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More Practical Dynamo: Practical Uses for Dynamo Within Revit

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Learning Objectives

- Learn how to program using visual programming.
- Discover more practical applications of Dynamo for Revit.
- Learn how to create practical uses in the office using the Dynamo extension for Revit software.
- Learn how to automate repetitive manual Revit tasks using the Dynamo extension.

Description

Have you ever wanted to learn more about the Dynamo visual programming language extension for Revit software but thought it wasn't for you? This lecture will describe the uses of the Dynamo extension and explain how it interacts with Revit software to help any Revit user. The Dynamo extension is a program that uses visual programming, but don't be scared. This lecture will teach attendees how to use the Dynamo extension even if they have no prior programming experience. This lecture will also give attendees very gradual doses of the Dynamo extension and visual programming so that they leave with the skills to apply the Dynamo extension to practical Revit software workflows. And don't forget that the Dynamo extension is an add-on to Revit.

Your AU Expert

Marcello is the BIM Director at John A. Martin & Associates Structural Engineers in Los Angeles, CA. He has been using Autodesk products for over 15 years including AutoCAD, 3ds Max, and Revit. Marcello is heavily devoted to helping advance the use and knowledge of BIM solutions within the AEC community. He is well known for modeling elements and creating workflows that others have thought not possible. He also frequently presents at Autodesk University and at The Revit Technology Conference where he has been voted the top rated speaker three years in a row at both conferences. He has worked on many well-known projects in the past including the Walt Disney Concert Hall in Los Angeles, CA, the Stata Center at MIT, and the Tom Bradley International Terminal Expansion at LAX. Marcello received B.S. and M.S. degrees in Civil Engineering and is a licensed Civil and Structural Engineer.

Read more of Marcello's work at **Simply Complex**, a blog dedicated to modeling and documenting complex geometry in the AEC industry using Autodesk products. You can also email Marcello (*marcellojs@hotmail.com*) or follow him on **Twitter**.

OUTLINE

Introduction to Dynamo

This is a very difficult question to answer simply because Dynamo does SO much. Below is my answer to this question and I hope it clarifies it for some of you.

Dynamo is a free program from Autodesk that uses visual programming. Dynamo primarily does two tasks:

1. **Creates its own geometry with parametric r e l a t i o n s h i p s .**
2. **Reads and writes to and from external d a t a b a s e s .**

Since Dynamo creates its own geometry and reads and writes to external databases it is a perfect fit to interact with Revit because....isn't Revit simply a database with parametric geometry? Dynamo is a stand-alone program but it could be used as an "add-on" to Revit.
Dynamo reads and writes back **data** to and from the Revit database via the Revit API. The data could be just about anything, parameter values, family geometry, and family placement.
Basically Dynamo manipulates the Revit database in ways that the UI (user interface) could not. For example in Dynamo you could set the base of all the walls and all the columns to the same elevation. This means that you could set parameters from different families equal to each other. Would that be helpful?

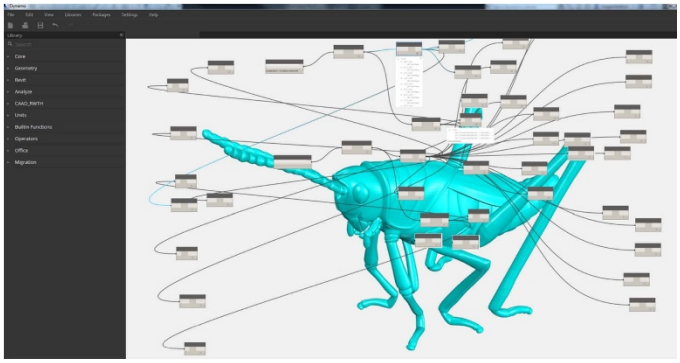
Dynamo also provides a direct relationship between its OWN geometry and Revit. For example in Dynamo you could model a cone and a plane, find the intersection of those elements (results in a curve) and then assign a Structural Revit Beam IN REVIT to that Dynamo curve and they would be forever "linked" meaning if the dynamo curve changed location then the Revit Beam would change location as well. All the while the original cone, plane, and curve would REMAIN in the dynamo program while the Structural Beam would remain in Revit. The applications for Dynamo and Revit are endless.

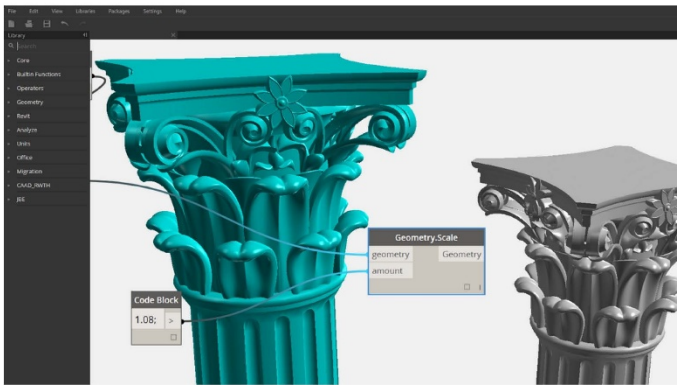
Every Revit User Gets to Touch the API

Any Revit user could learn Dynamo (since it uses visual programming it is very simple to learn) they could access the Revit api and perform simple tasks that only could have previously been performed with writing an add-on or writing a macro with .net language for Revit. Oh and don't forget that Dynamo is completely free and is updated constantly.

Dynamo is ever evolving so now is the time to download load it and learn it. Why wait its free! By the way Dynamo could also be used to create a grasshopper and a Corinthian column as shown in the figures below .

I am happy to say that Dynamo basically allows users to use the Revit API thru visual programming using “nodes” and “wires” instead of text. This means that any Revit user could use the API and create custom simple routines without having to know .net language or without having to hire an outside API consultant.





Installing or Updating DynamoBIM

DynamoBIM is a free open source program that also acts as an addin for Revit. Are you worried about addins to Revit? Since DynamoBIM's development is supported by Autodesk the download and install is seamless with Revit.If you needed to install it or need anyone else to install it. Go to DynamoBIM.org click download and install it. Click finish and that’s it!

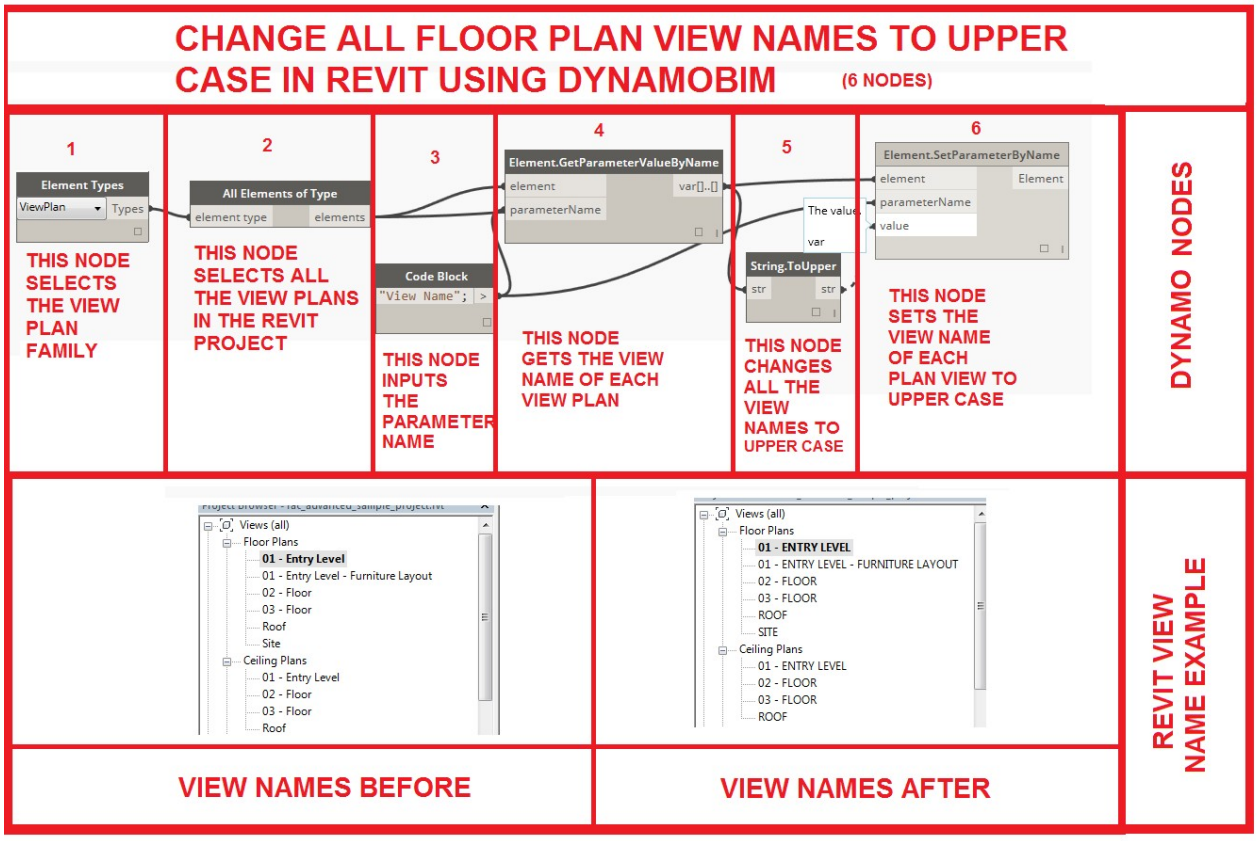
Click on the Dynamo button and it will open a separate window that is the Dynamo interface. It’s best to use dual monitors when using D y n a m o .

TEXT TO UPPERCASE

Changing Plan View Names to Uppercase in Revit

Have you ever wanted to change the plan view names in your Revit model to all UPPERCASE?

DynamoBIM is here to help you. Simply follow the Dynamo Graph below and you will get it done!

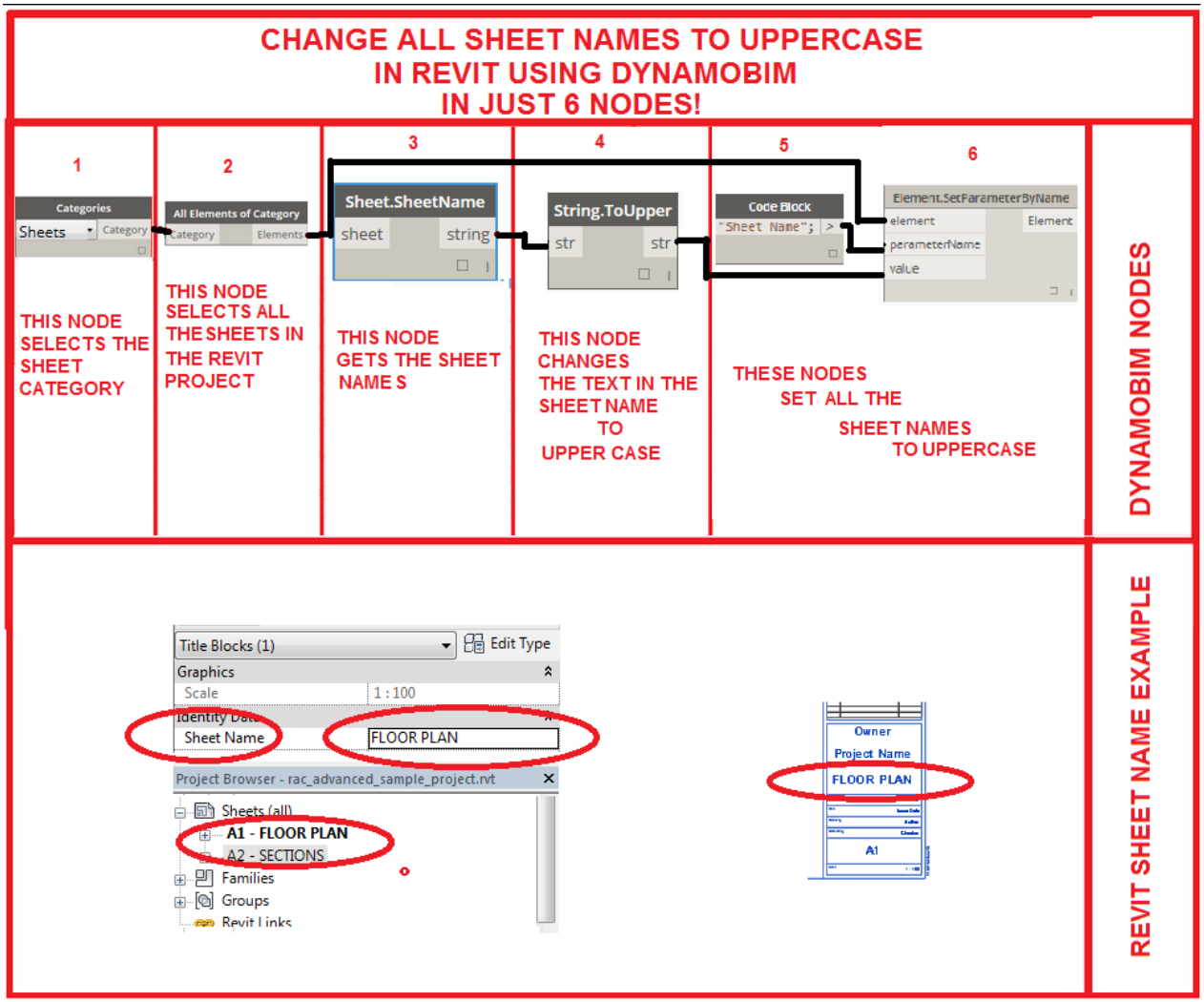


If it is your office policy to always use uppercase on your plan view names then this is a great tool to help you do it because DynamoBIM will save you time out of your busy schedule to "automate" this process instead of having to do it manually. Good Luck!

Changing Sheet Names to Uppercase in Revit

Have you ever wanted to change the sheet names in your Revit model to all UPPERCASE?

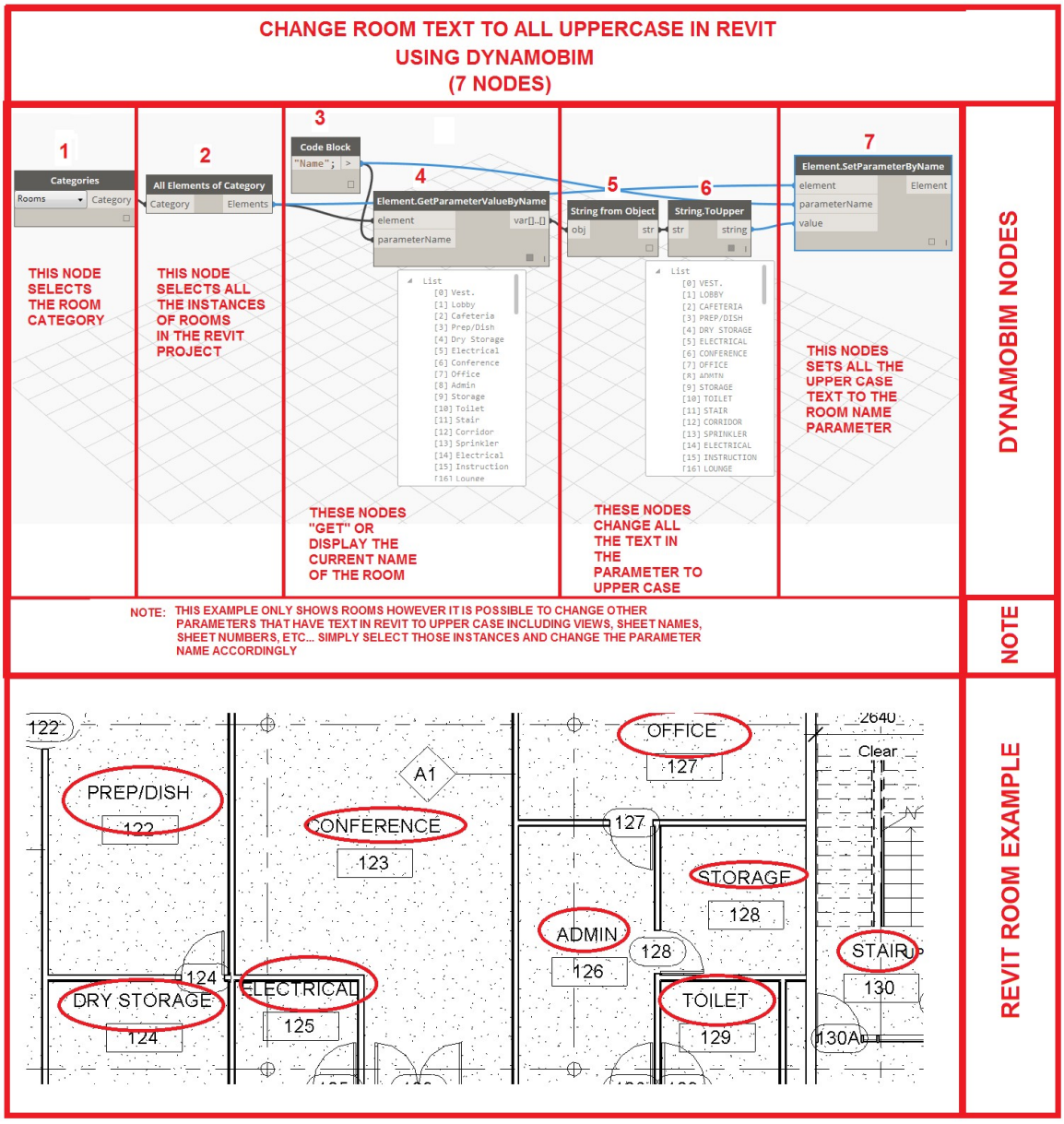
DynamoBIM is here to help you. Simply follow the Dynamo Graph below and you will get it done!



