MANUAL

Shaper

UVM
SYSTEMS

City**GRID**®
2024

contents

Cover picture: Prague, Leonhard Niederwimmer, Pixabay

1. City**GRID**® Shaper Basics

Shaper is a stand-alone module of the City**GRID**® Software Suite. With the corresponding data sets, building models can be created semi-automatically from LiDAR or matched pointclouds.

1.1. System requirements

A standard computer with 16GB RAM and a 3D-capable graphics card is sufficient to operate the City**GRID**® Shaper. Since shaper projects can become very large, a correspondingly large data storage is required (min. 1 TB).

> *Note:* More data - more performance! Depending on the point density, the size of the point clouds and the number of images, more or less memory is required to create a project. Make sure that the computer on which the creation is carried out has sufficient capacity. The created projects can then be distributed and processed on less powerful computers.

1.2. Geometry concept

Planes are automatically extracted from the pointclouds, whose area of validity is approximately limited with a polygon (alphashape). The intersection of two alphashapes generates an intersection line at a building edge, which is used for the building preview (Smart Preview).
To generate a valid intersection line, two conditions must be met: The two alphashapes involved in the intersection line must be clearly to the left and right of the intersection line respectively, and the two alphashapes must be sufficiently close to each other. The user has no influence on this, the quality of the pointcloud is decisive for this.
 If only one of the two requirements is met, an invalid intersection line is created, which is not displayed by default. Under certain circumstances, however, it can be helpful to display these invalid lines. More on this in chapter 2.3.3.3.
A section line can have different states which can be influenced by the user. The intersection of a plane (not its alphashapes) with the base plane creates the baselines, whose state depends on the state of the intersection. Through user interaction, a building preview can be created with the intersection lines and the baselines. When this preview is accepted, possibly edited, and finally saved, the building is saved to a City**GRID**®.xml.

There are four geometry classes in Shaper, which can be in different states:

a) Point geometry:

- Pointcloud points:

Status	User interaction
Assigned to a plane	Show/Hide
Not assigned to a plane	Show/Hide
Coloured depending on the assigned plane	Show/Hide

- Vertices:

Are always part of a line, an alphashape or an outline and therefore have the state of their parent geometry. They can only be changed in the accepted state of the parent geometry.

Parent geometry	User interaction
Line	Move end vertices or centre point in position
Alphashape	Move, add or delete vertices
Outline	Move, add or delete vertices

b) Line geometry: Shaper uses intersection lines and baselines.

- Intersection lines

Status	Description	User interaction
Invalid (not displayed)	Intersection lines that have not achieved candidate status because not all requirements have been met.	Are hidden by default but can be shown in certain situations.
Candidate (Red)	Status of a valid intersection line before user interaction.	
Used (Blue)	Intersection line *used* for Smart Preview	*Mouse Hover* over a line in candidate status changes status to *Used*; building preview is created.
Accepted (Green)	An intersection line *accepted* by user interaction, the preview of this line was accepted, however, in interaction with other candidates, the preview is still dynamically adjustable.	With an **LMC** on the *Used* intersection line, the status changes to *Accepted*.

Completed (Black)	An intersection line *completed* by user interaction. The preview of this intersection line is fixed and can no longer be changed by other intersection line candidates.	Command **Accept Building** or **Finish Building Part**. The intersection lines of these buildings are excluded from further preview.
Deactivated (Grey)	*Deactivated* intersection lines are lines in *candidate* status that are deliberately excluded from the Smart Preview by user interaction. They are no longer used for dynamic face generation.	**'T'** to deactivate or reactivate intersection lines.
Set aside (Magenta)	Lines in *candidate* status are *put aside* if one of the involved layers has too few points through user interaction to form a valid plane and thus an intersection line with another plane cannot be valid either.	Only lines in *candidate* status are *set aside* if the user filters the pointcloud so strongly with the data filter that some layers have no or too few points. The affected layers are hidden, the associated candidate lines are *set aside.*

- Base lines:

The status of baselines depends exclusively on the status of the originating intersection lines.

Status	User interaction
Used (Blue)	Baselines are *used* when the associated intersection line is *used*.
Accepted (Green)	Baselines are *accepted* if the associated intersection line is *accepted*.
Finished/Invalid baselines	Are not displayed

c) Polygon geometry: planes can have two types of polygons.

- *Alphashape*: is the automatically found boundary of a plane that is only approximated and often too small. If an intersection line between two planes is accepted, these planes get an outline in addition to the alpha shape. An outline can also be drawn in a flat roof situation where there are no plane intersections.
  Editing an alpha shape (adding, deleting, or moving a vertex) has a direct influence on the resulting intersection lines and thus an indirect influence on the face generation.

- **Outline**: is the user-edited or -created boundary that can delimit the plane more precisely. The extent of the outline determines the face generation. The vertices of an outline cannot be edited if they are on the border of another plane and editing them would change the intersection (ridge) between the planes.
  Editing outlines (adding, moving, or deleting vertices) has a direct influence on face generation.

> *Note: Editing an outline should not be followed by any more work with the alphashapes concerned or the associated intersection lines, as a user interaction on the outline takes precedence over that of the alphashape.*

d) Faces: No status, are derived from accepted lines or outlines

Editable Geometries:

Not all of the geometry classes mentioned can be edited.

a) **Vertices:**

 can be moved, added or deleted depending on their parent geometry.

b) **Lines**:
   - **Intersection Lines**: Can be modified in length.
   - **Baselines**: Can be moved in the plane.

c) **Alphashapes**:

Can be changed in their extension by changing their vertices and thus also change the intersection lines.

d) **Outlines:**

Can be changed in their extension by changing their vertices and thus change the face generation. Not all vertices of an outline can always be changed. The outlines of two planes that are adjacent to each other cannot be changed at the points of contact, as this would result in a change of the intersection line.

1.3. Data basics

To create City**GRID**® Shaper projects, a Lidar pointcloud dataset or a matched pointcloud dataset in .las or .laz format is required. The best results can be achieved with a classified LiDAR pointcloud. However, if no classification is available, point clouds that have been reduced to the buildings using external - spatial - filtering methods can also be used.

Data quality: A minimum requirement for the data quality of a las point cloud is assumed. Since Shaper assigns points to planes and extracts their boundaries, points must be assignable to planes. **Very noisy point clouds from poorly matched images are unsuitable for layer extraction for understandable reasons**.

An example of an unsuitable point cloud: The points are poorly distributed and scatter strongly. The planes calculated with very tolerant settings do not represent the planes in reality.
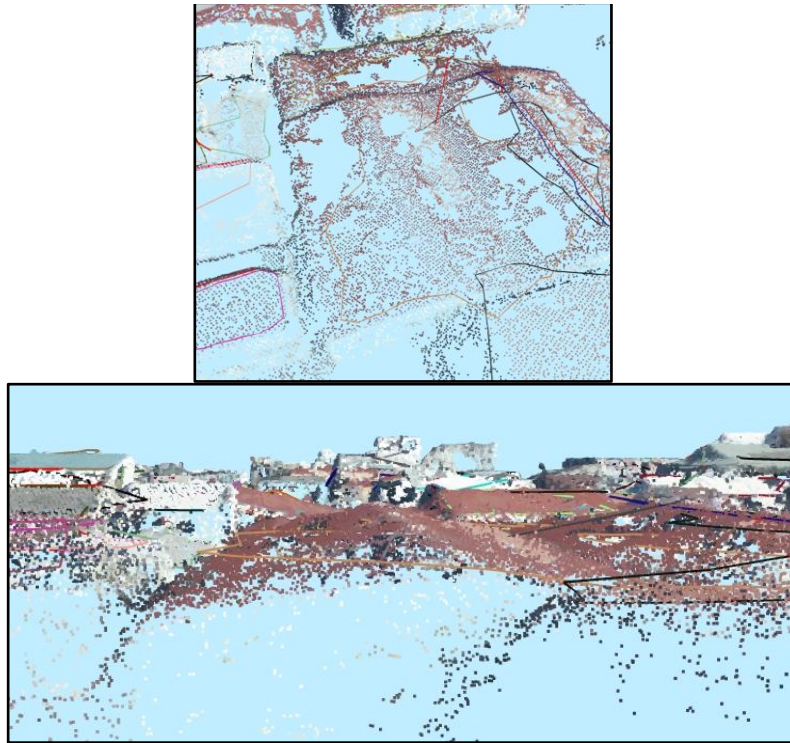
> ❗ *Note:* *A denser pointcloud is not always a better pointcloud. Shaper needs a minimum number of about 10 points per m² if these points are sufficiently well distributed. With a very dense matched point cloud, plane extraction is sometimes much more difficult than with a less dense LiDAR point cloud due to scatter points.*

Excessive points from terrain, vegetation or other "non-buildings" sometimes affect performance and should be removed before a project is created. In addition, these points can interfere with automatic plane detection and create superfluous or even incorrect planes.

During project creation, a classified point cloud can be analysed regarding its classes and unnecessary classes can be excluded.

> ❗ *Note: Know your data! The point cloud analysis shows the existing classes in the point cloud and an interpretation of the classes according to the ASPRS recommendation. However, the user must verify whether the classes are actually the recommended classes (6...buildings). Sometimes, if the classification is inadequate, the desired points can be found in several classes. In this case, all affected classes can be used.*
>
> *If no classes are specified, all points in the point cloud are used for layer extraction. However, this is only recommended if the points have already been reduced/thinned or similar beforehand.*

To enable productive work, a pointcloud must have at least intensity values, ideally RGB values. If neither is available, the pointcloud can be coloured via a corresponding orthophoto in .tiff or .jpg format during project creation.

Since navigating in the pointcloud alone sometimes causes difficulties, the additional usage of aerial images is recommended. The aerial images (oblique and/or Nadir) must have orientation values that are transferred in advance into a City**GRID**® XML format using an FME workspace and are processed during project creation.

1.4. Start Modul CityGRID® Shaper

The City**GRID**® Shaper is started via the Windows start menu entry.

1.5. Setting the language

Depending on which language is active, the menu item *Spracheinstellungen* or *Localisation* appears in the Help menu. Select the desired language of the user interface and restart the application.

1.6. Logging

In the event of an unforeseen programme action or a programme crash, it may be necessary to send the log file to UVM Systems GmbH. **Extended logging** can be activated via the menu item **Feedback**. Via the menu item **Send feedback**, the necessary log files are packed together and attached to an email in an installed email client to be sent by the user to the support. Extended logging takes more time and should therefore only be used after consultation with UVM Systems GmbH.

1.7. Cursor

A series of different mouse pointers illustrate possible user actions. Depending on the editing mode the user is in and the state of the geometry, the following mouse pointers are possible.

