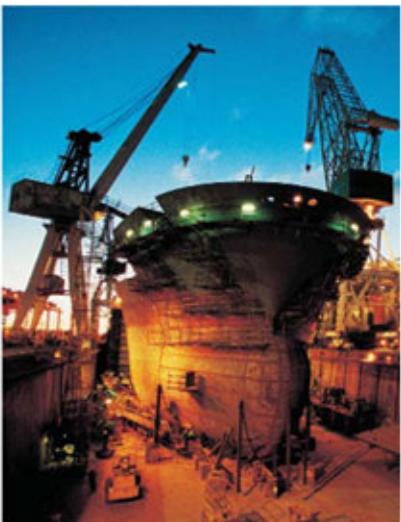
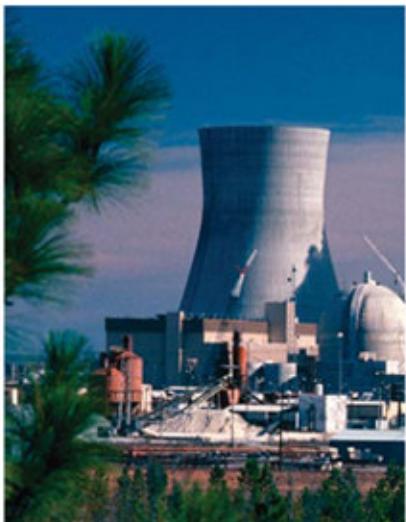


SmartPlant 3D

Grids / Structural Labs

Process, Power & Marine



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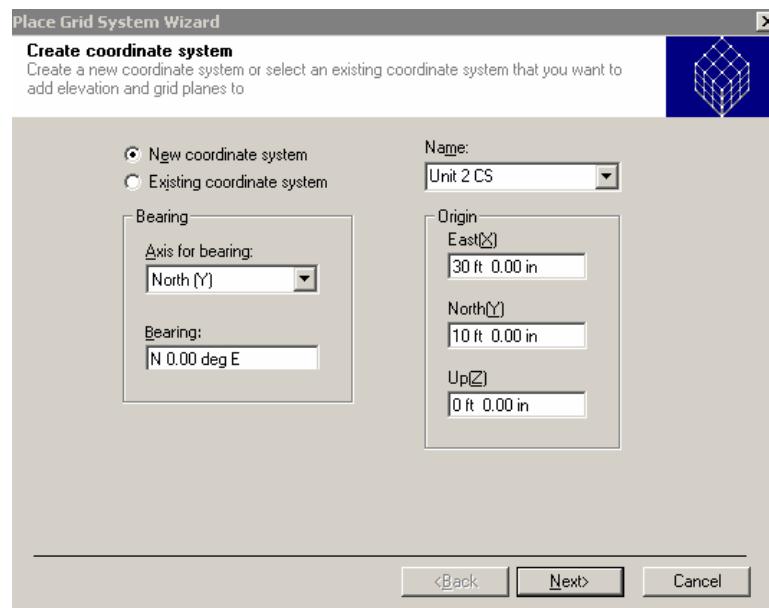
GRIDS TASK

LAB-1A: Placing Grids / Coordinate Systems

Objective

After This Lab Students will be able to Place Grids / Coordinate systems, using Grid Wizard and Ribbon Bar

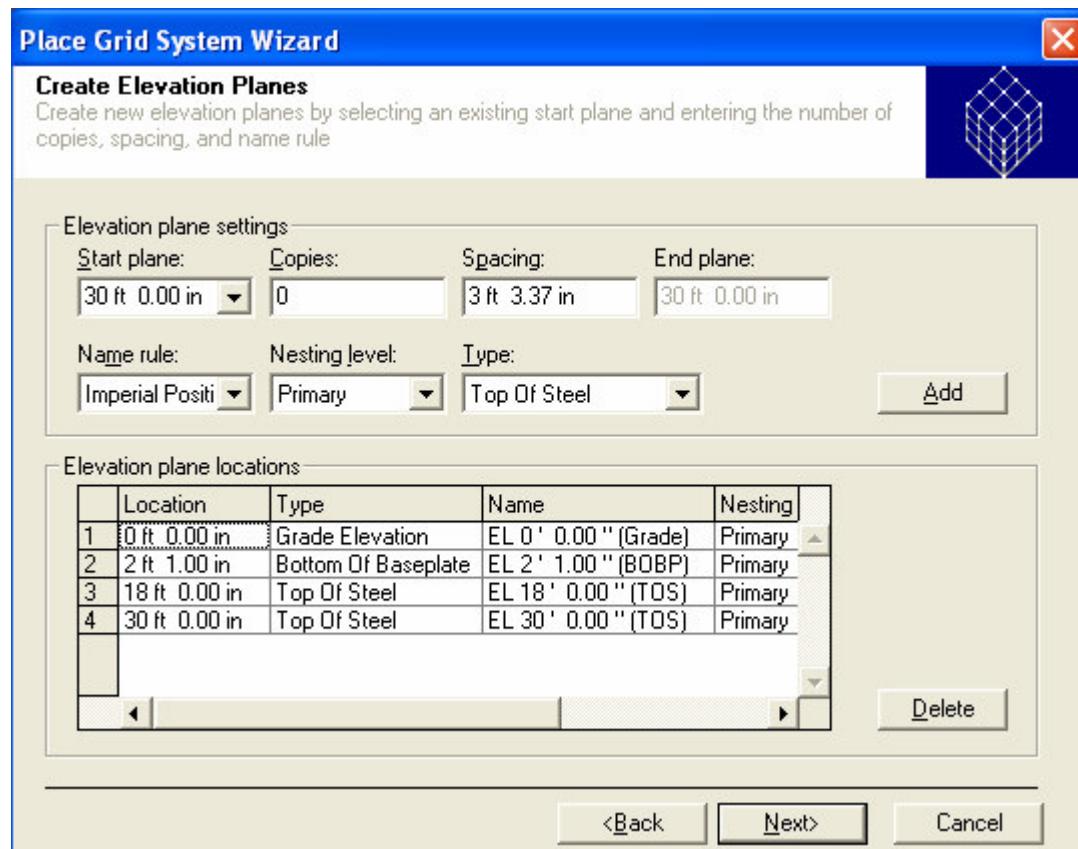
- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Grid Task environment. Make sure the Active Permission Group is set to *Layout*
- 3 Select the Grid Wizard command
- 4 Using Step 1 in the Grid Wizard command, create a new coordinate system based on the following information:
 Name: Unit 2 CS
 Axis for Bearing: North (Y)
 Bearing: N 0.00 deg E
 Origin:
 East (X): 30 ft
 North (Y): 10 ft
 Up (Z): 0 ft.



- 5 **Elevation Planes:** Using Step 2 in the Grid Wizard command, create the Elevation Planes based on the following information:

| Step | Start Plane | Copies | Spacing | Name Rule | End Plane | Type |
|------|-------------|--------|---------|-------------------|-----------|---------------------|
| 1 | 0 ft 0 in | 0 | Ignore | Imperial Position | 0 ft 0 in | Grade Elevation |
| 2 | 2 ft 1 in | 0 | Ignore | Imperial Position | 2 ft 1 in | Bottom of Baseplate |
| 3 | 18 ft | 0 | Ignore | Imperial Position | 18 ft | Top of Steel |
| 4 | 30 ft | 0 | Ignore | Imperial Position | 30 ft | Top of Steel |

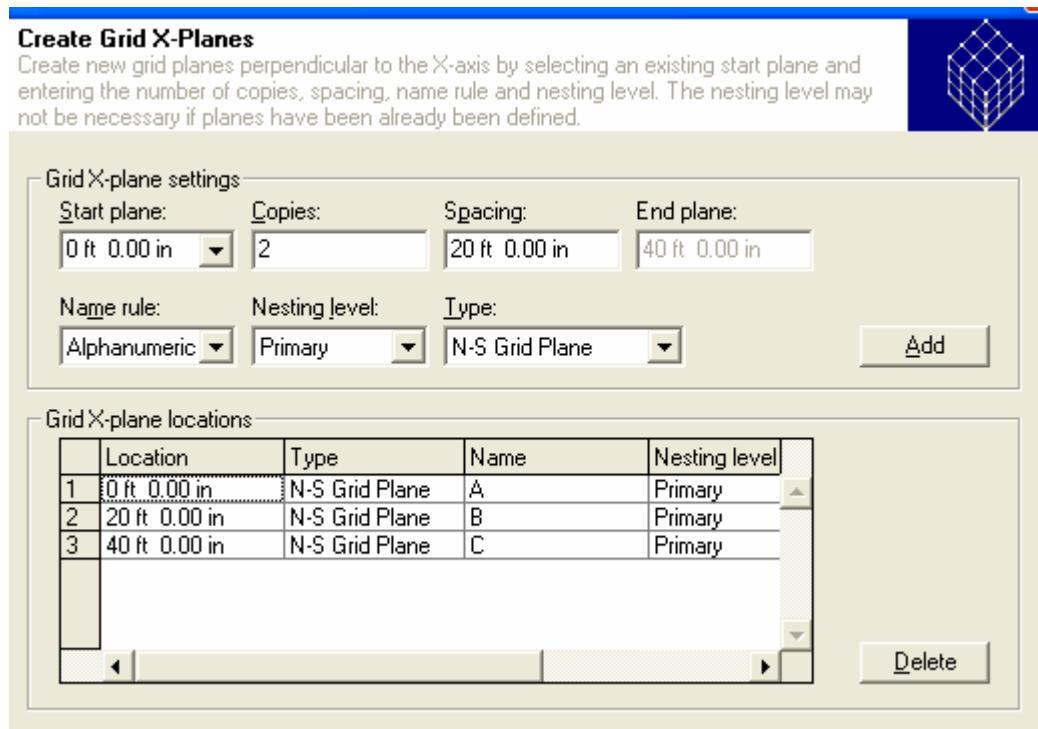
Elevation Plane Location settings:



Grid X-Planes: Using Step 3 in the Grid Wizard command, create the Grid-X Planes based on the following information:

Set the NameRule to Alphanumeric and Percent for All Grid Planes

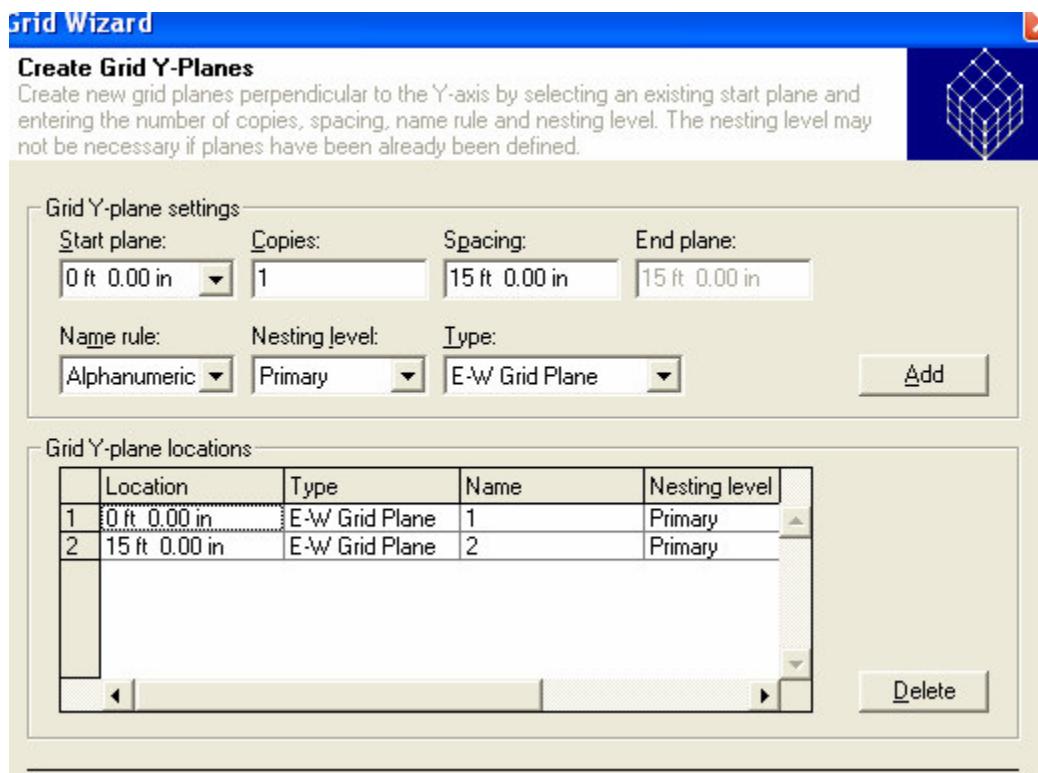
| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 2 | 20 ft 0 in | 40 ft 0 in | Primary | N-S Grid Plane |



- 6 **Grid-Y Planes:** Using Step 4 in the Grid Wizard command, create the Grid-Y Planes based on the following information:

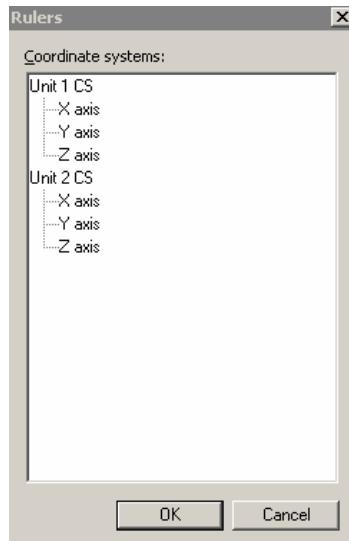
| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 15 ft 0 in | 15 ft 0 in | Primary | E-W Grid Plane |

Set the NameRule to Alphanumeric and Percent for All Grid Planes



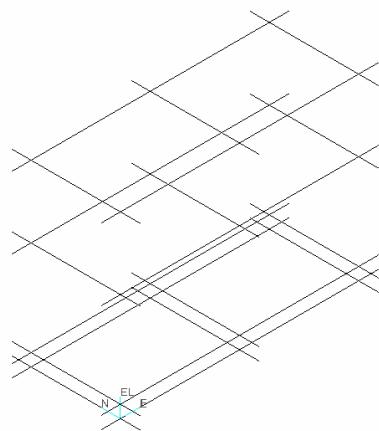
- 7 Hit next button on Create Radial Cylinder form
- 8 Hit next on Create Radial Plane form
- 9 Hit Finish on Associated Elevation Plane form
- 10 Go to the main menu and select View -> Ruler option to open the ruler dialog box.

11 Press the <Control> key and unselect all to turn off the rulers.



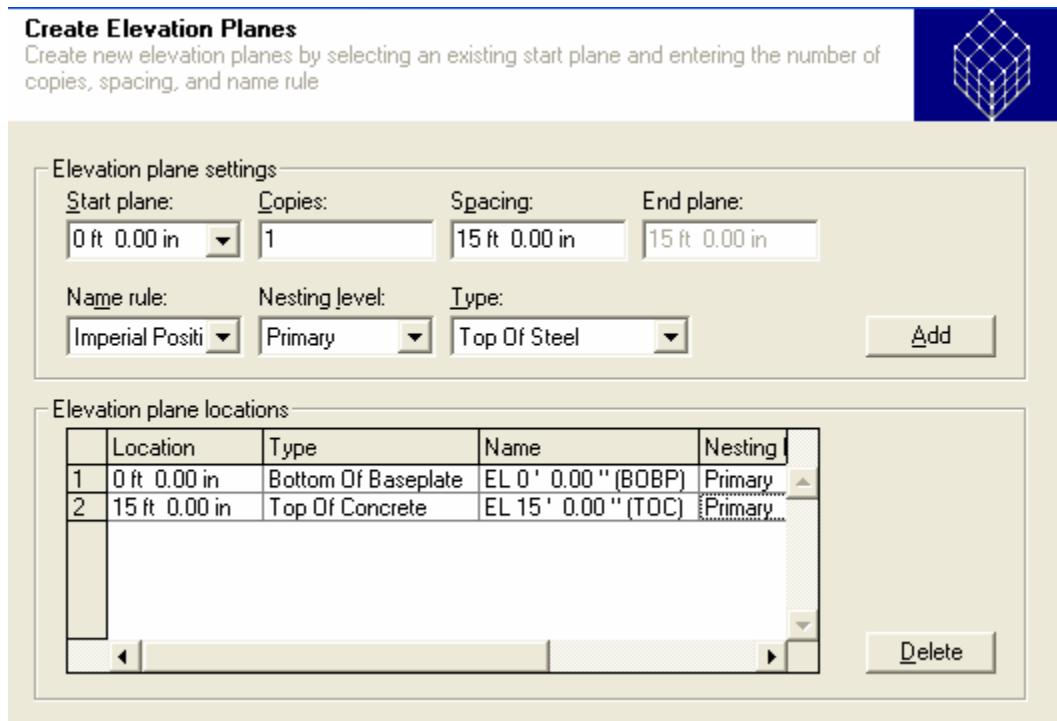
12 Select the Unit 2 CS to open the edit coordinate system ribbon bar.

13 Change the Parent System to Coordinate systems



LAB-1B: Placing Grids – Amines Unit CS

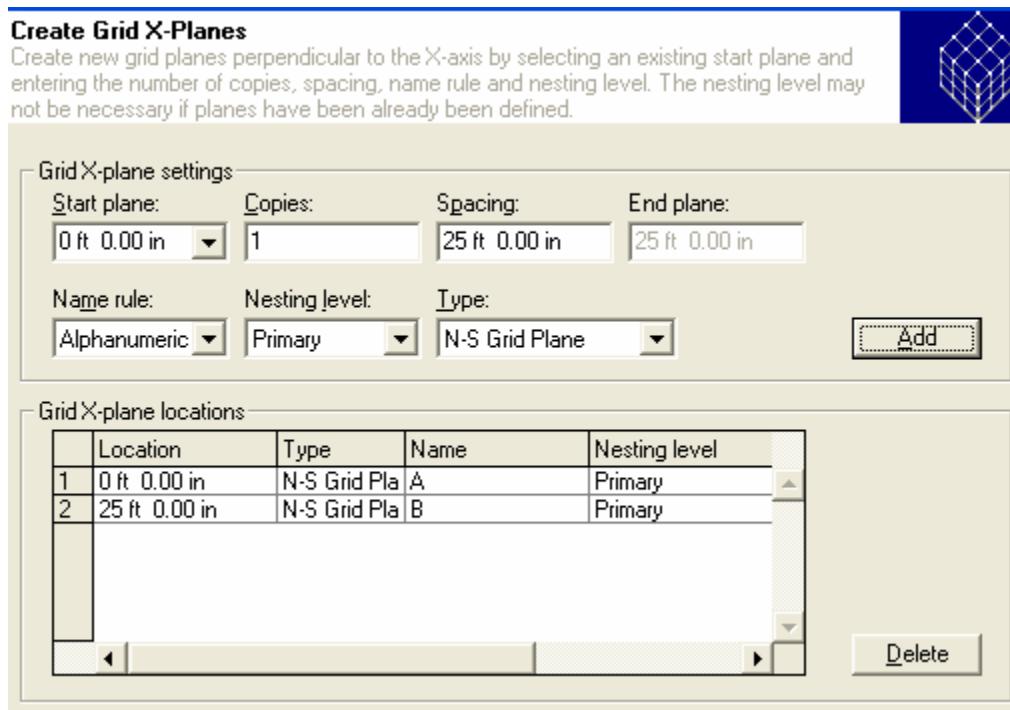
- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Grid Task environment. Make sure the Active Permission Group is set to *Layout*
- 3 Select the Grid Wizard command
- 4 Select Using Step 1 in the Grid Wizard command, create a new coordinate system based on the following information:
 Name: Amines Unit CS
 Axis for Bearing: North (Y)
 Bearing: N 0.00 deg E
 Origin
 East (X): 120 ft
 North (Y): 80 ft
 Up (Z): 0 ft.
- 5 Elevation Planes: Create the Elevation Planes based on the following information:
 Set the NameRule to Imperial Position for All Grid Planes



- 6 Grid X-Planes: Using Step 3 in the Grid Wizard command, create the Grid-X Planes based on the following information:
Set the NameRule to Alphanumeric and Percent for All Grid Planes

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 25 ft 0 in | 25 ft 0 in | Primary | N-S Grid Plane |

In the Grid-X Plane Locations setting, edit the Name as follows:



- 7 Grid-Y Planes: Using Step 4 in the Grid Wizard command, create the Grid-Y Planes based on the following information:
Set the NameRule to Alphanumeric and Percent for All Grid Planes

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 25 ft 0 in | 25 ft 0 in | Primary | E-W Grid Plane |

In the Grid-Y Plane Locations setting, edit the Name as follows:

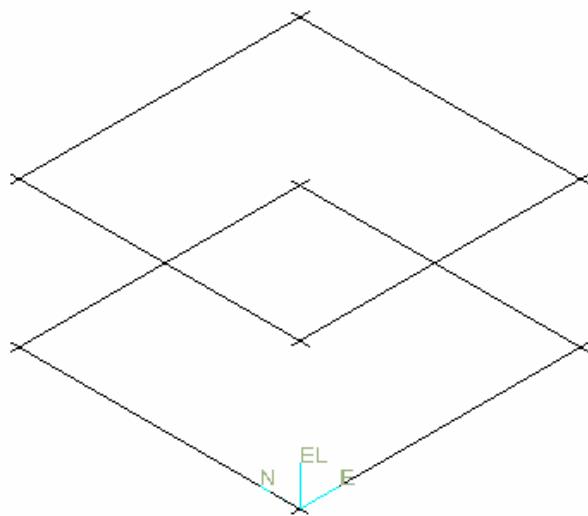
Create Grid Y-Planes

Create new grid planes perpendicular to the Y-axis by selecting an existing start plane and entering the number of copies, spacing, name rule and nesting level. The nesting level may not be necessary if planes have been already been defined.



| Grid Y-plane settings | | | | |
|---------------------------------------|----------------|----------------|------------------------------------|---------------|
| Start plane: | Copies: | Spacing: | End plane: | |
| 0 ft 0.00 in | 1 | 25 ft 0.00 in | 25 ft 0.00 in | |
| Name rule: | Nesting level: | Type: | | |
| Alphanumeric | Primary | E-W Grid Plane | <input type="button" value="Add"/> | |
| Grid Y-plane locations | | | | |
| | Location | Type | Name | Nesting level |
| 1 | 0 ft 0.00 in | E-W Grid Plane | 1 | Primary |
| 2 | 25 ft 0.00 in | E-W Grid Plane | 2 | Primary |
| <input type="button" value="Delete"/> | | | | |

- 8 Hit next button on Create Radial Cylinder form
- 9 Hit next on Create Radial Plane form
- 10 Hit Finish on Associated Elevation Plane form
- 11 Go to the main menu and select View -> Ruler option to open the ruler dialog box.
- 12 Press the <Control> key and unselect all to turn off the rulers.
- 13 Select the Amines Unit CS to open the edit coordinate system ribbon bar.
- 14 Change the Parent System to Coordinate systems
- 15 Your View should now resemble the following graphic.



LAB-1C: Placing Grids – Building 1 CS

- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Grid Task environment. Make sure the Active Permission Group is set to *Layout*
- 3 Select the Grid Wizard command
- 4 Select Using Step 1 in the Grid Wizard command, create a new coordinate system based on the following information:
 Name: Building 1 CS
 Bearing:
 Axis for Bearing: North (Y)
 Bearing: N 0.00 deg E

Origin

East (X): -35 ft

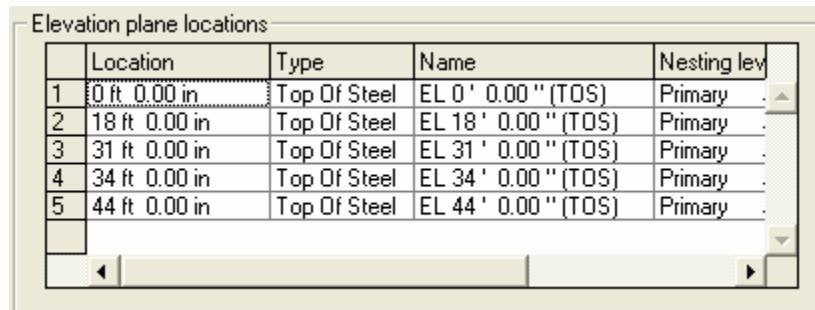
North (Y): 10 ft

Up (Z): 0 ft.

- 5 Elevation Planes: Create the Elevation Planes based on the following information:
 Set the NameRule to Imperial Position for All Grid Planes

| Step | Start Plane | Copies | Spacing | End Plane | Type |
|------|-------------|--------|------------|------------|--------------|
| 1 | 0 ft 0 in | 1 | 18 ft 0 in | 18 ft 0 in | Top of Steel |
| 2 | 31 ft 0 in | 1 | 3 ft 0 in | 34 ft 0 in | Top of steel |
| 3 | 44 ft 0 in | 0 | 3 ft 0 in | 44 ft 0 in | Top of steel |

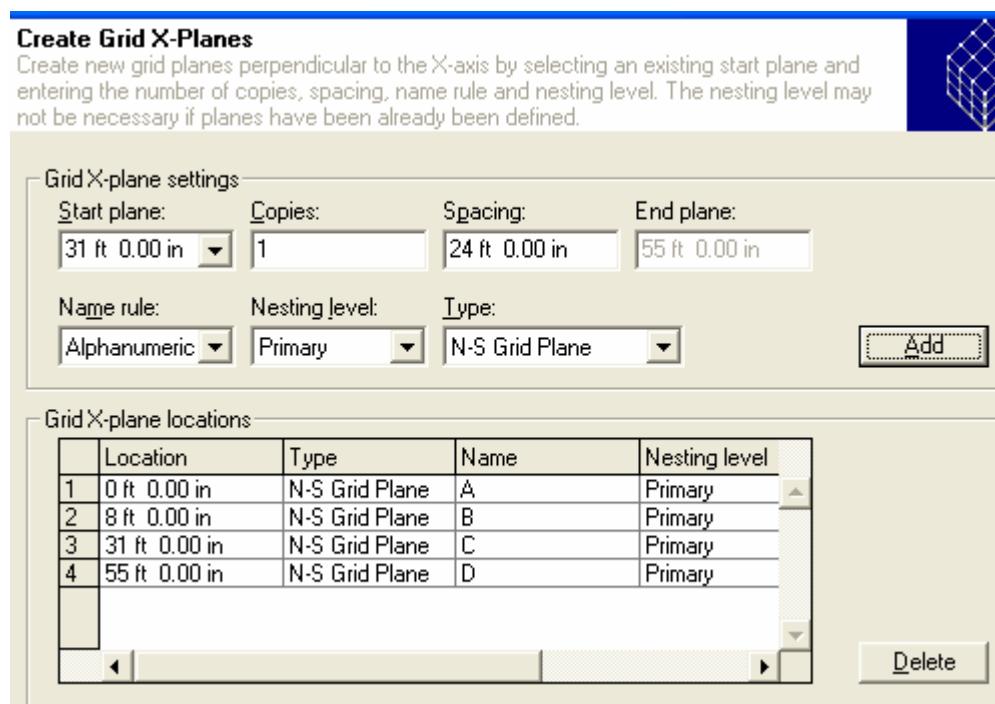
In the Elevation Plane Locations setting, edit the Name and Type as follows:



- 6 **Grid X-Planes:** Using Step 3 in the Grid Wizard command, create the Grid-X Planes based on the following information:
Set the NameRule to Alphanumeric and Percent for All Grid Planes

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 8 ft 0 in | 8 ft 0 in | Primary | N-S Grid Plane |
| 2 | 31 ft 0 in | 1 | 24 ft 0 in | 55 ft 0 in | Primary | N-S Grid Plane |

In the grid-X Plane Locations setting, edit the Name as follows:



- 7 **Grid-Y Planes:** Using Step 4 in the Grid Wizard command, create the Grid-Y Planes based on the following information:
Set the NameRule toAlphanumeric and Percent for All Grid Planes

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 2 | 20 ft 0 in | 40 ft 0 in | Primary | E-W Grid Plane |

In the Grid-Y Plane Locations setting, edit the Name as follows:

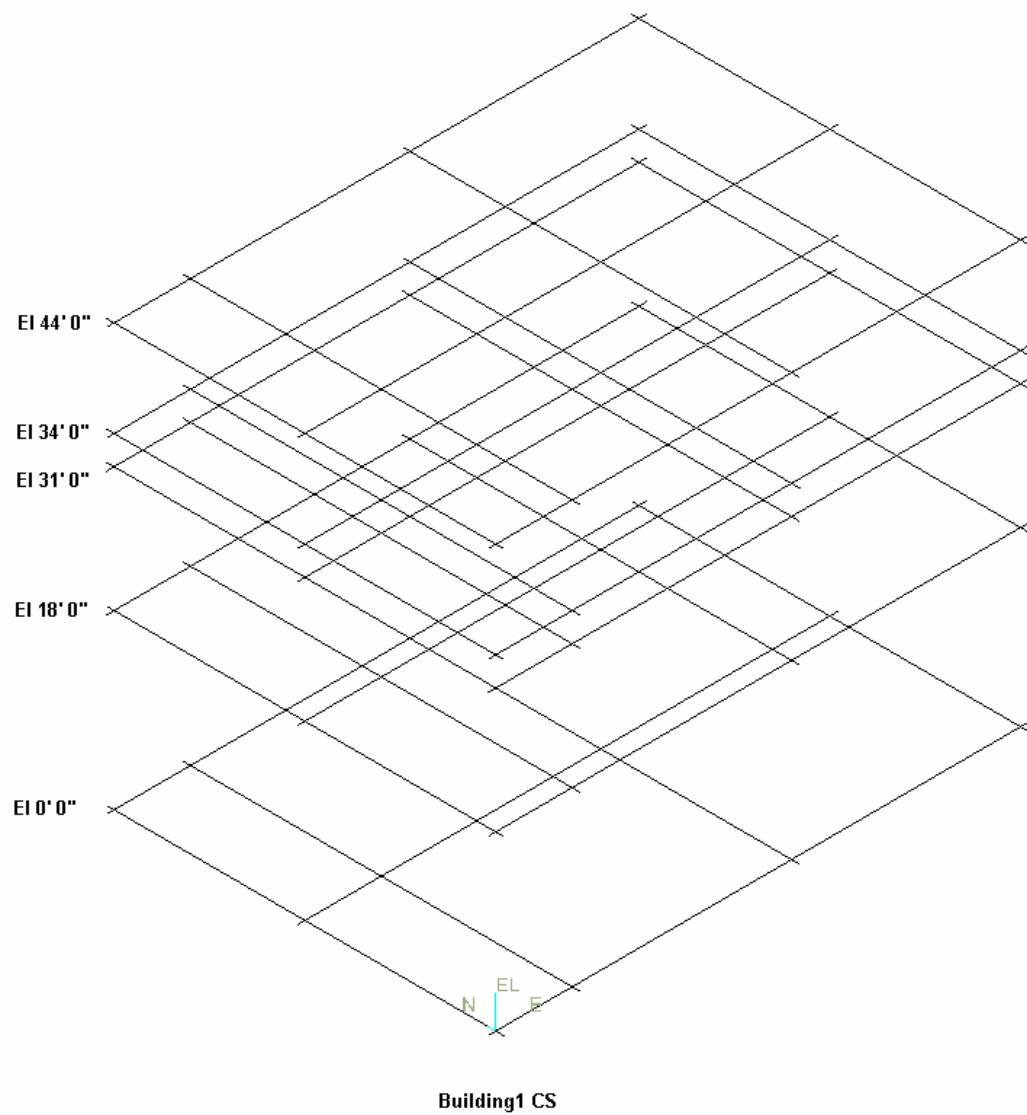
Create Grid Y-Planes

Create new grid planes perpendicular to the Y-axis by selecting an existing start plane and entering the number of copies, spacing, name rule and nesting level. The nesting level may not be necessary if planes have been already been defined.



| Grid Y-plane settings | | | | |
|---|----------------|----------------|---------------|---------------|
| Start plane: | Copies: | Spacing: | End plane: | |
| 0 ft 0.00 in | 2 | 20 ft 0.00 in | 40 ft 0.00 in | |
| Name rule: | Nesting level: | Type: | | |
| Alphanumeric | Primary | E-W Grid Plane | Add | |
| Grid Y-plane locations | | | | |
| | Location | Type | Name | Nesting level |
| 1 | 0 ft 0.00 in | E-W Grid Plane | 1 | Primary |
| 2 | 20 ft 0.00 in | E-W Grid Plane | 2 | Primary |
| 3 | 40 ft 0.00 in | E-W Grid Plane | 3 | Primary |
| <input type="button" value="Delete"/> <input type="button" value="Next"/> <input type="button" value="Previous"/> | | | | |

- 8 Hit next button on Create Radial Cylinder form
- 9 Hit next on Create Radial Plane form
- 10 Hit Finish on Associated Elevation Plane form
- 11 Go to the main menu and select View -> Ruler option to open the ruler dialog box.
- 12 Press the <Control> key and unselect all to turn off the rulers.
- 13 Select the Building 1 CS to open the edit coordinate system ribbon bar.
- 14 Change the Parent System to Coordinate systems
- 15 Your View should now resemble the following graphic.



LAB-2: Editing Grid Planes

Objective

After This Lab Students will be able to edit grid planes, add planes to existing grids / coordinate systems.

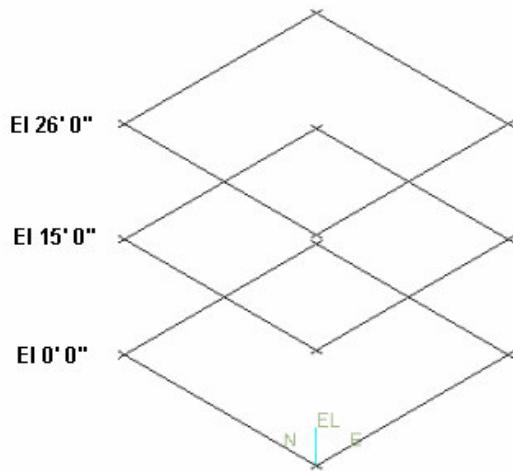
- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Grid Task environment. Make sure the Active Permission Group is set to *Layout*
- 3 Go to the Grid Task environment.
- 4 Placing Elevation Plane: Select the Place Elevation Plane command button from the command toolbar.
- 5 In the Elevation Plane horizontal ribbon bar enter the following parameters:



| | |
|--------------------|--|
| Coordinate System: | Pick the Amines Unit CS |
| Type: | Pick Top of Steel |
| Name: | Open the setting properties page and change the name rule to imperial position |
| Reference: | Origin |
| Copies: | 0 |

- 6 Key-in the offset value and hit <Enter> to commit the transaction
- 7 Offset value: 26 ft
- 8 The system places the elevation plane marker in the Ruler after entering the above parameters. Right mouse click to exit the command.

Your View should now resemble the following graphic.



9 Placing Grid Planes: X-Axis

10 Select the Place Grid Plane command button from the command toolbar

11 In the Grid Plane horizontal ribbon bar enter the following parameters:



Coordinate System: Pick Amines Unit CS

Axis: X

Type: Pick N-S Grid Plane

Reference: Origin

Copies: 1

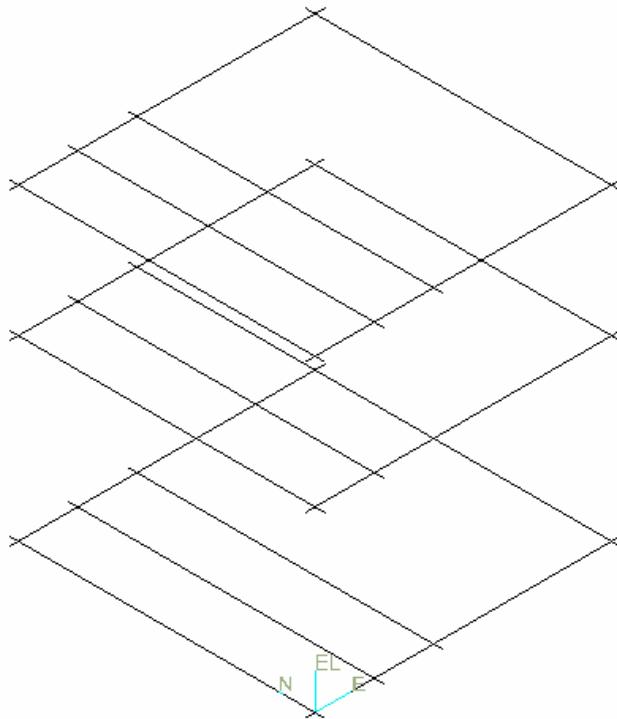
Nesting Level: Primary

Name: Open the setting properties page and change the name rule to Alphanumeric and Percent

12 Key in the offset value and hit <Enter> to commit the transaction

13 Offset value: 5 ft

14 The system places the X-Planes marker in the Ruler and the gridlines. Right mouse click to exit the command.



15 Placing Grid Planes: Y-Axis

16 Select the Place Grid Plane command button from the command toolbar.

17 In the Grid Plane horizontal ribbon bar enter the following parameters:



Coordinate System: Pick Amines Unit CS

Type: Pick E-W Grid Plane

Reference: Origin

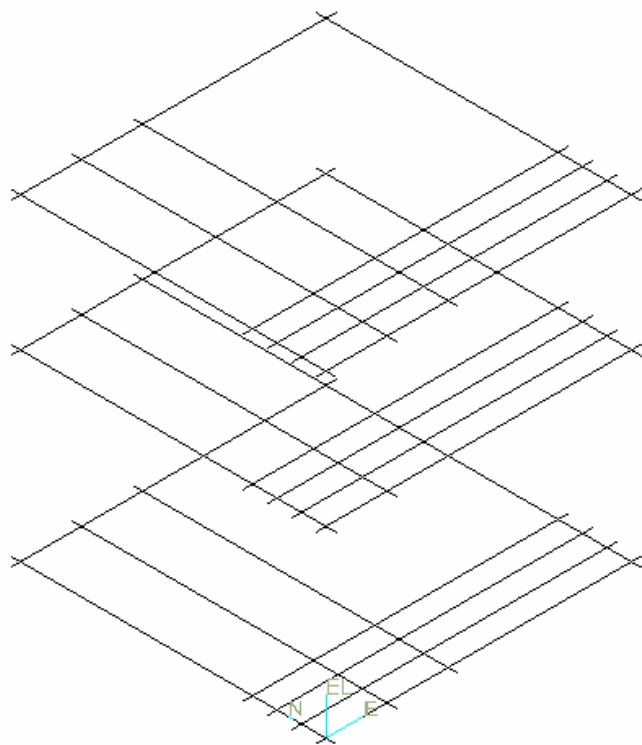
Copies: 2

Nesting Level: Primary

18 Key-in the offset value and hit <Enter> to commit the transaction

19 Offset value: 2 ft

20 The system places the Y-Planes marker in the Ruler and the gridlines. Right mouse click to exit the command



LAB-3: Offshore Coordinate System

- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Grid Task environment. Make sure the Active Permission Group is set to *Layout*
- 3 Go to the Grid Task environment.
- 4 Select the Grid Wizard command
- 5 Using Step 1 in the Grid Wizard command, create a new coordinate system based on the following information:

Name: Offshore CS

Bearing:

Axis for Bearing: North (Y)
Bearing: N 0.00 deg E

Origin:

East (X): -35 ft
North (Y): -30 ft
Up (Z): 0 ft.

- 6 Elevation Planes: Using Step 2 in the Grid Wizard command, create the Elevation Planes based on the following information:

Use Imperial Position as Name Rule

| Step | Start Plane | Copies | Spacing | End Plane | Type |
|------|-------------|--------|------------|------------|-----------------|
| 1 | 0 ft 0 in | 3 | 10 ft 0 in | 30 ft 0 in | Top of Concrete |

- 7 Grid X-Planes: Using Step 3 in the Grid Wizard command, create the Grid-X Planes based on the following information:

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 10 ft 0 in | 10 ft 0 in | Primary | N-S Grid Plane |

Use Alphanumeric and Percent as Name Rule

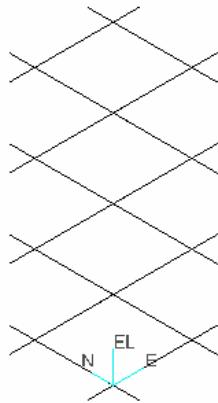
- 8 Grid-Y Planes: Using Step 4 in the Grid Wizard command, create the Grid-Y Planes based on the following information:

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 10 ft 0 in | 10 ft 0 in | Primary | E-W Grid Plane |

Use Alphanumeric and Percent as Name Rule

- 9 Select the Finish Button.

- 10 Turn off all Rulers

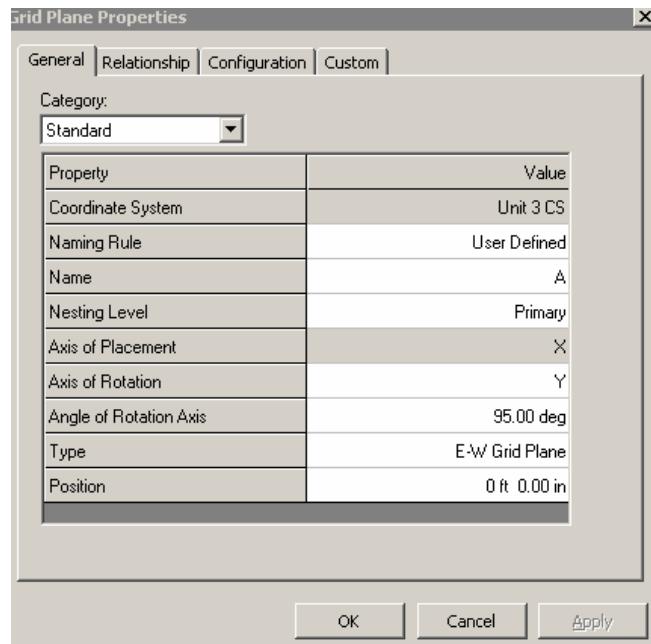


- 11 Select the Grid Plane A to open the Edit Grid Plane ribbon bar

- 12 Select the properties icon to open the properties page

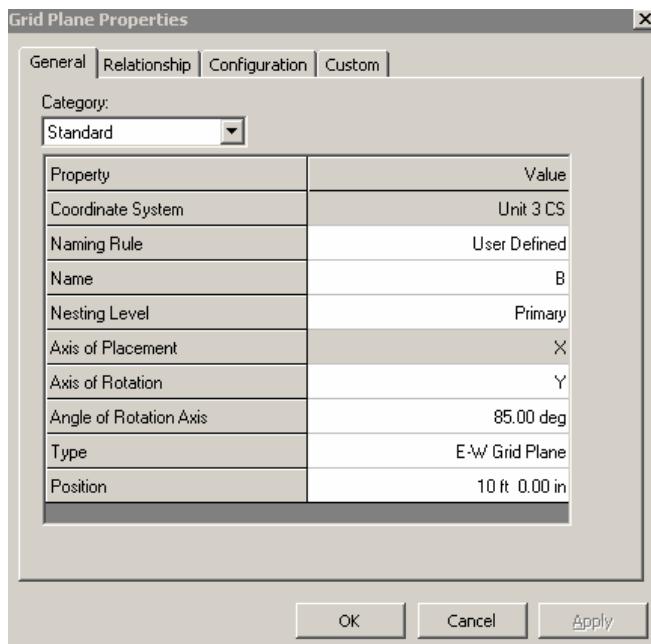
- 13 In the Grid Plane Properties page enter the following parameters:

| | |
|--------------------|----------|
| Axis of Rotation: | Y |
| Angle of Rotation: | 95.0 deg |



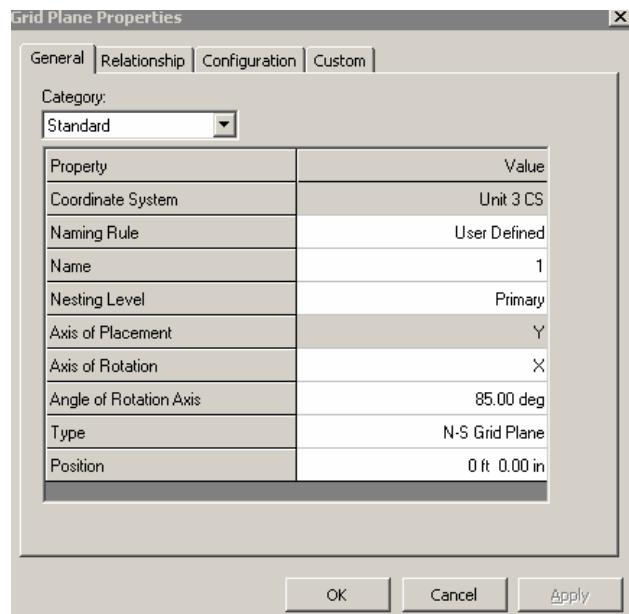
- 14 Hit Apply button to commit the transaction.
- 15 Select the Grid Plane B in the Workspace Explorer
- 16 In the Grid Plane Properties page enter the following parameters:

Axis of Rotation: Y
 Angle of Rotation: 85.0 deg

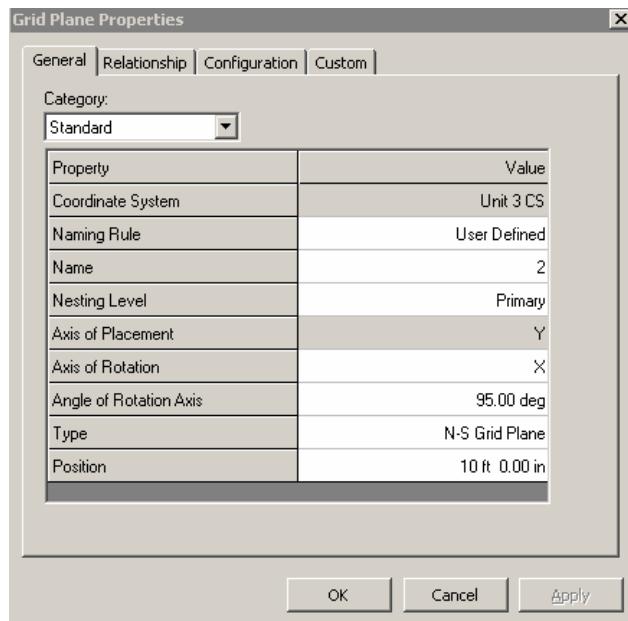


- 17 Hit Apply button to commit the transaction
- 18 Select the Grid Plane 1, in the Workspace Explorer
- 19 In the Grid Plane Properties page enter the following parameters:

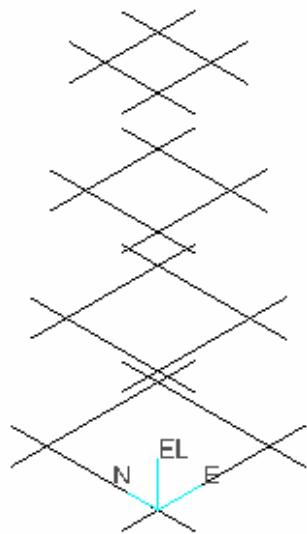
Axis of Rotation: X
Angle of Rotation: 85.0 deg



- 20 Hit Apply button to commit the transaction
 - 21 Select the Grid Plane 2 in the Workspace Explorer
 - 22 In the Grid Plane Properties page enter the following parameters:
- Axis of Rotation: X
Angle of Rotation: 95.0 deg



23 Hit OK button to commit the transaction.



LAB-4: Rotated Grid / Coordinate System

- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Grid Task environment. Make sure the Active Permission Group is set to *Layout*
- 3 Go to the Grid Task environment.
- 4 Select the Grid Wizard command
- 5 Using Step 1 in the Grid Wizard command, create a new coordinate system based on the following information:

Name:

Name: Storage Unit1 CS

Bearing:

Axis for Bearing: North (Y)

Bearing: N 20.00 deg W

Origin:

East (X): 20 ft

North (Y): -30 ft

Up (Z): 0 ft.

- 6 Elevation Planes: Using Step 2 in the Grid Wizard command, create the Elevation Planes based on the following information:

| Step | Start Plane | Copies | Spacing | End Plane | Type |
|------|-------------|--------|------------|------------|--------------|
| 1 | 0 ft 0 in | 1 | 18 ft 0 in | 18 ft 0 in | Top of Steel |

Use Imperial Position as Name Rule

- 7 Grid-X Planes: Using Step 3 in the Grid Wizard command, create the Grid-X Planes based on the following information:

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 10 ft 0 in | 10 ft 0 in | Primary | N-S Grid Plane |

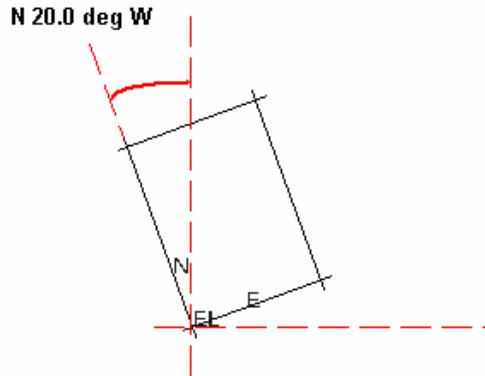
Use Alphanumeric and Percent as Name Rule

- 8 Grid-Y Planes: Using Step 4 in the Grid Wizard command, create the Grid-Y Planes based on the following information:

| Step | Start Plane | Copies | Spacing | End Plane | Nesting Level | Type |
|------|-------------|--------|------------|------------|---------------|----------------|
| 1 | 0ft 0in | 1 | 14 ft 0 in | 14 ft 0 in | Primary | E-W Grid Plane |

In the Grid-Y Plane Locations setting, edit the Name as follows:

- 9 Select the Finish Button.
 10 Your View should now resemble the following graphic.



PLAN VIEW

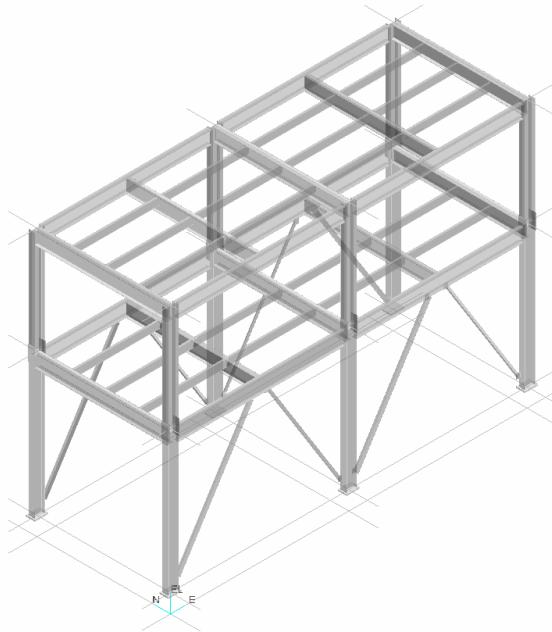
STRUCTURE TASK

LAB-1: Structure Modeling Basics

Objective

After This Lab Students will be able to Place Linear members, Place Member system with Frame connections, use Copy / Paste command, place split and place assembly connections.

Note: Use the grid system to help you place the structural members. Though not absolutely necessary, grids help in the modeling process by providing SmartSketch intersection points at which structural members can be placed. You may also want to make a relationship with gridlines so that if a gridline is moved, everything associated with that gridline will move also.



Placing Columns / Splits / beams

- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Structure Task environment. Make sure the Active Permission Group is set to *Structure*
- 3 Select the place linear member system command. Use the views shown in figure 1 to place the appropriate support columns and beams.
- 4 System displays the place linear member system smart step ribbon bar.
- 5 Use the ribbon bar and set the active member parameters as follows:

| | |
|-----------------|---|
| Connection: | By Rule |
| Type Category: | Column |
| Type: | Column |
| Section Name: | W14x53 |
| Cardinal point: | 5 |
| Angle: | 0 deg |
| System: | Area2->Unit 2 -> Structural -> Columns. |

- 6 Place the first column end at the grid intersections Elevation 2' 1".
- 7 Place the second column end at the grid intersections Elevation 30' 0"
- 8 Repeat the above steps to place the other support column.

Select Place Split command

- 9 Split Status: By Rule
- 10 Select the 18'-0" Elevation Plane in the Workspace Explorer or the Ruler
- 11 Select the members to split and click Finish.
- 12 Choose the Select command and change the Locate Filter to Split Connections. To see the connection highlighted, move your cursor over the split
- 13 Select Place Member Command
- 14 For Beams use the Ribbon Bar to set active properties as

| | |
|----------------|---------|
| Connection: | By Rule |
| Type Category: | Beam |

Type: Beam
 Section Name: W18x40
 Cardinal point: 8
 Angle: 0 deg
 System: Area2->Unit 2 -> Structural -> Beams.

Note: The next step is to place the first two beams at elevation 18 ft and elevation 0 ft. Beams are placed by selecting and lock constraint on to the column and then locate point-on any grid line passing through that column. Beams can also be placed by selecting Frame connection of Supporting members.

15 Place Beams at Elevation 18' and 30'

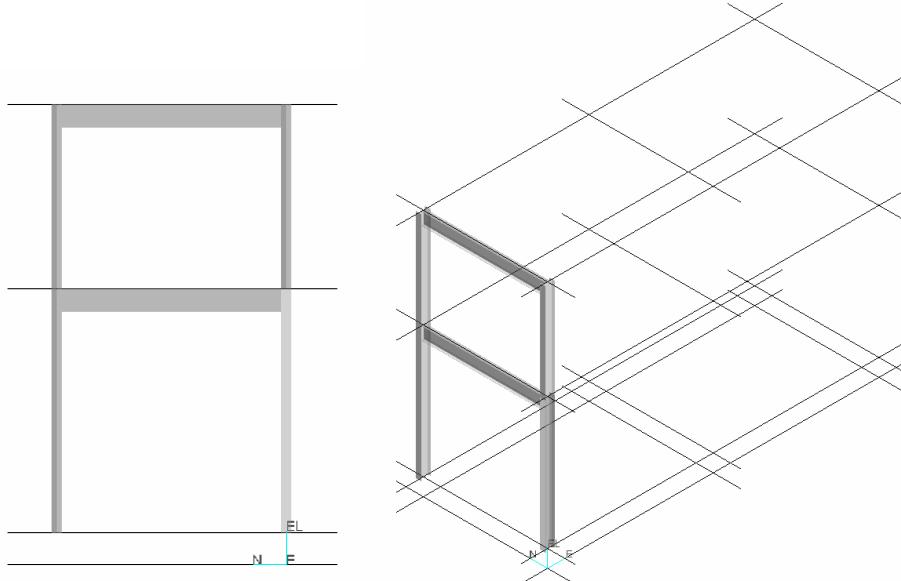


Figure 1 – Elevation and Isometric View of the Structure Unit 2 System

16 Set the select filter to Member System

17 Select all the members

18 Select Copy

19 Select paste

20 Re-establish all the relationship with East Plane locations 20' 0" and 40' 0". See figure 2. Make sure to select the appropriate objects to re-establish the connection in the Paste Special Dialog box.

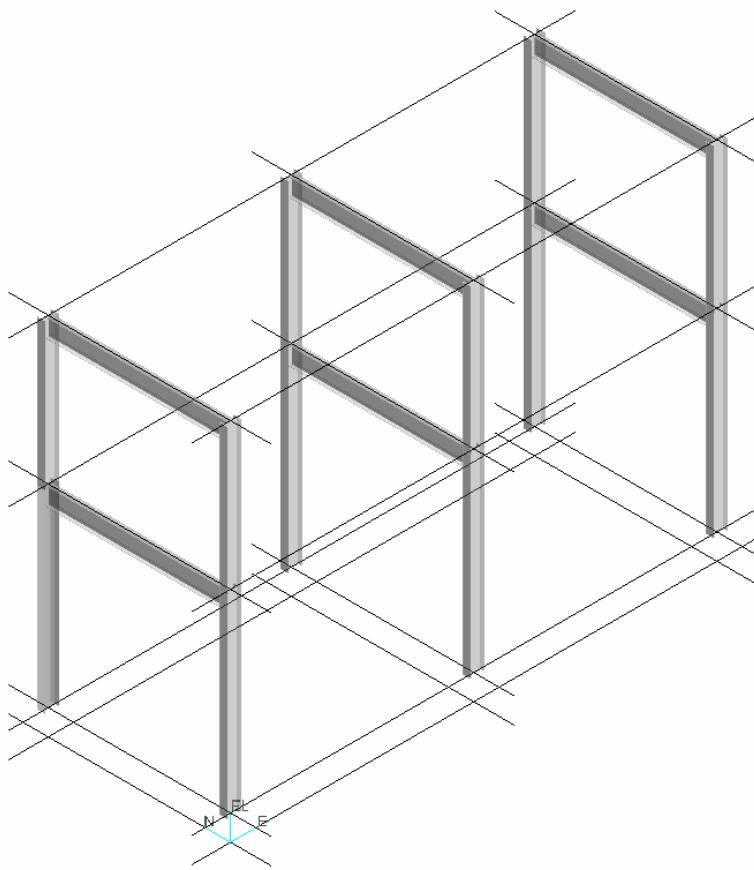
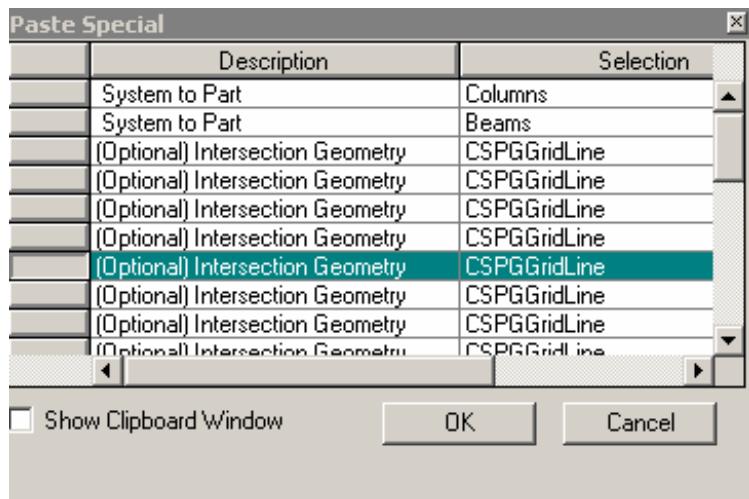


Figure 2 –Isometric View of the Structure Unit 2 System

Placing Perimeter Beams:

- 21 Select Place member command to place beams as shown in figure 3. Use following properties for perimeter beams:

Connection: By Rule
Type Category: Beam
Type: Beam
Section Name: W18x40
Cardinal point: 8
Angle: 0 deg
System: Area2->Unit 2 -> Structural -> Beams.

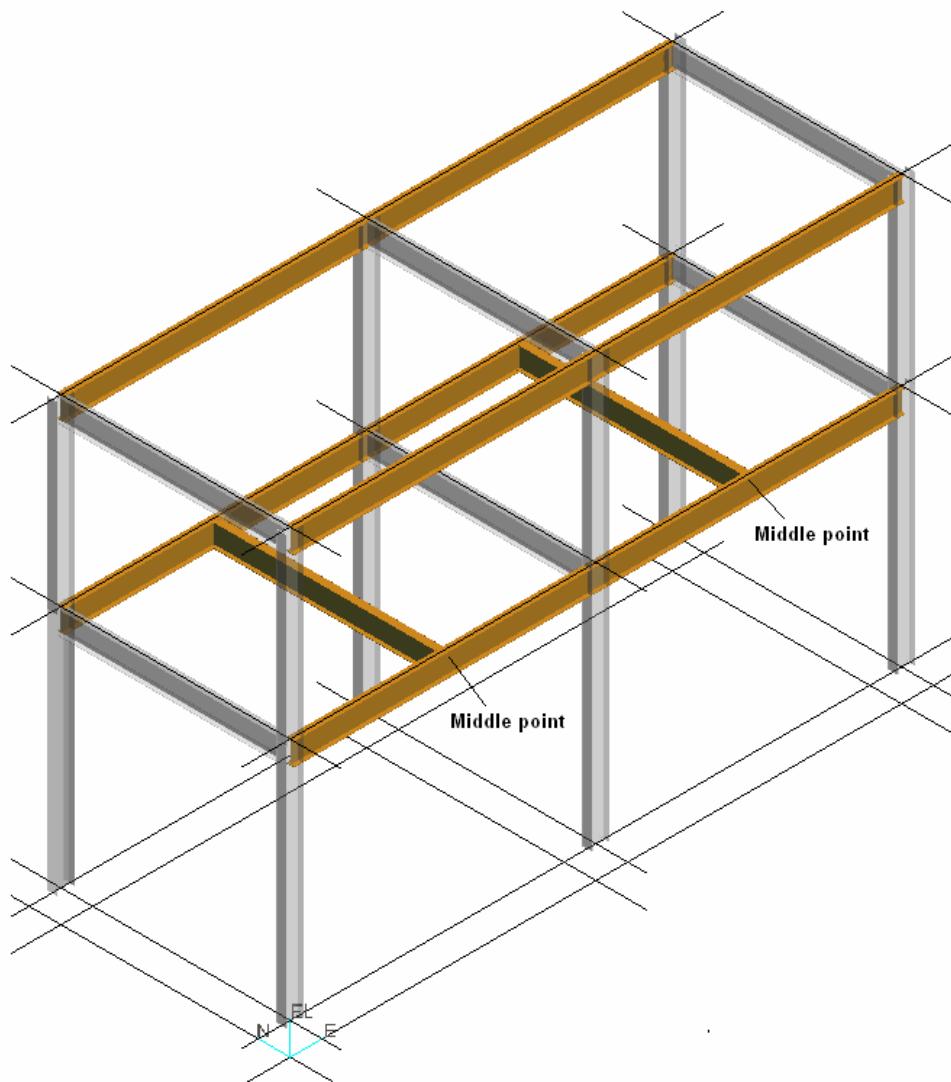


Figure 3 –Isometric View of the Structure Unit 2 System

Placing Intermediate Beams for the first floor frame

- 22 Select the place framing member command. Use the view shown in Figure 4 to place the structural members.
- 23 Use the Place Framing Member ribbon bar to set the active member parameters as follows:

| | |
|-----------------|--|
| Fit Mode: | By Count |
| Count: | 3 |
| Connection: | By Rule |
| Type Category: | Beam |
| Type: | Beam |
| Section Name: | C10x15.3 |
| Cardinal point: | 8 |
| Angle: | 0 deg |
| System: | Area2->Unit 2 -> Structural -> Horizontal Braces |

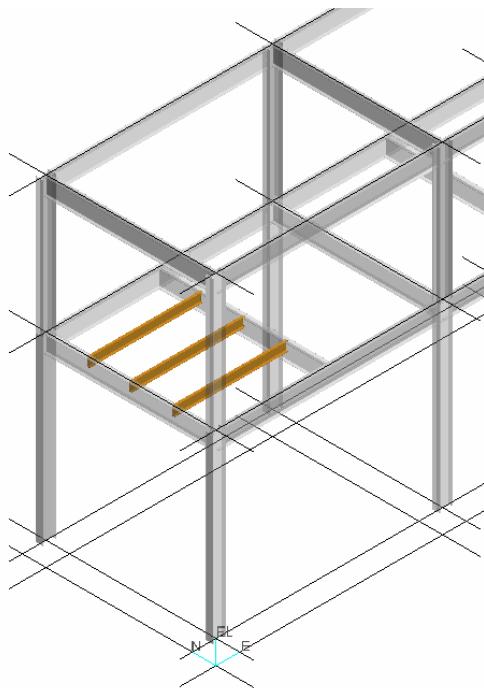


Figure 4 –Isometric View of the Structure Unit 2 System

- 24 Continue using the Place Framing Members command by selecting Supporting Member2 to place framing members as shown in Figure 5.

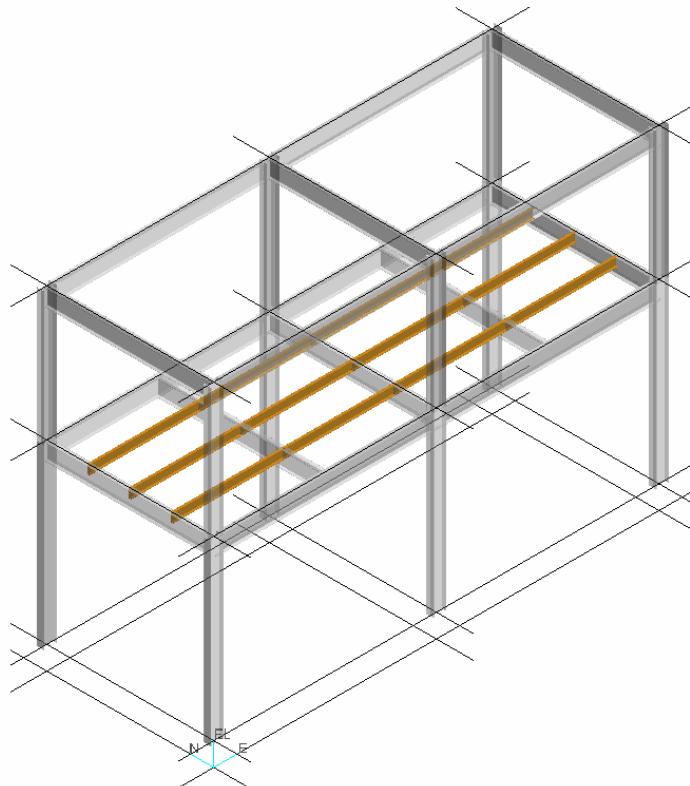


Figure 5 –Isometric View of the Structure Unit 2 System

Intermediate Beams for the second floor frame

- 25 To place the intermediate beams for the second floor frame at elevation 30 ft, Use the Copy/Paste command to place all the intermediate members for the first floor frame at elevation 30 ft. See Figure 6. Make sure to select the appropriate objects to re-establish the connection in the Paste Special Dialog box.

Hint: Set the select filter to Member System to select 14 members.
Only 7 related object need to re-establish the connections.
Use the Paste command once.

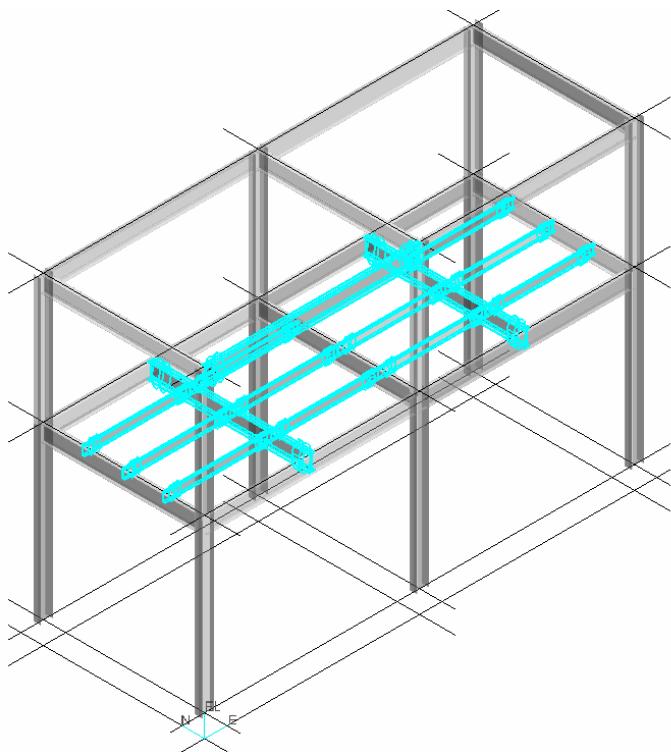
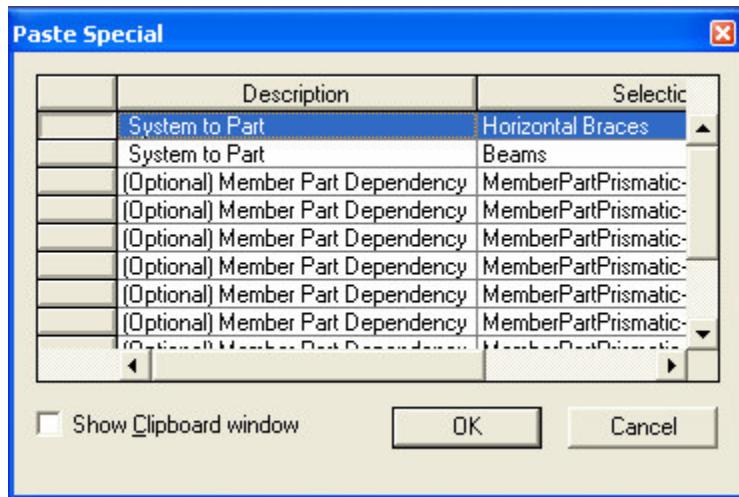
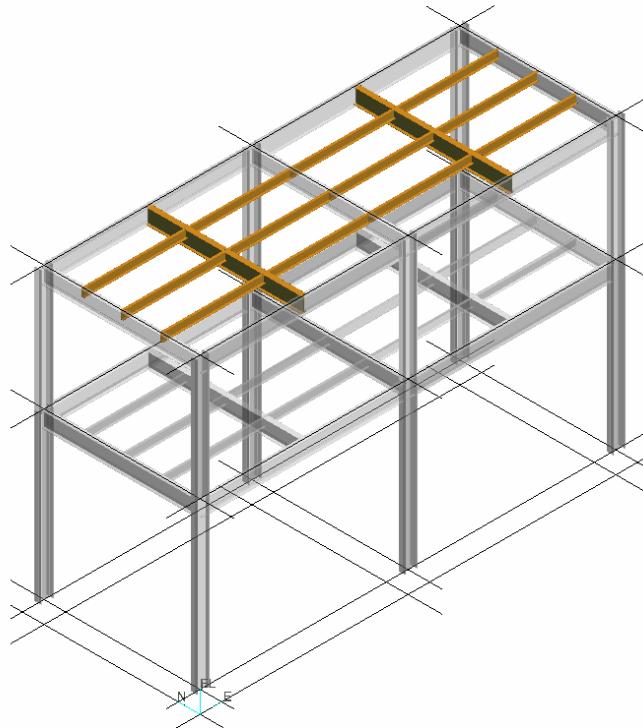


Figure 6 –Isometric View of the Structure Unit 2 System

Your View should now resemble the following graphic:



Placing Vertical Braces

- 26 Select the Place Bracing command.
- 27 Use the Place Bracing ribbon bar to set the active member parameters as follows:

| | |
|----------------|---|
| Bracing Type: | Chevron |
| Connection: | By Rule |
| Type Category: | Brace |
| Type: | Vertical Braces |
| Section Name: | L4x4x1/4 |
| Cardinal point | 5 |
| Angle: | 0 deg |
| System: | Area2->Unit 2 -> Structural ->Vertical Braces |

- 28 Select the first column (as in figure 7)

- 29 Select the second column

- 30 Select the Beam

31 Select Finish

32 Place all vertical braces shown in figure 7

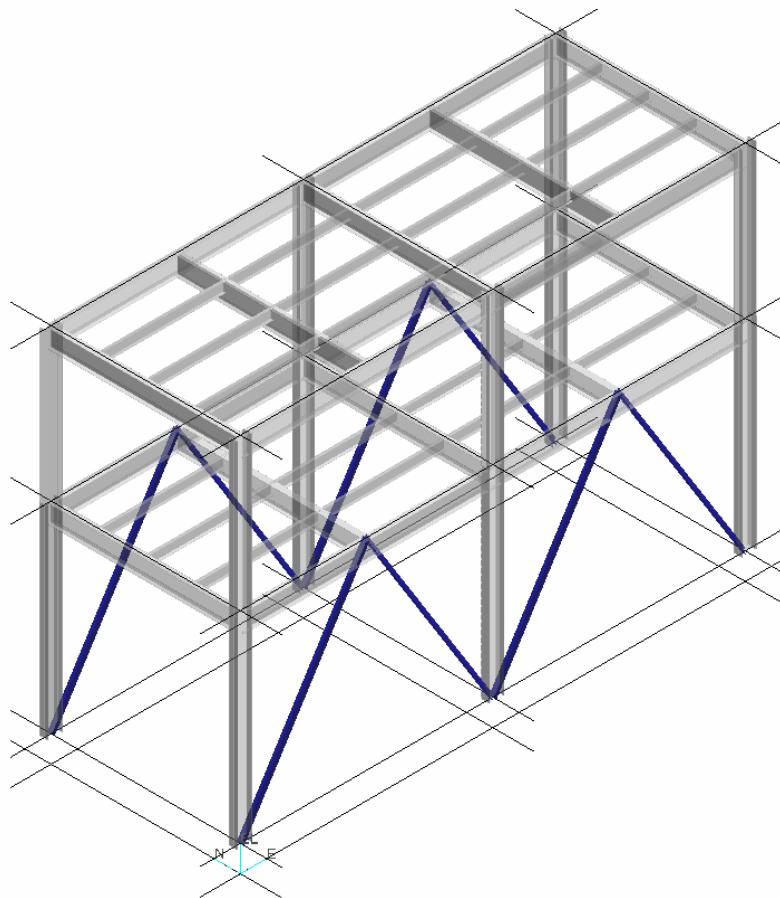
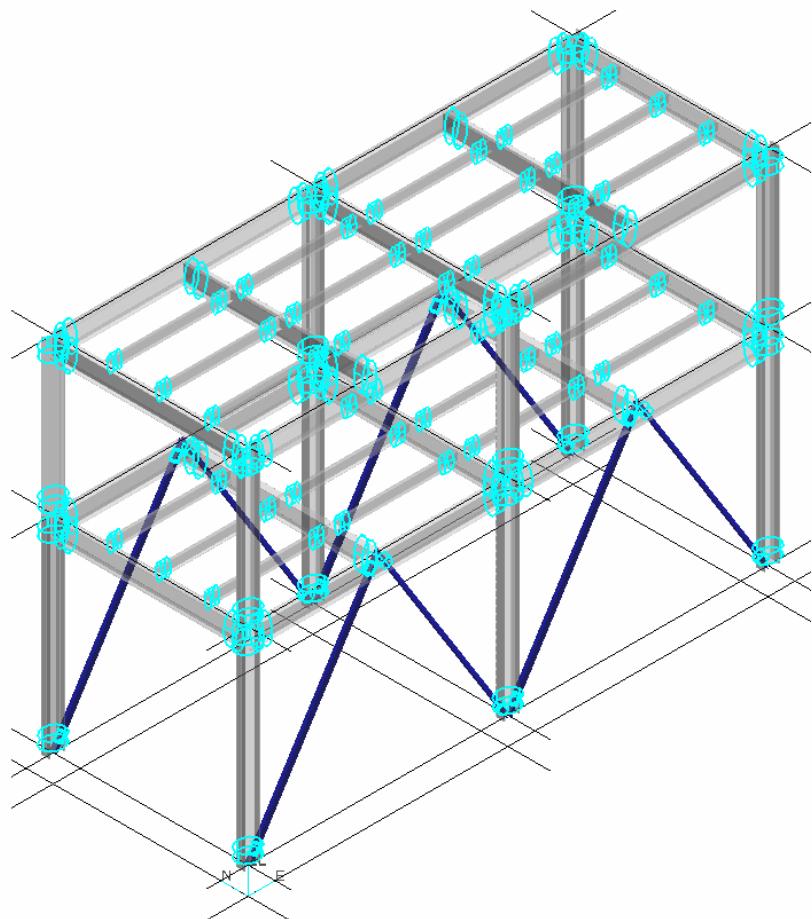


Figure 7 –Isometric View of the Structure Unit 2 System

Placing Assembly Connections

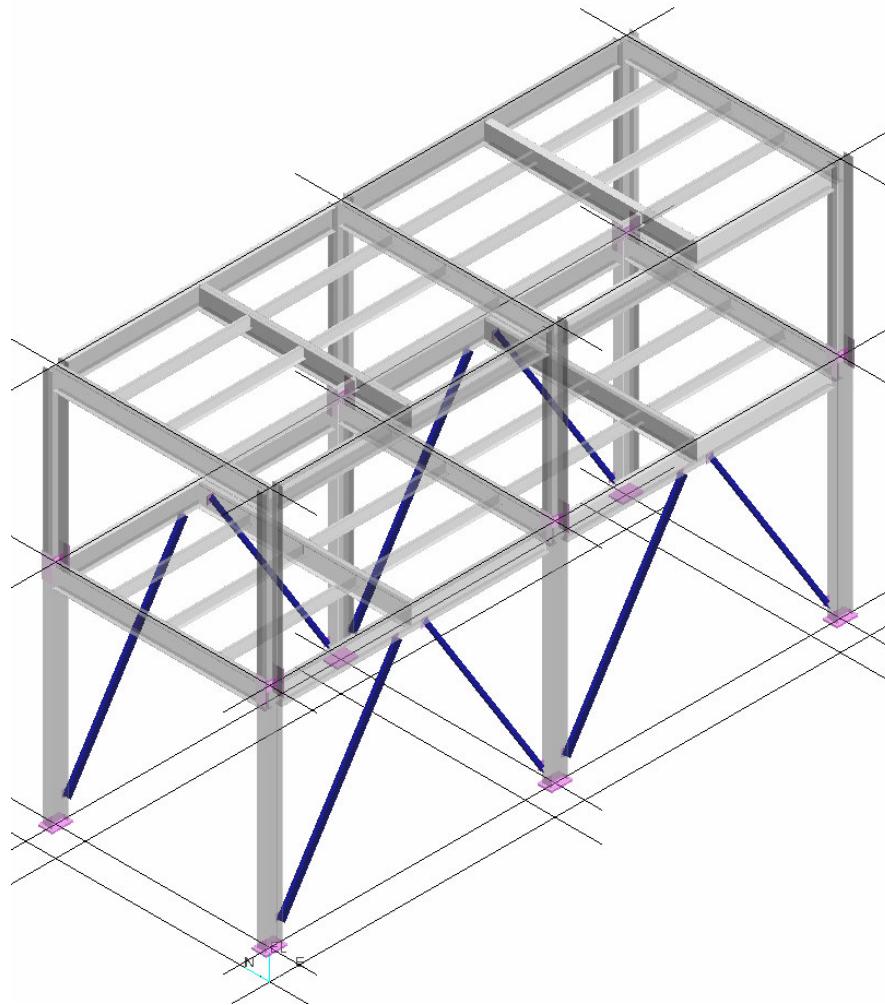
- 33 Set the select filter to Frame Connections and use the select fence option to select all frame connections located in the building
- 34 Select the Assembly connection command to open the ribbon bar
- 35 Make sure the check box by rule is checked
- 36 Place all assembly connections in System: Area2->Unit 2 -> Structural -> Assembly Connections
- 37 Select Accept command

38 Select Finish

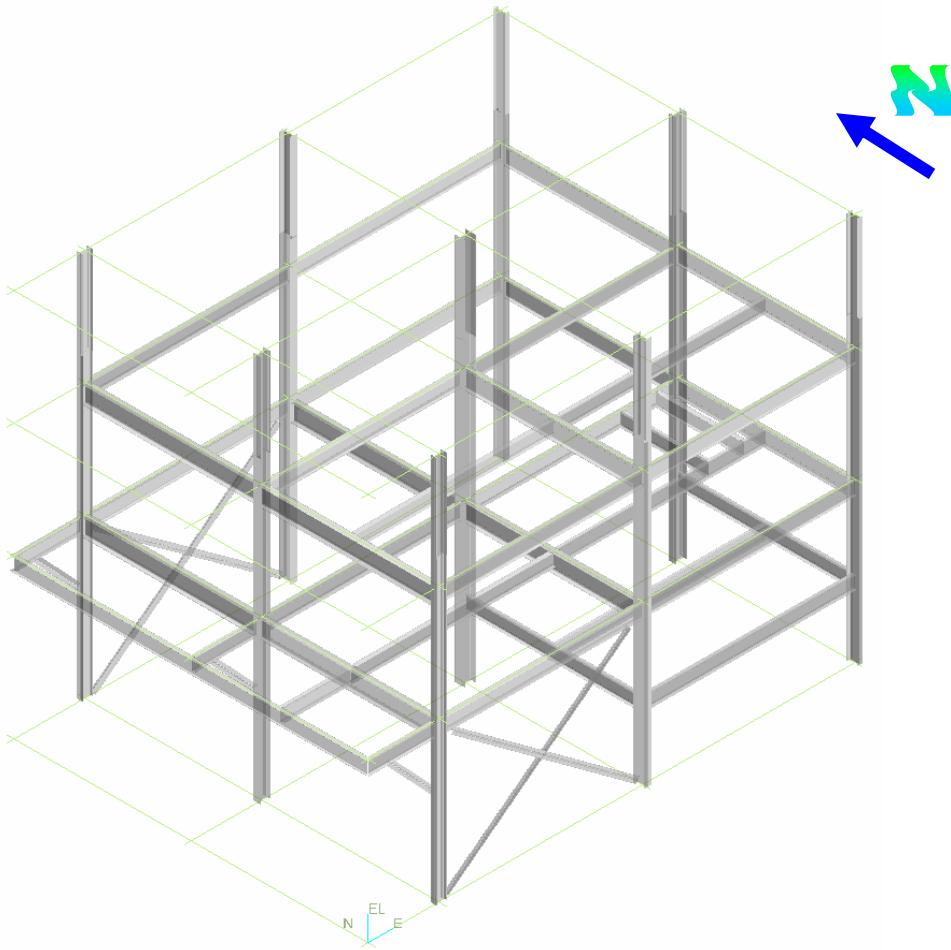


39 Verify all assembly connections are properly created.

Your View should now resemble the following graphic:



LAB-2: Structure Modeling Basics (Building 1)



Part I: Columns

- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Structure Task environment
- 3 Select the place linear member command. Use the Floor Plan shown in Figure 1 and Figure 2 to place the appropriate support columns
- 4 System displays the place linear member smart step ribbon bar.

5 Use the ribbon bar and set the active member parameters as follows:

| | |
|-----------------|---|
| Connection: | By Rule |
| Type Category: | Column |
| Type: | Column |
| Cardinal point: | 5 |
| System: | Area2->Building 1 -> Structural -> First Floor -> Columns |
| System | |

6 Place the starting point for column end at the grid intersections Elevation 0'-0".

7 Place the second point for column end at the grid intersections Elevation 44'-0".
Place all support columns as shown in Figure 1.

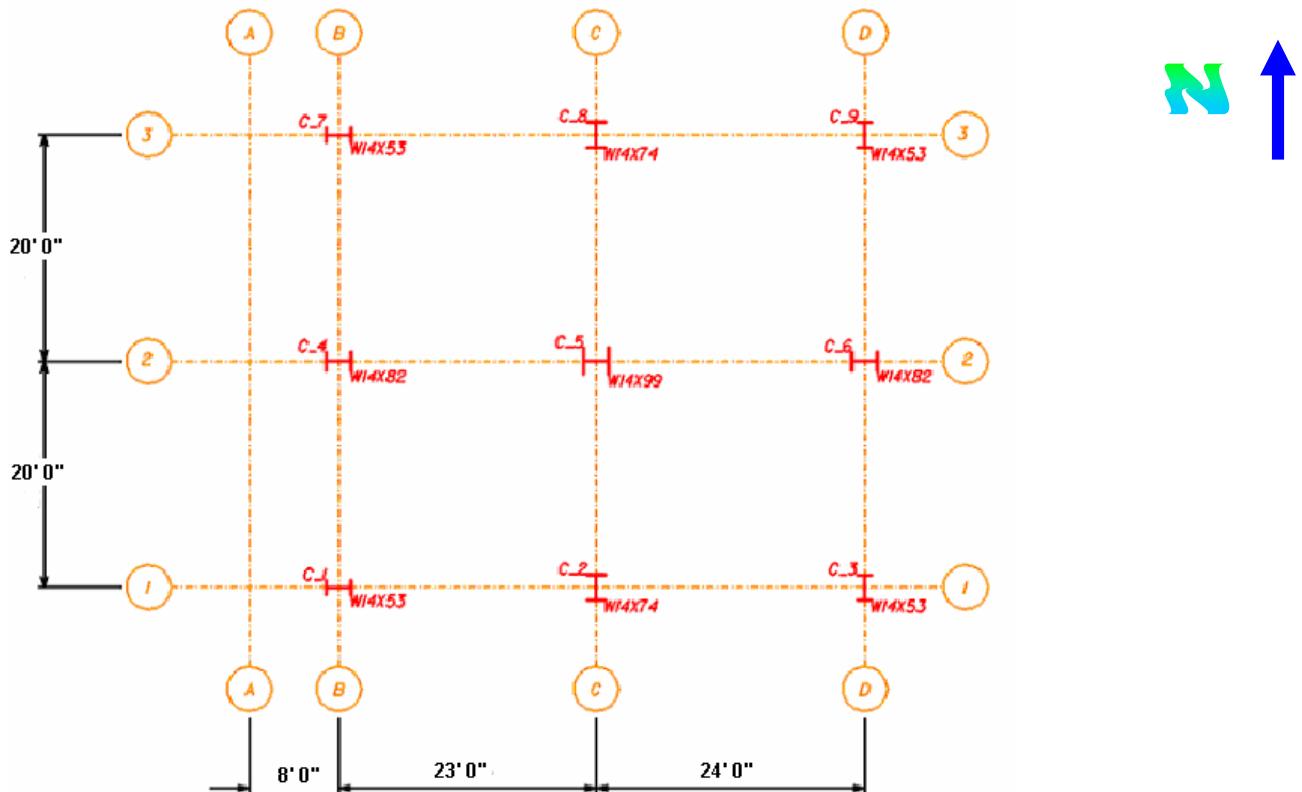


Figure 1 - Floor Plan

- 8 Create a split connection at elevation 34'-0".
- 9 Figure 2 shows Frame and Split connections highlighted.

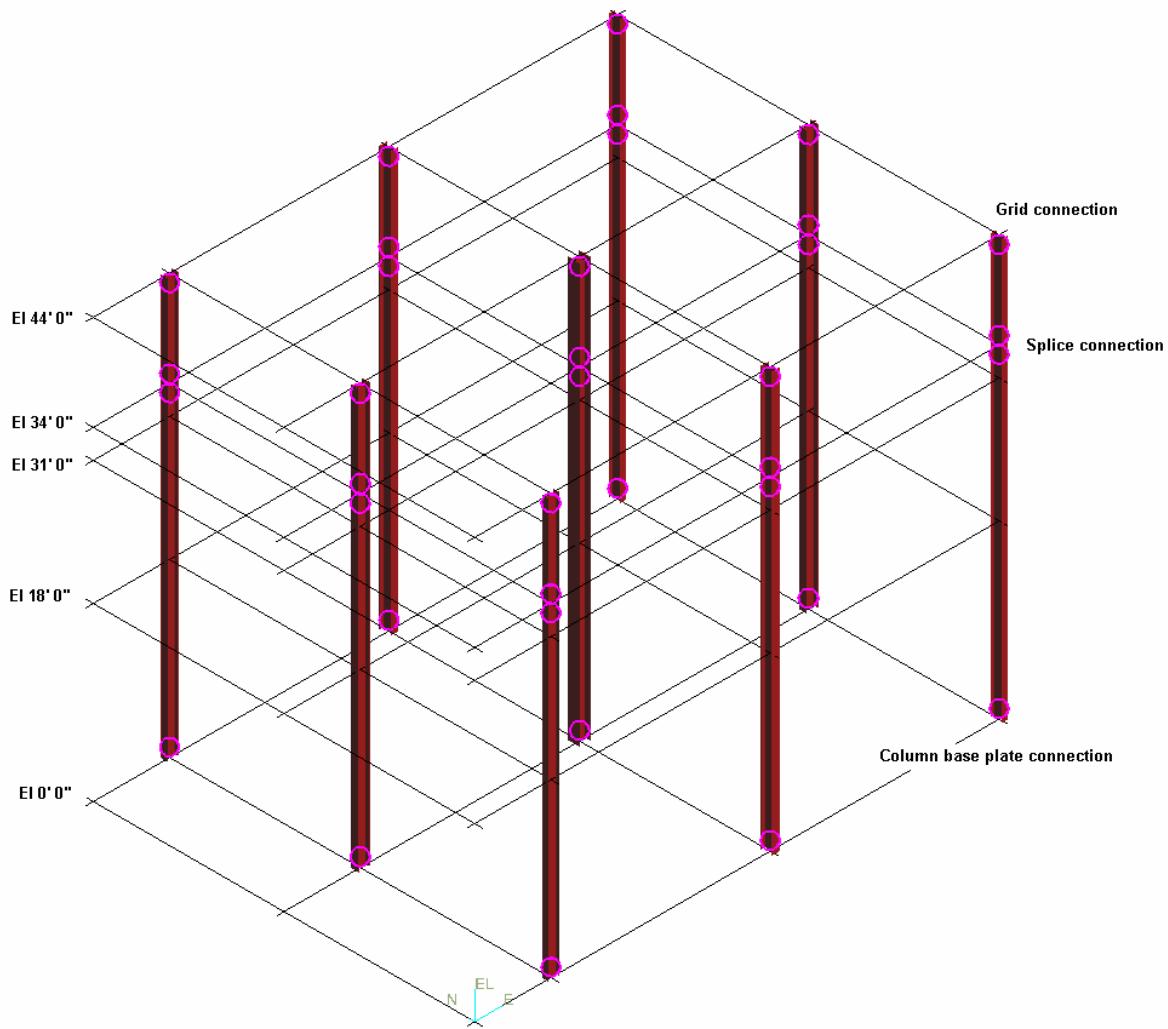


Figure 2 - Support Columns for the Two-Story Building

Part II: First Floor Frame

- 10 Select the Place Linear Member command.

- 11 Set the following parameters for Beams

Connection: By Rule
Type Category: Beam
Type: Beam
Cardinal Point: 8
System: Area2->Building1 -> Structural ->First Floor -> Beam System.

- 12 Place all intermediate frame members in the Area2->Building1 -> Structural ->First Floor -> Horizontal Braces.

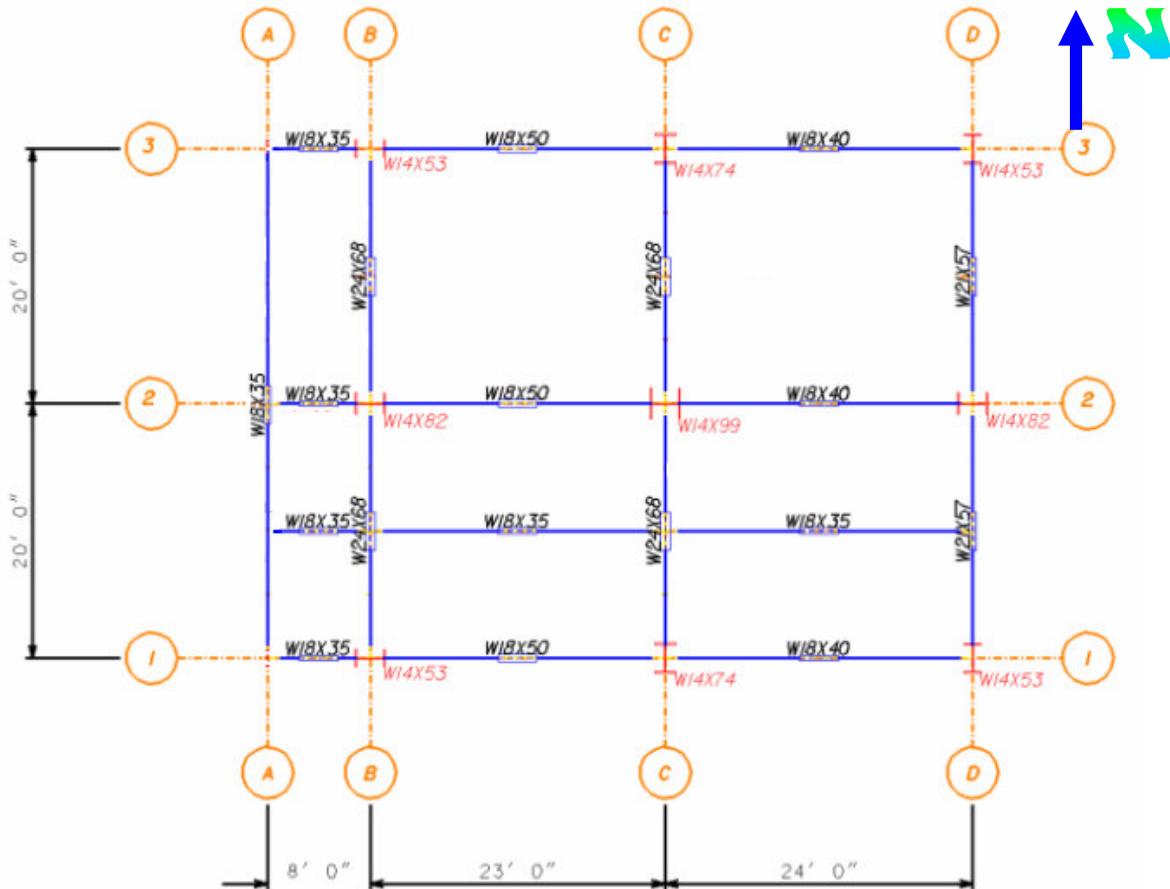


Figure 3 – First Floor Plan

Web/Flange connections should be created between at the intersection of the columns. See Figure 4.

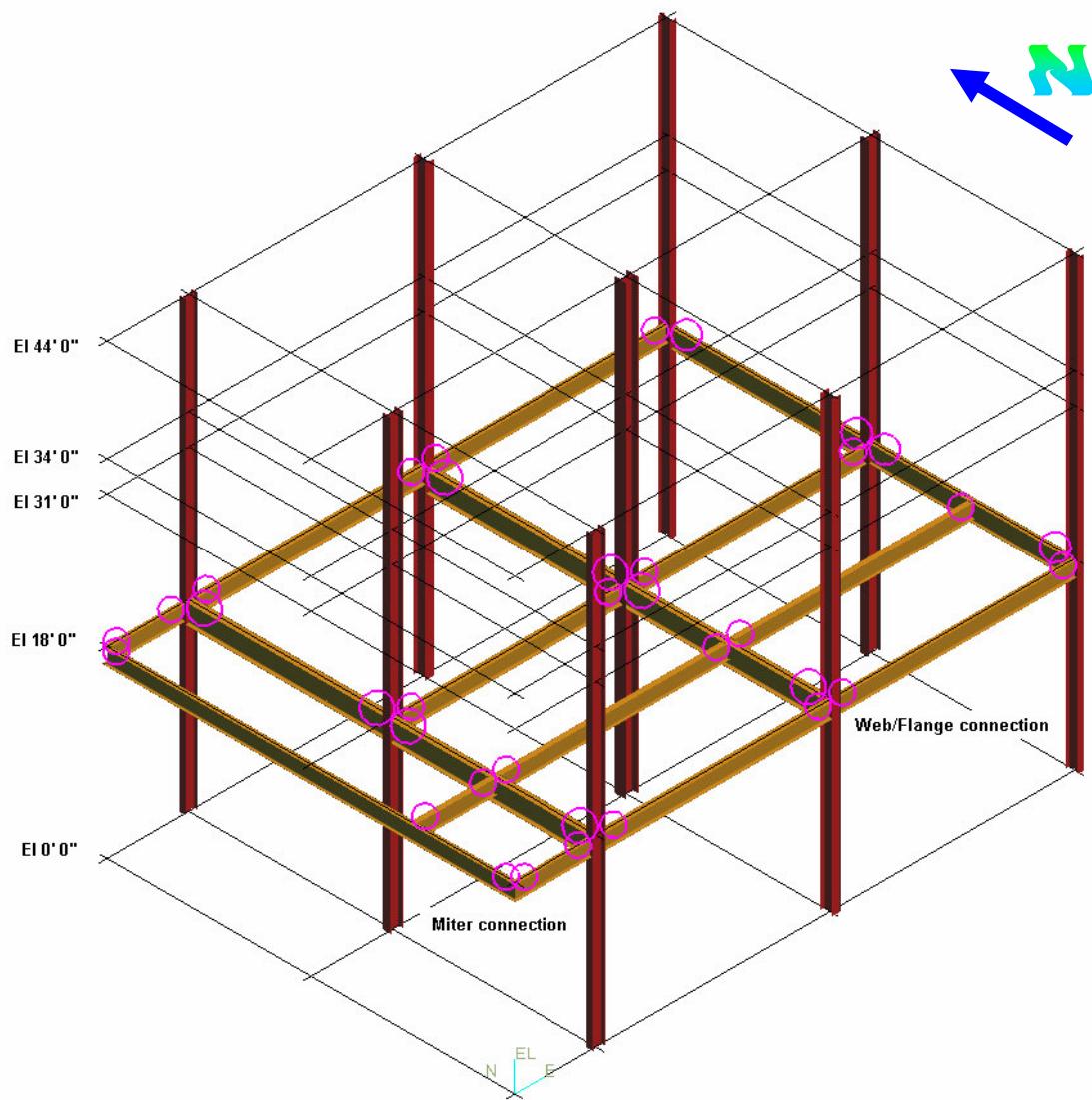


Figure 4 – Iso View of the First Floor Frame

Part III: Second Floor Frame

- 13 Select the place linear member command.
- 14 Use the Second Floor Plan as shown in Figure 5 to place the structural members at elevation 31'
- 15 Set the active member parameters as follows

| | |
|-----------------|---|
| Connection: | By Rule |
| Type Category: | Beam |
| Type: | Beam |
| Cardinal point: | 8 |
| System: | Place all girders in the Building1 -> Structural ->Second Floor -> Beam System. |
- 16 Place all intermediate frame members in the Area2->Building1 -> Structural -> Second Floor -> Horizontal Braces.

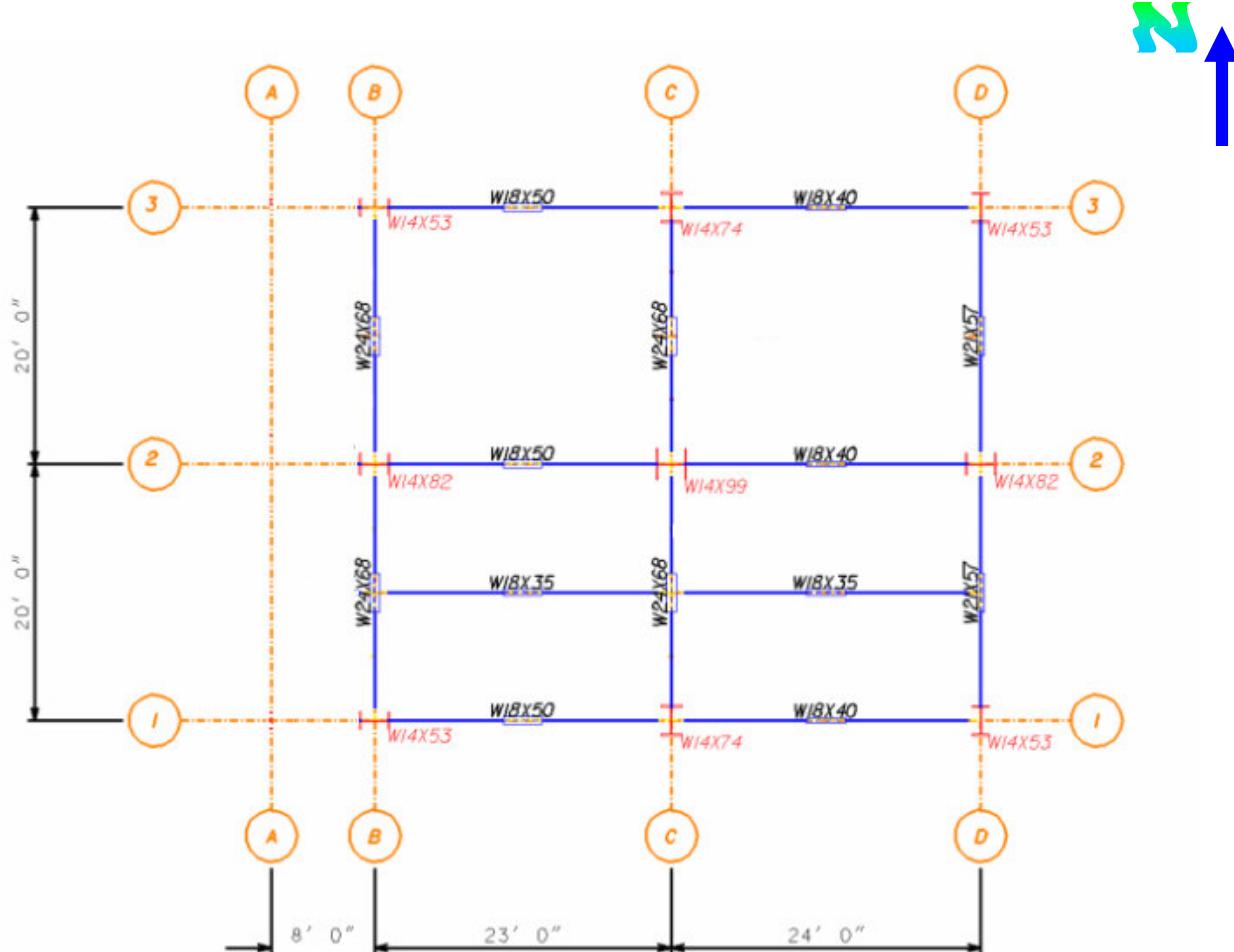


Figure 5 – Second Floor Plan

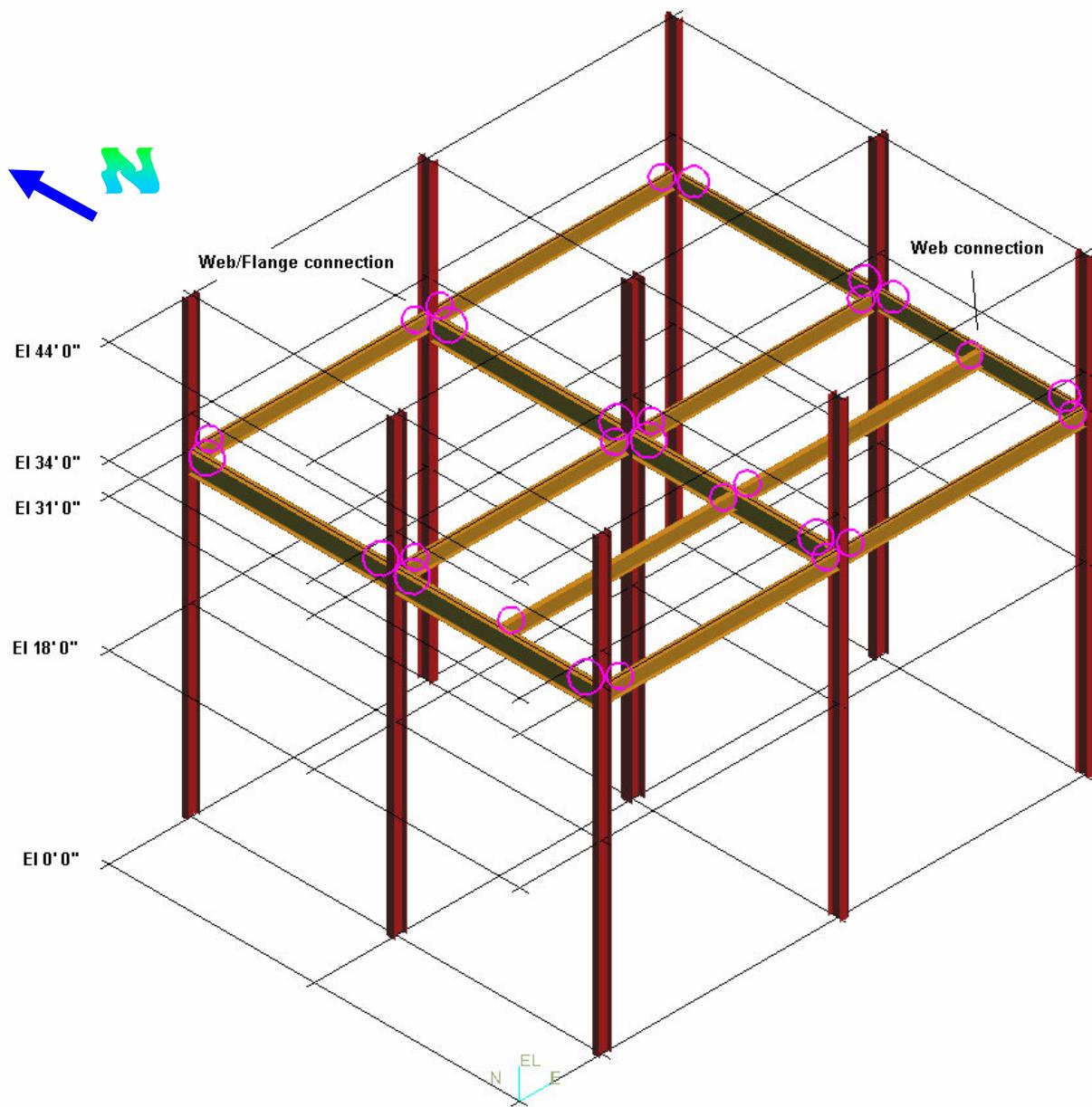
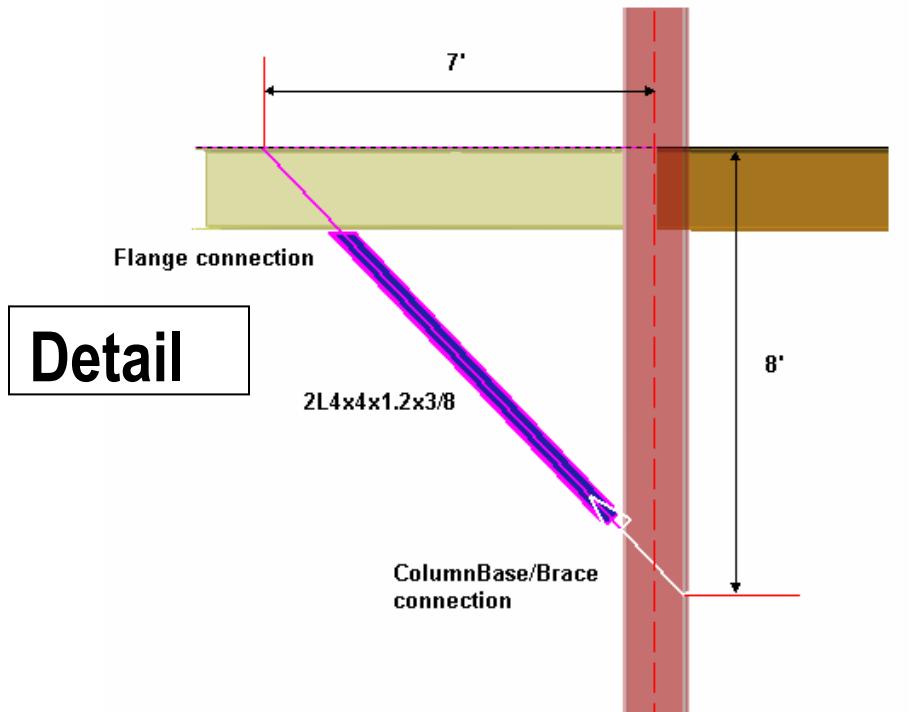


Figure 6 – Iso View of the Second Floor Frame

Part IV: Vertical Braces

- 17 Select the place linear member command
- 18 Use Pinpoint to place Vertical bracing at a given distance
- 19 Use Place Bracing Command to place cross bracing (Bracing Type set to Vertical Braces)
- 20 Set the parameters as

| | |
|----------------|---|
| Connection: | By Rule |
| Type Category: | Brace |
| Type: | Vertical Brace |
| Cardinal point | 5 |
| System: | Place all vertical braces in the Area2->Building1 -> Structural ->First Floor -> Vertical Braces. |



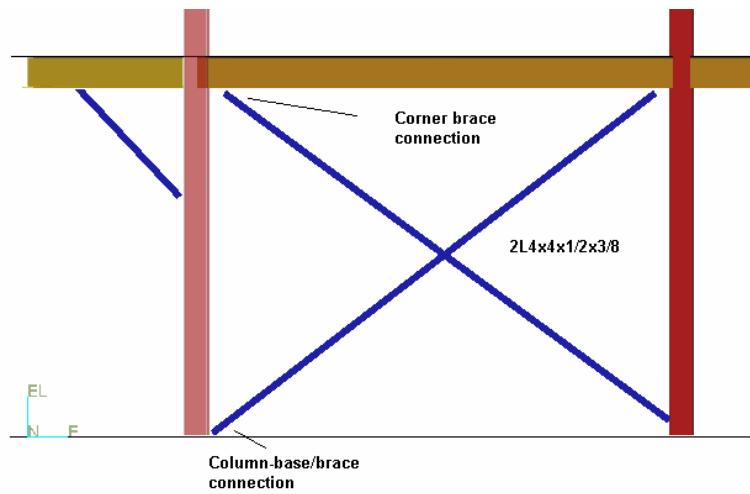


Figure 7 – North View of the Two-Story Building

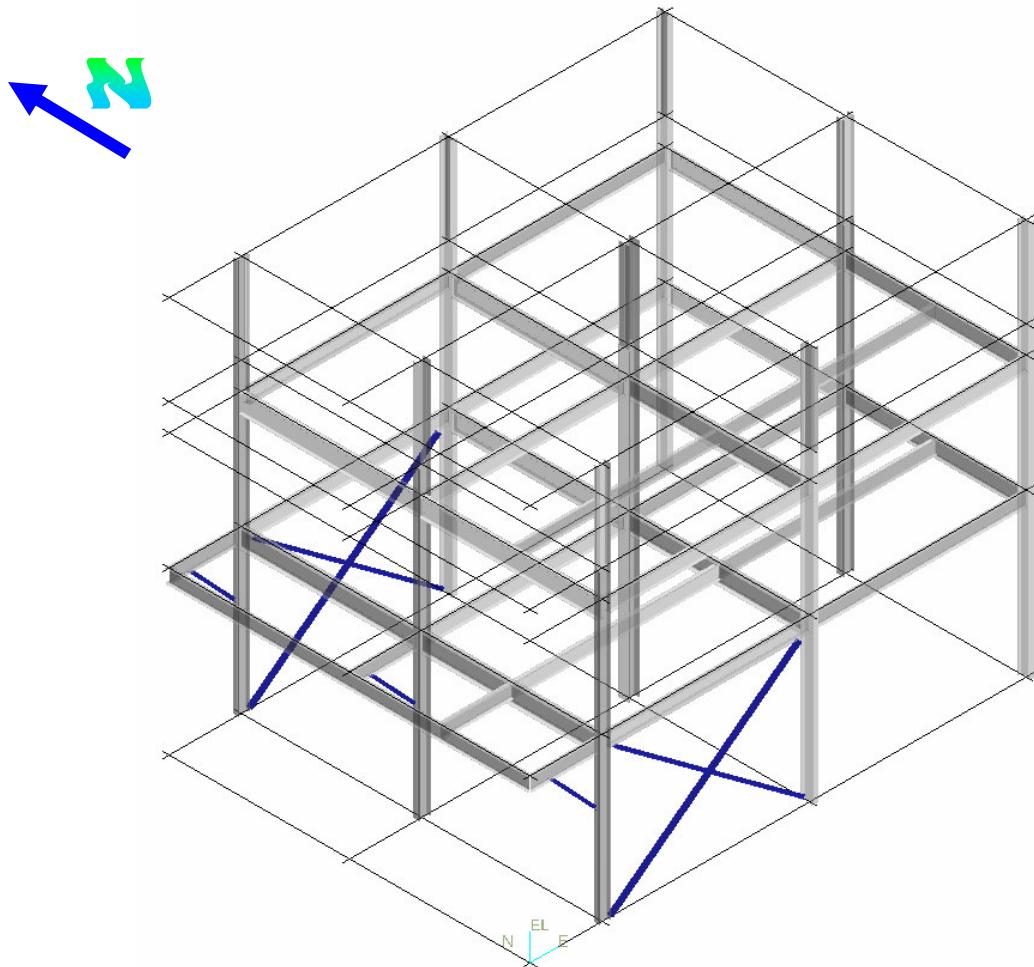


Figure 8 – ISO View of the Two-Story Building

Part V: Horizontal Braces

- 21 Select the place linear member command
- 22 Place two horizontal beams on the first floor frame as shown in Figure 9
- 23 Use the place linear member ribbon bar to set the active member parameters as follows:

Connection: By Rule
 Type Category: Beam
 Type: Beam
 Cardinal point 8
 System: Place the two horizontal beams in the Area2->Building 1 ->
 Structural ->First Floor-> Horizontal Braces.

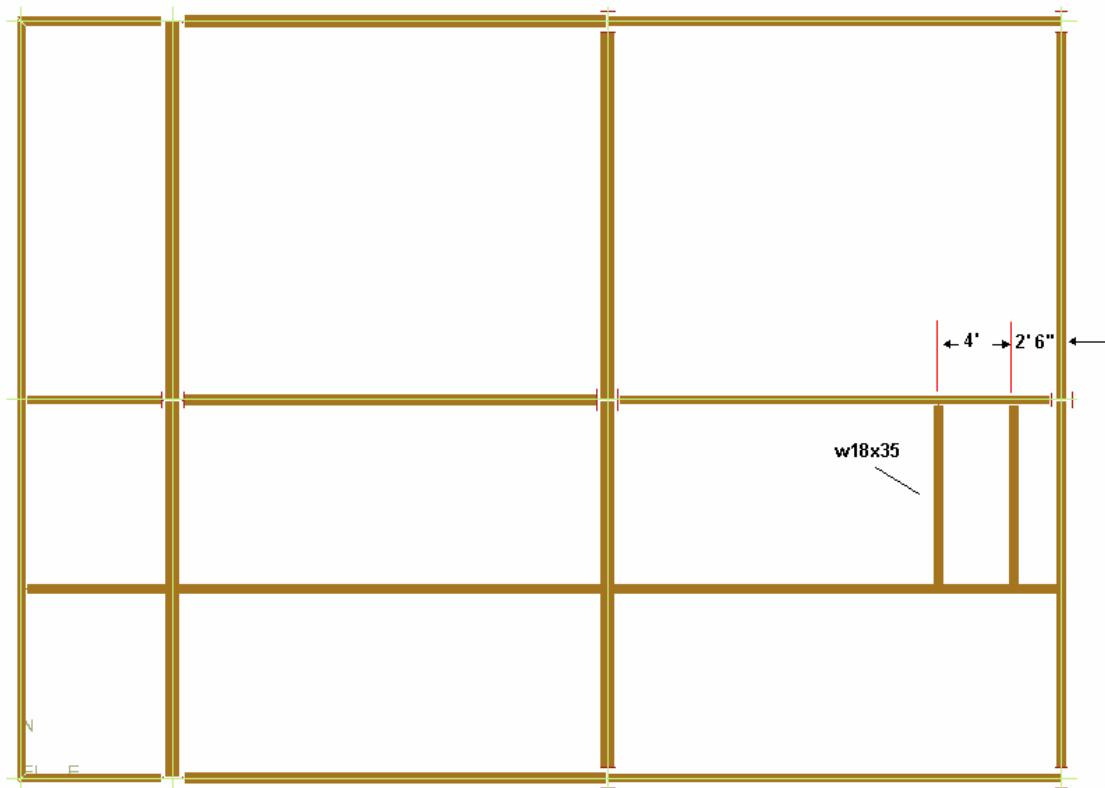


Figure 9 – First Floor Frame El –18' 0"

Part VI: Horizontal Beams on the Far-East Bay

- 24 Select the place linear member command.
- 25 Place three horizontal beams on the far-east bay of the building as shown in Figure 10.
- 26 Use the place linear member ribbon bar to set the active member parameters as follows:

| | |
|----------------|--|
| Connection: | By Rule |
| Type Category: | Beam |
| Type: | Beam |
| Cardinal point | 8 |
| System: | Place the three horizontal beams in the Area2->Building 1 -> Structural ->First Floor ->Horizontal Braces. |

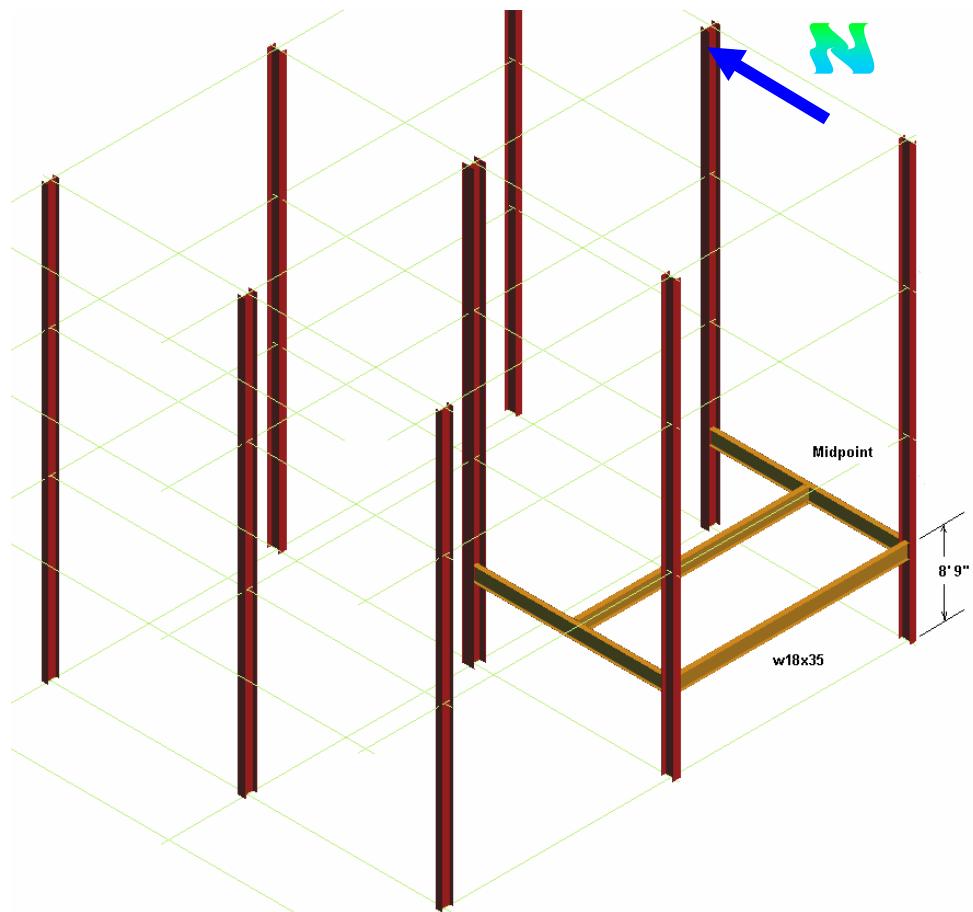


Figure 10 – ISO View of the Two-Story Building

LAB-3: Slabs

Objective

After This Lab Students will be able to Place Slabs using different Options

- 1 Select the place slab command
- 2 Select the Elevation Plane at 18' 0" for the support plane
- 3 Select the boundaries as shown in Figure 11 to define the edges of the slab
- 4 Use the place slab ribbon bar to set the active slab placement parameters.

| | |
|---------------------|--|
| Plane Method: | Coincident |
| Slab Type: | 4" Elevated slab - Composite |
| Composition: | 4" _Slab, 1.5VL22 |
| Face Position: | Bottom |
| Priority: | Primary |
| Boundaries Offsets: | none |
| System: | Place the slab in the Area2->Building1 -> Structural ->First Floor -> Slab System. |

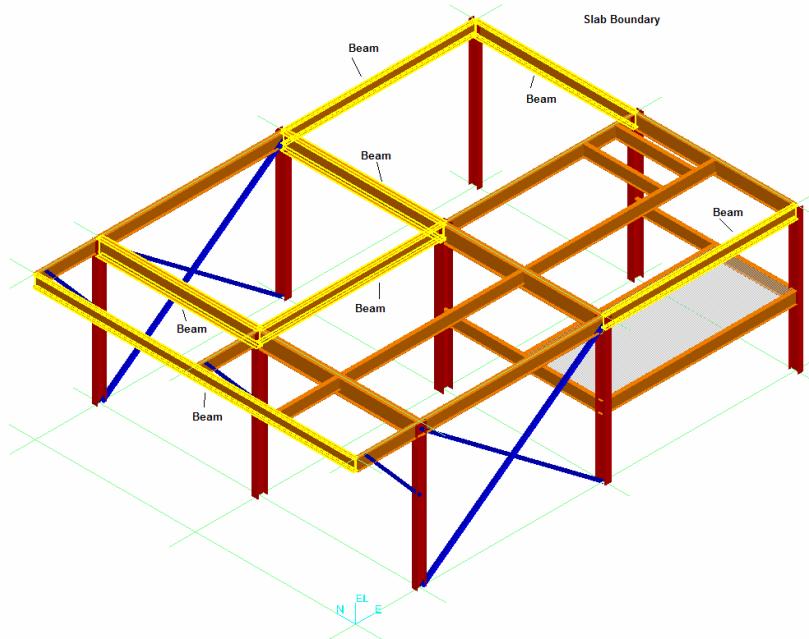


Figure 11 – ISO View of the First Floor Frame

Part II: Place Slab on Second Floor:

- 1 Select the place slab command
- 2 Select the Elevation Plane at 31' 0" for the support plane
- 3 Select the boundaries as shown in Figure 12 to define the edges of the slab
- 4 Use the place slab ribbon bar to set the active slab placement parameters.

Plane Method: Coincident

Face Position: Bottom

Slab Type: 4" Elevated slab - Composite

Priority: Primary

Composition: 4" _Slab, 1.5VL22

Boundaries Offsets: none

Place the slab in the Area2-> Building1 -> Structural -> Second Floor -> Slab System.

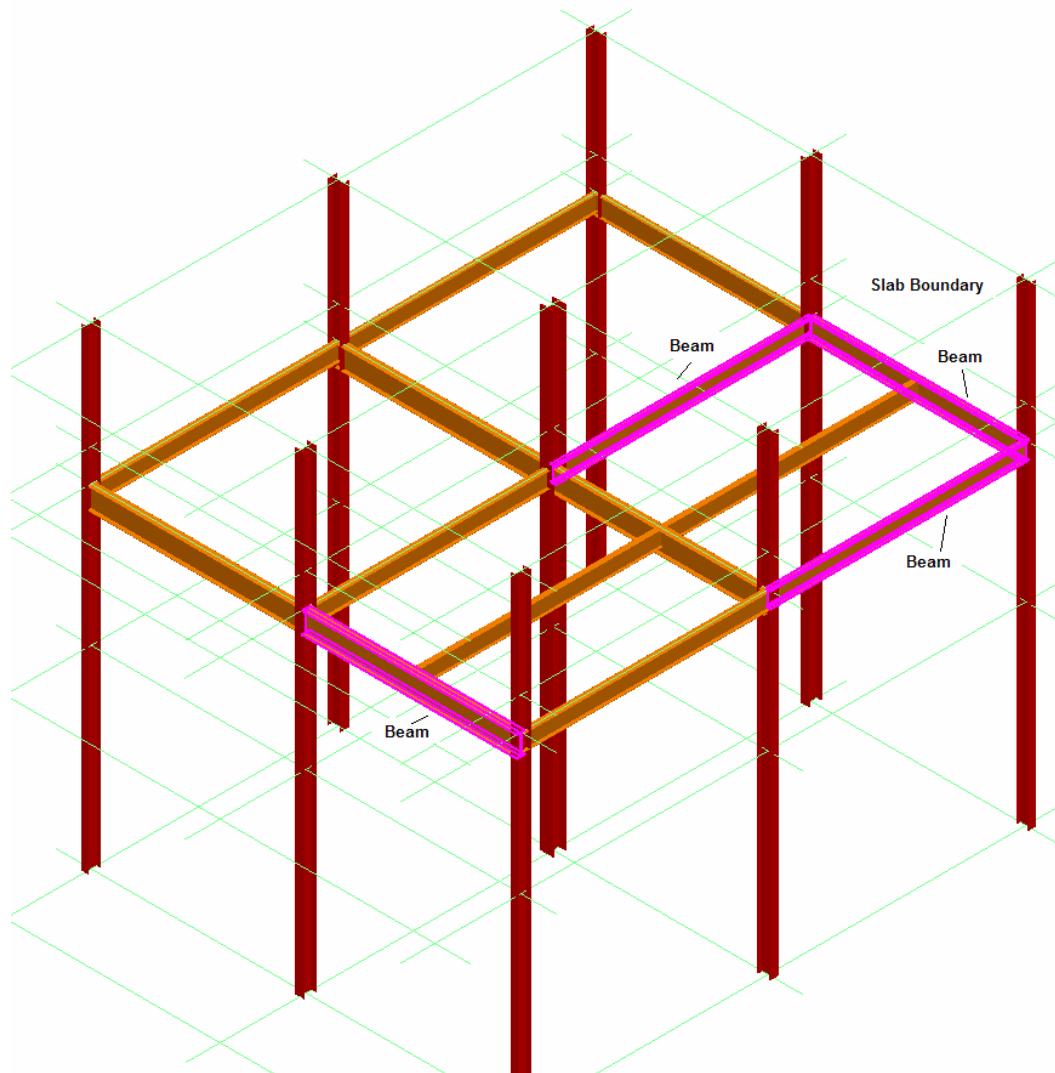


Figure 12 – ISO View of the Second Floor Frame

Part III: Roof Deck

- 1 Select the place slab command
- 2 Select Plane Method: Offset from a Plane
- 3 Select the Elevation Plane at 44' 0" for the support plane
- 4 Key in 1' for offset and green check
- 5 Select the boundaries as shown in Figure 13 to define the edges of the roof deck
- 6 Use the place slab ribbon bar to set the active deck placement parameters.

Plane Method: Offset from a Plane

Offset from Plane value: -1 ft

Slab Type: Roof Deck

Composition: RD_1.5B24

Place the roof deck in the Area2->Building1 -> Structural ->Third Floor > Slab System.

Face Position: Bottom

Priority: Primary

Boundaries Offsets: See Figure13

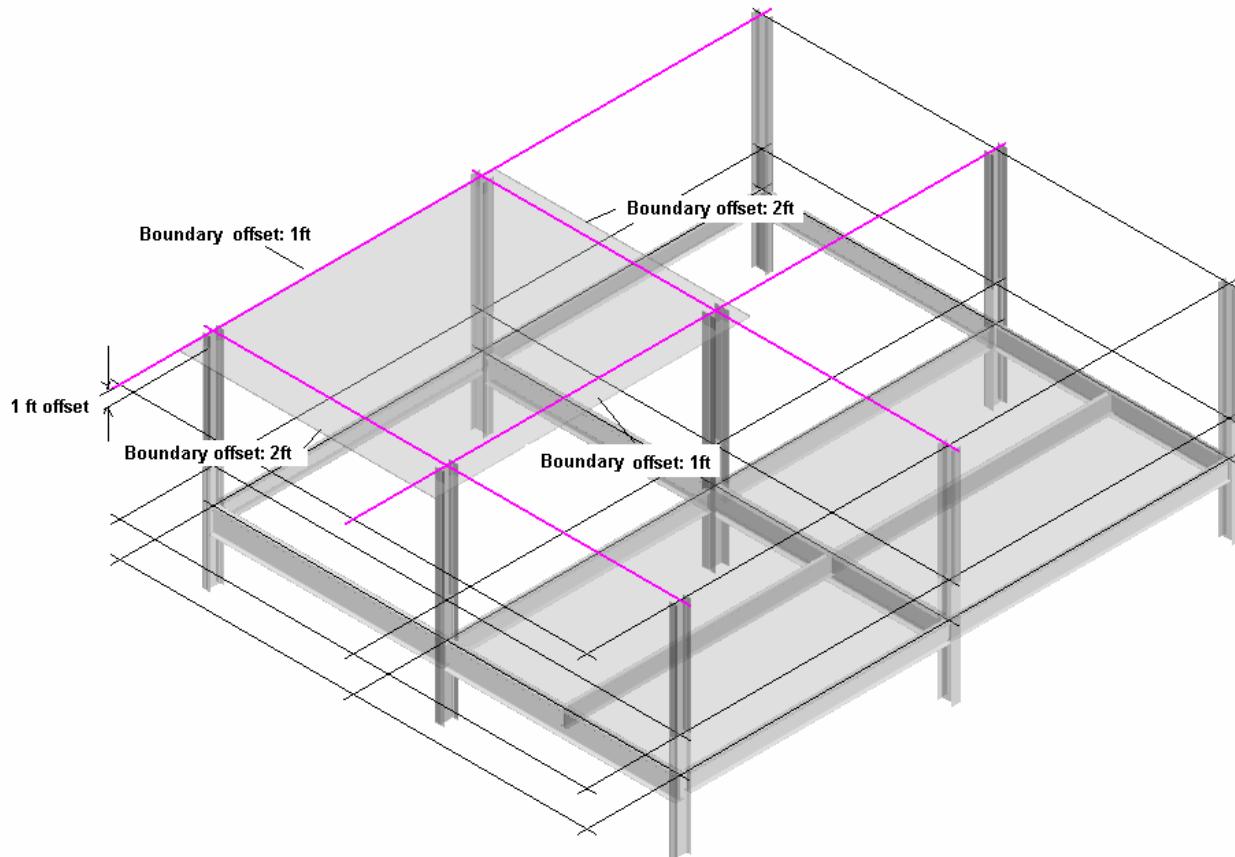


Figure 13 – ISO View of the Roof Deck

Part IV - Place a Slab on the Far-East Bay:

- 1 Select the place slab command
- 2 Select the Top surface of the beam located at Elevation 8' 9" for the support plane.
- 3 Select the boundaries as shown in Figure 14 to define the edges of the slab.
- 4 Use the place slab ribbon bar to set the active slab placement parameters.

Plane Method: Coincident

Slab Type: 4" Elevated slab - Composite

Composition: 4" _Slab, 1.5VL22

Place the slab in the Area2->Building1 -> Structural ->First Floor -> Slab System.

Face Position: Bottom

Priority: Primary

Boundaries Offsets: none

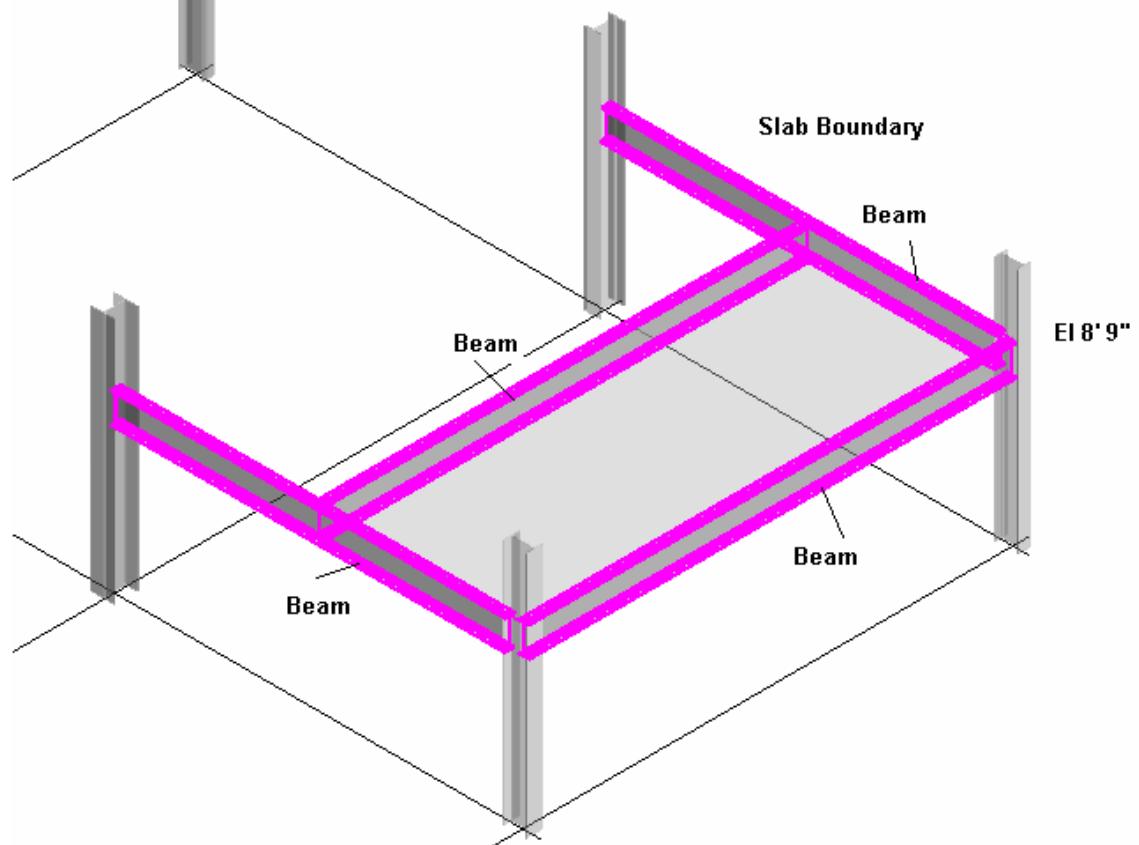


Figure 14 – ISO View of the Far-East Bay

Your View should now resemble the following graphic:

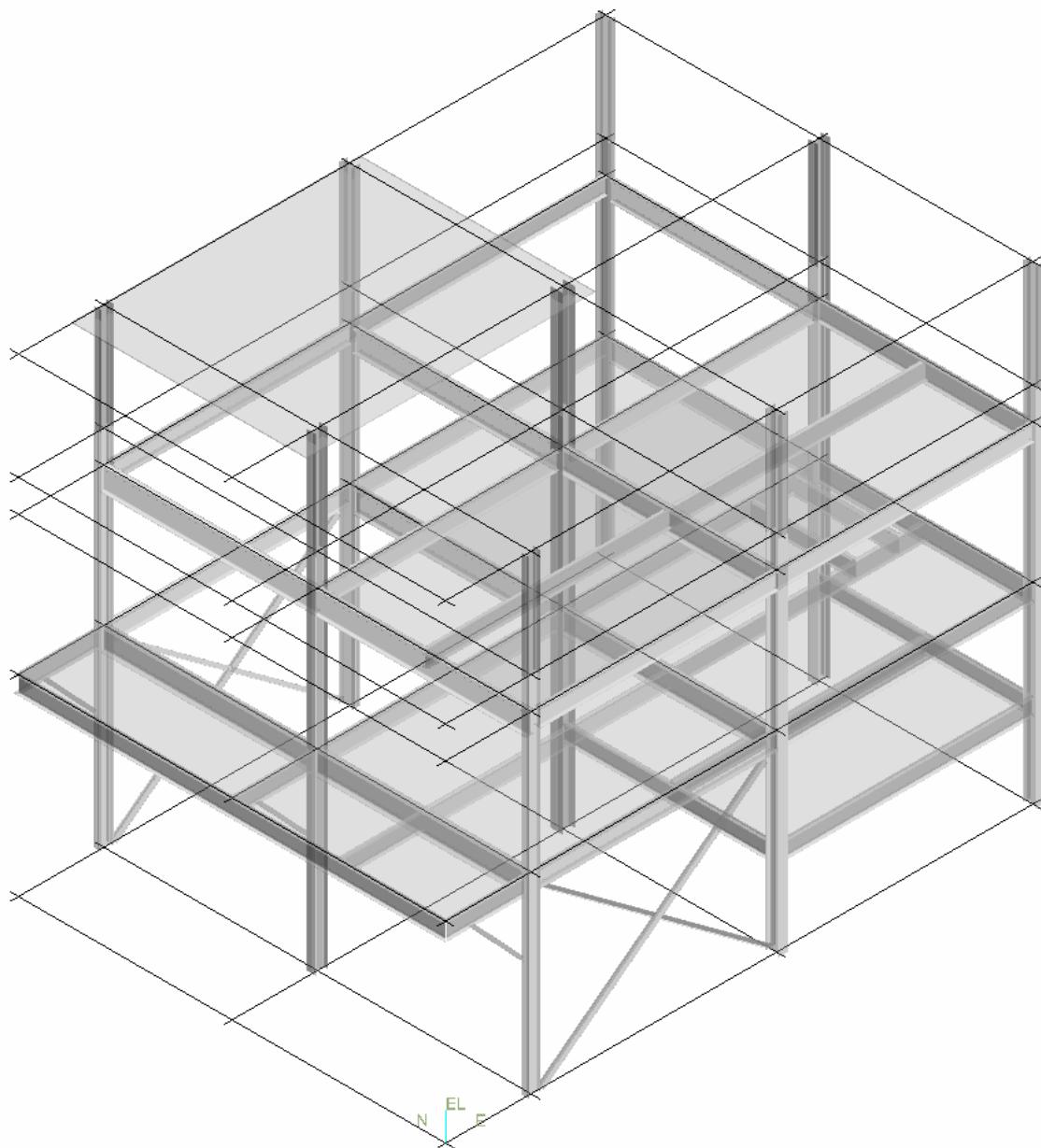


Figure 14 – ISO View of Building 1

Part V – Place Slab in Unit 2

- 1 Select the place slab command
- 2 Select the Elevation Plane at 18' 0" and 30' 0" for the support planes
- 3 Select the boundaries as shown below to define the edges of the slab
- 4 Use the place slab ribbon bar to set the active slab placement parameters.

Plane Method: Coincident

Slab Type: 4" Elevated slab - Composite

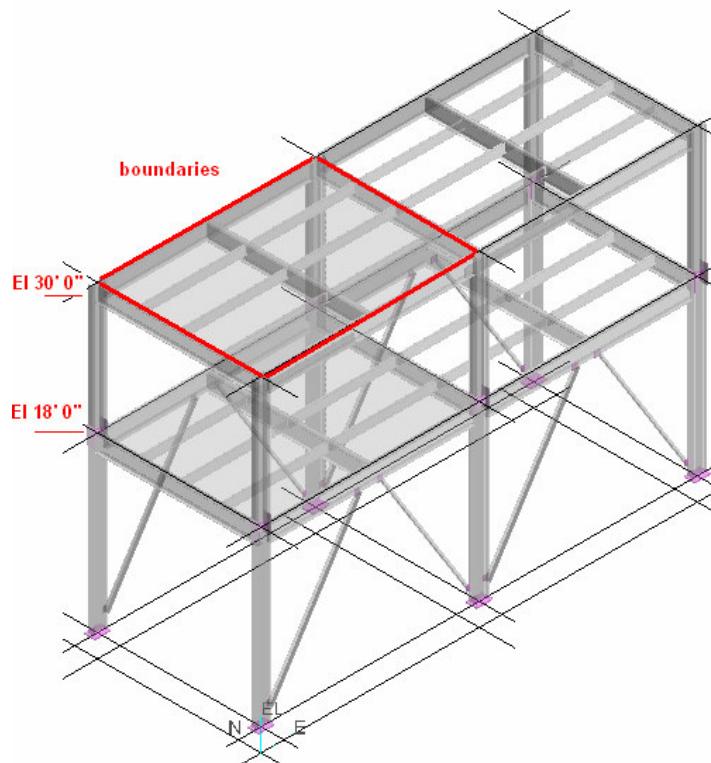
Composition: 4"_Slab, 1.5VL22

Boundaries Offsets: none

Priority: Primary

Boundaries Offsets: none

Place the slab in the Area2->Unit 2 -> Structural -> Slabs.



LAB-4: Openings

Objective

After This Lab Students will be able to Place openings using different methods

Part I -Place a Stairway Opening

- 1 Select the place opening command
- 2 Select the slab located in the first floor frame as shown in Figure 15
- 3 Select the members as shown in Figure 15 to define the boundaries of the opening. Use quick pick service to pick the members.
- 4 After selecting the members. Hit the Finish button.

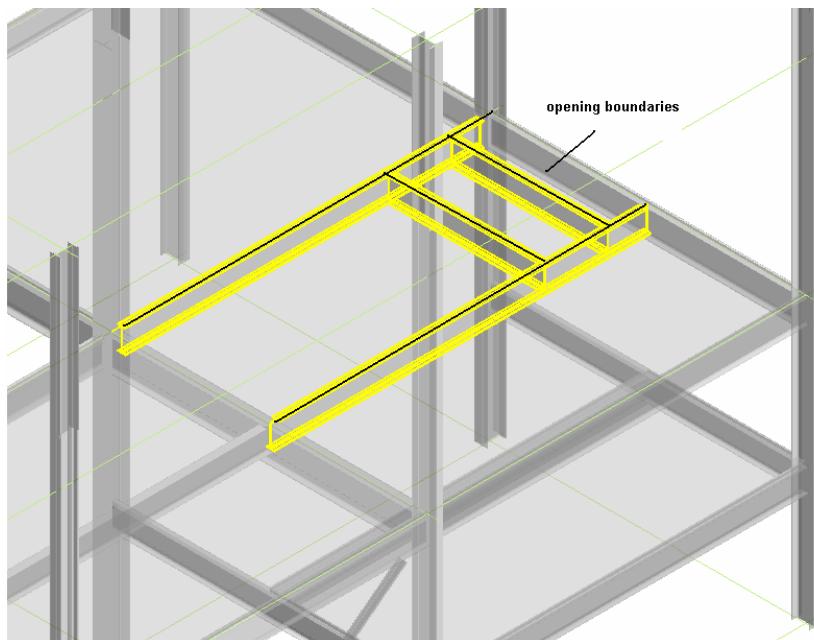


Figure 15 – ISO View of the Stairway Opening

Your View should now resemble the following graphic:

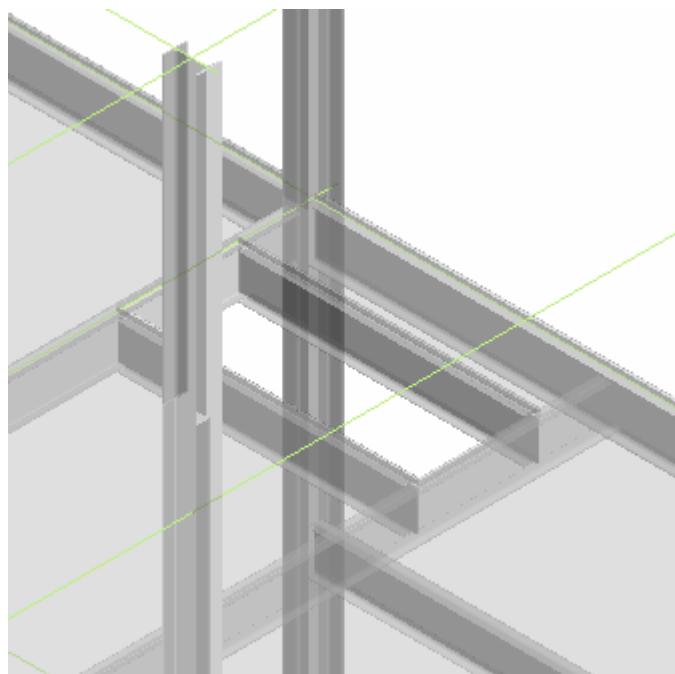
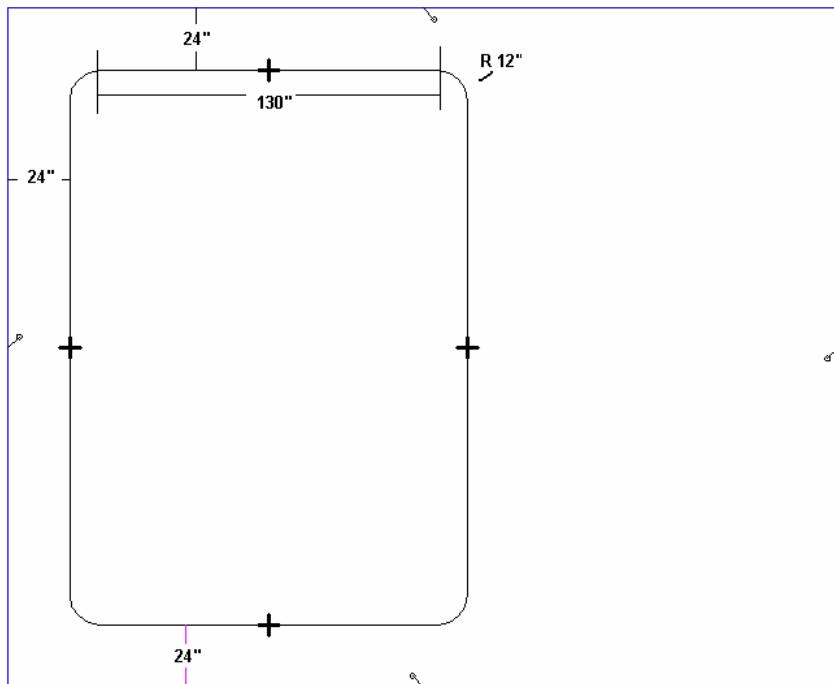


Figure 16 – ISO View of the Stairway Opening

Part II -Place Opening on the Roof Deck

- 1 Select the place opening command
- 2 Select the roof deck located at Elevation 43' as shown in Figure 17. Select the draw method button to define the boundaries of the opening. System automatically opens the Draft 2D.
Task.profile:



Hint: Use place line, fillet, and distance dimension commands

- 3 Hit the Close button
- 4 Hit the Finish button.

Your View should now resemble the following graphic:

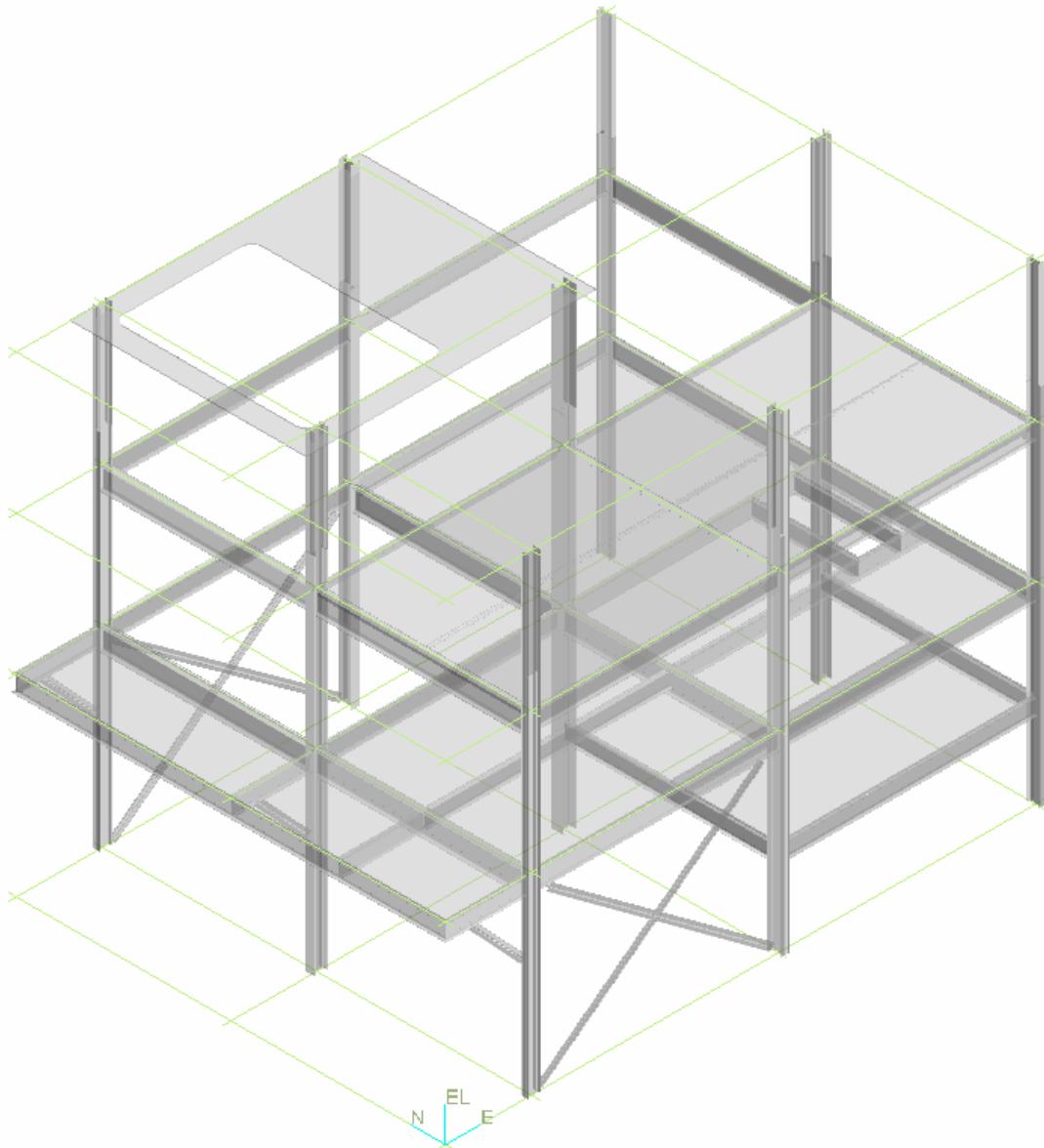
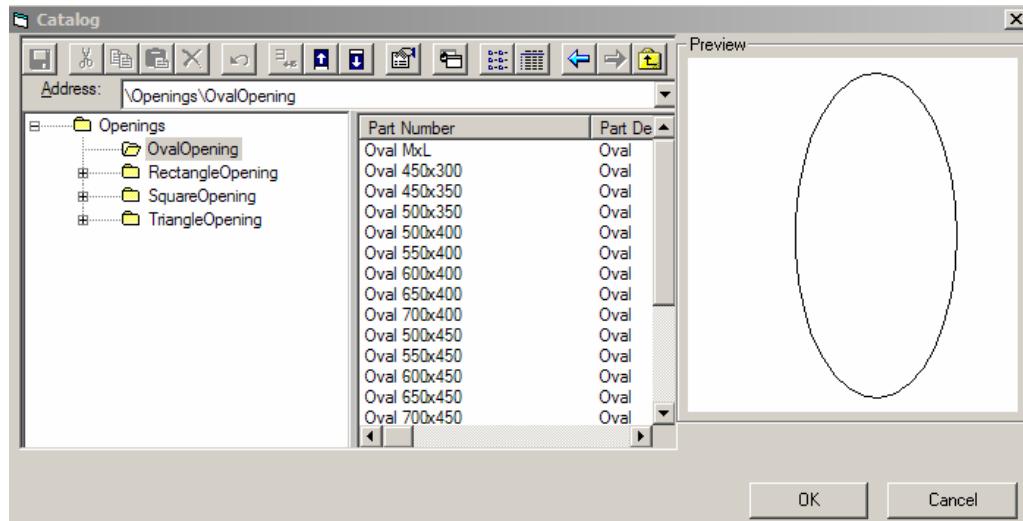


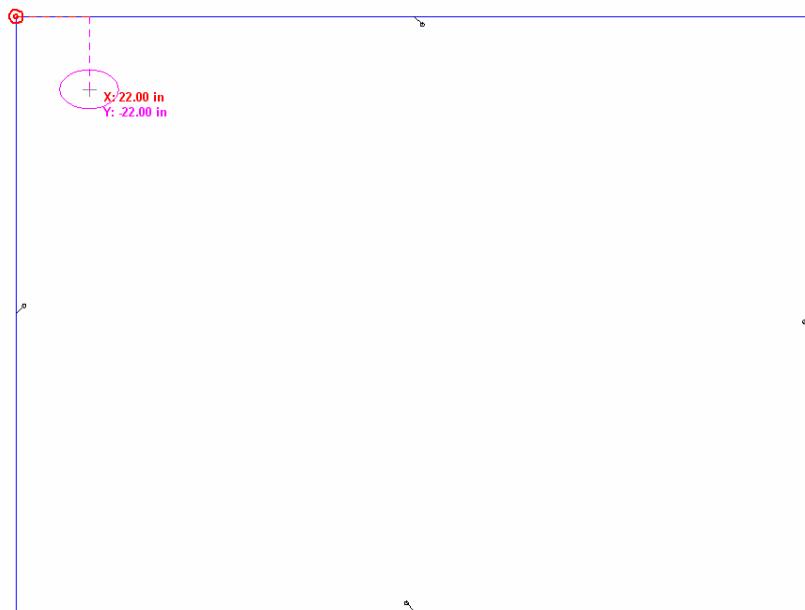
Figure 17 – ISO View of the Roof Deck Opening

Part III -Place Opening from Catalog

- 1 Select the place opening command
- 2 Select the slab located in the second floor frame of Unit 2
- 3 Select the slab to be the sketch plane
- 4 Select the draw method button to go to the Draft 2D Task
- 5 Select Shape button to open the Catalog browser
- 6 Navigate the tree and select Oval 450x300 opening as shown below.



- 7 Hit OK to close the Catalog browser
- 8 Use move command and pinpoint tool to place the center of the oval opening at the following location: (X= 22 in Y= - 22in)



9 Hit the close button to exit the Draft 2D Task

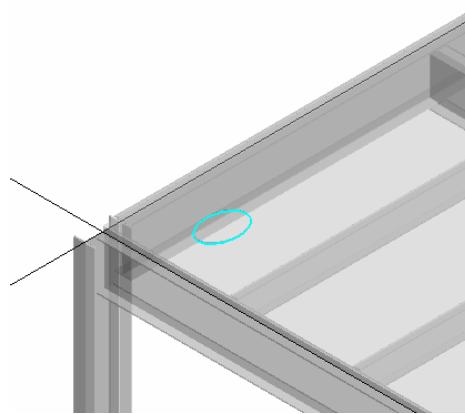
10 Set the Cutting Limit to User Defined

11 Key in the Cutting Depth as 0.50 inches



12 Hit the Finish button to create the oval opening

13 Your View should now resemble the following graphic.



LAB-5: Stairs / Ladders / Hand Rails

Objective

After This Lab Students will be able to Place stairs, ladders and Hand rails using different methods

Part I –Place First Stair

- 1 Select Place Stair Command on the vertical toolbar
- 2 Select stair A1 from the catalog browser dialog box
- 3 Select the top edge of the beam. This defines the top elevation of the stair
- 4 Select the elevation plane at 0' 0" for the stair. This plane defines the bottom elevation of the stair
- 5 Select the reference edge for the stair. See Figure 18
- 6 Using the following parameters define the location of the stair along the top edge.

| | |
|--------------------|---------|
| Width: | 2.50 ft |
| Angle: | 32 deg |
| Pitch: | 0.83 ft |
| Horizontal Offset: | 9.50 ft |
| Vertical Offset: | 0.0 ft |

Place the stair in the Area2->Building1 -> Structural ->First Floor -> Miscellaneous System
- 7 Click Finish Button.

Your View should now resemble the following graphic:

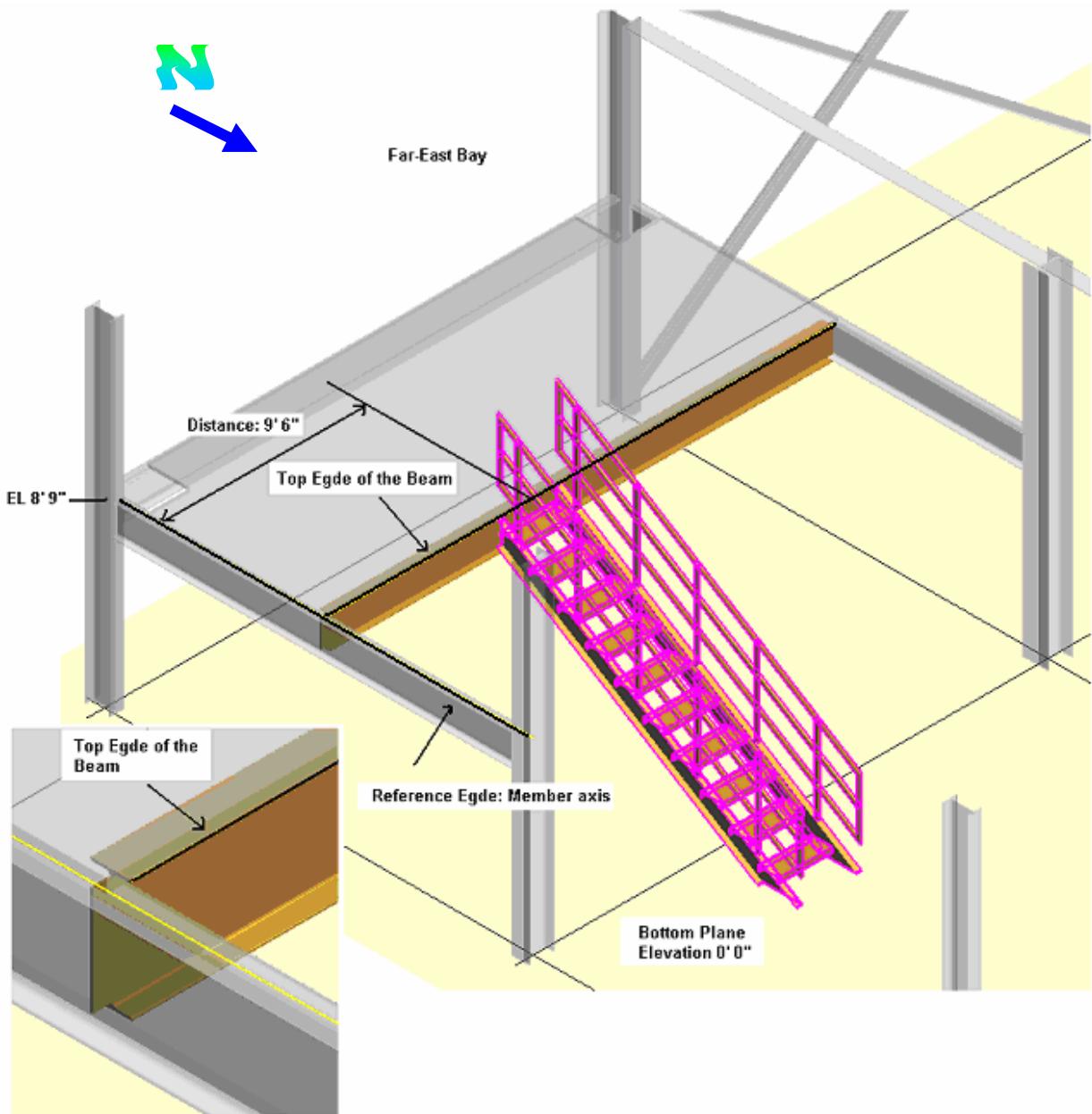


Figure 18 – ISO View of the first stair.

Part II -Place the Second Stair

- 1 Select Place Stair Command on the vertical toolbar
- 2 Select stair A1 from the catalog browser dialog box
- 3 Select the top edge of the beam. This defines the top elevation of the stair
- 4 Select the top surface of the slab for the stair. This plane defines the bottom elevation of the stair
- 5 Select the reference edge for the stair. See Figure 19.
- 6 Using the following parameters to define the location of the stair along the top edge.

| | |
|--------------------|---------|
| Width: | 2.50 ft |
| Angle: | 32 deg. |
| Pitch: | 0.83 ft |
| Horizontal Offset: | 4.5 ft |
| Vertical Offset: | 0.0 ft |

 Place the stair in the Area2->Building1 -> Structural ->First Floor -> Miscellaneous System.
- 7 Click Finish button.

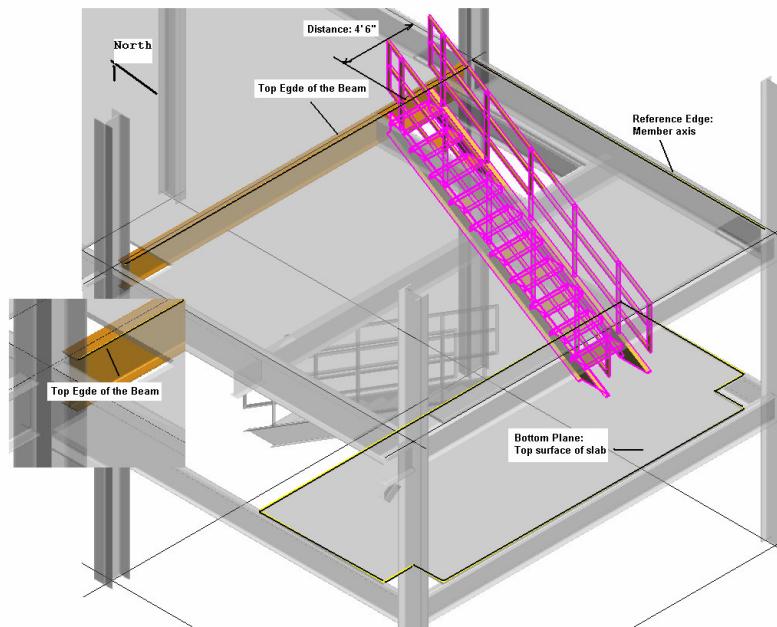


Figure 19 – ISO View of the second stair.

Part III – Place a Ladder

- 1 Select Place Ladder Command on the vertical toolbar
- 2 Select ladder A1 from the catalog browser dialog box
- 3 Select the top edge of the beam. This edge defines the top elevation of the ladder
- 4 Select the top surface of the slab located at Elevation 18'. This plane defines the bottom elevation of the ladder.
- 5 Select the reference edge for the ladder. See Figures 20 and 21.
- 6 Using the following parameters to define the location of the ladder along the top edge.
Width: 2.00 ft
Angle: 90.0 deg.
Pitch: 1.0 ft
Horizontal Offset: 5.0 ft
Vertical Offset: 0.0 ft
Place the ladder in the Area2->Building1 -> Structural ->Second Floor -> Miscellaneous System
- 7 Click Finish button.

Your View should now resemble the following graphic:

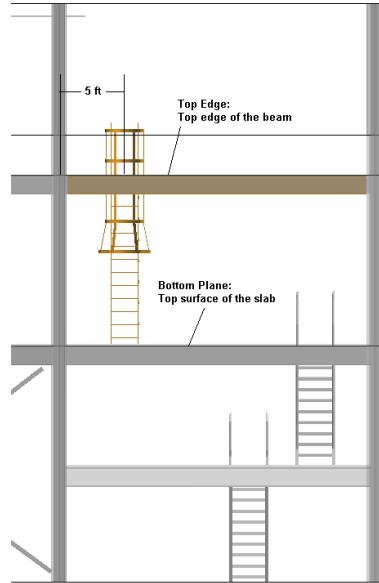


Figure 20 – North View of the two-story building.

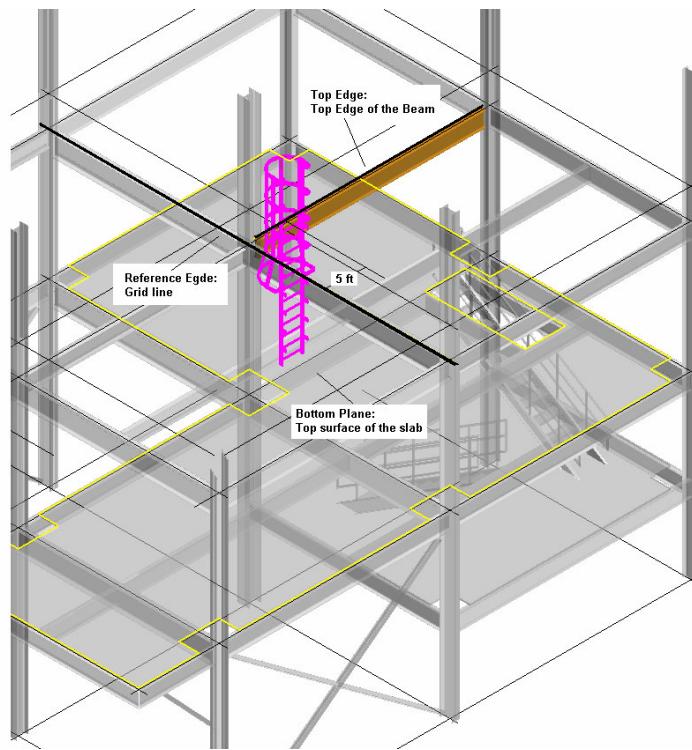


Figure 21 – Iso View of the two-story building.

Part IV – Placing Hand Rail

- 1 Select Place Handrail Command on the vertical toolbar
- 2 Select handrail TMHandrail from the catalog browser dialog box
- 3 Define the handrail path as shown in Figure 22.
- 4 Using the following parameters to define the handrail representation.
Begin Treatment: Rectangular
End Treatment: Rectangular
Place the handrail in the Area2->Building1 -> Structural ->First Floor ->
Miscellaneous System
- 5 Click Finish.

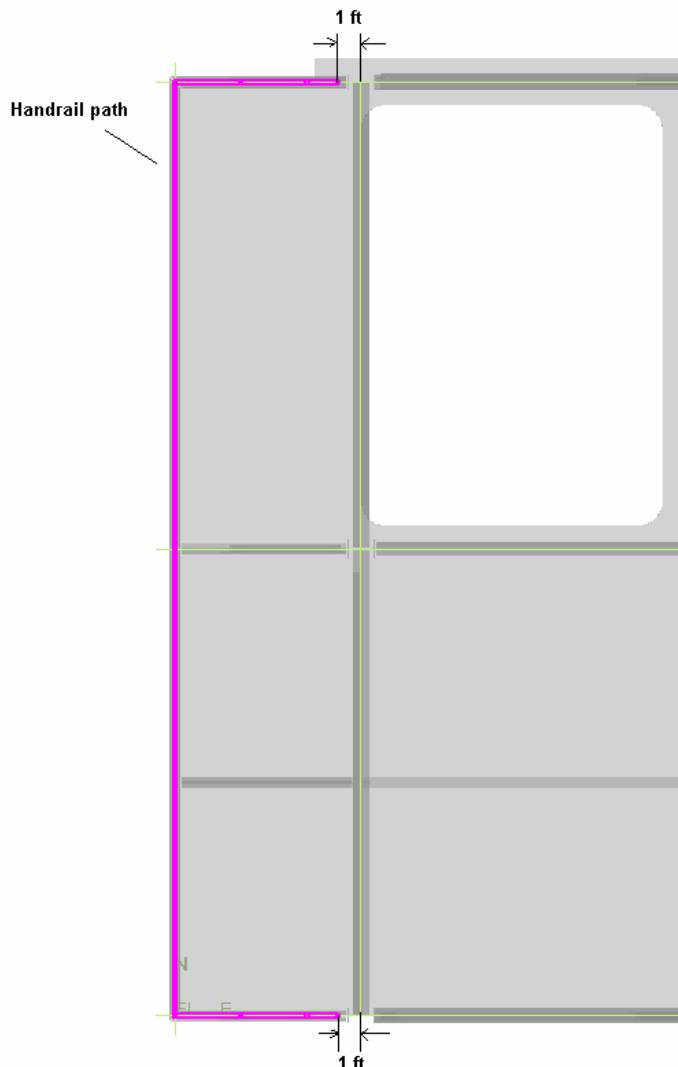


Figure 22 – Top View of the two-story building.
Your View should now resemble the following graphic:

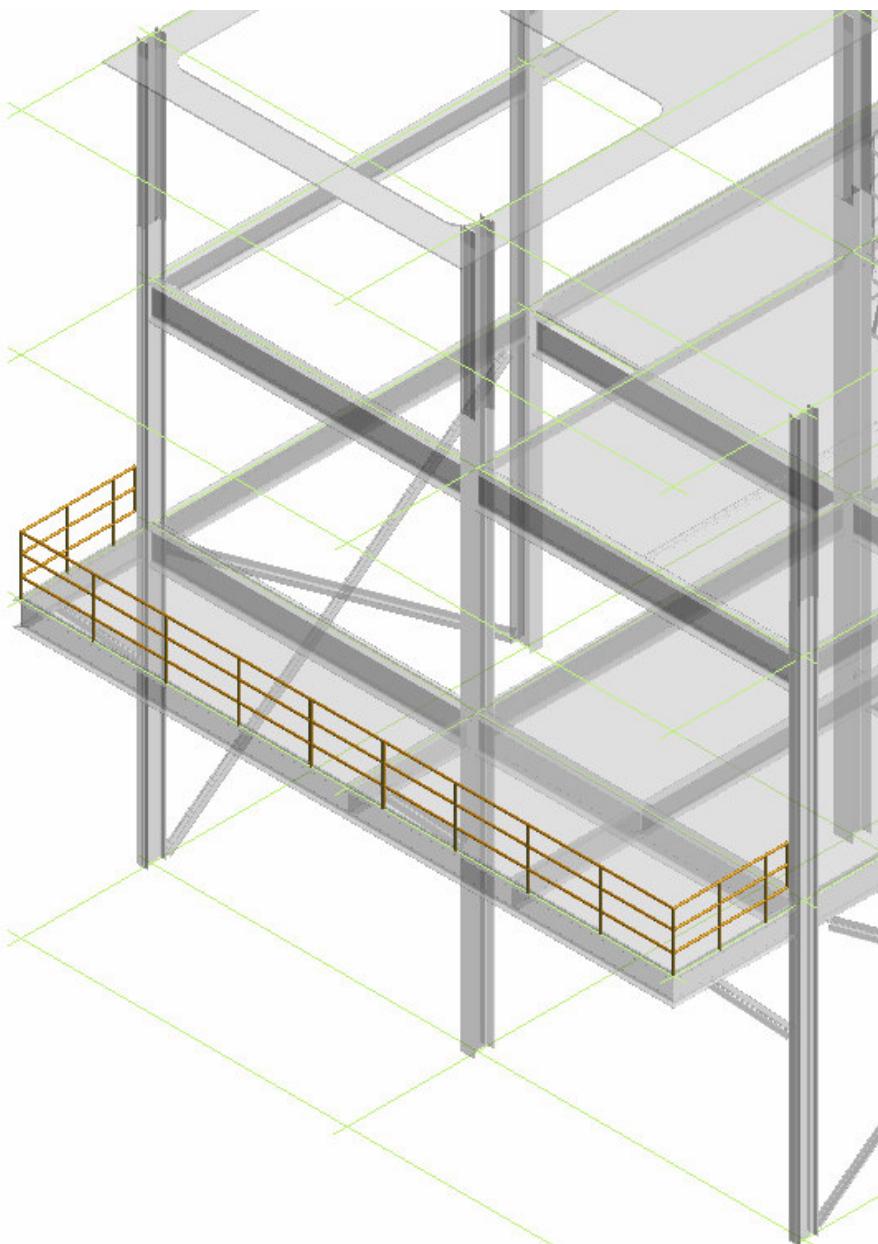
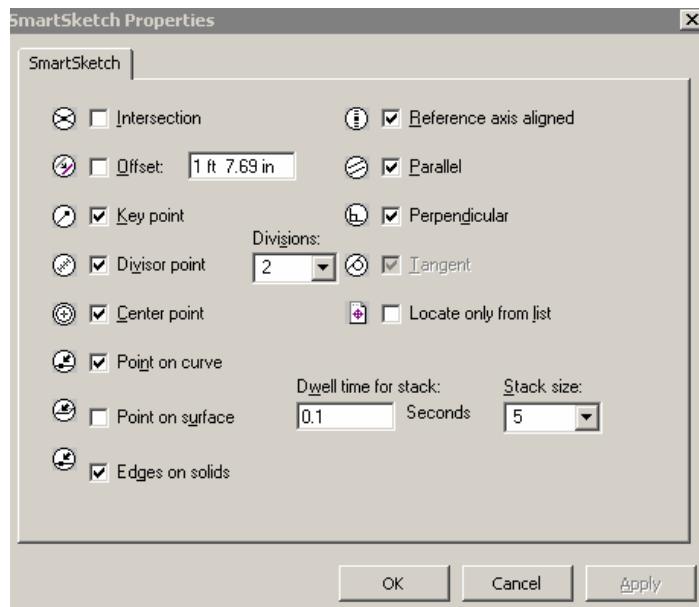


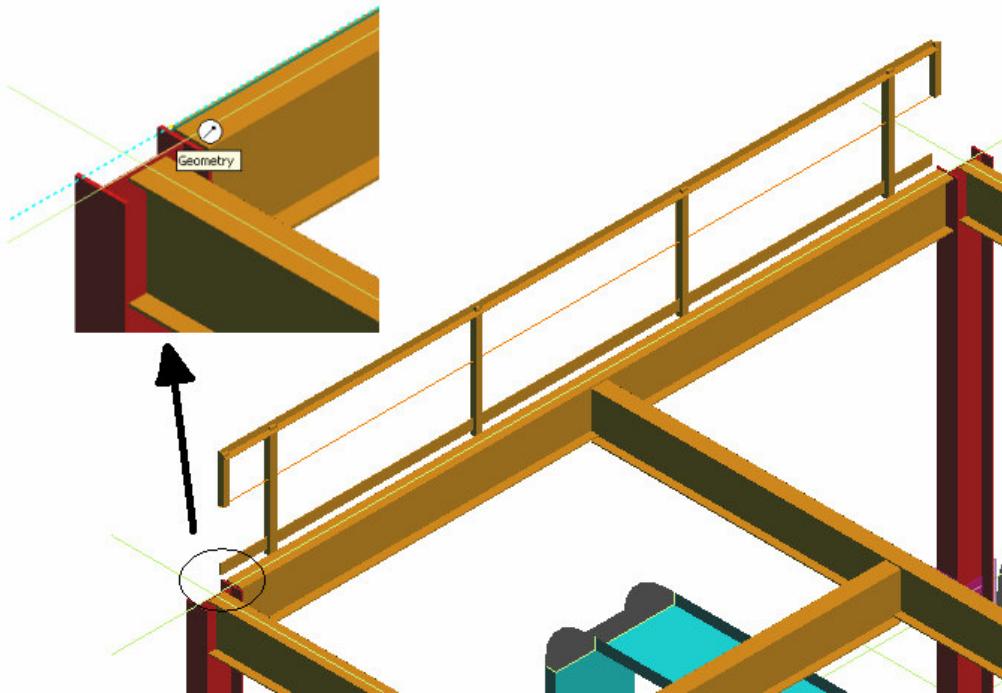
Figure 23 – Top View of the two-story building.

Part V – Placing Hand Rail in Unit 1

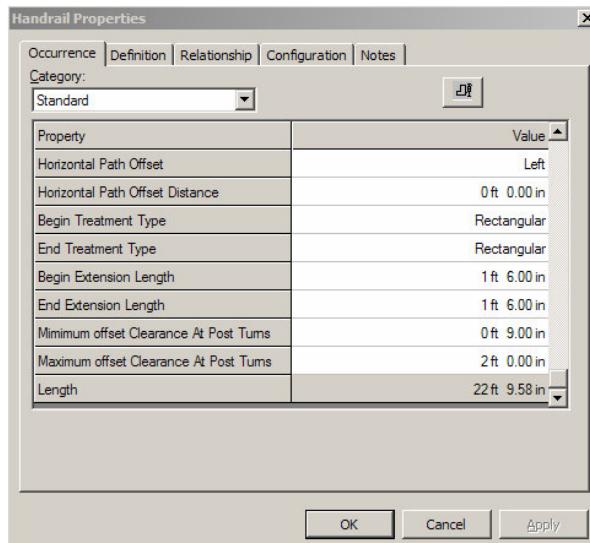
- 1 Select Tools, Option
- 2 Go to SmartSketch Tab
- 3 Turn on Edges on Solids option
- 4 Turn off Point on Surface



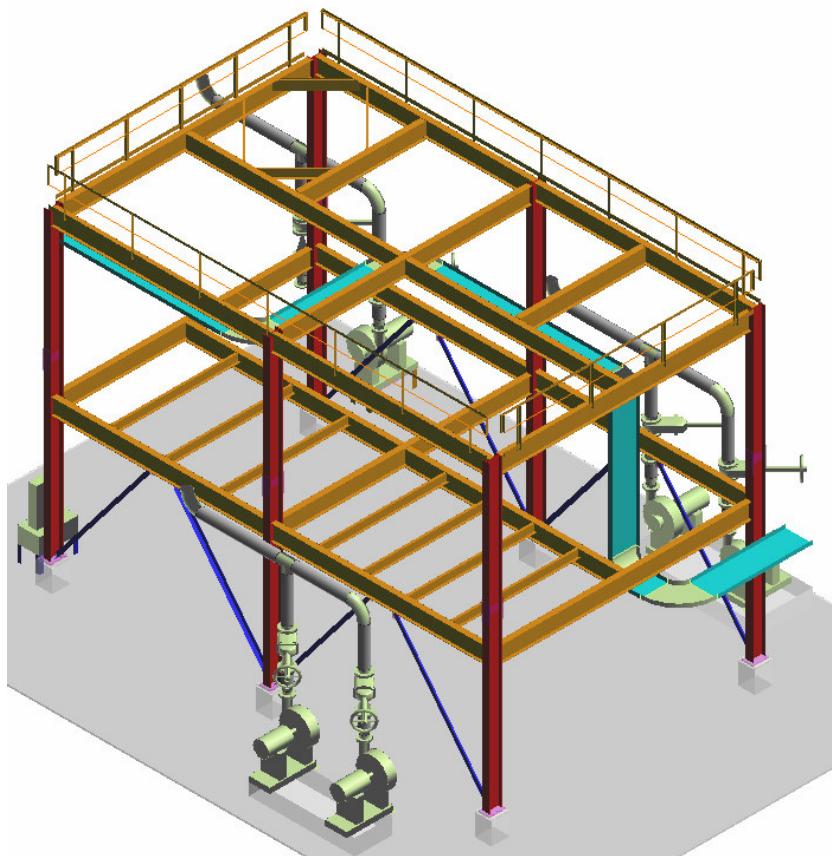
- 5 Select Place Handrail Command on the vertical toolbar
- 6 Define the handrail path as shown below:
Hints: Pick the edges of the Beam to define the path.



- 7 Select handrail SideMountHandRail from the catalog browser dialog box.
- 8 Use the following parameters to define the handrail representation
Begin Treatment: Rectangular
End Treatment: Rectangular
Connection Type: Side with Pad
- 9 Go to the System combo control and select Area2-> Unit 1 -> Structural -> Miscellaneous System
- 10 Open the properties page of the handrail and set the Horizontal Path Offset (Left or Right) as shown below:



- 11 Repeat the procedure above to place handrails around the second frame of the building.

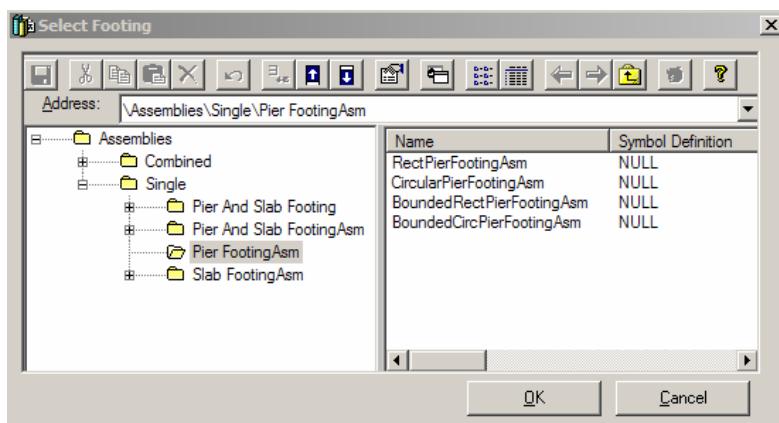


LAB-6: Footings

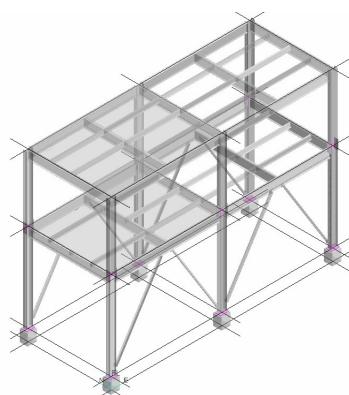
Objective

After This Lab Students will be able to Place different type of footings

- 1 Select Place Footing Command on the vertical toolbar
- 2 Navigate the tree and select RectPierFootingAsm from the catalog browser dialog box.



- 3 Hit OK button to close the catalog browser dialog box
- 4 Select all columns in Unit 2 and then select the Green Check button
- 5 Go to the System combo control and select Area 2 ->Unit 2 -> Structural ->Footings
- 6 Hit the Finish button to place all footings in the model.

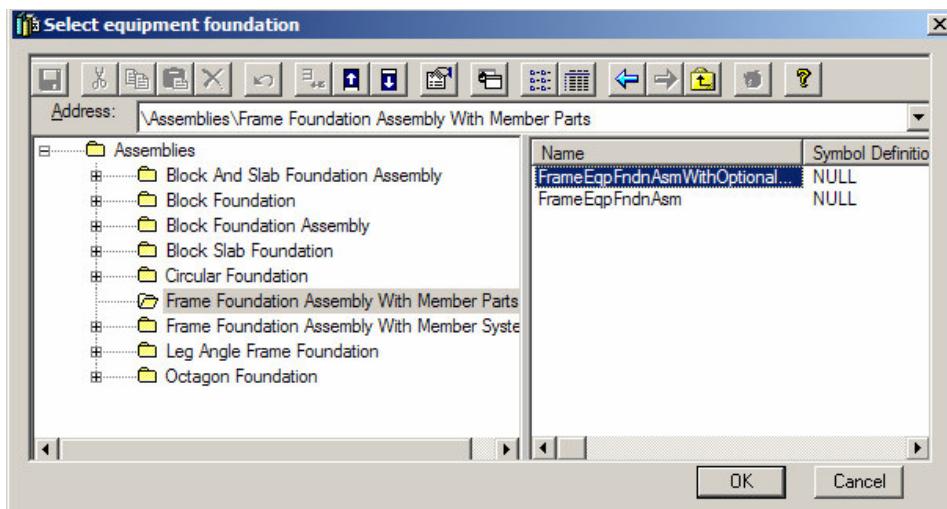


LAB-6: Equipment Foundation

Objective

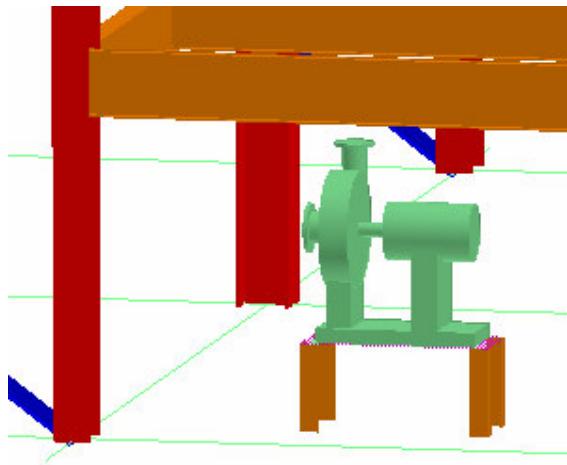
After This Lab Students will be able to Place different type of foundations

- 1 Set your workspace to show pump P-101
- 2 Select Place Equipment Foundation Command on the vertical toolbar
- 3 Select pump P-101
- 4 Uncheck the By rule option and Select the Type combo control to open the Catalog browser
- 5 Navigate the tree and select FrameEqpFndAsmWithOptionalPlane from the catalog browser dialog box



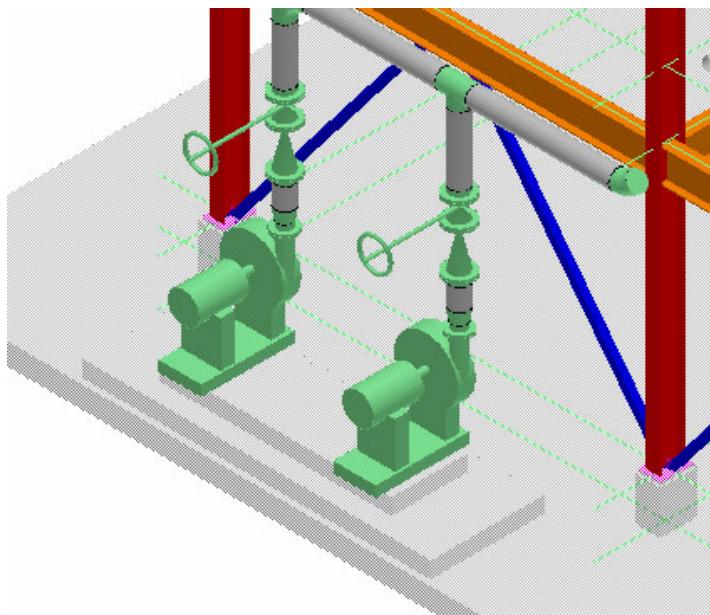
- 6 Hit OK button to close the catalog browser dialog box
- 7 Select the Green check button
- 8 Select the slab on grade for the support plane
- 9 Go to the System combo control and select Area2 ->Building 1 -> Structural -> Miscellaneous System
- 10 Hit the Finish button to place the equipment foundation assembly in the model.

Your View should now resemble the following graphic:

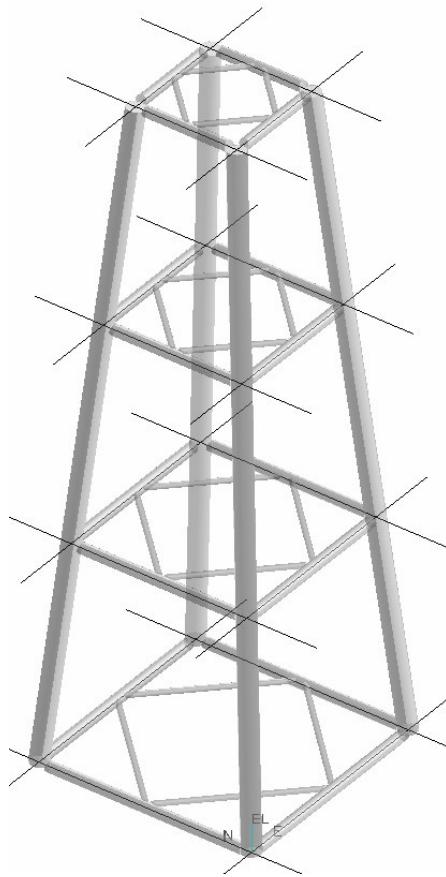


- 11 Select Place Equipment Foundation Command on the vertical toolbar
- 12 Check the By Rule Option
- 13 Select Pump-001 and Pump-002 in your workspace
Notice that the system selects the default foundation defined in the reference data
- 14 Select the Green check button
- 15 Uncheck By Rule and select BlockEqpFndnWithOptionalPlane
- 16 Select Slab on Grade for the support plane
- 17 Go to the System combo control and select Area2->Building 1 -> Structural -> Miscellaneous System.
- 18 Hit the Finish button to place the equipment foundation in the model.

Your View should now resemble the following graphic:



LAB-7: Structural Modeling (offshore Jacket) - Optional



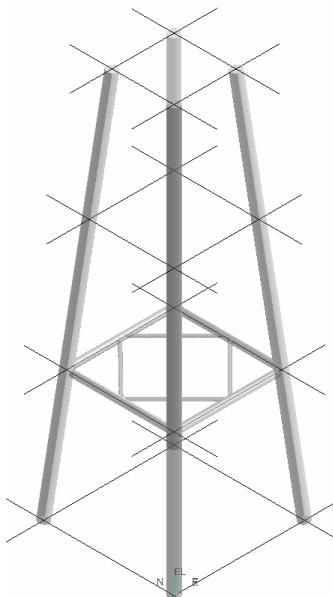
Part I: Jacket Pipes

- 1 Open or create a session file and define an appropriate filter for your workspace
- 2 Go to the Structure Task environment. Make sure the Active Permission Group is set to *Structural*
- 3 Select the place linear member system command. Use the views shown in Figure to place the appropriate support columns and beams
- 4 Use the ribbon bar and set the active member parameters as follows:
Connection: By Rule
Type Category: Column

Type: Column
 Section Name: CS10
 Cardinal point: 5
 Angle: 0 deg
 System: Area2 -> Offshore -> Structural > Column

- 5 Place the first point for column end at the grid intersections Elevation 0"
- 6 Place the second column end at the grid intersections Elevation 30' 0"
- 7 Repeat the above steps to place the other support columns. Toggle the start/end icons to set the discrete/contiguous placement method.
- 8 Place the Beams at elevation 10 ft
- 9 Use the ribbon bar and set the active member parameters as follows
 Connection: By Rule
 Type Category: Beam
 Type: Beam
 Frame Connection: Flush-Right for the perimeter pipe
 and Flush-Top for the intermediate pipe
 Section Name: CS3
 Cardinal point: 5
 Angle: 0 deg
 System: Area2 -> Offshore -> Structural > Beams

Your View should now resemble the following graphic:



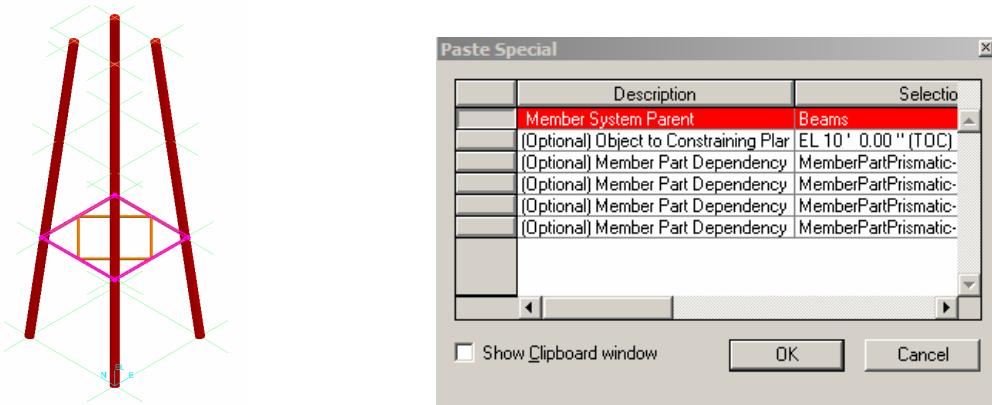
10 Place the other steel frames on the other elevations 0 ft, 20 ft and 30 ft.

Note: Use the Copy/Paste command to place all the perimeter members for the first frame at the other elevations. Make sure to select the appropriate objects to re-establish the connection in the Paste Special Dialog box.

Hint: Set the select filter to Member System to select 8 members.

Only 1 related object is needed to re-establish the connection (El plane).

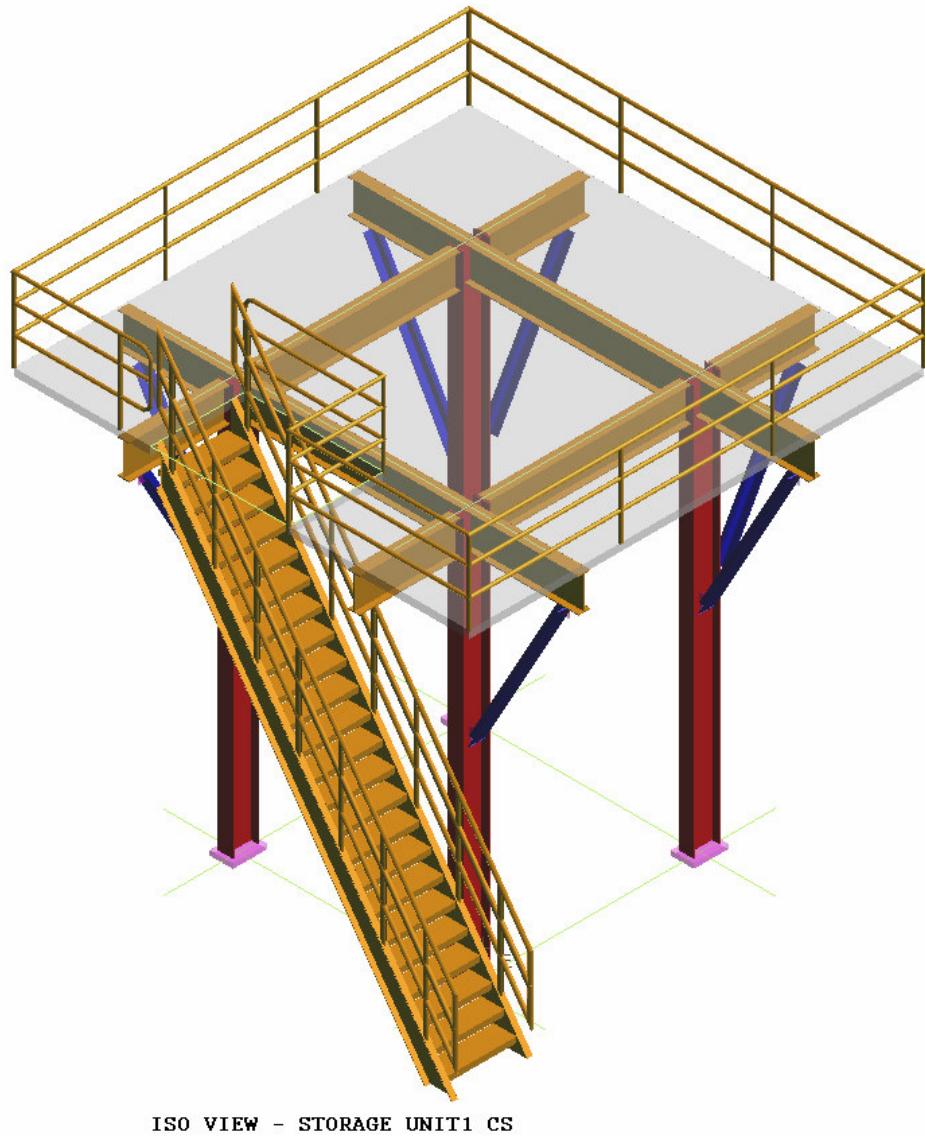
Use the Paste command three times.



11 Place assembly connections

Part II: Rotated Coordinate System – Optional

- 1 Model shown Structures from Pictures and information provided:



Coordinate System: Storage Unit 1 CS

Columns:

| | |
|-----------------|---|
| Connection: | By Rule |
| Type Category: | Column |
| Type: | Column |
| Section Name: | W14x53 |
| Cardinal point: | 5 |
| Angle: | 20 |
| System: | Area 2-> Storage -> Structural -> Columns |

Beams:

| | |
|-----------------|--|
| Connection: | By Rule |
| Type Category: | Beam |
| Type: | Beam |
| Section Name: | W18X40 |
| Cardinal point: | 8 |
| Angle: | 0 |
| System: | Area 2 -> Storage -> Structural -> Beams |

Beam Extension Length: 5' (TYP)

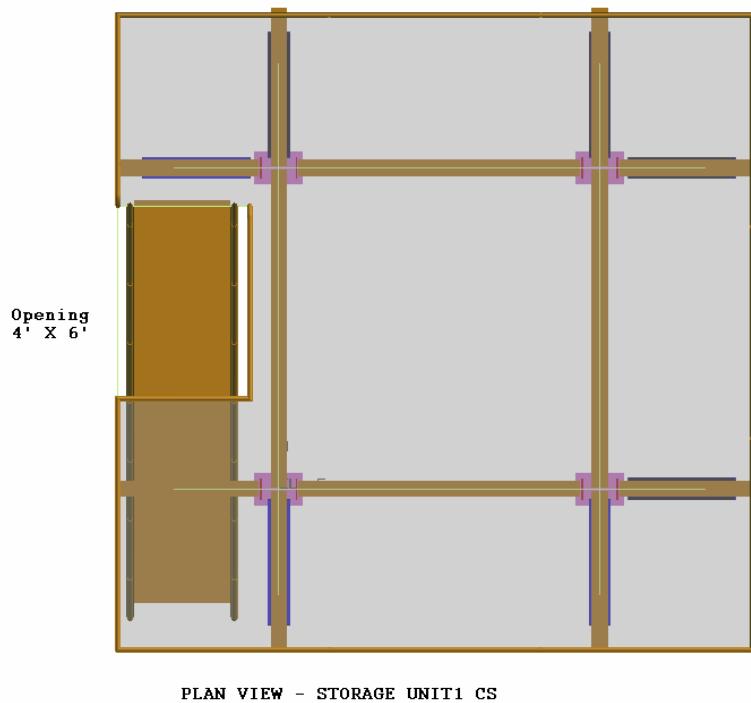
Vertical Braces:

| | |
|-----------------|---|
| Connection: | By Rule |
| Type Category: | Brace |
| Type: | V. Brace |
| Section Name: | 2L4X4X1/2X3/8 |
| Cardinal point: | 5 |
| Angle: | 0 |
| System: | Area 2 -> Storage -> Structural -> V. Brace |

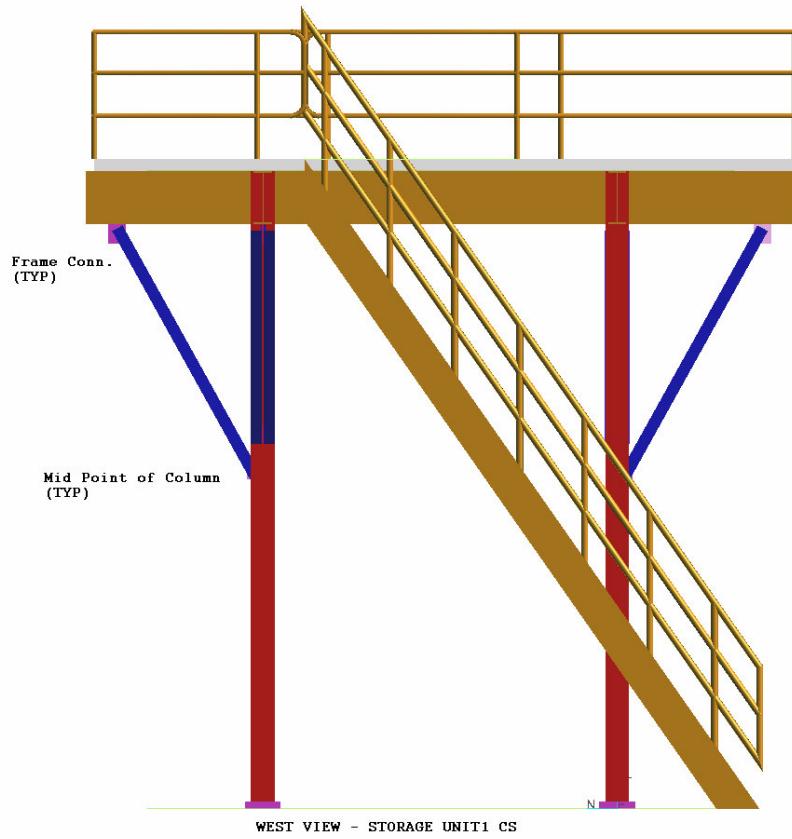
Stair:

| | |
|--------|---------|
| Type: | StairA1 |
| Width: | 3' |
| Angle: | 55 |

System: Storage -> Structure -> Misc



PLAN VIEW - STORAGE UNIT1 CS



WEST VIEW - STORAGE UNIT1 CS

Structural Analysis Task

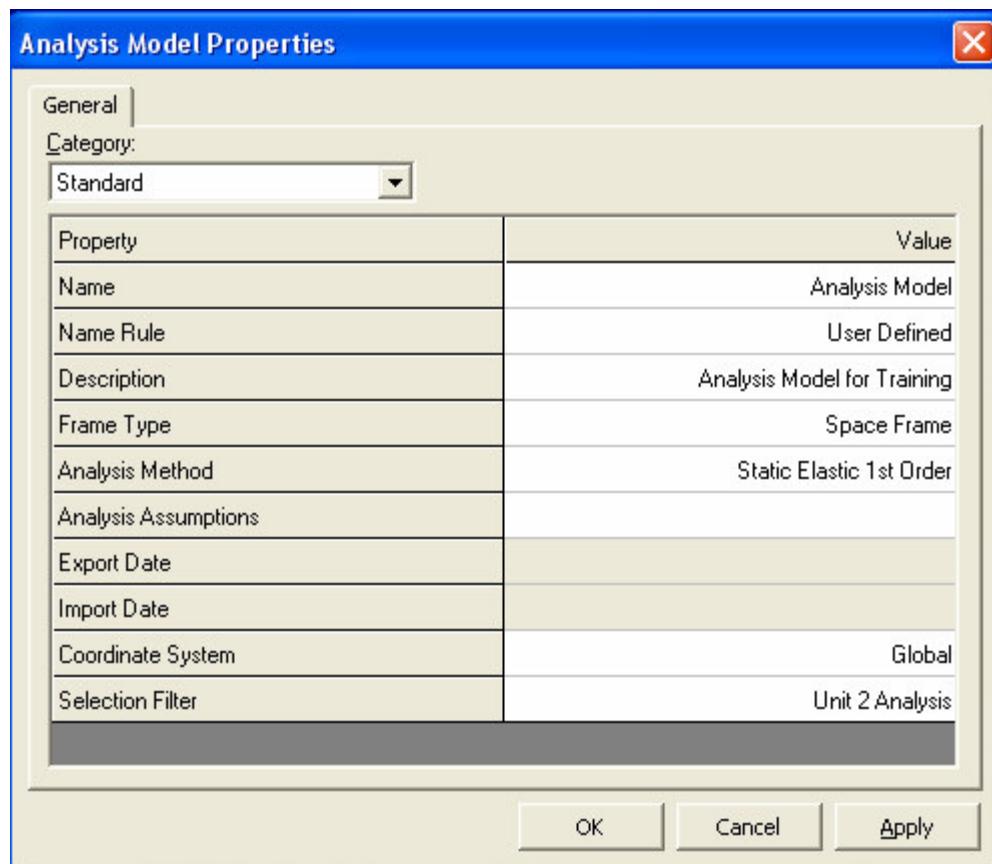
LAB-1: Loads, Releases, Boundary Conditions and Creating a CIS file

Objective

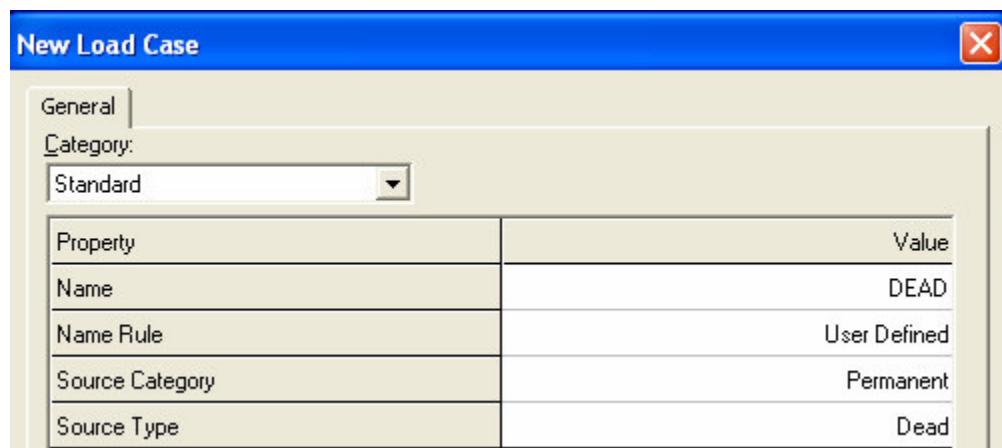
After This Lab Students will be able to Place dead and live distributed loads on beams. Place concentrated wind loads on one side of the structure. Define member end releases. Define member boundary conditions for the columns and Create a CIS file

Part I: Create Load Cases and Combinations

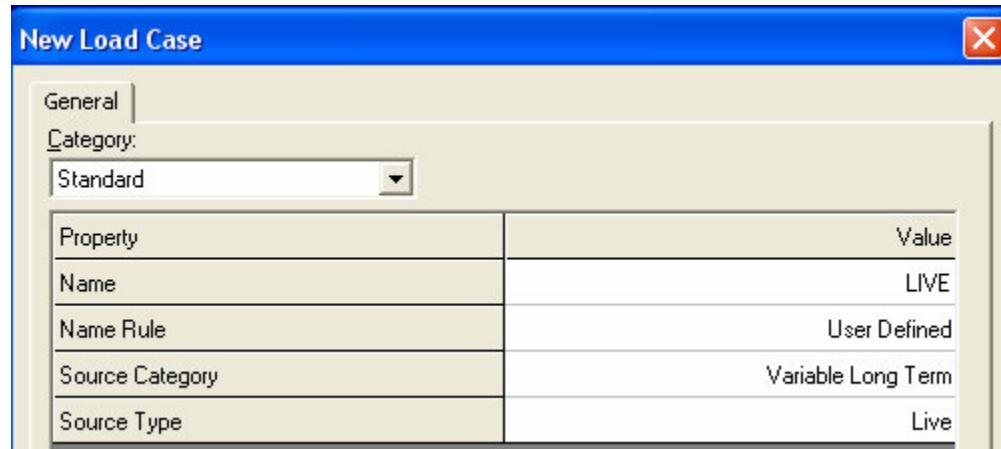
- 1 Open or create a session file and define an appropriate filter for your workspace that includes Grids, Structure, and Structural Analysis for Unit 2
- 2 Go to the Structural Analysis Task.
- 3 Create an Analysis Model. 



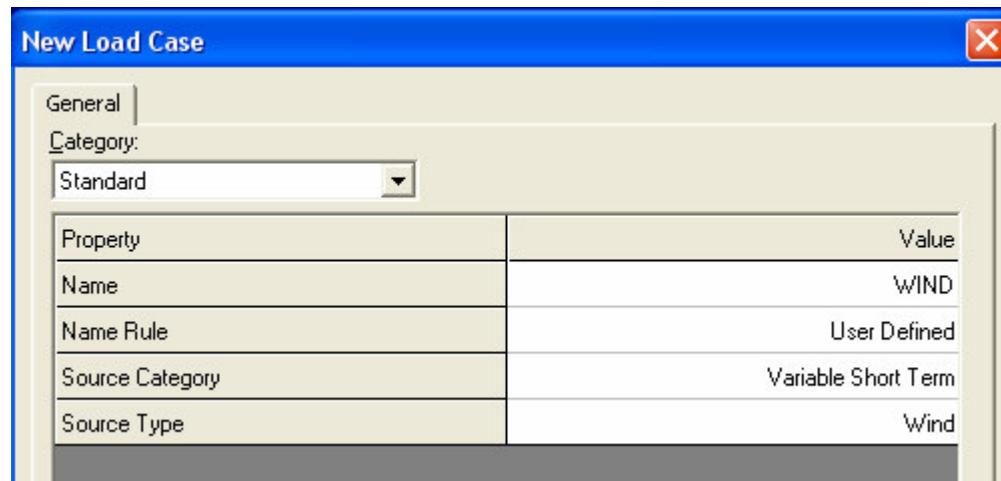
- 4 Select the Create New Load Case command. 
- 5 Create a DEAD load.



6 Create a LIVE load.

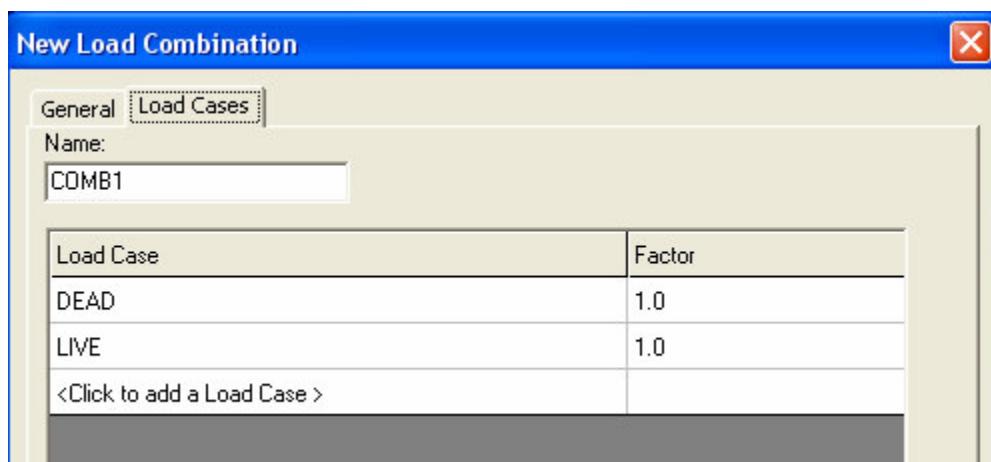
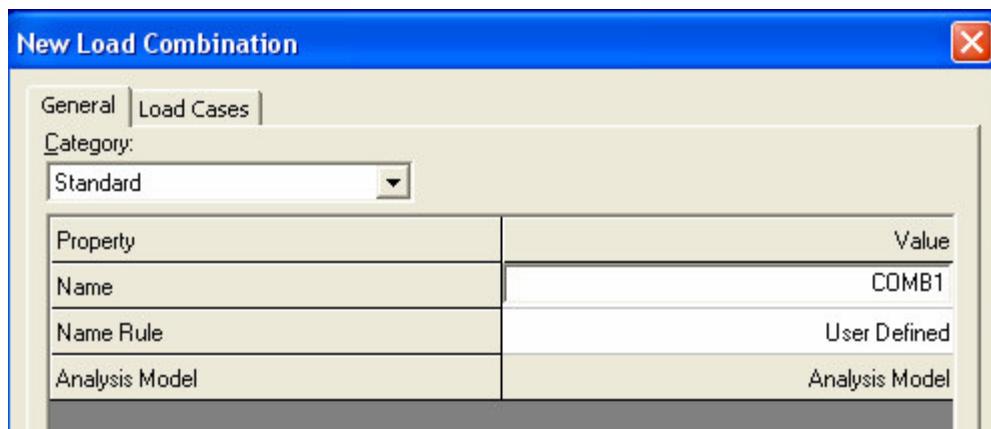


7 Create a WIND load.



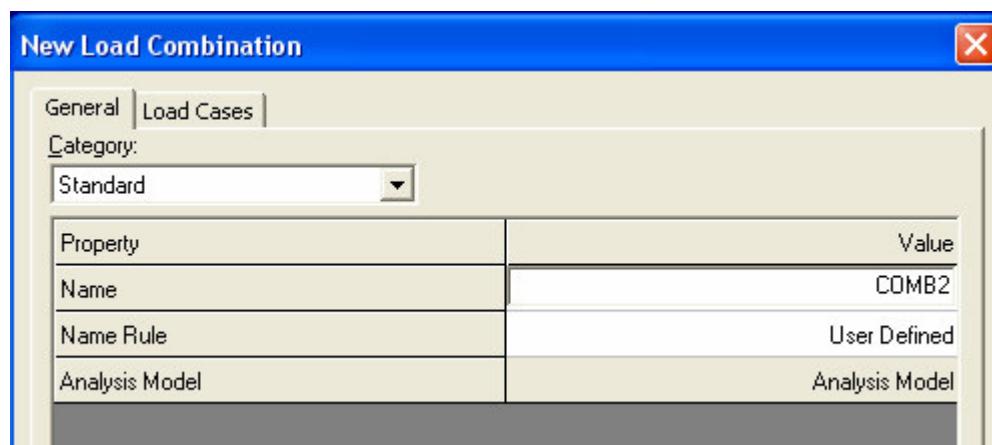
8 Create Load Combinations. 

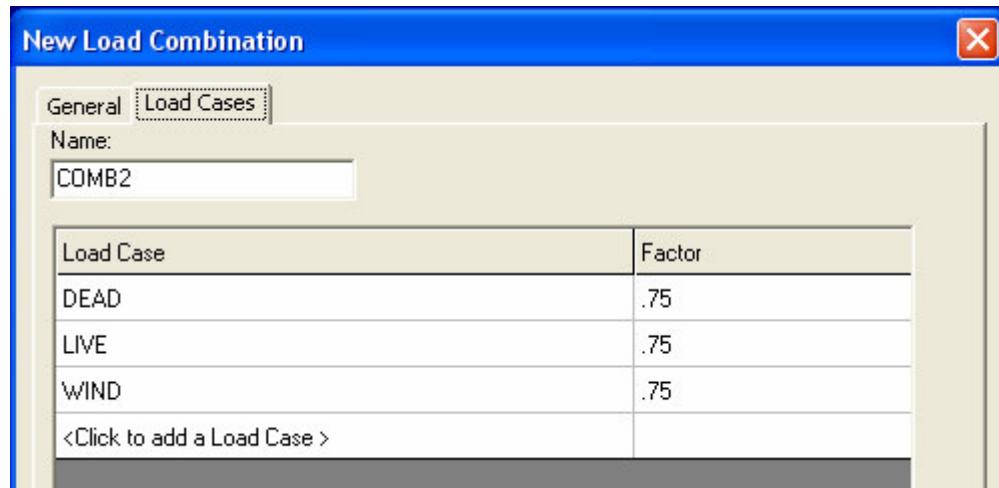
9 COMB1: Dead + Live with the Factor as 1.0



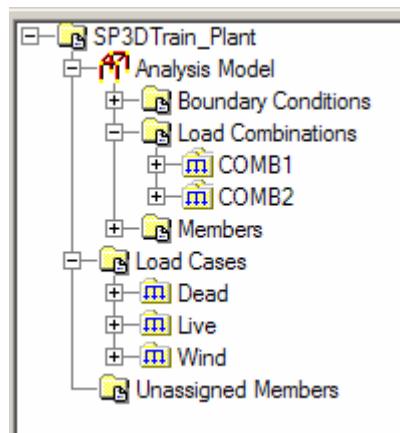
10 Create Load Combinations.

11 COMB2: Dead + Live + Wind with the Factor of 0.75





- 12 The Workspace Explorer now includes the Load Cases and Combinations created above on the Analysis Tab.



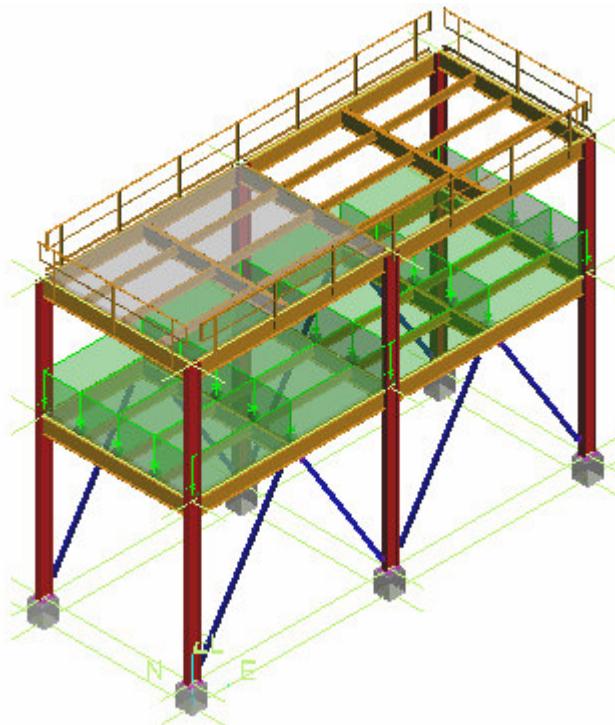
Part II: Place Live and Dead Loads

- 1 Click Place Distributed Load. 
- 2 the following load for the beams at Elevation 18'-0":
 Load Case: DEAD
 Load: Force Z
 Reference: Global
 Position as: Relative
 Start Position: 0

End Position: 1
Start and End Magnitude: -0.65 kpf

| | | | | | | | |
|------------|---------|------------|--------------|-----------------|---------------|------------------|----------------|
| Load Case: | Load: | Reference: | Position As: | Start Position: | End Position: | Start Magnitude: | End Magnitude: |
| DEAD | Force Z | Global | Relative | 0 | 1 | -0.65 kpf | -0.65 kpf |

Select all beams at Elevation 18'-0" and click Finish. Loads will be placed as shown below:

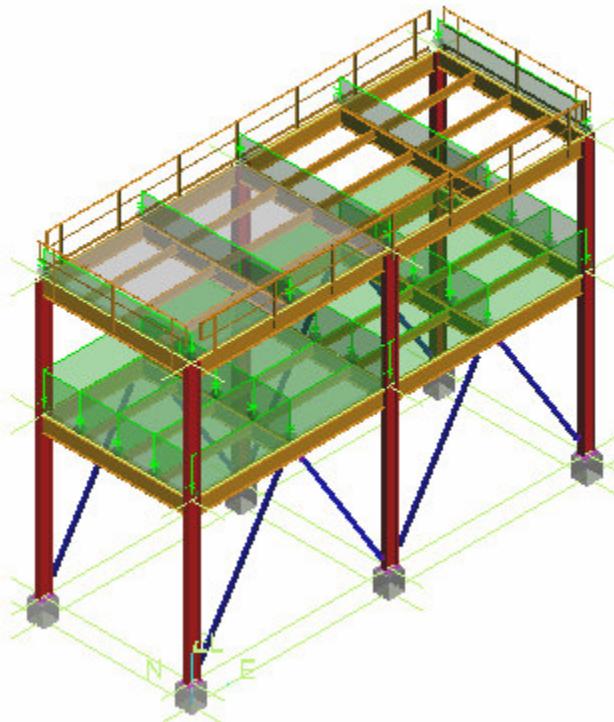


- 3 Define the following distributed load for the beams at Elevation 30'-0":

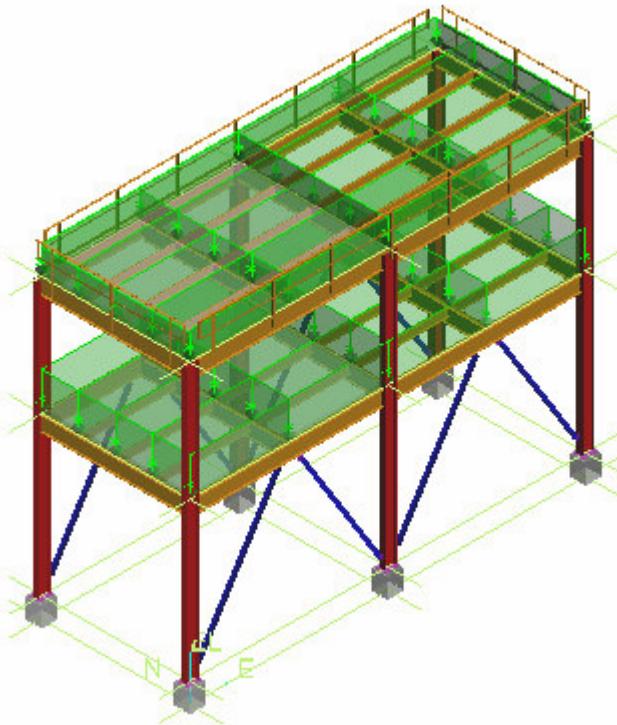
Load Case: DEAD
Load: Force Z
Reference: Global
Position as: Relative
Start Position: 0
End Position: 1
Start and End Magnitude: -0.100 kpf



- 4 Select the beams running north/south at Elevation 30'-0" and click Finish.
- 5 Loads will be placed as shown below:



- 6 Change the Magnitude to -0.200 kpf and apply this to the 4 primary beams running east/west at Elevation 30'-0".
- 7 Change the Load Case Name to Live and the Magnitude to -.220 kpf and apply the load to the 4 primary beams running east/west at Elevation 30'-0" and the interior framing members
- 8 Change the Magnitude to -0.110 kpf and apply the Live Load to the 3 beams running north/south at Elevation 30'-0"

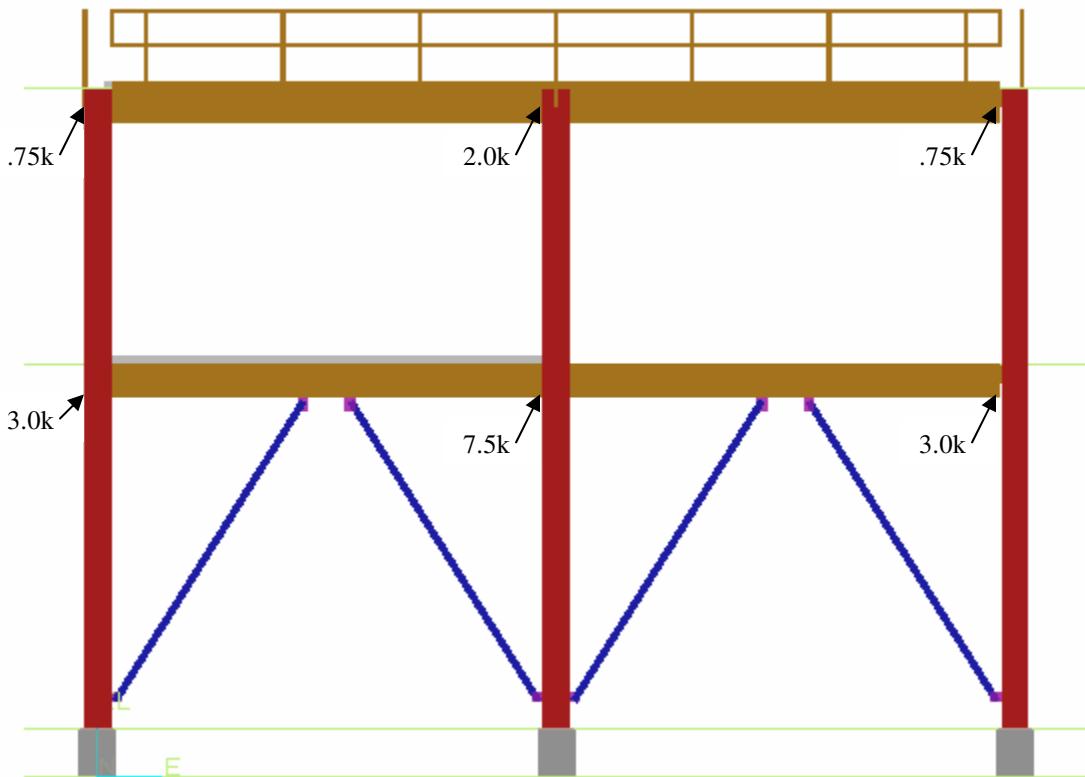


Part III: Place Wind Loads

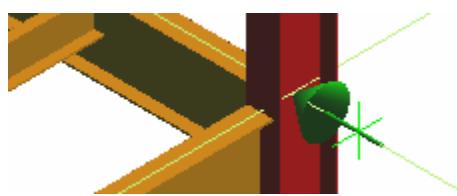
- 1 Click Place Concentrated Load. 
- 2 Define the load as:
Load Case: WIND
Load: Force Y
Reference: Global
Position as: Relative

| | | | | | |
|------------|---------|------------|--------------|-----------|------------|
| Load Case: | Load: | Reference: | Position As: | Position: | Magnitude: |
| WIND | Force Y | Global | Relative | 1 | 0.75 kip |

- 3 Place concentrated wind loads in the X direction on the south side of the structure with the following magnitudes:

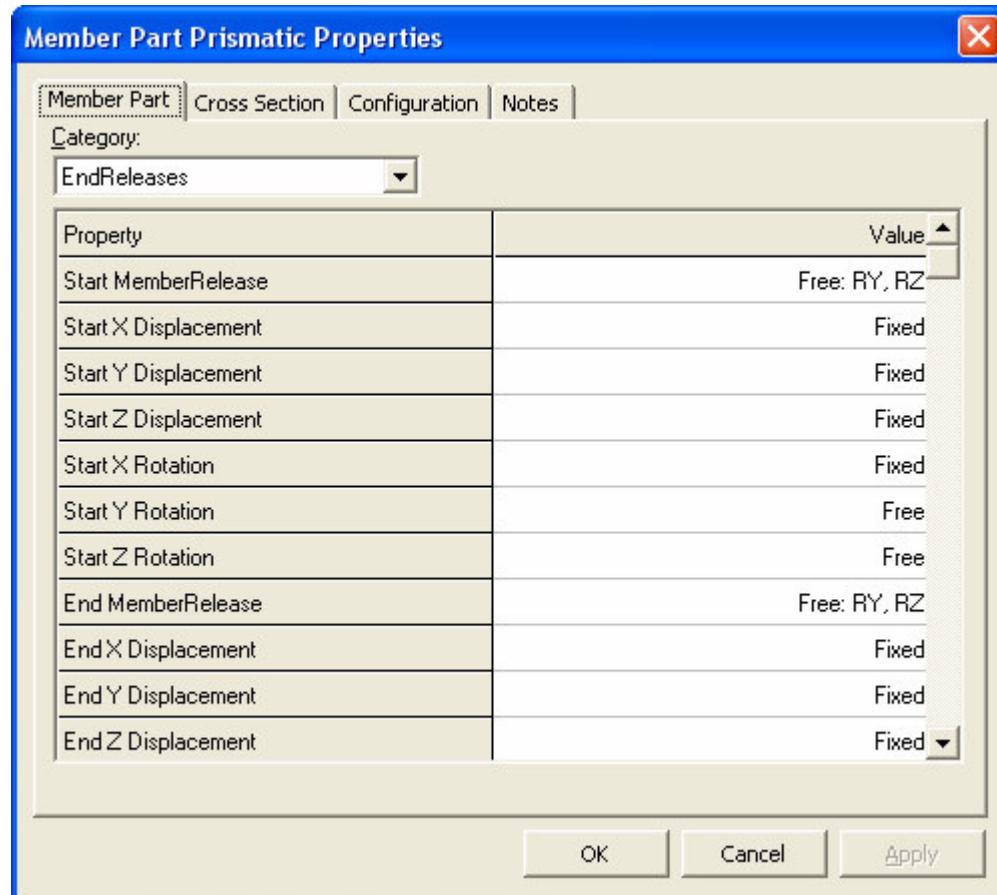


Load representation:



Part IV: Set Member Releases

- 1 Select all beams in Unit 2 with Locate Filter set to Member Parts
- 2 Select Edit -> Properties in Menu to open the Properties dialog box
- 3 Choose the End Releases Category.
- 4 Set Start and End MemberRelease to Free: RY, RZ.



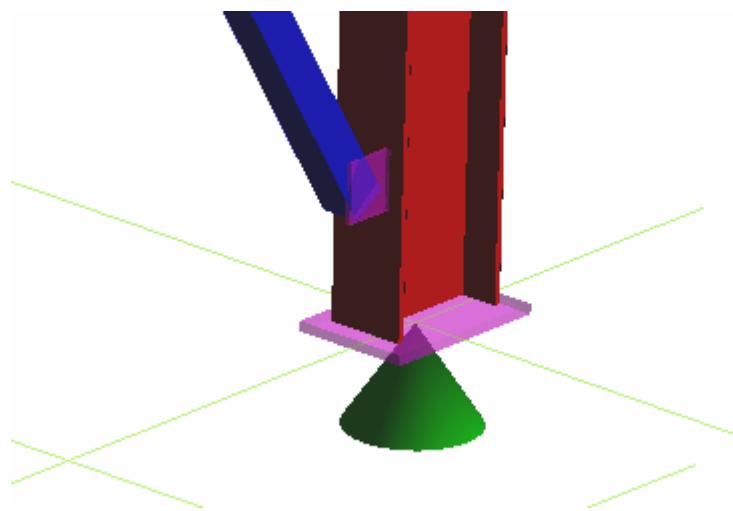
Part V: Place Boundary Conditions

- 1 Create a filter to include all member part in Unit 2. Select the Analysis Model in the Workspace Explorer. Apply the filter to the Analysis Model.
- 2 Select Place Boundary Conditions.
- 3 Select Frame Connections at the bottom of the first floor columns

4 Set the Type to Fix: X,Y,Z,RZ



5 Select Finish. Boundary Conditions are placed.

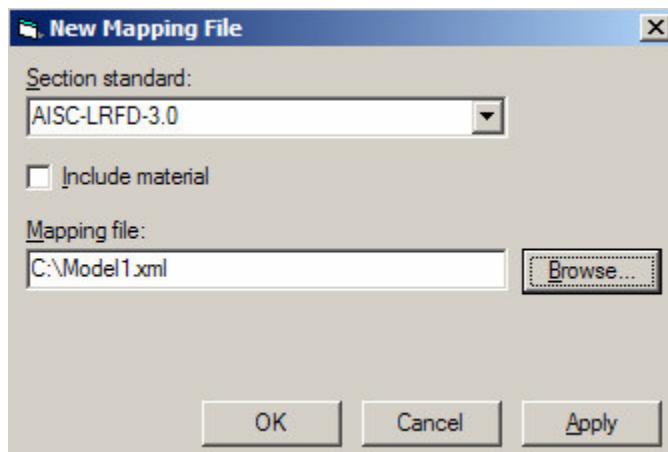


Part VI: Export Analytical Model and Update from Analysis

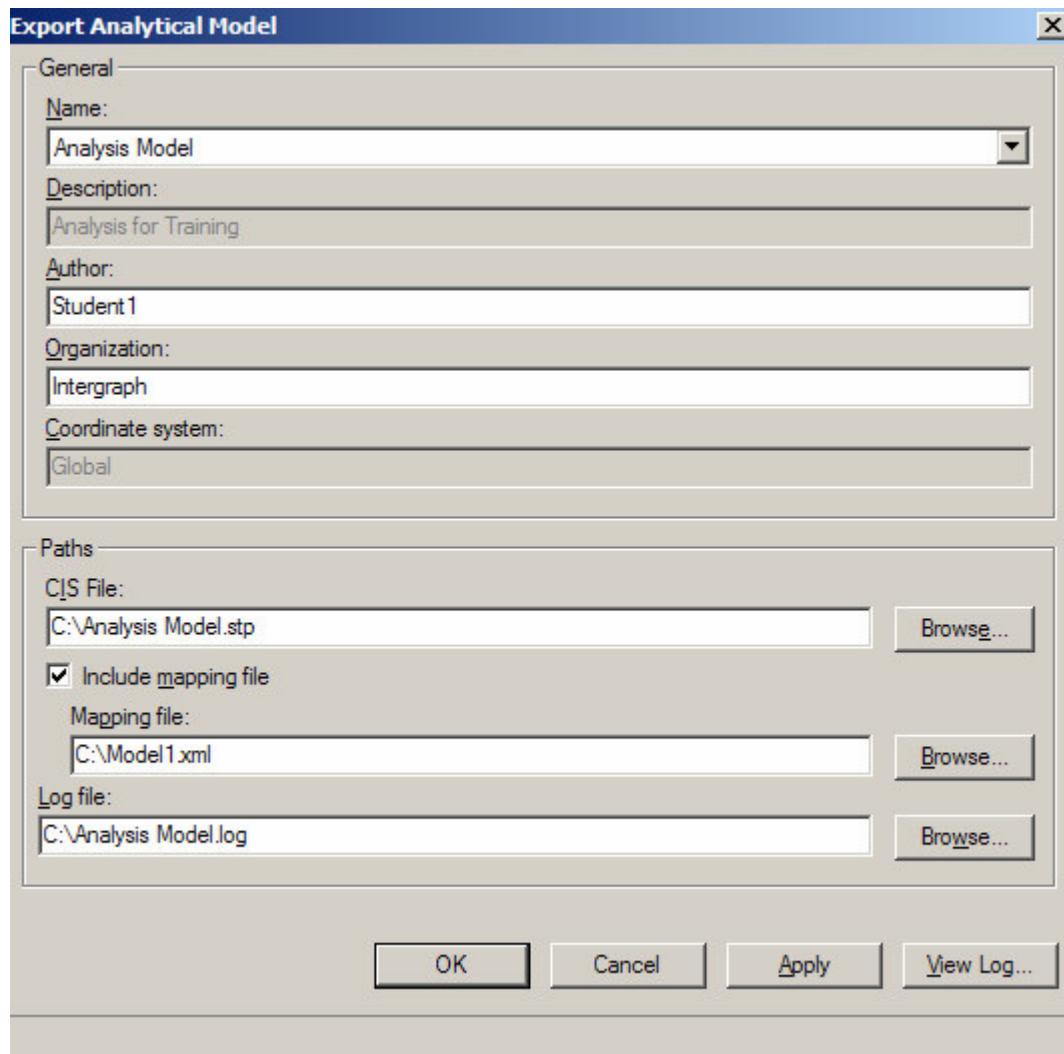
1 Select File -> New Mapping File

Note: First you need to create a mapping file. The mapping file must be used if the third party analysis program you are using calls the section standard a different name from what is delivered with SmartPlant 3D's mapping file. For example, STAAD calls its section standard 'AISC EDI Standard Nomenclature'. Therefore, the line in the mapping file that maps these two Section Standards must be changed from <Standard name="AISC-LRFD-3.0" externalname="AISC-LRFD-3.0". externalorganization="AISC" externaldate="2002" externalversion="3.0" /> to <Standard name="AISC-LRFD-3.0" externalname="AISC EDI Standard Nomenclature"externalorganization="AISC" externaldate="2002" externalversion="3.0" /> in order to get the section sizes updated.

Name the mapping file as follows:



2 To create a CIS file, select Export Analytical Model.



- 3 To update from a CIS file, select Update from Analysis/Design (Optional)