Trimble Business Center

Release Notes

Version 5.70

TRANSFORMING THE WAY THE WORLD WORKS

Welcome to Trimble Business Center

Trimble Business Center (TBC) provides a complete office software solution for survey and construction professionals. Having the ability to work in a single software environment streamlines operational efficiency while minimizing the costs of data management, software maintenance, and training.

Important Note! This version of Trimble Business Center is available to:

- Perpetual license users whose current warranty expiration date is **June 1, 2022** or later. (If your perpetual license warranty expires prior to this date and you proceed with the installation, licensed features will not be available.)

- Subscription license users whose subscription is currently active.

If necessary, you can contact your distributor to purchase a warranty extension or renew your subscription. In the TBC ribbon, select Support > License Manager to view your warranty or subscription expiration date.

New features

Following are the new features included in this version of Trimble Business Center. To view context-sensitive help at any time while using TBC, press **F1**.

Miscellaneous

- **Support for object-oriented total station setups** - You can now import "object-oriented" total station setups (also known as "unleveled setups") that were performed in the field and contained in a JXL file imported from Trimble Access. Unlike the orientation of a leveled total station setup, which is aligned to the Z axis, the orientation of an object-oriented total station is described by three rotation angles (X, Y, and Z), which are stored in the Station record in the JXL file. Object-oriented total station setups are used when the total station cannot be leveled, such as when the instrument is set up on a moving platform such as a barge or an oil rig or in a manufacturing environment where the object of interest, such as a beam or concrete slab, is not sitting flat.

- **Measure Distance CSV Report** - The new Measure Distance CSV Report command allows you to generate a CSV (.csv) report showing the results of one or more measurements stored in your project. Simply select the stored measurement(s) in the Project Explorer or graphic view, right-click, and select Measure Distance CSV Report in the context menu.

- **Enhanced Import command** - The Import command pane has a fresh, contemporary look and feel, providing a more intuitive and familiar interface for selecting and importing data files and folders into your project. (Note that although you can often drag-and-drop files to import data into your project, drag-and-drop does not allow you to view applicable import settings and make changes if necessary as the Import command pane provides. The default settings will be used.)

CAD

- **Create points using COGO 'command line' commands** - Use new point codes in the Create COGO command to add to COGO (COordinate GeOmetry) collections of lines in your project that you can use to create parcels and compute parcel closure.

- **Snap to nodes from imported vector PDFs** - You can now keep the coordinates of nodes that you can snap to in a vector PDF (indicated by a small x during georeferencing), by checking the Save snap locations box. Doing this will enable you to snap to those coordinates using the running Point Snap when the image is in your model (georeferencing is complete). Otherwise, the nodes from the vector PDF are no longer 'snappable' once the PDF is georeferenced.

- **Filter the Layer Manager** - You can now find a layer by name or just characters. Filter the layer list by entering any alphanumeric string into the Filter box. Delete the string from the Filter box and press Enter to see the full list of layers again. You can also enter regular expressions (regex) in the box to find layers.

Drafting

- **Block scale improvement for Sheet View** - When using blocks in sheet views in prior versions of TBC, you needed to account for the fact that most blocks were defined in model units (feet or meters). This usually required the user to adjust the block scale factors to account for this.. Now, you no longer have to enter/adjust the scale factor to convert from model to sheet units when inserting a block in Sheet View, the conversion is done for you (1.0' to 1.0"/1 m to 1 mm). Because of this change, you should check and correct the sizes of any blocks (e.g., north arrows) you previously inserted into sheets in projects before TBC version 5.70. Also, you are encouraged to create blocks only in model space (the Plan View).

Surfaces

- **View site balance factors in volume grid properties for a surface** – In the Properties pane for a selected volume grid, you will now find these fields:

  - Approximate balance amount – The vertical distance to move either the existing or design surface to balance the cut/fill volumes.

  - Approximate volume delta per 0.1 unit – The Approximate volumetric change if either surface is raised or lowered 0.1 of the project distance unit.