Why use DynamoBIM to do this? If it is your office policy to always use upper case on your sheet names then this is a great tool to help you do it. Why not make the sheet names all upper case to begin with? Well, we are all human and we will (at some point) mistakenly make a sheet name (or other tag or name) lower case. Dynamo will help keep you and your office stay in c h e c k !

Changing Room Text to Uppercase in Revit

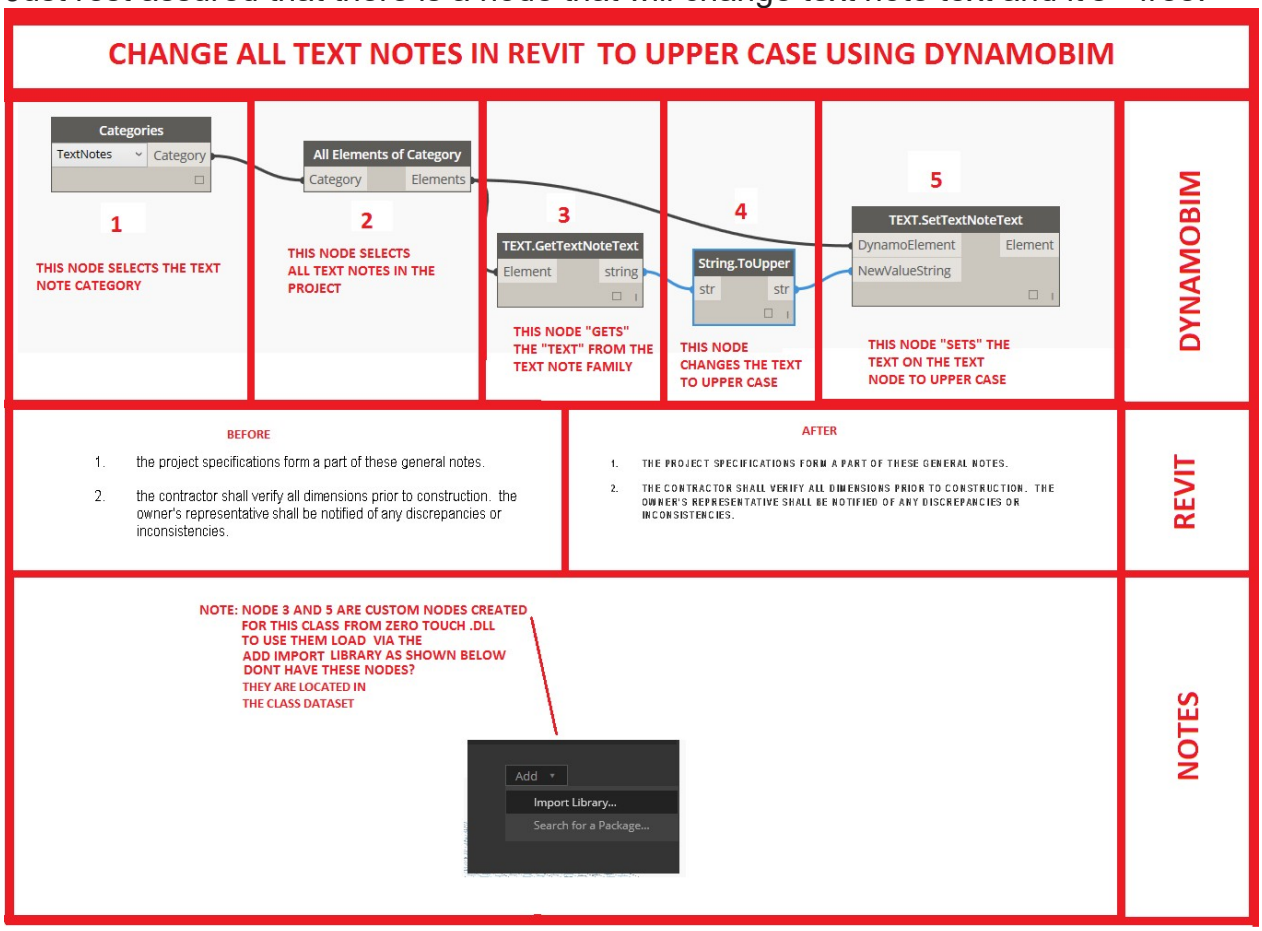
Have you ever wanted to change the names of your rooms (that is shown in your tags) in your Revit model to all UPPERCASE?
Simply follow the Dynamo Graph below and you will get it done!



This example only shows you how to change the name of the rooms to upper case but you could use this same method to change the text of Sheet Names, Sheet Numbers, Views and most any text parameter to upper case. Simply select those Revit Family Instances and change the parameter name from "Name" to something else. I have tried it on Sheet names and views already!

Text Note to Uppercase in Revit Using Custom Zero Touch Node

You are not able to change the text of a text note to uppercase using the methods shown previously because the text in a text note is not displayed in a parameter. I wish it were. Therefore, instead of using an out of the box dynamo node you have to create a custom node. in this case I already created a custom node that changes the text of a text note using Zero Touch and c#. If you don't know zero touch nodes are the new way of creating custom nodes in Revit. Since this is an introductory class into DynamoBIM I will not go into great detail on how it works. Just rest assured that there is a node that will change text note text and it's free!

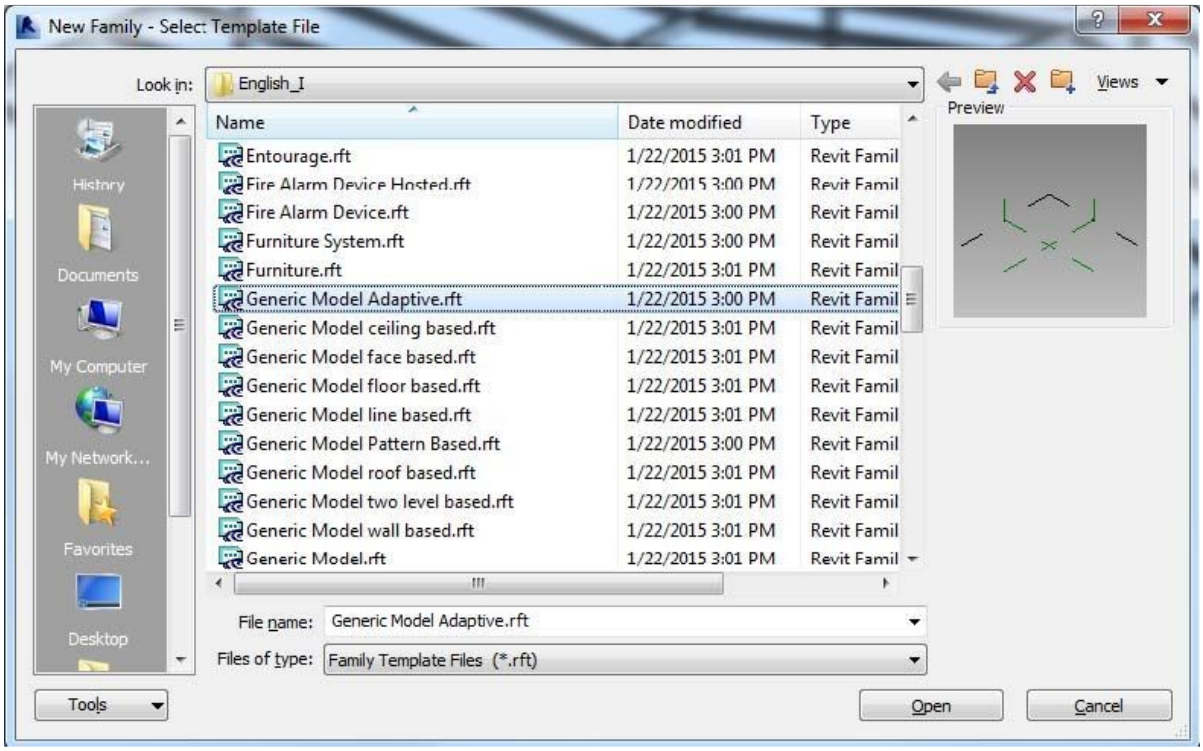


If you want to learn more about Zero Touch Custom Node creation then read about it **here**. Don't wait too long because all the cool kids are learning how to create custom nodes in Revit and you don't want to be left behind. Custom nodes are like custom families in Revit...you will have to learn how to create them eventually

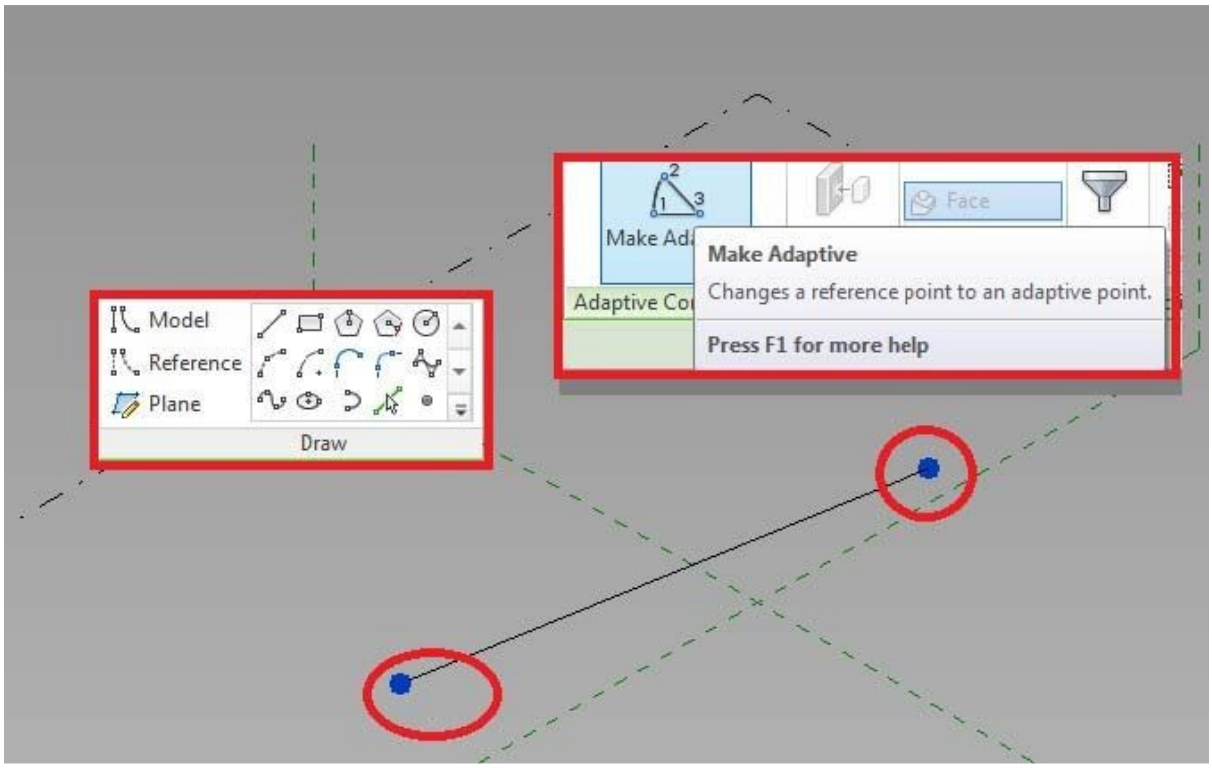
Structural Framing Using Adaptive Components

Let's review how to model beams if you use an adaptive component model line. It's the same thing as a beam analytical line only more r o b u s t .

1. Start a generic model adaptive as shown in the image b e l o w .



2. Make a two point adaptive by drawing a line with two nodes on each end. Then make those two points adaptive as shown in the image b e l o w .

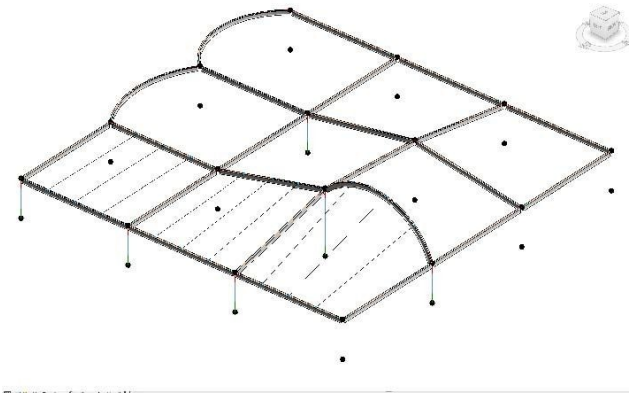


3. Insert the adaptive component into the project environment and follow steps 3 and 4 of the previous in-place mass example to get your structural framing in the correct locations.

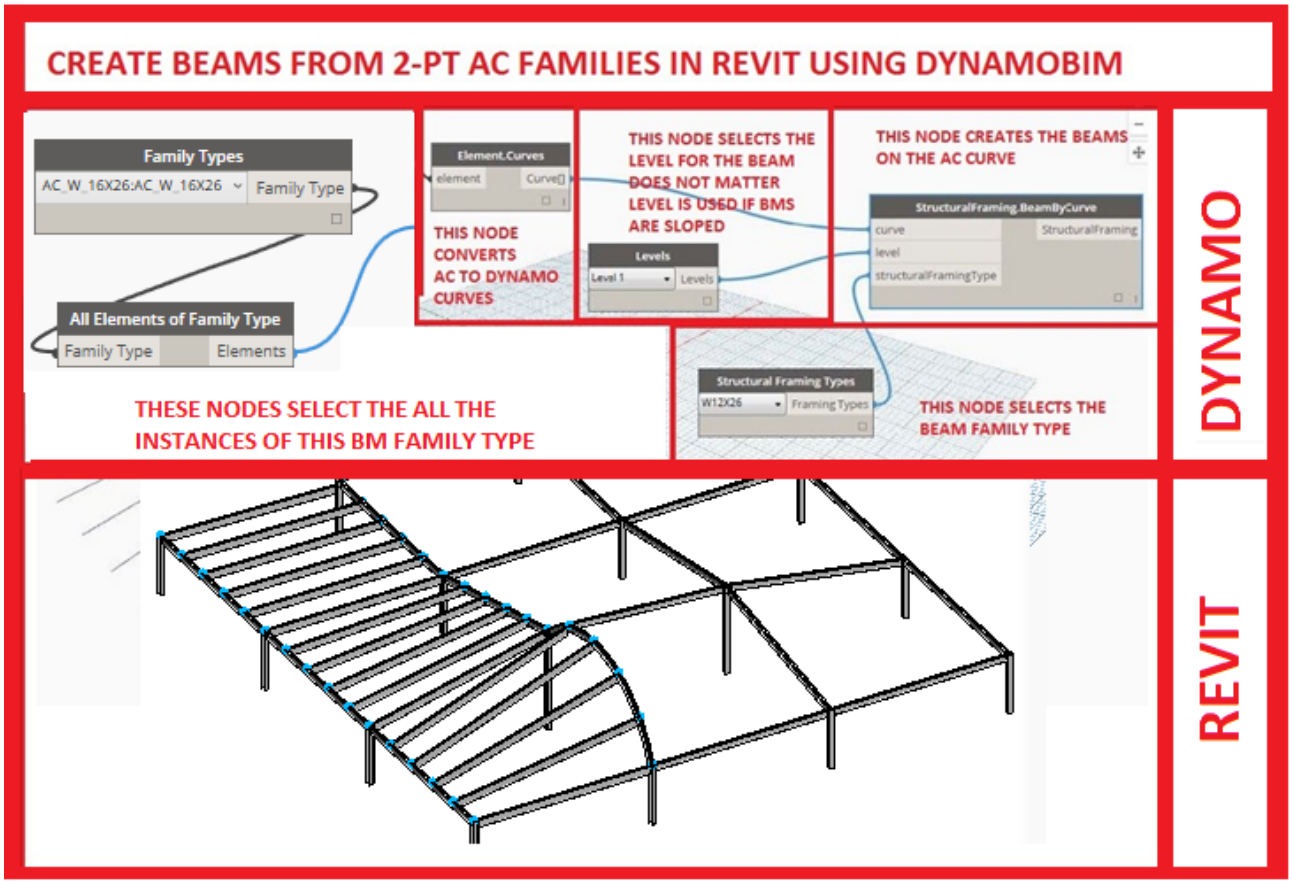
4. If you don't want to manually click on all the beams to place them on the AC lines then consider using dynamo! Its easy.

