

AS125241-L

Dynamo for Structure

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John A. Martin Structural Engineers

Learning Objectives

- Learn how to build structural beams, including roof framing, using Dynamo in Revit
- Learn how to get and set structural parameters in Revit using Dynamo
- Learn how to speed up the structural modeling process in Revit by using Dynamo
- Learn how to create complex structural shapes in Revit using Dynamo

Description

Very few classes focus on how Dynamo software could be used in the structural design office from a practical level—until now. This class will teach attendees how to use Dynamo to help model structural elements in Revit software, how to quality-control Revit model and analytical models, and even show how Dynamo could be used to help annotate structural drawings. If you model any type of Revit structural elements, then this class is for you. We will make modeling structure in Revit fun again!



Speaker

Marcello Sgambelluri currently serves as the BIM Director at John A. Martin & Associates Structural Engineers in Los Angeles. Marcello has worked on many BIM projects over the last 18 years as a project manager, design engineer, and BIM Director. Some of the BIM projects Marcello has worked on includes the Walt Disney Concert Hall in Los Angeles - CA, the Ray and Maria Stata Technology Center at MIT, Tom Bradley International Terminal Expansion at LAX. Marcello is internationally recognized as one of the top BIM leaders and contributors to the education and implementation of BIM technology in the building industry. Marcello continually speaks at Autodesk University and the Revit Technology Conference (BILT) where he has received the 1st place speaker award for a record 12 times between 2012 thru 2016 between both conferences. Marcello received his Bachelors and Master's degrees in Civil Engineering and he is also a licensed Civil and Structural Engineer.

Introduction

What is 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 (or boxes and wires). Dynamo primarily does two tasks:

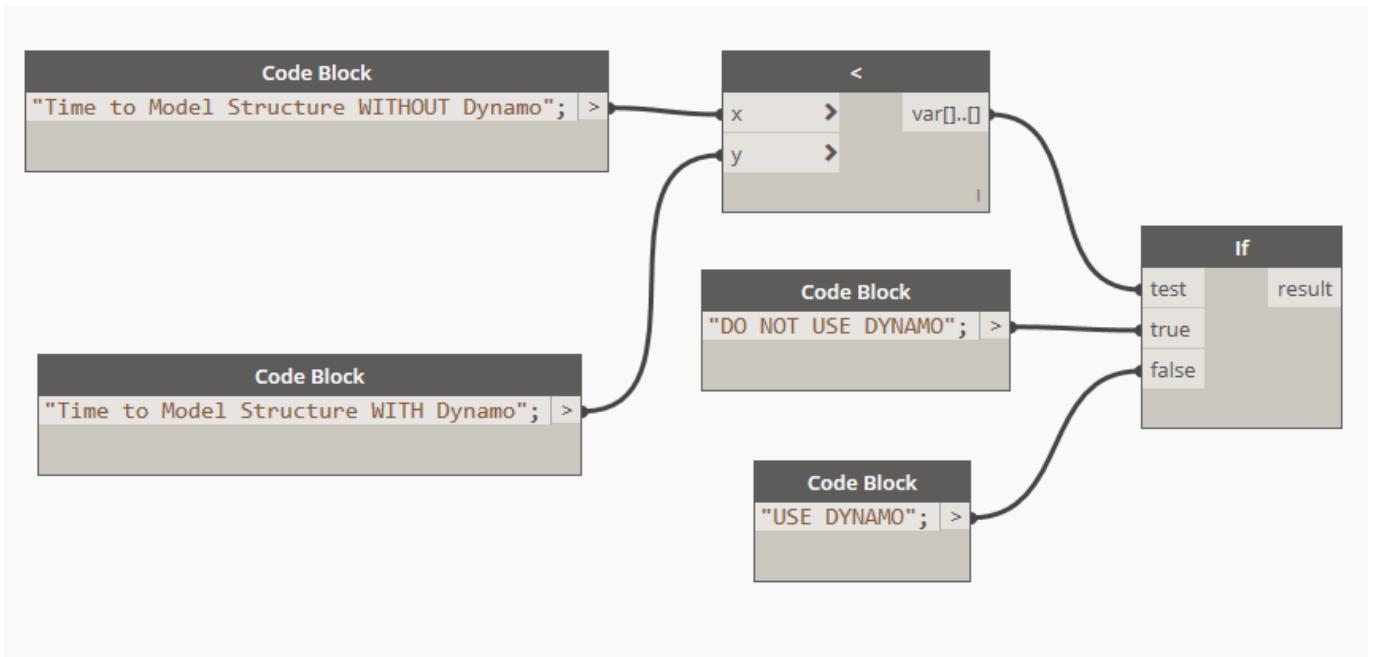
- 1. Creates its own geometry with parametric relationships .**
- 2. Reads and writes to and from external databases .**

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 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.

Why Dynamo?

Why not use Dynamo? You don't need to use Dynamo all the time but consider the following image and let that guide your decision on when to use dynamo and when not to.



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.



How this Handout is organized

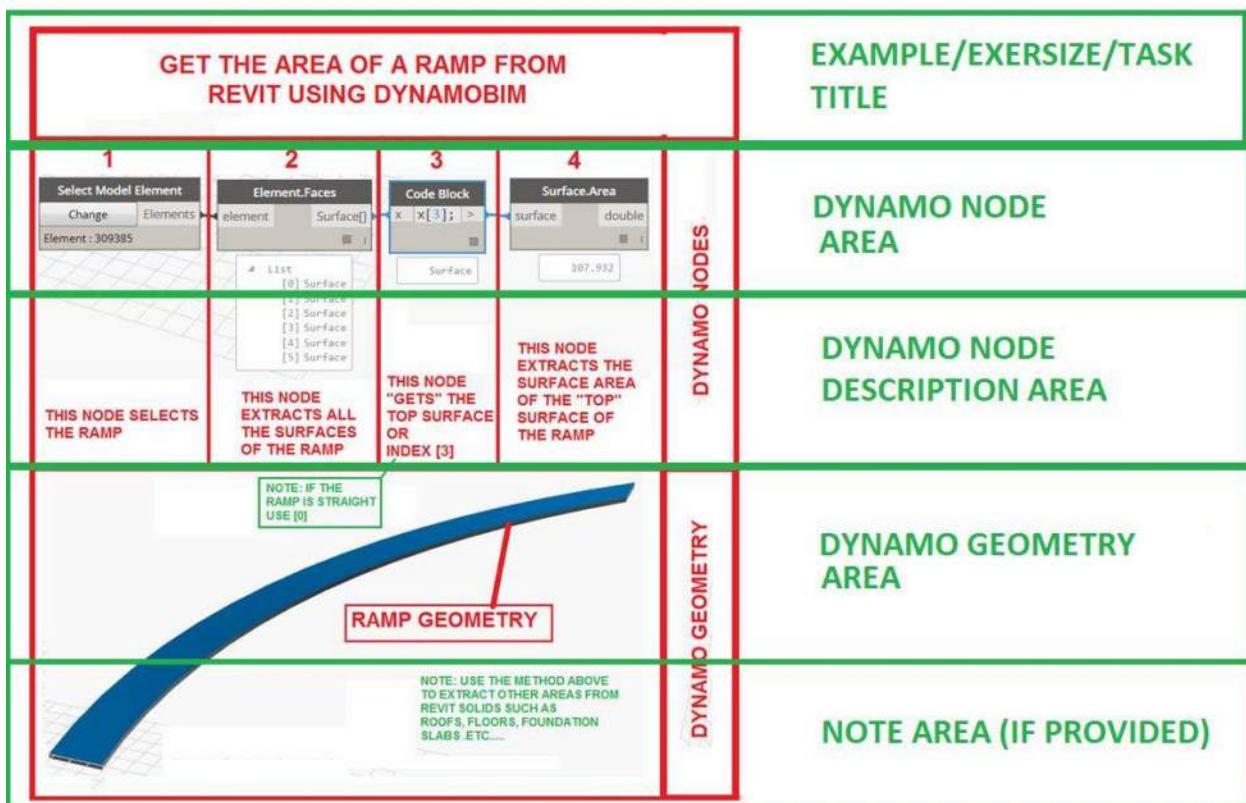
Each example is set up in a “picture” format meaning all you need to know on how to perform an example is completely contained within the image and not in the supporting text.

I felt that making this handout in the “picture book” format you could easily understand what to do and not have to read many lines of text to get the “step by step” method on how to perform the examples. I call this the “DynamoCheatSheet”

See the image below to understand how the DynamoCheatSheet is structured. I hope you like this new picture method format!

ANATOMY OF THE DYNAMO CHEATSHEET

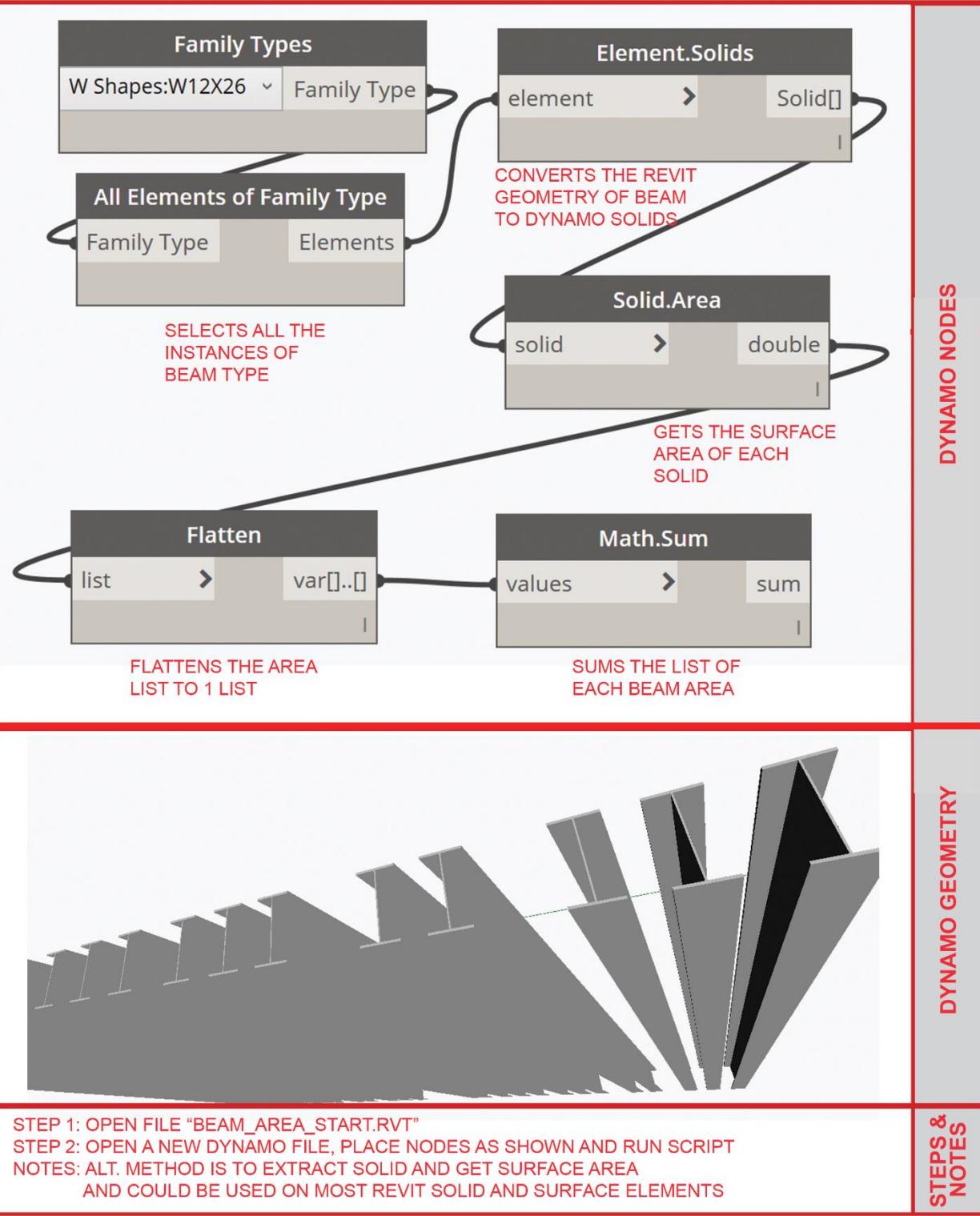
DYNAMOCHEATSHEETS.COM



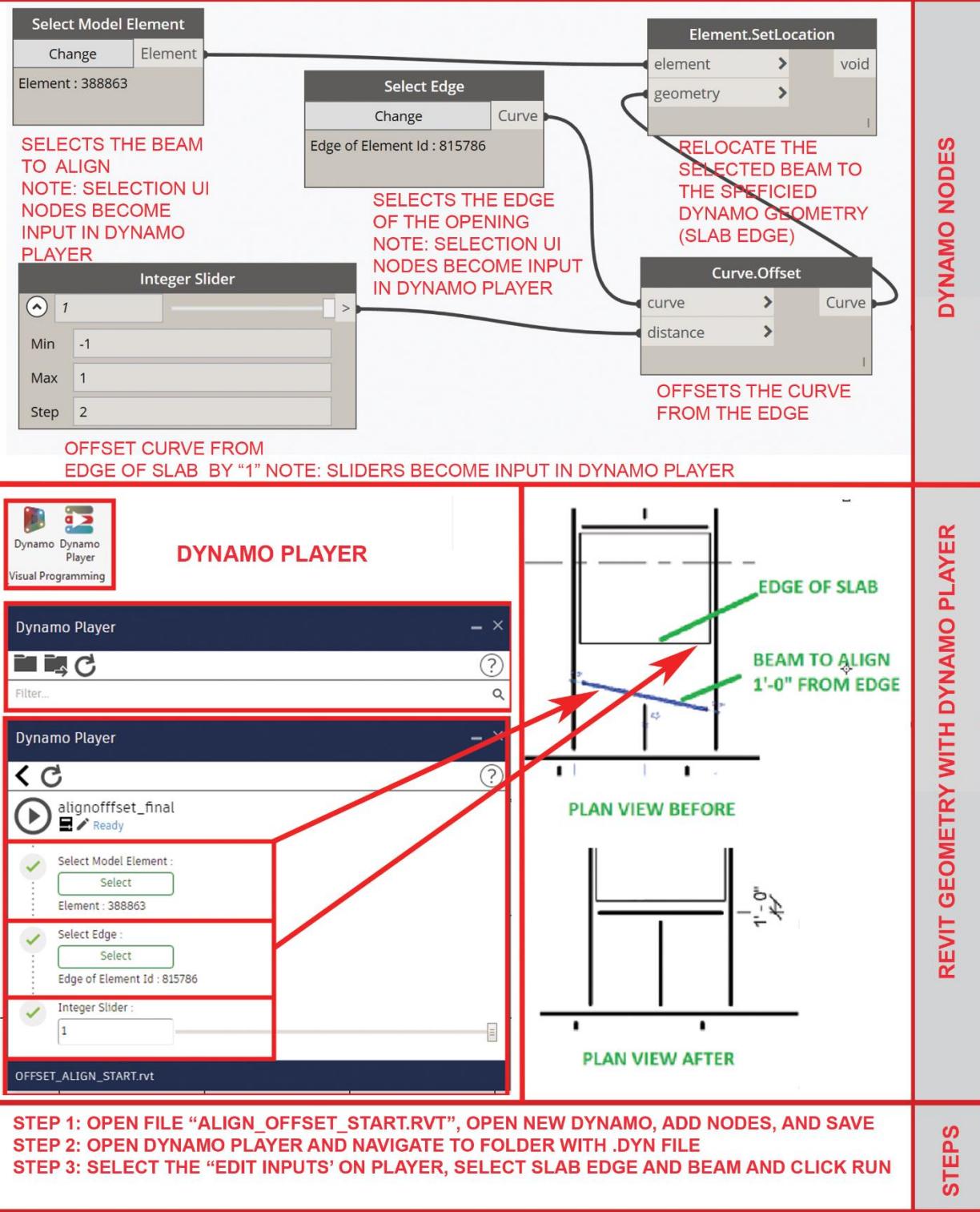
Lab Exercises

Download the dataset and
handout here
<http://a360.co/2x3FC6q>

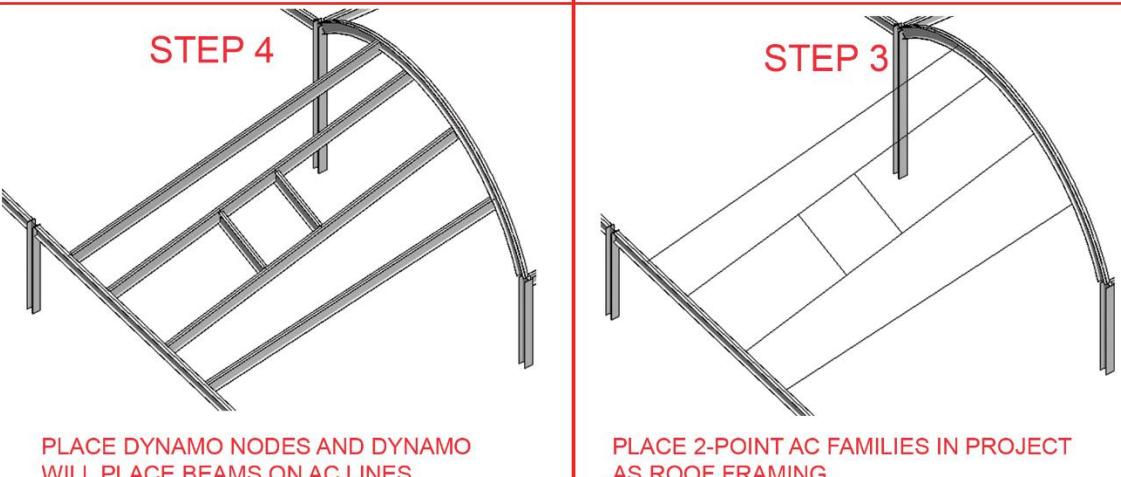
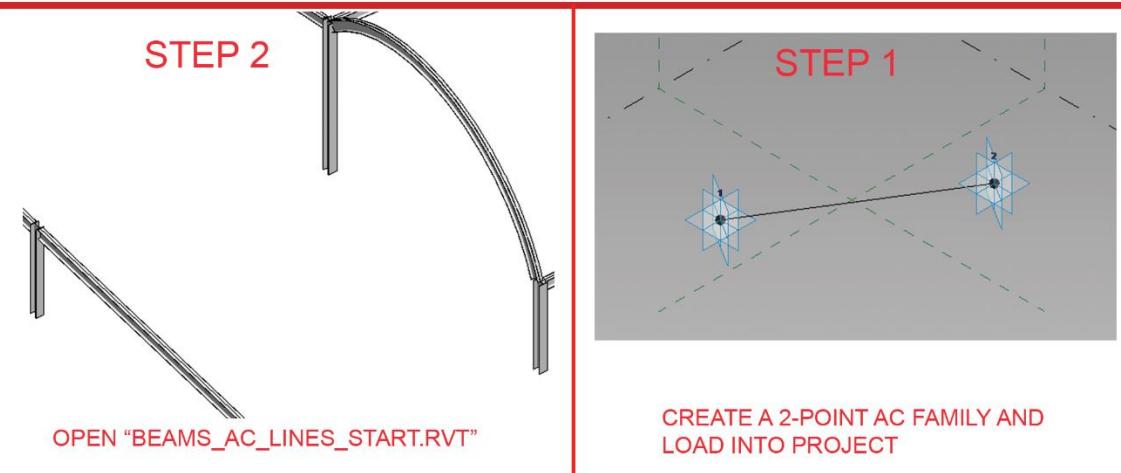
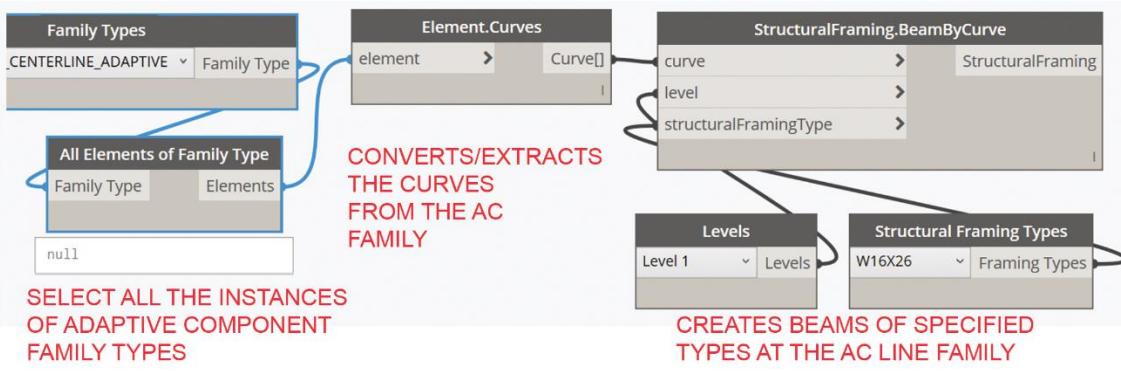
TOTAL SURFACE AREA OF STRUCTURAL BEAMS



ALIGN REVIT BEAMS WITH AN OFFSET WITH DYNAMO PLAYER



CREATE BEAMS FROM 2-PT AC LINE FAMILIES



SETTING MIN CONCRETE FLOOR THICKNESS USING ENGINEERING LOGIC

```

graph TD
    A[Select Model Element<br/>Change Element] --> B[Dimension.Value]
    B -- dimension --> C[double[]]
    C --> D[Code Block<br/>thickness (thickness/3)/12+1/12; >]
    D --> E[List.MaximumItem<br/>list max]
    E --> F[Code Block<br/>FamilyType.SetCompoundLayerWidth<br/>familyType layerIndex success width]
    F --> G[NOTE: CUSTOM NODE FROM CLOCK WORK PACKAGE<br/>Code Block<br/>0; >]
  
```

SELECTS DIMENSION STRING AND GETS VALUES

SELECTS SLAB ELEMENT AND ELEMENT TYPE

SETS MIN THICKNESS PER RULES OF THUMB AND GETS MAX VALUE

SETS THE FLOOR SLAB THICKNESS TO MIN

NOTE: CUSTOM NODE FROM CLOCK WORK PACKAGE

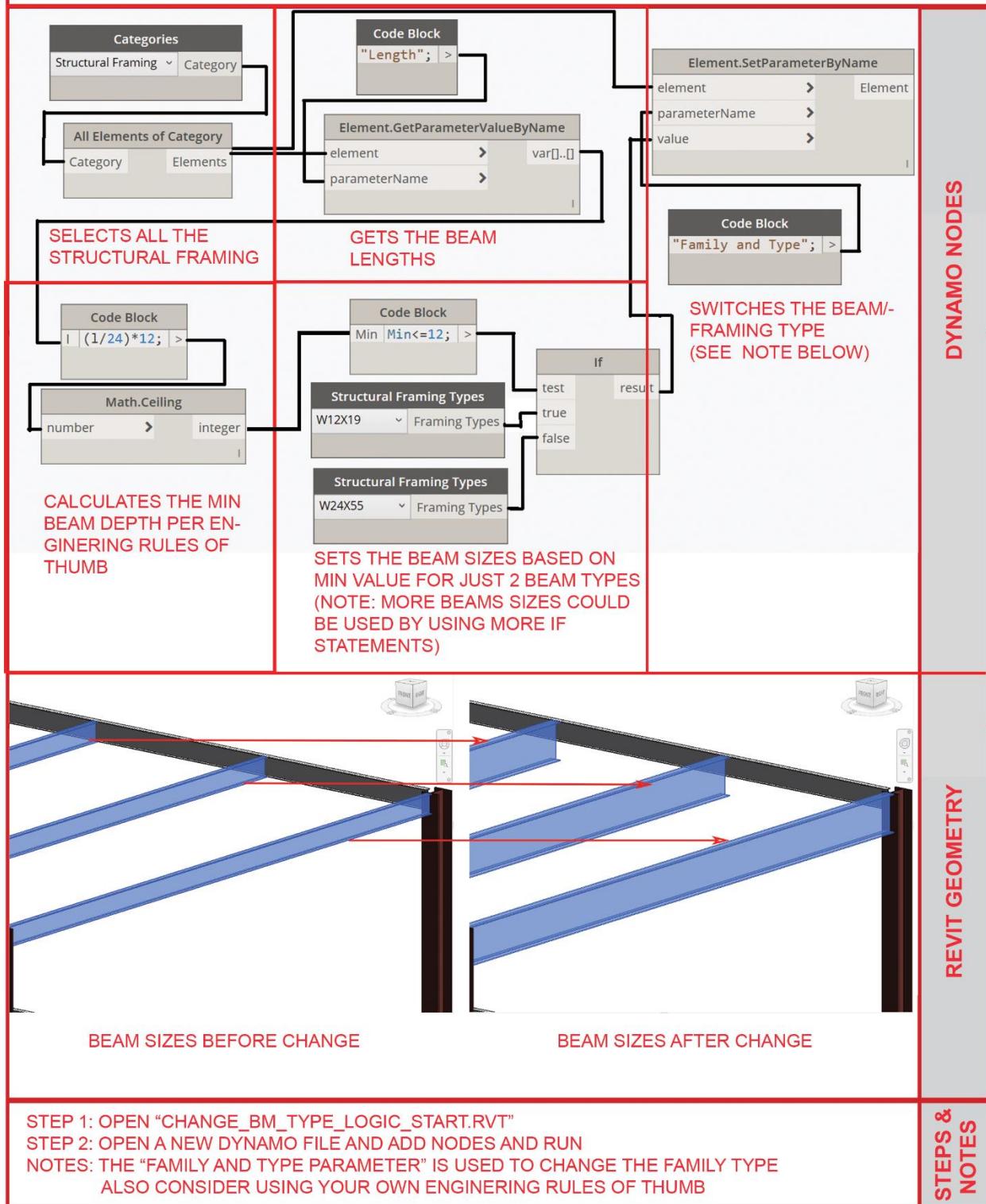
DYNAMO NODES

REVIT GEOMETRY

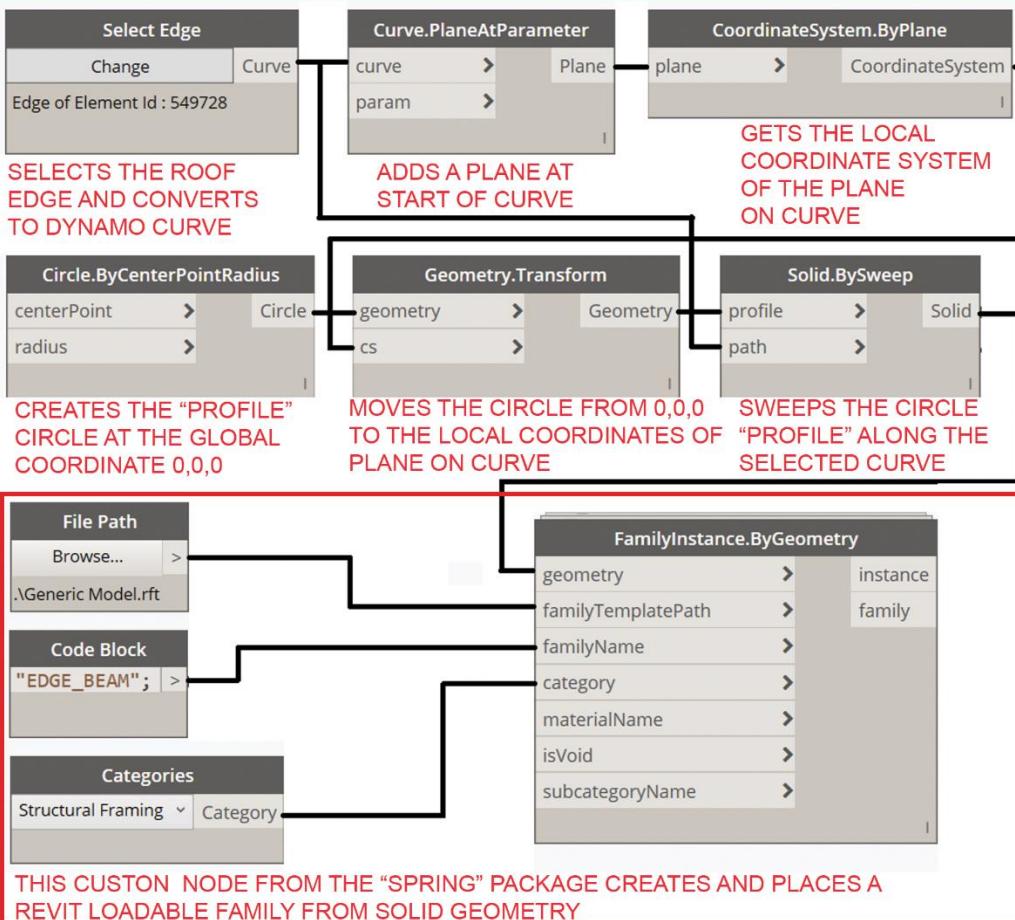
STEPS

STEP 1: OPEN "ONE_WAY_BEAM_SLAB_SYSTEM_START.RVT"
 STEP 2: OPEN NEW DYNAMO AND ADD NODES
 STEP 3: SELECT SLAB AND SELECT LOWER DIMENSION STRING W/ "SELECT" AND RUN DYNAMO

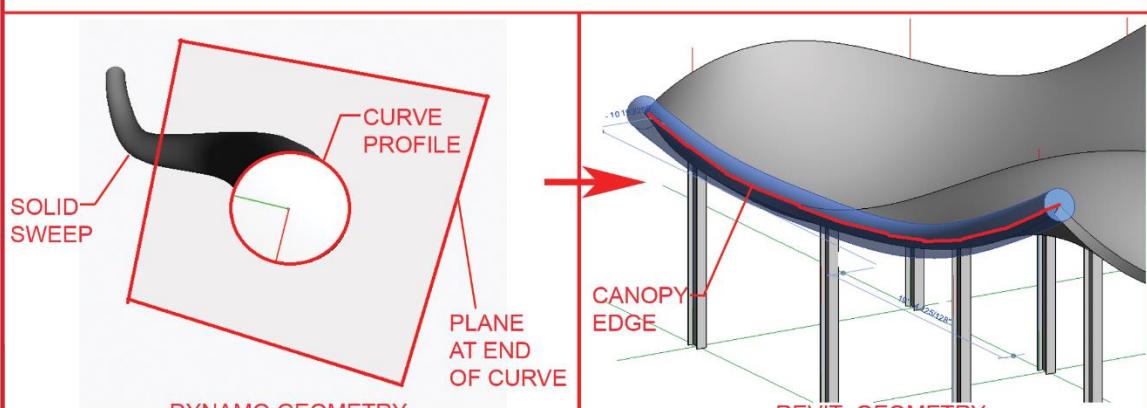
CHANGE BEAM TYPES USING ENGINEERING LOGIC



BUILD A COMPLEX BEAM IN DYNAMO AND SEND TO REVIT



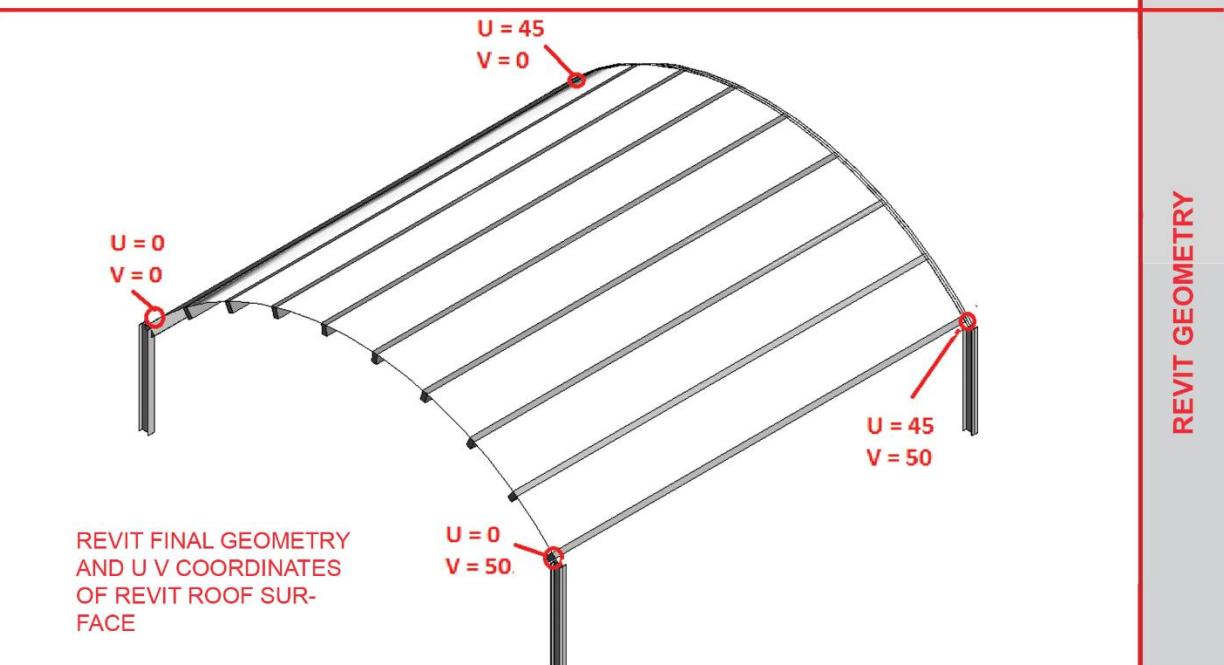
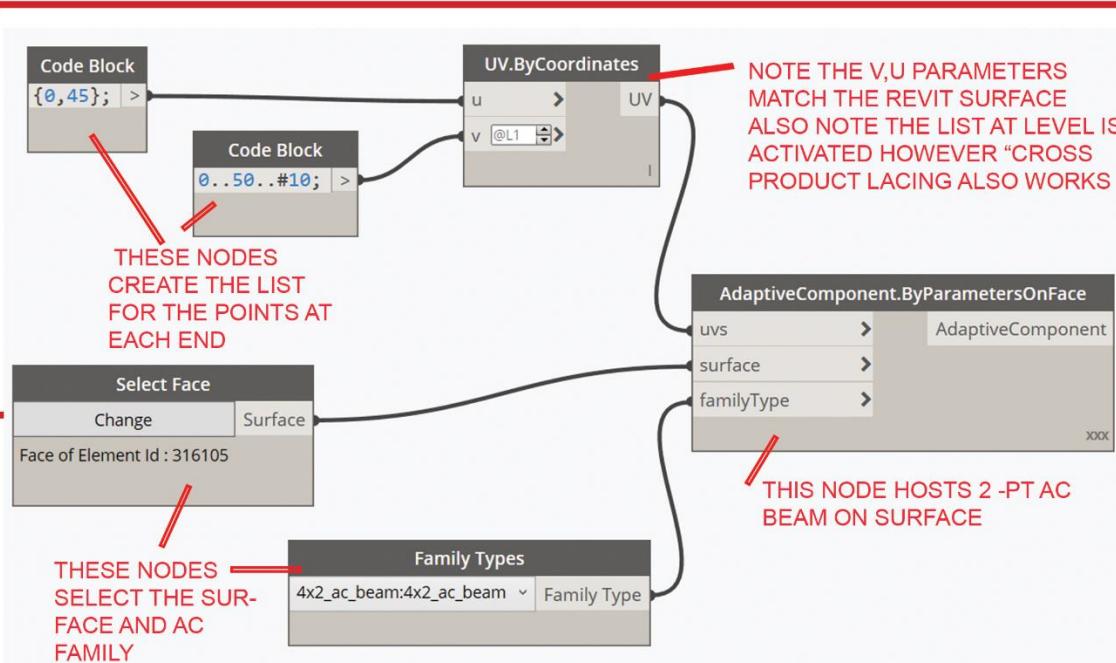
DYNAMO NODES



STEPS REVIT DYNAMO GEOMETRY

STEP 1: OPEN FILE "CANOPY_BEAMS_TO_REVIT_START.RVT", OPEN NEW DYNAMO, ADD NODES
STEP 2: SELECT THE CANOPY EDGE USING THE "SELECT EDGE" NODE AS SHOWN AND RUN

ORIENT BEAMS PERP TO SURFACE



STEP 1: OPEN "BEAM_ORIENTATION_START.RVT"
 STEP 2: OPEN A NEW DYNAMO FILE, AND ADD NODES
 STEP 3: SELECT THE SURFACE USING THE "SELECT FACE" NODE
 STEP 4: SELECT THE "4X2" FAMILY TYPE AND RUN - NOTE BEAMS ARE ADAPTIVE COMPONENTS

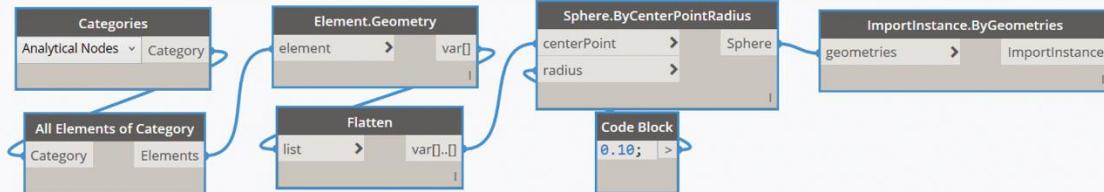
DYNAMO NODES

REVIT GEOMETRY

STEPS

CONVERT REVIT ANALYTICAL BMS + PTS TO SOLIDS FOR RENDERING IN A GAME ENGINE (SIMPLE METHOD)

ANALYTICAL NODES



SELECTS ALL ANALYTICAL NODES IN THE PROJECT

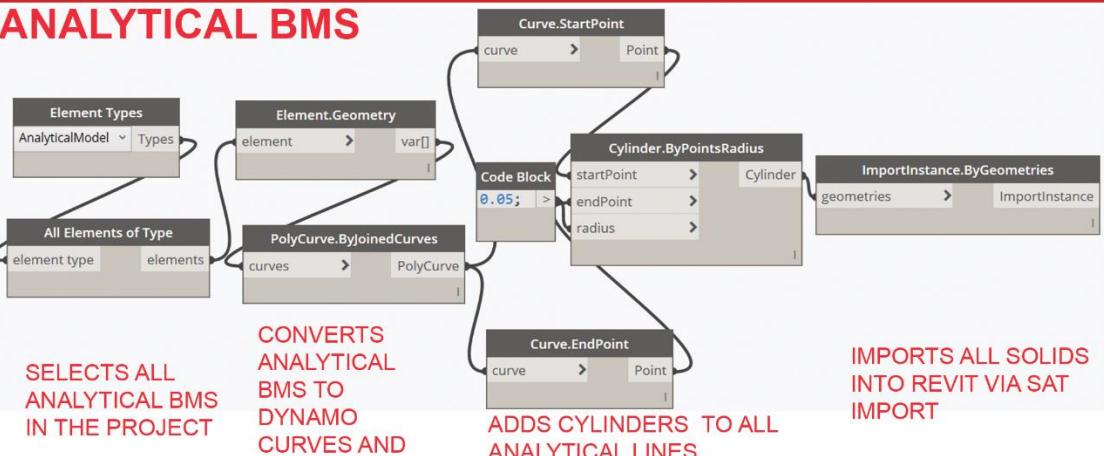
CONVERTS ANALYTICAL NODES TO DYNAMO PTS

ADDS SPHERES TO ALL ANALYTICAL NODES

IMPORTS ALL SOLIDS INTO REVIT VIA SAT IMPORT

DYNAMO NODES

ANALYTICAL BMS



SELECTS ALL ANALYTICAL BMS IN THE PROJECT

CONVERTS ANALYTICAL BMS TO DYNAMO CURVES AND JOINS THEM

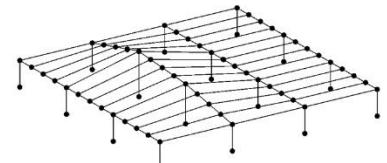
ADDS CYLINDERS TO ALL ANALYTICAL LINES

IMPORTS ALL SOLIDS INTO REVIT VIA SAT IMPORT

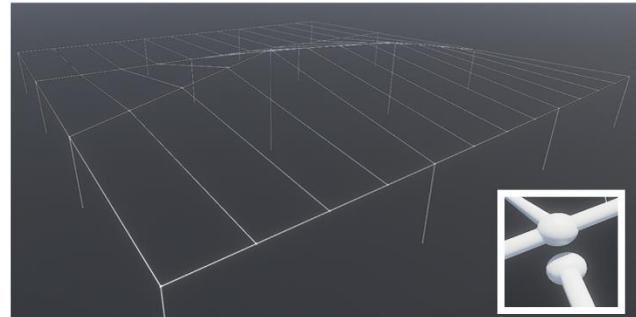
DYNAMO NODES



ANALYTICAL LINES IN REVIT



ANALYTICAL MODEL CONVERTED TO SOLIDS IN REVIT



ANALYTICAL REVIT SOLID MODEL RENDERED IN A GAME ENGINE

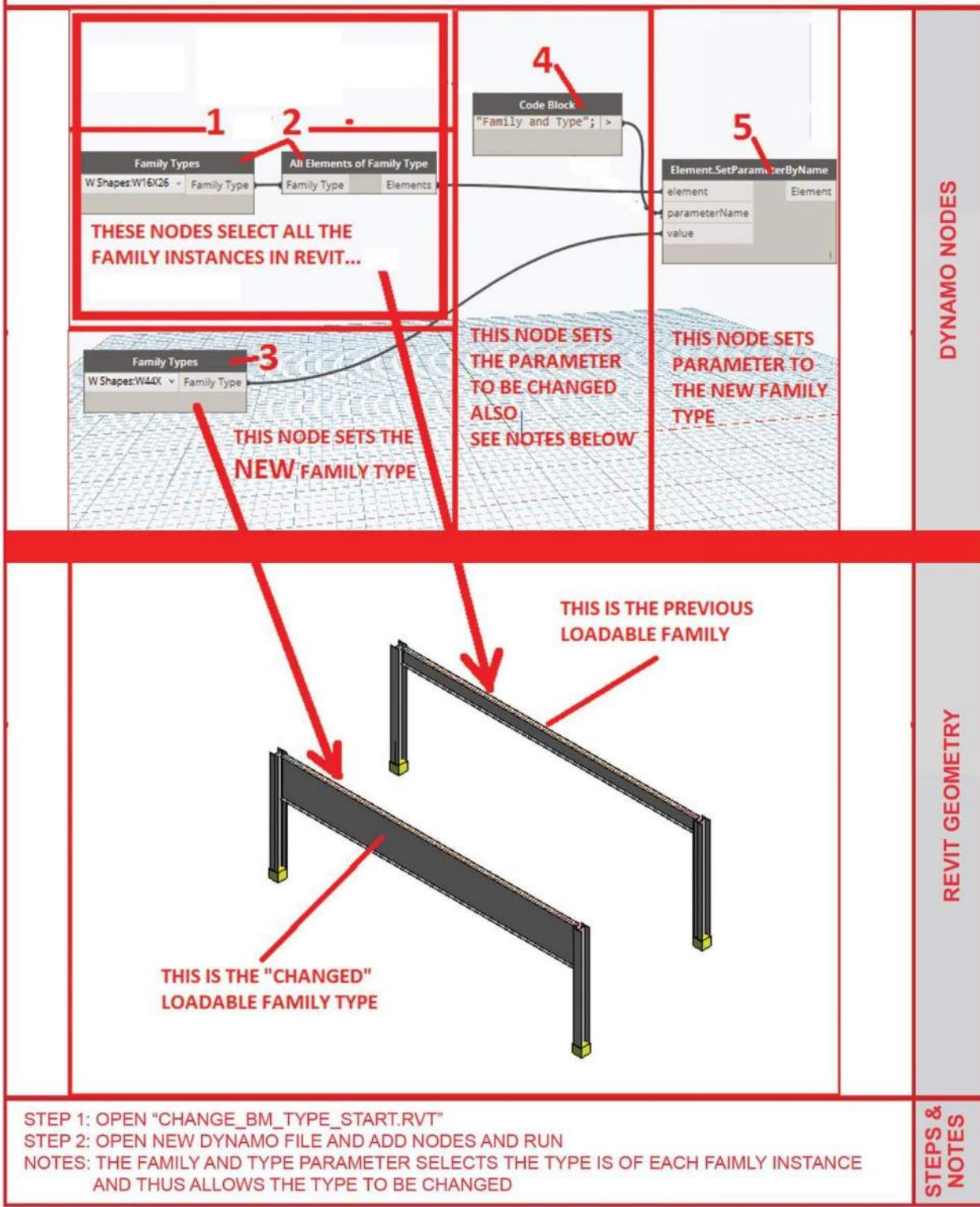
ANALYTICAL MODEL

STEP 1: OPEN “ANALYTICAL_MODEL_START.RVT”
STEP 2: OPEN A NEW DYNAMO FILE AND ADD NODES AS SHOWN AND RUN SCRIPT
STEP 3: ISOLATE AND OPEN OR EXPORT TO GAME ENGINE
NOTE: GAME ENGINES WILL NOT RENDER SINGLE LINES AND NODES THUS NEED METHOD ABOVE