	Outline mode: allows you to select an alpha shape for which an outline can be created or whose outline can be edited.
	Alphashape mode: Adding a new alphashape by selecting a variable number of points. Outline mode: Create an outline using the drawing function after an alphashape has been selected
	Alphashape mode: Adding a vertex to a segment of a selected alpha shape. Outline mode: Adding a vertex to a segment of an outline polygon whose alphashape is selected.
	Alphashape mode: Closing an alphashape created via Ctrl and single point selection. Is displayed when at least three points have been selected and the mouse is positioned over the last selected point. Another click closes the polygon. Outline mode: Closes a new outline polygon. Is displayed when at least three points have been drawn and the mouse is positioned over the last point drawn.
	Alphashape mode: Moving one or more vertex/vertices. Outline mode: Moving one or more vertex/vertices. Overview mode: Moving the selection area.
	Alphashape mode: Individual selection of a polygon to be edited- Line mode: Individual selection of a line to be edited
	SmartPreview: The mouse is in a situation in which intersection line candidates have been used but not yet accepted. To generate further preview faces, the current situation must be accepted with a LMC.
	SmartPreview: The mouse is in an ambiguous situation. On the one hand there are intersection line candidates that have been used but not yet accepted, on the other hand the mouse is over a line (section or base) that can be edited. The default behaviour is that a situation must first be accepted with a LMC before lines can be edited. However, this behaviour can be changed with Shift and switched to editing the lines.

	Line mode: Dividing a baseline.
	SmartPreview: Dividing a baseline.
	Line mode: Moving a baseline over its centre point.
	SmartPreview: Moving a baseline above its centre point.
	Line mode: Extending or shortening an intersection line via its end point(s)
	SmartPreview: Extending or shortening an intersection line via its end point(s)
	Line mode: Is displayed when the mouse is positioned over the vertex of an intersection line that has already been changed by the user.
	SmartPreview: Is displayed when the mouse is positioned over the vertex of an intersection line that has already been changed by the user.
	Line mode: Is displayed when the mouse is positioned over the vertex of an intersection line that has not yet been changed by the user.
	SmartPreview: Is displayed when the mouse is positioned over the vertex of an intersection line that has not yet been changed by the user.
	Line mode: Is displayed when the mouse is positioned over the centre point of a baseline that has already been changed by the user with the LMB held down.
	SmartPreview: Is displayed when the mouse is positioned over the centre point of a baseline that has already been changed by the user with the LMB held down.
	Line mode: Is displayed when the mouse is positioned over the centre point of a baseline that has already been changed by the user with the LMB held down.
	SmartPreview: Wis displayed when the mouse is positioned over the centre point of a baseline that has already been changed by the user with the LMB pressed.
	Line mode: Is displayed when the mouse is positioned over the centre of a baseline with open bindings (hotkey 'B'). The baseline can be moved without moving connected segments.
	SmartPreview: Is displayed when the mouse is positioned over the centre of a baseline with open bindings (hotkey 'B'). The baseline can be moved without moving related segments.
	Base plane mode: The base plane is set through the lowest point of the selected alphashape.
	Base plane mode: The base plane is set to the height of a selected point.
	Base plane mode: If the base plane is visible (visibility function), the base plane can be moved up or down manually (LMB pressed)
	Displayed when snapping is activated (S) and the mouse is positioned over the vertices of a face that can be snapped to. (activated: Geometry class: Faces, Geometry element: Vertices)
	Is displayed when snapping is activated (S) and the mouse is positioned over the segments of a face that can be snapped to. (activated: Geometry class: Faces, Geometry element: Lines)
	Displayed when snapping is activated (S) and the mouse is positioned over the face of a face that can be snapped to. (activated: Geometry class: faces, Geometry element: face)
	Displayed when snapping is activated (S) and the mouse is positioned over the centre of a face that can be snapped to. (activated: Geometry class: faces, geometry element: centre point)
	Displayed when snapping is activated (S) and the mouse is positioned over the vertices of a line that can be snapped to. (activated: Geometry class: Line, Geometry element: Vertices)
	Displayed when snapping is activated (S) and the mouse is positioned over the line segment of a line that can be snapped to. (activated: Geometry class: Line, Geometry element: Line)
	Displayed when snapping is activated (S) and the mouse is positioned over the centre point of a line that can be snapped to. (activated: Geometry class: Line, Geometry element: centre point)

	Displayed when snapping is activated (S) and the mouse is positioned over the points of a point cloud that can be snapped to. (activated: Geometry class: Point cloud, Geometry element: Vertices)
	Is displayed if snapping is activated (S) and the geometry is restricted to a perpendicular snap. (activated: constraints: perpendicular)
	Displayed when snapping is activated (S) and the geometry is limited to a parallel snap. (activated: constraints: parallel)
	Displayed when snapping is activated (S) and the geometry is limited to the snap along a vector. (activated: constraints: Vector)
	Is displayed if snapping is activated (S) and the geometry is restricted to the snap to the Z value of a geometry. (activated: constraints: Z)
	Is displayed when "Delete/hide building" is activated, and the mouse is positioned over a closed building. A LMC deletes the building
	Is displayed if a) "Edit building in Modeler" is active and the mouse is positioned over a completed building.
	b) "Complete building part" is activated and the mouse is positioned over a building part that has not yet been completed
	c) "Select active building part" is activated and the mouse is positioned over a building part that has not yet been completed.
	Pan

1.8. Tips for easier editing

Larger areas (entire cities/municipalities) should be divided into smaller, manageable regions for project creation. On the one hand, this speeds up project creation and, on the other, facilitates subsequent processing.

For more complicated roofs, it is advisable to first obtain an overview of the situation. This initial overview is possible in the point cloud, but it is also strongly recommended to work with aerial images. With a quickly triggered SmartPreview, you can zoom in on a suitable aerial image to better assess the building. Once you have gained a better understanding of the basic roof shape in this way, you should discard the first SmartPreview **(Ctrl + Z)** and then start the actual editing. In the first step (before the SmartPreview is triggered again), the intersection lines in line mode should already be adjusted as precisely as possible to the shape of the roof.

 If required, missing alphashapes can be created and edited at this stage and their cutting lines can be adjusted in length. After the corresponding preparation, the actual Smart Preview should be triggered.

Tip:

The user interaction has priority over the SmartPreview. This means that a line set by the user is not overwritten/lengthened/shortened by the SmartPreview. In the case of complicated roofs or situations in which the SmartPreview does not deliver the desired result, the algorithm can be helped by setting the section lines as desired.

For more complicated roofs, you should work as small as possible and always use the **Finish building part** function if a closed roof can be created. With the area creation options of CityGRID (penetration resolution), the behaviour of building parts in relation to each other (including roof details) can be set during export.

If an intersection line is displayed but does not create any faces when the SmartPreview is triggered, it may be because the alphashapes involved overlap so much that the line is declared invalid. In this case, it can help to edit one or both alphashapes involved so that the overlaps are minimized.

2. The User Interface

After starting Shaper, an initially empty user interface appears. To be able to see the full scope of Shaper, either an existing project must be loaded (via menu **File > Open**) or a new shaper project must be created (menu **File > New**, see 2.1.1.1).

Menu CGShaper

Here you will find general functions

2D Window

Aerial photos with line representation of the active building as a modelling aid

Toolbar

Switching the workspace, switching the editing modes, controlling the visibilities

Main window

Main tools depending on the set workspace and editing mode

Logwindow

Process monitoring

Status bar

If necessary, instructions to the user are given here.

3D-Window

Display of the pointcloud and the derived geometries (lines, alphashapes and surfaces).

The main window contains the central control mechanisms for the following tasks:

- Setting the data source and potentially recalculating pre-calculated data
- Parameters that change depending on the mode set
- Building creation

2.1. Menu

2.1.1. File

2.1.1.1. New

Expects the specification of a project folder in which all data created subsequently will be saved. After specifying the project folder, the "Create Shaper Data" dialogue opens, which guides you through the creation of the project. (Chapter 3.1)

2.1.1.2. Open

Opens an already created shaper project.

2.1.1.3. Recently opened projects.

Shows a list of recently opened projects.

2.1.1.4. Export

Exports all completed buildings of a project to a City**GRID**® XML file whose location must be specified. Any external data (such as building footprints and DTMs) are also saved in this file.
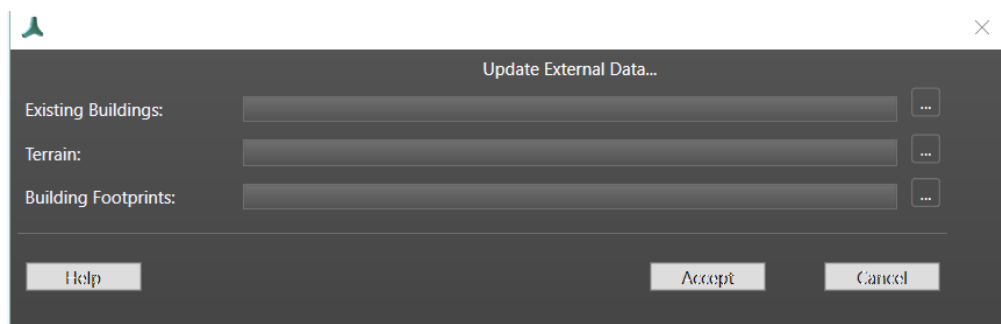
#### 2.1.1.5. Exit

Exits Shaper.

2.1.2. Edit

2.1.2.1. Optional Data

Opens the dialogue for updating or adding external data (already when creating the shaper project, external data can be added to the project, building footprints, terrain and/or existing city models).

2.1.2.2. Search

Enables the search for a shaper building, a building from an integrated existing city model or for an integrated building footprint. A string is expected as the search term.
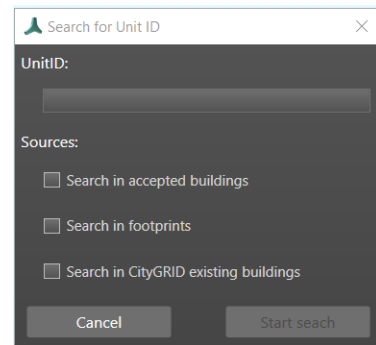
2.1.2.3. Create Building Attributes

If this option is set, an attribute dialogue is opened

when finishing/saving a building, which allows several predefined attributes. These are saved as City**GRID**® unit attributes in the adopted building. This option is inactive, only available if only optional attributes have been defined. If a mandatory attribute has been defined, the dialogue cannot be suppressed.

2.1.2.4. Edit Attribute Definition

In this dialogue, either attribute definitions that were prepared during project creation can be edited, or new ones can be created.

> *Note:* If buildings have already been saved with an existing attribute definition, a new definition does not change the existing attributes. Even if buildings have been saved without attributes, creating an attribute definition in the editing process will not add attributes to already saved buildings. The attributes created or changed only apply to those buildings that are saved AFTER the definition.

