3D print preparation

Prepare your model for 3d print

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Disclaimer: The models used in this guide are merely examples to demonstrate the necessary steps for 3D printing. This does not mean that your model will be accepted to our 3D print service if your model looks similar to the one appeared in the examples. Please refer to the decision maker section of this guide to see detailed description.

The latest up to date requirements for 3Dpirnting is also published on the booking system.

Q: What can I do or not do?

A:

3D printing can be used for both design process as well as for presentation model. However, in order to have your model printed, You will need to modify your model to make it suitable for 3D print. This is because that 3D printing can only print solid object and quite often, an architecture model build in popular software such as Sketchup is made up of surfaces with no thickness. In addition, your model cannot have any cavity inside as this will cause problems with the print and cause models to fail.

In theory, you can print 3d models at all stages of design development. Commercially people have been using 3D printing to present models such as facade exterior model, section, plan, site and concept iterations.

However, it is important to consider that 3D printings are expensive and time consuming. In addition, our facility has limited capacity so it will be impossible to print all your models and it is recommended to utilize other model making methods for your projects and only use our 3D printing service if your model cannot be produced by other fabrication methods.

Q: When to use 3D printer?

A:

Before consider 3d Printing, you need to consider other modeling methods for your projects such as lasercut and making models by hand.

In general, it is not recommended to use our 3D printing service if you model can be produced using flat pack materials. Here are a list of alternative solutions that you should consider for your model:

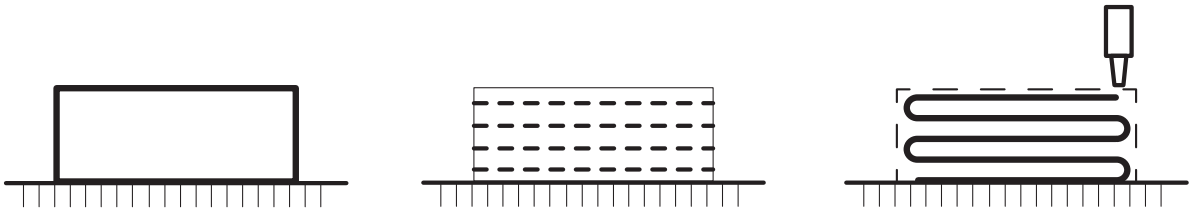
- For site model, use lasercut to model the contour lines to capture landscapes and apply 2D line drawings on building facades to represent building contexts.
- If for intricate site models , consider using paper or cards with less GSM to make a net model.
- If your model has a curvy surface, consider making it by piecing together precise cut paper or light-weight cards, like piecing together a puzzle.

There will be examples about the alternative methods in the additional resources section of this guide.

If you do think that your model can only be fabricated with 3D printing, carefully consider the scale and size of your model and follow this guide to prepare your model file before inquiring for our 3D printing service.

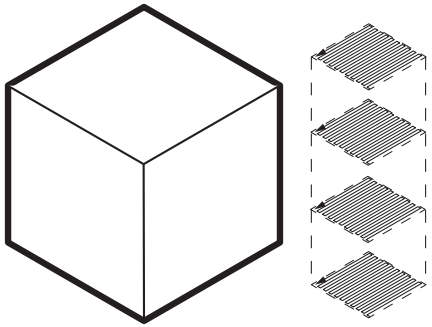
Theory and model requirement

To 3D print an object, the 3D model will be sliced by printing software, which will then be recognisable for the 3D printer. In order to make this possible, you need to make sure the model is a solid.



Model **Slicing** **Printing**

Solid



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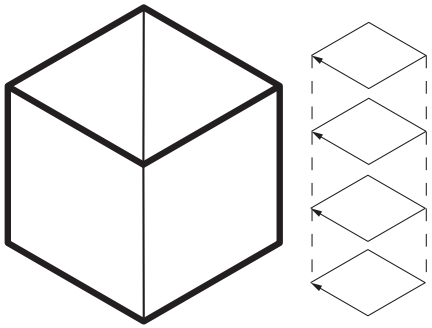
A solid object can be sliced layer by layer .

Non-solid



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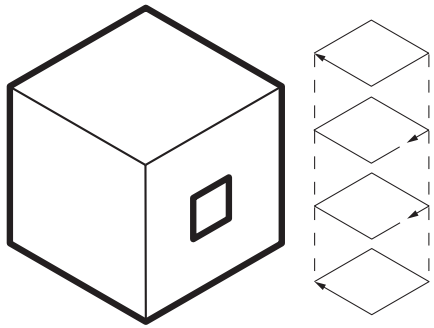
A non-solid object cannot be sliced properly because there is no geometric data inside to generate slicing.

Non-watertight



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A non-watertight object will be recognized as a solid and therefore will not be sliced properly.

In summary, in order to 3D print a model, you need to make sure your model is a solid object that is watertight.

Scaling down/ Divide up

The facility has a variety of 3d printers with different printing size please refer to the booking system to see the detailed size requirement.

Generally speaking FDM style 3D printer is larger than SLA resin type printer.

- FDM(fused deposition modeling) uses hot temperature to melt plastic.
- SLA(Stereolithography) uses light to cure resin