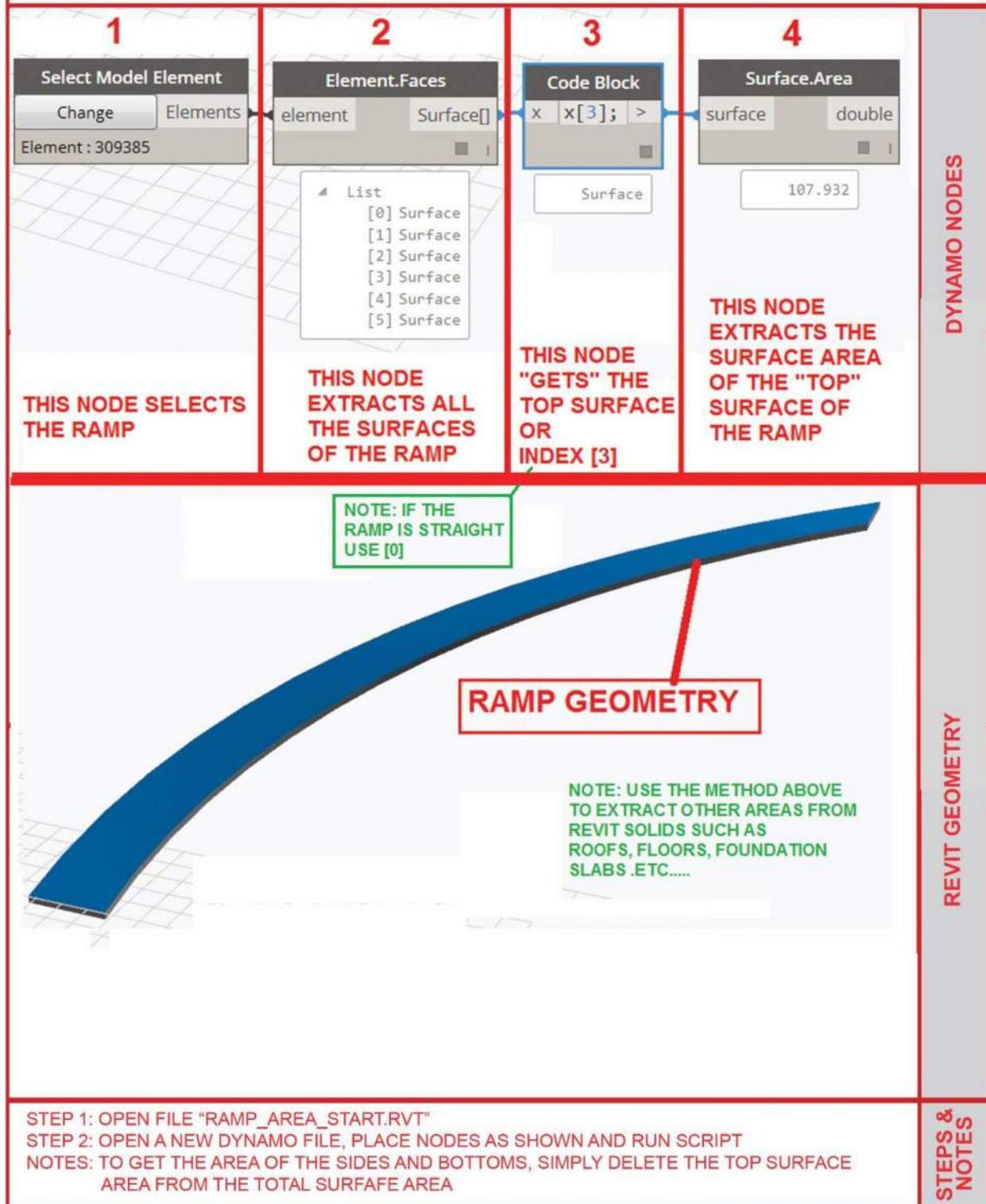
STEPS &
NOTES

Additional Examples

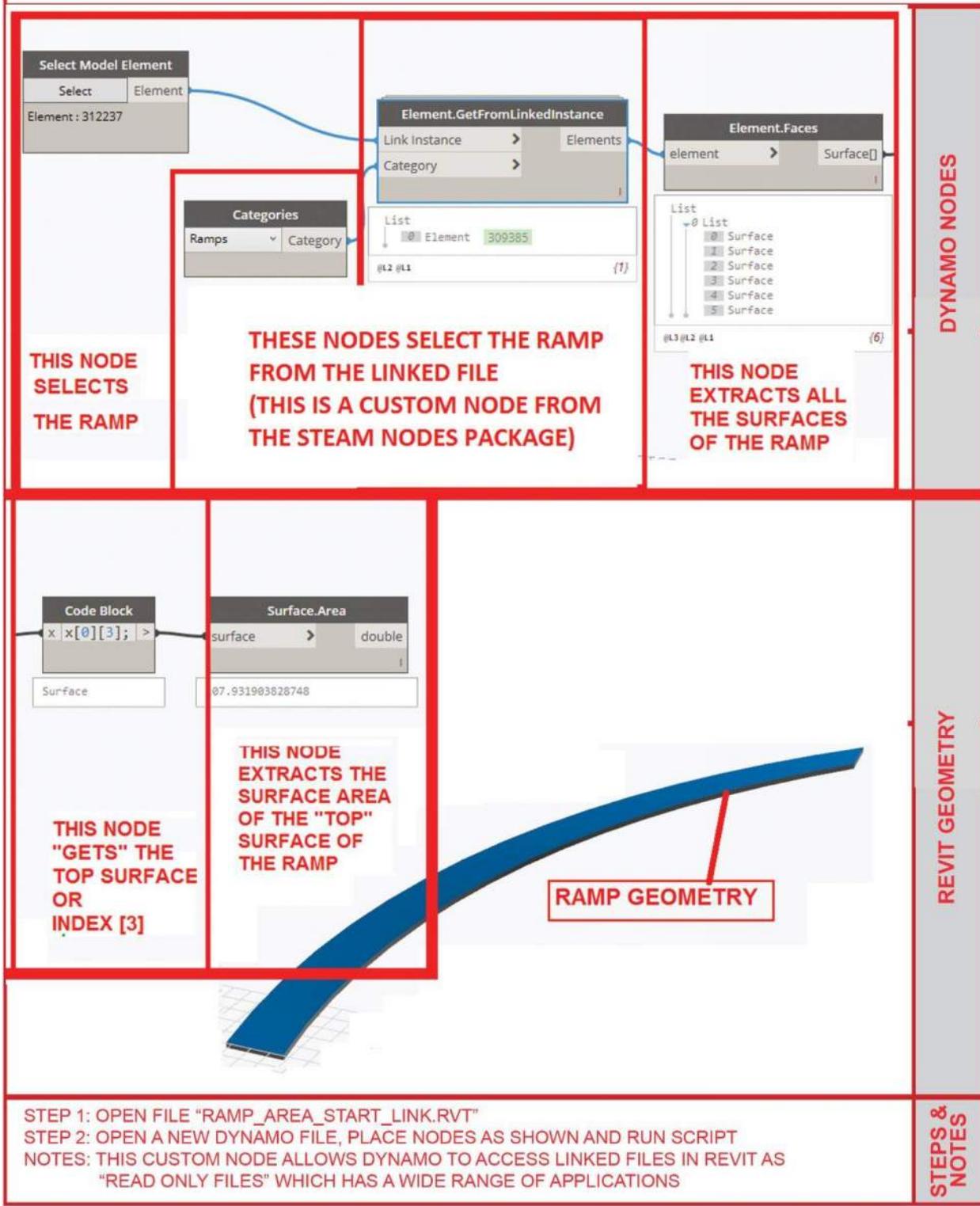
CHANGE LOADABLE FAMILY TYPES



SURFACE AREA OF RAMPS



SURFACE AREA OF RAMP FROM A LINKED FILE



TOTAL SURFACE AREA OF MECH EQUIPMENT

Select Model Elements	
Change	Elements
Elements : 4826 4898 4921 5019 5095 5147 5176 5242 5261 5308 5343 5382 5428 5463 5486 5499 5508 5557 5574 5634	

THIS NODE SELECTS ALL THE ELEMENTS IN REVIT

Element.Faces	Flatten		
element	Surface[]	list	var[]..[]

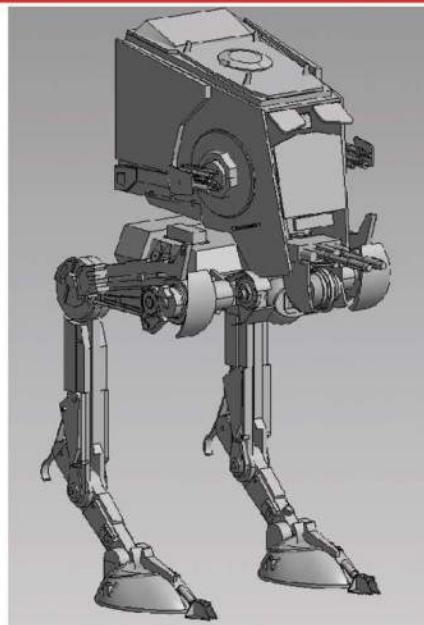
THIS NODE CONVERTS ALL THE REVIT FAMILY GEOMETRY TO DYNAMO SURFACES

THIS NODE FLATTENS ALL THE ITEMS INTO A SINGLE LIST

DYNAMO NODES



DYNAMO GEOMETRY

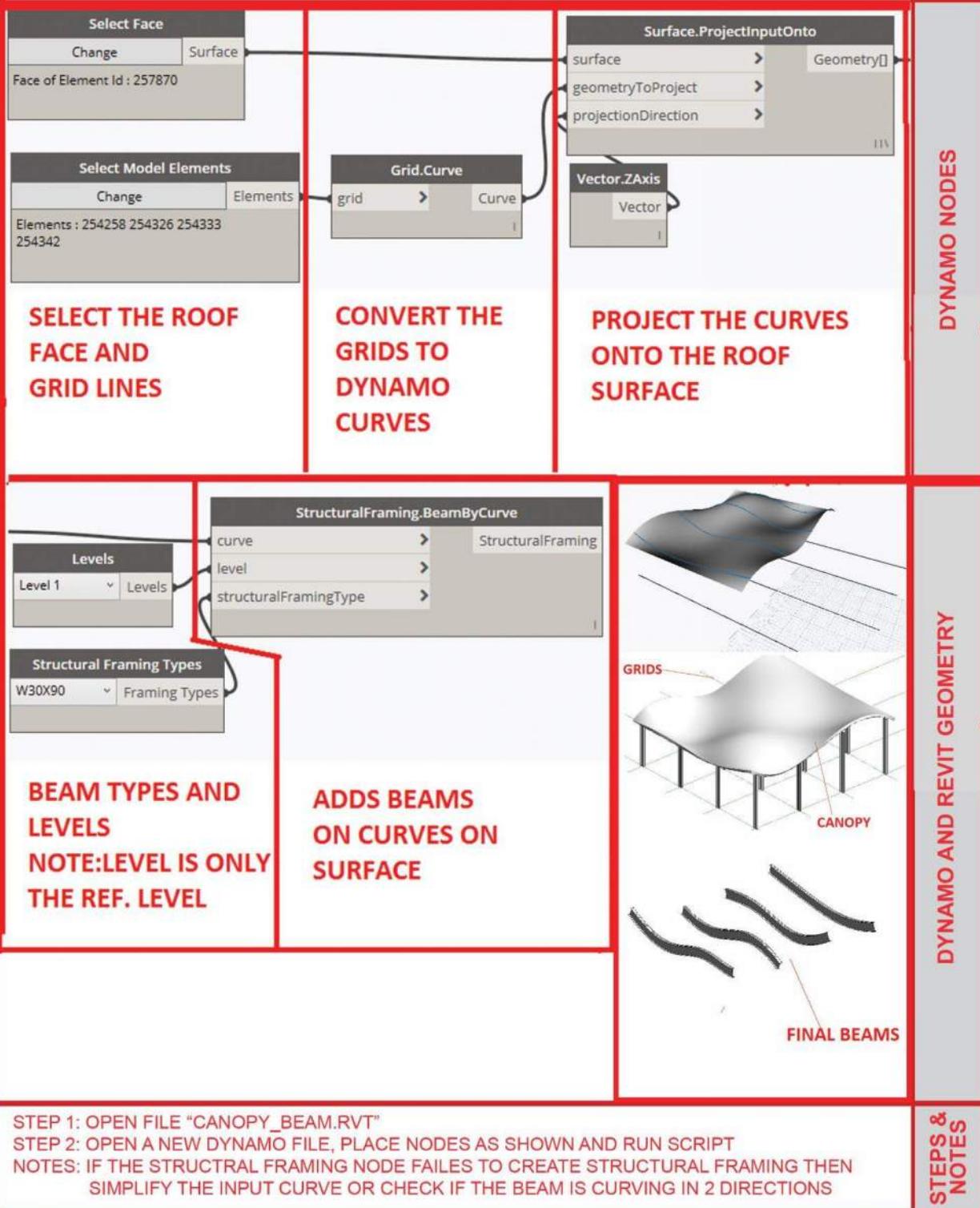


REVIT GEOMETRY

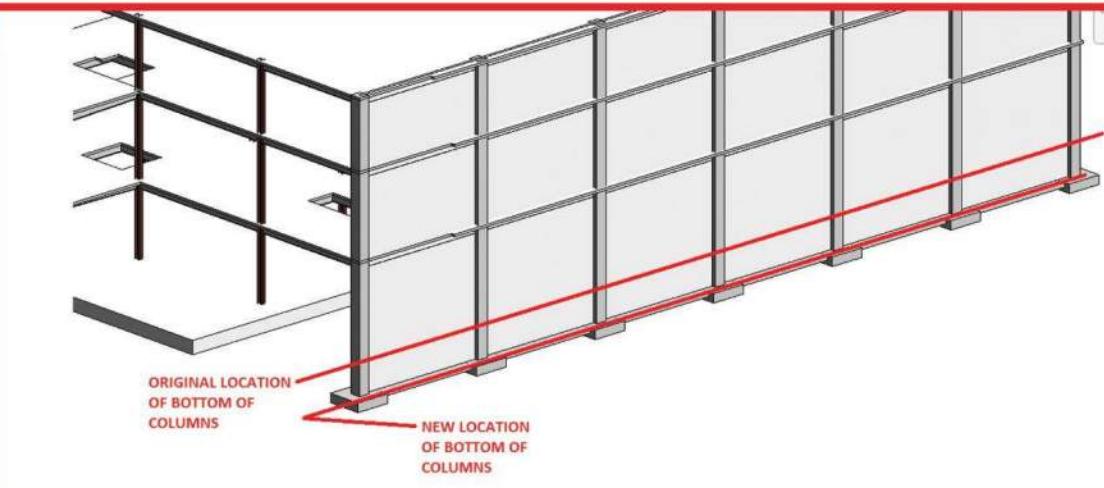
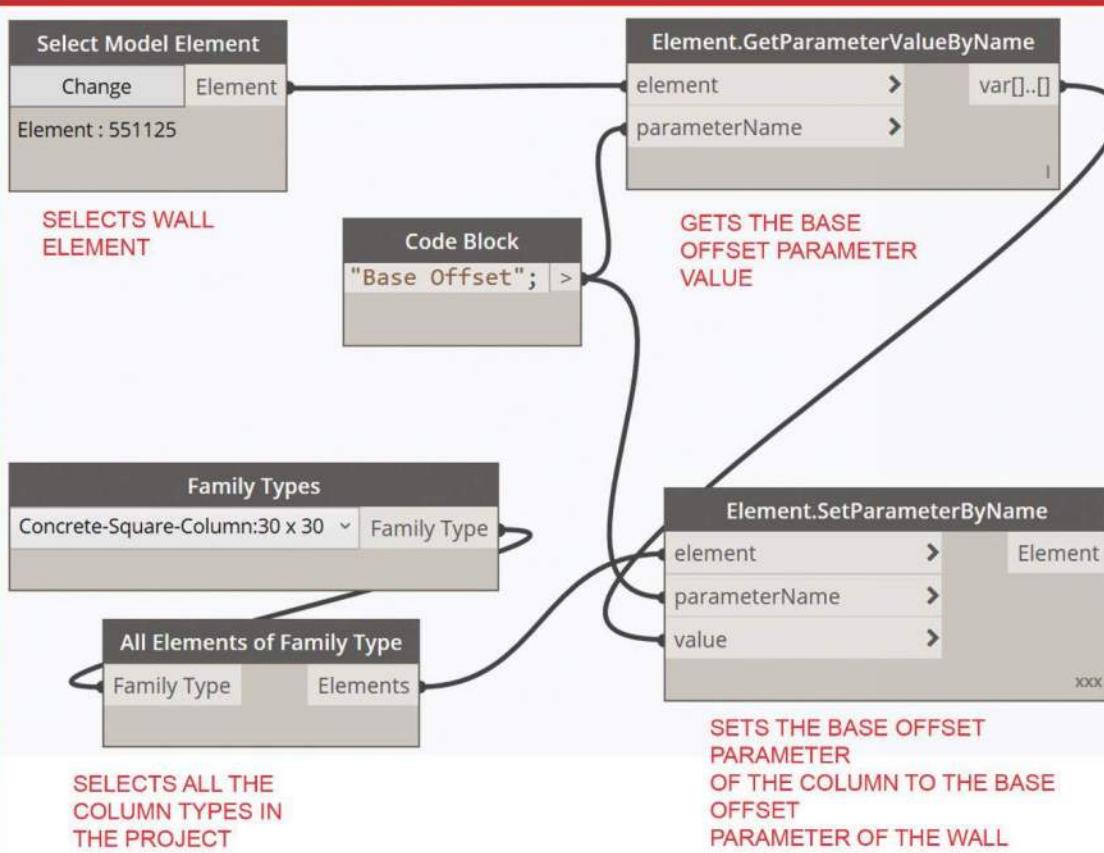
STEP 1: OPEN FILE "SURFACE_AREA_ROBOT_START.RVT"
STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
NOTES: ALT. METHOD IS TO EXTRACT SOLID AND GET SURFACE AREA
AND COULD BE USED ON MOST REVIT SOLID AND SURFACE ELEMENTS

STEPS & NOTES

CANOPY BEAM FRAMING ON GRIDS (USING PROJECTION)



GET AND SET INSTANCE PARAMETERS



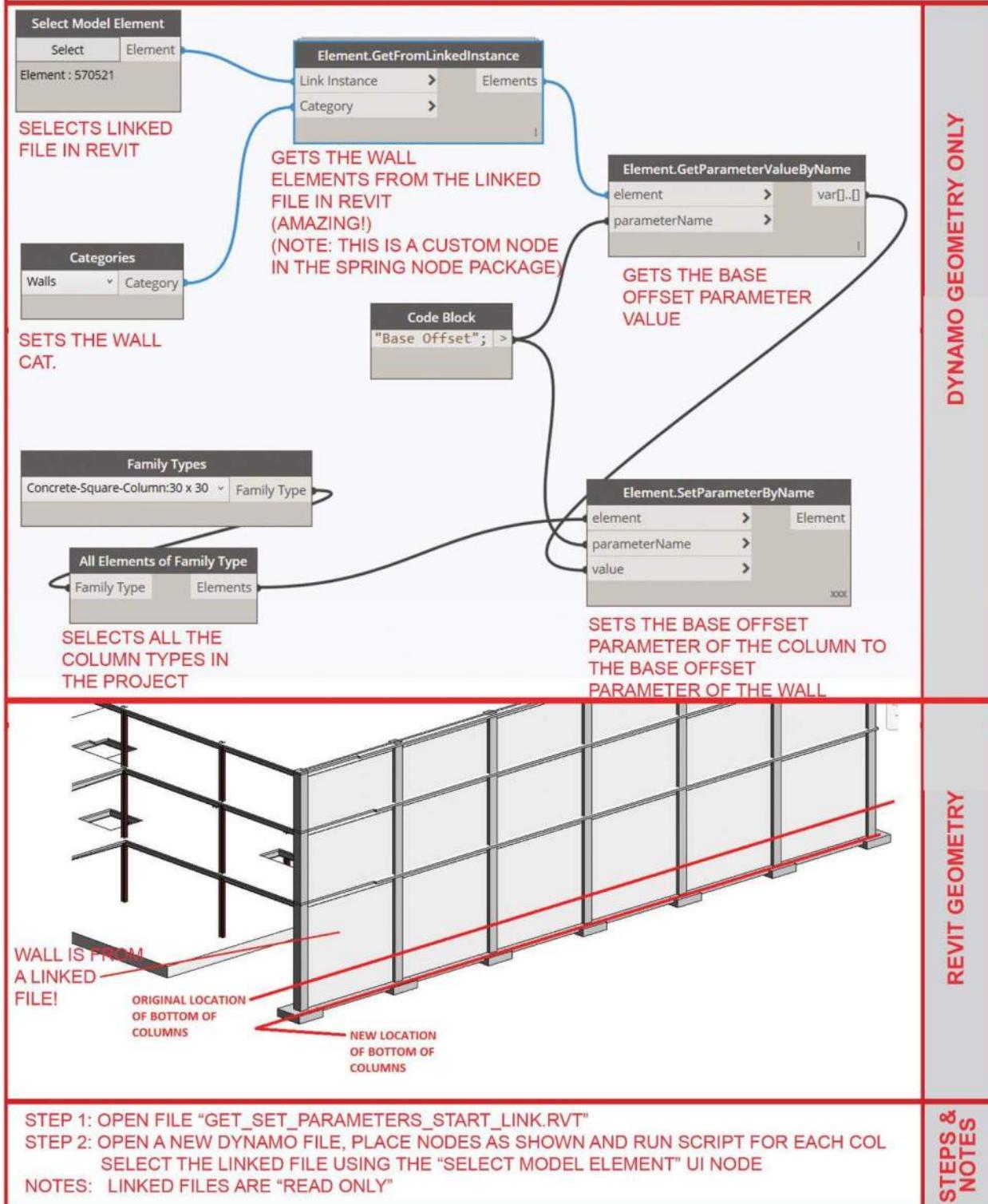
STEP 1: OPEN FILE "GET_SET_PARAMETERS_START.RVT"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT FOR EACH COL
 NOTES: THERE ARE MANY OTHER WAYS TO SELECT THE WALL AND COLUMNS

DYNAMO GEOMETRY ONLY

REVIT GEOMETRY

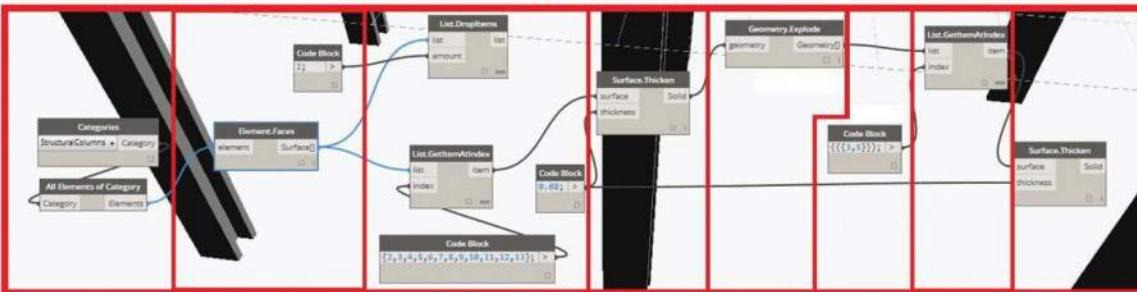
STEPS &
NOTES

GET AND SET INSTANCE PARAMETERS WITH LINK FILE



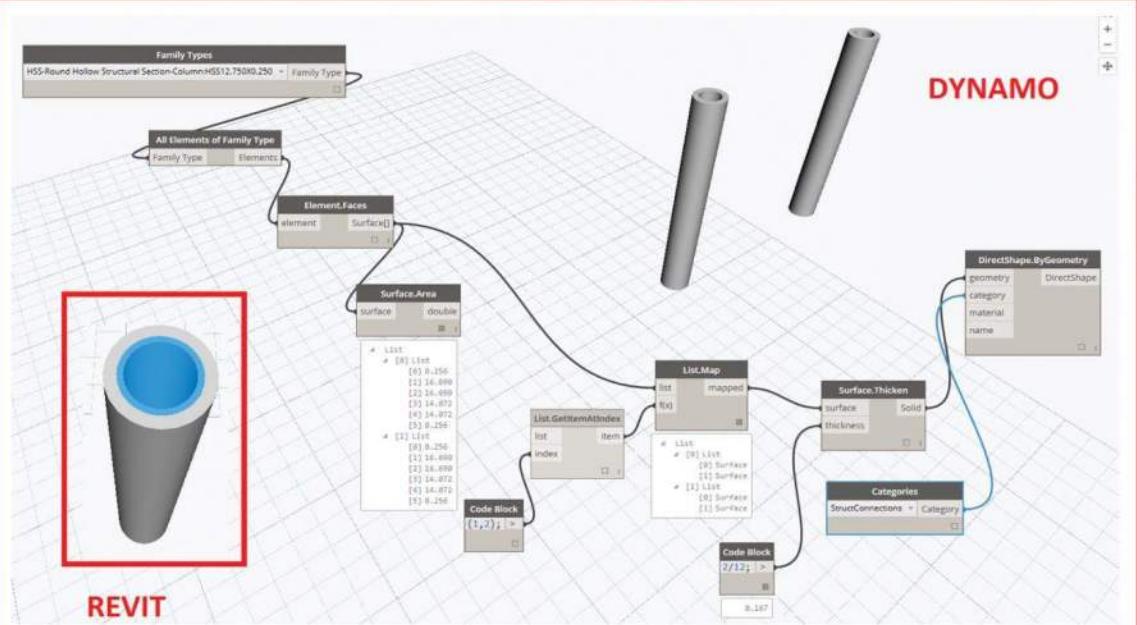
ADD FIREPROOFING TO WIDE FLANGE AND PIPE COLUMNS

WIDE FLANGE



DYNAMO GEOMETRY ONLY

PIPE COLUMN



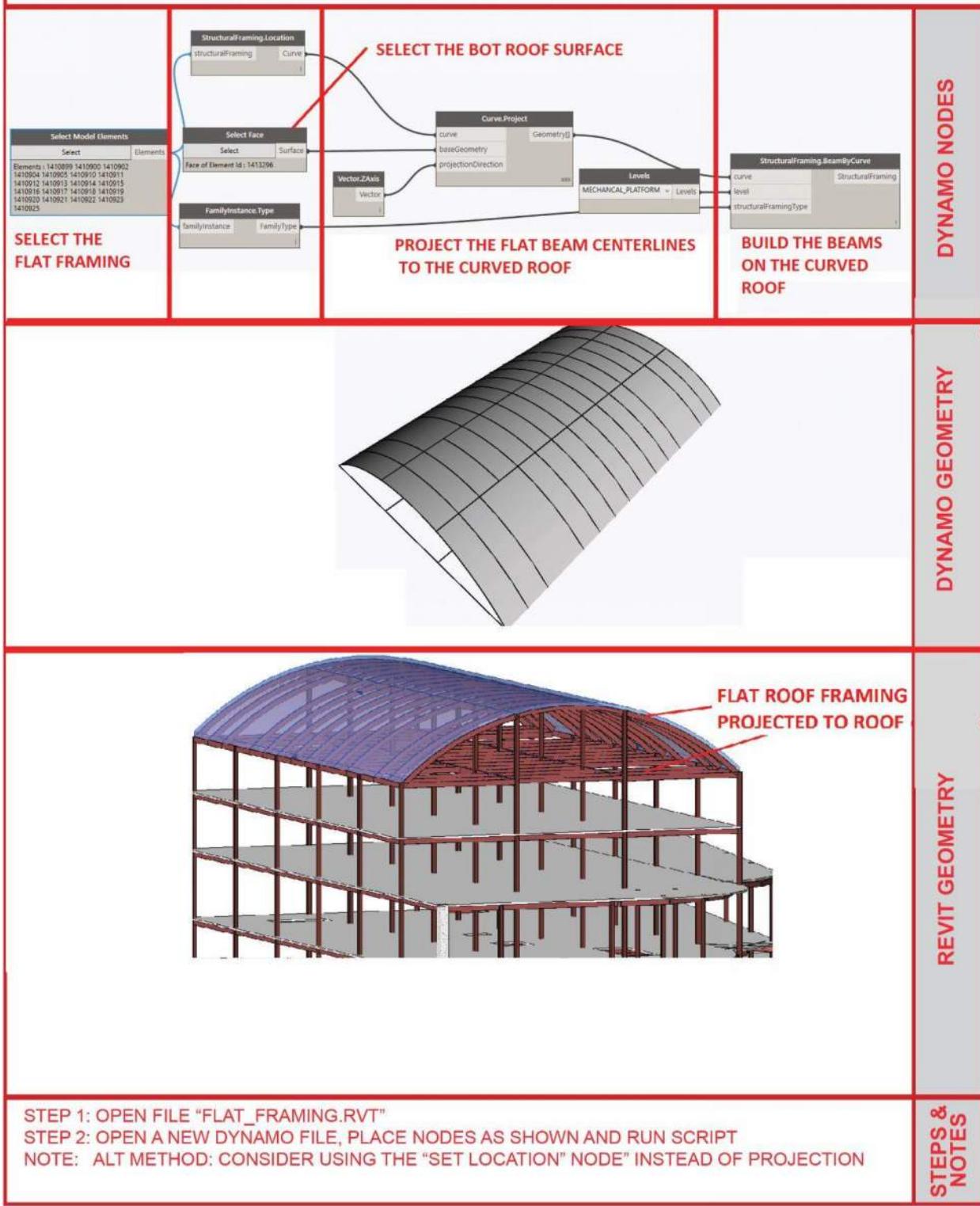
DYNAMO

DYNAMO AND REVIT GEOMETRY

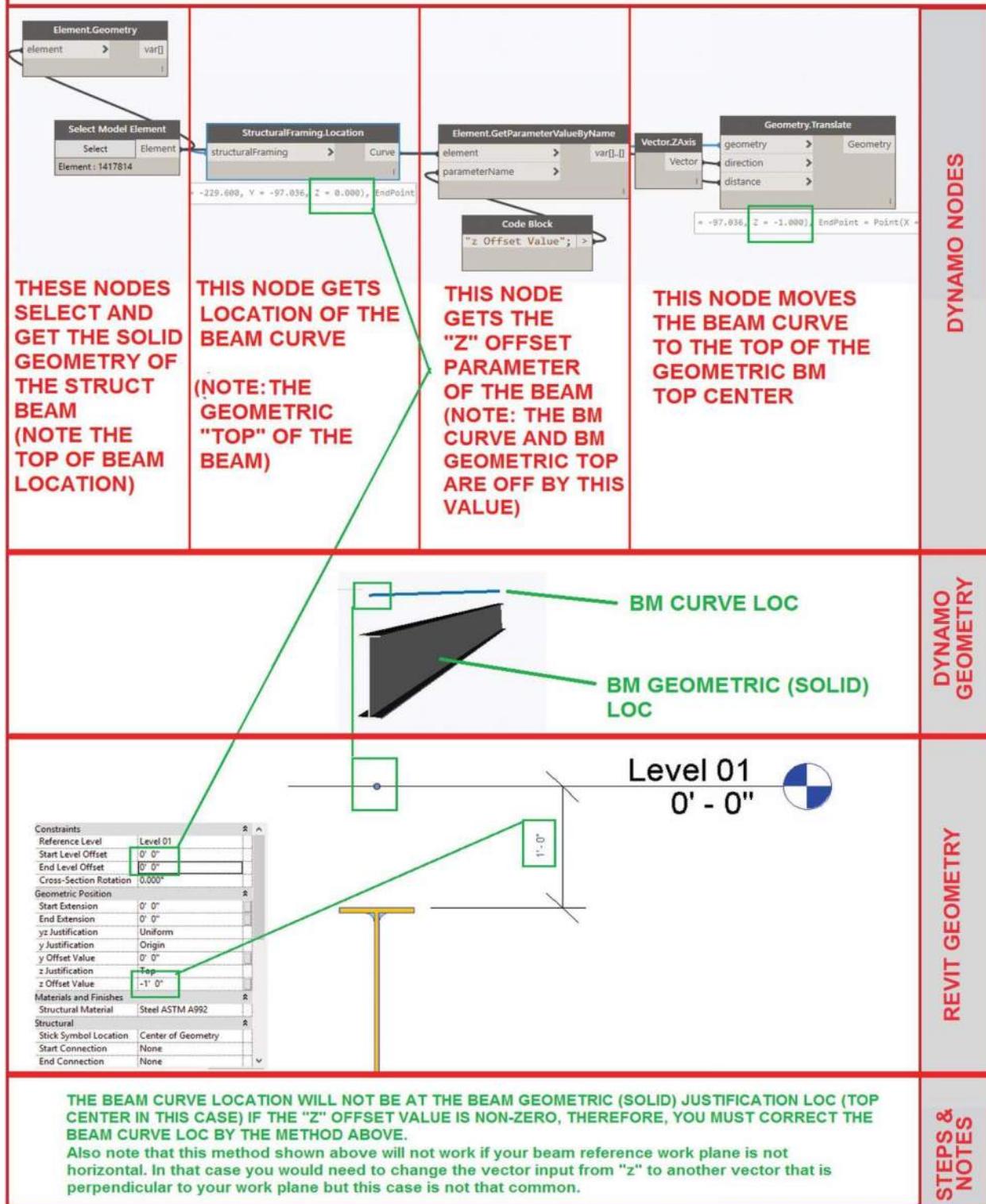
STEP 1: OPEN FILE "FIREPROOFING_START.RVT"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT FOR EACH COL
 NOTES: THERE ARE MANY WAYS TO BRING DYNAMO GEOMETRY INTO REVIT AND THIS METHOD SHOWS JUST ONE VIA OOTB NODE FOR DIRECT SHAPE FOR PIPE COL,

STEPS &
NOTES

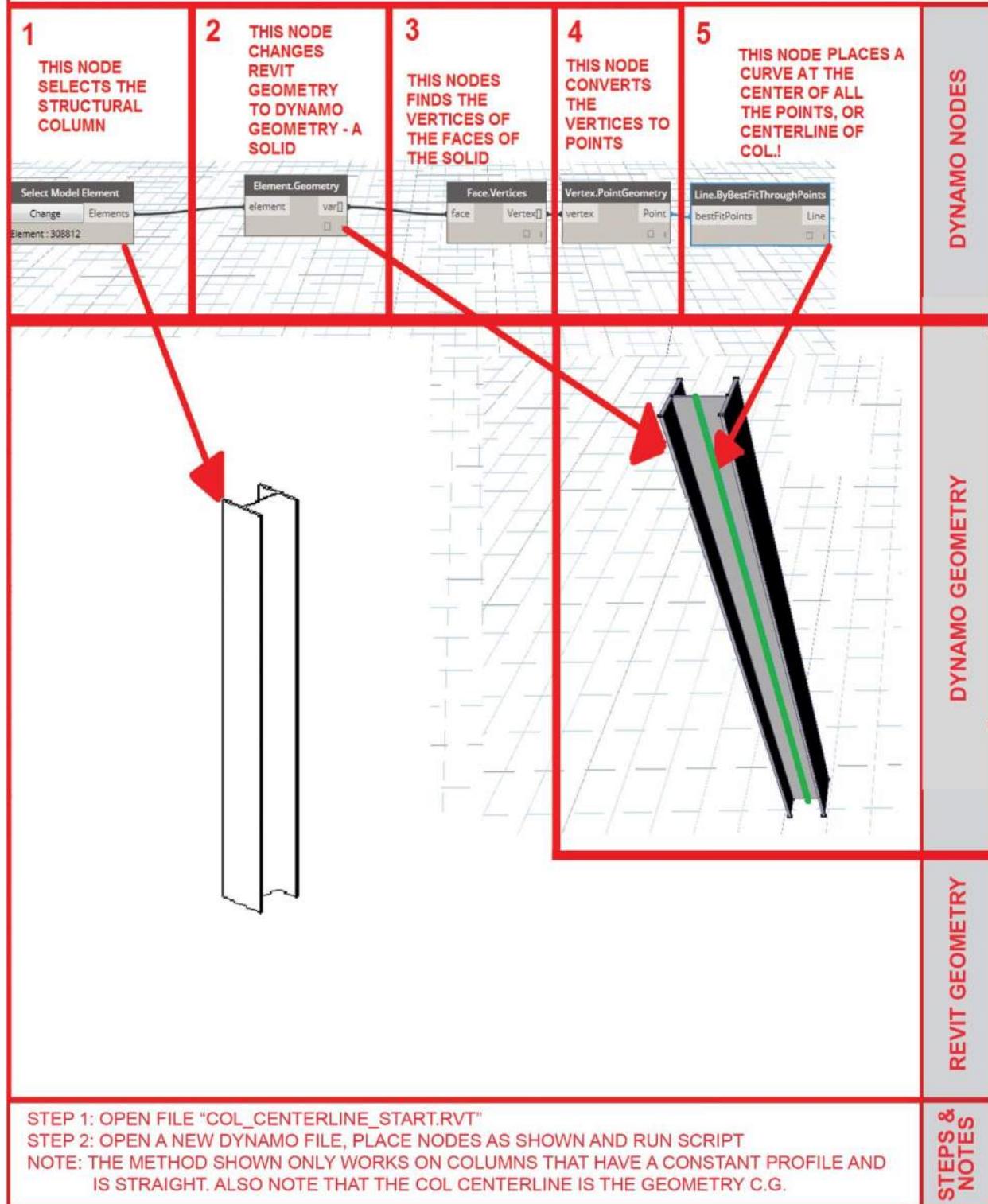
FLAT FRAMING TO CURVED (PROJECTION)



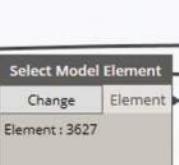
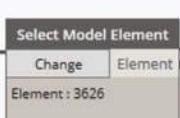
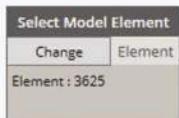
TRUE LOCATION OF CURVE OF BEAMS



