



Revit DevCamp, Russia, Moscow, June 25

Key Concepts of the Family Editor

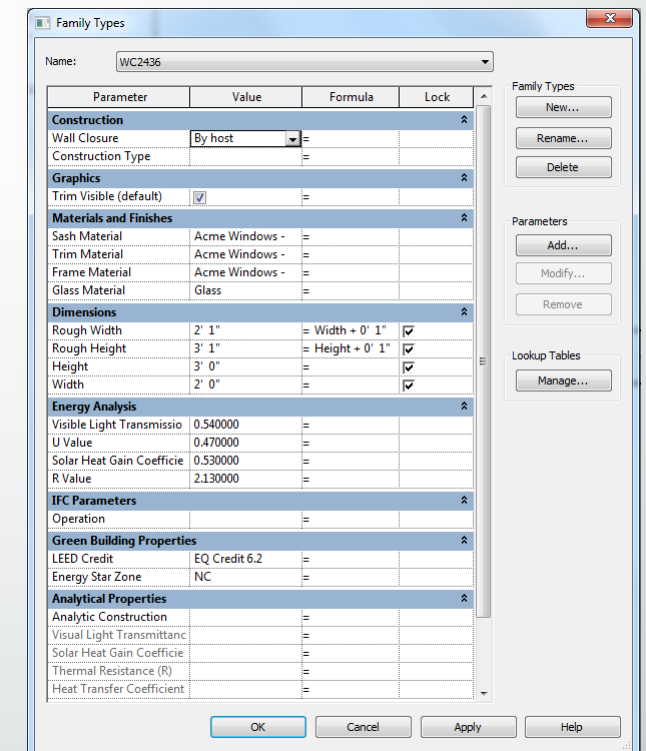
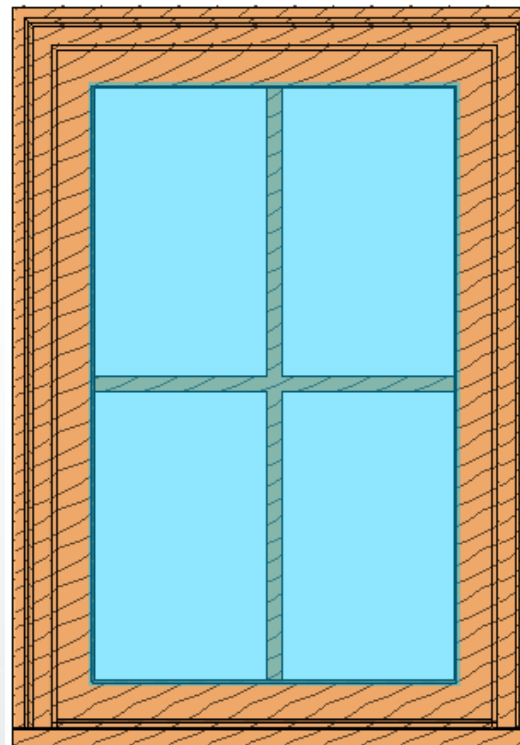
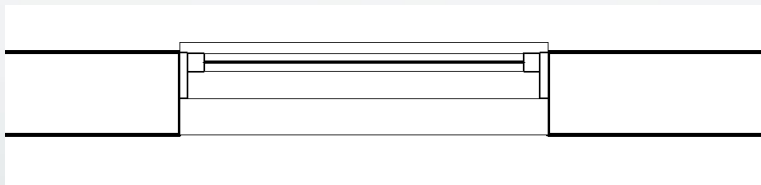
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Families

What is a family?

A family is a group of elements with a common set of properties, called parameters, constraints, and a related graphical representations.



Types of Families:

System vs. Standalone vs. In Place

System Families:

Typically assemblies that are constructed on the construction site

Wall, Floors, Roofs, Ceiling, with some exceptions...

They only exist in a project or template file.

Types of Families:

Standalone or "Loadable" Families:

Typically are manufactured pieces that are delivered to the construction site ready to install. They are intended to be used across many projects. Example: Windows, Doors, Light Fixtures, etc...

They are individual .rfa files.

In Place Families:

Project unique, built on site items that is stored only in the project.

Bone, Muscle and Skin:

So what is the best, most reliable way to build a family?

Build with the Bone, Muscle and Skin method.

Why?

Highest level of constraint is a labeled dimension attached to a reference plane.

Bone, Muscle and Skin:

The Bones, Muscle and Skin method describes the family as:

Bones = Reference Planes & Reference Lines

Muscle = Dimension, Label Parameters, Automatic Sketch Dimensions

Skin = Solids/Voids and Symbolic Linework

Bone, Muscle and Skin:

Thursday, April 02, 2009

The Family Editor: Bones, Muscle & Skin

I have heard the term "bones" and phrase "build the bones" used in the context of the family editor in the past. In fact some of the earlier Revit Technology Corporation (RTC) and Autodesk Family Editor documents have used the term too, perhaps for the first time even. Lately over the last year or two I've been expanding on the metaphor.

Bones = Reference Planes

Muscle = Dimensions, Labels/Parameters, Automatic Sketch Dimensions

Skin = Solids/Voids and Symbolic Linework

If you properly define the "bones" first and then connect the "muscle(s)" to them you'll find that your "skin", once anchored to the bones, will go wherever the muscle tell the bones to go. I just picture my arm and in fact I usually hold it up and move it at the elbow while I mention it in classes. A properly defined family will behave as consistently as your arm does, unless you manage to do it harm skiing?

Too clinical? Squeamish? Sorry!

Blog Post by Steve Stafford
The Family Editor: Bones, Muscle
& Skin

<http://revitoped.blogspot.com/>

The Bones...

Workplanes:

A work plane is a virtual 2-dimensional surface.

