# Exercise: Building and zone geometry import from SketchUp

## Purpose

Learn how to create and import building and zone geometry from SketchUp into IDA ICE.
Learn how to work with imported building and zone geometry in IDA ICE.

## Background

Sometimes it can be easier to import geometry from an external program than to create it in IDA ICE. In addition, it is not possible to create all possible shapes of buildings and zones with the IDA ICE geometry editing tools.

SketchUp is a popular tool for creating geometries and it is perceived as easy to use by many. It can be downloaded for free and you need to have it installed on your computer for this exercise.

## Instruction

1. A building or zone geometry that is imported into IDA ICE should be a volume enclosed by polygon surfaces (polyhedron) without holes between the surfaces. The geometry should describe the inner surface of the external walls for a building, and the inner surface of the zone walls for a zone. Such geometry is easy to create in SketchUp, so we begin by creating a simple building in SketchUp.

Start SketchUp. Delete any geometry that is created by the template (for instance a 2D woman).

Select the rectangle tool and draw a rectangle on the ground. Enter 10;7 (10,7 on some computers) on the keyboard to give it the dimensions 10 m x 7 m. If measurements are not shown, turn them on with View > Toolbars > Measurements. To change units use Window > Model info > Units or use a metric template in Window > Preferences > Template.

Select the push/pull tool and pull the rectangle 3 m upwards. Select the line tool and draw a line across the roof. Select the move tool and move the line 2 m upwards along the blue axis.
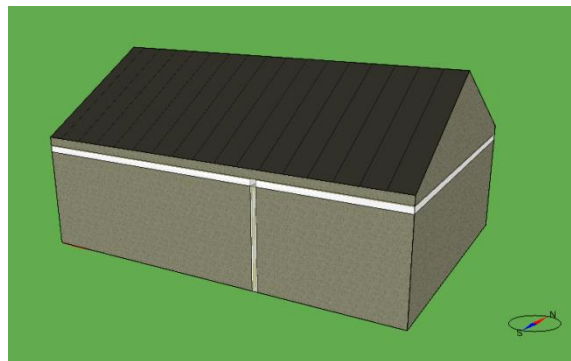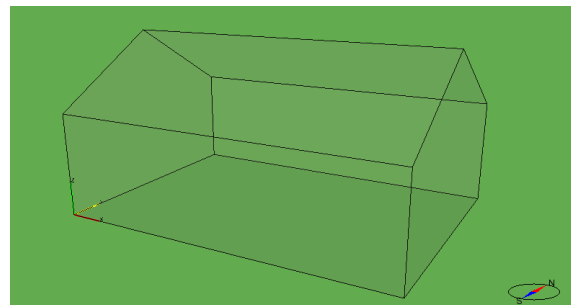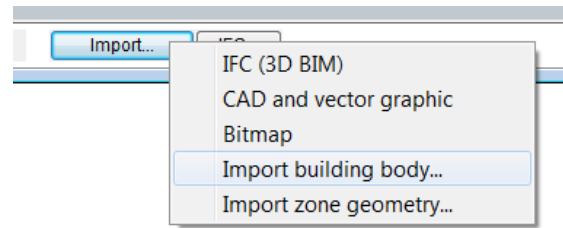
Save your SketchUp model.
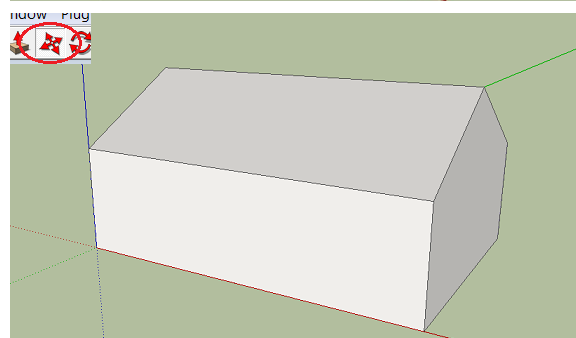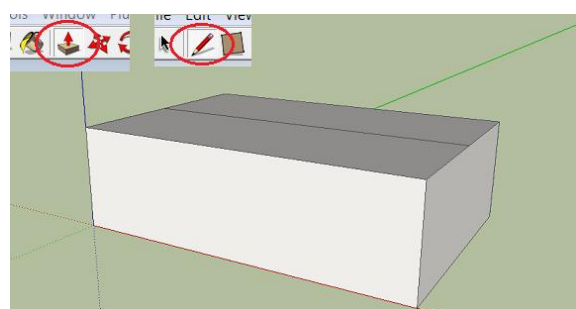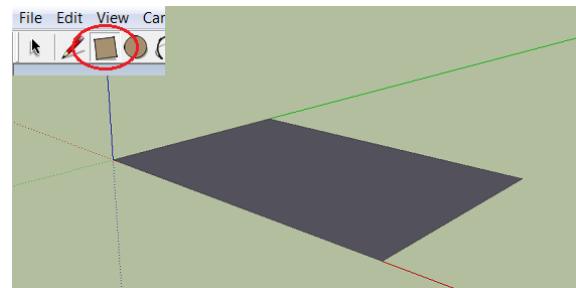
2. Create a default building in IDA ICE. Go to the Floor plan tab and delete the building and the zone. Select Import… > Import building body… and import your SketchUp model.



