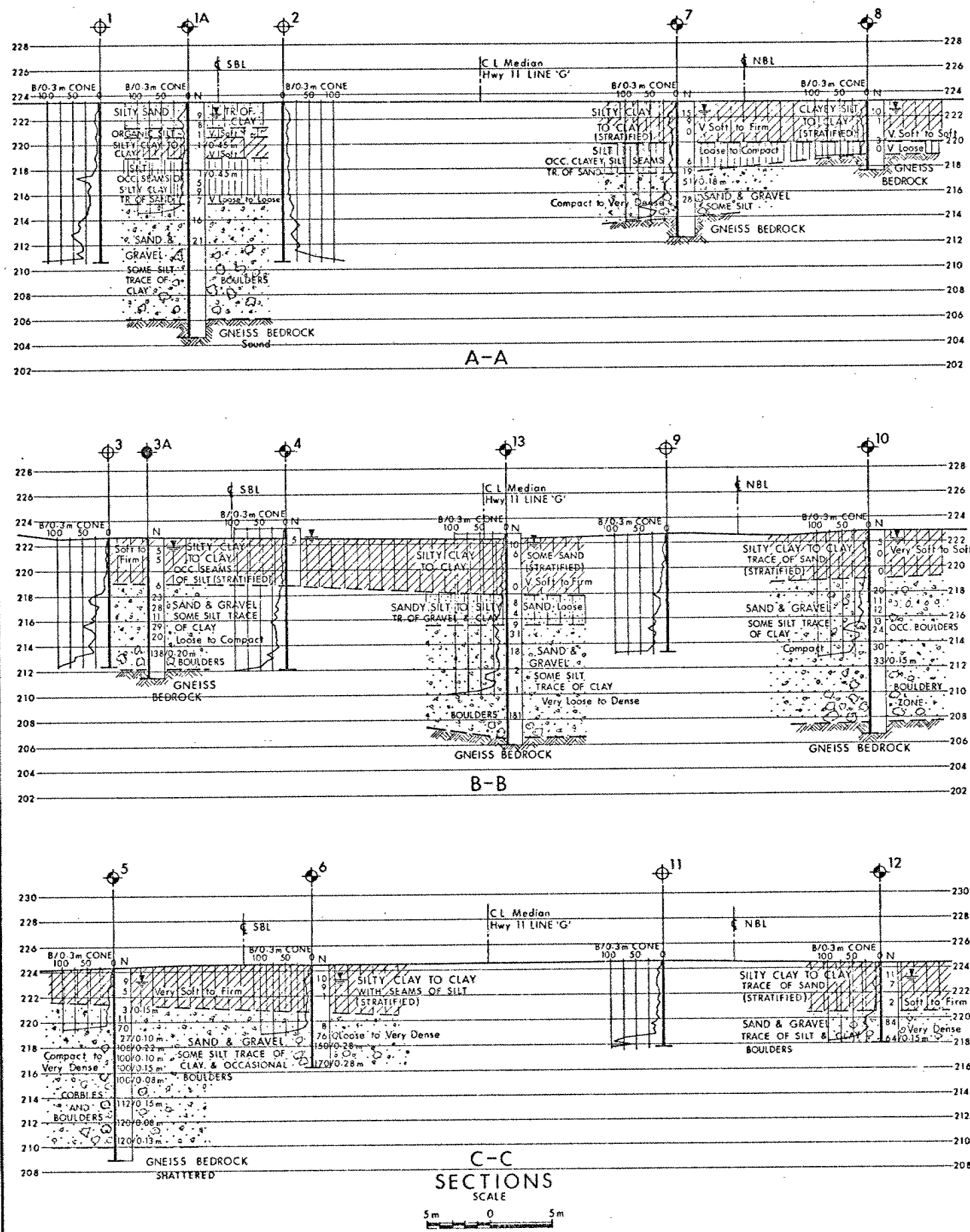
m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

STRESS AND STRAIN

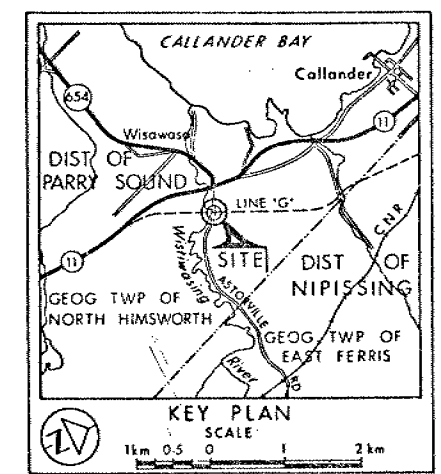
u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{\min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{\max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m^3	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						



CONT No
WP No 72-74-06/07
ASTORVILLE RD & WISTWASING
RIVER & HWY 11 OVERPASS
BORE HOLE LOCATIONS & SOIL STRATA



- LEGEND**
- Bore Hole
 - Dynamic Cone Penetration Test (Cone)
 - Bore Hole & Cone
 - N Blows/0.3m (Std Pen Test, 475 J/blow)
 - CONE Blows/0.3m (60° Cone, 475 J/blow)
 - WL at time of investigation 1979 08

No	ELEVATION	CO ORDINATES NORTH	EAST
1	223.4	5117 173.2	315 888.0
1A	223.4	5117 168.0	315 893.1
2	223.4	5117 162.8	315 898.4
3	222.7	5117 203.8	315 901.2
3A	222.7	5117 201.7	315 903.5
4	223.4	5117 195.8	315 913.2
5	224.3	5117 235.0	315 914.2
6	224.4	5117 223.7	315 925.7
7	223.3	5117 137.2	315 917.1
8	223.3	5117 126.5	315 927.7
9	222.8	5117 172.2	315 932.7
10	222.9	5117 161.1	315 944.0
11	224.6	5117 207.2	315 948.3
12	224.4	5117 195.1	315 960.7
13	222.8	5117 183.6	315 926.0

