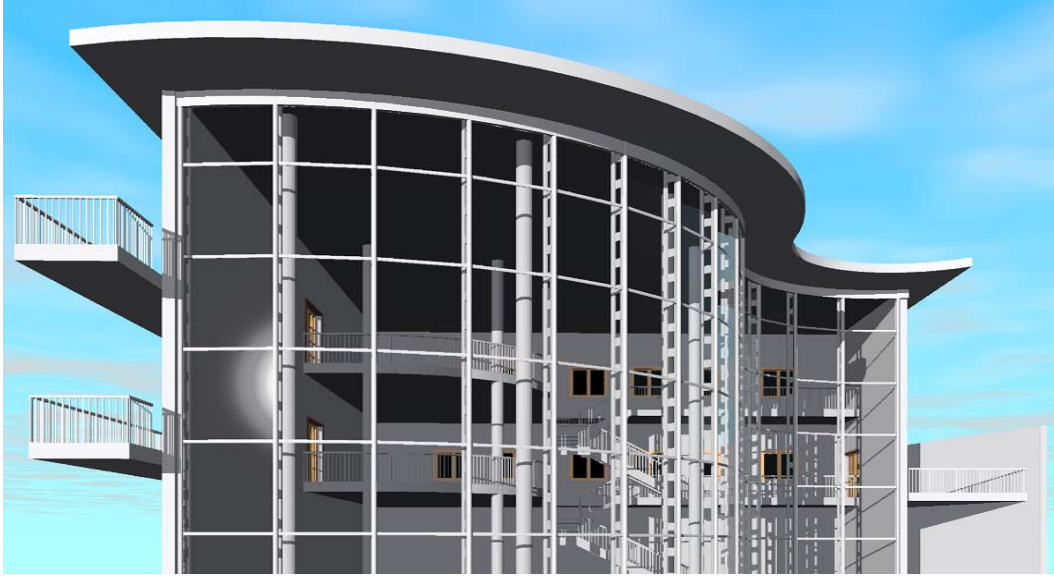


Tutorial for a custom parametric object modeling by REVIT.

In this tutorial, we describe the process for creating a new parametric component (double curved curtain wall system like following figure) within the family editor. During this tutorial, you learn the process for part-creation, parts-assembly and parametric control of them.



* This document more focuses to show overall procedure of modeling a custom object rather than line by line manual.

1. Parametric modeling of double curved curtain wall

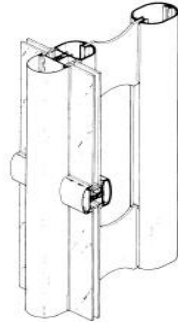
A. General description on the double curved curtain wall system.

- i. Detailed model with real section profile in catalog.

The double curved curtain wall system will employ real section profile, which shows in the figure 1. The profile is based on the kawneer curtain wall system 2800.

WEBS

NOTE: STANDARD SIZE 6" x 8"
OPTIONAL WIDTH 4" OR 8" ONLY.
STANDARD VERTICAL SPACING
- UP TO 2'-0" ON CENTER.



NOTE: WEB SIZE OR SPACING
OUTSIDE OF STANDARD WILL
REQUIRE **FACTORY ENGINEER-**
ING. PLEASE CONSULT YOUR
KAWNEER REPRESENTATIVE.

SQUARE CUT

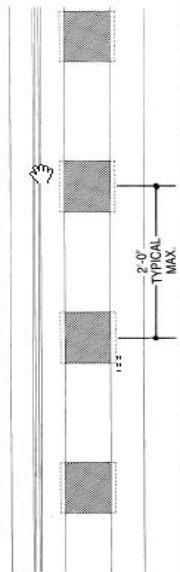


Figure 1. Kawneer 2800 curtain wall system.

This kawneer curtain wall system consists of mainly three two parts: vertical mullion and horizontal mullion. The vertical mullion also consists of main and sub vertical mullion and its connection(square cut).

- ii. Aligned to a double curved base line.

This kanwneer curtain all system will be installed on doubly curved line like a following floor plan. This doubly curved line is the composition of two arcs with different radius. Thus, along these arc, the vertical and horizontal mullion in the curtain wall system should be adjustable.

