Tekla Structures Basic Training

Tekla Structures 10.0

April 23, 2004

Contents

4 Custom Components

In this lesson

This lesson introduces custom components and details.

You will learn how to:

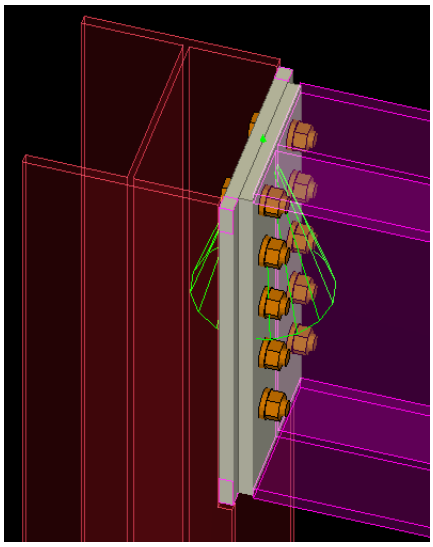
- Define custom components
- Use custom components
- Edit custom components to make them adaptive and parametric

4.1 Define User_end_plate Custom Component

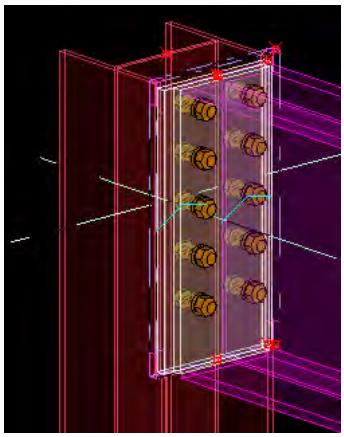
You can build custom components either by exploding and modifying an existing component, or by creating the component objects individually as we did in Lesson 2.

You then define a custom component by picking the objects to include in the custom component, and specifying the information the user needs to input, for example, main part, secondary parts, or points they need to pick. You can then apply the custom component to similar framing conditions in the model.

We will now create a Custom component from the column-beam connection, which was interactively created in Lesson 3. By changing the connection to a Custom component you can use it in other parts of the model and in other models.



Zoom in close to the component, which was interactively created between a column and a beam in Lesson 3. Make sure that all of the object types are visible in the view (welds, cuts, fittings, bolts, etc).



Define Custom component

1. Select **Detailing > Define custom component…** to open the **Custom component wizard** dialog box.
2. On the **Type/Notes** tab, set **Type** to Connection, enter a name and description (description is not mandatory) for the custom component as shown.

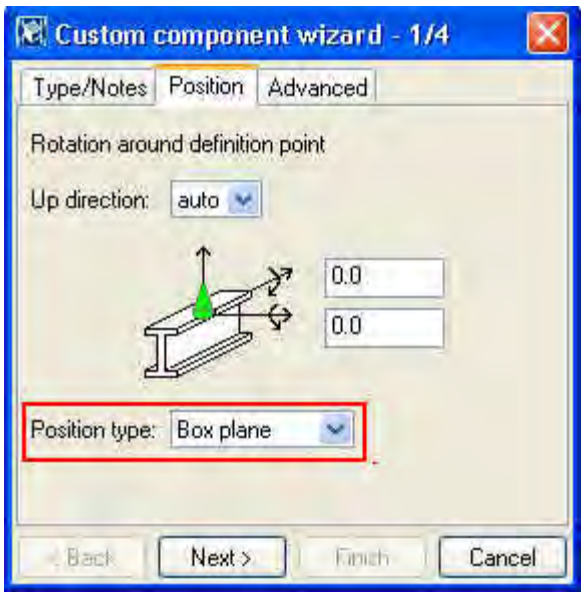
The Custom component types available:

- Component: A Component is 2 or more items connected together and is defined as having a main part and 1 or more secondary parts
- Detail: A Detail connects one or more items at the end of, or along the length of, a main part

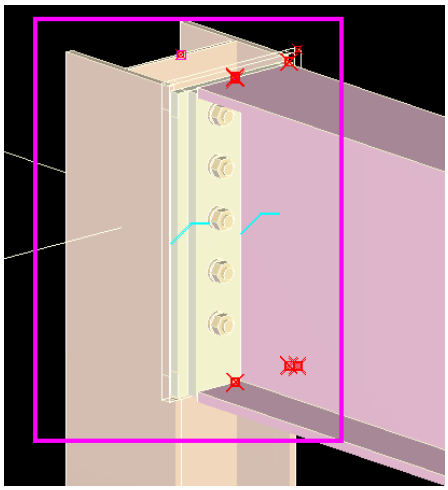
Part: A Part is a component in the model such as a ladder or cell form beam

3. On the **Position** tab set the Position type to Box plane and click **Next>**.

Help: Detailing > Custom components > Custom components reference > Position type



4. Use area select to select all the objects belonging to the component, click **Next>** on the wizard page 2/4.

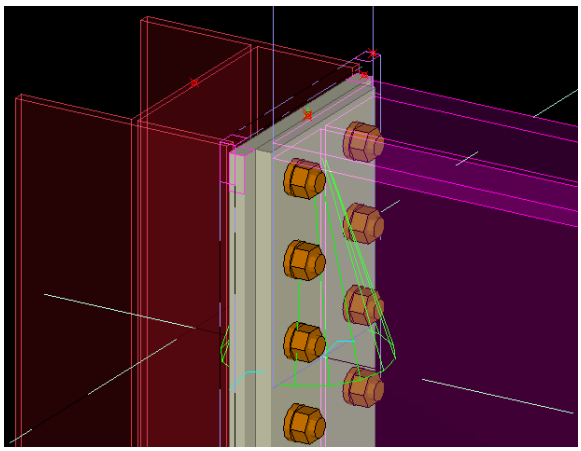


Be careful that you do not select objects (e.g. parts, bolts, welds or cuts) not belonging to this component. Otherwise when you use the custom component those objects will also be created.

Tekla Structures ignores the main part, secondary parts, grids and component symbols when you are selecting objects to include in the Custom component.

5. Select the column as the main part and click **Next>** on wizard page 3/4.
6. Select the beam as the secondary part and click **Finish** on wizard page 4/4.

Tekla Structures displays a connection symbol for the new Custom component.



The new custom component that you have defined is added to **Custom components** dialog box list.

