A Quick Spin on Revit® Architecture Curtain Walls

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AB110-1L & AB104-5L   This course is intended as a guide to Curtain walls for new users. We will look at basic curtain wall properties including wall types, panels, grids, and mullions

Key Topics:
- Curtain Wall Type and Instance properties
- Panel properties
- Grids
-mullions

About the Speaker:
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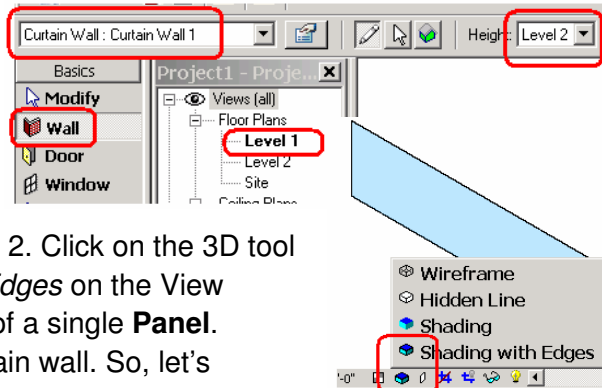
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Autodesk

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This course should be considered a "primer" on Revit Architecture 2008 Curtain Walls. We won't be doing a lot of fancy stuff, merely learning the basic foundations of Curtain Walls to build upon. So, let's get started.

From the Help file: **"Curtain walls are a wall type consisting of panels. When you draw the wall, Revit Architecture inserts a single panel that extends the length of the wall. If you created a curtain wall that has automatic curtain grids, the wall is subdivided into several panels."**

So, drawing a curtain wall is the same process as drawing a wall. Open the **AU 2007 CurtainWalls.rvt** project. Begin on the *Basics tab* of the *Design Bar*, click **Wall**. In the *Type Selector*, select *Curtain Wall: Curtain Wall 1*. Draw a 40'-0" horizontal wall constrained to Level 2. Click on the 3D tool in the View toolbar and change to *Shading with Edges* on the View control bar. Note that you have a wall consisting of a single **Panel**. Doesn't look much like what we think of as a curtain wall. So, let's investigate further.

Note above that by default Revit Architecture inserts a Single Panel. In order to make our Curtain Wall behave more like what we think of as a curtain wall, we need to add a **Curtain Grid** to it. Curtain Grids may be defined as part of the **Type Pattern** or may be added manually. Select the Curtain Wall you just drew, right click, and select *Element Properties…* from the pop up menu.

The first thing you'll notice is that just like Walls, Curtain Walls are **System Families**, meaning that they existing only in *rvt* files. Select the *Edit/New…* button to get to the Type parameters. Notice there are many things that may be preset in the Curtain Wall type. Under the *Construction* section, you may choose wall functions exterior, interior, retaining, foundation, or soffit.
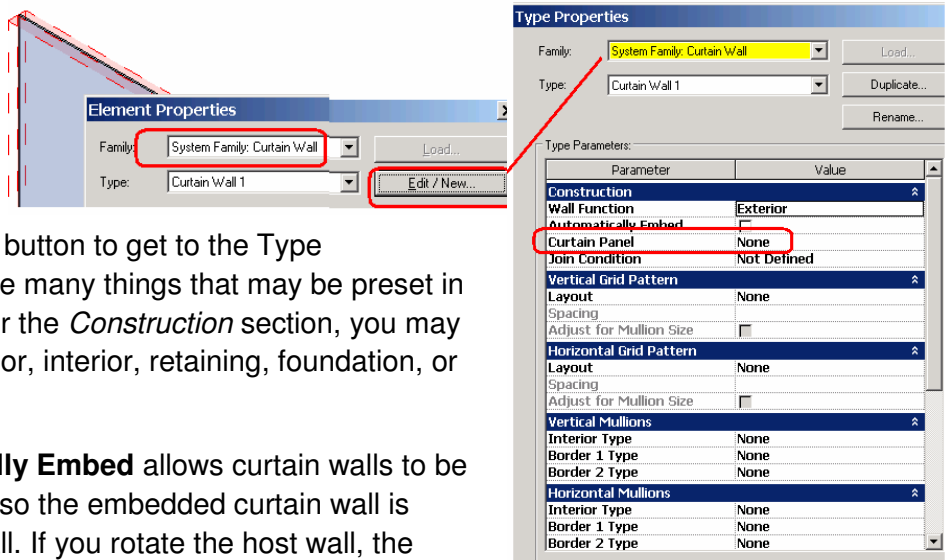
The next item, **Automatically Embed** allows curtain walls to be embedded into a host wall, so the embedded curtain wall is associated with the host wall. If you rotate the host wall, the embedded curtain wall moves with it. The embedded curtain wall does not resize if you resize the host wall. The behavior of an embedded curtain wall is similar to that of a window. With embedded curtain walls, you do not have to edit the host wall's profile, cut a hole in it, and then insert a curtain wall into that hole. Embedded curtain walls are useful when, for example, you need to create storefronts on the exterior walls of the building.

