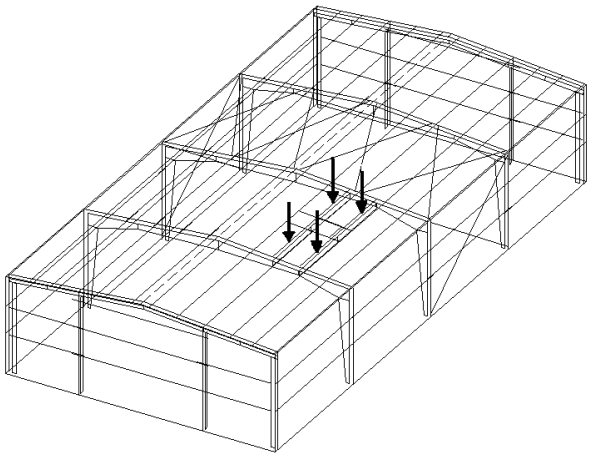
Lesson 17: Roof Top Unit Support Beams; Basic Point Loads:

- Inserting beams between frames to support Roof Top Units or concentrated loads
- Loading the roof beams so they design
- Locating a roof framed opening

Lesson Comments:

This lesson will discuss the procedure for adding beams in the roof and loading them so they design. In addition, we will be locating a roof framed opening.



Building Information:

Main Building	50x100x18 25' Bays	1:12

Use your default with local loading.

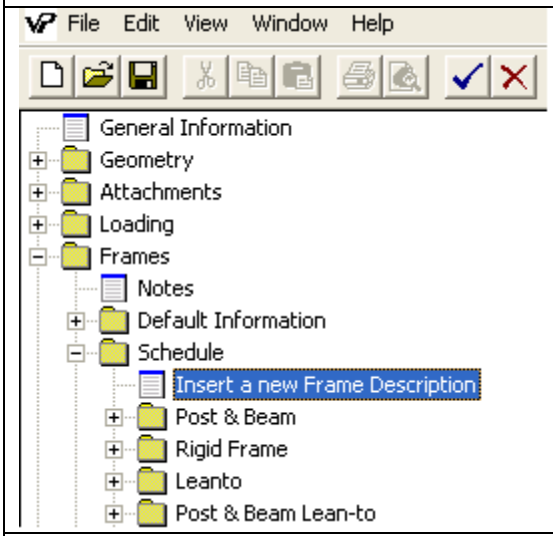
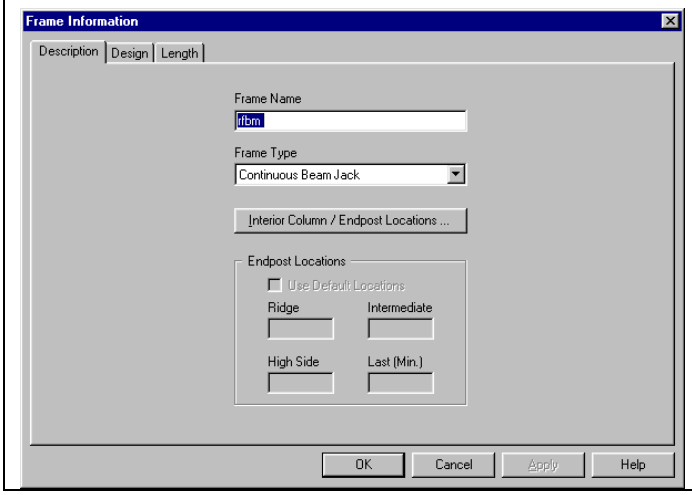
All deflections set for metal panels.

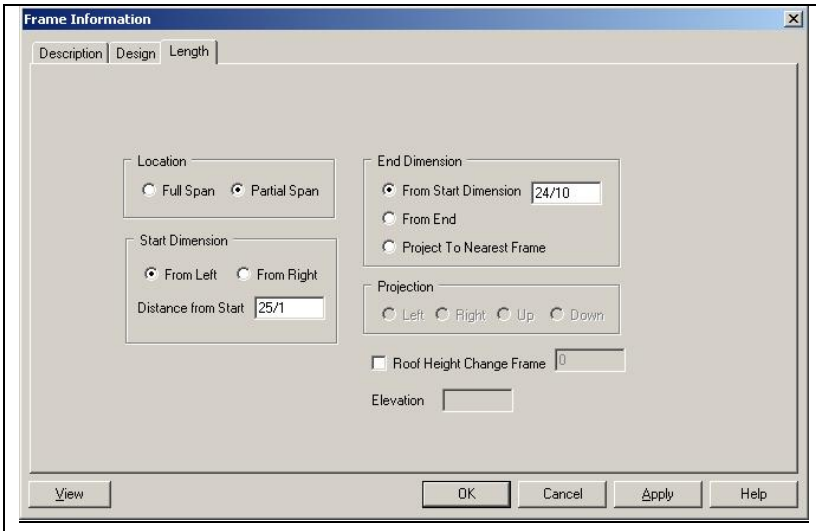
- The roof beams are to be located at 10' and 15' from the front sidewall (Wall 4) in the second bay. Each beam is to be loaded with 2 kips of concentrated Dead Load at 4' from the center of the beam on each side of the centerline of the beam (4 loads). These loads will come from pipes supporting the roof top unit.
- In addition to the roof beams, there will be a 4'x4' framed opening to allow a curb to flash the duct coming thru the roof centered on the beam locations

