

# USER GUIDE

## **Trimble Positions software suite: Trimble Positions Desktop add-in**

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Trimble Navigation Limited  
10368 Westmoor Drive  
Westminster, CO 80021  
USA  
[www.trimble.com](http://www.trimble.com)

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### **Release Notice**

This is the August 2014 release (Revision A) of the *Trimble Positions Desktop Add-in User Guide*. It relates to version 10.2.2.1 of the Trimble Positions Desktop add-in.

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## Introduction

The Trimble® Positions™ software suite adds support for Trimble high-accuracy GNSS receivers using Esri ArcGIS for Windows Mobile and ArcPad technology.

An add-in for the Esri ArcGIS for Desktop 10.2 application, the Trimble Positions Desktop add-in is used:

- to set up the required projects, devices, and sessions.
- for the day-to-day management of data collected using the Trimble Positions Mobile extension, the Trimble Positions ArcPad extension, or a custom field application built using the Trimble Positions toolkit.
- postprocessing collected GNSS data.
- assuring position accuracy is met.
- updating the GIS geodatabase.

This guide explains how to use the Trimble Positions Desktop add-in. It describes three workflows:

- one for users of the Trimble Positions Mobile extension or a custom application built using the Trimble Positions toolkit. See [ArcGIS for Windows Mobile workflow, page 6](#).
- two for users of the Trimble Positions ArcPad extension:
  - a check-in / check-out workflow. See [ArcPad AXF check-in and check-out workflow, page 18](#)
  - a QuickProject workflow. See [ArcPad QuickProject workflow, page 24](#).

**Note** – *Trimble Positions Desktop add-in users are expected to have a basic knowledge of and training in ArcGIS for Desktop and to be familiar with their GIS.*

## Overview of the Trimble Positions Desktop add-in

The following illustrates the components of the Trimble Positions software suite and the Esri ArcGIS software and applications:

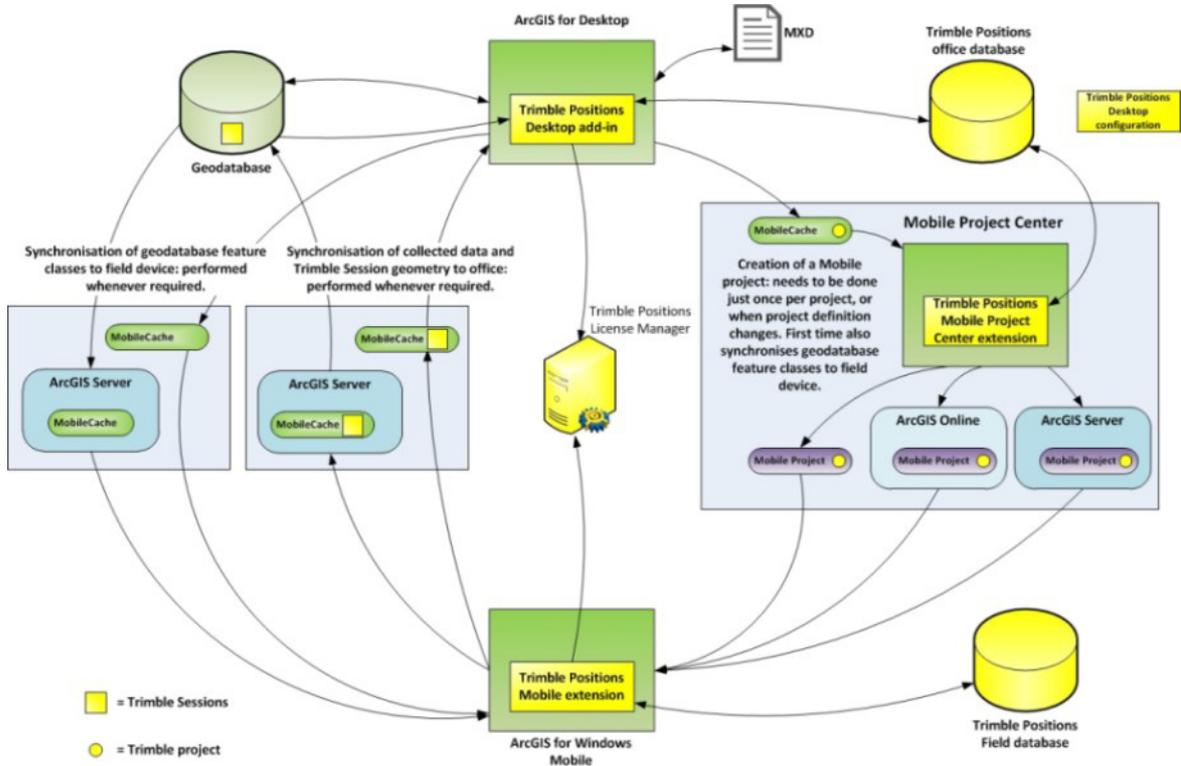


Figure 1.1 Data flow using Esri ArcGIS for Windows Mobile technology

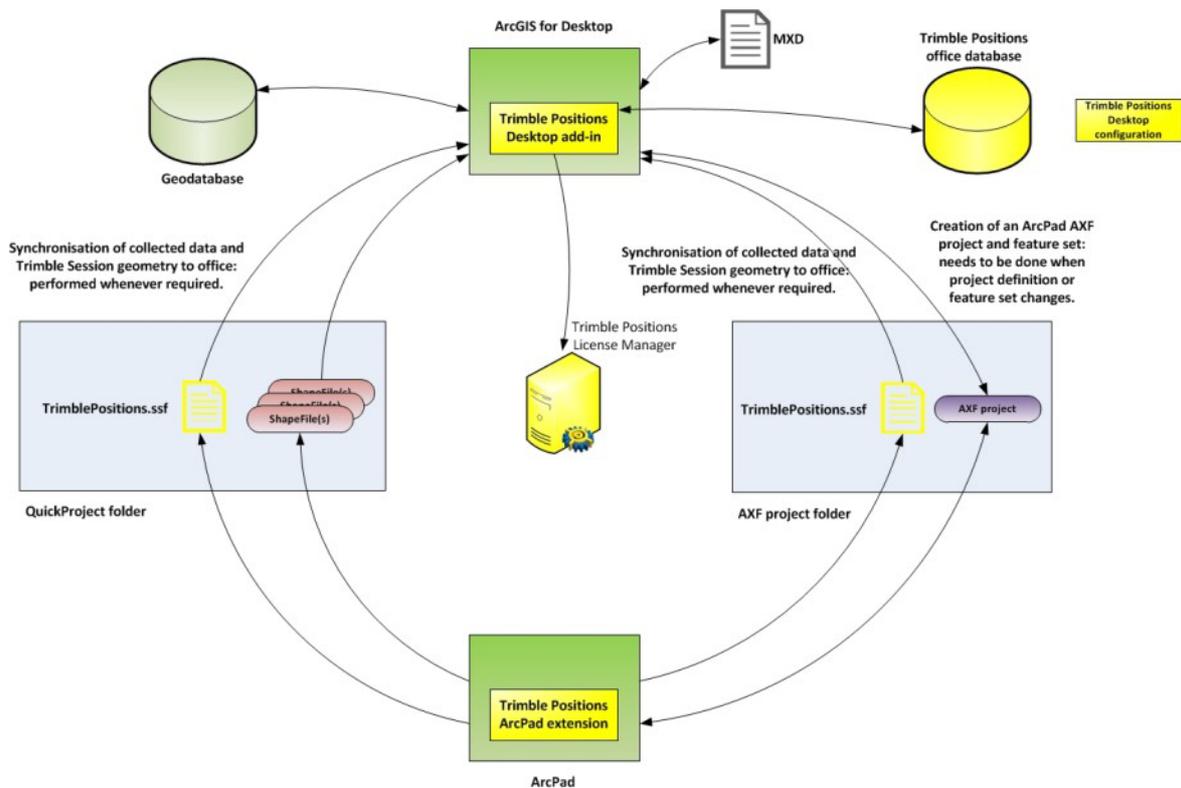


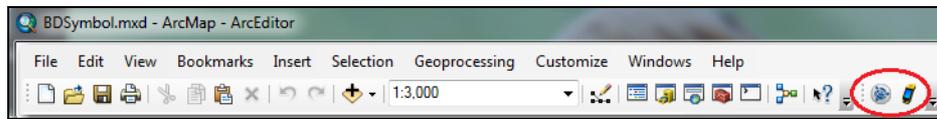
Figure 1.2 Data flow using Esri ArcPad technology

There are three parts to the Trimble Positions Desktop add-in:

- Configuration and administration. To enable GNSS data to be transferred from the field to the office, the GIS Administrator must create a dedicated feature class called TrimbleSessions, create an office database schema, create the map document, and publish the related mobile cache or mobile service. See the *Trimble Positions Desktop add-in Administrator's Guide* for configuration and administration information
- Project management.
  - For users of Esri ArcGIS for Windows Mobile technology, a project must be set up and linked to the map document and mobile cache or mobile service. See the *Trimble Positions Mobile Project Center Extension User Guide* for more information.
  - For users of Esri ArcPad technology, AXF files must be checked out using the Trimble Positions Desktop add-in project creation utility. Returned AXF files are associated with the project that was created for them as they are checked in. Esri QuickProjects must have a project created for them when they are copied from the device.
- Managing field devices and base data information, postprocessing GNSS data, and editing / updating features. Details are provided below.

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When the Trimble Positions Desktop add-in is installed, two additional icons appear in the ArcGIS for Desktop toolbar:



**Tip** – If the Trimble Positions Desktop add-in icons are not visible in the toolbar, right-click the toolbar and select Trimble Positions.

The Trimble Positions Desktop add-in may be disabled. To enable it, on the ArcGIS for Desktop menu bar, select *Customize / Extensions / Trimble Positions Desktop*.

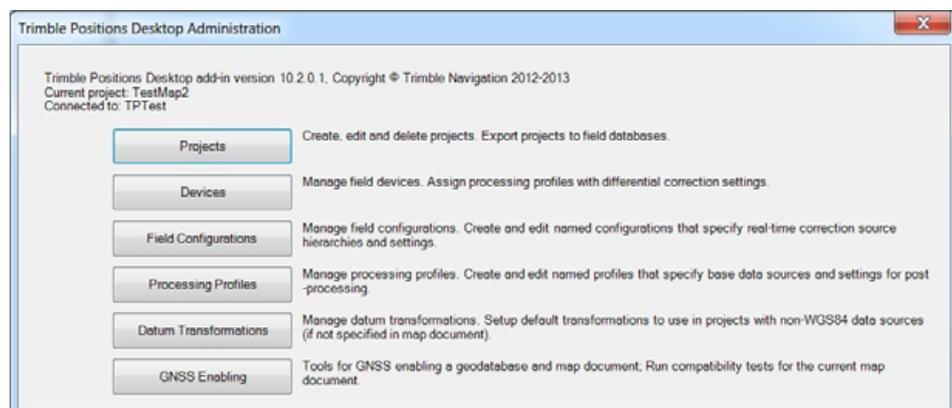
If the Trimble Positions Desktop add-in is not visible at the bottom of the ArcGIS for Desktop window, click the Toggle Trimble Positions Desktop Dockable Window Visibility  icon.

## ArcGIS for Windows Mobile workflow

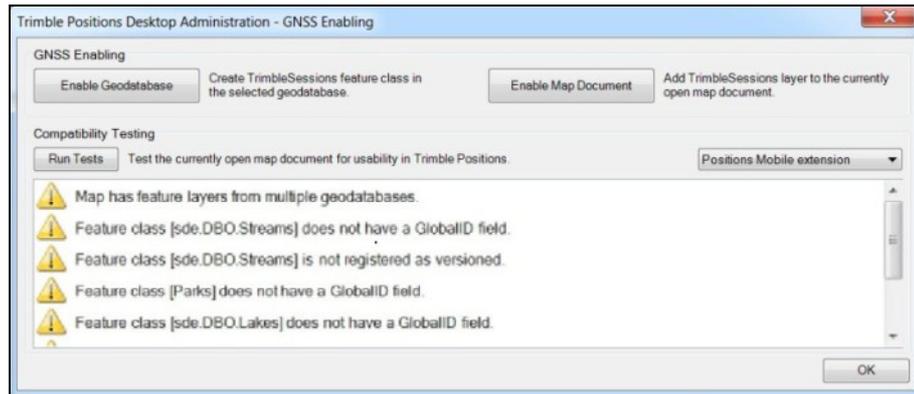
### Managing maps and Trimble sessions for ArcGIS for Windows Mobile

Before you can use the Trimble Positions Desktop add-in effectively, you must:

- enable a geodatabase for data collection. This must be done once for each geodatabase you are enabling. See the *Trimble Positions Desktop add-in Administrator's Guide* for configuration and administration information.
  - add a TrimbleSessions feature class layer to each of your map documents.
  - test the map against internal validation criteria, to make sure that the map will create a mobile cache and project that will work in the field to collect high-accuracy Trimble geometry.
1. Start ArcGIS for Desktop, and open an existing Map document (MXD file).
  2. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.

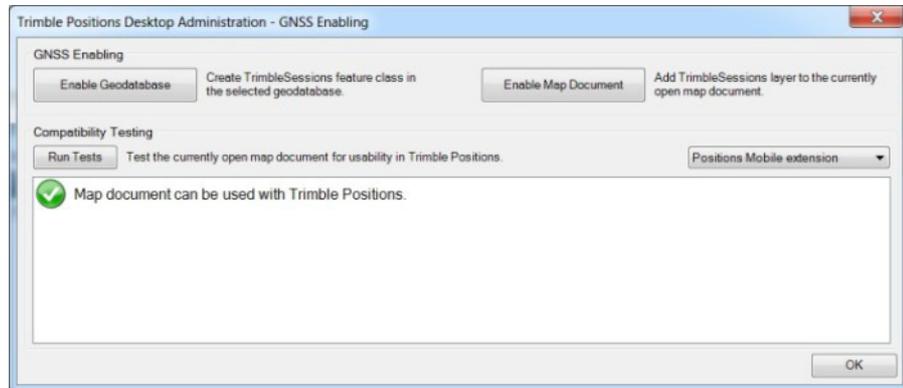


3. Click **GNSS Enabling**, then do one of the following:
    - To add the TrimbleSessions layer to your open map document, click **Enable Map Document**.
    - To test whether the currently open map can be used with the Trimble Positions software suite for high-accuracy geometry collection, select *Positions Mobile extension* from the dropdown list, and then click **Run Tests**.
- If there are issues with the map and/or feature classes used, they are listed:



Fix any errors, and test the map again.

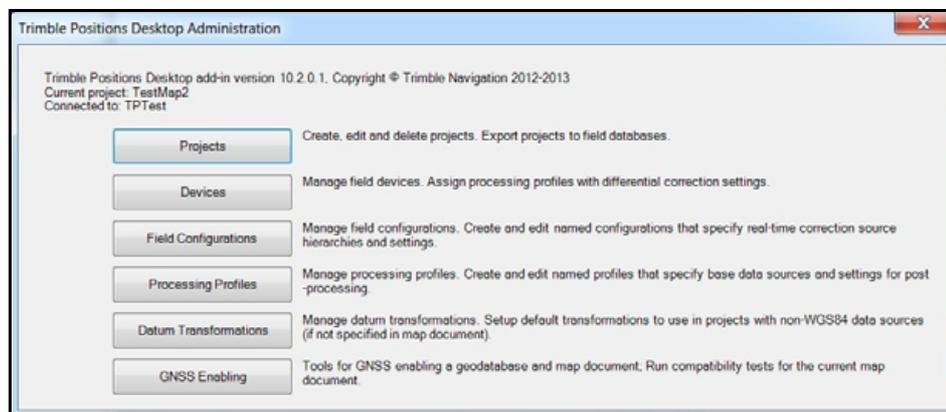
If the map is compatible with the Trimble Positions software suite, the following confirmation appears:



## Managing field configurations

Before you define a project, Trimble recommends that you create field configurations for the devices in your fleet. The field configurations are used in the project definition, and specify how the field devices are configured so that minimal input is needed from the field user. The configurations are transferred to the device within the project(s) that they are associated with.

1. Start ArcGIS for Desktop, and open an existing Map document (MXD file).
2. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.



