ACCURACY OF WORLD GEODETIC SYSTEM 1984 (WGS84) TRANSFORMATIONS

Purpose

To advise users of *LINZS25000 – Standard for New Zealand Geodetic Datum 2000* (NZGD2000) of technical issues concerning the World Geodetic System 1984 (WGS84).

The WGS84 datum

WGS84 is a global datum used to manage the Global Positioning System (GPS). It has been realised several times to maintain its alignment to the International Terrestrial Reference Frame (ITRF). As at August 2016, the most recent realisation was implemented in 2013 and is denoted WGS84(G1762). This realisation of WGS84 is consistent with the ITRF at the 1cm level.

Because it is fixed to the whole Earth, WGS84 coordinates for ground-fixed objects change with time, due to phenomena such as tectonic plate motion. These changes are relatively small, being about 5cm per year in New Zealand, and may be ignored for lower accuracy applications such as mapping. But for applications requiring higher levels of accuracy (approximately one metre or better), the time-varying nature of WGS84 coordinates must be recognised and treated appropriately.

WGS84 in LINZS25000

Section 4.3 of *LINZS25000* describes transformations from WGS84 to NZGD2000. Section 4.3.2 states:

> *A null transformation must always be used to convert coordinates from WGS84 to NZGD2000 and from NZGD2000 to WGS84.*

The associated commentary titled *Limitations of WGS84 coordinates* notes that:

> *WGS84 and NZGD2000 coordinates may be inconsistent at the sub-metre level*

That is, the null transformation specified in the standard is only accurate at the one metre level. It does not account for the time-varying nature of WGS84 coordinates, nor the fact that there are several slightly different realisations of WGS84.

Accurate transformations between NZGD2000 and WGS84

For transformations between NZGD2000 and WGS84 where the data is more accurate than one metre, a full time-dependent transformation is required to maintain the accuracy of the data. Further details of this are available on the LINZ website[1].

As of 27 June 2016, the time-dependent transformation has been implemented into the LINZ online coordinate converter.

[1] http://www.linz.govt.nz/data/geodetic-services/coordinate-conversion/geodetic-datum-conversions/wgs84-nzgd2000