The next item, **Curtain Panel**, is really where you can begin to create some very sophisticated Curtain Wall types. This type is using **None**, which in reality is using the *System Panel* called **Glazed** by default. When we look at this family shortly, you will notice the **offset** property that is causing it to not locate on the centerline of the wall you drew.

You may use regular Curtain Panel Families that may be created using the *Curtain Wall Panel rft* template file. These may be loaded as *Components* into your project, and then may be "swapped" with the default panel once you have defined a grid system. You will find three examples in the Doors Library folder: Curtain Wall Dbl Glass, Curtain Wall Sgl Glass, and Curtain Wall-Store Front-Dbl. The **Join Condition** establishes mullion priorities.
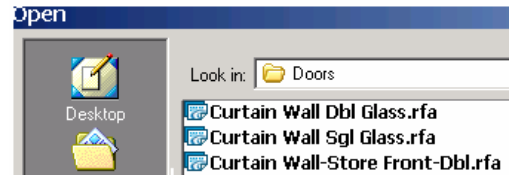
The next four sections establish the **Vertical** and **Horizontal** Grid Pattern and Grid Mullion Types. Layout and Spacing parameters are fairly self explanatory. Sometimes, when mullions are placed (particularly on borders of curtain hosts), it can result in panels of unequal size, even if the Layout is set to Fixed Distance. Adjust for Mullion Size corrects this.

The last physical components of Curtain Walls are the mullions. There are two types: **Interior** and **Border**. Curtain Wall mullions come in two types: "regular" and "corner". The difference between these two types is that you may specify a **custom profile** for a regular mullion, while there are currently only four types of corner mullions: L, Quad, Trapezoid, and V. These may not have custom profiles substituted.
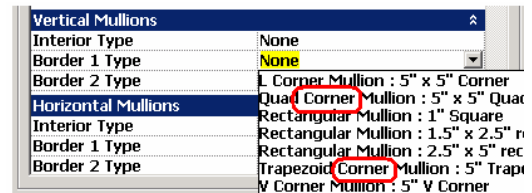
The last item to look at initially is the **Curtain Grid Layout** icon that appears when you select a curtain wall. This allows you to "twist" the overall angle the mullions are running at. Okay, let's add a little spice to this curtain wall.
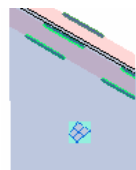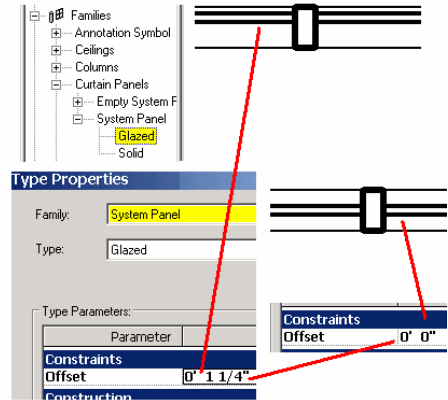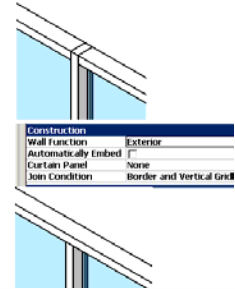
Curtain Grids

Let's go to our **South Elevation** and adjust the Level 2 height to be 21'-0". Let's **duplicate** this Curtain Wall 1 Type and call it *AU 2007 Curtain Wall*. Set both the Vertical and Horizontal Grid pattern to **Maximum Spacing**, with **Vertical** set to **5'-0"** and **Horizontal** set to **7'-0"**. Set all the **Mullion** types to **Rectangular Mullion: 2.5" x 5" rectangular**. After exiting the dialog boxes, switch back to the 3D view. We have a more interesting looking curtain wall.
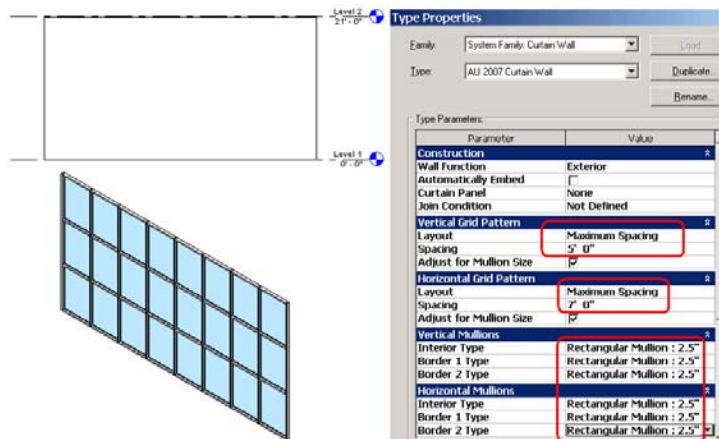
Let's go back into the properties for the AU 2007 Curtain Wall and change the **Join Condition** to **Border and Vertical Grid Continuous.**

Okay. Let's return to the **Level 1** Floor Plan view. Notice that the glazing is off-centered in the mullions. This is a property of the *Curtain Panel family* and not of the Curtain Wall. Expand the **Families** section of *Project Browser*, and under *Curtain Panels* expand *System Panel* and select *Glazed.* Go to its *Element Properties*. In the **Contraints** parameter section is *Offset*, that is currently set to 0' 1 ¼". Two other items with preset values are the *Material* and the *Thickness.* Let's change the *Offset value* to 0, and then pick the **OK** button. Notice that the glazing is now centered in the mullion.