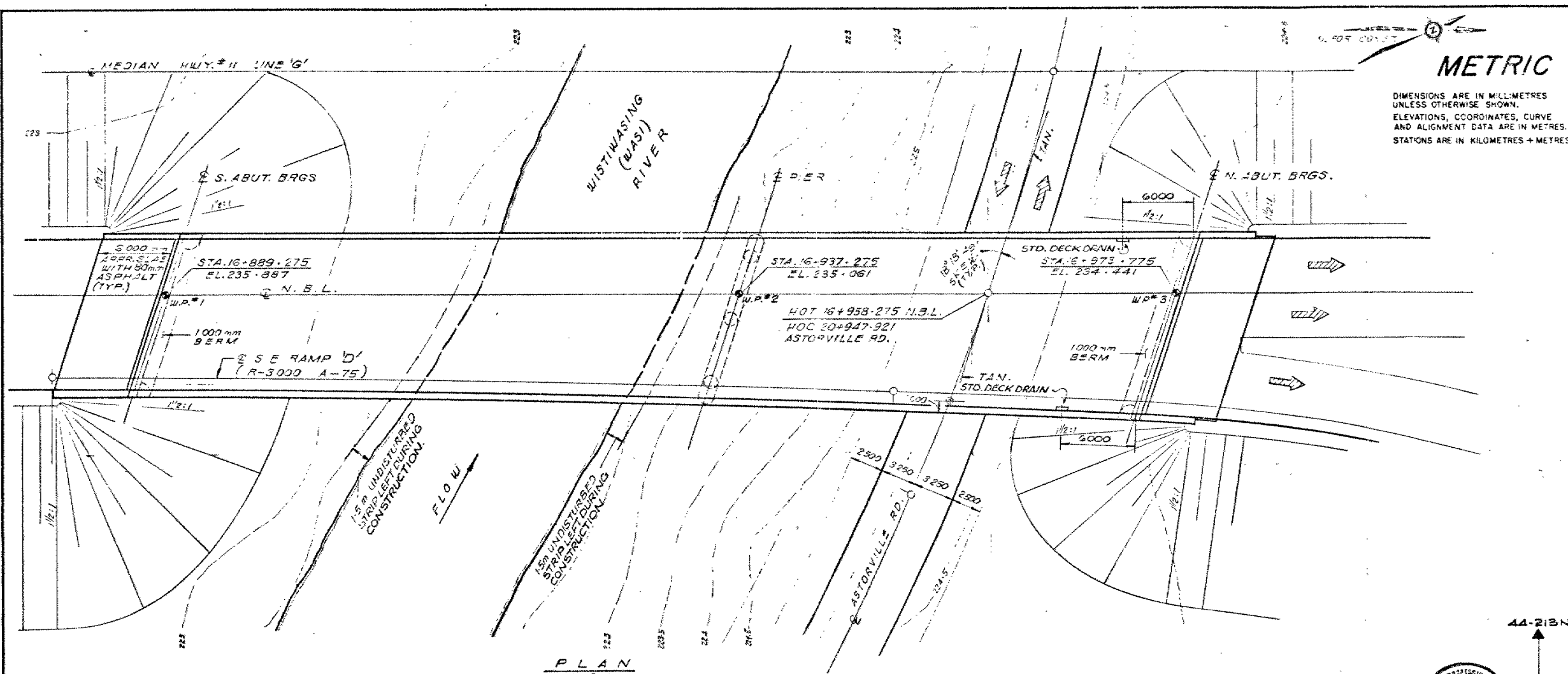
NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 311-45

HWY No 11 LINE 'G'	DIST 13
SUBM'D PP CHECKED	DATE 80 09 03
DRAWN BY CHECKED	APPROVED

DWG 727406/07-A



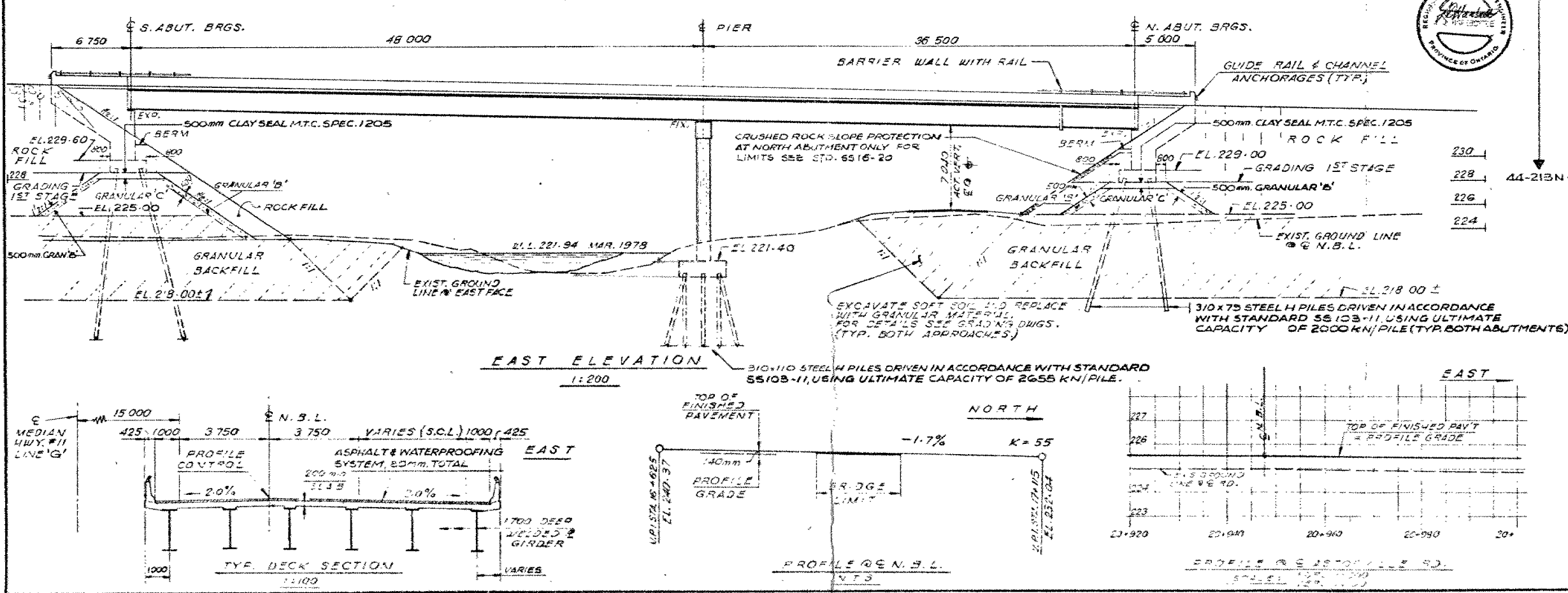
METRIC

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

DISTRICT No.13		SHEET
CONT No		
WP No 72-74-06		
ASTORVILLE ROAD INTERCHANGE (N.B.L.) GENERAL ARRANGEMENT		
NISBET LETHAM LIMITED CONSULTING ENGINEERS		

- GENERAL NOTES:**
- CLASS OF CONCRETE:**
 PIER, ABUTMENTS & WINGWALLS — 30 MPa
 DECK AND BARRIER WALLS — 30 MPa
 REMAINDER — 20 MPa
- REINFORCING STEEL:** GRADE 400
 BAR MARK WITH SUFFIX C SHALL BE
 COATED BAR.
- CLEAR COVER TO REINFORCING STEEL:**
 FOOTINGS — 75 mm.
 ABUTMENTS & PIERS — 50 mm.
 DECK TOP — 50 mm.
 DECK BOTTOM — 40 mm.
 APPROACH SLABS — 50 mm.
 AND/OR AS NOTED ON DRAWINGS.
- CONSTRUCTION NOTES:**
 THE CONTRACTOR SHALL FINISH THE BEARING
 SEATS DEAD LEVEL TO THE SPECIFIED
 ELEVATIONS TO A TOLERANCE OF ±3 mm.
 NO CONCRETE SHALL BE PLACED ABOVE
 THE ABUTMENT BEARING SEATS UNTIL THE
 CONCRETE IN THE DECK HAS BEEN PLACED.
 TO ACHIEVE THE MINIMUM CLEAR COVER OF
 50 mm. SPECIFIED AT TOP OF DECK, THE
 TOP LAYER OF REINFORCEMENT SHALL
 BE PLACED PRIOR TO CONCRETING WITH
 A CLEAR COVER OF 65 ± 15 mm. TOLERANCE.

