Make your Revit Families smart and adaptive !!

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Learning Objectives

1. What are Smart families?

   - ✓ Factors driving geometry of Revit families
   - ✓ Difference between adaptive & parametric
   - ✓ Application – Tools & elements

2. Family Organization & Composition
   - ✓ Plan & analyze the parametric behavior of the family.
   - ✓ Nesting families
   - ✓ Application – Placing Families in Revit

3. Task Automation with Dynamo
   - ✓ Setup Parameters
   - ✓ Placing Components
   - ✓ Influencing Components

What are
SMART FAMILIES?

Factors that define smart objects:

1) ***CUSTOMIZABLE*** – CAN BE MODIFIED AS REQUIRED

2) ***ADAPTIVE*** – ADJUSTS AS PER THE CONTEXT

3) ***DATA*** – STORE AND REPORT INFORMATION

How does all these drive geometry inside a Revit Family?

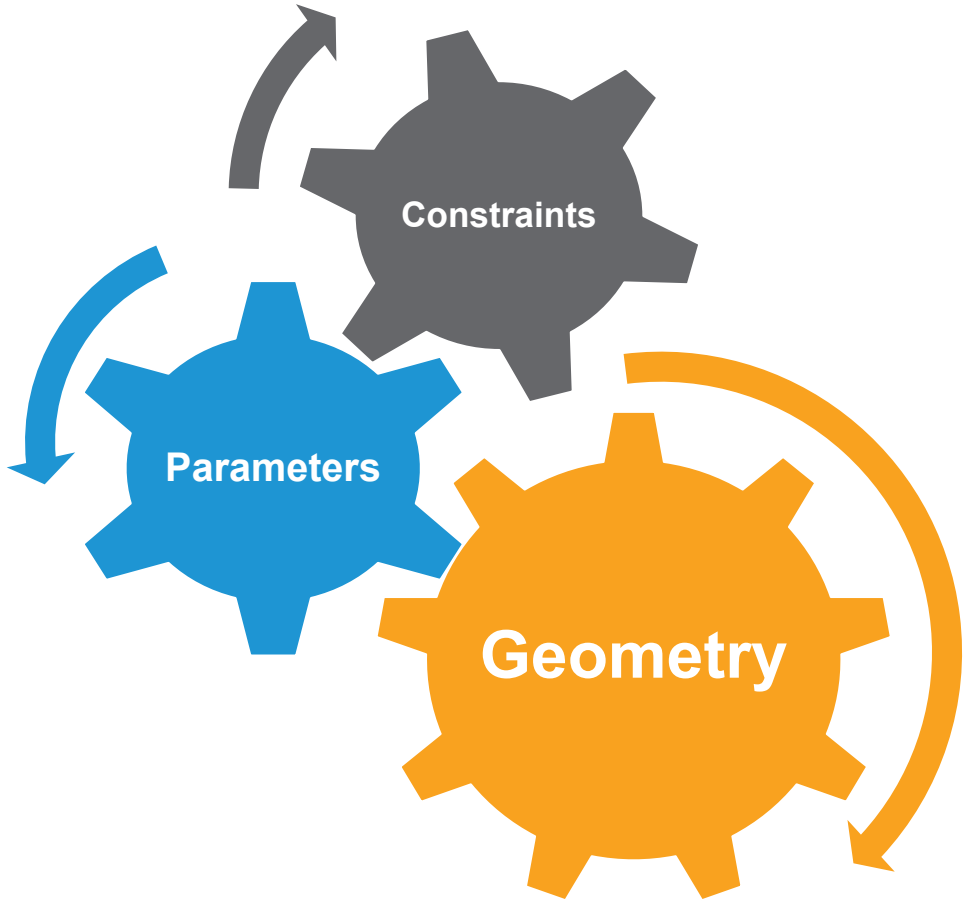
Key factors driving Geometry inside the Revit Families:

1) Parameters

constant or variable characteristic that defines a geometry or system of geometries