Let's switch back to the **South Elevation**. Move your cursor over the Curtain Wall and Grid System. Notice how either the mullions highlight when you are inside the wall, or the dashed line for the entire wall when you are at the edge. Select one of the mullions. Notice the **pin** icon. This indicates the mullion and grid line are locked or pinned in place. To relocate a mullion, you must *un-pin* the grid location. Hit the Esc key, then hover your mouse over this same mullion and keep hitting the **Tab** key. Notice how you may now select the *Grid Line, Panel(s), or entire Wall* as you tab. When you see the *Vertical dashed* line, pick it. It too is pinned because your wall type is set to a *Maximum spacing* type. Click the pin to "un-pin" this vertical grid line, then move it to either the left or the right. Now reselect the *Pin* and notice that the mullion returns to its default position.

> Hint: Do **not** re-pin a mullion after customizing its location if you don't want to lose it.

With the Vertical Grid line selected, notice on the **Option bar** that you may *Add or Remove Segments.* If a mullion segment is already there it is removed, and vice versa. Hit *Esc,* then reselect a mullion segment and right click. Try out all of the different **Select Mullions** conditions to see what they do. Hit Esc. Now *tab select* a **Panel** and try the different **Select Panels** options. Hit Esc.
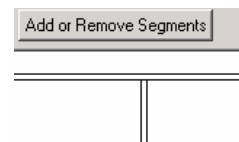
Switch back to the **3D** view. Let's replace a few panels. We'll begin by *loading* the **Curtain Wall-Store Front-Dbl** panel. From the *Basics* tab of the *Design Bar*, pick *Component*. On the *Option bar* pick the **Load…** button. From the *Doors* library, select the **Curtain Wall-Store Front-Dbl.rfa** family, then Open. Hit Esc. Hover over a panel in the bottom row and tab until the panel highlights, then pick it. From the *Type Selector* drop down list, choose this newly loaded family.
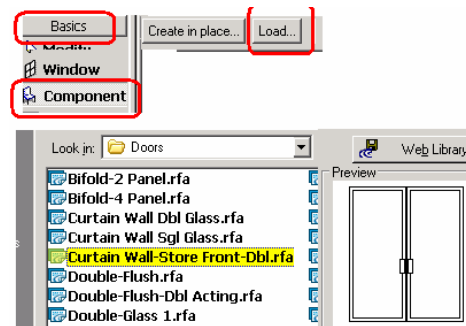
You now have a pair of doors that conform to the shape of the panel. Notice the mullion at the bottom that is no longer needed. Tab select, un-pin, and delete it with the *Delete* key. The door now extends to the ground.
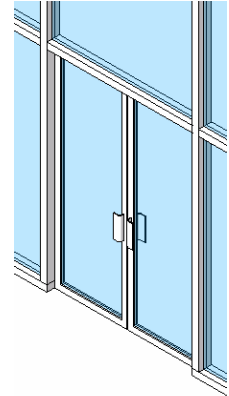
Experiment with replacing some other panels with wall types such as ones that include *masonry*. Notice that you have a great deal of flexibility in how you can customize your panels. They may be external *Families* that you load, or *System Families* such as any other wall type. For fun, I've included a couple of custom panels created by Phil Read of Autodesk. To get a quick flavor for these, let's begin by duplicating *Curtain Wall 1* leaving the name *Curtain Wall 2*. Set the **Vertical** and **Horizontal** Grid Pattern both to *Fixed Number*. Select