A work plane is used in the following ways:

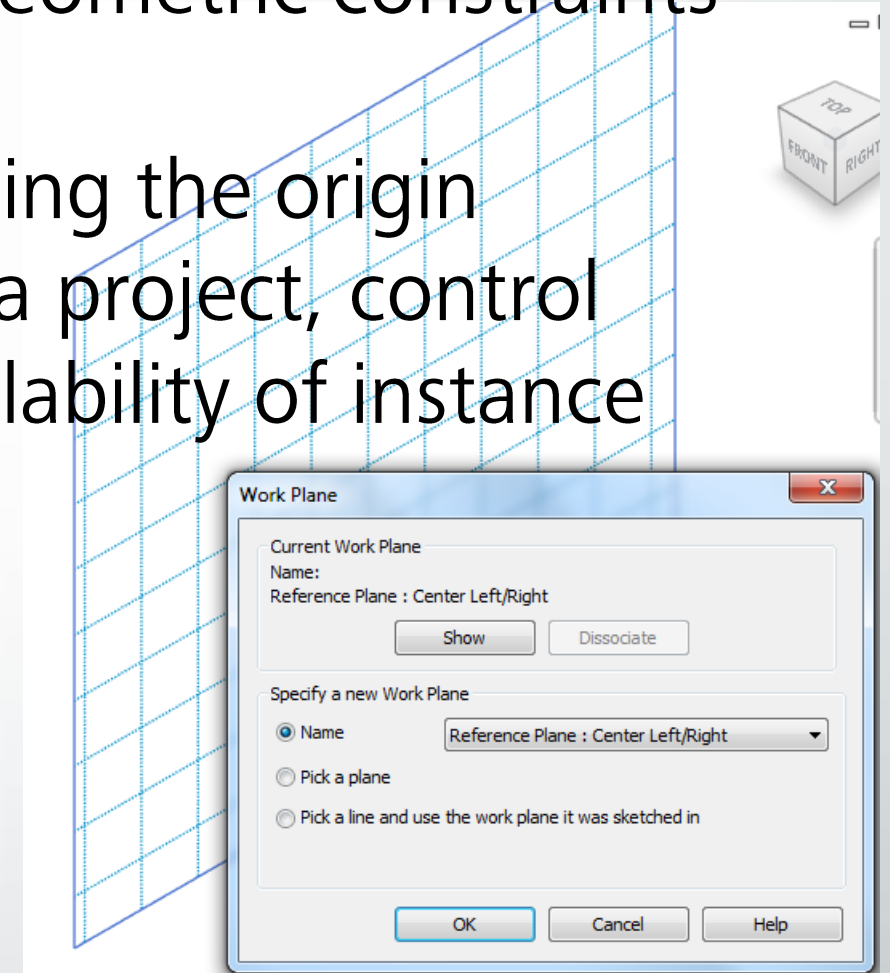
- as the origin for a view
- for sketching elements on
- for placing work plane-based components on

Workplanes:

Reference planes are the bones of a family

- They are a defined infinite plane in space
- They are intended to drive the geometric constraints

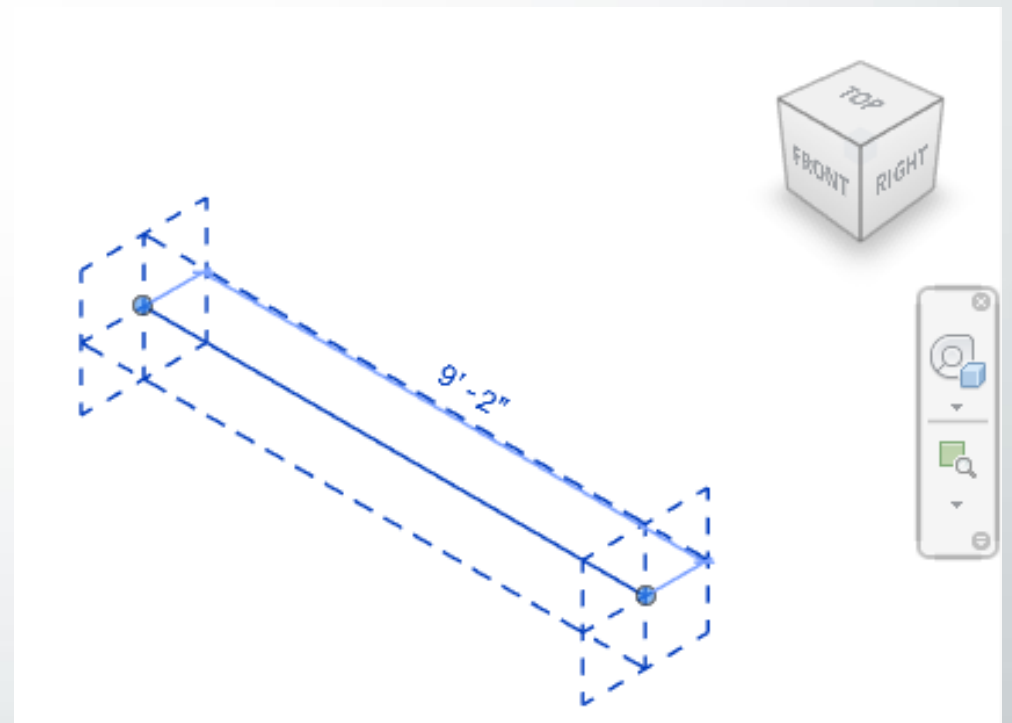
They have the added capability of defining the origin in a family, dimensioning to a family in a project, control snapping behavior and provide the availability of instance based shape handles.



Workplanes:

Reference Lines are 3D lines with a start and end point that contains 4 workplanes.



They were designed to specifically for driving angular constraints.



The Muscles...

Constraints:

Constraints are a method of limiting or restricting an elements movement.

con·strain  [kuh n-streynt]  [Show IPA](#)

noun

1. limitation or restriction.
2. repression of natural feelings and impulses: *to practice constraint.*
3. unnatural restraint in manner, conversation, etc.; embarrassment.
4. something that constrains.
5. the act of constraining.

4 Types of constraints in Revit

- Dimensions
- Labeled Parameters
- Automatic Sketch Dimensions???
- Pins

Constraints don't have to be static, they can be driven by a parameter value. Additionally a parameter's value can also be driven by a formula.

Parameters:

A Parameter is a setting that determines the appearance or behavior of an element, type, or view.

