AGSO

Australian Fundamental Gravity Network, 1992 Coober Pedy - Mt Willoughby Gravity Tie, South Australia

Operations Report

by

John W. Williams

AGSO Record 1997/32

AGSO
AUSTRALIAN
GEOLOGICAL SURVEY
ORGANISATION

AUSTRALIAN FUNDAMENTAL GRAVITY NETWORK

1992

COOBER PEDY - Mt WILLOUGHBY GRAVITY TIE, SOUTH AUSTRALIA

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June 1997

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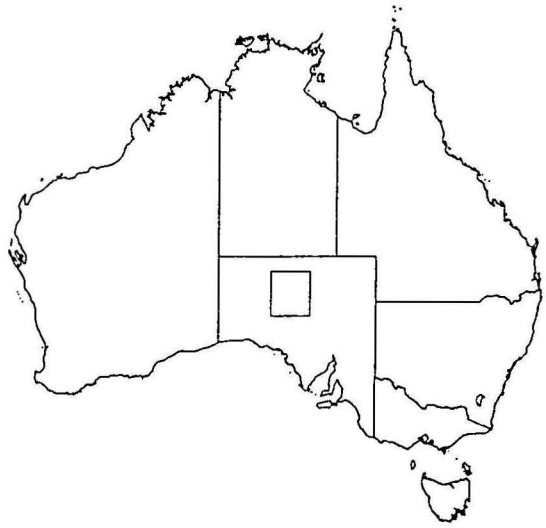
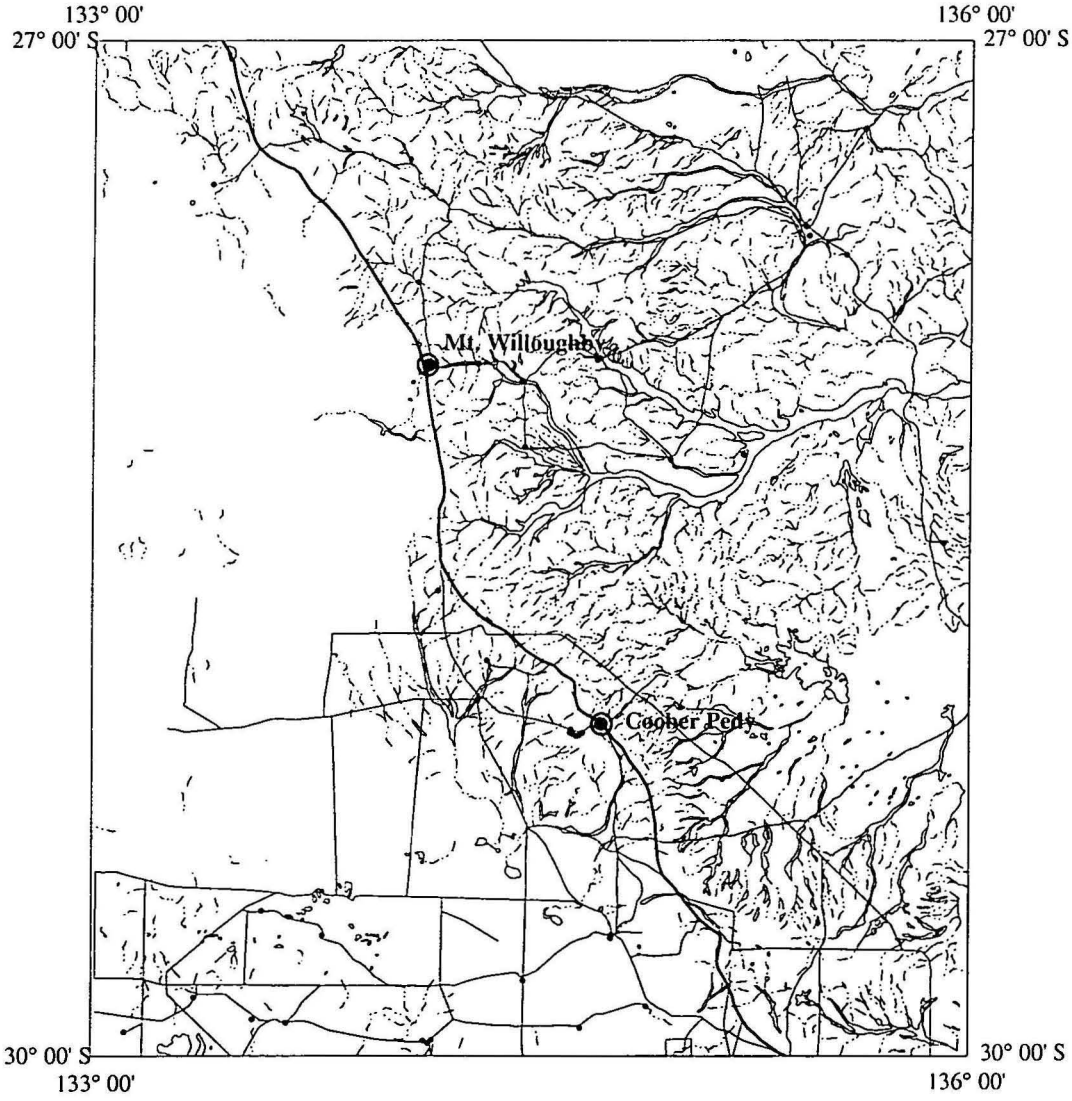
CONTENTS

