



# Survey Mobile Field Software



## User Guide

From v1.2

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(TNL - TEBV)

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## **11. General.**

11.1. *Assignment.* This Agreement will bind and inure to the benefit of each party's permitted successors and assigns. Trimble may assign this Agreement to any Affiliate or in connection with a merger, reorganization, acquisition or other transfer of all or substantially all of Trimble's assets or voting securities. You may not assign or transfer this Agreement, in whole or in part, without Trimble's written consent. Any attempt to transfer or assign this Agreement without such written consent will be null and void. If You obtain such consent from Trimble, You shall permanently assign or transfer all of your rights under this Agreement, provided You retain no copies and You transfer all of the Software (including all component parts, the media and printed materials, any upgrades, and this Agreement), and the recipient agrees to the terms of this Agreement. If the Software portion is an upgrade, any assignment or transfer must include all prior versions of the Software.

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- 11.3.1. If You obtained this Software in the U.S., this Agreement is governed by the laws of the State of California and the U.S. without regard to conflicts of laws provisions thereof, and without regard to the United Nations Convention on the International Sale of Goods ("UNCISG"). In such case the jurisdiction and venue for actions related to the subject matter hereof are the State of California and U.S. federal courts located in Santa Clara County, California, and both parties hereby submit to the personal jurisdiction of such courts.

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**11.4. Attorneys' Fees and Costs.** The prevailing party in any action to enforce this Agreement will be entitled to recover its attorneys' fees and costs in connection with such action.

**11.5. Notices and Reports.** Any notice or report hereunder shall be in writing. If to Trimble, such notice or report shall be sent to "Trimble Navigation Limited, 935 Stewart Drive, Sunnyvale, California 94085, U.S.A." to the attention of "General Counsel – Legal Notice". If to You, such notice or report shall be sent to the address You provided upon placing your order or at the time the Software has been first made available to You. Notices and reports shall be deemed given: (a) upon receipt if by personal delivery; (b) upon receipt if sent by certified or registered U.S. mail (return receipt requested); or (c) three (3) business days after being sent by a reputable international courier requiring signature for receipt, addresses to the party at its notice address. Either party may change its notice address by written notice to the other.

**11.6. Amendments; Waivers.** No supplement, modification, or amendment of this Agreement shall be binding, unless executed in writing by a duly authorized representative of each party to this Agreement. No waiver will be implied from conduct or failure to enforce or exercise rights under this Agreement, nor will any waiver be effective unless in a writing signed by a duly authorized representative on behalf of the party claimed to have waived.

**11.7. Entire Agreement.** This Agreement is the complete and exclusive statement of the mutual understanding of the parties and supersedes and cancels all previous written and oral agreements and communications relating to the subject matter of this Agreement. No provision of any purchase order or in any other business form employed by You will supersede the terms and conditions of this Agreement, and any such document issued by a party hereto relating to this Agreement shall be for administrative purposes only and shall have no legal effect. Notwithstanding the foregoing, if You have entered into a separate written license agreement signed by Trimble for use of the Software, the terms and conditions of such other agreement shall prevail over any conflicting terms or conditions in this Agreement.

**11.8. Independent Contractors.** The parties to this Agreement are independent contractors. There is no relationship of partnership, joint venture, employment, franchise or agency created hereby between the parties. Neither party will have the power to bind the other or incur obligations on the other party's behalf without the other party's prior written consent.

**11.9. Force Majeure.** Neither party shall be liable to the other for any delay or failure to perform any obligation under this Agreement (except for a failure to pay fees) if the delay or failure is due to unforeseen events, which occur after the signing of this Agreement and which are beyond the reasonable control of the parties, such as strikes, blockade, war, terrorism, riots, natural disasters, refusal of license by the gov-

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**11.12. Official Language.** The official language of this Agreement is English. For purposes of interpretation, or in the event of a conflict between English and versions of this Agreement in any other language, the English language version shall be controlling.

**11.13. Reservation of Rights.** Trimble reserves all rights not expressly granted by this Agreement.

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Trimble Navigation Limited, 935 Stewart Drive, Sunnyvale, CA 94085, U.S.A

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## Introduction

Spectra Precision Survey Mobile (SPSM) is an easy to learn and simple to use field software for surveyors who want to get their work done fast and efficiently. The user interface is designed to be simple and straightforward so surveyors can be productive immediately.

Sharing data between crews is seamless with importing and exporting capabilities. Surveyors can measure, stake out and calibrate a site in their coordinate system of choice after configuring their receiver settings.

The software is optimized for use on Android devices v4.3 and higher. Survey Mobile offers users the flexibility to use any Android supported device.

Survey Mobile is designed to be used with a Spectra Precision SP60 or SP80 GNSS receiver.

## Installation

- Download the installation file (an apk file) from the Spectra Precision website.
- Copy the file to any folder on your Android device.
- Touch the apk file to start installing Survey Mobile.
- Enter the POPN (Proof-Of-Purchase Number) you have received by email following the purchase of the part number corresponding to Survey Mobile.

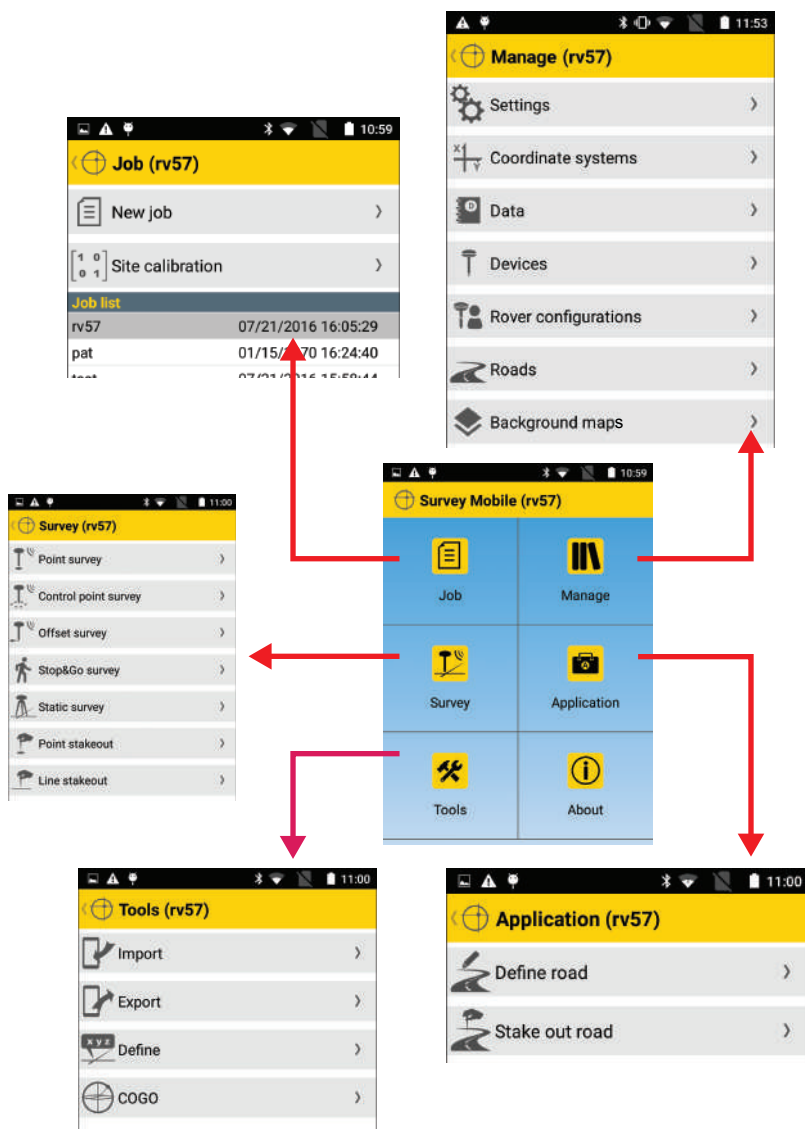
If you don't have a POPN, you may install and run the software but with limited features:

- Only one job can be created
- The number of points in the job is limited to 20
- The number of lines in the job is limited to 1
- The number of roads is limited to 1
- Only the first 20 stations of the road can be staked out.

NOTE: The installed software version is shown at the bottom of the splash screen when launching the application.

## Survey Mobile Main Menu & Submenus

See diagram below.





Jobs are required to perform real-time RTK surveys. You don't need to create a job to perform post-processed surveys (i.e. Static and Stop & Go surveys).

A post-processed survey may run in the background while performing a real-time RTK survey.

## Creating a Job

During this step, you will name the job you want to create and define a standard or custom coordinate system for the job.

- In Survey Mobile's main menu, touch .  
A new screen is displayed prompting you to create a new job or enter the **Site calibration** function. Existing jobs, if any, are listed under the **Job list** banner.
- Touch **New Job**.
- As prompted, touch the dimmed **Input** word within the **Job name** field. The keyboard then shows up on the screen.
- Type in a name for the job (e.g. MyJob), and, depending on your device, touch **OK** or **Done** on the virtual keyboard to validate the new name.
- Define the coordinate system used in the job. By default, Survey Mobile will suggest you use the coordinate system of the last opened job, but you may also define a new standard, custom or unknown coordinate system:
  - To define a standard system, touch  within the **Coordinate system** field and then select the desired system from the drop-down list. Depending on the standard coordinate system you select, Survey Mobile may ask you to define a zone (**Zone** field), a geoid (**Geoid** field) and a shift grid (**Shift grid** field).  
When you touch **OK** to save the coordinate system you have defined, Survey Mobile will name the system by combining the selections you made for **Coordinate System**, **Zone** and **Shift grid** (if applicable). Just touch **OK** to agree.


Example: The coordinate system will be named “World wide/UTM\_3 North\_EGM96 (Global)” if you have selected successively:

Coordinate system: World wide/UTM


Zone: 3 North

Geoid: EGM96 (Global)

NOTE: Coordinate systems created that way are then made available at the top of the drop-down list attached to the **Coordinate system** field.

- To define a custom system, touch  within the **Coordinate system** field and then define this system. See all the details in *Customizing the Coordinate System Used in a Job on page 5*.
- If you don't know which coordinate system should be used, define an unknown coordinate system by selecting **No datum, no projection**. Then you will run a calibration based on known points in the area to determine a valid local coordinate system.
- If you leave the field empty (first option in the drop-down list attached to the **Coordinate system** field), then WGS84 will be used and the coordinates of all measured points will be expressed as latitude, longitude and height.
- If the geodetic file you select for your custom coordinate system is missing, a message will appear with the option to download the file.

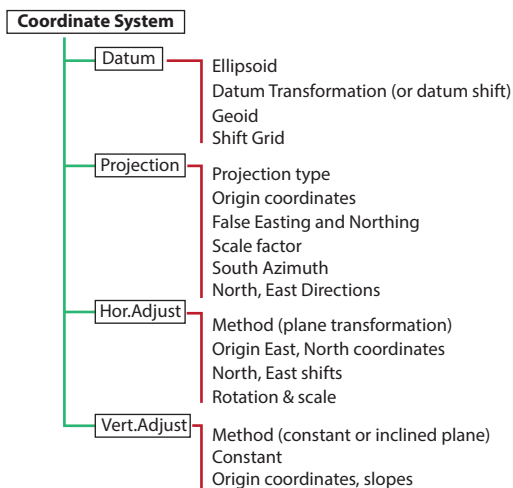
NOTE: To delete a coordinate system you have created in Survey Mobile:




- In Survey Mobile's main menu, touch .
- Touch **Coordinate systems**. The screen lists the coordinate systems you created in the upper part of the screen.
- Keep the finger pressed on the name of the coordinate system you want to delete, and then select **Delete**. This will delete the coordinate system unless it is used in one of your jobs in which case the delete operation will be canceled.
- After both the job name and the coordinate system have been defined, touch the big yellow **OK** button to create the job and open it in Survey Mobile (the name of the job is shown between brackets in the title bar).  
The name of the new job is also added to the list of existing jobs shown under the **Job list** banner.

## Customizing the Coordinate System Used in a Job

You may define a custom coordinate system in three different ways:



- Either from scratch:
  - Touch **+** within the **Coordinate system** field and enter all the system's parameters (see diagram below). Parameters are arranged in four different tabs.




- Once done, name the system and touch  in the title bar to save the system definition.
- Or you may first select a standard system and then derive your custom system from it:
  - Touch  within the **Coordinate system** field and select the standard system from which to derive your custom system.
  - Then touch **+** within the **Coordinate system** field and change only the parameters that make the custom system different from the standard one you selected.
  - Once done, name the system and touch  in the title bar to save the system definition.
- Or, after having selected a standard or custom coordinate system as explained above (a system necessarily including a projection), you may use the **Site Calibration** function to

“adjust” the coordinate system (see *Site Calibration on page 48*).


NOTE: Creating a coordinate system is also possible, outside of any open job, using the following procedure:

- From the main menu, touch  and then **Coordinate systems**.
- Touch  located in the title bar, then name and define all the parameters of the new coordinate system.