- LIST OF DRAWINGS:**
- 44-213N-1. GENERAL ARRANGEMENT.
 2. BOREHOLE LOCATIONS & SOIL STRATA.
 3. FOOTING LAYOUT.
 4. FOOTING REINFORCEMENT.
 5. NORTH ABUTMENT.
 6. SOUTH ABUTMENT.
 7. PIER.
 8. BEARINGS.
 9. GIRDER LAYOUT.
 10. STRUCTURAL STEEL DETAILS I.
 11. STRUCTURAL STEEL DETAILS II.
 12. DECK LAYOUT & SCREED ELEVATIONS.
 13. DECK REINFORCEMENT.
 14. BARRIER WALL WITH RAILING.
 15. RAILING FOR BARRIER WALL.
 16. 6000 mm. APPROACH SLAB.
 17. STANDARD DETAILS I.
 18. STANDARD DETAILS II.
 19. PILE DRIVING - STEAM & DIESEL HAMMERS.
 20. AS CONSTRUCTED ELEV & DIM.
 - 44-213N-21. BRIDGE DATE & SITE NUMBER DATA.



- CONCRETE QUANTITIES:**
 CONCRETE QUANTITIES ARE LISTED BELOW FOR
 THE APPROPRIATE CONCRETE LUMP SUM
 TENDER ITEMS.
1. CONCRETE IN PIER, ABUTMENTS AND WINGWALLS. — 397 m³
 2. CONCRETE IN DECK. — 260 m³
 3. CONCRETE IN BARRIER WALLS. — 40 m³
 4. CONCRETE IN APPROACH SLABS. — 42 m³

STRUCTURAL STEEL QUANTITY:

GRADE 350A	129.7 TONNE
GRADE 350AT	68.5 TONNE

BM 223.041
GEODETIC DATUM
 44 M N N FOOT
 OF 03 BULLS EIM
 73.5 RT 16+902.3

REVISIONS	DATE	BY	DESCRIPTION

NORTH FOR CONSTRUCTION 

LIST OF STEEL H-PILES				
LOCATION	TYPE	Nº REQ'D	LENGTH	REMARKS
SOUTH ABUT.	HP 310 x 79	20	16000	WITH DRIVING SHOES
PIER	HP 310 x 110	20	12000	
NORTH ABUT.	HP 310 x 79	17	12000	

NOTE: PILE LENGTHS SHOWN ARE THEORETICAL LENGTHS
BELOW CUT-OFF ELEVATIONS.

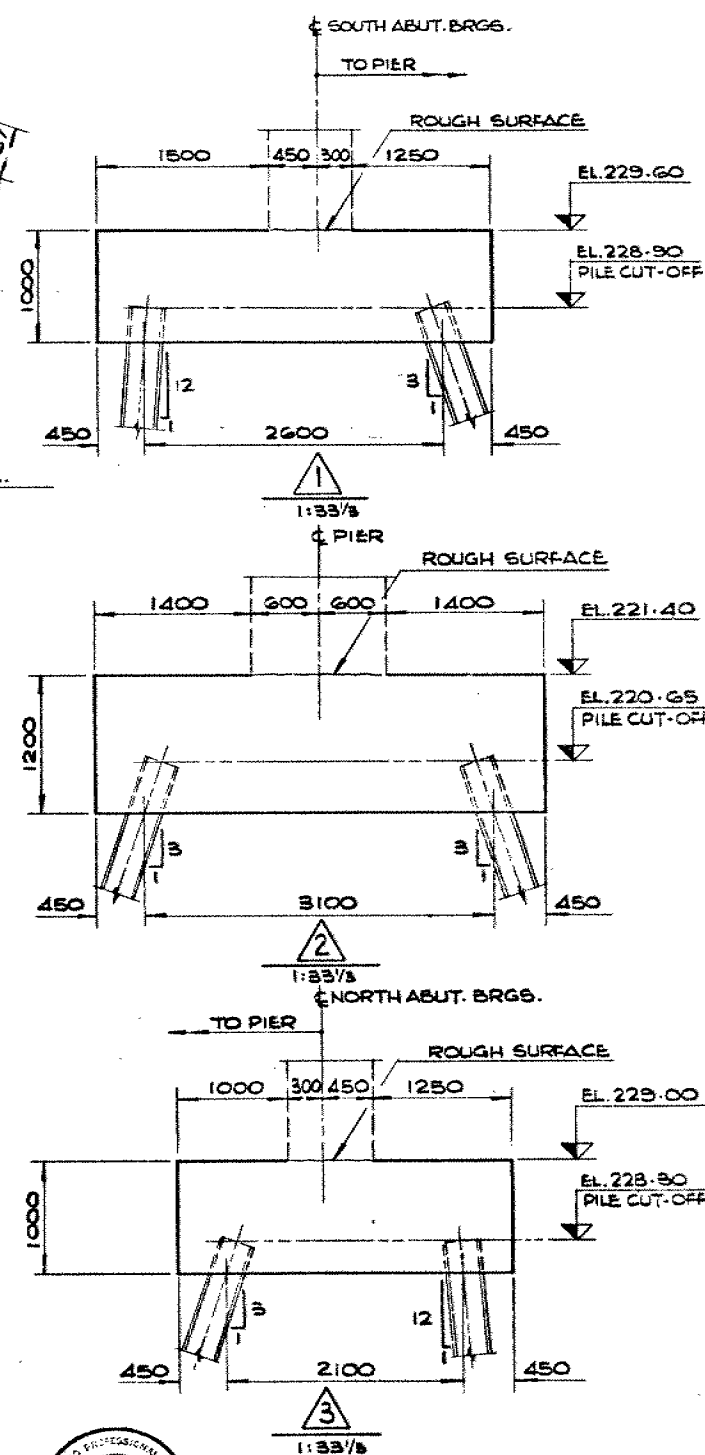
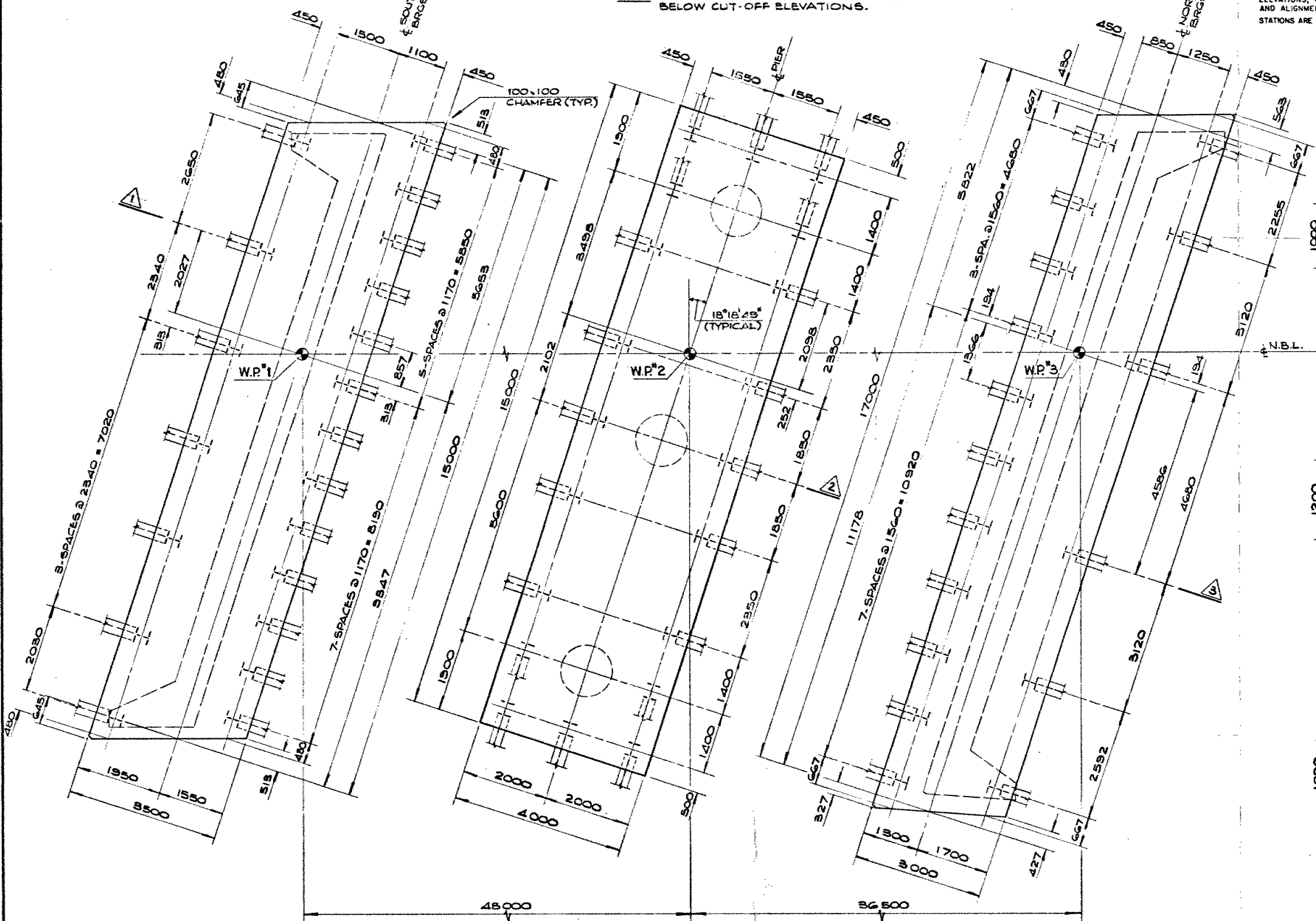
METRIC