3. Click **Field Configurations**.  
The *Trimble Positions Desktop Administration – Field Configuration* dialog appears. Initially, no configurations are available. When you have created field configurations, they are listed here.
4. Use the *Field Configuration* dialog to:
  - create a new field configuration. Click **Create....**
  - modify an existing field configuration. Select the configuration and click **Edit....**
  - copy an existing field configuration, so that you can create a new configuration based on an existing one. Select the configuration and click **Clone....**, and then edit the clone.

When creating or editing a field configuration, enter the following information:

Screen	Settings
General	<p>Assign a unique name to a field configuration.</p> <p>If required, add a description.</p> <p>Assign the port over which the GNSS receiver will be connected. Select this from the drop-down list (Auto, or COM0 - COM9).</p>
Real-time Settings	<p>Assign real-time sources and set their configurations. If Choice 1 is not available, the field software will defer to Choice 2, which is either None or SBAS. If None is selected, geometry is collected using autonomous GNSS positioning.</p> <p>Define a real-time age limit for the corrections, which enables corrections to be coasted when in an area of unreliable communication.</p>

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Screen	Settings
Logging Settings	<p>Set the the distance to the base station to be used as the postprocessing correction source, to enable a more precise calculation of predicted postprocessing accuracy (PPA).</p> <p>To further refine the PPA, select GPS or GLONASS+GPS to specify the corrections that the base station provides.</p>

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Click **Finish**.

- make a text file copy of existing field configurations. Click **Export All...**, select the folder to save the field configuration files to, then click **OK**. This is only applicable to workflows involving Trimble Positions toolkit applications. Individual configuration files must be deployed (copied) to each field device that requires them. Exported field configuration files cannot be used in the Trimble Positions Mobile extension. The selection mechanism provided in the Trimble Positions Mobile Project Center extension must be used for deploying field configurations to the Trimble Positions Mobile extension.
- delete an existing field configuration. Select the configuration, click **Remove**, then click **OK**.

## Working with projects for ArcGIS for Windows Mobile

Projects for use with the Trimble Positions Mobile extension are created using the Esri Mobile Project Center, installed with Esri ArcGIS for Windows Mobile, on the local computer. To use the Mobile Project Center in a Trimble Positions setting, Trimble Positions Mobile Project Center extension must be installed on the local computer. For more information, refer to the *Trimble Positions Mobile Project Center Extension User Guide*.

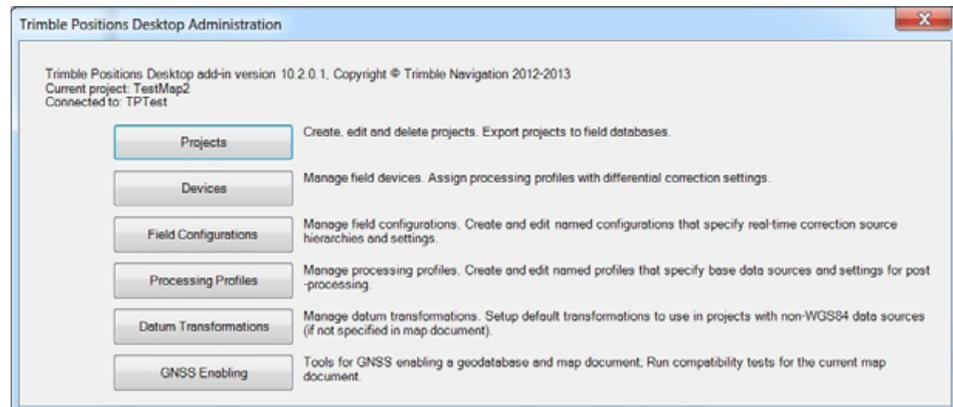
To create projects for applications built using the Trimble Positions toolkit, refer to the *Trimble Positions Toolkit Developers Guide*.

### Associating Map documents and projects

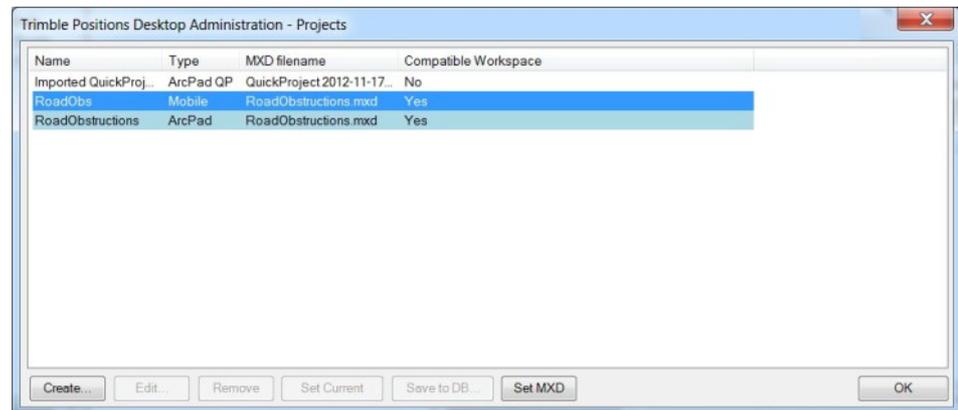
To properly use the Trimble Positions software suite, the project and the map documents must first be associated. This should be done before checking if new sessions are available, and ideally just after the project is created or modified.

1. Start ArcGIS for Desktop, and open an existing Map document (MXD file) that was used to create the mobile cache from which the project was created from.

- Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.



- Click **Projects**.  
A list of projects appears.



- Select the project you want to associate with the open map document. The *Compatible Workspace* column shows if the current map document is compatible with the project, that is, that the required feature layers are present. If the current map is not compatible, the **Set MXD** button is disabled. If it is enabled, click **Set MXD** and then click **Set Current**. The MXD filename column is populated with the current MXD filename and the association between the project and the map is made.
- Click **OK**.

## Transferring data between the field and the office

Projects and project data, including Trimble Positions session data, must be transferred between the office system accessing the GIS and the field device. You can do this using ArcGIS for Server, or by manually transferring files (using Microsoft ActiveSync or Windows Mobile Device Center) and synchronization of the mobile cache using the Synchronize Mobile Cache mobile geoprocessing tool.

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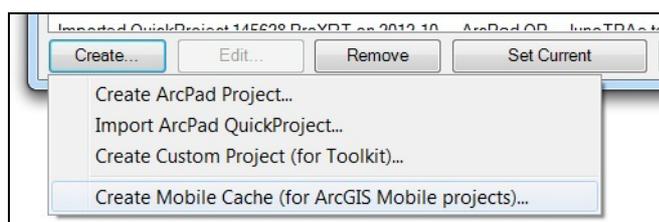
To reduce communication overhead and unnecessary time and cost, it is important to only allow synchronization of a TrimbleSession feature class to be made in one direction from field to the office.

If you use the Synchronize Mobile Cache mobile geoprocessing tool, the *Download Changes* check box should not be selected.

## Synchronization using a Mobile Cache

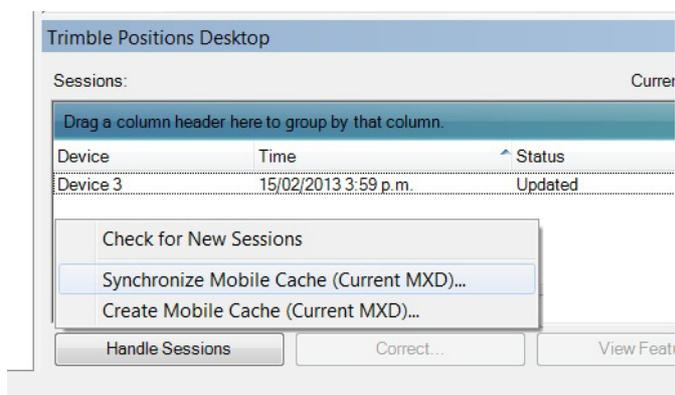
To enable GIS / GNSS data transfer using a Mobile cache between the Trimble Positions Desktop add-in and a field device using Trimble Positions Mobile extension, or a custom application built on the Trimble Positions toolkit / Esri ArcGIS Mobile SDK, you must:

- create a Mobile Cache, using the Create Mobile Cache ( for ArcGIS Mobile projects)... tool.
  - a. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.
  - b. Click **Projects**. A list of projects appears.
  - c. Click **Create....** Select *Create Mobile Cache (for ArcGIS Mobile projects)...* from the dropdown list.



- create a project which is related to the map document and mobile cache (refer to the *Trimble Positions Mobile Project Center Extension User Guide* and the *Trimble Positions Toolkit Developers Guide*, respectively). A project contains links to a subset of feature classes ( from the mobile cache) for which geometries will be collected with the field software. The project is stored in the Trimble Positions office database, and is saved to the field database that is deployed to the Trimble Positions Mobile extension, or with a custom application.
- synchronize the collected field data with the office:
  - a. Start ArcMap, and open an existing Map document (MXD file).
  - b. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.
  - c. Click **Projects**, highlight the required project, and then click **Set Current**.

- 
- d. Click **OK**, and then close the *Trimble Positions Desktop Administration* window. Available sessions appear in the *Trimble Positions Desktop* window.



- e. In the *Trimble Positions Desktop* window, click **Handle Session** and then select *Synchronize Mobile Cache (Current MXD)...*. Follow the prompts to synchronize the cache from the mobile device to the GIS.

If there is any data to be imported from the field for the selected project, it is transferred using the TrimbleSessions feature class in the geodatabase, and a dialog displays indicating the number of sessions inserted into the office database.

The session(s) appear in the session list when the transfer is complete.

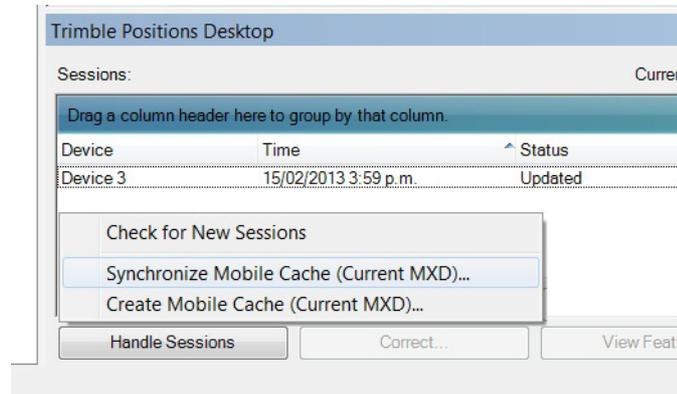
If there are no sessions to synchronize at your workstation, you can still select **Check for New Sessions** in case another workstation has synchronized the sessions.

## Synchronization using ArcGIS for Server

To enable GIS / GNSS data transfer using ArcGIS for Server between the Trimble Positions Desktop add-in and a field device using Trimble Positions Mobile extension, or a custom application built on the Trimble Positions toolkit / Esri ArcGIS Mobile SDK, you must:

- publish a map service using the tools built-in to ArcMap. To consume this service in ArcGIS for Windows Mobile, the *Mobile Data Access* capability must be enabled. For a map service to be editable, it must use an enterprise geodatabase. Refer to Esri documentation for more information on this topic.
- create a project which is related to the map document and mobile service (refer to the *Trimble Positions Mobile Project Center Extension User Guide* and the *Trimble Positions Toolkit Developers Guide*, respectively). A project contains links to a subset of feature classes (from the mobile service) for which geometries will be collected with the field software. The project is stored in the Trimble Positions office database, and is saved to the field database that is deployed to the Trimble Positions Mobile extension, or with a custom application.

- synchronize the collected field data with the office using the Synchronize task in ArcGIS for Windows Mobile or your custom application. In order for a session to be available for synchronization, it must be ended manually through the GNSS Sessions task or automatically by closing and re-opening the project. All collected data ( features and sessions) will synchronize through the mobile service to the backend enterprise geodatabase.
- check for new sessions in ArcMap:
  - a. Start ArcMap, and open the map document (MXD file) used to publish the map service.
  - b. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.
  - c. Click **Projects**, highlight the required project, and then click **Set Current**.
  - d. Click **OK**, and then close the *Trimble Positions Desktop Administration* window. Previously collected sessions appear in the Trimble Positions Desktop window.



- e. In the *Trimble Positions Desktop* window, click **Handle Sessions** and then select *Check for New Sessions*.

If there is any data to be imported from the field for the selected project, it is transferred using the TrimbleSessions feature class in the geodatabase, and a dialog displays indicating the number of sessions inserted into the office database.

The new session(s) appear in the session list when the transfer is complete.

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## ArcPad workflow

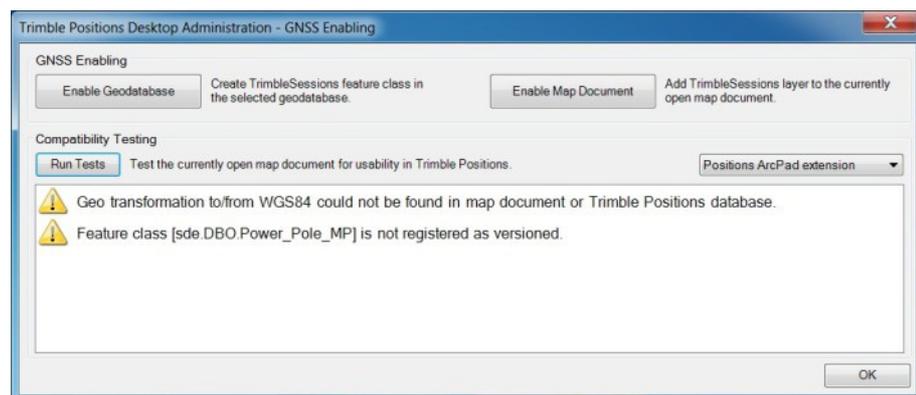
### Working with geotransformations in an ArcPad workflow

The Trimble Positions Desktop add-in must know which geotransformation to use between WGS-84 and the geospatial reference frame used in the map document and ArcPad layers being returned. For more information on using geotransformations, see [Appendix D: Geotransformations in the Trimble Positions Software Suite ArcPad Workflow](#).

### Testing the map document for compatibility

1. Open the Trimble Positions Desktop Administration dialog and click **GNSS Enabling**.
2. In the *Compatibility Testing* frame, from the drop-down control select *Positions ArcPad extension*, and then click **Run Tests**.

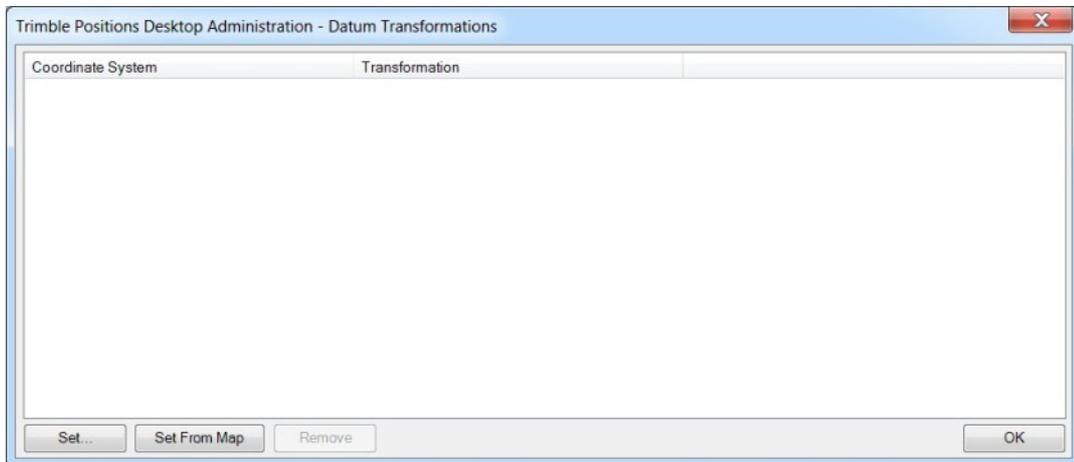
If there are no transformation(s) (pre-)defined in the map document template between the map projection and WGS-84, no WGS-84-based feature layers in the map document, or the geotransformation method has not yet been defined in the Trimble Positions office database, the tests return a warning.