## Opening an Existing Job

- In Survey Mobile's main menu, touch . A new screen opens on which all existing jobs are listed under the **Job list** banner.
- Touch the name of the job you want to open.  
A new screen is displayed providing a summary of this job (e.g. job name, coordinate system used, possibly the name of the particular area covered by the coordinate system).
- Touch the big yellow **Open** button to open the job. The name of that job is shown between brackets in the title bar.


## Editing or Deleting an Existing Job

- In Survey Mobile's main menu, touch . A new screen opens on which all existing jobs are listed under the **Job list** banner.
- Hold your finger pressed on the name of the job you want to edit or delete until a menu pops up.
- Select **Delete** to delete the job or **Modify** to edit the job.
  - If you select **Delete**, please confirm you really want to delete the job.
  - Selecting **Modify** allows you to edit the properties of the coordinate system used in the job. If you change the coordinate system, Survey Mobile will warn you that this may cause errors in the job. The decision is yours to continue or give up.

## Closing a Job


- In Survey Mobile's main menu, touch . A new screen opens on which all existing jobs are listed under the **Job list** banner.
- Hold your finger pressed on the name of the job you want to close until a menu pops up.
- Select **Close** to close the job.

## Creating Points in a Job

- In Survey Mobile's main menu, touch , then **Define**.



Field	Value
Point name	PT100
Point code	200
Control point	<input checked="" type="checkbox"/>
Point type	Grid_NEE
North	6244358m
East	1359172m
Elevation	137m

- Complete the different fields to define a new point:
  - Point name and code.
  - Control point tag: check this box if the point you are creating is a control point (i.e. a point with accurately known coordinates in local grid).
  - Point type (type of coordinates):  
Grid\_NEE (North, East, Elevation),  
WGS84\_LLLH (latitude, longitude and height),  
or WGS84\_XYZ (WGS84 Cartesian XYZ coordinates),
  - Input point coordinates.
- Touch the big yellow **Add** button to save the point.  
NOTE: After the point has been saved, the point name shown on the screen is automatically incremented. This new name may be appropriate for the next point you want to create.
- If you've made a mistake while entering the properties of the point, you can still correct its definition right after pressing **Add**, using the procedure below:
  - Touch , hold the finger pressed on the point definition you want to edit, then select **Edit** from the pop-up menu. You can then make all the changes you want to the definition of the point.

Remember this procedure only applies to the point (or series of points, see NOTE below) you have just defined. The general procedure to edit a point defined earlier is described on *page 9*.


NOTE: If you define several points in succession, then using the above procedure will allow you to edit not only the last point defined, but also all the points you've defined just before.

## Creating Lines in a Job


A line is a segment connecting two points. Points should have been created in your job before you can create lines.

In Survey Mobile, you want to create a line in a job because you want to stake it out. That's why lines can only be created within the Line Stakeout function. See *Line Stakeout on page 44*.

## Deleting Points or Lines from a Job

- In Survey Mobile's main menu, touch , then **Data**.
- Select **Points** or **Lines**. A new screen opens listing all the points or lines stored in the job. Several items are viewed at a time. Touch **Load More** to view the next items, if any.
- Hold your finger pressed on the point or line you want to delete until a menu pops up.
- Select **Delete** to delete the item, which is deleted right away. (The **More** option also available in the popup menu provides access to the **Delete all points from the job** button, then visible at the bottom of the screen).

## Listing Existing Points or Lines

- In Survey Mobile's main menu, touch , then select **Data**.
- Select **Points** to list all the points stored in the open job, or **Lines** to list all the lines created in the job (see list examples below).

Point list (rv57)		Line list (rv57)	
<b>PT100</b>		<b>L1</b>	
Point code	100	Line start point	PT100
Point type	Defined	Line end point	PT101
Control point	No	Interval	2.0000m
North	6244305.0000m	Length	68.1836m
East	1359140.0000m	Azimuth	085°47'40.714763"
Elevation	215.0000m		
<b>PT101</b>		<b>L2</b>	
Point code	100	Line start point	PT100
Point type	Defined	Line end point	PT102
Control point	No	Interval	3.0000m
North	6244310.0000m	Length	95.5249m
		Azimuth	006°00'32.421446"





NOTE: In the list of points, the coordinates of all user-defined points continue to be expressed in the system you initially chose to define them (Grid\_NEE, WGS84\_LLH or



WGS84\_XYZ), So these coordinates may not always be expressed using the type of coordinates that the coordinate system selected for the job normally suggests.

## Editing Points

Definitions of points may be corrected if necessary using the procedure below:

- In Survey Mobile's main menu, touch , select **Data** then **Points**.
- Touch briefly the definition of the point you want to edit.
- Touch  located in the upper-right corner of the screen. Editable fields then appear in red characters.
- Correct the value of each of the fields you want to change and when you are done, touch the yellow **Update** button. Survey Mobile then prompts you to update the previous or next point in the list.
- Touch  when you are done with editing points. This takes you back to the list of defined points.
- Touch  again twice to return to the main menu.

## Importing Points into the Open Job


For import operations other than with "Survey Mobile point" format, please refer to *Other Import / Export Functions on page 58*

### Where to Post the Files Before Importing Them

The files you wish to import should always be moved to the following folder before you can import them:

Internal memory/SurveyMobile.Droid/Import/  
or  
SD memory card/SurveyMobile.Droid/Import/

### Importing Point Files in Survey Mobile Point Format

- Open the job where to import data.
- In Survey Mobile's main menu, touch , then **Import**.
- Touch **Survey Mobile point**.
- Touch **File type** and select one of the available import formats (txt or csv).
- In the lower part of the screen, select the file you want to import.

NOTE: You can view the file content at this point. Hold the finger pressed on the file name, then select **Open file** and choose an application to view the file.

- Define the content of the file you want to import by selecting a template (**Template** field). Several templates are possible:
  - **Default template:** If you choose the “**Default template**”, the imported file is assumed to provide data in that order:
    - [1] Point name [2] Code [3] North [4] East [5] Elevation [6] Latitude [7] Longitude [8] Height [9] Horizontal precision [10] Vertical precision [11] PDOP [12] Solution type


When you make this choice, remember Survey Mobile will only pick the NEE or LLH coordinates for each point, never both. It is therefore your responsibility to choose which coordinates you would like to import.

This choice is made by setting the additional **Coordinates provided as** parameter accordingly.


- Two other templates may be used, which the files to be imported should comply with when you select one of them:

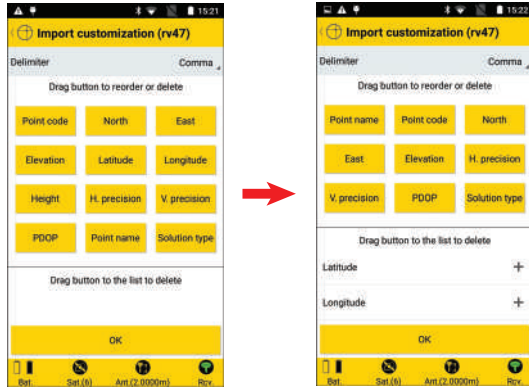
Name Code Latitude Longitude Height

Name Code North East Elevation

- **Customized template:** Touch  to build a customized template. A new screen opens on which you can define, 1) the field delimiter (comma, space, tab, or semicolon), and 2) the content of the template: all the fields currently included in the template are shown at the top of the screen as yellow buttons. You can re-order the fields by dragging the buttons accordingly within the upper list.

You can also remove some of them by dragging the corresponding buttons to the lower list.

Conversely, by touching  next to a field name in the lower list, you will re-incorporate this field into the template as the last field in the template.





Touch **OK** after you have defined your custom template.

- Touch the big yellow **Import** button to run and complete the import operation.

## Exporting Points from a Job


For export operations other than with “Survey Mobile point” format, please refer to *Other Import / Export Functions on page 58*


- Open the job from which to export points (see *Opening an Existing Job on page 6*).
- In Survey Mobile’s main menu, touch , then **Export**.
- Touch **Survey Mobile point**.
- Select the category, or categories of points you would like to export from the open job:
  - Touch  in the title bar. Survey Mobile suggests that you select points according to three different criteria: **Point Type**, **Point Library** and **Point Solution**.
  - For each of these criteria, check on the boxes corresponding to the points you want to export.
  - Touch **OK** when you are done with your selections. This takes you back to the previous screen.
- Touch **File type** and select one of the available formats (txt or csv) for the exported file.

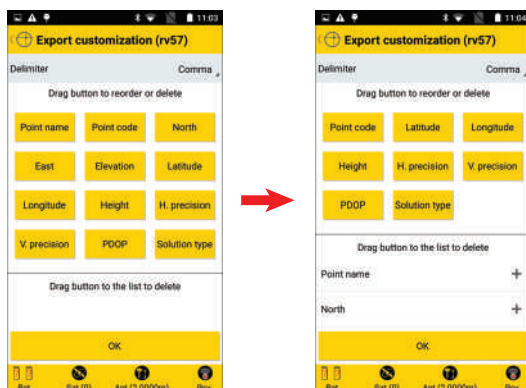
- Define the content of the exported file by selecting a template (**Template** field). Several templates are possible:
  - **Default Template:** The content of the exported file will be as follows (same as import):
 

[1] Point name [2] Code [3] North [4] East [5] Elevation [6] Latitude [7] Longitude [8] Height [9] Horizontal precision [10] Vertical precision [11] PDOP [12] Solution type
  - Template with a fixed set of fields, which are, in this order:
 

Name, Code, North, East, Elevation
  - Template with another fixed set of fields, which are, in this order:
 

Name, Code, Latitude, Longitude, Height
  - **Customized Template:** Touch  to build a customized template. A new screen opens on which you can define, 1) the field delimiter (comma, space, tab, or semicolon), and 2) the content of the template: all the fields currently included in the template are shown at the top of the screen as yellow buttons. You can re-order the fields by dragging the buttons accordingly within the upper list. You can also remove some of them by dragging the corresponding buttons to the lower list.

Conversely, by touching  next to a field name in the lower list, you will re-incorporate this field into the template as the last field in the template.





Touch **OK** after you have defined your custom template.

- Name the export file.
- Touch the big yellow **Export** button to run and complete the export operation.

NOTE: You can view the content of already exported files (listed in the lower part of the screen): Hold the finger pressed on one of the exported file names, then select **Open file** and choose an application to view the file.

## Interfacing Survey Mobile to a GNSS Receiver


### Connecting Survey Mobile to a Receiver via Bluetooth

- Turn on the GNSS receiver and wait until it has initialized.
- On Survey Mobile, touch  located in the status bar. This opens the **Connect** tab on the **Receiver** screen.
- Touch  located within the **Device** field, at the far right. This causes Survey Mobile to start scanning for Bluetooth devices. A new screen is displayed on which you can see the message **Scanning...**  
Every time a new Bluetooth device is detected, its Bluetooth ID is added to the list of available devices (under **Available devices**).  
Should the scanning fail, you can still touch the big yellow **Scan** button to resume a new search phase.
- Enable the check box corresponding to the GNSS receiver you want to work with and then touch **OK**.  
This takes you back to the previous screen where the Bluetooth ID of the chosen device now appears as the current selection in the **Device** field.
- Touch the yellow **Connect** button and then wait until the Bluetooth connection is established.



You may be asked to pair the two units the first time you make a Bluetooth connection with your receiver: either a large message window will pop up, or a more discreet notification will show up in the Android task bar. In both cases, just accept the pairing request.

The receiver status icon in the status bar tells you when the Bluetooth connection with the receiver is active:

Icon	Bluetooth
	Inactive
	Active

## Setting a Rover

Survey Mobile offers four different possibilities to allow the GNSS receiver to operate as a rover providing precise positions:

- **RTK Radio:** Corrections come from a radio transmitter via a radio link. The radio transmitter is connected to the base used.
- **RTK Network:** Corrections come from a VRS network via an NTRIP connection.
- **Network single base:** Corrections come from a single base via an NTRIP or Direct IP connection.
- **RTX:** Corrections come from a Trimble RTX service which broadcasts them either via the Internet or via satellites operating in the same frequency band as GNSS satellites. Supported services include CenterPoint, FieldPoint, ViewPoint and RangePoint.

**IMPORTANT:** When using a Trimble RTX service, the computed position will always be expressed in the current epoch of the ITRF2008 system.

The table below lists the hardware requirements for each of these options.


Option	Requirements
RTK radio	Radio receiver, ideally integrated to GNSS receiver (e.g. SP60 or SP80 with radio module)
RTK Network	SIM card with suitable subscription for mobile data acquisition. Inserted in the data controller (SP60) or in the GNSS receiver (SP80).
Network single base	
RTX	<p>Hardware requirements:</p> <ul style="list-style-type: none"> <li>• Via satellites: None</li> <li>• Via Internet: SIM card with suitable subscription for mobile data acquisition must be inserted in the data controller. Only the data controller may be used for an RTX Internet connection.</li> </ul> <p>In both cases, you also need to purchase a subscription to the chosen Trimble RTX service.</p>

Survey Mobile allows you to create and save different configurations to acquire corrections, based on either of the available options. That way, you can easily switch from one to another if you need to change the source of corrections while in the field.


If you also operate your own base, please set the base first (see *Setting a Base on page 53*).