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

DISTRICT No.13
CONT No
WP No 72-74-06

SHEET

N **NISBET LETHAM LIMITED**
CONSULTING ENGINEERS



FILE DESIGN DATA		
TYPE	LOAD AT SERVICEABILITY LIMIT STATES, TYPE II	FACTORED CAPACITY AT ULTIMATE LIMIT STATES
HPB10 x 79	335 kN	1145 kN
HPB10 x 110	885 kN	1600 kN

P L A N
1:50

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS						
	DATE	BY	DESCRIPTION			
1	DESIGN L.C.H.	CHECKG M.R.	LOADING	DOC-A-79	DATE MAY 18	
2	DRAWING R.P.	CHECKL J.H.	SITE NO 44-213N	DWG 5.		



METRIC

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

GENERAL NOTES:

CLASS OF CONCRETE:
PIER, ABUTMENTS & WINGWALLS — 30 MPa
DECK AND BARRIER WALLS — 30 MPa
REMAINDER — 20 MPa

REINFORCING STEEL: GRADE 400
BAR MARK WITH SUFFIX C SHALL BE COATED BAR.

CLEAR COVER TO REINFORCING STEEL:
FOOTINGS — 75 mm.
ABUTMENTS & PIERS — 50 mm.
DECK TOP — 50 mm.
DECK BOTTOM — 40 mm.
APPROACH SLABS — 50 mm.
AND/OR AS NOTED ON DRAWINGS.

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

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

TO ACHIEVE THE MINIMUM CLEAR COVER OF 50 mm, SPECIFIED AT TOP OF DECK, THE TOP LAYER OF REINFORCEMENT SHALL BE PLACED PRIOR TO CONCRETING, WITH A CLEAR COVER OF 65 ± 15 mm TOLERANCE.

LIST OF DRAWINGS:

1. GENERAL ARRANGEMENT.
2. BOREHOLE LOCATIONS & SOIL STRATA.
3. FOOTING LAYOUT.
4. FOOTING REINFORCEMENT.
5. NORTH ABUTMENT.
6. SOUTH ABUTMENT.
7. PIER.
8. BEARINGS.
9. GIRDER LAYOUT.
10. STRUCTURAL STEEL DETAILS I.
11. STRUCTURAL STEEL DETAILS II.
12. DECK LAYOUT & SCREED ELEVATIONS.
13. DECK REINFORCEMENT.
14. BARRIER WALL WITH RAILING.
15. RAILING FOR BARRIER WALL.
16. 6000 mm. APPROACH SLAB.
17. STANDARD DETAILS I.
18. STANDARD DETAILS II.
19. PILE DRIVING — STEAM & DIESEL HAMMERS.
20. AS CONSTRUCTED ELEV. & DIM.
- 44-2135-21. BRIDGE DATE & SITE NUMBER DATA.

CONCRETE QUANTITIES:

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEMS.

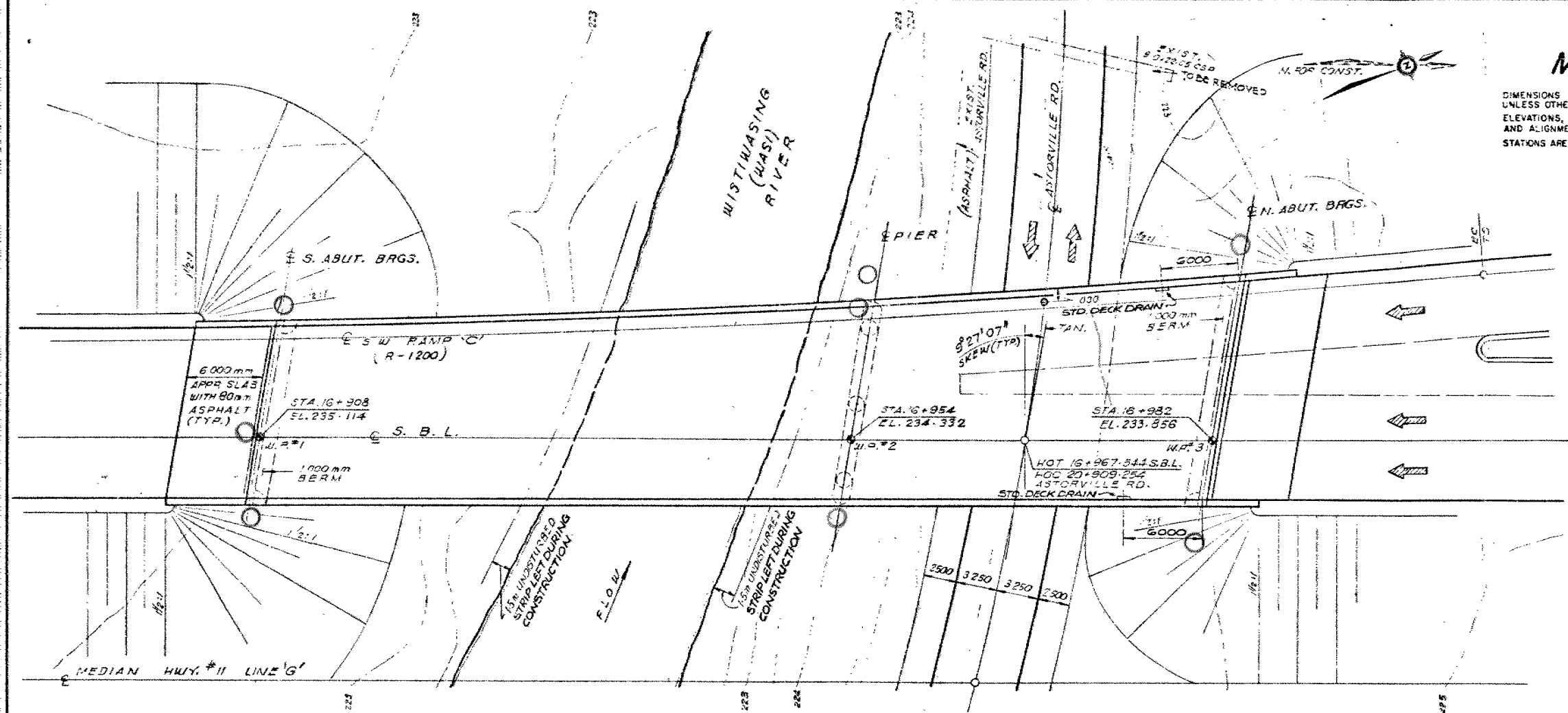
- | | |
|-----------------------------------------------|--------------------|
| 1. CONCRETE IN PIER, ABUTMENTS AND WINGWALLS. | 400 m ³ |
| 2. CONCRETE IN DECK | 247 m ³ |
| 3. CONCRETE IN BARRIER WALLS | 34 m ³ |
| 4. CONCRETE IN APPROACH SLABS | 47 m ³ |