Dynamo to the Rescue

5. Place your AC beams as 2 point repeaters in an in place mass or manually place them (one by one) in the project environment. You now have a “bunch” of “lines” that represent beams as shown in the image below.



6. To turn those ac lines into beams simply download and open Dynamo. Place the following nodes as shown in the figure below.

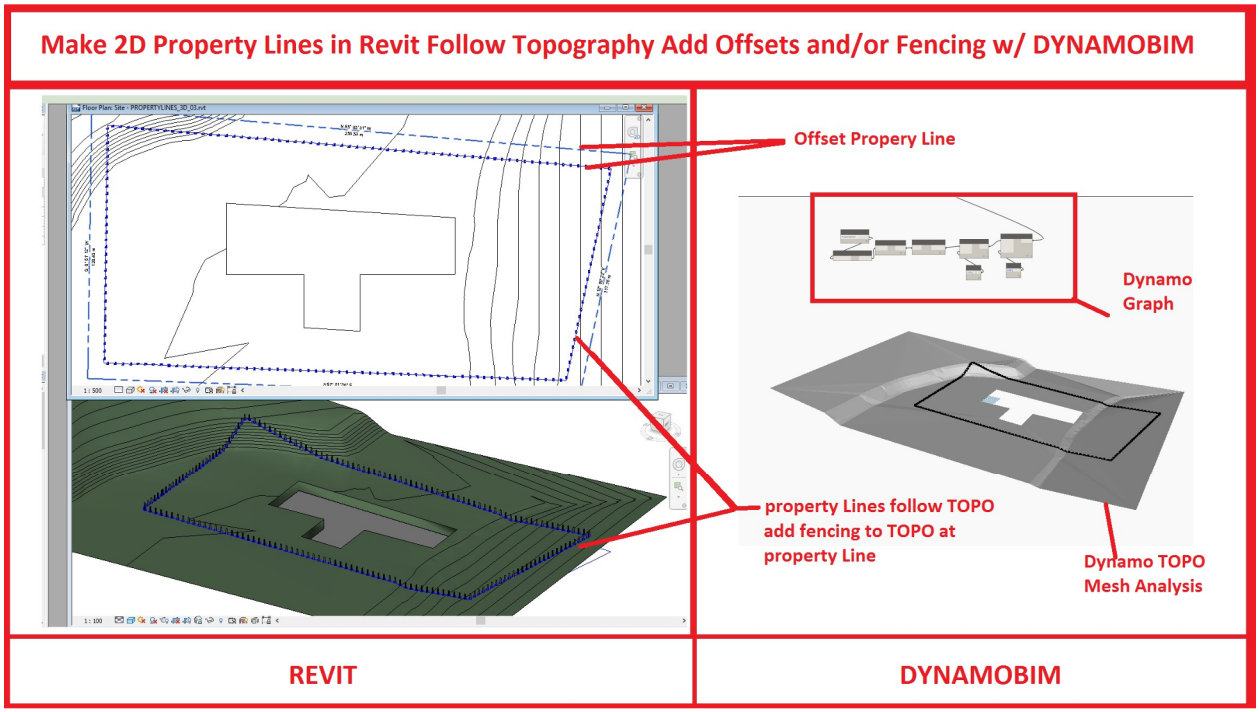


Topography Property Lines

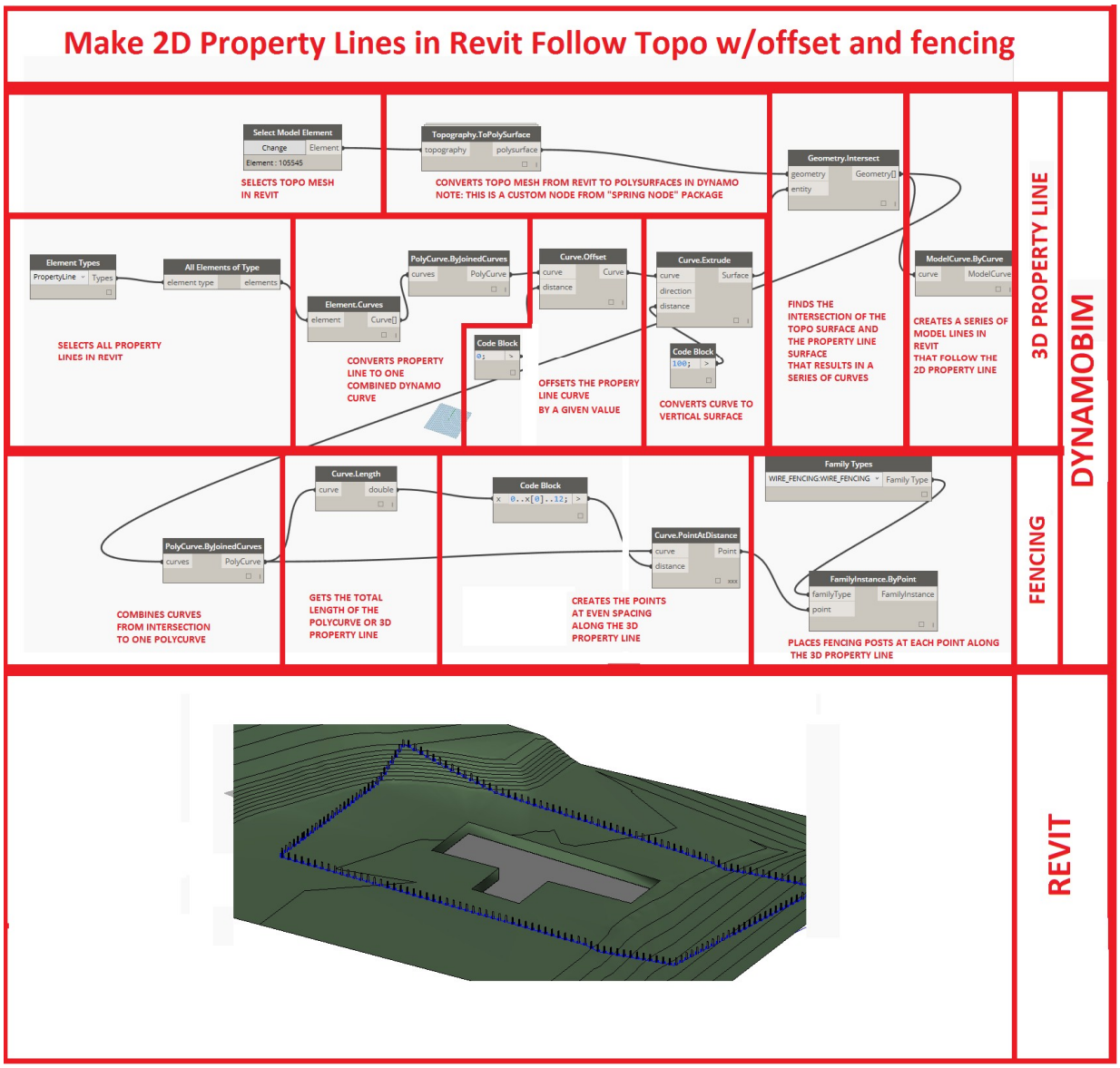
Making 2D property lines Follow Topography in Revit and adding offsets and fencing

Have you ever wanted to create a property line in Revit that follows topography? What about an offset of that property line or what about fencing around that offset property line?

It's easy if you use DynamoBIM and not that "import/export dwg" workaround. See the images below. Make sure you download the "Spring Nodes" package from the Dynamo Package manager since we will be using one of those custom nodes for this exercise. Thank you Dimitar Venkov for that!



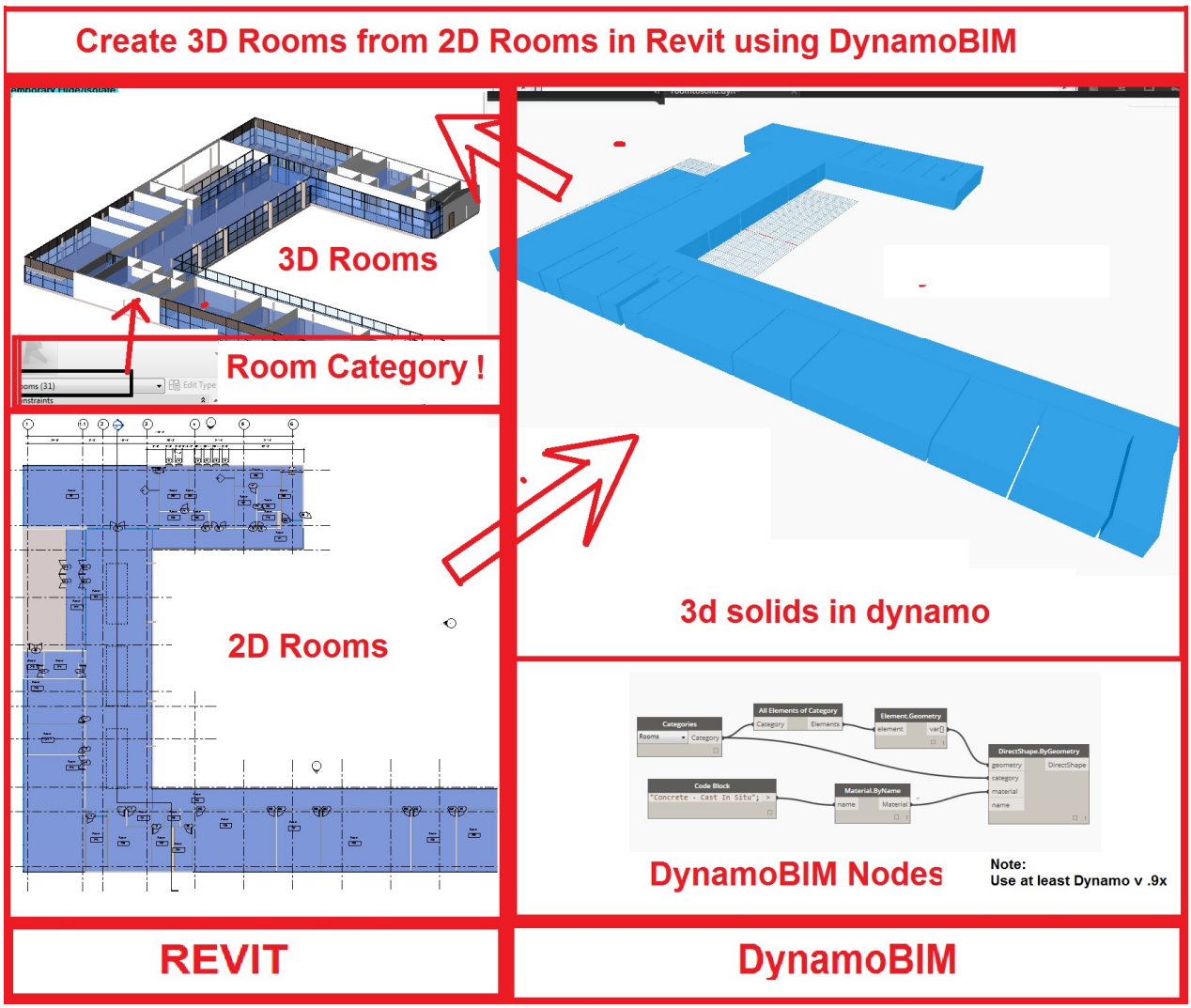
Note: If the points do not occur at the ends of the desired line vertices, then use the intersection command to place extra points at those locations. Or you could place end points at the original property line curves using D y n a m o .



Creating 3D Rooms
via Direct Shape

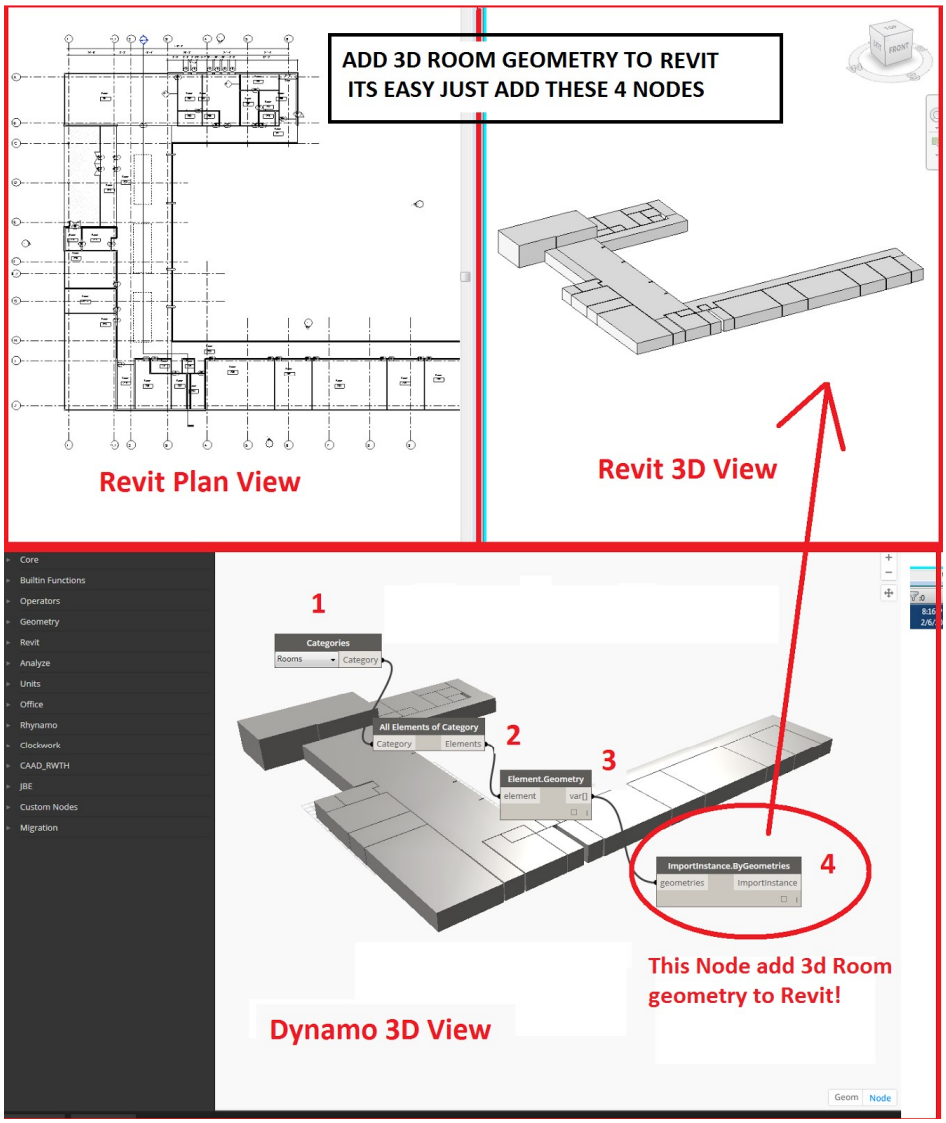
It is possible to CREATE 3D rooms in Revit based on 2D room geometry. The best method is to use Direct Shape!

Its simple. Just add the nodes as shown in the image below. And here's the best part: the 3D rooms are placed with this method in the Room Category! Just Make sure you are using at least Dynamo Version .9x



Creating 3D Rooms in Revit via SAT Import

A second method for creating 3D rooms in Revit based on 2D room geometry is to use an SAT Import. While it's simpler, it does not give you the room category. Just add the nodes as shown in the image below.



