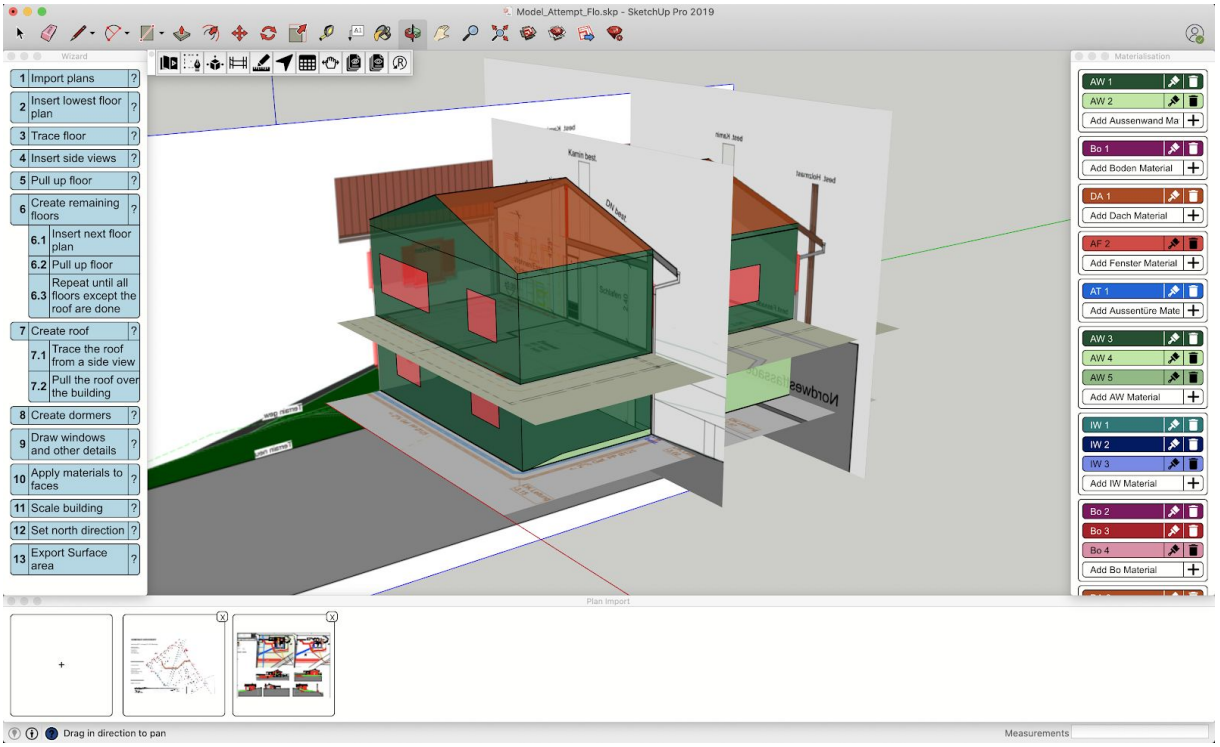
University of Applied Sciences and Arts
Northwestern Switzerland



Envelop Manual

Detailed Envelop Sketchup Extension Manual
Part of IIT22

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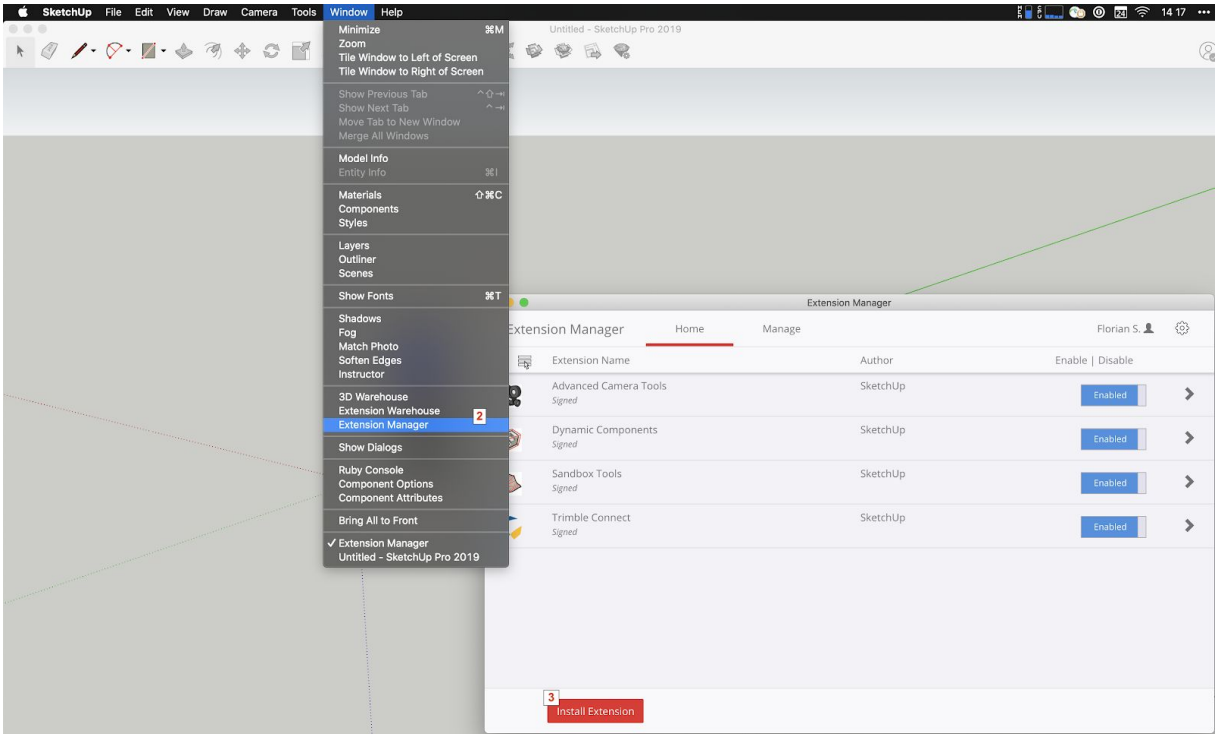
1. Installation

This chapter covers how to install, activate and deactivate the extension.

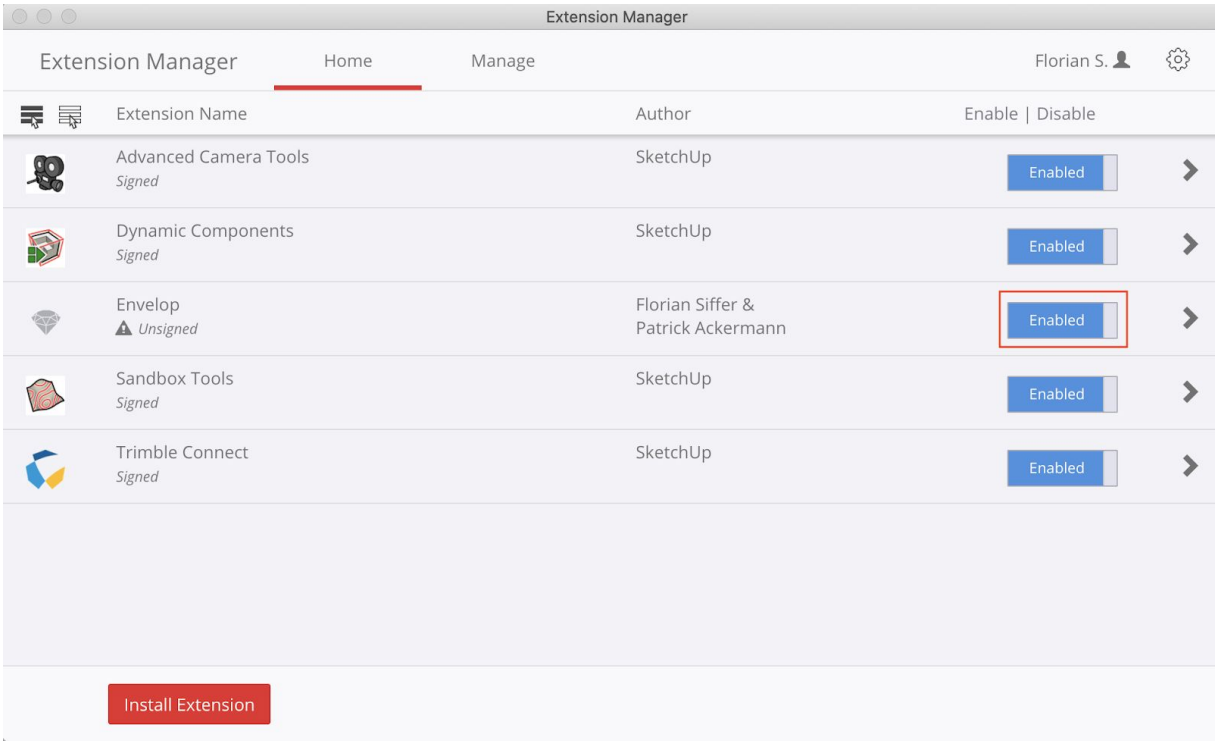
1.1 Installation

The following step by step instructions will allow you to install the Envelop Sketchup extension.



0. You must have an active Sketchup Pro subscription to install extensions.
1. Download the Envelop extension to your computer with the following link: [Envelop.rbz]
2. In SketchUp, select Window > Extension Manager. The Extension Manager window appears.
3. Click the Install Extension button.
4. In the Open dialog box that appears, navigate to the Envelop.rbz file saved to your computer, select the file, and click OK (Microsoft Windows) or Open (Mac OS X).
5. If SketchUp asks you about installing only extensions from trusted sources, click Yes to proceed and install your extension.