Wall from the *Basics* tab on the Design bar. Choose the *Curtain Wall: Curtain Wall 2* type. Open the *Element Properties* dialog box, and set the *Vertical* number to **3** and the *Horizontal* number to **2**. Draw another wall 40' long constrained to Level 2 from Level 1. Select all the panels and change them to the Spider Panel: Center Panel – 4 clamps. Dismiss the warning box. Reselect all the Panels and change to the *Pleated Curtain Wall* panel. Select a panel, and in the **Type** parameters, play with the *Pleat Extension* variable in the **Dimensions** section.
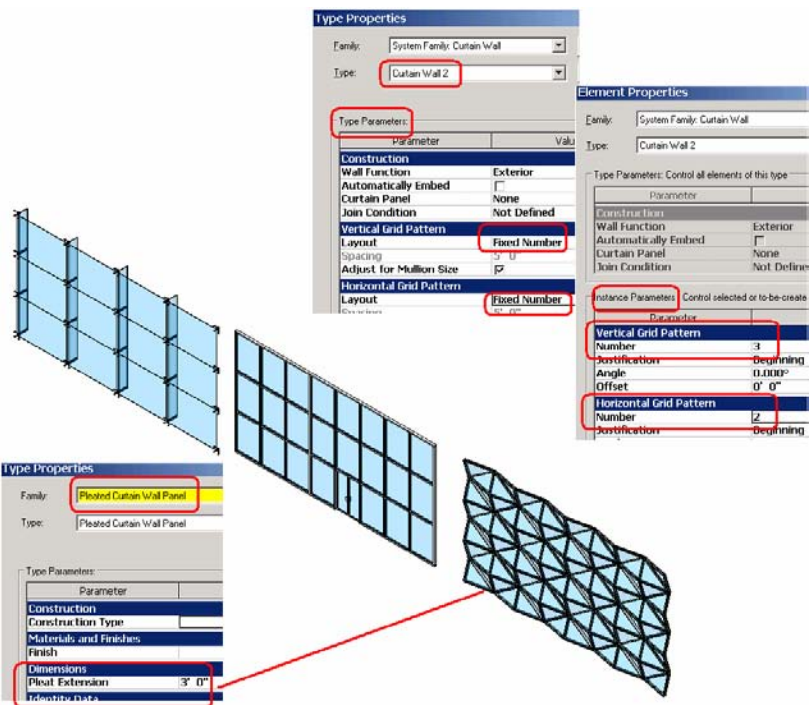
Wall Joins

Okay. Delete the Pleated Curtain Wall and open the **Level 1 Floor Plan**. Zoom in to the right end of the wall. Draw a *Basic Wall: Generic - 12"* using *Finish Face: Interior* from the lower right corner of the curtain wall mullion a few feet long. Now, try to

Move or *Align* the curtain wall so that it is aligned with the upper edge of the 12" wall you just drew. You aren't able to because both the Curtain and Basic walls have joined each other. You must *disallow* the join. To do this, select the curtain wall near the right end. Notice the blue dot at the end. Right click on the dot and choose *Disallow Join* near the top of the pop-up menu. You may now move the curtain wall without moving the generic wall.
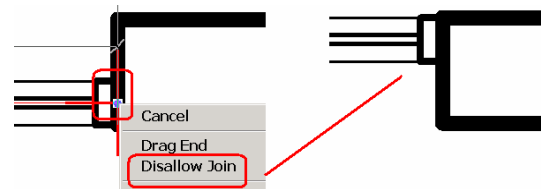
Note: If the edges of these walls do not appear to align, pick the **Thin Lines** tool to double check alignment

Edit Profile

Re-open the **South elevation** view, select the *Curtain Wall,* and choose *Edit Profile* from the *Options Bar*. Notice that you are now in **Sketch** mode and that the *Design Bar* has limited your options while in this mode. Delete the top blue line of the Curtain Wall Profile and using the **Lines** Design Bar option replace it with an *Arc passing through three points.* Add a *Circle* around a 3'-0" to 4'-0" radius near the center of the wall. Pick **Finish Sketch** and accept the deletion of the top border mullion. Switch back to the **3D** view.
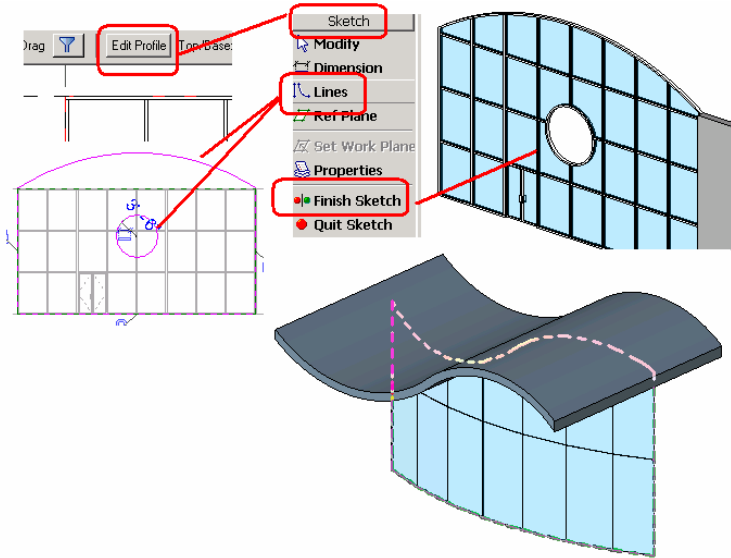
Note: This works for straight walls only. Curved Walls need to be attached at the Top/Base to another object (slab or roof).

Okay. So hopefully you now have a better overall grasp of Curtainwalls. Let's do a small, more formal exercise. In the spirit of giving credit where it is due, I was inspired by an on-line version of this created by Daryl Gregoire on the Web page located at http://revitrocks.blogspot.com/2007/09/revit-architecture-2008-curtain-systems.html. We will begin by opening the Greenhouse.rvt project.