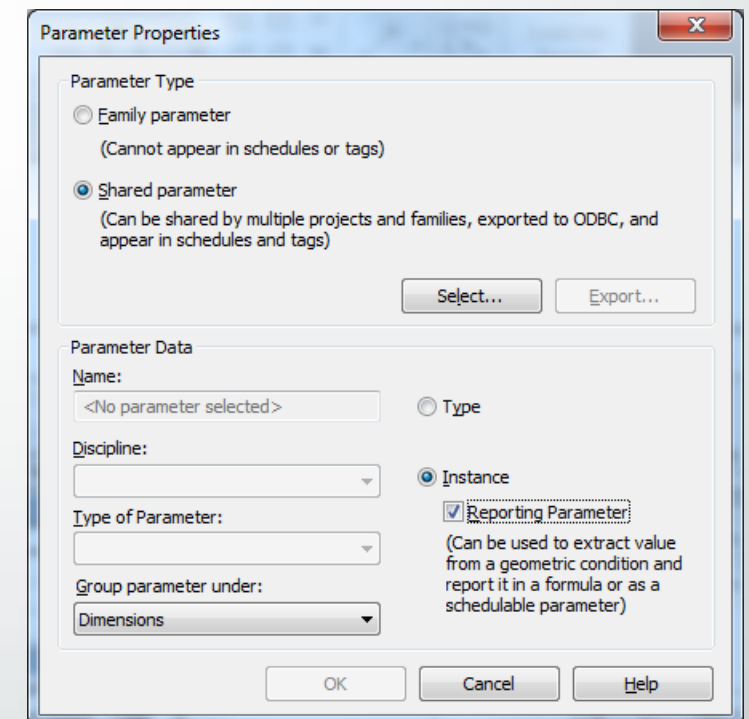
Parameters store and communicate information about all elements in a model. Parameters are used to define and modify elements, as well as to communicate model information in tags and schedules.

Parameters:

Parameter Types:

3 basic types:

System, Family and Shared parameters...

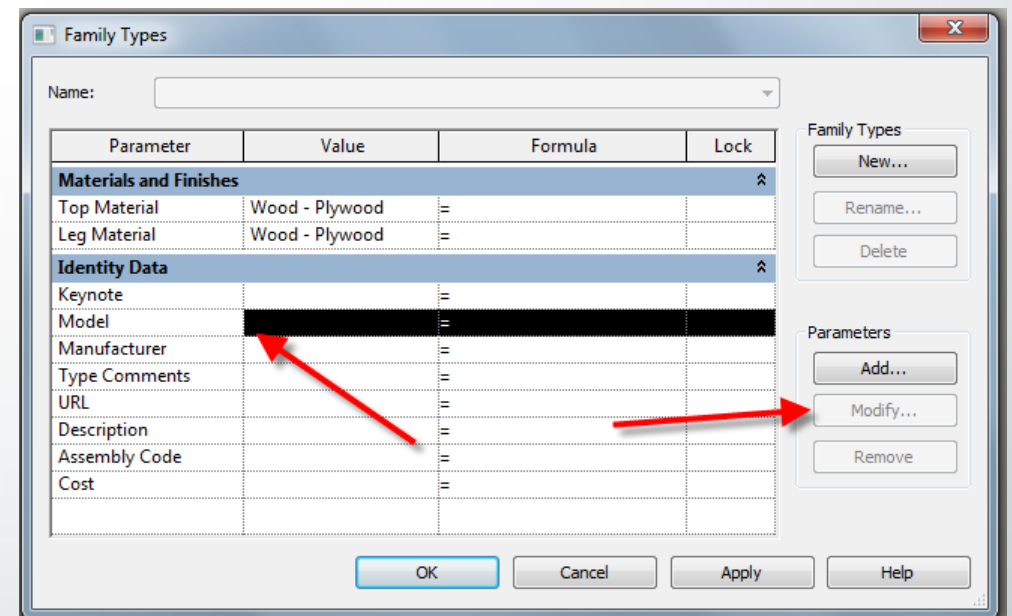


Parameters:

System Parameters:

Are built in parameters defined in the software, they can't be removed or renamed, but they do schedule.

Note: when the parameter is selected in the Family Types dialog modify button is greyed out.



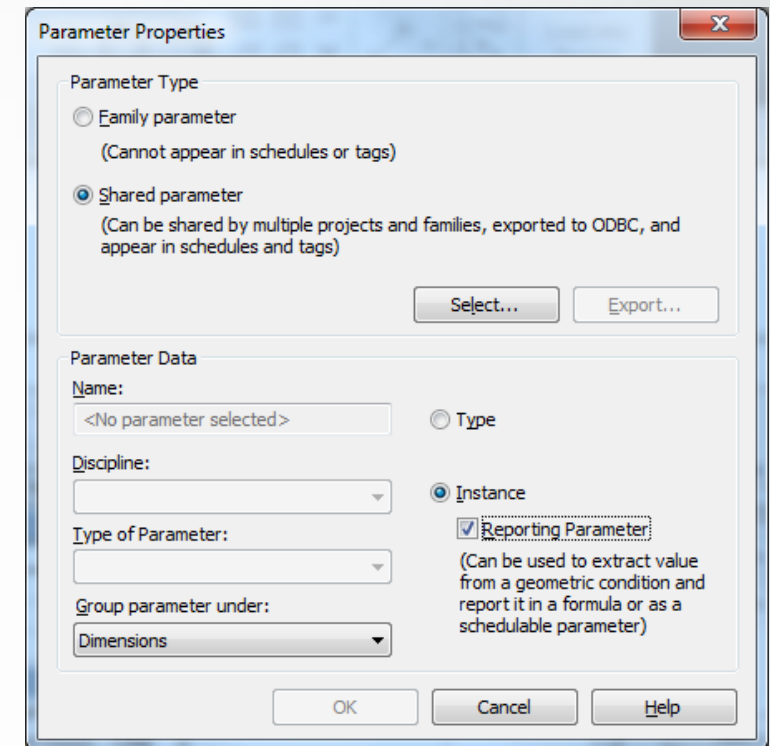
Parameters:

Family Parameters:

Are user based parameters that don't schedule.

Shared Parameters:

Are user based parameter with a shared definition and GUID that do schedule. The definition is stored in a shared parameter file, so the parameter can be loaded into many families.



