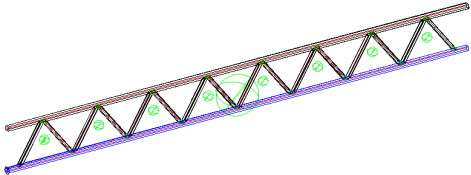
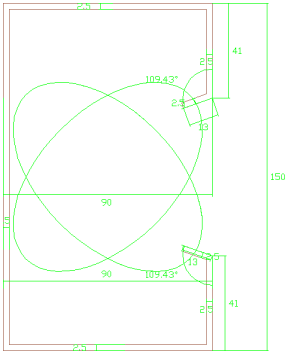
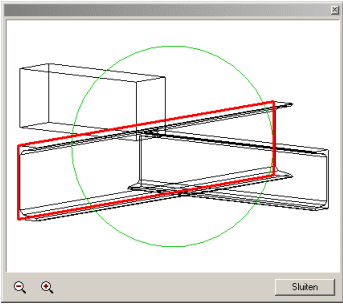
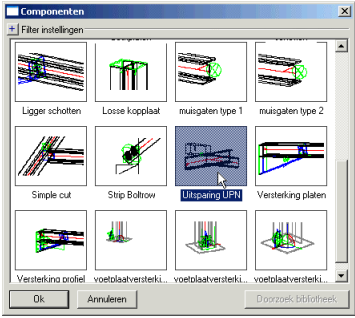
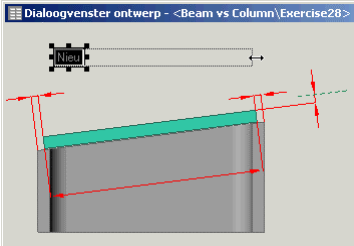
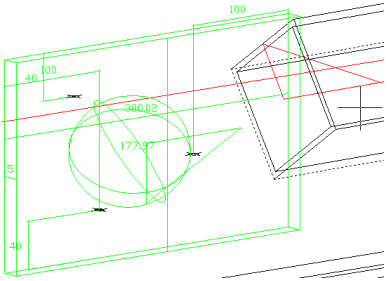


Parabuild training course

Exercises book

Creating and manipulating macros



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Creating connections

Introduction

When you are reading this exercises book, you will have already used connections in Parabuild.

A green sphere represents a connection. We call this a macro.

The macro contains data about the parts of the connection. This data defines how the parts of the connection have to be modified in relation to other parts.

In this exercises book we will learn how to create such a macro.

In this macro we tell the computer what the shape of each part of the connection should be.

We do this with the aid of geometric rules.

A geometric rule is for example "Parallel", "Coincident", "Perpendicular", "Distance between planes", ...

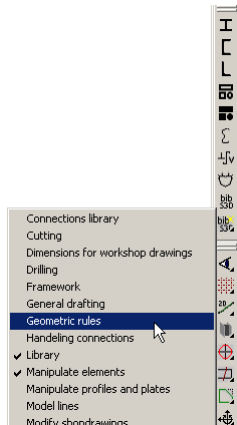
A macro is also split into pieces (we call each piece a module). This way we can structure the parts of a macro in an ordered manner. A macro can contain one module for each stiffener, each endplate, the bolts, ... and the collection of these modules is the connection.


All drawings needed to execute the exercises are located in the directory *\Exercises* on the installation CD of Parabuild or on your class computer.

Exercise 1: Familiarising with geometric rules

We will create some geometric rules in order to learn the procedures.

Step 1



 First we need to activate the toolbar **Geometric rules**.

- Move the cursor above a Parabuild toolbar and click the right mouse button.


- Activate **Geometric rules** from the dropdown menu that appears.

Step 2



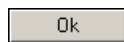
- Open the drawing  Exercise1.dwg



- Click on  **Set macro as current** in the toolbar that we've just activated.




- Select the macro in the drawing.



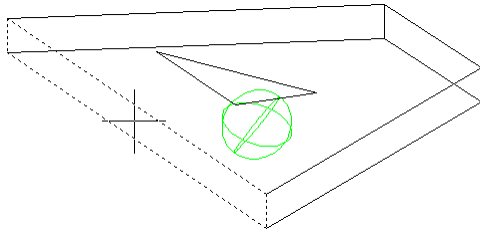
- Click on **Ok**.

Step 3

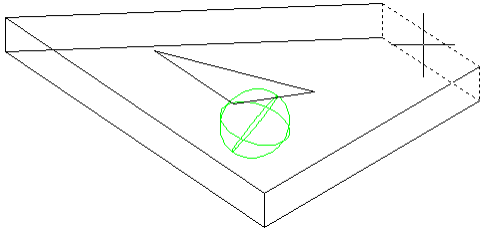
 Now we can draw a geometric rule.



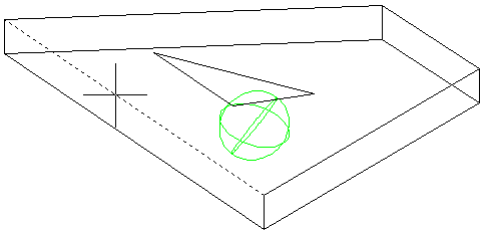
- Click on  **Distance between**



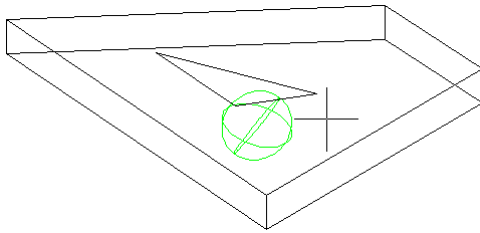
- Move the cursor to above the left side plane, not too close to a line, and then click the right mouse button. If the right plane is correctly drawn in dashed lines, then click the right mouse button to confirm.




- Move the cursor inside the right side plane, and click the left mouse button. The top plane is drawn in dashed lines but this is not the plane we want. Click again on the left mouse button without moving the cursor to select the side plane. If the correct plane is drawn in dashed lines, then click the right mouse button to confirm.

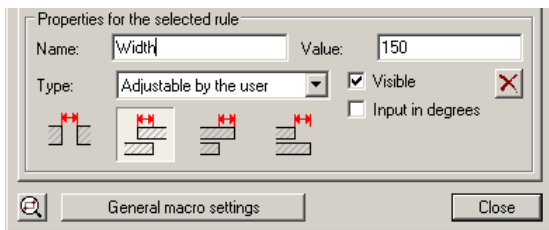


- Move the cursor to above a line and click the left mouse button to select the line. Click the right mouse button to confirm.




- Move the cursor to above the plate and click the left mouse button.

 In the dialog box that pops up we can see the **Distance** rule that we've just created.




- In the dialog box below, enter for the property **Name: Width**

- Enter for the property **Value : 150**

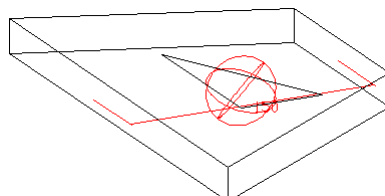
- Click below on the button  so that it is pressed.

- Click on **Close**.


 We will now look at the results of this geometric rule.

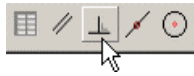


- Click on  **Recalculate all**.

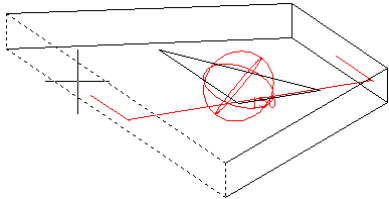


◀ Step 4 ▶

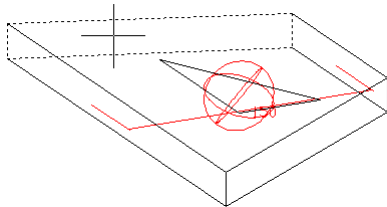
 We will now make a rectangular plate.



- Click on  **Perpendicular**



- Move the cursor to above the left side plane and click on the left mouse button. Click on the right mouse button if the correct plane is selected.




- Move the cursor to above the backside plane and click on the left mouse button. Click again on the left mouse button to select the side plane. Click on the right mouse button if the correct plane is selected.



- Click on **Close**.



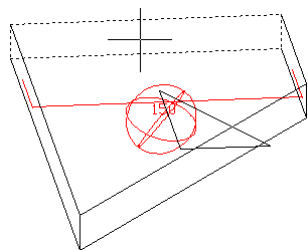
- Click on  **Recalculate all**.

 The plate rotates a little because we haven't constrained the placement of the plate.

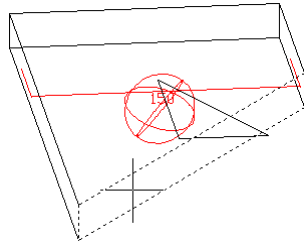
◀ Step 5 ▶



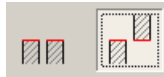
- Click on  **Parallel**




- Move the cursor to above the backside plane and click on the left mouse button. Click again on the left mouse button to select the side plane. Click on the right mouse button if the correct plane is selected.



- Move the cursor to above the front side plane and click on the left mouse button. Click on the right mouse button if the correct plane is selected.



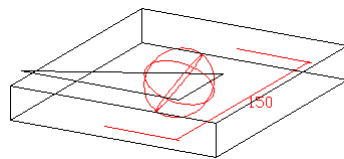
- Click in the dialog box on the button 



- Click on **Close**.



- Click on  **Recalculate all**.



Exercise 2: Rules to another second part

We will draw geometric rules between different parts. Doing this we will learn how to set the parts as fixed or flexible and what this means.

Step 1



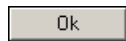
- Open the drawing  Exercise2.dwg



- Click on  **Set macro as current** .



- Select the macro in the drawing.

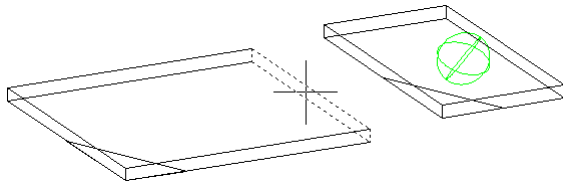


- Click on **OK**.

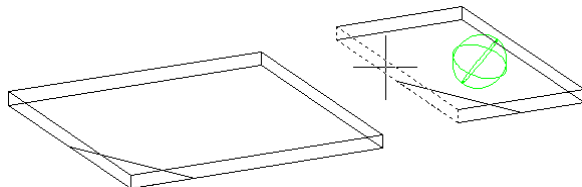
Step 2



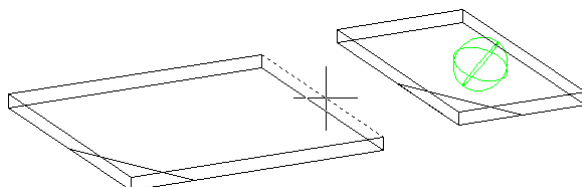
- Click on  **Distance between**



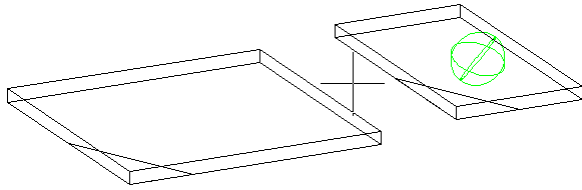
- Move the cursor to the side plane of the first plate and click on the left mouse button. Click left mouse button a second time so that the side plane of the plate is selected. Click on the right mouse button to confirm.



- Move the cursor to the side plane of the second plate, and then click the left mouse button. If the side plane of the plate is correctly selected, then click the right mouse button to confirm.

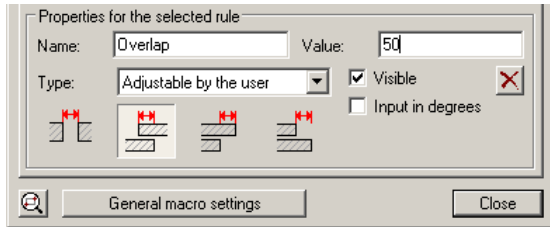


- Move the cursor to above a line of the plane so that the line of the plane is selected. Click on the right mouse button to confirm.



- Move the cursor to somewhere in the middle and click once on the left mouse button.

? The last 2 command inputs determine the orientation and location of the dimension we see on the screen. They are therefore not that important because they do not influence the results.



- In the dialog box below, enter for the property **Name** : *Overlap*

- Enter for the property **Value** : 50

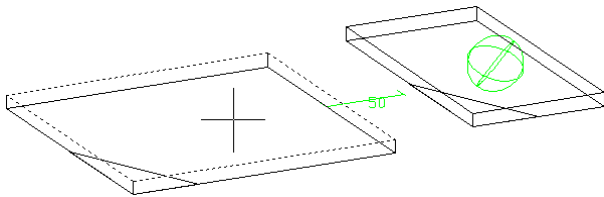
- Click on the button

- Click on **Close**.

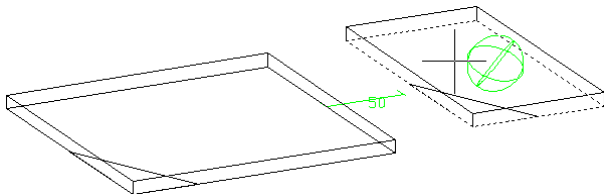
← Step 3 →



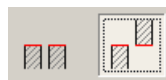
- Click on **Coincident**



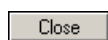
- Move the cursor to the middle of the first plate, and then click the left mouse button. If the top plane of the plate is correctly selected, then click the right mouse button to confirm.



- Move the cursor to the middle of the second plate, and then click the left mouse button. Click a second time on the left mouse button so that the underside of the plate is selected. Click on the right mouse button to confirm.



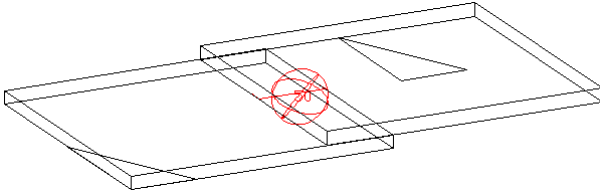
- Click in the dialog box on the button




- Click on **Close**.



- Click on  **Recalculate all.**

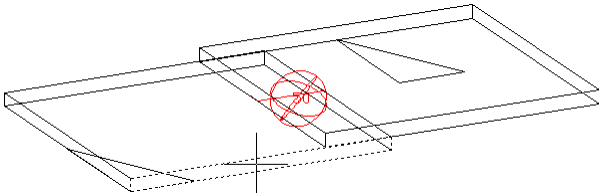


 *The plates are drawn on top of each other with an overlap of 50mm but they do not collide. The axis requested.*

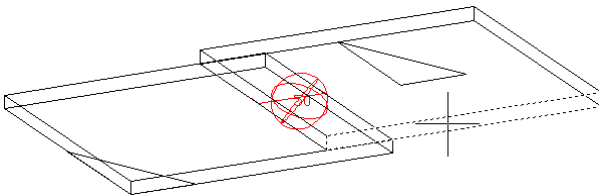
← Step 4 →



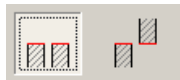
- Click on **Coincident**




- Move the cursor to above the side plane of the first plate and then click the left mouse button. If the side plane of the plate is correctly selected, then click the right mouse button to confirm.



- Move the cursor to above the side plane of the second plate and then click the left mouse button. If the side plane of the plate is correctly selected, then click the right mouse button to confirm.



- Click in the dialog box on the button 

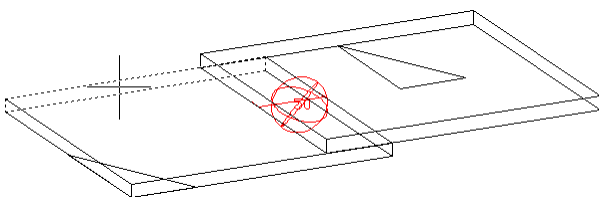


- Click on **Close**.

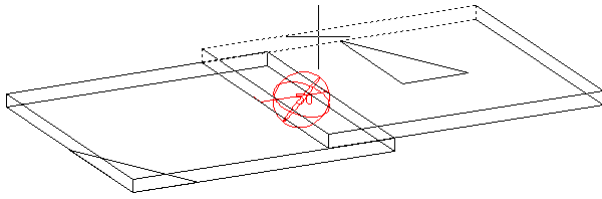
← Step 5 →



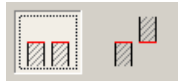
- Click on **Coincident**




- Move the cursor to the backside plane of the first plate and then click the left mouse button. Click again on the left mouse button so that the side plane of the plate is correctly selected. Then click the right mouse button to confirm.



- Move the cursor to the backside plane of the second plate and then click the left mouse button. Click again on the left mouse button so that the side plane of the plate is correctly selected. Then click the right mouse button to confirm.



- Click in the dialog box on the button 

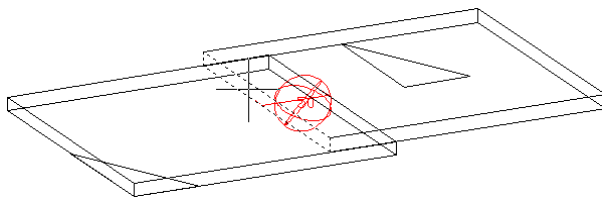


- Click on **Close**.

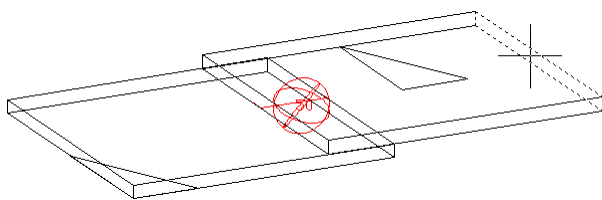
◀ Step 6 ▶



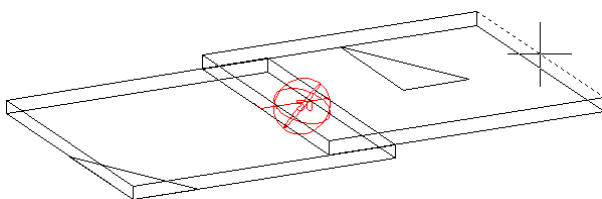
- Click on  **Distance between**



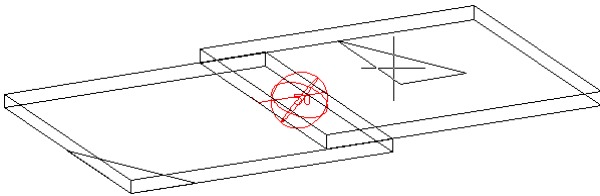
- Move the cursor to above the left side plane of the second plate and click on the left mouse button. If the side plane of the plate is correctly selected, then click the right mouse button to confirm.



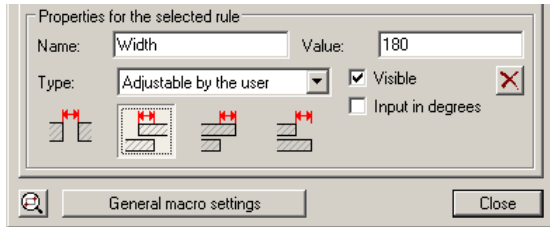
- Move the cursor to above the right side plane of the second plate and click on the left mouse button. Click a second time on the left mouse button so that the side of the plate is selected. Click on the right mouse button to confirm.




- Move the cursor to above a line of the second plate so that the line of the plate is selected. Click on the right mouse button to confirm.



- Move the cursor to the middle of the plate and click once on the left mouse button.

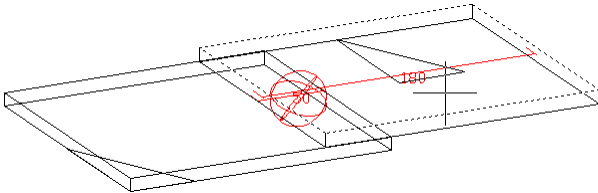


- In the dialog box below, enter for the property **Name** : *Width*
- Enter for the property **Value** : *180*
- Click on the button 
- Click on **Close**.

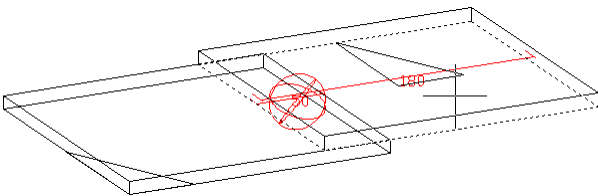
← Step 7 →



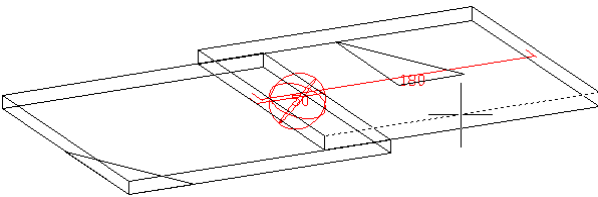
- Click on  **Distance between**



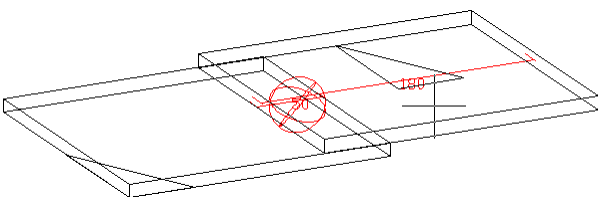
- Move the cursor to the middle of the right plate and click on the left mouse button. If the top plane of the right plate is correctly selected, then click the right mouse button to confirm.



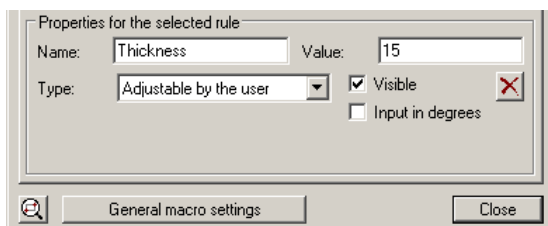
- Move the cursor to the middle of the right plate and click on the left mouse button. Click a second time on the left mouse button so that the bottom plane of the plate will be selected. Click on the right mouse button to confirm.



- Move the cursor to above the top line on the front of the plate. If the line is correctly selected, then click the right mouse button to confirm.



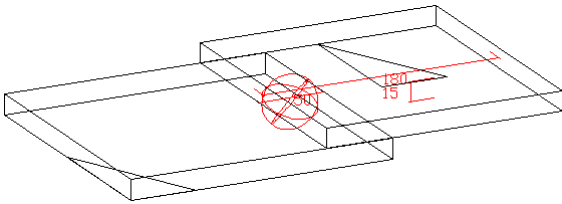
- Move the cursor to somewhere in the middle of the plate and click once on the left mouse button.




- In the dialog box below, enter for the property **Name** : *Thickness*
 - Enter for the property **Value** : 15
 - Click on **Close**.



- Click on  **Recalculate all.**



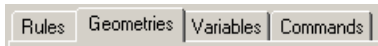
 *Both plates were modified by Parabuild.
This is because we have not yet set which plate should
be modified and which shouldn't.*

◀ Step 8 ▶

? We will now indicate that the the right plate should be modified and the left plate shouldn't.



- Click on **Edit macro**



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
P200X15-200(213)	Base	Fixed	<input type="checkbox"/>
P200X25-240(213)	Base	Flexible	<input type="checkbox"/>

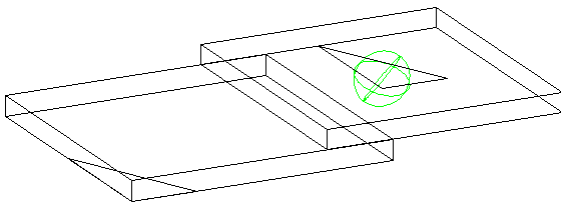
- Move the mouse over the first field of the column **Flexibility** and click on the left mouse button. Select from the list **Fixed**.



- Click on **Close**.



- Click on **Recalculate all**.



? The macro becomes green. This means that Parabuild has enough information to completely calculate the right plane. So now we've finished the right plate!

◀ Step 9 ▶

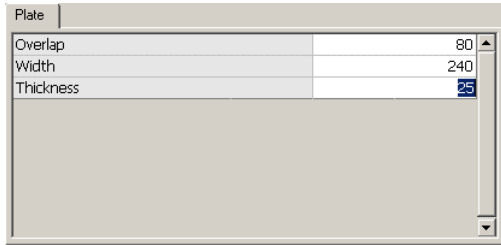
? We will test this new macro.



- Click on **Review macro**.



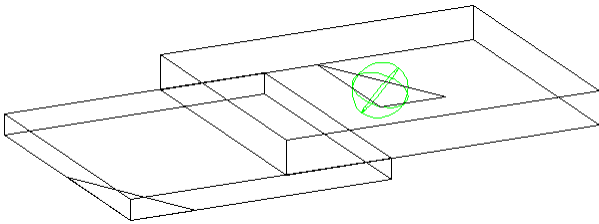
- Select the macro in the drawing and press **<Enter>**.




- Modify the **Overlap** to : 80
- Modify the **Width** to : 240
- Modify the **Thickness** to : 25

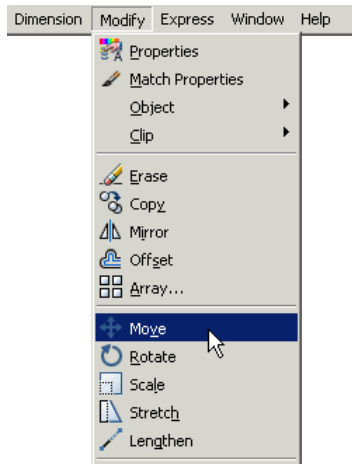
Close


- Click on **Close**.

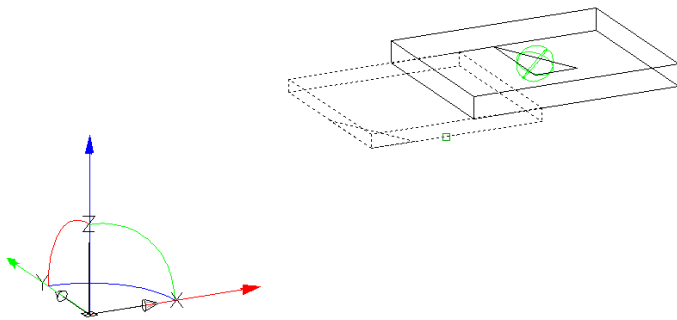


 Notice how the right plate modifies itself. It becomes bigger based on the left plate, following the rules that we've drawn.

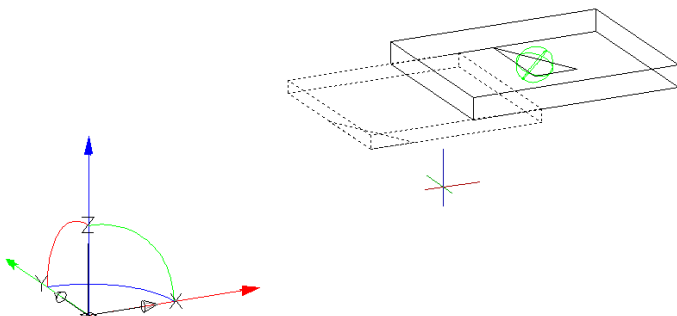
← Step 10 →



- Start the command  **Move**



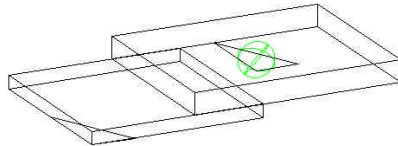
- Select the left plate and confirm by pressing **<Enter>**.




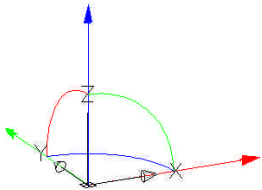
- Click somewhere to indicate the base point.



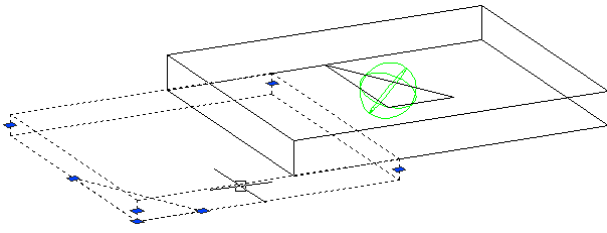
- Enter the following coordinates on the command line for the displacement :
@100,0,100 and then press **<Enter>**



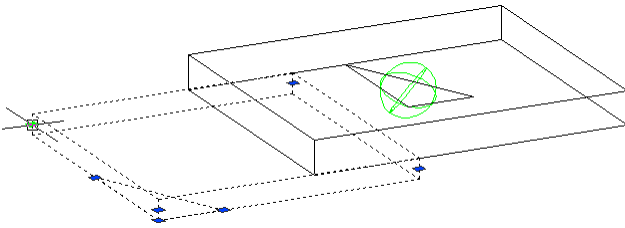
 *The macro takes care of the displacement of the right plate.*



Step 11



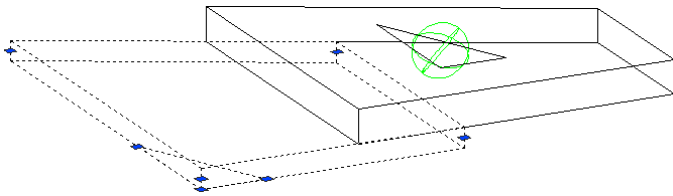
- Select the left plate so that the grips become visible.




- Move the cursor to above the upper left grip and click on the left mouse button.



- Enter the stretch coordinates on the command line : **@0,100,0** and press **<Enter>**.




 *The right plate gets the same oblique side because we've made those sides coincident using a geometric rule.*

Exercise 3: Rules for cylinders

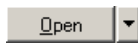
In this exercise we will draw geometric rules for cylinders.

◀ Step 1 ▶

 We start with an empty drawing so in the future we will know how to start from scratch.




- Start the command  **New drawing**.



- Click on **Open** to load the standard template.



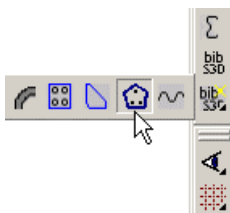
- Start the command  **Circle**.



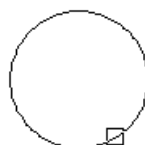
- Click a random location in the drawing.



- On the command line, type : *150* for the **radius** of the circle and press **<Enter>**.



- Start the command  **Plate with polyline**



- Select the circle and press **<Enter>**.

◀ Step 2 ▶

❓ To make the plate intelligent we need a macro.



- Start the command  **Create new macro** (red sphere).



- Click a random location in the drawing.




- On the command line, type for the **name** of the module : *Plate* and press **<Enter>**.

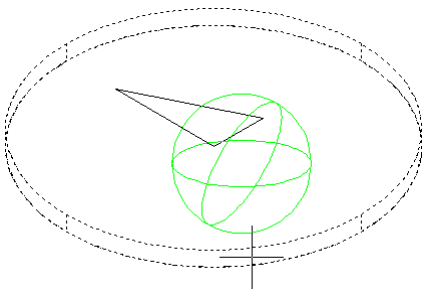


- Start the command  **SW Isometric View**

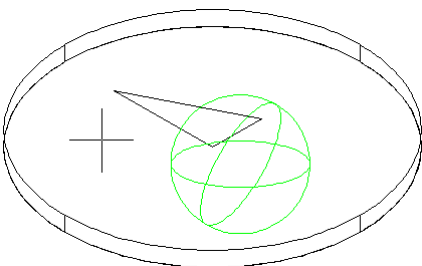
◀ Step 3 ▶



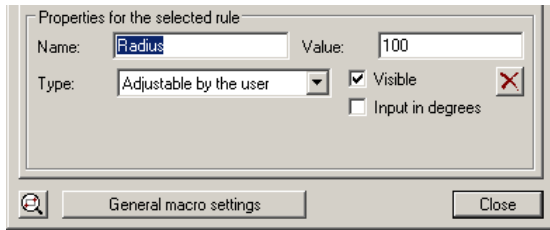
- Start the command  **Radius**



- Select the side plane of the plate, this is a cylinder. Click on the right mouse button to confirm the selection.



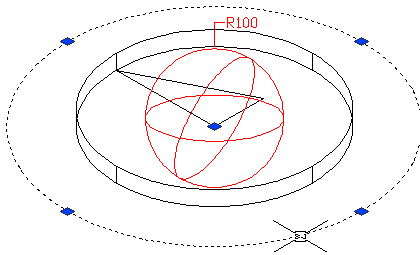
- Select a location somewhere in the middle of the plate.



- In the dialog box below, enter for the property **Name** : *Radius*
- Enter for the property **Value** : *100*
- Click on **Close**.



- Click on  **Recalculate all**.




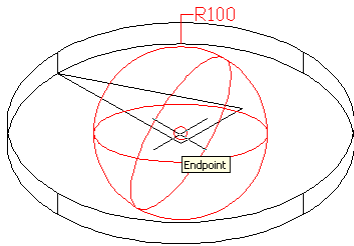
- Select the circle and press the **<Delete>** button to remove the original circle.

◀ Step 4 ▶

❓ We will draw a round hole in this plate.



- Start the command  **Circle**.



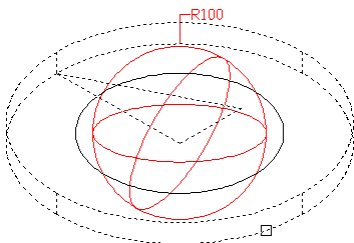
- Select the middle of the plate.



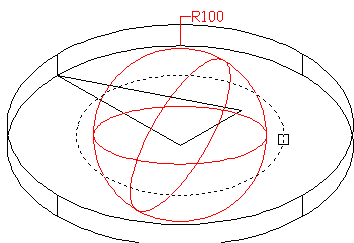
- On the command line, type for the **radius** of the circle : **60** and press **<Enter>**.



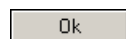
- Start the command  **Cut along polyline**.



- Select the plate and press **<Enter>**.



- Select the circle and press **<Enter>**.




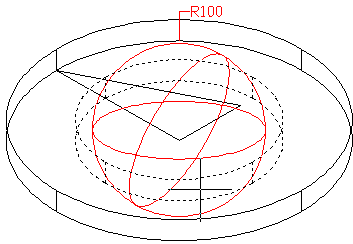
- Click on **Ok**.

← Step 5 →

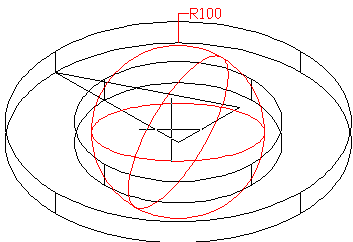
? Each type of detail (except for holes) can be constrained using geometric rules.



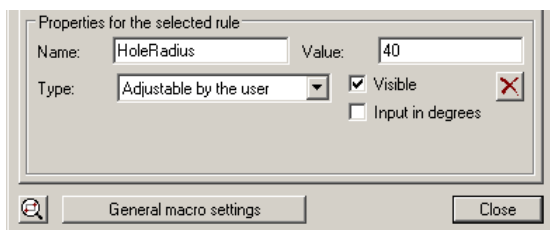
- Start the command  **Radius**



- Select the cylinder of the hole by moving the cursor over it and by clicking the left mouse button. Click again on the left mouse button to select the cylinder and press the right mouse button to confirm.



- Select a point somewhere in the middle of the plate.

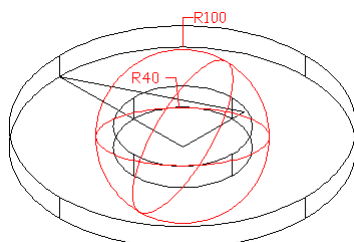


- In the dialog box below, enter for the property **Name** : *HoleRadius*
- Enter for the property **Value** : 40
- Click on **Close**.

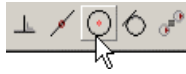
! A space in the name of a rule is not allowed.




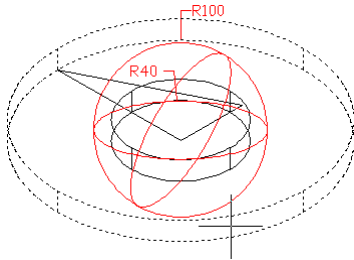
- Click on  **Recalculate all**.



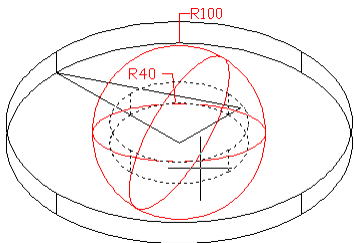
◄ Step 6 ►



- Start the command  **Concentric**.



- Select the outer cylinder and press the right mouse button to confirm.



- Select the inner cylinder by clicking the left mouse button twice and press the right mouse button to confirm.

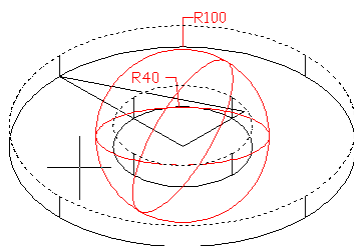


- Click on **Close**.

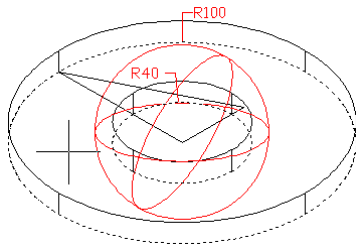
◄ Step 7 ►



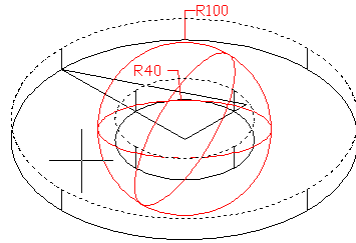
- Click on  **Distance between**



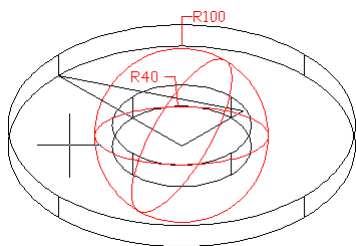
- Select the top plane of the plate. Both the upper circles are highlighted. Now press the right mouse button to confirm.



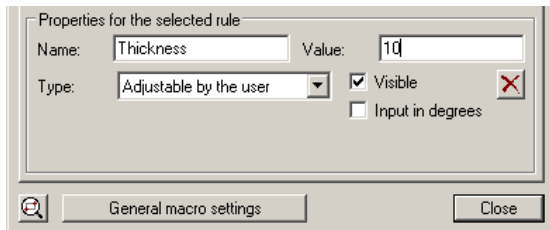
- Select the lower plane by pressing the left mouse button twice and press the right mouse button to confirm.



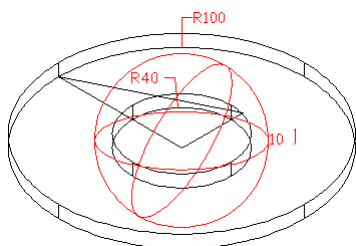
- Select the upper plane of the plate again and press the right mouse button to confirm.



- Select a point somewhere in the middle of the plate.



- In the dialog box below, enter for the property **Name** : *Thickness*
 - Enter for the property **Value** : *10*
 - Click on **Close**.




The macro's color stays red. Although the size of the plate has been determined, its position hasn't.

Exercise 4: Tangent and angles

In this exercise we will look some more at geometric rules for cylinders.
We will also learn how to draw an angle.

◀ Step 1 ▶

 For this exercise we will finish a stiffener. We start with the base geometry that we need.



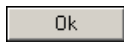
- Open the drawing  Exercise4.dwg



- Start the command  **Set macro as current.**

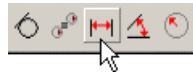


- Select the macro in the drawing.

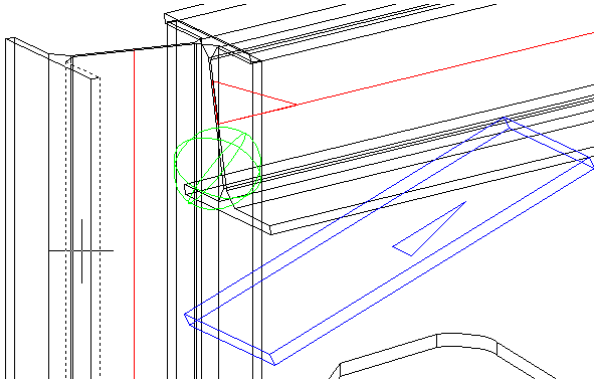


- Click on **Ok**.


← Step 2 →



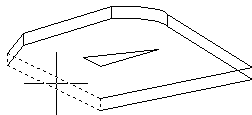
- Click on  **Distance between**



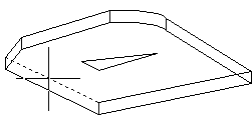
- Select the inside of the left flange of the column by pressing the left mouse button twice. Press the right mouse button to confirm.

 *To perform the upcoming selections you should zoom in to the stiffener. You can do this by using the mouse scroll wheel.*

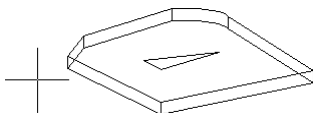
You can also move the view (= Pan) by keeping the wheel pressed in and moving the mouse at the same time.



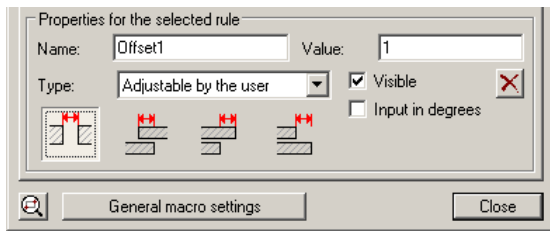
- Select the left side plane of the stiffener and press the right mouse button to confirm.



- Select a line of the plate and click on the right mouse button to confirm.

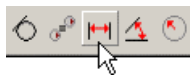


- Select a point somewhere in the neighbourhood of the plate.

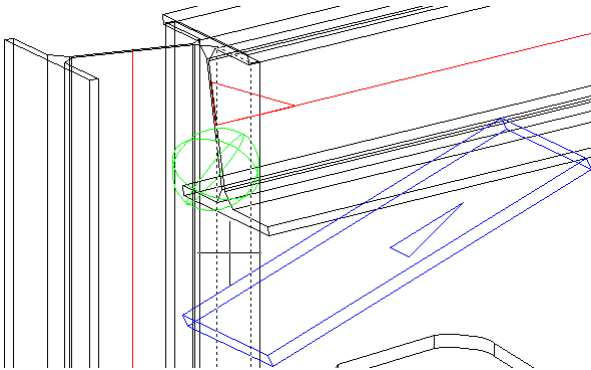


- In the dialog box below, enter for the property **Name** : *Offset1*
- Enter for the property **Value** : 1
- Click on the button
- Click on **Close**.

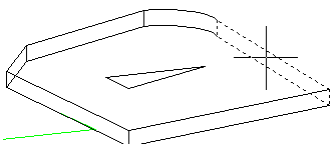
← Step 3 →



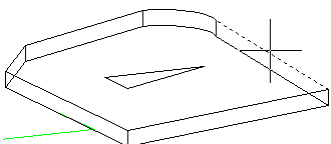
- Click on **Distance between**



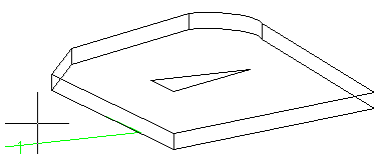
- Select the inside of the right flange of the column. Press the right mouse button to confirm.



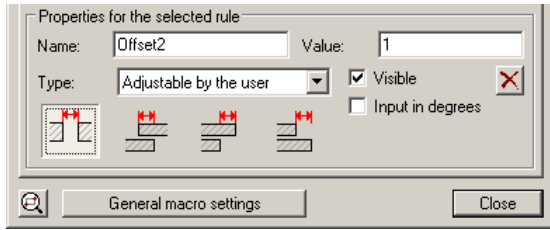
- Select the right side plane of the stiffener and press the right mouse button to confirm.




- Select a line of the plate and click on the right mouse button to confirm.



- Select a point somewhere in the neighbourhood of the plate.

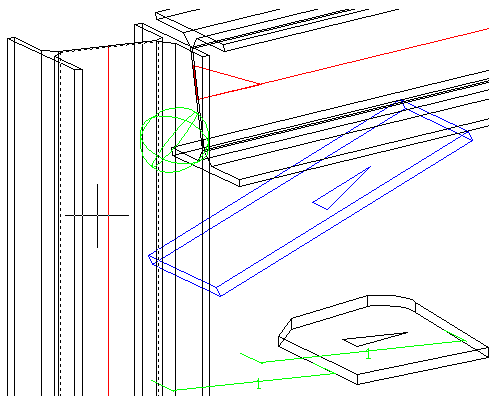


- In the dialog box below, enter for the property **Name** : *Offset2*
- Enter for the property **Value** : 1
- Click on the button 
- Click on **Close**.

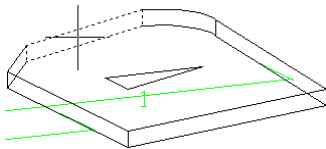
← Step 4 →



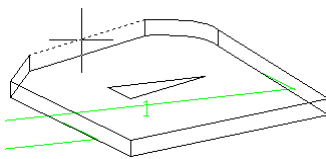
- Click on  **Distance between**



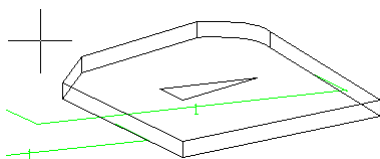
- Select the web of the column. Press the right mouse button to confirm.



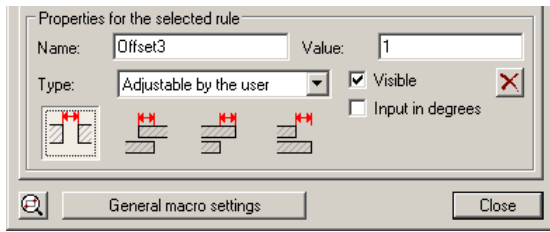
- Select the backside plane of the stiffener by pressing the left mouse button twice. Press the right mouse button to confirm.




- Select a line of the plate and click on the right mouse button to confirm.

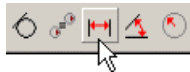


- Select a point somewhere in the neighbourhood of the plate.

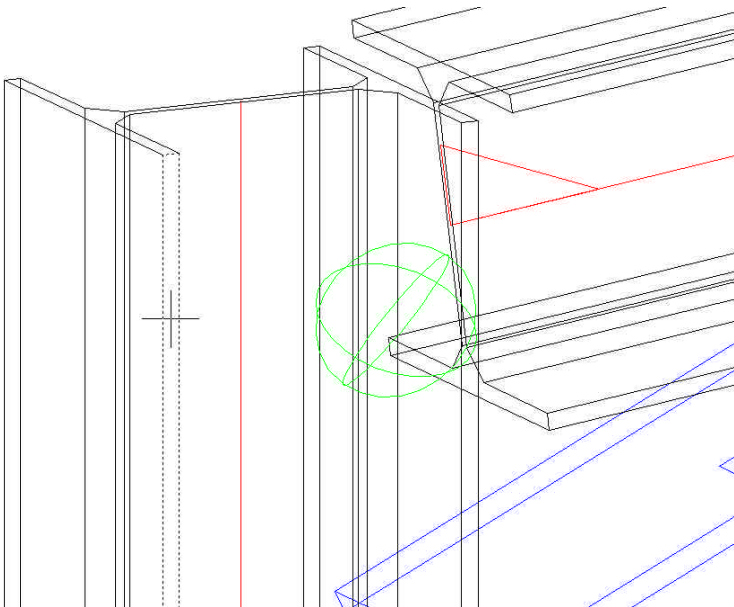


- In the dialog box below, enter for the property **Name** : *Offset3*
- Enter for the property **Value** : 1
- Click on the button 
- Click on **Close**.

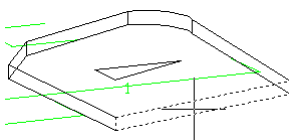
← Step 5 →



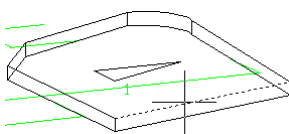
- Click on  **Distance between**



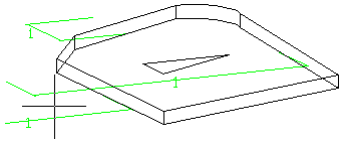
- Select the flange of the column. Press the right mouse button to confirm.



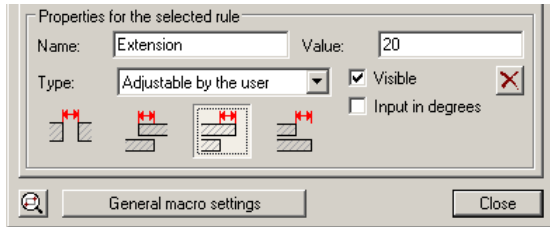
- Select the front side plane of the stiffener and press the right mouse button to confirm.




- Select a line of the plate and click on the right mouse button to confirm.

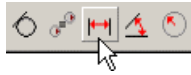


- Select a point somewhere in the neighbourhood of the plate.

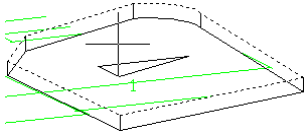


- In the dialog box below, enter for the property **Name** : *Extension*
- Enter for the property **Value** : 20
- Click on the button 
- Click on **Close**.

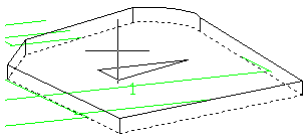
← Step 6 →



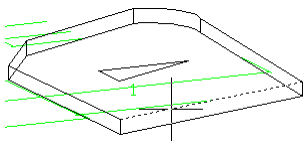
- Click on  **Distance between**



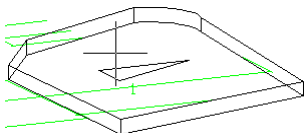
- Select the upper plane of the stiffener and press the right mouse button to confirm.



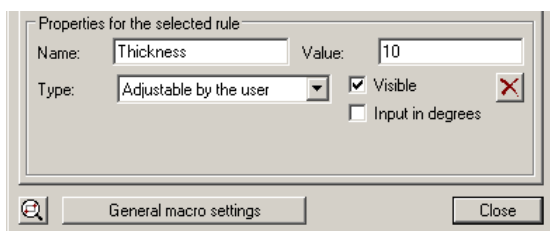
- Select the lower plane of the stiffener by pressing the left mouse button twice. Press the right mouse button to confirm.



- Select a line of the plate and click on the right mouse button to confirm.

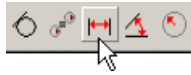


- Select a point somewhere in the middle of the plate.

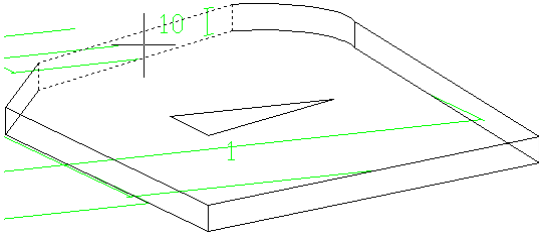


- In the dialog box below, enter for the property **Name** : *Thickness*
- Enter for the property **Value** : *10*
- Click on **Close**.

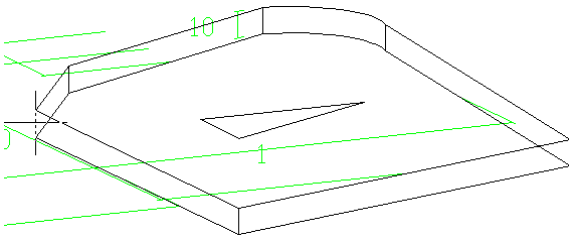
← Step 7 →



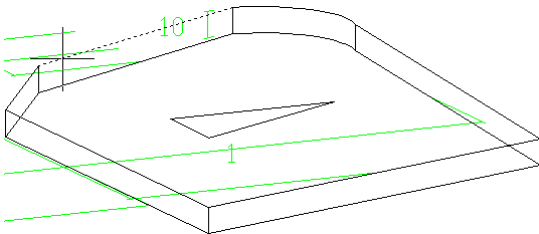
- Click on  **Distance between**



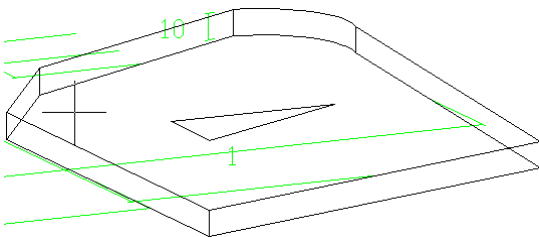
- Select the backside plane of the stiffener by pressing the left mouse button twice. Press the right mouse button to confirm.



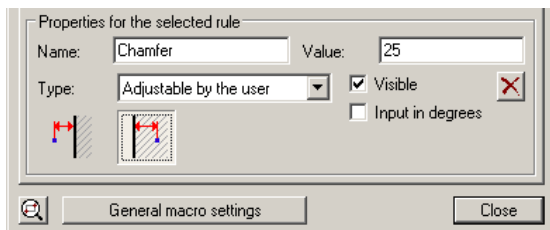
- Select the illustrated vertical line of the chamfer and press the right mouse button to confirm.



- Select a line of the plate and click on the right mouse button to confirm.




- Select a point somewhere in the middle of the plate.



- In the dialog box below, enter for the property **Name** : *Chamfer*

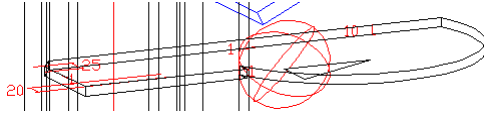
- Enter for the property **Value** : 25


- Click on the button 

- Click on **Close**.



- Click on  **Recalculate all**.

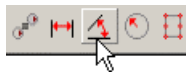


 *Parabuild can calculate the plate partially.
The strange shape of the arc is because of the arc not being determined and Parabuild doesn't know what to do with it.
We will undo this calculation because the shape of the plate has become unpractical.*

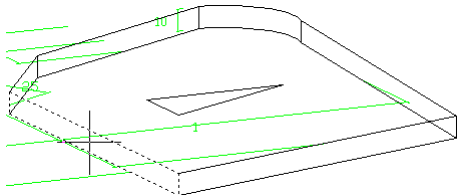


- Click on  **Undo**.

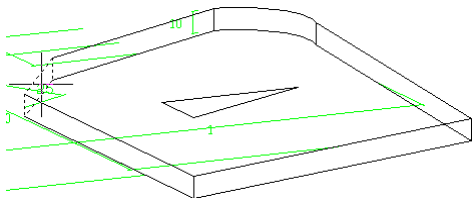
◀ Step 8 ▶



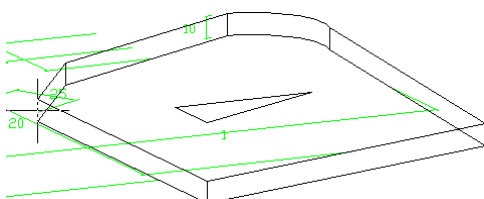
- Click on  **Angle between =**



- Select the left side plane of the stiffener and press the right mouse button to confirm.

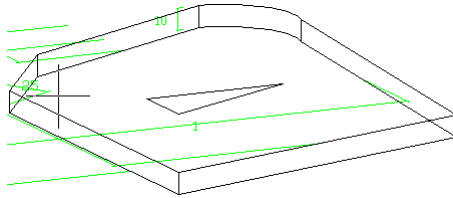


- Select the side plane of the chamfer by pressing the left mouse button twice. Press the right mouse button to confirm.

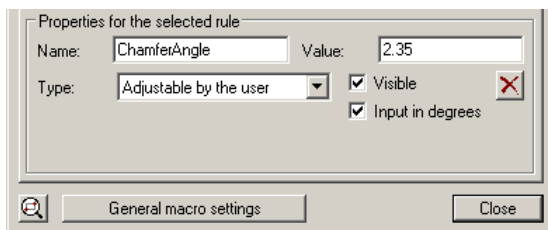


- Select for the axis of the angle the illustrated vertical line. Press the right mouse button to confirm.

? The axis of the angle is an important part of the rule. The angle is drawn around this line.



- Select a point somewhere in the middle of the plate.



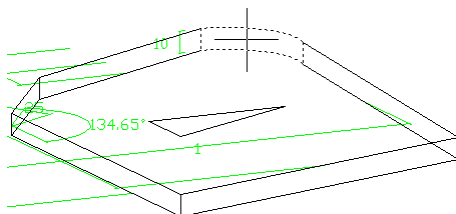
- In the dialog box below, enter for the property **Name** : *ChamferAngle*
- Enter for the property **Value** : 2.35
- Activate the checkbox **Input in degrees**.
- Click on **Close**.

? The value 2.35 is radians for about 135°. Parabuild always uses radians internally. The setting **Input in degrees** makes sure that when using the macro the angle can be modified in degrees.

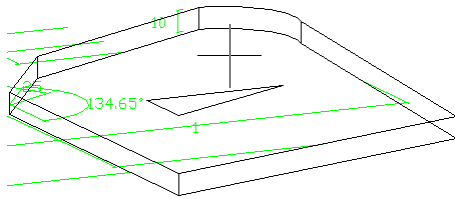
Step 9



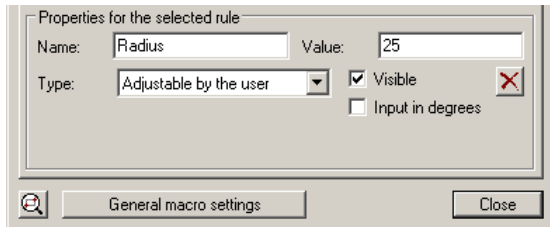
- Start the command  **Radius**



- Select the cylinder by pressing the left mouse button twice. Press the right mouse button to confirm.



- Select a point somewhere in the middle of the plate.

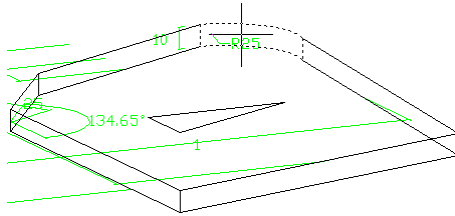


- In the dialog box below, enter for the property **Name** : *Radius*
- Enter for the property **Value** : 25
- Click on **Close**.

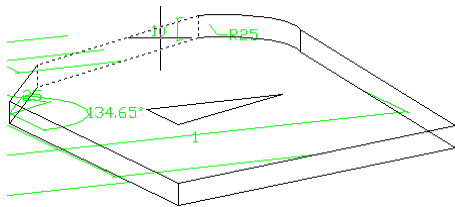
Step 10



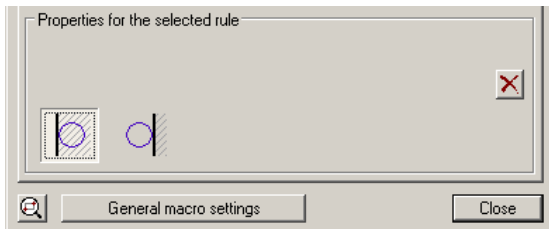
- Start the command **Tangent**




- Select the cylinder by pressing the left mouse button twice. Press the right mouse button to confirm.



- Select the backside plane by pressing the left mouse button twice. Press the right mouse button to confirm.

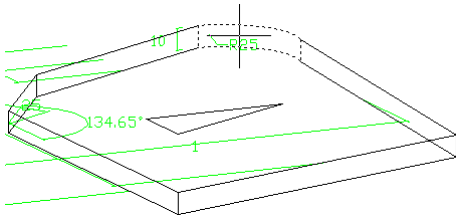


- Press the button 
- Click on **Close**.

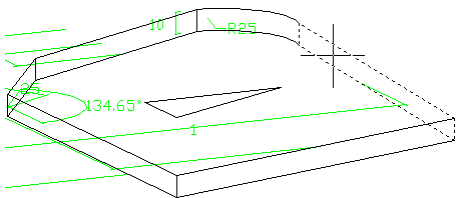
Step 11



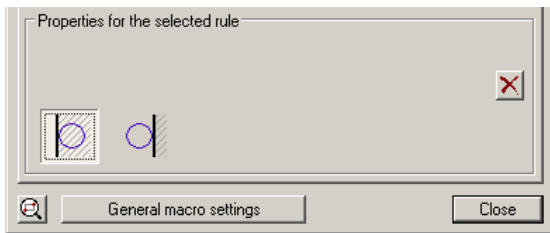
- Start the command **Tangent**




- Select the cylinder by pressing the left mouse button twice. Press the right mouse button to confirm.



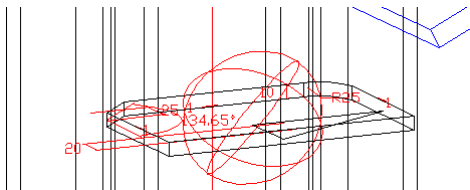
- Select the right side plane by pressing the left mouse button twice. Press the right mouse button to confirm.




- Press the button .
- Click on **Close**.



- Click on **Recalculate all**.



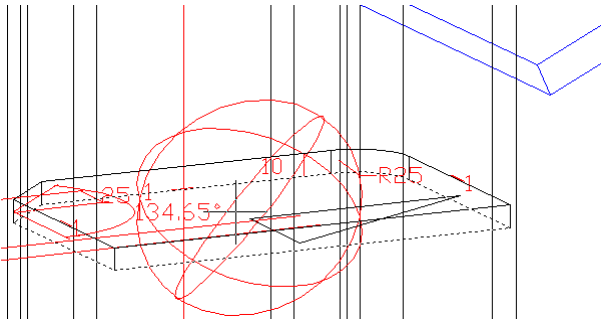
 *The plate can now be calculated but its position hasn't been determined yet.*

Step 12

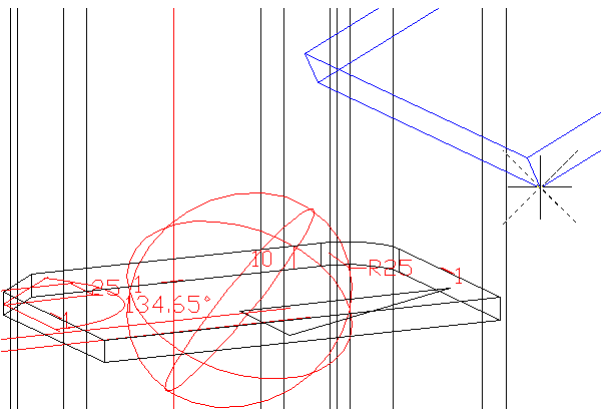
? We will now constrain the height of the stiffener to the same height as the reinforcing plate.



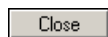
- Click on **Coincident**



- Select the lower plane of the plate by pressing the left mouse button twice. Press the right mouse button to confirm



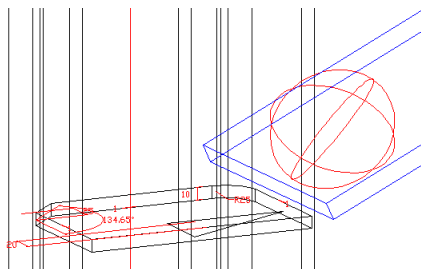
- Select the point in the corner of the blue reinforcing plate. Click on the right mouse button to confirm.



- Click on **Close**.



- Click on **Recalculate all**.



? The blue plate moves down to the height of the stiffener.
The macro is red.
It is not the purpose of this exercise to also modify the reinforcement.
We will correct this...



- Click on **Undo**.

Step 13



- Click on **Edit macro**



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
HEA-220(208782)	Base	Fixed	<input type="checkbox"/>
P126X10-186(20)	Base	Flexible	<input type="checkbox"/>
P220X15-435(20)	Base	Flexible	<input type="checkbox"/>

A dropdown menu is open over the 'Flexibility' column, showing options: Flexible (highlighted), Rigid, and Fixed. A mouse cursor is pointing at the 'Fixed' option.

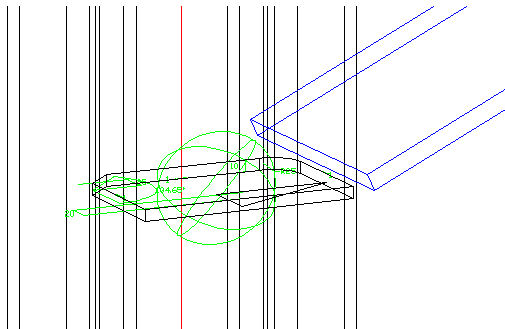
- Move the mouse over the last cell of the column **Flexibility** and click on the left mouse button. Select from the list **Fixed**.



- Click on **Close**.



- Click on **Recalculate all**.




? The stiffener now moves along with the rebar. The macro becomes green so the stiffener is now entirely defined.

Exercise 5: Variables and equations

In this exercise we will learn to work with variables.
We will start to use equations for the first time.

◀ Step 1 ▶

 We use the drawing we made in the previous exercise.



- Open the drawing  Exercise5.dwg



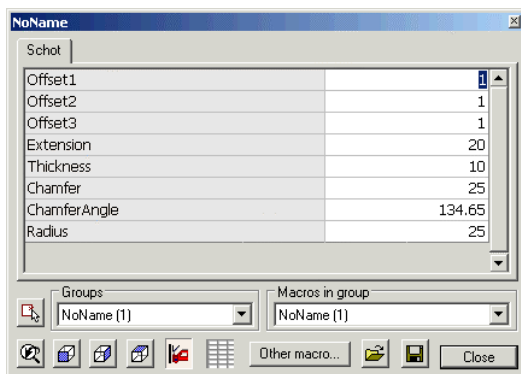
- Click on  **Review macro**.




- Select the macro in the drawing.

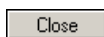


- Press **<Enter>**



 We see a setting in this dialog box for each distance we've drawn.

We can do different things with these settings, for example hiding and making them equal with each other.



- Click on **Close**.

← Step 2 →



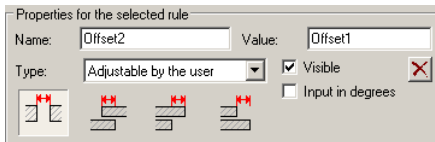
- Click on  **Edit macro**



- Select the macro in the drawing.

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
	Coincident	Plane	Point

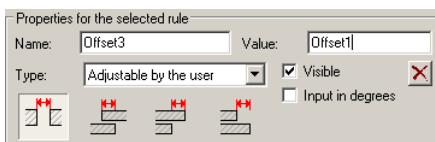
- Move the cursor to above the row **Offset2** and click on the left mouse button so that the entire row will be selected.



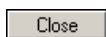
- Below, modify the setting **Value** to : *Offset1*

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
	Coincident	Plane	Point

- Select the row of the rule **Offset3**.



- Below, modify the setting **Value** to : *Offset1*



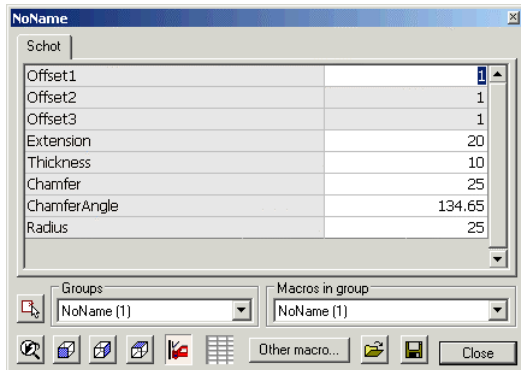
- Click on **Close**.




- Click on  **Review macro**.



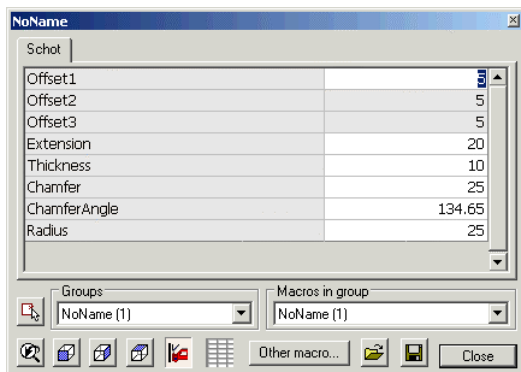
- Select the macro in the drawing and press **<Enter>**.




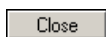
 *The settings **Offset2** and **Offset3** are not adjustable anymore in this dialog box. This is due to us making them equal to **Offset1**.*



- Modify the value of the settings **Offset1** to 5 and press the **<Enter>** key.



 *The values of **Offset2** and **Offset3** automatically become 5. This is why the values are't adjustable. In fact we've made the following equations :*
 $Offset2 = Offset1$
 $Offset3 = Offset1$



- Click on **Close**.

◀ Step 3 ▶

❓ We will now hide the settings *Offset2* and *Offset3* because they are not of use anymore.



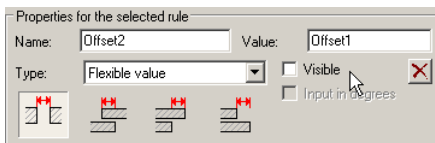
- Click on  **Edit macro**



- Select the macro in the drawing.

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
	Coincident	Plane	Point

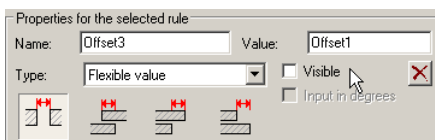
- Select the row of the rule **Offset2**.



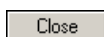
- Click below on the checkbox **Visible** so that it is deactivated.

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
	Coincident	Plane	Point

- Select the row of the rule **Offset3**.



- Click below on the checkbox **Visible** so that it is deactivated.



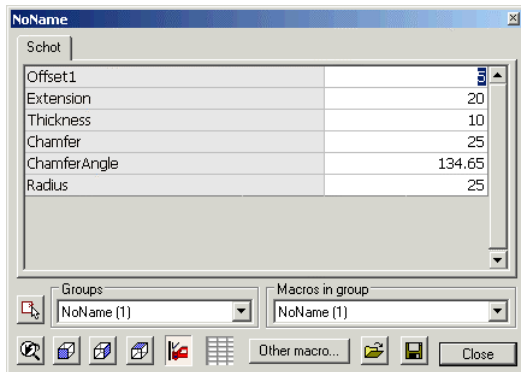
- Click on **Close**.



- Click on **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



Offset2 and Offset3 disappeared in this dialog box. They still exist, but only as internally used variables inside the macro.



- Click on **Close**.

← Step 4 →

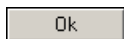
We will make the chamfer setting a little smarter by making it dependable on the radius of the column.



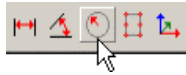
- Start the command **Set macro as current**




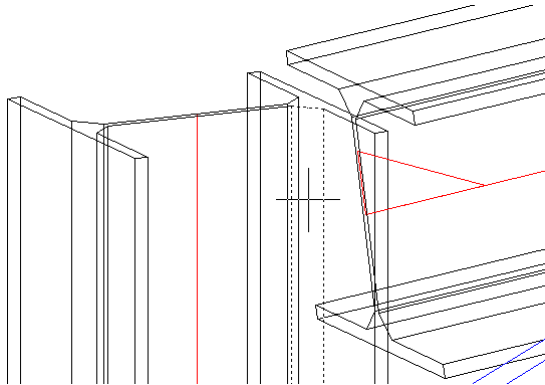
- Select the macro in the drawing.



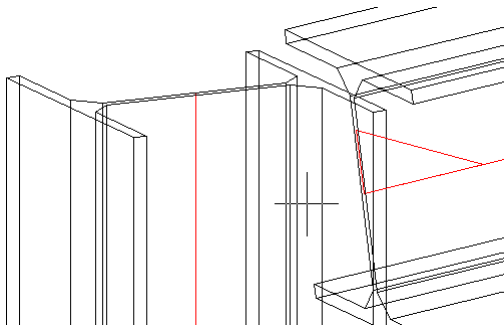
- Click on **Ok**.



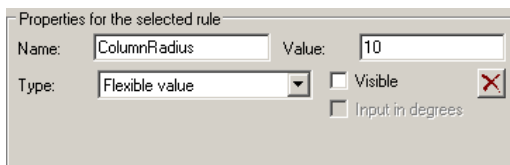
- Start the command  **Radius**




- Move the cursor to above the radius of the column and then press the left mouse button. Press the right mouse button to confirm.



- Indicate a point somewhere in the neighbourhood of the radius.



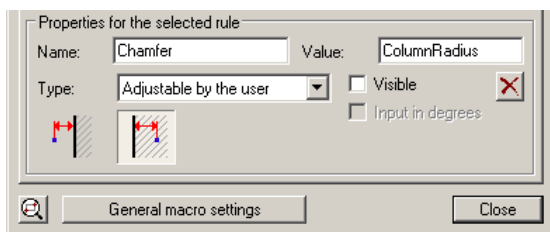
- In the dialog box below, enter for the property **Name** : *ColumnRadius*
 - Change the **Type** to: *Flexible value*
 - Deactivate the checkbox **Visible**.

 *By making this radius rule a **flexible value** we let the computer calculate the value of it. The fact that the member is a fixed element inside this macro the computer will set the value of the variable *ColumnRadius* equal to the real radius of the column member.*

← Step 5 →

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
	Coincident	Plane	Point
ColumnRadius	Radius	Cylinder	

- Select the rule **Chamfer** in the Edit macro dialog box (🔍).



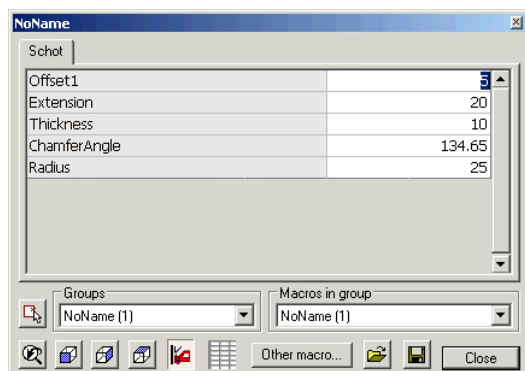
- Enter below for the property **Value** : *ColumnRadius*
 - Deactivate the checkbox **Visible**.
 - Click on **Close**.



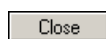
- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.




🔍 *The setting **Chamfer** is gone and is now automatically equal to the radius of the column.*



- Click on **Close**.

← Step 6 →

 We will now let the radius of the fillet of the stiffener calculate automatically, but we will also make something more advanced.



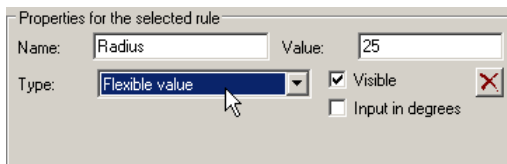
- Click on  **Edit macro**



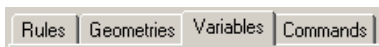
- Select the macro in the drawing.

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
	Coincident	Plane	Point
ColumnRadius	Radius	Cylinder	

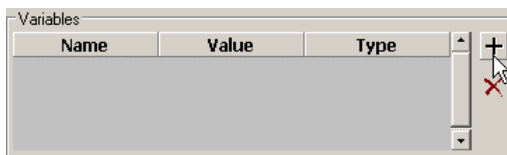
- Select the rule **Radius**.




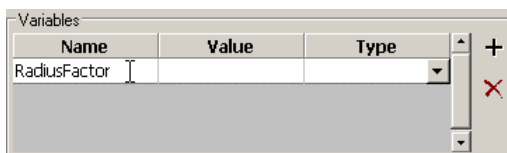
- Choose below for **Type** : *Flexible value*



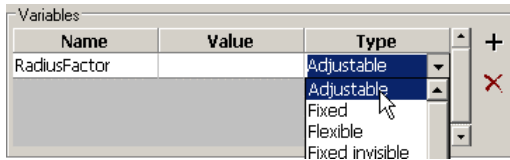
- Activate the tab **Variables**



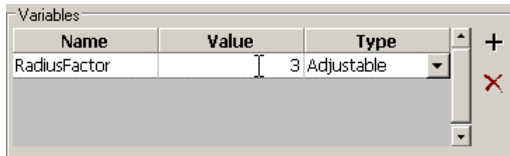
- In the section *Variables*, click on the button  **Add variable**.



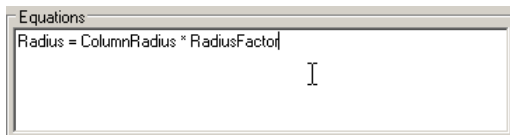
- For the column **Name**, type the name of the new variable : *RadiusFactor*



- Click on the arrow  in the column **Type** and select from the list: *Adjustable*



- Enter in the column **Value** : 3



- Go below to the equations field and type the following equation :
 $Radius = ColumnRadius * RadiusFactor$



- Click on **Close**.



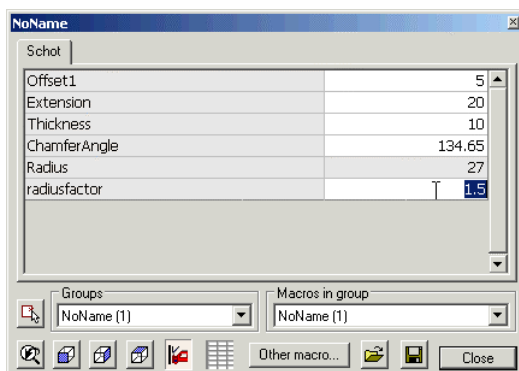
- Click on  **Recalculate all**.



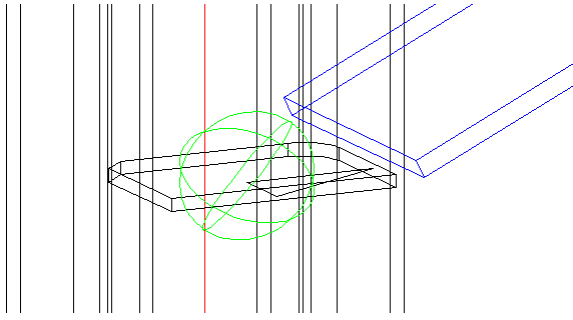
- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



- Modify the value of **radiusfactor** to : 1.5 and press **<Enter>**.




❓ *The radius of the fillet is now dependent on the radius of the member and it is adjustable with a factor value thanks to the equation.*

Exercise 6: Modules

We will create a second module inside one macro.

Then we will use a plate that is defined in the first module as a base element for the second module.

◀ Step 1 ▶

 We start out with the drawing that we made in the previous exercise.



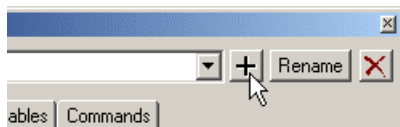
- Open the drawing  Exercise6.dwg




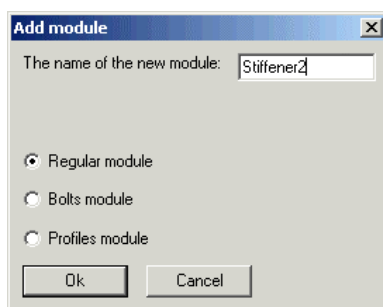
- Click on  **Edit macro**



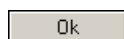
- Select the macro in the drawing.



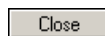
- At the top of the dialog box, click on  **Add new module**.



- Enter for the name of the new module : *Stiffener2*



- Click on **Ok**.



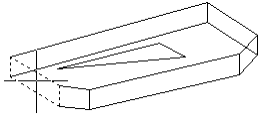
- Click on **Close**.

← Step 2 →

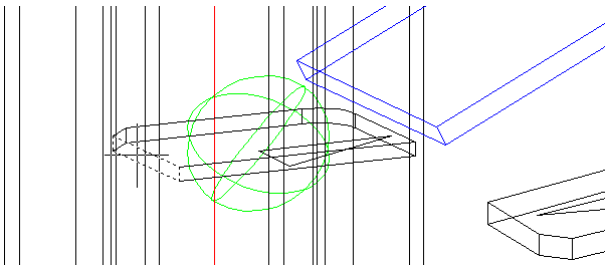
? All the geometric rules we draw from now on will be added to the new module because this was the active module in the Edit macro dialog box.



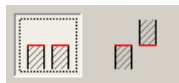
- Click on **Coincident**




- Select the left side plane of the new stiffener and press the right mouse button to confirm.



- Select the left side plane of the first stiffener by pressing the left mouse button three times and then press the right mouse button to confirm.



- Click in the dialog box on the button 

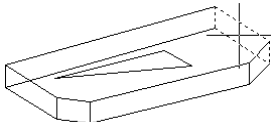


- Click on **Close**.

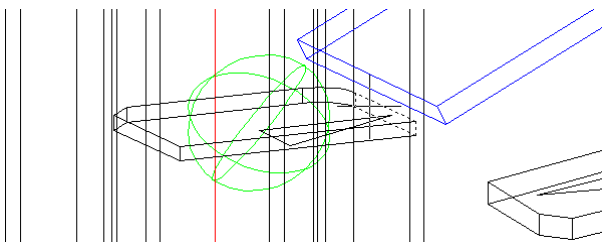
← Step 3 →



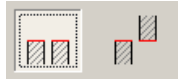
- Click on **Coincident**




- Select the right side plane of the new stiffener by pressing the left mouse button twice and then the right mouse button to confirm.



- Select the right side plane of the first stiffener by pressing the left mouse button twice and then the right mouse button to confirm.



- Click in the dialog box on the button 

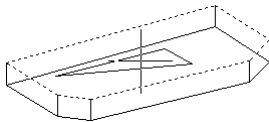
Close

- Click on **Close**.

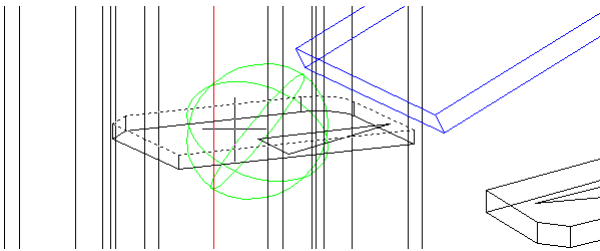
◀ Step 4 ▶



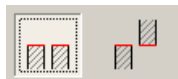
- Click on  **Coincident**




- Select the top plane of the new stiffener and press the right mouse button to confirm.



- Select the top plane of the first stiffener and press the right mouse button to confirm.




- Click in the dialog box on the button 

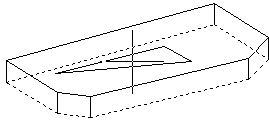
Close

- Click on **Close**.

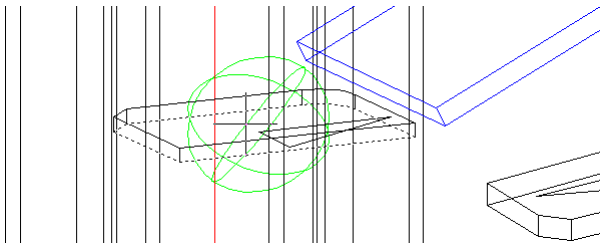
◀ Step 5 ▶



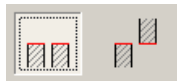
- Click on  **Coincident**




- Select the lower plane of the new stiffener by pressing the left mouse button twice and then the right mouse button to confirm.



- Select the lower plane of the first stiffener by pressing the left mouse button twice and then the right mouse button to confirm.



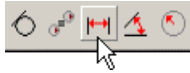
- Click in the dialog box on the button 

Close

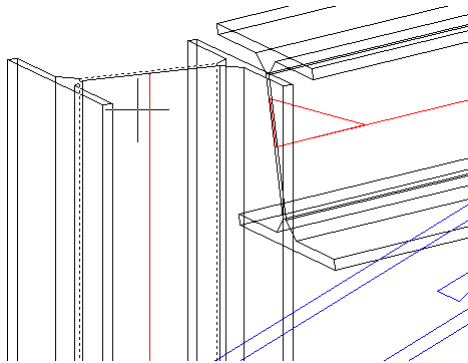
- Click on **Close**.

← Step 6 →

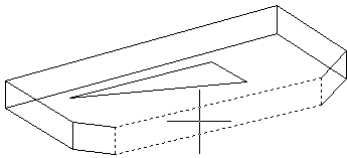
❓ For the next 2 geometric rules we can't use the first stiffener as a basis, you will notice why...



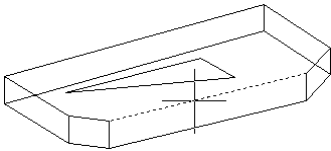
- Click on  **Distance between**



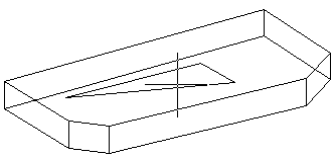
- Select the back plane of the web of the column by pressing the left mouse button twice. Press the right mouse button to confirm.



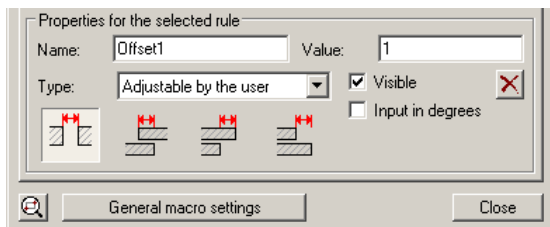
- Select the front side plane of the new stiffener and then press the right mouse button to confirm.



- Select a line of the new stiffener and then press the right mouse button to confirm.




- Select a point somewhere in the middle of the new stiffener.



- In the dialog box below, enter for the property **Name** : *Offset1*

- Enter for the property **Value** : 1

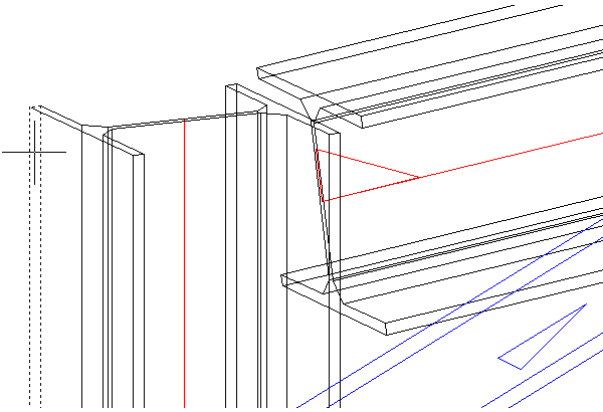
- Click on the button 

- Click on **Close**.

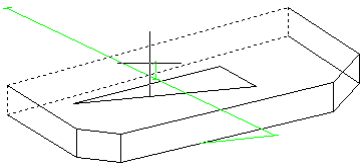
← Step 7 →



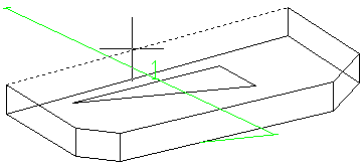
- Click on  **Distance between**



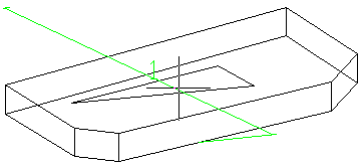
- Select the back plane of the flange of the column by pressing the left mouse button twice. Press the right mouse button to confirm.



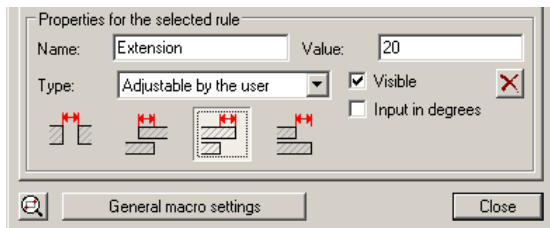
- Select the backside plane of the new stiffener by pressing the left mouse button twice. Press the right mouse button to confirm.



- Select a line of the new stiffener and then press the right mouse button to confirm.




- Select a point somewhere in the middle of the new stiffener.




- In the dialog box below, enter for the property **Name** : *Extension*

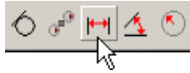
- Enter for the property **Value** : 20

- Click on the button 

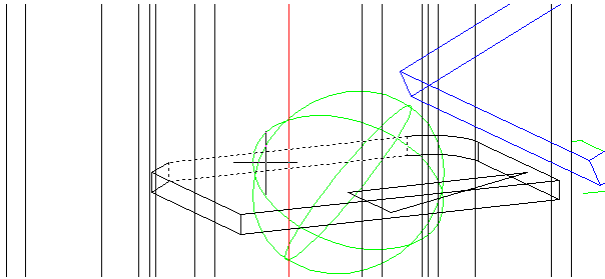
- Click on **Close**.

← Step 8 →

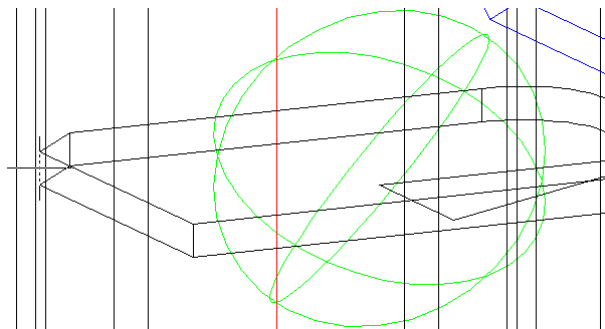
 To create the chamfers we will again use the first stiffener.



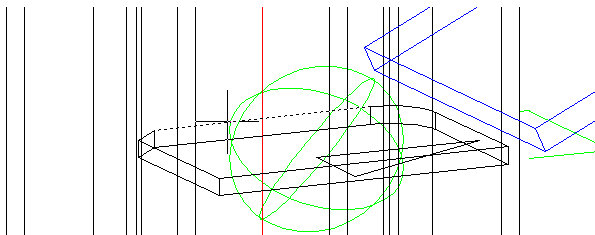
- Click on  **Distance between**



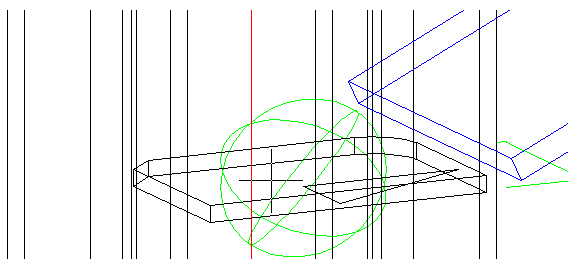
- Select the backside plane of the first stiffener by pressing the left mouse button twice. Press the right mouse button to confirm.



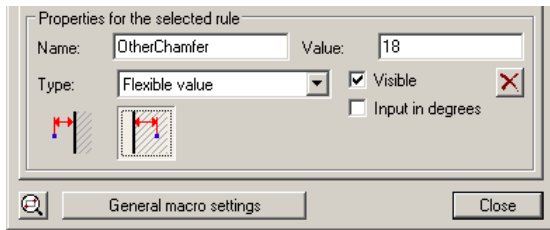
- Select the left vertical line of the chamfer and press the right mouse button to confirm.




- Select a line of the first stiffener and then press the right mouse button to confirm.




- Select a point somewhere in the middle of the first stiffener.



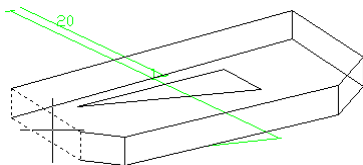
- In the dialog box below, enter for the property **Name** : *OtherChamfer*
- Modify the **Type** to : *Flexible value*
- Click on the button 
- Click on **Close**.

◀ — Step 9 — ▶

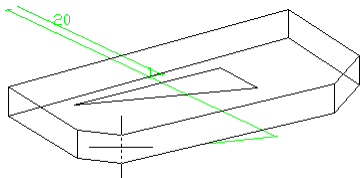
 We will now use the contents of the variable **OtherChamfer** for the value of the new chamfers.



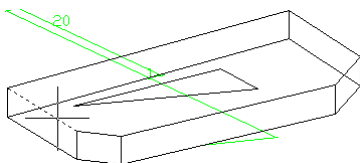
- Click on  **Distance between**



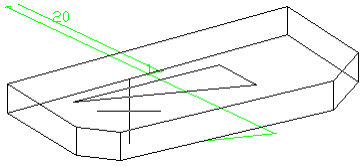
- Select the left side plane of the new stiffener and then press the right mouse button to confirm.



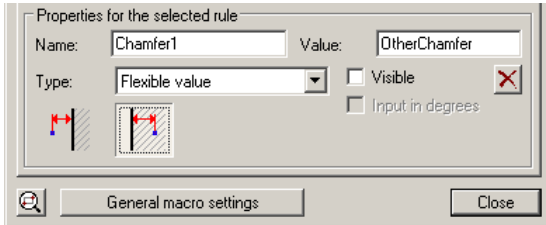
- Select the right vertical line of the chamfer and press the right mouse button to confirm.



- Select a line of the new stiffener and then press the right mouse button to confirm.



- Select a point somewhere in the middle of the new stiffener.

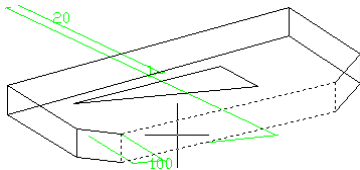


- In the dialog box below, enter for the property **Name** : *Chamfer1*
- Enter for the property **Value** : *OtherChamfer*
- Deactivate the checkbox **Visible**.
- Click on the button
- Click on **Close**.

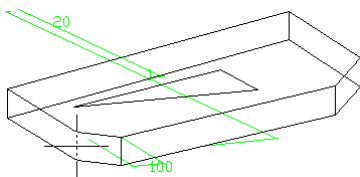
← Step 10 →



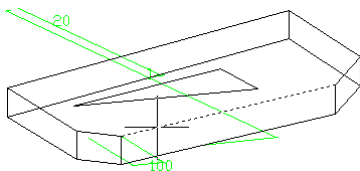
- Click on **Distance between**



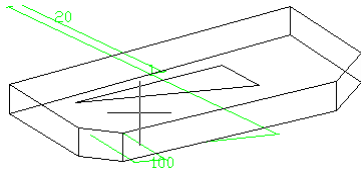
- Select the front side plane of the new stiffener and then press the right mouse button to confirm.



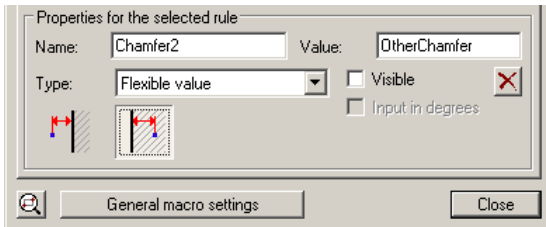
- Select the left vertical line of the chamfer and press the right mouse button to confirm.



- Select a line of the new stiffener and then press the right mouse button to confirm.



- Select a point somewhere in the middle of the new stiffener.

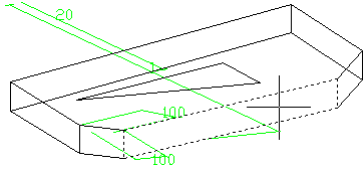


- In the dialog box below, enter for the property **Name** : *Chamfer2*
- Enter for the property **Value** : *OtherChamfer*
- Deactivate the checkbox **Visible**.
- Click on the button
- Click on **Close**.

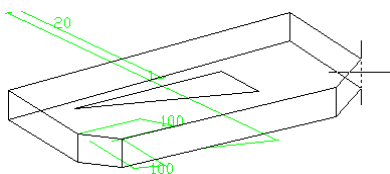
← Step 11 →



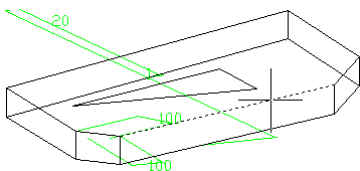
- Click on **Distance between**



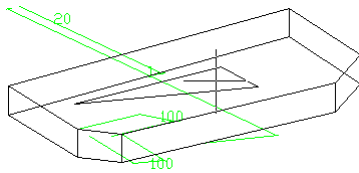
- Select the front side plane of the new stiffener and then press the right mouse button to confirm.



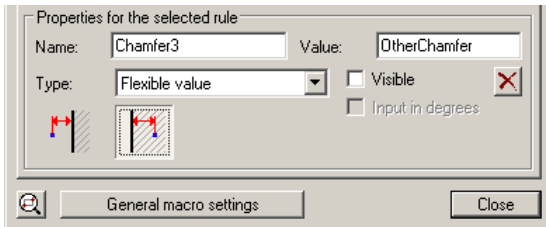
- Select the right vertical line of the chamfer and press the right mouse button to confirm.




- Select a line of the new stiffener and then press the right mouse button to confirm.



- Select a point somewhere in the middle of the new stiffener.

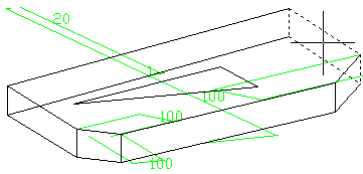


- In the dialog box below, enter for the property **Name** : *Chamfer3*
- Enter for the property **Value** : *OtherChamfer*
- Deactivate the checkbox **Visible**.
- Click on the button 
- Click on **Close**.

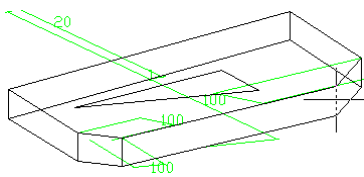
← Step 12 →



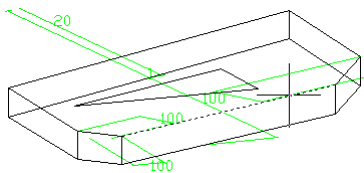
- Click on  **Distance between**



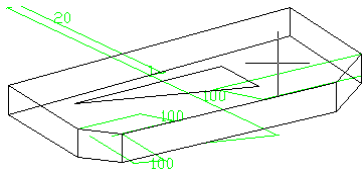
- Select the right side plane of the new stiffener by pressing the left mouse button twice. Now press the right mouse button to confirm.



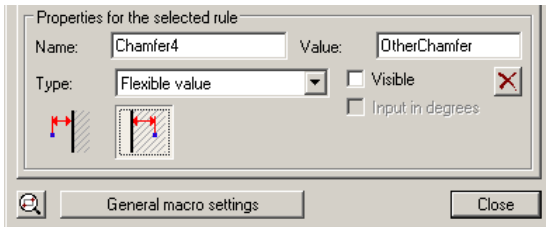
- Select the right vertical line of the chamfer and press the right mouse button to confirm.



- Select a line of the new stiffener and then press the right mouse button to confirm.



- Select a point somewhere in the middle of the new stiffener.

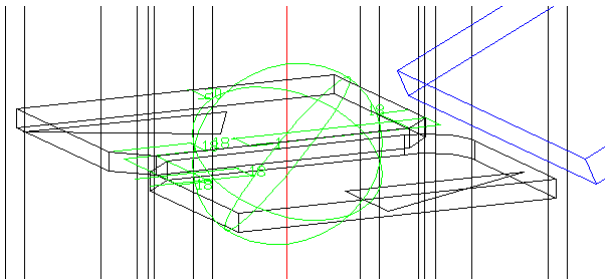


- In the dialog box below, enter for the property **Name** : *Chamfer4*
- Enter for the property **Value** : *OtherChamfer*
- Deactivate the checkbox **Visible**.

- Click on the button
- Click on **Close**.



- Click on **Recalculate all**.



The new stiffener is now completely defined. We've used the first stiffener as a basis to calculate this new stiffener. Parabuild calculates modules in series, so first the stiffener is calculated first and then the new stiffener is calculated. We could have also added this new stiffener to the same module. But you should know that it is better for Parabuild to have one element per module. It also brings more clarity to a complex macro.

You don't have the same result?
*Then you've made a mistake somewhere. You can review the geometric rules that you've created using the command **Edit macro**. Click in this dialog box on a geometric rule. The geometries of the selected rule are highlighted in the drawing. Check all the rules this way and delete the incorrect rules. You can then redraw the deleted rules, because the order in which you draw the rules doesn't matter!*

Exercise 7: Creating rules for oblique geometries

When a member is drawn oblique and we need to draw a plate against it, then we need to take into account the obliqueness while drawing the geometric rules.
We will show this using a simple example. In later exercises we will see more difficult situations.

