

Topcon Tools

Processing RTK Data



Application Guide



Topcon Tools Processing RTK Data Application Guide

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Notes:

How to Process RTK Data

TopSURV software allows a user to collect and save Real Time Kinematic (RTK) data to a job on Topcon Controllers with Windows CE and/or Controllers with Windows Mobile OS. TopSURV jobs have 'tsj'extention. ActiveSync® software running on a computer is needed to transfer jobs between the controllers and the computer. ActiveSync® is a free software from Microsoft® that establishes a connection between a computer (with operating system Windows XP) and an external device. If the user's computer operates under Windows Vista, ActiveSync is not needed. A connection between the computer and an external device with Windows CE/Windows Mobile will be automatically established after connecting your device to your computer via USB or COM ports.

Working with RTK data in Topcon Tools can be divided into two stages:

- creating a job in Topcon Tools and exporting this job to a Controller
- importing the job with field data from a controller to a computer, viewing and editing data, exporting to any desired file format.

To import/export, view and edit RTK data in Topcon Tools, only

RTK module has to be activated:



Creating TopSURV Job in Topcon Tools

There are two ways to create a TopSURV job:

- directly in Controller
- using Topcon Tools

If a user uses Topcon Tools for creating a TopSURV job, he can prepare a job to collect field data in TopSURV. This tsj job will contain:

- set of control points,
- code library,
- set of layers,

and the following separate files for this job:

- a georeferenced background image for work area,
- the desired geoid file for work area.

It is good to use Topcon Tools for selecting the coordinate system, preparing the geoid of minimal size, georeferencing the background image and importing the necessary set of points. Generally, for preparing a TopSURV job, Topcon Tools is used only once when creating the initial job for a local region.

How to Create a Geoid for Local Area

To save the internal memory of the Topcon Controller, we recommend creating the geoid file for the local region. For this procedure the user has to know the coordinates of boundary points of the work area and to have the original geoid file which is used for this area. As an example, let us create the geoid for the following area,



using g2003u07.bin as the base geoid model.

To create the geoid file for local work area, do the following:

1. Run Topcon Link (this is a free Topcon software),

2. Click File -> Convert Files

| % 1 | Торсо | on Lin | k | | | |
|------------|---------|--------|------|---------|--------|--------|
| | Edit | View | Add | Process | Window | Hel |
| 0 | pen Fi | le | | | Ctrl+ | 0 |
| S | ave Fil | е | | | Ctrl+ | S |
| S | ave As | | | | Alt+0 | Itrl+: |
| In | nport l | rom De | vice | | Shift | +F3 |
| E: | xport I | o Devi | :e | | Shift | +F4 |
| C | onverl | Files | | | F5 | |

3. Click the *Add files* button in the *Convert Files* window, select the file format '*USA 99 and 2003 Geoid*', navigate to the location of "g2003u07.bin" file, select this file and click the *Open* button:

| Source file path | | Source file type | Destination file name | U |
|--|---|---|-----------------------|---|
| Add files | 😭 Open | | | |
| estination format Overwrite existing Advanced conver | Look in: g03 g2003u01.bin g2003u02.bin g2003u03.bin | Geoid2003 g2003u04.bin g2003u05.bin g2003u06.bin g2003u06.bin g2003u07.bin | 置 g2003u08.bin | • |
| De Cor | File name: | 2003u07.bin | | |

4. In the *Destination file name* field, enter the name of created geoid file (for example: MY_GEOID.gff):

| Source file path | Source file type | 1 | Destination file name |
|------------------------------|---------------------------------|------|-----------------------|
| D:\Geoids\Geoid2003\g2003u07 | USA 99 and 2003 Geoid - Geoid F | ile. | MY_GEOID.gff |
| | | | |

5. Specify positions for the points limiting the use of this geoid

| model: | Minimum Latitude Maximum Latitude Minimum Longitude | 40*00'00.00000N 41*00'00.00000N 82*30'00.00000W |
|--------|---|---|
| | Maximum Longitude | 83*30'00.00000W |

6. Press the button RE Convert

to start creating the local geoid

7. If the file was created successfully, the *File Status* field will display:



8. Click OK.

This geoid file is ready for use in TopSURV. Copy the file into the Controller with TopSURV.

How to Import Control Points to the Job

It is useful to have in the TopSURV job true coordinates of the base station in the given coordinate system, and also coordinates of the control points in a local coordinate system to perform localization directly in TopSURV job.

Topcon Tools allows importing a text coordinate file that does not contain information about the coordinate system. These files contain ONLY the values of coordinates. To import the point coordinates in the corresponding coordinate system, the user has to:

- know this coordinate system or projection,
- set this coordinate system / projection as current (in the *Job Configuration* window) before importing.