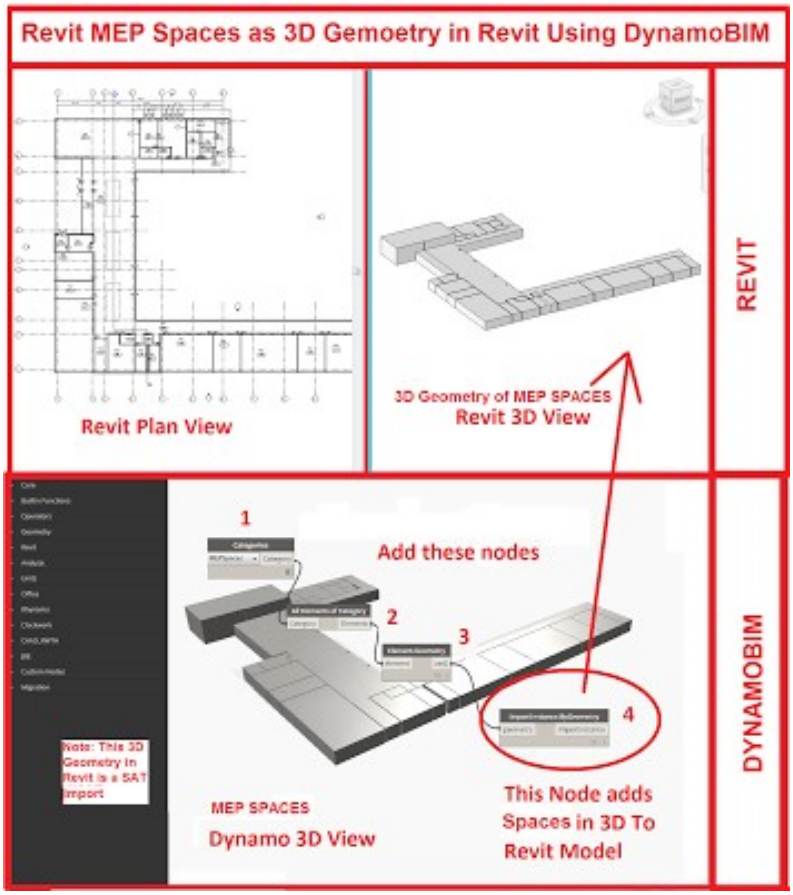
Creating 3D MEP SPACES in Revit via SAT Import

It's also possible to create 3D objects in Revit based on MEP space geometry.

Why would you do this? MEP spaces in Revit are 2D elements. Its simple. Just follow the steps outlined and summarized below.

Step 1: Place these 4 nodes as shown and wire them up (Categories, All Elements of Category, Element. Geometry, InportInstance. ByGeometries)

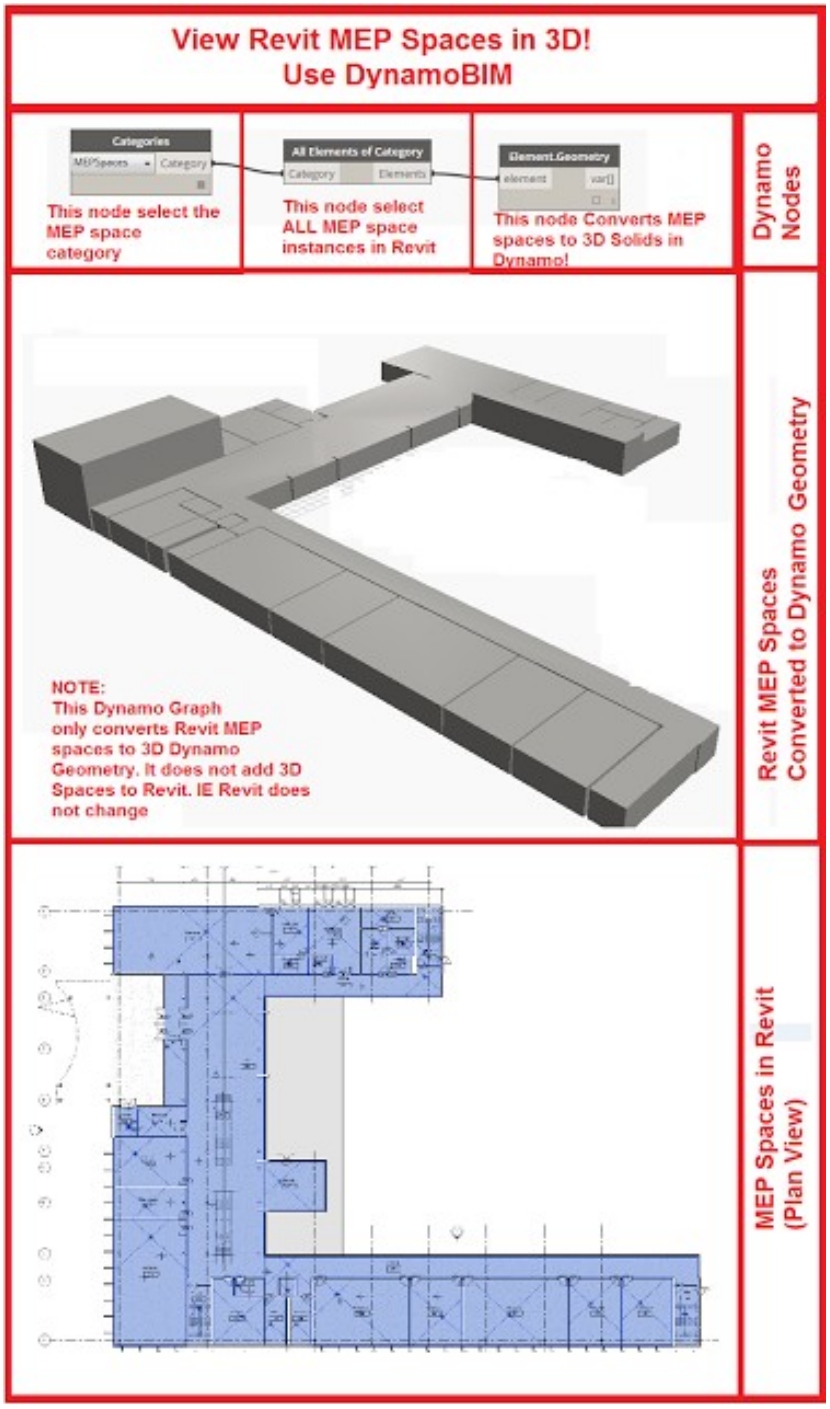
Step 2: Click Run. You will see a 3D view of your Revit MEP spaces in Dynamo and it will create 3D objects (as symbol imports) in your Revit Model.



View Revit MEP SPACES in 3D

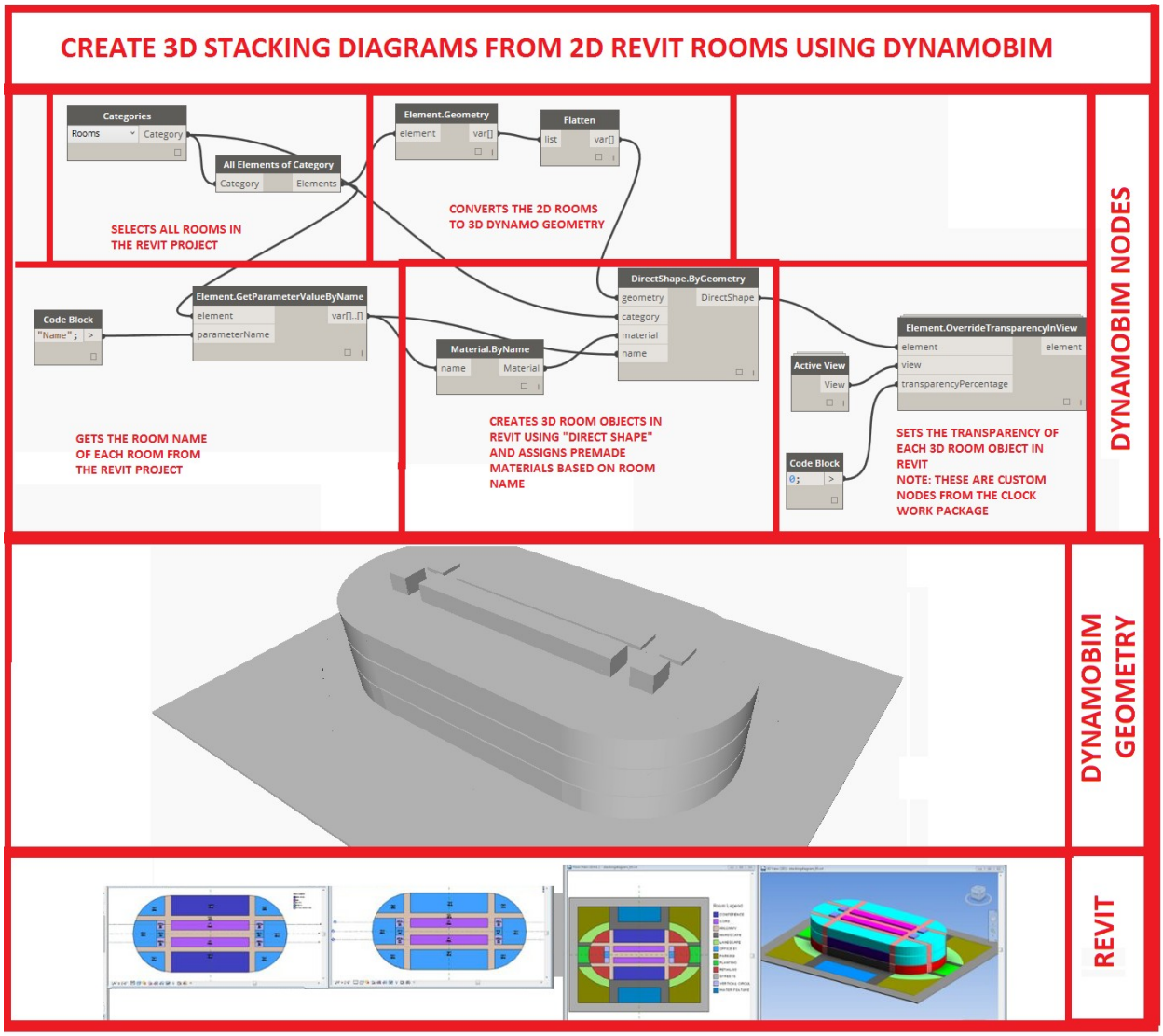
Have you ever tried to view your Revit MEP spaces in a 3D view in Revit? You cant do it using Revit.

Visualize them using DynamoBim! It only takes 3 Nodes. Simply follow the steps below.



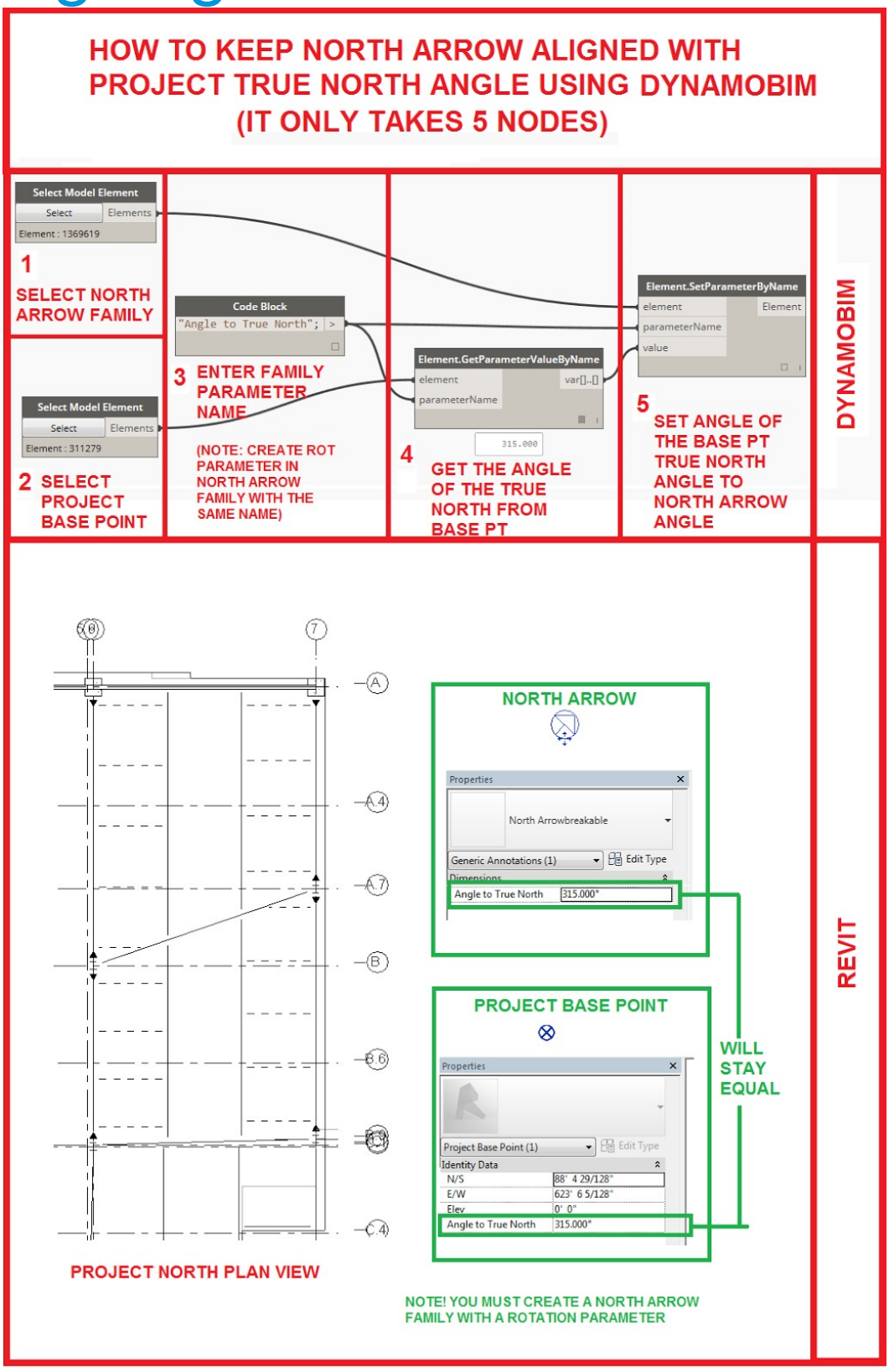
What is Direct Shape? And 3d Stacking Diagram

Direct shape is a new element that is created from Dynamo geometry that is then imported into Revit as a specific category. What category? Any category! Because of this it makes direct shape very powerful. Previous to direct shape there was only "sat import" that allowed you to take dynamo geometry into Revit. The only draw back from direct shape is that it "triangulates" or meshes out the geometry so if you have a curved surface it will turn it into triangle. That is good for rectilinear geometry such as rooms and MEP spaces and not so good for curved geometry. Below is an extreme sample of how you could use direct shape to send dynamo geometry into Revit. Lets take the example of some complicated dynamo geometry . Every wanted to create a 3d stacking diagram from rooms? See the following example below and it will show you how! Simply add the nodes that you see and you are all done!



