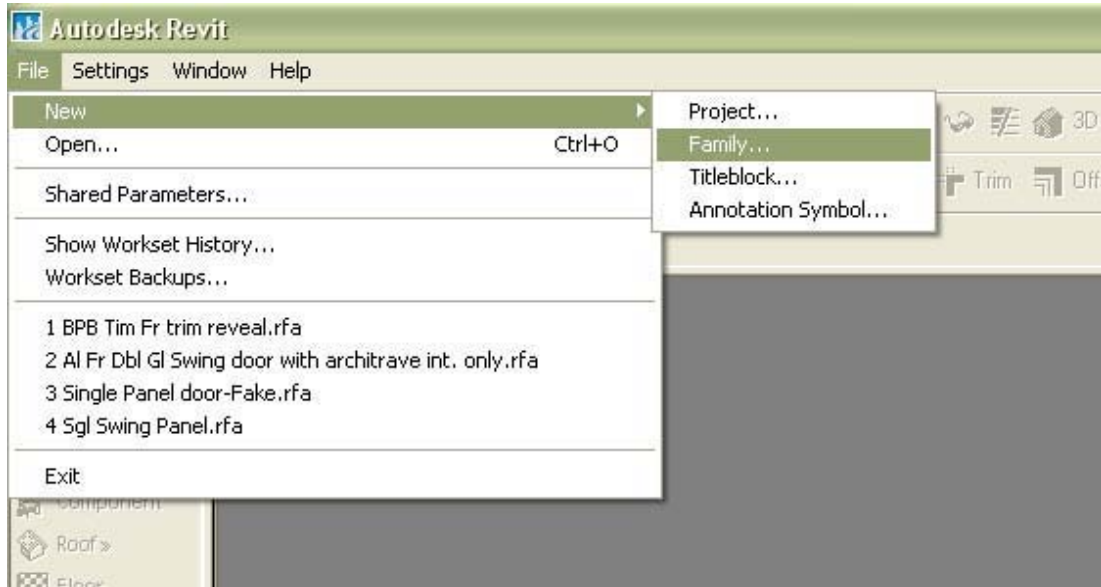


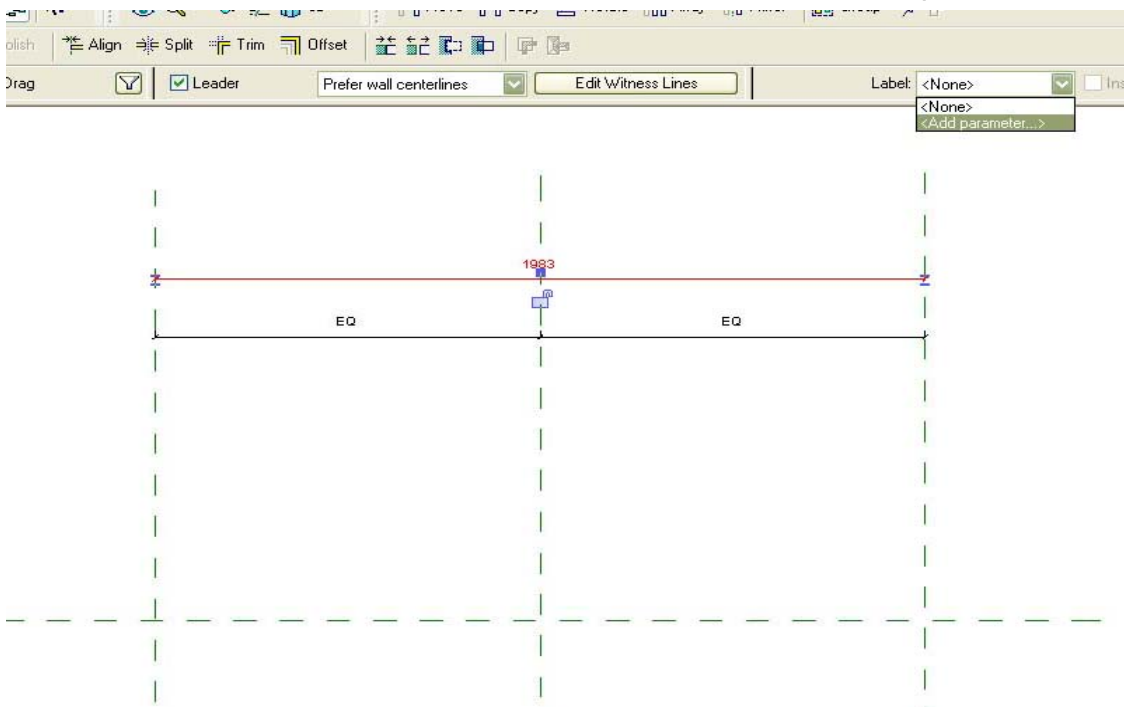
## NESTED & ARRAYED FAMILIES TUTORIAL

In this tutorial you will learn how to create a basic parametric louvered window.

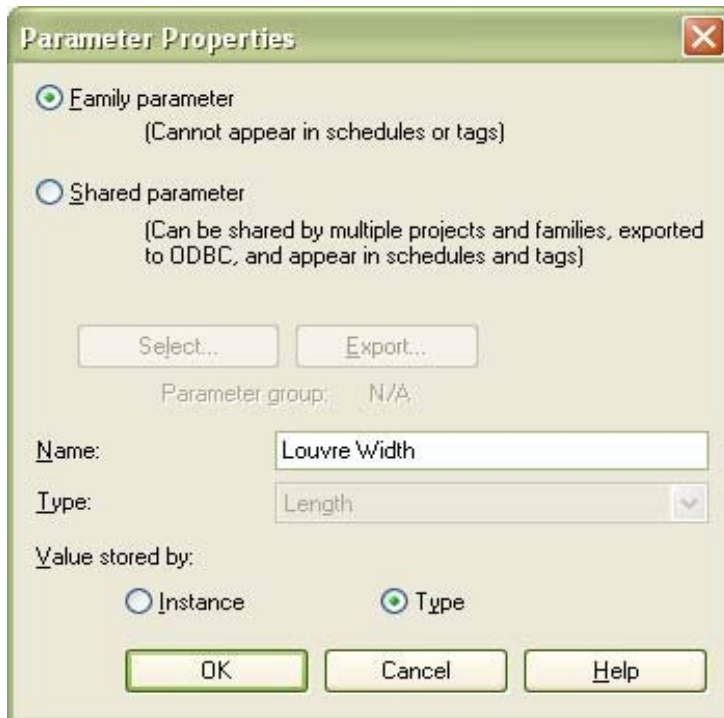
1. Begin by opening Revit (6.1 or later) and choose NEW»»FAMILY and then selecting Generic Model.rta from the list.



2. Next, open your floor plan»»reference level and place two reference planes vertically to the left and right of the centre reference plane. Dimension all these in one string and equalize the dimension. Then dimension between the newly created reference planes and select the dimension. Then from the label menu choose <Add parameter...>.