Discussion

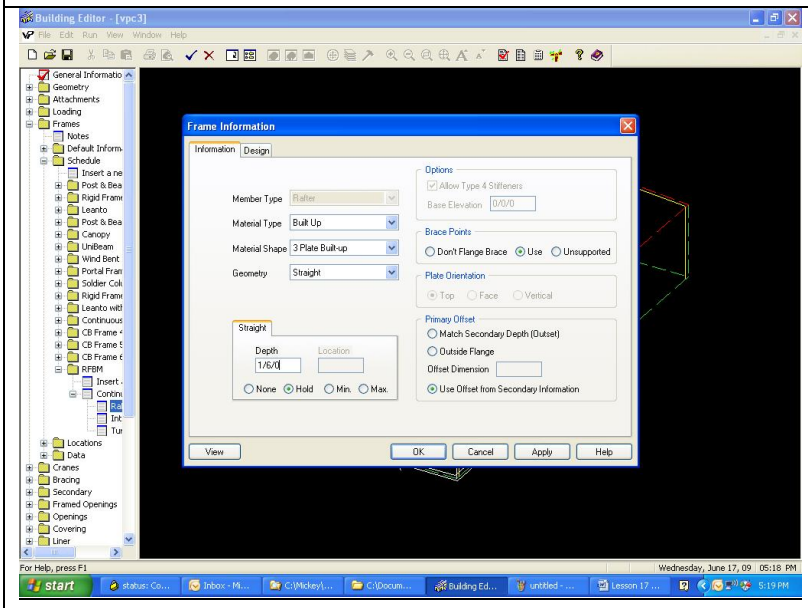
There are many occasions to put a beam in the roof of a structure to support hanging equipment, roof top units or to support another lean-to type frame. These beams can be input into VPCommand as frames using the Continuous Beam Jack frame without interior columns. One end of the beam will have a pin connection and the other end will have a simulated roller connection.

The beams will not pick up an environmental load that is placed on the roof. If it is necessary to load the beams, you must input using Frames, Data, Shape Name, Wall located, select the frame and double click on it. Select the member (rafter) and loading, properties. On this screen, the loads will be inserted on the member. If no loads are inserted on the member and no secondary touches it to put a load on it, the member will not design nor will the frames it touches.

General Instructions:	1) Start new job 2) Choose PR_PR_default (Or Your Default with local Loading) 3) Input General Information 4) Input Loading Information 5) Input a new shape, name it "Roof Beam Example" 6) Choose Rectangle for the shape 7) Input the dimensions for shape 8) Add frames, Rigid Frame & P & B to the Building.
	9) Add roof beams to the frame schedule, by revising Insert a new Frame Description.
	10) Name it "RFBM" and select the Continuous Beam Jack as the frame type.



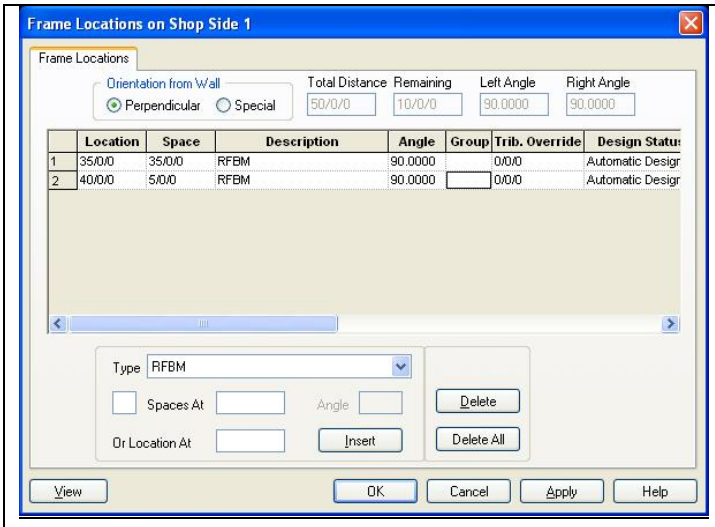
11) Set the length to partial and make the start dimension 25/1/0 from left and the "from start dimension" to 24/10/0. This will set the overall length of the beam to 24'-10", the distance between frames where the beam is to located.
    a) Note: A minimum of 1" separation between the end of the beam and the frame rafter is required for proper input.
12) Click OK.



13) Refresh the tree (F5) and go to the frame schedule. Open the roof beam (RFBM) and Cont. Beam Jack, open on the rafter folder. Make it straight and set the primary offset to match secondary depth outset. This will set the top of the beam at the same elevation as the main frames and will allow the secondary roof framed opening to pass over the roof beams.

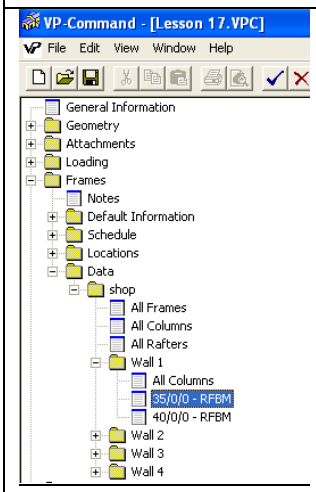
Optional Depth Constraint:

Set the Min. depth to L/24 of the span. (25x12/24=12.5") then Click OK. This is an approximate optimum depth and is meant as a guideline only.