◀ Step 1 ▶



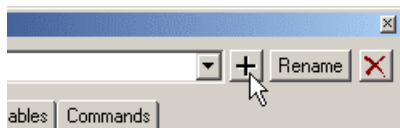
- Open the drawing  Exercise7.dwg




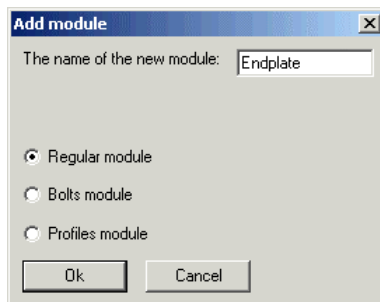
- Click on  **Edit macro**



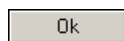
- Select the macro in the drawing.



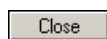
- At the top of the dialog box, click on  **Add new module.**



- Enter in the dialog box for the **Name** of the new module : *Endplate*



- Click on **Ok**.

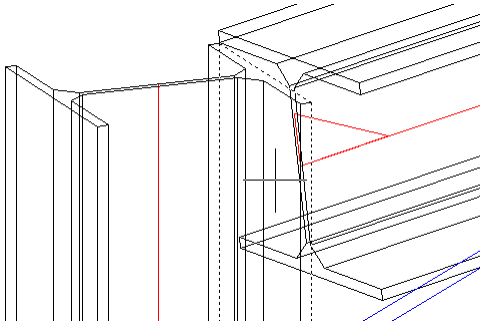


- Click on **Close**.

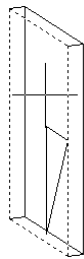
← Step 2 →



- Click on **Coincident**




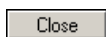
- Select the back plane of the column by pressing the left mouse button twice. Press the right mouse button to confirm.



- Select the front plane of the new endplate and then press the right mouse button to confirm.



- Click in the dialog box on the button 

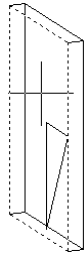


- Click on **Close**.

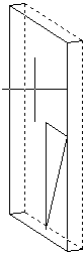
← Step 3 →



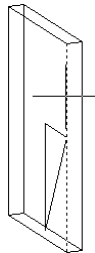
- Click on  **Distance between**



- Select the front plane of the new endplate and then press the right mouse button to confirm.



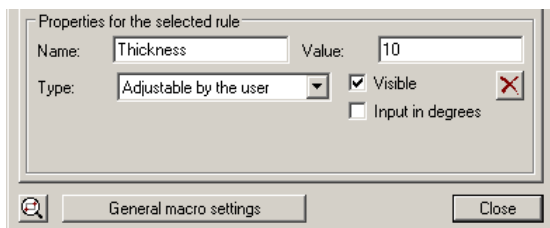
- Select the back plane of the new endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select a line of the new endplate and then press the right mouse button to confirm.



- Select a point somewhere in the middle of the new endplate.



- In the dialog box below, enter for the property **Name** : *Thickness*

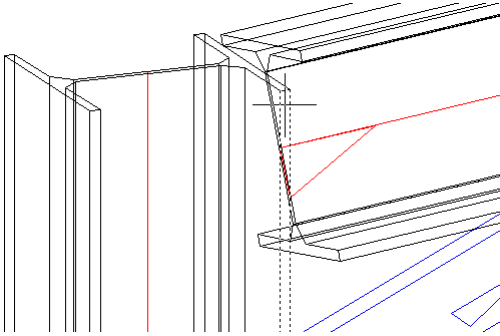
- Enter for the property **Value** : *10*

- Click on **Close**.

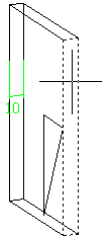
← Step 4 →



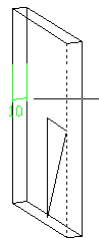
- Click on  **Distance between**



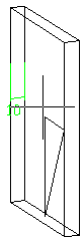
- Select the flange of the column and then press the right mouse button to confirm.



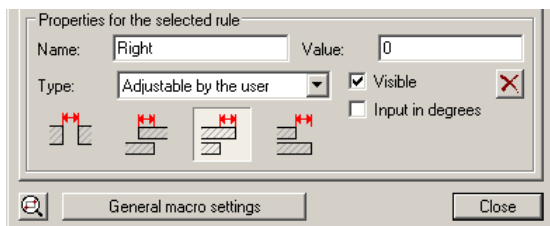
- Select the front side plane of the new endplate and then press the right mouse button to confirm.



- Select a line of the new endplate and then press the right mouse button to confirm.




- Select a point somewhere in the middle of the new endplate.



- In the dialog box below, enter for the property **Name** : *Right*

- Enter for the property **Value** : *0*

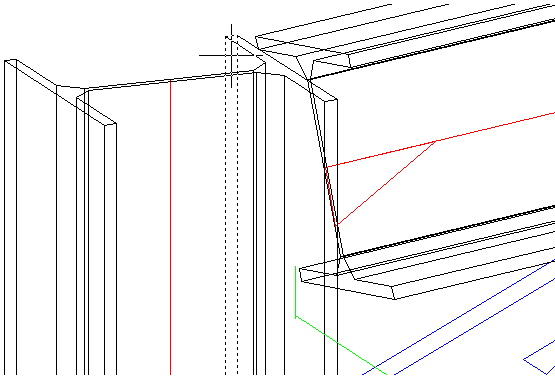
- Click on the button 

- Click on **Close**.

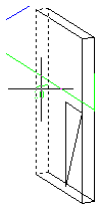
← Step 5 →



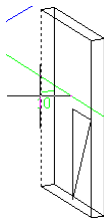
- Click on  **Distance between**



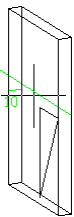
- Select the back flange of the column by pressing the left mouse button twice. Now press the right mouse button to confirm.



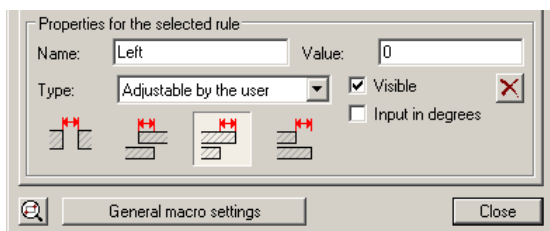
- Select the backside plane of the new endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select a line of the new endplate and then press the right mouse button to confirm.




- Select a point somewhere in the middle of the new endplate.



- In the dialog box below, enter for the property **Name** : *Left*

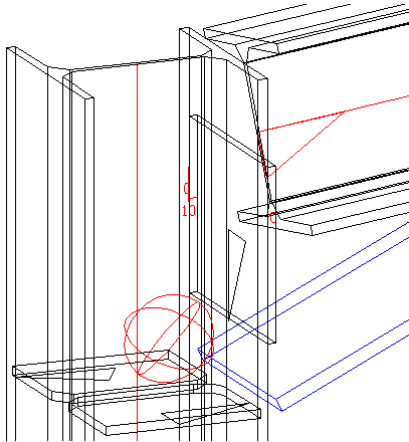
- Enter for the property **Value** : *0*


- Click on the button 

- Click on **Close**.



- Click on  **Recalculate all.**



 *Now we only need to constrain the top and bottom planes of the endplate.*

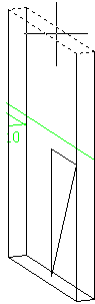


- Click on  **Undo.**

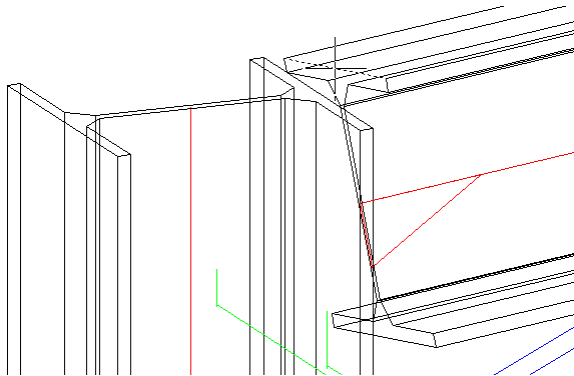
← Step 6 →



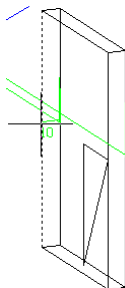
- Click on  **Distance between**



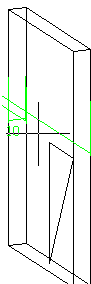
- Select the top plane of the endplate and then press the right mouse button to confirm.



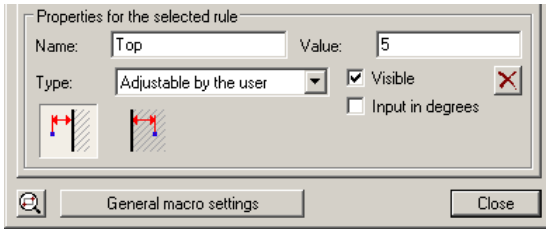
- Select the top line of the flange of the column and then press the right mouse button to confirm.




- Select a line of the new endplate and then press the right mouse button to confirm.



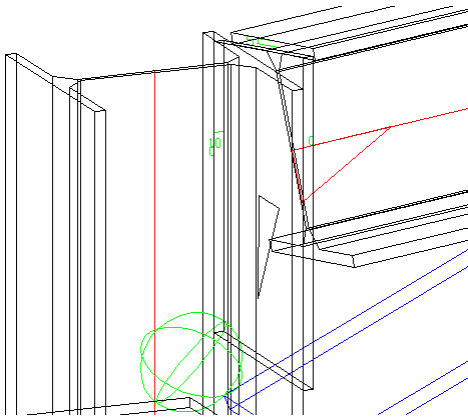
- Select a point somewhere in the middle of the new endplate.




- In the dialog box below, enter for the property **Name** : *Top*
- Enter for the property **Value** : 5
- Click on the button 
- Click on **Close**.



- Click on  **Recalculate all**.



 Note that the endplate follows the boliqueness of the beam at the top. This is thanks to the last geometric rule we created.

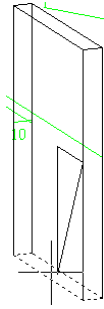


- Click on  **Undo**.

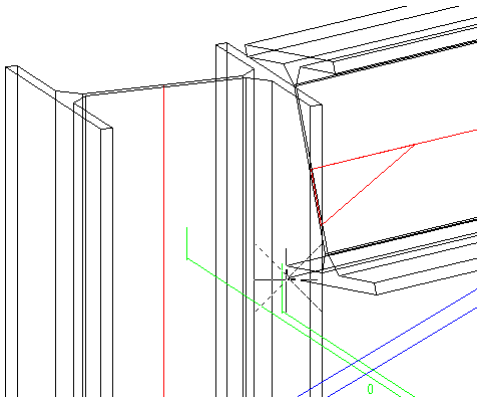
◀ Step 7 ▶



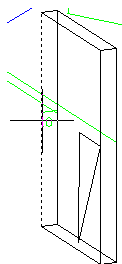
- Click on  **Distance between**



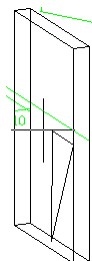
- Select the lower plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



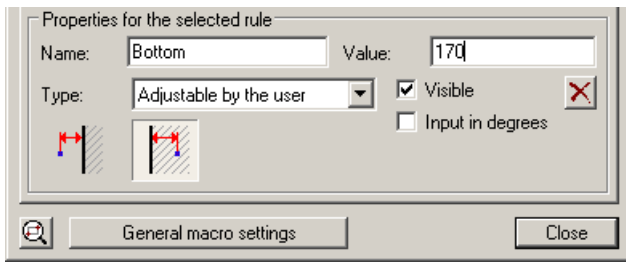
- Select the lowest point of the flange of the column and then press the right mouse button to confirm.




- Select a line of the new endplate and then press the right mouse button to confirm.




- Select a point somewhere in the middle of the new endplate.



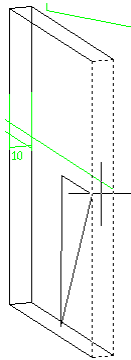
- In the dialog box below, enter for the property **Name** : *Bottom*
- Enter for the property **Value** : *170*
- Click on the button 
- Click on **Close**.

◀ — **Step 8** — ▶

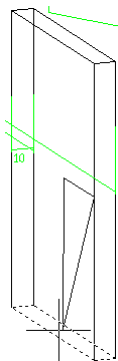
 *The underside of the endplate is not yet completely defined : the correct inclination is not yet defined because we've chosen a point. We will now define the inclination.*



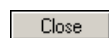
- Click on  **Perpendicular ...**



- Select the side plane of the endplate and then press the right mouse button to confirm.



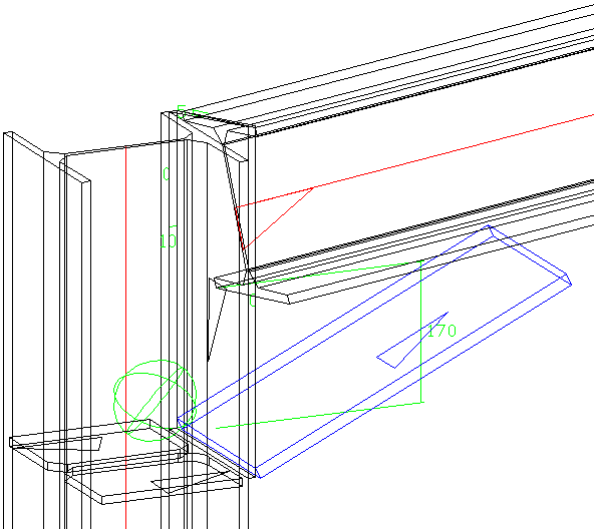
- Select the lower plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.




- Click on **Close**.



- Click on  **Recalculate all**.



 Now the underside of the plate is perpendicular to the side planes, which isn't the case for the top side due to the inclination of the column. It is always the drafter's obligation to decide which rules are best for each situation.

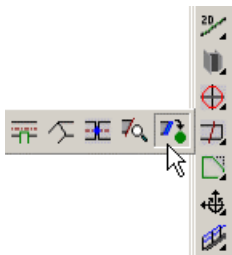
Exercise 8: Creating cuts

We will now learn how we can add an intelligent cut to a macro.
With an intelligent cut we mean a cut that can modify itself after modifications.

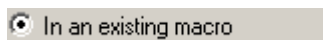
◀ Step 1 ▶



- Open the drawing  Exercise8.dwg



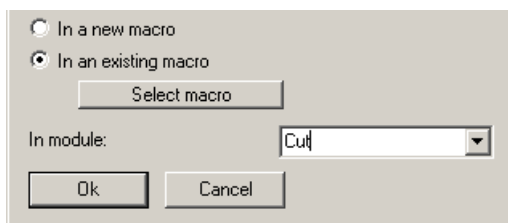
- Start the command  **Add cut to macro**




- Below in the dialog box, click on **In an existing macro**

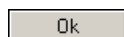


- Select the macro in the drawing.

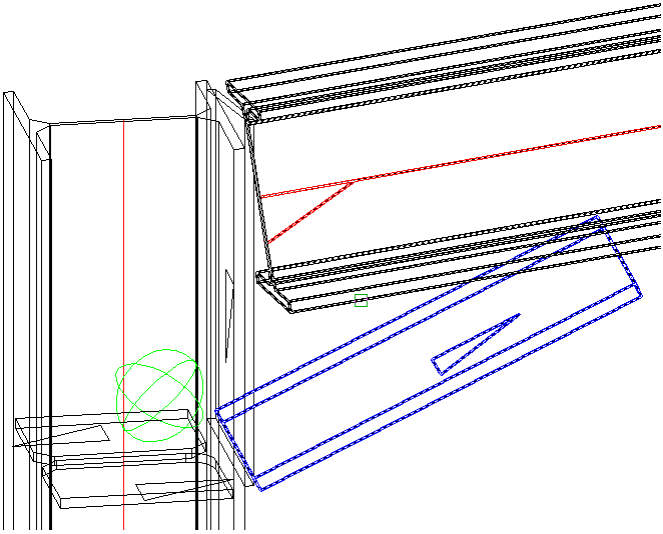


- Enter in the dialog box for **Module** : *Cut*

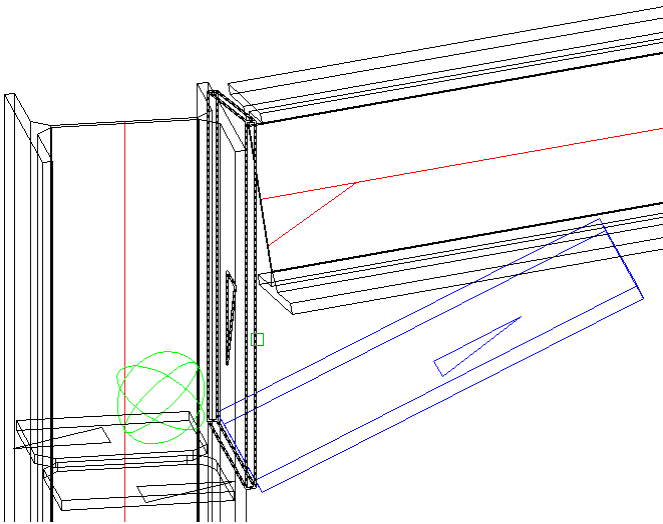
 *For the module we choose a new module named **Cut**. The cut can not be added to the existing module endplate. The reason for this is that the cut we're adding will depend on the endplate. Parabuild wouldn't be able to calculate the cut. If they are added in separate modules Parabuild will have no problems with the calculation.*



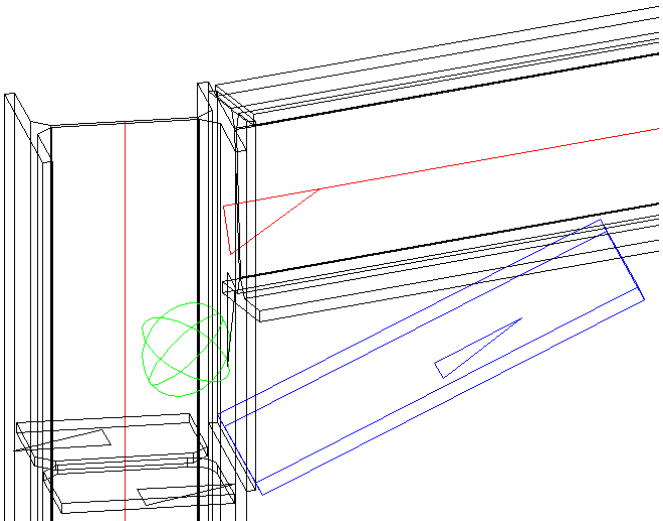
- Click on **Ok**.




- Select the beam.



- Select the endplate.



 *The beam is being cut immediatly.
The new cut is drawn inside the macro, in the module **Cut** that was created automatically at our request.*

Exercise 9: Creating a cut using geometric rules


There is another method to create a cut inside a macro.

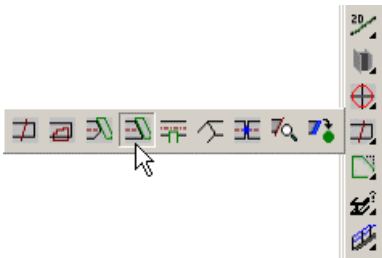
This method is more time-consuming, but in some situations it can provide more freedom because the cut can be defined using geometric rules.

This method is almost never used.

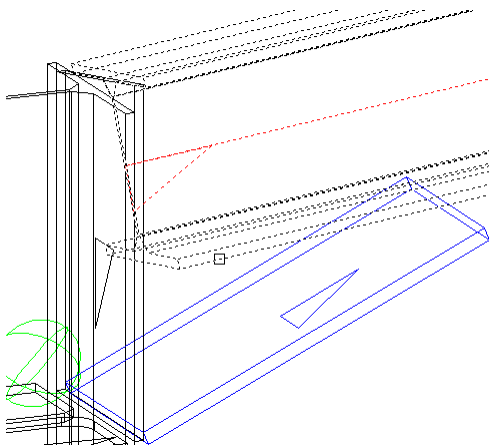
◀ Step 1 ▶



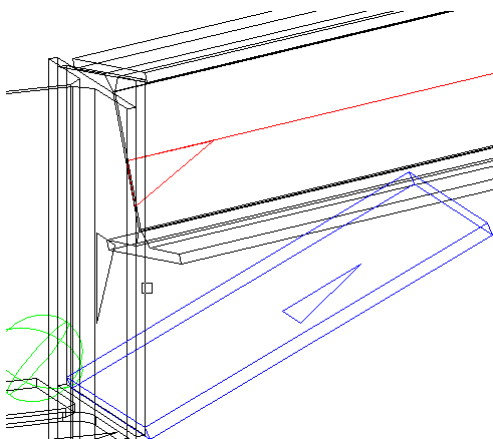
- Open the drawing  Exercise9.dwg



- Start the command  **Cut entire end against another element.**



- Select the beam and then press **<Enter>**



- Select the endplate.

? We've cut the beam, but the cut is not intelligent. Using a geometric rule we will now make this cut intelligent.

◀ Step 2 ▶

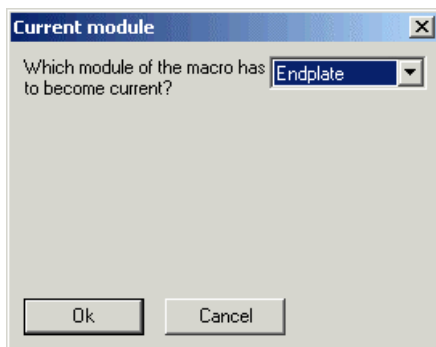
? We can constrain the cut in the same module as the endplate (this is not the case for the cut in the previous exercise).



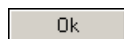
- Start the command  **Set macro as current**.



- Select the macro in the drawing.

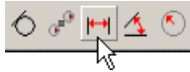


- Make sure that the **Endplate** is selected.

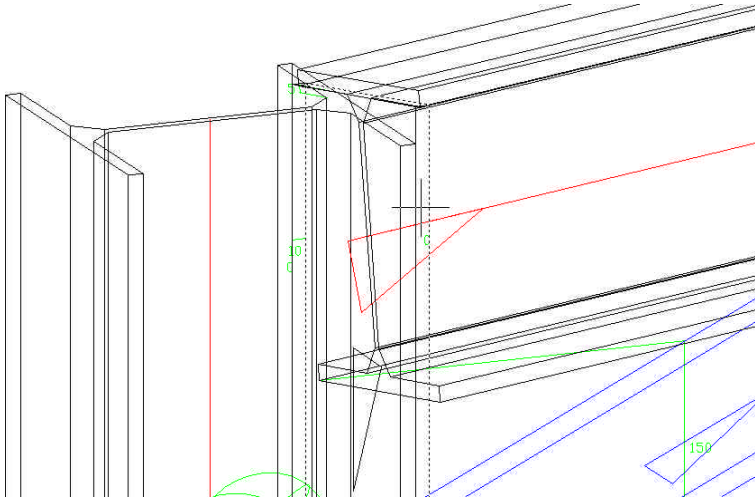


- Click on **Ok**.


← Step 3 →

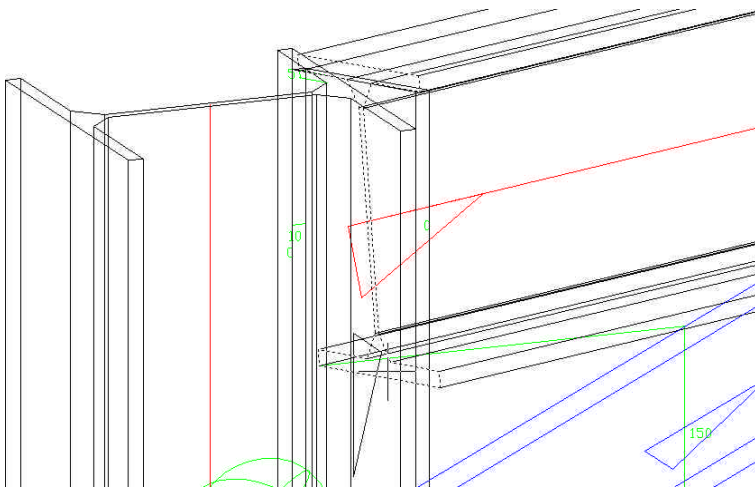


- Click on  **Distance between**

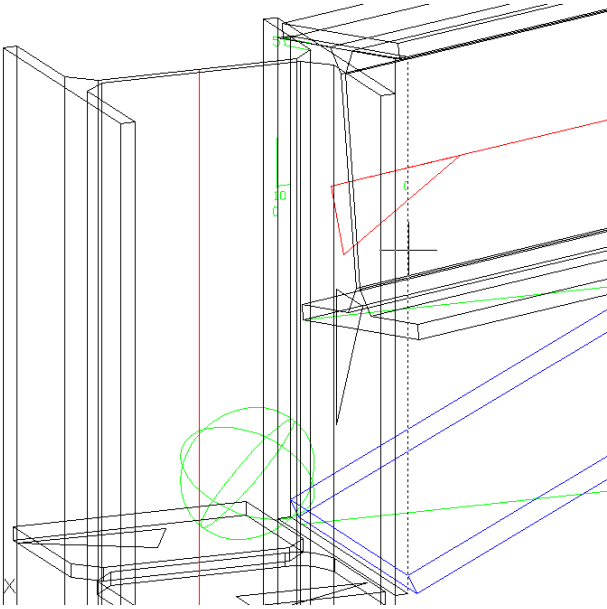


- Select the back plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.

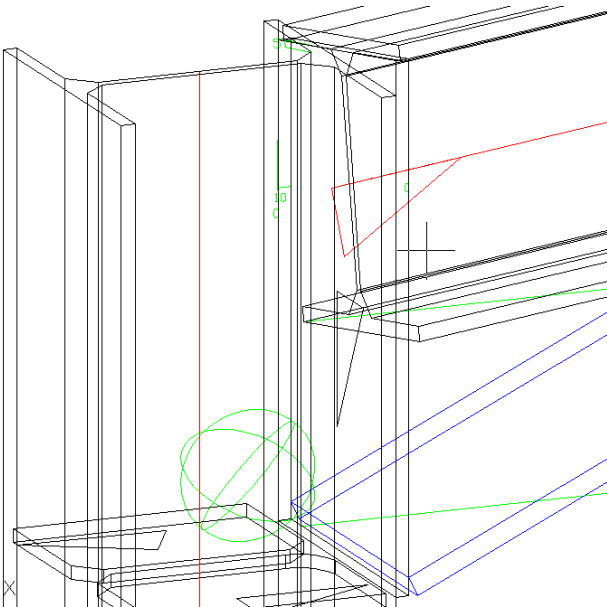
 *Make sure you don't select the front plane of the endplate.*



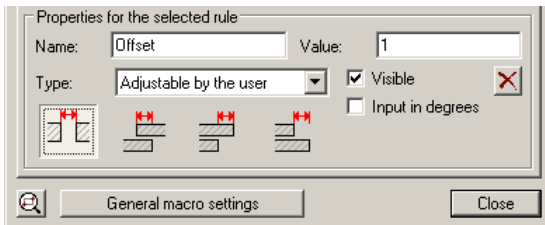
- Select the cut of the beam. Depending on where you move the cursor to you may have to click the left mouse button 1, 3 or 5 times. Now press the right mouse button to confirm.



- Select a line of the endplate and press the right mouse button to confirm.




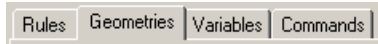
- Indicate a point somewhere in the neighbourhood of the endplate.



- In the dialog box below, enter for the property **Name** : *Offset*

- Enter for the property **Value** : 1

- Click on the button 



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
P222X10-415(212)	Base	Flexible	<input type="checkbox"/>
HEA220(2130583)	Base	Fixed	<input type="checkbox"/>
HEA220(2124372)	Base	Fixed	<input type="checkbox"/>
HEA220(2124372)	Cut 1	Flexible	<input type="checkbox"/>

In the list you can see the last row "Cut 1" of the column as flexible.
Thus a cut is seen as a separate part of a member and can be flexible without the entire member being flexible.



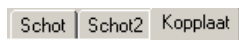
- Click on **Close**.



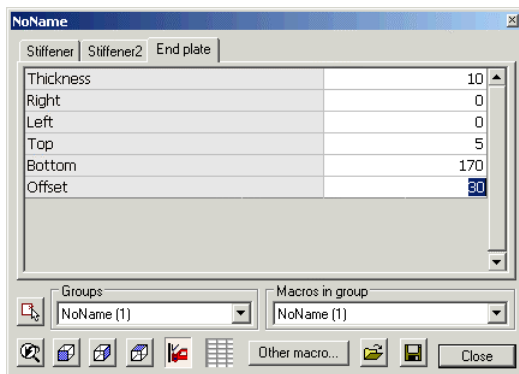
- Click on **Review macro**.



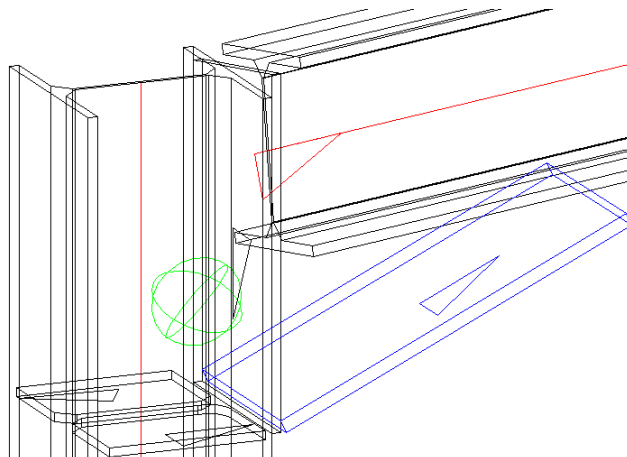
- Select the macro in the drawing and press **<Enter>**.



- Activate the tab **Endplate**



- Modify in the dialog box the **Offset** to : 30 and then click on **Close**.




Exercise 10: Drawing bolts

Adding multiple bolts to a macro is of course possible.

By working with a bolts pattern we can define the placement of a flexible amount of bolts.

◀ Step 1 ▶



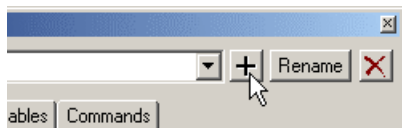
- Open the drawing  Exercise10.dwg




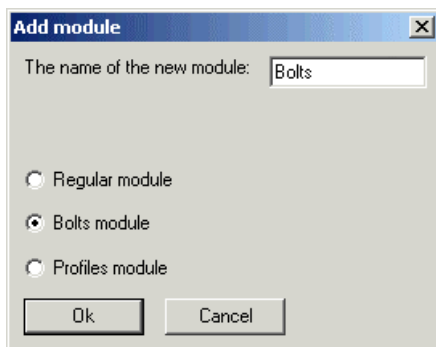
- Click on  **Edit macro**



- Select the macro in the drawing.



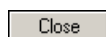
- At the top of the dialog box, click on  **Add new module.**



- Enter in the dialog box for the name : *Bolts*

- Click on **Bolts module.**

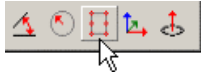
- Click on the button **Ok.**



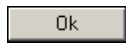
- Click on **Close.**

◀ Step 2 ▶

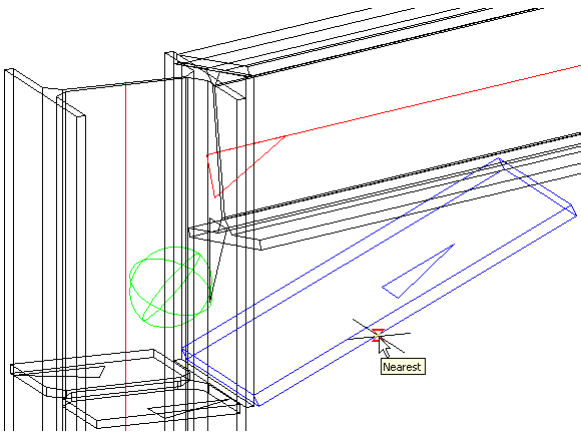
❓ First we need to draw the pattern.



- Start the command  **Create bolts pattern**.




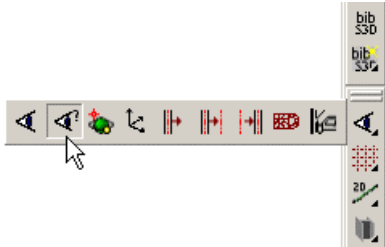
- Click on **Ok**.




- Indicate with the help of OSNAP a point somewhere, the exact location is not that important.

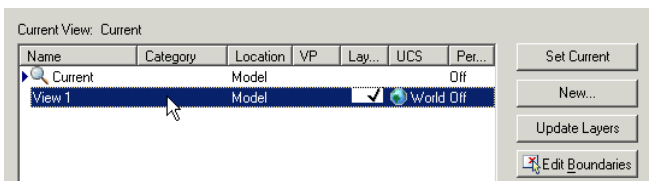
← Step 3 →

 We change the view so that we can more easily constrain the pattern against the endplate.



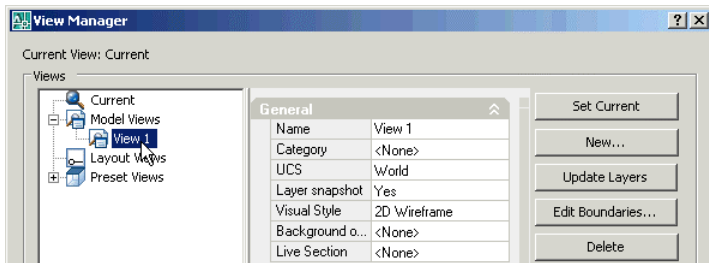
- Start the command  **Viewnames**

In AutoCAD 2002, 2004, 2005 and 2006:

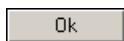


- Select in the list **View 1**

In AutoCAD 2007, 2008 and newer:




- Click on the button **Set Current**




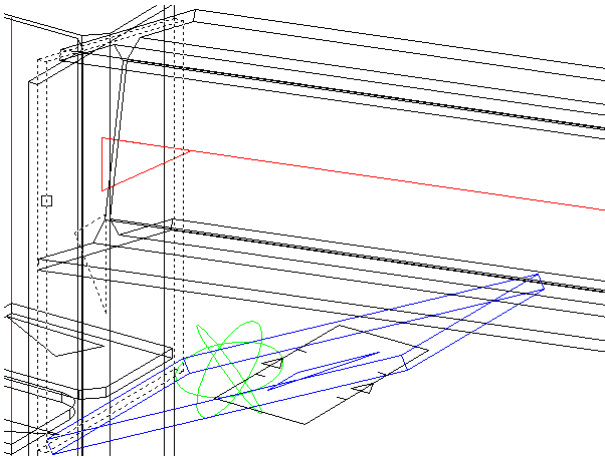
- Click on **Ok**.

← Step 4 →

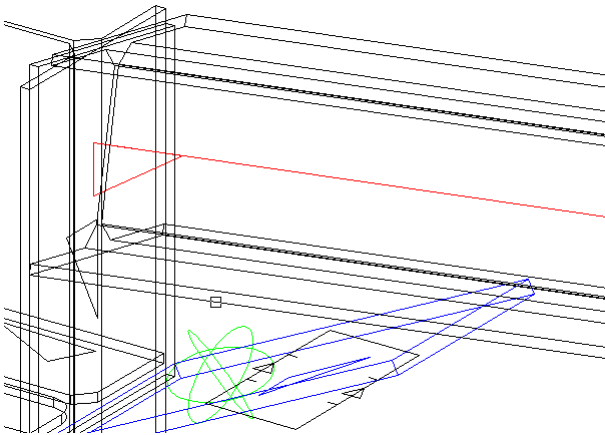
 We will weld the endplate against the beam and we'll make it into an endplate (green). Thanks to the colour difference we will more easily see the difference between plates and members.



- Start the command  **Weld**.




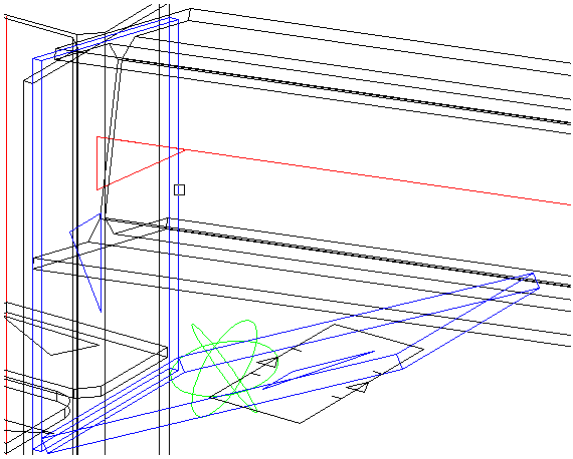
- Select the endplate and then press **<Enter>**.



- Select the beam.




- Start the command  **Endplate**.



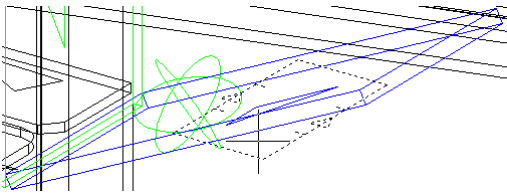
- Select the endplate.

← Step 5 →

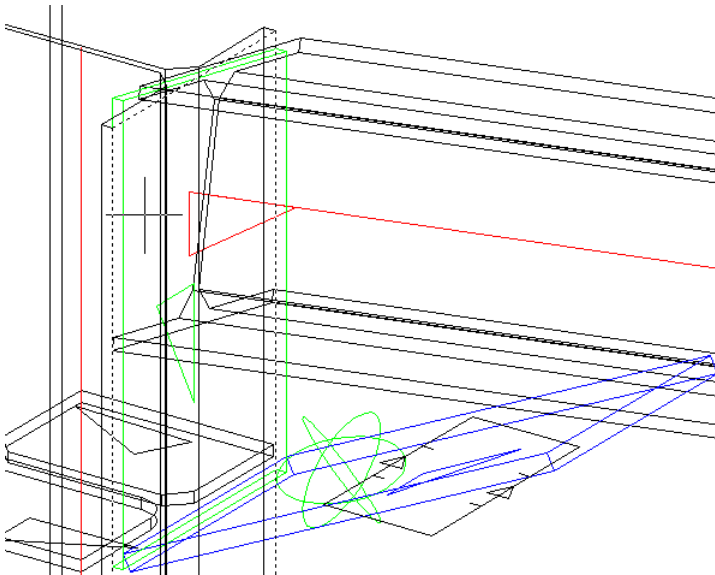
 In total we need 5 geometric rules to completely define the rectangular pattern.



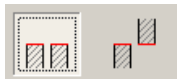
- Click on  **Coincident**




- Select the plane of the pattern by clicking the left mouse button. Now press the right mouse button to confirm.



- Select the plane of the column by clicking the left mouse button three times. Now press the right mouse button to confirm.



- Click in the dialog box on the button 

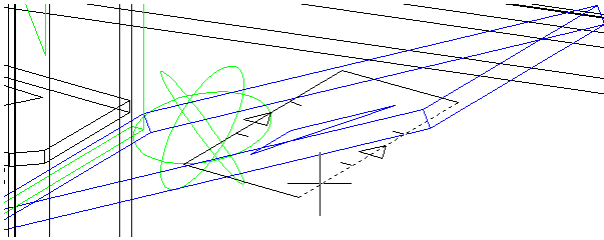


- Click on **Close**.

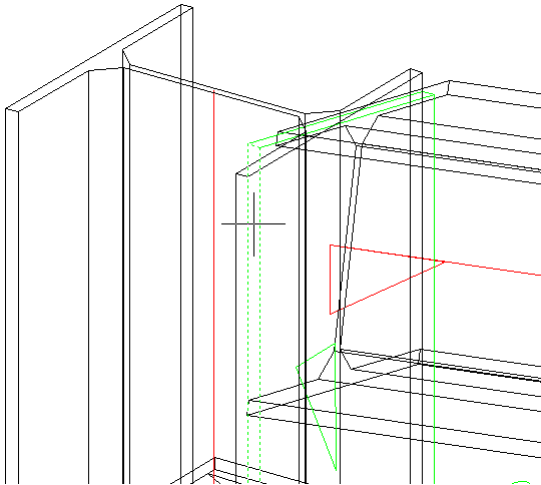
← Step 6 →



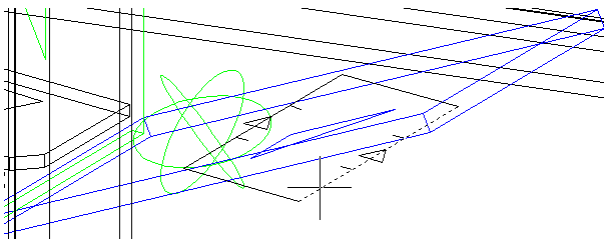
- Click on  **Distance between**



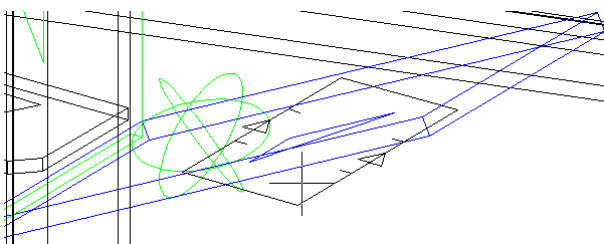
- Select the right line of the pattern and press the right mouse button to confirm.



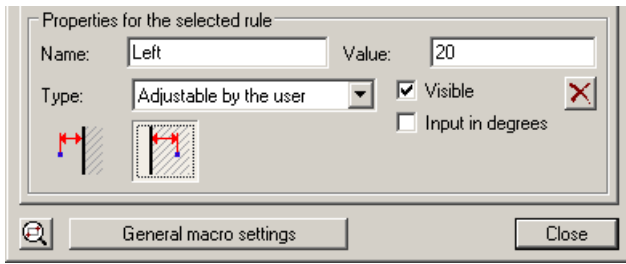
- Select the left side plane of the endplate and press the right mouse button to confirm.




- Select a line of the pattern and press the right mouse button to confirm.

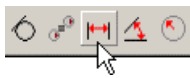


- Choose a point somewhere in the neighbourhood of the pattern.

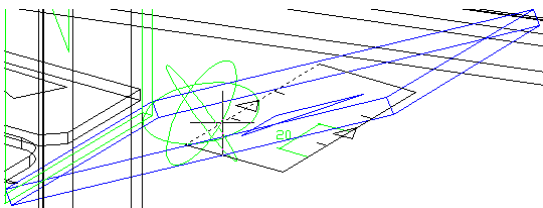


- In the dialog box below, enter for the property **Name** : *Left*
- Enter for the property **Value** : *20*
- Click on the button 
- Click on **Close**.

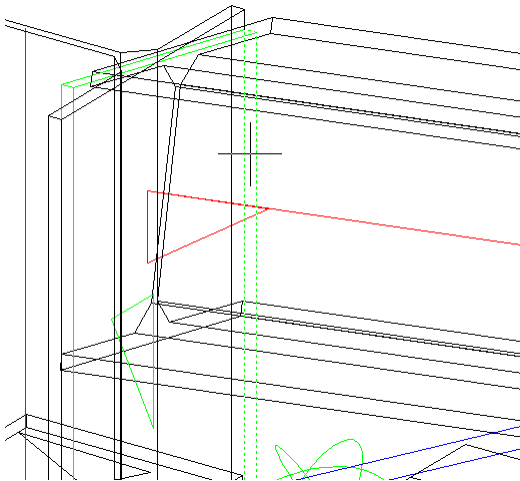
◀ Step 7 ▶



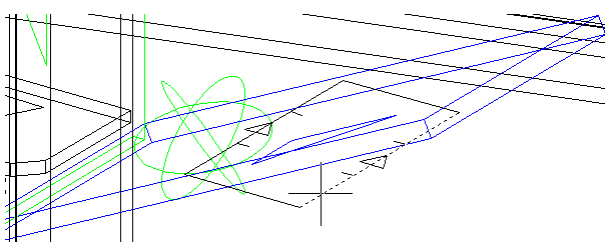
- Click on  **Distance between**



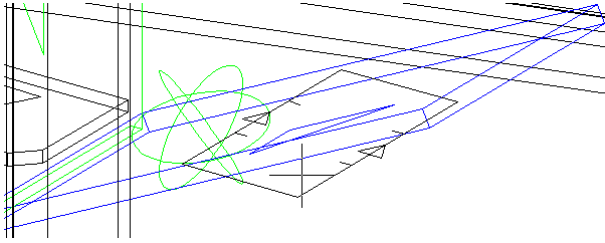
- Select the left line of the pattern and press the right mouse button to confirm.



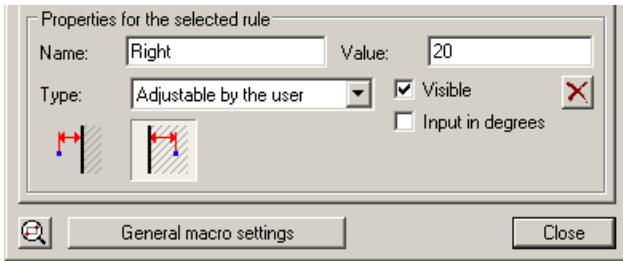
- Select the right side plane of the endplate by pressing the left mouse button four times. Now press the right mouse button to confirm.




- Select a line of the pattern and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the pattern.

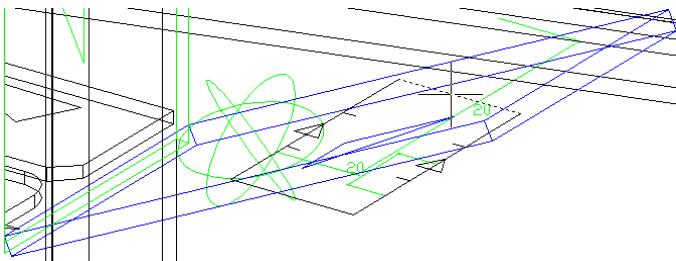


- In the dialog box below, enter for the property **Name** : *Right*
- Enter for the property **Value** : 20
- Click on the button 
- Click on **Close**.

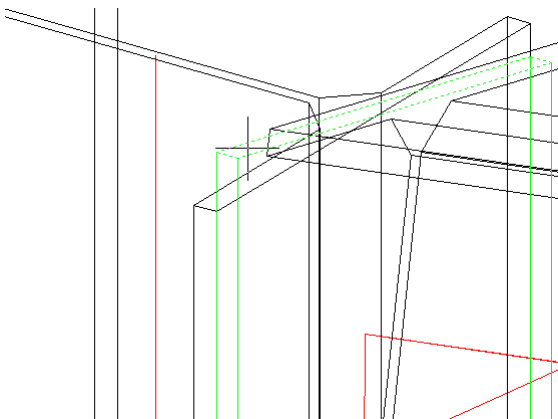
◀ **Step 8** ▶



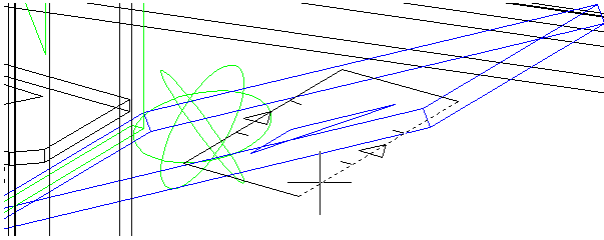
- Click on  **Distance between**



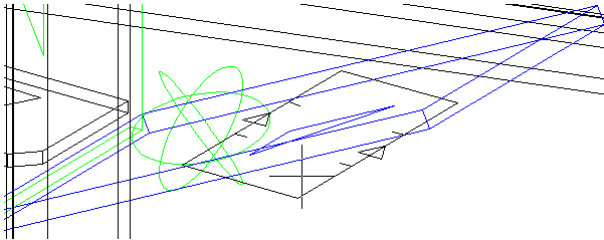
- Select the top line of the pattern and press the right mouse button to confirm.



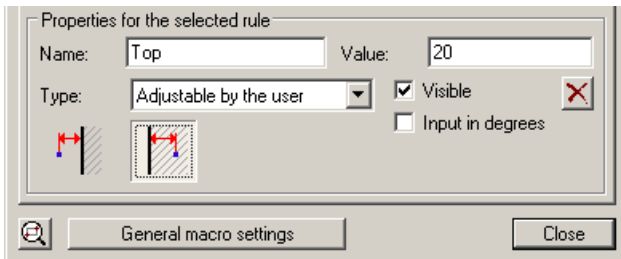
- Select the topside plane of the endplate by clicking the left mouse button. Now press the right mouse button to confirm.




- Select a line of the pattern and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the pattern.

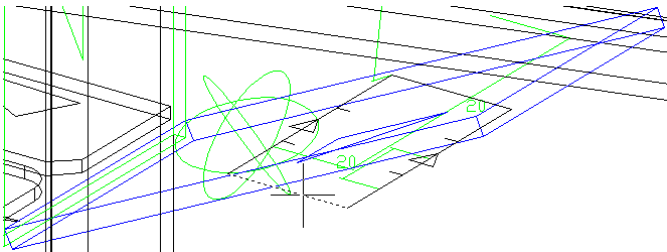


- In the dialog box below, enter for the property **Name** : *Top*
- Enter for the property **Value** : 20
- Click on the button 
- Click on **Close**.

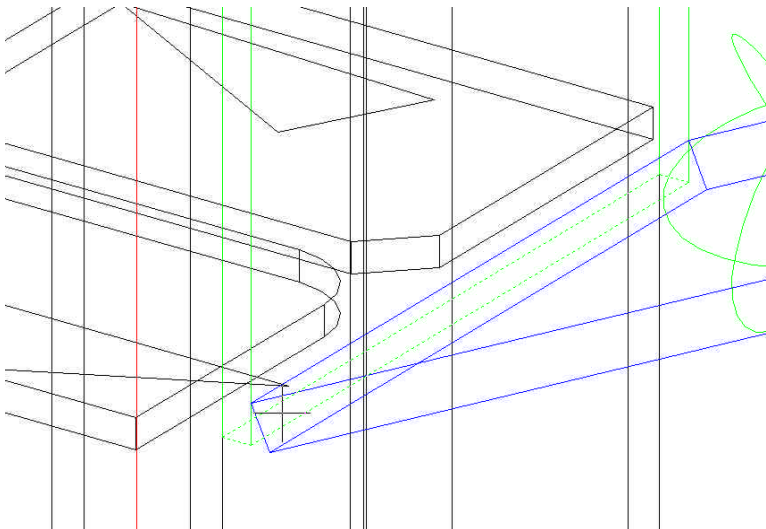
← Step 9 →



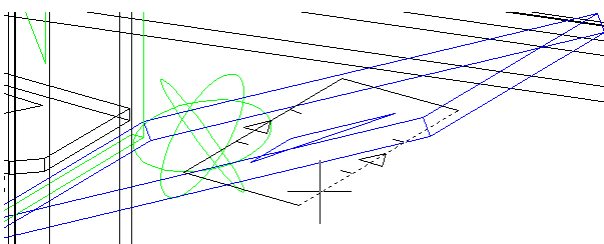
- Click on  **Distance between**



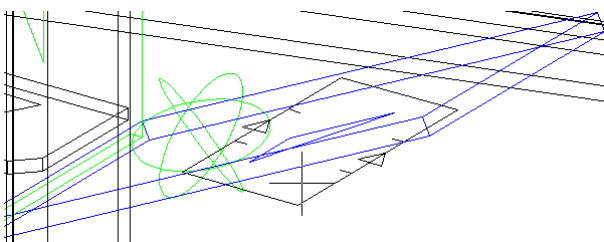
- Select the lower line of the pattern and press the right mouse button to confirm.



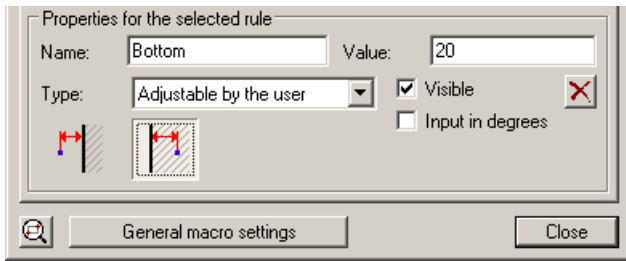
- Select the lowest side plane of the endplate by pressing the left mouse button two or four times. Now press the right mouse button to confirm.




- Select a line of the pattern and press the right mouse button to confirm.



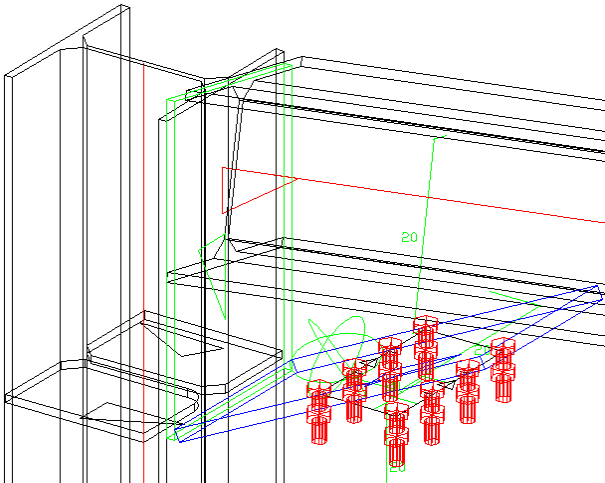
- Choose a point somewhere in the neighbourhood of the pattern.




- In the dialog box below, enter for the property **Name** : *Bottom*
- Enter for the property **Value** : *20*
- Click on the button 
- Click on **Close**.



- Click on  **Recalculate all**.

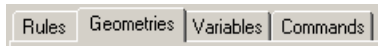


 *The pattern is not modified as expected. The reason is that the pattern is not yet set as flexible in the **Bolts** module.*

← Step 10 →



- Click on  **Edit macro**



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
Bolts	Base	Flexible	<input type="checkbox"/>
P222X10-395(211	Base	Flexible	<input type="checkbox"/>
Bolt(2115081712)	Base	Rigid	<input type="checkbox"/>
Bolt(2115081720)	Base	Fixed	<input type="checkbox"/>
Bolt(2115081728)	Base	Flexible	<input type="checkbox"/>
Bolt(2115081736)	Base	Flexible	<input type="checkbox"/>
Bolt(2115081744)	Base	Flexible	<input type="checkbox"/>
Bolt(2115081752)	Base	Flexible	<input type="checkbox"/>
Bolt(2115081760)	Base	Flexible	<input type="checkbox"/>
Bolt(2115081768)	Base	Flexible	<input type="checkbox"/>

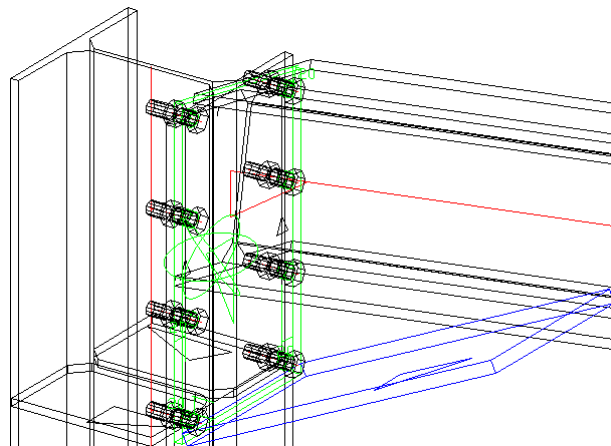
- Modify the **Flexibility** of the first row (the pattern) to flexible.



- Click on **Close**.



- Click on  **Recalculate all**.



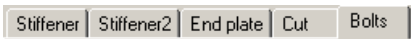
← Step 11 →



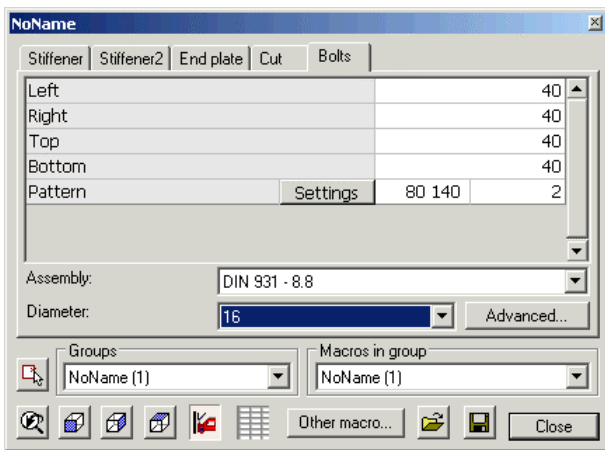
- Click on **Review macro**.



- Select the macro in the drawing and press **<Enter>**.

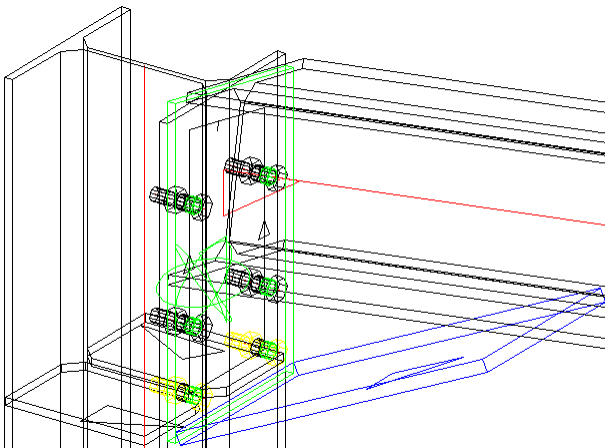


- Activate the tab **Bolts**.



- Enter in the dialog box for the setting **Left** : 40
- Enter for the setting **Right** : 40
- Enter for the setting **Top** : 40
- Enter for the setting under : 40
- Enter in the first field of **Pattern** : 80 140

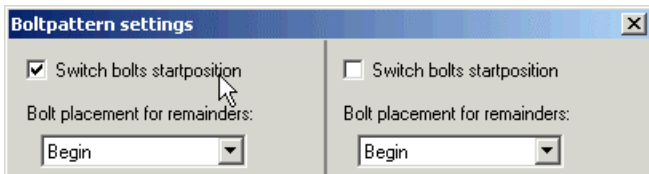
For the last setting that we modified, we used a space between two numbers to indicate that we're modifying the distances between bolts.



The distances we've entered start from the under side of the endplate. This is due to the orientation of the pattern. We can easily fix this problem...

Settings

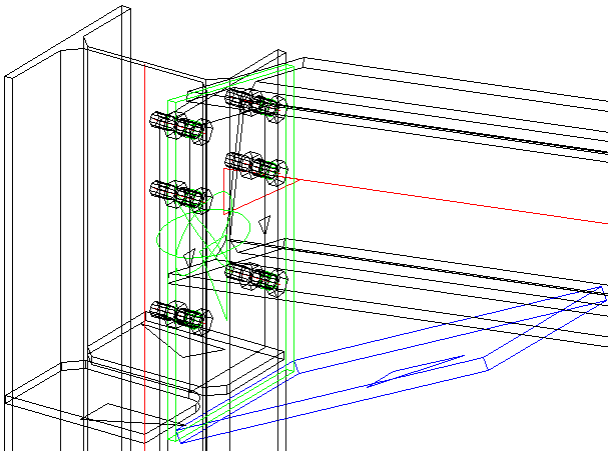
- Click in the dialog box on the button **Settings** near the fields of the pattern.




- Activate in the dialog box the most left checkbox **Switch bolts startposition**.

Close

- Click on **Close**.




 *There are also line patterns and circular patterns that we can draw and use the same way.*

Exercise 11: Adding a member to a macro

Drawing a member as part of a macro can be done fairly quickly. Only the line that we use as a base for the member needs to be constrained using geometric rules.

◀ Step 1 ▶



- Open the drawing  Exercise11.dwg



- Start the command  **Create new macro** (red sphere).




- Click a random location in the drawing.

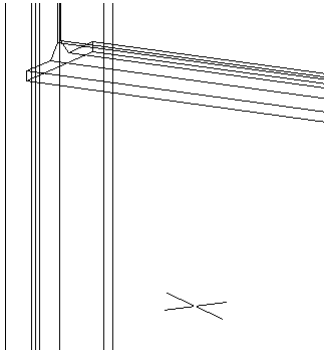


- On the command line, type for the **name** of the module : *line* and then press **<Enter>**.

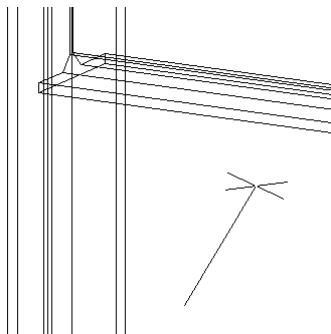
◀ Step 2 ▶



- Start the command  **Line**




- Indicate somewhere in the drawing the startpoint.



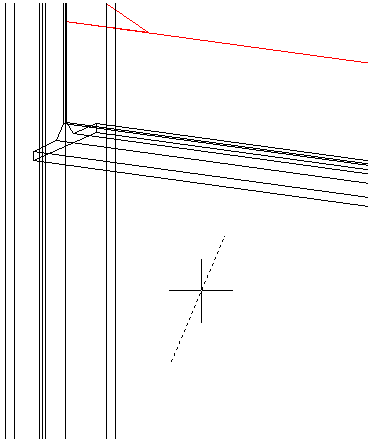
- Indicate somewhere in the drawing the endpoint and then press **<Enter>** to end the command.

← Step 3 →

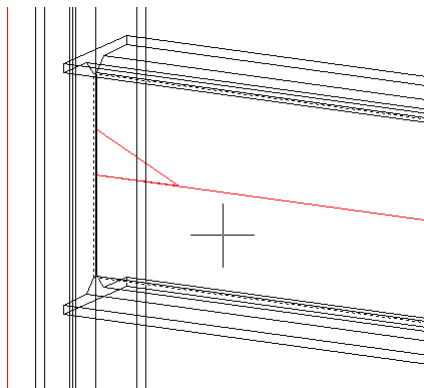
 We will later use the line to draw a clipangle between the beam and the column.



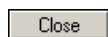
- Click on  **Coincident**



- Select the new line and press the right mouse button to confirm.



- Select the front plane of the web of the beam and then press the right mouse button to confirm.

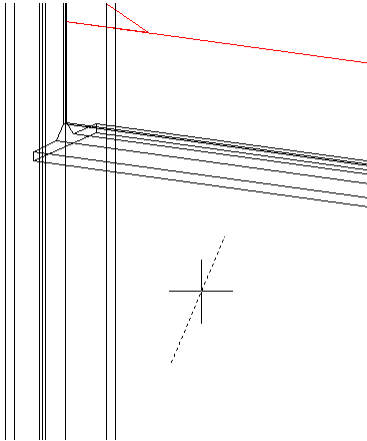


- Click on **Close**.

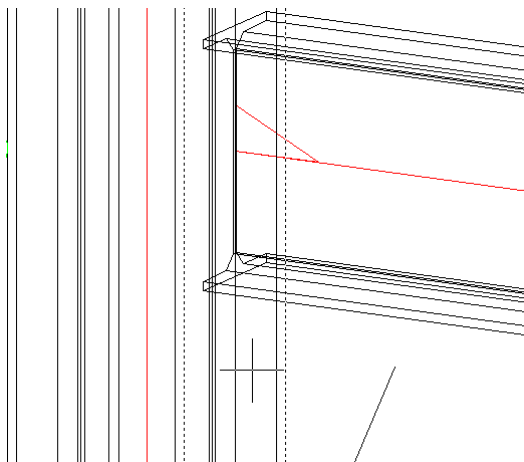
◀ Step 4 ▶



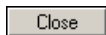
- Click on **Coincident**



- Select the new line and press the right mouse button to confirm.



- Select the front plane of the flange of the column and then press the right mouse button to confirm.

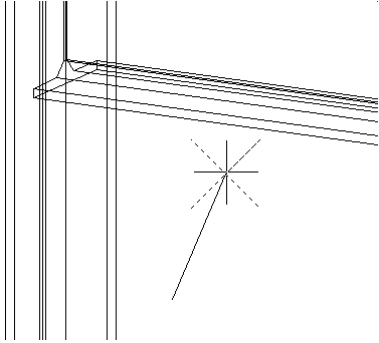


- Click on **Close**.

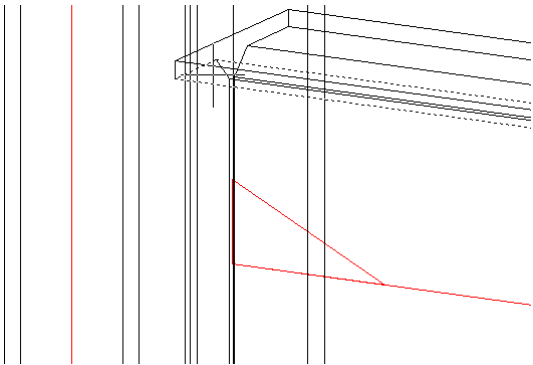
◄ Step 5 ►



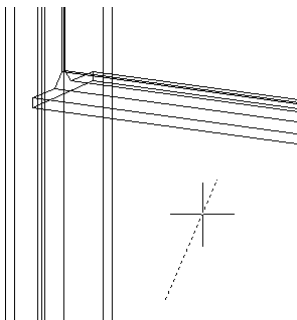
- Click on  **Distance between**



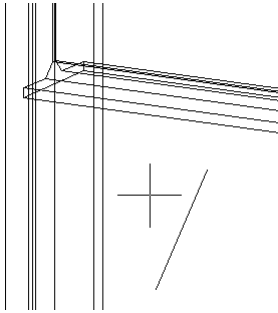
- Select the top point of the new line by pressing the left mouse button. Now press the right mouse button to confirm.



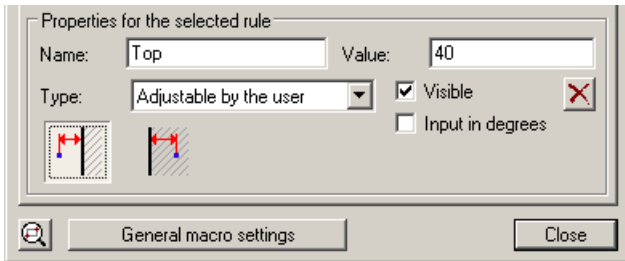
- Select the lower plane of the top flange of the beam by pressing the left mouse button twice. Now press the right mouse button to confirm.




- Select for example the new line and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the new line.

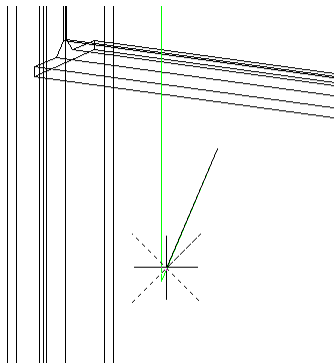


- In the dialog box below, enter for the property **Name** : *Top*
- Enter for the property **Value** : *40*
- Click on the button 
- Click on **Close**.

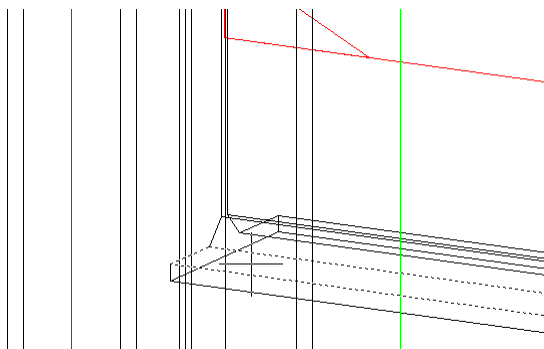
← Step 6 →



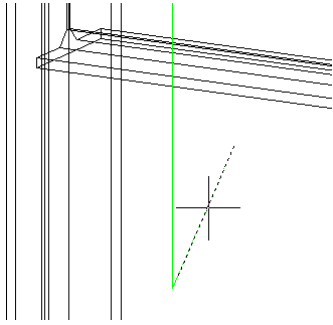
- Click on  **Distance between**



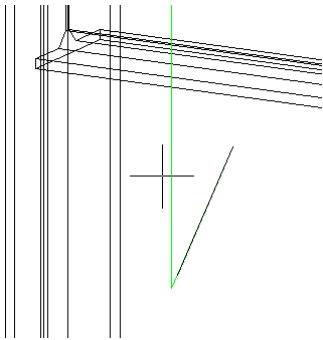
- Select the lowest point of the new line by pressing the left mouse button. Now press the right mouse button to confirm.



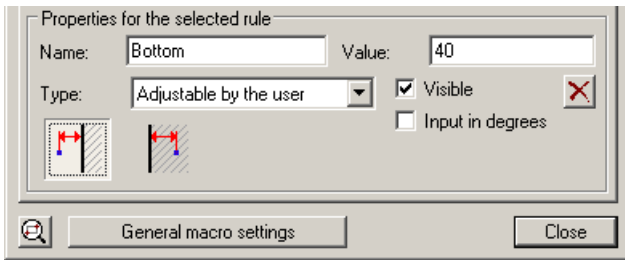
- Select the top plane of the lower flange of the beam by pressing the left mouse button twice. Now press the right mouse button to confirm.




- Select for example the new line and press the right mouse button to confirm.



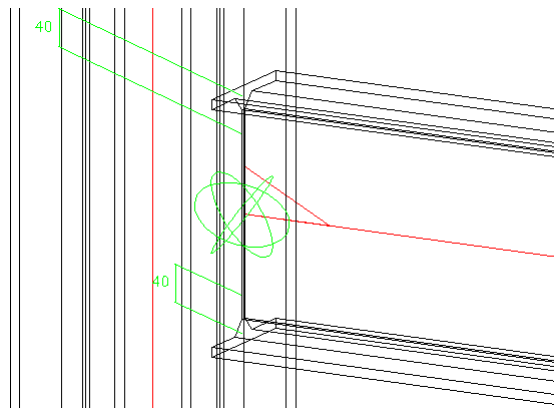
- Choose a point somewhere in the neighbourhood of the new line.



- In the dialog box below, enter for the property **Name** : *Bottom*
 - Enter for the property **Value** : 40
 - Click on the button 
 - Click on **Close**.



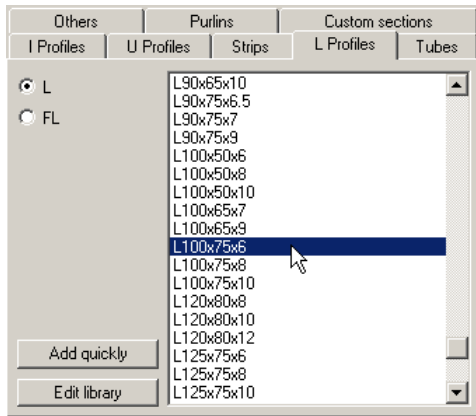
- Click on  **Recalculate all**.



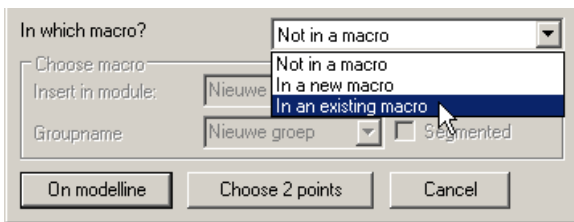
← Step 7 →



- Start the command **L** Angle profiles



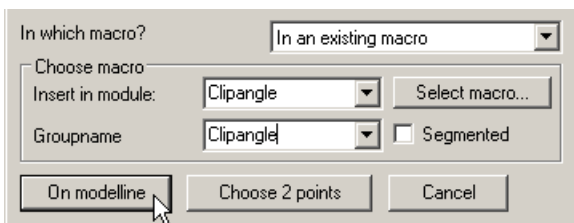
- Select in the list the section **L100x75x6**



- Modify in the dialog box below the setting **In which macro?** to : *In an existing macro*.



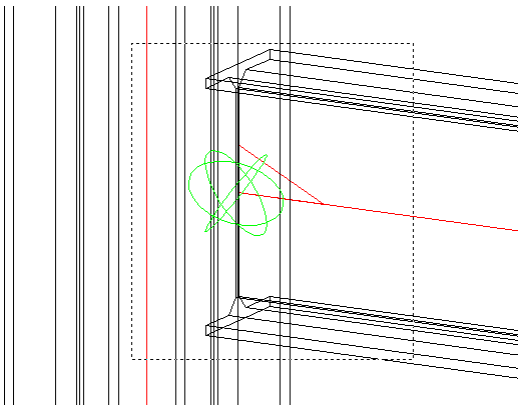
- Select the macro in the drawing.



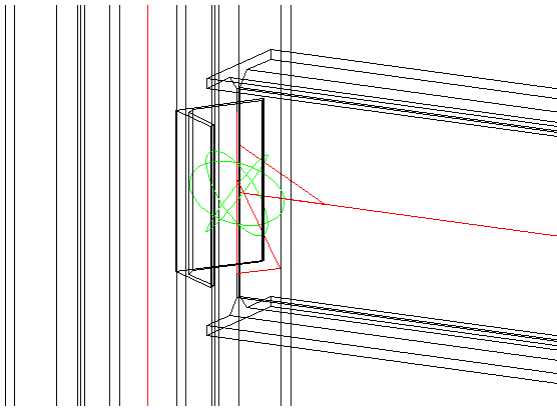
- Modify the setting **Insert in module** to : *Clipangle*

- Modify the setting **Groupname** to : *Clipangle*

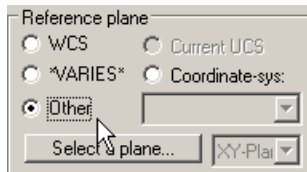
- Click on **On modelline**.



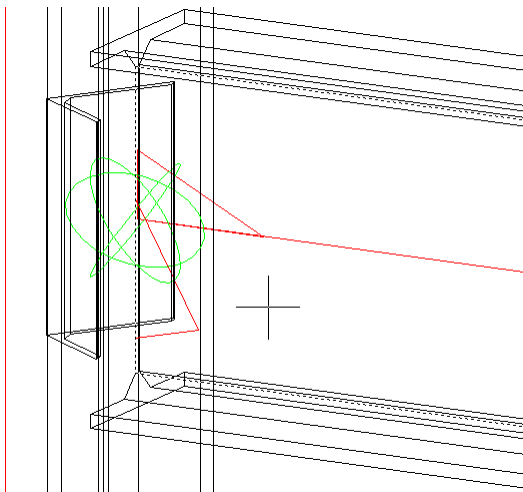
- Make a window from top right to bottom left around the entire connection so that you're sure you selected the new line. It does not matter that we also select members this way. Press **<Enter>** to confirm.



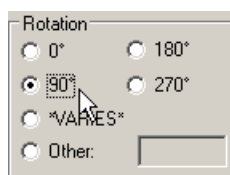
? The clipangle is drawn oblique. This is because it is drawn along the World UCS. We need to base the placement according to the beam or the column so that the orientation of the clipangle follows their orientation.



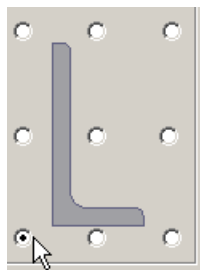
- Click in the middle under *Reference plane* on **Other...**



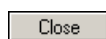
- Select the front plane of the web of the beam by pressing the left mouse button. Now press the right mouse button to confirm.



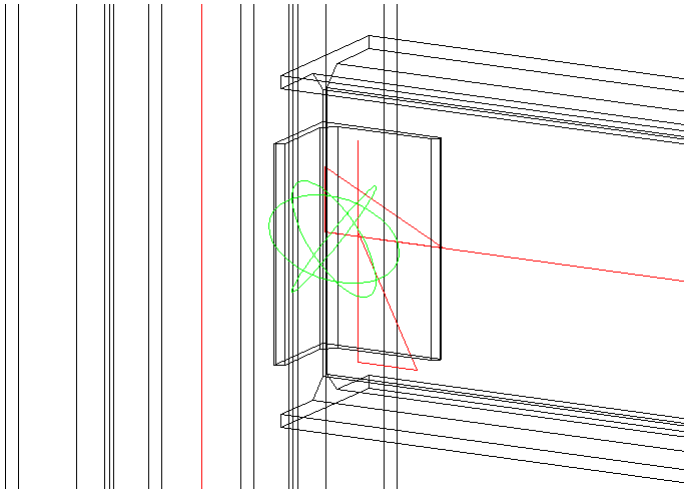
- Click under *Rotation* on **90°**.



- Click for the location on the lower left button.



- Click on **Close**.



② *The only thing this connection needs is bolt pattern(s) and a cut and it would be finished.*

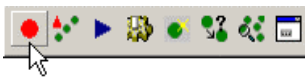
Exercise 12: Using the World of a drawing


To create a baseplate connection we need the World coordinate system of the drawing.
We need the World to fix the baseplate to the ground level.
To do this we will use the three-coloured coordinate system that is visible in every drawing.

◀ Step 1 ▶



- Open the drawing  Exercise12.dwg



- Start the command  **Create new macro** (red sphere).




- Click a random location in the drawing.



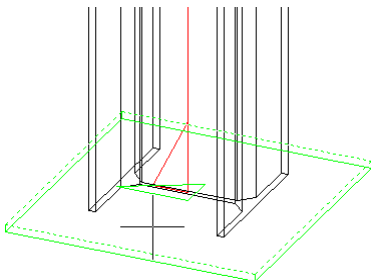
- On the command line, type for the **name** of the module : *Baseplate* and press **<Enter>**.

◀ Step 2 ▶

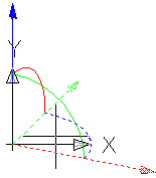
 *We draw the baseplate on the World. We need one geometric rule to do this.*



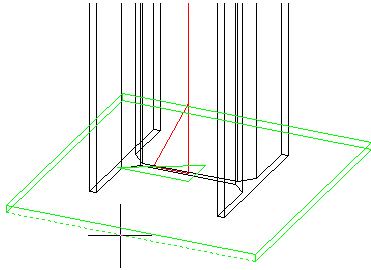
- Click on  **Distance between**



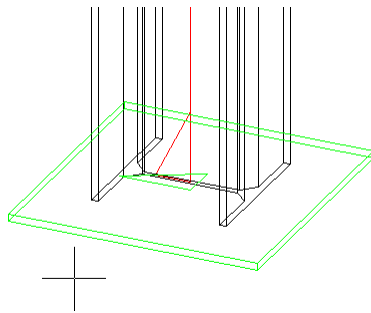
- Select the upper plane of the baseplate by clicking the left mouse button. Now press the right mouse button to confirm.



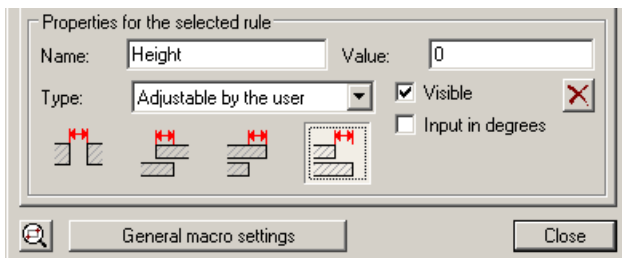
- Select the lower plane of the coordinate system by pressing the left mouse button twice. Now press the right mouse button to confirm.




- Select a line of the baseplate and press the right mouse button to confirm.




- Choose a point somewhere in the neighbourhood of the baseplate.



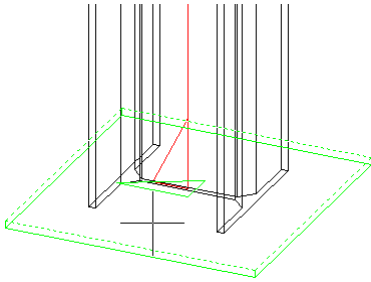
- In the dialog box below, enter for the property **Name** : *Height*
- Enter for the property **Value** : *0*
- Click on the button 
- Click on **Close**.

← Step 3 →

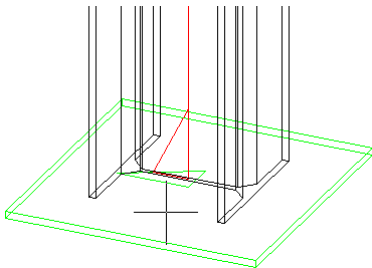
 We need the next 5 geometric rules to define the shape of the baseplate.



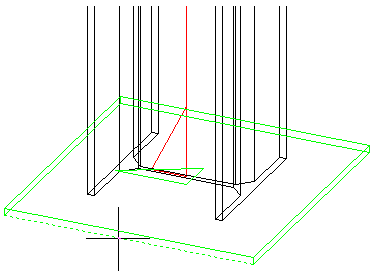
- Click on  **Distance between**



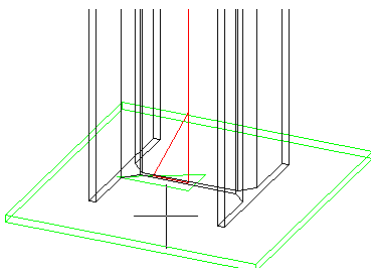
- Select the upper plane of the baseplate by clicking the left mouse button. Now press the right mouse button to confirm.



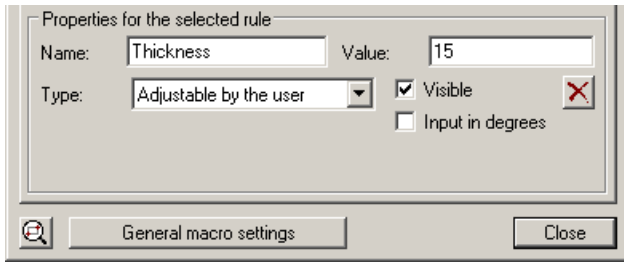
- Select the lower plane of the baseplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select a line of the baseplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the baseplate.

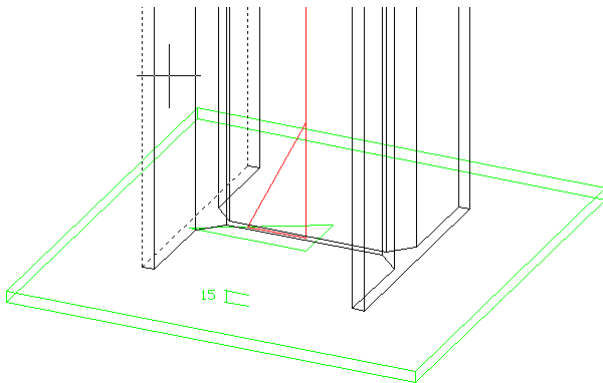


- In the dialog box below, enter for the property **Name** : *Thickness*
- Enter for the property **Value** : *15*
- Click on **Close**.

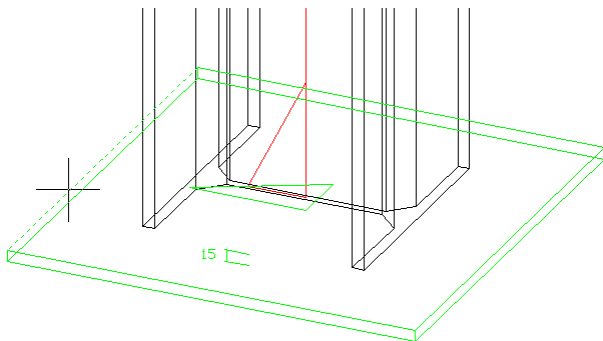
◀ Step 4 ▶



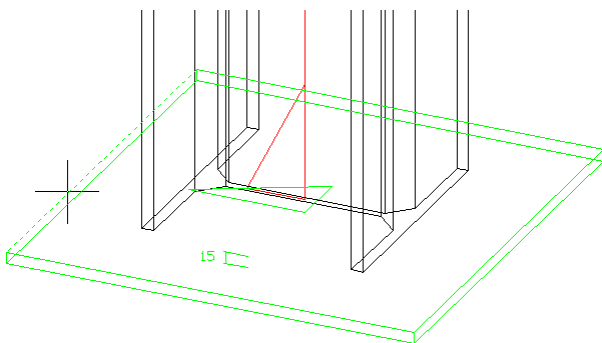
- Click on  **Distance between**



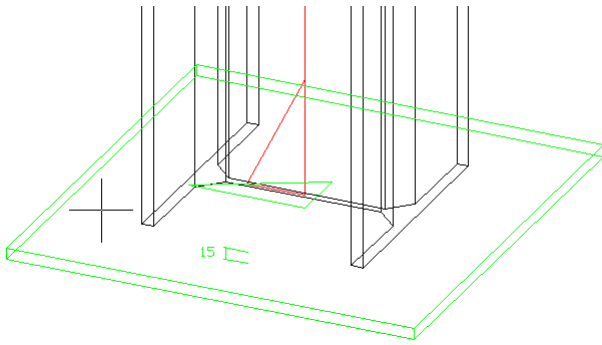
- Select the back flange plane left of the column by pressing the left mouse button twice. Now press the right mouse button to confirm.



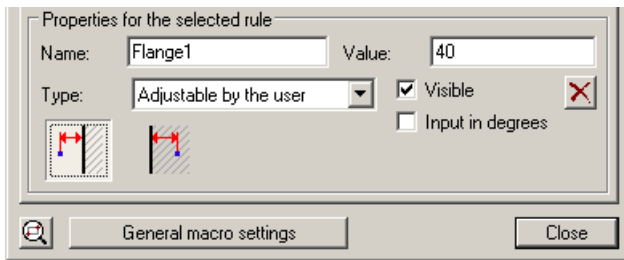
- Select the most left line of the baseplate at the top. Now press the right mouse button to confirm.




- Select a line of the baseplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the baseplate.

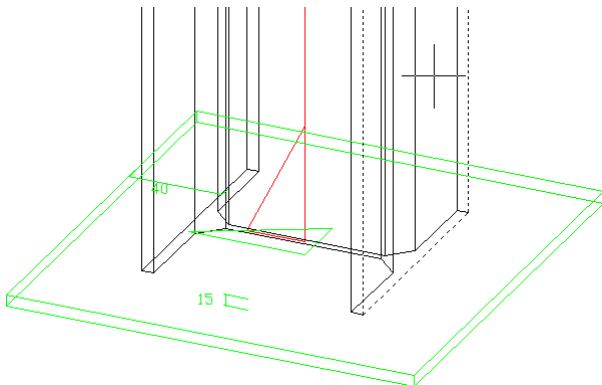


- In the dialog box below, enter for the property **Name** : *Flange1*
- Enter for the property **Value** : 40
- Click on the button 
- Click on **Close**.

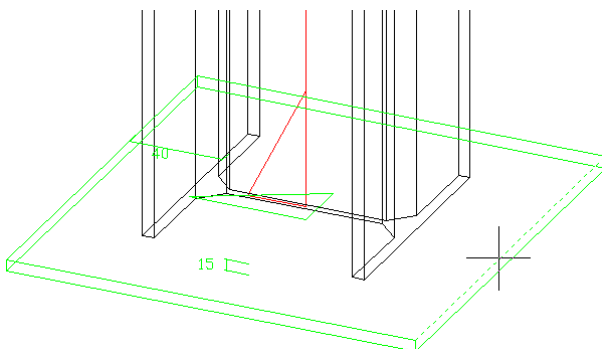
◀ Step 5 ▶



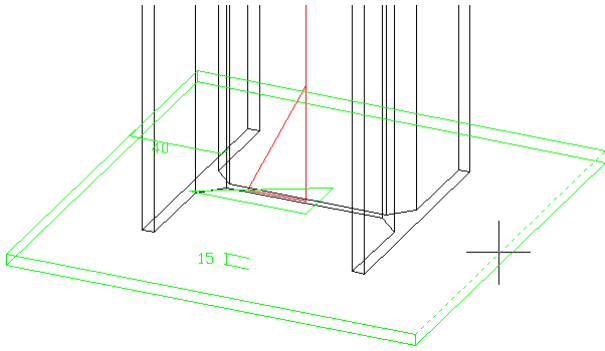
- Click on  **Distance between**



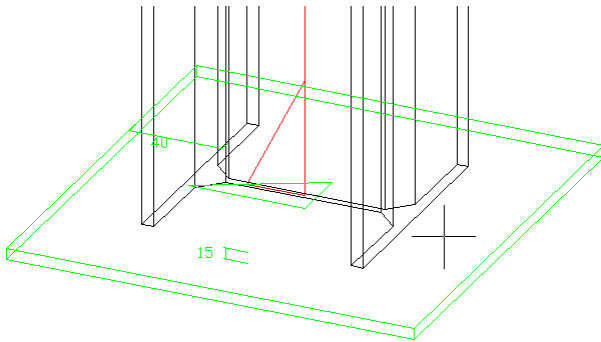
- Select the front flange plane right of the column by pressing the left mouse button. Now press the right mouse button to confirm.



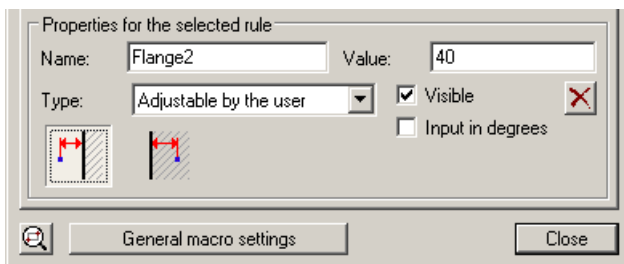
- Select the most right line of the baseplate at the top. Now press the right mouse button to confirm.




- Select a line of the baseplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the baseplate.

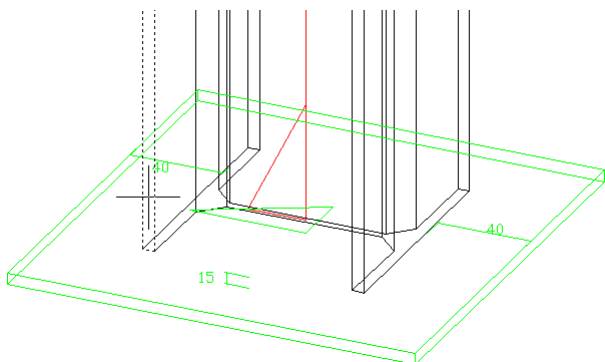


- In the dialog box below, enter for the property **Name** : *Flange2*
 - Enter for the property **Value** : 40
 - Click on the button 
 - Click on **Close**.

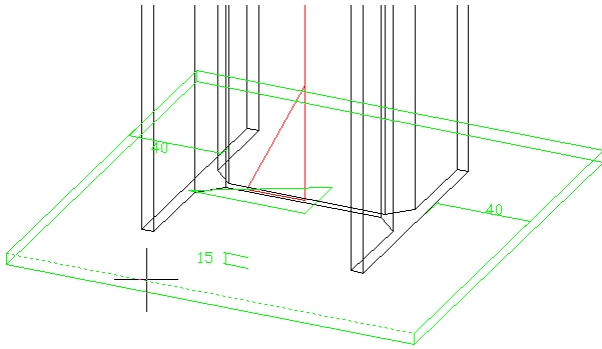
◀ Step 6 ▶



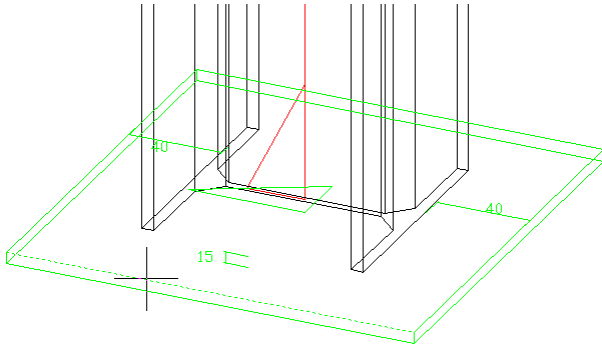
- Click on  **Distance between**



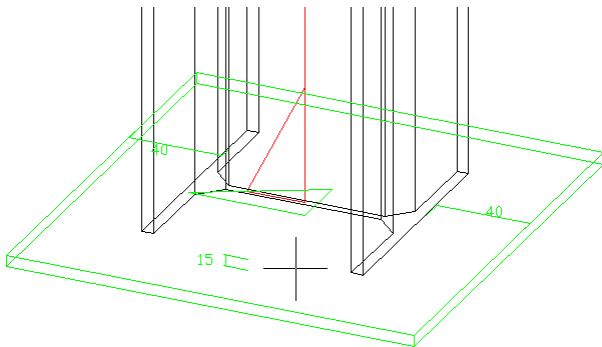
- Select the front flange plane left of the column by pressing the left mouse button. Now press the right mouse button to confirm.



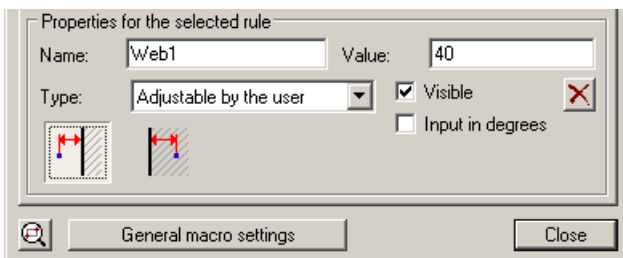
- Select the front line of the baseplate at the top. Now press the right mouse button to confirm.




- Select a line of the baseplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the baseplate.

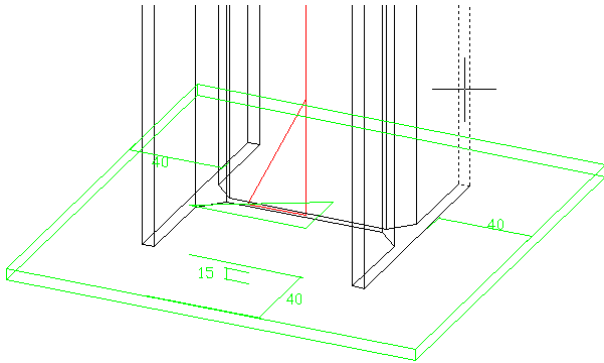


- In the dialog box below, enter for the property **Name** : *Web1*
 - Enter for the property **Value** : 40
 - Click on the button 
 - Click on **Close**.

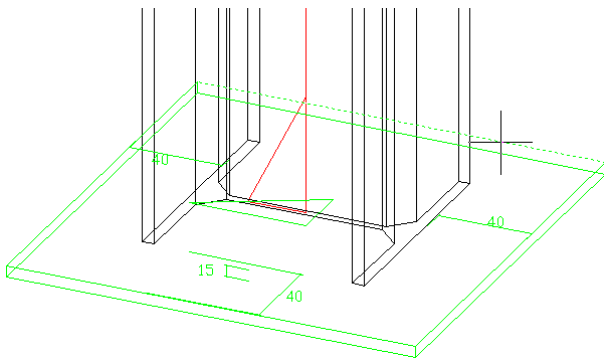
← Step 7 →



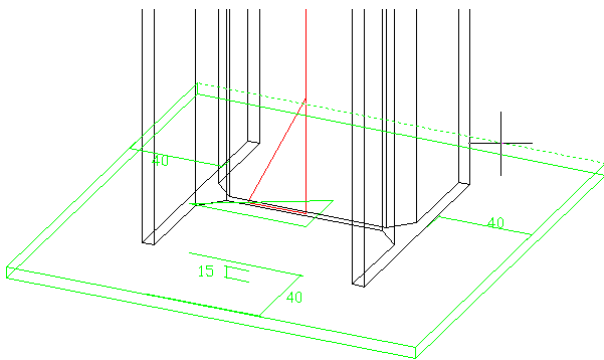
- Click on  **Distance between**



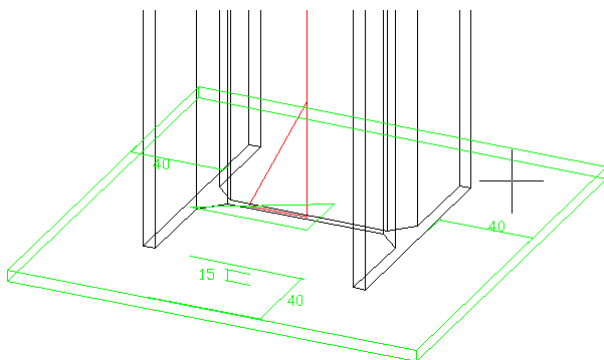
- Select the back flange plane right of the column by pressing the left mouse button twice. Now press the right mouse button to confirm.



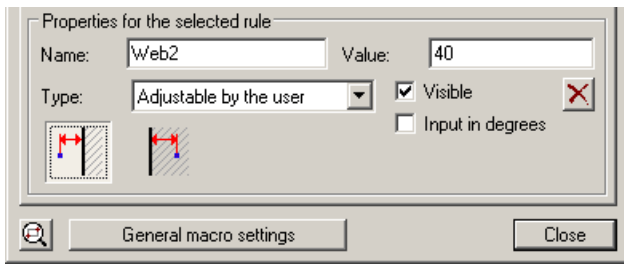
- Select the back line of the baseplate at the top. Now press the right mouse button to confirm.




- Select a line of the baseplate and press the right mouse button to confirm.



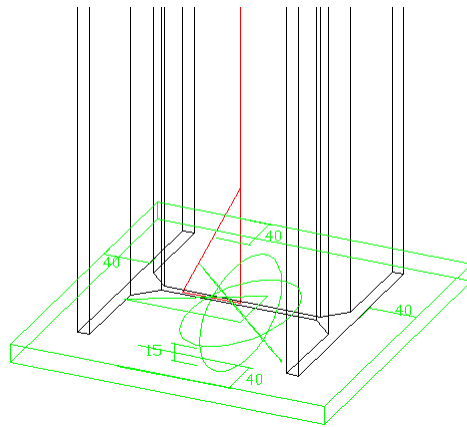
- Choose a point somewhere in the neighbourhood of the baseplate.



- In the dialog box below, enter for the property **Name** : *Web2*
- Enter for the property **Value** : *40*
- Click on the button 
- Click on **Close**.



- Click on  **Recalculate all**.




Exercise 13: Centre equation


In this exercise we will make an equation that makes sure that two variables always have the same value.

The purpose of this is to centre a plate in the middle of a member.

◀ Step 1 ▶

 For this exercise we will use the endresult of the previous exercise.



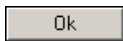
- Open the drawing  Exercise13.dwg



- Start the command  **Set macro as current.**



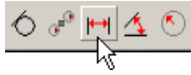
- Select the macro in the drawing.



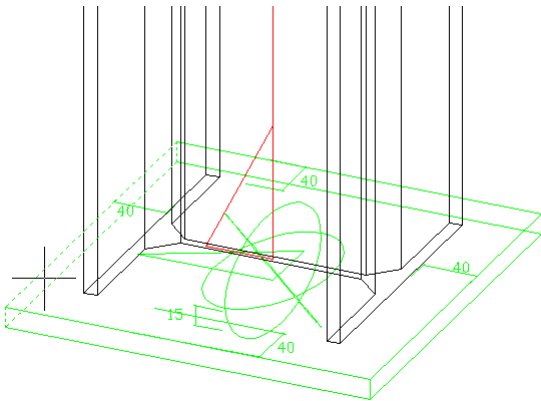
- Click on **Ok**.

← Step 2 →

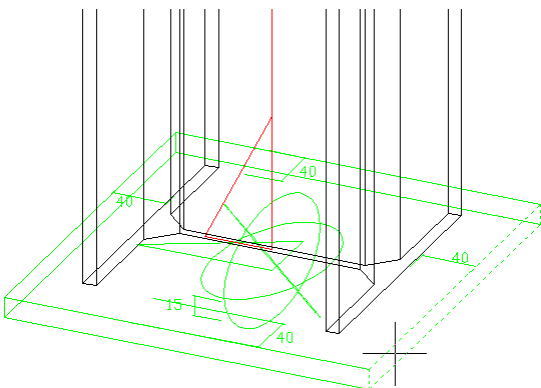
? We will make the width of the plate adjustable. We draw the geometric rule that is needed for this.