STRUCTURAL STEEL QUANTITY:

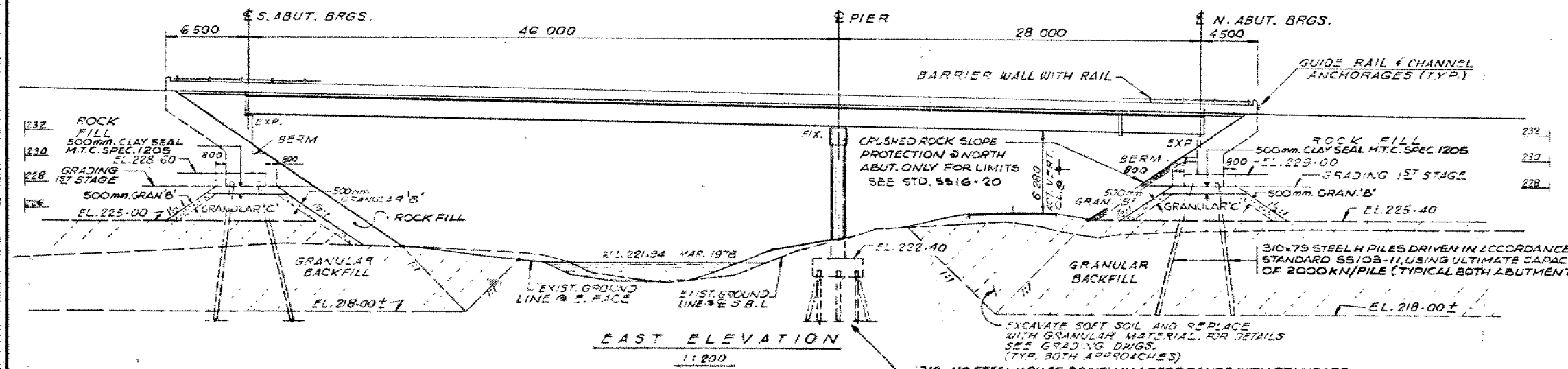
GRADE 350A	106.3 TONNE
GRADE 350AT	75.1 TONNE

BM 223.011
GEODETIC DATUM
N 4 W 14 N 9007
OF 0.3 BLSA11
73.5 RT 16+302.9

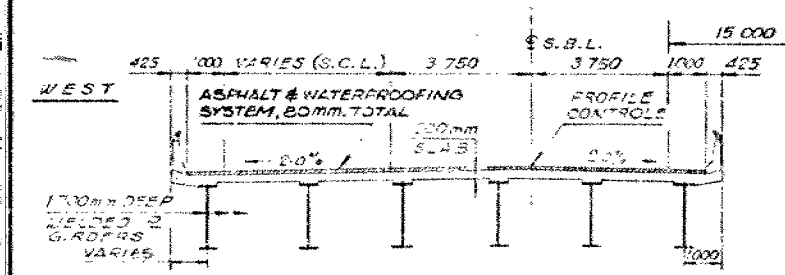
REVISIONS	DATE	BY	DESCRIPTION
DESIGN L.D.H.	CHECKED M.R.	LOADING M.P.C. & T.S.	CAT/MAT/21
DRAWING L.D.H.	CHECKED L.D.H.	SITE No 44-2135	SWG T.



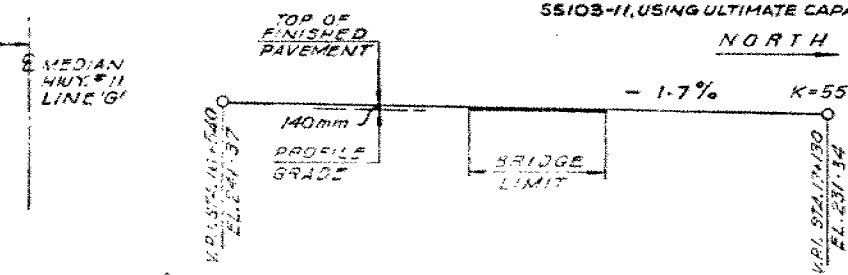
PLAN
1:200



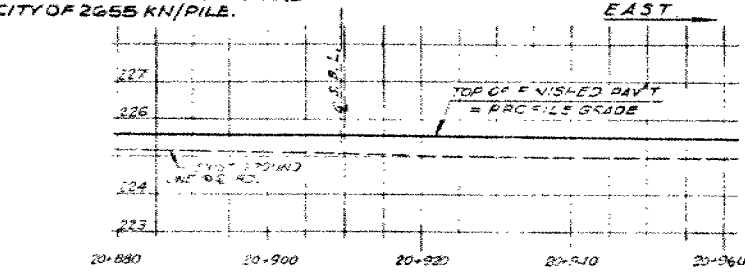
EAST ELEVATION
1:200



TYP. DECK SECTION
1:20



PROFILE OF S.B.L.



PROFILE @ ASTORVILLE RD.

PILE DESIGN DATA		
TYPE	LOAD AT SERVICEABILITY LIMIT STATES, TYPE II	FACTORED CAPACITY AT ULTIMATE LIMIT STATES
HP 310x79	285 kN	1149 kN
HP 310x110	285 kN	1600 kN

LIST OF STEEL H-PILES				
LOCATION	TYPE	Nº REQD.	LENGTH	REMARKS
SOUTH ABUT.	HP 310x79	20	13000	WITH DRIVING SHOES
PIER	HP 310x110	20	12500	
NORTH ABUT.	HP 310x79	19	12000	

NOTE: PILE LENGTHS SHOWN ARE THEORETICAL LENGTHS BELOW CUT-OFF ELEVATIONS.