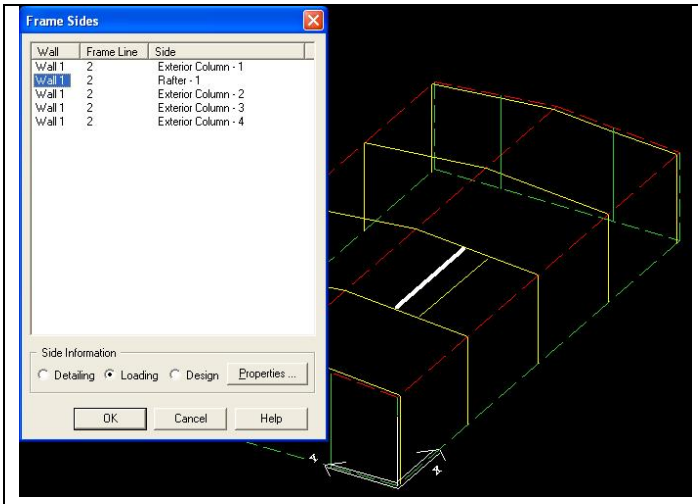


14) When locating the roof beam frame, locate it off the endwall (wall 1).Go to Frame / Location /Wall 1. The location of the beams will be at 35' and 40' measured from the left side of wall 1. This will place the beams at 5' apart.
15) In the Trib. Override column, input a 0/0/0 override. This is entered so that the beams will not pick up any roof loads. Click OK.
    a) Caution: Columns under beams at the ridge must be located exactly at the ridge and those over other interior columns must be located a minimum of 1/8" away from the column.

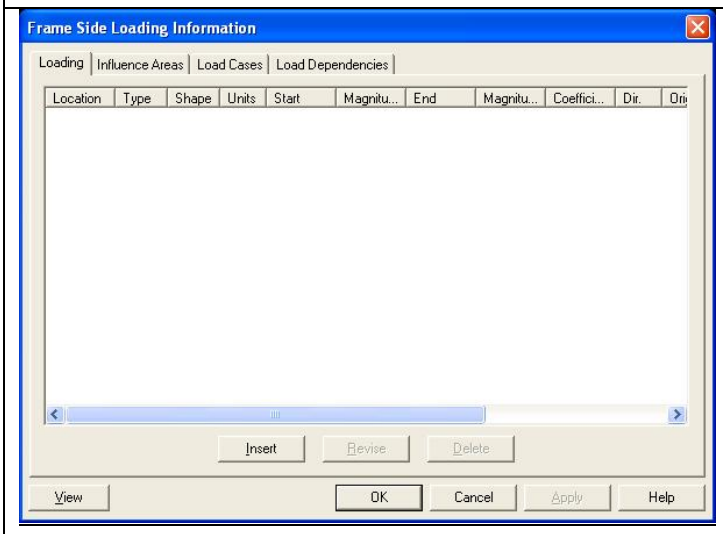
<u>This completes the process of inputting the beams and locating them in the roof.</u>



16) <u>Loading the Beams.</u> Refresh the tree (F5) and go to Frames/Data/Shape name/Wall 1.



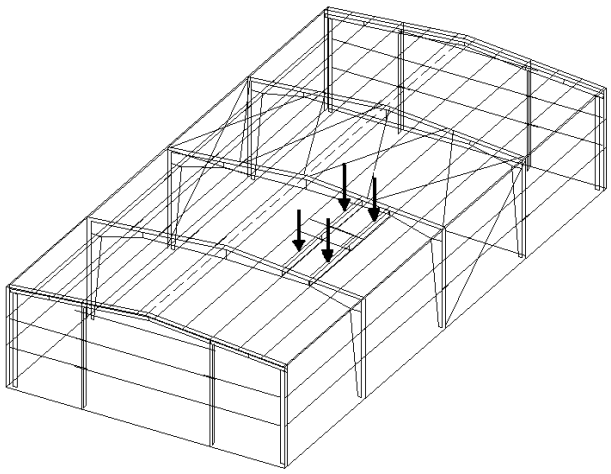
17) Select the beam to be loaded (double click). Select the rafter 1 and the loading and click on the properties button.



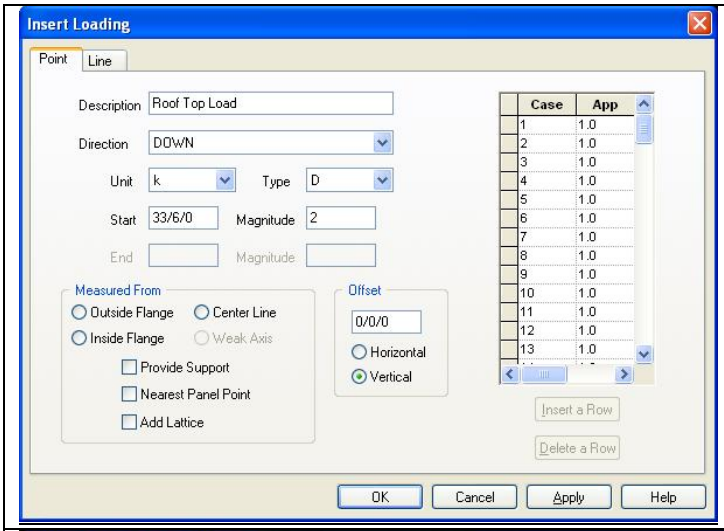
18) The loading window will open for the beam and will NOT show the loads on the frame.