1.2 Activation



Once the extension is installed, you can deactivate and activate it using the toggle marked in the above screenshot. Please restart Sketchup after disabling the Envelop extension.

2. Usage

This chapter will explain how to use all the features Envelop provides.

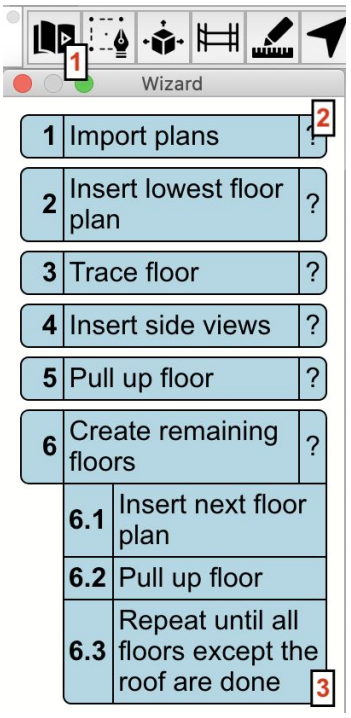
2.1 General Workflow

In order to learn the general modeling workflow with Envelop it is recommended you study the ‘Quick Guide’ directly within Sketchup.

2.2 Quick Guide

The following two chapters will teach you how to interact with the ‘Quick Guide’.

2.2.1 Overview

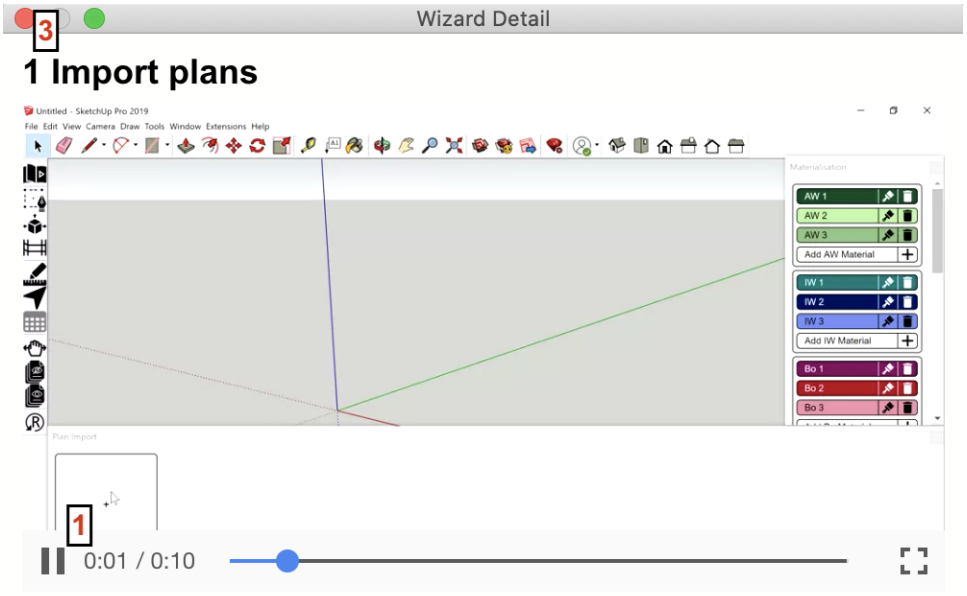


In order to open the ‘Quick Guide’, press the ‘Quick Guide’ button in the Envelop toolbar (1). Alternatively, in Sketchup, select Extensions > Envelop > Open Quick Guide.

In the ‘Quick Guide’ you can see step by step instructions how to construct a building model using Envelop. Note that this workflow is merely a sensible suggestion - any of these steps can be performed in any order. If the ‘Quick Guide’ window is too short for all the steps, such as in the screenshot, you can scroll to read the remaining steps (2).

If it is unclear how to perform any individual step, click on the corresponding question mark (3) to open the detail view for that step.

2.2.2 Detail View



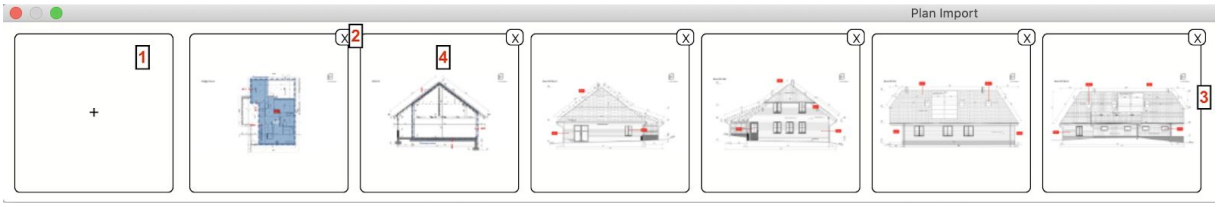
1. Click on the plus button on the Plan Import dialog
2. Select the plan files and click Open. Pdf and Image files are supported 2

The detailed view of any single step in the ‘Quick Guide’ shows its number and title, step by step more detailed instructions how to achieve this step and, most importantly, a short video showing how to perform the actions required.
You can control that video as expected using the controls provided (1).
Again, there might be additional instructions out of sight if the window is too small. If so, scroll to see all of the content (2).
To close the window, press the close button provided by your operating system (3).
Alternatively, you can press the ‘Escape’ key.

2.3 Plan Management

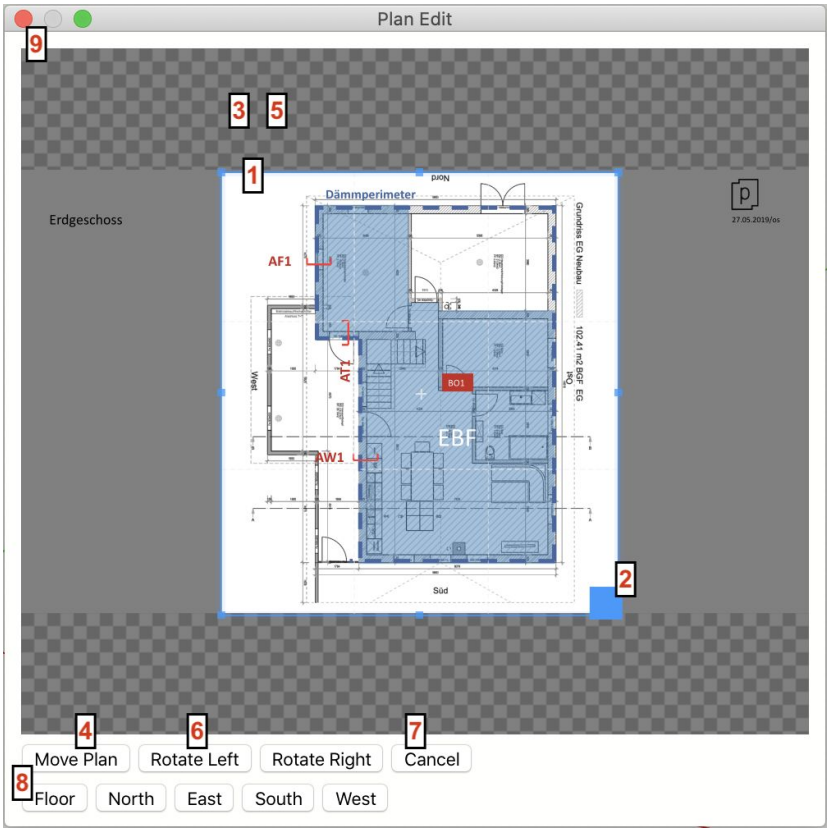
In this chapter you will learn how to import, edit, position, move and hide plans.

2.3.1 Plan Import



In the ‘Plan Import’ window, you can import plans. This window is opened automatically. Using the big ‘+’ button on the left hand side (1), you can open a file browser in which you can select one or many files to be imported. Alternatively, you can press the ‘A’ key or directly drag and drop files onto the ‘Plan Import’ window.
Image files as well as PDF files are supported. For each opened file, and each page in a PDF file, a small preview will be generated, as you can see in the above screenshot.
Remove a preview by pressing the small ‘x’ button in the top right of each preview (2).
If more previews are added than fit in the window, you can scroll (3) to view the rest.
Finally, click on a preview (4) to start the process of inserting a plan into the model.