Attribute name	Attribute type	Optional	Details
Attribute1	String	☐	
Attribute2	Integer	☐	[10,20]
Attribute3	Double	☐	[1.000,10.000]
Attribute4	Dropdown	☐	{BuildingType1,BuildingType2,BuildingType3}
Attribute5	Date	☐	dd.mm.yyyy
	String	☐	

Use attribute definition from project: [   ] [...]

Cancel   Ok

2.1.2.5. Image Orientation Tool

This option is used to start the image orientation tool from Shaper. For details on how it works, see the Image Orientation Tool manual.

2.1.2.6. Edit Hotkey Settings

A dialogue opens in which the default settings for hotkeys can be changed and reassigned. Hotkeys are preset for a number of actions of the City**GRID**® Shaper. However, these can be changed via the menu `Edit > Edit hotkey settings`. Here the existing hotkeys can be displayed sorted by groups. When selecting a command in the hotkey list, the existing hotkey is displayed. Press `Assign` and press a new hotkey combination (*Alt*

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cannot be used because *Alt* is already reserved for menu entries). If a key combination is assigned more than once, a warning appears in the lower window, but it is still permissible. A key combination can be removed via the **Remove** button. **Reset** resets to the default settings. **Save** saves the defined hotkeys.
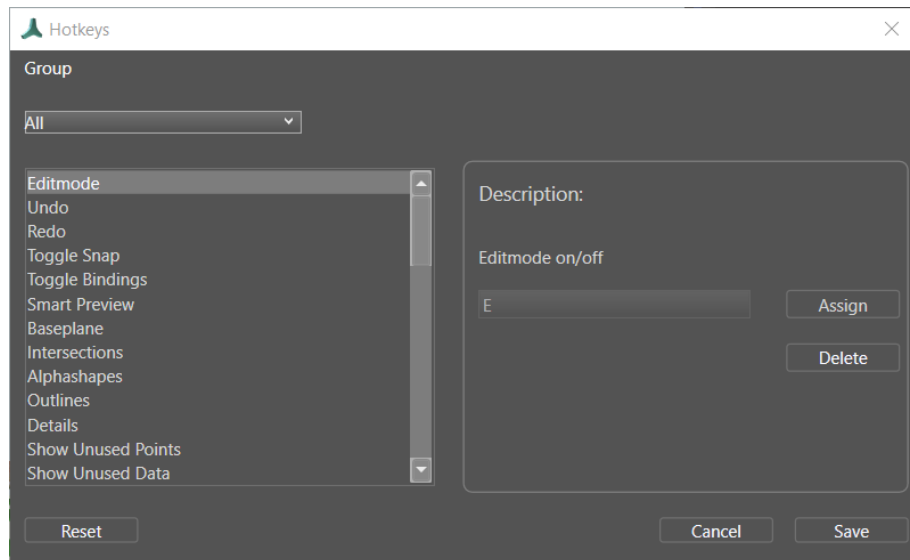
2.1.2.7. Colour options

In the colour options dialogue, the default colours for geometries and elements of the user interface can be changed.
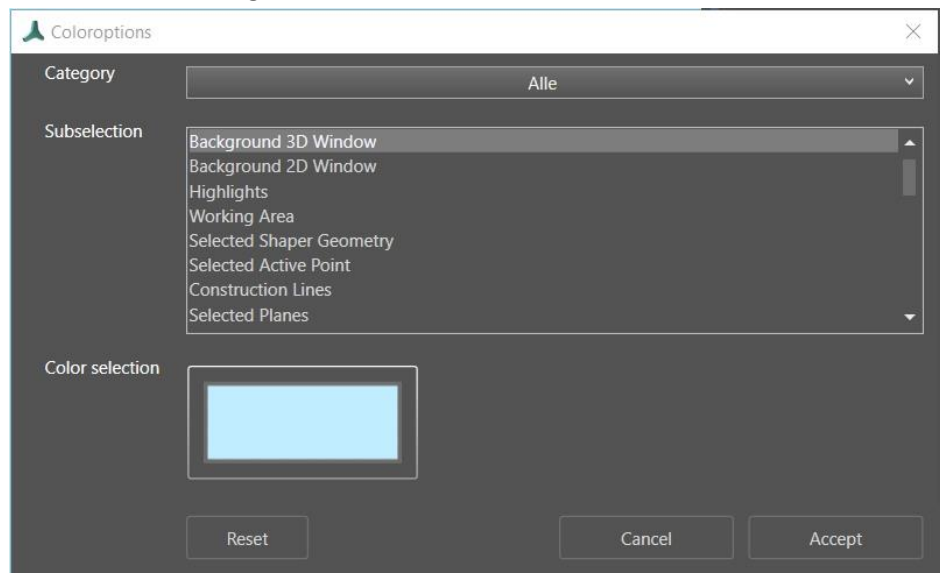
2.1.3. View

2.1.3.1. Save viewpoint

Saves the current view of the 3D window (default hotkey **Ctrl + F12**)

2.1.3.2. Switch to saved viewpoint

Switches to the last saved view of the 3D window (default hotkey **F12**)

2.1.3.3. Scout 3D

The 3D window can be switched on/off.

2.1.3.4. Texture 2D

The 2D window can be switched on/off.

2.1.3.5. Logging

The Logging window can be switched on/off.

2.1.3.6. Main Toolbox

The Main toolbox can be switched on/off.

2.1.4. Feedback

2.1.4.1. Extended Logging

When troubleshooting, this option can be activated.

2.1.4.2. Send Feedback

The error description (protocol and additional data) is zipped and added as an attachment in the installed email programme in an empty email.

2.1.5. Help

2.1.5.1. Manual

Opens the Manual of City**GRID**® Shaper.

2.1.5.2. About CityGRID® Shaper

Shows version information for City**GRID**® Shaper.

2.1.5.3. Localisation

Allows you to change the language settings, options are German, English, Turkish.

2.2. The Toolbar

2.2.1. General functionalities

2.2.1.1. Switching Workspace

(Default Hotkey E)

This button can be used to switch from selection mode to the general editing mode and back. Beforehand, an area must be selected with the size-adjustable selection cube.

2.2.1.2. Undo

(Default Hotkey Ctrl +Z)

Undoes the last editing action. Right-clicking opens the context menu and allows you to undo several editing actions.

2.2.1.3. Redo

(Default Hotkey Ctrl +Y)

Restores the last editing action. Right-clicking opens the context menu and allows you to restore several editing actions.

2.2.1.4. Snapping

(Default Hotkey S)

Snapping is activated with a left mouse click (or with a hotkey). However, snapping only works if the options are set in the context menu.

A right mouse click opens the context menu of this button, in which various snapping options can be set.

- Geometry class:

  Which geometry class do I want to snap to? (Multiple selection possible):
  - Pointcloud
  - Faces
  - Lines.

- Geometry elements:

  Which elements within the selected geometry class(es) do I want to snap to? (Multiple selection possible)
  - Vertex (in geometry classes pointclouds, faces or lines),
  - Edges (in geometry classes faces or lines),
  - Faces (in in geometry classes faces),
  - Centrepoint (in geometry classes lines or faces).

- Constraints:

  Here the geometries can be constrained (multiple selection possible).
  - Perpendicular: Allows Snap only to geometries at perpendicular angles.
  - Parallel: Allows snap only to geometries parallel from the initial geometry.

- Vector: Allows snap only along the direction vector of a line or of the incoming or outgoing segment of a polygon.

2.2.1.5. Bindings

(Default Hotkey B)

Bindings are activated by default. The baselines of a roof are connected to each other. If it becomes necessary to move baselines independently in the plane (e.g. in the case of cripple hipped roofs), it is important to remove the bindings beforehand.

Note: Do not forget to reactivate the bindings when the action for which the unbinding was necessary has been completed.

2.2.2. Editing functionalities

Changing the editing mode also changes the available functions in the main toolbox. Detailed description of the editing functions in chapter 2.3.3**.**

2.2.2.1. Smart Preview

(Default Hotkey *F1*)

The Smart Preview is the start mode for creating and editing a building. Buildings can be created here by placing the user's mouse over a red intersection line candidate, waiting until it turns blue, and accepting the preview with a click. With the general editing functions (**chapter 2.3.2) building parts can be closed** (the preview is fixed) and **reactivated**. Entire **buildings can be saved**, **edited in the Modeler,** or **deleted**.

2.2.2.2. Alphashape Editing Mode

(Default Hotkey F2)

For more complex buildings, it may sometimes be necessary to edit the alphashapes to obtain more accurate intersection line results.

To edit an alphashape it is necessary to select an alphashape, which is then highlighted in both the 3D window and the 2D window. In both windows the vertices of the alphashape can be edited (moved, deleted, added). In the 3D window you can deactivate an Alphashape by clicking on a segment, it changes colour and is displayed in light grey. The intersection lines in which the alphashape is involved disappear in this state. The alphashape can be reactivated with another click.

Note: Only one alphashape can be selected and edited at a time. To end the selection and choose another alphashape, press Esc.

2.2.2.3. Line Editing Mode

(Default Hotkey F3)

In line editing mode, intersection lines and baselines can be edited individually. A line must always be selected first. A selected line is highlighted in yellow, depending on its type (intersection line or baseline) different editing options are available.

2.2.2.4. Outline Editing Mode

(Default Hotkey F4)

The outlines of planes can be edited in some cases, in other cases (flat roofs) they must be created.

When intersection lines are accepted in the Smart Preview, outlines are subsequently created automatically - in addition to the alphashapes involved. Sometimes it may be necessary to edit these outlines, for example if the intersection line is shorter than the eaves to be created. Since the baselines automatically adjust to the length of the intersection line, they cannot be extended independently.

Note: Before editing an outline, all actions that affect the lines (extend, move) should be finished. An edited outline is weighted higher than the edited lines, therefore editing the lines afterwards can lead to undesired results.

2.2.2.5. Baseplane Editing Mode

(Default Hotkey F5)

This mode is only active if the checkbox `Set base plane automatically` is deactivated in Smart Preview mode. The base plane is used to delimit the building planes, the baselines are the result of the intersections between building and base planes. If the automatically set base plane leads to undesired results for the base lines, it can be set manually in the base plane edit mode.

A left mouse click sets the base plane through the lowest point of the selected alpha shape.

If *Ctrl* is additionally hold down, a point of the pointcloud can be selected through which the base plane is set.

2.2.2.6. Detail Editing Mode

Not yet implemented. (Default Hotkey F6)

2.2.2.7. Roof protrusion mode

Not yet implemented. (Default Hotkey F7)

2.2.3. Visibility functionalities

2.2.3.1. Show assigned points
(Default Hotkey Ctrl +9)

Points assigned to a plane can be shown and hidden.

2.2.3.2. Show assigned points (colour)
(Default Hotkey Shift +9)

Points that have been assigned to a plane and coloured depending on the plane can be shown and hidden.

