

Manual tool parametric design

BRICKINATOR.®

The screenshot shows the BRICKINATOR BY STACK3D software interface. At the top, there is a blue header bar with the title and window controls. Below the header, there is a control panel with a 'Push settings' button, a 'Choose Preset' dropdown menu set to 'Design 1', a 'Save Settings' button, a 'Restore Settings' button, a floppy disk icon, the 'STACK3D' logo, and a 'Question?' button. A warning message states: 'WARNING! When grasshopper is closed, saved presets will be deleted. Save them as separate file in the end.' Below this is a 'Choose Tool:' dropdown menu set to 'Tool 1: Point attractors in surface with sinus remap'. A horizontal navigation bar contains tabs for 'General Settings', 'Tool 1', 'Tool 2', 'Tool 3', 'Tool 4', 'Tool 5', 'Tool 6', 'Tool 7', 'Tool 8', 'Rhino.Inside', and 'Revit'. The main content area is divided into two panels: 'Wall settings' and 'Brick settings'. The 'Wall settings' panel includes input fields for Wall length (5000), Wall height (4000), Max. depth of the wall (400), Max. rotation of the wall (45), Horizontal joint (4), and Vertical joint (20). It also features a 'Type of bond' section with radio buttons for Stretcher bond (selected), Stacked bond, Raking stretcher bond (standing tooth), Raking stretcher bond (descending left), and Raking stretcher bond (descending right). The 'Brick settings' panel includes input fields for Bricks: Brick length (210), Brick width (100), and Brick height (50). It also has input fields for Half Bricks: Brick length (100), Brick width (100), and Brick height (50). A note at the bottom of the brick settings panel states: 'Based on the values given, the length of the halfbricks should be: 95 mm'.

Half bricks in the beginning of the wall

Option 1 and 2 changes the layers where the half bricks in the beginning of the wall are placed

Half bricks in the end of the wall

Option 1 and 2 changes the layers where the half bricks in the end of the wall are placed

To use this tool in Rhino/Grasshopper, no extra plug-in is required. If you want Grasshopper to be connected with Revit, you will have to download the plug-in: "Rhino.Inside.Revit". This can be done with the URL below.

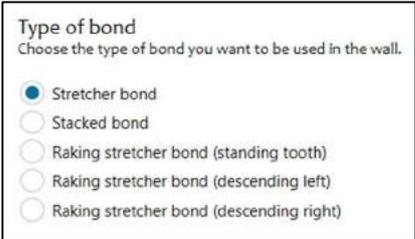
<https://www.rhino3d.com/inside/revit/1.0/>

Algemeen: Invullen van waarden

In the GUI, two different types of input blocks are mainly used:

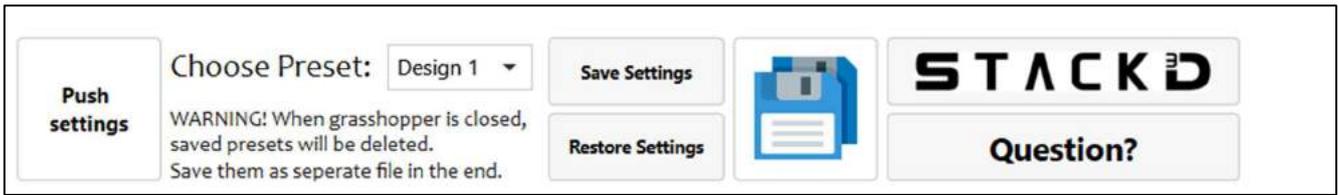
- Value box: 

Fill in the box with the desired value. This value is then passed to the script by pressing the "push settings" button at the top left of the screen.

- Radio buttons: 

With radio buttons you can see all the options and you have to check the box of the desired option.

The use of the header



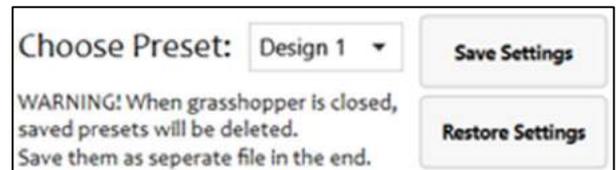
Above is the header displayed.

First of all there is the "Push settings" button. Once this is pushed the values of the elements in the settings will be pushed to the Rhino file. This means that changes will only take effect once this button is pressed. (this is not necessary when selecting options with radio buttons and entering images, that happens automatically).



Once the file is started for the first time, the button should also be pushed once to generate the wall.

In addition, there is a built-in save/restore mechanism. Temporary designs can be saved here to be recalled later. Once a wall is to your liking, set it to the desired save slot (Design 1 to 10) and press "Save Settings". Later, a different design can be saved to another slot. If you want to quickly compare different designs, you can select, for example, "design 1" and then press the "Restore Settings" button, which will automatically fill in all settings saved for wall design 1.



