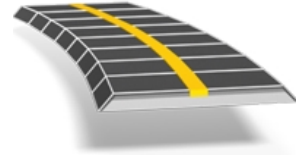


HELP



Trimble Access™

Roads



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Trimble Inc.

www.trimble.com

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Introduction Roads

Use the Trimble® Roads software to:

- Define your road:
 - Upload a Trimble, GENIO, or LandXML road definition.
 - Key in a road definition including horizontal and vertical alignments, templates, and superelevation and widening records.
 - Review the road (in 3D if using a Trimble tablet).
- Survey your road:
 - Stake a station on a string.
 - Measure your position relative to a string.
 - Measure your position relative to a road.
 - Stake a side slope.
 - Apply construction offsets.
 - Redesign in real time.
- Report your road:
 - Generate a report for surveyed road data on the controller while in the field.
 - Use these reports to check data in the field, or to transfer data from the field to your client or to the office for further processing with office software.

Road definition types

The Trimble Roads software supports the following road formats:

- [Trimble](#) roads
- Roads derived from a [LandXML](#) file
- Roads derived from a [GENIO](#) file

Trimble roads

Trimble roads can be:

- Defined by keyed-in components
- Uploaded from Trimble Business Center software.

- Uploaded via Trimble Link from a number of third party design packages including Autodesk Land Desktop, Autodesk Civil 3D, Bentley Inroads, and Bentley Geopak.

If you have a DC file that includes a road definition, convert the road to an RXL file. To do this, from the *Jobs* menu select *Import/Export / Import fixed format*.

Keyed-in roads are saved to the current project folder as 'road name'.rxl. Trimble roads are available for all jobs saved to the current project folder.

To use a file saved to the current project folder in another project, use Windows Explorer to copy or move the file to the appropriate project folder.

For more information on defining a Trimble road, see [Trimble roads](#).

LandXML files

LandXML files that define a road can be exported from a number of third-party road design software packages.

To use a LandXML file in Roads copy the file to the appropriate project folder on the controller. LandXML files are available for all jobs saved to the current project folder.

To use a file saved to the current project folder in another project, use Windows Explorer to copy or move the file to the appropriate project folder.

Before stakeout, you can review roads in a LandXML file using all the editing tools available for Trimble roads. If you edit the road definition, the road is saved as an RXL file. The original LandXML file remains in the current project folder.

For more information on reviewing and editing a road from a LandXML file, see [LandXML roads](#).

GENIO files

GENIO files that define a road can be exported from a number of third party road design software packages, including Bentley MXROAD and [12D Model](#).

The file extension for the GENIO file must be *.CRD, *.INP, or *.MOS. Files with the extension MOS are exported from [12D Model](#).

To use a GENIO file in Roads copy the file to the appropriate project folder on the controller. GENIO files are available for all jobs saved to the current project folder.

To use a file saved to the current project folder in another project, use Windows Explorer to copy or move the file to the appropriate project folder.

A GENIO file consists of a number of strings. When you define a road you select the appropriate strings from the GENIO file. The road name and the names of the selected strings are saved as a comment to the end of the GENIO file.

Note – *Because GENIO files do not include the units for the values in the file, you must configure the appropriate units for the GENIO file you are working with in the job.*

For more information on defining a road from a GENIO file, see [GENIO roads](#).

Roads software menus

From the Trimble Access menu tap Roads to:

- Manage your jobs

Create jobs, review job properties and data, view the map and import and export files.

For more information, see [Managing jobs](#).

- Define your road

For more information on defining:

- A Trimble road, see [Trimble roads](#).
- Roads from LandXML files, see [LandXML roads](#).
- Roads from a GENIO file, see [GENIO roads](#).

- Survey your road

For more information on surveying:

- A Trimble road, see [Trimble roads](#).
- Roads from LandXML files, see [LandXML roads](#).
- Roads from a GENIO file, see [GENIO roads](#).

- Report your surveyed road

Generate a report for surveyed road data on the controller while in the field. Use these reports to check data in the field, or to transfer from the field to your client or to the office for further processing with the office software.

When defining, surveying and reporting your road the road file must be in the same folder as the current job.

Further information

The contents of this file are installed on the controller with your application.

For information that extends or updates this Help, refer to the *Trimble Access Release Notes*. Go to <http://apps.trimbleaccess.com/help> to download the latest PDF file of the *Trimble Access Release Notes* or help file for each Trimble Access application.

Tip – For links between the Trimble Access application help PDF files to work, download PDF files to the same folder on your computer and do not change any of the file names.

To use this application with other applications, see [Interacting with other applications](#).

Interacting with other applications

You can run more than one application at a time and easily switch between them. For example, you can switch between functions in *Roads*, *Tunnels*, *Mines*, and *General Survey*.

To run more than one application at a time, use the Trimble button or Trimble icon in the top left corner of the screen to open the Trimble Access menu. From there, you can run the other application.

To switch between applications:

- Tap the Trimble button in the task bar to access the menu of available applications and services currently running, including the Trimble Access menu. Select the application or service to switch to.
- On the TSC3 controller, a short press of the Trimble button accesses the menu of available applications and services currently running, including the Trimble Access menu. Select the application or service to switch to.
- On the Geo7X/GeoXR controller, tap the Trimble button to access the menu of available applications and services currently running, including the Trimble Access menu and the *Windows Start Menu*.
- On the Trimble Slate controller, tap the Trimble button to access the menu of available applications and services currently running, including the Trimble Access menu.
- Tap *Switch to* and then select the required function from the list. If the *Switch to* button is not on your current screen, press **CTRL W** to open the *Switch to* pop-up list.
- Press **CTRL TAB**. This is the keyboard shortcut to scroll through the current list of *Switch to* functions.
- Tap *Favourites* or press **CTRL A** to select a preconfigured favorite.
- On a controller that has application/function keys, configure the appropriate key for the function you want to run. This method opens an application even if that application is not running.

For more information, see General Survey buttons.

Define Roads

Define menu

Tap *Define* to:

- define, edit, and review a Trimble road
- edit and review a LandXML file
- define a road from a GENIO file

To customize the language used in the Roads software, from the main Trimble Access menu select *Settings / Language* and then select:

- *Use railroad terminology* if you are surveying a railroad and wish to use railroad-specific terminology.
- *Use chainage distance terminology* to use the term *Chainage* instead of *Station* for the distance along the road.

Trimble roads

Use the *Define* option to:

- Define a road by entered components, or edit an existing road
- Define a road from selected entities in the map
- Review a road

Defining or editing a road

1. Tap *Define*.
2. Tap *New* and enter a name for the road. (To edit an existing road, highlight the road name and tap *Edit*.)

Tips

- To copy an existing road definition with all its components into the current road, tap *Copy*.
 - To configure the software to return to the *Select a file* screen when exiting the *Define* menu instead of to the main Roads menu, tap the arrow to access the second row of softkeys and then tap *Options*.
3. Choose a component to define:

- Horizontal alignment
- Vertical alignment
- Templates
- Template positions
- Superelevation and widening
- Station equations
- Additional strings
- Additional points

4. Tap *Store* when all components have been defined.

Defining a road from the map

You can also define a road from the map by selecting points, lines, or arcs or by selecting line work contained in DXF, STR, SHP, or LandXML files.

1. Tap *Define*.
2. Tap the *Map* softkey to display the map.
3. Tap the entities that you wish to use to define the horizontal alignment of the road. If the entities have elevations these will be used to define the vertical alignment of the road.

Tips

- The order in which points are selected and the direction of the lines and arcs is very important as this defines the road direction.
 - If selecting line work contained in DXF, STR, SHP, or LandXML files, tap the *Layers* softkey, select the file and then make active the appropriate layer(s) that will be used to define the horizontal alignment.
4. From the tap and hold menu, tap *Store road*.
 5. In the popup screen enter a road name, start station, and station interval.
 6. Tap *OK*.

The defined road can now be edited from the *Define* menu, where you can add other components such as templates and superelevation.

Tip - You may have to re-enter the *Define* menu to select the new road.

See also Active map.

Tips when defining a road

From the *Select a file* screen you can:

- Tap the *Report* softkey to generate a report of the offset, coordinates, elevation, and code for each position in the cross section for the selected stations. The values reported are for the resolved cross sections, that is, they include any superelevation and widening values that may have been applied, and any interpolation between different templates.
- Use *Rename* and *Delete* to rename or delete a road definition.

- Tap *Options* to:
 - Specify a [scale factor for the road](#)
 - [Enable templates and additional points or strings](#)

Road scale factor

This functionality is a requirement for the Ministry of Transportation Quebec, Canada but may have application elsewhere.

The specified scale factor scales a road horizontal alignment definition but retains the original station values. When defining the road, all values are entered and appear as unadjusted values. The scale factor is applied to the length/radius values defining each element/curve when computing the coordinates for the road definition. When surveying and reporting the road, the station values are not adjusted by the scale factor.

- For a road defined by End coordinates or End points, Trimble recommends you do not change the scale factor after initial entry. Otherwise the scale factor rescales the alignment elements, and since the End coordinates / End point coordinates are not changed a change in station values must occur.
- For a road defined by PI (Points of Intersection), Trimble recommends you do not change the scale factor after initial entry. Otherwise the scale factor rescales the curve components, and since the PI coordinates are not changed a change in station values must occur.

Enabling templates and additional points or strings

Alignments, as defined in General Survey, are defined as .rxl files which is the same format as a Trimble road. Select the *Enable templates and additional points/strings* check box to add templates (including positioning the templates and applying superelevation and widening records) and additional points and strings to an alignment.

Notes

- *The Roads software treats all road distances, including station and offset values, as grid distances. The value in the Distances field (accessed from the Trimble Access menu by selecting Settings / Units Cogo / Cogo Settings) has no effect on the road definition or the way road distances are displayed.*
- *If a ground coordinate system is defined in the job, the grid coordinates are, in effect, also ground coordinates.*
- *Defined roads are saved to the current project folder as 'road name'.rxl. Roads are available for all jobs in the current project folder.*
- *To use a file saved to the current project folder in another project, use Windows Explorer to copy or move the file to the appropriate project folder.*
- *Alignment files are saved as .rxl files - the same format as Trimble roads.*
- *Alignments can be created or edited using Key in Trimble roads.*

Reviewing a road

The review option enables you to confirm the road definition.

This section describes reviewing the road for all controllers except tablets. Tablet controllers support reviewing the road in 3D view. For more information, see [Review a road in 3D](#).

1. Tap *Define*.
2. For a:
 - Trimble road, highlight the road name to review and tap *Edit*.
 - GENIO road, select the GENIO file and then highlight the road name to review and tap *Edit*.
3. Tap *Review*. For a GENIO road, *Review* is available from the second row of softkeys.

A plan view of the road is displayed.

The horizontal alignment/master string is shown as a red line. The red circles represent the positions defined by the station interval. The blue lines connect the cross sections/3D and 5D strings.

For a Trimble road:

- The rules for connection are described in the [example alignment](#). Values defining the selected position are displayed at the top of the screen.
- To understand how cross sections are connected when consecutive horizontal elements are non tangential, see [Non tangent horizontal alignment elements](#).

By default, the first station on the alignment/master string is selected. To select another station or string, do one of the following:

- Tap a position displayed on the screen.
- Tap and hold on the screen to select a station or string from the list.
- Depending on your controller, use the arrow keys or use the available softkeys.

Tip - Tap and hold on the pan softkey to make it active and then use the left, right, up, or down arrow keys on the controller to pan around the screen.

Note - *The position of a side slope is indicative only and for a Trimble road is shown by a dashed line.*

4. To view the cross sections, tap the icon at the bottom right of the screen or press the **Tab** key.

By default, the last position selected in the plan view is selected. To view the cross section at other stations, do one of the following:

- Tap and hold on the screen to key in a station or to select a station from the list.
- Depending on the controller model, do one of the following to select another station:
 - Press an up or down arrow on the controller keyboard.
 - Use the scroll bar to the right of the graphics window.
 - Tap the *Sta +/-Sta* - softkeys

To select another string, do one of the following:

- Tap the string displayed on the screen.
- Tap and hold on the screen to select a string from the list.
- Depending on your controller, press the left or right arrow on the controller keyboard or tap the *Left/Right* softkey to select another string.

The horizontal alignment/master string is shown as a red cross. The blue circles represent the strings defined by the template/the 3D and 5D strings. The line work preceding the selected

string is shown as a bold blue line. Values defining the selected string and the line preceding the string are displayed at the top of the screen.

Note - The Roads software supports reviewing a position defined by a nominal station value. That is, the station does not have to coincide with a cross section. To do this, from either the plan or cross section view tap *Station* and then key in a station value.

For a Trimble road you can key in a nominal offset value. That is, the offset does not have to lie on a string. To do this, tap *Offset* and then key in an offset. The offset is computed from the alignment. The elevation for the resultant position is defined by interpolation of the cross section at the entered station and offset.

Reviewing a road in 3D

If you are using Roads on a tablet controller, you can review a road in 3D. To review a road using a different controller, see [Reviewing a road](#).

3D review enables you to rotate the road to view it from different sides. Viewing the road in 3D is useful for confirming the road definition visually and, for a Trimble road, for visualizing the road relative to other road definitions such as a complex interchange or urban intersection.

1. Tap *Define*.
2. Highlight the road name to review and tap *Edit*.
3. Tap *Review*. For a GENIO road, *Review* is available from the second row of softkeys.

A plan view of the road is displayed.

The road surface is shown shaded and the horizontal alignment/master string is shown as a white dashed line.

The black solid circles represent the positions on the strings at each cross section.

The gray lines represent the strings and connect the cross sections. Values defining the selected position are displayed at the top of the screen.

For a Trimble road:

- To understand how cross sections are connected when consecutive horizontal elements are non tangential, see [Non tangent horizontal alignment elements](#).
- The rules for connecting cross sections are described in the [example alignment](#).

By default, the first station is selected. The current selected position is shown as a larger blue circle. To select another station or string, do one of the following:









- Tap a position displayed on the screen.
- Tap *Station* or *Offset* to select a station or string from the list.
- Press an up or down arrow on the controller keyboard to select another station, or press the left or right arrow to select another string.

Tip - For a Trimble or LandXML road where the horizontal alignment starts before or finishes after the vertical alignment, that portion of the horizontal alignment is drawn on the groundplane. Similarly for a GENIO road where only a portion of the master string has elevations, the portion of the master string with no elevations is drawn on the groundplane.

Tap the Options softkey to edit the groundplane elevation and move it closer to the road, if required.

- Use the map toolbar to navigate around the map and to change between views.



The functions are described in the following table:

Button	Function
Select 	Tap Select to select a position on the road.
Zoom in 	Tap Zoom in to zoom in. Tap and hold the button to make it active. When active, tap the area of the map to zoom in on, or drag to create a box around the area of interest.
Zoom out 	Tap Zoom out to zoom out. Tap and hold the button to make it active. When active, tap the area of the map to zoom out from, or drag to create a box that the current screen content will fit into.
Pan 	Tap Pan to activate Pan mode. Tap an area of the map to center on, or tap and drag the map area to where you want to reposition the map.
Zoom extents 	Tap Zoom extents to zoom to the map extents. In 3D the current orientation is kept. Note - The current position of the GNSS antenna is not considered part of the map extents unless it is currently being used for GPS search.
Orbit 	Tap Orbit to orbit the data around an axis. Tap the map and then drag to rotate the view. The NE axes icon rotates accordingly, to show the orientation of the North and East elevations.
Predefined view 	Tap Predefined view to select a predefined view of the map. Tap the button and then select <i>Iso</i> , <i>Top</i> , <i>Front</i> , <i>Back</i> , <i>Left</i> , or <i>Right</i> . The <i>Iso</i> view shows an isometric view of the data where each angle is 60 degrees. Select <i>Iso</i> again to rotate the view by 90 degrees. To view the road in two dimensions, select <i>Top</i> , which shows a plan view of the road.
Cross section view 	Tap Cross section view to view the cross section for the currently selected station.

Some buttons can operate in an "active" mode. The effect of tapping on the map depends on the button selected.



Map softkeys

The functions are described in the following table:

Softkey	Function
<i>Station</i>	Tap <i>Station</i> to key in a station or to select a station from the list.
<i>Offset/String</i>	For a Trimble or LandXML road, tap <i>Offset</i> to key in an offset or to select a string from the list. For a GENIO road, tap <i>String</i> to select a string from the list.
<i>Options</i>	Controls the option to set the vertical exaggeration scale. The default setting of 1 indicates that the horizontal and vertical scales are identical, which gives a true representation of the data. Enter a larger value in the <i>Vertical exaggeration</i> field to emphasize vertical features which might be too small to identify relative to the horizontal scale. Controls the option to display a ground plane at a specified elevation. Controls the option to display the surface of the road with a color gradient. Controls the option to display surface triangles for the surface of the road.
<i>Layers</i>	Controls the display of Trimble road files. Use this option to review your current road relative to other, related, secondary roads. This is particularly useful for interchanges and intersections. As well as being able to view in 3D the relationship of your current road to a secondary road you can select positions on the secondary road to confirm coordinates and elevations. Secondary roads are displayed shaded gray. This option is not available for a GENIO road.
<i>3D drive</i>	Tap <i>3D drive</i> to view an automated 3D drive through the road. Tap  to start the drive through. Tap  to pause. Alternatively, press the Up and Down arrow keys on the controller to move forward and back along the road.

5. To view cross sections, tap .

The alignment/master string is shown as a red cross. The black circles represent the strings defined by the template. The larger blue circle represents the currently selected string. The line work preceding the selected string is shown as a bold blue line. Values defining the selected string and the line preceding the string are displayed at the top of the screen.

You can view the cross section one of two ways. By default, with the Fixed scale icon shown gray , each cross section is displayed so that it fills the screen, providing the best view of the cross section. To view cross sections relative to each other, tap the icon so that it changes to yellow . Each cross section is displayed with the scale fixed so that the widest cross section fills the screen.

By default, the last position selected in the plan view is selected. To view the cross section at other stations, do one of the following:

- Press an up or down arrow on the controller keyboard.
- Tap *Station* to key in a station or to select a station from the list.