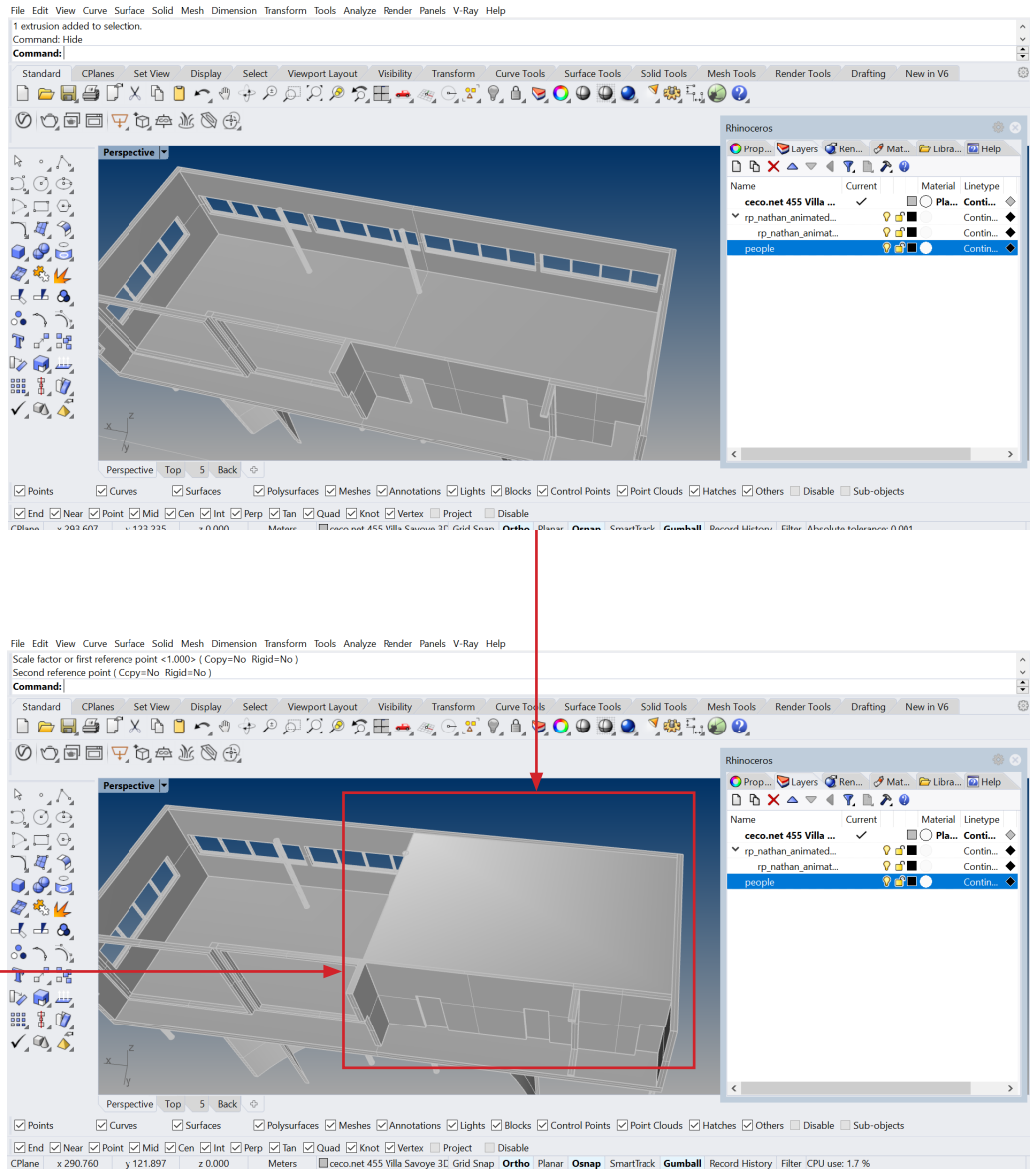
You need to make sure your model will fit into the maximum print size. Try different scales to find out the most suitable scales. In Rhino, use “scale” command and here are some common scales to use:

- 1:1000 use 0.001
- 1:500 use 0.002
- 1:200 use 0.005
- 1:100 use 0.01
- 1:50 use 0.02
- 1:20 use 0.05

You can also divide up your model to smaller pieces if scaling doesn't work

Remove unnecessary elements

It is important to simply your model by removing unnecessary elements such as the interiors. It is also-important to keep in mind that some details will become too hard to see after scaling down to printable size, which needs to be removed. This will make your model more suitable to print.

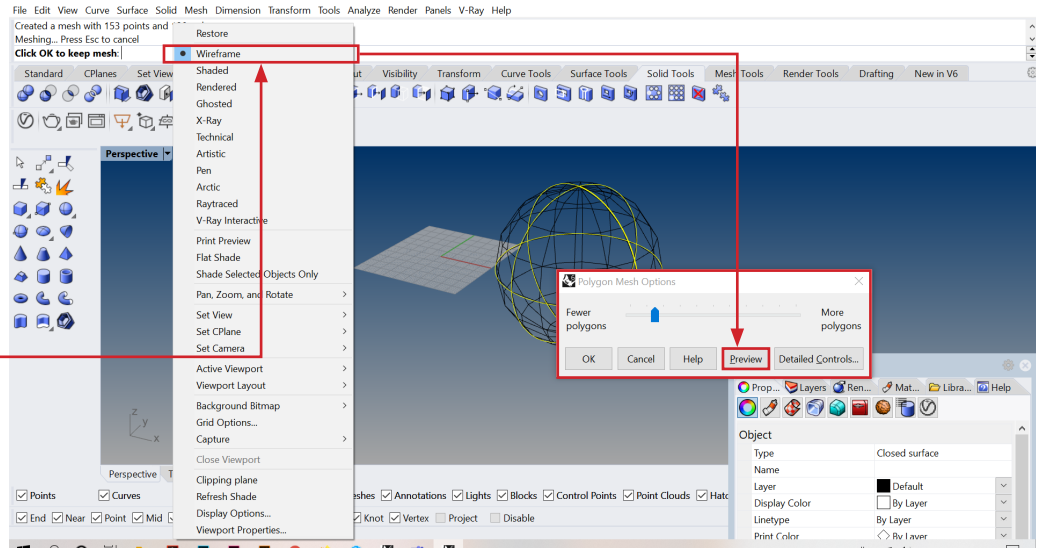


To edit the interior of the model, first turn off the roof to make the model easier to handle. Make a solid to fill in the void behind the internal wall because it will be impossible to clean out the support elements inside once the model was printed. In addition, internal void can make model more likely to fail so it is advised to avoid internal voids when possible.