COLUMN CENTERLINE



CREATING SURFACES WITH PROFILE ORDER

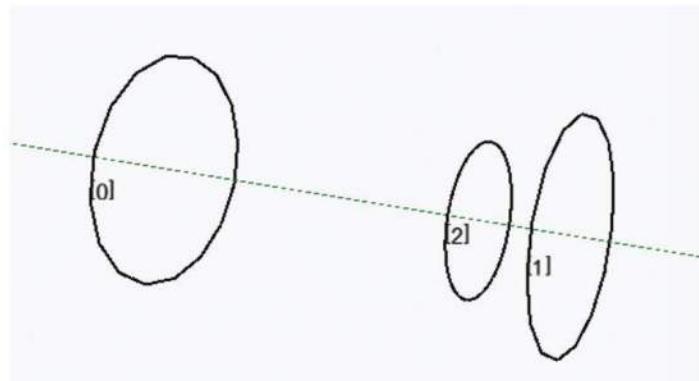


THESE NODES SELECT THE PROFILE CURVES

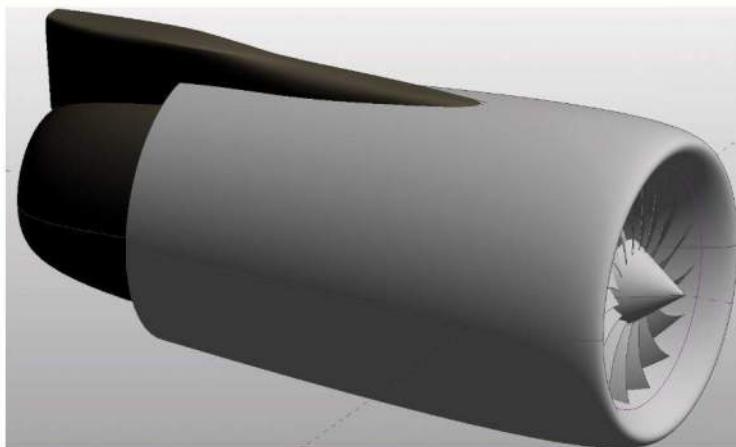
THIS NODE
CREATES A LIST
IN THE CORRECT
PROFILE ORDER

THIS NODE CREATES
THE
SURFACE LOFTED
OVER THE
CORRECT
PROFILE ORDER

DYNAMO NODES



DYNAMO GEOMETRY

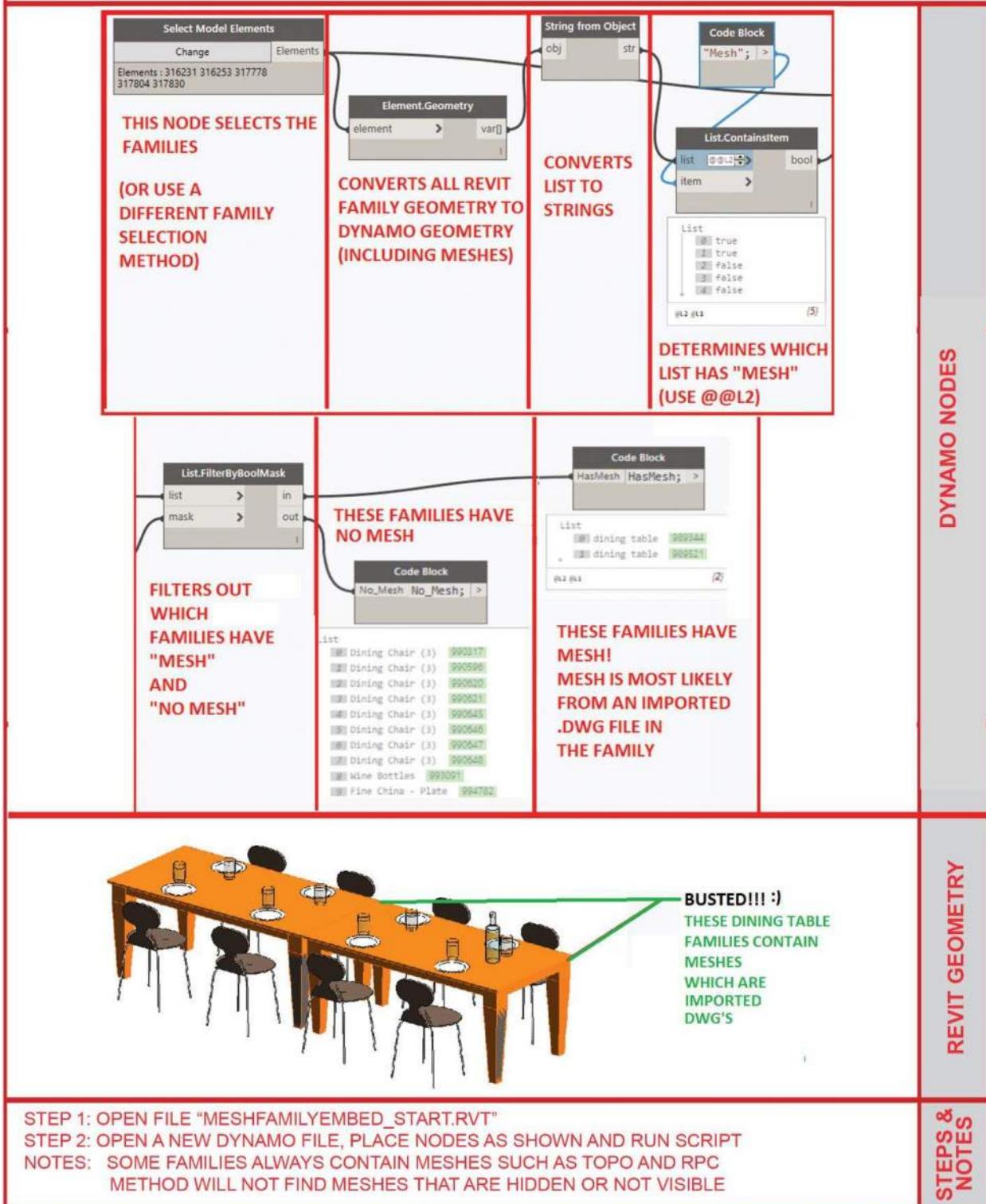


REVIT GEOMETRY

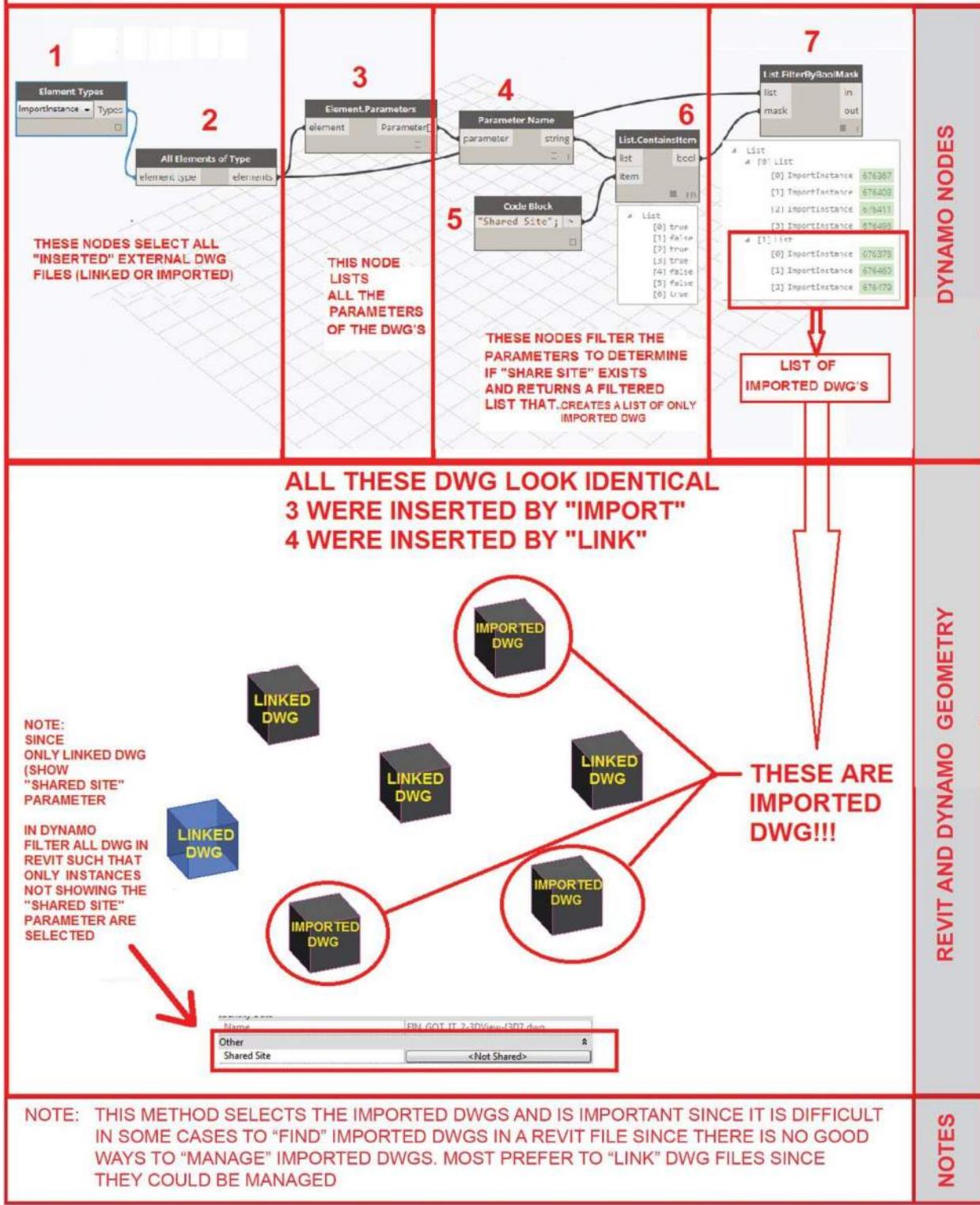
STEP 1: OPEN REVIT FILE "PROFILEORDER_START.RVT"
STEP 2: OPEN A NEW DYNAMO FILE AND ADD NODES AS SHOWN
STEP 3: SELECT ELEMENT 0,1,2 IN THAT ORDER USING THE "SELECT" NODE AND RUN
NOTE: THE REVIT MASSING FAMILY DOES NOT ALLOW FOR PROFILES TO BE SELECTED IN ORDER

STEPS &
NOTES

FIND FAMILIES THAT HAVE EMBEDDED MESHES/DWG



SELECT/FIND IMPORTED DWG



SET TYPE PARAMETER IN A LOADABLE FAMILY

<p>this node selects the family TYPE</p> <p>Then this node SETS the Type Parameter</p>	DYNAMO NODES
	REVIT GEOMETRY
<p>STEP 1: OPEN FILE "SET_TYPE_PARAMETER_START.RVT" STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT NOTE: THIS METHOD WILL NOT WORK FOR A SYSTEM FAMILY</p>	
STEPS & NOTES	

KEEP NORTH ARROW ALIGED WITH TRUE NORTH

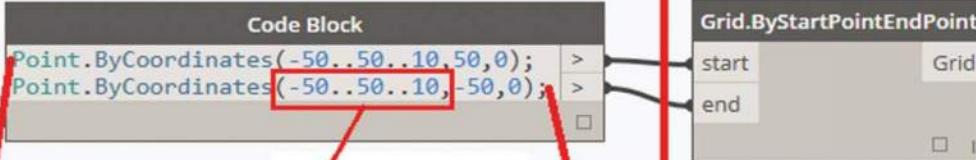
<p>1 SELECT NORTH ARROW FAMILY</p>	<p>2 SELECT PROJECT BASE POINT</p>	<p>3 ENTER FAMILY PARAMETER NAME (NOTE: CREATE ROT PARAMETER IN NORTH ARROW FAMILY WITH THE SAME NAME)</p>	<p>4 GET THE ANGLE OF THE TRUE NORTH FROM BASE PT</p>	<p>5 SET ANGLE OF THE BASE PT TRUE NORTH ANGLE TO NORTH ARROW ANGLE</p>	<p>DYNAMO NODES</p>	
<p>PROJECT NORTH PLAN VIEW</p>					<p>NORTH ARROW</p> <p>PROJECT BASE POINT</p> <p>WILL STAY EQUAL</p>	<p>REVIT GEOMETRY</p>
<p>STEP 1: OPEN FILE "NORTH_ARROW_START.RVT" STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT NOTE: CREATE A NORTH ARROW FAMILY WITH A ROTATION PARAMETER</p>					<p>STEPS & NOTES</p>	

LEVELS IN REVIT

DYNAMOBIM	REVIT	DYNAMO AND REVIT GEOMETRY
<p>Code Block START (ELEVATION) END (ELEVATION) NUMBER RANGE STEP (LEVEL HT)</p>	<p>Level 7 60'-0" Level 6 50'-0" Level 5 40'-0" Level 4 30'-0" Level 3 20'-0" Level 2 10'-0" Level 1 0'-0"</p>	<p>NOTE:</p> <ul style="list-style-type: none"> - IF FIRST LEVEL IS CREATED MANUALLY REST CREATED BY DYNAMOBIM WILL AUTORENAME IN ORDER
<p>Level.ByElevation elevation level</p> <p>THIS NODE CREATES LEVELS BY ELEVATION</p>		
<p>STEP 1: OPEN FILE "LEVELS_START.RVT" STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT</p> <p>NOTE: DESIGN SCRIPTS ARE USED TO RANGED EXPRESSIONS IN METHOD ABOVE</p>		STEPS & NOTES

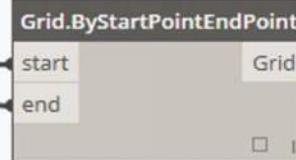
GRIDS IN REVIT

DESIGN SCRIPT



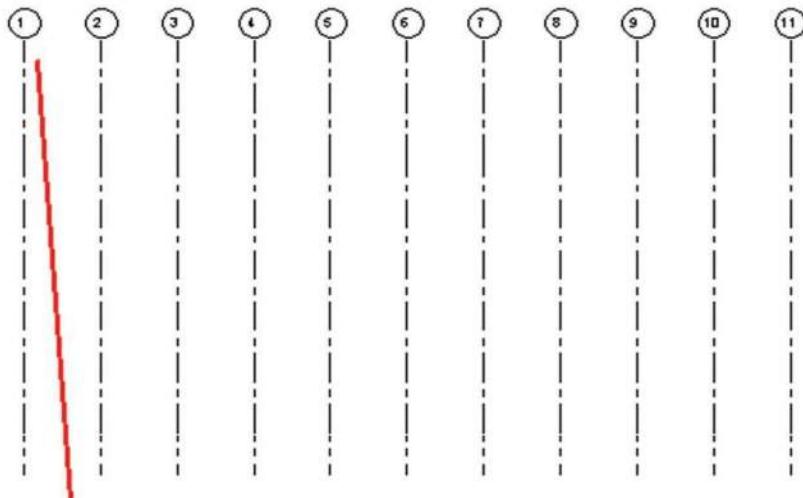
NUMBER
RANGE
START
POINT

END
POINT



CREATE GRID
IN REVIT

DYNAMO GEOMETRY ONLY



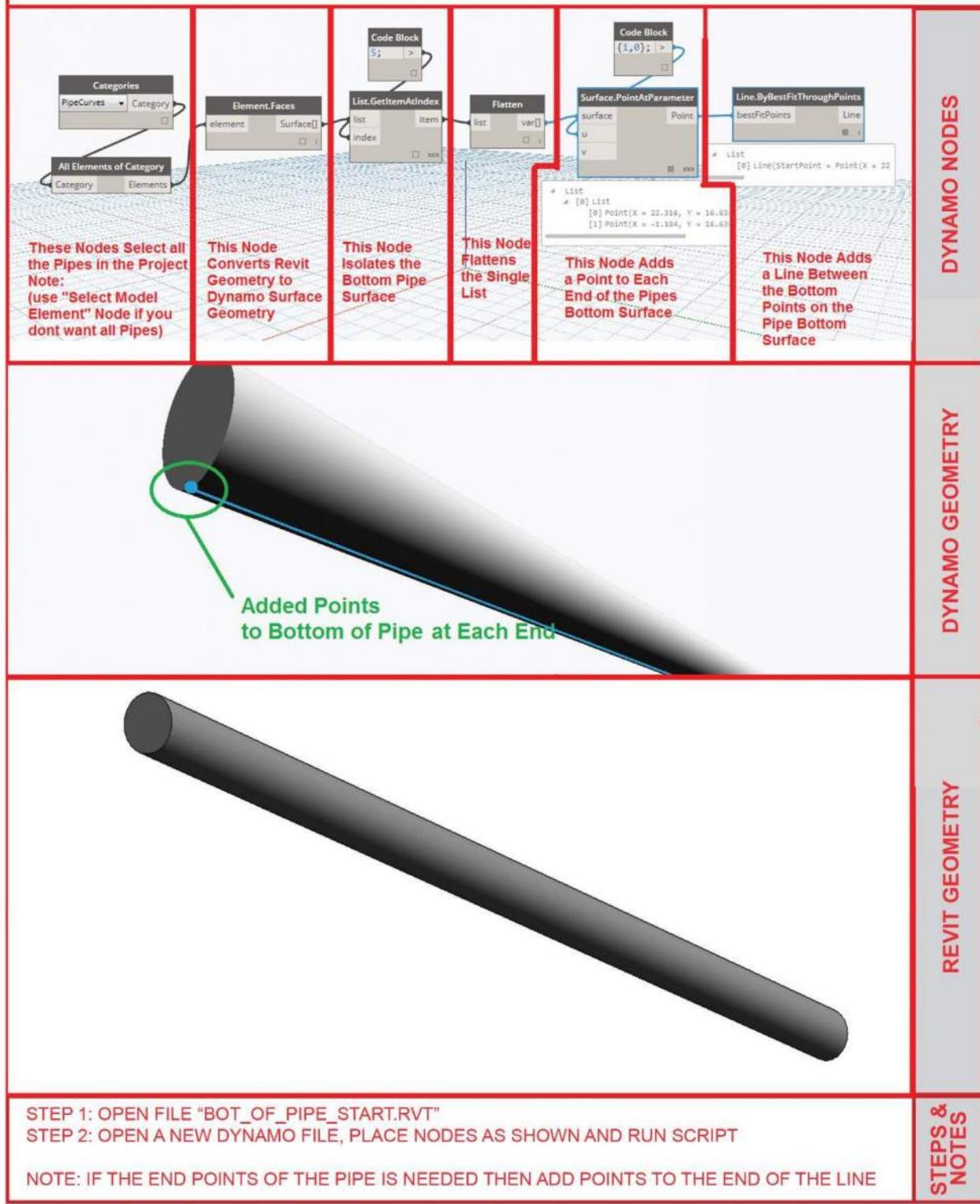
NOTE: IF YOU CHANGE THE NAME OF THE FIRST GRID NUMBER
DYNAMOBIM WILL AUTO RENumber GRIDS!

STEP 1: OPEN FILE "GRIDS_START.RVT"
STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT

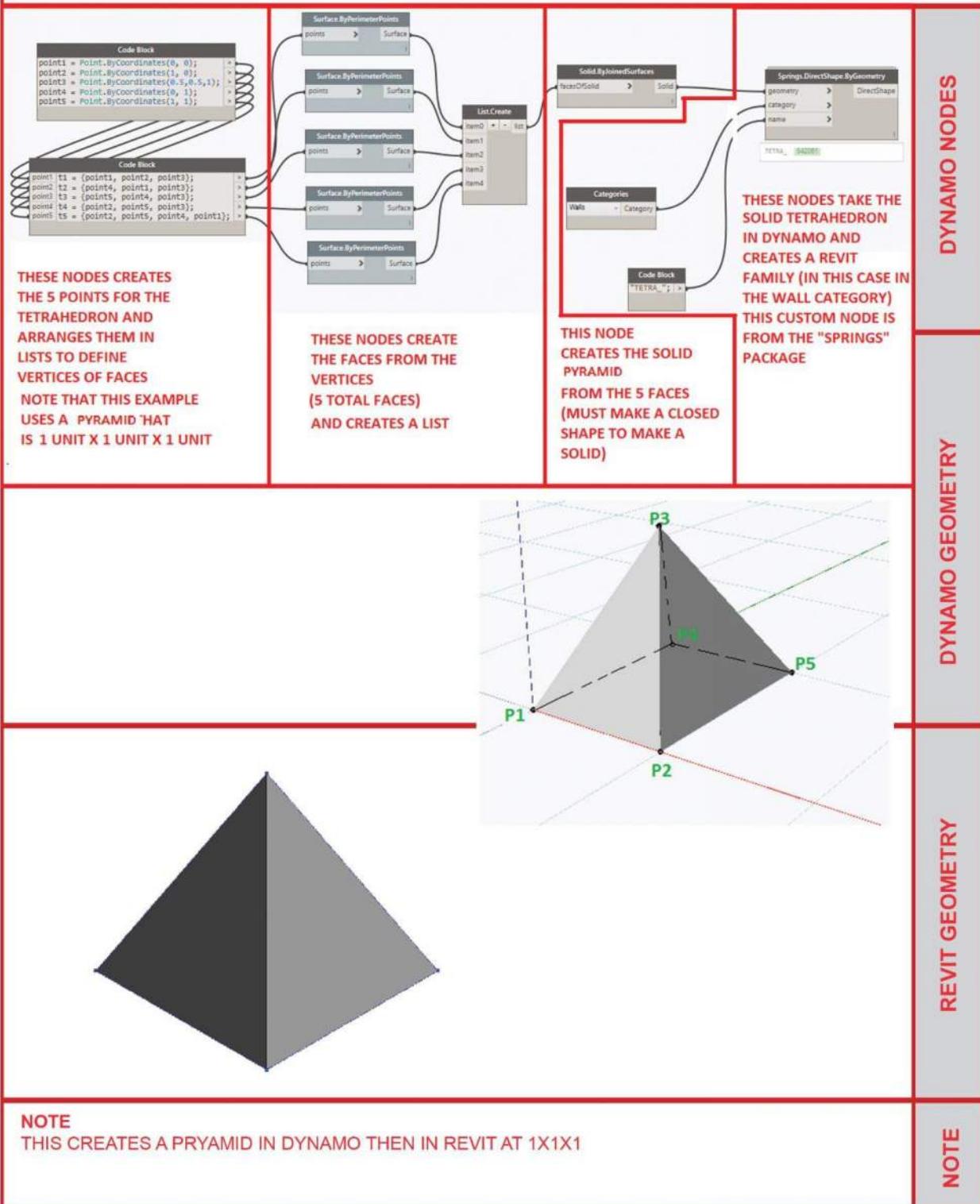
NOTE: DESIGN SCRIPTS ARE USED TO RANGED EXPRESSIONS IN METHOD ABOVE

STEPS &
NOTES

BOTTOM OF PIPE



REVIT 4 SIDED PYRAMID

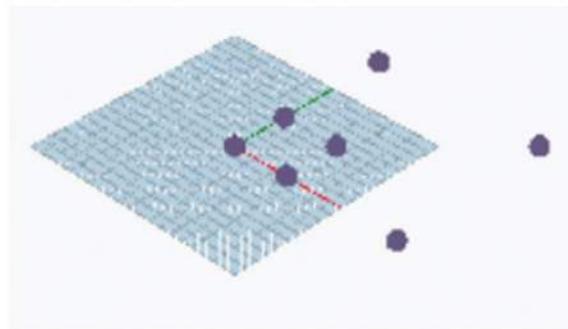


DYNAMO AND REVIT POINTS W/ SCALE VIA DESIGN SCRIPT

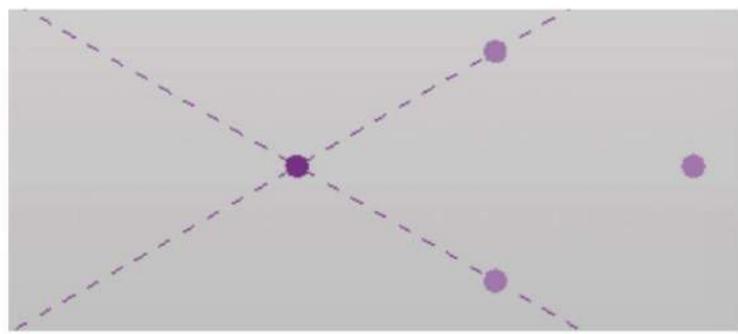
Code Block

```
p1=Autodesk.Point.ByCoordinates(0,0); >
p2=Autodesk.Point.ByCoordinates(0,25); >
p3=Autodesk.Point.ByCoordinates(25,25); >
p4=Autodesk.Point.ByCoordinates(25,0); >
points={p1,p2,p3,p4};
scaledpoints=points.Scale(3);
ReferencePoint.ByPoint(scaledpoints); >
```

DYNAMO NODES



DYNAMO GEOMETRY

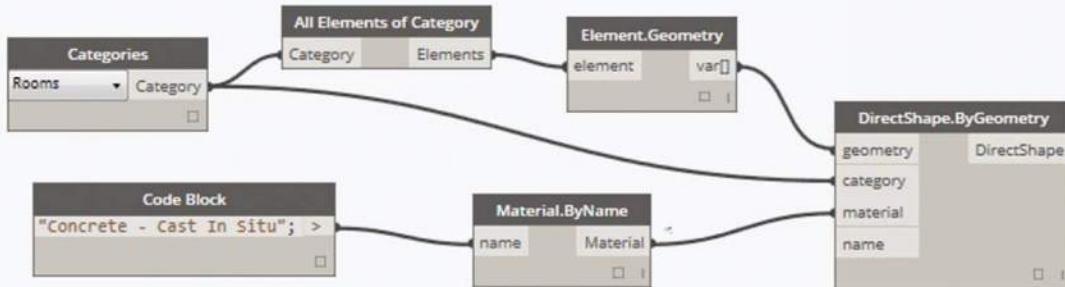


REVIT GEOMETRY

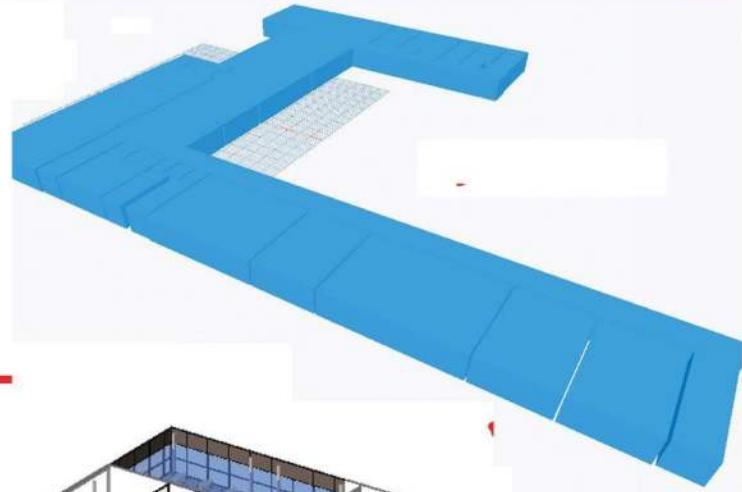
STEP 1: OPEN A NEW MASS FAMILY TEMPLATE
STEP 2: OPEN A NEW DYNAMO GRAPH AND ADD NODES AND RUN
NOTE: THIS CREATES DYNAMO POINTS AND SCALES 3X AND CREATES REVIT REFERENCE POINTS
IN THE MASSING EDITOR AT 3X SCALE

STEPS &
NOTES

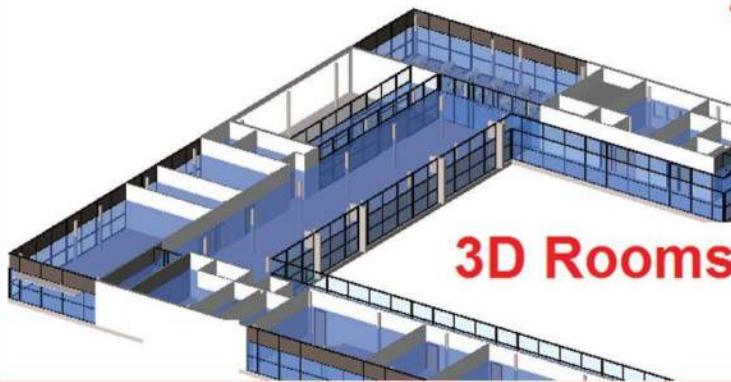
REVIT 3D ROOMS VIA DIRECT SHAPE



DYNAMO NODES



DYNAMO GEOMETRY

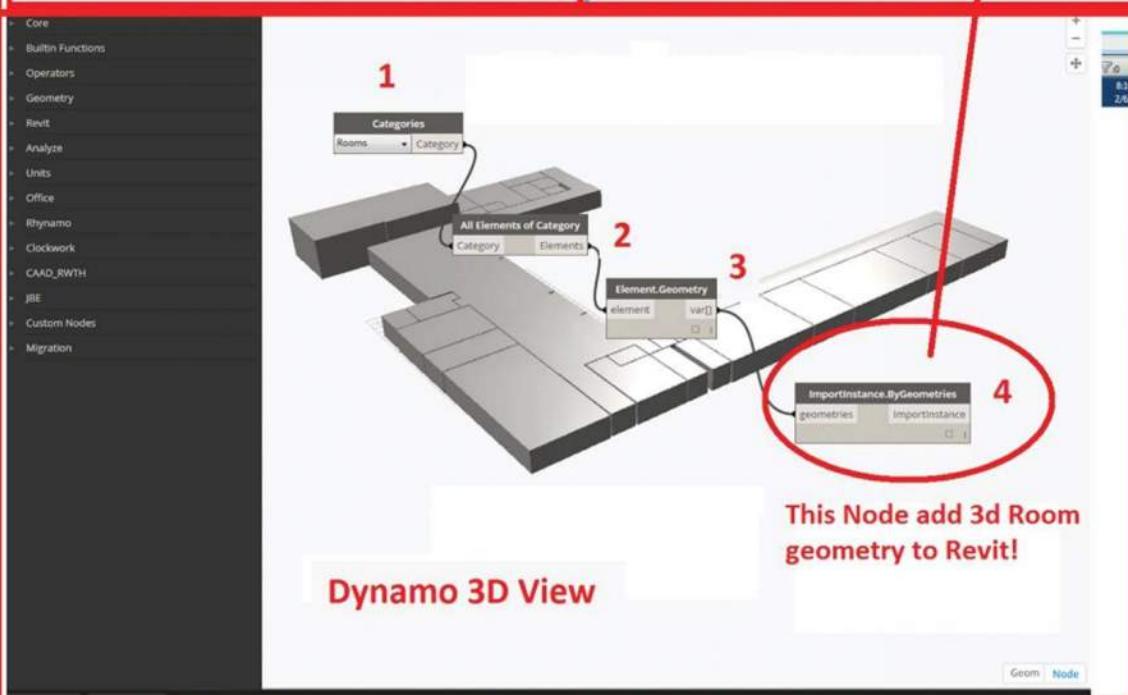
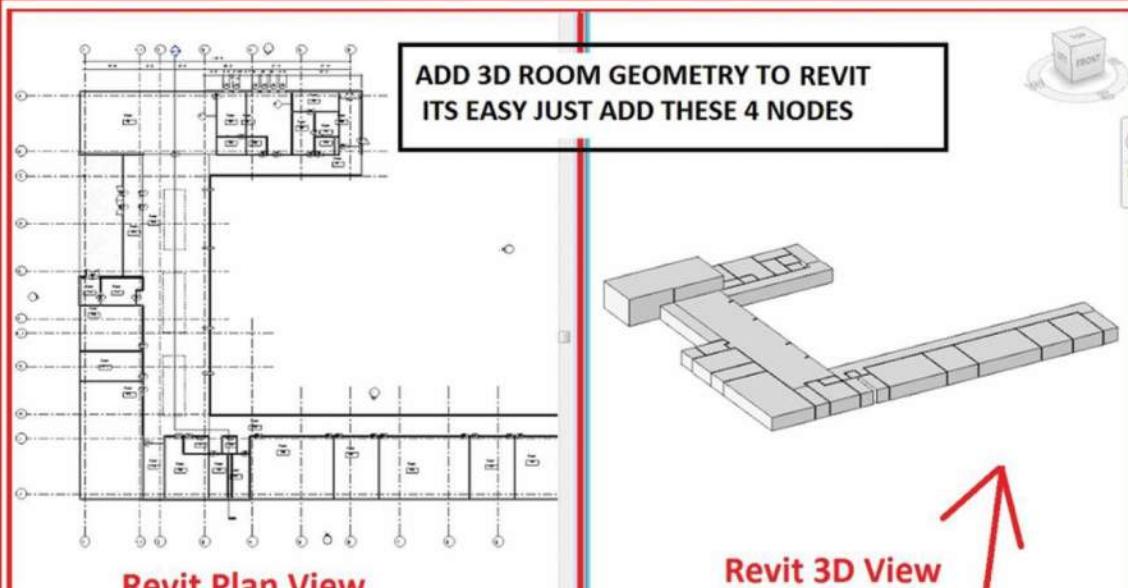


REVIT GEOMETRY

STEP 1: OPEN REVIT SAMPLE PROJECT "rac_advanced_sample_project.rvt"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: ROOMS IN REVIT ARE 2D ELEMENTS, THIS METHOD CONVERTS THE ROOMS TO 3D
 ALSO THERE ARE MANY OTHER METHODS TO GET DYNAMO GEOMETRY INTO REVIT

STEPS &
NOTES

REVIT 3D ROOMS VIA IMPORT INSTANCE



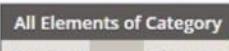
STEP 1: OPEN REVIT SAMPLE PROJECT "rac_advanced_sample_project.rvt"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: ROOMS IN REVIT ARE 2D ELEMENTS, THIS METHOD CONVERTS THE ROOMS TO 3D
 ALSO THERE ARE MANY OTHER METHODS TO GET DYNAMO GEOMETRY INTO REVIT

STEPS &
NOTES

VIEW REVIT 3D MEP SPACES IN DYNAMO



This node select the MEP space category



This node select ALL MEP space instances in Revit



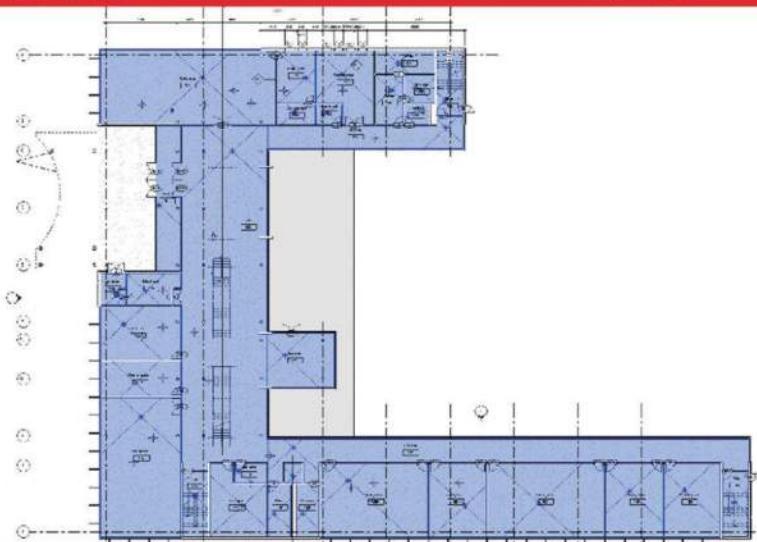
This node Converts MEP spaces to 3D Solids in Dynamo!

DYNAMO NODES



NOTE:
This Dynamo Graph
only converts Revit MEP
spaces to 3D Dynamo
Geometry. It does not add 3D
Spaces to Revit. IE Revit does
not change

DYNAMO GEOMETRY

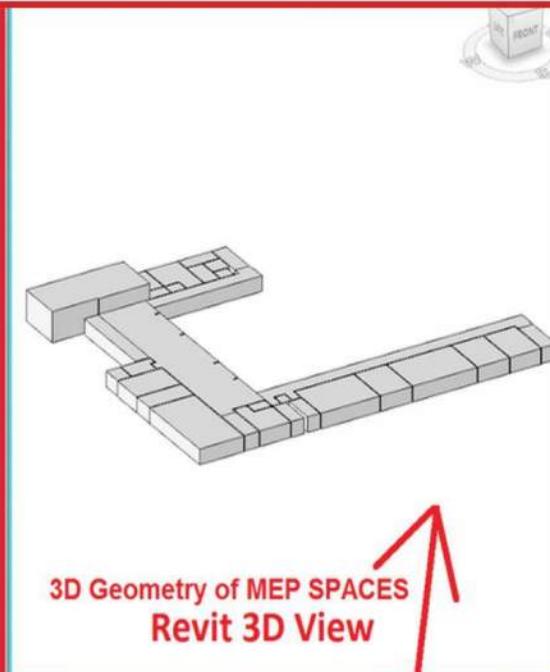
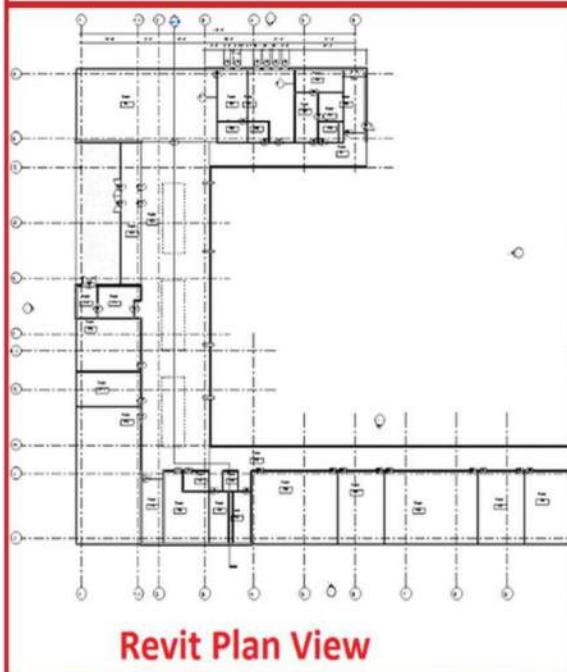


REVIT GEOMETRY

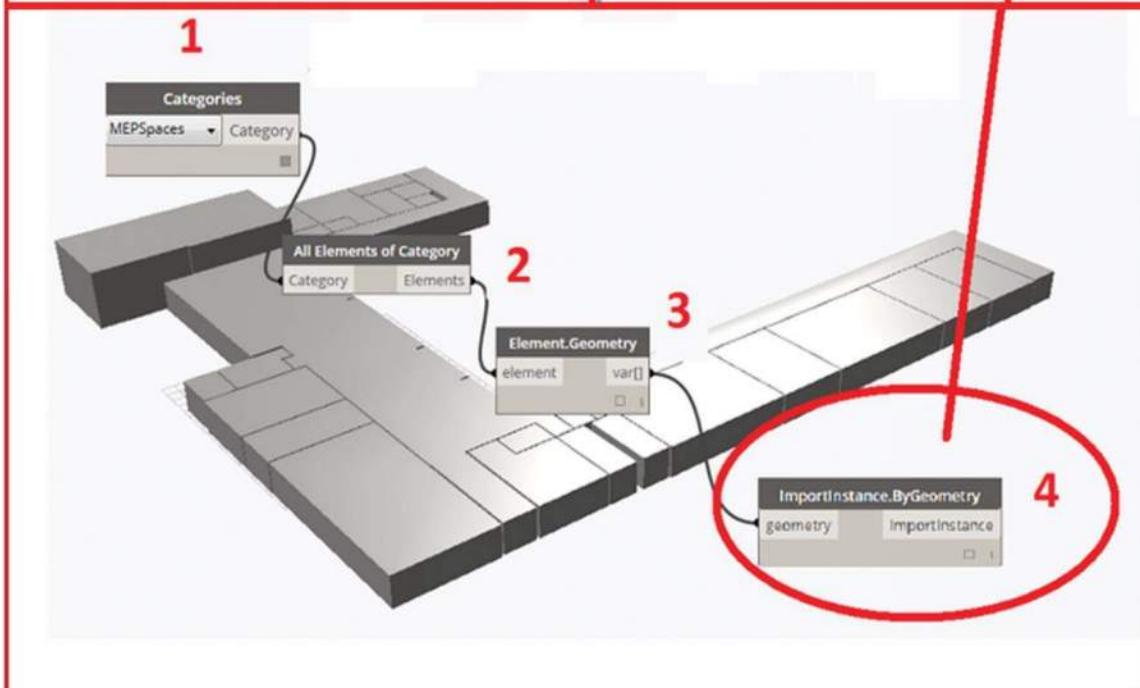
STEP 1: OPEN REVIT SAMPLE PROJECT "rac_advanced_sample_project.rvt"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: MEP SPACES IN REVIT ARE 2D ELEMENTS, THIS METHOD CONVERTS THE ROOMS TO 3D ELEMENTS IN DYNAMO ONLY