Note! These saved designs are temporary and only available when using grasshopper. These saved designs are not saved within the file itself and must be saved as separate files. When restarting Rhino/grasshopper, all previous saved designs will be deleted and the file starts again with an empty database.

Then there is the Save .gh file as... (visible as the save file logo) button. By pressing this button, the grasshopper file can be saved. Here you can immediately change the name to the desired name. So you don't have to go to the grasshopper file itself anymore.



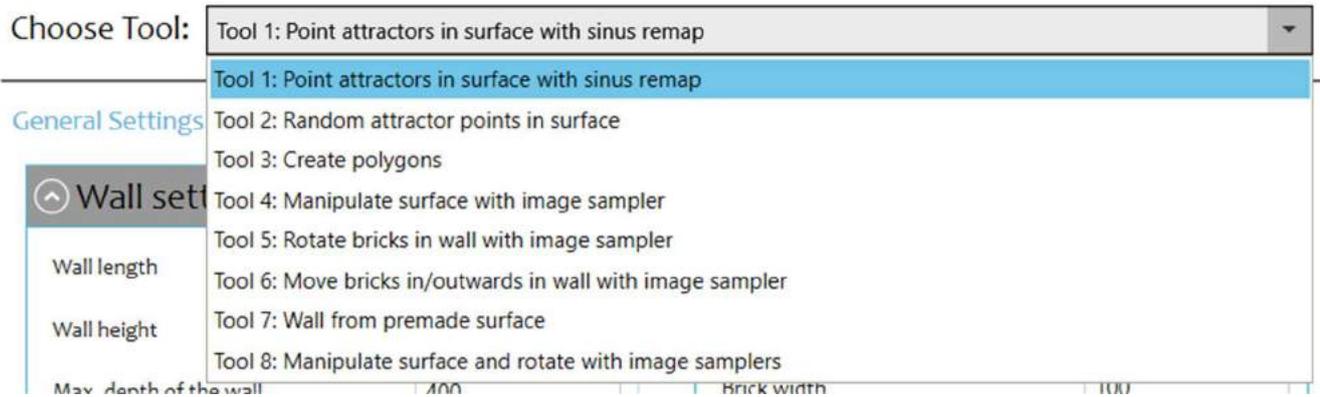
Finally, there are the two buttons with the Stack3D logo and the text "Question?". By pressing the Stack3D logo, the Stack3d website (www.stack3d.xyz) will open in your web browser. By pressing the "Question?" button, the contact form on the Stack3D website specifically for questions about the plug-in will open.



Step 1: Choose which tool you want to use

Choose below which of the following tools you want to use:

- Tool 1: Point attractors in surface with sinus remap
- Tool 2: Random attractor points in surface
- Tool 3: Create polygons
- Tool 4: Manipulate surface with image sampler
- Tool 5: Rotate bricks in wall with image sampler
- Tool 6: Move bricks in/outwards in wall with image sampler
- Tool 7: Wall from premade surface
- Tool 8: Manipulate surface and rotate with image samplers



Step 2: Adjust "General settings"

The settings below define the rough contours of the wall

Wall settings

Wall length	<input type="text" value="5000"/>
Wall height	<input type="text" value="4000"/>
Max. depth of the wall	<input type="text" value="400"/>
Max. rotation of the wall	<input type="text" value="45"/>
Horizontal joint	<input type="text" value="4"/>
Vertical joint	<input type="text" value="20"/>

Type of bond
Choose the type of bond you want to be used in the wall.

- Stretcher bond
- Stacked bond
- Raking stretcher bond (standing tooth)
- Raking stretcher bond (descending left)
- Raking stretcher bond (descending right)

Maximum length of the wall in mm.

Maximum height of the wall in mm.

Maximum depth of the wall in mm.

Maximum rotation of the bricks in the wall in degrees.

Height horizontal joint in mm.

Width vertical joint in mm.

Here you can choose the bond used in the wall. The options are:

- Stretcher bond
- Stacked bond
- Raking stretcher bond (standing tooth)
- Raking stretcher bond (descending left)
- Raking stretcher bond (descending right)

Brick settings

Bricks

Brick length	<input type="text" value="210"/>
Brick width	<input type="text" value="100"/>
Brick height	<input type="text" value="50"/>

Half Bricks

Brick length	<input type="text" value="100"/>
Brick width	<input type="text" value="100"/>
Brick height	<input type="text" value="50"/>

Based on the values given,
the length of the halfbricks should be: 95 mm

Length normal bricks in mm.

Width normal bricks in mm.

Height normal bricks in mm.

Length half bricks in mm.

Width half bricks in mm.

Height half bricks in mm.