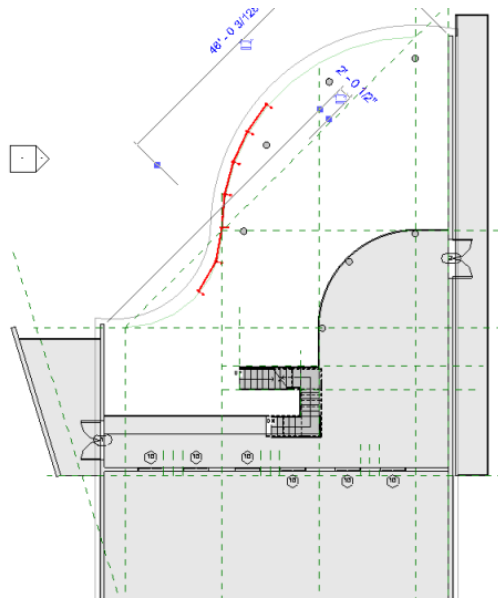


Figure 2. Floor plan of Piano building.

B. General description on the main process of modeling.

The main process for modeling of the custom parametric object mainly consists of two sections: parts modeling and assemble the part. The parts modeling process will make vertical mullion and horizontal mullion.

Each part also will be modeled to have its own parametric behaviors. The parametric behaviors of vertical mullions are adjusting heights and placing connections (square cuts) in the vertical mullion. The square cut should be inserted every 2 feet on the vertical mullion like the figure.

Horizontal mullions also have parametric behaviors. They should be placed every 6 feet to the vertical mullion, and they are arrayed automatically according to increase of the number of vertical mullions.

These vertical and horizontal mullions are assembled to be a curtain wall system. In this assembly process, parameters in assembly level are associated to parameters in the parts.