STEPS &
NOTES

REVIT 3D MEP SPACES VIA IMPORT INSTANCE



REVIT GEOMETRY

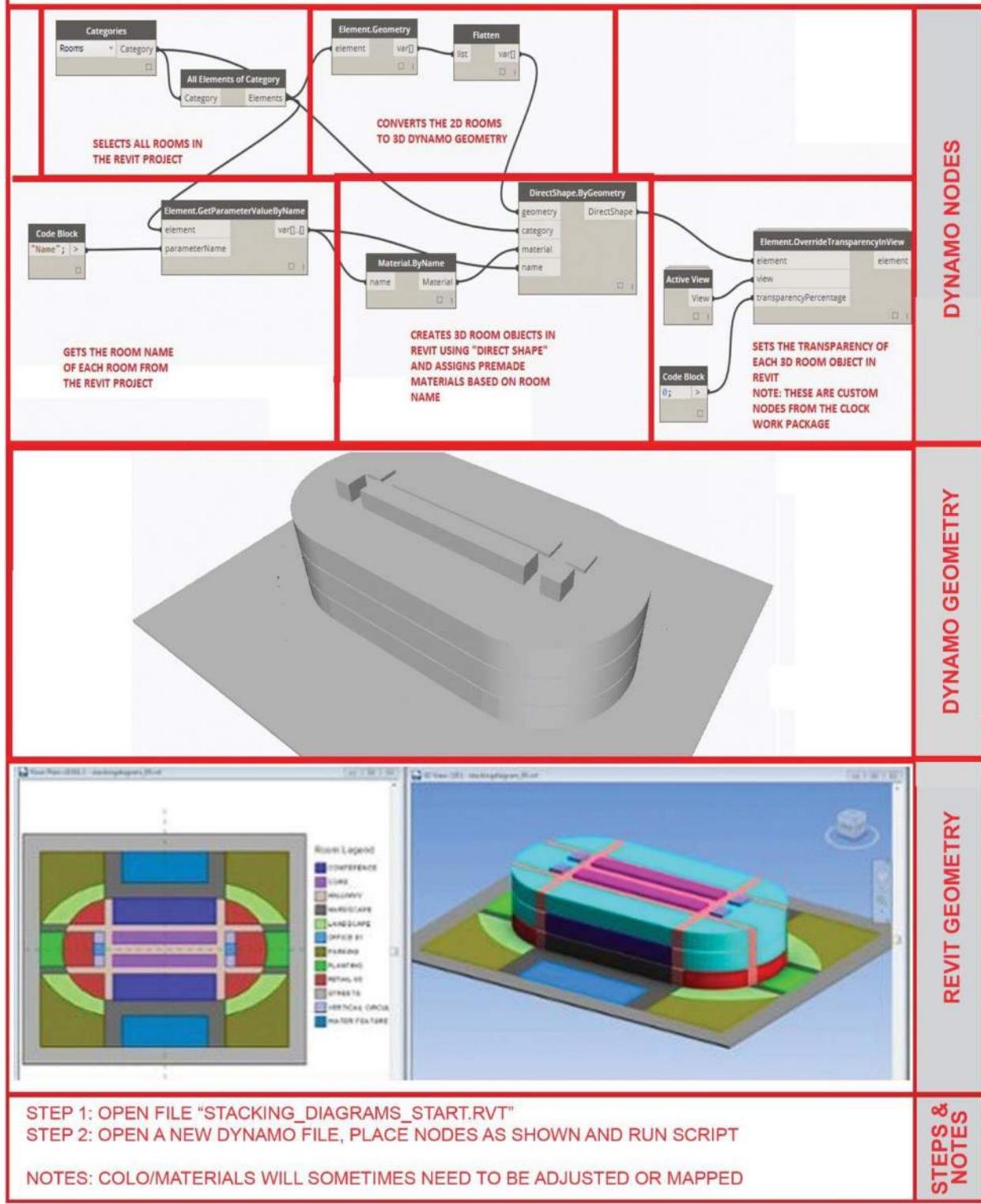


DYNAMO GEOMETRY AND NODES

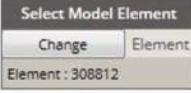
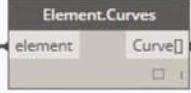
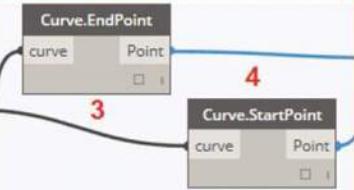
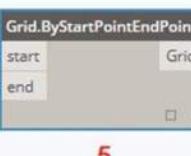
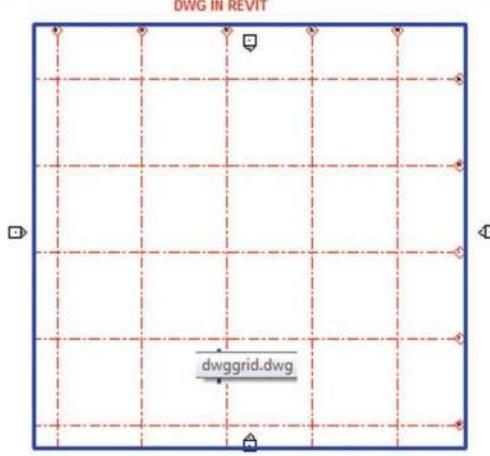
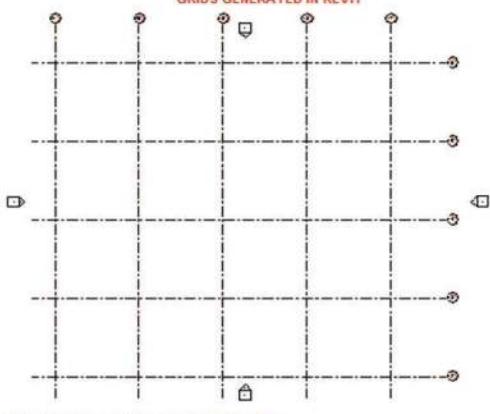
STEP 1: OPEN REVIT SAMPLE PROJECT "rac_advanced_sample_project.rvt"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: MEP SPACES IN REVIT ARE 2D ELEMENTS, THIS METHOD CONVERTS THE ROOMS TO 3D
 ALSO THERE ARE MANY OTHER METHODS TO GET DYNAMO GEOMETRY INTO REVIT

STEPS &
NOTES

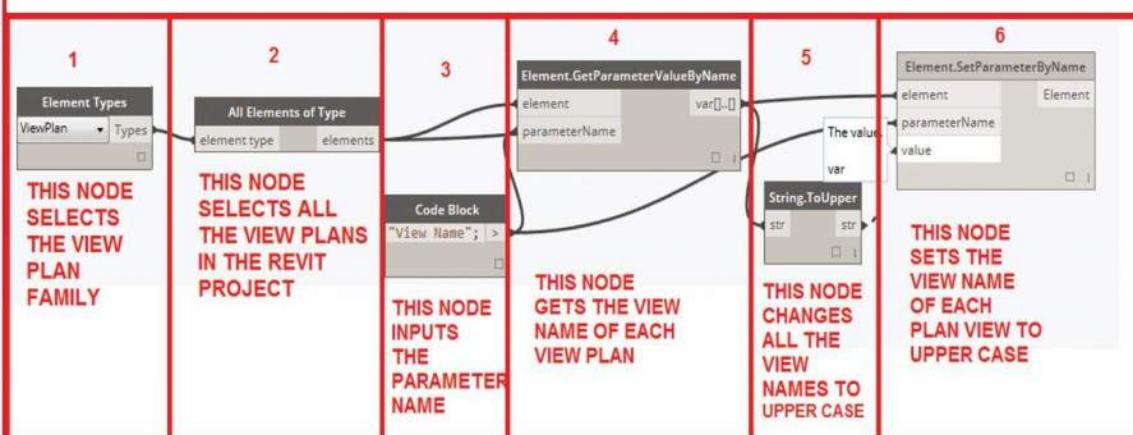
STACKING DIAGRAMS USING 3D ROOMS



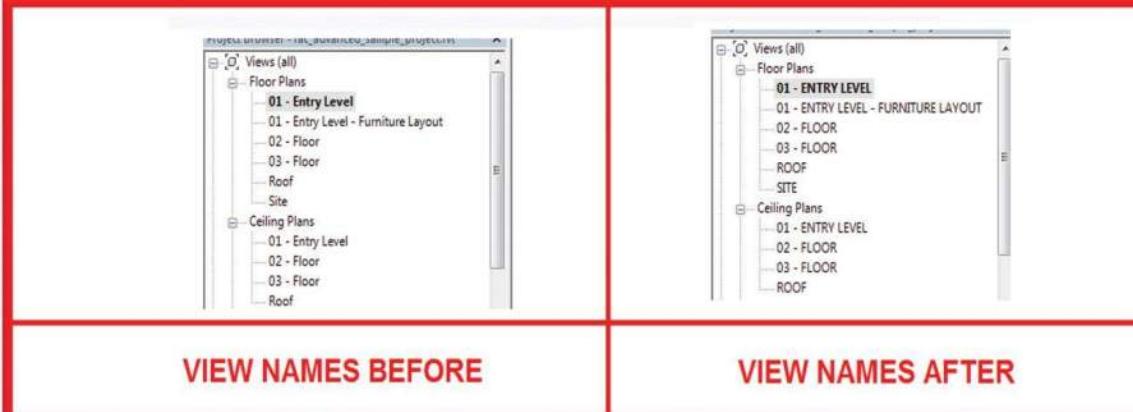
DWG TO GRID

<p>1 </p> <p>This node selects the DWG</p>	<p>2 </p> <p>This node changes the DWG into Dynamo Curves</p>	<p>3 </p> <p>These nodes extract the start and the end points of the Dynamo Curves</p>	<p>4 </p> <p>This node creates grids in REVIT based on start and end points</p>	<p>DYNAMO NODES</p>
 <p>DWG IN REVIT</p>	 <p>GRIDS GENERATED IN REVIT</p>			<p>REVIT GEOMETRY</p>
<p>STEP 1: OPEN FILE "DWG_TO_GRID_START.RVT" STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN STEP 3: LINK "DWG_GRID.DWG" INTO REVIT AND SELECT WITH "SELECT" NODE NOTES: ISOLATE LAYERS IN DWG BEFORE LINKING REVIT AND TRY TO CREATE OTHER ELEMENTS</p>				<p>STEPS & NOTES</p>

TEXT TO UPPERCASE PLAN VIEW NAMES START



DYNAMO NODES

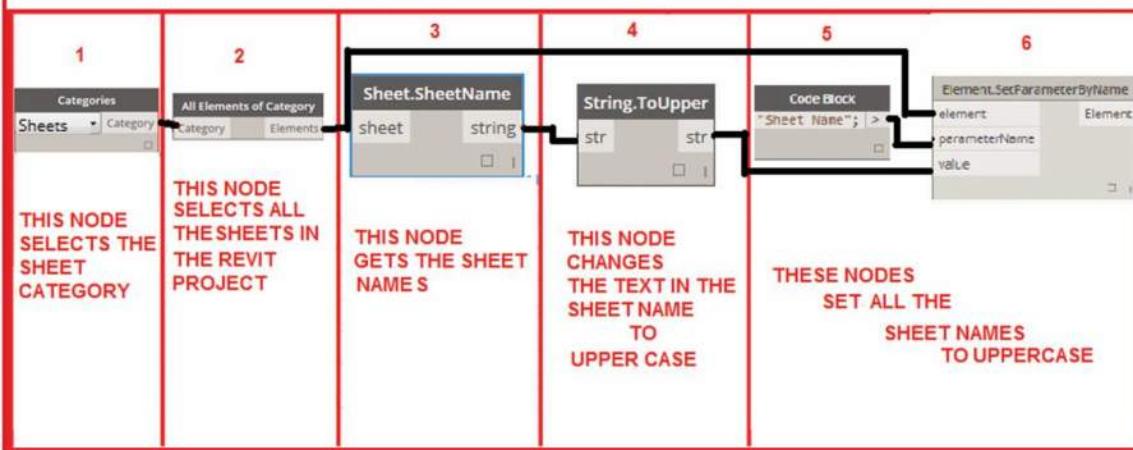


REVIT VIEW BROWSER

STEP 1: OPEN REVIT SAMPLE PROJECT "TEXT_TO_UPPERCASE_PLAN_VIEW_NAMES_START.RVT"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: THE METHOD ABOVE WORKS WELL WHEN CHANGING MANY VIEW NAMES TO UPPERCASE

STEPS &
NOTES

TEXT TO UPPERCASE SHEET NAMES

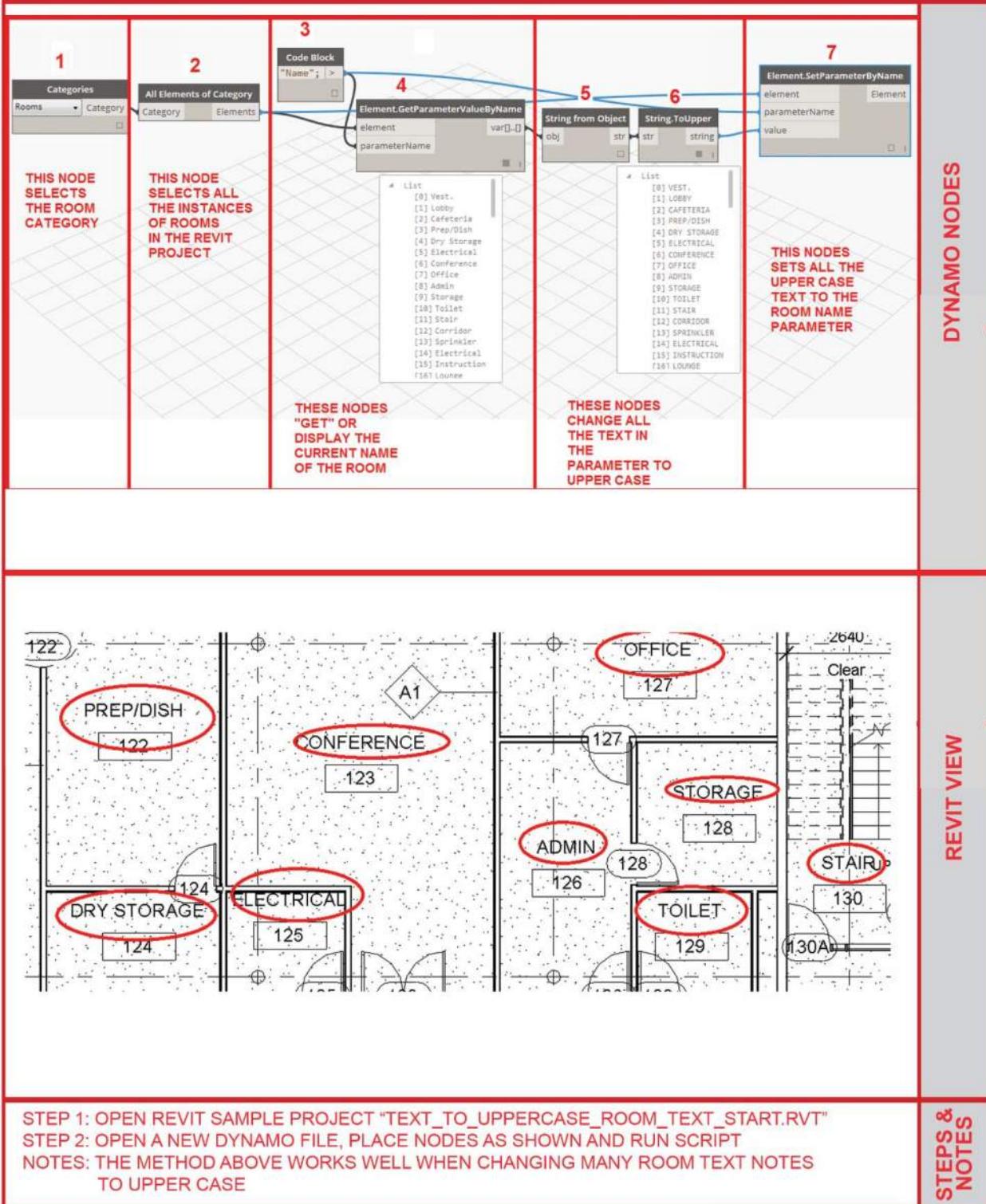


REVIT VIEW BROWSER

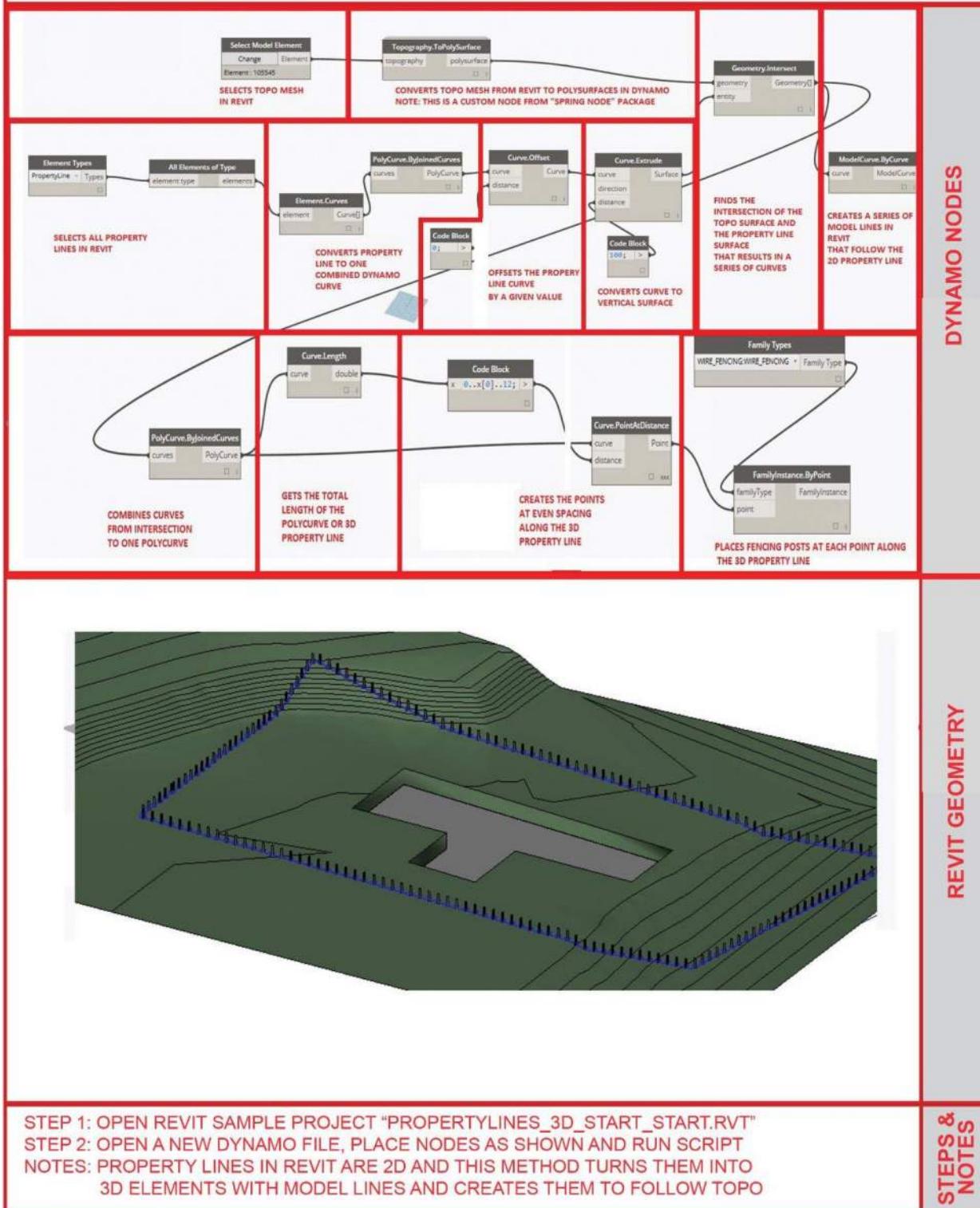
STEP 1: OPEN REVIT SAMPLE PROJECT "TEXT_TO_UPPERCASE_SHEET_NAMES_START.RVT"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: THE METHOD ABOVE WORKS WELL WHEN CHANGING MANY SHEET NAMES TO UPPERCASE

STEPS &
NOTES

TEXT TO UPPERCASE SHEET NAMES



CREATE PROPERTY LINES ON TOPO IN 3D



CREATE PIPING ON TOPO IN 3D

The diagram illustrates a custom dataset node in a Dynamo script. It starts with a 'Select Model Element' node, followed by 'Topography.ToPolySurface' and 'Geometry.Intersects' nodes. The output of 'Geometry.Intersects' feeds into a 'Code Block' node. This is followed by 'Element.Curves', 'Curve.Length', 'Curve.PointAtDistance', 'Code Block', 'Geometry.Translate', and 'Line.ByStartPointEndPoint' nodes. The final output is processed through 'PlatForm', 'Code Block', 'List.DropItems', 'List.RestOfItems', 'Levels', 'Element Types', 'All Elements of Type', 'Code Block', and 'PIPE.CreatePipe' nodes.

CUSTOM NODE IN DATASET

DYNAMO NODES

The screenshot shows a Revit 3D view of a terrain model with a blue pipe network. On the left, the Revit ribbon interface is visible, showing the 'Project Browser' with items like '03 - Floor', 'Roof', 'Site', 'Ceiling Plans', and '3D Views'. A 'Properties' panel is open on the left, showing settings for a 'Default' pipe type, including 'Horizontal Justification: Center', 'Vertical Justification: Middle', and 'Reference Level: 01 - Entry Level'.

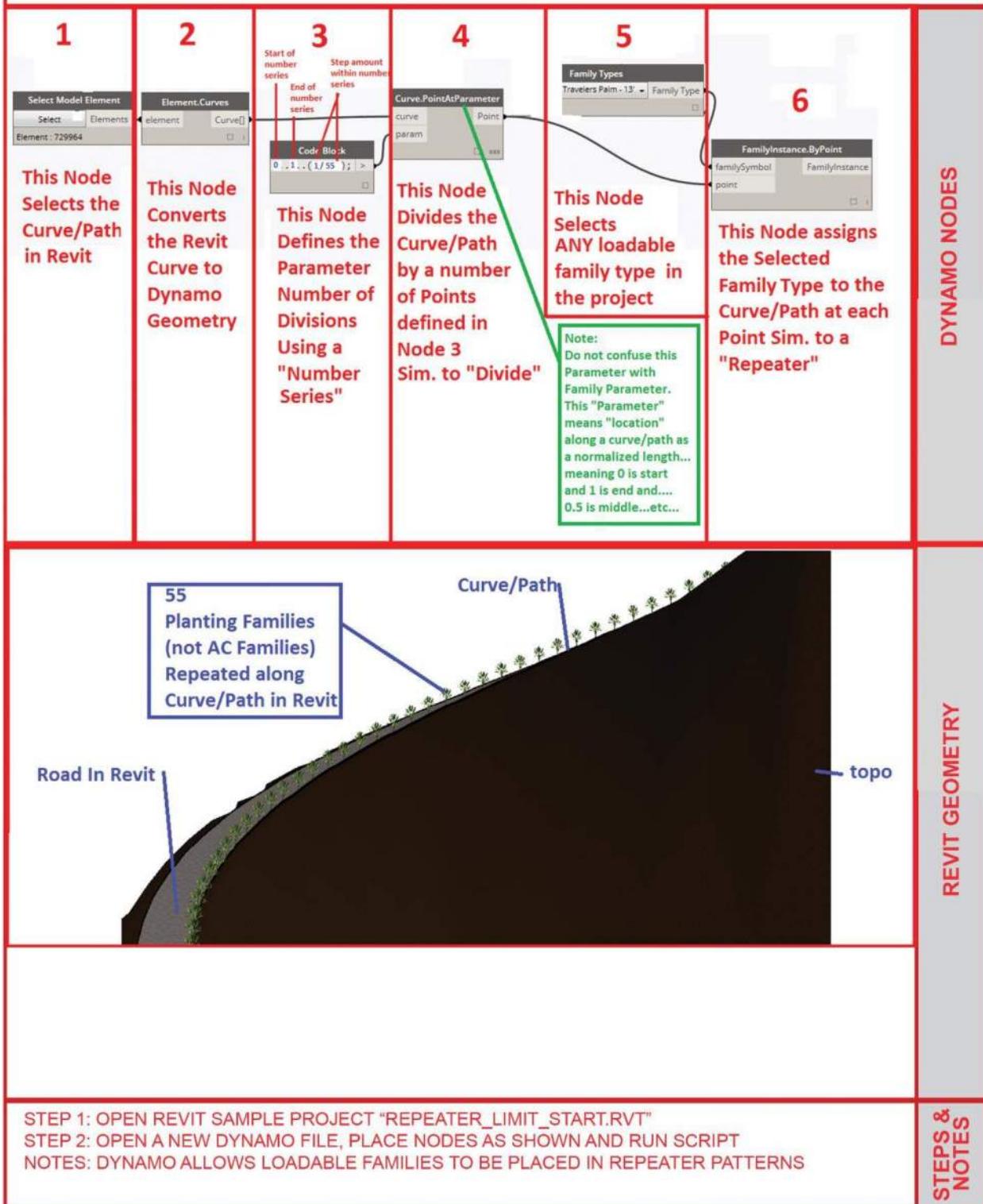
REVIT GEOMETRY

STEP 1: OPEN REVIT SAMPLE PROJECT "PIPE_TOPO_START.RVT"
 STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT
 NOTES: THIS METHOD PLACES MODEL LINES ON TOPO AND CREATES MEP PIPING

STEPS & NOTES

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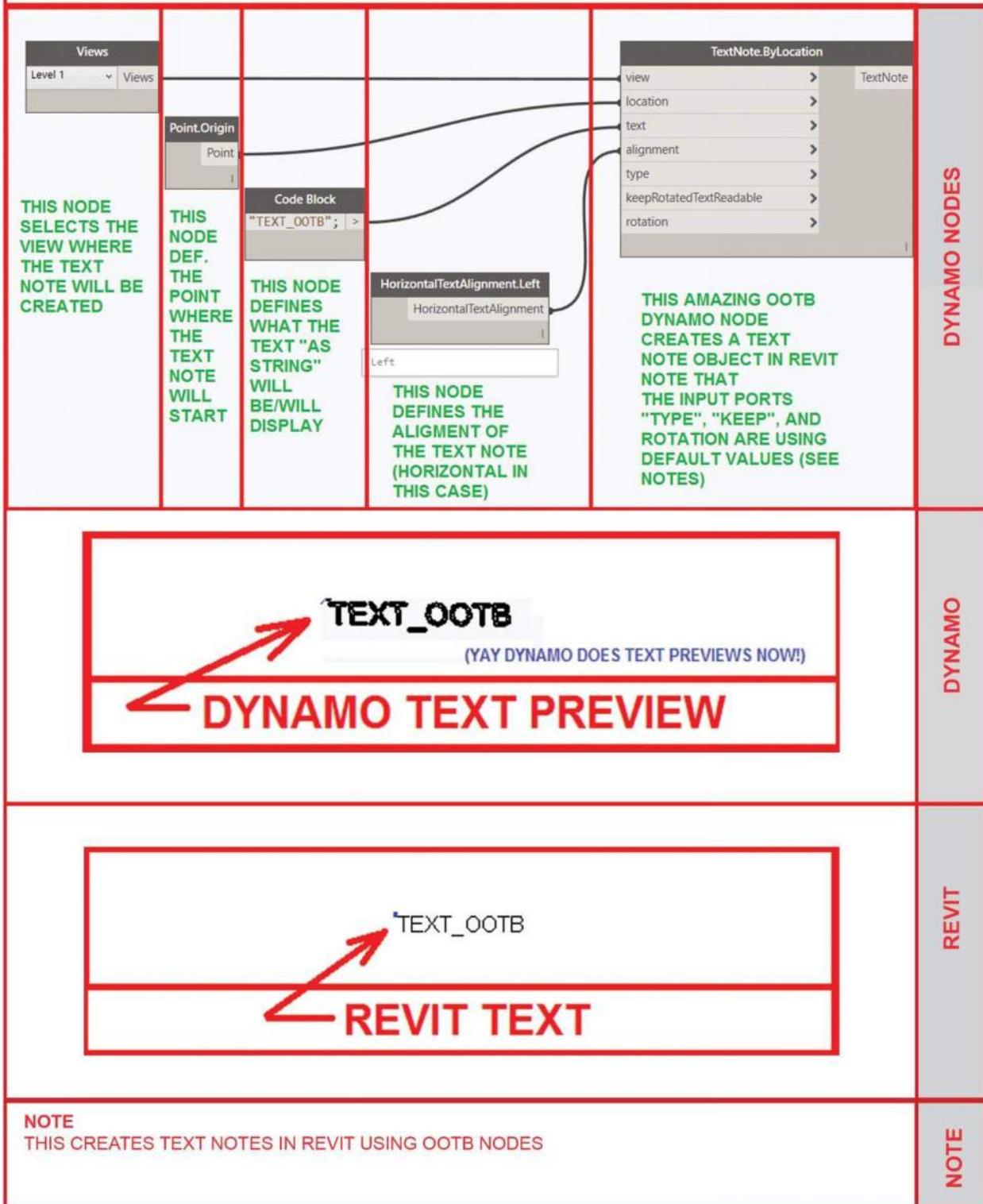
REPEAT A LOADABLE FAMILY NOT AC



DIVIDE A PATH GREATER THAN 200 LIMIT FROM REVIT

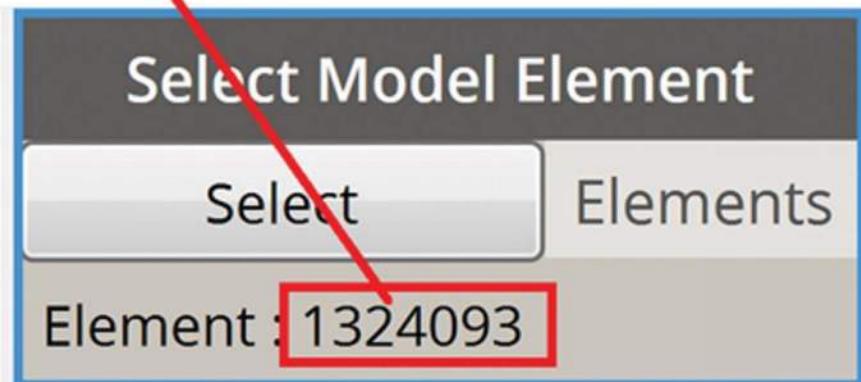
<p>1</p> <p>This Node Selects the Curve/Path in Revit</p>	<p>2</p> <p>This Node Converts the Revit Curve to Dynamo Geometry</p>	<p>3</p> <p>This Node Defines the Parameter Number of Divisions Using a "Number Series"</p>	<p>4</p> <p>This Node Divides the Curve/Path by a number of Points defined in Node 3 Sim. to "Divide"</p>	<p>5</p> <p>This Node Selects the Adaptive Component Family Type</p> <p>Note: Do not confuse this Parameter with Family Parameter. This "Parameter" means "location" along a curve/path as a normalized length... meaning 0 is start and 1 is end and.... 0.5 is middle...etc....</p>	<p>6</p> <p>This Node assigns the Adaptive Component to the Curve/Path at each Point Sim. to a "Repeater"</p>	<p>DYNAMO NODES</p>
<p>300 Adaptive Component "posts" "Repeated" along a Curve/Path in Revit</p> <p>Road In Revit</p> <p>Curve/Path</p>						<p>REVIT GEOMETRY</p>
<p>STEP 1: OPEN REVIT SAMPLE PROJECT "REPEATER_LIMIT_300_START.RVT" STEP 2: OPEN A NEW DYNAMO FILE, PLACE NODES AS SHOWN AND RUN SCRIPT NOTES: DYNAMO ALLOWS LOADABLE FAMILIES TO BE PLACED IN REPEATER PATTERNS GREATER THAN THE LIMIT OF REVIT DIVIDED PATH AND ARRAY</p>						<p>STEPS & NOTES</p>

TEXT NOTES



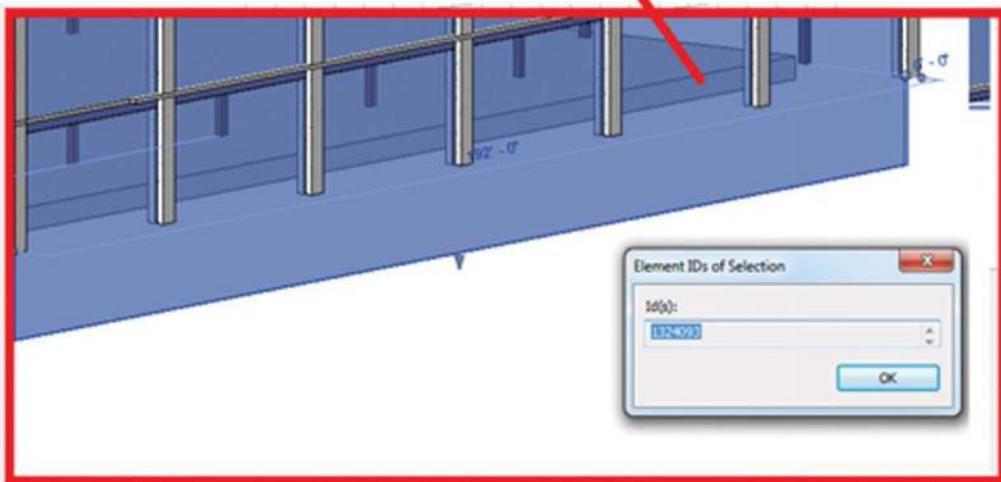
HOW DYNAMO SELECTS REVIT ELEMENTS

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



DYNAMO NODES

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

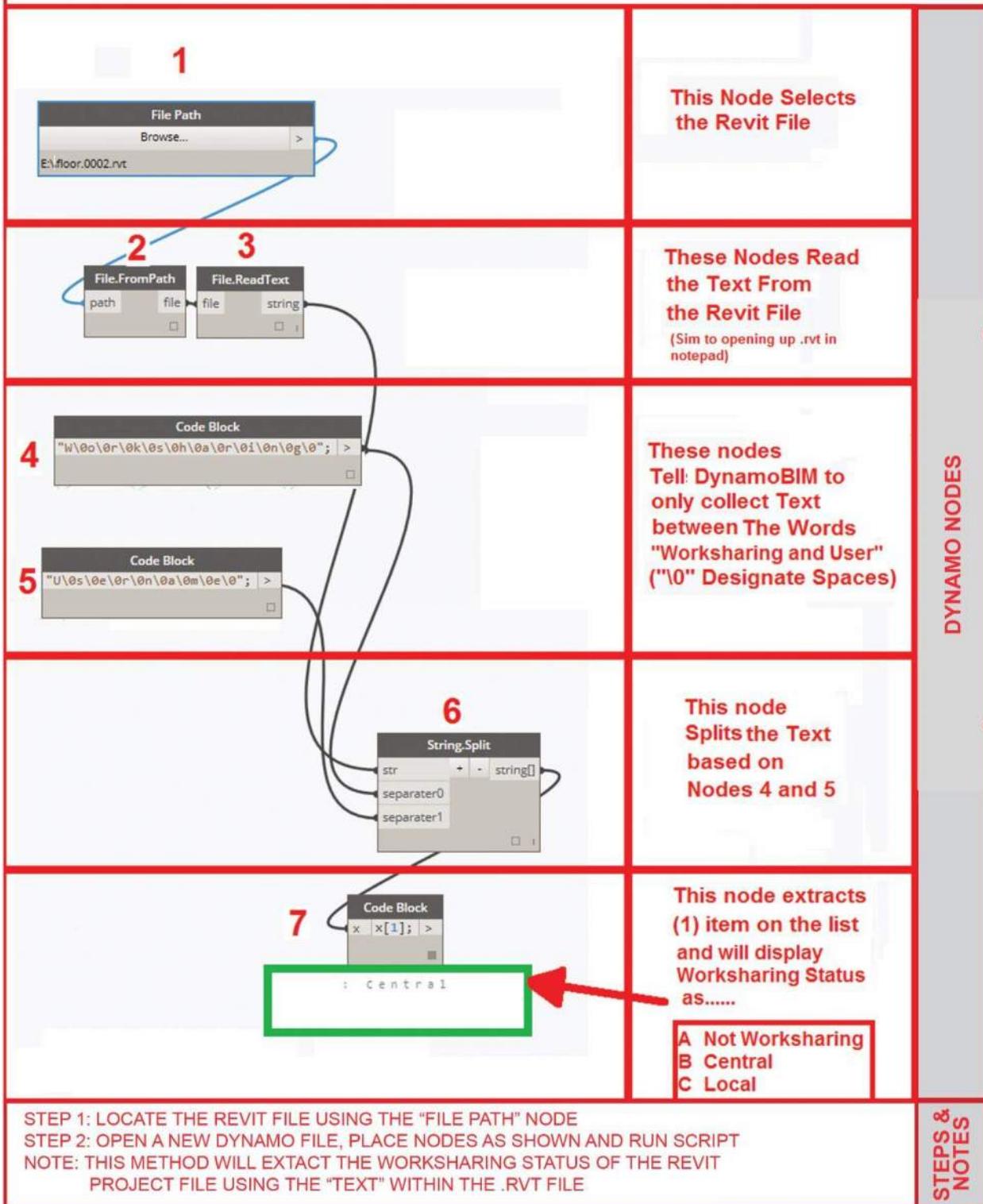


REVIT GEOMETRY

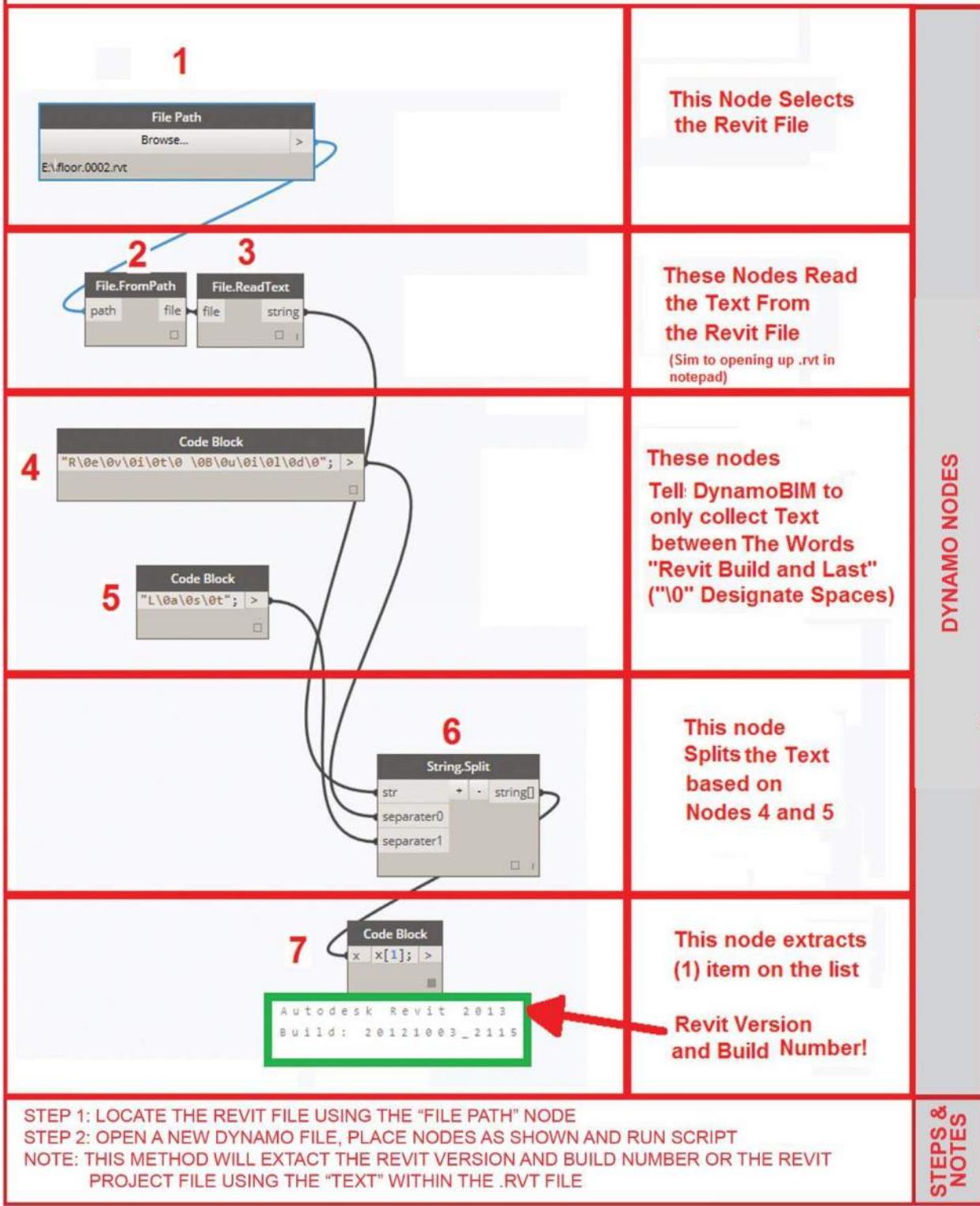
NOTE: THIS SHOWS HOW DYNAMO SELECTS REVIT ELEMENTS, ONCE THE REVIT ID IS DISPLAYED IN DYNAMO THEN DYNAMO HAS SELECTED THE REVIT ELEMENT

STEPS &
NOTES

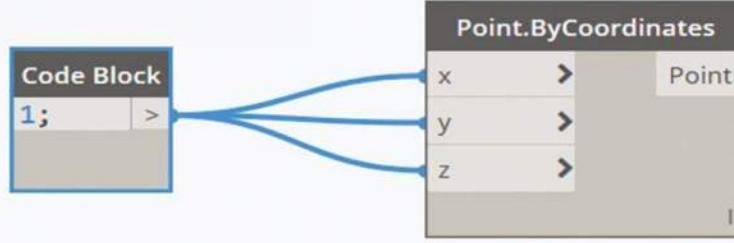
GET WORKSHARING STATUS OF REVIT



GET REVIT VERSION AND BUILD



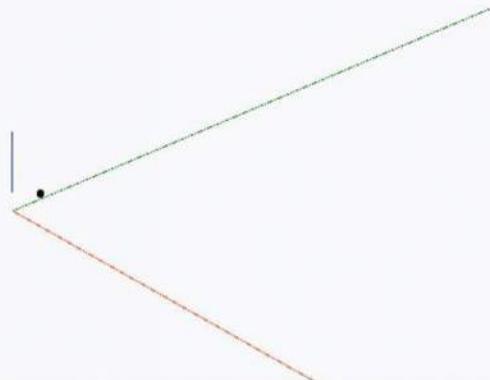
DYNAMO POINT



ADD A "DOUBLE" OR
NUMBER TO THE
INPUT PORT

CREATES A DYNAMO POINT
IN DYNAMO AT 1,1,1

DYNAMO NODES



DYNAMO GEOMETRY

NOTE

THIS CREATES A DYNAMO POINT AT X,Y,Z BY DEFAULT (NO DATA ENTERED INTO THE INPUT PORTS)
THEN THE POINT WOULD BE CREATED AT 0,0,0
ALSO NOTE THIS IS NOT!!!! REVIT GEOMETRY (NO REVIT POINTS WERE CREATED!)