At the bottom is a piece with "ideal length half brick". This window shows what the ideal length of a half brick in mm would be. This is based on the following formula:

$$1 \times \text{length brick} = 2 \times \text{width brick} + \text{vertical joint.}$$

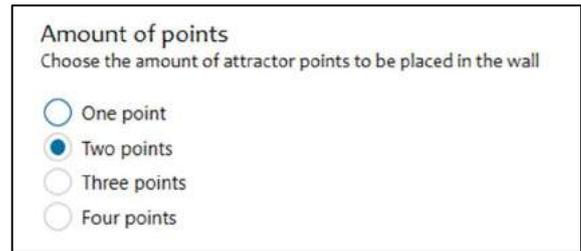
<p>Half bricks in the beginning of the wall</p> <p>Option 1 and 2 changes the layers where the half bricks in the beginning of the wall are placed</p> <p><input checked="" type="radio"/> Option 1</p> <p><input type="radio"/> Option 2</p>	<p>Half bricks in the end of the wall</p> <p>Option 1 and 2 changes the layers where the half bricks in the end of the wall are placed</p> <p><input type="radio"/> Option 1</p> <p><input checked="" type="radio"/> Option 2</p>
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This setting determines which layer the half stones must be modelled in at the beginning and end of the wall. By changing the option here, the layer in which the half stones are modelled changes by 1 layer. The end is determined by the length of the wall.

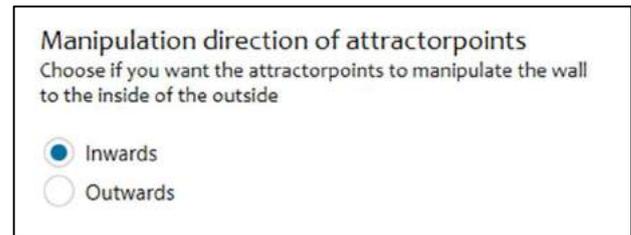
Tool 1: Pointattractors in surface with sinus remap

This tool moves bricks within the wall according to the chosen attractorpoints. These can be set in the settings for tool 1. The first thing to declare are the amount of attractorpoints. The options are:

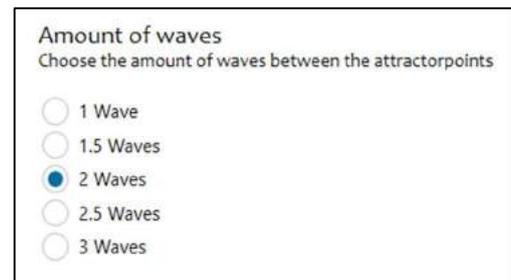
- One point
- Two points
- Three points
- Four points



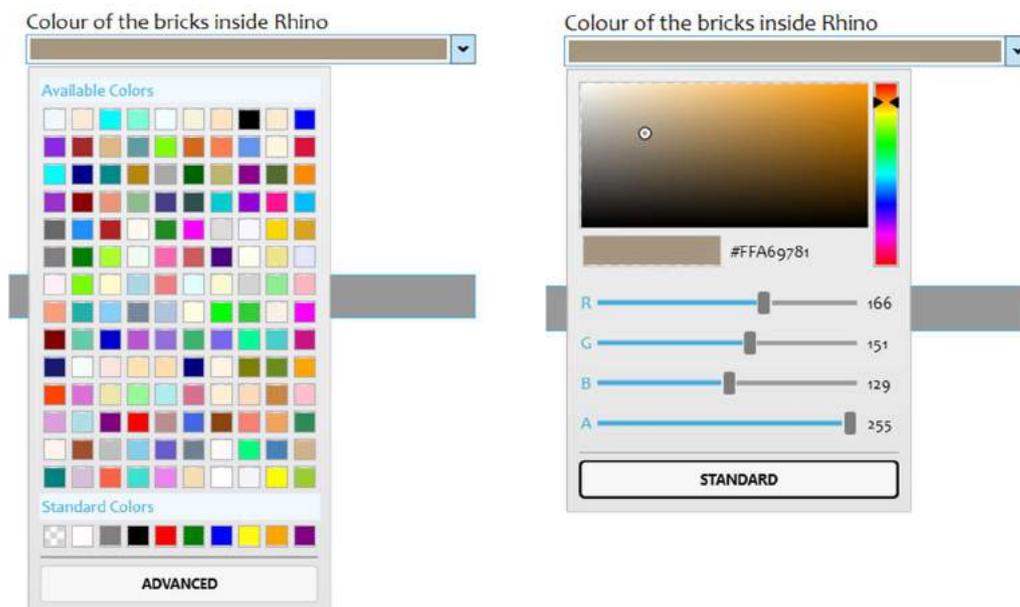
Afterwards you must decide whether you want these points to come towards you or be moved away from you. This can be done by choosing the options "inwards" and "outwards" at the following setting:



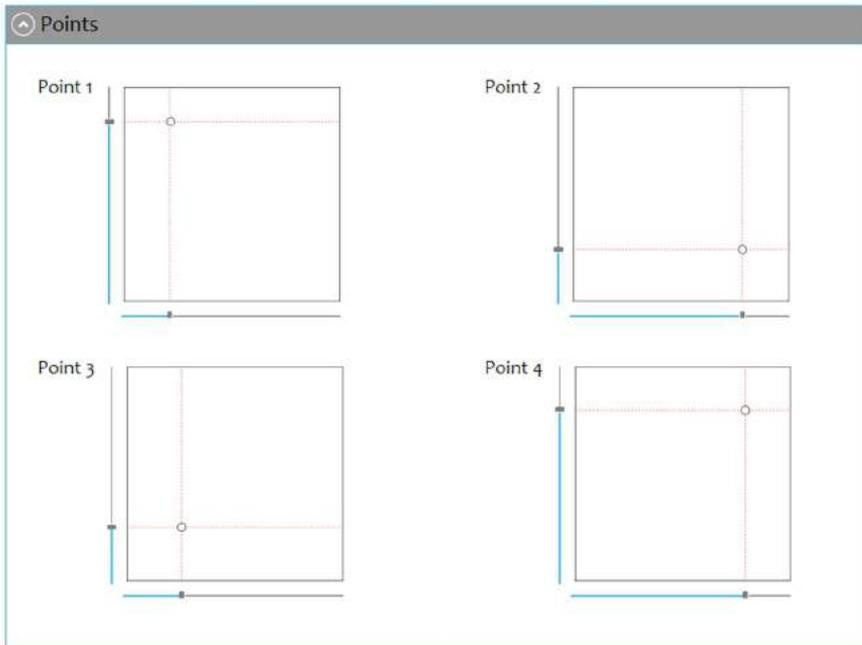
Then it must be determined how the distance from points to these attractor points should be remapped. For this there are 5 options which all create a different number of waves between the points.



Then choose in which colour the stones should be displayed in Rhino. You have the choice from a standard menu (left) or an advanced menu (right). By clicking "advanced" in the left picture, the advanced menu will open. In the same way you will go back to the standard menu.



Finally, we need to set the attractor points. This can be done with the 4 graphs located at the bottom of the group "Points":



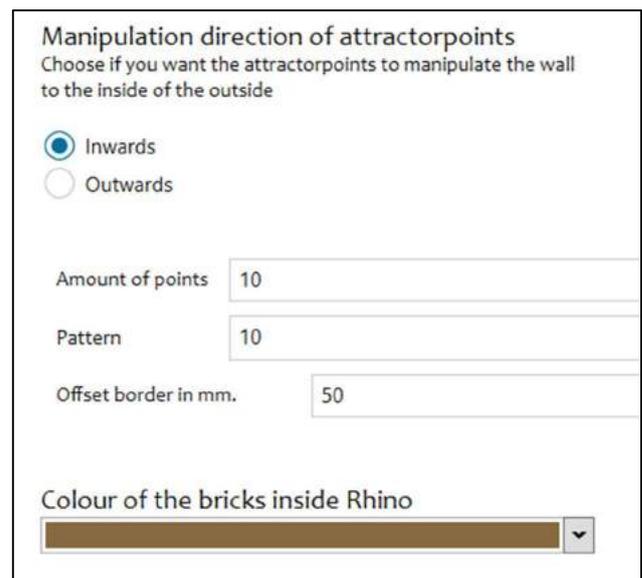
The coordinate systems represent the wall. Then you can drag the point to the desired position in the wall. Once you drag a ball, two values appear above the point (eg 0.19, 0.84). These stand for the coordinates within the [0-1] coordinate system. These can also be translated into 19% of the length and 84% of the height of the wall.

Tool 2: Random attractorpoints in surface

With this tool, random points are placed in the plane. The number of points can be determined, how big the border should be where no points may be located (measured from the outer edges of the wall) and which pattern should be used. This pattern is already pre-programmed in grasshopper and is purely a way to get a different output of the set number of random points.

The direction of the points (inwards or outwards) can also be determined.

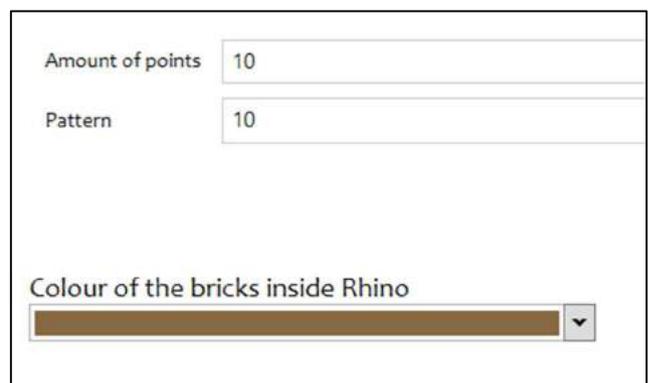
Finally, the colour of the wall in Rhino can be determined again.