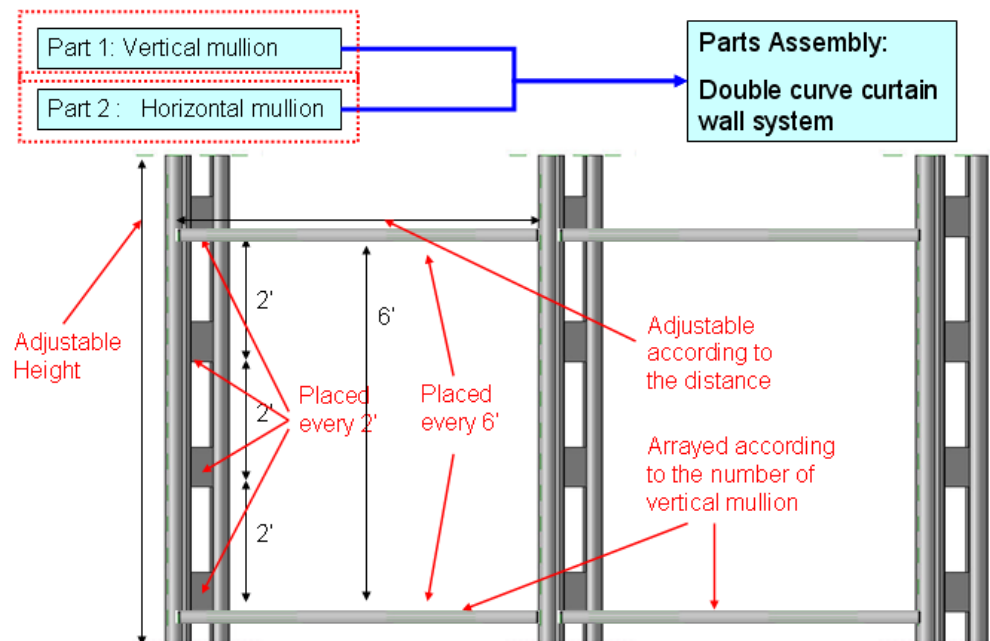


Figure 3. Parametric behavior of the custom curtain wall

2. Process 1 – Part modeling 1 (Generate vertical mullions).

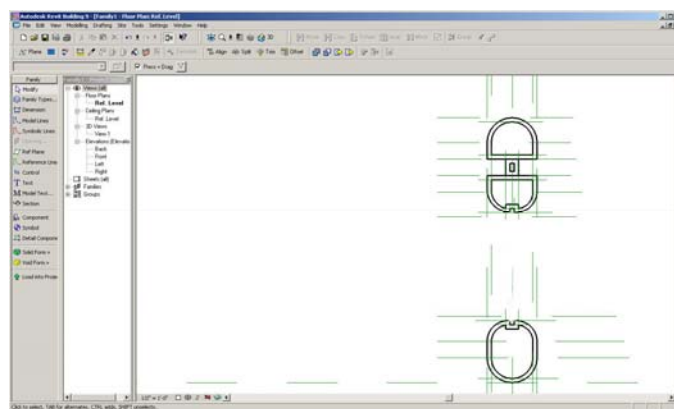
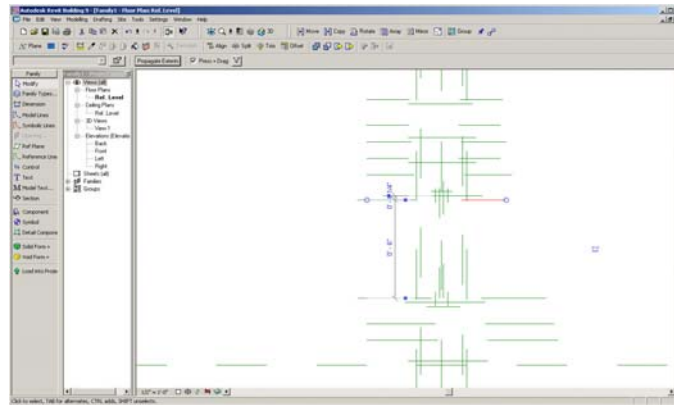
A. Shape modeling

i. Modeling main vertical mullion and sub vertical mullion

1. Draw section profile

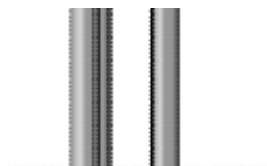
First step of modeling is to draw of a section profile of a vertical mullion in the family editor. Drawing of a section profile can be performed by using sketch mode, which open when the extrude-solid icon is clicked.

Section profile can be drawn more easily by using reference planes. The reference planes work as a guide lines for more accurate modeling, and they can be used for control lines for more easily handling. For example, in the case surfaces in an object are attached to a reference line, these surfaces behave together with movement of the reference line.



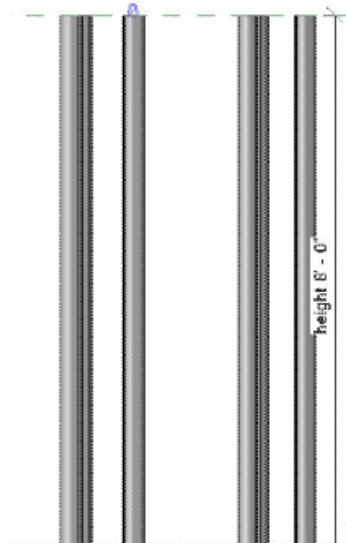
2. Extrude section profile

After closing the sketch-mode, Family editor extrude the section profile with default value like following figure.



3. Add parametric behavior.

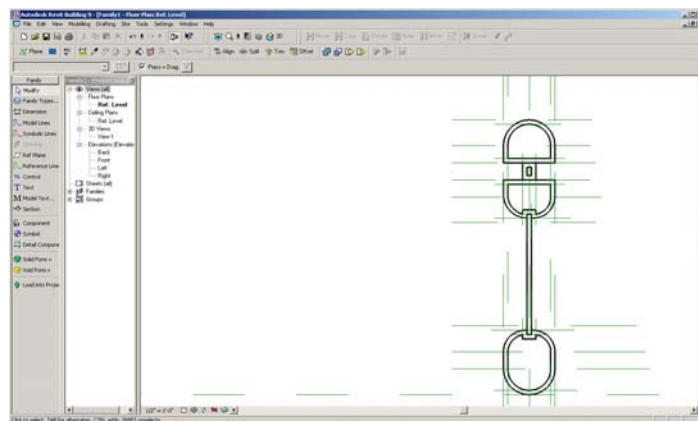
The height of extruded mullion can be controlled by using the reference plane. Draw reference plane on top of the extruded mullion and lock the top plane of the extrude mullion to the reference plane. And do dimensioning to the reference plane and name it as height. After this process, you can control the height of the extruded vertical mullion with the height parameter.



ii. Modeling connection between main vertical mullion & sub vertical mullion.