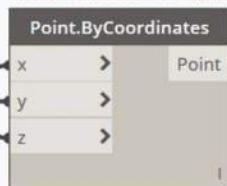
NOTE

DYNAMO LINE BY START AND END PTS

ADD A "DOUBLE" OR NUMBER TO THE INPUT PORT



CREATES A DYNAMO POINT IN DYNAMO AT 1,1,1

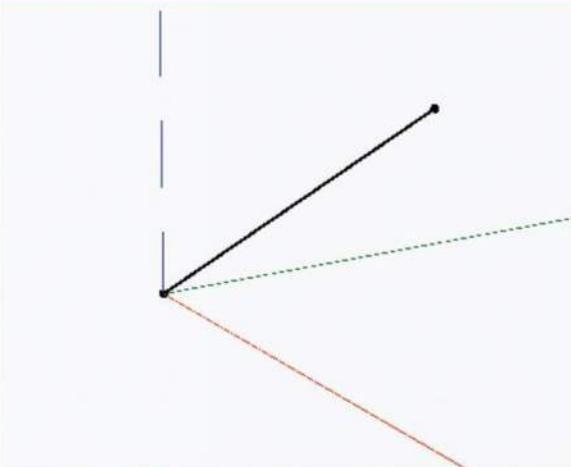


CREATES A DYNAMO POINT IN DYNAMO AT 0,0,0

CREATES A DYNAMO LINE BY START AND END PTS



DYNAMO NODES



DYNAMO GEOMETRY

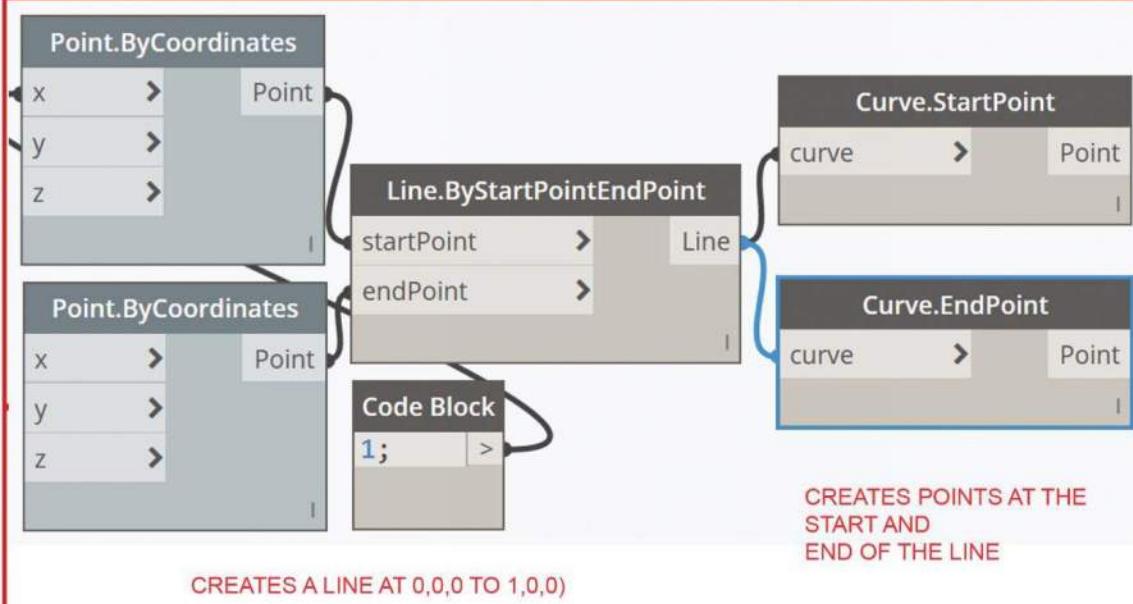
NOTE

THIS CREATES A DYNAMO LINE BY END POINTS, AND THERE ARE OTHER WAYS TO CREATE A LINE
DYNAMO REFERS TO STRAIGHT CURVES AS LINES (THEREFORE LINES ARE CURVES)
ALSO NOTE THIS IS NOT REVIT GEOMETRY

REVIT GEOMETRY

NOTE

CURVES : START AND END POINTS



DYNAMO NODES

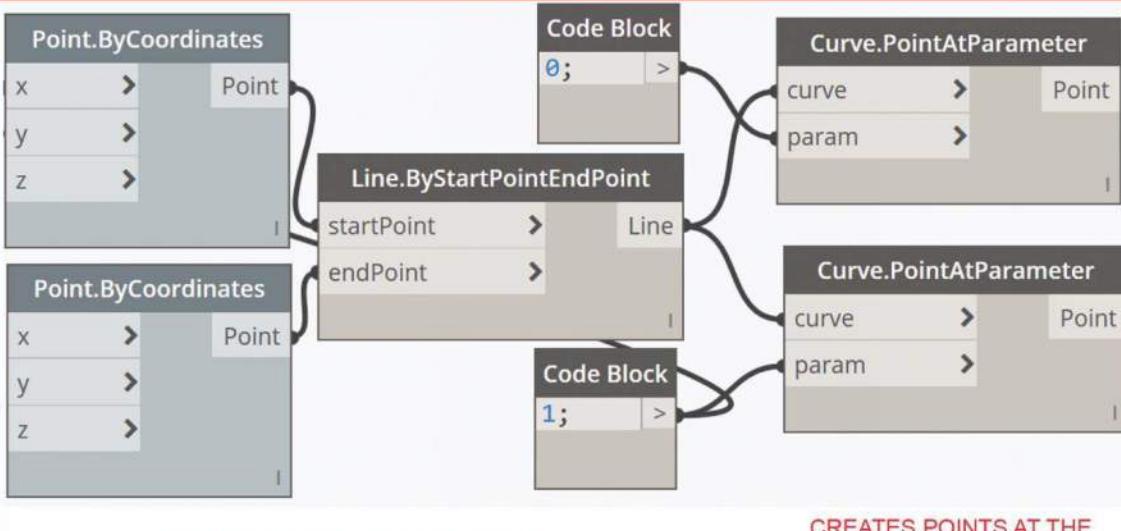
DYNAMO GEOMETRY

NOTE

A LINE IS A CURVE AND THEREFORE ALL "LINE" OUTPUT PORTS COULD BE CONNECTED INTO A "CURVE" INPUT PORT

NOTE

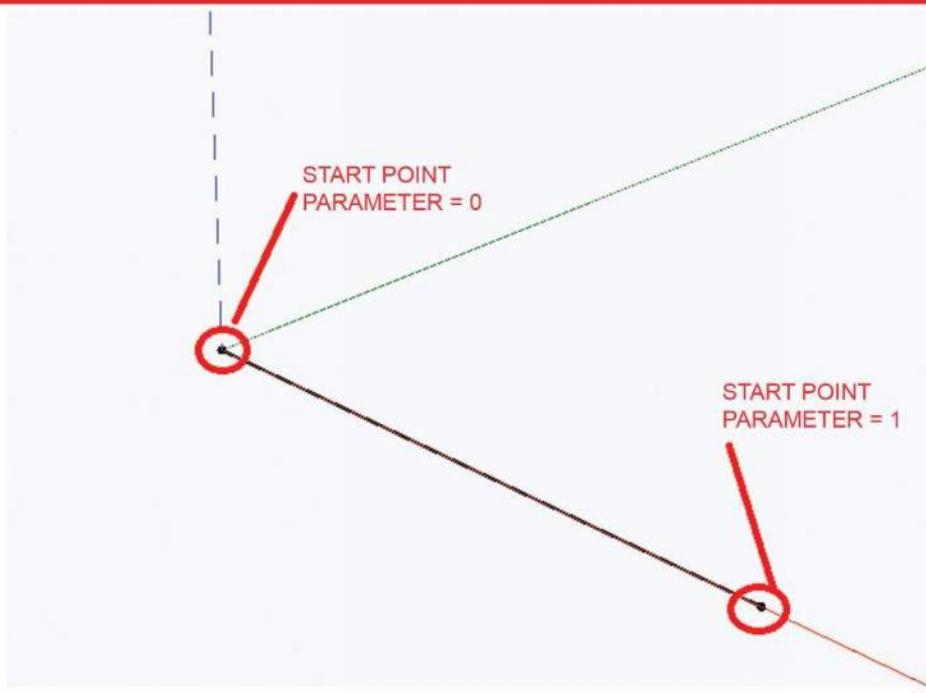
CURVES : START AND END POINTS USING PARAMETERS



CREATES A LINE AT 0,0,0 TO 1,0,0

CREATES POINTS AT THE
START AND
END OF THE LINE
USING PARAMETER
0,1

DYNAMO NODES



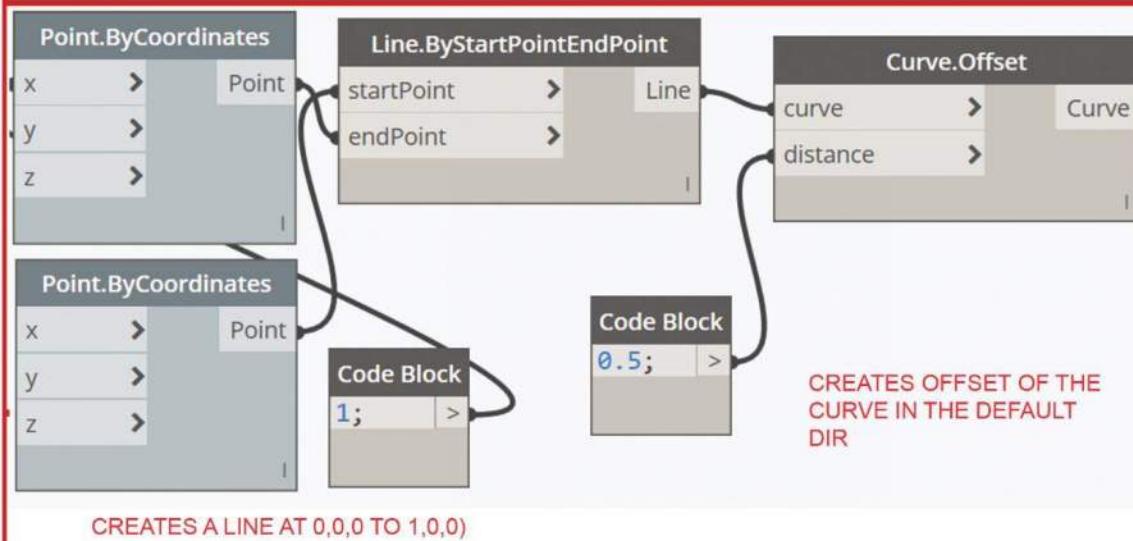
DYNAMO GEOMETRY

NOTE

A LINE IS A CURVE AND THEREFORE ALL "LINE" OUTPUT PORTS COULD
BE CONNECTED INTO A "CURVE" INPUT PORT
PARAMETER IS A VALUE FROM 0 TO 1 (START AND END) 0 = END (FOR EXAMPLE)

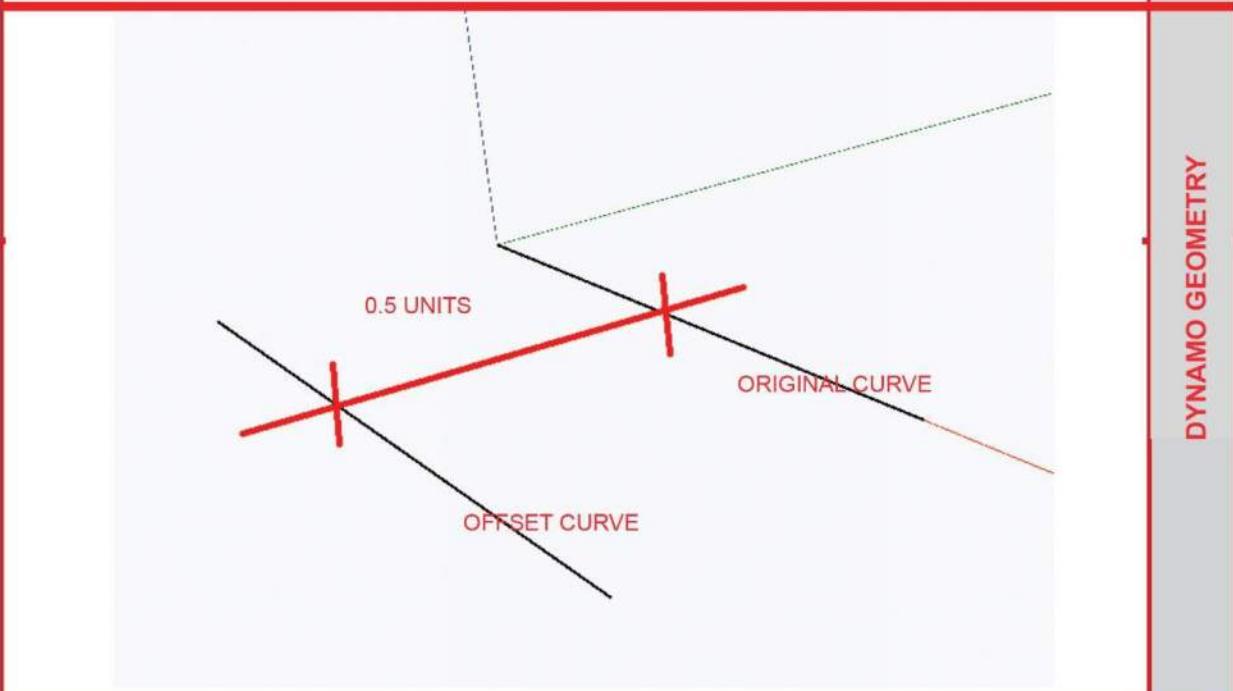
NOTE

CURVES : OFFSET



CREATES A LINE AT 0,0,0 TO 1,0,0

DYNAMO NODES



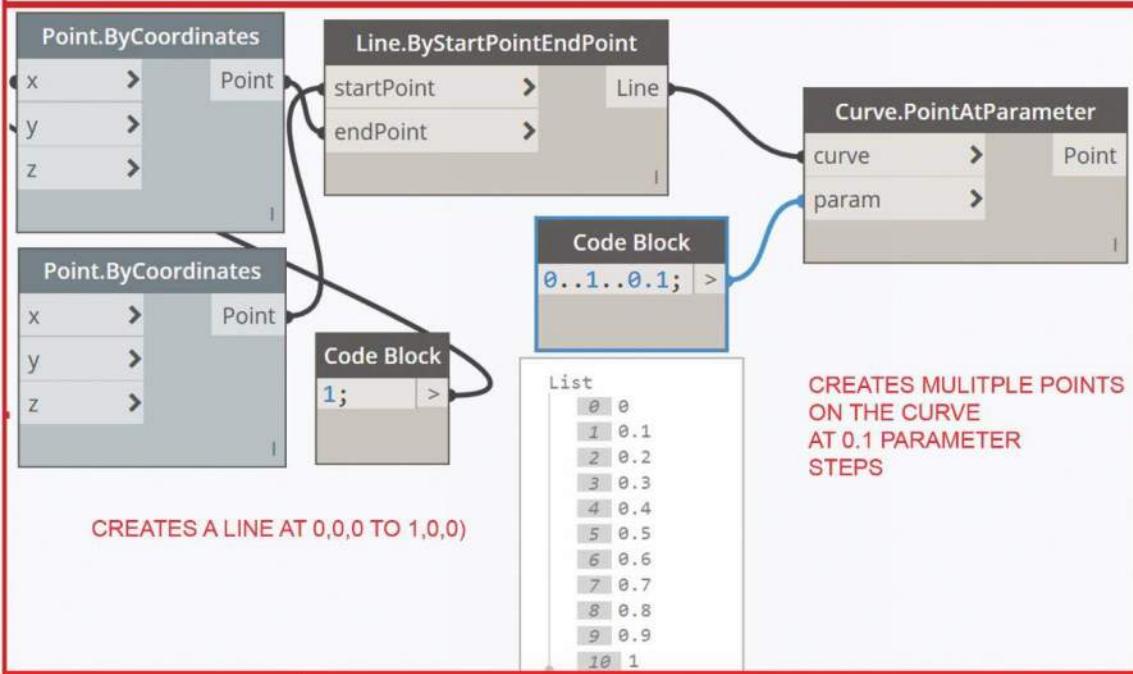
DYNAMO GEOMETRY

NOTE

A LINE IS A CURVE AND THEREFORE ALL "LINE" OUTPUT PORTS COULD BE CONNECTED INTO A "CURVE" INPUT PORT
OFFSET FOR A CURVE ONLY OFFSETS IN THE NORMAL VECTOR (IN THIS CASE (0,-1,0))

NOTE

CURVES : START AND END POINTS USING PARAMETERS



DYNAMO NODES

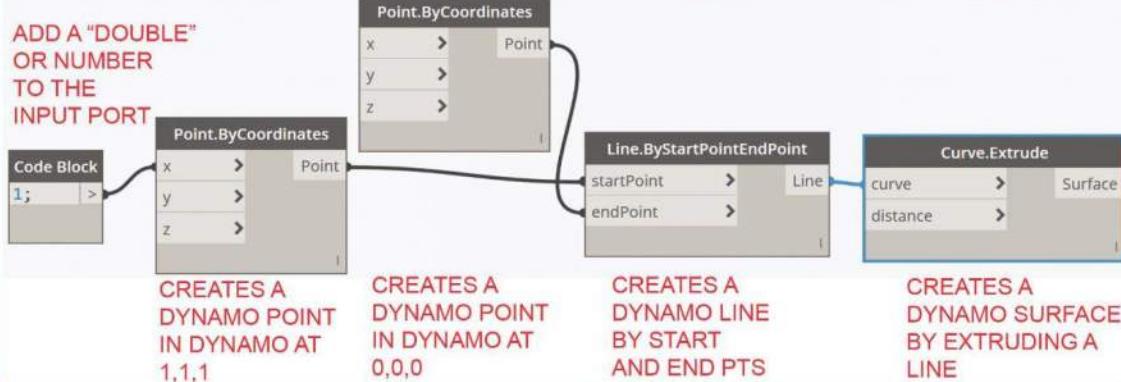
DYNAMO GEOMETRY

NOTE

A LINE IS A CURVE AND THEREFORE ALL "LINE" OUTPUT PORTS COULD BE CONNECTED INTO A "CURVE" INPUT PORT
PARAMETER IS A VALUE FROM 0 TO 1 (START AND END) 0 = END (FOR EXAMPLE)

NOTE

DYNAMO SURFACE BY CURVE EXTRUDE



DYNAMO NODES

DYNAMO GEOMETRY

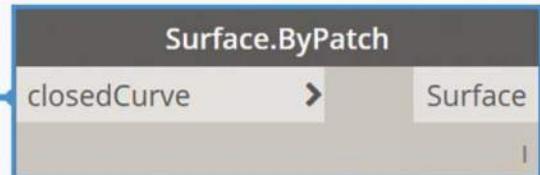
REVIT GEOMETRY

NOTE

THIS CREATES A DYNAMO SURFACE BY EXTRUDING THE LINE (CURVE). THERE ARE OTHER WAYS TO CREATE SURFACES. ALSO, THE CURVE IS EXTRUDED IN THE POSITIVE DIRECTION OF THE CURVE'S LOCAL AXIS WITH A DISTANCE DEFAULT OF 1. ALSO TRY NEG VALUES.

NOTE

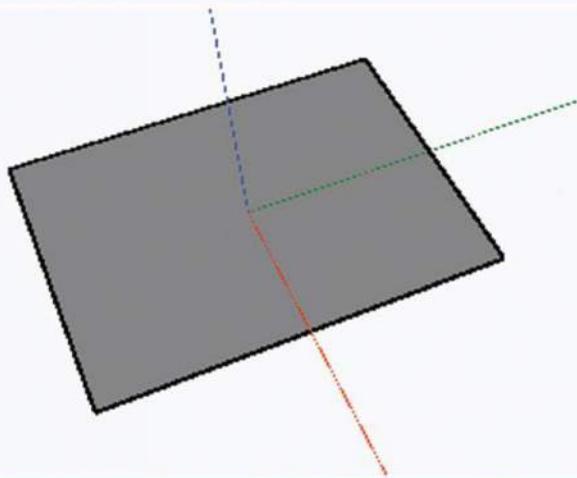
DYNAMO SURFACE BY PATCH FROM CLOSED CURVES



CREATES A RECTANGLE AT
WIDTH AND LENGTH = 1

CREATES A SURFACE
BY "FILLING IN"
CLOSED PERIMETER
CURVES

DYNAMO NODES



DYNAMO GEOMETRY

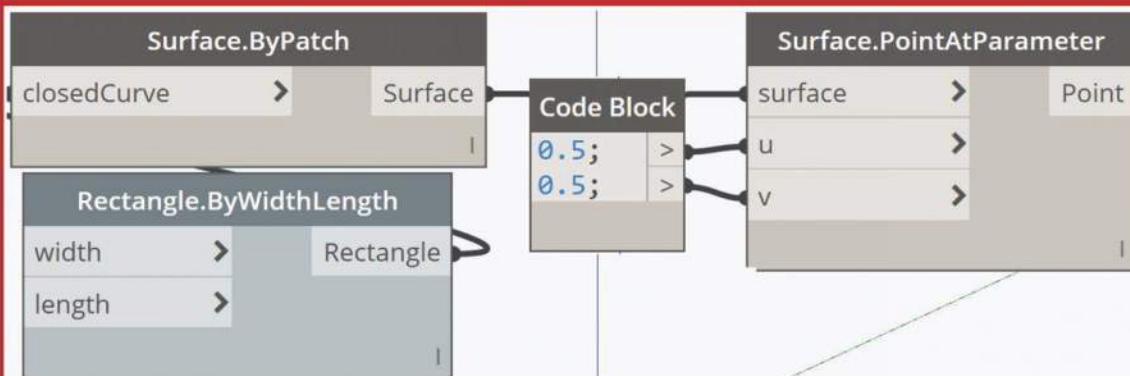
REVIT GEOMETRY

NOTE

THIS CREATES A DYNAMO SURFACE BY COLLECTING THE PERIMETER CURVES OF THE RECTANGLE AND "FILLING" IN THE THE CURVES WITH A SURFACE. ALSO NOTE THAT THE CURVES MUST BE CLOSED FOR "PATCH" TO WORK AND A RECTANGLE IS A COLLECTION OF CLOSED CURVES

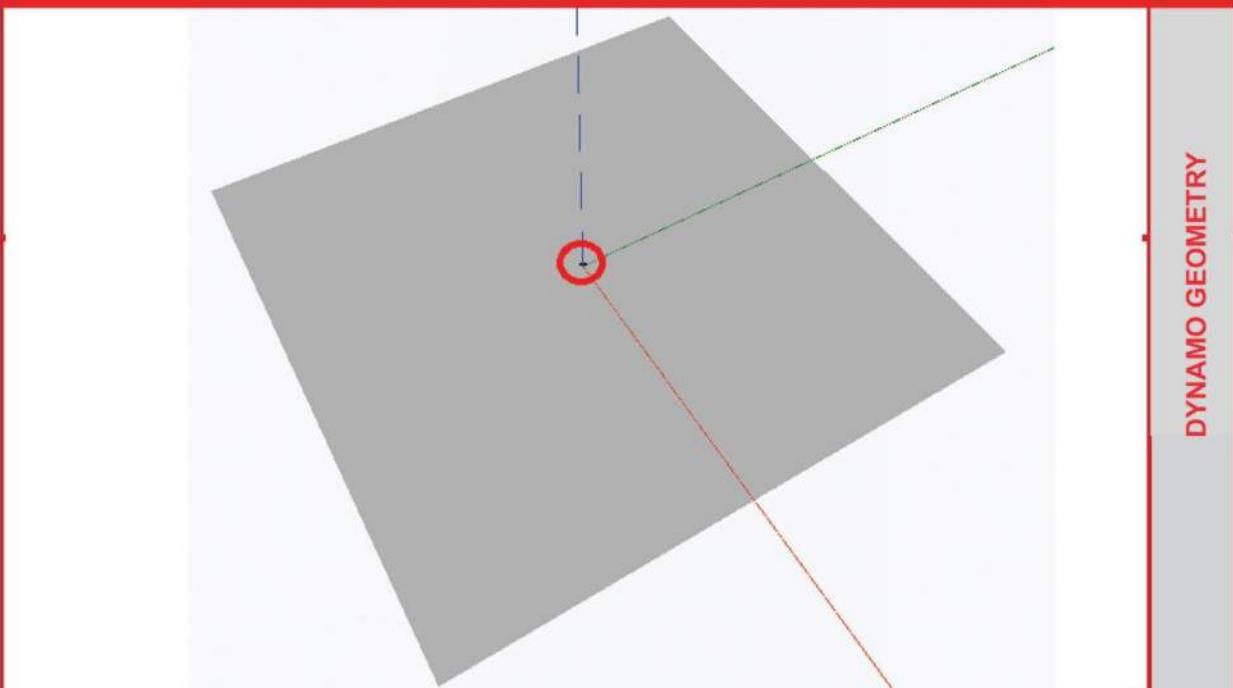
NOTE

DYNAMO SURFACE SINGLE PT AT PARAMETER U=0.5 V= 0.5



CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

CREATES A POINT AT
PARAMETER
U = 0.5
V = 0.5



DYNAMO NODES

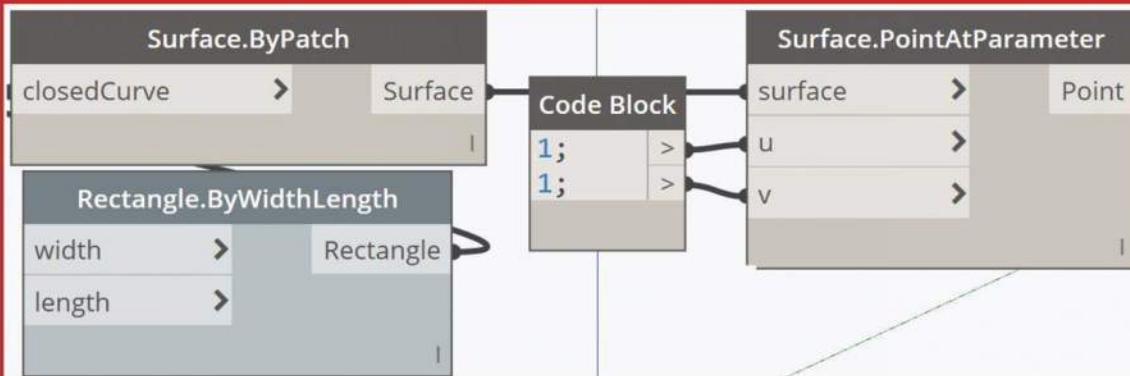
DYNAMO GEOMETRY

NOTE

NOTE

THIS CREATES A DYNAMO POINT(S) AT POINT AT PARAMETER(S) ON A SURFACE.
ALSO NOTE THAT PARAMETERS FOR SURFACES ARE DEFINED BY U AND V COORDINATES AND
RANGE FROM 0 TO 1

DYNAMO SURFACE SINGLE PT AT PARAMETER U=1 V=1

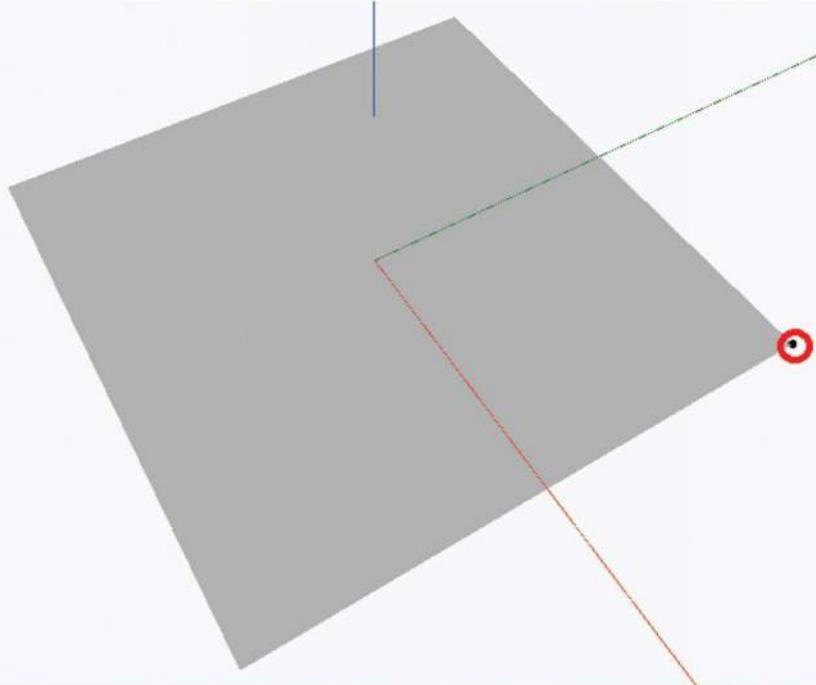


CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

CREATES A POINT AT
PARAMETER
U = 1
V = 1

DYNAMO NODES

DYNAMO GEOMETRY

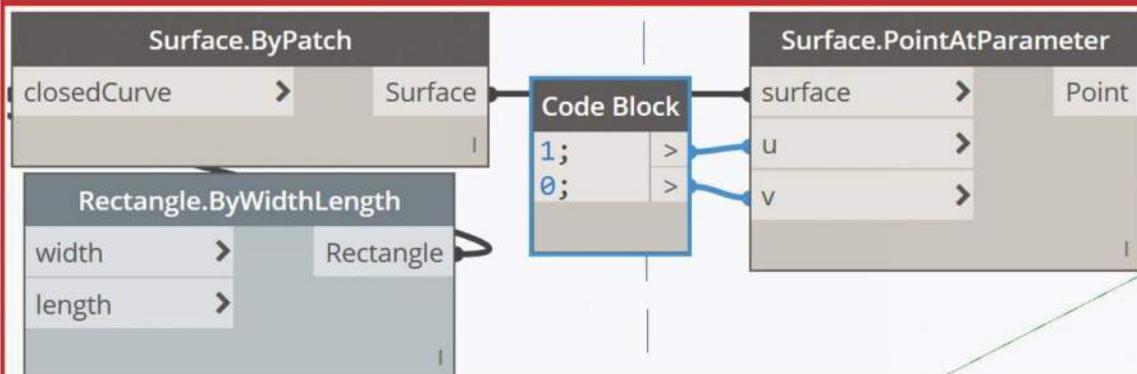


NOTE

THIS CREATES A DYNAMO POINT(S) AT POINT AT PARAMETER(S) ON A SURFACE.
ALSO NOTE THAT PARAMETERS FOR SURFACES ARE DEFINED BY U AND V COORDINATES AND
RANGE FROM 0 TO 1

NOTE

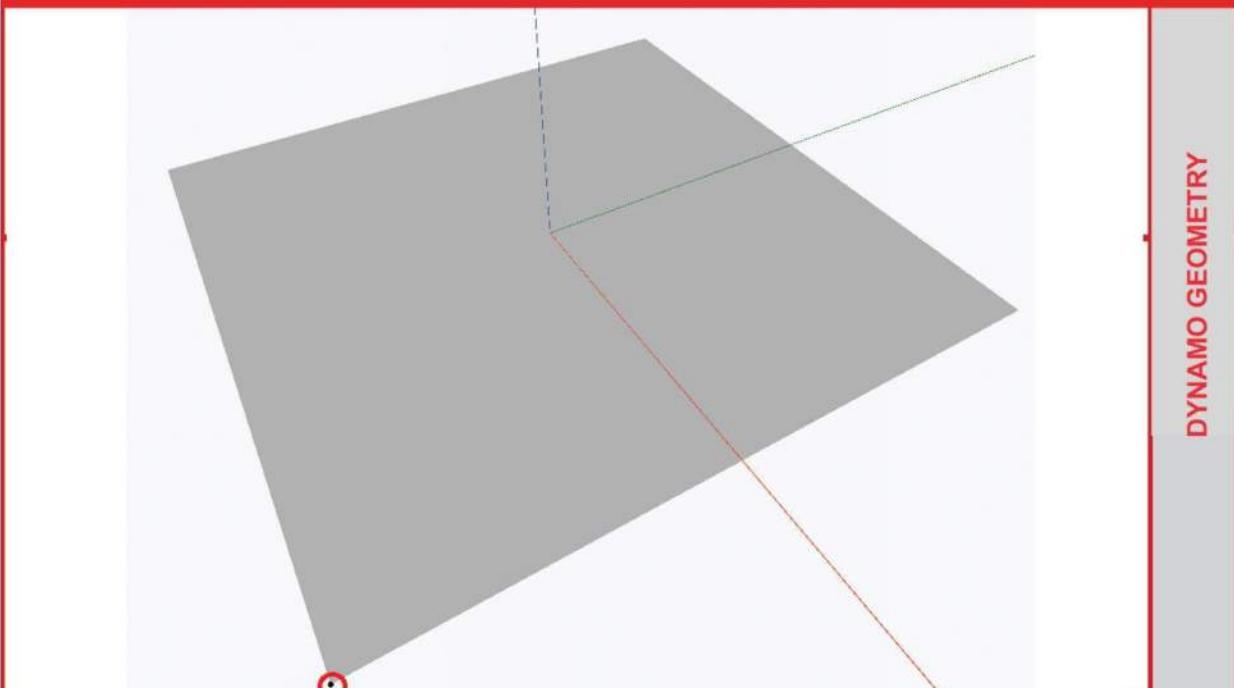
DYNAMO SURFACE SINGLE PT AT PARAMETER U=1 V= 0



CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

CREATES A POINT AT
PARAMETER
U = 1
V = 0

DYNAMO NODES



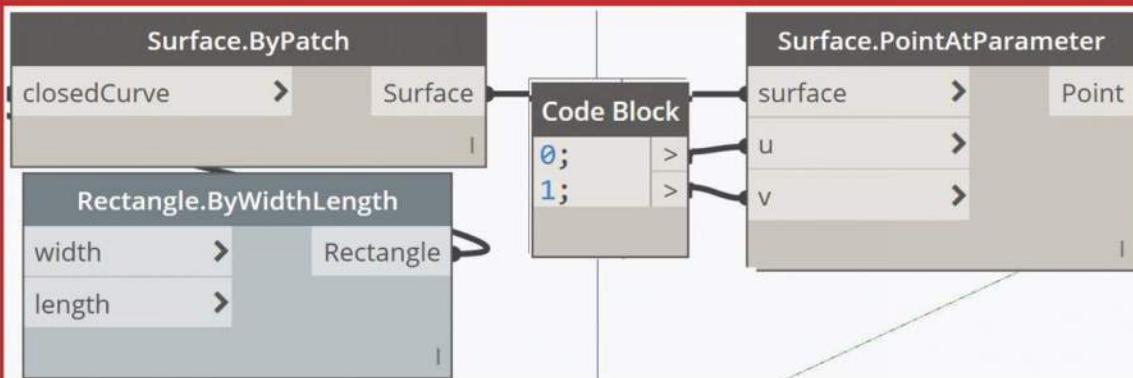
DYNAMO GEOMETRY

NOTE

THIS CREATES A DYNAMO POINT(S) AT POINT AT PARAMETER(S) ON A SURFACE.
ALSO NOTE THAT PARAMETERS FOR SURFACES ARE DEFINED BY U AND V COORDINATES AND
RANGE FROM 0 TO 1

NOTE

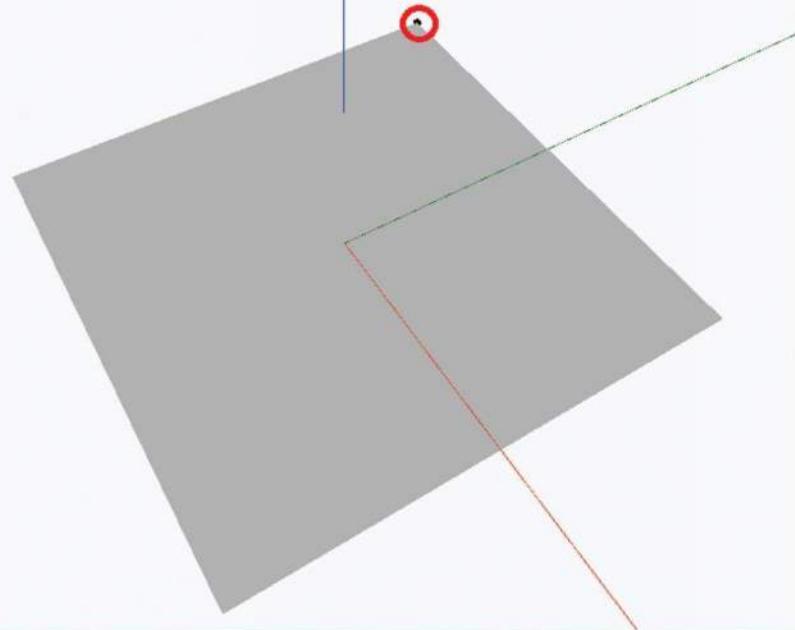
DYNAMO SURFACE SINGLE PT AT PARAMETER U=0 V= 1



CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

CREATES A POINT AT
PARAMETER
U = 0
V = 1

DYNAMO NODES



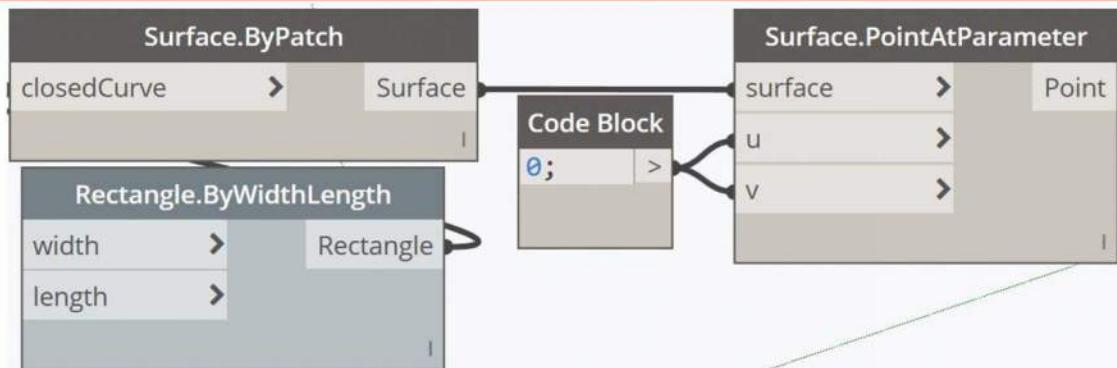
DYNAMO GEOMETRY

NOTE

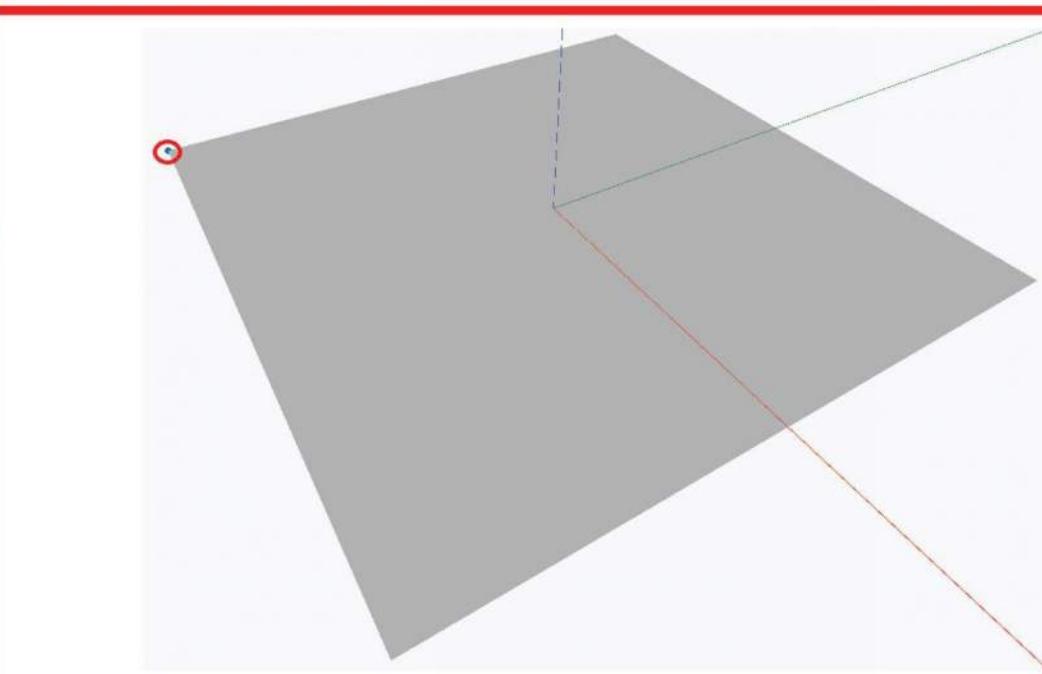
THIS CREATES A DYNAMO POINT(S) AT POINT AT PARAMETER(S) ON A SURFACE.
ALSO NOTE THAT PARAMETERS FOR SURFACES ARE DEFINED BY U AND V COORDINATES AND
RANGE FROM 0 TO 1