Note: This is because we gave a 0/0/0 Trib. Override at the Locations screen. If the screen shows any loads, go back to step 15 to correctly input the Trib. Override.

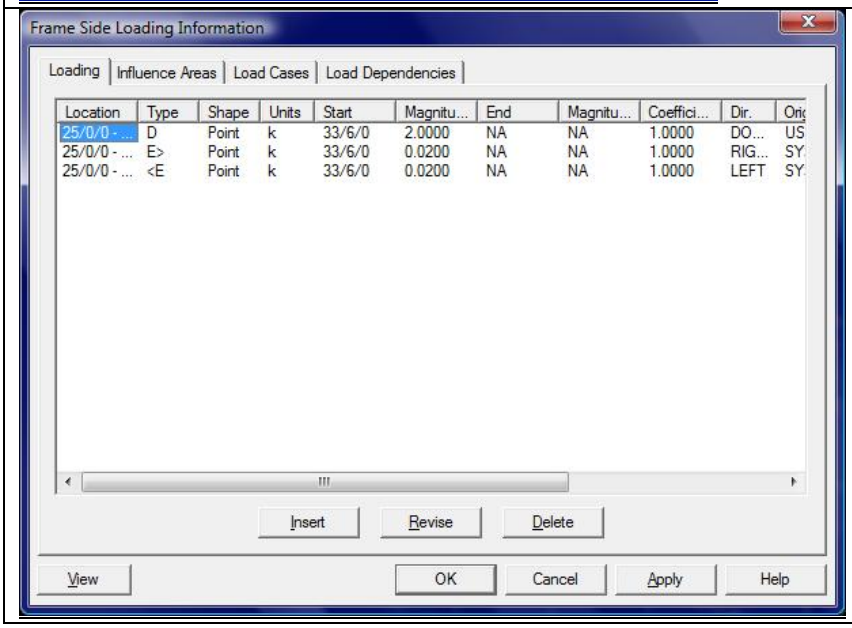
19) Click on the insert button at bottom left.



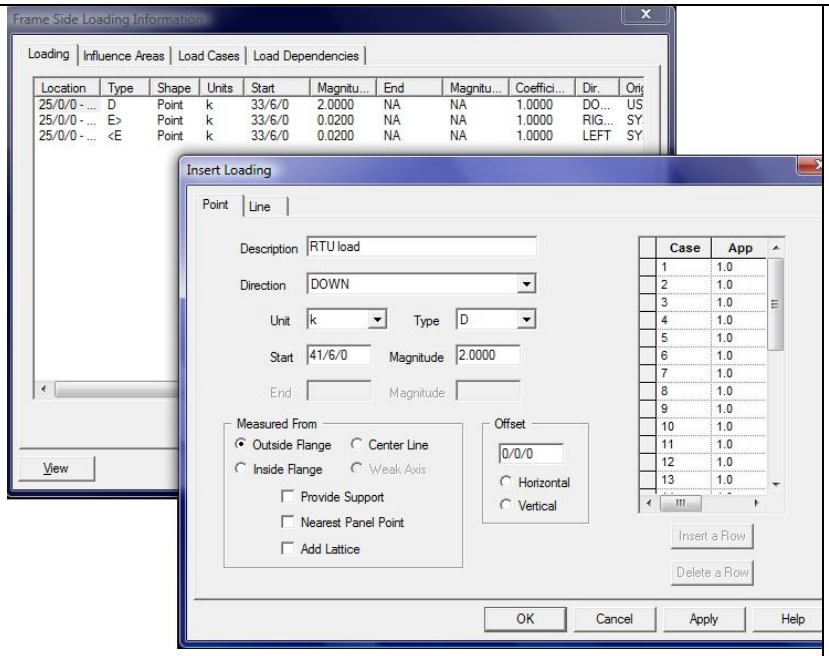
The Supports for the Roof top unit are located 8' apart on the beams, and the center of the bay is 37'-6" from Wall 1, then the loads should be applied at 33'-6", and 41'-6"



20) The screen will change to the load input screen and you can input the load on the frame.
   a) Put a 2 Kip Dead load on the beams for this example. This load magnitude will vary per project.
   b) The load start point is measured from the wall you inserted the beams on, in this case Wall1. Use the screen print to the right for reference.