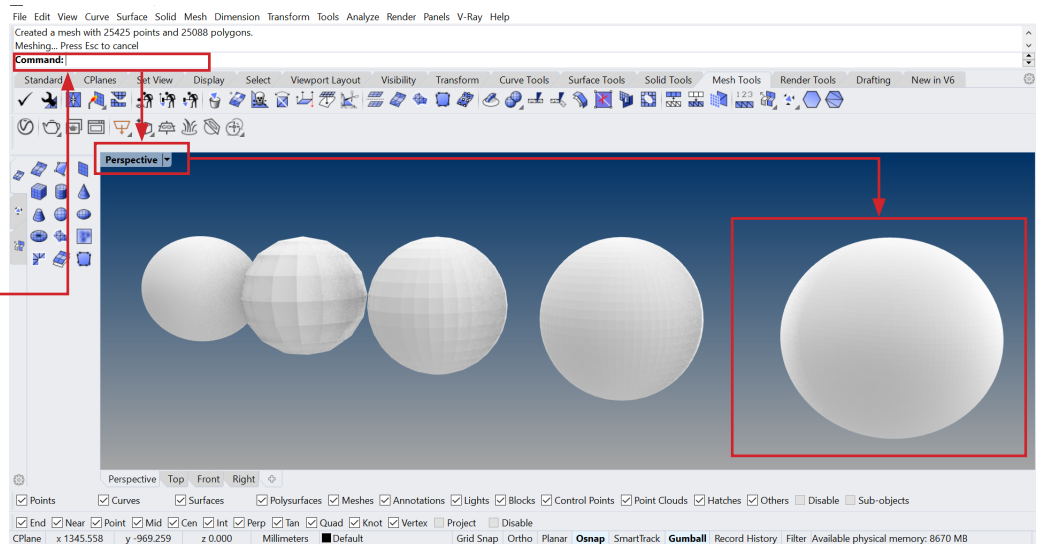
Convert to mesh

Model needs to be converted to mesh before saving it as STL format. To convert a Rhino Nurb model to mesh, type in “mesh” command to trigger conversion window. You will need to control the polygon count in order to adjust the quality of the model.

Change the view to “wireframe” and click on “Preview” button to see the polygon model.

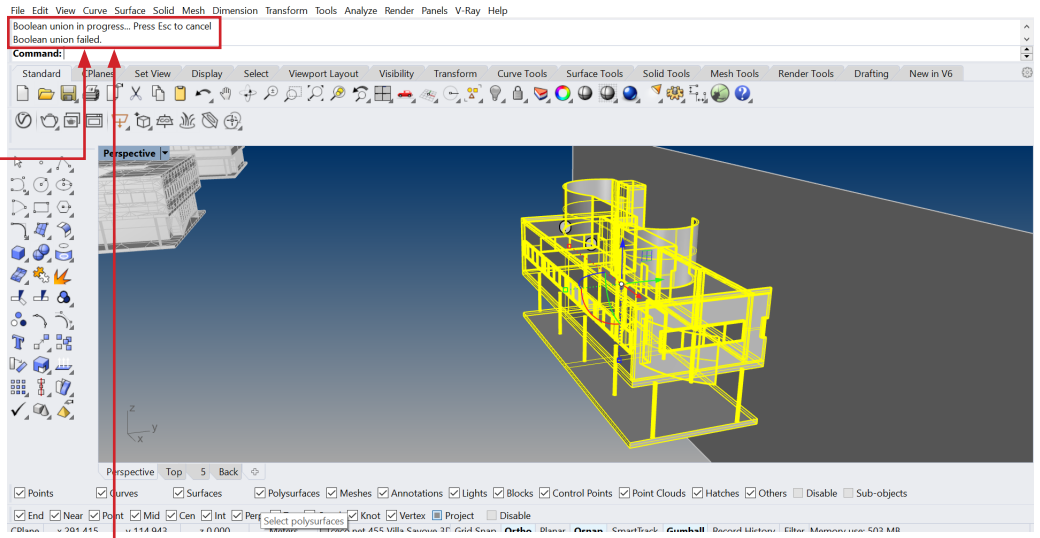


To choose the model with the best polygon count, type in “Flat Shade” to disable the smoothing display of the preview model. Switch the display model to “Rendered” view in order to see the optimised display, which will help you pick the best version of the model. Use high polygon count to get the best surface quality.