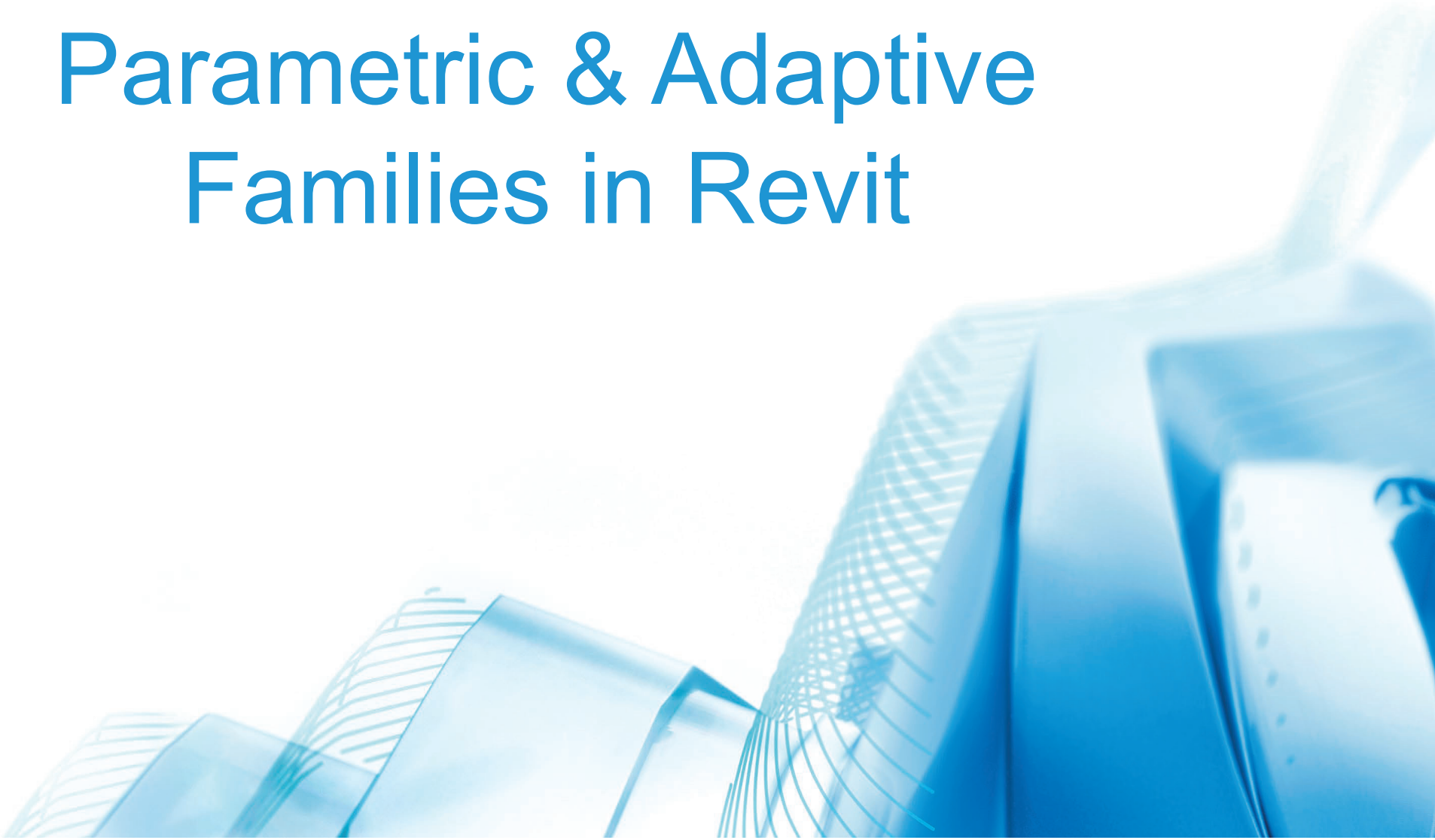
2) Constraints

Rules applied to control how the geometry behaves



How to achieve these in your
Revit Family?