Tool 3: Create polygons

With this tool, triangular planes are created on the wall. The only settings you can adjust are the amount of planes/points and, optionally, a different pattern with this set amount.

Finally, the colour of the wall can be determined in Rhino.

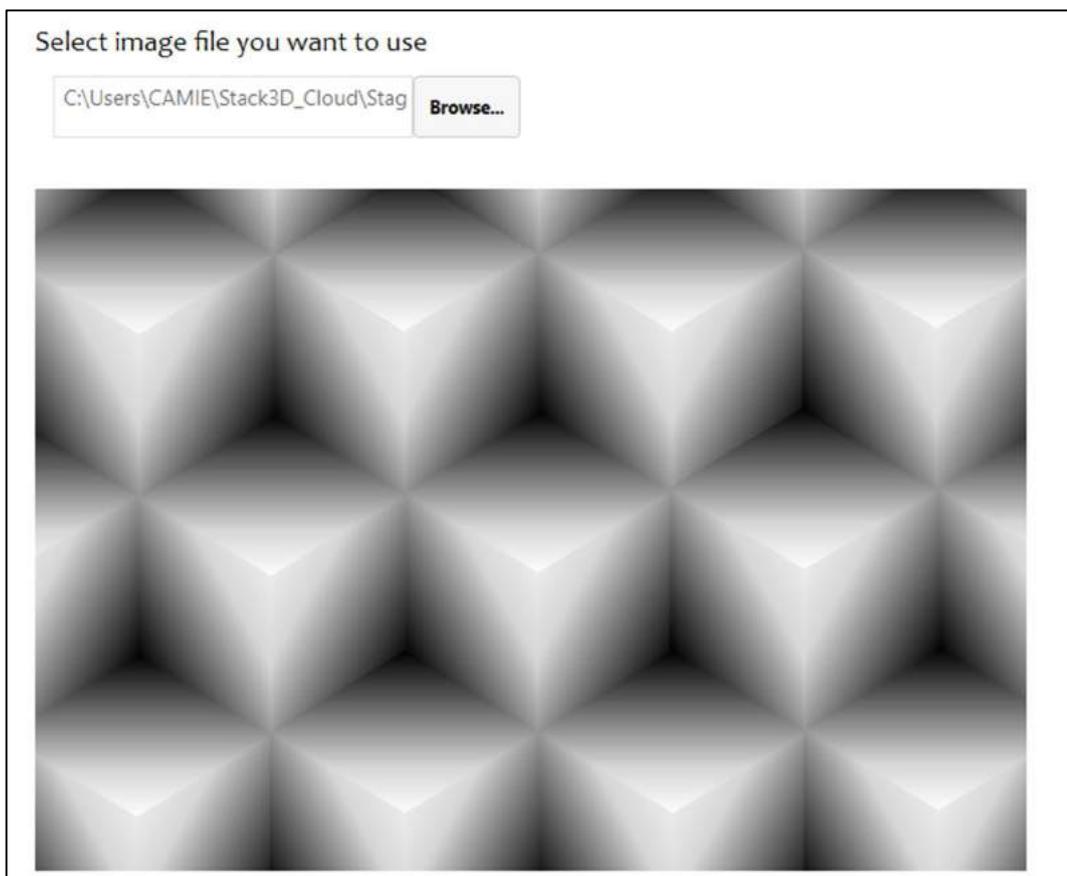
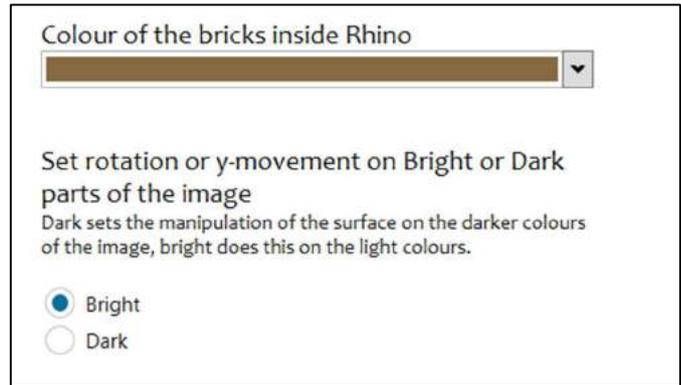


Tool 4: Manipulate surface with image sampler

With this tool, based on the colours of an image, it is determined whether the stones should be moved and if so, how many.

In the setting of tool 4, you can adjust the colour of the stones in Rhino and say whether the maximum displacement should be based on the light or dark colours in the image.

Then you can select the image by clicking on "Browse ..." and uploading an image there. This image is then visible under the "Browse ..." button. This is shown below.



Tool 5: Rotate bricks in wall with image sampler

This tool determines, based on the colours/shades of a picture, whether the stones have to rotate in a straight plane and if so, how many degrees.