4.2 Create User_end_plate Custom Component

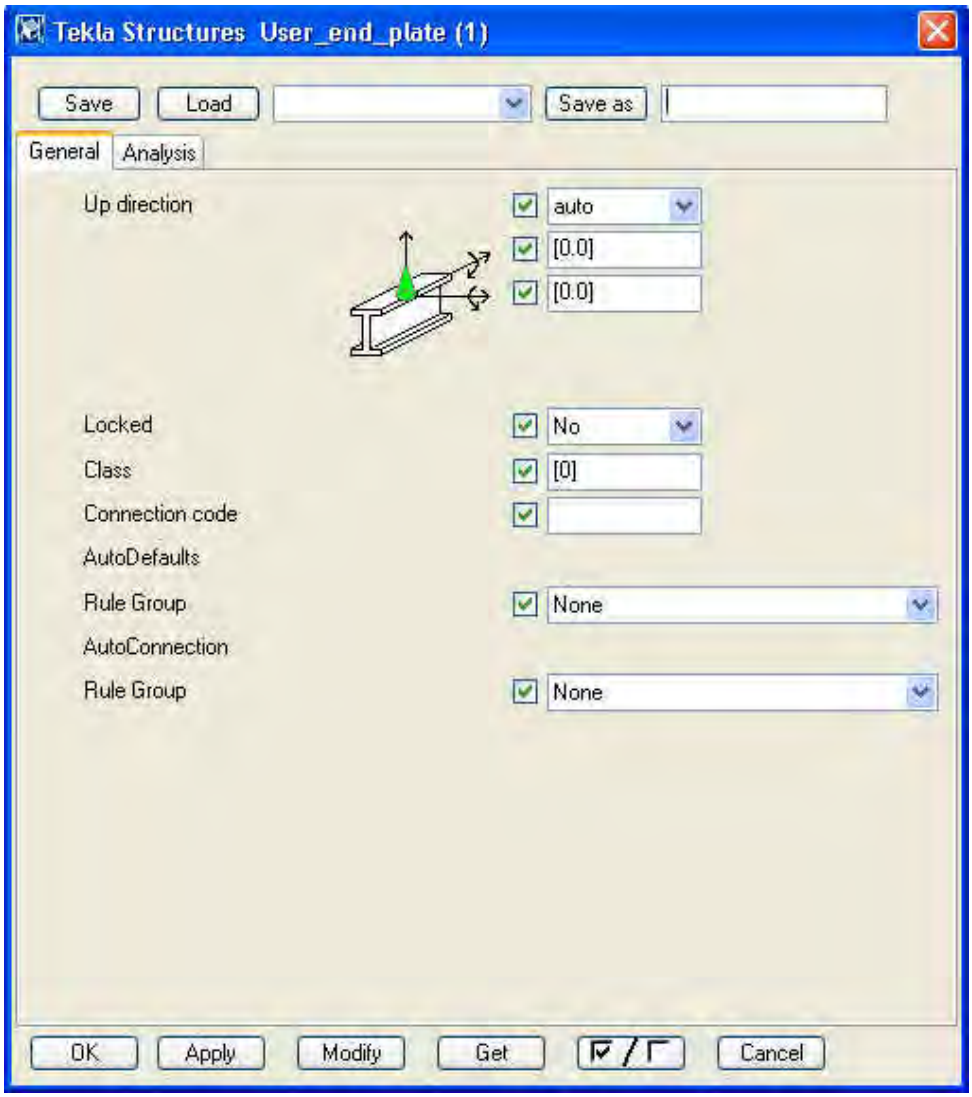
We will now use the Custom component that you just defined, to create a connection at the other end of the beam.

Create Custom component

1. Delete the **End plate 144** connection from the other end of the beam.
2. Click the **Find component** icon.

3. Select the **User_end_plate** component from the list.

4. Right-click and select **Properties...**



5. Review the properties and click **Apply**.

   Help: Detailing > Custom components > Defining Custom components > Custom components basic properties

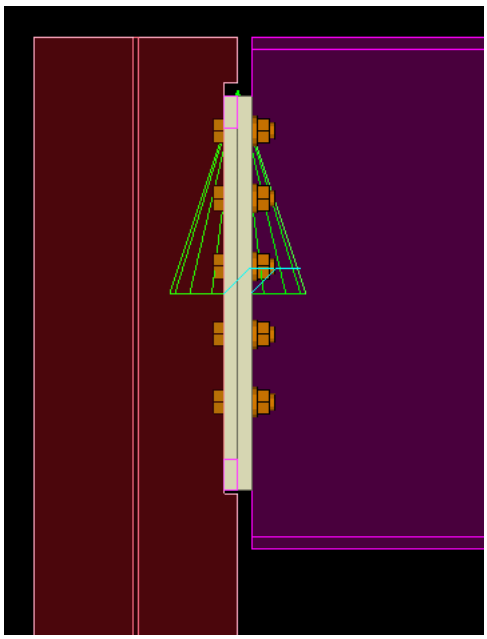
6. Pick the column as the main part and the beam as the secondary part.

The custom component is created.

Change the beam size

We will now check how the Custom component reacts when the situation changes.

1. Change the beam size from IPE600 to IPE750*137, **Modify**.



Once the custom component is created it has no intelligence or input values. In practice you can apply the custom component only in similar framing conditions to that which it was originally created.

2. Click the **Undo** icon to change the beam back to IPE600.

You can either create separate custom components for each different case needed in the model or you can parameterize the custom component (see the next section).

4.3 Parameterize User_end_plate Custom Connection

The User_end_plate connection is defined as a custom component but as yet has no intelligence or input values. In order to add these capabilities we have to edit the custom component.

We will not create a complete parametric custom component in this lesson, but will give you an idea how to build some simple dependencies between the component objects and the model.

We will create variables that will automatically adjust to suit a change in the beam profile and we will also input them in the finished connection interface:

- The end plate top and bottom position (which also defines the plate length)
- The distance from the 1st bolt to beam top flange

We will then create the following variables to automatically adjust to suit a change in the beam profile:

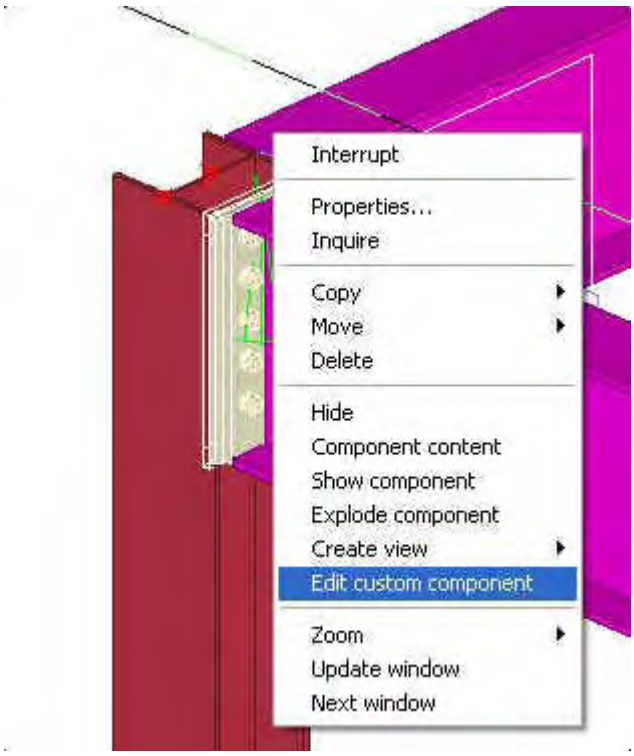
- Column plate top position
- Part cut top position