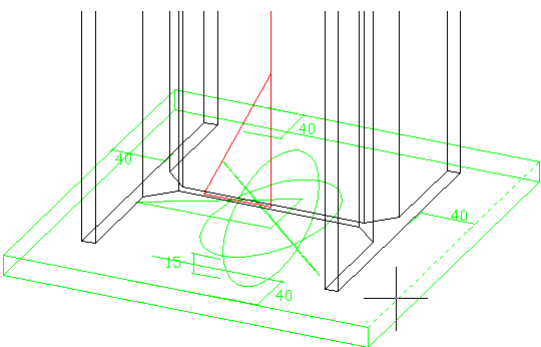
- Click on  **Distance between**



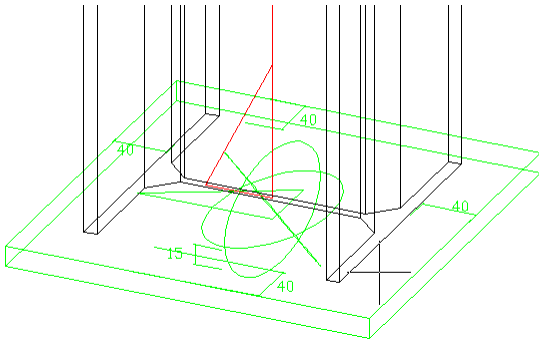
- Select the left side plane of the baseplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



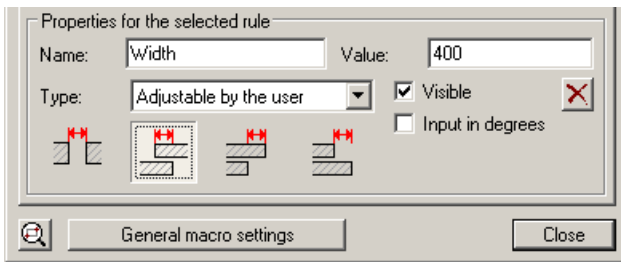
- Select the right side plane of the baseplate by pressing the left mouse button. Now press the right mouse button to confirm.




- Select a line of the baseplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the baseplate.



- In the dialog box below, enter for the property **Name** : *Width*
- Enter for the property **Value** : 400
- Click on the button 
- Click on **Close**.

← Step 3 →

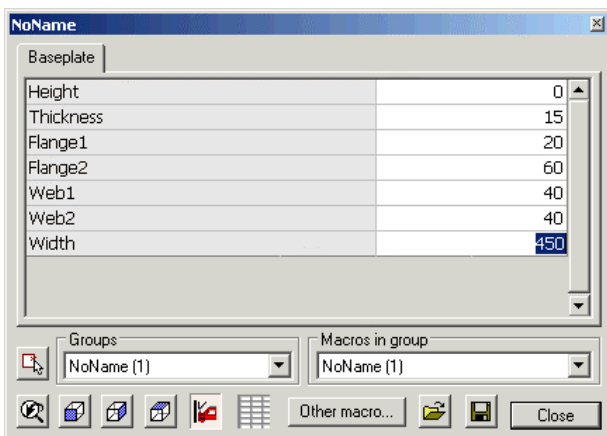
? If the width is adjustable, it then is impossible to also adjust the distances **Flange1** and **Flange2**. We will see why.



- Click on  **Review macro**.

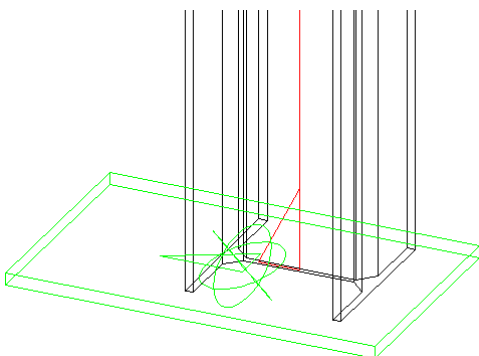


- Select the macro in the drawing and press **<Enter>**.




Modify the settings below and always look at the results in the drawing.

- **Flange1** : 20
- **Flange2** : 60
- **Width** : 450



? As you can see from the results Parabuild doesn't react to the modifications we make to the setting **Flange1**.
 The reason is a conflict with the geometric rule **Width**. They can't both be adjustable because they both try to define the width of the plate.
 Parabuild can only use 2 of the 3 setting, and this time it chooses for **Flange2** and **Width**. This choice is random.
 We call this overconstrained or overdefined.
 As a draftsman you should fix a problem like this to avoid problems.
 To fix this you can set one of the variables as flexible (**Flange1**, **Flange2** or **Width**).

← Step 4 →

 We will now set **Flange1** and **Flange2** as flexible so that they aren't adjustable.



- Click on **Close**.



- Click on  **Edit macro**



- Select the macro in the drawing.


Name	Rule	Geometry 1	Geometry 2
Height	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Flange1	Distance	Plane	Line
Flange2	Distance	Plane	Line
Web1	Distance	Plane	Line
Web2	Distance	Plane	Line
Width	Distance	Plane	Plane

- Select in the list the rule **Flange1**.

Properties for the selected rule

Name: Value:

Type: **Flexible value** Visible Input in degrees



- Modify the setting **Type** to *Flexible value*.


Name	Rule	Geometry 1	Geometry 2
Height	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Flange1	Distance	Plane	Line
Flange2	Distance	Plane	Line
Web1	Distance	Plane	Line
Web2	Distance	Plane	Line
Width	Distance	Plane	Plane

- Select in the list the rule **Flange2**.

Properties for the selected rule

Name: Value:

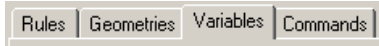
Type: **Flexible value** Visible Input in degrees



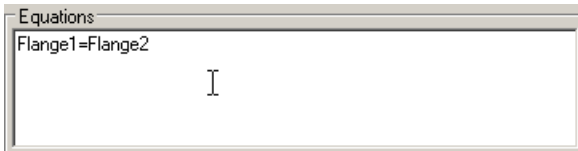
- Modify the setting **Type** to *Flexible value*.

← Step 5 →

Now that both zowel **Flange1** and **Flange2** are flexible the width is not yet fully defined.



- Activate the tab **Variables**



- Enter below in the dialog box under **Equations** the following equation :
 $Flange1 = Flange2$



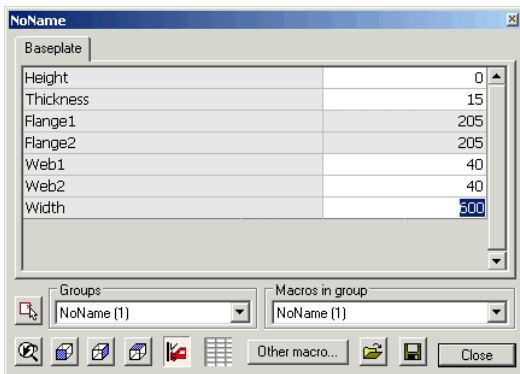
- Click on **Close**.



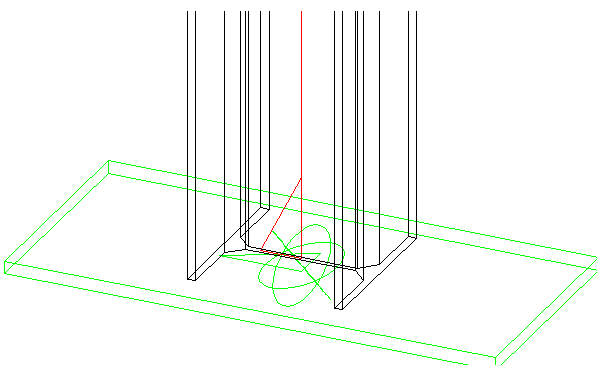
- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



- Modify the setting **Width** to 600 and press **<Enter>**.



The plate is now always centred in the direction of the width.

This is only possible thanks to :


- 1) Both **Flange1** and **Flange2** are flexible and are calculated by the computer.
- 2) the equation **Flange1 = Flange2** makes sure they will always get the same value.

Exercise 14: A plane as a helper-object


When we're making a macro we will regularly see geometries that are complicated. In this case it may be useful or maybe necessary to work with helper-objects. There is a helper-object specially designed for this purpose : the plane-object. With this helper-object we can calculate a certain plane that we can then further use. A helper-object allows us to split a complex problem into multiple smaller problems.

◀ Step 1 ▶



- Open the drawing  Exercise14.dwg



- Start the command  **Point**.



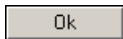
- Click a random location in the drawing and press the <ESC> key.



- Start the command  **Set macro as current**.



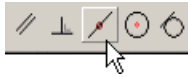
- Select the macro in the drawing.



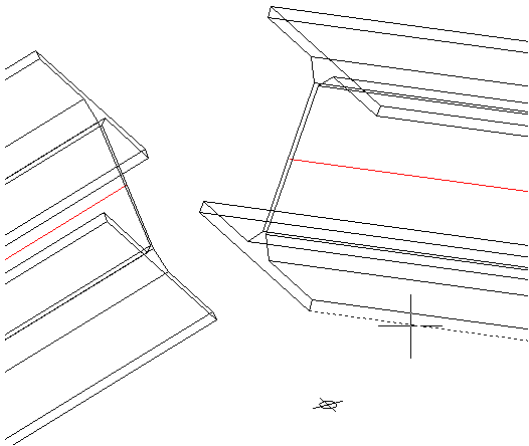
- Click on **Ok**.

◀ Step 2 ▶

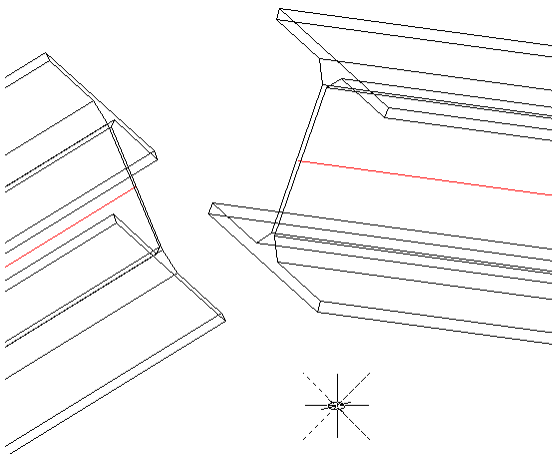
❓ We start with the calculation of the apex point on the underside of the beams.



- Click on  **Coincident**



- Select the lowest line of the right beam. Now press the right mouse button to confirm.



- Select the new point. Now press the right mouse button to confirm.

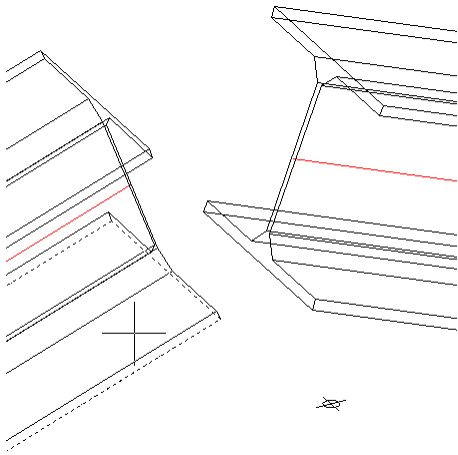
Close

- Click on **Close**.

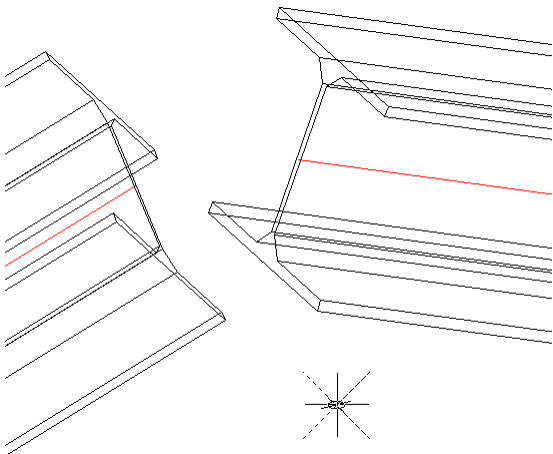
← Step 3 →



- Click on  **Coincident**



- Select the lower plane of the left beam by pressing the left mouse button twice. Now press the right mouse button to confirm.



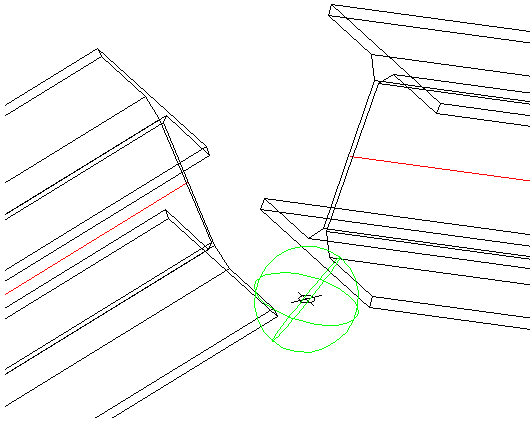
- Select the new point. Now press the right mouse button to confirm.




- Click on **Close**.

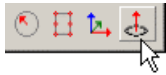



- Click on  **Recalculate all**.



 *This point is already finished.*

◄ Step 4 ►




- Start the command  **Create plane help geometry**.



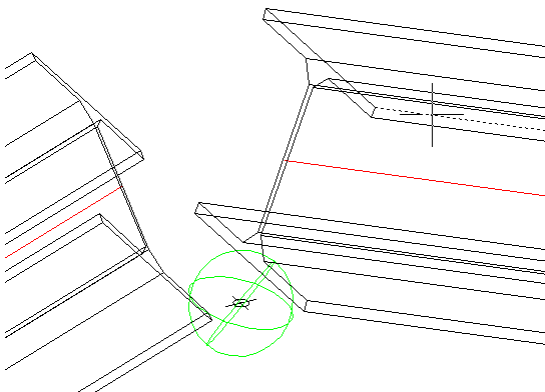
- Click a random location in the drawing.

◄ Step 5 ►

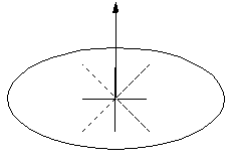
 *We will now define the top apex point of the beams, but we use the plane helper-object.*



- Click on  **Coincident**



- Select the top line of the right beam. Now press the right mouse button to confirm.




- Select the point of the new plane-object. Now press the right mouse button to confirm.

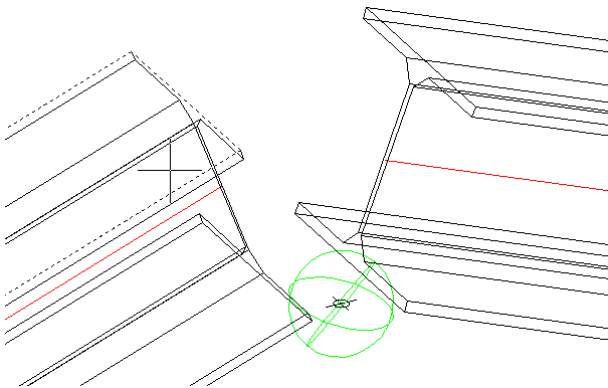


- Click on **Close**.

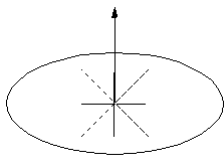
◀ Step 6 ▶



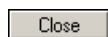
- Click on  **Coincident**



- Select the upper plane of the left beam. Now press the right mouse button to confirm.

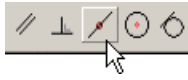


- Select the point of the new plane-object. Now press the right mouse button to confirm.

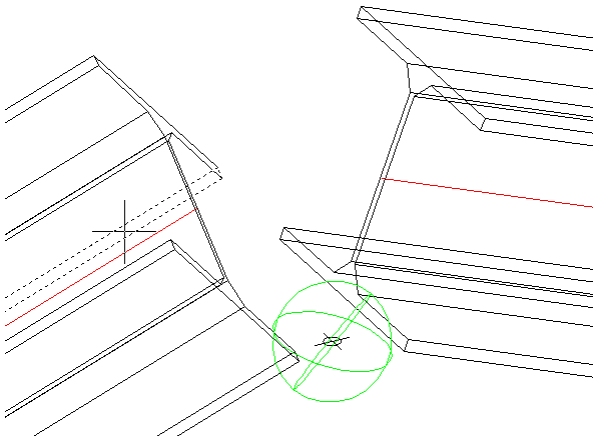


- Click on **Close**.

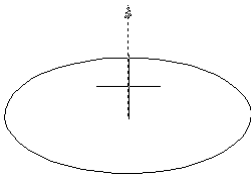
◀ Step 7 ▶



- Click on **Coincident**



- Select the first side plane of the left beam. Now press the right mouse button to confirm.

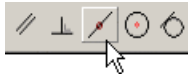


- Select the line of the new plane-object. Now press the right mouse button to confirm.

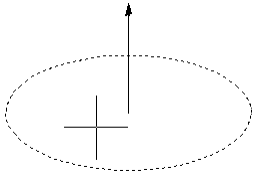


- Click on **Close**.

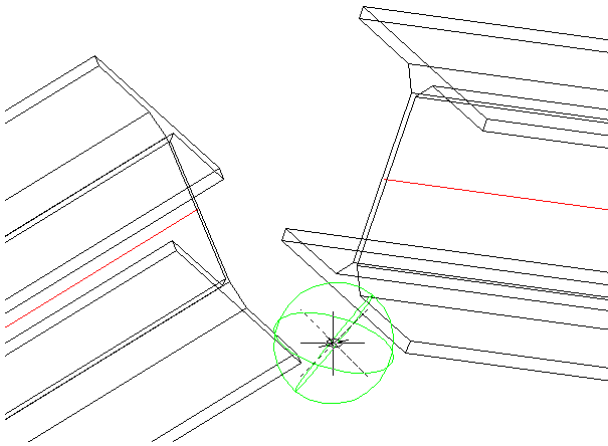
◀ Step 8 ▶



- Click on **Coincident**



- Select the plane of the plane-object. Now press the right mouse button to confirm.



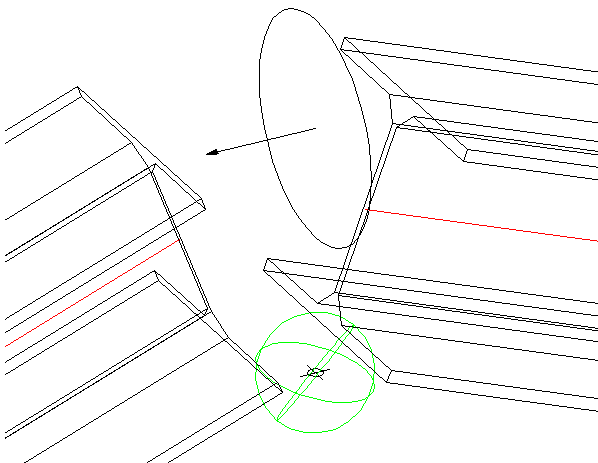
- Select the point below. Now press the right mouse button to confirm.




- Click on **Close**.



- Click on **Recalculate all**.



 *The plane can now be used to draw endplates against it.*

Exercise 15: Oblique, rotated

Until now we have always presumed that a beam is never rotated and that a column is always standing straight up.


But there are many situations where we shouldn't make such presumptions.

In this exercise we will make an endplate connection where we don't presume anything.

The member on whom the endplate is based is inclined in all directions and it is rotated.

◀ Step 1 ▶



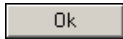
- Open the drawing  Exercise15.dwg



- Start the command  **Set macro as current.**



- Select the macro in the drawing.

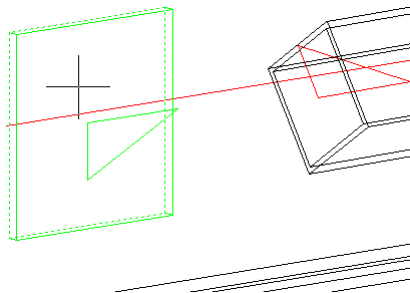


- Click on **Ok**.

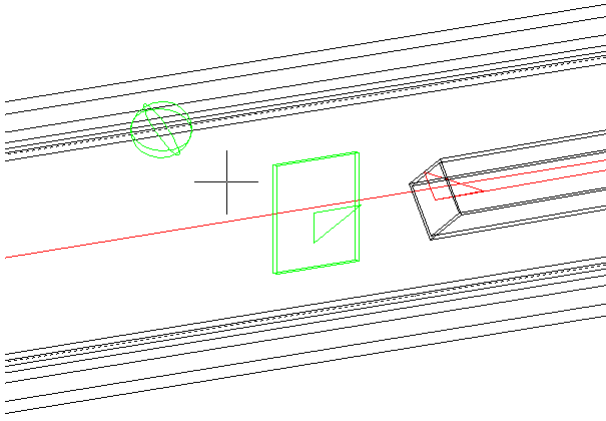
◀ Step 2 ▶



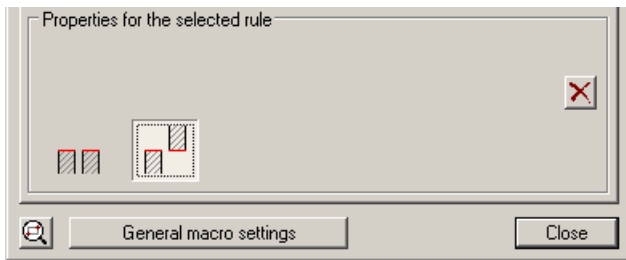
- Click on  **Coincident**




- Select the back plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select the web of the beam by pressing the left mouse button. Now press the right mouse button to confirm.

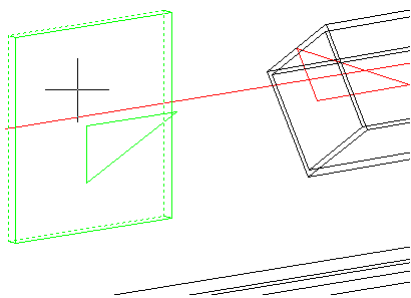


- Click on the button 
- Click on **Close**.

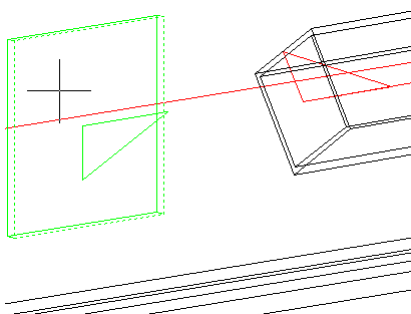
◀ Step 3 ▶



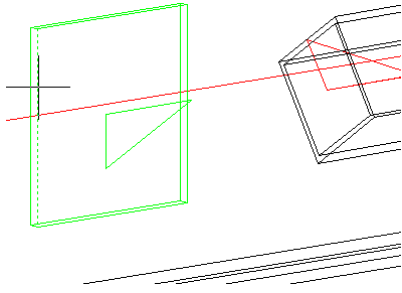
- Click on  **Distance between**



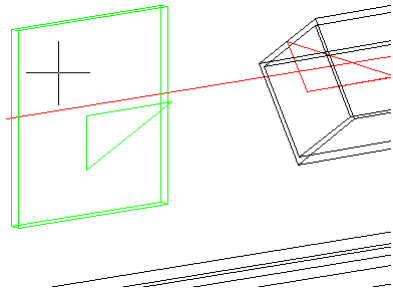
- Select the back plane of the endplate by pressing the left mouse button. Now press the right mouse button to confirm.



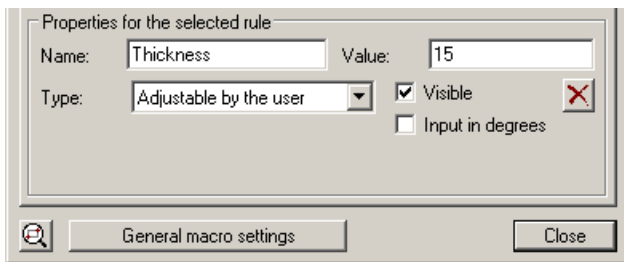
- Select the front plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select a line of the endplate and press the right mouse button to confirm.




- Choose a point somewhere in the neighbourhood of the endplate.




- In the dialog box below, enter for the property **Name** : *Thickness*
 - Enter for the property **Value** : 15
 - Click on **Close**.

◀ Step 4 ▶

 To define the placement of the endplate against the tube we first need to create some helper-points.



- Start the command  **Point**.

- Click a random location in the drawing.

- Click a second random location in the drawing.

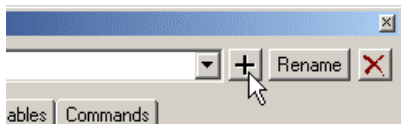
- Click a third random location in the drawing.


- Press the <ESC> key when the 3 points are drawn.

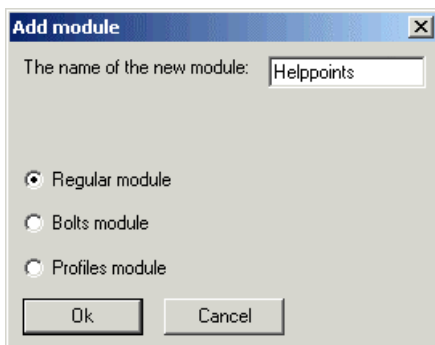
◀ Step 5 ▶



- Click on  **Edit macro**



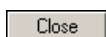
- At the top of the dialog box, click on  **Add new module**.



- Enter in the dialog box for the **Name** of the new module in: *Helppoints*




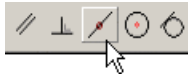
- Click on **Ok**.



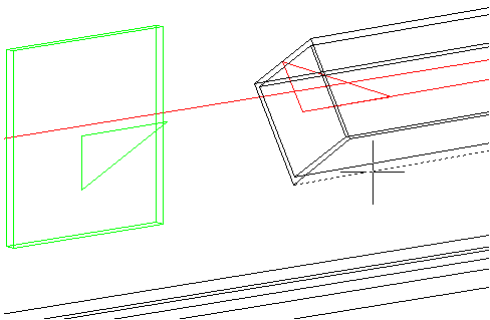
- Click on **Close**.

← Step 6 →

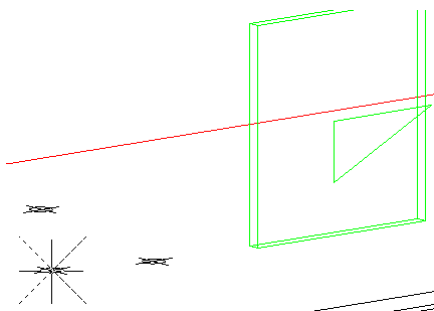
 The purpose of the helper points is to calculate the intersections of the tube with the beam.



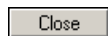
- Click on  **Coincident**



- Select the lower left line of the tube and then press the right mouse button to confirm.



- Select the first new point and then press the right mouse button to confirm.

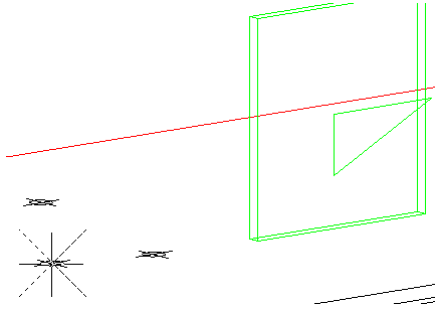


- Click on **Close**.

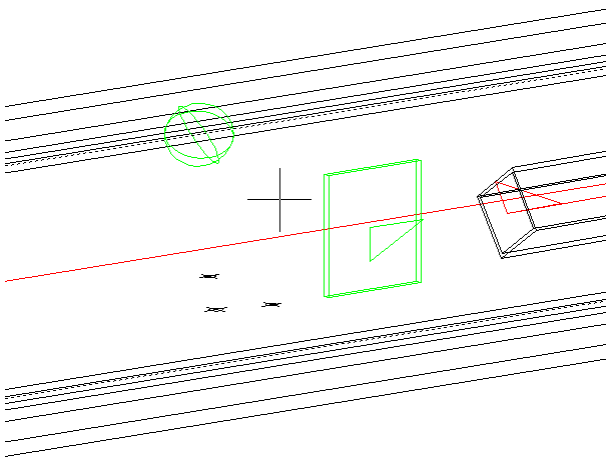
← Step 7 →



- Click on **Coincident**



- Select the first new point and then press the right mouse button to confirm.

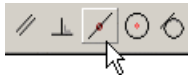


- Select the web of the beam by pressing the left mouse button once. Now press the right mouse button to confirm.

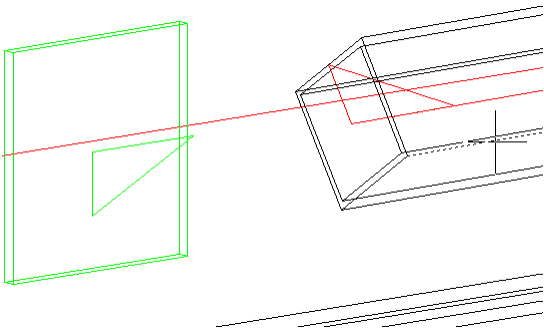


- Click on **Close**.

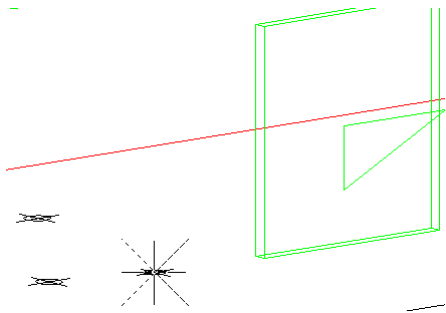
◀ Step 8 ▶



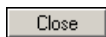
- Click on **Coincident**



- Select the lower right line of the tube and then press the right mouse button to confirm.



- Select the second new point and then press the right mouse button to confirm.

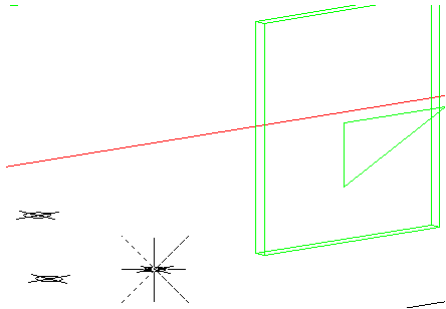


- Click on **Close**.

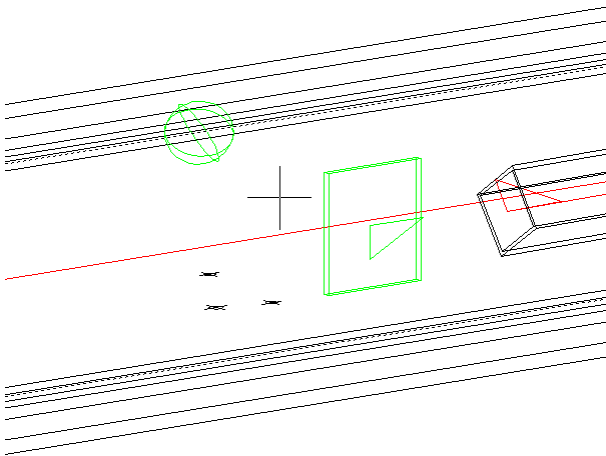
← Step 9 →



- Click on **Coincident**



- Select the second new point and then press the right mouse button to confirm.

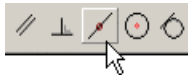


- Select the web of the beam by pressing the left mouse button once. Now press the right mouse button to confirm.

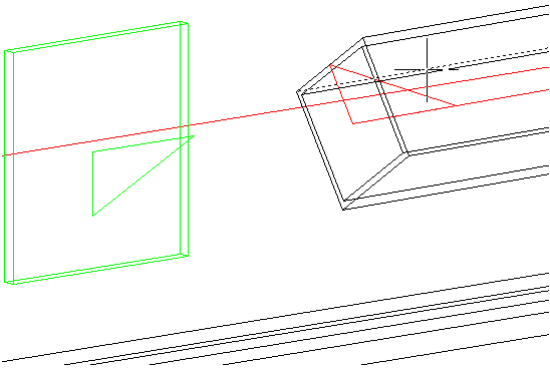


- Click on **Close**.

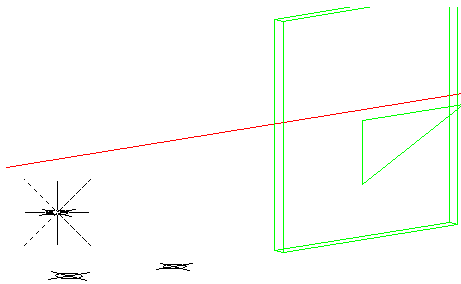
Step 10



- Click on **Coincident**



- Select the upper left line of the tube and then press the right mouse button to confirm.



- Select the third new point and then press the right mouse button to confirm.

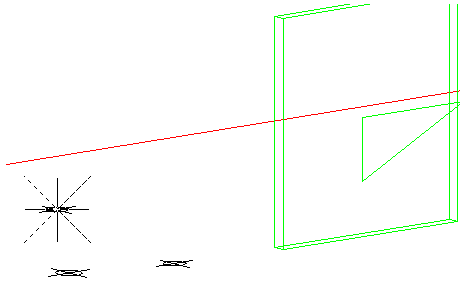


- Click on **Close**.

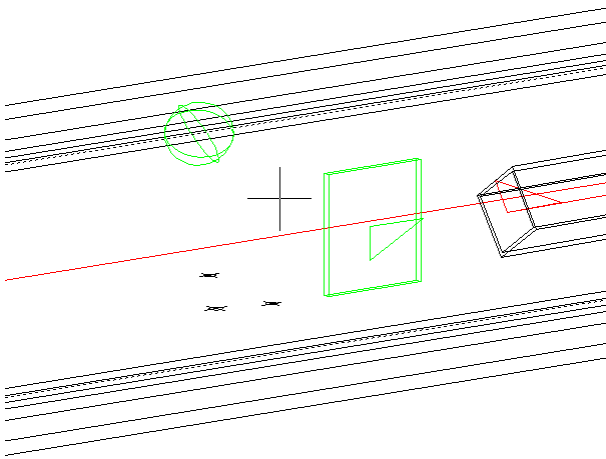
Step 11



- Click on **Coincident**



- Select the third new point and then press the right mouse button to confirm.



- Select the web of the beam by pressing the left mouse button once. Now press the right mouse button to confirm.

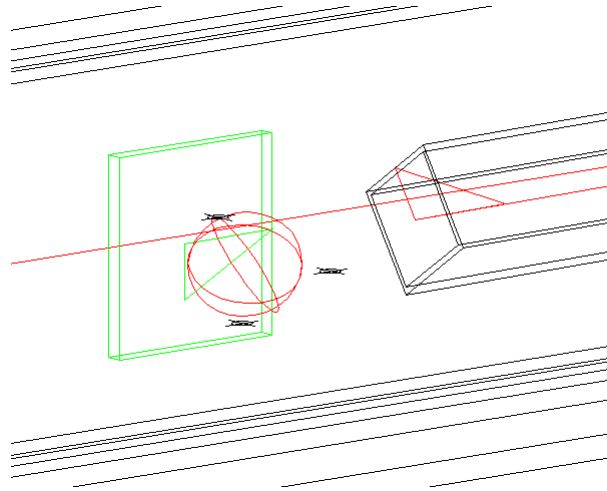


- Click on **Close**.



- Click on **Recalculate all**.

Step 12



- Study the results by rotating the drawing using **3D Orbit**. Press **<ESC>** to end the 3D Orbit command.



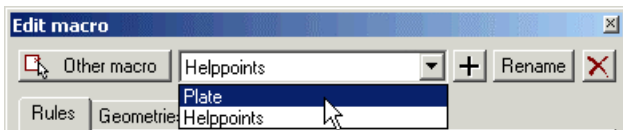
- Click on **Undo** to go back to the previous view.

Step 13

? We will now finish the endplate. First we need to reactive the module endplate so that the new geometric rules can be drawn inside it.



- Click on **Edit macro**



- Choose from the list at the top of the dialog box the module **Plate**.

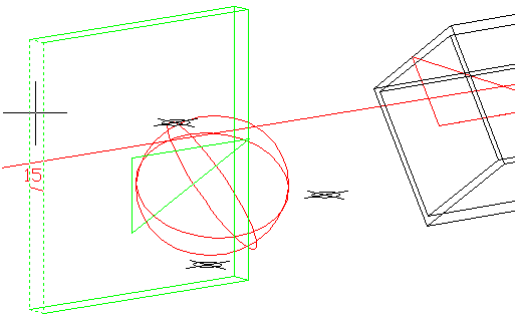


- Click on **Close**.

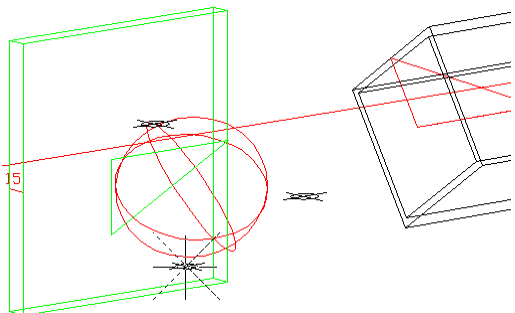
Step 14



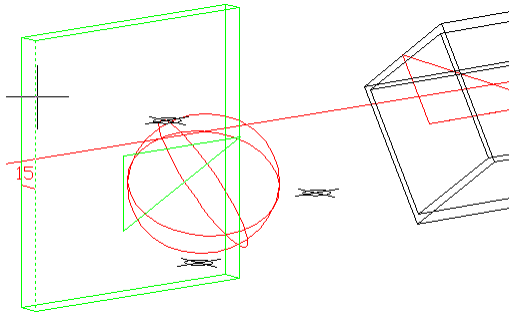
- Click on **Distance between**



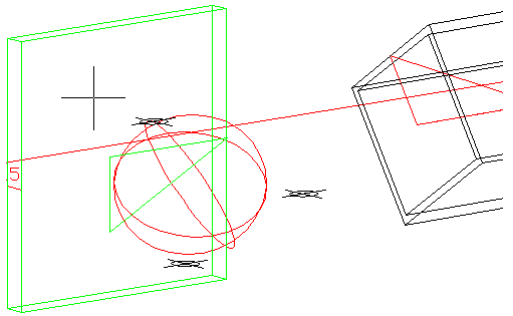
- Select the left side plane of the endplate and then press the right mouse button to confirm.



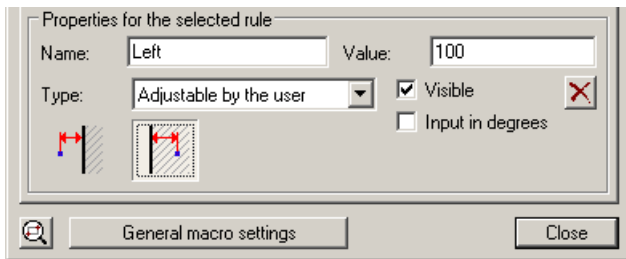
- Select the first new point and then press the right mouse button to confirm.




- Select a line of the endplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the endplate.

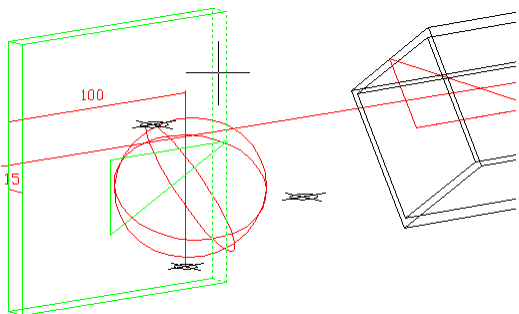


- In the dialog box below, enter for the property **Name** : *Left*
 - Enter for the property **Value** : *100*
 - Click on the button 
 - Click on **Close**.

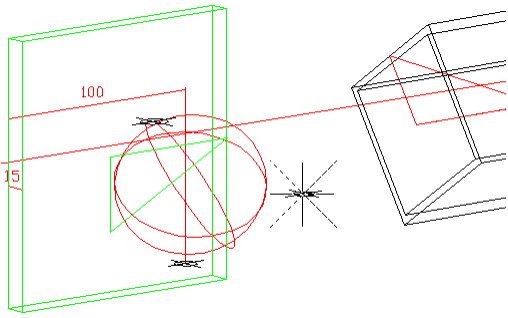
◀ Step 15 ▶



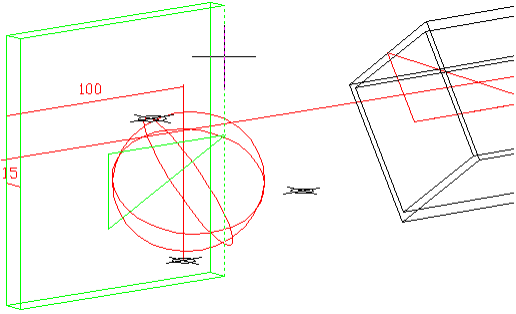
- Click on  **Distance between**



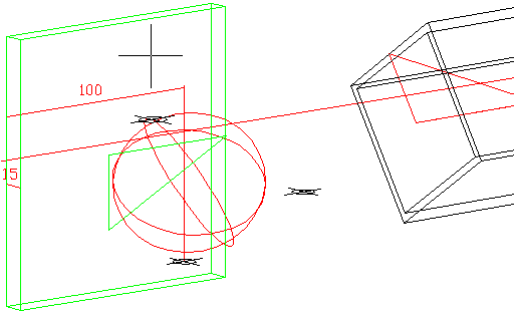
- Select the right side plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



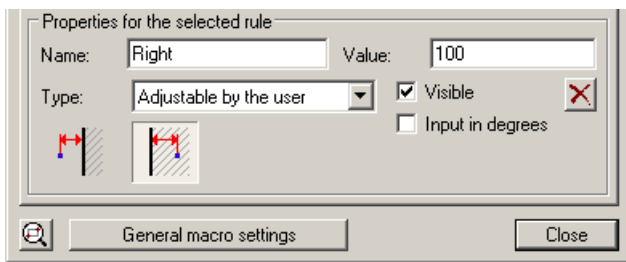
- Select the first second point and then press the right mouse button to confirm.




- Select a line of the endplate and press the right mouse button to confirm.

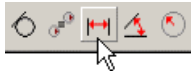


- Choose a point somewhere in the neighbourhood of the endplate.

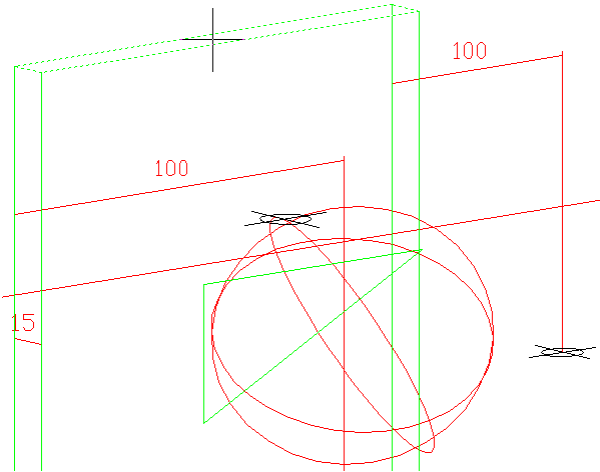


- In the dialog box below, enter for the property **Name** : *Right*
 - Enter for the property **Value** : *100*
 - Click on the button 
 - Click on **Close**.

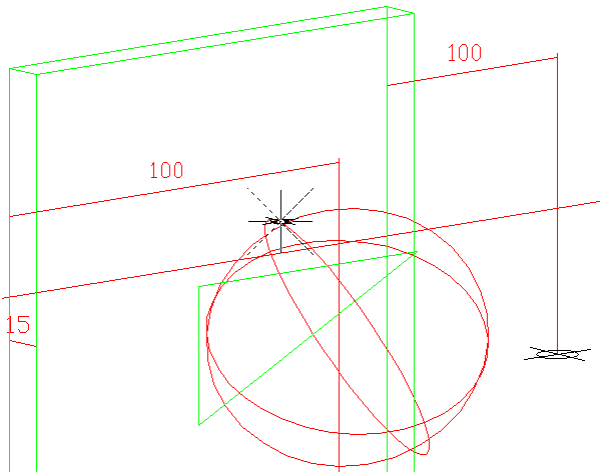
Step 16



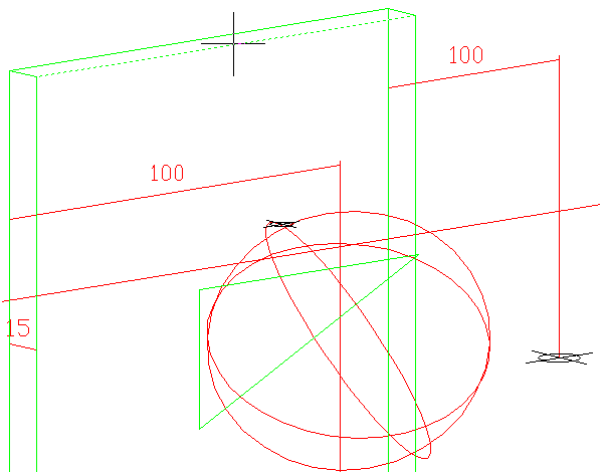
- Click on **Distance between**



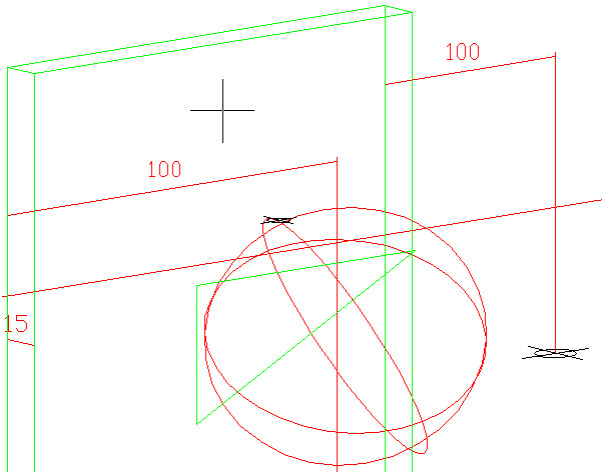
- Select the topside plane of the endplate and then press the right mouse button to confirm.



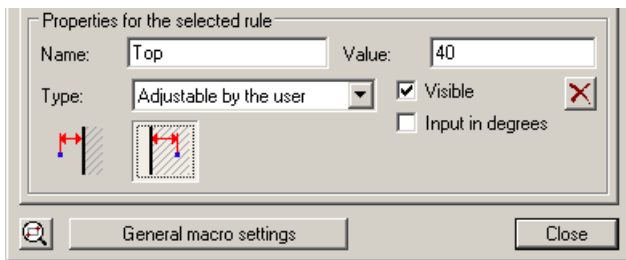
- Select the third point and then press the right mouse button to confirm.




- Select a line of the endplate and press the right mouse button to confirm.



- Choose a point somewhere in the neighbourhood of the endplate.

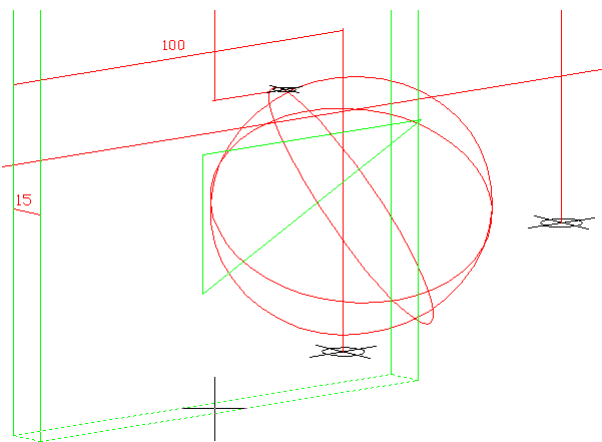


- In the dialog box below, enter for the property **Name** : *Top*
- Enter for the property **Value** : *40*
- Click on the button 
- Click on **Close**.

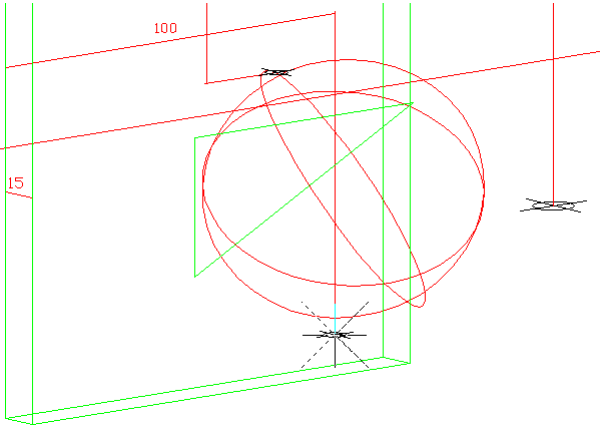
◀ Step 17 ▶



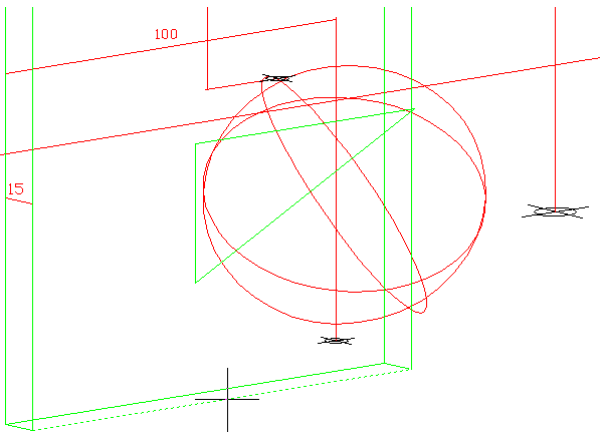
- Click on  **Distance between**



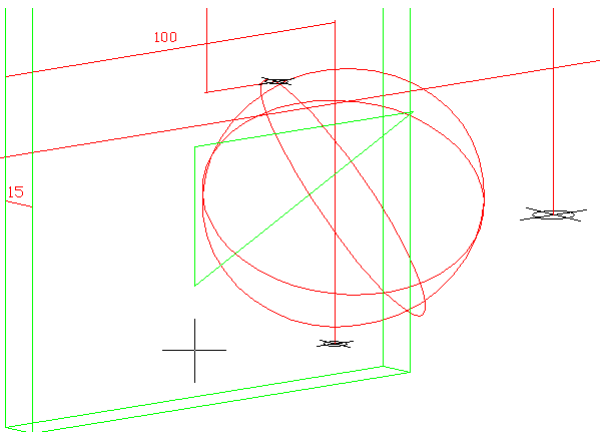
- Select the bottom side plane of the endplate by pressing the left mouse button twice. Now press the right mouse button to confirm.



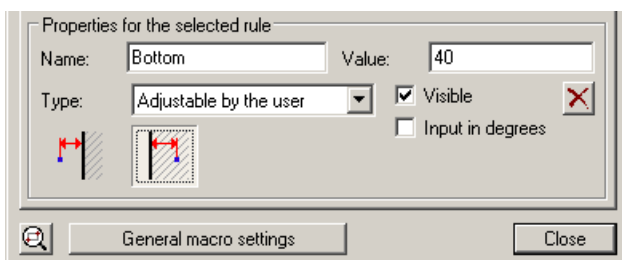
- Select the first point and then press the right mouse button to confirm.




- Select a line of the endplate and press the right mouse button to confirm.



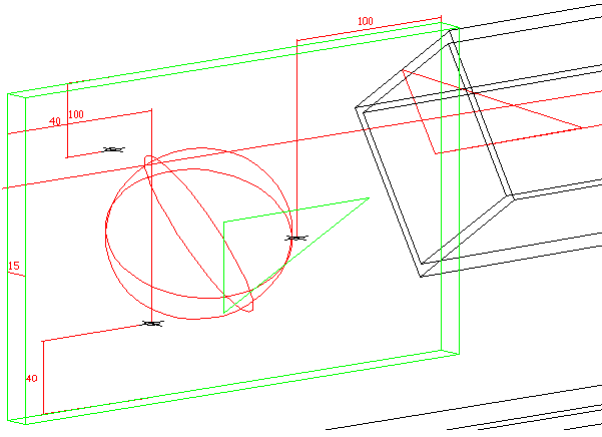
- Choose a point somewhere in the neighbourhood of the endplate.




- In the dialog box below, enter for the property **Name** : *Bottom*
 - Enter for the property **Value** : 40
 - Click on the button 
 - Click on **Close**.



- Click on  **Recalculate all**.

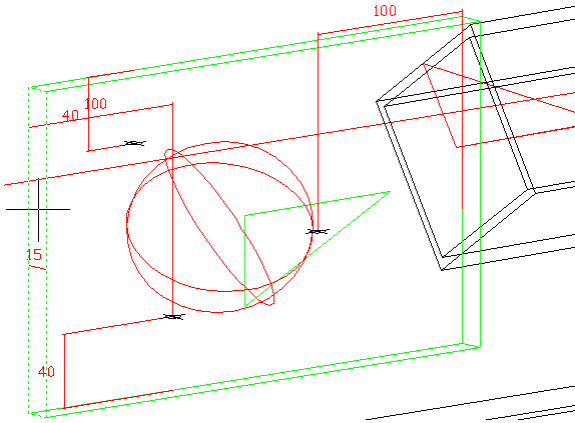


 *The last four rules define the size of the endplate, but not the rotation of each side plane. That is why the macro's colour is red.*

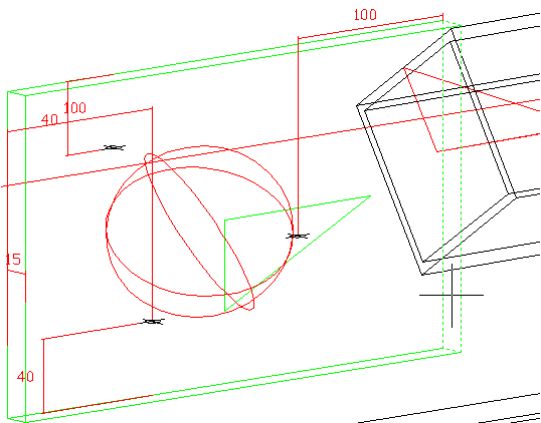
Step 18



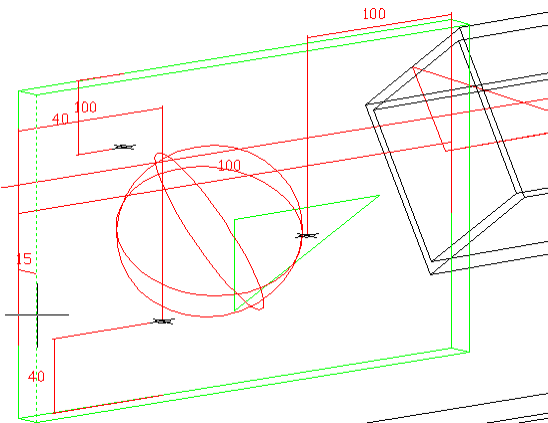
- Click on  **Distance between**



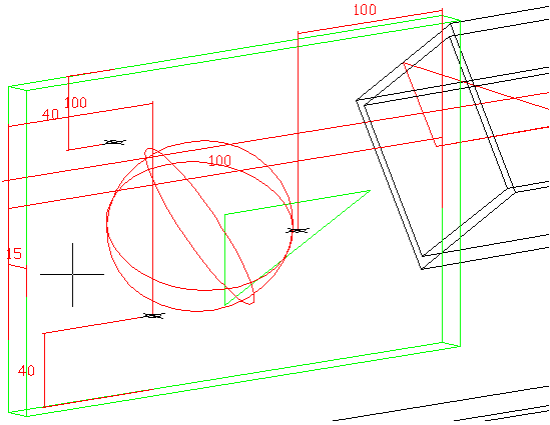
- Select the left side plane of the endplate and then press the right mouse button to confirm.



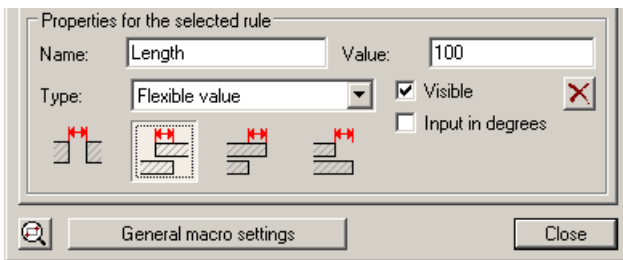
- Select the right side plane of the endplate by pressing the left mouse button 2 or 4 times. Now press the right mouse button to confirm.




- Select a line of the endplate and press the right mouse button to confirm.

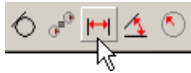


- Choose a point somewhere in the neighbourhood of the endplate.

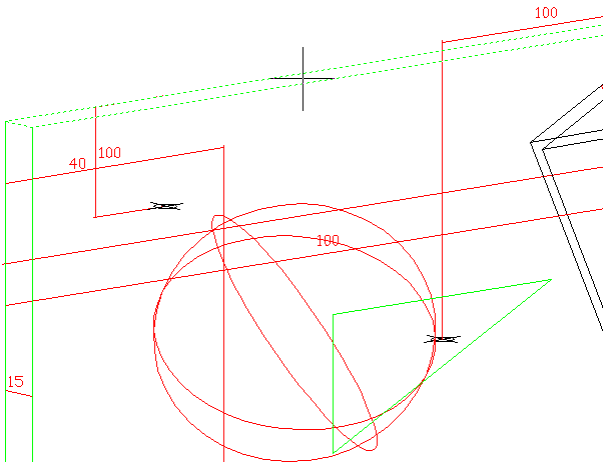


- In the dialog box below, enter for the property **Name** : *Length*
- Select for the **Type** : *Flexible value*
- Click on the button 
- Click on **Close**.

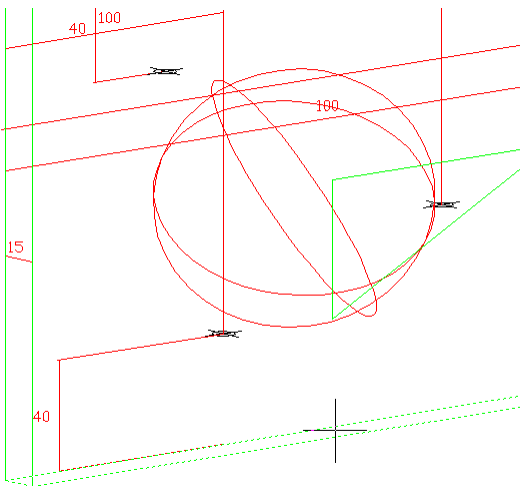
Step 19



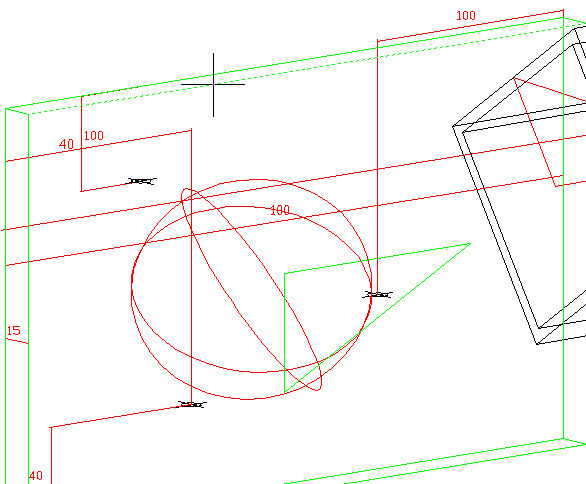
- Click on  **Distance between**



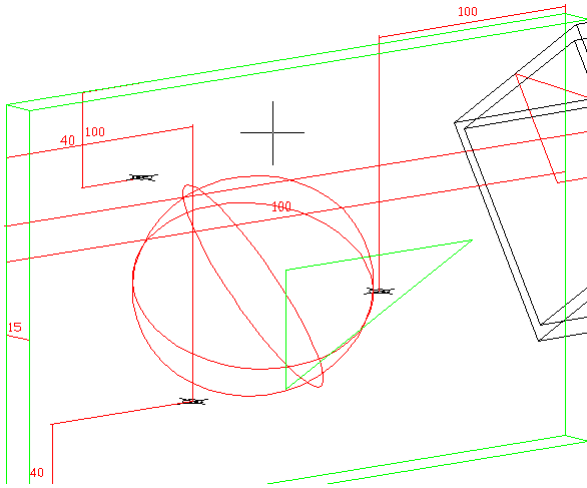
- Select the topside plane of the endplate and then press the right mouse button to confirm.



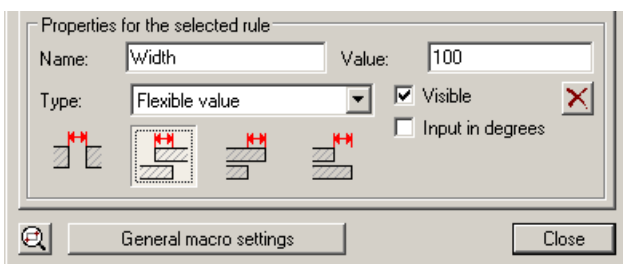
- Select the bottom side plane of the endplate by pressing the left mouse button 2 or 4 times. Now press the right mouse button to confirm.



- Select a line of the endplate and press the right mouse button to confirm.



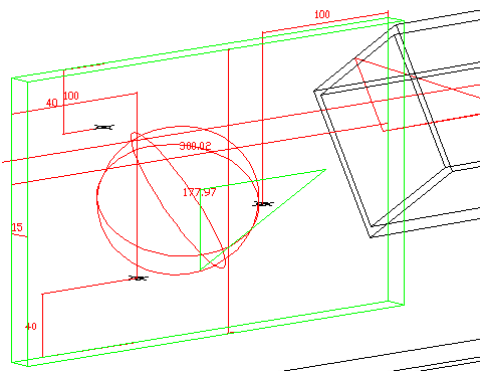
- Choose a point somewhere in the neighbourhood of the endplate.



- In the dialog box below, enter for the property **Name** : *Width*
- Select for the **Type** : *Flexible value*
- Click on the button
- Click on **Close**.



- Click on **Recalculate all**.



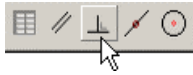
The purpose of the last 2 rules is reading the length and width of the plate, and also making the sideplanes parallel.

When we draw a distance rule between 2 planes or lines, then these geometries are automatically set as parallel, because otherwise we can't measure the distance between them.

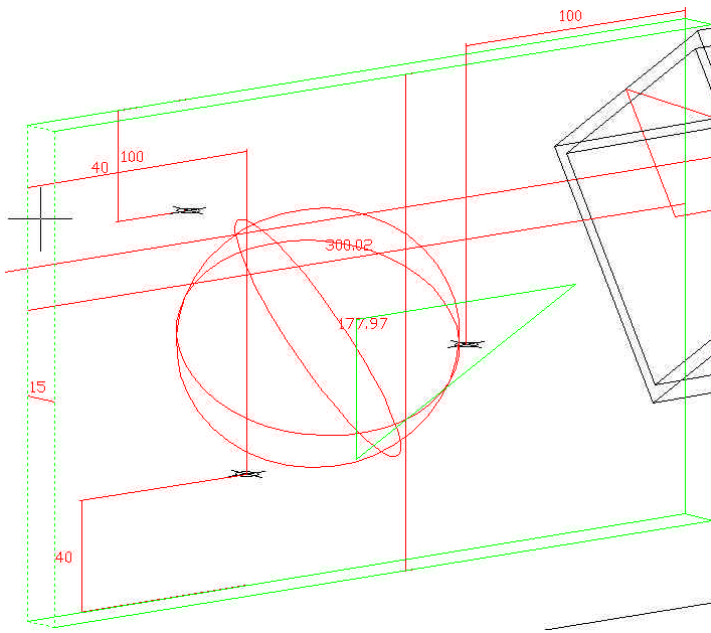
When you look at the command line (function key <F2>), you will see the following : --- **Plate is underconstrained, 2 degrees of freedom** ---
 "2 degrees of freedom" means that the plate still has 2 degrees of freedom, namely the rotation and the plate could also be a trapeze.

Step 20

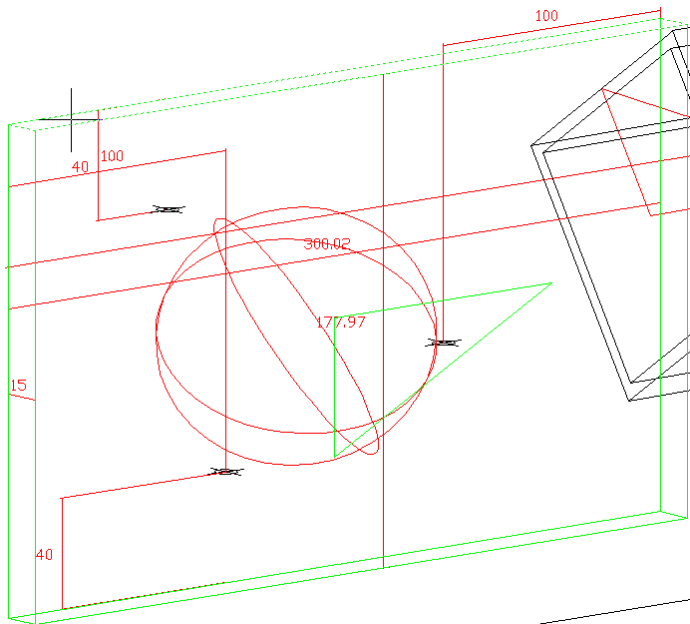
Now we still have to constrain the endplate to be an endplate, and how the plate should be rotated.



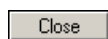
- Click on **Perpendicular ...**



- Select the left side plane of the endplate and then press the right mouse button to confirm.

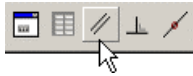


- Select the topside plane of the endplate and then press the right mouse button to confirm.

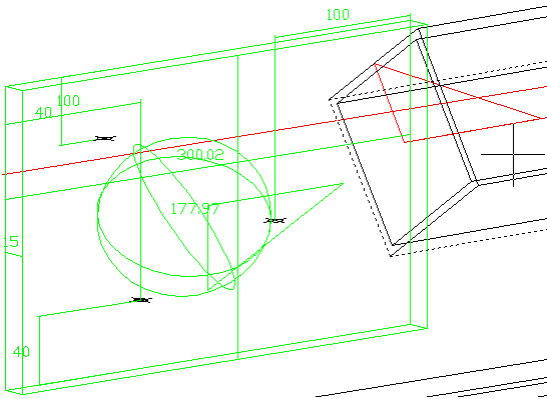


- Click on **Close**.

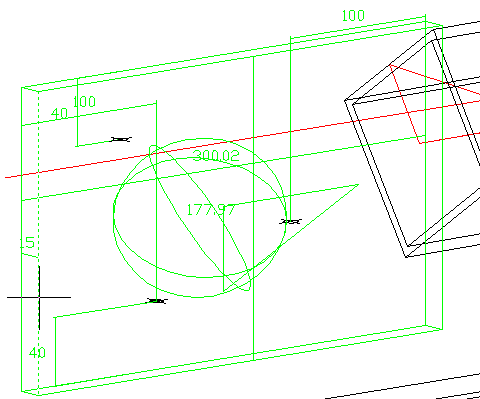
Step 21



- Click on **Parallel**



- Select the left side plane of the tube by pressing the left mouse button once. Now press the right mouse button to confirm.



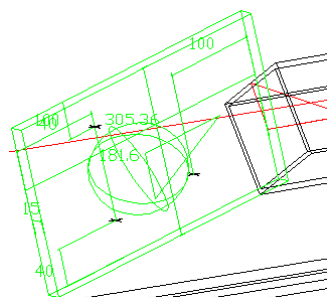
- Select the left line of the endplate and then press the right mouse button to confirm.



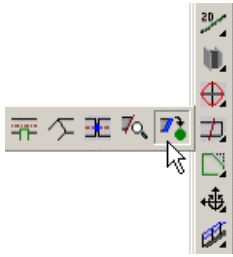
- Click on **Close**.



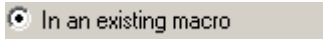
- Click on **Recalculate all**.



← Step 22 →



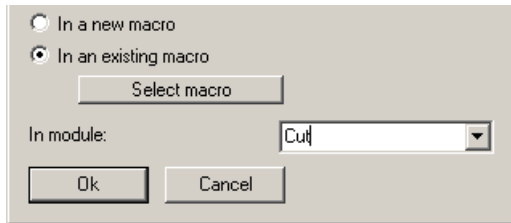
- Start the command  **Add cut to macro**



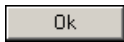
- Below in the dialog box, click on **In an existing macro**



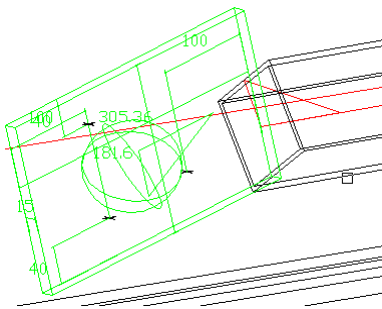
- Select the macro in the drawing.



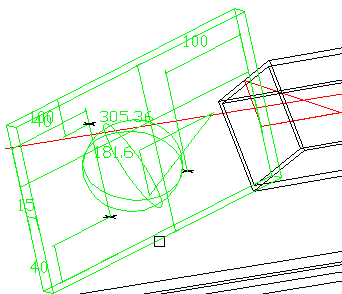
- Enter in the dialog box for **Module** : *Cut*



- Click on **Ok**.



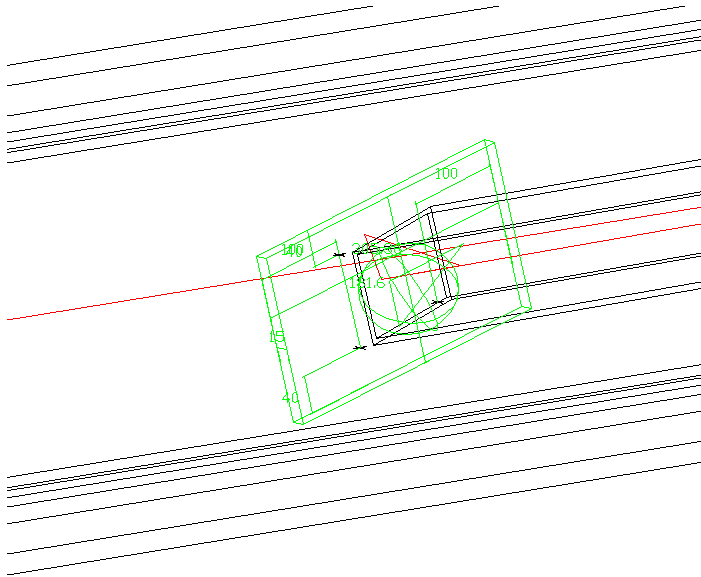
- Select the tube.




- Select the endplate.



- Click on  **Recalculate all.**



 Now we can notice that the 3 helperpoints that we created are actually just a calculation of the cut. We can't use the cut because the cut ends against the endplate.

The endplate has to be calculated first in module Plate, and after which the cut is calculated in another module.


All endplate-connections that are contained in the standard library of Parabuild were created in the same way to allow for complete freedom of inclination and rotation.

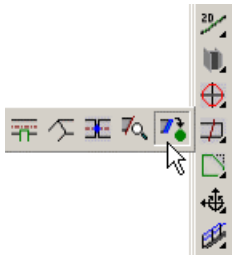
Exercise 16: Cut against plate/member

We will look further into creating end cuts and the available settings for these cuts.

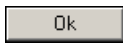
← Step 1 →



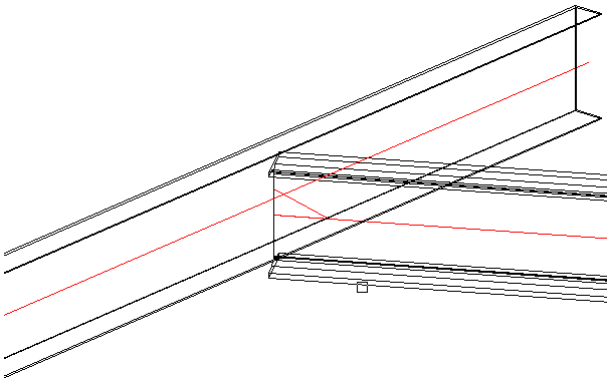
- Open the drawing  Exercise16a.dwg



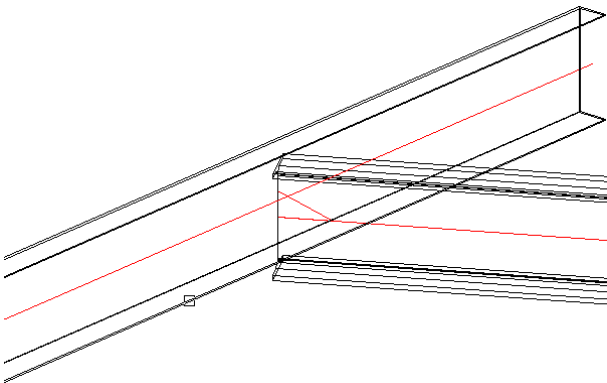
- Start the command  **Add cut to macro**



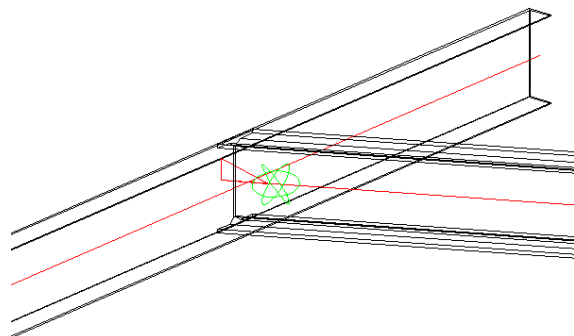
- Click on **Ok**.



- Select the IPE member.



- Select the U member.



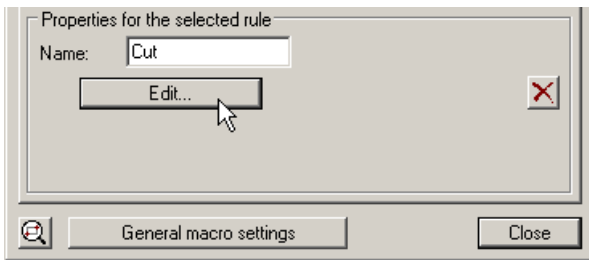
← Step 2 →



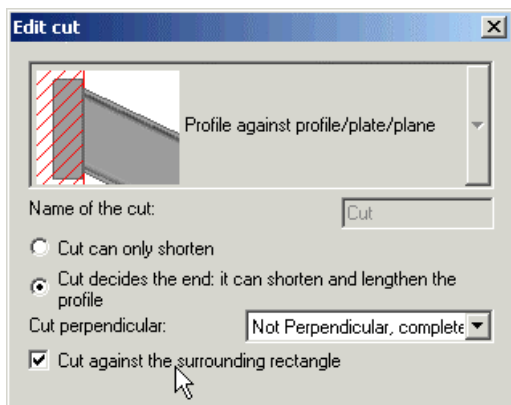
- Click on **Edit macro**



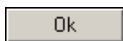
- Select the new macro.



- Click below the dialog box on **Edit...**



- Activate in the middle of the dialog box **Cut against the surrounding rectangle**.



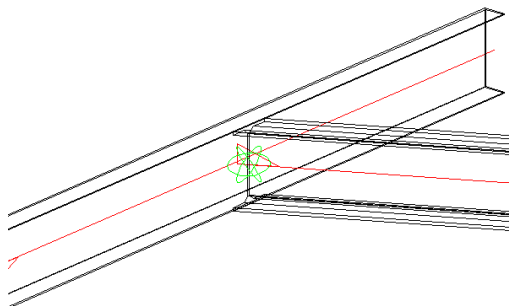
- Click on **Ok**.



- Click on **Close**.



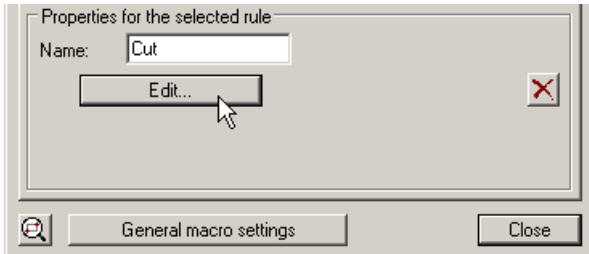
- Click on **Recalculate all**.



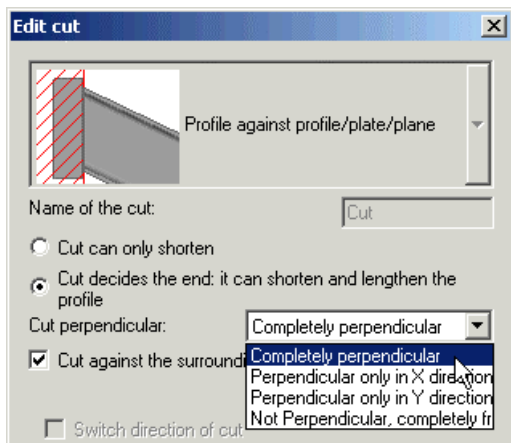
← Step 3 →



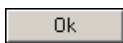
- Click on  **Edit macro**



- Click below the dialog box on **Edit...**



- Choose from the list in the middle of the dialog box the setting **Cut perpendicular: Completely perpendicular.**



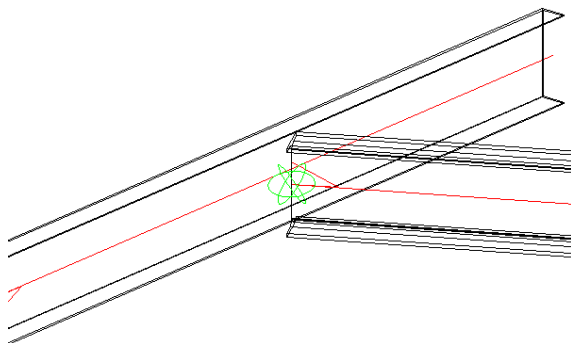
- Click on **Ok.**



- Click on **Close.**



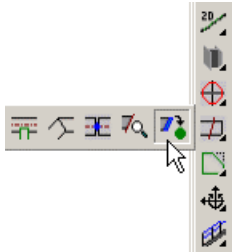
- Click on  **Recalculate all.**



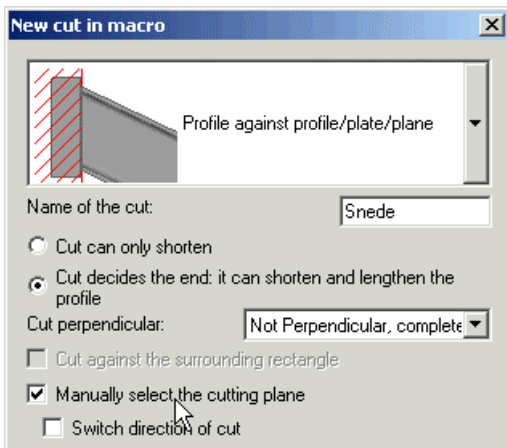
← Step 4 →



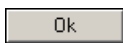
- Open the drawing  Exercise16b.dwg



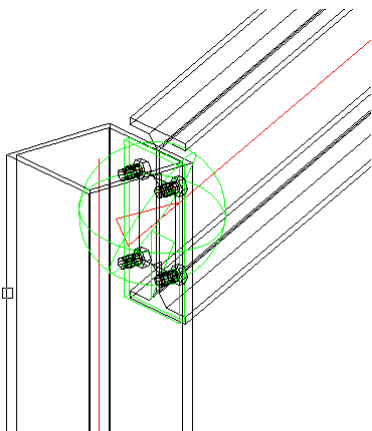
- Start the command  **Add cut to macro**



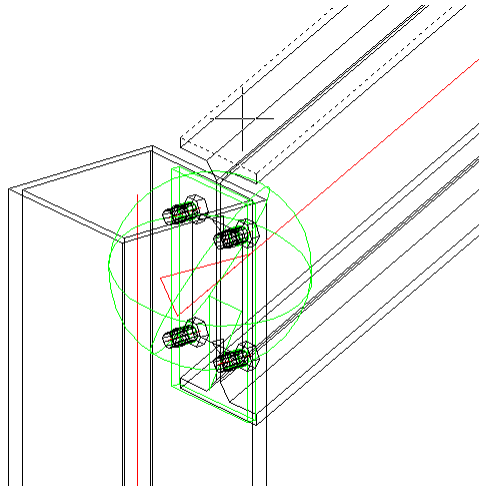
Activate in the middle of the dialog box the setting **Manually select the cutting plane**.



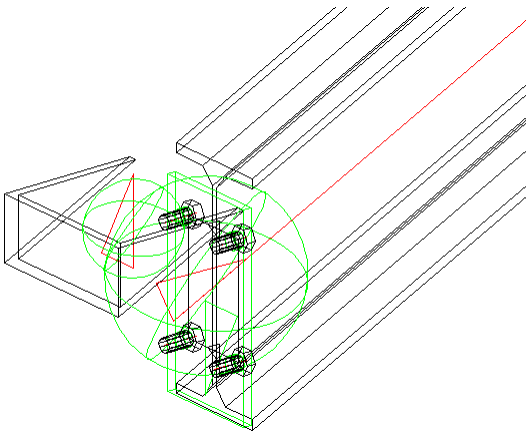
- Click on **Ok**.



- Select the tube.



- Select the upper plane of the beam and then press the right mouse button to confirm.

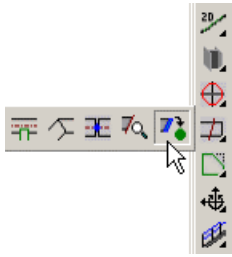


*The top side of the column stays in the drawing.
This is due to the direction of the plane of the beam.
The cut is cut against the material.
To resolve this we need to switch the orientation of the cut.*

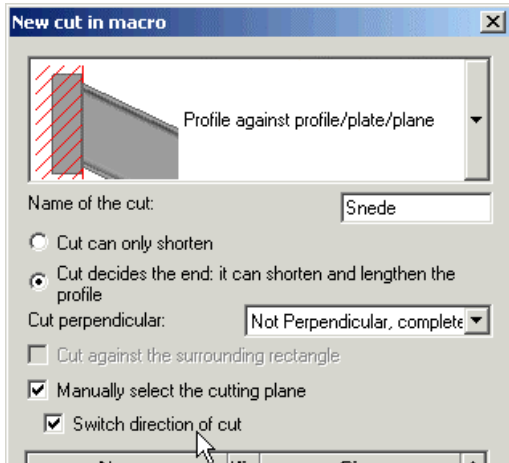


- Click on  **Undo**.

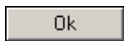
← Step 5 →



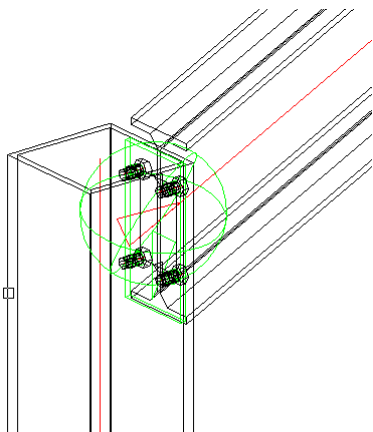
- Start the command  **Add cut to macro**



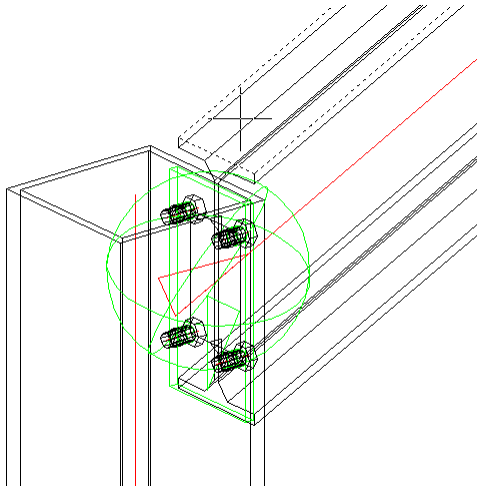
- Activate in the middle of the dialog box the setting **Switch direction of cut**.



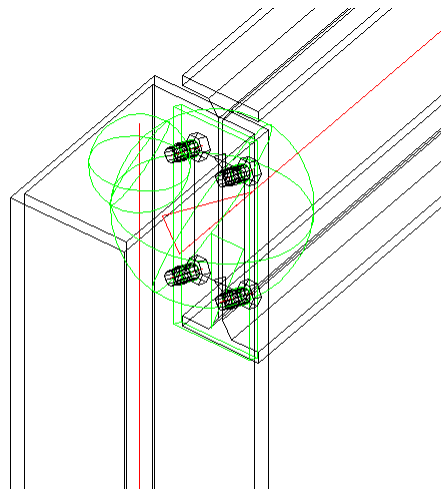
- Click on **Ok**.



- Select the tube.



- Select the upper plane of the beam and then press the right mouse button to confirm.




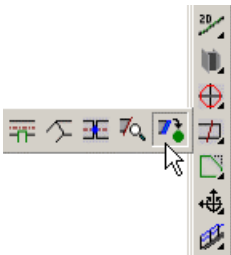
Exercise 17: Equal angled cuts

It is easy to cut two members in equal angled cuts.

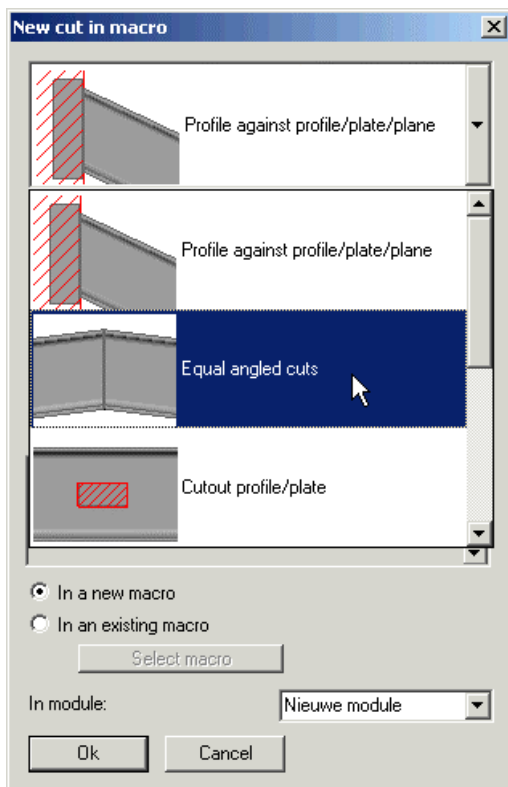
← Step 1 →



- Open the drawing  Exercise17.dwg



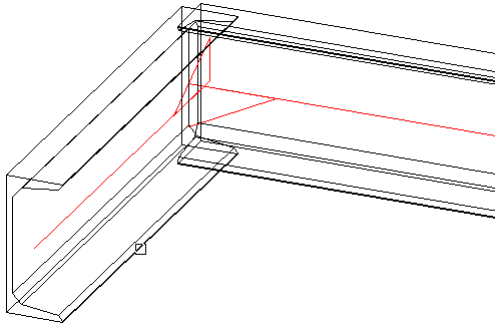
- Start the command  **Add cut to macro**



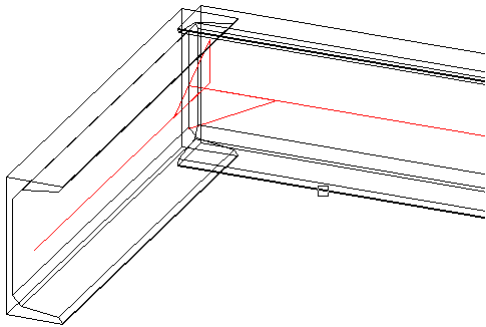
- Select from the list at the top of the dialog box : *Equal angled cuts*



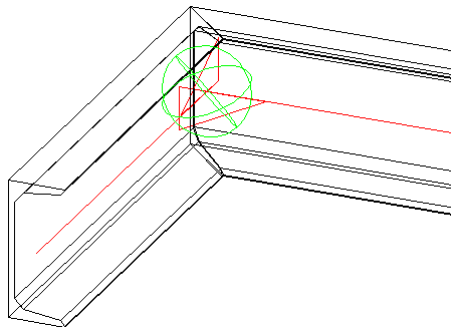
- Click on **OK**.



- Select the left beam.



- Select the right beam.




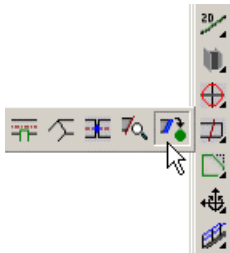
Exercise 18: Cutting a member inside a member

Creating a cutout is also possible with the help of a macro.

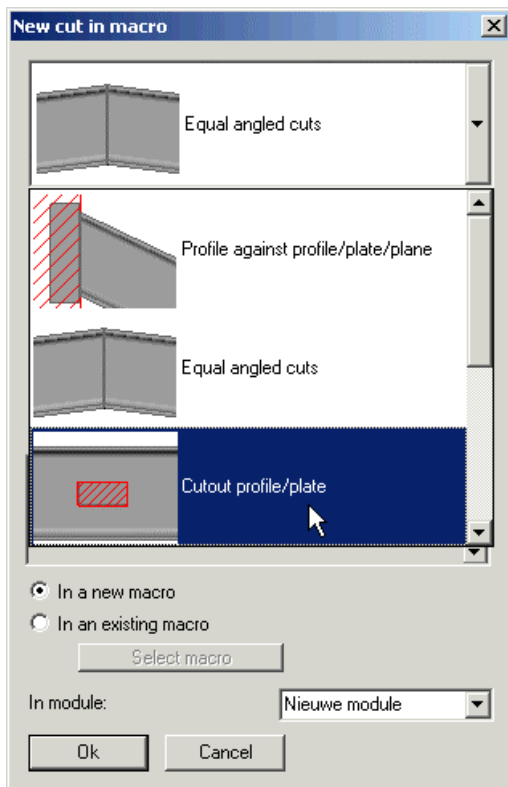
← Step 1 →



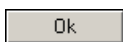
- Open the drawing  Exercise18a.dwg



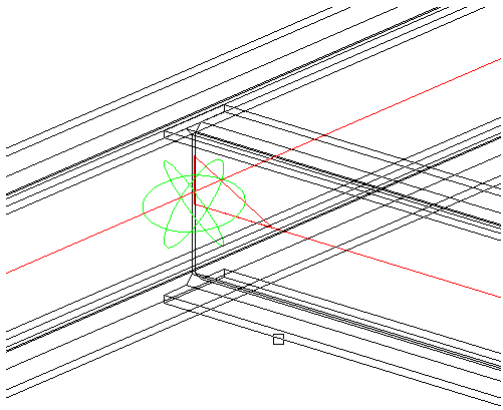
- Start the command  **Add cut to macro**



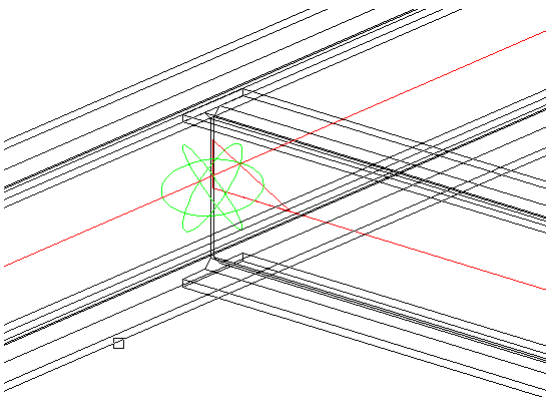
- Select from the list at the top of the dialog box : *Cutout profile/plate*



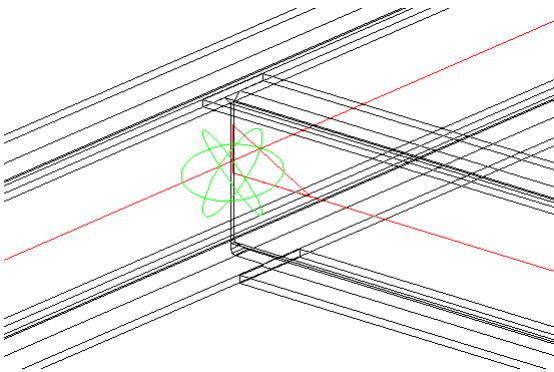
- Click on **Ok**.




- Select the right beam.




- Select the left beam.

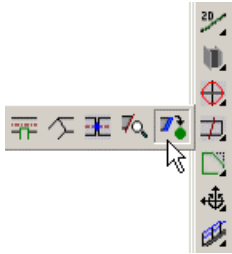


 *The entire section is being cut out of the member, so also the radius between web and flange is visible inside the cut.*

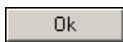
← Step 2 →



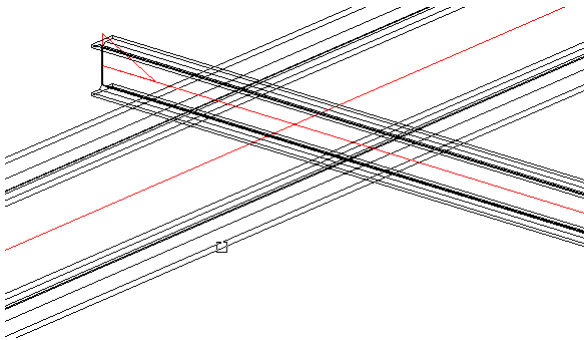
- Open the drawing  Exercise18b.dwg



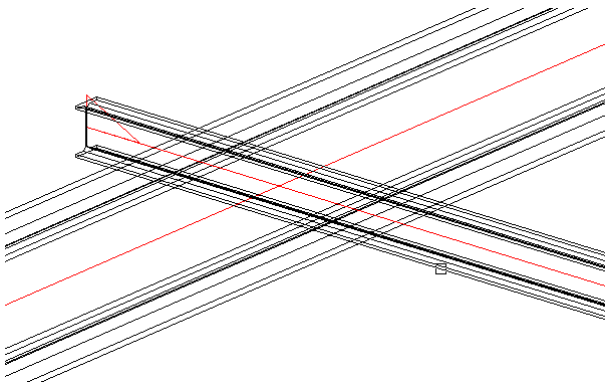
- Start the command  **Add cut to macro**



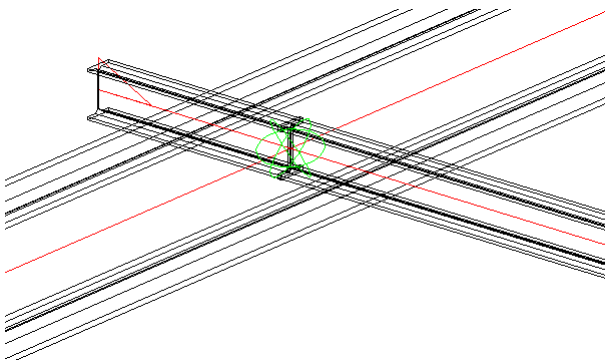
- Click on **Ok**.




- Select the left beam.



- Select the right beam.



 *We can make this cut more workshop-friendly with the help of a setting...*

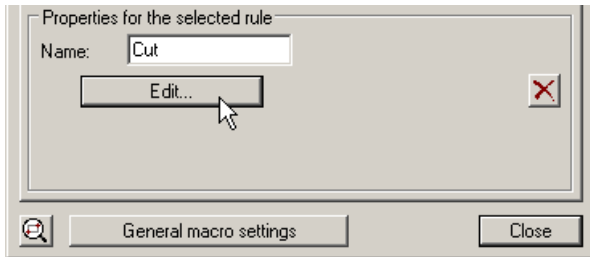
← Step 3 →



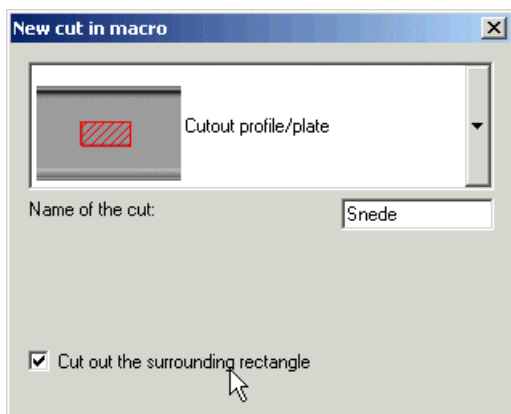
- Click on  **Edit macro**



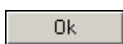
- Select the macro in the drawing.



- Click below the dialog box on **Edit...**



- Activate in the middle of the dialog box the setting **Cut out the surrounding rectangle**.



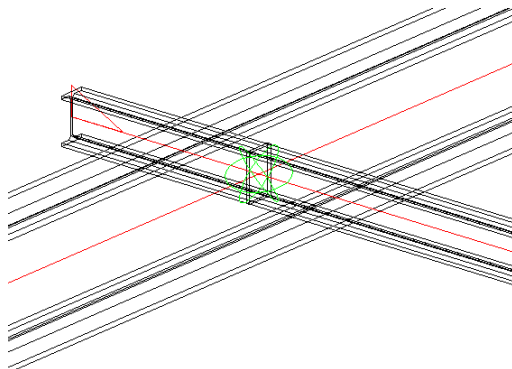
- Click on **Ok**.



- Click on **Close**.




- Click on  **Recalculate all**.

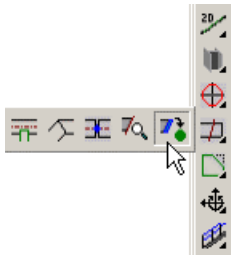


← Step 4 →

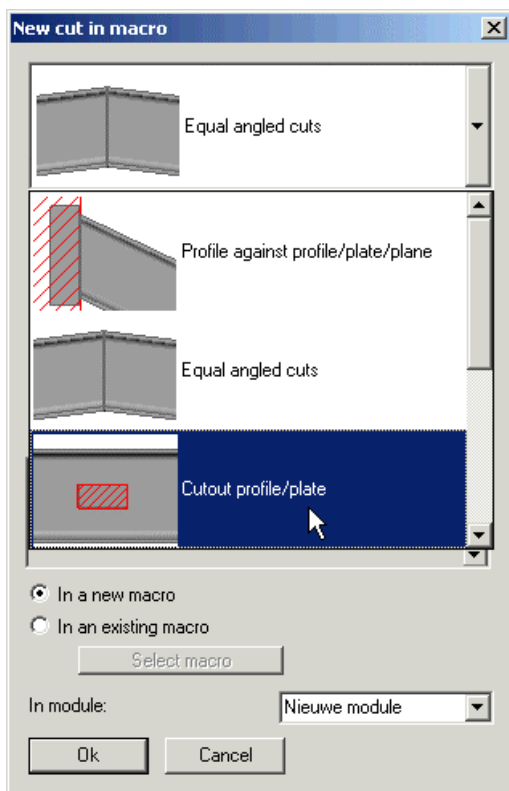
? It is also possible to use a plate to create a cut. This plate could be a helper-geometryn, constrained with geometric rules.



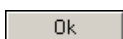
- Open the drawing  Exercise18c.dwg



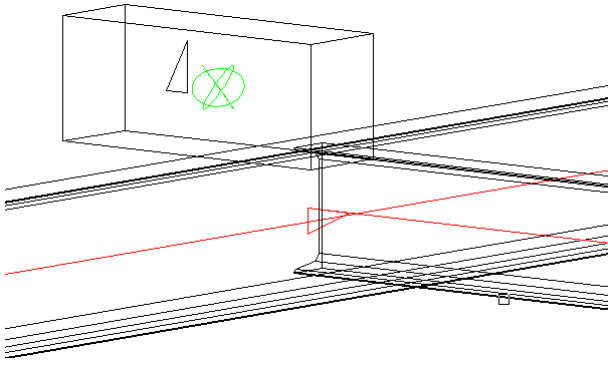
- Start the command  **Add cut to macro**



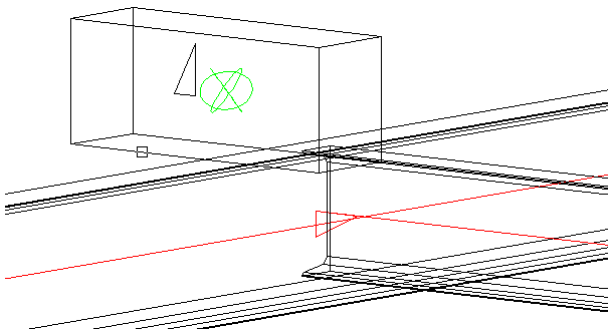
- Select from the list at the top of the dialog box : *Cutout profile/plate*



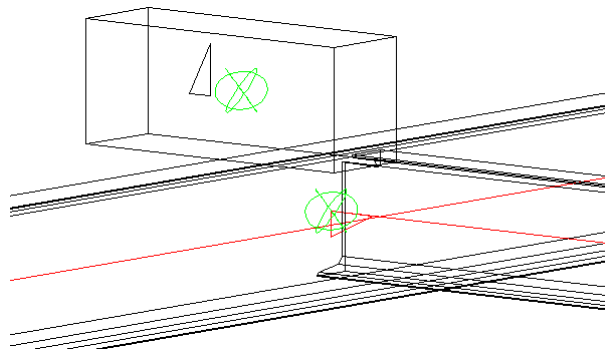
- Click on **Ok**.