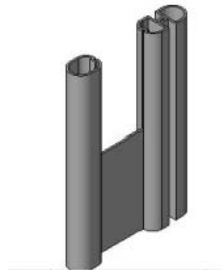
1. Draw section profile

For adding connections between main vertical mullions, first draw the section profile like following figure in Family Editor.



2. Extrude the profile

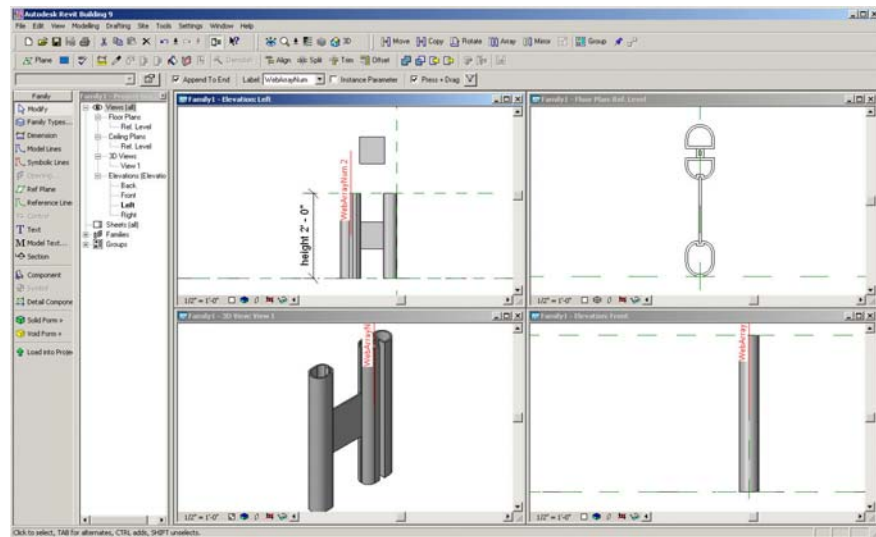
After finishing the section profile drawing, the connection also is extruded with a default value like figure X



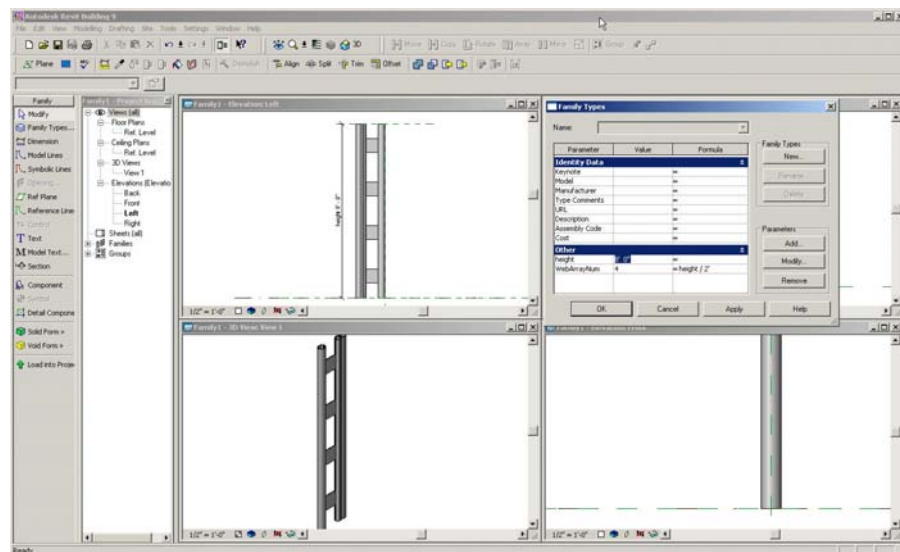
B. Add Parametric behavior

The connections should be arranged to the vertical mullion every 2 feet. Thus, when the

height of vertical mullion increases, the number of vertical mullion also should be increased. In order to add this parametric behavior, the array parameter (the number of array of connections) and the height parameter of vertical mullions should be linked.