Open Custom Component Editor

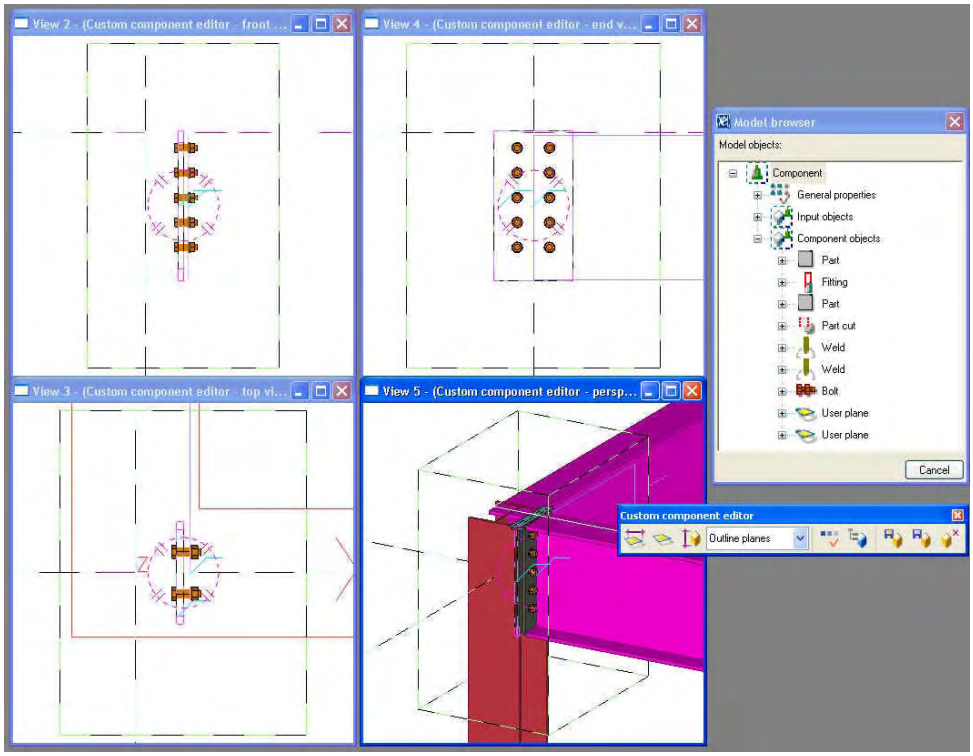
Since we have a custom component in the model we can open the Custom component editor.

Edit custom component

1. Select User_end_plate component symbol.
2. Right-click and select **Edit custom component**.



The **Custom component editor** opens along with the **Custom component editor toolbar**, the **Model browser** and four views of the custom component.

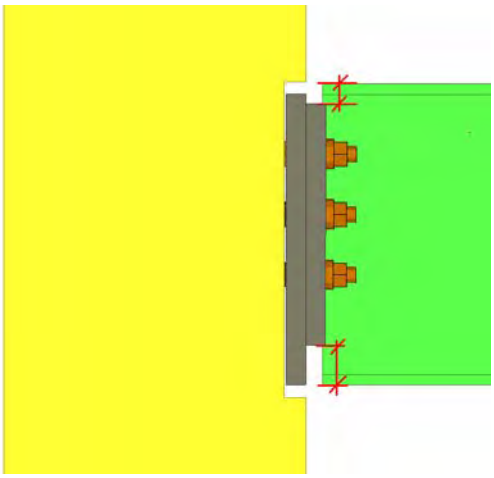


In the Custom component editor, you can create your own components and details and define their properties. You can build in dependencies between objects to make custom components parametric and have them adapt to changes in the model.

Define End Plate Top and Bottom Positions

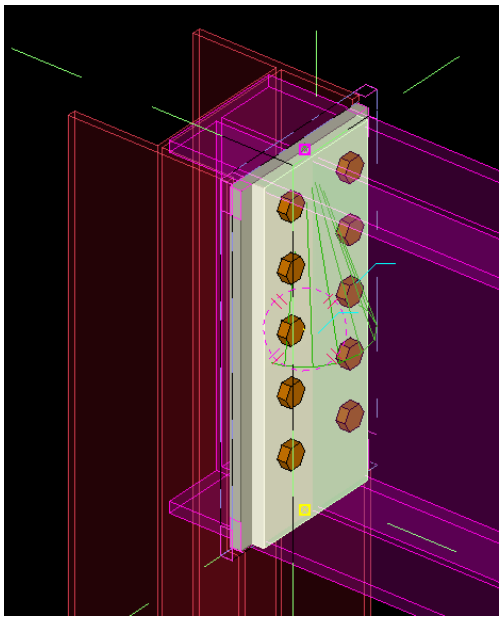
Our end plate is modeled with the beam command using plate profile PL20*230. This means the thickness (20) and the width (230) of the plate are defined by the profile. To change the thickness or the width of the plate we will need to parameterize the profile.

The length is defined by the start and end points picked for the "beam"(plate). We will now create dependencies between the end points and secondary beam top and bottom flanges.

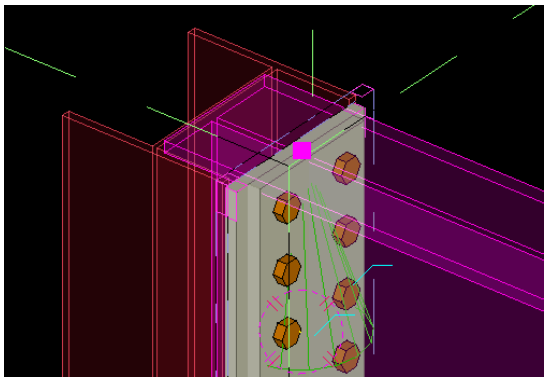


Tie end plate top to secondary beam top

1. Select the end plate.



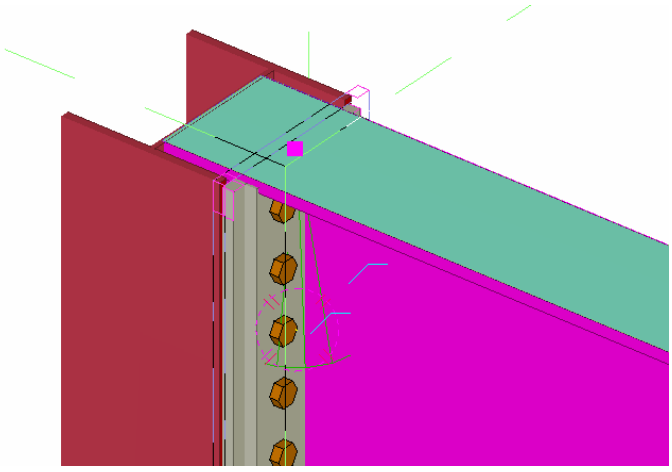
2. Select the upper handle of the end plate.



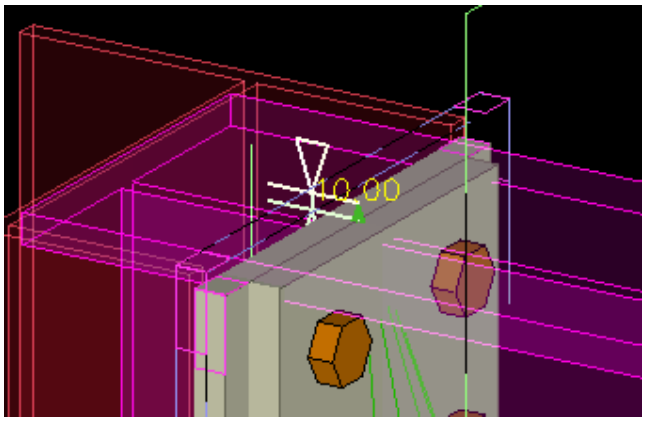
3. Right-click and select **Bind to plane**.