- Select the right UPN.



- Select the plate.




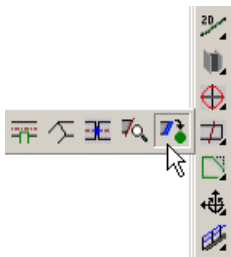
Exercise 19: Special cut

There is a special cut that offers us some more flexibility.
This is a 'partial' cutout.
The cutout is localised around a plane we can choose.

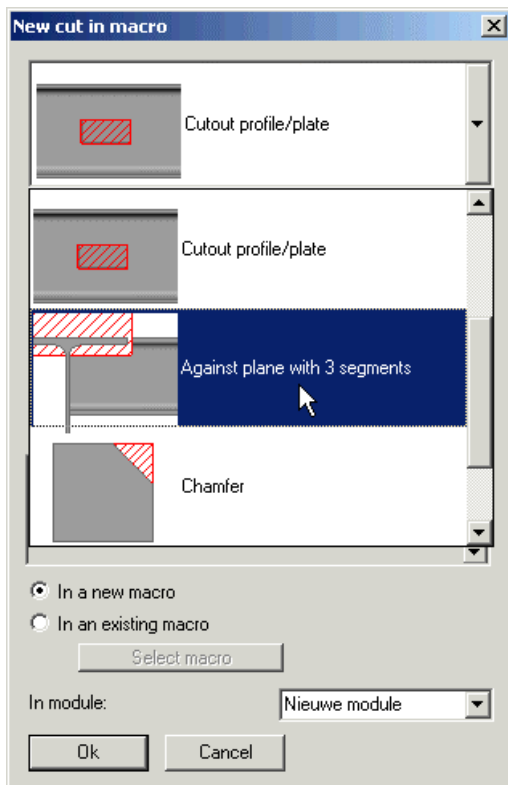
← Step 1 →



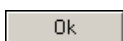
- Open the drawing  Exercise19.dwg



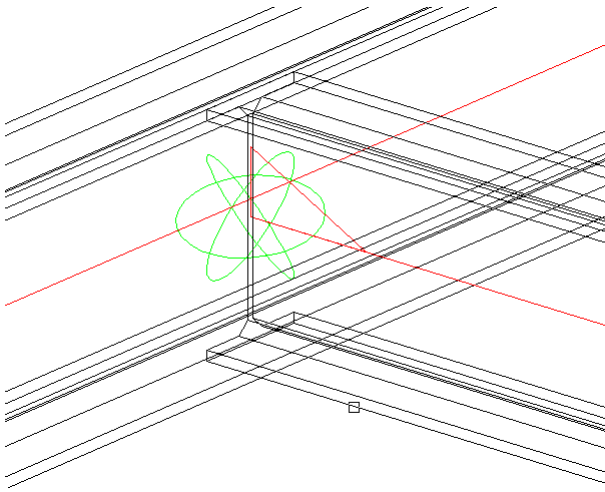
- Start the command  **Add cut to macro**



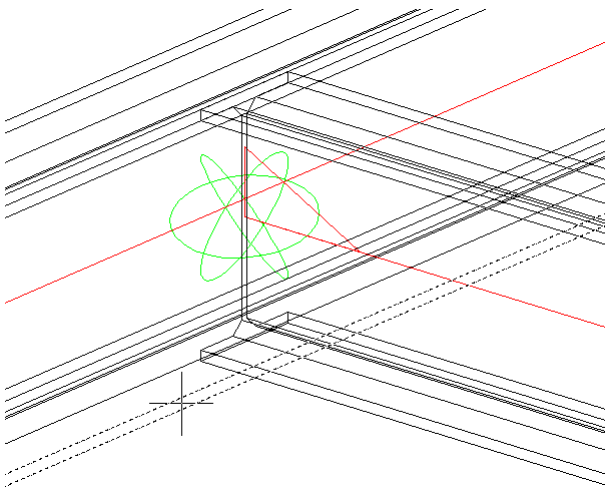
- Select from the list at the top of the dialog box : *Against plane with 3 segments*



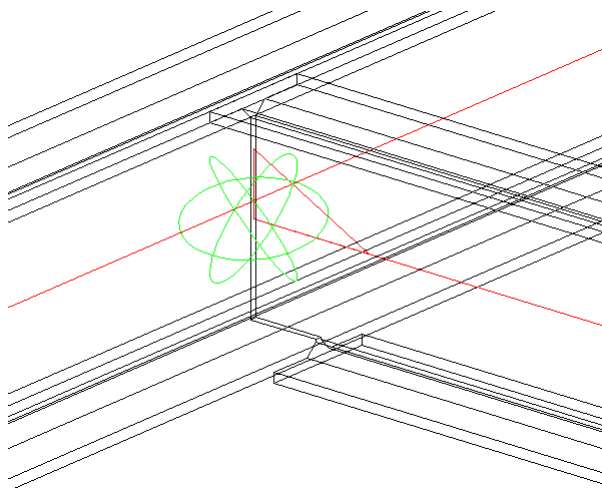
- Click on **Ok**.



- Select the right beam



- Select the bottom side plane of the left beam by pressing the left mouse button once. Now press the right mouse button to confirm.



Exercise 20: Chamfer and fillet


Also chamfers and fillets can be drawn using a macro.

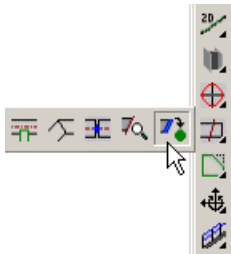
The chamfer and fillet in this exercise can only be used on a member.

If you would like to make a chamfer or fillet for a plate, then you should draw it in the section of the plate.

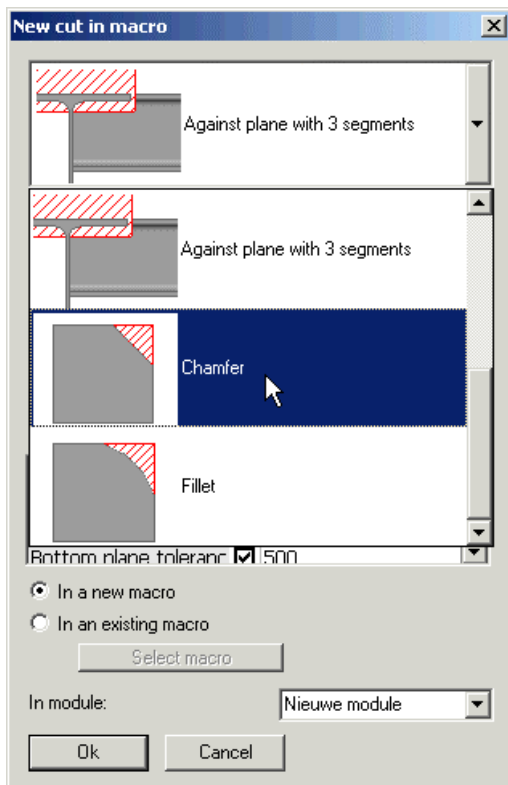
← Step 1 →



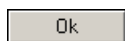
- Open the drawing  Exercise20.dwg



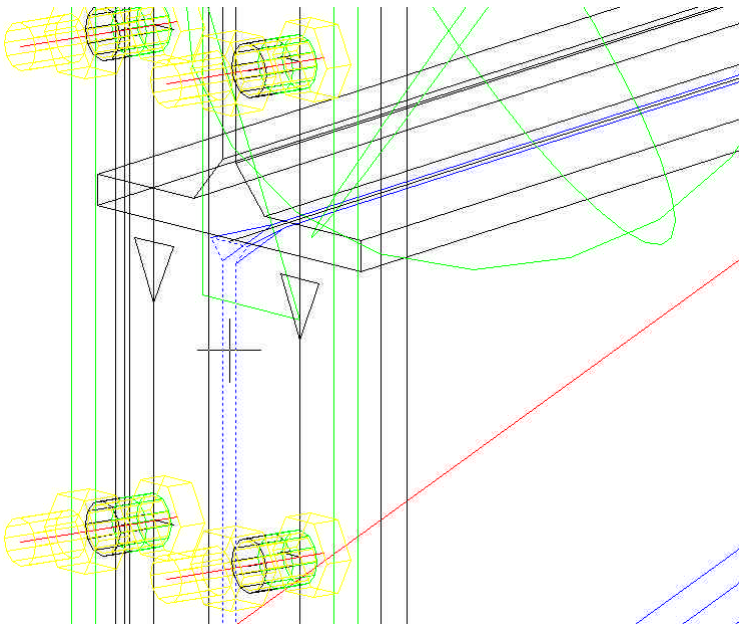
- Start the command  **Add cut to macro**



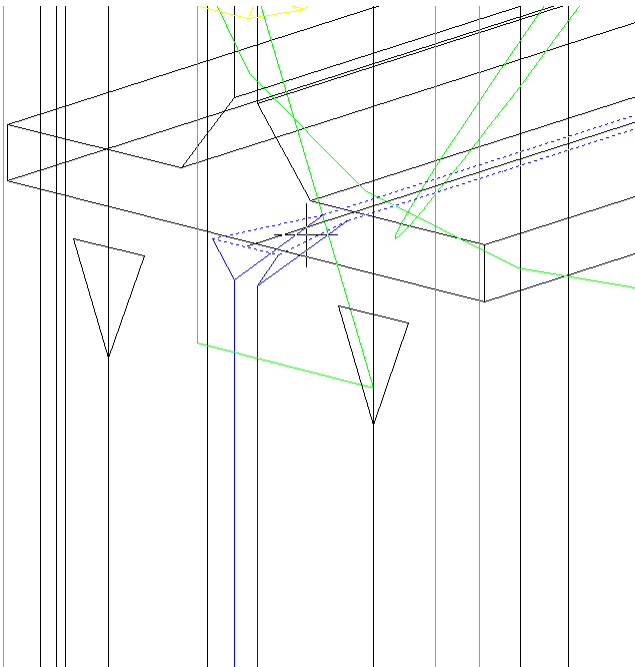
- Select from the list at the top of the dialog box : *Chamfer*



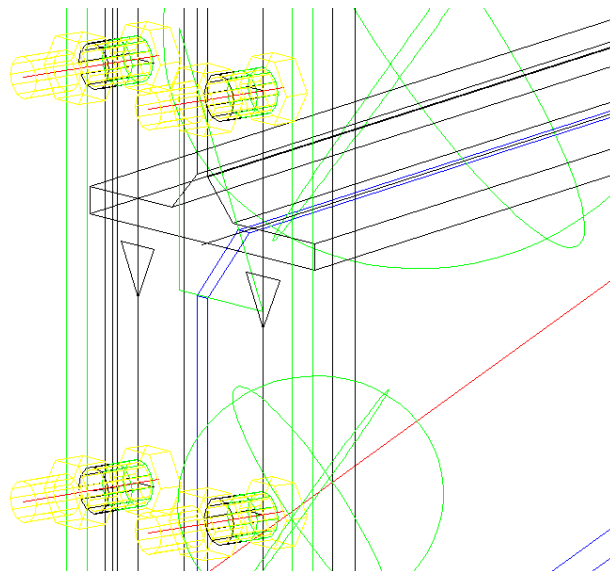
- Click on **Ok**.



- Select the left side plane of the reinforcement by pressing the left mouse button twice. Now press the right mouse button to confirm.



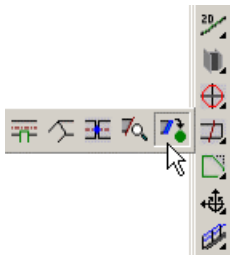
- Select the top side plane of the reinforcement by pressing the left mouse button twice. Now press the right mouse button to confirm.



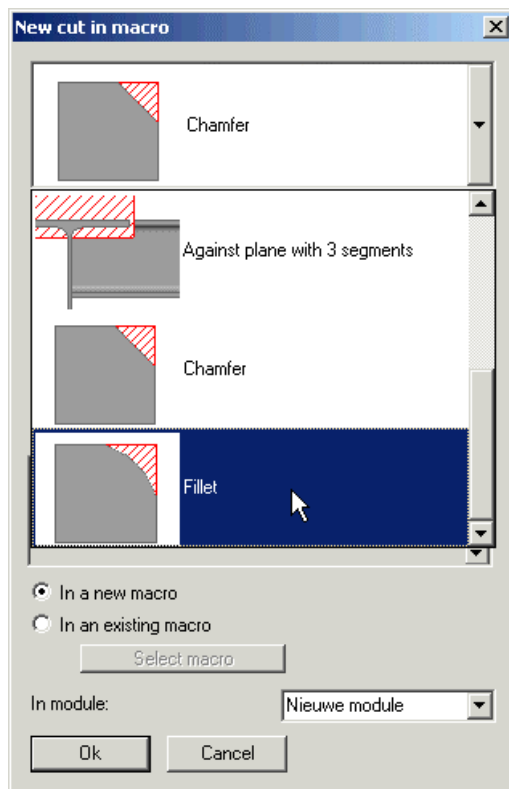
← Step 2 →



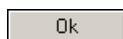
- Click on **Undo** as many times as needed to undo the creation of the chamfer.



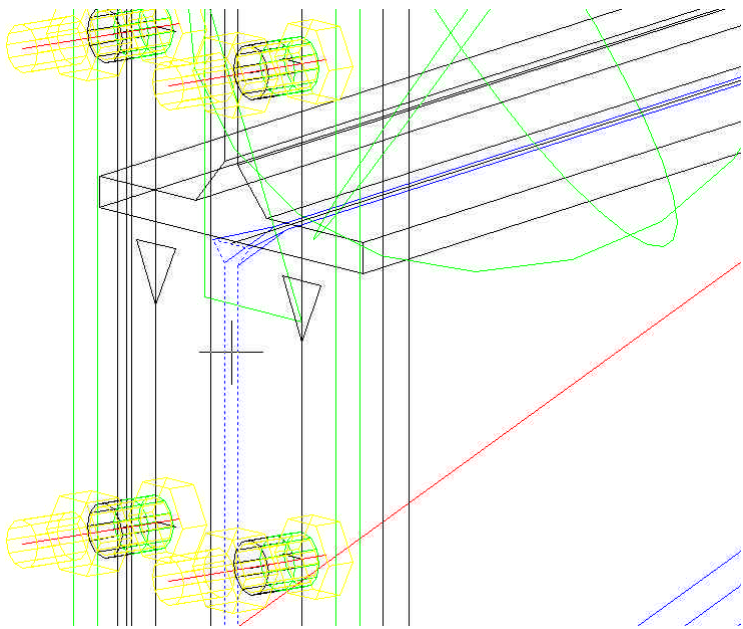
- Start the command **Add cut to macro**



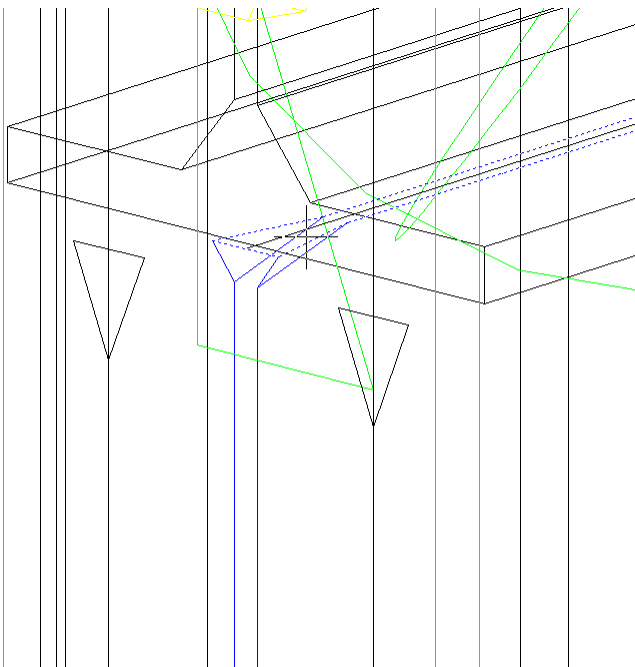
- Select from the list at the top of the dialog box : *Fillet*



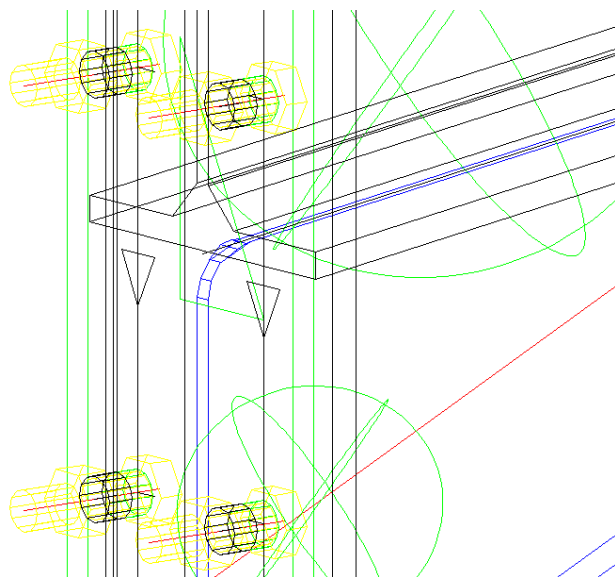
- Click on **Ok**.



- Select the left side plane of the reinforcement by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select the top side plane of the reinforcement by pressing the left mouse button twice. Now press the right mouse button to confirm.



Exercise 21: Copying macro's


The macro's we create can be copied to other members.

The only requirement to make this possible is that the macro uses one or more members as a basis.

It is these base members that are being asked when copying a macro over to other members.

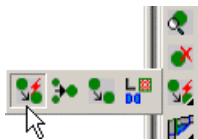
The command makes sure that the parts and all geometric rules of the macro will be copied and over to the other members.

◀ Step 1 ▶

 We will continue with the partly finished haunch connection of a previous exercise.



- Open the drawing  Exercise21a.dwg



- Start the command  **Automatically copy a macro**.



- Select the macro in the drawing and press **<Enter>**.




- Press the **<ESC>** key.



- Press the function key **<F2>**.

```
Command:
Command:
Command: S3d_AutoApplyMacro
Selecteer de te kopiëren macro:
Select objects: Specify opposite corner: 7 found: 2 groups
Select objects:
*Warning* Not all bases were assigned.
*Warning* Not all bases were assigned.
Selecteer het eerste profiel:
Select objects: *Cancel*
Command: |
```

 We can see the following warning on the command line :

***Warning* Not all bases were assigned.**

***Warning* Not all bases were assigned.**

We always get these warnings for new macro's.

The warning means that the command doesn't know which member is the first, and which is the second member.

To resolve this we need to use the command **Macro apply settings** once on the macro.

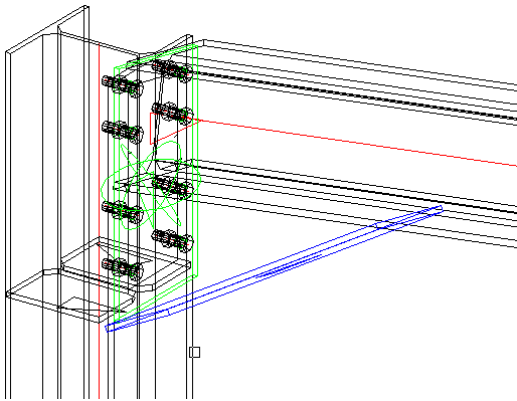
← Step 2 →



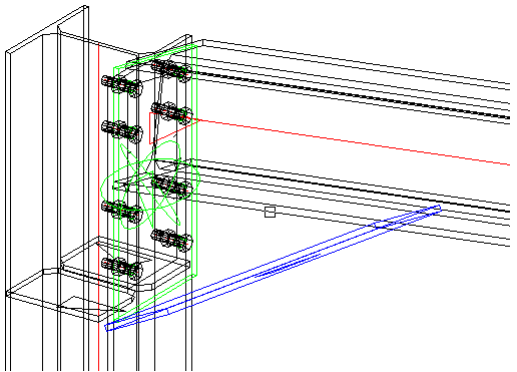
- Start the command  **Macro apply settings**.



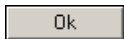
- Select the macro in the drawing.



- Select the column.




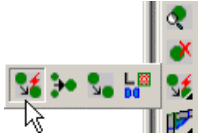
- Select the beam.



- Click on **Ok**.

← Step 3 →

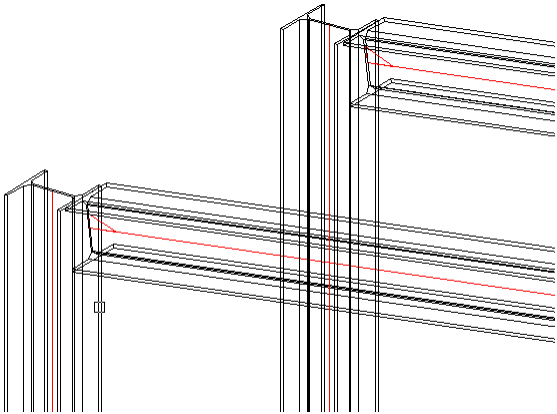
 Now that the column is set as the first and the beam as the second member we can copy the macro without surprises.



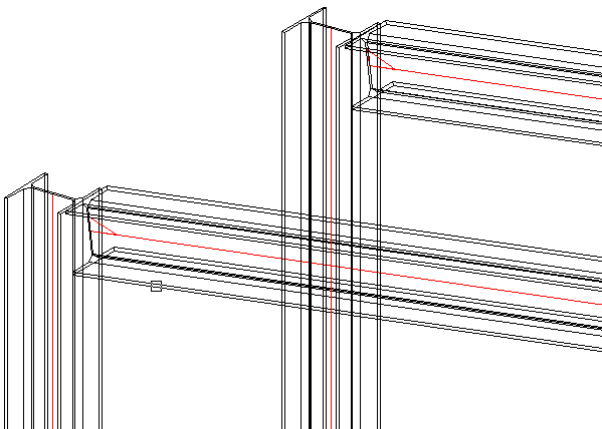
- Start the command  **Automatically copy a macro**.



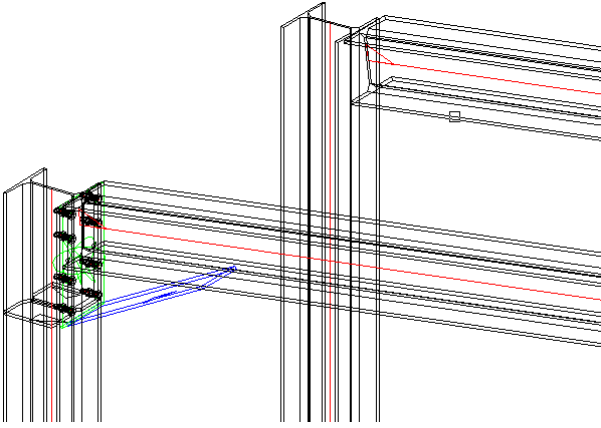
- Select the macro in the drawing and press **<Enter>**.



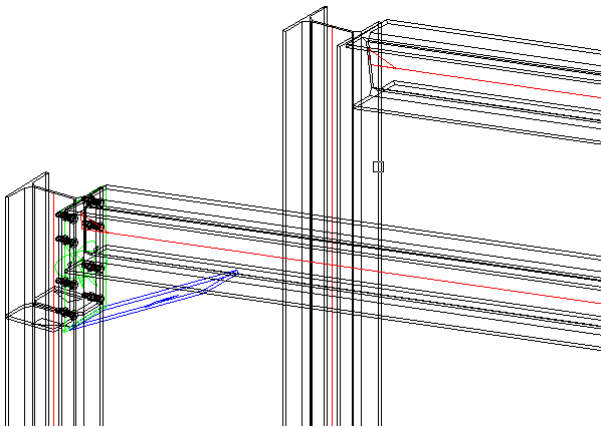
- Select the middle column that hasn't been connected yet.



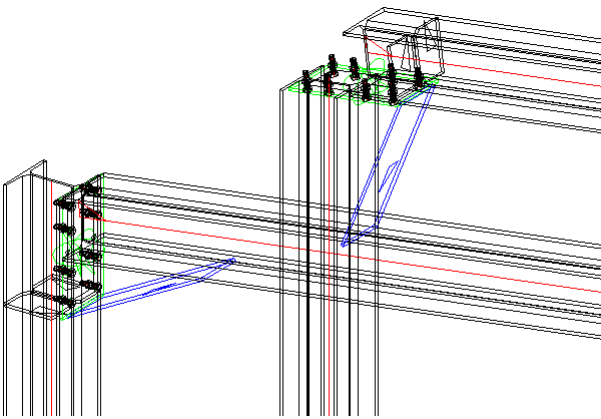
- Select the middle beam that hasn't been connected yet.



- Select the last beam that hasn't been connected yet.




- Select the last column that hasn't been connected yet.




? *This command can copy a macro to other members with other sections and orientations. If the orientations of the targetmembers are that different that the copy operation is impossible, then the command aborts without copying anything.*


← Step 4 →

 We create another example that shows how this command can rotate a macro.



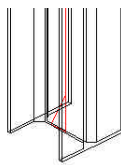
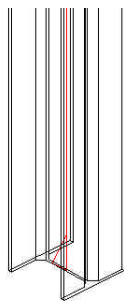
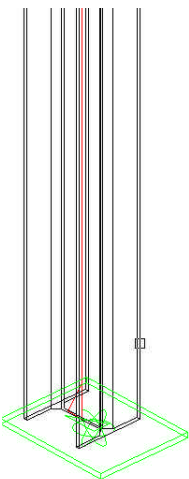
- Open the drawing  Exercise21b.dwg



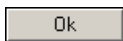
- Start the command  **Macro apply settings**.



- Select the macro in the drawing.

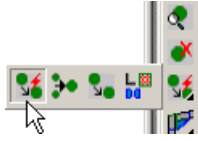


- Select the column at the front.



- Click on **Ok**.

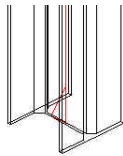
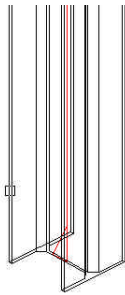
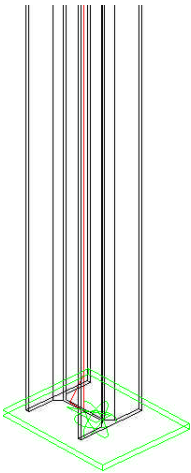
← Step 5 →



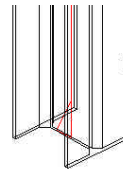
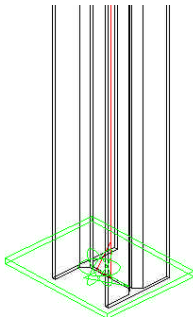
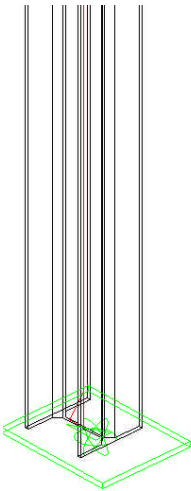
- Start the command  **Automatically copy a macro**.



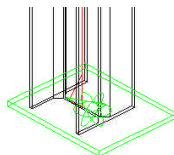
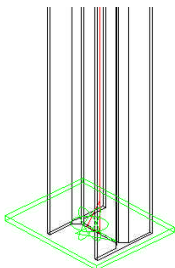
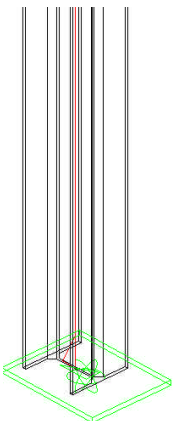
- Select the macro in the drawing and press **<Enter>**.




- Select the middle column on the backside.



- Select the last column at the front.



 *By clicking another location we can let the macro rotate or mirror during the copy command. The locations we choose inside the **Macro apply settings** command are used as a base reference for determining the correct rotation/mirror.*

Exercise 22: Storing macro's inside the library


The main purpose of macros is allowing us to reuse them in all of our projects. This is possible if we save the macros in the library. With the click of an icon we have direct access to all the connections in the connections library. Moreover Parabuild will automatically filter for us the macro's that aren't applicable in the current situation.

← Step 1 →



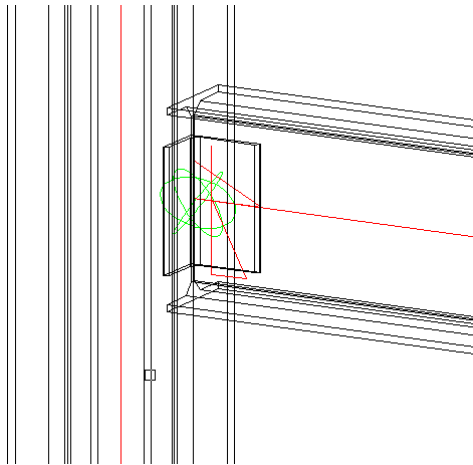
- Open the drawing  Exercise22a.dwg



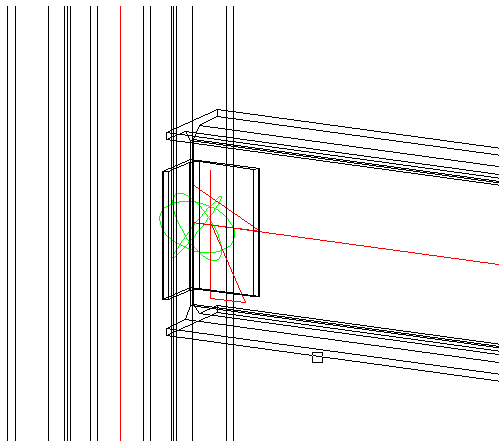
- Start the command  **Macro apply settings.**



- Select the macro in the drawing.



- Select the column.

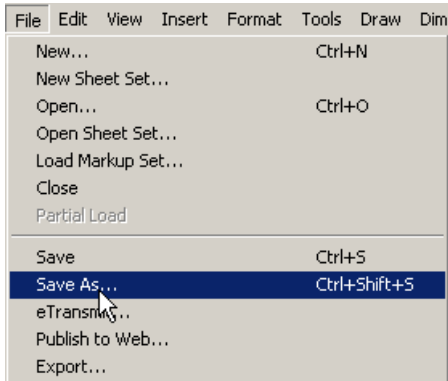


- Select the beam.

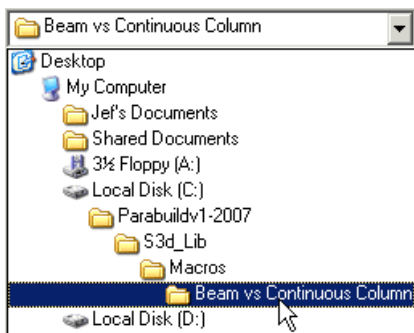


- Click on **Ok**.

← **Step 2** →



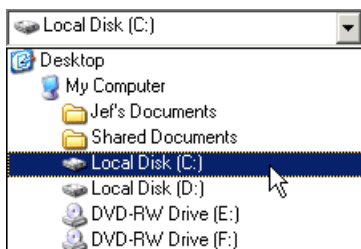
- Start the command **Save As...** under the menu **File**.



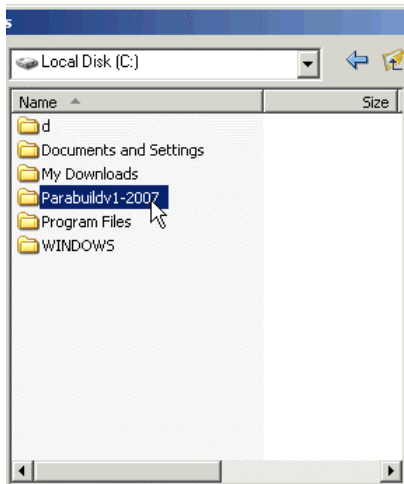
- Go to the following location in the **Save As** dialog box :
C:\Parabuildv1-2007\S3d_Lib\Macros\Beam vs Continuous Column\

Parabuild may be located in another location on your computer.

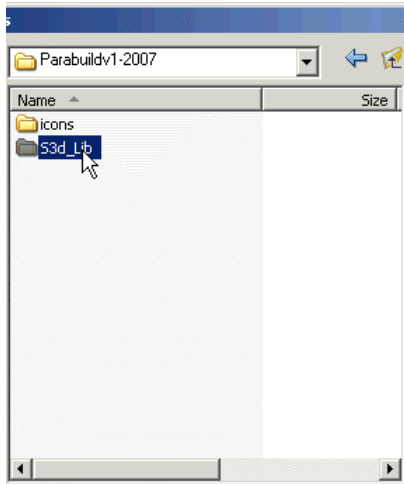
Normally you should already be familiar with the directory structure, but we will explain each step once.



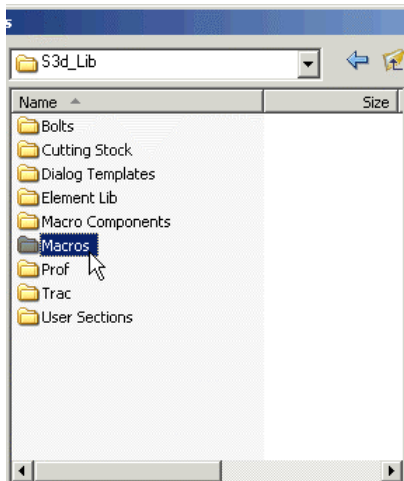
- Choose at the top from the list the disk **C:**



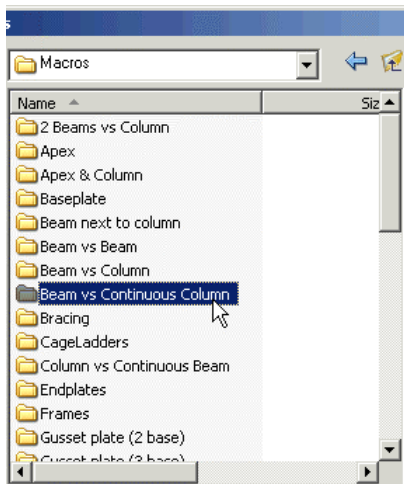
- Double-click on the directory **Parabuildv1-2007**



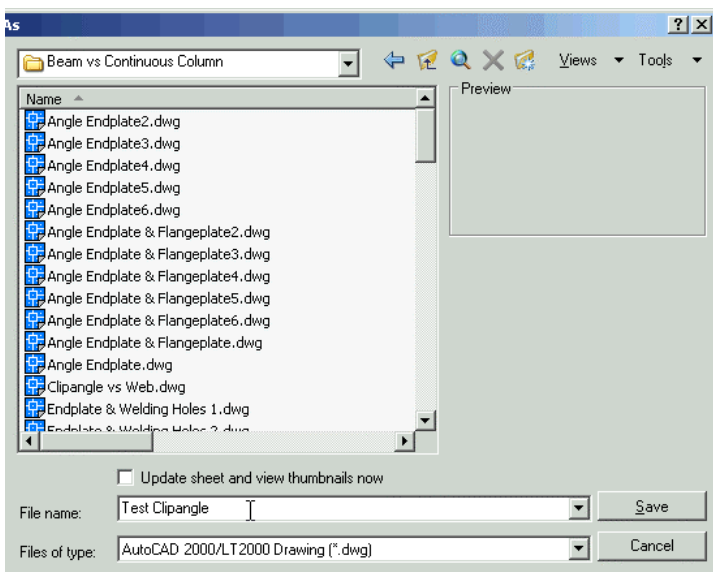
- Double-click on the directory **S3d_Lib**



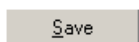
- Double-click on the directory **Macros**



- Double-click on the directory **Beam vs Continuous Column**




- Enter for the filename : **Test Clipangle**



- Click on **Save**




- Click on the cross  to close the drawing.

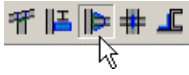
 *Don't forget to close the drawing!*
The library can't read the drawing if you have it opened.

Each directory located in the Macros directory contains a collection of similar connections that are accessible using one icon for each directory.

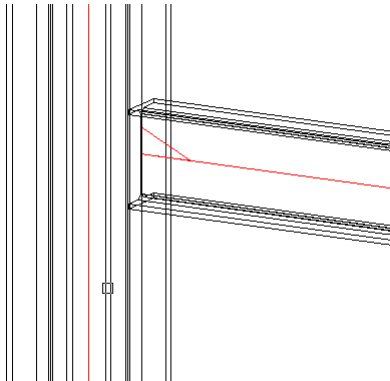
← Step 3 →



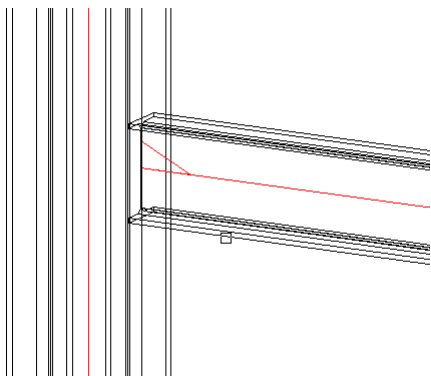
- Open the drawing  Exercise22b.dwg



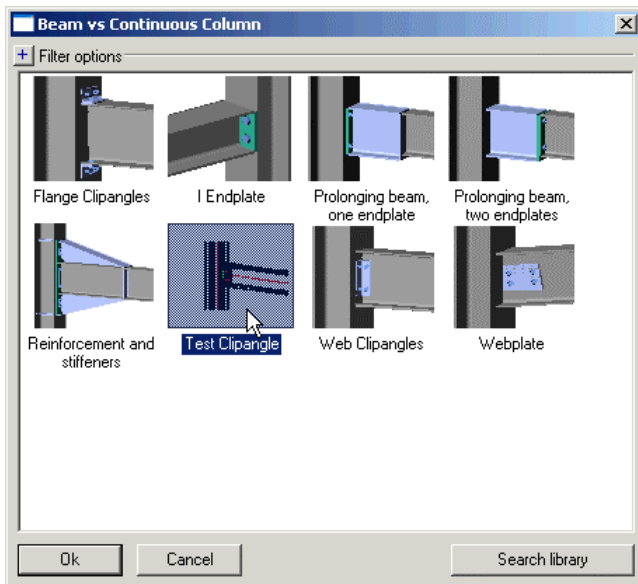
- Start the command  **Beam vs continuous column.**



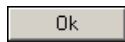
- Select the column.



- Select the beam.



- Select the connection **Test Clipangle** that we created earlier.



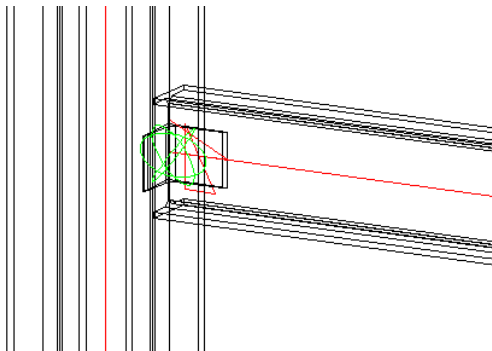
- Click on **Ok**.




- Press the **<Enter>** key to end the command.



- Click on **Close**.




 A drawing that we store in the library this way should contain just one macro. Otherwise Parabuild wouldn't know which of the two macros should be copied.

Exercise 23: Creating macro's with helper objects

It is also possible to create macro's that not only use members as a basis, but also points and planes.

A macro that has a member and one point or one plane as a basis, can also be copied to another member and point/plane.

◀ Step 1 ▶

 *To save us some time, we start with a macro that's almost finished.*



- Open the drawing  Exercise23a.dwg



- Click on  **Edit macro**

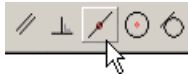


- Select the macro in the drawing.

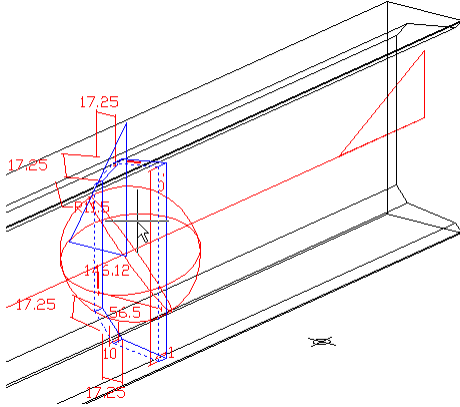


- Click on **Close**.

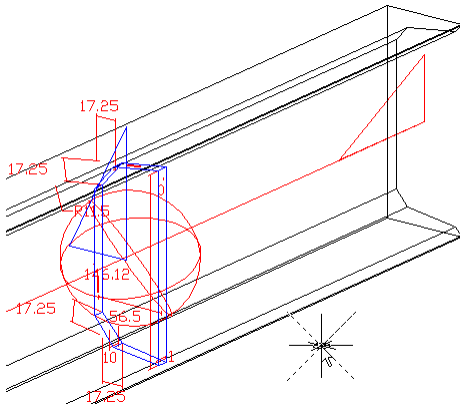
← Step 2 →



- Click on **Coincident**



- Select the first plane of the stiffener pressing the left mouse button once. Now press the right mouse button to confirm.



- Select the point and press the right mouse button to confirm.



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
P57X10-146(211	Base	Flexible	<input type="checkbox"/>
UPN160(211543	Base	Fixed	<input type="checkbox"/>
Point(211543723	Base	Fixed	<input type="checkbox"/>

- Modify the **Flexibility** of the point to: *Fixed*.



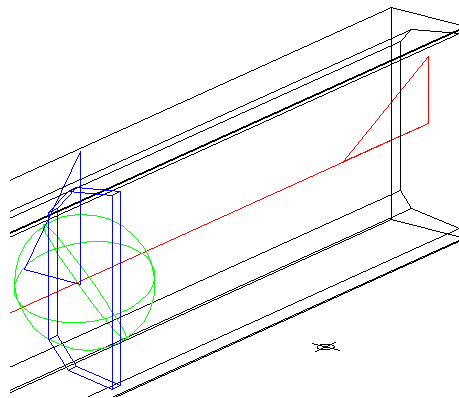
- Click on **Close**.




- Start the command  **Set macro as current.**

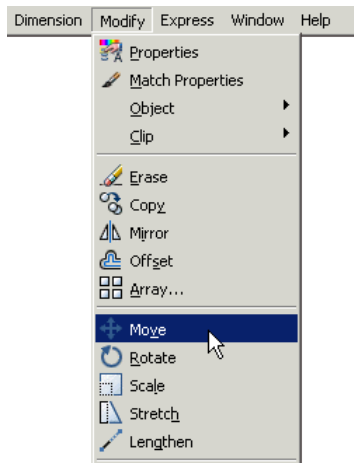



- Press the **<Enter>** key to deactivate the editing of the macro.

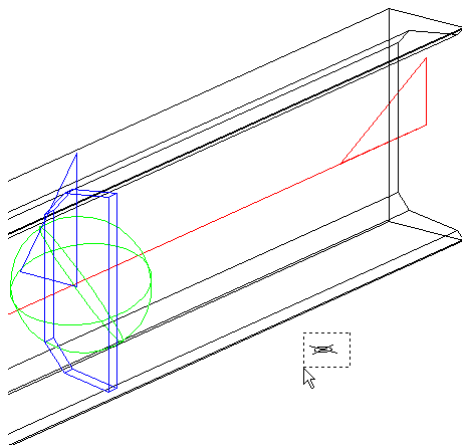


← Step 3 →

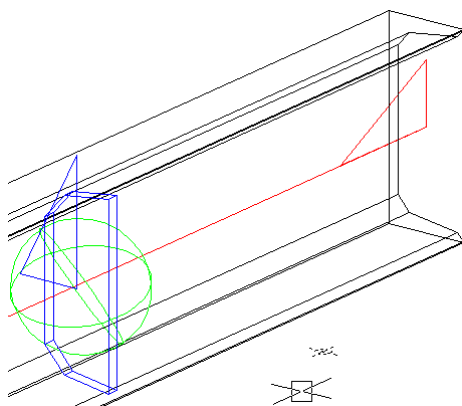
 With the last command we've activated automatic calculation.
Now all macro's will be recalculated after a modification...



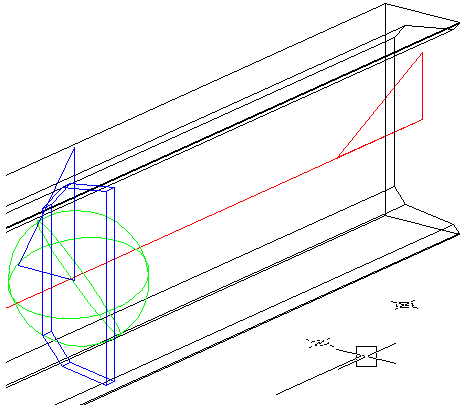
- Start the command  **Move**



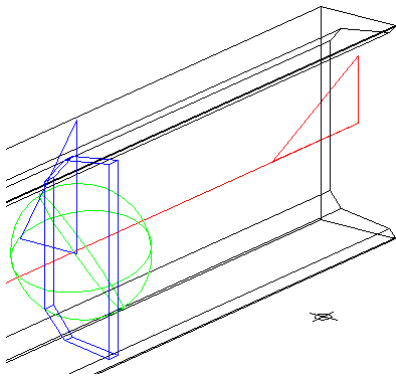
- Select the point and confirm by pressing **<Enter>**.




- Indicate as basepoint a point somewhere on the screen.



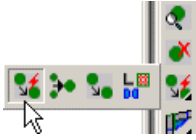
- Move the point 80 mm in the X-direction.



 Notice the movement of the stiffener.

← Step 4 →

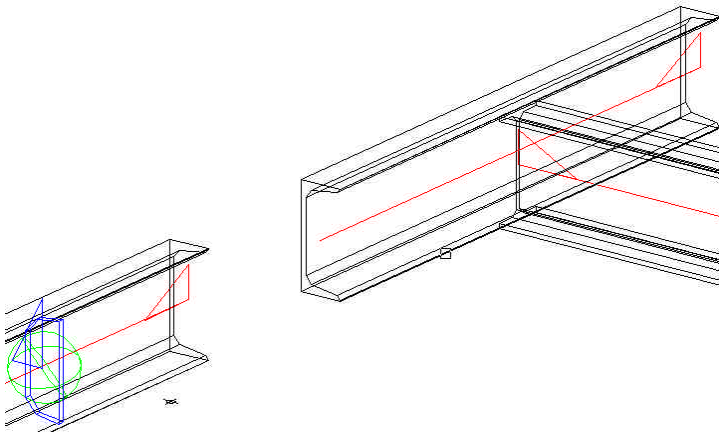
Now that the stiffener is based on a point and a member we will copy it.



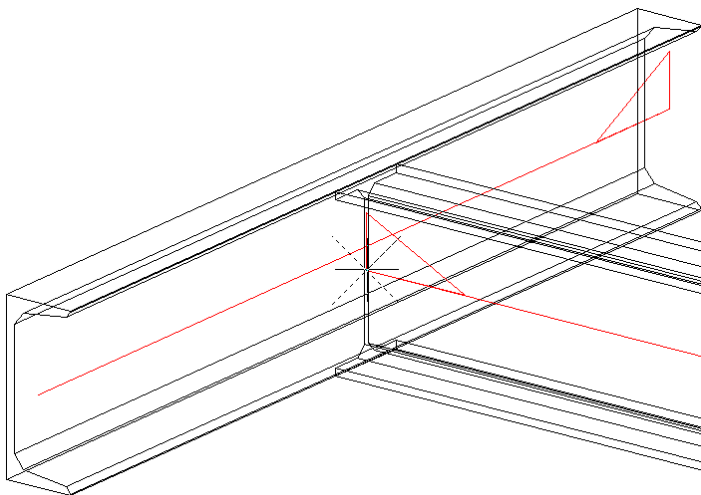
- Start the command  **Automatically copy a macro**.



- Select the macro in the drawing and press **<Enter>**.



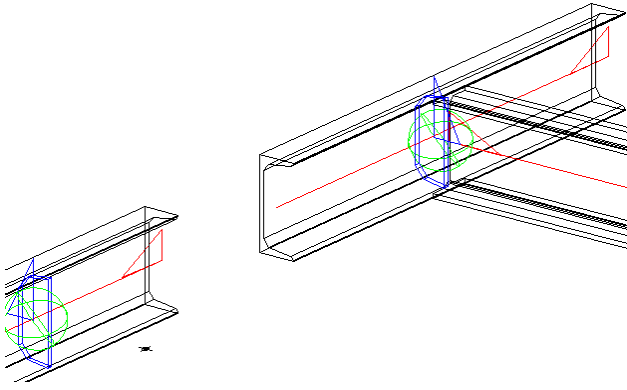
- Select the UPN member on the right that doesn't have a stiffener.



- Select the endpoint of the IPE beam by pressing the left mouse button once. Now press the right mouse button to confirm.




- Press the **<Enter>** key again to end the command.




❓ Thanks to the fact that we've based the stiffener on a point, Parabuild can copy the macro on the endpoint of another member. It doesn't matter if the target point is a real point or a part of an object.

← Step 5 →

 *We do the same but now with a plane.*



- Open the drawing  Exercise23b.dwg



- Click on  **Edit macro**

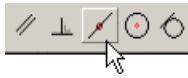



- Select the macro in the drawing.

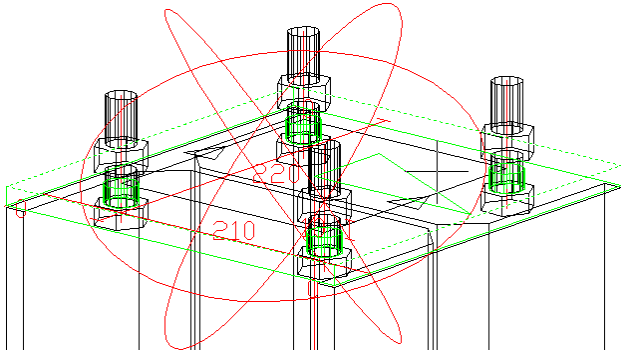


- Click on **Close**.

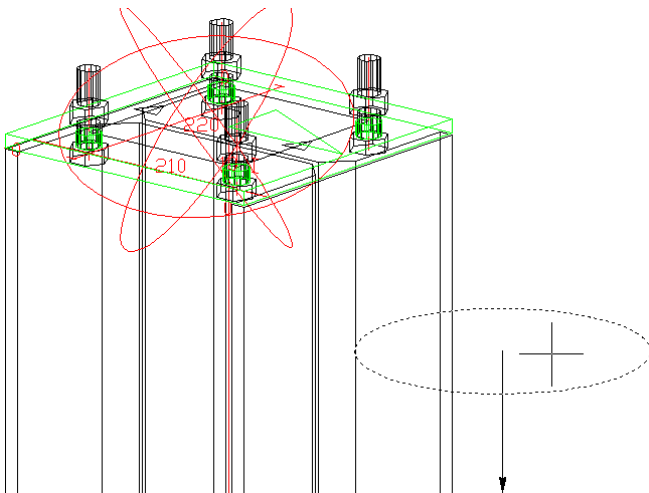
← Step 6 →



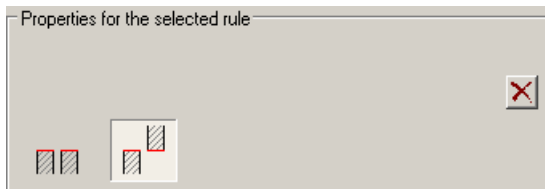
- Click on  **Coincident**




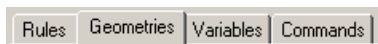
- Select the upper plane of the endplate by pressing the left mouse button once. Now press the right mouse button to confirm.



- Select the plane of the plane-object and press the right mouse button to confirm.



- Click below on the button 



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
P210X10-220(21	Base	Flexible	<input type="checkbox"/>
HEA220(210882	Base	Fixed	<input type="checkbox"/>
Point(210874806	Base	Flexible	<input checked="" type="checkbox"/>
Point(210874808	Base	Flexible	<input checked="" type="checkbox"/>
Point(210874807	Base	Flexible	<input checked="" type="checkbox"/>
Plane(21087481	Base	Fixed	<input type="checkbox"/>

- Modify the **Flexibility** of the plane to: *Fixed*.



- Click on **Close**.

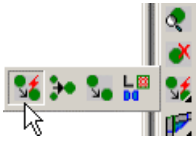


- Start the command  **Set macro as current**.



- Press the **<Enter>** key to deactivate editing of the macro.

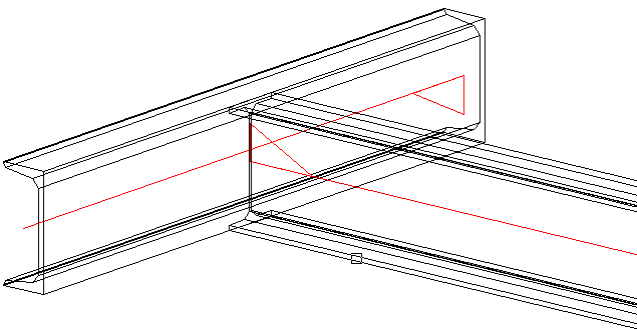
← Step 7 →



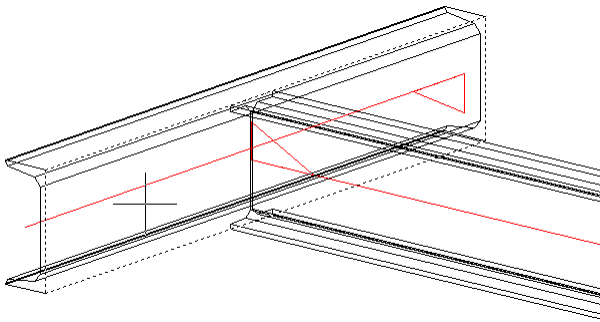
- Start the command  **Automatically copy a macro**.



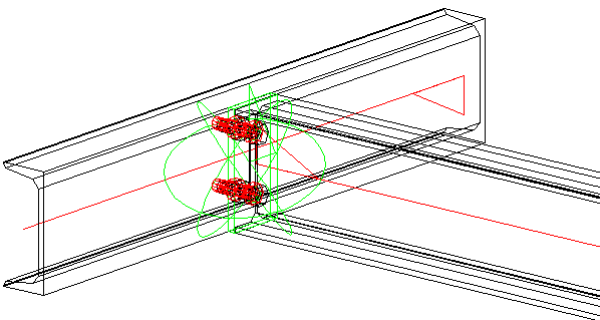
- Select the macro in the drawing and press **<Enter>**.




- Select the IPE member.



- Select the plane of the back of the UPN member pressing the left mouse button once. Now press the right mouse button to confirm.



 *You can create and store your own stiffeners or endplates like these.*


Store the drawing in the following directories :

Stiffeners :

C:\Parabuildv1-2007\S3d_Lib\Macros\Stiffeners

Endplates :


C:\Parabuildv1-2007\S3d_Lib\Macros\Endplates

 *Parabuild may be located in another location on your computer.*

Exercise 24: Merging settings


When making modules we regularly create settings that are multiple times adjustable, although they should be adjustable just once for the end-user.

This is possible by merging tabs.

 **Watch out:** We are merging the settings of modules together, we are not merging the modules themselves.

← Step 1 →



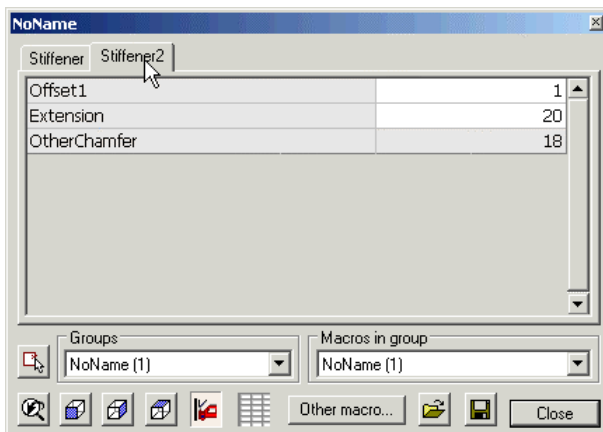
- Open the drawing  Exercise24.dwg



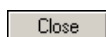
- Click on  **Review macro.**



- Select the macro in the drawing and press **<Enter>**.




- Activate the tab **Stiffener2**.



- Click on **Close**.

← Step 2 →

 The purpose of this exercise is to merge the settings in the tab **Stiffener2** with the settings of the tab **Stiffener**.



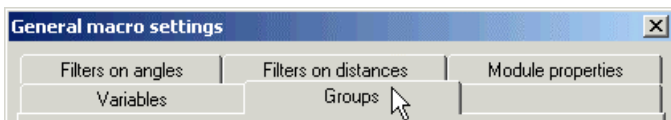
- Click on  **Edit macro**



- Select the macro in the drawing.



- Click below the dialog box on the button **General macro settings**.



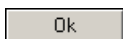
- Activate the tab **Groups**.

Name of the Module	Name of the group	Sorting
Stiffener	Stiffeners	Undetermined
Stiffener2		Undetermined

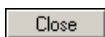
- Enter in the middle of the dialog box in the column **Name of the group** of **Stiffener** to : *Stiffeners*.

Name of the Module	Name of the group	Sorting
Stiffener	Stiffeners	Undetermined
Stiffener2	Stiffeners	Undetermined

- Enter in the middle of the dialog box in the column **Name of the group** of **Stiffener2** to : *Stiffeners*.



- Click on **Ok**.



- Click on **Close**.

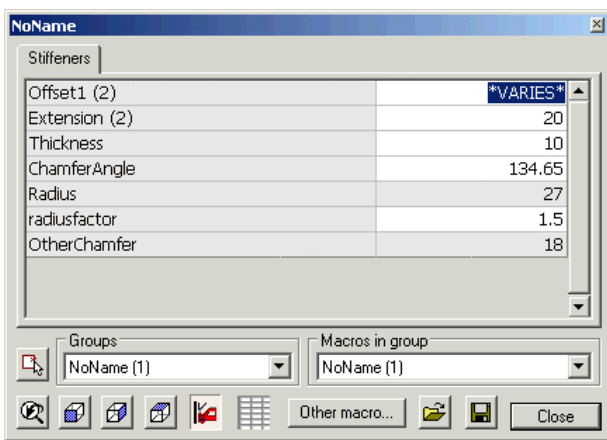
← Step 3 →




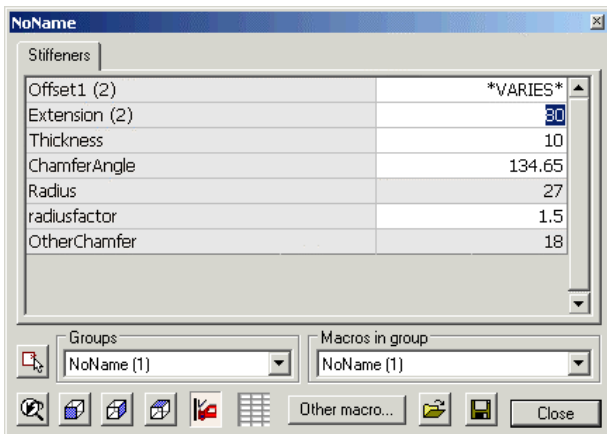
- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



 The tabs **Stiffener** and **Stiffener2** are grouped together in the tab **Stiffeners**. Concerning the geometric rules nothing has changed; the modules **Stiffener** and **Stiffener2** still exist separately. Only something has changed in the way the settings of these modules are represented in this dialog box. The setting **Offset1** is the proof of this : We can see for the name: **Offset1 (2)** between brackets the number 2, which means that effectively there are 2 settings with this name and they will be modified at the same time. The value of **Offset1** is ***VARIES***, this means that the value of one is 1 and the other has for example a value of 2.



- Modify the setting **Extension** to: 80

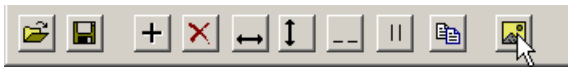
Exercise 25: Images for settings


We will make the dialog box that contains the settings of the macro user-friendly. We do this by using an image that illustrates the settings.

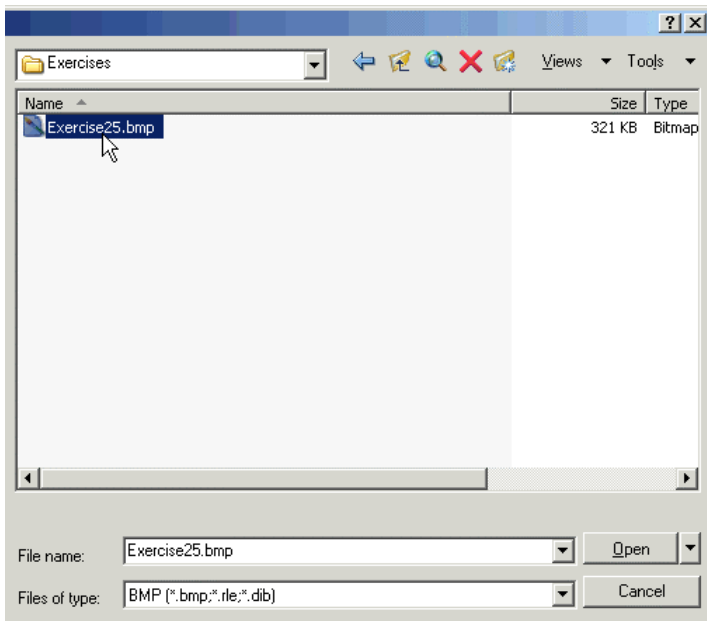
← Step 1 →



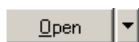
- Start the command  **Create dialog boxes**.



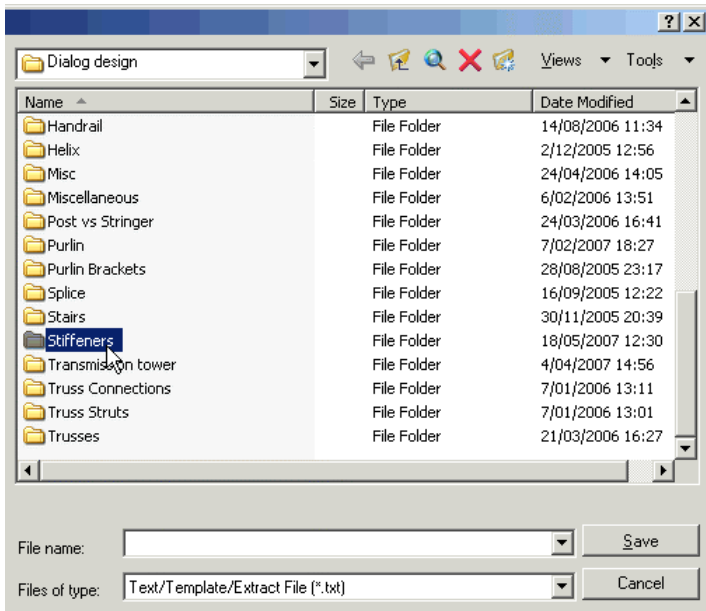
- Click on the button .



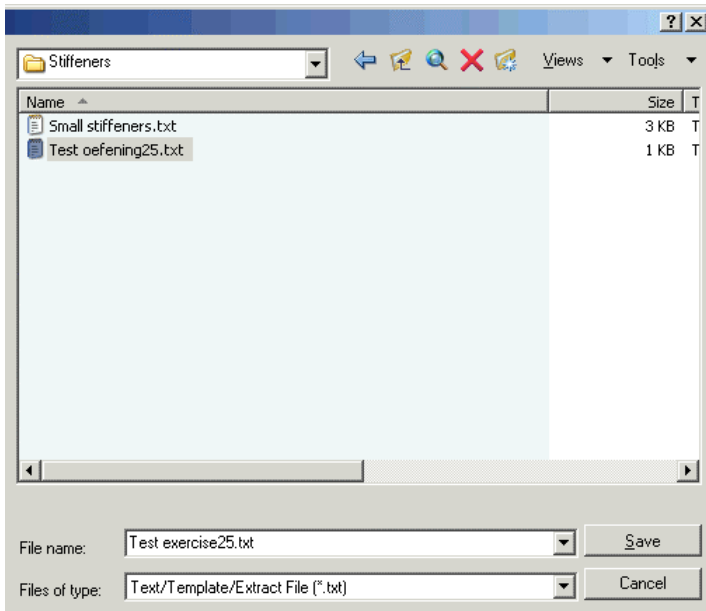
- Select the bitmap file *Exercise25.bmp* in the directory of the exercises.



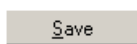
- Click on the button **Open**.




- Open the directory *Stiffeners* in the new **Save as** dialog box that has popped up.



- Enter for the filename : *Test exercise25*




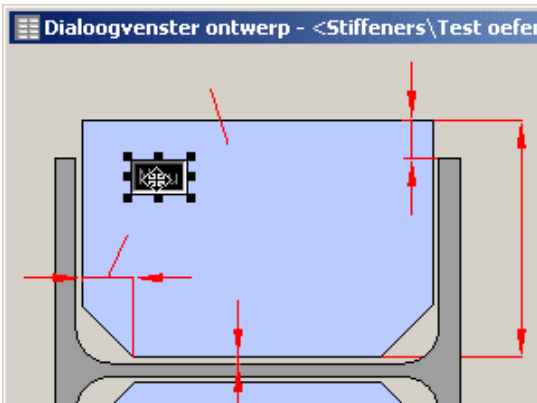
- Click on **Save**.

 With the second dialog box that pops up we immediately store the image as a dialog box in the correct location.

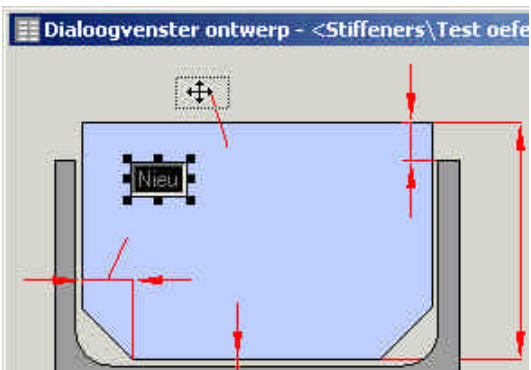
← Step 2 →



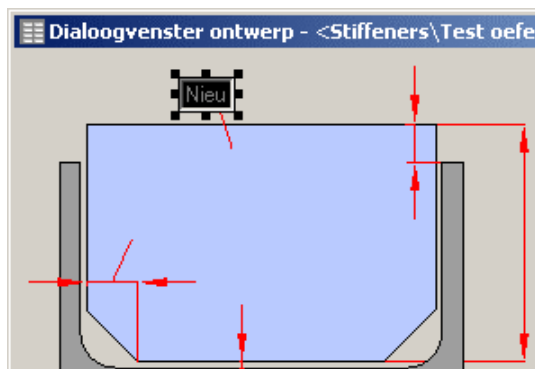
- Click on the button 

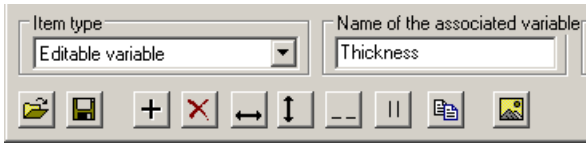


- Select the new field by moving over it with the cursor and pressing the left mouse button.



- Drag the field by pressing the left mouse button again and keeping it pressed. Move the mouse while pressing the left mouse button and move the field to above the red line. Release the left mouse button as soon as the field is on the desired location.





- While the new field is still selected, modify below the name of the field to:
Thickness.

Close

- Click on **Close**.


Yes

- Click on **Yes** to save the modifications you made to the dialog box.

← Step 3 →

Now that the image-dialog box is created, we still have to set it up that the macro should use this new dialog box.



- Open the drawing  Exercise25.dwg



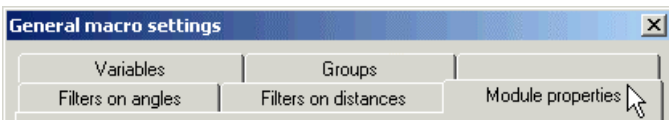
- Click on  **Edit macro**



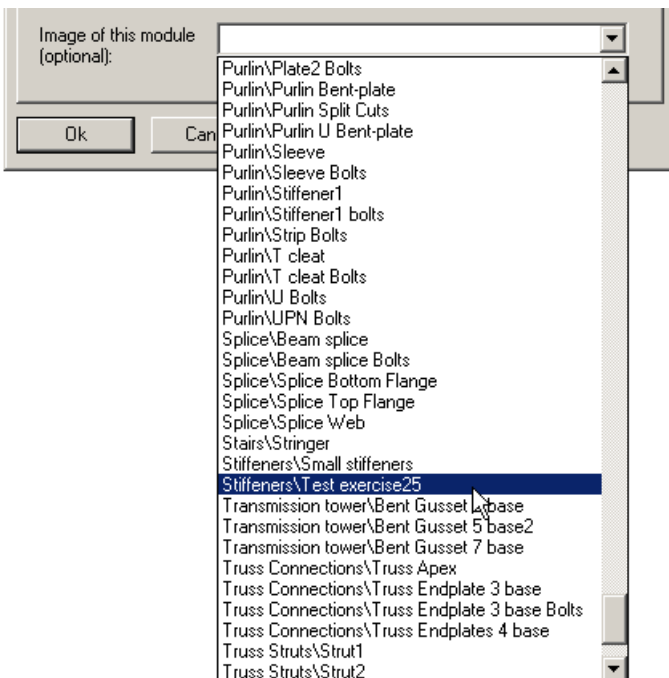
- Select the macro in the drawing.



- Click below the dialog box on the button **General macro settings**.



- Activate the tab **Module properties**.



- Choose from the list below the dialog box :
Stiffeners\Test exercise25



- Click on **Ok**.



- Click on **Close**.

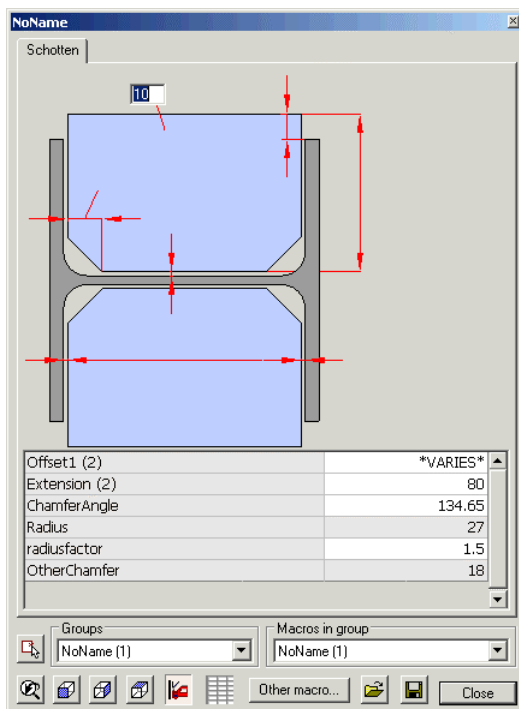
← Step 4 →




- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



 *The purpose is to have a clear visual representation of the settings of the macro. The settings that are not on the image are always shown below in a list.*

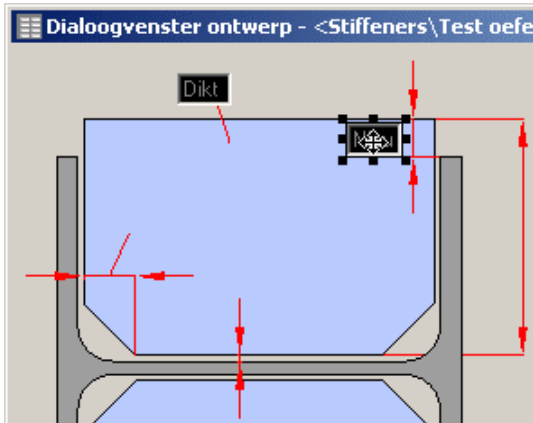


- Press the function key <F12> while the dialog box is still open.

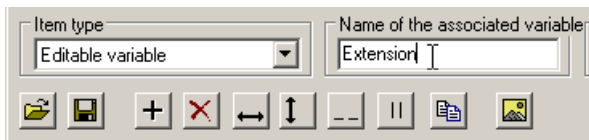
This way we immediately edit the dialog box without having to search for it in the directory structure.



- Click on the button



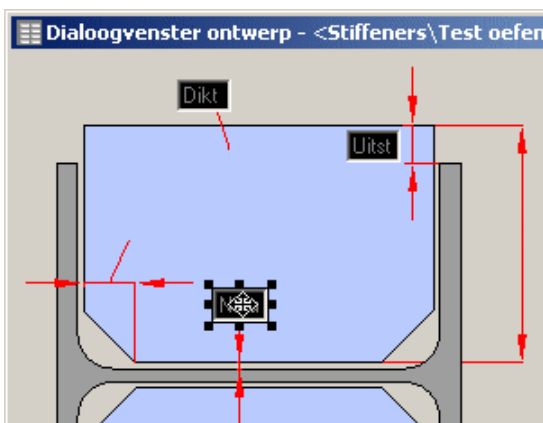
- Drag the new field to upper right by keeping the left mouse button pressed. Release the left mouse button as soon as the field is on the desired location.



- While the new field is still selected, modify below the name of the field to: *Extension*.



- Click on the button



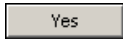
- Drag the new field to the middle by keeping the left mouse button pressed.



- While the new field is still selected, modify below the name of the field to: *Offset1*.



- Click on **Close**.



- Click on **Yes** to save the modifications you made to the dialog box.



- Click on **Close**.

← Step 5 →

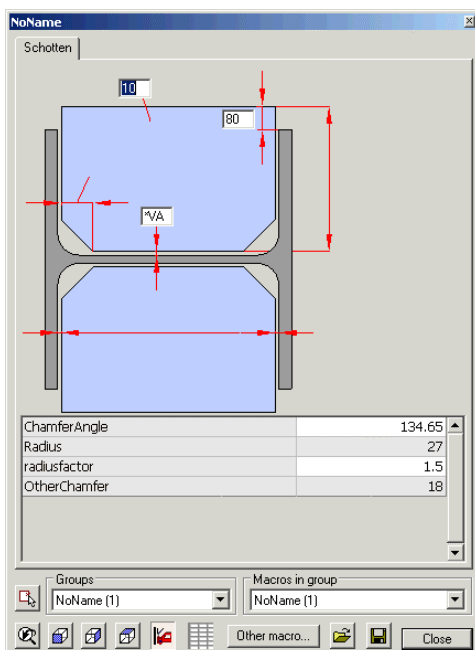
We have to reopen this dialog box to load the modified image.



- Click on **Review macro**.



- Select the macro in the drawing and press **<Enter>**.




If all the settings are placed on the image then the list below will disappear and the dialog box will become a lot smaller.

Exercise 26: Creating images

For creating the dialog boxes we need clear images.

In this exercise we show a method how to create the images themselves.

← Step 1 →

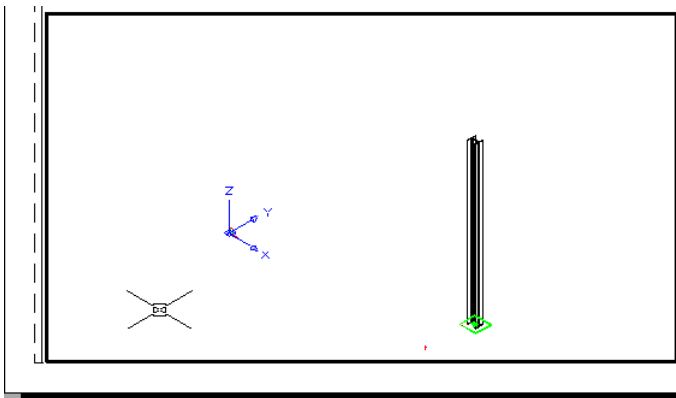
 We start out with a drawing that contains the connection(s) of which we want to create images. We illustrate the settings of the connection using AutoCAD dimensions, on a red layer for clarity.



- Open the drawing  Exercise26a.dwg



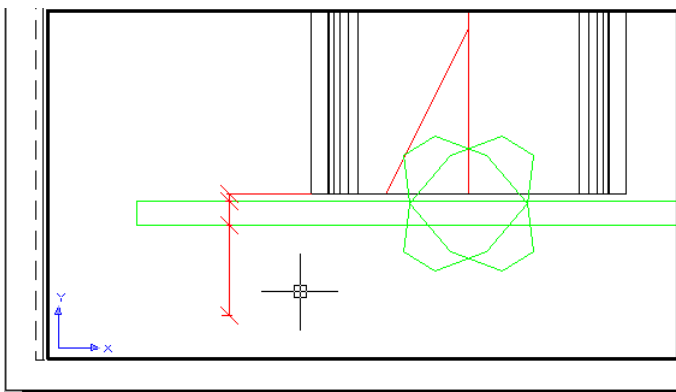
- Activate the tab **Images** that's located below the drawing.



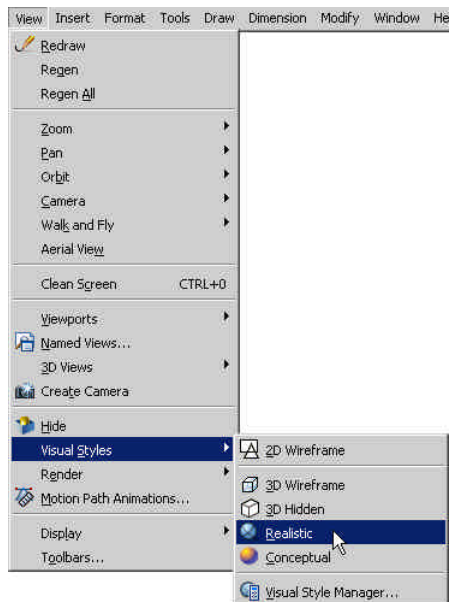
- Move the cursor to inside the bottom frame (viewport) and double-click with the left mouse button so that the frame is drawn thicker.



- Start the command  **Front View** (menu **View > 3D Views > Front**)



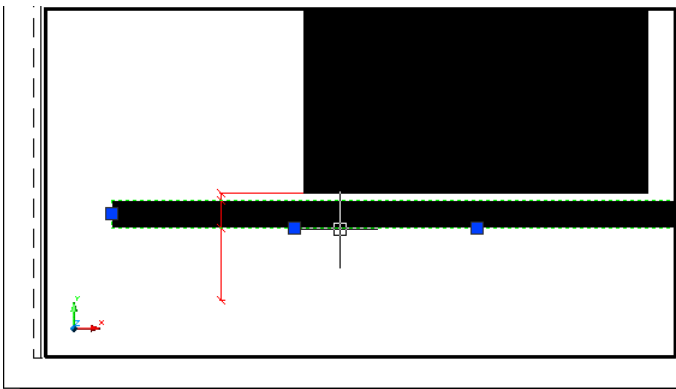
- Zoom in on the baseplate with the help of the wheel of the mouse. Roll the wheel to zoom, push the wheel to move the view (=Pan).



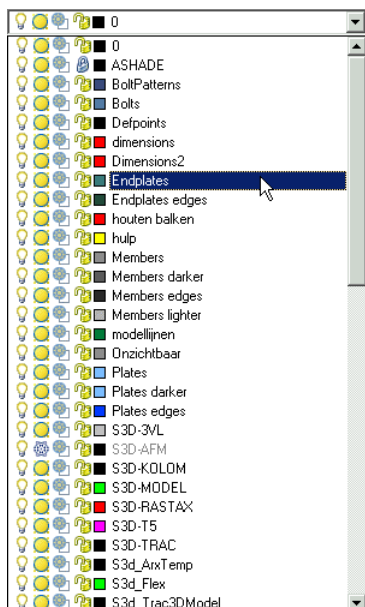
- Change the **Visual Style** to **Realistic** using the menu **View**.



- Start the command  **Groupselection on/off** once or twice so that the command line reads :
<Group-selection off>



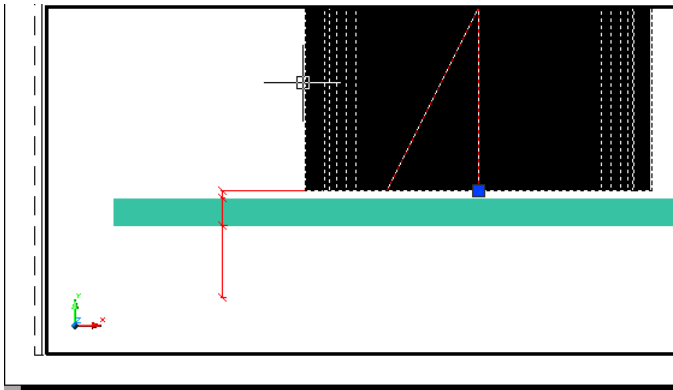
- Move the cursor above the endplate and select the endplate using the left mouse button.



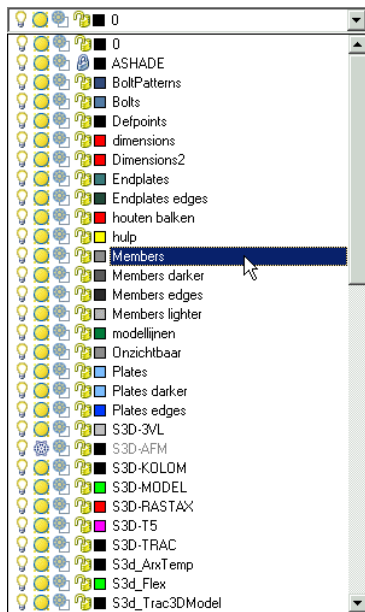
- Modify the layer to **Endplates**.



- Press the <ESC> key.



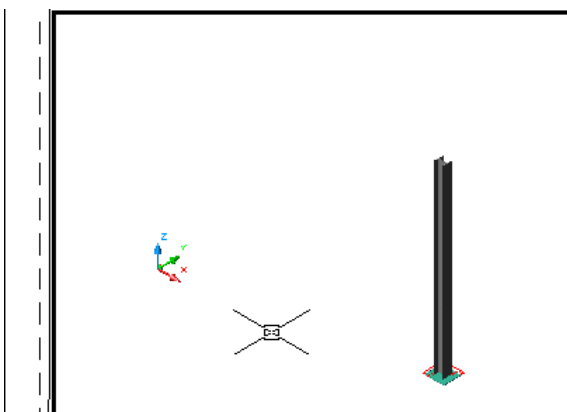
- Select the column.



- Modify the layer to **Members**.




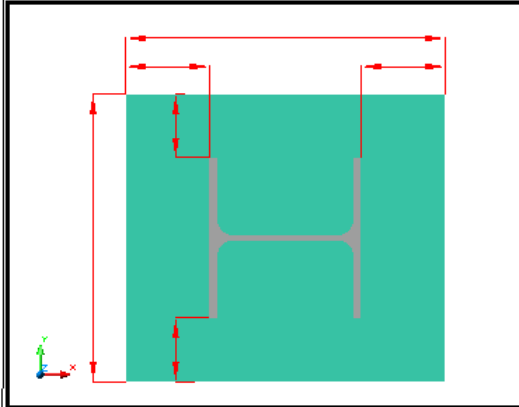
- Press the <ESC> key.



- Move the cursor to above the top frame (viewport) and click using the left mouse button so that the frame thickens.




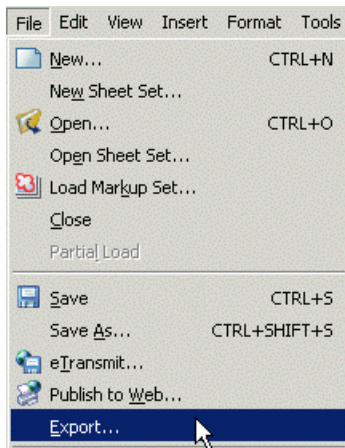
- Start the command  **Top View** (menu **View > 3D Views > Top**)



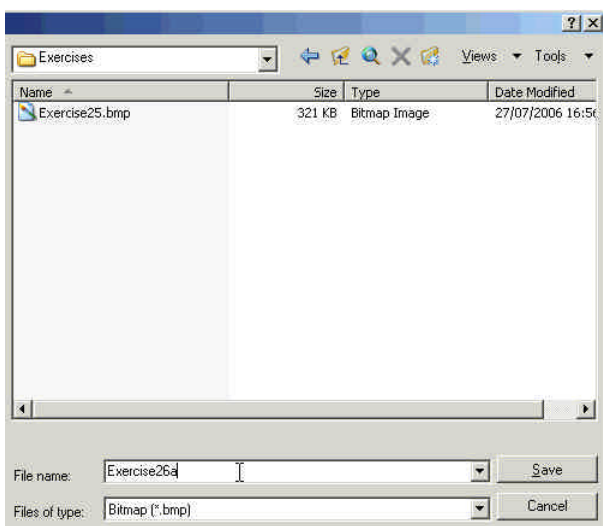
- Zoom in on the baseplate with the help of the wheel of the mouse. Roll with the wheel to zoom, push the wheel to pan the view.

← **Step 2** →

-  Now that the illustrations are about ready we can create bitmap files.



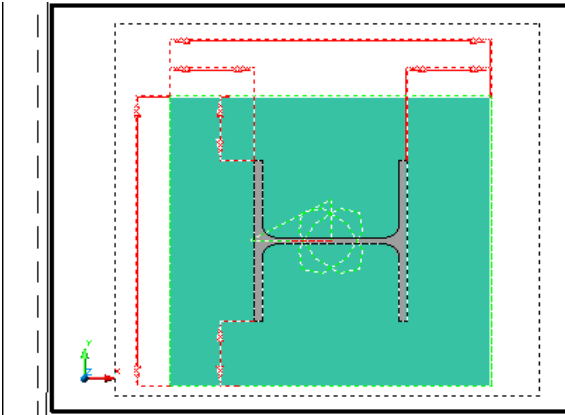
- Start the command **Export**.



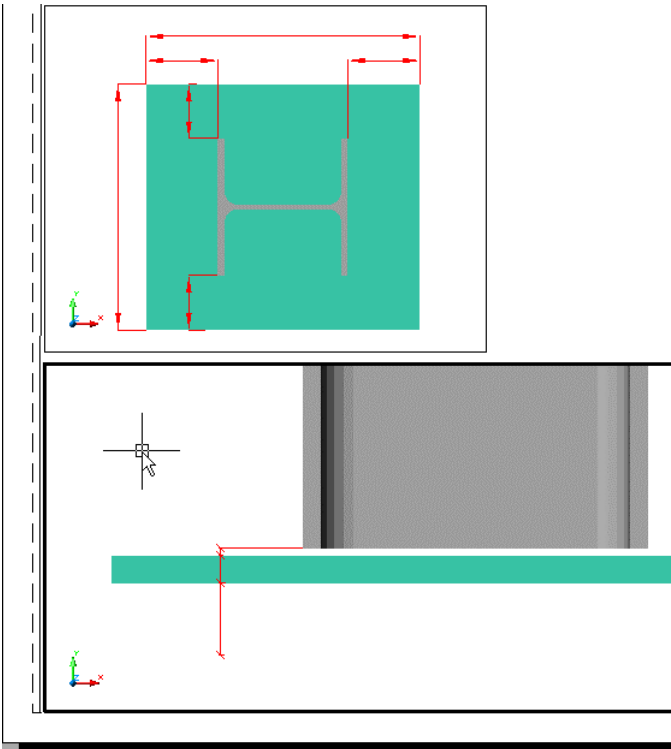
- Type for the filename : *Exercise26a*
- Select for **Files of type** : *Bitmap (*.bmp)*

Save

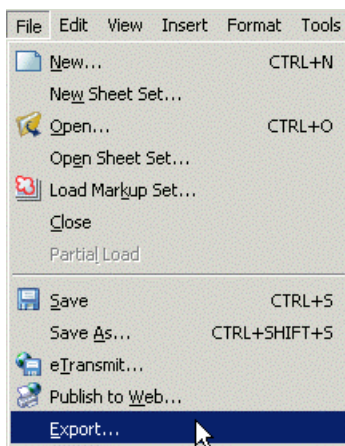
- Click on **Save**.



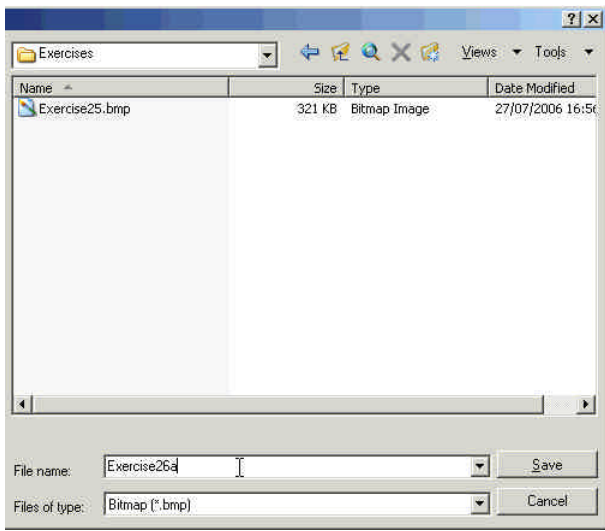
- Select all elements in the viewport and press the **<Enter>** key.



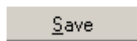
- Move the cursor to above the bottom frame (viewport) and click the left mouse button so that the frame thickens.



- Start the command **Export** using the menu **File**.



- Type for the filename : *Exercise26b*
- Select for **Files of type** : *Bitmap (*.bmp)*

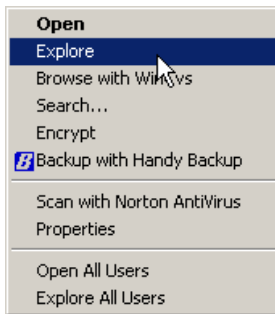


- Click on **Save**.

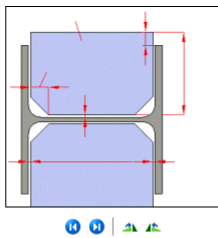


- Type on the command line: *All*
Now press the **<Enter>** key.

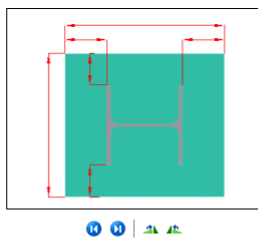
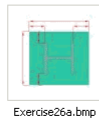
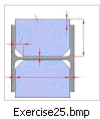
← Step 3 →



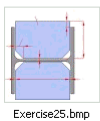
- Start **Windows Explorer** by clicking the right mouse button on the Start button of Windows.

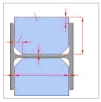
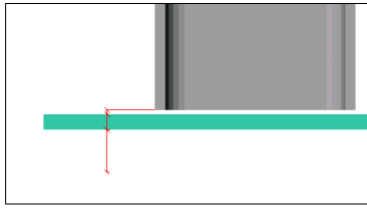


- Move the cursor to the directory *Exercises* and click on it.

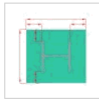


- Double-click on the bitmap : *Exercise26a.bmp*

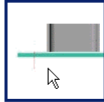




Exercise25.bmp

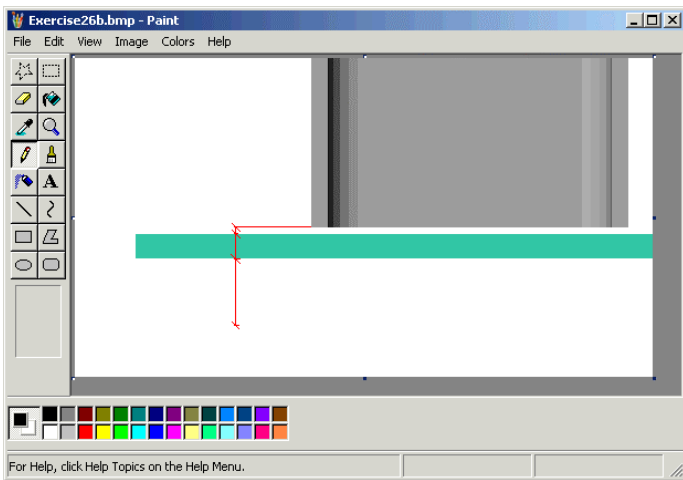



Exercise26a.bmp




Exercise26b.bmp

- Double-click on the bitmap : *Exercise26b.bmp*



 *The size of the viewport in the drawing determines the size of this bitmap.
These images are ready to be used as dialog boxes as we have done in the previous exercise.*

← Step 4 →

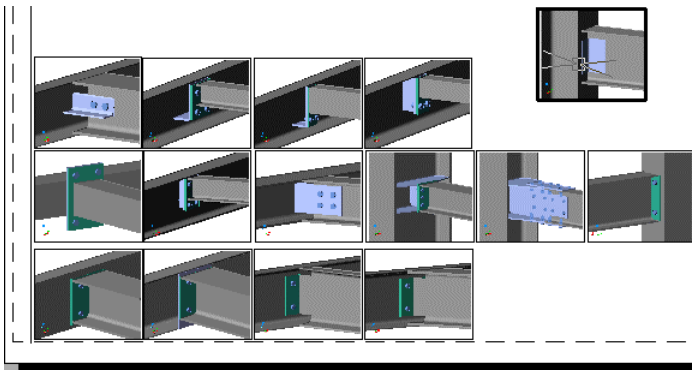
 We can also make the preview-images of connections this way.



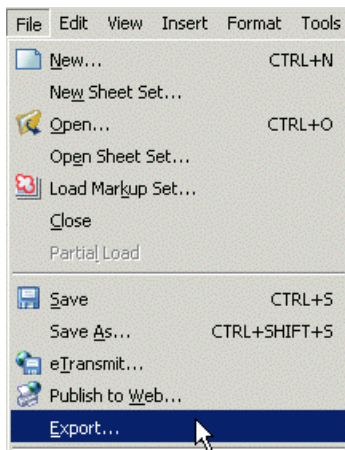
- Open the drawing  Exercise26b.dwg



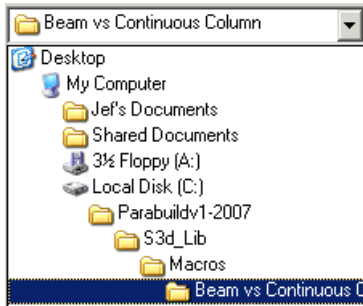
- Activate the tab **Images** of the drawing.




- Move the cursor to inside the frame right on top and double-click the left mouse button so that the frame thickness.

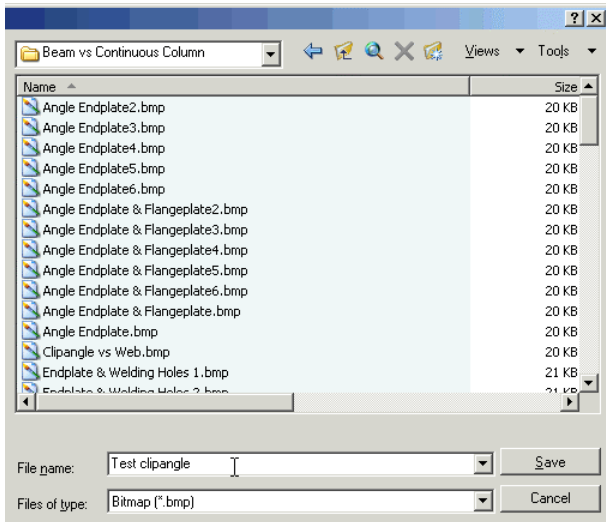


- Start the command **Export** using the menu **File**.

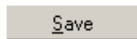


- In the dialog box go to the directory :
C:\Parabuildv1-2007\S3d_Lib\Macros\Beam vs Continuous Column

 *Parabuild may be located in another location on your computer.*



- Type for the filename :
Test Clipangle
 - Select for **Files of type** : *Bitmap (*.bmp)*




- Click on **Save**.

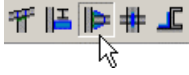


- Type on the command line: *All*
 Now press the **<Enter>** key.

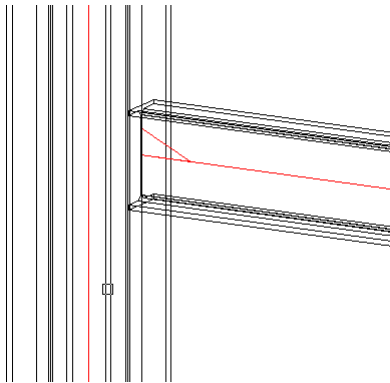
← Step 5 →



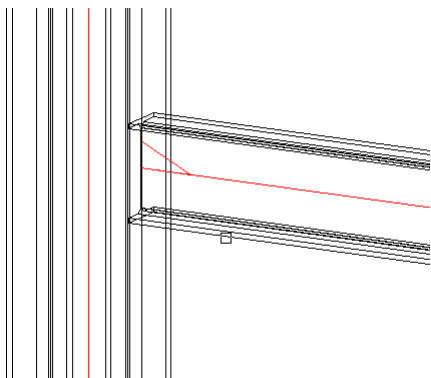
- Open the drawing  Exercise26c.dwg



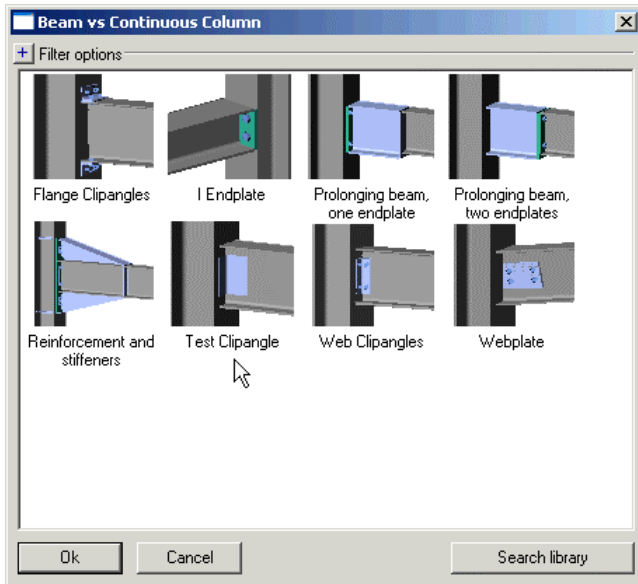
- Start the command  **Beam vs continuous column.**




- Select the column.



- Select the beam.



 *The image that we just created is shown in this dialog box as a preview. The file has to have the same filename as the drawing it represents, but with a .bmp extension.*



- Click on **Cancel**.


Exercise 27: Flexibility of variables

Sometimes it is necessary to give the user of a macro more flexibility.

An example that is common is the width and the length of a plate.

Sometimes the plate is desired to be centred in the middle, sometimes it is desired to be outlined to the right or the left. While creating the macro we do not yet know what is desired, so we have to allow all the possibilities.

← Step 1 →

 We use again the drawing of a previous exercise.



- Open the drawing  Exercise27.dwg



- Click on  **Edit macro**



- Select the macro in the drawing.

