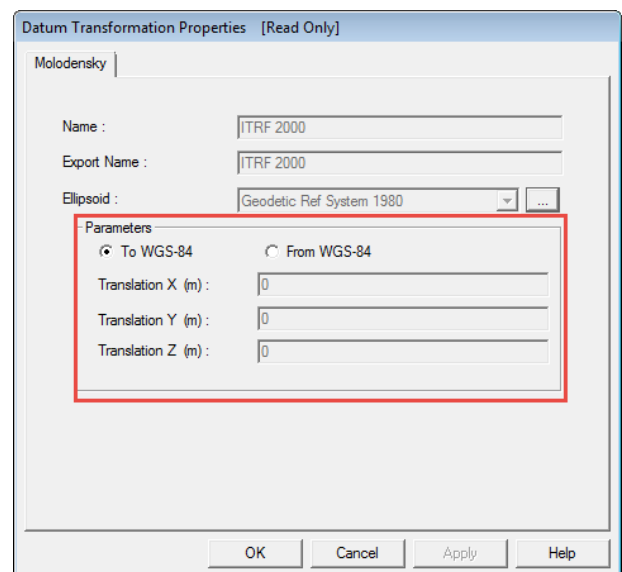
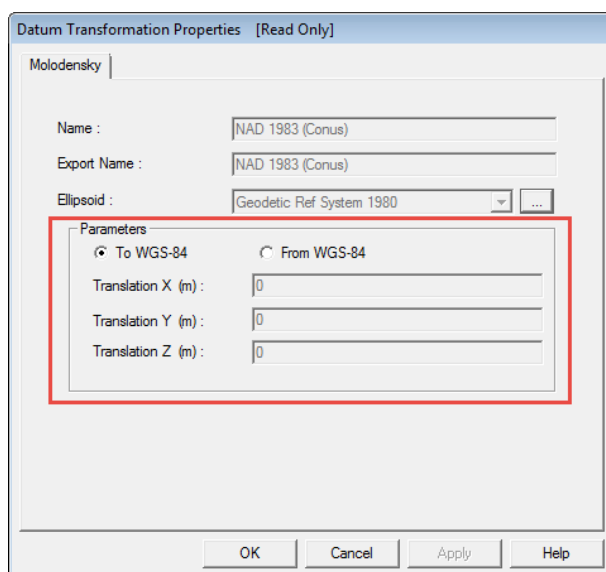
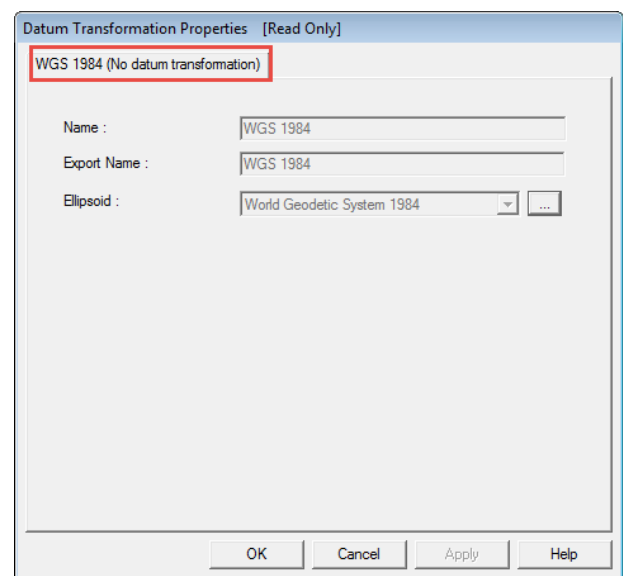
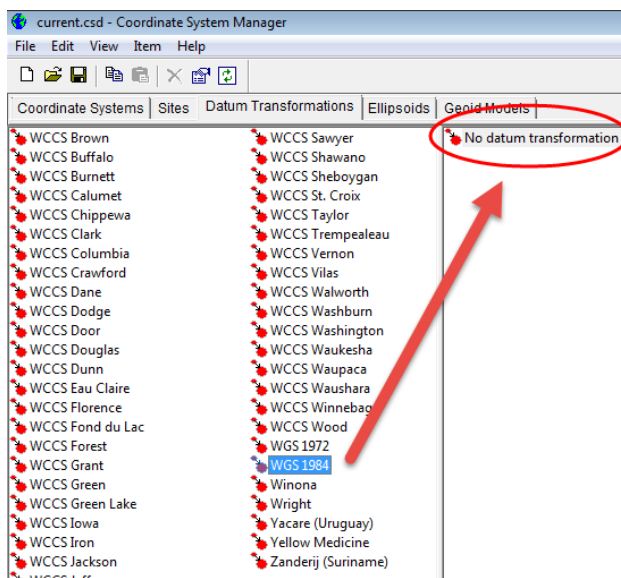