## RTK Radio

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*), do the following:

- Touch  and then open the **Rover** tab.
- Enable the **RTK Radio** check box within the **RTK Radio** field and then touch this field. This opens the **RTK Radio** screen.
- Complete these fields:
  - **Link type:** Type of radio used on GNSS receiver side.  
If the radio is separate from the GNSS receiver, select “**External radio**”.

If it's embedded in the GNSS receiver, select “**Internal radio**” (typically SP60 or SP80 with a radio module option installed).

With “**Internal radio**” selected, touch  to access the configuration parameters of the radio (SP60/SP80 internal radio):



- **Protocol:** Up to 7 different protocols available,
  - **Air link speed:** 4800 to 19200 Bd,
  - **Sensitivity:** Low/Medium/High/Off,
  - **Scrambling:** On/Off,
  - **Forward error correction (FEC):** On/Off,
  - **Power:** Power radiated by the radio when used as a transmitter (500 mW or 2 W).
- In most countries, you would typically choose, respectively, “Transparent FST”, “9600 Bd”, “Medium”, “Off” for both scrambling and FEC, in order to comply with the radio-frequency regulations in force. Ask your local dealer for more information.
- **Radio frequency:** Only if “**Internal radio**” is selected. Select the same frequency as the one used by the base. This frequency should be chosen from the list of available frequencies.
  - **Port, Baud rate, Data bits, Parity, Stop bits:** Only if an external radio is used. Tell Survey Mobile which port on the GNSS receiver is used to communicate with this radio. Enter the different parameters used in the serial connection between the GNSS receiver and the radio.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.



- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells that the whole system is ready for use.


### RTK Network


After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*), do the following:

- Touch  and then open the **Rover** tab.
- Enable the **RTK Network** check box within the **RTK Network** field and then touch this field. This opens a new screen.
- Complete these fields:
  - **Link type:** Choose “**Controller Internet**” for SP60, “**Internal Internet**” for SP80,
  - **IP, Port:** Enter the base IP address,
  - **User, Password:** Enter your credentials allowing you to receive corrections from the VRS network.
- Touch  in the **Mount point** field to download the NTRIP source table and then choose one mount point from the scroll-down list attached to this field.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
- Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
- Touch **Start** and wait until a message tells you that the whole system is ready for use.

### Network Single Base


After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*), do the following:

- Touch  and then open the **Rover** tab.
- Enable the **Network Single Base** check box within the **Network Single Base** field and then touch this field. This opens the **Network Single Base** screen.
- Complete these fields:
  - **Link type:** Choose “Controller Internet” for SP60, “Internal Internet” for SP80,



- **Protocol type:** Choose between “NTRIP” or “Direct IP” depending on the protocol used at the base,
  - **IP, Port:** Enter the base IP address,
  - **User, Password:** Enter your credentials allowing you to receive corrections from the base.
- For NTRIP only, touch  in the **Mount point** field to download the NTRIP source table and then choose one mount point from the scroll-down list attached to this field.
  - Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
  - Use the **Name** field to enter a name for the configuration you have just defined, then touch **Save** to save it.
  - Touch **Start** and wait until a message tells that the whole system is ready for use.

## RTX

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*), do the following:

- Touch  and then open the **Rover** tab.
- Enable the **RTX** check box within the **RTX** field and then touch this field. This opens the **RTX** screen.
- Complete these fields:
  - **Link type:** For SP60, choose “**Controller Internet**” (corrections via Internet) or “**RTX satellite**” (corrections via satellite). For SP80, you can only select “**Controller Internet**” (corrections via Internet),
  - **Stream** (only if **Link type= Controller Internet**): Choose the type of correction data received via the Internet (RTXAUTO and RTXIP can be used whatever the continent on which you are; RTXEU is for Europe only).

## Loading a Previously Saved Configuration

- Touch  and then open the **Rover** tab.
- Touch  within the **Name** field. This opens a new window listing all the saved configurations.
- Select the configuration you wish to use. As a result, this configuration is loaded to Survey Mobile as the current configuration to be used by the GNSS receiver to acquire RTK corrections.

## Battery Icons

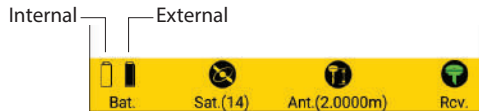
Two battery icons are shown in Survey Mobile's status bar:

- The one on the left shows the remaining charge in the receiver's internal battery.
- The one on the right shows the remaining charge in the external battery.





If the receiver is connected to an external DC power source, this icon shows a fully charged battery (100% remaining charge).

If there is no external battery the icon shows a "?" (see table below).

The exact percentage of remaining charge can be read on the screen by touching the two battery icons in the status bar. This opens a new screen on which you can read those percentages (see example below for an SP80).




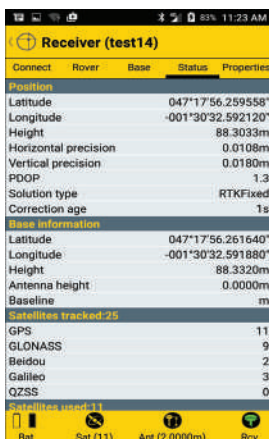
The table below shows what the battery icons may typically look like.

Icon	Meaning	Icon	Meaning
	Survey Mobile not connected to any receiver		Remaining charge: 50%
	Battery missing or exhausted (0%)		Remaining charge: 100%

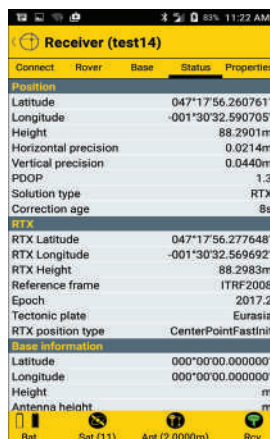
## Other Useful Information about the Receiver

Useful information about the GNSS receiver is available at any time:


- Touch  and then open the **Status** tab. This tab provides status information about the receiver power supply, the current coordinates of computed position, the base used and the satellites tracked and used. See the two examples below (with RTX position solution on the right).



Receiver (test14)				
Connect	Rover	Base	Status	Properties
<b>Position</b>				
Latitude	047°17'56.259558"			
Longitude	-001°30'32.592120"			
Height	88.3033m			
Horizontal precision	0.0108m			
Vertical precision	0.0180m			
PDOP	1.3			
Solution type	RTXFixed			
Correction age	1s			
<b>Base information</b>				
Latitude	047°17'56.261640"			
Longitude	-001°30'32.591880"			
Height	88.3320m			
Antenna height	0.0000m			
Baselines	m			
<b>Satellites tracked:25</b>				
GPS	11			
GLONASS	9			
Beidou	2			
Galileo	3			
QZSS	0			
<b>Satellites used:11</b>				
Bat.	Sat (11)	Ant (2.0000m)	Rcv.	



Receiver (test14)				
Connect	Rover	Base	Status	Properties
<b>Position</b>				
Latitude	047°17'56.260761"			
Longitude	-001°30'32.590705"			
Height	88.2901m			
Horizontal precision	0.0214m			
Vertical precision	0.0440m			
PDOP	1.3			
Solution type	RTX			
Correction age	8s			
<b>RTX</b>				
RTX Latitude	047°17'56.277648"			
RTX Longitude	-001°30'32.569692"			
RTX Height	88.2983m			
Reference frame	ITRF2008			
Epoch	2017.2			
Tectonic plate	Eurasia			
RTX position type	CenterPointFastInrt			
<b>Base information</b>				
Latitude	000°00'00.000000"			
Longitude	000°00'00.000000"			
Height	m			
Antenna height	m			
Bat.	Sat (11)	Ant (2.0000m)	Rcv.	

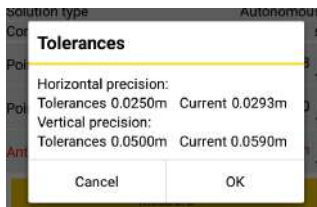
- Touch  and then open the **Properties** tab. This tab provides information about the receiver firmware version.

## Points vs. Control Points

For a “common” point, Survey Mobile assigns the last computed position delivered by the GNSS receiver to the surveyed point. The point position therefore results from a single measurement and the point is logged almost instantly. For a control point, Survey Mobile averages the successive positions delivered by the GNSS receiver over a user-settable period of time (controlled by the **Epochs** parameter). Only at the end of this time will Survey Mobile assign the averaged position to the control point. That position will statistically be more accurate than that obtained through a single measurement. Logging a control point therefore takes more time than logging a “common” point.

## Tolerances

- **Points:** Should the current horizontal and/or vertical precision be beyond the permitted tolerances when making a point measurement, then Survey Mobile would warn you (see example below). You can then choose whether you want to save the point measurement (**Yes**) or reject it (**Cancel**).



- **Control Points:** When measuring a control point, the message “**Failed to measure point**” will show up if at least 40% of the measurements made are not RTK fixed solutions.

## Naming Points and Lines

For repetitive actions on points, Survey Mobile will automatically increment the **Point name** field so you don't need to edit this parameter every time. The incrementation rules are the following:

- If the first point name you entered ends with a figure, Survey Mobile will increment this figure by one (+1) for the next point (e.g. PT100, then PT101, PT102, etc.). When the point name is in the form "...9", then the next prompted point name will be "...10".
- If the first point name you entered ends with a letter, Survey Mobile will add a figure (starting with "1") at the end of the point name for the next point (e.g. RET, then RET1, RET2, etc.).

Automatic incrementation of point names occurs in the following two cases:

- When manually creating several points in a row using the **Tools>Define** function.
- Within the **Survey** function when logging several points in a row.

The same applies for line names when creating several lines in turn from inside the Line Stakeout function.

## Shortcuts **Menu Shortcut**

Whenever you need to return to the root menu of a Survey Mobile function, from anywhere within this function, just touch this icon located in the top-left corner of the screen:



## **Point Survey Shortcut**

When you are ready to collect a point, you may alternately press the "**Volume -**" key of your Android platform (rather than touch the on-screen **Measure** button) to save the name and coordinates of that point.

## **Point Stakeout Shortcut**

After choosing the point you want to stake out, you may alternately press the "**Volume -**" key of your Android platform (rather than touch the on-screen **Start** button) to start walking to the selected point using the displayed guidance instructions.

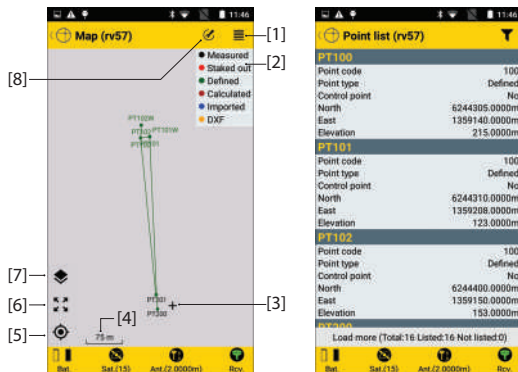
From there, after you have arrived at the target, you can alternately press the "**Volume +**" key of your Android platform

(rather than touch the on-screen **End and save** button) to save the point position and end the stakeout, or you can press the “**Volume -**” again (rather than touch the on-screen **End** button) to end the stakeout.

## Map View & Points List View

When working within the Survey function (📏), you can always take a look at the map or the list of the points present in your job. Exception is for Stop & Go and Static Surveys where there is no possible access to these two views. So as you are collecting points, you may:

- Touch 🗺️ in the title bar to access the map view (below left).
- Touch 👁️ in the title bar to access the points list (below right).



[1]: Touch this icon to show or hide the color legend

[2]: Color legend

[3]: This cross shows your current location.

[4]: Current value of map scale. The map scale can be zoomed in up to 8 mm.

[5]: When your current location is shown, touching this button will drag your current location to the center of the map screen.

[6]: Touch this icon to adjust the zoom so that all the points, lines, etc. present in the job can be seen on the screen with the highest enlargement possible. The map screen indefinitely retains the map scale resulting from this action until you intentionally choose to use another map scale.

[7]: Touch this icon to add background maps (see note below).

[8]: Provides access to the Auto-scroll function. When activated, this function will bring the current location back to the center of the screen whenever it's about to go beyond any of the edges of the map screen.

NOTE: To add background maps, see *page 60*.

To return to the measurement screen when the map view or points list is displayed:

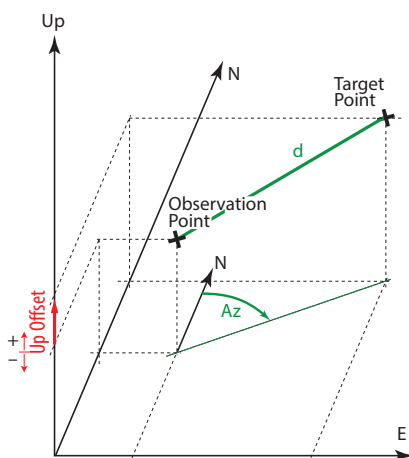
- Touch .

## Offset Points

The offset procedure is used when the point you want to measure (the “target point”) is inaccessible. In this case, you will rely on a point located nearby, called “observation point”. You will then have to describe the offset from the observation point to the target point. You should also make sure GNSS reception at the observation point you choose is good.

