Tekla Structures Basic Training

Tekla Structures 10.0

April 30, 2004

Contents

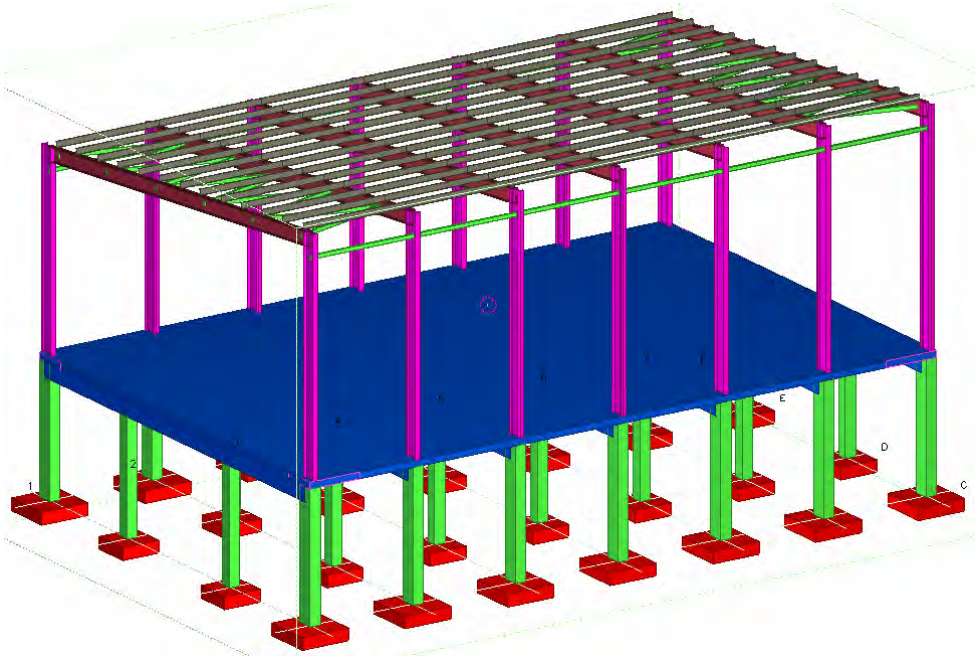
1 Basic Modeling 2

In this lesson

In this lesson we will cover some preliminary tasks that you need to do before starting to model in a real project. We will create a new model and recap the basic functions introduced in Lesson 1. After that, you will learn some more about the basic functions.

You will learn how to:

- Set up project- information
- Define part properties and numbering series
- Work in true planes (sloped, skewed)
- Use phases
- Combine separate models
- Create your own select filters



1.1 Start a New Model - BasicModel2

Start a new model and name it BasicModel2.

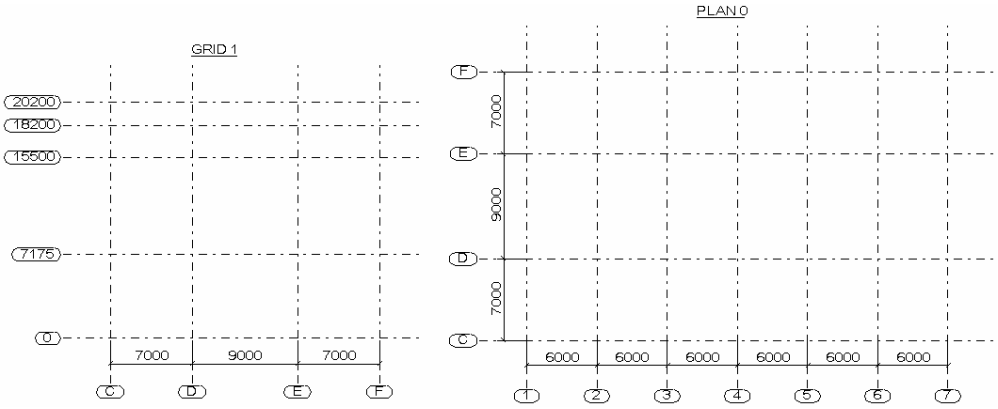
Create New Model

Start a new model

1. Pick the **New** icon.

2. Click after the path **C:\TeklaStructuresModels**, in the field at the bottom of the dialog box and type \BasicModel2.
3. Press the **OK** button and the model will be created.

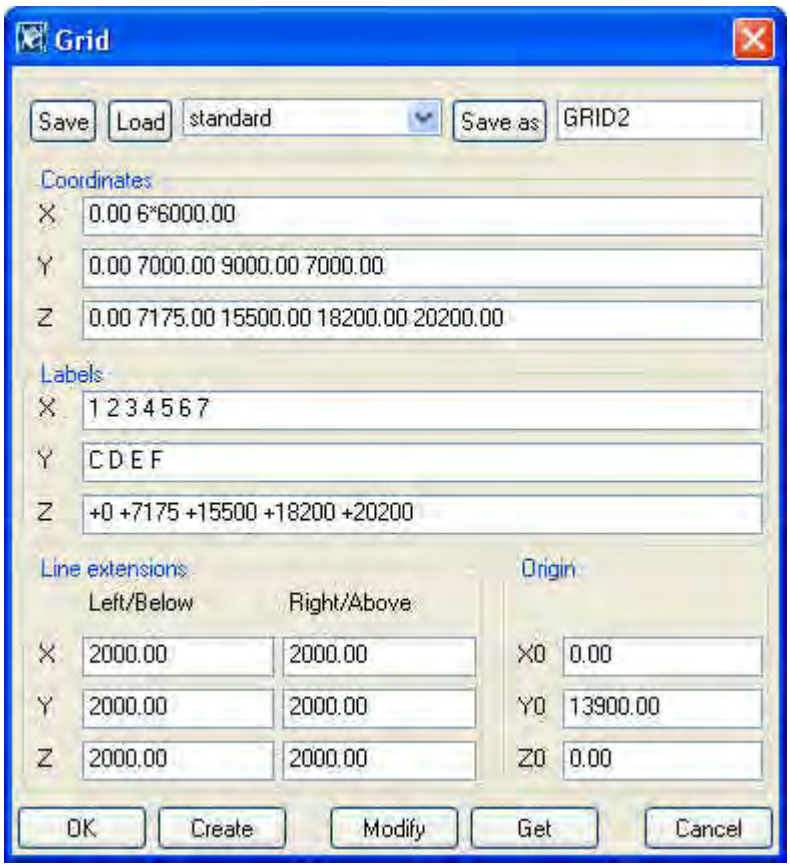
Create Grid



To create the appropriate grid for BasicModel2 modify the existing default grid.

Modify the existing grid

1. Double-click the grid line.
2. Edit the grid, in the **Grid properties** dialog box, according the grids shown above (coordinates and text).
3. Edit the grid origin **Y0** value to **13900**.

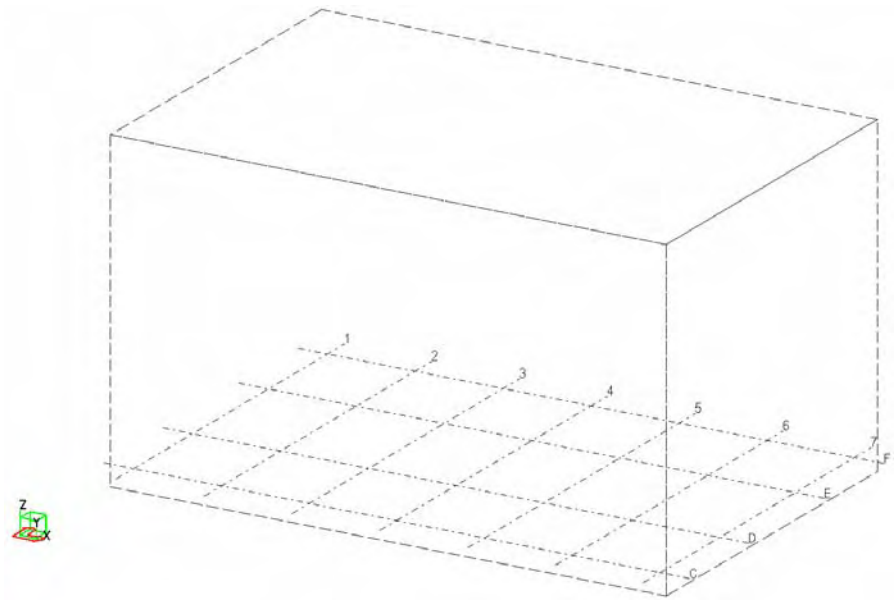


4. Click **Modify**, and the new grid values will be applied.
5. Enter GRID2 in the save as field and click the **Save as** button to save the grid values.

Fit work area

1. Left-click anywhere in the view.
2. Right-click and select **Fit work area**.

The view should now look like the one below.



Create Plane Views along Grid Lines

We will now create **Elevation** and **Plan** views along the grid lines.

Create grid views

1. Select the grid.
2. Right-click and select **Create view > Grid views** from the pop-up menu.
3. Click the **Show…** button on each view plane to open the **View properties** dialog box, set the view properties the way you want and click **OK**.
4. Click **Create** in the **Creation of views along grid lines** dialog box.

1.2 Setting Up Job Specific Information

Prior to adding any parts we will setup the model with the necessary job specific information:

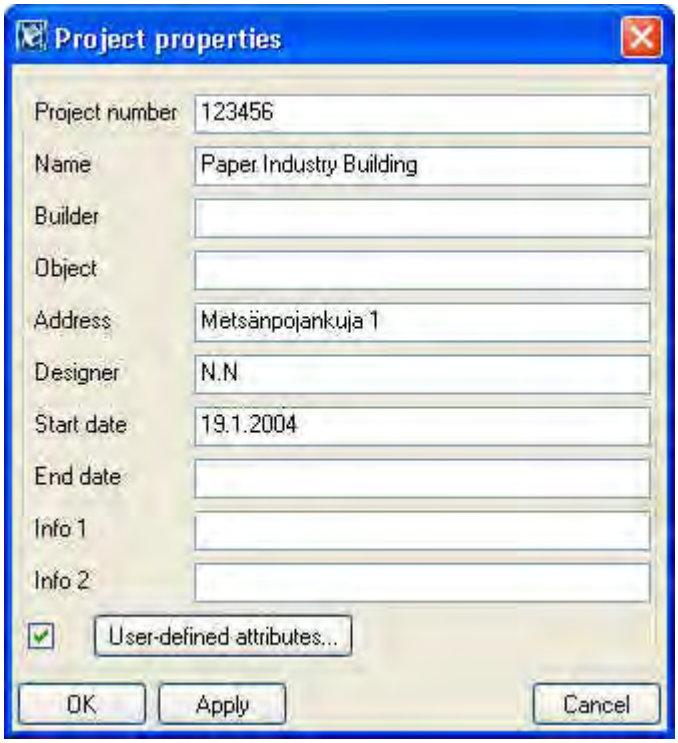
- Project properties
- Preferences
- Part properties and numbering series

Project Properties

Project properties are common to all drawings and can be used to fill in typical information in the title blocks.

Set up project properties

1. Open the **Project properties** dialog box by selecting **Properties-> Project…**
2. Fill in the information as shown in the dialog box below.
3. Press **OK**.



Check Preferences

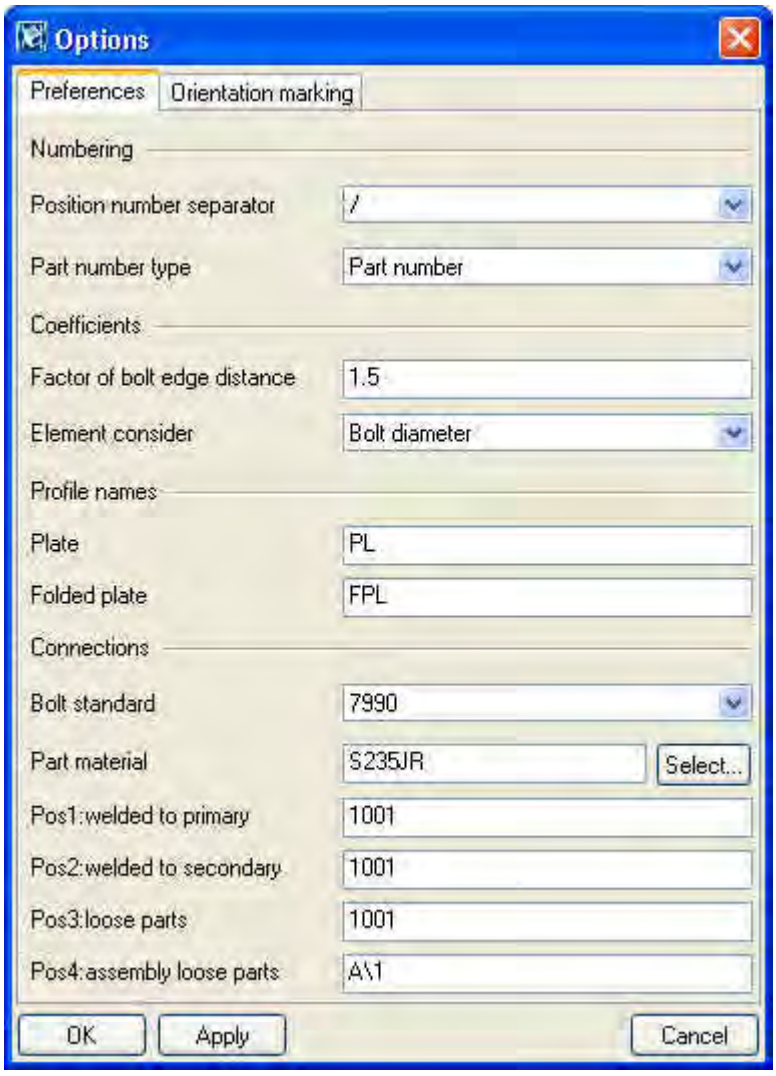
Before starting the modeling we will check that preferences are set up correctly.

