

Non-WGS 84 Datums in ESRI® ArcPad® and Trimble® Positions™

March 18, 2014

It has long been assumed that GNSS data collected with a Trimble Mapping system is always referenced to WGS 84.

It is absolutely true that the GNSS coordinates calculated by the receiver are always referenced to WGS 84. However, the data that is recorded by Esri's ArcPad software can actually be referenced to a different datum. The following steps will show you how to configure ArcPad and the Trimble Positions Desktop add-in to avoid datum shifts when using a non-WGS 84 datum.

Trimble Positions Desktop Add-in... before data collection

Trimble Positions software always stores calculated GNSS positions in the Lat/Long, WGS 84 coordinate system. If a feature class is specified in a different datum, Trimble Positions must be configured with the correct datum transformation to avoid a shift. In the Trimble Positions Desktop Administrator, click on Datum Transformations. From there, click the Set button and select the datum that your feature class is referenced to. After selecting the datum, a Select Geographic Transformation box will appear.

Select Geo Transformation

Convert from: GCS_North_American_1983

To: GCS_WGS_1984

Using: NAD_1983_To_WGS_1984_5

Method: Coordinate Frame - dx=-0.991000 dy=1.907200 dz=0.512900 rx=-0.025790 ry=-0.009650 rz=-0.011660 s=0.000000

OK Cancel

Click the dropdown arrow next to *Using* and specify the NAD_1983_To_WGS_1984_5 transformation. This will provide the best results in the continental US.

For more information about which datum transformation to use, please see ESRI's support note here <http://support.esri.com/en/knowledgebase/techarticles/detail/24159>.



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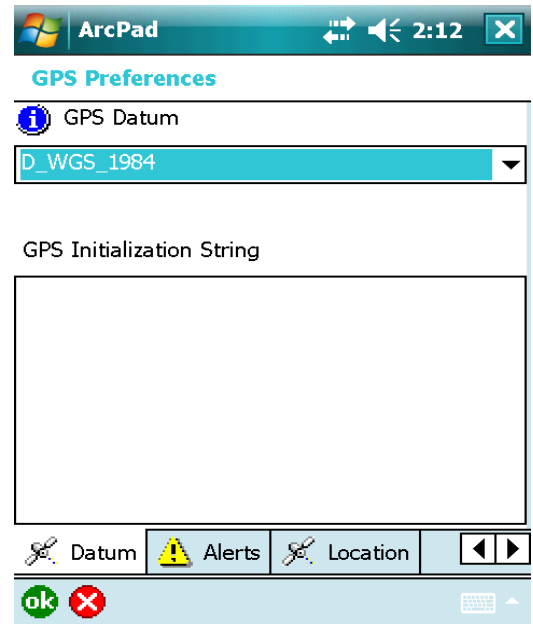
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ArcPad Software... during data collection

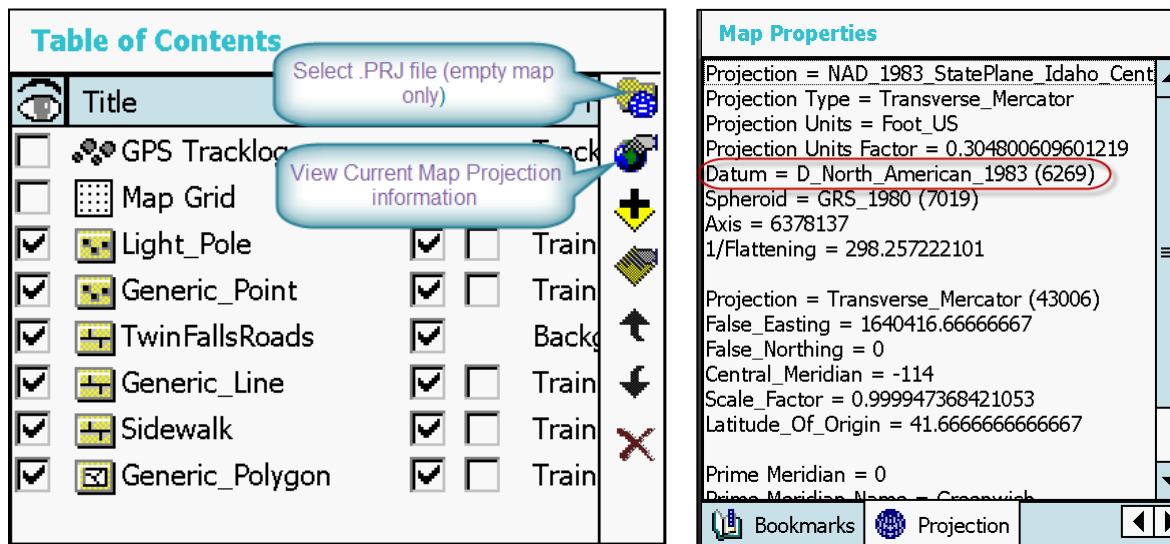
ESRI's ArcPad software records data in shapefiles or AXF files that can be referenced to any supported projected coordinate system and datum. To accurately transform incoming GPS coordinates, ArcPad needs to know three things – the input GPS datum (assumed to be WGS 84), the output datum (e.g. NAD 83 (CORS96)), and the datum transformation parameters.

