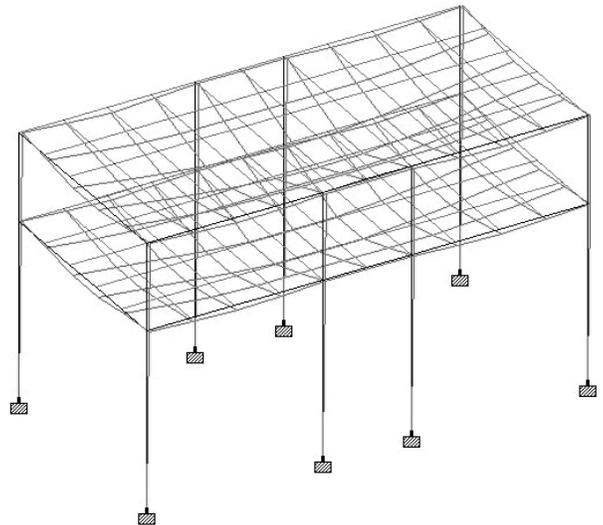
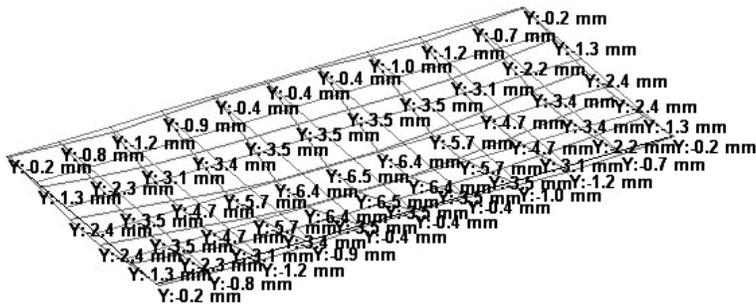
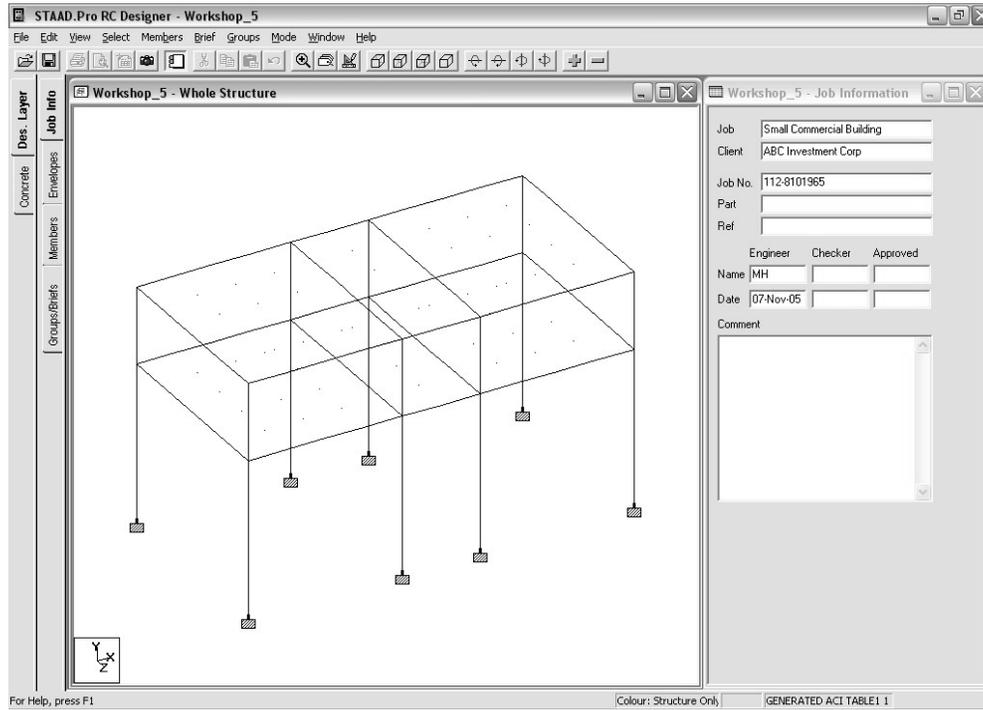


Using STAAD Pro 2005 Tutorial (With U.S. Design Codes)



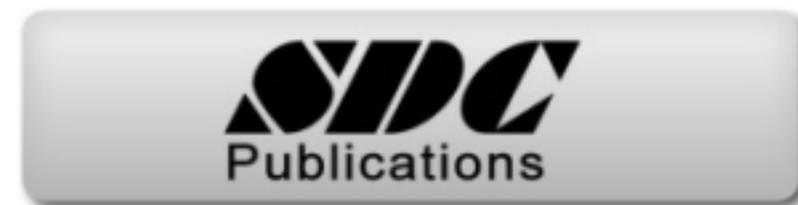
Munir M. Hamad

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Module 3:

Useful Functions to Complete the Geometry

This Module contains

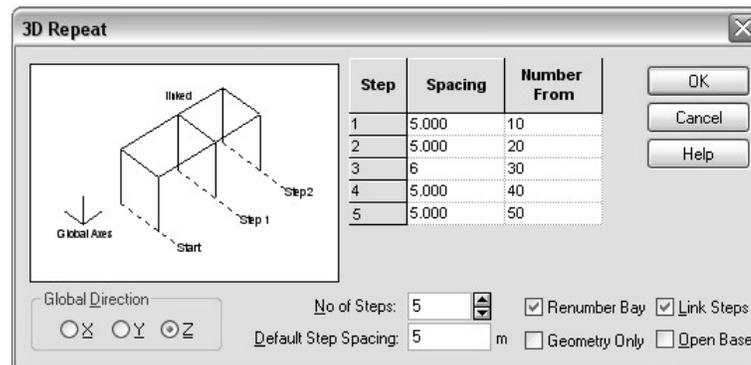
- Translational Repeat
- Circular Repeat
- Mirror
- Rotate
- Move
- Insert Node
- Adding Beams (Connecting & Intersecting)
- Cut Section
- Renumber
- Miscellaneous Functions

Introduction

- The five methods we discussed in Module 2 are used to create the basic geometry. However, cannot alone fulfill the creation of some complex requirements of structural engineer.
- In this module, we will discuss essential functions, which will enable the user to complete any unusual requirements in building up the geometry.
- User should select Node, Beam, or Plate before issuing any of the functions to be discussed herein.
- When you combine Module 2 & Module 3, you will know all the geometry function exists in STAAD Pro.

