SiteVision

User Guide

Trimble

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Release notice

This is the February 2025 release (Revision A) of the Trimble SiteVision Pro User Guide. It applies to version 2025.10 of the Trimble SiteVision system.

Contents

SiteVision introduction

Trimble® SiteVision® is a high accuracy augmented reality system that is ideal for use both indoors and outdoors.

A lightweight handheld positioning solution, SiteVision works with the Google® Play Services for AR technology or the Apple® ARKit® technology and enables you to interact with your spatial data in the context of the real world.

You can visualize and measure positions using LiDAR, GNSS, Electronic Distance Measurement (supported hardware and devices only) and Augmented Reality technology as you explore your project site.

Regulatory and safety

Before you use SiteVision, make sure you have read and understood the following information.

- Regulatory and safety information: using a Catalyst DA2 GNSS receiver, page 6
- Regulatory and safety information: SiteVision Integrated Positioning System, page 6
- Operational safety, page 10

For compliance information for the Trimble HPS2 handle, see the Trimble HPS2 Handle Compliance Information.

Regulatory and safety information: using a Catalyst DA2 GNSS receiver

For information on safety, handling, and compliance for the Trimble Catalyst DA2 GNSS receiver, refer to the Trimble Catalyst Help Portal: Safety, handling & compliance section.

Regulatory and safety information: SiteVision Integrated Positioning System

Europe

Hereby, Trimble® declares that the Trimble SiteVision Integrated Positioning System is in compliance with the following directives:

- RoHS Directive 2011/65/EU

Information about included radio modules

Bluetooth® Low Energy (BLE) radio module

- Frequency band: 2402–2480 MHz
- Max RF output power: +4 dBm (6 mW)

Notice to our European customers (WEEE)

For product recycling instructions and more information, please go to:

www.trimble.com/Corporate/Environmental_Compliance.aspx

To recycle Trimble batteries and WEEE (Waste Electrical and Electronic Equipment, products that run on electrical power).

Call +31 497 5324 21 or mail a request for recycling instructions to:

Trimble Europe BV

c/o Menlo Worldwide Logistics

Meerheide 45

5521 DZ Eersel, NL

USA

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

> **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 to that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

> **CAUTION –** Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Canada

This Class B digital apparatus complies with Canadian ICES-003.

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

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

Cet appareil numérique de la classe B est conforme à la norme NMB.003 du Canada.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- l'appareil ne doit pas produire de brouillage, et
- l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radio transmitters with IC certification number 4492A-2410G, 5123A-WT41U and 4908A-PMACS have been approved by the Industry of Canada to be used together with Trimble antenna part number 55001508, antenna gain 2 dBi.

Antenna types with a gain >2 dBi are strictly prohibited for use with this device.

Battery Safety

WARNING – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature, or direct sunlight.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

WARNING – Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage. To prevent injury or damage:

- Do not charge or use the battery if it appears to be damaged or leaking.
- Charge the Lithium-ion battery only in a Trimble product that is specified to charge it.
- Be sure to follow all instructions that are provided with the battery charger.
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in Trimble equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.
- Cover battery terminals with proper insulating tape before disposal to avoid heat generation by an inadvertent short-circuit.

> **WARNING –** Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage. To prevent injury or damage:
>
> - If the battery leaks, avoid contact with the battery fluid.
> - If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
> - If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid. If skin irritation or pain persists, seek medical attention.

Laser Safety

Before using the instrument, make sure that you understand this document, as well as all equipment, job site safety requirements and regulations.

This equipment has been tested and found to comply with IEC 60825-1:2014 and 60825-1:2007, and 21 CFR 1040.10 and 1040.11, except for deviations pursuant to Laser Notice no. 50, dated June 24, 2007 and Laser Notice no. 56 dated May 8, 2019.

> **WARNING –** Viewing the laser output with telescopic optical instruments (for example, telescopes and binoculars) may pose an eye hazard and thus the user should not direct the beam into an area where such instruments are likely to be used.

> **WARNING –** Use of controls or adjustments or performance of procedures other than those specified in the user documentation may result in hazardous LED or laser radiation exposure.
>
> 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. For further information regarding safe use of lasers, refer to the IEC 60825-1:2007 and IEC 60825-1:2014.

Aperture for distance measurement
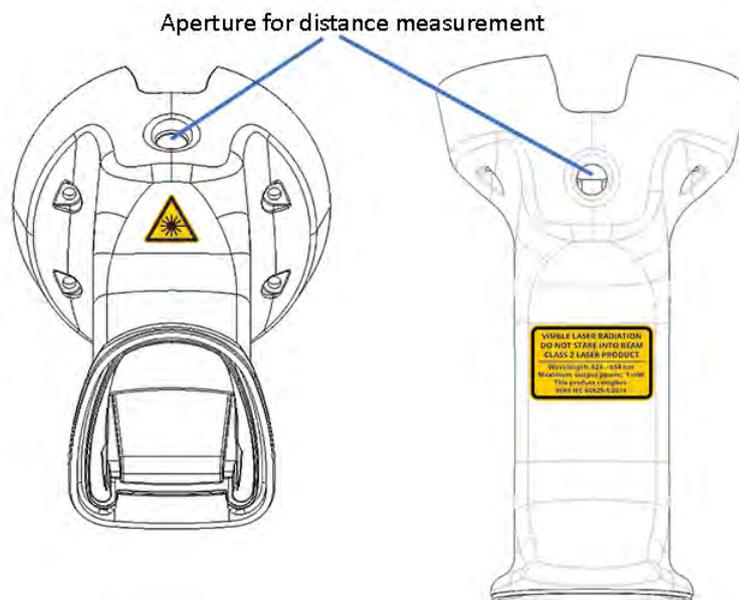
Operational safety

SiteVision is frequently used on construction sites and on streets. Make sure you follow the recommended safety procedures for your work environment.

> **CAUTION –** Because it mixes the real and digital worlds, SiteVision can impair the operator's field of vision and hide obstructions that may cause harm.
>
> - Use SiteVision in environments where it is safe to do so.
> - Always be aware of your surroundings.

> **CAUTION –** Trimble recommends that before you use SiteVision in the field, you:
>
> - Plan a path of travel and areas of interest.
> - Identify and either minimize or eliminate potential hazards.
> - Ensure others on site know that the device is in use.
> - Follow all work site health and safety requirements, including personal protection equipment.
>
> Additionally, during use:
>
> - Remain aware of your surroundings.
> - Keep a note of physical object vs Augmented Objects.
> - Stop and look rather than walk and look.
> - Be aware of machinery, site exclusion zones, site and public vehicles and identified hazards.

CAUTION – A hazard spotter is recommended to watch the user who is operating SiteVision in case of unexpected dangers on the work site.

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Getting started

The SiteVision system includes:

- the SiteVision app, which is supported on a user-supplied mobile device which meets the following requirements:
    - **iOS**: powered by iOS 13 and later, from iPhone® 6s and later, or iPad® (2017) and later, that is supported by the Apple ARKit technology.
    - **Android**: a device powered by the Android™ operating system version 9.0 and later, that is supported by the Google AR technology.
- cloud services (Trimble Connect®).
- support for two different hardware configurations*****:
    - mounted on a survey pole or extension rod with a standalone Trimble DA2 GNSS receiver.
    - using the Trimble HPS2 handle. The HPS2 handle integrates the Trimble DA2 GNSS receiver with Electronic Distance Measurement (EDM) technology and a power management system that provides power to the DA2 GNSS receiver and the EDM.
- Trimble positioning and correction services (Trimble Catalyst™ GNSS technology).

* Note: the legacy SiteVision Integrated Positioning System is a handheld option supported on Android devices only. The SiteVision Integrated Positioning System integrates the Trimble DA1 GNSS antenna with Electronic Distance Measurement (EDM) technology and a power management system that provides power to the DA1 GNSS antenna, the EDM, and your device running the SiteVision app.

To begin to use the system you will need a model that you want to visualize.

> **NOTE –** Two sample models are included when you install the app, so that you can explore the app's features.

The SiteVision system supports a wide range of model and data types including Building Information Modeling (BIM) formats, road designs, site designs, PDF plans, and utility services. It also supports the visualization of data from GIS systems.

Before you start

Before you start you will need:

- A mobile device — Android (9.0 or later, that is supported by the Google AR technology), or iOS (13 and later , from iPhone 6s and later and iPad (2017) and later, that is supported by the Apple ARKit

[technology]( ))

- The app downloaded to the device

- A Trimble Identity to be able to log in to the app

- A current subscription

- A model to view. Alternatively, you can create a model in the field or use the sample model included when you install the app.

Using your Trimble ID

To use the SiteVision system you will need a Trimble Identity to log into SiteVision, Trimble Connect, or any other Trimble system.

- If you have an existing Trimble ID you will be able to use it for all SiteVision related services.

- If you are a new Trimble user, go to the Trimble ID signup page to create a Trimble ID.

The Trimble ID allows you to log into the SiteVision system and Trimble Connect with the same username and password.

Deleting your Trimble ID account

If you want to delete your Trimble ID account, go to **Menu** / **Tools** / **About** / **Account**. You will be redirected to your **My Trimble account** page, where you can delete your account.

Obtaining a SiteVision subscription

Contact your Trimble distributor or Trimble sales representative to purchase a subscription to the SiteVision services. When you contact your distributor you will need to provide the email address that you use for your Trimble ID. Your distributor will assign the license to your Trimble ID.

Then proceed to download the SiteVision app from the Google Play Store or Apple App Store.

Downloading Trimble SiteVision

1. Go to the Google Play Store or Apple App Store and search for **Trimble SiteVision**.

2. Download and install the app.

3. Run the Trimble SiteVision app on your device.

4. To get started, accept the End User License Agreement and then enter your Trimble ID username and password.

About Trimble Connect

Trimble Connect is a cloud-based data management and collaboration platform that allows you to view, share, and access project information over the internet from anywhere at any time. Trimble Connect stores the 2D and 3D models, prepared in your office software, that are to be viewed in SiteVision.

The subscription for Trimble Connect is included with your SiteVision subscription. If you have separate users who will only be doing data preparation you can purchase separate standalone subscriptions for just Trimble Connect for them.

To get started with Trimble Connect, go to the Trimble Connect website.

About Trimble Catalyst technology

Trimble Catalyst is a GNSS receiver completely implemented in software (softGNSS receiver). Trimble Catalyst technology is used by SiteVision to obtain high accuracy GNSS positions on your mobile device.

A Trimble SiteVision subscription includes a Trimble Catalyst for SiteVision Subscription, which includes the precision accuracy level for use with the SiteVision app, access to Trimble Corrections Hub, including Trimble VRS Now™ networks and Trimble RTX® technology globally, and also supports GNSS corrections from other third party sources. To learn more about Trimble Catalyst, go to the Trimble Catalyst website.

About Google AR technology and Apple ARKit technology

Google and Apple have developed services for building augmented reality experiences. The service enables your mobile device to sense its environment, understand the world and interact with information.

To learn more about Google AR technology, go to the Google ARCore website.

To learn more about Apple ARKit technology, go to the Apple AR website.

SiteVision system requirements

Mobile devices

Trimble SiteVision runs on Android and iOS devices, as follows:

- any Apple device powered by iOS 13 and later, from iPhone 6s and later and iPad (2017) and later, that is supported by the Apple ARKit technology.

- and device powered by the Android operating system version 9.0 and later, that is supported by the Google AR technology. There are over 400 devices which are Google AR Services compatible. Refer to the list that Google maintains to check if your device is supported:

  https://developers.google.com/ar/devices

For best results, Trimble recommends using a device with the highest spec possible.

> **NOTE –** Certain features, such as the 3D Scan app require a LiDAR-equipped iPhone Pro or iPad Pro.

Internet connectivity

You must have an internet connection to download models from Trimble Connect. You can operate SiteVision without an internet connection but with the following limitations:

- You must have logged into SiteVision on the device previously.

- To use a model (or models) from Trimble Connect, you must have already downloaded it / them from Trimble Connect while connected to the internet. You can access previously downloaded models from the **Quick Access** list (see Loading a model, page 102).

- GNSS positioning may not be as accurate, as you will be operating with the satellite-delivered Trimble RTX correction stream or a local SBAS service. See Configuring the GNSS, page 32 for more information.

  > **NOTE –** Make sure you adjust the **GNSS Minimum High Accuracy** setting; see Working with GNSS, page 107.

- You cannot save BCF Topics, or sync measured data to Trimble Connect until you are back online.

For more information on GNSS and internet connectivity see Configuring the GNSS, page 32.

Installing the SiteVision software

Installing on an Android device

To install the SiteVision app on your Android device:

1. On your device go to the Google Play Store and search for **Trimble SiteVision**.
2. Download and install the software from Google Play Store.

> **NOTE –** You will also be prompted to download and install Google Play Services for AR and Trimble Catalyst Service if not previously installed on your Android device. These must be installed on your device for SiteVision to function correctly. Trimble recommends that you configure your device to allow automatic updates of these applications.

Installing on an iOS device

To install the SiteVision app on your iOS device:

1. On your device go to the Apple App Store and search for **Trimble SiteVision**.
2. Download and install the software from Apple App Store.

Setting up the SiteVision hardware

SiteVision supports two different GNSS hardware configurations:

Mounted on a survey pole or extension rod with a standalone Trimble DA2 GNSS receiver.

Using the HPS2 handle.

Using the SiteVision Integrated Positioning System.

> **NOTE –** SiteVision Integrated Positioning System is supported on Android devices only.

Setting up SiteVision on a survey pole or extension rod with a Trimble DA2 GNSS receiver

Step 1: Check the SiteVision hardware components

When you purchase SiteVision you will need:

- 1x Pole
- 1x Device Clamp
- Trimble Catalyst DA2 GNSS receiver kit that includes:
    - 1x Catalyst DA2 receiver
    - 1x 5/8x11 pole cap
    - 1x Battery pack mount strap
- 1x Nitecore NPB1 Power Bank
- 1x Sunshade attachment (optional)

> **NOTE –** This is the Trimble recommended hardware configuration for using SiteVision with the Trimble Catalyst DA2 GNSS receiver. Depending on the use case, it may be preferable to use alternative clamps or poles. As long as this alternative mounting system complies with the geometric requirements outlined in Step 2: Attach your device and the Catalyst DA2 receiver to the pole, page 17, and Step 3: Attach your device to the pole with your device clamp, page 18, this is acceptable.

> **NOTE –** A mobile phone / tablet is not provided. Refer to SiteVision system requirements, page 14.

Step 2: Attach your device and the Catalyst DA2 receiver to the pole

The Catalyst DA2 receiver has a convenient push-fit mount for simple attachment to any 1 ¼" diameter pole. A 5/8" x 11 thread adaptor for convenient installation/removal on standard mapping and surveying accessories is also included in the box.

For consistent and accurate results:

- When mounting the receiver on the pole, ensure that it is flat and secure on the pole.
- If using the push-fit 5/8" x 11 thread adapter, ensure that the yellow plastic of the thread adapter is completely concealed in the push-fit mount.

To assemble the battery mount

When using SiteVision with the Catalyst DA2 it is required to use an external USB power pack. You can attach a standard off-the-shelf single-cell USB power pack to the survey pole using the supplied battery mounting bracket and rubber straps. The supplied battery mount is designed to fit a variety of range pole and USB battery pack sizes.

For maximum rain-resistance, mount the battery with the USB socket facing towards the ground.
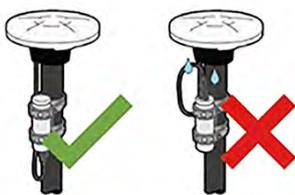
IMPORTANT - Do not plug the Catalyst DA2 receiver directly into your device to deliver power. When using SiteVision you must use an external USB power pack.

Step 3: Attach your device to the pole with your device clamp

When attaching your device to the pole, Trimble recommends the SECO magnetic device clamp. Depending on the specific use case requirements and device size, alternative mounting methods are acceptable. The key requirement when mounting the device to the pole is that it is attached parallel to the pole, so that the camera is pointing horizontally with respect to the Catalyst DA2 receiver.

IMPORTANT: Your device must be attached parallel to the pole, so that the camera is pointing horizontally with respect to the Catalyst DA2 receiver.

Step 4: Turn on the Catalyst DA2 receiver

Activate the USB battery pack and press the button on the bottom of the DA2 receiver to turn it on.

The LED status is as follows:

- Flashing blue = receiver is discoverable and ready to pair/connect.
- Solid blue = receiver is connected to SiteVision
- Red = Fault. Turn off the receiver, then turn it on again. If the fault indicator persists, contact your Trimble distributor.
- Yellow = receiver software update is in progress

Setting up the Trimble HPS2 handle

Step 1: Check the HPS2 handle hardware components

When you purchase the Trimble HPS2 handle you should find the following items in the case:

- Trimble HPS2 handle
- Pole mounting bracket
- Sunshade attachment
- Batteries (x 2)
- Battery charger

- Steel mounting plates (x2)
- Wrist strap
- QR code card

NOTE – A mobile phone / tablet is not provided. Refer to SiteVision system requirements, page 14.

Step 2: Charge the battery for +6 hours

Before turning on and using SiteVision on the HPS2 handle, charge the batteries fully with the provided charger. Plug the charger into your PC or an existing USB wall adaptor.

The battery charger will charge two batteries simultaneously and provides information on the level of charge.

Depending on the level of battery charge, charging the batteries fully may take over 6 hours.

CAUTION – Do not charge the battery in temperatures below 0 °C (32 °F) or above 40 °C (104 °F).

Step 3: Insert a battery into the HPS2 handle

1. Twist open the bottom of the handle.
2. Insert a fully charged battery, positive down as shown.
3. Push and twist the bottom cap of the handle to close it and secure the battery. Note that the cap must be fully closed to ensure a good seal.

CAUTION – Use only the supplied battery.

Step 4: Attach the wrist strap

Attach the wrist strap to the base of the system as shown.

1. Thread the fine chord loop through the attachment guide.

2. Feed the main wrist strap through the fine chord loop.

3. Pull on the wrist strap to tighten and ensure that it is secure.

Step 5: Attach an adhesive mounting plate to the device or rugged device case

Trimble recommends using a rugged hard plastic case with your mobile device, for example an OtterBox® Symmetry Series®.

> **CAUTION – DO NOT** use a soft plastic or rubberized case.
>
> - The adhesive on the mount used to attach the device to the HPS2 handle may not bond securely to the case material.
> - Some movement will occur between the case and the HPS2 handle, reducing the accuracy of the system.

Trimble recommends that you attach the adhesive mount to the rugged case. This allows you to use the device independently of the adhesive mount if required.

> **CAUTION –** The mount's adhesive is very strong, so in the event that you have attached it directly to your device, you must exercise extreme caution if you try to remove the mount.

If available, use isopropyl alcohol to clean the back of the device or device case where the adhesive mount will be attached.

1. With the adhesive covering on the mounting plate facing upward, attach a mounting plate to the magnets on the HPS2 handle.

2. Before you remove the adhesive covering on the mounting plate, place your device on top of the mounting plate and check that the mounting plate will be attached to your device in the correct place. Make sure the device will sit flat on the HPS2 handle, you can see the screen clearly, and the device's camera is visible and not obstructed by the DA2 receiver or the handle.

3. Remove your device, then remove the adhesive covering on the mounting plate.

4. Reposition your device over the mounting plate on the HPS2 handle and press down for a few seconds so the contact adhesive on the mounting plate can bond with the device.

IMPORTANT: Allow a minimum of one hour to ensure proper adhesion.

Step 6: Attach your device to the HPS2 handle

Position the device over the magnets on the HPS2 handle. The mounting plate on the back of the device will connect with the magnets with an audible click.

Step 7: Turn on the HPS2 handle

Push the power button on the HPS2 handle (under the receiver) to turn it on. The power button lights up when the system is switched on.

The illuminated button color indicates the charge level of the battery as follows:

- No light = off
- Green = Good battery charge
- Blue - Electronic Distance Measure (EDM) connected
- Flashing red = Low battery charge
- Solid red = Battery flat, EDM disconnected

Setting up the SiteVision Integrated Positioning System

Step 1: Check the SiteVision hardware components

When you purchase the SiteVision Integrated Positioning System you should find the following items in the case:

- 1 x Trimble SiteVision Integrated Positioning System
- 1 x USB C to USB C Cable
- 1 x Pole Mounting Bracket
- 1 x Sunshade Attachment
- 2 x Batteries
- 1 x Dual Battery Charger
- 1 x Charging Cable
- 1 x International Adaptor Kit
- 2 x Adhesive Phone Mounts
- 1 x Wrist strap
- 1 x Quick Start Guide
- 1 x Shoulder Strap for the Case

> **NOTE –** A mobile phone / tablet is not provided. Refer to SiteVision system requirements, page 14.

Step 2: Charge the battery for +6 hours

Before turning on and using SiteVision charge the batteries fully with the provided charger. Plug the charger into your PC or an existing USB wall adaptor.

The battery charger will charge two batteries simultaneously and provides information on the level of charge.

Depending on the level of battery charge, charging the batteries fully may take over 6 hours.

> **CAUTION –** Do not charge the battery in temperatures below 0 °C (32 °F) or above 40 °C (104 °F).

Step 3: Insert a battery into the SiteVision system

1. Twist open the bottom of the SiteVision system.
2. Insert a fully charged battery, positive down as shown.
3. Push and twist the bottom cap of the SiteVision system to close it and secure the battery. Note that the cap must be fully closed to ensure a good seal.

> **CAUTION –** Use only the supplied battery.

Step 4: Attach the wrist strap

Attach the wrist strap to the base of the system as shown.

1. Thread the fine chord loop through the attachment guide.
2. Feed the main wrist strap through the fine chord loop.

3. Pull on the wrist strap to tighten and ensure that it is secure.

Step 5: Attach an adhesive phone mount to the device or rugged device case

Trimble recommends using a rugged hard plastic case with your mobile device, for example an OtterBox® Symmetry Series®.

> **CAUTION – DO NOT** use a soft plastic or rubberized case.
>
> - The adhesive on the mount used to attach the device to the SiteVision system may not bond securely to the case material.
> - Some movement will occur between the case and the SiteVision positioning system, reducing the accuracy of the system.

Trimble recommends that you attach the adhesive mount to the rugged case. This allows you to use the device independently of the adhesive mount if required.

> **CAUTION –** The mount's adhesive is very strong, so in the event that you have attached it directly to your device, you must exercise extreme caution if you try to remove the mount.

If available, use isopropyl alcohol to clean the back of the device or device case where the adhesive mount will be attached.

1. Place your device on a flat surface.
2. Remove the protective film from the adhesive phone mount.
3. Align the phone mount with the center of the device, then press down firmly to fix the adhesive.

IMPORTANT: Allow a minimum of one hour to ensure proper adhesion.

Step 6: Mount your device to the SiteVision positioning system

1. Hold the SiteVision positioning system in one hand, and rotate the latch on the right side up (anticlockwise), to open the locking mechanism.
2. Hold your device securely with the camera on the right side of the SiteVision positioning system, and slide the mount plate on the back of your device into the mount slot on the SiteVision positioning system.

3. Hold your device firmly with one hand and rotate the latch down to secure the device in place. Check that the latch is fully down to the locked position.

Make sure your device's USB C socket is on your left when the device is mounted on the SiteVision system.

Step 7: Connect your device to the antenna using the USB cable

The end of the USB cable with the double plastic rim / 🛰 icon must be connected to the SiteVision system to ensure it is weatherproof.

Step 8: Turn on the SiteVision system

Push the power button on the SiteVision positioning system (under the antenna) to turn on the SiteVision system. The power button lights up when the system is switched on.

The illuminated button color indicates the charge level of the battery as follows:

- No light = off
- Green = Good battery charge
- Blue - Electronic Distance Measure (EDM) connected

- Flashing red = Low battery charge
- Solid red = Battery flat, system powered by mobile device, EDM disconnected

About the battery power

The SiteVision system's battery provides power to the GNSS and the EDM unit, and also provides a slow charge to your device to increase its operating time.

When the internal battery is flat, indicated by a solid red light, the system automatically switches to providing power to the GNSS system from the mobile device's battery instead. When this switching occurs you will see the GNSS system drop all satellite tracking and restart.

While operating in this mode:

- you can continue to visualize models and make GNSS measurements, but you cannot use the EDM to take measurements.
- your device's battery charge will deplete faster.

Trimble recommends that you replace the battery in the SiteVision integrated positioning system with a fully charged battery as soon as possible.

Performing a device calibration (HPS2 handle and SiteVision Integrated Positioning System only)

If you are using the HPS2 Handle or legacy SiteVision Integrated Positioning System, a device calibration is required to calibrate your device camera to work with the SiteVision hardware, for precise AR visualization and accurate EDM measurements.

The process requires aligning the cross-hairs on the screen with EDM measurements. These measurements must be performed at two different distances—the first point is at close range, and the second further away.

During the calibration process a recommended distance is displayed for each point, and the current EDM measured distance is displayed. This guides you to move the SiteVision system closer to or further away from your target until you are at the recommended distance.

If you have not undertaken a calibration prior to using the SiteVision measurement apps, then you will be prompted to run the device calibration procedure the first time you use the EDM measurement function.

The EDM uses a laser pointer that creates a red dot on the point to which it is measuring. This red dot is typically easy to see when inside, and difficult to see outside, particularly on a bright day. Alignment of the crosshairs with the red dot is automated, but relies on the camera being able to see the red dot. For this reason Trimble recommends that you complete the calibration inside where it is easier to see the laser pointer. Ideally, set the unit on a stable platform such as a table or range pole with a clear target such as a wall at a distance of 45 to 60 cm (1.5 to 2 feet), and another target such as a wall more than 3 m (9 feet) away.

1. Mount your device on the unit, connect to the GNSS receiver, and switch the unit on.

2. Tap ☰ / ✖ **Tools**/ ▦ **Configuration**, then next to **Device Calibration** tap **Calibrate**.

3. You may get a request to confirm that you allow the SiteVision system to connect to the EDM via Bluetooth. If this message appears, confirm that you allow the connection.

4. Read the instructions for Device Calibration, then tap **Start**.

5. Select Point 1 at close range (approximately 45 to 60 cm / 1.5 to 2 feet).

    a. Follow the instructions and move to the correct range band. Once within the correct range band the automatic detection will search for the red dot and align the crosshairs. They will turn white when you are within the permissible tolerance of the recommended distance for the calibration measurement.

    b. Tap **Select Pt 1** to confirm the measurement.

6. Select Point 2 (> 3 m / 9 feet).

    a. Repeat the process at the longer distance. The cross-hairs will turn white when the distance is > 3 m / 9 feet.

    b. Tap **Select Pt 2** to confirm the measurement.

Automatic alignment of the crosshairs can have difficulty in very cluttered environments or environments with red coloured objects. If the automatic alignment is not performing well, you can switch to manual alignment by tapping 🎮 (bottom right of the screen).

When using manual alignment the process is the same except you can use the joystick bubble to align the cross-hairs to the EDM laser (the red dot). Tapping the arrows on either side of the joystick provides fine tune adjustments.

Measuring camera offset values (pole mounted configuration only)

To provide high-accuracy augmented reality, the SiteVision system needs to know the offset between the antenna and the camera on your device.

When using SiteVision mounted on a survey pole or extension rod, you are prompted to measure and set them when you launch the app.

> **NOTE –** When using the handheld SiteVision Integrated Positioning System, these camera offset values are automatically calculated during the device calibration process.

> **NOTE –** You can also check or reset them in the **Configuration** menu (see Configuring the camera offset values in SiteVision, page 27 below).

Measuring camera offset values

Step 1: Ensure the device and Catalyst receiver are both attached to the pole

Ensure your hardware configuration is assembled correctly, and that both your device and the Trimble Catalyst DA2 receiver are attached to the pole.

IMPORTANT: Your device must be attached parallel to the pole, so that the camera is pointing horizontally with respect to the Catalyst DA2 receiver.

See Setting up SiteVision on a survey pole or extension rod with a Trimble DA2 GNSS receiver, page 16 for instructions.

Step 2: Measure the Camera Offset Values
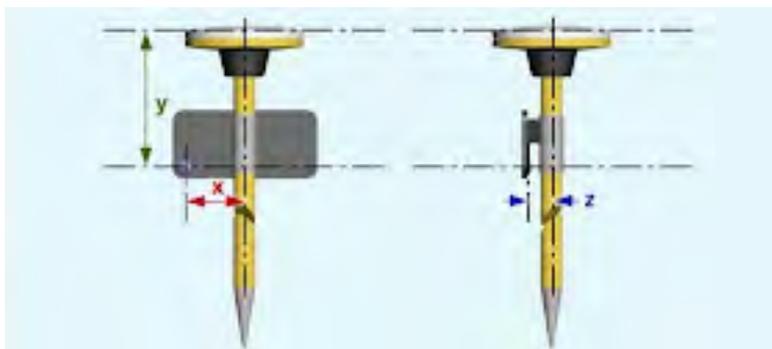
1. Measure the horizontal distance (X in the above image) from the center of the receiver to the center of the camera lens.

   > **NOTE –** For a device with multiple cameras, it is the "visual" camera. To confirm which camera lens to use, run the application and use your finger to cover each lens in sequence until you block the lens being used by the SiteVision app.

2. Measure the vertical distance (**Y** in the above image) from the top of the DA2 receiver to the center of the camera lens.

3. Measure the depth distance (**Z** in the above image).

Configuring the camera offset values in SiteVision

You are prompted to set camera offset values—if they are not set—when you launch the SiteVision app.

You can also check / set them in ☰ / ✕ **Tools** / ▤ **Configuration**, **Camera Offset**:

1. Tap ☰ / ✕ **Tools** / ▤ **Configuration**, and check your **Units** to confirm your distance measurement unit.

2. Enter the **Camera Offset** values for X, Y, and Z that you measured.

   > **TIP –** Tap the **?** at the top of the **Configuration** window for more assistance.

3. Tap **X** in the right corner to close the window.

Measuring the pole height

For accurate GNSS measurements it is important to correctly configure the Pole Height setting.

## Using SiteVision mounted on a survey pole or extension rod

Enter the height measurement from the tip of the pole to the bottom of the Catalyst receiver, as in the image at right. The correction for the offset from the bottom of the pole mount adaptor to the antenna phase center (the point where the GNSS measurement is made) is automatically applied.
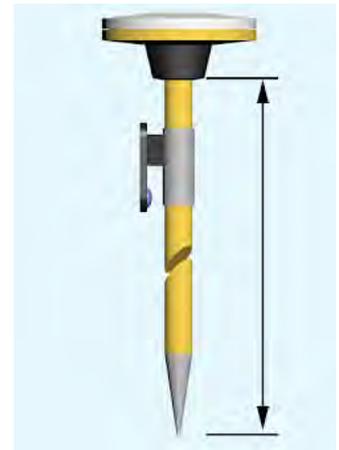
Using SiteVision with the handheld HPS2 handle or SiteVision Integrated Positioning System

Enter the height measurement from the tip of the pole to the bottom of pole mount, as in the image below. The correction for the offset from the bottom of the pole mount adaptor to the antenna phase center (the point where the GNSS measurement is made) is automatically applied.

If you are using the HPS2 handle or SiteVision Integrated Positioning system without a pole and place the unit on the ground during measurements, set the pole height to zero and the system will apply the offset for the height of the unit without the pole mount adaptor.

Standalone	**On Pole**
1 Pole height = 0 (bottom of unit)	**2** Bottom of Pole Mount Adaptor **3** Pole Height
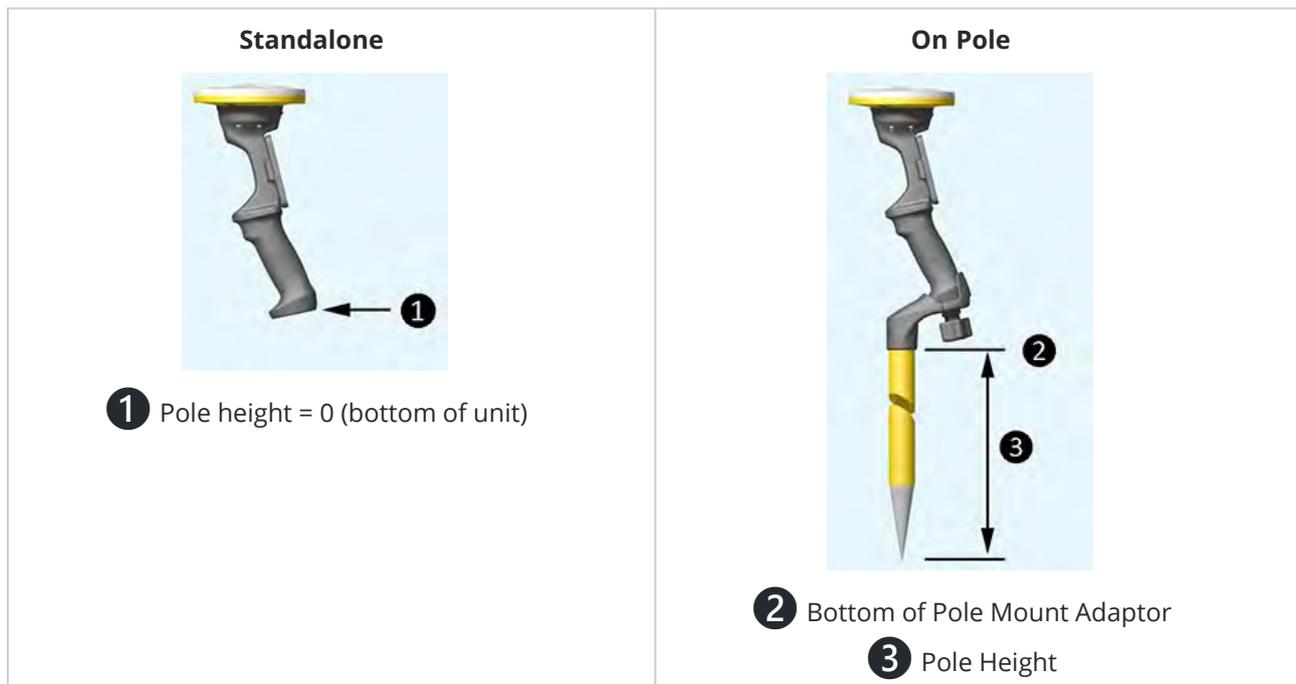
Getting started with the SiteVision software

Below are some SiteVision basics to get you started.