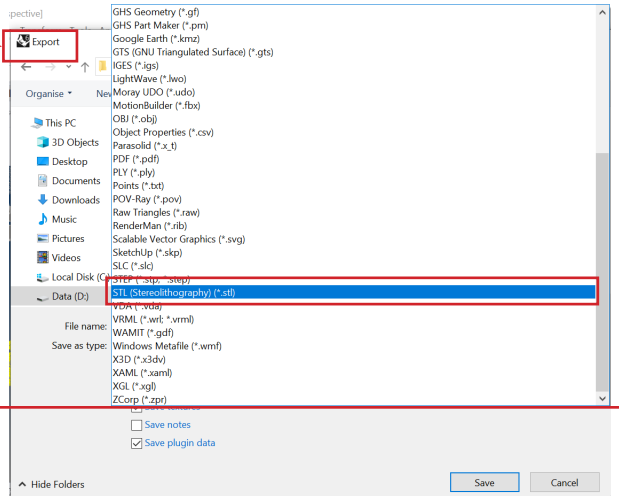


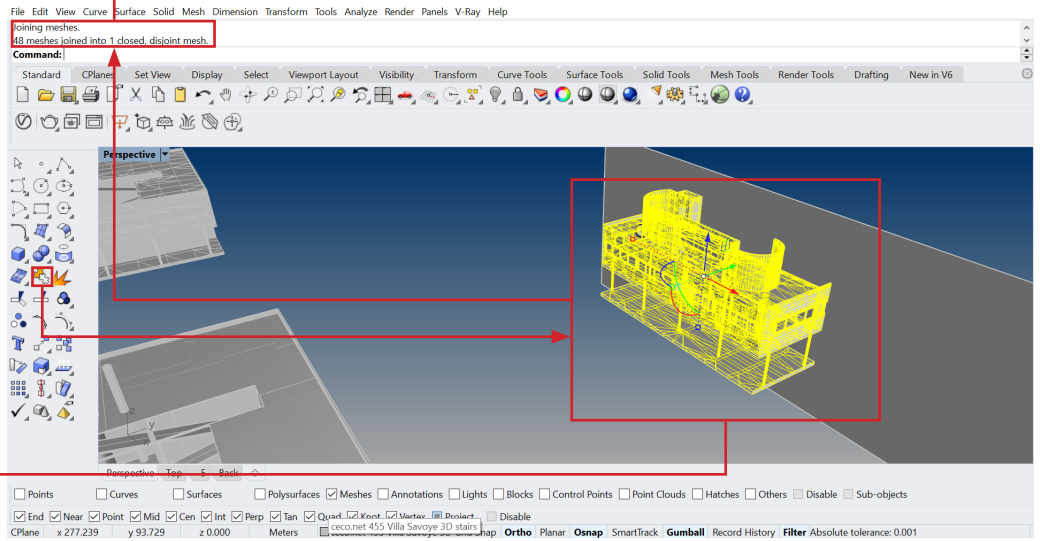
Your model needs to be joined as a whole piece before being printed. Try “boolean Union”. However, sometimes this cannot work.

If that happens, convert model to mesh, then use “join” to merge the geometries together.



Use “export selected” to export your model in STL format. However, also save your working Rhino working files just in case.





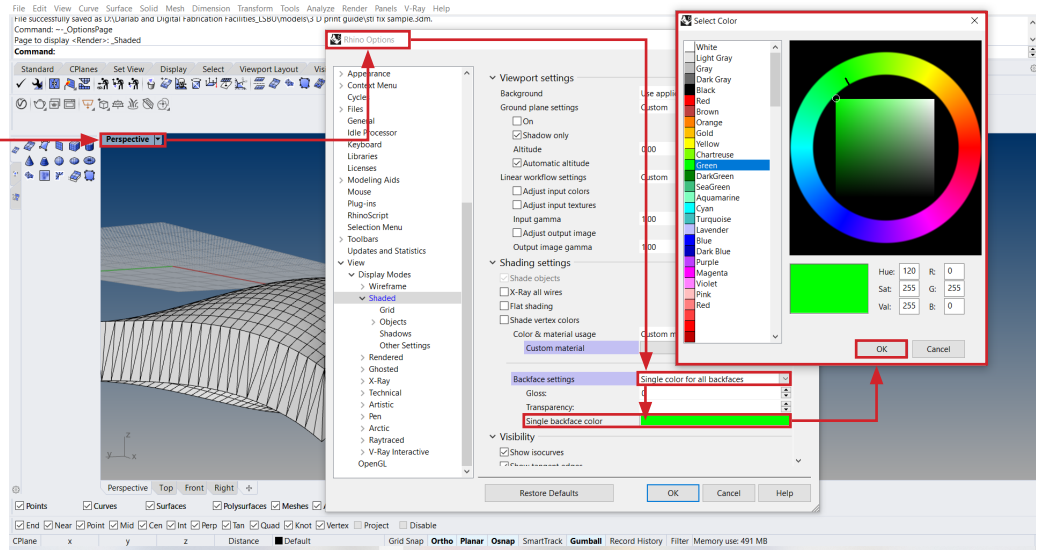
Make model water tight /Preparation

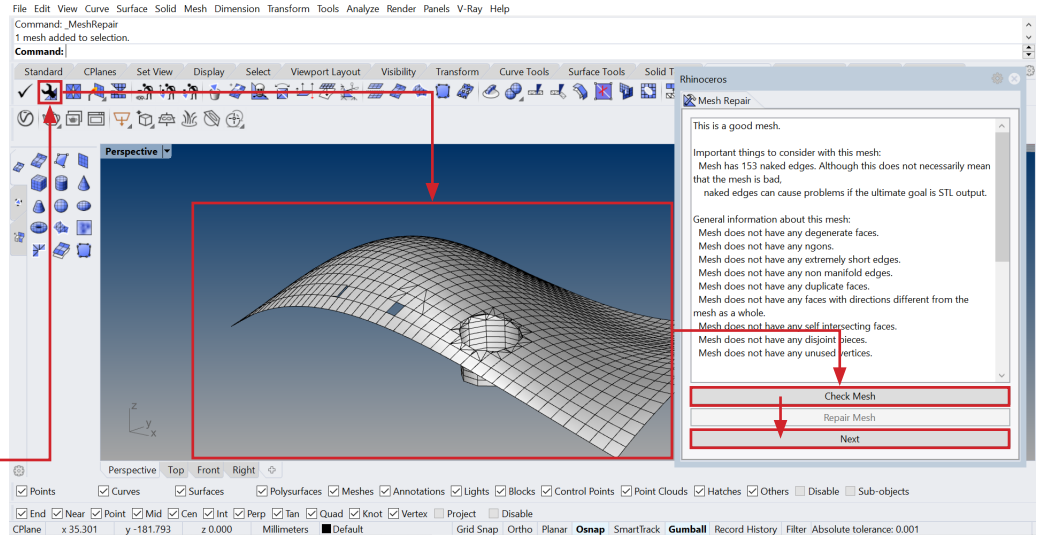
There are number of tools available to edit your mesh. Keep in mind that the goal is to make your model a watertight solid ,here are the main tools:

- Mesh repair wizards
- Mesh from closed polysurface
- Single mesh face
- Mesh normals
- Fill mesh hole

Turn on the back surface colour to help you better understand your mesh model. You will need to unify the surface direction of the mesh to make the model properly watertight.

Use the model “Mesh repair wizard” to check the condition of the mesh. It will tell you what kind of problem the model might have. Select the model to “check mesh” and then click “next” to trigger mesh analysis tool.