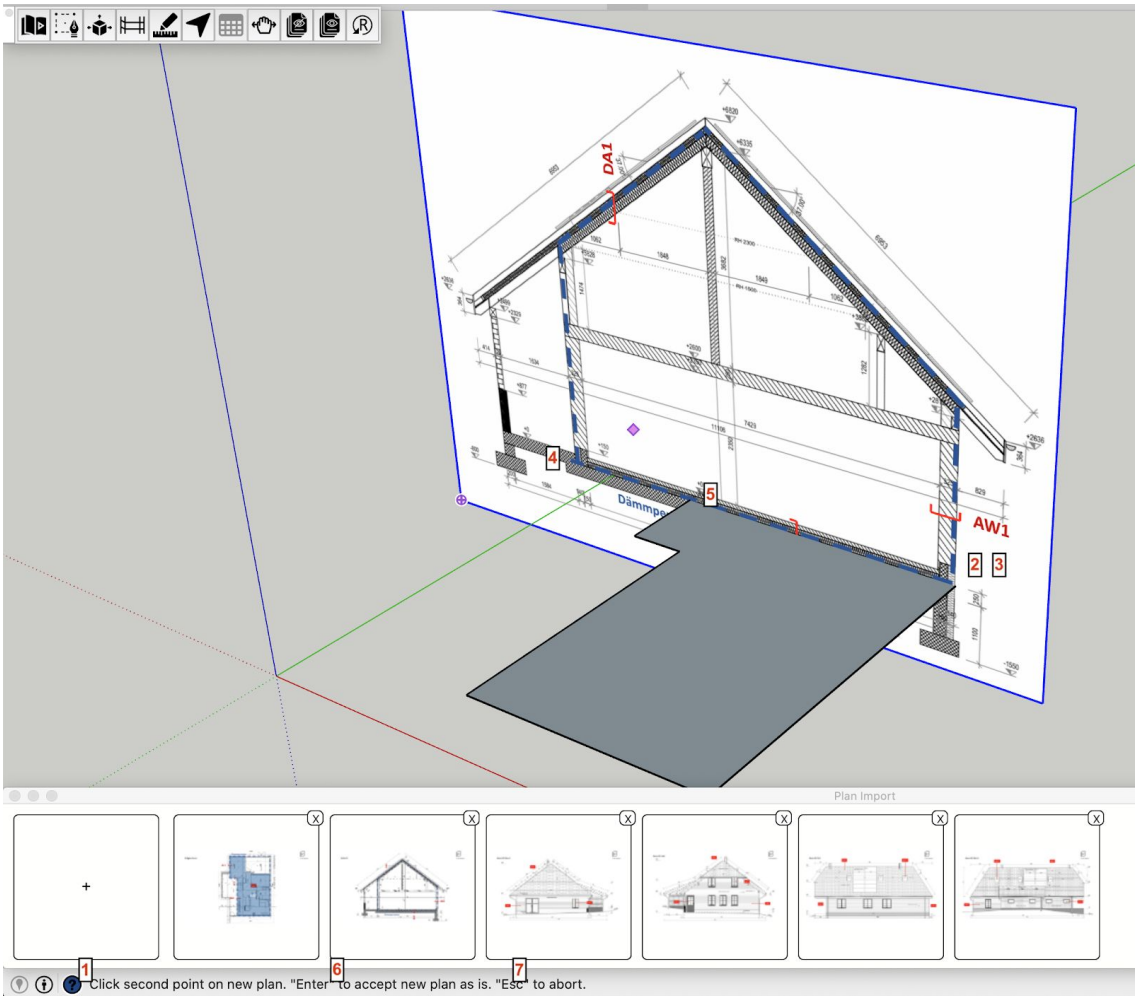
2.3.2 Plan Edit



The ‘Plan Edit’ window allows you to make minor adjustments to a plan before inserting it into the model.

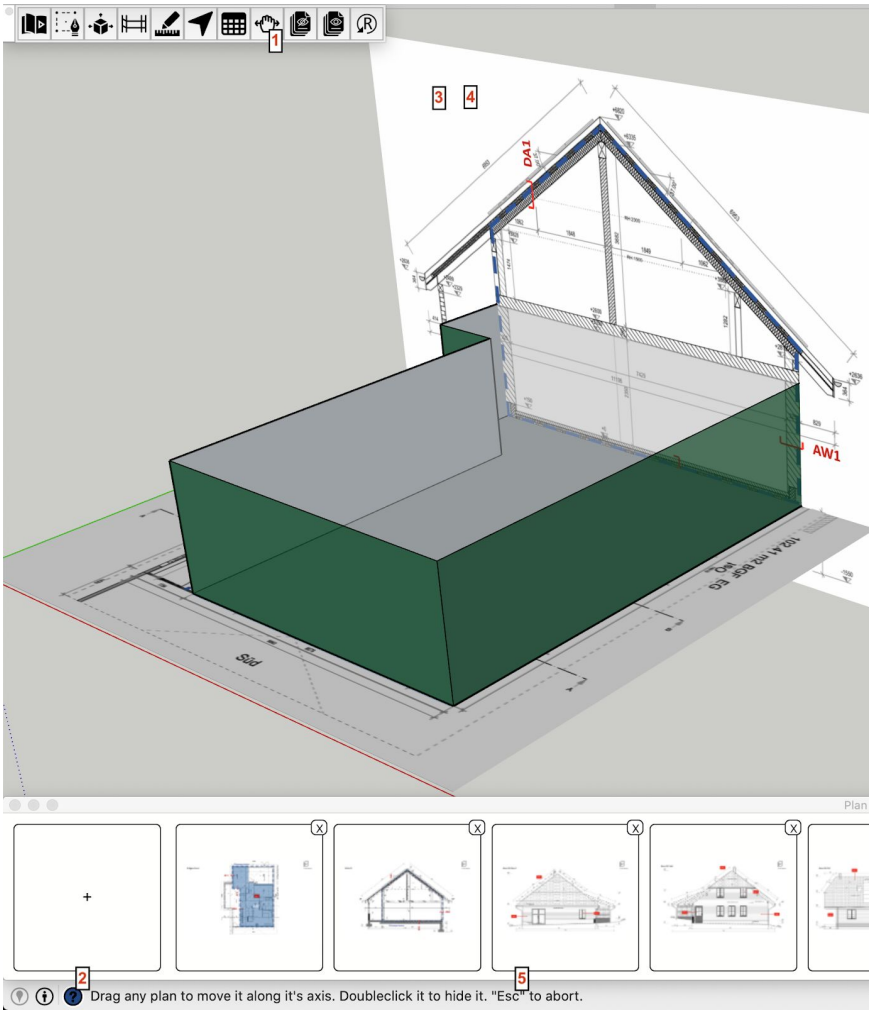
To select a portion of the plan to insert, drag a rectangle over the preview (1). You can either draw new rectangles or use the handles along the edge of an existing rectangle to modify the selection (2).
You can scroll on top of the preview to zoom (3).
If you press the ‘Move Plan’ button (4), the ‘Move Plan’ mode is activated. Now, if you drag the plan preview (5), you can move the plan around. Press the same button (4) again to return to the ‘Select Rectangle’ mode. Alternatively, you can use the following buttons to switch modes: ‘Shift’, ‘Control’, ‘Alt’ or ‘Meta’.
You can rotate the plan in either direction using the ‘Rotate Left’ and ‘Rotate Right’ buttons (6). Alternatively, you can use the left and right arrow buttons.
To abort the operation and close the window, press the ‘Cancel’ button (7). Alternatively, you can use the close button provided by the operating system (9) or press the ‘Escape’ key.
Finally, to confirm the operation and insert the selection into the model, you can press the corresponding orientation button: ‘Floor’, ‘North’, ‘East’, ‘South’ or ‘West’. Alternatively, you can press the ‘f’, ‘n’, ‘e’ or ‘o’, ‘s’ and ‘w’ keys. This will start the ‘Plan Position’ tool, if this is not the first plan being inserted.

2.3.3 Plan Positioning



After confirming the selection in the ‘Plan Edit’ window, the ‘Plan Position’ tool is started, if you have already imported another plan. The first plan is inserted without the ‘Plan Position’ tool.
At the bottom of the Sketchup window (1), there is a short explanation of what the tool expects of you and what you can do.
To position the plan, first click a point on the plan that you have already modeled and that is easy to identify (2). Often, the corners of the building are appropriate points to do this with. Then, click the corresponding point on the model (3). The plan will snap to that position.
To scale the plan, click a second point on the plan that you have already modeled and that is easy to identify (4). Then, click the corresponding point on the model (4). The plan will scale itself to match those two points and the tool will finish.
In order to confirm the current position and scale of the plan, you can at any point in the above process press ‘Enter’.
To abort the operation, in order to make a different selection in the ‘Plan Edit’ window for example, you can at any point in the above process press ‘Escape’.