A fully editable building body is created, just as if it was created in the IDA ICE roof editor, and it can be filled with zones on the floor plan in the same way as building bodies created in IDA ICE. This is true if the imported building geometry only has one floor and that floor is horizontal and does not contain any holes, and the geometry does not have any outward leaning walls (surfaces with their exterior normal pointing downwards). This is the same kind of geometry that can be created in the IDA ICE roof editor.



The building body would only have been resizable if the constraints above would not have been met. As we will see below, such a building body can only in certain cases be filled with zones on the floor plan.



3. We will now create a geometry in SketchUp that cannot be created within IDA ICE.

Draw a 9 m x 9 m rectangle with the rectangle tool. Pull it 3 m upwards with the push/pull tool. Use the move tool to move all the edges of the roof outwards 1 m so that all walls are tilted outwards.
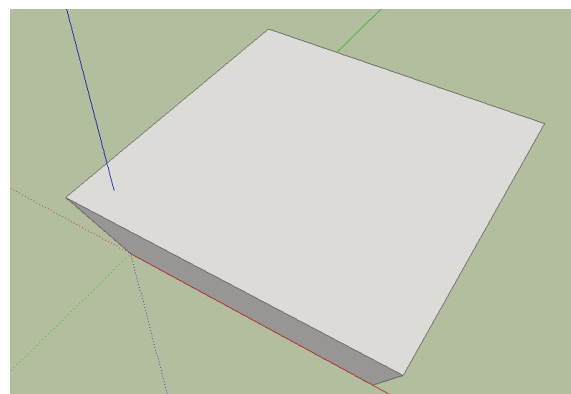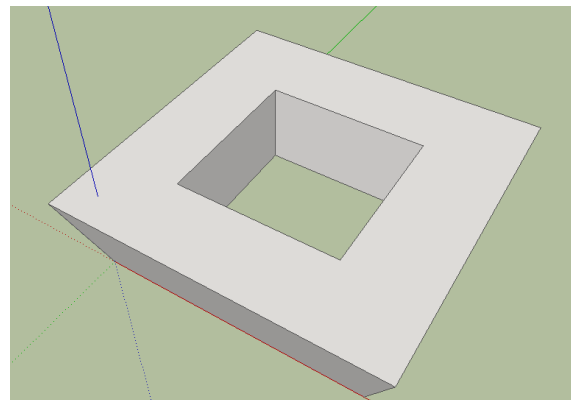
Draw a rectangle on top of the roof with the rectangle tool. Use the push/pull tool to push this rectangle down to align with the floor.
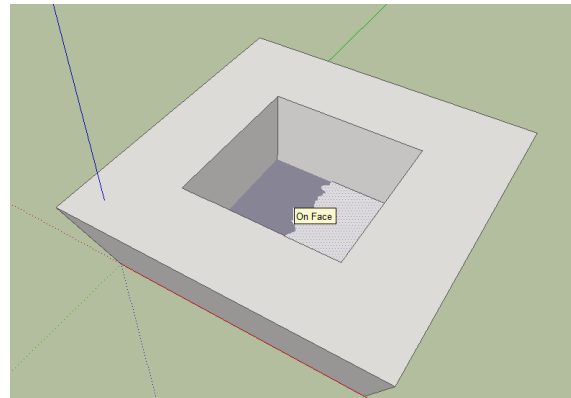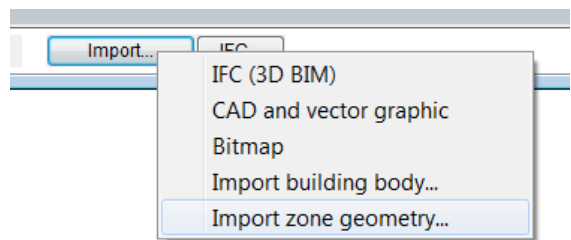
The result is a "donut-shaped" object.

Save your SketchUp model.

4. We will import this donut geometry as a zone in IDA ICE. Create a default building in IDA ICE. Go to the Floor plan tab and delete the building and the zone. Select Import… > Import zone geometry… and import your SketchUp model.

A zone is created along with a building body of the same shape. Both the zone and the building body are non-editable but resizable. They can also be moved, both on the floor plan and in the 3D view.
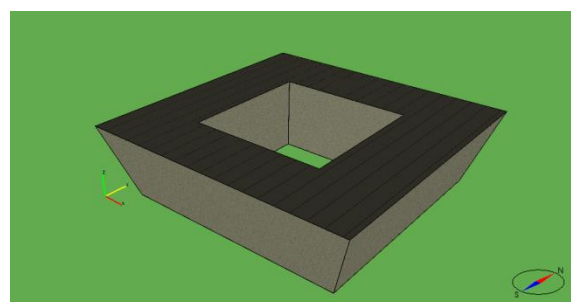
To move a building body or a zone in the 3D view, select it (a zone is selected by clicking on it twice), hold down the ctrl-key and drag the building body or zone. It will move in the x-y plane. To move it in the z-direction, also hold down the shift-key. A move operation can be aborted with the escape-key or undone with the undo-button.
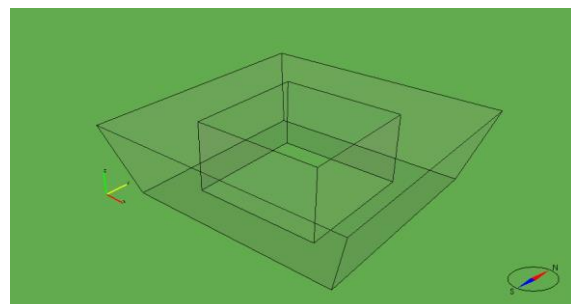
5. The geometry imported into IDA ICE should not contain any internal surfaces. Sometimes such internal surfaces are created by mistake in SketchUp and the import procedure in IDA ICE gives an error message.

   In those cases it is a good practice to check the geometry by importing it as an ordinary shading geometry by selecting Import… > CAD and vector graphic. Select Show… > X-ray on the 3D tab, and any internal surfaces should be easily detectable.
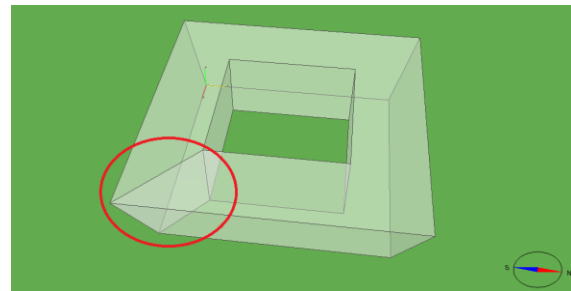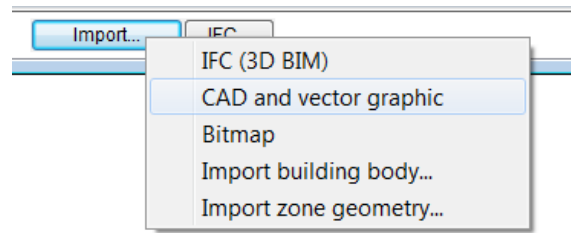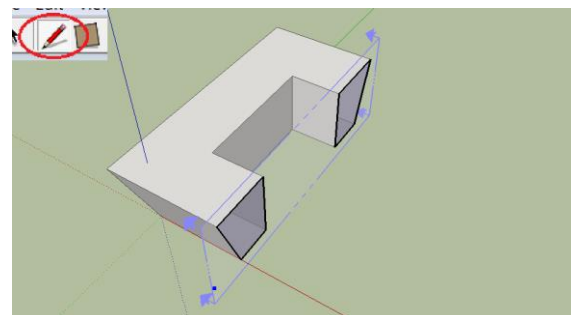
6. Multiple zones or building bodies can be imported from the same geometry file. We will now create a geometry file in SketchUp which contains two zones.
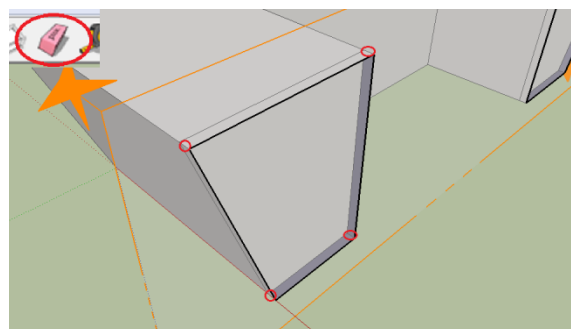
   Open your donut geometry. Use Tools > Section Plane to cut a section through the geometry.
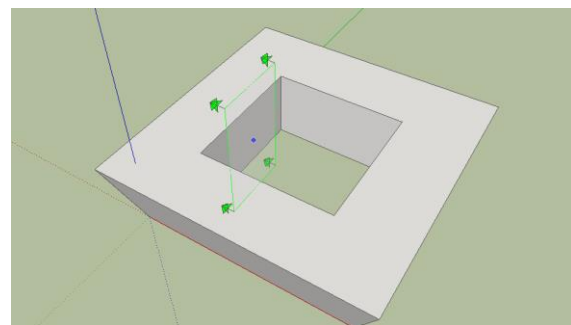
   Use the move tool to move the section plane. Trace the cut-contours with the line tool.
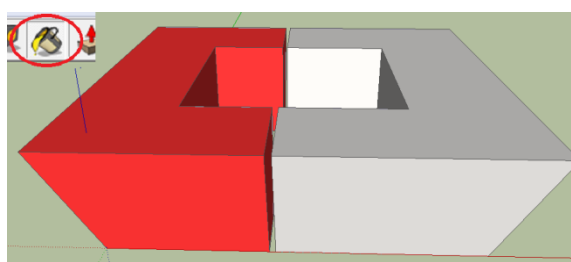
   Move the section one wall thickness, for instance 15 cm, and trace the new cut-contours.

   Use the eraser tool to remove the short lines between the cut-contours.

   Remove the section plane. The donut geometry is now cut into two pieces, each piece consisting of one polyhedron.

   Use the paint bucket tool to give the pieces different color. Hold down the ctrl-key and click on a surface and the surface and all connected surfaces are given the selected color. Save your model.

7. If a geometry file contains multiple polyhedron geometries, each with a separate color, they will be imported as separate building bodies or zones in IDA ICE. If surfaces are placed one wall thickness apart, these are regarded as internal walls.
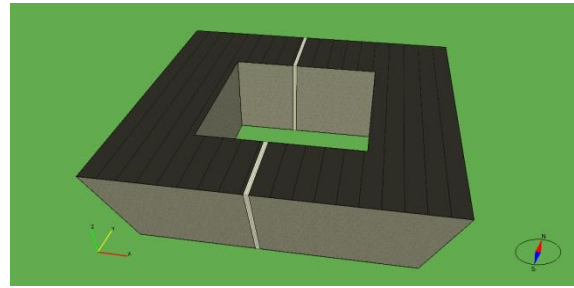


Import your SketchUp file into IDA ICE as zone geometry. Two zones are created along with building bodies of the same shape. The neighboring surfaces are connected with internal walls.
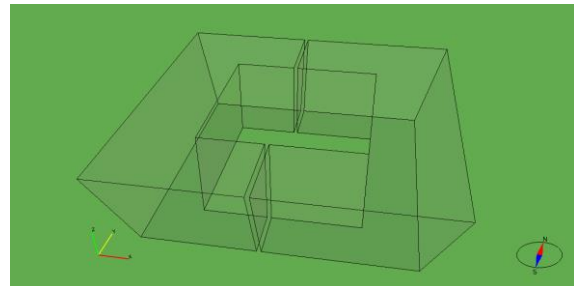


8. Building bodies are always created along with the zones when importing zone geometry. This is usually not a problem, since neighboring surfaces are regarded as internal walls. Sometimes, however, it is beneficial to import a separate building body. We will look at such an example.



Import the distributed file dodecahedron zones.skp as zone geometry. A number of zones with corresponding building bodies are imported. The hole in the middle of the building is an open courtyard (external walls have a grey textured surface).
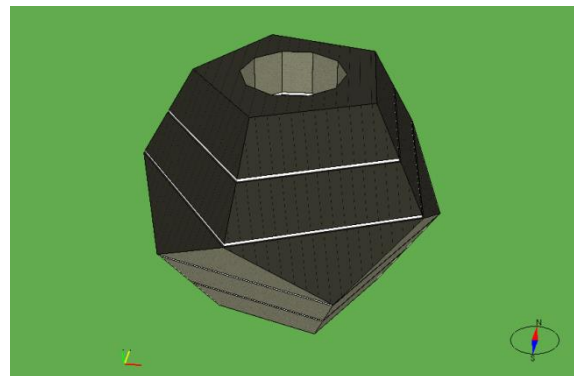


9. We would like to place a zone in the hole to convert the courtyard into a closed atrium. To accomplish that we will need to import a separate building body that encloses the entire building. Delete all building bodies created during zone import. This is most easily done in the 3D view after turning off the visibility of zones in Show… > Visual filter… Import the distributed file dodecahedron building.skp as building body. The walls of the hole change color to white indicating that they are internal.
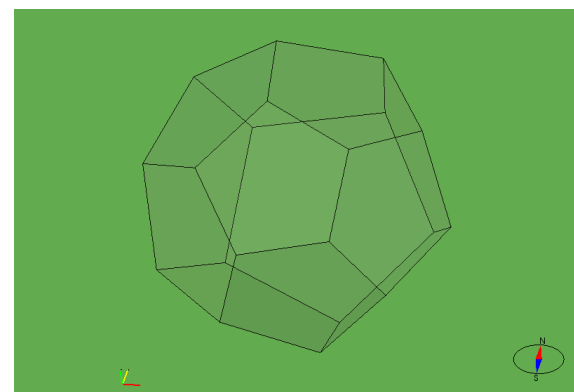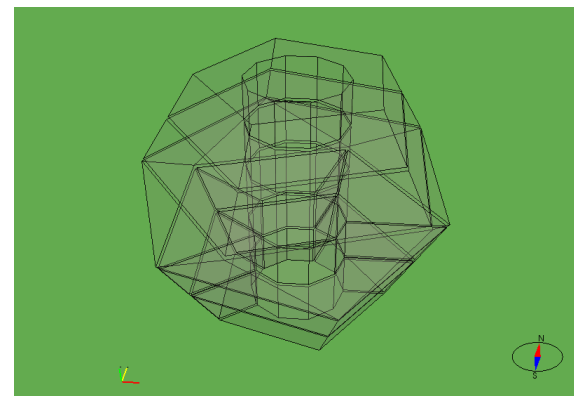
10. Note that the imported building body does not meet the requirements of an editable building body, see 2. Such a building body cannot be completely filled with zones on the floor plan. However, if there is a space inside the building that has room for an ordinary prismatic zone it can usually be created on the floor plan. The hole in this building is such a space.