Parameter Data:

Type Based Parameters:

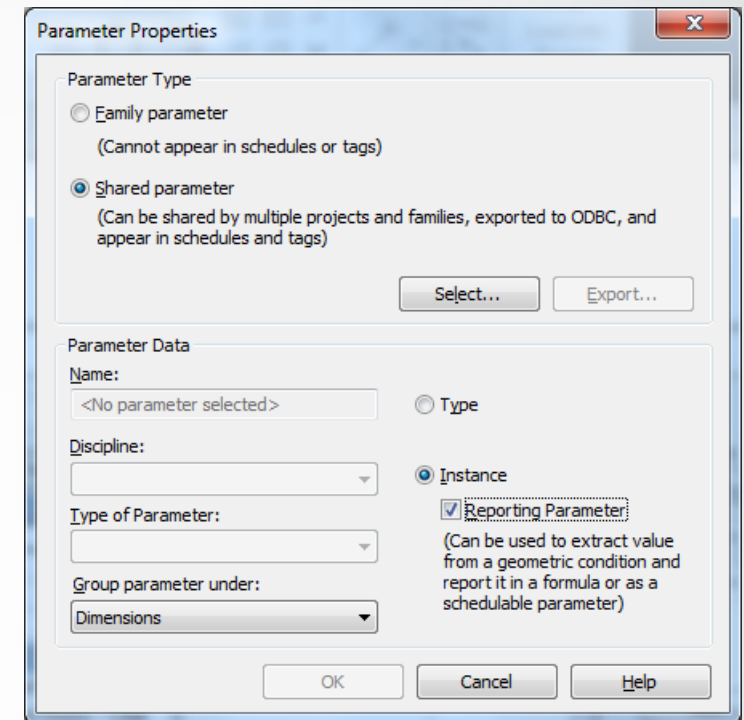
Predefined size typical that can be found in a manufactures catalog.

Instance Based Parameters:

Variable based user input parameters used on items the can come in any length, like a wide flange beam is manufactured to any length the structure engineer requires. In this case the length of the beam is instance based.

Reporting Parameter:

Instance based parameter that can extract a value from a generic condition. This type of parameter can only be a length or angle.



The Skin...

Elements:

There are 4 types of elements:

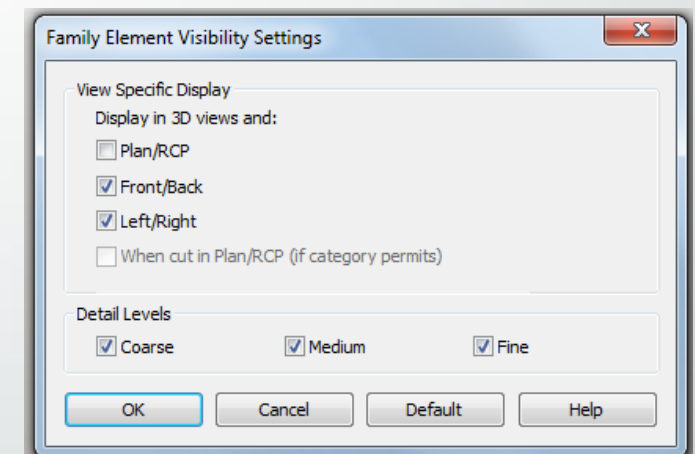
Model, View specific, View element, Datum elements

Model Elements: *(available in all views)*

- Solids and Voids
 - Extrusions, Blend, Revolve, Sweep and Swept Blend
- Model Lines

View Specific: *(available in the views created in)*

- Symbolic Lines
- Detail Lines



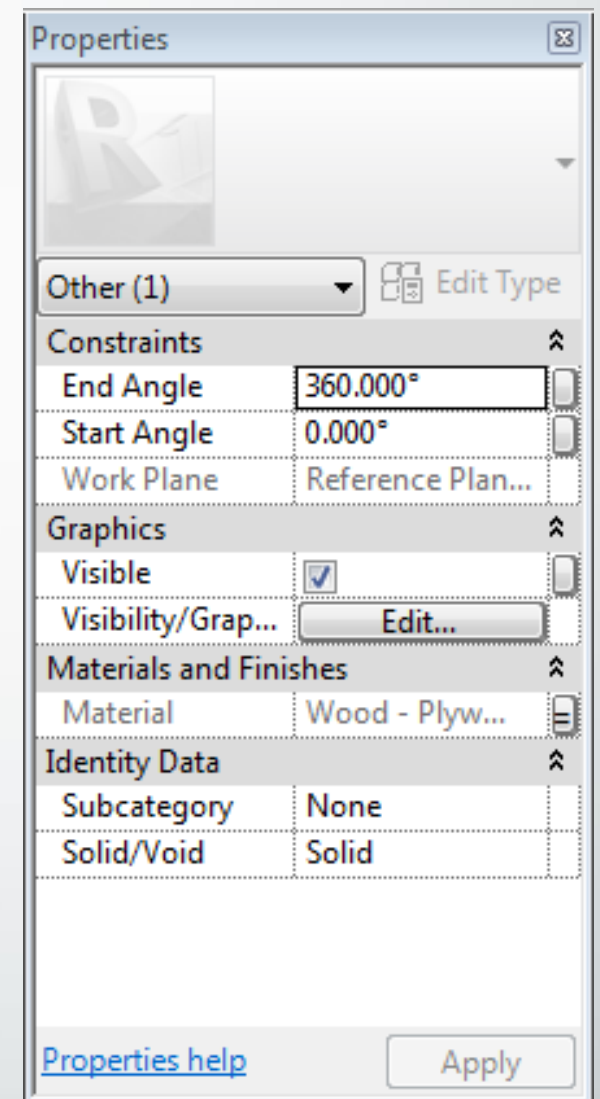
Elements:

Each have element properties, for example:

Model Elements:

- Subcategory
- Material
- Visible
- Visibility/Graphics

These properties can be used to control how an element looks and is displayed, along with other properties of that element.



Where do I start?

Family Templates:

How do I decide which template to start from?

Don't select a template just based on the category, thinking about the functionality first will give you more options.

Functionality is not tied to the category but is tied to the template.

The category adds the family parameters, built in parameters and subcategories required for that category. Also this selection will effect how the family schedules.

Note: It does take some learning all the special cases in Revit.

Family Templates:

Decision tree

2D vs. 3D family?

- 2D - What is the use?
 - Detail Item
 - Profile
 - Annotation
 - Titleblock

3D - Does the family require specific functionality?

- Yes - What is the special functionality for?
 - Baluster
 - Structural Framing
 - Rebar
 - Pattern Based
- No - Does the family require a host?
 - Yes - Which host?
 - Wall Based
 - Ceiling Based
 - Floor Based
 - Roof Based
 - Face Based
 - No - Then chose from:
 - Standalone (Level Based)
 - 2 Level Based (Column)
 - Line Based
 - Adaptive

Family Templates:

Then chose a category.