Help: System > Using Xsteel effectively > General > Preferences

Check that your preferences are set up correctly before you start modeling. If you change settings on the **Preferences** tab, Tekla Structures only applies the new settings to connections you subsequently create. Connections you created prior to changing the preferences are not affected.

Check preferences

1. Open **Setup > Options…**
2. On the **Preferences** tab check the values are as below, click **OK**.



Part Properties and Numbering Series

You use a numbering series (numbering prefixes and start numbers) to divide parts, assemblies (steel detailing) and cast units (concrete detailing) into groups. For example, you can allocate separate numbering series to different phases or part types.

You can name the numbering series to which a part, assembly or cast unit belongs, by using the part properties dialog box. The numbering series name consists of a prefix and a starting number.

If you already know in the beginning of the project how the members should be numbered it is a good idea to create the parts right from the start with the correct numbering series.

Help: Modeling > Parts > Numbering parts > Defining numbers to be used for parts

In Lesson 9 Numbering and reports, you will learn the basics of numbering parts in Tekla Structures; how numbering series result in different part / assembly /cast unit numbers, numbering settings etc.

Set the part properties

Go through each of the part properties dialog box (Beam properties, Column properties, Contour plate properties, etc.) and set them up with the information shown in the tables below and save each of them with a specific name. See the Adjust Beam properties example below the tables.

Steel Members

Parts/ command	Part prefix	Part start no.	Assembly prefix	Assembly start no.	Part name	Material	Class
Beam command							
Beams	PB	1	AB	1	BEAM	S355JR	6
Vertical braces	PV	1	AV	1	BRACING_V	S355JR	3
Horizontal braces	PH	1	AH	1	BRACING_H	S355JR	3
Rafters	PR	1	AR	1	RAFTER	S355JR	9
Purlins	PP	1	AP	1	PURLIN	S355JR	8
Column command							
Columns	PC	1	AC	1	COLUMN	S355JR	7
Silos	PX	1	AX	1	SILO	S355JR	1
Contour plate command							
Plates		1001	A	1	PLATE	S355JR	99

Concrete Members

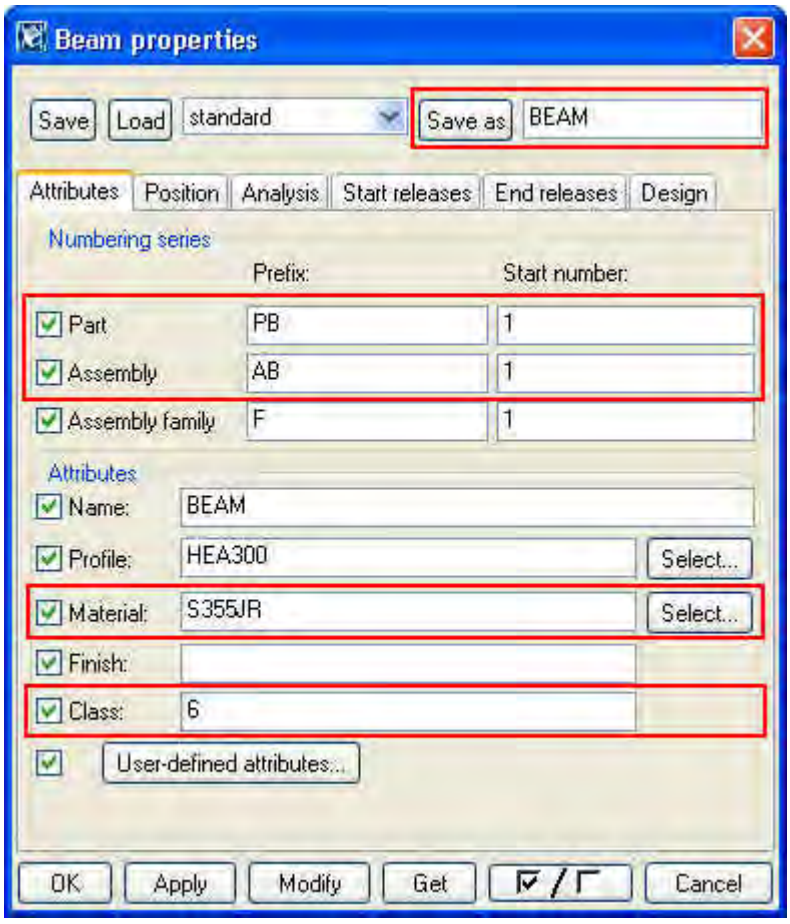
Parts/ command	Cast unit prefix	Cast unit start no.	Part name	Material	Class
Concrete beam command					
Beams	CB	1	BEAM	K40-1	4
Hollowcore slabs	CH	1	HCSLAB	K40-1	1
Concrete column command					
Columns	CC	1	COLUMN	K40-1	3

Pad footing command					
Pad footings	CP	1	FOOTING	K40-1	2
Concrete slab command					
Slabs	CS	1	SLAB	K40-1	4

Example: Adjust beam properties

1. Open the **Beam properties** dialog.
2. Match the highlighted fields in the dialog box below.

Type the part name **BEAM** in the save as field and click the **Save as** button.



Save Defaults

After you have setup the properties, you must save the **Project properties** and **Preferences** for this model with the **Save defaults** command.

The **Save defaults** command creates a set of standard files which also include the part properties files. These standard properties are loaded when you open the model.

In other words, when you want specific properties to be loaded by default when you open a model, setup and load the properties before using the **Save defaults** command.

Help: System > Files and Folders > Customizing Xsteel > Save defaults

Save Defaults

Click **Setup > Save defaults**.

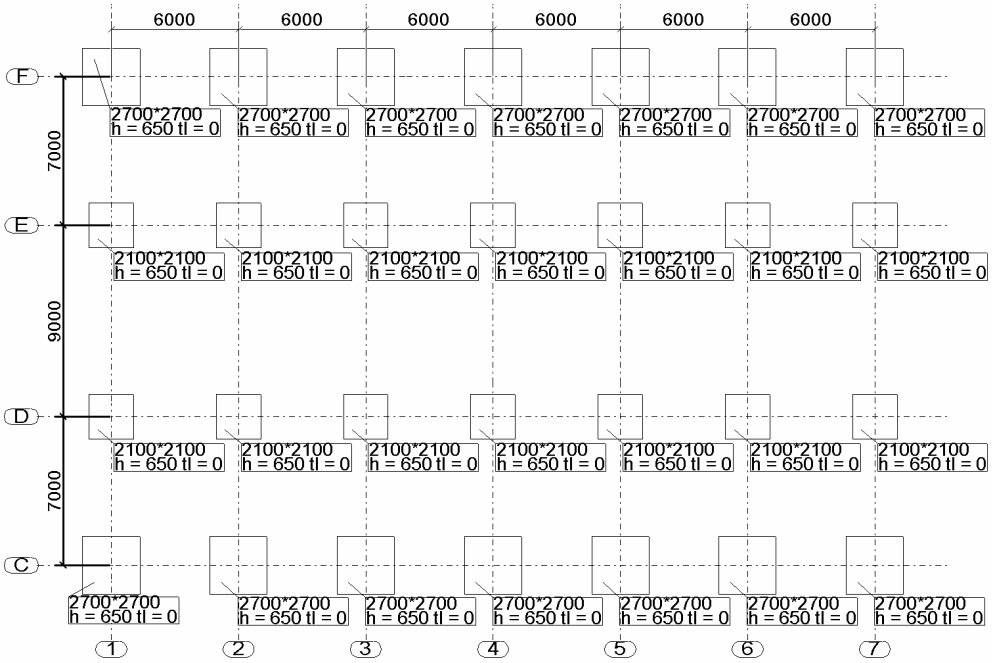
1.3 Create Concrete Members

First we will create pad footings, columns, and beams on grid line 1 and then copy them all at once to the other grid lines.

We will then create a slab on top of the columns/beams at level 7175.

Pre Cast Footings

We will now create foundations on grid line 1.



2700*2700 footing

1. Double-click the **Create pad footing** icon.

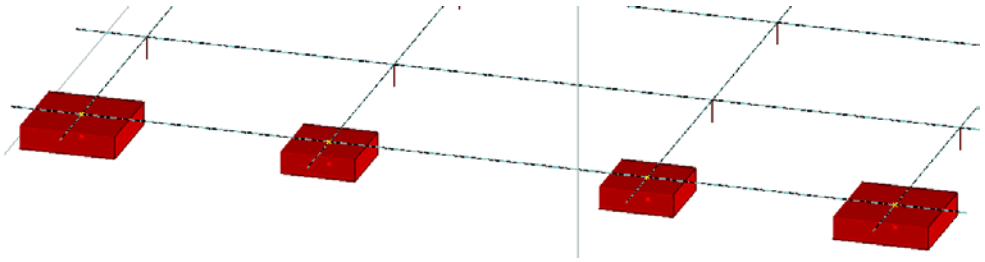
2. Load the saved **FOOTING** properties.
3. Enter the **Pad footing** information in the dialog box for a 2700*2700 footing as shown in the drawing (set the profile to 2700*2700, Bottom level to –650 and Top level to 0).
4. Click **Apply**.
5. Pick grid intersections C-1 and F-1.

2100*2100 footing

While still in the command:

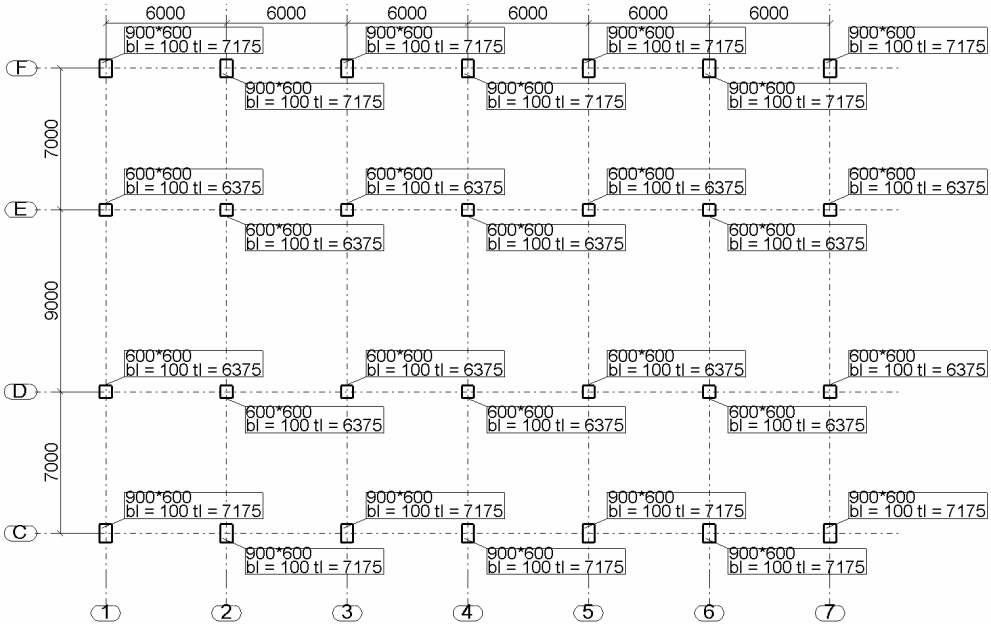
6. Enter the **Pad footing** information in the dialog box for a 2100*2100 footing (set the profile to 2700*2700, Bottom level to –650 and Top level to 0).
7. Click **Apply**.
8. Pick grid intersections D-1 and E-1.

The footings should now look like those shown below:



Pre Cast Columns

Now we will create the columns on grid line 1.