NOTE

DYNAMO SURFACE SINGLE PT AT PARAMETER U=0 V= 0



DYNAMO NODES



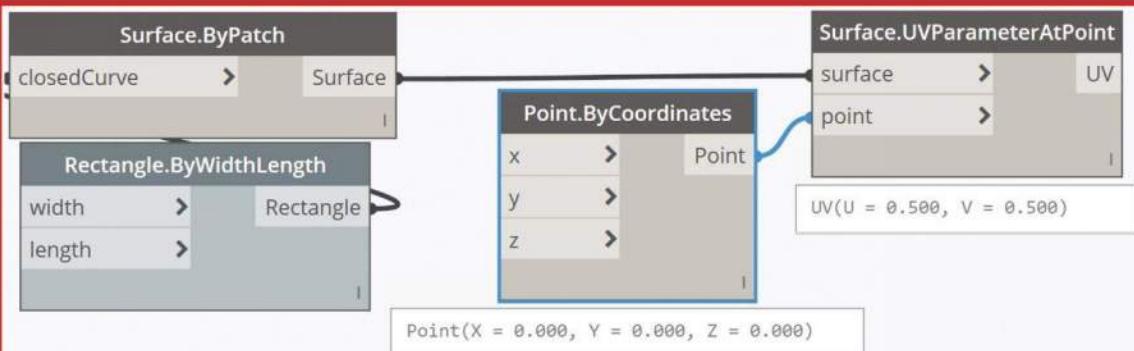
DYNAMO GEOMETRY

NOTE

THIS CREATES A DYNAMO POINT(S) AT POINT AT PARAMETER(S) ON A SURFACE.
ALSO NOTE THAT PARAMETERS FOR SURFACES ARE DEFINED BY U AND V COORDINATES AND RANGE FROM 0 TO 1

NOTE

DYNAMO SURFACE UV PARAMETER AT POINT

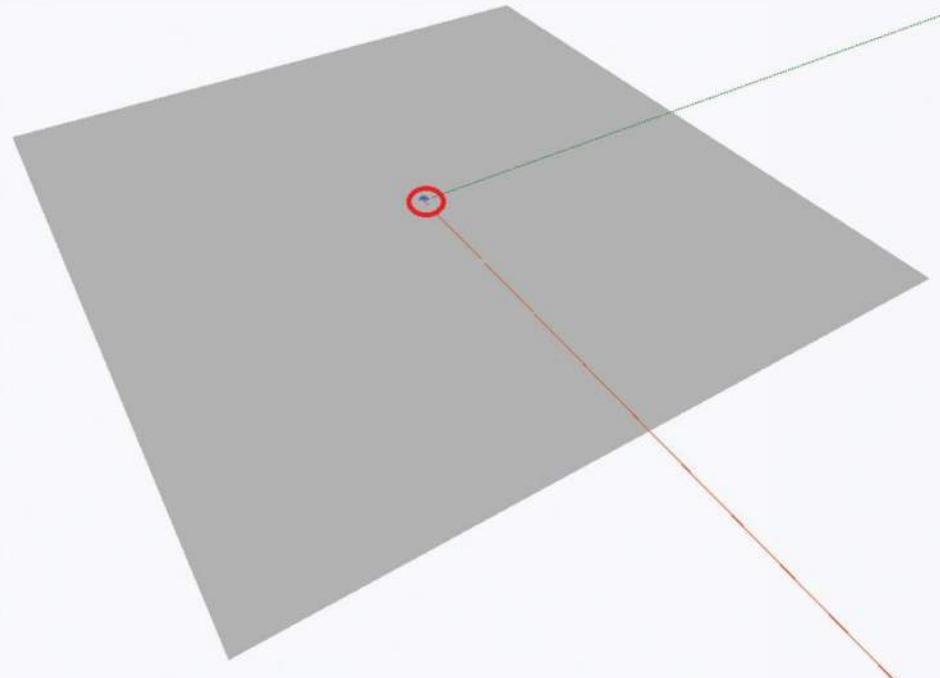


CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

CREATES A POINT AT 0,0,0

GETS THE UV PARAMETER
AT SPECIFIC POINT

DYNAMO NODES



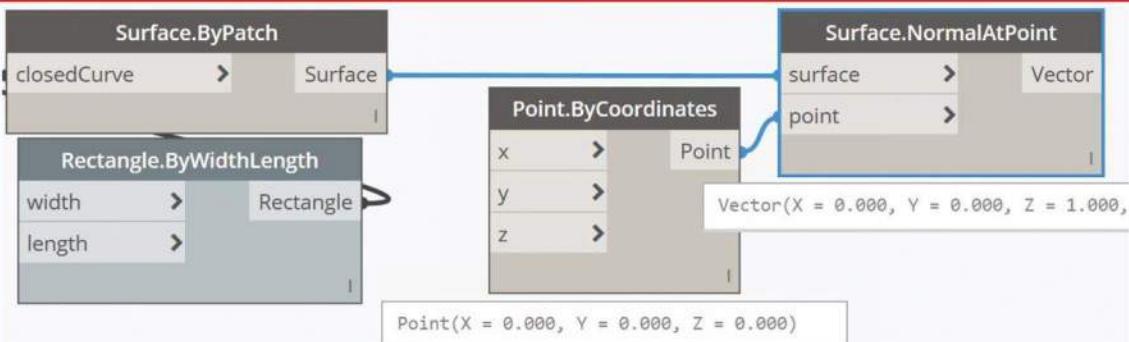
DYNAMO GEOMETRY

NOTE

THIS GETS THE U V COORDINATES AT A SPECIFIC POINT ON A SURFACE
ALSO NOTE THAT THE POINT MUST BE ON THE SURFACE

NOTE

DYNAMO SURFACE NORMAL AT POINT (0,0,0)

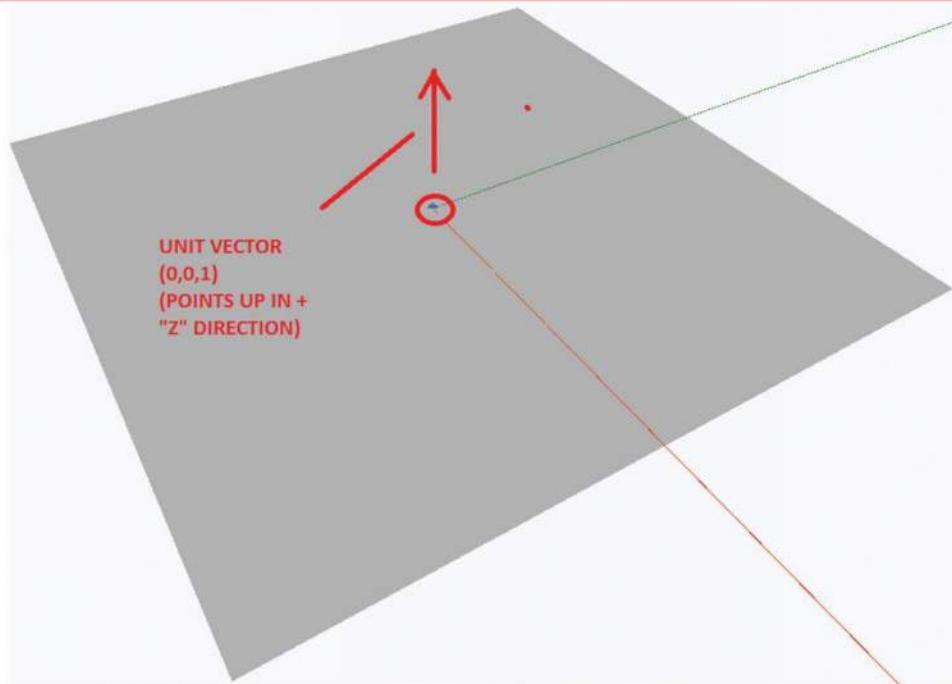


CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

CREATES A POINT AT 0,0,0

GETS THE NORMAL
(UNIT VECTOR)
AT SPECIFIC POINT

DYNAMO NODES



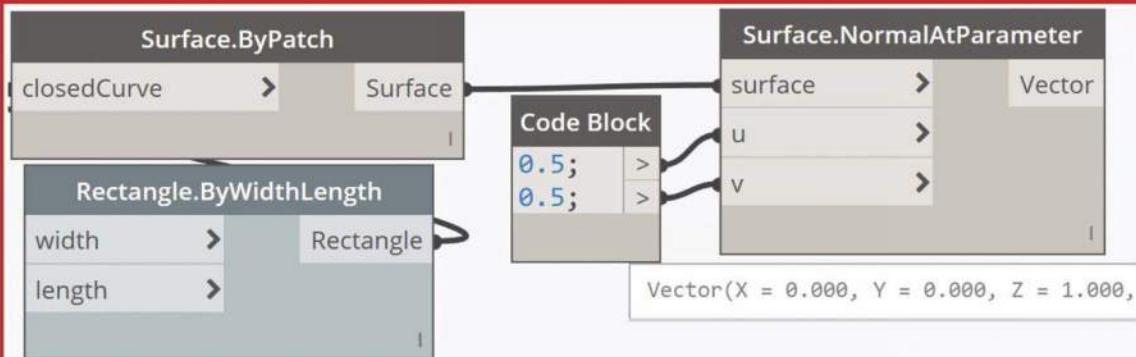
DYNAMO GEOMETRY

NOTE

THIS GETS THE NORMAL UNIT VECTOR AT A SPECIFIC POINT ON A SURFACE
ALSO NOTE THAT THE POINT MUST BE ON THE SURFACE

NOTE

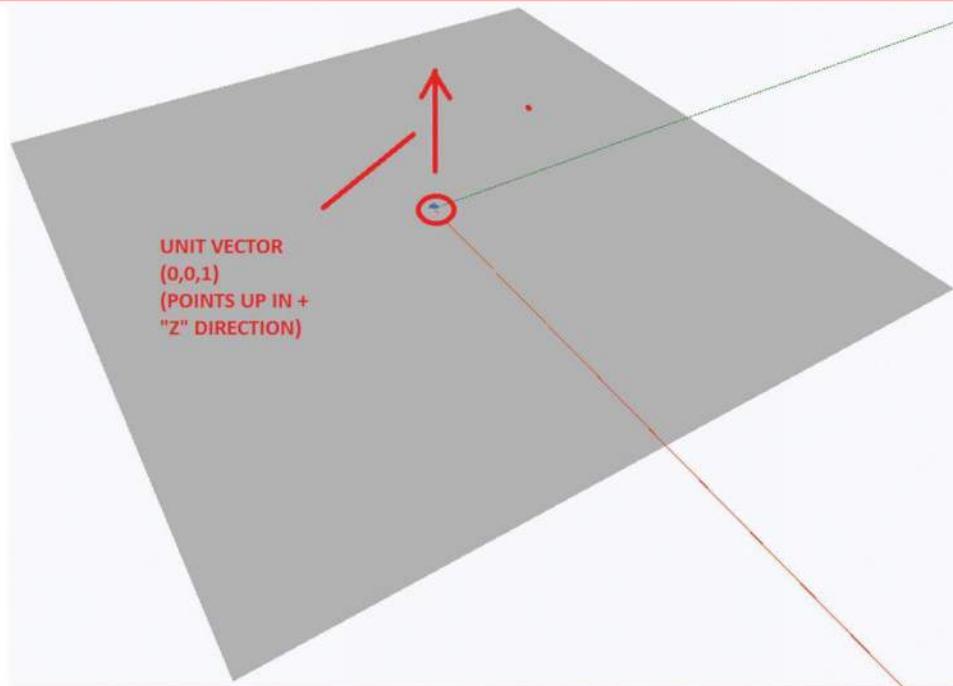
DYNAMO SURFACE NORMAL AT PARAMETER U=.5 V =.5



CREATES A SURFACE AT
WIDTH AND LENGTH = 1
ORIGIN (0,0)

GETS THE NORMAL
(UNIT VECTOR) ON A
SURFACE
AT
U = 0.5
V = 0.5

DYNAMO NODES



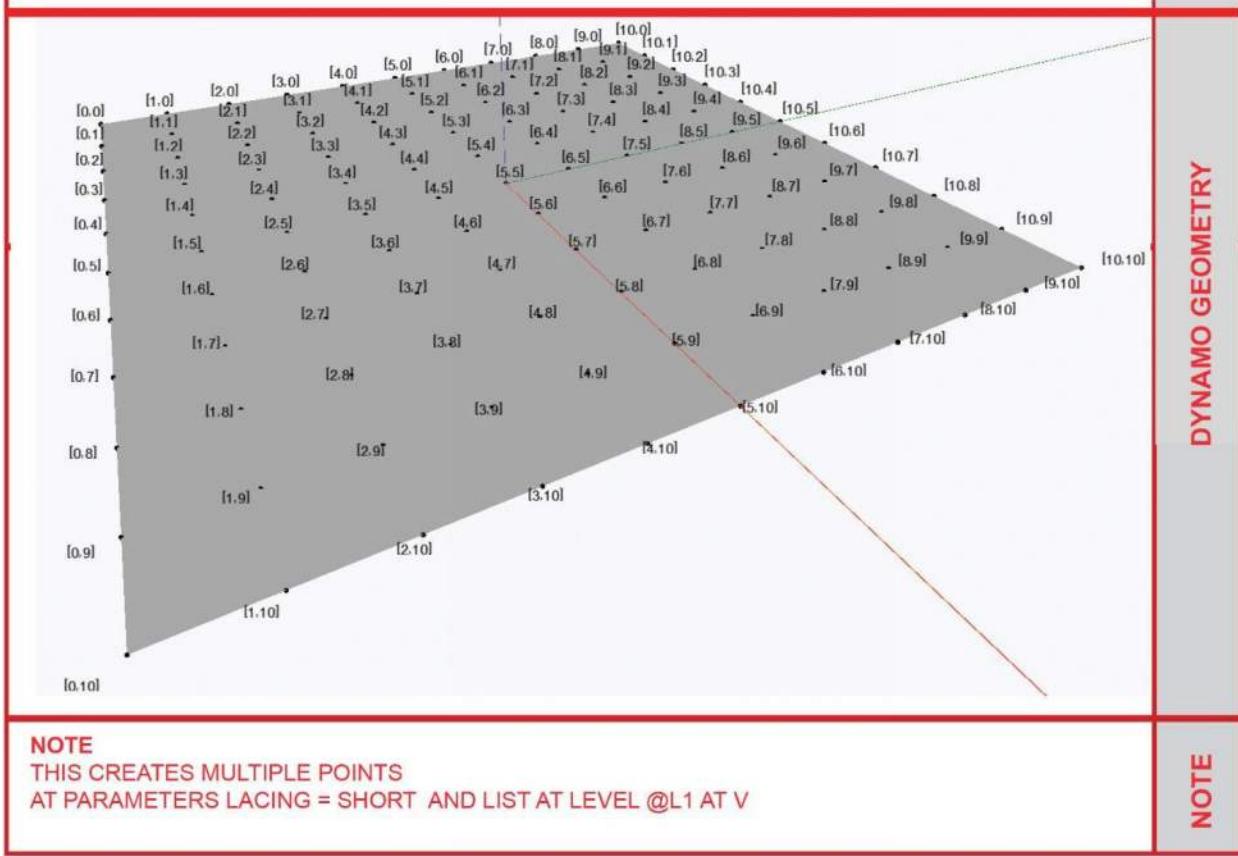
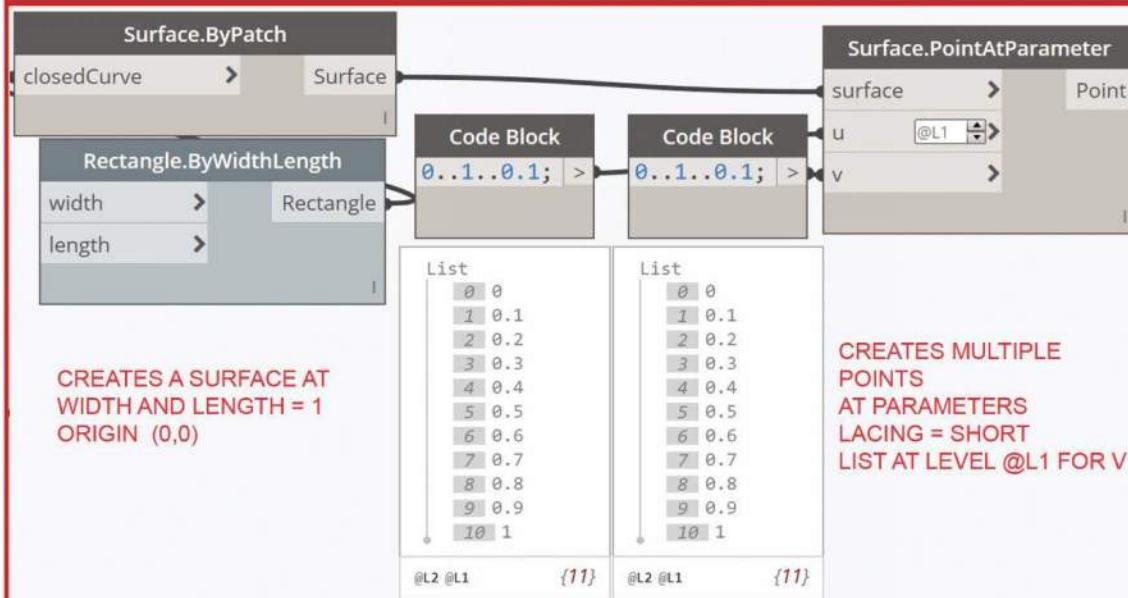
DYNAMO GEOMETRY

NOTE

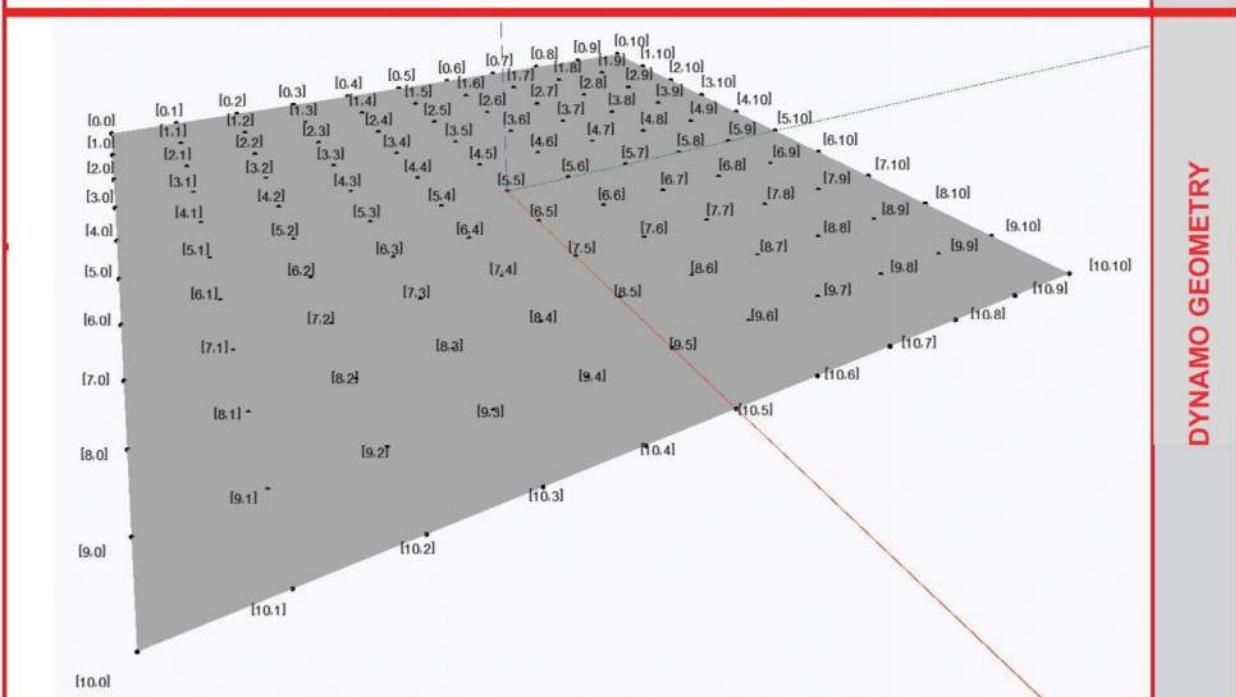
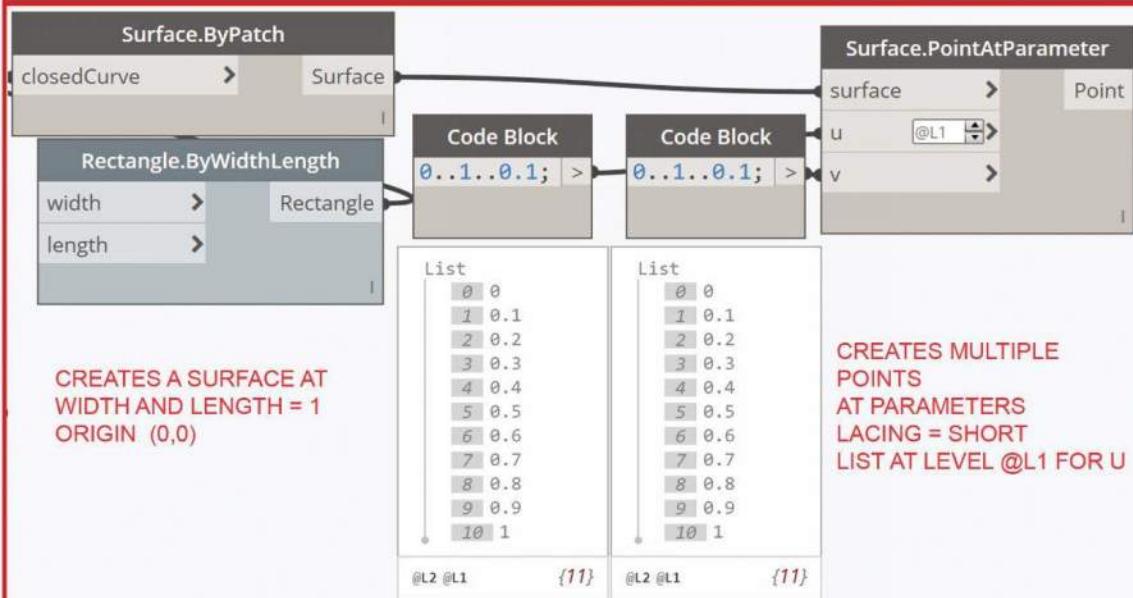
THIS GETS THE NORMAL UNIT VECTOR AT A SPECIFIC U V PARAMETER ON A SURFACE
ALSO NOTE THAT THE U V PARAMETER MAY BE DIFFERENT WITH A REVIT SURFACE

NOTE

SURFACE MULTIPLE PTS AT PARAMETERS LIST AT LEVEL V



SURFACE MULTIPLE PTS AT PARAMETERS LIST AT LEVEL U

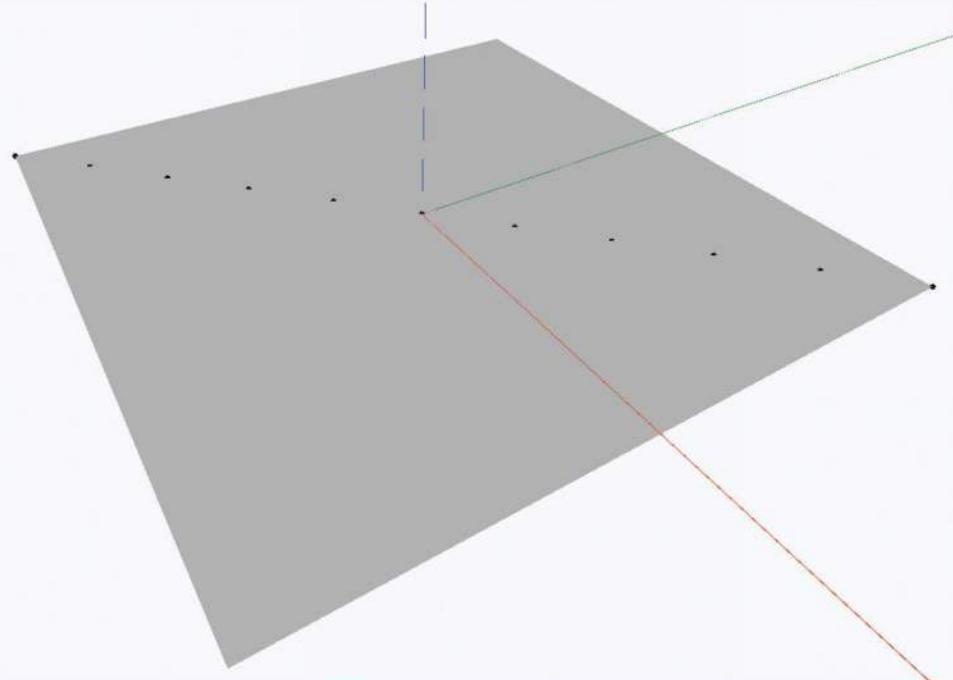
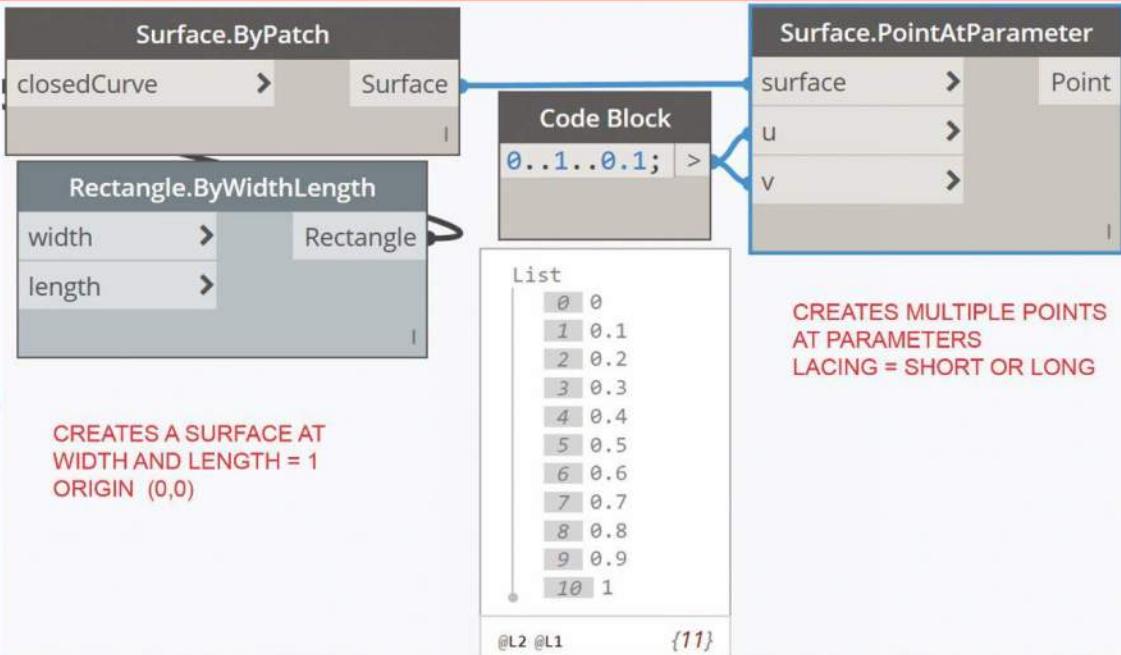


NOTE

THIS CREATES MULTIPLE POINTS
AT PARAMETERS LACING = SHORT AND LIST AT LEVEL @L1 AT U
ALSO NOTE THAT LIST AT LEVEL YIELDS THE SAME RESULT AT LACING CROSS PRODUCT

NOTE

SURFACE MULTIPLE PTS AT PARAMETERS LACING SHORT

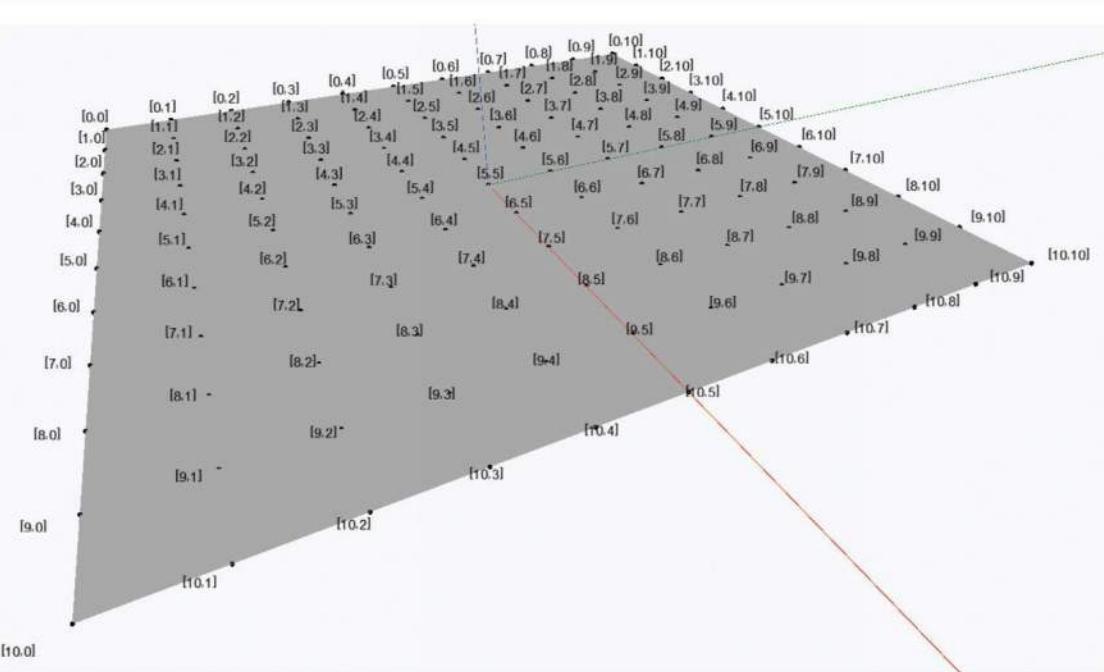
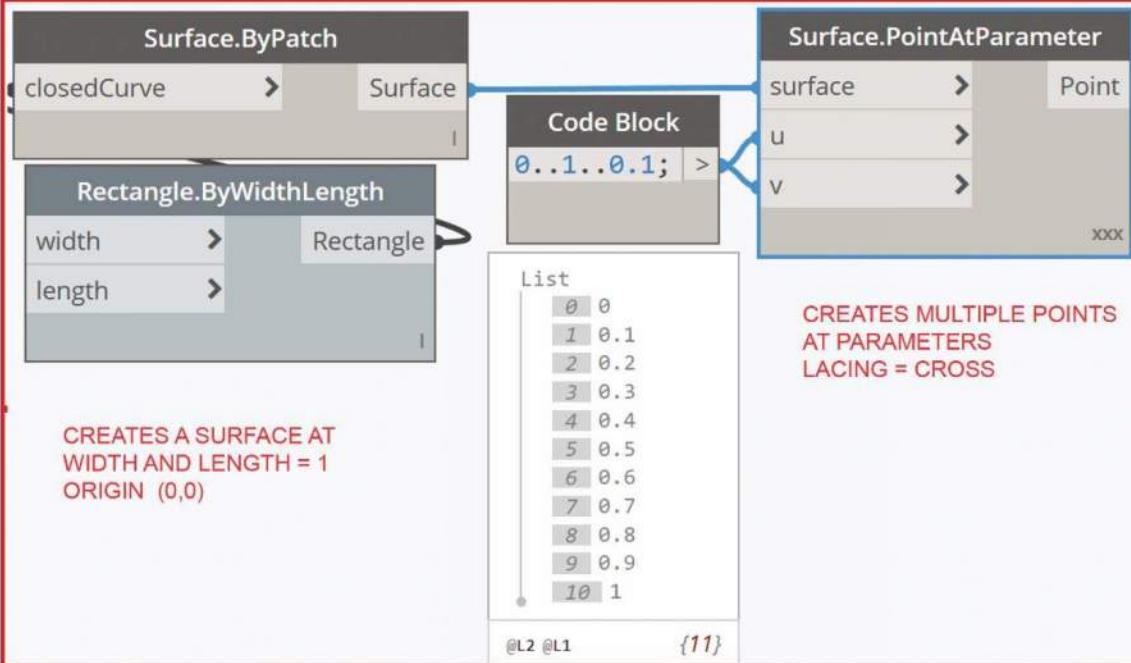


NOTE

THIS CREATES MULTIPLE POINTS
AT PARAMETERS LACING = SHORT OR LONG

NOTE

SURFACE MULTIPLE PTS AT PARAMETERS LACING CROSS



NOTE
THIS CREATES MULTIPLE POINTS
AT PARAMETERS LACING = CROSS PRODUCT

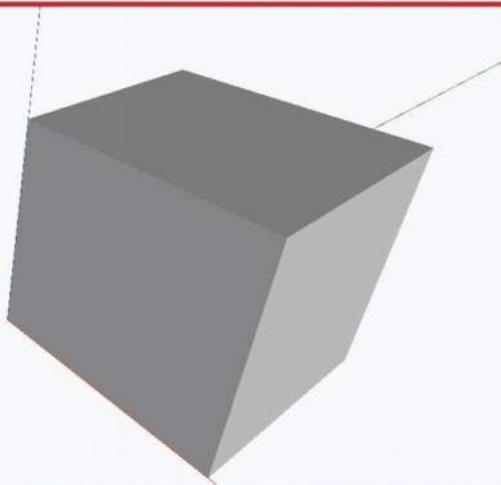
NOTE

CUBIOD LOW AND HIGH PT



CREATES A
CUBIOD AT
LOW PT (0,0,0)
HIGH PT (1,1,1)

DYNAMO NODES



DYNAMO GEOMETRY

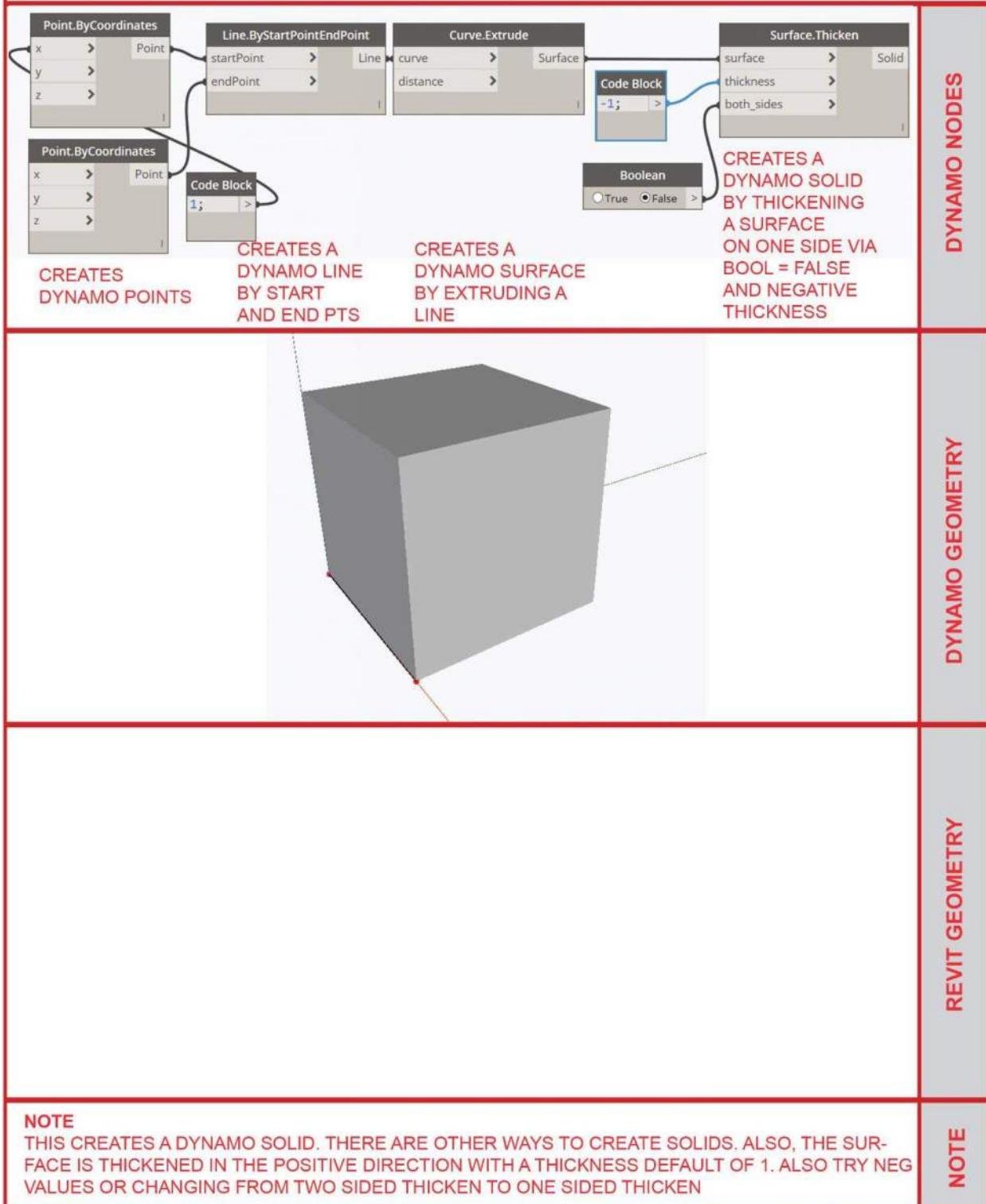
NOTE

THIS CREATES A DYNAMO CUBIOD (CUBE) LOW POINT IS DEFAULT PT (0,0,0)
HIGH POINT IS DEFAULT (1,1,1)

REVIT GEOMETRY

NOTE

DYNAMO SOLID BY THICKEN - 1 SIDE - NEG THICKNESS



DYNAMO SOLID BY THICKEN - 1 SIDE



DYNAMO NODES

DYNAMO GEOMETRY

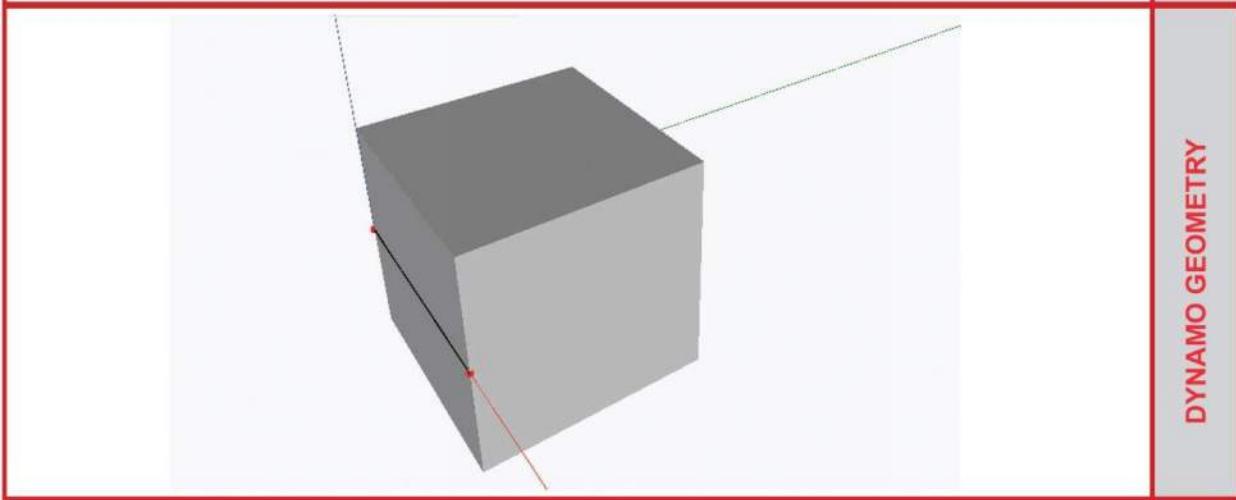
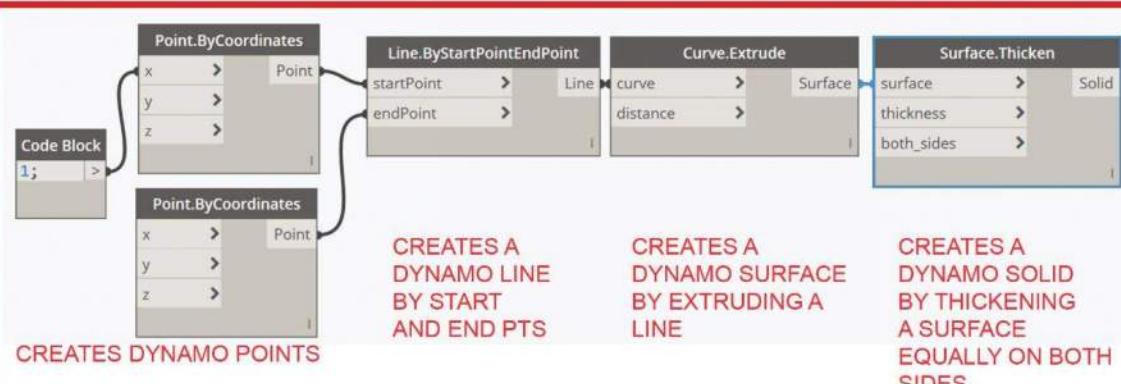
REVIT GEOMETRY

NOTE

THIS CREATES A DYNAMO SOLID. THERE ARE OTHER WAYS TO CREATE SOLIDS. ALSO, THE SURFACE IS THICKENED IN THE POSITIVE DIRECTION WITH A THICKNESS DEFAULT OF 1. ALSO TRY NEG VALUES OR CHANGING FROM TWO SIDED THICKEN TO ONE SIDED THICKEN