To import control points to the job, do the following:

- 1. Run Topcon Tools
- 2. Create a new Topcon Tools job: Click *Job->New Job* and type in a job name:

| 🖷 Topcon Tools | 💥 Create a i | new job | | | ? 🛛 |
|-------------------|-----------------|---------|-----------------------------|-------------|--------------------|
| Job Edit View Add | Job name | | or_RTK_TopSURV | > | |
| New Job | Job location | Ī | C\Documents and Settings\Us | er_Name\Top | |
| | Created by | Г | | | |
| | Date created | F | 5.01.2009 17:32:53 | | |
| | Comment | | | | |
| | Configurations: | | Design | • | Edit configuration |
| | | OK | | Cancel | |

3. For example, let us create the coordinate file for the base RTK station in SPC-83 grid system, zone Ohio (North) using the text editor *Microsoft Notepad*, and then import this file to the Topcon Tools job:



4. Click Job->Job Configuration->Coordinate System, select Ohio (North) projection in the Projection field,

| Job configuration | | | ? 🛛 |
|--------------------|------------------|--------------|-------------|
| Display | Setup Conversion | | _ |
| Coordinate Systems | Designation | This (North) | T Custom |
| - E Units | Projection | | Custom |
| E Save | | E Europe | |
| E Process | Datum | E B USA | Custom |
| Linework | | E-4 SPC83 | |
| Adjustment | Grid->Ground | Ohio (North) | |
| TS Computations | | UTMNorth | |
| Quality Control | Geoid | More | Geoids List |

select Grid coordinate system in the Coordinate Type field,



click Job->Job Configuration->Units and select US Feet in the field:



Click **OK** in the *Job Configuration* window to save this configuration of the Topcon Tools job. The *Status Bar* will display the selected

projection and linear unit: USFeet DMS Grid SPC83-Ohio (North)

5. To import this file, click *Job->Import*, select the file format *Name,N,E,Z,Code*', navigate to the location of the desired text file ('Base_Coordinates.txt') and click *Open* on the *Open* dialog box:

| 👫 Import | | | ? 🛛 |
|---------------------------------|------------|----------------------------|------------------|
| Look in: | 🗀 Exa | amples | - 🗲 🖻 🖻 |
| Base_Coordi | nates.txt | | |
| File name: | Base_Coord | dinates.txt | |
| Format name: | 🗗 Name,N | I,E,Z,Code - Coordinates (| *.csv) 💌 |
| Advanced op | tions | | |
| Metric unit: | De | efault (USFeet)] | - |
| Coordinate type: | [De | efault (Grid)] | • |
| Projection: | F | [Default (SPC83-Ohio (N | orth))] 💌 Custom |
| Datum: | NA | (D.83 | v |
| Point type: | Cor | ntrol | |
| | Open | | Cancel |

The Points tab displays the coordinates in the desired projection and

| | × | •° P | oints | | | | | | | | |
|--------------|----|------|-------|-----------------|-----------------|--------|-------------|------|------|--------------------|----|
| | | Icon | Name | Grid Northing (| Grid Easting (U | Eleval | tion (USft) | Code | | Control | ΤI |
| lingen unite | | ▲ | Base2 | 159017.389 | 1832308.223 | | 796.529 | | | Both | |
| innear units | - | | | | | | | | | | |
| | | | | | | | | | | | _ |
| | Re | ady | | | | | USFeet | DMS | Grid | SPC83-Ohio (North) | 1. |

Before importing a text coordinate file with local coordinate points, set the *Ground* coordinate system in the *Status Bar*



and perform the steps which described on

page 1-5.

After importing the local points, the *Map View* and the *Tab View* will display these points:

| 🗱 Map View | | | | | | | | | × |
|-----------------------|------------|--------------|---------------|----------|----------|-----------|--------|--------------|-----|
| Northing, – USFeet | | [A]109_LOC | [A]111_LOC | | | | | | |
| - | | | | | | | | | |
| - | | | | | | | | | |
| 5000 | | | | | | | | | |
| - | | [A]113_LO | 5 | | | | | | |
| | | 1 | | 1 | | 1 | | | Т |
| <u>**</u> | 4500 | 5000 | 5500 | 6000 | | 6500 | | Easting, USP | eet |
| × •° Points | | | | | | | | | |
| Icon Name | Ground Nor | thing (USft) | Ground Eastin | g (USft) | Elevatio | on (USft) | Code | Control | |
| ▲ Base2 | | | | | | | | Both | |
| ▲ 111_LO | = | 5470.086 | 54 | 74.592 | | 701.412 | | Both | |
| ▲ 109_LO | - | 5468.521 | 49 | 999.994 | | 702.357 | | Both | |
| ▲ 113_LO | - | 4797.208 | 50 | 29.723 | | 700.213 | | Both | |
| < | ш | | | | | | | | > |
| Ready | | | | | USFeet | DMS | Ground | Localization | |

How to See Imported Points on Google Earth

To see and check where imported points (in Grid coordinate system) is located, click *View->Google Earth:*



How to Create Background Map for Work Area

If the user has a digital image in one of the following formats: JPEG (*.jpg), Bitmap (*.bmp) or TIFF (*.tif), the user has to georeference the image to use it as background. To calculate relationship between the image and real coordinate system, the user needs to know minimum three of picture points in the desired coordinate system.

Let us create the georeferenced image for the JPG file which covers



the work area:

To georeference the image using Topcon Tools, do the following:

1. The image georeferencing parameters (the coordinate system, the coordinate type, and metric unit) are defined by the same parameters selected in the Status bar. Set the coordinate system and linear unit which will be used in the TopSURV job:

| LISEeet | DMS | Grid | SPC83-Obio (North) | |
|---------|-----|------|--------------------|--|
| 051660 | DHD | Gilu | 5FC03-0110 (N0101) | |

2. Click *View->Background images* and click the *Add Image* button in the *Background images* dialog box.



- 3. If the image is not georeferenced, Topcon Tools automatically opens the *Set Georeference* dialog box. This dialog box allows the user to mark the photo points on the image:
 - Click *Add point* in the Toolbar of this window. The cursor changes into (add point cursor).
 - Using the 'add point' cursor, identify and left-click the desired point on the image using a photographic sketch of ground point.