METRIC

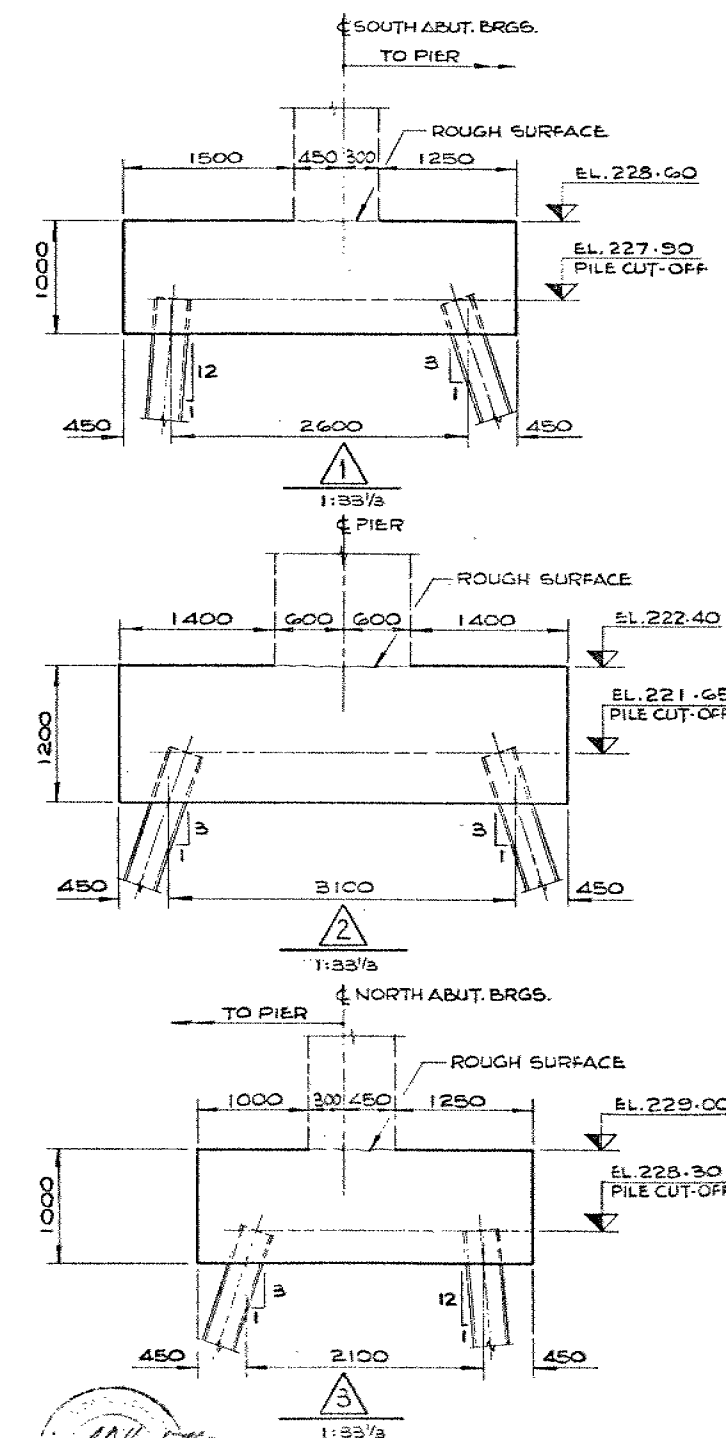
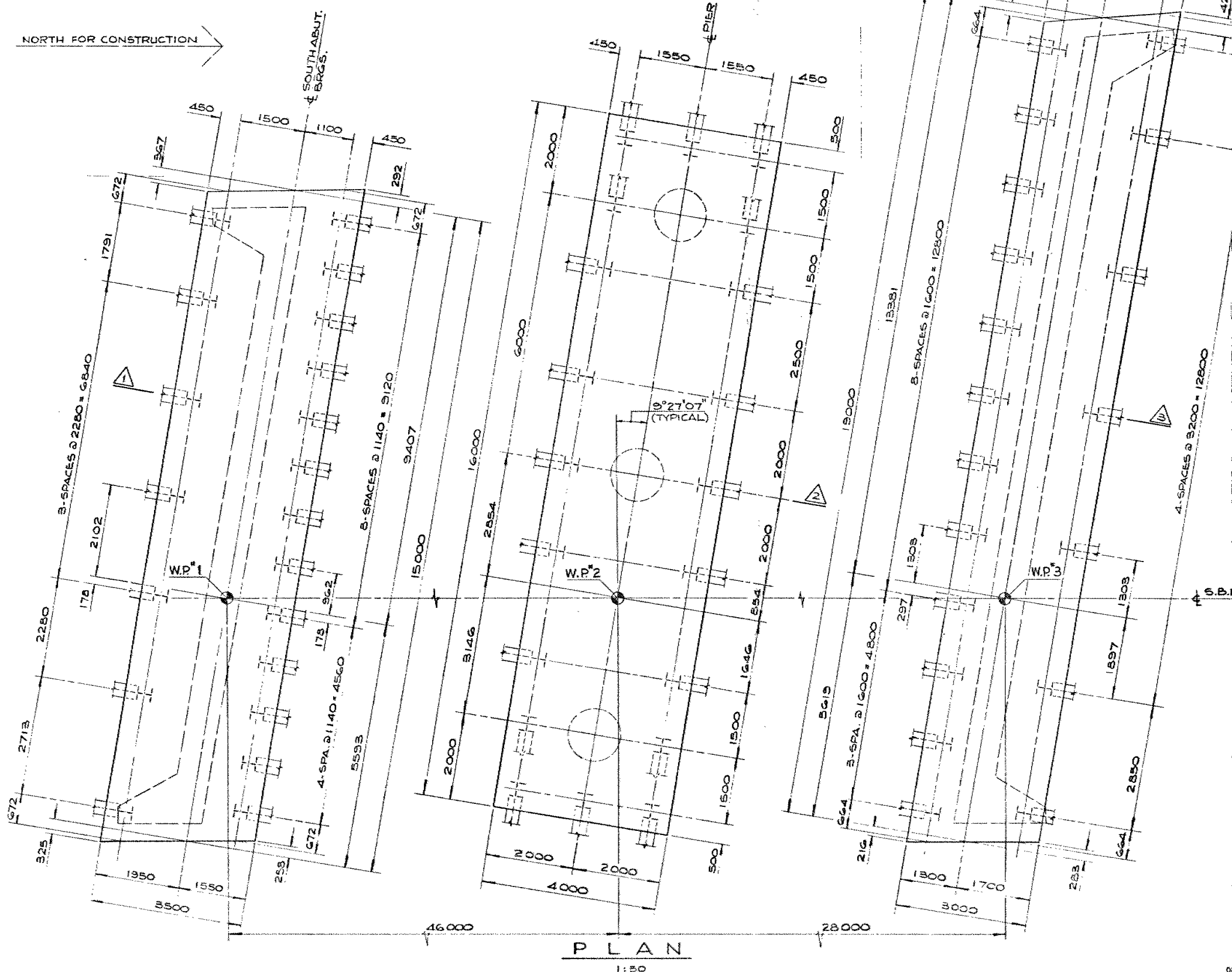
DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

DISTRICT No.13
CONT No
WP No 72-74-07

ASTORVILLE ROAD
INTERCHANGE(S.B.L.)
FOOTING LAYOUT

SHEET

NISBET LETHAM LIMITED
CONSULTING ENGINEERS



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN			
CHECK			
DRAWING			

memorandum



To: J. McDougall
Head, Geotechnical Section
Northern Region
North Bay

Date: 1984 03 07


Atten: E.W. Veritsky

RE: Sub-Excavation along Wistiwasí River
Highway #11N
W.P. 72-74-06/07

This is to confirm our verbal recommendations of 84 02 27.

