ContextCapture Cloud Processing Console

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Getting Started

Installation

ContextCapture cloud processing console does not require administrator rights to run, however you must have administrator rights to install the application.

To make sure you have the latest version go to www.bentley.com and log in to gain access to the installer downloads. If you have not done so before, you will need to register on the website when prompted.

Once you have downloaded the installer, simply double-click on the downloaded package and follow the installation instructions.

The minimum system configuration for installation is:

Supported Operating Systems	- Windows 10 (64-bit) - Home, Pro, Enterprise, and Education. - Windows 8.1 (64-bit) - Standard, Pro, and Enterprise. - Windows 8 (64-bit) - Standard, Pro, and Enterprise. - Windows 7 SPI (64-bit) - Home Basic, Home Premium, Professional, Enterprise, and Ultimate. Bentley does not support its software running on Microsoft operating systems versions that Microsoft has "retired". For more information on Microsoft's application retirement policy, click here. For similar information on Bentley products, refer to the Bentley Product Support article
Internet	Internet connectivity is required to use some of the features of the product and installation of software pre-requisites, if not already installed on the machine.

The minimum recommended workstation profile for running MicroStation CONNECT Edition is:

Processor	Intel® or AMD® processor 1.0 GHz or greater.

Memory	4 GB minimum.
Hard Disk	2 GB free disk space.
Video	NVIDIA or AMD graphics card, or Intel-integrated graphics processor compatible with OpenGL 3.2
Screen Resolution	1024 x 768 or higher.

Licensing

ContextCapture cloud processing console does not require a license to run and its usage is not counted. However, ContextCapture Cloud Processing Service entitlement is required to submit jobs to ContextCapture Cloud Processing Service:

ContextCapture Cloud Processing Service entitlement is available with:

- The Reality Modeling Cloud Service Entitlement (requires a CSS).
- The E365 Entitlement, as a Category B Product.

Submitting projects in the cloud with ContextCapture Cloud Processing Console will record usage, measured by:

- Processing Units: based on the amount of data processed.
- Data management units: based on the amount of data stored on ProjectWise ContextShare (input data, project files, output data).

ContextCapture Cloud Processing Service relies on ProjectWise ContextShare for the resource storage. ProjectWise ContextShare entitlement is not mandatory to user ContextCapture Cloud Processing service.

For more information, please review how those units are computed on Bentley Communities website.

Useful Concepts

An advanced use of ContextCapture requires to know a few concepts of photogrammetry and geodesy.

The interior orientation - or intrinsic parameters - of a camera refers to some internal properties of the camera: the size of the camera sensor, the focal length of the lens, the position of the principal point in the image plane, and the distortion of the lens.

We call photogroup a set of photographs with identical interior orientation. In the sequel, photogroup properties will refer to the interior orientation shared by all photos of a photogroup.

In practice, interior orientation is unique to one physical camera with all its settings fixed. Even for two cameras of the same model with same settings, their respective photographs do not constitute a single photogroup.

The exterior orientation - or pose - of a camera refers to the 3D position of the optical center of the camera and the 3D rotation of the coordinate system of the sensor in the world coordinate system.

To perform 3D reconstruction from photographs, ContextCapture must know very accurately the photogroup properties of each input photogroup and the pose of each input photograph. If you ignore these properties, or if
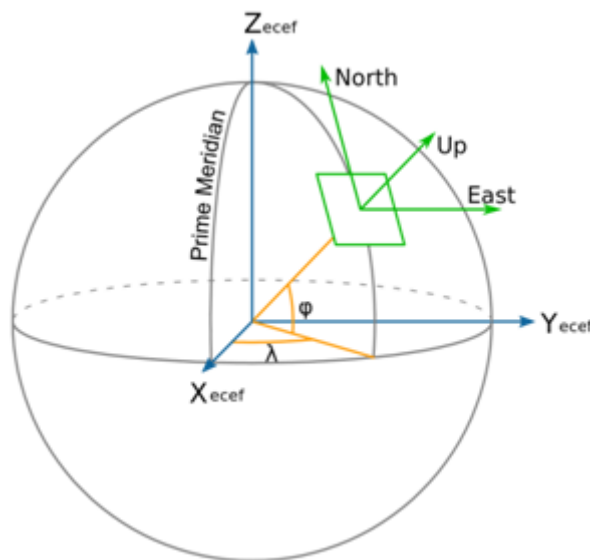
you do not know them with sufficient accuracy, ContextCapture can automatically estimate them through a process called aerotriangulation - or aerial triangulation - sometimes abbreviated to AT.

One important step of aerotriangulation is to determine pixels in two or more different photographs which correspond to the projections of a same physical point in the scene:

- If the 3D position of the physical point is not known a priori, the photo correspondences form a tie point. ContextCapture can automatically generate a large number of tie points.
- If the 3D position of the physical point is prescribed, the photo correspondences and the 3D position form a control point. When control points are present, the result of aerotriangulation can be accurately georeferenced. Whereas tie point generation is fully automated in ContextCapture , control points require some manual intervention to enter their 3D coordinates and their accurate projections in photographs.

When poses of photographs are georeferenced, ContextCapture uses the Earth Centered Earth Fixed (ECEF) spatial referential system. ECEF is a standard global Cartesian coordinate system. Please refer to http://en.wikipedia.org/wiki/ECEF for a complete definition.

Whereas ContextCapture uses ECEF for photo poses, it uses a local East North Up (ENU) spatial coordinate system for the 3D reconstruction process. ENU is a Cartesian coordinate system with a local origin, oriented along the WGS84 ellipsoid, with axes pointing to East (X), North (Y) and Up (Z) directions. ENU allows a more convenient manipulation of 3D models than ECEF, because its Z axis coincides with the up vector. However, please note that 3D models produced by ContextCapture can later be reprojected to any coordinate system.

In other circumstances, ContextCapture describes georeferenced positions using two geographic (longitude, latitude) or two projected (X, Y) coordinates, complemented with ellipsoidal height, which is the height above the reference ellipsoid (usually WGS84 , but it may be a different ellipsoid, e.g. GRS80 , for some spatial reference systems). Ellipsoid height differs from orthometric height, which is closer to the popular height above sea level. ContextCapture uses ellipsoidal height instead of orthometric height, because the former has a simple and unambiguous mathematical definition, whereas the latter is based on a geoid height grid subject to sampling and accuracy issues.

2
Bentley CONNECT

The Basics

The core premise of CONNECT is to facilitate successful project outcomes through common capabilities and shared services across desktop, mobile, server and cloud. To enable this, Bentley has utilized Microsoft's Azure cloud-service to connect uniformly and consistently with and across users, projects, and enterprises. To enable the value and your success on CONNECT it is imperative that users register for a free CONNECT account, sign in when using your CONNECT Edition products and associate your design models with a ProjectWise Project.

The User Advantage

Each CONNECTED user is provisioned with a **Personal Portal** on the Bentley CONNECT site. This portal provides you access to CONNECT services and more. See the section on CONNECTION client Sign In for more details on how to access this and other CONNECT services.

One of the key capabilities of CONNECT Edition products is the ability to receive update notifications and initiate updates directly from your desktop for all versions within the same generation of the product line. Users no longer need to sign into SELECT Downloads to look for updates of their product but will now be able to check for updates and receive notification of updates from within their products.

The Organization Advantage

The value of CONNECT just starts with the CONNECTED User advantage. Of course users and organizations work together on **projects**. If an Organization choses to register their projects with Bentley, those projects now become CONNECTED Projects. With CONNECTED users and ProjectWise Projects, the ability for project centric analysis, dashboards on who is working on the project where and how much, shared documents, deliverables status and more are now available through the **Project Portal**.

At this level, enterprises that have CONNECTED Users working on CONNECTED Projects with their CONNECT Edition products become CONNECTED Enterprises. Information that was once disjoint or unavailable, is now placed in context with Key Performance Indicators brought to the forefront to help our accounts improve project performance. All that from just signing in as a CONNECTED User and associating work with ProjectWise Projects.

Key Concepts

Bentley Profile

This is a single sign-in to all Bentley web pages and Cloud services. If you don't have one already, you should create a Bentley profile. This will let you:

- sign in to all Bentley web sites
- submit and manage service requests if you have a technical problem
- ensure you receive advice when new versions of CONNECT Edition products are available
- update you when new product training materials are available
- give you access to Cloud Services

ProjectWise Projects

Once you have a Bentley Profile, you (or your organization's IT administrator) should register a ProjectWise Project. This is a way of keeping track of everything you and your team members do within that project. A ProjectWise Project doesn't contain your project data, it is simply a universal common ID to link together all activity within a project. It also contains information such as Name, Number, Industry, Asset Type, Location etc.

The first time you open or create a file, you will be prompted to select a Project. All activities relating to that file will be associated with the project.

Bentley Cloud Services

This is a range of services for learning, file sharing, project sharing, transmittals, project analytics and more. Some of the key components you will use as a part of Cloud Services include -

- CONNECTION Client - small desktop application that manages your sign-in
- Project Chooser - a dialog box which lets you choose projects to associate your files with
- Personal Portal - web page where you can manage your Bentley profile and access learning content
- Project Portal - web page where you can manage your projects and launch cloud services

Register a CONNECTED User

To take advantage of the values of CONNECTED users must be registered and signed in, CONNECTED projects must be available and CONNECT Edition/Service products must be used to associate product work with CONNECTED Projects. Let's look at how to do each of these items.

Register as a CONNECTED User

If you have ever signed in to Bentleys SELECT site to download a product, submitted a service ticket or signed up for a webinar then you are already registered to use the CONNECT services. Proceed to the Sign-In section for information on how to sign in.

You can also log in directly from the Bentley website from https://ims.bentley.com. Doing this will send you to a sign-in web page where you can select the Register link to enter your profile information and password.

Sign-In as a CONNECTED User

Once you have registered as a CONNECTED User (see previous section) you can proceed to sign-in. Sign-in can be performed from one of two places:

CONNECTION Client Sign-In Window

If you have installed any CONNECT Edition/Services product then you have installed a CONNECTION client. This client shows up as an icon on your taskbar.

Double-click the icon or Right-Click>Open on the icon to expose the CONNECTION client Sign-in Screen. Enter the same email you provided in your registration and your password.

Product CONNECT Sign In

If you start ContextCapture cloud processing console while no CONNECT user is signed-in, the CONNECTION client will automatically open.

Forgot Your Password?

If you don't recall your password simply select the "Forgot Password?" link on the sign-in window and your password will be reset through email.

Register a CONNECTED Project

A fundamental requirement of CONNECT is the creation of projects. Only users with "Project Manager" and "Administrator" level role on their profile are allowed to create projects. Contact your account administrator to add projects or assign you rights to add projects yourself. See the Managing User Rights Section below. Projects are typically added to the Bentley registry for your company through any of the links on the Project Portal, Personal Portal or Project Chooser Dialog window.

Register Project from Project Portal

Right-Click the Bentley CONNECT icon in your taskbar and select "Personal Portal".

In the Personal Portal, select "Projects", this will take you to the "Project Portal".

In the "Project Portal, click "Register a Project" to add a new project. See the section "Managing User Rights" if you do not have the rights to add a project.

The project attributes should be entered accurately to obtain the greatest value from CONNECT. Content, recommendation and insight services are based specifically on the Asset type, industry and location.

Register Project from Personal Portal

Right-Click the Bentley CONNECT icon in your taskbar and select "Personal Portal". Hint, you can also navigate to the Personal Portal from the CONNECT widget in ContextCapture cloud service console.

Select the "+New" in the Recent Projects tile to Register a New Project. See the section "Managing User Rights" if you do not have the rights to add a project.

Register Project from Project Chooser Window

The project Chooser window is accessible from the "New" page in ContextCapture cloud processing console. To register a new project, select the +Register Project link on the upper left of the Project Chooser.

Managing User Rights

User rights in an organization are administered by the site administer in your company. This is typically the main contact for your company at Bentley. This user can assign you Project Manager Rights through the User Management Portal. Select the Manage button on the top of the window and search for a user.

Select the user and click "Modify Roles" to expose the roles window. Scroll down and select "Project Manager" to allow a user to add and manage projects.

3

Photogrammetry Concepts

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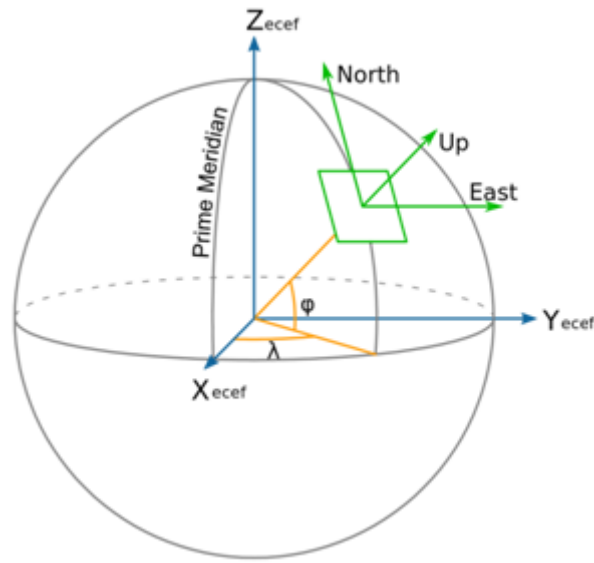
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Preparing the Imagery Dataset

Photo Acquisition

Overlap

Each part of the subject should be photographed from at least three distinct - but not radically different - viewpoints. The overlap between consecutive photographs should typically exceed two thirds. Different viewpoints of the same part of the subject should be less than 15 degrees apart.

For simple subjects, you can achieve this by taking approximately 30-50 evenly spaced photographs all around the subject.

For aerial photography, a longitudinal overlap of 80% and lateral overlap of 50% or more are recommended. To achieve best results, acquire both vertical and oblique photographs, in order to simultaneously recover building facades, narrow streets and courtyards. ContextCapture is remarkably robust for unstructured acquisition. You may however prepare a flight plan for more systematic acquisitions

Camera Models

ContextCapture supports a wide range of cameras: mobile phone, compact digital, DSLR, fisheye, photogrammetric, and multi-camera systems. It can process still photographs or extracted video frames from digital video cameras. It does not support linear pushbroom cameras. It does not support rolling shutter cameras under fast motion.

Although ContextCapture does not require a minimum camera resolution, a higher resolution camera allows acquisition of a subject at a given precision with fewer photographs, and thus more quickly, than a lower resolution camera. ContextCapture needs to know the width of your camera's sensor. If your camera model is not already listed in our database, you will be asked to enter this information. If you are unsure of your camera's specifications, you can consult your camera owner's manual or the

Digital Photography Review website: http://www.dpreview.com/products.

Projected Pixel Size

In the sequel, the projected pixel size means the extension of the classical ground resolution to a more general, possibly not aerial, acquisition configuration.

The resolution and precision of the generated 3D model is directly related to the projected pixel size on the subject. In order to achieve a desired projected pixel size, you must adopt a proper combination of focal length and distance to the subject, as defined by the formula below:

projected pixel size × focal length × photo's largest dimension = sensor width × distance to the subject

[m / pixel] [mm] [pixel] [mm] [m]

Uniform projected pixel size across the entire image is not required since ContextCapture will automatically propagate variations in projected pixel size to the resolution and precision of the generated 3D model. ContextCapture is unable, however, to join together photographs of radically different projected pixel sizes. If a wide range is required, photographs with intermediate values should be used to create a smooth transition.

Focal Length

Using a fixed focal length throughout the acquisition process is recommended.

To achieve a non-uniform projected pixel size, vary the distance to the subject. If you cannot avoid several focal length settings, e.g., if the distance to the subject is constrained, shoot several series of photographs, each with a fixed focal length.

When using a zoom lens, make sure its position remains fixed over a series of photographs. You can use a piece of adhesive tape with a manual zoom lens to keep it in place.

Wide-angle or fish-eye lens can be used if the suited camera model type is specified, ContextCapture can automatically estimate extreme lens distortion.

Do not use digital zoom.

Exposure

Select exposure settings that will avoid the motion blur, defocus, noise, and over or under-exposure that can seriously alter 3D reconstruction.

Manual exposure reduces the likelihood of color discrepancies in the texture map of the generated 3D model, and is therefore recommended for those with the necessary photography skills and under fairly stable and uniform lighting conditions. Otherwise, automatic exposure may be used.

Note: Turning off optical or digital image stabilization is recommended.

Lighting

Ambient, constant lighting is preferable to direct and/or time-varying lighting, since the latter increases the risk of overexposure and underexposure. For indoor acquisition, fixed lights are preferable to flash, and for outdoor acquisition, clouds (high-altitude cirrus clouds, no rain) are preferable to sun. If photos must be taken on a sunny day, take them around noon to minimize shadow areas.

Please note that correctly-exposed shadows do not affect the performance of ContextCapture , but will appear in the texture map of the generated 3D model.

Photo Retouching

Before inputting photographs into ContextCapture, do not perform geometry retouching (resizing, cropping, rotating, denoising). Make sure to deactivate your camera's auto-rotate feature.

ContextCapture does not support stitched panoramic photographs. It requires the original photographs which were used to create the panorama.

Photogroups

For optimal precision and performance, ContextCapture must group all photos taken by the same physical camera with identical focal length and dimensions (identical interior orientation) in one photogroup.

ContextCapture can automatically determine relevant photogroups if photos are organized in subdirectories according to the cameras used to shoot them: photos taken by different physical cameras (even if they are the same model) should be placed in separate subdirectories. Conversely, all photos taken by the same physical camera should be placed in the same subdirectory.

Masks

A mask can be associated to a photo to ignore specific parts of the image (e.g., moving obstacles, reflections) to be ignored in the workflow. A valid mask is a black and white TIFF image with the same dimensions as the photo. Pixels of the photo corresponding to black pixels of the mask will be ignored during aerotriangulation and reconstruction.

Mask are associated to input photographs through their file name:

- Associate a mask to one photo: for a photo named "fileName.ext", the mask file must be named "fileName_mask.tif" and placed in the same directory as the corresponding photo.

  Example: for a photograph "IMG0002564.jpg ", the corresponding mask should be " IMG0002564_mask.tif"
- Associate a mask to an entire directory (requires photos of same dimensions): if present in a directory, the file "mask.tif" is used as a mask for all photos contained in this directory.

ContextCapture Cloud Processing Console

ContextCapture Cloud Processing Console is a desktop application. Through a graphical user interface, it allows you to:

- Import the data sets,
- Define the processing settings,
- Submit tasks,
- Monitor the progress of submitted tasks,
- Download and visualize results.

The Console does not perform any local processing. It is used to prepare the data, uploads it to ProjectWise ContextShare and sends a package to ContextCapture Cloud Processing Service containing all the information to process the job (location of input data, photo/point cloud block information, processing settings, list of output, etcetera.).

ContextCapture Console's main interface manages the different steps of the ContextCapture workflow through a project.

Open Project

When starting ContextCapture Cloud Processing Console, the Open Project menu will display. From this interface, a User can select a project to open, create a new project, browse existing projects located on the computer or an external disk.

The User can use the filtering options to easily locate a specific project.
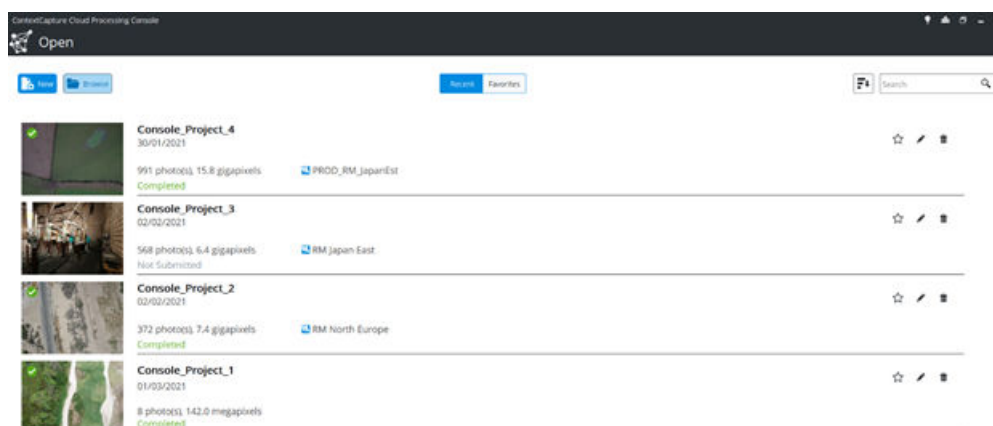
New

Create a new ContextCapture cloud processing console project.

Browse

Browse disk for ContextCapture cloud processing console projects that are not listed.

Sort button

Apply sorting to the project list.

View button

Arrange the project list as a list or tiles.
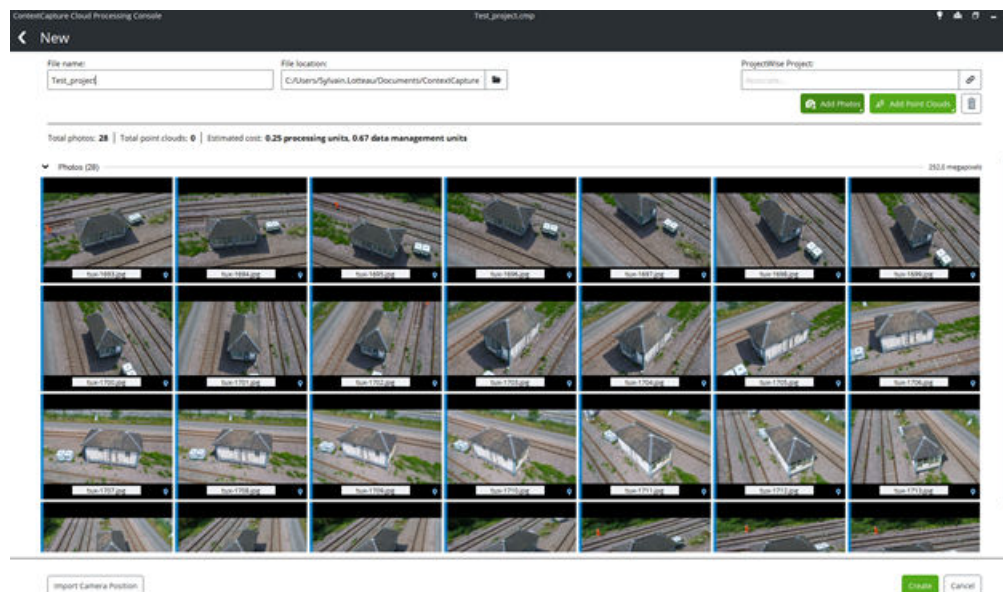
Search

Search recent project list.

Recent

List contains all recent projects.

Favorites

List only contains favorite projects.

New Project

File name

Name of the new ContextCapture cloud processing console project file.

File location

Location on disk of the new ContextCapture cloud processing console project files.

Add Photos - From Images

Add a selection of photo files to the project. Use Shift or Ctrl to perform a multi-selection.

Add Photos - From Video

The Import video frames dialog allows you to extract frames from a video file and add them to the project.

To extract frames from a video, enter the input video file and select the import settings:

- Start time/end time: allows you to import only a section of the input video (by default all the video will be imported).
- Extract a photo every: sampling interval, in seconds. This defines the number of photos that will be extracted from the input video sequence.
- Photo output directory: directory where the extracted photos are created.

Please select the video sampling interval to ensure a correct overlap between photos.
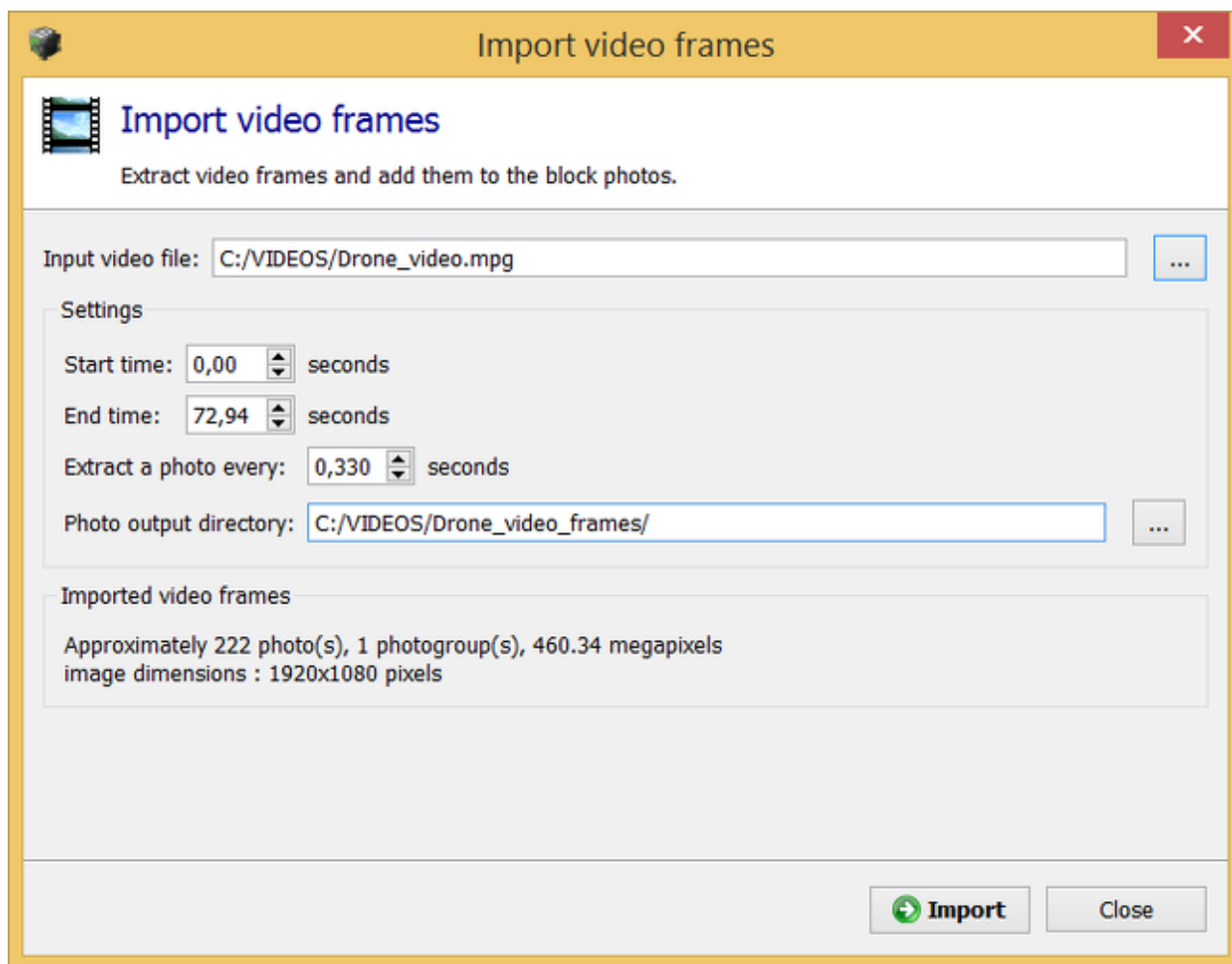
Note: Focal length variations are not supported.

All imported frames are added in one unique photogroup; ContextCapture assumes that the same camera model (with the same optical properties) is used during all the imported sequence. If the zoom varies during the video sequence, please use the start/end settings in our import to split the video in sections of constant zoom and to import each section separately.

Click on Import to extract and add the video frames.

Once imported, extracted photos can be inspected individually from the Camera devices dialog.

Frames imported from a video files have an unknown camera model. We recommend you to define the photogroup's main optical properties (sensor size, focal length and camera model type) before starting an aerotriangulation. One option for doing this is to search for a suitable camera model in the camera database.

Add point clouds

Add a selection of point cloud files to the project. Static scans and Mobile scans are supported.

Delete Button

Delete selected photo(s) from the project.

Import Camera Positions

The Import photo positions dialog allows you to import photo positions and rotations from a text file.

Use this option to set image positions and/or rotations from third-party data.

Various kinds of text files are supported. The common condition for all formats is that each photo must be represented by a single line.

The imported data must include at least the photo references, and the 3 coordinates for the photo positions. Rotations are optional.

```
*<_____Photo_File_____><____Easting___><___Northing___><_____Height___><____
__Omega___><_____Phi____><_____Kappa____>
   f:\project\images\4655.tif      47268.5080    -517764.1880       1514.7160
-0.2352         0.2168         -2.3779
   f:\project\images\4656.tif      46434.1570    -517745.9920
1513.0090         0.0662         1.1163         -2.2503
   f:\project\images\4657.tif      45618.8710    -517748.2010
1516.4190         0.0227         0.6976         -1.2857
   f:\project\images\4658.tif      44815.0070    -517756.2330
1520.3310         0.6212         0.1720         -0.6776
   f:\project\images\4659.tif      43971.6950    -517762.4530
1519.1290         0.3699         0.2398         -1.9075
   f:\project\images\4660.tif      43116.7510    -517767.1580       1518.0000
-0.4866        -0.4373         -2.8745
   f:\project\images\4661.tif      42266.8970    -517754.3210       1519.9090
-0.3243         0.8787         -2.6415
   f:\project\images\4662.tif      41407.3450    -517763.1880
1525.5080         0.0320         0.2612          0.0047
   f:\project\images\4663.tif      40520.2080    -517783.6610
1523.6580         0.1627         0.7922         -2.7976
```
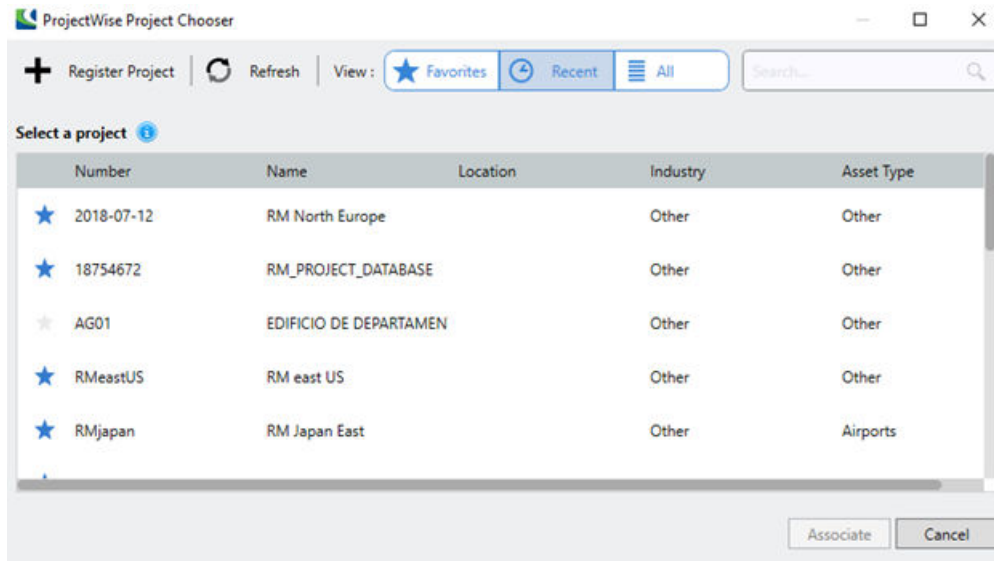
Example of text file with positions and rotations
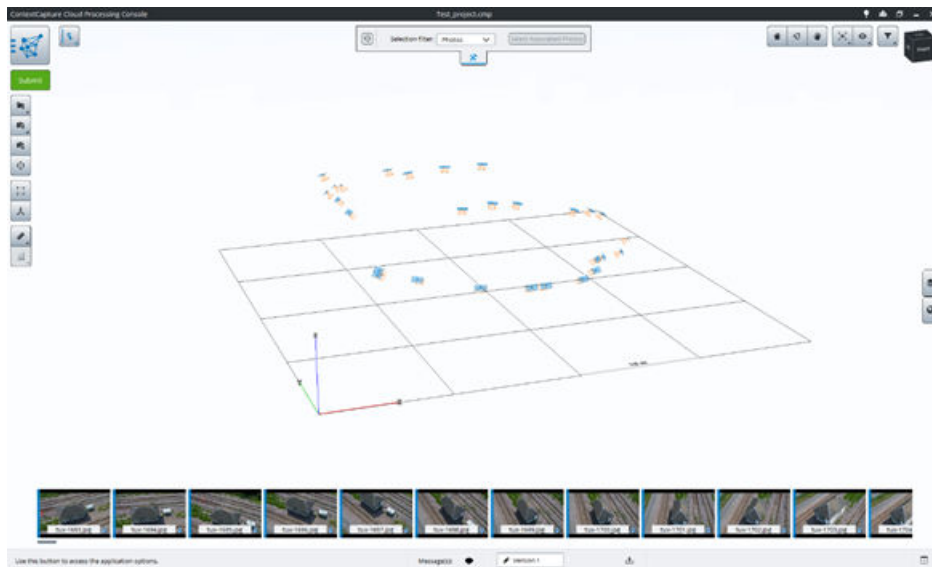
Associate ProjectWise Project

Opens the "ProjectWise Project Chooser" dialog to select a ProjectWise project to associate to the ContextCapture cloud processing project or register a new ProjectWise project.

Main Application Window

Backstage button

Opens the ContextCapture cloud processing console backstage. See "Backstage" section for more information.

Submit button

Opens the 3D model processing dialog. See "3D model processing" section for more information.

Add photos or point cloud

Add a selection of photo or point cloud files to the project. Use Shift or Ctrl to perform a multi-selection.

Import positions

The Import photo positions dialog allows you to import photo positions and rotations from a text file.

Use this option to set image positions and/or rotations from third-party data.

Various kinds of text files are supported. The common condition for all formats is that each photo must be represented by a single line.

The imported data must include at least the photo references, and the 3 coordinates for the photo positions. Rotations are optional.

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*<_____Photo_File_____><____Easting___><___Northing___><_____Height___><____
__Omega___><_____Phi____><_____Kappa____>
   f:\project\images\4655.tif      47268.5080     -517764.1880       1514.7160
-0.2352        0.2168         -2.3779
   f:\project\images\4656.tif      46434.1570     -517745.9920
1513.0090         0.0662         1.1163        -2.2503
   f:\project\images\4657.tif      45618.8710     -517748.2010
1516.4190         0.0227         0.6976        -1.2857
   f:\project\images\4658.tif      44815.0070     -517756.2330
1520.3310         0.6212         0.1720        -0.6776
   f:\project\images\4659.tif      43971.6950     -517762.4530
1519.1290         0.3699         0.2398        -1.9075
   f:\project\images\4660.tif      43116.7510     -517767.1580       1518.0000
-0.4866       -0.4373         -2.8745
   f:\project\images\4661.tif      42266.8970     -517754.3210       1519.9090
-0.3243        0.8787         -2.6415
   f:\project\images\4662.tif      41407.3450     -517763.1880
1525.5080         0.0320         0.2612         0.0047
   f:\project\images\4663.tif      40520.2080     -517783.6610
1523.6580         0.1627         0.7922        -2.7976
```

Example of text file with positions and rotations

Camera devices

Opens the Camera Devices dialog. See "Camera Devices" section for more informaton.

Surveys

Used to add Control points, User tie points and Positioning constraints. See "Surveys" section for more informaton.

Region of Interest

Use to define a region of interest for the reconstruction with a custom bounding box or a custom polygon. See "Region of Interest" section for more information.

Reconstruction constraints

Use this tool to add a 3D polygon or mesh as a constraint to the Reconstruction. Can be used to fix reconstruction issues on water bodies for example. See "Reconstruction Constraints" section for more information.

Measurements

Opens the Measurements dialog. See "Measurements" section for more information.

ContextCapture Cloud Processing Console

Quality metrics

Available after an aerotriangulation has been performed, use the quality metrics tool to display various quality information in the 3D view. See "Quality Metrics" Section for more information.

Home

Restores the default camera position of the 3D view.

Navigation mode

- **Orbit**: Rotate the camera position of the 3D view.
- **Pan**: Move the camera position of the 3D view.

Lock on Photo

This mode activates an immersive view of the scene through a selected photo. See "Lock on photo" section for more information.

Photo Navigation

Filter

Filter photo view by file name, Camera Model and components (main component/no component).

Display Style

Use the display style tool to choose what to display in the 3D view and adjust the display settings of the photos, survey points, automatic tie-points, geometry constraints, reality meshes, etcetera.
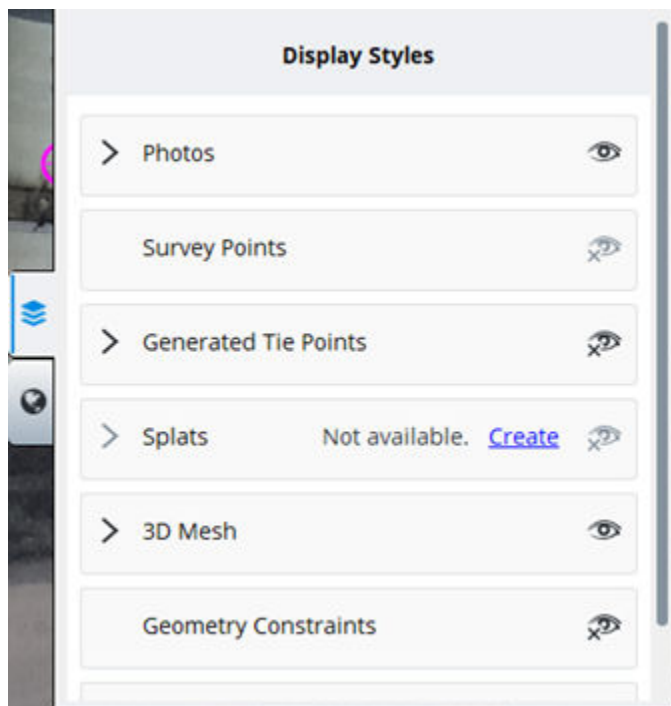
Basemap

Click the + sign to open the basemap manager. The basemap manager allows you to enter known coordinates of a bounding box that corresponds to the location of the dataset currently loaded in ContextCapture cloud

processing console. The basemap manager uses this bounding box to query the GeoCoordination Service for terrain and imagery data to be used as a basemap.

Status bar

Project is in **read only** mode. You can create a New Version to restart editing.		Message(s) ●	Version 2	⟲ ⬇	Share ⋖ ▶		□

- **Notifications**: Opens "Messages" dialog to see notifications from ContextCapture cloud processing service.
- **Version**: Select different versions.
- **New version**: Create a new version by using the drop-down menu when clicking on the version button.
- **Read-Only**: Displays when a model is being processed or already processed. When a model is read-only, it's not possible to add photos, import positions, modify camera devices or add surveys.
- **View reports**: View Production, Acquisition and Calibration reports.
- **Share**: Share the ContextShare link to the 3D model of the current view.
- **Open output directory**: Opens folder that contains intermediate, calibration and result files.
- **View Layout**: Choose between photos only, 3D view only, or photos and 3D view.

Add Photos

For optimal performance, photographs must be divided into one or more photogroups. Photogroups are homogeneous sets of photographs, all taken with the same physical camera with identical interior orientation (image dimensions, sensor size, focal length,...). If the photos are organized in subdirectories according to the camera used to shoot them, ContextCapture can automatically determine relevant photogroups.

Add point clouds

Importing point clouds Limitation: ContextCapture only supports point clouds with known scan source positions. Moreover, if scan source positions specified in the imported point cloud are incorrect, it will adversely affect the 3D reconstruction or even cause a completely incorrect 3D reconstruction.

Static scans

Point clouds can be imported from static scans in the following file formats:

- ASTM E57 file format (.e57).
- Cyclone point cloud export format (.ptx).
- LAS/LAZ file format (.las, .laz), When specifying a scanner position.

When importing a georeferenced point cloud file, please specify the spatial reference system when importing the file. Multiple files can be imported at once.

The user can specify a manual scanner position by checking the corresponding option. Manual scanner position is mandatory for .las and .laz files. When specifying a manual scanner position, only one file can be imported at once.

Mobile scans

Point clouds can be imported from mobile scans in the following file formats:

- ASTM E57 file format (.e57) with trajectory files.
- LAS/LAZ file format (.las, .laz) with trajectory files.

- NavVis PLY format (.ply).

According to the format, the trajectories must be provided as separated text files (.txt or .csv) describing successive scanner positions associated with time. ContextCapture integrates a text file import wizard to extract trajectory data for various text formats.

3D points of the provided point clouds must also include time data to be attached properly to the trajectories.

Input files

Define the input point clouds and trajectory files. Trajectories and point clouds are linked through the time stamp in both sets of files.

File format

Define how the trajectory files must be read. You can adjust the import parameters, so that each column in the Data preview table contains meaningful information:

- Number of lines to ignore at the beginning of the file: defines the length of the file header and ignores it during import.
- Delimiters: defines the column separators. Several characters can be specified. The option Combine consecutive delimiters can be required, for instance when sequences of white spaces are used as delimiter.
- Decimal separator: dot (123.456) or comma (123,456).

Data properties

When importing a georeferenced point cloud file from mobile scans, please specify the suited spatial reference system. Note that the point clouds and the trajectories must be in the same spatial reference system.

Fields

Specify role of columns for the trajectory data. You must associate each input column with its respective role. X (easting), Y (northing), Z (height/altitude) and time are required.

Camera Devices Dialog

Open the Camera Devices dialog where you can manage settings of camera devices for each camera model (photogroup).
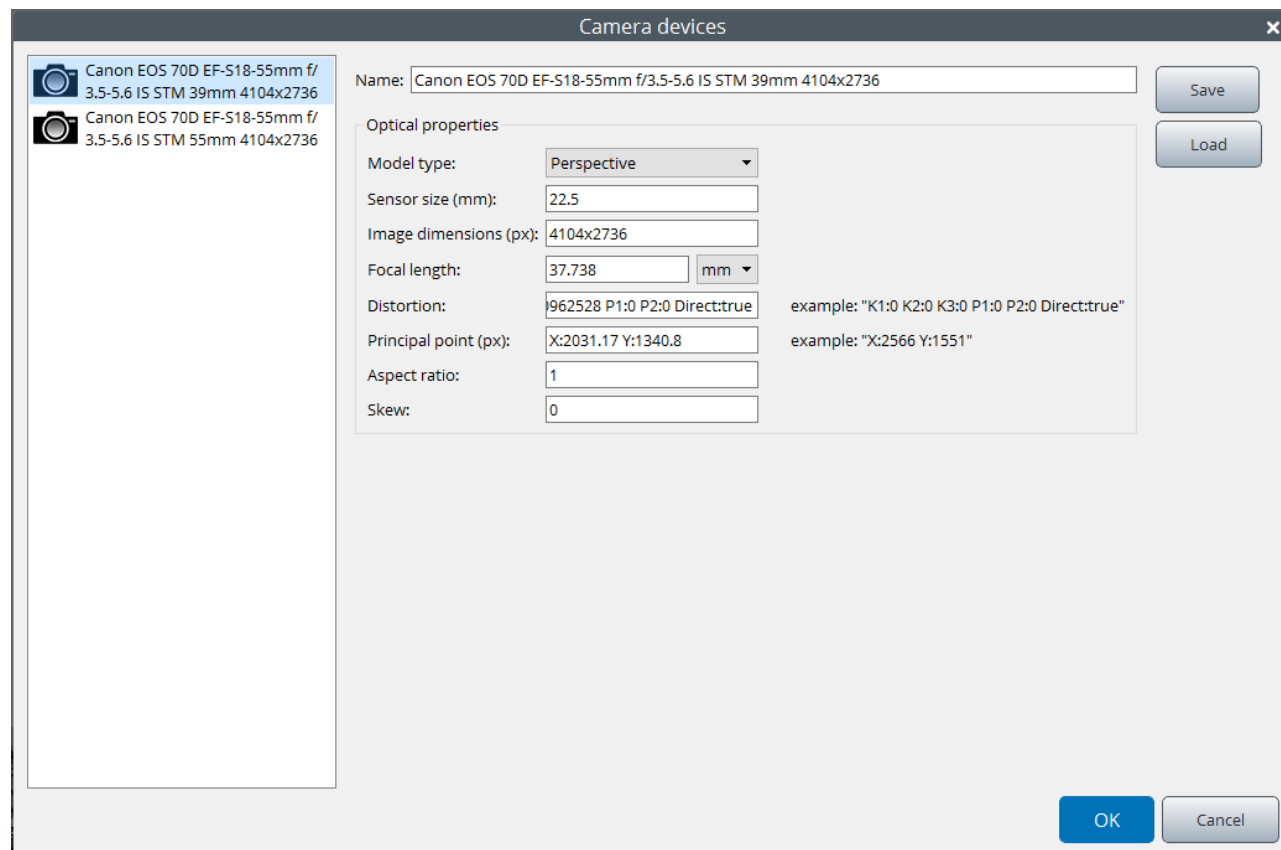
Optical properties

- **Model type**: Two camera model types are supported:

  - Perspective: perspective projection combined with a classical Brown's distortion model, suited for rectilinear lens or lens with low distortion.
  - Fisheye: Suited for wide-angle or fish-eye lens with extreme lens distortion.
- **Sensor size (mm)**: ContextCapture may need to know the size of your camera's sensor. The needed sensor size is the sensor's largest dimension. If your camera model is not already listed in our database, you will be asked to enter this information. If you are unsure of your camera's specifications, you can consult the Digital Photography Review or contact Bentley Systems technical support.
- **Image dimensions (px)**: Image dimensions in pixels.
- **Focal length**: For a newly created photogroup, ContextCapture can generally extract a coarse guess of the focal length in mm from EXIF metadata. Otherwise, you will be asked to enter this initial guess. Later, ContextCapture can automatically estimate the focal length more accurately by aerotriangulation.

  We recommend to specify sensor size and/or focal length for each photogroup. If these properties are missing, ContextCapture will assume that the 35 mm equivalent focal length equals to 50 mm. If the correct focal length value differs significantly, the aerotriangulation may fail. In such cases it is required to specify initial camera properties manually.
- **Distortion**: For a newly created photogroup, ContextCapture considers that there is by default no lens distortion. Later, ContextCapture can automatically estimate lens distortion more accurately by aerotriangulation. Not used for fisheye camera models.
- **Principal point (px)**: For a newly created photogroup, ContextCapture considers that the principal point is by default at the center of the image. Later, ContextCapture can automatically estimate the principal point more accurately by aerotriangulation.
- **Aspect ratio/Skew**: Properties used when pixels are not square.

  - Skew: coefficient defining the angle between x and y pixel axes.
  - Aspect ratio: different from 1 if the pixel are not square.

Save

Save modifications to camera model.

Load

Opens the camera database, it contains two kinds of items:

- ContextCapture items are camera models provided with ContextCapture. These items are read only and the item list is updated daily by the ContextCapture support team.
- User items are camera models you added or imported on your computer.

Surveys

The Surveys tab allows you to edit or display the survey data attached to a block: Survey points and positioning constraints

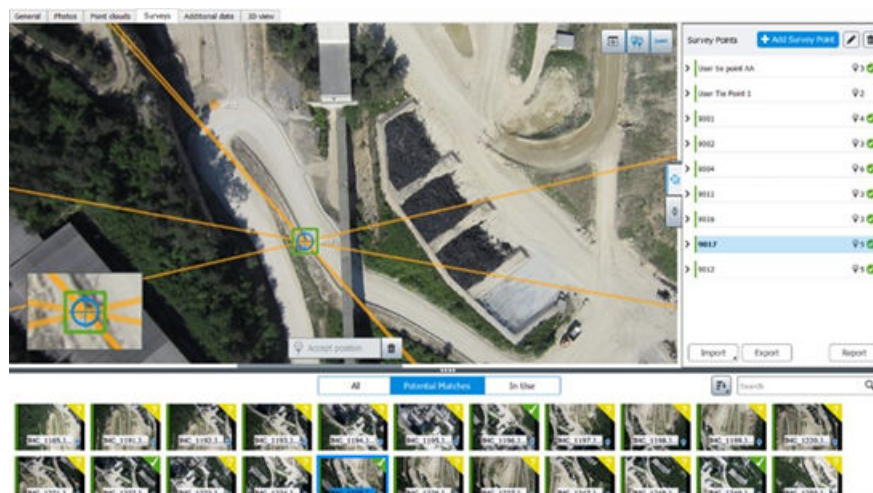**Note:** Once a reconstruction is created in a block, the Surveys tab is read-only.

Figure 1: The Survey tab

Survey points are optional positioning data used during the aerotriangulation of the block.

Two types of survey points can be added:

- Control points - allow to enter known 3D coordinates of one point located on photos and are used to register the 3D scene.
- Tie points - allow to identify one point on photos and are used to create positioning/scaling constraint, or to stitch photos.

Survey points can also be used after the aerotriangulation to identify positions on photos and to perform Quality control (on page 141).

Positioning constraints are position/orientation/scale priors based on user tie points. They are used during the aerotriangulation of the block.

Surveys data can be optionally extracted from photos in an automatic way using targets (see Aerotriangulation).

Control points

The Surveys tab allows you to edit or display the survey data attached to a block: Survey points and positioning constraints.

Note: Once a reconstruction is created in a block, the Control points tab is read-only.

Control points can be added manually or can be imported from a columned file. See also Importing control points (on page 60).

Usage

Adding control points to a block enables accurate geo-referencing and avoids long-range metric distortion.

A set of control points can be used by aerotriangulation if it consists of 3 or more control points, each of them with 2 or more image measurements.
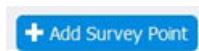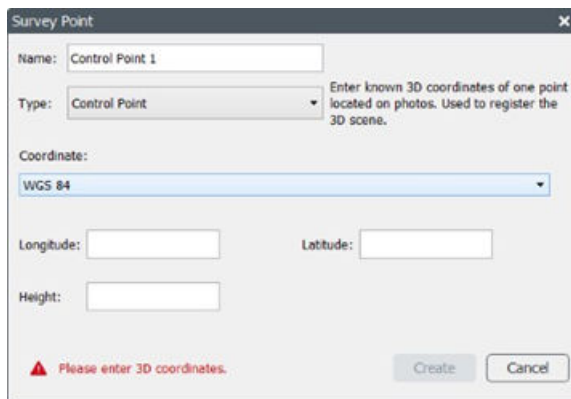
See also Aerotriangulation.

Adding a control point.

1. Click on Add Survey Point.

2. Define name.

In the Survey Point dialog, select Type "Control Point".
3. Enter 3D Coordinates. Select the input coordinate system in the combo-box, and the known 3D coordinates. "Local coordinate system" system can be used to enter non-georeferenced control points with arbitrary units or with known units.
4. Click on Create. The new Control point appears in the list.
5. You can set additional control point options (category, accuracy, check point, etc.) from the item properties (page 62).
6. Place the survey point on photos. Select a photo displaying the survey point, define its position in the photo with the yellow marker and click Accept position (alternatively, use Shift+Click to set directly the position on the photo).
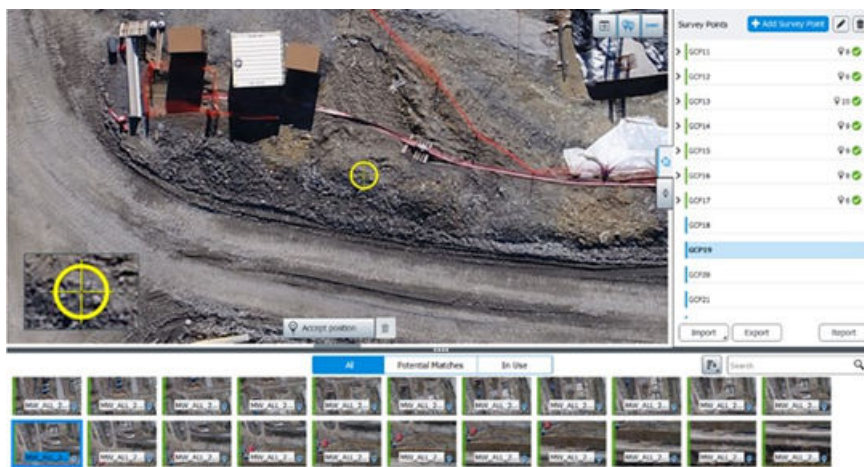

Figure 2: Defining positions on photos

Repeat the sequence of operations above to set the position in several photos.

Importing control points

There are two ways to import control points:

- With the block import: control points can be part of the block definition. See also Import blocks (on page 95)
- With a control points text file imported from the Surveys tab (Import button).

    Supported formats are TXT/CSV and ContextCapture Surveys (XML).

A basic example of supported control points files is a simple TXT file listing control points 3D positions with XYZ coordinates separated by a space.