Type in the point name in the *Label* field, the point coordinates in the current coordinate system and click **OK** to mark this point:

| Set georeference | | 2 🛛 |
|---|---|-----------------------------------|
| Add point X Delete point(s) | X Delete all points 🛛 斗 斗 🐥 🥙 | Calculate 🗖 Allow to rotate image |
| Pixels | S | 0 |
| 550 | Georeference point paramete Image point Label [CM3 Image X coordinate [108,39607 Image Y coordinate [571,12495 - Spatial point Job point page | ers ?X |
| | Northing (USft) [48568.092] 100 Exacting (USft) [558394.667] | Pixels |
| etric unit: USFeet Coordinate typ Cancel | pe: Grid Co | Apply |

- Using this technique, mark other photo points.
- Click **Excalculate** button to georeference the image. After

transforming, the *Set Georeference* dialog box will display the image in the current coordinate system:



• To save the transformed image, click the *Finish* button in the *Set Georeference* dialog box. Navigate to the location in which to save the file and type in the file name in the corresponding field of the *Save* dialog box. Click *Save* to complete:

| 🖷 Save | 2 |
|--------------------------------------|---|
| Save in: | 🗅 Examples 💽 🗲 🖻 📺 |
| | |
| | |
| | |
| | |
| File name: PSG1 | |
| Format name: 👘 J0 | GW files (*.jgw) |
| Advanced options | |
| | |
| Metric unit: | [Default (USFeet)] |
| Angular unit: | [Default (DMS)] |
| Coordinate type: | [Default (Grid)] |
| Projection: | [Default (SPC83-Ohio (North))] 💌 Custom |
| Datum: | NAD83 |
| Save | Cancel |

Topcon Tools creates and saves two file types in the selected folder:

- The transformed image in the same format which was selected for the image that was not georeferenced
- ESRI World File Format



These both files are ready to be used in TopSURV. Copy the files into the Controller with TopSURV installed.

How to Create a User's Layer

To create a new layer in the current job, click Add->Layers



1. On the *General* tab of the *Layer* dialog box, enter the following general parameters for the layer:

| 🥏 Add Layer : Layer New Layer 👘 🕐 🔀 | | | | | | | | |
|-------------------------------------|---------------------|-------|--|--|--|--|--|--|
| General Plo | tting styles Are | a | | | | | | |
| Name | Layer-1 | | | | | | | |
| Note | L1 | | | | | | | |
| Breakline Type | Breakline Type Auto | | | | | | | |
| Visible | | | | | | | | |
| ОК | Cancel | Apply | | | | | | |

- *Name* the name of the layer.
- Note enter desired comments.
- Breakline Type- select Auto.

2. On the Plotting Styles tab, select the following parameters for the

| | 🧭 Add Layer | : Layer New Layer | ? 🛛 |
|--------|---|-------------------|-------|
| layer: | General Plot Color Line Style Line Width Point Symbol | ting styles Area | - · • |
| | ОК | Cancel | Apply |

- *Line Style* select the type of line to display line information in the layer.
- *Line Width* select a width for lines in the layer.
- Color select a color for all data (point and line) in the layer.
- Point Symbol select a symbol to represent all points in the

layer.

3. On the *Area* tab, check the *Fill Area* field to fill the areas in this layer:

| 🛩 Add Layer : Layer New Layer 👘 💽 🔀 | | | | | | | |
|-------------------------------------|---------------|-------|--|--|--|--|--|
| General Plo | atting styles | Area | | | | | |
| ОК | Cancel | Apply | | | | | |

Topcon Tools allows you to create and save unlimited number of the different layers in the current job.

To view all job's layers, click *View->Layers*:

| Name | Visible | Line Style | Line Width | Color | Point Symbol | Breakline Type |
|-------------|---------|------------|------------|-------|--------------|----------------|
| <i>9</i> 0 | Yes | | 1 pt | | • | Auto |
| <i>€</i> 11 | Yes | | 4 pt 🗕 | | • | Auto |
| <i>∰</i> L2 | Yes | | 6 pt | | \diamond | Auto |
| | | | | | | |
| | | | | | | |

This tab also allows one to edit the layer's parameters.

How to Create User's Codes

To create a new code in the current job, click Add->Code



1. On the *General* tab, edit the code's name and select the desired type (*Point, Line, Area, Auto*) and the layer

| Properties : Code New Code ? | | | | | | | |
|----------------------------------|-----------------|-------|-------|---|--|--|--|
| General | Plotting styles | Point | Area | | | | |
| Code | Code-1 | | | _ | | | |
| Name | C1 | | | | | | |
| Туре | Line | | | | | | |
| Layer | L2 | | | • | | | |
| ОК | Canc | el | Apply | | | | |