Name	Rule	Geometry 1	Geometry 2
Height	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Flange1	Distance	Plane	Line
Flange2	Distance	Plane	Line
Web1	Distance	Plane	Line
Web2	Distance	Plane	Line
Width	Distance	Plane	Plane

- Select the geometric rule **Flange1**.

Name	Rule	Geometry 1	Geometry 2
Height	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Flange1	Distance	Plane	Line
Flange2	Distance	Plane	Line
Web1	Distance	Plane	Line
Web2	Distance	Plane	Line
Width	Distance	Plane	Plane

- Select the geometric rule **Flange2**.

Name	Rule	Geometry 1	Geometry 2
Height	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Flange1	Distance	Plane	Line
Flange2	Distance	Plane	Line
Web1	Distance	Plane	Line
Web2	Distance	Plane	Line
Width	Distance	Plane	Plane

- Select the geometric rule **Width**.

? Look closely at the settings (adjustable or flexible and value) of these 3 variables.
 We will make these 3 variables adjustable for the enduser.
 The enduser will have the ability to choose which variable becomes adjustable.
 The condition the variables have to meet is that the **value** doesn't contain an equation, only a number.

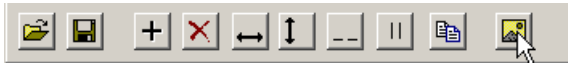


- Click on **Close**.

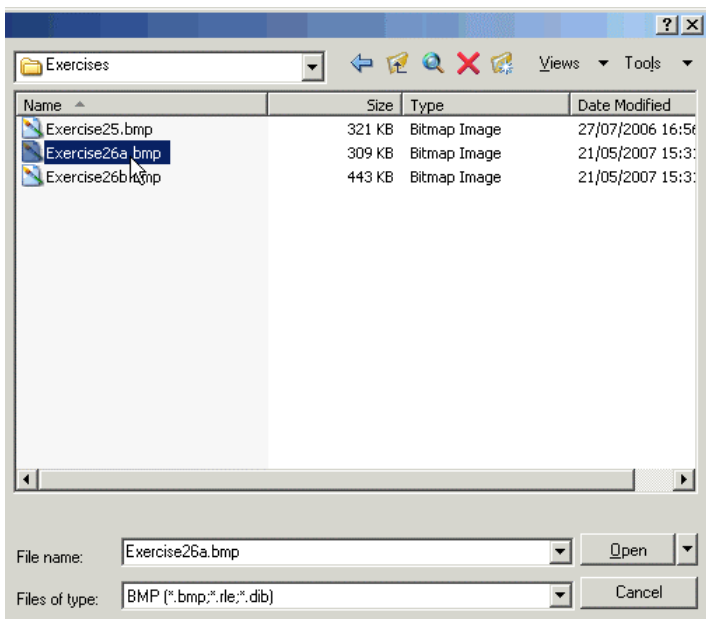
← Step 2 →



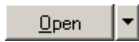
- Start the command **Create dialog boxes**.



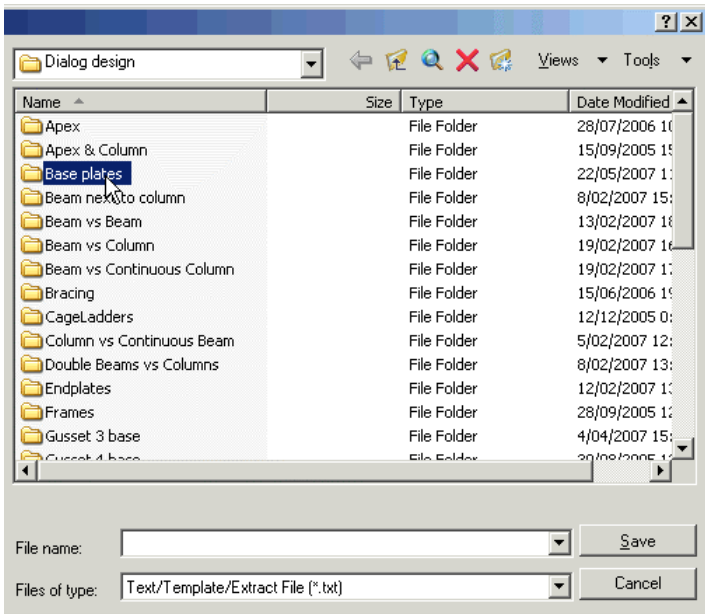
- Click on the button



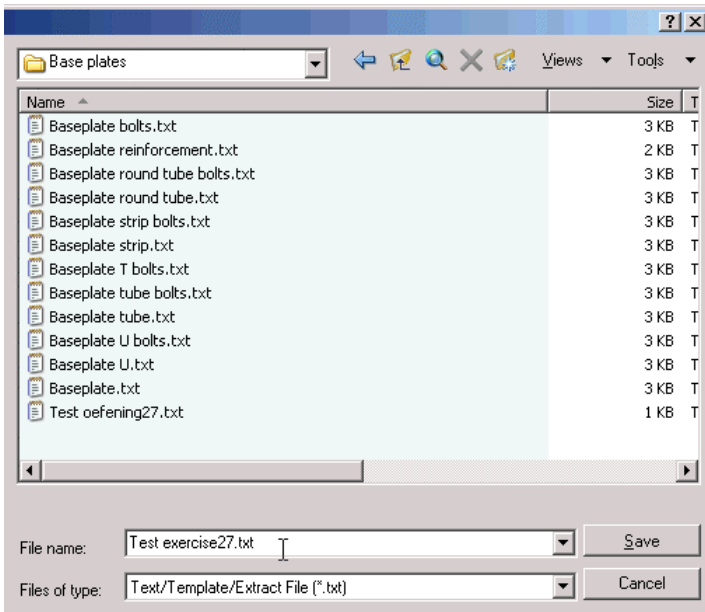
- Select the bitmap file *Exercise26a.bmp* or *Exercise27.bmp* in the same directory where the exercises are located.



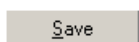
- Click on the button **Open**.



- Open the directory *Base plates* in the new **Save** dialog box that has popped up.



- Enter for the filename : *Test exercise27*

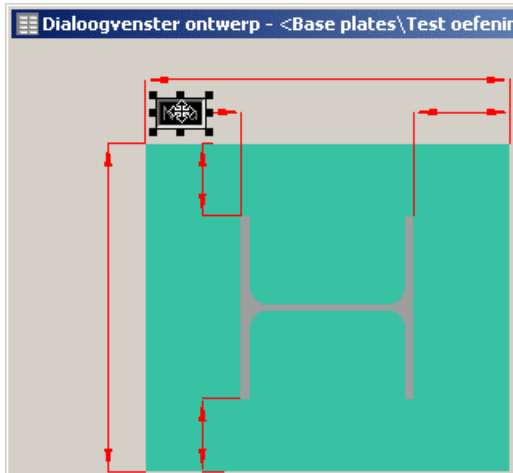


- Click on **Save**.

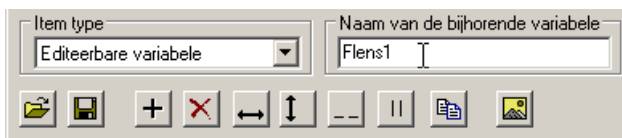
← Step 3 →



- Click on the button 



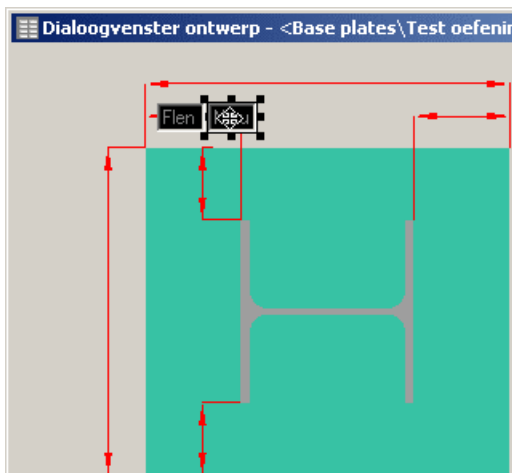
- Drag the new field by keeping the left mouse button pressed. Move the mouse while the left mouse button is pressed and move the field to above as shown in the illustration.



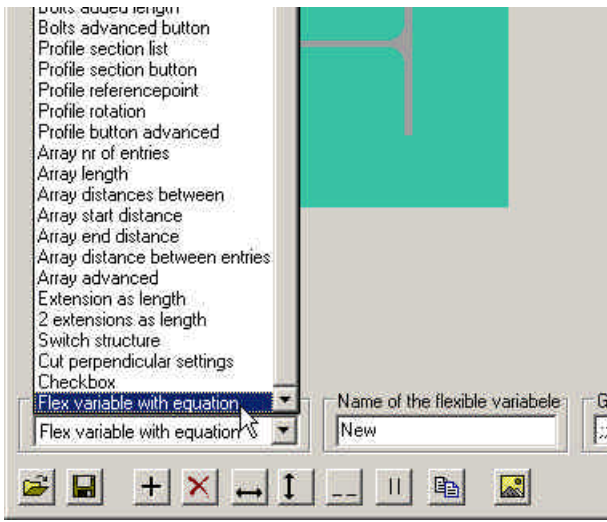
- While the new field is still selected, modify below the name of the field to: *Flange1*.



- Click on the button 




- Drag the new field to next to the other field as shown on the illustration.

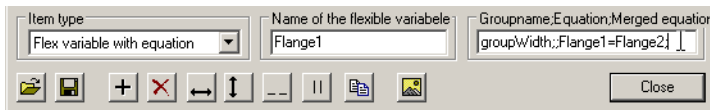


- While the new field is still selected, modify below the **Item Type** of the field to:
Flex variable with equation




- While the new field is still selected, modify below the name of the field that belongs to it:
Flange1.

 This setting means that we want to connect the button to the variable **Flange1**.



- While the new field is still selected, modify below the settings
Groupname;Equation;Merged equation to:
groupWidth;; Flange1=Flange2;

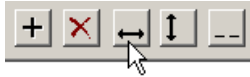
 This last setting is specific for this button. There are 3 settings merged together on 1 line with a ; separator.


We look at the meaning of each setting:

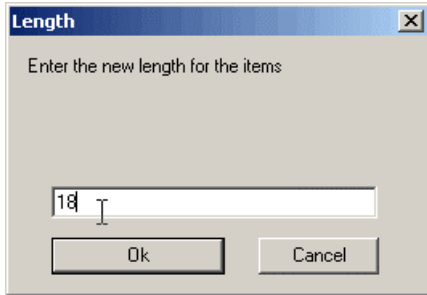
Groupname: Choose your own name. The groupname has to be the same as the other buttons that have to be connected to this button. For the width we will need to create 3 button that have the same groupname.

Equation: If the button is pushed, then Parabuild will add the equation you enter here to the module. This isn't used very often.

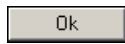
Merged equation: Enter this equation if this button can be connected to another button. This means that they can be pushed in at the same time. The equation then has to take care that both flexible values can be calculated. Most of the times this is simply an equal equation, like so : $Flange1 = Flange2$.



- While the new field is still selected, click on the button 

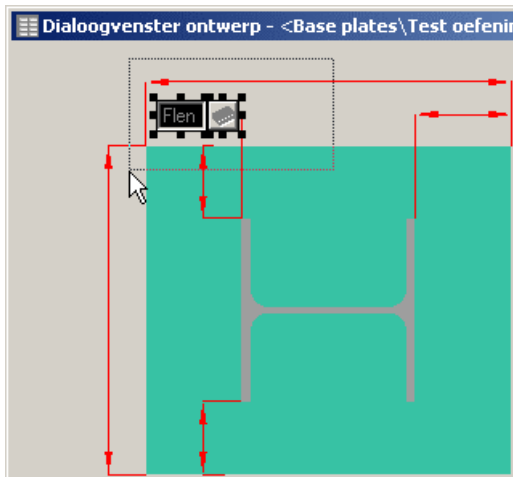


- Enter for the new length : 18




- Click on **Ok**.

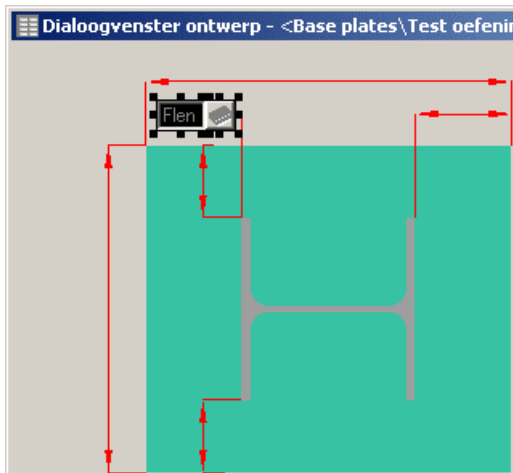
← Step 4 →



- Select the new fields together by making a window over both fields (keep the left mouse button pushed).




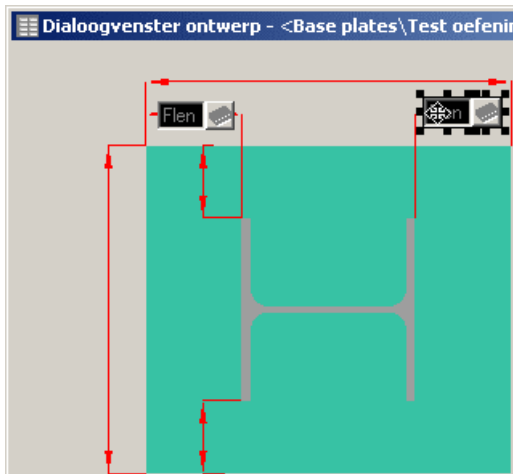
- Click on the button 



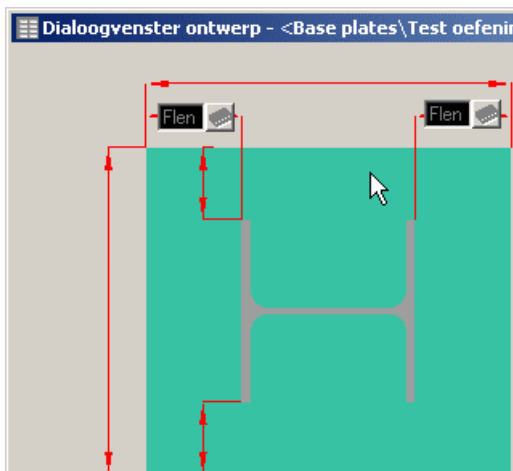
? This last tool moves the last field so that it is placed nicely against the other field. This is a useful tool for not having to move the field manually.



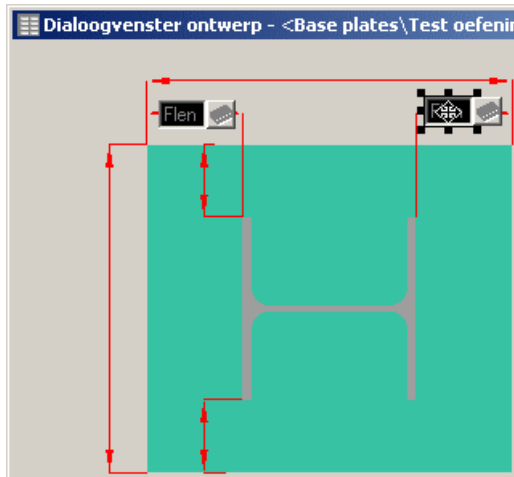
- While the new fields are still selected, click on the button 



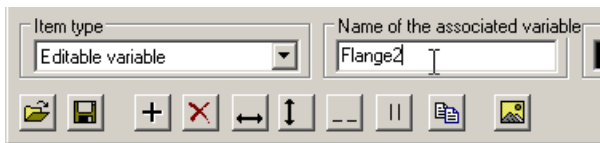
- Drag the copied fields to the top right as shown in the illustration.



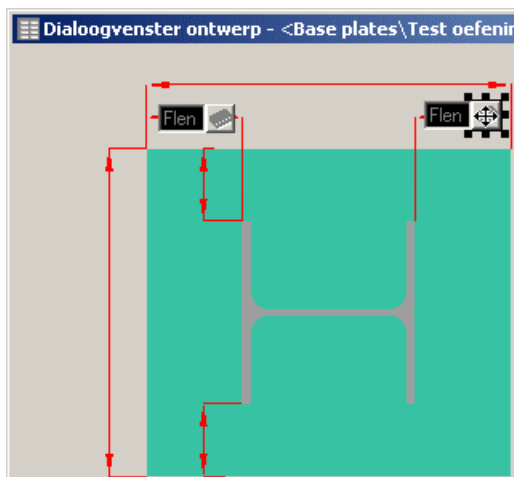
- Remove the selection by clicking with the mouse somewhere on an empty place.



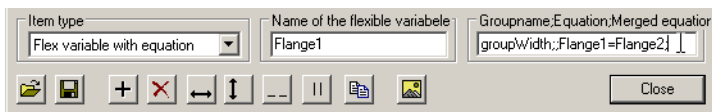
- Select just the copied field **Flange1** by clicking on it.



- While the new field is still selected, modify below the name of the field that belongs to it : *Flange2*.



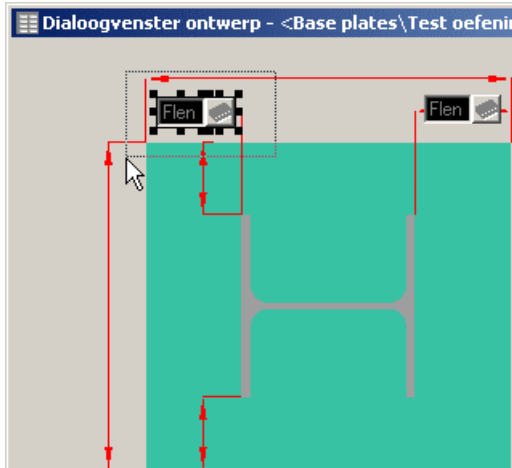
- Select just the copied button by clicking on it.



- While the button is still selected, modify below the name of the field that belongs to it : *Flange2*.


? *The groupname and the merged equations for this button have to be the same as the other button.*

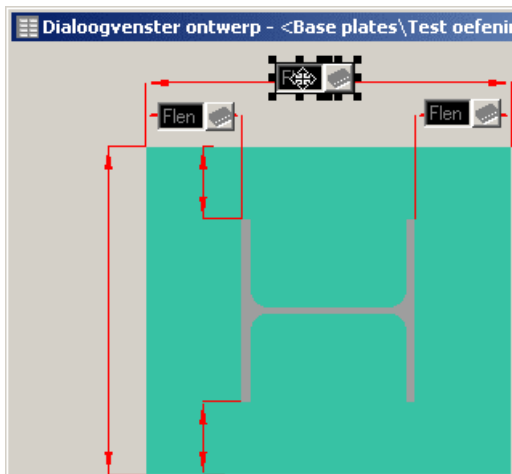
← Step 5 →



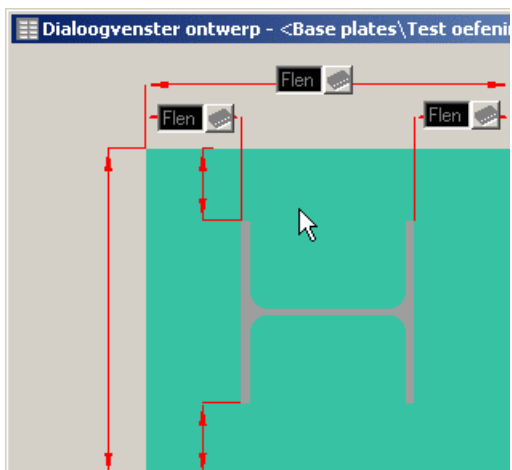
- Select the two fields together by making a window over both fields (keep the left mouse button pressed).



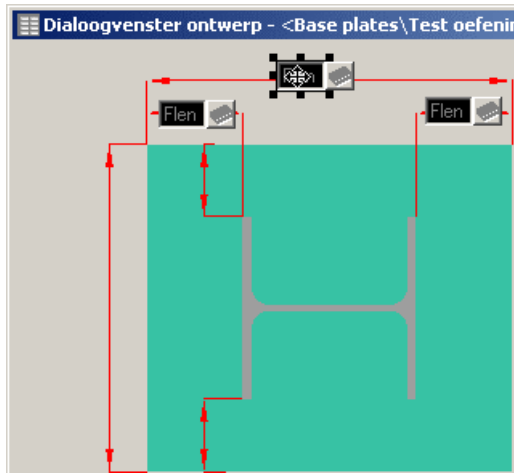
- While the fields are still selected, click on the button .



- Drag the copied fields to above as shown on the illustration.



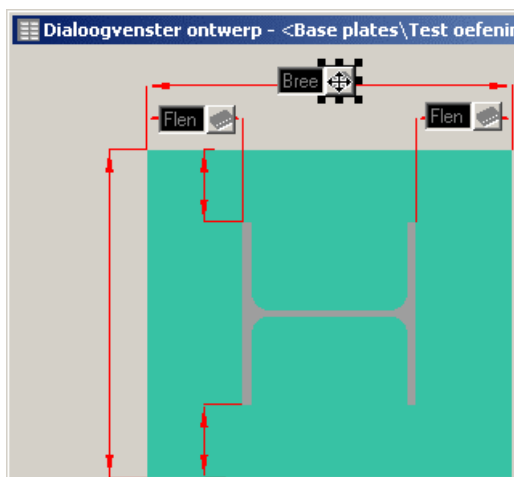
- Remove the selection by clicking the mouse somewhere on an empty space.



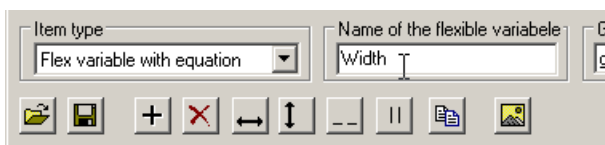
- Select just the copied field **Flange1** by clicking on it.



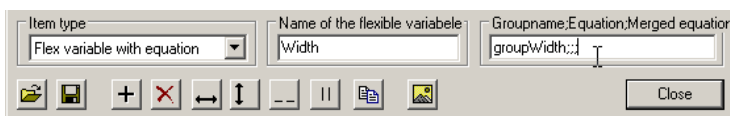
- While the new field is still selected, modify below the name of the field that belongs to it : *Width*.



- Select just the copied button by clicking on it.



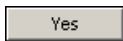
- While the button is still selected, modify below the name of the field that belongs to it : *Width*.



- While the button is still selected, remove the merged equation of the button: *GroupWidth;;;*



- Click on **Close**.



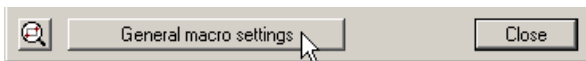
- Click on **Yes** to save the modifications you made to the dialog box.

← Step 6 →

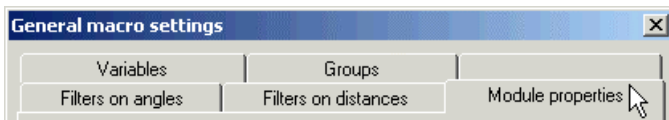
We will now use the new image dialog box in this macro.



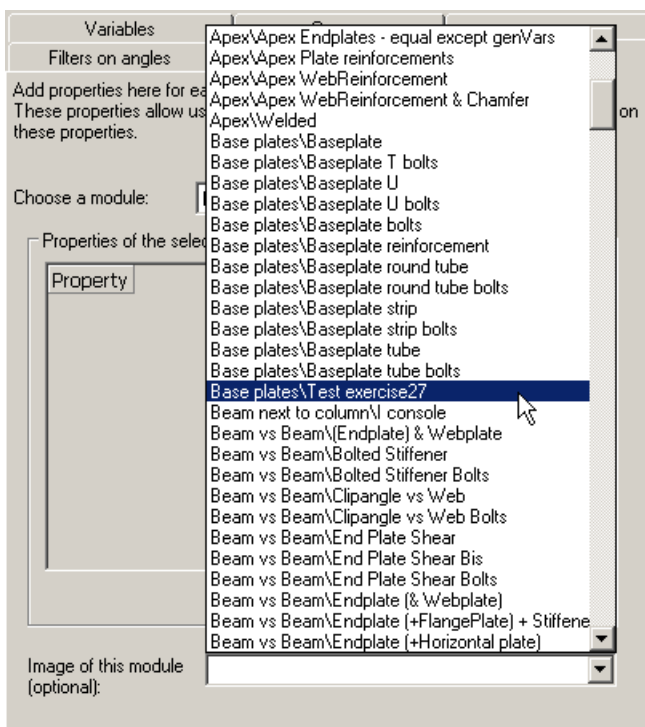
- Click on **Edit macro**



- Click below the dialog box on the button **General macro settings**.



- Activate the tab **Module properties**.



- Choose from the list below the dialog box : *Base plates\Test exercise27*



- Click on **OK**.



- Click on **Close**.

Step 7

? We will look at the possibilities of the buttons we just created.

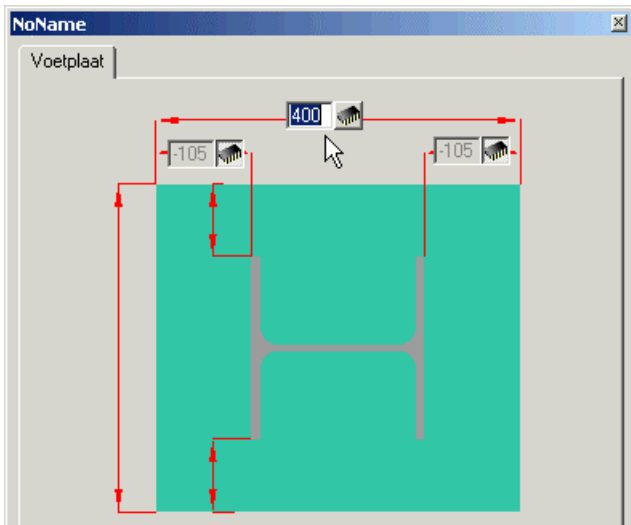
Always look at the modifications of the baseplate.



- Click on **Review macro**.

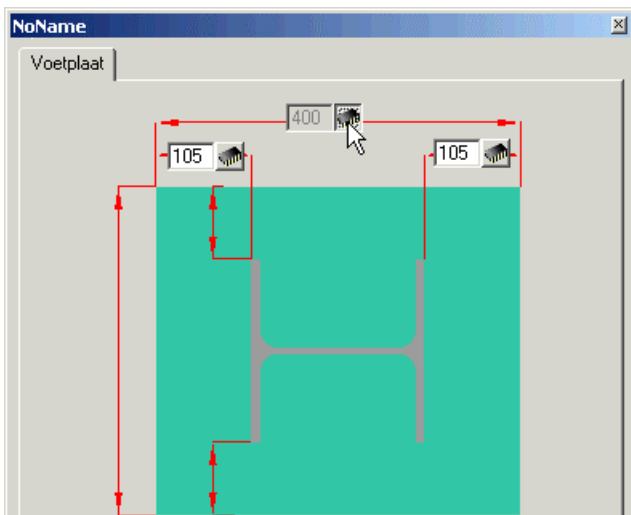


- Select the macro in the drawing and press **<Enter>**.



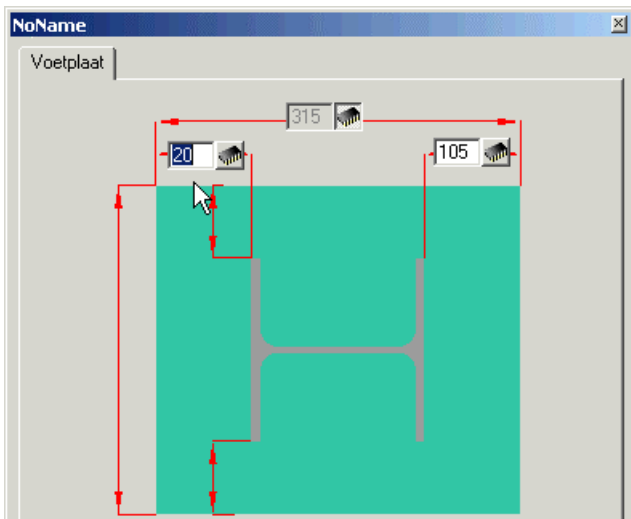
- Modify the total width to: 400.
Watch the modifications to the baseplate.
It is drawn centred.

? This dialog box takes care that when both buttons **Flange1** and **Flange2** are pushed, the equation **Flange1=Flange2** is added to the macro.
The correct settings inside the buttons make this possible.

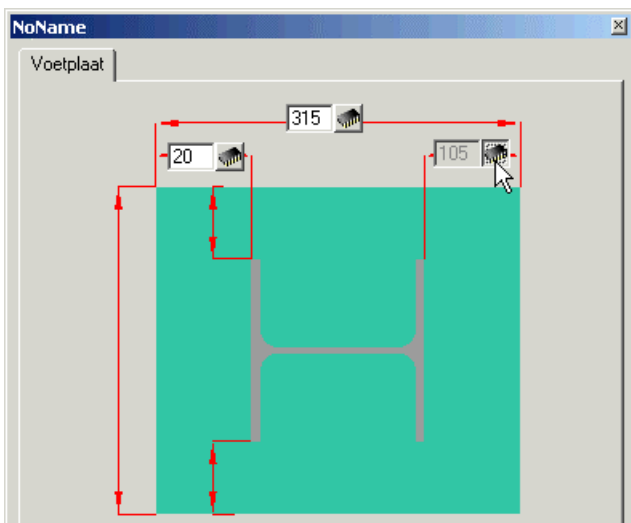


- Click on the button next to the total width.

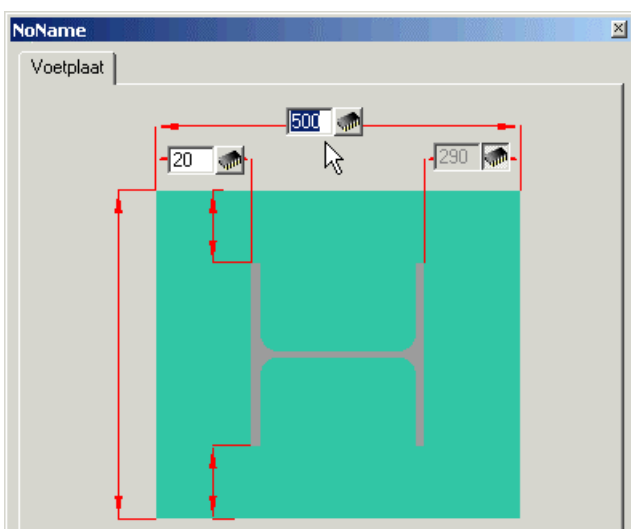
? The equation **Flange1=Flange2** is automatically removed from the macro.
This way the distances are adjustable independently.



- Modify the value of the left field to: 20.



- Click on the button next to the right field.



- Modify the total width to 500.

Exercise 28: Creating checkboxes

We can also create a checkbox on an image.


This is mostly used to change if an element is parallel or not.

We will first draw the geometric rules that are needed to create such a switch.

Then we will make the switch adjustable using a checkbox.

← Step 1 →



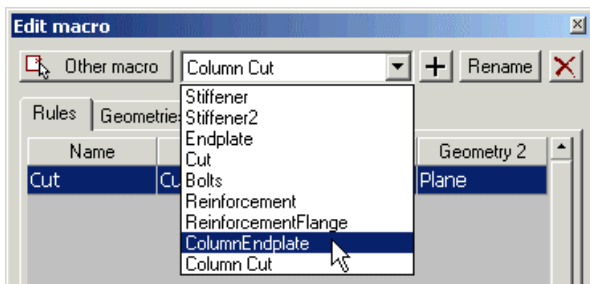
- Open the drawing  Exercise28.dwg



- Click on  **Edit macro**



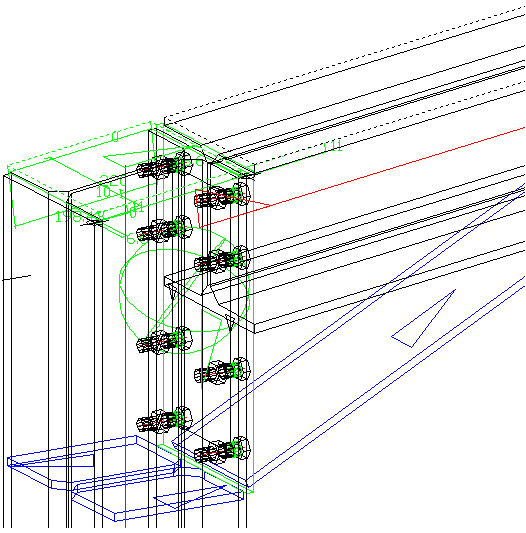
- Select the macro in the drawing.



- Select in the list at the top the module: *ColumnEndplate*.

Name	Rule	Geometry 1	Geometry 2
Extension2	Distance	Plane	Line
GetFlangeWidth	Distance	Plane	Plane
Length	Distance	Plane	Plane
	Coincident	Line	Point
setOffset	Distance	Plane	Point
	Coincident	Line	Point
setOffset2	Distance	Plane	Point
WeldSpace2	Distance	Plane	Point
WeldSpace	Distance	Plane	Point
	Perpendicular	Plane	Plane
	Coincident	Plane	Plane

- Select the last geometric rule

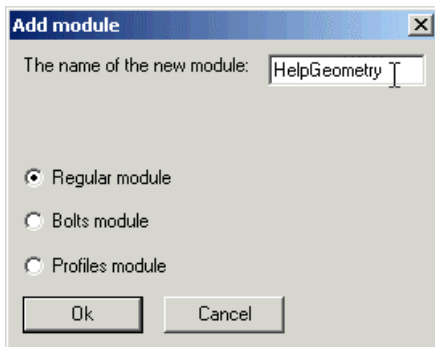


? This geometric rule puts the endplate always on the same plane as the top of the beam.
 We will modify this in this exercise by making the inclination of the endplate adjustable: either inclined along the inclination of the beam, or completely horizontal.

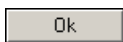
← Step 2 →



- At the top of the dialog box, click on **+** **Add new module**.



- Enter in the dialog box for the **Name** of the new module : *HelpGeometry*




- Click on **Ok**.



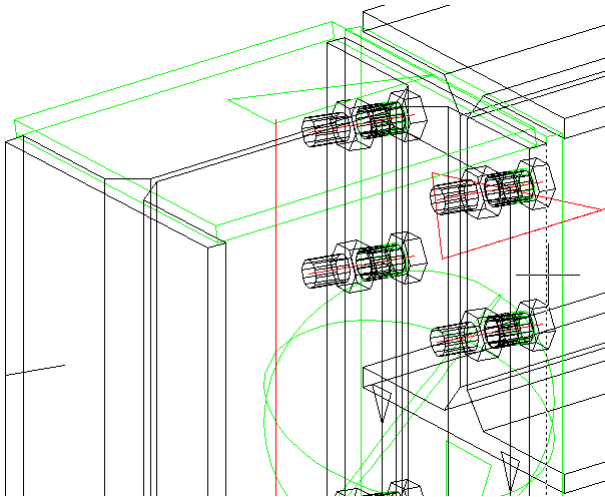
- Click on **Close**.

← Step 3 →

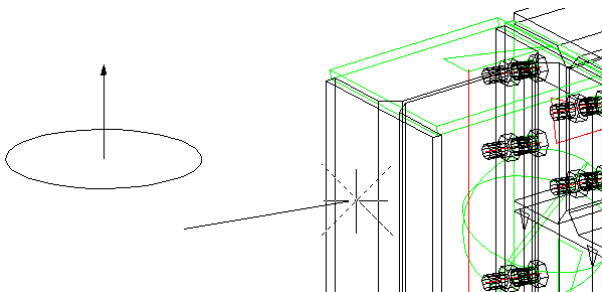
 We will use a line and a plane as helpgeometry to calculate the switch between inclined and horizontal.



- Click on  **Coincident**



- Select the most right vertical line of the column by pressing the left mouse button. Now press the right mouse button to confirm.



- Select the most right point of the helpline by pressing the left mouse button. Now press the right mouse button to confirm.

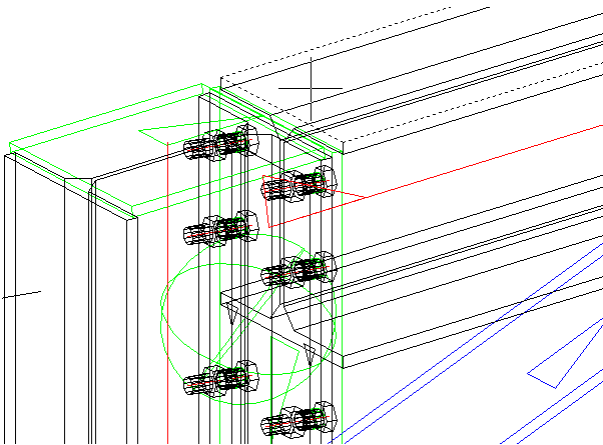
Close

- Click on **Close**.

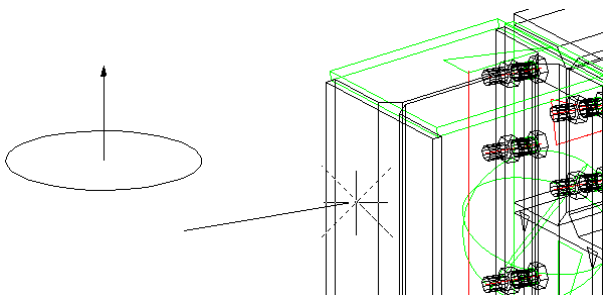
← Step 4 →



- Click on **Coincident**



- Select the upper plane of the beam by pressing the left mouse button. Now press the right mouse button to confirm.




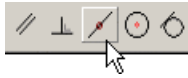
- Select the most right point of the helpline by pressing the left mouse button. Now press the right mouse button to confirm.



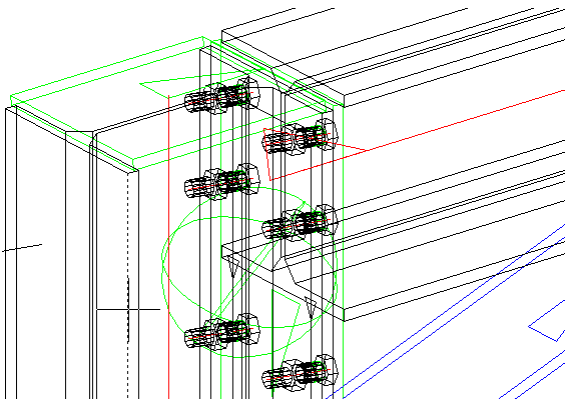
- Click on **Close**.

← Step 5 →

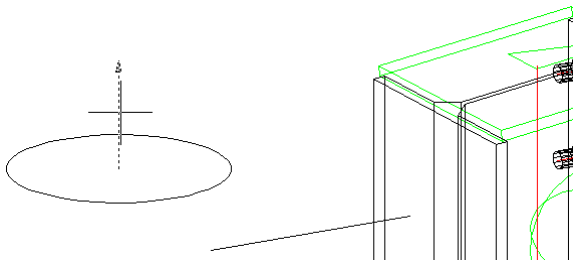
 With these rules we've constrained one point of the line. We will constrain the second point later.



- Click on  **Coincident**



- Select the front vertical line of the column by pressing the left mouse button. Now press the right mouse button to confirm.

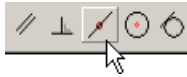


- Select the vertical line of the plane-object by pressing the left mouse button. Now press the right mouse button to confirm.

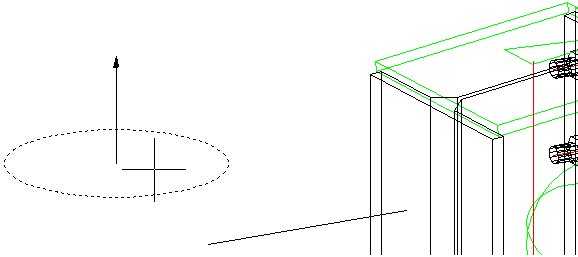
Close

- Click on **Close**.

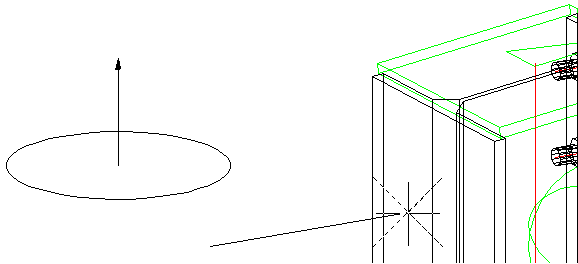
← Step 6 →



- Click on **Coincident**



- Select the plane of the plane-help object by pressing the left mouse button. Now press the right mouse button to confirm.



- Select the most right point of the helpline by pressing the left mouse button. Now press the right mouse button to confirm.

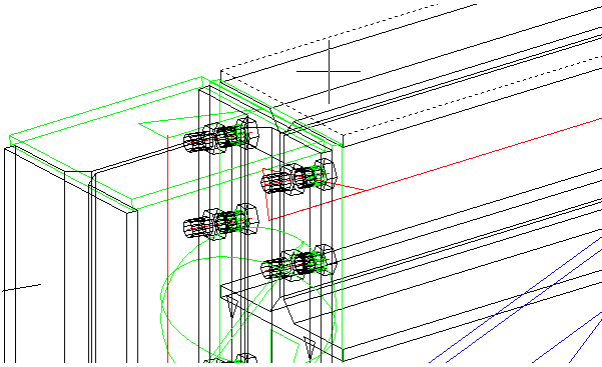


- Click on **Close**.

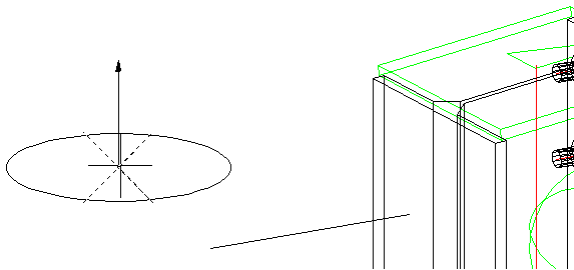
← Step 7 →



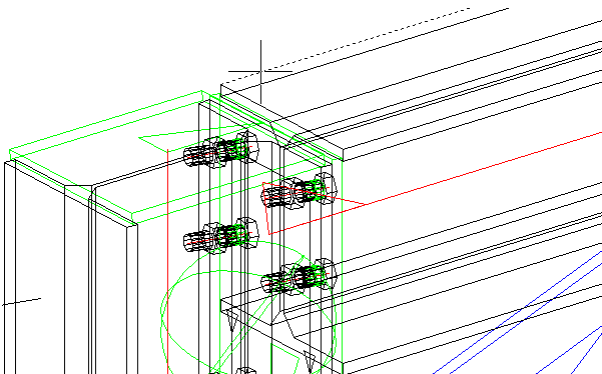
- Click on  **Distance between**



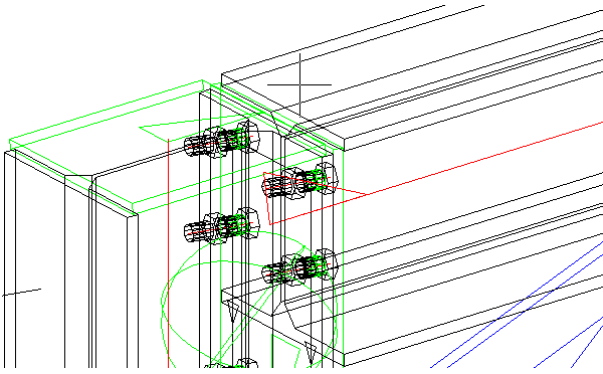
- Select the upper plane of the beam by pressing the left mouse button once. Now press the right mouse button to confirm.



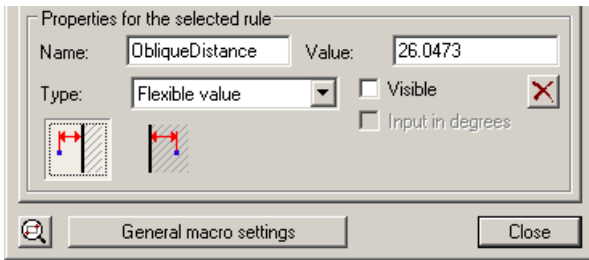
- Select the point of the plane-help object by pressing the left mouse button once. Now press the right mouse button to confirm.




- Select the top line of the beam and press the right mouse button to confirm.




- Choose a point somewhere in the neighbourhood of the column.



- In the dialog box below, enter for the property **Name** : *ObliqueDistance*


- Click on the button 
- Select for **Type** from the list : *Flexible value*
- Deactivate the checkbox **Visible**.
- Click on **Close**.

 We will use this geometric rule to measure the distance between the column and the plane. We will use the variable **ObliqueDistance** later to set put the line horizontal.

Close

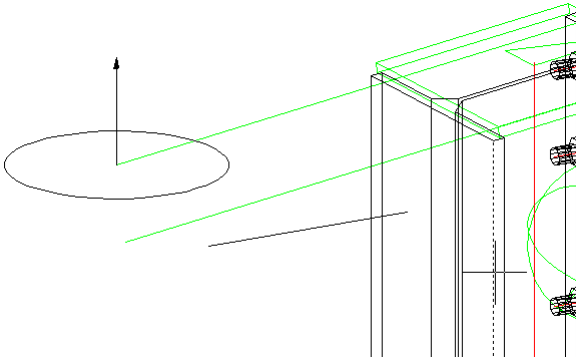
- Click on **Close**.

Step 8

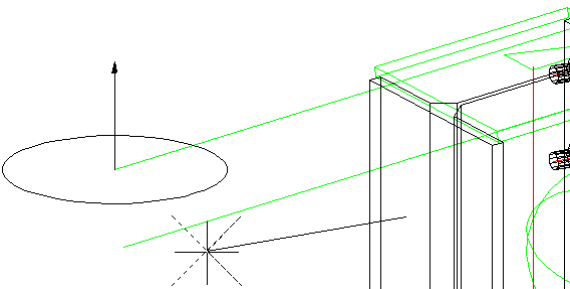
 We only have to constrain the left point of the line. We will do this with the following 2 geometric rules.



- Click on  **Coincident**



- Select the front vertical line of the column by pressing the left mouse button. Now press the right mouse button to confirm.



- Select the most left point of the helpline by pressing the left mouse button. Now press the right mouse button to confirm.

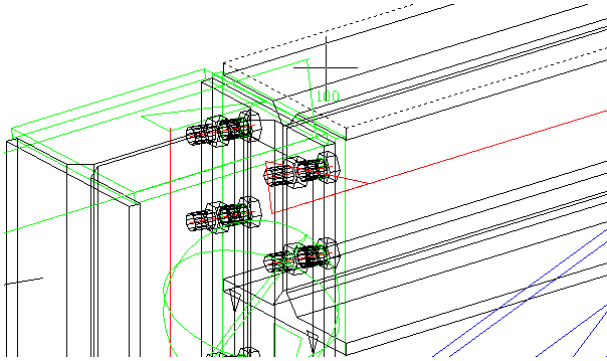
Close

- Click on **Close**.

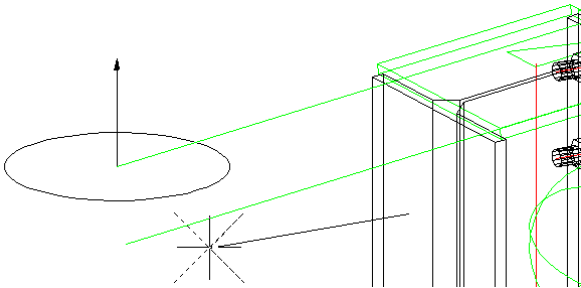
← Step 9 →



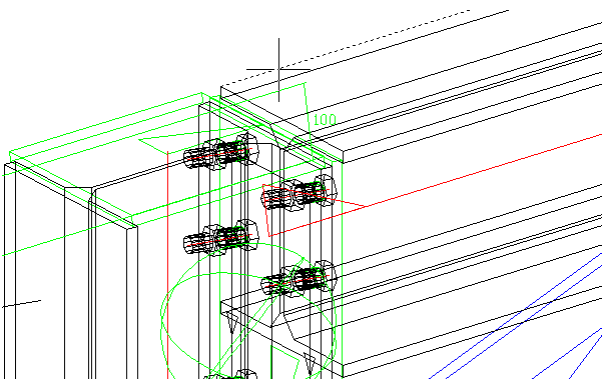
- Click on  **Distance between**



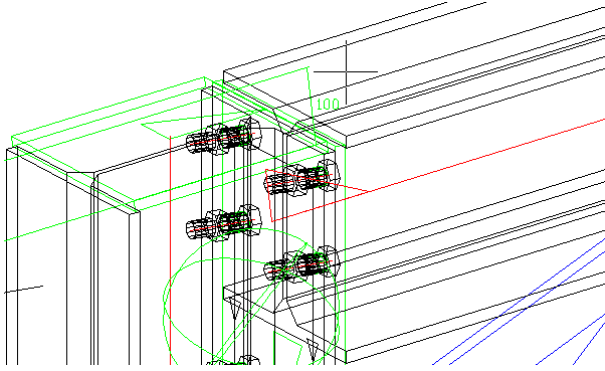
- Select the upper plane of the beam by pressing the left mouse button once. Now press the right mouse button to confirm.



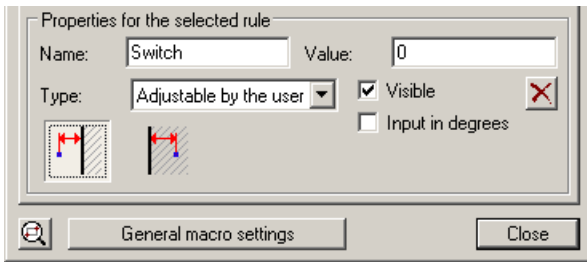
- Select the most left point of the helpline and then press the right mouse button to confirm.



- Select the top line of the beam and press the right mouse button to confirm.



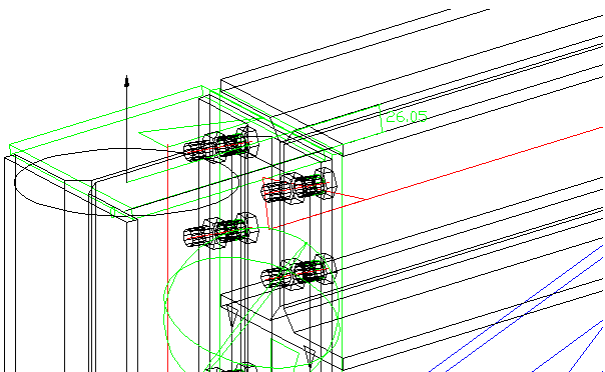
- Choose a point somewhere in the neighbourhood of the beam.



- In the dialog box below, enter for the property **Name** : *Switch*
- Enter for the value: *0*
- Click on the button
- Click on **Close**.



- Click on **Recalculate all**.



- By setting the variable **Switch** to 0 the helpline will be drawn inclined.*

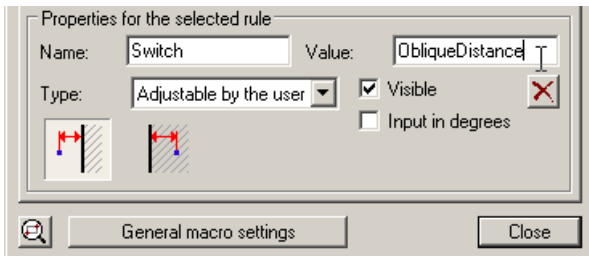
← Step 10 →



- Click on  **Edit macro**

Name	Rule	Geometry 1	Geometry 2
	Coincident	Line	Point
	Coincident	Plane	Point
	Coincident	Line	Line
	Coincident	Plane	Point
ObliqueDistan	Distance	Plane	Point
	Coincident	Line	Point
Switch	Distance	Plane	Point

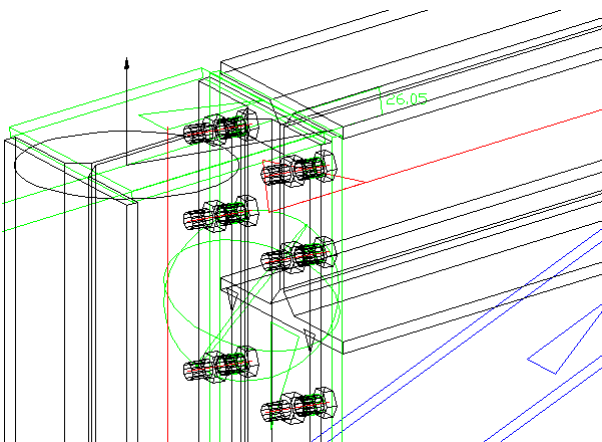
- Select the bottom rule **Switch**.




- Enter for the property **Value** :
ObliqueDistance
- Click on **Close**.



- Click on  **Recalculate all**.

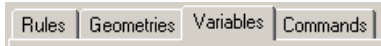


 *The line is now horizontal due to the value modification of **Switch**.
In the next step step we will make this switch between **0** and **ObliqueDistance** adjustable with the help of an equation.*

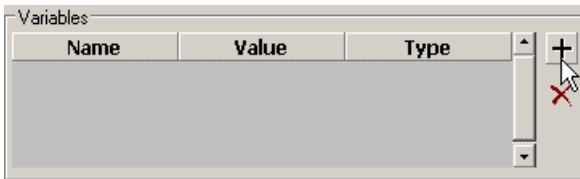
← Step 11 →




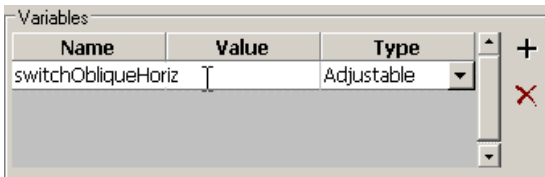
- Click on  **Edit macro**



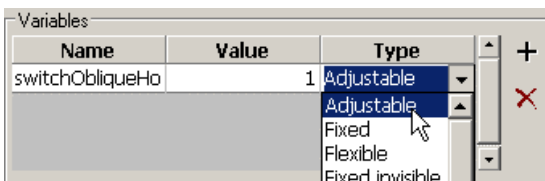
- Activate the tab **Variables**



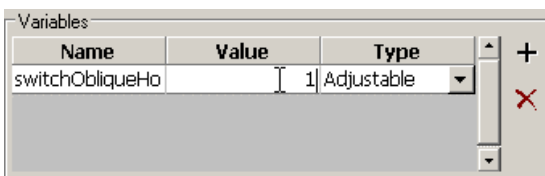
- In the section *Variables*, click on the button  **Add variable**.



- Enter under the column **Name** the name for the new variable : *switchObliqueHoriz*



- Click on the arrow  under the column **Type** and select from the list: *Adjustable*



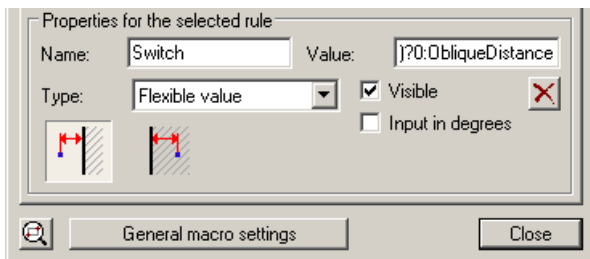
- Enter under the column **Value** : *1*



- Activate the tab **Rules**

Name	Rule	Geometry 1	Geometry 2
	Coincident	Line	Point
	Coincident	Plane	Point
	Coincident	Line	Line
	Coincident	Plane	Point
ObliqueDistan	Distance	Plane	Point
	Coincident	Line	Point
Switch	Distance	Plane	Point

- Select the bottom rule **Switch**.



- Enter for the value the following equation :
 $(SwitchObliqueHoriz)?0:ObliqueDistance$

- Click on **Close**.

The meaning of this equation is as follows :
 $(ForValue)?ValueIfTrue:ValueIfFalse$
 You can compare this to the conditional statement "IF THEN ELSE" for the programmers among us.
 If the variable between the brackets **is larger than 0**, then the first variable behind the questionmark will be used.
 If the variable between the brackets **is uqal to or smaller than 0**, then the second variable behind the colon will be used.

← Step 12 →



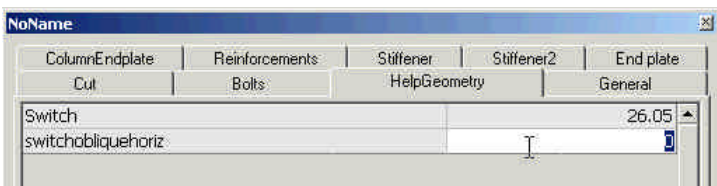
- Click on **Review macro**.



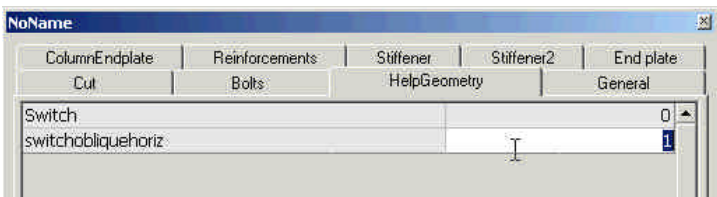
- Select the macro in the drawing and press **<Enter>**.



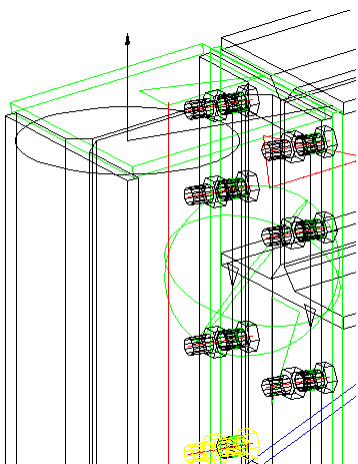
- Activate the tab **HelpGeometry**.



- Modify the value of **switchobliquehoriz** to :
0.



- Modify the value of **switchobliquehoriz** back
to : 1.



Look at the helpline in the drawing and also at the value of the variable **Switch** while making the changes.
The equation switches the value of **Switch** to 0 and 26.05.

← Step 13 →

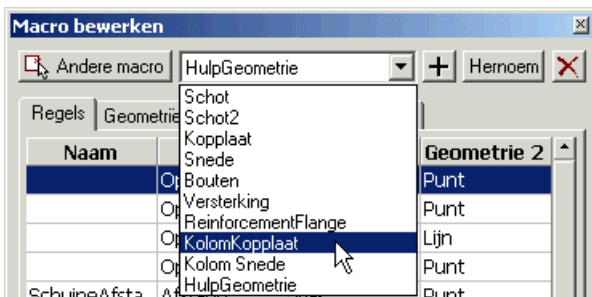
Now that the line can switch between inclined and horizontal we still need to let the endplate do the same.



- Click on **Edit macro**



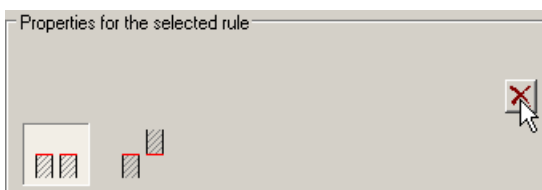
- Select the macro in the drawing.



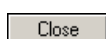
- Choose at the top from the list the module: *ColumnEndplate*.

Naam	Regel	Geometrie 1	Geometrie 2
Thickness	Afstand	Vlak	Vlak
Width	Afstand	Vlak	Vlak
Extension	Afstand	Vlak	Lijn
Extension2	Afstand	Vlak	Lijn
GetFlangeWid	Afstand	Vlak	Vlak
Length	Afstand	Vlak	Vlak
	Op elkaar	Lijn	Punt
setOffset	Afstand	Vlak	Punt
	Op elkaar	Lijn	Punt
setOffset2	Afstand	Vlak	Punt
WeldSpace2	Afstand	Vlak	Punt
WeldSpace	Afstand	Vlak	Punt
	Loodrecht	Vlak	Vlak
	Op elkaar	Vlak	Vlak

- Select the bottom rule.



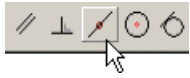
- Click below the dialog box **(not at the top)** on the button



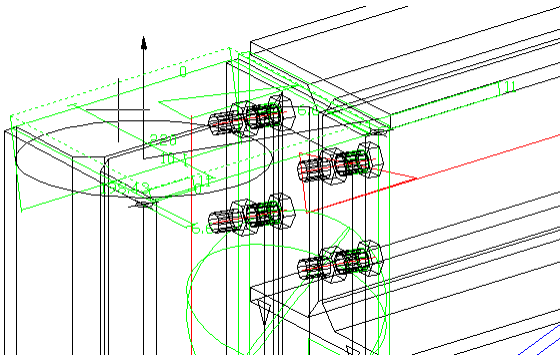
- Click on **Close**.

Step 14

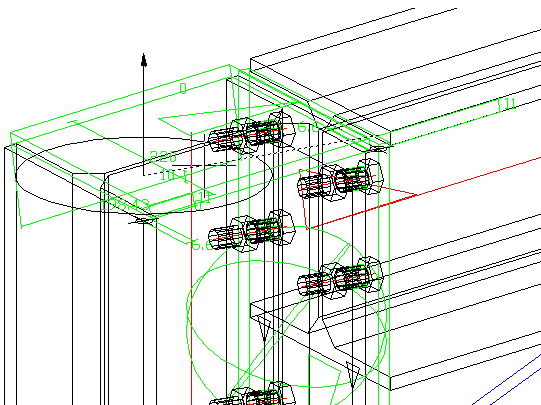
We will replace the rule that we just deleted with 2 new rules that put the plate on the helpline.



- Click on **Coincident**



- Select the upper plane of the endplate by pressing the left mouse button. Now press the right mouse button to confirm.



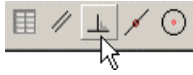
- Select the helpline by pressing the left mouse button. Now press the right mouse button to confirm.



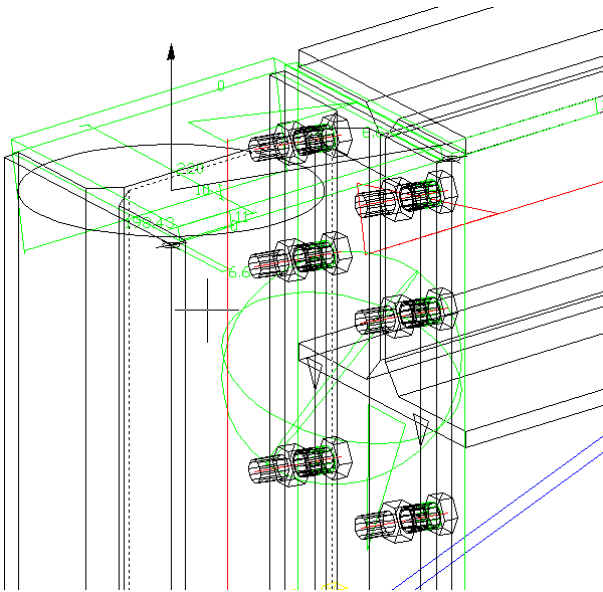
- Click on **Close**.

← Step 15 →

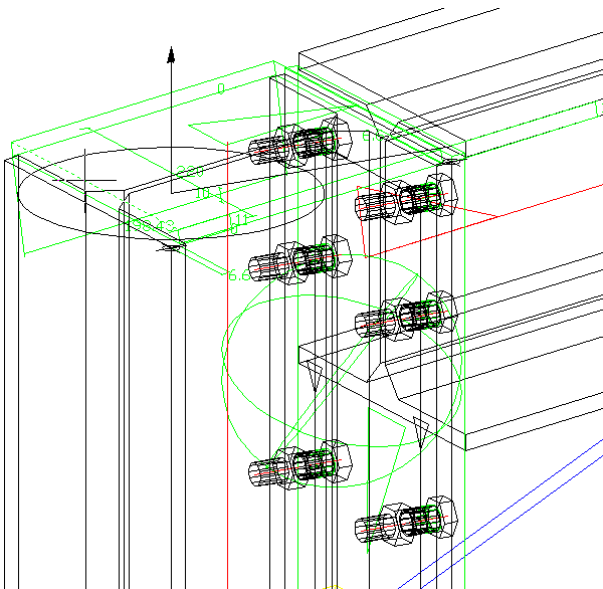
? The previous rule puts the plate on the line, but the plate can still freely 'move' around X-axis. (due to working with a line we need more rules) This is why we add a second rule that removes the freedom.



- Click on **Perpendicular ...**



- Select the web plane of the column by pressing the left mouse button. Now press the right mouse button to confirm.



- Select the most left line of the endplate at the top by pressing the left mouse button. Now press the right mouse button to confirm.



- Click on **Close**.

← Step 16 →



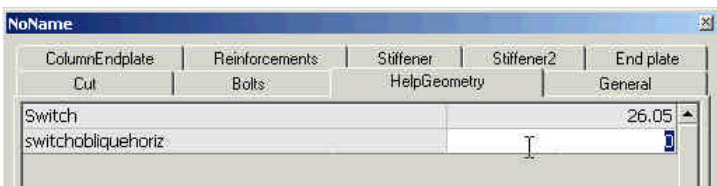
- Click on  **Review macro**.



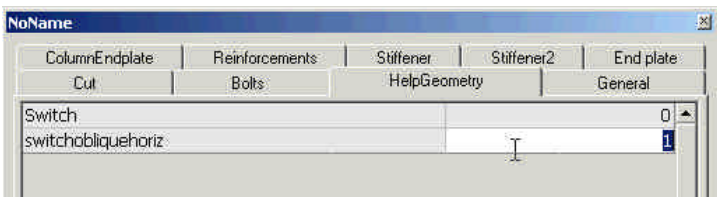
- Select the macro in the drawing and press **<Enter>**.



- Activate the tab **HelpGeometry**.



- Modify the value of **switchobliquehoriz** to :
0.



- Modify the value of **switchobliquehoriz** back
to : **1**.



- Click on **Close**.


← Step 17 →

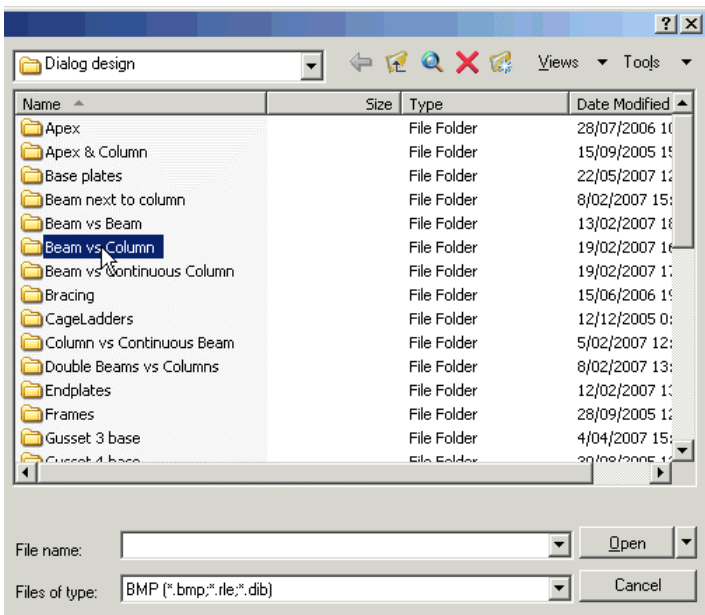
? The geometry is ready, now we only have to create the checkbox inside the dialog box.



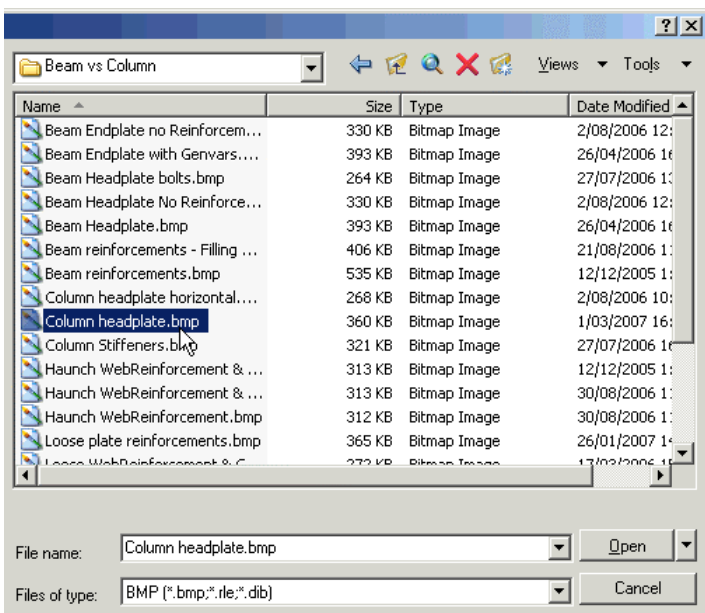
- Start the command  **Create dialog boxes**.



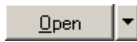
- Click on the button .



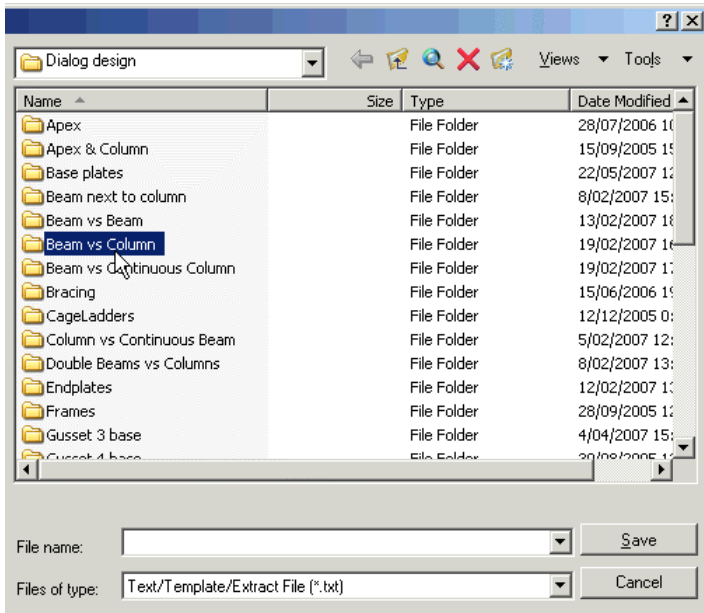
- Open the directory *Beam vs Column* in the dialog box that has popped up.



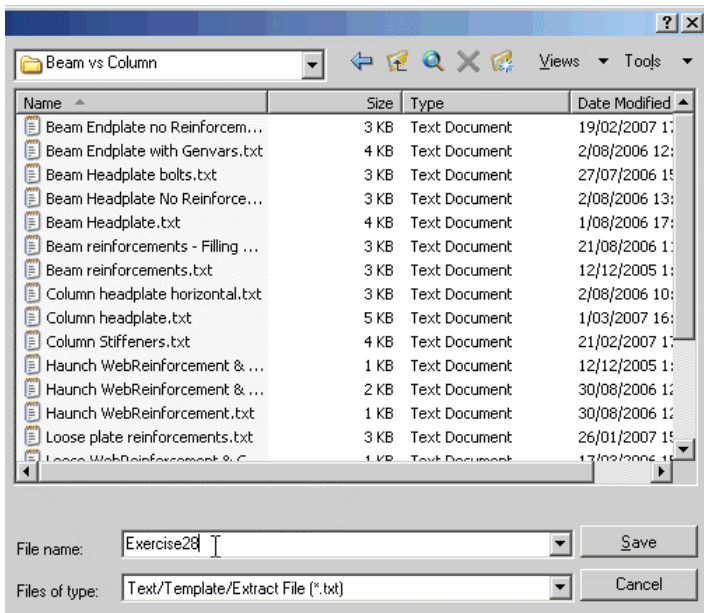
- Select the bitmap file *Column Headplate.bmp*.



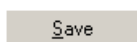
- Click on the button **Open**.



- Open the directory *Beam vs Column* in the new **Save** dialog box that has popped up.




- Enter for the filename : *Exercise28*

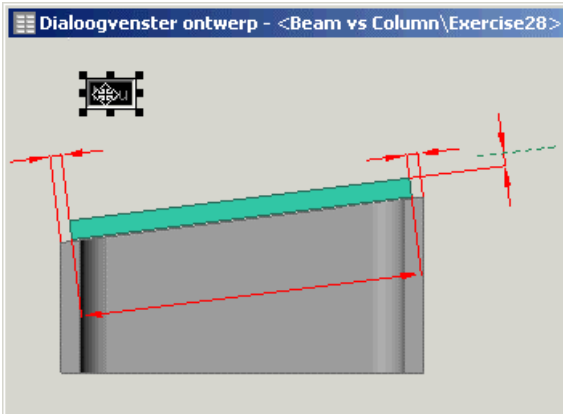


- Click on **Save**.

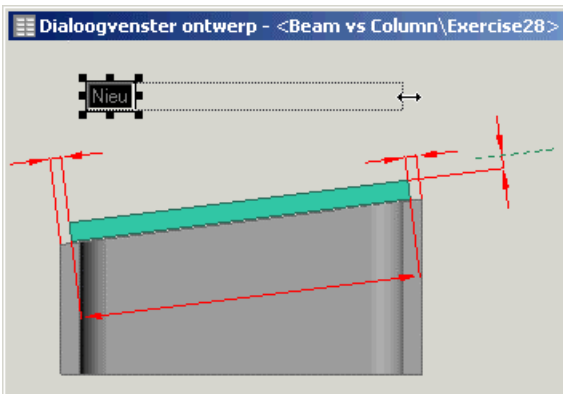
← Step 18 →




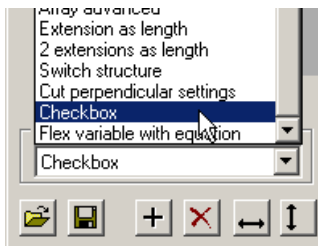
- Click on the button 



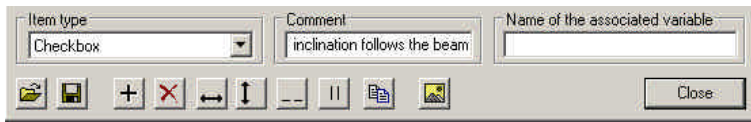
- Drag the new field by keeping the left mouse button pressed. Move the mouse while the left mouse button is pressed and move the field to the top as shown in the illustration.



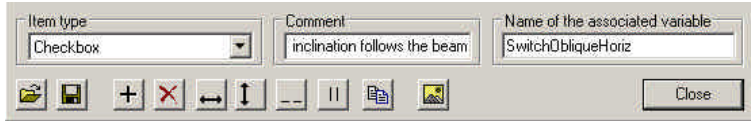
- Enlarge the field by moving the cursor to above the right rectangle . Then press the left mouse button and keep it pressed. Drag so that the field enlarges to the right side.



- While the new field is still selected, modify below the **Item Type** of the field to: *Checkbox*



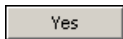
- While the new field is still selected, modify below the **Comment** of the field to:
Endplate's inclination follows the beam.



- While the new field is still selected, modify below the settings **Name of the associated variable** to:
switchobliquehoriz



- Click on **Close**.



- Click on **Yes** to save the modifications you made to the dialog box.

Step 19

We will use the new dialog box in the macro.



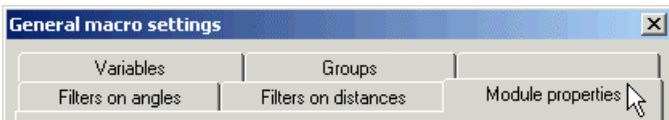
- Click on **Edit macro**



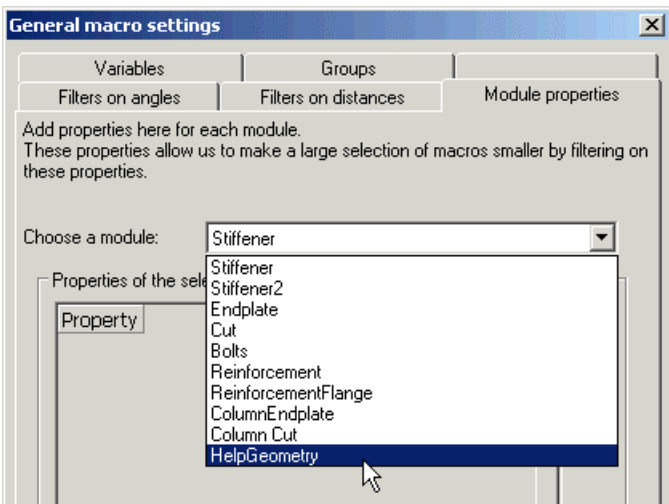
- Select the macro in the drawing.



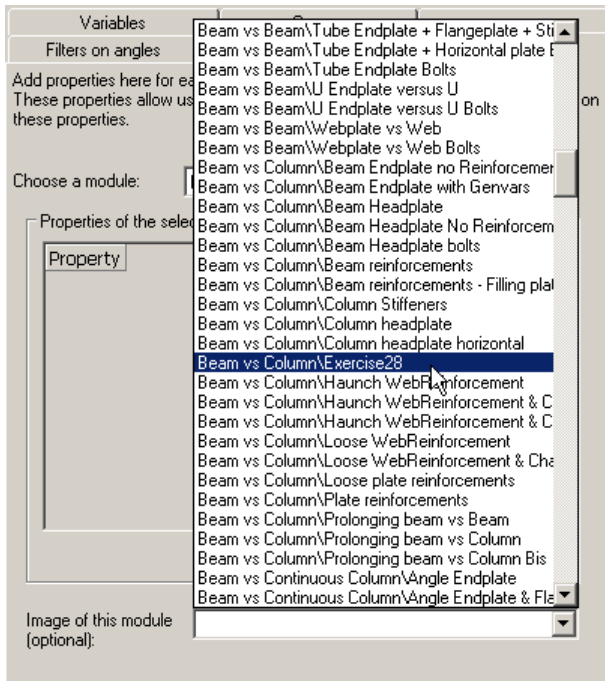
- Click below the dialog box on the button **General macro settings**.



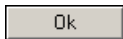
- Activate the tab **Module properties**.



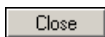
- Choose from the list at the top the module : *HelpGeometry*



- Choose from the list below the dialog box :
Beam vs Column\Exercise28



- Click on **Ok**.



- Click on **Close**.

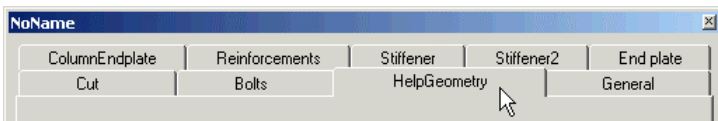
← Step 20 →



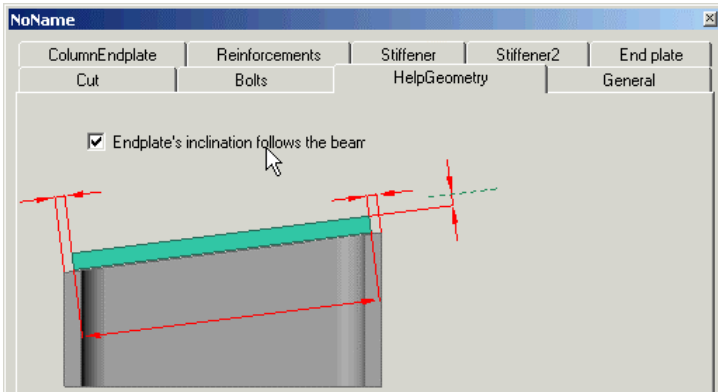
- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



- Activate the tab **HelpGeometry**.




- Activate and deactivate the checkbox **Endplate's inclination follows the beam** and watch the changes in the drawing.

Exercise 29: Hiding help geometry

The help geometry that we use inside a macro stands in the way.
For the finishing of the macro we can hide this help geometry.
This way the help geometry is still a part of the macro.

← Step 1 →

 We will hide the plane-object and the helpline of the previous exercise.



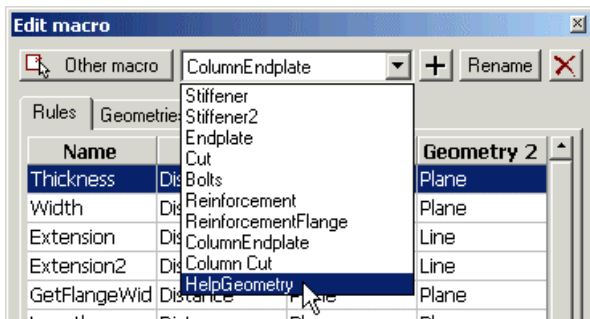
- Open the drawing  Exercise29a.dwg



- Click on  **Edit macro**



- Select the macro in the drawing.



- Choose at the top from the list the module: *HelpGeometry*.



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
HEA220(210675)	Base	Fixed	<input type="checkbox"/>
Line(210675636)	Base	Flexible	<input checked="" type="checkbox"/>
HEA220(210675)	Base	Fixed	<input type="checkbox"/>
Plane(21067563)	Base	Rigid	<input type="checkbox"/>

- Activate the checkbox in the last column of the row of the line.

Element	Geometry	Flexibility	Ai
HEA220(210675)	Base	Fixed	<input type="checkbox"/>
Line(210675636)	Base	Flexible	<input checked="" type="checkbox"/>
HEA220(210675)	Base	Fixed	<input type="checkbox"/>
Plane(21067563)	Base	Rigid	<input checked="" type="checkbox"/>

- Activate the checkbox in the last column of the row of the plane.

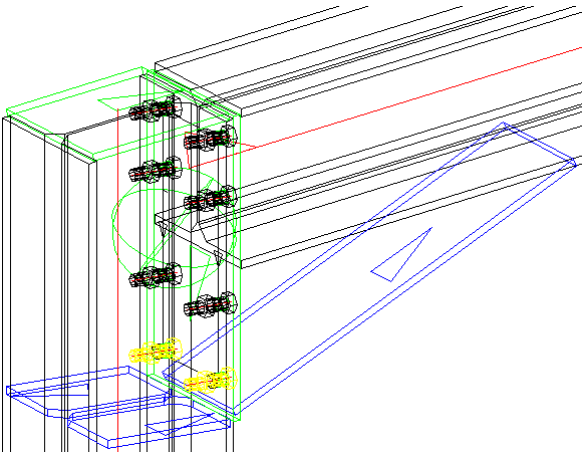
Close


- Click on **Close**.




- Start the command  **Set macro as current**.

- Press the **<Enter>** key so that the edit mode of the macro is deactivated.




 *The helpgeometry is only hidden when we deactivate the edit mode of the macro. The helpgeometry only becomes visible if you activate a module that uses the helpgeometry.*

← Step 2 →

 If we use a plate as helpgeometry, then something more has to be done than just hiding the plate.



- Open the drawing  Exercise29b.dwg



- Click on  **Edit macro**



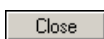
- Select the macro in the drawing.



- Activate the tab **Geometries**

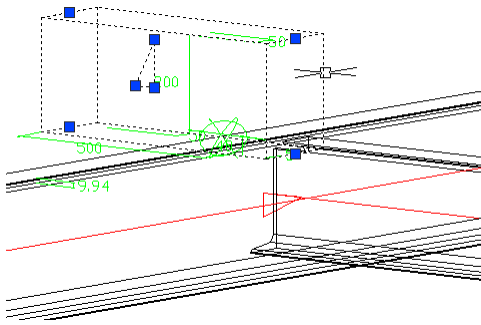
Element	Geometry	Flexibility	Ai
UPN300(210706	Base	Fixed	<input type="checkbox"/>
P240X185-605(2	Base	Flexible	<input checked="" type="checkbox"/>
UPN240(210706	Base	Fixed	<input type="checkbox"/>

- Activate the checkbox in the last column of the row of the plate.

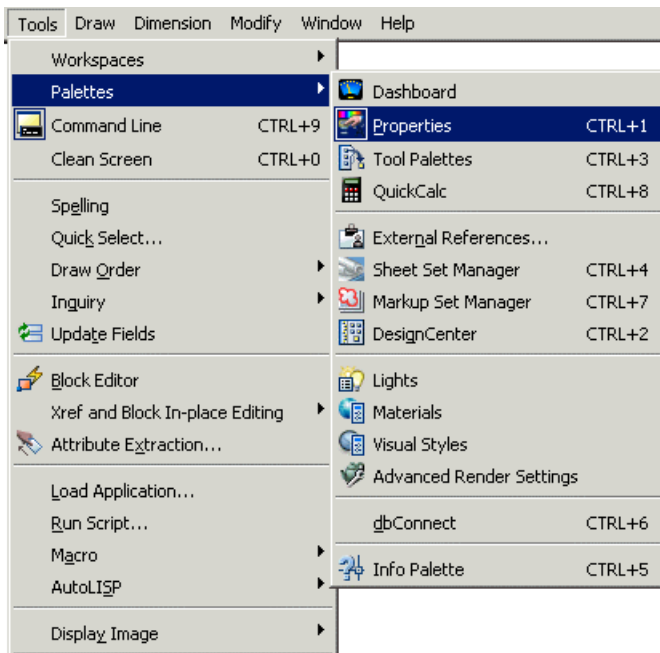


- Click on **Close**.

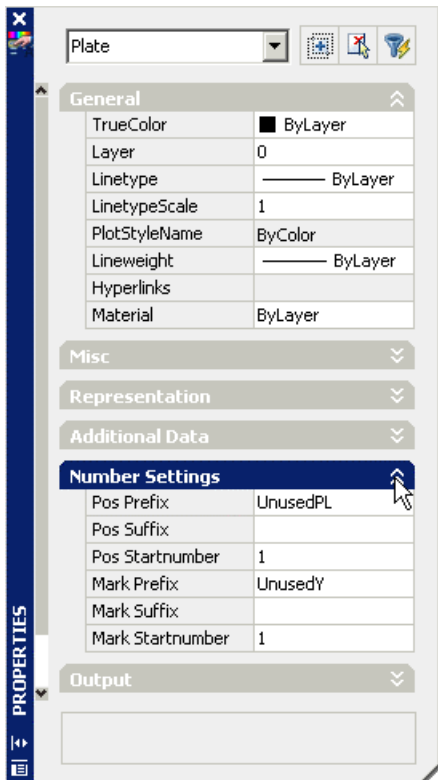
← Step 3 →



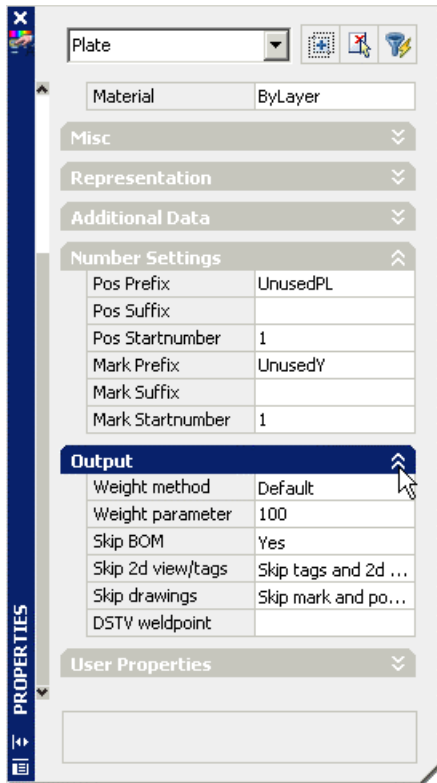
- Select the plate.




- Start the Properties dialog box through the menu **Tools > Palettes > Properties**.



- Open the group **Number Settings** by pressing the arrows .



- Open the group **Output** by pressing the arrows .

 Look at the following settings in this dialog box:

- **Pos Prefix**
- **Mark Prefix**
- **Skip BOM**
- **Skip 2D view/tags**
- **Skip drawings**

When we set this plate as helpgeometry Parabuild has automatically modified these settings for us.

*For example **Pos Prefix** is now set to *UnusedPL* so that the plate doesn't get a number that falls between the number of other plates.*

Also the bill of materials, the 2D drawings and the workshop drawings are being skipped for this plate.


Exercise 30: General variable

It can happen that a variable is needed in multiple modules.
Or maybe we want to move a variable from one tab to another.
Normally these things aren't possible due to the limitations of modules, but we can circumvent these limitations when we use general variables.
A general variable is a variable that exists in an entire macro.
The variable is available in all modules of the macro.

◀ Step 1 ▶

⚠ *Exercise 25 and 28 should be completed before you can start this exercise.*



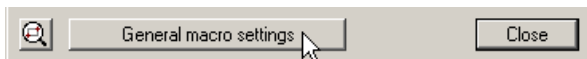
- Open the drawing  Exercise30.dwg



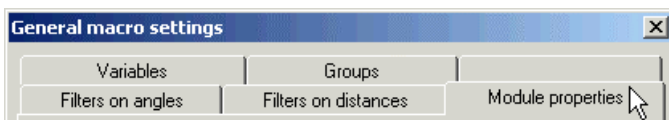
- Click on  **Edit macro**



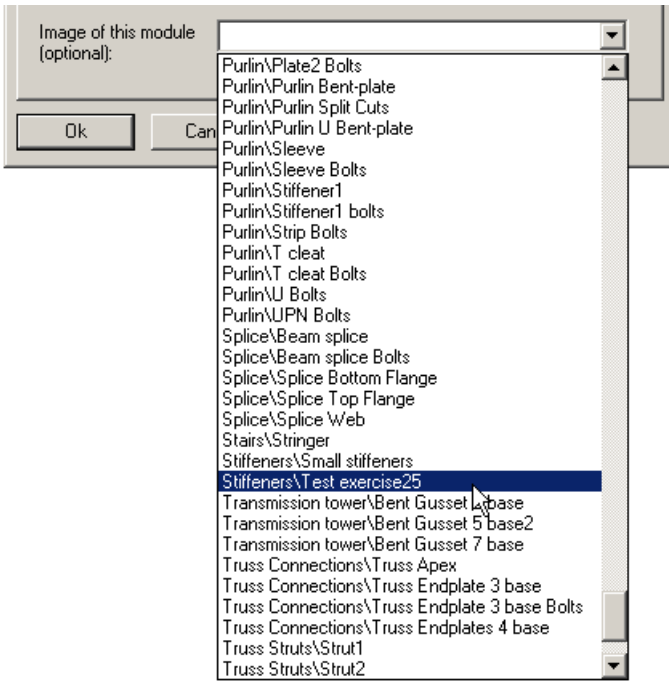
- Select the macro in the drawing.



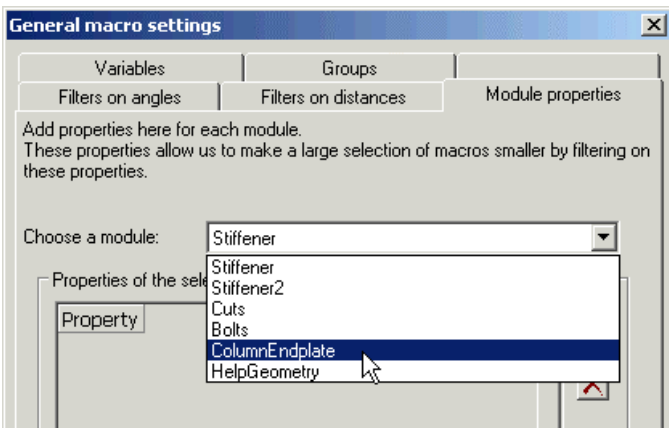
- Click below the dialog box on the button **General macro settings**.



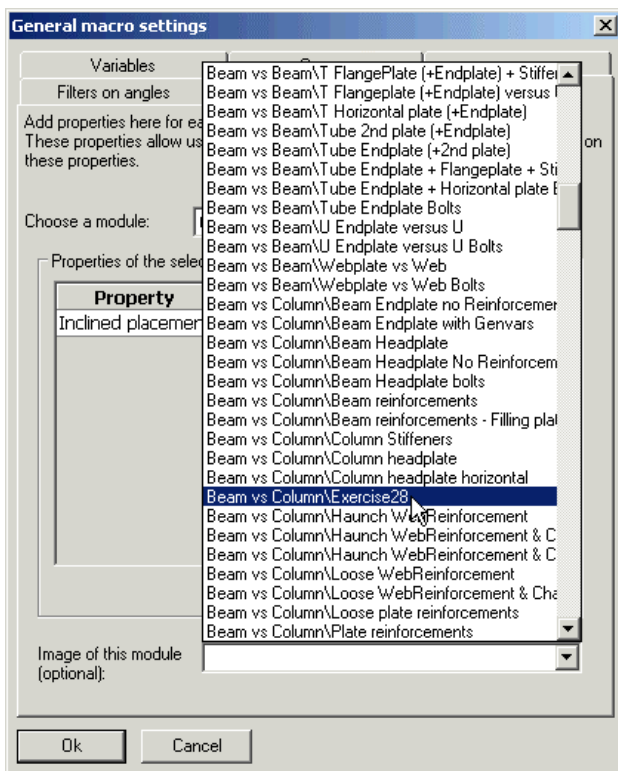
- Activate the tab **Module properties**.



- Choose from the list below the dialog box :
Stiffeners\Test exercise25



- Choose from the list at the top the module :
ColumnEndplate



- Choose from the list below the dialog box :
Beam vs Column\Exercise28

- Click on **Ok**.



- Click on **Close**.

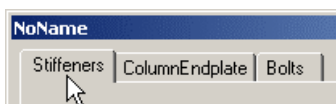
← Step 2 →



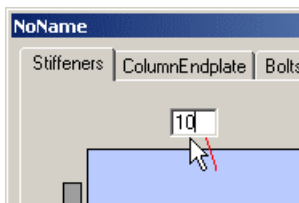
- Click on  **Review macro**.




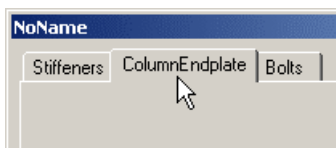
- Select the macro in the drawing and press **<Enter>**.



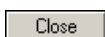
- Activate the tab **Stiffeners**.



 *In this exercise we will move the thickness (10) on the tab **Stiffeners** to the tab **ColumnEndplate**.*



- Activate the tab **ColumnEndplate**.



- Click on **Close**.

← Step 3 →



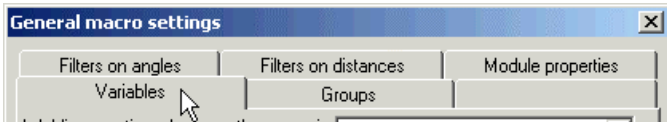
- Click on  **Edit macro**



- Select the macro in the drawing.




- Click below the dialog box on the button **General macro settings**.



- Activate the tab **Variables**.

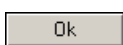
Name	Value
gen_StiffenersThickness	

- Enter in the middle of the dialog box in the column **Name** : *gen_StiffenersThickness*.

 *A general variable should always commence with gen_ for the recognition of it so that they can be split apart from the regular variables.*

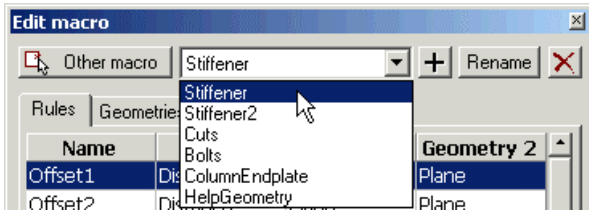
Name	Value
gen_StiffenersThickness	10

- Enter in the middle of the dialog box in the column **Value** : 10.



- Click on **Ok**.

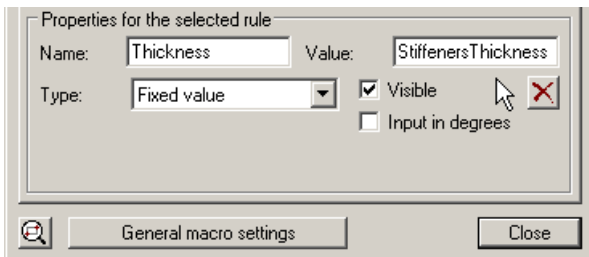
← Step 4 →



- Choose in the list at the top the module : **Stiffener**.

Name	Rule	Geometry 1	Geometry 2
Offset1	Distance	Plane	Plane
Offset2	Distance	Plane	Plane
Offset3	Distance	Plane	Plane
Extension	Distance	Plane	Plane
Thickness	Distance	Plane	Plane
Chamfer	Distance	Plane	Line
ChamferAngle	Angle	Plane	Plane
Radius	Radius	Cylinder	
	Tangent	Cylinder	Plane
	Tangent	Cylinder	Plane
ColumnRadius	Radius	Cylinder	
	Coincident	Plane	Point

- Select in the list the geometric rule : **Thickness**.



- Below, modify the setting **Value** to : *gen_StiffenersThickness*
- Deactivate the checkbox **Visible**.
- Click on **Close**.

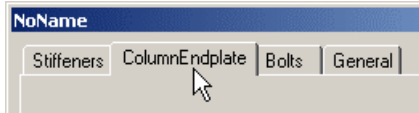
← Step 5 →



- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



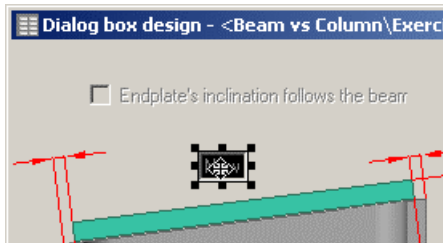
- Activate the tab **ColumnEndplate**.



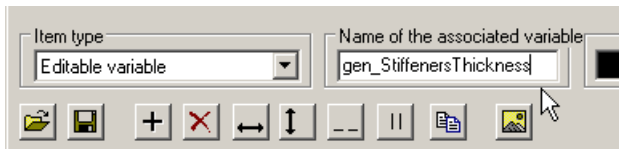
- Press the function key **<F12>**.



- Click on the button .



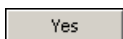
- Select the new field.



- While the new field is still selected, Modify the setting **Name of the associated variable** to : *gen_StiffenersThickness*



- Click on **Close**.



- Click on **Yes** to save the modifications you made to the dialog box.

← Step 6 →



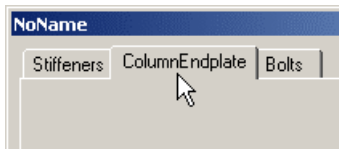
- Click on **Close**.



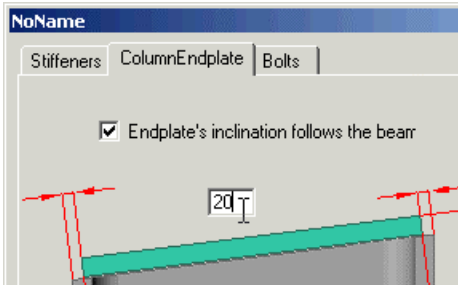
- Click on  **Review macro**.



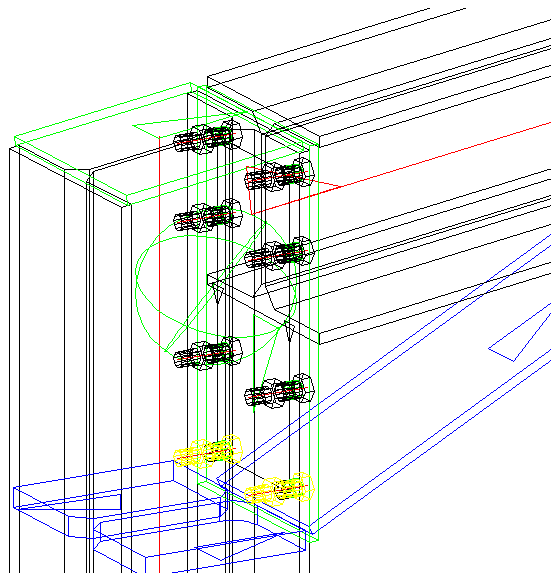
- Select the macro in the drawing and press **<Enter>**.



- Activate the tab **ColumnEndplate**.



- Modify the thickness of the stiffener to : 20.