By moving the cursor around you can now highlight the available planes.

4. Highlight the plane on the secondary beam top flange, and select it by clicking the mouse.



The appropriate dimension in the model will appear on the screen.



Tie end plate bottom to secondary beam bottom

By following the same procedure tie the end plate lower handle to secondary beam bottom plane.

1. Select the end plate.
2. Select the lower handle of the end plate.
3. Right-click and select **Bind to plane**.
4. Highlight the plane on the secondary beam bottom flange, and select it by clicking the mouse.

The appropriate dimension in the model should then appear on the screen.

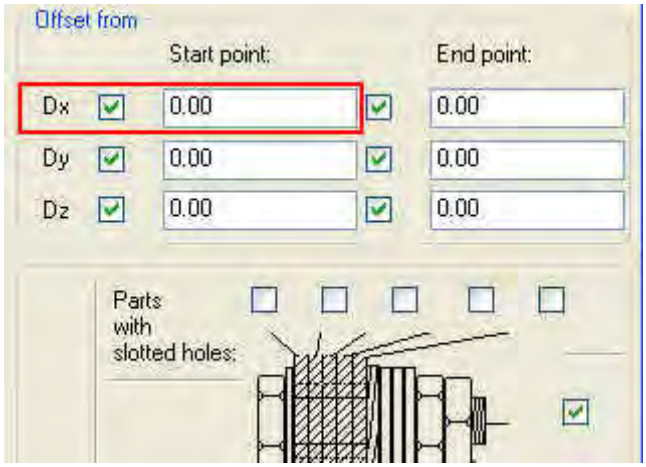
Define Distance from Beam Top Flange to the First Bolt

We will now add a variable to control the distance from the top of the beam to the first bolt.

Remove the bolt offset

To make it simpler to use the new variable, we will first remove the original offset from the bolt. This way the value added in the dialog will be the distance from the top of the beam to the first bolt.

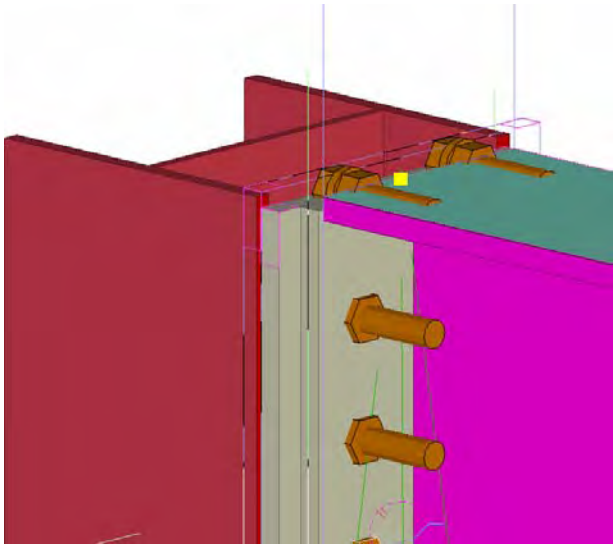
1. Double-click the bolt group to open the **Bolt properties** dialog box.
2. Change the **Start point** offset Dx to 0, click **Modify**.



Tie 1st bolt to secondary beam top

1. Select the bolt group.
2. Select the upper handle of the bolt group.
3. Right-click and select **Bind to plane**.

4. Highlight the plane on the secondary beam top flange, and select it by clicking the mouse.



The appropriate dimension in the model appears on the screen.

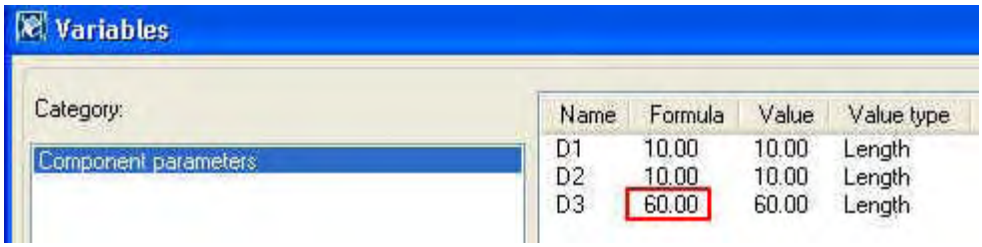
Display and test the variables

1. Click the **Display variables** icon to see all distance and parameter variables in a component.

The **Variables** dialog box appears:

Help: Detailing > Custom components > Custom components reference > Variables

2. Change the value of the lowest variable (the bolt distance), from 10 to 60 and press **Enter**.



Set the variable labels in dialog

3. To show the variables in the custom component dialog box set the variable visibility to **Show**.
4. Change the field names in the custom component dialog box by naming the variable labels as shown below.

Tie Column Plate and Cut Part Top to Beam Top Flange

Next we will tie the top of the column connection plate and the top of the part cut to the top flange of the beam.

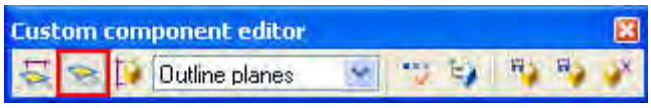
The column end plate (as well as the part cut) was modeled as a contour plate. Unlike beam, a contour plate does not have handles that we can bind. Instead we can create distance variables from the contour plate chamfers to a plane.

Instead of binding the chamfers one by one to a plane we will create a magnetic custom plane on the top face of the contour plate. We will then bind this magnetic plane to the beam top flange. The top face of the contour plate will then move with the magnetic plane.

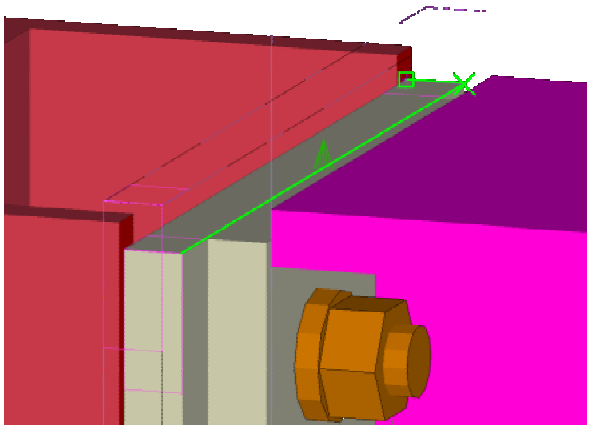
Help: Detailing > Custom components > Custom components reference > User defined planes

Create user defined planes

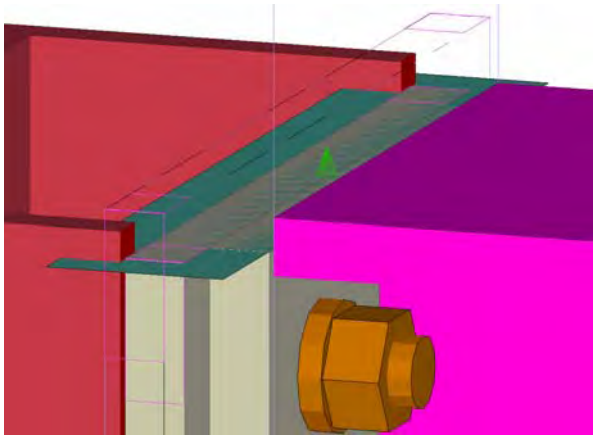
1. Click the **Create user-defined plane** icon.