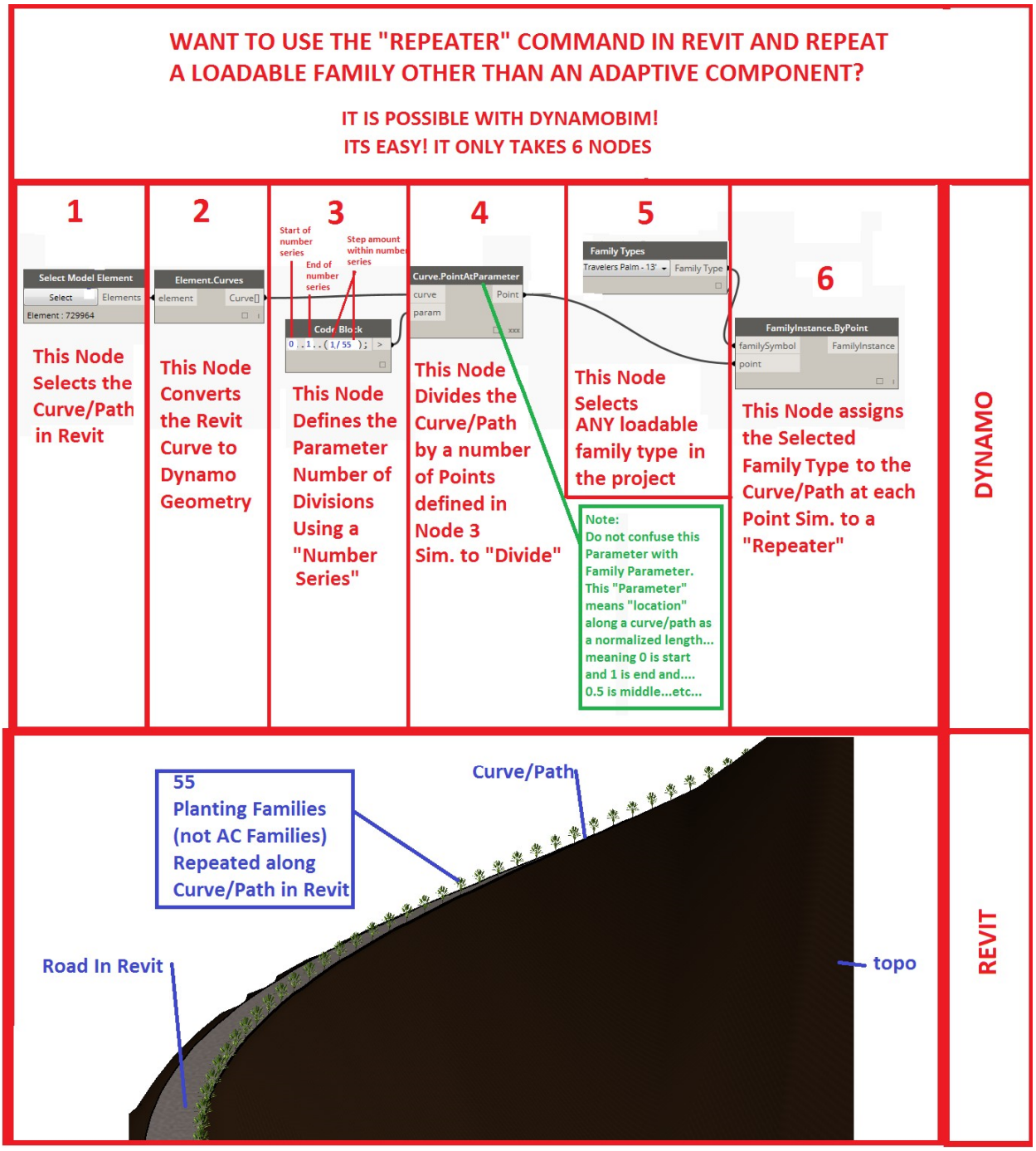
APPENDIX

Aligning True North with Revit



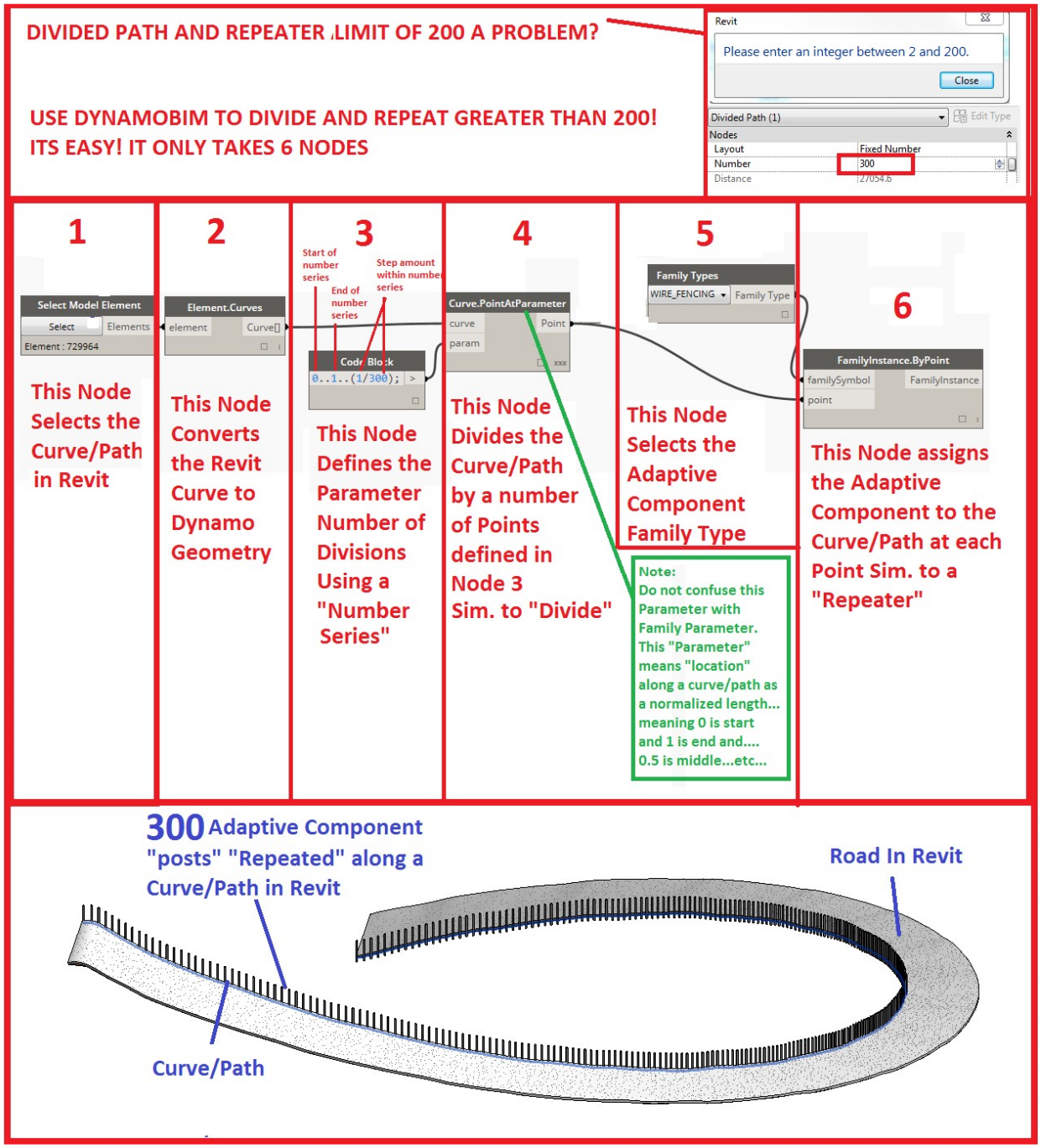
Using the Revit "Repeater" Command

It's possible with DynamoBIM! Its easy and it only takes 6 nodes. Follow the steps below.

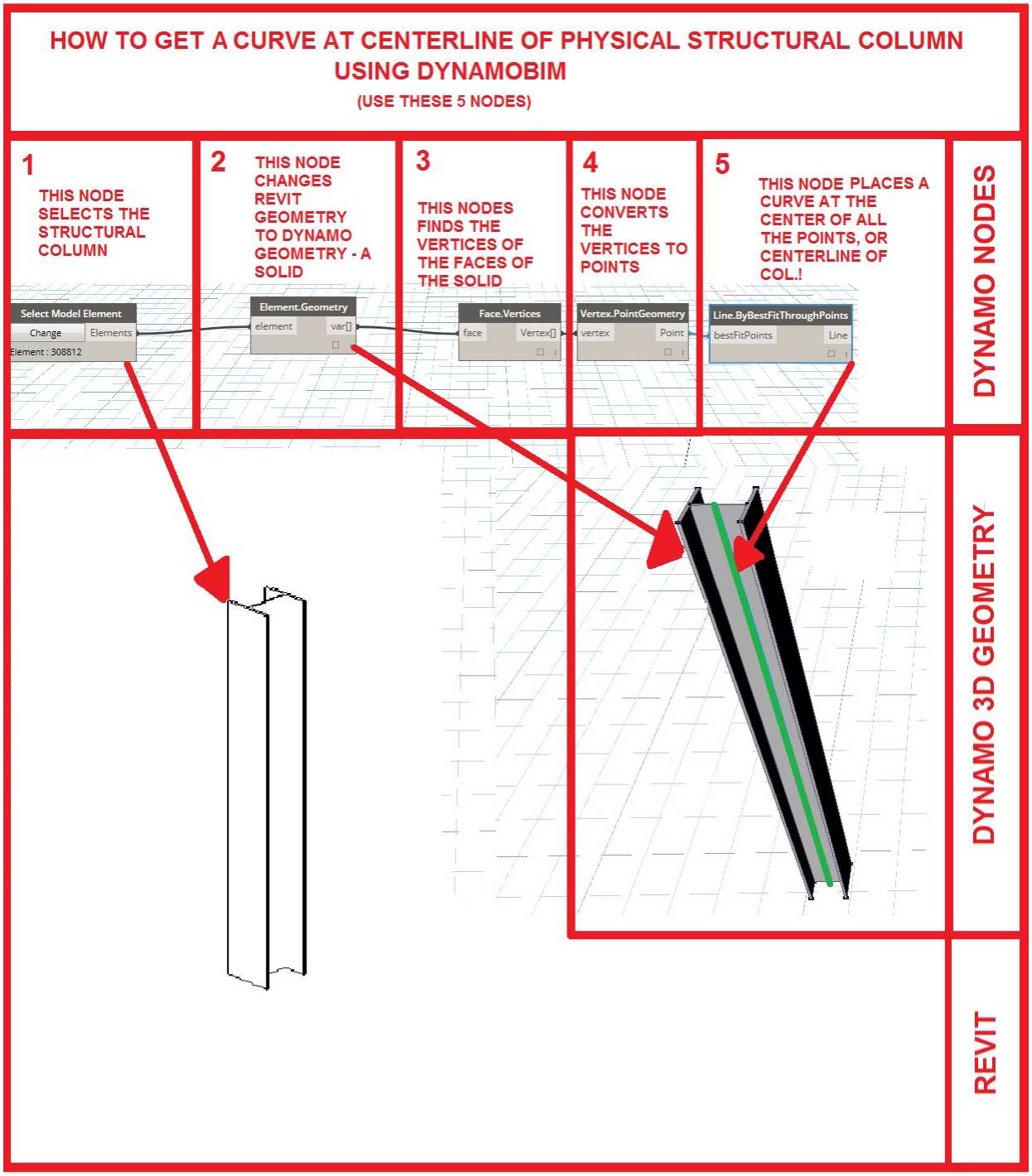


Increasing the Repeater Limit with DynamoBIM

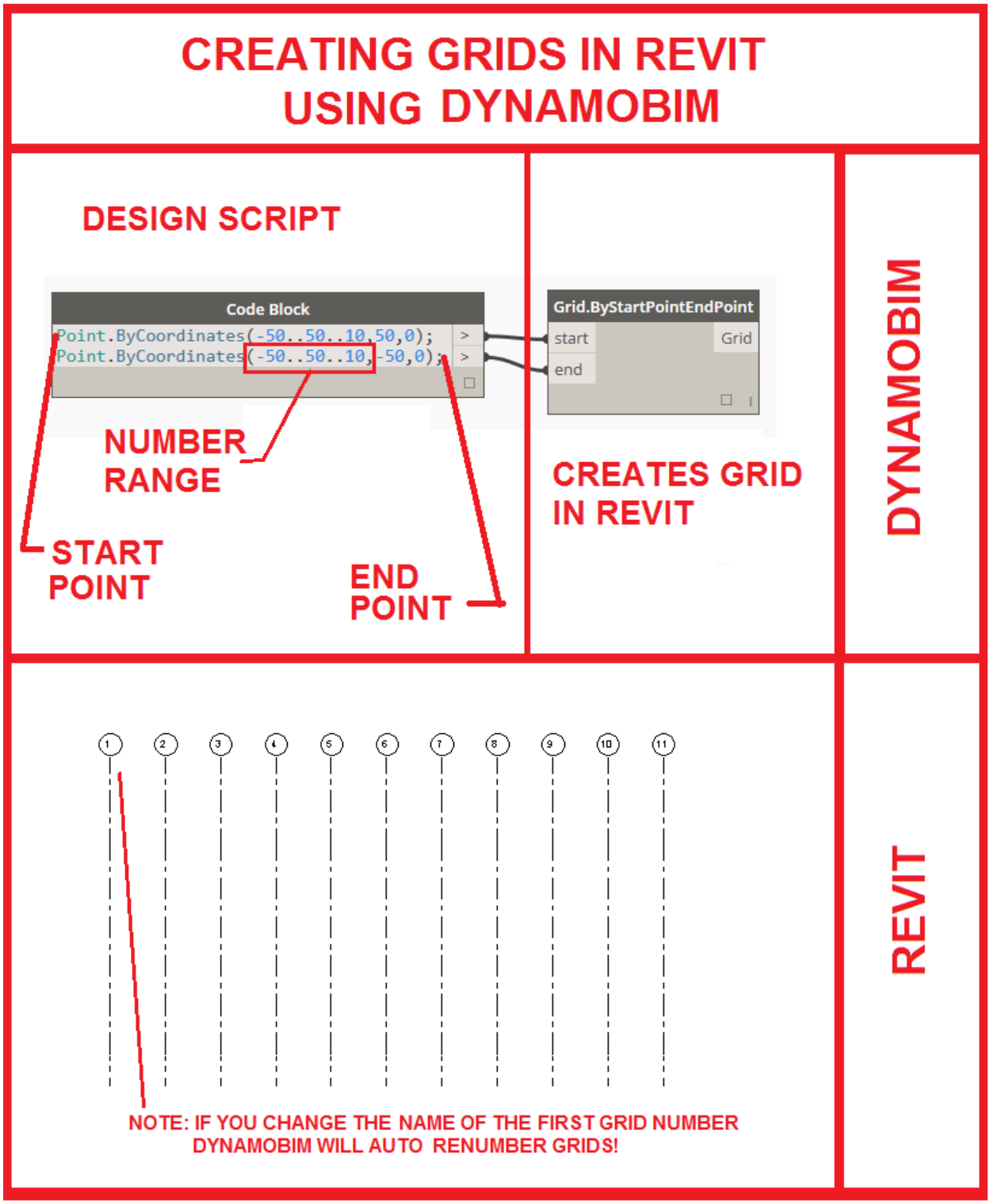
Its easy and it only takes 6 nodes. Follow the steps b e l o w .



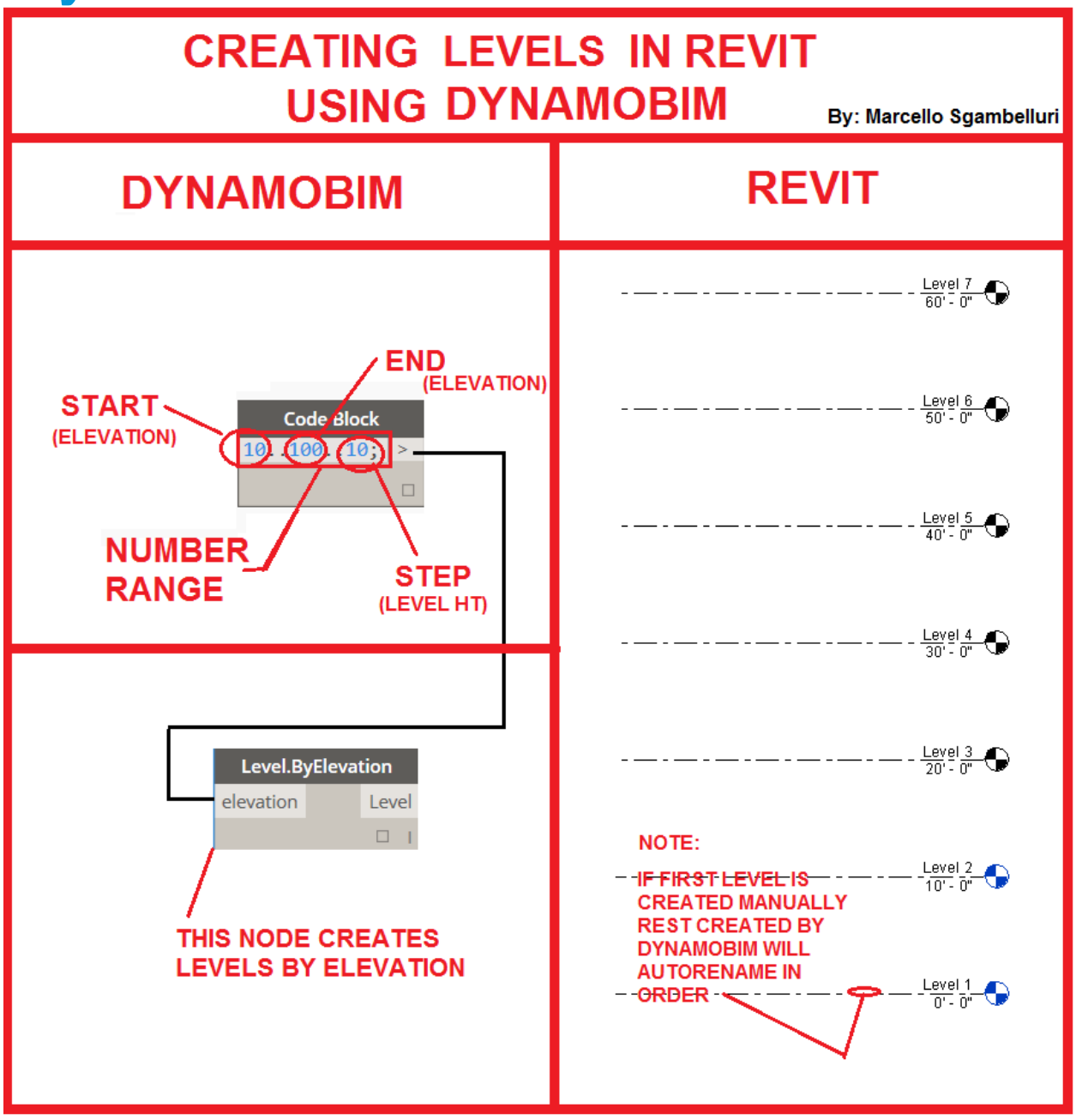
Get a Center-line of a Structural Column