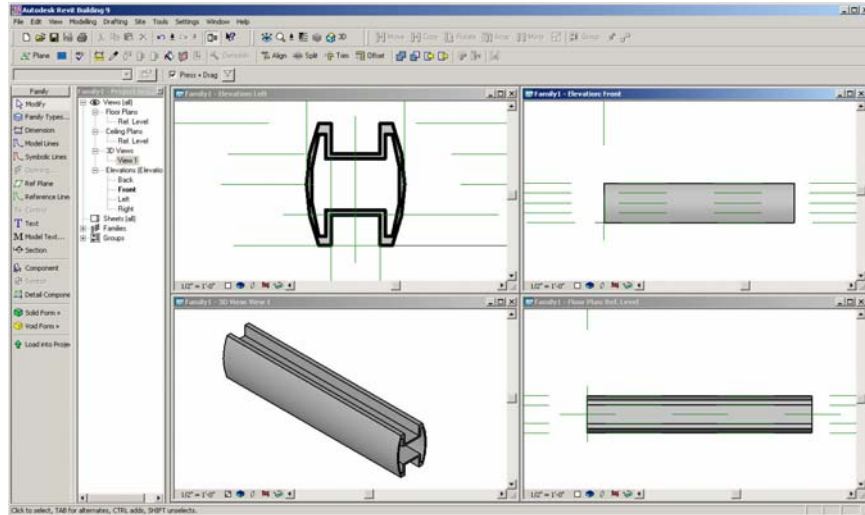
The parameter editor can define the relations between parameters. You can use basic algebra operators (+, -, X, /, =) , angular functions (sin, cos, tan) and absolute value function (abs) in order to define the relations between parameters. Following figure shows that parametric behavior of the vertical mullion. When the height of vertical mullion is changed, the connections automatically are arranged to the vertical mullion.



3. Process 2 - Part modeling 2 (Generate horizontal mullions).

A. Shape modeling

This step is the modeling of a horizontal mullion. A horizontal mullion has a section profile in the following figure.



B. Defines parametric behavior.

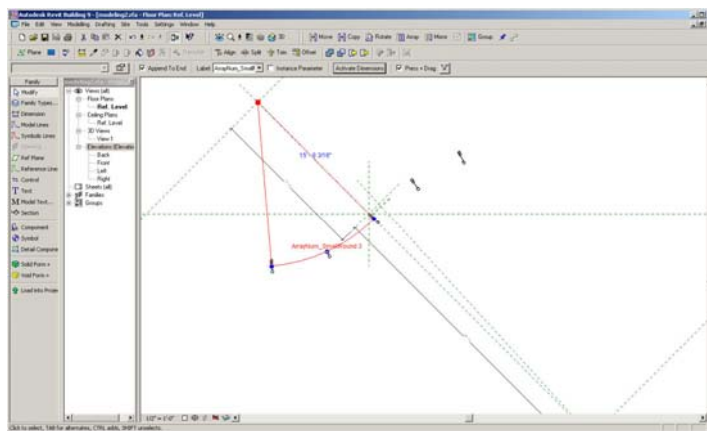
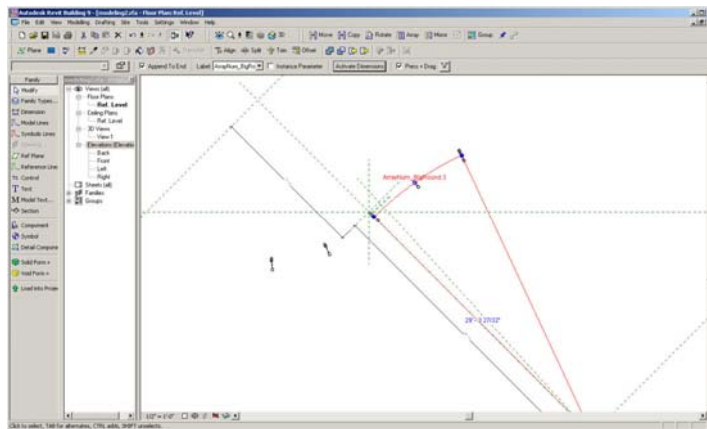
Its length also should be defined with parameter to be able to parametric control. The process for the parametric definition is same with the process of the vertical mullion.

