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COMMONWEALTH OF AUSTRALIA.

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DEPARTMENT OF NATIONAL DEVELOPMENT.  
BUREAU OF MINERAL RESOURCES  
GEOLOGY AND GEOPHYSICS.

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RECORDS.

1957/107

COMMONWEALTH AVENUE BRIDGE SITE

GEOLOGICAL REPORT ON FOUNDATION CONDITIONS

by

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INTRODUCTION

A seismic investigation of the proposed Commonwealth Avenue Bridge site was made in 1956 by the Geophysical Section of the Bureau of Mineral Resources (Hawkins, 1956). Exploratory drilling guided by the results of the geophysical survey was recommended by Gardner and Noakes (1957). The present report gives the results of the exploratory drilling -

GEOLOGY

Alluvium occurs from the surface down to depths of 20 to 33 feet (Plate 2). It consists of loam and silty loam from the surface down to approximately 15 to 20 feet. Below this the loam gives place to coarse sand and gravel. The gravel beds are lenticular, 10 feet thick at hole 1, 5 feet at hole 3, and absent in holes 2, 5 and 9. The country rock beneath the alluvium is the Lower Silurian Riverside Formation (Opik, 1955), consisting of claystone (or mudstone), silty claystone (or silty mudstone), siltstone, and a little very fine sandstone. Its upper 5 feet, immediately below the alluvium, is weathered and decomposed to a creamy yellow, plastic clay. Below this the country rock throughout much of the area, though weathered, is firm and has appreciable strength.

ZONES OF FRACTURING AND DEEP WEATHERING

Claystone and silty claystone similar to that found by diamond drilling is exposed in a road cutting 400 to 800 feet north of the present bridge. The strike appears to be constant throughout and is N.6°W. This is assumed to be the strike of the bedding at the drill sites. The dip of the beds exposed in the cutting is approximately 40° east. An anticlinal axis is situated a short distance west of the road cutting. Its exact position is not known. The axis has probably little if any pitch and if intersected by one or more of the diamond drill holes it should be recognised through horizontal or nearly horizontal bedding. However, the smallest dip observed in the drill core is 30°. It is concluded that the anticlinal axis lies some distance west of the drill holes, and that the dip of the bedding at the drill sites is to the east. On the basis of the assumed strike and easterly dip of the bedding, the strikes and dips of joints and fractures in the drill cores were measured, and they are recorded in Plate 2. In some instances where bedding could not be recognised, the attitudes of fractures were determined on the basis of a fracture cleavage that strikes approximately north 10° degrees west and dips steeply east.

The principal direction of jointing depicted on the joint rosette of Plate 2 appears to conform with the supposed zones of shearing and faulting indicated by the seismic investigation. However, the whole interpretation relies on the validity of the assumption that the strike of the beds remains constant. Actually, the beds could diverge considerably from the assumed strike, and this would not be apparent in the drill core. Should the strike of the beds be a factor to be considered in the design of foundations, it would need to be checked by drilling or excavation.

In holes 1, 8 and 3, the diamond drill passed repeatedly through masses of firm, relatively strong weathered rock into bands or pockets in which the rock material is fractured, softer and more completely weathered. The soft, fractured and weathered bands persist in hole No.1 down at least to 78 feet, and in hole No.8 to 97 feet. In hole No.3 the weathered bands and pockets persist down to the bottom (90'3) but they are less extensive and less weathered than in holes 1 and 8. Hole No.5 passed through white or grey-white, plastic clay down to approximately 180 feet. The country rock here was in earlier geological times the same as that encountered in the other boreholes, but it is now completely decomposed. Small fragments of the core recovered from the hole are silicified, and some fracture surfaces at a depth of approximately 167 feet are coated with pyrite. This suggests that the deep decomposition may be in part a result of hydrothermal activity, viz.- the action of heated aqueous solutions that rose from a considerable depth through fractures in the country rock.