```
Control points text file sample:
GCP_A 315796.627695945 4869916.09237971 627.8
GCP_B 315332.029686681 4870703.80261219 738.9
GCP_C 315483.66078491 4870210.48269584 833.2
GCP_D 315399.200463097 4871212.13895964 906.5
```

Thanks to the import wizard, you can import a custom text format with delimiter-separated-values, including advanced property like accuracy.

When importing control points, please ensure you have selected the right spatial reference system (SRS) (See Set the spatial reference system (on page 169).
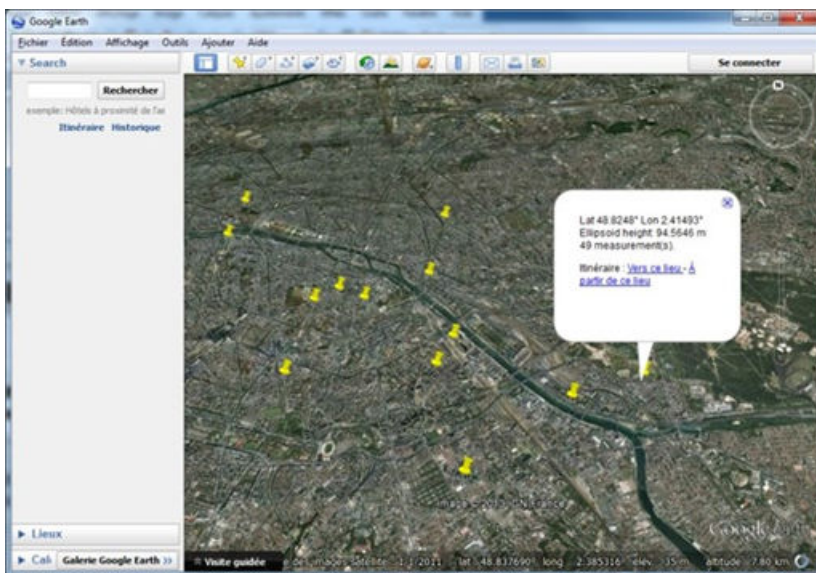
Control Point Properties

Properties

Click on Edit to access Control point properties.

Figure 3: Control Point Properties

Property	Description
Name	Control point alias.
Coordinate	Warning: for georeferenced control points, you must specify ellipsoidal height, and not the height above sea level, if your spatial reference system does not specifically include an orthometric vertical datum. For the WGS 84 reference system, for example, you must enter ellipsoidal heights; if your system is WGS 84 + NAVD 88 geoid height, then you must use heights above sea level. For more information, please refer to Useful concepts (on page 13). Edit the control point 3D position in the corresponding fields. Coordinate units depend on the chosen coordinate system: • Local coordinate system: same unit for X, Y and Z (known unit or arbitrary unit). • WGS 84: latitude and longitude in degrees, ellipsoidal height in meters. • Other: X, Y and height in meters (according to the selected coordinate system).

Property	Description
Check point	Enable this option if you want to use the control point for checking only. In such case the control point will not be considered during the aerotriangulation.
Category	• Full: XYZ coordinates will be used (default). • Horizontal: only X and Y coordinates will be used. • Vertical: only Z coordinates will be used.
Horizontal accuracy	Enter the given accuracy for the X and Y coordinates of the control point. Control points with a higher accuracy will have more weight in the aerotriangulation.
Vertical accuracy	Enter the given accuracy for the Z coordinates of the control point. Control points with a higher accuracy will have more weight in the aerotriangulation.

Tie points

Note: Once a reconstruction is created in a block, the Tie points tab is read-only.

Tie points are 2D correspondences corresponding to a same physical point with unknown coordinate.

The survey tab manages only user tie point ie. tie point defined manually by the user. Note than ContextCapture can automatically generate a large number of automatic tie points during the aerotriangulation process. See Automatic Tie points.

Tie points can be added manually or can be imported. See also Importing tie points (on page 66).

Usage

Used during the aerotriangulation of a block, user tie points can improve aerotriangulation accuracy and help the aerotriangulation in case of large baseline and ambiguous pattern. In most cases, user tie points are not required, because ContextCapture can cope with using only automatically generated tie points. User tie points should be used only to solve aerotriangulation issues. In all cases, before acquiring user tie points, we recommend to run a first aerotriangulation.

Improve Photo position

Some repetitive elements in photos can cause a photo to not be properly positioned.

By defining points that represent the same position in different photos, you can guide the aerotriangulation process towards to correct photo positioning.

Group aerotriangulation components

Sometimes the aerotriangulation cannot connect all the photos due to a too large baseline or scale difference between some images.

With user tie points defined across the picture set, the multi-pass aerotriangulation mode is able to stitch the pictures together. To enable aerotriangulation multi-pass mode, from aerotriangulation settings, set "Component construction mode" to "Multi-pass".

At least 3 user tie points must be defined in 4 images (2 measures in each component that you want to fuse).

Note: Adding user tie points increases components connection chances, but the connection is never guaranteed

Add positioning constraints

Positioning constraints are priors based on user tie points to provide scene origin/scale/orientation. Positioning constraints are used to perform a rigid registration of the block during aerotriangulation.
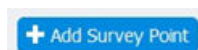
See also constraints.

Label positions

You can create user tie points to extract 3D-coordinates of points of interest. Once the scene is calibrated (after Aerotriangulation), ContextCapture can estimate accurately the 3D coordinates from 2D-pointing and can export this information (See Survey export).
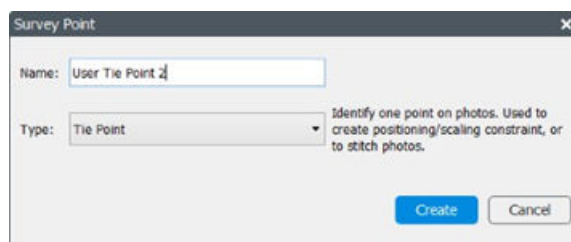
Adding user tie points

1. Click on Add Survey Point.

2. Define Name.

   Note: We recommend to use an explicit name for each tie point to ease the identification of an individual user tie point (for the constraint definition, etcetera).

3. Select Type Tie Point.
4. Click on Create.

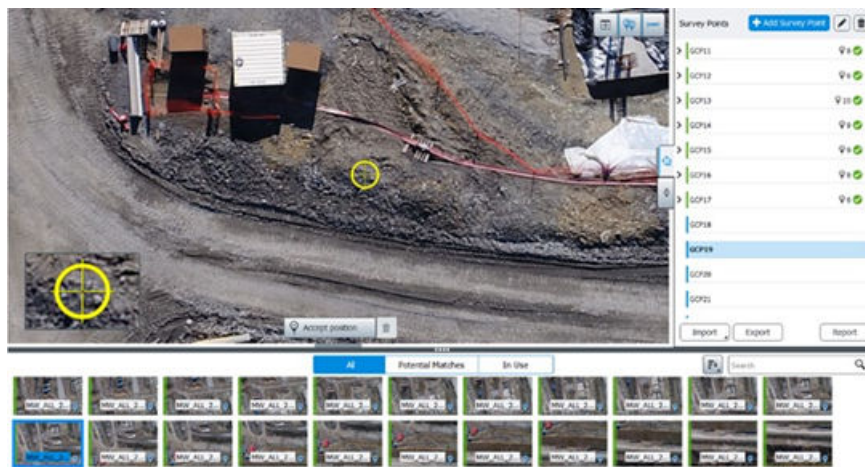   The new Tie point appears in the list.
5. Place the tie point on photos.

   Select measurement photo displaying the point, define its position in the photo with the yellow marker and click Accept position (alternatively, use Shift+Click to set directly the position on the photo).

Repeat the sequence of operations above to set the position on several photos.

Importing tie points

There are two ways to import tie points:

- With a ContextCapture Surveys file (XML) imported from the survey tab (Import button).
- With the block import: user tie points can be part of the block definition. See also Import Blocks (on page 95).

Surveys: Positioning Constraints

Positioning constraints are position/orientation/scale priors based on user tie points. They are used to perform a rigid registration of the block during aerotriangulation.

Positioning constraints are used only when using "Use positioning constraints on user tie points" mode during aerotriangulation.

You can set the origin and/or the scale and/or the orientation (either on axis or a plane).
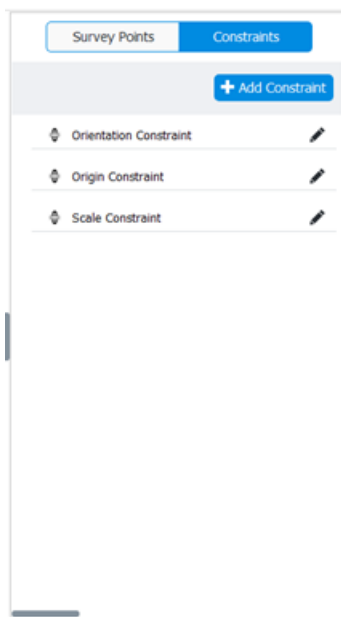
Property	Description
Origin constraint	Add constraint type > Origin constraint. ⚠ You cannot add an origin constraint if another origin constraint exists. Select the point corresponding to the Origin O=(0,0,0).
Scale constraint	Add constraint type > Scale constraint Select two points A and B and specify the distance between them. Select the distance unit if you know it, or use "units (arbitrary)" if it is not defined. You can add several scale constraints.

Axis constraint

Add constraint type > Axis constraint Orientation constraint based on an axis.

Select two points A and B and an axis, line AB being this axis (increasing values from A to B).

⚠ You cannot add an axis constraint if another orientation constraint exists (axis or plane constraint).

Plane constraint
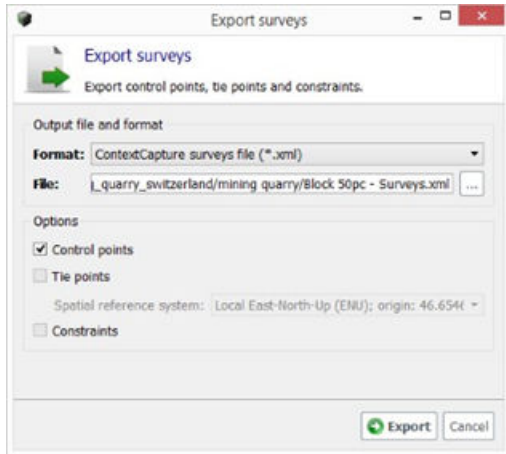
Add constraint type > Plane constraint Orientation

Constraint based on a plane

Select three points and two axes to specify a plane.

⚠ You cannot add a plane constraint if another orientation constraint exists (axis or plane constraint).

Export Surveys

Click on the Export button to export Surveys in various file formats.

KML file

Georeferenced control points or tie points (if ContextCapture can estimate the 3D position) can be exported to a KML file; you then can use this file to visualize the points in a standard GIS tool or in Google Earth.
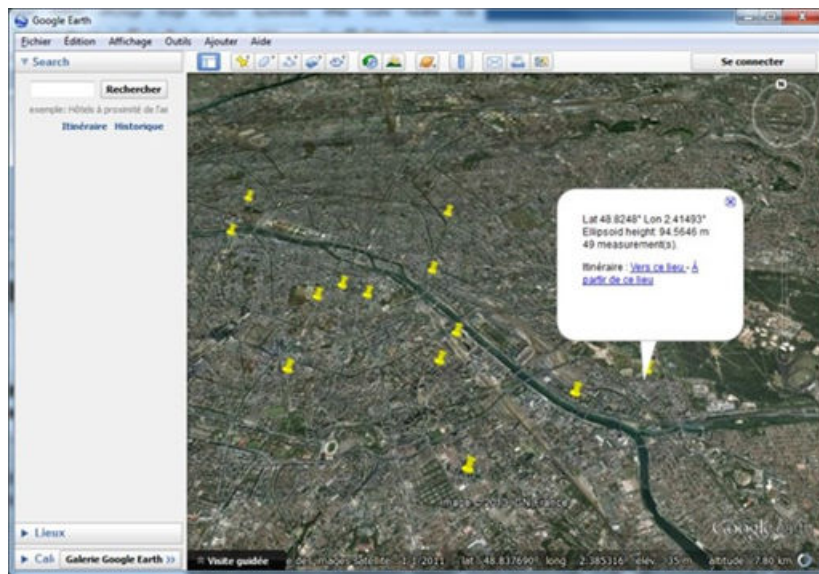