To select another string, do one of the following:

- Press a left or right arrow on the controller keyboard to select another string.
- Tap the string displayed on the screen.
- Tap *Offset/String* to select a string from the list.

Note - The Roads software supports reviewing a position defined by a nominal station value. That is, the station does not have to coincide with a cross section. To do this, from either the plan or cross section view tap *Station* and then key in a station value.

For a Trimble road you can key in a nominal offset value. That is, the offset does not have to lie on a string. To do this, tap *Offset* and then key in an offset. The offset is computed from the alignment. The elevation for the resultant position is defined by interpolation of the cross section at the entered station and offset.

Horizontal alignment

To add a horizontal alignment to a new road definition, select *Horizontal alignment*. You can enter the alignment using one of the following methods:

[Length / coordinates](#)

[End station](#)

[PI](#)

You can also define the horizontal alignment (and vertical alignment if the line work has elevations), from features (points, lines, and arcs) in a file. To do this:

1. From the map, tap the *Layers* softkey, select the file and then make active the appropriate layer(s) that will be used to define the horizontal alignment.
2. Select the features. See *Using the map for common tasks* for further details.
3. From the tap and hold menu, select *Store road*.
4. Enter a name, start station, and station interval.
5. Tap *OK*.

From the *Define* menu, you can view the horizontal (and vertical alignment if applicable) for the resultant road, and add templates, superelevation and widening records, and station equations if required.

Entry by length / coordinates

To add a horizontal alignment to a new road definition by entering the lengths of the elements or the end coordinates, select *Horizontal alignment* and then do the following:

1. Tap *New* to enter the first element that defines the alignment. The *Element* field is set to *Start point*. You cannot change this.
2. Enter the *Start station*.

3. In the *Method* field, choose one of the following options:

- *Key in coordinates*
- *Select point*

If you choose the *Key in coordinates* method, enter values in the *Start north* and *Start east* fields.

If you choose the *Select point* method field, enter a value in the *Point name* field. The *Start north* and *Start east* fields will update with the values for the entered point.

Tip - To edit the *Start north* and *Start east* values when they have been derived from a point, change the method to *Key in coordinates*.

4. Enter the *Station interval*. To add the horizontal element, tap *Store*.

5. Tap *Options* to select the *Transition type*.

Note - For more information on supported transition types, see [Transitions](#).

6. To enter the next horizontal element, tap *New*. In the *Entry Method* field, select *Length/Coordinates* and then tap *OK*.

7. Select the *Element* and *Method*, enter the required information and then tap *Store*. For details on supported elements and entry methods, see the following:

[Line elements](#)

[Arc elements](#)

[Entry transition/exit transition elements](#)

8. When you have entered the last element, tap *Accept*.

Tip - To delete an element, highlight it and tap *Delete*. When you add an element, it appears below the previous element that you added. To insert it at a particular place in the list, highlight the element that you want it to follow. Tap *New* and enter details of the element.

9. Enter the other road components or tap *Store* to store the road definition.

Line elements

If you select *Line* in the *Element* field, the *Start station* field displays the start station value for the line that you are defining. You cannot edit this.

The following table shows the available methods and the fields that appear when you select each one.

Method	Procedure
Azimuth and length	In the <i>Azimuth</i> and <i>Length</i> fields, enter values that define the line. The <i>End north</i> and <i>End east</i> fields update with the values entered.
End coordinates	In the <i>End north</i> and <i>End east</i> fields, enter values that define the line. The <i>Azimuth</i> and <i>Length</i> fields update with the values entered.
Select end point	In the <i>Point name</i> field, enter a value. The <i>Azimuth</i> , <i>Length</i> , <i>End north</i> , and <i>End east</i> fields update with the values entered.

Tip - For a line defined by *Azimuth and length*, the *Azimuth* field shows the azimuth as calculated from the previous element. To edit the azimuth, select *Edit azimuth* from the pop-up menu in the

Azimuth field. If the element is non tangential the icon at the start of the element is shown in red. To reload the original azimuth, select *Restore tangency* from the pop-up menu.

Arc elements

If you select *Arc* in the *Element* field, the *Start station* field displays the start station value for the arc that you are defining. You cannot edit this.

The following table shows the available methods and the fields that appear when you select each one.

Method	Procedure
Radius and length	Specify arc direction. In the <i>Radius</i> and <i>Length</i> fields, enter values that define the arc.
Delta angle and radius	Specify arc direction. In the <i>Angle</i> and <i>Radius</i> fields, enter values that define the arc.
Deflection angle and length	Specify arc direction. In the <i>Angle</i> and <i>Length</i> fields, enter values that define the arc.
End coordinates	In the <i>End north</i> and <i>End east</i> fields, enter values that define the arc. The <i>Arc direction</i> , <i>Radius</i> , and <i>Length</i> fields update with the values entered.
Select end point	In the <i>Point name</i> field, enter a value that defines the arc. The <i>Arc direction</i> , <i>Radius</i> , <i>Length</i> , <i>End north</i> , and <i>End east</i> fields update with the values entered.
End coordinates and center point	In the <i>End north</i> , <i>End east</i> , <i>Center point north</i> , and <i>Center point east</i> fields, enter values that define the arc. If required select <i>Large arc</i> . The <i>Azimuth</i> , <i>Arc direction</i> , <i>Radius</i> , and <i>Length</i> fields update with the values entered.
Select end and center points	In the <i>End point name</i> and <i>Center point name</i> fields, enter values that define the arc. If required select <i>Large arc</i> . The <i>Azimuth</i> , <i>Arc direction</i> , <i>Radius</i> , <i>Length</i> , <i>End north</i> and <i>End east</i> fields update with the values entered.

Tip - For an arc defined by *Radius and length*, *Delta angle and radius* or *Deflection angle and length*, the *Azimuth* field shows the azimuth as calculated from the previous element. If the element is non tangential the icon at the start of the element is shown in red. To reload the original azimuth, select *Restore tangency* from the pop-up menu.

Entry transition/exit transition elements

If you select *Entry transition/Exit transition* in the *Element* field, the *Start station* field displays the start station value for the entry transition or exit transition that you are defining. You cannot edit this.

Specify the arc direction. In the *Start radius*, *End radius* and *Length* fields, enter values that define the transition.

The *End North* and *End East* fields update to display the coordinates at the end of the element just added.

Note - For details on supported transition types see [Transitions](#).

Tips

- The *Azimuth* field displays the azimuth as calculated from the previous element. To edit the azimuth, select *Edit azimuth* from the pop-up menu in the *Azimuth* field. If the element is non tangential the icon at the start of the element is shown in red.
- If the transition type is NSW cubic parabola the computed *Transition Xc* value is displayed. If the transition is between two arcs the *Transition Xc* displayed is the value computed for the common tangent point with the smaller of the two arcs.

Entry by end station

To add a horizontal alignment to a new road definition by entering end station values, select *Horizontal alignment* and then do the following:

1. Tap *New* to enter the first element that defines the alignment. The *Element* field is set to *Start point*. You cannot change this.
2. Enter the *Start station*.
3. In the *Method* field, choose one of the following options:
 - *Key in coordinates*
 - *Select point*

If you choose the *Key in coordinates* method, enter values in the *Start north* and *Start east* fields.

If you choose the *Select point* method field, enter a value in the *Point name* field. The *Start north* and *Start east* fields will update with the values for the entered point.

Tip - To edit the *Start north* and *Start east* values when they have been derived from a point, change the method to *Key in coordinates*.

4. Enter the *Station interval*. To add the horizontal element, tap *Store*.
5. To enter the next horizontal element, tap *New*. In the *Entry Method* field select *End station* and then tap *OK*.
6. Tap *Options* to select the *Transition type*.

Note - For more information on supported transition types, see [Transitions](#).

7. Select the *Element* and *Method*, enter the required information and then tap *Store*. For details on supported elements and entry methods, see the following:

[Line elements](#)

[Arc elements](#)

[Entry transition/exit transition elements](#)

8. When you have entered the last element, tap *Accept*.

Tip - To delete an element, highlight it and tap *Delete*. When you add an element, it appears below the previous element that you added. To insert it at a particular place in the list, highlight the element that you want it to follow. Tap *New* and enter details of the element.

9. Enter the other road components or tap *Store* to store the road definition.

Tip - Tap *Method* to change the entry method to *Length*.

Line elements

If you select *Line* in the *Element* field, the *Start station* field displays the start station value for the line that you are defining. You cannot edit this.

In the *Azimuth* and *End station* fields, enter values that define the line. The *End North* and *End East* fields update to display the coordinates at the end of the element just added.

Tip - If this line is not the first line to be defined, the *Azimuth* field displays an azimuth calculated from the previous element. To edit the azimuth, select *Edit azimuth* from the pop-up menu in the *Azimuth* field. The icon preceding the element name is shown red if adjoining elements are non tangential.

Arc elements

If you select *Arc* in the *Element* field, the *Start station* field displays the start station value for the arc that you are defining. You cannot edit this.

The following table shows the available methods and the fields that appear when you select each one.

Method	Procedure
Radius and end station	Specify arc direction. In the <i>Radius</i> and <i>End station</i> fields, enter values that define the arc.
Deflection angle and end station	Specify arc direction. In the <i>Angle</i> and <i>End station</i> fields, enter values that define the arc.

The *End North* and *End East* fields update to display the coordinates at the end of the element just added.

Tip - The *Azimuth* field displays the azimuth as calculated from the previous element. To edit the azimuth, select *Edit azimuth* from the pop-up menu in the *Azimuth* field. The icon preceding the element name is shown red if adjoining elements are non tangential or if adjoining elements defining a curve have different radii.

Entry transition/exit transition elements

If you select *Entry transition/Exit transition* in the *Element* field, the *Start station* field displays the start station value for the entry transition or exit transition that you are defining. You cannot edit this.

Specify arc direction. In the *Start radius*, *End radius* and *End station* fields, enter values that define the transition.

The *End North* and *End East* fields update to display the coordinates at the end of the element just added.

Note - For details on supported transition types see [Transitions](#).

Tips

- The *Azimuth* field displays the azimuth as calculated from the previous element. To edit the azimuth, select *Edit azimuth* from the pop-up menu in the *Azimuth* field. The icon preceding the element name is shown red if adjoining elements are non tangential or if adjoining elements defining a curve have different radii.
- If the transition type is NSW cubic parabola the computed *Transition Xc* value is displayed. If the transition is between two arcs the *Transition Xc* displayed is the value computed for the common tangent point with the smaller of the two arcs.

Entry by PI

To add a horizontal alignment to a new road definition by entering the points of intersection (PI), select *Horizontal alignment* and then do the following:

1. Tap *New* to enter the first element that defines the alignment. The *Element* field is set to *Start point*. You cannot change this.
2. Enter the *Start station*.
3. In the *Method* field, choose one of the following options:
 - *Key in coordinates*
 - *Select point*

If you choose the *Key in coordinates* method, enter values in the *Start north* and *Start east* fields.

If you choose the *Select point* method field, enter a value in the *Point name* field. The *Start north* and *Start east* fields will update with the values for the entered point.

Tip - The selected entry method will be the default for subsequent elements. To change the entry method, select the *Method* option.

Tip - To edit the *Start north* and *Start east* values when they have been derived from a point, change the method to *Key in coordinates*.

4. Enter the *Station interval*. To add the horizontal element, tap *Store*.
5. To enter the next horizontal element tap *New*. In the *Entry method* field, select *PI* and then tap *OK*.
6. Tap *Options* to select the *Transition type*.

Note - For more information on supported transition types, see [Transitions](#).
7. Tap *New* and select the *Curve type*, enter the required information, and then tap *Store*. For details on supported curve types, see the following:

None

Circular

Transition | Arc | Transition

Transition | Transition

8. When you have entered the last element, tap *Accept*.

Tip - To delete an element, highlight it and tap *Delete*. When you add an element, it appears below the previous element that you added. To insert it at a particular place in the list, highlight the element that you want it to follow. Tap *New* and enter details of the element.

9. Enter the other road components or tap *Store* to store the road definition.

Curve type: None

Define the PI and then select *None* in the *Curve type* field.

Curve type: Circular

Define the PI and then select *Circular* in the *Curve type* field. Enter values defining the *Radius* and *Arc length* and then tap *Store*.

Curve type: Transition | Arc | Transition

Define the PI and then select *Transition | Arc | Transition* in the *Curve type* field. Enter values defining the *Radius*, *Arc length*, *Transition length in*, and *Transition length out* and then tap *Store*.

Note - For details on supported transition types see [Transitions](#).

Curve type: Transition | Transition

Define the PI and then select *Transition | Transition* in the *Curve type* field. Enter values defining the *Radius*, *Transition length in*, and *Transition length out* and then tap *Store*.

Note - For details on supported transition types see [Transitions](#).

Transitions

The Roads software supports the following transition types.

Method	Length	End station	PI
Clothoid spiral	*	*	*
Egg-shaped clothoid spiral	*	*	-
Cubic spiral	*	*	*
Bloss spiral	*	*	*
Korean cubic parabola	*	*	*
NSW cubic parabola	*	*	-

Clothoid spiral

The clothoid spiral is defined by the length of the spiral and the radius of the adjoining arc. The formulae for the x and y parameters in terms of these two values are as follows:

Parameter x :

$$x = l \left[1 - \frac{l^4}{40R^2L^2} + \frac{l^8}{3456R^4L^4} - \dots \right]$$

Parameter y :

$$y = \frac{l^3}{6RL} \left[1 - \frac{l^4}{56R^2L^2} + \frac{l^8}{7040R^4L^4} - \dots \right]$$

Egg-shaped clothoid spiral

By editing the *Start / End radius* for an *Entry / Exit transition* from *Infinite* to a required radius it is possible to define an egg shaped clothoid. To return to an infinite radius, select *Infinite* from the pop-up menu.

Cubic spiral

The cubic spiral is defined by the length of the spiral and the radius of the adjoining arc. The formulae for the x and y parameters in terms of these two values are as follows:

Parameter x :

$$x = l \left[1 - \frac{l^4}{40R^2L^2} + \frac{l^8}{3456R^4L^4} - \dots \right]$$

Parameter y :

$$y = \frac{l^3}{6RL}$$

Bloss spiral

Parameter x :

$$x = l \left[1 - \frac{l^6}{14R^2L^4} + \frac{l^7}{16R^2L^5} - \frac{l^8}{72R^2L^6} + \frac{l^{12}}{312R^4L^8} - \frac{l^{13}}{168R^4L^9} + \frac{l^{14}}{240R^4L^{10}} - \frac{l^{15}}{768R^4L^{11}} + \frac{l^{16}}{6528R^4L^{12}} \right]$$

Parameter y :

$$y = \left[\frac{l^4}{4RL^2} - \frac{l^5}{10RL^3} - \frac{l^{10}}{60R^3L^6} + \frac{l^{11}}{44R^3L^7} - \frac{l^{12}}{96R^3L^8} - \frac{l^{13}}{624R^3L^9} \right]$$

Note - The Bloss spiral can only be fully developed, that is, for an entry transition the start radius is infinite and similarly for an exit transition the end radius is infinite.

Korean cubic parabola

This cubic parabola is defined by the length of the parabola and the radius of the adjoining arc. The formulae for the x and y parameters in terms of these two values are as follows:

Parameter x :

$$x = l \left[1 - \frac{l^4}{40R^2L^2} \right]$$

This formula is the same as for the x parameter of the clothoid spiral, reduced to the first term of the series.

Parameter y :

$$y = \frac{x^3}{6RX}$$

Note - The Korean cubic parabola can only be fully developed, that is, for an entry transition the start radius is infinite and similarly for an exit transition the end radius is infinite.

NSW cubic parabola

The NSW cubic parabola is a special parabola used for rail projects in New South Wales, Australia. It is defined by the length of the parabola and an m value. Refer to

http://engineering.railcorp.nsw.gov.au/Civil_EngineeringStandards.asp and see *Track Geometry Stability*, Reference number: ESC 210 for the formulae for the x and y parameters in terms of these two values.

Vertical alignment

To add a vertical alignment to a new road definition, select *Vertical alignment*. You can enter the alignment using one of the following methods:

- [Vertical points of intersection](#)
- [Start and end points](#)

Note - The selected entry method applies to all elements defining the vertical alignment.

Tip - If you defined the horizontal alignment for your road from line work in a file, and the line work has elevations, these are used to define the vertical alignment as a series of *Point* elements. See [Horizontal alignment](#) for further details. The vertical alignment can be edited if required.

Entry by vertical points of intersection (VPI)

To add a vertical alignment to a new road definition by entering vertical points of intersection (VPI), select *Vertical alignment* and then follow these steps:

1. To enter the first element that defines the alignment, tap *New*.
2. In the *Station* and *Elevation* fields, key in the values that define the first vertical point of intersection. The *Element* field is set to *Start point*. You cannot change this.

3. Tap *Store* to add the vertical element record.
4. Tap *New*. In the entry method field select *VPI* and then tap *Ok*.
5. Select the *Element*, enter the required information and then tap *Store*. For details on supported elements, see the following:

[Point elements](#)

[Circular arc elements](#)

[Symmetric parabola elements](#)

[Asymmetric parabola elements](#)

6. When you have entered the last element, tap *Accept*.

Tip - To delete an element, highlight it and tap *Delete*. When you add an element, it appears below the previous element that you added. To insert it at a particular place in the list, highlight the element that you want it to follow. Tap *New* and enter details of the element.

Enter the other road components or tap *Store* to store the road definition.

Point elements

If you select *Point* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI. The *Slope in* field updates to display the calculated slope value. The *Slope out* field updates when the next element is added.

Note - A vertical alignment defined by VPIs must end with a point.

Circular arc elements

If you select *Circular arc* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI. Enter the radius of the circular arc in the *Radius* field. The *Slope in* field updates to display the calculated slope value. The *Length, K factor* and *Slope out* fields update when the next element is added.

Symmetric parabola elements

If you select *Sym parabola* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI and a length for the parabola. The *Slope in* field updates to display the calculated slope value. The *K factor* and *Slope out* fields update when the next element is added.

Asymmetric parabola elements

If you select *Asymmetric parabola* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI. Enter the In and Out lengths of the parabola. The *Slope in* field updates to display the calculated slope value. The *K factor* and *Slope out* fields update when the next element is added.