Create grids in Revit using DynamoBIM

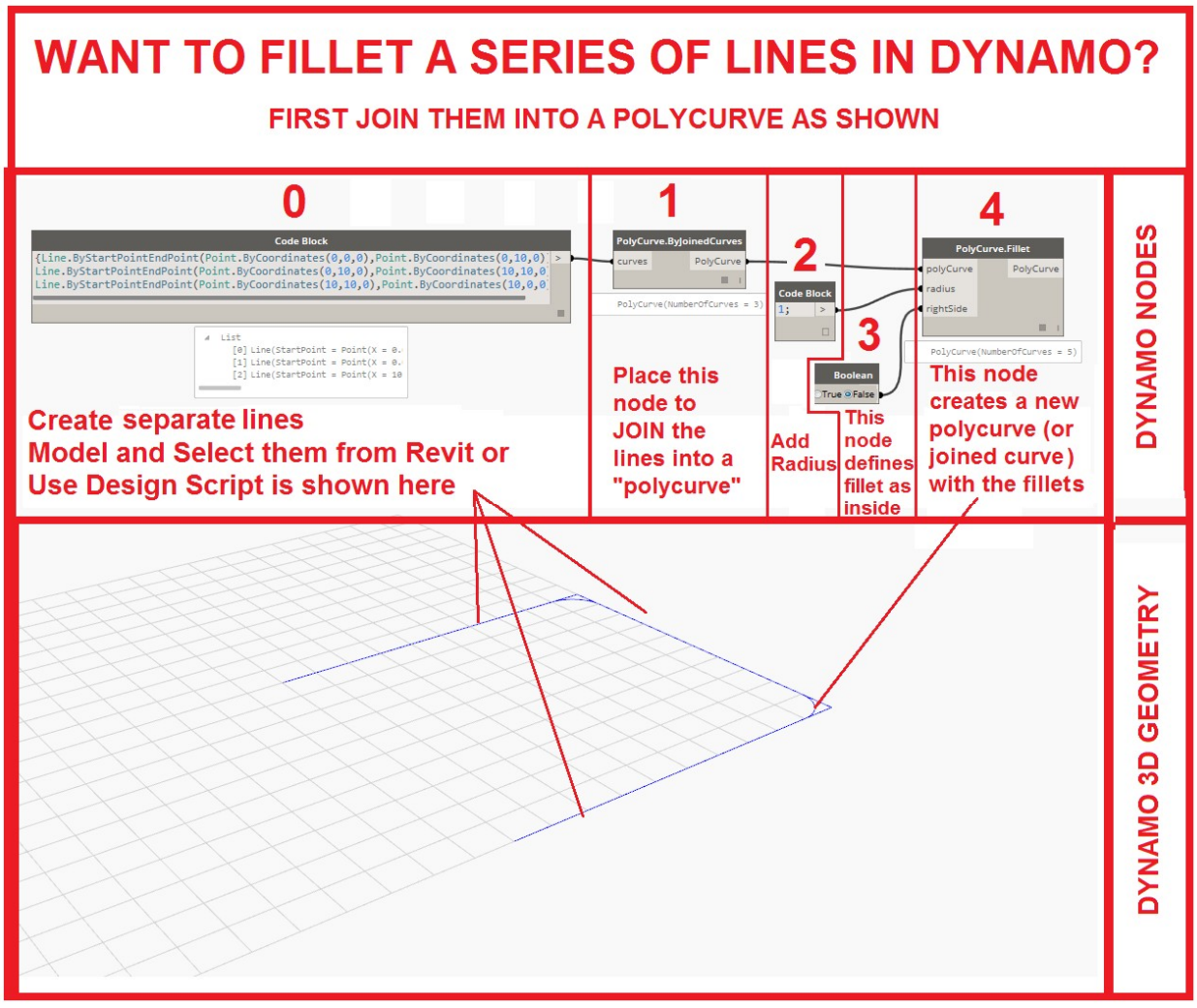


Create levels in Revit using DynamoBIM

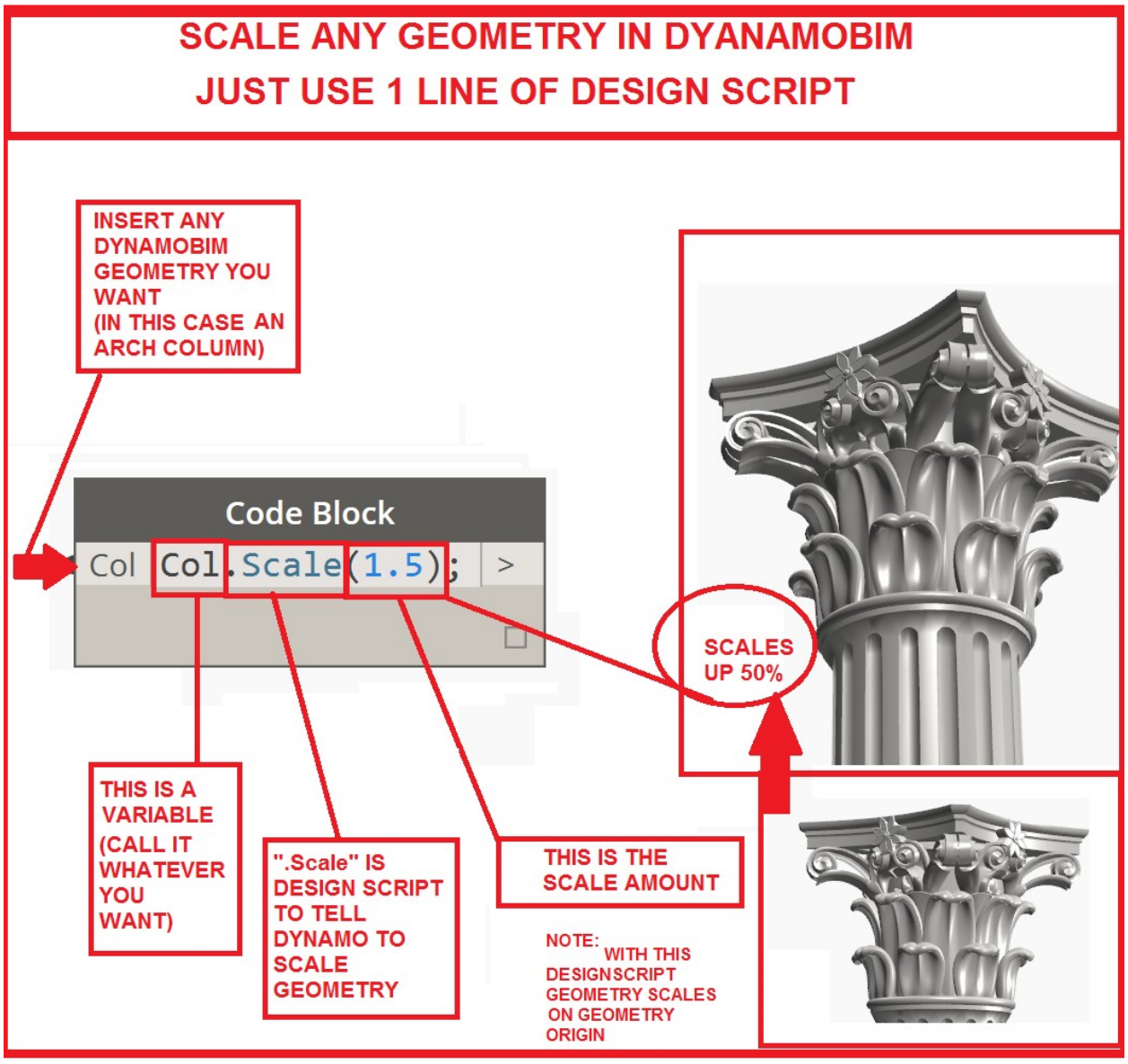


Add fillets to a series of separate lines in DynamoBIM

The easiest way to add fillets is to select the lines that form the corners and JOIN them into one polycurve then use the**PolyCurve.Fillet Node** and its a snap. The image below will summarize the process.

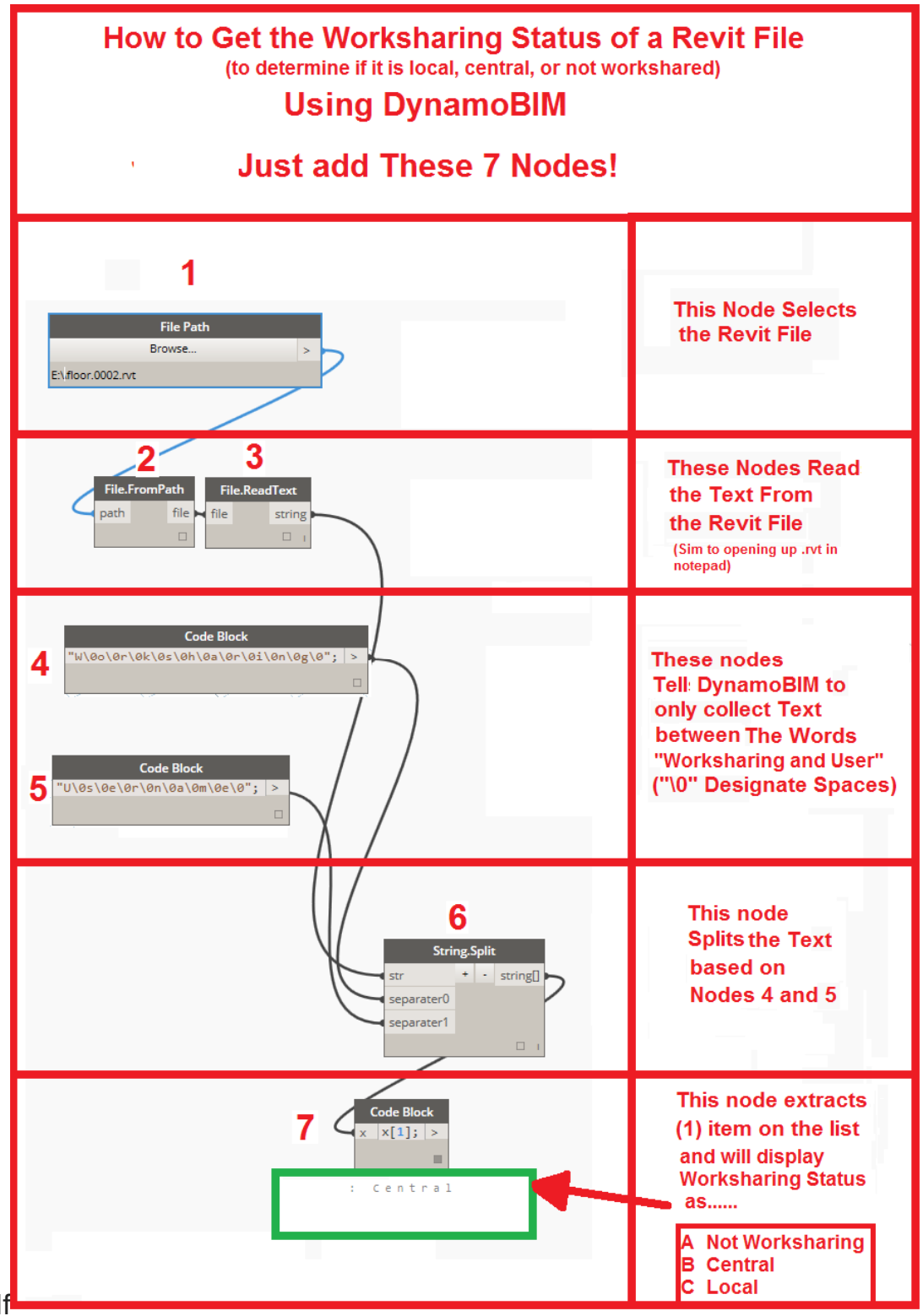


Scale Any DynamoBIM Geometry



Note that the Dynamobim geometry is scaled based on the geometry origin. If you want to scale about a different origin point then you have to use a different design script. Also note that this process only scales DynamoBIM geometry.

