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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES,  
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SEISMIC SURVEY OF THE ANZAC PARK  
BRIDGE SITE,  
CANBERRA, A.C.T.



by

L.V.HAWKINS AND A. STOCKLIN.

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- Plate 1. Locality map and seismic traverses.
- Plate 2. Vertical sections showing profiles of bedrock and higher-velocity refractor.

### ABSTRACT

A seismic refraction survey of the Anzac Park bridge site, Canberra, was conducted to determine the depths to bedrock and the seismic velocity in bedrock. Over most of the area two refractors were detected - the upper one coincides with the upper surface of weathered bedrock and the lower with the upper surface of unweathered bedrock.

The seismic results indicate that the weathered bedrock will provide reasonably good foundations at depths between 16 and 42 feet, with the exception of an area of low velocity extending 280 feet south from the river. This low velocity indicates very weathered bedrock which probably extends north-east under the river and may be within a fault zone.

The values of the Young's Modulus of the rocks are estimated from seismic velocities.

## 1. INTRODUCTION.

The Department of Works, Canberra, proposes to construct a new high-level bridge across the Molonglo River at Anzac Park Avenue near Scott's Crossing. The Department applied to the Bureau of Mineral Resources for a geophysical survey which it was considered may assist in an assessment of the subsurface at the proposed site, and in July 1956 the Geophysical Section of the Bureau conducted a seismic refraction survey of the site. The purpose of the survey was to investigate the approximate depths to bedrock and the seismic velocity in bedrock along two parallel traverses fifty feet on either side of the Anzac Park radial. Two refractors were detected over most of the area corresponding to weathered and unweathered bedrock.

The Department of the Interior, Canberra, carried out the topographical survey necessary, and the Department of Works, Canberra, supplied four field assistants and explosives.

The geophysical party consisted of L.V. Hawkins, (party leader) and A. Stocklin, geophysicists, and W.P. Pigott, field assistant.

## 2. GEOLOGY.

The geology of the Canberra City district has been described by Opik (1955) and is shown on the geological map of Canberra (Opik, 1953).

There is no rock cropping out in the area surveyed which is covered by alluvial material and soil. The rock beneath this surface cover is weathered to a variable degree and grades at depth into unweathered rock.

The geophysical stations are located on the alluvial flood plain of the river which extends from 800 ft. south-west of the river to 1,000 ft. north-east of the river. Beyond these limits traverses A and D (Plate 1) extend over the Riverside Formation, which is soil-covered and traverses B and C extend north-east from the alluvial flood plain over what is shown on the geological map as undifferentiated Recent to Pleistocene deposits. The St. John's Beds crop out about a quarter of a mile to the north-east of the north-eastern end of traverses B and C, and the City Hill Shale crops out about a quarter of a mile east of traverses A and D. The rocks underlying the above-mentioned undifferentiated Recent to Pleistocene deposits and alluvium along traverses B and C may belong to the St. John's Beds, City Hill Shale or the Riverside Formation, but no definite geological information is available.

The Riverside Formation consists of calcareous shales and mudstones, sandstones, prominent limestone lenses, tuffaceous sediments, tuffs and rhyolites. The City Hill Shale consists of dark grey, calcareous shale with limestone bands and lenses. The St. John's Beds consist of volcanic rocks (tuffs and porphyries) interbedded with tuffaceous mudstones, sandstones, limestones, shales and tuffs with limestone nodules.

The Riverside Formation and the City Hill Shale belong to the Canberra Group and are Lower Silurian in age. The St. John's Beds are Middle Silurian in age.

The term bedrock, as used in this report, refers to rock with a seismic velocity of 6,500 ft/sec or more and corresponds to the top of the weathered country rock; the term

5. CONCLUSIONS.

The seismic survey of the Anzac Bridge Site has given detailed information concerning the thickness and seismic velocity within the "overburden" and the velocity within the bedrock. The thickness of the "overburden" ranges from 18 to 42 feet south of the river, and between 16 and 34 feet north of the river.

