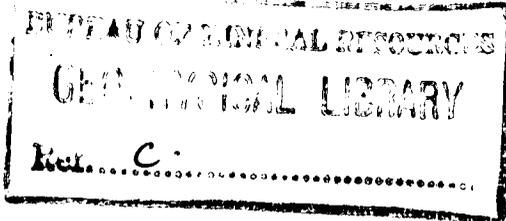


1963/27
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



RECORD No. 1963/27



ADELAIDE/MELBOURNE GRAVITY TRAVERSE, 1949

by

W.H. Oldham

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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ILLUSTRATIONS

Plate 1. Locality map showing gravity stations (Drawing No. J54/B2-17).

SUMMARY

In 1949 a gravity meter was used to establish a gravity value at Fishermens Bend, Victoria, by traversing from a pendulum station in Adelaide. Values were established at other points en route. This Record describes the operation and gives the results in tabulated form, revised to agree with the values for the Australian gravity network as adjusted in 1962.

1. INTRODUCTION

In 1948 the Industrial Chemistry Division of the CSIR (later to become the CSIRO) was engaged in research work that involved very precise pressure measurements. These measurements demanded a precise knowledge of the value of gravity. The CSIR enlisted the aid of the Bureau of Mineral Resources to determine this value at the Fishermens Bend laboratory, near Melbourne, where the work was being done.

The Bureau had already arranged to borrow pendulum equipment suitable for absolute gravity determinations from Cambridge University, but this would not have arrived for some time. The only equipment available was a Heiland gravity meter, which can make precise relative measurements. No sufficiently accurate value of gravity had ever been established in Victoria, but Mr Colin Kerr Grant, in 1937, had established a value of $979.7158 \text{ cm/sec}^2$ at the Old Observatory in West Terrace, Adelaide. This value, which had been measured with Cambridge pendulums, was then believed to be accurate within about 0.001 cm/sec^2 .

The gravity value was transferred from Adelaide to Fishermens Bend by a series of readings with Heiland gravity meter No. 58. At the same time, gravity values were established at many points along the road from Adelaide to Melbourne. The readings were taken by E. McCarthy and the author during January and February 1949.

This Record describes the operation in which the gravity value at Fishermens Bend was established. The results were made available to CSIR in 1949, and have since been used in various ways by the Bureau.

The results as originally calculated were based on Kerr Grant's value at Adelaide, and on the maker's calibration factor (0.1084 milligals per dial division) for the gravity meter. Since 1949, however, gravity has been determined with more accurate pendulum equipment at both Adelaide and Melbourne (Dooley, McCarthy, Keating, Maddern, & Williams, 1961). Subsequent gravity-meter ties have necessitated further adjustments to the adopted values (Dooley, 1962).

The results presented here in Table 1 are based on :

Old Observatory, Adelaide	979,722.20	mgal
Footscray, Melbourne	979,979.00	"
Calibration factor (Heiland 58)	0.10989	mgal/division

The two gravity values are those adopted after the 1962 adjustment, and the calibration factor is calculated to make the meter readings fit exactly between the Old Observatory and Footscray.

2. OPERATIONS

The heating coils of the Heiland gravity meter must be connected to a 6-volt accumulator throughout a survey. For convenience, the meter used on this survey was mounted in a sedan car; a hole cut in the floorboards permitted the tripod to be lowered, and the meter read from within the car. Readings were made like this at every station except the Old Observatory, where the meter and accumulator had to be carried down the stairs into the vault.

To correct for drift in gravity-meter readings, a 'looping' system was used; readings were taken at four stations roughly ten miles apart, then the stations were re-read in the reverse order, and once again in the forward direction. From these readings a drift curve was plotted and used to compute the gravity interval between the rear and forward stations. If a reasonably smooth drift curve could not be drawn - some meter readings were influenced by 'jumps' or earth tremors - that interval was repeated.

In order to make the results useful in regional gravity studies, corrections for altitude had to be made. Most of the route (Plate 1) was close to the Adelaide/Melbourne railway. Therefore as many gravity stations as possible were placed in railway yards or at other places close to railway bench marks, and the altitude of the gravity station was determined by spirit levelling from the bench mark.

3. RESULTS

There is a discrepancy of 106.57 ft between Victorian Railways levels and South Australian Railways levels where they meet at the State border. This arises almost entirely from the different datums used by the two States. The altitudes listed in Table 1 are all reduced to Victorian Railways datum; i.e., 106.57 ft has been subtracted from all altitudes determined from South Australian Railways levels.