The boundaries of the fractured and crushed zones are not accurately known, although they are approximately indicated by the results of the seismic investigations. The deep weathering in boreholes 1, 8, 3 and 5 appears to be associated with fractures or joints (Plate 2) that strike north-west and dip to the south-east at angles ranging from 60 to 85 degrees. Probably the crushed zones are lenticular in shape and are elongated in this direction of fracturing. Boundaries drawn on this assumption accord in a general way with the distribution of the low seismic velocities obtained during the geophysical investigation. The low seismic velocities obtained east and west of borehole No.10 suggest that narrow lenticular zones of crushing and weathering occur both north and south of the borehole, or alternatively that the borehole is situated in a large non-crushed block within a zone of crushing.

#### FOUNDATION CONDITIONS

The diamond drilling has shown that the geophysical estimate of the thickness of alluvium is substantially correct. As noted above in the section entitled "Geology" the gravel beds are lenticular and do not occur at the sites of some of the boreholes. They are probably not thick enough or extensive enough to be utilized for foundations. In addition they rest on the plastic clay derived by weathering of the upper part of the underlying country rock.

In the country rock the low seismic velocities (6,500 to 7,200 f.p.s.) indicate zones of fracturing in which deep weathering, softening and decomposition have proceeded in irregular bands and pockets down to considerable depth. At the site of hole 5 the entire rock mass is decomposed down to at least 180 feet. Its strength is probably about equal to that of the deeply decomposed country rock at Kings Avenue Bridge site. At the sites of holes 1, 8 and 3, the weathering, softening and decomposition have proceeded in bands and pockets within harder less-weathered rock. Foundation material which might have sufficient strength for spread footings is available at a depth of approximately 37' (10 feet below base of alluvium) in hole 3, at 48' (15 feet below base of alluvium) in hole 1 and at 34 feet (6 feet below base of alluvium) in hole 8. Any such site would need careful investigation, because of the irregular distribution of the advanced weathering and decomposition. The possible occurrence of one of these zones of crushing between holes 9 and 10 has been noted above in the paragraph dealing with "Zones of Fracturing and Deep Weathering". It is indicated in Plate 2.

The country rock that gives the high velocities, though somewhat weathered, has appreciable strength and can probably be used as a foundation for spread footings at a depth of approximately 5 feet below the bottom of the alluvium. This rock is relatively homogeneous in respect to its mechanical properties, i.e., it does not contain the irregularly distributed pockets and masses of strongly weathered material. It is not known whether loading tests have been made in this type of weathered rock. Loading tests have been made on similar country rock of the Riverside Formation at the site of the Academy of Science Building. However, at this locality the rocks are probably less weathered and harder.

#### CONCLUSION

Satisfactory foundations for spread footings at approximately 5 feet below the base of the alluvium are provided by the rocks that are characterized by relatively high seismic velocities, viz., those tested by boreholes 2, 4 and 10. The rocks of intermediate and relatively low seismic velocities, viz., those tested by boreholes 3, 1 and 8 may provide satisfactory foundations at depths of 6 to 15 feet below the base of the alluvium. However, because of the presence of highly decomposed bands or pockets, particularly in the areas of relatively low seismic velocity, any prospective pier sites would need thorough investigation. The area characterized by the lowest seismic velocity, that tested by drill hole No. 5 is decomposed and has little or no mechanical strength down to a depth of approximately 200 feet. A band of low-velocity rock may occur between drill holes 9 and 10.

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# APPENDIX I.