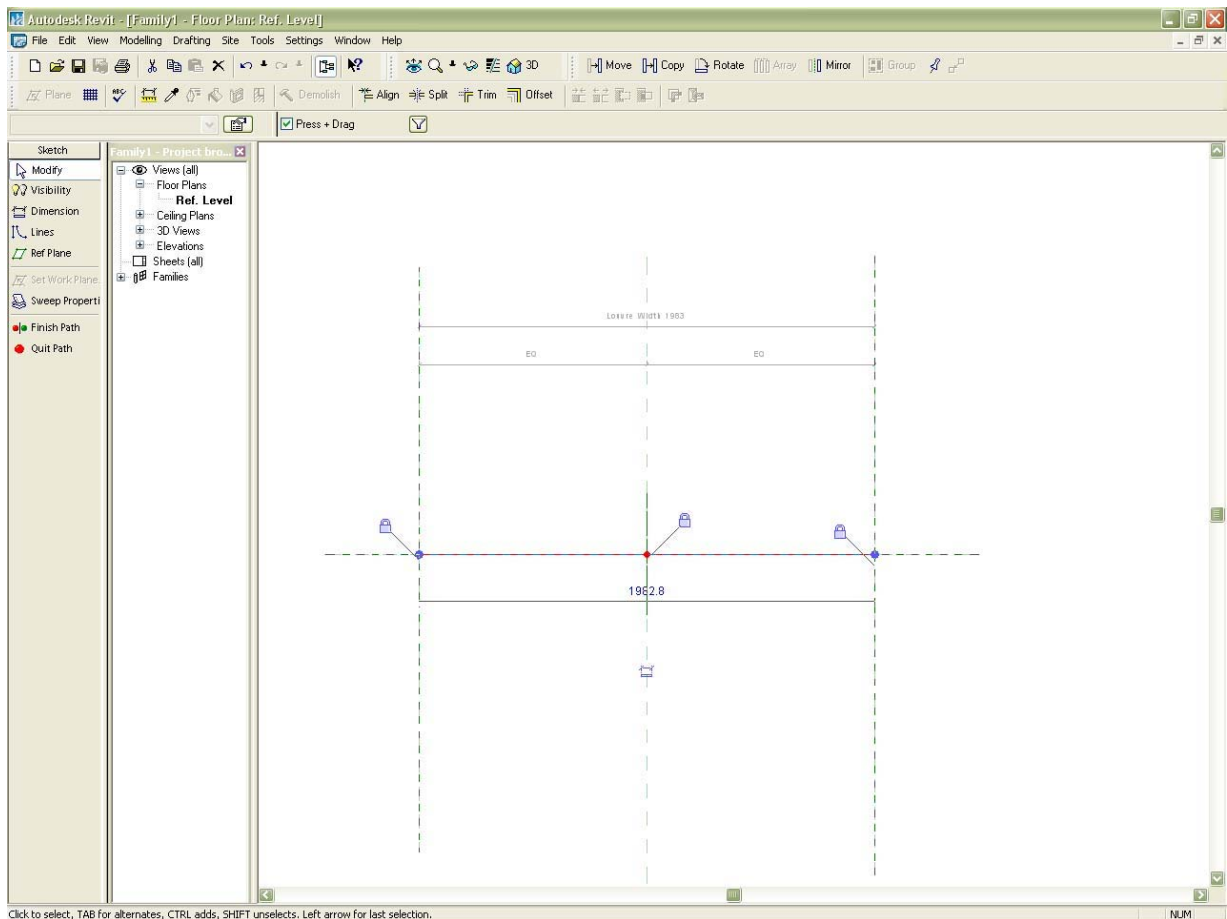
- Label the length parameter as Louvre Width and select Type then click OK.



- Now we need to create our louvre which we will later use to nest into our window family. Select solid from the menu at the left and choose Sweep then click OK.

