



Landgate Requirements for Refurbishment of Geodetic Marks

GSU-02 Version 2



Locate



Value



Secure

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Document control

Landgate requirements for refurbishment of geodetic marks, Version 2 – Sept 2023

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1. Purpose

The main purpose for the refurbishment of a geodetic mark is to maintain the integrity of the geodetic datum by confirming the viability and usability of the ground marks. This can be achieved by ensuring a minimal number of RMs still exist, maintaining the lids, hatch surrounds and updating the access/location sketch.

The geodetic marks known as Standard Survey Marks (SSM) or Bench Marks (BM) are required to be refurbished if they

- Have been highlighted by users as physically disturbed or
- After geodetic analysis of survey data, the mark's position requires further investigation.

The intended purpose of the mark refurbishment is to provide a definitive report on

- Physical condition of the primary mark as well as its RMs and
- 3D relative position changes between the primary mark and its RMs.
- Identify reasons for mark disturbance.

2. Validation of the 3D Position of the Primary Mark

At each mark (SSM or BM) where refurbishment is required, all RMs must be located. The use of a metal detector is recommended. As some RMs can be of nonferrous material or located near strong magnetic sources the attempt to locate an RM should not be limited to metal detector.

Once all the RMs are exposed the horizontal distances from the primary mark to all RMs and between RMs are to be observed and recorded on the station summary. Height differences are required to be observed between the primary mark and all RMs.

2.1. Horizontal Distance

The horizontal distance can be measured by using traditional plumb bob and offset tape or EDM instrument. If a total station is used, only high precision prism (2mm or better at steep vertical angles) installed on as short as possible pole, and braced, should be used. Standard length prism poles and/or 360° prisms (standard or mini) are not acceptable. Use of GNSS for mark validation is also not acceptable. Ensure EDM instrument maintains current calibration certificate.

2.2. Height Differences

The height differences should be measured using digital or optical levels with measured differences stated to the nearest 1 mm. Total station can also be used to determine height differences providing survey methodology ensures height differences are as accurate as derived by standard optical level measurements (as a minimum, observations should be taken on both faces).

3. Measurements Variations

Where the measured distances or height differences are in excess of 10 mm to the values as provided on the station summary or mark report, the new measurements should be verified and documented.

If there is a possibility that either RM or the primary mark has been displaced horizontally the angular relationships between the RMs from the primary mark should be observed. Using the observed angles and distances from the primary mark to RMs, compute distances between RMs and check if they agree within 5mm to the observed values between RMs. Probable cause for the disturbance, if able to be ascertained, should be noted in the report.

If the inconsistencies exist in the observed height differences a second round of observations should be undertaken. Again, the new values should be documented and the probable reason for the discrepancy should be ascertained and reported.

4. Missing Reference Marks

4.1. SSM

As a minimum requirement, an SSM should have an array of three RMs distributed approx. 120° from each other around the primary mark and located 3 to 5 m from the primary mark.

The distance from the primary mark can extend beyond 5 m if the location can provide greater longevity for the RM.

If during the verification process, insufficient number of RMs were located additional RM(s) should be installed. See **GSU-04 - Landgate Requirements for Placement of Standard Survey Mark** document on the specifications for the installation and measurements of a reference mark.

Avoid installing a new RM in the same location as the missing one. The naming (numbering) of new RM(s) should continue sequentially on from the highest RM number provided in the station summary. The naming (numbering) should continue clockwise. In case complete set of new RMs are installed the lowest name (number) should be assigned to the first RM arrived at clockwise from north when standing on the primary mark.

4.2. BM

As a minimum requirement, a BM should have two RMs. The installation requirements for BM's RMs are mostly the same as for SSM (Section 4.1). Consider suitable location, that will minimise the risk of both RMs being disturbed at the GSU-04 same event (e.g. due to road widening). Report the observed horizontal distances to the nearest cm.

The height differences should be measured using digital or optical levels with measured differences stated to the nearest 1 mm.

5. Maintenance of the Primary Mark

The condition of hatch surround and lid should be checked, and damaged or missing lids and surrounds replaced. When installing a new surround care should be taken to ensure the primary mark remains undisturbed. There must be a physical separation between the primary mark and the hatch surround (see **GSU-04 - Landgate Requirements for placement of Standard Survey Marks** document for details).

If practical any hatch cover 0.1 m below the ground surface should be raised flush.

Vegetation and soil should be removed from the lid and surround. Care should be taken to avoid contact with dangerous animals and sharp objects.

For a period, asbestos was used as a construction material of hatch surrounds. Whilst Landgate has attempted to identify and document surrounds which may contain asbestos, there are number of undocumented marks that may still contain asbestos. If a surround is suspected of contain asbestos and was not identified on the Landgate information sheet, this should be reported as soon as possible to Landgate. Please follow the Landgate's asbestos notification instruction which can be found under our Survey mark information webpage [here](#). If an asbestos hatch cover surround is damaged, weathered or otherwise degraded state, please advise Landgate via email on geodesy@landgate.wa.gov.au or (08) 9273 7111.

Missing or damaged witness plate (WP) should be replaced. WP's can be obtained from Landgate. In rural areas the WP should be attached to a SIP and stamped with azimuth and distance to the primary mark. In urban areas where the placement of WP presents a risk to public safety, or there are no suitable structures to place a WP, a broad yellow arrow pointing to the mark can be painted on a kerb or road. Size of the lettering should not exceed 0.1 m.

6. Report and Documentation

A colour print of the station summary can be used to document the measurements to RMs and amendments to the access sketch. The measurements and amendments should be clear and of contrasting colour. If electronic instruments were used, a readable ASCII file/s with the observations must be supplied. Ensure correct station name (as per station summary), target name, instrument height, prism height, prism type, etc) are provided. Where possible reduced slope distances to horizontal and vertical measurements.

If new reference marks have been installed, a sketch of the RM array showing all measured and computed values including numbering of RMs, depth and type of RM is required. A readable PDF scan of a field book is acceptable. The position and distances to the new RMs in relation to readily identifiable features found on site such as kerbs, power poles, footpaths etc. should be captured and provided to improve RM location in the future.

For height differences, a copy of the level book (pdf) or readable ASCII file as well as the Landgate levelling [abstract](#) (use available templates) must be supplied.

A short report of the investigation findings or refurbishment at each mark must also be included in a common digital format such as Microsoft Word document or PDF. If available supply images of marks, RMs and surroundings.