The method used to perform an offset point measurement is called **Distance-Azimuth Offset** (see diagram below). This method requires that you measure and provide Survey Mobile with the following two parameters:

- d: Slope distance between observation point and inaccessible point (target point).
- Az: Azimuth angle from observation point to target point.

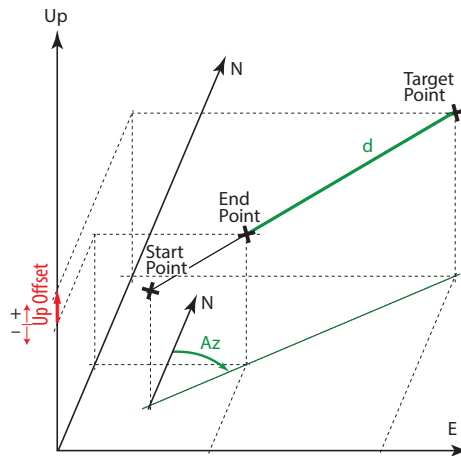


If unknown, the azimuth may be determined by Survey Mobile, directly in the field, **by specifying two points aligned with the target point** (see diagram below).



In this case you have two observation points instead of just one. These points are named as follows:

- **Start Point:** This is the point the farthest to the target point. This point should be occupied, making sure GNSS reception is good on this point.
- **End Point:** This is the point the closest to the target point and is located on the same line as the start and target points. You should occupy this point making sure GNSS reception is good at this point as well, and then you should measure the distance from this point to the target point using an external measuring tool (tape measure, etc.).



NOTE: The start and end points may be points stored in the job in which case you don't need to measure them but simply to mention their names to get their coordinates.

## About Static and Stop & Go Surveys

### Conventions Used to Name Raw Data Files

When running Static or Stop & go surveys, Survey Mobile automatically creates files to save the collected raw data. File naming is in the form:

For static surveys:

**G**<Receiver ID><Index><Year>.<Day>

For Stop & Go surveys:

**GFAST**<Index><Year>.<Day>

Where:

G: File header (ATOM format)

<Receiver ID>: The last 4 characters from the Bluetooth name of the connected receiver.

GFAST: identifies the raw data file as resulting from a Stop & Go survey.

<Index>: Rank in current day (A to Z, then AA to AZ) (A for file logged first)

<Year>: Last two figures of current year


<Day>: File extension. Day number in year (1-366)

Examples: "G0015A16.132" (static survey);

"GFASTA16.133" (Stop & Go survey).

### Clearing the Receiver Memory

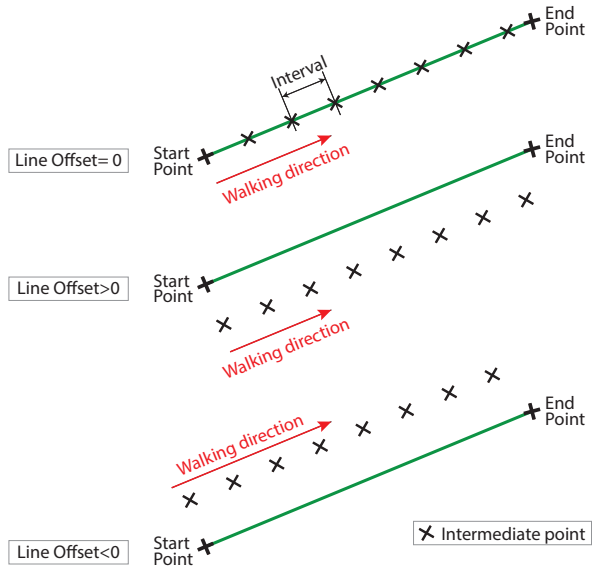
If you run out of receiver memory while being in the field, there is an emergency procedure that allows you to delete all the files from the receiver memory. Obviously you will not delete important files that have not been previously backed up at the office. So please think about the files still in memory before you use this procedure.

- In Survey Mobile, open the Static or Stop & Go screen.
- Touch  (located by the current value of memory size available).
- Confirm you want to delete all the files.

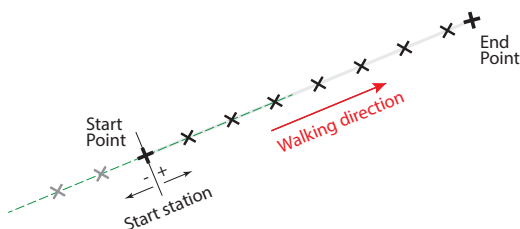
## About Line Stakeout



There are five important things to know about line stakeout:

1. When you stake out a line, Survey Mobile will guide you successively to intermediate points along the line, from the start point to the end point.
2. The number of intermediate points depends on how you set the **Interval** parameter. For example, if you choose **Interval**= 2 meters, then Survey Mobile will guide you successively to points 2 meters apart along the line. You may decide to stake out the line by asking Survey Mobile to guide you exactly along this line, or on the contrary, by walking at some distance from it, along a virtual line parallel to it. This is achievable by setting the **Line offset** parameter accordingly:
  - **Line offset**= 0: Guidance provided along the “real” line.
  - **Line offset**> 0: Guidance provided along a virtual line located to the left of, and parallel to the “real” line.
  - **Line offset**< 0: Guidance provided along a virtual line located to the right of, and parallel to the “real” line.



3. In addition, there is a way of starting staking out the line on the start point, or somewhere on the line before or after the start point. This is achievable by setting the **Start station** parameter accordingly:
- **Start station**= 0+000.000: Stakeout will start at the line's start point.
  - **Start station**> 0+000.000 (e.g. 0+020.000): Stakeout will start somewhere on the line, between the start point and the end point (see diagram below).
  - **Start station**< 0+000.000 (e.g. -0+020.000): Stakeout will start outside of the line, on a point aligned with the line and located before the start point (see diagram below).

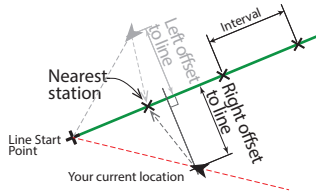


4. After staking out the first point on the line, which you can save or not, you will be using the following buttons to head for the next point:
-  : Will guide you to the next point in the direction from the start point to the end point. That point is distant from the previous one by the value given by the **Interval** parameter.
  -  : Will guide you to the next point in the direction from the end point to the start point. That point is distant from the previous one by the value given by the **Interval** parameter.

If necessary, you may also correct the **Start station** setting made while creating the line, by adjusting the **Line station** parameter.

5. While staking out a line, Survey Mobile will continuously provide the following additional information:
- **Right offset to line, Left offset to the line:** The distance from your current location to the line, along the perpendicular to that line.
  - **Nearest station:** Indicates which intermediate point on the line you are currently the nearest to.

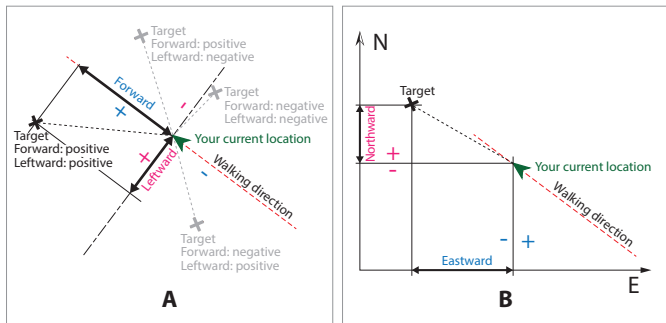
These two values are illustrated in the example below where the operator is guided to get to the line's start point.




## Stakeout Guidance Options

Whether you are staking out a point, a line or a road, you may decide which type of guidance instructions you want on the screen as you move around in the field to your current target. Survey Mobile offers two sets of guidance instructions:


- **Forward and Leftward:** Components of the distance still to go, as measured taking into account the current walking direction (see diagram A).
- **Northward and Eastward:** North and East components of the distance still to go (see diagram B).




To make this choice, touch  in the title bar after you have selected the desired stakeout function.

## Surveying With Survey Mobile

### Preparatory Steps Choosing Units, Number of Decimals and Tolerances


- In Survey Mobile's main menu, touch  and then **Settings**.  
The new screen that opens (see below) allows you to choose:
  - The units you want to use for distances (meters, feet, US survey feet), areas (square meters, hectares) and angles (Degrees, DDMSS, radians).
  - The number of decimal places you want Survey Mobile to provide for all distance, area and angle measurements.  
NOTE: In some languages, the decimal point is displayed as a comma.
  - The permitted tolerances in terms of horizontal and vertical precision, and of PDOP, for any real-time measurements made by the GNSS receiver.  
Should these figures be exceeded, Survey Mobile would warn you so you can choose whether you want to keep or reject those measurements not meeting the criteria.



- Touch  located in the title bar to validate all your changes.

## Entering the Antenna Height

Whether the GNSS receiver Survey Mobile is currently connected to is used as a base or a rover, you need to set the height of its GNSS antenna.

- Start a Bluetooth connection with the GNSS receiver, as explained in *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*).
- Touch . This opens the **Antenna** screen from which you can set the following parameters:
  - **Antenna Type:** A read-only parameter. This field indicates the model of GNSS receiver Survey Mobile is currently connected to.
  - **Measure to:** Indicate which point on the antenna is used as the reference point in the measurement of antenna height performed below.
    - “**Bottom of antenna mount**” is generally used at a rover. The resulting measurement is a vertical measurement which represents the true antenna height.
    - “**Slant measure mark**” is generally used at a base. The resulting measurement is a slant measurement which is not the true antenna height. But the GNSS receiver will automatically convert this measurement into the true value of antenna height.
  - **Antenna Height:** Enter the distance measurement you have made from the chosen antenna reference point (see above) to the survey point on the ground (max. permitted value: 999 m).
 

NOTE: The antenna height can also be changed when you are about to log a point.
- Touch the big yellow **OK** button to validate all your changes.

**IMPORTANT!** Survey Mobile wants to be sure you are always using the right values for these three parameters. That's why at the following steps, you will be asked to confirm or correct their values (see screen example) before Survey Mobile can go any further:


- When selecting **Point Survey**, **Control Point Survey** or **Offset Survey**.
- When selecting **Point Stakeout**, **Line Stakeout** or **Stake out road**.
- Before logging the start or end point of a line.
- Before logging a point within the site calibration function.
- Before logging a point within the COGO function.

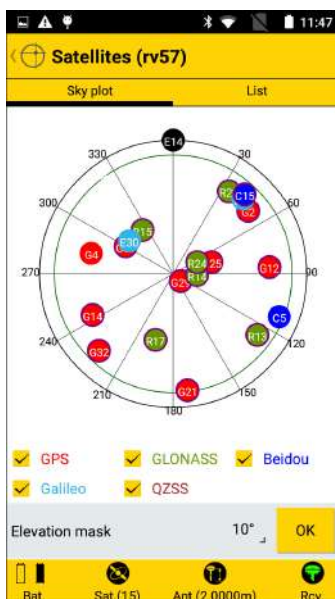
Antenna	
Antenna type	SP60
Measure to	Bottom of antenna mount
Antenna height	2m
Cancel	Continue

## Checking/Setting GNSS Reception & Elevation Mask

Survey Mobile provides a view of all the GNSS satellites currently tracked so you can see at a glance how well your receiver is running at its current location.

On the same screen, Survey Mobile allows you to adjust the value of elevation mask, if required.

- Start a Bluetooth connection with the GNSS receiver, as explained in *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*).
- Touch . Survey Mobile displays a polar view providing the current status of GNSS reception. See example below.



- To change the value of elevation mask shown at the bottom of the screen, just touch the current value and type in the desired value. Then touch **OK** to validate the new value.


NOTE 1: All GNSS constellations are tracked by default but you may deselect one (or more), if desirable, by clearing the corresponding check box shown on this screen.

NOTE 2: The number of satellites being used for computing the position is indicated by the satellite icon. If however the mobile device's internal GNSS receiver is used, this number will always be "0" regardless of the number of satellites actually used.

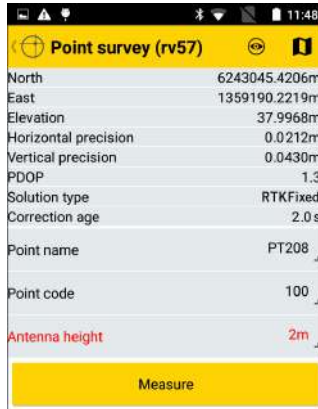


## Point Survey

Assuming your system is now ready for use:

- In Survey Mobile's main menu, touch .
- Touch **Point survey**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can log points.


The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).




- Use the last three fields in the lower part of the screen to prepare a point measurement: Enter a point name and optionally, a point code.  
The antenna height is shown in red characters. You may change it if necessary. If you do, the new height will then appear in the status bar after you've logged the point.
- Make sure you are standing exactly over the point, keep the pole vertical and stay at standstill.
- Touch the big yellow **Measure** button (or press **Volume-**). The point is being measured. While the measurement takes place, the top of the screen shows point coordinates in blue characters. If the measurement is successful, the point is created and saved to the job. A sound can be heard meaning the point measurement is complete. Survey Mobile then increments the point name (see *Naming Points and Lines on page 22*) and prompts you to log a new point.
- Log as many points as required using the above procedure.