Use these values to generate a specific cut or fill based on the target balance value. For example, if you know what is required to balance a site, but you need a 1000 unit export, use the balance amount to determine the design elevation adjustment you need to make to get to the export overage volume. The approximate volume delta is also shown in the Earthwork Summary Report as Change Per 0.1.

Corridors and Alignments

- **Create a Sub-Template** - Use the Create Sub-Template command to make a stand-alone shape (such as for a curb) to insert into a corridor or any other template, such as a corridor side slope template. Simply define a set of instructions for the shape and then reuse them. Using sub-templates can greatly reduce the number of instructions in a corridor template. All related corridor template functions work the same way for sub-templates; they are just a way to group and reuse instructions.

- **Disable corridor transition logic** - A new 'Transition allowed' checkbox in the Edit Corridor Template command (for Offset/Slope and Offset/Elevation instruction types) lets you turn off default transition logic that might, for example, connect a node in one corridor template to an incorrect node on the next template. The default logic may be incorrect in rare cases in which templates are complex or far apart. Unchecking the Transition allowed box lets you define such transitions manually. If you use a table to define an offset/slope/elevation (when adding instructions in the Edit Corridor Template command), no transition is computed so the checkbox is ignored.

- **Important corridor logic enhancement** - The connection/transition logic between nodes in one corridor template and corresponding nodes in the next template has been improved for uncommon scenarios, such as when a connecting line crosses a centerline.

  Warning: While this change will generally make your corridor shapes better, you should check corridors in any projects that you rebuild after upgrading to TBC version 5.70 to verify that all transitions and connections are still working as you intended.

Point Clouds

- **Filter point clouds** - The new Filter Point Clouds command allows you to easily create a new point cloud region that includes only the scan points located within a specified distance from a CAD line or alignment, or from a scan station. Once created, the new filtered point cloud region can be displayed exclusively in your graphic views using the View Filter Manager. Select scan points by specifying any of the following criteria:

  - Distance on either side and above and below a selected CAD line or alignment

  - Radius distance from a selected CAD line or alignment

  - Radius distance from a scan station

  Note: This new command replaces the previous Filter Scan Station Points command.

- **Lane line feature extraction enhancements** - When extracting linestrings from lane line marking features in point clouds, you can do any of the following:

  - **Create a dashed line style from an extracted dashed lane line** - Prior to TBC v5.70, when you created a linestring from a dashed lane line marking feature extracted from a point cloud, the resulting default linestring was created with a solid line style. Now, during the extraction process, a dashed line style is automatically created by default and applied to the linestring that matches the start/end of each extracted dash, so the linestring and the extracted dashed line match. Using the linestring's Properties pane, you can toggle between viewing the linestring using the Auto-Dash line style applied automatically during extraction or another user defined line style.

    Note: With the exception of a few scenarios, you can export the extracted dashed line as a 2D polyline that will display correctly in AutoCAD or other CAD systems. If you export it as a 3D linestring, it will display as a solid line.

  - **Snap an extracted dashed lane line to the center of a dash** - To ensure a linestring extracted from a dashed lane line accurately follows the dashes through a curving portion of the road, you can now use the "Snap to Dash Center" button to force the manual points to move to the center of the of the lane line marking at the middle of the dashes.

  - **Automatic extraction direction** - Now, when you pick on the end of a solid line, the extraction process automatically specifies that the initial direction of the extraction process be away from the end of the line (as indicated by the white direction arrow), where it might not find adequate points to continue. (In the past, the initial direction of the extraction process was always to the right, regardless of where you picked on the line.)

  - **Extract a dashed lane line parallel to a solid line with less errors** - The process for extracting a dashed lane line that runs parallel to a solid line has been enhanced to minimize errors that cause the extraction to jump from the dashed line to the solid line.

  - **Perform lane line extraction QA/QC** - Lane line extraction now includes QA/QC tools to verify and make changes to the extracted linestring as necessary.