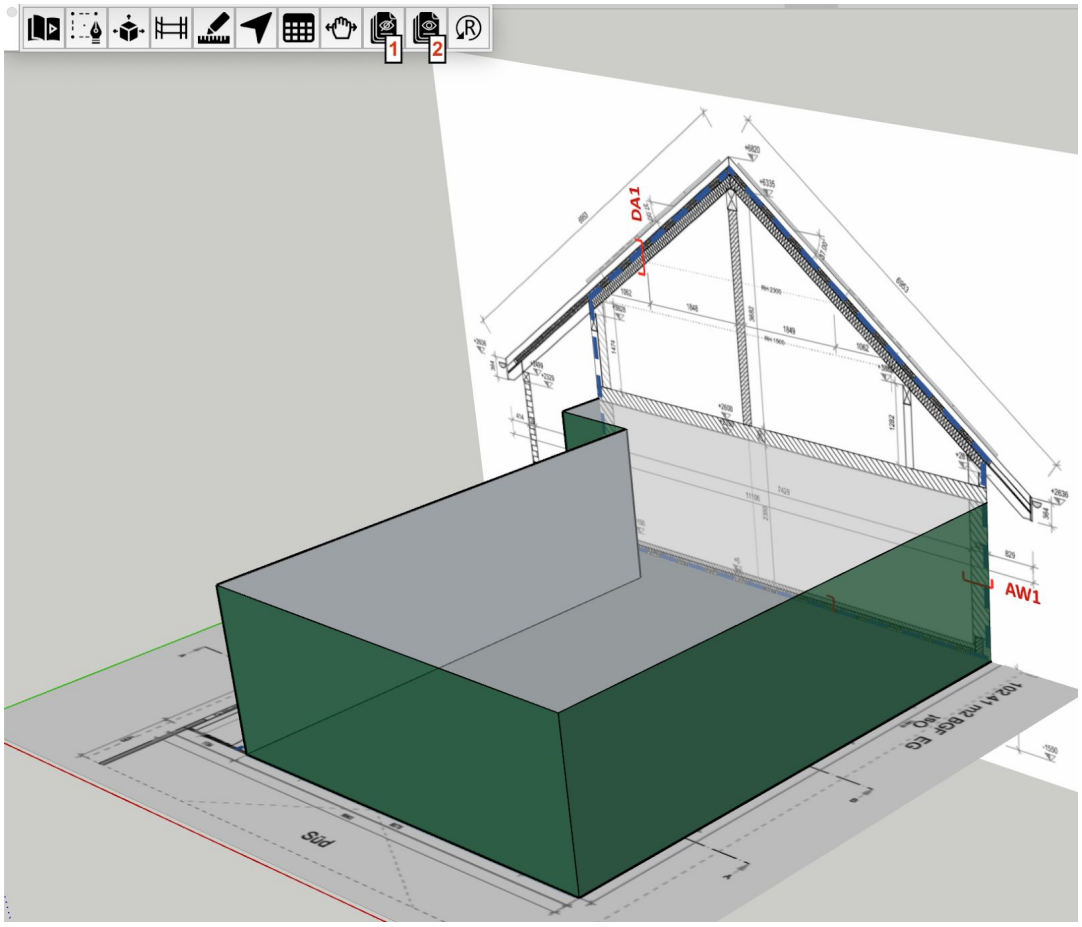
2.3.4 Plan Moving & Hiding



With the ‘Plan Management’ tool you can move and hide individual plans. This can be useful during the modeling process, in order to move an outline to the correct position or to declutter the model.

Press the ‘Plan Manager Tool’ button (1) in the Envelop toolbar to start this tool. Alternatively, in Sketchup select Extensions > Envelop > Plan Manager Tool.
As with all tools, you can find short instructions on how to use the tool on the bottom left of the Sketchup window (2).
To move a plan simply drag it (3) to the new position. You can move plans only along their normal axis. Alternatively to dragging, you can click the plan, move it by moving the mouse, and then confirm the position by clicking again.
To hide a single plan, double click (4) that plan. The plan will be hidden and can be shown again using the ‘Unhide all Plans’ function in chapter 2.3.5. Moreover, opening a save file turns all plans within visible.
To close the tool, press ‘Escape’ (5) or select a different tool.

2.3.5 Hiding & Unhiding all Plans



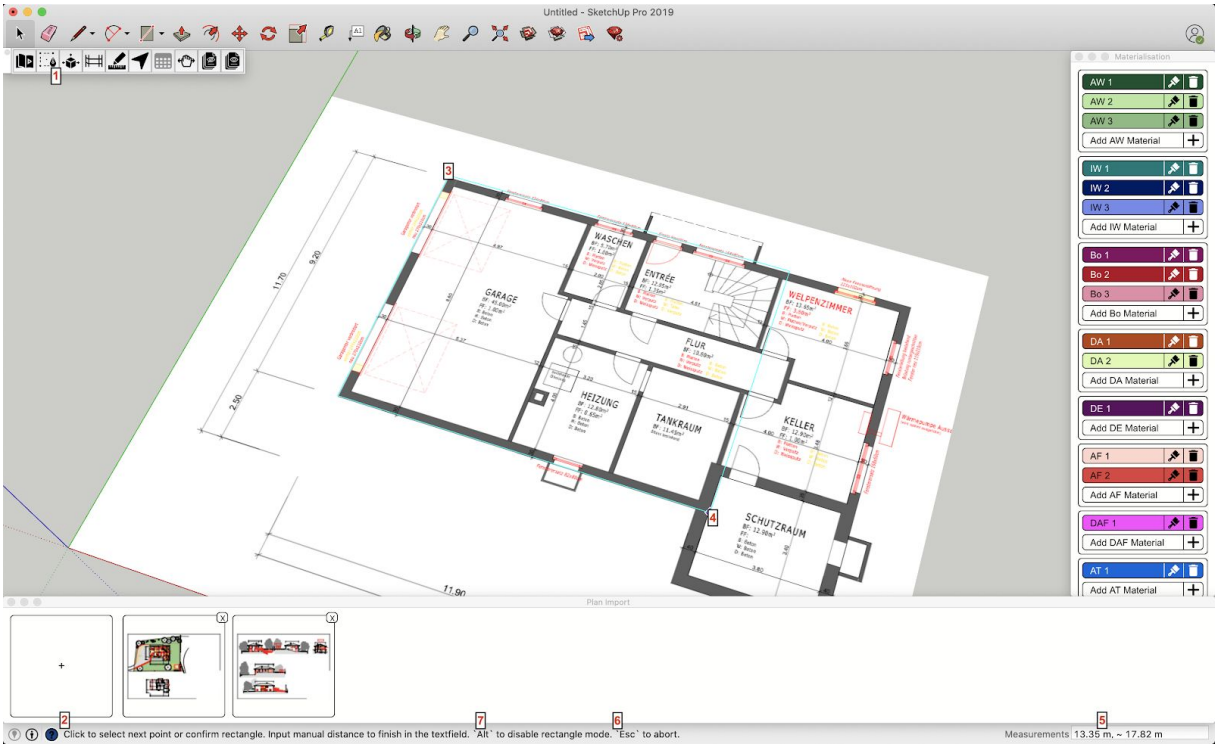
During the modeling process, or afterward, it might be useful to hide all plans at once or to show them again. For example, it is much simpler to find surfaces without a material assigned when all plans are hidden.
Press the ‘Hide all Plans’ button (1) in order to hide all plans. Alternatively, in Sketchup select Extensions > Envelop > Hide all Plans.
Press the ‘Unhide all Plans’ button (2) in order to unhide all plans. Alternatively, in Sketchup select Extensions > Envelop > Unhide all Plans.

2.4 Modeling

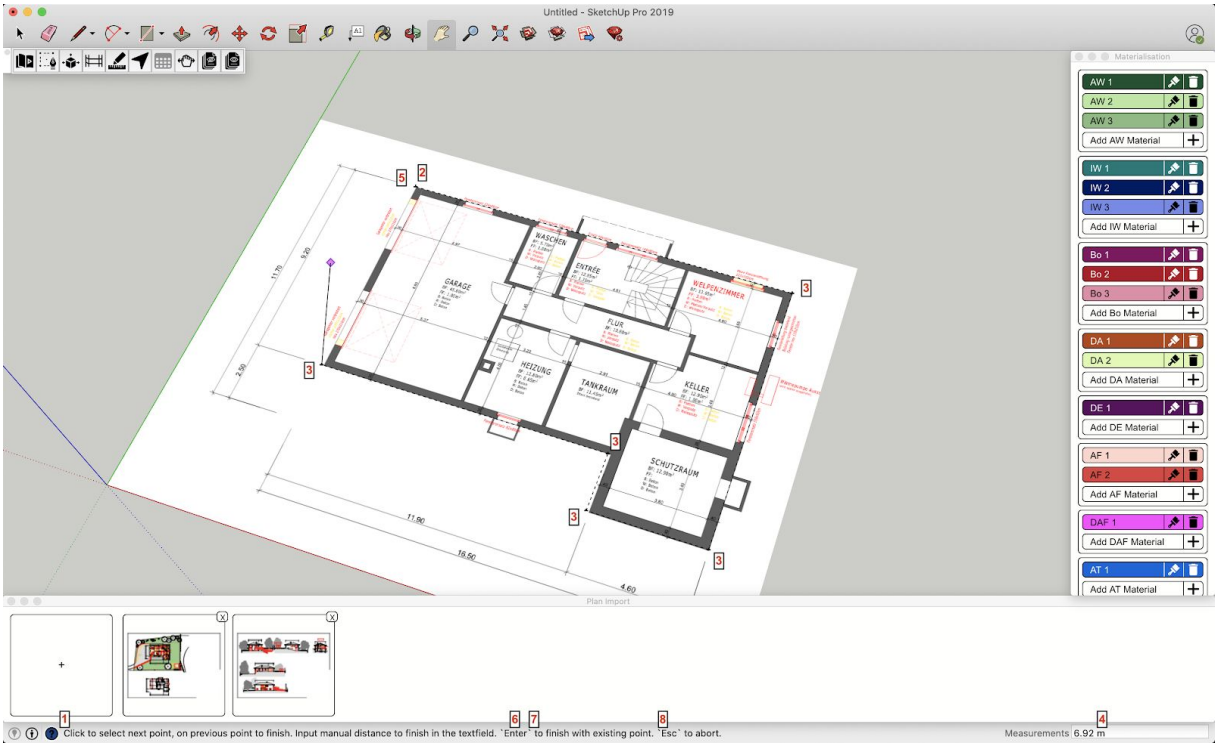
In this chapter you can learn how to work with the modeling tools Envelop provides.

2.4.1 Pen Tool

The ‘Pen Tool’ is used to draw individual lines or complete polygons into the model. It has two different modes, which will be explained with two screenshots.