## Control Point Survey

Assuming your system is now ready for use:

- In Survey Mobile's main menu, touch .
- Touch **Control point survey**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can log a new control point.

The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



Control point survey...	
North	6243045.4473m
East	1359190.1840m
Elevation	37.9388m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s
Point name	PT208
Point code	100
Antenna height	2m
Epochs	12
<b>Measure</b>	

- Use the last four fields in the lower part of the screen to prepare a measurement: Enter a point name and optionally, a point code.

The antenna height is shown in red characters. You may change it if necessary. If you do, the new height will then appear in the status bar after you've logged the control point.

Use the **Epochs** field to specify the required averaging time before Survey Mobile delivers a position for the control point. The greater this value, the longer the time before Survey Mobile delivers a position (1 epoch= 1 second).

- Make sure you are standing exactly over the point, keep the pole vertical and stay at standstill.
- Touch the big yellow **Measure** button (or press **Volume-**). Survey Mobile starts averaging the computed position over the requested number of epochs.

A progress bar is displayed (see example below with 10 epochs requested) showing how long you still have to stay at standstill before the averaged position is delivered.




If the measurement is successful, the control point is then created and saved to the job. A sound can be heard meaning the control point measurement is complete.

Survey Mobile then increments the point name (see *Naming Points and Lines on page 22*) and prompts you to log a new control point.

- Log as many control points as required using the above procedure.

## Offset Survey

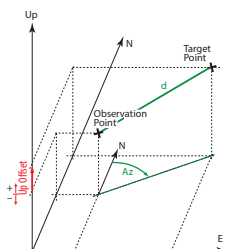
Please read *Offset Points on page 24* before starting. Then assuming your system is ready for use:

- In Survey Mobile's main menu, touch .
- Touch **Offset Survey**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can log a point using the **Distance-Azimuth Offset** method.

The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).

- Use the last seven fields in the lower part of the screen to prepare your offset measurement. The **Type** row reads **Distance-Azimuth offset**, which is the name of the method used to perform the offset point measurement. For more information on this method, see *Offset Points on page 24*.





- Then follow one of the procedures below depending on whether you already know the azimuth or you need to measure two points to determine this angle.

**1st case:** The azimuth from the observation point is known or was previously determined using an external measuring tool (compass, etc.):

- Choose the observation point from where to make the offset measurement.
- Touch 000°00'00.000000 in the **Azimuth to target point** field and enter the known value of azimuth.
- Measure and enter the distance from the observation point to the target point (**Distance to target point** field) using an external measuring tool (tape measure, etc.).
- Measure and enter the height deviation between the target point and the observation point (**Up offset** field) (positive if target point higher than observation point).
- Enter a point name for the target point and possibly a point code.

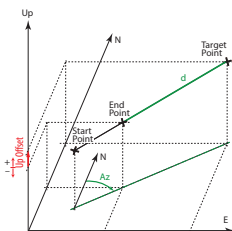
The antenna height is shown in red characters. You may change it if necessary. If you do, the new height will then appear in the status bar after you've logged the target point.


- Touch the big yellow **Measure** button (or press **Volume-**). The point is being measured and then saved to the job. While the measurement takes place, the top of the screen shows point coordinates in blue characters.

Mobile Survey then increments the point name (see *Naming Points and Lines on page 22*) prompting you to log a new offset point.

**2nd case:** Azimuth from observation point is unknown and you want to use Survey Mobile to determine this angle:

- Mark two points on the ground, both aligned with the target point.





- Touch . A new screen is displayed allowing you to calculate the azimuth. Survey Mobile needs to know the position of each of these points.



Calculate azimuth (rv57)		
<b>Start point</b>		
Start point	PT100	
North	6244305m	
East	1359140m	
Elevation	215m	
<b>End point</b>		
End point	PT101	
North	6244310m	
East	1359200m	
Elevation	214m	
Calculate		

This can be made: 1) either by entering manually the known coordinates of these points (if they are known), 2) by specifying the names of these points if they are stored in the job, or 3) by occupying these points one after the other. In the latter case, do the following:

- Stand on the start point (the one the furthest to the target point).
- Touch  to measure the coordinates of the point (you don't need to name the point).
- Move to the end point.
- Touch  to measure the coordinates of the end point (you don't need to name the point).
- Still standing on the end point, touch the big yellow **Calculate** button. This calculates the azimuth angle and takes you back to the previous screen.
- Measure and enter the distance from the end point to the target point (**Distance to target point** field) using an external measuring tool (tape measure, etc.).
- Measure and enter the height deviation between the target point and the end point (**Up offset** field) (positive if target point higher than end point).
- Enter a point name for the target point and possibly a point code.


The antenna height is shown in red characters. You may change it if necessary. If you do, the new height will then appear in the status bar after you've logged the target point.

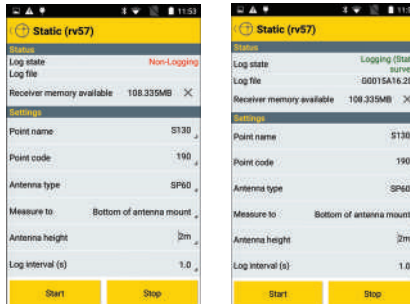
- Touch the big yellow **Measure** button. The point is being measured. While the measurement takes place, the top of the screen shows point coordinates in blue characters. If the measurement is successful, the offset point is then created and saved to the job. A sound can be heard meaning the offset point measurement is complete. Mobile Survey then increments the point name (see *Naming Points and Lines on page 22*) prompting you to log a new offset point.



**IMPORTANT:** Once you have computed the azimuth, while occupying the end point, you may not stay on this point to measure the target point. You are allowed to move along the line formed by the start, end and target points provided that at all times you get an accurate position computation AND the slope distance and up offset to the target point you have entered are the ones seen from your current location (and not from the end point).


## Static Survey

- Install your equipment on the point to be surveyed and then turn it on. Typically the GNSS antenna or receiver is mounted on top of a tripod or bipod.
- In Survey Mobile's main menu, touch .
- Touch **Static survey**. Survey Mobile opens a new screen from which you can start logging raw data at the chosen location.
- First enter the following settings (see screen below left):
  - **Point name:** Enter a name of the point where static occupation is going to take place.
  - **Point code:** Enter additional information about the point (optional).
  - **Antenna type:** A read-only parameter. This field is automatically filled in with the name of the GNSS receiver Survey Mobile is connected to.
  - **Measure to:** Indicate which point on the GNSS antenna the antenna height measurement refers to.
  - **Antenna height:** Enter the value of height measurement made so that Survey Mobile can determine the real height of the GNSS antenna.
  - **Log interval (s):** Enter the raw data recording rate, in seconds.
- Then touch **Start**. Data logging starts after a few seconds (**Starting...** message is displayed in the meantime).



- Let Survey Mobile log raw data. During this time, the top of the screen shows the data logging and memory statuses as well as the name of the file where raw data are being stored (see screen above right). The file is named according to the convention presented in *Conventions Used to Name Raw Data Files on page 26*.
- After enough data has been logged, touch **Stop** to end the static survey.

## Stop and Go Survey

- Get your equipment ready for Stop & Go operation and then turn it on. Typically the GNSS antenna or receiver is mounted on top of a range pole.
- In Survey Mobile's main menu, touch .
- Touch **Stop & Go survey**. Survey Mobile opens a new screen from which you can start logging raw data in Stop & Go mode.
- First enter the following settings (see screen below left):
  - **Antenna type:** A read-only parameter. This field is automatically filled in with the name of the GNSS receiver Survey Mobile is connected to.
  - **Measure to:** Indicate which point on the GNSS antenna the antenna height measurement refers to.
  - **Antenna height:** Enter the value of height measurement made so that Survey Mobile can determine the real height of the GNSS antenna.
  - **Log interval (s):** Enter the raw data recording rate, in seconds.



- Touch the yellow **Start** button. Survey Mobile starts logging GNSS raw data for your current location. A new screen is displayed showing the data logging status ("**Logging**"), the name of the opened raw data file and the amount of memory available on the receiver. Survey Mobile prompts you to enter the following parameters for the first point you will occupy:
  - **Point name**
  - **Point code**
  - **Occupation time (s)**, in seconds (typical values between 5 and 20 s).



NOTE: Enter “0” if you want to control manually the moment when you stop the occupation.




- Move to the first point you want to occupy and then, while staying static on this point, touch the yellow **Log point** button.


Keep static until Survey Mobile indicates the occupation time is up. You can check the progress of the occupation by watching the **Time elapsed (s)** parameter shown at the bottom of the screen.



Note that if you wish, you may shorten the occupation time by touching the yellow **Stop** button. This will instantly end the occupation time on the point.

- Resume the previous step for each of the points you want to occupy during your survey.
- Then when you are done, touch the yellow **Stop** button to end the Stop & Go survey.
- Touch  to return to the Survey menu.





## Point Stakeout

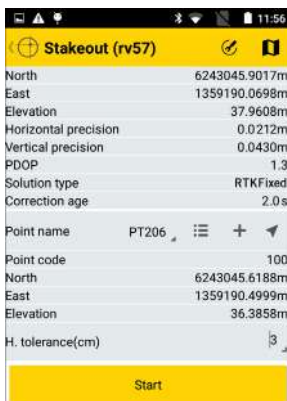
- In Survey Mobile's main menu, touch .
- Touch **Point Stakeout**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can stake out a point.

The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).

- Use the scroll-down list in the **Point name** field to choose the point from the open job that you want to stake out. The lower part of the screen shows information on the selected point (name, code, coordinates).

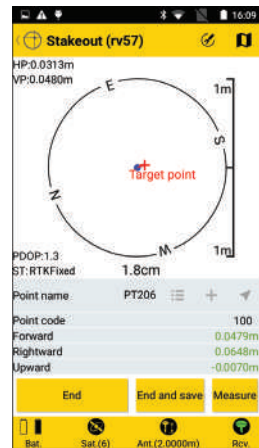
NOTE: Other possible actions from within this field:

- You may touch  located in the title bar to select the type of guidance you want to walk to the target (Northward/Eastward or Forward/Leftward; see *Stakeout Guidance Options on page 29*).
- You may touch  to list all the points stored in the job and select one to be staked out.
- You may touch  to create a new point that you would like to stake out.
- You may touch  to select the point in the job that is the nearest to your current position.



- Set the horizontal tolerance (expressed in the selected distance unit). The point will be staked out only if the horizontal precision on the position solution is better than this tolerance.

- Touch **Start** to begin (or press **Volume-**). The screen then shows a compass giving the direction to the point. The lower part of the screen also shows in real time the North, East and vertical components of the distance to go to reach the point (see below left).
- Walk in that direction, watching on the screen the values of these components as you move forward to the point. When you are exactly on the point, the screen looks like the one below right (note that when the computed coordinates turn green, you are within the expected tolerance and allowed to stake out the point).




- Dig a stake into the ground to mark the point.
- Touch **End and Save** (or press **Volume+**) if you want to quit and save the position solution currently provided by Survey Mobile for the staked out point. By default, the point will be named "<target\_point\_name>\_stakeout", but you may enter a different name if you wish. You may also type in a code for this point (**Point Code** field). After choosing a name and possibly a code for the point, tap **OK** to save it.

Touch **End** if you just want to quit without saving that position.

NOTE: At any time while walking to the target point, you may additionally measure any position you are on by touching the **Measure** button. Following this action you have the possibility to save that position as a new point by touching the big yellow **Measure** button again.


## Line Stakeout



- In Survey Mobile's main menu, touch .
- Touch **Line Stakeout**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can create and stake out a line. The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



Stakeout (rv57)	
North	6243045.4755m
East	1359190.1162m
Elevation	37.8738m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s
Line name	☰ +

### Creating a Line

- Touch  within the **Line name** row. This opens a new screen on which you can create a line. Define the following parameters:
  - **Line name:** Enter a name for the line.
  - **Line start point, Line end point:** Specify which point is the line's start point and then, which one if the line's end point. These points can be:
    - Directly picked from the open job (☰)
    - Measured in the field (👤)
    - Or created and added to the job (+).
  - **Interval:** Choose a stakeout interval (represents a distance), that is, tell Survey Mobile how accurate you want the line to be staked out. For example, if the distance unit used is meters, and you choose 2 meters, then Survey Mobile will guide you along the line, taking you successively to points 2 meters apart.
  - **Start station:** Define the location where you wish to begin staking out the line (see also *About Line Stakeout on page 27*).
- Touch the big yellow **Add** button to create the line. After the line has been created, complete the definition of the line before you start:

- **Line station** and  or  : May be used to shift the locations of intermediate points on the line by a certain distance. See *About Line Stakeout on page 27*.
- **Line offset (L-/R+)**: “0” if stakeout should take place exactly on the line, a positive or negative distance otherwise (see *About Line Stakeout on page 27*).
- **Design elevation**: Enter the planned elevation for the line.
- **North/East**: (Read-only fields) Coordinates of first point to go to (coordinates appear after changing the **Line station** value).
- **H. tolerance**: Choose a value in such a way that each point of the line will be considered as valid only if the horizontal precision on the position solution is below (better than) this tolerance.



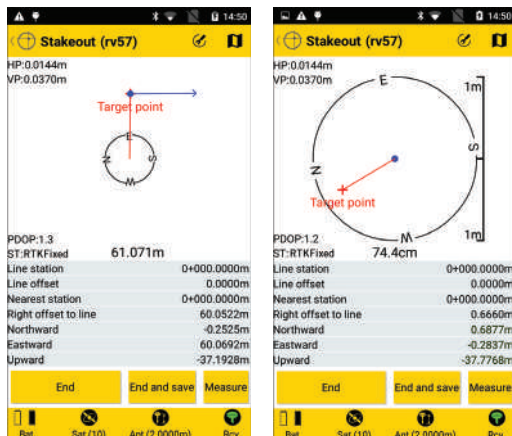
## Staking out the Line

- Touch the big yellow **Start** button. Survey Mobile guides you to reach the line's first point (i.e. the start point, or any other point according to the **Start station** and **Line station** settings).

The screen then shows a compass giving the direction to the point. The line you are staking out is shown in blue. The lower part of the screen also shows in real time the North, East and vertical components of the distance to go to reach the point (see below left).

- Walk in that direction, watching on the screen the values of these components as you move forward to the point.

When you are exactly on the point, the screen looks like the one below right (note that when the computed coordinates turn green, you are within the expected tolerance and allowed to stake out the point).



- Dig a stake into the ground to mark the point.
- Touch **End and Save** if you want to proceed with the next point and save the position solution currently provided by Survey Mobile for the staked out point. By default, the point will be named as detailed below, but you may enter a different name if you wish. You may also type in a code for this point (**Point Code** field). After choosing a name and possibly a code for the point, tap **OK** to save it.


<line name>\_<station number>\_<time>\_stakeout  
Where time is HHMMSS (for "hours, minutes, seconds").

Example:


"L1\_0\_103200\_stakeout" is the default name of the first point staked out and saved while staking out line L1 on its start point at 10:32.

Touch **End** if you just want to proceed with the next point without saving that position.


NOTE: At any time while walking along the line, you may additionally measure any position you are on by touching the **Measure** button. Following this action you have the possibility to save that position as a new point by touching the big yellow **Measure** button again.

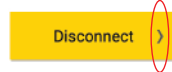
- Touch  to select the next point on the line and then repeat the present procedure until the line has been entirely staked out.

### Ending Bluetooth Connection

- On Survey Mobile, touch  , then touch the yellow **Disconnect** button. This instantly ends the Bluetooth connection between Survey Mobile and the GNSS receiver.

### Ending Bluetooth Connection and Shutting Down the Receiver

- On Survey Mobile, touch  , then touch precisely the right arrow in the yellow **Disconnect** button:



This opens a menu showing the **Disconnect and shut down** option.

- Select this option. After some 5 to 10 seconds, the GNSS receiver will shut down, then terminating the Bluetooth connection with the receiver.

## Site Calibration

### Purpose

The Site Calibration function allows you to “adjust” the coordinate system you chose for your job. This is required when you go back to a previously surveyed site for additional measurements, and you need that the new measurements and those made during a previous session are consistent with each other.

See also *Customizing the Coordinate System Used in a Job on page 5*.

**WARNING:** In a Survey Mobile job, all point coordinates are saved as LLH coordinates, whether you provided these coordinates as LLH or NEE coordinates. The NEE-to-LLH transformation is automatically done based on the coordinate system used in the job.



Through a site calibration, Survey Mobile corrects the LLH coordinates of each and every point stored in the job, based on the result of the calibration. For this reason, if you still need to use the points you initially defined through their NEE coordinates, please delete these points from the job and re-define or re-import them.

### Calibration Methods

Survey Mobile offers four different methods to make this adjustment. Choose the one that is best suited to your case of use:

- **Horizontal adjustment:** The initially selected coordinate system will possibly be scaled, translated and rotated horizontally. This transformation requires at least two “pairs of points” (see definition below).
- **Vertical adjustment:** Elevation will be corrected, applying either a constant value for every computed position (**Constant** sub-type), or a specific correction value, depending on the computed North/East coordinates of each surveyed point (**Inclined plane** sub-type). This transformation requires at least two “pairs of points” (see definition below).
- **Horizontal+Vertical adjustment:** The initially selected coordinate system will possibly be scaled, translated and rotated horizontally. Elevation will be corrected, applying either a constant value for every computed position (**Plane transform + Constant** sub-type), or a specific correction value, depending on the computed North/East coordinates of each surveyed point (**Plane transform + Inclined plane** sub-



type). This transformation requires at least two “pairs of points” (see definition below).

- **Single point:** This method does not make any changes to the initially selected coordinate system but saves a position deviation, which Survey Mobile will apply to all the points you will measure subsequently.

This method is particularly well suited if you choose to install the base at an unknown location (free base installation) and there is a control point available on site.

With this method, the calibration consists in defining a single pair of points through which the known local coordinates of the control point (target point) will be compared to those measured with the rover occupying this point (original point). The result of the calibration will be a position deviation, with its three components: North, East, and Elevation offsets.

By accepting the calibration result, you will agree to let Survey Mobile apply the position deviation to all the points you will measure subsequently, and save the corrected positions to the job.

## What a “Pair of Points” is

This expression designates two sets of independent coordinates describing the location of the same point:

- The first set of coordinates consists of local NEE coordinates, expressed in the still unknown local coordinate system (which the calibration procedure is about to determine). In Survey Mobile, this set of coordinates is designated as the “target point”.
- The second set of coordinates consists of GNSS (WGS84) coordinates, as determined by a GNSS receiver placed on this point. In Survey Mobile, this set of coordinates is designated as the “original point”.

Typically, “target points” are points measured in a previous survey session and stored in the job, whereas “original points” will most probably be points you will survey during the calibration procedure to build your pairs of points.


It is therefore assumed that some points in the working area have already been surveyed (their positions are expressed in NEE coordinates and are stored in the job) and you can occupy these points for a second time (i.e. these are points marked in the field).

## Running a Calibration


Calibration is therefore a three- or four-step procedure during which you will:

- Choose the suitable calibration method.
- Build the required pair, or pairs, of points.
- Allow Survey Mobile to determine the calibration values.
- For the first two methods only, name the resulting local coordinate system and make it the new system used in the job.

After running Survey Mobile and making sure your GNSS receiver is running, follow the instructions below to perform a calibration:

- In Survey Mobile's main menu, touch , and then **Site Calibration**.
- Touch **Calc. type** and select the method that best suits your case of use. Then if appropriate, use the **Calc. sub-type** field to complete the choice of the method you wish to use (see *Calibration Methods on page 48*).

NOTE: If you choose the single point method, you may need to touch the **Cancel** button to zero the North, East and Elevation offsets (shown at the bottom of the screen). If these fields are not "0.000", that means a single-point calibration was run previously and the result of this previous calibration should be cleared before you start a new one.


- Build the required pair or pairs of points as follows:
  1. Select a target point: In the **Target point** column, touch **Input** in the **Pt.** field and select the point name from the scroll-down list (This point should have been stored in the job beforehand).
  2. Surveying the original point: Head for the corresponding point in the field.
  3. When you are exactly on the point, touch  to save the current position, as computed by the GNSS receiver. The point's coordinates appear in the fields underneath (these may be either WGS84 LLH or WGS84\_XYZ (ECEF) coordinates).
  4. Use the **Input** field nearby to name the point. It's a good idea to name the point in relation to the target point name (e.g. "PT100\_GNSS if the target point name is "PT100").

NOTE: The point may have been surveyed earlier during the current working session, in which case you

just have to select the corresponding point name from the scroll-down list.





5. Touch the big yellow **Add** button to save the pair of points.  
At this stage, and only if you chose the single-point method, you just need to touch the yellow **Apply** button to complete the calibration procedure.
6. For the other two methods, resume the previous five steps to add more pairs of points.

- When enough pairs have been added, touch  in the title bar so you can check the list of point pairs now part of the calibration process. If needed, you may edit a point to correct its definition: hold the finger pressed on the point definition and select **Edit**.

A large number of pairs will provide redundancy in the measurements allowing you to qualify the contribution of each pair in the calculation result. It may be useful to remove from the calculation all those pairs showing high residuals.

NOTE: To delete a point pair from the list, hold your finger pressed within the area of the point pair you want to delete until a menu pops up, then select **Delete**.

Then touch  to go back to the previous screen if you wish to add other pairs of points.

- Touch  to read the final list of point pairs.
- Touch the big yellow **Calculate** button to let Survey Mobile determine the transformation parameters.

Survey Mobile then displays the result of the calculation. See example below.

Plane transformation	
Origin North	6243568.6040m
Origin East	1359185.6146m
Shift North	0.0052m
Shift East	0.0532m
Rotation	-000°00'13.892636"
Scale	0.99999401
View residual and RMS	
Inclined plane	
Origin North	6244399.9978m
Origin East	1359149.9974m
Slope North (PPM)	82.8764520600366
Slope East (PPM)	85.6372533553223
Constant	0.0010m
View residual and RMS	
Apply	


- Touch the big yellow **Apply** button to accept the new coordinate system. A warning message asks you to confirm your choice. Touch **OK** if you agree.
- Name the new coordinate system and touch **OK** to complete the calibration procedure.

Setting a base is a two-step procedure:

- First you choose the format in which the base will generate its corrections (7 different formats possible) and the means used to deliver its corrections. Survey Mobile offers two different options to deliver RTK corrections:
  - **RTK Radio:** Corrections are broadcast using a radio transmitter. The radio transmitter is connected to the GNSS receiver used (see *RTK Radio on page 53*).
  - **Network single base:** Corrections are delivered via an IP connection using the Direct IP protocol (see *Network Single Base on page 54*).
- Second, you enter the different parameters specific to the base:
  - **Antenna type:** A read-only field where you can read the name of the connected GNSS receiver.
  - **Measure to:** Indicate the point on the antenna used as reference for specifying the antenna height.
  - **Antenna height:** Distance measured from antenna reference point (defined above) to ground.
  - **Base index:** Base identification number
  - **Base site:** Base name
  - **Type of coordinates:** Choose the system in which the known base location is expressed. Available systems are WGS84\_LLH, Grid\_NEE and WGS84\_XYZ.
  - **Coordinates:** Enter the known coordinates of the base location. Coordinates may be “Latitude, Longitude, Height”, “North, East, Elevation” or “XYZ”, depending on the chosen coordinate system.

### RTK Radio

After activating the Bluetooth connection to the receiver (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*), do the following:


- Touch  and then open the **Base** tab.
- Enable the **RTK Radio** check box within the **RTK Radio** field and then touch this field. This opens the **RTK Radio** screen.
- Complete these fields:
  - **Link type:** Type of radio used on GNSS receiver side.

If the radio is embedded in the GNSS receiver, select “**Internal radio**”. If it’s separate from the GNSS receiver, select “**External radio**”.

- **Radio frequency:** Only if “**Internal radio**” is selected. Select the frequency you are allowed to use. This frequency should be chosen from the list of available frequencies.
  - **Broadcast format:** Choose a format to broadcast corrections. This can be: RTCM3.0, RTCM3.2, CMR, CMR+, ATOM standard, ATOM compact or ATOM super compact.
  - **Port, Baud rate, Data bits, Parity, Stop bits:** Needed only if an external radio is used. Tell Survey Mobile which port on the GNSS receiver is used to communicate with this radio. Enter the different parameters used in the serial connection between the GNSS receiver and the radio.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.
  - Touch **Start** and wait until a message tells that the base is operating.
  - Stop the Bluetooth connection between Survey Mobile and the GNSS receiver (see *Mettre fin à la connexion Bluetooth* on page 50), and let the base operate on its own.

## Network Single Base


After activating the Bluetooth connection to the receiver (see *Connecter Survey Mobile à un récepteur via Bluetooth* on page 14), do the following:

- Touch  and then open the **Base** tab.
- Enable the **Network Single Base** check box within the **Network Single Base** field and then touch this field. This opens the **Network Single Base** screen.
- Complete these fields:
  - **Link type:** Choose “**Internal Internet**” for SP80.
  - **Protocol type:** Choose “**DirectIP**” (“**NTRIP**” is not supported in this case).
  - **IP, Port:** Enter the base IP address.
  - **User, Password:** Enter your credentials allowing you to receive corrections from the base.
- Touch the big yellow **OK** button to save all the entered parameters. This takes you back to the previous screen.

- Touch **Start** and wait until a message tells that the base is operating.
- Stop the Bluetooth connection between Survey Mobile and the GNSS receiver (see *Mettre fin à la connexion Bluetooth* on page 50), and let the base operate on its own.

NOTE: SP60 cannot be used as a network single base.

## Stopping a Base

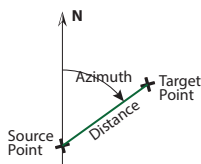
- At the end of your survey, go back to the base with you Android device.
- Establish a Bluetooth connection with the base (see *Connecting Survey Mobile to a Receiver via Bluetooth on page 14*)
- Touch  and then open the **Base** tab.
- Touch the **Stop** button.