Exercise 31: Grouping macros

We can group similar macros together.

This way we can influence which macros can be modified simultaneously, and which can't.

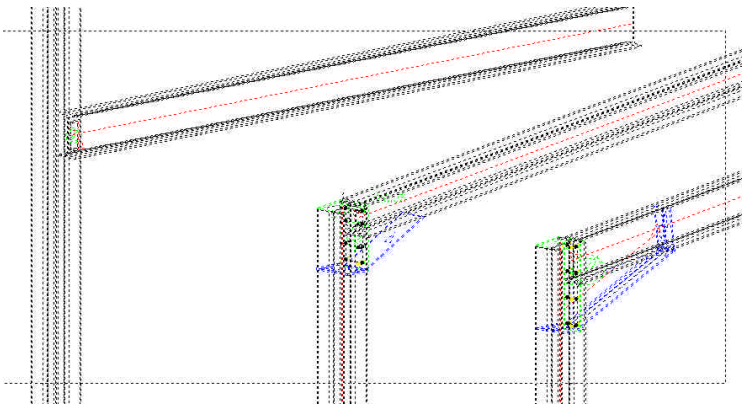
← Step 1 →



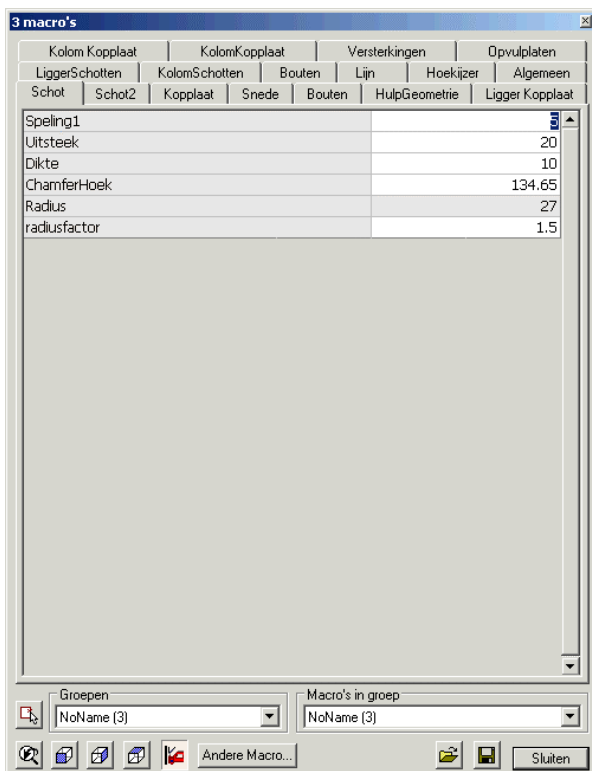
- Open the drawing  Exercise31.dwg




- Click on  **Review macro.**



- Select all macros in the drawing and press **<Enter>**.



 This dialog box merges all the macro with the same name, so we get a chaos of settings because all the 3 macros have the same name **NoName**.



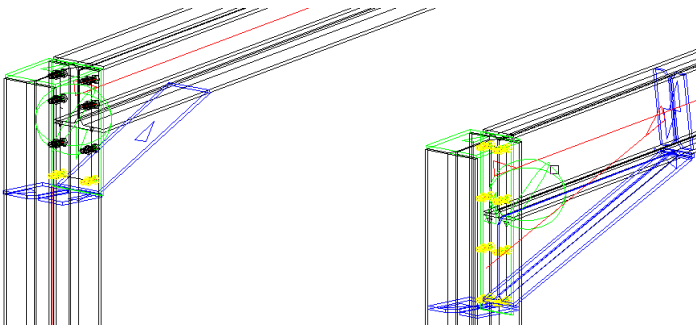
- Click on **Close**.

← **Step 2** →

When the macros have the same groupname they will be adjustable simultaneously.



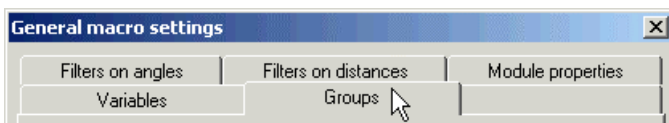
- Click on **Edit macro**



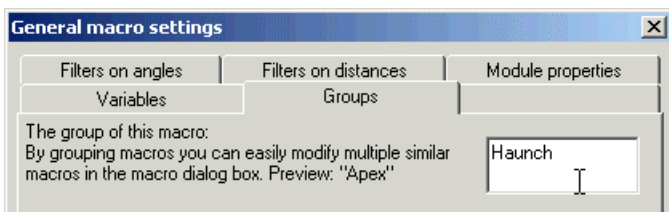
- Select the most right macro in the drawing.



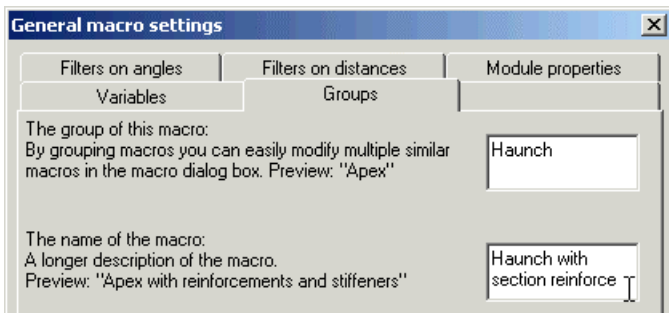
- Click below the dialog box on the button **General macro settings**.



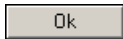
- Activate the tab **Groups**.



- Enter at the top for the groupname in : *Haunch*

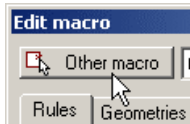



- Enter below that for the name :
Haunch with section reinforce

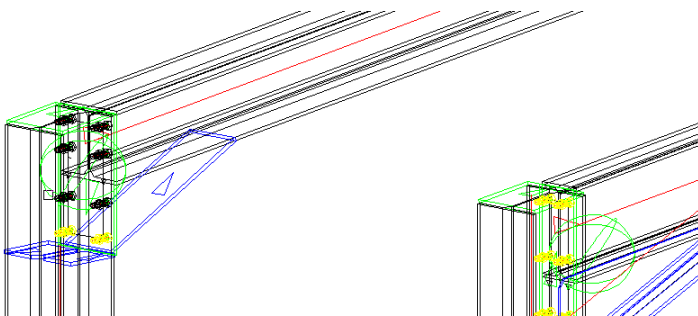


- Click on **Ok**.

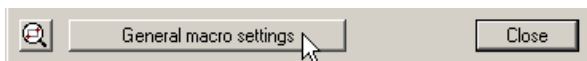
← **Step 3** →



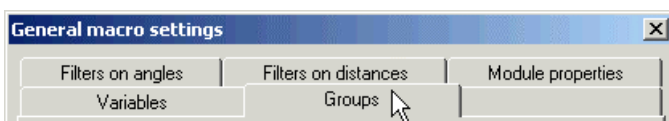
- Click at the top of the dialog box on the button  Other macro



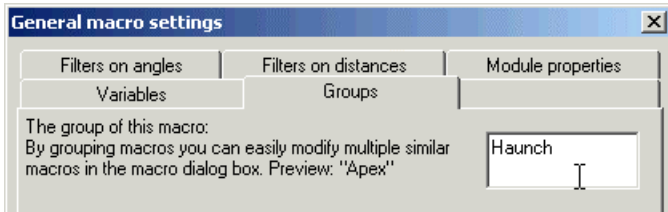
- Select the macro in the middle of the drawing.



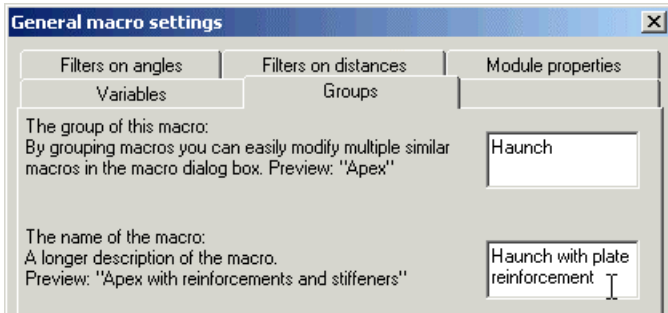
- Click below the dialog box on the button **General macro settings**.



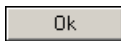
- Activate the tab **Groups**.



- Enter at the top the groupname :
Haunch

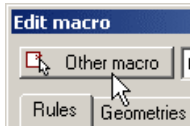


- Enter below that for the name :
Haunch with plate reinforcement

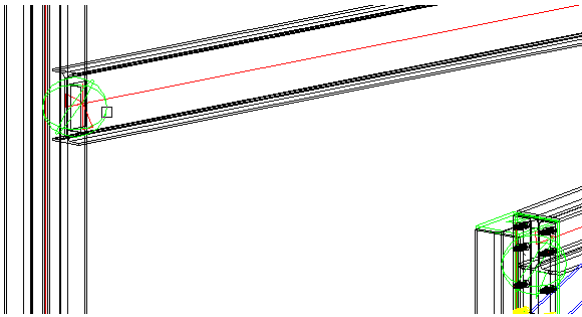


- Click on **Ok**.

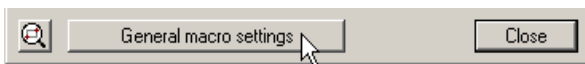
← Step 4 →



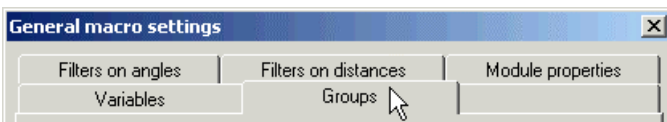
- Click at the top of the dialog box on the button **Other macro**



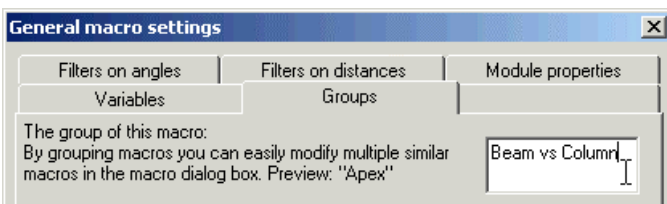
- Select the most left macro in the drawing.



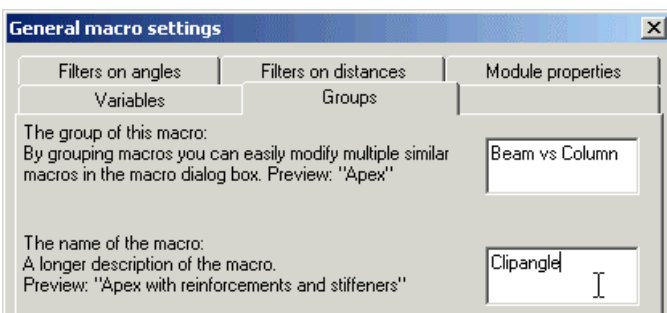
- Click below the dialog box on the button **General macro settings**.



- Activate the tab **Groups**.



- Enter at the top for the groupname : *Beam vs Column*



- Enter below that for the name : *Clipangle*



- Click on **Ok**.

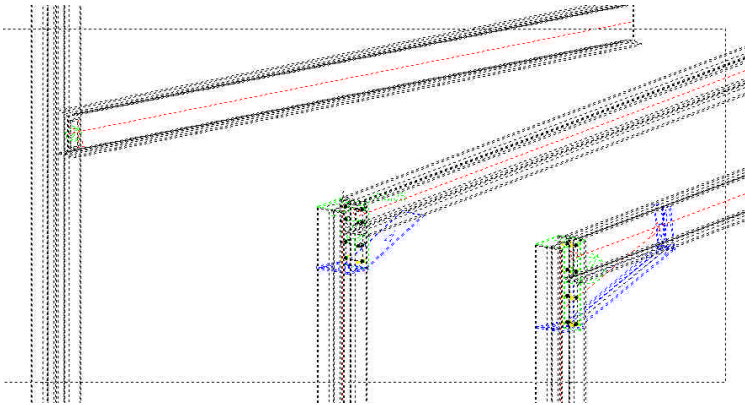


- Click on **Close**.

← Step 5 →

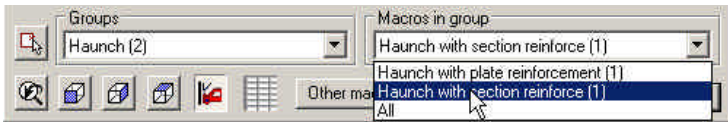


- Click on **Review macro**.



- Select all macros in the drawing and press **<Enter>**.

Always look at the available settings while we select other groups and other macro names.



- Choose below right in the list : *Haunch with section reinforce*



- Choose below right in the list : *All*



- Choose below left in the list : *Beam vs Column*

Exercise 32: Order of tabs

The order in which tabs are shown can be modified.

← Step 1 →



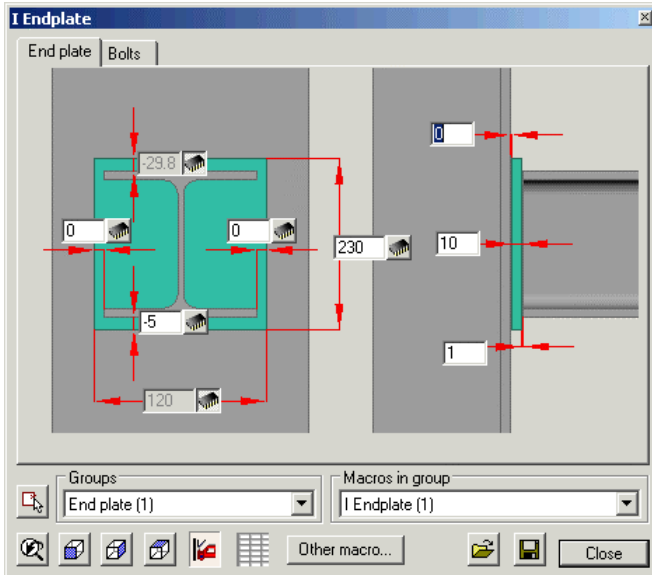
- Open the drawing Exercise32.dwg



- Click on **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



In this exercise we will move the tab **Endplate** to behind the tab **Bolts**.

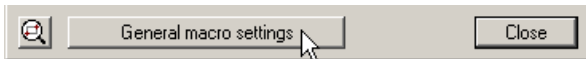
← Step 2 →



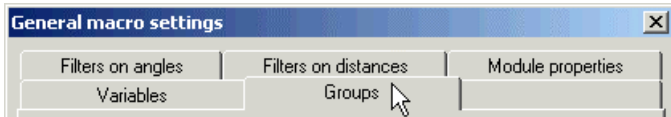
- Click on **Edit macro**



- Select the macro in the drawing.



- Click below the dialog box on the button **General macro settings**.



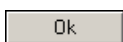
- Activate the tab **Groups**.

Name of the Module	Name of the group	Sorting
Endplate		2
Bolts		Undetermined
Extension Points		1
Cut		2
		3
		4

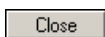
- Choose for the module **Endplate** the number 2.

Name of the Module	Name of the group	Sorting
Endplate		2
Bolts		1
Extension Points		Undetermined
Cut		1
		2
		3
		4

- Choose for the module **Bolts** the number 1.



- Click on **Ok**.



- Click on **Close**.

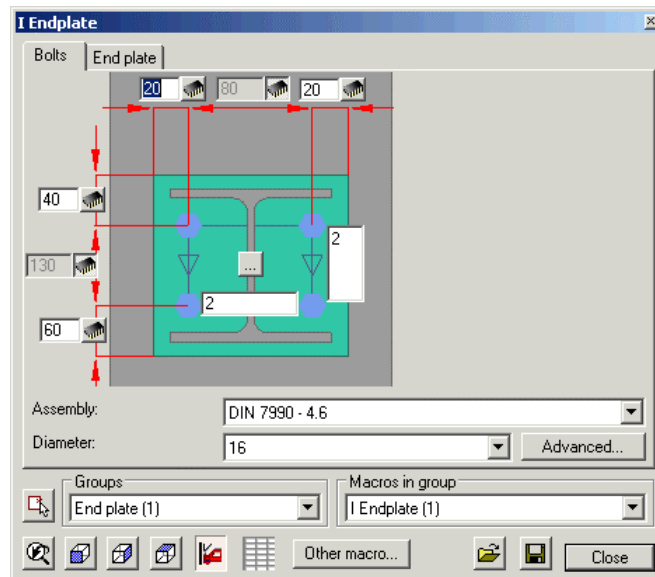
← Step 3 →



- Click on  **Review macro**.

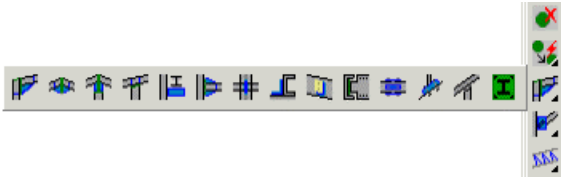


- Select the macro in the drawing and press **<Enter>**.



Exercise 33: Creating your own icons for macros

We know the row of icons of Parabuild with which we can draw connections in a drawing.



These icons allow us to retrieve the macros from the library that are based on 0, 1, 2, 3, 4 or more base members.

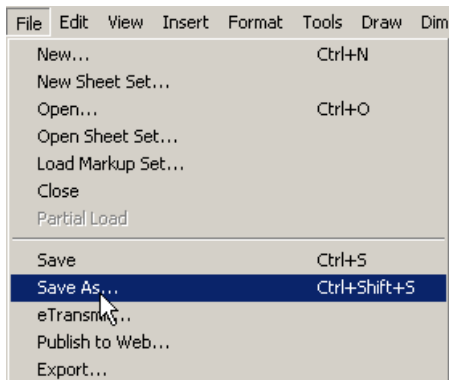
You can create your own icons like these for the macros that you've created.

The entire system of Parabuild that asks to select the base members and then filters the macros will also function on the macros that you create.

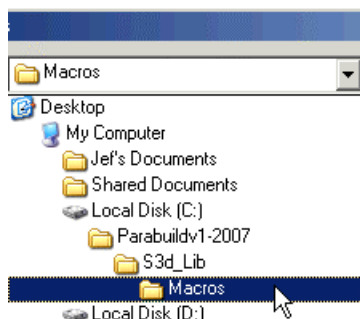
← Step 1 →




- Open the drawing  Exercise33a.dwg



- Start the command **Save As...**

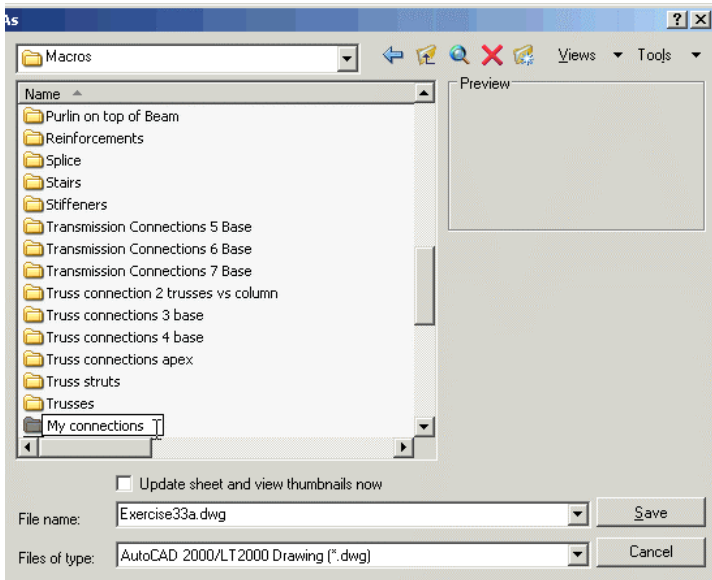


- Go to the following directory :
C:\Parabuildv1-2007\S3d_Lib\Macros\

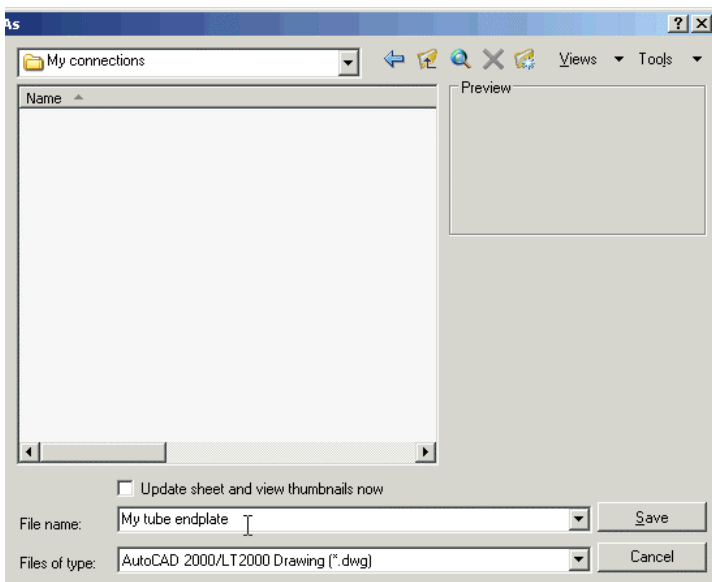
 *Parabuild may be located in another location on your computer.*



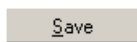
- Click on the button  **New Directory**



- Enter for the name of the new directory :
My connections



- Double-click on the new directory to open it and then enter below the filename : *My tube endplate*



- Click on **Save**.




- Click on the cross  to close the drawing.

← Step 2 →



- Open the drawing  Exercise33b.dwg

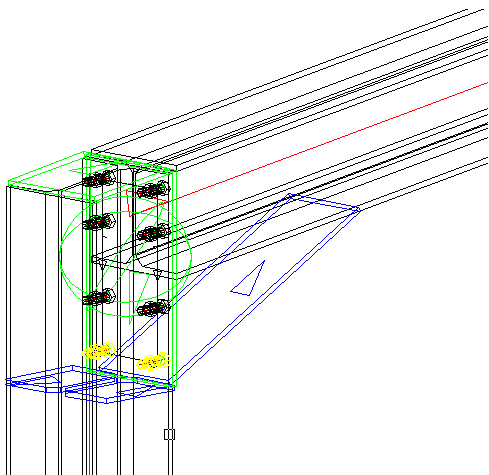
 *For new macros we have to make sure that the macro apply settings are set.*



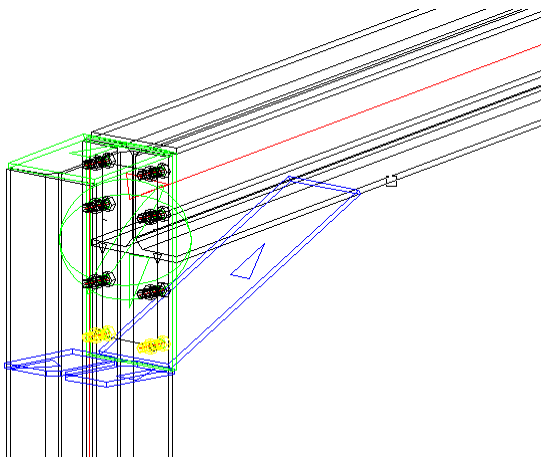
- Start the command  **Macro apply settings.**



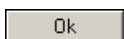
- Select the macro in the drawing.



- Select the column.

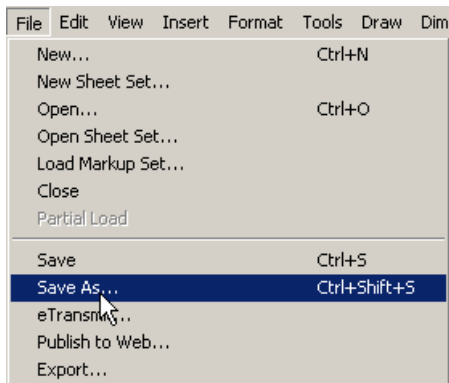


- Select the beam.



- Click on **Ok**.

← Step 3 →

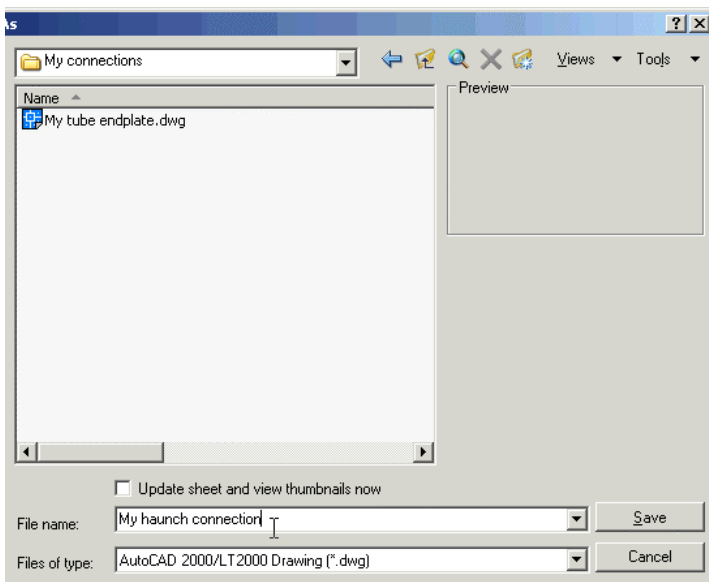


- Start the command **Save As...**

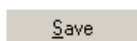


- Go to the following directory :
C:\Parabuildv1-2007\S3d_Lib\Macros\My connections\

⚠ *Parabuild may be located in another location on your computer.*




- Enter below for the filename :
My haunch connection.




- Click on **Save**.



- Click on the cross  to close the drawing.

 *Parabuild can't read drawings from the library if you have them opened. So always close the library drawings before you try to use an icon.*


← Step 4 →

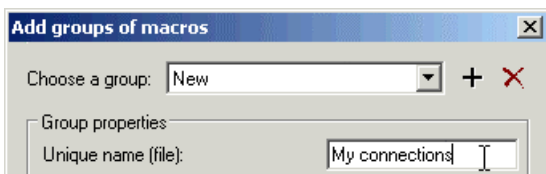
 *Now we will tell Parabuild that the group **My connections** exists and how many basemembers these connections have.*



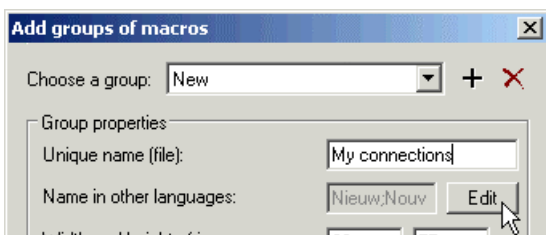
- Start the command  **Edit macro groups**.




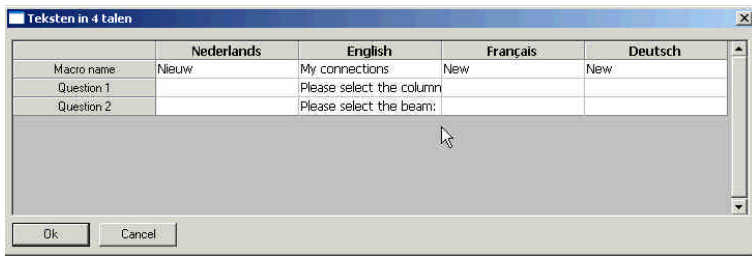
- Click at the top on the button  **Add group**.



- Enter for the **Unique name** :
My connections



- Click at the top on the button 



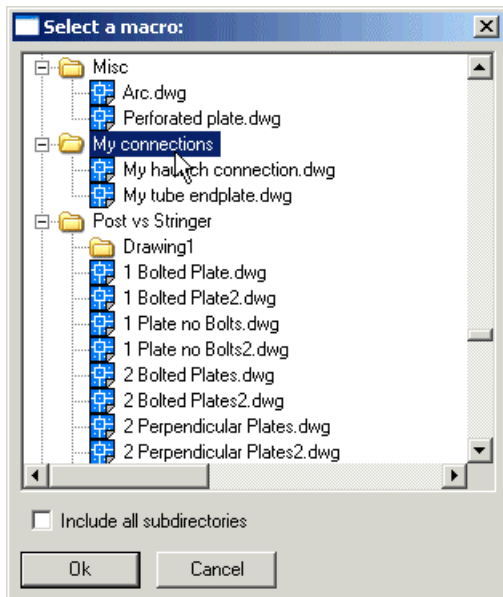
- Fill the column **English** as follows :
- **Macro name** : *My connections*
- **Question 1** : *Please select the column* :
- **Question 2** : *Please select the beam* :



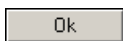
- Click on **Ok**.



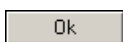
- Click below on the button **+** **Add macro**.



- In the list, search for the directory **My connections** and select this directory.



- Click on **Ok**.



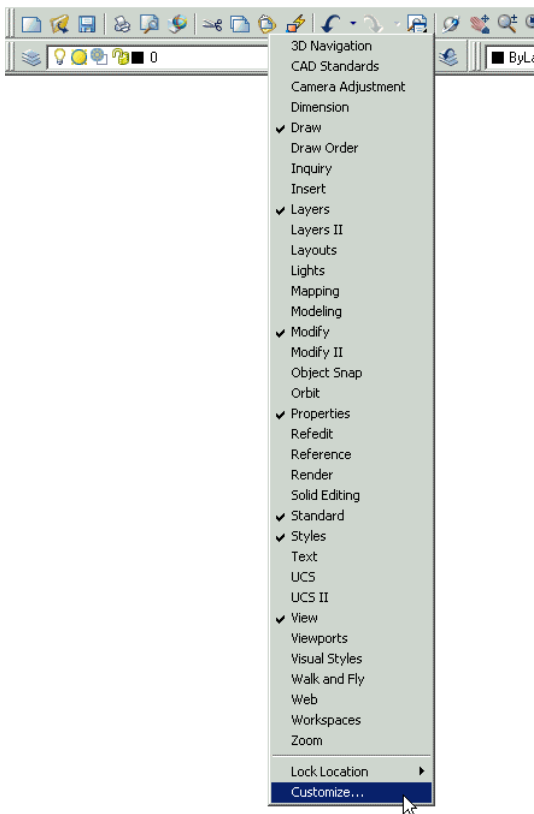
- Click again on **Ok**.

← Step 5 →

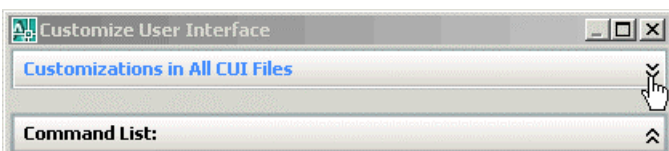
❓ The only thing we still need to do now is creating the icon.



- Move the cursor to above the standard bar and click on the right mouse button.



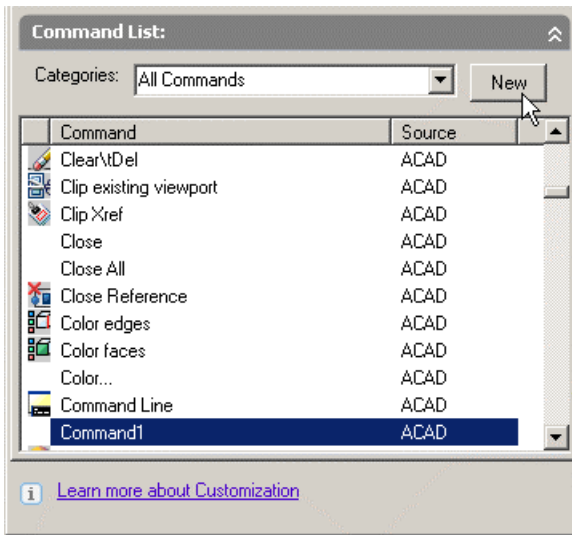
- Click in the new menu on the last item: **Customize...**



⚠️ **Only for AutoCAD 2008 or newer :**
- Click on the top right on the button ↗.

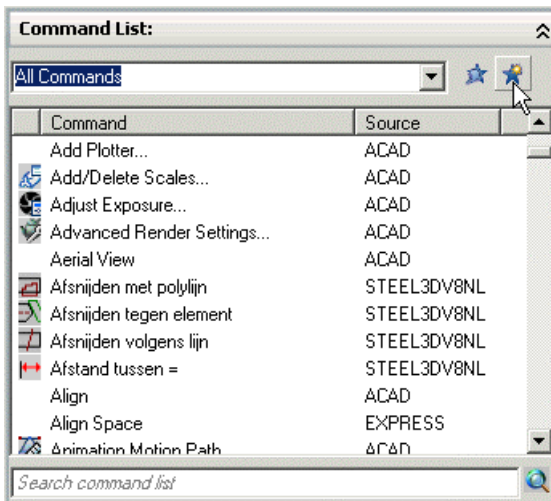


⚠️ **Only for AutoCAD 2008 or newer :**
- Click below right on the button ⏪ to show the entire dialog box.



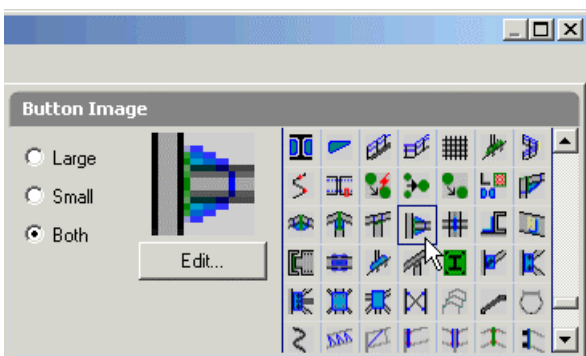
⚠️ **Only for AutoCAD 2006 and 2007 :**

- Click in the middle of the dialog box on the button **New**.

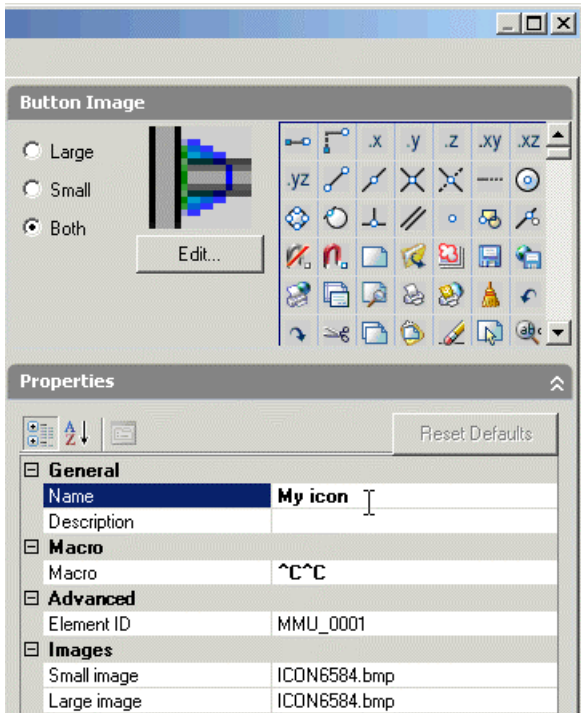


⚠️ **Only for AutoCAD 2008 or newer :**

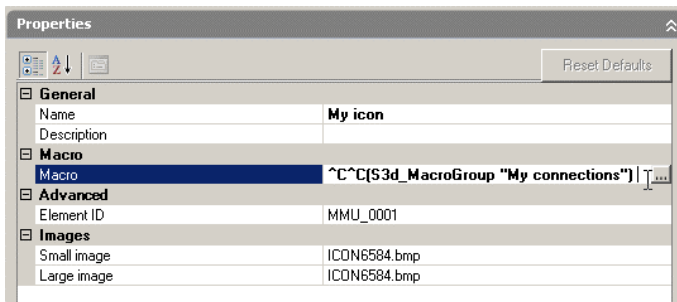
- Click in the middle of the dialog box on the button **Create a new command**.



- While the new item is still selected, choose from the icons list the same icons as illustrated.



- Modify in the middle right of the dialog box the **Name** of the icon to : *My icon*



- Modify the property **Macro** to :
`^C^C(S3d_MacroGroup "My connections")`

⚠ Don't forget to add a space to the end of this line after the closing bracket. (A space is the same as <Enter>)

🔍 Here are the explanations of the command line rule:

`^C^C(S3d_MacroGroup "My connections")`

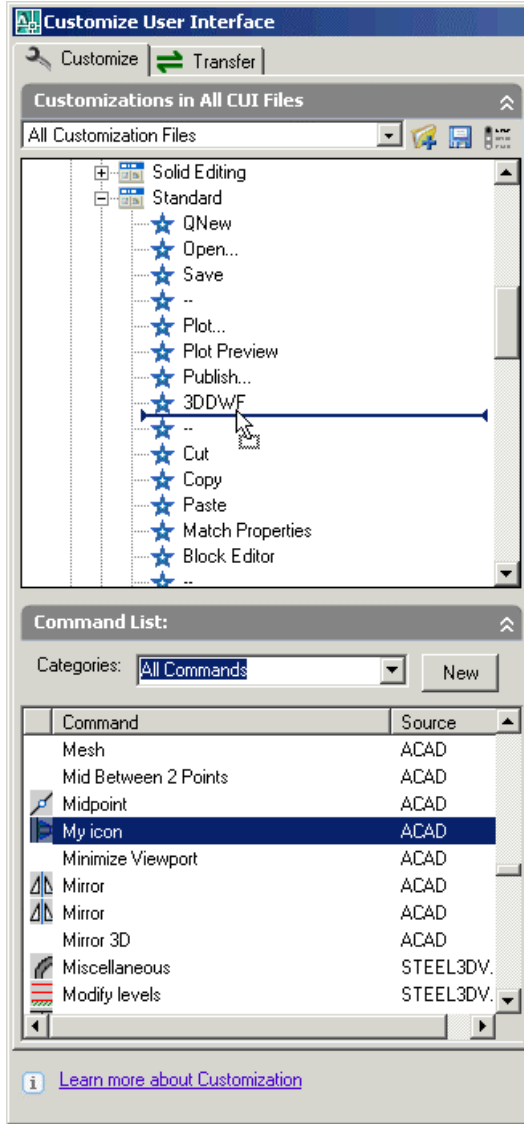
^C : Cancel, for cancelling a command that may still be active.

S3d_MacroGroup : the Parabuild command itself.

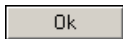
"My connections" : the name of the group that we created in the previous step.

() : the brackets are necessary because we pass a parameter to the `S3d_MacroGroup` command.

The space at the end is required, otherwise the command wouldn't start.




- Click below on the new item **My icon** but now keep the left mouse button pressed. Drag the mouse to above, between the items of the **Standard** bar. Now release the mouse button.




- Click on **Ok**.

← Step 6 →

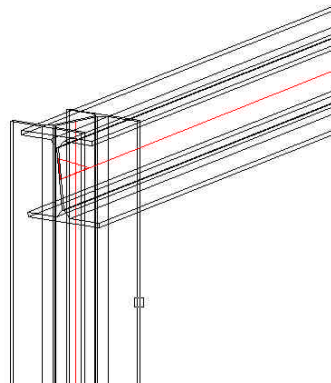
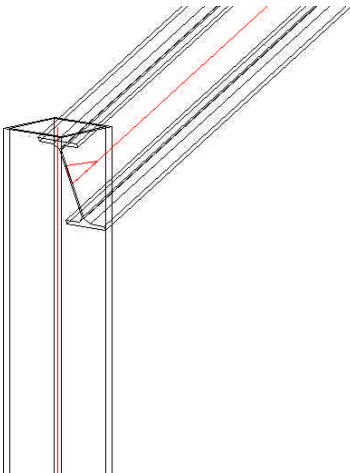
 *The icon is ready, now we just have to test it...*



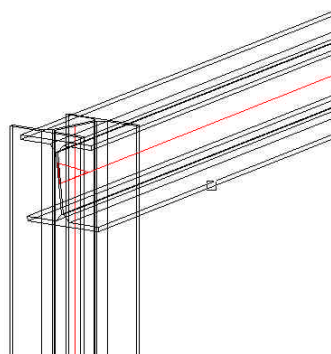
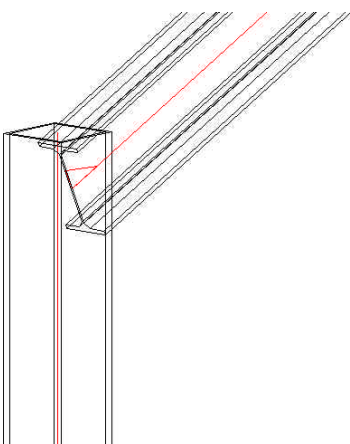
- Open the drawing  Exercise33c.dwg



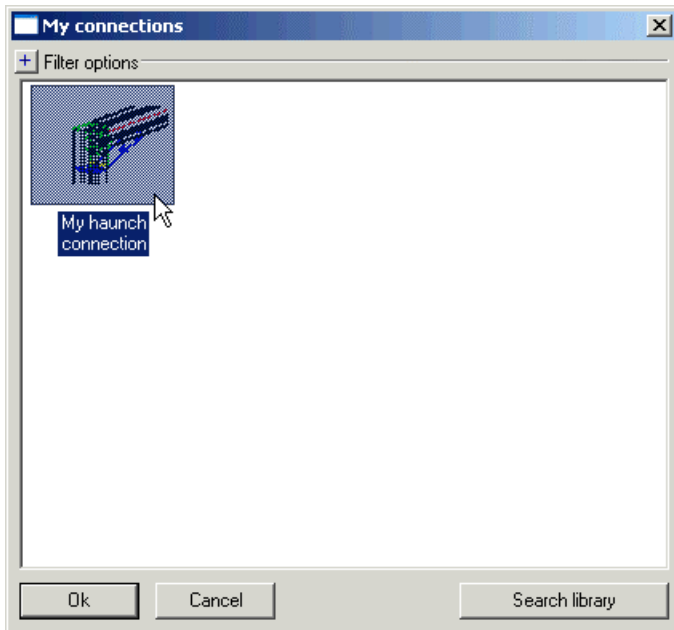
- Click on the icon that we just created.



- Select the most right column.



- Select the most right beam.



- Double-click with the mouse on **My haunch connection** in the list.



- Press **<Enter>** to end the command.

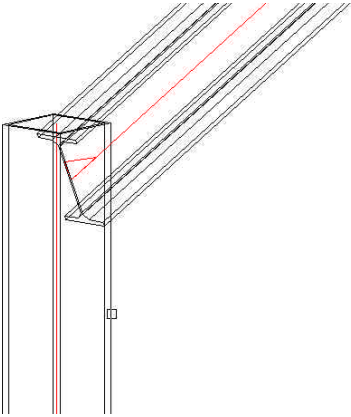


- Click on **Close**.

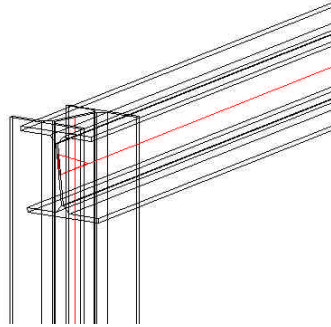
← Step 7 →



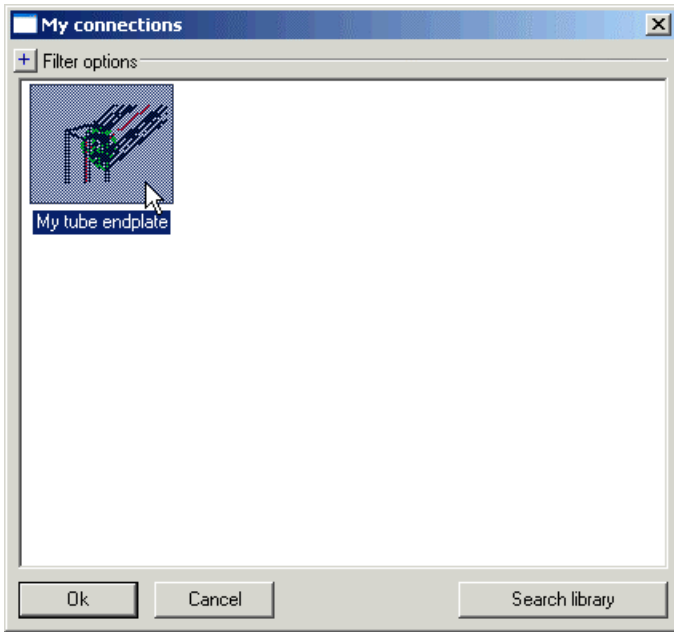
- Click on the icon that we just created.



- Select the most left column.



- Select the most left beam.



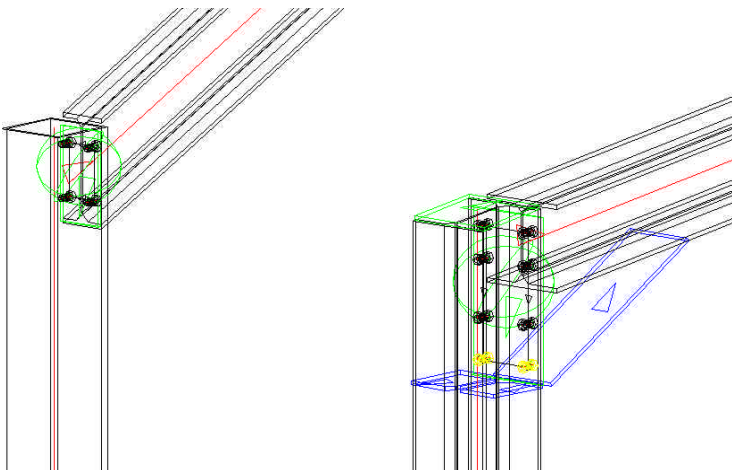
- Double-click with the mouse on **My tube endplate** in the list.



- Press **<Enter>** to end the command.



- Click on **Close**.




? As you can see Parabuild makes sure that the non-applicable macros aren't shown. You can store an entire collection of macros in one directory, they won't necessary be shown in the list.

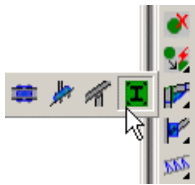
Exercise 34: Manually applying/copying a macro

When creating macros we will regularly see recurring geometric rules.
It is possible to reuse entire modules of a macro.
The command of this exercise is one of the tools that help us with this.

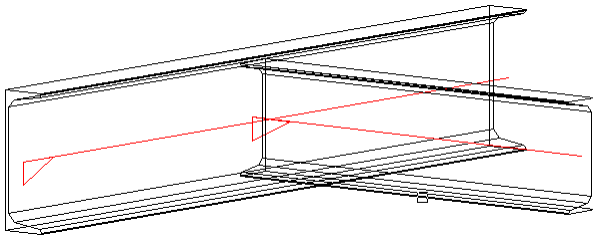
← Step 1 →



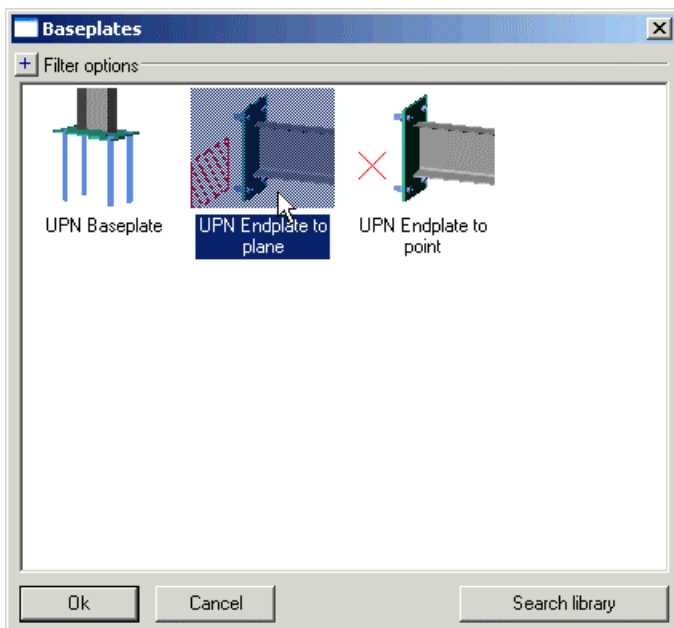
- Open the drawing  Exercise34.dwg



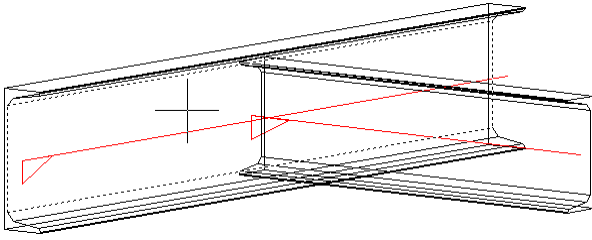
- Start the command  **End/Baseplates**



- Select the most right UPN.



- Double-click with the mouse on **Endplate to plane** in the list.



- Select the first web plane of the perpendicular UPN by pressing the left mouse button once. Now press the right mouse button to confirm.




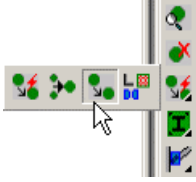
- Press **<Enter>** to end the command.



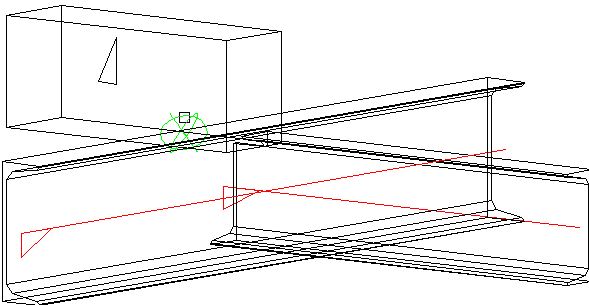
- Click on **Close**.

← Step 2 →

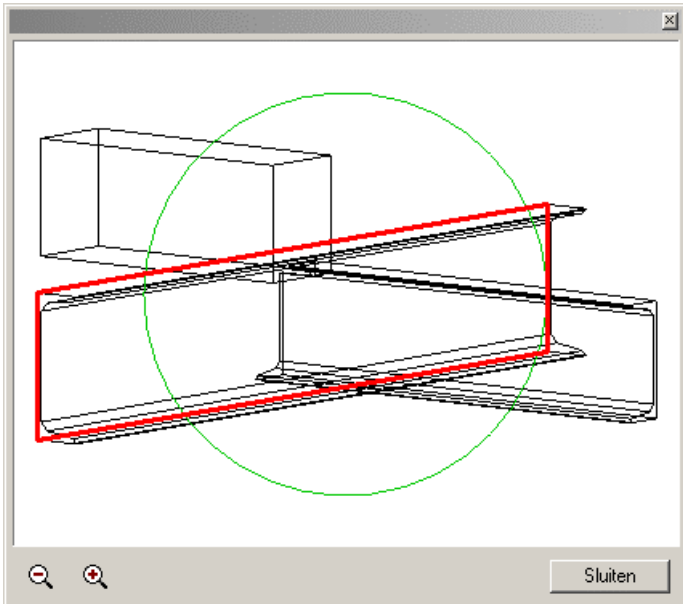
 We will copy the cutout macro on the left over to the connection we just created.



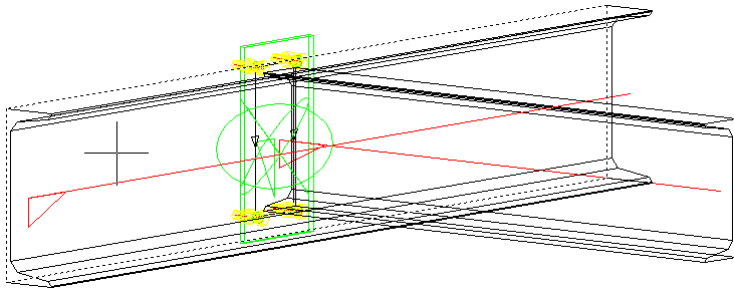
- Start the command  **Manually copy a macro**.



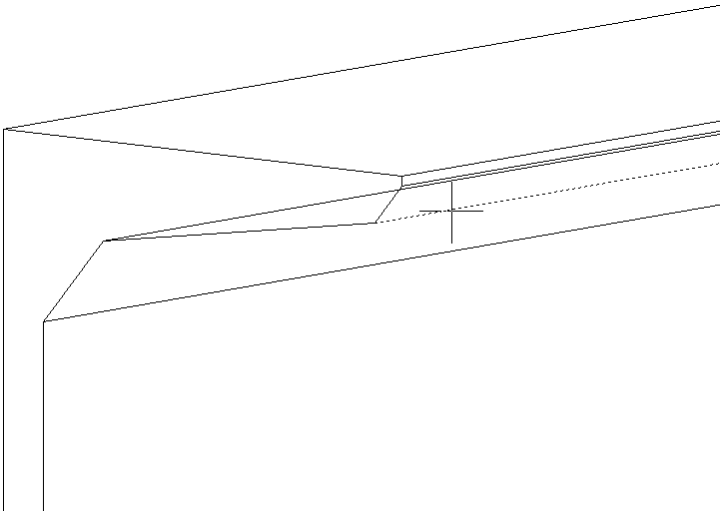
- Select the macro of the cutout.



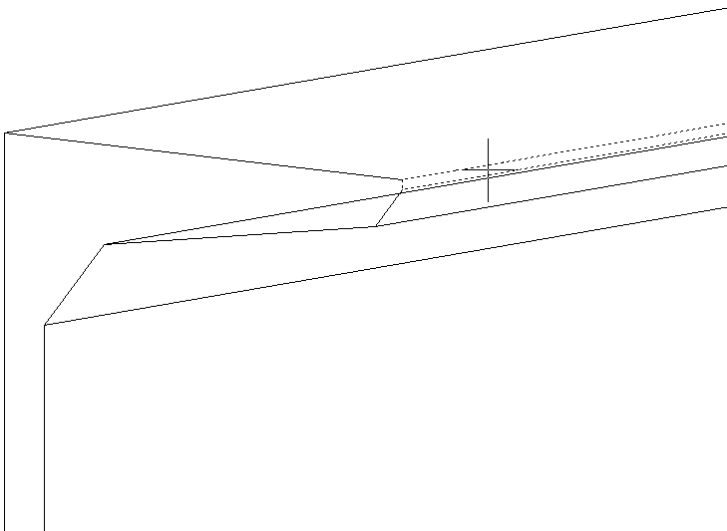
*This dialog box shows the geometry that we need to select on the targetmembers.
You can zoom in in this dialog box by using the wheel of the mouse.*



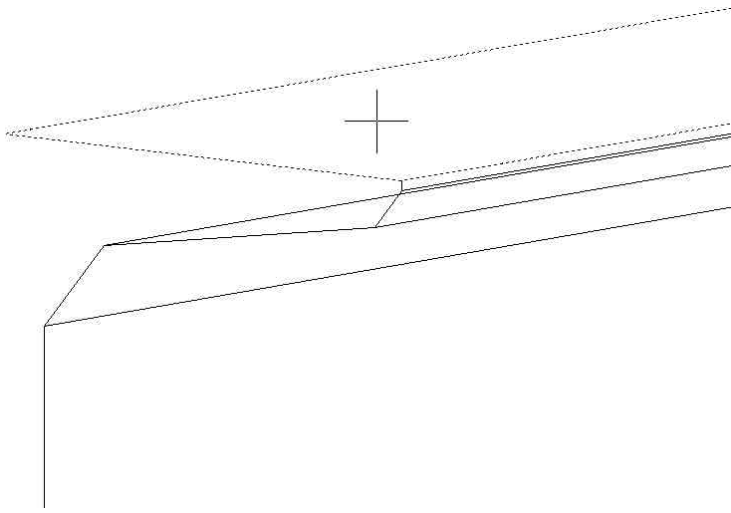
- Select the back of the perpendicular UPN by pressing the left mouse button twice.
Now press the right mouse button to confirm.



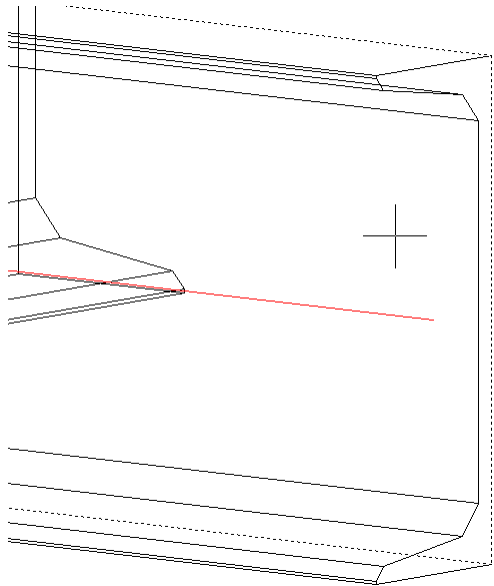
- Select the bottom line of the radius of the perpendicular UPN by pressing the left mouse button once.
Now press the right mouse button to confirm.



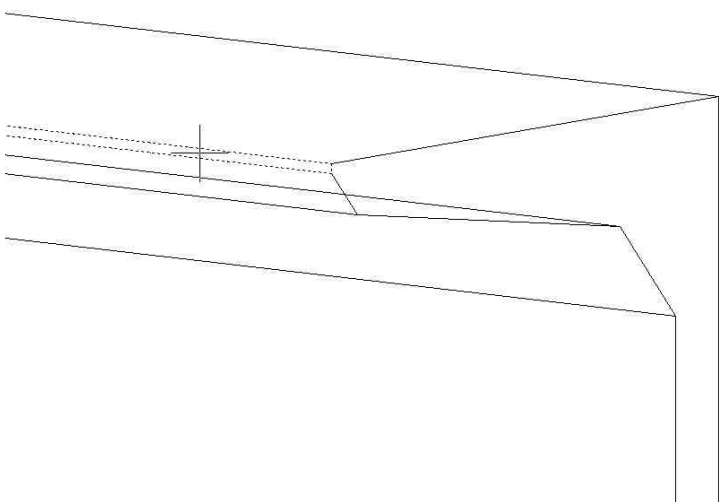
- Select the small side plane of the perpendicular UPN by pressing the left mouse button once.
Now press the right mouse button to confirm.



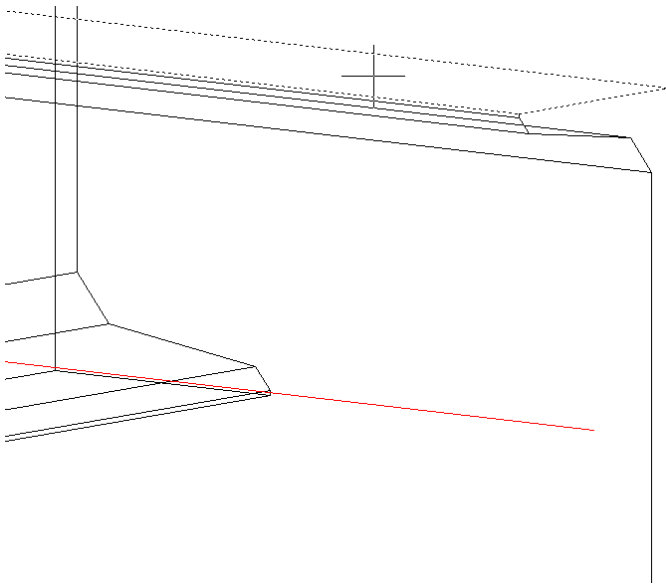
- Select the upper plane of the perpendicular UPN by pressing the left mouse button once. Now press the right mouse button to confirm.



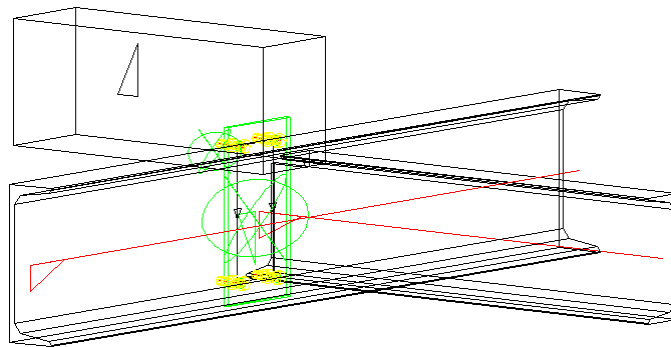
- Select the back of the most right UPN by pressing the left mouse button twice. Now press the right mouse button to confirm.



- Select the small side plane of the most right UPN by pressing the left mouse button once. Now press the right mouse button to confirm.



- Select the upper plane of the most right UPN by pressing the left mouse button once. Now press the right mouse button to confirm.




Exercise 35: Storing macros as components

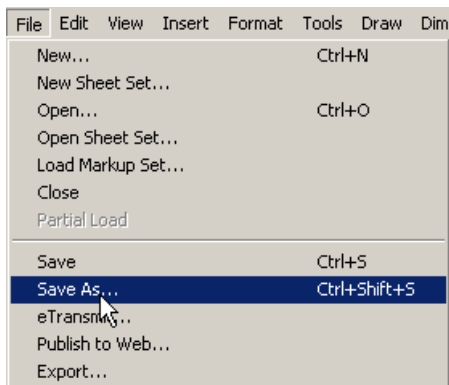
Reusing the parts of macros can be done more efficient by storing them in the components library.

By storing a component in the library it becomes easier to reuse it multiple times in different connections.

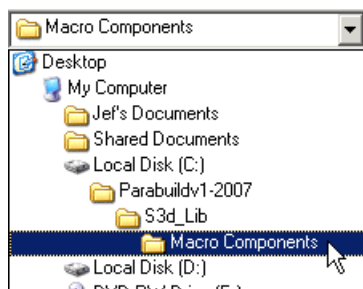
← Step 1 →




- Open the drawing  Exercise35a.dwg

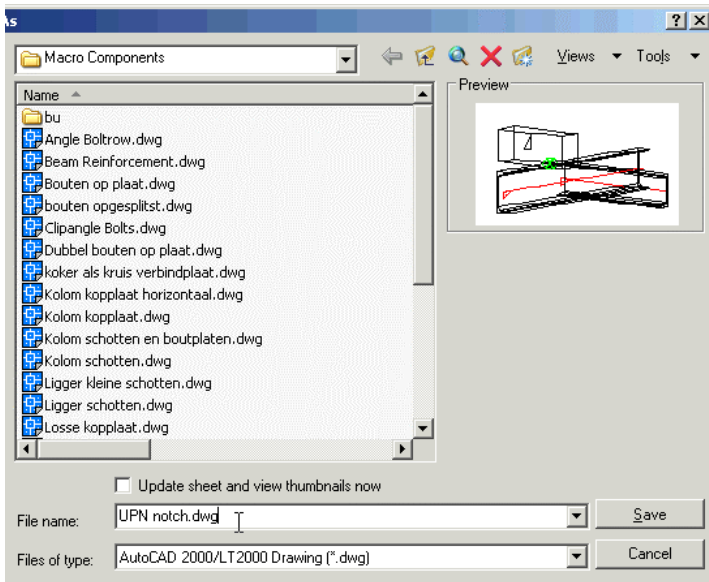


- Start the command **Save As...**

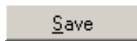


- Go to the following directory :
C:\Parabuildv1-2007\S3d_Lib\Macro
Components\

 *Parabuild may be located in another location on your computer.*




- Enter below for the filename :
UPN notch.




- Click on **Save**.

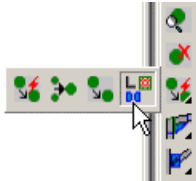


- Click on the cross  to close the drawing.

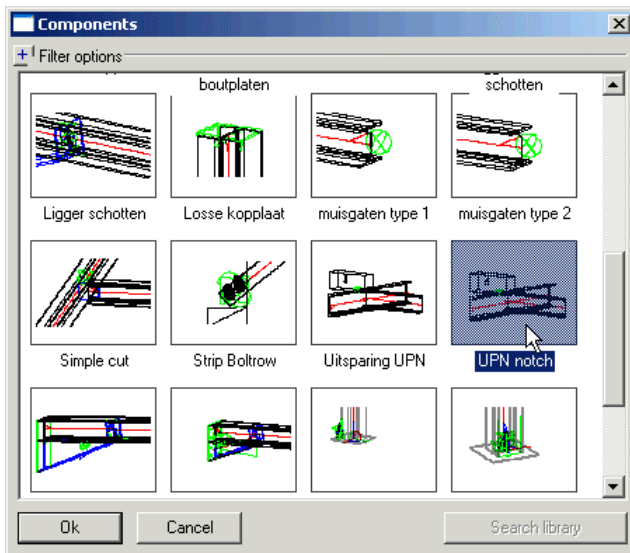
← Step 2 →



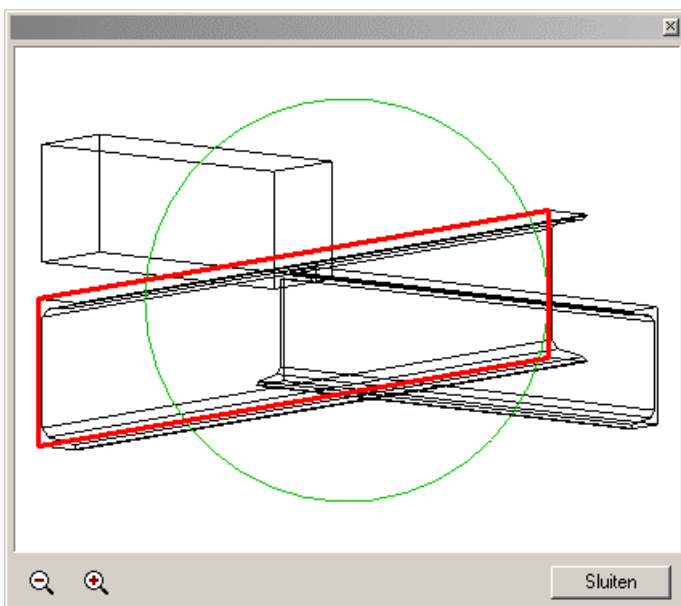
- Open the drawing  Exercise35b.dwg




- Start the command  **Macro components library**.



- Double-click with the mouse on **UPN notch** in the list.



 *Complete the exercise by yourself. Just select all the geometries that are asked. This is exactly the same as the previous exercise.*


Exercise 36: Merging macros

It is possible to merge macros.

This is necessary when we've copied parts of other macros.

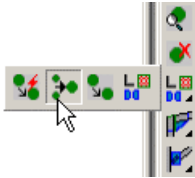
This causes us to have 2 macros and we want to merge it into just one macro.

← Step 1 →

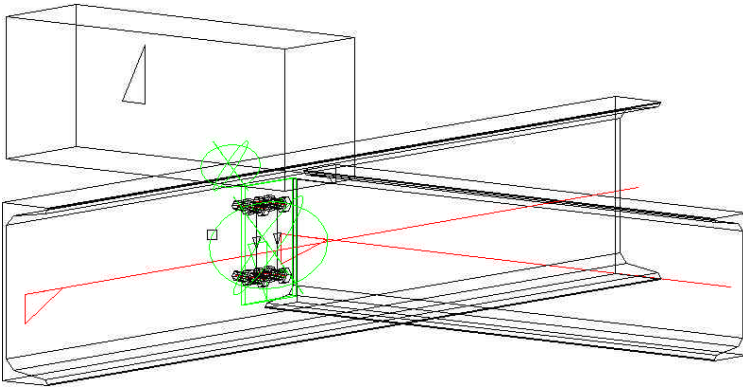
 We start where the previous exercise ended.



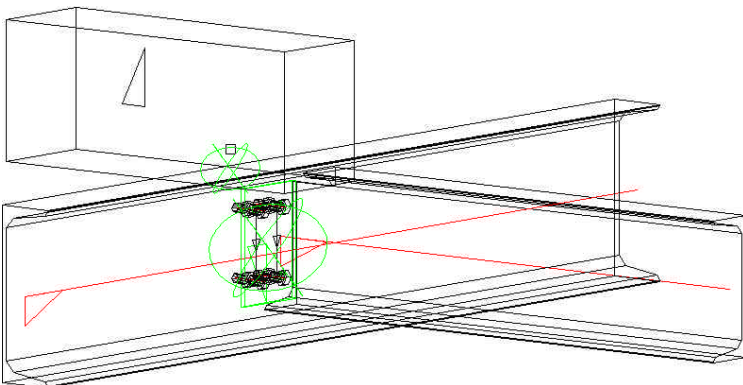
- Open the drawing  Exercise36a.dwg



- Start the command  **Merge macros**.



- Select the big macro.




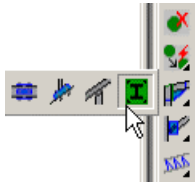
- Select the small macro.

← Step 2 →

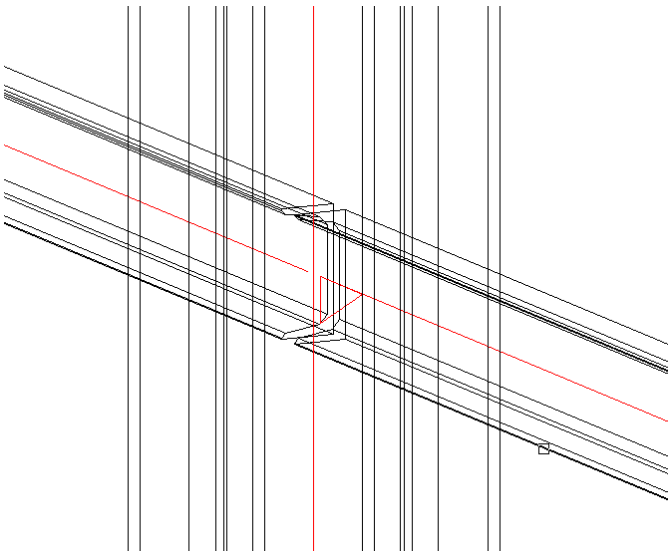
Now we will create an entirely different example for this example.



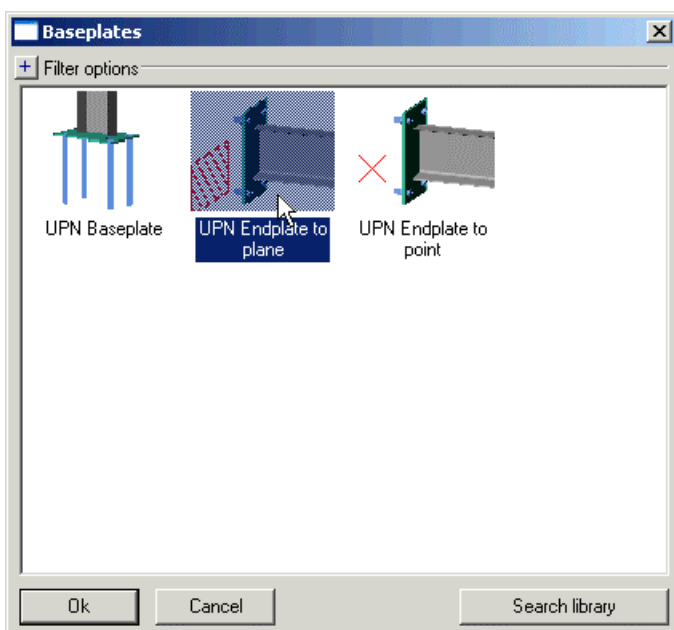
- Open the drawing  Exercise36b.dwg



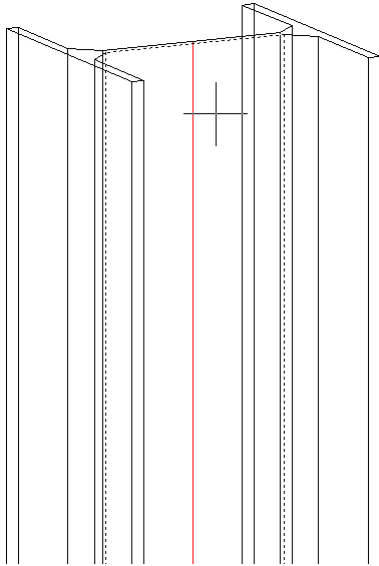
- Start the command  **End/Baseplates**



- Select the most right UPN.



- Double-click with the mouse on **Endplate to plane** in the list.



- Select the front web plane of the column by pressing the left mouse button once. Now press the right mouse button to confirm.

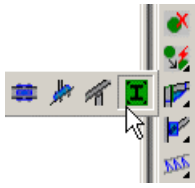


- Press **<Enter>** to end the command.

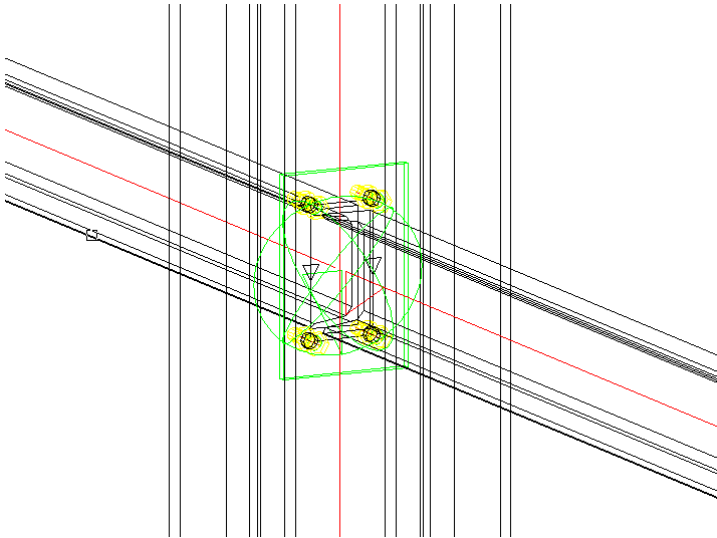


- Click on **Close**.

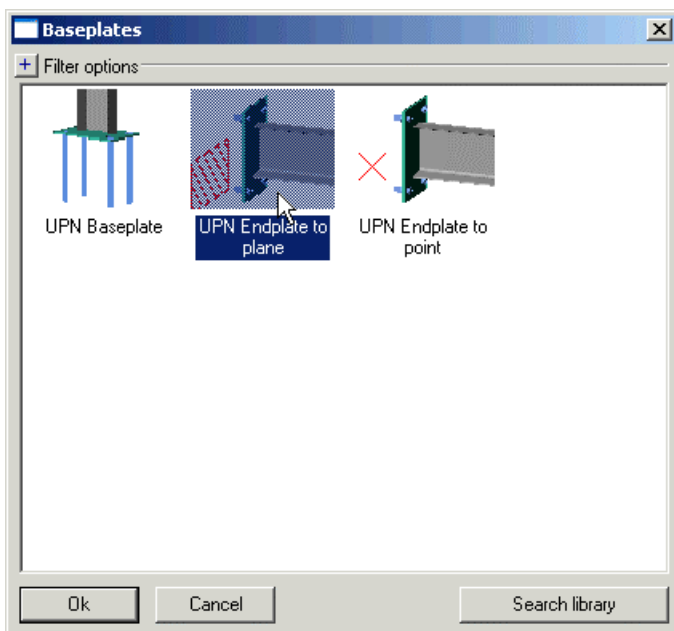
← Step 3 →



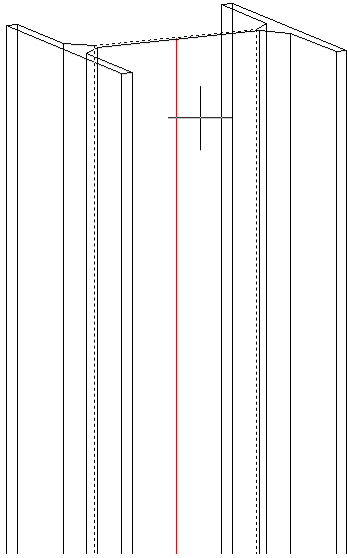
- Start the command  **End/Baseplates**



- Select the most left UPN.



- Double-click with the mouse on **Endplate to plane** in the list.



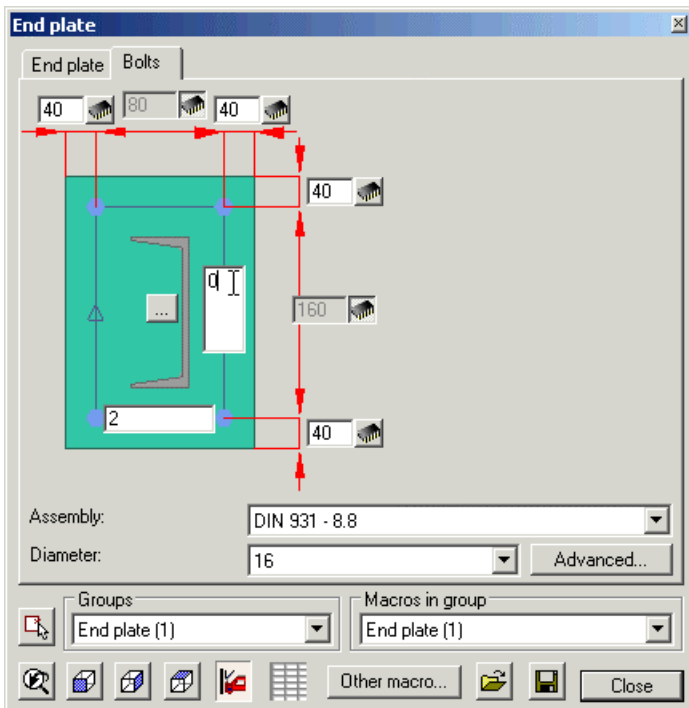
- Select the back web plane of the column by pressing the left mouse button twice. Now press the right mouse button to confirm.



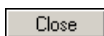
- Press **<Enter>** to end the command.



- Activate the tab **Bolts**.

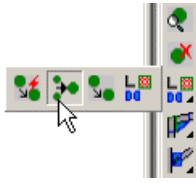


- Modify the number of bolts to: 0

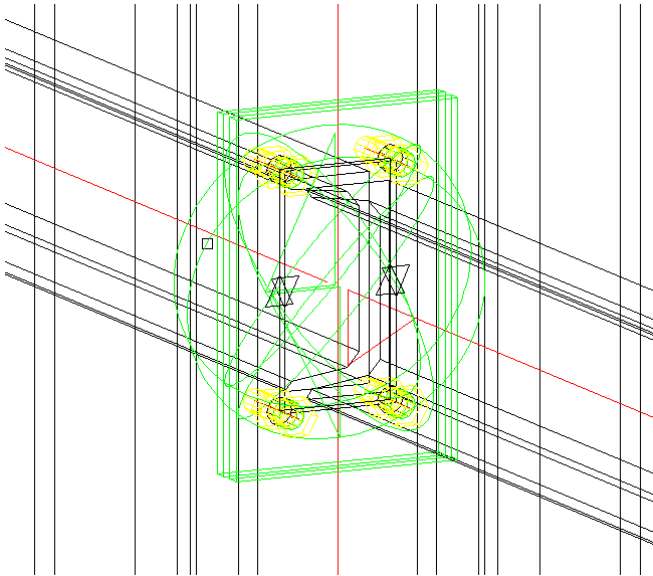


- Click on **Close**.

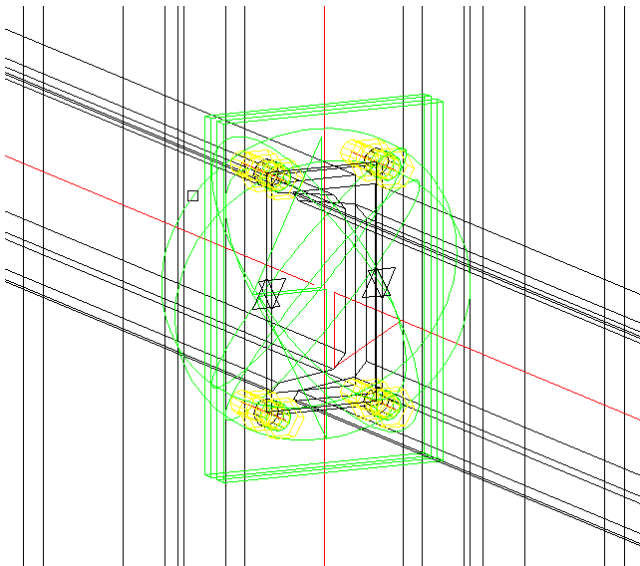
← Step 4 →




- Start the command  Merge macros.



- Select the first macro.



- Select the other macro.

 *The bolts are now being drilled through another endplate because both endplates are now merged into the macro.*

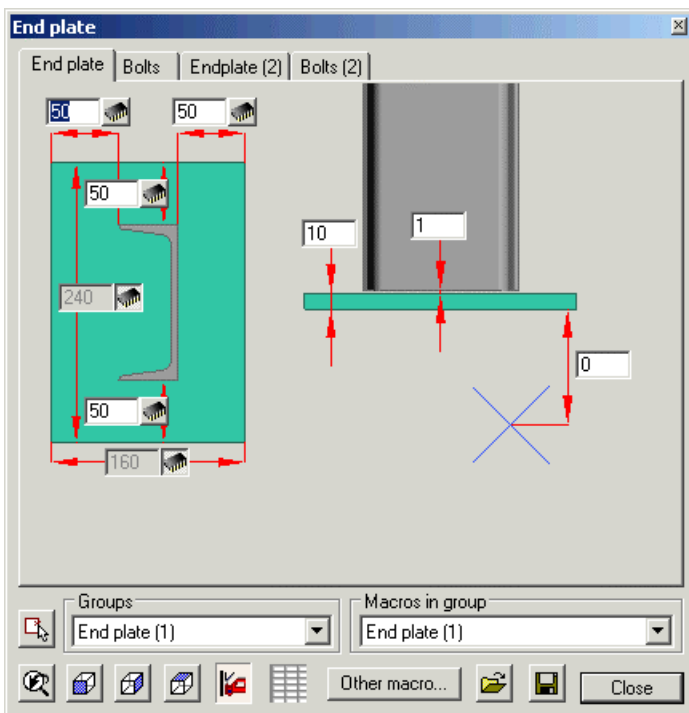
← Step 5 →




- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



 *The modules of both macros are simply added separately as tabs. We can remove the tab **Bolts (2)** because those bolts will never be used. If we want we can also merge the tabs **Endplate** and **Endplate (2)** so that the endplates will always get the same dimensions.*

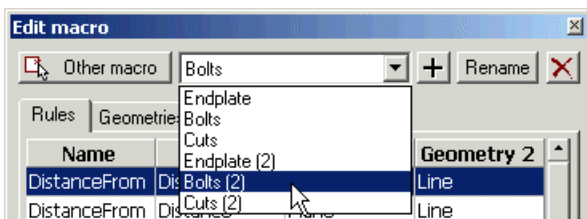
← Step 6 →



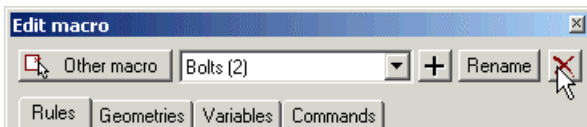
- Click on  **Edit macro**




- Select the macro in the drawing.



- Select at the top from the list the module: **Bolts (2)**



- Click at the top on the button  **Erase selected module**.



- Click on **Close**.



- Click on  **Review macro**.



- Select the macro in the drawing and press **<Enter>**.



← Step 7 →



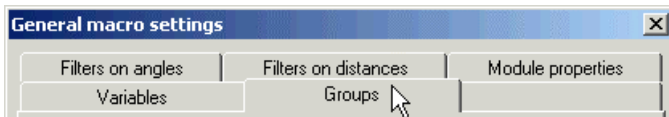
- Click on  **Edit macro**



- Select the macro in the drawing.



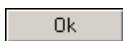
- Click below the dialog box on the button **General macro settings**.



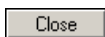
- Activate the tab **Groups**.

Name of the Module	Name of the group	Sorting
Endplate		Undetermined
Bolts		Undetermined
Cuts	Endplate	Undetermined
Endplate (2)	Endplate	Undetermined
Cuts (2)	Endplate	Undetermined

- Enter for the groupname for the module **Endplate (2)** : *Endplate*



- Click on **Ok**.



- Click on **Close**.

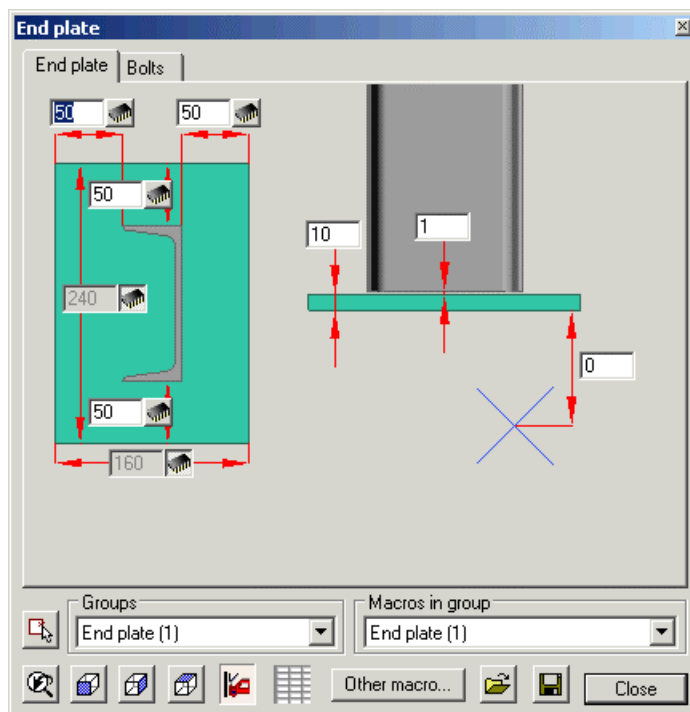
← Step 8 →




- Click on  **Review macro**.




- Select the macro in the drawing and press **<Enter>**.



← Step 9 →

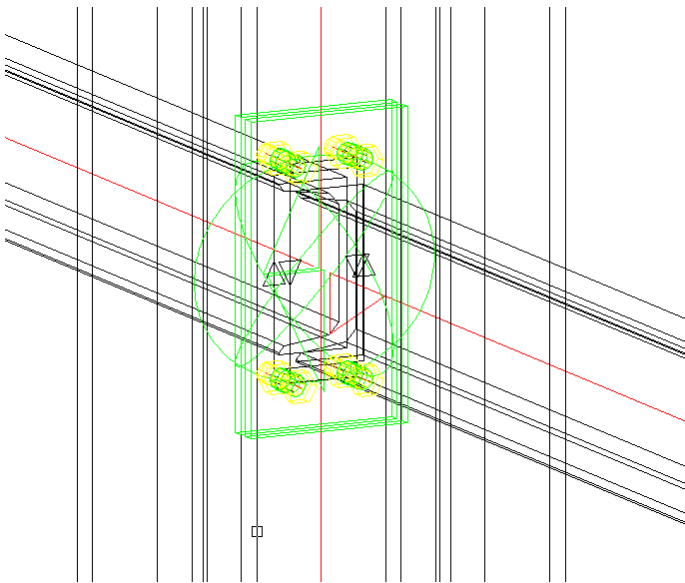
 We shouldn't forget that when we merge 2 macros, the apply settings have to be set again. By modifying the number of basemembers Parabuild doesn't know the order of the members.



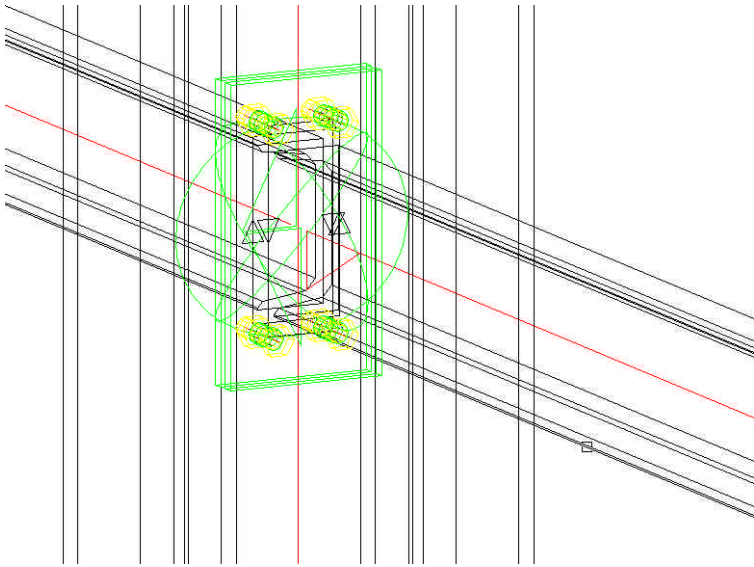
- Start the command  **Macro apply settings.**



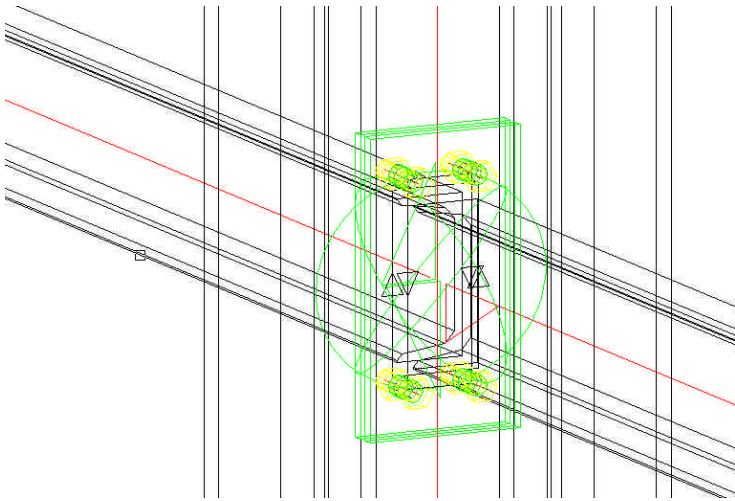
- Select the macro in the drawing.



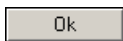
- Select the column.




- Select the most right UPN.



- Select the most left UPN.




- Click on **Ok**.

 *The macro is now ready to be copied or to be stored in the library.*


Exercise 37: Creating intelligent sections

In this exercise we will create an intelligent 2D section by constraining it with geometric rules.


← Step 1 →

 We start with a drawing that contains polyline(s). The dimensions of the polyline don't have to be correct, but the number of segments of the polyline has to be correct before starting to constrain.



- Open the drawing  Exercise37.dwg



- Start the command  **Create new macro** (red sphere).




- Click a random location in the drawing.



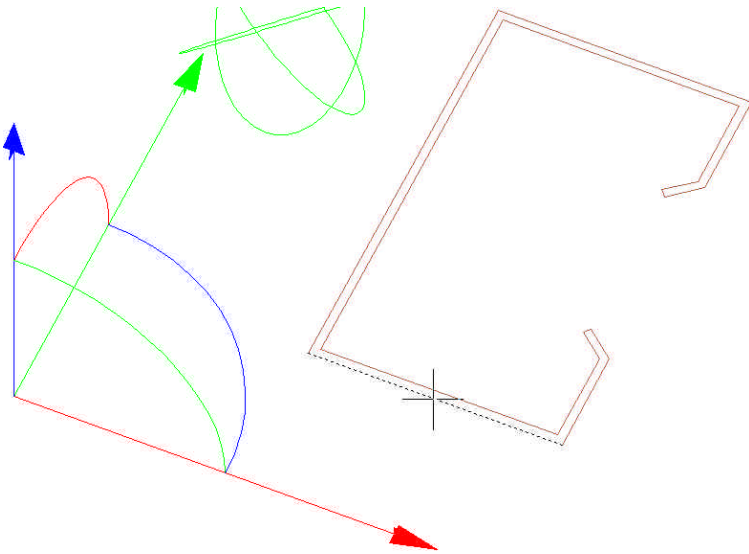
- On the command line, type for the **name** of the module : *Section* and press **<Enter>**.

← Step 2 →

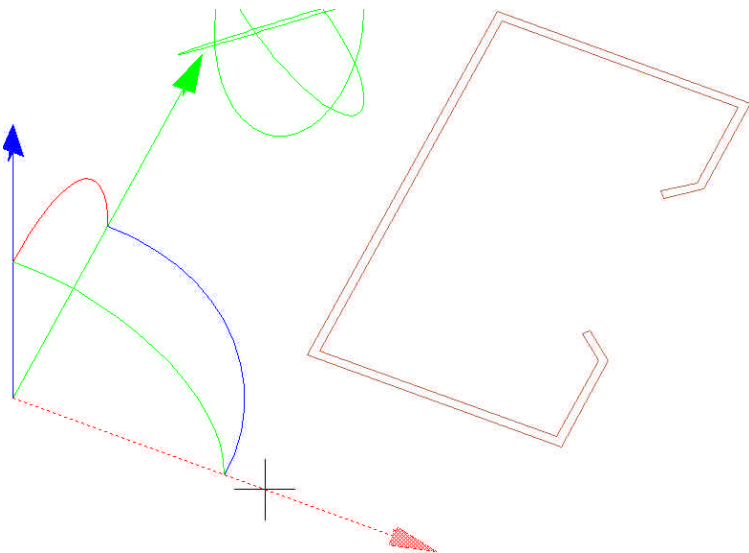
 The exact location of the section doesn't matter. To make it easy for ourselves we constrain the section to the World coordinate system of the drawing.



- Click on  **Coincident**



- Select the bottom line of the section.
Now press the right mouse button to confirm.

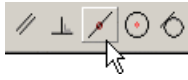


- Select the X-line of the coordinate-system
(the red line).
Now press the right mouse button to confirm.

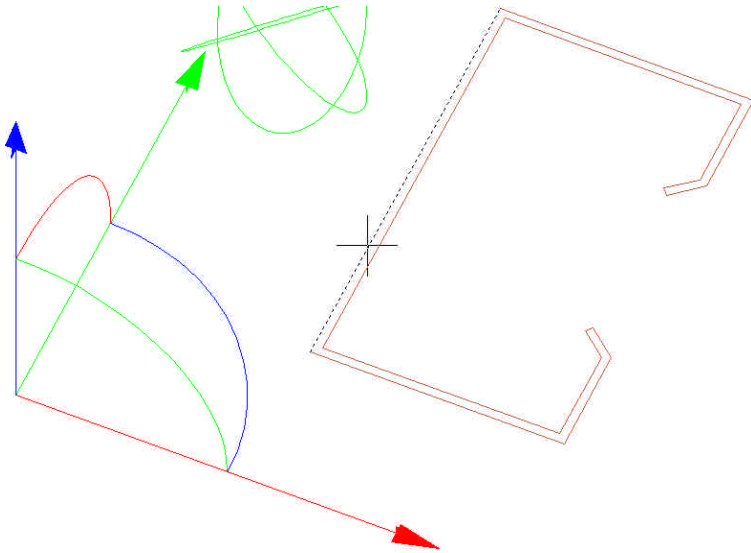
Close

- Click on **Close**.

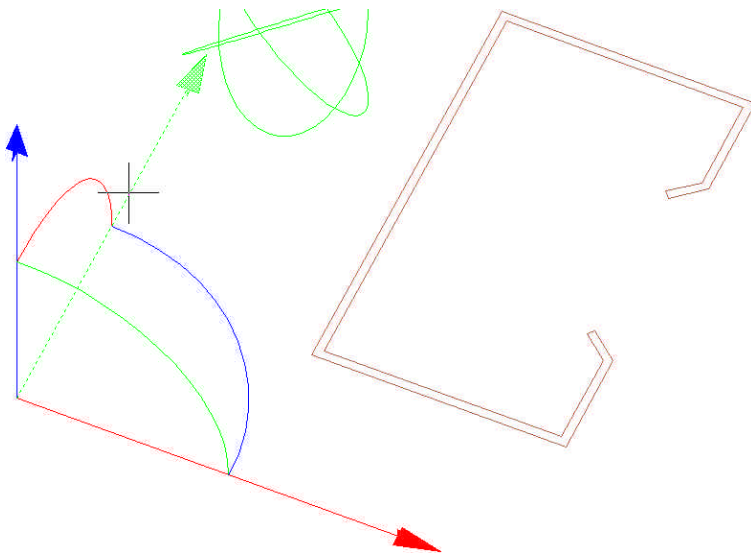
← Step 3 →



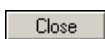
- Click on **Coincident**



- Select the most left line of the section.
Now press the right mouse button to confirm.




- Select the Y-line of the coordinate-system
(the green line).
Now press the right mouse button to confirm.



- Click on **Close**.

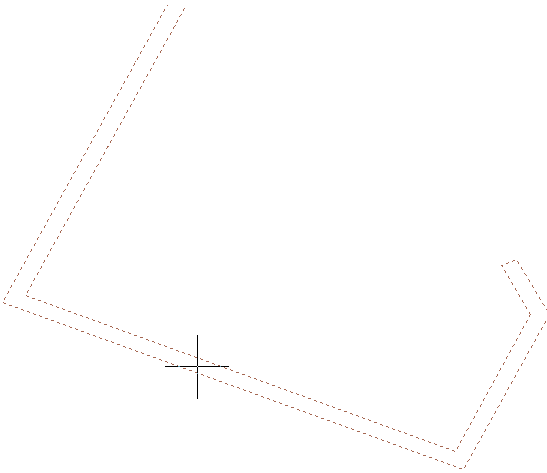
← Step 4 →

 The section is a 2D polyline, but we work in a 3D environment. That's why we have to constrain the line in 3D.

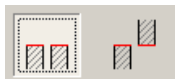
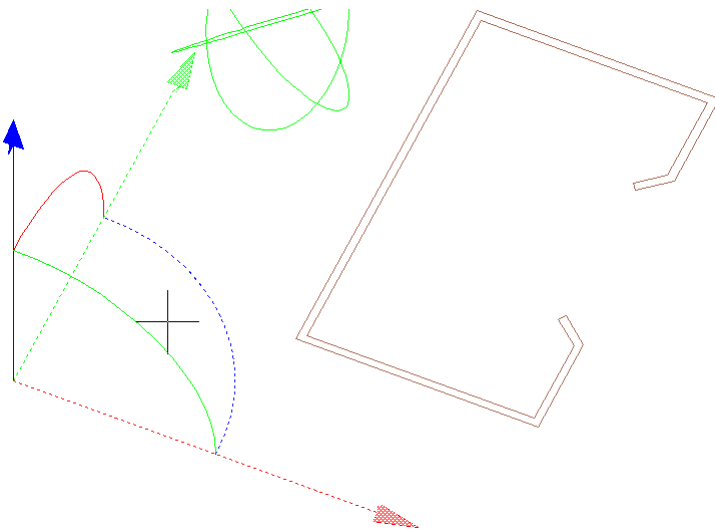



- Click on  **Coincident**

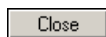
- Select the plane of the polyline by moving the cursor between two lines. Press the left mouse button once to select the plane. Now press the right mouse button to confirm.



- Select the ground plane of the coordinate-system (the blue arc). Now press the right mouse button to confirm.




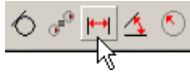
- Click in the dialog box on the button 



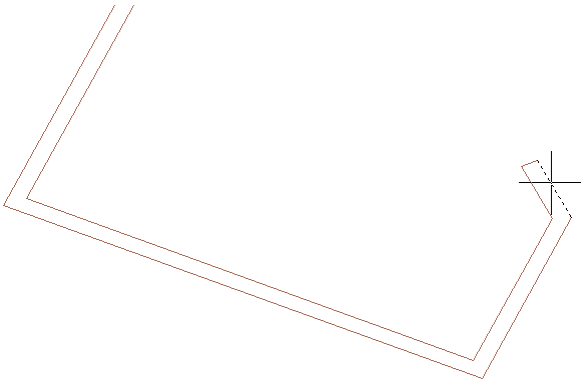
- Click on **Close**.