NOTE

DYNAMO SOLID BY THICKEN

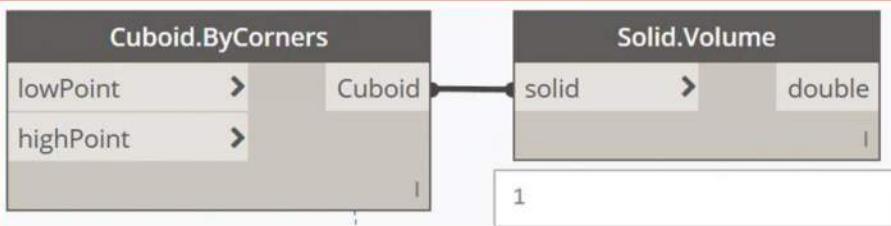


NOTE

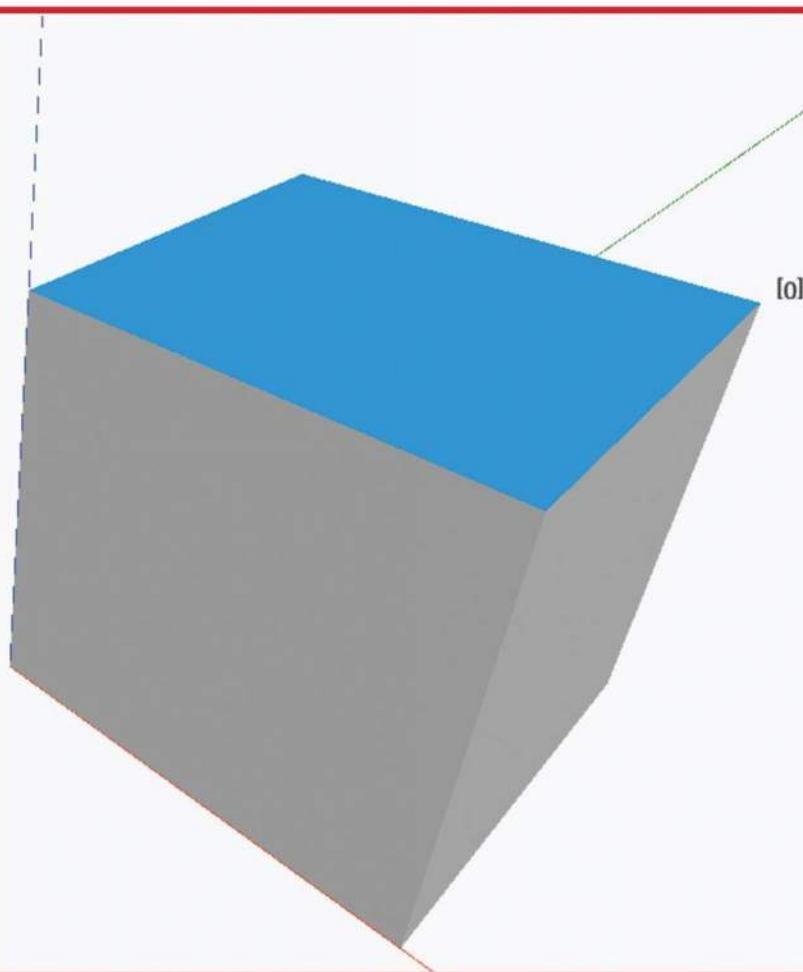
THIS CREATES A DYNAMO SOLID. THERE ARE OTHER WAYS TO CREATE SOLIDS. ALSO, THE SURFACE IS THICKENED IN THE POSITIVE DIRECTION WITH A THICKNESS DEFAULT OF 1. ALSO TRY NEG VALUES OR CHANGING FROM TWO SIDED THICKEN TO ONE SIDED THICKEN

NOTE

VOLUME FROM CUBIOD



DYNAMO NODES



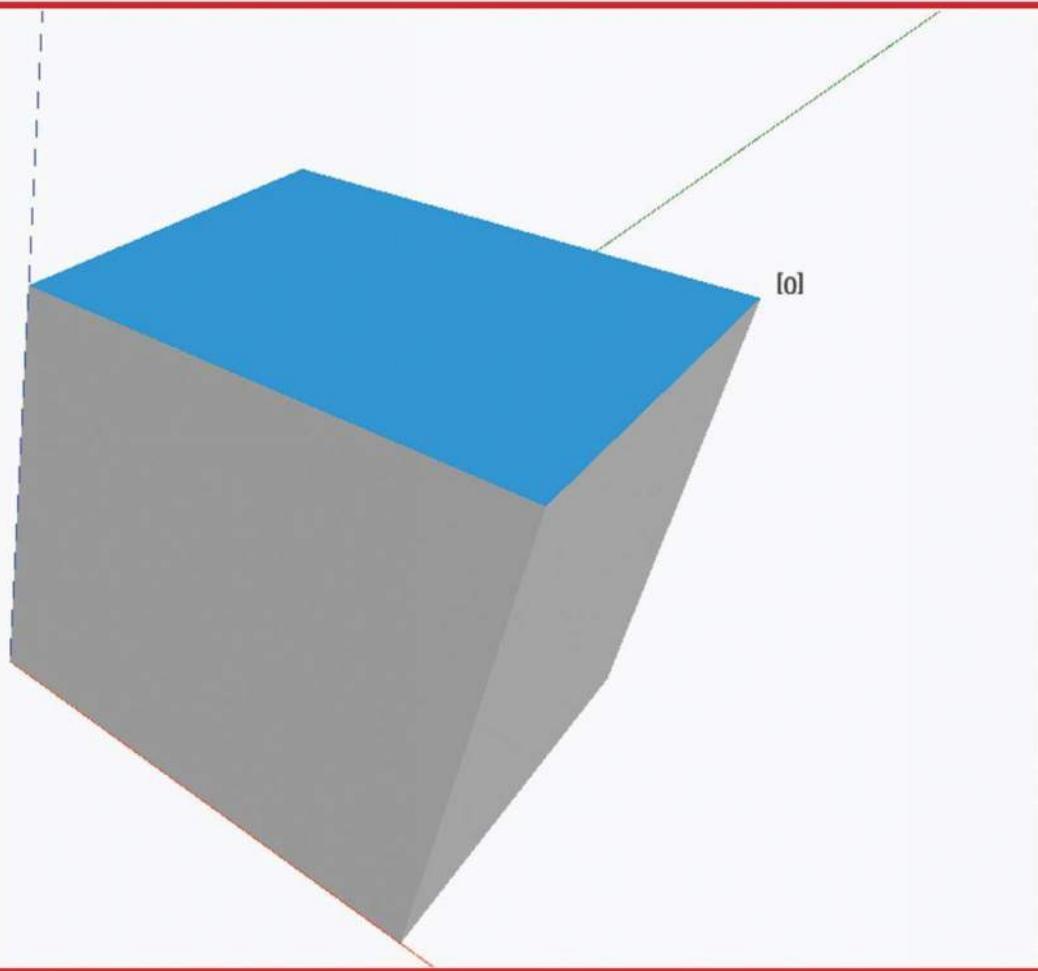
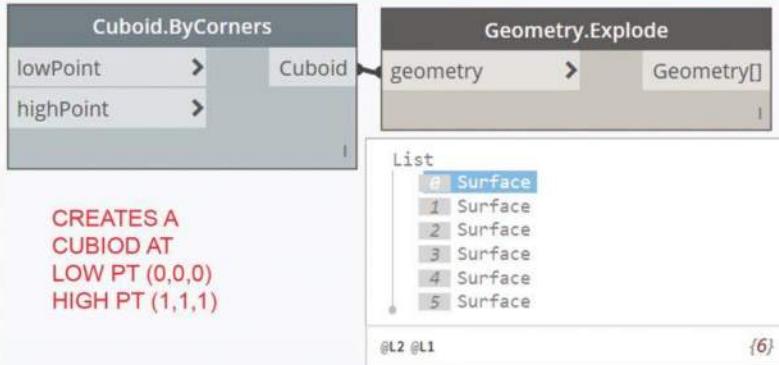
DYNAMO GEOMETRY

NOTE

THIS EXTRACTS THE VOLUME FROM A CUBIOD AND COULD BE APPLIED TO MOST SOLIDS.

NOTE

SURFACES FROM CUBIOD



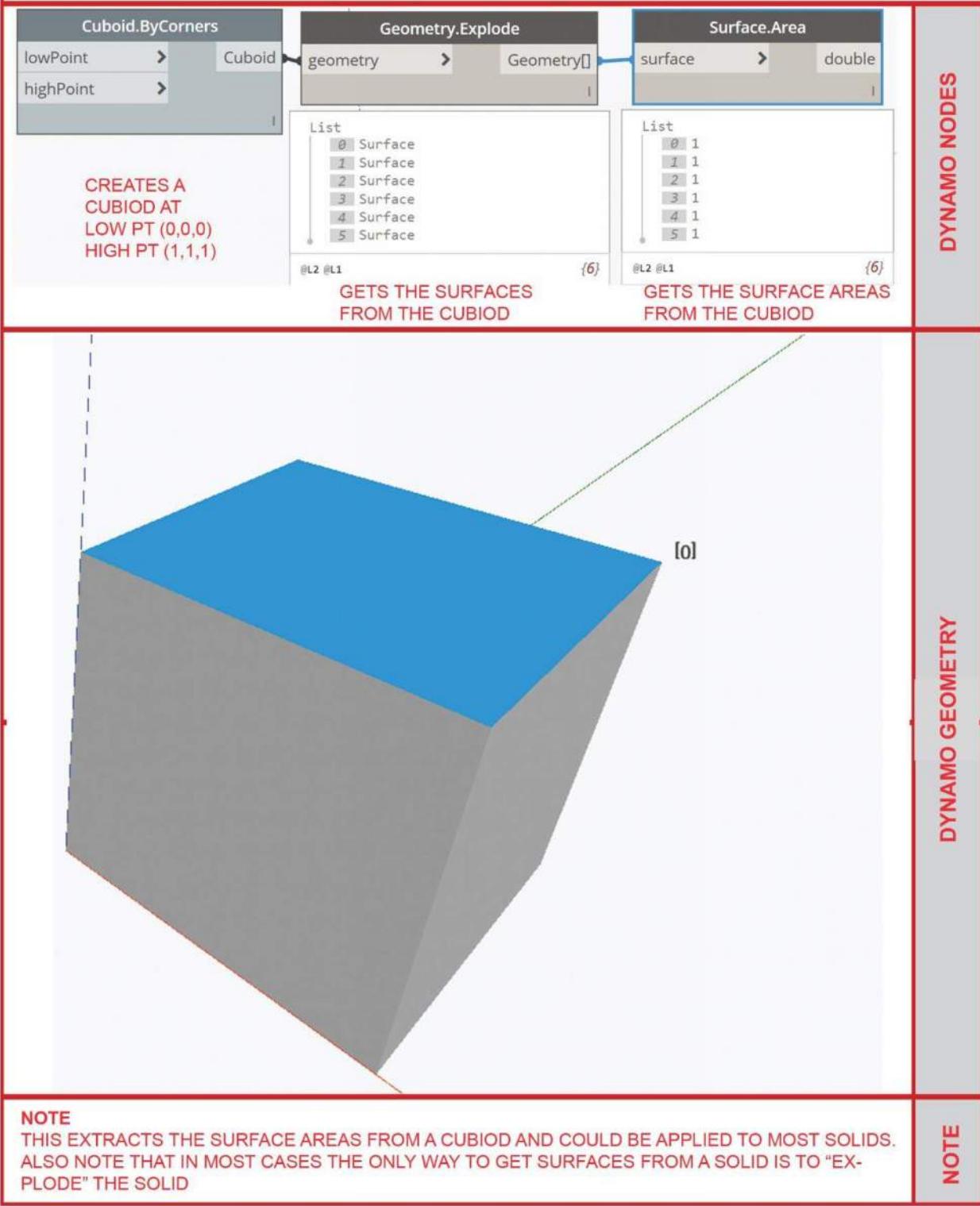
DYNAMO GEOMETRY

NOTE

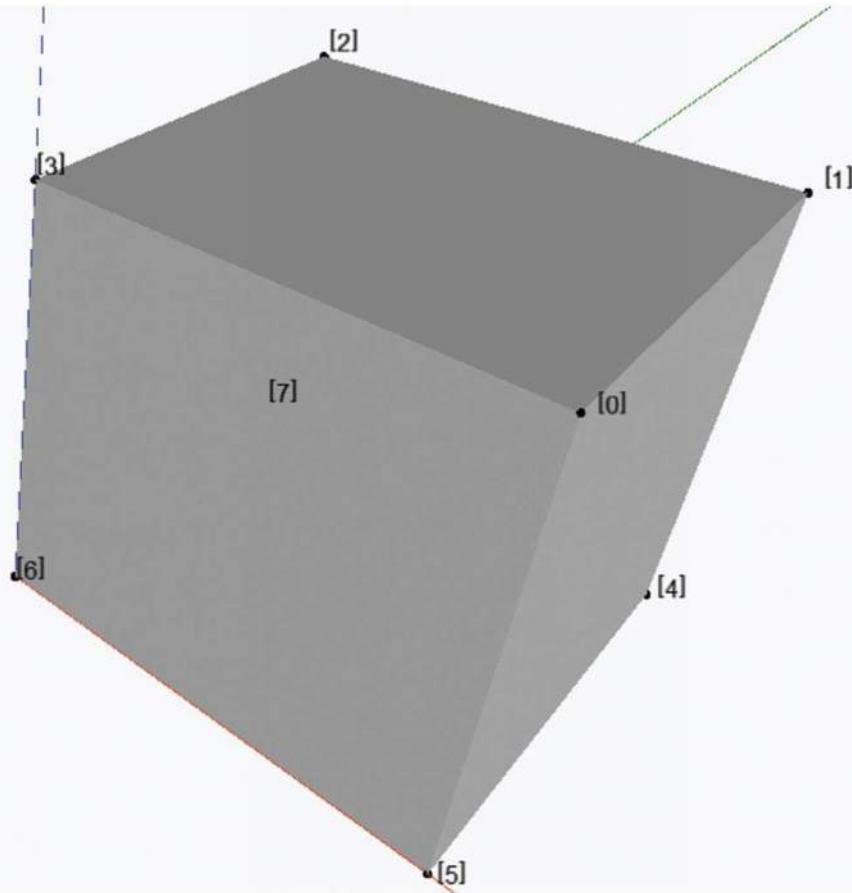
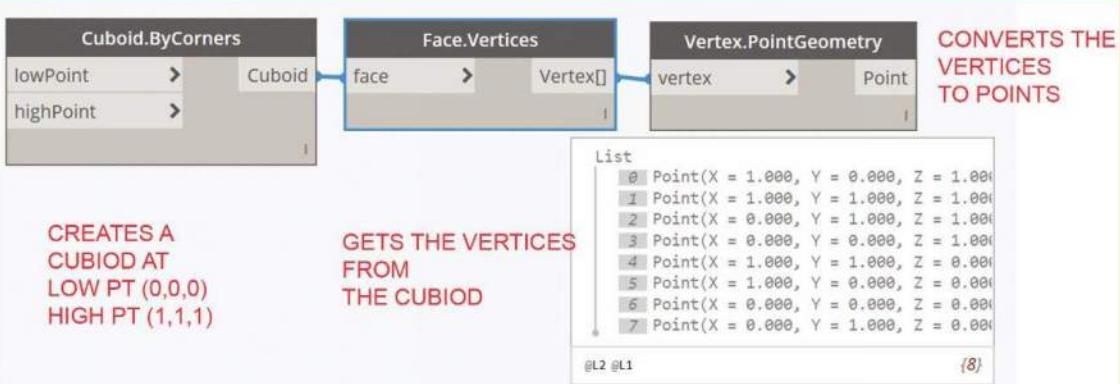
THIS EXTRACTS THE SURFACES FROM A CUBIOD AND COULD BE APPLIED TO MOST SOLIDS. ALSO NOTE THAT IN MOST CASES THE ONLY WAY TO GET SURFACES FROM A SOLID IS TO "EXPLODE" THE SOLID

NOTE

SURFACE AREAS FROM CUBIOD



POINTS AT VERTICES OF CUBIOD



DYNAMO GEOMETRY

NOTE
THIS EXTRACTS THE POINTS AT VERTICES ON A CUBOID

NOTE

EDGE CURVES ON CUBIOD

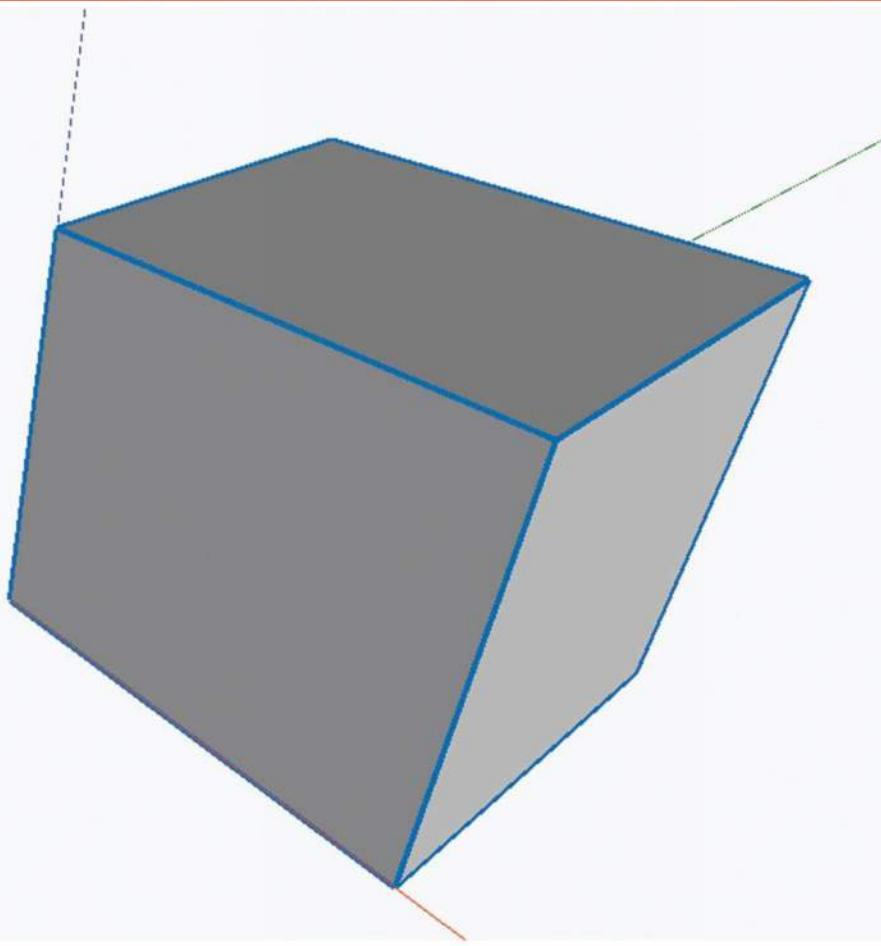


CREATES A
CUBIOD AT
LOW PT (0,0,0)
HIGH PT (1,1,1)

GETS THE EDGES
FROM THE CUBIOD

CONVERTS THE
EDGES TO
CURVES

DYNAMO NODES



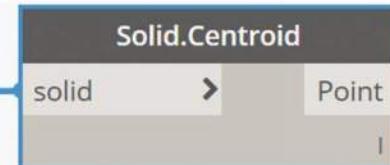
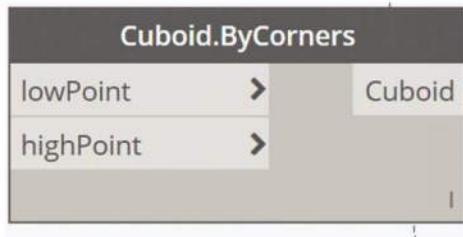
DYNAMO GEOMETRY

NOTE

THIS EXTRACTS THE EDGES FROM A CUBIOD AND COULD BE APPLIED TO MOST SOLIDS

NOTE

CENTER OF MASS FROM CUBIOD

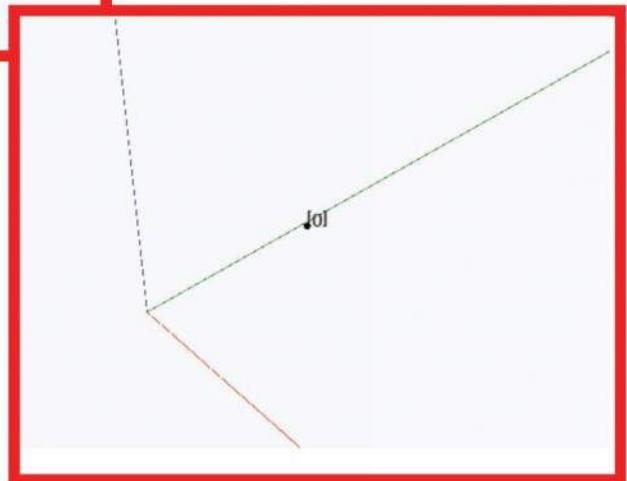
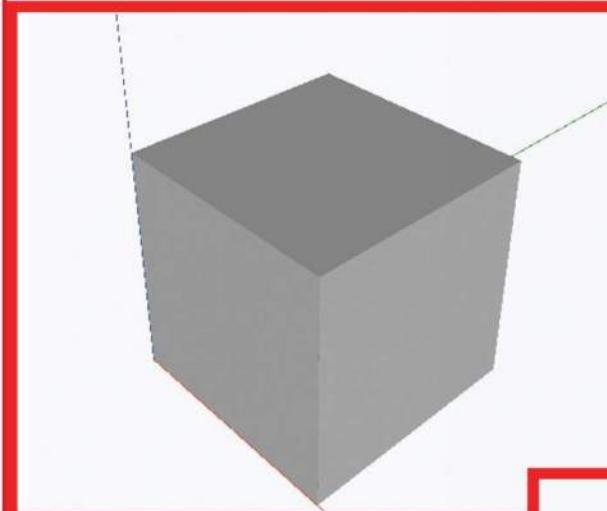


Point(X = 0.500, Y = 0.500, Z = 0.500)

CREATES A
CUBIOD AT
LOW PT (0,0,0)
HIGH PT (1,1,1)

GETS THE CENTROID
THE CUBIOD

DYNAMO NODES



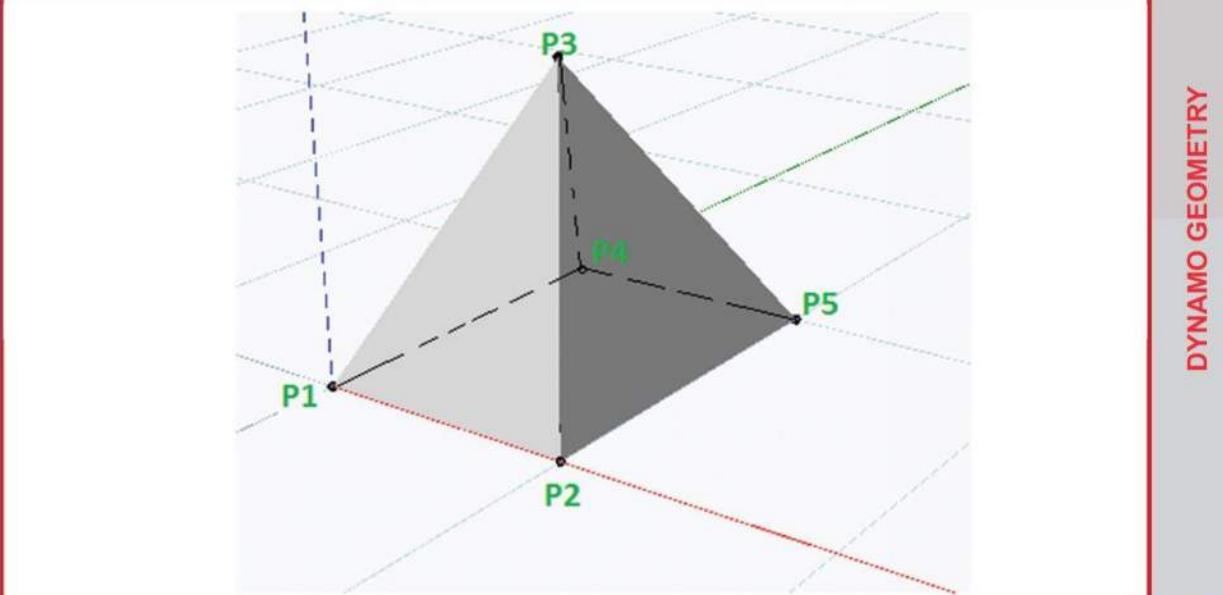
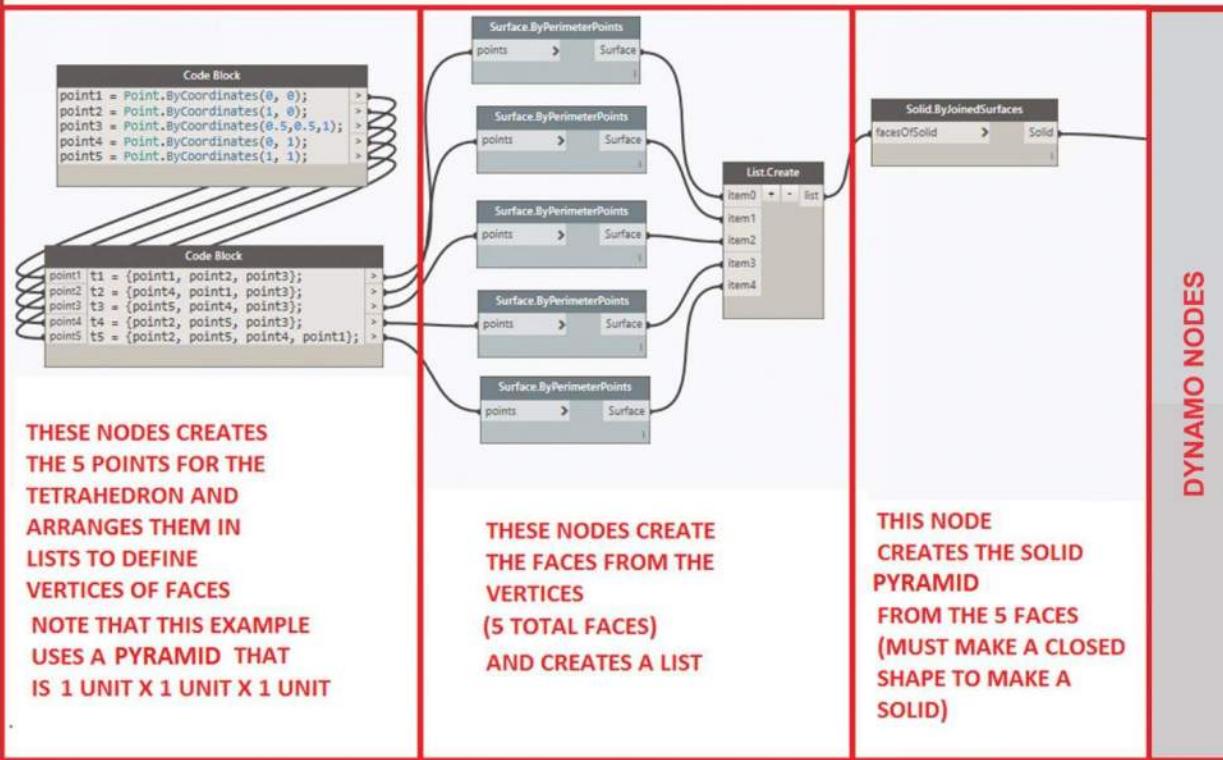
DYNAMO GEOMETRY

NOTE

THIS EXTRACTS THE CENTROID FROM A CUBIOD AND COULD BE APPLIED TO MOST SOLIDS.

NOTE

SOLID: 4 SIDED PYRAMID

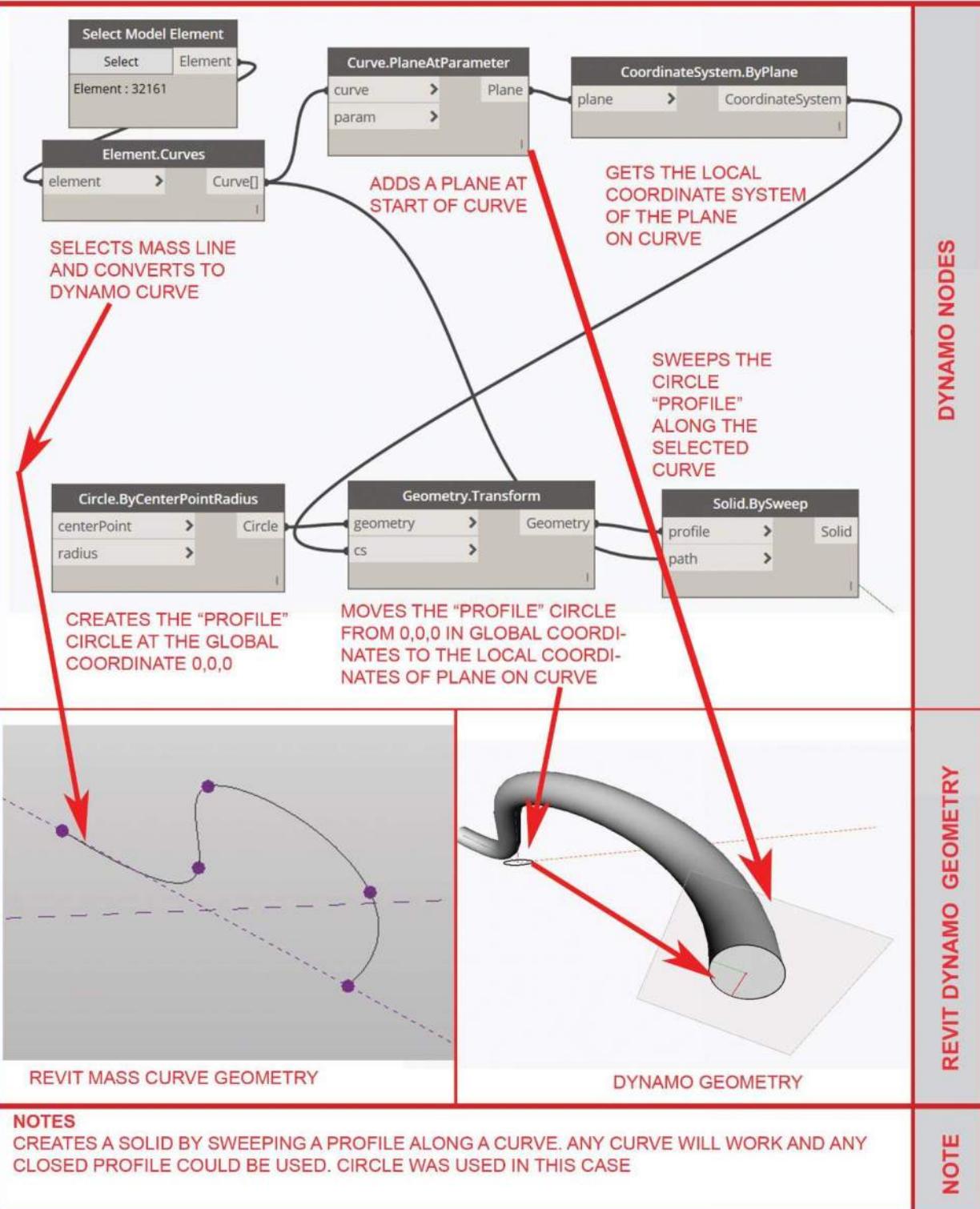


NOTE
THIS CREATES A PRYAMID IN DYNAMO AT 1X1X1

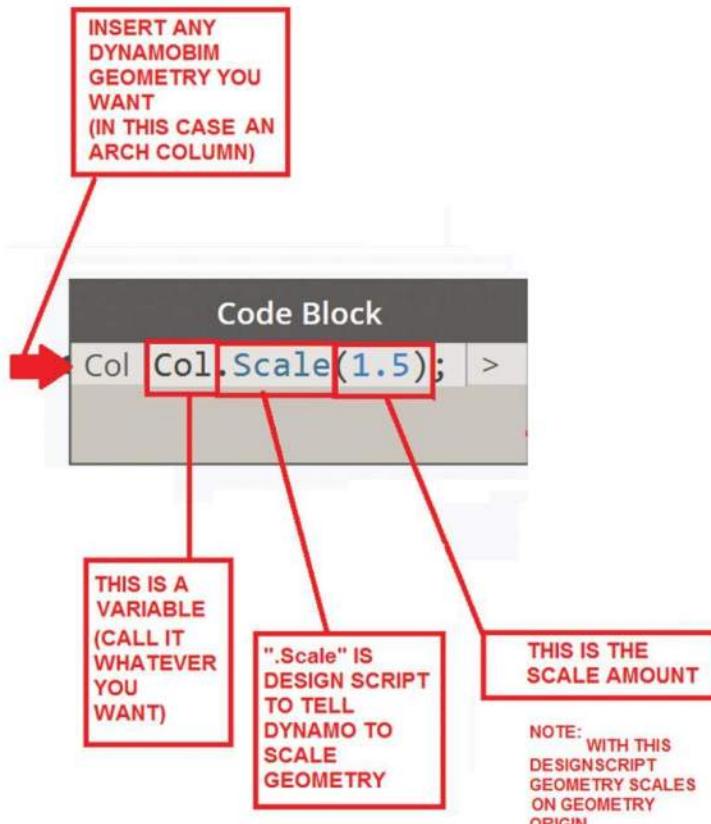
NOTE

DYNAMO GEOMETRY

DYNAMO SOLID : SWEEP PROFILE (CIRCULAR)



SCALE BY DESIGN SCRIPT



NOTE: THE METHOD SHOWS HOW TO SCALE ANY DYNAMO GEOMETRY USING 1 SIMPLE LINE OF DESIGN SCRIPT CODE. REVIT IS NOT INVOLVED WITH THIS EXAMPLE

NOTES

MIRROR DYNAMO GEOMETRY BY DESIGN SCRIPT

Code Block

```
cube1 = Cuboid.ByLengths(Point.ByCoordinates(0, 5, 5), 1, 1, 1);  
mirroredCube= cube1 Mirror(Plane.XZ());
```

TO ONLY CREATE MIRRORED GEOMETRY SIMPLY MOVE THE MIRROR COMMAND TO THE END OF THE CREATED OBJECT WITH A "." AS SHOWN HERE
WHY? BECAUSE ONLY ONE OBJECT IS CREATED (THE MIRRORED OBJECT)

Code Block

```
ube = Cuboid.ByLengths(Point.ByCoordinates(0, 5, 0), 1, 1, 1).Mirror(Plane.XZ());
```

```
Cuboid(Length = 1.000, Width = 1.000, Height = 1.000)
```

DYNAMO NODES

ORIGINAL (NOT CREATED)

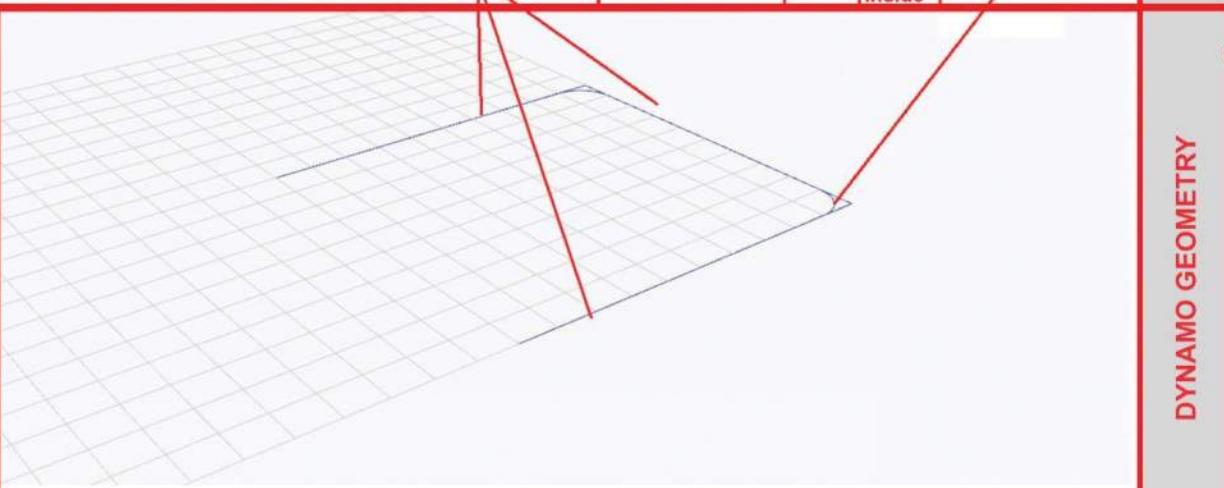
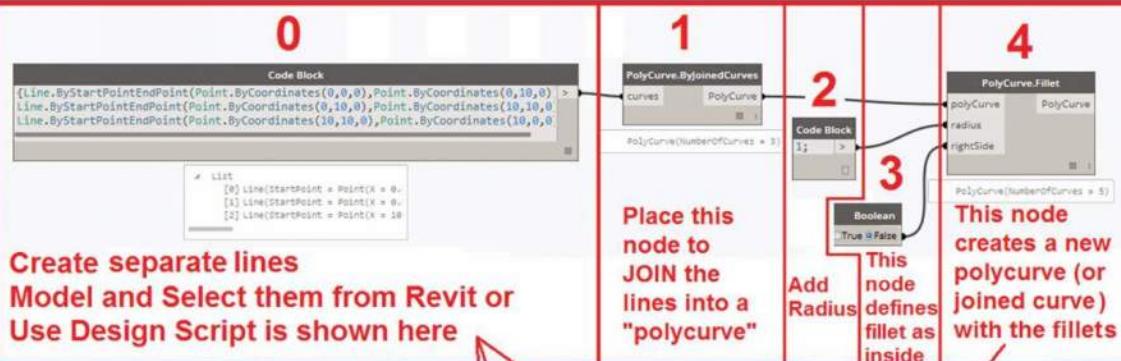
ONLY MIRRORED WAS CREATED

DYNAMO GEOMETRY

NOTE: THIS METHOD COULD BE USED FOR OTHER GEOMETRY MODIFICATIONS SUCH AS SCALE, EXPLODE, ETC. IT COULD ALSO BE USED ON OTHER GEOMETRY SUCH AS CUBIODS. TO DISCOVER WHAT OTHER MODIFICATIONS COULD BE MADE TO THE DYNAMO GEOMETRY SIMPLY ADD A "." AFTER THE GEOMETRY

NOTES

HOW DYNAMO SELECTS REVIT ELEMENTS

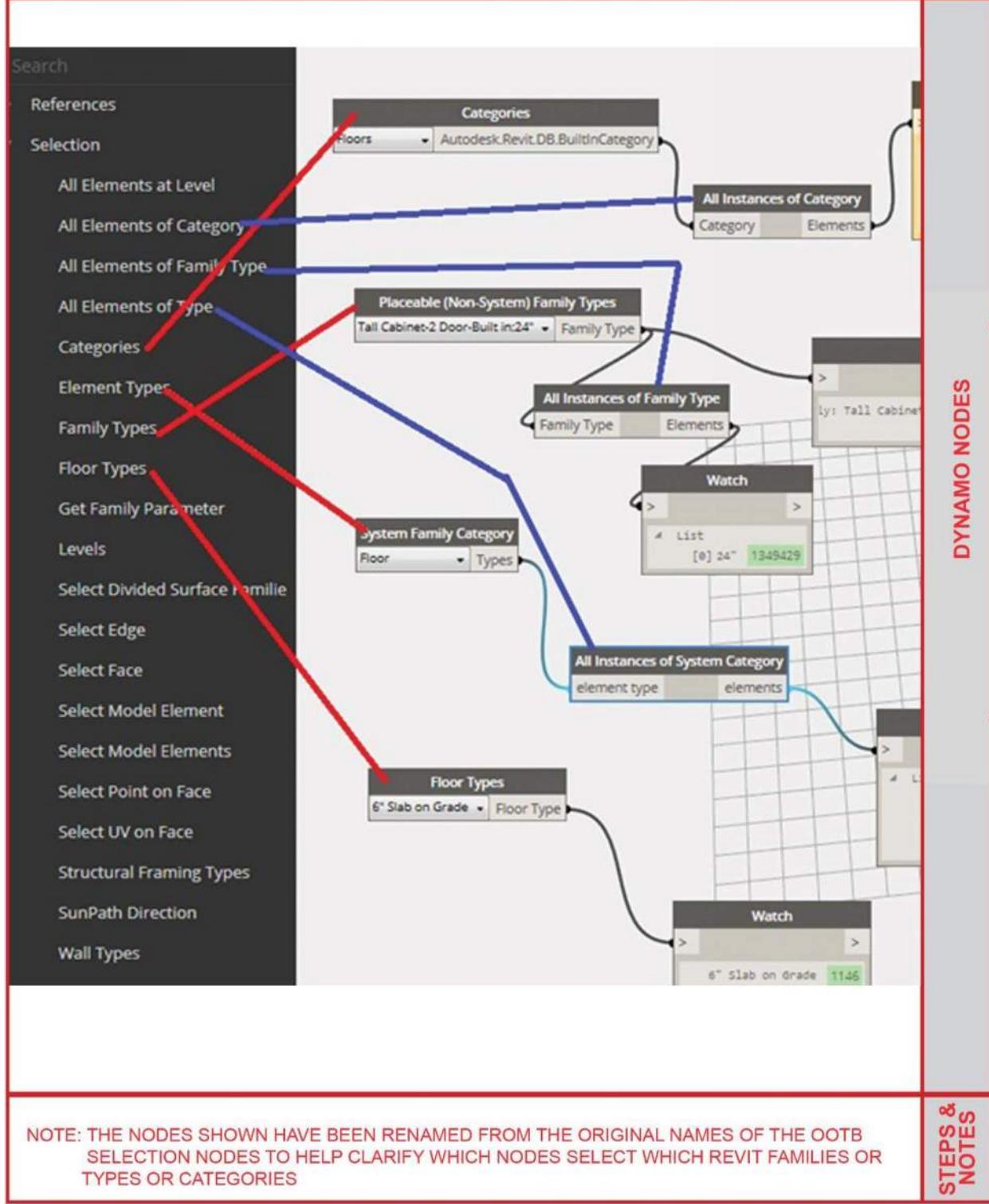


DYNAMO NODES

DYNAMO GEOMETRY

NOTES

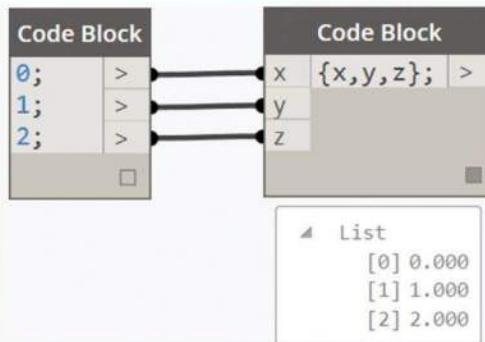
SELECTION NODE NAMING



CREATE LIST OR LISTS USING DESIGN SCRIPT

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

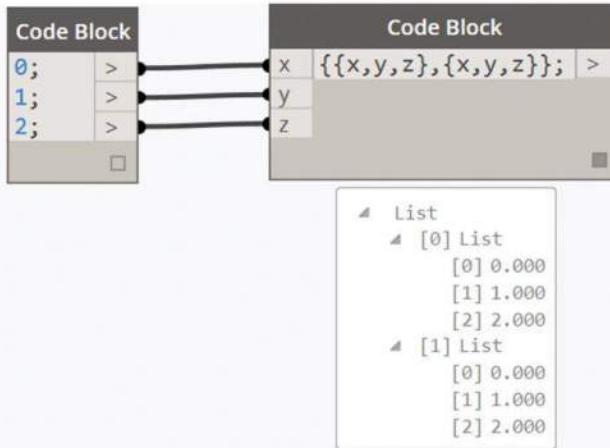
items separated by commas (,)
and closed with curly braces {...}) as shown



DYNAMO NODES SINGLE LIST

{List 1, List 2}

Nested List? Simply add more Curly Braces



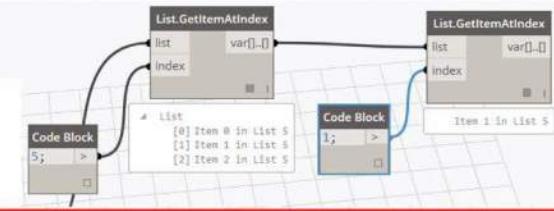
DYNAMO NODES NESTED LIST

NOTE: THE METHOD SHOWS HOW TO CREATE A LIST OR NESTED LIST USING
DESIGN SCRIPT AND "{}" CURLY BRACES

NOTES

GET ITEM FROM LIST BY DESIGN SCRIPT

NEW METHOD



**4 NODE
METHOD**

HOW DO YOU GET
THIS ITEM?

5 ITEMS
IN LIST

ITEM 5
IS ALSO A LIST WITH 3 ITEMS
(NESTED LIST)

LIST

**1 NODE
METHOD**

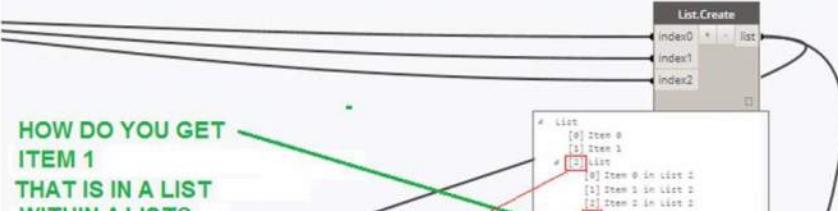
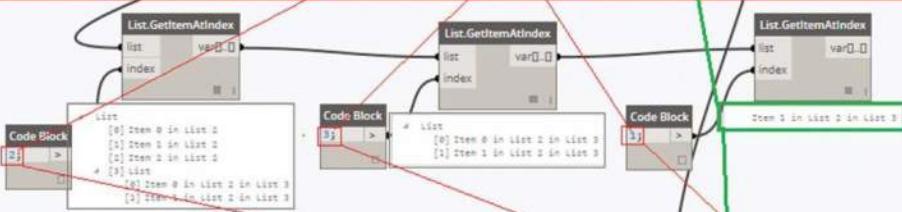
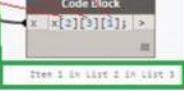
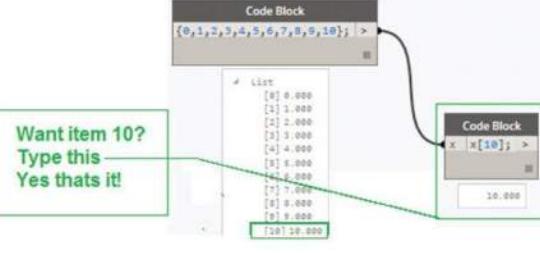
DYNAMO NODES

DYNAMO GEOMETRY

NOTE: THE METHOD SHOWS HOW GET A SINGLE ITEM FROM A NESTED LIST

NOTES

GET ITEMS FROM LIST BY DESIGN SCRIPT

		NESTED LIST	DYNAMO NODES
HOW DO YOU GET ITEM 1 THAT IS IN A LIST WITHIN A LIST?			
Using GetItemAtIndex takes 6 Nodes		NON DESIGN SCRIPT 6 NODES	
Using Design Script takes 1 Node!		DESIGN SCRIPT 1 NODE	
NOTE: Using Design Script to get an item from a single list is just as easy and it takes 1 Node!		SINGLE LIST	
NOTE: THE METHOD SHOWS HOW GET MULTIPLE ITEMS FROM A NESTED LIST			NOTES

CREATE RANGED EXPRESSION (LISTS OF NUMBERS IN A SEQUENCE)

A..B.. α C

(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)

DYNAMO NODES

Code Block
0..2..0.3; >

▲ List

[0]	0.000
[1]	0.300
[2]	0.600
[3]	0.900
[4]	1.200
[5]	1.500
[6]	1.800

Code Block
0..2..#7; >

▲ List

[0]	0.000
[1]	0.333
[2]	0.667
[3]	1.000
[4]	1.333
[5]	1.667
[6]	2.000

Code Block
0..2..~0.3; >

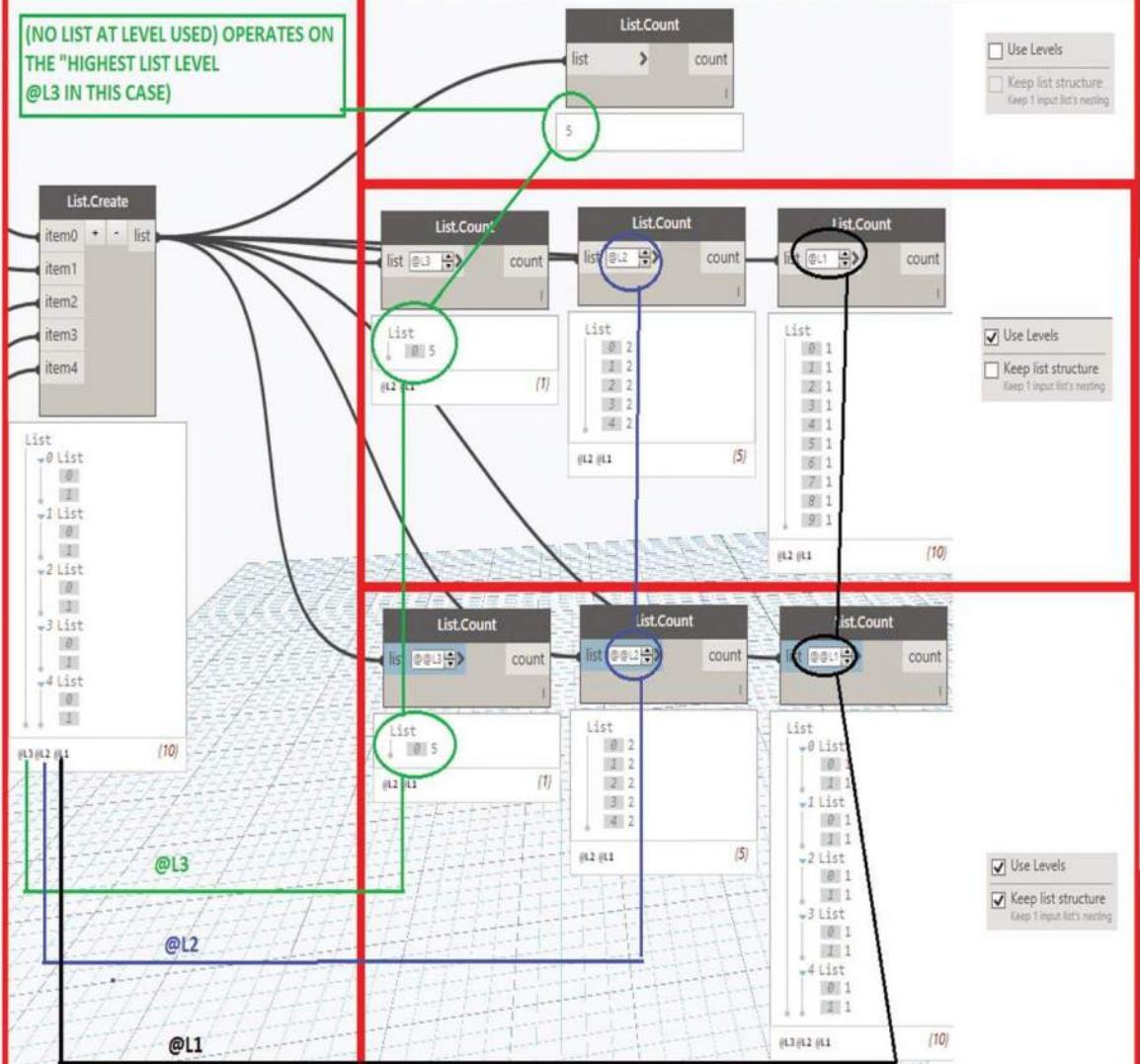
▲ List

[0]	0.000
[1]	0.286
[2]	0.571
[3]	0.857
[4]	1.143
[5]	1.429
[6]	1.714
[7]	2.000

NOTES: IN THE FIRST LIST [7] WAS NOT GENERATED B/C IT EXCEEDS "B" WHICH IS THE MAX VALUE
 COMMON FORMAT IS TO USE "A..B (NO 'C')", IF C IS BLANK THEN IT DEFAULTS TO 1
 EX: A..B..1
 ALSO, NOT ALL RANGED EXPRESSIONS ARE SHOWN

STEPS &
NOTES

BASIC LIST AT LEVEL

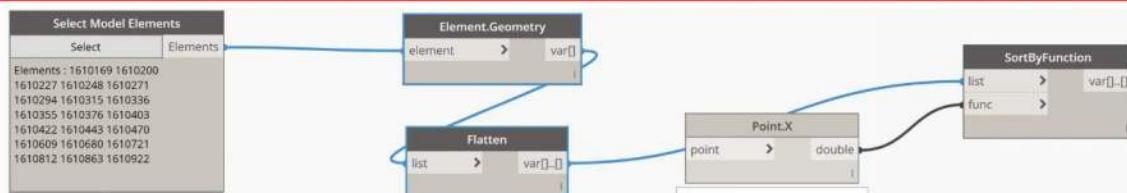


NOTE: THE METHOD SHOWS THE BASIC UNDERSTANDING OF LIST AT LEVEL

NOTES

VVV

REORDER LISTS OF POINTS BY ORDINATE



SELECTS ALL THE
REVIT POINTS IN NO
PARTICULAR ORDER

CONVERTS
REVIT POINTS
TO DYNAMO
POINTS AND
FLATTENS LIST

SETS THE X
COORDINATE
OF POINTS AS
THE SORT
FUNCTION

SORTS OR
REORGANIZES
THE LIST BY
"FUNCTION" IN
THIS CASE
"X" COORDINATE

DYNAMO NODES

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22]

ORIGINAL ORDER OF POINTS
NOTICE THE POINTS ARE "OUT OF ORDER"

DYNAMO GEOMETRY

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22]

NEW ORDER OF POINTS
NOTICE THE POINTS ARE "IN ORDER" IN THE X DIRECTION

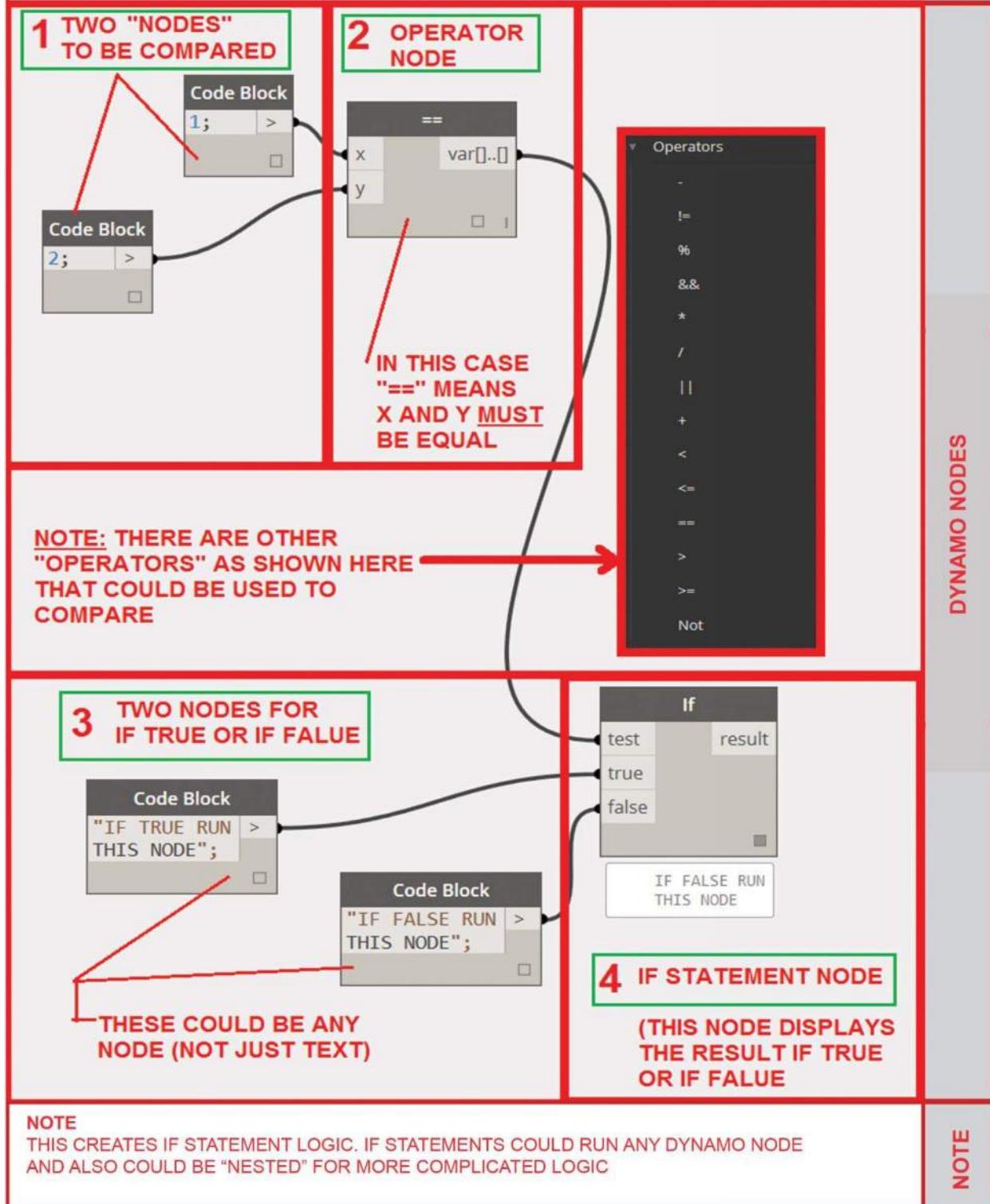
DYNAMO GEOMETRY

NOTE

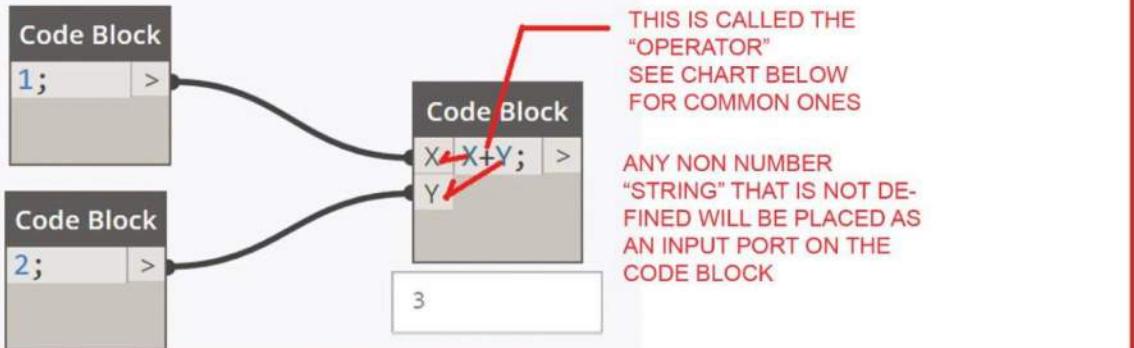
FUNCTIONS ARE CREATED WHEN NOT ALL THE INPUT PORTS CONTAIN INPUT WIRES SUCH AS THE POINTS.X NODE IN THIS CASE. THE POINTS.X IS USED AS A "CRITERIA" TO REORDER THE LIST. LIST BY FUNCTION ONLY WORKS IF THE FUNCTION IS RELATED TO THE LIST.

NOTE

SIMPLE IF STATEMENTS



MATH VARIABLES AND EQUATIONS



DYNAMO NODES

\times Abs (number)	\ln Log (number)	$x,45$ Round (number, digits)
\times Abs (integer)	\ln_b Log (number, logBase)	\pm Sign (number)
$\sqrt{}$ Acos	\ln_{10} Log10	\pm Sign (integer)
\swarrow Asin	$>$ Max (value1, value2)	\wedge Sin
\swarrow Atan	$>$ Max (int1, int2)	\swarrow Sinh
\swarrow Atan2	$<$ Min (value1, value2)	\checkmark Sqrt
$\frac{\oplus}{\ominus}$ Average	$<$ Min (int1, int2)	Σ Sum
$\lceil \rfloor$ Ceiling	x^y Pow	\checkmark Tan
\checkmark Cos	\triangleleft RadiansToDegrees	\checkmark Tanh
\checkmark Cosh	\diamond Rand	E E
\angle DegreesToRadians	\odot^n Random (seed)	Φ GoldenRatio
$\%$ DivRem	ω Random	π PI
e^x Exp	RandomList RandomList	PiTimes2 PiTimes2
$n!$ Factorial	RemapRange RemapRange	
$\lfloor \rfloor$ Floor	$.5$ Round (number)	

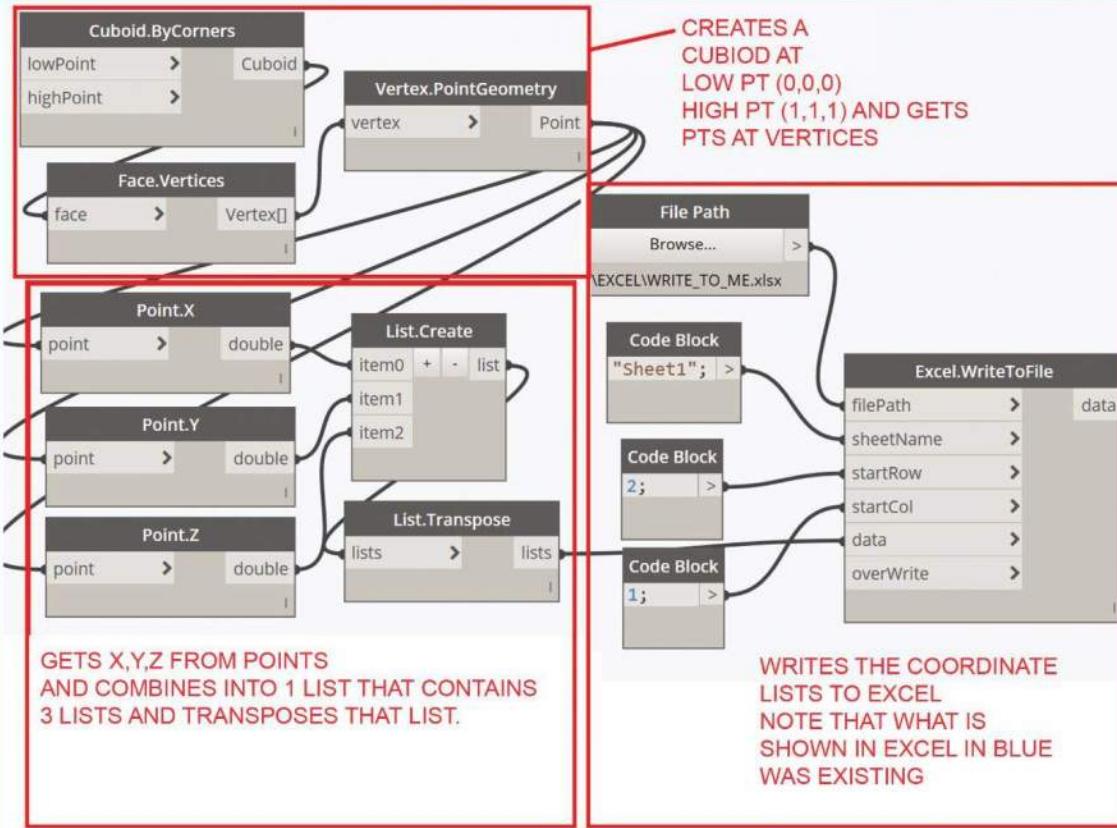
COMMON MATH VARIABLES

NOTE

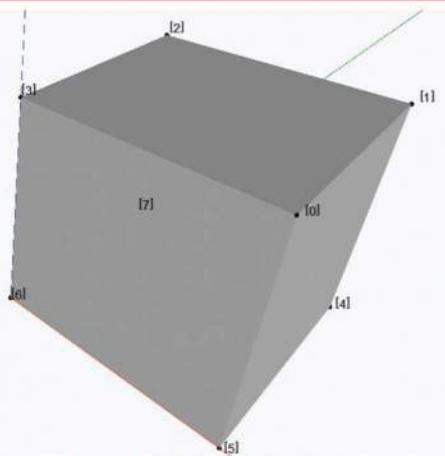
THIS CREATES AN EQUATION USING THE CODE BLOCK. ANY VARIABLE THAT IS NOT DEFINED IS PLACED IN THE INPUT PORT AND MOST OPERATORS COULD BE USED AS WELL AS THE FUNCTIONS SHOWN.

NOTE

POINTS COORDINATES AT VERTICES TO EXCEL



DYNAMO NODES



DYNAMO CUBOID

VERTICES OF CUBOID			
POINT	X	Y	Z
0	1	0	1
1	1	1	1
2	0	1	1
3	0	0	1
4	1	1	0
5	1	0	0
6	0	0	0
7	0	1	0

EXCEL SPREADSHEET

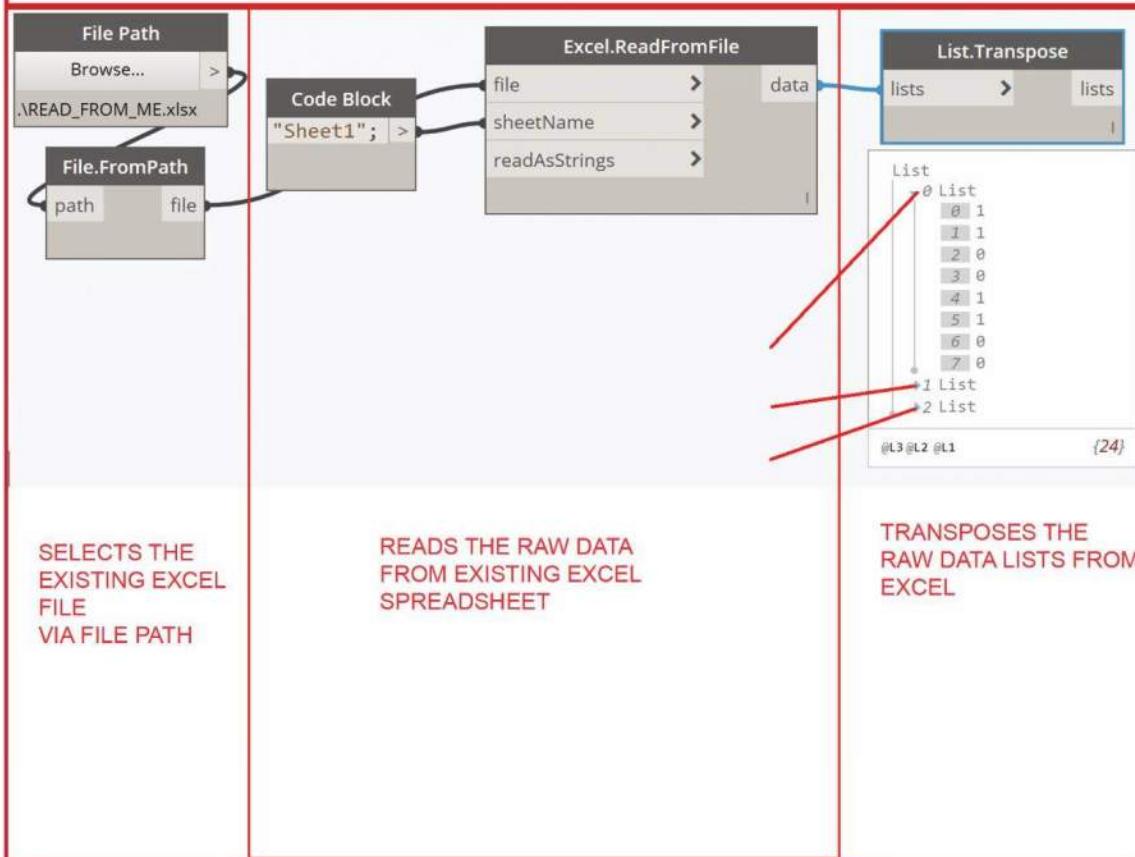
DYNAMO GEOMETRY + EXCEL

NOTE

THE EXCEL SPREADSHEET WAS EXISTING AND WHAT IS SHOWN IN BLUE WAS WHAT WAS PRESET IN EXCEL AND WHAT IS SHOWN IN ORANGE IS WHAT WAS WRITTEN IN BY DYNAMO

NOTE

READ RAW DATA FROM EXCEL



SELECTS THE
EXISTING EXCEL
FILE
VIA FILE PATH

READS THE RAW DATA
FROM EXISTING EXCEL
SPREADSHEET

TRANSPOSES THE
RAW DATA LISTS FROM
EXCEL

DYNAMO NODES

1	0	1
1	1	1
0	1	1
0	0	1
1	1	0
1	0	0
0	0	0
0	1	0

RAW EXCEL SPREADSHEET DATA

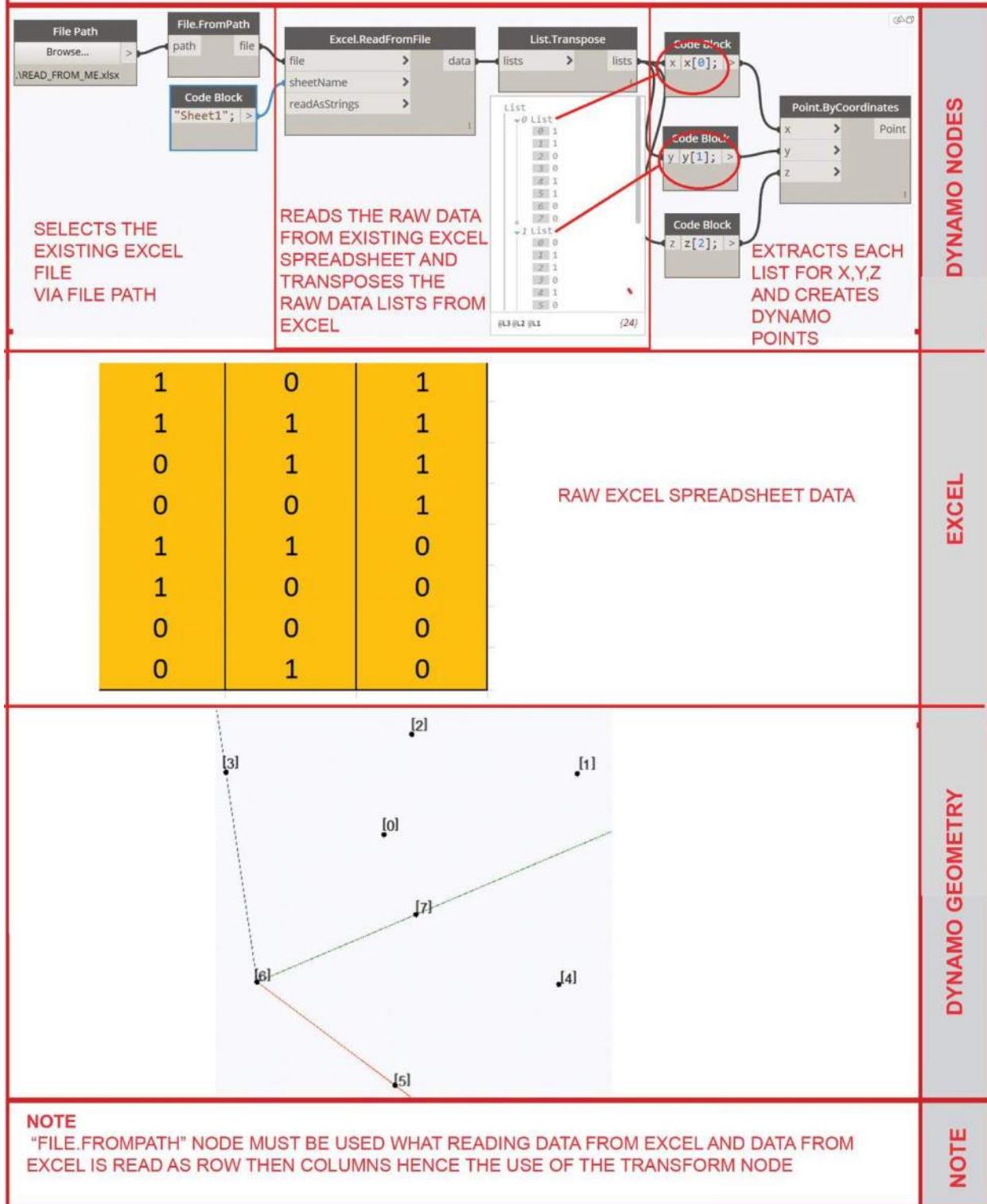
EXCEL

NOTE

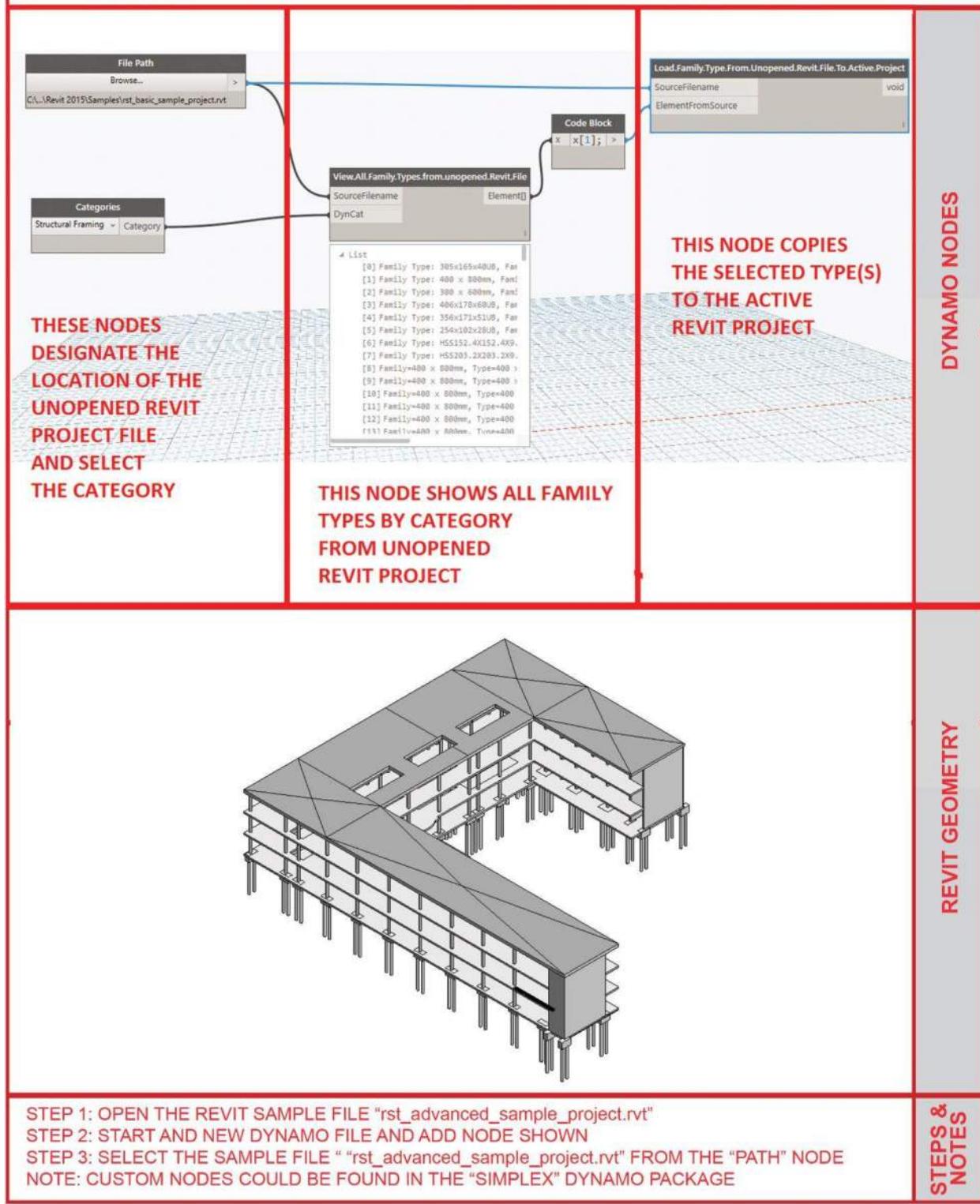
"FILE.FROMPATH" NODE MUST BE USED WHEN READING DATA FROM EXCEL AND DATA FROM EXCEL IS READ AS ROW THEN COLUMNS HENCE THE USE OF THE TRANSFORM NODE

NOTE

CREATE DYNAMO PTS FROM RAW EXCEL DATA



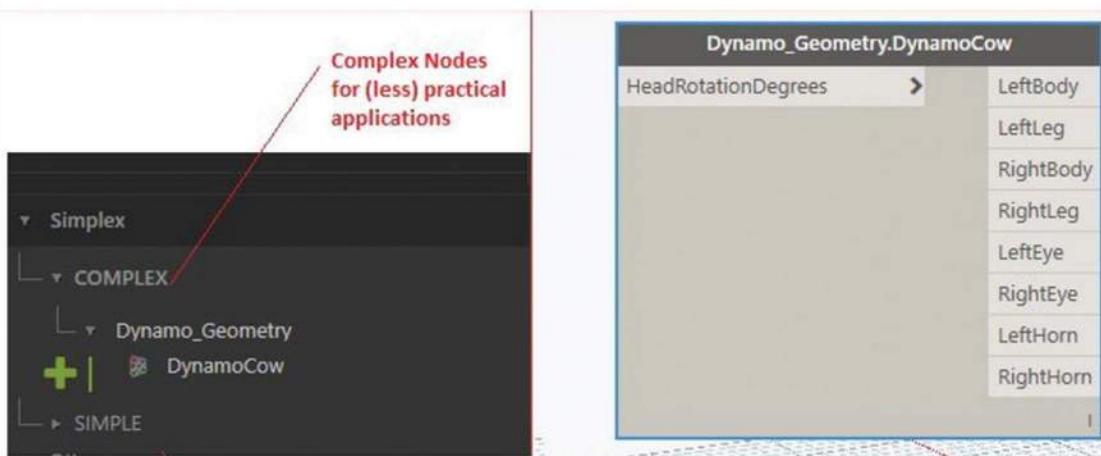
COPY TYPES FROM UNOPENED REVIT PROJECT TO ACTIVE REVIT PROJECT USING ZT DYNAMO NODES



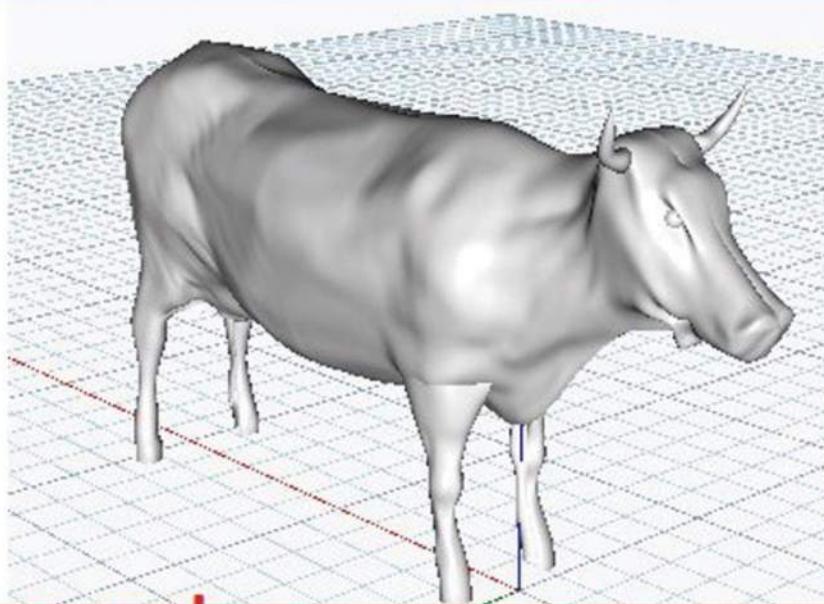
READ TEXT FROM MS WORD DOCUMENTS (.DOCX)

<p>The screenshot shows the Dynamo interface with a workflow. On the left, the node browser shows nodes under the 'Simplex' package. A red arrow points from the 'Word' section to the text 'SIMPLEX PACKAGE'. The main workspace contains three nodes: 'File Path' (with a value of 'D:\...\ZERO_TOUCH\word\sampleworkdoc.docx'), 'Word.GetWordParagraphs' (with a value of 'WordFileName > string[]'), and 'Word.GetWordText' (with a value of 'WordFileName > string'). A green line connects the output of 'GetWordParagraphs' to the input of 'GetWordText'. A black line connects the output of 'GetWordText' back to the 'File Path' node. A callout box labeled 'SIMPLEX PACKAGE' points to the 'Word' section in the node browser.</p>	<p>DYNAMO NODES</p> <p>USE THIS NODE TO LOAD IN THE WORD DOCUMENT</p> <p>File Path Browse... D:\...\ZERO_TOUCH\word\sampleworkdoc.docx</p> <p>USE THIS NODE TO HAVE DYNAMO PLACE EACH LINE WITH A "RETURN" IN WORD AS A SEPERATE LIST ITEM</p> <p>Word.GetWordParagraphs WordFileName > string[]</p> <p>USE THIS NODE TO GET ALL THE TEXT IN ONE SINGLE LINE</p> <p>Word.GetWordText WordFileName > string</p> <p>This is the first ParagraphThis is the 2nd</p> <p>List This is the first Paragraph This is the 2nd Paragraph This is the 3rd Paragraph This line has a return Any line with a return will be a new item in a list</p>	<p>File Home Insert Design Layout References Mailings</p> <p>This-is-the-first-Paragraph</p> <p>This-is-the-2nd-Paragraph</p> <p>This-is-the-3rd-Paragraph</p> <p>This-line-has-a-return</p> <p>Any-line-with-a-return-will-be-a-new-item-in-a-list</p>	<p>MS WORD</p> <p>Note: This workflow was intended for non-complex formated word documents</p>
			<p>STEPS & NOTES</p> <p>STEP 1: OPEN THE REVIT SAMPLE FILE "rst_advanced_sample_project.rvt" STEP 2: START AND NEW DYNAMO FILE AND ADD NODE SHOWN STEP 3: SELECT THE SAMPLE FILE "READ_TEXT_FROM_WORD.DOCX" FROM THE "PATH" NODE NOTE: CUSTOM NODES COULD BE FOUND IN THE "SIMPLEX" DYNAMO PACKAGE</p>

READ TEXT FROM MS WORD DOCUMENTS (.DOCX)



DYNAMO NODES



DYNAMO GEOMETRY

STEP 1: OPEN THE REVIT SAMPLE FILE "rst_advanced_sample_project.rvt"
STEP 2: START AND NEW DYNAMO FILE AND ADD NODE SHOWN AND RUN

NOTE: CUSTOM NODES COULD BE FOUND IN THE "SIMPLEX" DYNAMO PACKAGE

STEPS &
NOTES