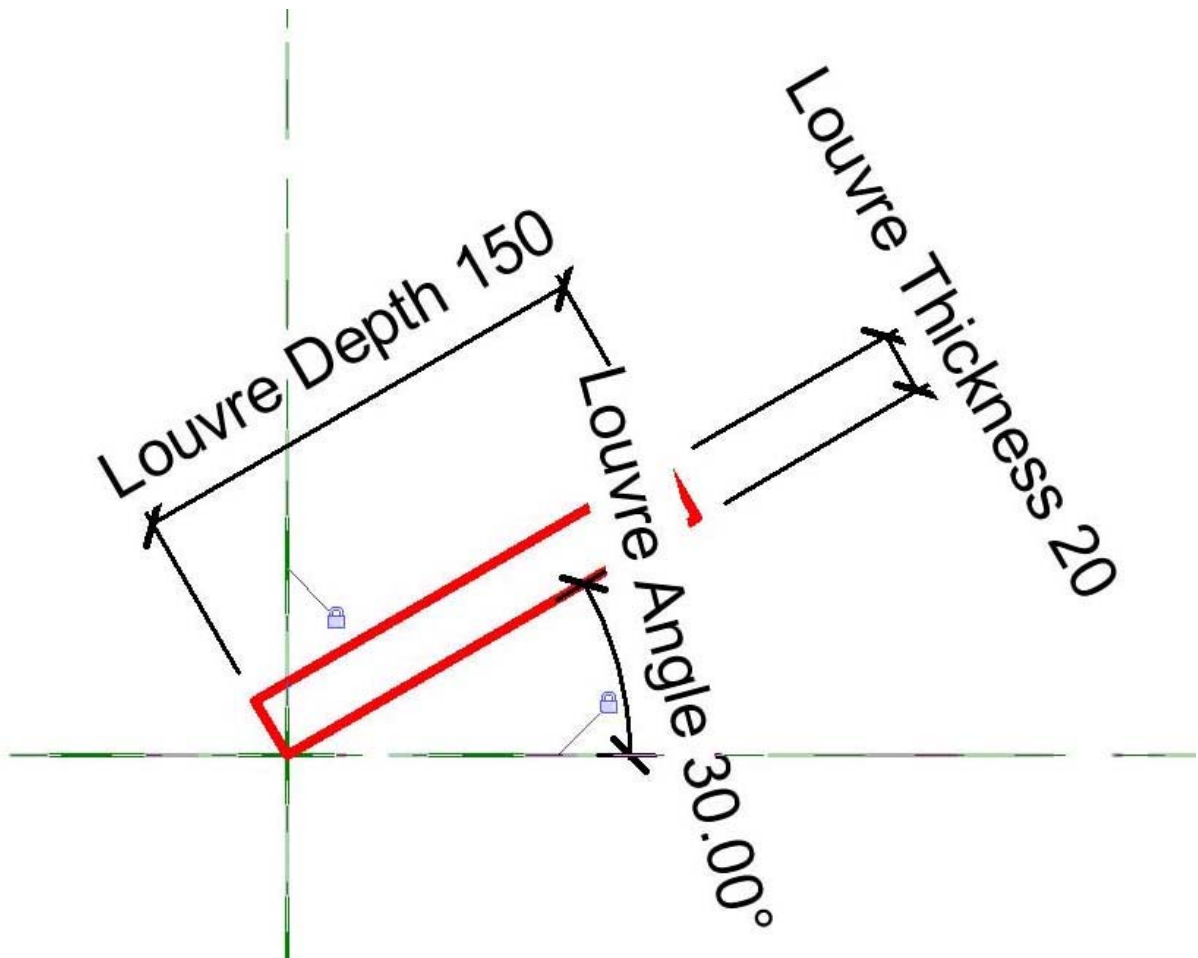


5. Whilst in the reference level view, select 'sketch 2D path'. Then draw a horizontal line on the reference plane going from the right reference plane to the left. Once finished lock all padlocks that come up. There are two that come up originally, one at the right and one on the centre, however we still need to lock the end point. Use the Align tool by first selecting the left vertical reference plane and then the end point of the sketched line which is to end at this point, then lock. Now when you select the line and click activate dimensions there should be three padlocks visible. If not align the other sections of line until there is.

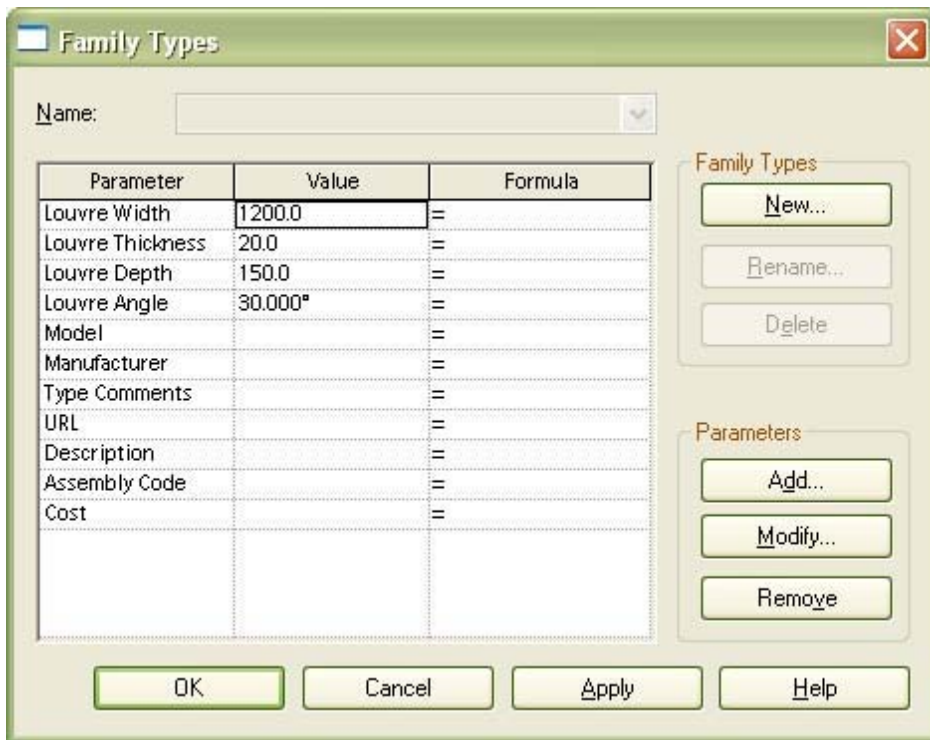


6. Select Finish Path from the sketch menu at the left of the screen. Now we need to create the profile which will follow this line. Select Sketch Profile. You will then be asked to open an appropriate view, select the left elevation.
7. Now we must draw the profile for a louvre. In this tutorial we will keep it simple by creating an angled box section louvre, however it is possible to create any detailed profiled louvre you require. The main thing to remember is where you locate the intersection of the reference planes in your sketch as this is the origin and will be how you locate the louvre in the window family. If done incorrectly it will become very irritating as you will find parameters may not function as planned.

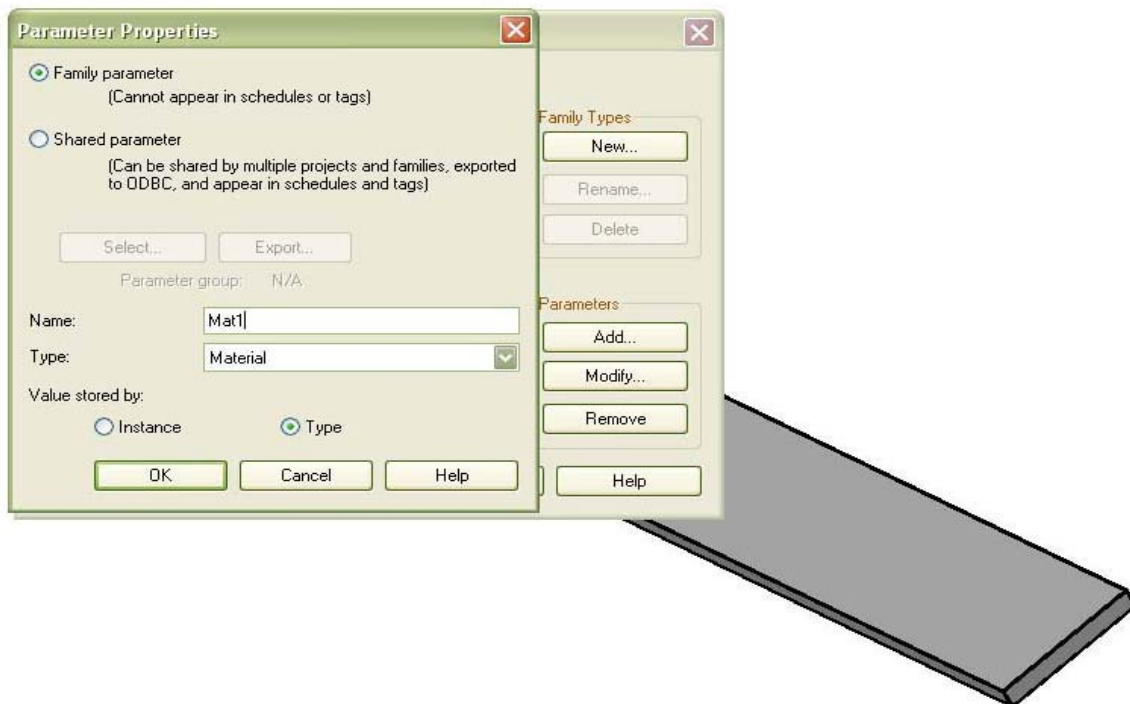
8. Draw a box section as shown below, making sure you locate the bottom left corner in the position shown. Once you have drawn the box section use the align tool on the bottom left corner to align it with the vertical and horizontal reference planes and then lock. Dimension the thickness and depth of the louvre as shown as well as the angle using an angular dimension (making sure your angular dimension is to the same references as below). Then select the dimensions and using the method shown previously create parameters as shown below. Finally select all the lines by hovering over one and using the tab key until the chain is selected then click activate dimensions. If everything is okay the two padlocks should show as below.