# Understanding how Trimble's Pathfinder Office & TerraSync Software use Datums

Trimble's Pathfinder Office (PFO) software handles the WGS84, NAD83 CONUS, and ITRF00 Datums as "No or Zero Transformation" Datums in the software. So, basically it treats all 3 as the same thing. This can be seen in the Coordinate System Manager in PFO under the Utilities/Options/Other menu (Below).





Below is a list of common Datums that are used in different types of GNSS corrections.

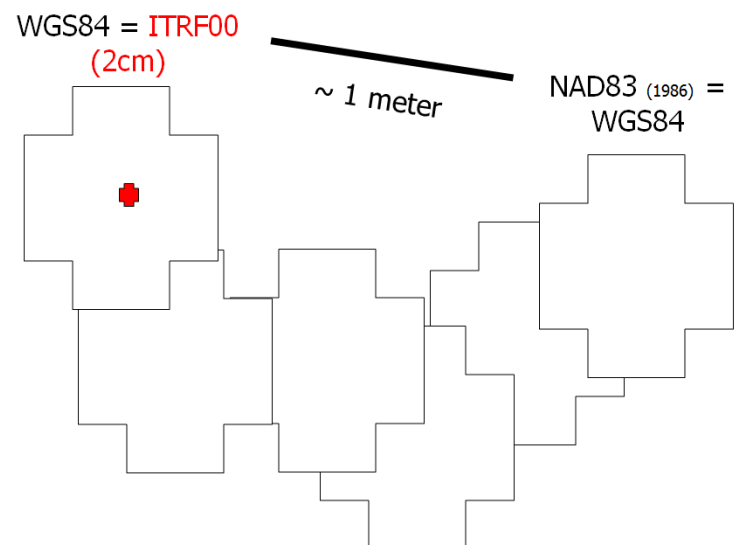
### Common GNSS Datums

- NAD83 (1986) = WGS84 (G730) first GPS version
- NAD83 (CORS96)  $\neq$  WGS84 (G1150)
- WGS84 (G1150) = ITRF00
- Autonomous GPS = ITRF00
- SBAS = ITRF00
- CONUS DGPS Beacon = NAD83(CORS96)
- OmniStar VBS (US) – NAD83 CONUS
- OmniStar HP – ITRF2008
- OmniStar XP – ITRF2008
- Reference Stations = NAD83 (some epoch date...CORS96, 2011)

Over the years the NAD83 datum has grown apart.

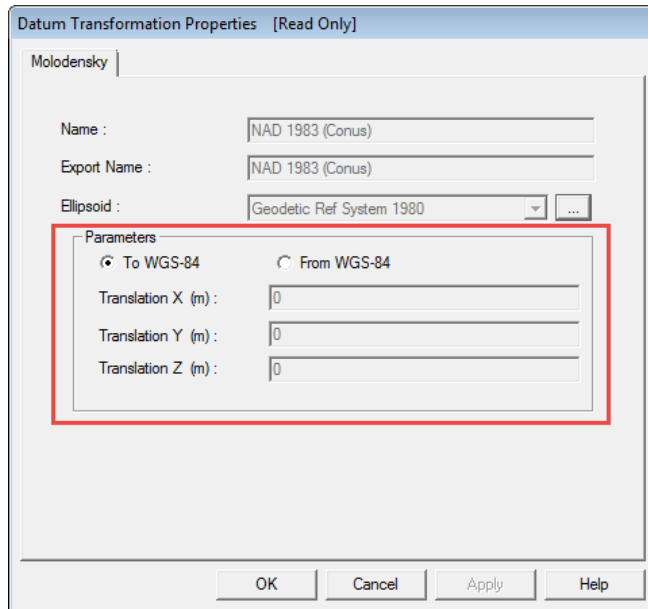
### **“Original” NAD83 = NAD83 (1986)**

- NAD83 (1992)
- NAD83 (CORS96) (Epoch 1997.00)
- NAD83 (2002)
- NAD83 (NSRS2007)
- NAD83 (2011)



The screenshots below represent the NAD83 Datums used in Trimble's Pathfinder Office software.