2. On the *Plotting styles* tab, select the line color, line style and line width. The line's plotting style can be edited for any code with or without a layer:

| Properties : Code New Code | | | | | | | |
|----------------------------|--------------------------------|--|--|--|--|--|--|
| General | Plotting styles Point Area | | | | | | |
| | | | | | | | |
| Line Color | BYLAYER | | | | | | |
| Line Style | BYLAYER | | | | | | |
| Line Width | BYLAYER 6 pt | | | | | | |
| | 3 pt 🛛 📉 🔼 | | | | | | |
| | 4 pt | | | | | | |
| ок | 5 pt | | | | | | |
| - | 6pt 4 | | | | | | |
| | 7 pt | | | | | | |
| | 8 pt 📰 | | | | | | |
| | 9 pt | | | | | | |
| | 10 pt | | | | | | |
| | BYLAYER 6 pt | | | | | | |
| | ~ | | | | | | |

3. On the *Point* tab, select the point color, point symbol. The points plotting style can be edited for any code with or without a layer

| Properties | : Code New Code | ? 🛛 |
|--------------|--------------------|------|
| General Plo | tting styles Point | Area |
| Point Color | BYLAYER | - |
| Point Symbol | BYLAYER ♦ | • |
| | : | ^ |
| | ÷ | |
| OK | \$ | |
| | × + | |
| | ' BYLAYER ◊ | |

4. On the *Area* tab, select the area color. Check the *Fill Area* field, to fill the areas of this code.

| Properties : Code New Code | | | | | | | |
|----------------------------|---------------------|------|--|--|--|--|--|
| General Plo | otting styles Point | Area | | | | | |
| Area Color 🥅 Fill Area | BYLAYER | • | | | | | |
| OK | | | | | | | |
| | Custom BYLAYER | ~ | | | | | |

Topcon Tools allows you to create and save unlimited number of the different codes in the current job.

To view all job's layers, click *View->Codes*. This tab also allows one to edit the code's parameters and to add desired attributes for the corresponding code.

| I., | Code | Name | Туре | Layer | | Line Color | _ * | I., | Attribute Name | Default Value |
|-----|-------|----------------|------------------|--------|-----------|------------|-----|-----|----------------|---------------|
| ٠ | Code1 | | Area | L1 | | BYLAYER | | | | |
| \$ | Code2 | Expor Expor | t to Device t | | | BYLAYER | | | | |
| | | New C | lode | | | | | | | |
| | | New A | Attribute | ۱. | Inte | ger | | | | |
| | | Cut | | Ctrl+X | Rea | l Number | | | | |
| | | Сору | | Ctrl+C | Tex | t | | | | |
| | | Delete | | Del | Mer | iu ii | | | | |
| | | Properties | | | Date/Time | | | | | |

How to Export a Topcon Tools Job to TopSURV Job

To export the current Topcon Tools job to a Topsurv job, click *Job*-> *Export*, select the file format 'TopSURV 7 Job' and type in the name of the TopSURV job.

| 🚰 Export | | | ? 🗙 |
|---------------------------------|---------------------|------------------|-------|
| Save in: | 🗀 Examples | • | + 🗈 💣 |
| | | | |
| | | | |
| | | | |
| L | | | |
| File name: | from Topcon Tools | | |
| Format name: | TopSURV 7 Job - Top | SURV Job (".tsj) | - |
| Advanced op | otions | | |
| | Save | Cancel | |

Click OK to start creating the TopSURV job.

How to Export a TopSURV Job to Controller

We have created the TopSURV job from the Topcon Tools job, which contains the control points in the different coordinate systems and the set of layers and codes. Also we created the local geoid and the georeferenced image for the work area. All these files were saved in the same folder on the computer.

If you have Windows XP operation system, make sure that *Microsoft ActiveSync* is installed on the computer and a successful computer-to-device connection is established. In this case the system tray displays

a green ActiveSync circle 🚳.

To export the created files into the Controller, close the Topcon Tools job and open Windows Explorer. Click the *Mobile Device* folder. The right-hand panel of the window displays the contents of the Topcon



To export the tsj job, open the folder TPS *TopSURV Jobs* on the Controller and copy this job to the selected folder:

| Card\TPS\TopSURV\Jobs | | |
|-----------------------|---|-------------------------|
| | × | 🖻 from topcon tools.tsj |
| J Mobile Device | ^ | |
| 🗉 🚞 Application Data | | |
| 🗉 🚞 My Documents | | |
| 🗉 🚞 Network | | |
| 🗉 🚞 profiles | | |
| 🗉 🚞 Program Files | | |
| 🗉 🧰 Recycled | | |
| 🖃 🚞 Storage Card | | |

To export the created geoid file, open the folder *TPS*\ *TopSURV*\ *Geoids* on the Controller and copy this file to the selected folder:



To export the created georeferenced image, open the folder $\TPS TopSURV$ on the Controller and copy these file to the selected folder.

Importing, Viewing and Editing TopSURV Job in Topcon Tools

This chapter describes how the user can use the Topcon Tools software for importing, viewing, editing a TopSURV job, and creating reports for this TopSURV job.

How to Import a TopSURV Job to Computer

After collecting field data and performing localization using control points, the closed TopSURV job is ready for import to Topcon Tools for viewing and editing.

Run Topcon Tools and create a new job. Click *Job-> Import from Device*, select mobile device and navigate to the location of "from topcon tools.tsj" file (*Storage Card/TPS/TopSURV/Jobs*).



Click *Open* in this dialog box to start import the TopSURV job to the current Topcon Tools job.