To start the ‘Pen Tool’ click the ‘Pen Tool’ button (1) in the Envelop toolbar. Alternatively, in Sketchup select Extensions > Envelop > Pen Tool.
Like all other tools, at the bottom of the Sketchup window (2), there is a short summary of how to use the tool.
In order to draw a rectangle with the pen tool, click and surface (3) and the opposite corner (4). Alternatively, after clicking the first point, exact measurements for the rectangle can be entered in the VCB (5). Use ‘,’ or ‘;’ to separate the two lengths. The pen tool can be used this way to edit the house model, for example in order to draw a window but also before the house exists to draw its foundation, like in the screenshot above.
Instead of completing the rectangle, you can press ‘Escape’ () to reset the tool. Press ‘Escape’ again, or select any other tool, to close the tool.6
To switch to the polygon mode of the tool, press any of the alternate mode keys (‘Alt’ (7) or ‘Ctrl’). Alternatively, the tool will switch automatically, if the second point that is clicked, creates a line along the blue, green or red Sketchup axis.



In the alternate polygon mode, the instructions at the bottom of the Sketchup window (1) update.

Again, click a point (2) to start the drawing process. Now, to draw a polygon, either click a second point so that a line along the blue, red or green axis is created. Alternatively switch the tool to the polygon mode using ‘Alt’ as described above before clicking the second point. Now you can continue drawing the polygon by clicking additional corners (3). Alternatively, to set additional points, you can set the direction of the next point with the mouse and enter an exact distance in the VCB (4).

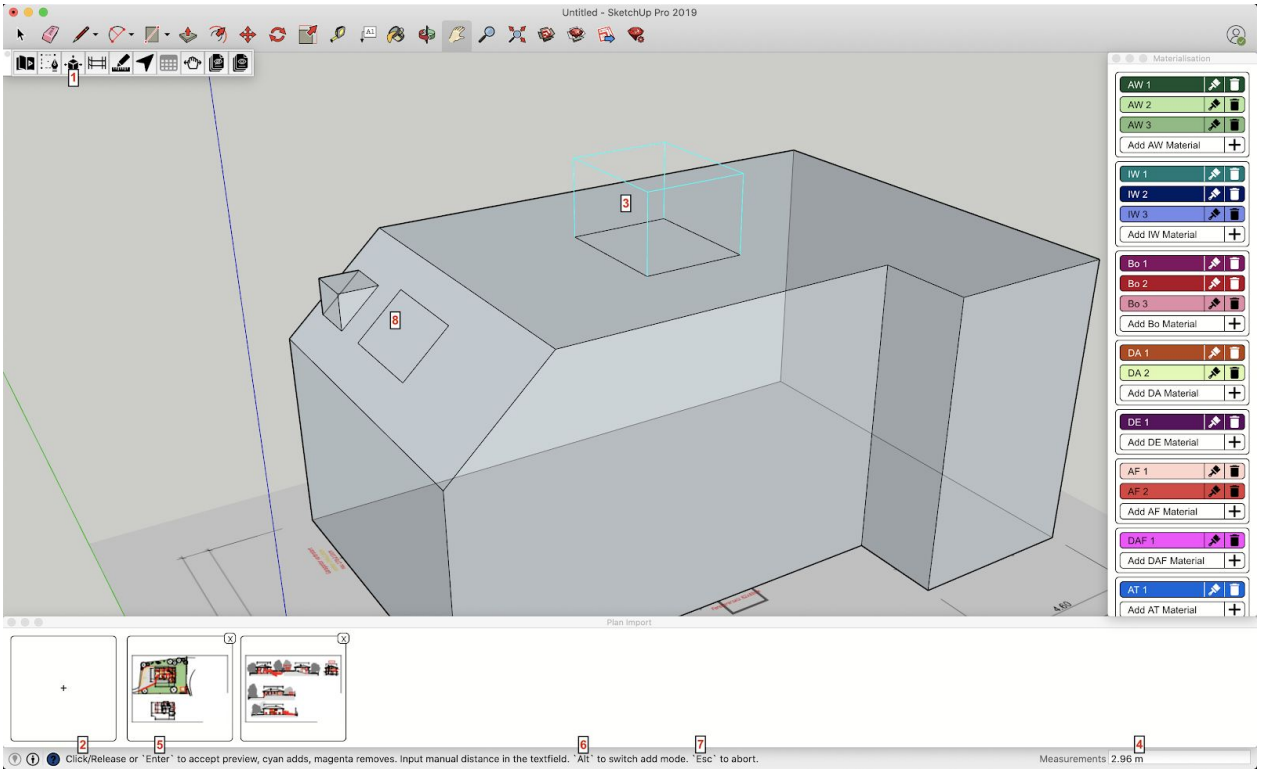
There are two ways to complete the polygon. The first is by clicking the first point again (5) and completing the polygon.

The second is to again switch into alternate mode using any of the mode keys (‘Alt’ or ‘Ctrl’) and then to confirm with the ‘Enter’ key (6). The preview will ensure you know what you are confirming.

You can also confirm the currently drawn lines, instead of finishing the polygon. This can be useful to add separating lines to already existing surfaces of a building. To do so, press ‘Enter’ (7) without switching into the alternate finishing mode first. Again, the preview will help you understand what you are confirming. In the screenshot above, the current lines will be confirmed without completing the polygon if ‘Enter’ is pressed.

2.4.2 Push-Pull Tool

The ‘Push-Pull Tool’ can be used to create volumes from shapes and either add or remove that volume from the house. It can also create dormers.

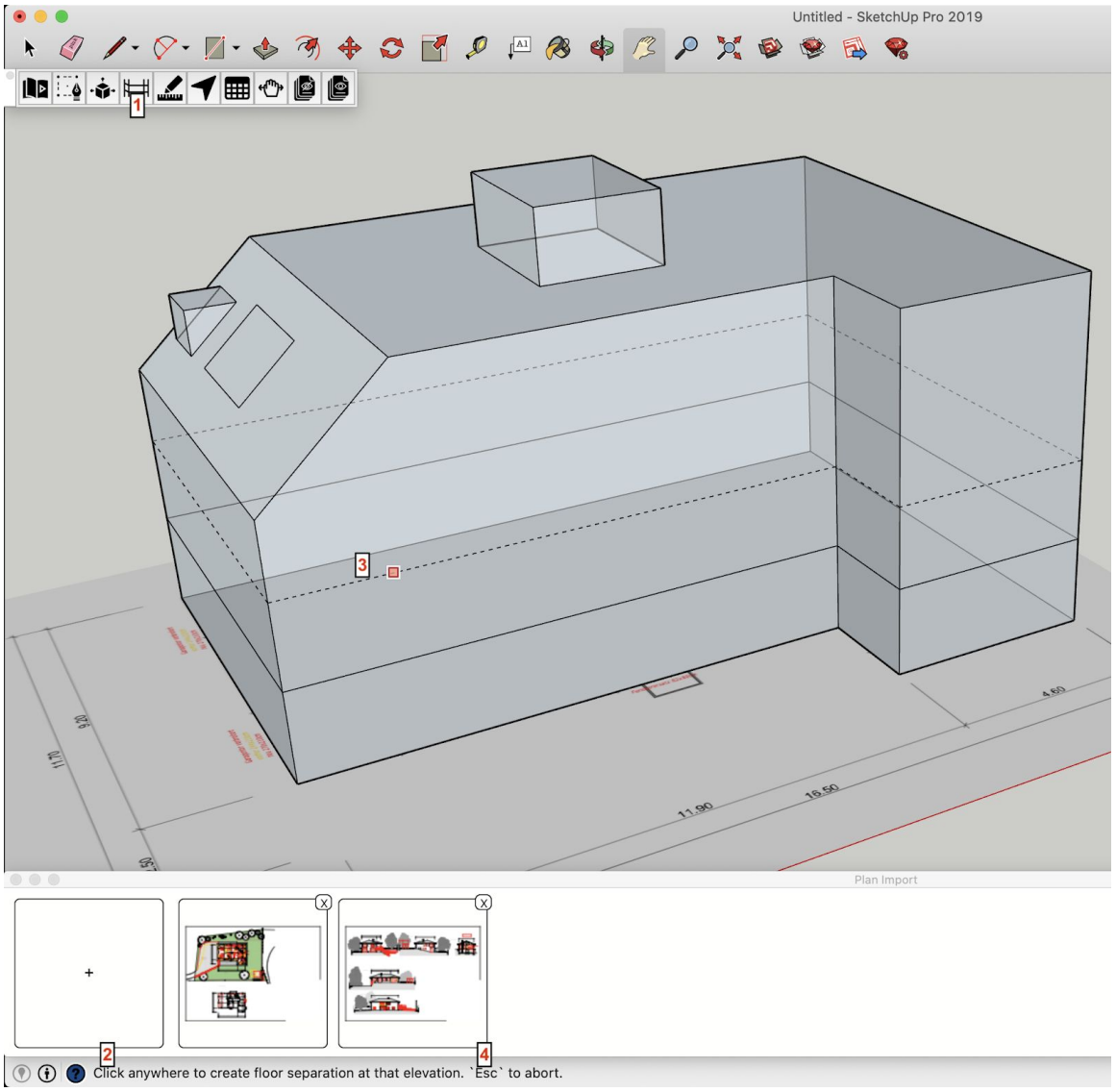


Activate the ‘Push-Pull Tool’ by clicking the ‘Push-Pull Tool’ button (1) in the Envelop toolbar. Alternatively, in Sketchup select Extensions > Envelop > Push-Pull Tool.
Like all tools, in the status bar at the bottom of the Sketchup window (2), a short description of the tool and its usage will be displayed.
After activating you can create a volume from any polygon, whether that polygon is already the side of a volume or a new one. To do so, simply drag (3) that polygon to the desired size. Alternatively, you can click the polygon, move the mouse freely to set the size, and click again to confirm. A third option, to set the size of the volume, is to enter the exact distance in the VCB (4). The last option is to use the ‘Enter’ key (5) to confirm the current preview.
The preview color indicates what will happen if the current volume is confirmed. A blue preview, like in the screenshot above, indicates that the volume will be added to the house. A red preview indicates that the volume will be removed. This is useful, for example to create complicated roofs or an elevator shaft. The tool tries to determine on its own, which mode is needed. You can also switch the modes manually, using the alternate mode keys ‘Alt’ or ‘Ctrl’ (6).
To abort and discard the preview, use the ‘Escape’ key (7).