    Fill the hole with a new zone on the floor plan. Make sure that the zone creation rectangle does not extend beyond the exiting zones.

    Open the new zone and choose Room height to roof. The hole is filled with an atrium zone that extends from the bottom floor to the roof.
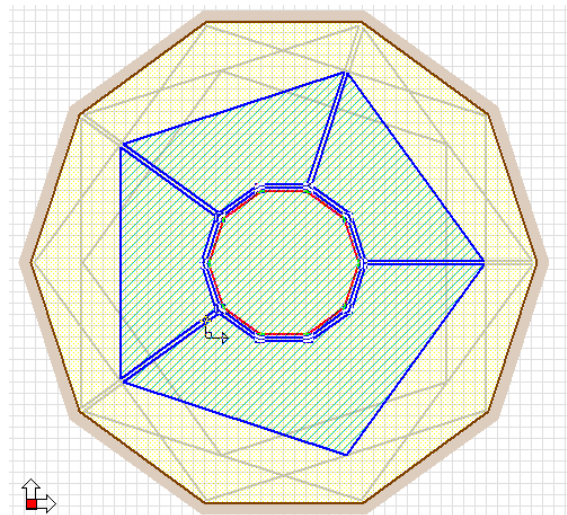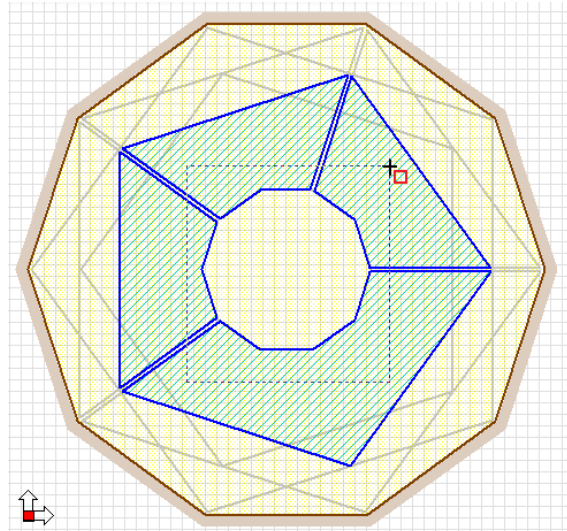


11. The imported zones are given the default constructions defined on the General tab, clicking on defaults. Now we will define a new wall construction and assign it to the walls of the atrium. Go to the 3D view and cut the building on the top floor. Double-click on one of the internal walls to open the wall form. Define a new internal construction on the advanced tab. Name it asymmetric and give the layers different thickness so that the construction is asymmetric.
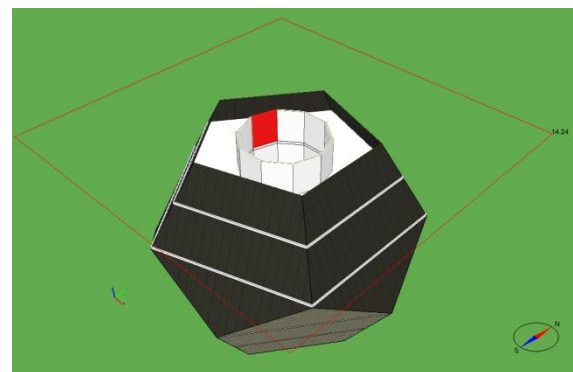


12. Click Palette on the side bar of the 3D view. All wall constructions of the model, including the one we just created, are shown sorted in categories in the palette. Additional constructions can be loaded from the database using the 📲 button on the top of the palette (first select an existing construction of the desired category or the category itself).

13. Double-click on the asymmetric construction (or select and click the ✔ button). The existing constructions are shown in the 3D view.
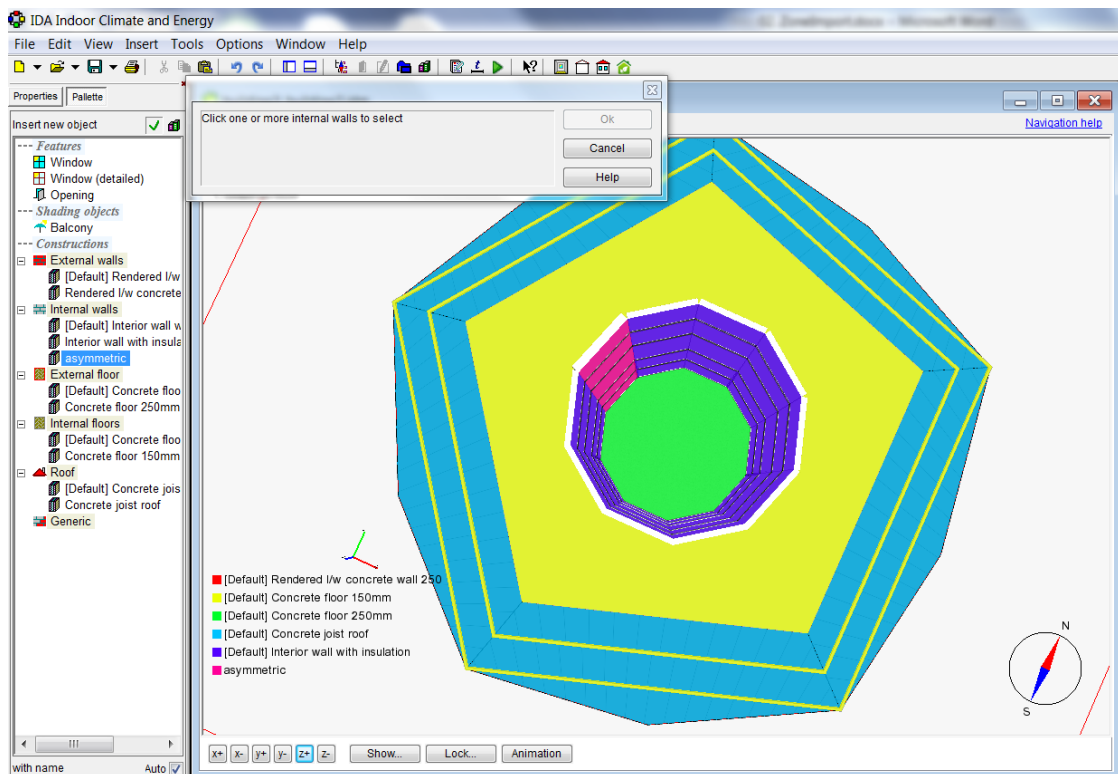


14. Select all walls of the atrium. Only walls of the correct category can be selected (internal walls in this case). When an internal wall/slab is selected all walls adjacent to this wall and all walls adjacent to those walls are selected. When an external wall/slab or roof is selected all external walls connected to the same façade is selected.

15. Click ok to accept the changes. The construction is assigned to both sides of the walls and with correct flip.