## BORE LOGS - (LITHOLOGY)

<u>Depth</u>		<u>Core</u>		<u>Description</u>	
<u>From</u>	<u>To</u>	<u>Recovered</u>			
<u>Feet</u>	<u>Feet</u>	<u>Feet</u>	<u>Inches.</u>		
<u>HOLE No.1</u>					
<u>Percussion Drilling</u>			<u>Cuttings</u>		
0	3	-		Fill, consisting of sand gravel, cobbles, and angular fragments of shale.	
3'	12'	-		Sand and gravel.	
12'	20'	-		Sand	
20'	30'	-		Sand and gravel	
30'	33'	-		Coarse sand	
33'	40'	-		Yellow clay representing decomposed mudstone.	
★ (On drying shows shrinkage cracks at 34' 38' and 39'.)					
<u>Diamond Drilling</u>			<u>Core</u>		
40'	43'10"	3'3"		Yellowish or pale yellow-brown mudstone. Weathered. Relatively soft but not plastic. Dip 30°. Very soft and broken into small fragments from 41'6" to 41'9" and 43'2" to 43'10".	
43'10	48'4	3'3"		Yellowish or pale yellow-brown weathered mudstone. Relatively soft but not plastic. A little harder from 43'10" to 45'. Softer and very broken from 45' to 48'6, partly because it is intersected by some high angle fractures.	
48'4	51'10	2'7"		Yellowish and reddish-yellow weathered mudstone. Dip 35°. Fair core from 48'4 to 50'; then very broken.	
51'10	59'6	4'0"		Ditto. Fair core to 53' and from 59' to 59'6. Remainder nearly all broken. Probably this is due in part to the occurrence of soft bands or laminae and in part to fracturing or jointing, dip-vertical to 70°. (ing.	
59'6	63'	3'2"		Yellowish and reddish-yellow weathered mudstone. Dip 40°. Fair coring in middle 2 feet. Remainder soft and broken.	
63'	64'8	1'0"		Weathered, thinly-bedded mudstone. Firm but not hard. No core length intact. Mainly in split 1" to 2" fragments.	
64'8	69'2	3'2"		Weathered, thinly-bedded mudstone. Dip 50°. Fair core to 66'9, then very soft, almost decomposed and broken into small fragments, maximum dimensions 1/4". Some very high angle jointing or fracturing.	

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	Inches	
69'2	73'	2'6"		Ditto. Mainly soft and broken.
73'	74'6"	0'8"		Firm but not hard. Broken into 1/2" - 2" fragments.
74'6"	78'	3'	approx.	Ditto. From 77' to 78' very soft and broken.
78'	80'	1'6"		Good core. Weathered but fairly hard or firm. Dip 50°.

HOLE NO.2.

<u>Percussion Drilling</u>			<u>Cuttings</u>
0'	3'	-	Black loam.
3'	6'	-	Grey <sup>brown</sup> /loam; contains fine mica.
6'	7'	-	Ditto; a little yellowish.
7'	12'	-	Yellowish-brown loam or silty clay.
12'	15'	-	Buff-coloured silty clay. Contains fine mica.
15'	27'	-	Coarse sand.
27'	30'	-	Yellow clay; represents decomposed mudstone or siltstone.
30'	32'	-	Yellowish and pinkish clay; represents weathered mudstone, firmer than that penetrated from 27' to 30'. Dried samples show shrinkage cracks down to 31'.

<u>Diamond Drilling</u>			<u>Core</u>
32'	38'4	5'0	Siltstone and mudstone or shale. In part is finely porous and may have been calcareous. Dip 40°. Mainly yellowish and reddish and a few narrow greenish bands. A colour banding may be a concentric zoning through weathering. Fairly firm or hard.
38'4	45'4	5'10	Ditto. Mainly thinly bedded mudstone. In part a little harder than the previous section.
45'4	52'	6'9	Ditto. Narrow bands of siltstone. Dip 40°. About as hard as previous section (38'4 to 45'4) and probably a little harder than first section (32' - 38'4). Last 2 inches of core broken into small fragments.