2. Pick three corner points of the top of the column plate.

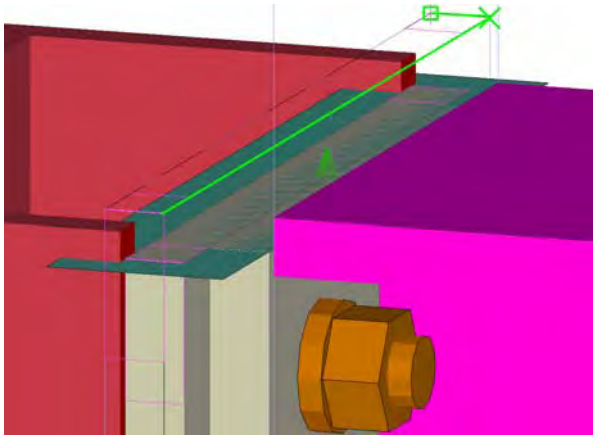


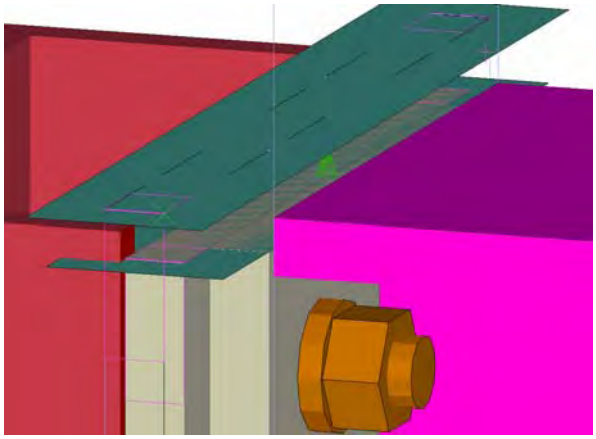
3. Click middle button and the plane is created.



While still in the command:

4. Pick three corners points at the top of the plate part cut.
5. Click the middle button and the plane is created.





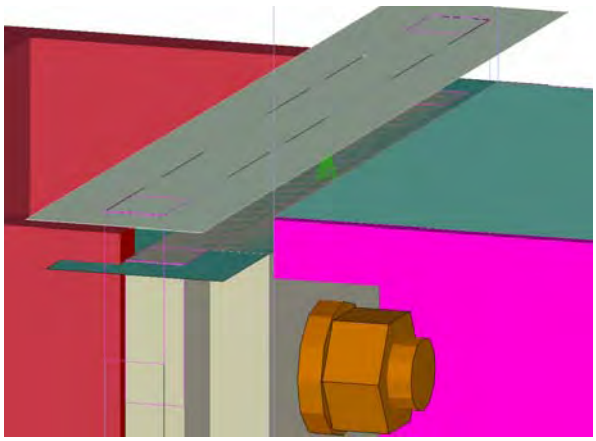
Edit custom planes to be magnetic

1. Double-click one of the user planes that you just created to open the **Plane properties** dialog.

2. Tick the **Magnetic** switch on and click **Modify**.

Bind magnetic planes to beam top

3. Select the magnetic custom plane.
4. Right-click and select **Bind to plane**.
5. Pick the highlighted plane on the top of the secondary beam.
6. Repeat for the other plane.



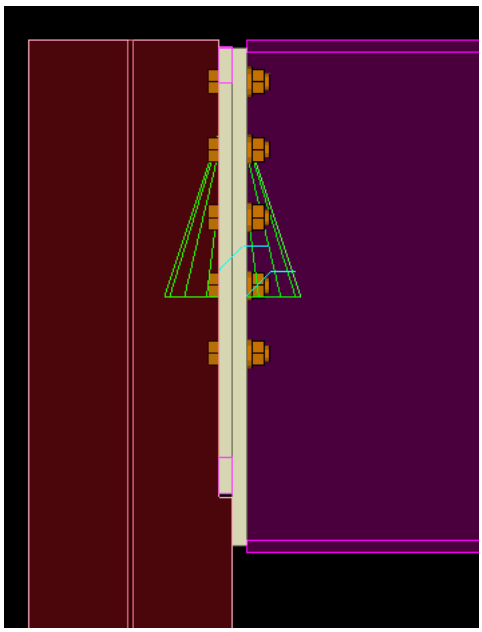
Value type	Variable type	Visibility	Label in dialog box
Length	Distance	Show	End plate top from secondary top
Length	Distance	Show	End plate bottom from secondary bottom
Length	Distance	Show	Top flange to 1st bolt
Length	Distance	Hide	D4.plane.Upper flange top plane
Length	Distance	Hide	D5.plane.Upper flange top plane

7. Close the editor by clicking the icon.

In a case where we would like to keep the existing Custom component in our model we could choose to save the custom component with a new name.

Change the beam size

Change the beam size from IPE600 to IPE750*137, **Modify**.



Test the variables

In the custom component dialog change each of the variables and **Modify** to test their function.

4.4 Define User_Hole_Creation Custom Detail

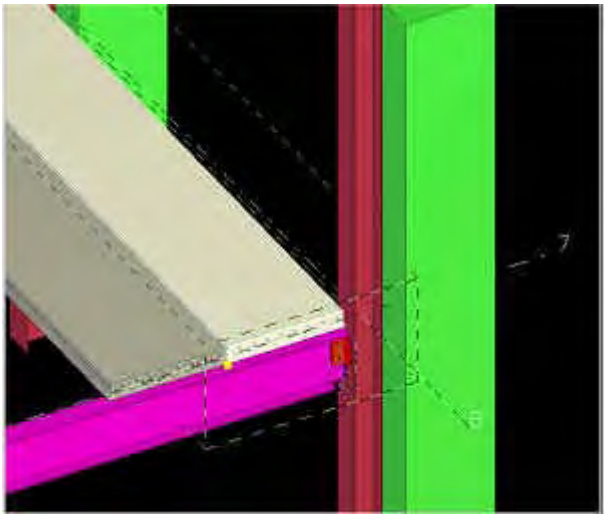
We will now create a Custom detail, which will cut a hole through a hollow-core slab.