Note - When you edit an element, only the selected element is updated. All adjoining elements remain unchanged.

Tip - To confirm the entry, use the *Slope in*, *Slope out*, *K factor* and *Sag / Summit* values.

Entry by start and end points

To add a vertical alignment to a new road definition by entering Start and end points, select *Vertical alignment* and then follow these steps:

1. To enter the first element that defines the alignment, tap *New*.
2. In the *Station* and *Elevation* fields, key in the values that define the first vertical point of intersection. The *Element* field is set to *Start point*. You cannot change this.
3. Tap *Store* to add the vertical element record.
4. Tap *New*. In the entry method field select *Start and End points* and then tap *Ok*.
5. Select the *Element*, enter the required information and then tap *Store*. For details on supported elements, see the following:

[Point elements](#)

[Circular arc elements](#)

[Symmetric parabola elements](#)

6. When you have entered the last element, tap *Accept*.

Tip - To delete an element, highlight it and tap *Delete*. When you add an element, it appears below the previous element that you added. To insert it at a particular place in the list, highlight the element that you want it to follow. Tap *New* and enter details of the element.

7. Enter the other road components or tap *Store* to store the road definition.

Point elements

If you select *Point* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the start point. The *Slope in* field updates to display the calculated slope value. The *Slope out* field updates when the next element is added.

Circular arc elements

If you select *Circular arc* in the *Element* field, use the *Start station*, *Start elevation*, *End station*, *End elevation*, and *Radius* fields to key in values that define the circular arc. The *Length*, *Slope in*, and *Slope out* fields update to display the calculated values.

Symmetric parabola elements

If you select *Sym parabola* in the *Element* field, use the *Start station*, *Start elevation*, *End station*, *End elevation*, and *K factor* fields to key in values that define the parabola. The *Length*, *Slope in*, and *Slope out* fields update to display the calculated values.

Note - When you edit an element, only the selected element is updated. All adjoining elements remain unchanged.

Tip - To confirm the entry, use the *Slope in*, *Slope out*, *K factor* and *Sag / Summit* values.

Templates

To define a template for a new road definition, select *Templates* and then do the following:

1. Tap *New*, enter a template name and then tap *OK*.

To edit an existing template, highlight the template name, tap *Edit*, select the string to edit from the graphical template view and then tap *Edit* again.

Tips

- Use the *Copy from* option to copy an existing template definition, either from the current road or from a previously defined road, into the current template.
- To create a template library, define a road that only contains templates.

2. Tap *New* to enter the first string defining the template.

3. Enter a *String name*.

Tip - A string is defined as the line work connecting adjoining templates. They typically define the shoulder, edge of the pavement, curb, and similar features that make up a road. The string name is displayed during stakeout.

4. If required, select the *Create gap* option to create a gap in the template. This is useful when the template does not start at the alignment.

A gap is shown as a dashed line from the current string to the previous string. When measuring your position relative to the road, and if your position is in the gap, the *V.Distance* to the road value is null.

5. Select a *Method* and enter the required information. For more information, see the appropriate section below:

[Cross slope and offset](#)

[Delta elevation and offset](#)

[Side slope](#)

6. To add the template string, tap *Store*. The string is added, and appears in the graphical template view. When you add a string, it appears after the previous string that you added. To insert it at a particular place, highlight the string in the graphical view that you want it to follow. Tap *New* and then enter details for the string.

Tip - To delete a string, highlight it and tap *Delete*.

7. To enter more strings that define this template, tap *New*.

8. When you have entered the last string, tap *Accept*.

9. To save the template, tap *Accept*.

Tip - To rename a template, highlight it and then tap *Rename*. To delete a template, tap *Delete*.

Cross slope and offset

1. In the *Cross slope* and *Offset* fields, enter the values that define the string.

Tip - To change the way a cross slope value is expressed, tap *Options* and change the *Grade* field as required.

2. Select the *Apply superelevation* and *Apply widening* check boxes as required.

Note - When the pivot position is set to *Pivot left* or *Pivot right*, the algebraic difference in cross slope between the first template string with superelevation applied and the superelevation value is used to calculate the superelevation for all other template strings with superelevation applied.

3. Select *Apply super rollover* and then specify a *Max* value to limit shoulder rollover. For more information, see [Understanding superelevation rollover](#).

Delta elevation and offset

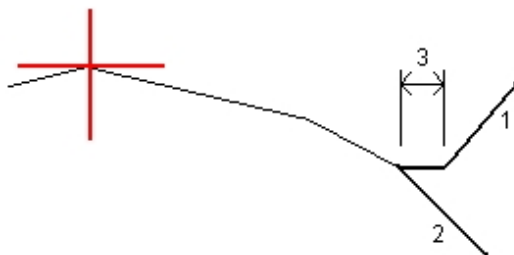
1. In the *Delta elevation* and *Offset* fields, enter the values that define the string.
2. Select the *Apply superelevation* and *Apply widening* check boxes as required.

Note - When the pivot position is set to *Pivot left* or *Pivot right*, the algebraic difference in cross slope between the first template string with superelevation applied and the superelevation value is used to calculate the superelevation for all other template strings with superelevation applied.

3. Select *Apply super rollover* and then specify a *Max* value to limit shoulder rollover. For more information, see [Understanding superelevation rollover](#).

Side slope

In the *Cut slope* (1), *Fill slope* (2), and *Cut ditch width* (3) fields, enter the values that define the string.



Note - Cut and fill slopes are expressed as positive values.

Tip - To define a side slope with only a cut or fill slope, leave the other slope value field as '?'.

Template positions

Define the position of templates in a road definition by specifying the station at which the Roads software starts to apply each template. A template is applied at the start station and the values defining each string are then interpolated linearly (applied on a pro rata basis) from that point to the station where the next template is applied.

To define the template positions:

1. Select *Template positions*.
2. Tap *New*.
3. In the *Start station* field, specify the start station for the template(s).

4. Select the templates to apply. The options in the drop-down list for the *Left template* and *Right template* fields are as follows:
 - <None> - no template is assigned. Use this option to create a gap in the road definition.
 - <Interpolate> - the template for this station is interpolated from the previous and next templates in the road definition.
 - Templates - defined using the *Key in / Templates* option.
5. Tap *Store* to apply the templates.
6. Tap *New* to enter more templates at other positions.
7. When all template positions are entered tap *Accept*.

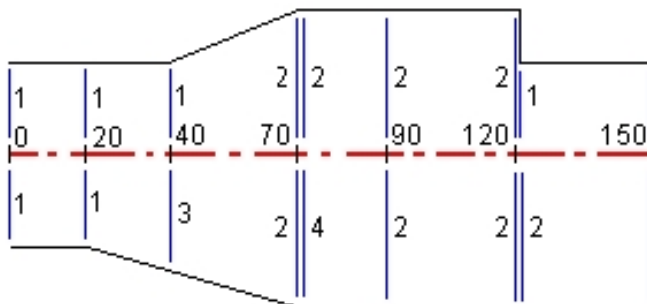
Tip - To delete a highlighted entry, tap *Delete*.
8. Enter the other road components or tap *Store* to store the road definition.

Note - To specify the interpolation method used to calculate cross sections between template positions tap the *Options* softkey and tap *Elevation* or *Cross slope*.

For more information, see the [example alignment](#) with the associated table. That topic describes how to use the template assignments, including the templates "None" and "Interpolate", to achieve the required road definition.

Example alignment

The following discussion explains how positioning of templates and use of system templates can be used to control a Trimble road definition. See the plan in the following figure.



Right side of the road

On the right side, template 1 is assigned to stations 0 and 20. The road transitions from template 1 at station 20 to template 2 at station 70. Because a template must be assigned at station 40 on the left side, the system template <Interpolate> 3 must be assigned to the right side of the road to maintain correct interpolation.

To correctly represent the gap between stations 70 and 90, the system template <None> 4 is assigned at a nominal distance after station 70 (5 mm). To complete the right side of the road, template 2 is assigned to stations 90, 120, and 120.005.

Left side of the road

On the left side, template 1 is assigned to stations 0, 20, and 40. The road transitions from template 1 at station 40 to template 2 at station 70. To correctly represent the design, template 1 is assigned a nominal distance after station 120 (5 mm).

Assign the templates at the specified start stations as shown in the following table:

Start station	Left templates	Right templates
0.000	Template 1	Template 1
20.000	Template 1	Template 1
40.000	Template 1	<Interpolate> 3
70.000	Template 2	Template 2
70.005	Template 2	<None> 4
90.000	Template 2	Template 2
120.000	Template 2	Template 2
120.005	Template 1	Template 2

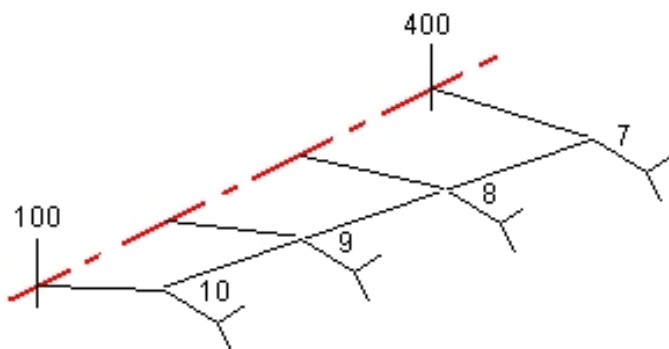
Template interpolation

The two methods used to calculate cross sections between template positions are:

- by elevation
- by cross slope

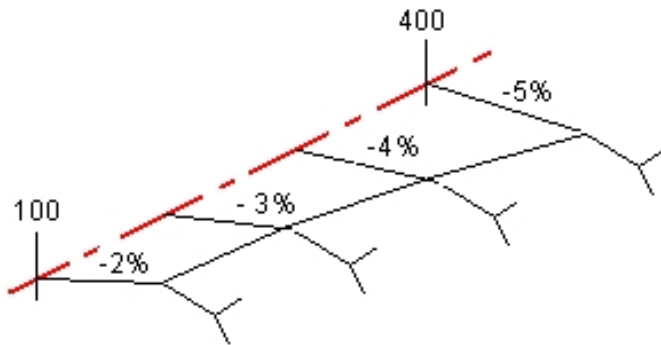
Interpolation by elevation

See the following figure where the template at station 100 has a string with an elevation of 10.0. The next template is assigned at station 400 and has a string with an elevation of 7.0. The cross section for stations 200 and 300 are interpolated as shown to provide even grading of elevation from station 100 to 400.



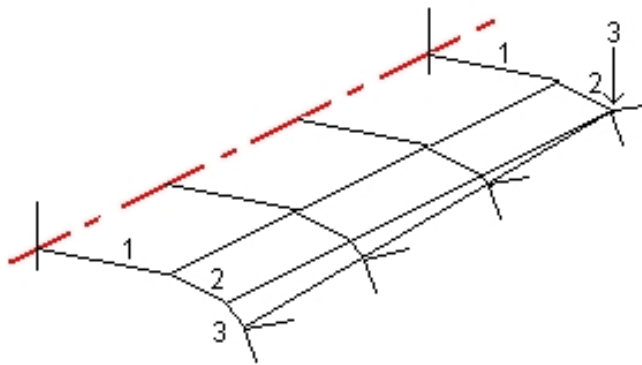
Interpolation by cross slope

See the following figure where the template at station 100 has a string defined by a crossfall of -2%. The next template is assigned at station 400 and has string defined by a crossfall of -5%. The cross section for stations 200 and 300 are interpolated as shown to provide even grading of cross slope from station 100 to 400.



Interpolating between templates that have a different number of strings

For templates with an unequal number of strings, the template with the least strings has, in effect, a string defined with a zero offset added before the side slope string. The interpolation is then performed given an equal number of strings exist. See the figure below, where an additional string (3) has automatically been inserted.



By adding strings defined with a zero offset, you can further control the interpolation process to best represent the road design.

Notes

- If the design requires a gap in its definition use the None templates.
- No interpolation occurs between a null and a valid template.
- Templates are interpolated after superelevation and widening have been applied.

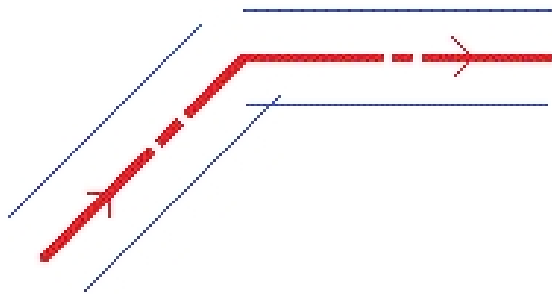
Interpolation of side slopes

If consecutive templates contain side slopes of differing values intermediate stations have side slopes interpolated based on the slope value as a percentage.

For example, if the side slope value at station 600 is 50% (1:2) and at station 800 it is 16.67% (1:6) the side slope value at station 700 will be $50\% + 16.7\% / 2 = 33.33\%$ (1:3).

Non tangent horizontal alignment elements

The following diagram illustrates how, for a Trimble road, cross sections connect when consecutive horizontal alignment elements are non tangential.



To understand how this affects the reported values when:

- measuring your position relative to a road and your current position is near the point of non tangency, see [Measuring your position relative to a Trimble or LandXML road](#).
- measuring your position relative to a string and your current position is near the point of non tangency, see [Measuring your position relative to a string](#).

Superelevation and widening

Define where superelevation and widening values are applied in a road definition by specifying the station at which the Roads software starts to apply them. Superelevation and widening values are applied at the start station, and values are then interpolated linearly (applied on a pro rata basis) from that point to the station where the next superelevation and widening values are applied.

To add superelevation and widening values to a new road definition:

1. Select *Superelevation & widening* and tap *New*.
2. In the *Start station* field, specify the station where the superelevation and widening starts.
3. In the *Left super* and *Right super* fields, enter superelevation values for the left and right sides of the horizontal alignment.

Tip - To change the way a superelevation value is expressed, tap *Options* and change the *Grade* field as required.

4. In the *Pivot* field, specify the position about which the template rotates. The options are *Pivot*

left, Pivot crown, and Pivot right.

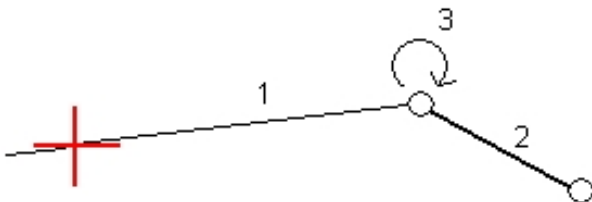
Notes

- For *Pivot left* the pivot position is the maximum offset, left of the alignment, of the last template string with superelevation applied.
 - For *Pivot crown* the pivot position is at the alignment.
 - For *Pivot right* the pivot position is the maximum offset, right of the alignment, of the last template string with superelevation applied.
 - When the pivot position is set to *Pivot left* or *Pivot right*, the algebraic difference in cross slope between the first template string with superelevation applied and the superelevation value is used to calculate the superelevation for all other template strings with superelevation applied.
5. In the *Left widening* field, enter the widening value to be applied.
This value is applied to each string in the template that has the *Widening* check box selected.
 6. Do the same for the *Right widening* field. Tap *Store* to add these superelevation and widening values to the road definition.
Note - *Widening* is expressed as a positive value.
 7. To enter more superelevation and widening records tap *New*.
 8. After entering the last superelevation and widening record, tap *Accept*.
Tip - To delete an entry, highlight it and tap *Delete*.
 9. Enter the other road components, or tap *Store* to store the road definition.

Understanding superelevation rollover

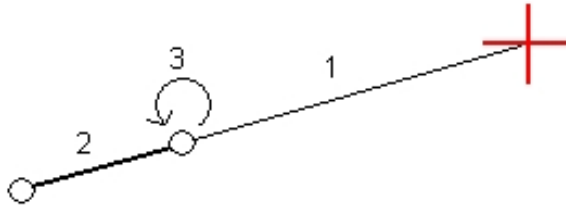
Outside of curve (high side)

As shown below, the superelevation rollover value is the maximum algebraic difference in cross slope (3) between the carriageway or travel lane (1) where the carriageway is adjusted by superelevation and the shoulder (2) which is not adjusted by superelevation. If the station being staked includes superelevation that results in the difference in cross slope exceeding the specified maximum, the slope defining the shoulder is adjusted so that the algebraic difference in slope is not exceeded.



Inside of curve (low side)

For the inside of a superelevated curve, the shoulder (2) uses its design value unless that value is less than the slope value of the superelevated carriageway (1). In that case, the superelevated value for the carriageway is used for the shoulder. This behavior happens only if you specified a maximum superelevation rollover value.



Station equations

Use *Station equations* when the horizontal alignment has changed but you wish to retain the original station values.

To define an equation:

1. Select *Station equations*.
2. Tap *New*.
3. In the *Back station* field, enter a station value.
4. In the *Ahead station* field, enter a station value. The *True station* value will be calculated.
5. Tap *Store*.

The values entered in the *Back station* and *Ahead station* fields are shown. The zone is indicated by a number after the colon in each field. The *Progression*, indicating whether the station value increases or decreases after the station equation, is also shown. For all station equations the *Progression* defaults to *Increasing*. However, you can set the *Progression* for the last station equation to *Decreasing*. To do this, define and store the last equation and then tap *Edit*.

Note - The zone up to the first station equation is zone 1.

6. To add further equations, tap *New*. To delete an equation, tap *Delete*. To accept the entered equations, tap *Accept*.

Additional strings

Use *Additional strings* to define features that are related to a road but are separate to the road, such as sound barriers or storm water drains. The additional string is defined by horizontal geometry comprising a series of lines that are defined relative to the horizontal alignment of the road and, if required, vertical geometry defined using all the options available when defining a vertical alignment for a road. See [Vertical alignment](#).

Tip – If the element is non-tangential the icon at the start of the element is shown in red.

Additional points

Use *Additional points* to define design features like key positions for a drainage system or road cross sections. The points are defined relative to a horizontal alignment, and optionally a vertical alignment. The points can be keyed in or imported.

To key in a new point, tap *New* and fill out the fields as required. Each additional point must include a *Station* and an *Offset* value. The *Elevation* and *Code* fields are optional.

To import points from a file, tap *Import*.

Note - Each position in the file must be defined by a station and offset and, optionally, an elevation and code, in that order. See the following:

1+000.000, 0.250, 25.345, ,

1+000.000, 2.000, 25.345, Median

1+000.000, 3.000, , Lane

1+000.000, 7.000, 25.294, Shoulder

Tip - When importing a file, for points with null elevations you can choose to use the elevation of the vertical alignment at the station value of the point.

LandXML roads

To review and edit a LandXML road:

1. Tap *Define*.
2. Highlight the LandXML file and then tap *Edit*.
3. Select the *Road name* and *Surface* to edit and then tap *Edit*.

Tips

- The LandXML format does not support side slopes. However, two options are provided which enable a side slope to be added:
 - if the last point in the cross section represents a side slope, select the *Set last cross section point as side slope* option to convert this point to a side slope. The slope value from the second last point to the last point is then used to define the side slope.
 - If the last point in each cross section represents a side slope hinge position, select the *Add side slope to last point in cross section* option and complete the fields to add cut and fill side slope values, including a cut ditch to this point. A side slope can be defined for both the left and right sides of the cross section.
- If the elevations defining the cross sections are absolute, select the *Absolute design cross-section elevations* option to ensure the templates are resolved correctly.
- When selecting a LandXML file from 12d Model where the transition type is *cubic* you will be prompted to select the applicable cubic type. This is because the cubic type is not identifiable in the file. Choose from:

2 Define Roads

- Cubic spiral
 - NSW cubic parabola
4. Choose one of the following components to edit:
 - Horizontal alignment
 - Vertical alignment
 - Templates
 - Template positions
 - Superelevation and widening
 - Station equations
 - Additional strings
 - Additional points
 5. If you edit the road definition, tap *Store* to save the edited road as a Trimble road (road name.rxl).
 6. Tap the *Review* softkey to see plan and cross section views of the road.
Tap the *Report* softkey to generate a report of the road.
For more information about reviewing and reporting, see [Trimble roads](#).

Notes

- *The Roads software treats all road distances, including station and offset values, as grid distances. The value in the Distances field (accessed from <MadCap:variable name="Survey_Variables.X_Access" /> Settings / Units Cogo / Cogo Settings) has no effect on the road definition or the way road distances are displayed.*
- *If a ground coordinate system is defined in the job, the grid coordinates are, in effect, also ground coordinates.*
- *When you review a road in a LandXML file, the road is temporarily converted to a Trimble road providing all the review options available for a Trimble road.*
- *When you edit a road in a LandXML file, the road is temporarily converted to a Trimble road, providing all the editing options available for a Trimble road. When you save the edits, the road is stored as a Trimble road (road name.rxl). The original LandXML file remains in the current project folder.*
- *The Roads software supports LandXML roads where the horizontal alignment is defined by elements or Points of Intersection (PI's). However LandXML files with curves defined by spiral-arc-connectingSpiral-arc-spiral are not supported.*

Tip - Trimble recommends that large LandXML files are saved as a Trimble road to improve performance at stakeout.

GENIO roads

Use the *Define* option to:

- [Define or edit a road](#)
- [Review a road](#)

Defining or editing a road

1. Tap *Define*.
2. Select a GENIO file from the list. Tap *Edit*.
3. Tap *New*, and enter a road name and then tap *OK*.
(To edit an existing road, highlight the road name and then tap *Edit*.)
4. Tap strings to select them. Alternatively, drag a box outline to select multiple strings. Selected master strings are shown as solid red circles. Selected sub strings are shown as solid blue circles. Tap a selected string to deselect it.
5. To clear your current selection or to undo your last selection, tap and hold on the screen and then select the appropriate option from the pop-up menu.
6. To select strings from a list of string names, tap and hold on the screen and then select *List selection* from the pop-up menu. Tap the string names you want to select. Selected strings appear in the list with a check mark next to them. To clear your current selection, tap *Clear*.

Tips

- Tap the up arrow to access the *map softkeys* to navigate around the graphical view.
 - Tap and hold on the pan softkey to make it active and then use the left, right, up, or down arrow keys on the controller to pan around the screen.
 - To see your current position when defining a road, start a survey.
7. Tap *Accept* to save your selection.
 8. Tap *Accept* to store the road.

Notes

- A road can include only one master string (6D). If the GENIO file does not include a 6D string but does include a 12D string, then the Roads software will generate a 6D string with the same geometry as the 12D string and positions every 5 meters / feet.
- Because the station values for 3D and 5D strings are defined relative to the selected 6D string, select strings that obviously define a road.
- Where available, Trimble recommends that you include the 12D string that is coincident with the selected master string in the road. 12D strings include the geometry for the vertical alignment that enables the Roads software to correctly interpolate elevations between positions along the master string.
- If a road includes a 12D string or if there is a 12D string in the GENIO file that is related to the 6D string in the road the station values in the 12D string that define the horizontal alignment are suffixed with their appropriate acronyms. For example, *PC* for the start of a curve.

- Unselected master and geometry strings appear as open red circles. Unselected sub strings (3D and 5D) appear as open dark gray circles.
- Tap and hold on a string to browse the string name. For a master (6D) string the station range is also displayed.
- To define a new 3D string, tap and hold on the screen and then select *New string* from the pop-up menu. This option is not available until you have selected a master (6D) string.
- To exclude the master string, tap and hold on the screen in the plan or cross section view and select *Exclude master at stakeout* from the pop-up menu.
- A GENIO file consists of a number of strings. When you define a road you select the appropriate strings from the GENIO file. The road name and the names of the selected strings are saved as a comment to the end of the GENIO file.

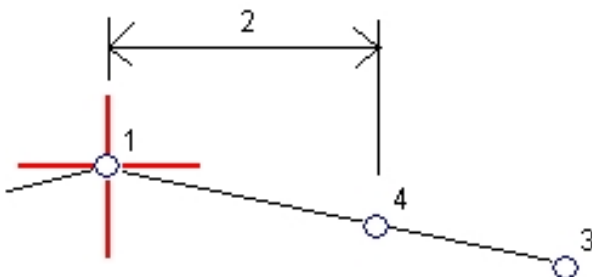
New string

Use this function to [define](#) a new string, [edit](#) a string you have defined, or [delete](#) a string.

Defining a new string

1. Select a GENIO file and define a new road or edit an existing road.
2. Tap and hold in the graphics screen and then select *New string* from the pop-up menu.
3. Enter a string name.
4. Select the string that the new string will be derived from.
5. Select a string derivation method and then enter values that define the new string.

The following figure illustrates the *Offset and calculated slope* method where the *Derived from* string (1), the *Offset* value (2) and the *Calculated from* string (3) define a new string (4) on the slope between the *Derived from* and *Calculated from* strings.



6. Tap Accept.

Notes

- When you define a new road, you must select a master (6D) string before the *New string* menu option is available.
- New strings are created as 3D strings.
- You cannot define a new string relative to a 5D string.

- When you define a new string by the *Offset and calculated slope method*, the new string is defined only where the station values for the *Derived from* and *Calculated from* strings match.
- New strings are colored teal.

Editing a new string

1. Select a GENIO file and then select the road containing the string to edit.
2. Tap and hold in the graphics screen and select *Edit string* from the pop-up menu.
3. Select the string to edit. You can edit only those strings that were defined using the *New* string function and that are derived from a string that belongs to the current road.
4. Edit the details as required.
5. Tap *Accept*.

Deleting a string

1. Select a GENIO file and then select the road containing the string to delete.
2. Tap and hold in the graphics screen and then select *Delete string* from the pop-up menu.
3. Select the string to delete. You can only delete strings that have been defined using the *New* string function.
4. Tap *OK*.

Tips

- Tap the up arrow to access the *map softkeys* to navigate around the graphical view.
- Tap and hold on the pan softkey to make it active and then use the left, right, up, or down arrow keys on the controller to pan around the screen.

Exclude master string at stakeout

If the master string (6D) has a vertical geometry that is unrelated to the road design, you can exclude this string.

To do this:

- When defining a GENIO road, tap and hold on the screen and from the pop-up menu select *Exclude master at stakeout*.

The master string will still be part of the road and will be used to calculate the station values at stakeout.

At stakeout, the master string will appear grayed out in the plan graphical selection screens and does not appear in the cross section view. The master string will also be unavailable from the string selection list.

Tip - To ensure that the master string is available at stakeout, clear *Exclude master at stakeout*.

Exporting GENIO files from 12d Model

To export a road as a GENIO file from 12d Model:

1. Start 12d Model and select a project.
2. Select *File I/O / Data output - GENIO*.
3. From the *Write GENIO File for* dialog, select the alignment string as the data to write.
4. Enter a file name.
5. Set the *Alignment dimension* field to 6D.
6. Select the *77 Format* check box.
7. Write the file but do not select *Finish*.
8. Select the remaining strings that define the road as the data to write.
9. Retain the file name used to write the alignment string.
10. Set the *Alignment dimension* field to 3D.
11. Write the file and then select *Yes* to append to the end of the existing file.
12. Select *Finish*.

Tip - Use the filter option to aid string selection.

Survey Roads

Staking out and measuring roads

Tap *Survey* to stakeout and measure:

- [Trimble roads](#)
- [LandXML roads](#)
- [GENIO roads](#)

See also:

- [Selecting a Trimble or LandXML road from the map](#)
- [Defining a road on the fly](#)

For stakeout and measurement information pertaining to all types of roads, see the following sections:

- [Survey settings](#)
- [Precise elevation](#)
- [Roads stakeout details](#)
- [Stakeout relative to a DTM](#)
- [Using the graphical display](#)
- [User definable stakeout reports](#)

Survey settings

When you start a survey, you are prompted to select a survey style. To learn more about survey styles and related connection settings, tap *Settings* from the Trimble Access menu and then tap:

- *Survey styles* to edit or define a survey style. Survey Styles define the parameters for configuring and communicating with your instruments, and for measuring and storing points.
- *Connect / GNSS contacts* to create or configure a cellular modem dial profile.
- *Connect / Auto connect* to configure your auto connect options.
- *Connect / Radio settings* to configure the Radio channel and Network ID on a Trimble servo total station. These settings are used with a conventional instrument in robotic mode.
- *Connect / Bluetooth* to establish a connection to other devices using Bluetooth wireless technology.

Precise elevation

Precise elevation enables you to combine the elevation from a robotic total station with the horizontal position from a GNSS survey. Typically, the robotic total station is set up in a remote location with good visibility and safe from machinery. The elevation is determined by one or more *Station elevation* measurements to point(s) with a known elevation. You can set up the robotic total station on a known control point, but this is not required.

Precise elevation is available for staking out Trimble, GENIO, and LandXML roads during an integrated survey.

Configuring an integrated survey style

1. From the Trimble Access menu, tap *Settings / Survey styles* and then tap *New*.
2. Enter the *Style name*, set the *Style type* to *Integrated Surveying* and then tap *Accept*.
3. Select the *Conventional* and *GNSS* styles you want to reference for the integrated style and then tap *Accept*.
4. Enter the *Prism to antenna offset*.
5. To stake a road using Precise elevation, where the GNSS horizontal position is combined with the elevation from a conventional setup, enable *Precise elevation*.
6. Tap *Accept* and then tap *Store* to save the changes.

Note - When the *IS rover* option is enabled, the only way to change the GNSS antenna height in an integrated survey is to use *Target 1* and enter the height to the **prism**. The GNSS antenna height is computed automatically using the *Prism to antenna offset* configured in the *IS style*.

Performing a station elevation setup and starting the RTK survey

1. From Roads, select *Survey / <integrated style name> / Station elevation*.
2. Set the corrections associated with the instrument.
If the *Corrections* form does not appear, tap *Options* from the *Station setup* screen to set the corrections. To make the *Corrections* form appear on startup, select the *Show corrections on startup* option.
3. Tap *Accept*.
4. If required, enter the Instrument point name, Code, and Instrument height. If you are set up in an arbitrary location, accept the default point name and 0.000 instrument height.
5. Tap *Accept*.
6. Enter the point name, code, and target details for the point with the known elevation. Tap *Measure*. Once the measurement is stored, the *Point residuals* appear.
Tip - You can use the pop-up arrow to select a point from a list, or key in a point. The point needs only a name and an elevation - horizontal coordinates are not required.
7. From the *Point residuals* screen, tap one of the following softkeys:
 - *+ Point*, to observe additional known points
 - *Details*, to view or edit point details

- *Use*, to enable or disable a point
8. To view the station elevation result, tap *Results* in the *Point residuals* screen. To accept the result, tap *Store*.

The RTK survey starts. Once the RTK survey has initialized, you can begin to stake out using Precise elevation.

During a precise elevation road stakeout survey, the horizontal navigation is provided by the RTK survey, and the elevation is provided by the robotic survey. When a measurement is initiated, both a GNSS measurement and a conventional measurement are started at the same time. Separate GNSS and conventional measurements are stored in the job database, along with a grid coordinate that combines the results.

Note - *If the robotic total station cannot measure to the target, the cut\fill and vertical distance values appear as "?".*

Road stakeout details that apply to all three road formats

The Roads software treats all road distances, including station and offset values, as grid distances. The value in the *Distances* field of *Jobs / Properties of job / Units* has no effect on the road definition or the way road distances are displayed.

If a ground coordinate system is defined in either the Trimble Geomatics or Roads software, then the grid coordinates are, in effect, also ground coordinates.


To customize the language used in the Roads software, from the main Trimble Access menu select *Settings / Language* and then select:

- *Use railroad terminology* if you are surveying a railroad and wish to use railroad-specific terminology.
- *Use chainage distance terminology* to use the term *Chainage* instead of *Station* for the distance along the road.

Stakeout relative to a DTM

Staking relative to a DTM is available for Trimble, GENIO, and LandXML roads.

When you do this the horizontal navigation is relative to the road but the displayed cut/fill delta value is to a selected DTM.

1. From Roads, select *Survey* and then select the road to stake.
2. Tap the *Options* softkey and from the *Display* group box select the DTM and then select the *Display cut/fill to DTM* option. Optionally specify a *V.Offset to the DTM*. Tap  and select whether the offset is to be applied vertical or perpendicular to the DTM.

Notes

- *If the road includes templates the displayed cut/fill delta will be to the selected DTM, not the templates.*
- *The heading for the displayed cut/fill value will change to V.dist DTM.*
- *When staking relative to a DTM you cannot view the cross sections.*
- *When a horizontal construction is applied, the cut/fill value reported is to the DTM at the position selected for stakeout and not to the DTM at your current position.*

Using the graphical display

The graphical display helps you to navigate to a position on the road. The display orientation assumes you are moving forwards at all times. The display varies depending on whether you are performing a [Conventional](#) or [GNSS](#) survey.

Tip - If navigating with TSC3 or Trimble Slate controller you can use the internal compass to aid navigation. See [Compass](#) for further details.

Conventional

To use the graphical display in a conventional survey:

If you are using the *Direction and distance* mode:

1. Hold the display screen in front of you as you walk forwards in the direction that the arrow is pointing. The arrow points in the direction of the point.
2. When you get to within 3 meters (10 feet) of the point, the arrow disappears, and the in/out and left/right directions appear, with the instrument as a reference point. Follow the instructions below to navigate in this mode.

If you are using the *In/out and left/right* mode:

1. The first display shows which way the instrument should be turned, the angle that the instrument should display and the distance from the last point staked to the point currently being staked.
2. Turn the instrument (two outline arrows will appear when it is on line), and direct the rod person on line.

If you are using a servo instrument, and the *Servo auto turn* field in the survey style is set to *HA & VA*, or *HA only* the instrument automatically turns to the point.

If you are working robotically, or when the *Servo auto turn* field in the survey style is set to *Off*, the instrument does not turn automatically. To turn the instrument to the angle indicated on the screen, tap *Turn*.

3. If the instrument is not in *TRK* mode, tap *Measure* to take a distance measurement.
4. The display shows how far the person holding the rod should move towards or away from the instrument.
5. Direct the person holding the rod, and take another distance measurement.
6. Repeat steps 2 - 5 until the point has been located (when four outline arrows are displayed), then mark the point.
7. If a measurement to the target is within the angular and distance tolerances, tap *Store* at any time to accept the current measurement. If the instrument is in *TRK* mode and you require a higher precision distance measurement, tap *Measure* to take an *STD* measurement and then tap *Store* to accept that measurement. To discard the *STD* measurement and return the instrument to *TRK* mode, tap *Esc*.

If you are operating a robotic instrument remotely from the target:

- the instrument automatically tracks the prism as it moves
- the instrument continuously updates the graphical display

- the graphical display is reversed and the arrows are shown from the target (prism) to the instrument

GNSS

When you use the graphical display in a GNSS survey to navigate to a position on the road, the screen first shows a large navigation arrow when you are some distance away from the point and then automatically changes to a bull's-eye target as you move in closer.

- The arrow assumes that you are moving forward at all times.
- The bull's eye target does not assume that you are moving forward.

To use the graphical display in a GNSS survey:

1. Hold the display screen in front of you as you walk forwards in the direction that the arrow is pointing. The arrow points in the direction of the point that you intend to measure.
2. When you get to within 10 feet (3 meters) of the point, the arrow disappears and a bull's-eye target appears.

When the bull's-eye target is displayed, do not change your orientation. Keep facing in the same direction and only move forwards, backwards, left or right.

3. Continue moving forwards until the cross, representing your current position, covers the bull's-eye target, representing the point. Mark the point.

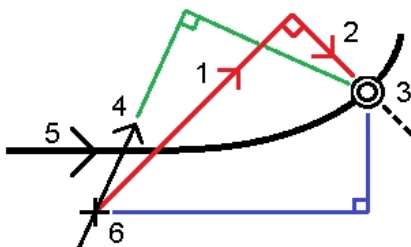
Stakeout display orientation

Select the display orientation when defining your survey style or, when in a survey, from the *Options* softkey. The options are:

- Direction of travel - the screen will orientate so that the top of the screen points in the direction of travel.
- North - the screen will orientate so that the north arrow points up the screen.
- Reference azimuth - the screen will orientate to the azimuth of the road.

Understanding the navigation directions

As shown in the diagram below, the values in the *Go Forward/Go Backward* (1) and *Go Right/Go Left* (2) fields in the graphical display are relative to the cross-section of the point that you are staking out (3). They are **not** relative to the current direction of travel (4), or to the direction of increasing station (5) at your current position (6).



User definable stakeout reports

When staking out roads, in addition to the usual translated stakeout reports provided by General Survey, the following additional stakeout reports are available:

- Road - Catch + offsets
Provides details of all the standard road staked deltas plus a list of the horizontal and vertical distances to each of the cross-section positions from the staked offset position. The reported horizontal and vertical distances include the applied horizontal and vertical construction offsets.
Provides details of all the standard road staked deltas plus a list of the horizontal and vertical distances to each of the cross-section positions from the staked offset position. The reported horizontal and vertical distances include the applied horizontal and vertical construction offsets.
- Road - Stake markup
Provides a simplified stakeout display that presents the vertical distance (cut/fill) to the road design position. Appropriate station and offset values and cross-section details (in the case of catch point staking) are reported, based on the road stakeout method.
- Road - XS details
Provides all the standard road staked deltas details as well as a list of the cross-section elements (left and right) that define the design cross-section at the selected station.

For more information, see As-staked point details.

Tips when surveying roads

This information applies when surveying a Trimble, LandXML, or GENIO road.

Selecting the road and stakeout method

From the main Roads menu, tap *Survey* and then from the *Select a file* screen, select the road to stake and tap *Next*.

Tips –

- To configure the software to return to the *Select a file* screen when exiting the *Survey* menu instead of to the main Roads menu, tap *Options*.
- To add files from another folder to the list, navigate to the required folder and then select the file(s) to add.
- To choose how the survey method will be selected, tap *Options*. Choose *Graphically* to use the graphical selection method or choose *Traditional menu selection* to use the menu selection method. The selected option is used for all subsequent surveys.
- For Trimble roads only:
 - To select a Trimble road to stake from the map, tap *Map*.
 - If you are warned that the road is incomplete or invalid, return to *Define* and select the road. Open each component defining the road and tap *Accept*. This will validate the

component and report any errors in the definition. Use the editing functionality to resolve the error.

At the selection screen

Note – The selection screens always appears for a GENIO road, but appears for a Trimble or LandXML road only when you are using the graphical option to select the survey method.

The top of the screen reports the following values:

- Relative to road (when measuring your position relative to the road)
- Station (when staking a station on a string)
- String name (when staking a station on a string or measuring your position relative to a string)
For a Trimble road, the Roads software uses the string name from the template definition. When the offset is 0.000 m, the string name defaults to CL.
- Design elevation of the selected position (shown in red if edited)
- Construction offsets
- When staking a side slope, the top of the screen also shows the:
 - Design side slope values
 - Cut ditch width (Trimble roads only)
- When staking a skew offset, the top of the screen shows the:
 - Skew offset
 - Deflection angle/azimuth

During stakeout

The top of the screen reports the following values:

- Relative to road (when measuring your position relative to the road)
- Station (when staking a station on a string)
- String name (when staking a station on a string or measuring your position relative to a string)
For a Trimble road, the Roads software uses the string name from the template definition. When the offset is 0.000 m, the string name defaults to CL.
- Elevation of your current position (shown in blue)
- Design elevation (shown in red if edited).
- Construction offsets
- When staking a side slope, the top of the screen shows the:
 - Side slope value defined by your current position (shown in blue)
 - Design side slope value (shown in red if edited)
- When staking a skew offset, the top of the screen shows the:
 - Skew offset
 - Deflection angle/azimuth

The graphical display shows:

- Horizontal alignment/master string as a red line
- Other strings as blue lines
- Construction offsets as green lines
- Skew offsets as dashed black lines
- A dashed green line is drawn from the current position to the:
 - horizontal alignment/master string when measuring your position relative to the road and you are within 30m of the alignment/string
 - selected string when measuring your position relative to a string and you are within 5m of the string
- Positions that have not been staked as open circles
- Positions that have been staked as solid circles

The base of the screen reports your current position relative to the item being staked:

- To select the delta display, tap the arrow to the left of the navigation deltas.
- Tap *Options* for further delta display options.

In addition, you can view the following information:

- To view the [cross section](#) of your current position, tap the icon at the bottom right of the graphics window. Alternatively, press the [Tab] key on the controller to switch between the plan view and the cross section view.
- To access the status bar while the graphics window is in widescreen mode, tap the arrow on the far right of the screen. The status bar appears for approximately three seconds, after which time the window returns to widescreen.
- To change the widescreen mode tap and hold in the graphics window and then select *Widescreen*.

When using a GNSS receiver with an in-built tilt sensor, you can:

- Tap *eBubble* to display an electronic bubble
- Configure the survey style to prompt a warning when the pole is outside a specified *Tilt tolerance*
- Tap *Options* to configure the quality control, precision, and *tilt settings*.

Surveying Trimble roads

The Roads software enables you to:

- [Measure your position relative to a road](#)
- [Measure your position relative to a string](#)
- [Stake a station on a string](#)
- [Stake a side slope from an alignment](#)
- [Survey additional strings](#)

Stake additional points

Stake an offset at a skew to the horizontal alignment

The first time you survey a road, the software prompts you to choose the selection method you want to use. Choose *Graphically* to use the graphical selection method or choose *Traditional menu selection* to use the menu selection method. The selected option is used for all subsequent surveys. To change the selection method, tap the *Options* softkey when selecting the road.

Notes –

- You cannot activate the *Side slope from alignment* option graphically.
- You cannot *stake a skew offset* using the traditional menu selection method.

When activating the survey method graphically, a selection screen showing a plan view of the road is displayed. This screen precedes the stakeout screen. The following table describes how to graphically activate a method from the selection screen:

Survey method	Graphical activation
Measure your position relative to a road	At the selection screen, with nothing selected, the Roads software is ready to measure your position relative to the road.
Measure your position relative to a string	<p>Tap the line work that represents the string.</p> <p>To select a different string, use the left/right arrow keys. You can also use the <i>String-</i> / <i>String+</i> softkeys to select another string. Alternatively, tap and hold in the graphics area and select a string from the list.</p> <p>To measure your position relative to the string nearest your position, tap and hold in the graphics area and then select <i>Measure nearest string</i>.</p>
Stake a station on a string	<p>Tap the circle that represents the station on the string to be staked.</p> <p>The cross section view is now available, enabling you to make sure that the correct position is selected.</p> <p>To change your selection (from the plan or cross section view), use the left/right arrow keys to select a different string and the up/down arrow keys to select a different station. You can also use the <i>String-</i> / <i>String+</i> softkeys to select another string and the <i>Station-</i> / <i>Station+</i> softkeys to select a different station. Alternatively, tap and hold in the graphics area and select a string and station value from the appropriate lists.</p>
Survey additional strings – Measure your position relative to a string	Tap the line work that represents the string. Alternatively, tap and hold in the graphics area and select a string from the list.
Survey additional strings – Stake a station on a string	<p>Tap the circle that represents the station on the string to be staked.</p> <p>Alternatively, tap and hold in the graphics area and select a string and station value from the appropriate lists.</p> <p>The cross section view is now available, enabling you to make sure that the correct position is selected.</p>
Stake additional	Tap the circle that represents the point. Alternatively, tap and hold in the

Survey method	Graphical activation
points	graphics area and select <i>Stake additional points</i> .
Stake skew offset	From the plan view, tap the circle that represents the station on the horizontal alignment that the skew offset will be applied from and then from the tap and hold menu select <i>Stake skew offset</i> .

The stations available for stakeout are controlled by the station interval and by the [Available stations](#) option.

To clear the current selection, from the plan view do one of the following:

- Tap in a clear space
- Tap the selection again

Note – You must specify a coordinate system before you can stake out roads with the Roads software.

WARNING – Do not stake out points and then change the coordinate system or perform a calibration. If you do, these points will be inconsistent with the new coordinate system and any points computed or staked out after the change.

Tips –

- During a conventional survey, you can use the tap and hold menu in the map to quickly measure a check point. If there are no points selected, *Check backsight* is available; if one point is selected *Check shot* is available. Alternatively, to measure a check shot from any screen, press **Ctrl + K** on the controller.
- You can also access the tap and hold menu from the graphics screen by pressing the space bar. This is useful if the touch screen has been disabled.

Position relative to a Trimble or LandXML road

You can measure a position relative to a Trimble or LandXML road using:

[Graphical selection](#)

[Menu selection](#)

These methods are described below.

Measuring your position relative to the road using the graphical selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble or LandXML file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).
5. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is

set correctly.

Note - The Station interval, while not required when measuring your position relative to a road, should be set now as it is used when staking a station on a string.

6. Tap *Next*. The graphical selection screen appears, displaying the road. You are, by default, ready to measure your position relative to the road.
7. If required, from the tap and hold menu, select *Define construction offsets* to enter a construction offset.

Note - The Vertical Offset value specified here is not applied to a DTM surface.

8. Tap *Start* and then use either the plan or cross section view to see your position relative to the road.

If your current position is within 30m of the horizontal alignment, the plan view shows a dashed green line drawn at a right angle from your current position to the alignment.

9. Measure the position.

For more information common to all road survey methods, see [Tips when surveying roads](#). See also the [notes](#) below.

Measuring your position relative to the road using the menu selection method

1. Tap *Survey*, select a survey style and start a survey.

From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.

2. Select a Trimble or LandXML file.

See also [Staking a road from the map](#).

3. Tap *Next*.

4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).

5. In the *Stake* field, select *Position on road*.

6. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.

7. If required, enter values in the *Construction offsets* fields.

Note - The Vertical Offset value specified here is not applied to a DTM surface.

8. Tap *Start* and then use either the plan or cross section view to see your position relative to the road.

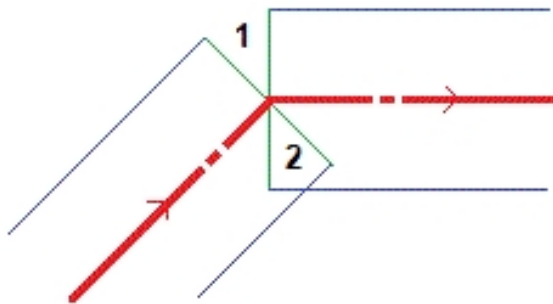
9. Measure the position.

For more information common to all road survey methods, see [Tips when surveying roads](#). See also the [notes](#) below.

Notes

- If you are using a conventional instrument, the road values only appear after you take a distance measurement.
- If your current position is more than 30 meters from the horizontal alignment, the graphical display navigates you to a position on the horizontal alignment. This is calculated by projecting your current position at right angles to the horizontal alignment.

- If the road consists of only a horizontal and vertical alignment the V. Dist value reports the vertical distance to the vertical alignment.
- Off road is displayed at the top of the screen if your current position is before the start of the road or beyond the end of the road.
- If your position is in a gap, the V. Dist value is null. Gaps are shown as a dashed line in the cross section view. To see how to create a gap in a template, see [Templates](#).
- Undefined is displayed at the top of the screen when consecutive horizontal alignment elements are non tangential and your current position is beyond the end tangent point of the incoming element but before the start tangent point of the next element and you are on the outside of the road. See position 1 in the diagram below.
- When consecutive horizontal alignment elements are non tangential and your current position is before the end tangent point of the incoming element but after the start tangent point of the next element and you are on the inside of the road, the station and offset is reported relative to the closest horizontal element. See position 2 in the diagram below.



Position relative to a string on a road

You can measure a position relative to string on a Trimble or LandXML road using:

[Graphical selection](#)

[Menu selection](#)

These methods are described below.

Measuring your position relative to a string on a road using the graphical selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble or LandXML file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).
5. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.

Note - The Station interval, while not required when measuring your position relative to a string, should be set now as it is used when staking a station on a string.

6. Tap *Next*. The graphical selection screen appears, displaying the road.
7. [Select a string](#). The string name is displayed at the top of the screen.
8. If required, from the tap and hold menu, select [Define construction offsets](#) to enter a construction offset.

Note - You cannot define a horizontal construction offset by your current position.

9. If required, from the cross section view define a [cross slope](#). The displayed cross section is for the station at your current position.
10. Tap *Start* and then use either the plan or [cross section](#) view to navigate relative to the string. The behavior at stake out depends on whether the string was selected graphically, selected from a list, or keyed in. For more information, see [Understanding keyed in and selected offset behavior](#).

If your current position is within 5m of the selected string, the plan view shows a dashed green line drawn at a right angle from your current position to the string.

11. If measuring relative to a side slope, tap and hold in the graphics area and then select *Stake cut slope hinge* to stake the hinge position for a cut slope. This option is useful when the side slope includes a cut ditch.
12. Measure the position.

Tips

- You can measure a position defined by a nominal offset. That is, the offset does not have to lie on a string. To do this, when you select the string, tap and hold in the graphics area and tap *Select string* and then key in an offset value. The offset is computed from the horizontal alignment. The elevation for the offset is defined by interpolation of the cross section at your position.
 - Enter a negative value for an offset to the left of the horizontal alignment.
 - Enter a positive value for an offset to the right of the horizontal alignment.
- To measure your position relative to the string nearest to your position, at the selection screen, tap and hold in the graphics area and then select *Measure nearest string*. The *Measure nearest string* option is not available for additional strings.

For more information common to all road survey methods, see [Tips when surveying roads](#). See also the [notes](#) below.

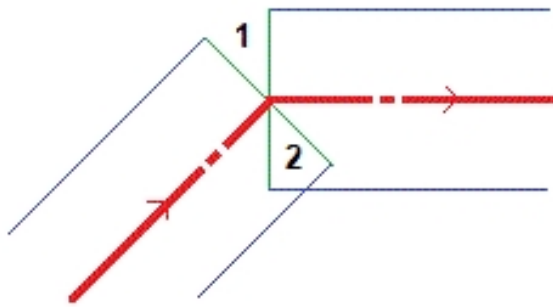
Measuring your position relative to a string on road using the menu selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble or LandXML file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).

5. In the *Stake* field, select *Nearest offset*.
6. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
7. Select an offset to stakeout. You can select an offset from the list or key in a value.
The offsets available in the list is determined by the templates assigned at your current position relative to the road.
To measure your position relative to the string nearest to your position, in the *Offset* field select *Nearest* from the list of offsets.
8. If required, enter values in the *Construction offsets* fields.
Note - *You cannot define a horizontal construction offset by your current position.*
9. Tap *Start* and then use either the plan or *cross section* graphical display to navigate relative to the string.
The behavior at stake out depends on whether the string was selected graphically, selected from a list, or keyed in. For more information, see [Understanding keyed in and selected offset behavior](#).
10. If required, from the cross section view define a *cross slope*.
11. If measuring relative to a side slope, tap and hold in the graphics area and then select *Stake cut slope hinge* to stake the hinge position for a cut slope. This option is useful when the side slope includes a cut ditch.
12. Measure the position.
For more information common to all road survey methods, see [Tips when surveying roads](#). See also the [notes](#) below.

Notes

- *If you are using a conventional instrument, the road values only appear after you take a distance measurement.*
- *If you are staking to a [catch point](#) with construction offsets, navigate to the catch point first and then tap *Apply* to add the construction offsets. You are prompted to apply the offsets from your current position. If you are not on the catch position, select *No*, navigate to the catch position and then tap *Apply* again. To store the catch position and the construction offset, see [Construction offsets](#).*
- *To edit the side slope value or to select a new hinge string, tap and hold in the graphics area and then select *Edit Side Slope*. See [Editing Side Slopes](#) for further details.*
- *Off road is displayed at the top of the screen if your current position is before the start of the road or beyond the end of the road.*
- *Undefined is displayed at the top of the screen when consecutive horizontal alignment elements are non tangential and your current position is beyond the end tangent point of the incoming element but before the start tangent point of the next element and you are on the outside of the road. See position 1 in the diagram below.*
- *When consecutive horizontal alignment elements are non tangential and your current position is before the end tangent point of the incoming element but after the start tangent point of the next element and you are on the inside of the road, the station and offset is reported relative to the closest horizontal element. See position 2 in the diagram below.*



See also:

[Catch point](#)

[Catch point staked deltas](#)

Station on a string

You can stake a station on a string on a Trimble or LandXML road using:

[Graphical selection](#)

[Menu selection](#)

These methods are described below.

Staking a station on a string on a road using the graphical selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble or LandXML file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).
5. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
6. Enter the *Station interval* or accept the default value set when the road was defined.
7. Tap *Next*. The graphical selection screen appears, displaying the road. Previously staked points are shown as solid circles.
8. [Select](#) a station on a string. The station value, string name, and elevation is displayed at the top of the screen.
9. If required, from the tap and hold menu, select [Stake skew offset](#) to stake an offset at a skew to the horizontal alignment. (This option is only available for a station selected on the horizontal alignment.)
10. If required, from the tap and hold menu, select [Define construction offsets](#) to enter a construction offset.

11. If required, from the tap and hold menu select *Edit elevation*. To reload an edited elevation, select *Reload original elevation* from the tap and hold menu.
12. If required, from the cross section view define a [cross slope](#) and/or a [subgrade](#).
13. Tap *Start* and then use either the plan or [cross section](#) graphical display to navigate to the point.
14. If measuring relative to a side slope, tap and hold in the graphics area and then select *Stake cut slope hinge* to stake the hinge position for a cut slope. This option is useful when the side slope includes a cut ditch.
15. When the point is within tolerance, measure the point.

Once a position has been measured and stored, you are returned to the selection screen where you can either select another position to stake or choose a different survey method.

Tip - You can stake out a position defined by nominal station and offset values. That is, the station does not have to coincide with a cross section and the offset does not have to lie on a string. To do this, when you select the string, tap and hold in the graphics area and tap *Select string* and then key in an offset value. Then tap *Select station* and key in a station value. The offset is computed from the horizontal alignment. The elevation for the resulting positions is defined by interpolation of the cross section at the keyed in station.

For more information common to all road survey methods, see [Tips when surveying roads](#). See also the [notes](#) below.

Staking a station on a string on a road using the menu selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble or LandXML file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).
5. In the *Stake* field, select *Station and offset*.
6. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
To select the point to be staked out, you must specify the station and the offset.
7. To specify the station, do one of the following:
 - Select from the list in the *Station* field pop-up menu.
 - Key in a value.
 - Tap *Sta+* or *Sta-* to select the next/previous station.
8. To specify the offset, do one of the following:
 - In the *Offset* field, select *List* from the pop-up menu and then select from the list.
 - Key in a value.

- Enter a negative value for an offset to the left of the horizontal alignment.
 - Enter a positive value for an offset to the right of the horizontal alignment.
 - To select the next left/next right template element or the rightmost/leftmost element, tap *Offs>>*.
9. Enter the *Station interval* or accept the default value set when the road was defined.
 10. If required, from the *Design elevation* field, tap the arrow and enter a new elevation. To reload an edited elevation, select *Reload original elevation* from the pop-up menu in the *Design elevation* field.
 11. If required, enter values in the *Construction offsets* fields.
 12. Tap *Start* and then use either the plan or *cross section* graphical display to navigate to the point.
 13. If required, from the cross section view define a *cross slope*.
 14. If measuring relative to a side slope, tap and hold in the graphics area and then select *Stake cut slope hinge* to stake the hinge position for a cut slope. This option is useful when the side slope includes a cut ditch.
 15. When the point is within tolerance, measure the point.

Once a position has been measured and stored, you are returned to the selection screen where you can either select another position to stake or choose a different survey method.

For more information common to all road survey methods, see [Tips when surveying roads](#). See also the [notes](#) below.

Notes

- If you are staking to a *catch point* with construction offsets, navigate to the catch point first and then tap *Apply* to add the construction offsets. You are prompted to apply the offsets from your current position. If you are not on the catch position, select *No*, navigate to the catch position and then tap *Apply* again. To store the catch position and the construction offset, see [Construction offsets](#).
- To edit a side slope or to add a side slope, tap and hold in the graphics area at the navigation screen and then select the appropriate option. See [Staking a side slope](#).
- If a road consists of a horizontal alignment only, you can stake it out in only two dimensions.
- The horizontal and vertical alignments of a road may not start and end at the same station values. When they start and end at different station values, you can only stake out points in three dimensions if their stations lie within the horizontal alignment.

See also:

[Catch point](#)

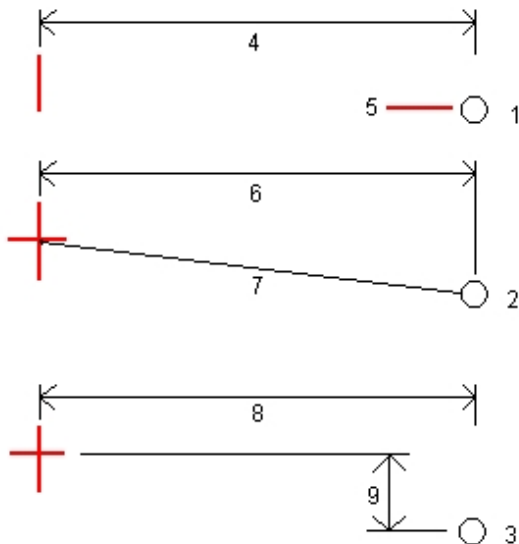
[Catch point staked deltas](#)

Staking out a side slope relative to an alignment

Note - This method is not available if you are using the graphical option to select the stakeout method.

To define and stake a side slope for a Trimble or LandXML road:

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble or LandXML file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).
5. In the *Stake* field, select *Side slope from alignment*.
6. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
7. Enter the *Station interval* or accept the default value set when the road was defined.
8. Enter a value in the *Station* field. For more information, see the section [Selecting a station](#).
9. Select a *Hinge derivation* method and complete the appropriate fields. The following diagram explains the three hinge derivation methods:



Key to the above diagram:

1 - *Offset and elevation*. Enter an offset (4) from the horizontal alignment, and the elevation (5) of the hinge position.

2 - *Offset and slope*. Enter an offset (6) from the horizontal alignment, and the slope value (7) from the intersection of the horizontal and vertical alignments to the hinge position.

3 - *Offset and vertical distance*. Enter an offset (8) from the horizontal alignment, and the vertical difference (9) from the intersection of the horizontal and vertical alignments to the hinge position.

Note - If the road definition consists of only a horizontal alignment, the only hinge derivation method available is *Offset and elevation*.

10. Complete the appropriate fields to define the [Side slope](#).

11. If required, enter values in the *Construction offsets* fields.
12. Tap *Start* and then use either the plan or *cross section* graphical display to navigate to the point.

When you are within 3m of the target the graphical display in the plan view shows your current position along with the target. Also displayed is a dashed line that connects the side slope catch position, (the point where the side slope intersects with the ground), to the side slope hinge position.

13. When the point is within tolerance, measure the point.

Note - If you are staking to a *catch point* with construction offsets, navigate to the catch point first and then tap *Apply* to add the construction offsets. You are prompted to apply the offsets from your current position. If you are not on the catch position, select *No*, navigate to the catch position and then tap *Apply* again. To store the catch position and the construction offset, see *Construction offsets*.

For more information common to all road survey methods, see *Tips when surveying roads*.

Survey additional strings

The Roads software enables you to:

- *Measure your position relative to an additional string*
- *Stake a station on an additional string*

Note – You can only stake out additional strings using the graphical selection method.

Measuring your position relative to an additional string

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble file.
See also *Staking a road from the map*.
3. Tap *Next*.
4. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
Note - The *Station interval*, while not required when measuring your position relative to a string, should be set now as it is used when staking a station on a string.
5. Tap *Next*. The graphical selection screen appears, displaying the road.
6. *Select a string*. The string name is displayed at the top of the screen.
7. If required, from the tap and hold menu, select *Define construction offsets* to enter a construction offset.
Note – You cannot define a horizontal construction offset by your current position.
8. If required, from the cross section view define a *cross slope*. The displayed cross section is for the station at your current position.
9. Tap *Start* and then use either the plan or *cross section* graphical display to navigate relative to

the string.

10. Measure the position.

For more information common to all road survey methods, see [Tips when surveying roads](#).

Staking a station on an additional string

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
5. Tap *Next*. The graphical selection screen appears, displaying the road. Previously staked points are shown as solid circles.
6. [Select](#) a station on a string. The station value, string name, and elevation is displayed at the top of the screen.
7. If required, from the tap and hold menu, select [Define construction offsets](#) to enter a construction offset.
8. If required, from the tap and hold menu select *Edit elevation*. To reload an edited elevation, select *Reload original elevation* from the tap and hold menu.
9. If required, from the cross section view define a [cross slope](#) and/or a [subgrade](#).
10. Tap *Start* and then use either the plan or [cross section](#) graphical display to navigate to the point.
11. When the point is within tolerance, measure the point.

Once a position has been measured and stored, you are returned to the selection screen where you can either select another position to stake or choose a different survey method.

For more information common to all road survey methods, see [Tips when surveying roads](#).

Stake out additional points

To stake out additional points relative to a Trimble road using:

[Graphical selection](#)

[Menu selection](#)

These methods are described below.

Staking out additional points relative to a Trimble road using the graphical selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble file.

See also [Staking a road from the map](#).

3. Tap *Next*.
4. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
Note - *The Station interval, while not required when staking an additional point, should be set now as it is used when staking a station on a string.*
5. Tap *Next*. The graphical selection screen appears, displaying the road. Previously staked points are shown as solid circles.
6. [Select a position](#). The station value, string name, and elevation is displayed at the top of the screen.
7. If required, from the tap and hold menu, select [Define construction offsets](#) to enter a construction offset.
Note - *The Vertical Offset value specified here is not applied to a DTM surface.*
8. If required, from the tap and hold menu select *Edit elevation*. To reload an edited elevation, select *Reload original elevation* from the tap and hold menu.
9. If required, from the cross section view define a [cross slope](#) and/or a [subgrade](#).
10. Tap *Start* and then use either the plan or [cross section](#) graphical display to navigate to the point.
11. When the point is within tolerance, measure the point.

For tips common to all road survey methods, see [Tips when surveying roads](#).

Staking out additional points relative to a Trimble road using the menu selection method

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a Trimble file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. In the *Stake* field, select *Additional points*.
5. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
6. Select the position to stake. Use the *Next* and *Prev* softkeys to select the next or previous position in the file.
7. If required, enter values in the [Construction offsets](#) fields.
8. If required, tap the arrow beside the *Design elevation* field and enter a new elevation. To reload an edited elevation, select *Reload original elevation* from the pop-up menu in the *Design elevation* field.
9. If required, from the cross section view define a [cross slope](#).
10. Tap *Start* and then use either the plan or [cross section](#) graphical display to navigate to the point.

11. When the point is within tolerance, measure the point.

For tips common to all road survey methods, see [Tips when surveying roads](#).

Stakeout - Available stations

When using Trimble or LandXML roads, to configure the stations available for stakeout, select the appropriate check boxes in *Available Stations*.

If you select the survey method graphically, to access the *Available Stations* tap the *Options* softkey in the screen where you enter the *Antenna/Target height* values. The stations available from the graphical selection screen are filtered accordingly

If you select the survey method using the traditional menu selection, to access the *Available Stations* tap the *Options* softkey in the screen where you select the survey method. The *Station* field list is filtered accordingly.

Note - This function is not available for GENIO roads.

Select one of the following check boxes to make the appropriate stations available:

1. *Regular Sections* (stations defined by the station interval)
2. *Horiz. Curve* (key stations defined by the horizontal alignment)
3. *Vert. Curve* (key stations defined by the vertical alignment)
4. *Template* (stations where templates have been assigned)
5. *Super/Widen* (stations where superelevation and widening has been assigned)

The following table lists the abbreviations that the Roads software uses:

Abbrev.	Meaning	Abbrev.	Meaning
CS	Curve to transition	SS	Transition to transition
PC	Point of curvature (Tangent to curve)	ST	Transition to tangent
PI	Point of intersection	TS	Tangent to transition
PT	Point of tangent (Curve to tangent)	VCE	Vertical curve end
RE	Road end	VCS	Vertical curve start
RS	Road start	VPI	Vertical point of intersection
SC	Transition to curve	XS	Regular sections
Hi	Vertical curve high point	Lo	Vertical curve low point
SES	Superelevation start	SEM	Superelevation maximum
SEE	Superelevation end	WS	Widening start
WM	Widening maximum	WE	Widening end
T	Template assignment	STEQ	Station equation

Selection options for a LandXML road

This topic applies to LandXML files when you:

- Measure your position relative to a road
- Measure your position relative to a string
- Stake a station on a string
- Stake a side slope from an alignment
- Stake additional points

After selecting a LandXML file when doing any of the above:

1. If the file contains multiple roads, select the road to be staked. To view a list of available roads, tap the arrow.
2. If the road contains multiple surfaces, select the surface to be staked out. To view the available surfaces, tap the arrow.
3. The LandXML format does not support side slopes. However, if the last point in the cross section represents a side slope, select the *Set last cross section point as side slope* option to convert this point to a side slope. The slope value from the second last point to the last point is then used to define the side slope.
4. If the elevations defining the cross sections are absolute, select the *Absolute design cross-section elevations* option to ensure the templates are resolved correctly.
5. Tap *Next*.

Note - When selecting a LandXML file from 12d Model where the transition type is cubic, you are prompted to select the applicable cubic type. This is because the cubic type is not identifiable in the file. Choose from *Cubic spiral* or *NSW cubic parabola*.

Surveying roads from LandXML files

When you survey a road from a LandXML file, the road is temporarily converted to a Trimble road, providing all the stakeout options available for a Trimble road. Choose from the following:

- Measure your position relative to a road
- Measure your position relative to a string
- Stake a station on a string
- Stake a side slope from an alignment
- Survey additional strings
- Stake additional points
- Stake an offset at a skew to the horizontal alignment

The method can be selected from a drop-down list. Alternatively, you can [activate the method graphically](#).

Notes –

- You cannot activate the Side slope from alignment method graphically.
- The Roads software does not provide stakeout for station values between template positions where the templates have a different number of elements.
- The Roads software supports LandXML roads where the horizontal alignment is defined by elements or Points of Intersection (PI's). However LandXML files with curves defined by spiral-arc-connectingSpiral-arc-spiral are not supported.
- You must specify a coordinate system before you can stake out roads with the Roads software.

WARNING – Do not stake out points and then change the coordinate system or perform a calibration. If you do, these points will be inconsistent with the new coordinate system and any points computed or staked out after the change.

Tips –

- During a conventional survey, you can use the tap and hold menu in the map to quickly measure a check point. If there are no points selected, *Check backsight* is available; if one point is selected *Check shot* is available. Alternatively, to measure a check shot from any screen, press **Ctrl + K** on the controller.
- You can also access the tap and hold menu from the graphics screen by pressing the space bar. This is useful if the touch screen has been disabled.

Surveying roads from GENIO files

The Roads software enables you to:

Measure your position relative to the road

Measure your position relative to a string

Stake a station on a string

Stake an offset at a skew to the master string

When activating the survey method graphically, a selection screen showing a plan view of the road is displayed. This screen precedes the stakeout screen. The following table describes how to graphically activate a method from the selection screen:

Survey method	Graphical activation
Measure your position relative to a road	At the selection screen, with nothing selected, the Roads software is ready to measure your position relative to the road.
Measure your position relative to a string	Tap the line work that represents the string. To select a different string, use the left/right arrow keys. Alternatively, tap and hold in the graphics area and select a string from the offset list. The strings in the list are determined by the templates assigned at your current position relative to the road.
Stake a station	Tap the circle that represents the station on the string to be staked.

Survey method	Graphical activation
on a string	<p>The cross section view is available, and you are prompted to confirm that the correct position is selected.</p> <p>To select a different position (from plan or cross section view), use the left/right arrow keys to select a different string and the up/down arrow keys to select a different station. Alternatively, tap and hold in the graphics area and select a string and station value from the appropriate lists.</p>
Stake skew offset	<p>From the plan view, tap the circle that represents the station on the master string that the skew offset will be applied from and then from the tap and hold menu select <i>Stake skew offset</i>.</p>

To clear the current selection, from the plan view do one of the following:

- Tap in a clear space
- Tap the selection again

If the master string has been excluded, the master string appears grayed out in the plan view and does not appear in the cross section view. To stake it out, return to *Define*, tap and hold on the graphics area and then select *Exclude master at stakeout*.

To treat a 5D string in a GENIO file as a 3D string, clear the *Auto side slope* check box.

Note – You must specify a coordinate system before you can stake out roads with the Roads software.

WARNING – Do not stake out points and then change the coordinate system or perform a calibration. If you do, these points will be inconsistent with the new coordinate system and any points computed or staked out after the change.

Tips –

- During a conventional survey, you can use the tap and hold menu in the map to quickly measure a check point. If there are no points selected, *Check backsight* is available; if one point is selected *Check shot* is available. Alternatively, to measure a check shot from any screen, press **Ctrl + K** on the controller.
- You can also access the tap and hold menu from the graphics screen by pressing the space bar. This is useful if the touch screen has been disabled.
- To improve performance when loading large GENIO files, increase the available memory. The following is an indication of loading times for GENIO files:
 - For a 1 MB GENIO file the load time is approximately 20 seconds
 - For a 3 MB GENIO file the load time is approximately 1 minute

Position relative to GENIO road

To measure your position relative to a GENIO road:

1. Tap *Survey*, select a survey style and start a survey.

From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a GENIO file and tap *Next*.

3. Select a road to stake and tap *Next*.
4. Enter a value in the *Antenna/Target height* field.
5. Tap *Next*. The graphical selection screen appears displaying the road. You are, by default, ready to measure your position relative to the road.

Tip - When you select *Next*, the software calculates the station values for all 3D strings relative to the 6D string for the road. The time taken to calculate the station values varies with the number of strings in the road and the length of the road. To improve performance when staking large GENIO files, Trimble recommends that you limit the number of strings in a road.

6. To define construction offsets, tap and hold in the graphics window and then select *Define construction offsets*.

Note - *The Vertical Offset value specified here is not applied to a DTM surface.*

7. Tap *Start* and then use either the plan or cross section view to see your position relative to the road.

If your current position is within 30m of the master string, the plan view shows a dashed green line drawn at a right angle from your current position to the string.

8. When the point is within tolerance, measure the point.

For tips common to all road survey methods, see [Tips when surveying roads](#).

Notes

- *To understand how your position is calculated between strings, see [String interpolation](#).*
- *If you are using a conventional instrument, the road values only appear after you take a distance measurement.*
- *If your current position is more than 30 meters from the master string, the graphical display navigates you to a position on the master string. This is calculated by projecting your current position at right angles to the master string.*
- *Off road is displayed at the top of the screen if your current position is before the start of the road or beyond the end of the road.*
- *If the road consists of only a master string (6D), the V.Distance value will report the vertical distance to this string.*

Stakeout along a string

To measure your position relative to a string in a GENIO road:

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a GENIO file and tap *Next*.
3. Select a road to stake and tap *Next*.
4. Enter a value in the *Antenna/Target height* field.
5. Tap *Next*. The graphical selection screen appears displaying the road.

Tip - When you select *Next*, the software calculates the station values for all 3D strings relative to the 6D string for the road. The time taken to calculate the station values varies with the

number of strings in the road and the length of the road. To improve performance when staking large GENIO files, Trimble recommends that you limit the number of strings in a road.

6. [Select a string.](#)

The graphical display shows the name of the selected string.

Once you select a string, tap the icon in the bottom right corner of the graphics window to view the cross section. The displayed cross section is for the station at your current position.

To return to the plan view, tap the icon again. Alternatively, press the [Tab] key on the controller to switch between the plan view and the cross section view.

If required, from the cross section view define a [cross slope](#).

Note - *If the road includes multiple side slopes that define benched side slopes, only the 5D / Interface string that is furthest from the master string will be converted to a side slope.*

Tip - You can edit the design elevation of the string. To do this, tap and hold in the graphical window and then select *Edit elevation*. This will set the elevation for all positions along the string to the edited value. To reload an edited elevation, select *Reload original elevation* from the pop-up menu in the *Design elevation* field. This restores the elevation of all positions along the string to their design values. The edited elevation is shown in red.

7. To define construction offsets, tap and hold in the graphics window and then select [Define construction offsets](#).

8. Tap *Start* and then use either the plan or [cross section](#) view to navigate along the string.

If your current position is within 5m of the selected string, the plan view shows a dashed green line drawn at a right angle from your current position to the string.

9. When the point is within tolerance, measure the point.

For tips common to all road survey methods, see [Tips when surveying roads](#).

Notes

- *The Roads software interpolates elevation values along the string. For more information, see [String interpolation](#).*
- *For 5D / Interface strings, the target may not coincide with the design position because the target is calculated relative to your current position.*
- *If you are staking a [catch point](#) (5D / Interface string) with construction offsets, navigate to the catch point and then tap *Apply* to add the construction offsets. You are prompted to apply the offsets from your current position. If you are not on the catch position, select *No*, navigate to the catch position and then tap *Apply* again.*

If you want to store the catch position and the construction offset, see [Construction offsets](#).

- *If the string selected to stake is a 5D string Roads converts this string to a side slope. The calculated slope value is defined by the slope between the 5D string and the adjacent 3D string.*
- *To configure the software to treat a 5D string as a 3D string, tap *Options* and then clear the *Auto side slope* option.*
- *For GENIO files defined from 12D Model, Roads treats all strings with a name that includes the letters INT as a 5D string and converts the string to a side slope. The calculated slope value is defined by the slope between the interface string and the adjacent 3D string.*

- To edit the side slope value of a selected 5D / Interface string or to select a new hinge string, tap and hold in the graphics window and then select *Edit Side Slope*. See [Editing side slopes](#) for further details.
- A side slope is shown in red if edited.

Stakeout station on string

To stake a station on a string in a GENIO road:

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a GENIO file and tap *Next*.
3. Select a road to stake and tap *Next*.
4. Enter a value in the *Antenna/Target height* field.
5. Tap *Next*. The graphical selection screen appears displaying the road.

Tips -

- Previously staked points are shown as solid circles.
 - When you select *Next*, the Roads software calculates the station values for all 3D strings relative to the 6D string for the road. The time taken to calculate the station values varies with the number of strings in the road and the length of the road. To improve performance when staking large GENIO files, Trimble recommends that you limit the number of strings in a road.
6. [Select a station on a string](#).

The Roads software also supports staking nominal offset and station values. To do this, tap and hold in the graphics area and select *Select string to stake* and then key in a numeric value that represents the offset. Then from the *Station to stake* field, key in a nominal station value. For more information, see [String interpolation](#).

Once you select a position, tap the icon in the bottom right corner of the graphics window to view the cross section.

To return to the plan view, tap the icon again. Alternatively, press the [Tab] key on the controller to switch between the plan view and the cross section view.

In the plan and cross section views, the bull's-eye icon (double circle) indicates the selected position. In the plan view, a selected string is shown with solid circles. To browse the string name, tap and hold on a string.

If required, from the cross section view define a [cross slope](#) and/or a [subgrade](#).

To stake relative to a secondary road, see [Secondary road](#).

Note - *If the road includes multiple side slopes that define benched side slopes, only the 5D / Interface string that is furthest from the master string will be converted to a side slope.*

7. If required, from the tap and hold menu, select *Stake skew offset* to stake an offset at a skew to the master string. (This option is only available for a station selected on the master string.)
8. To edit the design elevation, tap and hold in the graphical window and then select *Edit*

elevation. To reload an edited elevation, select *Reload original elevation* from the pop-up menu in the *Design elevation* field.

Note - An elevation is shown in red if edited.

9. To define a construction offsets, tap and hold in the graphics window and then select [Define construction offsets](#).

Tip - To activate the pop-up menu if the touch screen has been disabled, press the space bar.

10. Tap *Start* and then use either the plan or [cross section](#) graphical display to navigate to the position.
11. When the point is within tolerance, measure the point.

For tips common to all road survey methods, see [Tips when surveying roads](#).

Once a position has been measured and stored, you are returned to the selection screen where you can either select another position to stake or choose a different survey method.

Notes

- For 5D / Interface strings, the target may not coincide with the design position because the target is calculated relative to your current position.
- If you are staking a [catch point](#) (5D / Interface string) with construction offsets, navigate to the catch point and then tap *Apply* to add the construction offsets. You are prompted to apply the offsets from your current position. If you are not on the catch position, select *No*, navigate to the catch position and then tap *Apply* again.
If you want to store the catch position and the construction offset, see [Construction offsets](#).
- If the string selected to stake is a 5D string Roads converts this string to a side slope. The calculated slope value is defined by the slope between the 5D string and the adjacent 3D string.
- To configure the software to treat a 5D string as a 3D string, tap *Options* and then clear the *Auto side slope* option.
- For GENIO files defined from 12D Model, Roads treats all strings with a name that includes the letters INT as a 5D string and converts the string to a side slope. The calculated slope value is defined by the slope between the interface string and the adjacent 3D string.
- To edit the side slope value of a selected 5D / Interface string or to select a new hinge string, tap and hold in the graphics window and then select *Edit Side Slope*. See [Editing side slopes](#) for further details.
- A side slope is shown in red if edited.

Staking relative to a secondary road

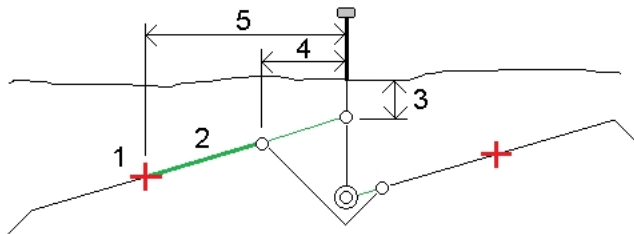
This function enables stakeout details from a secondary road to be referenced to a position being staked on a primary (current) road.

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a GENIO file and tap *Next*.
3. Select a road to stake (the primary road) and tap *Next*.

4. Enter a value in the *Antenna/Target height* field.
5. Tap *Next*. The primary road is displayed. Select a position on the 3D string to stake.

Note – *The secondary road option is not available for positions on 5D, 6D, and 12D strings.*
6. From either the plan or cross section view, tap and hold in the graphics window and then select *Select secondary road* from the menu. From the list of roads, select the road representing the secondary road. The secondary road appears as unavailable in the plan view. From the plan view, you cannot select positions to stake on a secondary road.

Tip –To deselect a secondary road, first select a position on a 3D string and then, from the tap and hold menu, select *Select secondary road* and then tap *None*.
7. From either the plan or cross section view, tap and hold in the graphics window and then select *View secondary cross section* from the menu. Referring to the following diagram, from the displayed cross section for the secondary road (1), tap the line (2) preceding the position you want to stake.



8. Tap *Accept* to confirm your selection.
9. Tap *Start* to begin navigating using either the plan or **cross section** graphical display to navigate to the point. For more information common to all road survey methods, see [Tips when surveying roads](#).
10. When the point is within tolerance, measure the point and mark up the stake with the deltas for the primary and secondary roads.

Note - *Stake details for the secondary road reported in the Confirm staked deltas screen include:*

- *V. Dist to road (3)*
- *Horizontal construction offset (calc'd) (4)*
- *Distance to alignment (5)*

String interpolation

The following rules apply to keyed-in station values:

- For a 6D string, the coordinates for keyed-in station positions are computed respecting the geometry of the string. Elevation values are computed by linear interpolation. However, if there is a 12D string coincident with the 6D string, the software uses the vertical alignment data available in the 12D string to compute the elevation values.
- For a 3D string, the coordinates for keyed in station values respect the horizontal geometry of the associated 6D string. Elevation values are computed by linear interpolation. However, if the deflection angle of the 3D string compared to that of the associated 6D string is greater than 30

minutes, the geometry of the associated 6D string will be ignored and the coordinates will be computed by linear interpolation instead. This is to avoid unexpected behavior when there is an acute change in direction in the 3D string for features such as slip lanes, bus bays, and so on.

- Interpolation between points along a transition is calculated using a clothoid spiral for 12D and 6D strings and approximated for 3D strings.

When measuring your position relative to a GENIO road or where your station and offset are nominal values your position is computed by linear interpolation from the nearest positions on adjacent strings.

In all situations where your position is interpolated, closer station intervals give greater accuracy.

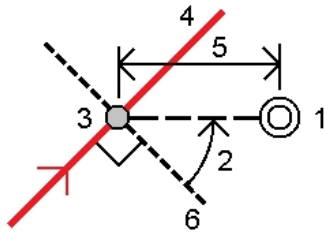
Staking a skew offset

This option enables a position to be defined at a skew to the horizontal alignment and is especially useful when staking culverts, bridge abutments, and similar features that are not at right angles to the alignment.

Note - This option is only available when using the graphical selection method.

1. Tap *Survey*, select a survey style and start a survey.
From the Trimble Access menu, tap *Settings / Survey styles* to edit an existing style or to define a new style.
2. Select a file.
See also [Staking a road from the map](#).
3. Tap *Next*.
4. If you have selected a LandXML file, see [Selection options for a LandXML file](#).
5. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
6. If staking a Trimble or LandXML road, enter the *Station interval* or accept the default value set when the road was defined.
7. Tap *Next*. The graphical selection screen appears, displaying the road. Previously staked points are shown as solid circles.
8. **Select** a station on the horizontal alignment/master string. The station value, string name, and elevation is displayed at the top of the screen.
9. From the tap and hold menu, select *Stake skew offset*.
10. Enter offset and skew values.

The diagram below shows a point defined by skew forward and offset to the right. The point to stake (1) is defined from the station (3) by an offset (5) along the skew (2). The skew can be defined by a forward or backward delta angle to a line (6) at right angles to the road being staked (4) or, alternatively, the skew can be defined by an azimuth.



11. Define the elevation for the point using one of the following:
 - *Slope from string*: The elevation is computed by a slope from the elevation on the string at the entered station.
 - *Delta from string*: The elevation is computed by a delta from the elevation on the string at the entered station.
 - *Key in*: The elevation is keyed in.

Note - If the road has only a horizontal alignment, the elevation for the point must be defined using *Key in*.

12. Tap *Accept*.

Note - If the computed position is before the start or beyond the end of the road the point cannot be staked.

13. If required, from the tap and hold menu, select *Define construction offsets* to enter a construction offset.
14. Tap *Start* and navigate to the point.
15. When the point is within tolerance, measure the point.

For tips common to all road survey methods, see [Tips when surveying roads](#).

Once a position has been measured and stored, you are returned to the selection screen where you can either select another position to stake or choose a different survey method.

Tip - You can stake out a skewed offset relative to a nominal station value. That is, the station does not have to coincide with a cross section. To do this, select any station on the horizontal alignment/master string and then from the tap and hold menu select *Select station* and key in a station value.

Staking a side slope

In some situations, you may need to add or edit the side slope.

Note – The side slope, and any edits to the side slope, are discarded after a position is measured or when you exit the stakeout screen.

Adding a side slope

You can add a side slope when staking a station on a string or measuring your position relative to a string.

The current string is, by default, the hinge string but you can [select a different string as the hinge string](#) if required.

You cannot add a side slope to the alignment.

Note - Adding a side slope is available only for a Trimble road.

Editing a side slope

If the design cut or file slope value or the cut ditch width value is not applicable, overwrite the value with a new one.

In some situations, it may be preferable to adjust the cut or fill slope value to the value defined by the slope from the current string to the next string or from the previous string to the current string. In either the *Cut slope* field or the *Fill slope* field, select *Slope to next string* or *Slope from previous string*. The *Slope* field updates with the appropriate slope value.

The example below shows where you might select the *Slope to next string* or *Slope from previous string* option for a cut slope. A similar approach can be used for a fill slope.

Note – The next or previous string slope options are available:

- Only if a next or previous string exists.
- In the *Cut slope* field, only if the next or previous slope values are positive, that is, if they define a cut slope.
- In the *Fill slope* field, only if the next or previous slope values are negative, that is, if they define a fill slope.

Sometimes, particularly for LandXML road files, the side slope may specify only one slope value, where the other is null (?). If, when staking a side slope, the design and calculated side slope values at the top of the navigation screen are null, this indicates that the undefined slope value is required to stake the catch. Use the *Edit side slope* option to specify the slope value to enable the catch to be staked.

You can also [select a different string as the hinge string](#), if required.

The side slope value is shown in red if edited.

Selecting a different string as the hinge string

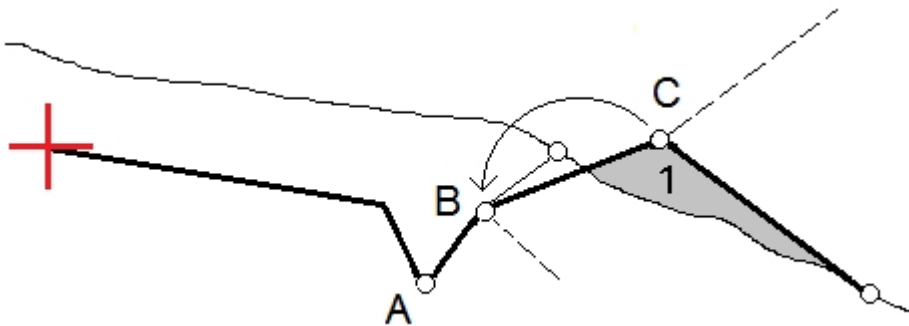
1. Tap and hold in either the plan or cross section graphics window and select *Add side slope* or *Edit side slope*.
2. From the *Hinge string* field tap the arrow and then select a string by one of these methods:
 - Tap a string on the screen
 - If appropriate for your controller, use the left/right arrow keys
 - Tap and hold on the screen and select the string from the list

The current hinge string is shown as a solid blue circle.

Example – select hinge string and edit side slope

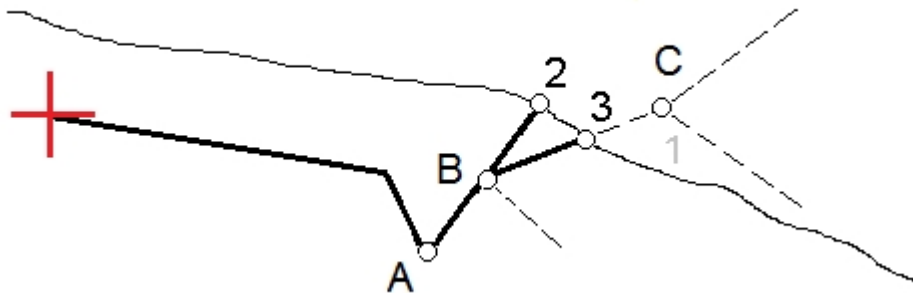
The diagram below shows where you might select a different string as the hinge string. In this example, the original design with the hinge at string C is in fill, resulting in an unwanted fill zone (1).

By selecting string B as the hinge string, the new design is now in cut and the unwanted fill zone is avoided.



With string B selected as the hinge string, the cut slope can be defined by either retaining the design slope value or keying in another value. Alternatively, the cut slope can be defined by selecting one of the following:

- *Slope from previous string* option to define the cut slope as the slope from the previous string A to the new hinge string B, resulting in a catch position at (2).
- *Slope to next string* option to define the cut slope as the slope from the new hinge string B to the next string C, resulting in a catch position at (3).



Specifying construction offsets

A point to be staked can be offset by a:

- [Horizontal offset](#)
- [Vertical offset](#)
- [Station offset](#) (available for roads from a GENIO file only)

A construction offset is indicated in the graphical display by a green line, with the double circle indicating the selected position adjusted for the specified construction offset(s).

Tips

- Construction offsets are job-specific. That is, a construction offset specified for a road is not used for the same road when it is accessed from a different job.

- Construction offsets are format-specific. That is, a construction offset specified for a road is not used for roads of the other two road formats.
- Construction offsets are not road-specific. That is, a construction offset specified for a road is used for all roads of the same format in the same job.
- Construction offsets are not survey session-specific. That is, a construction offset specified for a road is used for subsequent survey sessions.


Horizontal construction offsets

When measuring your position relative to the horizontal alignment/master string or when staking a station on the horizontal alignment/master string you can apply a horizontal construction offset to a point where:

- A negative value offsets the point to the left of the horizontal alignment/master string.
- A positive value offsets the point to the right of the horizontal alignment/master string.

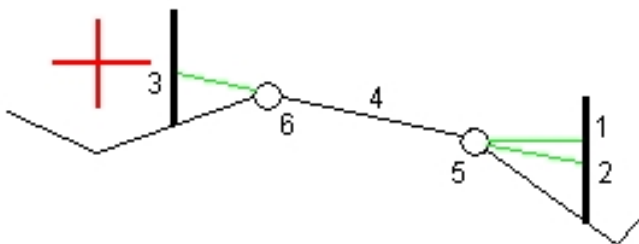
For all other strings, including side slope strings, you can apply a horizontal construction offset to a point where:

- A negative value offsets the point toward the horizontal alignment/master string (in).
- A positive value offsets the point away from the horizontal alignment/master string (out).


Use the advanced pop-up arrow () to specify if the offset is to be applied:

- Horizontal
- At the slope of the line from the previous string to the current string in the cross section
- At the slope of the line from the current string to the next string in the cross section

The following diagram shows a *Horizontal offset (1)*, *Slope previous offset (2)* and *Slope next offset (3)* applied to a position. For the *Slope previous* option, the slope of the offset is defined by the slope of the line (4) before the position (5) selected to stake. For the *Slope next* option, the slope of the offset is defined by the slope of the line (4) after the position (6) selected to stake. The *Vertical offset* value in the diagram is 0.000.

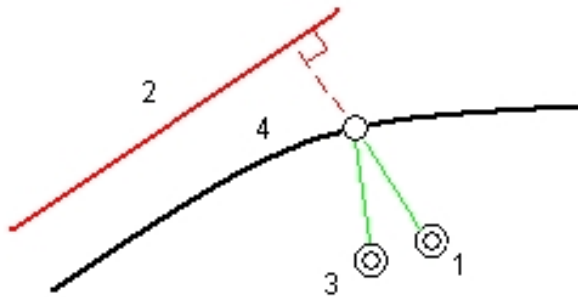


Note - For points with zero offset, you cannot apply construction horizontal offsets at the slope value of the previous line.


For a GENIO road, use the advanced pop-up arrow () to specify if the offset is to be applied:

- Perpendicular to the master string for the sub string being staked
- Perpendicular to the sub string being staked


The following diagram shows a *Horizontal offset (1)* applied perpendicular to the master string (2) and a *Horizontal offset (3)* applied perpendicular to the sub string (4).



Tips


- For Trimble and LandXML roads where you are measuring your position relative to a string (except by the *Measure nearest string* option) or staking a station on a string, you can define a horizontal offset by your current position. To do this:
 - Use the advanced pop-up arrow () and select *Calculated*
 - Navigate to the position you want to place the stake. Note that the *Go left / Go right* navigation delta is replaced by the distance to the horizontal alignment when the horizontal offset is *Calculated*.
 - Measure and store the point

The calculated horizontal offset is reported in the *As staked deltas*.

- For GENIO roads where you are staking a station on a string, you can define a horizontal offset by the distance from the selected position to the master string. To do this:
 - Use the advanced pop-up arrow () and select *At string*
 - Navigate to the target which will be at the master string
 - Measure and store the point

The calculated horizontal offset is reported in the *As staked deltas*.

This option is not available if the string being staked is a 5D string or if the horizontal offset is applied perpendicular to the sub string.

- For GENIO roads where you are measuring your position relative to a string or a station on a string, you can define a horizontal offset by the distance from the selected position to your current position. To do this:
 - Tap the advanced pop-up arrow () and then select *Calculated*.
 - Navigate to the position where you want to place the stake. Note that the *Go left / Go right* navigation delta is replaced by the calculated horizontal construction offset.
 - Measure and store the point

The calculated horizontal offset is reported in the *As staked deltas*.

This option is not available if the horizontal offset is applied perpendicular to the sub string.

Notes

- Construction offsets are not automatically applied to a side slope offset. For more information, see staking a [Catch point](#).
- When you stake a side slope, select the Store both catch and construction offset check box if you want to measure **and** store the catch position.

Vertical construction offsets

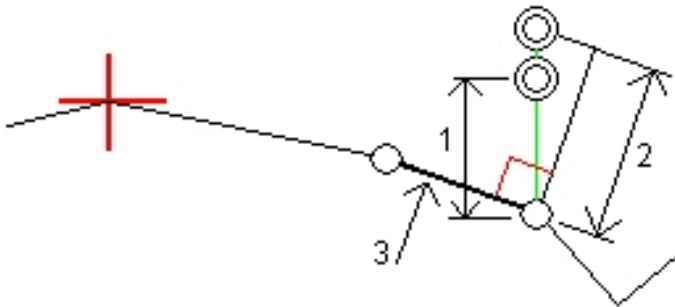
You can apply a vertical construction offset to a point where a:

- Negative value offsets the point vertically down.
- Positive value offsets the point vertically up.

In the *Vertical offset* field, use the advanced pop-up arrow (⌵) to specify if the offset is to be applied:

- Vertically
- Perpendicular to the element in the cross section before the point being staked

The following diagram shows a *Vertical offset* applied vertically (1) and a *Vertical offset* applied perpendicular (2) to the previous cross section element (3).

**Station construction offsets**

For roads derived from a GENIO file you can apply a station construction offset to a point where a.

- Positive value offsets the point in the direction of increasing station (Forward).
- Negative value offsets the point in the direction of decreasing station (Backward).

Notes

- You cannot apply a Station offset to a 5D string that represents the catch position.
- The Station offset respects the geometry of the string being staked.

Cross section view

The cross section that appears is orientated in the direction of increasing station. Your current position and the target are shown. If the target has construction offsets specified, the smaller single

circle indicates the selected position and the double circle indicates the selected position adjusted for the specified construction offset(s). The construction offset(s) appear as green lines.

When you view the cross section, the appropriate cut or fill side slope appears for the side of the road that you are currently on.

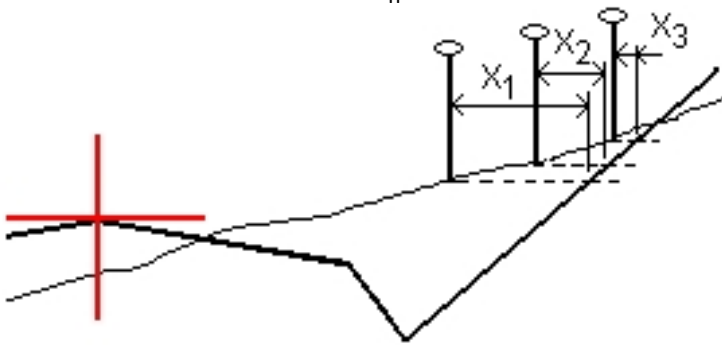
See [Cross slope](#) to graphically define a cross slope.

See [Subgrade](#) to graphically define a subgrade.

Catch point

The catch point is the point where the design side slope intersects with the ground.

The actual intersection position of the side slope with the existing ground surface - the catch point - is determined iteratively (by repetition). The Roads software calculates the intersection of a horizontal plane passing through the current position, and either the cut or fill side slope, as shown in the following diagram, where x_n is the *Go Right/Left* value.



The graphical display in the plan view, shows the calculated catch position. The calculated slope value (in blue) and the design slope value appears at the top of the screen.

To view the [cross section](#) of your current position, tap the icon at the bottom right of the graphics window. Alternatively, press the [Tab] key on the controller to switch between the plan view and the cross section view.

The cross section is displayed looking in the direction of increasing station. Your current position and the calculated target are indicated. A line is drawn (in blue) from the hinge position to your current position to indicate the calculated slope.

If the catch point has construction offsets specified, these appear in the cross-section view as green lines. The smaller single circle indicates the calculated catch position and the double circle indicates the selected position adjusted for the specified construction offset(s). The construction offsets appear only after you have applied them.

Note - For side slope offsets where the slope changes between templates, the Roads software calculates the side slope for intermediate stations by interpolating the slope value.

From the *Confirm staked deltas* screen (or *Review job*) tap [Report](#) to view the *Catch point deltas report* screen.

Catch point staked deltas

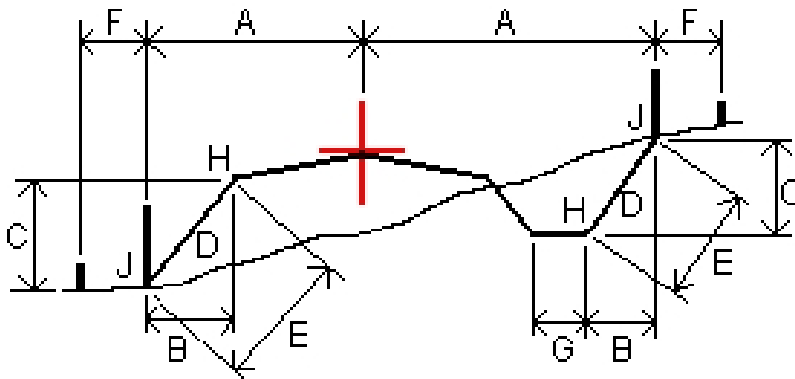
If you have the *View before storage* check box in the *Stakeout* options selected, the *Confirm staked deltas* screen appears before you store the point.

The Roads software supports user definable stakeout reports, which enable you to configure the display of staked information on the *Confirm staked deltas* screen that appears when you enable *View before storage*. For more information, see *As-staked point details*.

Note - The value in the *S.Distance to hinge + Constr off field* includes any construction offset values specified and reports the slope distance from the hinge to the as-staked position. The value is null (?) if there is no horizontal construction offset specified or the horizontal construction offset is applied horizontally.

Tip - Tap *Report* to view the *Catch point deltas report* screen. This screen shows the horizontal and vertical distances from the catch point to each string, up to and including the horizontal alignment. If the template includes a cut ditch, the report includes the hinge position at the toe of the cut slope. The reported values exclude any construction offset specified.

The following diagram explains some of these fields.



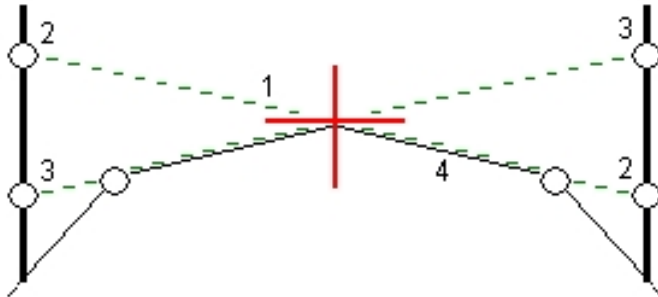
Where:

- A = Distance to horizontal alignment
- B = Horizontal distance to hinge point
- C = Vertical distance to hinge point
- D = Slope
- E = Slope distance to hinge point
- F = Horizontal construction offset
- G = Ditch offset
- H = Hinge point
- J = Catch point

Note - When you stake a fill side slope with a subgrade, the as staked deltas include the distance from the catch to the intersection of the subgrade with the side slope.

Defining a cross slope

Use this option when you need to confirm the construction of a road surface - typically the carriageway. Refer to the following diagram:

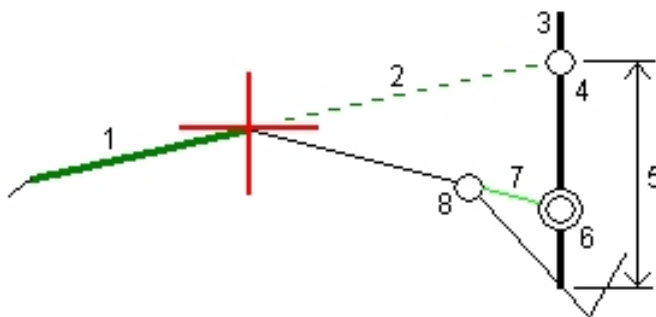


Typically a wire (1) is stretched from one side of the road to the other fixed at position (2) on each stake. The wire is then checked to see that it lies on the formed road surface (4). The process is then repeated for the other side of the road by fixing the wire to the stakes at position (3). The cross slope can be offset vertically so that the wire is above the surface making it easier to confirm the construction. If the cross slope is offset, the measured distance from the wire to the surface should be consistent. The cross slope option reports the deltas, enabling the stake to be marked up with positions (2) and (3).

A cross slope:

- is defined at the graphical selection screen (cross section view) when the stakeout method has been selected graphically.
- is defined at the stakeout screen (cross section view) when the stakeout method has been selected from the menu.
- cannot be defined when measuring your position relative to the road.

See the following diagram:



To do this:

1. From the cross section view, define a horizontal construction offset, typically at *Slope previous*, and enter a vertical offset if required.

The smaller single circle (8) indicates the selected position and the double circle (6) indicates the selected position adjusted for the specified construction offsets. The construction offset(s) appear as a green line (7).

2. Tap the line (1) that will define the cross slope. The selected line appears as a bold green line.

Note - You cannot select a line that defines a side slope to define a cross slope.

- From the pop-up menu select *Define cross slope*, enter a *Cross slope offset* if required, and tap *OK*.

A dashed green line (2) extends from the selected line to intersect with a vertical line (4) at the target stake (3).

- Navigate to the target and then stake the position.
- Use the *V. Dist. cross slope* value (5) to mark the stake with the second position.

Note - To de-activate the cross slope function, tap the selected line (1).

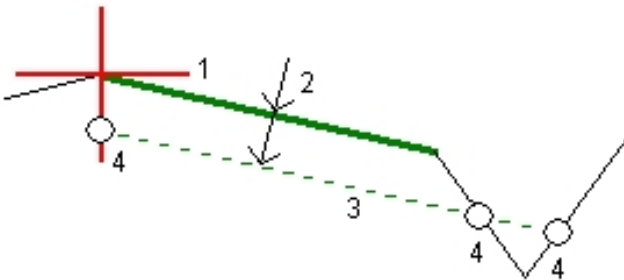
Defining a subgrade

Use this option where the cross section represents the finished road surface and you need to stake the points defining other surfaces in the road - typically the subgrade.

A subgrade can only be defined at the graphical selection screen (cross section view). It cannot be defined when the stakeout method is selected from the menu, or when measuring your position relative to a road or a string.

Subgrade points are computed by creating a temporary line that is parallel to, and offset from, a line between two strings in the cross section. The points can then be selected for stakeout.

See the following diagram:



To do this:

- From the cross section view, tap the line (1) that will define the subgrade. The selected line appears as a bold green line.

Note - You cannot select a line that defines a side slope to define a subgrade.

- From the pop-up menu, select *Define subgrade*, enter the depth to subgrade (2) where the depth is from the selected line to the subgrade surface and tap *OK*.

A dashed green line (3) extends to intersect with all encountered lines in the cross section. If no intersection(s) are found, computed points are created at the same start and end offsets as that of the selected line. The single circles (4) indicate the computed positions.

- Tap the position that you want to stake.
- Navigate to the target and then stake the position.

Note - To de-activate the subgrade function, tap the selected line (1).

Staking a road from the map

From the map you can:

- [Select a Trimble or LandXML road to stake](#)
- [Define a road on the fly to stake](#)

Selecting a Trimble or LandXML road from the map

1. Tap *Survey*.
2. From the *Select a file* screen, tap *Map* to display the map.
3. Tap *Layers* and then select and make active the road to stake.

Note - By default, all *.rxl* and *.xml* files in the current project folder are available from the *Layers* softkey. You can also add files from any location in the *Trimble Data* folder. See also *Active map*.

4. Tap *Accept* and then in the graphics area tap on the road to select it.
5. Tap *Stakeout* and then select the survey method, either graphically or from the menu.

Note - The first time you stake out a road, the software prompts you to choose the selection method you want to use. The selected option is used for all subsequent surveys. To change the selection method, from the tap and hold menu in the map select *Stake out road (menu based)* to select the survey method from the traditional menu. Alternatively select *Stake out road (Graphics based)* to activate the method graphically. See also [Surveying Trimble roads](#).

Defining a road on the fly

1. Tap *Survey*.
2. From the *Select a file* screen, tap *Map* to display the map.
3. Tap the entities you wish to use to define the horizontal alignment of the road. If the entities have elevations, these elevations will be used to define the vertical alignment. You can select points, lines, or arcs or line work contained in DXF, STR, SHP, or a LandXML file.

Tips

- The order in which points are selected and the direction of the lines and arcs is very important as this defines the road direction.
- If selecting line work contained in DXF, STR, SHP, or LandXML files, tap the *Layers* softkey, select the file and then make active the appropriate layer(s) that will be used to define the horizontal alignment.
- A road defined on the fly is not saved. To define and store a road from the map, see [Defining a Trimble road](#).

4. Tap *Stakeout* and then select the survey method, either graphically or from the menu.

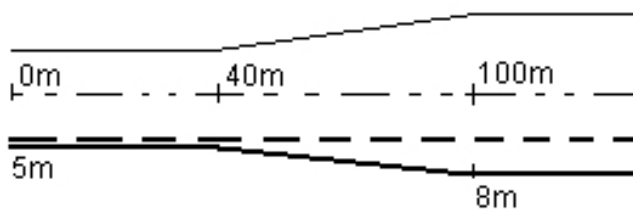
Note - The first time you stake out a road, the software prompts you to choose the selection method you want to use. The selected option is used for all subsequent surveys. To change the selection method, from the tap and hold menu in the map select *Stake out road (menu based)* to select the survey method from the traditional menu. Alternatively select *Stake out road (Graphics based)* to activate the method graphically. See also [Surveying Trimble roads](#).

Understanding keyed in and selected offset/feature behavior

The behavior at stake out differs depending on whether the offset/string was selected graphically, selected from a list, or keyed in.

- If you graphically select a string or select a string from the list, the Go Right/Go Left value at stakeout updates to reflect any changes in geometry due to template changes or widening.
- If you key in a numeric offset value (effectively defining a string on the fly) that value is maintained for the entire length of the road.

Consider the following diagram:



If you select an offset/string that has an offset value of 5m, the offset value updates to follow the solid line for subsequent stations. In this example, the offset changes from 5m to 8m between stations 40m and 100m and then is maintained at 8m for subsequent stations.


If you key in 5m for the offset, the offset follows the dashed line. That is, the offset of 5m is maintained for subsequent stations.

Generating a report

Use the *Report* option to create custom ASCII files on the controller while in the field. Use the predefined formats or create your own custom formats. With custom formats, you can create files of almost any description. Use these files to check data in the field, or to produce reports, which you can transfer from the field to your client or to the office for further processing with the office software.

You can modify a predefined format to meet your specific requirements, or use it as a template to create a completely new custom ASCII export format.

Creating a report of survey data

1. Open the job that contains the data to export.
2. From the main menu, tap *Report*.
3. In the *File format* field, specify the type of file to create.
4. Tap  to select an existing folder or create a new one.
5. Enter a filename.

By default, the *File name* field shows the name of the current job. The filename extension is defined in the XSLT style sheet. Change the file name and extension as required.

6. If more fields are displayed, complete them.

You can use the XSLT style sheets to generate files and reports based on parameters that you define. For example, when generating a Stakeout report, the *Stakeout horizontal tolerance* and the *Stakeout vertical tolerance* fields define acceptable stakeout tolerances. When generating the report you can stipulate the tolerances, then any stakeout delta greater than the defined tolerances appears in color in the generated report.

7. To automatically view the file after you create it, select the *View created file* check box.
8. To create the file, tap *Accept*.

Note - When the selected XSLT style sheet is applied to create the custom export file, the processing is all carried out in the program memory available on the device. If there is not enough memory to enable the creation of the export file, an error message will be displayed and no export file will be created.

The following factors affect whether the report file can be created:

1. The amount of program memory available to the device.
2. The size of the job being exported.

4 Generating a report

3. The complexity of the style sheet being used to create the export file.
4. The amount of data being written to the export file.

If it is not possible to create the export file on the controller, download the job as a JobXML file to a computer.

To create the export file from the downloaded JobXML file using the same XSLT style sheet, use the ASCII File Generator utility program (available from *Trimble Access Downloads* (www.trimble.com/support_trl.aspx?Nav=Collection-62098)).