Configuring your device settings

For correct operation, the following settings must be configured on your device:

- **Location services** must be turned on.
- **Bluetooth** must be turned on.

Launching SiteVision

1. Tap ⬤ in the Apps screen on your device.
2. When prompted sign into SiteVision using your Trimble ID.
3. You must agree to the End User License Agreement before you are permitted to use the application, and accept the Health and Safety Warning.
4. You are prompted to select your hardware configuration (Handheld or Pole).
5. If you are using SiteVision with a Catalyst DA2 receiver with your device, you are prompted to pair your device for Bluetooth connection.
6. You are then prompted to do one of the following depending on your hardware configuration:
    - for Handheld configuration, perform a device calibration.
    - for Pole configuration, check / set the Camera Offset Values.
7. And finally, you are prompted to **Go to Menu and** load a model**.**

> **TIP –** When working in SiteVision, various prompt messages appear across the screen. You can minimize these messages to give you a clearer view of the screen—tap ⬆.

> **NOTE –** A sample model is included in the SiteVision app, so that you can explore SiteVision's features.
>
> **NOTE –** If you want to visualize your data in SiteVision, you must first load it either to Trimble Connect into a project, or pre-process data directly loaded onto your device (see Loading a model, page 102 for the different available options).
>
> **NOTE –** To be able to access the data from Trimble Connect the SiteVision user must either be the project owner, or be invited to the Trimble Connect project as a part of the project Team, under the same Trimble ID that you use to log into SiteVision. If the data has been uploaded by another person they must invite you—using the email address of your Trimble ID—to the Project team before you can access the data with SiteVision.

Working with model data

To work with data in the field, SiteVision provides the following options:

- Load data from the cloud; you must first upload it to Trimble Connect. To use this option, use **Load Model** / **Trimble Connect**.

- Load a model by scanning a Marker. This will load the Trimble Connect model the Marker is associated with. To use the option, use **Load Model** / **Marker**.

- Create data in the field using the SiteVision apps. To use this option, do one of the following:

    - use **Load Model**, select **Trimble Connect** then tap ➕ to create a new model in Trimble Connect.

    - use **Load Model**, then tap ➕ to create a new model locally.

- Load data locally from the device. This must be model data that you have already, or that is manually copied to your device after processing your model data via Trimble Business Center, Trimble Connect for Windows, or other Trimble products that produce the TRB file format (see To load a model that is on your device or a file storage location, page 104) or WFS files (see Getting started with GIS data, page 35). To use this option, tap **Load Model** / **My Files**.

    - Load data you have previously downloaded and viewed already; use **Load Model** / **Quick Access**.

      If you are offline, you may not be loading the latest model if the data has been updated on Trimble Connect since you loaded it from Trimble Connect; you will be loading a local copy of the model file.

      If you are online, for any model that you select to load that is sourced from Trimble Connect, the app checks with Trimble Connect for an updated version and downloads it. This ensures you are loading the latest version.

      While online, you can also sync all or selected models before you load a model.

        - To check all models for updated versions and download the latest versions from Trimble Connect, tap 🔄 in the top right of the **Quick Access** screen.

        - To check selected models for updated versions and download the latest versions from Trimble Connect, tap-hold a model to select it, then tap any other models you want to sync, then tap 🔄 in the top right of the **Quick Access** screen.

See Loading a model, page 102 for information on each of these options.

> **TIP –** Go to the Trimble Connect website or SiteVision Youtube channel for more information and tips specific to Trimble Connect.

The SiteVision user interface

NOTE – Some of the icons shown below may not be visible when you start the system. They depend on your **Display Settings** (see Viewing a model, page 121) and GNSS connection status (see Working with GNSS, page 107).

1	GNSS Status. See Working with GNSS, page 107.	6	Applications. See Using the Apps: reporting, measurement, and design tools, page 127.
2	Orientation Status. See Orientation status, page 112.	7	Transparency Slider*
3	View Distance Slider*	8	2D/3D View Selector*
4	Menu**	9	Pit View*
5	Cross-section Slider*	10	Layers*

*See Viewing a model, page 121 for more information on these options.

**The main menu gives access to the following options:

- **Load Model**. See Loading a model, page 102.
- **Place Model**. See Placing a model, page 112.
- **Tools**. See Using the Display Settings, page 121, Configuring the GNSS, page 32 and Configuration, page 40.
- **Exit**. Tap to close SiteVision. Trimble recommends that you close the SiteVision app when it is not in use.

Configuring the GNSS

To configure GNSS Settings, tap ▤ / ✖ **Tools** / ▩ **GNSS Settings**.

By default, SiteVision uses Trimble Corrections Hub to receive GNSS corrections. To use a local correction source such as a 3rd party or government virtual reference station network or Internet Base Station (IBSS), deselect **Trimble Corrections Hub** and enter the required information.

> **TIP –** Use a local correction source when you are outside of Trimble Corrections Hub coverage areas.

> **NOTE –** All correction sources must be connected to the internet and be accessed via the internet (Wi-Fi or mobile network data).

Using Trimble Corrections Hub

By default, the SiteVision system uses Trimble Corrections Hub to receive GNSS corrections. This provides you the best accuracy available wherever you are in the world using corrections from Trimble Positioning System's VRS Now networks and the Trimble CenterPoint® RTX service.

Trimble VRS Now coverage is available throughout many parts of North America, Europe, Australia, and New Zealand when using a compatible GNSS receiver. Trimble VRS Now fully supports GPS, GLONASS, QZSS (not all networks), Galileo, and BeiDou satellite systems.

Before using the Trimble Corrections Hub check your coverage on the Precision Coverage Map.

In areas with VRS Now coverage, the SiteVision system will typically achieve accuracies of a few centimeters.

If you are operating in an area that does not have VRS Now coverage, the Trimble Corrections Hub will select the RTX service.

When using the RTX services the horizontal accuracies will vary by location, but are typically 2 - 5 cm (1 - 2 inches). The vertical accuracy of the model placement may vary when using the RTX services. The RTX service has global coverage and is used in all areas that are outside of Trimble VRS Now coverage.

For applications where high vertical accuracy is required such as checking road construction status or utility locations, Trimble recommends that you use the VRS Now service, a 3rd party VRS service or an internet base station service.

> **TIP –** By default SiteVision is configured to support working with high horizontal accuracies of < 5 cm. When working in areas where this level of accuracy is not available (e.g. when using the RTX or RTX Fast correction service) you may need to adjust the **GNSS Minimum High Accuracy** setting. This setting controls the minimum horizontal accuracy required to achieve a 'Green' GNSS icon, a requirement for many SiteVision workflows. To adjust this setting tap 🗏 / ⚒ **Tools** / 🗒 **Configuration** / **Advanced**.

When using Trimble Corrections Hub, by default the Target Reference Frame is set to the Automatic setting. This setting outputs positions in the most appropriate reference frame based on your current location. If your model appears to be positioned incorrectly, check with the provider of the data to confirm what datum the model is in, and set the target reference frame to match.

> **TIP –** If you do not have an internet connection when you start the SiteVision system, Trimble Correction Hub connects you to the satellite-delivered RTX correction stream or to a local SBAS service. If this occurs and you re-establish your internet connection, you can re-start the GNSS service by tapping **Save & Reconnect** in the **GNSS Settings** dialog; the system restarts using the internet-provided corrections service (VRS or RTX over IP).

Using a local correction source: NTRIP

If you are working in an area outside of the Trimble VRS Now coverage zone, you may want to configure your own GNSS correction source.

The NTRIP setting allows correction data to be received securely from an NTRIP Caster. The NTRIP source may be one of the following:

- A Trimble VRS Network
- A Trimble NTRIP Caster
- The Trimble Internet Base Station Service (IBSS)
- Another NTRIP compliant correction source

To configure and use a local correction source via NTRIP:

1. Deselect **Trimble Corrections Hub**.
2. Enter the server parameters for the local correction source.
3. Select the **Source Reference Frame** to match the reference frame of the VRS network or IBSS.
4. Select the **Target Reference Frame** to determine the coordinate output.
5. Tap **Save & Reconnect** to confirm your GNSS Settings.
6. If the **Source Reference Frame** of your NTRIP Caster is not on the list of supported reference frames, then ensure the **Target Reference Frame** is set to **Same As Source**. This will output positions without applying any transformation (the Source Reference Frame setting is effectively ignored in this case).

> **TIP –** If you tap **Save & Reconnect** when you are connected to the GNSS and receiving positions, your GNSS will restart/reconnect.

Understanding Target Reference Frames

A VRS network or local correction source will be broadcasting coordinates in relation to a known reference frame. This is called the Source Reference Frame.

Trimble SiteVision is capable of performing real time datum transformations of GNSS positions. This allows SiteVision to receive positions from a VRS or local correction source, and output them in a specified Target Reference Frame.

This provides flexibility to work in terms of a local datum, or common global datums as needed.

- **Same as source**: SiteVision will pass through positions as received by the receiver.

    - Trimble Corrections Hub dynamically adjusts the correction source to always provide the highest level of accuracy. For this reason it is not recommended to use the **Same as Source** setting in conjunction with Trimble Corrections Hub.

    - If you are using a local NTRIP source the positions will be in the same coordinate system as the local NTRIP source.

- **Auto Selection**: SiteVision looks at the current position to look up the reference frame you are most likely in based on your current position.

- **User Choice (from list)**: Select a reference frame from the list of supported datums, and this will be the output reference frame.

Understanding geoid models

A geoid model applies a vertical transformation to account for local variations in the earth's gravity field. There are many different geoid models ranging from global geoids such as EGM96, to regional geoids such as EIGEN-6C4, or GEOID12B.

- If your model data is in terms of a geoid model, then an appropriate Trimble Site Calibration file will be required to ensure your data is displayed correctly.

- SiteVision supports custom, or sub-gridded geoid models. For detailed instructions see Using custom geoid models, page 48.

Getting started with Trimble Business Center for SiteVision

Trimble Business Center versions 5.10 and later feature a built-in exporter for SiteVision. This exporter creates three files and can either save these locally or upload them directly to Trimble Connect:

- Project Link File (.VCL) containing, points, lines, and surfaces.

- TrimBIM (.TRB), a 3D model file in a Trimble proprietary format, optimised for visualization in SiteVision.

  > **NOTE –** This is the model file that will be visible from within SiteVision, and the one you need to select to view.

- A Trimble Site Calibration file to georeference the model containing the coordinate system information. This will be in one of three Trimble formats: JXL, CAL, or DC. The export option automatically selects the required format and the SiteVision system applies it to the model.

Getting started with Trimble SketchUp for SiteVision

Trimble SketchUp Pro (Desktop) has an extension for use with Trimble SiteVision. The extension has been developed to facilitate the automatic placement of 3D models designed in SketchUp alongside a Trimble Site Calibration file. The extension allows a single origin point to be created in relation to a local coordinate system. This helps manage geographic coordinate systems that are not natively managed by Trimble SketchUp.

You can download the Trimble SiteVision AR Exporter for SketchUp in two ways:

- **Directly from the** SketchUp Extension Warehouse. You will need to sign in to download the extension.

- **Manually in SketchUp Preferences**.

When you download the extension it will be packaged as an .rbz file. To install the extension:

1. Locate the **.rbz** file on your computer.

2. In SketchUp, select **Window** / **Extension Manager**.

3. In the **Extension Manager** window, click **Install Extension**.

4. Navigate to the **.rbz** file saved to your computer, select the file, and click **OK** (Microsoft Windows) or **Open** (Mac OS X).

5. SketchUp warns you about installing only extensions from trusted sources; click **Yes** to install the extension.

> **TIP –** Always save your model prior to applying the coordinate offset using the SketchUp plug-in, then **Save As** after applying the offsets to save the offset model to a different name. **Do not overwrite the original SketchUp model**.

Getting started with GIS data

The SiteVision system uses GIS data stored in Trimble Connect Map workspaces. Alternatively you can be connected to a compatible online Web Feature Service.

Trimble Connect Map workspaces

To use GIS data files with the SiteVision system you must first create a Map workspace in your Trimble Connect project.

There are two approaches to working with GIS data files:

- Uploading data files into a Map Workspace. The data must be in Esri Shapefile or Esri file geodatabase format. This is a good approach when working with data sourced from public databases.

- Connecting to your ArcGIS database, page 37. You can use the Trimble extension to ArcGIS to directly transfer data from your ArcGIS system to Trimble Connect for use by SiteVision. This approach can streamline internal company workflows by avoiding handling of files.

Supported file formats

The Map Viewer can import data from Shapefile and Esri File Geodatabase formats.

- Shapefiles must be zipped before uploading to the Map Viewer and must contain files with SHP, SHX, DBF, and PRJ file extensions.

- Multiple shapefiles can be uploaded in a single zip file.

- File Geodatabases must be zipped before being uploaded to the Map Viewer.

  - Only a single file geodatabase can be included in a single zip file

  - Multiple feature classes can be contained in the fgdb

  - The importer does not support Feature Data set hierarchy

> **NOTE –** Trimble recommends not exceeding 40 MB for import files.

Uploading to the Map Viewer

Uploading files to the Map Viewer is completed through your web browser in the Connect Map Workspace.

1. Go to connect.trimble.com and sign in.

2. Browse to your Project folder and open your Map Workspace.

3. At the bottom of the Data menu, click ➕ then from the menu select **Import from file**.

4. In the **Import file** window, you can either drag-drop, or browse to the file that you want to import.

   The file goes through a 3 stage upload process—first uploading the file to the Connect environment, then processing the data, and finally creating layers. Follow any on-screen prompts.

   - Data upload is as fast as your data connection allows.

   - Data processing takes longer and is based on the complexity and size of the dataset.

> **NOTE –** When the first Data upload stage is complete you can close the map page and the file will continue to process. Larger files may take some time to completely process and display so this is advised.
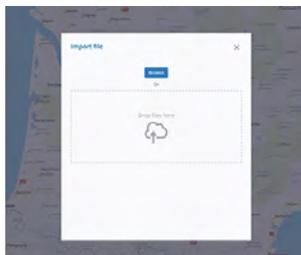
Once the file has been uploaded, the data processed, and layers created, the data will appear in the Data list as layers in your Map Workspace.

Connecting to your ArcGIS database
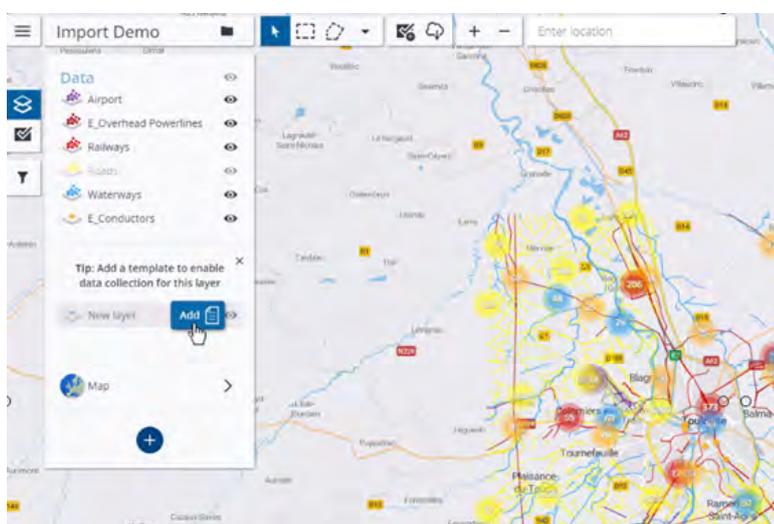
Go to https://geospatial.trimble.com/en/products/software/trimble-terra-office for information on and access to the plug-in for your ArcGIS system.

Once the Terra Office has been configured, data can be made available through the Map Workspace and accessed by the SiteVision system similar to data sourced from files as described above.

Web Feature Service connections

SiteVision supports loading of GIS data from supported online vector feature services. The following online feature service interfaces are supported:

- Esri Feature Service
- Open Geospatial Consortium (OGC) Web Feature Service (WFS)

- OGC WFS v1.1.0

- OGC WFS v2.0.0

The SiteVision Manager companion application is used to setup and configure the feature service. Once configured this is stored as a .WFS file, which is uploaded to Trimble Connect. To view the data in SiteVision this .WFS file is loaded from Trimble Connect in the same way as any other model.

> **NOTE –** Visualization rules are compatible with feature service data, and can be combined for a rich visualization experience.

Configuring your Feature Service Connection

Use the SiteVision Manager companion application to create and manage your Feature Service connections.

To install the SiteVision Manager, download it from the SiteVision website and install it on your office computer.

1. Click the SiteVision Manager icon on your desktop to launch the SiteVision Manager.

2. Select **File / New / Feature Service**.

3. In the **Server Details** section input the service URL, and select the appropriate **Server Type**.

   > **NOTE –** SiteVision supports both Esri Feature Service and OGC WFS. The automatic detection setting will parse the URL and identify either server type if available.

4. In the **Account** section input the account login details if required. For detailed information on configuring the authentication and account details for your Feature Service connection, see Configuring a GIS feature service connection, page 72.

5. In the **Feature Classes** section, select **Fetch**. This will connect to the server and return a list of available feature classes.

   > **NOTE –** Each Feature Class displays in SiteVision as a separate layer. SiteVision requires all Feature Classes to share a common coordinate system. If multiple Feature Classes with differing coordinate systems are included in a single Feature Service connection, SiteVision displays an error message to warn you.

6. Use the checkboxes to select which feature layers to include in the Feature Service connection. Once configured, select **File / Save As...**. You are prompted to save the Feature Service connection as a .wfs file.

7. Upload this .wfs file to Trimble Connect or copy directly to your device, and load from within SiteVision like you would any other model.

8. When you select the .wfs file to load, you are prompted to select a position—either Current or a Custom coordinate.

> **NOTE –** The Custom option is designed to allow you to preload data at a specific location prior to leaving the office.

9. SiteVision downloads the specified features within a 1km square bounding box. If you travel beyond the extents of the data, reload the .wfs file to reset the box around your current location.

> **NOTE –** You must have an internet connection to be able to load and view .wfs data in SiteVision.

2

Configuration

Tap ▤ / ⚒ **Tools** to configure the following:

- ⊡ **Display Settings**. See Using the Display Settings, page 121.
- ⚹ **GNSS Settings**. See Configuring the GNSS, page 32.
- ▤ **Configuration**: tap to access the following -
  - **Hardware Setup**.
    - Select **Handheld** if you are using the Trimble HPS2 handle or the SiteVision Integrated Positioning System.
    - Select **Pole** if you are using your device on a pole and connecting to a Trimble Catalyst DA2 GNSS receiver.
  - **Receiver Connection**:
    - For the **Handheld** setup when connecting to a SiteVision Integrated Positioning System with a DA1 antenna using a USB cable, the DA1 antenna displays once connected.
    - For the **Handheld** setup when connecting to a Trimble HPS2 handle with a built-in DA2 receiver, tap the Bluetooth icon then select the DA2 GNSS receiver that matches the serial number of the HPS2 handle. The receiver name displays once paired.
    - For the **Pole** setup, tap the **Bluetooth** icon then select the DA2 GNSS receiver you want to connect to. The receiver name displays once paired.
  - **Device Calibration**: see Performing a device calibration (HPS2 handle and SiteVision Integrated Positioning System only), page 25.
  - **Camera Offset**: see Measuring camera offset values (pole mounted configuration only), page 26.
  - **Pole Height**. Set the height of the pole so that GNSS measurements are recorded accurately. Pole height is applicable only to GNSS measurements.
  - **Units**: set your preferred Distance measurement unit (Metric, International Feet, US Survey Feet).
  - **Language**: Select the language you want the application to run in.
  - **Advanced**...

- **Minimum Distance to walk**: see Orientation status, page 112.

- **GNSS Minimum High Accuracy**: see Working with GNSS, page 107.

- **Coordinate Order**: set your preferred Coordinate Order (NEE, ENE).

- **Measured Placement**: **Reset** or **Suspend**. See Placing a model: measured placement, page 114.

- **Application Settings**: tap **Reset All** to clear changes you have made and reset the system to the default settings.

Tap **About** to view the Privacy Policy, Terms of Service, Version of the software, Subscription expiry date, and to access **Support**.

3

Preparing your data

Good data preparation is the essence of great visualization. As the SiteVision system supports a wide range of data types for a wide range of users, this section describes a range of typical workflows and discusses the benefits and limitations of different types of data and data preparation.

About model complexity and size

SiteVision features a powerful 3D visualization engine that allows it to load and display large and complex models, reducing the burden in terms of data preparation. This reduces the likelihood you will need to section your models into smaller pieces before loading into the application.

> **NOTE –** Depending on your use case you may still prefer to organize your data by sectioning it—for example, by floor. As there is no way to occlude the display of data behind physical walls / floors, it can be confusing to see data from the level above or below. Conversely, this can also be very helpful if you want to visualize a services riser traveling up through multiple levels, or to see what is behind a wall.

There are still limitations on how much data can be rendered at any given time; this limit is dependent on the device you are using. The more modern a device is, and especially the quantity of RAM, will be the governing factor.

One of the methods SiteVision uses to improve performance is to hide any small objects that are more than 8 m (24 ft) away from the current viewing position within the model. These small objects are typically bolts, or other physically small objects, which due to their size are difficult to see from a distance. Moving around within the model dynamically redraws these small objects so you will always see them in your vicinity so that you always see all your model content within 8 m (24 ft).

In some extreme cases, typically very complex and dense models, and especially if running on an older device, SiteVision may not be able to render all the objects within 8 m (24 ft). In this situation the following banner message displays notifying you that some objects may be missing from the visualization.
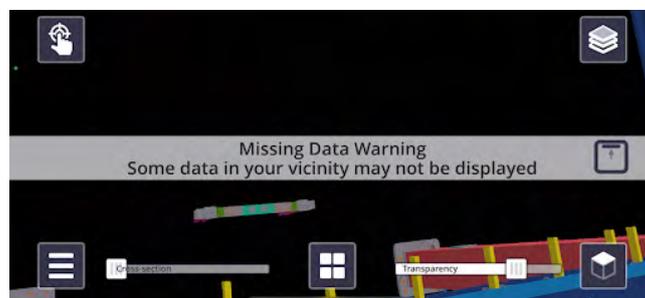
To manage this you can turn off unnecessary model data from the layers menu. As you disable each layer, SiteVision will reoptimize the visualization and once sufficient layers have been turned off that all data can be displayed, the banner message will disappear.

SiteVision has a maximum rendering distance limit. Only data within 10 km (approximately 6 miles) is displayed; data beyond this distance is not visible.

Supported data formats

The table below lists the supported data formats from Trimble products, open industry standards, and third party software.

Supported Data types						
Format	Points	Lines	Surfaces	Attributes	Textures	Alignments
VCL*	X	X	X	X	X	X
TTM			X	Image overlay	X	
TMAPS	X	X		X		
SKP	X	X	X		X	
TRB	X	X	X	X	X	X
LandXML	X	X	X (TBC only)	X		X
IFC (2x3, MVD EM.11)		X	X	X		
OGC WFS	X	X		X		
SHP	X	X		X		
GDB	X	X		X		
DWG	X	X	X			
Esri WFS	X	X		X		
NWD / NWC		X	X	X		

*VCL format refers to the export from Trimble Business Center using the SiteVision AR Exporter plugin. This generates the VCL, TRB and calibration files.

This section describes:

- Configuring Trimble Connect
- Creating a Trimble Site Calibration file

- Using custom Geoid models

- Using SnakeGrid Coordinate Systems

- Workflows for Architects and Landscape Architects

    - Using SketchUp

    - Using IFC

    - Using Navisworks

- Workflows for Civil Engineers and Contractors

    - Using Trimble Business Center

    - Using Civil3D

    - Using Bentley iModels

    - Alignments: Station and Offset

    - Working with Feature Codes

- Workflows for GIS Professionals

    - Guidelines for Preparing Esri Data

    - Configuring a GIS feature service connection

    - Defining Data Display Rules: Using The SiteVision Manager

    - Capturing and using new data with Terraflex

- TFLX (Trimble FieldLink)

- Establishing a QR marker network

Configuring Trimble Connect

The following section describes how to configure Trimble Connect for automatic placement of models.

> **NOTE –** You can skip this section if you intend to use the Measured Placement function to place your models in the field.

For automatic placement of models, SiteVision requires georeferencing information to be provided so that the data can be displayed in the correct location. Trimble Connect can be configured to provide this georeferencing information directly to SiteVision without the need for separate calibration files.

1. In the Trimble Connect Project Explorer view, tap **Settings** from the left hand menu.

2. Tap **Project Details**.
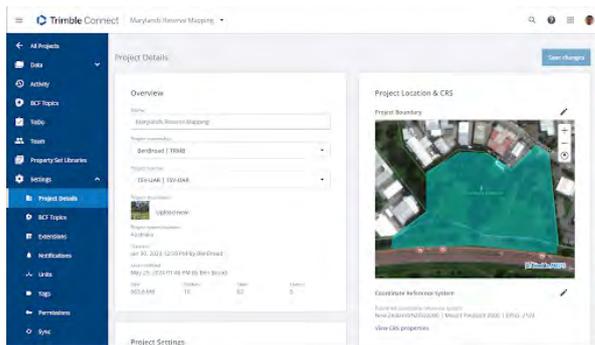
3. In the **Project Location & CRS** panel, tap the **Project Boundary** icon ✏.

4. Draw a boundary on the map, or input boundary coordinates to set the Project Boundary.

5. Tap the **Coordinate Reference System** icon ✏.

6. Select **Choose published coordinate system**.

7. Pick the appropriate coordinate reference system from the dropdown list that matches your data.
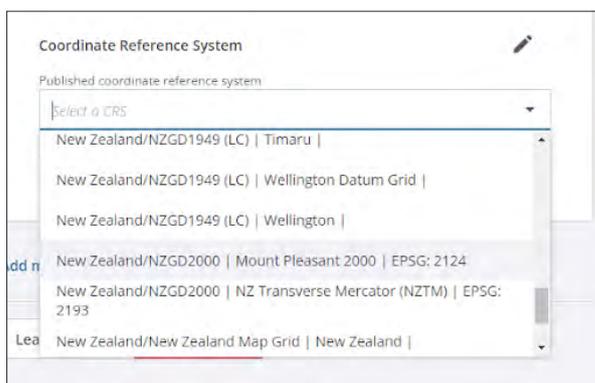
8. Tap **Save changes** at the top of the screen to confirm your selections.

> **TIP –** If the required coordinate system is not available from the list, or if you are working with a local site calibration you can instead choose to upload a calibration file

Once a Trimble Connect project has been configured in this way, any model loaded in SiteVision will use the defined coordinate reference system to automatically place the model in the correct location. Additionally, this same coordinate system will be applied to any new models that are created.

> **TIP –** By setting a coordinate reference system in Trimble Connect, then creating a new model, it is possible to use SiteVision to capture georeferenced data without requiring a model at all.

> **NOTE –** A standalone Trimble Site Calibration file (DC, JXL, CAL) will still take precedence over the coordinate reference system defined in the Trimble Connect project settings.

Creating a Trimble site calibration file

If the necessary georeferencing information is not available in Trimble Connect, a Trimble Site Calibration file (DC, JXL, CAL) can be used to provide this georeferencing information. If you do not have a Trimble Site Calibration file, use Trimble Business Center to create one:
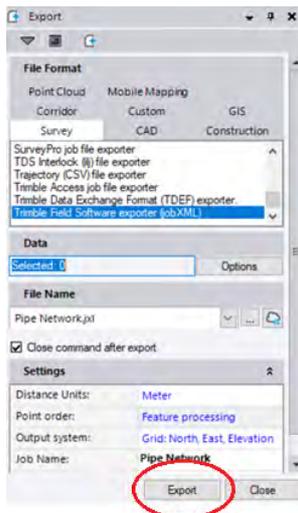
1. Start a new project in Trimble Business Center.

2. From the top toolbar, select **Project Settings**.
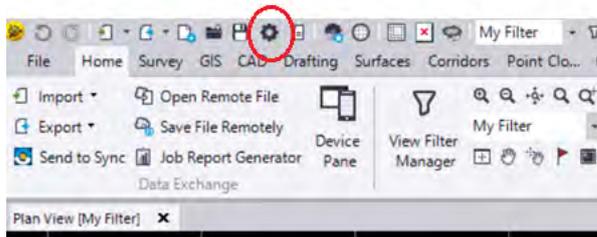
3. In the **Project Settings** window, select **Coordinate System** then tap **Change** to select your required coordinate system. Tap **OK**.
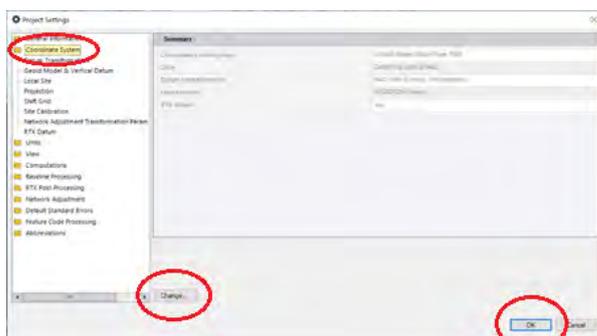
4. On the **Home** tab, tap **Export** and then select the **Survey** tab.

5. Select the Trimble Field Software exporter (jobXML).

6. Enter a file name and tap **Export**.

> **NOTE –** You do not have to have any points in the model. If there are control points in the model, they do not need to be selected for inclusion in the jobXML (JXL) file.

> **NOTE –** For georeferencing models that do not have a supported co-ordinate system, a JXL file with the Selected:0 data will create a Georeferenced file with just the necessary projection and geoid model information. This file must be renamed to match your model name and stored in the Trimble Connect folder with your model.

Setting a default Site Calibration file

Prior to SiteVision version 2.00, to associate a calibration file with a model file the file names of the model and the calibration file had to be the same; this meant that a calibration file needed to be created for each model file.

In SiteVision v 2.00 and later, you can place a "default" calibration file in a folder on Connect, and that calibration file will be applied to all model data in that folder. This means you do not have to create a new calibration file for each model, and you can instead set up a calibration for a folder / site.

To set a default calibration file:

- Name the default calibration file the same as the Connect Project.

- Place a copy of the default calibration file within each folder of your project that you want it to be applied to.

  > **NOTE –** Placing a copy of the default calibration file in the top level folder of a Trimble Connect project will apply this calibration file to all model data and folders within the project.

> **NOTE –** If another calibration file is associated with a model (i.e. there is a calibration file in the same folder as the model, and with the same name as the model) then that takes priority over the default calibration file.

The following example illustrates this:

- For the project Rolleston Test Project, a default calibration file has been created named Rolleston Test Project.jxl.

- When loading the models 8 Bellbird Place.trb, and 8 Bellbird Place rev02.trb, the default calibration file Rolleston Test Project.jxl is applied.

- When loading the model Bellbird Concept.skp, which has an existing matching calibration file Bellbird Concept.jxl, this matching calibration file takes precedence over the default calibration file.

Using custom geoid models

Custom geoid models are typically created by making a subset of a published geoid model. SiteVision supports custom geoid models in the .ggf format.
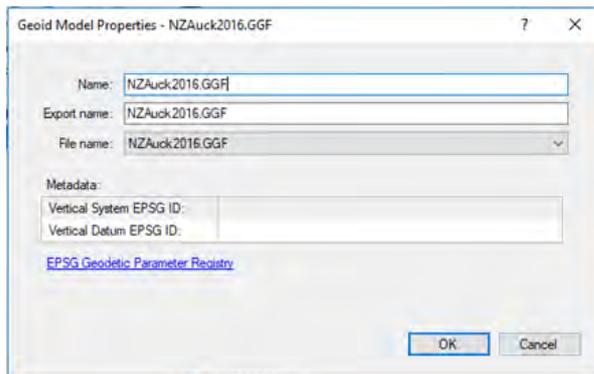
To use a custom model:

1. Create the custom model.

2. Place the custom model in the Geodata folder on your device's internal storage, with an extension of .ggf

   > **NOTE –** The Geodata folder can be found:
   >
   > - on Android devices, at *Internal shared storage\Android\data\com.trimble.sitevisionAR\files\Geodata*; you may need to connect your device to a computer to browse to this location.
   >
   > - on iOS devices, in the **Files** app under *Trimble SiteVision\Geodata*.