- **Automatically measure overhead line clearance** - The new Measure Overhead Line Clearance command enables you to select one or more overhead utility line features that have been extracted as linestrings (using the Extract Line Feature command) to automatically make a vertical measurement from the lowest point between two poles on each selected line to the classified point cloud region of your choice (for example, "Ground" or "Buildings") and store that measurement. You can select to flag vertical clearance measurements that are less than a specified distance, and you can generate a CSV (.csv) report showing the results of the measurements.

- **Perform a scan inspection** - Use the Scan Inspection command to display positioning deviations between either of the following pairings:

  - A 3D object (such as a surface, mesh, TRB, or IFC model) and a point cloud region

- Two point cloud regions

  The command creates a differential color map ("heat map") that graphically displays the deviations between the two selected objects in a variety of formats. You can view the inspection in graphic views, and you can generate a report showing the specified inspection points and the deviation values to perform further analysis.

- **Select point cloud data using a boundary** - Use the Point Cloud by Boundary command to select point cloud data within an existing 'boundary', rather than by clicking points to specify the boundary.

- **LAZ point cloud exporter enhancement** - The LAZ (.laz) point cloud exporter has been enhanced as follows:

  - You can select to export point cloud data in the latest LAZ version 1.4 record format.

  - Exported LAZ files include ASPRS classification code values.

- **Enhanced building detection/classification with aerial data** - The Extract Classified Point Cloud Regions command, which is used to automatically extract ASPRS-classified point cloud regions from a point cloud, has been enhanced to provide higher precision when working with aerial data, specifically when extracting buildings.

- **Colorized DTM point clouds** - Digital Terrain Model (DTM) point clouds are now colorized, resulting in increased detail that makes the clouds easier to interpret (for example, differentiate a forested area from a road). The denser the point cloud, the more detail available.

Construction data

- **Check for Errors in WorksManager designs** - Use the WorksManager Design Status command to see why a design failed to publish to WorksManager without having to log into WorksManager. Designs in error can often be fixed in TBC once you know the problem. You can see the status of all designs in your WorksManager account or for just those associated with the current TBC project.

Photogrammetry

- **Enhanced UAS data import** - The new Import UAS Data command pane displays when you import DJI® or Microdrones® aerial photogrammetry data contained in a UAS mission folder into your TBC project, whether you import using drag-and-drop, the new Import UAS Data command, or the standard Import command.

  The Import UAS Data command displays key parameters extracted from UAS image metadata (for example, camera focal length, pixel size, UAV height above ground, and GNSS quality) and specifies whether baseline processing or GCP measurements are recommended to perform an absolute orientation adjustment. Because these parameters are critical to the success of UAS data processing and deliverables creation, this command provides an opportunity for you to verify the parameters are complete and correct and, if necessary, make any changes prior to import.

The Import UAS Data command supports the DJI Phantom 4, DJI Phantom4 RTK, and DJI M300 (P1, L1), as well as the Microdrones mdMapper1000DG, mdLiDAR1000LR, mdLiDAR3000, and mdLiDAR3000DL.

Note: DJI and Microdrones UAS models do not produce a JXL (.jxl) file for import into TBC projects, as do UAS models from Trimble Gatewing®, Delair®, senseFly®, and Wingtra®. When importing UAS data from models that generate a JXL file, the Import UAS Data command is not used. See the TBC Help for more information.

- **Support for Microdrones UAS data** - Import and process data collected with Microdrones mdMapper1000DG and mdLiDAR1000LR using the new Import UAS Data command and the aerial photogrammetry workflow in TBC:

  Create high-quality deliverables (point clouds, elevation rasters, and/or orthomosaics) from the aerial images as required.

- **Colorized DTM point clouds** - Digital Terrain Model (DTM) point clouds are now colorized, resulting in increased detail that makes the clouds easier to interpret (for example, differentiate a forested area from a road). The denser the point cloud, the more detail available.