Many of the family template are open to multiple categories giving you different functionality depending on your choices.

Example:

User wants to build an escalator

If they follow the category first, the user will have adjust the escalator height on placement and any time the floor to floor height changes.

If they follow the functionality first you can end up with a 2 level aware escalator that re-adjust its size automatically when the floor to floor height changes.

Family Templates:

Template behaviors vs. category behaviors

Template have behaviors built in in relation to hosting, placement methods or even special editors

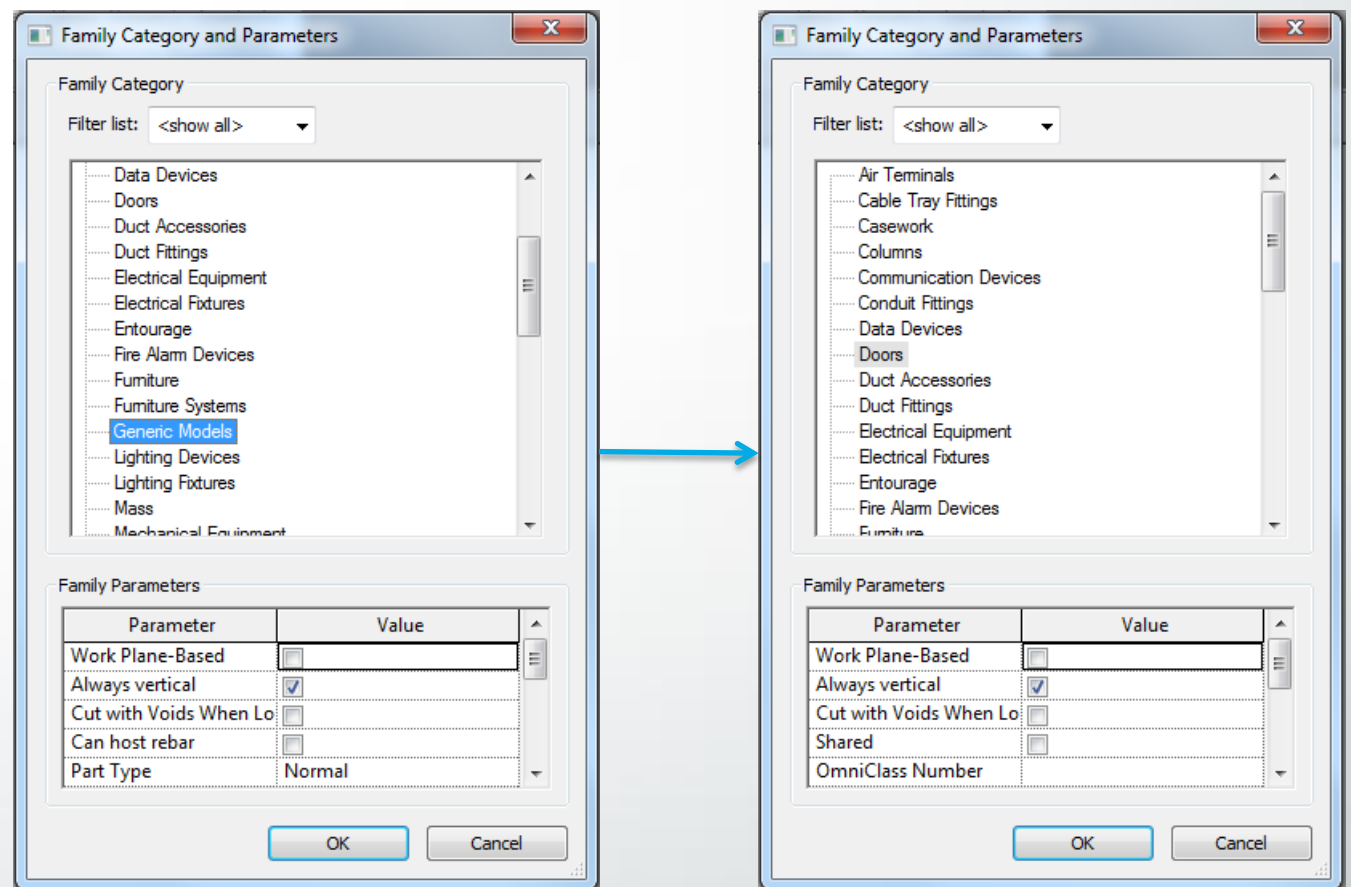
While categories have behaviors that are controlled by the settings in the Family Parameters under Family Category and Parameters dialog.

Changing the category changes the options available in the Family Parameters list. Some of the options include "Always Vertical", "Cut with Voids When Loaded" and "Shared"

Family Templates:

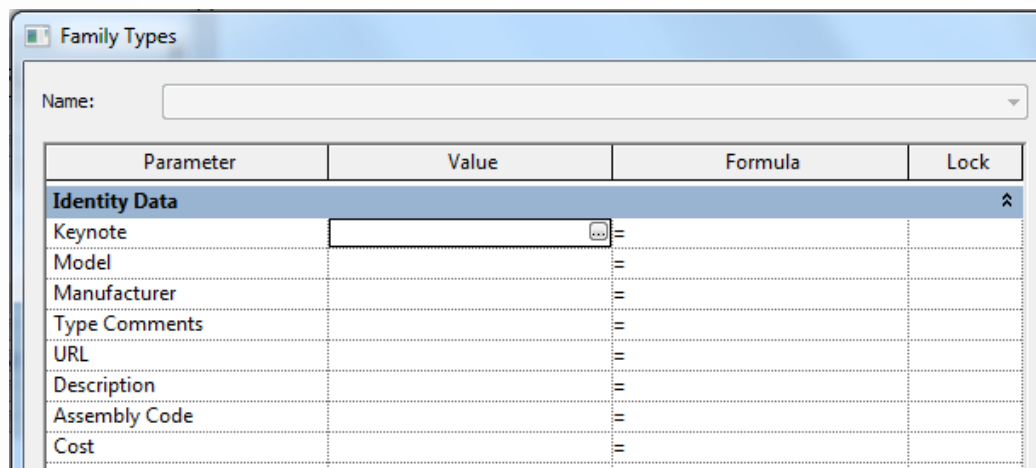
Additionally setting the category changes the available built in sub-categories and parameters.