2.2.3.3. Show Faces
(Default Hotkey 1)

The faces of the Smart Preview can be shown or hidden.

2.2.3.4. Show Alphashapes
(Default Hotkey 2)

Alphashapes can be shown or hidden.

2.2.3.5. Show intersection lines
(Default Hotkey 3)

Intersection lines can be shown or hidden.

2.2.3.6. Show accepted Buildings
(Default Hotkey 4)

Accepted buildings can be shown or hidden.

2.2.3.7. Show base plane
(Default Hotkey 5)

This button becomes active if the option `Set base plane automatically` in Smart Preview mode is not set. This allows you to control the visibility of the base plane.

2.2.3.8. Show unused points
(Default Hotkey 9)

The points that are not assigned to an alphashape can be shown or hidden.

2.2.3.9. Show unused data (alphashapes and lines)
(Default Hotkey 0)

Disabled alphashapes or lines in the selection area can be shown or hidden.

2.2.3.10. Show Existing Buildings
(Default Hotkey 6)

An existing city model in the selection area can be shown or hidden.

2.2.3.11. Show footprints

(Default Hotkey 7)

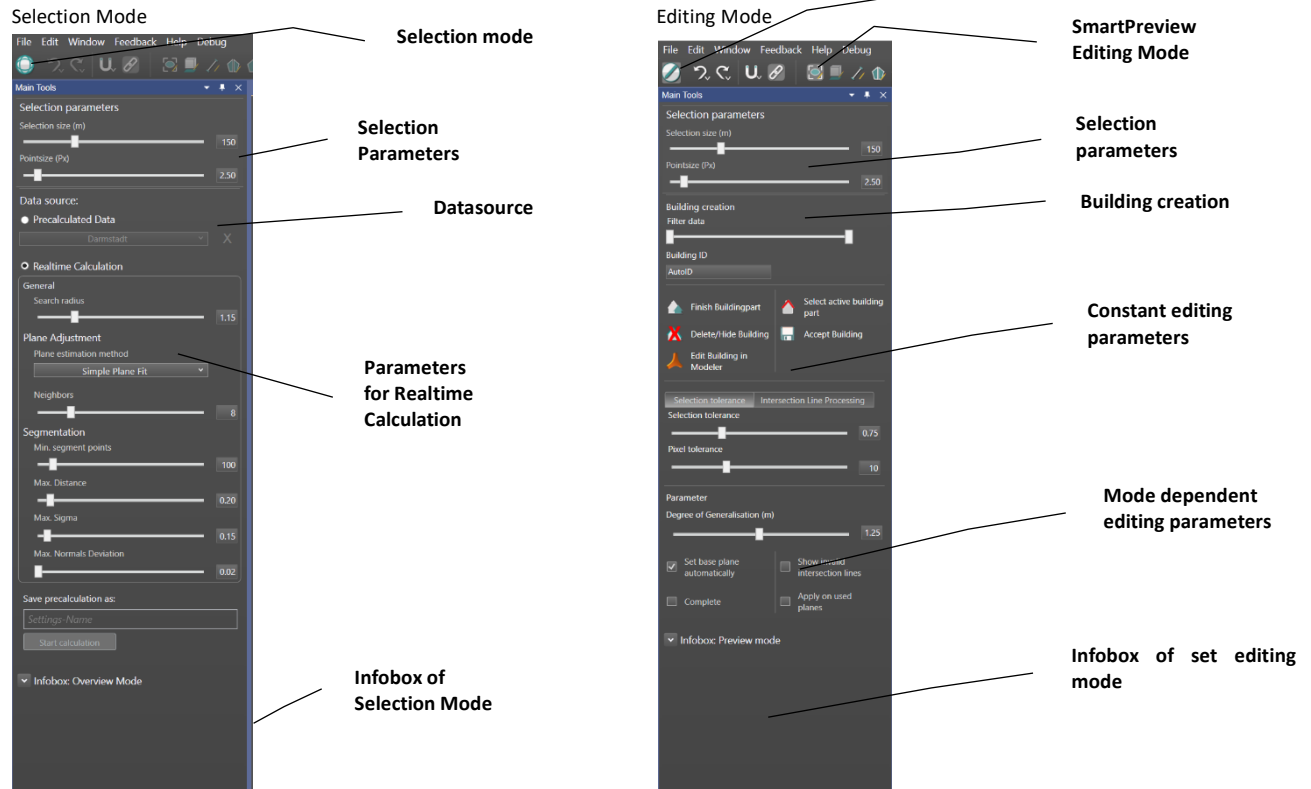The building footprints of the selection area can be shown or hidden.

2.2.3.12. Show DTM

(Default Hotkey 8)

A DTM can be shown or hidden in the selection area.

2.3. The main toolbox

The main toolbox changes its appearance depending on the selected mode.

Selection Mode — Selection mode

Selection Parameters

Datasource

Parameters for Realtime Calculation

Infobox of Selection Mode

Editing Mode — Editing Mode

SmartPreview Editing Mode

Selection parameters

Building creation

Constant editing parameters

Mode dependent editing parameters

Infobox of set editing mode

2.3.1. Selection mode

Immediately after creating the Shaper project, or each time the Shaper is restarted, the project is in selection mode. This means that all buttons except for the "Change workspace" button in the toolbar are deactivated, the entire precalculated pointcloud is displayed in the 3D window, and no images are displayed in the 2D window. In the 3D window the yellow highlighted selection cube can be dragged over the pointcloud with the left mouse button to define a new selection area. The selectable pointcloud is highlighted green.

In the main toolbox, the selection parameters can be used to change this selection area.

- Selection Size:
  controls the size of the selection range.
  For pre-calculated data the maximum is 150 m, for real-time calculation the maximum is 500 m.

- Point Size:
  controls the display of the point size of the pointcloud.
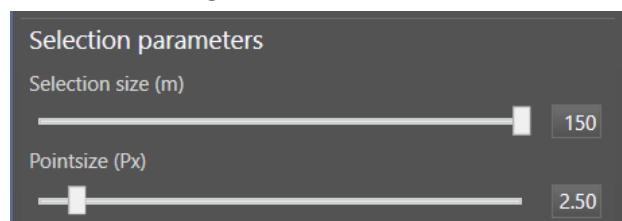
Data source:

The Data source section determines whether the pre-calculated data is to be used or if the project calculated with the default settings does not meet the individual requirements.
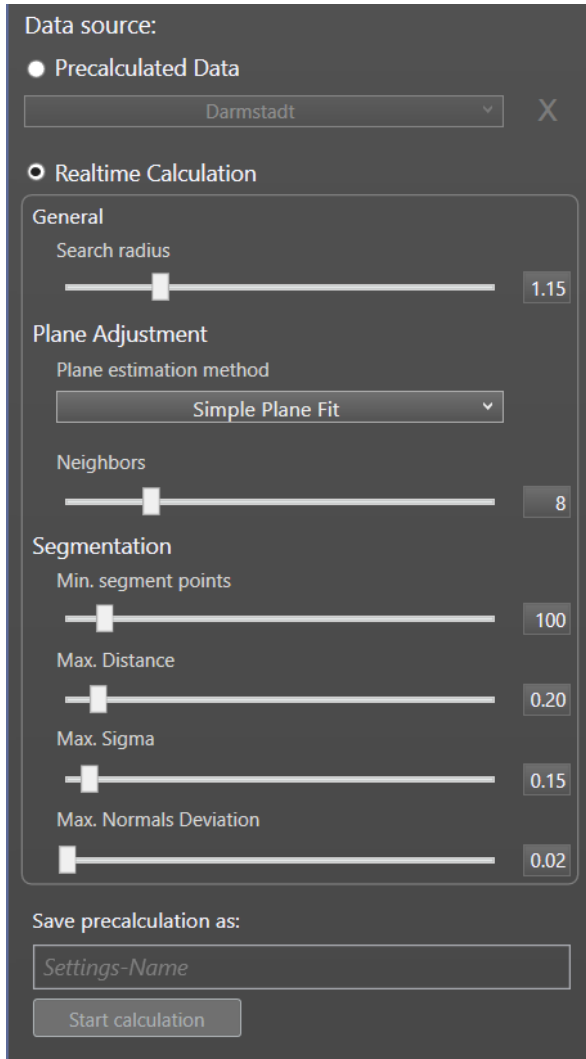
If the project calculated with the default settings does not meet the individual requirements, partial areas or the entire project can be recalculated with the real-time calculation and by changing the respective parameters. Pre-calculated datasets can be deleted with the button X

Parameter for real time calculation:

- General
  - ❖ Search radius
    Controls the size of the search radius within which points are selected for segmentation. It also controls the accuracy of the alphashapes. If alphashapes frequently "break up" (i.e. several polygons within an alphashape where there should actually only be one), it is recommended to reduce the radius.

In general, sufficient quality of the input data must be ensured. Nevertheless, there are possibilities to address different problems in the specific data set.

- **Plane Fitting**
  - ❖ Method for plane estimation (selection): depending on the choice of plane estimation, the number of neighbours must be increased.
    - ❖ Simple plane fit
      Recommended for clean, clear (LiDAR) pointclouds. It is the fastest, simplest plane adjustment without discarding outliers (stray points), 8 neighbours are sufficient (default value).
    - ❖ robust plane fit
      Recommended for well-matched pointclouds or rougher LiDAR pointclouds. It is an iterative adjustment in which the points with the largest deviation are successively removed from the point selection. Due to the iterative nature of the adjustment, robust plane adjustment is somewhat more time-consuming than simple plane adjustment. The number of neighbours must be increased for this method. This method only works if there are not too many gross errors. In addition, there must be correct points around the gross errors, otherwise the errors will not be recognised as such. In general, there should not be more than 20% of wrong points in the pointcloud to use this method.

❖ Minimum Covariance Determinant

Recommended for imprecisely matched pointclouds with many outliers. The robust plane fit with minimum covariance determinant generally allows for more errors (not unlimited!) than the robust level matching. The number of neighbours must be further increased for this.

Note: too many neighbours can "smear" the surface normals at the edges, which can again lead to difficulties in alphashape creation. With difficult data, it is recommended to work with a sample to make it easier to work out the ideal values for the entire data set.

❖ Neighbours (Slider): Number of neighbour (points) to be used for the plane estimation. Depending on the choice of plane estimation, the number of neighbours must be increased.

- **Segmentation**:
  ❖ Min. segment points
  ❖ Controls the minimum number of points needed to form an alphashape. The lower the number of points, the more alphashapes are formed. By default, at least 100 points are necessary for an alphashape. If no alphashapes are found for smaller planes, but they would be necessary for sensible modelling, it is helpful to set a lower value here.
  ❖ Max. distance (Slider)
  Defines the maximum distance a point may lie from a plane in order to be assigned to this plane. An increase in this value is recommended especially for unstable data, as it increases the tolerance for the formation of planes. If, for example, a plane is found from points lying close together where there should actually be two planes, it is helpful to reduce the maximum distance so that the distance between the points is higher than the value of Max. Distance.
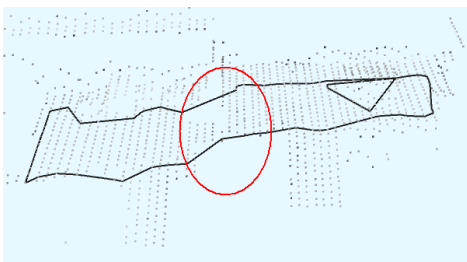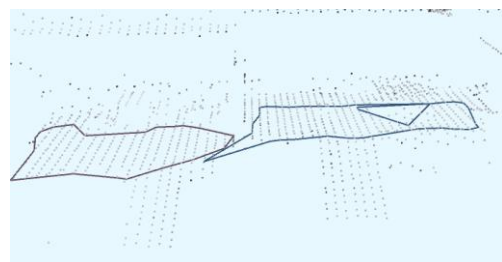
Max. Distance = 0.20m	Max. Distance =0.10m

  ❖ Max. Sigma (Slider)
  Sets the maximum normal accuracy used. If points have a maximum Sigma, that is higher than the setting of this value, they are not used for segmentation. Recommended is a value close to or lower than the set Max. Distance. Assuming the Max. Distance is set very high (tolerant), and Max. Sigma is quite low (strict), points that would still be used for segmentation due to their distance will still be removed due to the strict Max. Sigma value. Thus, too few planes may be found again.
  ❖ Max. Normal deviation.

Defines how much the normal of a point may deviate in order to be used as a seed point. A seed point is the point from which the plane found is extended further and further by adding points that fit into the plane.

The default value of 0.02 m is sufficient for most data situations, but if the quality of the pointcloud is rather insufficient and no planes are found, it can help to increase this value to also allow "worse" points.

Save pre-calculation:

Allows you to enter a name for the set parameter set with which the data will be recalculated. This name is added under *Pre-calculated data* after the calculation and can be selected before switching to edit mode.

Start calculation.

Calculates the alphashapes with the new settings for the entire data set, which may take some time.

> *Note: If parameters are changed without recalculating, these new settings only affect the data of the selection area when switching to edit mode.*

2.3.2. General editing functionalities

When switching from selection mode to editing mode, the settings in the main toolbox change. Some of them remain the same across all special editing modes (general editing functions), some change depending on the mode set.
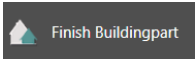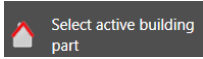
2.3.2.1. Selection parameters

❖ Selection size: In edit mode, the selection size controls the range of points displayed.
❖ Point size: Controls the point size of the pointcloud.

2.3.2.2. Building creation:

❖ Data filter: Filters the visible alphashapes according to size. The left slider filters small alphashapes (with a low number of points), the right slider filters large alphashapes (with a high number of points).

2.3.2.3. General Editing Functionalities:

❖ `Finish Buildingpart` (Button) takes over the generated faces and lines of a building part and fixes the faces of the Smart Preview.

❖ `Select Active Buildingpart` (Button) Allows the re-editing of a building section that has already been completed.
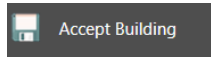
❖   [Accept Building]   `Accept Building` (Button Accepts a building (which can consist of several building parts) and writes it to a City**GRID**® xml file. An accepted building can no longer be edited in Shaper.

If Attributes (see *Menu > Create Building Attributes*, 2.1.2.3) is activated, an attribute dialogue is opened in which the corresponding values for the building can be entered. By pressing the *Confirm* button, the building is written into the XML file. This process cannot be undone.
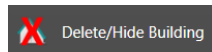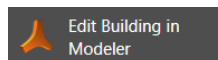

❖   [Delete/Hide Building]   `Delete Building` (Button) Deletes an accepted building. This process cannot be undone.

❖   [Edit Building in Modeler]   With `Edit Building in Modeler` an accepted building can be loaded and edited in the Modeler, provided the Modeler has already been started and placed in waiting position. **See Modeler Manual, Chapter 3.6.3**. Editing buildings in Shaper is blocked until the editing is saved and finished in Modeler, Modeler is brought back to the waiting position and the open dialogue in the shaper is closed with *Stop editing*. The edited building(s) is/are subsequently updated in Shaper **.**

Note: It is no longer possible to edit these buildings again in Shaper.

2.3.2.4. Parameter

▪ Selection tolerance

     ❖ Selection tolerance (m)
       The selection tolerance affects all operations that work with pointcloud points in the 3D area. It is the radius around the mouse position in which, for example, intersection lines are accepted in the Smart Preview (as a result of planes in pointclouds). The larger this value is, the larger is the area around the mouse position in which the points necessary for creating alphashapes are selected.

❖ Pixel tolerance (px)

The pixel tolerance works accordingly to the selection tolerance on line- and alphashape segments as well as vertices. Only those segments/vertices can be selected that are within this radius around the mouse position.

▪ Intersection lines processing

❖ Buffer width (m)

Specifies the maximum width of the strip around the intersection line between two alphashapes to be offered as a valid intersection line candidate. The value influences the number of intersection line candidates found, the higher the value, the more valid intersection line candidates are found.

❖ Overlaps (%)

Intersection lines of overlapping alphashapes are displayed depending on the set degree of overlap. Such overlaps of two alphashapes occur more frequently the flatter the intersection angle between the two planes involved. So, if the value for the allowed degree of overlap is set higher, the intersection lines of flatter intersecting alphashapes are suggested as candidates. The lower the value, the less intersection lines of flat intersecting alphashapes are suggested as candidates.
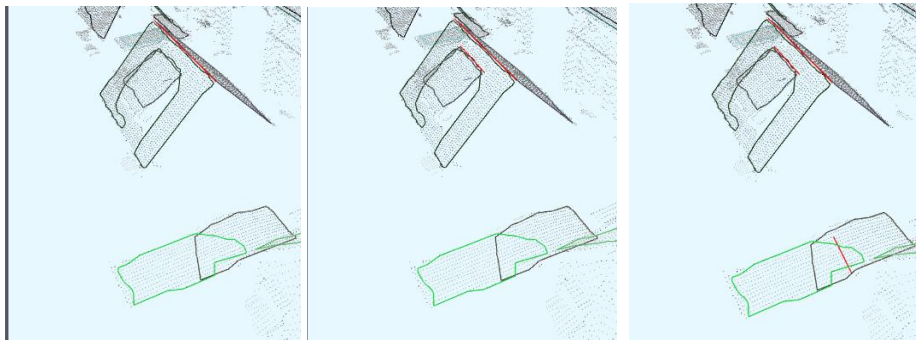
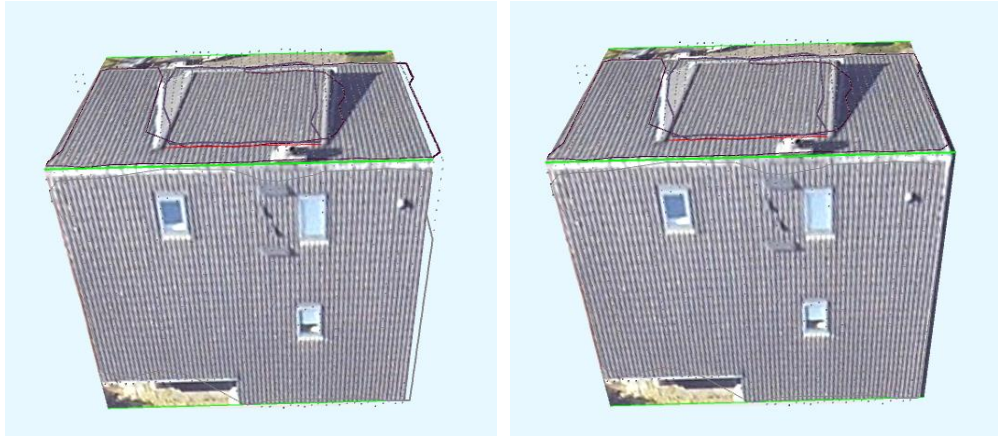overlaps: 0.05   overlaps: 0.15   overlaps: 0.55

❖ Extend:

Intersection lines are generally as long as the common edge of two alphashapes. If one alphashape is larger than the other, this has no effect on the intersection line. If the Extend option is set, the actual length of the intersection line is ignored and set to the maximum length of the larger alphashape.
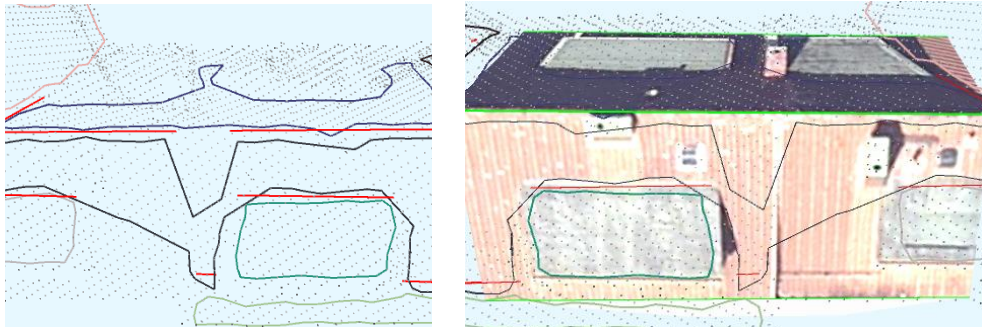
Default: off

❖ Merge Intersection Lines

If intersection lines between two alphashapes are interrupted by a recess in the alphashape, they can be merged after accepting one of the intersection line segments if this option is set.

Default: off

2.3.3. Special editing functionalities

2.3.3.1. Smart Preview Mode

When the workspace is changed from selection mode to editing mode, the Smart Preview mode is set as the start function. You can switch between the editing modes using the hotkey or toolbar.

If the mouse is over an intersection line (red), a preview of the face generation is displayed in Smart Preview mode when this intersection line (now blue) is accepted with a **left mouse click**. (Green)

With a **click of the right mouse button**, accepted lines can be returned to the candidate status. If the mouse is then removed from the line, the face generation of the preview is also reset.

By changing the settings that appear in the main toolbox when this mode is activated, the result of this preview can be changed/improved.

Lines (intersection lines and baselines) can also be edited in the Smart Preview, but for advanced line editing functions it is necessary to switch to line editing mode.