## COGO Functions

Survey Mobile offers three distinct COGO functions:

### 1. Calculating the coordinates of a point:

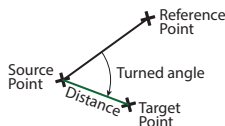
- **By distance and azimuth:** Calculating a **target point** by giving its azimuth and distance from a **source point**. The **source point** may be a known point, picked from the open job, or the current position of the receiver.



Touch **Calculate** after specifying all the input parameters. The coordinates of the resulting point are then displayed in the lower part of the screen.

If you want to save the resulting point, check on **Save** before touching **Calculate**. In that case, you will have to name the point before Survey Mobile can determine the target point coordinates.

- **By distance and turned angle:** Calculating a **target point** by giving a turned angle and a distance from a **source point**. The turned angle is given with respect to the line passing through the **source point** and a **reference point**. The source point and reference point may be known points, picked from the open job, or the current position of the receiver taken successively at two different locations.



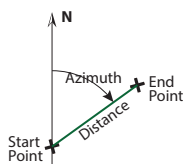
Touch **Calculate** after specifying all the input parameters. The coordinates of the resulting point are then displayed in the lower part of the screen.

If you want to save the resulting point, check on **Save** before touching **Calculate**. In that case, you will have to name the point before Survey Mobile can determine the target point coordinates.

### 2. Calculating the distance and azimuth between two points.

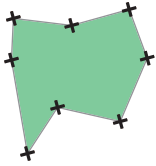
The **start point** and the **end point** may be any two points from the open job, or the current position of the receiver taken successively at two different locations.

Touch **Calculate** after specifying all the input parameters. The results are then displayed on the screen.





3. Calculating a 2D area or perimeter by specifying all the points making up the closed shape. When selecting this function, the screen shows the complete list of points stored in the job.



- First select each of the points making up the closed shape. You can select/deselect each point one after the other, or possibly select/deselect them all in one operation.

The shape is drawn in the order the selected points are listed, starting from the top of the list, down to the bottom of the list. A segment is drawn to close the shape from the last selected to the first selected point. As explained below, you may change the position of each point in the list, thus changing the geometry of the closed shape.

- To change the position of a point in the list, tap and hold the point name then select one of these options, depending on what you want to do: **Move up**, **Move down**, **Move up by N rows**, **Move down by N rows**. If you select one of the last two options, you must then indicate the size of the jump (from the current row to the desired row).
- Touch **Calculate** after specifying all the points. (Points are listed in the order they were collected.)

The resulting area and perimeter are then displayed in the lower part of the screen. This is a basic function because you cannot re-arrange the list of points that would allow you to control the way the closed shape is built.

## Other Import / Export Functions

Survey Mobile offers import/export functions other than those described in *Importing Points into the Open Job on page 9* and *Exporting Points from a Job on page 11*.

The other import functions available in Survey Mobile are:

- **Importing a Survey Mobile coordinate system file** (in scs format).

By default, the coordinate system imported in Survey Mobile will have the same name as that of the imported scs file, but you can enter a different name if you wish.

- **Importing a Trimble JobXML file** (in jxl format).

Importing this type of file will result in a new job created and opened in Survey Mobile. You need to name the job before you are allowed to import the jxl file.

- **Importing a Trimble road design file** (in rxl format).

Importing this type of file will result in a new road created in Survey Mobile, with the same name, or a different name if you specify one.

See also *Importing a Road on page 65*.

- **Importing AutoCAD files (in dxf format)**. See *Adding Background Maps on page 60* for more details.

NOTE: The files you wish to import should always be moved to the following folder before you can import them:


Internal memory/SurveyMobile.Droid/Import/  
or  
SD memory card/SurveyMobile.Droid/Import/

After moving a file to one of this folder, its name can be seen under the **Import** button so you can select it for import.

And the other export functions are:

- **Exporting points from the open job to a South CASS point file** (in dat format). Just name the export file and touch the **Export** button.
- **Exporting points from the open job to an SPSO survey data file or TBC survey data file** (both in dxf format). You need to specify the DXF version (R10, R11 or R12) and name the export file before touching the **Export** button.
- **Exporting a custom coordinate system from Survey Mobile**.

Select the custom coordinate system you want to export.

You may touch  to view the main properties of the selected coordinate system.

By default the exported file will have the same name as that of the selected coordinate system, but you can enter a different name if you wish.

When you are ready, touch **Export**.

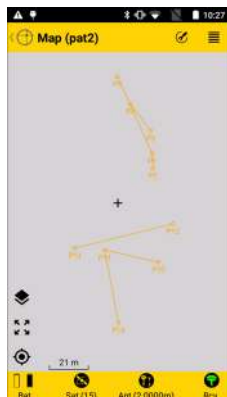
- **Exporting a job as a Trimble JobXML file** (in jxl format).  
By default the exported job will have the same name as that of the open job, but you can enter a different name if you wish.
- **Exporting a road to a Trimble design file** (in rxl format).  
First select the road you want to export before touching the **Export** button. By default the exported road will have the same name as that of the selected road, but you can enter a different name if you wish.
- **Exporting the parameters of a static survey in txt format**.  
First name the export file and then touch **Export**.  
The file will contain the occupied point name and code, the start time and duration of the static survey, the log interval used and the antenna parameters used.

NOTE: All exported files can be found in one of the following folders:

Internal memory/SurveyMobile.Droid/Export/  
or  
SD memory card/SurveyMobile.Droid/Export/

## Adding Background Maps

### Introduction



Survey Mobile allows you to display background maps resulting from importing DXF files to a job.

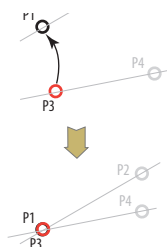
Background maps are shown orange on the job's map view (see legend on *page 23*). Survey Mobile supports the following objects from imported DXF files:

- Points
- Lines and polygons
- Circles and arcs

When importing a DXF file, Survey Mobile will first ask you to specify which distance unit is used in the file and suggest that you preview the file before actually importing it.

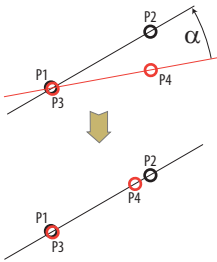
Where the background map will be located on your job's map view will depend on how you defined the XYZ coordinates of the objects in the DXF file:

- If these XYZ coordinates are consistent with the coordinate system used in the job, then the objects will appear on the map view at their accurate locations. In that case, using the so-called “original orientation” for the background map will allow Survey Mobile to correctly locate the objects of the background map on the job's map view.
- If the coordinates are not consistent with the coordinate system used in the job, corrections will be needed to adjust the locations of these objects on the job's map view. Corrections will include translating and/or rotating the objects in the horizontal plane. In that case, you will need to select “adjusted orientation” to accurately show the objects on the map view.



But before the “Adjusted orientation” option is a valid choice in Survey Mobile, you will need to take these additional steps using four different points (P1-P4):

- Associate one point from the job (P1) with one point from the DXF file (P3), thus requesting that these two points be the same point on the job's map view. As a result, Survey Mobile will compute and apply the amount of horizontal translation required from the background map to make this happen.

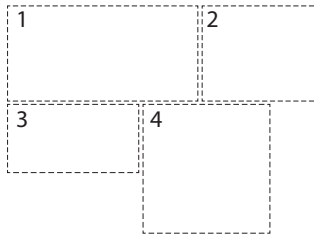


- Associate another point from the job (P2) with another point from the DXF file (P4), thus requesting that the background map be rotated by an angle whose value is given by the direction of segment [P1P2] and the direction of segment [P3P4].





NOTE: Survey Mobile will NOT re-scale the DXF objects to merge points P2 and P4 into one single point.

As a result, Survey Mobile will compute and apply the amount of horizontal rotation required from the background map to make this happen.

You may import as many DXF files as you want. Importing several DXF files to cover your working site makes sense when the resulting background maps only cover different though adjoining parts of the site (see background maps 1-4 below).

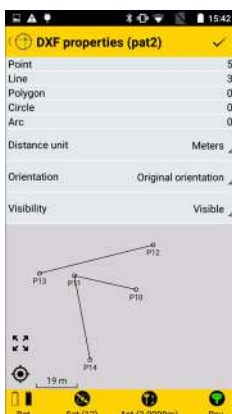


## Importing DXF Files



- Copy your DXF files to “/SurveyMobile.Droid/Import/”.
- Follow one of these two steps to access the “Import DXF” function:
  - In Survey Mobile’s main menu, touch  and then **Background maps**.
  - Or within a survey function<sup>(1)</sup>, touch  then .
- Touch . The lower part of the screen displays the list of DXF files stored in the “Import” sub-folder.
- Select one of these files and then touch the big yellow **Import** button.
- From the now displayed drop-down list, select the distance unit used in the DXF file and then touch **Continue**.

1.Except for “Static survey” and “Stop&Go survey”.

- Before actually importing the DXF file, you may preview its content: Touch **Preview**.






The preview includes the following information:

- Type and number of objects per type in the file
  - **Distance unit:** Distance unit used (may be changed)
  - **Orientation:** Only **Original orientation** can be selected at this stage as **Adjusted orientation** requires further steps (see *page 62*) to be usable.
  - **Visibility:** An imported DXF file may be made visible or invisible on the map view. Select the desired option.
  - Graphic view of the various objects found in the file, including the names of the points.
- Touch  or  to continue.
  - Touch **OK** to complete the import, or touch **Cancel** to abort.

## Adjusting the Orientation of a Background Map

After importing a DXF file to Survey Mobile, do the following:

- Follow one of these two steps to access the properties of the imported DXF file:
  - In Survey Mobile's main menu, touch  and then **Background maps**.
  - Or within a survey function<sup>(1)</sup>, touch  then .

The list of imported files is now displayed.

- Hold your finger pressed on the name of your DXF file and then select **Adjust orientation**.

1.Except for "Static survey" and "Stop&Go survey".

You are then invited to specify the first pair of points.

- Pick one point from the job (left), and the other from the background map (right):



: Use this button to select the point from a list.



: Use this button to make a graphic selection of a point on the map.



: Use this button to measure a new point whose coordinates will describe your current location.



: Use this button to create a new point in the job by entering its name and coordinates.


Keep in mind that you associate these two points because you want them to occupy the same location on the job's map view (see also *page 60*).

- Touch **Add**. You can now see your pair of points listed underneath this button. If you've made a mistake when creating the pair, you may hold a finger pressed on the pair and select **Edit** or **Delete** respectively to modify or delete the pair.
- The top of the screen still inviting you to enter a pair of points, pick another point from the job (left) and then another from the background map (right).

Keep in mind these two points are associated to determine the rotation angle to be applied to the background map so it correctly appears on the job's map view (see also *page 60*).


- Touch the big yellow **OK** button. A message is returned to indicate that computing the adjusted orientation was successfully completed.

At this point, you can preview the background map according to the adjusted orientation (choose **Preview**), directly accept the adjusted orientation (choose **OK**) or reject the computation (choose **Cancel**).

If you select **Preview**, touch  after you have checked the resulting background map to return to the above menu where you can select **OK** or **Cancel** to respectively accept or reject the adjusted orientation.

Once you have accepted the adjusted orientation, you can go back to the job's map view where you will see the background map shown in orange color.

## Other Functions Connected to Background Maps

In Survey Mobile's main menu, touch  and then **Background maps**. This displays the list of background maps currently used in the job. Hold your finger pressed on any of them to open the following popup menu:



The following functions can be selected from this menu:

- **Adjust orientation:** Allows you to ask Survey Mobile to determine an adjusted orientation for the selected background map (see theory on *page 60* and step-by-step instructions on *page 62*). If you select this function while an adjusted orientation has already been computed, then Survey Mobile will automatically delete the previously computed orientation so you can compute a new one.
- **Edit:** Allows you to review the properties of the selected background map, and possibly change some of its parameters: distance unit, orientation (original or adjusted) and visibility (visible or invisible).
- **Delete:** Deletes the selected background map. This does not delete the imported DXF file from which it originates.
- **Up/ Down:** Allows you to rearrange the order in which your background maps appear in the list of background maps used by the job.



## Introduction to Roads in Survey Mobile

Survey Mobile offers an entry-level road module, with the following three main functions:

- **Importing road projects in rxl format** (Trimble road design files).
- **Staking out roads**, in a much similar way as you stake out lines in Survey Mobile.

Survey Mobile will guide you successively to points along the road (along the centerline, the right or left edge or at some distance from the centerline), with the possibility to save the staked out points to the open job, which incidentally will provide the coordinate system in which all computed positions and saved points will be expressed.

- **Creating roads**. Each road will be defined by a horizontal alignment, a vertical alignment and a cross section.


## Importing a Road

- Move the rxl road file you want to import to the following folder:

Internal memory/SurveyMobile.Droid/Import/


or

SD memory card/SurveyMobile.Droid/Import/

- In Survey Mobile's main menu, touch  and then **Import**.
- Touch **Trimble road design (\*.rxl)**. A new screen appears listing all the rxl files stored in the Import folder.
- Check on the file you want to import.
- If required, complete the **Road name** field if you want the road resulting from the import to have a name different from that of the imported file. If you leave that field blank, the road name will be the same as that of the imported file.
- Touch the big yellow **Import** button to import the file in Survey Mobile.