The latitudes and longitudes listed on Table 1 were scaled from the 1:250,000 map sheets.

No topographical corrections have been made to the results; for almost all of the stations, topographical effects would be negligible, and in no case would they be large.

There are no large gravity anomalies at any of the stations. This tends to confirm the hypothesis that this part of Australia is isostatically well adjusted.

4. ACKNOWLEDGEMENTS

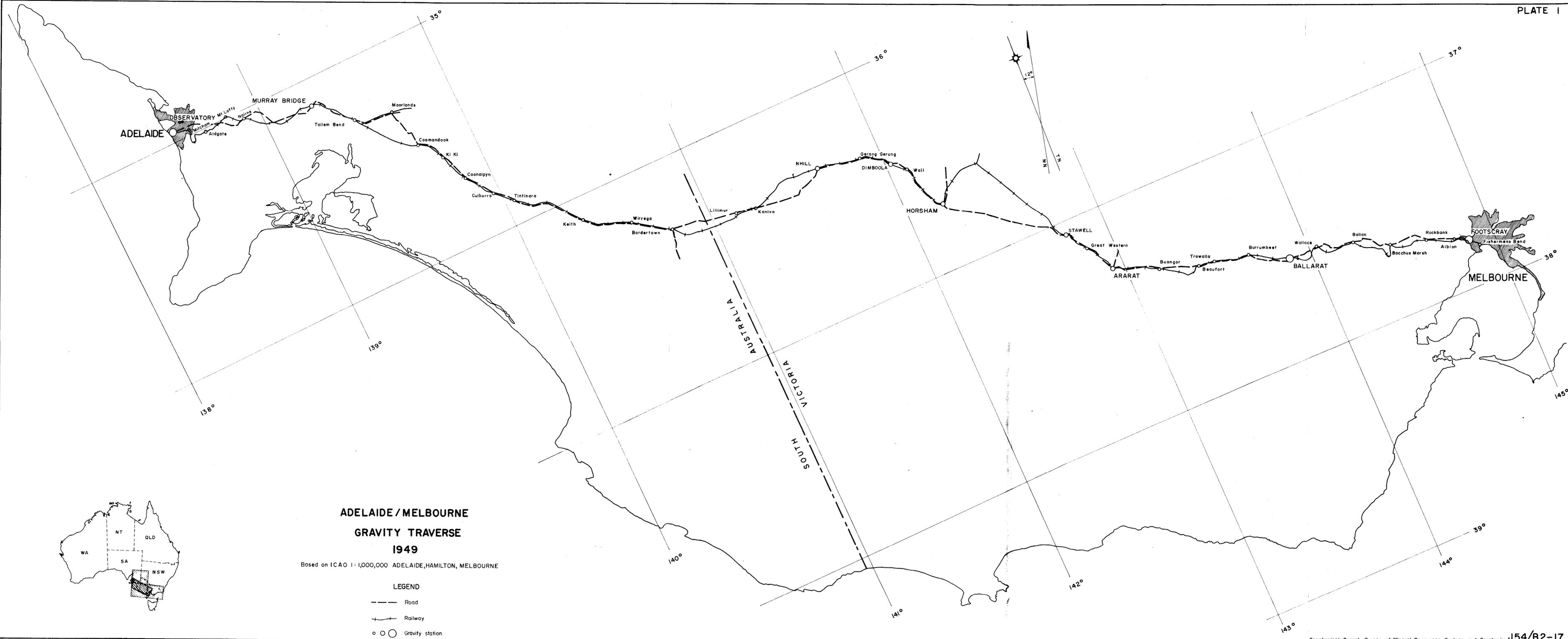
The author wishes to thank the staffs of the Victorian Railways and South Australian Railways for their generous help in providing elevation data.

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(unpubl.).