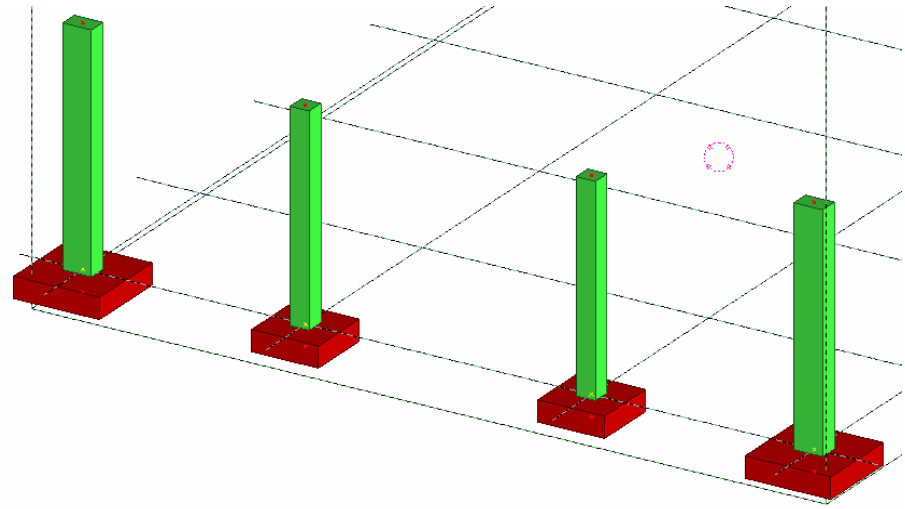
900*600 Columns

1. Double-click on the **Create Concrete column** icon.

2. Load the **COLUMN** properties that you saved earlier.
3. According to the drawing shown above, enter the information in the **Concrete column properties** dialog box for a 900*600 column, and click **Apply**.
4. Pick the intersections of grids C-1 and then F-1.While still in the command:

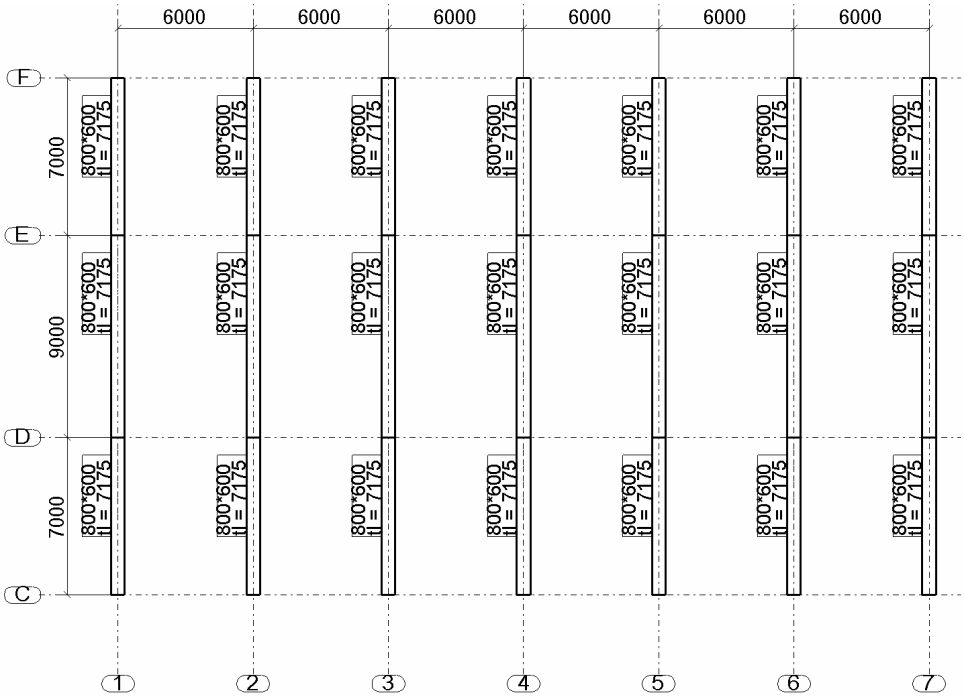
600*600 Columns

Complete the dialog for 600*600 columns and create them on grid intersections D-1 and E-1.



Pre Cast Beams

We will now create the beams on grid line 1 at level +7175.

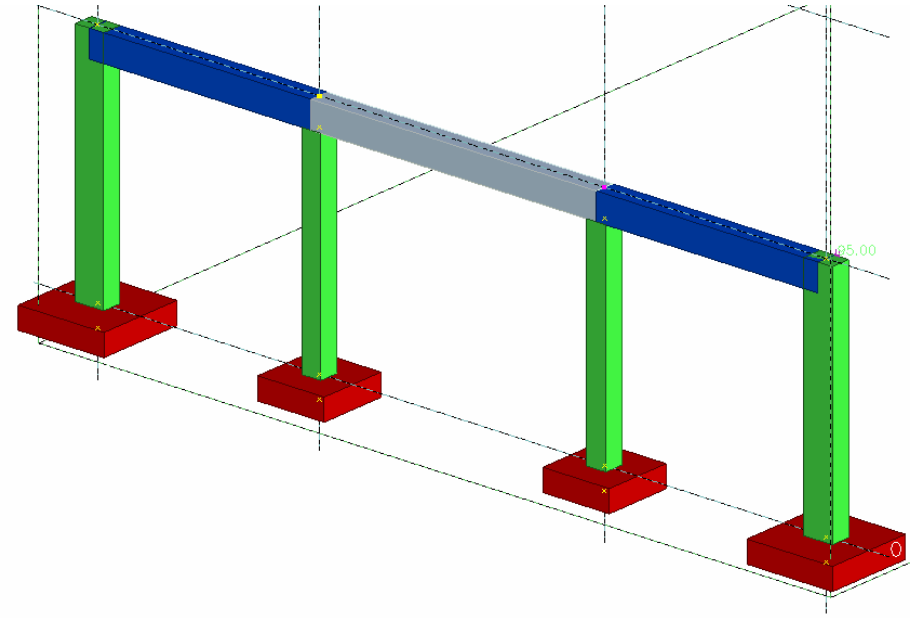


Create beams

1. Double-click the **Create concrete beam** icon.

2. Load the **BEAM** properties that you've saved.
3. Enter the information in the **Concrete beam properties** dialog according the drawing above, click **Apply**.
4. In the GRID 1 view pick the intersection of gridlines C-7175 and then D-7175.
5. End the command by clicking the middle button.

6. While on grid line 1, create the other two beams the same way.

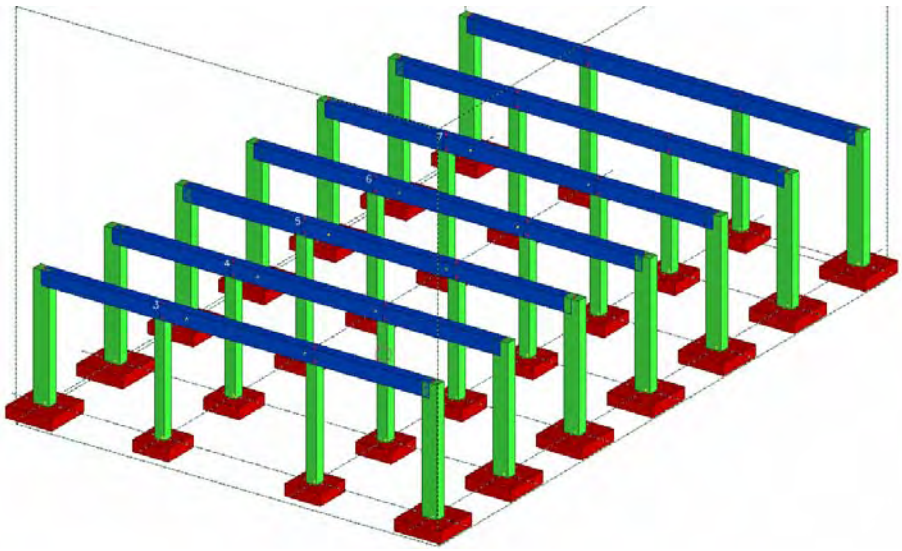


Copy the Members

We will now copy the footings, column and beams that we created to grid lines 2-7.

Copy the members

1. Select the footings, columns and beams.
2. Right-click and select **Copy > Translate...** from the pop-up menu.
3. Pick two points to show the translation vector (6000 in X direction).
4. Type in the number of copies (6).
5. Click **Copy**.

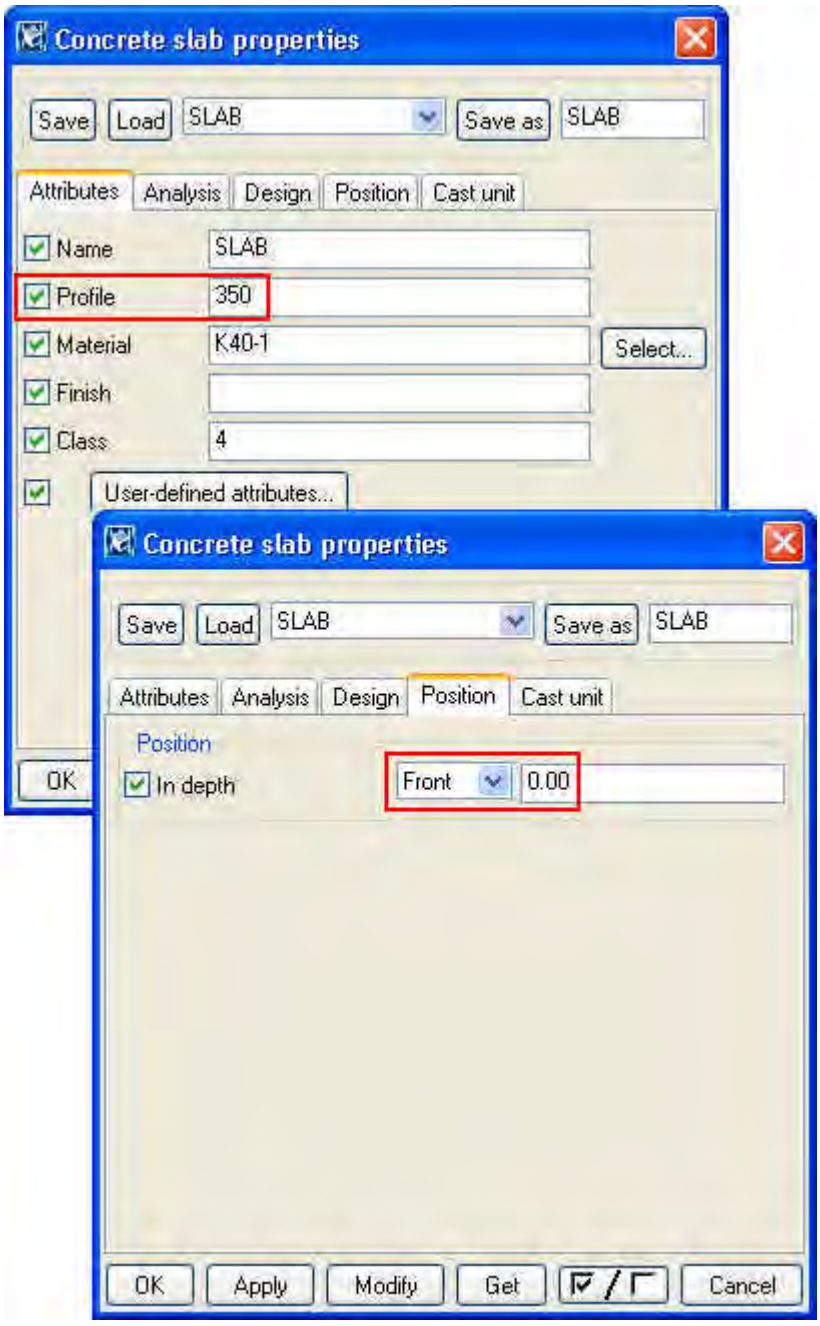


Insitu Slab

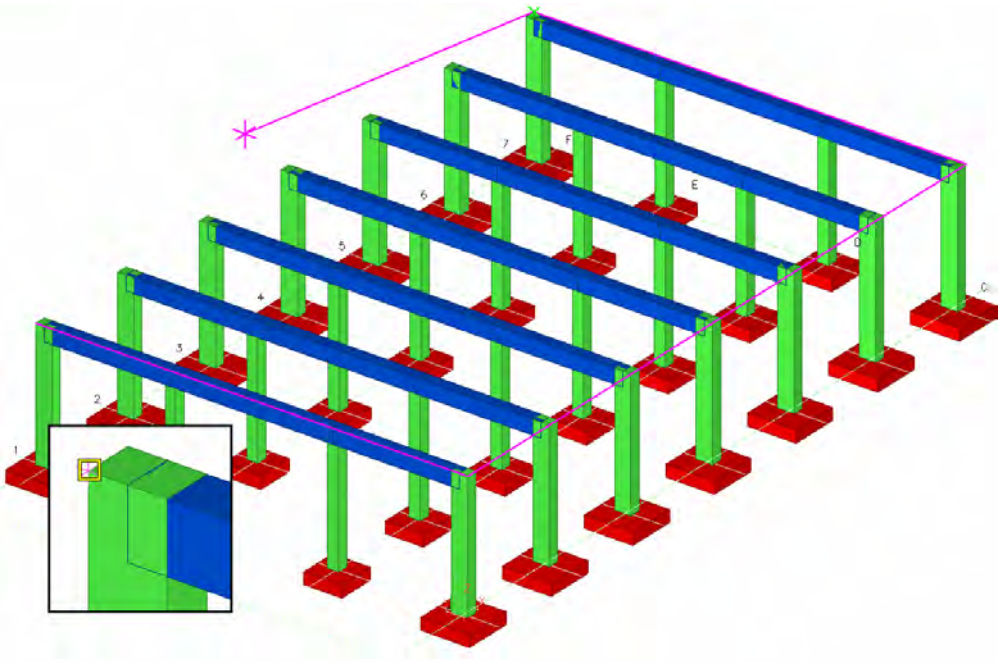
We will now create a 350 mm slab on top of the framework by using the outermost corners of the columns.