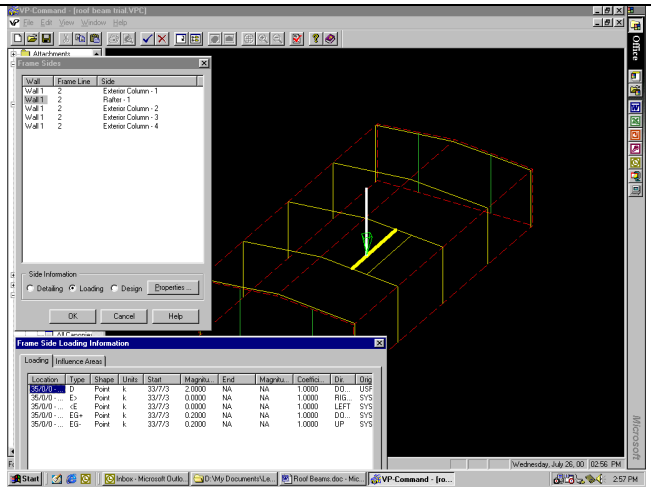


Note: If you highlight the first load at the Loading screen, and then click on the insert button, it will copy all of the information into the screen, and then you just have to change the Start Dimension.



21) The screen will change to the load input screen and you can input the load on the frame.
    a) Put a 2 Kip Dead load on the beams as you did before, at 41'-6".

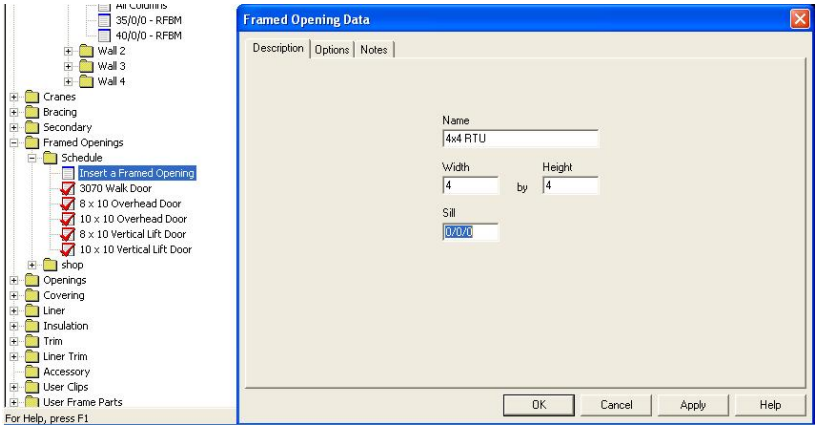
Repeat these steps on the other roof beam.

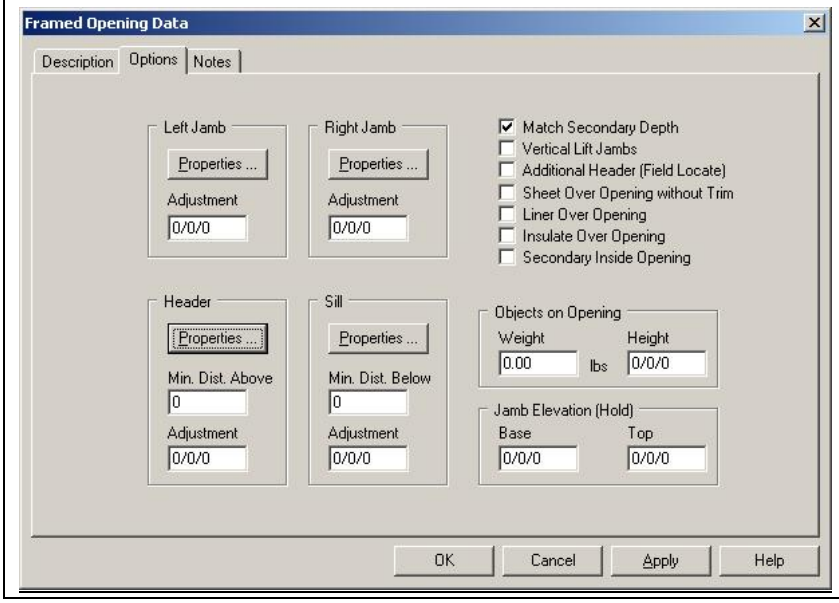


<u>You should have a total of 4 loads on the two beams</u>

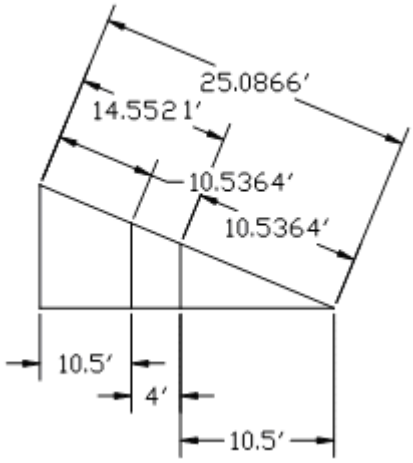
Tip: To see the load graphically, click OK, exit and come back in and click on the load. Move the window out of the way so you can see the building behind it and you should see the load on the beam.

Locating the Roof Framed Opening.