Translational Repeat

- With this function we can duplicate Nodes, Beams, Plates in the direction of X, Y, or Z.
- Select the desired Nodes, Beams, or Plates to be duplicated.
- From **Generate** toolbar, select **Translational Repeat**, or from menus select **Geometry/Translational Repeat**, the following dialog box will appear:



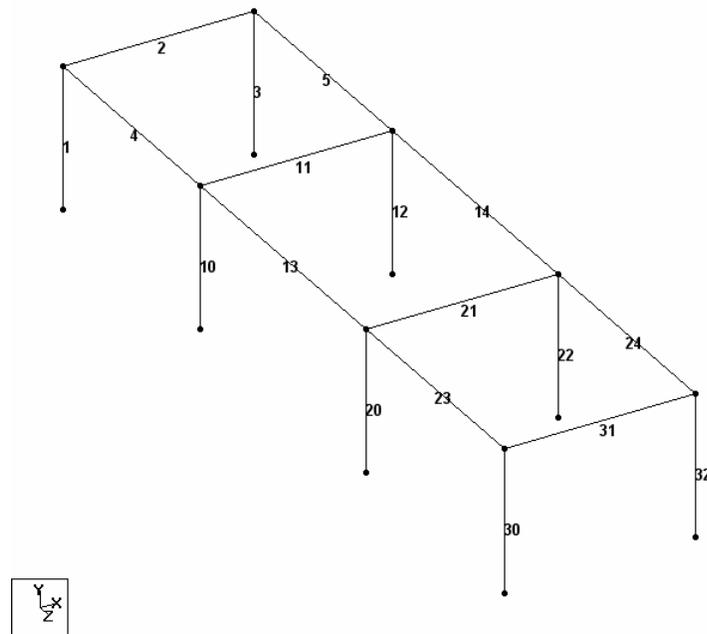
- Specify the **Global Direction**; you have three choices X, Y, or Z.
- Specify the **No. of Steps** excluding the geometry you draw.
- Specify the **Default Step Spacing** in the default length unit.
 - The Step Spacing may be positive or negative value (that is if the duplication process to take place in the negative side of X, Y, or Z).
 - You can change the individual step spacing from the table in the dialog box.
- Specify if you want to **Renumber Bays**, a new column will be added, so user can specify the starting number of Beam numbers STAAD Pro will start with, for each new frame will be added.
- Specify if you want to **Link Steps** or not. Linking Steps is to link the duplicate frames generated by Beams parallel to the direction of copying. Accordingly specify if you want to make the **Base** (the nodes at the bottom) to be linked or unlinked (**Open**).

Using Translational Repeat



Exercise 11

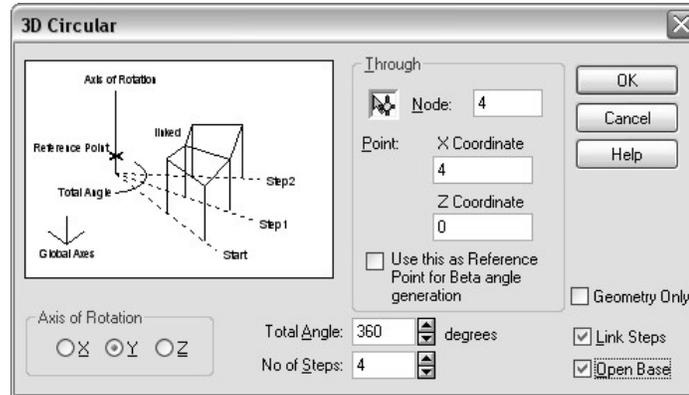
1. Start STAAD Pro, and create a new frame 4 meter in X-axis, and 3 meter in Y-axis.
2. Save this file under the name **Common.std** (this file will be used for the other exercises of this module and the other modules).
3. Select all Beams.
4. Start the **Translation Repeat**, and specify the input data in a way to produce the structure as shown below (leave the **Spacing** to be 5m):



5. Don't save and close.

Circular Repeat

- With this function, we can duplicate Nodes, Beams, and Plates in a semi-circular, or circular fashion around one of the major axes.
- Select the desired Nodes, Beams, or Plates to be duplicated. From **Generate** toolbar, select **Circular Repeat**, or from menus select **Geometry/Circular Repeat**, the following dialog box will appear:



- Specify the **Axis of Rotation**, which will be one of the three major axes X, Y, or Z.
- Specify the **Total Angle** (+ve=CCW) to be covered by the duplicate frames. Then specify the **No. of Steps** excluding the geometry you draw.
- To specify the point that the Axis of Rotation will go **Through**, you have three ways:
 - Click on the icon, and specify it on the screen.
 - You remember the Node Number, type it in.
 - You don't know the Node Number but you know its coordinate, type it in.
- Specify to **Link Steps**, or not, and to **Open Base**, or not.

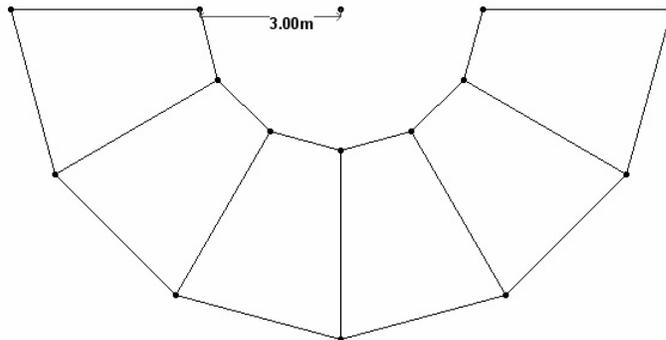


Using Circular Repeat



Exercise 12

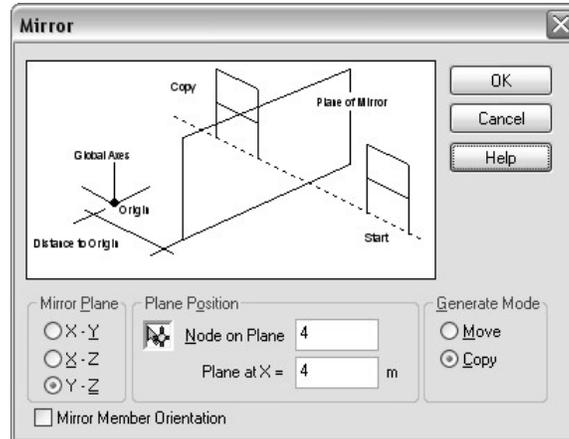
1. Open Common.std.
2. Select all Beams.
3. Start the **Circular Repeat**, and specify the input data in a way to produce the structure below (this is a top view):



4. Don't save and close.

Mirror

- With Mirror function, we can create a mirror image of the selected Nodes, Beams, and Plates around any of the three planes.
- Select the desired Nodes, Beams, or Plates to be duplicated. From **Generate** toolbar, select **Generate-Mirror**, or from menus select **Geometry/Mirror**, the following dialog box will appear:



- Specify the **Mirror Plane** one of the following X-Y, X-Z, or Y-Z.
- To specify the **Plane Position**, you have three ways:
 - Click on the icon, and specify it on the screen.
 - If you remember the Node Number, type it in.
 - If you don't know the Node Number but you know it's X coordinate, type it in.
- Specify **Generate Mode** whether:
 - **Copy** mode will generate the mirror image and keep the original geometry.
 - **Move** mode will generate the mirror image and erase the original geometry.