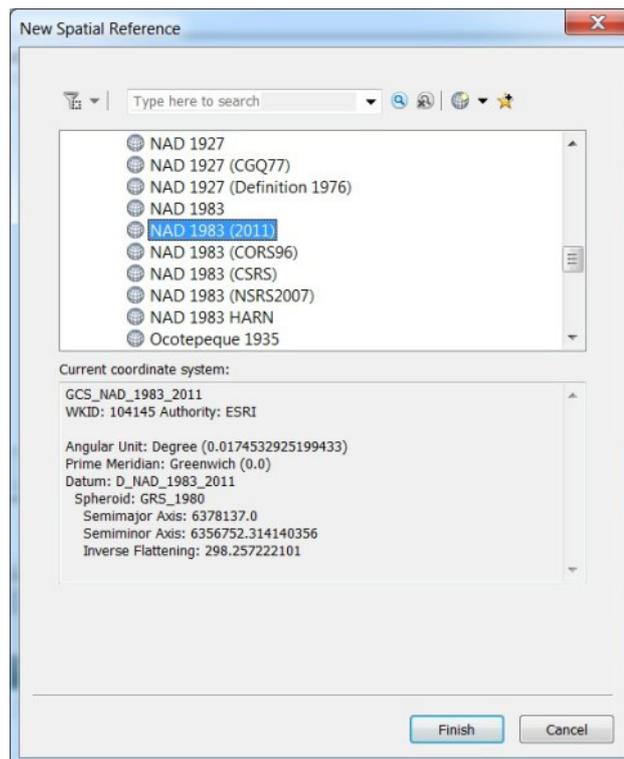
3. Click **OK**.

## Specifying a WGS-84 geotransformation

1. From the Trimble Positions Desktop Administration dialog, click **Datum Transformations**.

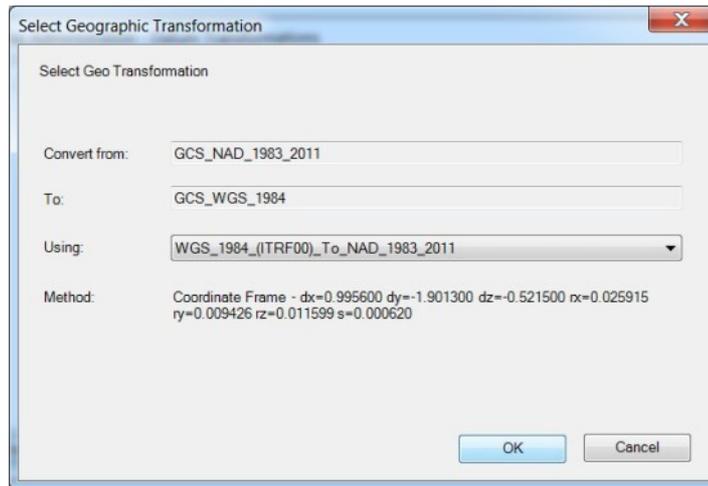


2. Click **Set** to set a new coordinate system transformation. A list of Esri spatial reference frame coordinate systems displays. Select the projected or geographic coordinate system to use and then click **Finish**.

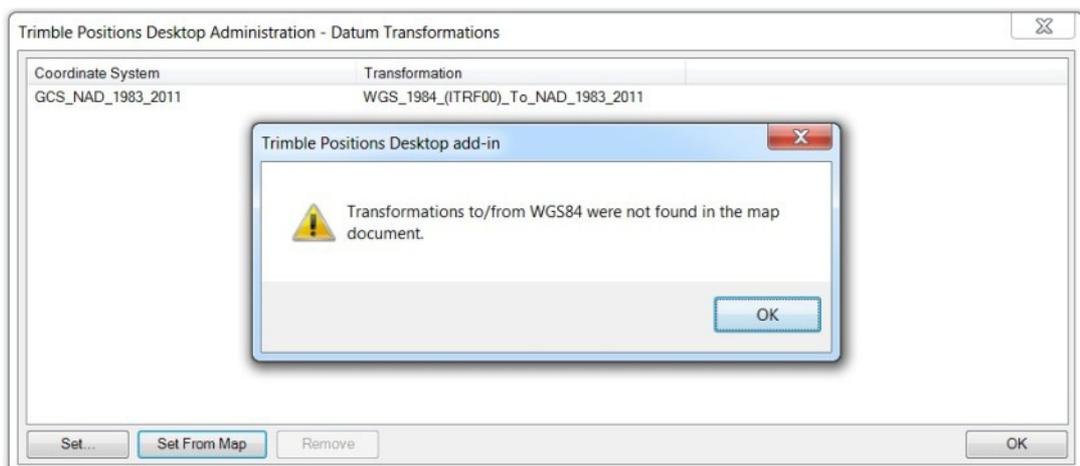


**Note** – It is possible to set a transformation to use for both a Projected Coordinate System (PCS) as well as the underlying Geographic Coordinate System (GCS) for the PCS. If the map layer is defined in the PCS, the transformation associated with the PCS (if any) will be used; if the map layer is defined in the GCS, or there is no defined PCS transformation, the transformation associated with the GCS (underlying the PCS, if appropriate) will be used.

3. In the *Using* list, select the geographic transformation you want to use to convert from the selected (underlying) datum to WGS-84. Confirm the method to be used is the correct one, then click **OK**.



4. If the map document has been created using a map template that has pre-defined transformations to WGS-84, or already has a WGS-84 feature layer and the geotransformation was already defined, click **Set From Map** to use that geotransformation. If the map does not define a transformation, a warning is displayed.

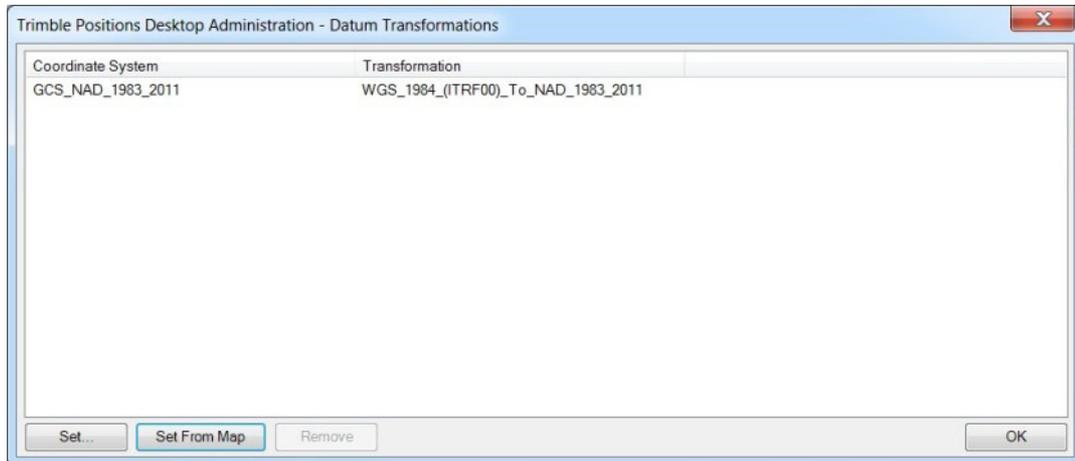


In this case, you must define your own transformation to use.

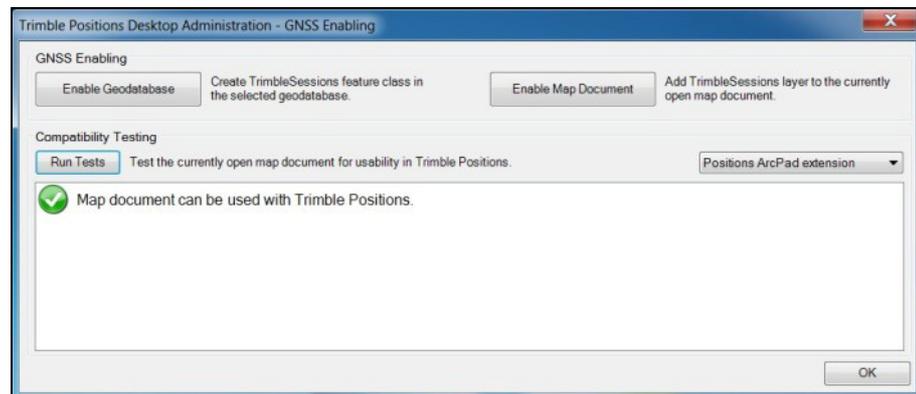
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The datum and associated transformation to be used by Trimble Positions Desktop add-in to convert GNSS data in WGS-84 to the selected map or feature layer datum is now populated in the list and added to the Trimble Positions office database.

5. Click **OK**.



Trimble recommends that you check the map document again by running the tests as described above ([Testing the map document for compatibility](#)). The test should confirm *Map document can be used with Trimble Positions*.



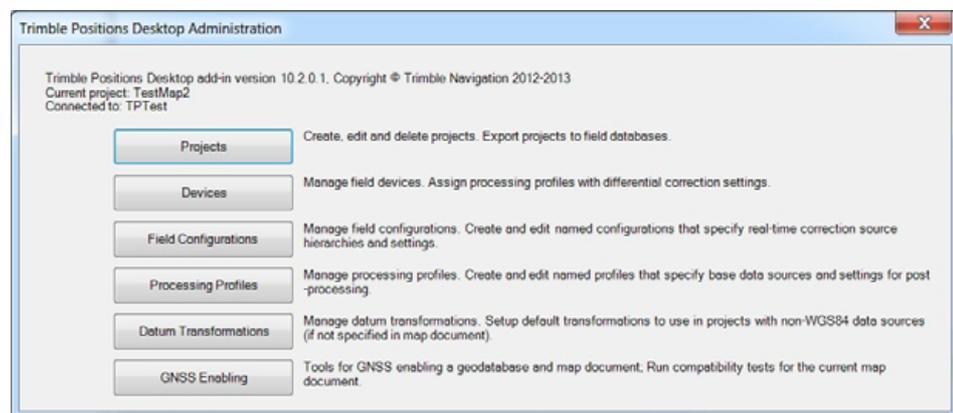
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## ArcPad AXF check-in and check-out workflow

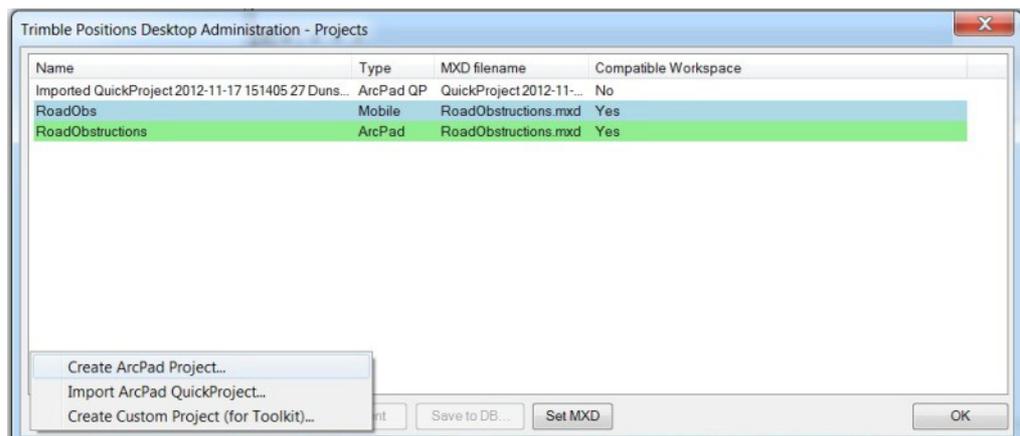
### Creating ArcPad AXF projects

Trimble Positions Desktop add-in uses the Esri ArcPad Data Manager tools to perform the check-out operation, but before it can, it must prepare the Trimble Positions office database by creating a project. An ArcPad project for AXF is created from within the Trimble Positions Desktop add-in.

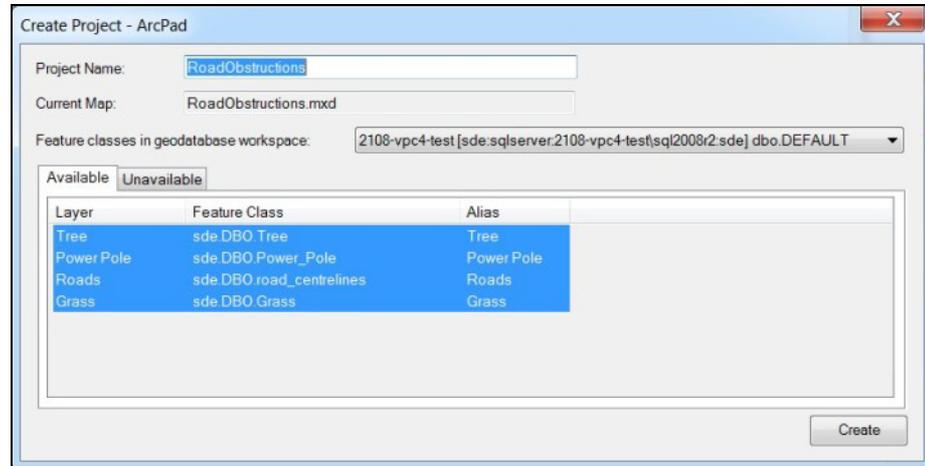
1. Start ArcGIS for Desktop, and open an existing or create a new Map document (MXD file) that will be used to define the feature layers to be checked out.
2. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.



3. Click **Projects**.  
A list of projects appears.
4. Click **Create...**  
A pull-down menu appears. Select **Create ArcPad project...**



- The *Create Project – ArcPad* window appears, with the name of the current map document and a suggested project name. You can change the name of the project if required.



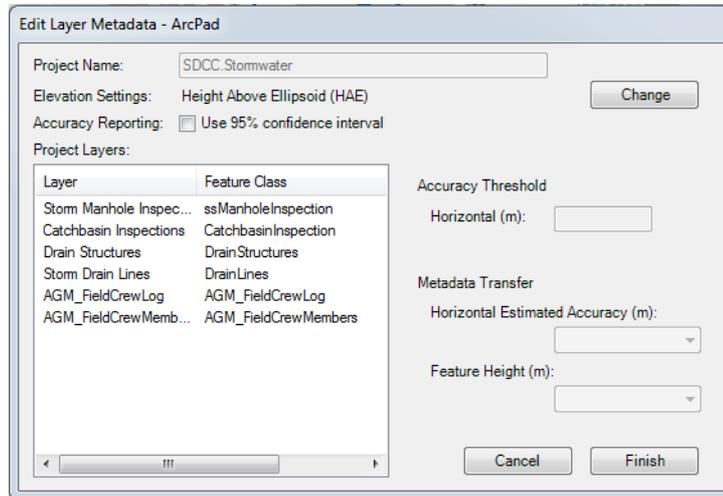
The Trimble Positions software suite can only handle feature layers from one geodatabase at a time. If the map document uses layers from more than one geodatabase, select the required geodatabase. The available feature layers from that geodatabase are listed on the *Available* tab. All other feature layers are listed on the *Unavailable* tab.

- When the features to be checked-out as an AXF file are selected, click **Create**.
- The *Edit Layer Metadata – ArcPad* window appears. For each layer, you can define the required accuracy threshold (used when updating the GIS), and select fields into which the Horizontal Estimated Accuracy and Feature Height metadata can be stored (data type must be numeric).

There are also several settings that apply to the entire project:

- **Elevation Settings** provides the ability to control how height above ellipsoid values are converted to mean sea level (MSL) elevations (or not) for both metadata and Z values (in the office). Click **Change** to make one of the following selections:
  - select *Height above ellipsoid (HAE)* to use height above ellipsoid values.
  - select *Apply fixed geoid separation* to compute elevations by applying the supplied fixed separation value in meters.
  - select *Calculate geoid separation from file* to compute elevations by applying the selected geoid file. These GGF files are available for download from the Trimble website: <http://www.trimble.com/globalTRLTAB.asp?Nav=Collection-71> and should be unzipped to C:\ProgramData\Trimble\Positions\10.1\GeoidFiles.

- **Accuracy Reporting.** By default, Trimble Positions uses a 68% circular error probable calculation for reporting accuracies. Alternatively, you can select the option for using a 95% confidence interval calculation if required (for example, US Federal Government standards).