4. Process 3 - Assemble vertical mullions and horizontal mullions.

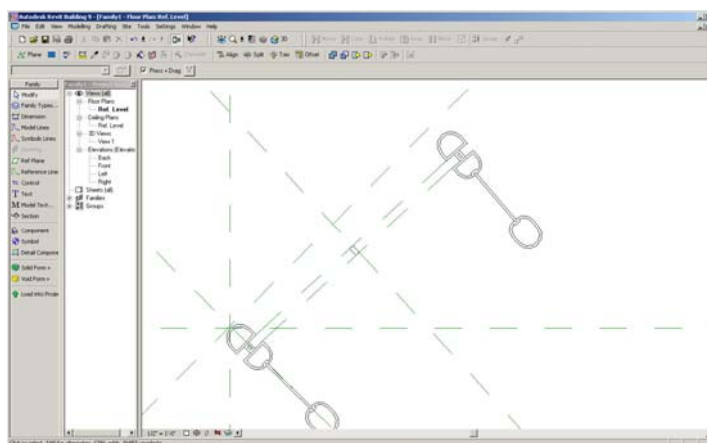
A. Placing vertical mullions and horizontal mullion for assembly

The parts-a vertical mullion and a horizontal mullion are saved as a component. To use these parts for modeling an assembly, they should be imported as a component in the Family editor. This assembly also can be a part for more complex assembly. Thus, we can build more complex assembly, which has a hierarchical structure with parts and assemblies.

In order to build a doubly curved curtain wall system, the vertical mullion should be arranged to the center of circle. The double curve of the curtain wall system consists of two arcs. Thus, the vertical mullion should be arrayed angularly to two centers of arcs. Following figure shows that the angular arrangement of vertical mullions to the two centers.

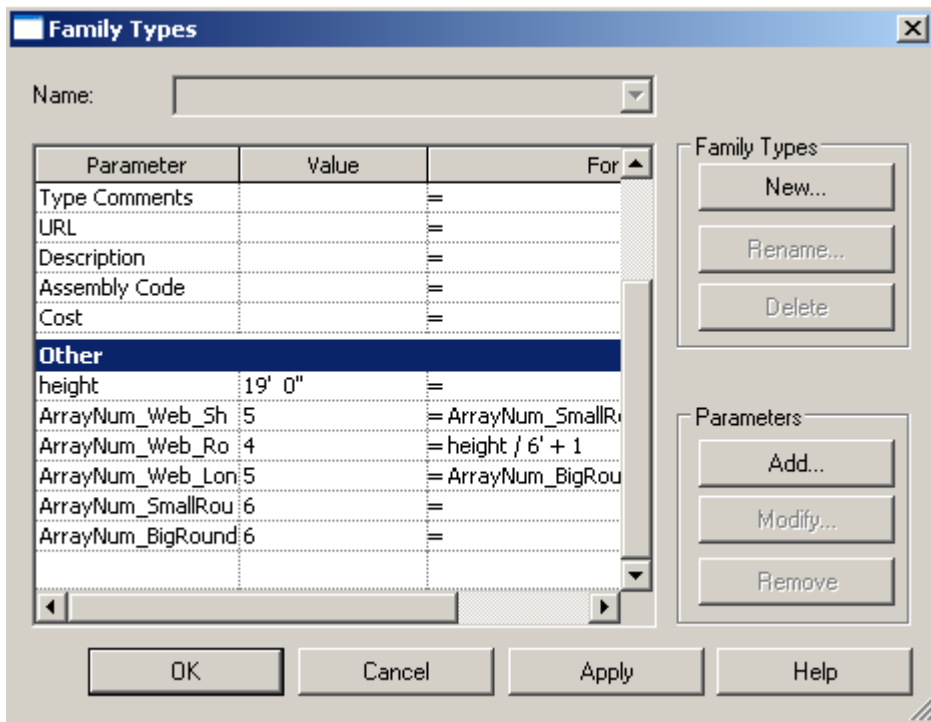


A horizontal mullion should be arranged between two vertical mullions. It also should be arrayed angularly to two centers, and the number of horizontal mullions follows the number of vertical mullions.