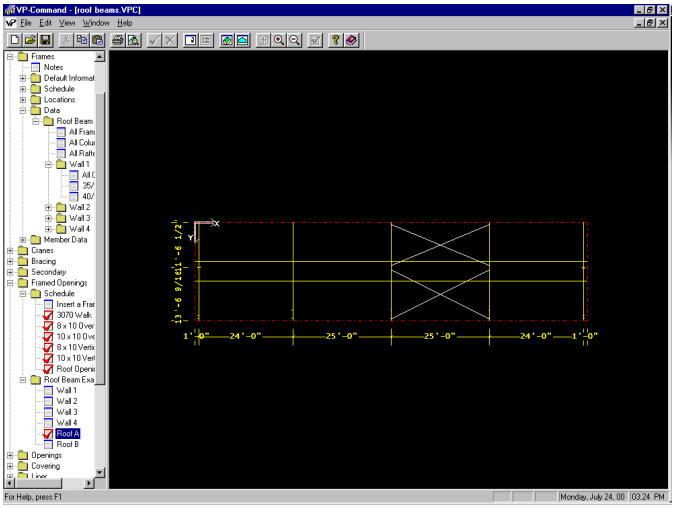




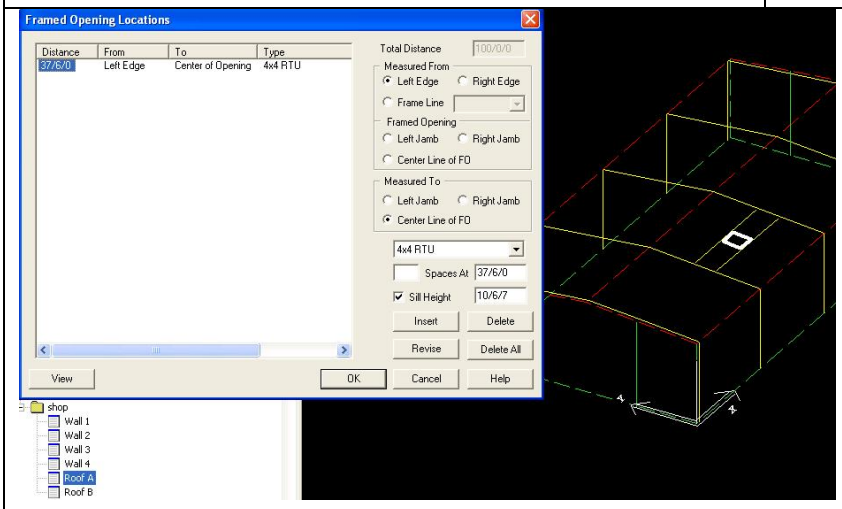
22) Go to Framed Openings/ Schedule and input a Roof Opening that is 4'x 4'
   a) Go into the Options tab and input "0" (zero) distance above header and below sil so the framed opening jambs will stop at the boundaries of the opening (4' x 4' in this example) and then seek out the closet available purlin for connections.



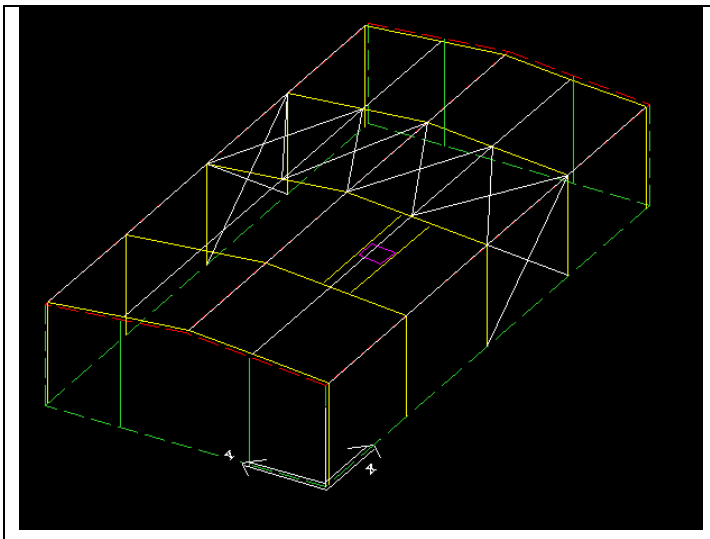
The sill distance is the distance from the ridge of the building to the sill of the opening, on the slope. (Framed openings are input on the wall with the sill from the floor line, on roofs the sill dimension is measured from the ridge of the building, or high side of a single-slope. The sill for our opening is a Sill of 10' 6 7/16".



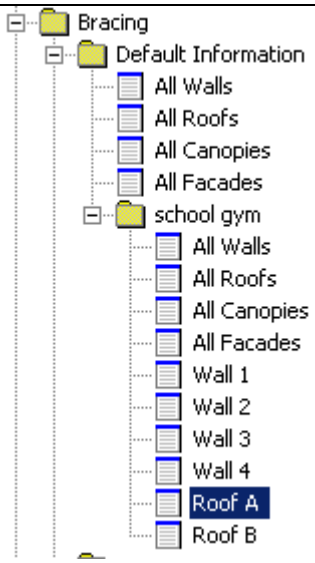
The horizontal location is measured from the origin of the roof, the Left Endwall in this case. Go to the roof elevation to see where the origin is located. This is where the Framed Opening will be measured from. Notice the origin is at the ridge and on the left endwall looking down on the roof plane. So the location of the opening should be 37' 6" from the left edge measured to the centerline of the opening. Input this information in the Framed opening screen to add your roof opening.