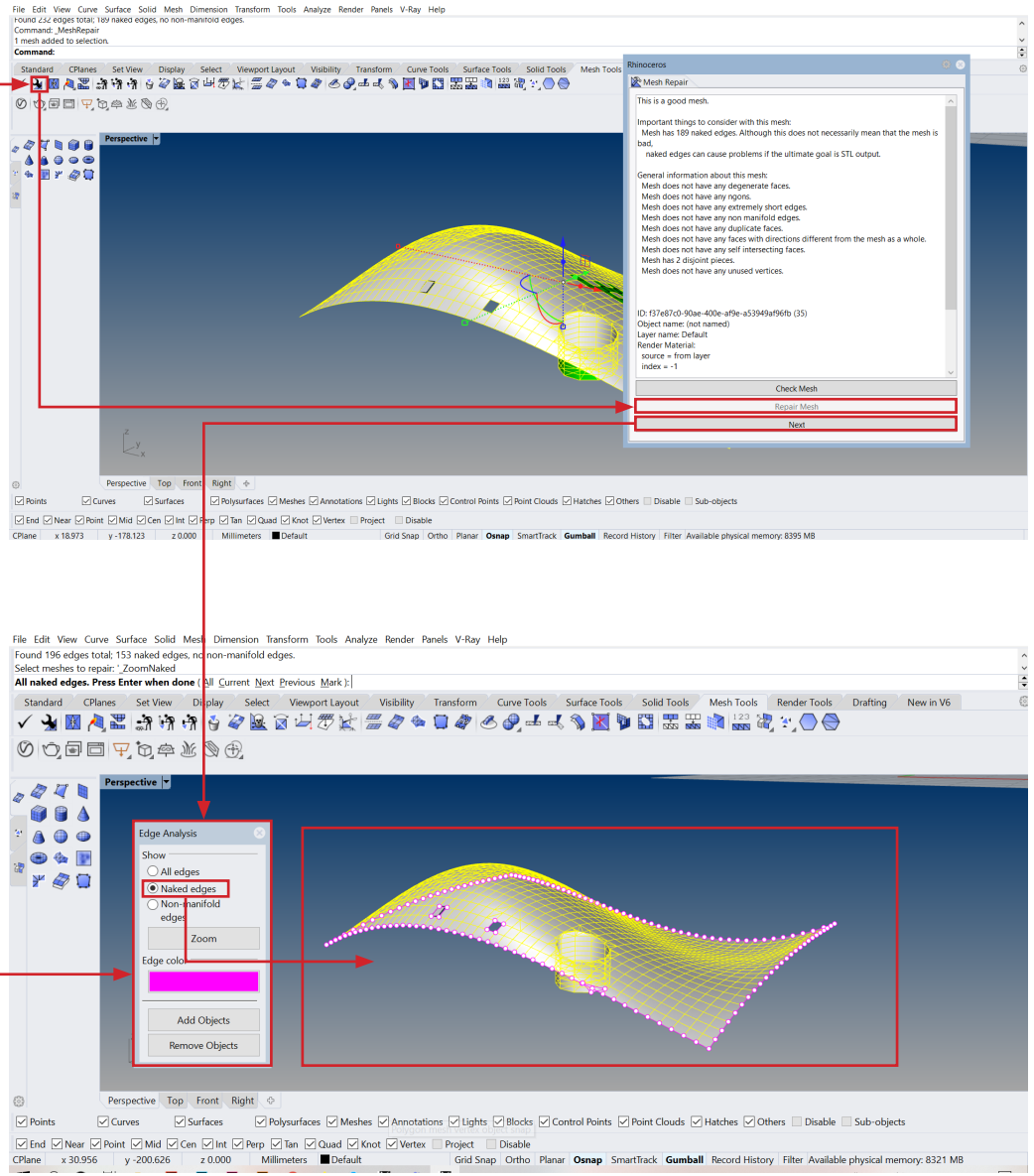


Mesh repair wizards

The “mesh repair wizards” needs to be used constantly to track the model repairing process.

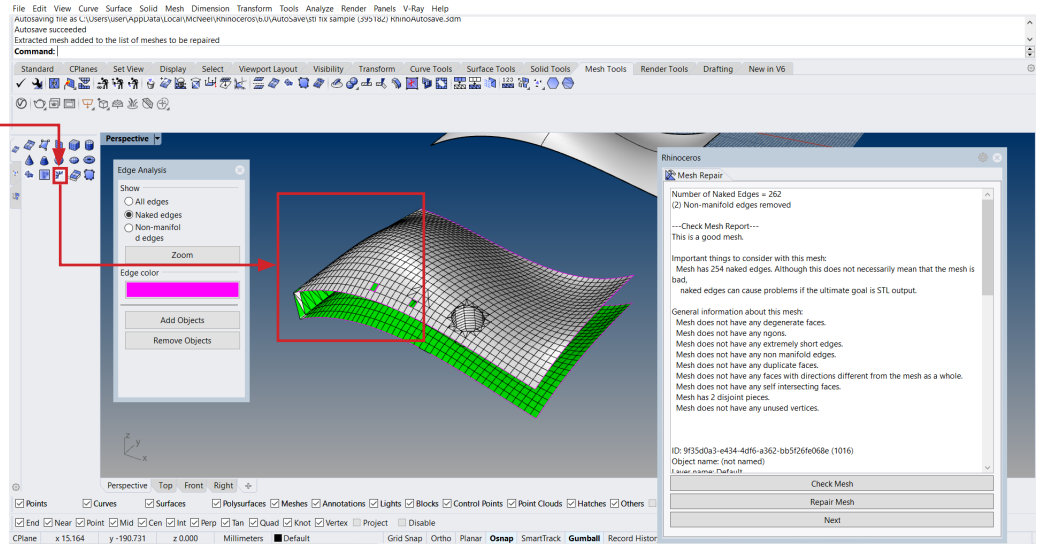
Use the model “Mesh repair wizard” to start getting analysis process. The key to look at is for the naked edges as that indicates gaps in the model. In this case, since the model is not a solid, it will highlight the border of the model as naked edges

Use “Edge Analysis” tool constantly to check the repairing process. To refresh it, Select the model and click on Zoom to get the info on latest edge condition.