- Degree of generalisation: A higher degree of generalisation increases the probability of closing smaller gaps in the Smart Preview, intersection lines are extrapolated.
- Caps Lock active: As long as the Caps Lock button is active, no new preview is triggered. Lines can be edited in the active preview without adding new areas.
- Extend: **Intersection lines** can be extended by moving the end points with the mouse. When intersection lines are extended, the associated baselines are automatically extended.
- Show disregarded **intersection lines**: *Shift + Ctrl* can be used to display invalid intersection lines and invalid segments of valid intersection lines that were discarded during pre-processing because they did not meet one or more criteria for a valid intersection line candidate. With an *LMC*, these intersection lines can be transferred to candidate status and thus used for Smart Preview.
- Click through lines: If **intersection lines** are so close to each other that their vertices lie on top of each other and cannot be selected individually, you can click through the segments of the accepted (green) lines with a hotkey (default **<)** to edit a line other than the top line and its vertices.
- Move: **Baselines** can be moved in the plane by moving the centre point up or down with the mouse.
- Split Line: **Baselines** can be split by holding down *Ctrl* and clicking on the line at the desired position.
- Expand and reduce the preview areas: *LeftShift* and mouse*wheel Scroll* can be used to expand and reduce the preview.
- Extending and reducing the selection tolerance: The selection tolerance - the radius around the cursor in which the candidate lines are used for the SmartPreview - can be extended and reduced with *RightShift* and *Mouse wheel scroll*.

**Parameter:**

❖ Set base plane automatically.
   If this option is not set, the base plane editing mode is available. In this mode, the height of the base plane can be set manually. If it is set, the height of the base plane is calculated automatically from the data.
   Default: on

❖ AutoComplete
   With this option set, all intersection lines that are recognised by adjacent planes as belonging to a complex are transferred to the preview and can be accepted at the same time with a mouse click. With *shift* and *mouse wheel* candidates can be removed from

the preview and added again. This function is recommended especially for simpler buildings, as it allows faster modelling. Default: off
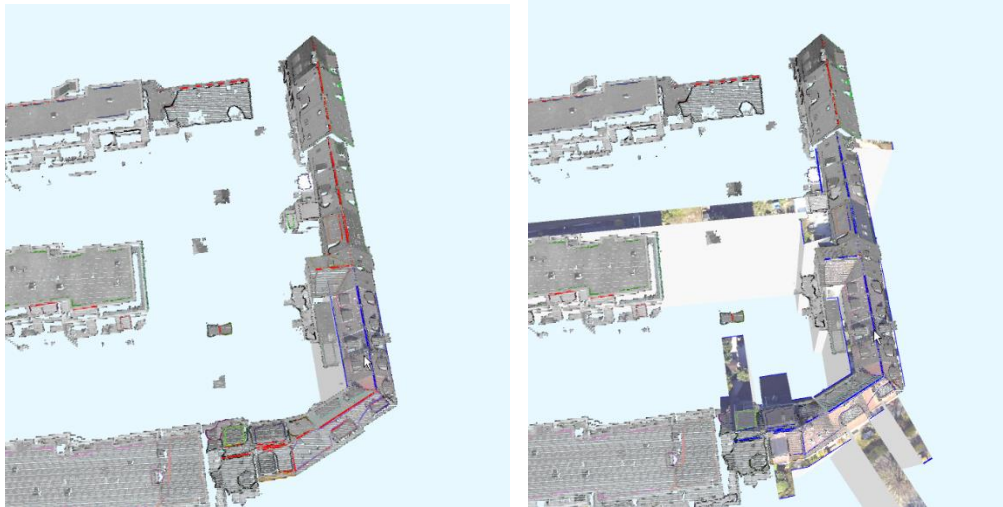
❖ Show only invalid intersection lines (checkbox).
If intersection lines not considered are to be displayed with *Shift+Ctrl,* this option can be used to filter the result. If NOT set, completely invalid intersection lines are displayed as well as the invalid segments of otherwise valid intersection lines. With this option, the invalid segments are suppressed and only the completely invalid intersection lines are displayed.

❖ Apply to used planes only (checkbox).
Another filter option for showing intersection lines that have not been considered. If this option is set, *Shift and Ctrl* will only find candidates with planes that are already used in the Smart Preview.

2.3.3.2. Baseplane Editing Mode

This mode is only active if the checkbox *Set base plane automatically* is deactivated in Smart Preview mode. The base plane is used to delimit the roof planes, the baselines are the result of the intersections between roof and base planes. If the automatically set base plane leads to undesired results for the base lines, it can be set manually in the base plane edit mode.
With a left mouse click the base plane is set by the lowest point of the selected alpha shape.
If *Ctrl* is additionally held down, a point of the pointcloud can be selected through which the base plane is set.

2.3.3.3. Intersection Line Editing Mode

Lines can be edited in line editing mode as follows.

* Lengthen/shorten: LMC to the end points of a selected **intersection line**.
* Move: LMC to the centre of a selected **baseline**.
* Hold down Ctrl and LMC to the selected **baseline**.

- Deactivate a selected **intersection line** ('T').
- (Re-)activate selected **intersection line** ('T')

2.3.3.4. Alphashape-Editing Mode

In some cases, alphashapes are too large or too small. The following functions can be used to change the extension of an alphashape.

Edit:

- *LMC* selects an alphashape.
- *Hotkey (Default 'T')* activates/deactivates selected alphashape.
- *LMC* on alphashape segment adds new vertex.
- *LMC* on alphashape vertex moves vertices.
- *Hover over Alphashape vertex + Del* deletes this vertex.
- *Hold down LMC and draw a rectangle* allows multiple selection of vertices.

Sometimes alphashapes are not found even for smaller planes (depending on the creation parameters). In these cases, they must be created manually. There are several possibilities for this in the alphashape mode:

Add:

- Hold *Ctrl* and select one point after another with *LMC* to define a plane. With a *LMC* on the first point the polygon will be closed, and the plane created. At least three points are necessary.
- Hold *Shift + LMC* selects a number of points. This selection can be extended or reduced dynamically with a mouse wheel scroll. With an *LMC* the selection is accepted and the alphashape is created.
- Hold *Shift + Ctrl* selects a number of points in a forced normal plane (horizontal). This selection can be dynamically expanded or reduced with a mouse wheel scroll. With an *LMC* the selection is accepted and the alphashape is created.
- Hold *Shift + Click of the mouse wheel*! several points are selected but not completed. More clusters of points can be added to the selection with the same key combination held down. Only an *LMC* finishes the selection and creates the plane.

For slightly bent roofs and other situations it is advantageous to split or merge an alphashape. When splitting an alphashape, the originally assigned points are reordered and assigned to the two new alphashapes. An intersection line is created between the two new alphashapes, making it easier to model slight bends. When an alphashape is selected, the following functions are available:

- *Horizontal division (draw a horizontal dividing line with two clicks)*
  allows you to create a horizontal dividing line through the selected alphashape with two mouse clicks.
- *Vertical division draw a vertical dividing line with two clicks)*
  allows you to create a vertical dividing line through the selected alphashape with two mouse clicks.
- *User defined division (draw a user defined dividing line)*
  allows you to create a user-defined dividing line through the selected alphashape with two mouse clicks.
- *Merge* allows you to merge the selected alphashape with another alphashape.

❖ **Parameter:**
  ❖ *Application radius* (Slider)
    Within this radius, pointcloud points are searched for during the alpha shape creation. The larger the radius around the mouse position, the more points are added to the selection.

2.3.3.5. Outline Editing Mode

To make an outline visible and thus editable, the alpha shape concerned must first be selected in outline mode. Only then will the created footprint be displayed.

Edit

In the 2D window as well as in the 3D window, vertices can then be added to the outline, moved and in most cases also deleted. Vertices at the intersection line cannot be moved or deleted.

- Press *Esc* to end the active selection.
- *LMC on* an alphashape its outline is also selected.
- De- and (re-)activating a selected alphashape in alphashape mode also de- or (re-)activates its outline.
- *Hover over* on outline vertex and press *Del* deletes this vertex.
- *LMC* on vertex allows moving.

Add:

- Select alphashape, which specifies the plane of the future roof. Draw the desired outline in the 2D window. An outline is automatically created in perpendicular mode after the second click. To suppress this, you must also press *Shift*. The last click must be on the first point to complete the polygon.

  > *Tip: The last corner of a roof does not have to be drawn with the perpendicular mode active, if the first three points have been digitised, the last click can be made on the first point, the polygon is automatically closed, and the last roof corner is automatically created.*

  > *Tip: An outline can also be created in the 3D window, but it can be drawn with more control in the 2D window.*

  > *Tip: If the main roof is not visible due to a parapet or other roof structures, the creation mode can be selected (In the main plane, In the drawing plane). If in the main plane is selected and the height is set to the height of the parapet using the Set drawing plane button, the outline can be drawn on the parapet in the 2d window, but the outline is created on the plane of the alpha shape.*

  If building footprints have been included in the calculation for a project (chapter...), these can be used for an easier flat roof creation. The prerequisite is a suitable quality of the footprints. Select the alphashape concerned to define the plane (height and inclination) of the future roof. Activate the button `Use footprint` and select the footprint that is to be lifted into the plane of the selected alphashape. The new outline is created 2D identical to the building footprint in the plane of the alphashape. The outline can still be edited in these cases as well.

- Parapets:
  A flat roof can also be created immediately with a parapet. To do this, select the creation mode (`main plane with parapet`), select a point at the top edge of the parapet for the height of the drawing plane, set the width of the parapet (note that this cannot be changed afterwards) and draw the outline in the 2D window on the outer edge of the parapet. After closing the outline, the main roof is at the height of the selected alpha shape, the parapet is at the height of the set drawing plane.

Parameters:

- Creation Mode (Dropdown)
  - ❖ In the drawing plane: The outline is created in the set drawing plane, at 0 the drawing plane corresponds to the main plane.

- ❖ In the main plane: The outline is created in the main plane (of the selected alphashape).
- ❖ In the main plane with parapet: The outline is created in the main plane, the parapet in the set height of the drawing plane.
- Height drawing plane (slider) relative height, 0 is the main plane.
- Parapet thickness (slider) must be set before creating a parapet. After that, the width can no longer be changed.
- LoD of the parapet (Dropdown)
  - ❖ 1
  - ❖ 2 Is treated as part of the main roof in City**GRID**® xml.
  - ❖ 3 is treated as a detail element complex in City**GRID**® xml.
- Set drawing plane (button) If this button is activated, a point of the pointcloud can be selected at the desired height. The height of the drawing plane is set to the height of the point.
- Select footprint (button). If this button is activated, a building footprint can be selected, which is subsequently raised to the height of the main plane and accepted as an outline.

2.4. The 3D Window

In the 3D window the calculated pointclouds and the derived data (depending on the visibility settings) are displayed. The alphashapes, the intersection and base lines, as well as the surfaces can be displayed here. All lines and polygons can be edited here in the corresponding editing modes.