With a little luck we will be in a Southwest Isometric – or parallel projection – view. This project contains a Mass Element representing a "Ghost House" along with a low brick wall, a floor slab, and three sets of lines: 1 set at Levels 1, 2, and 3. Let's begin by creating the **Level 1 Curtain Wall** using the **Curtain Wall: Curtain Wall 1** wall family.
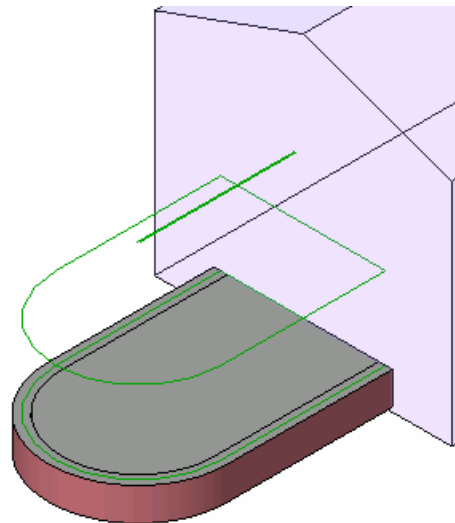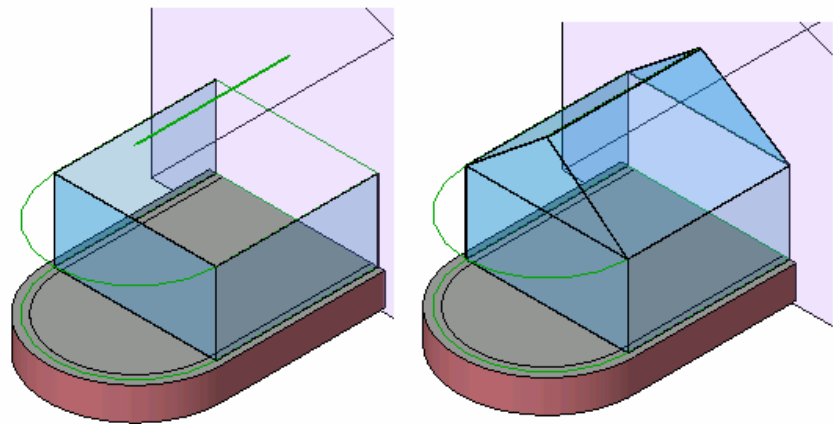
Switch to the **Level 1 Floor Plan view**. Zoom in to the "Greenhouse" area. Let's also make a quick adjustment to the **Glazed System Curtain Panel**. Select and right click it in Project Browser, and change the **Offset** value to **0"**. From the *Basic* rollout of the Design Bar, choose **Wall.** Change the type to **Curtain Wall: Curtain Wall 1**.

Starting at the upper right corner, draw the wall tracing the red line outline. Also, make sure that the **Height** in the *Options* bar is set to *Level 2,* and that *Chain* is checked. For the radiused end, switch to the *Arc passing through 3 points* option, then switch back to the *Line* option. End at the lower right corner. You now have 2 straight and one curved curtain panel segment. Really? Looks like three straight ones doesn't it. Pick *Modify* from the Design Bar then hover your cursor over the "curved" segment. Notice the dashed arc. You will need to add some **Curtain Grid lines** to this panel to subdivide it into smaller, straight pieces to resemble the curve. We will do this shortly.
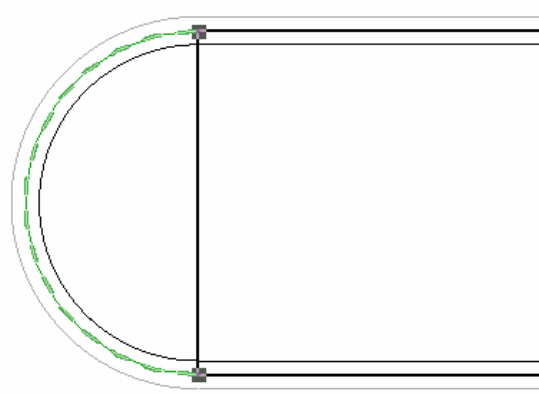
Switch back to the 3D **Southwest Iso** view. We will create a **Curtain System** using the *by Lines* option from the **Modelling** *Design Bar* rollout. We will create 4 systems by picking the matching lines from Levels 2 and 3. You may need to use the tab key to get to the **Lines: Model Lines: Line** object on Level 2 instead of the curtain wall. Be sure to keep an eye on the *Status Bar* as you tab. Remember, after each *Curtain System* creation sequence you must re-pick the command from the *Design Bar*, as this is a non-repeating command. You now have three straight sloping surfaces and one rounded sloped surface, though it too looks straight at the moment. Go back to the **Level 1 Floor Plan***.*