The created Topcon Tools job and the imported TopSURV job have different configurations. In process of import of the TopSURV job, Topcon Tools offeres to set the desired configuration in the *Override Job Configuration* dialog box. In this case we recommend setting the configuration used in the TopSURV job:

| 🛱 Ove | rride Job C | onfiguration | | ? 🛛 |
|---------------------|--------------------------------|--|--|--|
| The imp configur | orted TopSUR ation as shown | V or Topcon Tools job cor below. Check the box ne | nfiguration is different from xt to the configuration ite | n the current Topcon Tools job m(s) you want to use |
| Option | Use | in current Job | Use | in imported Job |
| Projection | n 🗆 | None | | from topcon tools-2.tsj Localization |
| Linear Ur | nit 🗖 | Meters | v | USFeet |
| Geoid | | | | MY_GEOID |
| Localizat | ion 🗖 | | N | 109:109_LOC Use:Horizontal and Vertical 111:111_LOC Use:Horizontal and |
| | | ОК | <u> </u> | Cancel |

If the geoid used in TopSURV is not presented in the current Topcon Tools job, the following message will appear:

| Topcon | ı Tools |
|--------|---|
| ⚠ | MY_GEOID : Geoid model is not in the list. Elevation calculations will work incorrectly if you do not load this geoid |
| | ОК |

To continue import of the TopSURV job to the Topcon Tools job, click OK.

How to Add a Geoid File to Topcon Tools Job

For correct calculation of points elevations, add the geoid to the current job:

1. Click *Job->Job Configuration->Coordinate System* and click the *Geoid List* button

| 🚰 for_RTK_TopSURV - 1 | Topcon Too | | | |
|--|-------------------------------------|------------------|--------|-------------|
| Job Edit View Add Sele | ct Process | | | |
| New Job Open Job | Job configuration | | | ? 🛛 |
| Save Job | Display | Setup Conversion | | |
| Save Job As Close Job | Coordinate Systems | Projection | None 💌 | Custom |
| Import | Save | Datum | WGS84 | Custom |
| Import from Device Import from Internet | Linework | 🗖 Grid->Ground | | |
| Export Export to Device | TS Computations GPS+ PostProcess | Geoid | | Geoids List |
| Print | Quality Control | Coordinate type | Ground | |
| Print Preview | | | | |
| Page Setup | | | | |
| Job Configuration | Ctrl+F2 | | | |

2. Click the *Add* button on the *Geoid List* dialog box, select the file format '*Topcon Geoid*', navigate to the location of the local geoid ('MY_GEOID.jff') and click *Open* on the *Open* dialog box:

| 🚰 Geoids List | | | | ? 🗙 |
|---------------|-------------|--------------------------|--------------|--------|
| I., Name | Path | Minimum Longit | Maximum Long | \sim |
| | | | | Add |
| 🛱 Ор | en | | | ? 🛛 |
| Look in: | 9 | Local Disk (C:) | | |
| | GEOID.gff | | | |
| File nam | e: MY_GE | EOID.gff | | |
| Format r | iame: 🗗 Top | ocon Geoid (*.gff;*.jff) | > | |
| < | Open | | Cancel | |

3. The *Geoid List* dialog box displays the area covered by the geoid:

| I., Name | Path | Minimum Longit | Maximum Long | | | | |
|----------|-----------------------------------|--------------------------------|--------------|-----|--|--|--|
| MY_GEOID | C:\MY_GEOII | 0.gff 82°30'00.00000W | 76°59'00.000 | | | | |
| | Properties : I | Regional model geoid | MY_G ? 🔀 | Add | | | |
| | General | | | 1 | | | |
| | Name | MY_GEOID | | | | | |
| | Datum | NAD83_NO_TRANS | | | | | |
| - | Path | C:\MY_GEOID.gff | | | | | |
| | Minimum Latitude | nimum Latitude 39°59'00.00000N | | | | | |
| | Minimum Longitude 82°30'00.00000W | | | | | | |
| | Maximum Latitude | 41*00'00.00000N | | | | | |
| | Maximum Longitude | Longitude 76°59'00.00000W | | | | | |
| | | Canad | é metu | | | | |

To add this local geoid to the current Topcon Tools job, click the *Close* button on the *Geoid List* dialog box and select this geoid from the *Geoid* list on the *Job Configuration* window:



After setting the desired geod, Topcon Tools automatically recalculate the orthometric heights of the imported job.

Note, that orthometric heights will be displayed if either Ground,

Grid, or *Datum Elevation* is selected in the *Status Bar*. In this case, the orthometric heights are displayed in the '*Elevation*' column of the *Points* tab.

Viewing Collected Data

After importing the TopSURV job to the Topcon Tools job, all collected data can be displayed in the *Tab View*, *Map View*, *Cad View* and *Google Earth View*:

The *Points* tab displays the coordinates of the points measured from the base station in the selected coordinate system, standard

deviations for each component of RTK observations, codes and layers in use:

| • Po | bints | | | | | | | |
|------|-------|---------------|-----------------|---------|------------------|------------------|------------------|-------------------|
| Icon | Name | Grid Northing | Grid Easting (U | Elevati | Std Dev n (USft) | Std Dev e (USft) | Std Dev u (USft) | Std Dev Hz (USft) |
| • | 100 | 159135.875 | 1832325.253 | 792.171 | 0.009 | 0.006 | 0.010 | 0.011 |
| • | 101 | 159215.137 | 1832470.546 | 792.457 | 0.014 | 0.009 | 0.018 | 0.016 |
| • | 102 | 159105.281 | 1832361.732 | 790.344 | 0.009 | 0.016 | 0.011 | 0.019 |
| • | 103 | 159028.391 | 1832273.795 | 789.908 | 0.006 | 0.004 | 0.008 | 0.007 |
| • | 104 | 158956.033 | 1832220.924 | 791.343 | 0.008 | 0.008 | 0.012 | 0.011 |
| • | 105 | 159047.804 | 1832203.630 | 793.490 | 0.013 | 0.008 | 0.013 | 0.015 |
| • | 106 | 159154.759 | 1832084.745 | 797.905 | 0.014 | 0.016 | 0.021 | 0.021 |
| | 107 | 100001-070 | 1000050 040 | 706 140 | 0.010 | 0.011 | 0.017 | 0.022 |

The *GPS Occupations* tab displays information about collected occupations (used antenna type, antenna height, duration, method of measurements, recording interval):

| | 🔗 GI | PS Occupatio | ns | | | | | | | |
|---|------------|--------------|--------------|-----------|----------|------------|-----------|----------|--------|----------|
| I | Point Name | Original | Antenna Type | Antenna H | Ant Heig | Start Time | Stop Time | Duration | Method | Interval |
| ۲ | Base2 | Base2 | CR-4 with C | 7.000 | Slant | 05.05.20 | 05.05.200 | 0:52:10 | Base | |
| 0 | 100 | 100 | TPSGR-3 | 6.004 | Vertical | 05.05.20 | 05.05.200 | 0:00:24 | Торо | 1000 |
| 0 | 101 | 101 | TPSGR-3 | 6.004 | Vertical | 05.05.20 | 05.05.200 | 0:00:20 | Торо | 1000 |
| 0 | 102 | 102 | TPSGR-3 | 6.004 | Vertical | 05.05.20 | 05.05.200 | 0:00:20 | Торо | 1000 |
| 0 | 103 | 103 | TPSGR-3 | 6.004 | Vertical | 05.05.20 | 05.05.200 | 0:00:20 | Торо | 1000 |
| 0 | 104 | 104 | TPSGR-3 | 6.004 | Vertical | 05.05.20 | 05.05.200 | 0:00:25 | Торо | 1000 |
| 0 | 105 | 105 | TPSGR-3 | 6.004 | Vertical | 05.05.20 | 05.05.200 | 0:00:20 | Торо | 1000 |
| 0 | 106 | 106 | TPSGR-3 | 6 004 | Vertical | 05.05.20 | 05 05 200 | 0.00.23 | Topo | 1000 |

The *GPS Observations* tab displays the name of point "from" and point "to", horizontal/vertical precision of the vector, components of computed vector, and information about solution type.

| | | | | 🤗 GPS Obs | | | | | | |
|----|---------|----------|----------|----------------|--------------|-----------|-----------|------------|----------|------------------|
| I | Point F | Point To | Duration | Horizontal Pre | Vertical Pre | dN (USft) | dE (USft) | dHt (USft) | Method | Solution Type |
| 0 | Base2 | 100 | 0:00:24 | 0.011 | 0.010 | 118.486 | 17.030 | 2.394 | RTK Topo | Fixed,Phase Diff |
| 0, | Base2 | 101 | 0:00:20 | 0.016 | 0.018 | 197.748 | 162.323 | 2.680 | RTK Topo | Fixed,Phase Diff |
| ٩, | Base2 | 102 | 0:00:20 | 0.019 | 0.011 | 87.892 | 53.509 | 0.567 | RTK Topo | Fixed,Phase Diff |
| 0, | Base2 | 103 | 0:00:20 | 0.007 | 0.008 | 11.002 | -34.428 | 0.132 | RTK Topo | Fixed,Phase Diff |
| 0, | Base2 | 104 | 0:00:25 | 0.011 | 0.012 | -61.356 | -87.299 | 1.566 | RTK Topo | Fixed,Phase Diff |
| • | Base2 | 105 | 0:00:20 | 0.015 | 0.013 | 30.415 | -104.593 | 3.714 | RTK Topo | Fixed,Phase Diff |
| | Raca? | 106 | 0.00.23 | 0.021 | 0.021 | 137 370 | -223 478 | 8 120 | DTV Topo | Fived Dhace Diff |

The *Map View* is a graphical view of latitude/longitude or northing/easting of points, observations and background map



The *CAD View* is a graphical view of linework, roads, and surfaces with the associated points:



The *Google Earth* is a client application to work with a 3D map of the Earth created using live satellite imagery (a connection with the Internet is needed): MAP View CAD View



How to Estimate Precision of Data

To estimate the precision of each GPS observation of the job, it is useful to automatically mark those vectors, which have the precision worse than the values set in this job by the user. The user can set threshold values in the *GPS Obs Precisions* tab (*Job Configuration -> Quality Control*) and activate this test in the *Automatic Tests* tab:



After that Topcon Tools will automatically highlight in red the 'bad' GPS observation(s):



Viewing and Editing Localization

If localization was performed in TopSURV, the user can see (in the current Topcon Tools job) the localization parameters and pair points

which were used in localization. To open the *Localization dialog* box, click *Process->Localization:*

| | | | WGS Point | Local Point | Use | N Residual (USft) | E Re Rotation |]25°32'20.8195 |
|---------------------|------------|---|-----------|-------------|------------------|-------------------|------------------------|-----------------|
| | | | ▲ 109 | 109_LOC | Horizontal and V | 0.002 | Scale | 1.0001628626 |
| | | | ▲ 111 | 111_LOC | Horizontal and V | -0.017 | Deflection North | 0.0018 7082 |
| ocess | | | ▲ 113 | 113_LOC | Horizontal and V | 0.014 | Deflection East | 0*00'59.4940 |
| Adjustment | F8 | | | | | | Origin Lat | 40*06*11.09365N |
| Compute Coordinates | | | | | | | Origin Lon | 82°59'16.23281W |
| Localization | Shift+F8 | | | | | | Origin Ell. H (USft) | 789.884 |
| Loop Closures | Ctrl+L | | | | | | Origin Northing (USft) | 5468.521 |
| Process Properties | Alt+Ctrl+P | | | | | | Origin Easting (USft) | 4999.994 |
| | | _ | | | | | Origin H (USft) | 702.357 |
| | | | < | 1. | | | 🕞 🦵 Keep Scale 1.000 | |

The *Localization* window allows one to add the pair points for calculating the localization parameters:

• before adding a new pair, be sure that the *Points* tab contains the desired point(s) with coordinates in the both coordinate systems (*Ground/Localization* and *Grid/Datum*). If needed, to create such

| a point you can use the option Add > Doint (| <i>,</i> | Add | | ` |
|--|----------|-------|--------|---|
| a point, you can use the option Add -> Point (| | Point | Ctrl+. |) |

and type in the desired coordinates in the corresponding

coordinate system:

| Add Point : Point User1 | | | | | | | | |
|-------------------------|-------------|--|--|--|--|--|--|--|
| Quality control | Photo Notes | | | | | | | |
| Ground | Coordinates | | | | | | | |
| Ground Northing (m) | 1563.043 | | | | | | | |
| Ground Easting (m) | 213 708 | | | | | | | |

- Click Add Point in the Localization window.
- Select the desired point from the *WGS Point* list:

| 🀔 Localizat | ion |
|-------------|-----|
| WGS Point | |
| 🔺 109 | |
| 🔺 111 | |
| 🔺 113 | |
| 101 | - |
| 101 | ^ |
| 101_LOC | |
| 102 | |

- Select the desired point from the *Local Point* list:
- 🖇 Localization WGS Point Local Point A 109 109 LOC A 111 111_LOC A 113 113_LOC A 101 103 100 101
- Click to calculate localization parameters using new Compute parameters pair points.

Editing Antenna Height

Topcon Tools allows one to edit the Antenna Height and/or Antenna Height Method and/or Antenna Type columns as needed. For multiple points:

101

102

103

104

105

106

107

P... Original ...

101

102

103

104

105

106

107

105

106

107

• in the GPS Occupations tab press Shift (and/or Ctrl) and highlight the desired

> I... 101

102

103

104

105

106

107

I... 🔺

101

102

103

104

105

106

107

0,0,0,0,0,0,0

0 105

106

107

| • | |
|---------|--|
| points: | |
| F | |

| • | click a | point: |
|---|---------|--------|
| | | 1 |

| | | | | 😤 GPS Occu | pations |
|---|-----|---|----------|------------|-------------|
| I | | P | Original | Antenna T | Antenna Hei |
| 0 | 101 | | 101 | TPSGR-3 | 6.004 |
| 0 | 102 | | 102 | TPSGR-3 | 7.7777 |
| 0 | 103 | | 103 | TPSGR-3 | 6.004 |
| 0 | 104 | | 104 | TPSGR-3 | 6.004 |

TPSGR-3

TPSGR-3

TPSGR-3

🔗 GPS Occupations P... Original ... Antenna T... Antenna Hei...

🔗 GPS Occupations

Antenna T... Antenna Hei... TPSGR-3

6.00393

6.004

6.00

6.004

6.004

6.004

6.004

6.004

6.004

TPSGR-3

• type in a new height:

| | | 🔗 GPS Occupations | | | |
|---|-----|-------------------|----------|-----------|-------------|
| I | | P | Original | Antenna T | Antenna Hei |
| 0 | 101 | | 101 | TP5GR-3 | 6.004 |
| 0 | 102 | | 102 | TPSGR-3 | 7.778 |
| 0 | 103 | | 103 | TPSGR-3 | 7.778 |
| 0 | 104 | | 104 | TPSGR-3 | 6.004 |
| 0 | 105 | | 105 | TPSGR-3 | 6.004 |
| 0 | 106 | | 106 | TPSGR-3 | 7.778 |
| 0 | 107 | | 107 | TPSGR-3 | 7.778 |

• press *Enter*:

After this updating, you need to recalculate the coordinates of the network.

How to Recalculate the Coordinates

To recalculate the coordinates of the given RTK network with any modification, click the *Process -> Compute coordinates*.

Note that if the base station antenna does not have information about

antenna type, antenna height and antenna height method, the phase center coordinates of this antenna will be used to compute the coordinates of all points in this network.



Reporting Data

To create a report in *Microsoft Excel* for all GPS observations of the given job, take the following steps:

• Click Report-> Report Configuration

| Report | | |
|--------|-----------------|--------|
| Qualit | y Control | Ctrl+5 |
| Points | Ctrl+4 | |
| Locali | Ctrl+3 | |
| GPS C | Ctrl+2 | |
| Adjus | Ctrl+1 | |
| Repor | t Configuration | F9 |

• Select the *GPS observations* report in the *Report* list and *Microsoft Excel* in the *Report format* field:



- Click OK to save that report configuration.
- To create the corresponding report, click *Report-> GPS Observations*. The following report displays

| Г | | Δ | В | 0 | D | F | F | G | |
|------------------|-----|------------------------|---------------|-------------------|---------|-----------------------------|---------------------------|----------|--|
| ľ | 1 | | | Ū, | | L | | <u> </u> | |
| | 2 | | ' | | | | | | |
| | 3 | TOPCON | | | | | | | |
| | 4 | Project Sum | nmary | | | | | | |
| | 5 | 5 | | | | | | | |
| $\left \right $ | ы | Project nam | ne: from topc | on tools.ttp | | | | | |
| | / | Surveyor: | | | | | | | |
| | 8 | Comment | | | | | | | |
| | 9 | Linear unit | USFeet | | | | | | |
| $\left \right $ | 10 | | | | 05 | C Observations | | | |
| ł | 11 | Nomo | AN /UC#Y | | | Upricental Provision (UCff) | Vortical Drasisian (UCff) | | |
| ł | 12 | Ranne Roco2-100 | 110 676 | 16 260 | 2 204 | nonzontal Precision (OSIC) | venucal Frecision (USIC) | | |
| ł | 1.0 | Bace2-100 | 100.649 | 161.000 | 2.034 | 0.011 | 0.01 | | |
| ł | 14 | Bace2=101 | 99 195 | 69.016 | 2.075 | 0.010 | 0.010 | | |
| ł | 16 | Dase2 102 | 10 000 | -94 497 | 0.007 | 0.013 | 0.011 | | |
| ł | 17 | Dase2 100 Pace2=104 | 61.003 | -04.407 08.060 | 1.666 | 0.007 | 0.000 | | |
| ł | 18 | Bace2-104 | 20 820 | -104 767 | 9 719 | 0.011 | 0.012 | | |
| ł | 19 | Bace2=100 | 196 115 | -224 222 | 9.197 | 0.013 | 0.013 | | |
| ł | 20 | Bace2=107 | 212.052 | -266 169 | 5 201 | 0.021 | 0.027 | | |
| ł | 20 | Dase2 107 | 210.000 | -200.100 | 0.001 | 0.022 | 0.017 | | |
| ł | 21 | Bace2 100 | 210.047 | 202.300 | 4 027 | 0.010 | 0.013 | | |
| ł | 22 | Bace2-103 | 417 109 | -199 324 | 9.007 | 0.024 | 0.019 | | |
| ł | 20 | Bace2=111 | 666.924 | 129.65 | 2 004 | 0.014 | 0.011 | | |
| ł | 24 | Dase2 111 | 25.026 | -197 970 | 2.304 | 0.010 | 0.011 | | |
| ł | 26 | Bace2-113 | -232 026 | 27.073 | 1 752 | 0.012 | 0.011 | | |
| ł | 20 | Bace2-114 | -97 491 | -122 118 | 2 9 4 2 | 0.017 | 0.011 | | |
| ł | 28 | D0362-114 | -37.431 | -122.110 | 2.342 | 0.017 | 0.021 | | |
| н | | | | | | | | | |

Export to Coordinate File

To export the coordinates of the measured RTK points to a text file format, do the following:

• Select the desired linear unit (US Feet) and coordinate system

(Ground/Localization) in the Status Bar USFeet DMS Ground Localization

• Click *Job-> Export*, select the file format '*Name*,*N*,*E*,*Z*,*Code*', type in the name of the created file and click OK:

| 🚰 Export | | ? | × |
|--------------------------------------|------------------------------|---------|---|
| Save in: 📔 | Examples | - 🗢 🖿 (| Ť |
| | | | |
| | | | |
| | | | |
| | | | |
| File name: RTK_ | POINTS | | |
| Format name: 👘 Na | me,N,E,Z,Code - Coordinates | (*.csv) | • |
| Advanced options | | | |
| | | | _ |
| Metric unit: | [Default (USFeet)] | | • |
| Coordinate type: | [Default (Ground or Localiza | tion)] | • |
| | | | |
| Coordinate system: | None | | |
| | | | |
| Save | | Cancel | |

The created file will have the following type:

| File | Edit | Options | Help |
|------|------|---------|------------------------|
| 10 | 0,51 | 18.280 | ,5171.041,700.819, |
| 10 | 1,51 | 28.082 | ,5336.271,701.140,NAIL |
| 10 | 2,50 | 75.055 | ,5191.009,699.005,OAK |
| 10 | 3,50 | 42.959 | ,5078.684,698.552,NAIL |
| 10 | 4,50 | 00.020 | ,5000.016,699.978,NAIL |
| 10 | 5,50 | 90.421 | ,5023.473,702.112,NAIL |
| 10 | 6,52 | 37.847 | ,4961.485,706.483,NAIL |
| 10 | 7 59 | 91 BJi5 | አዒሪና ይአአ 783 799 MH |



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Notes:



Topcon Positioning Systems, Inc.7400 National Drive, Livermore, CA 94550800·443·4567www.topconpositioning.com



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