B. Define Assembly level parametric behavior.

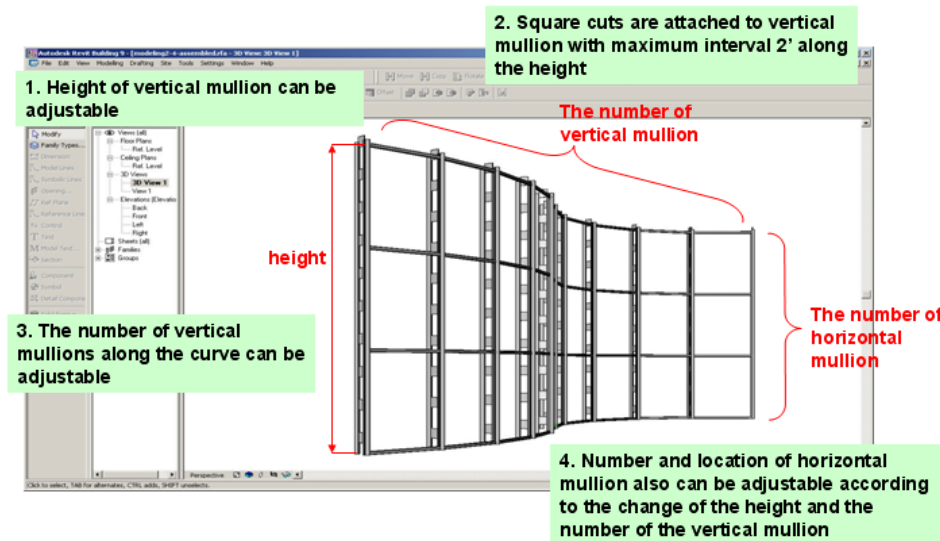
In order to make the assembly to have intended parametric behavior, Parameters in Parts and the assembly should be linked. After the part is imported as a component to assembly, the parts parameter and assembly parameter can be linked on the family type dialog.



Following figure show that the final assembly. It has following parametric behavior.

1. Height of the vertical mullions is adjustable. When the height is changed, the number of vertical mullions connections and horizontal mullions are changed also.
2. The number of vertical mullions in small and wide round also adjustable.

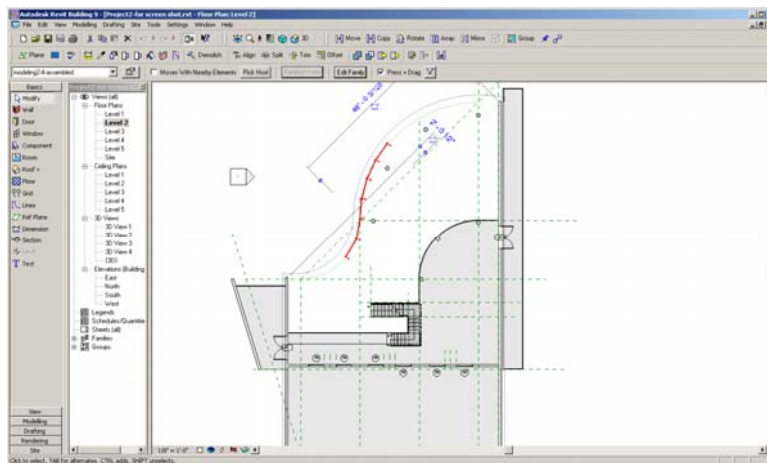
This assembly also should be saved as a component for later use.



5. Process 4 – Placing of the parametric custom object.

A. Placing the double curved curtain wall to a building.

The custom parametric object can be imported as a component to the project. Following figure show the inserted custom parametric object.



By changing the parameters in the assembly, the custom curtain wall system can be adjusted to fix in the place. Following figure shows the adjusting process by changing assembly parameters.

