



mainroads
WESTERN AUSTRALIA

Asset and Geospatial Information Branch
Survey and Mapping Section

Minor Control Points

67-08-37

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1.1	November 2013	Full revision of standard	N/A
1.2	January 2014	Partial revision for SP1 version 2.0 compliance	N/A
1.3	March 2017	Format Change / Review	All

1 PURPOSE

The purpose of this standard is to detail the Main Roads requirement for Minor Control surveys.

2 SCOPE

This standard shall apply for all Minor Control surveys for roads in Western Australia. Advice and further information can be obtained by contacting the Senior Geodetic Surveyor.

3 DEFINITIONS

The following terms used in this procedure have the specific meanings indicated:

Term	Definition
SSM	Standard Survey Mark
RM	Reference Mark
GNSS	Global Navigation Satellite System
AHD	Australian Height Datum
ICSM	Intergovernmental Advisory Committee on Surveying & Mapping
MGA	Map Grid, Australia
GDA	Geodetic Datum, Australia
MCP	Minor Control Point
RRM	Road Reference Marks – Random Construction Control
RTK	Real Time Kinematic GPS observation methods

4 REFERENCES AND RELATED DOCUMENTS

The following documents relate to this procedure:

Document Number	Description
	ICSM - Standards for the Australian Survey Control Network (SP1 ver 2.0)
67-08-36	Main Roads Survey and Mapping Standard “67-08-36 Road Reference Marks”
67-08-43	Main Roads Survey and Mapping Standard “67-08-43 Digital Ground Survey”
67-08-100	Main Roads Survey and Mapping Guideline “67-08-100 Metadata Requirements”
D09#47734	Main Roads Survey and Mapping Guideline “D09#47734 Digital Ground Survey”

5 ENTRY ONTO LAND

It is the Consultant's responsibility to seek and obtain permission from landowners, occupiers or management authorities before entering any property to undertake survey work. Property includes Crown land which may consist of Reserves, National Parks or State Forests. Survey work may include, but is not limited to, investigation, capture, placement and coordination of points.

The consultant shall maintain a written report of all contact made with landowners while working on the survey contract. Details of landowner contact are to be outlined in the metadata statement.

Any queries made by land owners with respect to the project are to be referred to the Main Roads Project Manager.

If access onto land is refused by the owners, the consultant will be required to immediately contact the Main Roads Project Manager to discuss the need for entry onto the land. If entry is required for the completion of the contract and there are no other alternatives, then Main Roads will arrange formal notification using delegated powers under the Land Administration Act. A formal notice of entry requires Main Roads to provide 7 days' notice to the owners. The process to arrange the formal notice of entry may take some time and the consultant must liaise with the Project Manager to ensure disruption to the contract schedule is minimised.

6 ENVIRONMENTAL IMPACT

All work is to be performed such that environmental impact is minimised. Any breach of environmental and heritage legislation during the execution of works is the sole responsibility of the consultant.

The consultant shall ensure any disturbances are kept to an absolute minimum. The consultant shall reinstate, clean-up and leave the site as close to its pre-disturbed condition as possible on completion of any work or investigation.

New tracks shall not be formed, existing tracks altered, fencing cut, clearing carried out, or damage or disturbance made of any kind unless approved by the Main Roads Project Manager.

The consultant shall be responsible for the cost of reinstating any damage to property resulting from their work.

7 STANDARDS FOR MINOR CONTROL

7.1 GENERAL

Minor Control Points are established as a point of reference for the acquisition of digital ground survey and other engineering investigation surveys.

Depending on project needs, minor control is often used to supplement (in-fill) the RRM network that is required for construction, or other permanent survey control that has already been established (i.e. SSM's) on Main Roads survey projects.

They therefore have a finite usefulness in a project area. Often they are either destroyed because of their location or unreliable due to their age and ultimately replaced by the RRM network when new road design has been finalised.

7.2 REFERENCE DATUM

The horizontal positions of all minor control will be supplied in MGA 94 coordinates and the defined project zone for the project area.