Mesh repairing tools

Single mesh face

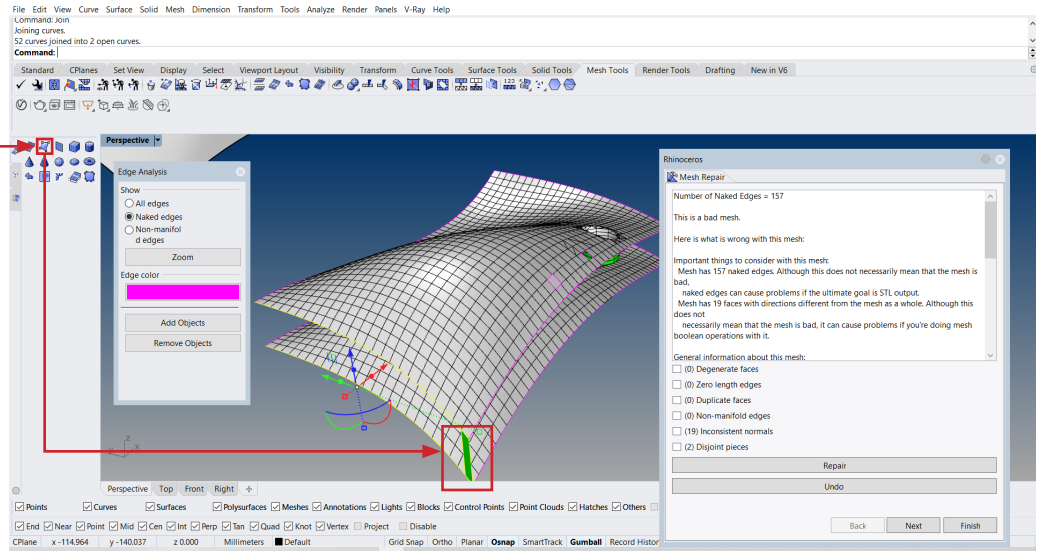


To close the surface model, it is sometimes better to create new mesh objects and join them as a solid object. Here are the process:

- First, use “dupEdges” command to get the borderlines.
- Second, join the borderlines and draw new lines in order to get a closed polysurface.
- Third, use “Mesh from Closed polysurface” tool to create a new mesh model.
- Forth, Use “join” command to merge all mesh parts.

You can also use “single mesh face” command to make individual mesh in order to fix up smaller imperfections

Mesh from closed polysurface



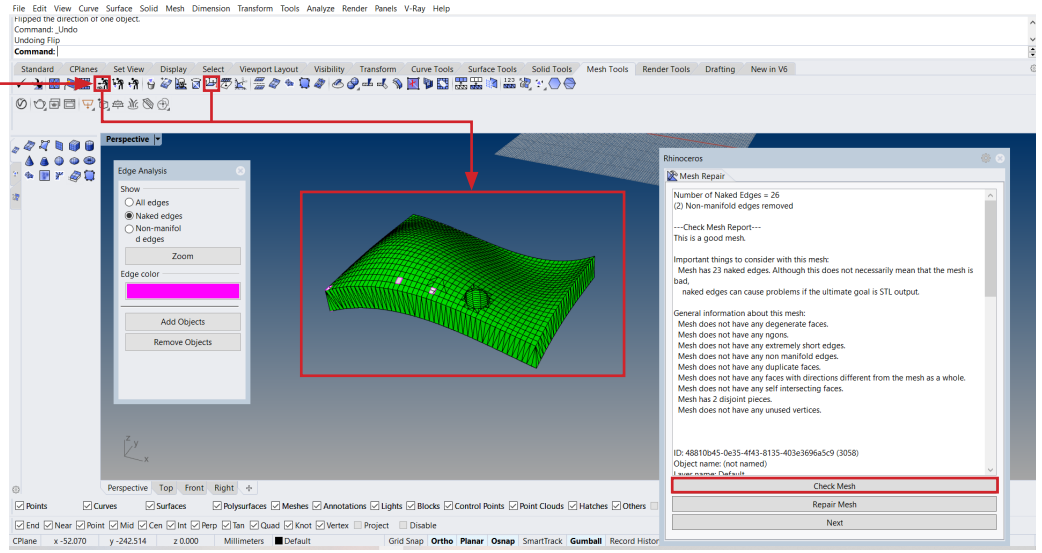
Finish-up

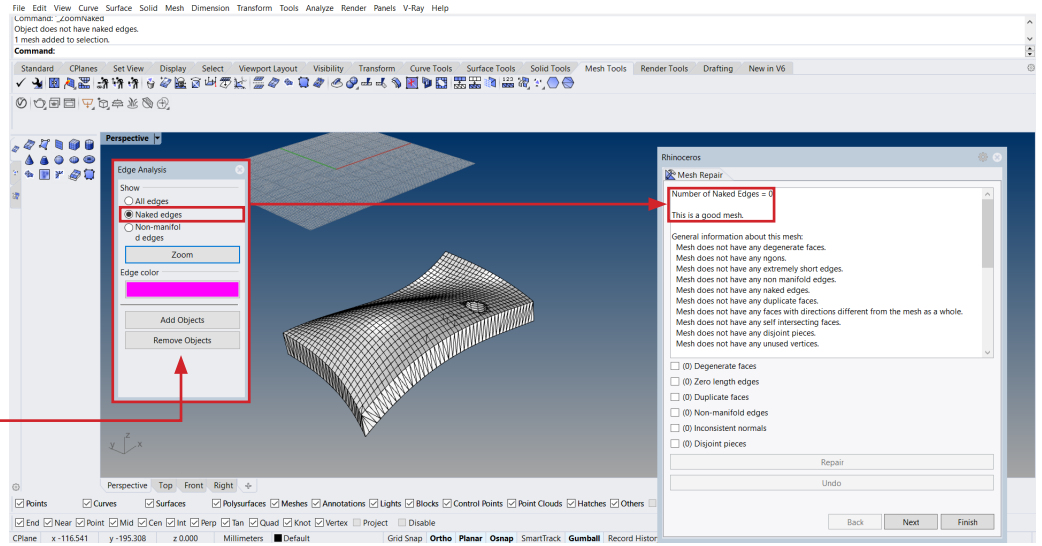
To finish up the model, you need to fill any remaining holes and unify the surface normals. Surface normal indicates the inside and outside of the model. In this model, the surface is green which means the surface is inverted and it was turned inside out. Then, use the Edge analysis again to see if there are any remaining naked edges.