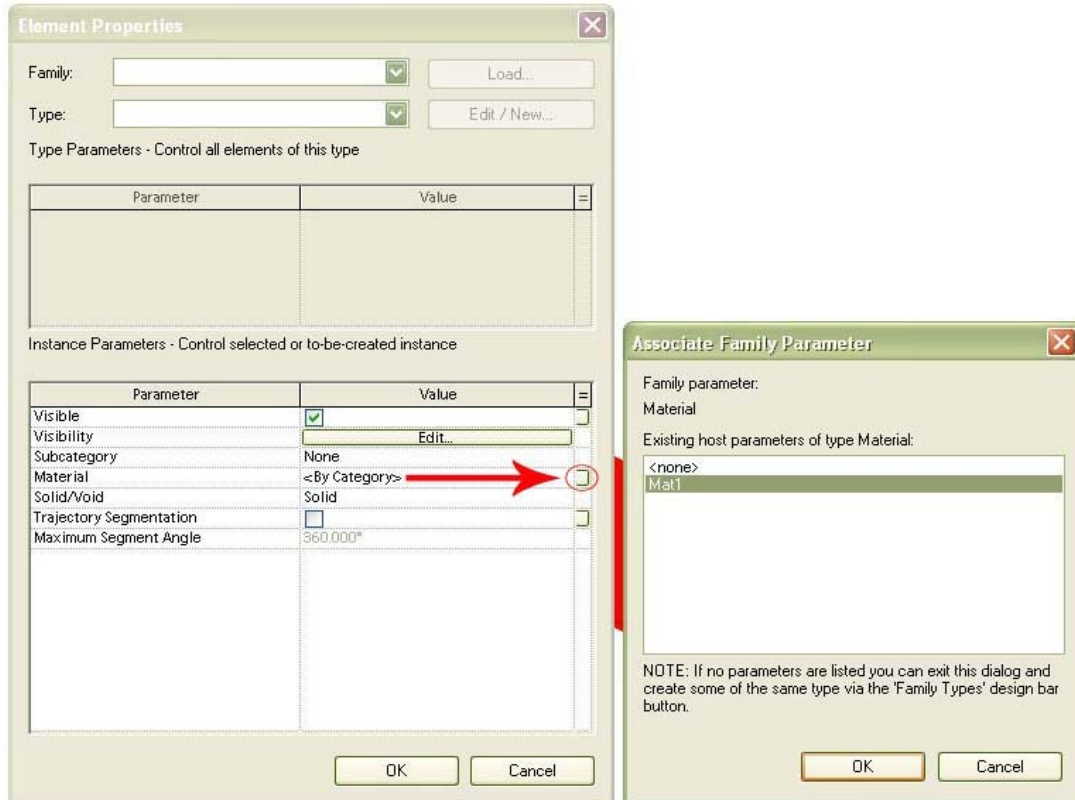
9. Once everything is correct select Finish Sketch from the Sketch menu and then Finish Sweep.
10. It is now a good time to check to see all our parameters are functioning correctly. From the menu at the left choose Family Types and then edit all the dimensions (select different values) and then click Apply or OK if everything changes without errors your doing well...



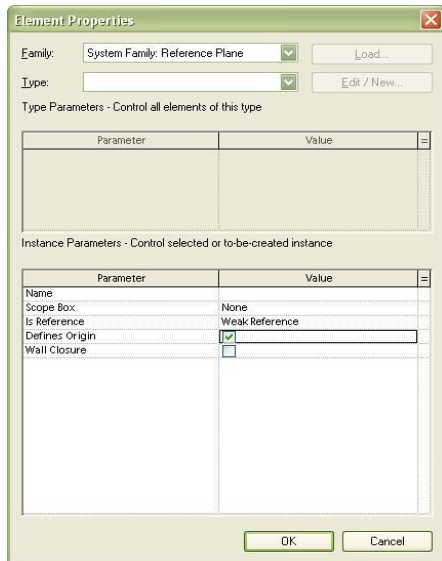
11. We now need to create a material parameter for our louvre so we're not stuck with default grey. Click Add... in the parameters menu as seen above and give your material a name (I called it Mat1) then choose the type of parameter you wish to add from the drop down menu. Select Material and Type. Now click OK.



12. At the moment this material isn't linked to our louvre so changing it at the moment will have no effect on our louvre. To link it, go to the 3D view and select the louvre. Go to the properties of the louvre. Where the louvre material is defined, in the far right hand column there is box select this as shown below then choose the parameter you want to link. In my case Mat1.



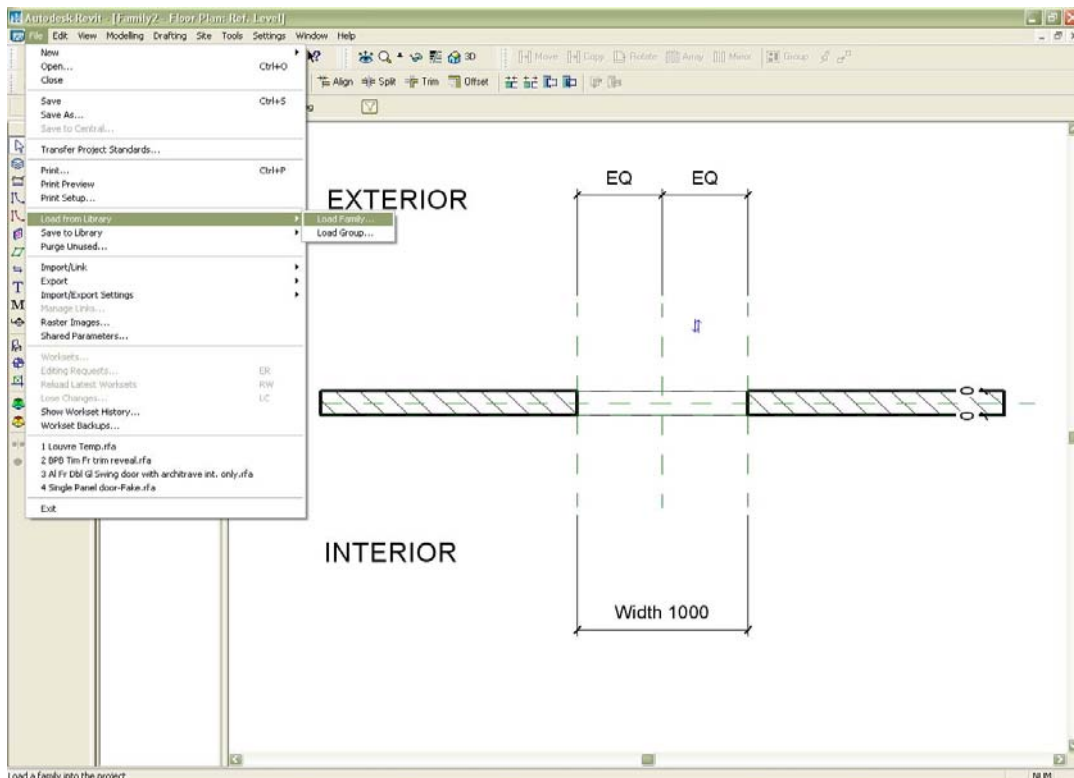
13. Finally, we must change the origin for the plan view. This has to be done in order to locate the louvre properly in the window family. Go to the Ref. Level and select the left vertical reference plane. Go to the properties and select Defines Origin.