- **Increased rectified image size** - The Create Rectified Image command has been enhanced to automatically render multiple image "tiles" when creating a rectified image from a selection that exceeds GPU limitations of 16,384 pixels in each direction. The multiple image tiles are then combined into a single rectified image for import into your project. This allows you to make much larger selections when creating rectified images, resulting in much larger images (increased from approx. 268.5 MP to 500 MP).

- **Enhanced building detection/classification with aerial data** - The Extract Classified Point Cloud Regions command, which is used to automatically extract ASPRS-classified point cloud regions from a point cloud, has been enhanced to provide higher precision when working with aerial data, specifically when extracting buildings.

- **Reduced processing time for DSM and True Orthophoto generation** - The processing time required to generate a Digital Surface Model (Highest Quality) or a True Orthophoto from aerial photogrammetry data has been reduced significantly.

Tunnels

- **New** *Tunnel Set Outs As-Built Report* - Generate a customizable Microsoft® Word-based report that compares the location of as-built tunnel set outs with their associated set outs in the tunnel design. This report can be used for quality control and verification on surveyed vs. constructed positions of rock bolts, anchors, pipe umbrellas, and more.

- **Edit an as-built tunnel mesh** - Use the new Add/Remove As-Built Tunnel Mesh Members command to add or remove members (typically scanned or surveyed points) that define the shape of an as-built tunnel mesh. This can be useful if there are missing or unnecessary vertices in the mesh, resulting in an inaccurate shape.

- **Choose computation method for best-fit circle delta value in tunnel reports** - When creating an MS Word-based tunnel report that includes a best-fit circle delta value, you can choose the method to use to compute that value:
  - As-built value minus Design value
    or
  - Design value minus As-built value

  This choice allows you to easily customize any of the following reports to best suit the requirements of your audience:

  - Tunnel As-Built Report (with best-fit circle)

  - Profile MS Word Report

  - Profile MS Word Report

- **Specify chart scaling for *Tunnel Convergence Reports*** - When creating a *Tunnel Convergence Report*, you can specify the scaling to apply to all charts displayed in the report (just as you can with images): either use the same scale for all charts, or use the best-fit scale for each chart, providing greater detail when movement patterns are different between stations.

Monitoring

See "Resolved issues" for a list of Monitoring issues that were resolved in this version of TBC.

Mobile Mapping

Trimble Business Center 5.70 has been enhanced to significantly increase the efficiency of scan generation and to provide a fluid image navigation experience.

- **Camera Markers** – When displaying the Panoramic View of a run, TBC displays all of the 360° camera positions (called Camera Markers) for all runs in all views.

  - Click on a specific camera position in a view to move to that specific location in all views.

  - Jump to the next, previous, first, or last camera position by choosing the related command from the pop-up menu.

  - Customize your keyboard keys to jump to a camera position by increment.

  - Choose a specific camera position in a Panoramic View or Planar View and center it in the Planar View and 3D View.

- **Hide and display referenced images** – Hide/display the projected images in all views by unchecking/checking the related option(s) in the Filter Manager, or only in a specific view by toggling off/on the related option in the view.

- **Quick View** – The Quick View mode has been removed so only the Full View mode remains. Point Clouds are no longer displayed in overlay over the referenced images by default. Hide/display the point clouds in each view (Panoramic and Planar) by toggling off/on the related scans in the view or in all views from the Project Explorer and from the View Filter Manager.

- **Image blurring** - Image blurring performance has been improved by taking advantage of the GPU instead of the CPU.

- **Register Run to Run from multiple missions** - Register pairs of runs together from different missions. When using the Register Run to Run command for one mission, one run will be defined as a Reference Run, meaning that its trajectory will not change. The other run will be defined as an Adjusted Run, meaning that its trajectory will be optimized with regards to the Reference Run's trajectory. As a result, a new SBET file will be created for the adjusted mission.

- **Define a region of interest on a trajectory** – Define a bounding box around a position on a trajectory and navigate along the trajectory with the bounding box activated with a step you have to define.

