



Trimble® Earthworks Soil Compactor

For SITECH Only

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Controls and Guidance

In this chapter:

- ▶ Viewing Licenses
- ▶ On-screen Lightbars
- ▶ External Lightbars
- ▶ Transferring Files
- ▶ Network
- ▶ Text Grid View

You need to set up and control the guidance system and understand the guidance information the system provides. This chapter describes, in general terms, how these components are used.

1.1 Viewing Licenses

To view the Licenses screen:

- From the Dashboard, tap the Licenses tile.
- From the System Settings menu, select Licenses.

Your technician can install licenses manually on your system, or synchronize them with the cloud.

You can tap Refresh to check that your licenses are up to date.

If the installed license is from the cloud, a cloud icon  displays.

1.1.1 License types

Licenses enable different levels of functionality within the system. The following types of licenses are available:

License Type	Description
Core license	Allows the system to operate and provide basic machine guidance.
Software maintenance license	Bundled together with the core license to allow users to install upgrades during the period of validity.
Module license	Optional licenses that build on the core license to provide additional functionality. For example, Infield Designs, 3D Design Guidance.
Advanced module license	Optional licenses that build on the core license to provide advanced functionality. For example, Earthmoving, workflow optimization.
GNSS receiver license	Required together with some module licenses if GNSS receivers are used for the guidance solution. The license name depicts the type of corrections received. For example, Left GNSS Receiver with Full RTK Precision.

License Type	Description
GNSS constellation license	Optional GNSS receiver licenses you can enable to receive signals from the following GNSS constellations: • Global Positioning Satellite System (GLONASS) satellites, operated by the Russian Department of Defense. • Galileo Satellite System, operated by the European Space Agency. • BeiDou Navigation Satellite System (BDS) satellites, operated by the Chinese National Space Administration. <i>Note – By default, all GNSS receivers can receive signals from the Global Positioning System (GPS) satellites, operated by the United States Department of Defense and Quasi-Zenith Satellite System (QZSS) satellites, operated by the Japanese Satellite Positioning.</i>

1.1.2 Status icons

The system provides a status icon beside each license, as shown below:

Icon	Type	Description
	Good	For the current configuration, the license is installed correctly.
	Attention	• For the current configuration, a license that is expected, and which adds functionality, is missing or expired. • The installed license is about to expire.
	Warning	For the current configuration, a license that is required is missing or expired.
	None	A device is connected, but has no license installed.

1.1.3 License information

Tap on an installed license for more information. An information panel displays the following details:

License Attributes	Description
Functionality	Description of the functionality that the license provides.

License Attributes	Description
Status	Whether the license is installed or not installed.
Type	• Perpetual – an open-ended license. • Subscription – license that expires after a fixed term, if not renewed.
Location	• Installed on the system ECM. • Installed on the display. • Installed on the left/right GNSS receiver.
Expiration (if subscription)	The date the license will expire. Note – Your technician can manage licenses via the Web Interface.

1.2 On-screen Lightbars

Lightbars provide you with guidance information. They enable you to view the guidance information, drum, and the surface you are working at the same time.

To receive lightbar guidance, you must be using Design mode or Infield mode.



TIP – Lightbars provide guidance to designs or alignments, they do not provide guidance to a point.

1.2.1 The Lightbars screen

Use the Lightbars screen to select the guidance that you want. You can access the Lightbars screen from the System Settings menu .

The screen shows the current lightbar configuration.

There are also options for the left, center and right lightbars. Use the toggle to turn the lightbars on and off.

1.2.2 Understanding lightbar information

The on-screen lightbars appear along the left, top, and right edges of the display, depending on your system configuration.

The following table describes the different items in the left/right on-screen lightbars:

Item		Function
Live location arrow		The arrow moves along the lightbar, tracking changes in the position of the drum edge. It shows whether the current position is cut, fill or on grade in relation to the design or target surface.
Cut		The cut zone is red, and is above the on grade tolerance zone. The cut zone is active when the current position of the drum edge is above the design or target surface.
On grade tolerance	 or 	The on grade tolerance zone is always bright green. Note – To change the on grade tolerance zone, go to <i>System Settings > Grade Tolerance</i> .
Fill		The fill zone is blue, and is below the on grade tolerance zone. The fill zone is active when the current position of the drum edge is below the design or target surface.

The lightbars behave differently depending on the mode you are working in.

The following tables describe what the lightbars display for each mode.

Design and Infield modes

Left lightbar

Cut/Fill guidance for the left drum focus:

Red – Cut

Blue – Fill

Green – On grade

Center lightbar

The distance and direction (left or right) from the drum focus to a selected line.

Green – the drum focus is on the line.

Amber – the drum focus is not on the line.

Right lightbar

Cut/Fill guidance for the right drum focus:

Red – Cut

Blue – Fill

Green – On grade

1.2.3 Useful text items

- Cut/Fill Left
- Cut/Fill Right
- Offline

Note – If the text item value is Cut then the icon in the text item shows a red arrow; if it is Fill it shows a blue arrow; and if it is within the on-grade tolerance it shows a green arrow.

1.2.4 System buzzer

When the lightbars are in Cut/Fill Left and Cut/Fill Right, the system buzzer Cut/Fill is determined on the drum focus that is farthest from design. Both tips need to be within grade tolerance for the buzzer to sound.

1.2.5 Troubleshooting

The lightbars are disabled if there is no guidance available, for example:

- The system is using Compaction Mapping mode
- The machine is off design
- A guidance line is not selected

When the lightbars are disabled, they appear as follows:

- The location arrow does not appear
- The lightbars are grayed-out
- The Cut/Fill or Offline text items do not show any values

1.3 External Lightbars

Lightbars provide you with guidance information. Properly installed external lightbars enable you to view guidance information, the drum, and the surface you are working, at the same time.

1.3.1 The Lightbars screen

Use the Lightbars screen to select the guidance that you want. You can access the Lightbars screen from the System Settings menu .

The screen shows the current lightbar configuration.

There are also options for the left, center and right lightbars. Use the toggle to turn the lightbars on and off.

To adjust the brightness of the lightbars, use the slider at the bottom of the screen.

1.3.2 External lightbar behavior

You can install up to three lightbars on your machine. The lightbars behave differently depending on what mode you are working in.

The following tables describe what the lightbars display for each mode.

Note – To change the on-grade tolerance zone, go to System Settings > Grade Tolerance.

Design mode

Left lightbar

Cut/Fill guidance for the left drum tip:

Green – On grade

Amber – Not on grade

Center lightbar

The distance and direction (left or right) from the drum tip to a selected line.

Green – the drum focus is on the line

Amber – the drum focus is not on the line

Right lightbar

Cut/Fill guidance for the right drum tip:

Green – On grade

Amber – Not on grade

1.3.3 Useful text items

- Cut/Fill Left
- Cut/Fill Center
- Cut/Fill Right

Note – If the text item value is Cut then the icon in the text item shows a red arrow; if it is Fill it shows a blue arrow; and if it is within the on grade tolerance it shows a green arrow.

1.3.4 System buzzer

When the lightbars are in Cut/Fill Left and Cut/Fill Right, the system buzzer Cut/Fill is determined on the drum tip that is farthest from design. Both tips need to be within grade tolerance for the buzzer to sound.

1.3.5 Troubleshooting

The lightbars are disabled if there is no guidance available. When the lightbars are disabled, they appear as follows:

- The location arrow does not appear
- The lightbars are grayed-out
- The Cut/Fill or Offline text items do not show any values

If you notice either of the following problems, ask your technician to check the configuration of the external lightbars in the Web Interface:

- A lightbar pattern is inverted.
- The lightbars are lit in the wrong order, for example the right lightbar is showing the left side Cut/Fills.

1.4 Transferring Files

The File Transfer screen is available in the System Settings menu . It lets you do the following:

- Import files to the machine from the display's hard drive, or, an external storage device.
- Export files from the machine to the display's hard drive, or, an external storage device.
- Custom select, if enabled, the files you want to import from the display's hard drive, or, an external storage device.

If you have an Operator Plus account you can perform further file management functions via the Advanced button on either the File Transfer screen or the Project screen.

Note – To transfer files via a USB flash drive, you must have a TD5x0 display and a FAT32 format USB flash drive. Any USB flash drive larger than 32GB may require a third-party application to format it as FAT32.

1.4.1 File categories

Each time you import or export files to or from the machine, you need to choose the files that you want to transfer. To do this, select the checkbox next to the category.

- Earthworks Data: You can transfer all data files or none.
- Projects: You can transfer the project files of your choice. Expand the Projects file to show each project with its own checkbox.



TIP – Within the expanded project, select Infield Data to only export the infield surfaces for the project.

- Production Data: You can transfer data files for use in VisionLink, WorksOS or both.

1.4.2 File structure for external storage devices

When using Import Files TO Machine files on external storage devices, the files must be saved within the folder structure below:

Path	Description of Contents
<Root>:\ProjectLibrary	Top-level folder containing the data sub-folders.
<Root>:\ProjectLibrary\ EarthworksData	Top-level folder for data files.
<Root>:\ProjectLibrary\GeoData	Geographical data which is used in one or more projects.
<Root>:\ProjectLibrary\Projects	Project folders containing project-specific data such as designs.

Note – Place files only within the sub-folders of the top-level folders.

Note – Custom File Import TO Machine does not require the above folder structure on the external storage device.

1.4.3 Syncing files with the Connected Community

Transfer files between the machine and Connected Community to ensure the machine has the latest files and that the office has access to the data recorded on the machine.

If your machine is configured for syncing, an option to Sync Files with Connected Community Sync displays in the File Transfer screen. All relevant files within the current project are synchronized.

Automatic file sync

When automatic file sync is enabled in the Web Interface, files will automatically synchronize to Connected Community every 15 minutes, whenever the machine is powered and has an active internet connection. You are not told when the sync is in progress, or if it was successful or not.

Manual file sync

You can initiate a manual file sync to Connected Community at the end of the day; for example, if automatic file sync is not enabled or to ensure that all of the files from the last 15 minutes have been synced and are available in the office.

1. Access the File Transfer screen.
2. Confirm Sync Files with Connected Community is selected in Transfer Type.
3. Tap Sync. The File Transfer screen grays-out and a progress meter displays. Once the system connects with Connected Community, the progress meter indicates the file categories that are transferring.

To stop the sync, tap Cancel. The file transfer stops and any partial transfers (categories that did not completely transfer) are deleted. Any categories that did completely transfer are kept.

When the file transfer is complete a success notification displays.

If you initiate a sync with Connected Community and an automatic file sync is already in progress you are asked if you would like to continue. If you choose:

- Yes, the sync that is currently in progress stops and the sync that you initiated starts.
- No, the automatic sync that is currently in progress continues and the Transfer Files screen redisplay.

1.4.4 Transferring files via an external storage device

Note – The TD5x0 display only supports USB flash drives that are FAT32 format. Any USB flash drive larger than 32GB may require a third-party application to format it as FAT32.

Import Files TO Machine

Before you can use the Import Files TO Machine option, you must create a folder structure on your external storage device that matches the machine's file organization structure. This enables the machine to place your files in the correct location during the transfer process.



TIP – Export the machine's existing folder structure to your external storage device to quickly create the necessary folder structure for transfers. For more information, see 1.4.6 Exporting files from the machine.

Preparing your external storage device for file transfer

1. Format your USB flash drive in the FAT32 format, if using a USB flash drive.
2. Create the top-level folder, or folders, required for the data to be transferred on your external storage device. For more information, see 1.4.2 File structure for external storage devices.
3. Copy your files to the appropriate folder on the external storage device (for example, copy your project files to *ProjectLibrary > Projects*).

Connecting your external storage device for file transfer

1. Log in to the display.
2. Connect your external storage device to the display. The File Transfer screen displays.
3. Import or export the files of your choice.



ATTENTION - When transferring files to or from an external storage device, an Android OS screen displays. The first time the screen displays, it is blank, apart from three vertical dots  in the upper right-hand corner. Select the dots and then select Show SD Card. The Android screen changes. From the left-hand panel, select your external storage device and then select SELECT in the lower right-hand corner. (Do not select any files or folders from the right-hand panel.)

1.4.5 Importing files to your machine

1. Access the File Transfer screen.
2. Select Import Files TO Machine from the *Transfer Type* field.
3. Select the source type from the *From* field.
4. Tap Next. The Import Files screen displays.
5. Select the files that you want to import.
6. Tap Import to start the file transfer. Tap Cancel to exit the screen without applying any changes.

The import process

After you tap Import a progress meter displays and the File Transfer screen is grayed-out.

First the system checks the available storage on the machine. Once sufficient space is confirmed the progress meter indicates the files that are transferring.

If you tap Cancel the file transfer stops.

When the file transfer is complete a success notification displays.

Files are overwritten with newest versions

When transferring files from an external storage device to the machine, all files on machine that have the same name as the files on the external storage device will be overwritten with the external storage device files. This includes the user preferences file `userdata.pref.xml`, which saves the settings; for example, the text items that are configured.

To keep the user preferences saved on a machine, either:

- Perform a File Transfer of the EarthworksData to the USB flash drive first, then perform a File Transfer from the USB flash drive to the machine

OR

- Untick the EarthworksData box when transferring files from the USB flash drive to the machine

Note – The `userdata.pref.xml` file is stored at `ProjectLibrary > EarthworksData > [Machine Name Folder]`

1.4.6 Exporting files from the machine

1. Access the File Transfer screen.
2. In the *Transfer Type* field, select Export Files FROM Machine.
3. In the *To* field, select the destination.
4. Tap Next. The Export Files screen displays.
5. The available files to export are listed. Select the files that you want to export.
6. To initiate the file transfer, tap Export; to exit the screen without applying any changes, tap Cancel.

The export process

After you tap Export a progress meter displays and the File Transfer screen is grayed-out.

The system checks the available storage on the destination device. Once sufficient space is confirmed the progress meter indicates the files that are transferring.

If you tap Cancel the file transfer stops.

When the file transfer is complete a success notification displays.

Note – If a full backup of all files on the machine is required this can only be performed via the Web Interface “Back up all” option on the File Management page.

1.4.7 Using custom file import

1. Access the File Transfer screen.
2. Select Custom File Import TO Machine from the *Transfer Type* field.
3. Select the project to import the files into, or add a new project, from the *Project* field.

4. Tap Next. If adding a new project, enter a unique project name in Project Name and tap Save.



TIP – Use unique names when naming projects. This ensures the project file will transfer successfully.

5. Find the file or files you want to import on the file list screen.
 - a. Tap a single file to select it.
 - b. Tap and hold to select multiple files within a directory and tap Open in the upper right corner. If you require files from multiple directories on the storage device, repeat the process in each directory.
6. Confirm the files you want to import on the Import Files screen and tap Import.

1.4.8 Troubleshooting

The following notices may appear when you are transferring files:

Unsuccessful Connection

This message displays if the system cannot connect to the Connected Community. Tap OK to return to the File Transfer screen. Check the Connected Community settings and the Internet Connection Status in the Web Interface.

Insufficient Storage

This message displays if sufficient space is not available in the destination device. Tap OK to return to the File Transfer screen. From here you can choose a different destination device (if available) and then retry, or tap Cancel.

Failed File Export

This notice displays if for any other reason a file export fails (for example if the USB flash drive is disconnected during a transfer).

1.4.9 System operation in Android 11

There are differences in system behavior when you use a display with the Android 11 operating system:

- There is no longer an icon for the applications menu. To access the applications menu, touch and drag upwards from anywhere on the home screen.
- When you touch-and-hold on a file to copy it to a new location, drag the file over the new location and wait for a green + icon.
- Holding the file over a new drive will open the drive and show the sub-directories.

- If the directory that the system opens is higher than the root directory, tap the overflow icon in the upper left corner to access lower directory levels.
- When you navigate to a different location, select the folder and tap the Use This Folder button.
- If you change the display's orientation and tap the Android Overview/Recents button (the onscreen navigation button on the right), the apps will appear upside down. To avoid this, set the display in the correct orientation before using the system.
If apps are upside down, close and re-open them with the display in the intended orientation.
- The first time that you transfer files from the machine to the display, the display will ask for *All files access* permission. Grant permission.
- Every time you transfer files from the machine to the display, when you select the target folder, the display will ask permission to access the folder. Grant permission.
- If you use FileFlipper to save converted files to a USB drive, the files are not written to the drive until after FileFlipper reports the process is complete. Either:
 - Wait 5 seconds after FileFlipper reports that the process is complete before you remove the USB drive.
 - Eject the USB stick safely: Swipe down to open the quick setting menu, tap the USB stick notification, and then tap the Eject button.

1.5 Network

Action bar icons

The Network icons that appear on the action bar show the high-level status of the associated network feature. The icons are:

	Connection Status (cell)	A warning (orange) shows if the connection is not yet established on start-up, or lost during operation.
	Connection Status (Wi-Fi)	
	Cloud Services	A warning (orange) shows if any of the underlying services fail to connect, or if cell/Wi-Fi connection is lost.

Tap an icon to open the Network screen.

Network screen

The connection icons on the Network screen show the 3 parts of the connection:

1. Gateway Device () – the hardware acting as the connection device on your system
 - Error state (red) – device not found
 - Warning state (orange) – the device is configuring or there is an issue with the device configuration
2. Connection – a cell () or Wi-Fi () icon, depending on the gateway configuration
 - Warning state (orange) – there is a missing or unconfigured device, or a problem with the connection to the internet
3. Cloud Services () – the different parts of the cloud service:
 - Only configured services show in the list
 - Warning state – the last attempt to connect or transfer data failed

The potential parts of the service are:

- Trimble Construction Cloud/Connected Community (TCC):

Field	Description
Service Connection	Status of the latest sync with TCC: – Green tick: The most recent TCC sync was successful – Grey icon: The system has not synced with TCC yet – Orange warning: The most recent TCC sync failed
Machine Status & Diagnostics	Status of reporting machine diagnostics to WorksManager
Over the Air Firmware	Status of receiving system firmware from WorksManager
Surface Download	Status of surface download from WorksOS
Project Data	Status of project download from WorksManager

- VisionLink:

Field	Description
Service Connection	Status of the latest connection to VisionLink
File Transfer	Status of receiving projects and designs from VisionLink

Note – The warnings are sequential, so if there is a warning for the Gateway Device, there will also be a warning for Connection Status and Cloud Services.

1.6 Text Grid View

A text grid view replaces the guidance view in one or more of the work screen views, and is used to display selected text items in a prominent position.

The size of a text item in a text grid view depends on the number of items selected for the view, but is typically larger than in the text ribbon.

1.6.1 Displaying text grid views

In the System Setup menu:

1. Open Layouts.
2. Select the layout for the work screen.
3. Select Text Grid for one or more views, as required.
4. By default, the text grid view is empty. To add text items to the view:
 - Tap  to open the Text Grid Layout screen. For more information, see 1.6.2 Configuring a text grid from the System Setup menu.
 - Tap Apply to return to the work screen. In the work screen configure the text grid directly. For more information, see 1.6.3 Configuring a text grid from the work screen.

1.6.2 Configuring a text grid from the System Setup menu

In the System Setup menu:

1. Open Layouts.
2. Select the layout and the views you require.
3. To display a text grid in a view, select Text Grid from the view's drop down menu.
4. To configure a text grid view tap  for that view. The Text Grid Layout menu opens.
5. The Text Grid Layout menu controls the order in which text items are displayed for a Text Grid view:
 - a. Tap, hold, and drag a text item to reposition that text item in the display order. In the Text Grid view, text items are arranged left to right, starting from the top left corner, and wrapping to the next line when a line is full.
 - b. To save the text grid display order and return to the work screen, tap Apply. Otherwise, to edit the list of text items that may be displayed, Tap Edit. The Edit Text Grid menu opens.
6. The Edit Text Grid menu lets you add or remove text items from the list of items that may be displayed.

For more information, see 1.6.4 Text grid layout restrictions.

1.6.3 Configuring a text grid from the work screen

From a text grid view in the work screen:

- Long tap on an empty space in a text grid to open a context menu. The context menu lets you add new items to the text grid in the space you tapped. Empty spaces include the spaces between text items already in the grid.
- Long tap on a text item, and:
 - Drag the item to a new position in the text grid.
 - Remove the item from the text grid.

For more information, see 1.6.4 Text grid layout restrictions.

1.6.4 Text grid layout restrictions

You can add any number of text items to a text grid, however the following restrictions apply:

1. For TD520 and TD540 displays, the maximum number of text items that can be displayed per view in a configured layout is:
 - a. One View layout: 16
 - b. Two View layout: 14 per view
 - c. Three View layout: 2 per Views 1 and 2, and 12 for View 3

Note – For smaller displays the number of text items that can be displayed in a text grid view will be reduced.

2. If you select more than the maximum displayable text items for a view, the text items are displayed in the order they are listed in the Text Grid Layout menu for that view.
3. The displayed size of individual text items depends on the display size, and the number of text items chosen for display in a particular view.

Using Infield Guidance

In this chapter:

- ▶ [Infield Surfaces](#)

This chapter introduces the use of infield surfaces.

2.1 Infield Surfaces

Infield surfaces enable you to create a 3D surface in the cab. Using the infield surface wizard, you can create a simple surface or a complex alignment with a cross-section applied to it.

2.1.1 Creating a new infield project

When you create an infield surface, you can either store it in an existing project or create a new infield project.

To create a new infield project:

1. From the Job Setup screen, tap the plus icon  on the right-hand side of the *Project* field. The Create Project screen displays.
2. In the *Project Name* field, enter a unique name for your new infield project and tap Save.

2.1.2 Creating an infield surface



TIP - When you create an infield surface, you can name it. This can be useful if you want to use it again in future.

To begin creating an infield surface:

1. In the Job Setup screen, select a project and then go to the *Mode* field and select Design.
2. Tap the plus icon  on the right-hand side of the *Guidance Surface* field. The infield surface wizard displays.
3. Tap Level  or Slope  to create a simple surface; tap Alignment and Section  to draw an alignment and section and then combine the two.



TIP - Select a design from the *Design File* field to show that design's linework when you view the completed infield surface on the work screen.

When you create a new infield surface, it is automatically selected as your guidance surface.

2.1.3 Level pad surface

To create a level pad surface, select your guidance focus and then set an elevation.



TIP - Tap  Here to use the current Elevation of the focus point.

2.1.4 Slope surface

There are four steps to creating a slope:

1. Select the guidance focus and then set the coordinates of the initial point in your alignment.
2. Select the slope type:
 - Point and Direction: Create a slope design by combining an initial point with a defined direction and grade.
 - 2-Point: Create a slope surface using two points in the path of your alignment.

3. Define the surface.

For the Point and Direction method, enter angles for the direction of the path of your alignment and the grade for the mainfall slope of your surface in the direction specified.

For the 2-Point method, select the drum focus and then set the coordinates of a second point, which defines the direction and grade of your alignment.

4. Enter the angle of the cross slope. For a dual cross slope, enter the left and right angles of the slope.



TIPS:

- Tap  Here to use the current coordinates of the focus point.
 - Tap Level to set the angle(s) of the cross slope to 0%.
 - When you change the Slope Type from 2-Point to Point and Direction, the new field values are calculated from the values entered for the two points. Use this to check if the calculated direction and grade are within design limits.
-

Note – Surface shading extends only 1km (0.6mi) from the alignment on the work screen. Guidance is still given past 1km (0.6mi) but surface shading is unavailable. Consider creating a second infield slope design parallel to the original if surface shading is required beyond 1km (0.6m) from the original line.

2.1.5 Alignment & Section surface

When you create an Alignment & Section, you will be guided through a 3-step process:

1. Create an alignment.
 - Create the points that define the path of the alignment (Plan view).
 - Adjust the elevation of the points to establish the grade of the alignment (Elevation view).
2. Create a section.
3. Combine the section and alignment to create a 3D model of the infield surface.

You can create an infield surface with your drum focus directly on screen or using an existing template.

Step 1: Create alignment

Select one of the drawing methods described in the following table.

Icon	Method and description
	Drawing with points . Use points that you have recorded on your work screen or points imported from the office.
	Drawing with the drum focus . Use the focus of your drum to define alignment points.
	Importing an existing alignment . Use an existing alignment as a template. You can edit it and save it as a new alignment.

Alignment editing modes

The different editing modes described in the table below are common to each of the alignment drawing methods.

By default, the edit coordinate mode  is selected. Tap to select the editing mode you prefer.

Icon	Mode and description
	Edit Coordinate. Use this to edit the Northing, Easting and/or Elevation of a point.
	Edit Segment. Use this to edit the distance, internal angle and elevation of a point.

There are two steps to creating an alignment:

1. Create the points that define the path of the alignment ([Plan view](#)).
2. Adjust the elevation of the points to establish the grade of the alignment ([Elevation view](#)).



TIP - Tap inside any field to directly edit it.

Drawing with points

Plan view

You can use points that you have previously recorded on the work screen or those that have been imported from the office to create a new alignment. Tap

 to select a point from the Points screen and add it to the alignment.

Use the filters on the Points screen to view only the points that were recorded on the work screen, imported from the office, or both.

Office points are stored in office-created projects. To use any available office points, first select the Office project in Job Setup.



TIP - Use the plan view preview to quickly check the placement of your points in your work area. Points that you have selected are highlighted.

The cursor  identifies the active point. Additional points are relative to the origin point.

Note – Once an origin point has been created it cannot be edited as all the other points created are positioned relative to this point. To change the origin point, tap  and create a new one.

Tap  to undo your last action. Tap  to delete a selected point or double tap individual points to delete them.

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.



TIPS:

- Touch and hold the point you want to edit until its color changes to yellow before you try to drag and drop it to its new position.
 - Zoom in to place your points more accurately. The resolution of the grid will get finer as you zoom in.
-

Note – The lock to grid setting  will affect the positioning of the point when dragging and dropping.

The icons in the toolbar provide useful tools for creating your design. See [Common drawing tools](#).

Elevation view

After you create the points that define the path of the alignment, tap the Elevation view tab to define the grade of the alignment by adjusting the elevation of the points.

This view shows the elevation of all points along the length of the alignment. By default, the first and last points in the alignment are active . The black dotted line indicates a consistent grade between the two points.

Note – Select any two points on the line by touching them in succession to make them active.

The black dots show the change in elevation between the active points.

Once you select the segments bound by the active points, tap the Align Vertices button  to align the segments between the active points. This is useful if you need to apply the same slope or grade to a series of segments.

Note – The Align Vertices button is only available in Elevation view and is only enabled after you create three or more points.

Note – If you alter any of the horizontal positions in the Plan view, you must also check the Elevation view and make adjustments if necessary.

Tap Next when you are finished.

Drawing with the drum focus

Plan view

You can use your drum focus to create a new alignment. Tap the Focus icon  to select an alternative focus point.

The cursor  identifies the active point. Additional points are relative to the origin point.

Note – Once an origin point has been created it cannot be edited as all the other points created are positioned relative to this point. To change the origin point, tap  and create a new one.

Each time you move the drum to the next point, tap the Add Point icon .

Tap  to undo your last action. Tap  to delete a selected point or double tap individual points to delete them.

After using the drum focus to create a point, you can edit it.

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.



TIPS:

- Touch and hold the point you want to edit until its color changes to yellow before you try to drag and drop it to its new position.
- Zoom in to place your points more accurately. The resolution of the grid will get finer as you zoom in.

Note – The lock to grid setting  will affect the positioning of the point when dragging and dropping.

The icons in the toolbar provide useful tools for creating your design. See [Common drawing tools](#).

Elevation view

After you create the points that define the path of the alignment, tap the Elevation view tab to define the grade of the alignment by adjusting the elevation of the points.

This view shows the elevation of all points along the length of the alignment. By default, the first and last points in the alignment are active . The black dotted line indicates a consistent grade between the two points.

Note – Select any two points on the line by touching them in succession to make them active.

The black dots show the change in elevation between the active points.

Once you select the segments bound by the active points, tap the Align Vertices button  to align the segments between the active points. This is useful if you need to apply the same slope or grade to a series of segments.

Note – The Align Vertices button is only available in Elevation view and is only enabled after you create three or more points.

Note – If you alter any of the horizontal positions in the Plan view, you must also check the Elevation view and make adjustments if necessary.

Tap Next when you are finished.

Importing an existing alignment

You can use an existing alignment as a template. You can then edit and save it with a unique name as a new alignment.

Note – Any alignments you create as part of an infield surface will be included in the list of available templates.

The cursor  identifies the active point. Additional points are relative to the origin point.

Note – Once an origin point has been created it cannot be edited as all the other points created are positioned relative to this point. To change the origin point, tap  and create a new one.

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.



TIPS:

- Touch and hold the point you want to edit until its color changes to yellow before you try to drag and drop it to its new position.
- Zoom in to place your points more accurately. The resolution of the grid will get finer as you zoom in.

Note – The lock to grid setting  will affect the positioning of the point when dragging and dropping.



TIP – To add a new point in the middle of a segment, touch the first point to highlight it and then tap .

Tap  to undo your last action. Tap  to delete a selected point or double tap individual points to delete them.

The icons in the toolbar provide useful tools for creating your design. See [Common drawing tools](#).

Tap Next when you are finished.

Step 2: Create Section

Sections are like templates that define roads, banks and channels. A section consists of a number segments.

To create a section, use one of the methods described in the following table.

Icon	Method and description
	Drawing directly on-screen with your finger . Use your finger directly on the screen to define section points.
	Drawing with the drum focus . Use the drum focus to define section points.
	Importing an existing section . Use an existing section memory as a template. You can edit it and save it as a new section memory.

Section editing modes

The different editing modes described in the table below are common to each of the section creation modes.

By default, the edit line mode  is selected. Tap to select the editing mode you prefer.

Icon	Mode and description
	Edit Point. In edit point mode you use relative measurements to specify a point's position (like rise over run).
	Edit Line. In edit line mode you use an angle and a horizontal distance from the previous point to specify a point's position.
	Scale All. In scale all mode you use a width and a height to specify the sections size. <i>Note – In scale all mode,  indicates that the height and width ratio will be maintained on scaling. Tap to adjust these measures independently of each other (.</i>



TIP - Tap inside any field to directly edit it.

Drawing directly on-screen with your finger

You can draw points directly on the screen with your finger to create a new section and then save it.

The cursor  identifies the active point. Additional points are relative to the origin point.

Every time you lift your finger off the screen a new point is added.

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.

Tap  to undo your last action. Tap  to delete a selected point or double tap individual points to delete them.

The icons in the toolbar provide useful tools for creating your design. See [Common drawing tools](#).

Tap Next when you are finished.

Drawing with the drum focus

You can use your drum focus to create a new section. Tap the Focus icon  to select an alternative focus point.

Each time you move the drum to the next point, tap the Add Point icon .

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.

After using the drum focus to create a point, you can edit it.

After using the bowl focus to create a point, you can edit it.

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.



TIPS:

- Touch and hold the point you want to edit until its color changes to yellow before you try to drag and drop it to its new position.
 - Zoom in to place your points more accurately. The resolution of the grid will get finer as you zoom in.
-

Note – The lock to grid setting  will affect the positioning of the point when dragging and dropping.

The icons in the toolbar provide useful tools for creating your design. See [Common drawing tools](#).

Tap Next when you are finished.

Importing an existing section

You can use an existing section as a template. You can then edit and save it with a unique name as a new section.

The cursor  identifies the active point. Additional points are relative to the origin point.

Note – Once an origin point has been created it cannot be edited as all the other points created are positioned relative to this point. To change the origin point, tap  and create a new one.

Tap the point you want to edit and then, either edit the numeric fields directly, or drag and drop it to a new position.



TIPS:

- Touch and hold the point you want to edit until its color changes to yellow before you try to drag and drop it to its new position.
- Zoom in to place your points more accurately. The resolution of the grid will get finer as you zoom in.

Note – The lock to grid setting  will affect the positioning of the point when dragging and dropping.

Tap  to undo your last action. Tap  to delete a selected point or double tap individual points to delete them.

The icons in the toolbar provide useful tools for creating your design. See [Common drawing tools](#).

Tap Next when you are finished.

Step 3: Combine Alignment and Section

In this final step, the section is attached to the alignment. By default, the first point of the section acts like an anchor and is attached to the alignment.

Drawing tools

The icons on the drawing screen provide useful tools to assist with combining the alignment and section.

Icon	Description
	Enter the distance to extend the surface back from the first point defined in the alignment. The maximum value is 500 m.
	Enter the distance to extend the surface beyond the last point defined in the alignment. The maximum value is 500 m.
	Tap to move the intersection of the section and alignment to the previous point.
	Tap to move the intersection of the section and alignment to the next point.
	Tap to horizontally flip the section without changing the intersection of the section and alignment. Use this feature if the section is attached to the wrong side of the alignment and you need to flip it to the other side. For example, if the section is attached to the left side of the alignment and needs to be on the right side, or vice-versa.
	Tap to reset the zoom and display the entire drawing in the view.

Plan view

To edit the intersection point of the section, tap the Next Point  and/or Previous Point  icons. The axes hairs show you where the section and alignment intersect.

3D view

Use the 3D view to perform a sanity check on the surface.



TIP - Zoom in to inspect the surface closely.

The system automatically assigns the next available name to the surface, for example: "Infield 2". If required, tap inside the *Name* field and enter another name. If you want to rename a surface later, you can do this from the Surfaces Manager screen.

Tap Apply.

Common drawing tools

The icons on the drawing screen provide useful tools to assist you with drawing alignments or sections.

Icon	Description
	Tap to undo the last action.
	Mirror the existing section either from the origin point or from the end point. Select the mirroring direction in the pop-over box. Select  to replicate and reflect the section and attach it to the end. Select  to replicate and reflect the section and attach it to the origin. <i>Note – This is not available for Step 1: Create Alignment.</i>
	Tap to reset the zoom and display the entire drawing in the view.
 	Lock to Grid. New points are placed on the nearest intersection on the drawing grid. Unlock from Grid. New points are placed anywhere in the drawing window. Tap to switch between the modes. <i>Note – Lock to Grid only applies to points created or edited on-screen by touch.</i>

Tips to avoid overlapping surfaces in infield surfaces

Using the Alignment and Section method to create infield surfaces can create overlapping surfaces. The system may fail to give guidance to overlapping surfaces.

To use the Alignment and Section method to create surfaces that do not overlap, create alignments that:

- Are straight or with wide corners and curves.
- Start and end on straight portions - if the surface must close on itself. Leave a small gap between the alignment's start and end.
- Have shallow or smooth elevation changes.
- Are along the inside edges of the desired surfaces so that placing the sections creates surfaces along the open sides of the alignments.
- Have narrow cross sections, especially on surfaces with corners or curves.

When you combine the alignment and section, use the 3D view to check for:

- Overlapping sections - dark gray
- Missing sections - no gray
- Poorly formed sections - possible poor guidance points

Note – When you create a section, the system does not render lines that have an angle change of less than 5° in either the work screen or the preview pane. If you tap where the unrendered line is located, you can still select the line.

Renaming an infield surface

You can rename an infield surface from the Surfaces Manager screen. If you will use the surface again, it can be useful to rename it with a memorable name.

1. Tap this icon  beside the appropriate surface. The overflow menu displays.
2. Select Rename. The Rename Infield Surface dialog displays.
3. Enter the new name for your infield surface.

Editing an infield surface

There are 2 ways to edit an existing infield surface:

- From the Surfaces Manager screen:
 - a. Tap this icon  beside the infield surface's name.
 - b. Select Edit. This opens the surface in the infield surface wizard.
- From the work screen:
 - a. Touch and hold on the work screen to open the context menu.
 - b. Tap the infield surface to edit. The system shows options for the surface.
 - c. Tap Edit. This opens the surface in the infield surface wizard.

Deleting an infield surface

You can delete an infield surface from the Surfaces Manager screen:

1. Tap this icon  beside the appropriate surface. The overflow menu displays.
2. Select Delete. A confirmation dialog displays.
3. Tap Yes. The infield surface is deleted.

Showing design linework and getting guidance

You can load an office design file while using an infield surface. You can either show the linework in the design as a reference or you can select a line for horizontal guidance.

From the Job Setup screen:

1. Select the office design file from the *Design File* field.
2. Create or select your guidance surface from the *Guidance Surface* field.
The work screen will show your infield surface as the guidance surface, but will show linework from the design.
3. Touch and hold on a line to select it for horizontal guidance.

Using Design Guidance

In this chapter:

- ▶ Using Design Mode
- ▶ Using Elevation Offsets
- ▶ Horizontal Guidance
- ▶ Working with Points
- ▶ Measured Data
- ▶ 3D Line Guidance
- ▶ Lane Guidance
- ▶ Using GNSS

To generate guidance information, the system measures the drums's position relative to a three dimensional (3D) digital map of the design surface. This is called Design guidance. 3D sensors such as GNSS receivers allow the system to always know the machine's three dimensional location.

3.1 Using Design Mode

Design mode lets you do any of the following:

- Select and load a 3D design created in the office
- Select and load, or create, a guidance surface
- Start working without a design or surface

Designs may contain one or more surfaces.

Designs and infield or office surfaces may contain optional linework.

You can get guidance in Design mode in multiple ways:

Guidance to...	For more information...
Office Surface 	Select a Project + Design file + Office Surface. See below.
Infield Surface 	You can create or select an infield surface. Select a Project + Infield Surface. If you load an office design as well, you can show up to 2 surfaces from the design as reference surfaces. See the <i>Infield Surfaces</i> guide.
3D Line 	Select one of the following: • A Project + Design file that includes 3D linework • A Project + Infield Surface that includes 3D linework When you select a 3D line for guidance (on the work screen), the system generates a temporary guidance surface for it. See the <i>3D Lines</i> guide.
2D Line 	Select one of the following: • Project + Design file that includes 2D linework • Project + Infield Surface that includes 2D linework When you select a 2D line for guidance, the line's elevation matches the surface. See the <i>Horizontal Guidance</i> guide.

For information on design file formats, see [Project and Design Files](#).

3.1.1 Selecting Design mode

1. From the Dashboard, tap the Machine Setup tile.
2. From the Machine Setup screen, select the 3D positioning source that you require and tap Apply.
Note – The positioning source you select will determine the modes that you can select from the Job Setup screen.
3. From the Dashboard, tap the Job Setup tile.
4. From the Job Setup screen, select or create a project from the *Project* field.
5. Set the *Mode* field to Design.
6. Select any of the following as required:
 - A design file
 - A guidance surface, see [Selecting a surface](#).
 - A master alignment (if available in the design).
7. From the Dashboard, tap Start. The work screen displays.

3.1.2 Selecting a surface

On the Job Setup screen, tap  beside the *Guidance Surface* field to open the Surfaces Manager screen.

It shows all the surfaces available for the current design and enables you to select surfaces. You can select one guidance surface and up to two reference surfaces at once. You cannot get guidance to a reference surface, and it will only display on the cross section and profile views.

The list of surfaces is sorted into office surfaces and infield surfaces. Tap the Office or Infield button to select which surfaces display first:

- Office surfaces are contained in a design, so the office surfaces that are available differ depending on which design is selected.
- Infield surfaces are contained in a project, so the infield surfaces that are available remain the same for all designs in a project, or if a design is not selected.

To select a surface:

1. Select the round button for the type of surface: Guidance or Reference.
2. Tap the surface to assign. If a surface is already selected, it is gray.

To deselect a surface, tap the  button beside the surface name.

If you tap a surface in the list when the available surfaces are already occupied:

- Guidance surface: your selection will replace the existing guidance surface selection.
- Reference surface: your selection will replace the second reference surface selection.

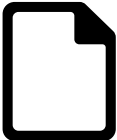
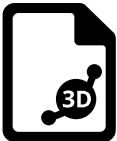
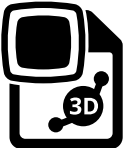
Tap the  button beside an infield surface to edit, rename, or delete it.

Touch and hold the icon to open the Job Setup screen.

3.1.3 Project and design icons

The system displays icons representing the selected guidance options on:

- The work screen's guidance bar
- The Job Setup screen's infobox

Icon	Description
	• Office project selected
	• Infield project selected
	• Project contains one or more avoidance zones
	• Design file selected • No guidance surface
	• Design file selected • No guidance surface • Design contains 3D linework
	• Design file selected • Office surface selected
	• Design file selected • Office surface selected • Design contains 3D linework

Icon	Description
	• Design file selected • Infield surface selected
	• Design file selected • Infield surface selected • Design contains 3D linework
	• No design file selected • Infield surface selected
	• No design selected • No surface selected
	• No design selected • No surface selected (Compaction mapping mode)
	• Design file selected • Office surface selected (reference surface only)

Measured Data name

For compactors, Compaction Mapping data is recorded to a Measured Data store. The guidance bar lists the title of the current Measured Data store.

Touch and hold the icon to open the Measured Data screen: 

The system does not show Compaction Mapping data when the machine is off the design.

The Design offset icons

The offset icons always appear in the same order left to right on the guidance bar, as shown below:

Horizontal offset	Vertical elevation offset	Perpendicular elevation offset
		

Note – Either the vertical elevation offset **or** perpendicular elevation offset icon displays, depending on which offset type is in use.

Use the offset icons in the following ways:

- Tap to cycle through the configured offset memories.
- Touch and hold to access the respective offset configuration screens.

The offset settings screens

- Use the horizontal offset screen to select a line and configure an offset value.
- Use the elevation offset screen to configure a vertical or perpendicular offset.

3.1.4 Overlays

The overlays icon is in the top right-hand corner of the guidance bar: 

Use this icon to directly access the Overlays screen, which controls what displays on the guidance view.

3.1.5 The guidance view

The guidance view displays the machine relative to the surface being worked. You can set up to three different views to display at once, from the following view types:

- 3D

***Note** – The 3D view only renders the design surface for a radius of 300 m (about 1000 feet) from the current machine position.*
- Cross-section
- Profile
- Plan
- Compaction Mapping (options vary depending on machine configuration)
- Text Grid

3.1.6 Text items

Use the text ribbon (across the bottom of the guidance view) to display text items of your choice. By default, the system displays ribbon items appropriate for your machine. Useful text items for Design mode are:

- Cut/Fill Left
- Cut/Fill Right
- Offline

There are several text ribbon items that are unique to compactors. Some of these values require a configured sensor:

- CMV – the current Compaction Metered Value, as reported by the compaction sensor or the machine ECM.
- CMV % Change – percentage change in Compaction Metered Value compared to the previous sample.
- MDP – Machine Drive Power measurement, which indicates soil stiffness.
- MDP % Change – percentage change in Machine Drive Power compared to the previous sample.
- Amplitude – the current vibration amplitude of the drum, as reported by the compaction sensor or the machine ECM.
- Frequency – the current frequency of the drum, as reported by the compaction sensor or the machine ECM.
- Vibration – shows whether the drum's vibration is on or off.
- Passes – the current number of passes performed by the machine.
- RMV – The Resonance Metered Value reported by the compaction sensor or the machine ECM.

Touch and hold any text item in the text ribbon to open the corresponding context menu:

- Tap Add  to select a new text item to add to the text ribbon.
- Tap Replace  to select another text item to replace the current one.
- Tap Remove  to remove the current text item from the text ribbon.

At the bottom of the context menu, you can tap Go to Text Ribbon . Alternatively you can access it from the System Settings menu . The Text Ribbon screen allows you to:

- Drag-and-drop items to reorder your list. Alternatively, you can drag a text item in the text ribbon to shuffle it.
- Tap Edit to select which items appear.
- Tap Default to reload the default ribbon items for your machine.
- Enable or disable the display of the text ribbon in the work screen.

3.1.7 System settings

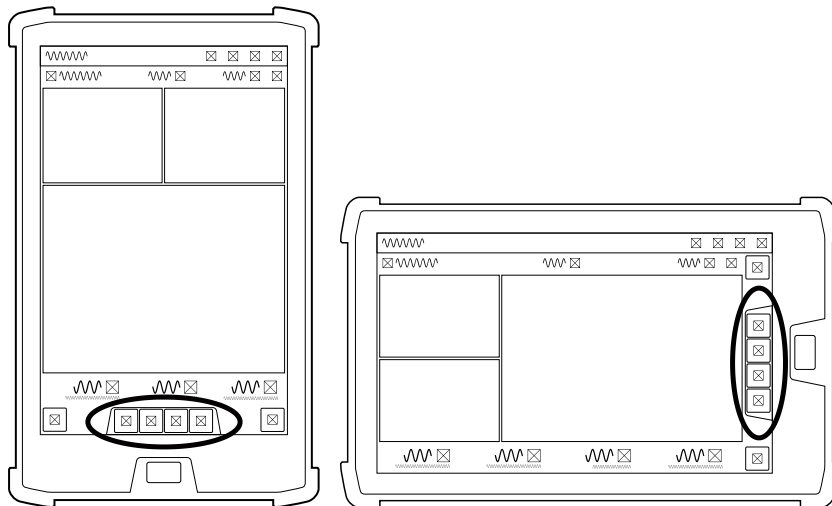
The System Settings icon is on the work screen: 

Use System Settings to access and configure various functions, including (but not limited to):

- Lightbars
- Units

- File Transfer
- Increments (where the inc/dec switches step size can be set)

The shortcut bar



The shortcut bar enables you to easily perform frequently repeated tasks. The shortcut icons are for Design relevant items such as Record Point and Drum Focus.

3.1.8 The Back icon

The Back icon is in the top left-hand side of the title bar: 

You can tap the icon or title to return to the previous screen; either the Dashboard or work screen.

Work settings

The Work Settings icon is in the lower right-hand side of the work screen: 

Use the Work Settings menu to access and configure those settings that change according to the requirements of each individual task, including (but not limited to):

- Elevation Offset
- Record Point

3.2 Using Elevation Offsets

Often, a compactor is working material that is being placed in layers or lifts which may be some distance above or below the finished design surface.

If it is useful to see the cut/fill values in the text items and lightbars with respect to the current layer or lift you are working on, you can apply an elevation offset to achieve that. For

example, you could also use a -0.300 m/ 1 ft elevation offset to shift the design surface down to subgrade.

3.2.1 Accessing the Elevation Offset screen

Note – The Elevation Offset screen is only available when Design is selected as the mode in the Job Setup screen.

Perform one of the following actions to access the Elevation Offset screen:

- Open the Work Settings menu .
- Touch and hold the elevation offset field in the guidance bar.

The appearance of the offset icons on the guidance bar depends on:

- The direction of the working surface offset
- The direction of the elevation offset
- The type of offset – vertical or perpendicular

Working Surface Offset	Elevation Offset	Vertical	Perpendicular
Negative	Negative		
	Zero		
	Positive		
Zero	Negative		
	Zero		
	Positive		
Positive	Negative		
	Zero		
	Positive		

3.2.2 The Elevation Offset screen

Use the Elevation Offset screen to:

- Apply or edit an elevation offset
- Select or edit an existing Elevation Offset memory
- Apply or edit a Working Surface offset

You can also access the Offset Memories screen, which you can use to create elevation offset values that the system saves and can be selected for later use.

When you work in Design mode, you can use elevation offsets to do the following tasks:

- Add an offset to the design surface.
- Select an offset from the offset memories.
- Apply a new working surface that is a offset above or below the design surface that you want to achieve at the end of the current task (this is done under Advanced Options).

For example, create a working surface that is 300 mm (1 ft) below the design and bulk shift to that working surface. Then, add material back in offset increments of 50 mm (2 in) each to build back up to the design surface.

- Choose the offset direction (vertical or perpendicular) that applies to both the elevation offset and any working surface offset.

3.2.3 Applying an elevation offset

Use either of the following methods:

- Access the Elevation Offset screen, enter the following data and then tap Apply:
 - Offset value
 - Focus for guidance
 - Offset direction (optional item under Advanced Options):
 - Vertical - typically for a known elevation
 - Perpendicular - typically for a known thickness, particularly on a sloping surface
- Open the work screen and tap the elevation offset field in the guidance bar to cycle through the saved offset memories.

3.2.4 Creating, editing or deleting memories

In the Elevation Offset screen:

- Tap the Save button to save an entered offset value as a memory.
- Tap the Memories icon  on the right-hand side of the memory to open the Offset Memories screen.

In the Offset Memories screen:

- Tap the overflow icon  to edit or delete a memory.
- Tap the Create button to create a new memory.
- Touch and hold on a memory to select multiple memories for deletion.

Note – The Save button saves the offset value only. The Working Surface offset and offset direction are not saved.

3.3 Horizontal Guidance

You can receive horizontal guidance relative to the following design features:

- Lines within office designs or infield surfaces
- Design surface boundaries

Setting a horizontal offset moves the horizontal guidance away from the selected line. You add or subtract an offset square to the selected horizontal line.

Pass Shift

Pass Shift is another way of getting horizontal guidance to a line. Pass Shift moves the guidance line so that the overlap distance with the previous pass is achieved. Use Pass Shift where uniform coverage over an area is required.

3.3.1 Access the Horizontal Guidance screen

Perform one of the following actions to access the Horizontal Guidance screen:

- Open the Work Settings menu .
- Touch and hold the Pass Shift shortcut key on the shortcut bar.
- Touch and hold the horizontal offset field in the guidance bar.

The horizontal offset icon on the guidance bar displays differently according to the value of the current horizontal offset:

Offset type	Icon	Offset value
Negative		Negative/left of line
None		Zero
Positive		Positive/right of line



TIP – The arrows on the selected line indicate the direction of the line. A positive offset is to the right-hand side of the selected line, relative to the direction of the line. A negative offset is to the left-hand side of the selected line, relative to the direction of the line when you look along the line in the direction of the arrows.

3.3.2 The Horizontal Guidance screen

Use the Horizontal Guidance screen to:

- Select a horizontal line to guide to
- Optionally apply an offset
- Optionally apply an overlap value for Pass Shift

Select a line for horizontal guidance

1. Access the Horizontal Guidance screen.
2. If you have not already done so, select a line to guide to. Either select a line from the drop-down list or tap a line on the plan view.
3. Tap Apply.

In the Horizontal Guidance screen, the plan view draws the selected line in red. Arrows indicate the direction of the line.

Alternatively, you can select a line for horizontal guidance from the context menu in the work screen. The options vary depending on which line types are present in the area you touch and hold:

1. From the plan view guidance pane, touch and hold anywhere near the line you want to select. A context menu displays.
2. Tap either Select 2D Line or Select 3D Line:
 - If only one line is available within the area you touched, it is selected automatically.
 - If there are multiple lines in the area you touched, a list displays. Select a line.
3. Tap Horizontal Guidance.

To use the context menu to stop guidance to the line, repeat this process and select this icon .

If you selected a design in the Job Setup menu that contains 3D lines, from the work screen use the shortcut key  or Work Settings menu to select a 3D line for guidance.

If you change from one line to another for horizontal guidance, any horizontal offset is retained.

Apply a horizontal offset

The horizontal offset is the offset distance left (–) or right (+) of the selected line.

1. Access the Horizontal Guidance screen.
2. Optionally, select a line to guide to.
3. Optionally, enter the value of the offset or tap the  or  buttons to increase or decrease the value.

4. To save this as a memory, tap Save.
5. Tap Apply.

When an offset is entered (other than zero), in the Horizontal Guidance screen, the plan view draws the original selected line in cyan. Arrows indicate the direction of the line. A positive offset is to the right-hand side of the selected line, relative to the direction of the line. A negative offset is to the left-hand side of the selected line, relative to the direction of the line when you look along the line in the direction of the arrows.

The guidance line is drawn in red, it is offset from the selected line by the offset value and is the line guidance is provided to.

Tap Memories to select an existing horizontal offset memory or to create the new offset memory values that the system saves for later use.

Applying a horizontal increment

1. Access the Increments screen from the System Settings menu .
2. Optionally, enter the value of the increment in the Horizontal Distance field.
3. Tap Apply.

The horizontal increment value is the amount the horizontal offset changes each time the  or  buttons are tapped in the Horizontal Guidance screen.

If the optional horizontal offset remote switch is installed, each time the rocker switch is pressed the horizontal offset value increments or decrements by the horizontal increment value on the guidance bar. For more information, see The remote switch.

Applying an overlap value

1. Access the Horizontal Guidance screen.
2. Optionally, enter the value of the overlap required as either:
 - a. The distance in meters
 - b. A percentage of the drum width
3. Tap Apply.

Using Pass Shift

When you are in the work screen a pass shift can be applied by using the shortcut keys or by using the optional remote switch if it has been installed. For more information, see The remote switch.

The shortcut keys

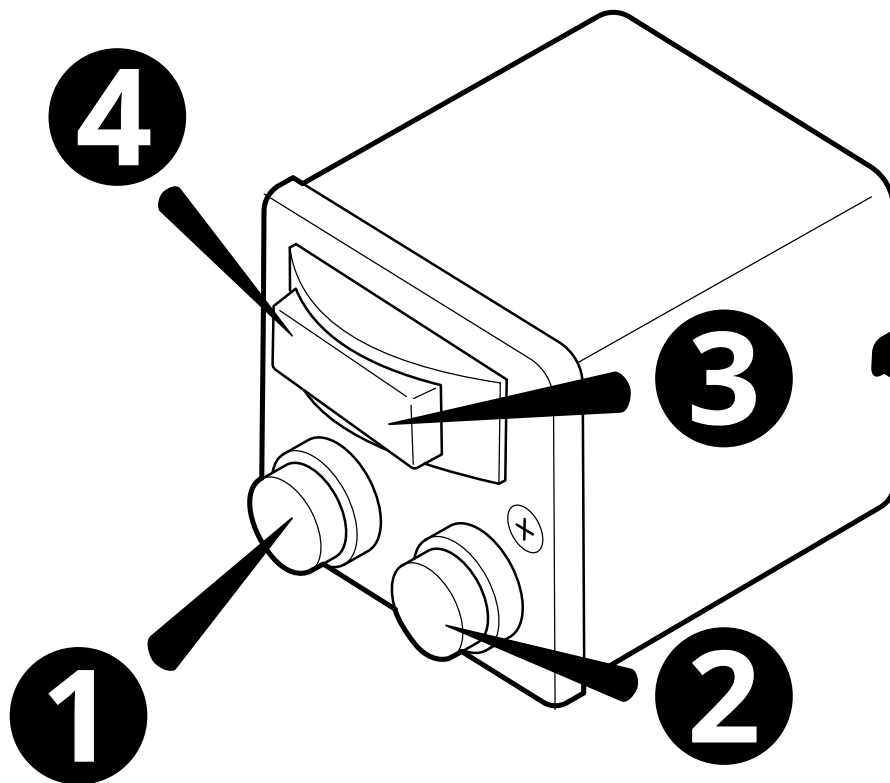
When you are in the work screen, you can use the shortcut keys to shift the guidance line. The system creates a new guidance line so that the current pass overlaps the previous pass with the overlap value entered in the Horizontal Guidance screen:

1. Tap  to shift the guidance line right of the direction of the guidance line.
2. Tap  to shift the guidance line left of the direction of the guidance line.

If no guidance line is selected, tap either shortcut key to open the Horizontal Guidance screen.

You can also touch and hold either shortcut key to open the Horizontal Guidance screen.

The remote switch



- | | |
|--|--|
| ❶ Decrement Pass Shift count switch. | ❷ Increment Pass Shift count switch. |
| ❸ Increment horizontal distance offset switch. | ❹ Decrement horizontal distance offset switch. |

3.3.3 Horizontal position information

The center lightbar provides horizontal guidance from the focus to the guidance line. For more information, refer to the *On-screen Lightbars* guide or the *External Lightbars* guide.

In addition to the lightbar, the following text items are also useful:

- **Offline:** Shows the horizontal distance from the drum edge with focus to the guidance line.
- **Pass Shift:** Shows the number of Pass Shifts made from the guidance line. A negative value means the line was shifted to the left of the direction of the guidance line.
- **Total Horizontal Offset:** Shows the sum of total Pass Shift distance plus the horizontal offset shown in the guidance bar.

3.3.4 Creating, editing or deleting memories

In the Horizontal Guidance screen:

- Tap the Save button to save an entered offset value as a memory.
- Tap the memories button  to open the Horizontal Offset Memories screen.

In the Horizontal Offset Memories screen:

- Tap the overflow icon  to edit or delete a memory.
- Tap the Create button to create a new memory.
- Touch and hold on a memory to select multiple memories for deletion.

3.4 Working with Points

Points are available when you are in Compaction Mapping or Design mode and the machine has 3D sensors. If you use GNSS receivers, the machine must be within the GNSS Tolerance Precision.

You can create points in the office or in the field.

3.4.1 Displaying points

To control the appearance of infield points on the work screen, adjust the settings in the Overlays screen. To open the Overlays screen, tap  in the top right-hand corner of the guidance bar. The Points drop-down on the Overlays screen enables you to hide on-screen points, or show combinations of the icon, *Name* and *Code* field.

If you choose to show points with their *Name* and *Code*, the system may truncate the onscreen text so the important parts of the name fit on the screen.

Office points that are included in a layer in a .vcl file are managed the same way as linework within the layer. When you use the Layers Manager screen to:

- Show the layer, the points also display.
- Hide the layer, the points are also hidden. Infield points remain visible.

3.4.2 Filtering points

On the Points Manager screen, you can filter to limit which points appear in the list. You can show:

- All points
- Only points created in the office
- Only points created in the field (all Measured Data stores)
- Only points contained in a specific Measured Data store

3.4.3 Deleting a point

In the Operator App, you can only delete a point that was created in the field. A point created in the office must be deleted from the office software.

When you delete a point created in the field, the system preserves the point so the data is still available to the office. The point is moved from the Measured Data file to a file named *<Measured_Data_name>.<machine_name>.deleted*.

To delete a single point:

- From the Points Manager screen, tap the overflow icon  on the right-hand side of the point and select Delete.
- On the work screen:
 - a. Touch and hold the point name. The pop-up menu displays.
 - b. Tap > and then tap Delete.

To delete multiple points:

- From the Points Manager screen, touch and hold the overflow icon  on the right-hand side of any point to display check boxes for multiple selection.
 - Tap each check box next to the point you want to delete.
 - Tap Delete.
- A **Confirm Deletion** message displays.

3.4.4 Recording a point

Use Record Point to save the 3D position (Northing, Easting and Elevation) of a point. It is useful for recording points of interest on site, such as the location of a manhole.

Your machine does not have to be stationary to record a point. Whether your machine is moving or stationary, the system records the current position of the focus point *when*:

- you enter the Record Point screen
- you use the Record Point shortcut key 

You can access the Record Point screen from the Work Settings menu . The Record Point screen lets you set up how the system logs the points that you record. It allows you to set specific identifiers for the points, as required for the current job and environment. There are three types of identifiers for points: name, code, and Measured Data.

The Edit Point screen has the same fields as the Record Point screen. It enables you to modify an existing point.

Name

In the Record Point screen, tap in the *Name* field to enter a name for the point.

If a point in the system already has this name (for example Manhole) the system alerts you with a message and adds a numeric suffix to the new point (for example Manhole 3). The suffix automatically increases with each new point that has the same name. This lets you quickly and repeatedly record points via the shortcut key or record point switch without having to enter anything into the Record Point screen.

If you do not enter anything into the *Name* field the name is just the numeric suffix. If you do not specify a suffix, the system generates one automatically. You can edit the name and the suffix as required.

Use this icon  (next to the *Name* field) to select from a list of previously used names.

Code

The *Code* field is a string of text that helps describe the point, for example Mainfall 1. In the Record Point screen, you can manually enter a *Code* string when you record the point, or you can use this icon  to select a string that was predefined in the office software. The predefined *Code* strings are exported from the office software in a .fxl file.

If you do not enter anything into the *Code* field, the code will be undefined.

Measured Data

See [Measured Data](#).

Northing, Easting, and Elevation

If the Northing, Easting, and Elevation coordinates are available at the time you access the Record Point screen, they will appear. The coordinates do not change if you move the focus point. You can use the on-screen keypad to enter or change coordinates if required.

The Always Prompt toggle

If Always Prompt is on, the Record Point screen displays each time you tap the Record Point icon in the Work screen. Do this if you want to change the point name, code, or work order for each point you record.

If you want to record a number of points with the same name, code, and Measured Data, set the Always Prompt toggle to off.

Cancel

To discard your changes, tap Cancel. The screen closes and the Work screen displays.

Save

To record the new point, tap Save. The screen closes and the Work screen displays.

3.4.5 How to record a point

1. Place the focus point onto the point that you want to record.
2. To record the point, do one of the following:
 - Access the Record Point screen, enter a name, code, and Measured Data, tap Here and then Save.
 - Touch and hold the Record Point icon in the shortcuts bar ; this opens the Record Point screen. Enter a name, code, and Measured Data, tap Here and then Save.
 - Tap the Record Point icon  to record a point that inherits the last used name (the system adds a numeric suffix to the new point).

3.4.6 Point files

Infield points are stored in a .pnt file. There is a separate .pnt file for each Measured Data, using the naming convention *<measured data>.<machine name>.V01.pnt*.

3.4.7 Navigating to a point

The system can provide navigation to an infield or office point. On the Points Manager screen, tap the overflow menu icon  beside the appropriate point and select Navigate To Point.

When the system provides guidance to a point, the work screen border turns blue and shows a blue line between the focus and the point. The text ribbon shows:

- Nav Direction: the direction to the point relative to the machine direction
- Nav Distance: the horizontal distance to the point

- Nav Depth: the vertical distance to the point

Tap this icon  to stop navigation.

3.4.8 Troubleshooting

If the record point icon does not appear in the shortcuts bar, and the Record Point option is not in the Work Settings menu, check that you are in Design mode and that your system includes a 3D sensor.

3.5 Measured Data

Measured Data are containers. For compactors, they contain Compaction Mapping data and points.

They enable you to group related points together so you can sort through many points. For example, you might use a Measured Data to group all points created on a specific day together. You can then set filtering to display only the points in that Measured Data.

Measured Data are created in the field.

3.5.1 Creating a Measured Data

You can access the Measured Data screen from the Work Settings menu .

1. From the Measured Data screen, tap Add. The New Measured Data screen displays.
2. Enter a name for the Measured Data and then tap Save. The new Measured Data displays in the list.

Measured Data naming conventions

Measured Data names can be up to 90 characters long.

Avoid using the following in Measured Data names:

- , : * | \ / ?
- Emojis
- Duplicate names

3.5.2 Deleting a Measured Data

You can only delete a Measured Data created in the field. When you delete the Measured Data, the system preserves the points that are contained within it so the office still has access to the data.

You can access the Measured Data screen from the Work Settings menu .

1. On the Measured Data screen, select the Measured Data to delete.
2. Tap the overflow icon  and select Delete. A confirmation dialog displays.
3. Tap Yes to confirm the deletion.

3.5.3 Changing the Measured Data of a point

When you create a point, it is assigned to a Measured Data. You can access the Points Manager screen from the Work Settings menu .

To move a point from one Measured Data to another:

1. On the Points Manager screen, select the point.
2. Tap the overflow icon  on the right-hand side of the point and select Edit. The Edit Point screen displays.
3. Select the new Measured Data from the Measured Data drop-down list.
4. Tap Save to save the point and return to the Points Manager screen.

3.6 3D Line Guidance

The system supports guidance along 2D lines and 3D lines. Lines do not have to be straight. They can include curves and change direction.

The system supports names for 3D lines.

3.6.1 3D line surfaces

When you select a 3D line for guidance, the system generates a temporary surface for it. You can do the following with a 3D line:

- Vary the width of the line's surface.
- Extend the length of the 3D line. This also extends the line's surface. See [Line extensions](#).
- Set the slope, or slopes, of the line's surface.

3.6.2 Types of line guidance

A 2D line does not include elevation, so it rests along the surface of the design. The guidance to a 2D line is called Horizontal Guidance. For more information, see the *Horizontal Guidance* guide.

A 3D line includes elevation and has a surface of its own, so it is independent of the design's surface. The guidance to a 3D line can be:

Guidance Type	Description
2D (Horizontal)	The line's elevation follows the design surface. You can apply 2D guidance to a 3D line.
3D (Level)	Generates a level surface attached to the line.
3D (Slope)	Generates a cross slope surface attached to the line. <i>Note – This type of 3D line guidance requires a license.</i>
3D (Dual Slope)	Generates a surface attached to the line that is comprised of two sloping planes. Each plane is half the width of the surface. The planes can be mirrored or they can be different angles. <i>Note – This type of 3D line guidance requires a license.</i>

3.6.3 Line extensions

A 3D line has named start and end points. The start point is named A and the end point is named B.

When you select the line for 3D guidance, you can extend the line beyond the start and end points. The points themselves do not move.

When you extend a line before the A point, the stationing/chainage has a negative value.

3.6.4 Loading a 3D lines file

You need to load a design containing a 3D line before you can enable 3D line guidance. You can do this from the Dashboard:

1. On the Dashboard, tap the Job Setup tile. The Job Setup screen displays.
2. From the Project drop-down, select a project that contains a 3D lines design.
3. From the Modes drop-down, select the Design mode.
4. From the Design drop-down, select a design that contains 3D lines. If the selected design contains 3D lines, the infobox will show the 3D lines icon .
5. Tap Apply. The Dashboard displays.
6. Tap Start. The work screen displays.
7. Use the shortcut key  or context menu to select a 3D line for guidance.

3.6.5 Option 1: Selecting a 3D line with the 3D line shortcut key

When your design contains one or more 3D lines, the 3D line shortcut key  becomes available. To select a 3D line for guidance:

1. Tap the shortcut key . The work screen view changes to plan view and the screen border turns blue.
2. In the plan view, select the line that you want to work with. You can pan and zoom the plan view as required.
3. Tap the appropriate line. Only 3D lines are visible. 2D lines are hidden.



TIP – If there is only one 3D line within the radius of where you tap the screen, the line is selected automatically. If your tap covers more than one line, a list of lines displays.

4. Select the type of guidance required.

3.6.6 Option 2: Selecting a 3D line with the context menu

1. In Plan view, touch and hold on a 3D line. The context menu displays.
2. Tap Select 3D Line.



TIP – If there is only one 3D line within the radius of where you tap the screen, the line is selected automatically. If your tap covers more than one line, a list of lines displays.

3. Select the type of guidance required.

3.6.7 Level guidance

1. Select Guidance (Level) to create a level surface for your line. The 3D Line Guidance (Level) screen displays.
2. Define your surface's features:
 - a. Surface alignment:

Icon	Description
	Surface is centered on the line
	Surface is to the right of the line (relative to the A-B direction)
	Surface is to the left of the line (relative to the A-B direction)

- b. Surface width: Define how wide the surface is. The value must be between 0.10 of a meter and 600.00 meters (4 inches and 1968.5 feet).

- c. Point A Extension (optional): Extend the line's start point and, therefore, the surface start point. The maximum length that you can add is 100 meters (328 feet).

Note – When you select the Point A or B Extension fields, the view jumps to show that point. An extension displays as a dotted line.

- d. Point B Extension (optional): Extend the line's end point and, therefore, the surface end point.
3. Tap Apply. The work screen displays with the view reverted to its original state. The selected line is shown in red. Any end point extensions display as a dashed red line, and the guidance surface that is generated displays in dark gray. Horizontal guidance is to the 3D line. Vertical guidance is to the line's surface.

3.6.8 Slope guidance

Select Guidance (Slope) to create a surface with a cross slope for your line. The 3D Line Guidance (Slope) Step 1 screen displays:

1. To define the cross slope, either:
 - Enter a value in the Cross Slope field.
 - Drag the line in the image.
 A positive value slopes up to the right. A negative value slopes up to the left.
2. Tap Next. The Select Guidance (Slope) Step 2 screen displays.
3. Define the surface:
 - Surface alignment:

Icon	Description
•	Surface is centered on the line
	Surface is to the right of the line (relative to the A-B direction)
	Surface is to the left of the line (relative to the A-B direction)

- Surface width: Define how wide the surface is. The value must be between 0.10 of a meter and 600.00 meters (4 inches and 1968.5 feet).
 - Point A Extension (optional): Extend the line's start point and, therefore, the surface start point. The maximum length that you can add is 100 meters (328 feet).
- Note** – When you select the Point A or B Extension fields, the view jumps to show that point. An extension displays as a dotted line.
- Point B Extension (optional): Extend the line's end point and, therefore, the surface end point.
4. Tap Apply. The work screen displays with the view reverted to its original state. The selected line is shown in red. Any end point extensions display as a dashed red line,

and the guidance surface that is generated displays in dark gray. Horizontal guidance is to the 3D line. Vertical guidance is to the line's surface.

3.6.9 Dual slope guidance

Select Guidance (Dual Slope) to create a surface comprising of two sloping planes. The 3D Line Guidance (Dual Slope) Step 1 screen displays:

1. Select whether the two planes are mirrored or unique:

Icon	Description
	The left surface slope is the same as the right surface slope
	The left surface slope can differ from the right surface slope

2. Select the slope of the left plane. Either:
 - Enter a value in the Left Angle field.
 - Drag the left side of the line in the image.

A positive value slopes up to the left. A negative value slopes down to the left.
3. Select the slope of the right plane. Either:
 - Enter a value in the Right Angle field.
 - Drag the right side of the line in the image.

A positive value slopes up to the right. A negative value slopes down to the right.
4. Tap Next. The Select Guidance (Dual Slope) Step 2 screen displays.
5. Define the surface:
 - Surface alignment:

Icon	Description
	Surface is centered on the line. The left angle slope applies to the left of the line and the right angle slope applies to the right of the line.
	Surface (comprised of two sloping planes) is entirely to the right of the line (relative to the A-B direction). The two planes meet halfway across the width of the surface.
	Surface (comprised of two sloping planes) is entirely to the left of the line (relative to the A-B direction). The two planes meet halfway across the width of the surface.

- Surface width: Define the entire width of the surface (each sloping plane will be half this width). The value must be between 0.10 of a meter and 600.00 meters (4 inches and 1968.5 feet).

- Point A Extension (optional): Extend the line's start point and, therefore, the surface start point. The maximum length that you can add is 100 meters (328 feet).

Note – When you select the Point A or B Extension fields, the view jumps to show that point. An extension displays as a dotted line.

- Point B Extension (optional): Extend the line's end point and, therefore, the surface end point.

6. Tap Apply. The work screen displays with the view reverted to its original state. The selected line is shown in red. Any end point extensions display as a dashed red line, and the guidance surface that is generated displays in dark gray. Horizontal guidance is to the 3D line. Vertical guidance is to the line's surface.

3.6.10 Lightbar guidance to a 3D line

You can use the vertical guidance and horizontal guidance lightbars to guide you to your chosen 3D line.

3.6.11 Preview the guidance surface

When you create the line's guidance surface, the preview shows in Plan view by default. It can be difficult to assess your surface in Plan view, so you can tap the  icon on the preview frame to see the surface in the 3D view.

3.6.12 Useful text items

- Cut/Fill Left
- Cut/Fill Center
- Cut/Fill Right
- MA Offset (you can use this to gauge how far you are from your chosen 3D line).

3.7 Lane Guidance

Lane guidance enables you to extend a lane sideways. It is available when:

- You are in design mode
- You have a .dsz design loaded
- A master alignment is present

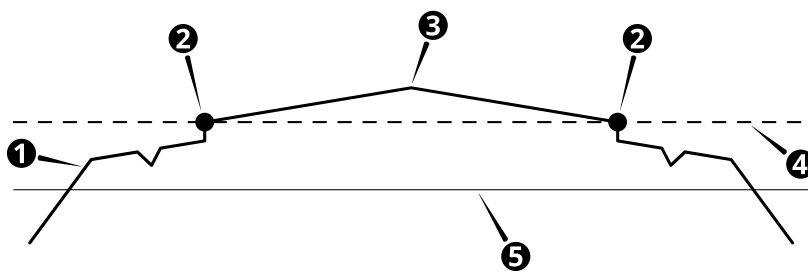
Working surface, vertical and perpendicular lifts and horizontal guidance all work with lane guidance.

Note – When you show cut/fill mapping while using lane guidance, you see a subset of the entire mapped ground surface. This is most noticeable when using lane guidance on a horizontal curve. Toggle lane guidance off to display the ground surface mapping over the complete design reference.

3.7.1 Extending a lane sideways

Lane guidance lets you select a lane or two lines and extend the surface of the lane or the grade between the two lines out to the left and right, to suit different situations.

For example, you can select a lane for guidance and extend it to the side to either meet the cut or fill batter or sideslope of the road. This is often also offset in height as well so that the design is built up in layers. See the figure below:



①	Original design	②	Lane side	③	Master alignment
④	Lane surface	⑤	Lane surface for guidance (offset by 1 meter)		

3.7.2 The shortcut key

When you are in the work screen, you can use the shortcut key  to select a lane:

1. Position the machine with the drum focus point between the required lane sides.
2. Tap .

You can also touch and hold the shortcut key to open the Lane Guidance screen.

If your design does not have a master alignment, and you try to enable Lane Guidance via the shortcut key, the Select Master Alignment screen displays. In the plan view, tap the line that you want to use or select a named alignment from the drop-down list. Once you have selected a master alignment, the work screen displays.

3.7.3 The Lane Guidance screen

To open the Lane Guidance screen:

- Touch and hold the shortcut key , or;
- Go to the Work Settings menu  > Lane Guidance.

The Lane Guidance screen contains a plan view of the machine on a design. You can pan and zoom this view as required.

If the .dsz file contains named lines, you can select them from the Line A and Line B drop-down lists.

The master alignment

The lane surface is calculated at right angles to the master alignment.

If the .dsz file contains a master alignment, it displays in the plan view as a solid blue line. You must use this master alignment and cannot change it.

If the .dsz file does not contain a master alignment, you must select one before you select the lane sides:

1. Touch and hold . The Select Master Alignment screen displays.
2. In the plan view, tap the alignment that you want to use as the master alignment. Or, select an alignment from the drop-down list.

The master alignment is stored with the design indefinitely. If the design is unloaded and reloaded then the last selected master alignment is used.

***Note** – Think of the two lane sides and master alignment as a group. If you change the master alignment, but not the lane sides, this changes the lane surface and the guidance to it.*

You can use the master alignment itself as one of the sides of the lane.

Creating a lane surface

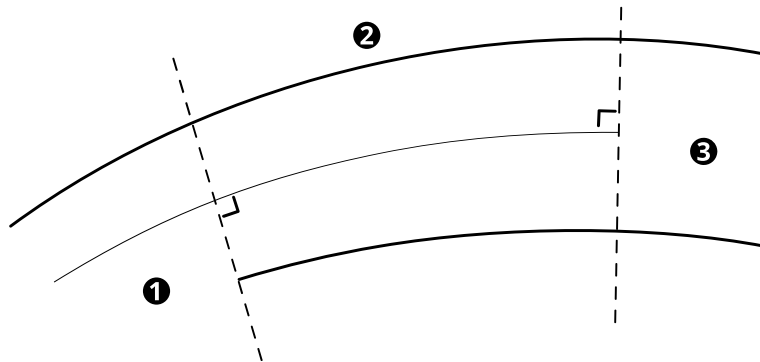
To create a lane surface from the Lane Guidance screen, do one of the following:

- Select the alignments from the drop-down lists.
- Tap each lane side on the plan view.
- Touch and hold the area between two lane sides.

3.7.4 Lane Guidance limits

- The lane must be a minimum of 300mm (12in) wide.
- The lane sides must not turn more than 90° away from the master alignment.
- Lane Guidance starts only when all three lines (the master alignment, left-hand lane

side and right-hand lane side) have started. See the figure below:



- | | | |
|---|---|---|
| <p>❶ Lane guidance unavailable: only one lane side is present</p> | <p>❷ Lane guidance available: two lane sides and the master alignment are present</p> | <p>❸ Lane guidance unavailable: no master alignment present</p> |
|---|---|---|
-

3.7.5 Troubleshooting

Lane guidance is unavailable when:

- You are more than 100 meters extension (left/right) of the guidance lane sides.
- Either lane side does not lie above the design surface.

3.8 Using GNSS

3.8.1 Troubleshooting

The table below lists some of the error messages that may appear in the work screen and common error states during operation.

Operational State	Problem	Solution
Coordinate System Failed To Load. Unable to load the coordinate system for the current project.	One or more of the coordinate system files, or the site calibration file, may be corrupt.	Contact your technician, site engineer, or surveyor.

Operational State	Problem	Solution
Coordinate System Failed To Load. <filename>not specified in coordinate system database XML.	A file that is referenced in the project site calibration is not included in the coordinate system database. The coordinate system database may need to be updated to include the required file.	Contact your technician, site engineer, or surveyor.
Coordinate System Failed To Load. <filename> is missing or invalid.	A file that is referenced in the project site calibration is not present in the GeoData on the EC520.	Contact your technician, site engineer, or surveyor.
GNSS Error. Autonomous GNSS.	The GNSS receiver is tracking satellites but there are no valid corrections.	Check the radio and cables. Check that the channel setting for the radio matches that of the base station. Ask your site supervisor to check that the GNSS base station and any repeaters in the radio network are working correctly.
GNSS Error. No GNSS Position.	The GNSS receiver is not outputting data.	Check the GNSS receiver and cables, and ensure the antennas have a clear view of the sky.
GNSS Error. Old GNSS Position.	The GNSS receiver is not tracking enough satellites, or is still acquiring satellites and not yet computing a valid position.	Check the GNSS cables and receiver for faults, and ensure the antennas have a clear view of the sky.
GNSS Error. Out of Geoid Range.	The GNSS position is out of the range of the loaded geoid grid, or the correct project or Geoid has not been loaded.	Move the machine into range, or load a project with the correct Geoid for your location. If problems continue, contact your technician, site engineer, or surveyor.

Operational State	Problem	Solution
New Base Station Coordinates Detected. Continued operation may give poor results. Contact your site supervisor.	The base station radio channel set up for your system, is also being used by another base station within radio range.	Contact your site supervisor.
Sensor Invalid. GNSS Receiver - Left/Right is disconnected.	Only one of the GNSS receivers is generating positions.	Check the cable and power for the receiver. If problems continue, contact your site supervisor.
Sensors warming up, accuracy could be degraded.	The sensor or sensors are below the minimum temperature required to provide accurate guidance.	Wait while the internal sensor heaters warm the sensors up to the minimum temperature required for accurate guidance. When the sensors reach the minimum temperature, the 'Initialization required, stay stationary and tap Restart' message displays. You can move the machine while waiting for the initialization to complete.

Using Single-3D Guidance

In this chapter:

- ▶ [Using UTS for Guidance](#)
- ▶ [Best Practices When Using Single-3D Guidance](#)

You can use either a single GNSS or UTS to provide 3D guidance.

4.1 Using UTS for Guidance

Configure the machine to connect to a Universal Total Station (UTS) instrument for machine guidance.

To enable UTS guidance, select a UTS option as the positioning source in the Machine Setup screen.

4.1.1 The UTS Settings screen

The UTS Settings screen enables you to set the radio network ID and channel that both the system and UTS instrument communicate over. Ensure that the Channel and Network ID settings chosen on the machine match those set on the UTS instrument.

Note – Ensure that the UTS instrument has been set up in Machine Control mode using Trimble SCS900 or Siteworks and that the small screen on the front of the UTS instrument displays "Waiting for connection".

Note – Ensure that each machine using UTS guidance in the same area of a site has a unique Target ID for its MT9xx Machine Target.



TIPS:

- Look at the small screen on the front of the UTS instrument to check which Channel and Network ID it is using.
- In the UTS Settings screen, toggle Auto Search off if you prefer to move the machine back to the last tracked position where the MT9xx Machine Target was lost and manually start a search.

If you have an Operator Plus account you can configure the UTS tolerance thresholds via the Advanced button on the UTS Settings screen.

4.1.2 The UTS Management screen

The UTS Management screen enables you to select and use UTS instruments that are on the same radio channel and network as the machine and within radio range of the machine.

The system supports connection to a maximum of five UTS instruments.



TIPS:

- For best accuracy, select an instrument to use for guidance that is less than 200 m from the machine
- Set a custom name for your Trimble SPSx30 Total Station using Trimble SCS900 or Siteworks software.

Note – Use Trimble SCS900 or Siteworks software to connect to and set up UTS instruments in Machine Control mode before connecting to them from the machine. The accuracy of guidance on the machine depends on an accurate UTS instrument setup.

Note – The system will clear the bench and transition offsets if you stop the UTS instrument currently being used for guidance and start it again in a different position, or if you start using a different UTS instrument. A confirmation message **Bench and Transition Offsets will be Cleared** is displayed before you can use the UTS instrument for guidance.

Note – Tap within the UTS Name or Status column area to start or use the UTS instrument for guidance. Tapping on a UTS instrument row in any other areas will not be recognized. This prevents unintentional activation when your fingers are close to the screen in those columns.

Understanding UTS statuses

Item	Function
Configuring	Appears after you have tapped a UTS instrument to start it and while a radio connection is being established with it.
Searching	Appears when the UTS instrument is searching for the target.
Tracking	Appears when a UTS instrument is tracking the target.
Used for Guidance	Appears instead of the status of Tracking for the UTS instrument that you have tapped to use for guidance. The UTS instrument providing guidance is listed at the top and is highlighted orange.
Target Lost	Appears when the UTS instrument is not tracking the machine target and a search has failed to find the machine target, or when auto search is disabled and the UTS instrument is not tracking the machine target and you have not started a search.
UTS out of level	Appears when a UTS instrument reports that it is out of level. To correct this, stop the connection to that UTS instrument using the overflow menu  , re-level it and redo the UTS Instrument setup using Trimble SCS900 or Siteworks before starting it again from the machine.
Configuration failed	Appears after you tap to start a UTS instrument but the radio connection to it from the machine fails to be successfully established. To correct this, stop the connection to that UTS instrument using the overflow menu  and redo the UTS Instrument setup using Trimble SCS900 or Siteworks before starting it again from the machine.
Out of Range	Appears if your UTS instrument is positioned at a distance greater than the Maximum Distance limit set for UTS tolerances. For more information, see Understanding UTS tolerances.

Understanding Horizontal and Vertical Differences

UTS guidance accuracy decreases as the distance increases from the UTS instrument used for guidance. Some jobs require using more than one UTS instrument to ensure accurate guidance over the length of a pass. In this case, you must transition between UTS instruments as the machine moves along the pass.

When multiple UTS instruments are used for a pass, the horizontal and vertical difference values displayed in the UTS Management screen are the differences between the target position reported by the UTS instrument used for guidance and the positions reported by any other UTS instruments tracking that target. The horizontal and vertical difference values provide an indication of the quality of the UTS instrument setup along a pass.

The first UTS instrument to track a target is assumed to have zero error. At each transition between UTS instruments, the horizontal and vertical differences between the previous UTS instrument and the new UTS instrument are compensated for by the system. These compensations accumulate with each transition into a value referred to as the transition offsets.



ATTENTION – If an action is performed that resets the transition offsets to zero during a pass, then there may be significant changes to the elevation of the formed surface and to horizontal guidance.

Understanding UTS information

Several icons appear in the UTS Management and work screens.

Icon	Description
	Displays when the distance to the UTS instrument has exceeded the warning threshold. For more information, see Understanding UTS tolerances .
	Displays when the distance to the UTS instrument is outside of the distance or position tolerances. For more information, see Understanding UTS tolerances .

Icon	Description
	Tap to display the overflow menu for an instrument in the list. Use the overflow options as follows: - Tap  to establish the radio connection to a UTS instrument and move it to the Connected Instruments list. <i>Note – Once a UTS instrument is started by a machine it is not available for other machines or surveyors to connect to.</i> - Tap  to use a connected UTS instrument for guidance. <i>Note – Not available when the UTS instrument is out of range or is outside of the distance or position tolerances. For more information, see Understanding UTS tolerances.</i> - Tap  to stop using the UTS instrument. This makes it available for other machines or surveyors on site to use. - Tap  to activate a search for the UTS instrument to find the MT9xx target if it has lost tracking. - Tap  to cancel a search in progress. - Tap  to view diagnostic information for the UTS instrument and the machine target.
	Displays when the UTS instrument is connected to an external power source.

Understanding UTS diagnostics

The Diagnostics pop-up information box displays status information for the UTS instrument and the MT9xx machine target. Use this information to troubleshoot errors during operation.

The information box displays the name of the UTS instrument and its current status.

UTS

The fields in this area display status information for the UTS instrument.

Field	Explanation
Northing Easting Elevation	The setup location of the UTS instrument.
Compensator	The instrument's compensator status. For best results, ensure that this is enabled.

Field	Explanation
Instrument height	The setup height of the UTS instrument above a known control point.
Scale factor	The scale factor set on the UTS instrument.
PPM	The offset that corrects the error in the UTS instrument's Electronic Distance Meter (EDM) caused by temperature and pressure.
Point Name	The name of the point at which the UTS instrument was set up.

Machine Target

The fields in this area display the status of the machine target.

Field	Explanation
Northing Easting Elevation	The location of the center of the machine target as measured by the UTS instrument, but adjusted for mast lean.
Search window	The position of the machine target relative to the search window specified during UTS instrument set up.
Slope distance Horizontal angle Vertical angle	The observed location of the machine target relative to the UTS instrument.

Understanding UTS tolerances

If you are using more than one UTS instrument and are transitioning between them, you can configure the acceptable thresholds for the distance and position differences between the UTS instruments in the Web Interface. Use the thresholds to disable transitions between UTS instruments outside tolerances.

In the work screen, the following information is displayed for UTS instruments:

- The text ribbon can be configured to display a text item that shows which MT9xx machine target on the machine is currently being tracked and its distance from the UTS instrument.
- The plan view displays the location of UTS instruments available on site. An orange icon indicates the UTS instrument in use.

Bench UTS

Benching matches the drum edge elevation to a known elevation on site. It **does not** match the Northing or Easting horizontal position.



TIP – You can access the Bench UTS screen from the work settings menu or by tapping the Bench button in the UTS Management screen.

To bench:

1. Have a surveyor mark a position with a known elevation on the ground.
2. Open the Bench UTS screen.
3. Position the drum edge accurately on the mark made by the surveyor. You may move the machine to achieve this.
4. In the Drum Edge field, select which edge you want to bench: Left or Right.
5. Enter the value of the known elevation from the surveyor into the Elevation - (A) field.
6. Tap Bench.
7. Before moving the machine, go back into the Bench UTS screen and check that the last bench elevation (A) displayed matches the elevation entered in step 5.

Common UTS problems

Problem	Action
UTS instrument not displayed in UTS Management screen	Check that the radio channel and network on the machine are set correctly to match those of the UTS instrument.
UTS instrument tracks the Machine Target on another machine	In the UTS Settings screen, change the target ID on the machine. Ensure that each machine using UTS guidance in the same area of a site has a unique Target ID for its MT9xx Machine Target.

4.1.3 Troubleshooting UTS guidance

The table below lists some of the error messages that may appear in the work screen and common error states during operation.

Operational State	Problem	Solution
UTS Out of Level	The tilt compensator on the UTS instrument is out of range.	1. Stop the UTS instrument. 2. Repeat the position setup for the instrument using Trimble SCS900 or Siteworks, making sure that the tripod is secure and the instrument is level. 3. Start the UTS instrument from the UTS Management screen.
Target Lost. Searching...	The UTS instrument used for guidance has lost line of sight to the machine target and Auto Search is enabled.	1. If required, tap Cancel to cancel the search. 2. Move the machine or remove any obstruction to the line of sight. 3. Start a search for the UTS instrument from the UTS Management screen. 4. Optionally, hold and point the UTS instrument at the target to regain the lock.
UTS - Low Battery xx% of battery remaining	This message displays briefly on screen, first when the UTS battery level is at 15%, and then when the UTS battery level reaches 5%.	You can choose to carry on working or select another instrument from the UTS Management screen. Guidance is still provided. Check the remaining battery level of the UTS instrument in the UTS Management screen.

4.2 Best Practices When Using Single-3D Guidance

The following best practices are recommended:

- Maintain the machine in good condition to remove the play in joints that is caused by excessive wear.
- Ensure that the system has an accurately calculated orientation by moving the machine when prompted to do so. An accurately calculated orientation is required for accurate guidance.

4.2.1 GNSS

- Select the GNSS Precision Tolerance suitable for your application from the System Settings menu.

Note – The acceptable precision values are set in the Web Interface.

4.2.2 Specifying machine direction of travel

If you are using single 3D guidance, the system displays an orange *Move Machine* operational state message at start-up. When the machine is moved, and during normal operation, the system determines when the machine is traveling forward and when it is traveling in reverse. If the determined direction is incorrect at any time, tap the direction of travel shortcut button  to manually set the direction.

Project and Design Files

In this chapter:

▶ [Project and Design Files](#)

This chapter describes the LandXML design format, the process of downloading a design from an online service, how project and design file validation works, troubleshooting information for designs that fail validation, file naming best practices, and how to export a successful LandXML design from Trimble Business Center.

5.1 Project and Design Files

This chapter covers information relevant to project and design files.

It includes:

- Design file formats
- Details of the LandXML design format
- The process of downloading a project from an online service
- How project and design validation works
- Troubleshooting for designs that fail validation
- Project file naming best practices
- Exporting a LandXML design from Trimble Business Center

5.1.1 Design file formats

You can use LandXML, .dsz or .vcl designs that are created in an office design tool such as Trimble Business Center. You can also create or select an infield surface.

When you select a LandXML or .vcl design file that contains multiple surfaces, you can further select an individual guidance surface from the file and you can select a master alignment for that surface (if available).

.dsz design files only contain a single surface, so if you select a .dsz design file the system automatically selects it in the *Guidance Surface* field. If required, you can deselect the surface or change it to an infield surface.

The system supports filled 2D linework in .vcl files. The fill reflects the color set in Trimble Business Center.

5.1.2 LandXML design files

The system supports designs in the industry-standard LandXML format, loaded from a USB drive or an online service.

Store the LandXML design in the project's /Designs/ folder, as you do with .vcl and .dsz designs. A LandXML design requires the same supporting files, such as a .cal site calibration for GNSS or UTS guidance.

The system will validate the LandXML file to ensure it is usable. For more information, see 5.1.4 Design validation.

Supported LandXML features

Surfaces

Any surfaces must be full TIN models. Files that contain parametric surface definitions (i.e. stringlines or cross-sections), or source data (i.e. breaklines), are not supported.

For instructions on exporting a LandXML design with the correct surface type from Trimble Business Center, see 5.1.7 Exporting a LandXML design from Trimble Business Center.

Linework

The system supports lines connecting coordinate points (either as part of a surface mesh or separately).

The system supports lines that contain horizontal and vertical geometry and station (chainage) information.

- Horizontal:
 - Straight lines
 - Circular arcs
 - Spirals (clothoid and parabola types only)
- Vertical:
 - Points
 - Circular arcs
 - Parabolic
 - Elevations defined under the <Alignment> tag are not supported. 3D linework is supported in plan features.
- Attributes:
 - Alignment/layer names created in Trimble Business Center.
 - Colors defined in Trimble Business Center. Other color definition formats are not supported.

Points

3D points marking exact locations.

Roadways

Roadways are supported through triangulated surface meshes, alignments, and planimetric features. String line, cross-section, and structural models are not supported.

Railways

Railways are supported through triangulated surface meshes, alignments, and planimetric features. String line, non-linear stationing, cross-section and track, and structural models are not supported.

Waterways

Waterways are supported through triangulated surface meshes, alignments, and planimetric features. Cross-section, string line, or structural models are not supported.

Features not supported in LandXML

The following LandXML features are not supported:

- Surfaces derived from parametric source data (i.e. breaklines)
- Surface derived from parametric surface definitions (i.e. stringlines or cross sections)
- Non-linear stationing
- Pipe networks

5.1.3 Receiving projects/designs from WorksManager

If you are connected to WorksManager, the service can push the latest project and design files to your system.

Note – Using an online service may require a paid subscription.

If the Project and Design drop-downs show a cloud icon beside the name, the project and design are managed from an online service. The cloud icon states are:

Icon	Description
	For a project: All the project files, including design files, are downloaded. For a design: The design is successfully downloaded from the online service and validation is complete. It is available to use.
	For a project: Part of the project is still to be downloaded. For a design: The design on the service is new or updated, and is queued to download to your system. It is not currently available to select. If a number displays beside the icon, it represents the design download percentage.

Icon	Description
	There was an error downloading the project or design. It is not available to select. • For more information, contact your site's data manager. • There is additional troubleshooting information in the Configuration Guide contained in the technician's commissioning manuals. • You can view the state of published files in WorksManager.
No icon	The design is not published directly from WorksManager.

On start-up, your system will check with the online service to ensure your designs are up to date. Any updates download automatically.

If the files are updated on the online service while your system is running, the online service sends the updates to your system. If you have a design selected when it is updated, the system notifies you and returns you to the Job Setup screen. You will need to reselect the design and the guidance surface.

If your system is connected to a service and you are in Design Mode, the Refresh button on the Job Setup screen is available. It enables you to manually check with the service to ensure you have:

- All available projects and designs
- The latest version of each project and design

If the check finds any files that are out-of-date or missing, the system automatically downloads them.

On the Project screen, you can expand the project to show the files that are included.

If the machine has Autos engaged when the project is updated, Autos will continue to operate. When Autos is disengaged, the warning message displays and the Operator App returns to the Dashboard.

Troubleshooting WorksManager downloads

Viewing the state of published files

You can view the state of published files in WorksManager.

Design validation

If a downloaded file is invalid, the Operator App reports **Issue > Invalid File > Check Design**.

There is an issue with the file in WorksManager. Check that the file is valid and that the design elements are supported in the grade control system.

Perform a TCC sync

For new EC520 devices, perform a TCC (Connected Community) sync to authenticate the device before you can use WorksManager.

WorksManager updates project/design that operator is using

If WorksManager updates a project that the operator is currently using, the Operator App reports **Project updated remotely**.

If WorksManager updates a design that the operator is currently using, and auto-archive is enabled, the grade control system deletes the design and downloads the new version. The Operator App reports **Design deleted remotely**.

The dashboard displays so the operator can select the updated project/design. If Autos is engaged, the system waits until Autos is disengaged before returning to the dashboard.

Re-download of deleted project is incomplete

If you delete the local copy of a project sent from WorksManager, the system re-sends the project. However, the re-sent project may be slow to start downloading.

To work around this issue, tap the Refresh button on the Job Setup screen. This re-sends the full project.

***Note** – Manually deleting a project with a cloud icon via the Web Interface (or another local means) does not persist. When the grade control system next connects to the Internet, the projects are re-sent to the device. To delete a WorksManager project permanently, you must remove it in WorksManager.*

Project or design renamed on WorksManager appears to be deleted

If a project or design is renamed in WorksManager, the grade control system believes that it is deleted. The system deletes the local copy and downloads the new version. The Operator App will report either **Project deleted remotely** or **Design deleted remotely**.

Download connection is poor

If the download connection is poor, causing low download speed, you can select the project and design in the Operator App's Job Setup screen. This prioritizes these downloads above other projects and designs in the queue.

Download fails to complete

If a download fails to complete in the allotted time, the partial download can resume when the internet connection is back online.

Known issues

TCC sync delays WorksManager design download

An issue has been reported where the user could not apply a new design, despite download status of 100%.

The grade control system delays installing a design if it is simultaneously syncing large files from TCC. The design becomes available after the TCC sync completes.

Project converted from local to cloud appears twice

An issue has been seen where WorksManager adds a design to a project that is saved on a local device (so, WorksManager effectively takes control of the project). The system showed 2 versions of the project in the list on the Job Setup screen: one version with the cloud icon indicating it is linked to the cloud, and one version that appears local.

Workaround: Exit the Job Setup screen and then re-open it. The list will only show one version.

5.1.4 Design validation

The system supports designs in LandXML, .vcl or .dsz format. When a design is added to the system, the system validates the file to ensure it is valid. You cannot use the file until validation is complete.

When a design is queued for validation, the system shows the validating icon .

When the system is validating the design:

- The system displays the validating icon  and a time on the Job Setup screen beside the design's name in the Design File menu.
- The time is an estimate of how long the validation will take.
- A warning message displays:

On-screen Message	Description
 File > Validation in progress...	Wait for the system to complete the validation process.

Note – If you load a design, the system will pause validation of other designs.

If a .vcl or .dsz design was received automatically from WorksManager, the error or warning is also recorded in the WorksManager system.

Validation timing

The time that the system takes to validate your designs varies depending on the complexity of the design:

- In the Design File drop-down, the system shows a countdown of the estimated time remaining for the design that is being validated.
- To validate a specific design ahead of other designs, select it in the Job Setup screen.

Note – If you introduce a project that contains many complex designs, the time to validate them may be significant.

5.1.5 Troubleshooting designs



TIP – To correct a design that fails validation, you must adjust the design in the office software that generated it (such as Trimble Business Center). Therefore, the information in this section may be most relevant to site engineers or data managers.

Files within a project can fail validation for a number of reasons. This section describes some causes. Validation occurs for several file types within a project (not just designs).



TIP – Highly complex designs can fail validation because they require too many system resources. Smaller designs (for example, less than 20 MB) are less likely to cause problems.

Validation troubleshooting

You can receive 2 types of validation message:

- A red cross : the design cannot be used. The file fault will need correcting in the design tool.
- An orange exclamation mark : the design can be loaded, but there is a warning. It may not display fully or provide guidance as expected.



ATTENTION – If an orange warning displays after you tap the Apply button on the Job Setup screen, refer to the Monitor > Program Log screen in the Web Interface for more detail. Look for warnings relating to <NavigationProcessorComponent>. For example:

WARNING - <NavigationProcessorComponent> Validation warning: Linework extends outside design boundary (400x400km)

If you select a design that contains an issue, but you can still proceed, the system displays a pop-up message when you tap Apply on the Job Setup screen.

Note – The design may display with expected elements missing. If the element you require is not present, the file issue will need correcting in the design tool.

If there are a mix of issues across surfaces and linework, the surface error will display.

Issues that stop the system from loading the design include:

On-screen Message	Description
 Issue > File Missing > Check File Structure	You cannot load the design because the system could not find the file. This issue can also occur if the file is present but is 0 kB.
 Issue > Unrecognized Format > Check Design	You cannot load the design because the system does not recognize the file format.
 Issue > Invalid File > Check Design	You cannot load the design because the file is invalid. This may be because: • The file does not conform to the design schema. (This condition does not apply to LandXML.) • Units of measure are not defined in the file. • The units that are defined are unsupported. • The maximum number of line elements is exceeded.
 Issue > Invalid File > File Size Too Large > Check Design	You cannot load the design because the file's size is too large: • For .vcl files, the limit is 150 MB. • For LandXML files, the limit is 50 MB. • For .dsz files, there is no size limit.
 Issue > Surface Too Complex > Check Design	There are too many triangles in the design's TIN model (more than 65,000 in one page).
 Missing project coordinate system file	The system cannot find a .cal file for this project. Check the project's \OfficeData\ folder.
 No Measured Data selected	Select a Measured Data file in Job Setup screen.

Issues where there is a problem with the design, but you can still load it, include:

On-screen Message	Description
 Avoidance zones do not work with a 2D positioning source	The selected project contains one or more avoidance zones, but cannot display them because you are using a 2D positioning source.
 Design File > Surface Issue Design loaded, but only valid TIN surfaces will show. Check the design file.	The system can load the design, but there is an issue with one or more surfaces: • The surface may be missing an element. • The surface is not a valid TIN model.
 Design File > Surface Issue Design loaded, but one or more surfaces contain missing or invalid data and may be unusable. Check the design file.	The system can load the design, but there is an issue with one or more surfaces. Causes include: • Missing faces or points • Invalid points • Invalid face • Face refers to non-existent points • System cannot process the surface TIN model
 Design File > Linework Issue Design loaded, but one or more layers contain missing or invalid linework data and may be unusable. Check the design file.	There are many possible causes of this error.

On-screen Message	Description
Linework elements unsupported in LandXML • Line is not 2D or 3D • Curve is not 2D or 3D • Curve has inconsistent radius • Curve length does not match provided length • Curve has undefined bearing or arc length • Invalid point list • Point list has incorrect number of values • Line color is unknown format • Point has invalid coordinates • Point has no name • Curve has invalid rotation • Curve has invalid or no center coordinate • Start/end dimensions do not match • Line has wrong contents • Alignment does not have a name • Alignment has no staStart or length • Alignment total length does not match	
• Line only has one horizontal element • Error converting string to double • cgPoint contains no value or reference • Invalid spiral radius • Cannot find point in layer • No layer exists • Circular referencing • Invalid point • Cannot find point in lookup table • Point name should be unique • Feature tag has empty label • Feature tag has empty value • Invalid PI dimension • Spiral start and end point is neither 2D nor 3D • Linework contains bad data • Unsupported linework type	

On-screen Message	Description
Linework elements unsupported in VCL:	
• Linestring element: – Dependent Location Three Point Arc – Dependent Three Point Arc – Dependent Segment Three Point Arc – Dependent PI Arc with elevation – Offset with useSlope – Offset endpoint with negative along • Unsupported linestring vertical element: – eStationSlopeToParabola – eStationSlopeFromPI – eStationSlopeFromParabola – eStationSlopeToFromPI – eStationSlopeToFromParabola – eStationSlopeToArc – eStationSlopeFromArc – eStationSlopeToFromArc • Unsupported singular best fit arc linestring element • Unsupported best fit arc linestring element with the same start and end points	• Unsupported linestring with no elements • 3D spirals • Smart text • Unsupported Point Coordinate Component • Unsupported Point Coordinate Type • Only single point coordinates supported, <number> points found • Only alignments with curve type = "arc" are supported • Only alignments with spiral type = "Clothoid" or "Cubic" or "Cubic Parabola" or "NSW Cubic Parabola" or "Half Sine" are supported • Decreasing stationing not supported. • Vertical alignment segment of type "<type>" is unsupported • Offsets to alignment spirals not supported • Any entities defined on a cutting plane are unsupported • Any entities defined using a User Coordinate System are unsupported

Design complexity limits

A design can also fail validation if it contains too many elements. Exceeding the following limits can cause a design to fail validation:

Element	Limit
Too many lines or linework elements (including curves)	65,534 lines in one page.

Element	Limit
Dense surface	Avoid using surfaces where the TIN triangles are too small, e.g. under 0.01 m ² per triangle or has more than 65,000 triangles in an area of 50 m x 50 m.
Too many points	160,000 points.
Oversized triangles	Triangles with 5 km sides. If you require extremely large TIN triangles, use .dsz format.

In addition, use of the following may cause issues within a design:

- Contains a spiral, horizontal cubic, or NSW spiral
- 3D lines of curves
- Complex vertical segment arcs with horizontal spirals
- Ferguson linestring elements
- Excessive text/labels
- Excessive line names
- Excessive layers
- Design triggers many warnings/information notes

5.1.6 File naming conventions

This section describes appropriate naming conventions for files in projects (including designs):

- Ensure all designs have a version number in the name. If you edit the file, increase the version number.
- Ensure that version numbers are uppercase. The Operator App may show the version number in uppercase, even if it is actually lowercase.
- When a file is imported to the system from an online service or from USB, the system automatically converts the filename extension to lowercase (for example, .dsz, .vcl, .xml, .ggf, .cal).
- If the system encounters two versions of a file with the same name and version number:
 - a. If one version is sent from an online service, it is retained and the local file is deleted.
 - b. If both files are on the local system, the file with the newer date is retained and the older file is deleted.
- Avoid duplicate filenames.
- Avoid using slashes and backslashes in design file names.
- Avoid using symbols and emojis in design file names.
- Ensure geodata file names (.ggf) are lowercase (filename and extension).

- Avoidance zones files must always end with .avoid.svl.
- Linework files end with .svl.

5.1.7 Exporting a LandXML design from Trimble Business Center

1. In TBC, click the Export icon. The Export dialog displays.
2. Select LandXML exporter from the list of file formats.
3. Select Options > Select All from the Data field.
4. Click the ... button in the File Name field.
5. Specify the filename and the stored location.
6. Set the Surface description in the Settings field to 2 – Triangles. This ensures that all surfaces are TIN surfaces. Other forms of surface are not supported.
7. Click the Export button.

To use the design in the grade control system:

1. In File Explorer, navigate to the location you selected when exporting.
2. Copy the LandXML design file.
3. Paste the file into the grade control system's USB file structure: ProjectLibrary / Projects / (Project Name) / OfficeData / Designs.
4. Use the USB file transfer method to import the design into the system.

The system does not support .tsd files exported from TBC as a .dsz design. To use data from a .tsd, export the file from TBC as a .vcl and import the .vcl file into the grade control system.

Project and design creation

You can create project files in TBC v3.80 or later. For customers using TBC's .vcl design file format in the grade control system, use TBC v5.21 or later.

Mapping

In this chapter:

- ▶ [Compaction Mapping](#)
- ▶ [Cut/Fill Mapping](#)

This chapter introduces the use of mapping. Mapping provides a location-oriented record of machine activity and site information.

For compactors, there are 2 types of mapping: compaction and cut/fill.

6.1 Compaction Mapping

6.1.1 Introduction

Note – Mapping and the features mapping offers are configurable in the Web Interface by your technician or from the Operator App by users with Operator Plus permission. In addition, advanced mapping features may only be available if the correct license is installed. If mapping or a mapping feature is not available on your system, contact your technician or dealer.

Compaction mapping data is recorded at the center of the drum, as the machine works. The elevation of the base of the drum is also recorded and is used to produce cut/fill mapping.

For compactors, mapping is enabled by default.

For information on cut/fill mapping see 6.2 Cut/Fill Mapping

6.1.2 Compaction mapping

Compaction mapping data is stored to the currently selected Measured Data.

In either the Job Setup screen or on the Guidance Bar in the work screen, ensure you select the Measured Data you want to store compaction mapping data to. You can change the selected Measured Data or create a new Measured Data while you are working to store compaction mapping data to suit your current job or task. For more information about Measured Data, see [Measured Data](#).

To access the compaction mapping settings, touch and hold the compaction mapping shortcut key  from the work screen or select Compaction Mapping from the Work Settings menu (see [Compaction Mapping settings](#)).

Compaction Mapping views

To select the compaction mapping views to display, open the Layout screen from the Work Settings menu. From the Layout screen, select Compaction Mapping and then one of the view types listed below:

- Passes: The number of passes the drum has made.
- CMV: The Compaction Metered Value measured at the drum, when the drum vibration is on, which can provide an indication of material stiffness. This view requires a CMV sensor to be installed and configured by the technician in the web interface.
- CMV Change: The change in the measured CMV between consecutive passes over the same area. This view requires a CMV sensor to be installed and configured by the technician in the web interface. Use this view to determine when making passes over the material is no longer increasing the stiffness, so the machine would be better moved to another area.

- Evib: A measure of the amount of material compression during the downward phase of the drum vibration. This view is only available on machines with an Evib-capable ECM configured by the technician in the web interface.
- Evib % Change: The pass-to-pass change in Evib, expressed as a percentage. This view is only available on machines with an Evib-capable ECM configured by the technician in the web interface.
- HVM: A measure of the relative stiffness of the material. This view is only available on machines with an HVM-capable ECM configured by the technician in the web interface.
- HVM % Change: The pass-to-pass change in HVM, expressed as a percentage. This view is only available on machines with an HVM-capable ECM configured by the technician in the web interface.

Note – *The compaction values given by a compaction measurement system depend on the type and thicknesses of the material being compacted. It is important to understand the consistency and thickness of the material in order to understand the mapped compaction values. In some cases, these values can be influenced by material several meters beneath the surface that the machine is currently working on.*

A color scale for compaction maps displays in the upper left corner and shows the target number. If the setting to map beyond the target is enabled (see [Operator Plus controls](#)), the map continues to update, counting passes and displaying compaction values after the target is reached. In this case, the color scale is extended beyond the target color.

The scale on the Compaction Mapping view is hidden:

- In the two small views in the 3-view layout.
- When an operational state message occupies the required screen space. When the operational state resolves, the compaction mapping scale redispays.

The system records mapping data in a grid with squares of 340 mm (approximately 1 foot) sides. A grid square is updated when any part of the drum passes through the center of the grid square, so sometimes the mapped edges of a pass are not a smooth straight line.

Decoupling occurs when the drum bounces off the ground and can damage the material and the compacted surface, actually reducing the material stiffness. This can occur if the drum vibration frequency / amplitude level is set too high as the material stiffness increases. If the system detects the drum decoupling during mapping, the map is updated with black in those areas and the system displays an operational state message.

If you need to see design linework or other features that are obscured by the mapping, tap the eye icon  to hide the mapping data in that view. Tap the eye icon  again to show the mapping data.

When a CMV sensor is installed (or on machines where the ECM provides the vibe state directly), the system can detect whether the drum vibration is on or off and mapping can automatically pause and resume when a change in the vibration state is detected. In

between vibration state changes detected by the system, the operator can use the shortcut key  to pause or resume mapping at any time.

Compaction Mapping settings

To access the compaction mapping settings, touch and hold the compaction mapping shortcut key  from the work screen or select Compaction Mapping from the Work Settings  menu.

The information in the top left of the screen shows settings that can only be changed by your technician or if you have Operator Plus permissions (see [Operator Plus controls](#)).

You can edit the following settings:

Target Passes

Enter the minimum number of passes needed to meet the material stiffness required for the job. This is often determined by running a plateau test or through experience.

The mapping color displayed in the work screen is one color per pass, with green when the Target value is reached.

Target compaction values

Enter the target compaction values needed to meet the material stiffness required for the job. These are one or more of:

- Target CMV
- Target Evib
- Target HMT

The mapping color displayed in the work screen is determined by the percentage of the target compaction value that has been achieved, with green for 80% to 130% of the target.

These values are often determined by running a plateau test or through experience.

6.1.3 Inspecting a map

To view details of the mapping data on a plan view, touch-and-hold on an onscreen location where mapping data is recorded. Select Inspect Map from the context menu.

Note – When a design surface is loaded that contains different slopes and gradients, mapping colors may appear to vary slightly across the changes in grade. This is expected as the display applies different surface shading to the different slopes to make it clear that there are changes in slopes and gradients. Using map inspection, you can confirm the actual value of the mapped data in specific areas if you are unsure from the colors alone.

6.1.4 Operator Plus controls

If you have Operator Plus permission, you can configure a wider range of Compaction Mapping settings. Your technician can also configure these settings in the Web Interface.

The Advanced button on the Compaction Mapping screen (see [Compaction Mapping settings](#)) opens the Web Interface's Operation > Mapping screen. The following setting can be configured:

- Generate Veta Files (.tds) – Disabled by default. Enable this if mapping data is required in this file format for producing reports in the office.
- Map Beyond Target Passes – Enabled by default. Disable if you do not want the map to update once the target number of passes is reached.
- Map Beyond Target CMV – Enabled by default. Disable if you do not want the map to update once the target CMV is reached.

Note – *The map still updates if decoupling is detected.*

- Map Beyond Target Evib – Enabled by default. Disable if you do not want the map to update once the target Evib is reached.

Note – *The map still updates if decoupling is detected.*

- Map Beyond Target HVM – Enabled by default. Disable if you do not want the map to update once the target HVM is reached.

Note – *The map still updates if decoupling is detected.*

When one of the Map Beyond settings is enabled, the color scale extends past the target value to show the additional mapped data.

When a CMV sensor is installed (or on machines where the ECM provides the vibe state directly), the system can detect whether the drum vibration is on or off and mapping can automatically pause and resume when a change in the vibration state is detected. In between vibration state changes detected by the system, the operator can use the shortcut key  to pause or resume mapping at any time.

Review the table below and enable the combination of toggles that best suits your workflow and the requirements for collecting compaction mapping data on your job.



ATTENTION – The compaction maps in the work screen do not update when mapping is paused. Only mapped data is written to Veta (.tds) files. Paused data is not written to Veta (.tds) files. All data is written to the Production Reporting (.tag) files and the state, Paused or Recording, is included so the data can be filtered in the office software.

Setting	Enabled	Result
Vibration On Resumes Mapping	✓	(Default) Map recording is started by turning on vibration or tapping the Compaction Mapping shortcut key  .
Vibration Off Pauses Mapping	✗	Map recording is paused only by tapping the shortcut key.
Vibration On Resumes Mapping	✗	Mapping pause/resume is controlled only by tapping the Compaction Mapping shortcut key.
Vibration Off Pauses Mapping	✗	
Vibration On Resumes Mapping	✓	Mapping pause/resume is controlled by vibration state or overridden by tapping the Compaction Mapping shortcut key.
Vibration Off Pauses Mapping	✓	

6.1.5 Troubleshooting

The table below lists some of the issues that may appear when you use mapping.

Issue	Possible cause(s)
High speed over rough ground can start compaction mapping if the <i>Vibration On Resumes Mapping</i> option is enabled	If the machine is fitted with a compaction sensor and the <i>Vibration On Resumes Mapping</i> option is enabled, travel at high speed over rough ground can start compaction mapping. Additionally, if the <i>Vibration Off Pauses Mapping</i> option is disabled, compaction mapping will be enabled indefinitely. To avoid this, maintain a moderate speed over rough ground or, if mapping does start when not desired, use the shortcut key to pause it.
The map view for MDP or MDP Change does not update	The machine must be moving more than 1 km/h (0.6 mph) in a low gear for MDP data to be valid.

6.2 Cut/Fill Mapping

6.2.1 Introduction

Note – Mapping and the features mapping offers are configurable in the Web Interface by your technician or from the Operator App by users with Operator Plus permission. In addition, advanced mapping features may only be available if the correct license is installed. If mapping or a mapping feature is not available on your system, contact your technician or dealer.

Compaction mapping data is recorded at the center of the drum, as the machine works. The elevation of the base of the drum is also recorded and is used to produce cut/fill mapping.

The exact elevation recorded depends on whether the drum includes padfeet, and whether you choose to include the height of the padfeet in the Elevation Mapping Adjustment entered in the Drum Manager screen.

For compactors, mapping is enabled by default.

6.2.2 Cut/fill mapping

Cut/fill mapping enables you to:

- Display the cut/fill differences between the recorded elevation data and the guidance surface.
- Display an initial map generated from the cut/fill differences between a pre-mapped surface transferred onto the machine, called a ground surface, and the design surface. This initial map is then updated as the machine works and records elevation data.

For example, the ground surface is produced in the office from a survey of the original site and transferred onto the machine. The initial cut/fill map enables you to plan your work around the site more efficiently because the high and low areas are easily identified in the work screen.

Note – The ability to select a ground surface is a licensed feature. Contact your dealer for more information.

The Cut/Fill Mapping shortcut key

When you are in the work screen, you can use the shortcut key  to turn the display of cut/fill mapping data on and off.

You can also touch and hold the shortcut key to open the Cut/Fill Mapping screen.

On the Cut/Fill Mapping screen, you can select a ground surface from which to generate the initial Cut/Fill Map.

Note – Changing the selected Ground Surface resets the cut/fill map including any updates made while the machine was working.

Cut/fill mapping rules

Cut/Fill Mapping data is automatically collected.

The data is displayed in the following way:

Color	Meaning
Shades of red (cut)	The shaded area is above the current design surface (including any Elevation Offsets).
Shades of green (on-grade)	The shaded area is within the on-grade tolerance of the current design surface (including any Elevation Offsets).
Shades of blue (fill)	The shaded area is below the current design surface (including any Elevation Offsets).
Gray	Cut/fill values are being calculated and loaded.

Starting cut/fill mapping with an empty map

To start mapping with an empty map:

1. From the Work Settings menu open the Cut/Fill Mapping screen, or touch and hold  in the shortcut bar.
2. Optionally, toggle Display Mapping Data on or off.
3. If available, from the Ground Surface drop down, select None.
4. Tap Apply.



ATTENTION – Changing the Ground Surface setting deletes any existing mapping data stored on the machine.

Starting cut/fill mapping with a pre-mapped surface

Note – The ability to select a ground surface is a licensed feature. Contact your dealer for more information.

To start mapping with a pre-mapped surface:

1. Transfer a ground surface .ttm file onto the machine. Either sync with Connected Community or import the ground surface file from a USB flash drive.

Note – If a Connected Community sync adds a new ground surface .ttm file to the current project, then a notification is displayed.

Note – To import a ground surface .ttm file from a USB flash drive, the ground surface file must be in the ProjectLibrary \ Projects \ [project name] \ OfficeData folder on your USB flash drive.

2. From the Work Settings menu open the Cut/Fill Mapping screen, or touch and hold  in the shortcut bar.
3. Optionally, toggle Display Mapping Data on or off.
4. From the Ground Surface drop down, select the ground surface file to load.
5. Tap Apply. If Display Mapping Data is on, a cut/fill map is generated showing the difference between:
 - The guidance surface of the currently loaded design; and
 - The ground surface

Note – If Lane Guidance is selected, then the cut/fill map generates using the lane guidance surface. In this case, cut/fill data is only displayed within 20 m (65 ft) of the machine.



ATTENTION – Changing the Ground Surface setting deletes any existing mapping data stored on the machine.

As you work, the pre-mapped ground surface elevations are overwritten by the measured elevations.

If you select a different design within the same project, the cut/fill map regenerates using the new design.

Downloading ground surface data from an online source

If your technician has enabled access, you can request Earthworks to download the latest ground surface data in a .ttm file from an online source. This includes data from other machines on the site.

This option downloads data once when requested.

1. On the Mapping screen, set the *Ground Surface* field to WorksOS download.
2. Tap Apply.

Downloading information for a large area can take a while.

Note – This feature requires an Advanced Mapping license. A machine can only download ground surface data for a compatible design.

Resetting cut/fill map data

To reset any existing cut/fill mapping data stored on the machine:

1. From the Work Settings menu open the Mapping screen, or touch and hold  in the shortcut bar.

2. Tap Reset Map.

If a pre-mapped surface was initially loaded and Display Mapping Data is on, then the cut/fill map of the differences between the design surface and the pre-mapped surface is reset to its original state.

Note – You cannot delete compaction mapping data.

6.2.3 Inspecting a map

To view details of the mapping data on a plan view, touch-and-hold on an onscreen location where mapping data is recorded. Select Inspect Map from the context menu.

Note – When a design surface is loaded that contains different slopes and gradients, mapping colors may appear to vary slightly across the changes in grade. This is expected as the display applies different surface shading to the different slopes to make it clear that there are changes in slopes and gradients. Using map inspection, you can confirm the actual value of the mapped data in specific areas if you are unsure from the colors alone.

6.2.4 Troubleshooting

The table below lists some of the issues that may appear when you use mapping.

Issue	Possible cause(s)
Error message: Unable To Load Cut/Fill Map	• Suspect a corruption of the mapping database, or a corruption of a ground surface file. • Otherwise, suspect a system state issue, and restart the system.

Avoidance Zones

In this chapter:

▶ [Avoidance Zones](#)

This chapter introduces the use of avoidance zones.

7.1 Avoidance Zones



WARNING — Entering an avoidance zone could cause personal injury or damage to the machine. Always be aware of nearby avoidance zones when operating a machine.



WARNING — You are responsible for observing safe operating practices. This product does not guarantee error-free avoidance zone guidance.

Avoidance zones indicate areas on a site that machines need to avoid. They appear as solid magenta shapes on the site plan and at the current machine elevation.

Avoidance zones display as horizontal boundaries that do not describe objects such as pipes or overhead wires.

Avoidance zones are available on machines with:

- an applied project that has an avoidance file loaded into it
- 3D positioning sources only

Avoidance zone files are added to project files by the office or your technician.

Projects must be applied and include an avoidance zone file for the avoidance zones to display.

7.1.1 Avoidance zone icons

Applied projects that have avoidance zones (supplied by the office) can display the following icons:

Note – You can continue working when any of these icons display. These icons are for information only.

Icon	Meaning	Action
	Project includes an avoidance file	Continue working
	Avoidance file cannot be loaded Avoidance file has too many edges	Be aware that if you continue working, intended avoidance zones will not display. Notify your technician.

Icon	Meaning	Action
	The avoidance file requires a 3D positioning source Some machine measurements are not configured	Be aware that if you continue working, intended avoidance zones will not display. Notify your technician.

7.1.2 The work screen

Applied projects that have avoidance zones (supplied by the office) can display the following border colors on the work screen:

Indicators	State	Machine proximity to zone
Blue border	Zone detected	The machine is approaching the avoidance zone but is still outside the warning perimeter.
Orange border Audible beep	Zone warning distance	The machine is within the warning perimeter of 8 m minimum, configurable in the Web Interface.
Magenta border Continuous audible beep	Zone breached	The machine is in the avoidance zone.

Note – When a machine breaches an avoidance zone, full guidance continues.

7.1.3 Machine boundary

The machine boundary is the magenta outline around the machine.

To show or hide the machine boundary outline, use the Machine Boundary toggle on the Overlays screen.

7.1.4 Troubleshooting

The table below lists an error message that may appear when working with avoidance zones.

Error Message	Possible cause(s)	Action
Avoidance Zone Proximity and Guidance Lost	Machine orientation is unknown.	Identify the avoidance zone on the site and move or rotate the machine away from the avoidance zone.

A

Remote Switch Configuration on other machine models

In this chapter:

- ▶ [Remote Switch Configuration for machines with Pass Shift enabled](#)

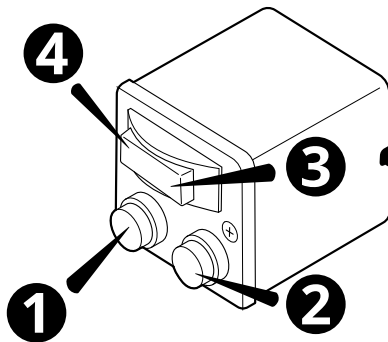
This section describes how remote switches integrate with the system allowing you to perform common features.

A.1 Remote Switch Configuration for machines with Pass Shift enabled

You can use the remote switch to perform common tasks while keeping your hands close to the machine controls. The remote switch only functions when you are in the work screen.

The horizontal offset remote switch lets you:

- increment (❷) or decrement (❶) the Pass Shift count
- increment (❸) or decrement (❹) the horizontal offset



- | | |
|---|--------------------------------------|
| ❶ Decrement Pass Shift count switch. | ❷ Increment Pass Shift count switch. |
| ❸ Increment Horizontal Distance D switch. | ❹ Decrement Horizontal Distance D. |

B

Legal and Regulatory

In this chapter:

- ▶ END USER LICENSE AGREEMENT
- ▶ Copyright Information
- ▶ Compliance notices
- ▶ Safety information

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2.4 – LIMITATION OF LIABILITY. TRIMBLE'S ENTIRE LIABILITY UNDER ANY PROVISION OF THIS AGREEMENT SHALL BE LIMITED TO THE GREATER OF THE AMOUNT PAID BY YOU FOR THE SOFTWARE LICENSE OR U.S. \$25.00. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL TRIMBLE OR ITS LICENSORS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR ANY OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OR INABILITY TO USE THE SOFTWARE, OR THE PROVISION OF OR FAILURE TO PROVIDE SUPPORT SERVICES, EVEN IF TRIMBLE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. BECAUSE SOME STATES AND JURISDICTIONS DO

NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU. THE LIMITATIONS SET FORTH IN SECTION 2.4 SHALL APPLY EVEN IF THE LICENSEE'S REMEDIES UNDER THIS AGREEMENT FAIL OF THEIR ESSENTIAL PURPOSE

3 INFORMATION PROVIDED BY YOU FOR 'CONNECTED' FEATURES

The Software is designed to enable certain connected features, such as virtual reference station ("VRS") and Internet base station service ("IBSS") corrections, file sync (for design files, user preferences, Product firmware updates, etc.), 3D productivity services, and connected site services provided by others ("Connected Services"). Please refer to the Software documentation for additional information about Connected Services supported by the Software. You must separately obtain the right to access and use Connected Services, e.g., by maintaining a current subscription for the relevant services. To enable Connected Services, the Software may collect and/or receive data and information (the "Connected Information") relating to your Product and the equipment on which your Product is installed (your "Equipment"), including without limitation:

- Geolocation and 3D position
- Status (including configuration and operation)
- Equipment progress and activity
- VRS and IBSS correction information
- File sync and GNSS data
- Operator Key

The Connected Information may be transferred to your Connected Services providers through the networking and telematics systems installed on your Equipment (whether utilizing cellular, satellite, local area networks, ethernet or other similar systems, the "Telematics System") or manual file transfer (e.g., USB). The actual Connected Information collected and received will vary based on, among other things, the configuration of your Product and Equipment (including your Telematics Systems) and the related Connected Services that you separately elect to access and use. Please carefully review any agreements and documentation relating to such Connected Services to understand how the Connected Service provider may store and use the Connected Information.

In addition, Trimble or its affiliated companies may collect, store and receive data and information ("User Information") relating to your use of the Software, Product and Equipment, including without limitation:

- Device/Company Identity Data includes machine ID, machine sensor configuration, and software configuration
- Location includes Global Navigation Satellite System and beacon-based location
- Analytics Data includes Software versions, display model, stack trace system configuration, current design, features in use, time in each screen, button pushes, and Software bug and crash reports.