With the setting of tool 5, you can say whether the maximum rotation should be based on the light or dark colours in the picture, in which direction the stones should rotate and what the domain of the rotation should be. With $-0.5x$ to $0.5x$, the stones are rotated in both directions. At 0 to x , they are only rotated in one direction. In addition, the value of "x" is displayed. This is the entered value of the maximum rotation for the General Settings.

In addition, it is possible to use multiple brick types/brick colors with tool 5. This can be set by setting the radio buttons to the desired number of types/colors. Then you have to specify the threshold values between the different types/colors. With one color, all boxes must be set to 100. This is how the domain of type 1 is [0-100]. If two types/colors are chosen, the threshold value must be filled in in the first text box. For example, if 80 is entered here, this means that the stones with a rotation value below 80% of the maximum rotation value will get type 1. And the stones with a rotation value above 80% of the maximum will get stone type 2. The range of values between which a value must be chosen is also indicated in brackets. If 50% is entered in box 1, box 2 will be (50-100). And the same applies to 3 and 4 brick types/brick colors.

Rotation Settings

Set rotation on Bright or Dark parts of the image
Dark sets the manipulation of the surface on the darker colours of the image, bright does this on the light colours.

Bright
 Dark

Set the direction of rotation

Clockwise
 Counter clockwise

Set the domain of the rotation
With domain $-0.5x$ to $0.5x$ the bricks will rotate to both sides

domain [0 to x]
 domain $[-0.5x$ to $0.5x]$

In this case $x = 45$ degrees.
This setting can be changed in "General Settings"

Colour settings

Amount of bricktypes (brickcolours)

One bricktype
 Two bricktypes
 Three bricktypes
 Four bricktypes

Bricktype one (colour)

Splitting domain (0-100%) at following %:

Bricktype two (colour)

Splitting domain (100-100%) at following %:

Bricktype three (colour)

Splitting domain (100-100%) at following %:

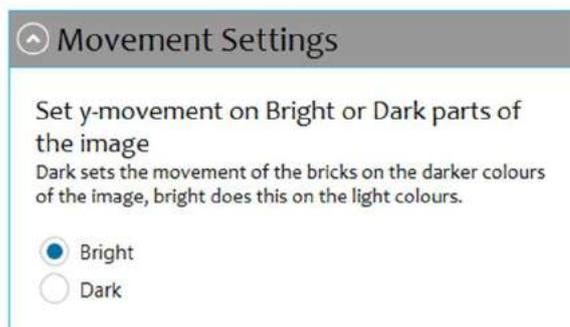
Bricktype four (colour)

Choosing a picture works the same as with Tool 4. Here too, the chosen picture is displayed below the input field as soon as it is loaded.

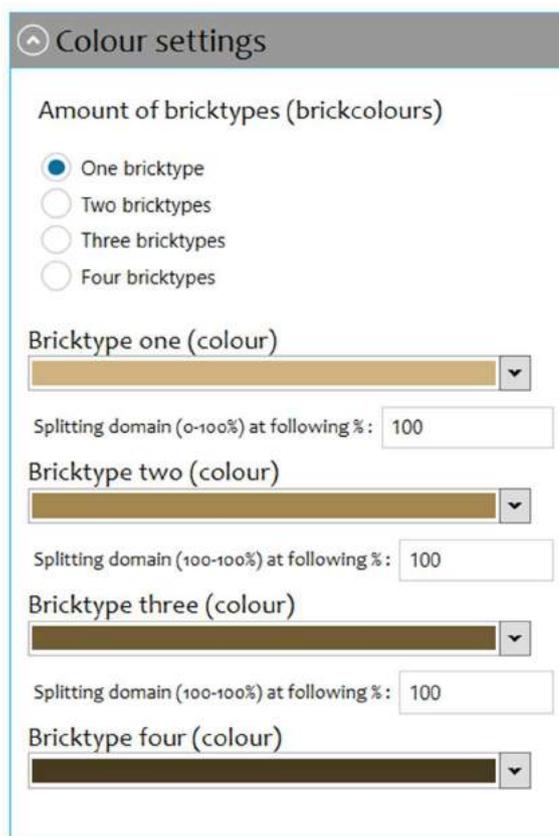
Tool 6: Move bricks in/outwards in wall with image sampler

With this tool, it is determined based on the colours/shades of a picture whether the stones should come to the front (or back) in a straight line and if so, how many mm.

For setting of tool 6, you can say whether the maximum displacement should be based on the light or dark colors in the picture.