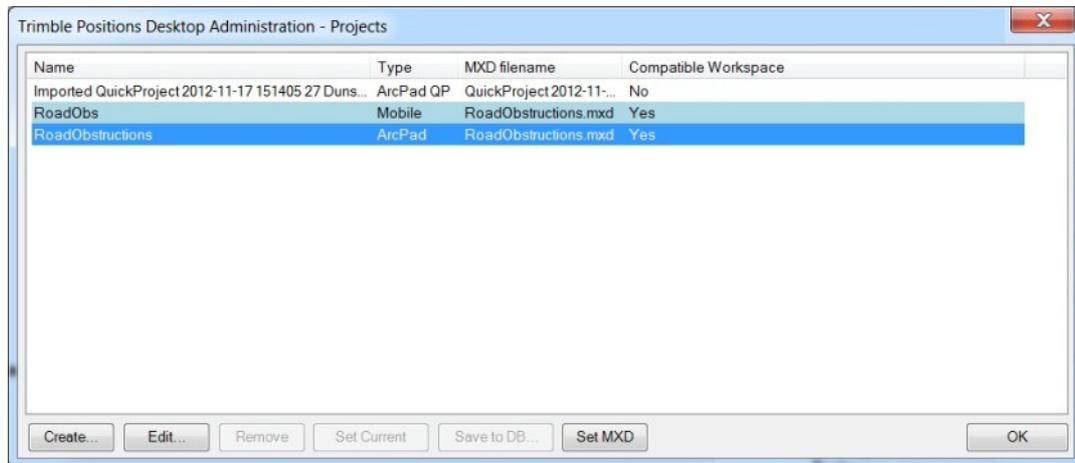
8. Click **Finish**.

## Working with ArcPad AXF projects

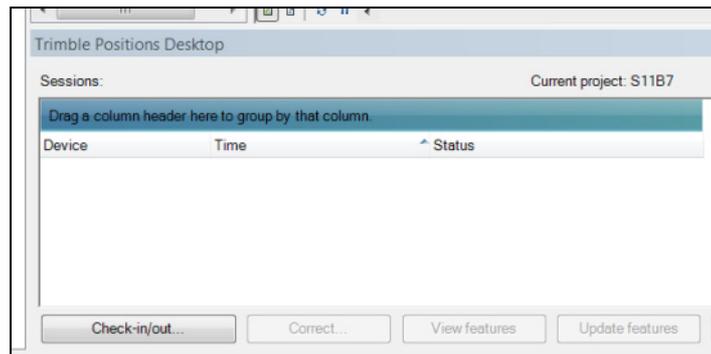
### AXF Check-out

When a Trimble Positions project has been created for the ArcPad AXF workflow, it is added to the list of Trimble Positions projects. A Trimble Position project can be re-used for multiple ArcPad AXF check-out operations.

1. When a project has been created for ArcPad AXF workflow, select it as the current project from the list of projects.

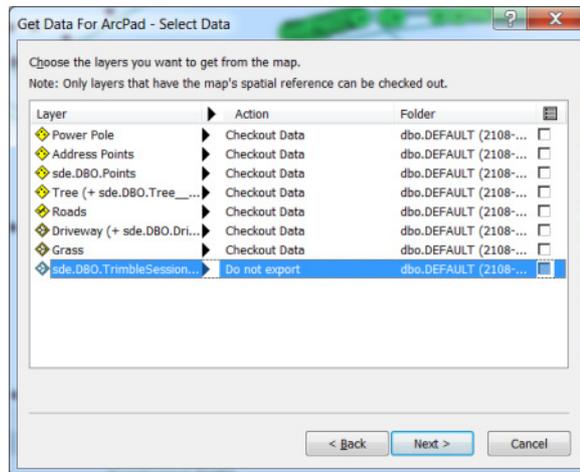


2. On the *Trimble Positions Desktop* pane, click **Check-in/out...**, then select *Check Out to ArcPad* on the menu that appears.



This starts the ArcPad Data Manager Get Data For ArcPad workflow.

3. If you included a TrimbleSession layer from the map document the project is associated with, make sure you change the *Action* to Do not export.



### Transferring data between the field and the office

The AXF data folder must be transferred between the office system accessing the GIS and the field device. You do this by manually transferring files (using Microsoft ActiveSync or Windows Mobile Device Center).

When collecting data in the field using Trimble Positions ArcPad extension, the TrimblePositions.ssf file containing GNSS measurements is stored in the AXF data folder.

When a data collection/maintenance session has been completed, copy the AXF data folder back to the office desktop.

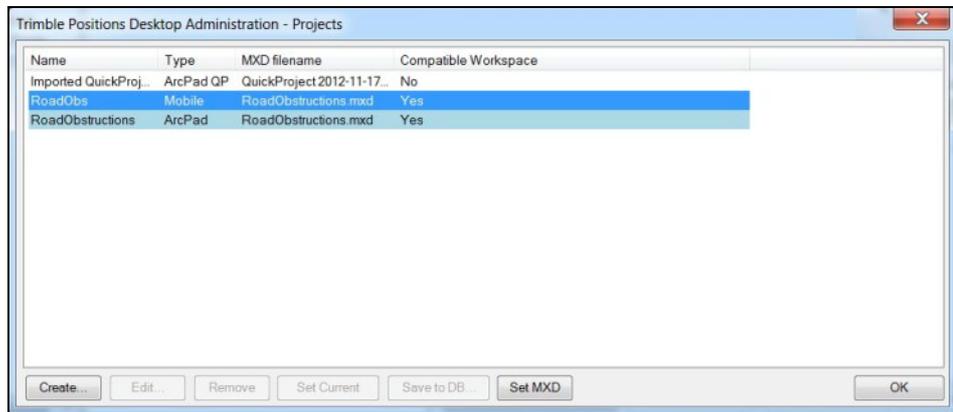
### AXF Check-in

When the AXF data folder has been copied back to the office computer, you can process the TrimblePositions.ssf file using the Trimble Positions Desktop add-in. You must select the Trimble Positions project associated with the AXF data folder from the list of Trimble Positions projects. You can re-use a Trimble Position project for multiple ArcPad AXF check-in operations. During AXF check-in, Trimble Positions Desktop add-in will make a backup copy of the AXF file.

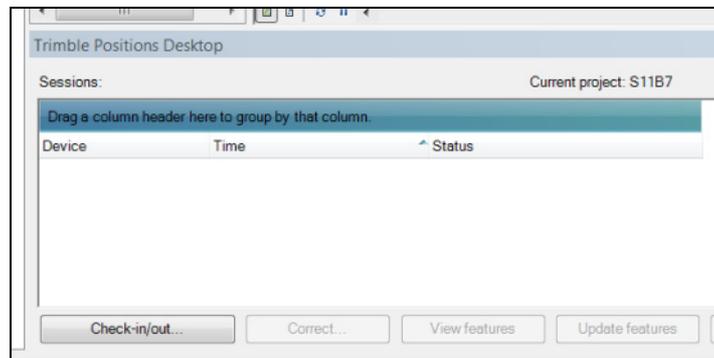
The Trimble Positions Desktop add-in attempts to create a backup of the AXF file as the first step in the check-in process. The backup file is stored in the same folder as the original AXF file, with the same name as the AXF file, but has the file extension ".backup". For example, if your AXF file is called "test.axf", the backup copy is called "test.axf.backup".

If you need to use the backup copy (the AXF file before being checked-in), delete or rename the checked-in version of the AXF file, make a copy of the backup file, and rename the copy to reinstate the extension as ".axf".

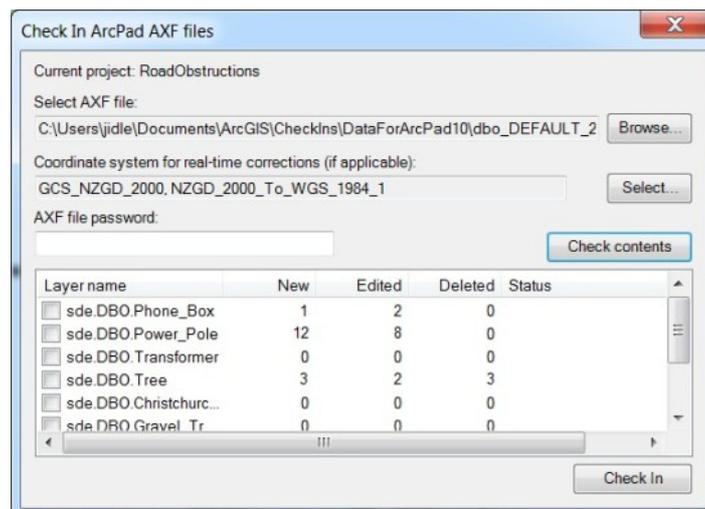
1. When a project has been created for ArcPad AXF workflow, select it as the current project from the list of projects.



2. On the *Trimble Positions Desktop* pane, click **Check-in/out...**, then select *Check In AXF file* on the menu that appears.



This starts the ArcPad Data Manager Check In ArcPad AXF files workflow.



---

**Note** – It is important to check in the AXF file using this workflow, as the ArcPad Data Manager workflow does not import the TrimblePositions.ssf file.

3. Select the AXF file to check-in. This would have been copied from the device to a drive accessible by your computer.
4. If the data was collected using a real-time correction source whose reference position is not expressed in terms of WGS-84, you must select the reference coordinate system. If you do not do this, Trimble Positions Desktop add-in treats the coordinates of collected positions as if they are in terms of WGS-84. If no appropriate geotransformation between the selected reference system and WGS-84 is set in the Trimble Positions software, you must select one from the list of available geotransformations. If an incorrect geotransformation is selected, position coordinates will not be correctly converted to WGS-84. Both cases may cause misalignment of the Trimble Positions features and the ArcGIS features.
5. If necessary, enter the password of the AXF file.
6. Click **Check contents**. The list of AXF feature layers and their status is displayed in the list.
7. Click **Check In** to import the feature classes and to import the session data.
8. When the session has been imported a confirmation dialog appears. Click **OK**.  
The Trimble Session bounding box is displayed on the map document, along with the features. The Trimble Positions Desktop window now has the session populated in the list.

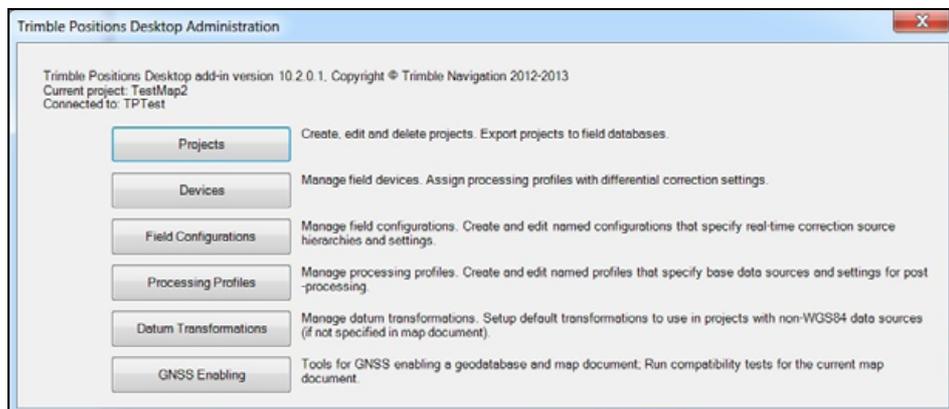
## ArcPad QuickProject workflow

### Working with ArcPad QuickProjects

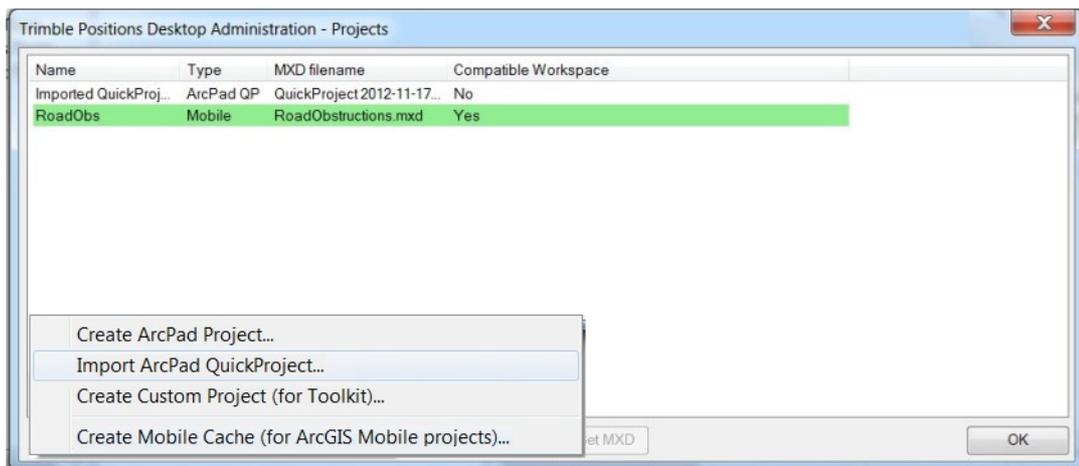
ArcPad data collection software allows a field user to create a QuickProject, a simple schema consisting of a Point, a Line, and a Polygon feature layer. Trimble Positions Desktop add-in uses this schema to create a Trimble Positions project when the QuickProject data folder is transferred from the field to the office.

1. Start ArcGIS for Desktop, and open an existing or create a new Map document (MXD file) that will be used to import the feature layers from the QuickProject.

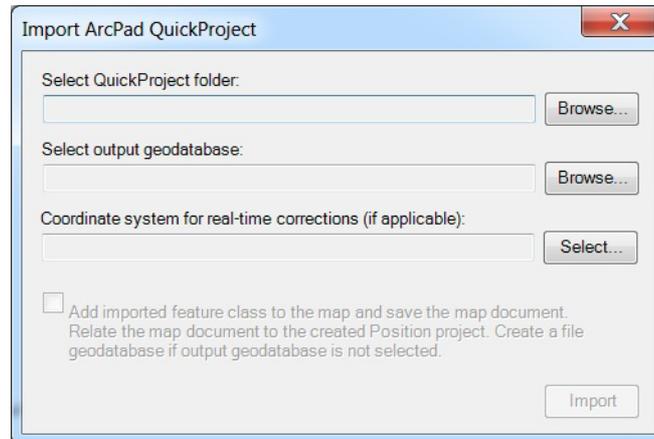
- Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.



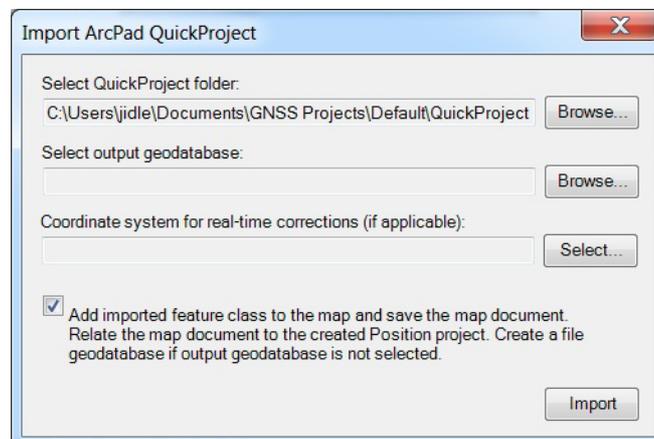
- Click **Projects**.  
A list of projects appears.
- Click **Create...**  
A pull-down menu appears. Select **Import ArcPad QuickProject ...**



The *Import ArcPad QuickProject* window appears.

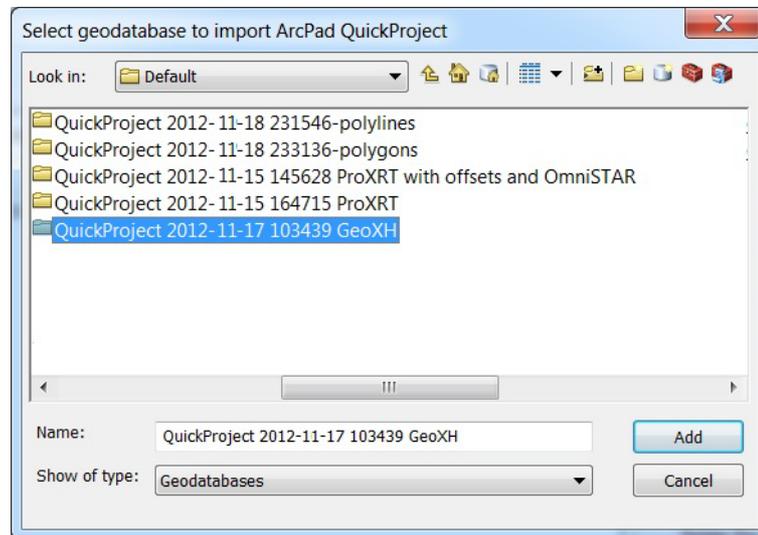


5. Click the *Select the QuickProject folder* **Browse...** button to browse to and select the QuickProject folder.
6. If the data was collected using a real-time correction source, you must select the reference coordinate system. If you do not do this, Trimble Positions Desktop add-in treats the coordinates of collected positions as if they are in terms of WGS-84. If the real-time source reference coordinate systems is not WGS-84, the Trimble Positions features and the ArcGIS features will be misaligned.
7. If the currently open map document is a blank document and does not contain any feature layers, the option to add the imported feature layers to that map is enabled.