To create a dormer using the ‘Push-Pull Tool’, first create a rectangle outline of the dormer using the ‘Pen Tool’. Then, activate the ‘Push-Pull Tool’ and double click into that rectangle (8).

2.4.3 Floor Tool

The ‘Floor Tool’ is used to divide surfaces along a height selected by the user.

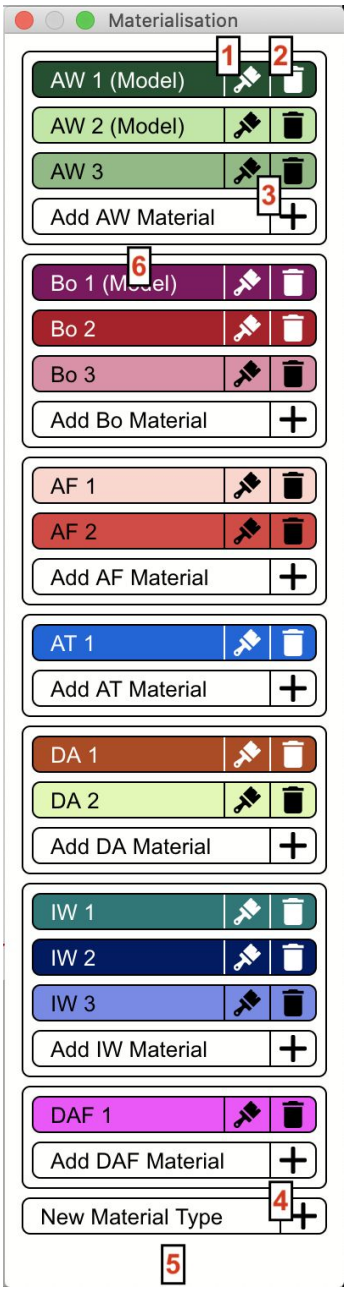


You can activate the ‘Floor Tool’ by pressing the ‘Floor Tool’ button (1) in the Envelop toolbar. Alternatively, in Sketchup, select Extensions > Envelop > Floor Tool.
As all other tools, there is a short description of the usage of the tool at the bottom left of the Sketchup window (2).
Creating a floor means dividing all surfaces of the building horizontally on a certain height. To do so, simply position the cursor over the building at the desired height and click (3). The preview will show where the floor will be created.
To close the tool select another tool or press ‘Escape’.

2.5 Materialisation

In the following chapters you can learn how to manage materials and how to assign them to surfaces in the model.

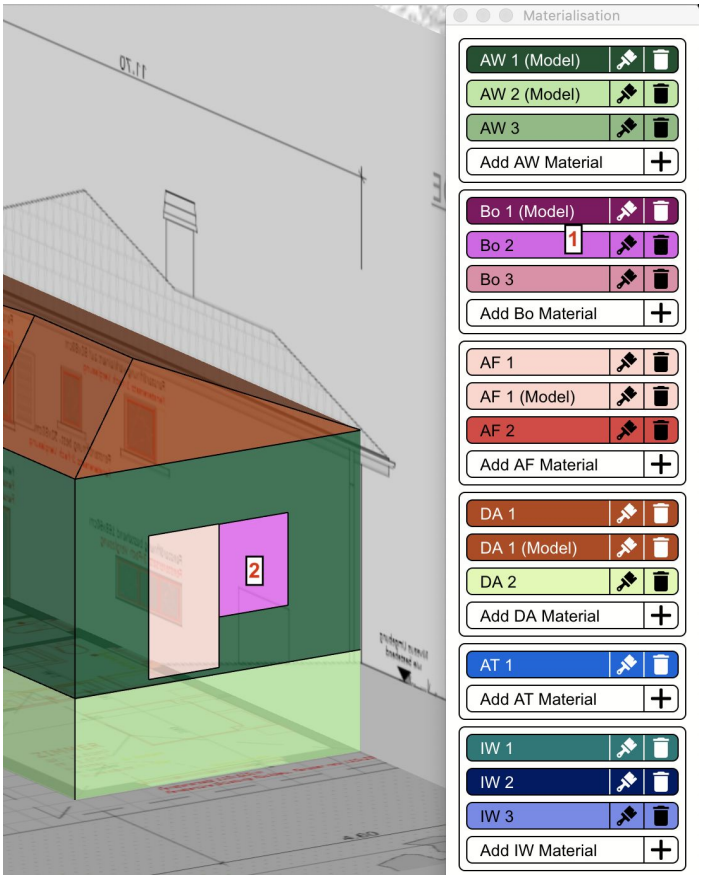
2.5.1 Managing Materials



In the ‘Materialisation’ window, you can create and delete materials, as well as change their color. This window is always open.
All the materials are grouped by their name. Multiple materials with the same name have an increasing number appended to their name as can be seen in the screenshot to the right.
Any changes you make to the list of available materials is saved to your computer. In your next building model, you will have access to the same list of materials. In addition to the materials saved on your computer, the ‘Materialisation’ window will also show you materials that have been used in the model but that are not saved on your computer. This can happen, when you open a file that was sent to you by a colleague with different materials. Such materials are marked with ‘(Model)’ in the list.

You can change the color of a material by clicking on the paint brush icon (1) next to a material. As mentioned before, changes to materials from your computer are saved immediately. Changes to materials from the model are saved once you save the model.
To delete a material, simply press the trash icon (2) next to a material. If the material is still in use, Envelop will ask you to confirm the deletion. If you confirm, all instances of the material in use will be replaced by the default material. Changes are saved as described above.
To add a new material within an existing group, press the ‘Add Material’ button (3) at the bottom of each material group. The next free number within the group will be used and the material will be saved to your computer.
To add a new material type, in other words a new material group, press the ‘New Material Type’ button (4) at the bottom of the materials list. Alternatively you can press the ‘N’ key. Envelop will ask you for the name and create a new material group with that name. The new group is saved immediately to your computer.
The list of materials might be longer than your ‘Materialisation’ window. In that case you can scroll (5) to see the rest of your materials.
Finally, in order to start the materialisation tool with a specific material, to apply that material to surfaces, click the name (6) of the desired material.

2.5.2 Applying Materials



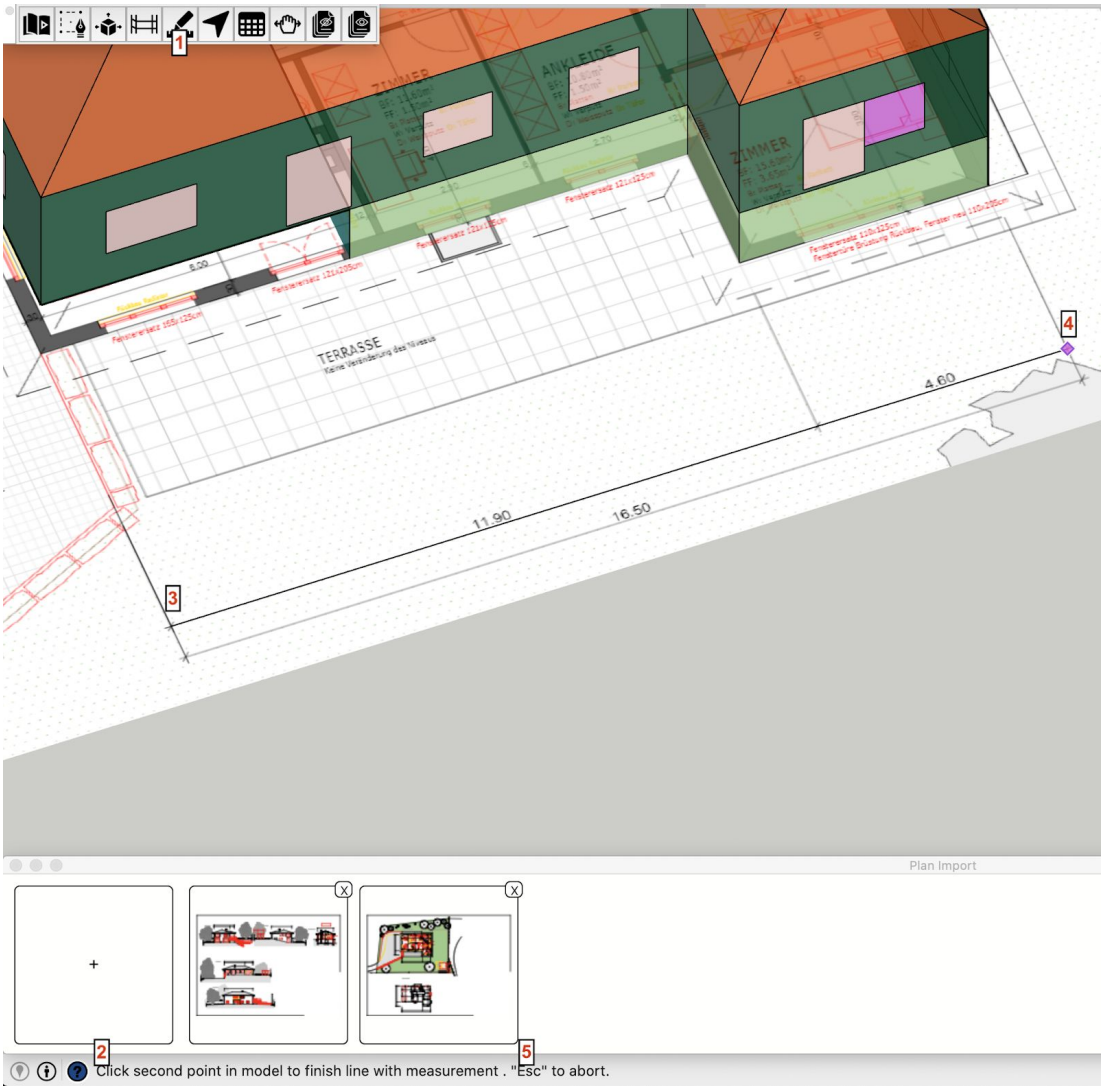
In order to apply materials to surfaces in your model, first select the desired material by clicking its name or the surrounding box (1) in the ‘Materialisation’ window.
Then simply click on all the surfaces (2) in the model that should have the selected material.