TABLE 1

STATION	OBS. GRAV. DIFFERENCE (dial div.)	OBS. GRAVITY	LONG E		LAT. S		THEORETICAL GRAVITY	ALTITUDE (ft)	FREE-AIR ANOMALY (mgal)	BOUGUER ANOMALY (2.67) (mgal)
			o	'	o	'				
Old Observatory	0	979,722.20	138°	35.3	34	55.8	979,739.6	-	-	-
Cricket Pitch	+7.8	723.06	138	34.9	34	55.6	739.4	76.84	-9.1	-11.7
Mitcham	-38.4	717.98	138	36.5	34	58.7	743.7	228.93	-4.2	-12.0
Mount Lofty	-697.3	645.57	138	42.5	35	00.6	746.4	-	-	-
Aldgate	-535.3	663.38	138	44.0	35	00.7	746.5	1386.83	+47.3	+0.1
Nairne	-487.3	668.65	138	54.5	35	02.2	748.7	1238.64	+36.5	-5.7
Murray Bridge	+139.5	737.53	139	15.9	35	07.0	755.4	46.46	-13.5	-15.1
Tailem Bend	+366.2	762.44	139	27.6	35	15.5	767.5	55.68	+0.2	-1.7
Moorlands	+521.3	779.49	139	38.6	35	17.7	770.6	32.41	+11.9	+10.8
Coomandook	+686.4	797.63	139	41.8	35	28.8	786.3	33.32	+14.5	+13.3
Ki Ki	+737.0	803.19	139	47.5	35	34.7	794.7	85.29	+16.5	+13.6
Coonalpyn	+758.9	805.60	139	51.4	35	42.4	805.7	65.96	+6.1	+3.9
Culburra	+826.2	812.99	139	57.6	35	49.3	815.5	57.29	+2.9	+0.9
Tintinara	+840.7	814.58	140	02.8	35	53.4	821.4	53.97	-1.7	-3.6
Coombe	+973.9	829.22	140	12.8	35	57.8	827.6	87.28	+9.8	+6.9
Keith	+1207.5	854.89	140	21.2	36	06.2	839.7	94.32	+24.1	+20.9
Wirrega	+872.7	818.10	140	35.0	36	12.6	848.8	202.26	-11.7	-18.6
Bordertown	+1047.6	837.32	140	46.2	36	18.8	857.7	261.67	+4.2	-4.7
Lillimur	+1047.4	837.30	141	08.6	36	22.5	863.0	393.96	+11.4	-2.1
Kaniva	+1021.5	834.45	141	14.9	36	22.9	863.6	472.66	+15.3	-0.8
Nhill	+926.1	823.97	141	39.1	36	19.8	859.1	426.04	+4.9	-9.6
Gerang Gerung	+1051.3	837.73	141	53.3	36	22.3	862.7	445.54	+16.9	+1.8
Dimboola	+1082.1	841.11	142	02.2	36	27.4	870.0	369.95	+5.9	-6.7
Wail	+1112.6	844.46	142	06.3	36	30.4	874.3	441.57	+11.7	-3.3
Horsham	+1319.5	867.20	142	11.9	36	42.8	892.2	422.93	+14.8	+0.4
Stawell	+1313.4	866.53	142	46.4	37	03.7	922.3	760.50	+15.8	-10.1
Great Western	+1258.6	860.51	142	51.0	37	09.2	930.3	784.28	+4.0	-22.7
Ararat	+1376.7	873.49	142	56.7	37	17.1	941.7	1032.59	+28.9	-6.3
Buangor	+1381.4	874.00	143	09.9	37	22.2	949.1	1106.83	+29.0	-8.7
Beaufort	+1306.2	865.74	143	23.0	37	25.8	954.3	1272.72	+31.2	-12.2
Trawalla	+1245.3	859.05	143	28.4	37	26.2	954.9	1214.56	+18.4	-23.0
Burrumbeet	+1133.0	846.71	143	39.4	37	28.2	957.8	1317.44	+12.8	-32.1
Ballarat	+1321.1	867.38	143	51.5	37	33.7	965.8	1415.07	+34.7	-13.5
Wallace	+934.9	824.94	144	02.9	37	33.5	965.5	1926.32	+40.6	-25.0
Ballan	+1260.0	860.66	144	13.6	37	36.4	969.7	1672.48	+48.3	-8.7
Bacchus Marsh	+2031.9	945.49	144	26.2	37	41.4	977.0	345.88	+1.0	-10.8
Rockbank	+2133.5	956.65	144	39.2	37	43.9	980.6	362.24	+10.1	-2.2
Albion	+2327.1	977.23	144	49.4	37	46.7	984.7	132.23	+5.7	+1.2
Footscray	+2336.9	979.00	144	53.5	37	47.2	985.4	114	+4.3	+0.4
Fishermens Bend	+2436.8	979,989.98	-	-	37	49.5	979,988.8	-	-	-



**ADELAIDE / MELBOURNE
GRAVITY TRAVERSE
1949**

Based on ICAO 1:1,000,000 ADELAIDE, HAMILTON, MELBOURNE

- LEGEND**
- Road
 - +— Railway
 - ○ ○ Gravity station

