



# CREATE STL WITH SKETCHUP FOR SOLIDO / TRISCO

## 1. Introduction

This document describes how to generate .STL files with Sketchup and use them for SOLIDO or TRISCO.

## 2. STL files

A STL file contains oriented triangles. Each triangle is defined by the coordinates of the three vertices and by the coordinates of the unit normal to the triangle face (which defines the front side or external surface of the triangle).

All triangles in a STL file of a valid 3D object (as required by SOLIDO) form the watertight surface of the object. The triangle unit normals must point outwards against the object.

The STL file can be in text format or in binary format.

In the STL file format there is no scale definition from the coordinate unit to a length unit (e.g. m, mm or cm).

SOLIDO can read STL in text or binary format, but writes STL (after a coordinate transformation) only in binary format.

## 3. SketchUp STL plugin

SketchUp can not fully handle .STL files by default.

Therefore, install first a Plugin in SketchUp to handle .STL files (e.g. "STL import & Export 2.2.0").

SketchUp is not a solid modeler, but a drawing program in 3D based on faces.

The user should take care that the exported faces are the correct (watertight) surface of a 3D object.

Interesting Plugin tools for Sketchup which may help detecting errors in a STL file (e.g. internal faces, non-watertight faces) are "Solid Inspector<sup>2</sup>" and "CleanUp<sup>3</sup>".

## 4. Draw object in SketchUp

The faces of each material and boundary condition must be exported to a separate STL file (as required in SOLIDO, with reference to a colour with index between 0 and 255). It is a good practice to put the faces of each material and boundary condition into a separate layer (with layer name containing the colour index number).

For each layer select all faces and put them into a group (using the command *Edit > Make Group*) to fix the geometry and disconnect it from the faces of other layers (which faces may share the same vertices).

The faces of a STL object may not contain any internal face inside the object (remove internal face for example with the Plugin "Solid Inspector<sup>2</sup>").

All faces of the STL object must have their front side (with white colour) facing outwards of the object. Use *Reverse Faces* from the context menu (click right mouse button) if the back side (with blue colour) appears on the external object surface.

Any back face on an external surface of an object must be reversed.

## 5. Export STL file

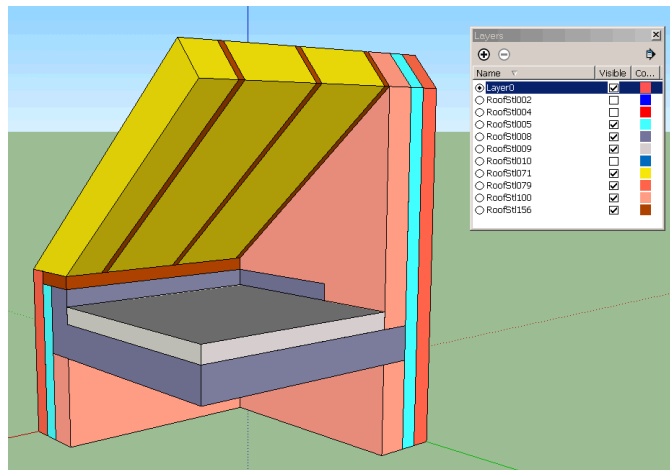
SOLIDO requires a separate STL file per material.

Select separately each material group in Sketchup and export as STL file ("Export STL..." and check "export current selection"). Repeat this for every material group to generate the separate STL files.

Now the STL files (in text format) are ready for use in SOLIDO.

See the SOLIDO data file [RoofStl.sld](#) for an example of object description with STL files, created in SketchUp ([RoofStl.skp](#)).

View in SketchUp of [RoofStl.skp](#) (coloured by layer).



## 6. Create TRISCO data with SketchUp (via STL files loaded into SOLIDO)

SketchUp is very well suited to create a rectangular geometry, as required in TRISCO.

Create STL files as described above, which are loaded in SOLIDO .

Then create a minimum grid (*Grid > Minimum Grid...*) to initialise the Grid window.

Insert all STL coordinates as grid coordinates (*Grid > Insert STL Coordinates...*).

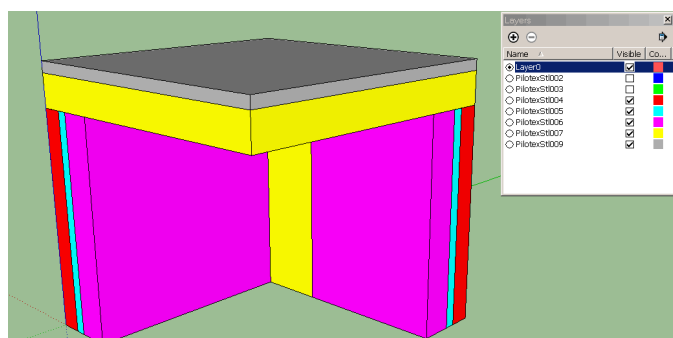
Fill the STL blocks (*Image > Fill Blocks*) and rasterise using the grid coordinates (*Image > Fill Grid*).

Now the rasterised object can be saved as TRISCO file (*File > Save As...* with type: TRISCO data file).

In TRISCO rectangular blocks allow to use a grid corresponding to the block coordinates.

For rectangular blocks the three dimensions (X, Y and Z) have less interaction with one another, and the grid definition is less critical than for arbitrary shapes in SOLIDO (where node fitting interacts more closely with the three dimensions).

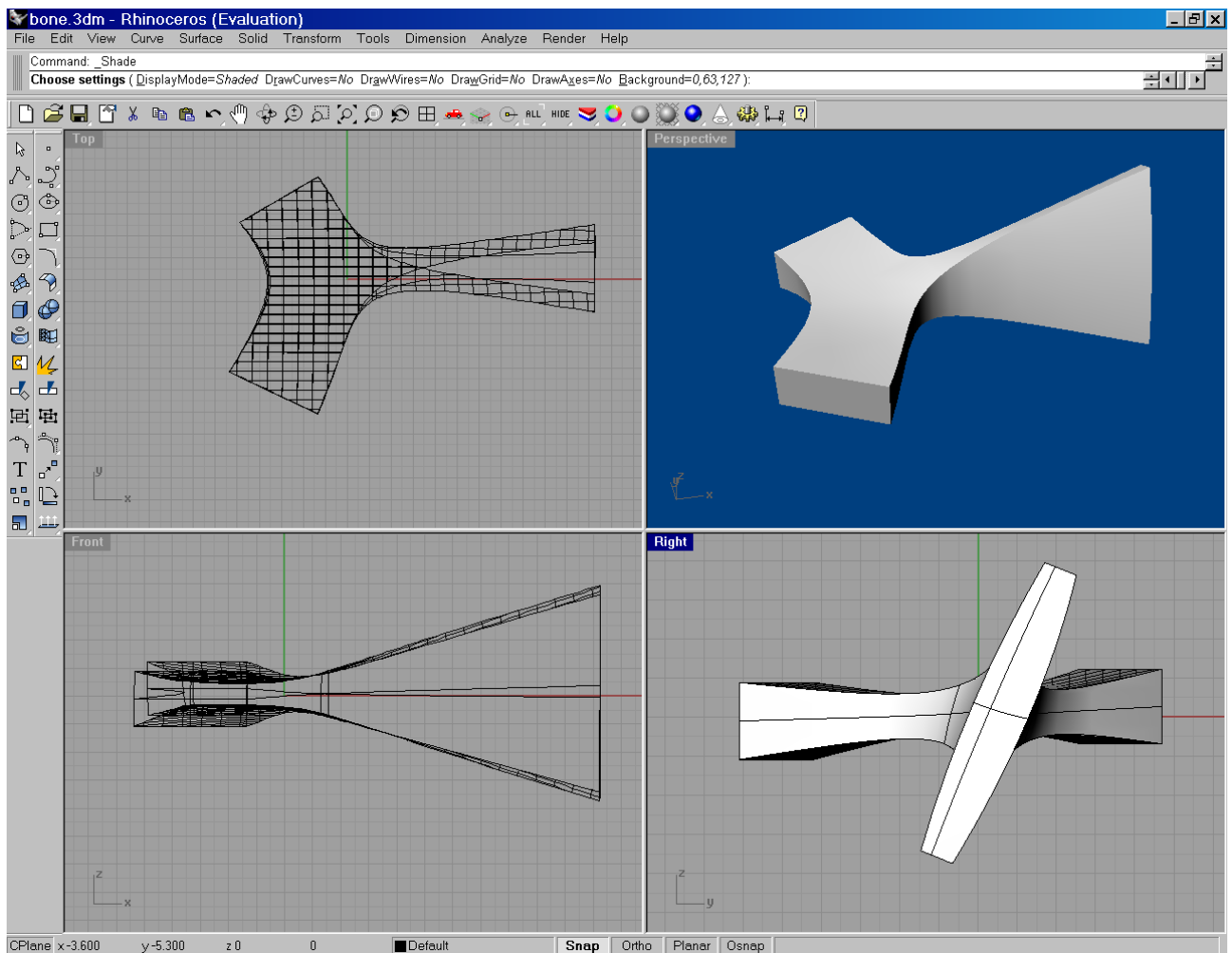
View in SketchUp of [PilotexStl.skp](#) (coloured bylayer).



## 1. Introduction

This short information note shows the principles of how the Physibel program SOLIDO uses solid objects created in a CAD program such a Rhinoceros (Robert McNeel & Associates).

## 2. Program Rhinoceros

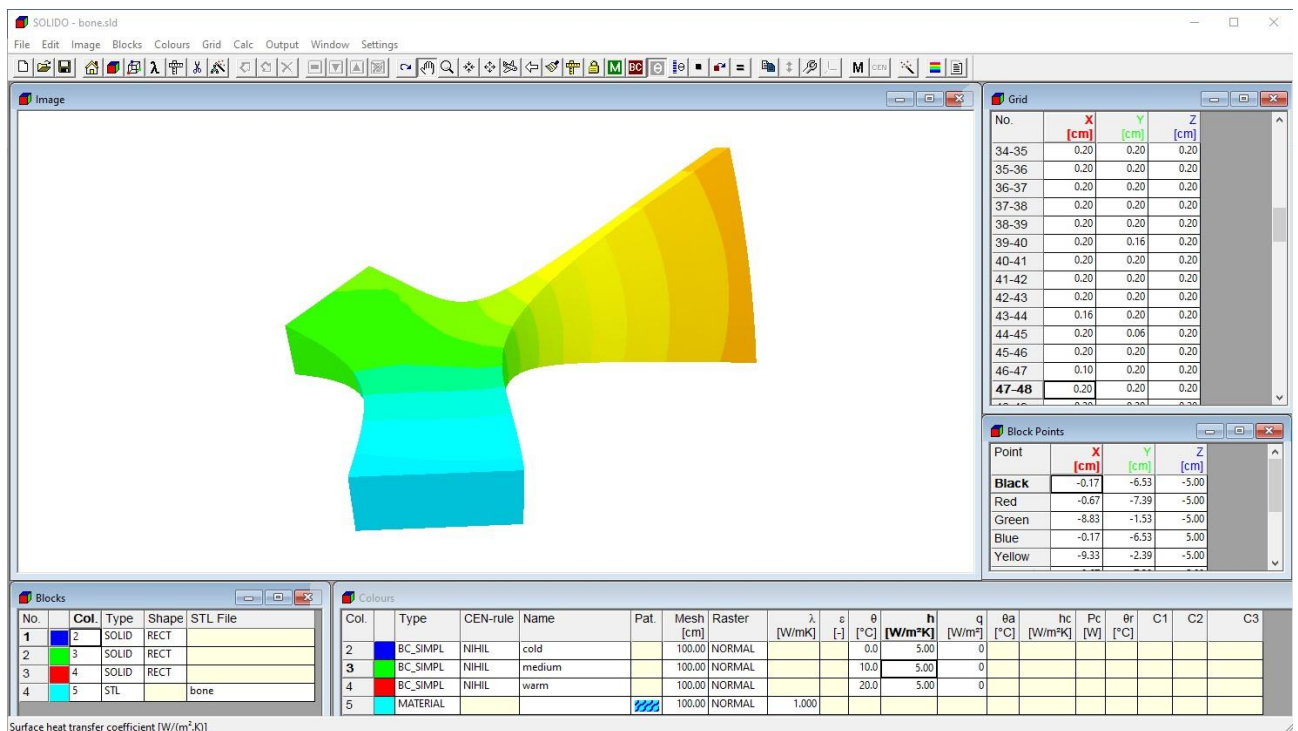


A sample file bone.3dm containing a “solid” was downloaded from <http://laminadesign.com/procbo.html> and opened in the program Rhinoceros.

Use >File > Save as > Save as type ‘Stereolithography \*.STL > bone.stl > tolerance OK > STL export option ASCII.

Important: The objects created in the program Rhinoceros have to be of the type solid.

### 3. Program SOLIDO



In the program SOLIDO, the file bone.stl was imported in the Blocks window. 3 additional blocks were defined for 3 boundary conditions at the edges of the bone-object. A grid with a maximum grid size of 0.2 was created. The number of nodes amounts to 18 304. The temperature field is shown in the picture above.

Important:

- At least one STL file is required pro material.
- Blocks (including STL blocks) can be copied and transformed in SOLIDO.
- Thin layers (for example metal sheet) that are not perpendicular to one of the axes (X,Y,Z) have to be avoided. Such layers require a relatively fine grid or a large number of nodes.