Create the slab

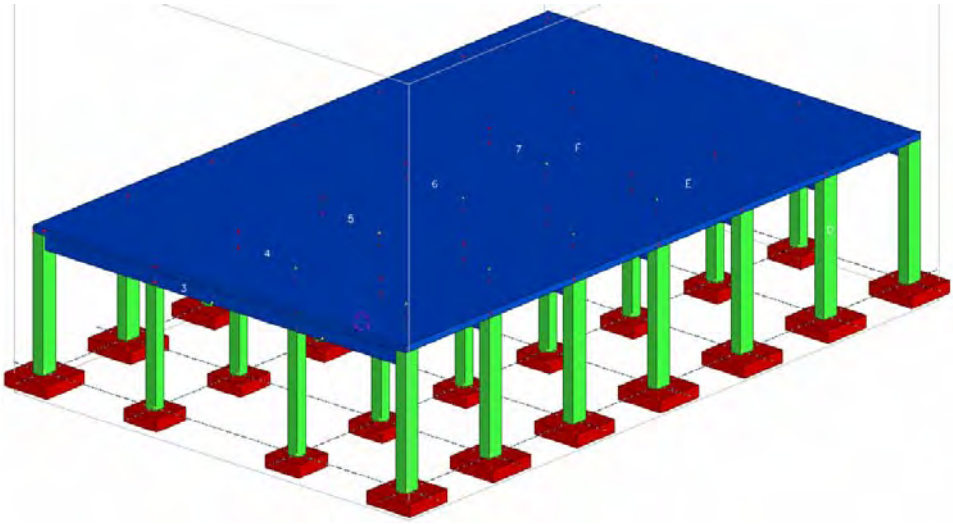
1. Double-click the **Create concrete slab** icon.
2. Load the **SLAB** properties that you saved earlier.
3. Complete the **Concrete slab properties** dialogue box as shown and **Apply** this.



4. In the PLAN +7175 view pick the outermost corners of the four columns as shown.



5. Click middle button to create the slab.



1.4 Create Steel Members

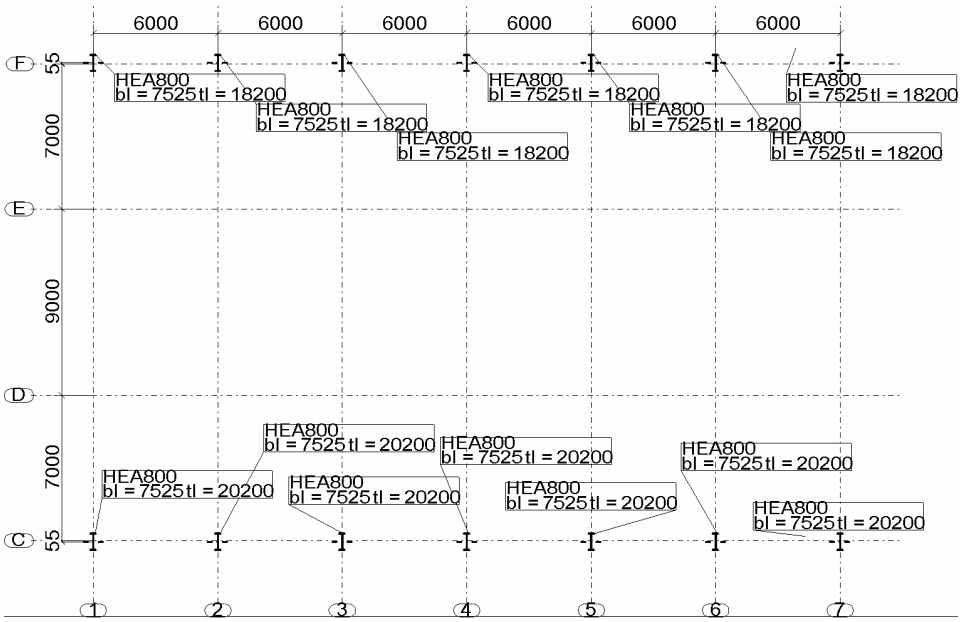
First, we will create two columns on grid line 1 and then a rafter between them.

After that we will create the construction points needed to create the horizontal bracing and purlins. We will copy translate the completed portal frame and points. By taking advantage of sloping work plane and view planes we will model the horizontal bracing and purlins.

Finally we will create vertical bracing on grid lines C and F.

Steel Columns

We first create two columns on grid line 1.

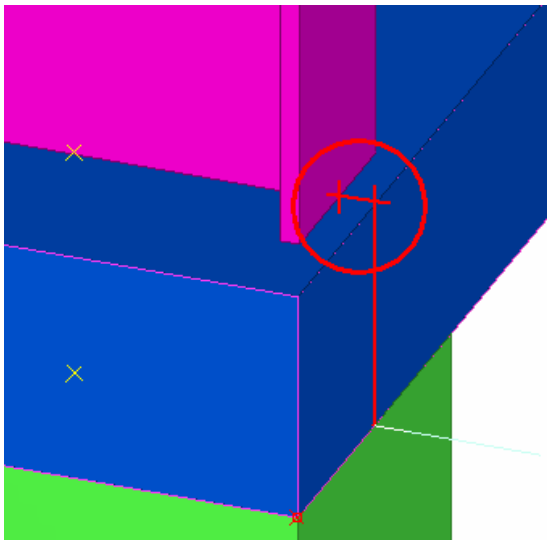


Create columns

1. Double-click the **Create column** icon.

2. Load the **COLUMN** properties.
3. Complete the **Column properties** (profile and the levels) for the column at the grid intersection C-1 as shown in the figure above and click **Apply**.
4. Pick the grid intersection C-1 to create the column.
5. Complete the **Column properties** for the column at grid intersection F-1, and click **Apply**.
6. Pick the grid intersection F-1 to create the second column.

Since the profile depth of the concrete and steel columns are different (900*600 => h=900 while HEA 800 => h=790) middle positioning results a gap in the outer face.

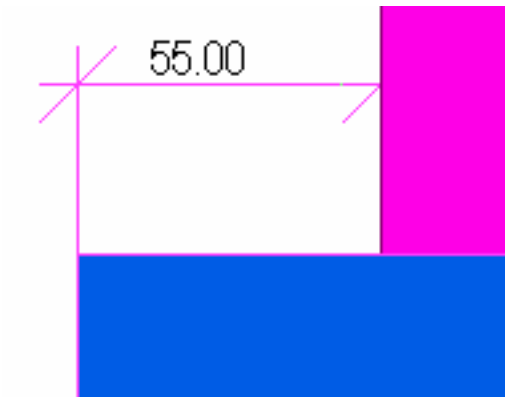


Use the **Measure** tool to measure the distance from the edge of the column to the edge of the slab.

Measure the gap

1. Click the **Create x measure** icon.

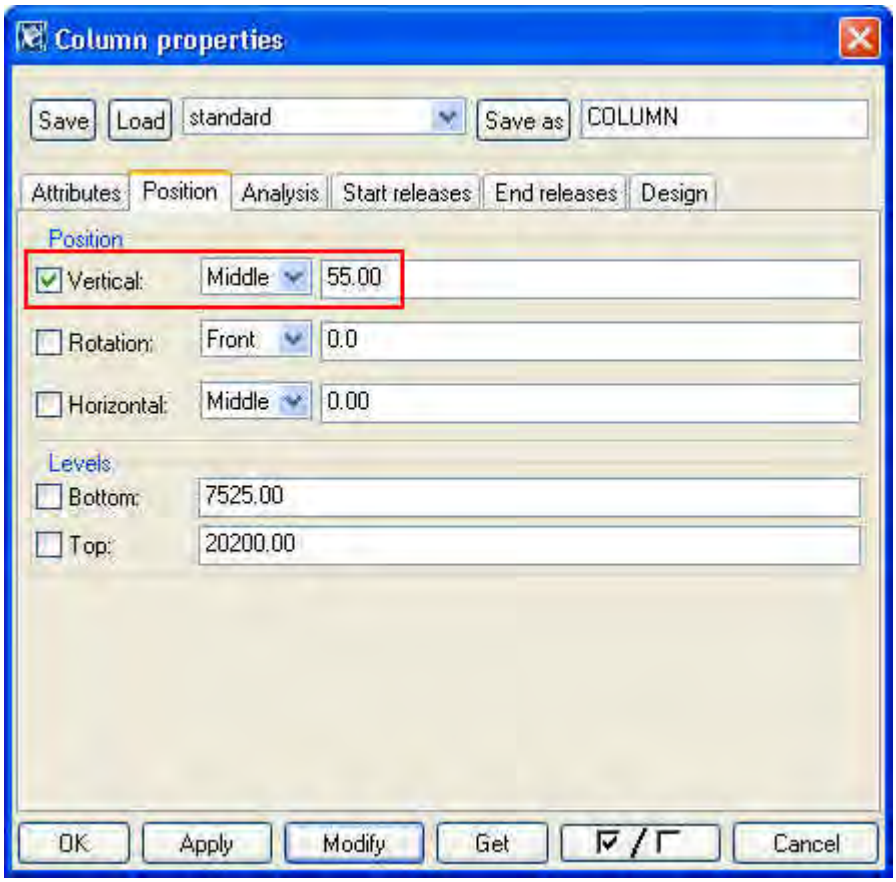
2. In the grid 1 view pick the point in the slab corner then the point in the column corner.
3. Pick a position to place the dimension.



Adjust the vertical position

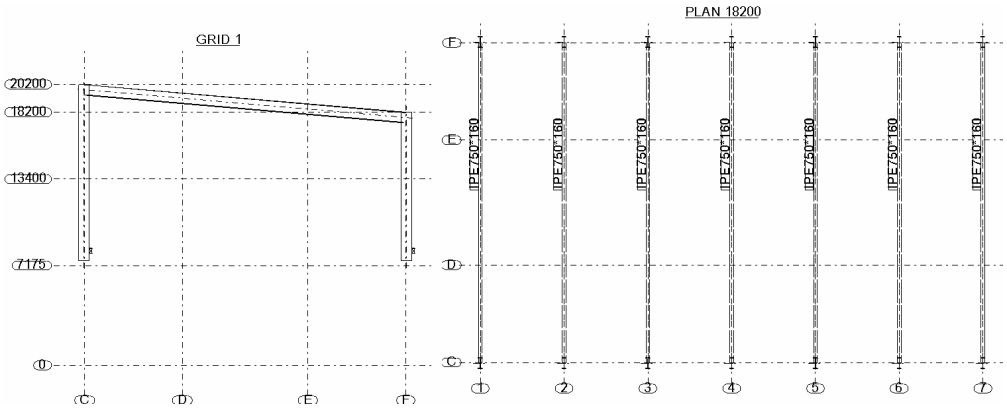
Adjust the column edge to the slab (and concrete column) by using the vertical position offset in the **Column properties** dialog.

1. Open **Column properties** dialog box.
2. **Modify** the column on grid line F using a vertical offset of 55.
3. **Modify** the column on grid line C using a vertical offset of -55.



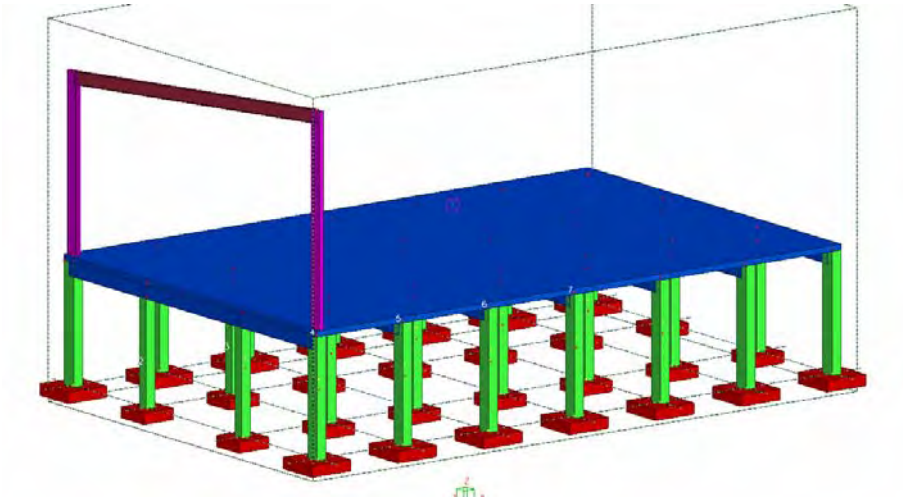
Steel Rafter

Now we will create a rafter between the 2 columns that we just created.



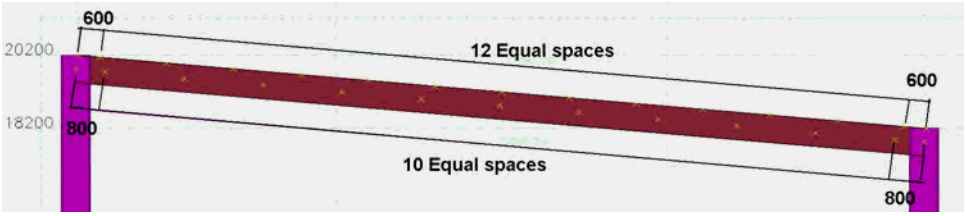
Create rafter

1. Double-click the **Create beam** icon.
2. Load the **RAFTER** properties.
3. Enter the rafter information in the dialog according the drawing above (Profile: IPE750*160) and click **Apply**.
4. In the GRID 1 view pick the intersection of grids C-20200 and then F-18200.



Work Points for Horizontal Bracing and Purlins

After inputting the two columns and the rafter, we will layout points for modeling the purlins, vertical and horizontal braces.



Bracing Work Points

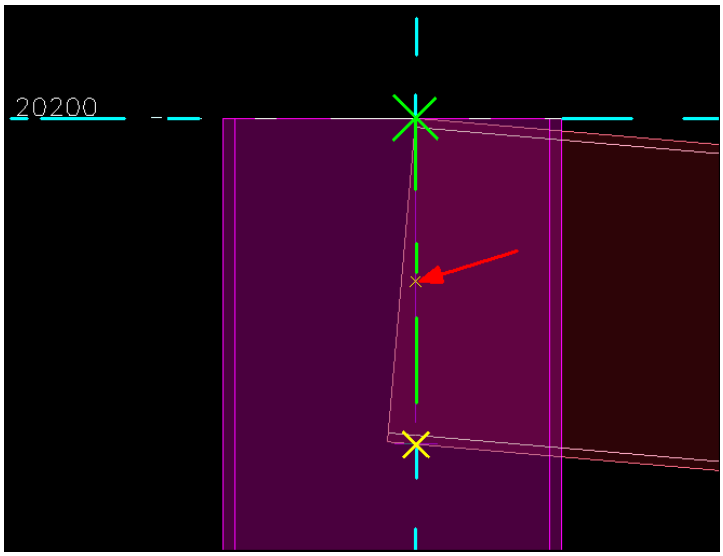
We need first to create points at the intersection of grid C and rafter centerline and intersection of grid F and rafter centerline. Then using the points we will create work points for the braces.

To create a point at the intersection (shown with red arrow) of grid C and rafter centerline:

Intersection of grid and rafter centerline

1. Double-click **Create divided line points** command.

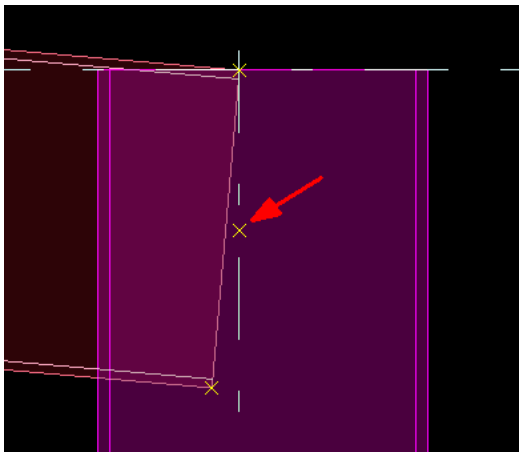
2. Type in 1 (1points) and pick the positions shown below.



Copy the point to the other side

To create the point in the intersection of grid F and rafter centerline on the other end of the rafter we simply copy the first point.

1. Select the point just created, right-click and select **Copy – Translate…**
2. Pick the start point of the rafter then the end point of the rafter, click **Copy**.

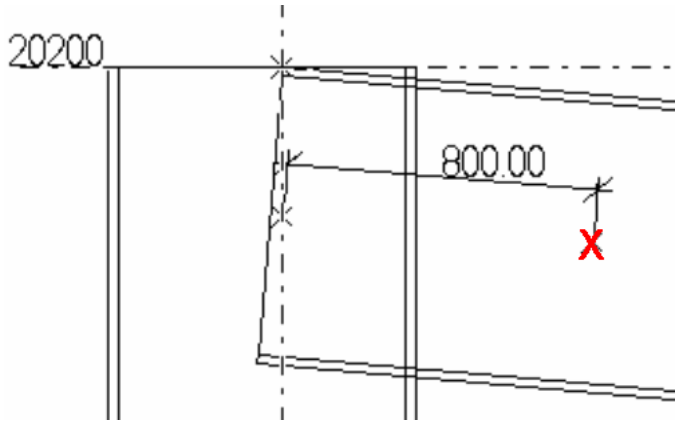


We will now create the work points for first and last brace.

First and last brace work points

1. Double-click **Create extension point** icon.

2. Type in –800, click **OK**.
3. Pick from one of the points just created then the other.



4. Repeat, picking the points in the reverse order

Using the **Create divided line points** command divide the space between the work points that you just created into ten equal spaces (9 points).

Divide the working points in ten segments

1. Double-click the **Create divided line points** icon.

2. Enter 9 as the number of dividing points, click **OK**.

3. Pick from one of the work points that you just created and then the other.

Purlins Work Points

We can now use the grid intersections C-20200 and F-18200 to create the work points for first and last purlins.

First and last purlins work points

1. Double-click **Create extension point** icon.

2. Type in –600, click **OK**.
3. Pick the grid intersections C-20200 and then F-18200.
4. Repeat, picking the points in the reverse order.

Divide the working points in 12 segments

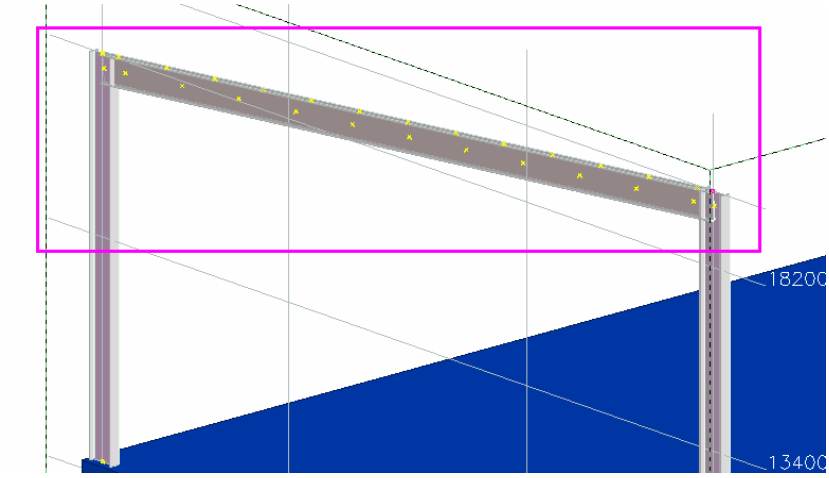
Using the **Create divided line points** command divide the space between the work points that you just created into 12 equal spaces (11 points).

Copy the Portal Frame and the Points

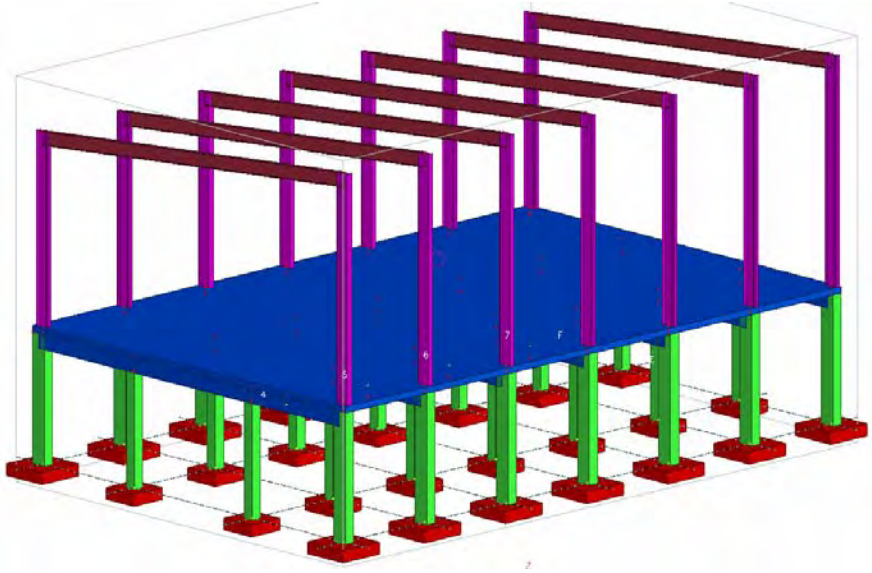
We will now copy the columns, rafter and the points to grid lines 2-7.

Copy the members

1. Select the columns, rafter and points.



2. **Copy > Translate…**
3. Pick two points to show the translation vector (6000 in X direction).
4. Type in the number of copies (6).
5. Click **Copy**.



Set Sloping Work Plane for Bracing and Purlins

The next step is to model the horizontal bracing and purlins at the sloped roof. To place the parts in the correct plane we will first change the work plane (which currently is the local coordinate system of the model) to the roof slope.

Help: Modeling > Getting Started > Basics > Defining the work area and shifting the work plane

Help: Modeling > Getting Started > View reference > View > Work plane > To part plane

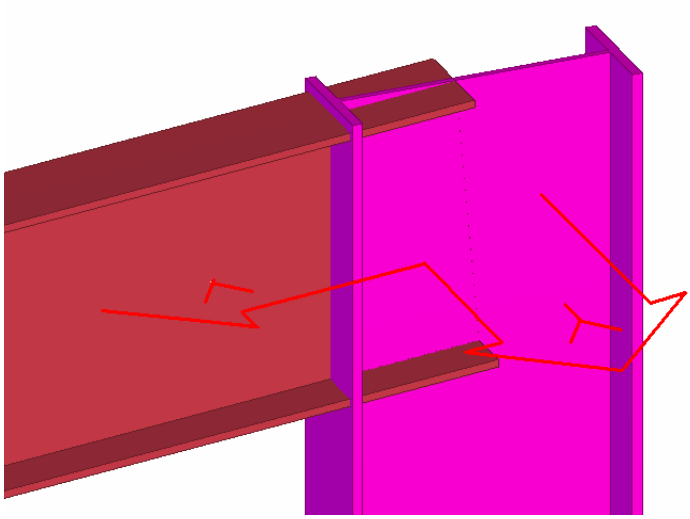
Set work plane to the roof slope

To set the work plane to the roof slope:

1. Pick the **Set Work plane to part top** icon.

2. Pick the rafter on grid line 1.

The work plane is now positioned in a plane parallel to the top plane of rafter.



The **Set work plane to part plane** command sets the work plane parallel to the part plane (front top, back, bottom) on the center line of the part.

You can use the command, **Work plane > With one point**, to set the work plane exactly to the desired position. This command keeps the work plane parallel to the current work plane, but moves it to a new position using a single picked point.

True Plan View

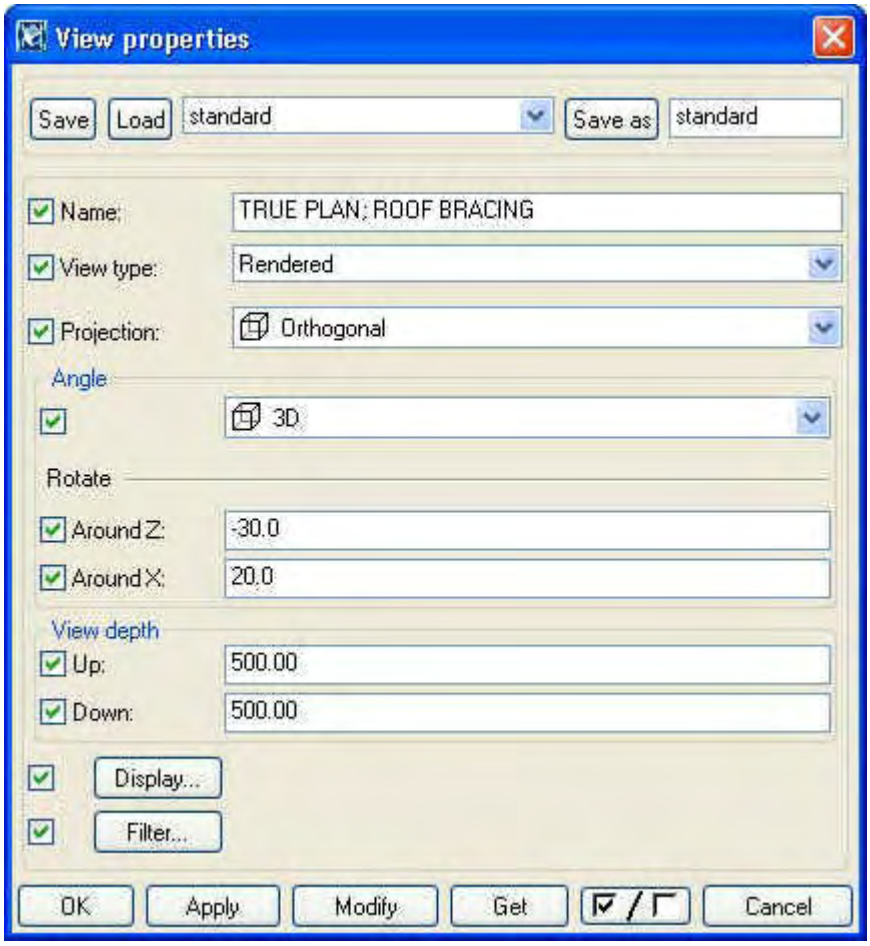
To make it easier to add the roof bracing we will now make a true plan view on the roof bracing by creating a view perpendicular to the work plane. We can also use the true plan view in drawings.

Working in a true plan view makes it easier to model E.g. sloped objects since the grids are also shown in the true plan and points in the view plane are represented as yellow crosses.

The part positioning, copying etc however always comply with the work plane coordinate system no matter in which view you perform the commands.

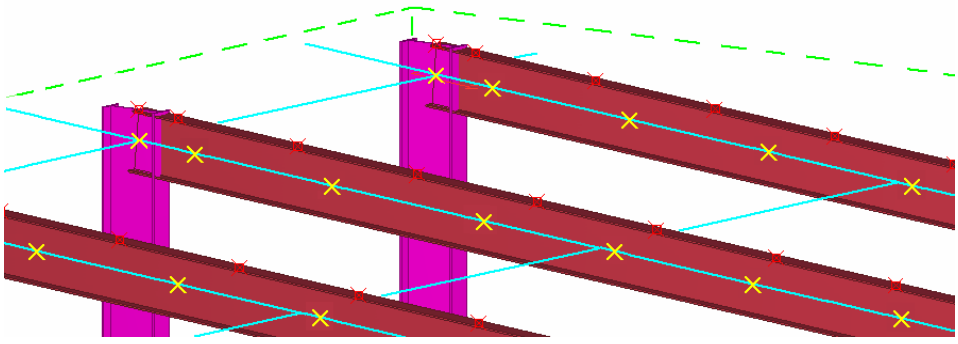
Create true plan view

1. Pick **Properties > View...**
2. Complete the properties as shown below, click **OK**.



3. Select **View > Create view > To workplane**.

The new view is created. The work points created for braces appear in yellow since they are now on the view plane. The grid is also shown in the true plan view plane.