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	inches	
52'	54'	1'4"		Dark-green silty mudstone, softer than the core obtained above it. Very soft at bottom and in middle, and probably loss of core occurred at these places.
54'	59'6	5'0"		A little soft dark-green silty mudstone but mainly the harder yellow-brown and reddish mudstone obtained from below 38'4. Dip 35°. Minor fractures about 3 70°.
59'6	64'9	5'3"		Mainly yellowish and reddish banded mudstone, a little harder than higher up. Softer silty bands from 62'6 to 62'9, 63'6 to 63'9 and 64'3 to 64'6.
64'9	69'3	4'5"		Alternating mudstone (reddish) and silty mudstone (dark green). The reddish mudstone is hard; the silty mudstone is sectile.
69'3	75'	5'6"		Alternating reddish and yellowish banded mudstone and bands of siltstone or silty mudstone. Dip 20°. A fair amount of minor fracturing, vertical to 70°. Hardness similar to last section. Greenish colour prominent in core below 64'9.

HOLE No.3.

<u>Percussion Drilling</u>			<u>Cuttings</u>
0'	8'	-	Dark grey loam. Contains a small proportion of medium and coarse sand.
8'	10'	-	Pale yellow-grey loam. A little fine mica.
10'	12'	-	Pale buff loam. A little fine mica.
12'	16'	-	Ditto, a little sandier.
16'	21'	-	Pale buff sandy loam.
21'	23'	-	Sand and small gravel.
23'	27'	-	Sand and gravel.
27'	28'	-	Fine sand.
28'	34'	-	Pale buff clay; represents decomposed mudstone (When dried, strong shrinkage appears at 31', a little at 32', traces at 34'.)

<u>Diamond Drilling</u>			<u>Core</u>
34'	38'7	1'4"	Mudstone containing "sandy" particles. The core recovered appears to be below 37'3.

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	inches	
38'7	41'2	2'6"		Weathered mudstone in approx. 5 inch bands alternating with weathered mudstone containing "sandy" particles. Dip. approx. 40°. From 37'6 quite firm and appears to be suitable foundation for spread footings.
41'2	43'2	2'0		Mudstone, including "sandy" mudstone from 42'4 to 42'8. Firm but not hard. Dip 40°. A lineation at 25° to dip. Lineation appears to dip 45°.
43'2	48'2	4'10"		Good core to 46'2 of weathered mudstone containing three minor "sandy" bands. Fairly hard. From 46'2 to 48'2 in mudstone, more weathered, softer. Has a very high angle fracturing same strike and dip direction as bedding.
48'2	55'7	6'4"		Mudstone. Good core, mainly in about 5" lengths; firm but not very hard. From 51'6 to 53' is broken and softer. Three narrow "sandy" bands in this length.
55'7	60'4	4'5"		Weathered mudstone similar to above but contains four fairly soft broken sections mostly white and decomposed. Decomposed material on vertical and high angle joint. Show.
60'4	66'2	5'8		Mudstone, off-white and reddish. Dip 40°. High angle (?) shearing, strike and dip direction same as bedding. Softer than sections higher up. Last 3 feet very broken and soft.
66'2	71'	5'2"		Ditto. Shearing very marked in some of this. All fairly soft.
71'	78'5	7'0		Weathered mudstone, top of it decomposed but not hard. From 77'8 to 78'5 is very soft and broken into small fragments.
78'5	86'5	8'		Weathered mudstone, firm but not very hard. From 85' to 86'5 is more weathered and softer.
86'5	90'3	3'6		Weathered mudstone, in part firm and in part fairly soft.
Has decomposed bleached sections after about 46'.				Foundation conditions at 37'6 are as good as anywhere in the hole.

HOLE No.4.