Create a Part Cut through a Hollow-Core Slab

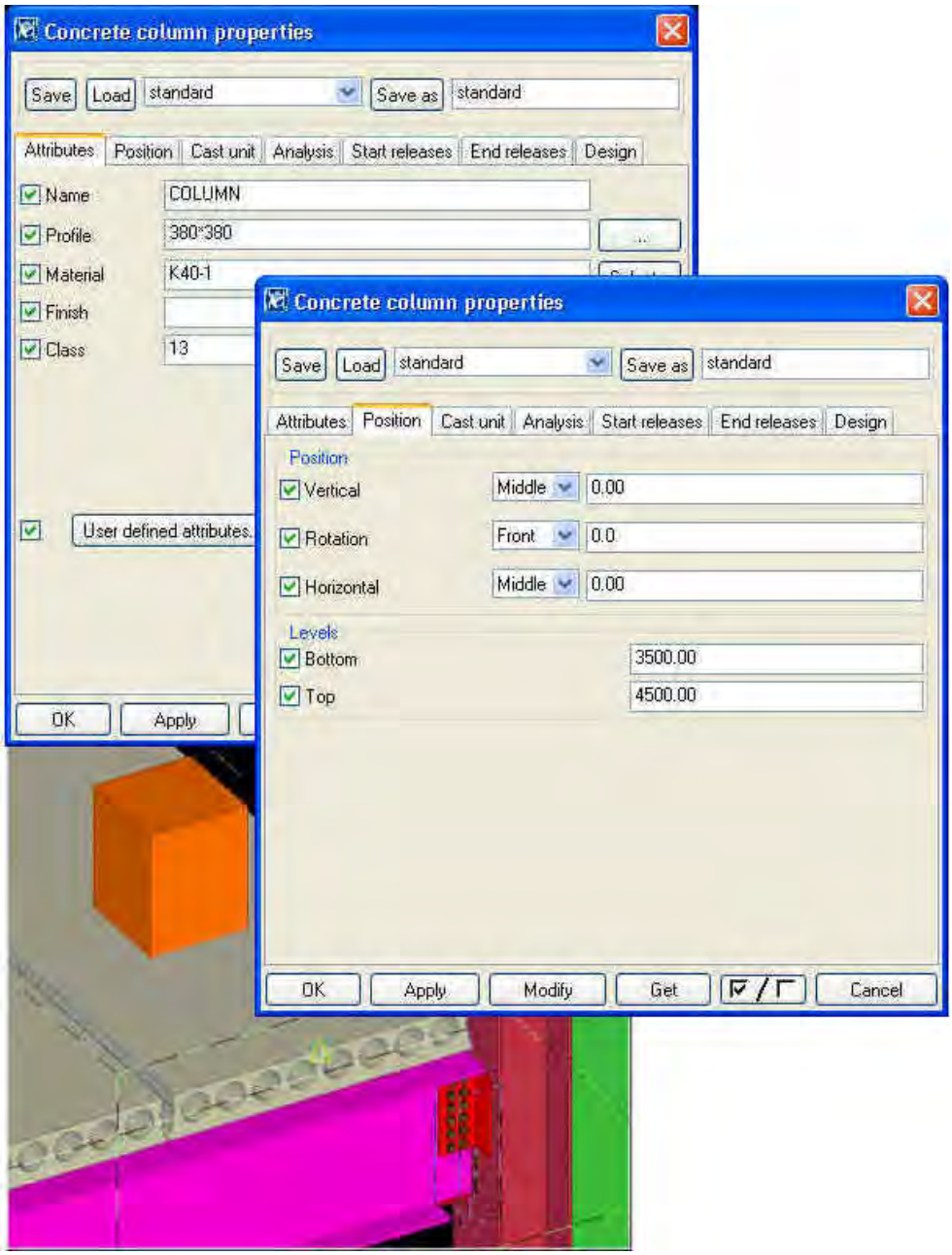
First we will create a part cut through a hollow-core slab by using a column to define the shape of the cut.

Create cutting part

1. Select a hollow-core slab on level **+3800** between grid lines 7 and B and create a part basic view of it by right-clicking and from the pop up menu select: **Create view > Part basic view**.



2. To create square part cut of size 380*380 mms:
   - Double-click the **Create concrete column** icon and define column size and position.
   - Close the dialog with **OK**.



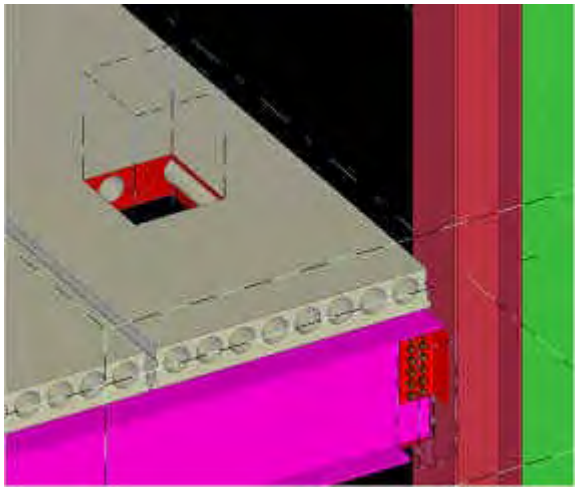
   - If necessary, restart the column command and then pick the middle point at the outer end of the hollow-core slab while holding **Ctrl** button down (this is a reference point for column position).
   - Release the **Ctrl** button, and type **r** to open **Enter numeric location** dialog.
   - Type @-1000,0,0 and press **Enter** to create the column 1000 mms from the edge.

Cut part

Cut the hollowcore slab using part cut:

1. Pick the **Create part cut** icon.

2. Pick the hollowcore slab.
3. Pick the column.
4. To end the command right-click and select **Interrupt**.
5. Remove the cutting part by picking the column and pressing the **Delete** button.



Define a Custom Detail

Next we will create a detail type custom component.

Define Custom Component

1. Select **Detailing > Define custom component…** to open the **Custom component wizard** dialog box.
2. On the **Type/Notes** tab, set the **Type** to Detail, enter a **Name** and a **Description** (description is not mandatory) for the custom component as shown below.

3. On the **Position** tab, set the **Position type**: to Box plane and click **Next >**

Help: Detailing > Custom components > Custom components reference > Position type

4. Select the objects (cut + hollowcore slab using the **Ctrl** key) and press **Next >**.
5. Pick the main part (hollowcore slab) and press **Next >**.
6. Select middle point at the outer end of the hollow-core slab to set the position.
7. Press **Finish**.

4.5 Parameterize User_Hole_Creation Custom Detail

The User_Hole_Creation custom detail is defined as a custom component but as yet has no intelligence or input values. In order to add these capabilities we have to edit the custom component.

We will not create a complete parametric custom component in here, but will give you an idea how to build some simple dependencies between component objects and the model.