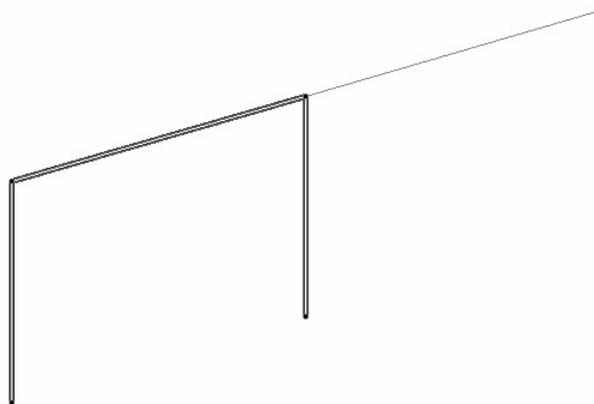


Using Mirror



Exercise 13

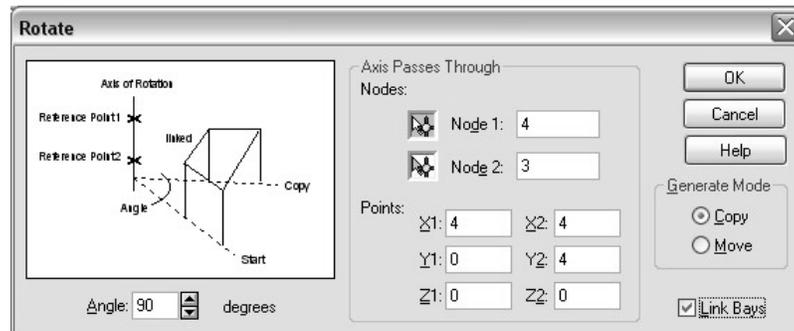
1. Open Common.std.
2. Select all Beams.
3. Start the **Generate-Mirror**, and specify the input data in a way to produce the structure below.



4. Don't save and close.

Rotate

- With Rotate function, we will be able to rotate Nodes, Beams, and Plates around any axis we specify.
- Select the desired Nodes, Beams, or Plates to be rotated. From **Generate** toolbar, select **Generate-Rotate**, or from menus select **Geometry/Rotate**, the following dialog box will appear:



- Specify the rotation **Angle** in degrees.
- To specify the **Axis Passes Through** point you have three ways to do that:
 - Click on the icon, and specify Node 1, and Node 2 on the screen.
 - If you remember the Node Number, type it in.
 - If you don't know the two Nodes Number but you know their coordinates, type it in.
- Specify **Generate Mode** whether:
 - **Copy** mode will generate the rotated geometry and keep the original geometry. Specify to **Link Bays** or not.
 - **Move** mode will generate the rotated geometry and erase the original geometry.

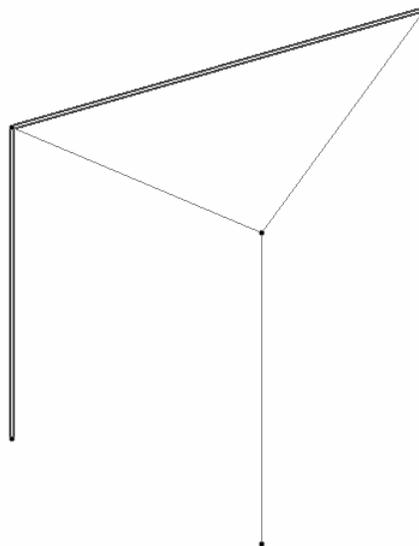
Note ■ Positive rotation angle will rotate Counter Clock Wise.

Using Rotate



Exercise 14

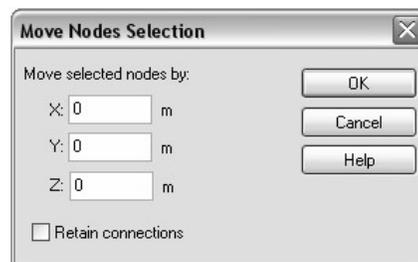
1. Open Common.std.
2. Select all Beams.
3. Start the **Generate-Rotate**, and specify the input data in a way to produce the structure below. (Hint: Use Rotate with angle =+40).



4. Don't save and close.

Move

- In Module 2, we found that STAAD Pro geometry is the *Nodes*. Beams, and Plates are defined based on the Nodes at their ends or corners, hence when you move Nodes, as if you are moving Beams, or Plates, or stretching them (stretch here means the two movement; elongating or shortning)
- Select the desired Nodes (you can select Beams, or Plates, but move will move their Nodes).
- You have three ways to access the function:
 - Press F2.
 - Right-click and select Move.
 - From the menus select **Geometry/Move**, then one of the options.
- The following dialog box will appear:



- Input the movement distance and which direction.
- Depends on your selection the output will be either moving or stretching.

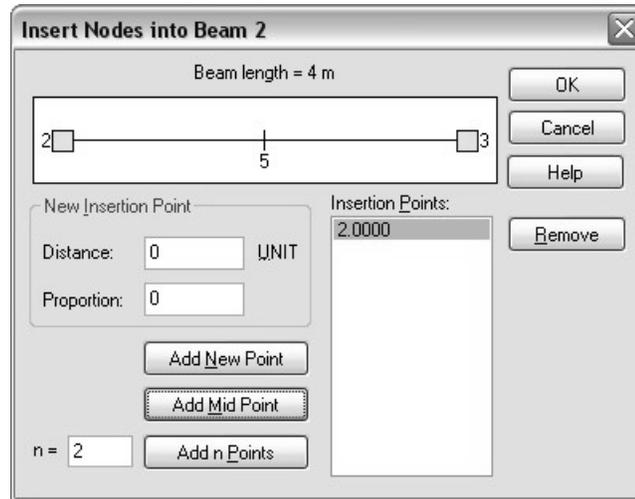
Insert Node

- Node in STAAD Pro is stiffed joint, hence there will be 6 reactions on it. That means, if user inserted a Node, at the middle of a Beam, the stability of the structure will not be affected.
- Select one Beam.
- You have three ways to access the function:

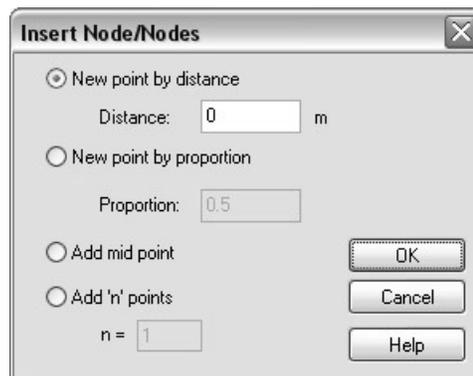


- Start the **Insert Node** function by clicking on the function from the **Geometry** toolbar
- Select **Geometry/Insert Node**, or **Geometry/Split Beam!**
- Right-click and select **Insert Node**.