The level datum shall be AHD, unless specifically exempted by the Senior Geodetic Surveyor, Main Roads WA.

7.3 CONTROL POINT NUMBERING ALLOCATIONS

MCP number allocations are to be obtained by application from the Senior Geodetic Surveyor. (Phone: 9323 4152). The application should include details such as road name, road number, start and finish SLK, road section name.

7.4 PLACEMENT OF MINOR CONTROL POINTS

MCPs should have a unique identifying label attached to the physical mark where possible. This label will have the MCP number marked on it in a permanent way (ie. the number stamped or engraved on an aluminium tag).

MCPs may be physically marked by any of the following methods;

- Star iron picket, with or without concrete
- Steel spike, Cooke's nail
- Wooden peg, dumpy
- Nail and plate
- Ramset nail in concrete
- Or with other similar materials

In urban areas with sandy soil, it is important to preserve the vertical stability of the mark so it is suggested that the ground mark be of suitable material to achieve this.

An indicator may be placed adjacent to the mark where this will assist in re-locating the mark and its survival. However, indicators must not be placed where they may present a danger to the public (such as along minor urban roads or footpaths) or within 1 metre of a bitumen road edge.

The prime considerations when placing new MCPs are:

- The safety of the surveyor and public,
- The suitability of the mark for radiate observations,
- The long term vertical stability of the mark,
- To avoid grazing and low rays when occupied for observations,
- That no single radiate observation shall exceed 130 metres in length.
- Extreme caution to be exercised where underground services may be present-thus long star pickets (0.5m or longer) may not be best.

MCPs are to be ideally re-useable for 5 years after placement.

Should more permanent mark types be required on a project, then these should be placed according to the Main Roads WA RRM Standard 67-08-36.

7.5 REFERENCING AND STATION SUMMARY

There is no need to place reference marks or compile a station summary form for MCPs unless requested to do so. However it may be prudent to place reference nails in the nearby bitumen or kerbs for example and document this so that the mark can be relocated easily.

7.6 METHODS OF SURVEY

Methods of horizontal survey shall include the following:

- A minimum of two and preferably three or more existing control points must be included in the new network. Such existing control can be RRM or SSMs, with GNSS ties to the latter to not exceed 5km if possible. Existing minor control may be included in the traverse provided their origin is known, they have been placed within the past 5 years and they only form part of the adopted traverse.
- The position and height of any existing mark shall be verified by check measurements to RMs or nearby mark before being adopted and used.
- NO new MCP shall be coordinated by radiation. There must be sufficient observational redundancy in the new network to do an adjustment.
- In the case of conventional surveying methods, an orientation angle must be observed between the existing network and the new network.

7.7 HORIZONTAL ACCURACY

The survey of all new minor control for Main Roads shall ensure that good relative positional accuracy is maintained. When conventional equipment is used, and the new control points are less than 260 metres apart, at least two rounds of angles and 3 distances are to be recorded between all stations. Thus most distances will have two mean values which will assist the adjustment redundancy. The intention for MCP control is to have the same level of precision as RRM control-only the marking standard and spacing of the MCPs is different.

GNSS equipment in Static mode will not be able to deliver sufficient accuracy over the short distances (260 metres maximum) between new Minor Control but may be necessary to provide ties to existing marks upon which the survey is to be based or between Minor control points 500 metres apart along the traverse.

Minor Control networks or traverses shall be adjusted using a Least Squares adjustment.

7.8 VERTICAL ACCURACY

All MCPs shall be two-way spirit levelled or form part of a single level run between two known benchmarks which have been verified from their RMs.

A minimum of two existing benchmarks (can be SSMs, RRM and/or MCPs) shall be included in the levelling to verify the levelling run, where they exist. In exceptional circumstances this rule can be relaxed with the agreement of the Survey and Mapping Manager.

The height difference between two known bench marks in a single run shall not exceed $0.012 \times K$ where K is the distance in kilometres and K is greater than or equal to 1 km.

Refer to SP1 Ver.2.0 Differential levelling Guideline, section 3.1.2, for ideal observation parameters to achieve $0.012 \times K$ standard levelling.

The vertical accuracy for distances less than 1 km shall be on a pro-rata basis relative to the 1 km tolerance (0.012 metre). For example the accuracy tolerance for a run 500 metres long shall be +/- 0.006 meter.

Observations which result in a level misclose which is acceptable between existing bench marks shall be adjusted proportionally according to the distance between points. The final heights of the Minor Control points will be the adjusted reduced levels.

Errors detected in the original benchmark traverse are to be reported to the Senior Geodetic Surveyor.

8 VOLUME SURVEYS

An MCP typically in the form of a short star picket shall be established in a safe location for volume surveys of material stockpiles and shall be surveyed to Main Roads WA Digital Ground Survey Standard 67-08-43 Class B. Thus +/- 0.02m horizontal and +/- 0.015m vertical relative to any existing control. However, in remote areas, adopted MGA coordinates for one MCP need only be accurate to +/- 30 metres and an assumed level datum may apply. Thus the absolute position of the Stockpile may not be essential and this would allow the use of hand-held GNSS receivers or other methodologies to establish the datum. After the initial base level surface has been surveyed, the stockpiles themselves can be surveyed relative to the minor control placed (+/- 50mm horizontal and +/- 20mm vertical-Thus RTK GNSS is acceptable).

Statements of expected coordinate accuracies must be included in the Metadata Statement.

9 DOCUMENTATION

An Excel spreadsheet must be compiled for lodgement. This spreadsheet must contain for each point, its point #; Easting, Northing, RL, Project Zone, Datum, description of the mark and its locality as well as a listing of any existing control used and their coordinate values.

Refer to the example at Appendix A.

10 LODGEMENT

For each project the following information must be submitted to the Project Manager:

- a) A brief written survey summary with details of methodology used, adjustment details, summary of existing Control used including coordinates used in the adjustment, and any other relevant information. This may be contained within the excel spreadsheet at item c) below.
- b) A Metadata Statement in accordance with the Metadata Guideline 67-08-100.
- c) An excel spreadsheet file as per Item 9 and Appendix A.
- d) A station summary if Reference marks are placed (see Item 7.5).

11 APPENDICES

Appendix	Title
Appendix A	Minor Control Point Data Summary
Appendix B	Minor Control Point Summary

APPENDIX A: MINOR CONTROL POINT DATA SUMMARY

Project Name:		Detail pickup for culvert replacement				
Date of survey:		Feb-March 2009				
Location: eg Nearest town		Bunbury				
Road/Highway #		Bunbury Bypass H59				
Surveyor		Survey Data R Us				
POINT LISTING						
POINT #	EASTING	NORTHING	RL	PROJECT ZONE	DATUM	MARK DESCRIPTION
5005	36751.029	110887.41	1.588	PCG 94	GDA 94	Drill hole in granite outcrop; 18.5 to road C/L; 100m west of junction
5006	36925.123	110654.26	1.956	PCG 94	GDA 94	spike sunk 0.1 in gravel verge; 12.5 to C/L; 15.2 from power pole.
Collie 232	36650.256	110923.26	2.103	PCG 94	GDA 94	SSM-published coords adopted
Collie 231	37123.874	110125.96	3.225	PCG 94	GDA 94	SSM-published coords adopted

APPENDIX B: MINOR CONTROL POINT SUMMARY



MINOR CONTROL POINT No.

ROAD NAME:	Road No.
SECTION:	SLKm:
REGION:	LOCAL AUTHORITY :
SURVEYOR:	DATE:
FIELD BOOK No:	LEVEL BOOK No:

MGA 94 ZONE:	EASTING:		
PROJECT GRID:	NORTHING:		
HEIGHT (MARK):	EASTING:		
	NORTHING:		
	(RM1):	(RM2):	
OBSERVATION TYPE:	RTK <input type="checkbox"/>	GNSS STATIC <input type="checkbox"/>	TOTAL STATION <input type="checkbox"/>

DESCRIPTION AND LOCATION DIAGRAM