Still in the *Modelling* Design Bar rollout, choose **Curtain Grid**. Make sure to select the **One Segment** option from the *Options Bar*. Hover your cursor over red arc until you see the equal 90 degree temporary dimensions, and then hit your left mouse button. Your straight Curtain panel now becomes two diagonal panels. Continue this process at the 45 degree marks, then at the 22.5 degree marks, and then pick *Modify* from the Design Bar.
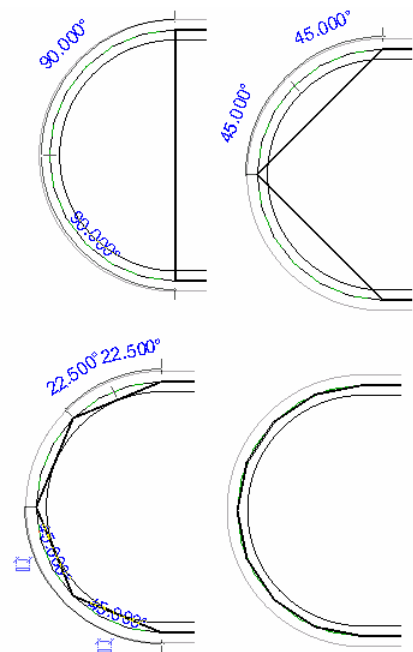
By default, the *Curtain Grid* will try to divide your panel into halves or thirds. Go back to the **Southwest Iso** 3D View. Repeat this process for the curved *Curtain System*. We will complete the Grid exercise on the "South" panels only. You may want to switch the *View Type* to **Hidden Line** to better see the temporary dimensions. Subdivide at **10'-0", 5'-0",** and finally at **2'-6"** for the *South Curtain Wall*. Align the *Curtain System grid* with the wall panels below. At this point there should be **8 panels** on the South, and **8 panels** around the West curve. You now have only *Vertical* divisions.
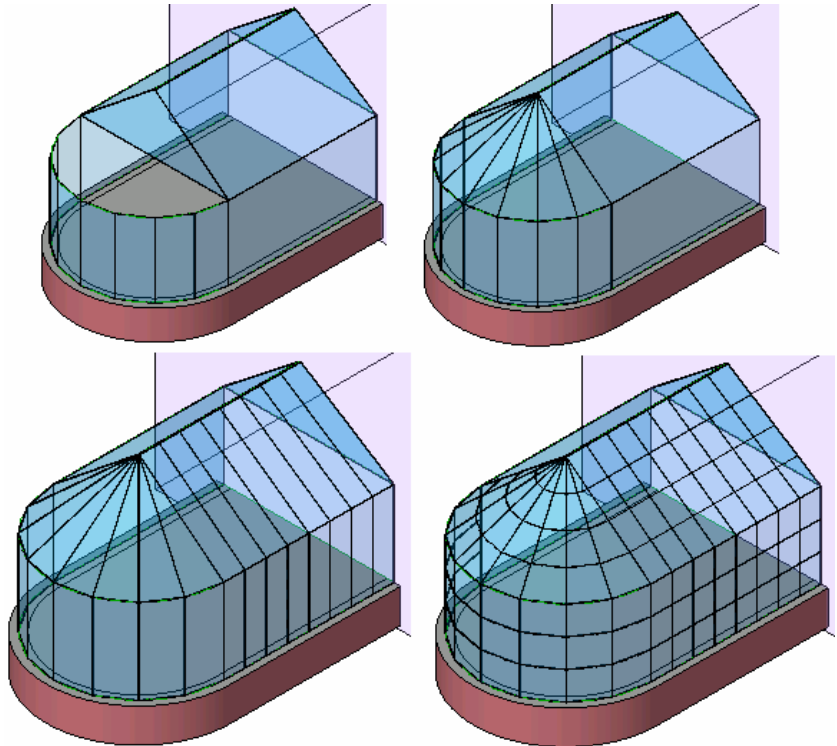

Finally we will add some *Horizontal* divisions. In the *Options Bar* switch to **All Segments** and add three horizontal grids at **3'-4"** apart for the vertical walls, and the sloping *Curtain Systems* into four divisions, using the "half-way" snapping feature as your guide.

> Note: There is an "undocumented" limitation of 200x200 grid lines per Curtain Wall. If you need more divisions, you must use the *Split* tool on the wall.
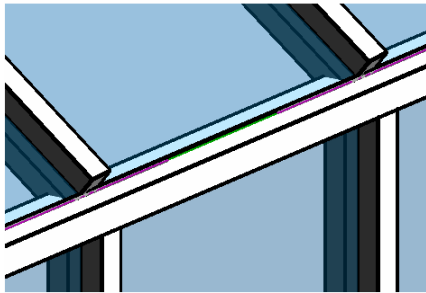
Mullions

To finish off this class, we will add some customized **Mullions** at our *Grid Lines*. Begin by selecting **Mullion** from the *Modelling* Design Bar rollout. From the *Type Selector* choose the *Rectangular Mullion: 2.5" x 5" rectangular*, then pick the **Element Properties** tool. In the *Element Properties* dialog box pick the *Edit/New…* button, In the *Type Properties* dialog box choose the