Depth		Core	Description
From	To	Recovered	
Feet	Feet	Feet    Inches	
<u>Percussion Drilling</u>			<u>Cuttings</u>
0'	4'	-	Dark buff-coloured loam. Contains fine mica.
4'	8'	-	Silty loam.
8'	9'	-	Buff loam. Contains sand of medium grain size.
9'	14'	-	Ditto. Contains sand of fine grain size. Fine mica throughout.
14'	18'	-	Buff coloured loam. Sand fraction a little coarser.
18'	19'	4	Sandy loam.
19'	26'	-	Sand and gravel.
26'	28'	-	Coarse sand.
28'	31'	-	Fine white clay.
31'	34'	-	Coarse clean sand in part coated by white clay. Appears to have been leached of iron.
34'	36'	-	Ditto. with fragments of shale and mudstone.
<u>Diamond Drilling</u>			<u>Core</u>
36'	40'	1'9"	Fairly hard weathered mudstone, in part shaly. Dip 45°. Some fracturing, dips about 25° and vertical. Weathering associated with a high angle fracturing (70° plus), that strikes about 20° to bedding. This may be cause of core loss.
40'	43'10	4'0"	(2 inch of core belongs to previous section). Fairly hard or very firm weathered mudstone, white and yellowish. The bottom 8" is very weathered and soft.
43'10	48'	3'5"	To 45'9, greyish-white weathered mudstone, firm but not hard. From 45'9 to 48' is mainly very weathered and soft.
48'	51'4	3'1"	Mudstone, greyish-white; in part a little silty; in part shaly. Dip 35°. From 48' to 50'4 is quite firm. Remainder more weathered and soft (has a close fracturing dipping 70°). Foliation appears vertical, same strike as bedding.
51'4	53'9	2'0	Grey-white mudstone, a little silty. To 51'10 is very weathered and soft. The 1 foot of core is medium-firm, and remainder is broken, but firm.



Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	Inches	
53'9	58'5	4'5"		Mudstone. grey-white or faintly greenish-grey, Dip 40°. From 53'9 to 55' is very firm. Remainder firm except 56' to 56'6" and 57'5 to end, where it is more weathered and soft, but not decomposed. A faint foliation approximately parallel to bedding in strike and vertical or very steep dip in same direction as dip of bedding.
58'5	60'	1'0"		Grey-white firm but not hard weathered mudstone. The middle 4" is broken.

HOLE No.5.

Percussion Drilling

Cuttings

0'	6'	-	Dark loam (clay and silt).
6'	17'	-	Buff loam (clay and silt)
17'	19'	-	Pale buff loam (clay and silt and occasional sand grains).
19'	21'	-	Coarse sand.
21'	28'	-	Off-white (creamy) clay.
28'	30'	-	Off-white (greenish or bluish) clay. Very high shrinkage on drying.

Diamond Drilling

Core

30'	37'4"	1'11"	White clay (decomposed shale or mudstone).
37'4"	46'	0'7"	Ditto. A few inches of the core recovered is slightly silicified and a little harder than the remainder.
46'	55'	2'3"	Ditto. A few harder fragments.
55'	60'	0'4"	The core recovered is greyish-white and appears to be a little silicified.
60'	64'3	2'1"	Greyish white clay (Decomposed mudstone or shale).
64'3"	70'3"	1'2"	Ditto.
70'3"	76'6"	2'1"	Mainly clay (quite decomposed mudstone or shale). Some firmer fragments. Trace of bedding, dips 45°. Bottom broken.
76'6"	80'	1'9"	Ditto. Nearly all quite decomposed and plastic. A few firm lumps.
80'	84'6"	2'1"	Clay.
84'6	88'6	1'9"	Ditto. The last 2" is hard silicified mudstone.