- The following dialog box will appear:



- Add Mid Point** ■ If you click this button, a new Node at the middle of the Beam will be added.
- Add n Points** ■ In the field of **n** specify the number of Nodes to be added, then click **Add n Points**.
- Add New Point** ■ In the field of **Distance** specify the location from the start of the Beam, and click **Add New Point**. STAAD Pro will produce in the field of **Proportion**; the percentage of the distance to the whole length of the Beam.
 - Alternatively, you can input the **Proportion**, and the **Distance** will be measured.
- Note** ■ If you select more than one Beam and initiate the function, the following dialog box will appear:



- This dialog box will give you the ability to perform this function on multi-beams in one single command.

Add Beam between Mid-Points

- To add Beams from the middle of one Beam to the middle of another Beam.



- From the Geometry toolbar, click the **Add Beam between Mid-Points**.



- The mouse shape will change to this shape.

- Click the first Beam (click anywhere in the Beam), a new Node at the middle will be added.
- Go the second Beam, and click anywhere on the Beam.
- A new Beam will be added from the middle of the first Beam to the middle of the second Beam.

Add Beam by Perpendicular Intersection

- The same as the previous function except this function will link an existing Node in a perpendicular fashion to an existing Beam.



- From the Geometry toolbar, click the **Add Beam by Perpendicular Intersection**.

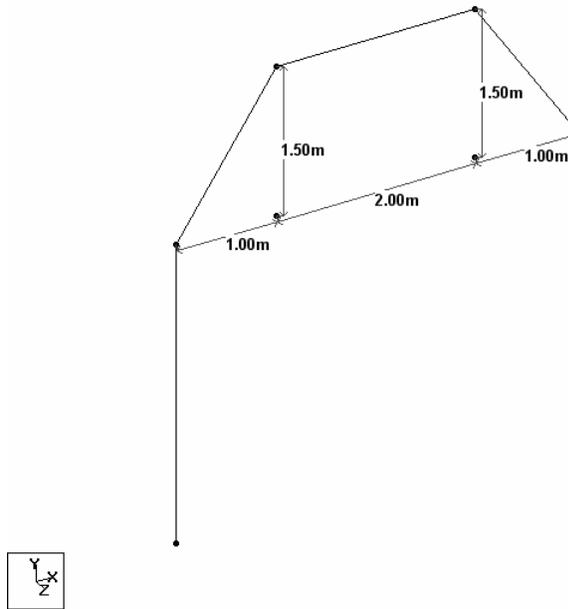
- Click on an existing Node.
- Click on any Beam.
- A new Beam will be added perpendicular on the selected Beam.

Using Tools to add Nodes and Beams

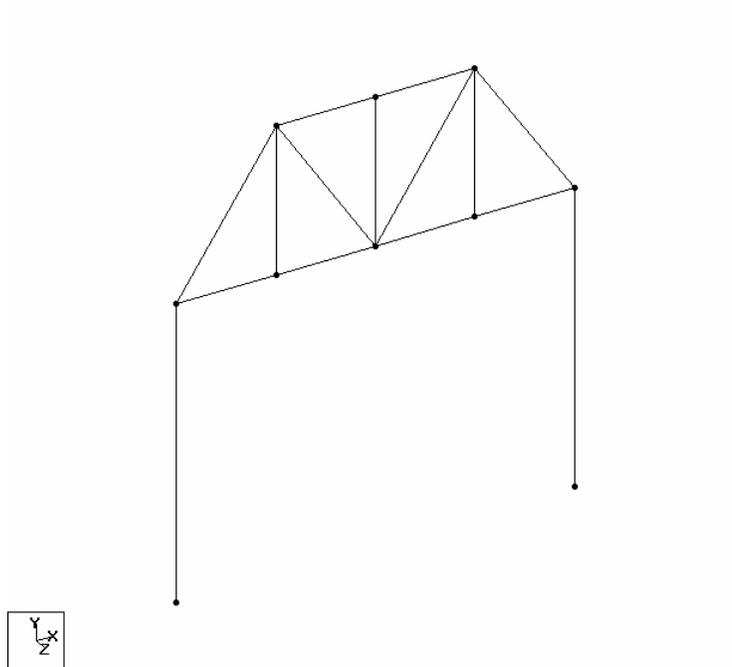


Exercise 15

1. Open Common.std.
2. Select the 4 m Beam.
3. Using Insert Node, and Move try to do the geometry below:



4. Do the following steps to produce the below geometry from the geometry you just created:
 - a. Add Beams
 - b. Add Beam between Mid-Points
 - c. Add Beam by Perpendicular Intersection



Connect Beams along an Axis

- You can connect Nodes along any of the major axes with Beams.
- Select the desired Nodes to be connected along X, Y, or Z.
- From the menus select **Geometry/Connect Beams along**, then choose one of the three axes. The Nodes will be connected with Beams.

Intersect Selected Members

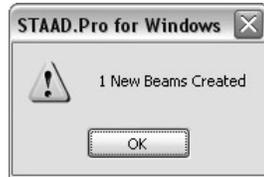
- Sometimes, it happens that two Beams intersect each other without creating a Node at the intersection point. This may happen specially in DXF files importing. This will lead STAAD Pro to interpret that there will be no transmitting of the forces between these two Beams, therefore we need to make a check for such a case, and correct it.
- From the menus select Geometry/Intersect Selected Members, then you can select Intersect, or Highlight.
 - Highlight will only highlight any occurrence of such a problem.
 - Intersect will solve the problem.
- A dialog box will appear asking you to specify the tolerance. Specify the tolerance value, click OK.



- If such a problem is not present in your geometry, STAAD Pro will produce the following message:



- If such a problem is present in your geometry, STAAD Pro will create Nodes at intersection as needed, and produce the following message:



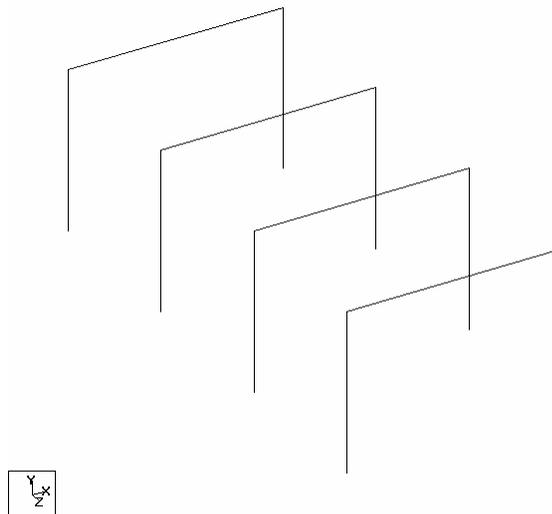
- Note** ■ If you don't want to use **Highlight** function, select the beams you suspect have this problem, then issue the command **Intersect**.