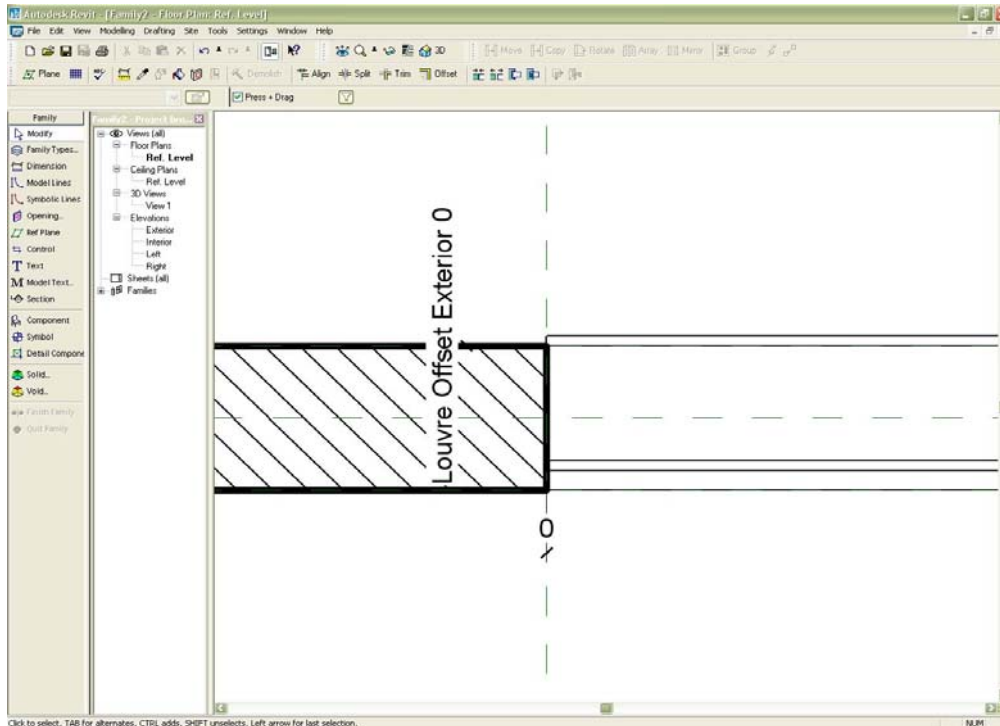
14. Now save the family with an appropriate name in location you can find. Now we are ready to start our window family.

15. Close the louvre family when saved. Start a new family using the Metric Window Family.rta (in this case we will not use any casing to simplify the formulas that will be needed).

16. Now we need to load our newly created louvre. Go to Load from Library and locate the louvre, then click OK.

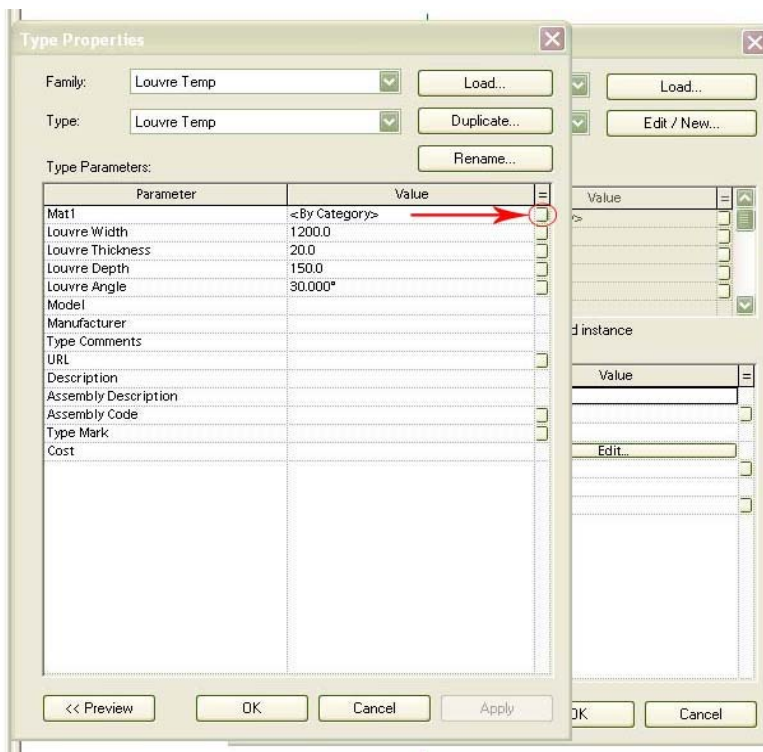
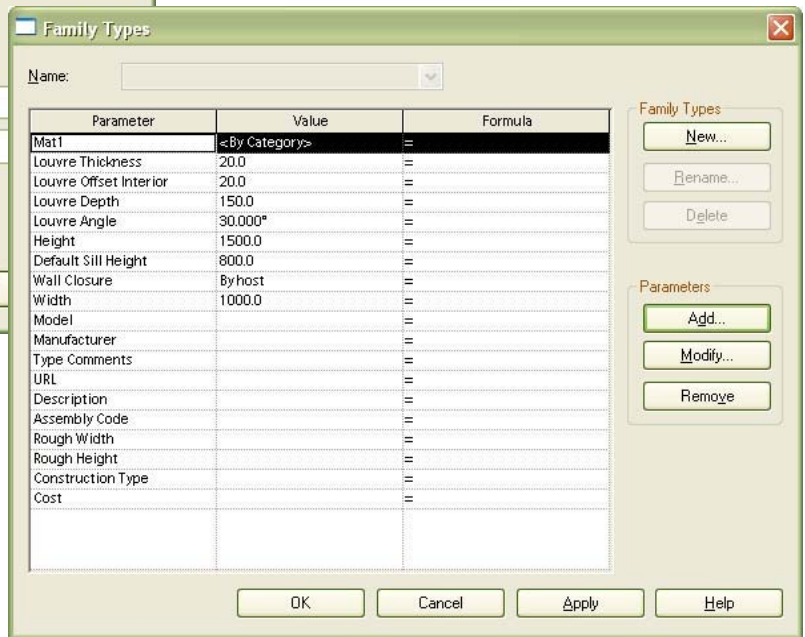
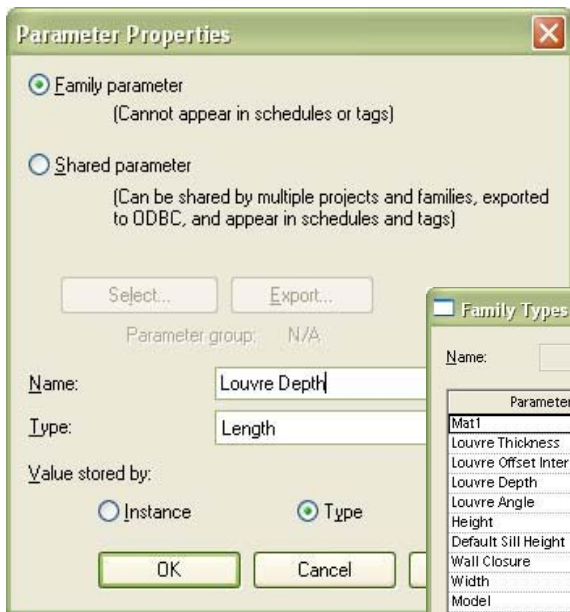


