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MINISTRY OF NATIONAL DEVELOPMENT
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APRIL - MAY 1952.

These notes deal with a brief experimental seismic survey undertaken by the Bureau of Mineral Resources for the Victoria Railways.

The object of the survey was to determine whether the seismic refraction method was suitable for subsurface exploration in the area between Dynon and Footscray Roads, West Melbourne. The information desired by the Railways was concerned with the existence or otherwise of a "foundation" rock capable of supporting constructions associated with railway sidings and marshalling yards.

Records of seismic refractions were obtained along three traverses, located as shown in the accompanying sketch plan of the area. The location of Traverse C was selected so that the seismic depth determinations could be compared with the logs of bores sunk previously. Traverses A and B are located on the "swamp" area, the site under consideration for the Railways' new constructions. On each traverse, seismograms were recorded for up-dip and down-dip shooting. The siesmic party consisted of three geophysicists. The Heiland 12 Channel Recording Equipment, mounted in a truck, and Apache geophones were used for the work. Charges of up to 2½ lbs. of gelignite were used.

RESULTS:

Time distance graphs were plotted from the seismograms. The following velocities of layers and depths were calculated from the graphs:-

TRAVERSE A

Velocity of Layer	Depth to Bottom of Layer	
	North End (S.P.I)	South End (S.P.2)
1000 f.p.s.	8 Feet	3 Feet
2540	22	17
5400	-	-

TRAVERSE B

Velocity of Layer	Depth to Bottom of Layer	
	Nort End (S.P.3)	West End (S.P.4)
1250 f.p.s.	15 Feet	17 Feet
5230	137	168
12400	-	-

TRAVERSE C

Velocity of Layer	Depth to Bottom of Layer	
	East End (S.P.5)	West End (S.P.6)
1000 f.p.s.	15 Feet	13 Feet
4620	72	50
6890	141	113
10000	-	-

TRAVERSES A and B

On these traverses, the first layers of velocities 1000 f.p.s. and 1250 f.p.s. respectively are the normal weathered surface layers. The second layer of 2540 f.p.s. on Traverse A corresponds to some type of fill material or alluvium at shallow depth, known to extend over the area. This layer is not evident on the records of Traverse B. The velocity of approximately 5000 f.p.s. recorded on Traverses A and B, is comparable with that of 4620 f.p.s. on Traverse C, and can be interpreted as due to wet soft materials e.g. clays and silts. On Traverse B, the next layer of 12400 f.p.s. is undoubtedly the compacted bedrock sediments. The depth to this layer is 137 feet of Shot Point 3 and 168 at Shot Point 4. Because of the danger of high tension wires and high noise level from road and rail traffic, the length of Traverse A could not be extended to allow refractions from deeper layers to be recorded. It has been calculated that the depth to bedrock at Shot Point I could not be less than 150 feet which agrees with the depth of 168 feet recorded close by at Shot Point 4.

TRAVERSE C

Traverse C is located close to Bores Nos. A16 and A17. The velocity of the first layer, 1000 feet per second, is the velocity normally recorded for weathered surface material. The calculated thickness of this layer is 15 feet at the east end (Shot Point 5) and 13 feet at the west end (Shot Point 6). The velocity of 4620 f.p.s. recorded in the next layer, is of the order of that which would be expected from a layer of soft, uncompacted material, below water table level, such as the silt or clay logged in the neighbouring bores. The velocity of 6990 f.p.s. recorded in the next layer is high enough to correspond to Silurian sediments and the next velocity of 10,000 f.p.s. is certainly attributable to solid Silurian bedrock. There is no sharp discontinuity between these two layers and the former may represent a weathered or less compacted zone of the Silurian bedrock.

The bores put down in this part of the area showed the presence of a "reef" at depths which are marked on the sketch plan. In driving a pile at a point 100 feet north-east of Shot Point 5, a hard rock was encountered at approximately 40 feet depth and is probably the same "reef" as logged in the bore holes. It can be seen that the depths of the layers calculated from the seismic work bear no relation to the depth at which the "reef" was encountered in the boring and also that the general dip of the seismic layers is in a direction opposite to that of the "reef"

The nature of the "reef" and its thickness are not known as the boring was stopped when it was struck. As it is at a much shallower depth than that calculated for the bedrock it could possibly be the remains of the Tertiary basaltic lava. The important point is that a layer hard enough to serve as a support for piles has been completely missed by the seismic work.

SUMMARY:

The seismic results from the "swamp" area south of Dynon Road indicate that along Traverse A the bedrock is at least 150 feet deep and on Traverse B it is 137 feet deep at the east end and 168 feet deep at the west end.

On Traverse C the depth of bedrock is at least 72 feet at the east end and 50 feet at the west end. No seismic evidence was obtained of the hard layer or "reef" shown by the boring to exist at a shallower depth.

The velocities measured in the bedrock indicate that it is composed of sedimentary and not igneous rocks.

From the experimental survey it appears very doubtful whether the refraction seismic method could give all the information

required on the "swamp" area. The depth to the true Silurian bedrock could be obtained reliably but the bedrock here is too deep to be of practical use for foundations. The possibility must be recognised that within the soft clay or silt a layer of more compact material may exist and although thick enough to support piles may nevertheless be too thin to be detectable by the seismic method. For instance a layer of sand 8 to 10 feet thick, which, it is understood would be capable of supporting piles, could scarcely be detected if it occurred in clays or silts at a depth of 20 feet or more below the surface. This view seems to be supported by the results north of Dynon Road where the "reef" proved by boring was not detected by the seismic work. Here, the reef may be too thin or have insufficient velocity contrast to show up in the seismic results.

It may also be noted that the vibration on the ground surface caused by road and rail traffic, and electrical interference from high tension cables combined to make seismograph recording extremely difficult. The extraneous vibrations made it necessary to use heavier explosive charges than would normally be required.

May 28th, 1952.

S. GUNSON Geophysicists.
J. QUILTY

Distribution:

1. Chief Civil Engineer, Victorian Railways.
2. Chief Geologist, Canberra.
3. Geophysical Library, Melbourne.
4. " " "
5. " " "

BORE No 19 ⊙ No reef to 80'

BORE No 18 ⊙ Reef at 67'

BORE No 17 ⊙ Reef at 53'

DEPTHS	VELOCITIES
0'-13'	1000 f.p.s.
13'-50'	4620 "
50'-113'	6990 "
113'	10,000

BORE No 16 ⊙ Reef at 27'

DEPTHS	VELOCITIES
0'-15'	1000 f.p.s.
15'-72'	4620 "
72'-141'	6990 "
141'-	10,000 "

SP 6 C600 — TRAVERSE 'C' — S.P.5 C00

403.25'

BORE No 15 ⊙ Reef at 24'

32°

POLE 39

222.75'

42½°

95.75' — 96.25' — 92'

POLE 37 POLE 36 POLE 35 POLE 34

BORE No 14 No reef to 80'

BORE No 13 ⊙ Reef at 77'

BORE No 12 ⊙ Reef at 57'

BORE No 11 ⊙ Reef at 43'

BORE No 10 ⊙ Reef at 33'

STORAGE SHED

STORAGE SHED

BORE No 7 ⊙ No reef to 80'

BORE No 6 ⊙ Reef at 60'

BORE No 5 ⊙ Reef at 57'

BORE No 4 ⊙ Reef at 60'

BORE No 3 ⊙ Reef at 62'

DYNON ROAD

PYLON

PYLON

PYLON

PYLON

HUME STEEL WORKS

DEPTHS	VELOCITIES
0'-17'	1250 f.p.s.
17'-168'	5275 "
168'-	12400 "

SP 4 B 950 W — TRAVERSE "B" — S.P.3 800

DEPTHS	VELOCITIES
0'-15'	1250 f.p.s.
15'-137'	5275 "
137'	12400 "

17½°

A 00 S.P.1

146°

DEPTHS	VELOCITIES
0'-8'	1000 f.p.s.
8'-22'	2535 "
22'-	5430 "

668.5'

TRAVERSE 'A'

DOG TRACK

DEPTHS	VELOCITIES
0'-3'	000 f.p.s.
3'-16'	2535 "
16'-	5430 "

A 5005 S.P.2

SKETCH PLAN
SHOWING
LOCATION OF SEISMIC TRAVERSES AT WEST MELBOURNE
TRACED FROM AERIAL MOSAIC
APPROXIMATE SCALE:-100 FT. = 1 INCH