Visual example:
Generic Model to Doors

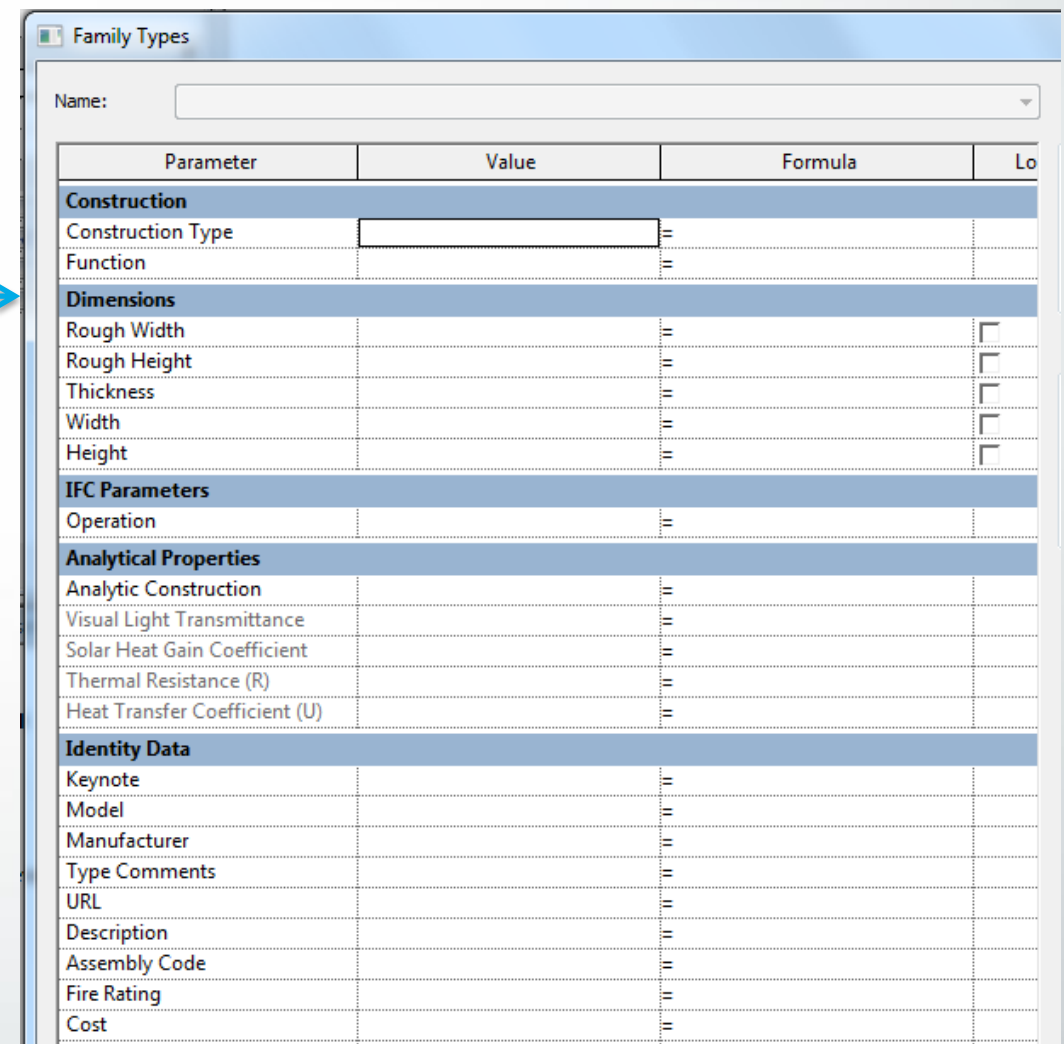


Family Templates:

Visual example:
Generic Model to Doors



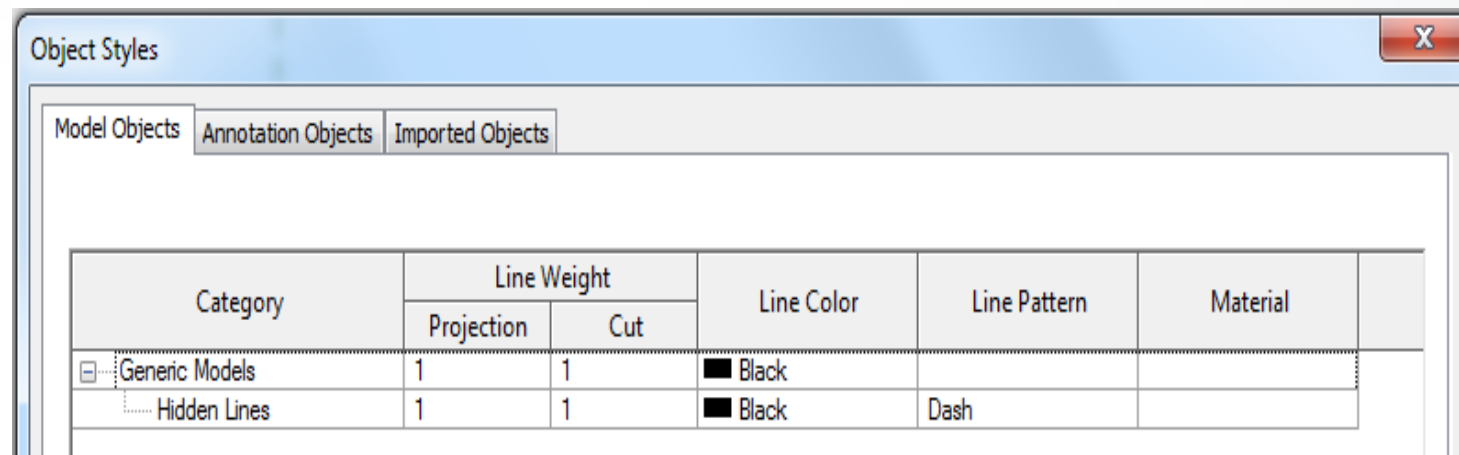
Parameter	Value	Formula	Lock
Identity Data			
Keynote		=	
Model		=	
Manufacturer		=	
Type Comments		=	
URL		=	
Description		=	
Assembly Code		=	
Cost		=	