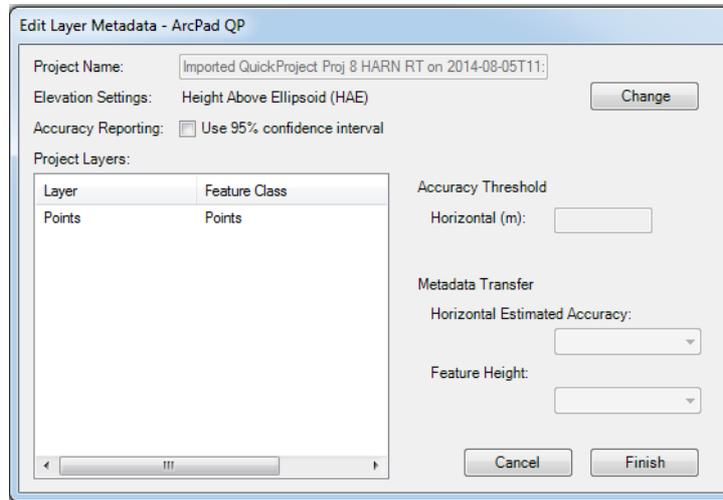
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If the option to import the features to a blank map is enabled and selected, the geodatabase can be left blank and a local file geodatabase is created during import. If you want to specify an existing geodatabase, or the option is disabled, click the *Select output geodatabase* **Browse...** button to select the geodatabase to which the QuickProject feature layers will be imported.



8. Click **Import**. The *Edit Layer Metadata – ArcPad QP* window appears. For each imported layer, you can define the required accuracy threshold (used when updating the GIS), and select fields into which the Horizontal Estimated Accuracy and Feature Height metadata can be stored (data type must be numeric). There are also several settings that apply to the entire project:
  - **Elevation Settings** provides the ability to control how height above ellipsoid values are converted to mean sea level (MSL) elevations (or not) for both metadata and Z values (in the office). Click **Change** to make one of the following selections:
    - select *Height above ellipsoid (HAE)* to use height above ellipsoid values.
    - select *Apply fixed geoid separation* to compute elevations by applying the supplied fixed separation value in meters.
    - select *Calculate geoid separation from file* to compute elevations by applying the selected geoid file. These GGF files are available for download from the Trimble website: <http://www.trimble.com/globalTRLTAB.asp?Nav=Collection-71> and should be unzipped to C:\ProgramData\Trimble\Positions\10.1\GeoidFiles.

- **Accuracy Reporting.** By default, Trimble Positions uses a 68% circular error probable calculation for reporting accuracies. Alternatively, you can select the option for using a 95% confidence interval calculation if required (for example, US Federal Government standards).



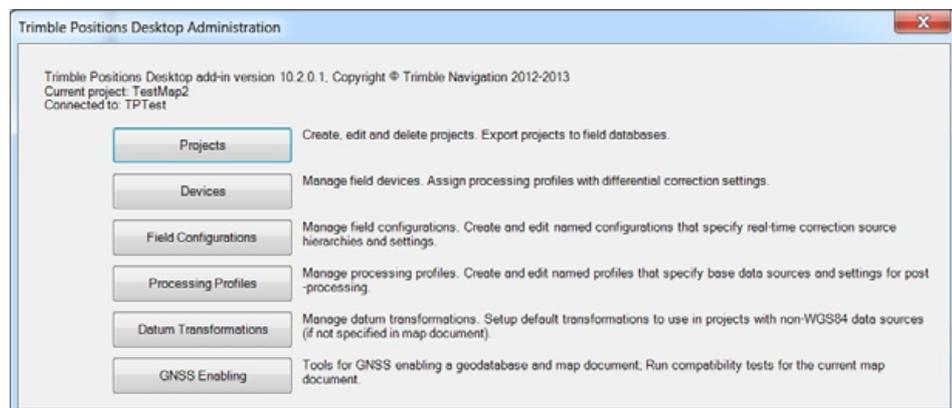
9. Click **Finish**.

## Managing processing profiles

Once session data is returned to the office, Trimble recommends that it is postprocessed against a local base station. Base station metadata is held in the Trimble Positions database and is populated during installation. The metadata can also be updated when required.

Use the *Trimble Positions Desktop Administration - Processing Profile* dialog to manage base stations into profiles, which devices can later be associated with.

1. Start ArcGIS for Desktop, and open an existing Map document (MXD file).
2. Click the *Show Trimble Positions Desktop Administration Window*  icon. The *Trimble Positions Desktop Administration* window appears.



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3. Click **Processing Profiles**.

A list of processing profiles appears. Initially, no profiles are available.

4. Do one of the following:

- To create a new processing profile, click **Create....** In the Edit Profile dialog, enter a *Profile Name*.
- To modify an existing processing profile, select the profile and then click **Edit...**

*Note* – You cannot directly modify the name of a processing profile. You must create a new processing profile with the desired name and remove the existing one.

5. Specify the base data source. Do one of the following:

- select *Using a single base station* and then click **Select** to browse to the required base station. In the *Select Base Station* dialog you can filter the list of base stations by selecting a city from the drop down menu and a radial distance from the selected city. You can further narrow the list of base stations by base station type and whether or not the base station supports GLONASS.

If required, click **Update List** to update the list of base stations from the Trimble FTP server. If you require access to a listed base station that requires authentication, make a copy of the base station and modify the details in the *Security* window of the copy.

When you have chosen a base station, click **OK** to assign the selected base station to the profile.

- select *Using a folder or specific base files* and then click **Select** to browse to the required folder / files. You can also specify whether the reference position comes from a base file or a base station. Click **OK**.

6. Click **OK**.

To delete an existing processing profile, click **Remove**, then click **OK**.

## Using base station data

Base station metadata used in the Trimble Positions software is stored in the Trimble Positions office database. If the table is empty when the Trimble Positions Desktop add-in is started, it will be populated from the list supplied by the Trimble Positions Desktop add-in installation script (cbs\_list.csv). You can update the base station list from the central list stored on the Trimble FTP server by clicking the **Update List** button.

*Note* – This may take a short while, during which time the application may appear to not be responding.

If you have a list of user-defined base stations created in different software (for example, the Trimble GPS Pathfinder® Office software, or the Trimble GPS Analyst™ extension for ArcGIS for Desktop software), you can import it at the same time.

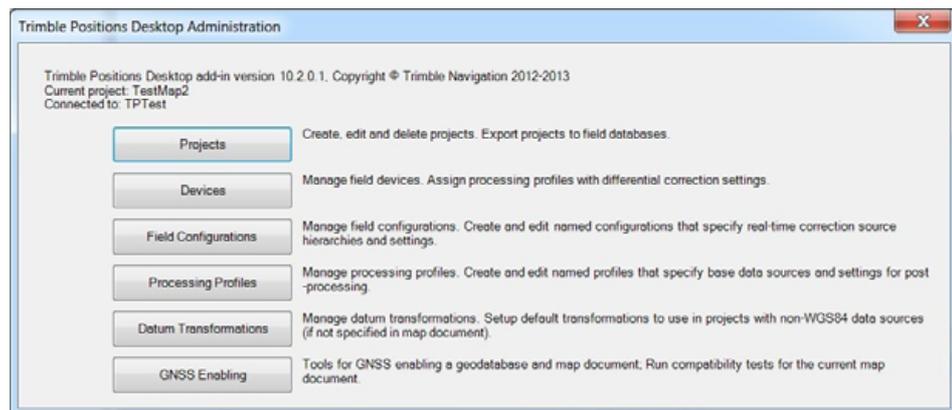
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## Managing device profiles

Once data has been collected or updated in the field, it must be sent to the office database.

Once session data has been returned to the office, you can use the *Trimble Positions Desktop Administration - Devices* dialog to manage field devices and specify which Processing Profile they use for postprocessing.

1. Start ArcGIS for Desktop, and open an existing Map document (MXD file).
2. Click the Show Trimble Positions Desktop Administration Window icon . The *Trimble Positions Desktop Administration* window appears:



3. Click **Devices**. A list of handheld devices which have been used to send data to the Trimble Positions Desktop Add-in appears.

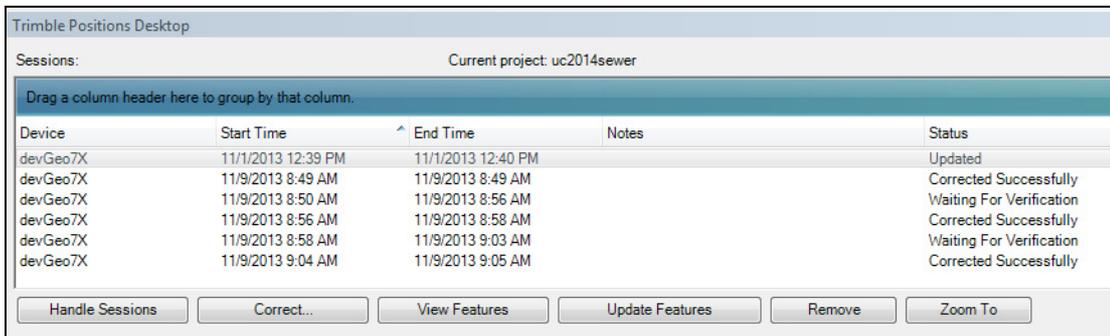
*Note – Devices cannot be managed until they have returned Trimble Positions session data to the office.*

4. Highlight the device you want to manage, and do one of the following:
  - To remove a device, click **Remove**, and then click **OK** to confirm.  
*Note – If a device still has outstanding sessions, it cannot be removed.*
  - To edit the device ID, name, or serial number, click **Edit** and change the details as required in the *Edit Device Data* dialog. Click **Save**.  
*Note – The Edit Device Data dialog shows the device processing profile as read-only; you cannot edit the processing profile here. To change a device's processing profile, click Set Profile—see below.*
  - To set a device's processing profile / base data source, click **Set Profile...** From the list which appears, select the processing profile to associate to the device, or select None.
5. Click **OK**.

---

## Working with collected data

Once high accuracy data has been collected or updated in the field and handled through the appropriate ArcGIS for Windows Mobile or ArcPad workflow, the primary location for working with that data (sessions, features, GNSS positions and constructions) is the main *Trimble Positions Desktop* window (also referred to as the 'dockable' window as it is dockable anywhere within ArcMap).



After selecting a project (that is, clicking **Set Current**) in the *Trimble Positions Desktop Administration* window, the dockable window displays the *Sessions* panel and a list of all existing sessions in the selected project. Functionality for getting new sessions, correcting sessions, updating GIS features, zooming to sessions, and viewing Trimble Positions features within sessions is exposed through the buttons on the *Sessions* panel in the dockable window. As you inspect sessions in more detail by looking at features within a session, or GNSS positions within a feature, this dockable window will change to show the *Features* panel or *Positions* panel respectively.

Each session has a status:

- Waiting for Correction - if the session has not yet been postprocessed.
- Waiting for Verification - if the session has a feature or position that does not meet the defined verification criteria, and requires manual editing.
- Waiting for Update - if the session has been postprocessed already and its features edited as required to meet verification criteria, and it is now ready to update the GIS.
- Corrected Successfully - if the session has been successfully postprocessed and has met verification criteria without requiring editing, it is ready to update the GIS. Once successfully updated to the GIS, sessions are removed from the list.

## Correcting session data

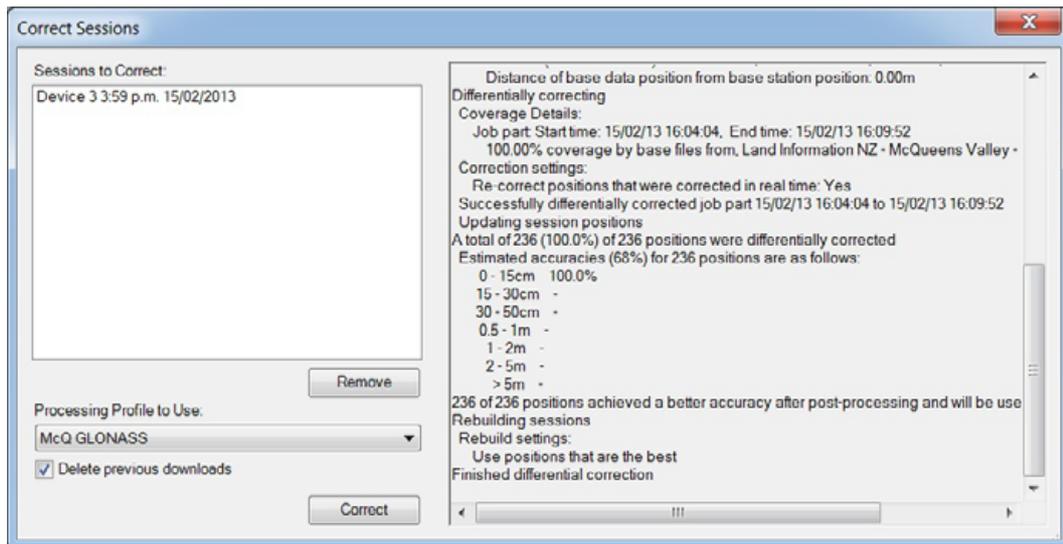
To achieve greater accuracy, postprocess the feature positions using session data acquired in the field.

1. Highlight the session(s) you want to postprocess and click **Correct...**

If you have already corrected this session, you are asked if you want to postprocess it again. Click **Yes** to continue postprocessing.

The *Correct Sessions* dialog appears.

2. In the *Sessions to Correct* list, select the session(s) you want to postprocess.
3. From the Processing Profile to Use drop-down, select the required processing profile. By default, the profile that you assigned to the device is selected (see [Managing device profiles, page 30](#)).
4. Click **Correct** to begin postprocessing. The ongoing status displays in the textbox on the right side of the dialog.



When postprocessing is completed successfully, a summary of the corrected positions appears, and the message **Finished differential correction** shows at the bottom of the log text.

**Note** – *The position summary provides GNSS position accuracy at one sigma (68%).*

(If you have started a postprocessing session by mistake, click **Cancel**.)

5. When the postprocessing has completed, click  to close the dialog.
6. Check the status of the session in the *Trimble Positions Desktop* window:
  - If the required accuracy was achieved, the session's status shows **Corrected Successfully**. See [Updating features, page 37](#) for details on updating the geodatabase with the corrected feature position.
  - If the session status is **Waiting for Verification** after postprocessing, view and edit feature positions to remove inaccurate data. See [Editing features](#), below.
  - If 100% coverage was not available, this may be because the data was not yet available from the base station. After waiting and verifying that base station data is available, you can correct the session(s) again, but make sure the *Delete previous downloads* check box is selected. When selected, previously downloaded base station data for this base station is discarded and the latest data is downloaded. If left unselected, previously (possibly incomplete) downloaded data will be re-used.

---

## Inspecting session data in the map

Trimble Positions sessions and features are color-coded on the ArcGIS map, according to their status.

Trimble Positions sessions are bounded by an extents box, which is colored according to the session status when the session is selected:

- Waiting for correction: yellow
- Successfully corrected: dark green
- Waiting for validation: light goldenrod
- Unknown: black
- Waiting for update: gold
- Updated: royal blue
- Unknown: black

Trimble Positions features within the session are colored according to their status:

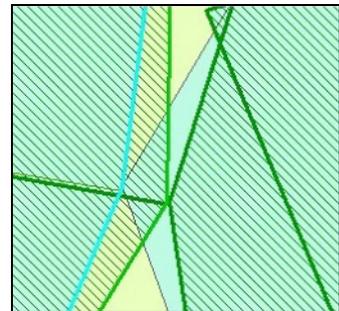
- Valid: medium green
- Unlinked: powder blue
- Exception: orange
- Invalid geometry: red
- Insufficient accuracy: dark red

Trimble Positions GNSS positions within a feature are colored according to their status:

- Uncorrected: blue
- Real-time corrected: pink
- Postprocessed: mauve
- Manual: black

If you view the features from a corrected session in the map, note that the Trimble Positions and the ArcGIS features do not entirely overlap, because the Trimble Positions features have been corrected. The ArcGIS feature is displayed using the defined map symbology, whereas the Trimble Positions feature is displayed in the appropriate status color, and polygons are cross-hatched.