Figure 4: Control points KML export displayed in Google Earth

Text file

Control points or tie points (if ContextCapture can estimate the 3D position) can be exported to a simple text file with Name and coordinate (X, Y and Z).

Survey points text file sample:

GCP_A	315796.627695945 4869916.09237971 627.8
GCP_B	315332.029686681 4870703.80261219 738.9

ContextCapture Surveys file (XML)

All surveys data (including survey point properties, position on photos and positioning constraints) can be exported to XML format.

Tools

ContextCapture provides various tools to ease the survey points acquisition: filters or sorts, display hints, etcetera.

Photos filter

Use these options to apply filters on the list of photos.

Status filters

This filter allows to select photos according to their status for the selected Survey point.

All

Display all photos

Disables filtering according to status for the selected survey point.

Potential Matches

Display only recommended photos, on which the selected survey point may be placed.

It uses the available positioning data of the block to find the photos.

Note: In some cases, it may be interesting to process a first aerotriangulation with an approximate georeferencing based on GPS tags or on few control points to be able to take advantage of the selection mode based on block orientation, and then acquire the entire control point set more easily.

Note:

Potential Matches filter works for photos with known photogroup properties and pose.

Incomplete block photos are not handled when using this selection mode.

ContextCapture takes advantage of the available block data, including the current survey data to improve potential matches estimation: on a calibrated scene, potential matches become more relevant after adding the first survey points (typically from the 4th).

In Use

Display only photos where a position is already registered for the selected survey point.

Sort

Two sorting modes are available:

- Alphabetical: photos are sorted by name, alphabetically.
- Distance from point: for a control point, closest photos are displayed first (ignoring rotation).

Filter by name

Allow to select photos by name.

Image display options

These options allow to control the content of the image view.

Show/hide all potential positions

Show the potential position of all survey points on the current photo.

For the selected survey point, the potential position is displayed with the placement marker (in yellow).

For other surveys points, the potential positions are displayed with orange markers.

Show/hide potential position of the current point

Enable epipolar lines display to highlight the potential matching region, or to check the survey point quality.

Note: We recommend to process a first aerotriangulation, to be able to take advantage of the selection mode based on block orientation. This will greatly ease the process of defining user tie points.

Note: The display photo filter based on block orientation works for photos with known photogroup properties and pose.

Region of Interest

The region of interest allows the user to manually define, or import, a clipping polygon for the project. The output generated for this project will be clipped according to the region of interest.

To modify the region of interest, click on the "region of interest" button in the main window.

Note: The region of interest cannot be modified in Read-only mode. If necessary, create a new version to edit the region of interest.

Automatic

By default, ContextCapture cloud processing console creates an automatic bounding box, to the extent of the entire area containing data.

Custom Bounding Box

ContextCapture Cloud Processing Console

To manually edit the region of interest with an adjustable bounding box, click on the "Custom Bounding Box" button. You can adjust the dimensions of the bounding box by clicking and dragging faces of the 3D box.

Click the "import" button to import a custom polygon from a KML or a DGN file.

Click the "reset" button to reset the region of interest to the automatic one.
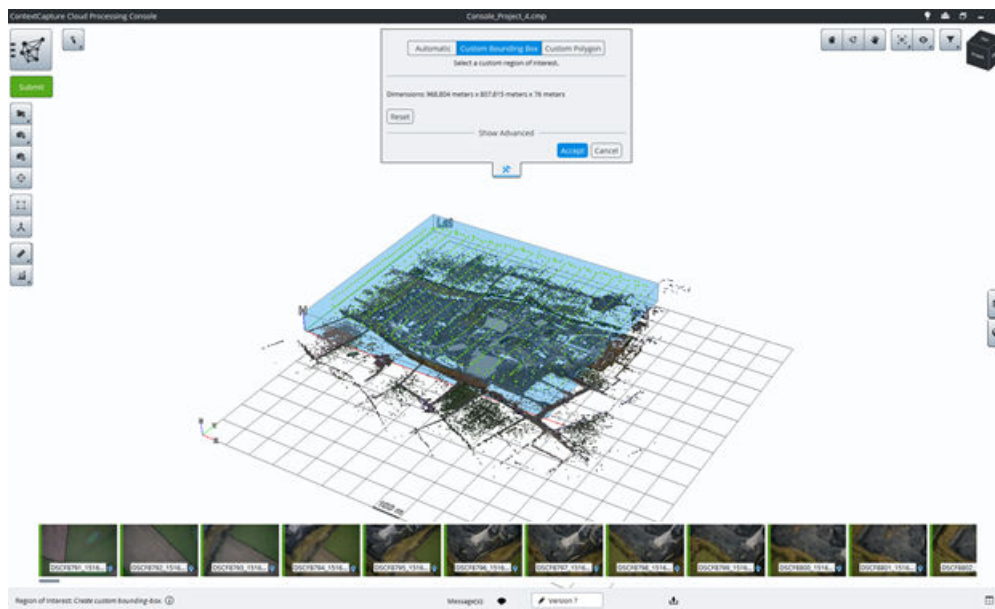

Custom polygon

Use the custom polygon button to draw the clipping polygon in the 3D view.

Click in the 3D view to draw the polygon. Press enter or close the polygon to validate it. Adjust the polygon minimum and maximum Z by using the arrows or adjusting the parameters in the Advanced settings (Show advanced).

Press Accept to validate the region of interest definition.
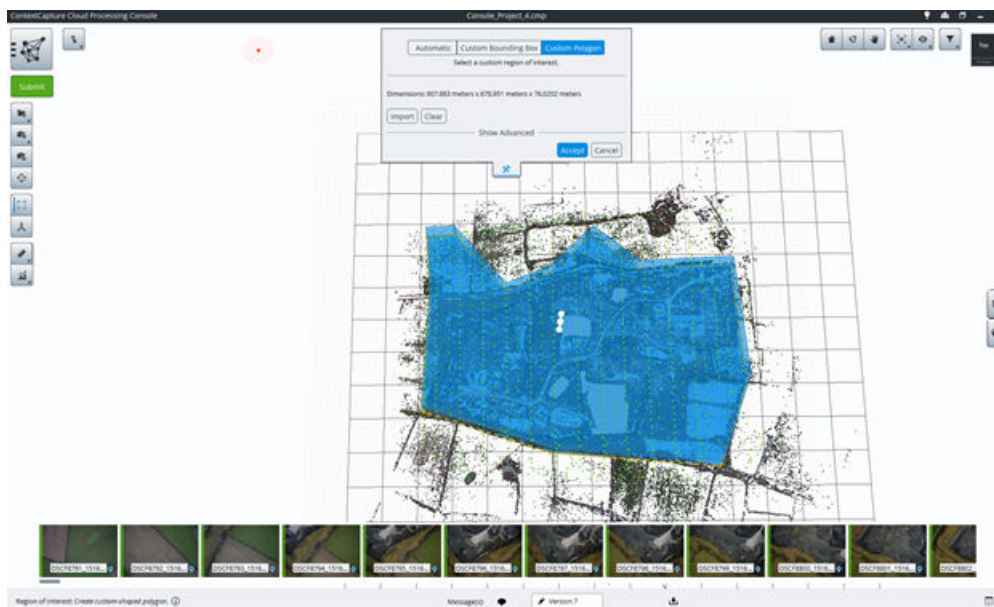
Reconstruction Constraints

Reconstruction constraints are 3D polygons that can be drawn in 3D view or imported to your project, before reconstruction, to improve the quality of the final product on surfaces that are challenging for photogrammetry (water bodies, glass buildings, windows, etcetera).

Reconstruction constraints cannot be created in Read-Only mode. If necessary, create a new Version.

Open the reconstruction constraint tab by clicking on the "reconstruction constraints" button in the main window.

The reconstruction constraints tab contains 3 new tools.

Import Constraints

Note: When importing a reconstruction constraint, ContextCapture creates a mesh from the imported polygon or mesh. The normals of the mesh triangles should be facing up along the Z axis for a proper reconstruction.

When importing a reconstruction constraint, it is recommended to check its correct location in the 3D view and the correct direction of the normal. Dark orange indicates the bottom, and light orange the top.

Import Polygon

The import from polygon button allows to import a reconstruction constraints described by a polygon in .DGN or .KML format.

Import Mesh

The import from polygon button allows to import a reconstruction constraints described by a polygon in .OBJ or .DGN format.

Create constraint

Click on create constraints to start drawing your constraint in the 3D view. Two modes are available for the plane definition:

- Average: The plane used by the reconstruction will be averaged on all the polygon vertices clicked in the 3D view.
- Horizontal: The plane used by the reconstruction will be horizontal and averaged on the vertices height mean value.

Press enter or close the polygon to define the constraint. Use the arrows to modify the elevation of the constraint if needed.
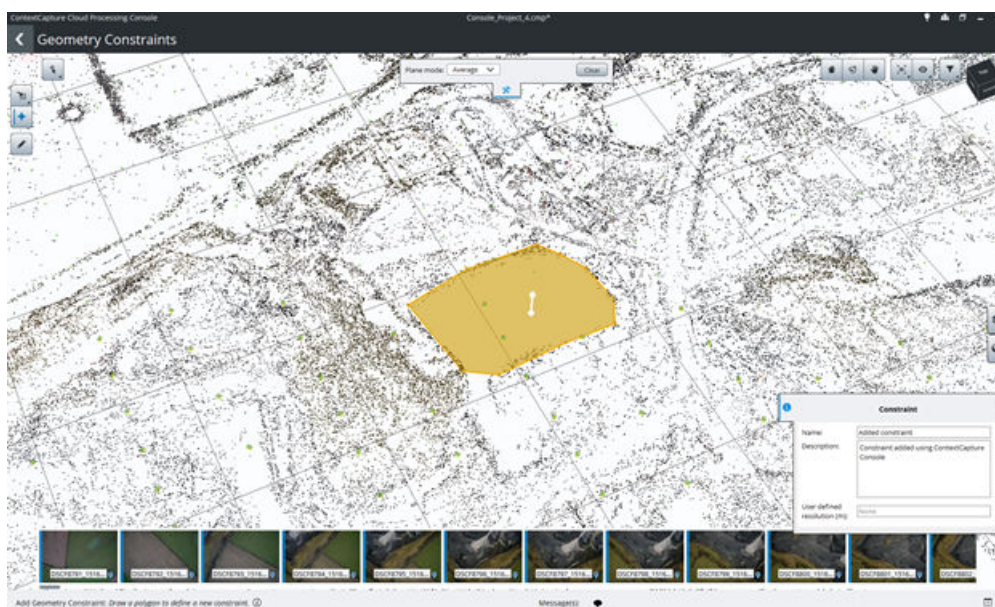
Edit constraint

Use the edit constraint tool to select and edit an existing constraint. All the constraints are editable should it be imported from an external file or drawn in the 3D view.

In edit mode, hold left click on a vertex to drag it and modify its position. Click and drag on an edge to add a new vertex.

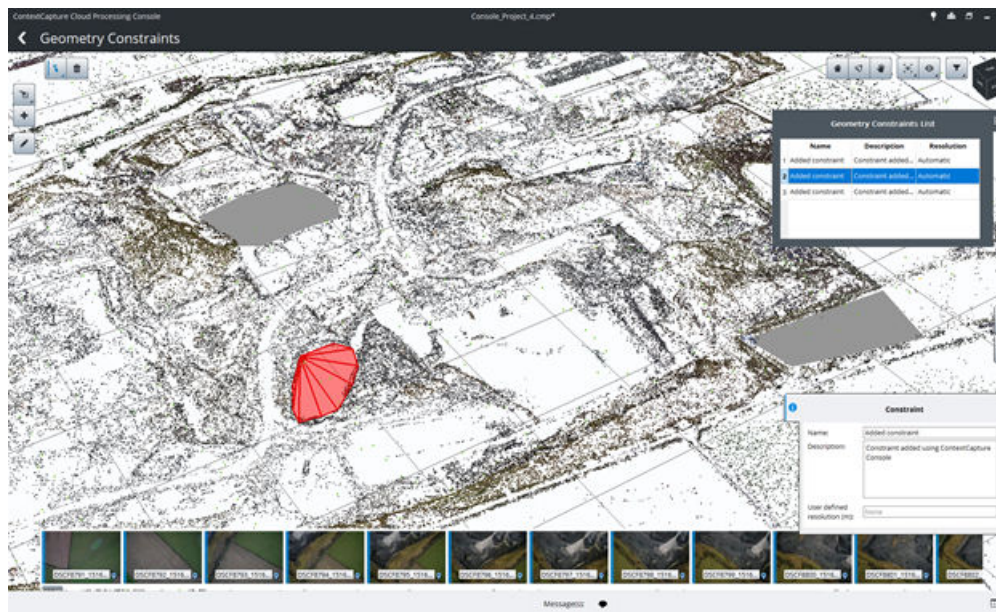Use the arrows to modify the elevation of the constraint.

Press Enter to validate the changes.

Press ESC to discard the changes.

Geometry Constraint list

Use the constrain list button to open the geometry constraints list.

This list can be useful to search and locate specific surface constraints.

Measurements

Opens the measurement tool.

The following measurement modes are available:

- Location: get accurate 3D coordinates of a point in a given coordinate system.
- Distance: get 3D distance and height difference between two points.
- Area: get polygon area and contour length.

- Volume: get volume measurement between the 3D model and a reference plane in a polygon.

For each measurement mode, several measurements can be performed and displayed in the 3D view.
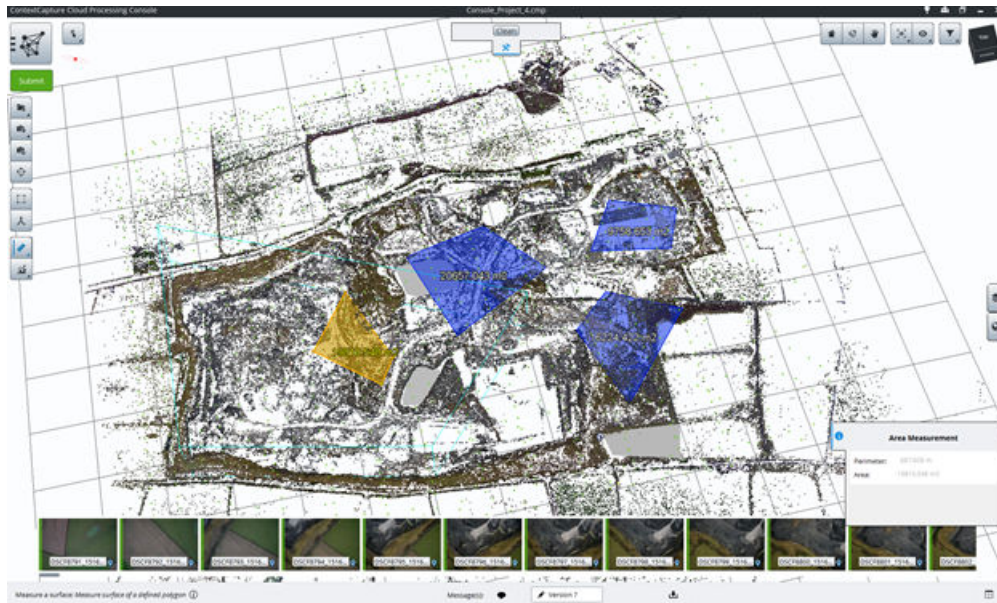
Quality Metrics