- 1) The level of the sub-excavation base should not be higher than El. 219 on the south side of the river.
- 2) The water level in the excavation should not be below the level of the prevailing river water level (otherwise stability problems may occur).
- 3) Build silt barriers if required.

We have no further comments to offer on this subject.


P. Payer, P. Eng.
Foundations Engineer

PP/mmj

TEL CONVERSATION WITH E. VERITSKY (FEB. 27/84)

- 1.) BOTTOM OF SUB-EXC. EL. 219 (SOUTH SIDE)
- 2.) KEEP EXCAVATION FULL OF WATER TO THE LEVEL OF EXISTING RIVER WATER-LEVEL (NORTH & SOUTH SIDE)
- 3.) BUILD SILT BARRIERS IF REQUIRED.

memorandum

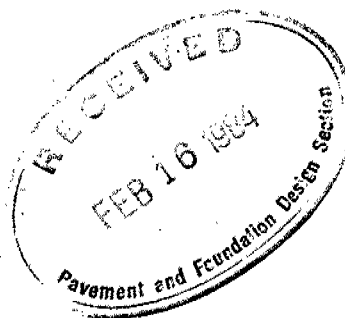


To: Mr. K. G. Selby
Sr. Foundations Engineer
Pavement & Foundation
Design Section
Central Building
DOWNSVIEW

Date: 84 02 15

Attention: Mr. P. Payer

FROM: Geotechnical Section
Northern Region



RE: WP 72-74-09, HWY 11
FROM 1.9 km SOUTH OF HWY 94 S'LY 4.6 km
DISTRICT 13, NORTH BAY

As discussed, this memorandum is submitted with respect to WP 72-74-06 and 07 concerning the interchange structures at Astorville Road, NBL and SBL associated with the above project. The options for doing the work at the proposed excavation to remove the soft clays and silts for the structure foundations and the approach embankments were discussed in the Northern Region because of the proximity to the river banks. This is a critical area environmentally especially on the south side where the limits of the excavation come very close to the river bank because of the meandering nature of the stream.

The main concern in the Region was the stability of the excavation near the river bank because of the depth of the excavation which is below the bottom of the streambed. The purpose of the excavation is to remove soft material and that area between the limits of the removal and the river may be affected if only a 1.5 m undisturbed strip remains.

Alternatives presented in the discussion consisted of the following:-


- 1) If the limits of the excavation cannot be changed then special excavation procedures may have to be detailed with a possible construction sequence. One consideration is removal in strips adjacent to the river. Backfill would be required simultaneously as the excavation progresses. Normal excavation can be completed outside a certain area.
- 2) With the award of the contract later this year another possibility is to excavate and backfill this area during the winter when freezing conditions are prevalent. This has some advantages including a low water level but associated with it are the hazards of winter conditions which may include settlements at a later date.

- 3) The other alternative which was discussed is altering the proposed limits of the excavation especially in the forward direction. This would keep the removal further away from the river and a wider undisturbed strip. Although the slopes were definitely required when discussed with you it could be an alternative. We realize that the 1:1 slope near the river may be steepened somewhat but this does make it more susceptible to sloughing.

Your comments with respect to these concerns are solicited. A scheme is required to satisfy the Environmental Group and at this time the completion of design is also a factor. A reply by 1982 02 23 would be appreciated. Please include your recommendations for a construction sequence if this is chosen.

To aid you in your considerations the following are attached:-

- i) A plan view showing the limits of the excavation and fills and their proximity to the banks of the stream.
- ii) Part of the profile prepared for the project indicating the area of concern.



E. W. Veritsky
Pavement Design &
Evaluation Officer

EWV/ap

Attach:

cc: D. F. Barnes
F. M. Adams

memorandum



To: Mr. A. Radkowski
Design Engineer
Structural Office
3501 Dufferin St., 4th Floor

Date: 83 01 27

From: Pavement & Foundation Design
Room 315, Central Building
Downsview, Ontario

Re: Review of Final Drawings
W.P. 72-74-06, Site 44-213N (N.B.L.)
Astorville Road Interchange Overpass
Hwy. 94, District 13

The submitted drawings and special provisions have been reviewed by this Section. Comments are as follows:

- all steel H piles are to be driven in accordance with M.T.C. Standards SS103-10 or SS103-11
- estimated refusal elevations of steel H piles are as follows:

South Abutment	214 m
Center Pier	207 m
North Abutment	205 m

D. H. Dundas

D.H. Dundas, P. Eng.
Project Foundations Engineer

DHD:syc

memorandum



To: Mr. C.S. Grebski
Head
Operating Section

Date: 82 07 08

From: Pavement & Foundation Design
Room 315, Central Building
Downsview, Ontario

Re: W.P. 72-74-06, Site 44-213N (N.B.L.)
W.P. 72-74-07, Site 44-213S (S.B.L.)
Astorsville Road Interchange Overpass
Hwy. 94, District 13

W.P. 72-74-07, Site 44-213S

The submitted drawings and special provisions have been reviewed by this section. Comments are as follows:

- all steel H piles are to be driven in accordance with M.T.C. standards SS103-10 or SS103-11
- estimated refusal elevations of steel H piles are as follows:

South Abutment	210 m
Center Pier	210 m
North Abutment	218 m

W.P. 72-74-06, Site 44-213N

Please send us $\frac{1}{2}$ size drawings for this W.P.

D. H. Dundas

D.H. Dundas
Project Foundations Engineer

For:

K.G. Selby
Senior Foundations Engineer

DHD/jb

Mr. A.E. McKim
Head, Operating Section
Structural Office

Pavement & Foundation Design Section
Room 313, Central Building

81 01 20

Astorville Road Interchange Structures
W.P. 72-74-06/07, Site 44-213 N/S
Highway 11, Dist. 13, North Bay

A review of the preliminary plans for the above listed structures over Astorville Road leads to the following comments.

The granular cores within the rockfill approaches should be constructed with a filter and clay seal as shown in the attached figure.

Driving of the steel H-piles should be controlled with SS 3-10/11 rather than being driven to refusal. The tip elevations given in the report are estimates of where the design capacity will be achieved. Due to the variable nature of the glacial till subsoil, large variations in pile lengths within the same pile cap may be anticipated. All pile tips should be reinforced with standard flange plates to prevent damage due to boulders in the subsoil.