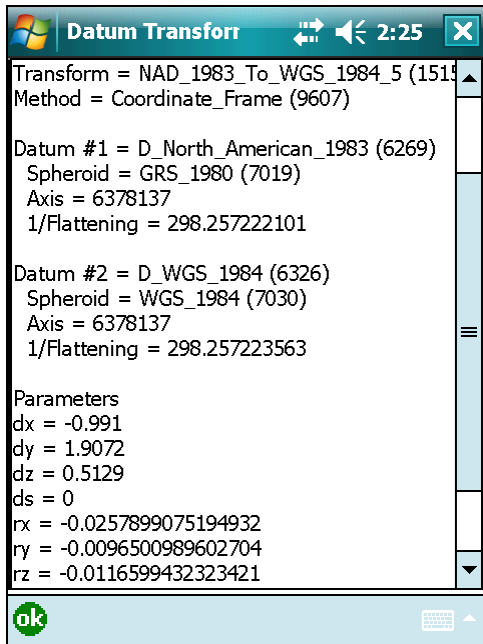
The input GPS datum in ArcPad is selected from the GPS Datum drop-down list found in GPS Preferences >Datum tab. The default is D_WGS_1984.


The **only** reason to ever adjust this from the default is if a real-time correction source referenced to a different datum is being used. Otherwise, always leave the GPS Datum set to D_WGS_1984. If real-time corrections are being received from a beacon, VRS or single base station, the datum is likely NAD 83, and this setting should be adjusted accordingly.



The output datum is specified in the .prj file used by ArcPad to set the Map Projection. The .prj file used will be the .prj associated with the first layer loaded in the current map, the ArcPad.prj file found in \My Documents (if present), or the .prj file chosen in the Table of Contents. Press the 'Map Properties' button to view current map projection information (last page), including the datum being used in the map.





The datum transformation parameters can be verified after a map projection is set by pressing the  button on the Datum tab. In ArcPad 7.0.1 and later, the default datum transformation from WGS 84 to NAD 83 is the _5 transformation, which is essentially WGS 84 to NAD 83 (CORS96).

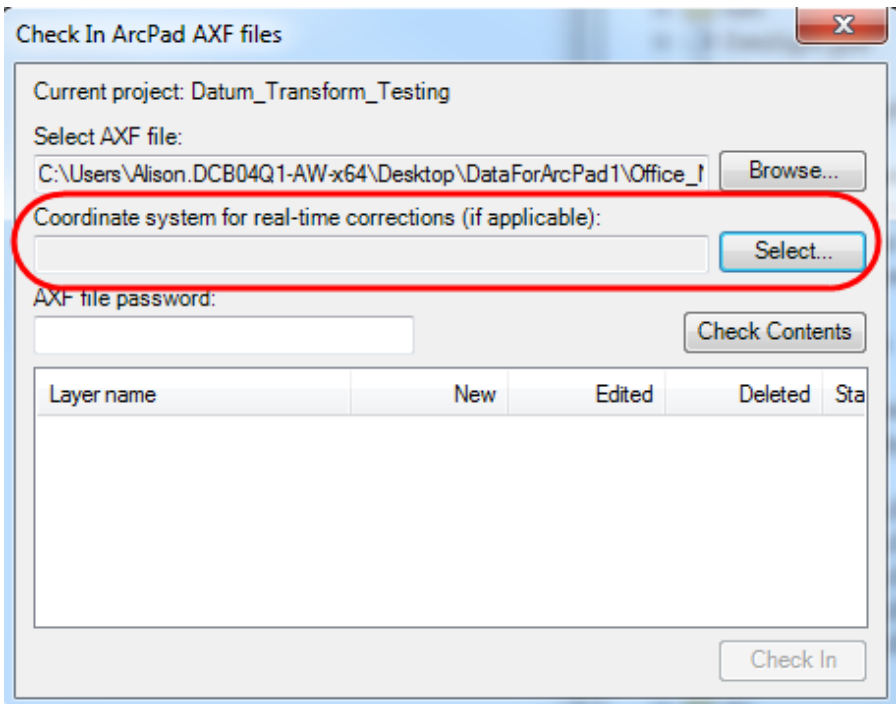
Note- In ArcPad 7.0 and 6.0.x the default transformation between WGS 84 and NAD 83 is a 'zero' datum transformation. This could lead to 1 meter horizontal errors when compared with NAD 83 (CORS96) control.

Trimble Positions Desktop Add-in... after data collection

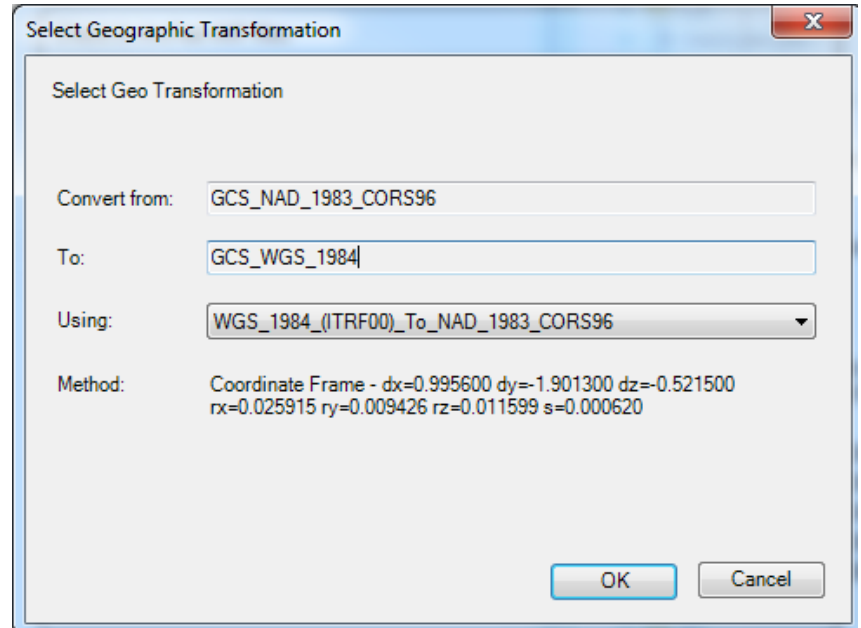
Check-in

If you did not have real-time differential correction in the field or if the datum of your real-time correction source is WGS 84, then you can ignore this setting.

If you were collecting data in ArcPad while connected to a real-time correction source referenced to a different datum, you must select the appropriate datum on check-in by selecting the Geographic Coordinate System that has the same datum as your correction source.



Once you have selected the appropriate datum, you will again be asked for the transformation to convert from WGS 84 to your selected datum.



Processing Profile

When you are creating a processing profile, you have the choice between using a single base station or using a folder or specific base file.

When using a **single base station**, all reference positions contained in Trimble's base station list have been converted to the ITRF00 (essentially WGS 84 (G1150)). The reliability of the assumption that all of these reference positions are in terms of ITRF00 depends upon the coordinate supplied by the base provider; and if the reference position was originally referenced to a NAD 83 realization, whether the correct realization could be determined when converting to ITRF00. Particularly with CORS stations, data sheets exist that document clearly which NAD 83 realization the reference position is referenced to, whereas with private base stations, that is not always so easily determined. This could introduce positional errors. For example, if a base station reference position were actually referenced to NAD 83 (1986) but it was assumed that it was referenced to NAD 83 (CORS96) when the reference position contained in Trimble's base station list was converted to ITRF00, there could be 1 meter horizontal errors introduced by what amounts to an 'incorrect' reference position. In the case of non-CORS stations, there may be confusion regarding what that spatial reference is. In reality, it could be WGS 84 or any realization of NAD 83. This could cause positional errors, since the input datum may not be known accurately.

When using a **folder or specific base files**, you are given the option to 'Use reference position from base files' or 'Use reference position from base station'. The '**Use reference position from base files**' will use whatever reference position is supplied by the base station operator in whatever datum it has been established. In the case of CORS stations, that would be NAD 83 (CORS96) (2002.00 or 2003.00 epoch), NAD83 (PACP00), or NAD83 (MARP00). Therefore, if this option is selected, GPS data will actually be transformed to the datum of the base station reference position, in this case NAD 83 (CORS96), NAD83 (PACP00), or NAD83 (MARP00). The '**Use reference position from base station**' option allows you to select a base station from the list, and then the assumed ITRF00 reference position will be used when applying differential corrections to the data and avoid a shift.