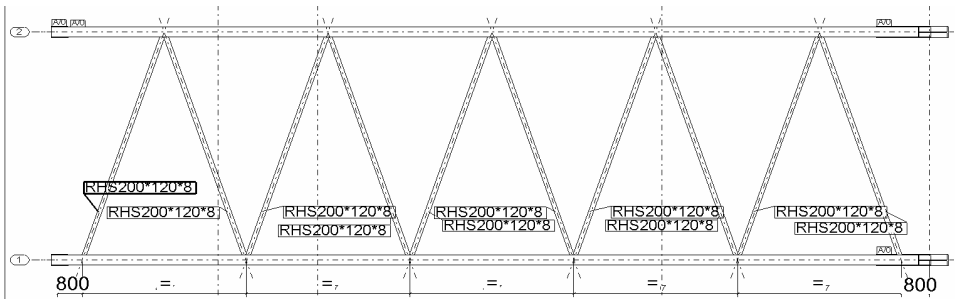


Create Horizontal Bracing

Working in the true plan view we will next create the horizontal bracing members using the **Create beam** tool.

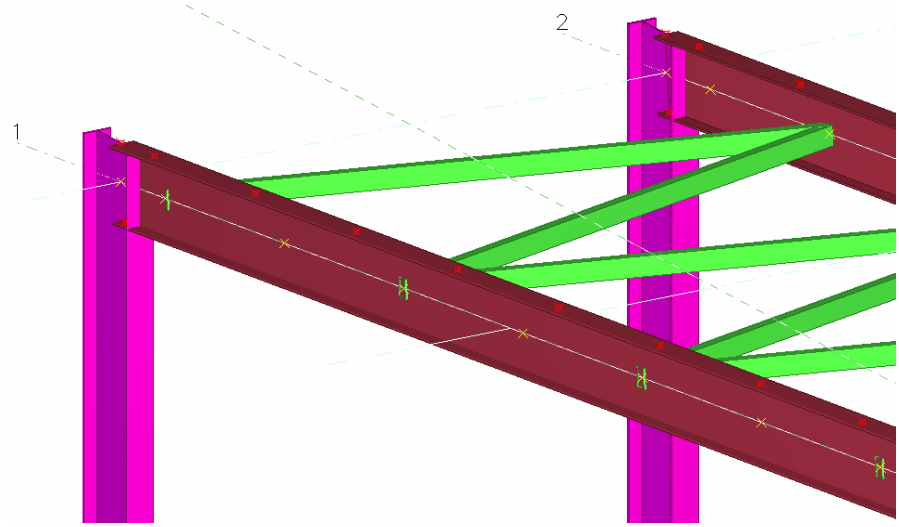
Create horizontal bracing

1. Double-click the **Create beam** icon.
2. Load the **BRACING_H** properties.



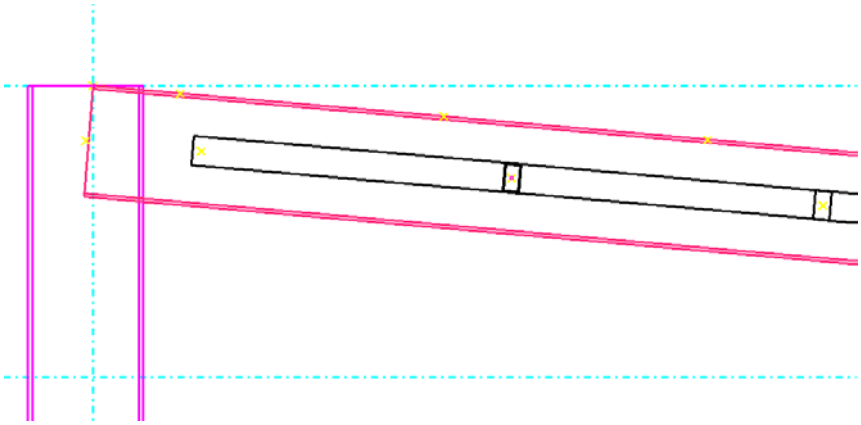
Complete the dialog box according to the information shown in the drawing above and change the **Position at depth** to: **Middle** and **Apply**.

3. In the true plan view create the braces shown in the drawing by snapping to the yellow points.



Check the positioning

Check the position of the braces in the 3d view and elevation view on grid 1.



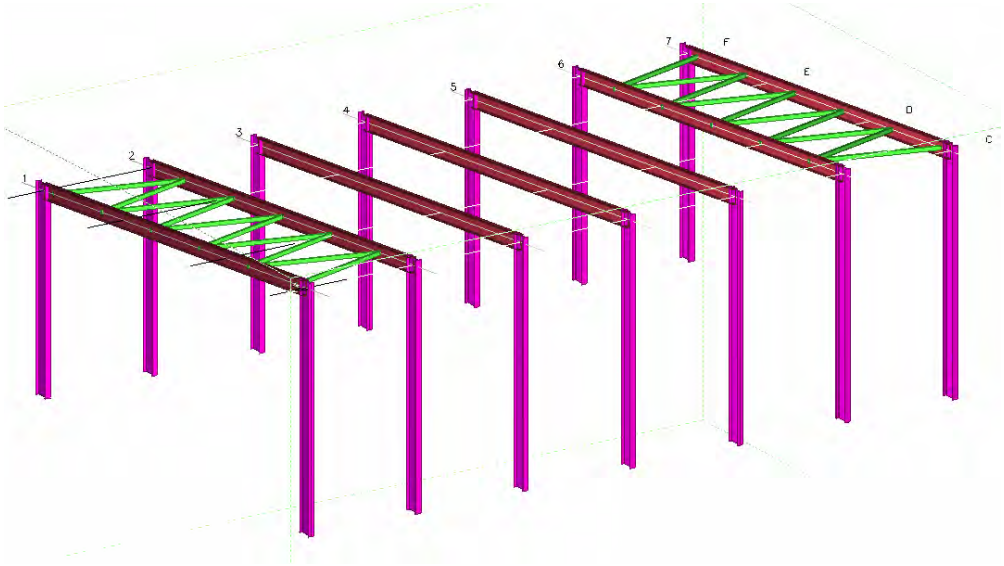
We will now copy mirror the braces to the other end of the building (between gridlines 4 and 5). Since the work plane is now at the same slope with the TRUE PLAN view, it is easy to pick the points for the mirror line.

The **Copy > Mirror** command copies and mirrors objects through a plane that is perpendicular to the work plane and passes through a line you specify.

Mirror the braces

1. Select the braces.
2. **Copy > Mirror**.

3. In the **True plan** view pick two points on gridline 4 to set the mirror line and click **Copy**.

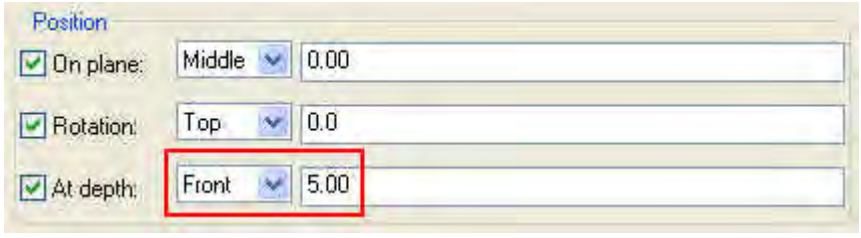


Create Purlins

While still working in the true plan view we will create the purlins by using the **Create beam** tool.

Create purlins

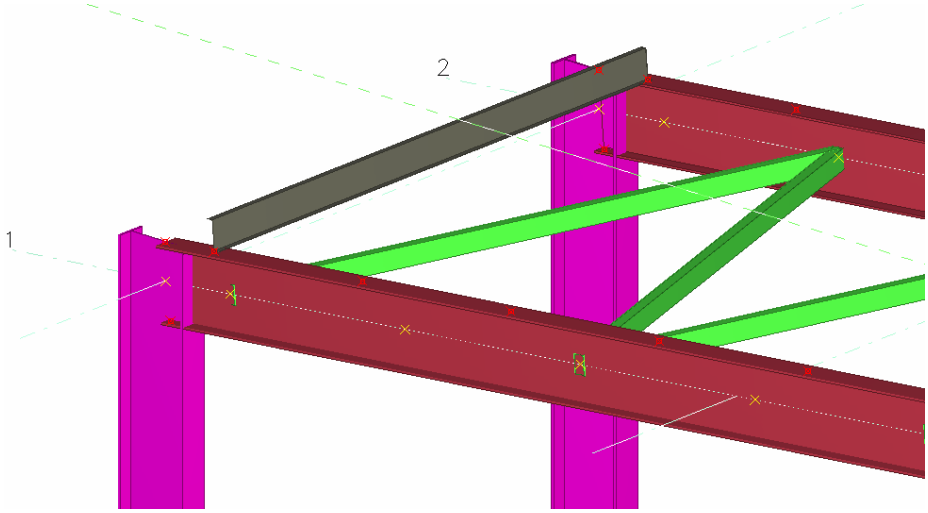
1. Double-click the **Create beam** icon.
2. Load the PURLIN properties.
3. Select a Z300/3.0 profile for the purlin.
4. Change the **Position / At depth** to: **Front** and **Apply**.



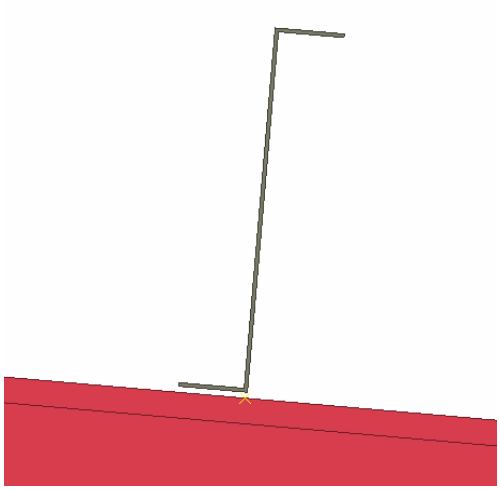
5. Pick the purlin work point near grid intersection F-1 at the command **Pick first position**.

The point that you pick for the purlin is red since it is not on the view plane.

6. At the command: Pick second point, pick the work point near grid intersection F-2.



7. Check the elevation view on grid 1 to ensure that the purlin is orientated and positioned correctly.



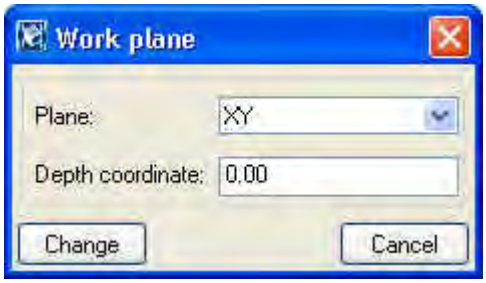
With asymmetric profiles (Z,L etc) the picking order of first and second position determines the orientation. It is not possible to change the orientation using the beam properties.

8. Create the rest of the purlins by using the **Copy > Translate** command.

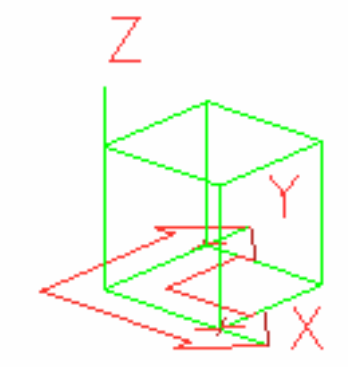
Set the work plane back to global origin

Now we must switch the work plane back to global origin to carry on modeling outside of the roof plane.

1. Pick **View > Work plane > Work plane…**
2. Select **Plane: XY** set the depth coordinate to 0 and click **Change**.



The work plane is now set back to the global origin.

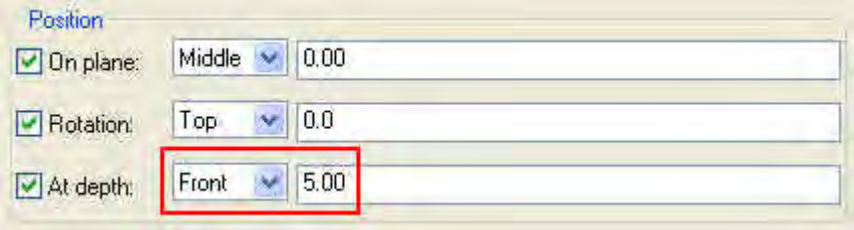


Vertical Bracing

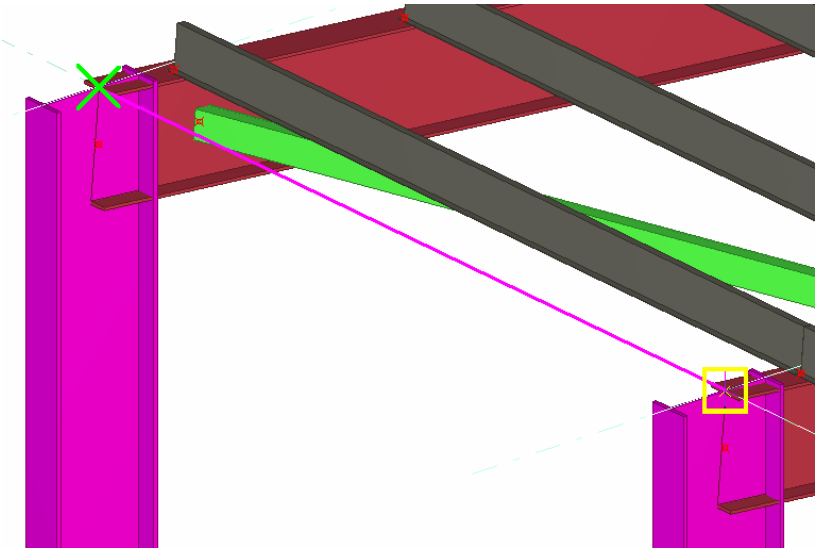
Working in the elevation on grid C view we will create vertical bracing using the **Create beam** tool.