NAD83 CONUS (1986) "No/Zero Transformation"



Datum Transformation Properties [Read Only]

Molodensky

Name : NAD 1983 (Conus)

Export Name : NAD 1983 (Conus)

Ellipsoid : Geodetic Ref System 1980

Parameters

☒ To WGS-84 ☐ From WGS-84

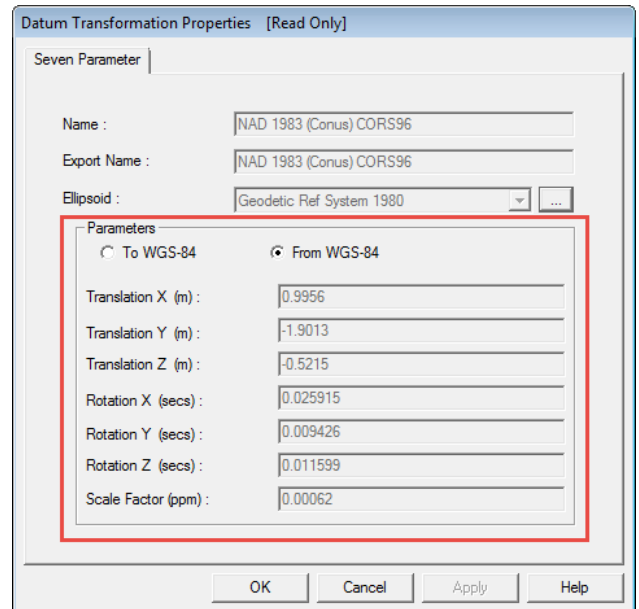
Translation X (m) : 0

Translation Y (m) : 0

Translation Z (m) : 0

OK Cancel Apply Help

NAD83 CONUS CORS96 (Transformation)



Datum Transformation Properties [Read Only]