Connecting Nodes, and Creating Intersections

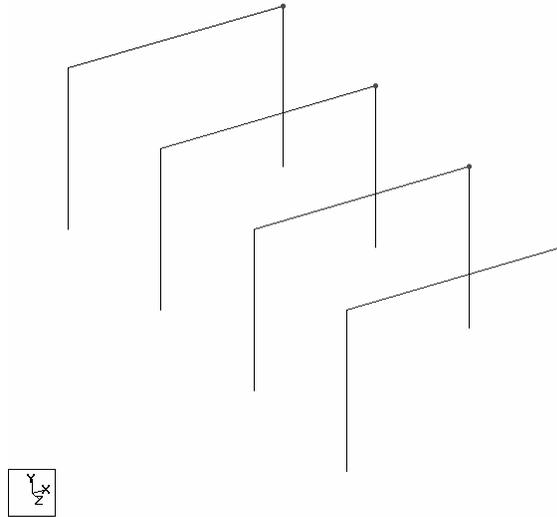


Exercise 16

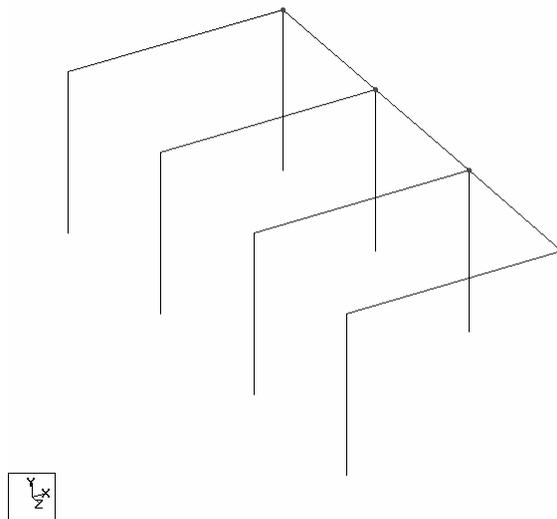
1. Open Common.std.
2. Select all Beams, and start Translational Repeat. The Global Direction is Z, Default Step Spacing is 3m, and No. of Steps is 3, **Don't Link Steps**, Click **OK**.
3. The shape should look like the following:



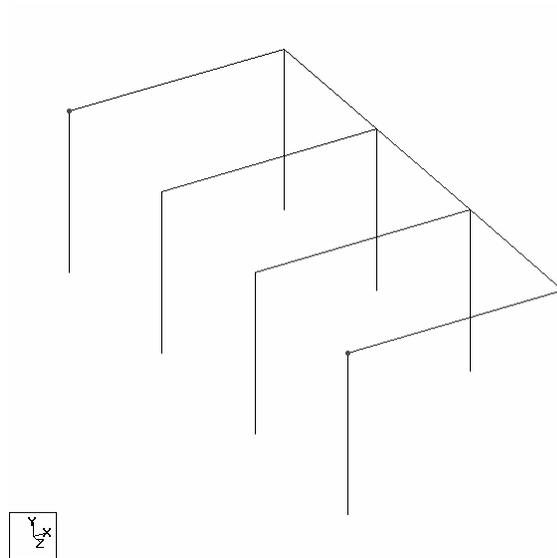
4. Change to the Node cursor, and select the Nodes at the upper-right, like the following:



5. From Menu select **Geometry/Connect Beams Along/Z Axis**. The shape should be like the following:



6. Select the first Node and the last Node, on the upper-left side:



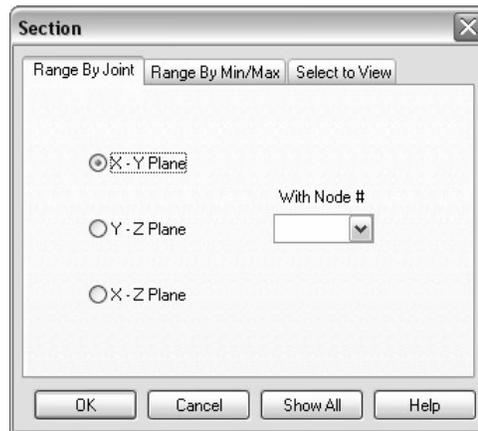
7. From Menu select **Geometry/Connect Beams Along/Z Axis**. A single Beam will be added connecting the first Node and the last Node.
8. Change to the Beam cursor.
9. Select the whole geometry (Ctrl+A).
10. From menu select **Geometry/Intersect Selected Members /Intersect**, and accept the default tolerance value.
11. A dialog box will tell you that **“2 new Beams Created”**.
12. Don't save and close.

Cut Section

- Dealing with 3D View of a geometry with all of the Beams and Plates shown may lead to confusion, and accordingly will slow the production of geometry or other functions like inputting cross-sections. Cut Section is the suitable function to create a slice of the geometry so user can focus on the job.



- From **Structure** toolbar, select **Cut Section**, or from menus select **Tools/Cut Section**.



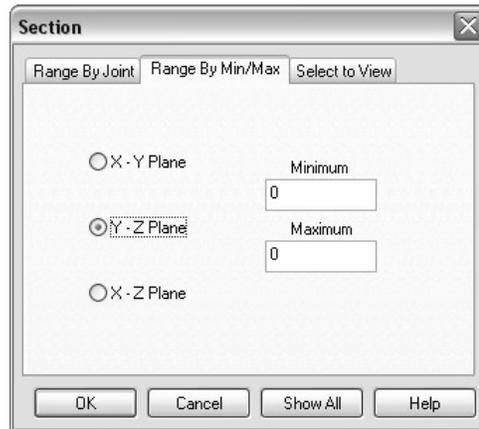
- You have three ways to create a slice of your geometry:
 - Range By Joint
 - Range By Min/Max
 - Select to View

Range By Joints ■ Specify the Plane you want to slice parallel to it. You have three choices, X-Y, Y-Z, and X-Z.