3. Using Trimble Business Center, create a project using the custom geoid model. When creating the custom geoid definition in Coordinate System Manager, ensure the Name of the geoid model matches the File name.

4. From the project, do one of the following:

   a. export your model using the SiteVisionAR export option.

   b. export a JXL file and name it with the same name as your model. Place it in the project folder in Trimble Connect alongside the model that uses the custom model.

Using SnakeGrid coordinate systems

SiteVision supports SnakeGrid coordinate systems that use the .DGF or .DAT datum grid file format.

To use a SnakeGrid coordinate system:

1. Create the custom model.

2. Place the custom model in the Geodata folder on your device's internal storage, with an extension of .dgf or .dat

   > **NOTE –** The Geodata folder can be found:
   >
   > - on Android devices, at *Internal shared storage\Android\data\com.trimble.sitevisionAR\files\Geodata*; you may need to connect your device to a computer to browse to this location.
   >
   > - on iOS devices, in the **Files** app under *Trimble SiteVision\Geodata*.

3. Using Trimble Business Center, create a project using the SnakeGrid coordinate system. When creating the SnakeGrid coordinate system in Coordinate System Manager, ensure its Name matches the File name.

4. From the project, do one of the following:

   a. export your model using the SiteVisionAR export option.

   b. export a JXL file and name it with the same name as your model. Place it in the project folder in Trimble Connect alongside the model that uses SnakeGrid coordinate system.

Workflows for architects and landscape architects

This section covers workflows using:

- Sketchup — 3D modelling software that generates 3D models in the .SKP format.
- IFC Files — an Industry Foundation Classes file.
- Navisworks — a file format for the exchange of 3D model data.

Workflows for architects and landscape architects: using SketchUp

Trimble SketchUp is a highly versatile 3D modelling software that generates 3D models in the .SKP format. To use the 3D model in SiteVision you will need to georeference the model in some way to connect the model co-ordinate system to the real world.

When preparing your SketchUp models, note the following:

- For best visualization in SiteVision apply material textures to individual object faces.
- The Green axis is the North-South axis.
- Do not create multiple surfaces at the same location, such as two different faces on a wall. When models with two surfaces in the same location are drawn by SiteVision the display engine will try to draw both surfaces and their assigned colors which will result in flickering of the model in the area of that surface.
- Organize your model by using components. You can create a component by selecting an object and right-clicking to access the **Create Component** function. Organize your components by layer to allow simpler selection/viewing in SiteVision.
- To display attributes you must be using SketchUp Pro. From the Components created right-click on your component and select Dynamic Components\Component attributes. Then add the attributes as required. Refer to the on-line tutorial at Sitevision.trimble.com for more information.
- Note that very high resolution (4k) textures can quickly consume device memory, a large number of high resolution textures can result in models failing to load. Care should be taken to ensure textures are an appropriate level of detail. If high resolution textures are required then the number of such textures should be managed appropriately.

> **NOTE –** The Geo-location function within SketchUp will not automatically georeference the model in the real world with SiteVision. You must use one of the methods described below.

SiteVision supports several methods (see Placing a model, page 112) for connecting the model to the real world.

Method	Ease in office	Ease in the field	Accuracy	Stability
Automatic placement	Most complex	Easiest No field work	Best	Best
Measured placement	Easy No office work	Easy	Good	Best
Manual placement	Easy No office work	Easy	User dependent	AR only

Manual placement

Manual placement is the easiest method to place a model in SiteVision for users who are unfamiliar with co-ordinate systems.

With this method, you go to the site, select your model, drag it around horizontally to position it where you want to view it, then drag it vertically to sit it at the right height, and finally, rotate it about you if required.

While a simple process, it is a manual process and the accuracy is dependent upon you exercising an appropriate amount of care. The model can drift over time because it is maintained in position using only the visual odometry of the device's AR system.

Measured placement

Measured placement is ideal for users who are unfamiliar with co-ordinate systems or for designers that have used an arbitrary reference (e.g. a co-ordinate origin of 0,0,0).

When using the measured placement method, it is important to include in your design some reference points that you can use to position the model on site. Ideally, these will be points that can be referred to throughout the construction process. In the example below the designer has added the property lines to the model:

When doing the measured placement, measurements are made with the SiteVision system at two property corners; these are used to position and orientate the model on site.

In the image below a measurement was made with the SiteVision GNSS at property corner 151, and this property corner was selected in the model to position the model correctly. The arrows show the land parcel surface and property corner in the SketchUp model:

Having a single depth surface such as the property boundary makes setting the elevation simple because both the top and bottom of the model in that location are at the same elevation.

When you do a measured placement the results are stored in Trimble Connect and are available for any future visits to site, for you and any others who use the model and access it from your Trimble Connect project. This means that the measured placement procedure only needs to be done once, and the model is automatically located in the same place for all future use. See Placing a model: measured placement, page 114 for more details.

> **TIP –** Having a single surface such as the existing ground makes setting the elevation simple because both the top and bottom of the model in that location are at the same elevation.
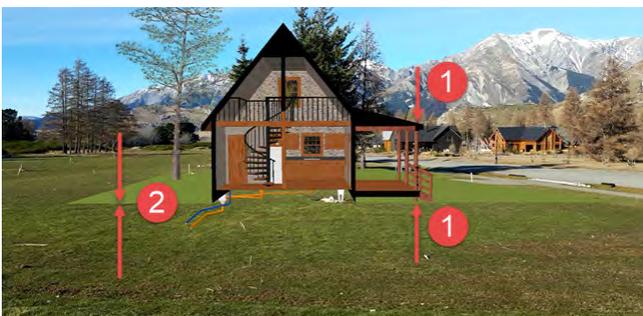
- ① If your reference point is in an area with multiple surfaces you must select the top or bottom of the model during measured placement, or the model will be drawn at the wrong elevation.

- ② With a single surface the top and bottom of the model are at the same elevation.

Automatic placement

The Automatic Placement method requires two additional pieces of software to automatically georeference a model:

- The SiteVision extension for SketchUp available from the SketchUp Extension Warehouse. See https://extensions.sketchup.com/extension/090b20c2-804f-4c90-bb0a-fb217d761fb8/trimble-site-vision-ar-exporter-for-sketch-up

- A copy of Trimble Business Center, or access to a georeferenced file from a Surveyor or other Trimble Business Center user in the Trimble JXL, DC, or CAL file format.

To generate models that are automatically placed:

1. Prepare your model in SketchUp with the Green axis as your North orientation.

2. When the model is complete, save it.

3. Enter the origin coordinates from within SketchUp using the SiteVision AR exporter; tap 📐, enter the origin coordinates and click **Ok** to apply them to the model.

4. In the SiteVision AR exporter tap 🔵 to export the model for SiteVision. **Save the file under a different name**, such as MyModel-for-SiteVision.SKP

5. Drag and drop your SKP file into your Trimble Connect project.

6. Create or obtain the JXL file for georeferencing the model from Trimble Business Center.

7. Rename the JXL file to exactly match the .SKP file name, except for the extension. For example if the .SKP file is called MyModel-for-SiteVision.skp, then the JXL file should be called MyModel-for-SiteVision.jxl.

8. Drag and drop the JXL file into the same project folder and the design model.

Workflows for architects and landscape architects: using IFC files

The IFC file extension is an Industry Foundation Classes file. The IFC-SPF file format is:

- developed by the buildingSMART organization, a worldwide not-for-profit organization driving change in the Building Construction industry.

- used by Building Information Modeling (BIM) programs to exchange models and designs of facilities, buildings and other infrastructure.

IFC exports are available from most leading CAD / Modelling software such as SketchUp, Revit, AutoCAD, AECOsim Building Designer, and Tekla.

To use the IFC model in SiteVision you will need to georeference the model in some way to connect the model co-ordinate system to the real world.

> **NOTE –**
>
> - IFC2X3 files do not support the necessary records to georeference a model.
>
> - IFC V4 has provisions for including georeference information. SiteVision will check if a valid coordinate system is defined by the IfcProjectedCRS and IfcMapConversion IFC Classes. If a valid coordinate system definition is present it will be used to automatically place the IFC model. Note that a calibration file can still be used to manually override any embedded coordinate system information.

When preparing your IFC file, consider the layering system you use. When an IFC model is exported from a model authoring package it will contain layers. SiteVision will recognize these layers, allowing you to adjust the visible entities within SiteVision. However it is important to define the correct layer mapping settings within your authoring package before performing the IFC export or these layers may not contain useful information.

When exporting from Autodesk Advance Steel, Trimble recommends using IFC MVD EM.11.

The workflow and process for using IFC files is similar to using .SKP files; see Workflows for Architects and Landscape Architects: Using SketchUp.

1. Start by dragging and dropping the IFC file into the Trimble Connect project folder.

2. You can place the model manually, register it on site with a measured placement, or automatically place it using a Trimble Site Calibration file (JXL, DC or CAL).

   For automatic placement, the .IFC model's origin must be in the same coordinates as the real world coordinates system you are using. How this is achieved depends on the CAD/Modelling software you are using. For example, if your design is to be located at N: 19419586.429, E:5763889.413, Elev:211.465 the .IFC model coordinates need to match N: 19419586.429, E:5763889.413, Elev:211.465.

   As IFC files are most commonly used on larger commercial building projects, the recommendation is to engage a Surveyor to generate a JXL file for use with the IFC model.

3. Rename the JXL file to exactly match the .IFC file name (except for the extension). For example if the .IFC file is called CommercialBuilding.ifc, then the JXL file should be called CommercialBuilding.jxl, then upload the JXL file to the same folder as the IFC.

Workflows for architects and landscape architects: using Navisworks NWD/NWC

Navisworks NWD/NWC is a popular file format for the exchange of 3D model data.

- Developed by Autodesk
- Used by Building Information Modeling (BIM) programs primarily for design review and collaboration

Trimble Connect supports viewing Navisworks model files (.NWD and .NWC) in the 3D viewer by automatically converting models into a Trimble Connect compatible 3D format when they are uploaded. In certain cases, it is possible that the Navisworks model conversion fails and the model cannot be viewed in 3D. Typically the reason for this is that the Navisworks model contains data types that are not supported by Trimble Connect, or the Navisworks model is too large.

Identifying and resolving conversion problems

If problems with the conversion process are encountered, the following steps are recommended:

1. Open the Navisworks model in the original model authoring tool.
2. Remove or replace unsupported data.
3. Re-export the model with optimized settings for smaller size and complexity.
4. Re-upload the model to Trimble Connect.

Identifying and removing unsupported data types

If the Navisworks model contains unsupported data types it could result in the conversion failing.

1. Notably most point cloud data within the Navisworks model is not supported by the Trimble Connect browser: delete or hide point clouds and other unsupported elements.
2. Replace unsupported data with compatible alternatives. For instance, approximate the location and shape of point cloud data with solid geometry; or convert point clouds to 3D meshes.

Example of unsupported point cloud data, typically captured with a laser scanner or photogrammetry software:
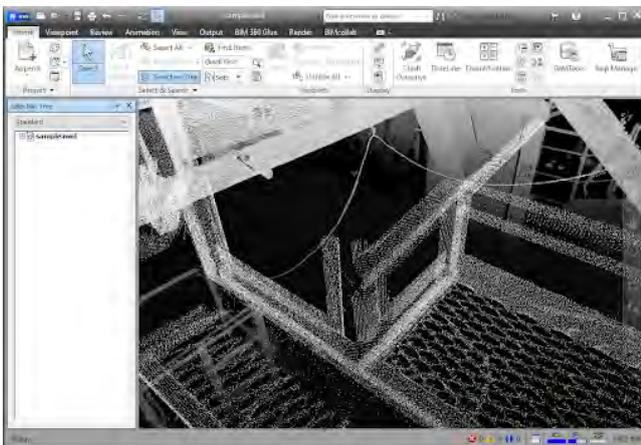
How to optimize the Navisworks model to be smaller and less complex

1. For very large projects, consider exporting sub-models. You can do this by dividing your model into logical sections and exporting each one separately. Ensure you consult with your digital team to make sure any changes to model management complies with and is reflected by the project BIM management plan and associated model management processes.

2. Conduct a review of model content and look for opportunities to reduce geometric complexity. Common areas where efficiencies can often be found include:

    - Fitout or soft furnishings such as office chairs, plants.

    - Standard supplier models that have been inserted that are modeled at a very high LOD such as facade systems or flashing/moldings.

    - Specialist plant or equipment—valve handles, curved pipe and fittings rendered with a high number of polygons.

    - Reinforcing steel within concrete components.

3. Conduct a review of model content and look for opportunities to reduce embedded model metadata. While a core aspect of the value delivered by BIM, excessive amounts of embedded model metadata can impact the size and efficiency of models.

    - Model metadata can often end up inserted and potentially duplicated at varying levels of the model hierarchy.

    - Model metadata can also be inserted due to import/export/conversion by various applications that can cause duplication.

After making the necessary changes, re-upload the revised model to Trimble Connect. If you are still experiencing difficulties with Navisworks model conversion, contact the appropriate support channel.

Workflows for civil engineers and contractors

Civil Engineers and Contractors are often working with highly complex CAD data from a range of sources. To prepare a successful visualization within SiteVision it is crucial to spend some time preparing the data in your native CAD authoring application.

In particular consider the following guidelines for CAD-based workflows:

- Hide or remove any unnecessary layers or information. Actively select the minimum number of layers and pieces of data required to perform the visualization. This will ensure you get the best possible performance from the SiteVision app.

- Consider rationalizing a large number of layers by combining information to provide more control during the visualization. CAD data will often be spread across many hundreds of layers, however a large number of layers can be difficult to manage during a visualization.

> **NOTE –** You can also use the SiteVision Manager to control default visibility of CAD layers.

- Check for 0, or -9999 elevation data. SiteVision operates in a fully 3D environment; if your data has inconsistent or erroneous elevation information it will not present well.
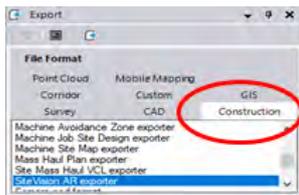
Using Trimble Business Center

Trimble Business Center is a highly versatile tool for preparing data for site works and road construction, and is an ideal tool for preparing data for use with SiteVision. It can import data from a broad range of formats, and combine data from different sources such as GIS data from an existing database with topographical surveys and design data.

Trimble Business Center version 5.10 or later has an export option for SiteVision, on the **Construction** export tab.

1. Before you start the export, set up your external services profile so that you can save data remotely on Trimble Connect; select **File** / **Options** / **External Services-Profiles**. Create a service profile for Trimble Connect. For more information refer to the Trimble Business Center documentation.

2. On the **Home** tab, tap **Export**.

3. In the **Export** pane select **Construction**.

4. Select the **SiteVision AR exporter** file format.

5. Using the standard selection tools in Trimble Business Center select the data you want to export.
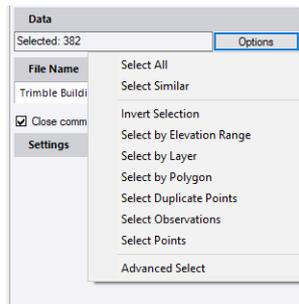
6. When you have selected your data click on the cloud symbol by the file name to save the exported data to Trimble Connect.

7. In the **Save File Remotely** window, select the server location, project, and folder on Trimble Connect and name the file you want to save, then click **Save**.
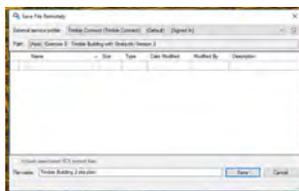
8. At the bottom of the **Export** tab, click **Export**. Trimble Business Center will export the files.

9. In the SiteVision app, tap ☰ / 🏠 **Load Model** / ↻ **Trimble Connect**. Navigate to the project and folder you saved the model to then select the model.

When exporting using the SiteVision AR exporter four files are created and stored in the selected Trimble Connect project folder:

- The Trimble Site Calibration file. If the Trimble Business Center project contains an applied Site Calibration, the exporter creates a .CAL file. For a project without an applied Site Calibration, it creates a .JXL file. Both files include any selected Control Points.

- A VCL file of the selected data for use with other Trimble products such as Siteworks and Earthworks.

- A TRB file, which is the model optimized for high speed visualization performance for use by SiteVision.

- An FXL file, which contains the feature definition library for the project including defined Feature Codes.

SiteVision supports the following elements from Trimble Business Center using the SiteVision AR exporter; exported objects contain attribute information:

- Points

- Lines (including Arcs/Circles)

- Surfaces

- Utilities

- Corridors

- Alignments

> **TIP –** If you want to visualize fully rendered models of pipe networks from Trimble Business Center, export the network as a LandXML file and also export a JXL file with the same name using the Trimble Field Software exporter option.

There are some additional limitations and elements that are not supported by the Trimble SiteVision AR Exporter:

- Grid Lines

- CAD Blocks. These are not supported and not included in the export.

  > **TIP –** If you need to export blocks, you can explode them.

- Point cloud regions. These are not supported and cause the exporter to crash if they are included in the export selection.

- IFC Models are not supported and not included in the export. You can export these separately using the IFC exporter in the **CAD** tab of the **Export** window.

- When an object is selected for export, all dependent objects are also included in the export. For example, if a draped line is exported, the 2D line that defines the draped line is also included in the export (you can explode a draped line to create a discrete, 3d linestring). This also occurs with surfaces if a surface is defined by another surface, e.g. a surface tie or utility trench; all related surfaces will be included in the export.

- Trimble Business Center Utilities Module:

- Utility nodes are treated as a dependent object of a utility pipe run; exporting a pipe will also export the associated nodes.

- Be mindful that some of the 3D blocks used to represent utility nodes can be quite complex. For larger utility networks it may be necessary to select node representations that are geometrically simple, or SiteVision performance may be impacted.

Visualizing cut/fill map images and images

SiteVision allows you to drape images onto surface models using tools in Trimble Business Center. The key elements required are:

- A Trimble Terrain Model (TTM) file containing a model of the surface that you want to drape the image onto.

- A Trimble Site Calibration file (JXL, DC or CAL) to georeference the TTM and images.

- Georeferenced images such as a PGN file with its associate PGW georeference file.

To create the TTM file:

1. Select the **Export** option.

2. Select the **Construction** tab.

3. Select **TTM Exporter**.

4. Select the surface that you want to use for draping.

5. Click the cloud icon and select the Trimble Connect project and folder to place the TMM in.

6. Click **Save** and then **Export**.
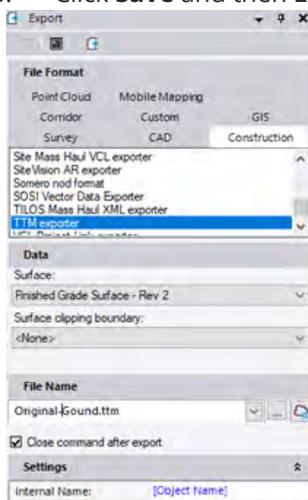
To create the Trimble Site Calibration file if you do not already have one, see Creating a Trimble site calibration file, page 46.

To create a cut/fill image:

1. From the **Surfaces** menu select the **Cut/Fill Map** command.

2. Select the initial surface, which should be your original or existing ground surface.

3. Select you second surface, which should be your design surface.

4. Click **OK**.

5. Press F12 to open the command window and select the **CreatePlotBox** command or enter CreatePlotBox.

6. Define the plot box height, width, and rotation.

7. From the **CAD** ribbon select the **Capture Image** command.

8. Select the image resolution. It is recommended not to exceed 4000 x 4000 pixels.

9. You can calculate the optimal resolution using the following formula:

    ```
    Imperial Units: PlotboxSize x DPI = Pixels

    Metric Units: PlotboxSize x 0.03937 x DPI =
    Pixels
    ```

    where `PlotboxSize` is the larger of Width or Height, and `Pixels` is the resulting size of the image that will be produced.

10. Name the image file to suit and save. This will create a PGN and PGW file. Drag and drop these files into the Trimble Connect project folder where the TTM is stored.

> **NOTE –**
>
> - You can have multiple images stored with the TTM, so if higher resolution is required, create multiple cut/fill map images at higher resolution.
> - The image name becomes the layer name in SiteVision.
> - You can view one layer/image at a time, draped on the surface.
> - Images can be any form of image, such as historical imagery, cut/fill maps, pass count maps, or PDF plans, provided that the images are georeferenced.

For more information see the video *Data prep – TBC 03 – Thematic maps* at the resource page of sitevision.trimble.com.

Using AutoCAD/Civil3D

While DWG is the native data format of Civil3D, Trimble Connect also supports the use of LandXML files. This can be an advantageous data format to use due to the improved support of attribute information compared to traditional CAD formats. A LandXML can be created from Civil3D with the **Export** command.

DWG

1. Drag and drop the DWG file into your selected Trimble Connect project folder.

2. To automatically position the model in the field, create a JXL file (see Using Trimble Business Center, page 57 for details) with the same name as the DWG file and copy this to the Trimble Connect Project folder.

> **NOTE –**
>
> - SiteVision supports DWG versions up to version DWG 2018.
>
> - SiteVision does not support DWG Civil extensions.
>
> - SiteVision has very limited support of geometry generated using ARX extenders and it is suggested to avoid using them in the import model if at all possible.
>
> - To ensure correct model scaling, you should define the INSUNITS parameter in the DWG file to specify the intended unit dimensions.
>
> - If the Trimble Connect import fails, the DWG file might be corrupted. Try running the AUDIT command in AutoCAD to detect and fix any errors.

LandXML

1. Export a LandXML from AutoCAD.

2. Drag and drop the LandXML file into your selected Trimble Connect project folder.

3. To automatically position the model in the field, create a JXL file (see Using Trimble Business Center, page 57 for details) with the same name as the LandXML file and copy this to the Trimble Connect Project folder.
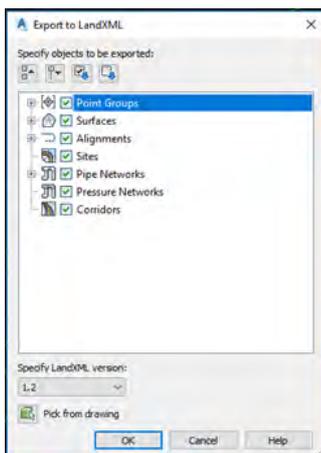
Using Bentley iModels

The recommended workflow for using iModels from Bentley's OpenRoads software is to import the model into Trimble Business Center. Do this using either the iModel file or by creating an external service profile and accessing iModels from ProjectWise. Once the model is in Trimble Business Center export it to Trimble Connect using the SiteVision AR export option.

The alternative workflow for Bentley data is to import a DGN file into Trimble Connect. The DGN file will need to be supplemented with a matching JXL file for automatic placement, or use the measured placement option to accurately georeference the model on site.

> **NOTE –** SiteVision supports version 7 and version 8 of the DGN format.

Alignments: Station and Offset

SiteVision supports the display of the user's current position in terms of **Alignment Station** and **Offset** values. This refers to the distance along the Alignment (Station or Chainage) and the perpendicular distance from the Alignment (Offset). This is a common way to refer to positions when working on linear projects such as roads or railways.

SiteVision supports the display of Station and Offset for Alignments exported from Trimble Business Center that contain the following objects:

- **Horizontal Alignment (HAL)**
    - Line
    - Arc
    - Spiral In*
    - Spiral Out*
    - Combining Spiral*

        *Important: Only transition spirals of Type: Clothoid are supported

- **Vertical Alignment (VAL)**
    - Grade Break
    - Symmetrical Vertical Curve
    - Vertical Curve

> **NOTE –** Station Equations defined in Trimble Business Center are also supported, and Station values will be calculated on the basis of these Station Equations.

SiteVision also supports the display of Station and Offset for Alignments in LandXML 1.2 format. A LandXML file can be uploaded to Trimble Connect and loaded directly within SiteVision. **Important: Only Clothoid transition spirals are supported.**

Working with feature codes

SiteVision supports the use of Feature Codes to assist with consistent and organized capture of field data. Feature Codes are contained within a Trimble Feature Library, a text file with an FXL extension that contains the definitions of feature codes, attributes, linework and symbology, and control codes.

To add a Feature Library to SiteVision, the FXL file must be placed alongside the model in the same way you would with a calibration file.

> **NOTE –** Unlike calibration files, an FXL file does not need to exactly match the model name, it will be applied to any model in the same folder.

When working with data on Trimble Connect, simply place the FXL file in the same folder as the model you are working with. When you load the model the FXL file is automatically downloaded to your device.

When working with a model on your local device, you can manually copy the FXL file to the model folder. An example folder structure on an Android phone using the existing Sample Model is the following:
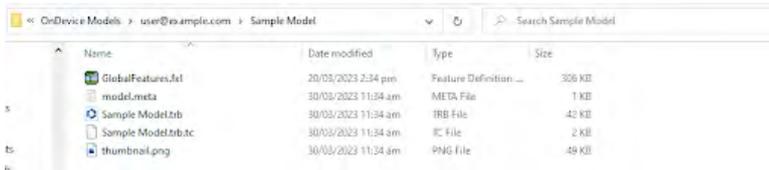

Note the location depends on your phone operating system:

- Android: Phone\Internal\storage\Android\data\com.trimble.sitevisionAR\files\OnDevice Models\user@example.com\Sample Model\

- iOS: Files app under Trimble SiteVision\OnDevice Models\user@example.com\Sample Model\

> **TIP –** Publishing a model from Trimble Business Center using the SiteVision AR Exporter will automatically detect and publish any associated Feature Library.

Assigning Feature Codes in the field

When SiteVision detects an FXL file is present, it changes the input code field within the measure point dialog to a multi-select dropdown. This dropdown can be used to select and assign feature codes to this measurement. Alternatively, you can type in existing or custom codes.
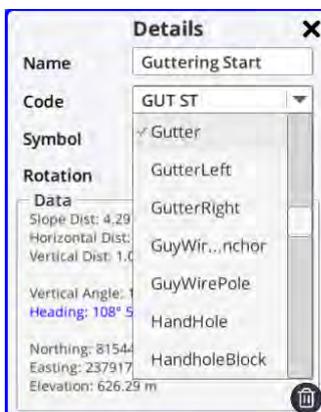

> **NOTE –** It is possible to select and apply more than one feature code by simply selecting more than one option.

Take some measurements and apply your feature codes. For example, Sidewalk (SW) and Start Line (ST).

After synchronizing the measurements and importing the CSV measurements into Trimble Business Center (see Syncing measurements for sharing in the office, page 151) you can see the Feature Codes have been applied to the captured points.
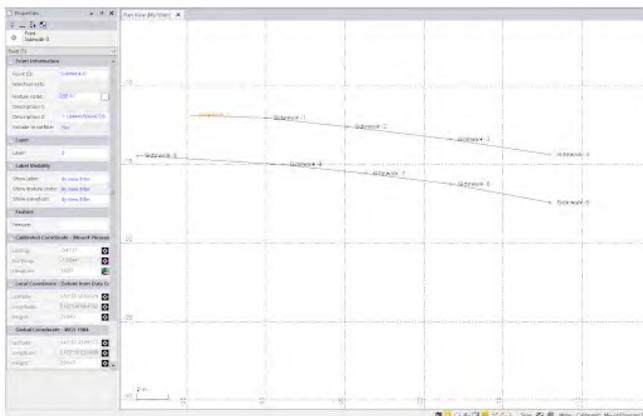
Feature Code custom symbols

SiteVision also supports combining Features Codes with custom symbols. Once correctly configured, measuring a point and assigning a Feature Code will result in a 3D Symbol being automatically applied.

To enable this capability the following requirements must be met:

- A 3D sketchup model of a symbol must be created and imported to the Symbols folder on your device (see Creating and importing custom symbols, page 85):
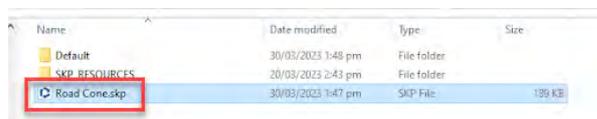
- The Feature Library FXL file must contain a Feature Definition with both a Feature Code and applied Symbol:
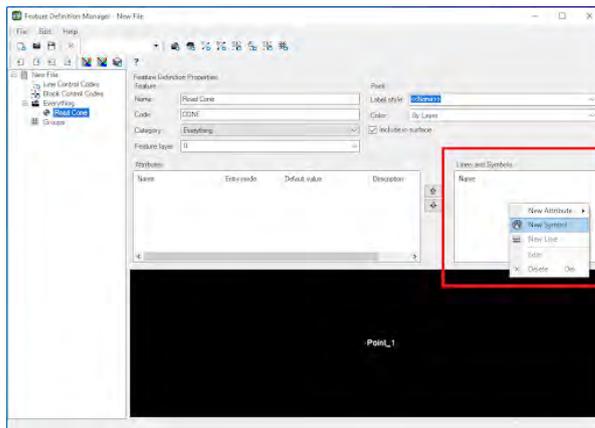
> **NOTE –** Use the Feature Definition Manager to configure and edit your Feature Library if needed

- Finally, the names of the feature library Symbol and the sketchup model custom symbol must match:
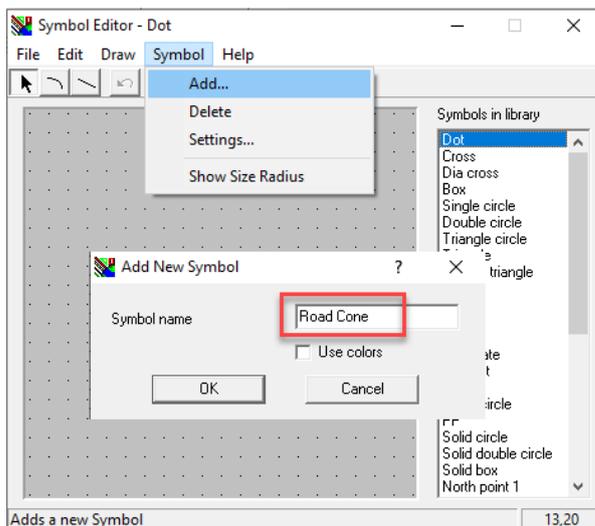
> **TIP –** If you are creating a new symbol you will need to add a drawing to your new symbol otherwise it will not be able to be assigned to a Feature Code.

Once this configuration is complete, measure a point and assign the feature code. The 3D custom symbol is automatically selected:
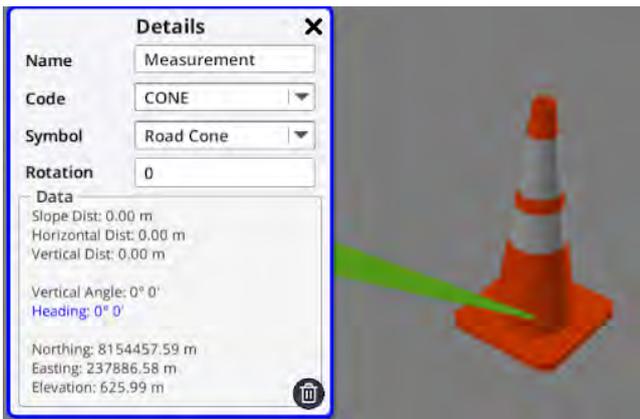
NOTE – The selected symbol can still be changed and overridden, and any subsequent measurements will use this overridden symbol.

Workflows for GIS professionals

SiteVision is a great tool for creating value from your investment in building a GIS database, allowing users to accurately visualize data from the GIS in the field.

SiteVision supports both Esri format Shapefile and File Geodatabase data uploaded to a Trimble Connect Maps workspace, or direct connection to a compatible OGC web feature service, or Esri feature service for streaming of online data.

Different GIS users configure and capture their GIS data in different database structures. If the data is complete, and structured in a suitable way, SiteVision can present the information as a fully modelled 3D representation of the GIS data. This is done using the SiteVision Manager that analyzes the attribute information such as pipe type, pipe depth, and pipe diameter, or tree type, height, and spread to create the model. Symbols for point features are customized by creating SketchUp models to represent the feature type and applying rules to scale the models.

Not all GIS systems have complete information or adequate data on height/depths. In these cases, SiteVision can either drape the 2D data on a supported surface model, or present the information as a 2D layer drawn approximately at ground level. This approach allows users to simply locate the assets with SiteVision, in a manner similar to having a locating crew paint the service locations on the road.

Preparing Esri file data

Esri format Shapefile and File Geodatabase data must be uploaded to a Trimble Connect Maps workspace. See Getting started with GIS data, page 35 for instructions on how to upload this data to a Trimble Connect Maps workspace ready to view in SiteVision.

Supported Feature Classes

SiteVision supports the following Esri Feature Class types:

- Line
- Point
- Polygon
- Multipoint

NOTE – SiteVision does not support Multipatch Feature Class types. However you can use the Export to CAD command within ArcGIS to save these as a DWG which is supported by SiteVision.

