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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
EXPLORATION GEOPHYSICS SECTION

REPORT ON GRAVITY STATIONS IN THE METROPOLITAN AREA AND SALISBURY

by

J. McG. Hall
Geophysicist

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22nd September, 1964.

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ABSTRACT

Readings were taken at, or near, a number of previously established gravity stations in the Metropolitan area and Salisbury and at a new station at Weapons Research Establishment for the purpose of determining the absolute value of gravity at the W.R.E. station. This was done to within the accuracy of the known value at Adelaide Airport, and in addition new values were obtained for other previously determined stations whose exact position had been lost.

INTRODUCTION

This survey was undertaken at the request of the Weapons Research Establishment who wished to know the absolute value of the gravitational acceleration at a station within W.R.E. It was intended to refer this station to one of the three main stations in and near Adelaide, viz. Parafield, Adelaide Airport and the new Observatory. On investigation, it was found that only the Adelaide Airport station could be re-occupied with certainty, and it was decided that this would be used as the base station for the W.R.E. determination, and new station would be established at Parafield and the Observatory at the same time. Readings would also be taken at the Kensington Gardens end of the B.M.R. gravity meter calibration range (ACS1) to determine the absolute value of gravity over the range.

DESCRIPTIONS OF GRAVITY STATIONS

Adelaide Airport
(Woollard & Rose (1963))

At foot of steel steps in passenger waiting room of new terminal with control tower on top.

University of Adelaide

Observatory basement - on the floor of the first main room on the left past the vestibule, 5'6" from the corridor wall and 12'6" from the northern wall.

Kensington Gardens

On the southern end of the verandah of the Walker Scout Hall, Kensington Gardens, midway between the line of pillars and the wall and midway between the two end pillars.

Parafield Aerodrome

On left corner of bottom step of central double door into terminal from tarmac.

Weapons Research Establishment

Building No. 7, Technical Services Area North - on verandah one foot from wall near door opposite ferry stop and beneath a brass plaque on the wall.

For descriptions of the original stations at Parafield and the University, see Woollard & Rose (1963).

METHODS USED

Because of distance between stations and traffic problems, it was impossible to read all the stations in one loop. Instead, several alternate readings were taken between W.R.E. and Parafield, Parafield and Kensington Gardens, Kensington Gardens and the University, and finally between the University and Adelaide Airport. The readings were corrected for drift and the average differences between stations converted to gravity units. These differences are recorded in section IV. It was considered that a direct tie between Adelaide Airport and W.R.E. to complete the loop would not be feasible as the time between readings would be too long for the drift control to be as accurate as that for the intermediate stages.

Dial units were converted to milligals using a calibration factor of .1127 milligals/dial unit.

(1.127 g.u./dial unit (g.u. = gravity unit)).

GRAVITY DIFFERENCES BETWEEN STATIONS

Weapons Research Establishment - Parafield Aerodrome

(value at W.R.E. less than that at Parafield)

Difference in dial units:

32.75
32.50 Omitting the highest and lowest, the average
32.25 difference is 32.170 dial units, i.e.
32.05 $\bar{x}$ = 36.256 g.u.
32.05
32.00 Standard deviation, $S = \left[\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}\right]^{\frac{1}{2}}$
31.80
S = .23 g.u.

Parafield Aerodrome - Kensington Gardens (ACS1)

(value at Parafield less than that of ACS1)

Difference in dial units:

20.15
20.20 Omitting the highest and lowest, the average
20.05 difference is 20.016, i.e.
19.85 $\bar{x}$ = 22.559 g.u.
19.75

Standard deviation, S = .17 g.u.

ACS1 - University of Adelaide (Observatory)

(Value at ACS1 less than that at the University)

Difference in dial units:

149.50
149.60 Omitting the highest and lowest, the average
149.75 difference is 149.73, i.e.
149.85 $\bar{x}$ = 168.749 g.u.
149.95

Standard deviation, S = .14 g.u.

University of Adelaide - Adelaide Airport (WA3001)

(value at the University greater than that at WA3001)

Difference in dial units:

40/45
40.00 Omitting the highest and lowest, the average
39.75 difference is 39.9625, i.e.
39.80 $\bar{x}$ = 43.038 g.u.
40.00
40.05 Standard deviation, S = .12 g.u.

The standard deviation for any value of gravity obtained on this survey relative to any other station here recorded is considered to be .03 milligals, or 3 g.u.

GRAVITY VALUES AT STATIONS

Adelaide Airport

As this station was the only one (whose absolute value was known) which could be occupied exactly with certainty, it was used as the base for this survey. The value used was that obtained from Dooley (1962), viz., 979719.1 ± .1 milligals.

University of Adelaide

The value obtained was 979723.6 ± .1 milligals. This compares with 979723.7 mgals from Dooley (1962). However, it must be noted that since the readings for the latter value were taken, extensive building has been in progress in the area. In particular:

a. The surface structures of the Observatory have been completed.

b. The Bragg Laboratories and Lecture Theatre has been built immediately alongside the Observatory.

c. The multi-storey Teachers College buildings has been completed within one hundred yards of the observatory.

In addition, the written description of the original station is insufficient to fix its position and the plan (G69-386, from B.M.R. Bulletin No. 46) is misleading, being a very inaccurate representation of the Observatory basement rooms.

Kensington Gardens

This station is part of the B.M.R. gravity meter calibration range in Adelaide (designated ACS1). Its absolute value is 979706.7 ± .1 milligals. Hence, the value at Norton Summit (ACS2) is 979644.1 m.gals. (Difference over range ACS1-ACS2 is given as 62.60 ± .03 m.gals.).

Parafield Aerodrome

Although an exact re-occupation of this could not be made with certainty, it is felt that the present station is within a few inches of the original (WA3002) in elevation and within 10 feet radius (and may be within one foot radius). The value

obtained was 979047.5 ± .1 milligals, which is the same given by Dooley (1962).

Weapons Research Establishment

This is the new station at which knowledge of the absolute value of gravity was desired and which prompted the present survey. The value is 979700.8 ± .1 milligals.

This value (and all the others previously given) is observed value. When corrections are made for latitude and elevation, a corrected value is obtained of -17.8 ± .1 m.gals. relative to sealevel and the international ellipsoid. The elevation correction factor was .6 g.u./foot based on an assumed surface density of 2.67 gm/cc.

In terms of the present survey, the value at W.R.E. is taken as being 18.3 ± .03 milligals less than the value at the Adelaide Airport station, WA3001. Its absolute value can be given to ± .1 milligals only, however, as this is the accuracy to which the value at Adelaide Airport is known at this time.

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