Duplicate… button, and change the name to *2" x 4" rectangular.* Pick OK. Under the *Construction* parameter, change the depth to **4"**. In the *Dimensions* parameters, change both widths to **1"**.
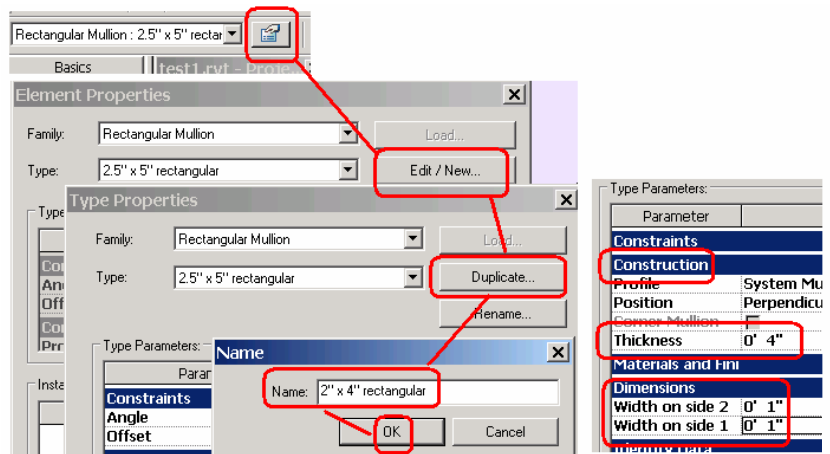
To place these mullions on the grids, you have several choices on the *Options Bar:* Grid Line Segment; Entire Grid Line; All Empty Segments. The latter two will create the mullions more quickly, but will double them where the "straight" wall segments meet the "curved" ones. If you choose these methods, simply delete the extra mullions created at the corners. After creating the mullions, for fun, turn on *Shadows.* Okay, now turn them off again.
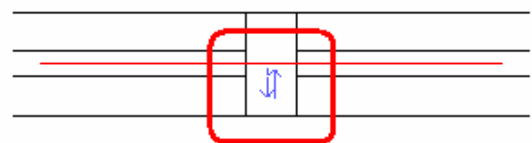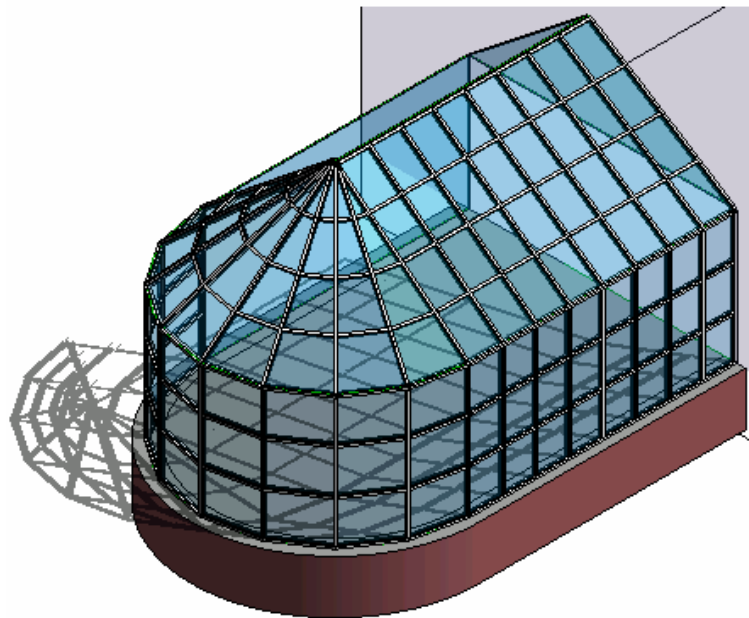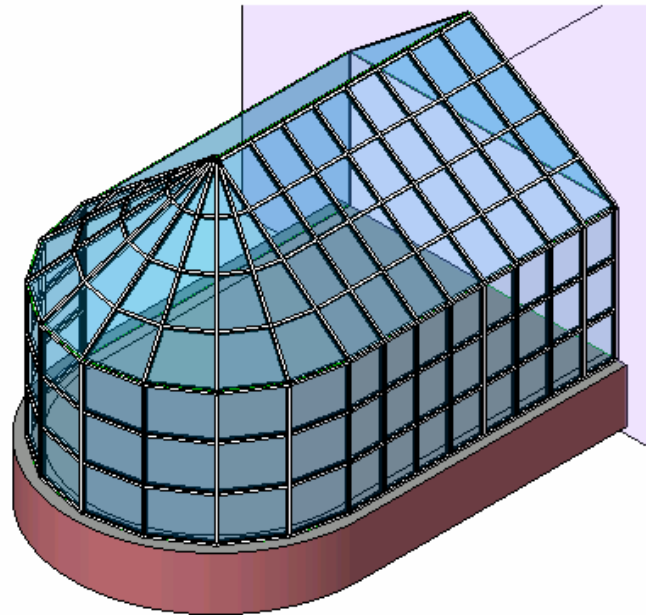
You may continue to experiment with the panels and mullions. Try swapping out a glass panel for a brick wall, or deleting grids lines to enlarge a panel.

The last thing to look at is the mullion where the sloped *Curtain System* meets the vertical *Curtain Wall* which looks like the image below:

Not so good, huh?