In addition, it is possible to use multiple brick types/brick colors with tool 6. This can be set by setting the radio buttons to the desired number of types/colors. Then you have to specify the threshold values between the different types/colors. With one color, all boxes must be set to 100. This is how the domain of type 1 is [0-100]. If two types/colors are chosen, the threshold value must be filled in in the first text box. For example, if 80 is entered here, this means that the stones with a rotation value below 80% of the maximum rotation value will get type 1. And the stones with a rotation value above 80% of the maximum will get stone type 2. The range of values between which a value must be chosen is also indicated in brackets. If 50% is entered in box 1, box 2 will be (50-100). And the same applies to 3 and 4 brick types/brick colors.



Choosing a picture works the same as with Tool 4. Here too, the chosen picture is displayed below the input field as soon as it is loaded.

Tool 7: Wall from premade surface

With this tool it is possible to load a previously made surface as a façade form. This surface must then be in the 3dm file of Rhino. The grasshopper instance must then be opened on that file and then the surface can be loaded at tool 7. You do this by clicking the "Surface" button and then selecting this surface in rhino.



Note! This tool will place the same amount of stones on each row. So for certain shapes where the number of stones per row must differ, this tool will not work properly.

Tool 8: Manipulate surface and rotate with image samplers

With this tool, tools 4 and 5 are actually combined. First, a façade with depth is generated from an image. Then certain stones are rotated according to the second image. With this you can create a nice edge with depth in the first image and leave a black area in the middle. With the black area he does nothing and so it will be a straight wall. Then with the second image sampler, something of a symbol or text can be rotated on this area.

With the setting of tool 8, you can say whether the maximum rotation should be based on the light or dark colours in the picture, in which direction the stones should rotate and what the domain of the rotation should be. With $-0.5x$ to $0.5x$, the stones are rotated in both directions. At 0 to x , they are only rotated in one direction. In addition, the value of "x" is displayed. This is the entered value of the maximum rotation for the General Settings.

In addition, it is possible to use multiple brick types/brick colors with tool 8. This can be set by setting the radio buttons to the desired number of types/colors. Then you have to specify the threshold values between the different types/colors. With one color, all boxes must be set to 100. This is how the domain of type 1 is $[0-100]$. If two types/colors are chosen, the threshold value must be filled in in the first text box. For example, if 80 is entered here, this means that the stones with a rotation value below 80% of the maximum rotation value will get type 1. And the stones with a rotation value above 80% of the maximum will get stone type 2. The range of values between which a value must be chosen is also indicated in brackets. If 50% is entered in box 1, box 2 will be $(50-100)$. And the same applies to 3 and 4 brick types/brick colors.

Choosing an image works the same as with Tool 4. The chosen image is also displayed below the input field as soon as it is loaded. Note that this tool requires the input of two images. One image for creating the shape and the other image for rotating the stones.

Rotation Settings

Set rotation on Bright or Dark parts of the image
Dark sets the manipulation of the surface on the darker colours of the image, bright does this on the light colours.

Bright
 Dark

Set the direction of rotation

Clockwise
 Counter clockwise

Set the domain of the rotation
With domain $-0.5x$ to $0.5x$ the bricks will rotate to both sides

domain $[0$ to $x]$
 domain $[-0.5x$ to $0.5x]$

In this case $x = 45$ degrees.
This setting can be changed in "General Settings"

Colour settings

Amount of bricktypes (brickcolours)

One bricktype
 Two bricktypes
 Three bricktypes
 Four bricktypes

Bricktype one (colour)
[Color swatch]

Splitting domain (0-100%) at following %: 100

Bricktype two (colour)
[Color swatch]

Splitting domain (100-100%) at following %: 100

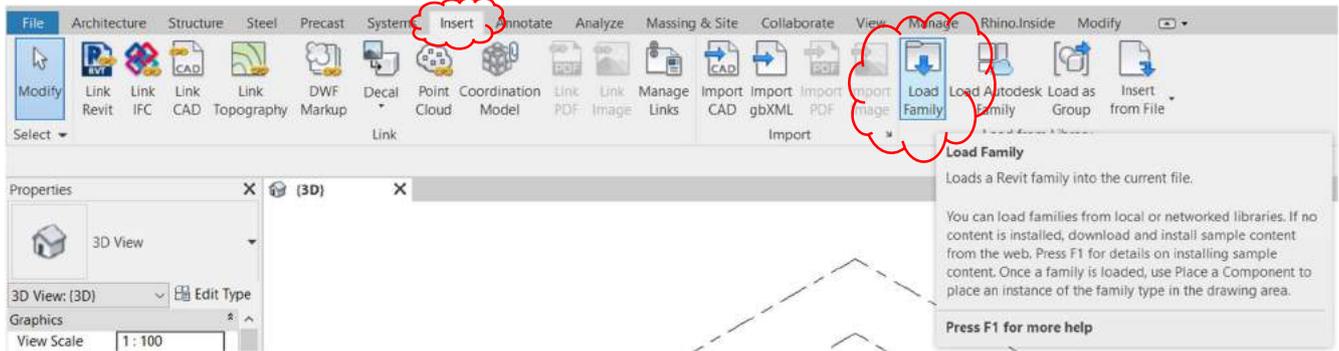
Bricktype three (colour)
[Color swatch]