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	Inches	
88'6"	92'	1'0"		Fairly hard, silicified mudstone. Vertical jointing.
92'	96'6	2'6"		Clay.
96'6	167'			(A See page 11.) White clay, (kaolinitic) (decomposed mudstone and siltstone). Some hard silicified portions. Core recovery very poor. Not described in detail, as core boxes removed from drill site.
167'	172'	3'5"		White clay, Marked shrinkage on drying.
172'	175'6"	1'4"		Ditto. A few inches of broken harder material.
175'6"	180'	2'11"		Mainly harder material: weathered but firm mudstone. Dip 35°. In part broken fragments, in part core lengths to 4". No strongly marked fracturing. The breaks appear to be vertical, also nearly horizontal and along bedding.
180'	183'	2'5"		Weathered mudstone. About two-thirds of core is firm: one-third completely decomposed. From 180' to 180'3" firm weathered mudstone contains round pellets about 0.5 mm. like scattered round quartz grains. Bedding appears to be practically horizontal. Near some decomposed portions a jointing dips 80° to 85° and contains fine quartz stringers.
183'	188'	2'9"		Mainly firm weathered mudstone. Dip difficult to recognise because of a cross fracturing about same dip. Two crushed bands 3" and 9" very decomposed.

#### HOLE No. 8.

Poor material generally. Much of it decomposed, e.g. ~~even~~ down 65' - 69' and 72'6" - 73'6". May be firm enough at 39' but would want checking: Most of 88'6" - 97' decomposed.

#### Percussion Drilling

#### Cuttings

0	6'	-	Dull grey clayey loam (contains a little medium-grained sand) Fine mica.
6'	12'	-	Pale buff-grey clayey loam. Little sand. Some mica.
12'	22'	-	Dull grey clayey loam. Practically no sand.
22'	28'	-	Sand and small gravel.
28'	34'	-	Pale red-yellow clay (Driller states that it is soft, but a little harder than clay). (28' only some evidence of shrinkage).

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	inches	
<u>Diamond Drilling</u>				<u>Core</u>
34'	37'	1'0"		Reddish-yellow and brown siltstone, firm to hard. Fractured. (O.K. for foundation. what core recovered). (Decomposed sections persist down hole.)
37'	39'	0'9"		Ditto; clayey towards bottom of core.
39'	41'6"	1'6"		Firm reddish-yellow siltstone and yellow-brown clay. Dip about 30° - 35°.
41'6"	45'	1'7"		As above. Fragments only in core.
45'	49'	1'9"		As above. Largest piece of core 6" of firm to hard siltstone. (45°)
49'	53'	0'11"		Fragmental siltstone as above.
53'	56'	2'0"		Reddish and yellow-brown siltstone and probably interbedded yellow-brown silty clay, 40°
56'	59'	1'0"		Grey soft siltstone and silty yellow-brown clay with firm siltstone fragments probably from thin interbeds.
59'	62'	2'9"		Top 1'0" is yellow-brown soft siltstone, some darker possibly carbonaceous material, 6" probably fractured claystone, 6" yellow brown siltstone.
62'	65'	2'3"		As for 53' to 56' a fine silt
65'	67'	1'1"		Firm siltstone, light grey to reddish Core fragmentary. Black film on fractures may be manganese.
67'	69'	0'9"		At top firm bedded yellow-brown siltstone, Below yellow-brown soft siltstone.
69'	73'6"	3'0"		First 1'6" is firm yellow-brown siltstone dip 40° - 45°, contains dark thin laminae. Then 9" firm reddish yellow-brown siltstone. fractured. At bottom soft silty yellow-brown clay.
73'6"	77'	2'6"		Interbedded firm yellow brown and fine siltstone and soft yellow-brown siltstone.
77'	81'	3'2"		Ditto. Small scale slumping.
81'	85'	3'0"		Ditto.
85'	88'6"	2'4"		Ditto.
88'6"	93'	3'5"		Ditto, Some crushing and irregular fracturing. The most weathered parts split off along the cleavage.

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	inches	
93'	97'	3'2"		Interbedded firm reddish and yellow brown sandy siltstone and soft yellow-brown (sandy) siltstone. Curly structures.
97'	100'	2'3"		Ditto. (About 40% "C" class, 60% soft "B" class).

HOLE No.9.