The actual User Information collected and received will vary based on, among other things, the configuration of your Product and Equipment and the related product(s) that you separately elect to access and use. You acknowledge and agree that Trimble or its affiliated companies may, directly or indirectly through the services of third parties, use User Information for its internal business purposes, including but not limited to: (i) making the Software and Products available and providing services to you; (ii) improving the performance of the Software and Products, researching and developing updates and other products and services, and analyzing adoption and usage of the Software and Products; and (iii) verifying your compliance with the terms of this Agreement and enforcing Trimble's rights, including all intellectual property rights in and to the Software and the Product(s). In order to provide you with the full range of benefits made possible by the Product(s) and our services, and in connection with the uses described above, Trimble may share the User Information with its affiliated companies. The affiliated companies may use the User Information for their own internal purposes in a manner consistent with the uses described above. Trimble and its affiliated companies may also disclose User Information if we have a good faith belief that (1) the disclosure is necessary or useful to our provision of services; (2) the disclosure is necessary to protect our rights, interests, or property; (3) the disclosure is necessary or useful to protect your safety or the safety of others, to investigate fraud, or to respond to a government request; (4) the disclosure is required by law, such as to comply with a subpoena, search warrant, court order, or similar legal or administrative process; or (5) Trimble or its affiliated company is or will be purchased or otherwise acquired, in which User Information will likely be among the assets transferred. Trimble and its affiliated companies and third parties acting on Trimble's or its affiliate's behalf may analyze User Information to analyze and create performance metrics, collect and evaluate other information relating to the Software and Product(s), and track anonymized and technical information to improve the Software and Product(s) ("Machine Performance Data"). Any information Trimble or its affiliated companies track in this manner is anonymous and limited to usage and volume statistics. Trimble and its affiliated companies may make the Machine Performance Data commercially available to third parties to the extent that it is aggregated or otherwise de-identified so that it cannot be used to identify you. By accepting this Agreement, you acknowledge and agree to the collection and use of the Connected Information, User Information and Machine Performance Data as provided above.

The Software may also automatically provide Software bug and crash reports via your Equipment's Telematics Systems to Trimble or its vendors for purposes of maintaining, supporting, or improving the Software.

You may incur additional charges for the transfer of Connected Information, User Information and Machine Performance Data, or Software bug and crash reports by your telecommunications service providers or your Connected Services providers, as applicable.

4 GENERAL

4.1 – This Agreement shall be governed by the laws of the State of California and applicable United States Federal law without reference to "conflict of laws" principles or provisions. The United Nations Convention on Contracts for the International Sale of Goods will not

apply to this Agreement. Jurisdiction and venue of any dispute or court action arising from or related to this Agreement or the Software shall lie exclusively in or be transferred to the courts located in Santa Clara County, California, and/or the United States District Courts for California. You hereby consent and agree not to contest, such jurisdiction, venue and governing law.

4.2 - Notwithstanding Section 4.1, if you acquired the Product in Canada, this Agreement is governed by the laws of the Province of Ontario, Canada. In such case each of the parties to this Agreement irrevocably attorns to the jurisdiction of the courts of the Province of Ontario and further agrees to commence any litigation that may arise under this Agreement in the courts located in the Judicial District of York, Province of Ontario.

4.3 - Official Language. The official language of this Agreement and of any documents relating thereto is English. For purposes of interpretation, or in the event of a conflict between English and versions of this Agreement or related documents in any other language, the English language version shall be controlling.

4.4 - Trimble reserves all rights not expressly granted by this Agreement.

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B.2 Copyright Information

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The Bluetooth word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Trimble Inc. is under license.

B.3 Compliance notices

B.3.1 — US FCC regulations

The following statement applies to these devices:

- EC520 electronic control module (FCC ID: K7T-WIFIHU2S and FCC ID: TLZ-NM230NF)
- TD5x0 display (FCC ID: TLZ-NM230NF)
- BT510 Bluetooth® module (FCC ID: K7T-WIFIHU2S)

- GS520 grade sensor
- GS513 grade sensor
- GS510 grade sensor
- AA510 audible alarm
- CI510 CAN interface
- CI520 CAN interface

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

B.3.2 Canadian license-exempt RSS standards

The following statement applies to these devices:

- EC520 electronic control module (IC: 2377A- WIFIHU2S and IC: 6100A- NM230NF)
- TD5x0 display (IC: 6100A- NM230NF)
- BT510 Bluetooth® module (IC: 2377A- WIFIHU2S)
- GS520 grade sensor
- GS513 grade sensor
- GS510 grade sensor
- AA510 audible alarm
- CI510 CAN interface
- CI520 CAN interface

CAN ICES-3 (B)/NMB-3(B)

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and;
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme avec Industrie Canada RSS standard exempts de licence (s). Son fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne peut pas provoquer d'interférences; et
2. Cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un mauvais fonctionnement de la appareil.

B.3.3 — European Union CE compliance

The following statement applies to these devices:

- EC520 electronic control module
- TD5x0 display
- GS520 grade sensor
- GS513 grade sensor
- GS510 grade sensor
- BT510 Bluetooth® module
- AA510 audible alarm
- CI510 CAN interface
- CI520 CAN interface
- VM510 valve module

These devices are compliant with the following Directives and standards

- Machinery 2006/42/EC
- RoHS 2015/863/EU
- EN 13766-1:2018

The EC520 electronic control module and the TD5x0 display are also compliant with the following additional Directives and standards:

- Radio Equipment Directive 2014/53/EU
- IETSI EN 300-328 V2.2.2
- ETSI EN 301-489-1 V2.2.3
- ETSI EN 301-489-17 V3.2.4



B.3.4 — European Union recycling compliance

These products comply with the WEEE Directive 2012/19/EU. For recycling in Europe call:

+31 479 53 24 30

To request instructions by writing:

Trimble Europe BV

C/O Menlo Worldwide Logistics

Meerheide 45

5521 CZ Eersel, NL

B.3.5 — Australian and New Zealand EN 55032 compliance

AS/NZS 55032 compliance applies to these devices:

- EC520 electronic control module
- TD5x0 display
- GS520 grade sensor
- AA510 audible alarm
- CI510 CAN interface
- CI520 CAN interface

B.3.6 — Japan Radio Type Approval

Construction Design Certificates apply to these devices:

- EC520 electronic control module (R 208-160089)
- TD5x0 display (R 201-163179 and T D160253201)

B.3.7 — RoHS Statement

This device conforms to RoHS (Reduction Of Hazardous Substances) European Union regulations that set maximum concentration limits on hazardous materials used in electrical and electronic equipment.

CAUTION: RISK OF EXPLOSION IF BATTERY IS DISPOSED OF INCORRECTLY. DISPOSE OF THE DEVICE AND THE BATTERY ACCORDING TO INSTRUCTIONS FOR ELECTRONIC WASTE.

B.3.8 Taiwan

低功率電波輻射性電機管理辦法

第十二條：經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條：低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。低功率射頻電機需忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

SAR 標準值 2.0W/Kg，送測產品實測值為 0.545w/Kg

B.4 Safety information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "DANGER", "WARNING" or "CAUTION". The Safety Alert "WARNING" label is shown below.



WARNING — This alert warns of a potential hazard which, if not avoided, can cause severe injury.

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by "NOTICE" labels on the product and in this publication.

Trimble cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Trimble is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Dealers have the most current information available.

B.4.1 Laser Safety

As with any bright light source, such as the sun, electric welding arcs or arc lamps, common sense applies:

- DO NOT look into the laser aperture when the laser is on.
- Viewing laser output with telescopic optical instruments (for example, telescopes and binoculars) may pose an eye hazard.
- Do not remove any warning signs from the laser.
- Use of a laser transmitter by personnel that are not trained on the product may result in exposure to hazardous laser light.

For further information regarding safe use of lasers, refer to the IEC 60825-1 2007, or the manufacturer's documentation supplied with your laser transmitter.

B.4.2 Magnet Safety

The neodymium magnets supplied with the magnetic display mount are very strong. Handling them with care is necessary to prevent personal injuries, and property damage:

- Pacemakers may be damaged or switch to "Test Mode" in the presence of a strong magnetic force. If a pacemaker is in use, keep a minimum of 30 cm (1 foot) distance.
- Be extremely careful when handling the magnets near other magnets or ferrous metal. Losing control of a magnet may result in damage to intervening objects, such as a finger or a cab window.
- Do not remove any warning signs from the magnets.
- The strong magnetic fields of the magnets can damage electronic devices such as hearing aids, items that rely on magnetic storage media such as credit cards, bank cards, and computers, and items containing ferromagnetic components such as mechanical watches.

B.4.3 Crushing prevention and cutting prevention

Support the equipment properly when you work beneath the equipment. Do not depend on the hydraulic cylinders to hold up the equipment. An attachment can fall if a control is moved, or if a hydraulic line breaks.

Unless you are instructed otherwise, never attempt adjustments while the machine is moving. Also, never attempt adjustments while the engine is running.

Whenever there are attachment control linkages, the clearance in the linkage area will increase or the clearance in the linkage area will decrease with movement of the attachment. Stay clear of all rotating and moving parts.

Keep objects away from moving fan blades. The fan blade will throw objects or cut objects.

Do not use a kinked wire cable or a frayed wire cable. Wear gloves when you handle wire cable.

When you strike a retainer pin with force, the retainer pin can fly out. The loose retainer pin can injure personnel. Make sure that the area is clear of people when you strike a retainer pin. In order to avoid injury to your eyes, wear protective glasses when you strike a retainer pin.

Chips or other debris can fly off objects when you strike the objects. Make sure that no one can be injured by flying debris before striking any object.

B.4.4 Operation

Clear all personnel from the machine and from the area.

Clear all obstacles from the machine's path. Beware of hazards (wires, ditches, etc).

Be sure that all windows are clean.

Secure the doors and the windows in the open position or in the shut position.

Adjust the rear mirrors (if equipped) for the best visibility close to the machine.

Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.

Fasten the seat belt securely.

Warm up the engine and the hydraulic oil before operating the machine.

Only operate the machine while you are in a seat.

The seat belt must be fastened while you operate the machine. Only operate the controls while the engine is running.

While you operate the machine slowly in an open area, check for proper operation of all controls and all protective devices. Before you move the machine, you must make sure that no one will be endangered.

Do not allow riders on the machine unless the machine has the following equipment:

- Additional seat
- Additional seat belt
- Rollover Protective Structure (ROPS)

Note any needed repairs during machine operation. Report any needed repairs.

Avoid any conditions that can lead to tipping the machine. The machine can tip when you work on hills, on banks and on slopes. Also, the machine can tip when you cross ditches, ridges or other unexpected obstructions.

Avoid operating the machine across the slope. When possible, operate the machine up the slopes and down the slopes.

Maintain control of the machine.

Do not overload the machine beyond the machine capacity.

Be sure that the hitches and the towing devices are adequate.

Never straddle a wire cable. Never allow other personnel to straddle a wire cable.

Before you maneuver the machine, make sure that no personnel are between the machine and the trailing equipment.

Always keep the Rollover Protective Structure (ROPS) installed during machine operation.

Monitor the location of mounted components. Ensure that the components do not come into contact with other parts of the machine during operation.

B.4.5 Exposure to radio frequency (RF) signals

This system uses devices that contain radio transmitters and receivers. The radiated output power is far below the international radio frequency exposure limits. These limits are part of comprehensive guidelines and establish permitted levels of RF energy for the general population. The guidelines are based on the safety standards previously set by international standards bodies:

- American National Standards Institute (ANSI) IEEE. C95.1-1992.
- National Council on Radiation Protection and Measurement (NCRP). Report 86. 1986.
- Int'l Commission on Non-Ionizing Radiation Protection (ICNIRP) 1996.
- Ministry of Health (Canada), Safety Code 6. The standards include a substantial safety margin designed to assure the safety of all persons, regardless of age and health.

Use of unauthorized or modified antennas may impair signal quality and damage a device, causing loss of performance. To assure optimal performance, and ensure human exposure to RF energy is within the guidelines set forth in the relevant standards, always use a device in its normal-use position.

Maintain a minimum 20 cm distance from radio transmitters when they are in use. Avoiding contact with the antenna area when a device is IN USE optimizes the antenna performance.

Exposure to radio frequency radiation from Bluetooth and WLAN transmitters

Devices are approved as a portable devices with respect to Radio Frequency (RF) exposure compliance. The radiated output power of the internal wireless radio transmitters is less than 100 milliwatt, which results in exposure levels far below the FCC radio frequency exposure limits, even when operated in close proximity to the body. The internal wireless radios operate within guidelines found in international radio frequency safety standards

and recommendations, which reflect the consensus of the international scientific community. Trimble therefore believes the internal wireless radios are safe for use by users. The level of electromagnetic energy emitted is hundreds of times lower than the electromagnetic energy emitted by wireless devices such as mobile phones. However, the use of wireless radios may be restricted in some situations or environments, such as on aircraft. If you are unsure of restrictions, you are encouraged to ask for authorization before turning on the wireless radios.

Exposure to radio frequency radiation from cellular wireless transmitters

Devices equipped with wireless cellular modem radios have been designed and manufactured to meet safety requirements for limiting exposure to radio waves. When used in accordance with the instructions set forth in this manual, the equipment has been independently verified to not exceed the emission limits for safe exposure to radio frequency (RF) energy as specified by the Federal Communications Commission of the U.S. Government in 47 CFR §2.1093. These limits are part of comprehensive guidelines and establish permitted levels of RF energy for the general population. The guidelines are based on standards that were developed by independent scientific organization through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons, regardless of age and health.

B.4.6 Telecommunications & Internet Association (TIA) information

Hearing Aids: Some digital wireless phones may interfere with some hearing aids. In the event of such interference, you may want to consult your wireless service provider, or call customer service to discuss alternatives.

Pacemakers and Other Medical Devices: The Health Industry Manufacturers Association recommends a minimum separation of six inches be maintained between a handheld wireless phone and a pacemaker to avoid potential interference with the pacemaker. These recommendations are consistent with the independent research by and recommendations of Wireless Technology Research. Persons with pacemakers should use the ear opposite the pacemaker to minimize the potential for interference. Persons with pacemakers should exercise great caution if using a hands-free device such as a headset, as these persons may be at greater risk of the device not maintaining the recommended minimum six inches of separation from the pacemaker. If you have any reason to suspect that interference is taking place, turn the device OFF immediately.

If you use any other personal medical device, consult the manufacturer of your device to determine if they are adequately shielded from external RF energy. Your physician may be able to assist you in obtaining this information.

Turn the device OFF in health care facilities when any regulations posted in these areas instruct you to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.

B.4.7 Warnings



WARNING — When replacement parts are required for this product Trimble recommends using Trimble replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material. Failure to heed this warning can lead to premature failures, product damage, personal injury or death.



WARNING — Disconnect the negative battery terminal before commencing any welding. Ensure that power is removed from the system by disconnecting the power input cable(s). Failure to follow this warning may result in electric shock.



WARNING – Do not use damaged cables or connectors. Doing so may cause fire or electric shock.



WARNING – Do not disassemble or modify the product as this may result in fire, electric shock or burns.



WARNING – Do not use a voltage other than the indicated power supply voltage. Doing so may cause fire or electric shock.



WARNING – Do not plug or unplug cables with wet hands. Doing so may cause electric shock.



WARNING – Do not weld on or drill into any part of the machine's Roll Over Protection Structure (ROPS) as this could weaken its structural integrity.



WARNING — When transporting machines with removable sensors such as GNSS receivers or UTS targets installed, if the sensor mounting bracket clamp loosens, then the sensor may be dislodged from the machine which may result in injury or death. Always remove and store removable sensors prior to transport.



WARNING — When removing or installing removable sensors such as GNSS receivers or UTS targets, if the sensor is accessed improperly, then a fall may result in injury or death. Always follow site, state or national Health and Safety guidelines when removing or installing removable sensors.



WARNING — The magnets on the magnetic display mount are strong. If parts of your hands get between two magnets when you move them, the magnets may suddenly move and pinch or clamp the skin. When the magnets are close together, position your hands so they are not between the two magnets.



WARNING — If you have a pacemaker and handle the magnetic display mount, the magnet can affect the function of the pacemaker and cause physical harm. Remain at least 30 cm (1 foot) from the magnetic display mount if you have a pacemaker.



WARNING — Before disconnecting electrical components, disconnect the battery cable and attach a Do Not Operate tag in the operator's compartment to inform personnel that the equipment is being worked on. Accidental engine starting can cause injury or death to personnel working on the equipment. To avoid accidental engine starting, place and lock a lock-out box onto the battery terminal.



WARNING — The cutting edge may move abruptly during automatic control system tuning. To avoid injury, when the machine is stationary engage the machine's park brake (if present) and have an operator in the machine cab to supervise the tuning. Maintain adequate clearance from people and objects during the automatic control system tuning.



WARNING — The TD520 display screen is designed to minimize glare in a wide variety of environments. However, when using the display in direct sunlight, there is still the possibility of sun-strike on the screen leading to loss of visibility.



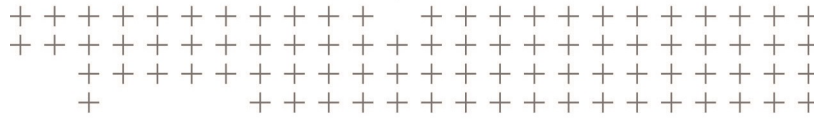
WARNING — Do not stare into the laser beam when the laser transmitter is operating. For more information, refer to the documentation that came with your laser.



WARNING — Entering an avoidance zone could cause personal injury or damage to the machine. Always be aware of nearby avoidance zones when operating a machine.



WARNING — You are responsible for observing safe operating practices. This product does not guarantee error-free avoidance zone guidance.



Notices

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- Terms and conditions.
- Important safety information.
- Warranty and compliance information.

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