17. Select component from the menu at the left and then place the louvre somewhere in the floor plan. Don't worry too much about where you put it yet as we will dimension it soon to locate it properly. Now place a dimension from the left end of the louvre to the left reference plane. Then place another dimension from the Exterior Wall Face Reference plane to the second line from the top of your louvre (It is these lines that the origin was defined in the louvre family, so be sure to dimension to these points). Select the louvre and change the dimension to the left reference plane to 0 and lock. Select the other dimension and choose <Add Parameter...> and define it a name as below. This could be setup as an instance parameter as opposed to a type if you desire.

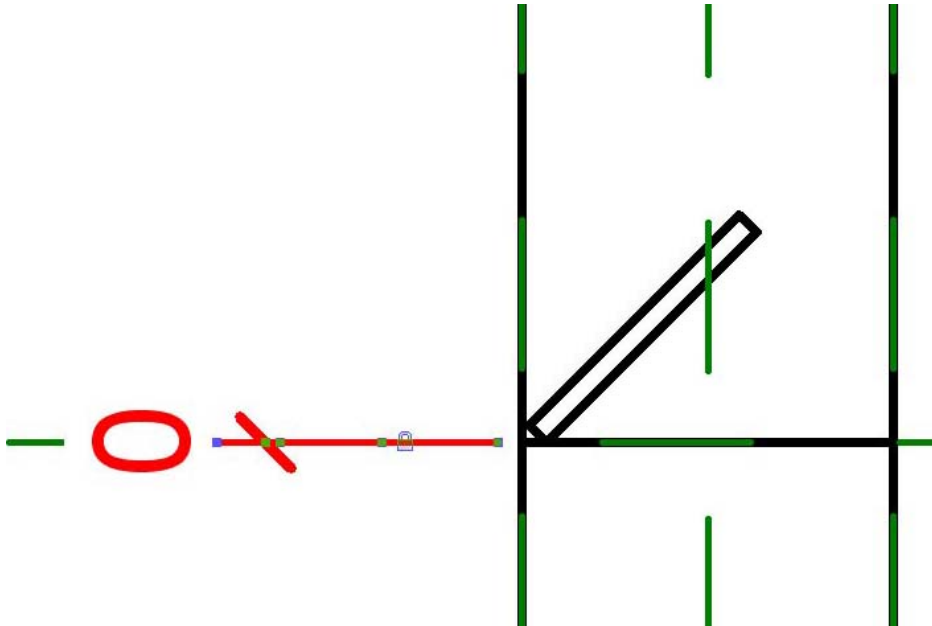


18. Now we need to link the parameters we setup to adjust the louvre in the previous family so we can adjust the louvre in this one. Select Family Types as we need to add parameters into this family that we can link. In the parameter menu select New and create parameters for louvre depth, thickness, angle and material. There is no need to create one for the width as we will just use the Width already defined. Make sure all parameters are selected as Type parameters and their type is correctly selected, that is angle for the angle, length for thickness/depth and material for the material. Note: The parameters do not have to have the same name. You will notice that the length and angle parameters default to 0. Before we can link them we must set realistic values otherwise we will have errors. Once complete click OK and go to a plan view. Now, select the Louvre and go to it's properties and click the Edit/New tab. Next to each parameter in the far right column select each parameter then link to the appropriate parameter in this family.