Ok, so I cheated a bit and pre-created a Mu*llion Profile Family* and loaded it into the project. Let's swap out the top grid line with these mullions. First, go to the **Level 1** *Floor Plan view.* Select the bottom (south) *Curtain Wall.* Make sure the "double flip arrows" are facing toward the outside. Go back to the **Southwest Iso** *3D View.* Select any top mullion on the South wall, right click, and from the pop-up menu, choose *Select Mullions-> On Gridline.*
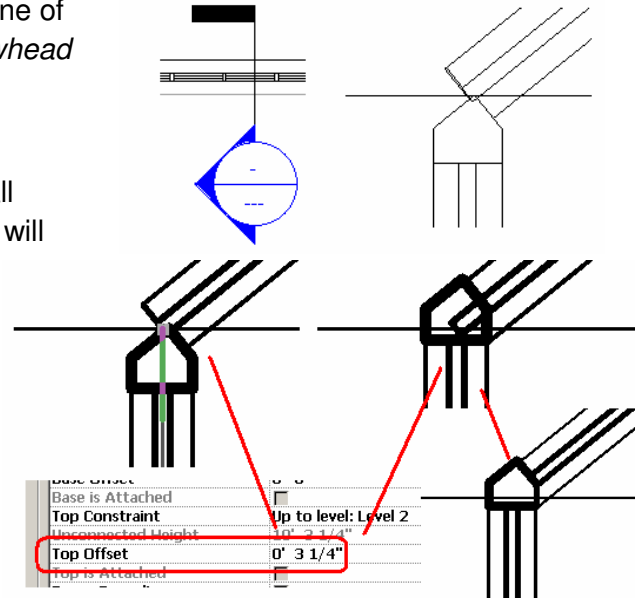
From the *Type* list, choose *Rectangular Mullion: Top Mullion*. Your mullions will now match the angle of the sloped Curtain System. To confirm this, re-open the *Level 1 Floor Plan* view and create a small *Building Section* through one of the glass bays, then double click on the *Blue Arrowhead* to switch to that view.

While the angle is correct, the height is not. This is because *Revit* forces the entire mullion shape to fall within the *Height Constraint* of the Curtainwall. We will "cheat" a bit and simply raise the height of the wall. Place your cursor near the middle of the top mullion. When you see the dashed line appear and it says *Walls : Curtain Wall : Curtain Wall 1* at the *Status line,* pick it. Right click and select the last item, *Element Properties…* Change the *Top Offset* value to **3.25"**. If you want to complete the "look", go to the *Drafting Tab* of the *Design Bar*, and choose *Masking Region.* Change the line *Type* to *<Invisible lines>* and sketch a boundary to hide what is inside the top mullion. Switch back to the **Southwest Iso** view.

To complete this lab, let's look at how this mullion was created. I started by creating a new Profile using the **Profile-Mullion.rft** family. In *Project Browser*, go down to the *Familes->Profiles* section and right click on the **Top-mullion** profile. Choose *Edit* from the right click menu and **Yes** to open the *Family Editor.* I've centered the mullion on the *Front/Back Reference Plane,* and placed it entirely above the *Center of Mullion Reference Plane (called Wall Face)*. I've added three *dimensional contraints* to lock the mullion dimensions at 2", and added a *Label Angle Dimension Family Parameter.* This last parameter gives me the ability to adjust the *Profile Angle* to meet different sloping conditions. This *Profile* will now be used to create a new **Custom Rectangular Mullion.**
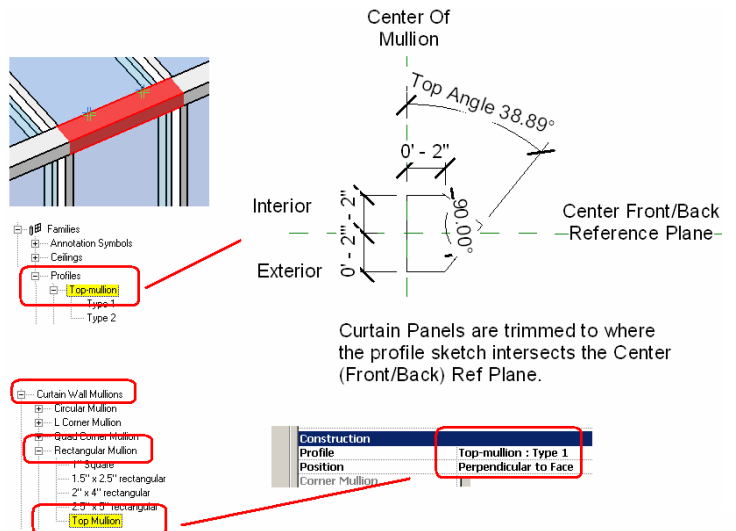
Close the *Top-mullion.rfa* file, saying no to changes. In *Project Browser* right click on the *Top Mullion* under *Curtain Wall Mullions->Rectangular Mullion*. Under the *Construction Profile Type Parameter*, I've assigned the *Top-mullion : Type 1* custom profile.

Well, as they say: "That's All Folks!" Thanks for joining me today.