FIGURES

APPENDICES

LOCATION OF SURVEY





SUMMARY

This report describes gravity meter ties conducted to establish new gravity control stations at the Coober Pedy aerodrome in South Australia.

Two LaCoste and Romberg gravity meters (G132, and G252) were used to measure the gravity intervals during the survey.

The control station used for this survey was at Mt Willoughby airstrip windsock, station 6491.9018.

The new control stations have been marked with inscribed brass identifier discs glued onto concrete at the observation sites.

The following table summarises the new station values. Station locations have not been surveyed and are only approximate.

NEW STATIONS ESTABLISHED DURING THIS SURVEY

Station ID	Latitude	Longitude	Location	Gravity μms^{-2}	Ties
9293.2018	29° 02.5'	151° 12'	Coober Pedy Terminal	9791976.86	3:2
9293.2118	29° 02.5'	151° 12'	Coober Pedy A/S Windsock	9791982.68	3:2

INTRODUCTION

The Australian Geological Survey Organisation (AGSO) has the responsibility of maintaining the Australian Fundamental Gravity Network (AFGN), previously known as the Isogal Network. This network provides a consistent gravity datum to control all gravity surveys carried out in and around Australia.

AGSO is currently putting additional effort into a project to refurbish the AFGN since the last systematic survey of the network in 1980. A large number of base stations have been destroyed by redevelopment of roads and buildings etc. During each annual survey program while progressively restoring and augmenting the AFGN, new control stations are installed in areas needed by Government departments and the mineral exploration industry where there is only a sparse distribution of control stations.

The aim of this survey was to establish new control stations at the Coober Pedy Airstrip following a request by BHP Exploration to improve the coverage of gravity control stations in the Coober Pedy area.

On the 22 of May 1992, the Gravimetry Section of AGSO performed a gravity survey in the Coober Pedy - Mt Willoughby area of South Australia establishing new gravity control stations (9293.2018 and 9293.2118) at the Coober Pedy Airstrip.

The new stations were tied to an existing gravity station at the Mt Willoughby airstrip windsock, station numbered 6491.9018.

Two La Coste and Romberg gravity meters (G132 & G252) were read by one operator over one day.

SURVEY METHOD AND OPERATIONS

The field party consisted of Harry Reith (Technical Officer grade 2), with a Toyota LWB 4WD vehicle, and two La Coste and Romberg gravity meters, G132 and G252.

While travelling between survey locations, the opportunity was taken while in the Coober Pedy area to tie gravity control station 6491.9018 at Mt Willoughby to two new stations 9293.2018 and 9293.2118 at the Coober Pedy airstrip.

Two loops (3:2tie), using two meters, were made over a period of 10 hours on the 22May 1992.

Data was recorded using a Husky Hunter data logger for processing at Canberra.

SURVEY DATA PROCESSING

The Husky Hunter data logger was down loaded in the field and the data sent to Canberra on a floppy disc for processing on a Sun computer (via an IBM PC) by J W Williams.

The field data from the two meters was re-formatted to an input file format suitable for calculation of Earth tidal gravity correction, drift and gravity interval using AGSO programs ERTIDE and GRVHTS.

The readings were arranged to form loops which were then corrected for earth tide, results of which are shown in Appendix 4.
The corrected readings were then input to the network adjusting program which used the two unknown stations as nodes, the primary control station being at Mt Willoughby. The closed loops defined the drift of each meter. The drift and tide corrected measured gravity intervals between the nodes for each loop and for each meter, were least square adjusted to provide best fit values for all measured intervals. Final gravity values were then calculated for each station using the control station value and the adjusted intervals.

RESULTS

Both meters performed well. Adjustments for and between meters were better than 0.26 μms^{-2} .The standard deviation of adjustments was 0.16 μms^{-2}. All readings have been used for the final processing as shown in Appendix 5. The final gravity values are shown in the following table.

FINAL GRAVITY VALUES

STATION NUMBER	LATITUDE degrees	LONGITUDE degrees	HEIGHT m	GRAVITY μms^{-2}	LOCATION
64919018	27.09783	134.01450	278.53	9790780.40	MT WILLOUGHBY WINDSOCK
92932018	29.00416	134.07166	225.	9791976.86	COOBER PEDY TERMINAL
92932118	29.00416	134.07166	225.	9791982.68	COOBER PEDY WINDSOCK

APPENDIX 1

Field Party and Equipment

Personnel;	Harry Reith (Technical Officer grade 2),
Gravity Meters	LaCoste and Romberg numbers G132 and G252.
Vehicle	Toyota LWB 4WD.
Other Equipment	Husky Hunter Data Logger, Base plates camera, cement, station markers.

APPENDIX 2

Gravity Base Station Location Diagrams.

The following diagrams describe the locations of the Fundamental Gravity Network stations measured on this survey. The descriptions and gravity values shown are accurate at the time of installation (May 1992) but these may change to some degree as the envroment around each station is modified in the future.

Control Information.

The reference value used to control the gravity datum for this survey was 9790780.4 μms^{-2} at the MtWilloughby airstrip windsock; gravity station number 6491.9018, as shown on Station diagram Mt Willoughby Sheet 1 of 1.

STATION NAME	STATION CODE
COOBER PEDY	9293.2118

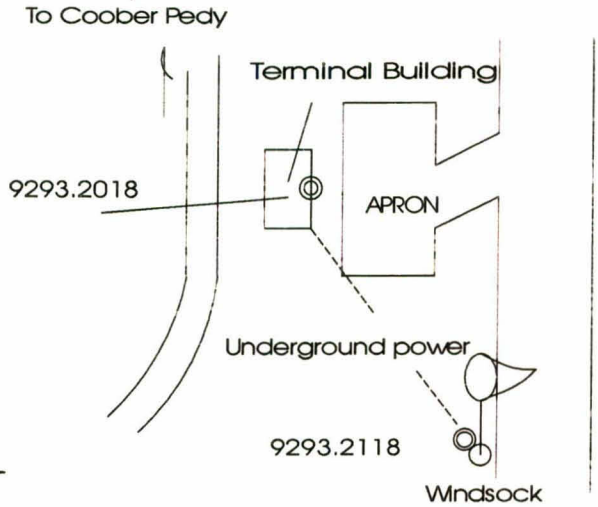
LOCATION	DESCRIBED / RECOVERED BY	OBSERVED GRAVITY (μms^{-2})	DATE
Coober Pedy A/S Windsock	H. Reith *Drawn by J.W. Williams*	9791982.54	May 1992

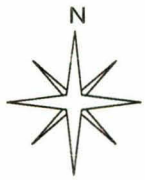
DESCRIPTION:

Station Class:

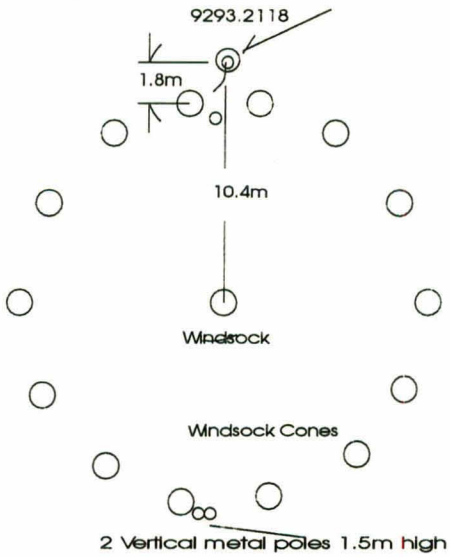
STATION TYPE: Base
POSITION: S 29 02' 30" E 134 43' 00"
Position Source: CAA Enroute Supplement
ELEVATION: 254. m
Elevation Source: CAA

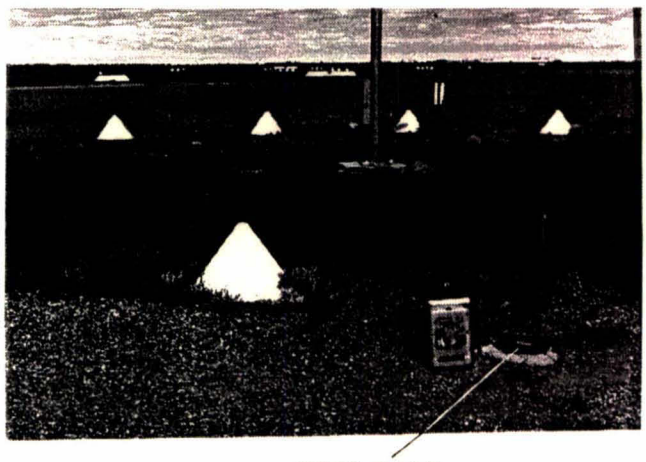
9293.2118





Brass disc placed on round concrete block marked "ELEC"





9293.2118

GRAVITY STATIONS
AUSTRALIAN NATIONAL GRAVITY NETWORK

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Station No. 9293.2018 COOBER PEDY Sheet 1 of 2

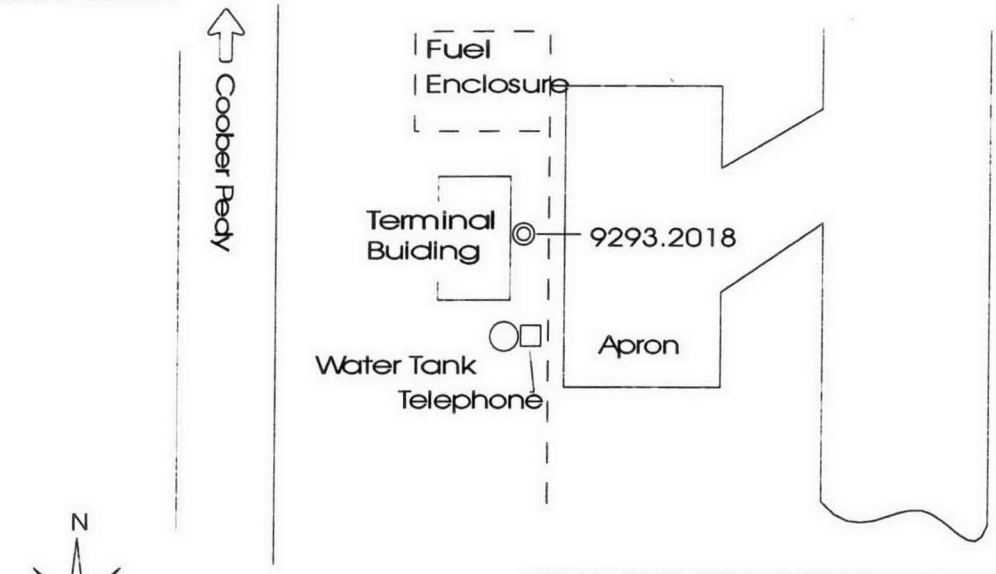
STATION NAME	STATION CODE
COOBER PEDY	9293.2018

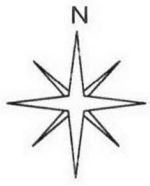
LOCATION	DESCRIBED / RECOVERED BY	OBSERVED GRAVITY (μms^{-2})	DATE
Coober Pedy A/S Terminal	H. Reith *Drawn by J W Williams*	9791976.55	May 1992

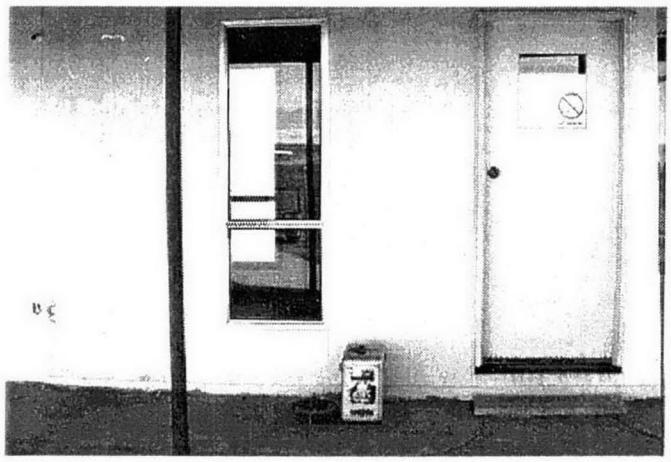
DESCRIPTION:

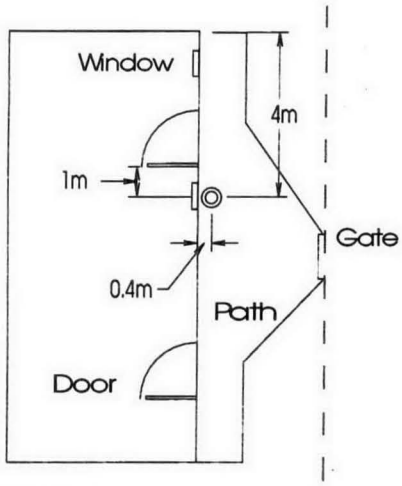
Station Class:

STATION TYPE: Base
POSITION: S 29 02' 30" E 134 43' 00"
Position Source:
ELEVATION: 254. m
Elevation Source:









9293.2018 On east side of terminal
4.0m South of wall
1.0m Sourh of door
0.4m East of window on concrete walkway

GRAVITY STATIONS
AUSTRALIAN NATIONAL GRAVITY NETWORK

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Station No. 9293.2018 COOBER PEDY A/S TERM Sheet 2 of 2

APPENDIX 3

FIELD OBSERVATIONS

```
MT WILLOUGHBY COBER PEDY TIE                                          GRAVITY

Station # Time Reading Latitude Longitude Comments

TRAVERSE  1220592   132L          1
64919018   728 2629884 2758700  13408700  MT WILLOUGHBY WINDSOCK
92932018   919 2742981 2902500  13443000  COOBER PEDY TERMINAL
92932118   931 2743521 2902500  13443000  COOBER PEDY WINDSOCK
92932118   957 2743525
92932018  1011 2742992
64919018  1157 2629938
92932018  1334 2742961
92932118  1346 2743520
92932018  1429 2742958
92932118  1445 2743518
64919018  1727 2629898
                                                              ENDFLGHT
TRAVERSE  1220592   252L          1
64919018   734 2694132 2758700  13408700
92932018   925 2807910 2902500  13443000
92932118   935 2808451 2902500  13443000
92932118  10 0 2808479
92932018  1015 2807912
64919018  12 2 2694157
92932018  1338 2807894
92932118  1349 2808441
92932018  1437 2807865
92932118  1453 2808432
64919018  1732 2694093
                                                              ENDFLGHT
                                                              ENDGRAVS
```

APPENDIX 4

TIDAL GRAVITY CORRECTIONS

MT WILLOUGHBY COBER PEDY TIE GRAVITY

Page No. 1 Computed on 1996/09/06

Station.	Day	Hrs	Min	Corr.rdg.	Lat(deg.min)			Long(deg.min)			Correction(mGal)
TRAVERSE 1	22/ 5/92			132L 1.05000				GMT+ 8H 0M			
64919018		7	28	2629.856	27	5.8700	S	134	0.8700	E	-0.029
92932018		9	19	2742.929	29	0.2500	S	134	4.3000	E	-0.053
92932118		9	31	2743.469	29	0.2500	S	134	4.3000	E	-0.053
92932118		9	57	2743.475	29	0.2500	S	134	4.3000	E	-0.052
92932018		10	11	2742.943	29	0.2500	S	134	4.3000	E	-0.050
64919018		11	57	2629.916	27	5.8700	S	134	0.8700	E	-0.022
92932018		13	34	2742.956	29	0.2500	S	134	4.3000	E	-0.005
92932118		13	46	2743.516	29	0.2500	S	134	4.3000	E	-0.003
92932018		14	29	2742.959	29	0.2500	S	134	4.3000	E	0.001
92932118		14	45	2743.520	29	0.2500	S	134	4.3000	E	0.002
64919018		17	27	2629.887	27	5.8700	S	134	0.8700	E	-0.011
TRAVERSE 1	22/ 5/92			252L 1.05000				GMT+ 8H 0M			
64919018		7	34	2694.101	27	5.8700	S	134	0.8700	E	-0.031
92932018		9	25	2807.858	29	0.2500	S	134	4.3000	E	-0.053
92932118		9	35	2808.399	29	0.2500	S	134	4.3000	E	-0.053
92932118		10	0	2808.429	29	0.2500	S	134	4.3000	E	-0.051
92932018		10	15	2807.864	29	0.2500	S	134	4.3000	E	-0.049
64919018		12	2	2694.137	27	5.8700	S	134	0.8700	E	-0.020
92932018		13	38	2807.889	29	0.2500	S	134	4.3000	E	-0.004
92932118		13	49	2808.438	29	0.2500	S	134	4.3000	E	-0.002
92932018		14	37	2807.867	29	0.2500	S	134	4.3000	E	0.002
92932118		14	53	2808.434	29	0.2500	S	134	4.3000	E	0.002
64919018		17	32	2694.081	27	5.8700	S	134	0.8700	E	-0.012

APPENDIX 5

PROCESSING SUMMARY AND STATISTICS.

GRVHTS Version 6 of November 1992 - Phase one sub-program
Computed on 1996/09/06 at 11:44:54

********** Input data for this pass being read from non-standard unit 40

Gravity meter data reduction

Use new scale correction for LaCoste meters

Latitude-Longitude data saved

Segment identification *MT WILLOUGHBY COOBER PEDY TIE GRAVITY *

TRAVERSE Flight 1 22/ 5/92 Meter 132L Scale factor 1.05000

Scale correction factor is 1.0002140000000

Station	Time	Gravity	Drift	Diff	Reading
6491.9018	728	0.000	0.000	0.003	2629.856
9293.2018	919	119.622	0.026	0.003	2742.929
9293.2118	931	120.202	0.029	-0.009	2743.469
9293.2118	957	120.202	0.036	-0.009	2743.475
9293.2018	1011	119.622	0.039	0.004	2742.943
6491.9018	1157	0.000	0.057	0.010	2629.916
9293.2018	1334	119.622	0.062	-0.005	2742.956
9293.2118	1346	120.202	0.063	0.007	2743.516
9293.2018	1429	119.622	0.063	-0.003	2742.959
9293.2118	1445	120.202	0.063	0.011	2743.520
6491.9018	1727	0.000	0.048	-0.012	2629.887

TRAVERSE Flight 1 22/ 5/92 Meter 252L Scale factor 1.05000

Scale correction factor is 1.0007160000000

Station	Time	Gravity	Drift	Diff	Reading
6491.9018	734	0.000	0.000	0.008	2694.101
9293.2018	925	119.669	0.016	0.002	2807.858
9293.2118	935	120.255	0.017	-0.016	2808.399
9293.2118	1000	120.255	0.030	0.003	2808.429
9293.2018	1015	119.669	0.031	-0.007	2807.864
6491.9018	1202	0.000	0.042	0.004	2694.137
9293.2018	1338	119.669	0.042	0.008	2807.889
9293.2118	1349	120.255	0.040	0.002	2808.438
9293.2018	1437	119.669	0.030	-0.003	2807.867
9293.2118	1453	120.255	0.028	0.010	2808.434
6491.9018	1732	0.000	0.000	-0.012	2694.081

MNSLOPE completed at 0.4 seconds.

Position data saved on scratch file

Position data transfer completed at 0.4 sec

********** Scratch file closed

GRVHTS Version 6 of November 1992 - Phase two sub-program Computed on 1996/09/06 at 11:44:55

Least squares adjustment phase - commenced 0.4 sec

Number of segments to adjust together 1

*MT WILLOUGHBY COOBER PEDY TIE GRAVITY *

Free nodes

9293.2018
9293.2118

Fixed nodes	Values
6491.9018	9790780.400

Free and fixed node lists compared

Number of free nodes deleted is 0

Final number of free nodes is 2
Final number of fixed nodes is 1

Total number of nodes in list is 3

Maximum adjustment expected - Height 5.00 metres
Gravity 1.00 mums-
Magnetic 10.00 gammas

Data search commenced 0.4 sec

Segment identification *MT WILLOUGHBY COOBER PEDY TIE GRAVITY *

TRAVERSE 1 22/ 5/92
********** Internal loop - tied to node 9293.2118 from reading 3 to reading 4
TRAVERSE 1 22/ 5/92
********** Internal loop - tied to node 9293.2118 from reading 3 to reading 4

Linkage search commenced 0.4 sec

Matrix inversion commenced 0.4 sec

Matrix inversion completed 0.5 sec

Least squares values for free nodes

node	VALUE
9293.2018	9791976.856
9293.2118	9791982.684

Connection table and adjustments

Node		Node		Difference	Adjustment	Flight	
6491.9018	FIXED	9293.2018		1196.219	0.237	TRAVERSE	1
9293.2018		9293.2118		5.801	0.027	TRAVERSE	1
9293.2118		9293.2018		-5.801	-0.027	TRAVERSE	1
9293.2018		6491.9018	FIXED	-1196.219	-0.237	TRAVERSE	1
6491.9018	FIXED	9293.2018		1196.219	0.237	TRAVERSE	1
9293.2018		9293.2118		5.801	0.027	TRAVERSE	1
9293.2118		9293.2018		-5.801	-0.027	TRAVERSE	1
9293.2018		9293.2118		5.801	0.027	TRAVERSE	1
9293.2118		6491.9018	FIXED	-1202.021	-0.264	TRAVERSE	1
6491.9018	FIXED	9293.2018		1196.693	-0.237	TRAVERSE	1
9293.2018		9293.2118		5.855	-0.027	TRAVERSE	1
9293.2118		9293.2018		-5.855	0.027	TRAVERSE	1
9293.2018		6491.9018	FIXED	-1196.693	0.237	TRAVERSE	1
6491.9018	FIXED	9293.2018		1196.693	-0.237	TRAVERSE	1
9293.2018		9293.2118		5.855	-0.027	TRAVERSE	1
9293.2118		9293.2018		-5.855	0.027	TRAVERSE	1
9293.2018		9293.2118		5.855	-0.027	TRAVERSE	1
9293.2118		6491.9018	FIXED	-1202.548	0.264	TRAVERSE	1

Standard deviation of adjustments 0.16
Mean of adjustments 0.00
Maximum adjustment 0.26

Number of lines in network 18

Flight data adjusted - starting 0.5 sec.

Segment identification *MT WILLOUGHBY COOBER PEDY TIE GRAVITY *
Gravity differences scaled by 10.0 for micrometres

```
        Station list sort commenced          0.5 sec

        Final sorted values


         *MT WILLOUGHBY COOBER PEDY TIE                                    GRAVITY *
       6491.9018       9790780.400  NODE
       9293.2018       9791976.856  NODE
       9293.2118       9791982.684  NODE


        Number of stations in sorted list      3

        Number of different stations           3


        Station list sort completed          0.5 sec
GRVHTS  Version 6 of November 1992  -  Phase two sub-program     Computed on 1996/09/06 at 11:44:55

        Latitude-longitude insertion phase - Commenced       0.5 sec

        Number of segments to merge    1

Segment identification  *MT WILLOUGHBY COOBER PEDY TIE                        LATLONG *
             TRAVERSE       1     22/ 5/92
             TRAVERSE       1     22/ 5/92


        Final position list checked


        Merging of position data completed       0.6 sec

                0  Non-fatal mistakes discovered

                0  Missing positions in final list

                0  Fatal errors occurred in merging


GRVHTS  Version 6 of November 1992  -  Phase two sub-program    Computed on 1996/09/06 at 11:44:56

         Creation of new segment file

        New output file created on unit   2
        labelled  *AUSTRALIAN GRAVITY DATA                                   96/09/06*

        **********         3 Stations output in newly created segment on unit   2
  labelled  *MT WILLOUGHBY COOBER PEDY TIE                                    96/09/06*

*****************************************************************************


        New output file on unit    2  terminated

        labelled  *AUSTRALIAN GRAVITY DATA
96/09/06*

        CREATE completed at        0.6 sec.
```