Create brace

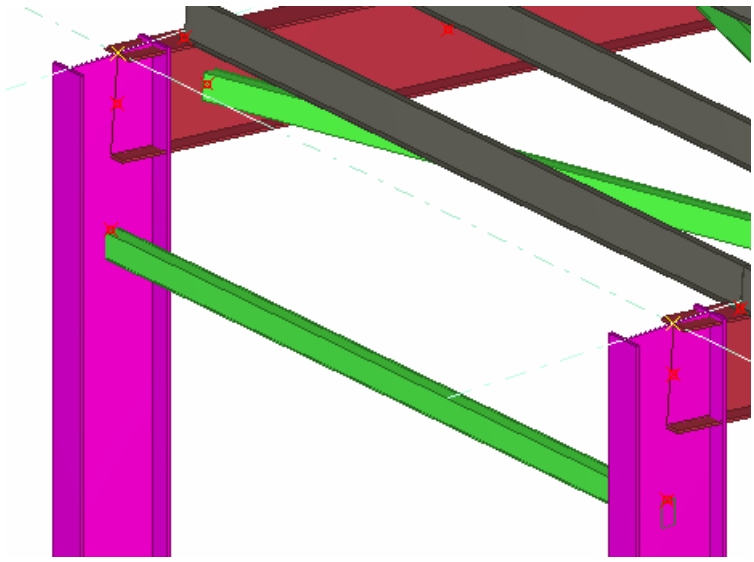
1. Double-click the **Create beam** icon.
2. Load the **BRACING_V** properties.
3. Enter **RHS200*120*8** as the profile.
4. Change the **Position / At depth** to: **Front** and add a 5 mm offset, click **Apply**.



5. Create one brace using the column top positions at C-1 and C-2.



6. Move the brace 1300 mm downwards and to the middle of the column.

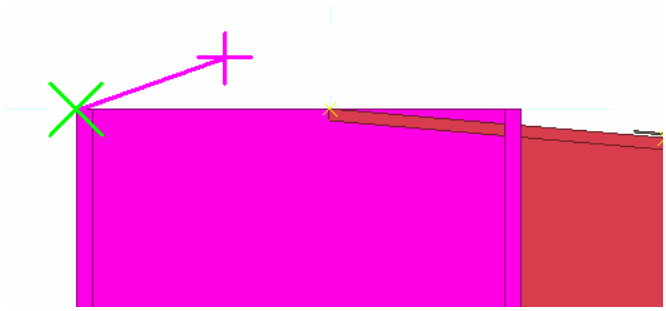


Copy the brace along grid C

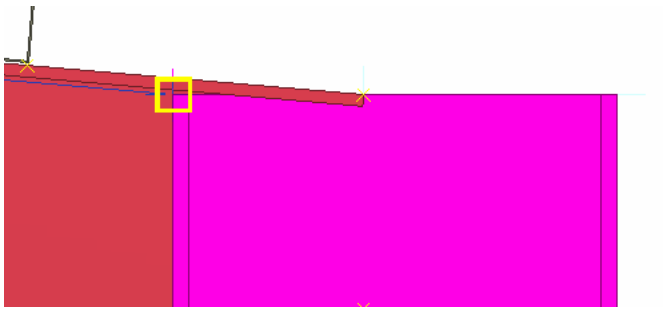
1. Select the brace and use **Copy > Translate…** to copy the brace five times at 6000 mm along grid line C.

Copy the braces to grid line F

2. Select all the braces on grid line C and select **Copy > Translate…**
3. In the grid 1 view, pick the outer corner of the column on grid line C as the first position.



4. Pick the inner corner of the column on grid line F as the second position, click **Copy**.

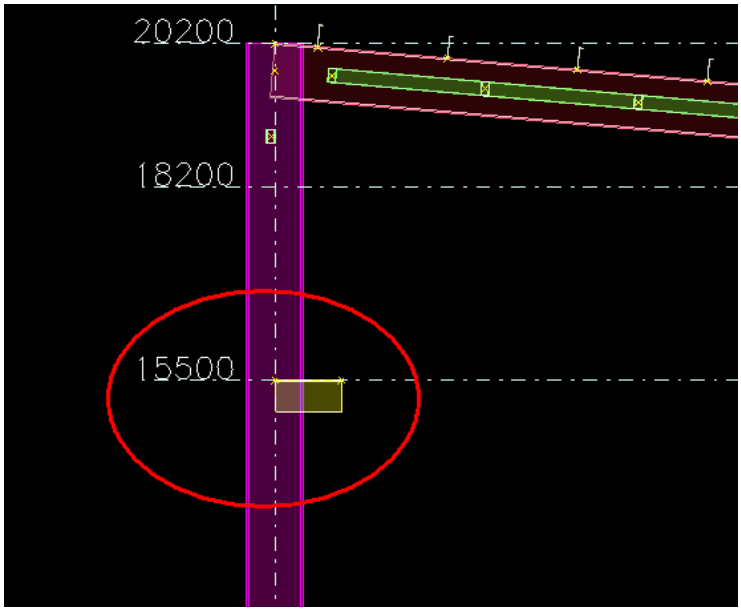


Crane Girders

Next we will add crane girders to the framing.

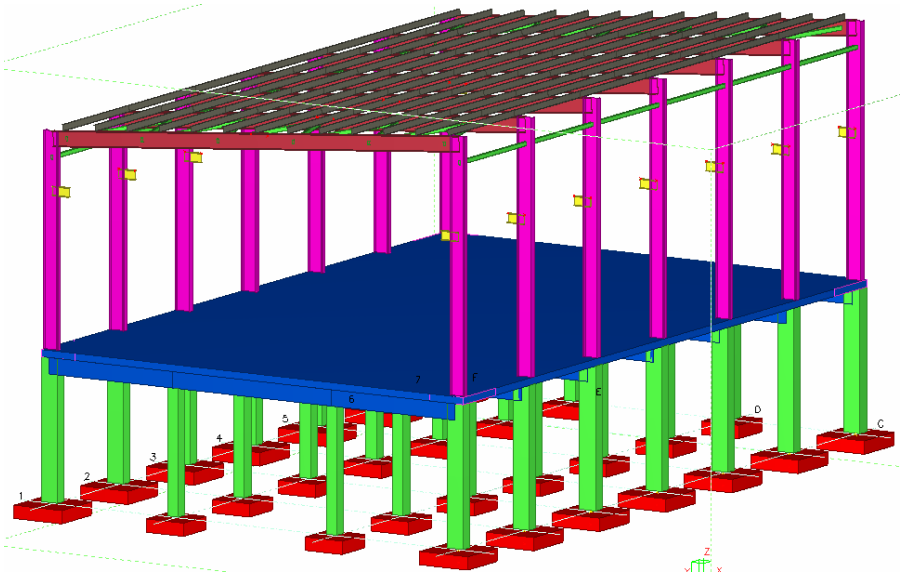
Create girder

1. Double-click the **Create beam** icon.
2. Load the **BEAM** properties.
3. Enter IPE450 for the profile size.
4. In the GRID 1 view pick the grid intersection C-15500.
5. Use the cursor to snap (Do not pick!!) in the Y direction.
6. With the keyboard type 930 for the numeric location and press **Enter**.



Copy girders

1. Copy the girder that you created to other columns on grid line C.
2. Use the **Copy – mirror** command to copy the girders from grid line C to gridline F.



The BasicModel2 model is now complete.

Save the model

Save the model.

Save the model with a new name

1. Click **File > Save as...**
2. Click after the path **C:\TeklaStructuresModels**, in the field at the bottom of the dialog box and type **\BasicModelCombined**.
3. Press the **OK** button. The model has now been saved with the new name.

1.5 Combine Models 1&2

Next we will combine BasicModel1 and BasicModelCombined by copying the objects in phase 1 from BasicModel1. To copy the objects from another model we will use the command; **Copy from model**. This command copies objects from specified phase(s) from another model.

To be able to manage the objects from the two models after we have combined them we will first transfer the model 2 parts a different phase.

Help: Modeling > Settings and tools > Settings > Phases

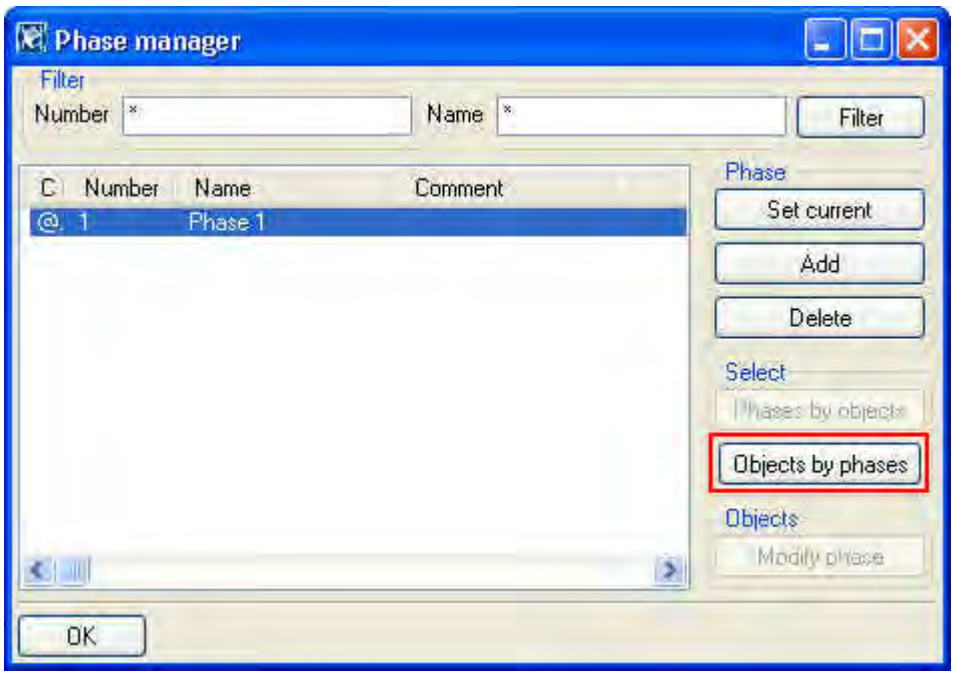
Change the Phase of BasicModel2 Members, Preparation

Check objects by phases

1. Click **Properties > Phase number...** to open the **Phase manager** dialog box.

By default only **Phase 1** appears in the dialog box.

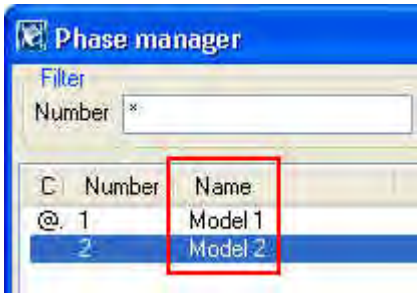
2. Select **Phase 1**.
3. Click **Objects by phases**.



All the parts in the model will become highlighted, indicating they belong to Phase 1.

Add a new phase – Model2

4. Click **Add** button to add a new phase.
5. Edit the name of the new phase to Model 2.



6. Also edit the name of the Phase 1 to Model 1.
7. See that all of the parts are still highlighted in the Model 2 phase.
8. Click **Modify phase**.
9. Now all of the parts in the model have changed to Phase number 2.

In the BasicModel1 the column footings on gridline B were dimensioned both for steel columns on gridline B and concrete columns on gridline C. After combining the models the footings on gridline C will no longer be needed and you can delete them.

Remove the pad footing

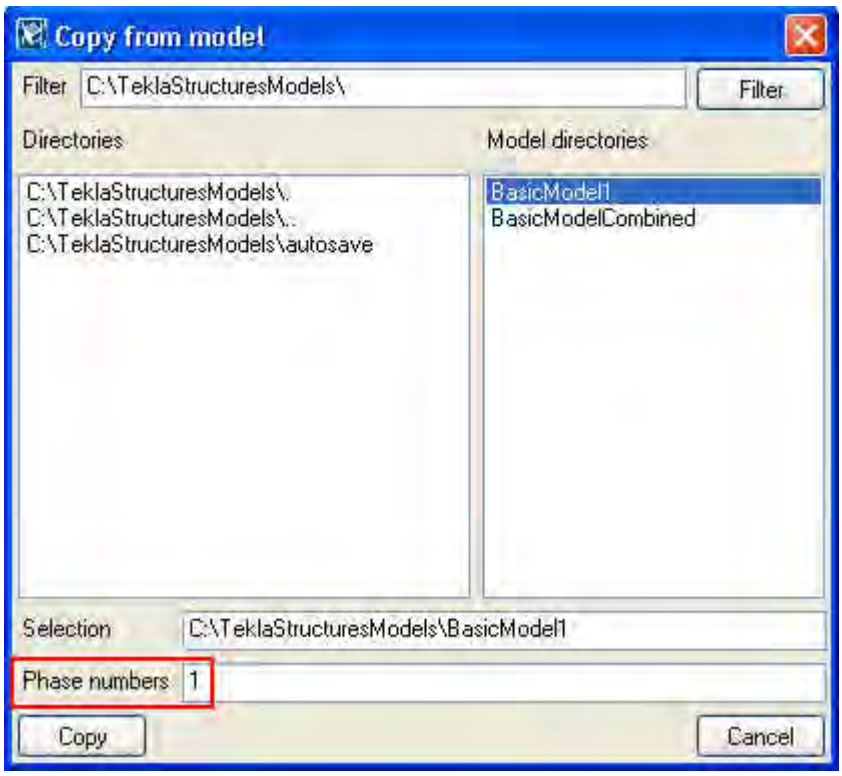
Delete the pad footings from grid line C.

Edit > Copy from Model

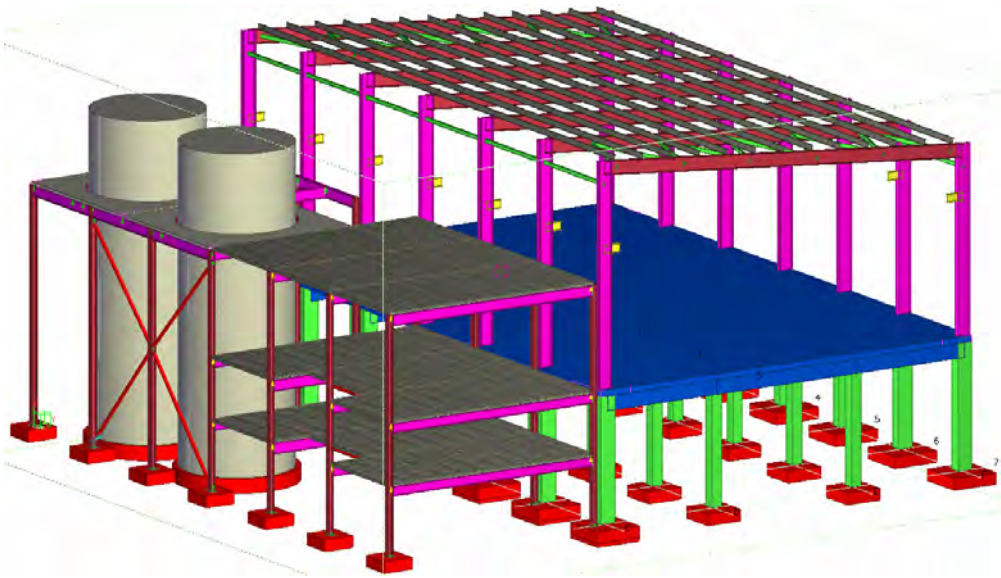
Since we did not edit the phases in BasicModel1 they all belong to phase number 1.

Copy from model

1. Click **Edit > Copy > From model...**
2. Select the BasicModel1 as the model to copy from in the **Model directories** list.
3. Enter 1 as the **phase number** from which to copy the objects.
4. Click **Copy**.



The model 1 parts will now in the combined model.



With the **Copy > From model** command you are not able to import drawings with the model.

Change the Model 1 Part Properties and Numbering Series

The Model 1 parts were created without paying attention to part properties and they are not consistent with the Model 2 parts (color, name, numbering series, and material).

The different numbering series and material would result otherwise equal parts getting different numbers when numbering.

In this combined model we want all of the parts to be numbered according to the numbering series shown in the table in the beginning of the lesson. To achieve this we will need to modify the Model 1 part properties so that they are consistent with the Model 2 parts.

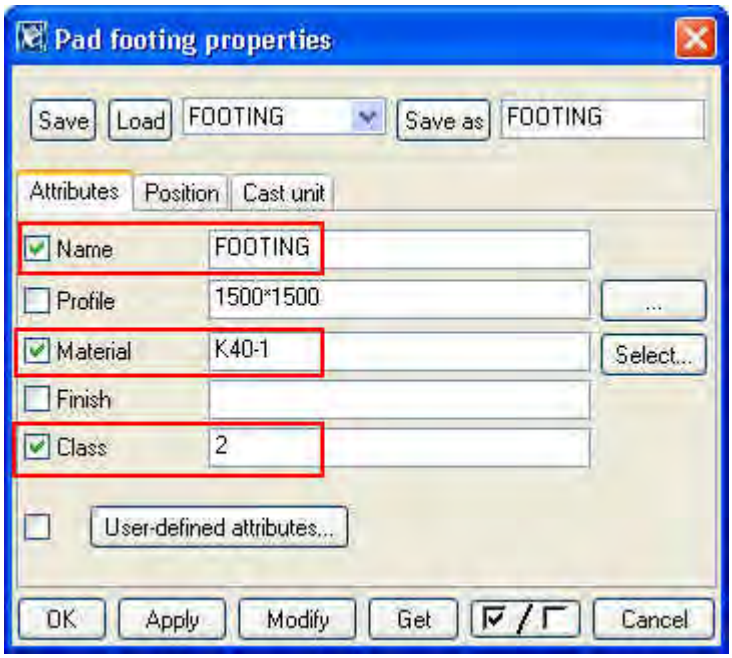
The properties of the connection parts to be created in the new model will be consistent with the existing ones since we used same default Preferences in both models.

Change Pad footing properties

1. Select the Model 1 pad footings.

You can try the available select filters for selecting the footings.

2. Load the **FOOTING** properties.
3. Remove the modify switches and check only **Name**, **Material**, **Class** and **Numbering series** switches.



4. Click **Modify.**

Change other parts properties

By following the procedure above change the properties for:

- Beams
- Concrete beams
- Columns
- Concrete columns
- Slabs
- Hollowcore slabs
- Horizontal bracing
- Vertical Bracing
- Silos

1.6 Define Your Own Select Filters

To make the selecting of parts easier in the future we will now define select filters for each part type. We will use the name of the part as the filtering criteria.

For steel/concrete beams and columns we will add also the material as the filtering criteria to be able to filter them separately.

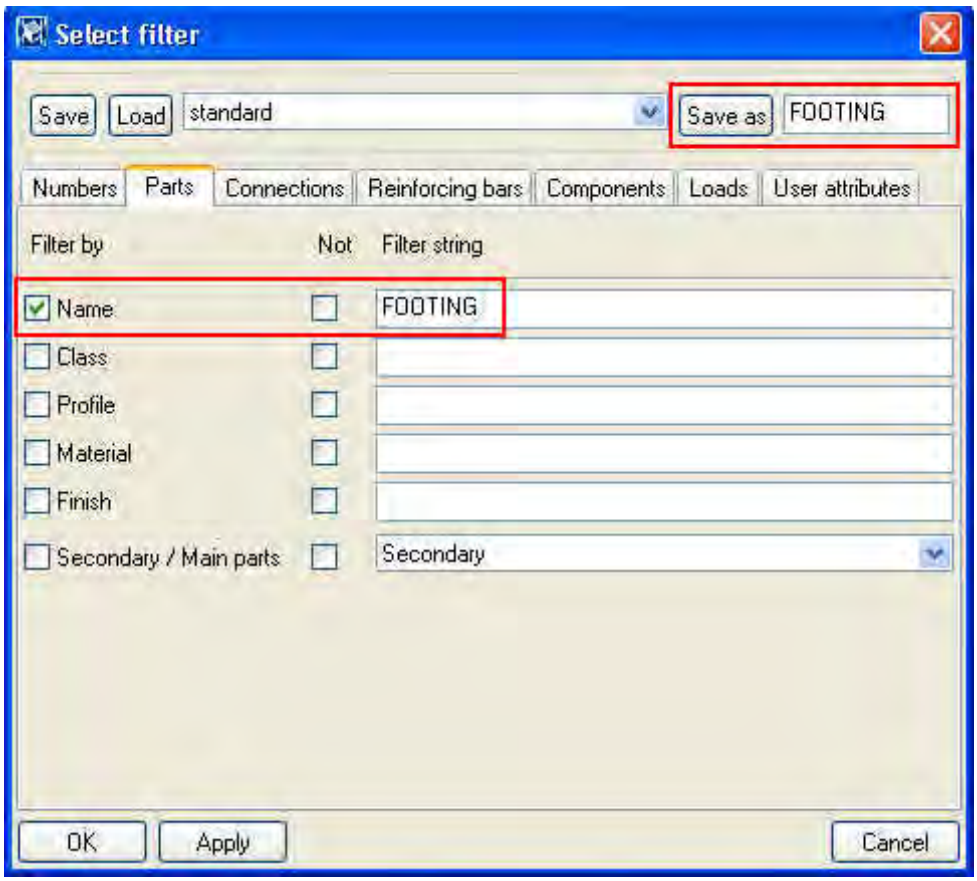
Help: Modeling > Settings and tools > Filter > Select filter

Define select filter for footing

1. Click the **Display select filter dialog** icon to open the **Select filter** dialog box.

2. Load the **standard** filter to turn out all the possible filtering.
3. Enter name **FOOTING** in the **Name** field of **Parts** tab.
4. Enter name **FOOTING** in the **Save as** field and click **Save as**.

You can now choose the new filter from the drop down list.



By following the procedure above define select filters for:

- Slabs
- Hollowcore slabs
- Horizontal bracing
- Vertical Bracing
- Silos
- Rafters
- Purlins

Define Select filter for plates

To define select filters for plates created both manually and by the connections:

1. Enter name ***PLATE*** in the **Name** field of **Parts** tab.

   (***PLATE*** matches all parts of which name includes word **PLATE**)

2. Enter name **PLATE** in the **Save as** field and click **Save as**

Define Select filter for steel beams

To define select filters for Steel Beams:

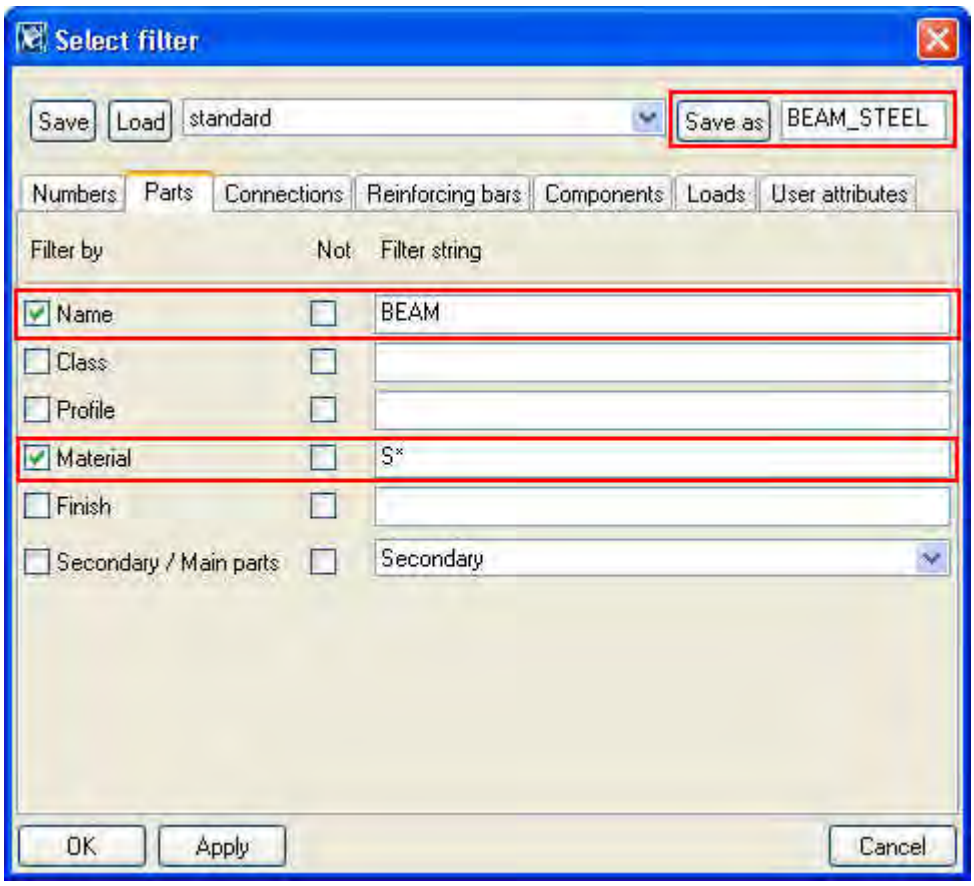
3. Enter the name **BEAM** in the **Name** field of **Parts** tab.
4. Enter **S*** in the **Material** field of **Parts** tab.

   (**S*** matches all materials with a material name that begins with the characters **S**)

5. Enter name **BEAM_STEEL** in the **Save as** field and click **Save as**.

By following the procedure above define select filters for:

- Concrete beams
- Steel columns
- Concrete columns

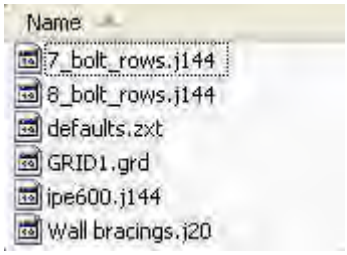


Create your own select filters to use both when modeling and using wizards to automate drawing creation.

Copy from model command only copies the objects from another model (not e.g. attributes from the model folder). We will now bring the attributes created in Basicmodel 1 to BasicModelCombined.

Bring the BasicModel1 attributes

1. **Tools > Open model folder**.
2. Browse to model **BasicModel1 > Attributes**.
3. **Copy** the files.
4. Browse to **BasicModelCombined > Attributes**.
5. **Paste**.



Save the model

Finally save the model.