Seven Parameter

Name : NAD 1983 (Conus) CORS96

Export Name : NAD 1983 (Conus) CORS96

Ellipsoid : Geodetic Ref System 1980

Parameters

☐ To WGS-84 ☒ From WGS-84

Translation X (m) : 0.9956

Translation Y (m) : -1.9013

Translation Z (m) : -0.5215

Rotation X (secs) : 0.025915

Rotation Y (secs) : 0.009426

Rotation Z (secs) : 0.011599

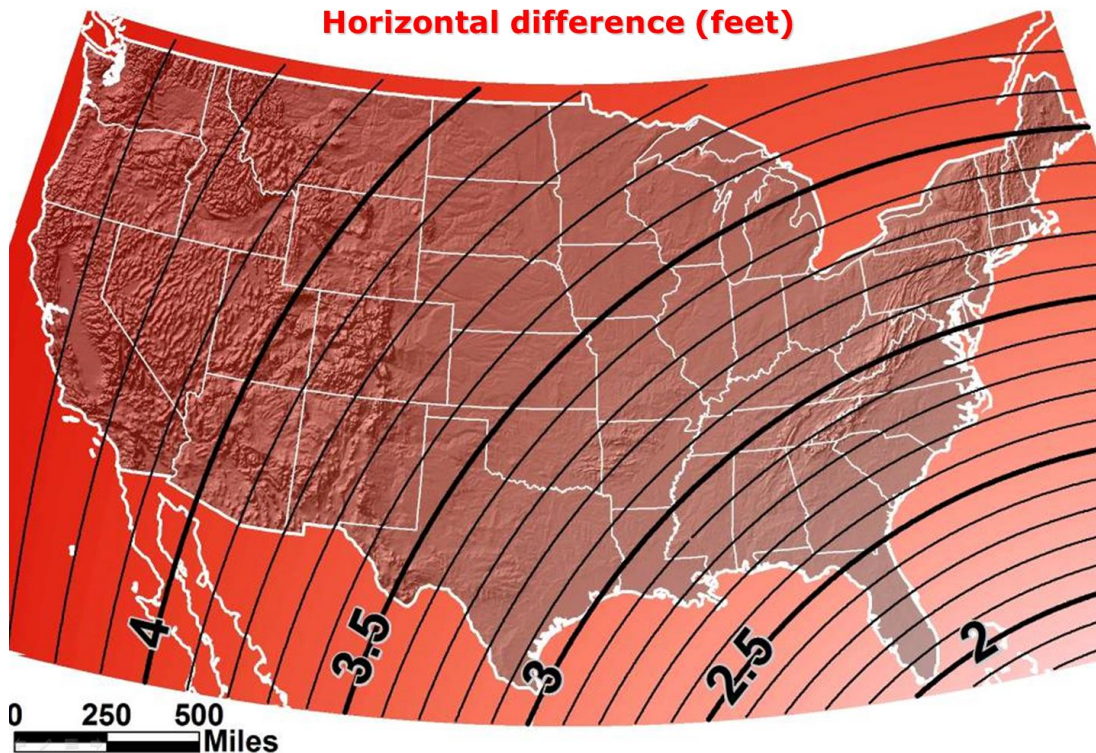
Scale Factor (ppm) : 0.00062

OK Cancel Apply Help

Below you can see that the further west you are in the US, the larger horizontal shift you will have.

## Difference between NAD 83 and WGS 84 (G1150) at 2002.0

**Horizontal difference (feet)**



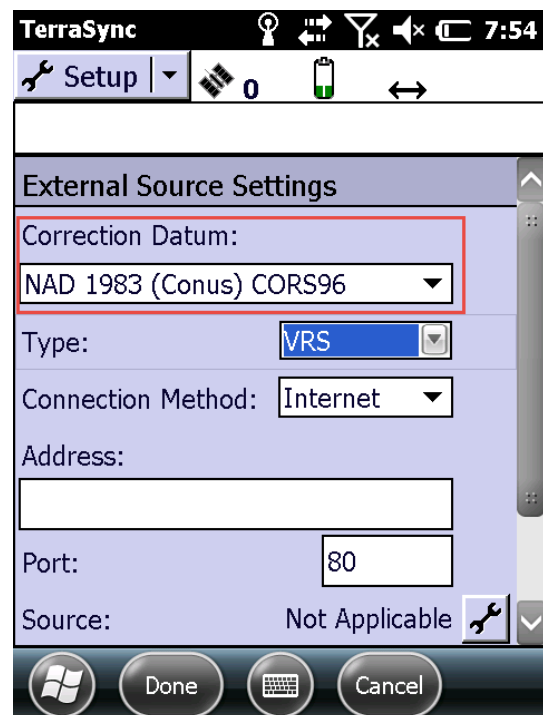
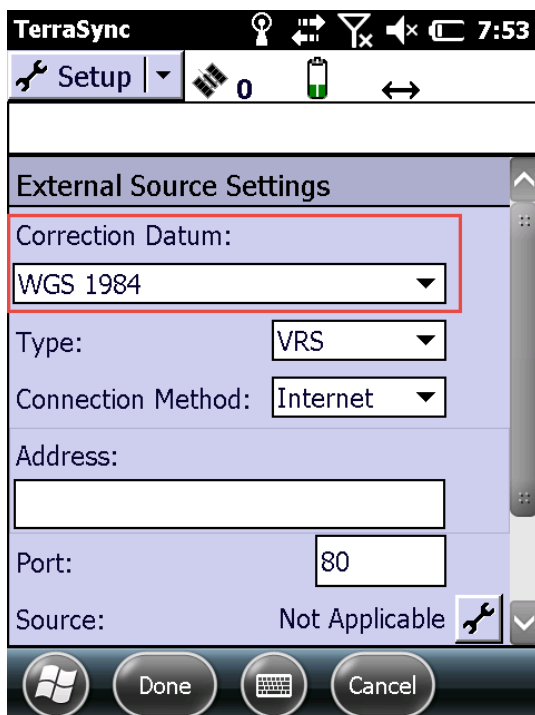


**If you mix two Datums, then you will see a shift.**

The most common problem we see is that users are exporting data out of PFO using the NAD83 CONUS (1986) datum and then they are comparing that data to imagery or control that is referenced to the NAD83 CORS96 or 2011 datum. In this example you will typically see a shift that is represented in the images on the previous page.