We will create the following variables to automatically adjust to suit a change in the hole position, size and shape and we will also input them in the finished connection interface:

- The hole position in X-direction
- The hole position in Y-direction
- The hole size and shape

Open Custom Component Editor

Edit custom component

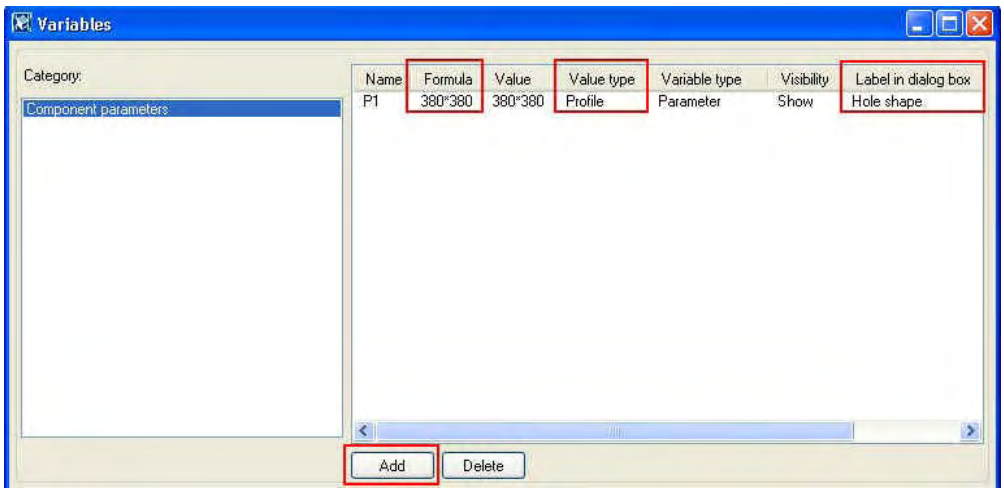
1. Select the User_Hole_Creation custom detail symbol.
2. Right-click and select **Edit custom component**. A new toolbar named **Custom component editor** opens along with the **Model browser** and 4 basic views of the custom component.

Define Parameters

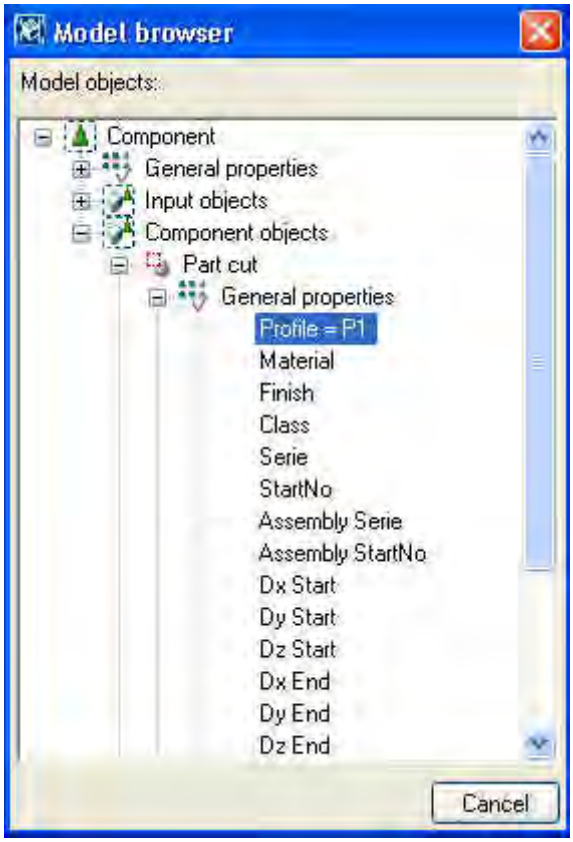
Hole size and shape

1. Open variables dialog by pushing the **Display variables** icon.

2. Add new variable by pressing the **Add** button.
3. Define the **Value type** as Profile.
4. Set the **Formula** to 380*380.
5. In the **Label in dialog box** field enter Hole shape.



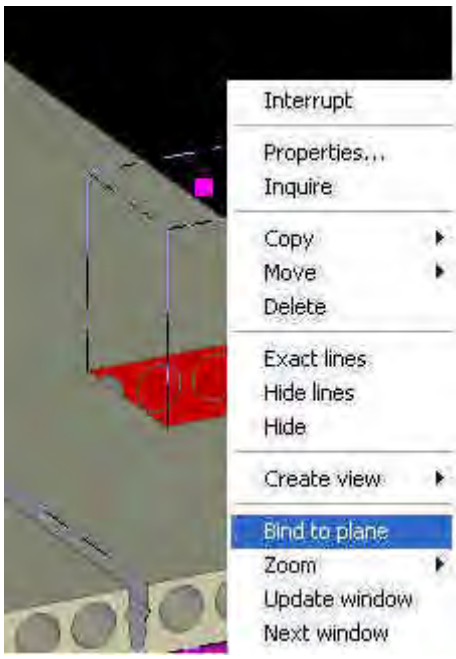
6. Select **Part cut** from the **Model browser**.
7. Select **Profile** of the part cut.
8. Right-click **Profile** and select **Add equation** to edit the name.
9. Type **Profile=P1** (variable name).



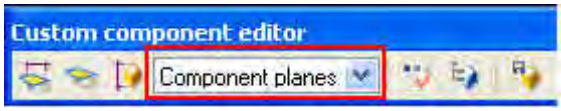
Bind hole definition points

We will define the hole position by binding the part cut's reference points.

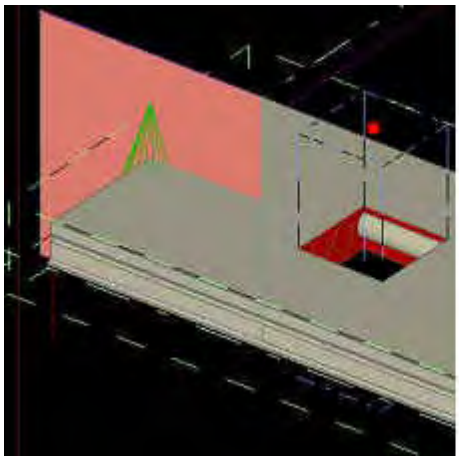
1. Select the part cut in any of the views.
2. Select the upper reference point.
3. Right-click and select **Bind to plane** command.

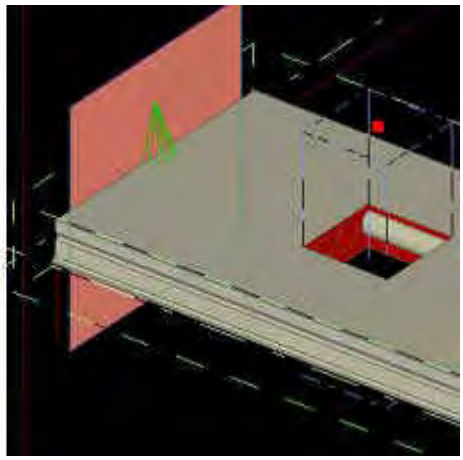


4. Select **Component planes** from **Custom component editor** toolbar's drop down menu.

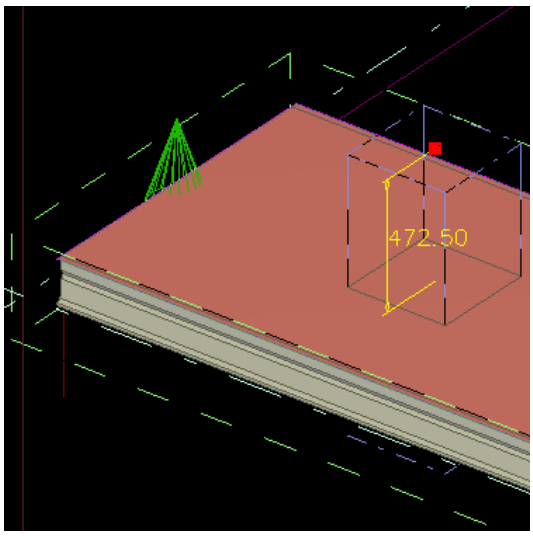


5. Zoom in to the detail symbol.
6. Rotate to highlight the XY plane.
7. Pick the detail's **XY** plane.





8. Rotate to highlight the YZ plane.
9. Pick the **YZ** plane.
10. Select **Boundary planes** from **Custom component editor** toolbar's drop down menu.
11. Zoom out and rotate to highlight the top boundary plane of the slab.
12. Pick the **top** plane.