Splitting domain (100-100%) at following %: 100

Bricktype four (colour)
[Color swatch]

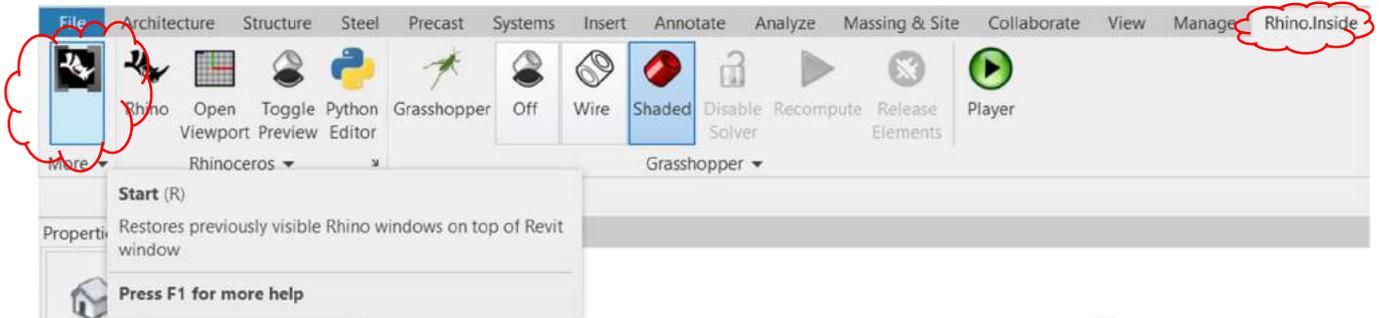
Rhino inside Revit

To get the geometry within Revit with the help of families, you first need to insert that familie within your Revit project. A parametric family with the placement point in the middle of the bottom face of the brrick is desired. This way you can also make multiple types within the same family such as half bricks etc. These families can be provided by Stack3D! When you have a familie, you need to insert it into the Revit file (Preferable an empty document). Inserting the family can be done by seleting the insert tab and choose “Load Family”. Once the wall is finished you can group all the bricks and copy paste it into the project of the existing building.



Make sure the family has a type for normal and half bricks.

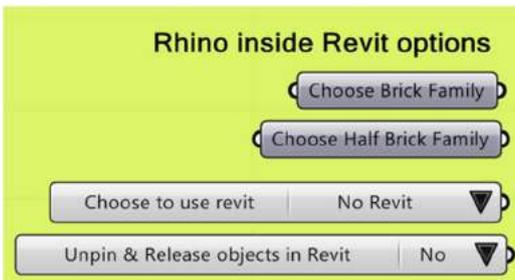
Then click “Rhino.Inside” on top in the ribbonbar and start the application.



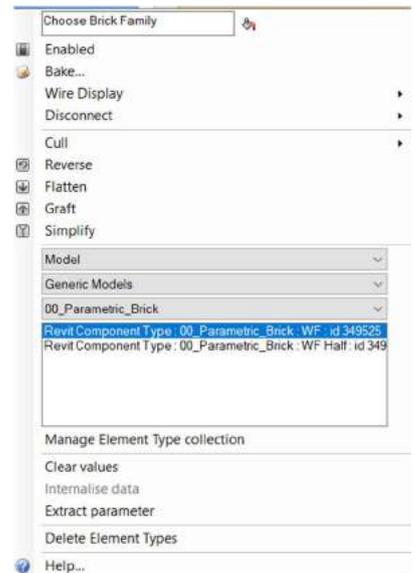
After that, you have the option to click on Rhino and Grasshopper. Basically, you only need grasshopper. But if you want to check your designs in between, it is handy to also set Rhino next to it. Then you have all the functionalities that you would normally have if you were designing from Rhino/grasshopper.

Once grasshopper is opened, you can open the tool and everything will work as described above.

To get the geometry inside Revit, there is a small section programmed at the bottom of the tool:



The top 2 blocks represent the family/type of the bricks that needs to be placed. One for the normal bricks and one for the half bricks. This can be done by right clicking the block and selecting the correct type within the correct map.



The families created by Stack3D will all be generic models. Within this map they should be easy to find.

As soon as the settings above are made correctly, we can push the geometry to Revit. When “Choose to use Revit” goes from “No Revit” to “Build within Revit”, the script will start building the wall within Revit. All elements are pinned and connected to the Grasshopper script. As soon as the wall changes, the elements within Revit will also change. To unpin and disconnect the wall from Grasshopper, you must change the last option bar to yes. This can be done before and after the wall is rebuild within Revit. But keep in mind once the elements are unpinned once. You have to remove them manually if you would like to build another wall.