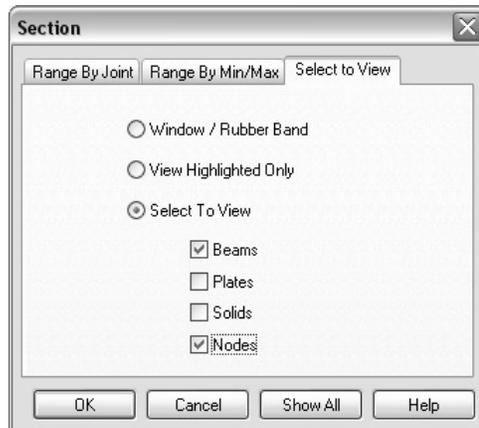
■ Specify a Node number, so the slicing will take place at it.

Range By Min/Max ■ Specify the Plane you want to slice parallel to it. You have three choices, X-Y, Y-Z, and X-Z.

■ Specify the **Minimum** distance, and the **Maximum** distance, any geometry parallel to the plane selected and with the range of the distance will be shown.



Select to View ■ You have three choices in this slicing method:

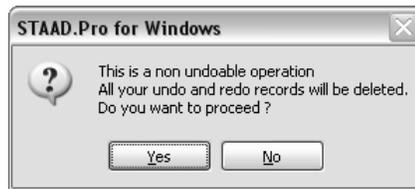


- **Window/Rubber Band**; whereis the user to make a window (click left button and hold to make a rectangle) whatever in it will be shown. (Note that the *Middle Point* of the member is the important part to be included inside the Window, and any Node within the Window).
- Select Nodes, Beams, or Plates, then choose **View Highlight**. If you selected Nodes, Nodes only will be shown, etc.
- Click on **Select To View**, and choose the part of geometry you want to see, you can select more than one choice.

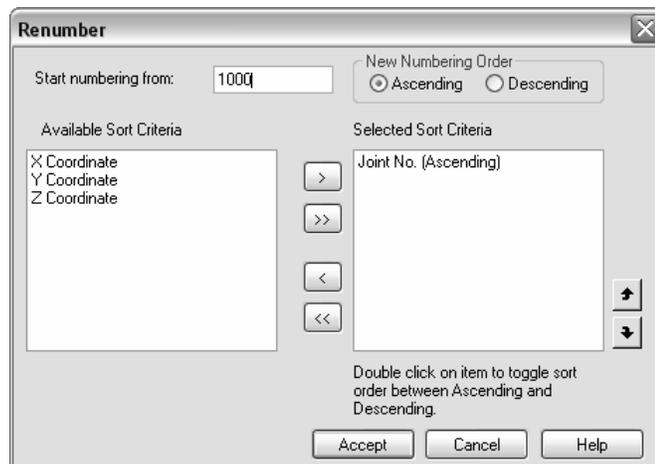
- According to your choice, part of the structure will be shown.
- Show All** ■ Whenever you are done working with your desired slice, simply select the function again, and click on **Show All** button, the whole structure will appear again.

Renumber

- Numbering Nodes, Beams, and Plates is the mission of STAAD Pro, but we can interfere in it and renumber whatever we want.
- Select Nodes, Beams, or Plates.
- From menus, select **Geometry/Renumber**, choose suitable option.
- Warning message will appear:



- Read this message carefully, as it will remove any undoing from this file, hence it may be something you don't want to do.
- If you click on **No**, nothing will happen. If you click **Yes**, a dialog box will appear:



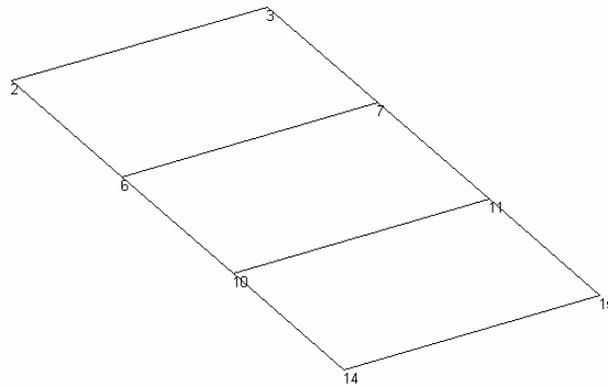
- Specify **Start numbering from**, and whether it will in **Ascending** order, or **Descending** order, then specify the **Sort Criteria**.

Cutting Section & Renumbering

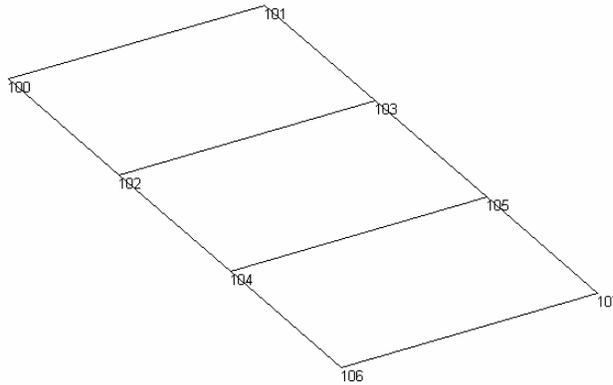


Exercise 17

1. Open Common.std.
2. Select all Beams, and start Translational Repeat. The Global Direction is Z, Default Step Spacing is 3m, And No. of Steps is 3, Link Steps, and Open Base.
3. Right-click and select **Labels**, and then click **Node Numbers** on. Identify one of the Nodes at the top (let it be Node # 2).
4. Start **Cut Section**, at the **Range By Joint**, select **X-Z**, **With Node # 2**. The shape of the Geometry should look something like this:



5. Change the cursor to **Node** cursor, and select all Nodes.
6. Select **Geometry/Renumber/Nodes**.
7. Select to start numbering from 100, and in an **Ascending** order. Specify the Sort Criteria to be **Joint No.**
8. The geometry should look like the following:



9. Select **Cut Section** again, and click **Show All**.
10. Don't save and close.

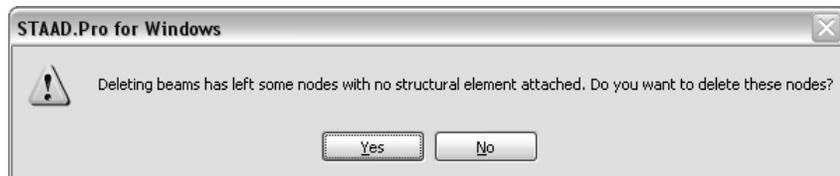
Delete

- You can delete Nodes, Members, and Plates.
- **Delete Nodes** ■ If you want to delete Nodes, any thing attached to them (namely; Beams or Plates) will be deleted:
 - Select Nodes.
 - Press **Del** Key at the keyboard.
 - A warning message will appear:



- If you click **Yes**, the operation will be done and the Nodes will be deleted. **No**, will stop the operation.