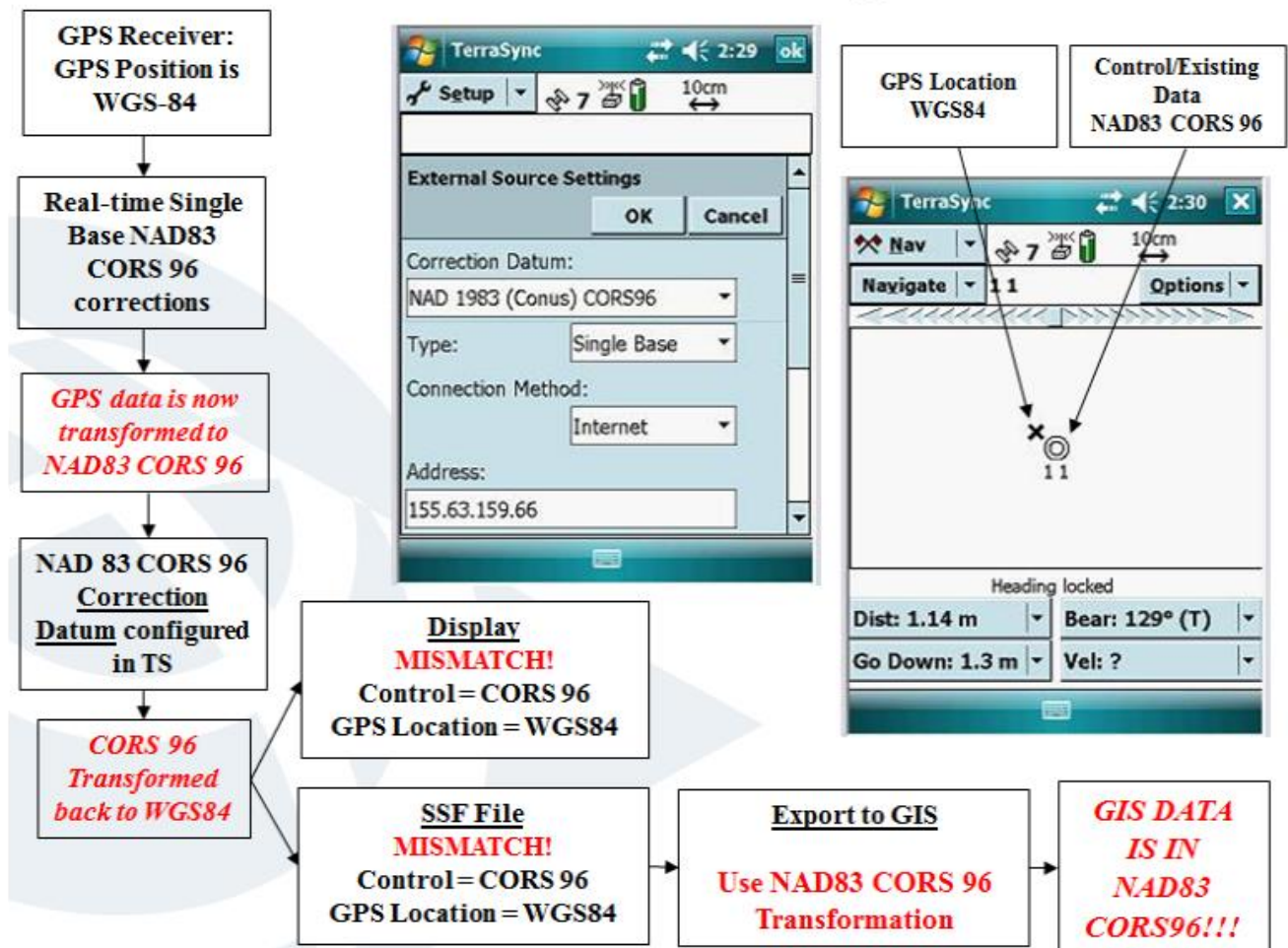
Another issue that we are seeing is when users collect data using real-time corrections from a or Single Base or VRS that are in the NAD83 CORS96 datum and then export the data out of PFO using the NAD83 CORS96 datum. In this example, the real-time data has already been shifted to the NAD83 CORS96 datum and then on export it is shifted again to the NAD83 CORS96 datum, thus causing a “Double Shift.”

Also, when users setup the Real-Time corrections External Source Settings in TerraSync, they can introduce or take away a shift depending on what is selected.



For example, if you are using Real-time corrections from a Single Base or VRS you have the option to tell the TerraSync software what the incoming correction datum is. This part can be very confusing. If your incoming Correction Datum is referenced to the NAD83 CORS96 datum and you select NAD83 CORS96, you are converting the data back to WGS84 datum.

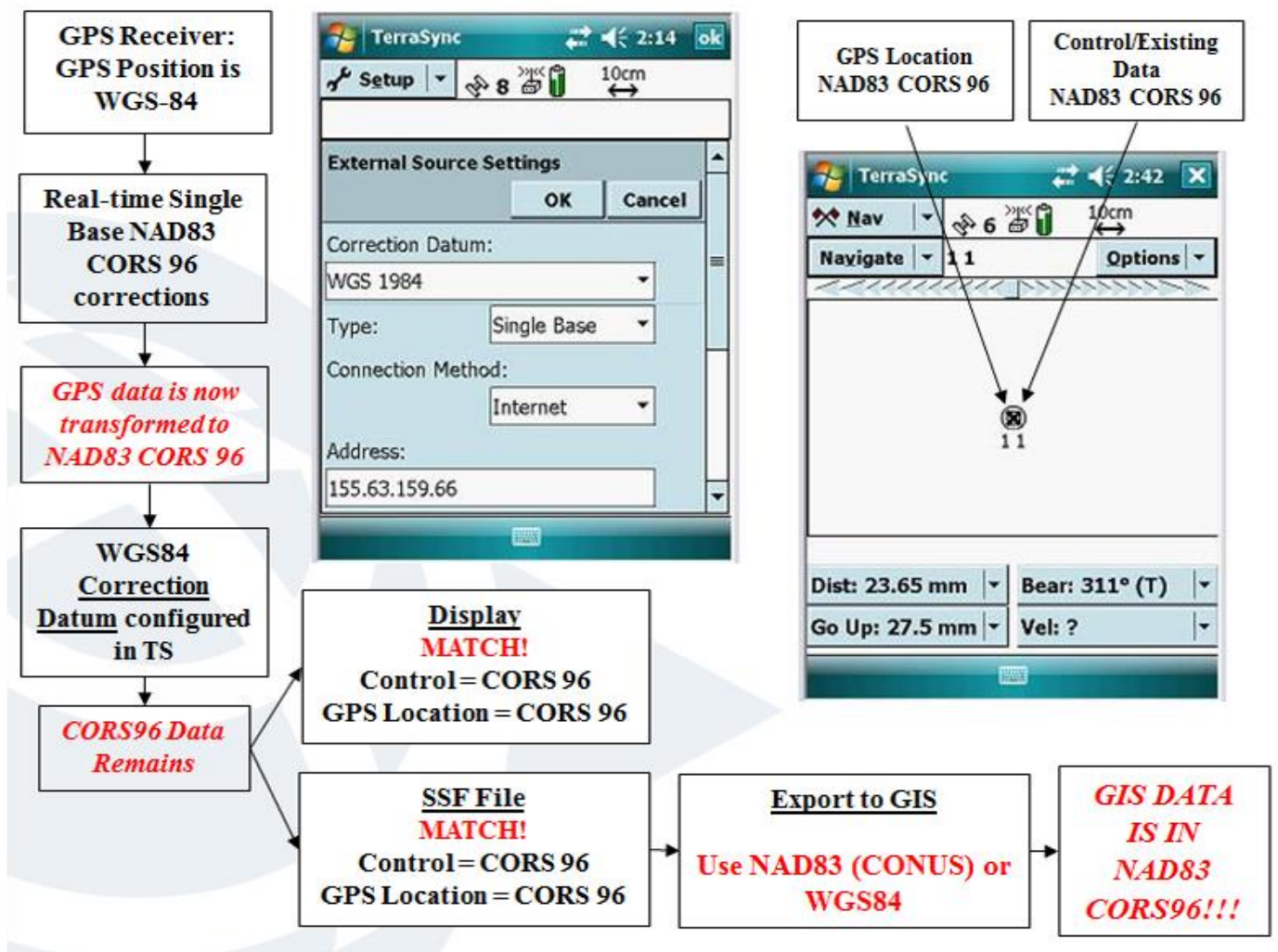
## What happens when we select the matching datum?





Now if your Real-time corrections are referenced to the NAD83 CORS96 datum and you choose NAD83 CONUS or WGS84 (remember the “No Transformation” Datums) as your incoming Correction Datum, then the data stays in the NAD83 CORS96 datum.

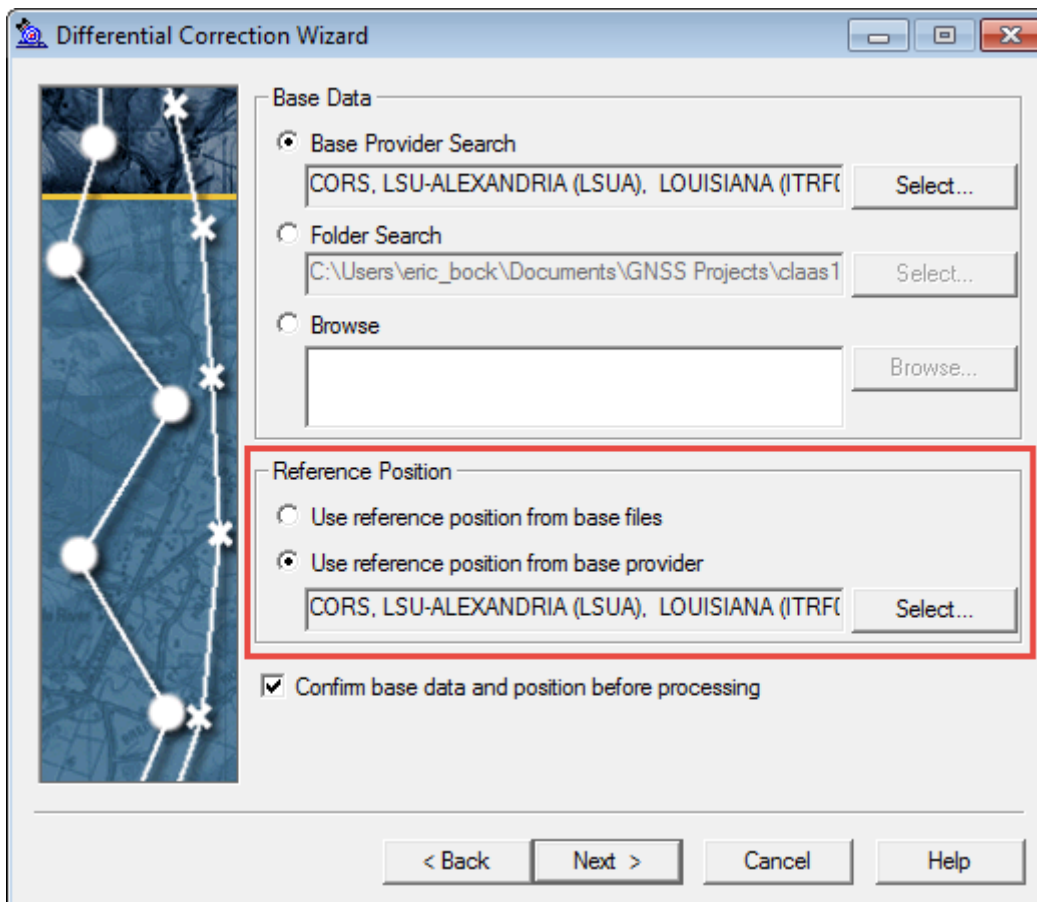
## Correction Datum for Display/Navigation





Post processing your data in Pathfinder Office using the Differential Correction wizard can also introduce a shift in the data. Your data assumes the Datum of the Reference Position during Differential Correction. Users have the option to choose the following when post processing the data:

- Use Reference Position From Base Files
- Use Reference Position From Base Provider (Default)



Trimble recently updated the base station list and the **reference position for base provider** is now in terms of ITRF00 (EPOCH 1997). The **reference position from base files** can be represented differently, so don't assume anything and always verify the reference datum. For example, a CORS base station base files may be referenced to the NAD83 (2011) datum, where a private base station may be referenced to the WGS84 or NAD83 (CORS96) datum.



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Confusing??? So, how do you avoid these shifting problems? We recommend that you ask yourself these questions when trying to determine the proper workflow that you should choose in the Pathfinder Office and TerraSync software.

- Verify your Datum and EPOCH in your GIS
- Confirm the GPS Reference Frame
- Apply the Correct Transformation

Everyone's workflow may be different and some users may need to use multiple workflows in their organization. I always recommend testing your workflows against published control points and/or your GIS data to see what workflow suites your needs best.

If you want to learn more about Datums and specific workflows, then I highly recommend checking out the links below.

- [Resolving the Datum Transformation Issue](#)
- [NGS Articles](#)
  - Search for Modern Terrestrial Reference Systems Part 2: The Evolution of NAD 83

Feel free to contact nei support if you have any questions and we can help determine which workflow may best suit you.

Office: 1-800-949-1446

[Neigps.com](http://Neigps.com)

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