NOTE: Survey Mobile only supports the clothoid spiral as transition, and only one cross-section for an entire road, meaning the cross section can only be made up of a single width and slope on each side of the road's centerline.

## Staking Out a Road


- In Survey Mobile's main menu, touch  and then **Stake out road**. Confirm or correct the antenna parameters then tap **Continue**. Survey Mobile opens a new screen from which you can select and stake out a road.


The upper part of the screen shows the coordinates of your current position – as computed by the GNSS receiver – as well as accuracy-related figures (horizontal/vertical accuracies, PDOP) and the position computation status (solution type, correction age).



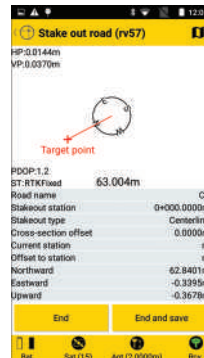
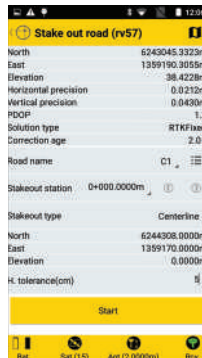
Stake out road (rv57)	
North	6243045.0225m
East	1359190.3584m
Elevation	38.1768m
Horizontal precision	0.0212m
Vertical precision	0.0430m
PDOP	1.3
Solution type	RTKFixed
Correction age	2.0 s

- Touch the **Road name** drop-down list to select the road you want to stake out.

Still in this field, you may touch  to access the entire list of existing roads and then touch any of them if you want to read its full definition.

- After selecting a road, choose where to start staking out, compared to the beginning of the road (**Stakeout station**).  
(Touch  to adjust this parameter.)
- Set the **Stakeout type** field allowing you to choose which part of the road you want to stake out: the centerline, the right or left edge of the road, or at some distance (**custom offset**) from the centerline. With the latter option, you should then enter the desired value of offset (**cross-section offset**).
- Set the horizontal tolerance (**H. tolerance**, expressed in centimeters, 3 cm by default; If you change this value, it will be prompted by default for the next road you will stake out). Points along the road project will be staked out only if the horizontal precision on the position solution is below this tolerance.
- Touch **Start** to begin (or press **Volume-**). The screen then shows a compass giving the direction to the first point of the road. The lower part of the screen also shows in real

time the North, East and vertical components of the distance to go to reach the point (see below left).



- Walk in that direction, watching on the screen the values of these components as you move forward to the point. When you are exactly on the point, the screen looks like the one above right (note that when the computed coordinates turn green, you are within the expected tolerance and allowed to stake out the point).
- Dig a stake into the ground to mark the point.
- Touch **End and Save** (or press **Volume+**) if you want to proceed with the next point and save the position solution currently provided by Survey Mobile for the staked out point. The following name will be automatically assigned to the point:

**<road name>\_<stakeout\_station>\_<time>\_stakeout**


Where time is HHMMSS (for "hours, minutes, seconds").

Example:

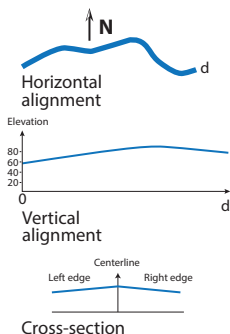
**R1\_100\_103200\_stakeout**

Describes a point staked out at station "100" at 10:32 and is part of the road named "R1".

Touch **End** if you just want to proceed with the next point without saving that position.

- Touch  to select the next point along the road and then repeat the present procedure until the road has been entirely staked out.

## Creating a Road



## Introduction

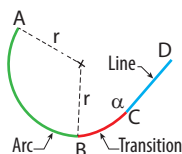
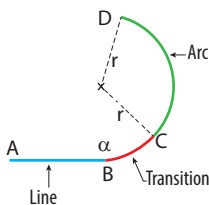
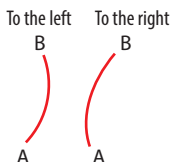
A road is defined by:

- A *horizontal alignment*, which shows the shape of the road centerline, as you would see it on a geographical map.
- A *vertical alignment* (or longitudinal section), which describes the vertical profile of the road along the road's horizontal axis.
- A *cross-section alignment*, which describes the road, as seen on a plane perpendicular to the longitudinal axis of the road.
- A *distance interval*, which tells Survey Mobile how accurate you want the road to be staked out.

## Horizontal Alignment

The horizontal alignment (or centerline) may be defined using two different methods (which cannot be combined):

1. By specifying in turn each of the elements making up the road, starting with the definition of a start point for the road as well as an azimuth to orientate the first element. Geometrically speaking, an element may be a straight line, an arc or a transition.



- A *line* is defined by a length.
- An *arc* is defined by a length, a direction (left/right; see illustration) and a radius.
- A *transition* is a curve with changing radius allowing smooth connection between two elements.

A transition is therefore defined by a length, a direction (left/right), a start radius and an end radius.

In the first example, the start radius of the transition (at point B) should be set to infinite ( $\alpha$ ) and the end radius (at point C) should be equal to "r", i.e. the radius of the arc element that follows the transition.

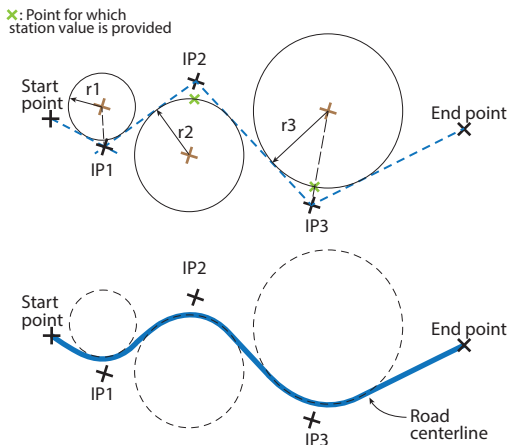
Conversely, in the second example, the start radius of the transition (at point B) should be equal to "r", i.e. to the radius of the arc element that precedes the transition, and the end radius (at point C) should be set to infinite ( $\alpha$ ) to make a smooth connection with the line element that follows.

2. By specifying in turn the start point of the road, a number of intersection points and the end point of the road:
  - The start point is defined just by its North and East coordinates (no radius required), or it can also be an existing point picked from the list of imported or surveyed points.

- Intersection points are also defined by their North and East coordinates. If only these two fields are filled in for an intersection point, then the road is extended by a straight line from the previous point to this one. If you add a circle radius in the definition, then the road takes a turn that follows the circle tangent to the direction given by the intersection point and the previous intersection point, and the direction given by this intersection point and the next one. Additionally you may specify two distances (LS1 and LS2) to smooth the shape of the road at the connection points (in the same way as you would define transitions in the first method).
- The end point is defined just by its North and East coordinates (no radius required).

NOTE: You will be requested to enter a **Station** value for each intersection point you define. This parameter indicates the curvilinear distance of the road from the start point to the intersection point being defined (more exactly to the point on the road resulting from the intersection of the road with the segment joining the intersection point to the center of the arc; see diagram below). It is admittedly a redundant parameter when a straight line is generated, but not when it's an arc. So this parameter must be defined for every intersection point you define.

The diagram below is a simple example of a road defined using intersection points (noted "IPx" on the diagram).



Start point: North and East coordinates, station

IP1: North and East coordinates, circle radius ( $r_1$ ), station: Straight line + arc generated

IP2: North and East coordinates, circle radius ( $r_2$ ), station: Straight line + arc generated

IP3: North and East coordinates, circle radius ( $r_3$ ), station: Straight line + arc generated

End point: North and East coordinates, station: Straight line generated.

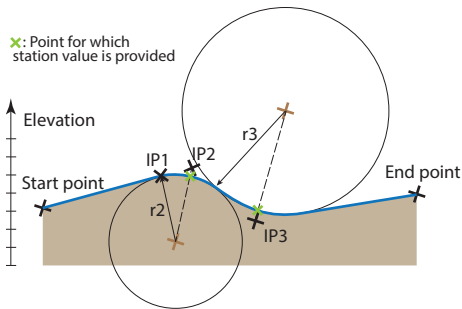
## Vertical Alignment

The vertical alignment (or longitudinal section) is defined a bit the same way as the horizontal alignment, when defined using the second (“intersection point”) method. The vertical alignment consists of:

- The start point is defined by a **slope station** and a **slope elevation** (no radius required).
- Intersection points are also defined each by their own **slope station** and **slope elevation**. If no circle radius is specified, the vertical alignment will be a straight line connecting the elevation from one point to that of the next one (see diagram below).

But if you add a circle radius in the definition, then the elevation will follow an arc, a concave one if the elevation for the point is greater than that of the previous point, or a convex one otherwise.

- The end point is defined just by a **slope station** and a **slope elevation** (no radius required).



NOTE : You cannot define transitions in a vertical alignment.

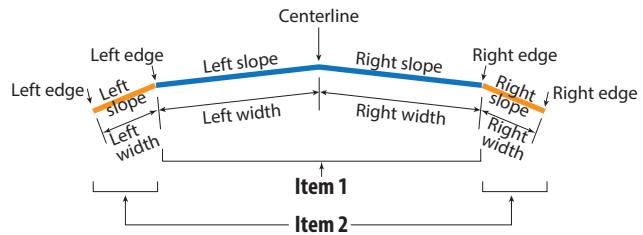
## Cross-Section

An item of road cross-section is defined by:


- A left width, a right width (distance).
- A left slope and a right slope (in %).

The two parts of the item, located on either side of the centerline, may be made symmetrical by setting **Left = Right**.

Defining a second item will result in creating a cross-section that will look like the one shown on the diagram below.



## Step-by-Step Procedure


- In Survey Mobile's main menu, touch  and then **Define road**.
- Enter a road name.
- Define the horizontal alignment by entering successively elements or intersection points. After you have chosen a method, you cannot switch to the other, unless you define another new road. Touch **Add** after defining each element or intersection point.

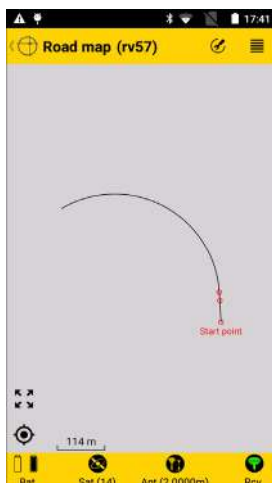
Elements or intersection points show up in the lower part of the screen as you add new ones.


By holding a finger pressed on one of them in that list, you will access a popup menu allowing you to edit, delete or move up or down this item.

If you select **Edit**, Survey Mobile will bring up the definition of the item in the upper part of the screen for modification. Then touch **OK** after you have made your changes to save the modified item.

If you are defining elements, the popup menu will also include an **Insert** option allowing you to insert a new element before the selected one.


You may touch  after adding each element or intersection point to see what the horizontal alignment looks like (see example below).



Touch  when you are done with the horizontal alignment.


- Define the vertical alignment. Intersection points are listed in the lower part of the screen as you add new ones. These can be edited, deleted or moved up or down as explained for the horizontal alignment.

NOTE: Survey Mobile does not provide a view of the vertical alignment.

Touch  when you are done with the vertical alignment.

- Define the cross-section alignment. If the road cross-section is symmetrical, enable the **Left = Right** check box before starting. Any left width or slope you will define will then be replicated symmetrically on the right (or the other way round). If the road cross-section is not symmetrical, disable the **Left = Right** check box and enter separately the description of the left and right sides of the cross-section alignment.

Add as many cross-section items as necessary.

Touch  when you are done with the cross-section alignment.




- Define the distance interval. This parameter will be used when staking out the road to let Survey Mobile determine the next point to be staked out along the road.
- Touch **Create** to save the road definition. Survey Mobile first checks the consistency of the road definition before the road is effectively saved.


If inconsistencies are detected in the entered **Station** values, you are prompted to let Survey Mobile recalculate them using the first or the second point in the road as the point having the right station value (sometimes the station value for the first point is unknown).

### Checking/Editing a Road


This function is used to determine the coordinates and azimuth of any point on the road from a known **Station** value. This can be done while creating a road (just before or after saving the road) using directly the **Check road** button, or later by editing the road:

- In Survey Mobile's main menu, touch  and then **Roads**. Survey Mobile displays the list of existing roads.
- Hold a finger pressed on the name of the one you want to check and then select **Edit** from the pop-up menu.
- Touch the yellow **Check road** button.
- Enter a **Station** value in the last field and then touch the big yellow **Check** button. As a result, Survey Mobile provides the coordinates and azimuth of the corresponding point on the road.



- Touch  when you are done with this function.
- From there you can edit any of the existing alignments and then touch the **Save** button to save all the changes made to the road.

## Deleting a Road

- In Survey Mobile's main menu, touch  and then **Roads**. Survey Mobile displays the list of existing roads.
- Hold a finger pressed on the name of the one you want to delete and then select **Delete** from the pop-up menu. The road is then deleted right away.

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