2.6 Output

In this chapter you will learn how to generate the table of surface area totals and how to fulfill the prerequisites. Of course, you need to model a building first.

2.6.1 Scaling Tool

Before generating the surface area totals, the model must be scaled.

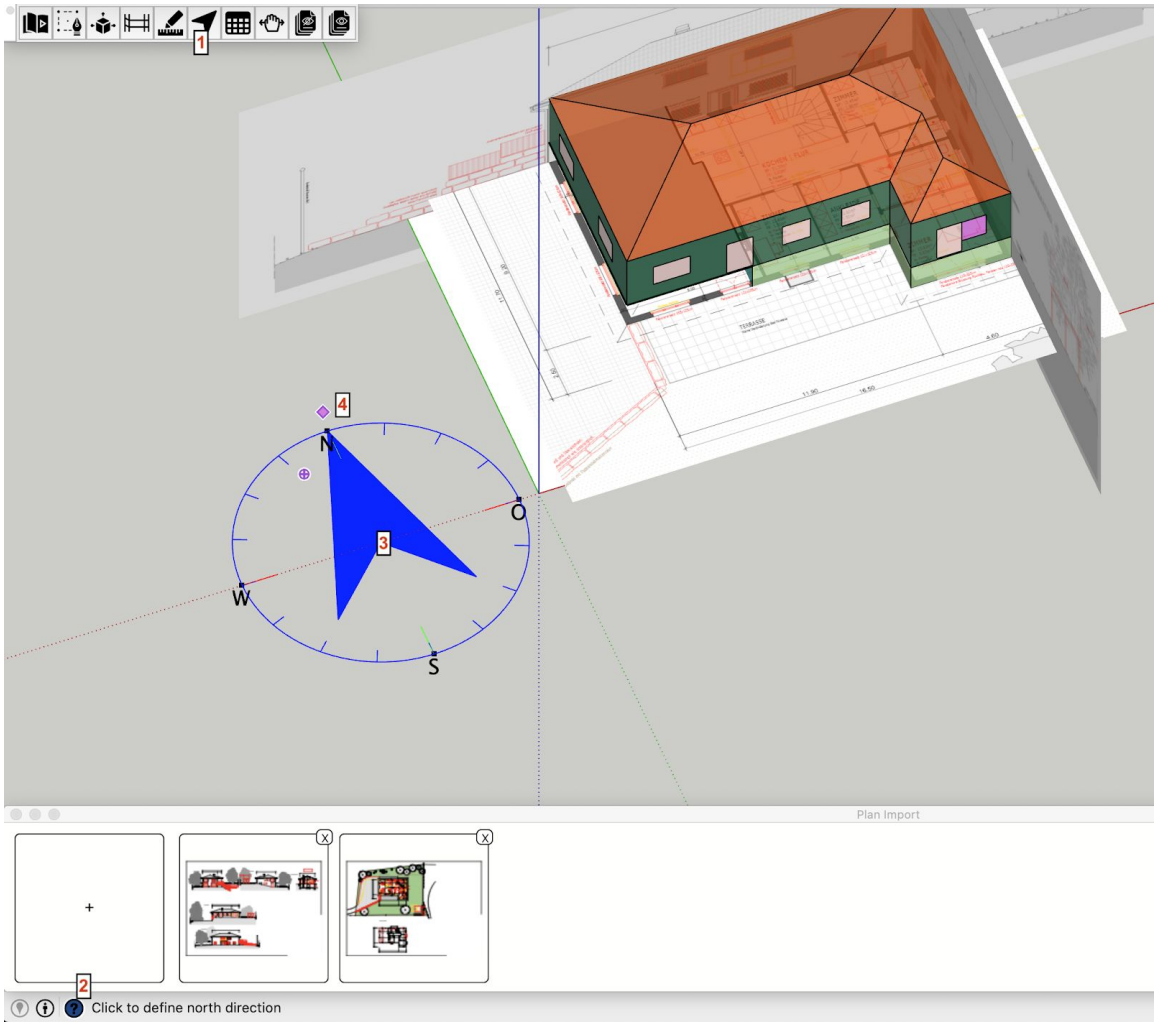


Start by activating the ‘Scale Tool’ by pressing the ‘Scale Tool’ button (1) in the Envelop toolbar. Alternatively, in Sketchup select Extensions > Envelop > Scale Tool.
Like all other tools, there is a short description of how to use the tool in the status bar (2) in the lower left corner of Sketchup.
After activating the tool, click on one end of a known distance (3) within the model. Lines on plans, like in the screenshot above are often the best choice for this. Make sure to choose a long distance, to reduce imprecision errors.
Now click the other end (4) of the chosen distance. Envelop will now ask you for the distance that line should have and scale the complete model accordingly.

You can abort the operation in the window in which Envelop asks you to input the distance or before that by pressing ‘Escape’.

2.6.2 Orientation Tool

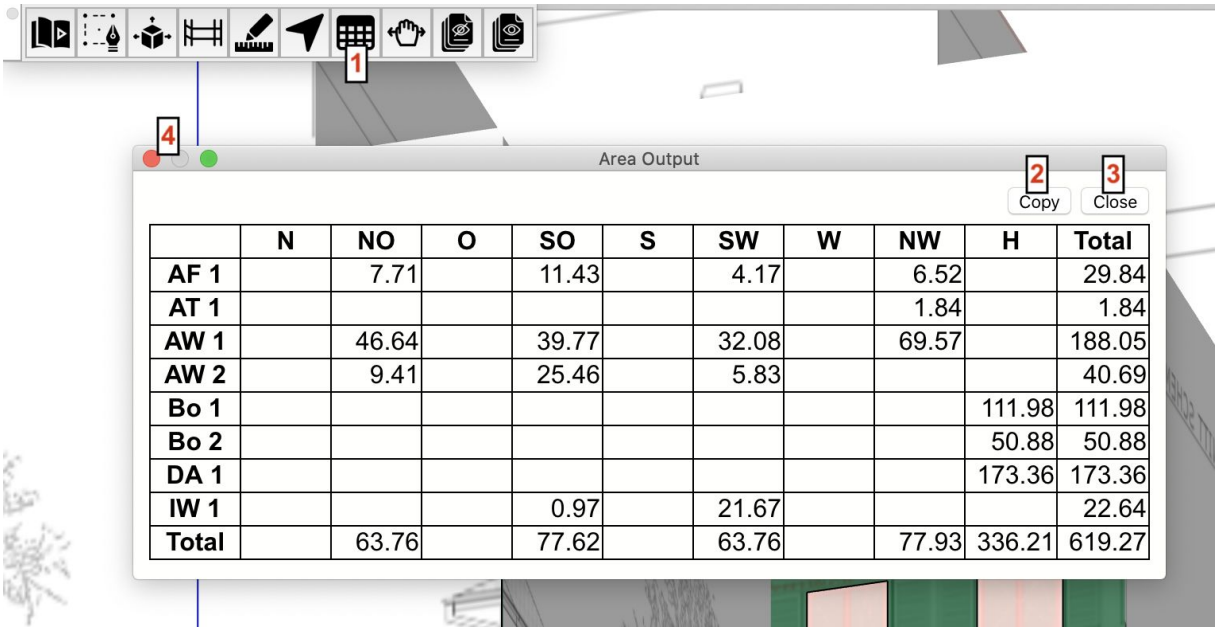
By default, north is in the direction of the positive green Sketchup axis. This means up on the floor plans is north. you may wish to correct this default before generating the area totals.



To start the ‘Orientation Tool’, press the ‘Orientation Tool’ button (1) in the Envelop toolbar. Alternatively, in Sketchup select Extensions > Envelop > Orientation Tool.
Like all other tools, there is a short description of how to work with the tool in the Sketchup status bar (2) in the lower left corner of the main window.
After activating the tool, click a point in the model (3) to open the compass as seen in the screenshot above.
Then, rotate your cursor, until the compass points to the desired direction. The compass will snap to the lines shown around the circle. To confirm the current orientation of the compass, click (4) again. The corrected north will now be used in the ‘Plan Edit’ window, as well as in the ‘Area Output’ window.