Data Prep

- **Add an Elevation Line rules to vertical designs** - Reduce the number of user-defined rules (such as Connector rules) required to copy an elevation from one line to another while elevating multiple lines from 2D to 3D. To apply the rule, simply specify a vertical radius and start and end coordinates. All lines in between the source and target lines are computed with an elevation at the intersection point.

- **Apply a rule property to all crossing lines in a vertical design** - Use the new Apply to all crossing lines property to apply a rule's parameter to crossing lines that are included in the vertical design; any lines that are intersected between the source line and target line for the rule with this property enabled have the rule applied and are computed equally. This property now is available for these vertical design rules:

  - Cross slope rule

  - Cross dZ rule

  - Elevate by slope rule

  - Elevate by dZ rule

- **'Shrink wrap' a region outline** - Use the Shrink Wrap command to quickly create a boundary around outer lines, points, and other types of objects in your Plan View (can be used to create interior "holes" in the data as well). The shrink wrapped region is derived from portions of the bounding lines/edges that planimetrically intersect. This command can save you the tedious work of drawing boundaries around linework and surveyed data, which is a common task in data prep and takeoff.

Utility

- **Add a No Fitting node type to the end of open-ended utility pipes** - For gravity networks, you can now select a No Fitting type for a utility node at the end of a pipe; this type applies when there is an open end (and therefore no applicable fitting) at the downhill terminus of a utility run, such as an under-drain that goes into a basin.

Takeoff

- **Use boundaries when categorizing takeoff layers** - Automatically apply boundaries to Finished Design and Original Ground takeoff surfaces when using the Categorize Takeoff Layers command. A polygon icon in the layer list in the Design and Original tabs indicates layers that are classified as surface boundary layers (similar to the green checkmark for site improvement boundary layers). The 'Takeoff Surface Boundaries' section in the command now contains a surface boundaries checkbox to classify one or more layers selected as surface boundaries for the respective tab you are working in for both Design and Original tabs. Using this boundary function in the Categorize Takeoff Layers command will overwrite any existing surface boundaries you created using other commands.

Coordinate System

- **Coordinate System settings enhanced to properly display RTX calibration data** - When working with JXL or DC files with RTX calibrations, TBC has been enhanced to import and display RTX offsets with appropriate labeling and explicit reference to the intermediate reference frame and reference epoch. To support these changes, the RTX Calibration settings group in Project Settings > Coordinate System has been updated as follows:

  - The "RTX Datum" settings label has been renamed "RTX Calibration" to more accurately described the settings.

  - The "ECEF Offset" settings label has been renamed "Offset" because offsets can use either ECEF (for JXL files) or ENU (for DC files) coordinates.

  - The Δ symbol has been added as a prefix to offset labels to better match other offset labels in TBC and Trimble Access.

  - The "Sigma" settings label has been renamed "Precision" and now displays horizontal and vertical precision to better match offset labeling in Trimble Access.

  - The "ITRF" settings label has been renamed "Measurement" and now displays the reference frame and reference epoch.

  - When working with JXL files, the "Clear RTX Calibration" button allows you to delete any offset values displayed in the RTX Calibration settings and prevent them from being exported.

- When working with DC files, the "Estimate RTX Calibration" button allows you to specify that the software estimate the offsets for a DC file using time-dependent transformations.

  In addition, the global reference datum displacement model is now displayed in Project Settings > Coordinate System.

- **Change Coordinate System enhancements** - The Change Coordinate System dialog (Project Settings > Coordinate System > Change) has been enhanced as follows:

  - It includes a new search option that allows you to easily search for and select the appropriate coordinate system to use in your project. Simply enter the name, country, or EPSG ID for the coordinate system for which you are searching. (The search results list is filtered and updated immediately as you type.) Then, select from the filtered list.

  - The default width for the Coordinate System Group column has been expanded to better display the entire coordinate system group name without requiring manual resizing.