Percussion Drilling

Cuttings

0'	13'	-	Dark grey loam. Mainly clayey loam, but a little sandy in places.
13'	15'	-	Coarse sand.
15'	21'	-	Clay, cream yellow or very pale yellow brown. Much shrinkage on drying.
21'	23'	-	Ditto. No evidence of shrinkage.

Diamond Drilling

Core

23'	27'	1'10"	Firm yellow-brown siltstone and soft yellow brown silty claystone. Dip about 35°. Core fragmentary. Probable manganese staining on joint surfaces.
27'	29'	1'10"	As above. Largest piece of core 3". Claystone is very soft.
29'	32'	3'5"	Yellow-brown and reddish firm siltstone. Dip 45°. Manganese staining on joints (vertical) Bottom foot very broken. (Vertical to V. steep.)
32'	35'6"	3'4"	Yellow-brown and reddish firm siltstone. Core traversed by hair-thin iron-stained veins; little irregular. Same strike and dip as bedding.
35'6"	40'	4'5"	Ditto. Bottom 6" broken. Dip 45°.
40'	43'	2'11"	As above, yellow-brown and creamy yellow. About 2" soft siltstone at 40'6" and at bottom.
43'	47'	2'4"	Broken core of firm creamy siltstone.
47'	50'	2'0"	Interbedded soft yellow-brown silty shale and firm yellow-brown and reddish siltstone.
50'	54'	3'6"	Firm yellow-brown and reddish siltstone. Dip about 40°. Bottom 6" fractured.
54'	57'	2'3"	As above. Core fractured. Soft siltstone in bottom 12".
57'	58'6"	1'5"	As above.

Depth		Core		Description
From	To	Recovered		
Feet	Feet	Feet	Inches	
58'6"	61'	2'5"		Firm siltstone as above and soft yellow brown siltstone in lower 18".
61'	66'	4'10"		Firm yellow-brown and reddish siltstone. Manganese in fractures.
66'	71'	4'5"		As above. Soft siltstone and fractured in bottom 12".
71'	74'6"	1'4"		Firm siltstone ( and very fine siltstone) Soft broken siltstone in lower 9". Dip 40°.
74'6"	80'	3'6"		Yellow-brown siltstone, firm when dry, softer when wet. Core Broken.
80'	83'	2'9"		As above.
83'	85'	1'11"		Firm yellow and reddish siltstone; much jointed,
(Soft "B" class).				

HOLE No.10.

Percussion Drilling

Cuttings

0'	10'	-	Grey river alluvium, fine-grained sandy loam.
10'	16'	-	Grey, poorly sorted sand with very coarse to fine conglomerate size angular quartz grains (probably lake beds).
16'	25'	-	Pale yellow-brown clay and silt; probably decomposed shale, siltstone and claystone. (No obvious shrinkage or drying).
Rock bit 25'	26'	-	Clearing rubble from hole.

Diamond Drilling

Core

26'	28'9"	1'0"	Fairly hard at start. Good foundation. Broken, firm light brown and reddish micaceous siltstone and silty claystone.
28'9"	30'4"	1'7"	As above. (Curly structure masks bedding).
30'4"	32'0"	1'8"	As above. Much of this rock is on border between a siltstone and claystone. Coarser bands are definitely siltstone with mica flakes. This core is much broken. Manganese on 65° fractures.
32'	36'3"	4'3"	Firm light yellow brown and reddish siltstone and silty claystone. Possible dip 45°. Mostly good long cores 4" to 6". Last 6" completely broken. Manganese on fracture surfaces - some tends to be very fine sandstone. Curley structures. Cannot get bedding.



## APPENDIX 2

### STRIKE AND DIPS OF BEDDING, JOINTS AND FRACTURES IN

#### DIAMOND DRILL CORE

(The strike of the bedding is assumed to be the same as that exposed in the road cutting about 400 ft. north of the present bridge.)