Moving in the 3D window:
- ❖ Rotate with right mouse button.
- ❖ Pan by pressing the mouse wheel.
- ❖ Zoom by scrolling the mouse wheel.
- ❖ Draw a selection rectangle with the left mouse button

2.5. The 2D Window

In the 2D window the calculated aerial images are displayed. In the image selection it is possible to switch to another aerial image. The active building is represented in the selected aerial image with intersection lines and a face representation. In the different editing modes, it is also possible to edit in the 2D window. (Outline, alphashape and lines).

Move in 2D Window:
- ❖ Zoom by scrolling the mouse wheel.
- ❖ Pan by pressing the mouse wheel.

2.6. The Log Window

All Shaper processes are logged in the log window. If there are any crashes or warnings, they are displayed here.

3. Working with CityGRID® Shaper

3.1. Creating a Shaper project

A project directory must be entered under the menu item *File->New*. Subsequently, the wizard `Create Shaper Data` opens automatically and guides you through the creation of the project. The paths to the source data for the City**GRID**® Shaper project are set here. (Point cloud(s), orthophotos (optional), aerial images (optional), environmental data (optional)), as well as parameters for their integration).
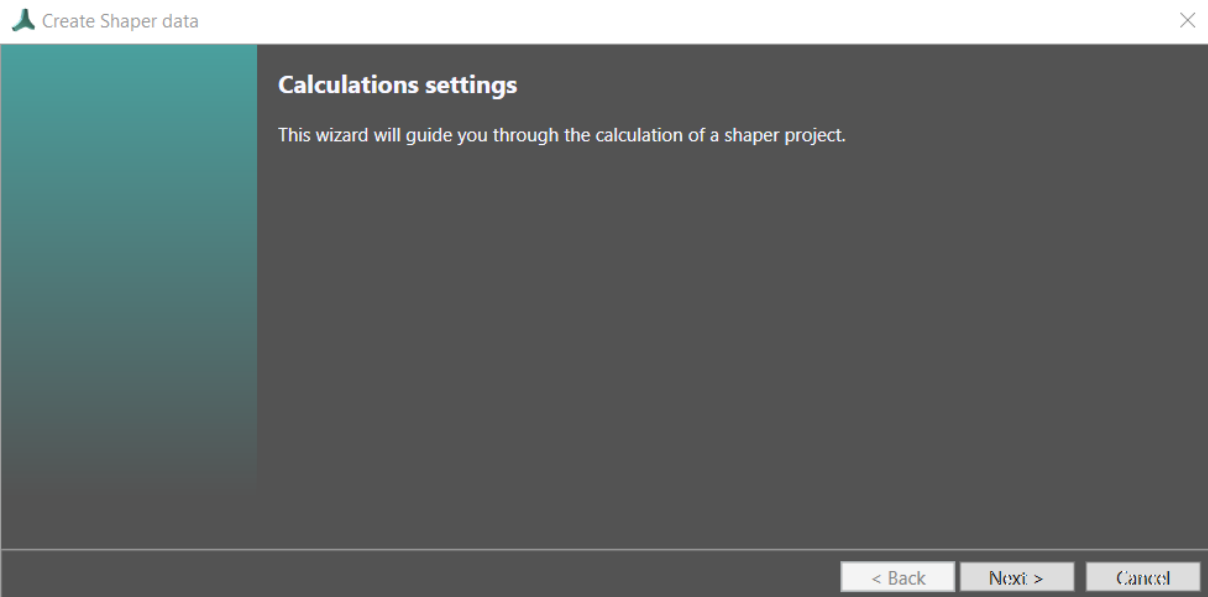
3.1.1. Pointcloud settings (required)
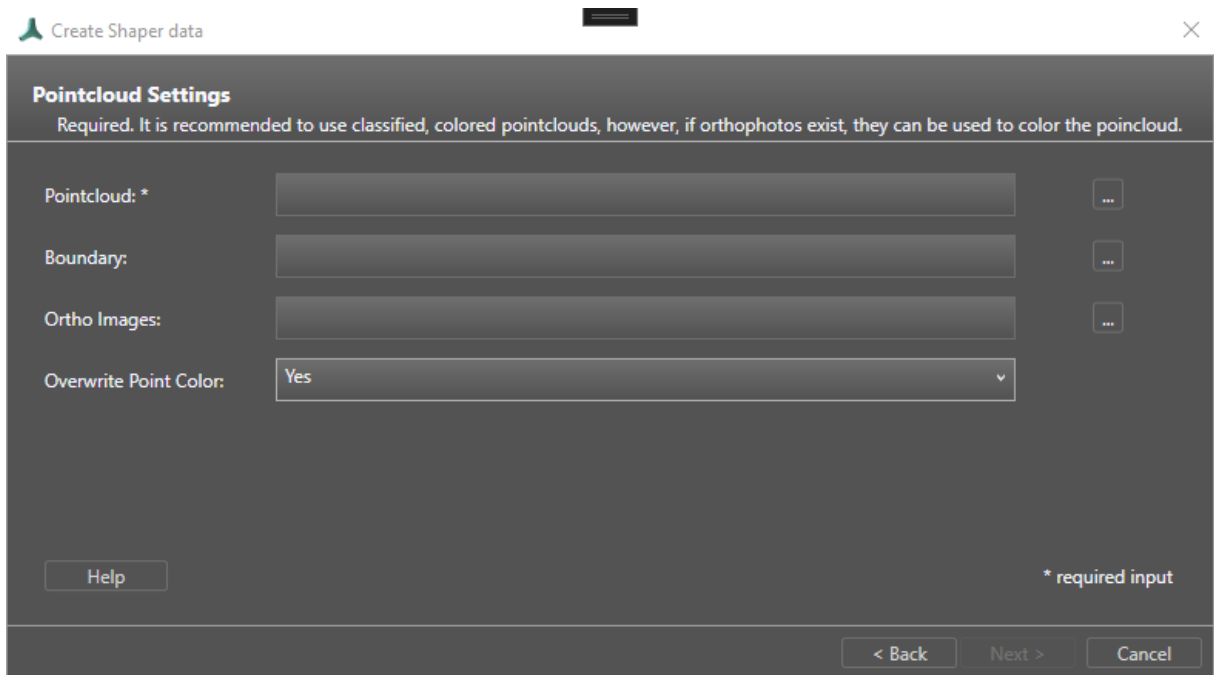
❖ Pointcloud: Selecting one or more .las or .laz files (required)

❖ Boundary: Select a shape file that restricts the pointcloud(s) to a working area. For example, building footprints (processed with buffer) or an area boundary. (Optional)
❖ Orthophoto: Select one or more ortho images to colour the pointclouds. (Optional)
❖ Overwrite point colour: Controls whether an already coloured pointcloud is to be overwritten with the values of the orthoimage.

Help: Provides more detailed information about the parameters on this wizard page.
Next: Switches to the aerial image parameter settings.

3.1.2. Pointcloud Classes

❖ Use all points for plane extraction: All points of the selected las/laz files are used for plane extraction.

> *Note: This setting is only recommended, if the pointcloud is cleaned up/reduced beforehand. Unclassified pointclouds should be reduced with spatial methods. Classified pointclouds should be checked for relevant classes.*

Use points from class(es) for plane extraction: If this setting is checked, the selected las/laz files are analysed for classes. The process can be aborted when the relevant classes are shown in the table below. With this setting at least one class must be used for plane extraction. All other classes can be used for visualization purposes. For these no planes will be extracted.

Create Shaper data

Pointcloud classes
Define which classes of the Pointcloud should be used for plane extraction

○ ....Use all points for the plane extraction
◉ ....Use points from class(es) for plane extraction

Available Classes	Use for Plane extraction	Use for Visualisation only	Class Info
1	☐	☐	unclassified
2	☐	☐	ground
4	☐	☐	medium vegetation
5	☐	☐	high vegetation
6	☐	☐	building

Help
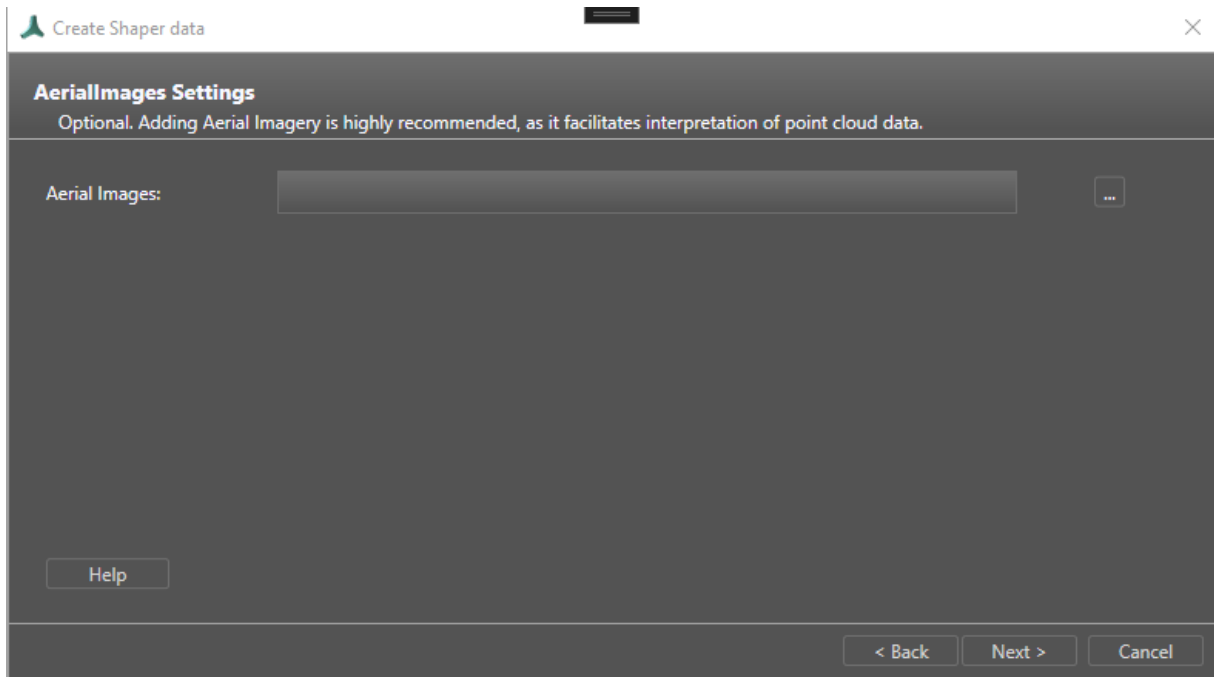
< Back   Next >   Cancel

- ❖ Available Classes: Shows the available class codes of the selected files.
- ❖ Use for plane extraction: At least one of the available classes must be selected.
- ❖ Use for Visualization only: The points of the selected classes will be used only for visualization purposes. All unchecked classes will not be processed further. Planes will not be extracted.
- ❖ Class Info: Description of the classification codes according to ASPRS recommendations. The user must ensure that the classification corresponds to the recommendations. It is not checked whether class 6 really only contains building points.