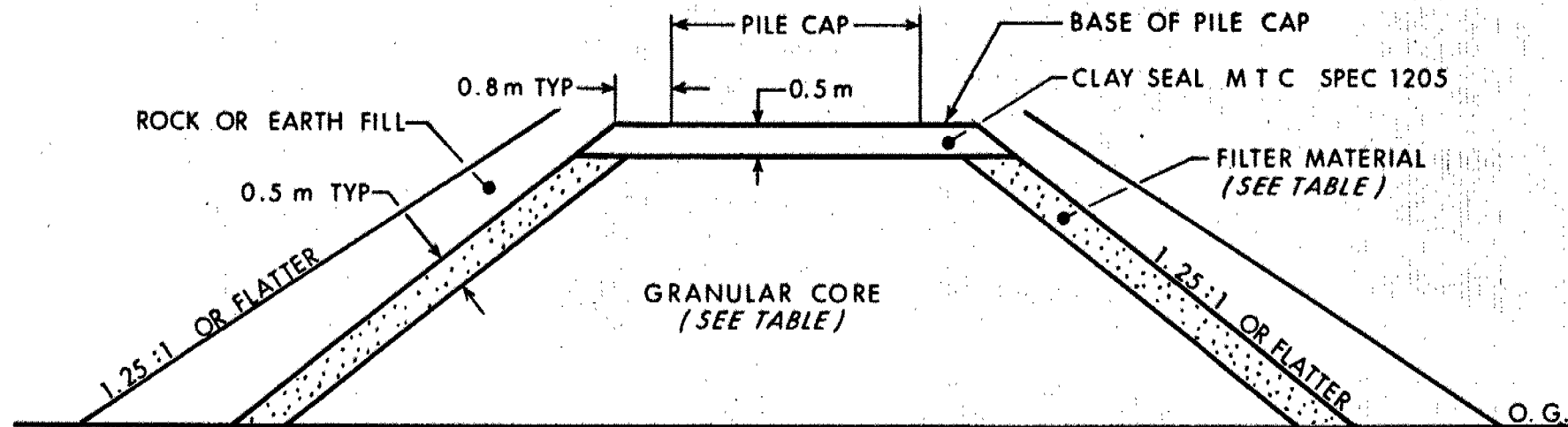
Peter J. Stuart
Foundations Engineer
For:
M. Devata
Senior Foundations Engineer

PJS:ea

Encl.

cc: G.J. Ricker

FILTER MATERIAL REQUIREMENTS	GRANULAR CORE COMPOSITION
NOT REQUIRED	GRAN 'A'
NOT REQUIRED	GRAN 'B'
GRAN 'A' or 'B'	GRAN 'C' MINUS STONES LARGER THAN 75 mm
DEPENDENT ON GRADATION OF CORE	OTHER GRANULAR MATERIAL



REQUIREMENTS FOR GRANULAR CORE

NT S

FIG 1



SUBGRADE CHECK FIELD SHEET

PAGE NO. 1
TWP. S. Himsworth

DATE Nov. 30 1979
W. P. NO. 72-74-09

16+895 20.00 LT CL

0 - 100	Blk Org
100 - 1.00	Sa Cl Lo Stiff
1.00 - 1.50	Sa Lo Fr Wat @ 100
1.50 - 3.50	M Cl Stiff Soft @ 2.10
3.50 - 7.00	F-VF Sa Lo (Unable to sample after 2.00 due to sloughing)
	Bldy @ 6.20
7.00	NFP Blds

VANE TEST (kPa)

16+895 20.00 LT CL

Depth	τ_f kPa	τ_r kPa	S.T.
2.40 - 2.70	27	2	14
3.10 - 2.40	51	3	17

Unable to push vane farther

HWY. NO. 11 LOCATION Callander Bypass

E. Richards
ENGINEER



SUBGRADE CHECK FIELD SHEET

2

PAGE NO. _____

S. HIMSWORTH

TWP. _____

Nov. 29

79

DATE _____ 19 _____

72-74-09

W. P. NO. _____

16+895 30.00 RT CL

0 - 0.50 Blk Org

0.50 - 1.50 Sa Cl Lo Stiff Fr Wat @ 600

1.50 - 2.00 M Sa Lo

2.00 - 3.50 M Cl Firm-Soft

3.50 - 3.70 Sa Lo Grly

VANE TEST

16+895 30.00 RT CL

Depth	Tf	Tu	S.T.
1.80 - 2.10	64	8	8
2.40 - 2.70	20	3	7
3.10 - 3.40	50	4	19

HWY. NO. 11 LOCATION Callander Bypass

E. Richards

ENGINEER



SUBGRADE CHECK FIELD SHEET

3

PAGE NO. _____

S. HIMSWORTH

TWP. _____

Nov. 29

79

DATE _____ 19 _____

72-74-09

W. P. NO. _____

16+895 30.00 LT CL

0 - 050

Blk Org

050 - 450

Sa Cl Lo Wet

450 - 1.70

F Sa Lo Wet Fr Wat @ 600

1.70 - 2.00

Sa Lo Grly Bldy

2.00 - 3.60

M Cl Firm-Stiff Soft @ 3.00 (unable to penetrate bldy layer
with vane)

3.60 - 8.10

F-VF Sa Lo (Unable to sample after 2.50 due to sloughing)

8.10

NFP BR

HWY. NO. 11 LOCATION Callander Bypass

E. Richards

ENGINEER



SUBGRADE CHECK FIELD SHEET

PAGE NO. 4
TWP. S. HIMSWORTH

DATE Nov. 29 19 79
W. P. NO. 72-74-09

16+880 30.00 RT CL

0 - 060 Blk Org
060 - 1.20 F Sa Lo Bldy Wet Fr Wat @ 300
1.20 NFP BR

16+895 20.00 RT CL

0 - 050 Blk Org
050 - 1.80 M Cl Stiff Fr Wat @ 300
1.80 - 2.10 M Sa Lo
2.10 - 2.70 M Cl Soft (Unable to sample after 2.00 due to sloughing)
2.70 - 3.70 F Sa Lo Cobb.
3.70 - 4.70 M Cl Soft
4.70 - 5.00 F Sa Lo
5.00 - 5.60 Sa Lo Bldy Grly
5.60 NFP BR

VANE TEST 16+895 20.00 RT CL

Depth	τ_f kPa	τ_u kPa	S.T.
4.30 - 4.60	67	13	5

HWY. NO. 11 LOCATION Callander Bypass

E. Richards
ENGINEER



SUBGRADE CHECK FIELD SHEET

5

PAGE NO. _____

S. Himsworth

TWP. _____

DATE Nov. 28 1979

W. P. NO. 72-74-09

16+870 12.00 LT CL

0	-	050	Blk Org
050	-	1.00	M Cl Stiff
		1.00	NFP BR

16+870 30.00 LT CL

0	-	050	Blk Org
050	-	900	M Cl Stiff Fr Wat @ 150
900	-	2.40	M Sa Lo Cobb.
		2.40	NFP BR

16+880 12.00 RT CL

0	-	030	Blk Org
030	-	1.10	M Cl Stiff
1.10	-	1.80	M Sa Lo Stny Wet
1.80	-	3.50	M Cl Soft
3.50	-	4.50	F Sa Bldy (Unable to sample after 2.00 due to sloughing)
		4.50	NFP BR

HWY. NO. 11 LOCATION Callander Bypass

E. Richards

ENGINEER



SUBGRADE CHECK FIELD SHEET

6

PAGE NO. _____

S. HIMSWORTH

TWP. _____

Nov. 28

79

DATE _____ 19 _____

72-74-09

W. P. NO. _____

VANE TEST

16+780 30.00 LT CL

DEPTH	τ_f kPa	τ_u kPa	S.T.
600 - 900	53	15	4
1.20 - 1.50	40	3	15
1.80 - 2.10	20	2	11
2.40 - 2.70	19	3	7
2.70 - 3.00	19	2	11

VANE TEST

16+800 12.00 RT CL

DEPTH	τ_f kPa	τ_u kPa	S.T.
1.20 - 1.50	58	9	6
1.80 - 2.10	68	Unable to remould	
2.70 - 3.10	32	3	12

HWY. NO. 11 LOCATION Callender Bypass

E. Richards
ENGINEER