Use “fill hole” command to cap any remaining on the model surface.

Use Normal fixing tool to finalised the model. Left click to unify normal automatically and right click to manually flip normal

Use check “mesh repair wizard” and “edge analysis” too again to do final check.



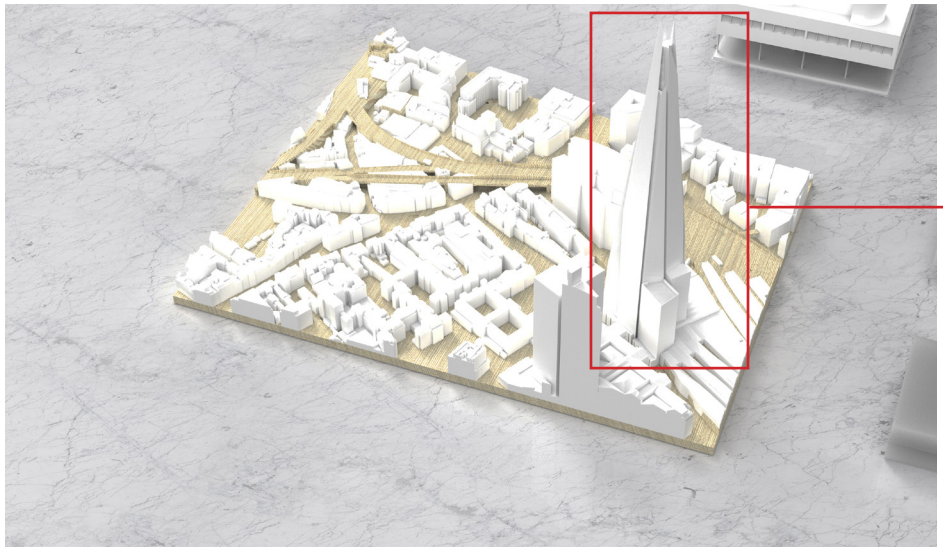


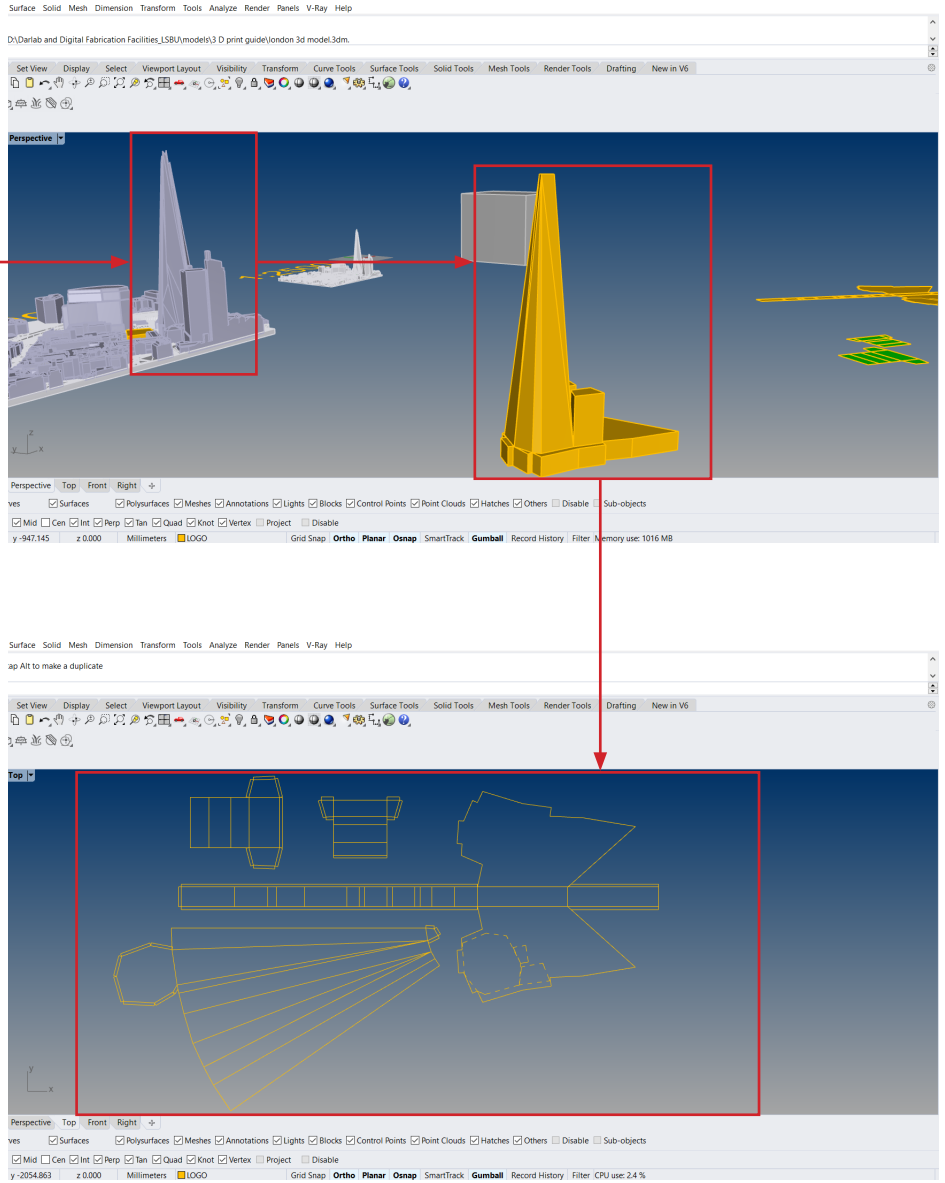
Alternative methods

Net paper model

Use this methods to create a net model to make it in out of paper for more intricate site model. Here is the process for making the model:

- Simplify the model
- Create a net out of the 3d model by flattening it
- Print the model out and cut it out of paper or lightweight card to assemble





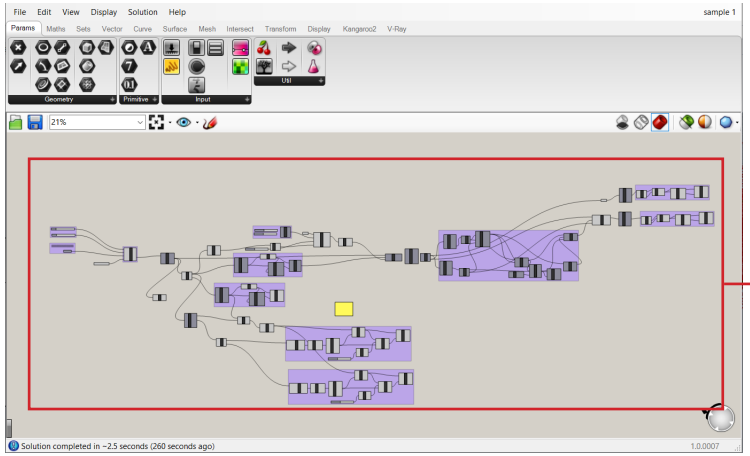
Alternative methods

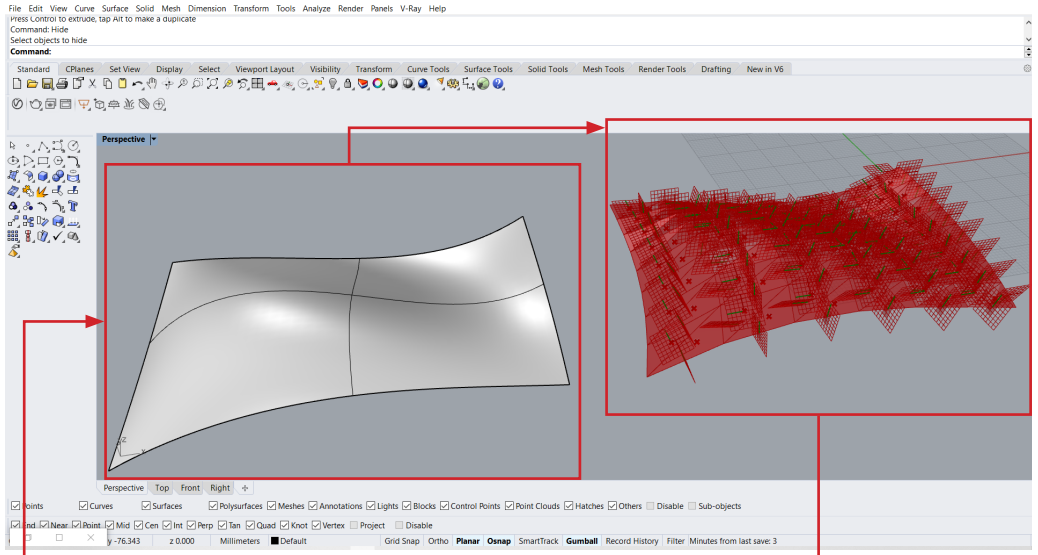
Puzzle assembly methods

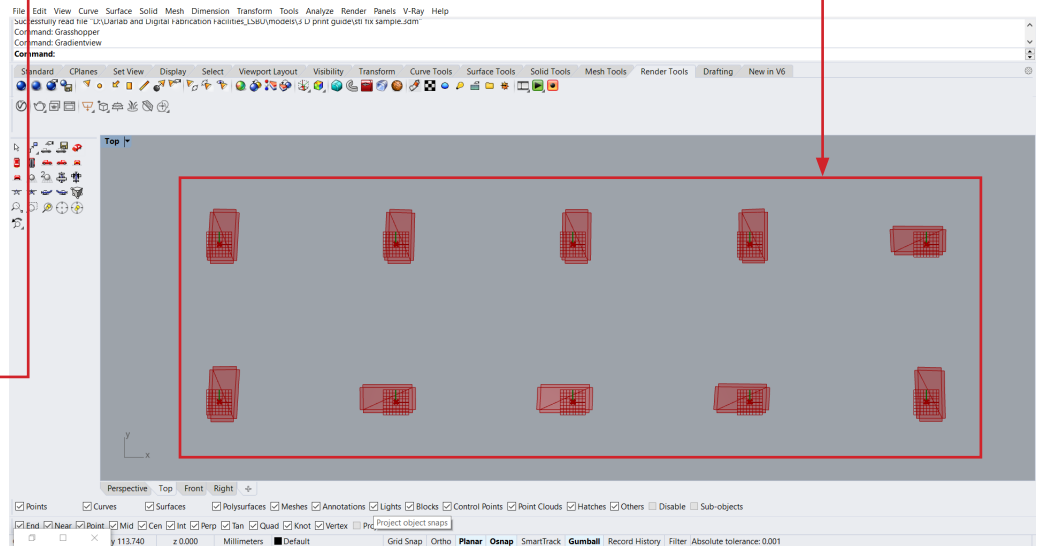
Use this methods to create model for complex wavy surface out of lightweight cards:

- Get the model as single wavy surface and make sure it is not a polysurface
- Use grasshopper script to generate flat parts

Contact additional support to get script and help to use this advanced method.







Q: I finished this guide, so what now?

A:

Now it is time to get to work. If you have questions, You can contact us.

Here are also some online resources:
- Rhino user manual

Disclaimer:
There is no guarantee that your model can be accepted with our 3D printing services even if you followed this guide to prepare your model. In general, your request may not be granted if we think your model is not good enough to be printed.

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