Get the Worksharing Status of a Revit File



Create a list or nested list in DynamoBIM Using Design Script

MAKE A LIST AND NESTED LIST(S) IN DYNAMOBIM

USE DESIGN SCRIPT

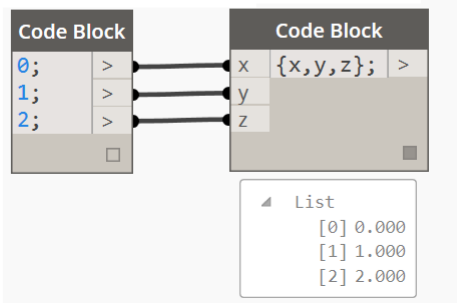
SINGLE LIST

FORMAT

{item1,item2,item3,etc...}

items separated by commas (,)
and closed with curly braces ({...}) as shown

SAMPLE



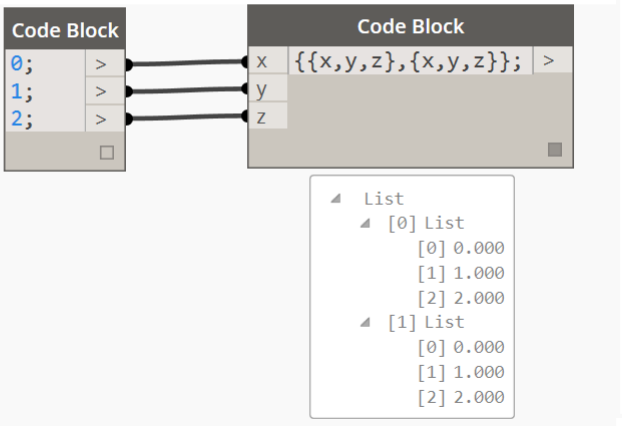
NESTED LIST

FORMAT

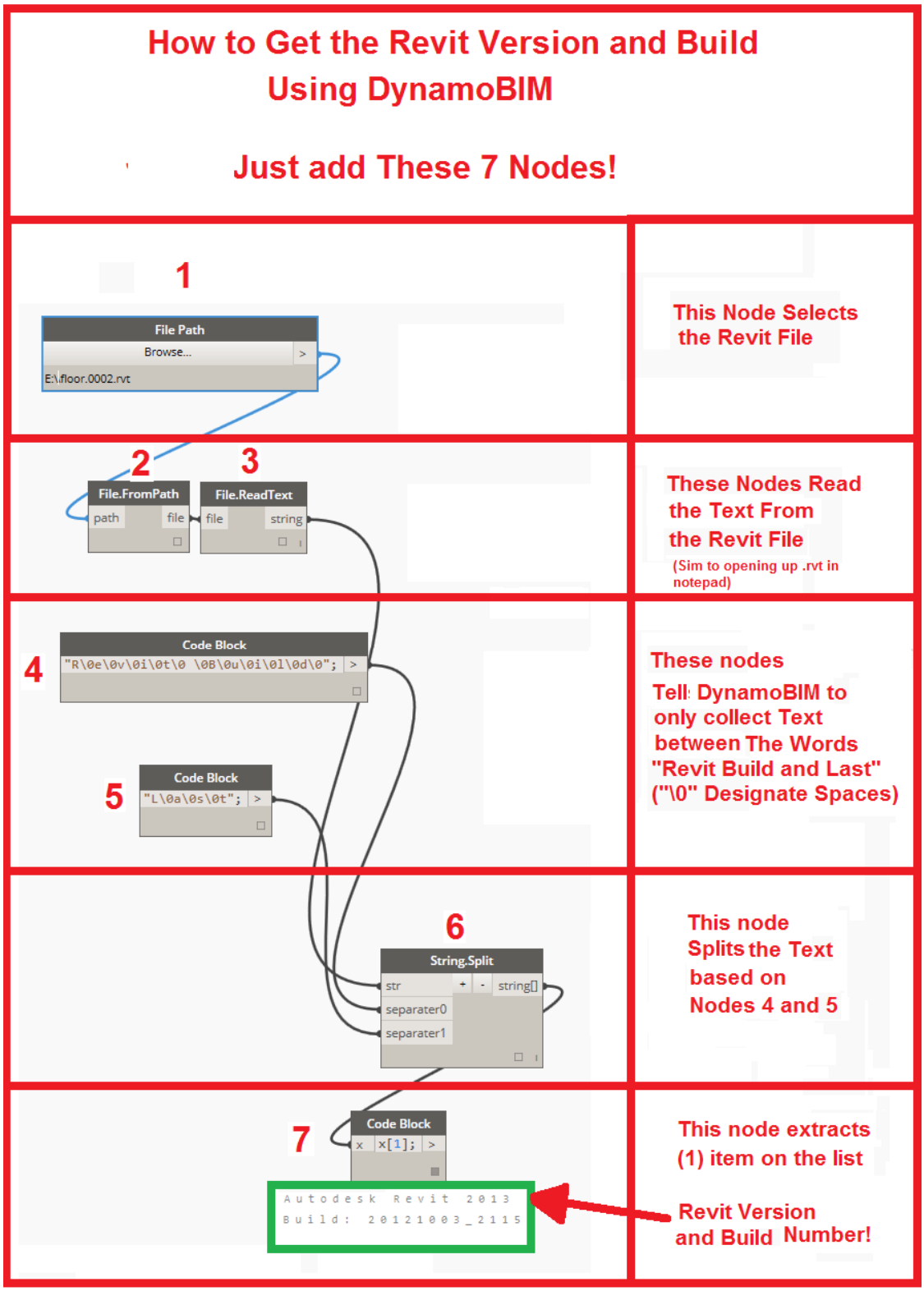
{List 1, List 2}

Nested List? Simply add more Curly Braces

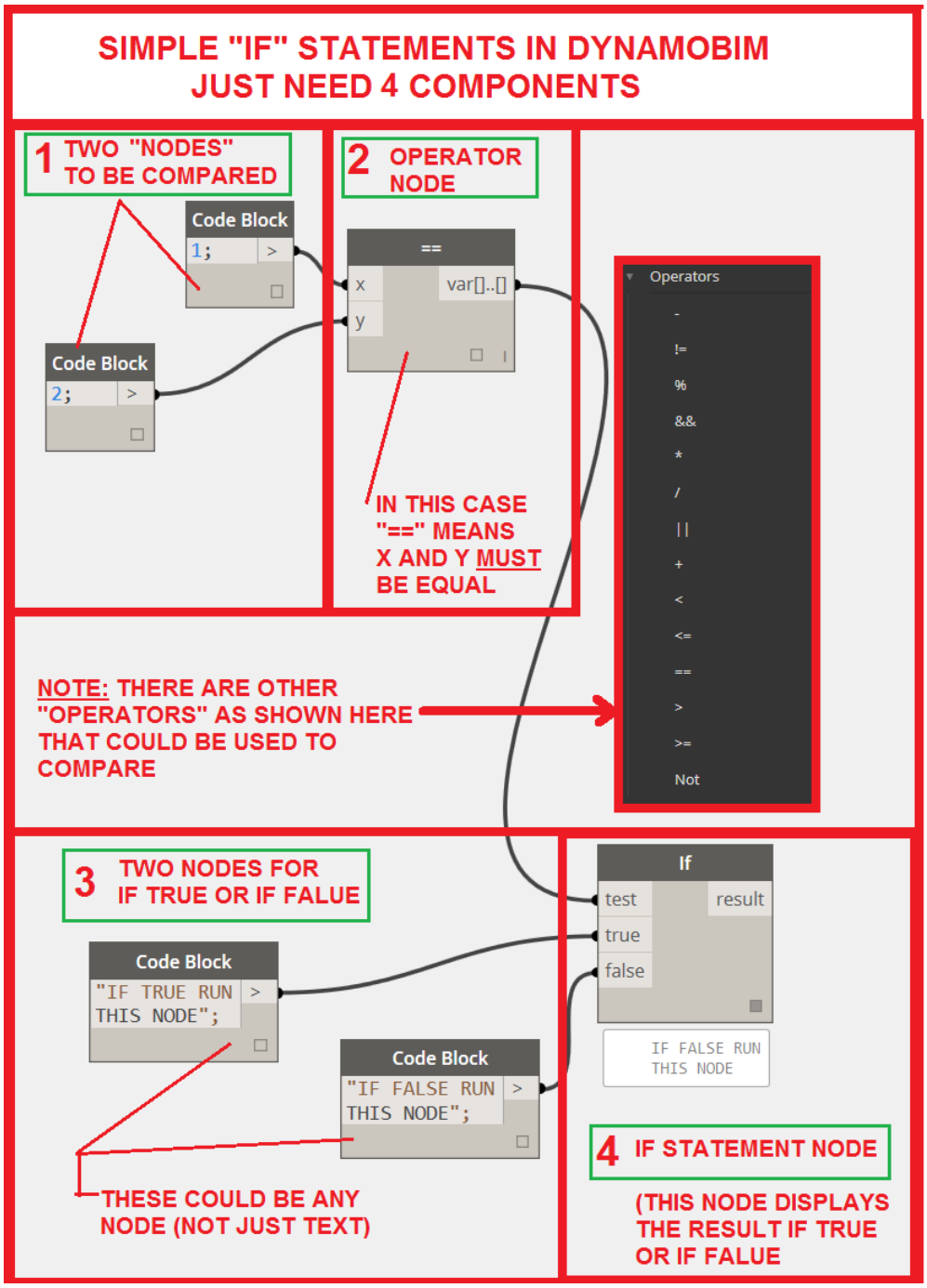
SAMPLE



Get the Revit Version and Build Number



How to Use IF Statements in DynamoBIM



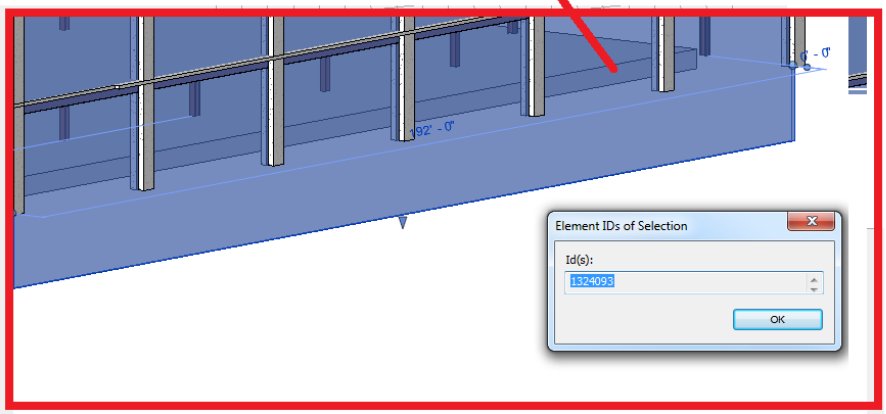
What a Selected Element looks like in Dynamo

HOW DO YOU KNOW DYNAMOBIM HAS SELECTED A REVIT ELEMENT?

IT DISPLAYS THE ELEMENT ID NUMBER

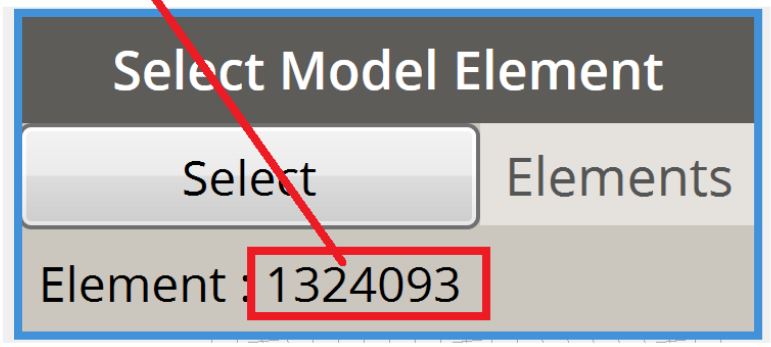
REVIT

When you select a Revit Element using Revit it turns it BLUE

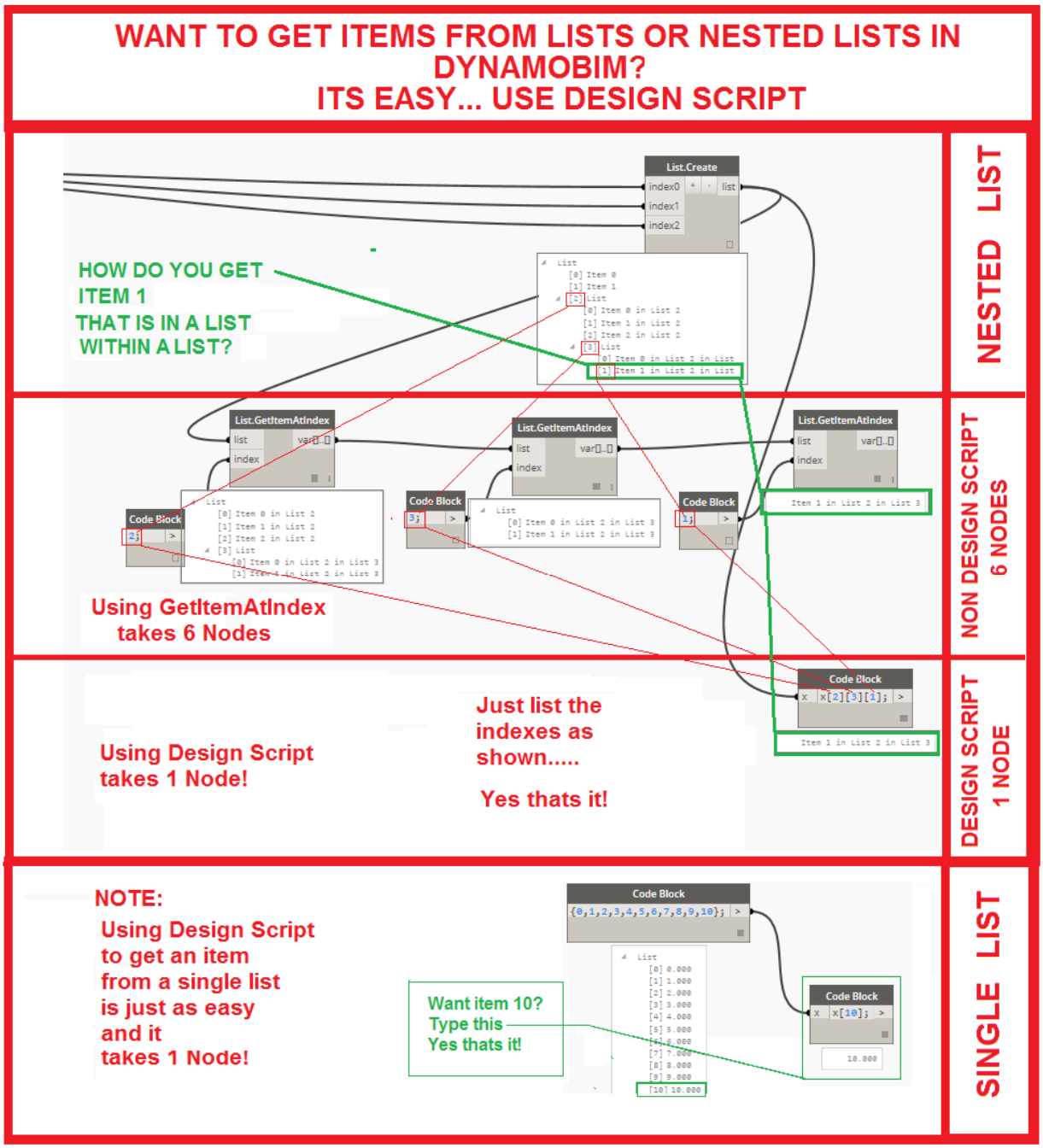


DYNAMOBIM

When you select a Revit Element using DynamoBIM it displays the Element ID



Extract an item from a list in DynamoBIM



Ranged Expressions using Design Script in DynamoBIM

A Range Expression

Creates a
List of Numbers in a Sequence

FORMAT

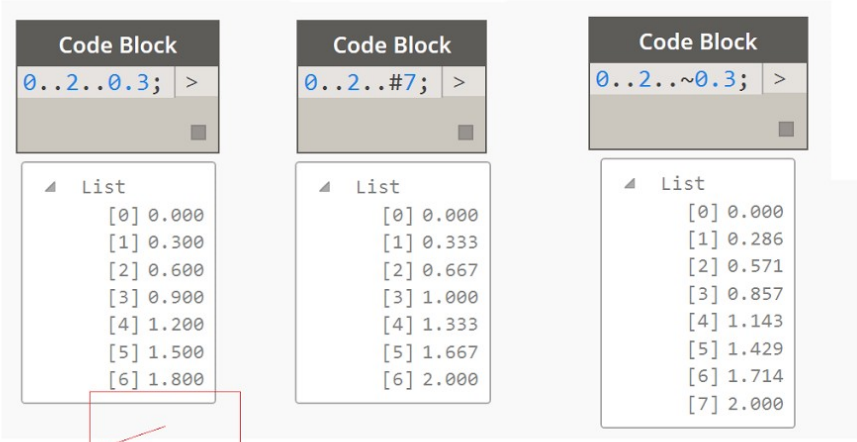
A..B..αC

(3 entries separated by two periods "..")

- **A** START of the Number RANGE
- **B** END of the Number RANGE
- **C** Step or Amount depending on α

α
- Blank = Step (Not to exceed end range value)
- # = Amount (equal steps from start to end result)
- ~ = Step (Estimate such that end range value results)

EXAMPLES

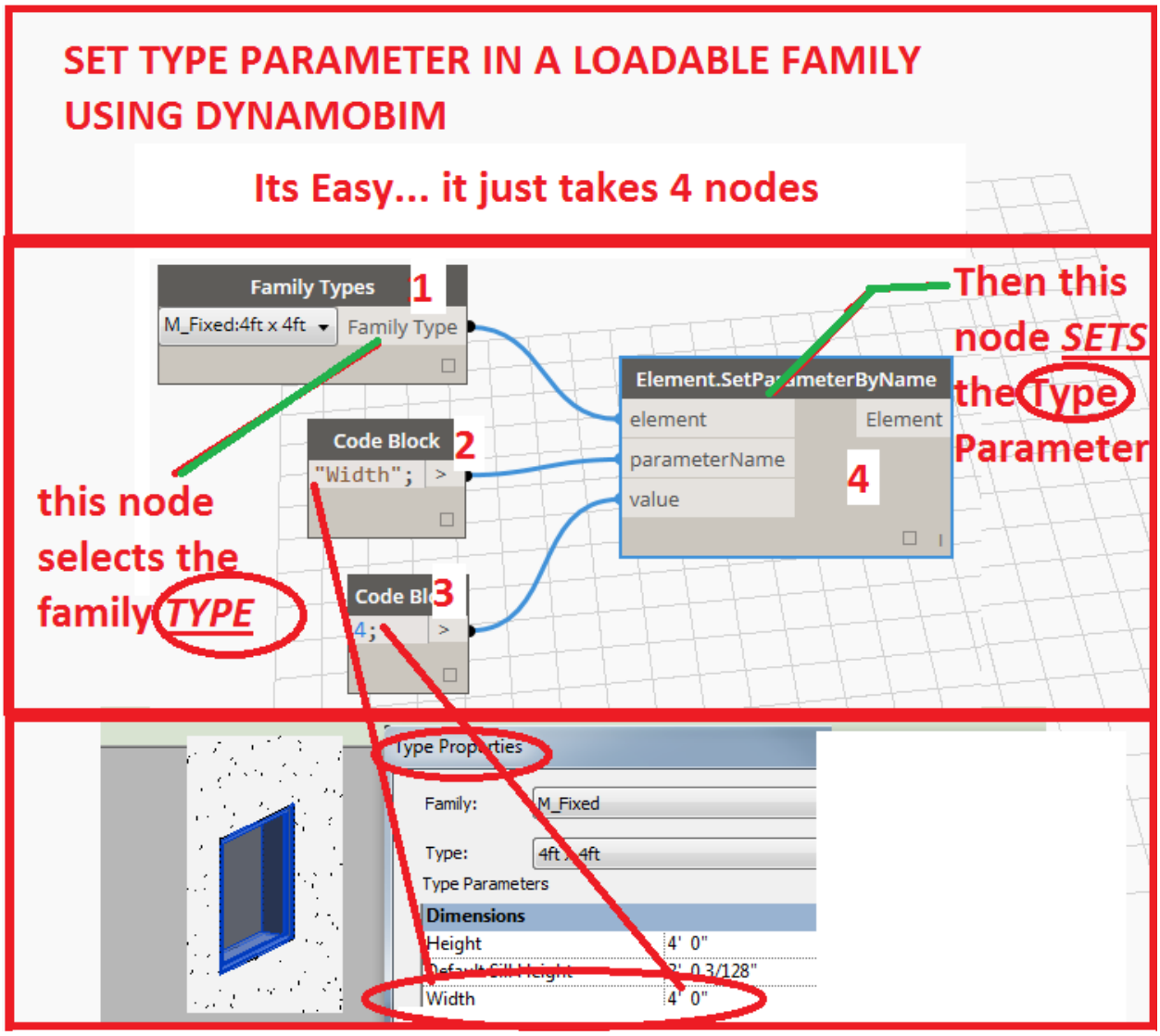


NOTES

Note:
[7] 2.100
was not generated
because it exceeds B
which is the
maximum range