You can modify Trimble Positions feature constructions before you update the geodatabase; see [Editing features](#), page 34.



## Viewing the features in a session

To view detailed information about a session's features, highlight the session you want to view the features for and then click **View features**.

Label	Status	Est. Accuracy (m)
Pole_637aa267-352c-4bcb-918a-a005da78bd60	Exception	0.904
Pole_7c4436e5-881c-42d7-9ff1-7a4d0e9769d9	Verified	0.011
Pole_713bad62-9142-4e3b-951b-4f9674b37ec7	Verified	0.013
Pole_6af56063-2483-49d9-afe3-15e98d35d306	Verified	0.010
Pole_30ea2691-76d1-42eb-a564-239526fb5d9b	Verified	0.013
Pole_50341e15-24b7-4516-836d-c83a5ed502fa	Verified	0.014
Pole_5af0f682-7eec-4b8f-9394-69b2d86fb1c	Verified	0.031
Pole_3effae56-ad74-4605-b2c8-2f08de1483ab	Verified	0.014
Pole_81b43474-b6c5-486a-bead-b3d4d06cf09b	Verified	0.013
Pole_39d1f714-0cd3-40ad-a200-a2f7b72f4ce8	Verified	0.012
Pole_af65ff85-5a29-4d1e-9c11-c816c2f8031b	Verified	0.022
Pole_17b1772d-3418-40de-ac3f-4670519f64f6	Verified	0.014
Pole_0ea6f276-7c95-4e49-b1da-6907ebe4e929	Verified	0.015
Address Points_f058fbd4-2ff8-4c39-a4c6-42fb54899ef1	Verified	0.011
Address Points_9f77d6df-016f3-49d1-b39a-a2030143edfd1	Verified	0.011

A list of features associated with the session is displayed in the feature list.

### Feature status

Each feature has a status:

- Valid - the feature meets the defined accuracy threshold.
- Insufficient accuracy - the feature does not meet the defined accuracy threshold.
- Unlinked - see below.
- Exception - see below.

### Editing features

For each feature, you can:

- remove the link between the GNSS data and the geodatabase feature. During an Update operation (see [Updating features, page 37](#)), the feature geometry in the geodatabase will not be updated. To remove the link, highlight the feature and click **Unlink**. The feature's status changes to Unlinked.

*Note* – You can relink an unlinked feature; highlight the feature and click **Link**.

- select a geodatabase feature even if its accuracy does not meet the defined accuracy threshold. Highlight the feature and click **Exception**. The feature's status changes to Exception.
- zoom to the feature on the map. Highlight the feature and click **Zoom To**.

- edit individual feature position information. Highlight the feature you want to edit and then click **View positions**. A list of logged GNSS positions displays. Each position has a status of Uncorrected or Postprocessed.

You can:

- click on the column headers to sort the positions by that column.
- deselect a position to remove it from the feature’s data set.
- If any positions are not selected, easily select all positions—click **Use All**.

Click **Finish**. If you made any changes to the feature’s positions, you are prompted to save the changes. Click **Yes** to save the changes; click **No** to discard them.

*Note – digitization of ‘missing points’ or moving points should be performed wholly within the Esri context after updating the GIS.*

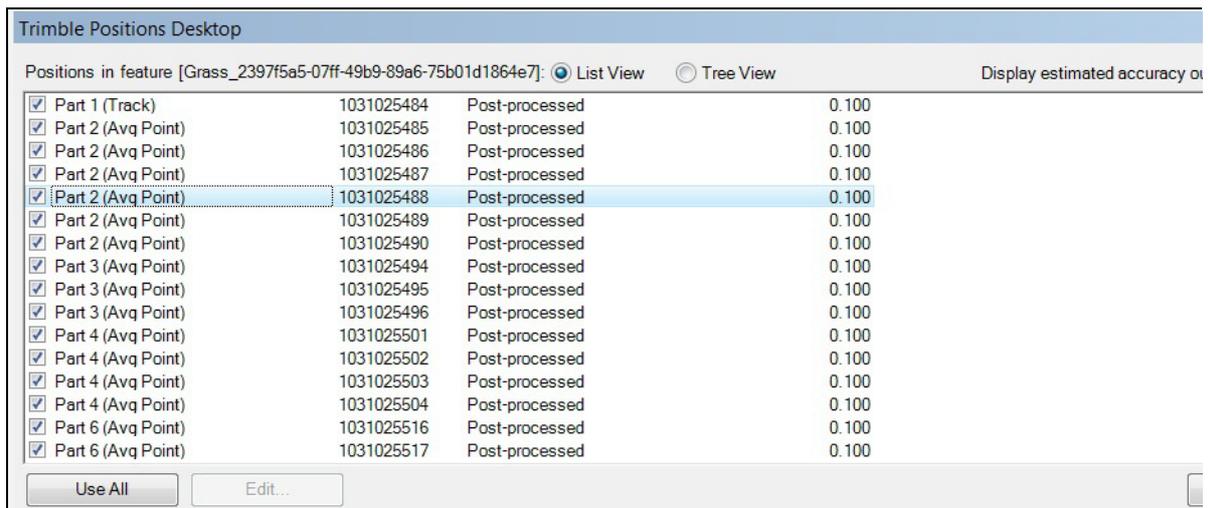
To save any changes you make to the session’s features, click **Apply**. To close the window and discard any changes, click **Finish** and then click **No**.

### Viewing and editing positions within features

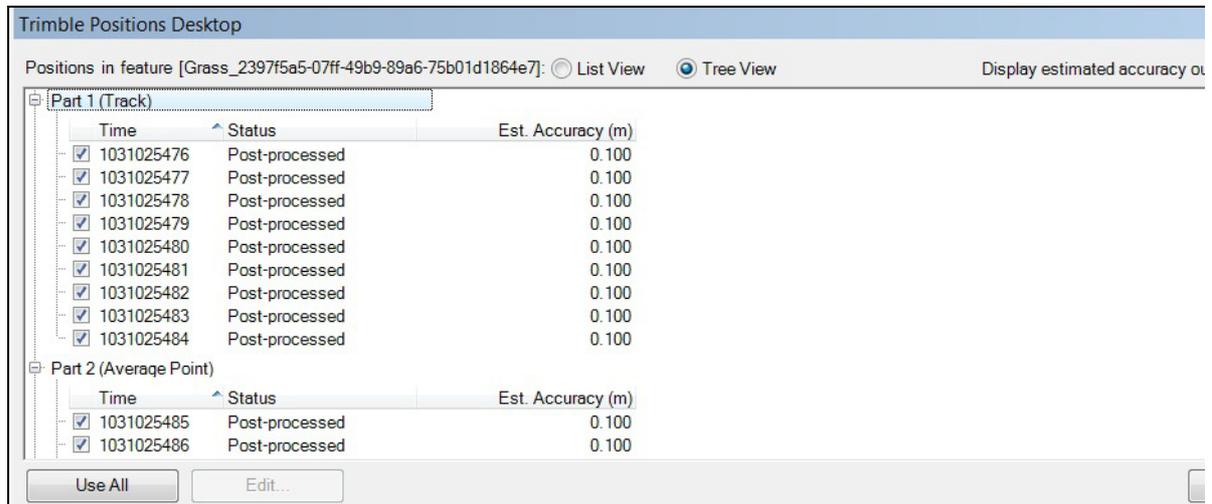
To view individual feature position information, highlight the feature you want to inspect from within the *View Features* dialog and click **View positions**.

A list of logged positions used for the selected feature displays. Each position has a status of Uncorrected, Real-time corrected, or Postprocessed. You can display the positions in List view, or Tree view:

- Use List View to:
  - click on the column headers to sort the positions by that column.
  - deselect a position to remove it from the feature’s data set.
  - select all positions if any required positions are not selected. Click **Use All**.

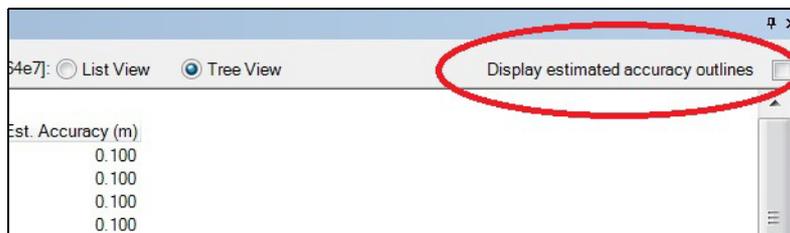


- Use Tree View to:
  - view the construction hierarchy of the selected feature.
  - view the positions grouped by construction part.
  - expand the part into the observations.
  - edit the offset defining the part.



When a position is selected from the list, it is highlighted on the map document. You can scroll through the positions by using the up- and down-arrow keys on the keyboard.

You can also display the estimated accuracy for the features and positions on the map—select the *Display estimated accuracy outlines* checkbox.



## Position status

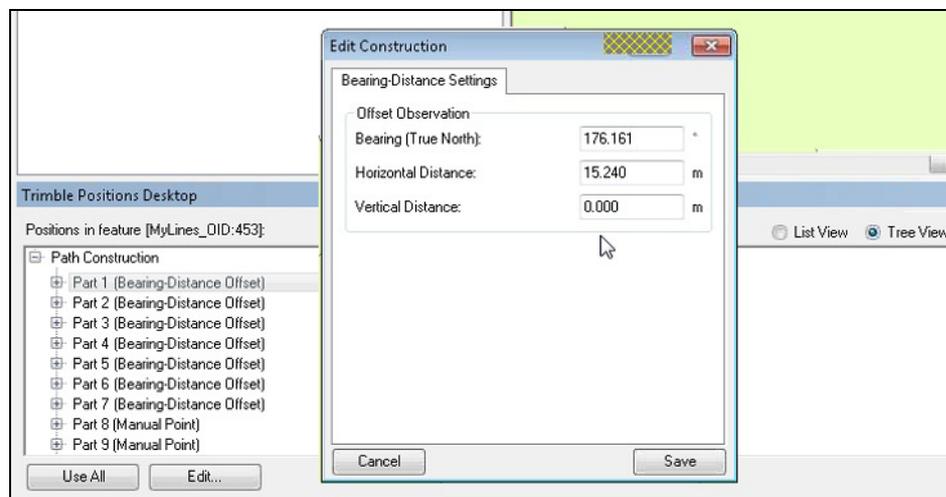
Each position has a status:

- Uncorrected - the position is an autonomous GNSS position.
- Real-time corrected - the positions has been corrected in real-time at the time of collection in the field.
- Postprocessed - the position has been corrected during postprocessing in the office.
- Manual - the position has been provided using a manual method.

---

## Editing position constructions

When a part with associated offset is highlighted in Tree View, the **Edit...** button is enabled. Click **Edit...** to open the Edit Construction dialog.



The dialog adapts to the offset type used when collecting the position (distance-bearing, bearing-bearing, distance-distance). If required, change the settings and click **Save** to save your edits, or click **Cancel** to return without accepting any edits made.

***Note** – Simple left-/right-offsets applied when collecting a polyline or polygon feature are translated into individual distance-bearing offsets by ArcPad, and are not recoverable as simple offsets.*

## Inspecting edited feature positions in the map

When you apply changes, the feature construction is rebuilt and displayed on the map.

## Saving feature edits

You can apply edits made to feature positions at any time by clicking **Finish** in the *View Positions* dialog. If you want to apply changes made to features during an edit session, click **Apply**.

To end the edit session, click **Finish**. You are prompted to save any remaining open edits. Edits, once applied, can only be undone manually by reversing the position selection or offset edits.

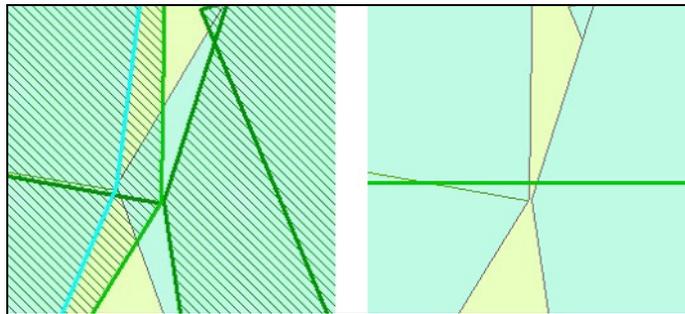
## Updating features

To update the geodatabase with the corrected feature geometries, highlight the session you want to update and then click **Update features**.

A dialog appears showing a successful update, or a failed update. If the update was successful, the status of the session changes to Updated.

---

The map document updates the ArcMap features and the Trimble Position features are removed.



### Removing sessions

To remove a session from the Trimble Positions database, highlight the session you want to remove and then click **Remove**.



---

**WARNING** – The session is permanently removed and cannot be recovered.

---

### Zooming to a session

To zoom to a session on the map, highlight the session you want to zoom to and then click **Zoom to**.

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## Finding additional information

If you have a problem and cannot find the information you need in the product documentation, contact your Trimble reseller.

### Documentation and downloads

- Trimble Positions Desktop Add-in Administrator's Guide
- Trimble Positions Mobile Extension User Guide
- Trimble Positions Mobile Extension Administrator's Guide
- Trimble Positions Mobile Project Center Extension User Guide
- Trimble Positions Mobile Project Center Extension Administrator's Guide
- Trimble Positions ArcPad Extension User Guide
- Trimble Positions ArcPad Extension Administrator's Guide
- Trimble Positions Toolkit Developer's Guide
- Trimble Positions Desktop Add-in Release Notes
- Trimble Positions ArcPad Extension Release Notes
- Trimble Positions Mobile Extension Release Notes
- Trimble Positions Mobile Project Center Extension Release Notes
- Trimble Positions Toolkit Release Notes

## Appendix A: Positions software suite workflow overview for ArcGIS mobile

The following table provides an overview of the steps required to install and use the Trimble Positions software suite in an Esri ArcGIS Mobile environment. The steps in bold are covered in detail in this guide. For all other steps, refer to the other Trimble Positions software suite documentation, as listed above.

Initial administration tasks	Install and license ArcGIS for Desktop 10.2 on each office computer.
	Install ArcGIS for Windows Mobile 10.2.0 (this is to get the Mobile toolbox for ArcGIS for Desktop installed, and to install the Esri Mobile Project Center utility) on each office computer and Windows Mobile device.
	Download Trimble Positions Desktop add-in 10.2.0.1.
	Optionally, install the Trimble Positions License Manager to a computer(s) that is/are accessible from the office computer (and field devices).
	On each office computer that has ArcGIS for Desktop 10.2 installed, install and license Trimble Positions Desktop add-in 10.2.0.1.
	Download Trimble Positions Mobile extension 10.2.0.1.
	On each mobile device that has ArcGIS for Windows Mobile 10.2.0 installed, install and license Trimble Positions Mobile extension 10.2.0.1.
	On office computers that have the Esri Mobile Project Center installed, install Trimble Positions Mobile Project Center extension 10.2.0.1.
	Optionally, create a new Microsoft SQL Server or Oracle database, if an enterprise database is required and not yet created.
	Configure Trimble Positions Desktop database ( <i>Start / All Programs / Trimble / Trimble Positions Tools / Desktop Configuration</i> ).
	Start ArcGIS for Desktop and enable Trimble Positions Desktop add-in.
	<b>If not already done during a previous installation, add TrimbleSessions to each geodatabase using Trimble Positions Desktop add-in.</b>
Desktop add-in tasks when enabling Map documents	<b>Open map document.</b>
	<b>Add feature layers to Map from geodatabase.</b>
	<b>Add TrimbleSessions to Map using Trimble Positions Desktop add-in.</b>
	<b>Check Map for compatibility using Trimble Positions Desktop add-in.</b>
	<b>Create a Mobile Cache using Trimble Positions Desktop add-in.</b>
	<b>Create Field Configuration(s).</b>
Mobile Project Center extension user tasks for each new or modified mobile project	Open Mobile Project Center ( <i>Start / All Programs / ArcGIS / ArcGIS for Windows Mobile / Mobile Project Center</i> ).
	Create a new Project.
	Import operational layers from Mobile Cache.
	Configure layer for data collection and metadata autofill fields.
	Configure TrimbleSessions Data Collection Layers' Accuracy-Based Logging thresholds, and Field Configurations.
	Configure Project extents.
	Save Project.
	<b>In Trimble Positions Desktop add-in, associate Project and Map.</b>

Regular transfer tasks between field and office	<b>Transfer Project definition and Mobile Cache to Windows Mobile field device.</b>
	Collect data using Trimble Positions Mobile extension 10.2.0.1 for ArcGIS for Windows Mobile 10.2.0.
	Transfer Mobile Cache to office computer.
Regular Desktop add-in user tasks	<b>If not already created, in Trimble Positions Desktop add-in, create processing profile(s).</b>
	<b>If not using ArcGIS for Server, use Trimble Positions Desktop add-in to synchronize the mobile cache.</b>
	<b>In Trimble Positions Desktop add-in, manage devices and optionally associate with a processing profile.</b>
	<b>In Trimble Positions Desktop add-in:</b>
	• <b>Check for new sessions</b>
	• <b>Postprocess against chosen processing profile</b>
	• <b>Verify against required accuracy thresholds</b>
	• <b>Modify geometry (unlink, exception)</b>
• <b>Update GIS geodatabase</b>	
<b>Save and close Map document.</b>	

## Appendix B: Positions software suite workflow overview for ArcPad AXF

The following table provides an overview of the steps required to install and use the Trimble Positions software suite in an Esri ArcPad workflow using AXF files. The steps in bold are covered in detail in this guide. For all other steps, refer to the other Trimble Positions software suite documentation, as listed above.

