

Landgate Requirements for Placement of Standard Survey Marks (SSMs)

The installation of Landgate Standard Survey Marks is to be in accordance with ICSM [Special Publication No 1 \(SP1 v2.2\)](#) and [SP1 Guideline for Installation and Documentation of Survey Control Marks \(SP1 v2.2\)](#). The Landgate requirements below shall prevail over the SP1 v2.1 guidelines where there is inconsistency between the two.

1 Site Requirements

The placement of an SSM should be undertaken considering the following:

- Installed in a location that provides long term stability and durability of the mark and is least likely to be damaged, destroyed or constitute a hazard to the public.
- Clear sky view
- Limit potential multi-path and Radio Frequency Interference sources
- Ease of access and occupation
- Avoid or minimize vegetation clearing (present and future)
- Limit hazard to public safety.

Consideration of the placement of the mark should be given to avoid service corridors. Mark should be located at a sufficient distance from any potential earth works to prevent future damage or disturbance to the mark.

2 Placement of SSM

- 2.1 The mark should consist of a Landgate provided SSM or brass plaque set in concrete, constructed in accordance with the sketches shown in section 5 or 6. To improve structural rigidity, the precast SSMs require steel reinforcement running the entire length of the monument. A hatch cover is required in developed or planned for development areas, or where the SSM may be at risk or pose a risk to public safety.
- 2.2 The Landgate provided unique mark identifier shall be stamped on the brass plaque.
- 2.3 The SSM and hatch cover when installed, must be unconnected allowing for hatch movement.
- 2.4 A minimum of three (3) reference marks (RMs) shall be placed around the SSM preferably at 120° separation at least 0.2 m below the natural surface and approximately 3 to 5 metres away from the SSM. The RMs should be 13 mm diameter mild steel rods, of sufficient length to ensure stability (0.6m preferred) and surrounded by a 0.2 m diameter concrete collar of at least 0.25m in depth. If the placement of subsurface marks is impractical, alternative types of RMs (200mm where possible bridge nails in bitumen, masonry nails in concrete etc) may be used. These

alternative marks should be placed with regard to the long-term stability of the reference mark. Alternative RMs must also be capable of unambiguous height measurement with a staff. RMs placed in fence posts, power poles, kerbs, brick paving or cracks in concrete are not considered to be acceptable RMs. Masonry nails, if used, should be of the hammer interference fit anchor type installed into a drill hole (for example Ramset Shuredrive™). Concrete nails should only be used in medium hardness materials that allow the nail to be driven in without distortion.

- 2.5 Use of a metal reinforced precast mark is preferred. If a precast mark not available, only good quality reinforced concrete should be used in the construction of the SSM.
- 2.6 Measure and record the height difference from the SSM to ground level and where a hatch cover has been installed, from the hatch cover to SSM and ground level.
- 2.7 A Landgate witness plate near the SSM is required and attached to a star iron picket or a suitable nearby fixture. The distance and bearing to the SSM is to be stamped onto the witness plate. Where public safety is likely to be an issue, the requirement for a witness plate can be waived.
- 2.8 In urban environments where witness plates are not suitable, SSM lettering and a broad arrow pointing to the mark can be stencilled onto the kerb or roadway in yellow paint.

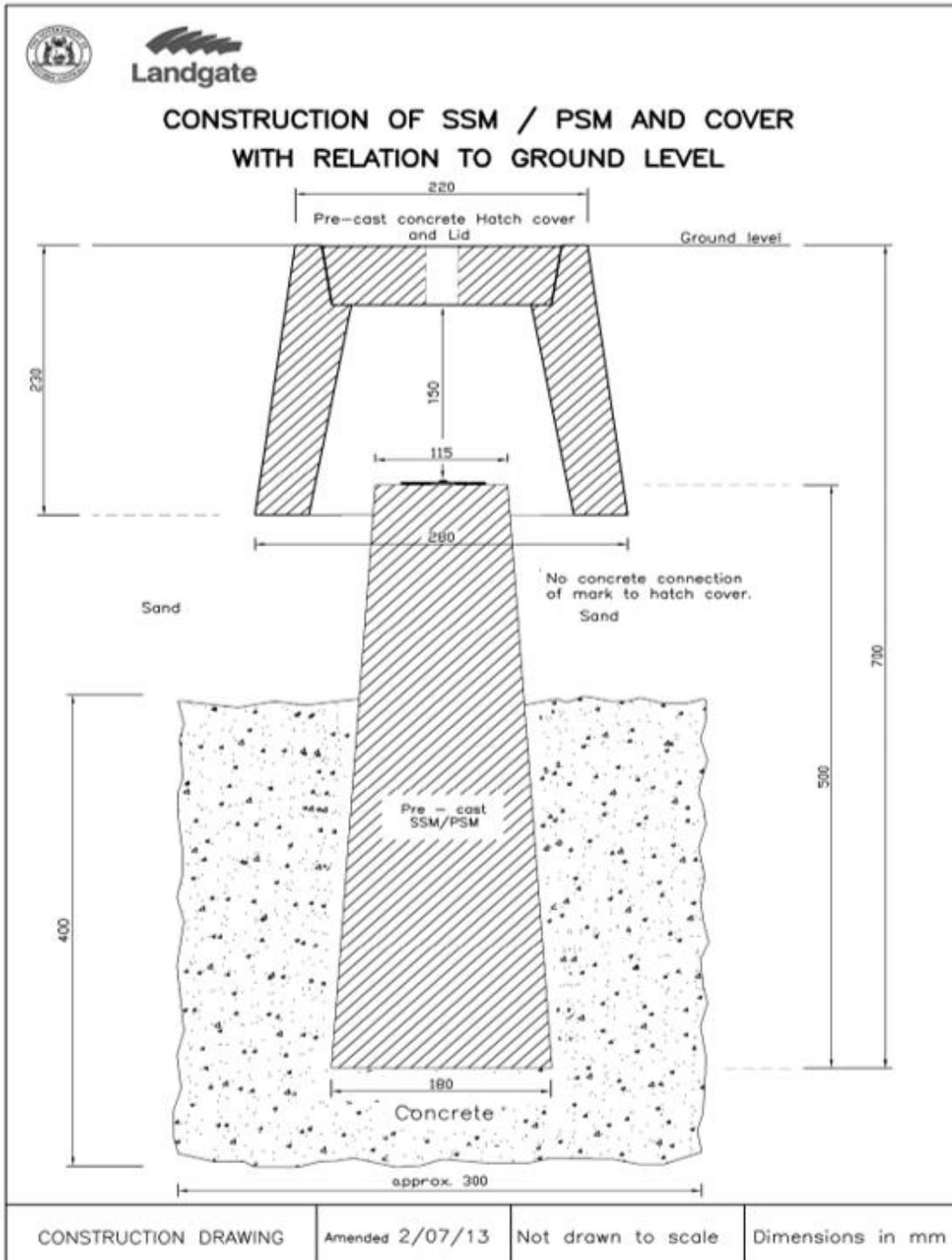
3 Reference Mark Measurement

- 3.1 All distances between the SSM and RMs, and between RMs must be measured and recorded to three decimal places.
- 3.2 Bearings from the new SSM to each RM are to be recorded to at least 10 seconds of arc. The bearings should be oriented to true azimuth by observing an angle from an adjacent known point within the geodetic network. If a known suitable SSM or Landgate co-ordinated mark is not available, a true azimuth should be established by observing to a permanent distant reference mark (DRM) utilising GNSS (static / rapid static baseline or RTK / VRS techniques can be used). The distant reference mark should be of sufficient distance away from the primary mark to ensure reliable azimuth determination. Where possible a distance should be measured to the DRM and recorded.
- 3.3 Differences greater than 5mm between measured and calculated distances are unacceptable.
- 3.4 The difference in height between RMs and SSM must be accurately measured using a spirit level (digital or optical). The method of observation should eliminate errors caused by the staff foot being incorrectly placed on the mark. The method used must demonstrate redundancy of measurement. Total stations can be used for RM levelling however the survey method must be detailed in the report and the instrument height, reflector height and collimation errors are reduced (2 face measurement) so that the height differences obtained achieve accuracies expected of a level instrument. Only a 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.
- 3.5 Measure and provide the height difference from the RMs to ground level.
- 3.6 RMs are numbered consecutively clockwise with number 1 being assigned to the first RM as viewed clockwise from north.
- 3.7 The use of GNSS (including RTK and VRS) is not acceptable for the measurement of RMs.

4 Station Summaries

- 4.1 A sketch with access information, a description of the mark's location relevant to nearby features, and the physical characteristics (such as precast concrete with brass plaque or spike in concrete) of the SSM and RMs are to be provided. This should include sufficient access, recovery information and connections to any local features that will enable the SSM to be readily found.
- 4.2 A station summary CAD file should be prepared using the supplied station summary template.

5 Installation of Precast SSM



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6 Installation of Brass Plaque SSM