The Quality Metrics allows a quick 3D analysis of aerotriangulation result. A variety of metrics are proposed, ranging from scene coverage to position uncertainty for photos and survey points.
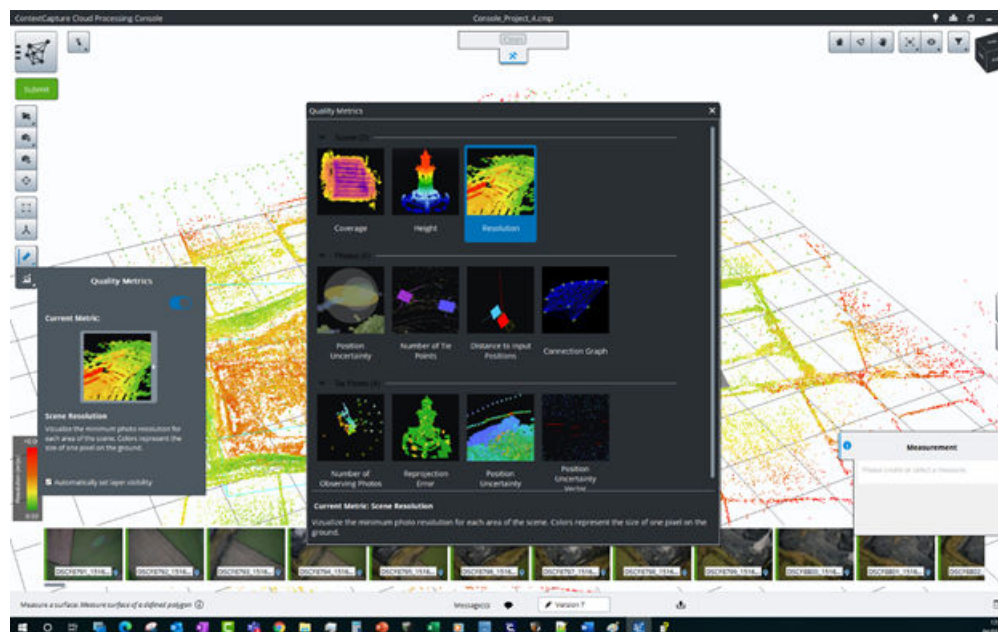
Access the metrics by clicking on the "Quality Metrics" button:

Subsequently, click on the metric thumbnail to access the entire list of metrics.

Click on the metric thumbnail to access the entire list of metrics.

The Quality Metrics dialog, with the current metric and the list of all available metrics.

Proposed metrics:

1. Scene

- Coverage: indicates the number of photos that potentially see each area. Note: occlusions are ignored, points that are hidden by other parts of the scene are considered as visible if they are in the field of view of the photo.
- Height: colors the generated tie points according to their vertical position.
- Resolution: displays the ground resolution (in 3D units/px) for each generated tie point.

2. Surveys

- Position uncertainty: exposes a visual representation of how certain are the image positions of each survey point. Transparent spheres around the survey points indicate how uncertain is the position (scaled for readability). Colored ellipses show the most uncertain direction and its magnitude. Note: only available if surveys are present in the scene.
- Control point distribution: indicates how far from a control point are the generated tie points. To calculate this distance, we consider the photos and the link between photos. Note: only available if control points are present in the scene.

3. Photos

- Position uncertainty: illustrates to what point the ContextCapture optimization is certain of the estimated photo positions. Transparent spheres around photos indicate the position uncertainty (scaled for readability). Colored ellipses show the most uncertain direction and its magnitude.
- Number of tie points: colors the photos according to the number of tie points linked to them.
- Distance to input positions: shows the offset between the input positions and the computed photo positions. Colors indicate the magnitude, and lines indicate the direction of the change in position. Note: only available if input positions are provided.
- Distance to input rotations: illustrates the difference between the input rotations and the computed photo rotations. Colors indicate the angle difference. Note: only available if input rotations are provided.

- Connection graph: displays links between photos; two photos are paired together if they have tie points in common.

4. Tie Points

- Number of observing photos: represents the number of photos that have been used to define each point, smoothed over the set of photos seeing the point. The average mean value is used in order to provide a comprehensive information about the scene and filter noisy data.
- Reprojection error: considers the pixel reprojection error for each tie point.
- Position uncertainty: indicates the individual tie point position uncertainty, averaged over the photos seeing the point. This metric illustrates how well placed can we expect the generated tie point to be after the ContextCapture optimization.

Lock on Photo

This mode activates an immersive view of the scene through a selected photo.

Photo is aligned on the scene thanks to photo and photogroup parameters (pose and optical properties). Navigation is locked on photo viewpoint.

Use Photo overlay settings to change image plane depth and opacity.

Lock on photo shows simultaneously 3D objects and photographs in a same space. Using photos aligned on 3D model allows to cross-compare 3D data with reference data (quality control, etc.), and enhances 3D views with reliable context and details.

Example of applications:

- Understand acquisition/scene.
- Check 3D data alignment with photos: scan, tie points, mesh, etcetera.
- Identify/understand reality mesh misconstructions.
- Enhance 3D view inspection: details, context, etcetera.
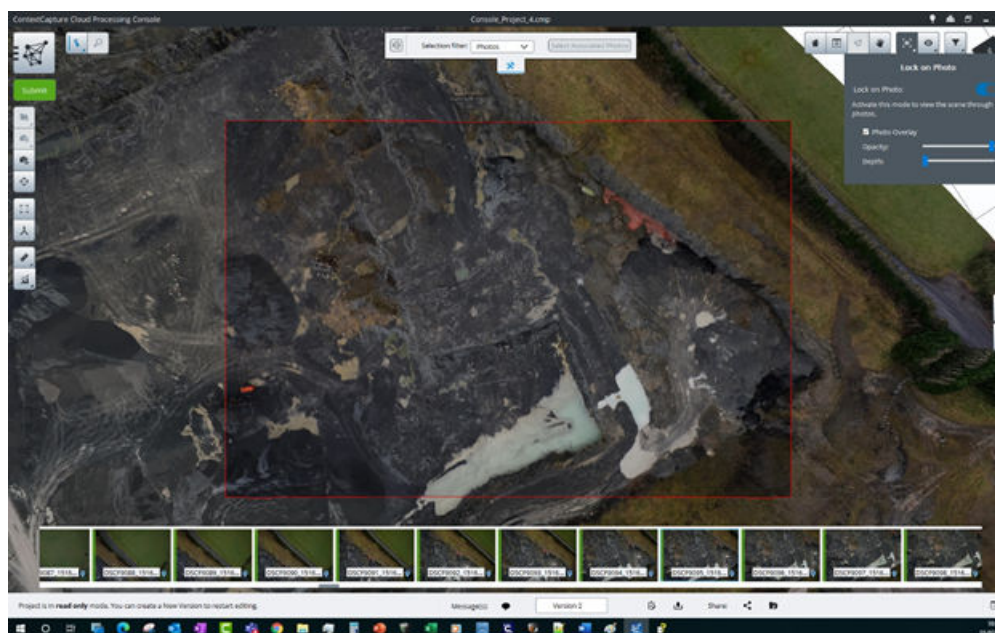
Spatial Reference System

Georeferenced project requires to define a cartographic system by selecting a Spatial Reference System (SRS) at the reconstruction (Spatial framework) and production levels.

The interface used for Spatial reference system choice proposes a default selection adapted to the context, a list of recent choices, and a direct access to the Spatial reference system database for more choice.
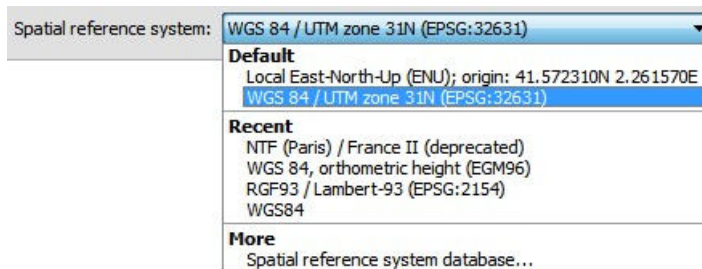
Spatial reference system database

In the spatial reference system list, click on More: Spatial reference system database to access the database.
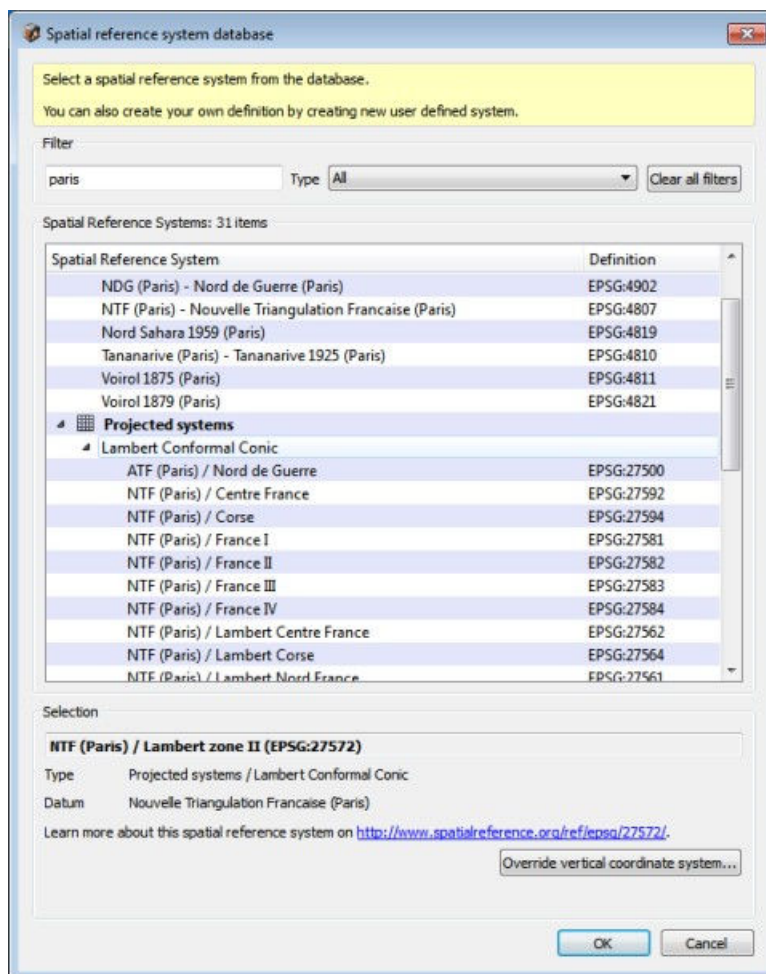
The database proposes more than 4000 spatial reference systems and is extensible with custom user definitions.

Spatial reference systems are sorted by type:

- Cartesian systems: 3D cartesian coordinate systems, including ECEF (geocentric) and Local East-North-Up (ENU) coordinate system.
- Geographic systems: coordinate systems based on a spheroid, for instance the WGS 84 latitude/longitude coordinate system.
- Projected systems: map projections sorted by projection type (UTM, Lambert Conformal Conic, etc.). Projected systems also include the specific Web map projection Bing Maps system.
- User defined systems: custom user definition.

Use the filter to quickly find an existing Spatial reference system in the database and select an item in the filtered table.

For specific types of systems you may be asked to enter additional parameters:

- Local East-North-Up (ENU): needs latitude and longitude of the origin. See also ENU (on page 13).
- Bing Maps system: needs level of detail from 1 to 23. See also Bing Maps Tile System.

User defined system: needs name and definition (see after).

Exporting Spatial reference system

Projected, geographic or user defined spatial reference systems can be exported in standard PRJ files including the WKT definition.

Right-click on an item and choose Export to create a PRJ file.
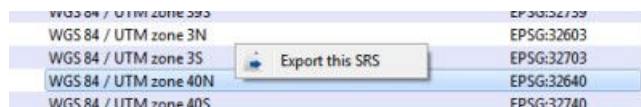
ContextCapture Cloud Processing Console

Exporting SRS allows to adjust a SRS definition externally or export a user defined SRS to another computer.

Vertical coordinate system

Geographic and projected systems use the datum on which they are based as height reference (ellipsoidal height).

For convenience you can override the vertical coordinate system to use another reference for heights.

⚠ Some vertical coordinate system definitions are based on geoid approximation subject to sampling and interpolation, resulting in loss of vertical accuracy.

Click on Override vertical coordinate system to select a new reference for heights.
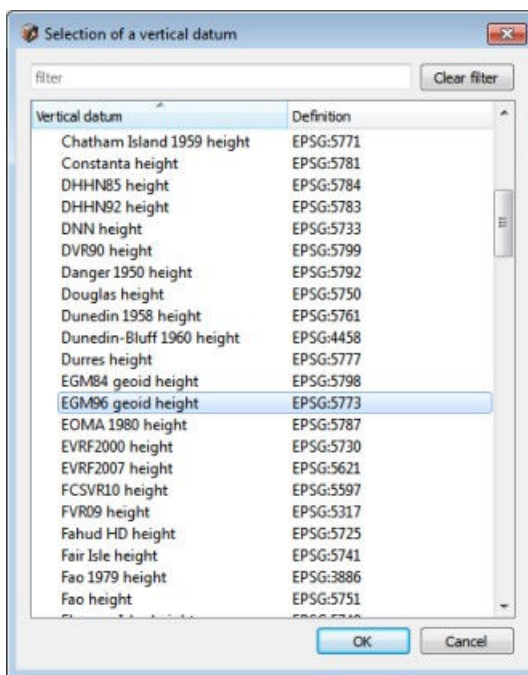
Upon confirmation of your choice, a new user defined system is created with the overridden vertical coordinate system.

Note: Ellipsoid height may be confusing compared to traditional mapping data using orthometric height or mean sea level (MSL) as reference.

Using EGM96 geoid as vertical coordinate system allows to get a good approximation of mean sea level (MSL) heights.

User defined system

To Create a Custom Spatial Reference System (SRS) (on page 173).

To find a spatial reference system, you can visit http://www.spatialreference.org/.

PROJ.4

PROJ.4 declaration allows to enter a custom projection system (for instance "+proj=utm +zone=11 +datum=WGS84").

See also http://trac.osgeo.org/proj/wiki/GenParms.

Well Known Text (WKT)

OpenGIS Well Known Text format for coordinate systems can be provided in an attached PRJ file. In such case, enter the projection file path as SRS definition (for instance "C:\projections\myProjection.prj").

Example of WKT definition contained in a PRJ (.prj) file:

```
GEOGCS["WGS 84",
    DATUM["WGS_1984",
                       SPHEROID["WGS 84",6378137,298.257223563,
            AUTHORITY["EPSG",7030]],
        TOWGS84[0,0,0,0,0,0,0],
        AUTHORITY["EPSG",6326]],
    PRIMEM["Greenwich",0,AUTHORITY["EPSG",8901]],
    UNIT["DMSH",0.0174532925199433,AUTHORITY["EPSG",9108]],
    AXIS["Lat",NORTH],
    AXIS["Long",EAST],
    AUTHORITY["EPSG",4326]]
```

Additional data

Some spatial reference systems use external dependencies which, prior to their use, must be installed in the "data\gdal" subdirectory of ContextCapture installation directory.

For instance, a spatial reference system with a custom vertical coordinate system may use a GTX grid to approximate the geoid.

Create custom spatial reference systems

You can create custom spatial reference systems in three steps:

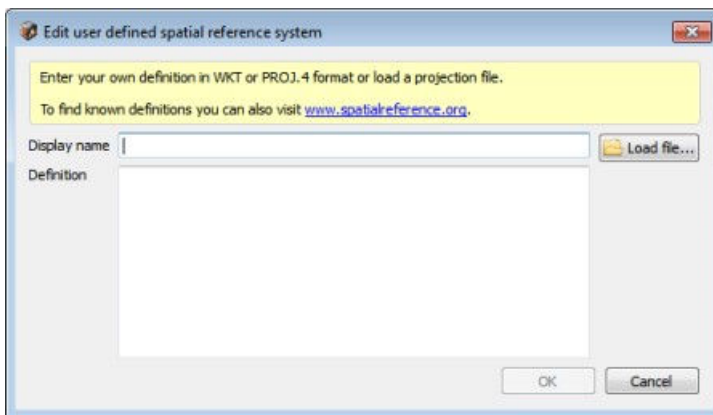**1.** Select the item Define new user system to start the creation of a new spatial reference system.
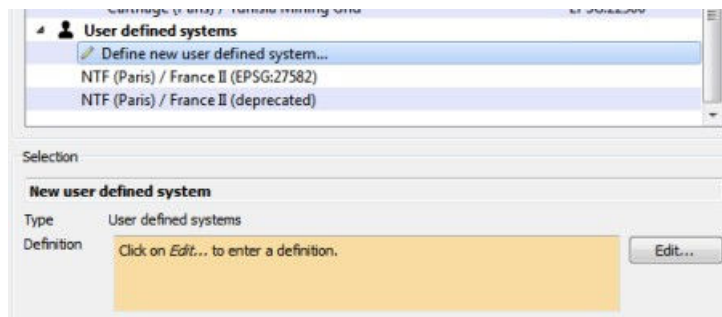
2. Click on Edit to define the new spatial reference system.

3. Enter a display name and the definition of the new user defined system.

Any well known SRS definition can be entered, which includes PROJ.4 declarations, Well Known Text (WKT), or the name of a PRJ file containing a definition.

To find a spatial reference system, you can visit www.spatialreference.org.

3D Model Processing

Click the 3D model processing button to open the "3D model processing" dialog where productions can be selected and submitted to ContextCapture cloud processing service.
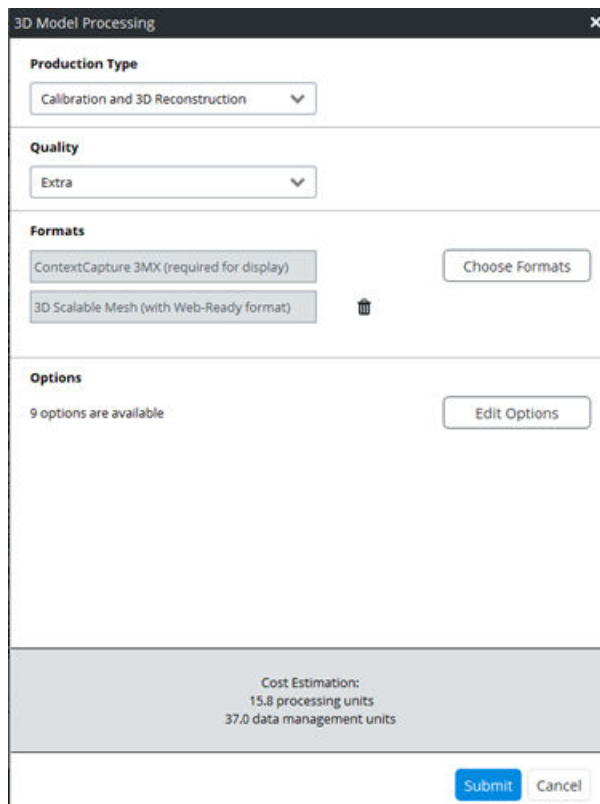
Production type

- Calibration Only: this mode will only perform the first step of the process, the calibration (aka the Aerotriangulation).
- Calibration and 3D reconstruction: this mode will perform the calibration and the reconstruction, in a single job. While the job is processing, the calibration results will be downloaded and displayed in the 3D view, when available.
- 3D reconstruction Only: this mode will perform only the 3D reconstruction. It is available when a calibration results is already available (from a previous process or from block import), or when processing a lidar point cloud.

Mesh Quality

- **Extra (default)**: extra precision, larger file size (tolerance of 0.5 pixel in input photos).
- **Medium**: medium precision, best suited for Orthophoto/DSM productions (tolerance of 2 pixels in input photos).
- **Draft**: best suited for quick reconstruction to validate photo acquisition. The fastest and most memory-efficient mode.

Output formats

- **3MX**: open format proposed to facilitate the distribution of ContextCapture data.

  - Interoperability with some V8i Generation and early CONNECT generation of Bentley design products, such as Bentley Descartes and MicroStation.
  - Interoperability with third-party applications (3D GIS).
  - Web publishing, by using our free Acute3D Web Viewer.
- **Scalable Mesh**: Contains two productions.

  - **3SM file**: suitable for display, analysis and editing of large 3D meshes in CONNECT generation of Bentley design applications.
  - **3D Tiles**: suitable for display in Bentley's Navigator Web and Cesium.
  - **POD point cloud**: suitable for display, analysis and editing of large Point Clouds Bentley design applications.
  - **Orthophoto/DSM**: suitable for creation of large textured DSM models or orthophoto mosaic in Bentley design applications and third-party applications.

Note: production of 3MX format is mandatory in ContextCapture cloud processing console. This format is downloaded locally at the end of the production and is required to display the resulting textured model in the applications 3D view.

Advanced Options

- Input camera models calibration:

  - **Accurate**: The model is positioned according to photo positions.
  - **Not Accurate**: The model is rigidly registered to photo positions.
- Orthophoto/DSM:

  - **Coordinate system**: Geographic Coordinate System of the resulting orthophoto/DSM files.
  - **Sampling distance (meters)**: sampling distance for the resulting raster file.
  - **Maximum image dimensions (px)**: the maximum tile size for the resulting raster file.
  - **Orthophoto format**: TIFF/GEOTIFF, JPEG or KML Super-overlay

- **Orthophoto No data**: color representing no information.
- **DSM generation**: Enable/Disable generation of DSM production.
- **DSM format**: TIFF/GEOTIFF, ESRI ASCII raster/ASC or XYZ
- **DSM No data**: pixel value representing no information.

Cost Estimation

Estimation of ContextCapture cloud processing service image processing units required to process all the selected formats. Also estimates space required to store all resulting productions in ProjectWise ContextShare.

Submit Processing

Submits jobs and uploads input photos to ContextCapture cloud processing service to reconstruct all the selected formats according to the selected settings.

Each format, as well as the ContextCapture input files, are stored in individual Reality Data in ProjectWise ContextShare. The logged-in user must have the necessary permissions to create the Reality Data in ProjectWise ContextShare. See "ProjectWise ContextShare" section for more information.

When processing is finished, the logged in user receives an email indicating the productions are completed. If the "Scalable Mesh" production was selected, the email contains a link to view the textured model in Navigator Web. If the ContextCapture cloud processing console project was associated to a CONNECTED project, the email contains a link to the associated CONNECT project's "Project Share" page where resulting Reality Data can be shared with project members, streamed to CONNECT generation design applications and downloaded for use in V8i and early CONNECT generation design applications.

Note: if you do not receive, or stop receiving, the emails, make sure to check the Spam folder in your email client.
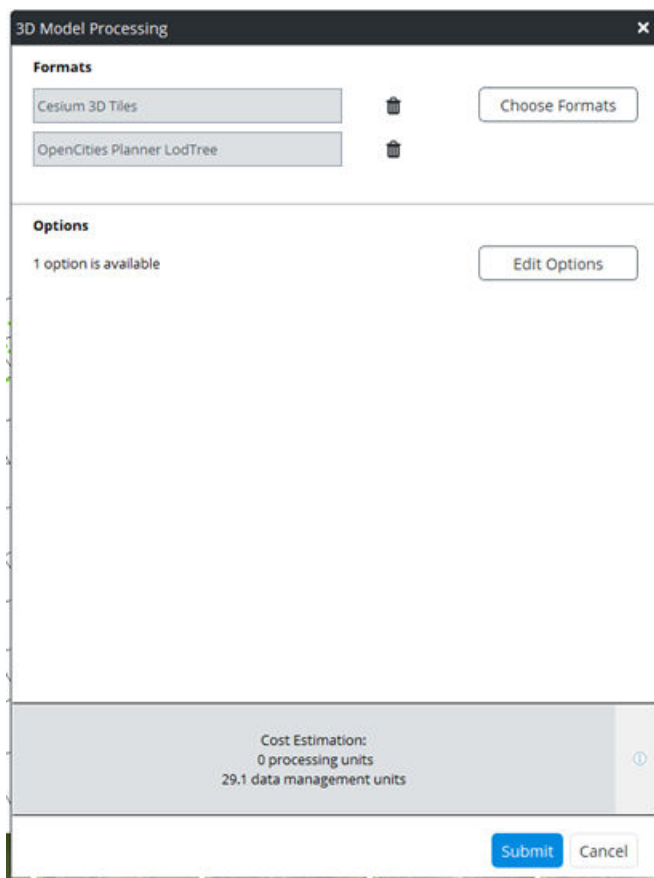
Additional format processing

Once a first reconstruction has been performed for a given version, press the submit button to generate new export formats. Select the new format from the format list and edit the options if necessary.

If you would like to modify some reconstruction settings at this stage, please create a new version from the bottom banner.

Download Manager

The download manager lists the different production and download available for each version of your project.

Note: You can choose to automatically download the outputs at the end of a cloud processing or keep this process manual by changing the option in the console settings.

When a cloud production is completed, the download manager will be accessible. To open it, click on the download manager icon in the status bar.

Backstage

Click the ContextCapture icon to open the backstage.

Bentley CONNECT

Click on the name of the signed-in user to open the "User profile" page. Click on the "Go to personal portal" link to open the personal portal in your default browser.

Project

Click on the project name to navigate to the application's main window.

New

Navigate to the New page to create a new ContextCapture cloud processing console project.

Open

Navigate to the Open page to open a ContextCapture cloud processing console project.
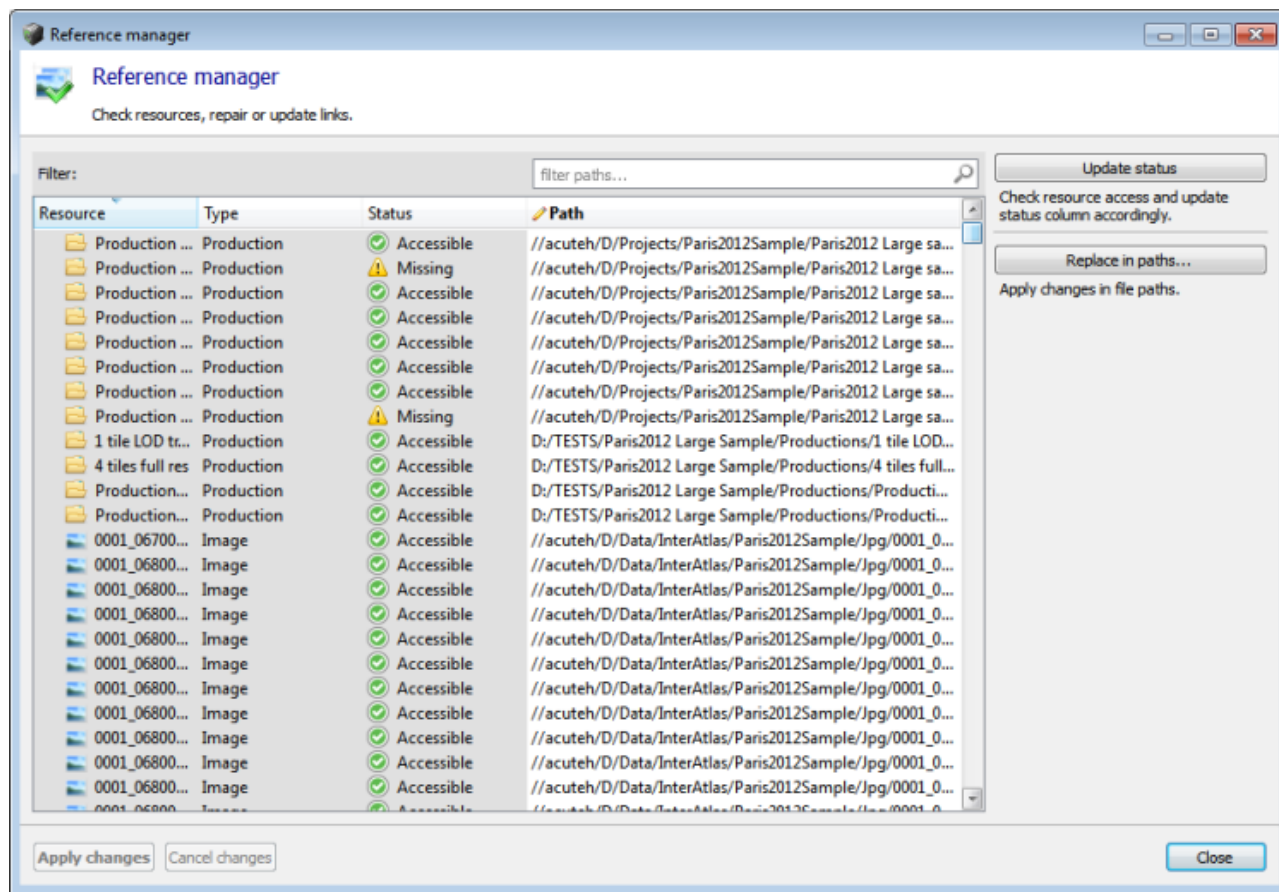
Save

Save changes to the opened ContextCapture cloud processing console project.

Reference Manager

Check resources, repair or update links.

ContextCapture projects refer to several external resources: input photos and masks, as well as output directories. The reference manager interface allows you to check, repair or update corresponding links.

Check resources status with Update status. Repair or update links with the Replace in paths tool, or editing resources paths directly.

Changes appear in bold characters in the resources table and are applied only when you click on Apply changes.

Information

Navigate to the Information page of the ContextCapture cloud processing console project. This page displays information about the project and allows to Associate/Disassociate a ProjectWise Project.

Settings

Navigate to the Settings page of the ContextCapture cloud processing console project. This page allows to set proxy settings and a color theme.

Tools

Navigate the" Tools" page to access various tools to help you with your project. Here you can use the Target creation tool to create QR codes or compact target for automatic detection of tie-points or ground control points in your photo block.

Help

Navigate to the Help page where it's possible to open the About dialog and the product's documentation.

Exit

Close the ContextCapture cloud processing console application.

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ProjectWise ContextShare

ProjectWise ContextShare is a CONNECT service to store, manage and share Reality Data. It supports the following Reality Data types:

Type	Description
ContextCapture Orientations	Include information about camera calibration, camera pose, photogroups, point clouds references, and also aerotriangulation results if available.
ContextCapture Image Collection	Collection of Image dataset.
ContextCapture Scan Collection	collection of scan dataset.
ContextCapture Cloud Project	Contains the files of a cloud projects.
ContextCapture 3MX	Result of a Mesh production in 3MX format.
3D scalable mesh (3SM)	Result of a Mesh production in 3D Scalable Mesh format.
We-Ready Scalable mesh	Result of a Mesh production in Web-ready Scalable Mesh format for online viewing and streaming.
Scene Layer Package (SLPK)	Results of a Mesh production for use in ESRI products.
OpenCities Planner LodTree	Results of a Mesh production for use in OpenCities Planner product.
Cesium 3D tiles	Results of a Mesh production for use in Cesium platform.
Pointools POD	Results of a point cloud production in POD format.
LAS Point Cloud	Results of a point cloud production in LAS format.
OrthoPhoto and DSM	Results of a raster production for orthophotos or DSM.

Permissions

Creation and access to Reality Data is controlled using a ProjectWise ContextShare - create" entitlement and project based Permissions.

Create Reality Data

To create reality data on ProjectWise ContextShare portal, a user needs:

1. ProjectWise ContextShare - Create entitlement

    • An Administrator or Co-administrator can assign this entitlement from the entitlement management page of the Enterprise portal.

    Note: If the "ProjectWise ContextShare - Create" is not listed, please contact Bentley's Technical support.

2. ContextCapture Cloud Processing Service entitlement, that bypasses ProjectWise ContextShare entitlement.

    • An Administrator or Co-administrator can assign this entitlement from the entitlement management page of the Enterprise portal.

Associate and dissociate Reality Data from a CONNECT project

The ProjectWise ContextShare "Assign" permission grants the user permission to Associate and Dissociate Reality Data that belong to the enterprise to the project.

• An Administrator, Co-administrator or Project Manager can assign this permission from the "Project Team Management" page of any CONNECT page.

Stream Reality Data to Navigator Web or a CONNECT design application

The ProjectWise ContextShare "Use" permission grants the user permission to stream Reality Data that are associated to the project.

• An Administrator, Co-administrator or Project Manager can assign this permission from the "Project Team Management" page of any CONNECT page.

Manage Reality Data

The ProjectWise ContextShare "Manage" permission grants the user permission to create, assign and stream Reality Data that are associated to the project.

• An Administrator, Co-administrator or Project Manager can assign this permission from the "Project Team Management" page of any CONNECT page.