- **Updates to Coordinate System and Time-Dependent Transformation databases** -

  The Coordinate System Database includes the following enhancements:

  - Added French Geoid Model RAF20

  - Added new Brazilian geoid hgeoHNOR2020

  - Added new ICS83 LDP zones for Illinois

  - Fixed wrong ellipsoid used with predefined datum ETRF2000 (EPOCH:2010.5)

  - Added datum grid, geoid model, and zones for Saxony, Germany

  - Added support for Australian Vertical Working Surface (AVWS)

  The Time-Dependent Transformation Database, which is used to transform between ITRF 2014 at the epoch of measurement and the global reference frame, includes the following enhancements:

  - Added kinematic datum and displacement model for Mexico

  - Added new kinematic datum and displacement model for India

  - Checked or updated EPSG ID and ISO ID of supported kinematic datum

  - Added support for latest version of HTDP 3.4.0 in US

  - Cleaned up database by removing useless kinematic transformations

Third-party tools

- **New ANZ Toolbox commands** - UPG and SITECH Construction Systems are actively helping to improve Trimble Business Center (TBC) for users in Australia and New Zealand. As part of this, they are continually developing commands and enhancements for the Australasian market which can be installed as extensions to (TBC).

These new commands are licensed to the ANZ Toolbox Module:

- **Validate ADAC objects** – The Validate ADAC command allows you to validate objects (points, lines, or polygons) or an ADAC XML file against the ADAC schema and inspect any validation errors in order to fix them.

- **Remove duplicate objects** – Use the Remove Duplicates command to remove duplicate lines, points, and text based on a selection of properties such as position, geometry, name/ID, text, and color.

- **Run a Utility Conformance Report** – The Utility Conformance Report command is for reporting as-built utility strings against a design surface such as electrical, comms, and subsoils and displaying information such as grades, depths, and location. The report includes options for a summary display and to visualize output in the Plan View prior to creating the report.

Support

- **Windows 11 support** - TBC is fully compatible with the Microsoft Windows® 11 operating system.

- **User Profile Manager support for multiple configuration templates** - The User Profile Manager provides a single location to perform all tasks related to backing up customized configuration and project template files on the Trimble cloud and restoring (importing) them into your project at any time using your free Trimble Identity (TID) login. Prior to this release, you could use the User Profile Manager to back up only one User Options template file (*.options) and one Ribbon Layout template file (*.xml) at a time. Every time you performed a backup, the stored template file was overwritten. Now, the command supports the storage of multiple User Options and Ribbon Layout template files on the Trimble cloud. Using the User Profile Manager, you can back up your current template to the Trimble cloud without overwriting any existing template files already stored there, restore any stored template into your project, delete any template file stored on the Trimble cloud, or save a template file stored on the cloud to a local drive, where it can be share with others.

- **Installation customization options** - The TBC Installation wizard has been enhanced as follows:

  - You can easily select just the specific program features and tools/utilities you want to include in the installation based on the workflows you want to perform. This can result in faster installations and lower disk space requirements.

  - You can add (install) a program feature to an existing TBC installation without performing a full re-installation of TBC. (To modify an existing installation, run the installation wizard and select Modify to change which program features are installed.)

Resolved issues

The following major issues **have been fixed** in this version of TBC:

- An error could occur when selecting to hide Layers in the View Filter manager.

- When pressing the Scan button while using the Create Sheet Set command, an error could occur.

- When creating a PDF using the Create 3D PDF command, some text and symbols were missing or displaying incorrectly.

- When using the Extract Line Feature command, an error could occur when you closed the Plan View before clicking the Extract button.

- When working with imported DJI aerial survey data, the adjustment could fail after processing baselines with Internet Download data from the closest reference station.

- The CORS Reference Station download was not working correctly with some stations.

- After opening a project VCE file where a vector PDF was already imported with a previous TBC version, an error could occur.

- Opening the Extract Point Feature command or the Extract Line Feature command could cause an error.