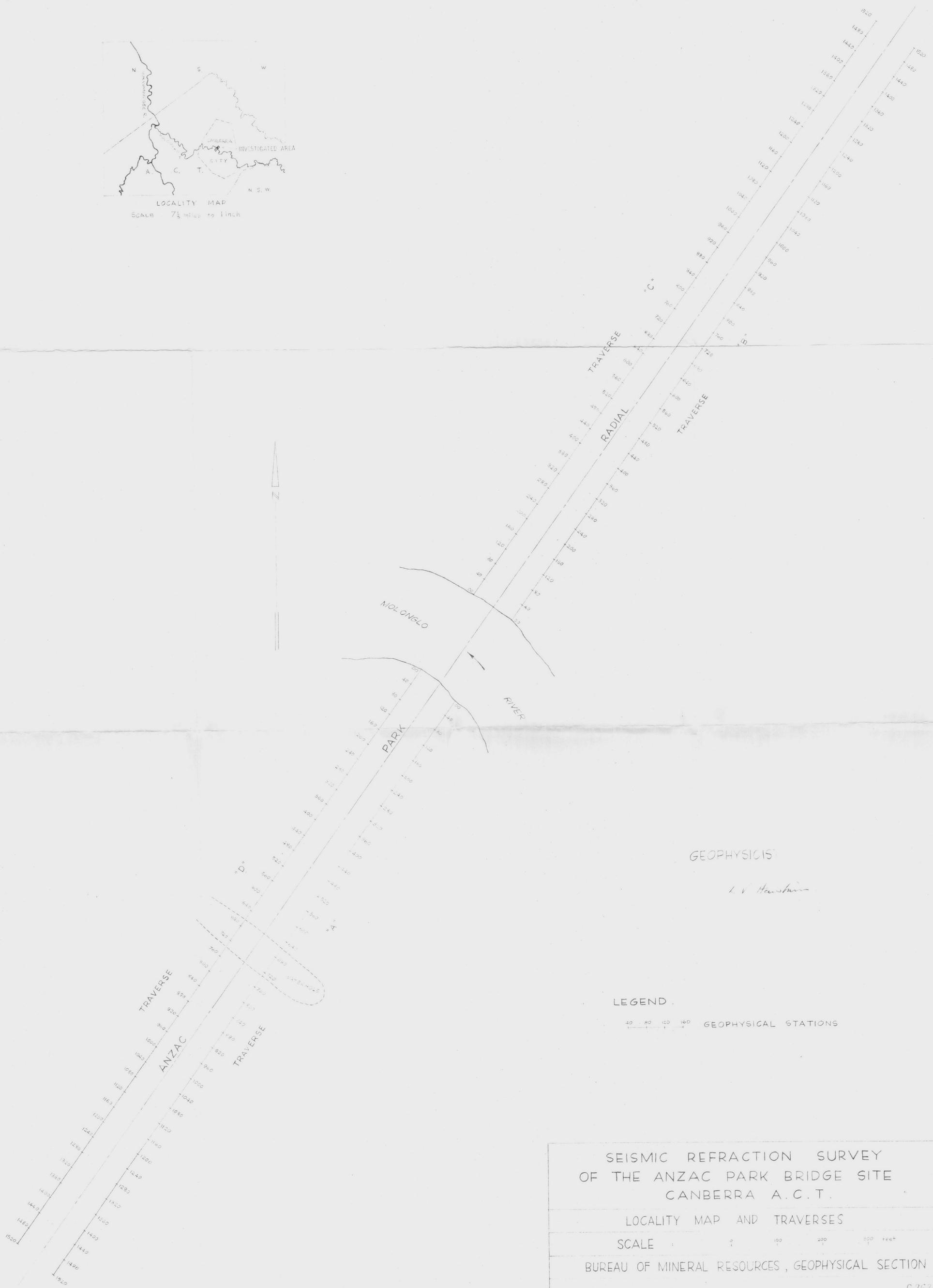
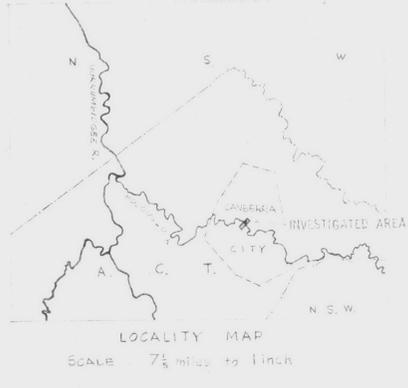
The velocity in weathered bedrock is relatively high (8,800 ft/sec. to 20,000 ft/sec.) over the proposed bridge site except for a low velocity zone (6,500 ft/sec.) extending some 280 feet south-west from the river. It seems likely that this zone extends north-east under the river and may be a fault zone.

Between stations D400 and D640 the weathered bedrock has a velocity of 8,800 ft/sec. and an approximate Young's Modulus of  $1.76 \times 10^6$  lbs/in<sup>2</sup>. Elsewhere with the exception of the low velocity zone mentioned above the velocities are in the range of relatively unweathered rocks which should provide reasonably good foundations (approximate Young's Modulus of  $2.1 \times 10^6$  lbs/in<sup>2</sup>. or greater).

It is unlikely that the overburden would be suitable for bridge foundations and the piers would therefore have to be founded on bedrock. Whether or not the bedrock would be suitable for foundations can only be determined by drilling or pitting but the seismic velocities are a reliable guide to the elastic properties of the rocks.

6. REFERENCES.

- |                                       |                                                                                                                           |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Hawkins, L.V., 1957a                  | - Geophysical survey of the Acton Weir site, Canberra, <u>Bur. Min. Resour. Aust., Records 1957</u> , No. 31              |
| Hawkins, L.V. and Stocklin, A., 1957b | - Seismic survey of the Commonwealth Avenue bridge site, Canberra. <u>Bur. Min. Resour. Aust., Records 1957</u> , No. 34. |
| Opik, A.A., 1953                      | - Geological Map of Canberra. <u>Bur. Min. Resour. Aust., A.C.T. G2-12</u> .                                              |
| Opik, A.A., 1955                      | - The Geology of the Canberra City district, <u>The Aust. Cap. Territory as a Region</u> .                                |



GEOPHYSICIS

L. V. Houston

LEGEND

40 80 120 160 GEOPHYSICAL STATIONS

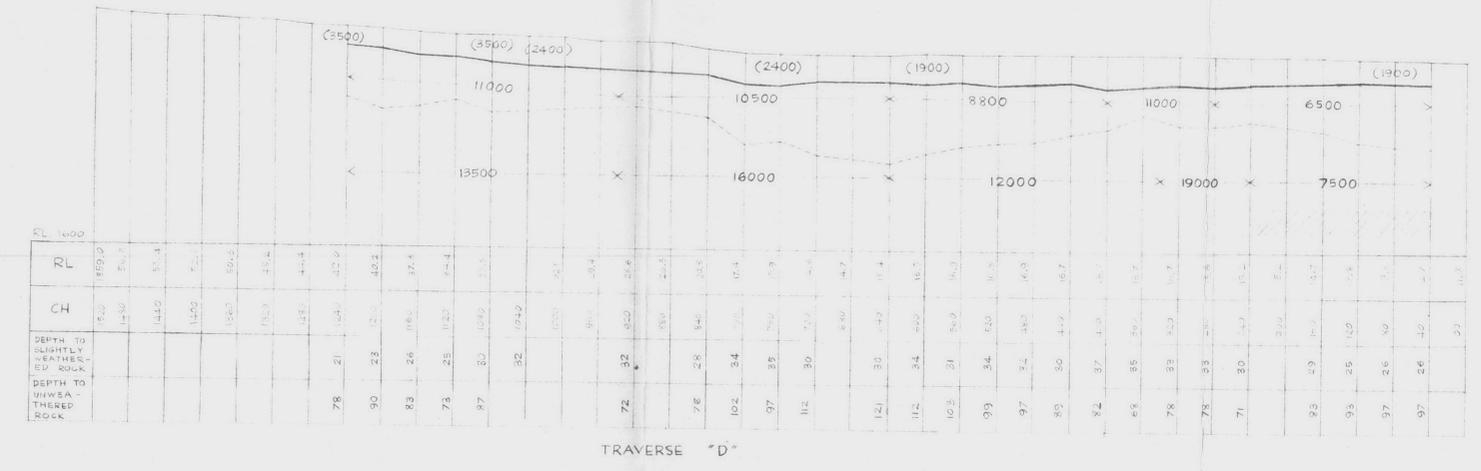
SEISMIC REFRACTION SURVEY  
OF THE ANZAC PARK BRIDGE SITE  
CANBERRA A.C.T.

LOCALITY MAP AND TRAVERSES

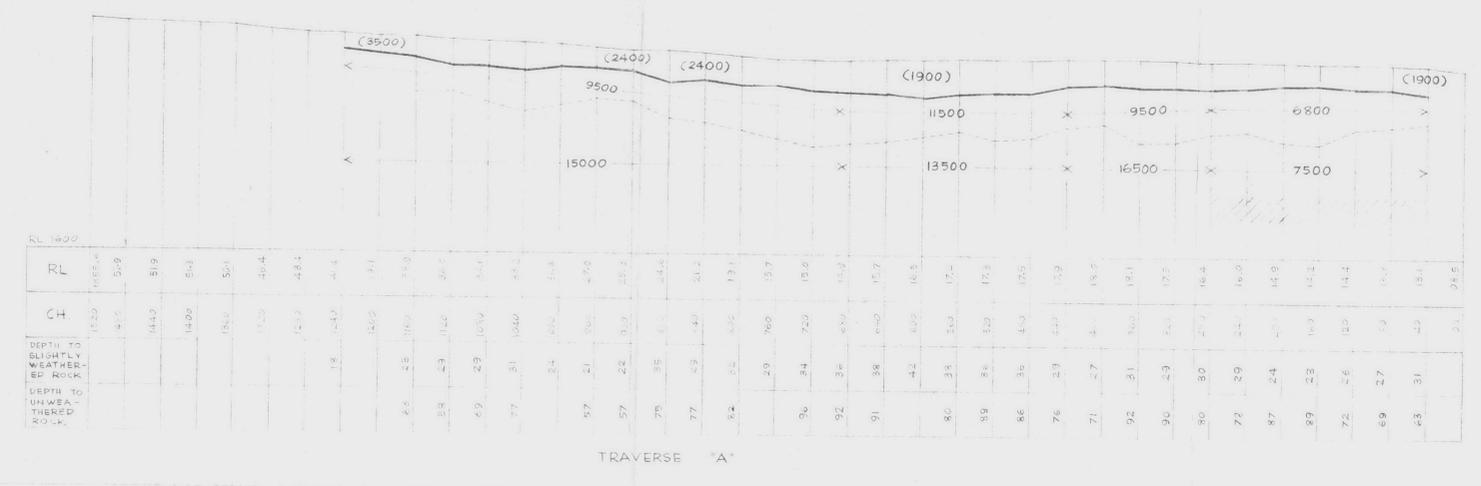
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BUREAU OF MINERAL RESOURCES, GEOPHYSICAL SECTION

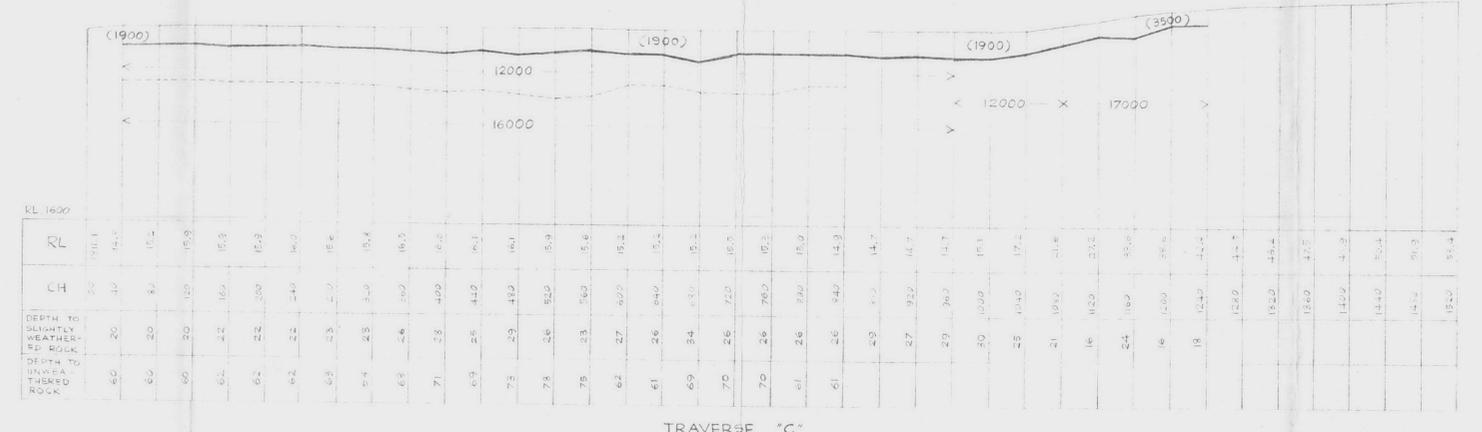
GEOPHYSICIST *L. V. Hawkins*



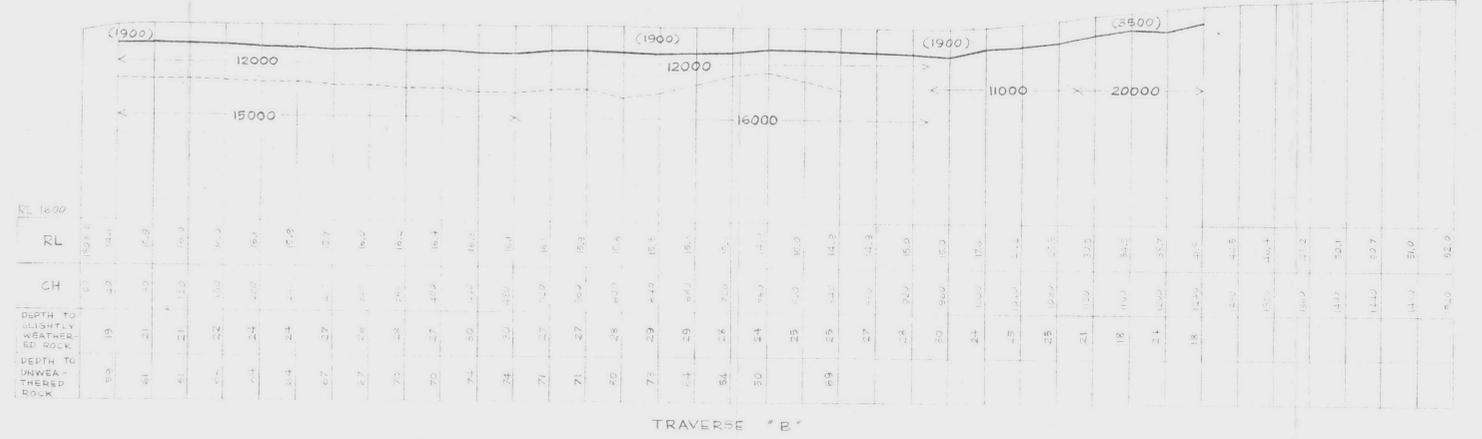
TRAVERSE "D"



TRAVERSE "A"



TRAVERSE "C"



TRAVERSE "B"

LEGEND

- BEDROCK OR OTHER HIGH VELOCITY BEDROCK BELOW AND WEATHERED BEDROCK
- - - WEATHERED AND UNWEATHERED BEDROCK
- 12000 SEISMIC VELOCITIES IN FEET PER SECOND
- (1900) AVERAGE VELOCITIES IN FEET PER SECOND, THROUGH OVERBURDEN
- LOW VELOCITY ZONE

SEISMIC REFRACTION SURVEY OF THE ANZAC PARK BRIDGE SITE CANBERRA A.C.T.

VERTICAL SECTIONS SHOWING PROFILES OF BEDROCK AND HIGHER-VELOCITY REFRACTOR

SCALE 0 100 200 300 FT

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