← Step 5 →

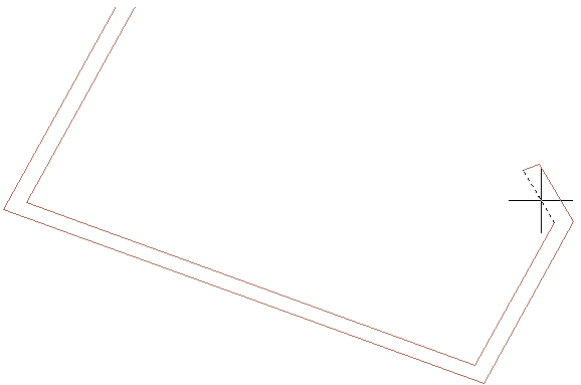
 We will now constrain each segment of the section.



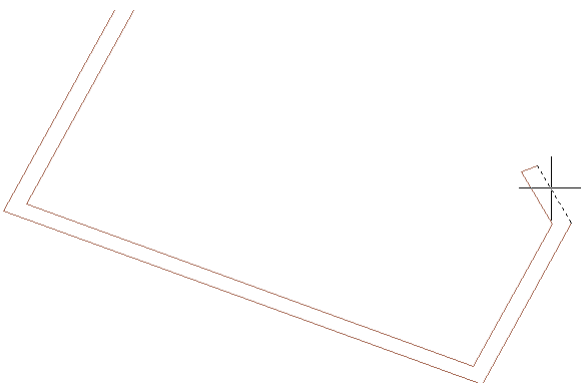
- Click on  **Distance between**



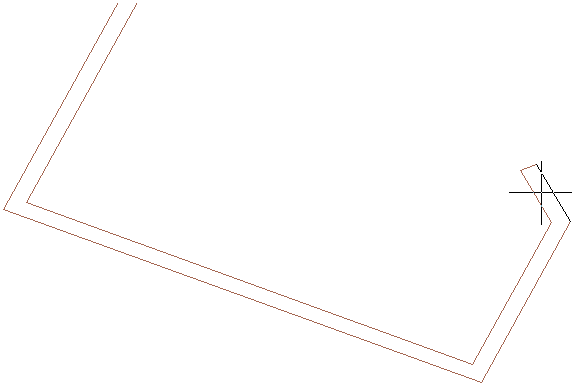
- Select the indicated inclined line and confirm with the right mouse button.



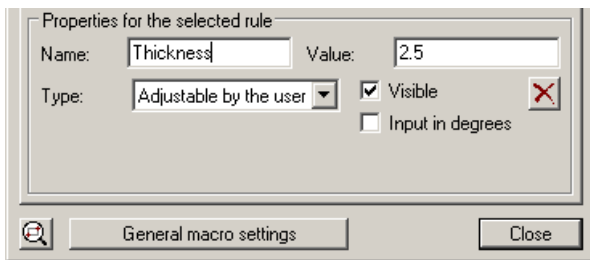
- Select the indicated inclined line and confirm with the right mouse button.



- Select the indicated inclined line and confirm with the right mouse button.



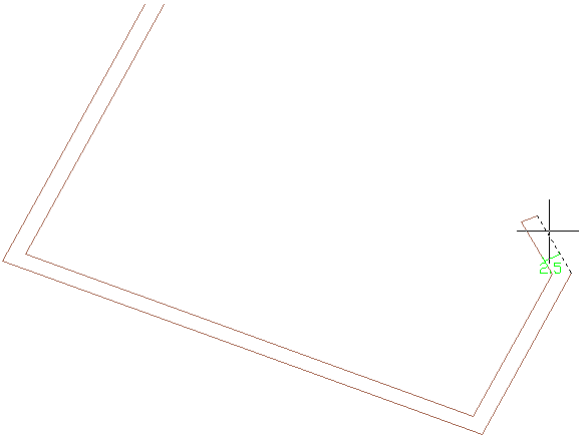
- Choose a point somewhere between the two inclined lines.



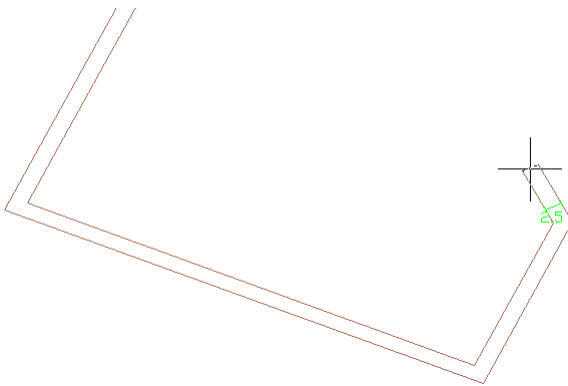
- In the dialog box below, enter for the property **Name** : *Thickness*
- Enter for the property **Value** : 2.5
- Click on **Close**.

← Step 6 →

- Click on  **Perpendicular ...**



- Select the indicated short line and confirm with the right mouse button.

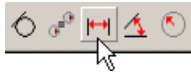


- Select the indicated inclined line and confirm with the right mouse button.

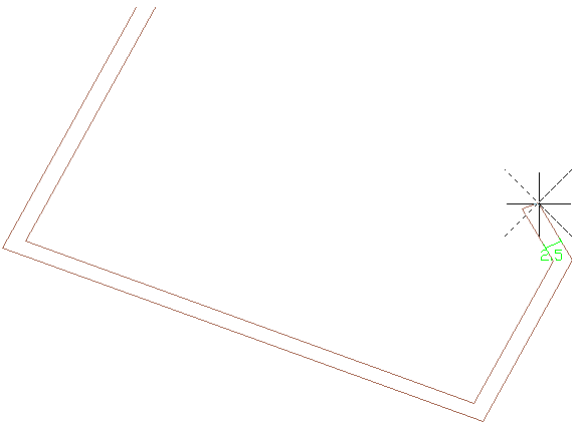
Close

- Click on **Close**.

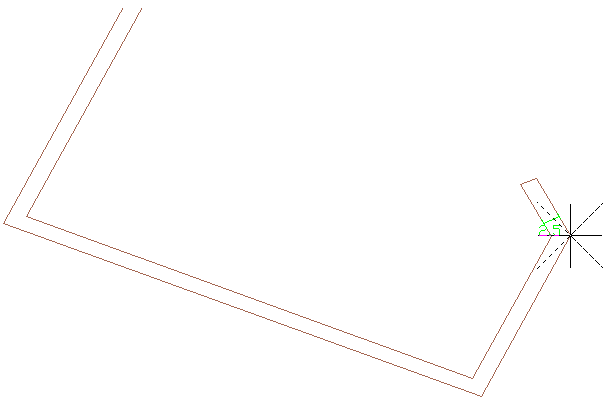
← Step 7 →



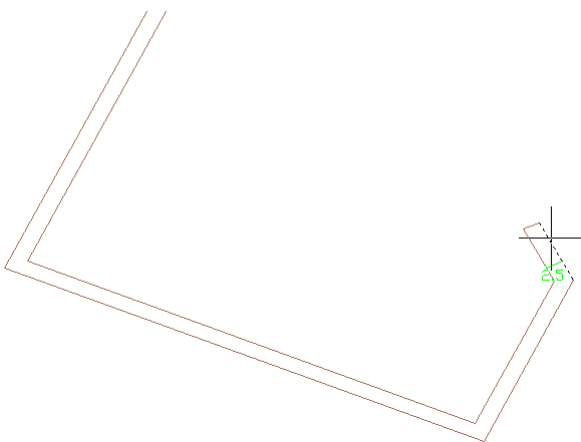
- Click on  **Distance between**



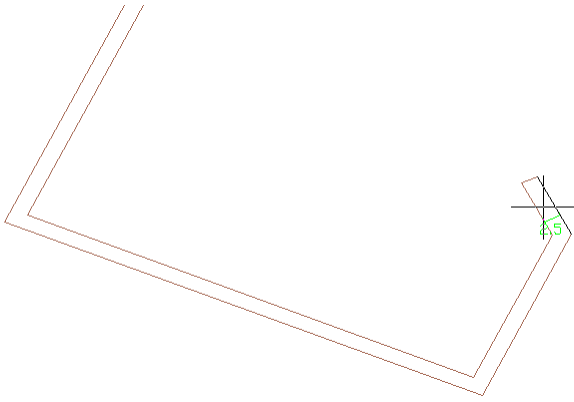
- Select the indicated point and confirm with the right mouse button.



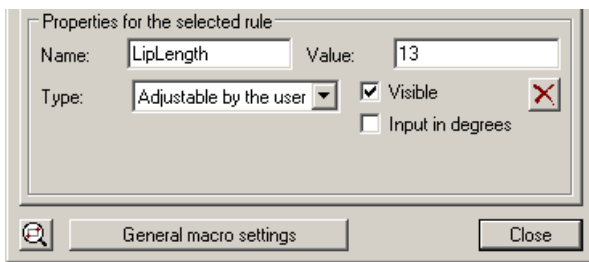
- Select the indicated point and confirm with the right mouse button.



- Select the indicated inclined line and confirm with the right mouse button.

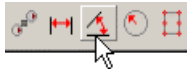


- Choose a point somewhere between the two inclined lines.

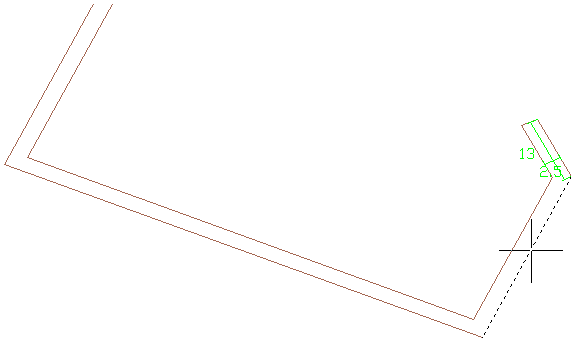


- In the dialog box below, enter for the property **Name** : *LipLength*
- Enter for the property **Value** : 13
- Click on **Close**.

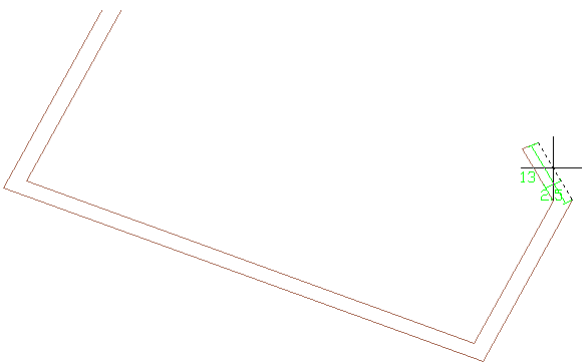
← Step 8 →



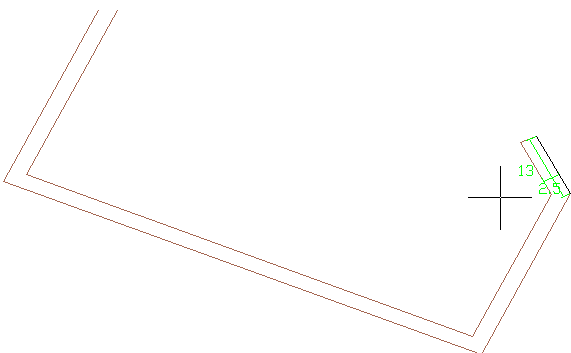
- Click on  **Angle between =**



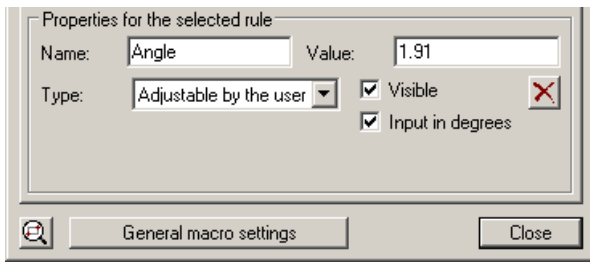
- Select the indicated line and confirm with the right mouse button.



- Select the indicated inclined line and confirm with the right mouse button.

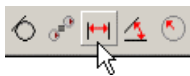


- Choose a point on the inside of the lines that we've selected. This way we indicate on which side the angle should be placed.

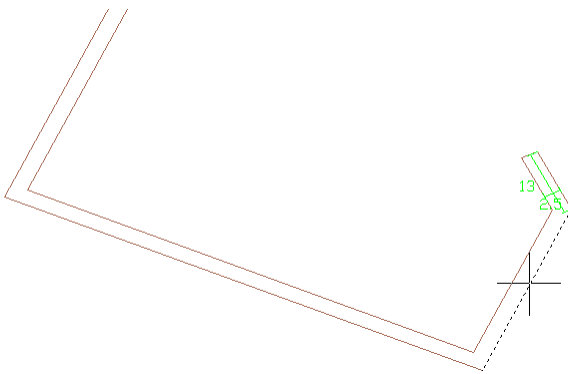


- In the dialog box below, enter for the property **Name** : *Angle*
- Enter for the property **Value** : *1.91*
- Activate the checkbox **Input in degrees**.
- Click on **Close**.

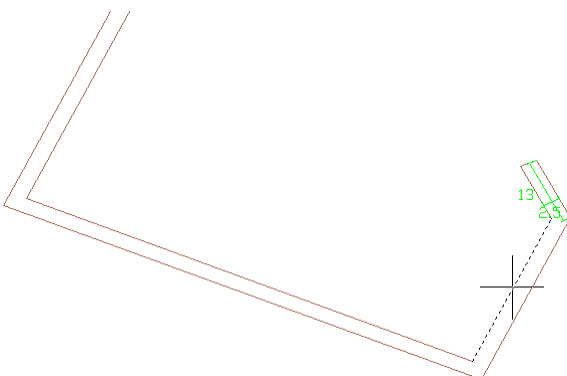
◀ Step 9 ▶



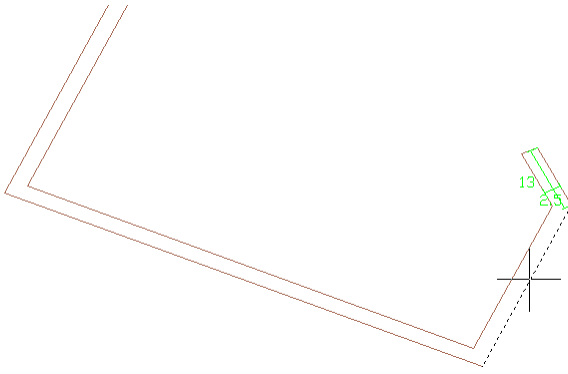
- Click on  **Distance between**



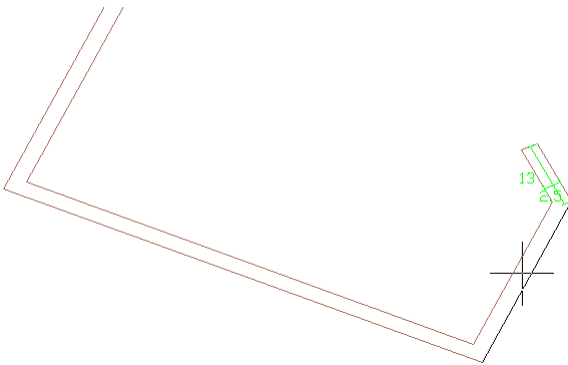
- Select the indicated line and confirm with the right mouse button.



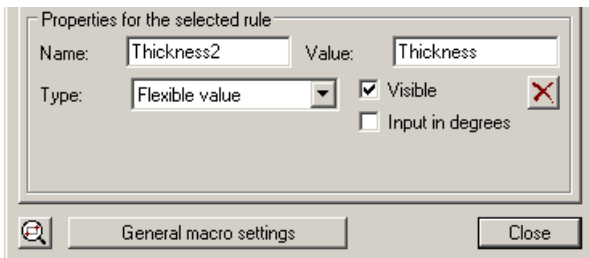
- Select the indicated line and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.

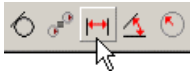


- Choose a point somewhere between the two lines.

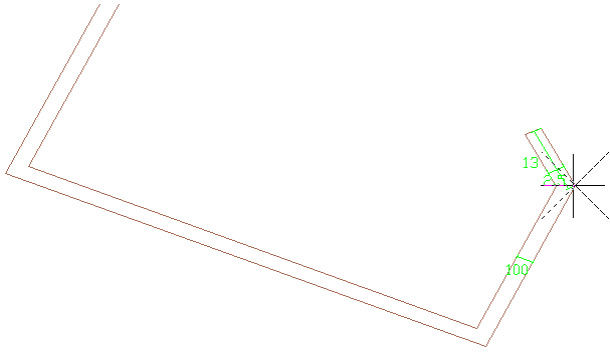


- In the dialog box below, enter for the property **Name** : *Thickness2*
 - Enter for the property **Value** : *Thickness*
 - Click on **Close**.

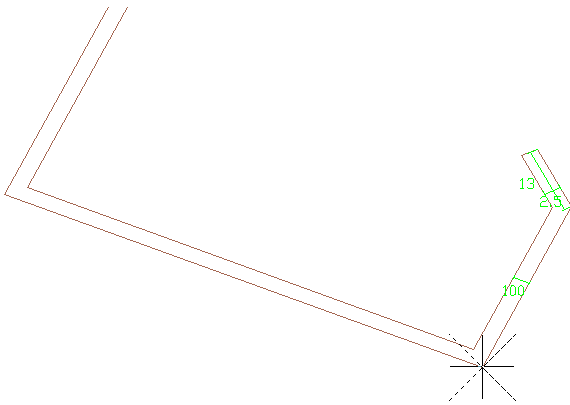
← Step 10 →



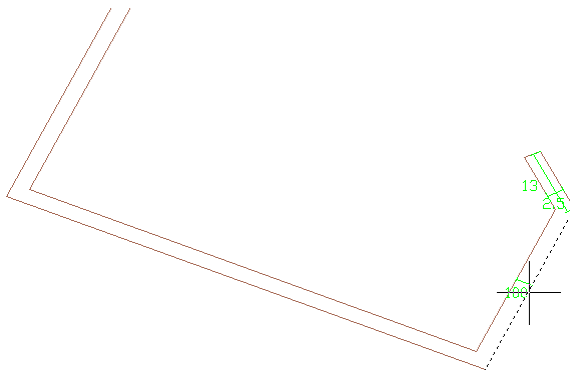
- Click on  **Distance between**



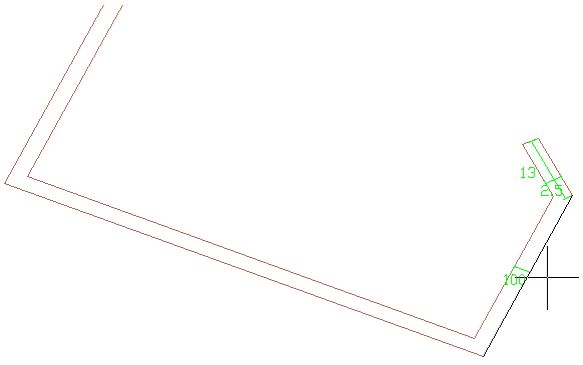
- Select the indicated point and confirm with the right mouse button.



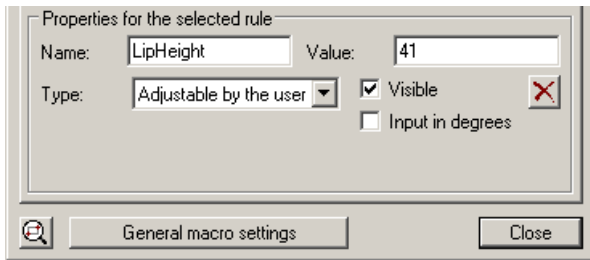
- Select the indicated point and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.

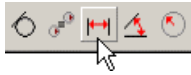


- Choose a point somewhere outside the line.

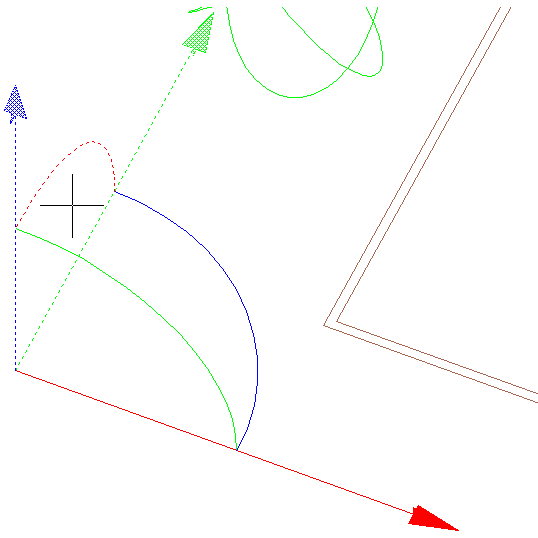


- In the dialog box below, enter for the property **Name** : *LipHeight*
- Enter for the property **Value** : 41
- Click on **Close**.

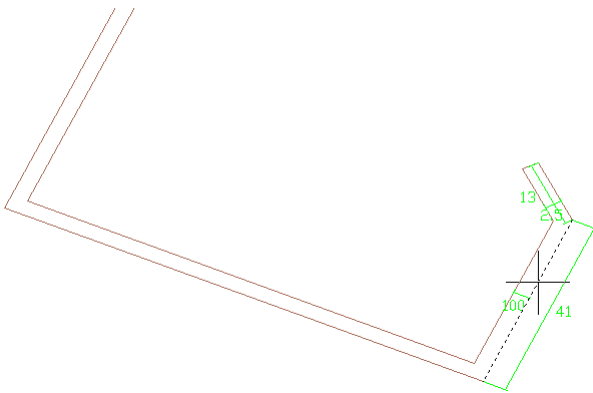
Step 11



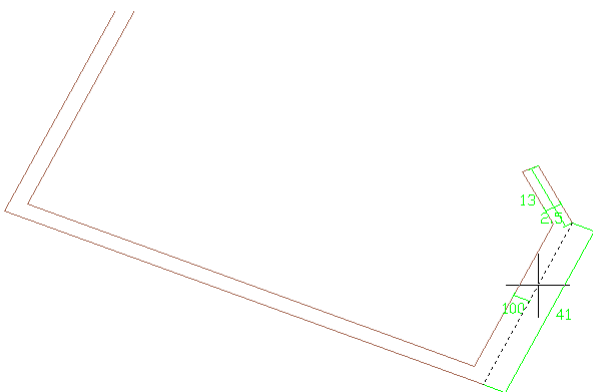
- Click on  **Distance between**



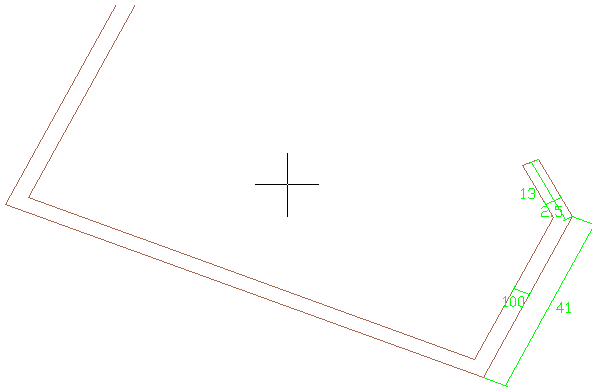
- Select the (red) plane of the coordinate-system and confirm with the right mouse button.



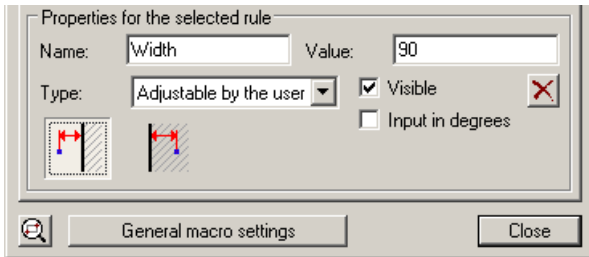
- Select the indicated line and confirm with the right mouse button.



- Select again the same line and confirm with the right mouse button.




- Choose a point somewhere in the middle of the polyline.



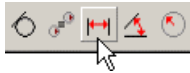
- In the dialog box below, enter for the property **Name** : *Width*

- Enter for the property **Value** : 90

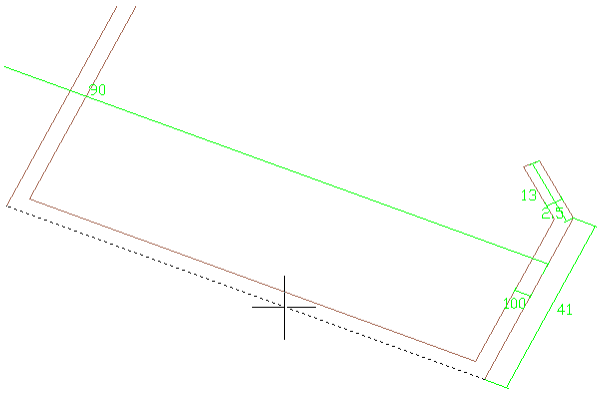
- Click on the button 

- Click on **Close**.

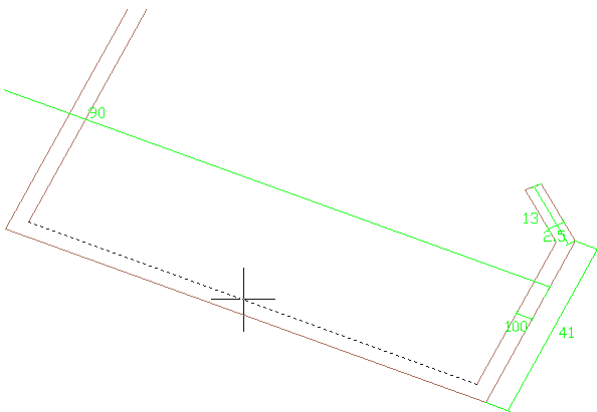
Step 12



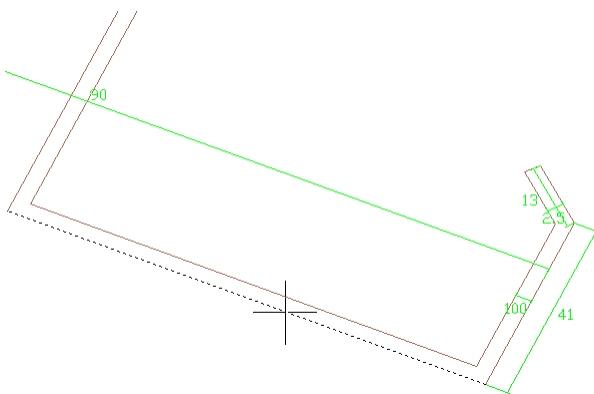
- Click on  **Distance between**



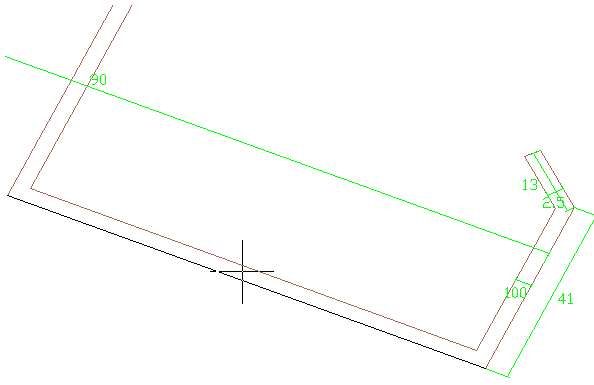
- Select the indicated line and confirm with the right mouse button.



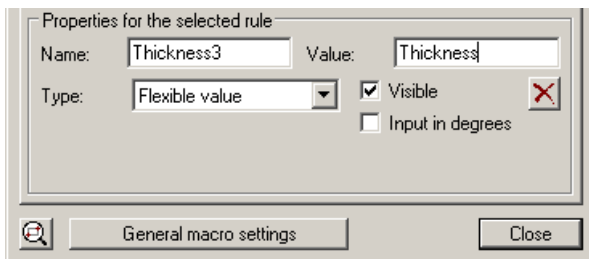
- Select the indicated line and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.

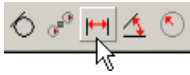


- Choose a point somewhere between the two lines.

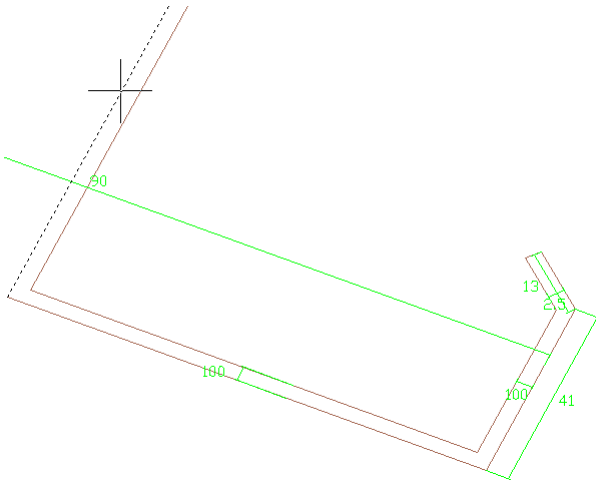


- In the dialog box below, enter for the property **Name** : *Thickness3*
- Enter for the property **Value** : *Thickness*
- Click on **Close**.

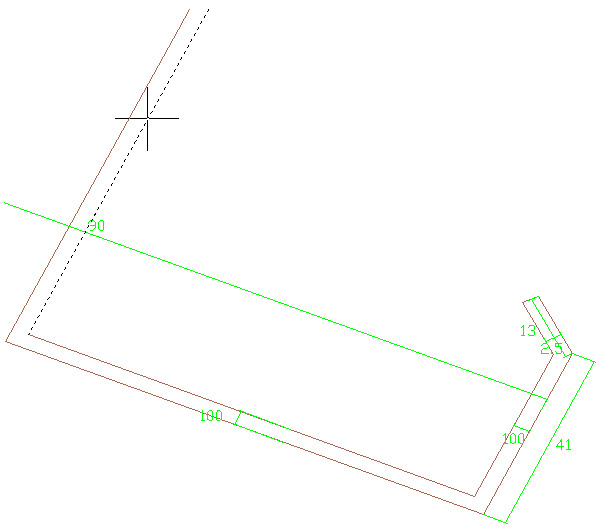
Step 13



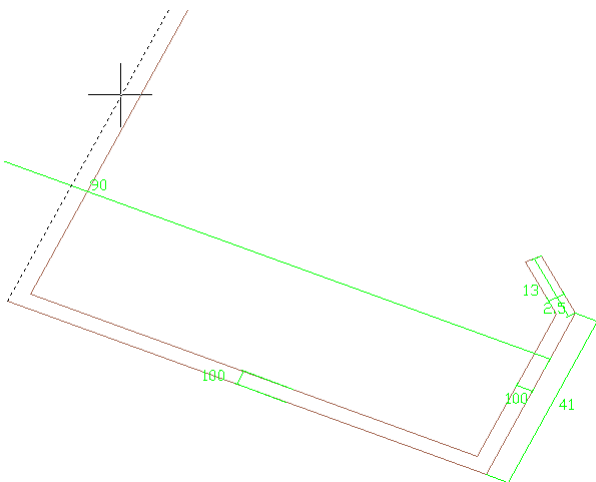
- Click on  **Distance between**



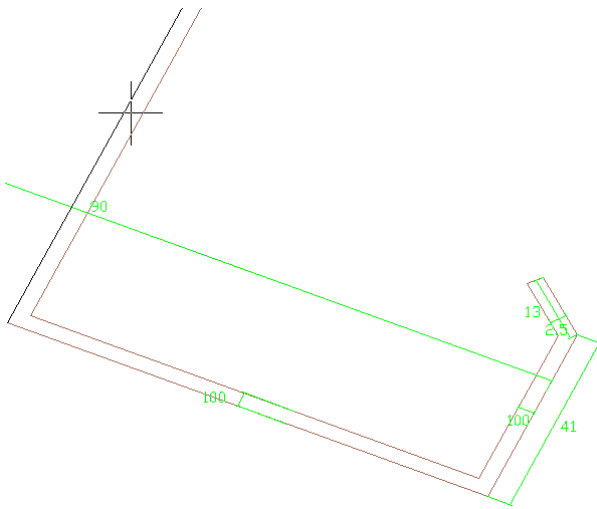
- Select the indicated line and confirm with the right mouse button.



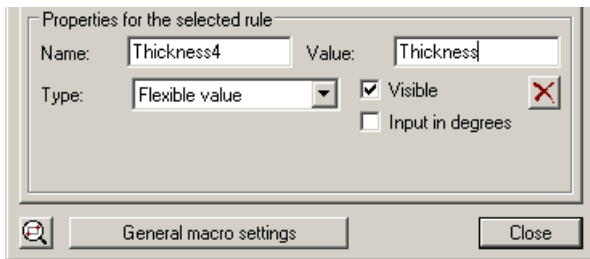
- Select the indicated line and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.

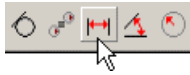


- Choose a point somewhere between the two lines.

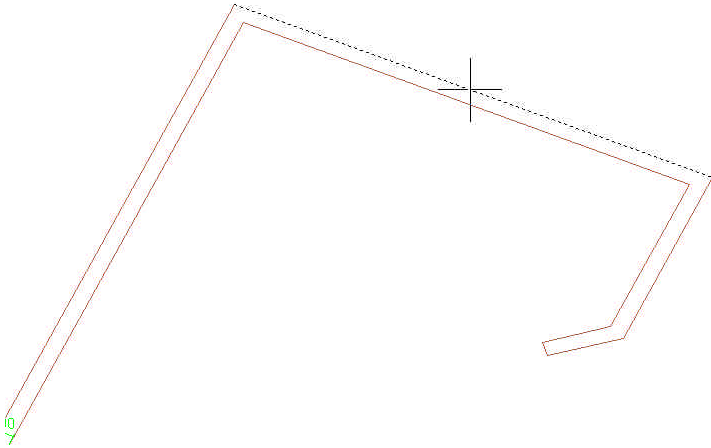


- In the dialog box below, enter for the property **Name** : *Thickness4*
- Enter for the property **Value** : *Thickness*
- Click on **Close**.

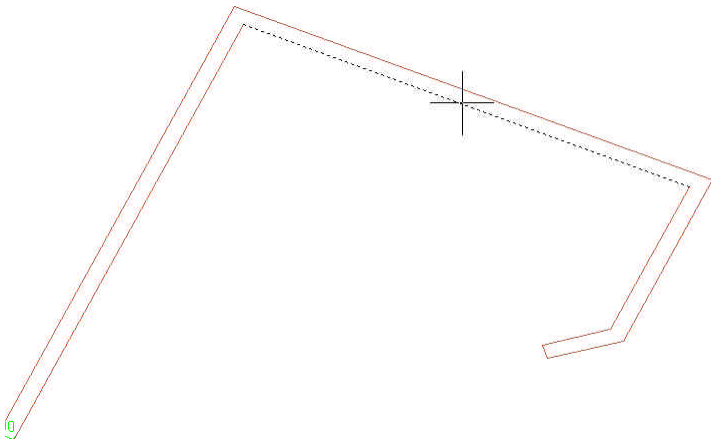
Step 14



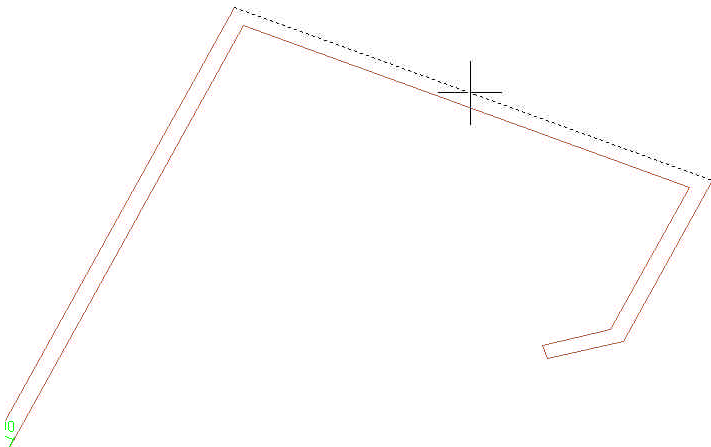
- Click on  **Distance between**



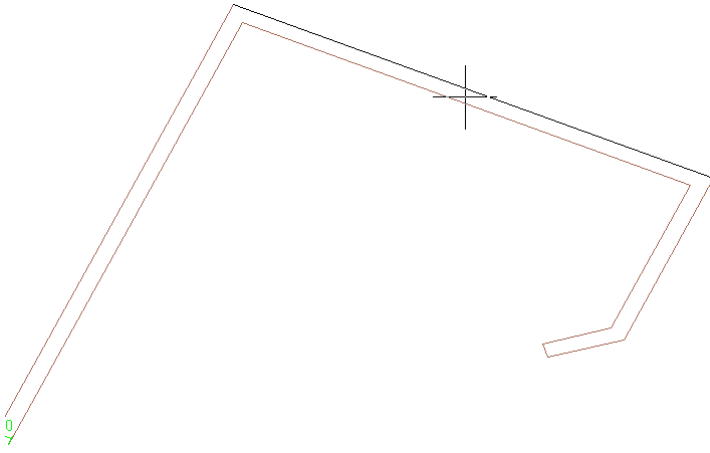
- Select the indicated line and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.



- Choose a point somewhere between the two lines.

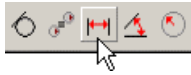
Properties for the selected rule

Name: Value:

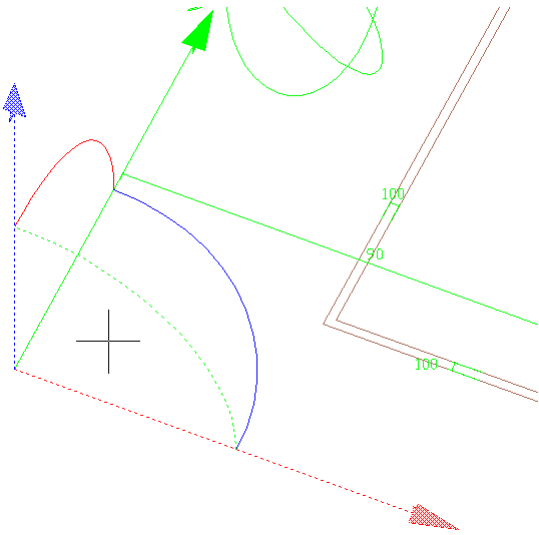
Type: Visible Input in degrees

- In the dialog box below, enter for the property **Name** : *Thickness5*
- Enter for the property **Value** : *Thickness*
- Click on **Close**.

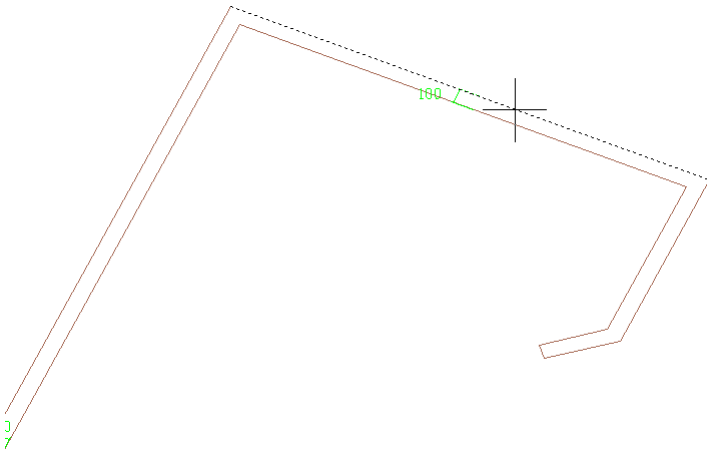
Step 15



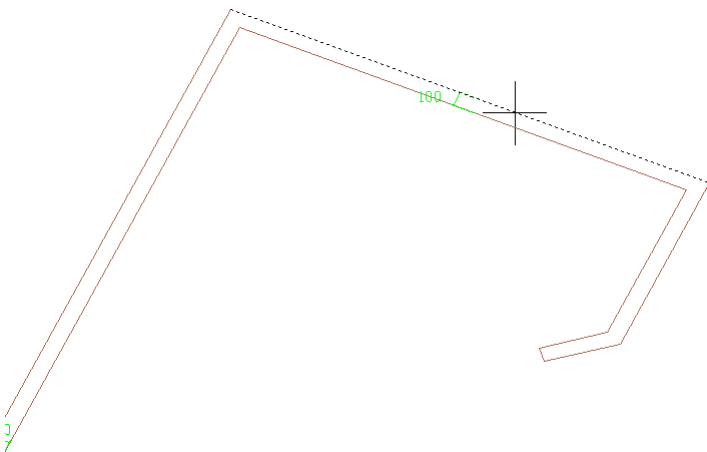
- Click on  **Distance between**



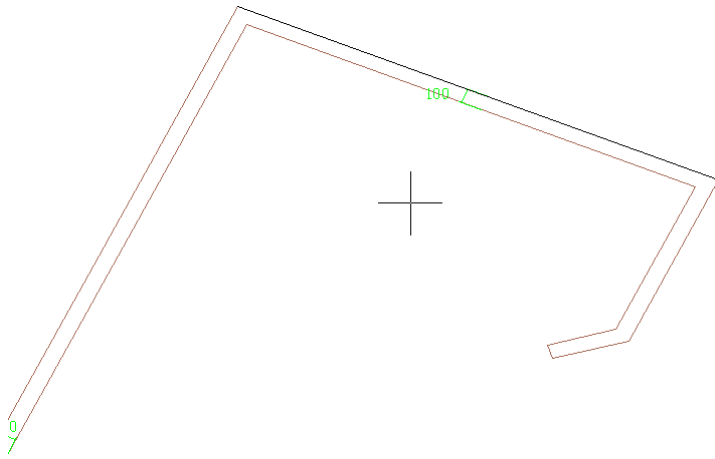
- Select the (green) plane of the coordinate-system and confirm with the right mouse button.



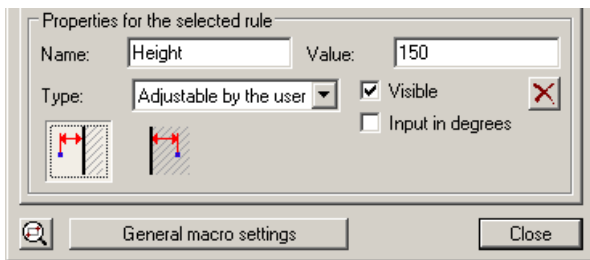
- Select the indicated line and confirm with the right mouse button.




- Select again the same line and confirm with the right mouse button.

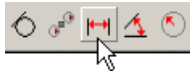


- Choose a point somewhere in the middle of the polyline.

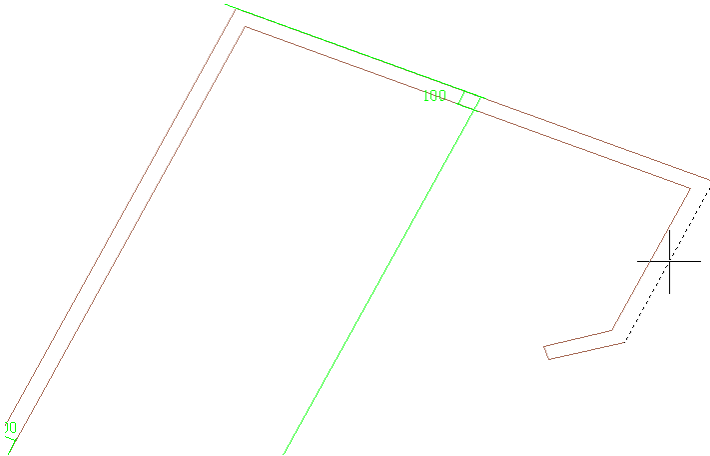


- In the dialog box below, enter for the property **Name** : *Height*
- Enter for the property **Value** : *150*
- Click on the button 
- Click on **Close**.

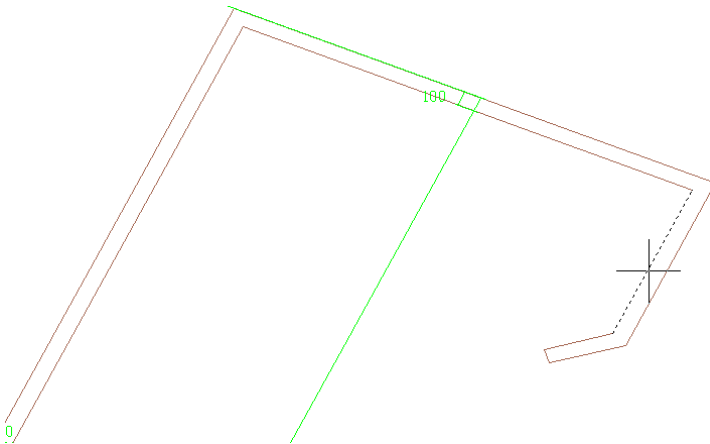
Step 16



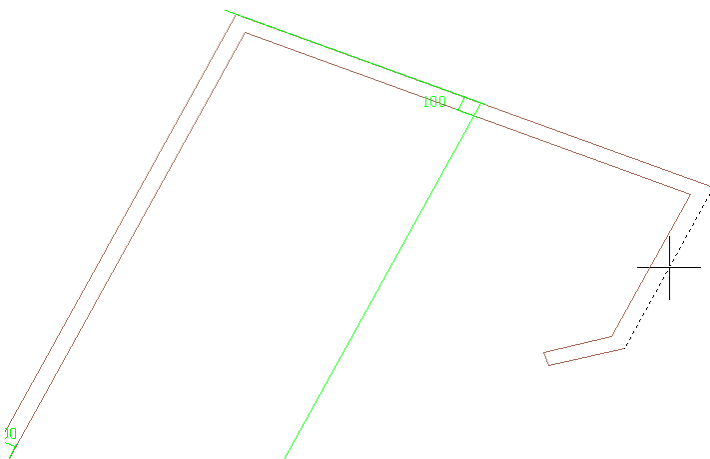
- Click on  **Distance between**



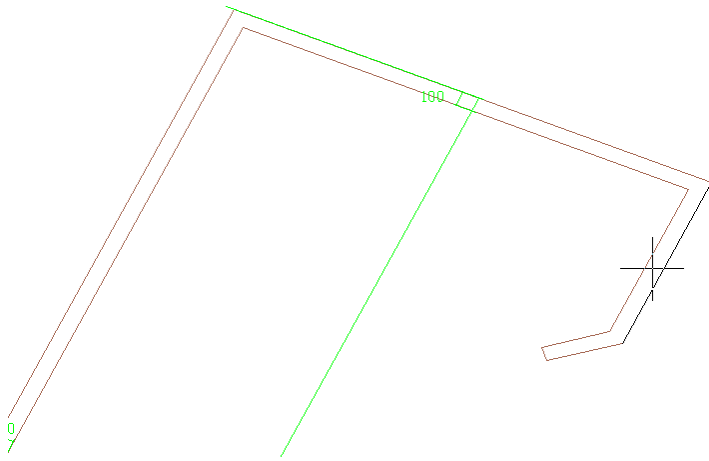
- Select the indicated line and confirm with the right mouse button.



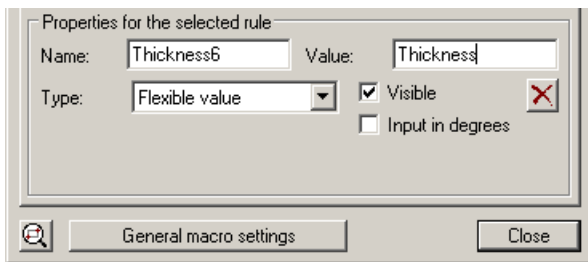
- Select the indicated line and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.

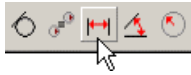


- Choose a point somewhere between the two lines.

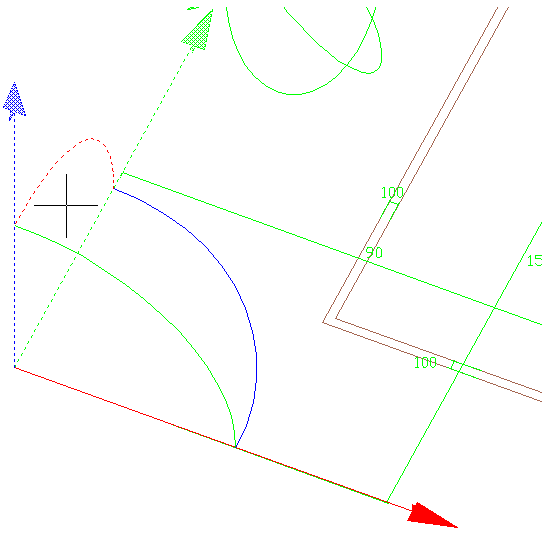


- In the dialog box below, enter for the property **Name** : *Thickness6*
- Enter for the property **Value** : *Thickness*
- Click on **Close**.

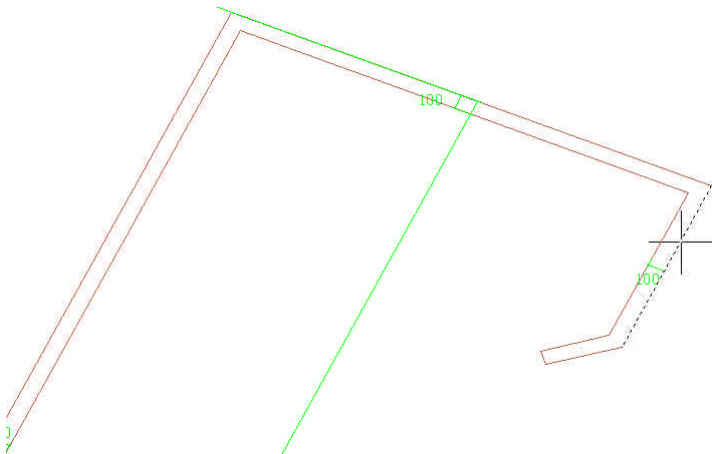
Step 17



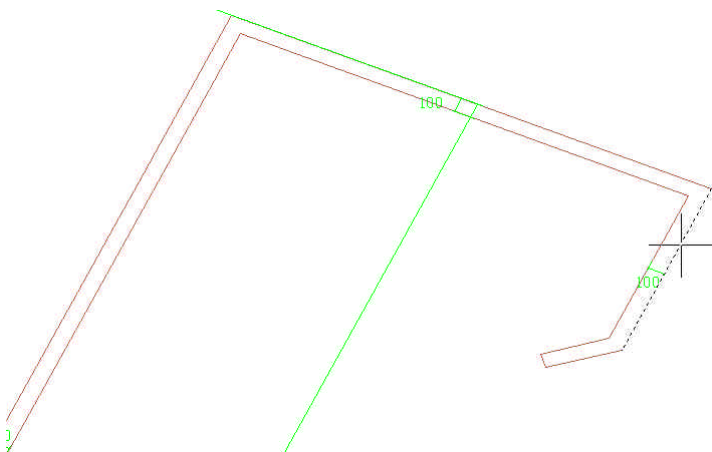
- Click on  **Distance between**



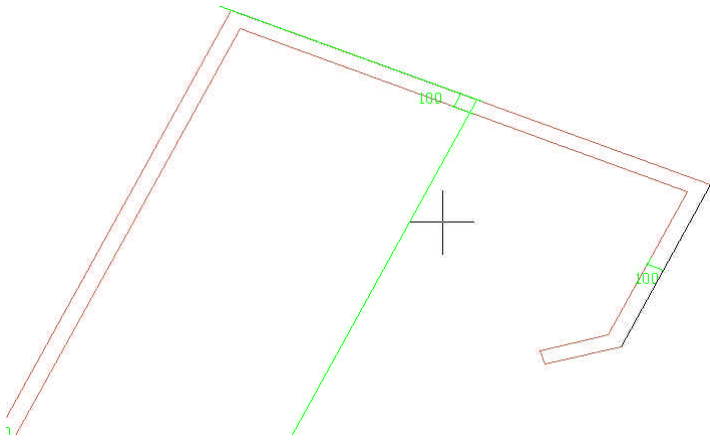
- Select the (red) plane of the coordinate-system and confirm with the right mouse button.



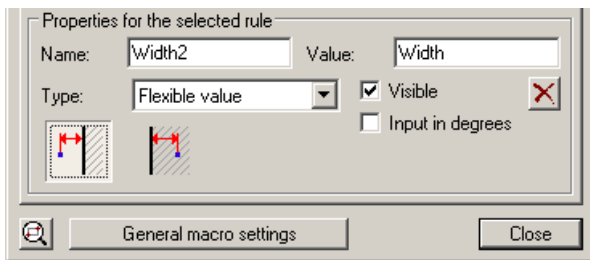
- Select the indicated line and confirm with the right mouse button.




- Select again the same line and confirm with the right mouse button.

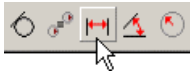


- Choose a point somewhere in the middle of the polyline.

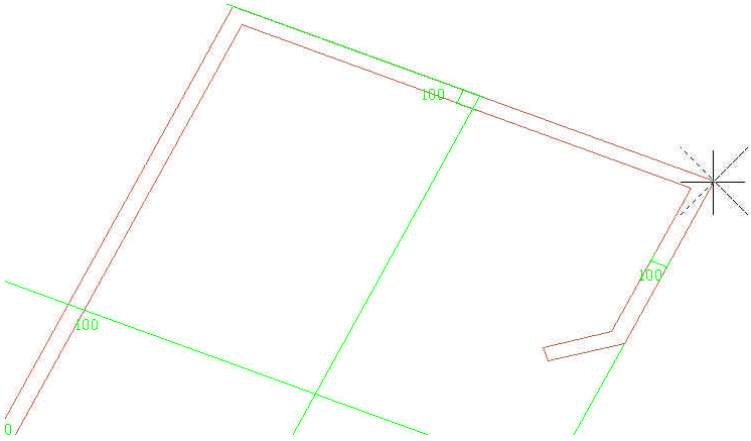


- In the dialog box below, enter for the property **Name** : *Width2*
- Enter for the property **Value** : *Width*
- Click on the button 
- Click on **Close**.

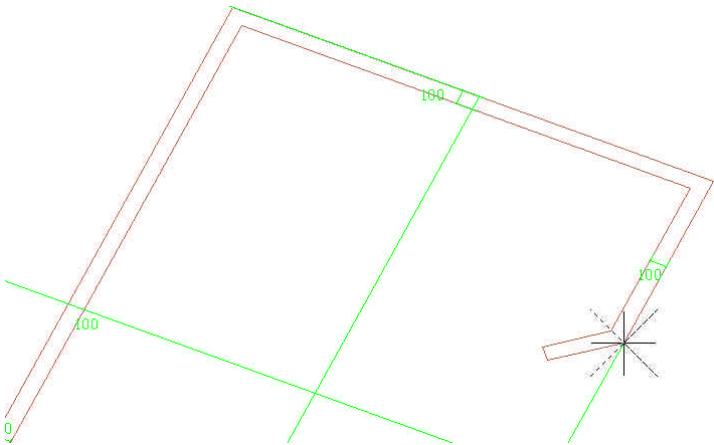
Step 18



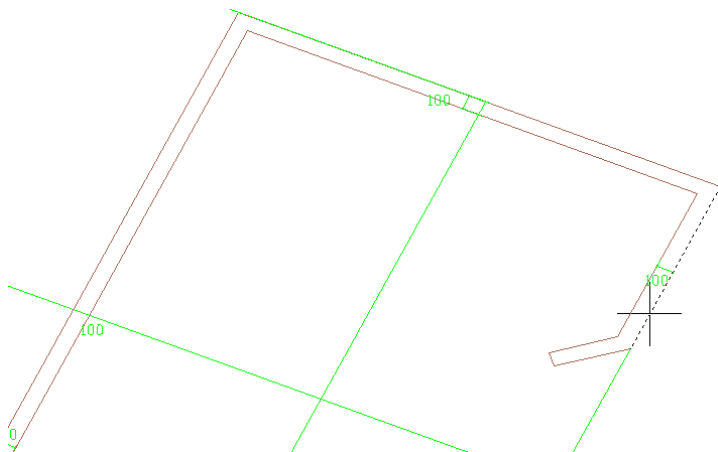
- Click on **Distance between**



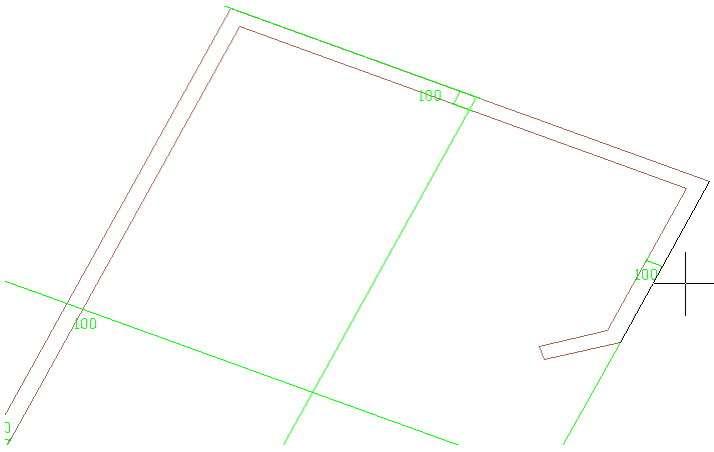
- Select the indicated point and confirm with the right mouse button.



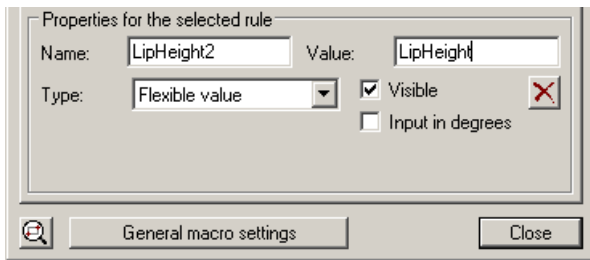
- Select the indicated point and confirm with the right mouse button.



- Select the indicated line and confirm with the right mouse button.

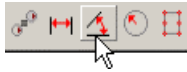


- Choose a point outside the polyline.

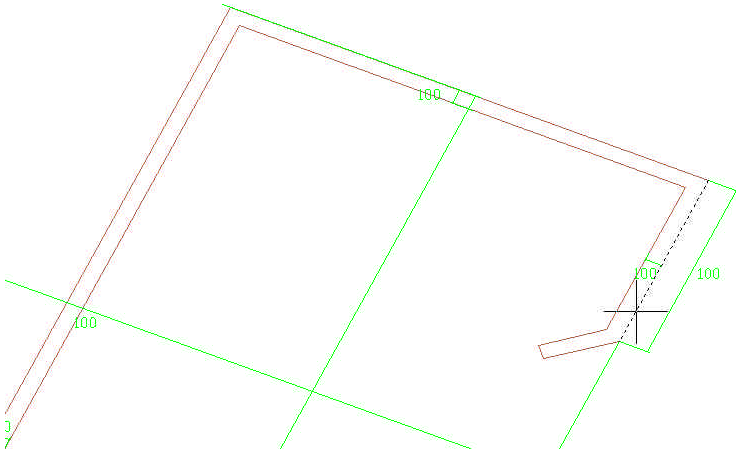


- In the dialog box below, enter for the property **Name** : *LipHeight2*
- Enter for the property **Value** : *LipHeight*
- Click on **Close**.

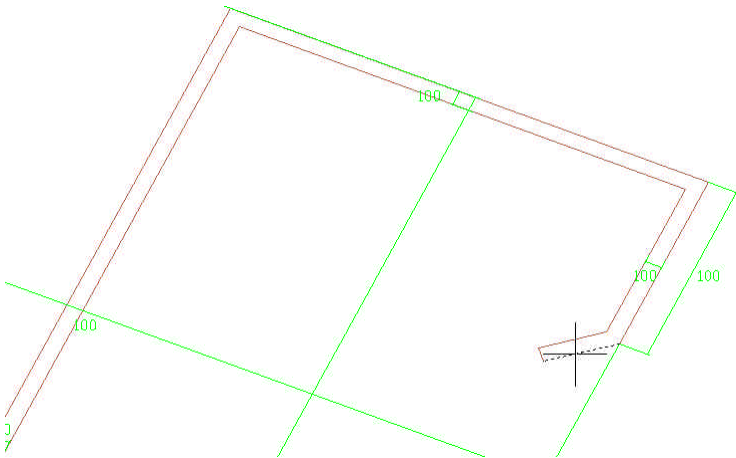
Step 19



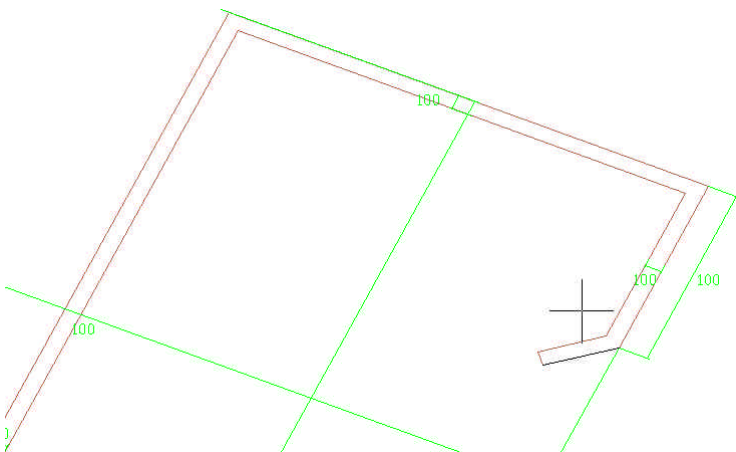
- Click on **Angle between =**



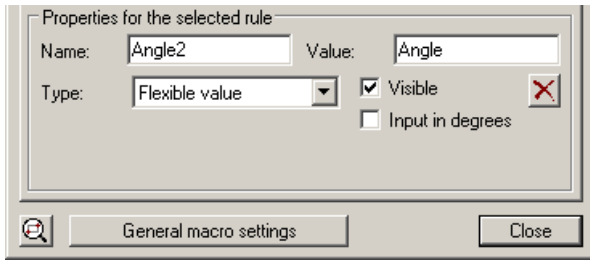
- Select the indicated line and confirm with the right mouse button.



- Select the indicated inclined line and confirm with the right mouse button.

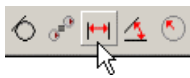


- Choose a point on the inside of the lines that we've selected. This way we indicate on which side the angle should be placed.

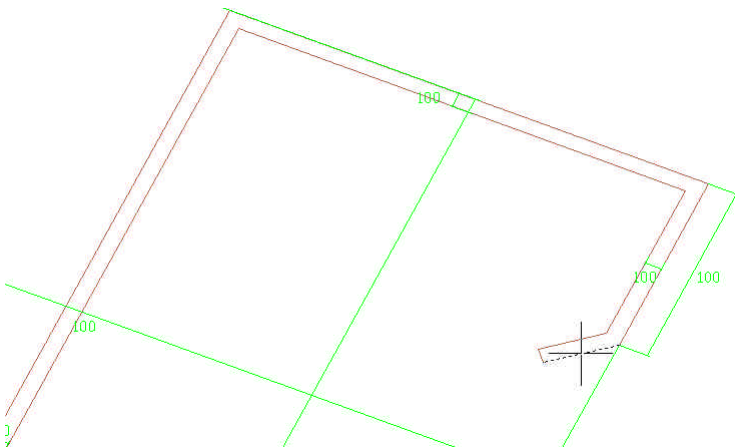


- In the dialog box below, enter for the property **Name** : *Angle2*
- Enter for the property **Value** : *Angle*
- Click on **Close**.

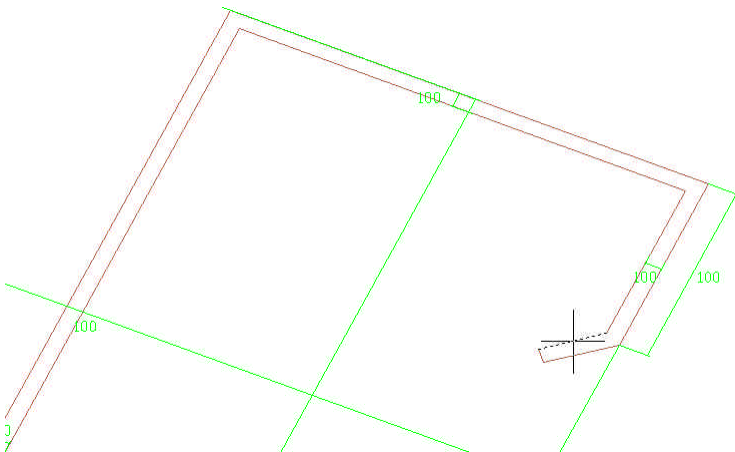
◀ Step 20 ▶



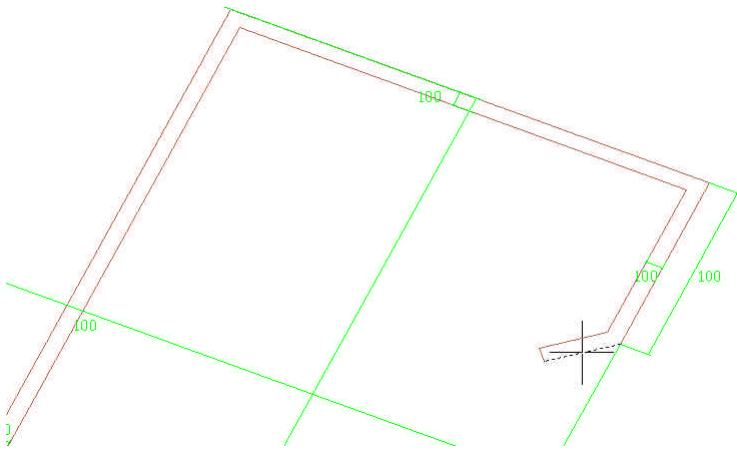
- Click on  **Distance between**



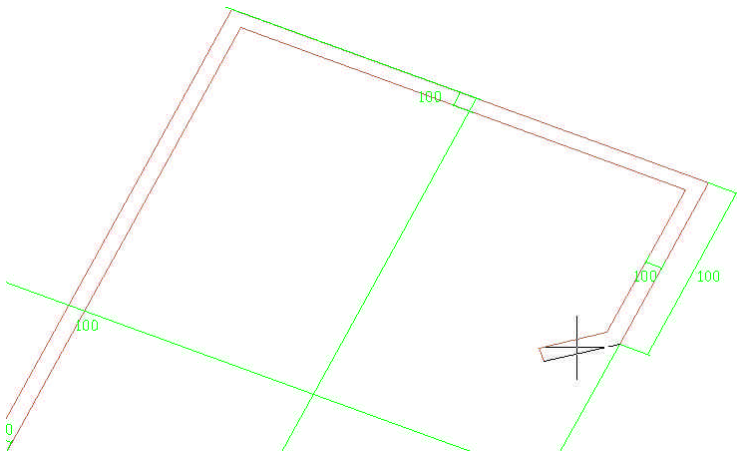
- Select the indicated inclined line and confirm with the right mouse button.



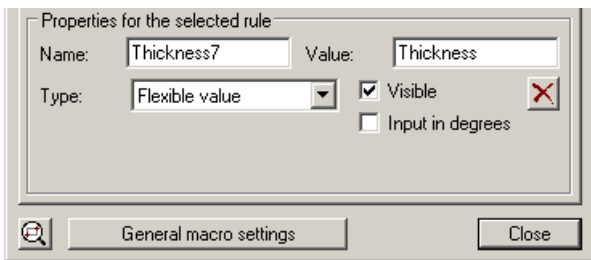
- Select the indicated inclined line and confirm with the right mouse button.



- Select the indicated inclined line and confirm with the right mouse button.

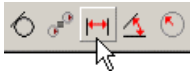


- Choose a point between the two lines.

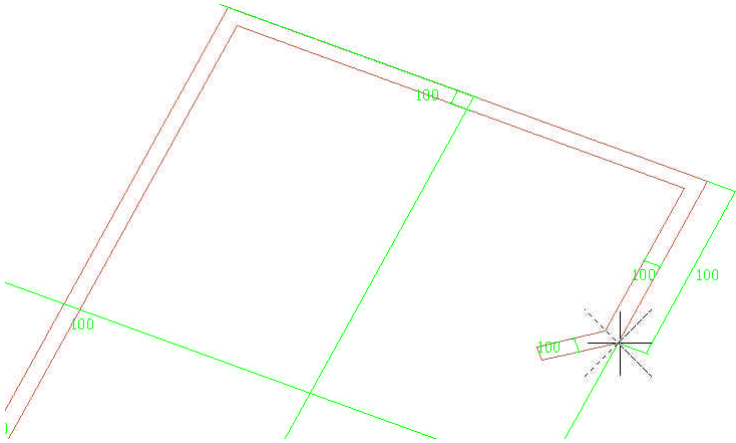


- In the dialog box below, enter for the property **Name** : *Thickness7*
 - Enter for the property **Value** : *Thickness*
 - Click on **Close**.

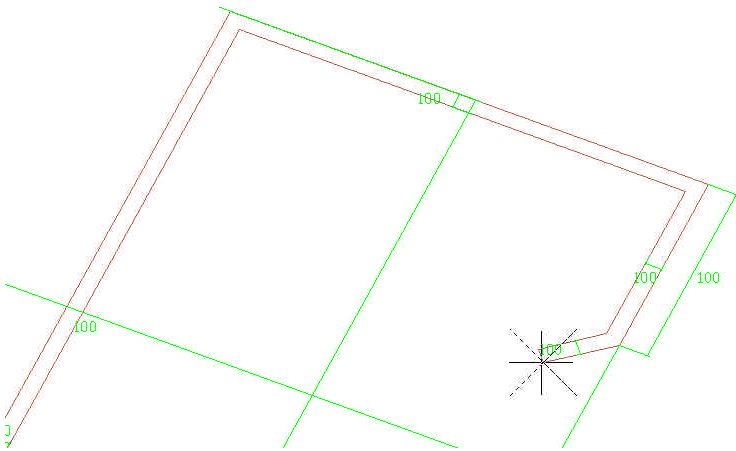
Step 21



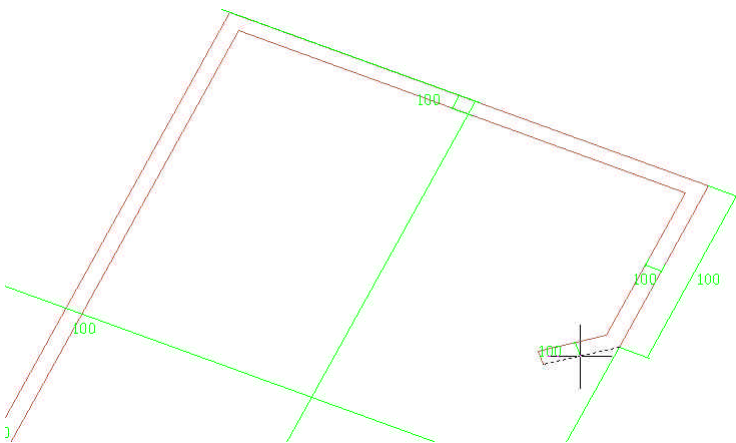
- Click on **Distance between**



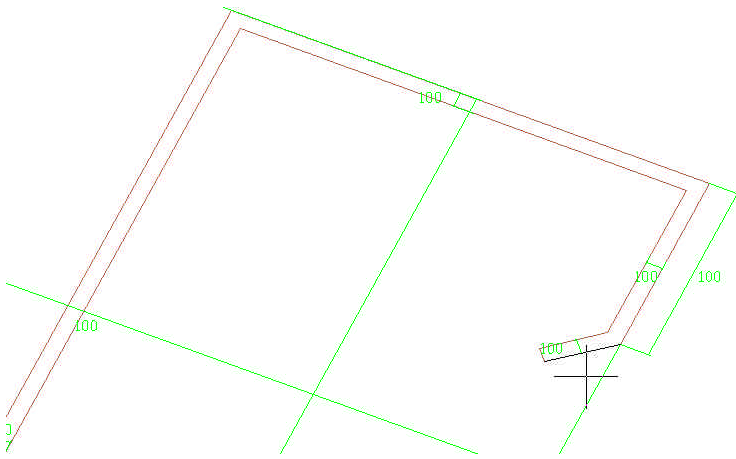
- Select the indicated point and confirm with the right mouse button.



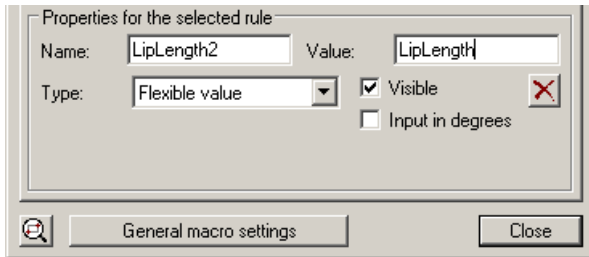
- Select the indicated point and confirm with the right mouse button.



- Select the indicated inclined line and confirm with the right mouse button.



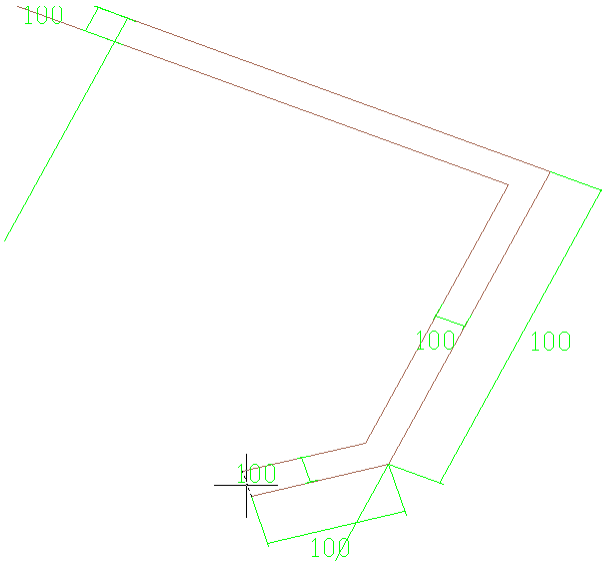
- Choose a point just outside the polyline.



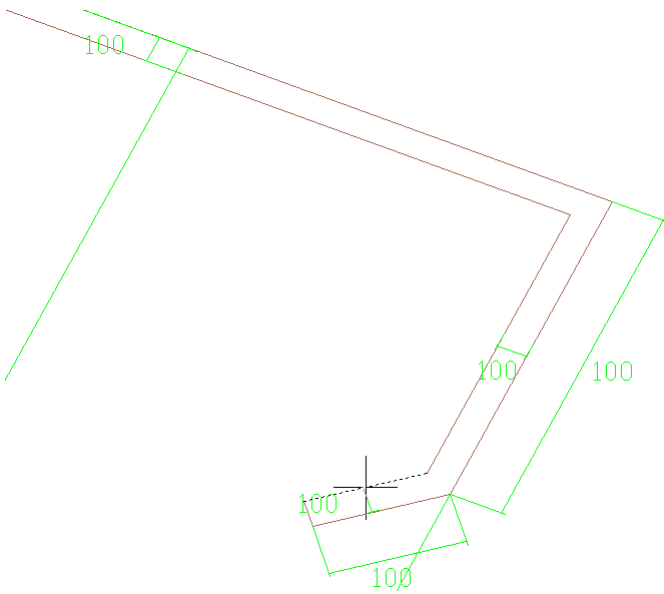
- In the dialog box below, enter for the property **Name** : *LipLength2*
- Enter for the property **Value** : *LipLength*
- Click on **Close**.

← Step 22 →

- Click on  **Perpendicular ...**



- Select the indicated short line and confirm with the right mouse button.



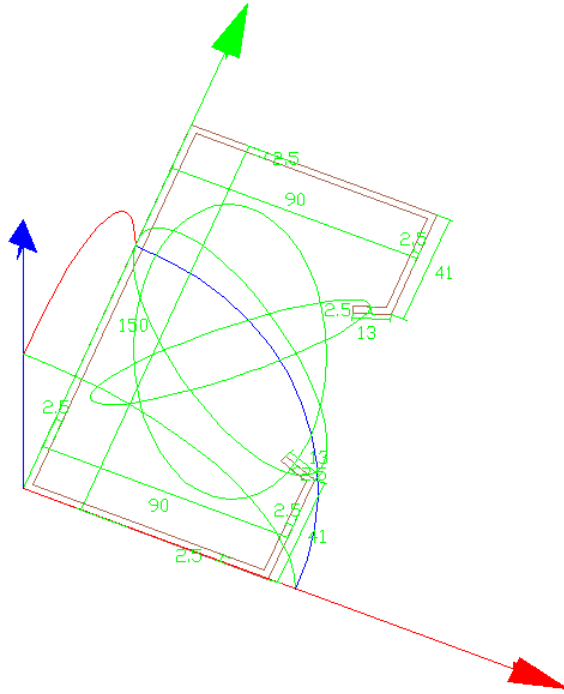
- Select the indicated inclined line and confirm with the right mouse button.



- Click on **Close**.



- Click on  **Recalculate all.**




Exercise 38: Using intelligent sections

We will add an intelligent section to the sections library.

The dimensions of the section can be modified in a spreadsheet.

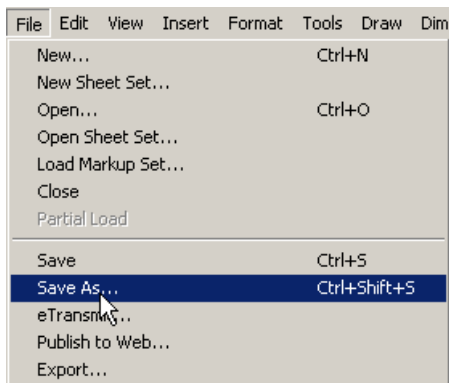
Parabuild uses it to calculate the resulting section while drawing the 3D member.

← Step 1 →

 We will first store the finished drawing of the previous exercise in the location where Parabuild searches for all the intelligent sections.



- Open the drawing  Exercise38.dwg




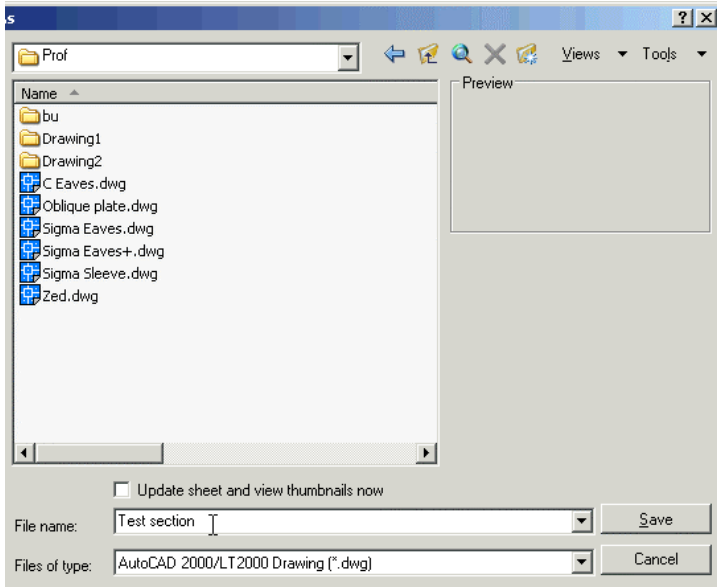
- Start the command **Save As...**



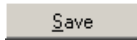
- Go to the following location in the **Save As** dialog box :

C:\Parabuildv1-2007\S3d_Lib\Prof\

 Parabuild may be located in another location on your computer.




- Enter for the filename : **Test section**



- Click on **Save**

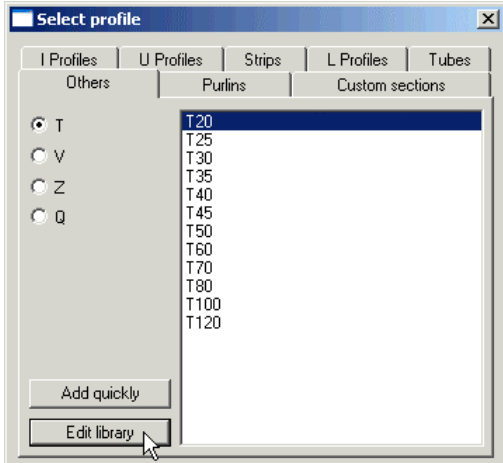


- Click on the cross  to close the drawing.

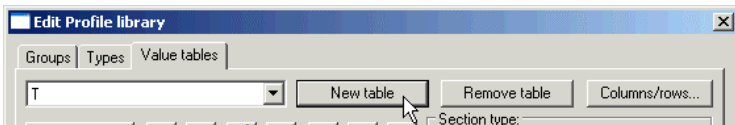
← Step 2 →



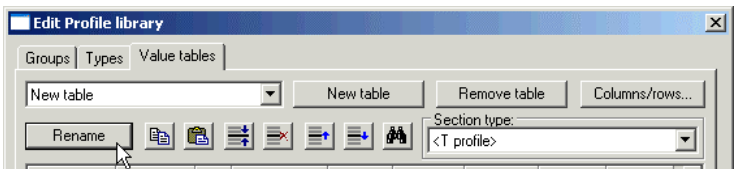
- Start the command **Other profiles**



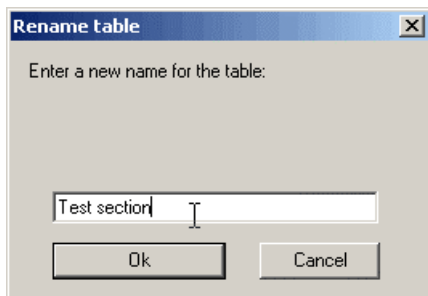
- Click on the button **Edit library**



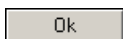
- Click at the top on the button **New table**



- Click on the button **Rename**



- Enter for the name : **Test section**

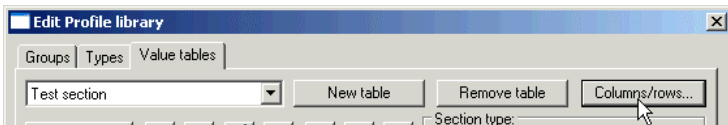


- Click on **Ok**.

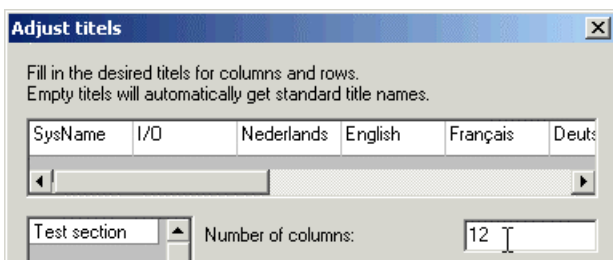
← Step 3 →



- Choose from the list for **Section type** :
Test section.dwg

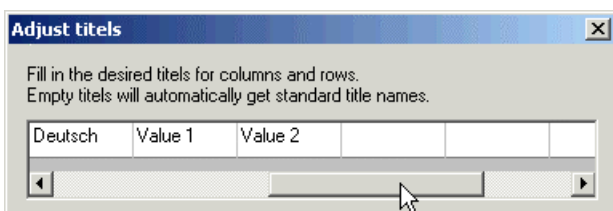


- Click on the button **Columns/rows...**

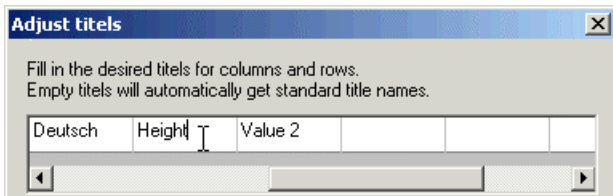


- Modify the **Number of columns** to : 12

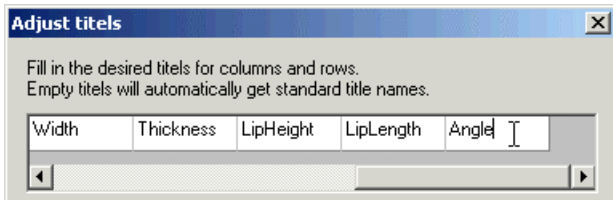
? We need 12 columns :
 - **Sysname** : unique name for each section
 - **I/O** : section on/off
 - Name in 4 languages
 The first 6 columns are always required, the columns after that can be used for the dimensions of the section.



- Move the horizontal bar so that the fields right in the list are shown.

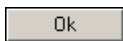


- Double-click on the field **Value 1** and Modify the text of that field to: *Height*



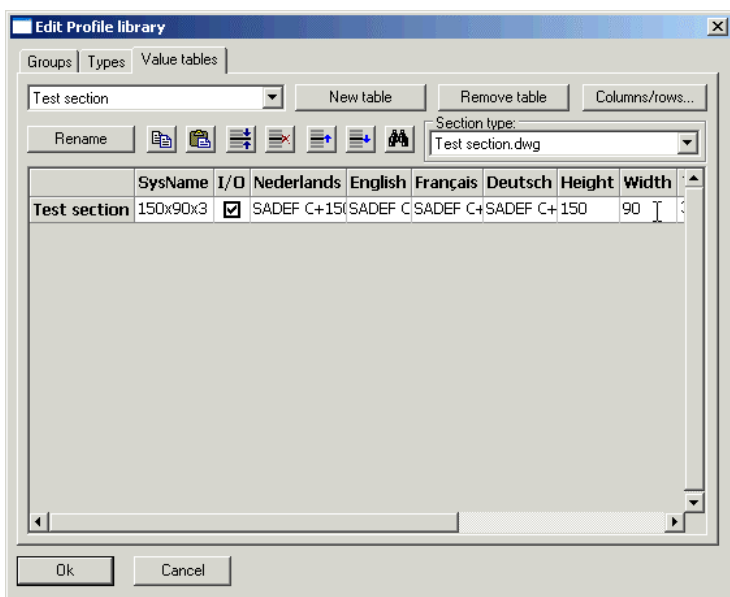
- Now enter for the other fields the following 5 column names :
Width, Thickness, LipHeight, LipLength and Angle.

*These last 6 columnnames have to correspond with the names of dimensions/variables in the macro of the section-drawing.
This way Parabuld know which variables should be filled inside the macro.*



- Click on **Ok**.

← Step 4 →



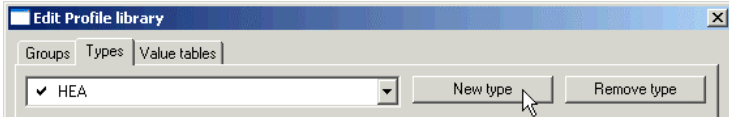
Enter in the spreadsheet the values for the first member :

- **Sysname:** 150x90x3
- **I/O :** Checked
- **Nederlands:** SADEF C+150x90x3
- **English :** SADEF C+150x90x3
- **Français :** SADEF C+150x90x3
- **Deutsch :** SADEF C+150x90x3
- **Height :** 150
- **Width :** 90
- **Thickness :** 3
- **LipHeight :** 41.05
- **LipLength :** 13.05
- **Angle :** 110

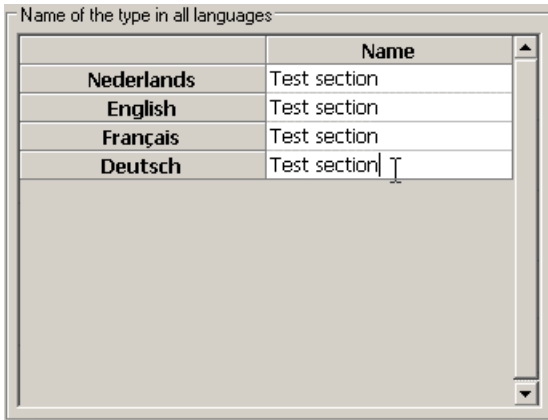
← Step 5 →



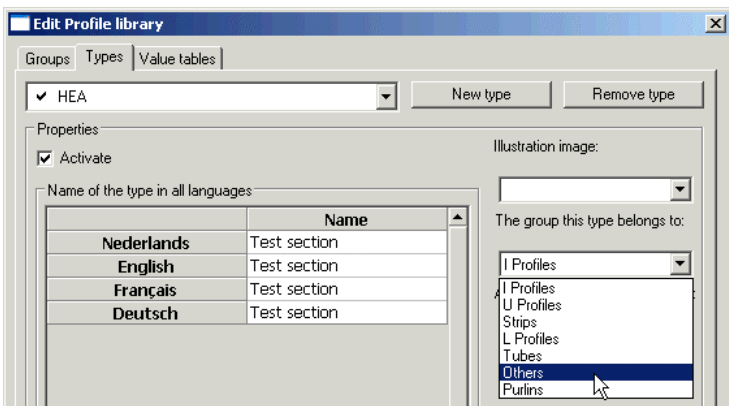
- Activate the tab **Types**.



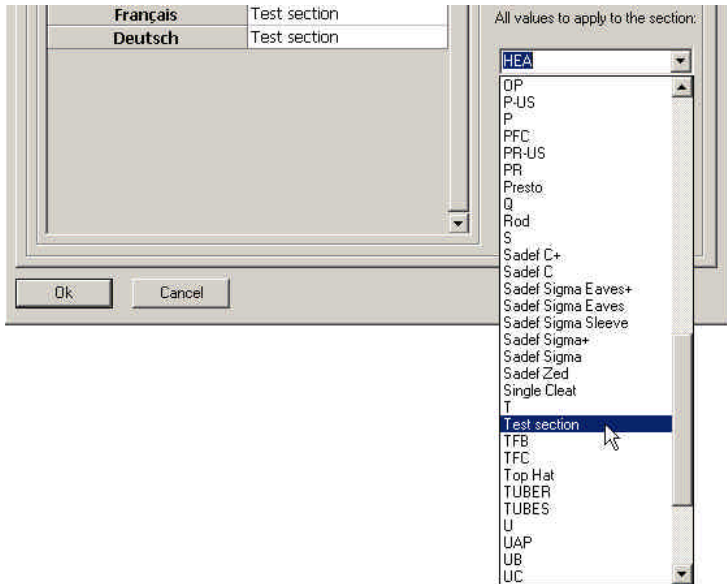
- Click on the button **New type**



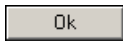
- Enter for all 4 languages the name : *SADEF C+*



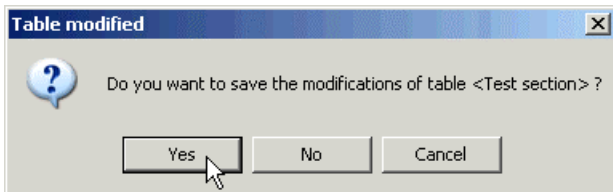
- Modify the setting **The group this type belongs to** to : *Others*



- Modify the setting **All values to apply to the section** to : *Test section*

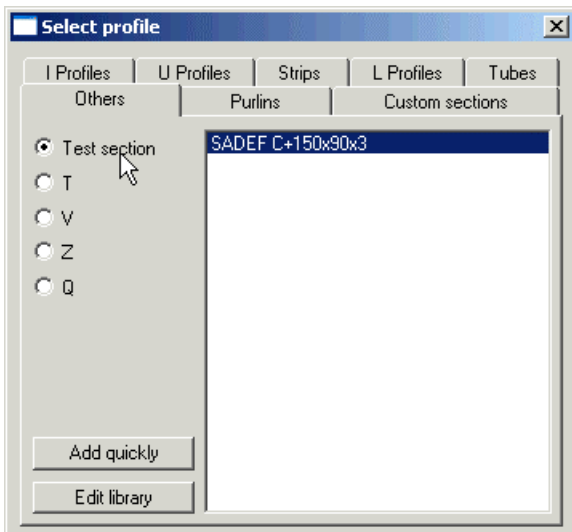


- Click on **Ok**.

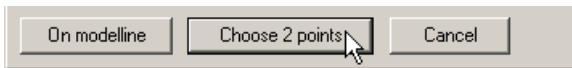


- Click on **Yes** when asked to change the modifications.

← Step 6 →



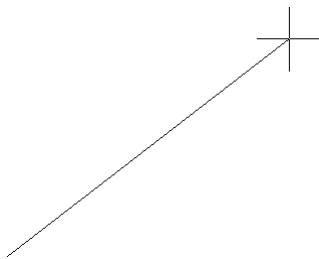
- Click on the new button **Test section**



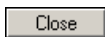
- Click on the button **Choose 2 points**



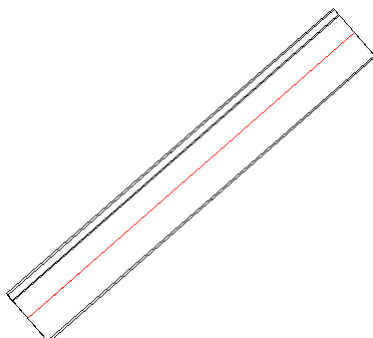
- Click a random location in the drawing for the startpoint of the member.




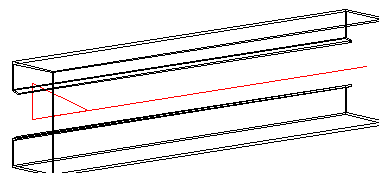
- Click a second location for the endpoint of the member.



- Click on **Close**.



 *If everything runs well you should have the same result.*



Exercise 39: Creating an array of macros, preparations

Sometimes it is necessary to make an array of a macro.

With the help of a special array-object we can copy one macro multiple times, for example over the length of a line.

At each moment in time we can change the number of copies to add more or less.


Some examples of applications of the array are:

- Trusses
- Frames
- Girders, Purlins
- Threads
- The posts of a bannister
- Cage ladders

In this exercise we will use an array repeat the struts of a truss.

We create one strut in a macro. Using an array we will then copy the truss in the exercise after this one.

Step 1

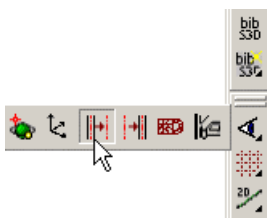
 We start with a drawing that already has two constrained beams of the truss.

The beams are those that are already available in the library : the top line determines the placement, length, direction and inclination of the truss.

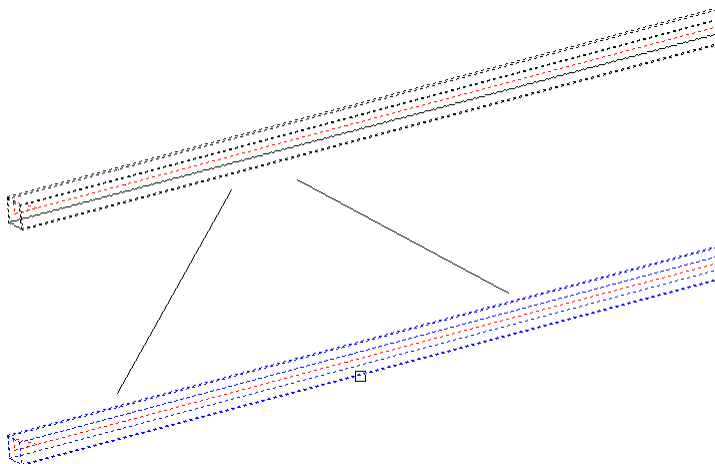
Study this macro if you need to create a similar macro yourself.



- Open the drawing  Exercise39.dwg



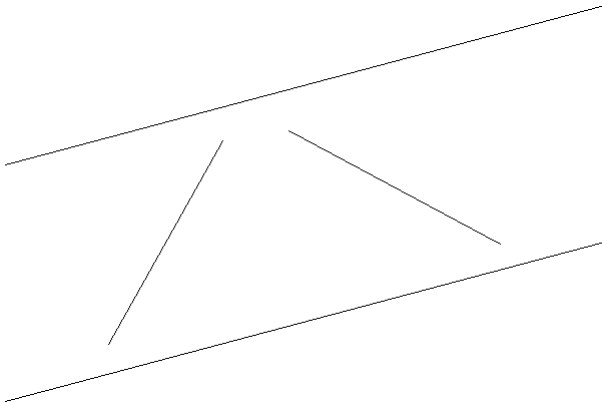
- Start the command  **Volumes** -> **axes**



- Select both tubes.



- Press **<Enter>**.

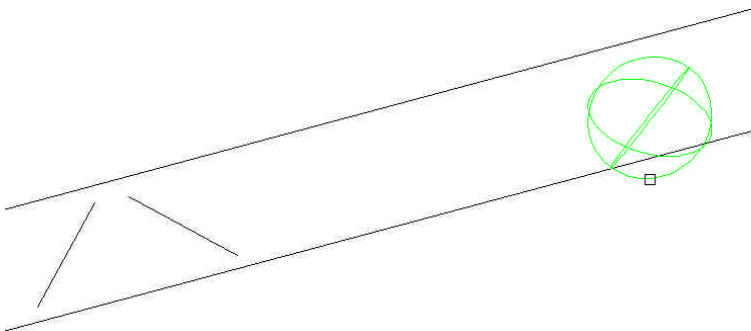


? *By hiding the tubes we make it visually easier for ourselves to draw the geometric rules. In this case we don't need the tubes to draw the struts.*

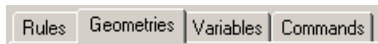
← **Step 2** →



- Click on **Edit macro**



- Select the big macro.



- Activate the tab **Geometries**

Element	Geometry	Flexibility	Ai
Plane(21237595)	Base	Rigid	<input checked="" type="checkbox"/>
Line(212375940)	Base	Fixed	<input type="checkbox"/>

- Deactivate the checkbox of the plane-object (the first row).

? *By deactivating the checkbox the plane-object is not hidden anymore. We will use this plane-object in a new macro.*


← Step 3 →



- Start the command  **Set macro as current**.



- Press **<Enter>** to deactivate automatic calculation.

 *We need to put the struts in a different macro, otherwise they can't be copied. We will draw 2 inclined lines for this.*



- Start the command  **Create new macro** (red sphere).




- Click a random location in the drawing.

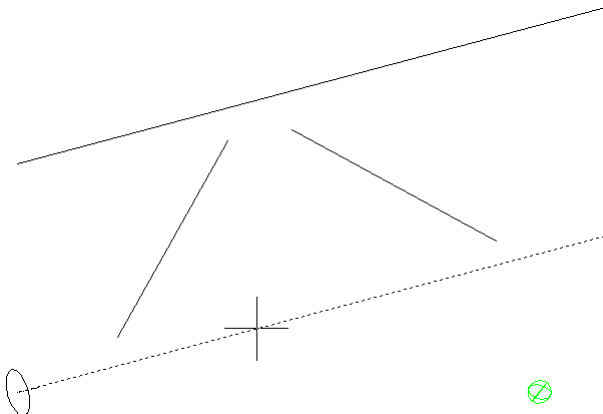


- On the command line, type for the **name** of the module : *Line1* and press **<Enter>**.

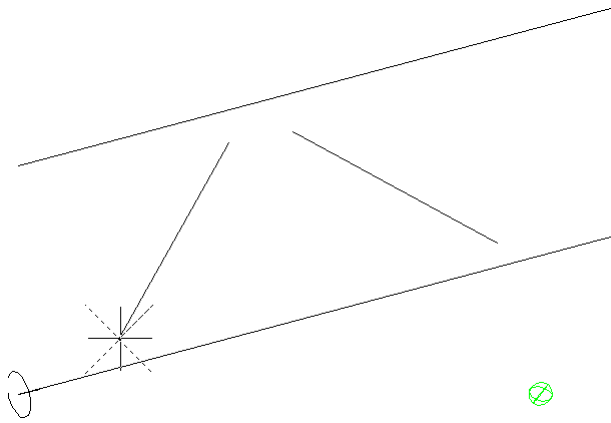
← Step 4 →



- Click on  **Coincident**



- Select the bottom horizontal line.



- Select the lowest point of the first inclined line.

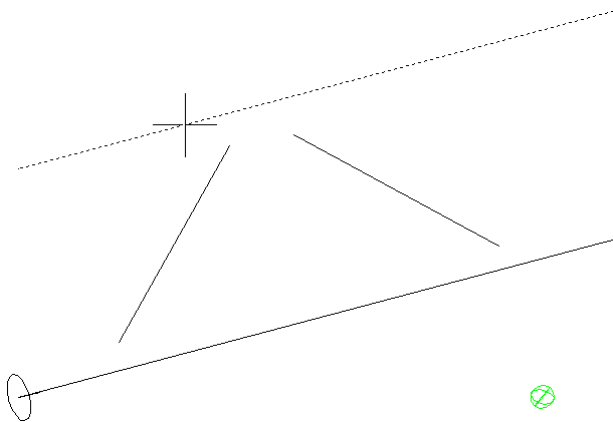
Close

- Click on **Close**.