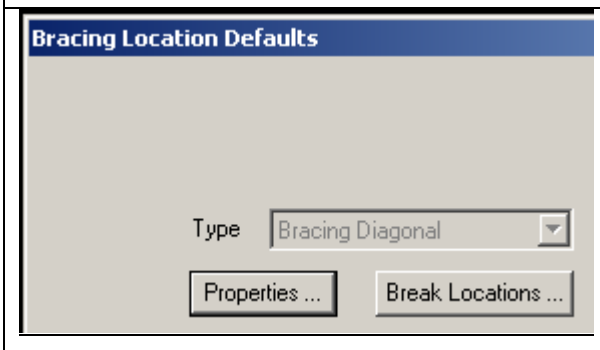
23) Open Framed Openings/Shop/Roof A, and insert your 4x4 RTU in with the location of 37/6, and the sill height of 10/6/7.



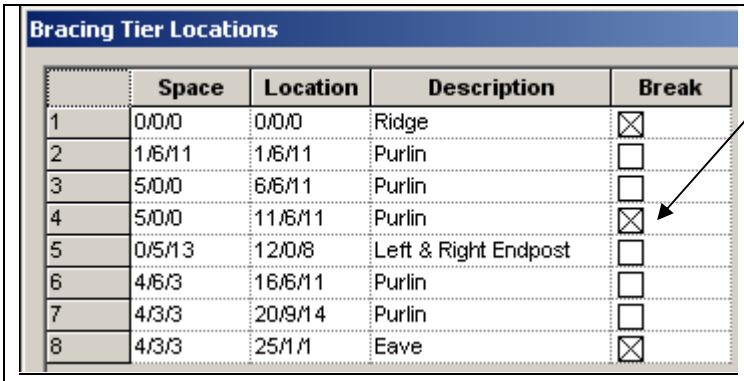
Once you OK, you will see that the bracing is now cutting through the framed opening.

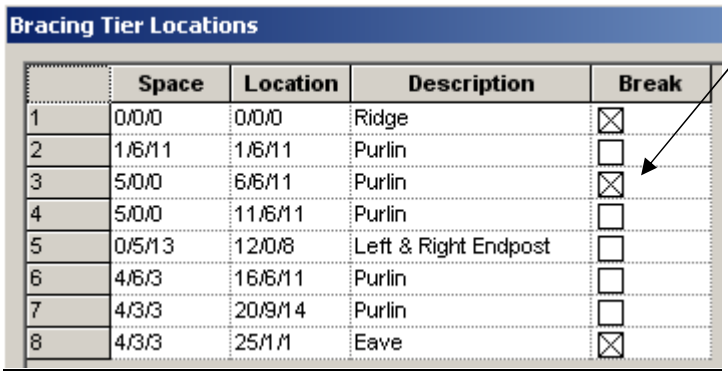


24) Refresh the tree, and then open Bracing/Default Information/(Shape name)/ Roof A.

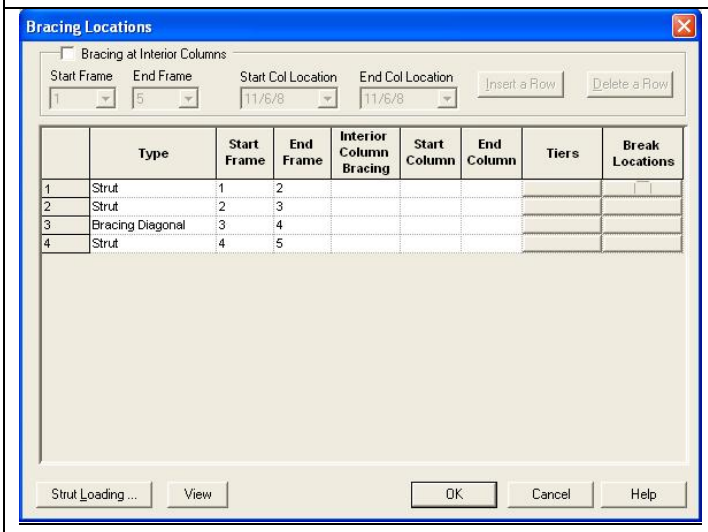


25) From the bracing location default window, click on the Break Locations button.