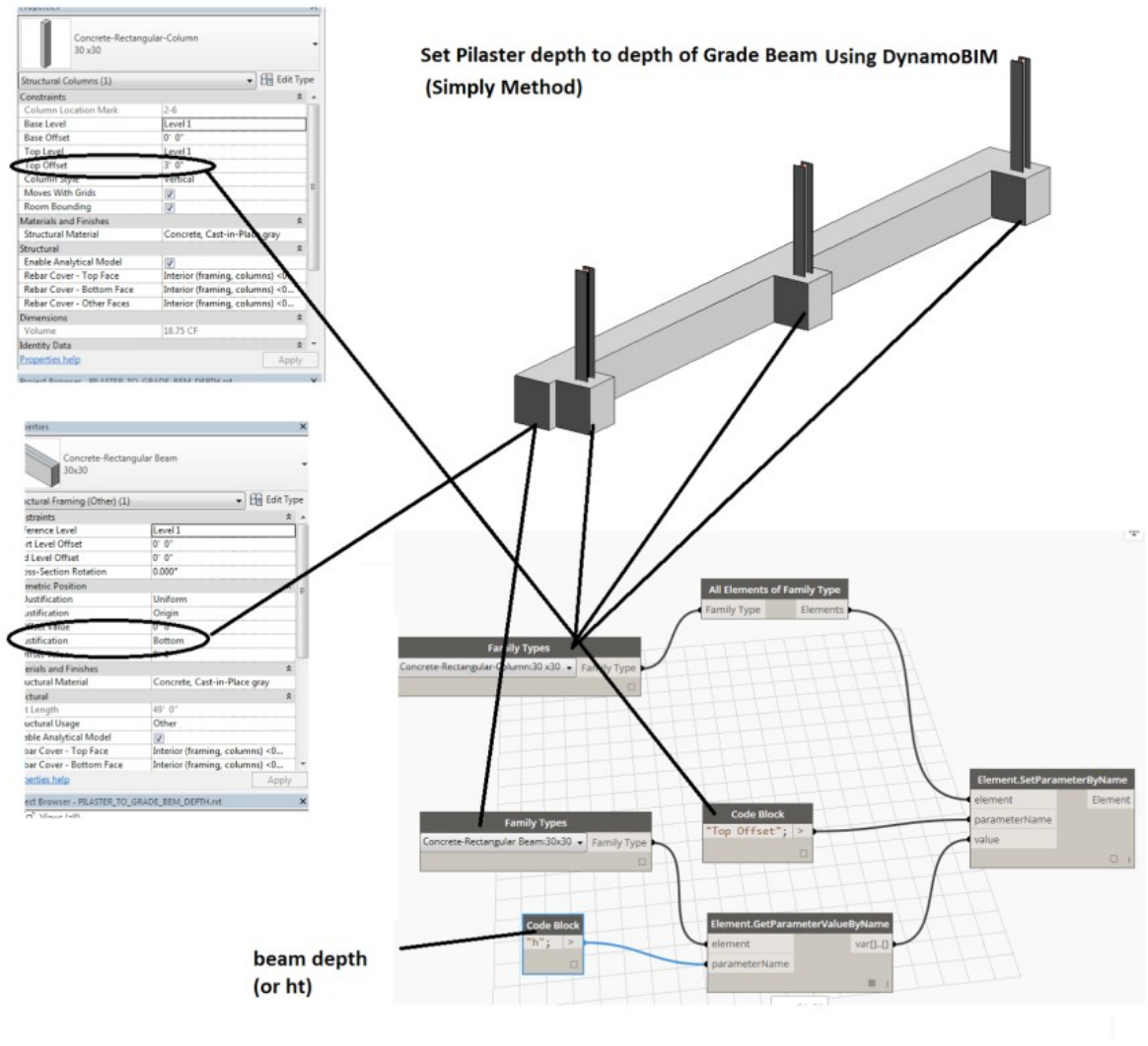
Note:
Sometimes you will see
A..B (no C)
which means if C is blank then
it defaults to 1
ex: A..B..1

Set a Type parameter in a loadable family

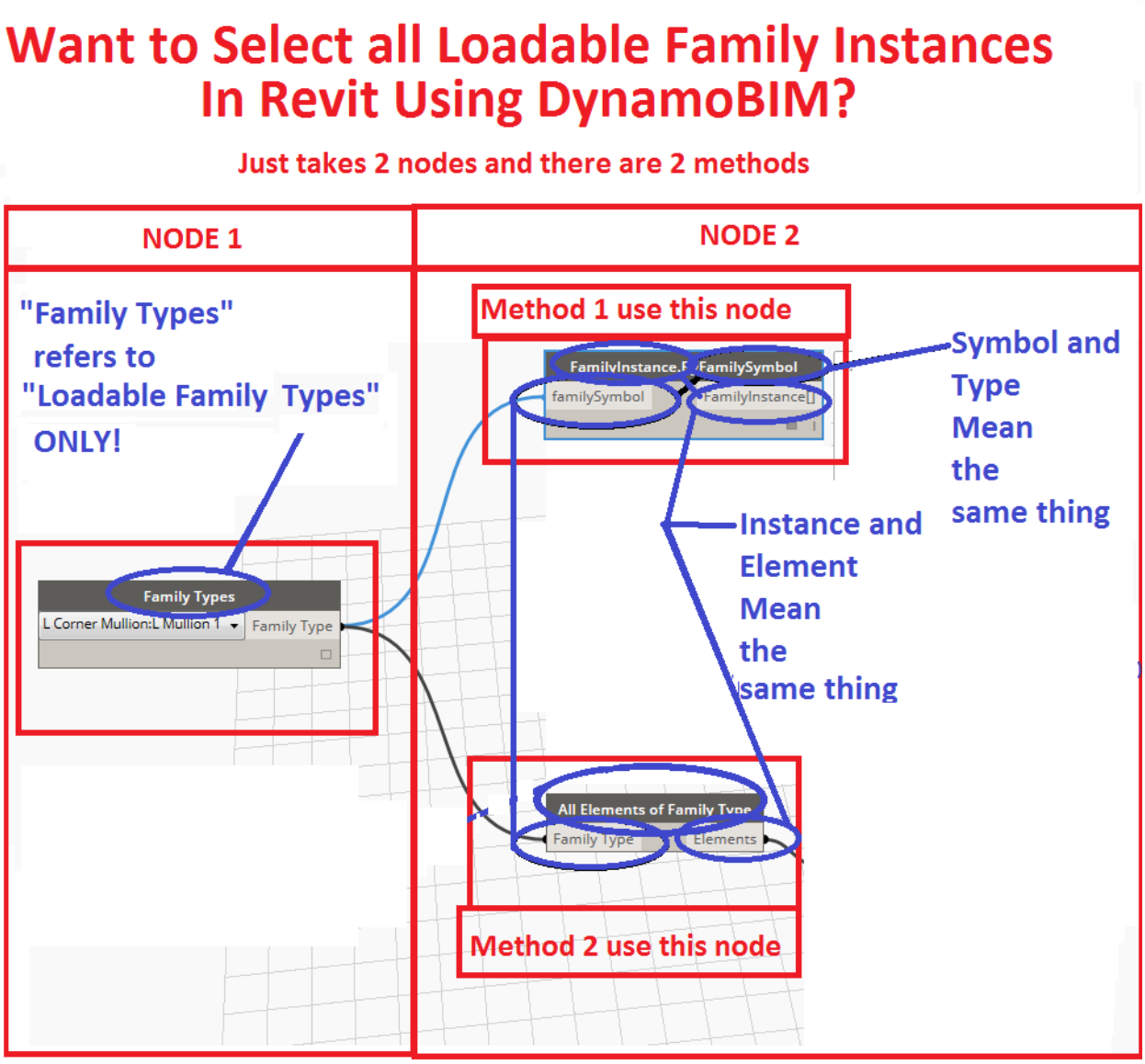


Setting Pilaster Height Equal to Grade Beam Depth

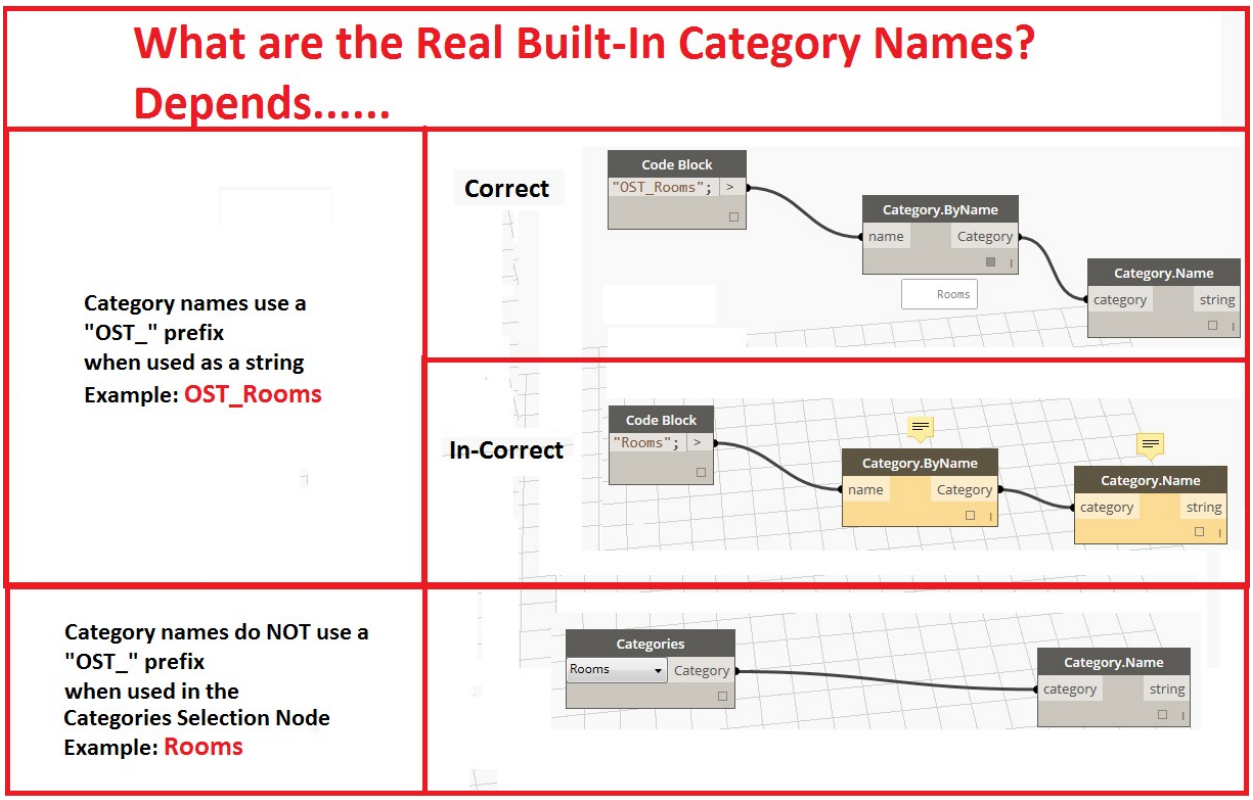
See the image and good luck getting and setting type and instance parameters to each other!



Select all Loadable Revit Family Instances Using DynamoBIM?



The real Category Names in DynamoBIM? ... It Depends....



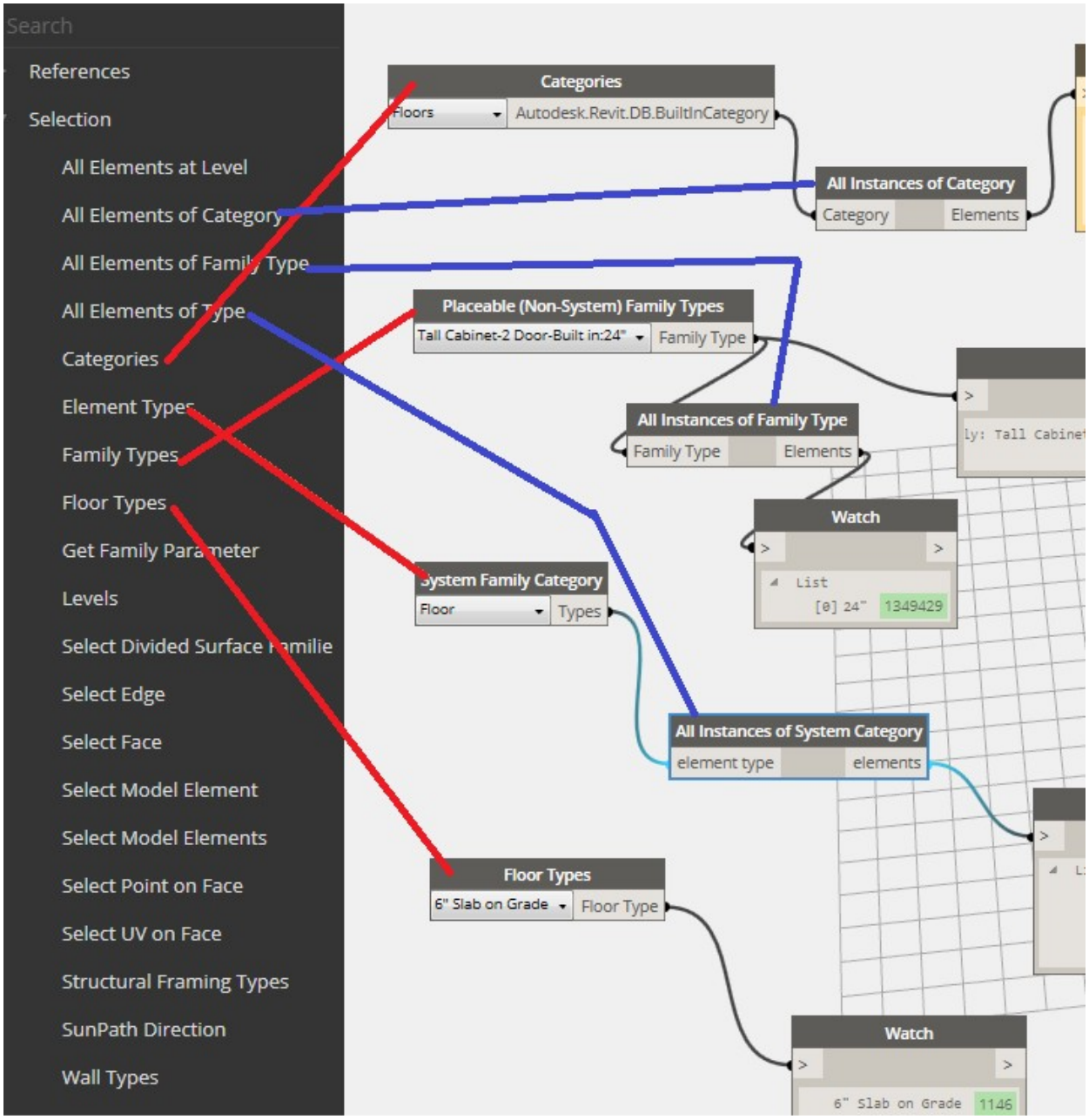
Confused by Revit Family Selection Node Names in Dynamo?

REVIT FAMILY SELECTION NODE NAMES IN DYNAMO ARE A LITTLE CONFUSING. THIS IS WHAT THEY REALLY R E P R E S E N T ...

Selecting family types and family instances in Revit using Dynamo could be a little confusing because the naming of nodes in Dynamo does not always make sense to the Revit UI user.

I have created a table and image of what the Dynamo family selection nodes and what they really mean and hopefully this will help you understand what they represent.

Current Node Name	What they Represent
Family Types	Placeable Family Types
Element Types	System Family Categories
All Elements of Family Type	All Instances of Family Type
All Elements of Type	All Instances of System Family Category
All Elements of Category	All Instances of Category


Search
References
Selection
All Elements at Level
All Elements of Category
All Elements of Family Type
All Elements of Type
Categories
Element Types
Family Types
Floor Types
Get Family Parameter
Levels
Select Divided Surface Familie
Select Edge
Select Face
Select Model Element
Select Model Elements
Select Point on Face
Select UV on Face
Structural Framing Types
SunPath Direction
Wall Types
Categories
Floors
Autodesk.Revit.DB.BuiltInCategory
All Instances of Category
Category
Elements
Placeable (Non-System) Family Types
Tall Cabinet-2 Door-Built in:24"
Family Type
All Instances of Family Type
Family Type
Elements
Watch
List
[0] 24"
1349429
System Family Category
Floor
Types
All Instances of System Category
element type
elements
Floor Types
6" Slab on Grade
Floor Type
Watch
6" Slab on Grade
1146