Initial administration tasks	Install and license ArcGIS for Desktop 10.2 on each office computer.
	Install ArcPad 10.2 (this is to get the ArcPad Data Manager toolbox for ArcGIS for Desktop installed, and to install the ArcPad Datum Configuration tool) on each office computer and Windows Mobile device.
	Download Trimble Positions Desktop add-in 10.2.0.1.
	Optionally, install the Trimble Positions License Manager to a computer(s) that is/are accessible from the office computer (and field devices).
	On each office computer that has ArcGIS for Desktop 10.2 installed, install and license Trimble Positions Desktop add-in 10.2.0.1.
	Download Trimble Positions ArcPad extension 10.2.0.1
	On each mobile device that has ArcPad 10.2 installed, install and license Trimble Positions ArcPad extension 10.2.0.1.
	Optionally, create a new Microsoft SQL Server or Oracle database, if an enterprise database is required and not yet created.
	Configure Trimble Positions Desktop database ( <i>Start / All Programs / Trimble / Trimble Positions Tools / Desktop Configuration</i> ).
	Start ArcGIS for Desktop and enable Trimble Positions Desktop add-in.
Setting up datum geotransformations	<b>Open the Trimble Positions Desktop Administration Datum Transformations dialog.</b>
	<b>Associate default transformations to WGS-84 for the datums and projections you use in your work.</b>
Desktop add-in tasks when enabling Map documents for AXF check-out	<b>Open map document.</b>
	<b>Add feature layers to Map from geodatabase.</b>
	<b>Check Map for compatibility using Trimble Positions Desktop add-in.</b>
Creating an ArcPad project and checking-out an AXF project	<b>Create a new ArcPad Project in Trimble Positions Desktop add-in.</b>
	<b>Select the feature layers for the project.</b>
	<b>Configure each layer's accuracy threshold and metadata autofill fields for GIS update.</b>
	<b>Associate the Trimble Positions ArcPad project with the MXD document.</b>
	<b>Set the Trimble Positions Arcpad project to be the current project.</b>

Regular transfer tasks between field and office	<b>Check-out Trimble Positions ArcPad project.</b>
	Copy AXF project folder to the field device.
	Collect data using Trimble Positions ArcPad extension 10.2.0.1 and ArcPad 10.2.
	Copy AXF project folder with TrimblePositions.SSF file(s) to the office computer.
Regular Desktop add-in user tasks	<b>If not already created, in Trimble Positions Desktop add-in, create processing profile(s).</b>
	<b>In Trimble Positions Desktop add-in, check-in AXF project folder and associated SSF file(s) to Trimble Positions office database and the geodatabase.</b>
	<b>In Trimble Positions Desktop add-in, Manage devices and optionally associate with a processing profile.</b>
	<b>In Trimble Positions Desktop add-in:</b>
	• <b>Postprocess against chosen processing profile</b>
	• <b>Modify offsets, if required</b>
	• <b>Verify against required accuracy thresholds</b>
	• <b>Modify geometry (unlink, exception) if required</b>
	• <b>Update GIS geodatabase</b>
<b>Save and close Map document.</b>	

## Appendix C: Positions software suite workflow overview for ArcPad QuickProjects

The following table provides an overview of the steps required to install and use the Trimble Positions software suite in an Esri ArcPad workflow using QuickProjects. The steps in bold are covered in detail in this guide. For all other steps, refer to the other Trimble Positions software suite documentation, as listed above.

Initial administration tasks	Install and license ArcGIS for Desktop 10.2 on each office computer.
	Install ArcPad 10.2 (this is to get the ArcPad Data Manager toolbox for ArcGIS for Desktop installed, and to install the ArcPad Datum Configuration tool) on each office computer and Windows Mobile device.
	Download Trimble Positions Desktop add-in 10.2.0.1.
	Optionally, install the Trimble Positions License Manager to a computer(s) that is/are accessible from the office computer (and field devices).
	On each office computer that has ArcGIS for Desktop 10.2 installed, install and license Trimble Positions Desktop add-in 10.2.0.1.
	Download Trimble Positions ArcPad extension 10.2.0.1.
	On each mobile device that has ArcPad 10.2 installed, install and license Trimble Positions ArcPad extension 10.2.0.1.
	Optionally, create a new Microsoft SQL Server or Oracle database, if an enterprise database is required and not yet created.
	Configure Trimble Positions Desktop database ( <i>Start / All Programs / Trimble / Trimble Positions Tools / Desktop Configuration</i> ).
	Start ArcGIS for Desktop and enable Trimble Positions Desktop add-in.
Setting up datum geotransformations	<b>Open the Trimble Positions Desktop Administration Datum Transformations dialog.</b>
	<b>Associate default transformations to WGS-84 for the datums and projections you use in your work.</b>
Regular transfer tasks between field and office	Collect QuickProject data using Trimble Positions ArcPad extension 10.2.0.1 and ArcPad 10.2.
	Copy ArcPad QuickProject folder with TrimblePositions.SSF file(s) to the office computer.

Regular Desktop add-in user tasks	<b>If not already created, in Trimble Positions Desktop add-in, create processing profile(s).</b>
	<b>Open (blank) Map document.</b>
	<b>In Trimble Positions Desktop add-in, import ArcPad QuickProject and associated SSF file(s) to Trimble Positions office database and the geodatabase.</b>
	<b>Configure each layer's accuracy threshold and metadata autofill fields for GIS update.</b>
	<b>In Trimble Positions Desktop add-in, manage devices and optionally associate with a processing profile.</b>
	<b>In Trimble Positions Desktop add-in:</b>
	<ul style="list-style-type: none"> <li>• <b>Postprocess against chosen processing profile</b></li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Modify offsets, if required</b></li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Verify against required accuracy thresholds</b></li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Modify geometry (unlink, exception) if required</b></li> </ul>
	<ul style="list-style-type: none"> <li>• <b>Update GIS geodatabase</b></li> </ul>
<b>Save and close Map document.</b>	

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## Appendix D: Geotransformations in the Trimble Positions Software Suite ArcPad Workflow

### Overview

Autonomous GNSS positions are calculated in terms of World Geographic System 1984 (WGS84), at the epoch (time) they were collected. Sometimes, to improve the GNSS positions' instantaneous accuracy, you must use a real-time correction source (such as Satellite-Based Augmentation System, for example WAAS or EGNOS, VRS™ software, or a single base station), but this causes the achieved positions to be referenced to the spatial reference frame used to define the reference position of the correction source, which, for non-SBAS systems, is possibly a local coordinate system.

Feature classes in the GIS are likely to be defined in terms of a particular spatial reference (Projected Coordinate System (PCS) or Geographic Coordinate System (GCS)), other than WGS84, and referenced to a different, past, epoch, to maintain a consistent temporal-spatial environment within the GIS geodatabase(s). Simply put, a PCS usually provides the position coordinates in terms of a measurement unit East and North of a defined origin, and has an underlying GCS: a GCS provides its coordinates in terms of angular Latitude-Longitude measurements and the Height above Ellipsoid based on a defined spheroid or Height above Mean Sea-Level (hMSL) based on a defined geoid, or an XYZ measurement in define length units, referenced to the centre of the Earth.

To transform between a PCS and another PCS or GCS, the PCS coordinate is reduced to its GCS coordinate, and then a geographical transform is used to transform between the current GCS coordinate and the new GCS coordinate. If the final outcome is a PCS coordinate, the new GCS coordinate is re-projected to the new PCS coordinate.

When transforming between one GCS and another, or between different epoch realisations of a single GCS, a datum transformation is used. The types of datum transformation available are many and varied, but the most common use one of three methods, in order of least to most accurate resolution: Molodensky 3-parameter [XYZ shift]; Helmert 7-parameter transformation [XYZ shift, XYZ rotation, scale]; and, a datum grid [a file of coordinate pairs and vector shifts].

***Important:*** *To retain consistency, it is imperative that when transforming between GCSs the same transformation method is used throughout the workflow.*

## Geotransformations applied in the ArcPad workflow

The following figure shows the many geotransformations that could occur in a complicated ArcPad dataflow.

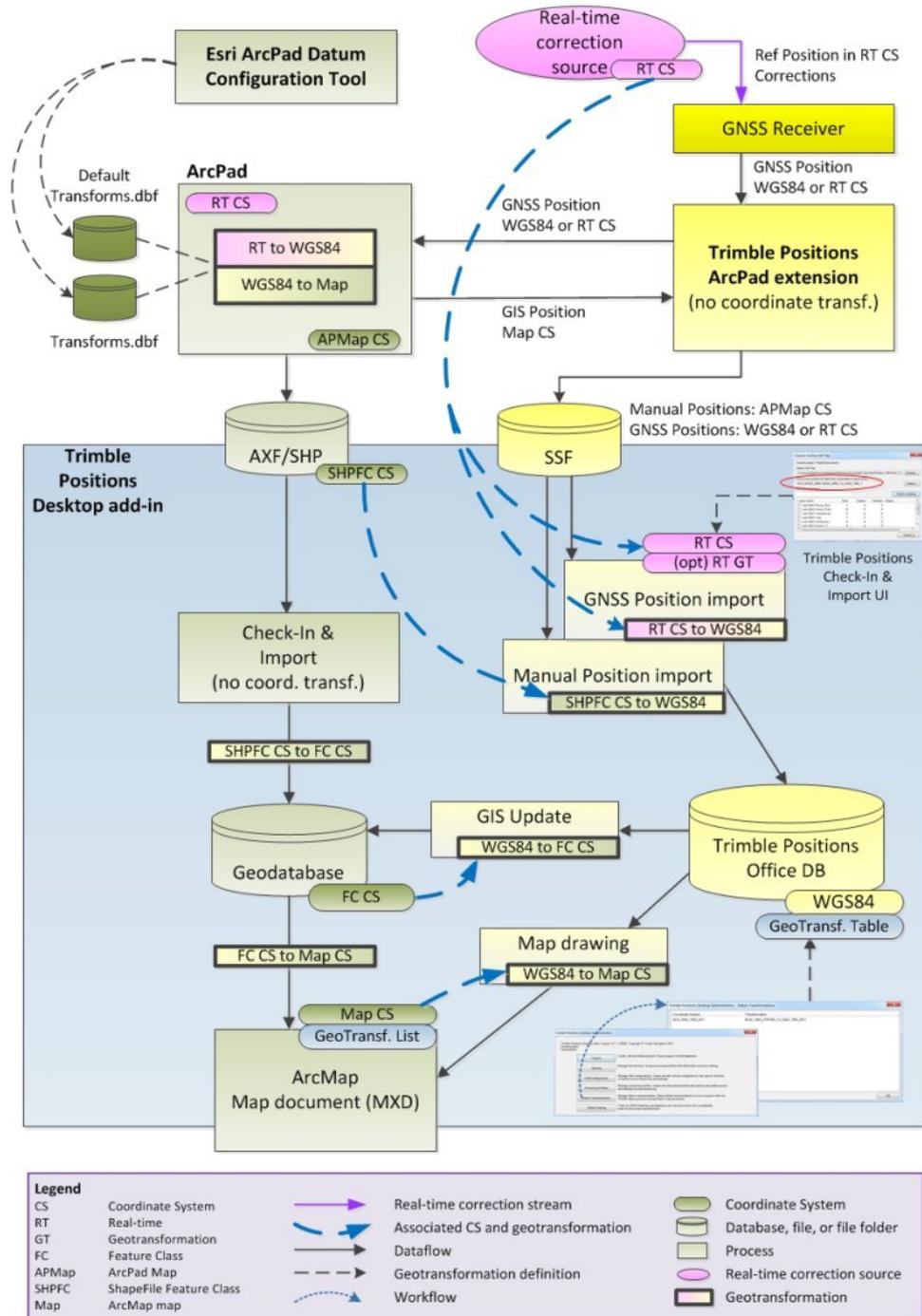


Figure 1.3 Spatial Reference frames (coordinate systems) and Geotransformations defined and applied during the ArcPad workflow

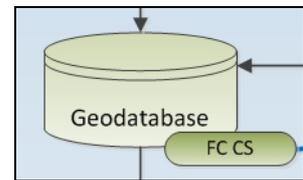
## Spatial reference definition

To maintain high accuracy of collected positions, you must know the feature class, map, and correction source spatial reference frame, and define consistent transformations between them, as necessary.

**Important:** Each spatial reference frame (coordinate system) used within the workflow should explicitly define the transformation to be used between itself and others, otherwise inconsistent transforms may be used. The Esri software uses a null transform if nothing else has been defined. Errors exceeding 100 meters can be introduced into the workflow if proper care is not taken.

## Feature class

The GIS is made up of a collection of feature classes. These feature classes may come from different sources and do not always share the same spatial reference frame. If the data is static, it may be prudent to re-project the feature class from a third-party or archived source, however this might not be feasible if the feature class is continually being updated and republished.

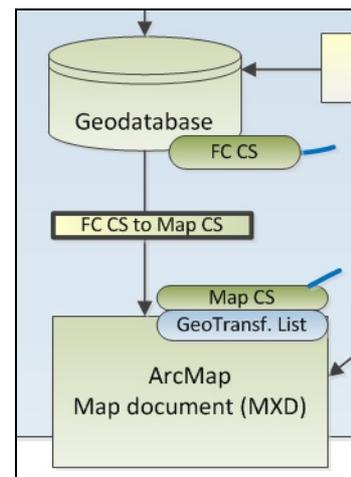


## ArcGIS map document

When the feature class is used in a map document, a transformation method from the feature class spatial reference frame and the map document spatial reference frame is defined. If you are creating a map document from the Blank template, you are prompted to specify the transformation to use between the map and feature class spatial reference frames (should they be different). If you are creating the map document from a template used by your organisation, or are opening an existing map document, the transformation method may have already been defined.

If one or more feature classes are defined in terms of WGS84, or an existing template defines a WGS84 to map spatial reference frame transformation, this is recorded in the transformation list in the MXD map document and is available for Trimble Positions to use (see [Testing the map document for compatibility, page 14](#)). If this is not the case, you must define the transformation between the feature class and WGS84 in the transformation table, using the Trimble Positions Datum Transformation utility.

When an AXF project is checked out of the geodatabase, the individual feature layers are re-projected to the spatial reference frame of the map document, and the AXF project uses the ArcMap map document spatial reference frame.