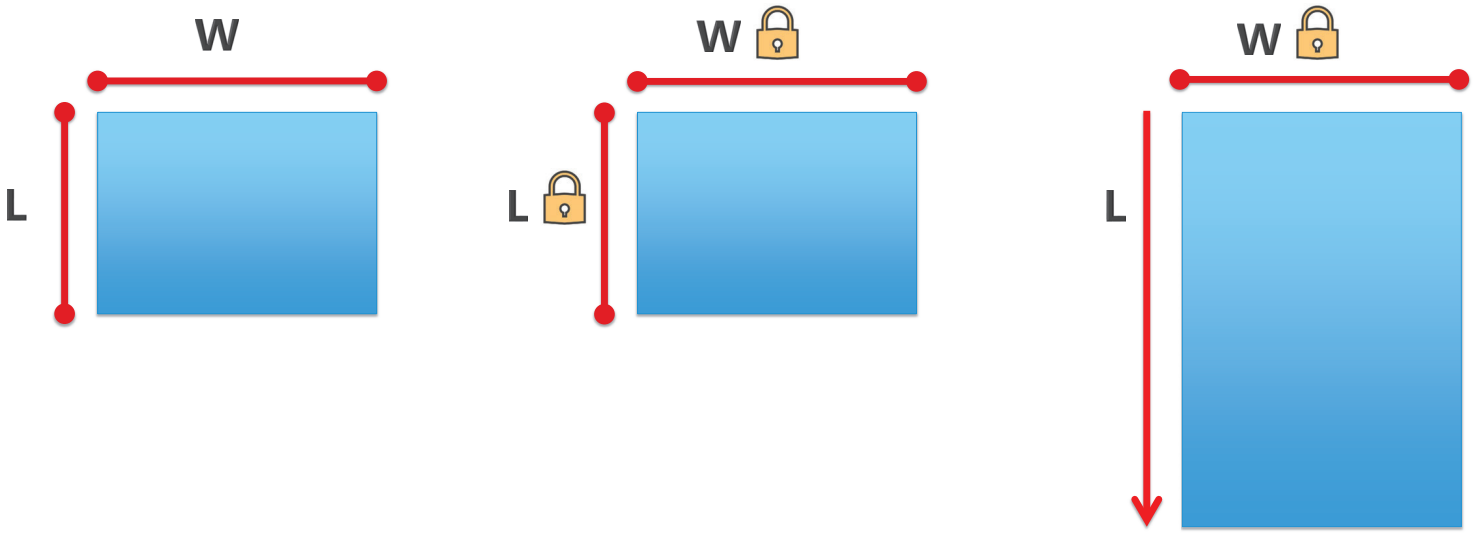
Parametric & Adaptive Families in Revit



Parametric Families

Allows you to create inter-related parameters & set of rules that controls geometry.

Define **PARAMETERS** ➡ Set **RULES & CONSTRAINTS** ➡ Specify **VARIABLES**



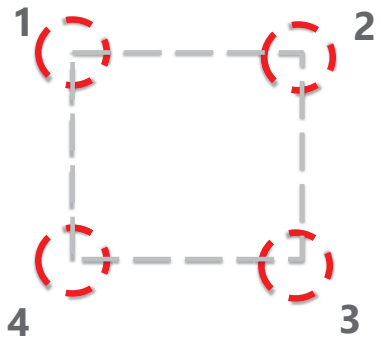
Adaptive Families

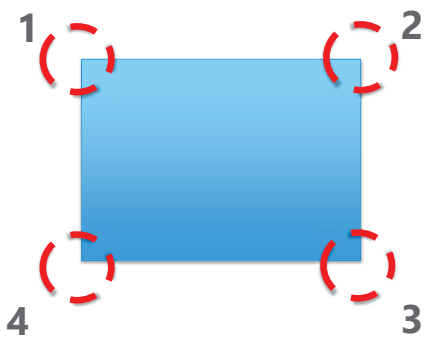
Allows you to place these points in 3D that drives all the geometry which is drawn by snapping to these flexible points.