#### REFERENCES

- └30° Strike and dip of bedding.  
The strike of the bedding is N6°W.
- └70° Strike and dip of joint or fracture.
- └80° Strike and dip of shearing and  
cleavage (where recorded).
- Mn Manganese staining on joint surface.

Depth in Feet		Bedding, Joints, Fracture and Cleavage. (Strike of bedding is assumed to be N6°W.)	
From	To		
<u>Bore 1</u>			
40' 0"	43' 10"	└30°	
41' 6"	41' 9"	└	✗ Mn
43' 2"	43' 10"		
45' 0"	48' 4"	└45°	75°
50' 0"	51' 10"	└	✗
51' 10"	59' 6"	└	✗ 70°
63' 0"	64' 8"	└	✗
64' 8"	69' 2"	└	[ ✗ Mn
69' 2"	73' 0"	└50°	✗ rough curves
78' 0"	80' 0"	└50°	
<u>BORE 2</u>			
32' 0"	38' 4"	└40°	
48' 4"	52'	└40°	85°
54' 0"	59' 6"	└35°	70°
69' 3"	75' 0"	└20°	
<u>BORE 3</u>			
38' 7"	41' 2"	└40°	
41' 2"	43' 2"	└45°	
55' 7"	60' 4"	└40°	85° to vertical
71' 0"	78' 5"	└40°	Decomp. Quartz & a little limonite 70° 60°

BORE 4

36'0"	40'0"	45°
48'0"	50'0"	35°
50'0"	51'4"	35°
53'9"	58'5"	40°

Very fine  
53° limonite  
coating(?)  
75°  
Also irregular  
breaking across &  
15° along bedding. Fine  
lining of limonite.  
65° limonite.  
75° close platy

BORE 5

70'3"	76'6"	45°
175'6"	180'0"	35°
180'0"	183'0"	15°

65°  
70°  
Limonite(?) & pyrite  
on fracture surface.  
Green coating .5mm. thick.  
Also flat joints connect  
these // joints.

BORE 8

39'0"	41'6"	40°
45'0"	49'0"	45°
53'0"	56'0"	40°
62'0"	65'0"	
73'6"	77'0"	40°
77'0"	81'0"	
81'0"	85'0"	

70° Mn  
60° Mn  
80° Mn  
55° Mn  
80° Mn  
85° Mn

BORE 9

23'0"	27'0"	35°
29'0"	32'0"	45°
35'6"	40'0"	}
39'6"	40'0"	
43'0"	47'0"	
50'0"	54'0"	}
53'6"	54'0"	
54'0"	57'0"	
57'0"	58'6"	

70° Mn  
35° Mn  
70° Mn  
70° Shear  
35° Shear  
Fracture .5mm. thick, with  
black limonite or. Mn.

BORE 9

61'0"	71'0"	30°
70'0"	71'0"	
73'9"	74'6"	40°
74'6"	80'0"	50°
83'0"	85'0"	

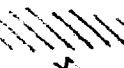

60°  
75°  
80°  
30°  
A fair amount of splitting in  
cleavage, & Mn in cleavage.

(iii)

BORE 10

30° 4"	32° 0"	└ 25°	<del>65°</del> Mn	
32° 0"	36° 3"	└ 45°		
36° 3"	41° 0"	└ 30°	└ 75°	
41° 0"	47° 0"	└ 35°		
53° 0"	59° 0"	└ 30°	<del>Mn</del> 75°	└
59° 0"	63° 0"	└ (c.f. 53'-59')		└ 75°
74° 9"	78° 0"	└	<del>φ</del> Mn	└ 75°

# COMMONWEALTH AVENUE BRIDGE SITE EXPLORATORY DRILLING BASED ON SEISMIC REFRACTION SURVEY

 Areas of low seismic velocity indicating possible fault zones or shear zones  
 Low velocity area extending beyond limit of seismic survey.  
1900 Seismic velocity in f.p.s.  
○ Drilling site