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## ArcPad datums and projections

### Map datum

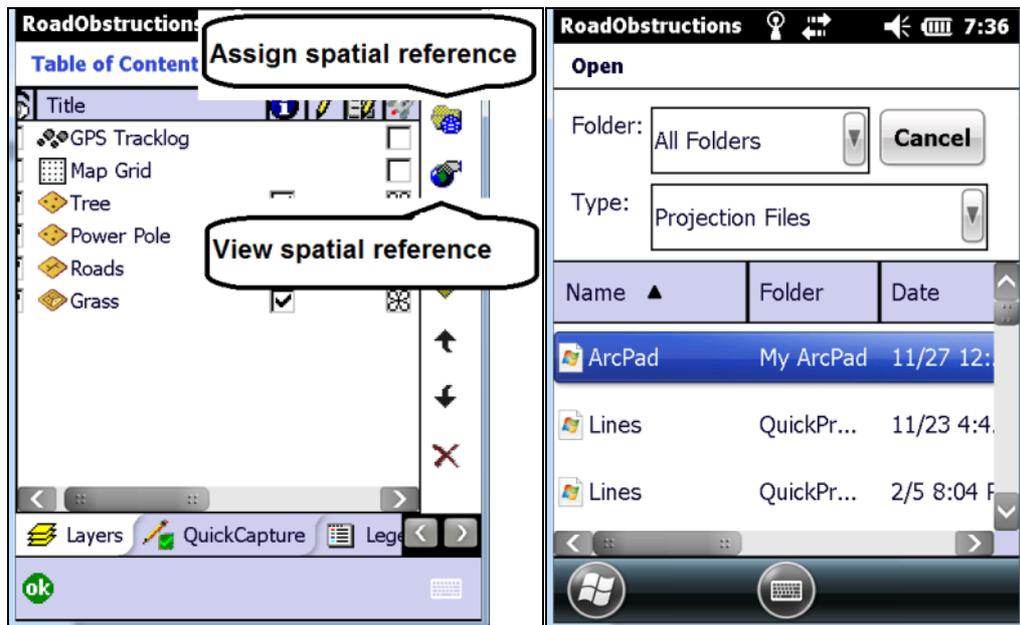
ArcPad's map spatial reference frame (datum and projection) is defined by one of the following:

- an empty map projection definition, defined in a reference .prj file
- an opened, checked-out AXF project, embedded in the .apm file
- the first data layer to be added to an empty map, defined in that feature layer's projection file (.prj)
- a QuickProject coordinate system definition, defined in a reference .prj file

The default spatial reference frame for a newly-opened, empty ArcPad map is WGS84 latitude and longitude decimal degrees.

If a projection file named *arcpad.prj* is found in the ... / *My Documents* folder, its spatial reference frame becomes the default for a newly-opened, empty ArcPad map.

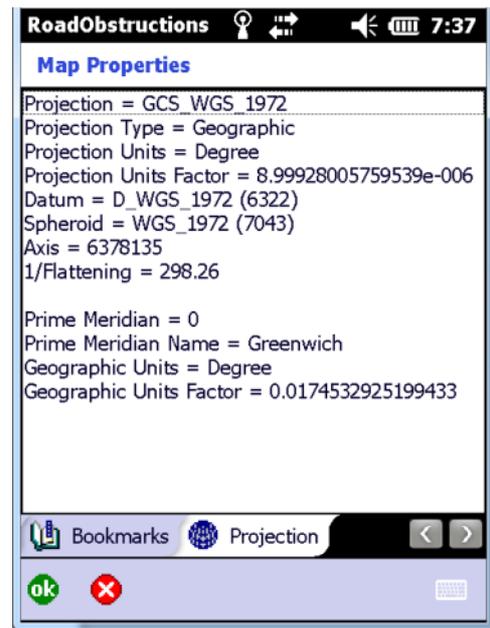
If a data layer or map with a defined spatial reference frame is added to a newly-opened, empty ArcPad map, that spatial reference frame replaces the default. If a map's first added data layer lacks a defined spatial reference frame, you can manually assign one—tap the first icon along the *Table of Contents*' right margin, and select one from a folder containing .prj files.



To view a map's current spatial reference frame, tap the second icon along the *Table of Contents*' right margin, or tap | *Map Properties...* | *Projection*.

Users should copy a projection (.prj) file suitable for their area of interest to the **.../My Documents** folder and rename it **ArcPad.prj**, or else, ensure that the first data layer or map added to a newly-opened, empty ArcPad map has a defined spatial reference frame that accurately reflects its feature's coordinates.

ArcPad transforms and projects on-the-fly from the feature class(es) spatial reference frame and the map document spatial reference frame.



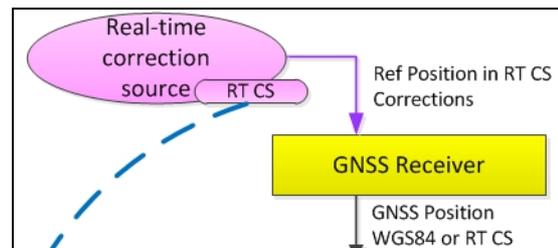
## GPS Datum

The datum of incoming GNSS latitude and longitude is established by making a selection from the *GPS Datum* dropdown list.

Once set, ArcPad treats GNSS coordinates as being referenced to this datum, and all subsequent processing is based on that expectation. D\_WGS\_1984 is the default datum.

The GPS datum should not be confused with the intended spatial reference frame of ArcPad's current map.

GNSS receivers operating in autonomous mode issue coordinates in WGS84. When GNSS positions are corrected by an external source, the coordinates are transformed into the correction source's spatial reference frame. For example, if the real-time correction source is a US Coastguard NDGPS station referenced to NAD83(CORS96), the corrected positions generated by the GNSS receiver are in terms of NAD83(CORS96). In this case, the *GPS Datum* setting should be set to NAD83(CORS96) and the appropriate NAD83(CORS96) to WGS84 transformation defined and applied.



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## ArcPad transformations

A datum-to-datum transformation is required when incoming GNSS coordinates are referenced to a different spatial reference frame than ArcPad's current map. This is because each datum is based on a different mathematical model of the Earth. Two transformation complications can arise, however:

- ArcPad may not support the transformation best-suited to a particular situation. For example, ArcPad does not currently support the NGS-sanctioned WGS84-to-NAD83 transformation.
- Multiple transformations may be available for any given datum pair. For example, ArcPad supports 21 WGS84-to-NAD27 transformations, and 5 WGS84-to-NAD83 transformations, each being suited to a particular geographic area.

When ArcPad is installed on the office computer in readiness to deploy to Windows Mobile device(s), the Datum Configuration Tool utility is also installed. Each spatial reference frame used in your workflow<sup>1</sup> should also be managed by this utility, and the default transformation required to be used in ArcPad defined. This utility also enables custom spatial reference frame and transformation definitions to be uploaded to the ArcPad installation(s).

1. Click *Start / All Programs / ArcGIS / ArcPad 10.2 / Datum Configuration Tool* to define a custom transformation, or to set the default transformation for a given datum pair.

In the example below, the current NGS-sanctioned WGS84-to-NAD83 transformation is defined on the *Define Datum Transformation* tab.

<sup>1</sup>. An Esri document titled Supported Geographic (Datum) Transformations list all supported transformations, as well as their intended area of use.

2. Enter the required parameters and then click **Save**.

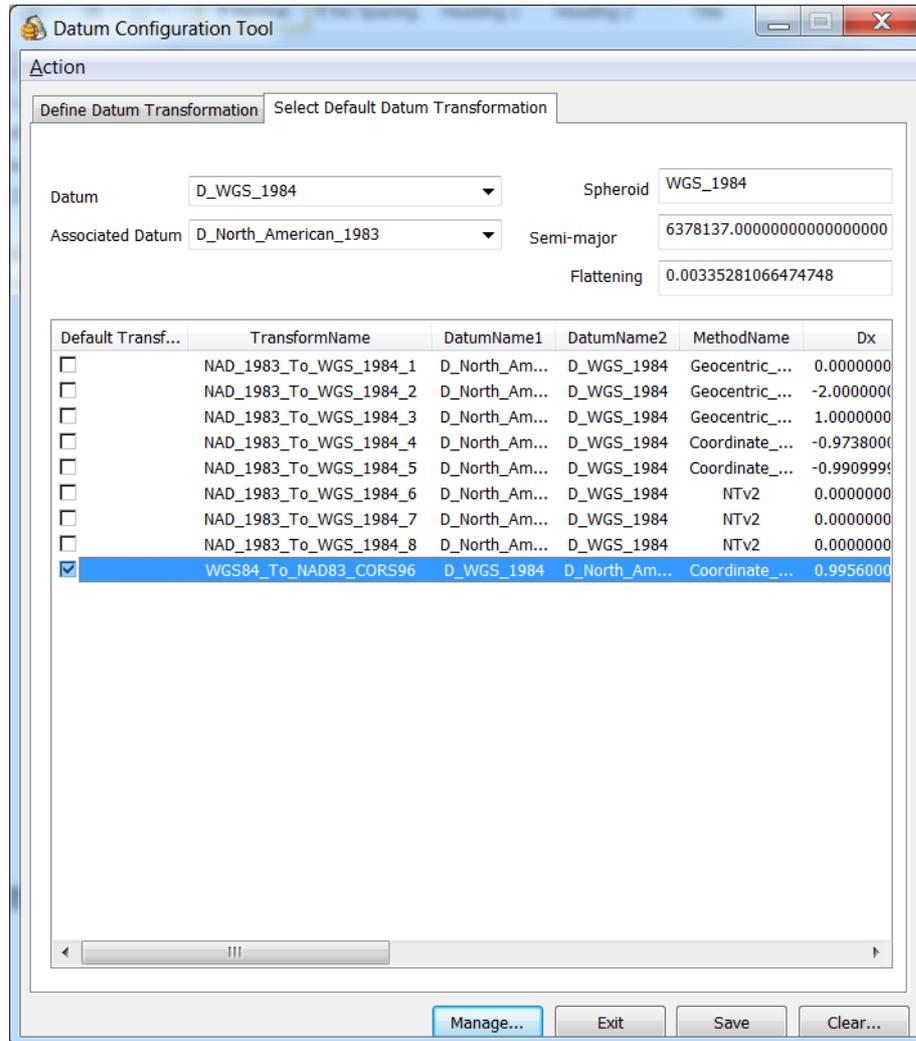
3. Click **Manage** to manage custom definitions.

TRANSFORM	METHOD	DATUM_1	SPHEROID_1	A_1	F_1	DATUM_2	SPHEROID_2	
WGS84_To_...	Coordinate_...	D_WGS_1984	WGS_1984	6378137.00...	0.00335281...	D_North_Am...	GRS_1980	637
WGS84_To_...	Coordinate_...	D_WGS_1984	WGS_1984	6378137.00...	0.00335281...	D_North_Am...	GRS_1980	637

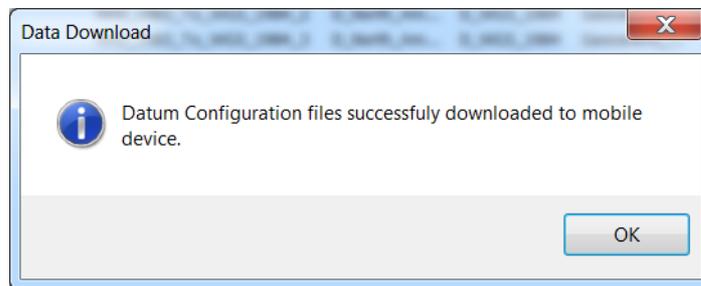
To delete a row, select it and click **Delete Row**, and then click **Update** to update the local database. Until you update the local database, the custom definition is not available for selecting the default transform. Click **Close** to continue.

To set a default transformation for the user-selected datum pair, select the *Select Default Datum Transformation* tab, and select the checkbox corresponding to the transformation you want to set as the default.

This list also includes ArcPad's internal transformations for the datum pair.

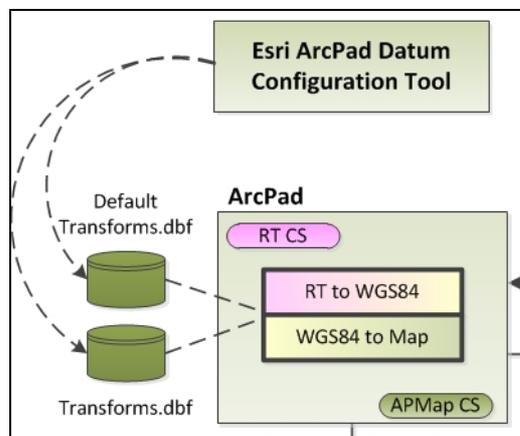


When you have saved the definitions, connect the ArcPad Windows Mobile device to the office computer, and select *Action / Download to Mobile Device* from the menu bar.



The Datum Configuration Tool utility creates and uploads two files to the ArcPad installation in the *.../ArcPad/System* folder:

- **DefaultTransforms.dbf** contains a user-selected default transformation for each datum pair of interest to the user. ArcPad interrogates DefaultTransforms.dbf before referring to its internal default transformation table, and uses the listed transformation if it finds a record matching ArcPad's current GPS datum and map datum. If no match is found, ArcPad uses its internal default transformation for the current datum pair.
- **Transforms.dbf** contains user-defined customized transformation parameters. ArcPad attempts to match each custom transformation's datum pair to ArcPad's current GPS datum and map datum, and applies the associated custom transformation parameters if a match is found. If no match is found, ArcPad uses its internal default transformation for the current datum pair.

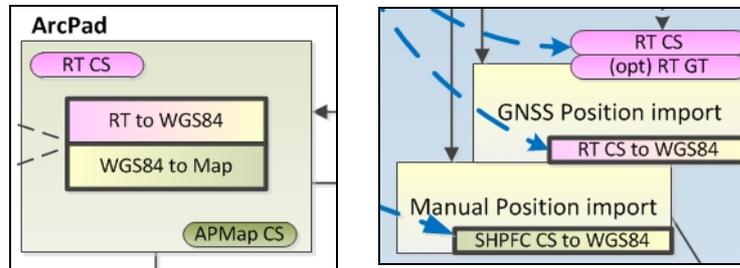


When generated, you can copy these files to other devices.

**Note** – *It is important to re-start ArcPad after these files have been transferred.*

## Real-time correction source spatial reference frame

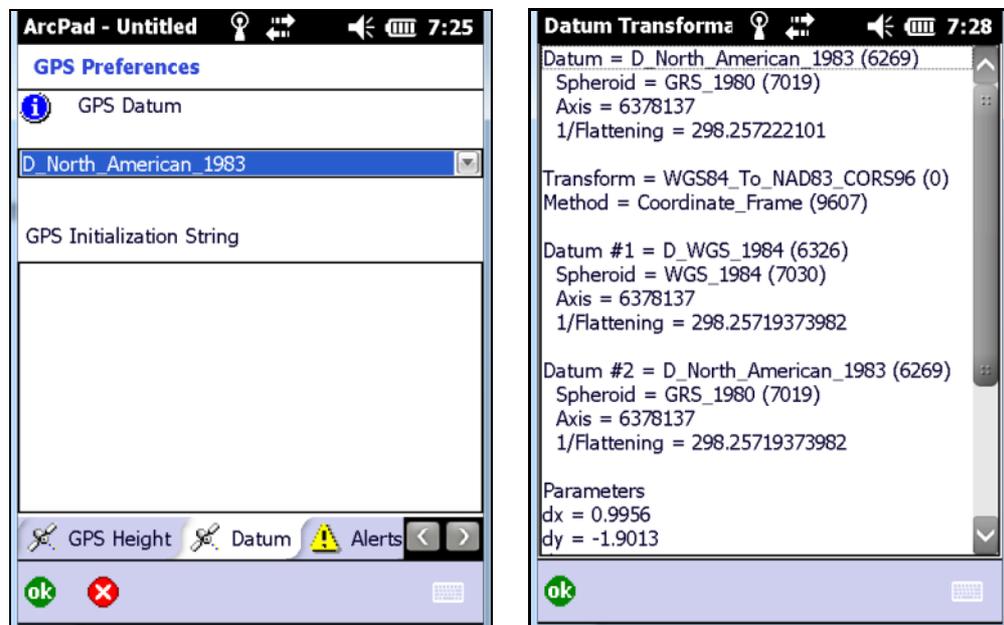
When using a real-time GNSS correction source that defines the reference coordinate in terms of a non-WGS84 spatial reference frame, the transformation ArcPad uses must be defined and also replicate in the geotransformation list or table in the office software.



If the real-time correction source spatial reference frame is neither WGS84 nor that of the ArcPad map spatial reference frame, ArcPad performs a double datum transformation: Real-time CS -> WGS84 -> Map CS. Both the RT CS -> WGS84 and the WGS84 -> Map CS datums and transformation methods must be defined and configured on the ArcPad device, as well as replicated in the Trimble Positions geotransformation table or available in the ArcMap geotransformation list.

In ArcPad, tap / *GPS Preferences...* / *Datum* to select the datum.

For example, select *D\_North\_American\_1983*. Click *GPS Datum* to confirm that the currently active transformation is appropriate for ArcPad's current datum pair.



**Important:** It is imperative that the datum definition and transformation methods employed by ArcPad are identical to those used by ArcMap, otherwise inconsistencies will arise.