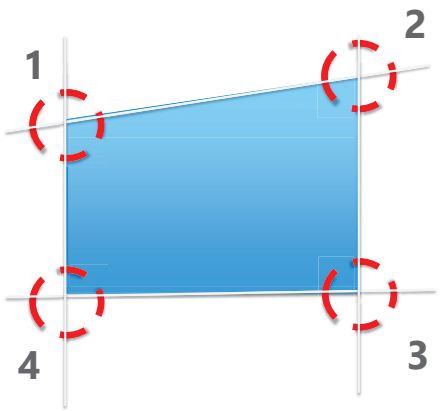
Specify
INSERTION POINTS
& Reference Planes with it

Establish
RELATION OF GEOMETRY
to those points

Place the points
MANUALLY or as a
PATTERN







How to choose the application of these components?

Application of Adaptive & Parametric families

Any object that you see around you, as long as you are able to identify the following:

1. **Relationship** among the various elements of that object

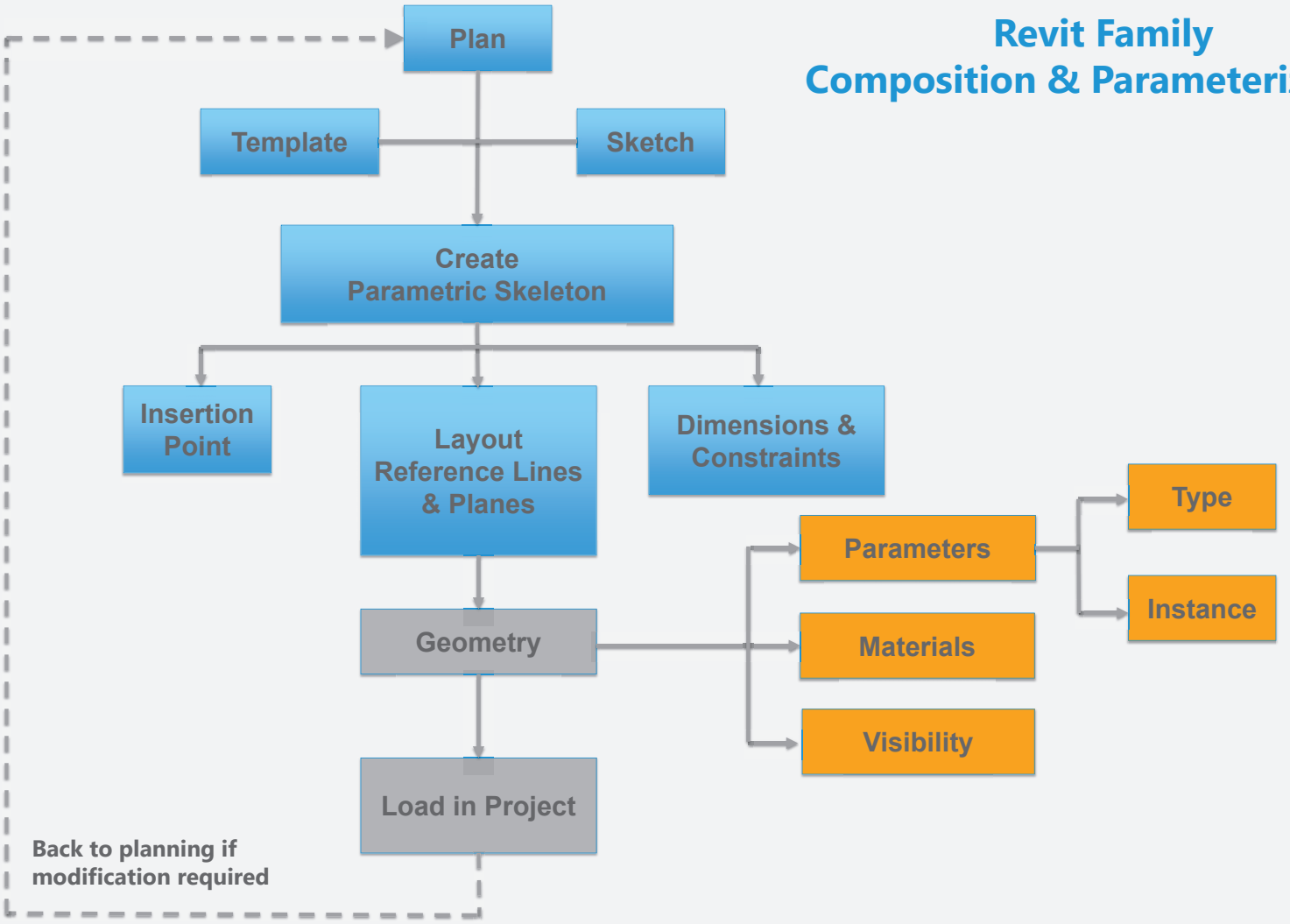
2. **Flexibility** to adapt to many unique contextual conditions.

