Tekla Structures Basic Training

Tekla Structures 10.0

April 28, 2004

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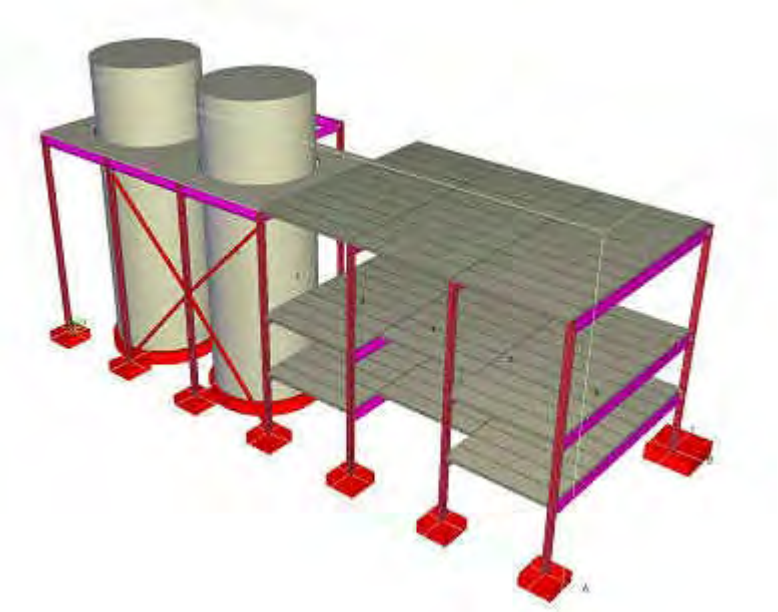
1 Basic Modeling

In this lesson

We will go through the basic functions of Tekla Structures: How to create a new structural 3D model, how to create grids (i.e. module lines), grid views and structural members in the model. As a result of this lesson the model will look as shown below.



1.1 Starting Tekla Structures

Starting Tekla Structures

To start Tekla Structures, click the Windows **Start** button. Navigate through **Programs > Tekla Structures > Singleuser > Tekla Structures enu Europe**. This will start Tekla Structures in European environment using English language.

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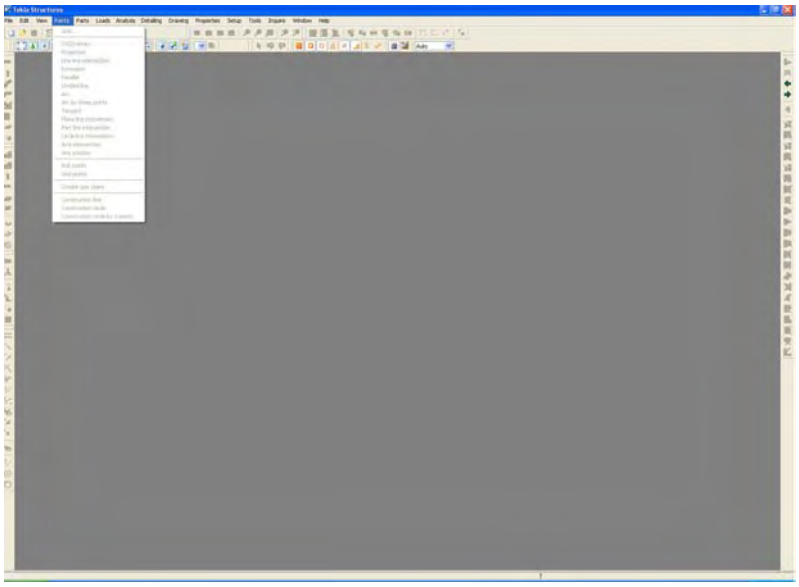
The modeling user interface is now opened. At first, most of the menu options and all the icons are gray indicating that they are inactive. When you open an existing model or create a new model, the icons and available menu options become active.



1.2 Create a New Model – BasicModel1

To start a new model, you first need to create an empty model database with a unique name. In this lesson use the name BasicModel1.

Start a new model

1. Select **File > New…** from the pull-down menu or click the **New** model icon in the **Standard** toolbar to open the **New model** dialog box.

2. At the lower left corner of the dialog box, Tekla Structures suggests the name New Model for the model. The full path of the model folder is shown in this field.

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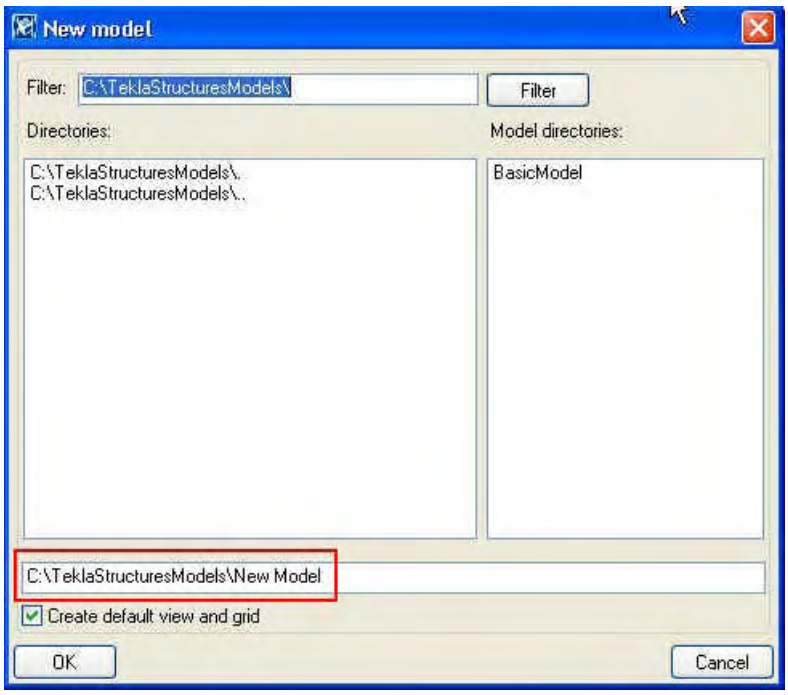
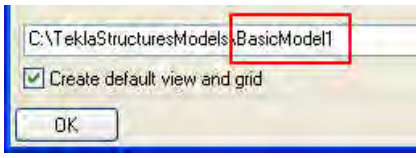


3. Click after the folder path, for example **C:\TeklaStructuresModels** and replace the New Model name by **BasicModel1**. Accept the default option of Tekla Structures to **Create default view and grid**.



4. Click the **OK** button to create the new model.

The menus and icons become activated and the model name appears in the title bar of the Tekla Structures window.

Every model must have a unique name. Tekla Structures does not allow duplicate model names. Do not use special marks (/ \ ; : |) in model names.

You can only have one model open at a time. If you already have a model open, Tekla Structures prompts you to save that model.

As we had the **Create default view and grid** checkbox selected, Tekla Structures automatically created a grid and a view according to the saved standard view properties. The default 3D view and grid are shown below.

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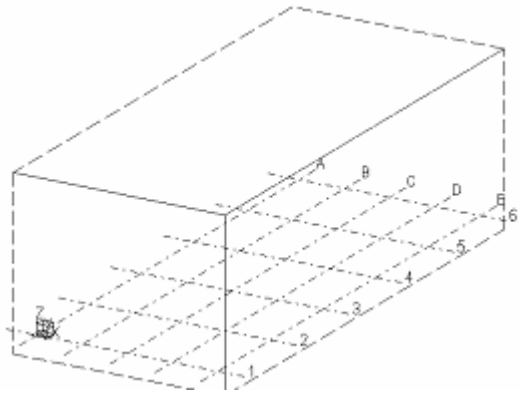

Cyan dash-and-dot lines show the projections of the grids which are visible on the view plane. Tekla Structures indicates the work area of a view using green, dashed lines. For more information, see: **Help: Modeling > Getting started > Basics**.

Save the model

To save the model:

Select **File > Save** from the pull-down menu or click the **Save** icon in the **Standard** toolbar.

Remember to save your model every now and then, and always when opening another model or exiting Tekla Structures.

Tekla Structures includes also an auto save feature that backs up and saves your work automatically at set intervals. These are set in the **Autosave properties** dialog box obtained from the **Setup > Autosave…** pull-down menu.

For more information on saving and auto saving, see:

Help: Modeling > Getting started > Saving a model and exiting Tekla Structures

Most commands of Tekla Structures are found both in menus (main or pop-up) and in toolbars (icons). In this training manual we will mainly use the pop-up menu to activate commands.

There are several ways to execute commands in Tekla Structures:

- Icons
- Commands in main pull-down menu
- Commands in pop-up menu

By default all the commands are found in pull-down menu, most of them in the icons. A pop-up menu appears when you click the right mouse button (right-click). If you have an object selected, the commands on the pop-up menu relate to that object.

For more information on Tekla Structures screen layout and toolbars, see:

Help: Modeling > Screen layout

Help: Modeling > Toolbars

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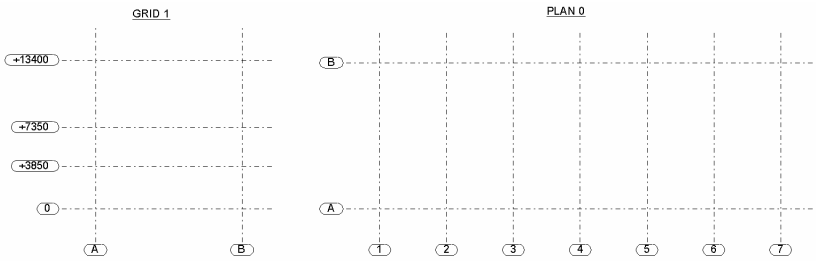
1.3 Create Grids

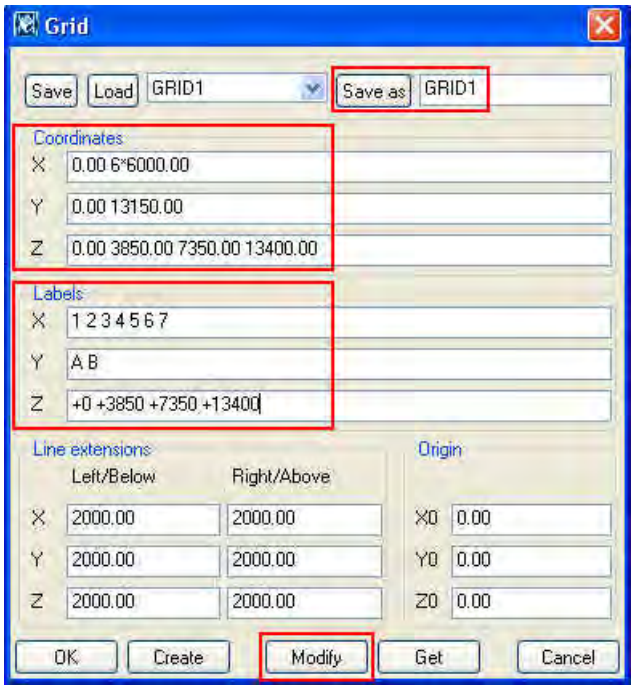


To create the appropriate grid for BasicModel1 as shown above, you can delete the existing grid and create a new one from the **Points > Grid…** pull-down menu. Alternatively you can modify the existing grid.

Modify the existing grid

To modify the existing grid:

1. Double click the grid line.
2. Complete the appearing **Grid** dialog box as shown below by filling in the X, Y and Z coordinates and the labels for the grid lines.



3. Click **Modify** to apply the new grid values.
4. Enter the grid file name, GRID1, and click the **Save as** button to save the grid values for later use. The file GRID1.grd appears in the **attributes** subfolder of your model folder.

For more information on grids and dialog box buttons, see:

Help: Modeling > Introduction > Inputting information > Common buttons

The number of decimals used in the **Grid** dialog box (as well as in other modeling dialog boxes) can be controlled from the **Units and decimals**... dialog box obtained from the **Setup** pull-down menu.

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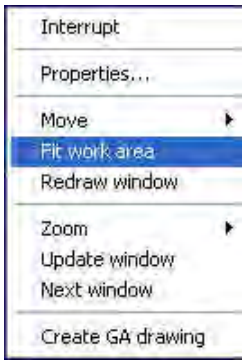
When the grid was modified, the work area of the view, shown with the green dashed line, was not updated.