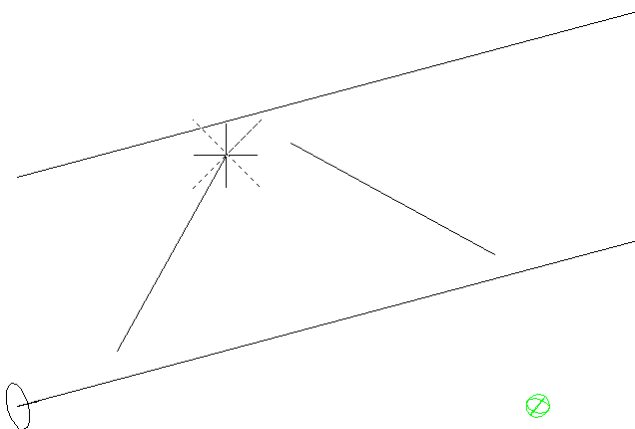
Step 5



- Click on  **Coincident**



- Select the top horizontal line.



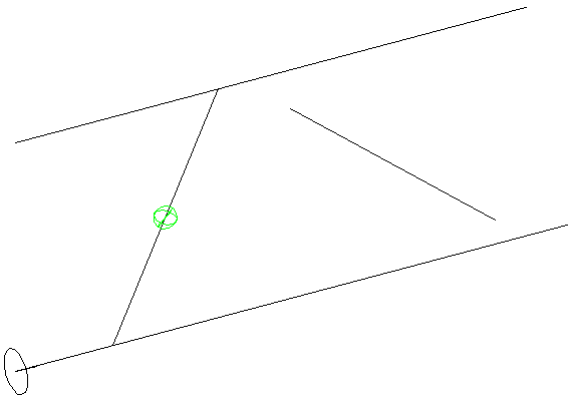
- Select the top point of the first inclined line.


Close

- Click on **Close**.

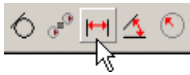


- Click on  **Recalculate all**.

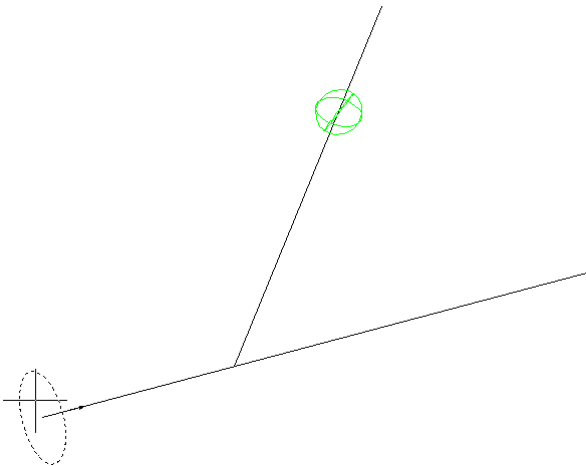


 *We haven't yet constrained the start-and end position of the line.*

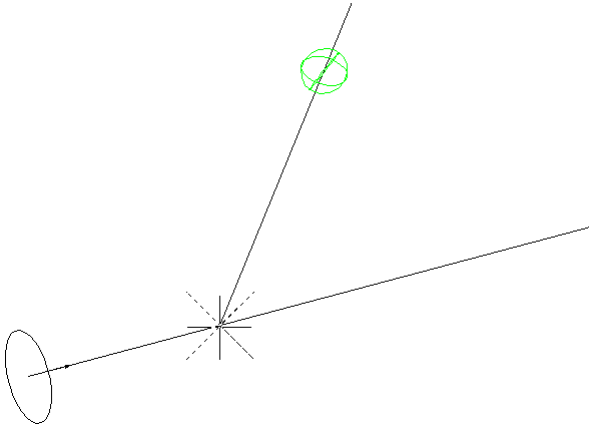
◄ Step 6 ►



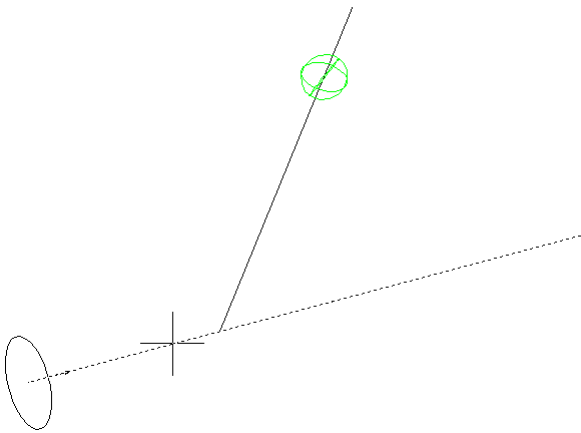
- Click on  **Distance between**



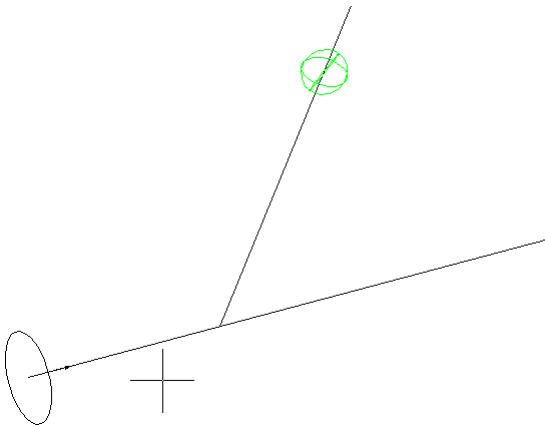
- Select the plane of the plane-object.



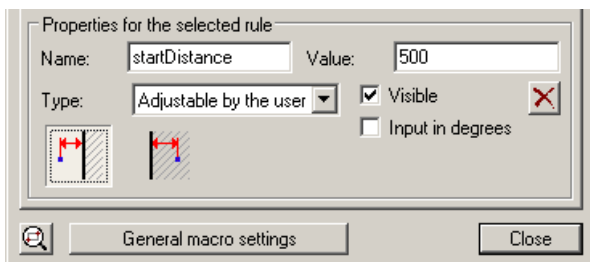
- Select the lowest point of the first inclined line.



- Select the bottom horizontal line.




- Indicate a point under the horizontal line.



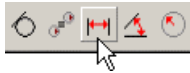
- In the dialog box below, enter for the property **Name** : *startDistance*

- Enter for the property **Value** : 500

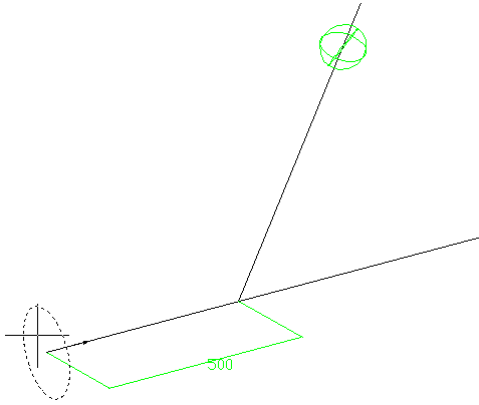
- Click on the button 

- Click on **Close**.

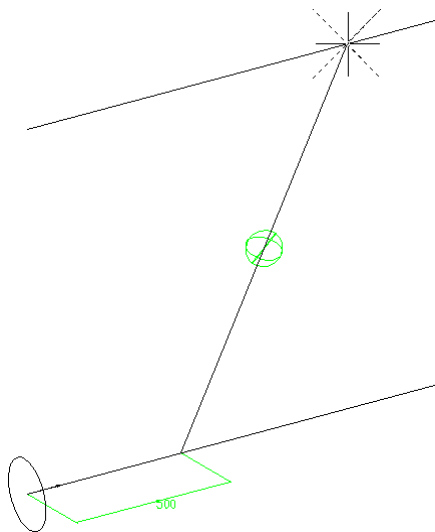
← Step 7 →



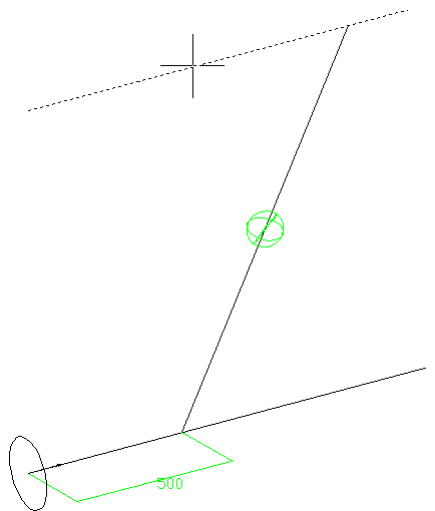
- Click on  **Distance between**



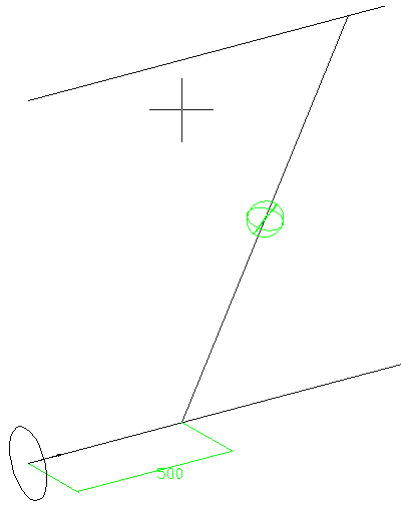
- Select the plane of the plane-object.



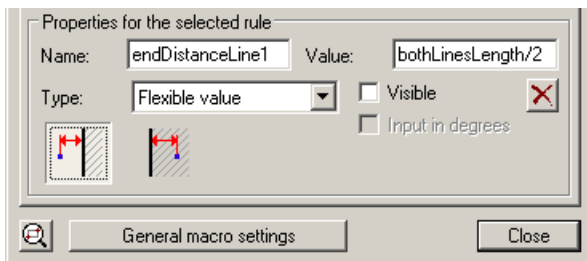
- Select the top point of the first inclined line.



- Select the top horizontal line.




- Indicate a point under the top horizontal line.




- In the dialog box below, enter for the property **Name** : *endDistanceLine1*

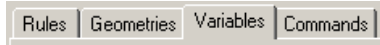
- Enter for the property **Value** : *startDistance+bothLinesLength/2*

- Deactivate the checkbox **Visible**.

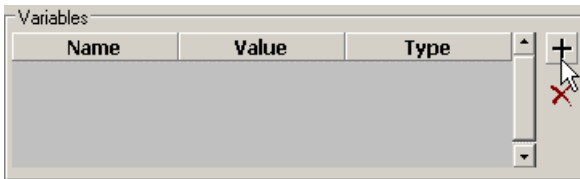
- Click on the button 

← Step 8 →

 We've used the variable **bothLinesLength** in the last rule in an equation, but it doesn't exist yet. We'll create it and make it an adjustable variable.



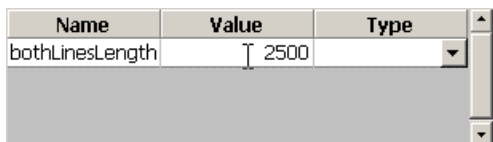
- Activate the tab **Variables**



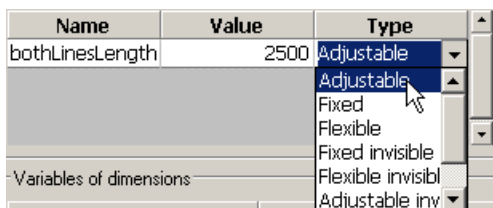
- In the section *Variables*, click on the button **+** **Add variable**.



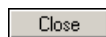
- Enter for the **Name** : *bothLinesLength*



- Enter for the **Value** : 2500



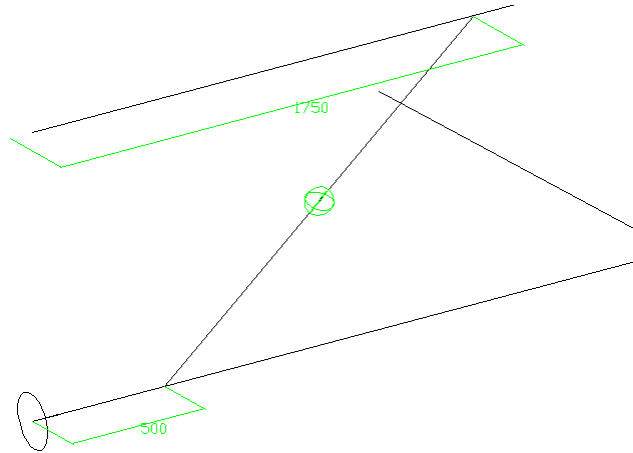
- Choose for the **Type** from the list : *Adjustable*



- Click on **Close**.



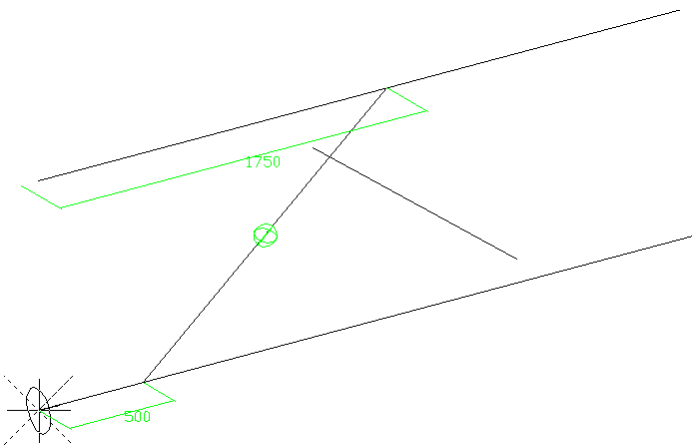
- Click on  **Recalculate all.**



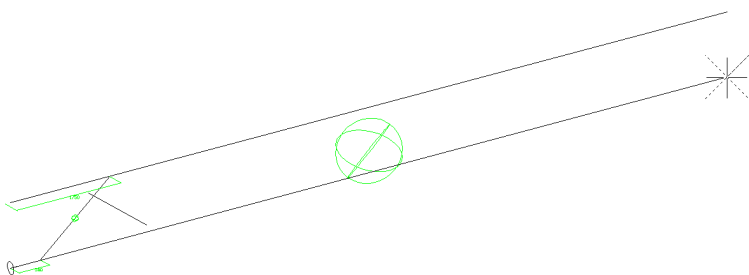
← **Step 9** →



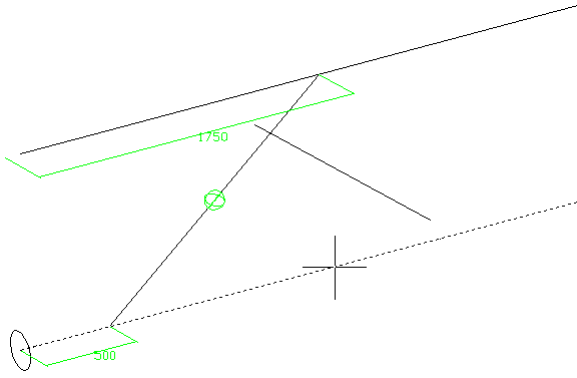
- Click on  **Distance between**



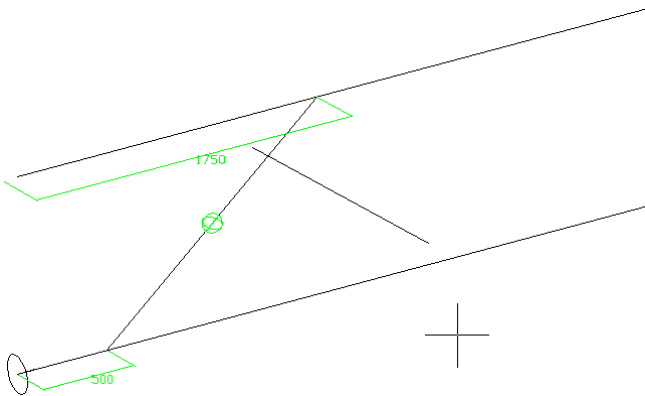
- Select the startpoint of the horizontal line.



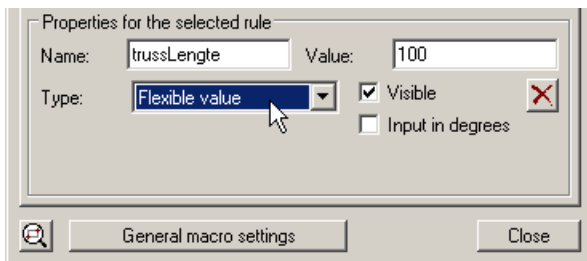
- Select the endpoint of the horizontal line.



- Select the bottom horizontal line.



- Indicate a point under the horizontal line.

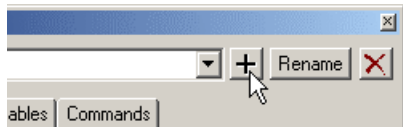


- In the dialog box below, enter for the property **Name** : *trussLength*

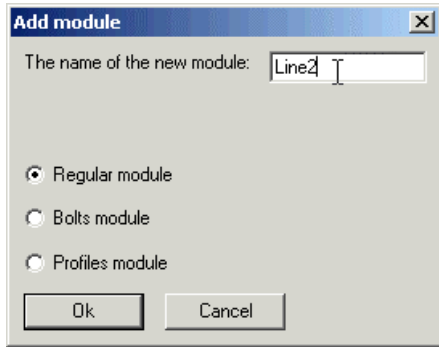
- Select for **Type** from the list : *Flexible value*

? *With this last geometric rule we measure meten the total length of the truss. We will need this later on when we're copying the macro.*

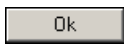
← Step 10 →



- At the top of the dialog box, click on **+** **Add new module**.



- Enter in the dialog box for the **Name** of the new module in: *Line2*

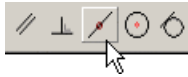


- Click on **Ok**.

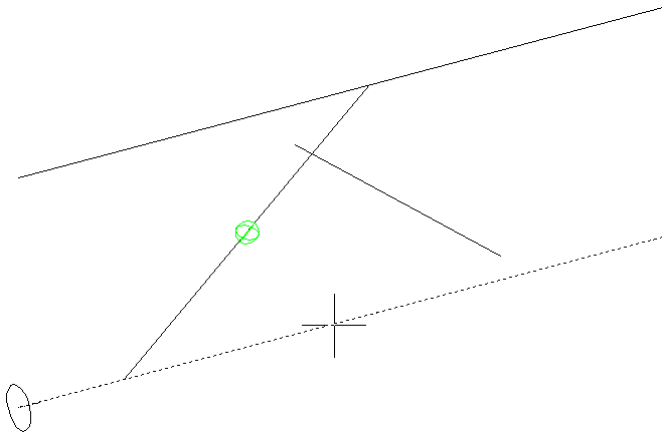


- Click on **Close**.

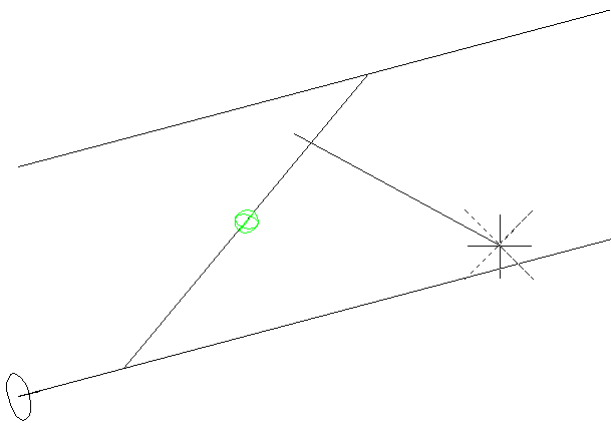
◀ Step 11 ▶



- Click on **Coincident**



- Select the bottom horizontal line.

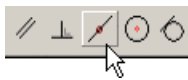


- Select the lowest point of the second inclined line.

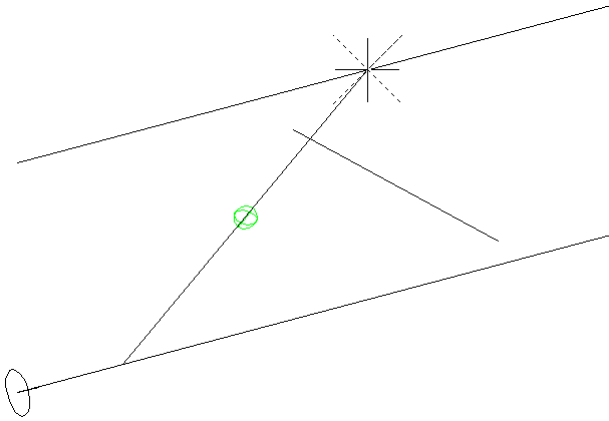


- Click on **Close**.

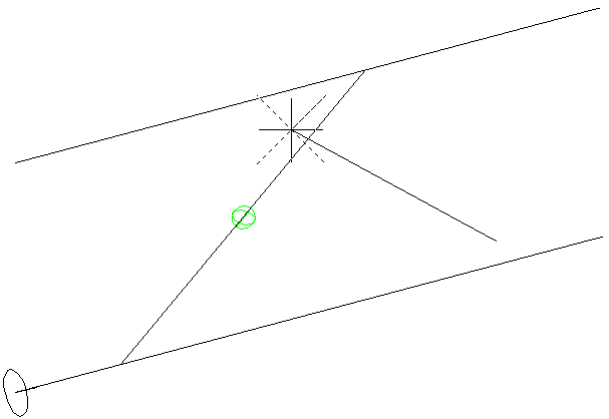
Step 12



- Click on **Coincident**



- Select the top point of the first inclined line.



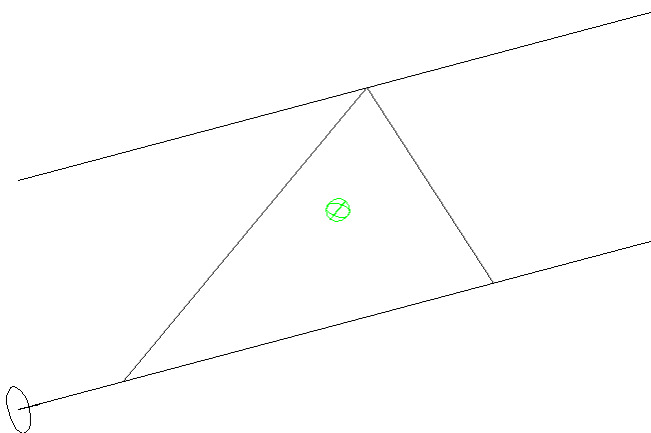
- Select the top point of the second inclined line.



- Click on **Close**.

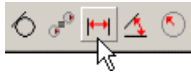


- Click on **Recalculate all**.

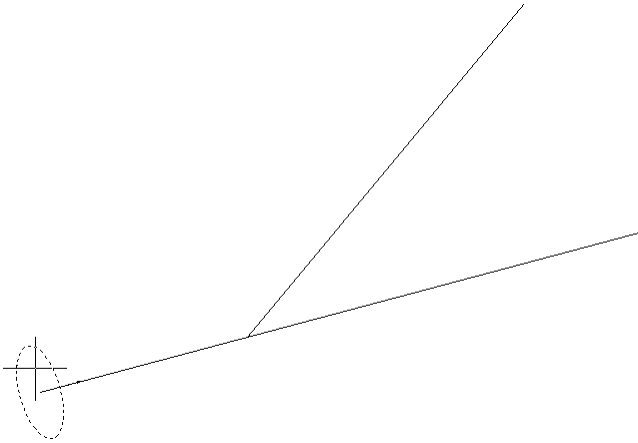


? *We've constrained the startlocation of the line. Only the endlocation needs to be done.*

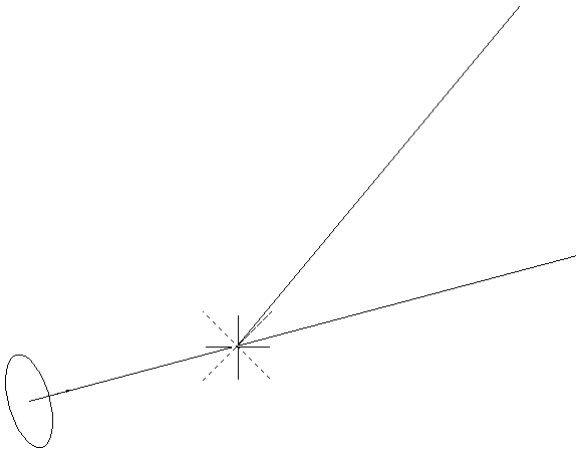
◄ Step 13 ►



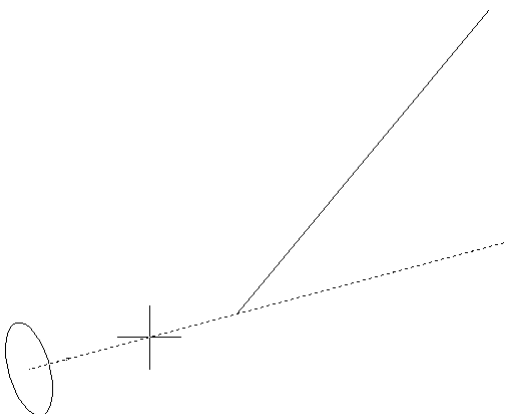
- Click on  **Distance between**



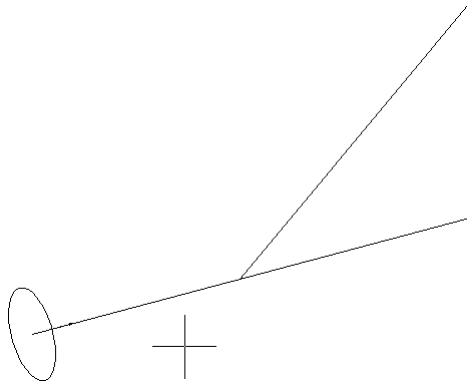
- Select the plane of the plane-object.



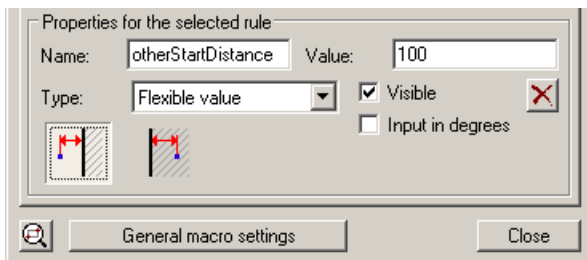
- Select the lowest point of the first inclined line.



- Select the bottom horizontal line.




- Indicate a point under the horizontal line.



- In the dialog box below, enter for the property **Name** : *otherStartDistance*

- Select for **Type** from the list : *Flexible value*

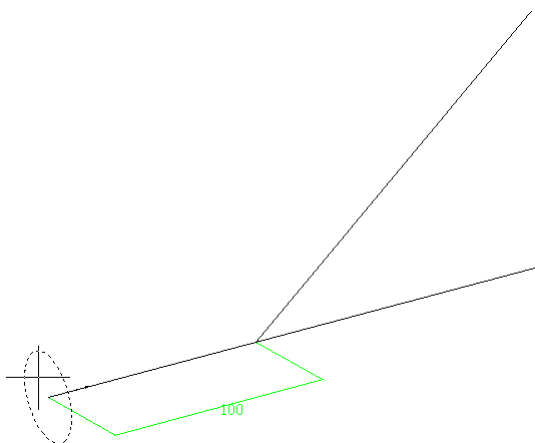
- Click on the button 

- Click on **Close**.

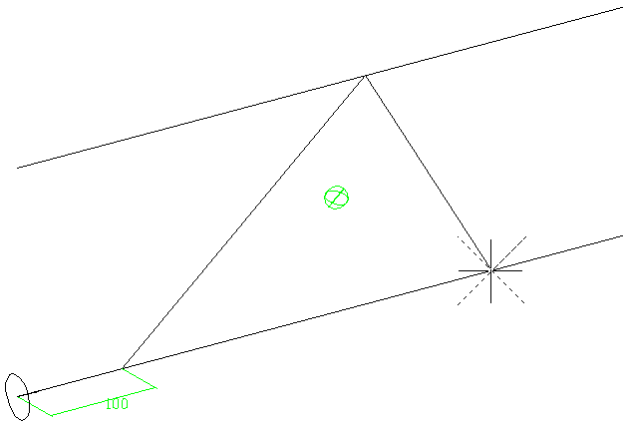
◀ Step 14 ▶



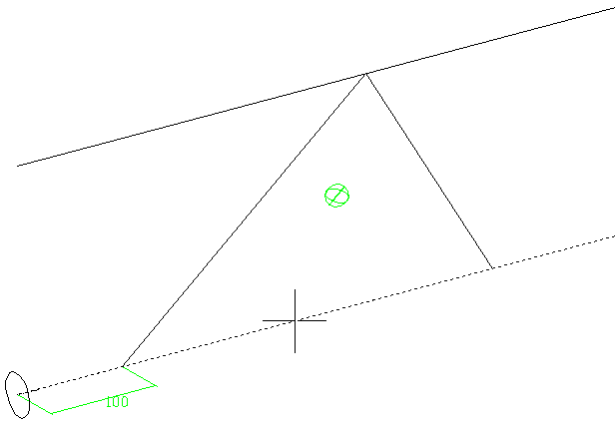
- Click on  **Distance between**



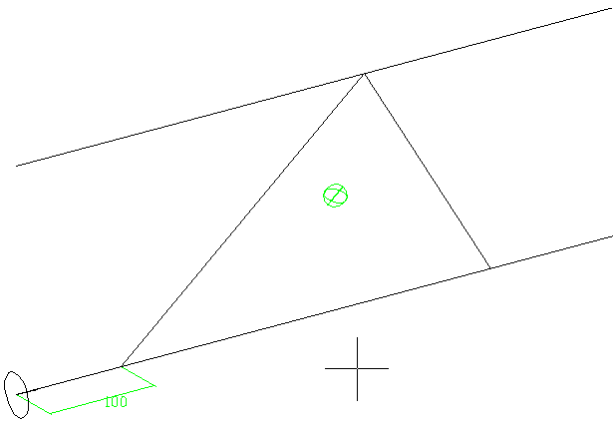
- Select the plane of the plane-object.



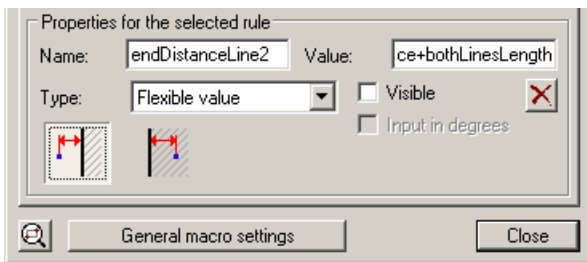
- Select the lowest point of the second inclined line.



- Select the bottom horizontal line.




- Indicate a point under the horizontal line.




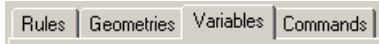
- In the dialog box below, enter for the property **Name** : *endDistanceLine2*

- Enter for **Value** : *otherStartDistance+bothLinesLength*

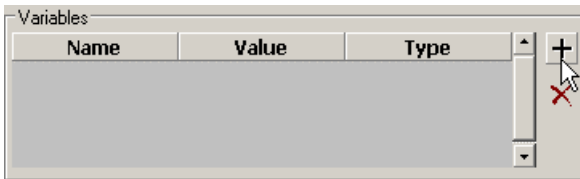
- Click on the button 

← Step 15 →

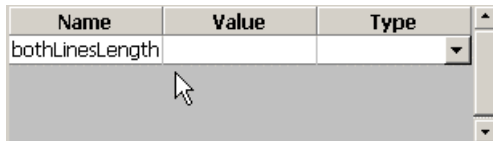
 The variable **bothLinesLength** still needs to be created.
We've done this earlier, but that was in a different module.



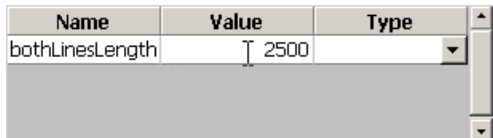
- Activate the tab **Variables**



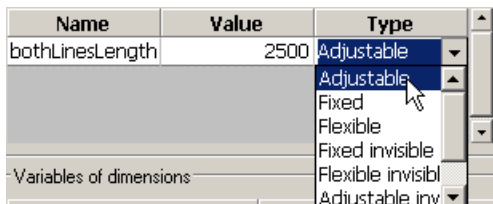
- In the section *Variables*, click on the button **+** **Add variable**.



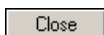
- Enter for the **Name** : *bothLinesLength*



- Enter for the **Value** : *2500*



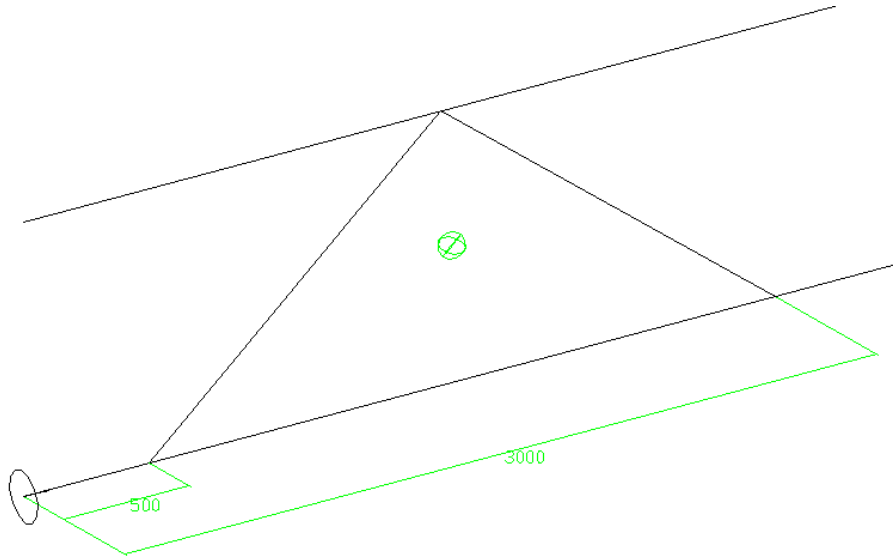
- Choose for the **Type** from the list : *Adjustable*



- Click on **Close**.




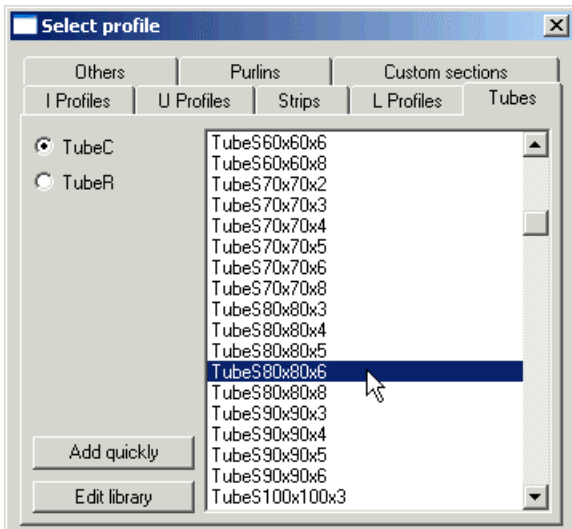
- Click on  **Recalculate all.**



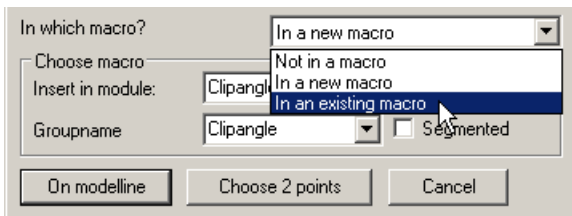
← Step 16 →



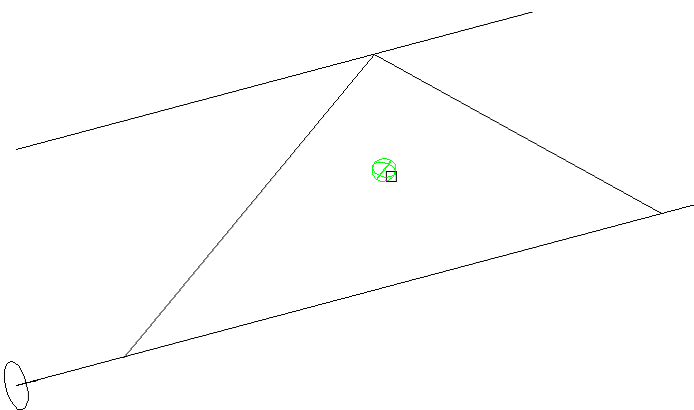
- Start the command  **Tubes**.



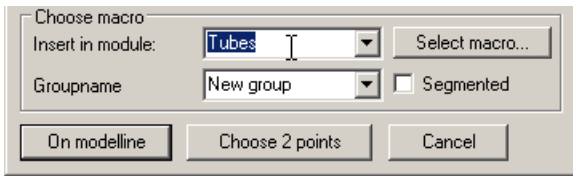
- Choose from the list of tubes: **Tube80x80x6**.



- Choose below for **In which macro?** : *In an existing macro*.



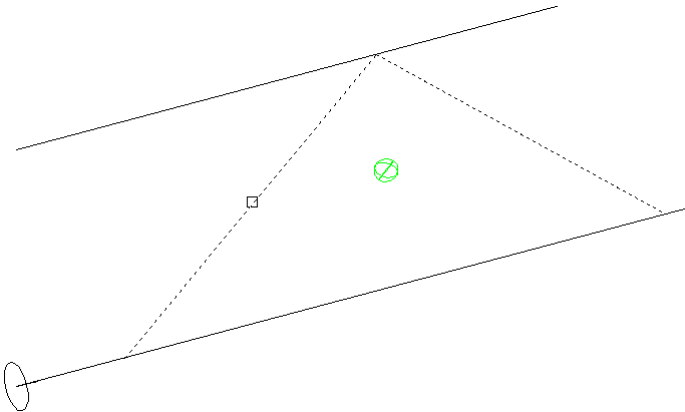
- Select the macro of the strut.



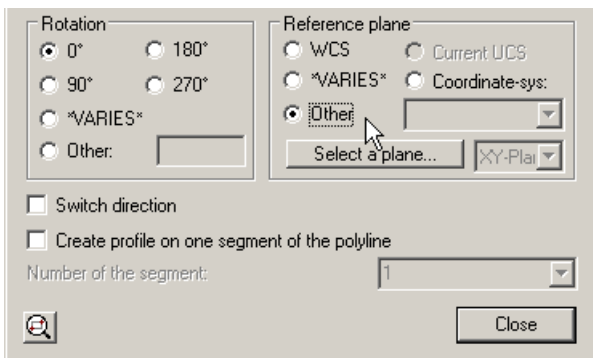
- Enter below for **Insert in module:** *Tubes*.



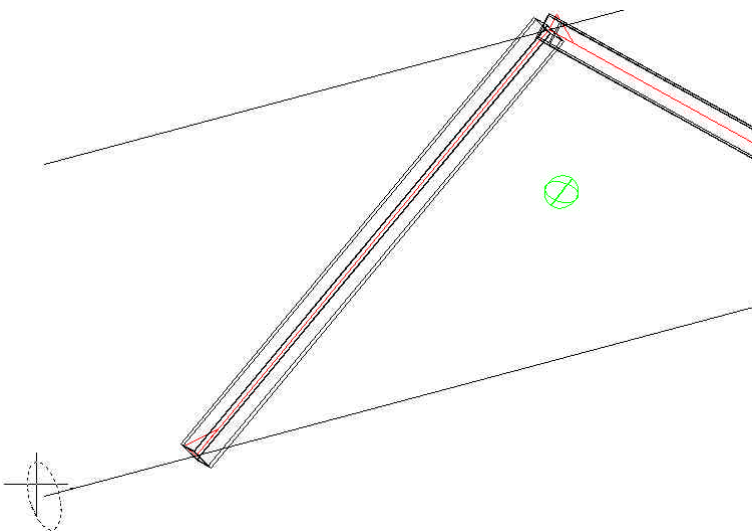
- Click on **On modelline**.



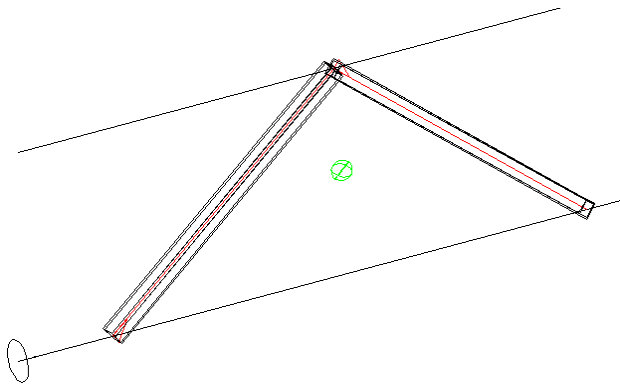
- Select both inclined lines and press **<Enter>** to confirm.



- Click below for **Reference plane** on : *Other...*



- Select the plane of the plane-object.

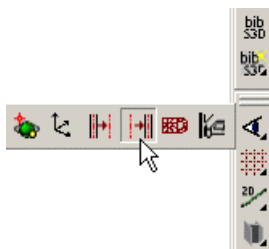


❓ This last handling, choosing the reference plane, is not strictly necessary in this situation. But if the truss would be rotated in a certain way, then the tubes have to rotate along with it. Setting the reference plane on a plane of the truss itself makes sure this is done.



- Click on **Close**.

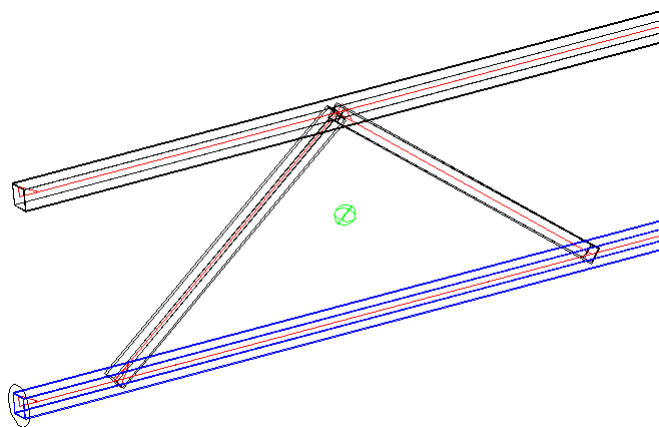
◀ Step 17 ▶



- Start the command  **Axes->Volumes**



- Press **<Enter>** to show all hidden members.



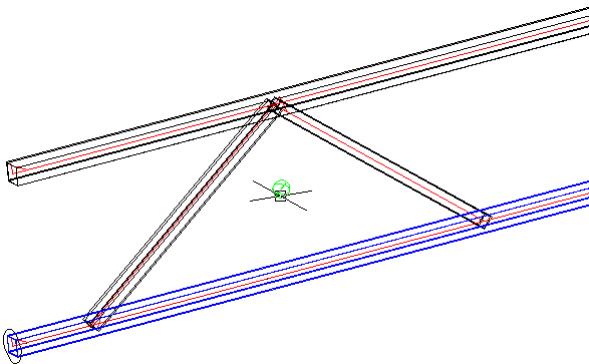
Exercise 40: Creating an array of macros

In this exercise we will use the prepared drawing of the previous exercise to copy the macro of a strut.

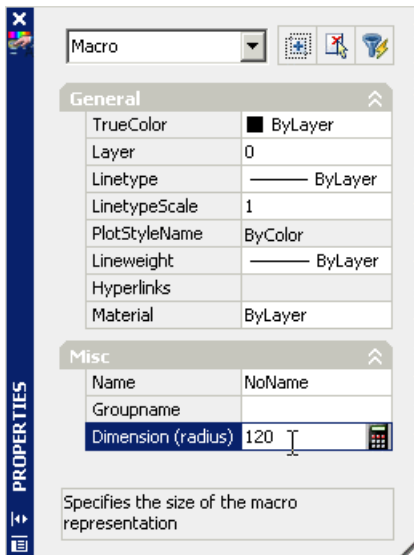
← Step 1 →



- Open the drawing Exercise40.dwg



- Move the cursor to above the macro and double-click on the left mouse button.

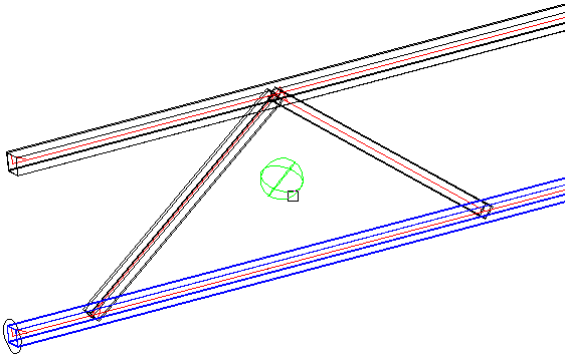


- In the Properties dialog box that appears, modify the setting **Size (radius)**, to : 120

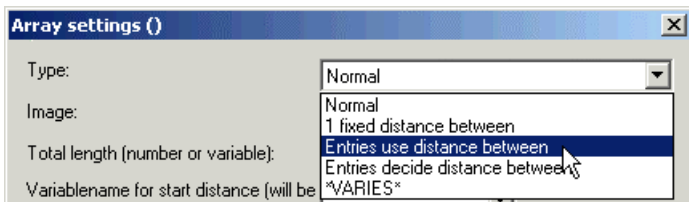
← Step 2 →



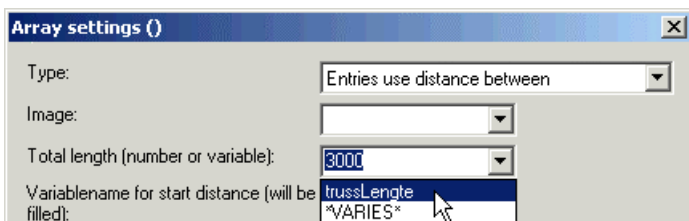
- Start the command  **Create array of macros**.



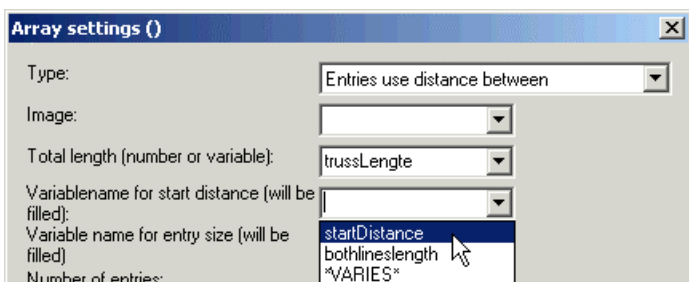
- Select the macro of the strut.



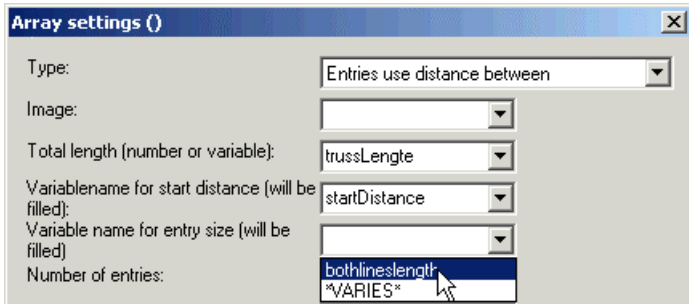
- Choose from the list for the setting **Type** :
Entries use distance between



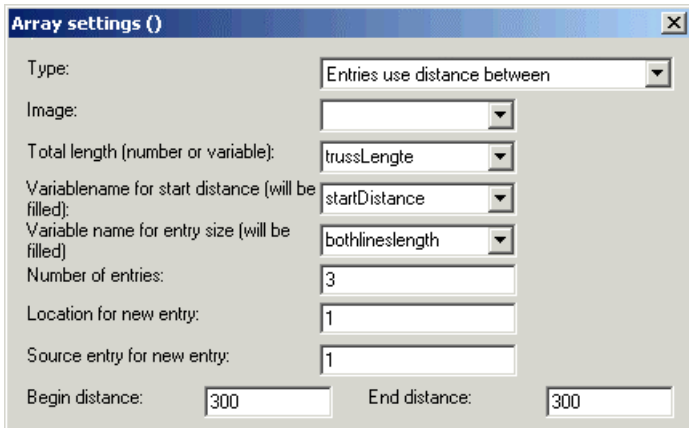
- Choose from the list for the setting **Total length** :
trussLength



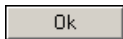
- Choose from the list for the setting **Variable name for start distance** :
startDistance



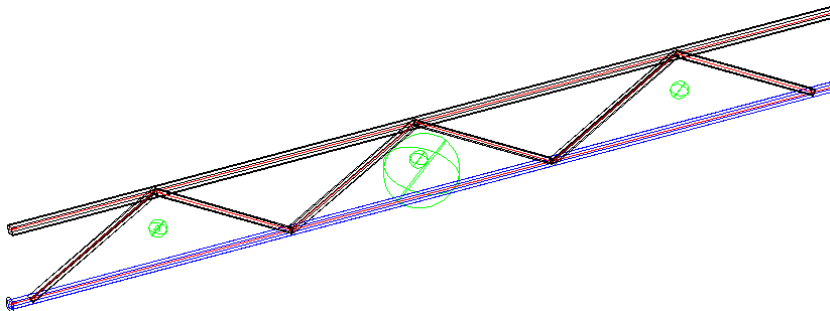
- Choose from the list for the setting **Variable name for entry size** : *bothlineslength*



- Modify the setting **Number of entries** to : 3
- Modify the setting **Location for new entry** to : 1
- Modify the setting **Source entry for new entry** to : 1
- Modify the setting **Begin distance** to : 300
- Modify the setting **End distance** to : 300



- Click on **Ok**.

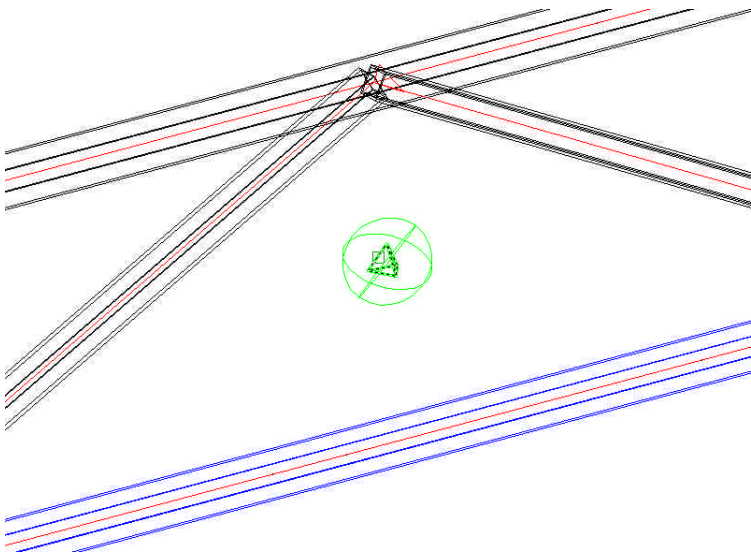


← Step 3 →

? The tubes still need to be cut. To make it easy for ourselves we will let Parabuild draw just one strut and then we will cut that one. Afterwards the array will do all the other cuts for us.




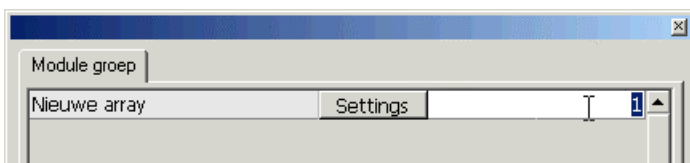
- Click on  **Review macro**.



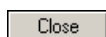
- Select the small pyramid and press **<Enter>** to confirm.



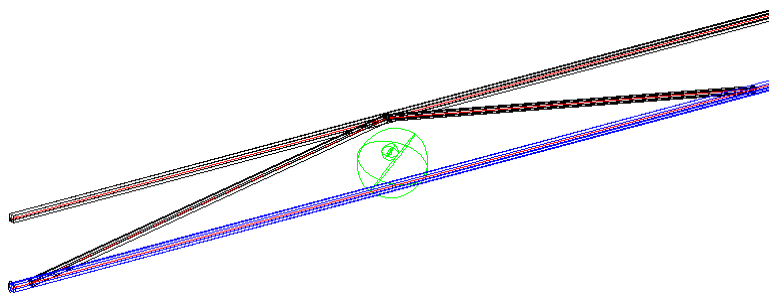
- Click once on the button  so that it is not pressed.



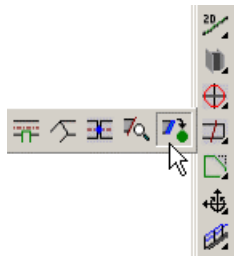
- Modify the number of the **New array** to : 1



- Click on **Close**.



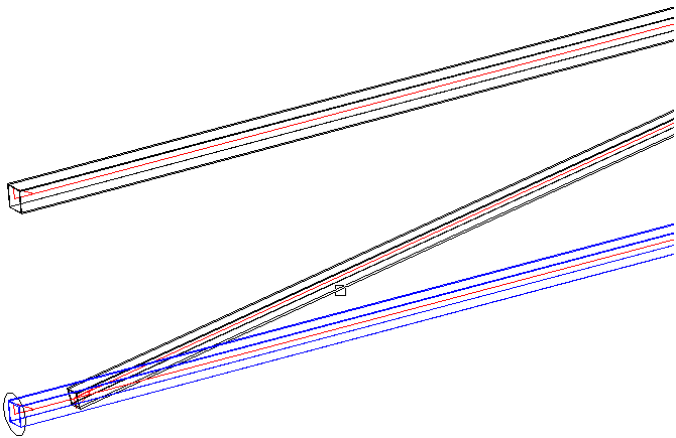
Step 4



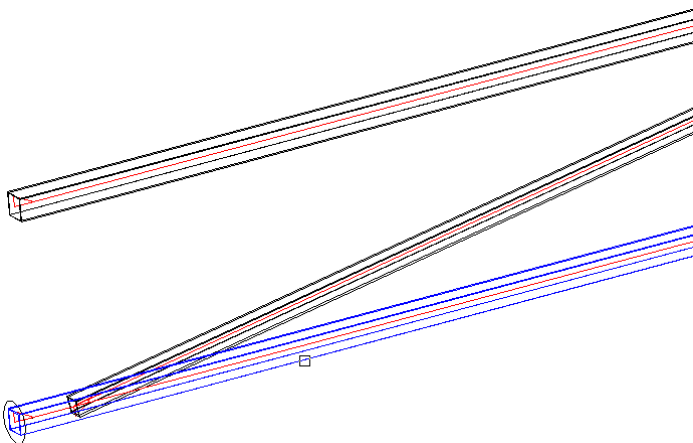
Ok

- Start the command  **Add cut to macro**

- Click on **Ok**.

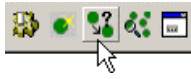


- Select the first inclined tube.

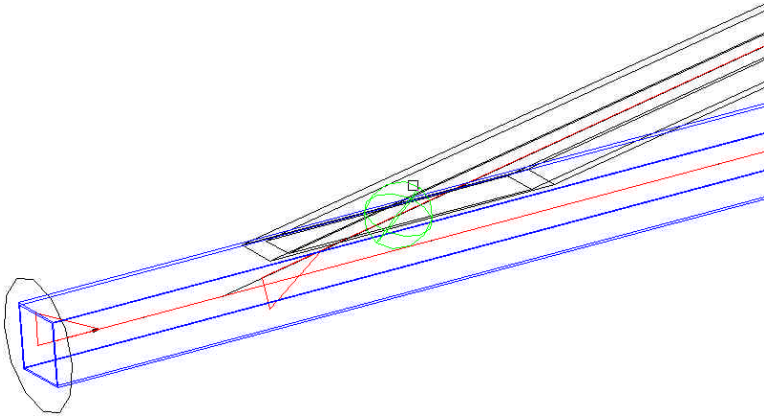


- Select the bottom horizontal tube.

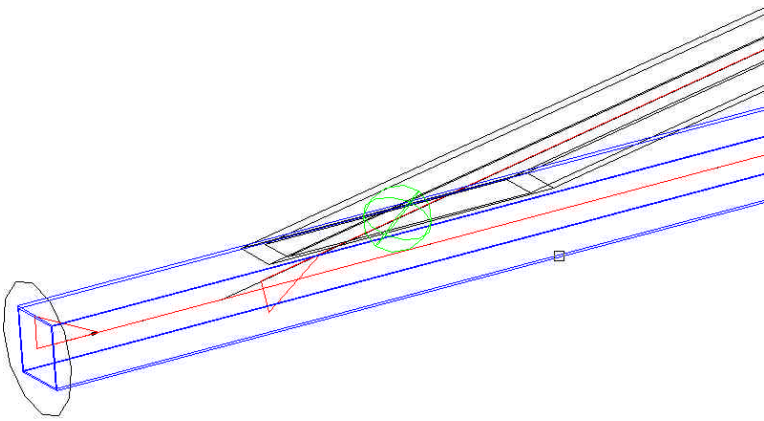
← Step 5 →



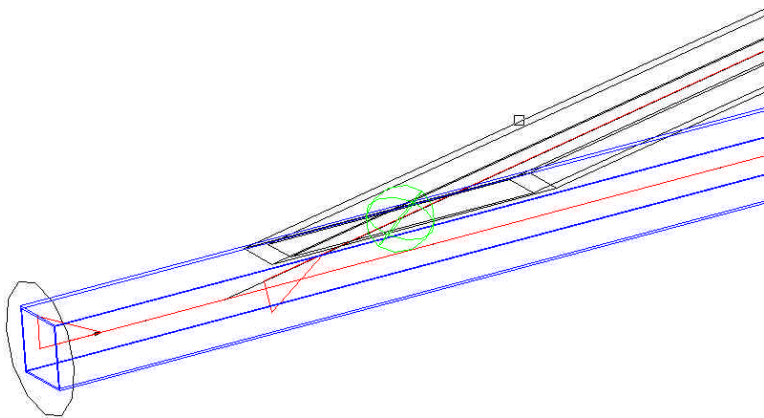
- Start the command  **Macro apply** settings.



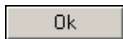
- Select the new macro.



- Select the bottom horizontal tube.

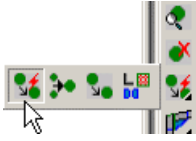


- Select the first inclined tube.

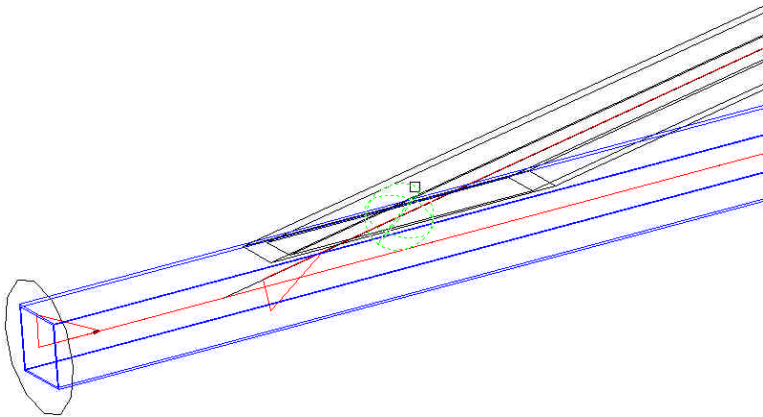


- Click on **OK**.

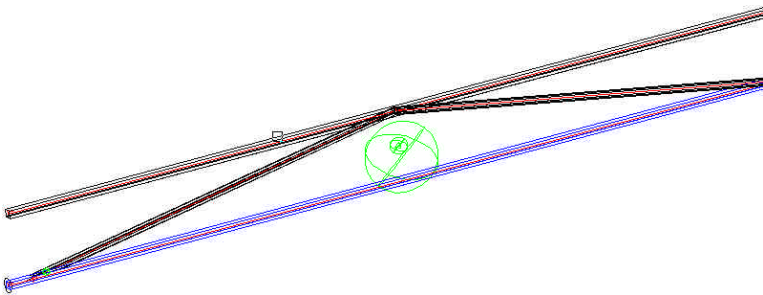
← Step 6 →



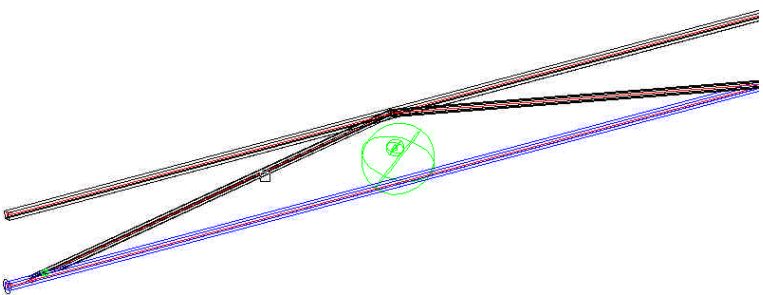
- Start the command  **Automatically copy a macro**.



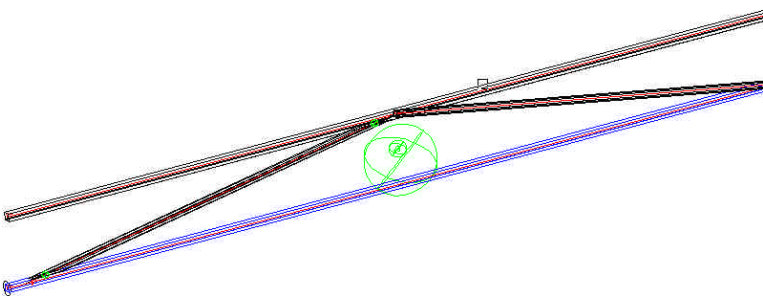
- Select the new macro and press **<Enter>** to confirm.



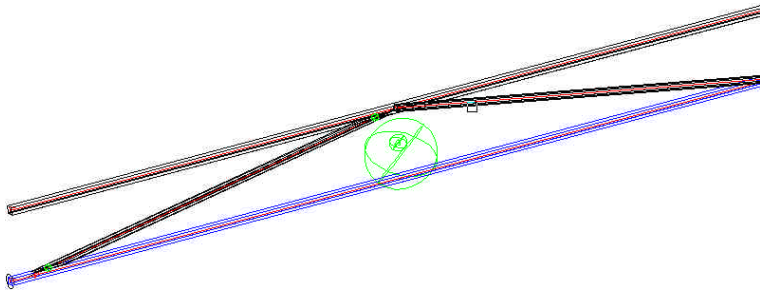
- Select the top horizontal beam.



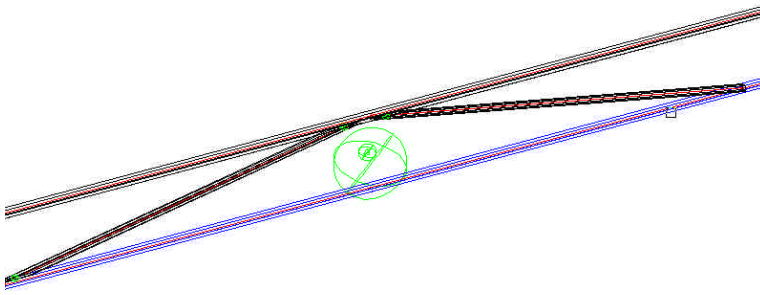
- Select the first inclined beam.



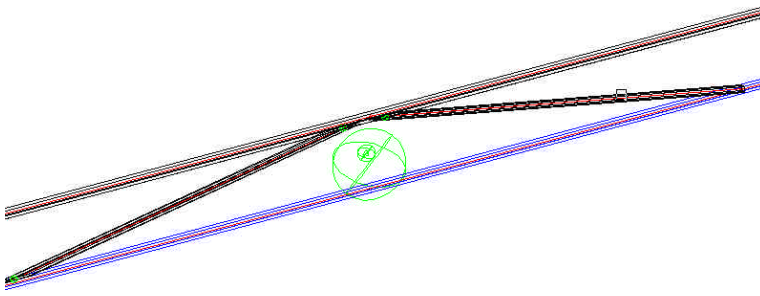
- Select the top horizontal beam.



- Select the second inclined beam.



- Select the bottom horizontal beam.



- Select the second inclined beam.

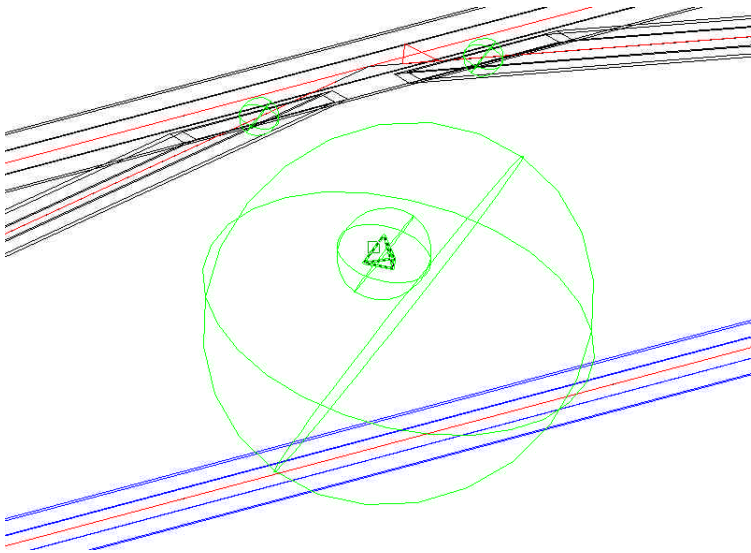


- Press **<Enter>** to end the command.

← Step 7 →



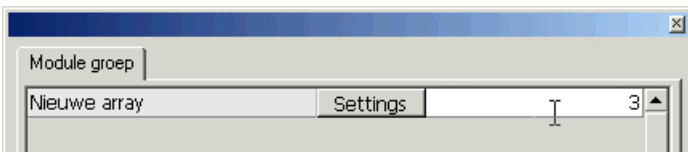
- Click on  **Review macro**.



- Select the small pyramid and press **<Enter>** to confirm.



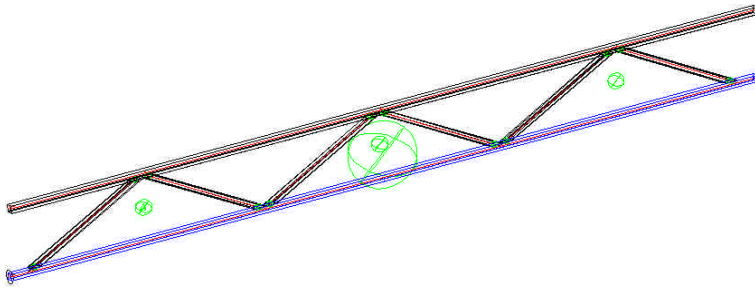
- Click the button  again so that it is pressed.



- Modify the number of the **New array** to : 3



- Click on **Close**.




Parabuild has copied 2 macros with cuts for each strut-combination.

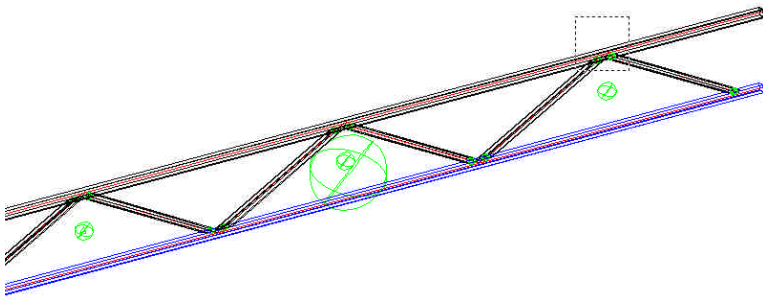
But Parabuild can also handle more complex situations, for example when there are macros between the macros that need to be copied...

← Step 8 →

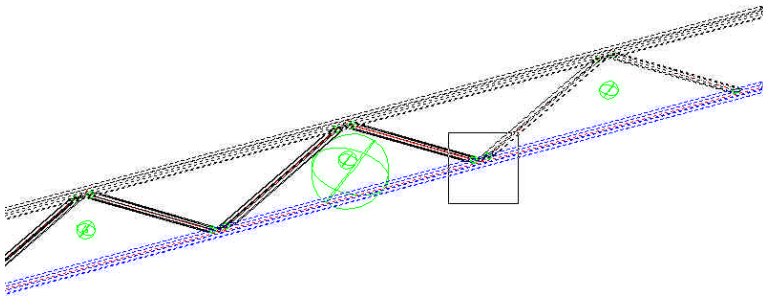
? We will create macros that are more advanced on those places where 2 tubes come together. To do this we first need to remove some of the macros.



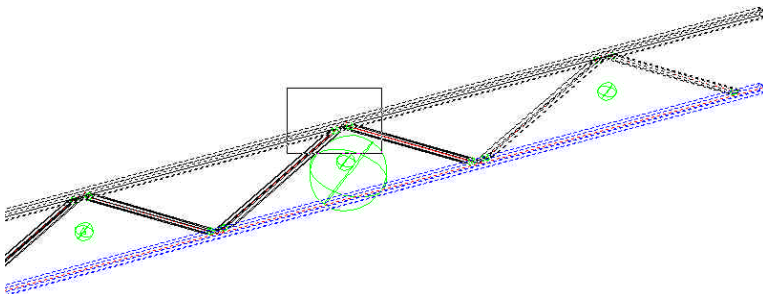
- Start the command  **Erase macro.**



- Select the two upper right macros by making a window around it.

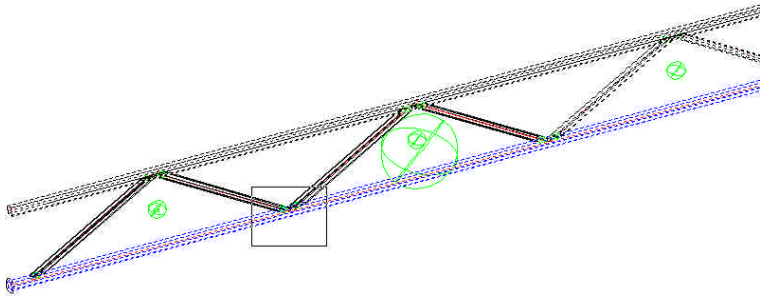


- Select the two lower right macros by making a window around it.



- Select the two upper middle macros by making a window around it.

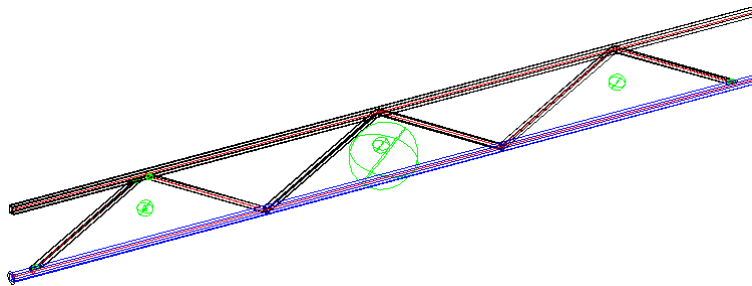
⚠ Make this window from lower left to upper right so that the other macros aren't selected.



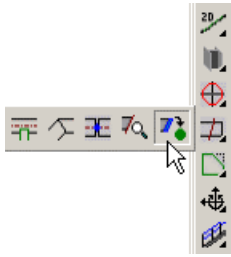
- Select the two lower left macros by making a window around it.



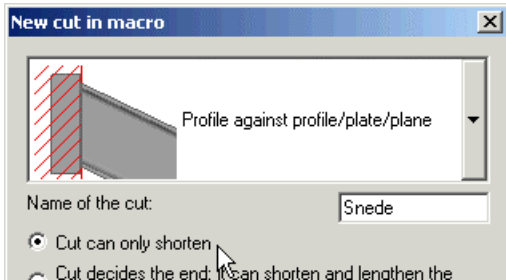
- Press **<Enter>** to confirm the selection.



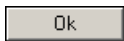
← Step 9 →



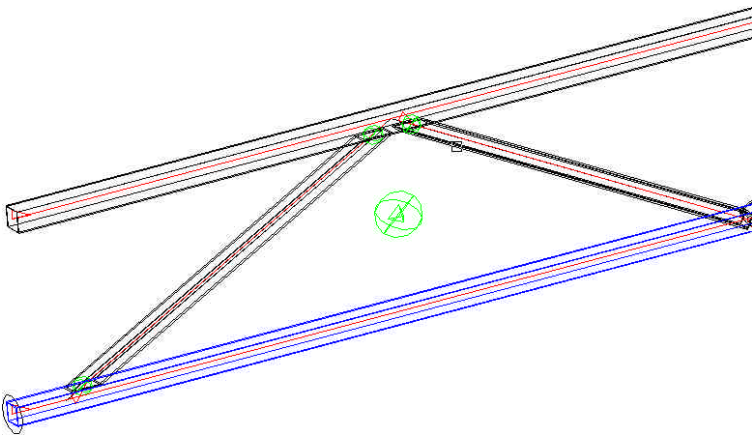
- Start the command  **Add cut to macro**



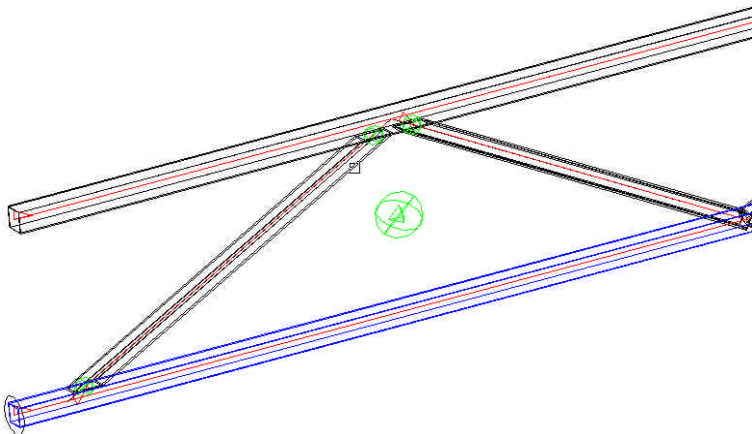
- Activate the setting **Cut can only shorten.**



- Click on **Ok.**

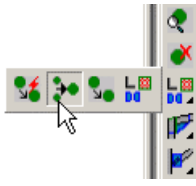


- Select the second inclined tube.

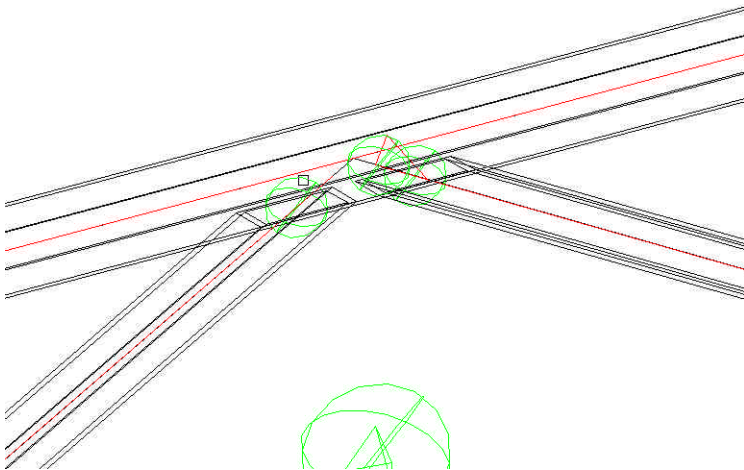


- Select the first inclined tube.

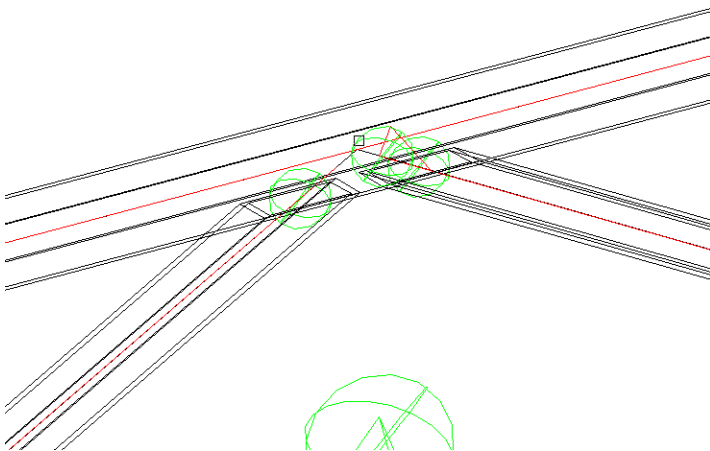
Step 10



- Start the command  Merge macros.

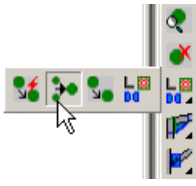


- Zoom in on the location where we've just cut and select the most left macro.

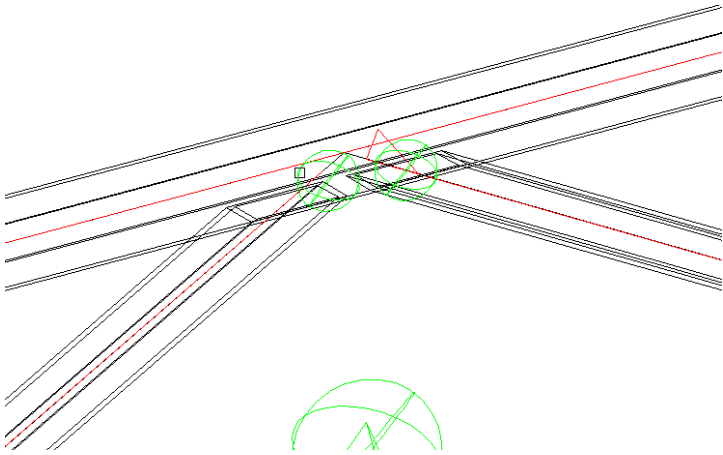


- Select the middle macro.

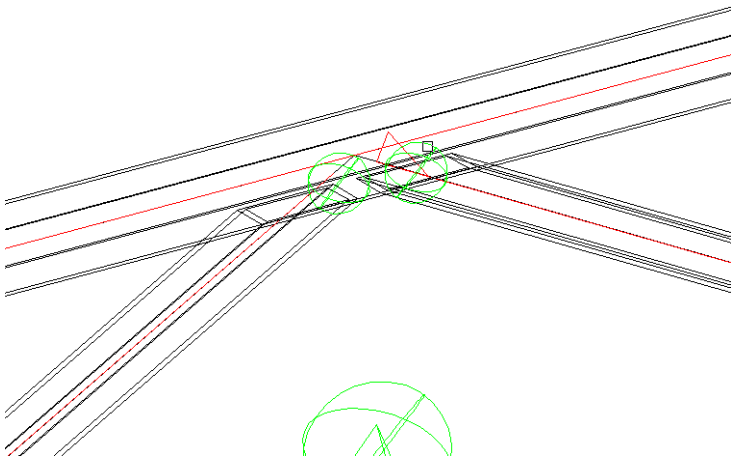
Step 11



- Start the command  Merge macros.

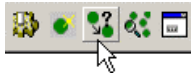


- Select the left macro.

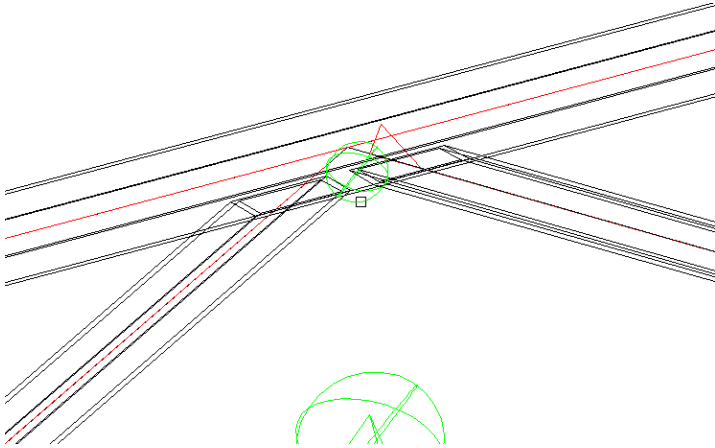


- Select the right macro.

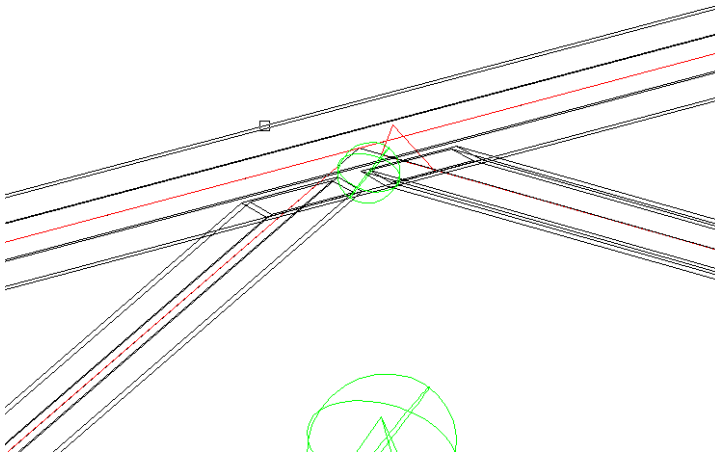
Step 12



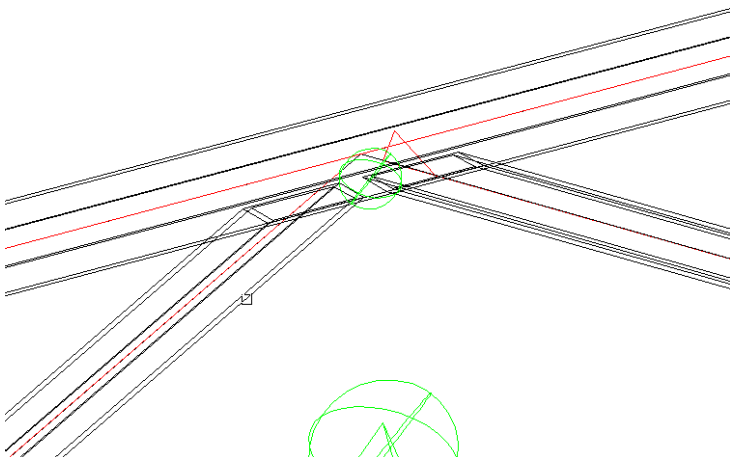
- Start the command **Macro apply** settings.



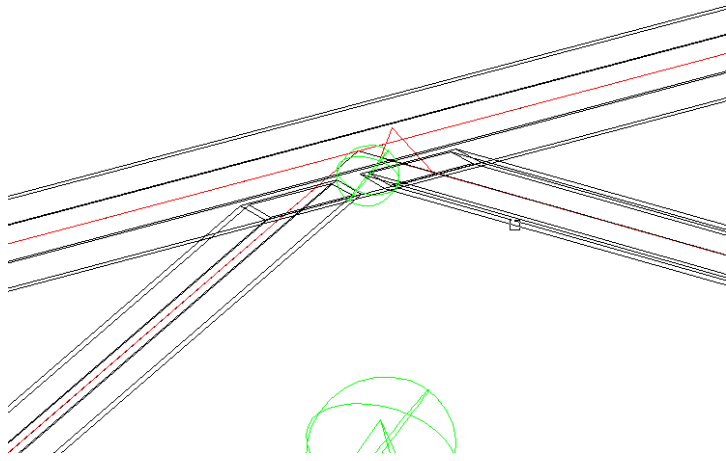
- Select the newly merged macro.



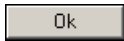
- Select the top horizontal tube.



- Select the first inclined tube.

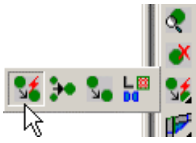


- Select the second inclined tube.

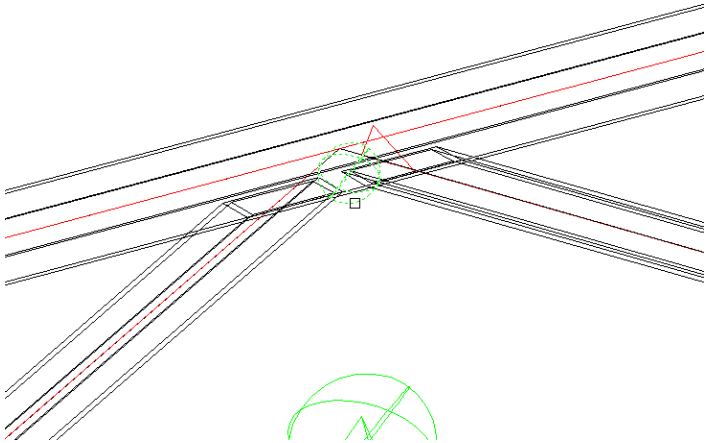


- Click on **Ok**.

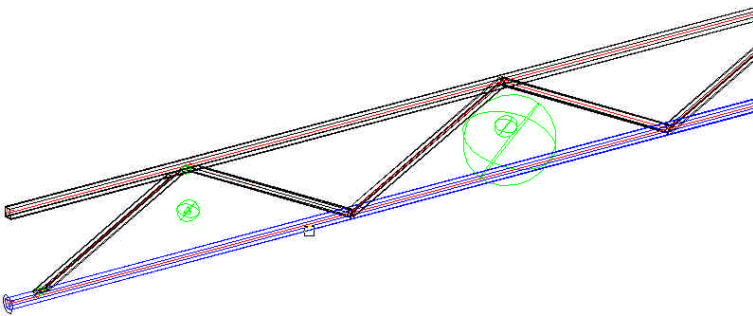
Step 13



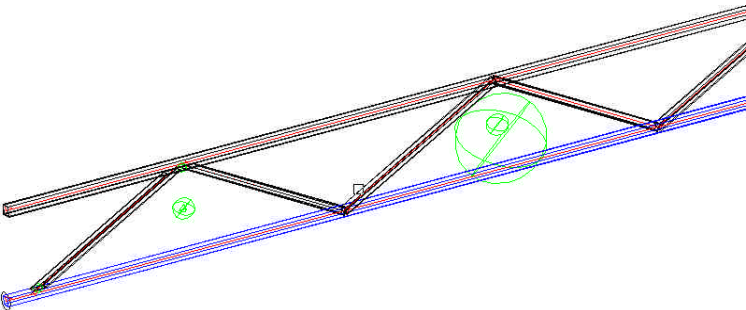
- Start the command  **Automatically copy a macro**.



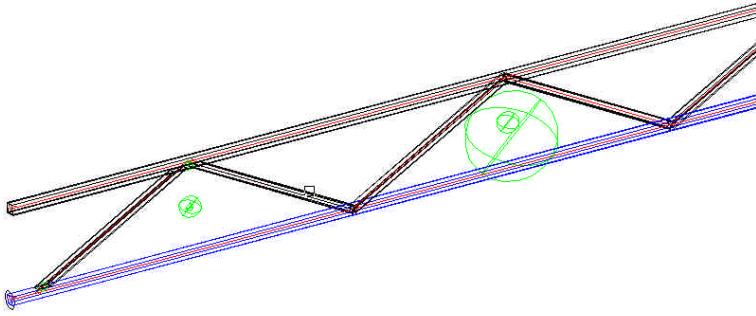
- Select the newly merged macro and press **<Enter>** to confirm.



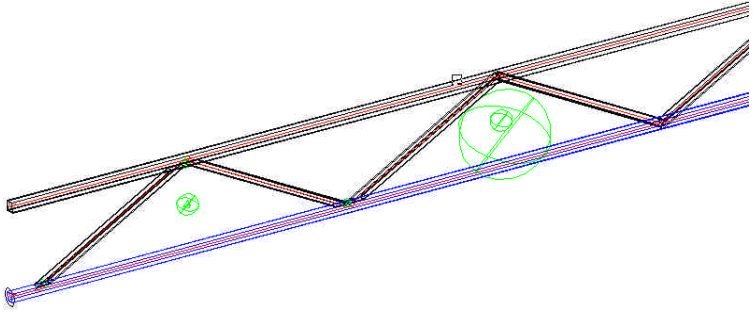
- Select the bottom horizontal tube.



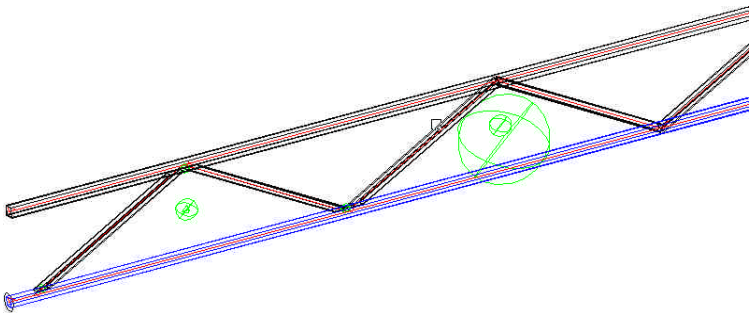
- Select the third inclined tube.



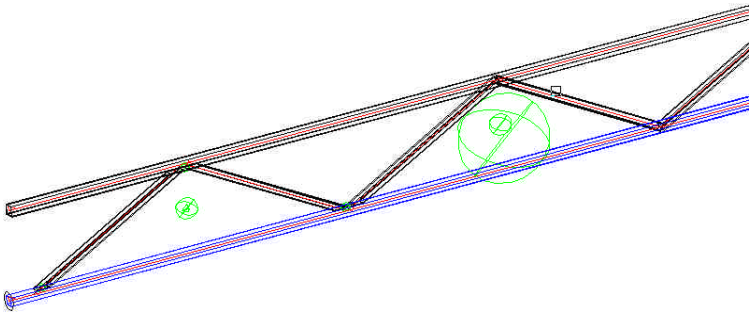
- Select the second inclined tube.



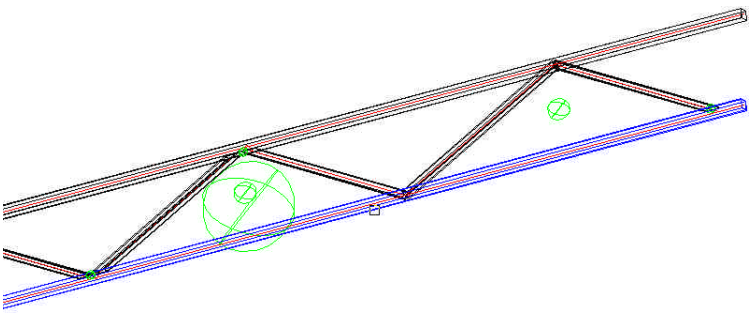
- Select the top horizontal tube.



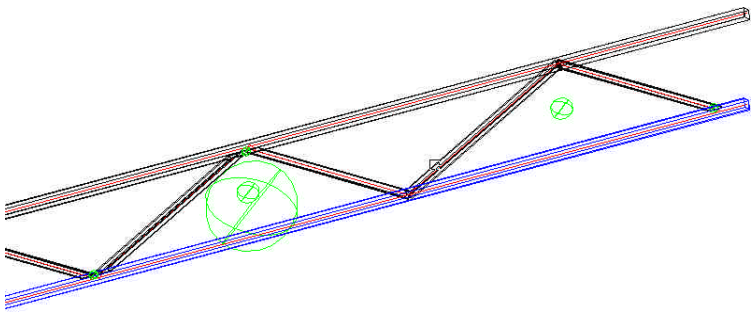
- Select the third inclined tube.



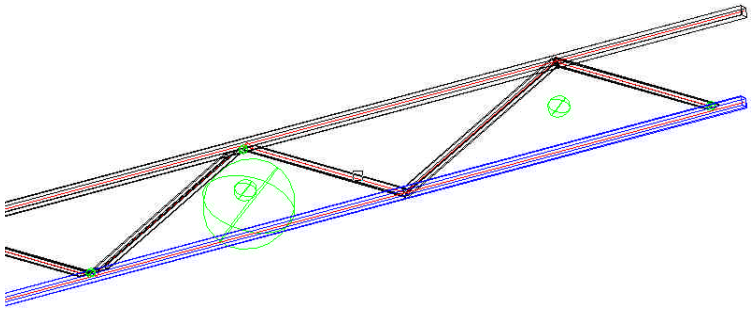
- Select the fourth inclined tube.



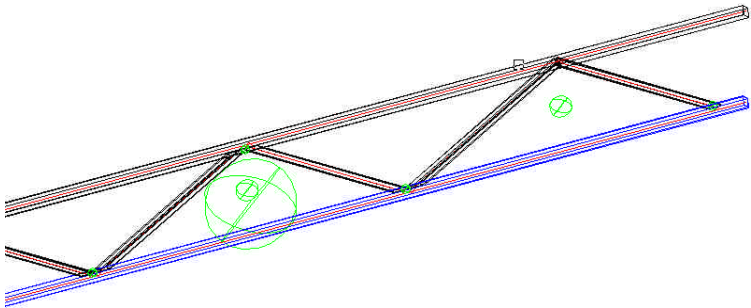
- Select the bottom horizontal tube.



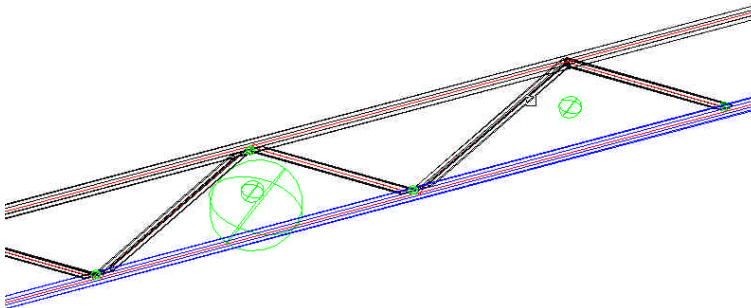
- Select the fifth inclined tube.



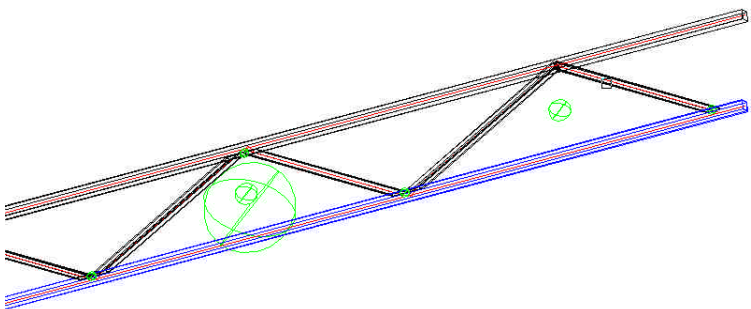
- Select the fourth inclined tube.



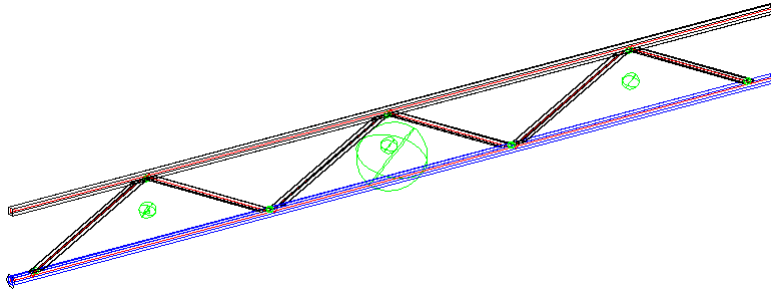
- Select the top horizontal tube.



- Select the fifth inclined tube.



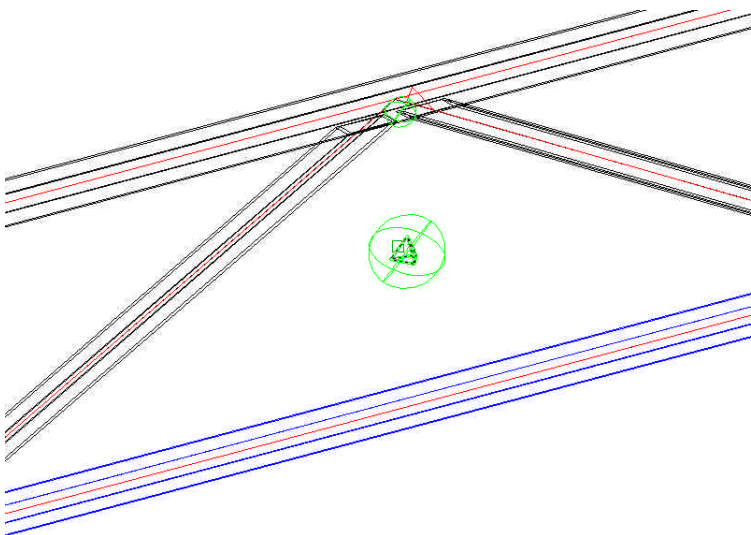
- Select the last inclined tube.



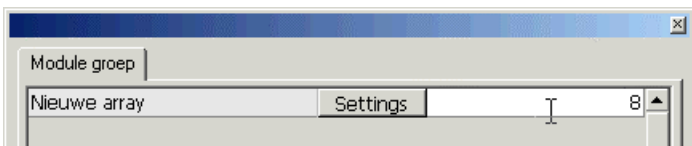
← Step 13 →



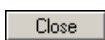
- Click on  **Review macro**.



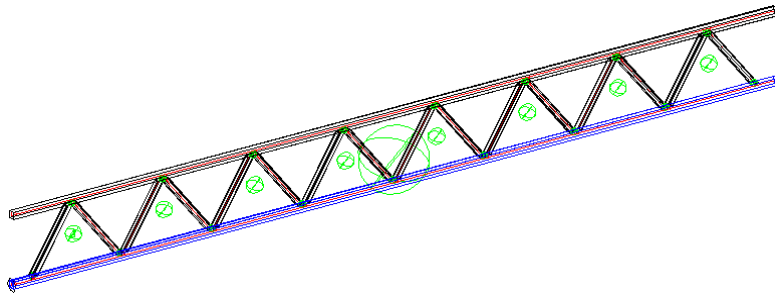
- Select the small pyramid and press **<Enter>** to confirm.



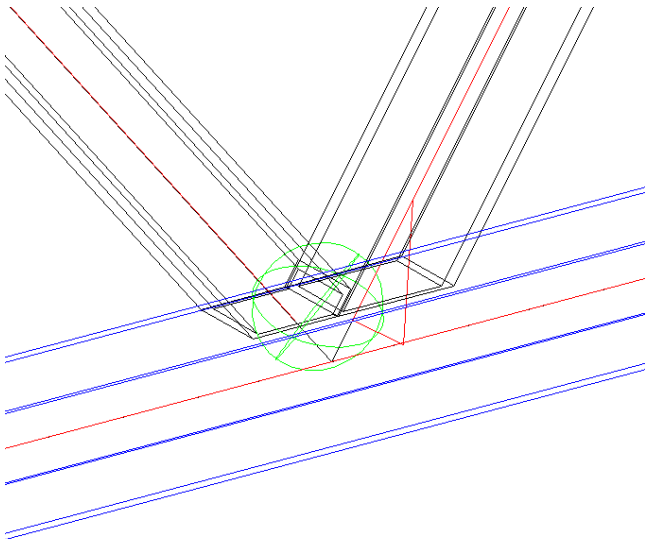
- Modify the number of the **New array** to : 8




- Click on **Close**.



- Zoom in on one of the locations where two tubes come together.



 Normally these tubes would collide, but thanks to the extra cut of earlier we have one strut cut against the other strut.
We've merged the three cuts together into one macro.

Although this macro is drawn between two succeeding strut macros, Parabuild has no problems copying it too.

This macro could also contain bolts and plates (think of a bannister), even then the array would copy everything over without any problems.