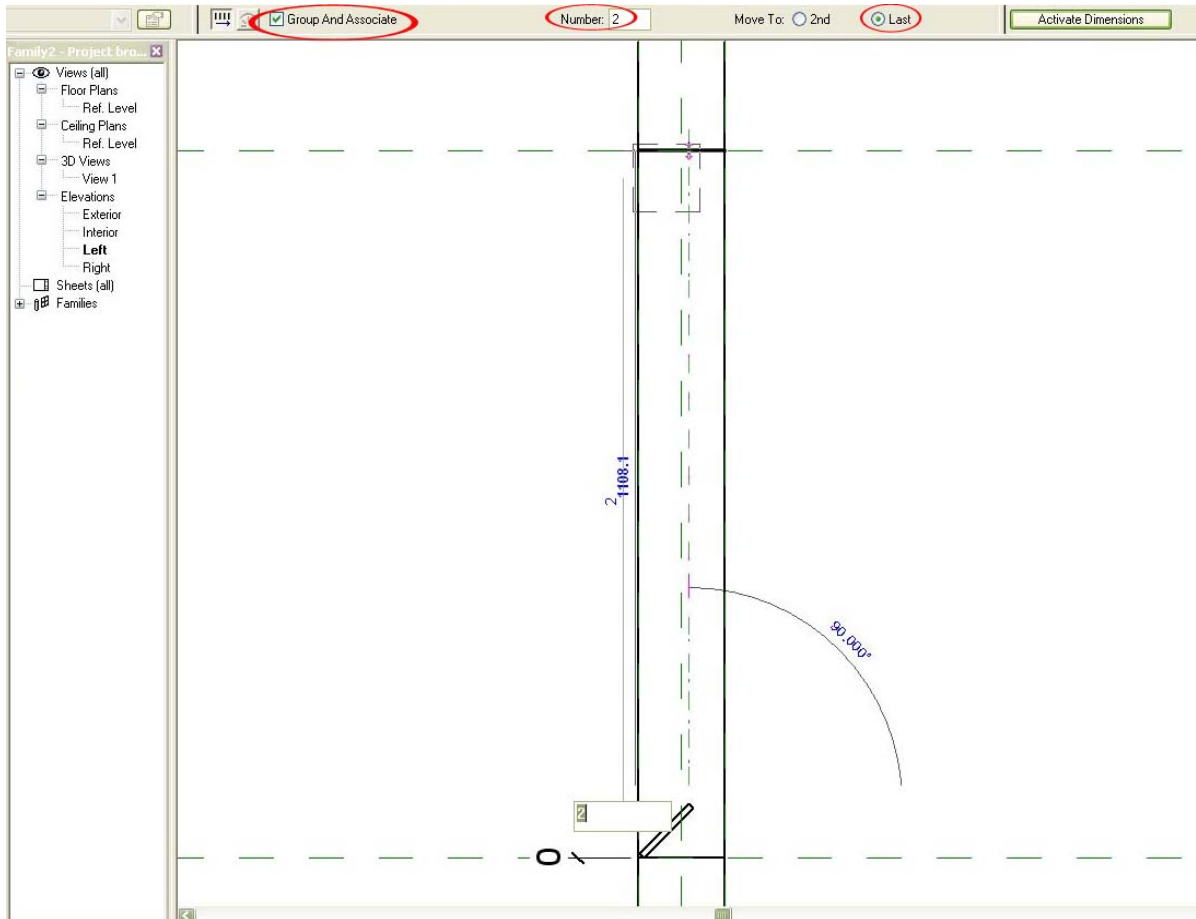


19. Now we have setup these properties we need to setup the louvre in elevation. Go to the Left Elevation. You will notice at the moment the louvre is sitting on the ground. Place a dimension from the lowest point of the louvre up to the sill reference plane. Now select the louvre and change the dimension to 0 then lock.

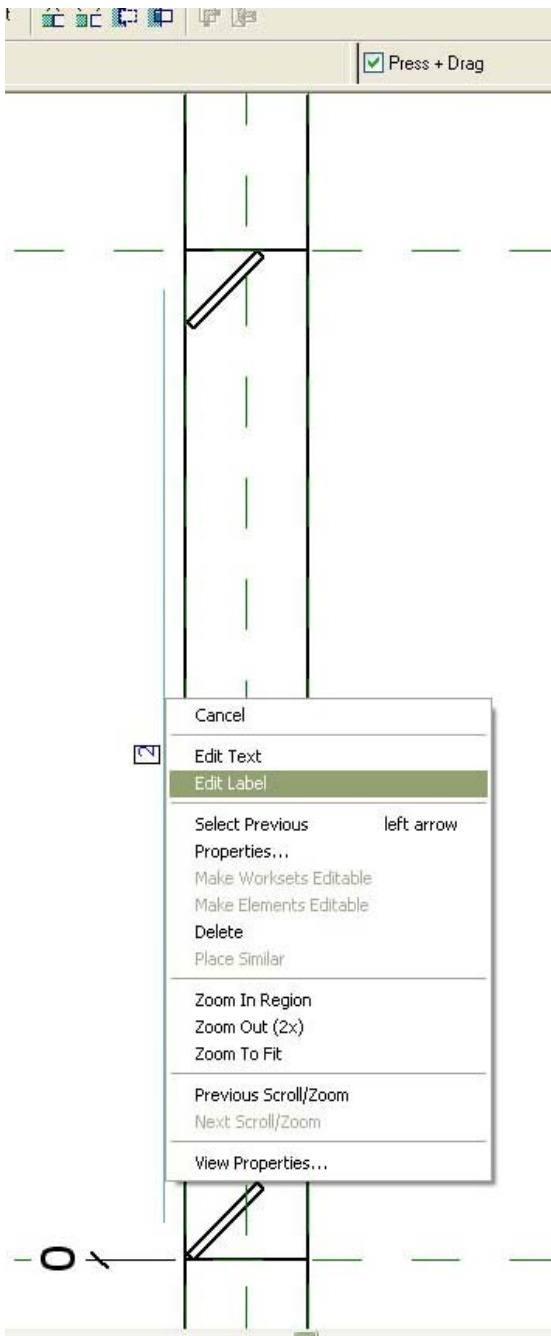


20. We are almost ready to do our array, but first we should check that everything functions correctly. Go to the family types and change each value then click okay. If there are no errors and everything changes as defined then your doing really well. If you have problems identify which parameter is causing the problem and then go back a few steps and try to identify what you've missed (most likely it will be not dimensioning to the correct point on the louvre/**not using an origin point**).

21. Once everything is working, in the left elevation, select the louvre and click Array. Now you need to adjust the options at the top of screen as shown below. Group and Associate should be ticked, No. of items 2, & Array to last. Now select the base array point as the upper most point of the louvre and, making sure to stay vertical, select the head of the window as the finish point.

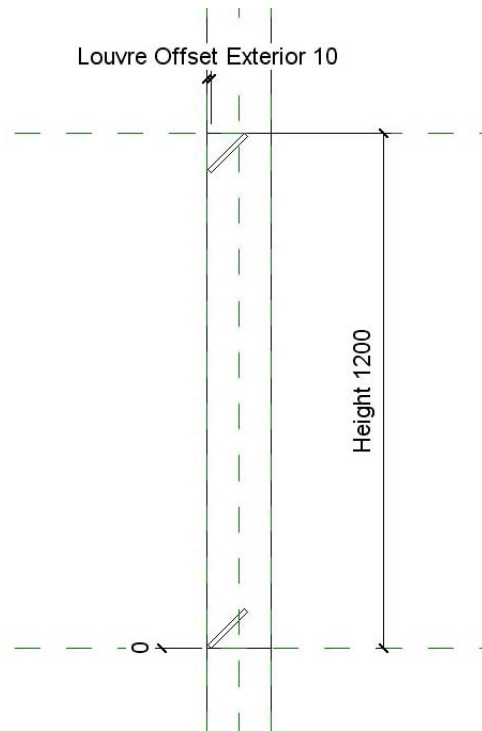


22. The next step is to add a parameter for the number of louvres. Right click on the line just below the number 2 and choose edit label.



23. Now from the drop down menu that has appeared choose <Add Parameter...>. Now give the integer a name (to maintain consistency with this tutorial call the parameter 'No of Louvres'.

24. Now we need to define the height extent of the top louvre. Add a dimension from the sill reference plane to the highest point of the top louvre then select the dimension and change the dimension to be the height parameter from the drop down menu at the top right of the screen. Now go to your Front elevation and add a dimension from the left reference plane to the left side of the upper louvre and lock at 0.