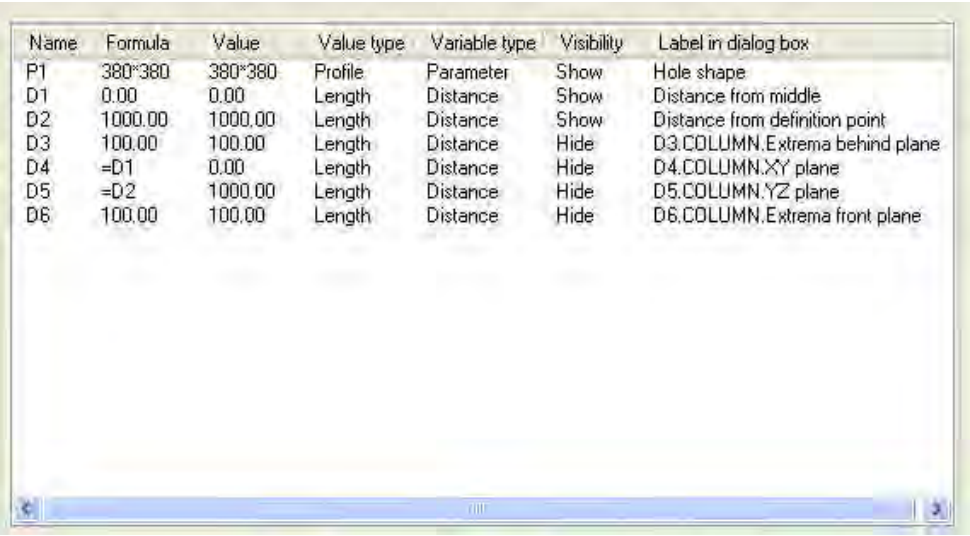
You have now bound the upper reference point in three directions. The distances are now visible in **Variables** dialog.

Repeat steps 3 - 12 to the part cut's lower reference point by binding it to XY and YZ directions in the Component plane and to slab bottom plane using Boundary plane.

Edit hole definition variables

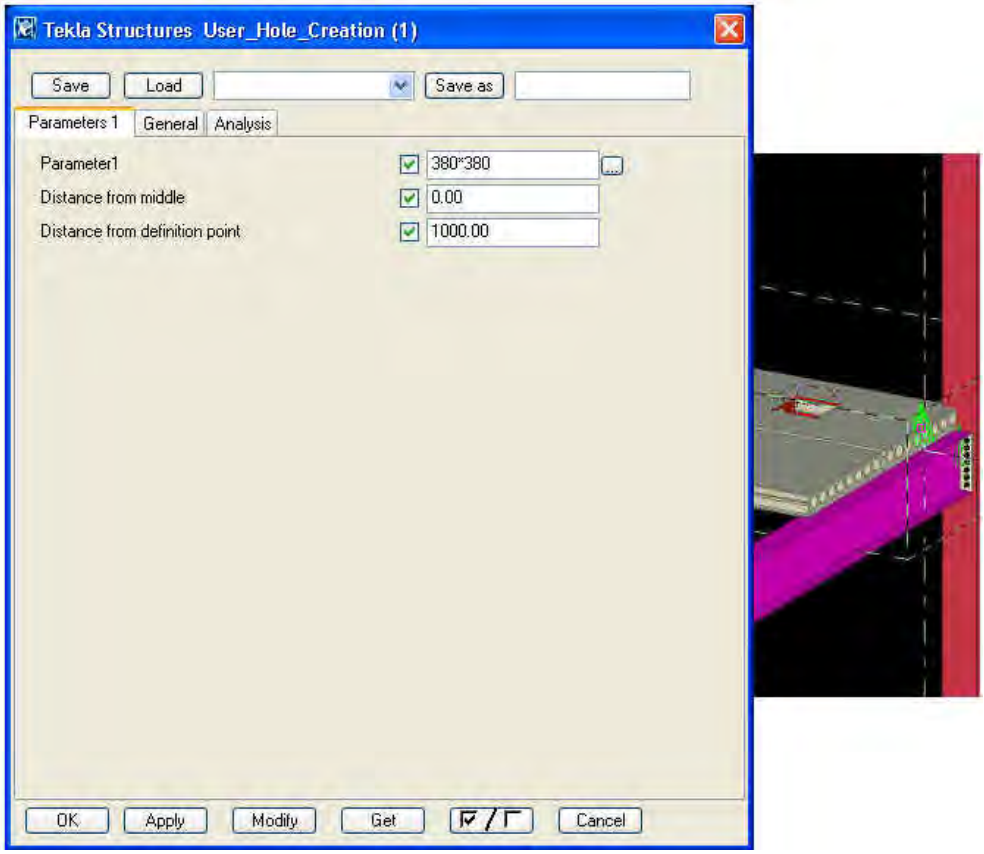
We will next edit the hole position variables and define visibility on detail's dialog.

1. Open the **Variables** dialog.



Name	Formula	Value	Value type	Variable type	Visibility	Label in dialog box
P1	380*380	380*380	Profile	Parameter	Show	Hole shape
D1	0.00	0.00	Length	Distance	Show	Distance from middle
D2	1000.00	1000.00	Length	Distance	Show	Distance from definition point
D3	100.00	100.00	Length	Distance	Hide	D3.COLUMN.Extrema behind plane
D4	=D1	0.00	Length	Distance	Hide	D4.COLUMN.XY plane
D5	=D2	1000.00	Length	Distance	Hide	D5.COLUMN.YZ plane
D6	100.00	100.00	Length	Distance	Hide	D6.COLUMN.Extrema front plane

2. Edit D1 variable: Label: Distance from middle.
3. Edit D2 variable: Label: Distance from definition point.
4. Edit D3 variable: Formula: 100, Visibility: Hide.
5. Edit D4 variable: Formula: =D1, Visibility: Hide.
6. Edit D5 variable: Formula: =D2, Visibility: Hide.
7. Edit D6 variable: Formula: 100, Visibility: Hide.
8. Close editor, save changes.



Check the Results

We will now check that the dialog custom detail dialog has needed fields and that they function correctly.

Modify custom detail

1. Double-click the User_Hole_Creation custom detail symbol. A dialog opens.
2. Change cut size and location, press **Modify**.