2.6.3 Area Output Window

After having modeled the building, assigned the materials, corrected the orientation and scaled the model, you are now ready to generate the surface area totals.



	N	NO	O	SO	S	SW	W	NW	H	Total
AF 1		7.71		11.43		4.17		6.52		29.84
AT 1								1.84		1.84
AW 1		46.64		39.77		32.08		69.57		188.05
AW 2		9.41		25.46		5.83				40.69
Bo 1									111.98	111.98
Bo 2									50.88	50.88
DA 1									173.36	173.36
IW 1				0.97		21.67				22.64
Total		63.76		77.62		63.76		77.93	336.21	619.27

Open the ‘Area Output’ window by pressing the ‘Area Output’ button in the Envelop toolbar. Alternatively, in Sketchup select Extensions > Envelop > Area Output. These buttons are only active if you have already modeled a house. Envelop then checks, if there are any surfaces with the default material left. If so, you have the option to abort or ignore the warning and proceed. If also checks if you have scaled the model as described in chapter 2.6.1. If not, it warns you and starts the ‘Scale Tool’.
In the ‘Area Output’ window you can see the surface area totals, by facing and material, as well as totals for each row and column and the overall total.
To copy the values, simply press the ‘Copy’ button (2) on the top right. Alternatively, you can select all the values like any text and manually press ‘Ctrl’ + ‘C’. Finally, you can also copy the values by pressing ‘C’. The values can be correctly inserted into Excel, for example.
To close the window again, either use the ‘Close’ button (3) or the window handles provided by the operating system (4). You can also press the ‘Escape’ key.

2.7 Advanced Modeling

In this chapter you can learn how to recover from mistakes and unexpected exceptions. You should not need these instructions during regular usage of Envelop. However, they might be helpful if you are trying to model a building with complications not foreseen during the development of Envelop.

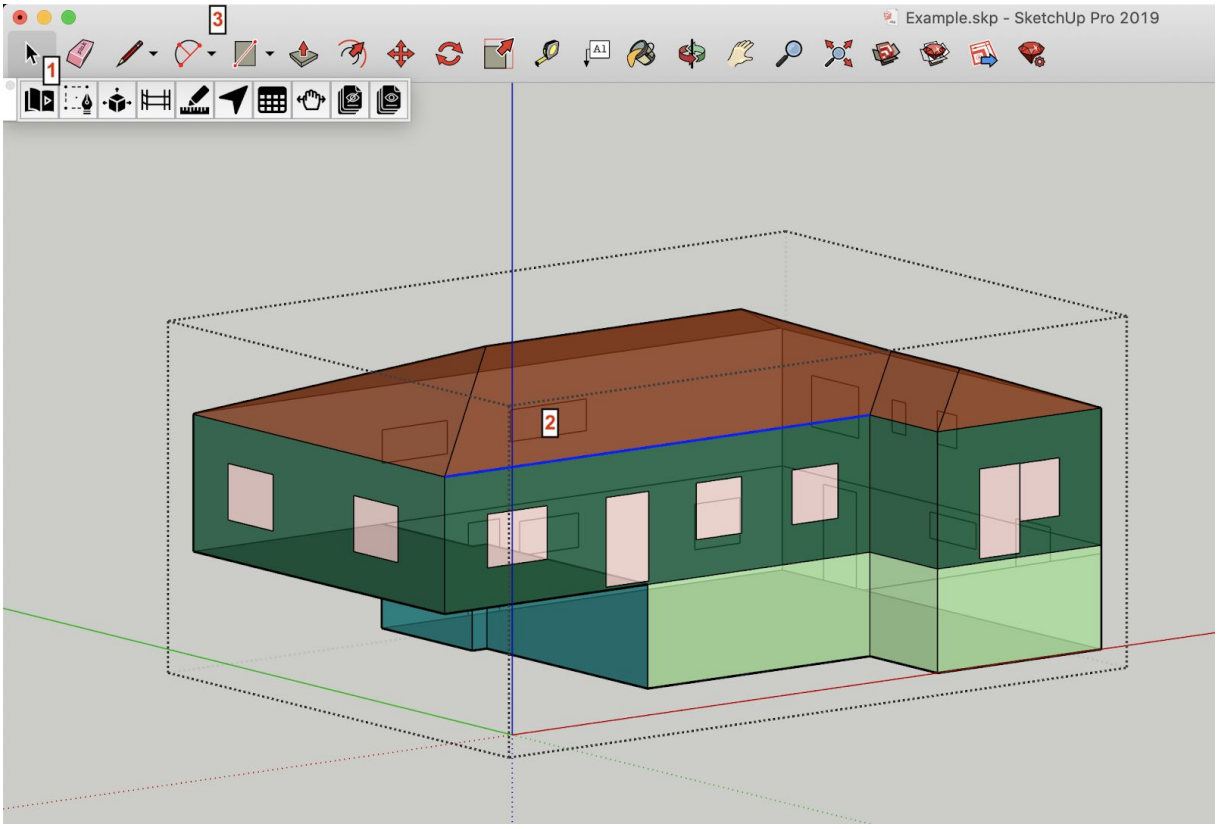
2.7.1 Recovering from Mistakes and Exceptions

There are five ways you can try to recover from mistakes and exceptions. They are listed from least to most disruptive.

- Undo Operation
  If an error occurs or you've made a mistake, the simplest way to fix it is to undo recent operations, either by pressing 'Ctrl' + 'Z' or by selecting Edit > Undo. Then, try to perform the operation again, but with slight variations, such as from a different camera angle or a slightly different position.
- Reload Extension
  If an error occurs or the Envelope behaves in unexpected ways, you can try to reload the Envelope extension without restarting Sketchup. To do so, select in Sketchup Extensions > Envelop > Reload.
- Restart Sketchup
  If the errors persist, try a more thorough reload of both Sketchup and Envelop by closing Sketchup and opening it again.
- Modeling outside of Envelop
  If you spot errors in the model but are unable to fix them using the tools provided by Envelop, carefully try to fix them using the techniques described in the following chapter 2.7.2.
- New Model
  If you are unable to recover from a mistake or unexpected behaviour, you might have to close Sketchup, delete the save file of the model and start a new one.

2.7.2 Modeling outside of Envelop

To recover from mistakes or to model buildings with complexities that cannot be realised using the tools provided by Envelop, it might be necessary to use the modeling tools from Sketchup.



Envelop manages the building within a Sketchup group. If you want to use Sketchup tools to edit that group, you have to activate the selection tool by pressing the corresponding button (1) in the Sketchup toolbar. Alternatively, in Sketchup select Tools > Select.
Now double click (2) the building. The first click selects the group. You can see that you have the group selected by a blue outline around the whole building. The second click opens the group for editing. You can confirm that the group is open by a black dotted outline around the whole group, as shown in the above screenshot.
You can now use the tools provided by Sketchup (3). In doing so you have to make sure to leave the building model in an airtight state. This means, there cannot be any holes in the building volume, and the building volume must be one continuous volume.
To learn more about how to use the tools provided by Sketchup, visit the Help Center.

3. Development

This chapter is only relevant for developers interested in continuing the development of Sketchup.

3.1 Technical Manual

To learn more about how Envelop works study the project report in the repository with the following link: IIT22: Modelling Building Envelopes Report.pdf. A significant part of this report concerns the technical details of a Sketchup extension in general and even more so specifically the details concerning Envelop.

3.2 Development Environment

In this chapter, key information regarding the development environment used to develop Sketchup is used.

8.5.2 Inclusion in Sketchup

The repository should not be cloned into the extension directory of Sketchup. Instead, you should clone the repository onto your computer and manually create a Ruby file (*.rb) in the extension directory. Within that file, place two lines. Firstly, extend the load path with the '/envelop' directory in the repository like so: '$LOAD_PATH << '[absolute path to /envelop]''. Secondly, you must load the 'envelop.rb' file like so: 'require 'envelop.rb''

8.5.1 Debugging

The easiest way to debug the extension is to write to the Sketchup ruby console by calling 'puts' or 'warn'. A more elaborate way is to use breakpoints from your prefered IDE. Debugging from within an IDE can be set up by following the instruction on https://github.com/SketchUp/sketchup-ruby-debugger.

8.5.2 Hot Reloading

To reload the Envelop extension during development without having to restart Sketchup, you can, in Sketchup, select Extensions > Envelop > Reload. Some changes, such as changes to the toolbar, require a complete restart of Sketchup though. Also consider, adding a reload button to the Envelop toolbar. To do so, simply uncomment lines 218 and 222 in the following file in the repository: '/envelop/envelop/ui/toolbar/toolbar.rb'. Make sure to remove that button from the toolbar again before releasing an update to Envelop.

8.5.3 Ruby Console

To read logging statements and interact with the Envelop extension while it is running, open the Ruby console built into Sketchup. To do so, in Sketchup select Window > Ruby Console.

8.5.4 Issue Tracking

Githubs built in issue tracker was used to gather and manage issues, including bugs, refinements and new features. Working on small issues is a very good way to familiarize yourself with the codebase. Finally, it is strongly encouraged to continue to enter new bugs and desired improvements there: Issues.

8.5.5 Git Flow

There are no strict git flow rules defined on this project. As long as the number of developers stays small, they are encouraged to commit often in order to reduce merge conflicts. Short lived feature branches can be used locally to reduce the risk of unwieldy merge conflicts further.

3.3 Repository

The open source repository can be found at the following address: IP6_ModellingBuildingEnvelopes.