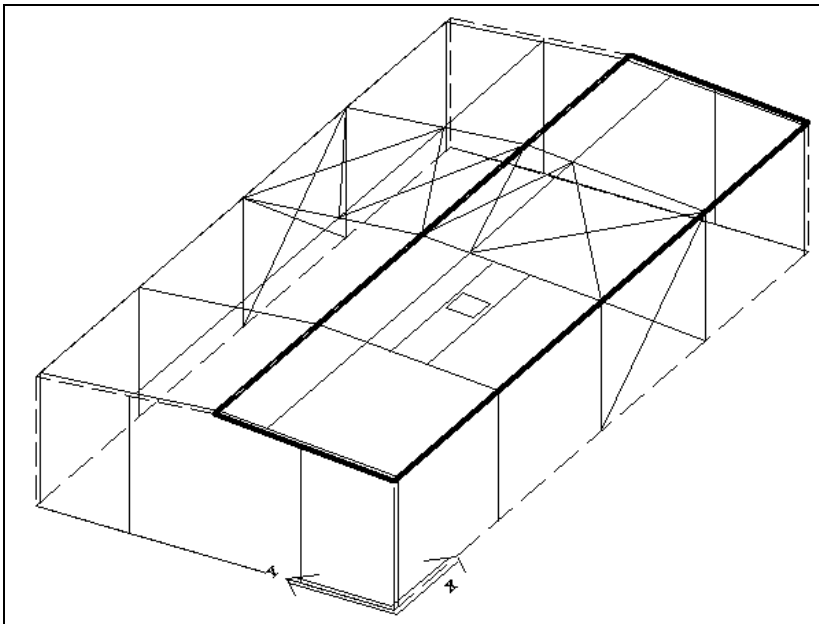




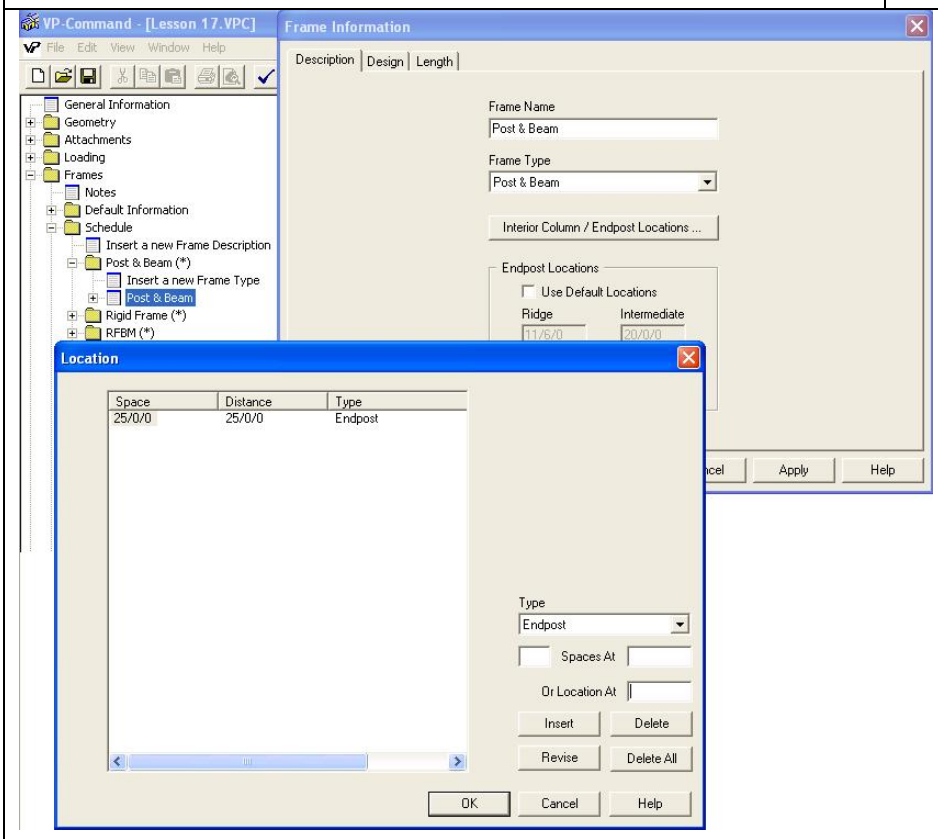
26) At the Bracing Tier Locations window, Delete the X at line 4, in the Break Column. This will remove the break at that location on the roof.
27) Then click on the X at Line 3.
28) Once Done click on OK / OK.



29) Once you have done line 1, you will have to repeat the steps for all lines.

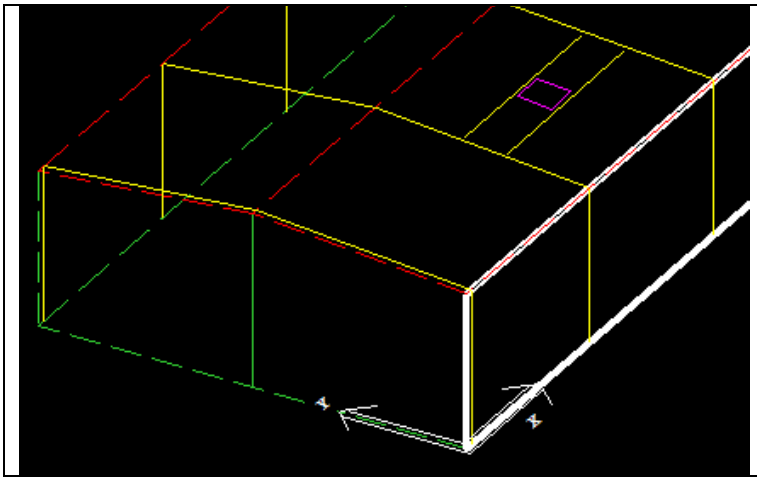


30) Once you make the change the roof Bracing should look like this.



You may want to change the endpost spacing on the Post & Beam frame so you only have one post for the 50' endwall.

31) Open the Frames/Schedule/Post & Beam folders, and then revise the Post & Beam file.
32) Then un-check the Use Default Locations, and click on the Interior Column/Endpost Locations button.
33) Then at the Locations screen Insert the endpost at 25/0/0, and then OK out of the screens.

	Once Complete the building should look like this. 34) Run pricing & edit reports 35) Verify all unpriced items & either fix them or add money for condition. 36) Rerun pricing and edit reports. 37) Should look like this.

Notes: