

## 04

# Coordinate transformations between GDA94 and GDA2020

Coordinate transformation is the process of changing coordinates from one reference frame or datum to another.

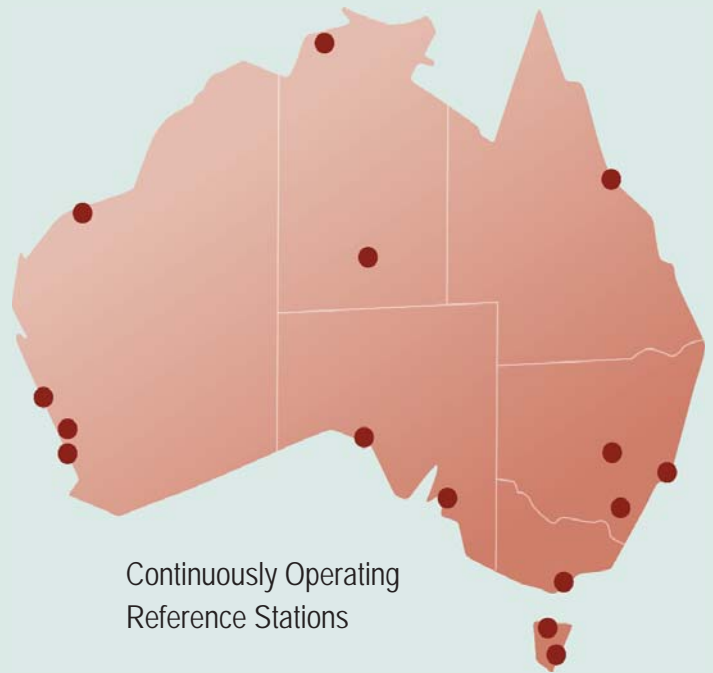
The Intergovernmental Committee on Surveying and mapping (ICSM), in conjunction with Geoscience Australia, has defined the following GDA94 <> GDA2020 transformations:

1. a seven-parameter similarity transformation that supports 2D and 3D operations; and
2. two 2D Canadian National Transformation version 2 (NTv2) format transformation grid files.

### GDA94 <> GDA2020 seven-parameter similarity transformation

The seven-parameter similarity transformation accounts for the difference in scale, rotation and translation between two reference frames or datums using a mathematical formula which relates the two by applying three origin translations (dX, dY, dZ), a rotation about each axis (Rx, Ry, Rz) and a change of scale (dS). It is a conformal transformation, meaning it preserves angles and hence the shape of objects.

The seven parameters have been computed by modelling the differences in the 'known' coordinates at GNSS Continuously Operating Reference Stations (CORS) sites common to the GDA94 and GDA2020 definitions.



*Approximate location of stations used to compute similarity transformation parameters.*

### What do I need to know?

To be reliable, location information must be identified by the datum as well as the coordinates. When the relevant datum information is available, coordinates may be transformed into corresponding coordinates on another datum. Different coordinate transformations may have varying levels of accuracy and be suited to particular circumstances. ICSM publishes official information about transformations to use in Australia.

## GDA94 <> GDA2020 transformation grids

A transformation approach utilising grid-shift files allows the inconsistent relationship between coordinates from two datums on national ground survey control networks to be modelled.

Two 2D national grids in the widely used NTV2 format have been defined:

1. **Conformal:** replicates the seven-parameter similarity transformation; and
2. **Conformal + Distortion:** incorporates the conformal seven-parameter transformation plus localised and regional distortion revealed by incorporating coordinates on 170,000 ground survey control marks across the nation.

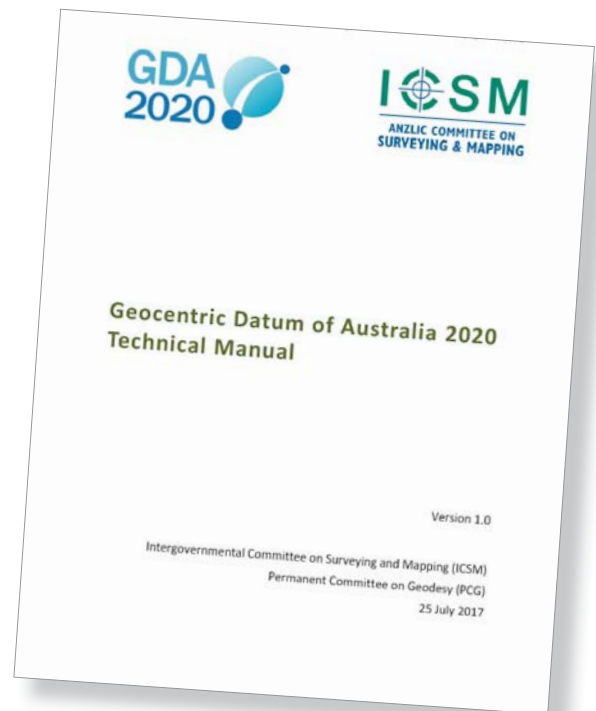
Further information about the grids is available in the ICSM technical fact sheet: *T1 GDA94 to GDA2020 transformation grids*.

## Which transformation method do I use?

The appropriate transformation to use – Conformal or Conformal + Distortion – differs depending on the jurisdiction and the accuracy and lineage of the dataset being transformed. Basic recommendations are listed in the *Geocentric Datum of Australia 2020 Technical Manual*, but if in doubt, individual state, territory or Commonwealth jurisdictions should be consulted for specific advice.

## Know your data know your datum

Correctly dealing with coordinates on different datums is very important. The metadata for the transformed dataset must always contain details of the transformation method to ensure other users of the data are able to determine the transformation accuracy and data lineage.



*The Geocentric Datum of Australia 2020 Technical Manual provides basic recommendations on the transformation tools suited to particular types of coordinate datasets.*

## Further information

For detailed information about GDA2020, GDA94 and historic Australian datums – including the relationships between them and realisations of the International Terrestrial Reference Frame (ITRF) – consult the *Geocentric Datum of Australia 2020 Technical Manual*: available at <http://www.icsm.gov.au/gda/tech.html>

General information and resources relating to the datum modernisation – including a simple explanatory animation, frequently asked questions, fact sheets, technical tools and progress updates – are available on the ICSM website: [www.icsm.gov.au](http://www.icsm.gov.au)