Help: Provides more detailed information about the parameters on this wizard page.

Next: Switches to the aerial image parameter settings.
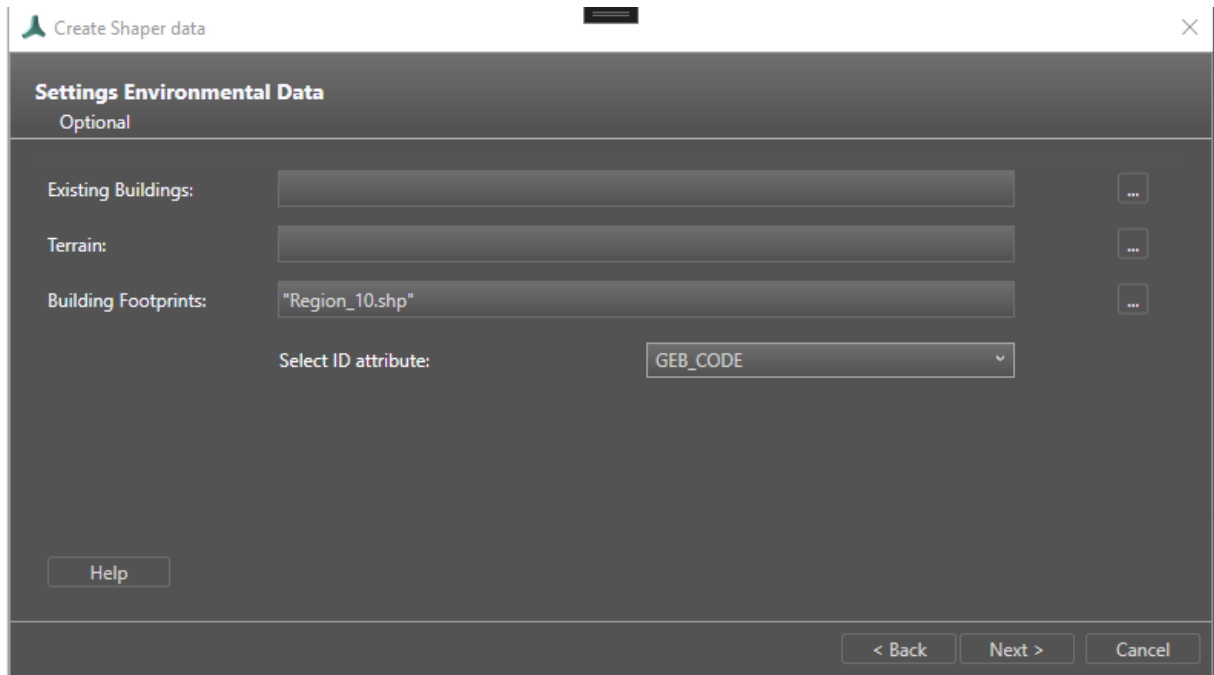
3.1.3. Aerial Image Settings (optional)

❖ Aerial images: This navigates to the aerial image orientation file(s) in the form of a City**GRID**®
xml file.

Help: Provides more detailed information about the parameters on this wizard page.
Next: Switches to the settings of the environment data.

3.1.4. Environment Data Settings (optional)

❖ Existing buildings: Existing City**GRID**® city model data can be added as reference data to a
shaper project. This facilitates city model updates. Requires City**GRID**® XML.

❖ Terrain. Terrain data can be used to get a better impression of an area to be modelled. If a terrain is available, the building facades of the models are intersected with it and written into the file as Terrain Intersection Line (TIC) or City**GRID**® Terrain during export. Requires City**GRID**® XML.

❖ Building footprints: For easier orientation in the shaper project, or as modelling aids for flat roof buildings. Are written into the file as User defined Layer during export. Requires ESRI shp. Footprint data requires a unique ID attribute. The specified files are automatically analysed for a matching attribute. If there are several attributes that match the criteria, the attribute names are offered to the user for selection in a drop-down list.

Help: Provides more detailed information about the parameters on this wizard page.
Next: switches to attribute definition.

3.1.5. Settings attribute definition (optional)

In the attribute definition, attributes can be defined for buildings that are valid for the entire project. They can be edited or deleted subsequently. You can choose between 5 *types* for the attribute definition.

❖ *String*. Allows a user-defined text field.
❖ *Integer*. Restricts the entry of a value to integer values. A min and a max value can be entered.
❖ *Double*. Allows decimal numbers. A Min and a Max value can be entered, as well as a precision.
❖ *Dropdown*. Allows you to choose between predefined values,
❖ *Date*. Allows you to enter a date in a predefined format. There are four predefined formats to choose from, but a user-defined format is also possible.

> *Tip*: *Instead of creating a new attribute definition manually, the definition from an existing project can also be used by navigating to an existing project file with the ... button.*

The ***Optional*** column indicates whether an attribute is required or not.
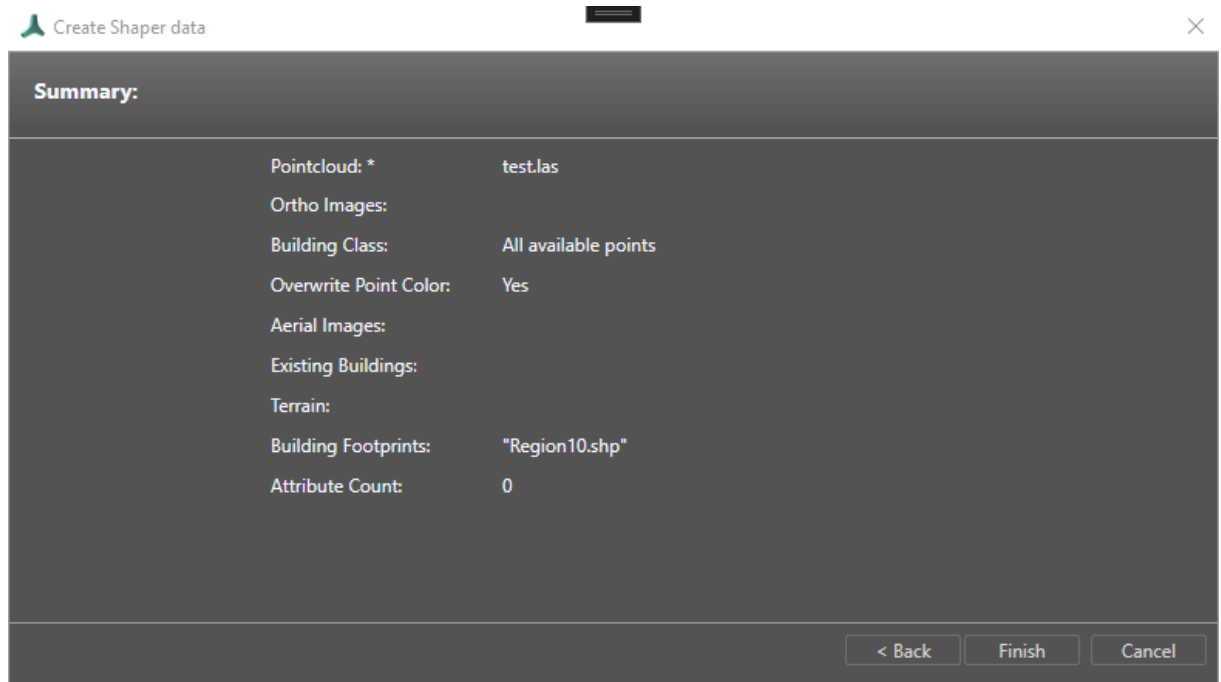
The ***Details*** column shows a summary of the definition given.

The **X** button allows you to delete a line.

Help: Provides more detailed information about the parameters on this wizard page.

Next: Switches to the summary.

3.1.6. Summary

❖ Shows an overview of the set parameters.

Finish: Starts the calculation of the shaper project. Depending on the amount of data, this may take several hours.

> *Note:* To be able to use a fully calculated shaper project, the program must be restarted after the calculation and the new project loaded.

4. Integrating and updating external data

For certain areas of application, the integration of various external (auxiliary) data is useful.

❖ Building footprints

Facilitate orientation in the pointcloud, in outline mode footprints enable the quick creation of (some) flat roofs. The prerequisite is a certain minimum accuracy and topicality of the footprints. Flat roofs that are created using a building footprint should not have a roof overhang. In this case, the roof must be subsequently processed and extended.

The footprint data must have a unique ID attribute. The file, that is provided by the user will be analysed for a suitable attribute. If more than one suitable attribute is found within the file, the user can choose the id field from a dropdown list.

❖ Terrain

Creates an intersection with the created façade surfaces and gives a realistic impression of modelling.

❖ Existing building models

Facilitate the updating of an existing city model, as new building models can be snapped to the existing buildings and thus gaps avoided. If errors are found in the existing city model, the affected building can be identified with an original file and edited there.

The data can either be included right at the beginning when calculating the shaper project (Chapter 3.1.4) or subsequently with **Menu > Edit > Optional data** (Chapter 2.1.2.1) 2.1.2.1).

5. Known Problems

- In some cases, TIF images with certain specifications cannot be processed correctly. These aerial images (in the known situations nadir images with alpha channel) cause grayscale roof textures when they are processed.
  This does NOT affect all nadir images and not all tifs with alpha channel. So far, the problem has only occurred with TIFs that cannot be opened in other applications (Photoshop, GIMP) or can only be opened in a roundabout way. Images from Trimble, Vexcel/Ultramap are sometimes affected.

  > *Tip:* To ensure that the images are not converted to grayscale after a long calculation time, it is recommended that all images are converted to jpg before processing (IrfanView, FME, GIMP, Paint.Net).

- It is strongly recommended to divide areas with large amounts of data into regions before creating the project.

6. Error Handling

The City**GRID**® Software is developed, tested, and maintained by UVM Systems with the aim of being error-free. Nevertheless, we cannot exclude the possibility of errors occurring during processing.

The database concept and version management guarantee that data cannot be lost. If an error in the software actually corrupts the data of the edited version, there is still the last stable version, which has not changed. In important cases, corrupt versions can usually still be repaired if the error has been found.

The following errors can occur:

If you want to send a bug report, please include the following information/data:

1. description of the actions that led to the error.
2. send the data in the menu **Feedback > Send Feedback** to the City**GRID**® Support Team

For errors in the shaper:

If the error is reproducible in the shaper, we also ask for a detailed log:

1. perform all actions before the error occurs.
2. activate in the **menu Feedback > Extended Logging** (slows down the software considerably).
3. Execute the action that produces the error. 4.
4. send the data in the menu **Feedback > Send Feedback** to the City**GRID**® Support Team
5. deactivate detailed logging again.

Please send bug reports to support@uvmsystems.com

7. Contact

www.citygrid.at

www.uvmsystems.com