Parameter	Value	Formula	Lock
Construction			
Construction Type		=	
Function		=	
Dimensions			
Rough Width		=	<input type="checkbox"/>
Rough Height		=	<input type="checkbox"/>
Thickness		=	<input type="checkbox"/>
Width		=	<input type="checkbox"/>
Height		=	<input type="checkbox"/>
IFC Parameters			
Operation		=	
Analytical Properties			
Analytic Construction		=	
Visual Light Transmittance		=	
Solar Heat Gain Coefficient		=	
Thermal Resistance (R)		=	
Heat Transfer Coefficient (U)		=	
Identity Data			
Keynote		=	
Model		=	
Manufacturer		=	
Type Comments		=	
URL		=	
Description		=	
Assembly Code		=	
Fire Rating		=	
Cost		=	

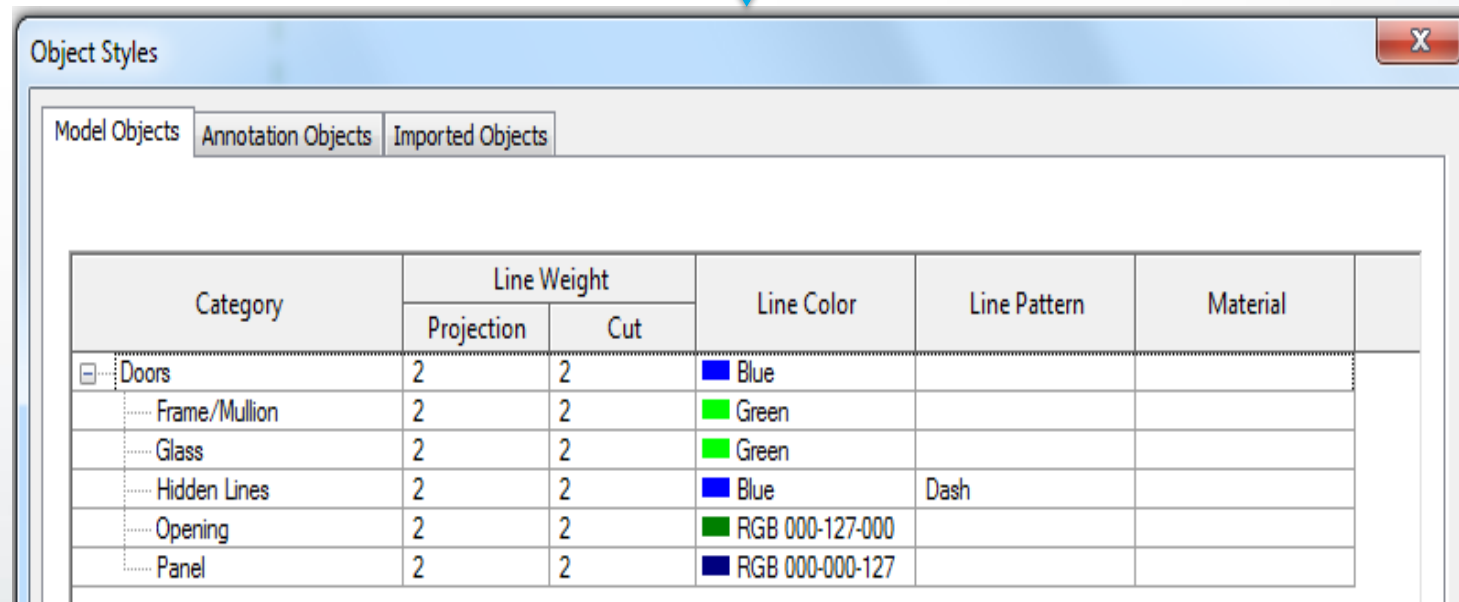
Family Templates:

Visual example:
Generic Model to Doors



The screenshot shows the 'Object Styles' dialog box with the 'Model Objects' tab selected. The table below lists the styles for the 'Generic Models' template.

Category	Line Weight		Line Color	Line Pattern	Material
	Projection	Cut			
Generic Models	1	1	Black		
Hidden Lines	1	1	Black	Dash	



The screenshot shows the 'Object Styles' dialog box with the 'Model Objects' tab selected. The table below lists the styles for the 'Doors' template.

Category	Line Weight		Line Color	Line Pattern	Material
	Projection	Cut			
Doors	2	2	Blue		
Frame/Mullion	2	2	Green		
Glass	2	2	Green		
Hidden Lines	2	2	Blue	Dash	
Opening	2	2	RGB 000-127-000		
Panel	2	2	RGB 000-000-127		

The Process...

The Process:

The “process” for building families is the most important aspect of family creation that one needs to learn.

Process order:

1. Pick your template
2. Plan (Insertion Point, Parametric Origin, etc.)
3. Layout Reference Planes (add **The Bones**)
4. Add Parameters and Constraints (add **The Muscles**)
5. Add multiple host thickness types (for testing hosted families)
6. Add 2 or more types
7. Flex Types and Host (Testing Procedure)
8. Add a Single Level of Geometry (add **The Skin**)
9. Repeat until you are satisfied with the results
10. Test in Project Environment (create testing project)

Tips for Success:

A successful piece of content meets all the users needs for BIM.

Build not only for the user but how the information will be use along the whole BIM life cycle.

Ask yourself

What is your use case? And how will it be used?

What is the proper level of detail and or level of development for this piece of content?

Additionally try to meet all requirements for:

- Proper graphic representation in all view types.
- Enough information provided to support the down stream applications.
- Good parametrics for the expected use cases.
- Good performance



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Additional Topics:

- Type Catalogs
- Is Reference

Type Catalogs:

Type Catalogs are an external group of types or catalog of a family in a delimited text format. Type catalog allow the user to selectively load a type from a long list.