- CAD hatch and CAD solids did not have a Layer Group property like other CAD objects.

- Stop-and-go baseline processing could fail due to the JXL Importer importing the rover file into the wrong folder.

- When using the Move Survey Point command, an error could occur.

- IFC objects did not display in dynaviews.

- The Reference Surface command link in the TBC Help did not link to the command in TBC.

- In regard to swapping triangles after the rebuild of a surface, the TBC Help incorrectly stated that the swapped edge changes are not retained when, in fact, they are.

- Tunneling:

  - There was a discrepancy between the Tunnel As-built report and Tunnel Inspection Map values for the same data set (design compared to total station measurements).

  - The error message displayed when a user does not have access to a tunnel convergence project was not clear.

  - Threshold changes were not maintained when subsequent epochs were added while monitoring tunnel convergence.

- Monitoring:

- The point sorting order used in the Project Explorer, Monitoring Epochs Manager, and the Monitoring Report did not match.

- The decimal precision setting specified in the Project Settings was not being applied to the Monitoring Point Chart, Monitoring Report, and the Monitoring Epochs Manager.

- Sorting by point ID was not possible in the Monitoring Epochs Manager.

- Auto-selection was not working when creating monitoring points in an existing Monitoring Project with monitoring points.

- When creating a new monitoring project, the last letter in the new name was dropped.

- When importing an epoch file with a very large number of epochs (for example 1,000+), the import could timeout and fail.

Important notes and known issues

See the TBC Help for a complete, up-to-date list of important notes and known issues related to TBC.

System requirements

Microsoft operating system:	Windows® 10 (64-bit version)
	Windows 11 (64-bit version)
Processor:	Dual-core 1.80 GHz or better recommended
	Quad-core 2.80 GHz or better (additional cores with hyper-threading support highly recommended for Aerial Photogrammetry, Mobile Mapping, and Scanning modules)
	Important! Because components of TBC make use of Intel-only multi-thread processing, ***AMD Ryzen processors are not supported***.
Random access memory (RAM):	4 GB or more recommended
	32 GB or more recommended for Aerial Photogrammetry, Mobile Mapping, and Scanning modules

Hard disk space available:	10 GB or more recommended
	100 GB or more on solid-state drive required for Aerial Photogrammetry, Mobile Mapping, and Scanning modules
	The recommended SSD overall hard drive capacity is 500GB or more for Aerial Photogrammetry, Mobile Mapping, and Scanning modules
Monitor:	1280 x 1024 or higher resolution with 256 or more colors (at 96 DPI)
I/O Ports:	USB 2.0 port required if HASP hardware key is used
Graphics:	DirectX 11 compatible graphics card with 512 MB memory or more
	OpenGL version 3.2 or later required when working with point cloud data (latest version recommended)
	8 GB graphics card or higher (for example, NVIDIA Quadro P4000) required when working with Aerial Photogrammetry, Mobile Mapping, and Scanning modules
	Note: If you are using a laptop computer with both an integrated (on-board) graphics card and a discrete NVIDIA graphics card enabled via Optimus technology, your computer must allow you to select to disable the integrated graphics card and use only the discreet graphics card when working with point cloud data. See "Disabling a laptop integrated graphics card" in the "Miscellaneous notes" section earlier in this document.

Important!
It is critical that you keep your graphics driver(s) updated if you are working with point cloud data.
Whether your computer has one or multiple graphics cards installed, you must ensure each has been updated with the latest driver provided by the card's manufacturer. The best way to determine if your driver needs to be updated and, if so, perform the update is to visit the card manufacturer's website. For more information, see "Update and Configure Your Graphics/Video Driver" in the online Help.
(If, instead, you decide to update your driver using the Windows Device Manager and the "Search automatically" option, the program may suggest using a Microsoft-approved WHQL version of the driver. However, to ensure you have the latest bug fixes and new features for your graphics card, it is recommended that you use the latest manufacturer version instead.)