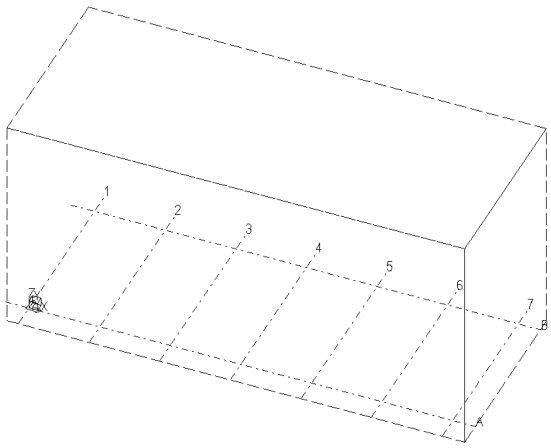
Fit work area

To fit the work area according to the modified grid:

1. Click the view.
2. Right-click and select **Fit work area** from the pop-up menu.



The view should now look as shown below:



1.4 Create Plane Views Along Grid Lines

We will now create Elevation and Plan views along the grid lines created in the previous section.

A view is a representation of a model from a specific location. Each view is displayed in its own window inside the Tekla Structures window. Each view has a view plane on which the grids are visible and points are represented as yellow crosses. Points outside the view plane appear as red dots.

For more information, see: **Help: Modeling > Getting started > Views**.

Create grid views

To create views along grid lines,

1. Select one grid line.
2. Right-click and select **Create view > Grid views** from the pop-up menu to open the **Creation of views along grid lines** dialog box.

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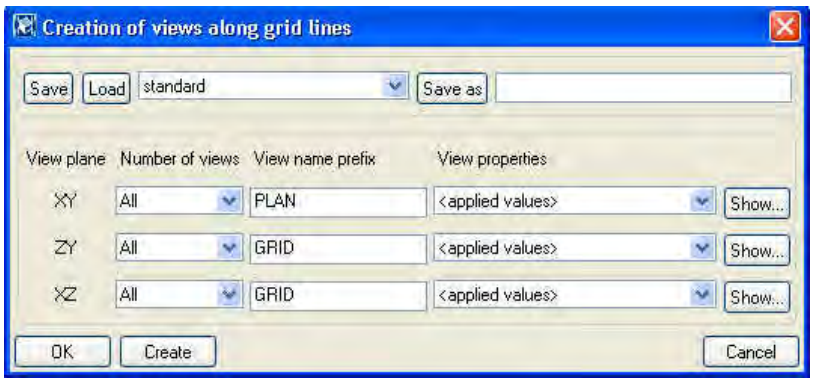
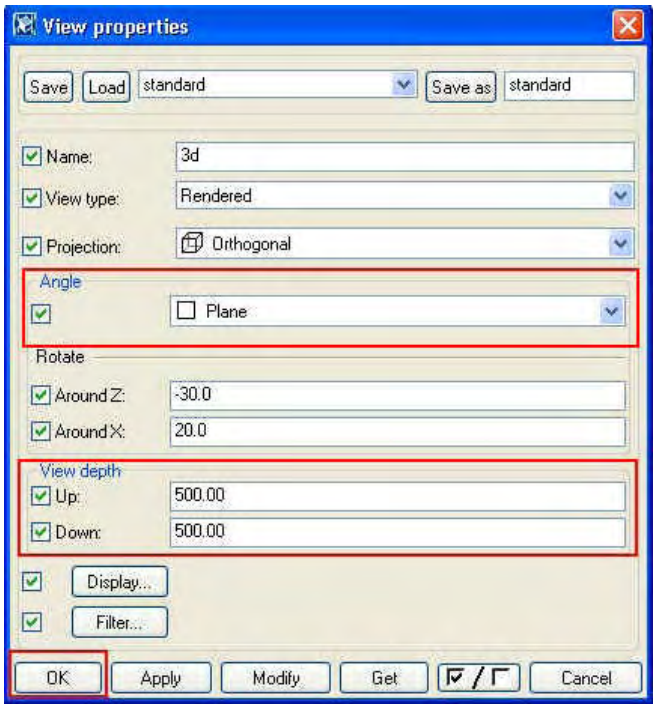


3. Click the **Show…** button of the XY view plane to open the **View properties** dialog box.
4. Change the **Angle** and **View depth** values as shown below and click **OK** to close the dialog box.



5. Select the number of views as **All** and click **Create** in the **Creation of views along grid lines** dialog box.

The **Views** dialog box appears presenting all the created views. All invisible named views are listed on the left, and all visible views on the right.

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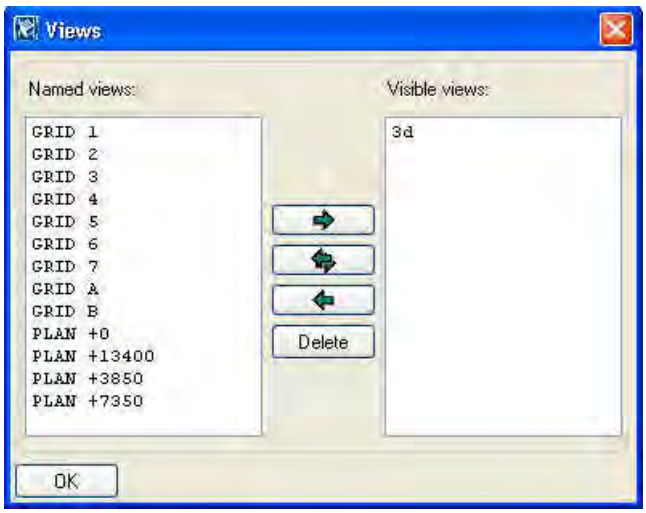


For more information on view properties, see:

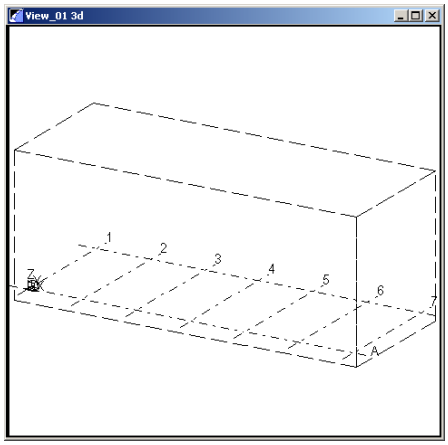
Help: Modeling > Getting started > Views > View properties

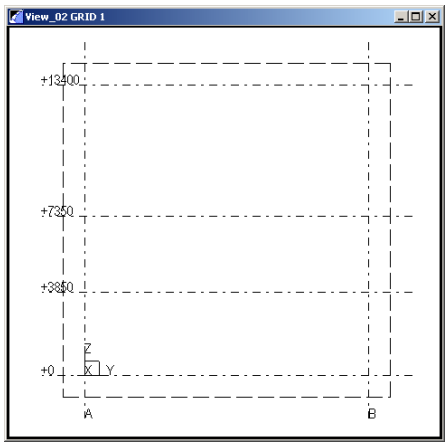
Display or hide views

To display or hide views:

1. Click the **Open named view list** icon to open the **Views** dialog box (which is now already open).

2. Select the view(s) you want to display or hide.
3. Use the arrows to move view(s) from left to right (visible) or vice versa (invisible).





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Do not keep too many views open at the same time. Nine is the maximum number of open views. You can open or close named views by clicking the **Open named view list** icon. Delete unnecessary views from the view list.

To switch between views, press **Ctrl+Tab**.

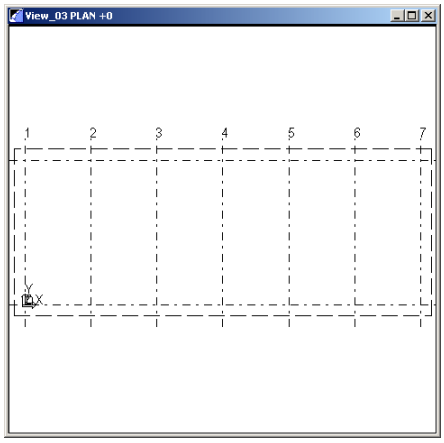
Rotate the model

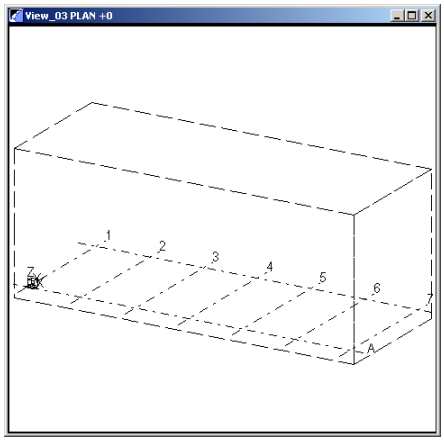
You can rotate the model in a 3D view with rendered view type.

1. Press the key **V**.
2. In the view, pick a center of rotation.
3. Hold down the **Ctrl** key, and click and drag with the middle mouse button.

Change between 3D / Plane

With the shortcut **Ctrl+P** you can change the view angle between 3D and Plane, which is very useful.





1.5 Create Foundations

We will now create foundations for the BasicModel1.

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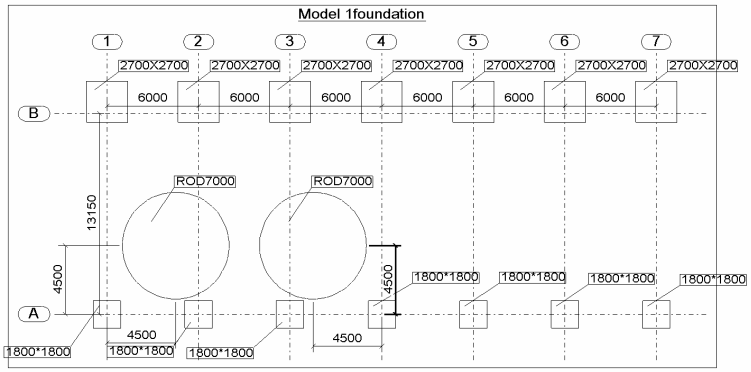


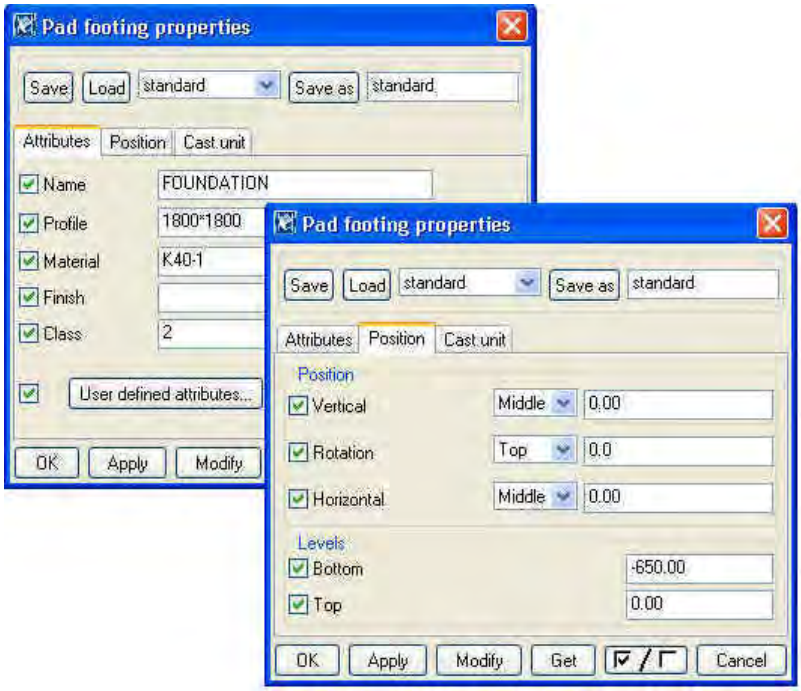
Column Footing

1800*1800 footing

To create footings for columns:

1. Double-click the **Create pad footing** icon. This will open **Pad footing properties** dialog box

2. Complete the **Pad footing properties** dialog box as shown and click **Apply**.



3. In the 3d view, pick the intersection of grids A-1 to create the footing.
4. Create the rest of the 1800*1800 footings at other intersections of grid line A by picking each position.

Help: Part position

Help: Profile library / Parametric

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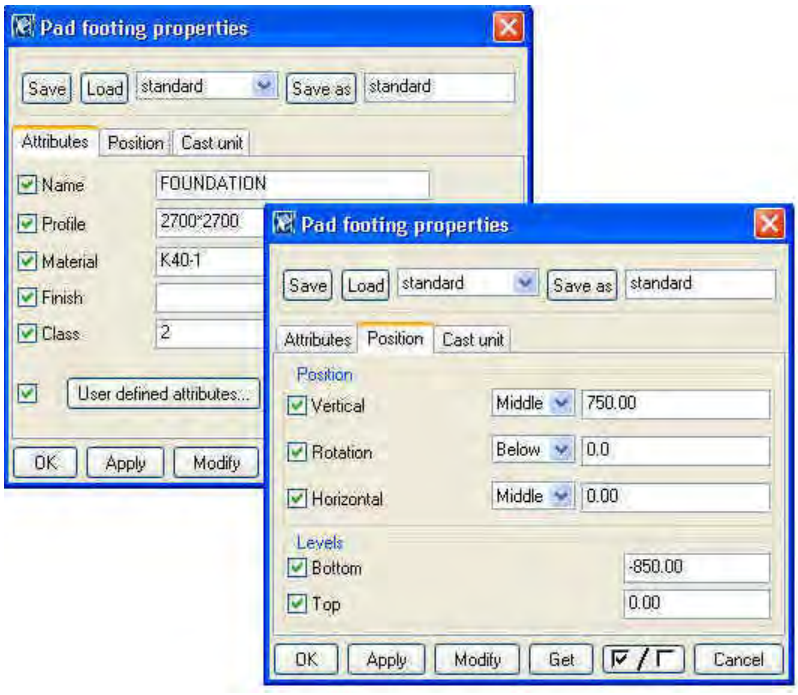
You can undo (and redo) previous commands one by one since the last save by clicking the icons shown or typing **Ctrl + Z** (Undo) and **Ctrl + Y** (Redo).

2700*2700 footing

While still in the command,

5. Complete the **Pad footing properties** dialog box for 2700*2700 footing as shown and **Apply** this.

   The footings on grid B need offsetting from the grid line because there will be additional columns modeled afterwards. This offset will be accomplished by adjusting the **Vertical Position** value in the **Pad footing properties** dialog box.



6. Create the footings at intersections of the gridline B.
7. Right click and select **Interrupt** to end the command.

The commands will stay on until you interrupt them.

To end commands right-click and select **Interrupt** from the pop-up menu, or press the **Esc** key.

To restart the last command used press **Enter**.

Foundations for Silos – Parametric Profiles

We will create two identical circular foundations for the silos. At first, one foundation will be created at the coordinate 4500,4500,0 and then the other foundation will be created as a copy of the first one.

Tekla Structures contains standard (library), parametric, and user-defined profiles. For the foundation, we will use parametric profiles instead of the library profiles.

Help: Modeling > Parts > Profile

Help: Modeling > Settings and tools > Appendix A: Parametric Profiles

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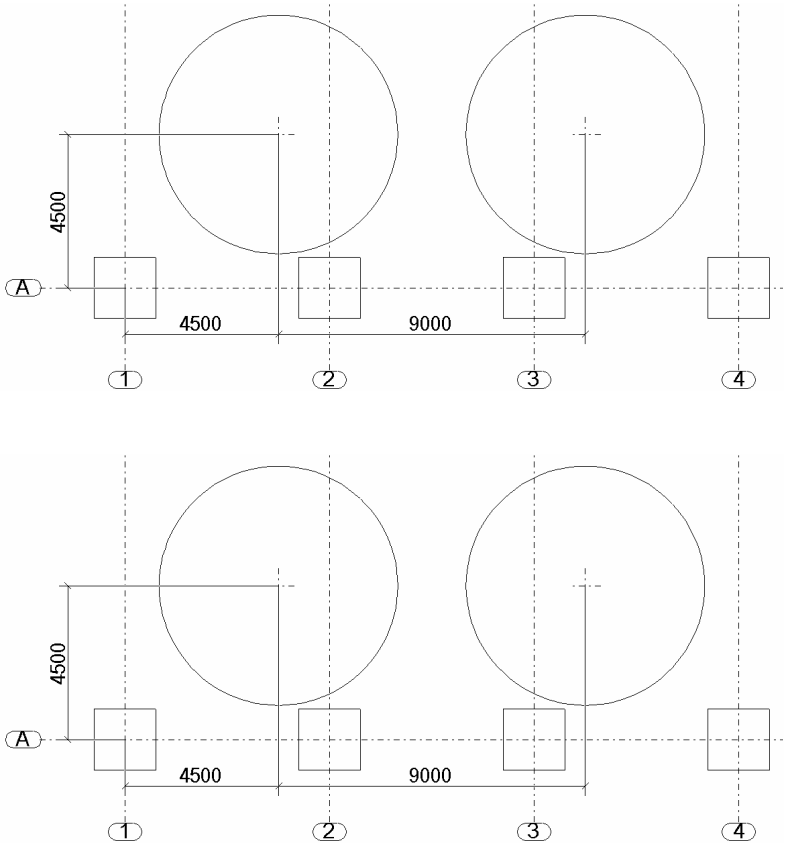

Create footing

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

2. Complete the Pad footing properties dialog box as shown and click **Apply**.

You can select the profile of a part from the **Select profile** dialog box that opens next to the Profile field in the part properties dialog box.

You can as well enter a profile name in the Profile field in the part properties dialog box.

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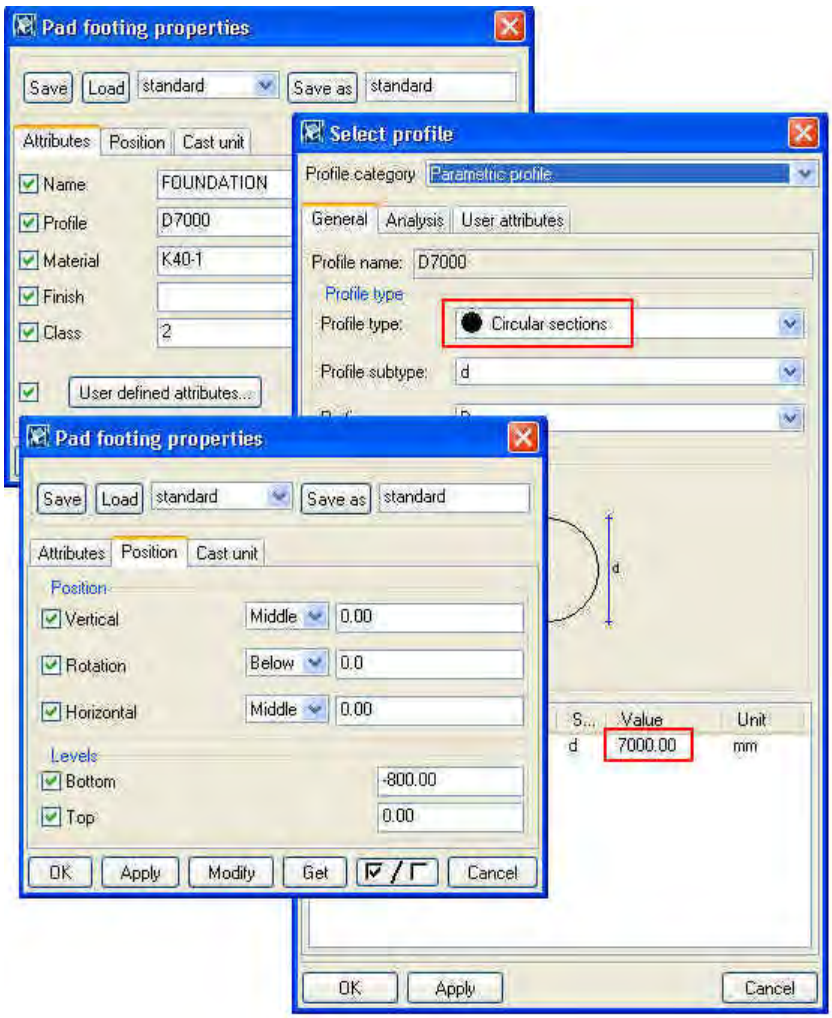
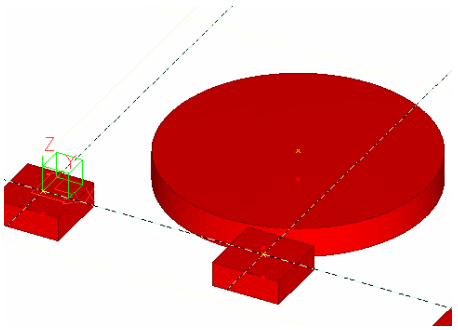


3. Type 4500,4500 to define the position for the footing (typing the numbers automatically displays the **Enter a numeric location** dialog box).

4. Click **Enter**, and the foundation is created.



Help: Modeling > Settings and tools > Snapping

Copy the footing

1. Click the footing once to select it.
2. Right click and select **Copy > Translate...** from the pop-up menu. Complete the dialog box as shown.

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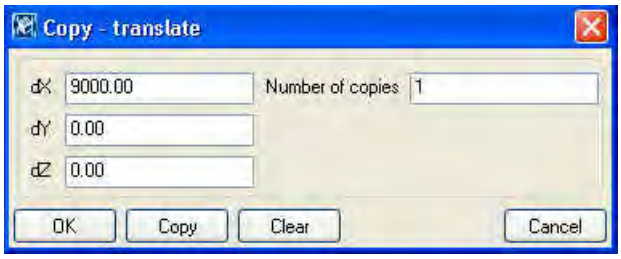
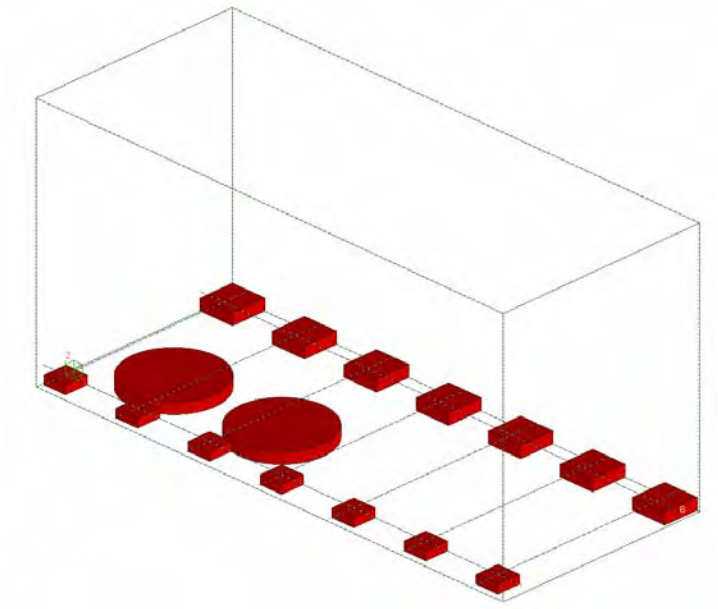
3. Click **Copy**.



Now the footings should look like those shown below:



1.6 Create Steel Members

Columns

We will first create two of the columns and then use the **Copy** command to create the other columns.

Create columns

To create the first two columns:

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

2. Complete the **Column properties** dialog box as shown below, and then click **Apply**.

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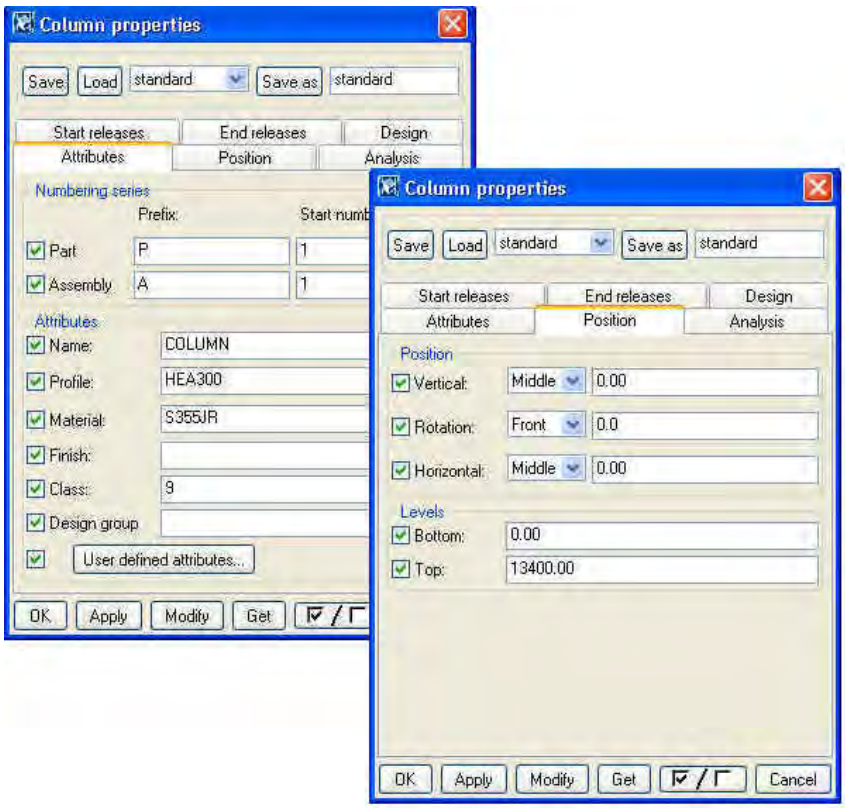
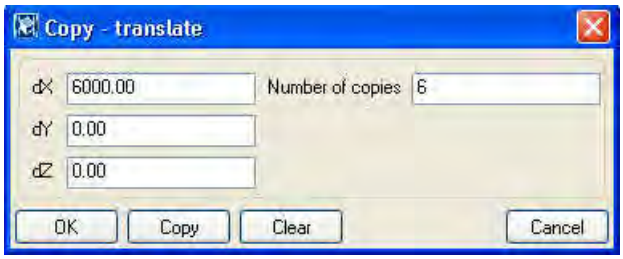


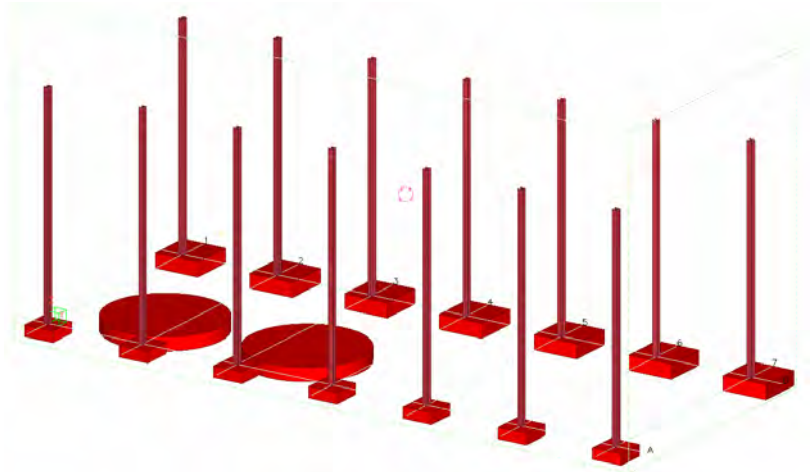
3. Pick the intersection of grids A-1 to create one column, and then pick grid B-1 to create the second column.

Copy columns

1. Select the columns that you just created by dragging a window across them.
2. Right click and select **Copy > Translate...** from the pop-up menu. Complete the dialog box as shown below and click **Copy**.



Now all the columns appear in the model.



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When identical structures appear in the model, you can alternatively create one footing (and its reinforcement), the steel column on top of it and the base plate connection between the footing and the column, and copy this structural entity to all other positions of similar structures.

You can select multiple parts in the model by holding down the **Ctrl**-key and picking objects in the model.

Help: Modeling > Introduction > Selecting model objects > How to select objects

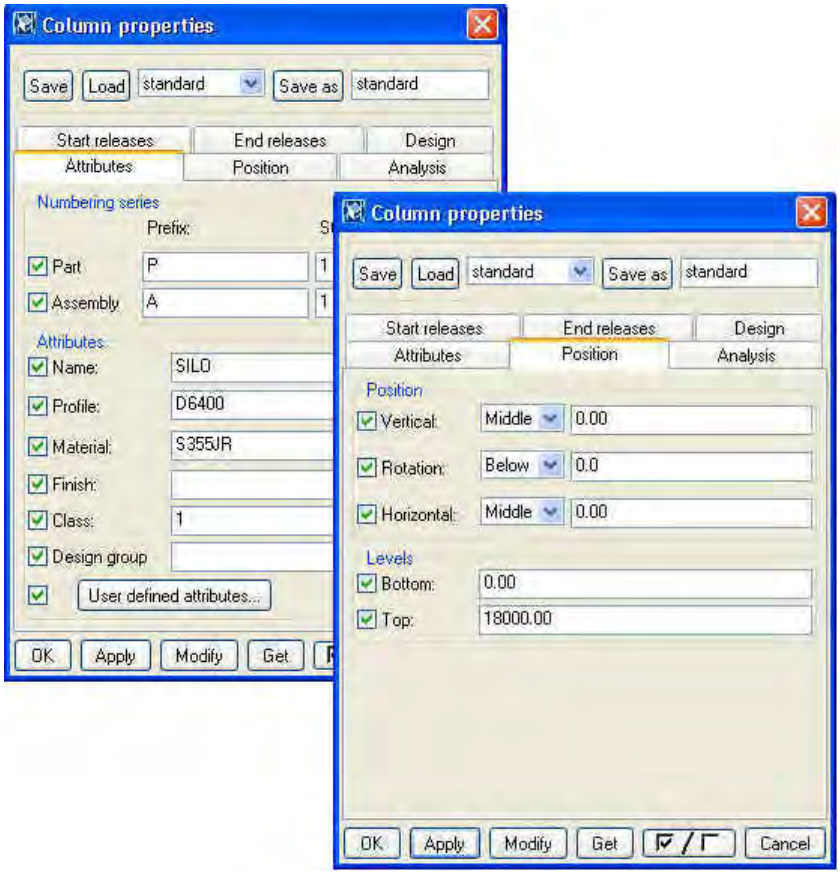
Silos

We will now model the silos by using solid parametric profiles. A more precise alternative would be to create the silo as a circular hollow section with a contour plate welded on top of it.

Create silos

1. To create the silos, double-click the **Create column** icon.

2. Complete the **Column properties** dialog box as shown below, and then click **Apply**.



3. Pick the top point of the first silo footing and then the other.

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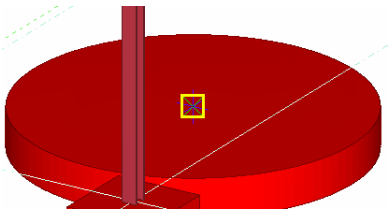
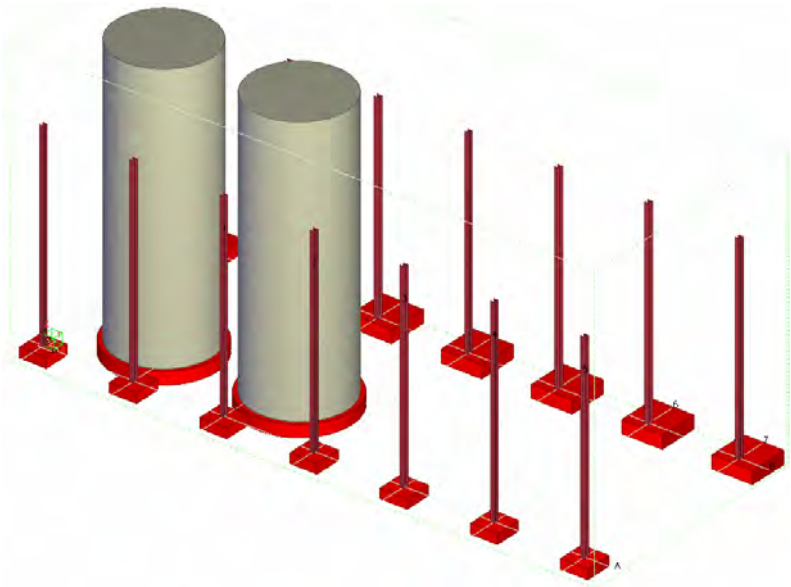


Now the silos appear in the model.



The visibility of objects in views depends on the work area, view depth, view setup, and view filter. You can also temporarily hide parts in a view by using the **Hide** tool.

In the pictures hereafter all the model objects created may not always be visible.

Help: Modeling > Getting started > Views > Displaying and hiding objects in views

Level 3850 Beams

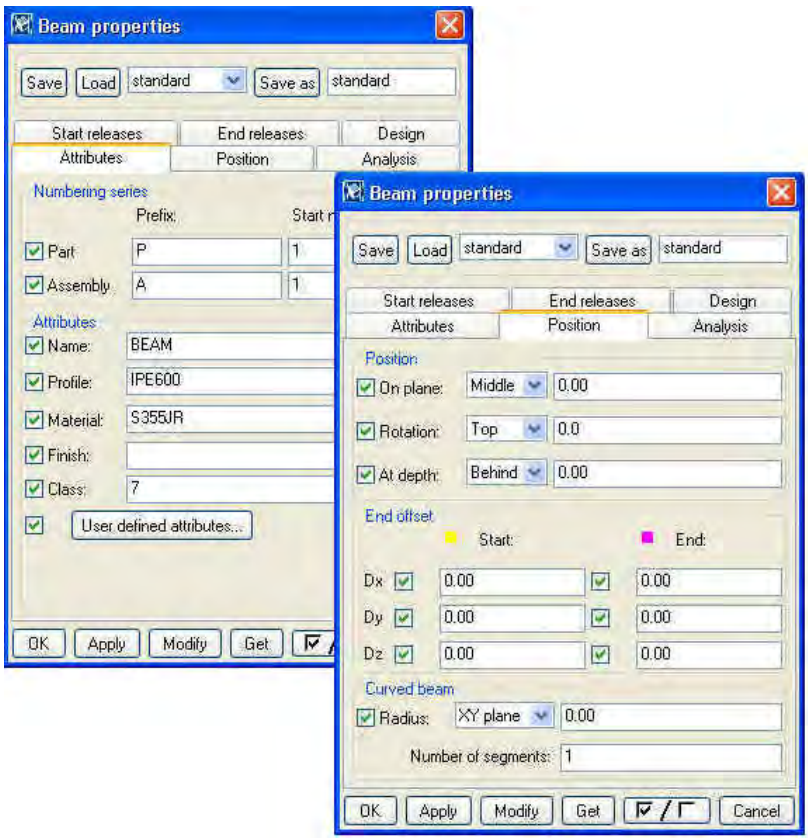
We will first create the beams at the +3850 level and then copy them (using the select filter) to the two upper levels.

Create beams

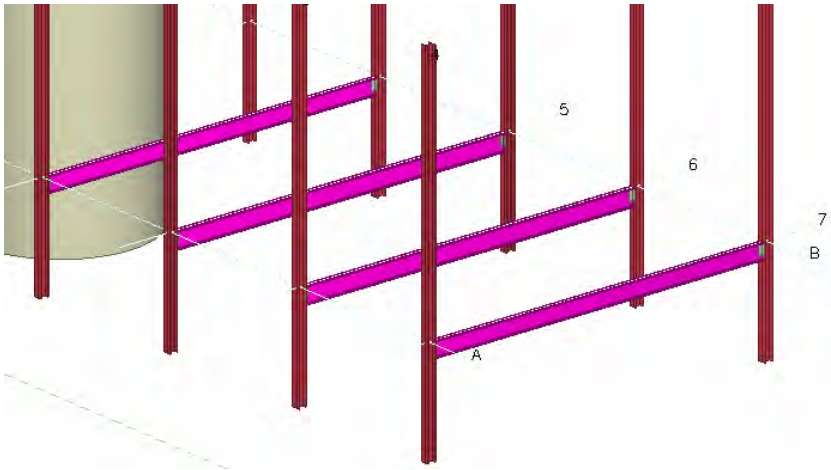
1. Open the **PLAN +3850** view.

2. Double-click the **Create beam** icon.

3. Complete the **Beam properties** dialog box as shown and **Apply**.



4. In the **PLAN +3850** view pick intersection of gridlines A-4 and then B-4.
5. Continue at grid lines 5, 6, and 7.



When inputting horizontal members always pick from left to right or from bottom to top for consistency purposes.

Copy Beams to Upper Levels

Filter beams

1. Choose the select filter option **beam_filter** from the drop down list.

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

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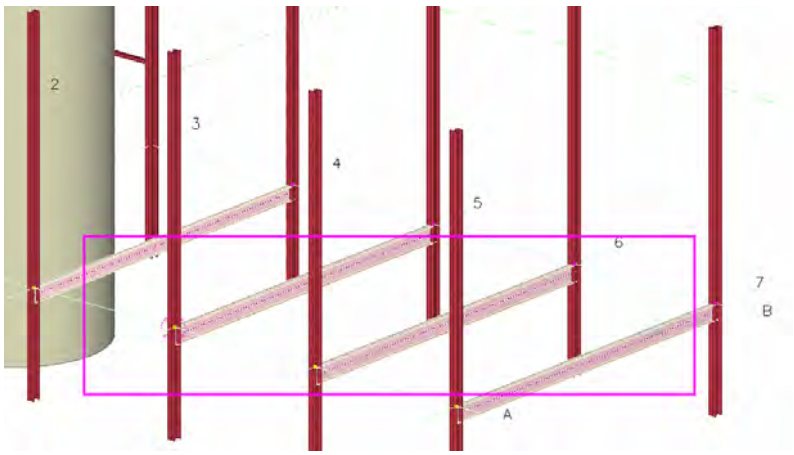
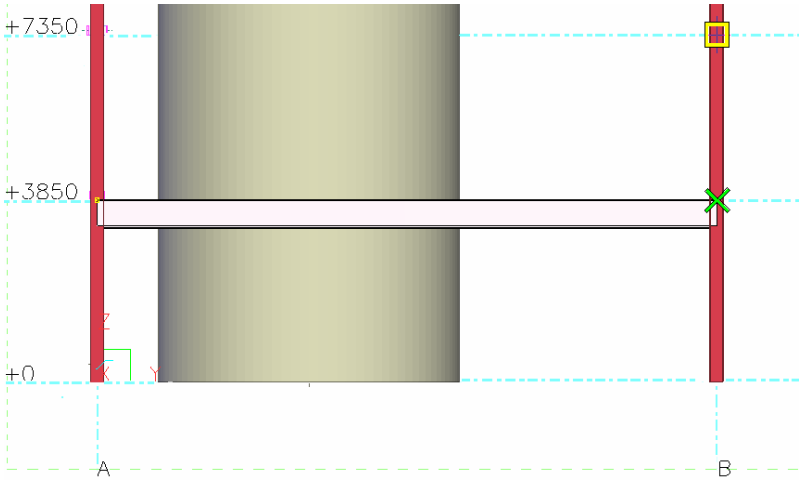
2. By dragging the mouse, select an area through the model.

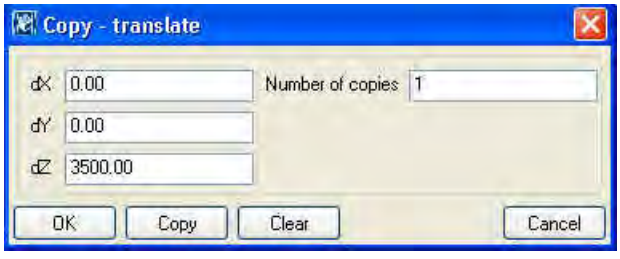


Copy beams

1. In the **Grid 7** view right-click and select **Copy > Translate…** from the pop-up menu.



2. Pick the grid line intersection B-3850 and then B-7350. Check the values in the dialog box.



3. Click **Copy**.
4. Copy beams to level +13400 by repeating steps 3-6.
5. Change the select filter option back to **standard** to enable also the selection of other objects but beams.

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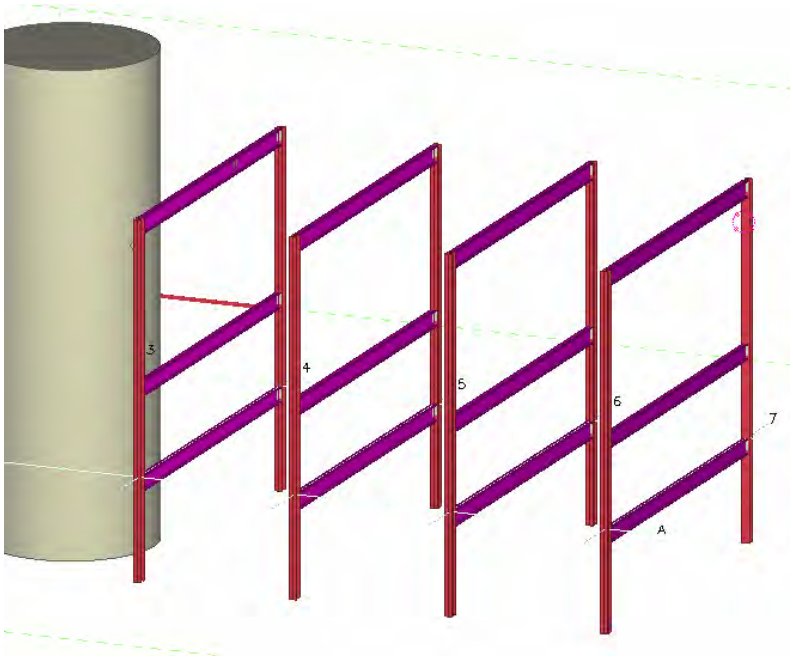
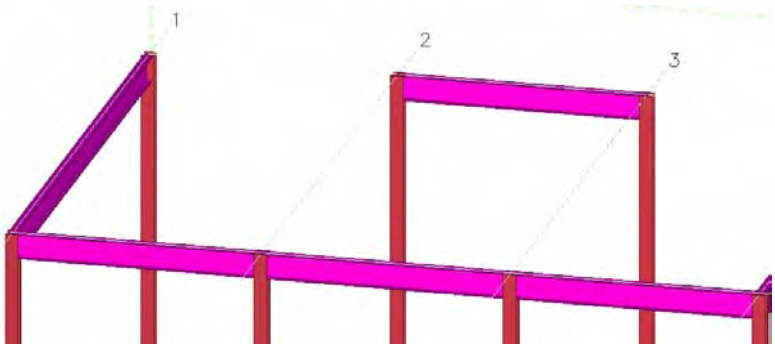


Level 13400 Beams

Next we will create beams at the view +13400 level.

Create grid beams

By using the same beam properties that we applied earlier, create the missing beams at the grid intersections shown in the figure below.



Create the rest of the beams

Next we will create beams in locations where no grid lines intersect. The snapping tools help you pick points to position objects precisely without having to know the coordinates or layout additional lines or points.

Help: Modeling > Settings and tools > Snapping

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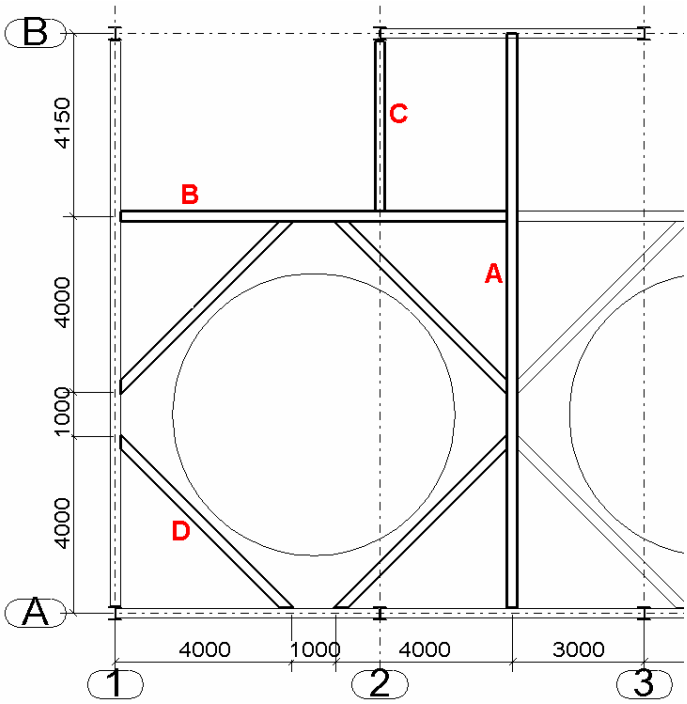
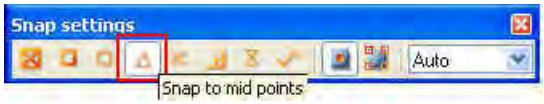


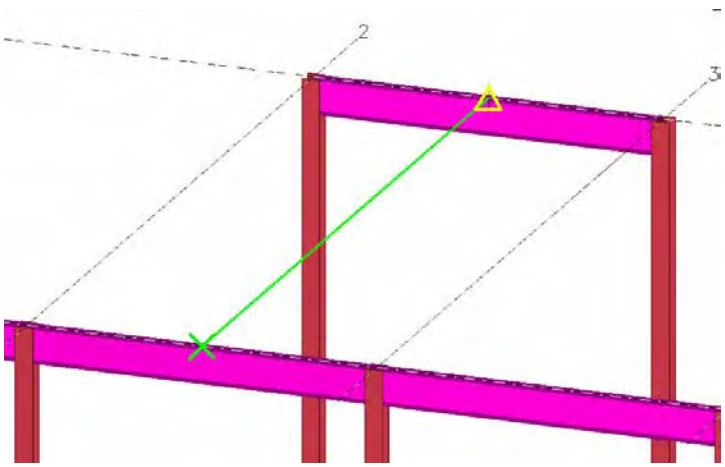
Create beam A

1. Double-click one of the existing beams in the model and press **Apply**.
2. Start the beam command.
3. Make sure only the **Snap to reference lines / points** icon of the two main snap switches on the right is pressed down.

4. Make sure the **Snap to mid points** icon is pressed down.



5. Pick a midpoint of the beam between grid A-2 and A-3 and then the midpoint of the beam between grid B-2 and B-3.



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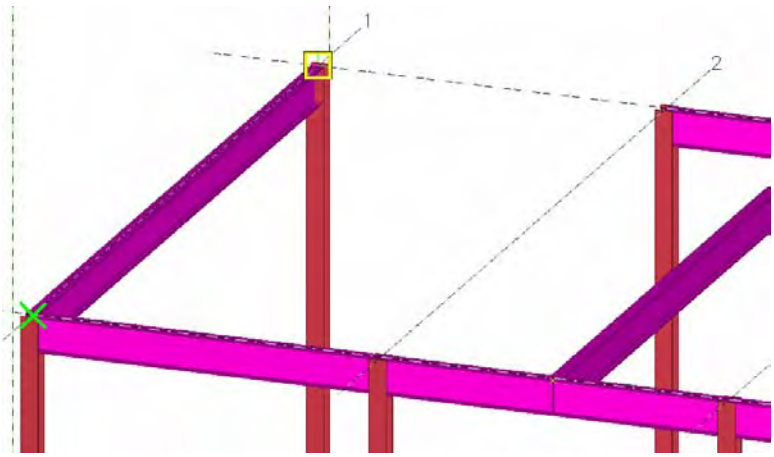
Create beam B

We will pick the start position of beam B by using the grid intersection A-1 as a temporary reference point and tracking along grid 1 to the intersection B-1 direction for 9000 units.

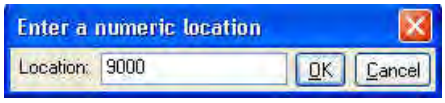
We will then pick the second position of beam B using the temporary snap switch **Perpendicular**.

Pick the first position of beam B

1. Start the beam command.
2. Hold down the **Ctrl** key and pick grid intersection A-1 as the origin to show the "From" location coordinates.
3. Then use the cursor to snap (Do not pick!!) in the correct direction (e.g. to grid intersection B-1).



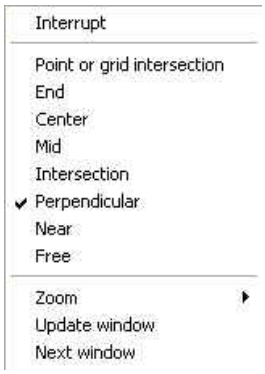
4. Type 9000 for the numeric location. (**Enter a numeric location** dialog box will open automatically).



5. Press **Enter** and the cursor snaps to the correct position. (=9000 mm from A-1 in the direction of B-1).

Pick second position of beam B

6. Right click and select **Perpendicular**.



7. Pick the 2nd position on beam **A** (see below).

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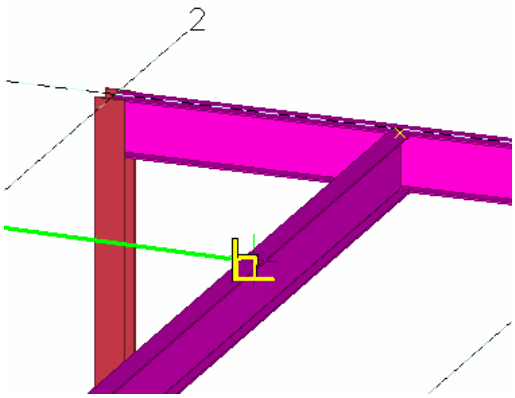
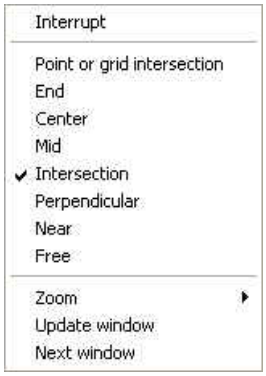


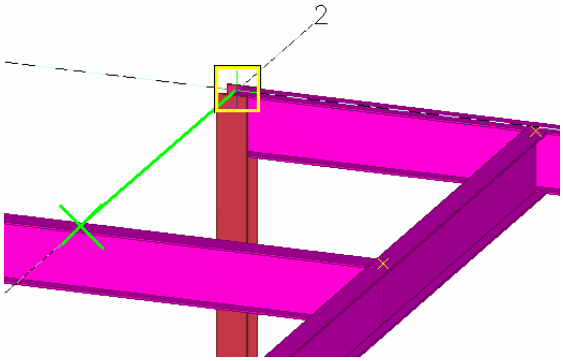
Create beam C

While still in the beam command,

8. Right click and select **Intersection** for snap override.



9. Pick the intersection of beam B and grid 2 and then the intersection of grid B-2.



Create beam D

We will first create one of the beams that frame around the silo and then by using the **Copy > Rotate** command create the other three.

Help: Modeling > Settings and tools Settings and tools reference > Edit > Copy > rotate

1. Hold down the **Ctrl** key and pick grid intersection A-1 to show the “From” location coordinates, use the cursor to snap (Do not pick!!) in the correct direction. (E.g. grid intersection B-1).
2. Type 4000 for the numeric location and press **Enter**, the cursor snaps to the correct position.

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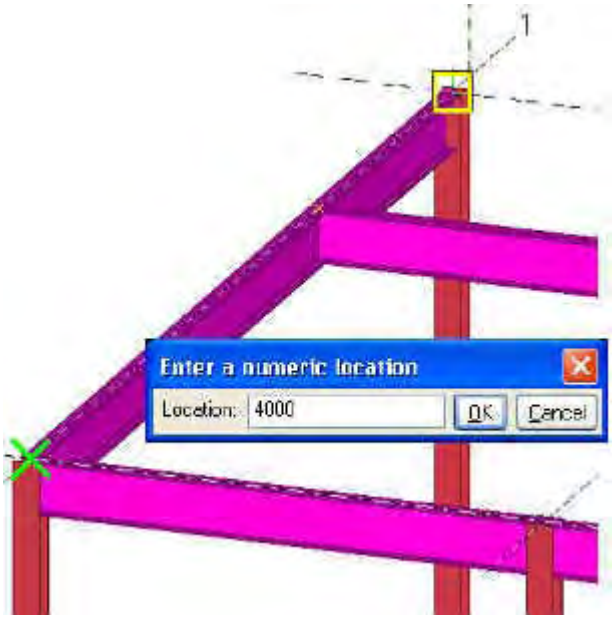
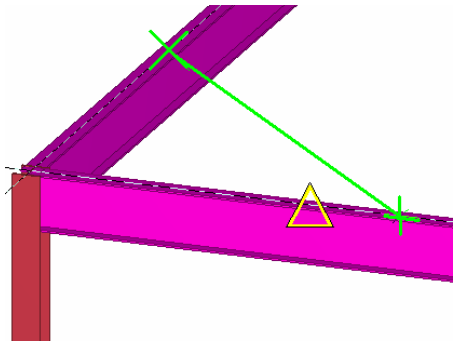
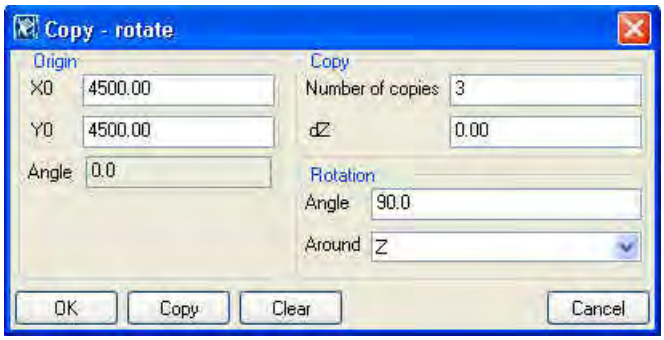


3. Press the letter **O** on the keyboard, to snap to positions in orthogonal directions on the work plane (0, 45, 90, 135, and 180 degrees).
4. Let the cursor to snap to the midpoint as shown below and pick.
5. Press the letter **O** to turn the ortho off.



Copy rotate the beam

1. Select the beam that you just created.
2. Right click and select **Copy > Rotate…** from the pop-up menu.



3. Pick the center point of the silo as the point to define the rotation (select a view in which the silos are visible and pick near the circumference to snap to the center point). The origin X0 and Y0 values will appear in the dialog box.
4. Complete the other fields in the dialog.
5. Click **Copy**.

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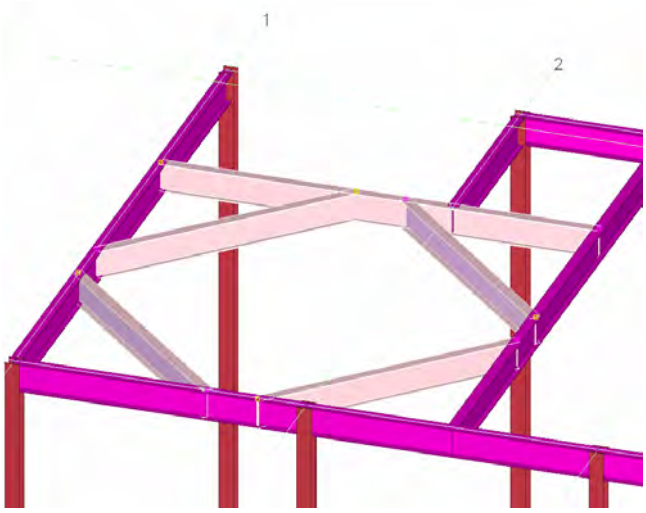
Copy translate the beam to the other silo

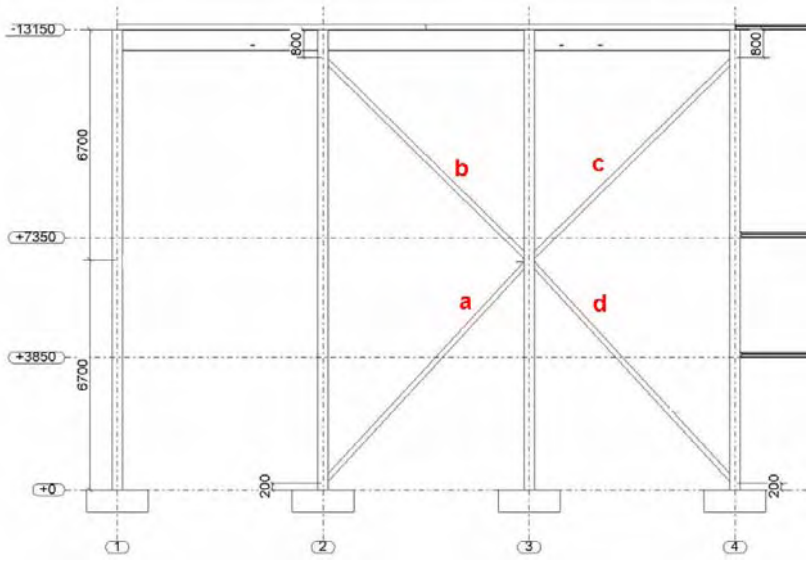
We will now copy the beams to the other silo.

1. Select the beams shown highlighted in the picture (press the **Ctrl** key to add parts to the selection).
2. **Copy > translate…** them 9000 mm in the x direction.



Bracing

Working in the **Grid A** elevation view, we will input the vertical bracing members using the **Create beam** tool.



Create braces a and b

1. Double-click the **Create beam** icon.
2. Complete the **Beam properties** dialog box as shown and **Apply**.

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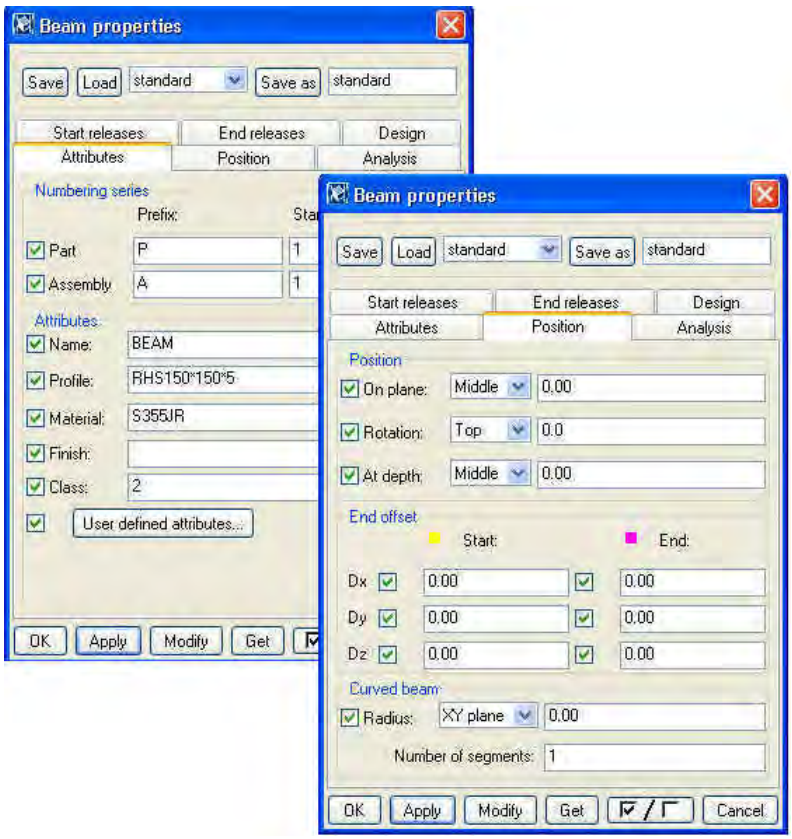
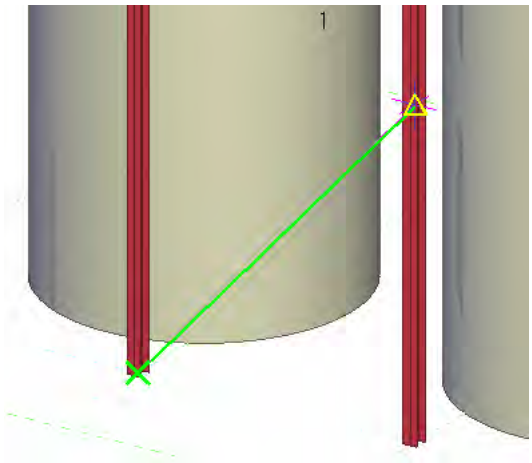


3. In the 3d view create brace a by first picking the grid intersection A-2 and then the midpoint of column A-3.



4. Create brace b by picking the top position of column A-2 and then midpoint of column A-3.

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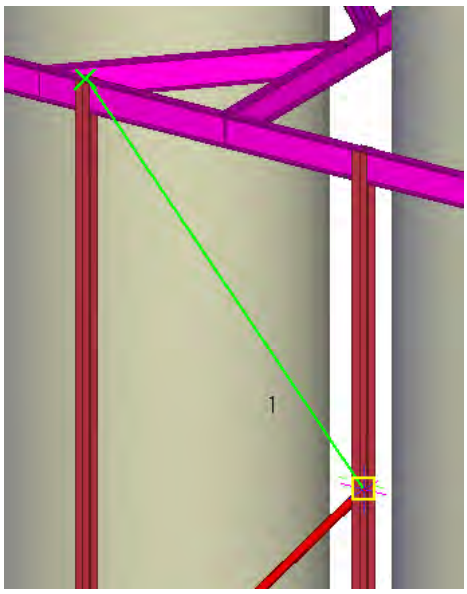
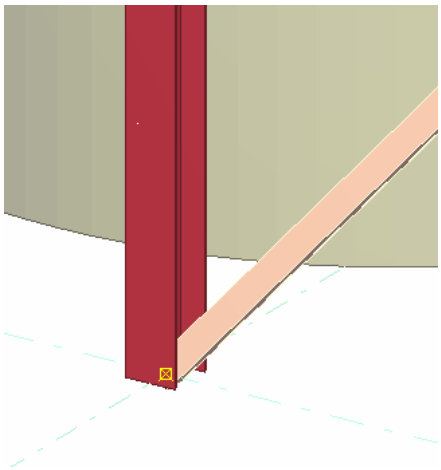


Use handle to move brace end

We can see from the drawing above that the lower end of the brace needs 200 mm offsetting from the grid. Now we will use the handles to move the part end.

Help: Handles

1. Select brace **a** to display the handles.



2. Pick the yellow handle (Tekla Structures then highlights the handle).
3. Right click and select **Move > Translate…** to move the handle 200 mm upwards.
4. Click **Move**.
5. Repeat the procedure to move brace **b**'s top handle 800 mm downwards.

Copy mirror braces a and b

1. Select braces **a** and **b**.
2. Right click and select **Copy > Mirror…**
3. In the 3d view, pick grid A-3 then grid B-3 to define the mirror line.
4. Click **Copy**.

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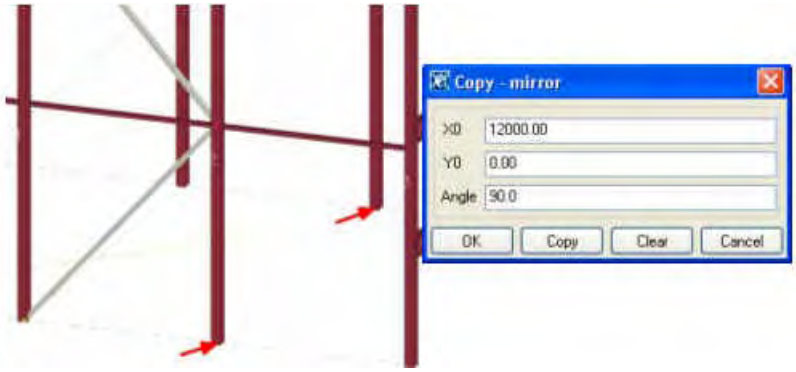
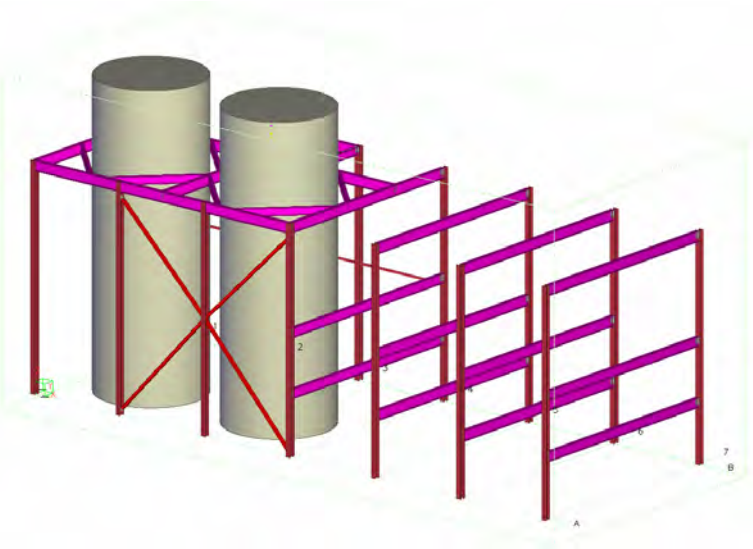


Help: Copy > Mirror

Now we have modeled all the steel members in Model1. The model should look like in the figure below.



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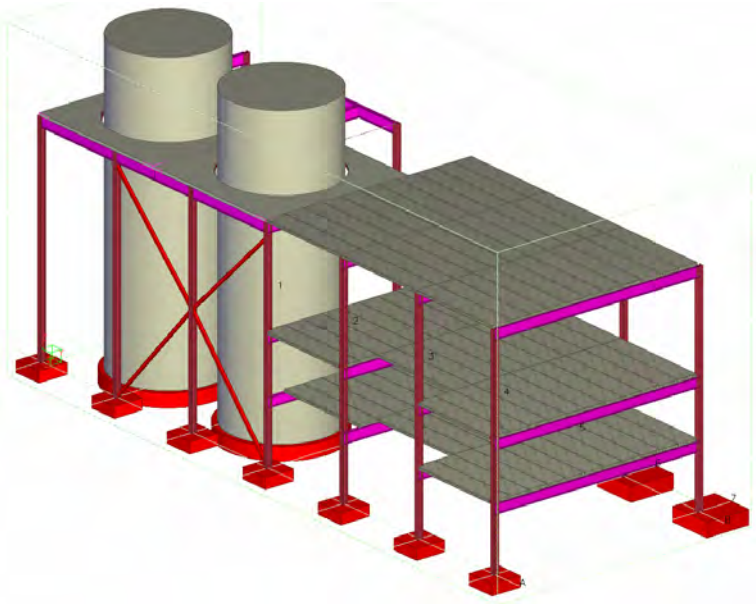
1.7 Create Concrete Members



Concrete Hollow Core Slabs

We will now create concrete hollow core slabs. Instead of positioning the slabs to the grid line intersection we will model the slabs to the face of the steel columns.

Create hollow core slabs

In the **PLAN +13400** view:

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

2. Complete the **Concrete beam properties** dialog box as shown and **Apply**.

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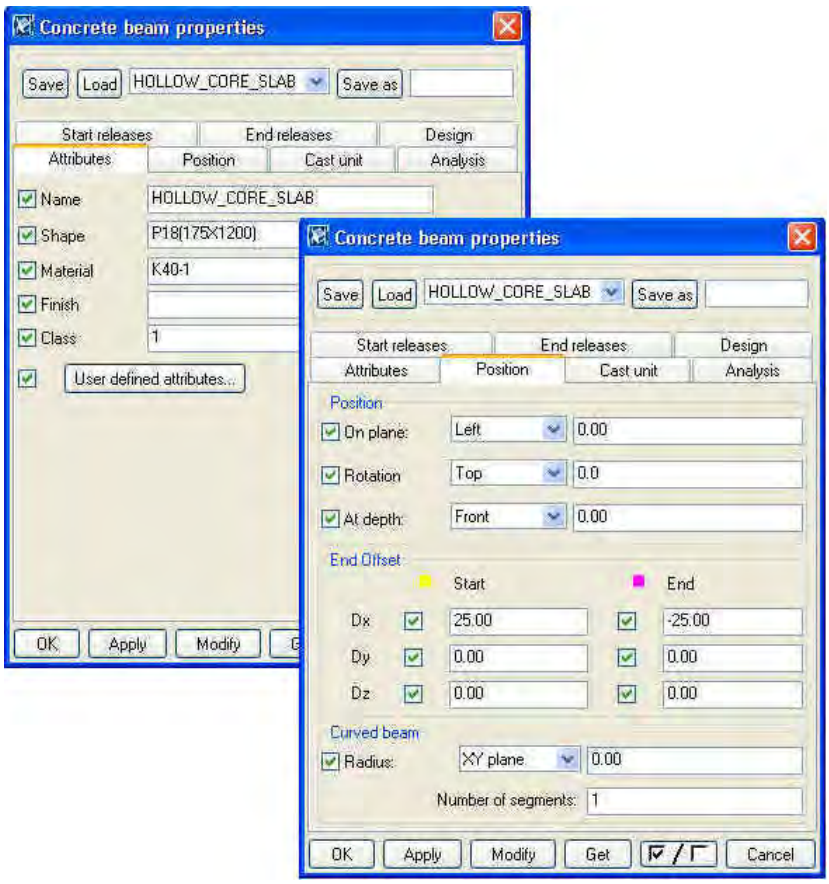
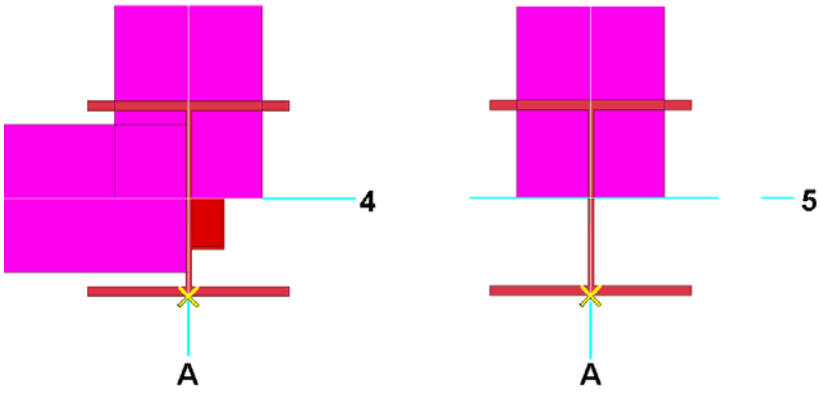


3. Pick the intersection of the column flange outer face and gridline 4 then intersection the column flange outer face and grid line5 (be sure that the **Snap to geometry lines/points** is pressed).
4. Click the middle mouse button to create the slab.



Copy the slabs in Y direction

1. Select the slab that you just created.
2. Right click and select **Copy > Translate…** from the pop-up menu.
3. Type 1200 in the **dY** field of the **Copy – translate** dialog box and 10 as the number of copies.

Copy the slabs in X direction

1. Drag an area select, choosing all the concrete slabs.

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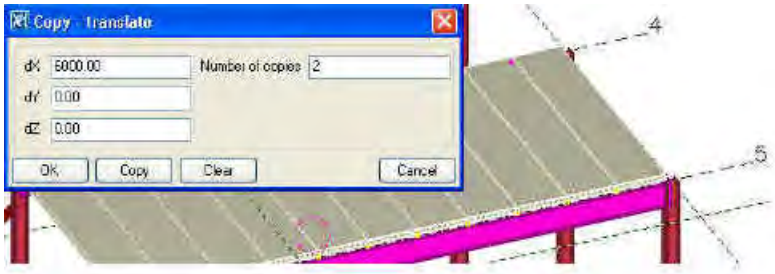
2. Right click and select **Copy > Translate…** from the pop-up menu.
3. Type 6000 in the **dX** field of the **Copy - translate** dialog box.

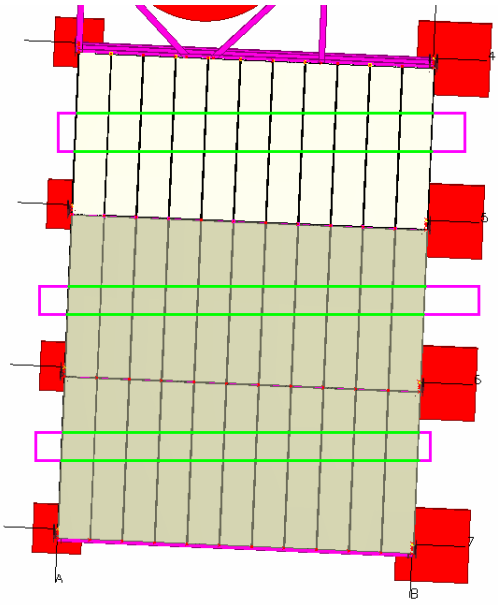


4. Click **Copy**.

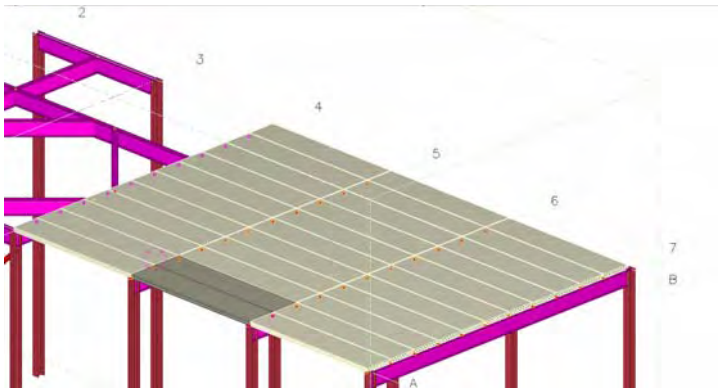
Copy Concrete Hollow Core Slabs to Levels 7350 and 3850

Copy the slabs

1. Hold down **Ctrl** key and choose all the hollow core slabs by dragging 3 areas through the slabs.



2. Still holding down **Ctrl** key pick the two slabs shown in the picture below to unselect them (we will create stairs here in a later chapter).



3. Right click and select **Copy > Translate…** from the pop-up menu.

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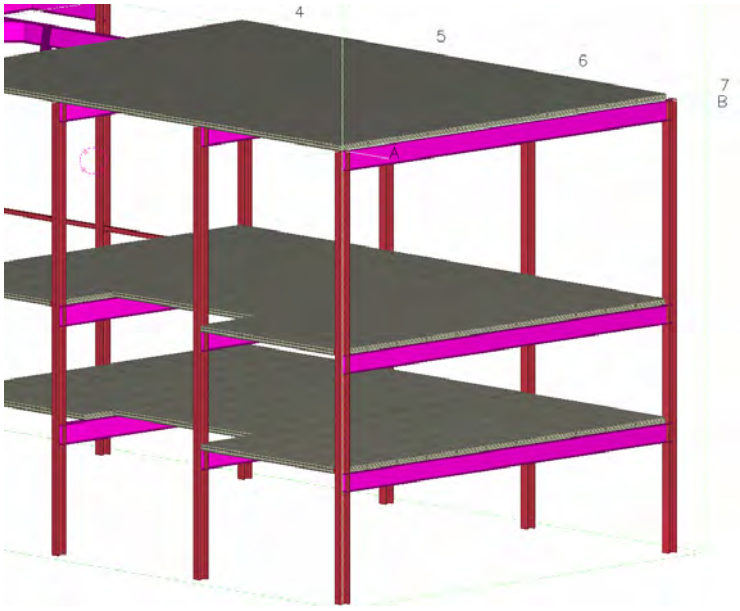
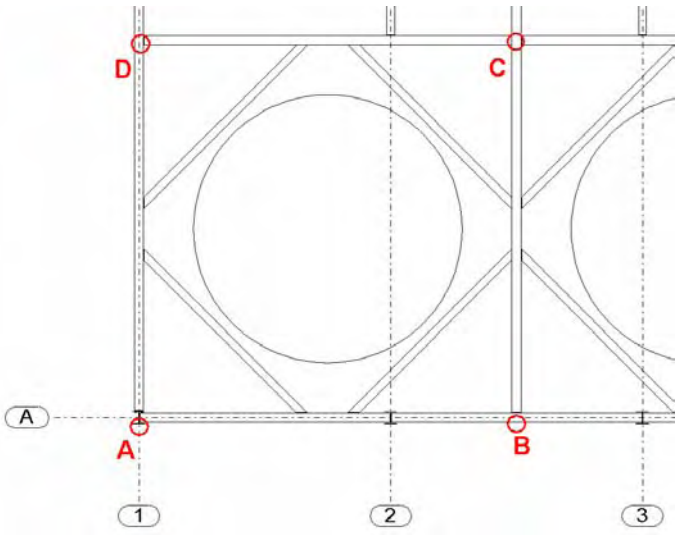
4. Enter -6050 in the **dZ** field of the **Copy – translate** dialog box, click **Copy**.
5. Enter -9550 in the **dZ** field of the **Copy – translate** dialog box, click **Copy**.



Concrete Slab



Start the slab command

1. Double-click the **Create concrete slab icon**.
2. Complete the **Concrete slab properties** dialog box as shown and **Apply**.

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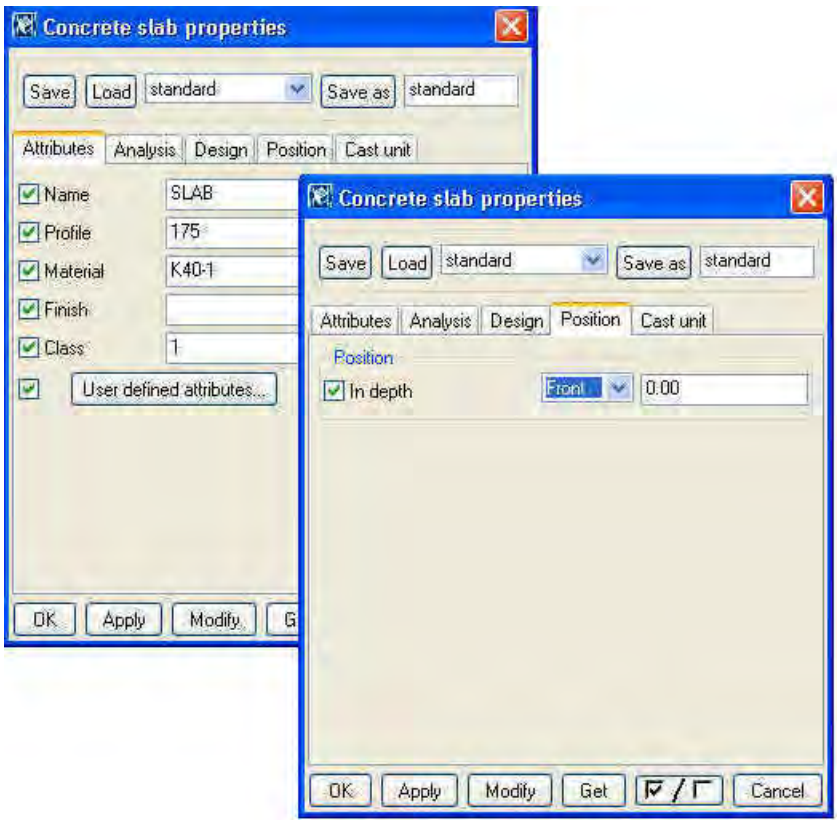
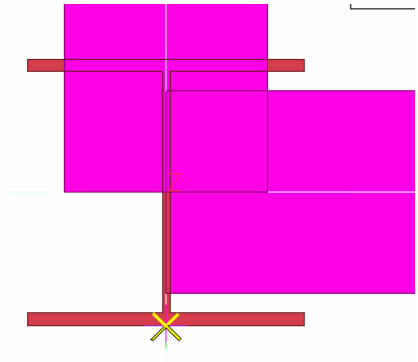


Pick positions for the slab

3. In the **PLAN +13400** view pick point **A** (intersection of column flange outer face and gridline 1, shown in the previous figure).



4. Let the cursor snap to position just picked (do not pick!) and press **Y** to lock the Y coordinate.

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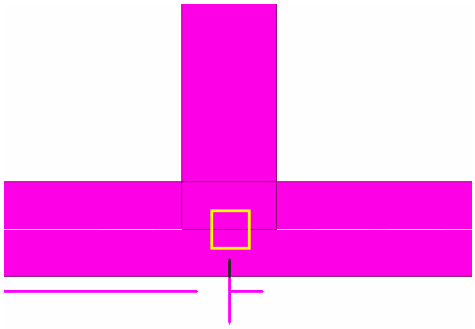
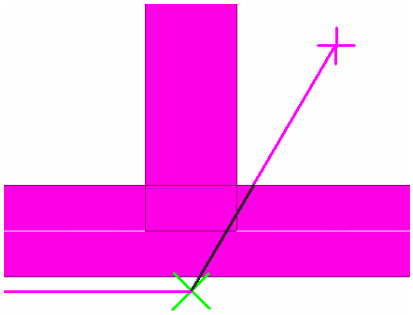
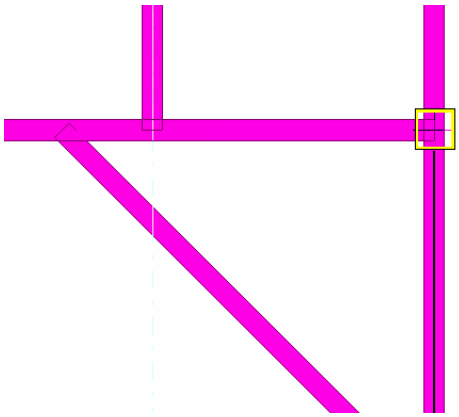
5. Let the cursor now to snap to the end point of beam near point **B** and pick.



6. Press **Y** to release the coordinate lock.



7. Pick point **C**.



8. Pick point **D**.

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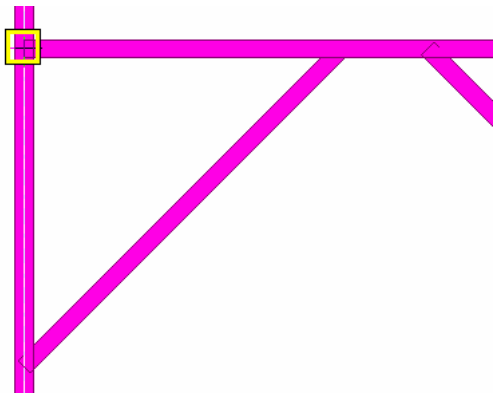
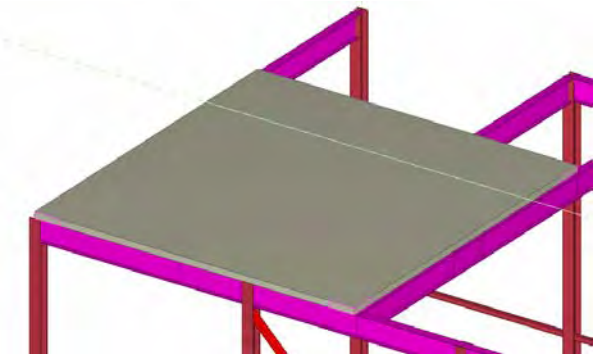


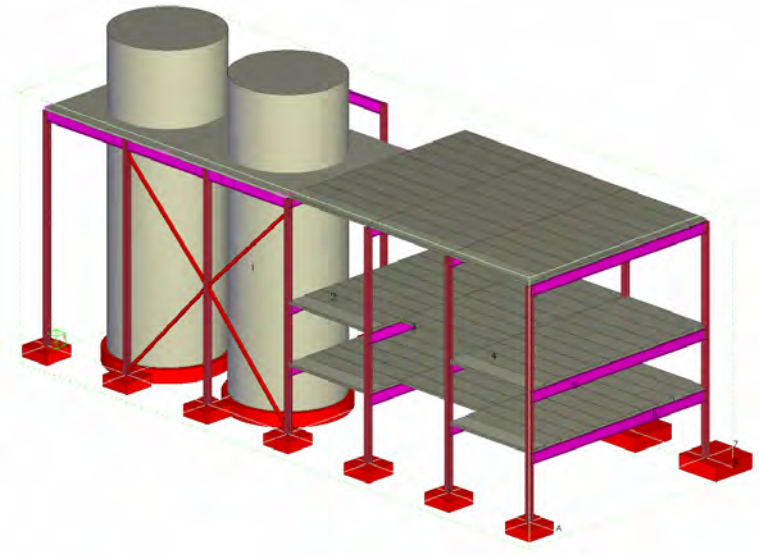
9. Click middle button to create the slab.



Copy concrete slab

1. Select the slab that you just created.
2. **Copy translate** the slab 9000 mm in X direction.

Now the Model1 framework is finished.



Links to additional information

Help: Modeling > Introduction > General informationSingle user mode vs. multiuser mode

Help: Modeling > Introduction > General information > Languages and environments

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