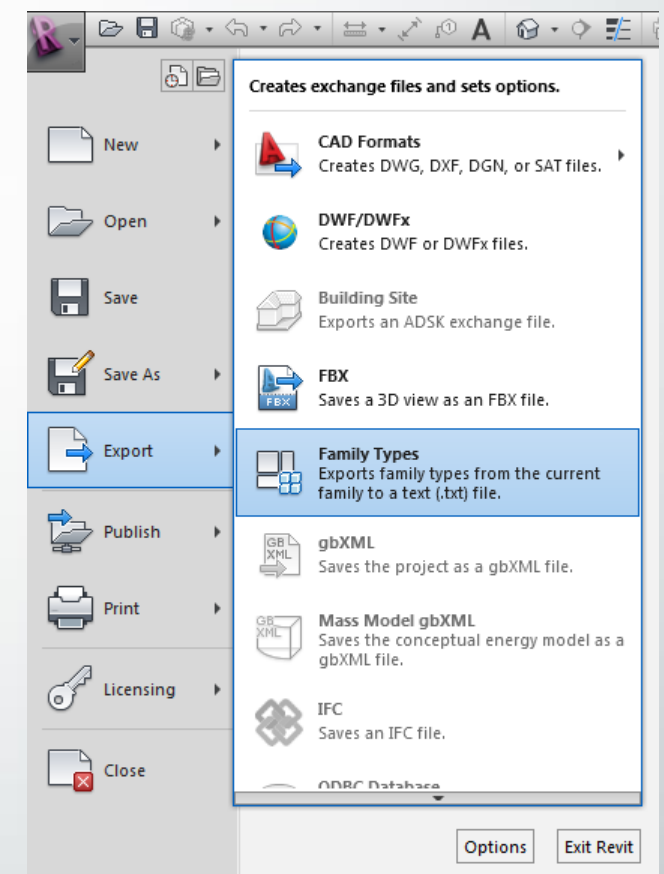
The type catalog name must match the family name but with a .txt extension.

Tip:

The simplest way to create a type catalog is to export the current types by:

Click "R" > Export > (Family Types).

Open the file in a text editor and modify as needed.



Type Catalogs:

```
,Manufacturer##other##,Length##length##centimeters,Width##length##centimeters,  
Height##length##centimeters  
MA36x30,Revit,36.5,2.75,30  
MA40x24,Revit,40.5,3.25,24
```

The first line defines the delimiter and the parameters in the type catalog
The first character of the first line is the delimiter “,”

The schema:

<parameter name>##<parameter type>##<units>,

The next lines are the catalog entries:

<type name1>,<parameter1>,<parameter2>,<parameter3>,<parameter4>

Type Catalogs:

Parameter Declaration Table:

Type of Parameter	Parameter Declaration	Notes
Text	param_name##OTHER##	
Integer	param_name##OTHER##	
Number	param_name##OTHER##	
Length	param_name##LENGTH##FEET	
Area	param_name##AREA##SQUARE_FEET	
Volume	param_name##VOLUME##CUBIC_FEET	
Angle	param_name##ANGLE##DEGREES	
Slope	param_name##SLOPE##SLOPE_DEGREES	
Currency	param_name##CURRENCY##	
URL	param_name##OTHER##	
Material	param_name##OTHER##	
Yes/No	param_name##OTHER##	Defined as 1 or 0 with 1 equaling Yes and 0 equaling No.
<Family Type>	param_name##OTHER##	Family name:type name with no file extension

Type of Parameter	Parameter Declaration	Notes
Metadata parameters:		
Keynote	Keynote##OTHER##	
Model	Model##OTHER##	
Manufacturer	Manufacturer##OTHER##	
Type Comments	Type Comments##OTHER##	
URL	URL##OTHER##	
Description	Description##OTHER##	
Assembly Code	Assembly Code##OTHER##	
Cost	Cost##CURRENCY##	

Is Reference:

Reference planes have a property called “Is Reference”. By setting this property, you specify that the reference plane can be dimensioned or snapped to when you place a family into a project.

Additionally labeled instance parameters attached to reference planes with weak or strong “Is Reference” will allow shape handles for the user to control.

Is Reference:

A “strong reference” has the highest priority for dimensioning and snapping.

For example, you create a window family and place it into a project. As you are placing the family, temporary dimensions snap to any strong references in the family. When you select the family in the project, temporary dimensions appear at the strong references. If you place a permanent dimension, the strong references in the window geometry highlight first. A strong reference takes precedence over a wall reference point (such as its centerline).

Is Reference:

A “Weak reference” has the lowest priority for dimensioning and snapping. When you place the family into the project and dimension to it, you may need to press Tab to select a weak reference, as any strong references highlight first.

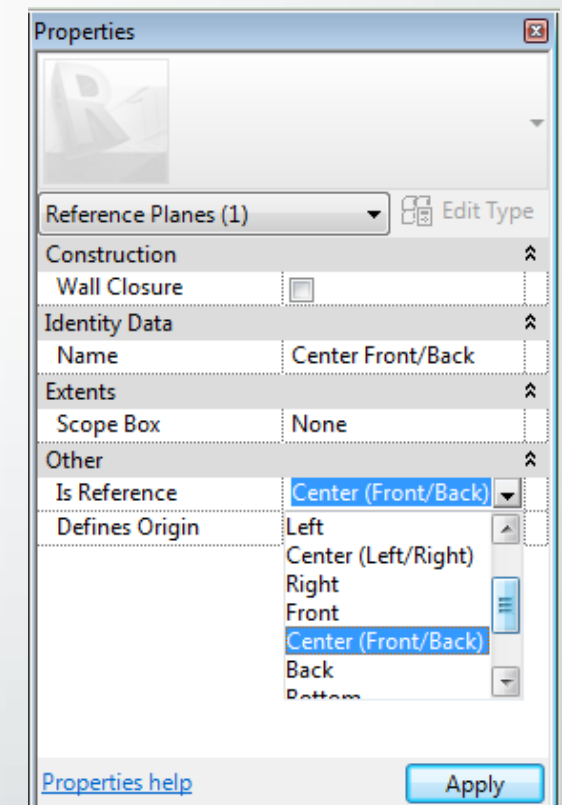
A “Not a reference” is not visible in the project environment so you cannot dimension or snap to those locations in a project.

Is Reference:

All named "Is Reference": Left, Right, Top... are considered strong references.

But the "Name" of the reference plane has no relation to the function of the "Is Reference" parameter.

Strong References	Weak References	Not a References
<ul style="list-style-type: none">• Strong Reference• Left• Center (Left/Right)• Right• Front• Center (Front/Back)• Back• Bottom• Center (Elevation)• Top	Weak Reference	Not a Reference



Additional resources

Blogs

- [The Building Coder](#)
- [Revit OpEd - Steve Stafford](#)
- [do-u-revit.blogspot.com/](#)

Newsgroups:

- [http://www.augi.com/](#)
- [http://www.revitforum.org/forum.php](#)

Books:

- [http://paulaubin.com/](#)