2D data

SiteVision supports 2D Esri data. When 2D data is detected, SiteVision by default displays the data on a horizontal plane located 1.5 m below the APC of the SiteVision unit. For typical handheld use in flat areas this places the data close to the ground surface.

For more accurate visualization of 2D Esri data, you can also drape the data by combining it with a Trimble Terrain Model (TTM) file (see Draping 2D Esri data, page 71 for more information) or applying attribute based elevations with the SiteVision Manager.

3D data

SiteVision also supports 3D Esri data. When 3D data is detected, SiteVision by default treats the Z values as absolute elevations and displays the features at the appropriate elevation.

You can alter this behavior by defining rules using the SiteVision Manager, so it is possible to differentiate between e.g. ground surface, pipe invert, or depth below ground.

Coordinate systems

SiteVision supports Esri data in most common published coordinate systems, including both Geographic and Projected coordinate systems. When you create a Trimble Maps workspace you will be prompted to set the Map workspace coordinate system.
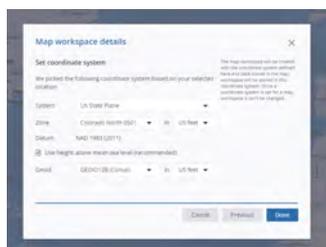
> **NOTE –** If the coordinate system of your data does not match the coordinate system of your Trimble Maps workspace, then Trimble Maps will attempt to convert your data when you upload it.

Height Above Mean Sea Level

Select this option if your data has been captured in terms of a Geoid model. If this setting does not match, your data may display at the incorrect height. Note that this setting will only apply if your Esri data is 3D.

Unsupported coordinate systems

Trimble Maps contains an extensive database of published coordinate systems. If however your data is in an unsupported coordinate system, a message will display indicating this.

> **NOTE –** Given the variability in how GIS users configure their data, if you experience difficulty with getting your data to visualize correctly, Trimble recommends that you engage the services of a suitably qualified consultant such as a Trimble distribution partner's GIS consulting services team to assist in the configuration of your workflow.

Draping 2D Esri data

To enhance the visualization of 2D Esri data, you can drape the data on a 3D surface. This is particularly helpful in areas where the terrain is sloping or undulating—points and lines will follow the natural shape of the land rather than resting on a horizontal plane.

Currently SiteVision only supports surface draping with a Trimble Terrain Model (TTM), which is a vector based TIN surface. Only 2D Esri data can be draped. 3D Esri data (or 2D data that has had 3D elevations assigned by the SiteVision Manager) will not drape, and is always displayed based on the elevation contained within the data.

> **NOTE –** If you experience unexpected behavior with data draping, check your data is in fact 2D. 3D data with '0' value elevations can easily be mistaken for 2D data.

Draping data on a TTM surface

To enable draping the TTM file must be placed into the same folder on Trimble Connect as the Tmap containing your Esri data, with the matching file name. The TTM data must be in the same coordinate system as the Esri data.
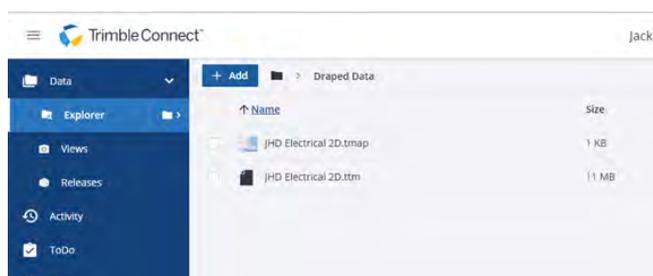
Viewing your draped data in SiteVision

When you view the draped model in SiteVision, the Esri data displays draped in 3D, while the TTM surface is invisible so will not be displayed.

1. Open Sitevision.
2. Select **Load Model**.

3. Navigate to the location of your Esri data.

4. Select the Esri data and tap .

Configuring a GIS feature service connection

GIS data can be loaded directly from a compatible OGC web feature service, or Esri feature service. See Web Feature Service connections, page 37 for instructions on how to use SiteVision Manager to set up and configure this feature service connection.

> **NOTE –** An internet connection is required to view and load Feature Service data.

Supported data types

SiteVision supports feature service data delivered in the following output formats:

- GeoJSON
- GML v2
- GML v3
- GML v3.2

The following data types are supported for each format:

GeoJSON	GML
linestring	linestring
polygon	polygon
multilinestring	curve
multipolygon	surface (boundary only)
point	multilinestring
xyzpoint	multipolygon
	multicurve
	multisurface (boundary only)
	point
	multipoint

Feature Service authentication

SiteVision supports a range of Feature Service authentication options. While many publicly available Feature Services will have no authentication requirements, this area can be quite technical to set up and configure.

The expectation is that you will need to contact your Feature Service provider so they can supply you with the correct URLs and credentials.

To specify the authentication approach, in the **Account** panel select the appropriate **Login Type** from the dropdown:
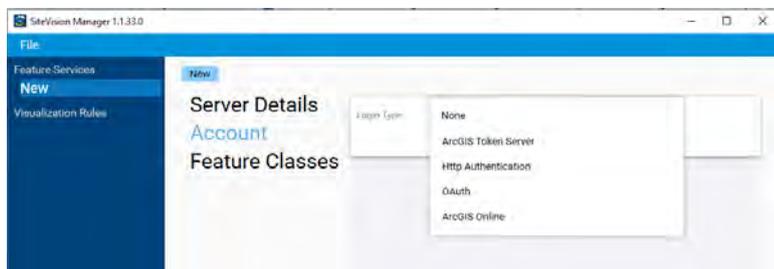
- **None**: Many Feature Services do not require any authentication.

- **ArcGIS Token Server**: Requires an Account Name and Password, and a Token Server URL. Leaving the field blank will prompt the input of this information when the WFS is loaded in SiteVision.

- **Http Authentication**: Requires an Account Name and Password. Leaving the field blank will prompt the input of this information when the WFS is loaded in SiteVision.

- **OAuth**: Requires quite extensive inputs, contact your OAuth service provider for these details.

- **ArcGIS Online**: Effectively a pre-populated OAuth connection, this may require some server side configuration to allow SiteVision to successfully connect.

> **NOTE –** In the case of both **ArcGIS Token Server** and **Http Authentication** it is possible to supply a username/password either as part of the WFS configuration, OR by leaving these fields blank, SiteVision will prompt the user to supply this information when they attempt to load the .WFS file. This allows a company to choose between a common shared login across all their users (so they don't need to manage individual credentials), OR the improved security associated with each individual user being required to login and have access provided to each feature service at an individual level.

After inputting the appropriate credentials the **Test** option can be used to confirm receipt of a valid login token. A valid response will display a ⊘ icon.

> **NOTE –** For an OAuth (or Esri Online) login, after selecting **Fetch** you will be prompted to input your login credentials to proceed.

Advanced configuration options

There is a wide variety of server side configurations available when establishing an OGC web feature service. While the vast majority of these configurations are handled, there are advanced options available in SiteVision Manager that may be required based on the server settings.

> **NOTE –** While the default configuration should work in most instances, if you receive an error message indicating there is no WFS data available at your location this may be an indication that these settings need to be changed.

To access the advanced settings, click **More** at the bottom of the **Server Details** panel.

- **BBox Type**: This setting controls the format and order of the coordinates used by the BBox (bounding box) function. It can be common for older OGC WFS (v1.1.0) to require BBox coordinates in a reversed Latitude, Longitude coordinate order.

- **Send BBox EPSG**: Determines if the BBox coordinate EPSG is appended to the BBox fetch request. It should be very uncommon that this setting would need to be adjusted.

- **Invert Axis Order**: Enabling this reverses the coordinate order of received feature data. This is a common requirement for OGC WFS that serve data in GML format.

2D data

SiteVision supports 2D Feature Service data. When 2D data is detected, SiteVision by default displays the data on a horizontal plane located 1.5 m below the APC of the SiteVision unit. For typical handheld use in flat areas this places the data close to the ground surface.

3D data

SiteVision also supports 3D Feature Service data. When 3D data is detected, SiteVision by default treats the Z values as absolute elevations and displays the features at the appropriate elevation.

You can alter this behavior by defining visualization rules using the SiteVision Manager, so it is possible to differentiate between e.g. ground surface, pipe invert, or depth below ground.

Coordinate systems

SiteVision will identify the coordinate system of the Feature Service automatically and display your data accordingly. The EPSG code of the coordinate system will be displayed in the Model Information window.

Important: SiteVision does not support Feature Services that deliver data in the Pseudo-Mercator (EPSG 3857) coordinate system.

As with any other SiteVision model it is also possible to apply a Trimble Site Calibration file (JXL, CAL, DC). Calibration files can be helpful in the following cases:

- Transform data in Lat/Long to a cartesian coordinate system

- Apply a different or custom Geoid model

- Incorporate a Site Calibration to adjust for a local height datum or control network

> **NOTE –** Given the variability in how GIS users configure their data, if you experience difficulty with getting your data to visualize correctly, Trimble recommends that you engage the services of a suitably qualified consultant such as a Trimble distribution partner's GIS consulting services team to assist in the configuration of your workflow.

Defining data display rules: using the SiteVision Manager

Use the SiteVision Manager to tell SiteVision how to interpret and display your data.

When defining your rules, it is important to understand your data set and how the data was collected, particularly with regard to depths and elevations. This enables SiteVision to vertically offset geometries correctly, placing objects on the ground or at the correct depth below ground level.

To install the SiteVision Manager, download it from the SiteVision website and install it on your office computer.

To launch the SiteVision Manager, click the SiteVision Manager icon on your desktop.

> **TIP –** You can also download sample Rules files.

To exit the SiteVision Manager, click **File** / **Exit** or click **X** in the top right corner.

Overview

The app has:

- three Rules panels—Feature Class, Attribute, and Discrete
- two Display Style panels—Points and Lines.

Feature Class	**Feature Class** rules allow you to specify how you want SiteVision to display your feature classes. To enable SiteVision to vertically offset geometries correctly, you will need to know how the data was collected to configure these rules. You can also apply a style (a symbol, or a color) to a feature class, and set it to display or be hidden. If your **Feature Class** rules meet your data interpretation and display requirements, you do not need to define **Attribute Rules** or **Discrete Rules**, or configure **Point Styles** and **Line Styles**. You do not need to define **Feature Class** rules if you define **Attribute Rules** and / or **Discrete Rules** that meet your requirements.
Attribute Rules	**Attribute Rules** define how the attributes within a feature class are interpreted in SiteVision. You can define **Attribute Rules** as well as **Feature Class** rules to further specify how you want SiteVision to display your data.

	You can define only **Attribute Rules**; if they meet your data interpretation and display requirements, you do not need to define **Feature Class** rules or **Discrete Rules**, or configure **Point Styles** and / or **Line Styles**. However if you use the `Feature Display Style` option when defining your **Attributes Rules**, you must have **Point Styles** and/or **Line Styles** defined.
	EXAMPLE – You have two feature classes that both have Pipe_Diameter as an attribute type, and the Pipe_Diameter attribute has different units in each of the feature classes. You want to distinguish between the same attribute Pipe_Diameter on the different feature classes, so you would define two **Attribute Rules**, and select the **On Feature class** option and specify the feature class name for each of the rules.
	You do not need to configure **Point Styles** and / or **Line Styles**, but if you define **Attribute Rules** using the **Attribute Use** = `Feature display style` option, you must define **Point Styles** and / or **Line Styles**.
Discrete Rules	**Discrete Rules** allow you to define rules that apply to specific attribute values within a feature class.
	If your **Discrete Rules** meet your data interpretation and display requirements, you do not need to define **Feature Class** rules or **Attribute Rules**.
	You do not need to configure **Point Styles** and / or **Line Styles** if the default values meet your display requirements.
Point Styles	Use **Point Styles** to define your own point styles to use with **Attribute Rules**, **Discrete Rules** and/or **Features Class** rules. Apply a symbol to the style, and if required, a scale.
	• For use with **Attribute Rules**, create a point style which is named the same as an attribute value in your imported data. When you create your Attribute rule, select the attribute that contains the value that matches your point style name, then under **Attribute Rules**, select **Attribute Use** = `Feature display style`.
	EXAMPLE – If you have an attribute named Species, and its values are Pine and Birch, you can define a point style named Pine another one named Birch, and an **Attribute Rule** for the Species attribute with **Attribute Use** = `Feature display style` to apply the style. Pine trees are shown as the Pine point style and Birch trees are shown as the Birch point style.
	• For use with **Discrete Rules** and **Feature Class** rules, you can name the point style anything you like. When you create your rule, under `Display style`

	select from the dropdown the point style you have created.
Line Styles	Use **Line Styles** to define your own line styles to use with **Attribute Rules**, **Discrete Rules** and/or **Features Class** rules. Apply a line profile to the style, and if required, a color. • For use with **Attribute Rules**, create a line style which is named the same as an attribute value in your imported data. When you create your Attribute rule, select the attribute that contains the value that matches your line style name, then under **Attribute Rules**, select **Attribute Use** = `Feature display style`. EXAMPLE – If you have an attribute named Material, and its values are PVC and Concrete, you can define a line style named PVC another one named Concrete, and an **Attribute Rule** for the Material attribute with **Attribute Use** = `Feature display style` to apply the style. PVC lines are shown as the PVC line style and Concrete lines are shown as the Concrete line style. • For use with **Discrete Rules** and **Feature Class** rules, you can name the line style anything you like. When you create your rule, under `Display style` select from the dropdown the line style you have created.

About Rules files and ordering of rules

When you define rules, save the file as a *.rules.json file type. The file must be stored:

- either in the Trimble Connect folder alongside the model data. It must be in the same folder, but the model and the Rules file do not have to have the same name.

- on your mobile device in the *Internal shared storage\Android\data\com.trimble.sitevisionAR\files\Config* directory. The model and the Rules file do not have to have the same name.

If you have Rules files in Trimble Connect, and also on your mobile device, the Rules files on the mobile device are ignored.

The order of your rules is important:

- If you have multiple rules files, the rules are applied based on the Rule type first: Discrete Rules first, followed by Attribute Rules, followed by Feature Class rules. Within these three categories, the rules are then sorted alphabetically based on their file name.

- the rules are applied to your data in the order that they are listed in the Rules file.

- Within a Rules files, the following hierarchy applies—if you have an Attribute rule that competes with a Discrete rule within the same Rules file, then the Discrete rule takes precedence. So if a feature matches both rules, only the Discrete rule is applied to the feature, but if the feature only matches the Attribute rule, the Attribute rule is applied.

Values that you type in when defining your rules are not case-sensitive.

Working with Rules files in the SiteVision Manager

To load an existing Rules file, click **File** / **Open...** and navigate to the required file. Select the Rules file to load it into the SiteVision Manager. The file path and name shows at the top of the window.

To create a new Rules file, click **File** / **New**. Note that you can start a new Rules file if you already have a Rules file open; the new Rules file becomes the active file.

To save changes you have made to an existing open Rules file, or to save a new Rules file you have created, click **File** / **Save**.

To save an existing open Rules file as a new file, click **File** / **Save As...** and give the file a new name.

Within each of the rules panels you can:

- re-order the rules. Click the Up / Down priority arrows in the top right corner of an item to move it up or down.

  The order of the rules within each rule type (Feature Class, Attribute, and Discrete) controls the priority of the rules—i.e. the order in which they are applied / which rule is applied.

  > **EXAMPLE –** You have two feature class rules; one to display the feature class Wastewater as blue, and another to display all feature classes as orange.
  >
  > - If the Wastewater=blue rule is above the other rule, it will be applied to the feature class Wastewater and color them blue, and then the second rule will be applied to color the remaining feature classes orange.
  > - If the feature classes = orange rule is above the Wastewater=blue rule, it will be applied to all feature classes, including the feature class Wastewater, and color them orange.

  > **NOTE –** The order of your Point Styles and Line Styles is not important, unless you have inadvertently defined a style with the same name. However ordering Point and Line Styles allows you to group similar styles together, which is useful to help manage the task of creating and maintaining a large style library.

- delete a rule. Click the trashcan icon in the top right corner of an item to delete it.
- define more rules. Click at the bottom of the window.

Defining Feature Class rules

In the **Feature Class** panel, specify the height that your data describes and any potential styles to apply to the entire feature class/dataset.

1. In the **Feature class** field:

   a. Select an operator from the dropdown:

      - `Equals` - an exact match, useful to define a rule for a particular feature class name.

      - `Contains` - a partial match, useful to define a rule for any feature classes that are similarly named.

      - `Starts with` - useful to define a rule for any feature classes with names that start the same.

      - `Ends with` - useful to define a rule for any feature classes with names that end the same.

      - `Wildcard` - use wildcards (* or ?) along with your search text to widen the match results. * represents any number of characters; ? represents one character.

        > **EXAMPLE –**
        >
        > - If you enter P*, all attribute starting with P are matched regardless of word length (e.g. PVC, Pipe diameter, Point).
        >
        > - If you enter P??e, only attributes containing four letters, starting with P and ending with e are matched (e.g. Pipe, pole, pane).

      - `Matches everything` - use this to define a catch-all rule, that applies to everything that doesn't match any rules defined above it. Using this option only makes sense when you define it as the last rule, to catch all 'other' feature classes that are not matched by any of the previous rules. This operator is mainly useful to turn off visibility.

   b. For all operators other than `Matches everything`, type in the feature class name, or part of it depending on your selected operator, that you want to define the rule for.

2. Specify the **Geometry height**. You will need to know how the geometry was collected / surveyed, and select the correct option here so that SiteVision can correctly manage the geometry's vertical offset.

3. Select a **Display style** if required; from the dropdown select a symbol or a color to instruct SiteVision how to display the entire feature class.

4. Toggle the **Visible** switch on or off to set the feature class to display or be hidden as required.

   > **NOTE –** If you set the **Visible** switch to off, the layer in SiteVision will be hidden. You can turn visibility on in SiteVision using the Layers visibility switch. See Viewing a model, page 121 for more information.

Defining Attribute rules

In the **Attribute Rules** panel, define rules to specify how SiteVision interprets your data and displays a feature's attributes.

1. In the **Attribute** field:

    a. Select an operator from the dropdown:

    - `Equals` - an exact match, useful to define a rule for a particular attribute name.

    - `Contains` - a partial match, useful to define a rule for any attributes that are similarly named.

    - `Starts with` - useful to define a rule for any attribute names that start the same.

    - `Ends with` - useful to define a rule for any attribute names that end the same.

    - `Wildcard` - use wildcards (* or ?) along with your search text to widen the match results. * represents any number of characters; ? represents one character.

        > **EXAMPLE –**
        >
        > - If you enter P*, all attribute starting with P are matched regardless of word length (e.g. PVC, Pipe diameter, Point).
        >
        > - If you enter P??e, only attributes containing four letters, starting with P and ending with e are matched (e.g. Pipe, pole, pane).

    - `Matches everything` - use this to define a catch-all rule, that applies to everything that doesn't match any rules defined above it. This operator is mainly useful to turn off visibility.

        Using this option only makes sense when you define it as the last rule, to catch all 'other' attributes that are not matched by any of the previous rules, unless you are defining the rule for a specific feature class (see step 2)—then this rule does not have to be the last rule.

    b. For all operators other than `Matches everything`, type in the required attribute name, or part of it depending on your selected operator, that you want to define the rule for.

2. Define the rule to apply to the selected attribute(s) for any feature class that contains the attribute(s), or for a specific feature class only:

    - to specify a feature class, make sure the `On Feature class` dropdown is set to `On Feature class` and type in the required feature class name.

    - to define the rule on all feature classes with the selected attribute, click the `On Feature class` dropdown and select `On any Feature class`.

3. Select an **Attribute Use** to tell SiteVision how to interpret the attribute data.

    The default type is `Not specified`—the feature will be displayed as a line or simple point depending on the data, and without any interpretation applied. To select a use, tap the dropdown:

    - `Feature display style`. Select this option if you have a point or line style defined for an attribute value for the attribute that you entered at step 1. SiteVision uses the point / line style settings that match attribute values for the selected attribute. See Defining Point Styles

and Defining Line Styles below.

> **TIP –** You can enter an attribute value here, and then define the Point or Line style later using the same name.

- `Attribute value layers`. Select this option to use the attribute value to create sub-layers. The sub-layers are named the same as the attribute values.

  > **EXAMPLE –** A feature class named Pipe would, by default, place all its features into a Pipe layer. If the Pipe feature class has an attribute named Material, and you define a rule for this attribute with **Attribute Use** set to `Attribute value layers` you would instead get layers labeled with the values of the Material attribute (e.g. Concrete, Steel, PVC, etc.).

- `Symbol scale`, `Horizontal symbol scale`, `Vertical symbol scale`. The attribute value will be applied as a scale factor, either horizontally and vertically, or only horizontally or only vertically. Note that this scale is applied multiplicatively along with any scale applied when defining the Point Style.

  > **EXAMPLE –** An attribute named Tree diameter might be used to scale a tree symbol to draw it correctly. However to achieve the desired scaled size, the original size of the tree symbol must be considered. e.g. a 2 m wide tree symbol scaled by an attribute value of 2.5 will be drawn 5 m wide.

- `Symbol rotation`. Rotates the symbol by the attribute value, in degrees from north.

- `Point Feature, depth`. Sets the point feature's depth from 1.5 m below the SiteVision Integrated Positioning System.

- `Point Feature, elevation`. Sets the point feature's geometry elevation.

  > **EXAMPLE –** If you have a 2D point feature class representing the location of manholes, you can use this rule to define an elevation contained in the attribute table to set the elevation of each manhole, so that they display in the correct 3D position.

- `Pipe options`. Select the option that describes how the pipe data was recorded, then select the unit of measurement from the dropdown. You will need to know how the pipe's geometry was collected / surveyed, and select the correct option here so that SiteVision can correctly position the pipe.

  - Pipe depth sets the polyline feature class depth from a reference point of 1.5 m below the SiteVision Integrated Positioning System when the data is 2D. With 3D data, a depth rule will modify the z value geometry of the polyline features, IF the feature class geometry height is set to Ground. If the geometry height is set to any of the other 4 options, a depth or elevation rule on 3D data will have no effect.

- Pipe elevation sets the polyline feature class depth from sea level, regardless if the data is 2D or 3D. Likewise, if the geometry height within the feature class rule is set to anything other than Ground, a depth or elevation rule will have no effect.

- Pipe external diameter, pipe internal diameter, and pipe thickness. When you use either of the diameter options within a rule, the associated feature class will display it as a pipe (rather than a line) , including and overriding any feature classes that have a line style associated with them that specify their profile as Line.

  If you specify the external diameter + either the internal diameter or the thickness, SiteVision will only draw the external diameter (and not the internal diameter/thickness). If you specify internal diameter + thickness, and not external diameter, SiteVision will calculate the external diameter appropriately.

> **TIP –** You can define sloping pipes based on an upstream and downstream elevation/depth.
>
> This requires two Attribute Rules to be created, each referencing the appropriate upstream and downstream attribute. The order of these Attributes Rules must match the direction of the pipe feature.
>
> For example, a pipe is defined with an upstream invert depth attribute (upstr_id) of 2.5 m, and a downstream invert depth (dwnstr_id) attribute of 2.8 m. The pipe feature is drawn in the direction upstream to downstream. To correctly visualize this pipe the first Attribute Rule will contain: Attribute Equals upstr_id and SiteVision type Pipe invert, depth. The second Attribute Rule will contain: Attribute Equals dwnstr_id and SiteVision type Pipe invert, depth.
>
> For this approach to work all pipes features on the affected feature class must have been created in a consistent direction.

> **NOTE –** The priorities of the rules (see using the up and down arrows, above) mean that an attribute can be interpreted only once by the SiteVision Manager. For example:
>
> - if you have a rule that specifies the attribute Depth to be "top of pipe elevation in meters", and then another rule that specifies Depth to be "bottom of pipe depth in cm", the rule that appears higher in the rules list will be the only one applied.
>
> - if you have multiple rules using that same attribute value that specify which *feature class* the rule applies to, then all of the relevant rules will apply. For example, one rule = Depth is "top of pipe depth in cm" on feature class Wastewater, and another rule = Depth is "top of pipe depth in m" on feature class Watersupply

4. Toggle the **Visible** switch on or off to set the attribute to display or be hidden as required.

> **NOTE –** If you set the **Visible** switch to off, when you tap a feature in SiteVision, the attribute will be hidden in the Attributes pop-up. You cannot turn visibility on for the attribute in SiteVision. See Interacting with a model's features, page 124 for more information on the Attributes pop-up.

Defining Discrete rules

Use **Discrete Rules** to define styles that the SiteVision app applies to attribute values in your imported data. The first style that matches an attribute's value is used to display the object.

Can use standalone. Can also not use at all.

To define a Discrete Rule:

1. In the **Attribute** field, select an operator from the dropdown and type in the required attribute name, or part of it depending on your selected operator, that you want to define the rule for. The available operators are:

   - `Equals` - an exact match, useful to define a rule for a particular attribute name.

   - `Contains` - a partial match, useful to define a rule for any attributes that are similarly named.

   - `Starts with` - useful to define a rule for any attribute names that start the same.

   - `Ends with` - useful to define a rule for any attribute names that end the same.

   - `Wildcard` - use wildcards (* or ?) along with your search text to widen the match results. * represents any number of characters; ? represents one character.

     EXAMPLE –

     - If you enter P*, all attribute starting with P are matched regardless of word length (e.g. PVC, Pipe diameter, Point).

     - If you enter P??e, only attributes containing four letters, starting with P and ending with e are matched (e.g. Pipe, pole, pane).

   - `Matches everything` - use this to define a catch-all rule, that applies to everything that doesn't match any rules defined above it. This operator is mainly useful to turn off visibility.

     Using this option only makes sense when you define it as the last rule, to catch all 'other' attributes that are not matched by any of the previous rules, unless you are defining the rule for a specific feature class (see step 2)—then this rule does not have to be the last rule.

2. Define the rule to apply to the selected attribute(s) for any feature class that contains the attribute(s), or for a specific feature class only:

   - to specify a feature class, make sure the `On Feature class` dropdown is set to `On Feature class` and type in the required feature class name.

- to define the rule on all feature classes with the selected attribute, click the `On Feature class` dropdown and select `On any Feature class`

3. **When value**. Select an operator from the dropdown and then type the attribute value, or part of it depending on your selected operator, you wish to target the rule with. The operators are:

   - `Equals` - an exact match, useful to define a rule for a specific attribute value.

   - `Not equal` - selects everything that does not match the attribute's value.

   - `Less than` - useful to define a rule specifying a minimum value for any numeric attribute values.

   - `Greater than` - useful to define a rule specifying a maximum value for any numeric attribute values.

   - `Contains` - a partial match, useful to define a rule for any attribute values that are similar.

   - `Starts with` - useful to define a rule for any attribute values that start the same.

   - `Ends with` - useful to define a rule for any attribute values that end the same.

4. **Display style** - From the dropdown, select the style that you want to apply to the feature containing the specified attribute value. You can select symbols, colors, or point / line styles that you have defined.

> **TIP –** Start typing in the field to jump to the style you want to use.
>
> **TIP –** You can enter a name here, and then create / define the Point Style or Line Style later using the same name.

Defining Point styles

Define **Point Styles** to use in conjunction with **Attribute Rules**, **Discrete Rules** and /or **Feature Class** rules to configure how your points will display in SiteVision using symbols and, if required, a scale.

You can define a **Point Style** first, then select it when you define your rule, or define your rule first then create the **Point Style**:

- For use with **Attribute Rules**, create a point style which is named the same as an attribute value in your imported data. When you create your Attribute rule, select the attribute that contains the value that matches your point style name, then under **Attribute Rules**, select **Attribute Use** = `Feature display style`.

  > **EXAMPLE –** For an attribute Feature Type with values "hydrant", "water valve", "storm-water grate" etc., name your point styles "hydrant", "water valve", "storm-water grate" etc. The SiteVision Manager will then match these attribute values to the equivalent point style.

- For **Discrete Rules** and **Feature Class** rules, you can name the point style anything you like. When you create your rule, under **Display style** select from the dropdown the point style you have created, or if you have not yet created the point style, type in the name that you will use to create the point style.

1. Click **Point Styles**, and enter a name for the style.

2. Select a **Symbol file** to represent the point.

> **TIP –** Start typing in the field to jump to the Symbol file you want to use.
>
> **TIP –** You can create your own symbols. See Creating and importing custom symbols, page 85.

3. Optionally, specify at what scale the point will display. For example, 0.5 to display the symbol at half its size, or 2 to display it at twice its size.

Defining Line styles

Define **Line Styles** to use in conjunction with **Attribute Rules**, **Discrete Rules** and /or **Feature Class** rules to configure how your lines will display in SiteVision using a line profile and a color.

You can define a **Line Style** first, then select it when you define your rule , or define your rule first then create the **Line Style**:

- For use with **Attribute Rules**, create a line style which is named the same as an attribute value in your imported data. When you create your Attribute rule, select the attribute that contains the value that matches your line style name, then under **Attribute Rules**, select **Attribute Use** = `Feature display style`.

  > **EXAMPLE –** For an attribute Pipe Material with values "PVC", "Steel", "Concrete" etc., name your line styles "PVC", "Steel", "Concrete" etc. The SiteVision Manager will then match these attribute values to the equivalent line style.

- For **Discrete Rules** and **Feature Class** rules, you can name the line style anything you like. When you create your rule, under **Display style** select from the dropdown the line style you have created, or if you have not yet created the line style, type in the name that you will use to create the line style.

1. Click **Line Styles**, and enter a name for the line style.

2. Select a line profile to represent how the line is displayed (Line or Pipe).

3. Optionally, specify a color for the line style. If you don't specify a color, the color is as specified in Trimble Connect.

> **TIP –** Start typing in the field to jump to the color you want to use.

Creating and importing custom symbols

When you use SketchUp to create a new symbol, make sure the model is centered on the origin, including within the components or groups.

The default symbols are always updated when SiteVision starts.

Do not change the default symbol files; instead create your own symbols. If required, you can copy a default symbol to use as a base to create your own. If you edit the default symbols, your changes will be overwritten when the default symbols are updated when SiteVision starts.

To create your own symbols:

For SiteVision on Android

1. Design a symbol using Trimble SketchUp or download one using SketchUp 3D Warehouse.

2. Save the model as a .SKP

3. Connect your device to your PC and navigate to yourDevice/Android/data/com.trimble.sitevisionAR/files/Symbols.

4. Copy-paste your symbols into this folder.

For SiteVision on iOS

1. Design a symbol using Trimble SketchUp or download one using SketchUp 3D Warehouse.

2. Save the model as a .SKP

3. Connect your device to your Mac, or use iTunes to navigate to On My iPad/Trimble SiteVision/Symbols.

4. Copy-paste your symbols into this folder.

For SiteVision Manager on Windows

1. After placing the .SKP model file on your device, if you wish to use this custom symbol with any SiteVision Manager rules, you need to copy the .SKP to your Windows computer.

2. Navigate to Windows (C:) \ Program Files \ Trimble SiteVision Manager \ Symbols, and insert your new symbol into this folder. Your new symbol will now be included within the Display Style list in the SiteVision Manager.

3. Follow the instructions in Using the SiteVision Manager to allocate the new symbols to Attributes.

# Capturing data with the Trimble TerraFlex software

Trimble TerraFlex® software provides a GIS data capture workflow to capture new data or update an existing GIS database. Using Trimble Connect Maps this workflow integrates seamlessly with SiteVision for accurate visualization of the captured data.

When capturing new data in TerraFlex, you can define a template in Trimble Connect Maps to collect all the required attribute information. These attributes can in turn be used to drive SiteVision visualization rules .

Using SiteVision to review data captured or updated with TerraFlex is a great way to perform quality assurance checks on updates to your GIS system.

Creating and capturing data with TerraFlex

1. Start by creating a Project template and forms in Trimble Maps workspace

2. Start a Trimble Connect Project.
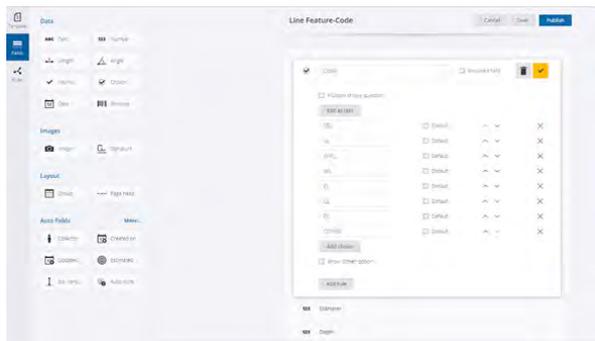
3. Create a Map Workspace.
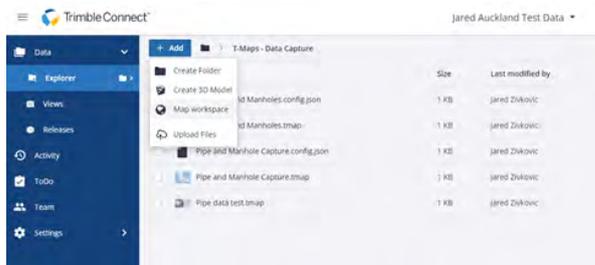
4. Name and add a description to your new Map Workspace.

5. From the menu click **+** then **New Template**.
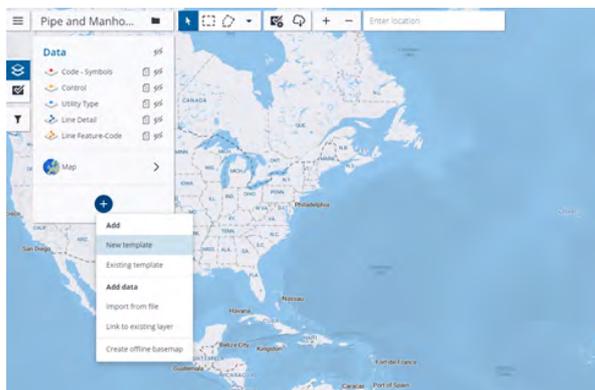
6. Change the lines to be **Lines Feature-Code**.

7. Include fields in the template: Attribute Name and Value.

8.   Click **Publish** to save your template.

Use TerraFlex and the project template you created above to collect data.

> **NOTE –** When using TerraFlex with a connected antenna, you can set the antenna height in the **Settings** menu. This is important as TerraFlex captures 3D data and an incorrect antenna height could result in incorrect elevations that will become apparent during a SiteVision visualization.
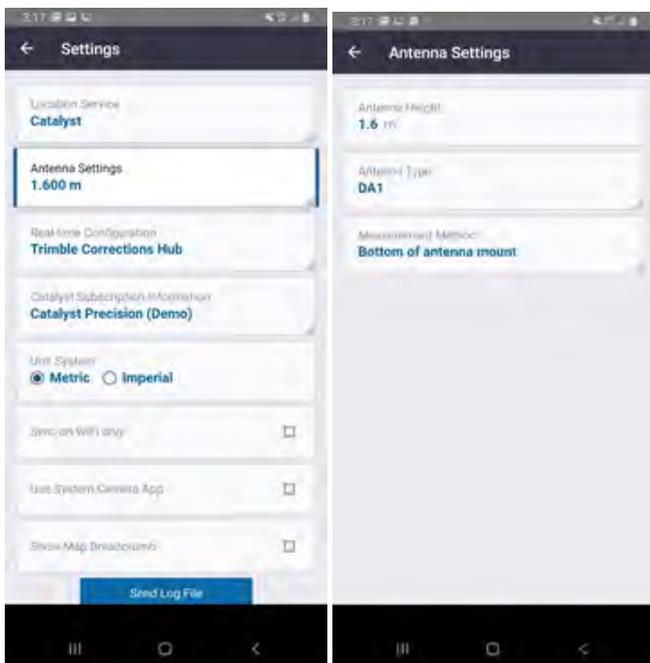
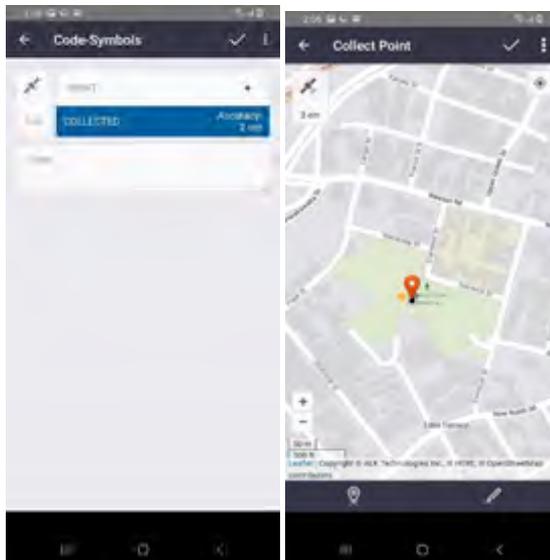1. Open TerraFlex, tap **Projects** and navigate to your project to load it.

2. Identify and move to the data points you want to collect.
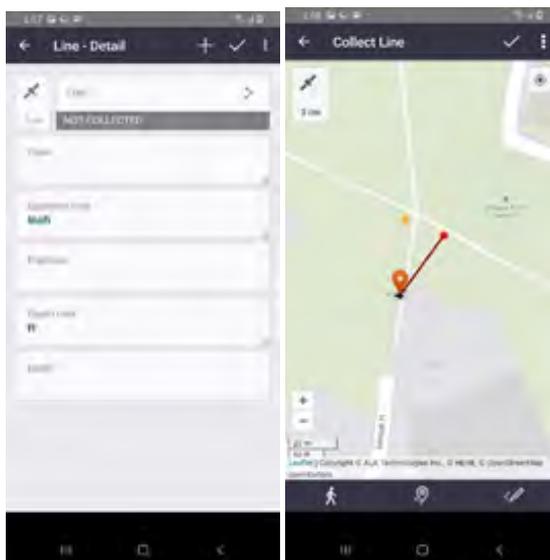
3. Tap [+] .
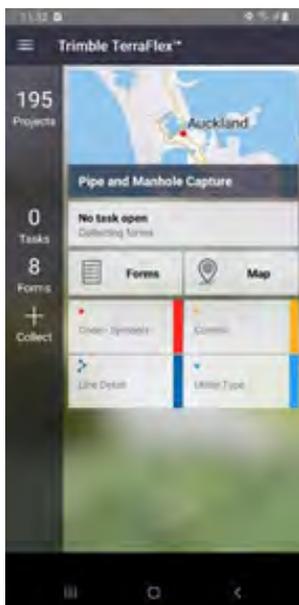
4. Select your form.

5. Collect your position data:

- Point data is collected automatically. To edit a point, tap the **Point** field next to the GNSS accuracy, then in the map that displays, use one of the collection methods to collect the point at your location. Tap ✓ to save the captured data.

- To collect line data, tap the **Line** field to bring up a map, then collect data using one of the collection options. Tap ✓ to save the captured data.

6. Fill in the required fields, then tap ✓ to save the data.

7. Repeat as need to collect all the required data.

8. When all the required data is collected, tap the menu icon then tap **Sync**.

Updating existing Trimble Map Workspace data using the TerraFlex software

1. Open TerraFlex, tap **Projects** and navigate to your project to load it.
2. Use the map to find your data location.

3. Click the **Forms** tab then select the form you want to edit. Tap ✐ .
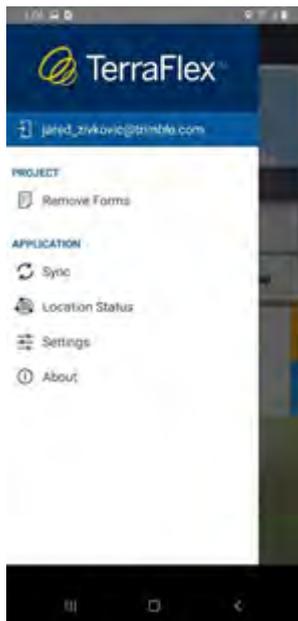4. Collect your position data:

- Point data is collected automatically. To edit a point, tap the **Point** field next to the GNSS accuracy, then in the map that displays, use one of the collection methods to collect the point at your location. Tap ✓ to save the captured data.

  - To collect line data, tap the **Line** field to bring up a map, then collect data using one of the collection options. Tap ✓ to save the captured data.
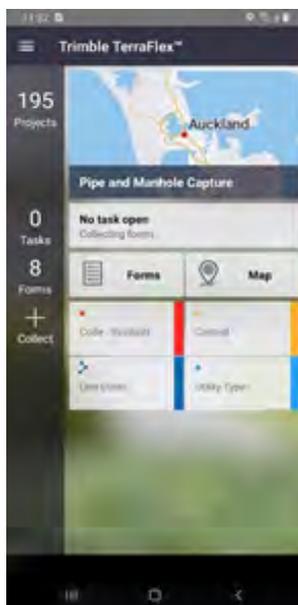
5. Fill in the required fields, then tap ✓ to save the data.

6. Repeat as need to collect all the required data.

7. When all the required data is collected, tap the menu icon then tap **Sync**.

Viewing your TerraFlex data in SiteVision

When you have created, edited, or updated your data as required with the TerraFlex software, you can view it in SiteVision.

1. Sync your TerraFlex project.

2. Close TerraFlex fully on your device.

3. Open Trimble SiteVision.

4. Select **Load Model**.

5. Navigate to your project then to your Trimble Map Workspace.

6. Load the project.

7. Use SiteVision to navigate to and visualize your data.
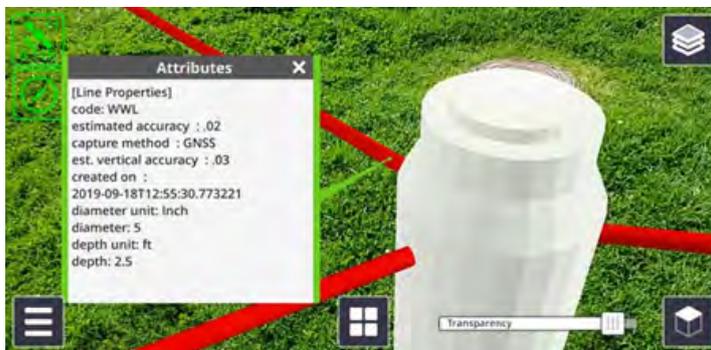
The data shows any attributes recorded and applies symbols from your rules file (if applicable).

TFLX (Trimble FieldLink)

TFLX is the Trimble FieldLink project format and can contain a range of data including points, lines and arcs. These points can represent design, control, or staked points including if the point has been staked in or out of tolerance.

SiteVision supports visualization of the following categories of TFLX points:

- Points
- Lines
- Arcs

Points can be a range of types and are visually represented with the following icons depending on their type:

Visual Classification	Point Type	Image
Control	Control	⬤
Design	Design	⬤
Stake in tolerance	Design / Control	✅
Stake out tolerance	Design / Control	❌
Plane level in tolerance	Design	🟩
Plane level low tolerance	Design	🔺
Plane level high tolerance	Design	🔻

Establishing a QR marker network

To enable placement of models on-site in GNSS adverse or even indoor locations it is possible to establish a QR Marker network. These markers provide a link between a known location in the model and the real world. Digital representations of the Markers are created within the model, a PDF printout of each Marker is downloaded, then installed in the corresponding real world location.

SiteVision has been designed so these Markers can act as either:

- a standalone positioning system, for example in a tunnel where it is not possible to obtain a GNSS position
- a supplementary positioning system where they can be incorporated on a project and used in conjunction with GNSS positioning, for example placed underneath a bridge, or inside a structure as part of a larger project.

Marker placement guidelines

For best performance, Trimble recommends installing markers on a flat, vertical surface such as a wall or column. Sloping or horizontal placement of markers is supported, however a lot more care is required when installing a sloping or horizontal marker to ensure the marker alignment is accurate.

- The markers should be flat, and securely fastened on all four corners. Any wrinkles or curvature of the marker may adversely impact model alignment.
- The markers can be laminated to provide protection from water / dampness.

- To ensure optimal performance, Trimble recommend placing Markers with as much clear, flat space around them as possible, as opposed to right at the edge or corner of a surface.

Immediately after scanning a Marker to place a model, the model should be very well aligned and accurately located. However as you move around, and the further away from the marker you get, you will see the digital model will drift out of alignment with the real world. This is completely normal, and reflects the present limitations of this type of visualization technology when unaided by GNSS. The extent of this drift will vary depending on the device you are using—the more recent the device model, the less drift you should expect to see.

To manage this drift, it is recommended to establish a network of Markers around your jobsite. These can be placed in critical locations, or more generally around the jobsite depending on your needs. As a general guideline Trimble recommends operating within 5 to 10 meters (5.5 to 11 yards) of a Marker, so Markers placed every 10 - 15 meters (11 - 16.5 yards) should prove sufficient.

Installing the Trimble Connect Marker extension

Markers are created and managed within Trimble Connect Web, using the Trimble Connect Marker extension. Whoever is responsible for creating and managing the Marker network will need to install the Trimble Connect Marker extension.

1. Load your 3D model in Trimble Connect.

2. From the right end of the ribbon menu, select **Settings** / **Extensions**.

3. Activate the QR **Marker** extension by clicking the toggle switch.
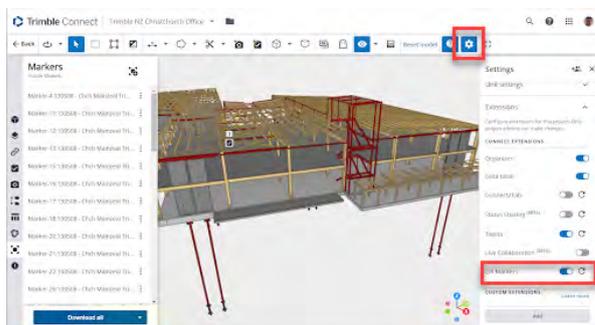

Creating Markers

Once the Trimble Connect Marker extension is installed, it will be available within Trimble Connect Web when any 3D model is loaded.

1. Load your 3D model in Trimble Connect.

2. From the left panel, click the Trimble Connect Marker extension icon:

3. Navigate in the 3D view to where you want to create your Marker.

> **TIP –** It can be helpful to use the Clip Plane feature of Trimble Connect to expose interior sections of the model.

4. Click **Create New Marker** to create a Marker, then click the desired location in the model. The location you click will correspond to the **bottom left corner** of the QR code portion of the Marker.

    The created Marker appears in the 3D view, and the Marker management pane is opened automatically.
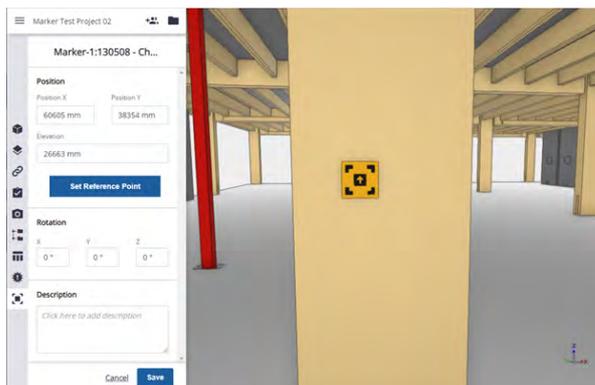
5. Here you can make adjustments to the **X** and **Y** positions or **Elevation** of the Marker in terms of your model coordinate system.

    > **TIP –** Use this approach to reference known survey control points on your jobsite.

    You can also use the **Set Reference Point** feature to reference other model components to assist with accurate positioning of the Marker. When you click **Set Reference Point**, you are prompted to select a point within the 3D view; the X, Y, and Z Reference Offset values are then displayed. Manually editing these values will adjust the location of the Marker while keeping the reference point fixed. You can click **Redo Reference Point** to select an alternative reference point if required.
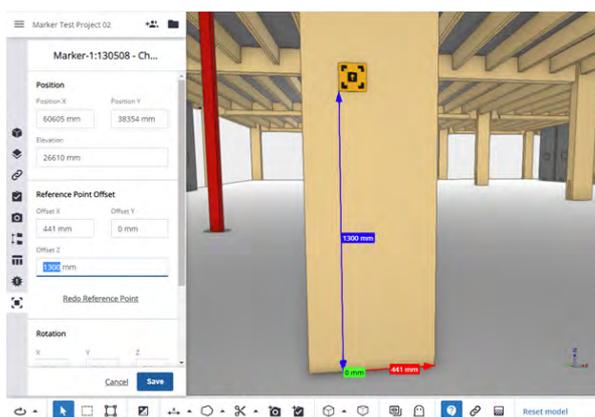
> **TIP –** Use this approach to accurately place Markers with a tape measure at standard heights / offsets to allow for easy setting out in the field.

6. Click **Save** to confirm the creation of your Marker, and return to the Marker list.
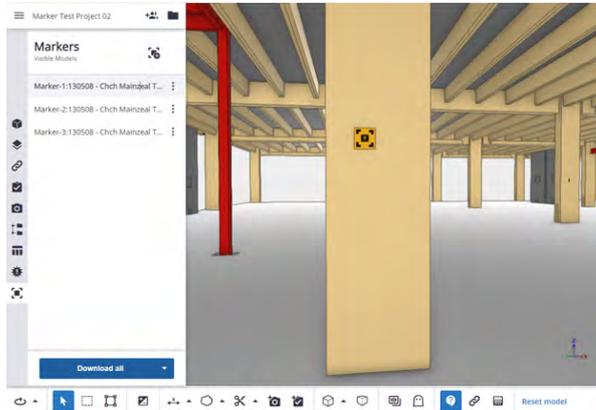
Clicking next to the Marker enables you to Edit, Delete, or Download the Marker as a PDF.

Installing Markers in the field

When you have created all the Markers you require in Trimble Connect, you must install the Markers in the field.

1. Download and print the Marker PDFs. The **Download all** button is a useful shortcut if you are managing a large number of Markers.

   IMPORTANT - Ensure when you print the markers that there is no page scaling applied. The Markers must be printed at 100% size.

The Marker printout contains **Setout Point** coordinates which correspond to the location of the lower left corner of the QR code. These coordinates are expressed in terms of the parent model coordinate system. The Marker printout also features **Setout Guide Lines** to assist with aligning the Marker on site. The **Reference Point Offsets** and **Marker Creation** data are also displayed.

2.   Install the Marker on-site either with a tape measure, or by keying in the **Setout Point** coordinate to a Robotic Total Station or similar setout tool. Make sure the Marker is securely fastened on all four corners and sits flat on the surface.

> **TIP –** There is also an option to download a .CSV file containing all of the Marker Setout Point coordinates. This .CSV file is formatted to be imported directly into Trimble Field Link, which is used in conjunction with Trimble Robotic Total Stations to accurately position setout points with a visible laser.

Once your Markers are installed on-site, any SiteVision user with access to the project will be able to use the Markers to place any model within the project. This is important to understand as Markers are most

frequently installed using structural models. As long as your other project models (such as Mechanical, Electrical, etc.) all share the same coordinate system, they will be able to be positioned using the same set of project Markers.

Markers can also be used to load the model within the SiteVision app. This is especially useful where a single federated model is being used, and enables field users to easily load the correct model without having to locate this in Trimble Connect.

> **NOTE –** When loading a model using Markers in this way, SiteVision always attempts to load the latest revision of the model (assuming it is online).

For further information on loading and placing your models using Markers within the app, see Placing a model: marker placement, page 116.

4

Using SiteVision in the field

Before using SiteVision in the field make sure that:

1. **Your data preparation is complete**. For automatic georeferencing in the field, check you have configured your Trimble Connect project coordinate reference system, or your models have a Trimble georeferencing file (.JXL, .DC or .CAL) and are named correctly to link them together.

    > **TIP –** Before you go on-site, if you require a model that is on Trimble Connect, confirm you can access the required model by using the **Trimble Connect** option from the **Load Model** menu option. If you want to view the model while in the office, use the **Place Model** / **Manual Placement** option to view the model indoors. See Placing a model, page 112 for more information. When you reload the data in the field it will be automatically georeferenced.

2. **You have verified the GNSS Correction Source**. Confirm the GNSS Correction Source to be used in the field (see Configuring the GNSS, page 32).

    - Trimble Corrections Hub
    - Local Correction Source - NTRIP
    - Local Correction Source - IBSS

3. **You have internet connectivity**.

    - Your mobile device must be connected to an internet source with a 3G connection as a minimum, to receive corrections for your GNSS positions.

    > **NOTE –** You can operate SiteVision without an internet connection but with the following limitations:
    >
    > - You must have logged into SiteVision on the device previously, while online.
    > - You must have already downloaded your model(s) from Trimble Connect while connected to the internet. See Loading a model, page 102 for more information on these options.
    > - GNSS positioning will not be as accurate, as you will be operating with the satellite-delivered Trimble RTX correction stream or a local SBAS service. See Configuring the GNSS, page 32 for more information.
    >
    >   > **NOTE –** You may need to adjust the **GNSS Minimum High Accuracy** setting; see Working with GNSS, page 107.

4. **The hardware is assembled and all batteries are charged**. Confirm that you have all hardware, including accessories, to use SiteVision in the field. Check that batteries are fully charged. See Setting

up the SiteVision hardware, page 16.

5.   You have done one of the following depending on your hardware configuration:

- If working with the HPS2 handle or the SiteVision Integrated Positioning System make sure you have performed a device calibration. The laser pointer that the EDM uses creates a red dot on the point to which it is measuring. This red dot is typically easy to see when inside, and difficult to see outside, particularly on a bright day.

- If your device is on a pole, make sure you have measured and entered the camera offset values.

> **TIP –** Different range poles have different assumptions about the target / antenna offsets. If you are using a range pole, always use a range pole designed for use with Trimble GNSS receivers or check your range pole length by measuring it directly with a tape.

Health and safety

> **WARNING –** Viewing a screen while walking can be dangerous on any project site. Only use SiteVision in environments where it is safe to do so. Maintain awareness of the existing surroundings at all times. Failure to do so may put the operator's safety at risk.

> **CAUTION –** A hazard spotter is recommended to watch the user who is operating SiteVision in case of unexpected dangers on the work site.

As a reminder, each time you launch SiteVision you will be prompted with a Health and Safety Warning. You must tap **Accept** before using the application.

The default message is:

You can also define your own custom warning:

- Create a text file named *StartupWarning.txt* and save it:
    - on Android devices, in *Android/data/com.trimble.sitevisionAR/files*.
    - on iOS devices, in the *Files* app under *Trimble SiteVision*.

- You can use <b>, <i>, and <color> tags to format the text. The color can be specified in HTML format e.g., #rrggbbaa …where the letters correspond to pairs of hexadecimal digits denoting the red, green, blue and alpha (transparency) values (e.g., cyan at full opacity would be specified by color #00ffffff); or you can specify hexadecimal values in uppercase or lowercase (e.g., red = #FF0000 or #ff0000).

Selecting the antenna connection

The first time you launch SiteVision and you accept the Health and Safety Warning, you are prompted to select how you will connect to the Catalyst antenna / receiver:

Handheld. Select this option if you are using either of:

- the HPS2 handle and connecting to the DA2 GNSS receiver using Bluetooth.

- the legacy SiteVision Integrated Positioning System and connecting to the Trimble Catalyst DA1 antenna using a USB cable. SiteVision will wait for a USB cable to be plugged in before connecting to the antenna.

Pole. Select this option if you are using your device on a pole and connecting to the Trimble Catalyst DA2 receiver via Bluetooth. SiteVision will attempt to connect to any paired Bluetooth Catalyst receiver. This will be indicated by the GNSS icon flashing.

Once connected via Bluetooth, if a USB connection is detected a popup dialog displays asking if you wants to change the connection type.

> **NOTE –** Once selected, this is set in ☰ / ⚒ **Tools** / 🗐 **Configuration**/ **Antenna Connection**. You can change the connection type here if required.

Calibrating your device (HPS2 Handle and SiteVision Integrated Positioning System only)

If you are using the HPS2 handle or the SiteVision Integrated Positioning System (Handheld configuration), and your device is not calibrated, you are prompted to calibrate the device; see Performing a device calibration (HPS2 handle and SiteVision Integrated Positioning System only), page 25.

Setting camera offset values (pole mounted configuration only)

It is good practice to check your camera offset values prior to each SiteVision session.

If your camera offset values are not set, and your device is mounted on a pole, you are prompted to set the camera offset values for the device you are using.

You can also check or reset them at any time in the **Configuration** menu (see Configuration, page 40).

Checking the pole height

It is good practice to check your pole height prior to each SiteVision session. See Measuring the pole height, page 28.

Loading a model

In SiteVision in the field, you can:

- load a model from Trimble Connect
- load a model that is stored on the device or a file storage location
- create a model in the field
- load a model that you have previously loaded or created on your device

> **TIP –** When working in SiteVision, various prompt messages appear across the screen. You can minimize these messages to give you a clearer view of the screen—tap ⬚.

About Trimble Connect

Trimble Connect is a cloud-based data management and collaboration platform that allows you to view, share, and access project information over the internet from anywhere at any time. Trimble Connect stores the 2D and 3D models, prepared in your office software, that are to be viewed in SiteVision.

The subscription for Trimble Connect Business is included with your SiteVision subscription. If you have separate users who will only be doing data preparation you can purchase separate standalone subscriptions for just Trimble Connect for them.

To get started with Trimble Connect, go to the Trimble Connect website.

To load a model from Trimble Connect

If you have data stored elsewhere that you want to visualize in SiteVision in the field, you must upload it to Trimble Connect:

1. Go to connect.trimble.com

2. Sign in using your Trimble ID.

3. Confirm which server you want to store your data on.

4. Create a new project for your Project Site, or select an existing project.

5. If you are using automatic placement of georeferenced models, set your Trimble Connect project coordinate reference system.

6. Create a new folder to store your 2D and 3D models.

> **NOTE –** You cannot upload folders to Trimble Connect from within SiteVision; you will need to upload your data to Trimble Connect via the Trimble Connect web or desktop applications.

7. Upload your models to Trimble Connect.

To load the data in SiteVision, do one of the following:

- To select the model from **Trimble Connect**:

  a. Tap ☰ / ⬡ **Load Model** / ▷ **Trimble Connect** and select the required project folder.

  b. Find the model you want to visualize, select it and tap 　👁　 .

  > **TIP –** In Trimble Connect, your files can be on different regional servers. The North America server is the default. Tap the menu icon in the top left of the Project Menu window to select a different server.

  > **NOTE –** Models in supported file formats are displayed. Any files associated with the selected model file (e.g. JXL, CAL) are not shown in the file listings but will be automatically downloaded as required.

  > **NOTE –** A small badge icon ⬇ will be displayed in the top right of the model tile. This indicates a model that has not yet been downloaded from Trimble Connect; or a downloaded copy exists, but is out of date.

- If you have created Markers for a model (see Establishing a QR marker network, page 93) you can scan these Markers to load a model. This is particularly useful if it is not easy to locate where the model may be stored in the folder structure in Trimble Connect .

  a. Tap ☰ / ⬡ **Load Model** / ⬚ **Marker**.

  b. Scan the Marker. The Trimble Connect browser opens in the app and takes you to the location where the associated model is; it is selected by default.

> **NOTE –** If you are offline, and you had already downloaded the model in a previous session while online, SiteVision will instead take you to the model in **Quick Access**; it is selected by default.

c. Click ⬤ to download the model to SiteVision.

To load a model that is on your device or a file storage location

You can load a model that is stored on your device, or that is stored in a number of different file storage sources, such as iCloud Drive, Google Drive, DropBox, OneDrive etc. To use a file from a file storage source, you must, on your device, have added the required file storage source(s) to the device's File Management app so that SiteVision can access them.

This option requires the model to be stored in one of the following formats:

- .WFS file. See Web Feature Service connections, page 37 for more information.
- TrimBIM (.trb)

TrimBIM (.trb) is a Trimble propietary file format for efficiently storing 3D BIM/Civil geometry and attributes with in-memory fast random access. It is not a replacement for IFC or any other formats, but a more intelligent way to access model data. TrimBIM speeds up BIM processes significantly.

There are several ways to convert your model to .trb format:

- From Trimble Connect Desktop
- From Trimble Business Center using the SiteVision AR Exporter
- From Trimble Quadri

See below for details on each of these options.

> **NOTE –** Automatic Placement using a Trimble Calibration File (JXL, CAL, DC) is not supported when loading a model from your device or external storage location.

1. Tap ▤ / ▣ **Load Model** / ▢ **My Files**.
2. Navigate to where the model is stored.
3. Tap to select the model that you want to load then tap it.
4. Tap ⬤ to visualize it.

Converting data from Trimble Business Center

For data in Trimble Business Center a .trb can be quickly generated by using the SiteVision AR Exporter. For more detailed instructions on how to use the AR Exporter see Workflows for Civil Engineers and Contractors - Using Trimble Business Center.

1. From the **Export** window in Trimble Business Center, use the **SiteVision AR exporter** to export your model data.
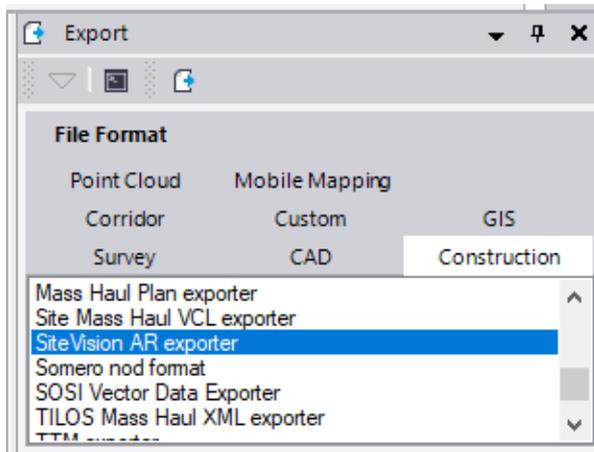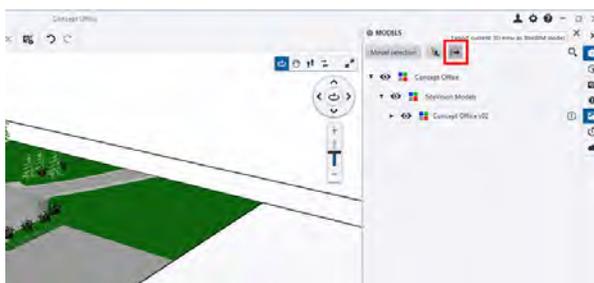

This will export three files, including a .trb.

2. Copy the .trb file to your device. You can then load it with the **My Files** workflow.

Converting data from Trimble Connect Desktop

For data on Trimble Connect, the Trimble Connect Desktop application can be used to generate a .trb file.

> **TIP –** By selecting and viewing multiple models, this workflow can also be used to combine these models into a single TRB file. Additionally, any filters you apply within Connect Desktop will be preserved during this export. This allows you to export a specific subset of model elements based on the embedded model attributes.

1. Load your model in Trimble Connect Desktop.

2. In the right hand **MODELS** pane, click the **Export current 3D view as TrimBIM model** button (highlighted below).
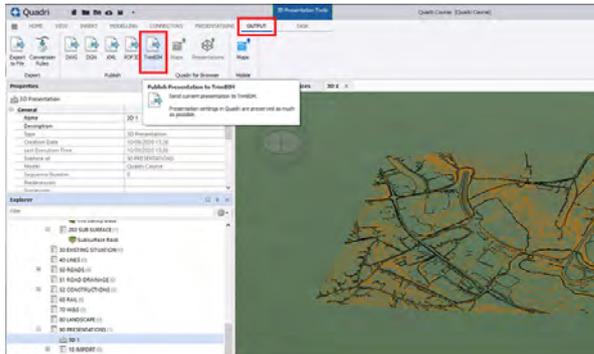

3. Copy the .trb file to your device. You can then load it with the **My Files** workflow.

Converting data from Quadri

For data on Quadri, a .trb can be generated as an output from any 3D Presentation Task.

1. Create a 3D Presentation Task containing the model data you require.

2. Select the **Output** tab of the 3D Presentation task, then from the **Publish** ribbon select the **TrimBIM** option.

3. Confirm the settings, select your preferred output location from the list of **Connections** in the **External Delivery** ribbon, then click **Finish**.

4. Copy the .trb file to your device. You can then load it with the **My Files** workflow.

To create a blank model directly in SiteVision in the field

This option may be useful for visualization or simple data collection.

> **NOTE –** **You must have an internet connection to create a new model in the field in Trimble Connect.**

1. Tap 📋 / 🟦 **Load Model**, then do one of the following:
    *   select **Trimble Connect** then select a Trimble Connect project. Tap ➕ to create a new model under the selected project in Trimble Connect.
    *   tap ➕ to create a new model locally locally on your device.

    > **NOTE –** Models created locally on your device are not associated with a Trimble Connect project, and access to many of the advanced workflows — such as BCF Topics — is restricted. Even if you plan to do most of your work offline, Trimble recommends that you create a new model on Trimble Connect, to enable syncing of data once you are back online.

2. Enter a name for the model and tap **New**.

Models that you create in the field are automatically saved in a new folder, under the selected project; the folder name is the same as the model name that you entered when you created the model.

SiteVision creates a localized Transverse Mercator projection around you, with coordinates of 0,0,0.

You can sync data and measurements that you collect in the model to the project in Trimble Connect.

To load a model that you have previously loaded or created on your device

All models you load or create in SiteVision are available from **Quick Access**. You can see models that only you have previously loaded or created, and not models loaded or created by a different user.

 Quick Access stores a local copy of model files sourced from Trimble Connect that enables you load and work with the model offline. If you are offline, you may not be loading the latest model if the data has been updated on Trimble Connect since you loaded it from Trimble Connect.

> **TIP –** This option is useful if you do not have data connectivity out in the field, or if you want to save on cellular data usage. You can download the data in the office on Wi-Fi prior to heading out to site.

1. Tap ☰ / 🔷 **Load Model**.

2. If you are online, for any model that you select to load that is sourced from Trimble Connect, the app checks with Trimble Connect for an updated version and downloads it. This ensures you are loading the latest version.

   > **NOTE –** When online, a small badge icon ⬇ will be displayed in the top right of the model tile if there is a newer version available on Trimble Connect for download.

3. While online, you can also sync all or selected models before you load a model.

   - To check all models for updated versions and download the latest versions from Trimble Connect, tap ⬇ in the top right of the **Quick Access** screen.

   - To check selected models for updated versions and download the latest versions from Trimble Connect, tap-hold a model to select it, then tap any other models you want to sync, then tap ⬇ in the top right of the **Quick Access** screen.

4. Find the model you want to visualize, select it and tap 👁 .

> **NOTE –** Under **Quick Access**, you can delete any models you no longer need to see listed here. To delete a model, tap to select it then tap 🗑. To delete multiple models, tap-hold a model to select it, then tap other models to select them and tap 🗑.

Working with GNSS

The GNSS Status icon (e.g. 📡, top left of the screen) shows you the status of the GNSS positions being received and their estimated accuracy.

High accuracy GNSS is required to accurately place a model in your surroundings using the measured and automatic placement functions.

> **NOTE –** Your mobile device must be connected to an internet source with a 3G connection as a minimum, to receive corrections for high accuracy GNSS positioning. Without an internet connection, GNSS positioning will not be as accurate; Trimble Correction Hub connects you to the satellite-delivered RTX correction stream or to a local SBAS service.

The GNSS Status icon will show any of the following:

- Red with no numbers. The system is starting for the first time, or is not running.

- Red with numbers. The system has started tracking satellites. If the distance number is displayed the system is using the satellites to generate a position.

- Yellow with numbers. The system is receiving differential corrections from a source and the position accuracy lies between 0.5 m (1.64 ft) and 5 cm (0.16 ft)—or the minimum accuracy you have set for GNSS.

- Green with numbers. The GNSS positioning accuracy has reached the threshold set for the accuracy limit (default 5 cm / 2 inches) to permit viewing and positioning models.

The information shown on the GNSS Status icon is as follows:

- number in the top right = number of satellites being tracked during start up or being used in the positioning solution.

- distance value at the bottom = estimated horizontal accuracy of the GNSS position.

The default minimum GNSS value is 5 cm (0.16ft). When the estimated accuracy is at this value or less, the GNSS Status icon turns green.
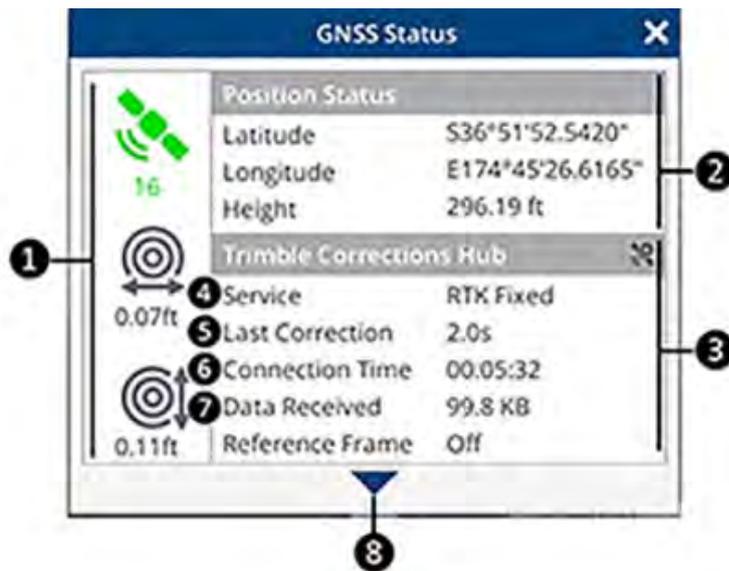
To change the minimum value tap ▤ / ⚒ **Tools**/ ▤ **Configuration**, then tap **Advanced** and set the **GNSS Minimum High Accuracy**.

When using the Trimble RTX correction service, Trimble recommends that you change this threshold to 10 cm (0.33 ft), provided that this level of accuracy is sufficient for the type of work the model is being used for.

> **NOTE –** If you change this setting it is applied to all future work. If you are going to use the system later for tasks requiring greater accuracy, you must change the value back to a suitable level for the future work.

Viewing detailed GNSS status information

For detailed GNSS Status information tap the GNSS Status icon (e.g. [icon], top left of the screen).

1	**Summary**. Shows:
	• the number of satellites being tracked / used and the status of the GNSS corrections.
	• the estimated horizontal accuracy of the position.
	• the estimated vertical accuracy of the position.
	TIP – To change the distance units displayed in GNSS Status, go to **Menu** / **Tools** / **Configuration** / **Units**.
2	**Position Status**. Provides the Global Coordinates of your position: Latitude, Longitude, and Height.
3	**Correction Source**. This will display as Trimble Corrections Hub, NTRIP, or Direct depending on your GNSS Settings.
4	**Service**. This indicates the type of positioning solution being used. The types displayed when using SiteVision are:
	• Autonomous • Differential • SBAS
	• HDRTK • RTX
	When connected to a VRS Now or 3rd party network or an RTK network the positioning types will be:
	• Autonomous: An uncorrected position while waiting to receive and process corrections.
	• A differential solution using GNSS code phase information.
	• An HDRTK solution using GNSS carrier phase information where the integer ambiguity has been resolved for the best possible accuracy.
	When connected to the Trimble RTX service the positioning solutions will be:

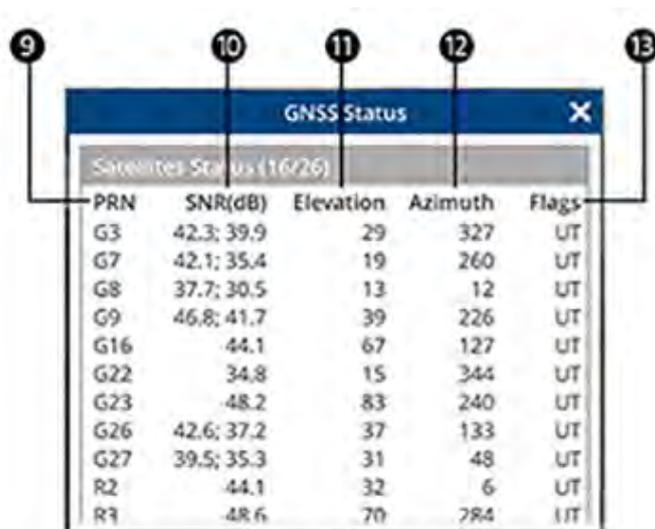|	
	• Autonomous: An uncorrected position while waiting to receive and process corrections. • An RTX Code solution using GNSS code phase information. • An RTX solution using GNSS carrier phase information this solution converges over time to sub-decimeter accuracy. If no VRS or RTX solution is available, possibly because of internet connectivity issues, and you are in an area with SBAS services (WAAS, EGNOS, QZSS etc.) then an SBAS positioning solution will be used. The Trimble Catalyst service monitors the accuracy that your system can achieve from the different signal types and automatically selects and outputs the solution type with best available accuracy.
5	**Last Correction**. Time since last correction, in seconds.
6	**Connection Time**: The time elapsed from the first connection to a corrections service by the SiteVision system.
7	**Data Received**. Quantity of corrections data received since connection.
8	**Satellite Status**. Tap ▼ to expand the window to show the detailed status of the GNSS systems being used. The list shows the satellites that are being tracked and used in the position solution. The header bar shows the number of satellites being used and the number being tracked.
9	**PRN**. Identification Numbers of satellites in view. Each GNSS constellation is identified by a leading character. • G=US GPS satellite • R=Russian GLONASS satellite • E= European Union Galileo satellite

	• S=SBAS correction satellite • C= Chinese BeiDou satellite • J=Japanese QZSS satellite • O=OmniSTAR
10	**SNR (dB)**. Signal-to-noise ratio (SNR) values for the satellites in view, expressed in decibels. **NOTE –** GPS satellites and QZSS satellites that broadcast the L2C code on the L2 frequency are shown with two SNR values. The first is for the L1 signal and the second is for the L2 signal. To get to an RTK Fixed solution for the most accurate positions you need to be tracking 4 or more satellites with L1 and L2 signals.
11	**Elevation**. Elevation angles of satellites in view, expressed in degrees.
12	**Azimuth**. Azimuth angles of satellites in view, expressed in degrees.
13	**Flags**. Flags indicate if a particular satellite is being tracked (T) or is being used in the positioning solution (U). If the VRS network you are using does not provide corrections for all the constellations then you will see that the satellites are being tracked, but not used.

Managing GNSS

If the system does not initialize to green (<5 cm / 0.16 ft RTK Fixed) within a reasonable timeframe (two to three minutes) consider the following:

- **Minimum Satellites Required**. In general, at least six satellites are required to initialize and obtain a GNSS position. Of these at least 3 must be GPS satellites tracking both L1 and L2 signals.

  The SiteVision system has the ability to track the following satellite constellations: GPS, GLONASS, QZSS, BeiDou, and Galileo.

  To use these constellations the correction source needs to support these constellations. For more information about Trimble Corrections Hub go to catalyst.trimble.com.

- **Low latency correction**. A low latency correction is when the time since the last correction is less than three or four seconds. If the latency is greater than five seconds the accuracy of the GNSS position will degrade with the increasing age of the corrections. If the age of corrections is high, check the reliability of your internet connection.

- **Correction Source Setup**. Confirm that you have the correct credentials, such as:

  - Server URL

  - Server Port

  - Server Account Name

  - Server Account Password

- **Distance to your closest base station**. The precision of GNSS depends on the distance between the base station and your location. It is desirable to keep the distance between them to less than 20 km (12 miles).

Orientation status

The Orientation Status icon ⊘ shows you the status of the system orientation. Orientation is required to produce an accurately placed model in your surroundings.

- Red - No orientation. The system prompts you to walk until a set of high accuracy orientation observations have been made.

- Yellow - Low orientation. The system is indicating that the orientation accuracy is primarily from image tracking and may drift over time. Walking a short distance with good GNSS positioning will improve the orientation.

- Green - Good orientation. The system is indicating that the GNSS orientation is aligned with the mobile device's AR orientation.

If the icon is spinning, the orientation is being updated with high accuracy GNSS and should correct any model drift that may have occurred.

The default minimum distance to walk to obtain orientation is 10 m (10 yd). When you have walked this distance and if the correlation between the visual tracking of the AR technology and the GNSS vectors is good, the Orientation Status icon turns green. If the correlation is not good you will be instructed to walk further.

If you have been running SiteVision for a long session, or you return a number of times within a session to the same area, or if AR is not behaving as it should, you may see "jumps" in the rendering of the model. If you experience this, tap the Orientation Status icon ⊘ to reset the orientation.

> **TIP –** To change the minimum distance to walk value, tap ☰ / ✖ **Tools**/ ▦ **Configuration** then tap **Advanced** and set the **Minimum Distance To Walk**. You should avoid changing this value unless it is necessary because with a shorter walk the orientation of the model is less accurate. Only change this value if you are working in a confined space where a 10 m (10 yd) walk is not possible. Remember that you must reset this value when returning to a more open environment to ensure accurate alignment.

Placing a model

In SiteVision, there are five ways to position a model on site:

- **Automatic**. Automatic Placement requires high accuracy GNSS. It also requires and uses coordinate system information within the data, Trimble Connect project. or reads a Site Calibration file associated with the model.

  See .

- **Measured**. Measured Placement requires high accuracy GNSS.

This method is useful when you want to use GNSS for precise outdoor positioning for a model that is not automatically placed correctly. For example, when there is no Site Calibration file assigned, when there is a difference between the source data and the GNSS on site, or you want to make an adjustment to the Automatic Placement.

See Placing a model: measured placement, page 114.

- **Marker**. This is the recommended method for model placement. It requires QR Markers to be created within the digital model at known locations. Physical printouts of the Markers are then placed in the corresponding real world location. Once this Marker network is established, the model can be accurately positioned by simply scanning the nearest Marker.

    See Placing a model: marker placement, page 116

- **Manual**. Placement is by using gestures on the screen and the augmented reality technology on your mobile device.

    See Placing a model: manual placement, page 117.

- **Component**. A placement method designed for fabricators working on construction components in a workshop environment. This method includes a search feature to isolate a specific assembly or spool, along with a 3-point placement workflow to align the model to the physical component. This method is disabled by default; you can enable it in the Display Settings.

    See Placing a model: component placement, page 118.

Placing a model: automatic placement

Automatic Placement requires high accuracy GNSS. It also requires and uses coordinate system information within the data, Trimble Connect Project, or a Site Calibration file associated with the model. To use Automatic Placement, ensure your Trimble Connect project coordinate reference system is configured. Or, one of the following Site Calibration file formats must be used:

- Calibration (CAL)

- JobXML (JXL)

- Data Collector (DC)

- World Files (PGW)* For use with PNGs only.

    > **TIP –** These formats can be generated by Trimble Business Center, Trimble Access, Trimble Siteworks, and Trimble SCS900 Site Controller software.

- Projection files (PRJ) that are included in Esri Shape files.

    When using GIS data—such as Esri Geodatabase or Shape files—that is georeferenced and has been imported into or connected to a Trimble Connect map workspace no calibration file is required. SiteVision will automatically place the Trimble Connect map workspace data (.TMAP files).

Placing a model: measured placement

Measured Placement requires high accuracy GNSS.

Before you start a measured placement

Before performing a Measured Placement, confirm that:

- your GNSS Correction Source is configured.
- you have obtained a high accuracy position (GNSS status 📱 is green).

The Measured Placement method steps you through measuring two known positions on site, such as control points, and associating with them with the corresponding positions in the model, providing the model a position and orientation. For best accuracy Trimble recommends that the Measured Placement procedure is conducted using a survey range pole with a calibrated bubble.

When you complete a Measured Placement, the information is stored and is applied between sessions. In the case of model data from Trimble Connect, the Measured Placement information is stored on Trimble Connect. If a new user subsequently opens the model in SiteVision, it will be displayed where you have placed it using Measured Placement.

To perform a measured placement

1. When you have loaded the required model (see Loading a model, page 102), tap ☰ / 📷 **Place Model** / 📷 **Measure** to start the Measured Placement process.
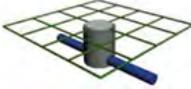
   > **TIP –** Be aware of the extents of your data model. To ensure accurate positioning on site Trimble recommends choosing two positions at the extents of your model to obtain the best results.

   > **NOTE –** You do not have to maintain continuous tracking between the points so after recording the first point you can walk or drive some distance to the second point, reacquire an accurate position and then measure the second point

   Follow the Measured Placement guidance steps on screen, as follows.

2. **Confirm your model selection point**:

Bottom of Model	This option is good to use for placing above ground structures. It selects the first surface from underneath the model during the placement procedure.
Top of Model	This option is good to use for placing manholes or underground

	utilities. It selects the first surface from above the model during the placement procedure.
	• If you are using a pole (recommended) enter the pole height. See Measuring the pole height, page 28.

Tap **Start** to walk through the Measured Placement process.

> **TIP –** Tap 🔘 to learn more about Measured Placement settings.

3. **Select Point in Model**. Select a known point in the model. This position will be used to place or coordinate your model in terms of the local site. Ideally this point will be in the open away from buildings and trees to get the best possible accuracy.

> **TIP –** Use **Center Model** 🔲 to move the model to be centered and appropriately zoomed on the screen. Zoom in on the model using two fingers, and use one finger to drag the model horizontally.

4. **Measure Position**. Walk to the point you selected . Ensure that the antenna is vertical then tap **Measure**. The Measure function will count down from 3 and then display `Measuring`. Take particular care to ensure that you have an accurate measurement with a good elevation accuracy because this first measurement controls the location of the model in X,Y, and Z .

5. **Select Point in Model for Orientation**. Select a second known point in the model. This position will be used to orientate your model in terms of the local site. Remember the greater the distance between your first and second point, the more accurate your orientation will be.

6. **Measure Position**. Walk to the second known point in your model. Ensure that the antenna is vertical then tap **Measure**. The Measure function will count down from 3 and then display `Measuring`.

> **TIP –** By default, you will be shown your first measured position in the 2D Plan View. This is indicated by a red star pointer. Zoom out and pan to your second known position before applying the orientation.

7. **Apply Measured Placement**. Tap **Apply** to confirm the model placement, and walk 10 meters (10 yards) to align the model to the line between the two points, completing the Measured Placement operation.

8. Trimble recommends that you then visit a third known location and check the accuracy of the Measured Placement by viewing the actual known location and comparing that with its location in the model.

> **TIP –**
> - To permanently remove the measured placement, tap ▤ / ⚒ **Tools/** ▤
>   **Configuration**, then under **General**, **Measured Placement** tap **Reset**.
> - To temporarily suspend the measured placement for a session, tap ▤ / ⚒ **Tools/** ▤
>   **Configuration**, then under **General**, **Measured Placement** tap **Suspend**.

How measured placement is applied to other users on the project

When the first user on a project undertakes a measured placement, if the model was loaded from Trimble Connect, the results are sent to Trimble Connect and are then available to any other users on the project; if the model was loaded using a model stored locally on the device, the results are stored locally. When the other users start the project their models are automatically placed, using the data from the first user's measured placement.

If a second measured placement is made by either the original user or a different user on the project, then this new measured placement is sent to Trimble Connect and replaces the first measured placement. It becomes available as an update to all users on the project.

- An individual user can suspend the use of a measured placement. This suspends its use only on that user's device.
- An individual user can reset the measured placement. This deletes the measured placement in Trimble Connect for all users.

> **NOTE –** A measured placement is not saved to Trimble Connect if:
> - you are using model data loaded from your device, using the **Load Model** / **My Files** option.

Placing a model: marker placement

Using Markers is the recommended way to place your model on site. Before you can use this workflow you must have created at least one Marker in your project, and installed the physical Marker printout in the corresponding location on site. See Establishing a QR marker network, page 93 for more information.

1. Load the required model (see Loading a model, page 102), then tap ▤ / ⚙ **Place Model** / 🖼
   Marker to start the Marker Placement process.

2. For best performance, it is recommended to spend a few seconds moving around your working environment, scanning the area with the camera. This will help SiteVision learn the local environment and will improve the visualization stability.

> **TIP –** For best results when scanning your working area, look at the areas of interest with the camera, then back to the Marker, and toward any other nearby Markers you are likely to use.

3. Approach and scan the Marker. When you are close enough, the progress circle appears. Complete the progress circle by shifting side to side to view the Marker from a range of angles.

> **TIP –** When completing the progress circle, the objective is to view the Marker from a range of angles. The animation below the progress circle shows how to best do this by orbiting around the Marker from side to side, keeping the camera pointed at the Marker.

Scanning additional Markers

When you have used a Marker to place a model, you can tap the ![icon] icon to go back to Marker scanning mode. This allows you to scan additional Markers as you move into new areas of the job site, or to rescan and update Markers you have already scanned if you find the visualization has drifted.

1. Tap ![icon] in the top left of the screen.

2. Approach the Marker to be added or rescanned, complete the progress circle by shifting side to side to view the Marker from a range of angles.

Canceling a marker placement

When you have used a Marker to place a model, the ![icon] icon shows in the top left of the screen, indicating that you have performed a Marker placement. To cancel the Marker placement:

1. Tap-hold ![icon] in the top left of the screen.

2. You are prompted to confirm `Do you want to remove your Marker Placement?`. Tap **Continue** to cancel the placement.

> **NOTE –** When using Marker placement, the first Marker you scan relies on the flatness of the Marker and the surrounding surface to provide an accurate orientation. When a second Marker is scanned, the physical separation between the Markers is used to provide a more accurate orientation. However this can be adversely impacted by the visualization drift; for the best possible two-Marker placement, keep your motion between scanning your two Markers to a minimum.

Placing a model: manual placement

1. When you have loaded the required model (see Loading a model, page 102), tap ![icon] / ![icon] **Place Model** / ![icon] **Manual** to start the Manual Placement process.

2. Navigate the plan view of your model to get the approximate location and correct orientation for the model placement.

3. Adjust the position of the model:

   • Drag two fingers on the screen to make large adjustments, and one finger to make small, fine adjustments to the model placement

- Use the adjustment tools on the right of the screen to align the model correctly with the real world:

    Vertical

    Horizontal

    Rotate

- View the model from a number of different perspectives / angles while making small adjustments to fine-tune the model's placement.

> **NOTE –** When there is a horizontal plane within 50 cm (20 in) of the ground, a yellow icon   is visible. Tapping this icon will align the horizontal plane in the model to the ground in the real world; the icon changes to green   .

4. When the model is correctly placed, tap **Finish**.

When you have manually placed a model, the   GNSS Status and   Orientation Status icons are hidden from the top right of the screen. Instead—if your device is connected to the antenna—the   icon shows, indicating that you have performed a manual placement.

Canceling a Manual Placement

To cancel the Manual Placement and reinstate the GNSS connection:

1. Tap-hold   in the top left corner of the screen.

2. SiteVision prompts `Do you want to remove your Manual Placement?"`. Tap **Continue** to cancel the Manual Placement. The connection to the antenna is reinstated, and the   GNSS Status and   Orientation Status icons redisplay. Their color (red, yellow, or green) will depend on their status. See Working with GNSS, page 107 and Orientation status, page 112 for more information.

> **TIP –** If you have already performed a Marker-based placement, you can use the Manual Placement workflow to access the fine-tune adjustment controls. This is helpful if you have moved away from your Markers and have experienced some drift.

Placing a model: component placement

Component Placement is specifically designed for use by fabricators in a workshop environment. This feature includes a search to quickly isolate a specific assembly or spool, along with a placement workflow to easily align the model with the physical component regardless of its orientation.

Due to the specialized nature of this workflow, this placement option is disabled by default in a fresh installation of SiteVision and must be enabled via the Display Settings.

1. When you have loaded the required model (see Loading a model, page 102), tap   /   **Place Model** /   **Component** to start the Component Placement process.

2. Search for and isolate the component you want to place by entering the associated assembly or spool ID. If more than one result is found, use the arrows to move through the different components to review the results. Tap **Next** to confirm your component selection.

> **NOTE –** SiteVision will search all the associated attribute data in the model and provide autocomplete options in a dropdown menu. These options require an exact character match, but are not case sensitive.

Once you have isolated a component from the rest of the model, SiteVision will show the component as an individual layer (see below). Use the visibility icon 👁 to make the model visible again as needed.
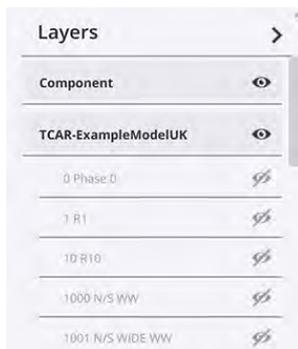
> **NOTE –** Search uses the Trimble Connect Assembly Mode. This is applied to the highest level assemblies within your model's data structure and will group objects based on a universal assembly property. If you experience difficulty isolating components, it is likely because this assembly level information is not present in your model data. Modeling applications and formats can behave quite differently. For example, Trimble has found that Autodesk Advance Steel requires IFCs to be exported using the MVD EM.11 schema in order to capture this assembly level information.

3. If the isolated component includes a Marker within its bounds, this is detected and you are asked if you want to place the component using the Marker.
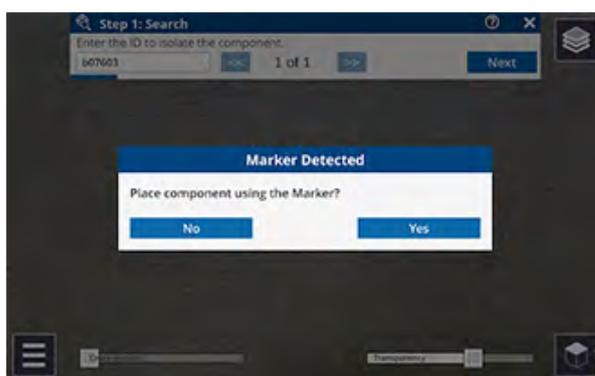
- If you tap **Yes**, you are prompted to scan the Marker; see Placing a model: marker placement, page 116 for instructions on how to scan a Marker.

- If you tap **No**, you are prompted to orient the model to match the physical component.

  - Drag two fingers on the screen to make large adjustments, and one finger to make small, fine adjustments to the model placement

  - Use the adjustment tools on the right of the screen to align the model correctly with the real world:

    - ⬛ **Vertical**
    - ⬛ **Horizontal**
    - ⬛ **Rotate**

  - To change the orientation of the model, double-tap on the face of the bounding box. This will roll the component by 90°, towards the ground.

    You can deselect a face at any time by tapping outside of the bounding box.

4. Do one of the following:

   - If you are satisfied with the placement, tap ❌ to exit the workflow.

   - If you are not satisfied with the placement, tap **Next** to perform a **Three Point Alignment**, where you will measure three pairs of points, matching the points on the model to the points in the real world.

     a. Measure the first point on the real world component; tap the crosshairs or 🔘 to measure the point. You can remeasure the point to ensure you get the correct position. Tap **Next** to confirm your real world point measurement.

     b. Measure the same point on the model. Your camera feed will switch off during this step and you will only be able to see your model.

     > **TIP –** Measurements are the most accurate when taken on a wider plane, for example the face of a beam rather than the edge. This is due to how depth is measured, and is most accurate when there is a significant surface to "see".

     c. Repeat steps **a** and **b** for the second and third sets of points, and then tap **Finish** to complete the placement.

     > **NOTE –** You can remeasure real world points after your placement is complete; tap the misaligned red point you want to remeasure.

     > **TIP –** For best results, measure the first two pairs of points along the length of the component, and the third pair across the width. Measure real world points on flat surfaces, and look at the point from different angles to confirm your point is in the correct position.

To remove the placement, tap-hold 🔍 in the top left corner of the screen. This will revert the Search feature as well, so your model visibility will return to default.

Viewing a model

Using the Display Settings

Use the **Display Settings** to interact with and view your model in different ways.

Tap ☰ / ⚒ **Tools** / ▣ **Display Settings** and use the checkboxes to show or hide the **Display Settings** tools on the main screen.

- **2D / 3D View**. When selected, the **2D / 3D View** 🔲 displays in the bottom right corner of the screen. Tap to switch between views.

- **Layers** enable you to manage which details of the model you want to view at any given time.

  When selected, the **Layers** icon ⬢ displays in the top right corner of the screen.

  - To show / hide any layers in your model, tap ⬢ then tap the required layer(s) to show or hide them.

 - To isolate a single layer and hide all other layers, long-tap on the required layer.

> **TIP –** If you have a lot of layers you can turn them all on/off by tapping the model name at the top of the layer list.
>
> **TIP –** You can also hide selected data in a layer; these will show as ◀ in the **Layers** manager. See Interacting with a model's features, page 124.

> **NOTE –** When you have an active Component Placement, your isolated component will be visible under **Component**. All of the other model layers will be turned off when using this placement method.

When you record measurements or designs [in the field, SiteVision creates a layer, under a `User Measurements` layer, for each app that you use. Any placed PDFs and measurements from previous sessions of SiteVision— Points, Grade & Distance, Lines & Area, Volumes, Cut-Fill only—are also stored under a **Prior User Measurements** layer., This enables user-created data to be hidden or displayed in the 2D or 3D view of data.

Any control points from your calibration file (JXL, CAL, DC) are also placed in their own layer.
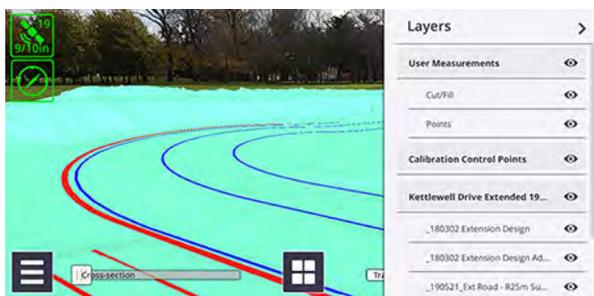
- **Pit View** is an important tool to improve the visualization of subsurface models, such as utility data, or data below the floor surface—to remove the perception of the data floating. Using Pit View you can set the Pit position to fixed or movable, change its diameter, depth, and shape, and choose options to view subsurface data (round, half round, surface only).

  By default, the Pit displays:

  - 1.5 m (5 ft) below the device camera if you do not have an antenna connected.

  - at the tip of the pole, if you have an antenna connected and the pole is not set to 0 m / ft.

  When selected, the **Pit View** information displays on the right side of the screen:
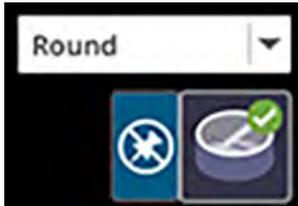
  > **TIP –** Use the following gestures to adjust the diameter and depth of the Pit: pinch to expand / reduce the radius of the pit, and use a two-finger swipe up / down on the screen to change the depth of the pit.

  If you are using the HPS2 handle or the SiteVision Integrated Positioning System, for more accurate depth information, you can use EDM for placement. When using EDM with Pit View, the Pit height adjusts with the slope of ground, and lines along the wall of the Pit will be more meaningful. If EDM is not available, SiteVision reverts to the default, i.e. the Pit being 1.5 m (5 ft) below the device camera if you do not have an antenna connected, or at the tip of the pole, if you have an antenna connected and the pole is not set to 0 m / ft.

  When you use Pit View with EDM, the **Pit View + EDM** icon displays on the right side of the screen.

  The lines on the Pit View wall are displayed at the following distances, depending on the Distance measurements units you set:

  - Metric - thick line interval = 1 m, thin line interval = 10 cm.

  - International Feet - thick line interval = 1 ft, thin line interval = 1 in.

  - US Survey Feet - thick line interval = 1 ft, thin line interval = 0.1 ft.

- The **Transparency Slider** enables you to change the opacity level of the model, allowing you to compare design to existing.

- The **Cross-section Slider** enables you to section through your data from your current position, to the extents of your data. This is useful for visualizing inside of large structures such as buildings or houses, as well as comparing designs to the existing ground. The cross-section is always perpendicular to the direction in which you are looking.

- The **View Distance Slider** enables you to section through your data from the furthest extent of your data, back to where you are currently standing. This is useful for visualizing large models where objects at a distance can cause confusion and it is helpful to remove those portions from view by reducing the viewing distance. Using the View Distance Slider to turn off information that is outside the area of interest can also improve the responsiveness of the system by eliminating the need to draw items that are outside of the area of interest.

- By editing the **Model Placement Methods** you can control which placement methods are available in the main **Place Model** menu. Options include:

  - Measure

  - Manual

  - Marker

  - Component

    > **NOTE –** By default the option for Component Placement is disabled and must be enabled via this setting.

- Using the **Overlay Lines** option, you can choose **None**, **Grid Lines**, or **Contours** to improve the display of model objects in 3D view. The lines are displayed at the following distances, depending on the Distance measurements units you set:

  - **Grid Lines**:

    - Metric - grid size = 1 m.

    - International or US Survey Feet - grid size = 3 ft.

  - **Contours**:

    - Metric - thick line (major contours) interval = 1 m, thin line (minor contours) interval = 10 cm.

    - International Feet - thick line (major contours) interval = 3 ft, thin line (minor contours) interval = 3 in.

    - US Survey Feet - thick line (major contours) interval = 3 ft, thin line (minor contours) interval = 0.3 ft.

- **Plan View Background**: You can change the Plan View (2D View) background color to either: None, Black, Grey, or White according to your preference. This can be particularly helpful if you receive a model where some data is in either black or white, and may be invisible against the background you have set.

- **Line Width**: Use the **Line Width** tool, to choose how lines are displayed:

  - select **World Scale** to view a line with real-world perspective; the line thickness is adjusted as it 'moves' into the distance, by the unit value entered

- Select **Screen Size** to display a line at a constant thickness (i.e. without real-world perspective) according to the **Pixels** value entered for the line thickness (height and width).

Interacting with a model's features

On the main screen, you can interact directly with a model and view the following:

- **Attributes**: You can view attribute information when in 2D or 3D View, by tapping on a part of the model you are interested in. The attributes available are a function of your model and how it is prepared.

  > **TIP –** The layer that the selected data is in is also displayed at the top of the **Attributes** window.

  When you tap a part of a model, it is highlighted to emphasize it . This may be useful when creating BCF Topics.

  3D View:
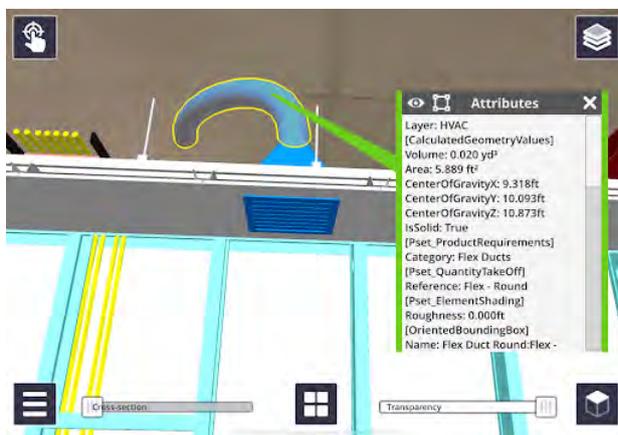
  The 2D View shows attribute information, as well as Control point names and your current location and orientation.

  At the top of the **Attributes** window, you can use the 👁 icon to hide a selected object. This is useful to hide data to see what is behind it.

  Long-tapping 👁 will isolate the selected object. This hides all the surrounding data leaving only the selected object visible.

  When selected data is hidden within a layer, the **Layers** window shows the layer and the data that is partially hidden with ◀ . Use the **Layers** window to turn back on hidden data.

  > **NOTE –** This is not supported for any user measurements.

- **Assemblies**: If a selected object is part of an Assembly or System level hierarchy, this is indicated by the icon 🔲 at the top of the **Attributes** window. Tapping 🔲 expands the object selection to include the entire assembly or system.
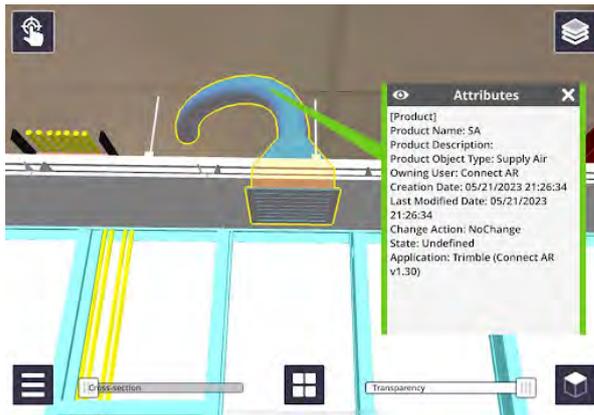
> **TIP –** When viewing an assembly, the displayed attributes will also be updated to display the assembly or system level attributes.

- **Textures**: If your data model includes textures you can visualize them in SiteVision.

  > **NOTE –** Textures are not available for all data types. Their availability is determined by what the authoring software supports on export.
  >
  > - Data from SketchUp and Novapoint support textures.
  > - Data from Trimble Business Center supports textures applied through the Site and Material Manager.

- **Draping of 2D Data**: Draping is a method for visualizing 2D data in 3D by using existing terrain models. To use this functionality you must have 2D data and a Trimble Terrain Model (.TTM) located in the same folder in Trimble Connect with the same file name.

  TTM is a Trimble file format. Trimble Business Center has an export option that will create a TTM from any surface within Trimble Business Center.

  To create a TTM model from data from 3rd parties, such as data from AutoCAD or a LandXML file, import the data into Trimble Business Center, model it as necessary, and export the data as a TTM file, storing it directly into Trimble Connect in that process.

- **Thematic Maps**: Thematic maps are a use case for Draping where you can drape a real surface model, for example a Cut/Fill map, over a terrain model to understand the design vs. the work

completed. To use draping and thematic maps you need an image file (.PNG, .PGW) of the cut/full information and a Trimble Terrain Model (.TTM) located in the same folder in Trimble Connect with the same file name.

There are many different uses for the thematic information. For example, you can create a project with a TTM and associate with it a georeferenced PDF, a georeferenced orthophoto, and a cut/fill map. Within the project in SiteVision these different images are managed as different layers. You can switch between a world scale PDF, orthophoto or cut/fill map by selecting a different layer. Note that only one image can be turned on at any point in time.

> **NOTE –** The recommended maximum resolution for an individual thematic map image is 4000 by 4000 pixels. For larger maps it may be necessary to tile multiple images.

Displaying Station and Offset

When a model is loaded that contains a supported Alignment (see) the **Station and Offset** display panel shows on the left of the screen.

Once you have a green position and orientation, your current position is displayed in terms of **Station** (the distance along the Alignment) and **Offset** (the perpendicular distance from the Alignment). This is a helpful way to navigate, and reference positions on linear projects such as roads and railways.
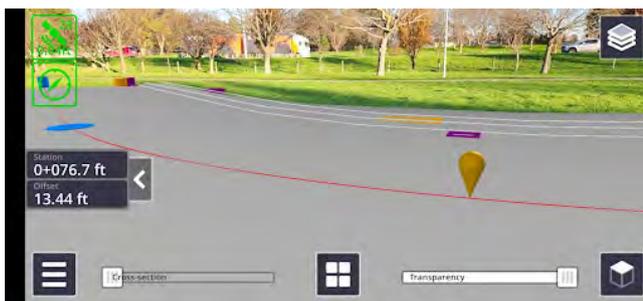
Station and **Offset** values are always calculated from your current position with respect to a **Reference Alignment**. If the model only contains a single Alignment, this is selected by default. When a model contains multiple Alignments, you are prompted to select which Alignment is to be used as the Reference Alignment.

> **NOTE –** SiteVision also supports **Station Equations** defined in Alignments exported from Trimble Business Center. Station values are calculated on the basis of these Station Equations.

To select a different Reference Alignment, tap the **Station and Offset** display panel, then in the **Station & Offset Settings** dialog, select the required Reference Alignment from the **Alignment** dropdown.
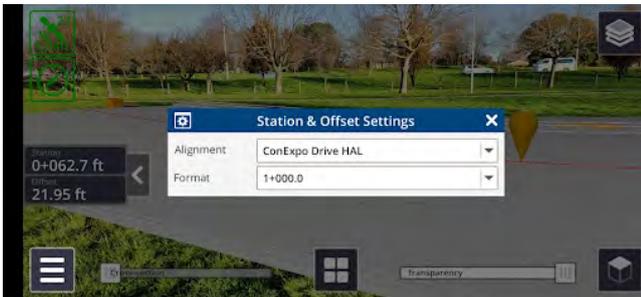

You can also change the display **Format** of the **Station** values depending on your requirements.

> **TIP –** Tap the arrow on the **Station and Offset** display panel to minimize or maximize the panel.

In the 3D view, you will see a yellow pin that is located on the currently Selected Reference Alignment at your current Station value.

In the 2D view, you will see a perpendicular line connecting your current position to the location of the pin which represents your Offset.
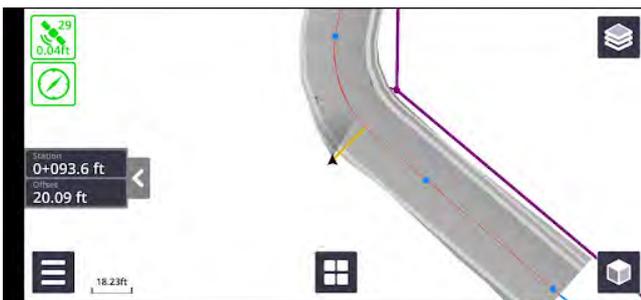
> **NOTE –** **Station** and **Offset** values will be included in the CSV file for any captured measurements.

Using the Apps: reporting, measurement, and design tools

SiteVision provides a number of reporting, measurement, and design tools that can be used alone or together in the field, to achieve things such as measuring a point and applying a symbol to visualize it, measuring surface areas, or defining trenches to be dug.

All measurements and design data are recorded in a .csv, with all of the positions, angles, distances, accuracy estimates, etc., and are associated with the model loaded at the time these measurements or designs are made.

> **NOTE –**
>
> - The measured data and designs using the BCF Topics, Plane, and Profile apps are visible only for the current session and model loaded. Any placed PDFs, or measurements using the Points, Grade & Distance, Lines & Area, Volume, and Cut-Fill apps are preserved from earlier SiteVision sessions; these are stored under a **Prior User Measurements** layer.
>
> - You cannot use the measurement and design tools if you have 2D model data loaded.
>
> - If the orientation status is red, the measurement and design tools are disabled for all measurement modes except GNSS measurement mode.

Before you start using the apps:

- See About measurement modes, page 130 for more information.

- For information on using each of the apps, see the links in Accessing the apps, below.

When you record measurements or designs in the field, SiteVision creates a layer for each app under a `User Measurements` layer. Any placed PDFs and measurements from previous sessions of SiteVision— Points, Grade & Distance, Lines & Area, Volume, and Cut-Fill measurements only—are also stored under a **Prior User Measurements** layer. This enables user-created data to be hidden or displayed in the 2D or 3D view of data. To hide / display any layers, tap 🗇 then tap the required layer(s) to hide or display them. See Viewing a model, page 121 for more information on layers.

Accessing the apps

To access the apps, tap or swipe-up the App icon ▦ (center of the main screen). The Apps carousel displays the available apps:

- / BCF Topics / Screensnap

- Measure Point

- Measure Grade & Distance

- Measure Lines & Area

- Measure Volumes

- Scan

- Measure Cut/Fill

- Plane

- Profile

- PDF

> **TIP –** When you tap ⊞, it changes to ⊞. Tap ❓ to see a brief description of the selected app. To see a brief description of other apps, tap the app icon on the carousel, or tap **Previous** or **Next**.

To use one of the apps, tap its icon from the carousel; it becomes the active app and is displayed in the center of the screen, replacing the ⊞ icon.

> **TIP –** To select a different app, tap-hold or swipe upwards on the current active icon. All the available apps are redisplayed on the Apps carousel.

Each of the apps can be used in some or all of the following measurement modes:

- **GNSS**

- measurements to the Real World, using:

    - **EDM** (supported only on the HPS2 handle and the SiteVision Integrated Position System)

    - **LiDAR** (supported devices only)

    - **Camera**

- **Model** measurements to the Digital Model

See About measurement modes, page 130 for more information.

The active measurement mode is indicated on the active app icon, as a border around the button. For example, the Measure Point ⊙ app using LiDAR based measurements will show as ◁⊙.

To select a different measurement mode tap the arrow to the left of the active app icon. The available modes (shown here with Measure Point + GNSS as the active app) show as:
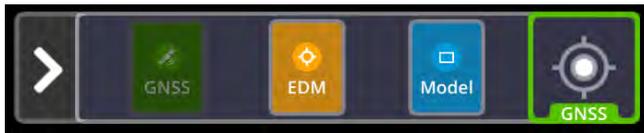
Tap the required measurement mode; the active app icon is updated showing the new measurement mode.

About measurement modes

The SiteVision system supports measurements between the real world and the digital model using three types of measurement modes:

- Recording Measurements with GNSS (Global Navigation Satellite System)
- Recording Measurements to the Real World: EDM, LiDAR, or Camera
- Recording Measurements to the Digital Model

Recording measurements with GNSS (Global Navigation Satellite System)

GNSS measurements are taken using the SiteVision GNSS. GNSS is shown in green. When you measure in GNSS mode, the measurement is taken at the location of the antenna, and the pole height and antenna offset are applied.

> **TIP –** To set the correct pole height, tap ☰ / ✖ **Tools** / ☷ **Configuration**.

To take a measurement using **GNSS**:

1. With your required measurement app active (bottom center of the screen), tap it.

2. On completion of the measurement a blue marker (10 cm diameter sphere) appears in the model. The position in local coordinates and latitude / longitude / height is displayed.

    > **TIP –** To discard the measurement, tap the delete button in the bottom right corner of the results dialog.

Once a measurement has been made the **Sync** icon ⟳ appears on the right side of the main screen. When you use the Sync function, measurements are sent for processing to:

- Trimble Connect, if you loaded your model from Trimble Connect. The first time you send measurements to Trimble Connect you will be asked for a name for the .csv file. There is only one .csv file per model. Each time you sync your measurements the revised file updates Trimble Connect.
- the **SV Measurements** folder on your device, if you used the **Load Model / My Files** option. The

first time you sync measurement you will be asked for a name for the .csv file. There is only one .csv file per model. Each time you sync your measurements the revised file is updated.

Recording measurements with the EDM mode

EDM measurements use the integrated range finder module located under the DA2 receiver of the HPS2 handle, or the DA1 antenna in the SiteVision Integrated Positioning System. EDM measurement mode is shown in orange and requires a Bluetooth connection between your mobile device and the SiteVision system (the connection will be established automatically).

> **NOTE –** You must have Bluetooth® turned on on your device to use the EDM.

If there are multiple SiteVision units being operated in a small area, such as for training, it is important to power up and connect each unit in sequence.

1. Start one unit and complete the connection to the EDM as above.

2. Start the second unit and complete the connection to the EDM.

3. Repeat for each unit.

    The SiteVision unit connects to the first available (unpaired) EDM unit it finds, so failing to follow the procedure above may result in the device mounted on unit A connecting to the EDM in unit B or unit C.

To initiate EDM measurements, tap the active measurement app (bottom center of the screen), or tap the cross-hairs.

• When EDM measurement is turned on the EDM measures continuously to get an estimated range to the target. This estimated range is used to automatically align the sighting cross-hairs to account for the offset between the camera lens and the EDM lens in the SiteVision positioning system.

> **NOTE –** Due to this offset, take care when operating at short ranges to confirm the crosshairs and EDM red dot are aligned on the same target before measuring.

• The cross-hairs appear as red or white, as follows:

the cross-hairs are red when...	the system is re-aligning the cross-hairs.
	the EDM doesn't return a valid distance measurement (e.g. if pointing to the sky, or to some surfaces that it can't easily measure to, such as glass or reflective surfaces).
the cross-hairs are white when...	the cross-hairs are aligned with the target, indicating that the EDM and the cross-hairs are aligned at the same target.

> **NOTE –** To generate coordinates for the remote point the SiteVision system uses the orientation derived from integrating the GNSS and the AR vectors. For best accuracy, walk toward the point to be measured for a few meters / yards before taking the measurement. Stopping and then rotating quickly will reduce the orientation accuracy to the level of the AR visual tracking and may result in a significant error in the horizontal position.

- > **TIP –**
  >
  > - For more accurate operation, steady the device; using it on a short range pole can assist with this.
  >
  > - Accuracy is also dependent upon the GNSS position so ensure that you have a high accuracy GNSS position when measuring to remote objects.

The EDM unit has a range of up to 100 m (300 ft) depending on the target type surface and lighting conditions, but for accurate operation (< 20 cm / 8 inches) Trimble recommends that you use it at range of 0.5 m to 10 m (1.5 ft to 30 ft), or up to 25 m (80 ft) to record features requiring lower accuracy (such as trees).

Depending on the reflectivity of the surface, steadiness of pointing and other factors, you may get a message indicating that the measurement has failed. Either repeat the measurement, move closer to the point and re-measure, or try measuring from a different angle.

/ Recording measurements with LiDAR or camera

Real World LiDAR and Camera measurement modes are shown in orange.

Real World measurements measure a point in the real world, captured in the coordinate system of the model you have loaded. The measurements are based on the technology of the device being used. For most devices this is based on visual odometry, calculating distances using camera images and sophisticated algorithms. Some more modern devices include a LiDAR sensor, which allows for much more reliable and accurate measurements. However even with LiDAR, the range tends to be limited to approximately 5 meters (5.5 yards). SiteVision will automatically detect and use the best available Real World measurement method.

> **NOTE –** Due to the limited inherent accuracy of these measurements it is not advised to use these measurements for purposes that require high levels of accuracy.

To initiate LiDAR or Camera measurements, tap the active measurement app (bottom center of the screen), or tap the cross-hairs.

- The cross-hairs appear as red or white, as follows:

the cross-hairs are red when...	SiteVision is unable to return a valid distance measurement (e.g. if pointing to the sky, or to some surfaces that it can't easily measure to, such as plain vertical walls with no defining features, or glass / reflective surfaces).
the cross-hairs are white when...	a valid distance measurement is able to be returned (edges of objects, or patterned surfaces will provide more reliable results for Camera based measurements. LiDAR enabled devices should perform well in most circumstances).

- Both Camera and LiDAR measurements have a limited range of approximately 5 meters (5.5 yards). Beyond these ranges it becomes very difficult to achieve a valid measurement.

Recording measurements to the digital model

Model-based measurements use the Google AR or Apple ARKit functionality to measure to a point directly within the 3D visualization.

To initiate Model measurements, point the cross-hairs at the point in the model you want to measure to, then tap the active measurement app (bottom center of the screen), or tap the cross-hairs.

> **WARNING –** Due to limitations of the AR technology, positions measured to the Real World or to the Digital Model are not warranted for survey or safety purposes. Use survey grade equipment with appropriately trained professionals if certified accuracy is required for remote measurements.

Using the BCF Topics / Screensnap app

If you loaded a model that was stored on your device, the Screensnap app is available. Tap it to take a screensnap.

If you loaded a model from Trimble Connect, the BCF Topics app is available . A BCF Topic is an open source industry standard reporting mechanism which enables you to take and send georeferenced, augmented reality screensnaps and notes to a project member. SiteVision provides tools to create new Topics, and also view, edit, and navigate to existing Topics. These tools can be used to support a variety of field workflows including inspections, QA/QC, and coordination.

When you have selected the BCF Topics tool, shows as the active app icon.

> **TIP –** Tap it to take a photo, or double-tap to take a photo without the SiteVision user interface.
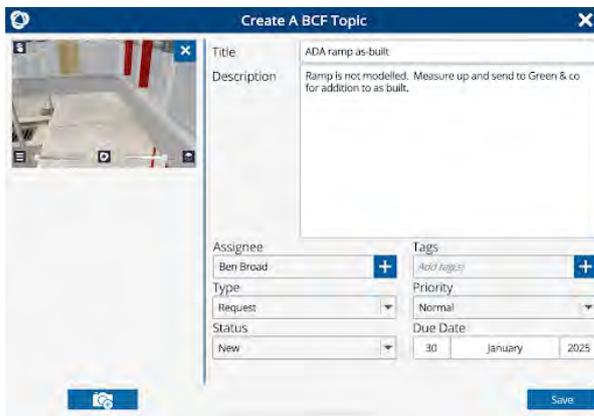
Completing the BCF Topic details

- The system automatically names the BCF Topic but you can edit this to suit.

- You can enter a description of the task by typing it or, if supported by your device model / configuration, record using voice.

- Project team members can be assigned to a BCF Topic, and will receive an email notification.

- The Trimble Connect user that the BCF Topic is assigned to can receive an email notification with the details and associated link.

> **TIP –** Project members must be set up in the Trimble Connect project to enable BCF Topics to be assigned to them.

- Tags can be added; the list of available Tags can be configured in Trimble Connect.

- You can also assign a Type, Priority, and Status from a preset dropdown list. These dropdowns come with preset defaults but can be managed and customized within Trimble Connect.

- A due date can be set. This will default to +7 days.

> **TIP –** For more detailed instructions on how to configure custom Tags, Type, Priority, and Status fields, refer to the Trimble Connect Topics help portal.

- You can take and add more photos from the details window by tapping 📷 (bottom left).

- The photos come through in the BCF Topic in Trimble Connect as attachments.

Photos taken with BCF Topics

To capture a photo with the AR content that is displayed during operation, the BCF Topics function captures images by doing a screen capture. This limits the resolution of the images to the native screen resolution of the device (so the image will not appear as sharp as a photograph taken with the camera).

SiteVision stores the following information in the image as meta data::

- The high accuracy position from the SiteVision GNSS
- The orientation

The images stored include the composite image of the AR and real world, together with the accurate position and orientation of the image.

The images will be automatically attached to the BCF Topic and uploaded to Trimble Connect. When reviewing BCF Topics in the Connect 3D model viewer, selecting a BCF Topic will automatically navigate to the 3D location where the image was captured.

Managing BCF Topics

Immediately to the right of the ⬡ BCF Topics app icon is the ☰ button. Tap ☰ to open the **BCF Topics** panel which displays all active BCF Topics in the current Connect project. The location of the BCF Topics is also visible in the main view in both AR and plan by the ⬡ icon.
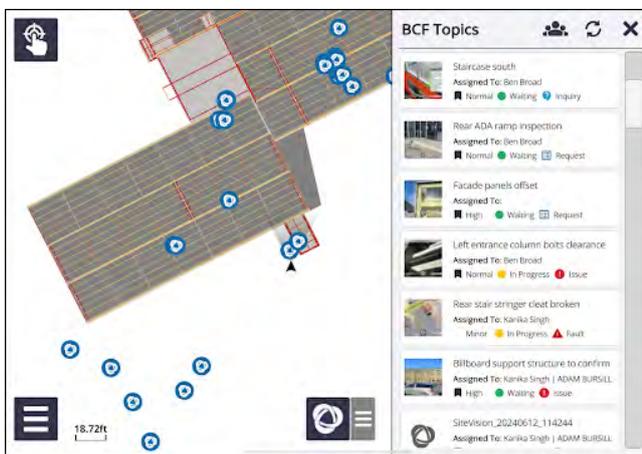
> **TIP –** By default all active project BCF Topics are displayed in the BCF Topics panel. Tap 👥 to filter the displayed BCF Topics to show only the active BCF Topics assigned to you.

To select an individual BCF Topic, tap on the list view or directly on the icon in AR view or plan view.

Once selected, the individual BCF Topic details are displayed in a summary window with a green indicator line pointing to its location. This can aid in navigating to the location where the BCF Topic was created.

To enter full-screen editing mode, and allow you to make updates and edits to existing BCF Topics, tap 🖉 in the summary window.

> **NOTE –** Only the Creator, Assignee, or Project Admin is permitted to edit an existing Topic.

Using the Measure Point app ⊙

Measure Point is used to record the coordinates of a single position. The point name, code, and coordinate information is recorded.

You can record points using GNSS ( ), Real World (/ /) or Model ( ) based measurements.

A measured point is shown as a blue sphere in SiteVision, unless you assign a symbol to it.

To measure a point, tap the Measure Point active app icon. The **Point Details** window displays, where you can:

- A default library of symbols is provided in SiteVision, and you can also upload to the device symbols from SketchUp or the 3D Warehouse, as SKP files. These symbols should be copied on to your device and placed in the following location:

    - On Android: yourDevice/Android/data/com.trimble.sitevisionAR/files/Symbols.

    - On iOS: Files/SiteVision/Symbols/

    For best performance, ensure your symbol models are as simple as possible, and not too complex. The maximum symbol model size is approximately 250,000 triangles.

    When you have selected a symbol to represent a measured point, the next point you measure uses the same symbol by default. You can change this as needed from the **Symbol** dropdown.

- rotate a point's assigned symbol to suit the environment; enter the rotation value in the **Point Details** window.

> **TIP –** You can also swipe left or right anywhere on the results dialog to rotate the symbol.

- edit a point's details.
- remove a point; tap 🗑 in the bottom right corner of the **Point Details** window.

Measured points and their assigned symbols and rotation values are stored as a .csv file.

> **NOTE –** The insertion point of a symbol corresponds to the SketchUp model's drawing axes. When creating or editing a new symbol, positioning the model near (or centered on) the drawing axes will ensure it appears in the correct location.

Tap **Sync** to sync the .csv file to Trimble Connect or the **SV Measurements** folder on your device (depending on how you loaded the model). See Syncing measurements for sharing in the office, page 151.

Using the Measure Grade & Distance app ✎

Measure Grade & Distance requires two points to be measured, creating a line. The name, code, grade, calculated distance, horizontal distance, and vertical distance are recorded. A line is shown in yellow with the two measured points shown as blue spheres.

You can record points using GNSS (▨), Real World (▨ / ▨ / ▨) or Model (▨) based measurements.

> **TIP –** In the **Grade & Distance Details** window, you can delete a measurement; tap 🗑 in the bottom right corner of the window.

Tap **Sync** to sync to Trimble Connect or the **SV Measurements** folder on your device (depending on how you loaded the model). See Syncing measurements for sharing in the office, page 151.

Using the Measure Lines & Area app ⬠

Measure Lines & Area is used in one of two modes to either measure an open polyline length, or closed surface area. A line measurement shows the length and total length; an area measurement also shows the surface area of the measured region. Measurements are saved in a .csv file.

You can measure areas using GNSS (▨), Real World (▨ / ▨ / ▨) or Model (▨) based measurements.

To measure a line or area:

1. Measure the first point.

   When measuring points for a line or area, they are shown as a blue sphere.

2. Measure the second point. The yellow line is shown between the two points.

The length between the points appears in a panel on the left of the screen, along with the current surface area defined by the measured points (0 m^2 for a straight line).

3. Continue to measure required points.

As you measure more points, the measurements shown on the left of the screen show the length between the last 2 points, and also the total length from the first measured point to the last point and the area defined by the measured points.

> **TIP –**
> - If required, you can delete any point by double-tapping it.
> - If you need to insert a point after any previously measured point, tap the previously measured point to 'activate' it, then measure your new point. The new point is inserted after the 'activated' point.

4. Tap the **Area** checkbox in the panel on the left side of the screen to toggle between measuring an open polyline or a closed surface area. When measuring an area the surface is displayed in purple.

5. When you have finished measuring a line or area, tap ☑ to complete the measurement.

> **TIP –** To cancel the entire current line or area you are measuring, double-tap ⬠.

6. Tap **Sync** to sync to Trimble Connect or the **SV Measurements** folder on your device (depending on how you loaded the model). See Syncing measurements for sharing in the office, page 151.

Using the Measure Volumes app ⬡

Measure Volumes is used to measure volumes using one of two volume calculation methods:

- By first measuring a base perimeter / area and then measuring individual height / depth points for the volume.
- By first measuring a base perimeter / area and then applying a fixed depth / height offset to create a volume.

Each measurement shows the Perimeter, Base Surface Area, and Volume of the measured region. Measurements are saved in a .csv file.

You can measure volumes using GNSS (GNSS), Real World (EDM / Camera / LiDAR) or Model (Model) based measurements.

To measure a volume:

1. Measure the first point.

Measured points are shown as blue spheres.

2. Measure the second point. The yellow line is shown between the two points.

The length between the points appears in a panel on the left of the screen, along with the current base surface area defined by the measured points (0 m^2 for a straight line).

3. Continue to measure required points for the base of the volume.

As you measure more points, the measurements on the left of the screen show the total measured perimeter length, and also the total base surface area.

> **TIP –**
>
> • If required, you can delete any point by double-tapping it.
>
> • If you need to insert a point after any previously measured point, tap the previously measured point to 'activate' it, then measure your new point. The new point is inserted after the 'activated' point.

4. Tap ❯ to move to the next step.

5. You can now do either of the following:

   • Measure various height points within the base surface. This will create a triangulated surface in real time and is best for measuring irregular shapes such as stockpiles.

   • Tap the **Depth** panel on the left side of the screen and manually key in a depth. This will project the base surface vertically and compute the volume. This is best for road subgrade or foundations.

   > **NOTE –** When keying in a Depth value, use a positive value to create the volume below the base surface area; use a negative value to create a volume above the base surface area.

The measurements on the left of the screen then display the calculated volume:

   • **Fill Material** for volume above the base surface

   • **Cut Material** for volume below the base surface

6. When you have measured a volume, tap ✓ and give the measured volume a name. Tap **Finish** to save it.

The volume is displayed in dark blue.

> **TIP –**
>
> - To cancel the entire volume you are measuring, double-tap 🔺/🔺; the icon will vary depending on the step of the volume measurement you are in.
> - In the **Volume Details** window, you can delete a volume measurement; tap 🗑 in the bottom right corner of the window.

7. Tap **Sync** to sync to Trimble Connect or the **SV Measurements** folder on your device (depending on how you loaded the model). See Syncing measurements for sharing in the office, page 151.

Using the 3D Scan app 📥

The 3D Scan app is used to capture a high quality georeferenced point cloud. This point cloud is saved in LAZ format, and includes coordinates, color, and classification.

Important: The 3D Scan app is only available on LiDAR-equipped iPhone Pro and iPad Pro devices. The Scan app is not available on iOS devices without a LiDAR sensor, or Android devices.

Prior to scanning you will need to load a model. Scans will be captured in the same coordinate system as the model you have loaded.

To begin scanning:

1. Open the 3D Scan app from the apps carousel.

   The first time you open the app you are prompted to choose your scan setting:

   To close the scan setting panel, tap ❯. Tap ❯ to reopen the scan setting panel at any time — even while scanning — to adjust the setting as needed.

   > **TIP –** The scan setting slider offers a trade-off between a longer scanning range versus a higher quality, less diffuse point cloud. Trimble recommends that you keep the slider set to higher quality. However longer range can make scanning larger areas faster, and can be necessary when scanning taller objects such as walls or ceilings.

2. Tap 📷; the app begins capturing points. The range of point capture varies based on the scan setting, and will range from 3 meters (3 yards) at Higher Quality up to a maximum of 9 meters (9 yards) at Longer Range. The material being scanned, the lighting conditions, and the device model can all impact scanning range, potentially reducing this maximum range.
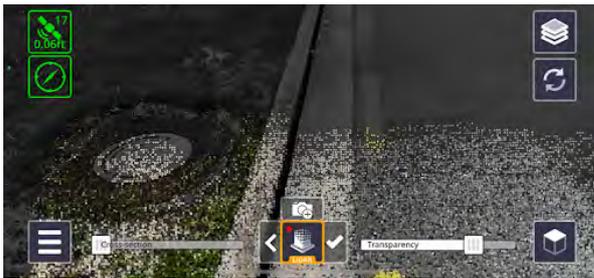
3. Continue capturing points until you have completed your scan. You can pause (and resume) point capture at any time by tapping ![icon].

4. While scanning, you can quickly capture a full resolution photograph by tapping ![icon]. A preview image will briefly appear at the bottom left of the screen to confirm the photograph has been captured.

> **TIP –** If you want to cancel your scan, double-tap ![icon].

5. Once you have completed scanning, tap ![icon] on the right side of the Scan icon; you are prompted to enter a name for the scan.
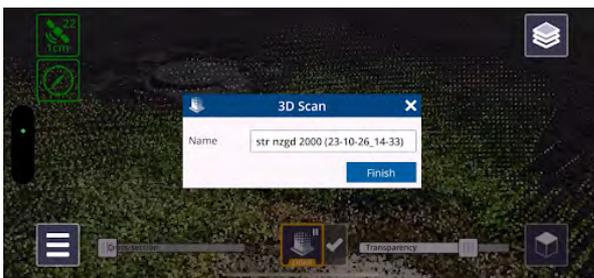
6. Tap **Finish** to save the scan.

Once you have captured a scan the Sync icon ![icon] appears in the top right of the screen. When you are ready to begin the sync process, tap ![icon].

> **TIP –** Due to the size of scan data it may be preferable to use a Wi-Fi data connection (rather than cellular) to sync the data.

The scan data and any captured photographs will be uploaded to Trimble Connect and placed in a new folder called **SiteVision Scans**. This folder will be created in the same location as your loaded model.

In addition, the scans saved to Trimble Connect will be automatically published to the Trimble Reality Capture Platform Service.

> **TIP –** The Trimble Reality Capture Platform Service allows point clouds to be viewed within the Trimble Connect 3D browser. This enables powerful QA/QC workflows by visualizing and comparing scans with 3D models.

> **NOTE –** You can also capture a 3D scan with a model loaded from your local device. In this case, when you tap ⟳ , you are prompted to save the LAZ file via the iOS share dialog. This allows you to save the file locally to your device, or send it to other file sharing apps such as Google Drive.

Georeferencing your 3D scans

To ensure accurate scan results that are georeferenced correctly to your model, it is important to ensure your model is placed correctly prior to starting your scans.

GNSS placement

When scanning with models using GNSS placement, placed automatically or with a Measured Placement with an active GNSS connection, you must obtain both a green position and orientation before you are able to initialize the 3D scan.

While scanning, if your GNSS accuracy subsequently degrades (due to entering a GNSS denied area), you can continue scanning but you will be restricted to an area within 5 meters (5 yards) of your last green GNSS position. This area is displayed as a yellow circle (as shown in the image below), and it is not possible to capture data outside the limits of the circle.

Returning to a green GNSS position will allow you to resume scanning as normal.

Non GNSS placement

It is still possible to create georeferenced scans when working with a Manual placement or Marker placement. This allows for scanning in GNSS denied areas such as indoors or even underground. With a Manual placement, the 3D Scan region will be limited to within 5 meters (5 yards) of where the scan was initialized; with a Marker placement, the 3D Scan region will be limited to within 5 meters (5 yards) of any scanned Marker.

Size of scans

The exact area and size of scan that can be captured varies based on the device, and also the complexity of the loaded model. SiteVision will calculate the maximum size of allowable scan. Once 65% of the scan size is reached, a green progress bar appears on the screen above the 🔅 icon. When the maximum scan size is between 80% and 90%, the progress bar changes to orange; between 90% and 100%, it changes to red). Scanning can continue, but will be halted once the bar completely fills up.

Scanning best practices

Following are some tips and tricks for getting the best results using the 3D Scan app:

- Ensure your system calibration or camera offsets are correctly configured prior to scanning.

- For best quality results, use slow and steady movements when scanning. Fast movements and swings can reduce the quality of the data. Horizontal sweeping (a natural tendency) is not recommended, and vertical sweeping (unless gently) gives the worst results. An exception is that a gentle vertical single pan is the best way to capture features such as poles.

- Reducing the speed and the frequency of turns will help keep AR drift to a minimum.

- For edges, such as those of concrete slabs, it is recommended to walk in the same direction as the edge, to get the best definition.

- It can be difficult to capture shiny or reflective surfaces such as bare metal or road signs, and transparent materials such as glass or water will not be captured. It is also difficult to capture black surfaces and certain vegetation.

> **TIP –** For optimal performance keep your LiDAR sensor clean by following the manufacturer instructions. Buildup of dust/grease can impair the performance of the sensor.

Using the Measure Cut/Fill app ⚏

Measure Cut/Fill records the difference between the existing ground surface and the design surface, as a virtual stake.

- Red - Indicates a cut.

- Blue - Indicates a fill.

Cut/Fill measurements can be taken with:

- GNSS , for best accuracy. The accuracy with GNSS measurements is a few centimeters.

- EDM , often quick and convenient for a number of measurements. The accuracy of the cut/fill with the EDM depends on the accuracy of the tilt sensors in your device, which vary by device model.

When used in conjunction with a high precision RTK Fixed GNSS position, typical accuracies of +/- 10 cm (4 in) can be achieved for points at short ranges (5-10 m / 15-30 ft).

- LiDAR [LiDAR] or Camera [Camera].

> **TIP –**
>
> - In the **Cut/Fill Details** window, you can delete a cut/fill measurement; tap 🗑 in the bottom right corner of the window.
>
> - Cut/Fill measurement will return valid values only when there are design surfaces above or below the point.
>
> - If you have multiple surfaces loaded in SiteVision, use **Layers** to manage which surface is measured to. SiteVision will measure to the lowest design surface that is visible (turned on). See Viewing a model, page 121 for more information on Layers.
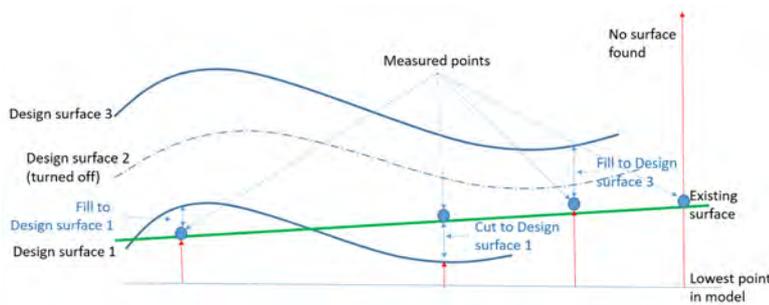

Using the Plane app ◆

The **Plane tool** allows you to design flat or sloping surfaces (planes), compatible with Trimble Earthworks and Trimble Business Center. The designs are stored locally on the device and can be synchronized to Trimble Connect.

> **TIP –** Using the Trimble File Flipper app, you can transfer a design directly to your Trimble Earthworks machine control system in the field.

You can design planes using GNSS ([GNSS]), Real World ([EDM] / [Camera] / [LiDAR]) or Model ([Model]) based measurements.
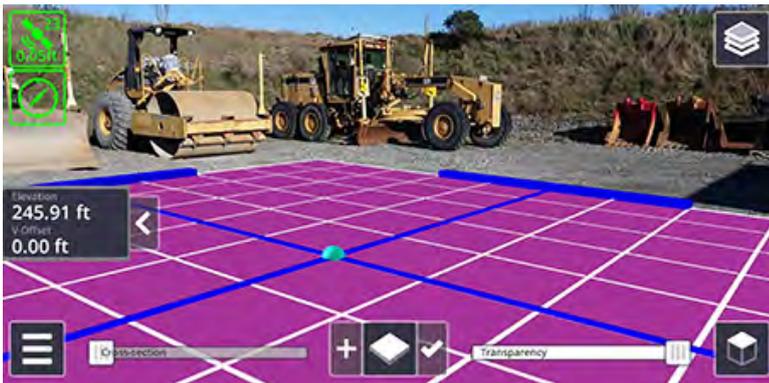
To design a plane:

1. Measure a point. This creates a flat square plane (10 m x 10 m; 32.8 ft x 32.8 ft) centered on the measured point. It is shown on screen in purple.

   - To resize the plane in length and/or width, tap-hold a handle at the edge of the plane, then drag the handle to extend or shrink the plane from that edge. You can also pinch-zoom the plane to extend or shrink it in length and width.

   - To change the elevation of the plane, enter the required elevation value in the panel on the left of the screen, or drag the plane's central point up or down.

   - To add a vertical offset, enter the required value in the panel on the left of the screen.

2. To create a sloping plane, tap ✚ (left of the active app icon) to add a second point to the plane.

   - To define the grade of the slope along the axis of the plane (the line along the two points), and/or to define the cross slope of the plane (that is transverse to the axis), drag the handles at the extents of the plane up or down, or enter the required values in the panel on the left of the screen.

3. When you have created the plane, tap ✔ to give the plane a name. Tap **Finish** to save it.

   - The plane is saved as a .dsz file.

   - A .cal file is also created with the same name, containing the necessary coordinate system information for use with Trimble Earthworks.

   - Entries containing the points used to define the plane are added to the .csv measurements file.

   > **TIP –** To cancel the entire plane that is in progress and start again, double-tap the app button at any stage before you tap ✔.

As with the Profile tool, when you create a plane you can sync it to Trimble Connect. Tap ⟳ then tap **Sync**. See Syncing measurements for sharing in the office, page 151.

Using the Profile app 🔲

The **Profile tool** allows you to design linear trenches, bunds, etc, compatible with Trimble Earthworks and Trimble Business Center. The designs are stored both locally on the device and synchronised to Trimble Connect.

You can design profiles using GNSS ( ), Real World (/   /   ) or Model (   ) based measurements. For best results, use GNSS measurement mode.

To design a profile, you measure the first point of the alignment, draw the profile template on a grid, then measure additional points to extend the profile's alignment in the required direction and distance.

A completed profile alignment is shown as:

- a yellow line which corresponds to the alignment (following the measured points)
- white lines which represent the borders / changes in the profile's angles
- a purple surface

1. Measure a point, which is the first point of the profile's alignment.

    A grid appears on the screen. You may need to step back to fully see the grid.

2. Tap points on the grid as needed to draw the profile template.

    > **NOTE –** You can also enter values in the panel on the left of the screen.

    > **TIP –** To discard a profile template's point, double-tap it. To move a point, tap-hold and drag it in the grid. You can also edit its values in the side panel.
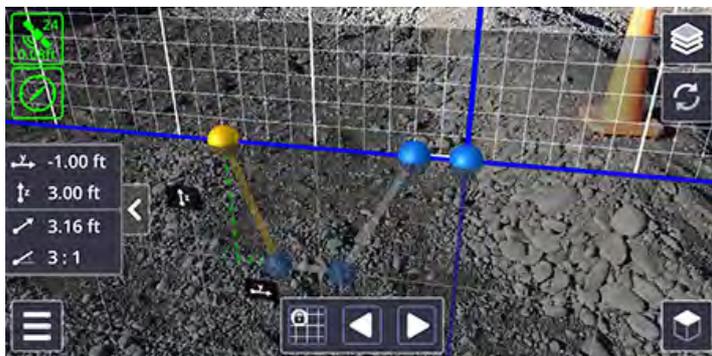
    By default, points are snapped to the nearest corresponding point on the grid. To turn off the 'snap' functionality, tap 🔲 to 'unlock' the grid and place points freely.

3. When the profile template is complete, tap ▶.

4. Walk in the direction that the profile is to extend in (i.e. the alignment), and measure a second point. The profile will extend from the first measured point to the second measured point.

5. Walk and measure additional points as needed.

> **TIP –** To discard a point in the profile's alignment, double-tap it.
>
> **TIP –** To insert a point after a previously measured point, tap the previously measured point to 'activate' it, then measure your new point. The new point is inserted after the 'activated' point.

> **NOTE –** If you turn at a sharp angle, a curve is created in the design.

6. You can adjust the elevation of the profile alignment. Tap [icon] to see the **Edit Alignment Elevation** window, and edit if required the **Start Elevation**, **End Elevation**, **Grade**, **Start Offset**, and **End Offset**.

   The **Start Elevation**, **End Elevation**, and **Grade** fields are all linked; editing one requires another to change accordingly. When you edit one of these fields, the other field that you most recently edited stays fixed, while the remaining field changes. Initially, the **Start Elevation** is considered the most recently edited.

   Tap **Apply** to save your edits.

   In the window, the red line (the line between the first and last point of the alignment) represents the alignment's grade.

7. When you have created the profile as needed, tap [icon] to give the profile a name. Tap **Finish** to save it.

   - The surface and associated linework is saved as a .dsz file.
   - A .cal file is also created with the same name, containing the necessary coordinate system information for use with Trimble Earthworks.
   - Entries containing the points used to define the profile alignment are added to the .csv measurements file.

> **TIP –** To cancel the entire profile that is in progress and start again, double-tap the app button at any stage before you tap [icon].

As with the Plane tool, when you create a profile you can sync it to Trimble Connect, or if you used the **Load Model** / **My Files** option, to the **SV Measurements** folder on your device . Tap [icon] then tap **Sync**. See Syncing measurements for sharing in the office, page 151.

Using the PDF app 📄

The **PDF tool** allows you to visualize a PDF plan or JPG, TIF, PNG, or HEIC image alongside an existing 3D model or the real world. The workflow for PDFs and images is the same. The JPG, TIF, PNG, and HEIC image formats can be imported, scaled, and viewed in SiteVision in exactly the same way as PDF plans.

To position and correctly scale a PDF plan or image file you will need to identify two known points in the real world that correspond to the PDF plan / image.

> **TIP –** By tapping on a PDF or image file either on your device or as an email attachment, you will have the option to **Open with Trimble SiteVision**; this automatically imports the file into the app, and adds it to the **Document Library**, ready to visualize.

1. Tap the 📄 app icon.

    - If the file you want is not already loaded into the SiteVision app, you will need to import it. You can select a file to import from Trimble Connect, your device, or some other file storage location such as iCloud Drive, Google Drive, DropBox, OneDrive etc. Tap Trimble Connect or 📂 **My Files** from the side panel to navigate to the file you want to import.

        > **NOTE –** To select a file from a file storage location, you must have added the required file storage source(s) to your device's File Management app so that SiteVision can access the storage source(s).

    - If you have imported PDF or image files into SiteVision already, you can select them from the **Document Library**.

        While you are online, to ensure all data is up to date, tap ⬇ in the top right of the screen to sync all files from this **Document Library** with Trimble Connect. Alternatively, tap-hold a file to select it, then tap other files to select them, then tap ⬇ to sync just the selected files.

        > **NOTE –** The **Document Library** shows all the files imported to the device, including from previous sessions.

        > **NOTE –** When syncing files, any files already placed within models will be automatically updated.

2. Tap 👁 to continue.

> **NOTE –** When you select a file to place, and that file is from Trimble Connect, if you are online the file is synced automatically with the latest on Trimble Connect.

3.   Scroll through the page preview and tap to select the specific page you want to visualize.

4.   Select the first known point on your plan by zooming and panning to position the crosshairs at the correct location. Tap **Select** to confirm the point selection.
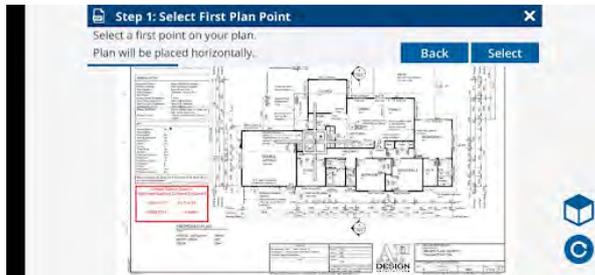
- •   The ⬠ button toggles between horizontal and vertical placement.
- •   The ⟳ button will rotate the sheet if it has not been loaded with the correct orientation.

5.   Navigate to the first known point. Place the SiteVision unit on top of the point and tap **Measure** to measure this position. When placing a PDF horizontally, the height of the first position is used to determine the height at which the PDF will be placed (the height of the second point that you will measure in the next step is ignored; the file is placed flat / horizontal). Trimble recommends using SiteVision mounted on a pole for this step.

6.   Repeat the previous two steps to select and measure a second known point. When placing a PDF vertically, it is important that the second point is not directly above the first (there must be some horizontal separation between the two points to correctly determine the orientation). After measuring the second point the file will be placed in the 3D view at the correct scale and location.

> **TIP –** When selecting two points to use to position the file, Trimble recommends that you select points that are far away from each other to provide a good baseline and ensure accurate positioning and scaling.

Multiple pages from the file can be loaded and displayed in this way. Each page will be displayed within the SiteVision layer manager, and visibility can be toggled like any other layer. Each page is stored as a separate layer—e.g. if you place 3 pages from a single file, 3 separate layers are created, indicated by <PDFname> + (<page number>).

Any placed files from previous sessions of SiteVision are stored under a **Prior User Measurements** layer.

Deleting files from the Document Library

You can delete files from the **Document Library** if required.

- To delete a single file, tap to select it then tap ▢.

- To delete a number of files, tap-hold a file to select it, then tap other files to select them, then tap
  ▢.

Viewing measurements

After taking measurements, you can view and interact with these in SiteVision.

The measured data and designs using the BCF Topics, Plane, and Profile apps are visible only for the current session and model loaded. Any placed PDFs, or measurements recorded using the Points, Grade & Distance, Lines & Area, Volume, and Cut-Fill, apps are preserved from earlier SiteVision sessions; these are stored under a **Prior User Measurements** layer.

- A point measurement is shown as a blue sphere by default, unless you have applied a symbol to it.

- A measured area is shown with blue spheres for the measured points, yellow lines for the lengths, and purple for the surface area.

- A measured volume is shown with blue spheres for the measured points, yellow lines for the perimeter, and dark blue for the volume.

- A cut/fill measurement is shown as a virtual stake. Red indicates a cut. Blue indicates a fill.

- A grade & distance measurement is shown as a yellow line with the two points shown as blue spheres.

- A plane is shown as purple for the surface area.

- A profile is shown as a yellow line which represents the profile alignment, white lines which represent the borders / changes in the profile's angles, and a purple surface.

> **TIP –**
>
> - For placed PDFs, Point, Grade & Distance, Lines & Area, Volume, and Cut/Fill measurements, tap the measurement on the screen to view its attributes. The **Details** window displays.
>
>   In the **Details** window, you can delete a measurement; tap 🗑 in the bottom right corner of the window.
>
>   > **NOTE –** You cannot tap and view details, or delete measurements for Plane, or Profile measurements.
>
> - Turn off the layers in the model to view only the measurements.
>
> - When you record measurements or designs in the field, SiteVision creates a layer for each app under a **User Measurements** layer. This enables user-created data to be hidden or displayed in the 2D or 3D view of data. To hide / display any layers, tap 📚 then tap the required layer(s) to hide or display them. See Viewing a model, page 121 for more information on layers.

Syncing measurements for sharing in the office

SiteVision has many apps that generate or record data which you can share for use in the office.

- For data that is measured for models that were loaded from Trimble Connect, the data is synced back to Trimble Connect.

- If you loaded a model using the **Load Model / My Files** option, you cannot sync to Trimble Connect; instead the data is available to share using third party applications such as your email app, Google Drive, iCloud Drive, or any file storage solution you use.

Each time you sync your measurements, files storing the results—whether on Trimble Connect or locally—are updated to the latest version of the files on your device.

> **TIP –** In Trimble Connect, you can see an earlier version of the file using the **History** function.

To sync your measurements once you have completed them:

1. Tap 🔄 and confirm the name in the **Sync Measurements** window.

2. Tap **Sync**.

   > **TIP –** Tap-hold **Sync** to rename the .csv file.

> **NOTE –** Measurements recorded using the BCF Topics, Plane, and Profile apps cannot be viewed in SiteVision after the model session has been completed unless they are merged into the original data model and re-published. Any placed PDFs, or measurements using the Points, Grade & Distance, Lines & Area, Volume, and Cut-Fill apps are preserved from earlier SiteVision sessions; these are stored under a **Prior User Measurements** layer.

Using Infotech Mobile Inspector with SiteVision

SiteVision integrates with the Infotech Mobile Inspector web application to enable digital field data collection workflows, supporting construction inspection processes. Inspection tasks can be posted within Mobile Inspector; SiteVision will then list these tasks and provide tools enabling site inspectors to collect accurate digital measurements. This helps site inspectors focus on tasks, capture asset and location data digitally, and communicate updates back to the construction management system.

IMPORTANT: The SiteVision integration with Mobile Inspector is not supported on iOS devices.

System requirements

SiteVision supports Infotech Mobile Inspector integration with any of the following:

- Infotech construction management systems:
    - AASHTOWare Project Construction & Materials
    - AASHTOWare Project FieldManager
    - AASHTOWare Project SiteManager
    - Appia
- Any SiteVision compatible Android device.

Setup and installation

The Infotech Mobile Inspector application must be installed on your field device, and the device registered with your Infotech construction management system.

For detailed instructions refer to the Infotech documentation available here:
https://learn.infotechinc.com/guides/mobile-inspector-install-guide.pdf

Trimble SiteVision and the Trimble Measure Service must also be installed on your device. These are available to install from Trimble Installation Manager.

> **NOTE –** The Trimble Measure Service is not available for download via the Google Play store. Use Trimble Installation Manager to set up and install the Trimble Measure Service.
>
> For detailed instructions on installing Trimble Installation Manager, go to https://install.trimble.com/

Installing SiteVision and the Trimble Measure Service

1. Open Trimble Installation Manager on your device.
2. If Trimble SiteVision is not visible, tap the Show All icon.
3. Tap the Trimble SiteVision icon.

4. Ensure both the Trimble Measurement Service and Trimble SiteVision boxes are checked.

5. Tap Install.
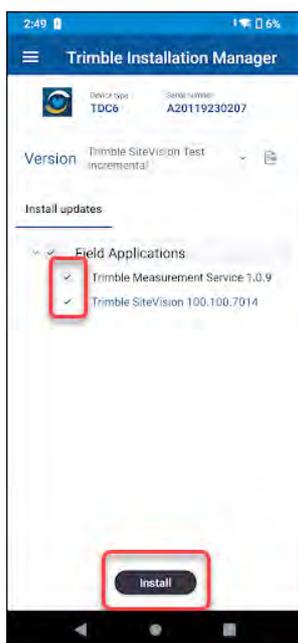
Custom units file

SiteVision supports a default units library that contains common point, length, area, and volume calculation units and their SI Converter. However, due to different naming conventions and abbreviations which can vary

from project to project, it may be necessary to support additional, custom unit definitions.

SiteVision supports the use of a custom units file — a simple .TXT file that contains these additional unit definitions. SiteVision features a workflow to import these units on each device, which requires the .TXT file to be copied to the Downloads folder of each device running SiteVision.

For support creating and editing a custom units file, Trimble recommends contacting your Trimble distributor.

A sample custom units file is provided below.

```
// Each unit line has three comma separated elements
// <name>,<type>,<SI unit multiplier>
//
// Spaces and capitalization in the name are ignored when matching.
// <type> must be "length","area", or "volume"
// Volume units
m3,volume,1.0
cuft,volume,35.31467
cubicft,volume,35.31467
cf,volume,35.31467
cy,volume,1.30795
gal,volume,264.172
l,volume,1000.0
// Area units
m2,area,1.0
sqft,area,10.7639
squareft,area,10.7639
acre,area,0.000247105
ha,area,0.0001
sf,area,10.7639
sy,area,1.1959
syin,area,1.1959
// Length units
m,length,1.0
ft,length,3.28084
```

```
k,length,0.001

lf,length,3.28084

lm,length,0.000621371

lkm,length,0.001

mile,length,0.000621371

yard,length,1.0936

ym,length,1.0936

km,length,0.001
```

Using SiteVision with Mobile Inspector

Posting measure requests

When working with Mobile Inspector, measurement requests can be added to any Field Report Posting.

1. Select the **Postings** tab.

2. Add a new Posting or edit an existing Posting.

3. Complete any required fields.

4. Tap the blue **Measure Service** button to post the measure request.

A confirmation message displays at the bottom of the screen confirming the measure request has

been successfully posted.


Fulfilling measure requests

Once measure requests have been posted, they are displayed in SiteVision in the Mobile Inspector inspection panel. This panel is visible within the main SiteVision AR interface and allows you to select a measure request and perform the necessary measurements to fulfill the measure request.

When using SiteVision with Mobile Inspector, Trimble recommends that you first load a model that contains a valid alignment. This will allow all measurements to be captured in terms of the alignment station and offset. See working with alignments for more information.

1. Tap in the top right of the main interface to open the inspection panel.
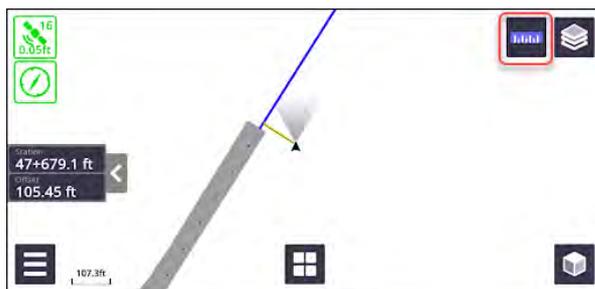
2. The list of measurement postings is displayed along with the associated measurement type and units. If required, tap **Import Units** to open the Downloads folder of your device and select your custom units file.
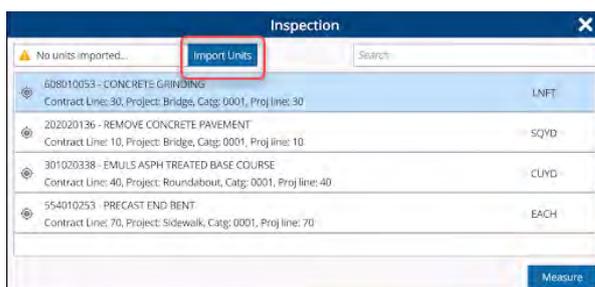
If a measurement type does not appear to correspond to the required units, this indicates that a custom units file is required. Unrecognized units will default to the Point measurement type.

Once imported, the active units file name is displayed, and the measurement type icon is updated to the correct measurement type.

The measurement types show as ◉ Point , ⌒ Line, ⬠ Area, or ◈ Volume.
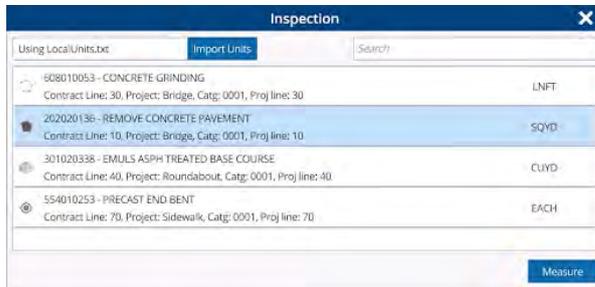

3. Tap a measurement posting to select it, then tap **Measure** (bottom right) to begin measuring.

4. The main AR view displays, with the appropriate measurement tool selected according to the measurement type. You can now conduct the necessary measurements using the measurement tools, see Using the Apps: reporting, measurement, and design tools, page 127

Once a measurement has been completed it will be displayed in the workflow panel on the right hand side of the screen. It is possible to attach multiple measurements to a single measure request.

> **TIP –** Tapping ✖ will remove a measurement from the measure request. Tapping the measurement in the AR view will add it back to the measure request.
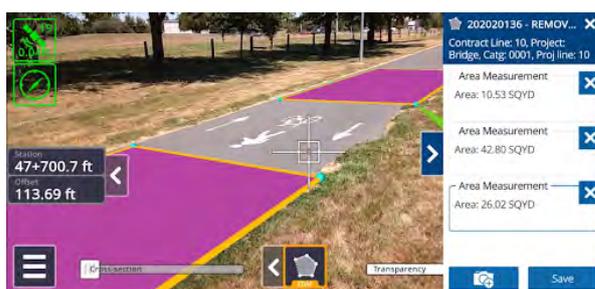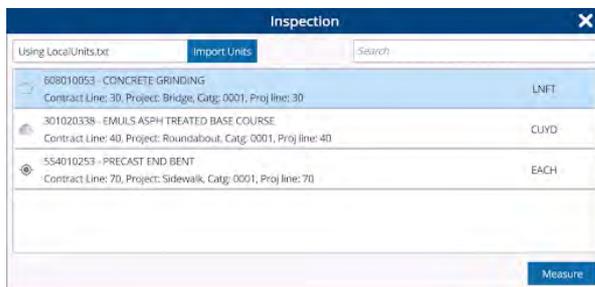

5. AR Photographs can also be attached to a measure request; tap 📷 in the workflow panel.
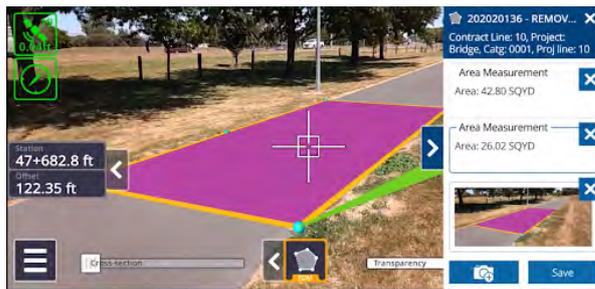
6. Once all necessary measurements are complete, and necessary photographs attached, tap **Save** to complete the measure request.

    The inspection panel displays, and the previously fulfilled measure request will be removed from the list.

Once the measure request has been fulfilled, all associated measurements and photographs are automatically attached to the posting within the Mobile Inspector app.

> **NOTE –** If an error is made and a completed measurement request must be redone, you must open Mobile Inspector and resend the posting to the measure service.

5

Troubleshooting and tips

Contacting Support: Sending a SiteVision log file

If you need to send a SiteVision log file to the Trimble SiteVision Support team:

1. Tap **Tools** / **About** / **Support**.

2. Enter the required email address to send the log files to. This could be your internal support contact, or local Trimble distributor.

3. Optionally, take a photo of the issue; tap the camera icon, focus the screen, then tap to take the photo.

4. Tap **Send email**. Select the email application to send the log files with, e.g. Gmail. The email application launches with the log files automatically attached as a .ZIP file.

5. Add a detailed description of the issue you are experiencing and then send the email.

Image sizes

SiteVision supports the draping of georeferenced images and PDF files onto a surface in the Trimble TTM format. If the image resolution is too high the image will fail to load.

Trimble recommends:

- a maximum image resolution of 4000 x 4000 pixels;

- that you use Trimble Business Centre to prepare your data.

For scale plans ensure the Plotbox scale matches the scale of your plan. The recommended Image Capture resolution can then be set based on paper size:

International Paper Size	Recommended Resolution		American Paper Size	Recommended Resolution
A3	High (120 DPI)		ANSI/ARCH B	High (120 DPI)
A2	High (120 DPI)		ANSI/ARCH C	High (120 DPI)
A1	High (120 DPI)		ANSI/ARCH D	Medium (96 DPI)
A0	Medium (96 DPI)		ANSI/ARCH E	Medium (96 DPI)

To determine the best Image Capture resolution (DPI) you can use the following formula:

- `Imperial Units: PlotboxSize x DPI = Pixels`

- `Metric Units: PlotboxSize x 0.03937 x DPI = Pixels`

  Where `PlotboxSize` is the larger of Width or Height, and `Pixels` is the resulting size of the image that will be produced.

  > **NOTE –** You may need to adjust your Plotbox Scale to achieve the desired Plotbox Size.

Operating temperature

Smart phones and tablets are designed for consumer use and have limitations when used in demanding professional environments. One of the limitations is the operating temperature range.

Device manufacturers build in a level of protection to prevent a device being operated at temperatures outside its specification.

Running computationally intensive applications causes the internal temperature in the device to rise and limits the ambient temperature that the device will operate in.

Direct sun loading will cause additional internal temperature rise.

The SiteVision system running the camera, Google AR service or Apple ARKit service, and Catalyst softGNSS is a computationally intensive application. The model size and complexity affects the amount of computational load, and associated temperature rise that occurs.

The upper operating temperature limit varies by device. More modern devices are computationally more efficient and will operate at a higher temperature. The difference between devices Trimble has evaluated and other models can be up to 5 °C (41 °F) of operating temperature range.

Charging the device also adds to the temperature rise in the device.

> **TIP –** Always use the sunshade when operating in high temperatures to reduce the effect of sun loading on the device.

When operating in high temperatures, you may experience:

- The device shutting down the charging from the SiteVision system. This is indicated on Samsung phones by a red LED turning on.

- The screen darkening as the device shuts down the backlight to reduce the temperature rise in the device.

- Intermittent performance as the device's operating system reduces the processing available to applications.

- The device shutting down.

For more information on the operating temperature of Samsung devices, see
https://www.samsung.com/us/support/answer/ANS00076952/.

Accuracy of measuring remote points with the EDM / LiDAR

The three main sources of error that effect horizontal position accuracy are:

- The orientation accuracy
- Measuring by hand on flat angles
- Undetected errors in the Google AR or Apple ARKit reference frame
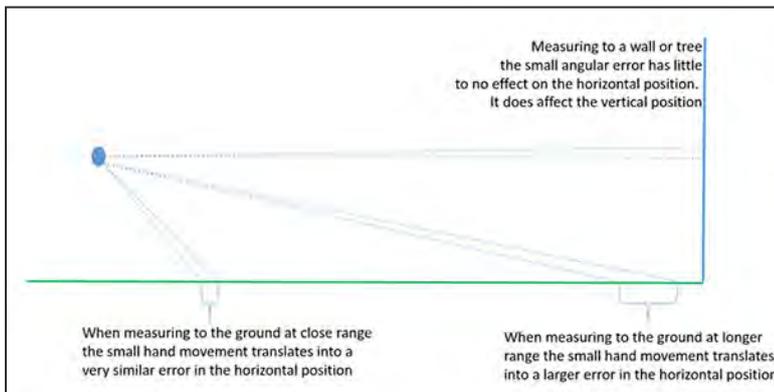
Orientation accuracy

SiteVision merges GNSS data with the Google AR or Apple ARKit visual odometry to obtain an accurate heading. This process relies on the GNSS vector created from multiple points while moving to get a reliable heading. When you are stationary for a period of time the system becomes increasingly dependent on the accuracy of the visual odometry. The visual odometry drifts over time, and rapid movements can also induce errors in the visual odometry. For the best accuracy:

1. Walk towards the point to be measured, before the measurement is made.
2. Avoid rapid rotations of the device before measuring. Rapid rotation can cause a heading error.
3. Keep the measurements as short as possible. The practical range is 2 - 10 meters. Shorter range reduces the position error introduced by errors in orientation.

TIP – For the best accuracy, make the measurements directly with the GNSS and a pole.

Measuring at flat angles

When measuring to the ground it is best to measure short distances. The longer the distance, at flat angles, the greater the horizontal movement from any small movement of your hand.

Measuring to a wall or tree the small angular error has little to no effect on the horizontal position. It does affect the vertical position

When measuring to the ground at close range the small hand movement translates into a very similar error in the horizontal position

When measuring to the ground at longer range the small hand movement translates into a larger error in the horizontal position

Undetected errors in the Google AR or Apple ARKit reference frame

The Google AR technology and Apple ARKit technology use visual odometry in conjunction with other sensors in the mobile device to track movement over time within the AR reference frame. A key limitation of this is

that errors continually accumulate with time. This shows up as a drift in the model. The SiteVision application constantly corrects for this drift by utilizing a high accuracy GNSS reference frame. This is performed for both your position and your heading.

However not all errors can be detected automatically by the SiteVision system. As a result remote points measured with EDM / LiDAR are not warranted for survey or safety purposes.

Optimizing battery life

When using a measurement application the EDM measures distances continuously. Switching to a non-EDM measurement mode will deactivate the EDM and save a small amount of battery power.

Connecting to EDM via Bluetooth

If there are multiple SiteVision units being operated in a small area, such as for training, it is important to power up and connect each unit in sequence.

1. Start one unit and complete the connection to the EDM as above, then

2. Start the second unit and complete the connection to the EDM.

3. Repeat for each unit.

The SiteVision unit connects to the first available (unpaired) EDM unit it finds, so failing to follow the procedure above may result in the device mounted on unit A connecting to the EDM in unit B or unit C.

SiteVision camera tracking stability

SiteVision uses visual odometry and requires contrast and definable objects in the camera scene that can be tracked. Any lack of visually distinct features such as pointing at a blue sky, low light, repeated patterns (such as striped carpet), busy environments with a lot of movement, can cause freezing and / or jumping in the visualization. Note this performance can vary by phone make and model.

SiteVision incorporates algorithms to manage this behavior, and will inform you if tracking is lost for any of these reasons. Often this is a momentary interruption and SiteVision is able to re-establish and continue tracking. However extended or severe loss of tracking will drop the orientation indicator back to a red state (which will then require reorientation).

For these reasons, Trimble does not warrant the accuracy of the SiteVision visualization in low light conditions.

Trimble Catalyst DA2 receiver and Bluetooth connections

If your iOS device is not automatically detecting and connecting to your previously paired Trimble Catalyst DA2 receiver there are a few troubleshooting steps to try:

1. If you previously connected your Catalyst DA2 receiver to your iOS device, unpair the receiver, then try to pair and connect it again.

2. If you can pair your Catalyst DA2 receiver with some devices but not your iOS device, unpair the receiver from your other devices, then try to pair and connect it again.

TIP – You can quickly reset your Catalyst DA2 receiver by holding down the power button until the blue LED turns off. This will unpair your receiver from all devices.