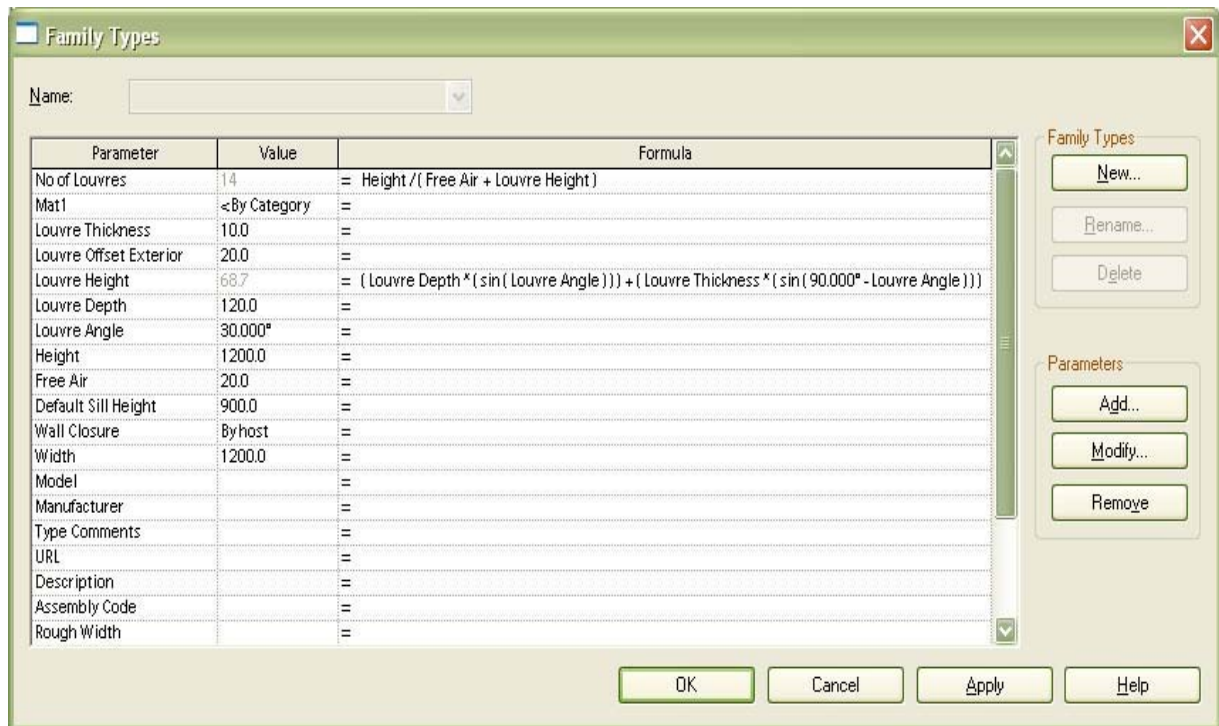


25. Here comes the fun part we now need to create a formula so Revit will calculate the number of louvres to use in given situations. Begin by going to your family types (you may wish to enlarge the window so you have more space to view your formula information). First, create a parameter by clicking add and make a new length parameter called "Free Air" this will become the spacing of our louvres. Now give this parameter a value (eg: 20mm).
26. Now add another parameter called Louvre Height using the same method as the Free Air parameter. We need this to calculate the vertical height of the louvre for set angles and louvre depths/thicknesses. This requires some knowledge of Pythagoras and basic trigonometry. The formula for the louvre height should work out as below (this step is not essential but shortens the formula we need to specify the number of louvres):

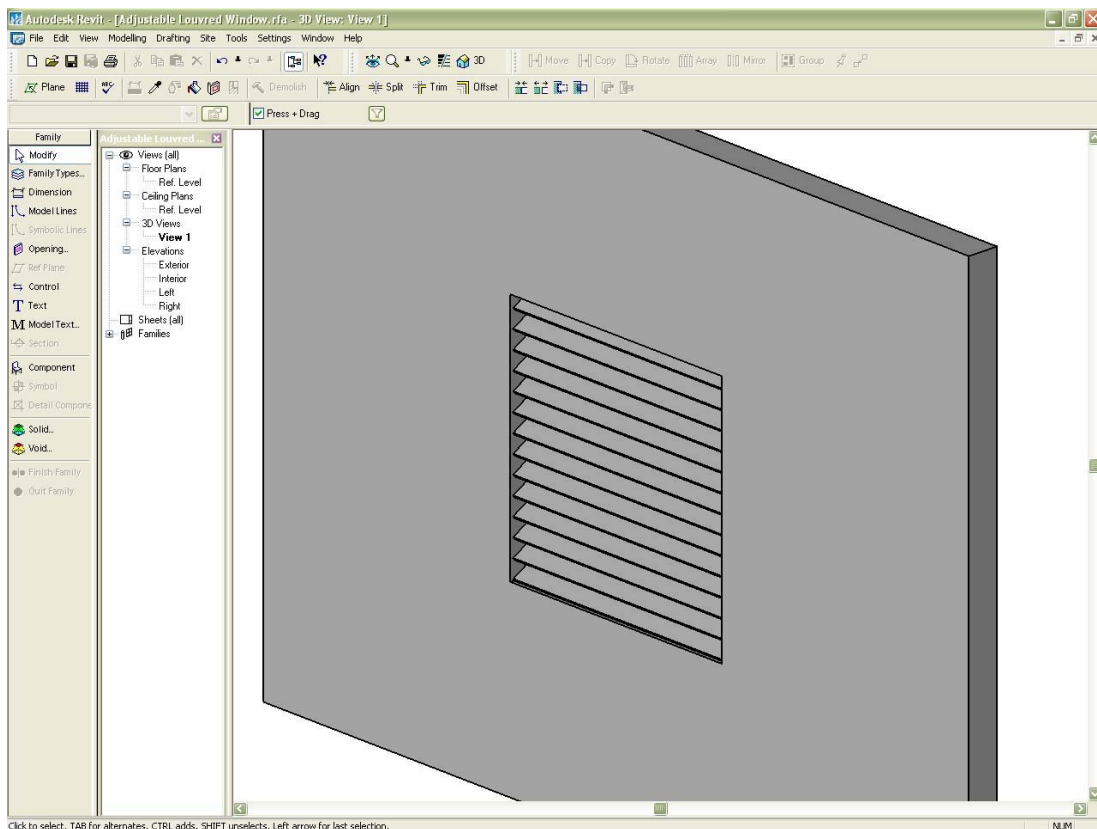


10.0	=	
10.0	=	
91.9	=	( Louvre Depth * ( sin ( Louvre Angle ) ) ) + ( Louvre Thickness * ( sin ( 90.000° - Louvre Angle ) ) )
120.0	=	
15.000	=	

27. Now we can add formula information to the No of louvres parameter as detailed below. Revit will now calculate exactly how many louvres we require to achieve a specified free air gap, louvre depth and angle.



28. The final step is to test out these parameters to see if everything adjust as desired. Now save your new louvered window in an appropriate place for use in your next project.



## NOTES TO REMEMBER

- When creating an Array the two defining elements of the array are always the first element and the (second or last depending on how you have created you array, IE; array to 2<sup>nd</sup> or last). These two elements must be locked in all directions. That is, left/right, back/front and top/bottom.
- When nesting a family only use type based parameters in the family to be nested otherwise your linked parameters may not function properly.
- Always locate your origin in your nested family to a place that will be useful in the final family to constrain the element.
- Systematically test your families before attempting an array. Make sure everything is functioning properly before you complicate things by arraying.