- **Delete Beams and Plates** ■ Select the desired Beams, and Plates:
 - If you select one Beam and press **Delete**, the Nodes at its end will remain intact (except if your geometry is one Beam).
 - If you select more than one Beam, STAAD Pro will give you a warning message:



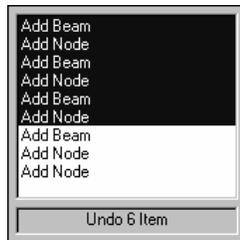
- Based on your answer, you can keep the Nodes, or remove them as well.
- The same thing applies for Plates, except deleting a single Plate will lead to the warning message.

Undo / Redo

- You have unlimited number of Undos, and Redos to perform in one session.



- After you perform several functions, you want to undo one or two of them, from the File toolbar, click **Undo**, or select **Edit/Undo**, or you can press **Ctrl+Z**.
- Also, you can undo group of actions, if you clicked on the pop-up list, you can click on a certain action, accordingly STAAD Pro will highlight anything between what we select and the point you are standing on it right now, then double-click or press Enter.



- Redo is to undo the undone
- From **File** toolbar, click **Redo**, or from menus select **Edit/Redo**, or press **Ctrl+Y**.
- All Undo specifications apply to Redo.

Zooming and Panning

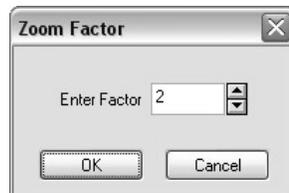
- You can zoom and Pan using different methods in STAAD Pro. You will find all zoom commands and Pan command in **View** toolbar, and from menus in the **View/Zoom** or **View/Pan**.



- **Zoom Window**, is to draw a window (rectangular shape by specifying two opposite corners) around the desired portion of the geometry to be magnified, by clicking the left button of mouse and holding until you specify the other corner of the window. Whatever inside this window will be magnified.



- **Zoom Factor**, is to specify a magnifying factor (greater than 1) or shrinking factor (less than 1), the following dialog box will appear:



-  ■ **Zoom In**, to get you closer to the geometry, step-by-step.
 -  ■ **Zoom Out**, to get you farther from the geometry, step-by-step.
 -  ■ **Zoom Extents** (the menu option is All), after several zooms in and out, this options allows you to see the whole geometry filling the screen.
 -  ■ **Zoom Dynamic**, just like **Zoom Window**, except Zoom Dynamic will create a window conatining the new view, and you can scroll up and down, left and right, to view the other parts of the structure.
 -  ■ **Zoom Previous**, to get you back to last view.
 -  ■ **Pan**, a hand will appear, to allow the user to pan the geometry in all of the sides, click the left button and drag the geometry in any direction (it is more practical to use Pan with other zooms), to disabe it press **Esc**, or click the icon again.
 -  ■ **Display Whole Structure**, just like **Zoom Extents**. It works with Cut Section (discussed earlier) as **Show All** option.
 -  ■ **Magnifying Glass**, a glass will appear, click and hold, you will see a bigger picture of the part, once you start moving you will magnify other parts of your geometry.
- Using IntelliMouse**
- If you have IntelliMouse (the mouse with a wheel), you can use it to Zoom In, and Zoom Out.
 - If you move the wheel forward you are zooming in.
 - If you move the wheel backward you are zooming out.
 -  ■ **Previous Selection**, STAAD Pro remembers the last selection you made. To re-use the last selection, simply click this button, and STAAD Pro will select it for you.

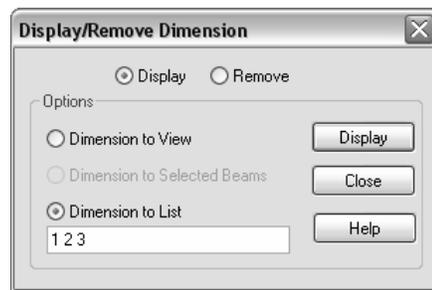
Dimensioning

- You can dimension your geometry to make it more meaningful for anybody will view your model.
- There are two ways to put dimension in STAAD Pro:
 - Using **Dimension** function
 - Using **Node to Node Distance** function

Dimension function



- Dimension function will put dimension over Beams only, stating the length of the Beam on the middle of it.
- From Structure toolbar, click **Dimension**, or from menus select **Tools/Dimension Beams**. The following dialog box will appear:



- While Display mode is on, select either to:
 - **Dimension to View**, to dimension all Beams at the current view.
 - **Dimension to Selected Beams**, the selected Beams prior to the initiation of this function will be dimensioned.
 - **Dimension to List**, type in the numbers of Beams that you desire to dimension (leave spaces between Beam numbers).
- To remove the dimension from the geometry, select the **Remove** mode, and click **Remove**.

Node to Node Distance function



- This function is manual, you will click on two Nodes and STAAD Pro will put a dimension between these two Nodes. There is no need for a Beam to be between the two Nodes.
- From the Structure toolbar, click the Node to Node Distance, or from menus select Tools/Display Node to Node Dimension.
- In both ways, the mouse shape will change.
- Click the first Node, then click the second Node, dimension will appear on the distance you clicked. Keep doing this, until you are done.



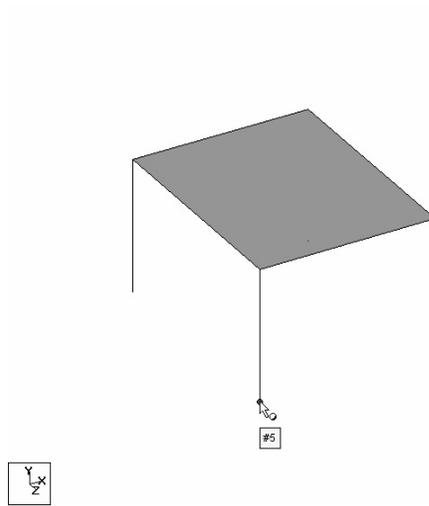
- To remove this type of dimension, from **Structure** toolbar, click **Remove Node to Node Distance**, or from menus select **Tools/Remove Node Dimension**. The dimension will disappear.

Pointing to Nodes, Beams, and Plates

- Without issuing any command, if you point to Node, Beam, or Plate STAAD Pro will give you the number of the Node, Beam, or Plate.

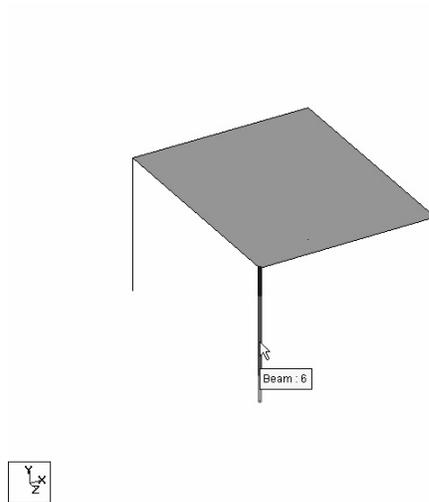
Pointing to Node

- Using the Node cursor, point to a Node, the cursor will provide the Node Number:

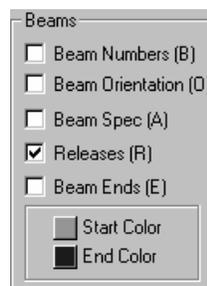


Pointing to Beam

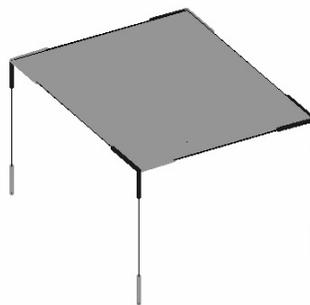
- Using the Beam cursor, point to a Beam, the cursor will provide the Beam Number, and the Start and End Colors:



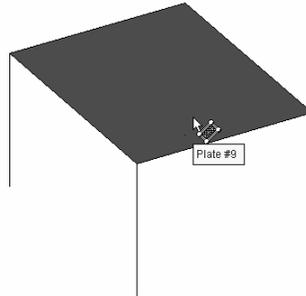
- As we mentioned before, each Beam is defined by the two Nodes at its ends. Since STAAD Pro will number every thing in the geometry, we will never know how STAAD Pro wrote the definition of Beam in the input file except using the following:
 - Opening the input file, and verify.
 - Go the the Beam table in the **Geometry** Page Control.
 - Using the color code.
- By default the green will be the Start, and blue is the End.
- This particularly important when you want to use Loading system.
- To change the colors of the Start and End:
 - Right-click, and select **Labels**, from **Beams**, there will be two colors labeled **Start Color**, and **End Color**. Click the desired color icon, and change the colors.



- To permanently set the color code of the Beams, click **Beam Ends** on in the same dialog box.

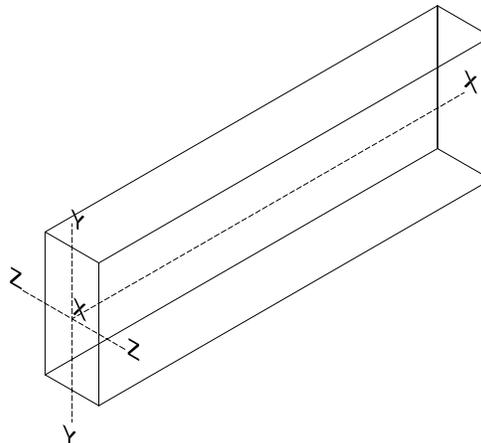


- Pointing to Plate** ■ Using the Plate cursor, point to a Plate, the cursor will provide the Plate Number.



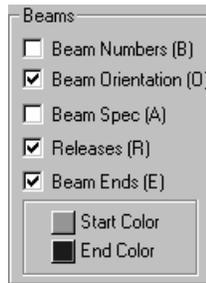
Global and Local Coordinate Systems

- There is a single **Global Coordinate System** in STAAD Pro, which we defined the Node coordinates using it.
- The **Global Coordinate System**, appear at the lower left corner of the main window.
- We use GX, GY, and GZ, to differentiate them from the Local Coordinate System X, Y, and Z.
- For each Beam, there is a Local Coordinate System, as follows:
 - X, is always from Start to End along the member.
 - Y, in the direction of Minor principle axis.
 - Z, in the direction of Major principle axis.

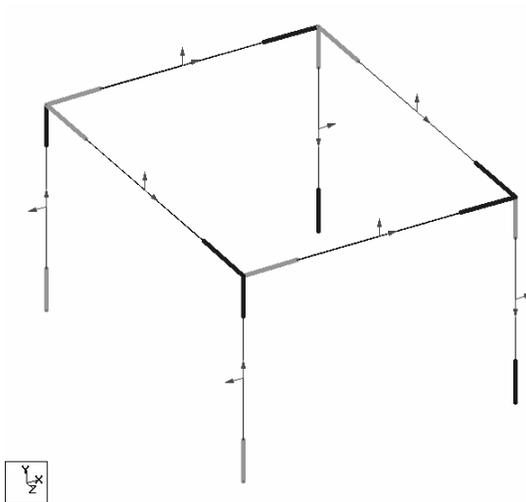


- Beam results always produced using the Local Coordinate System, such as F_x (Axial Load), F_y (Shear), and M_z (Bending moment).

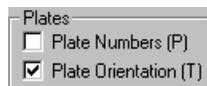
- To view the Local Coordinate System of the Beam
 - Right-click, and select **Labels**.
 - From **Beams**, click **Beam Orientation ON**



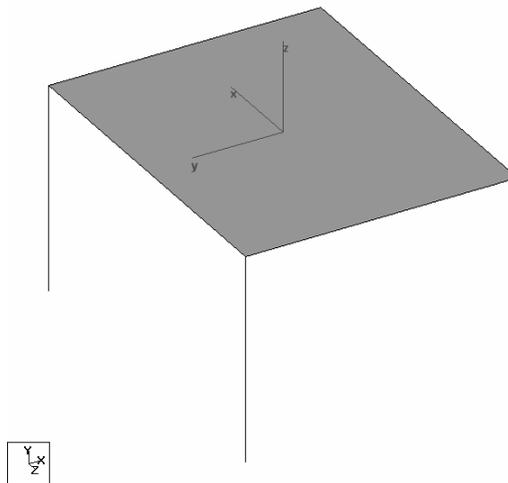
- You will see the X, and Y, and you can determine Z.



- For each Plate there is Local Coordinate System, which will be as follows:
 - X, is from first Node to the second Node.
 - Y, lies in the Plane defined by the third point orthogrphical to X.
 - Z, is derived from the Right-Hand-Rule (which defines the relationship between the three axes).
- To see the orientation of Plate Local Coordinates:
 - Right-click, and select **Labels**.
 - From **Plates**, click **Plate Orientation ON**.



- You will see the X, Y, and Z of the Plate:



Module Review



1. In the Mirror function which of the following statements is true:
 - a. I can define a User-Defined Plane to Mirror around it.
 - b. I can only Mirror around X-Z Plane.
 - c. I can Mirror around any of the three main Planes.
 - d. There is only Copy mode in Mirror.
2. In the Translational Repeat:
 - a. The distances between steps generated should be the same.
 - b. I can repeat parallel to any of the three main axes.
 - c. I can't link steps.
 - d. I can't renumber step Beams.
3. Use _____ command to cut a slice of your geometry.
4. If you delete Nodes, the Beams, and Plates attached to them will be intact:
 - a. True
 - b. False
5. There is one method to place dimension on your geometry:
 - a. True
 - b. False
6. Some of the Zooms options are _____, _____, _____, _____

Module Review Answers

1. c
2. b
3. Cut Section
4. b
5. b
6. Window, In, Out, Dynamic, Previous, etc.