3. **Repetition** achieved by arraying multiple components that conform to constraints.

Revit Family
Composition & Parameterization

"Choose parameters that are **flexible** enough
to address issues that otherwise may take
multiple families to handle"

Revit Family
Composition & Parameterization



Stages of creating Revit Family

1. Modeling

- POINT
- LINE
- REFERENCES
- CONSTRAINTS

2. Nesting

- NESTING FAMILIES
- MAPPING PARAMETERS

3. Placement

- ARRAY
- ADAPTIVE POINTS

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1.1 Sketch it out !!

Analyze the parametric behavior of the family

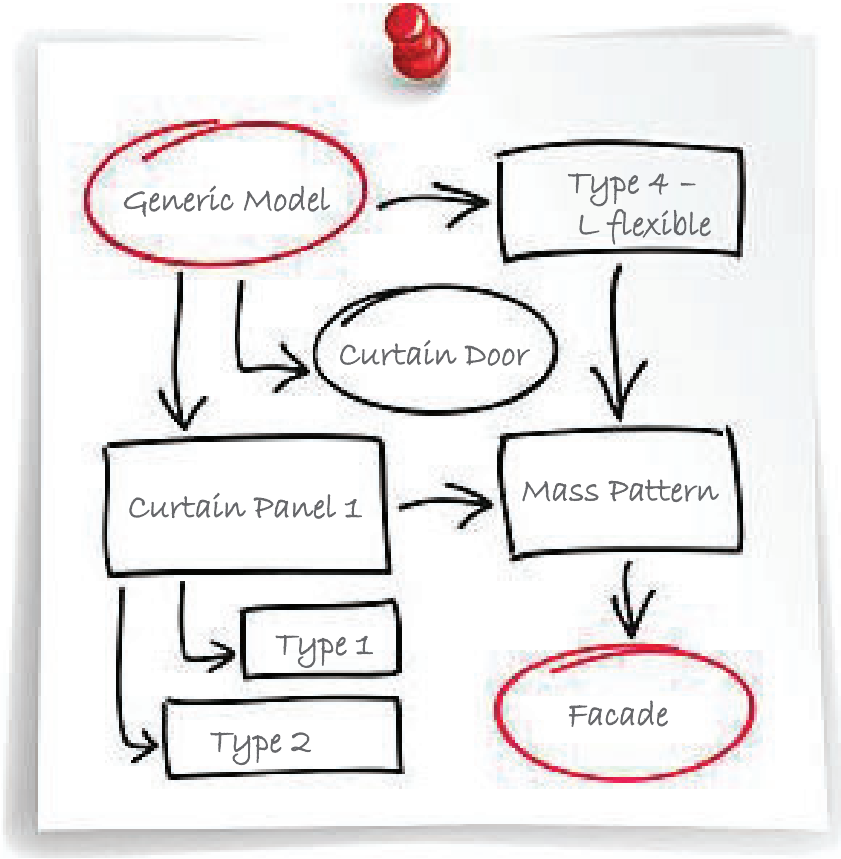
Establish how the data in parameters is related.

Collect relevant information beforehand,

such as Dimensions, materials and number of family types.

Establish splitting strategy

understand how many families are required in order to solve the parameterization



In doing so, the family parameters and their related formulas can be clearly identified.

1.2 Choose correct Revit family template

- Contains **pre-defined features for each category** and determine the behavior of each element.
- When planning a family, it is important to understand the **settings that a template file contains**.
- **Generic model template** is often chosen as a go-to option for basic families, as it allows you to change the category at a later stage.

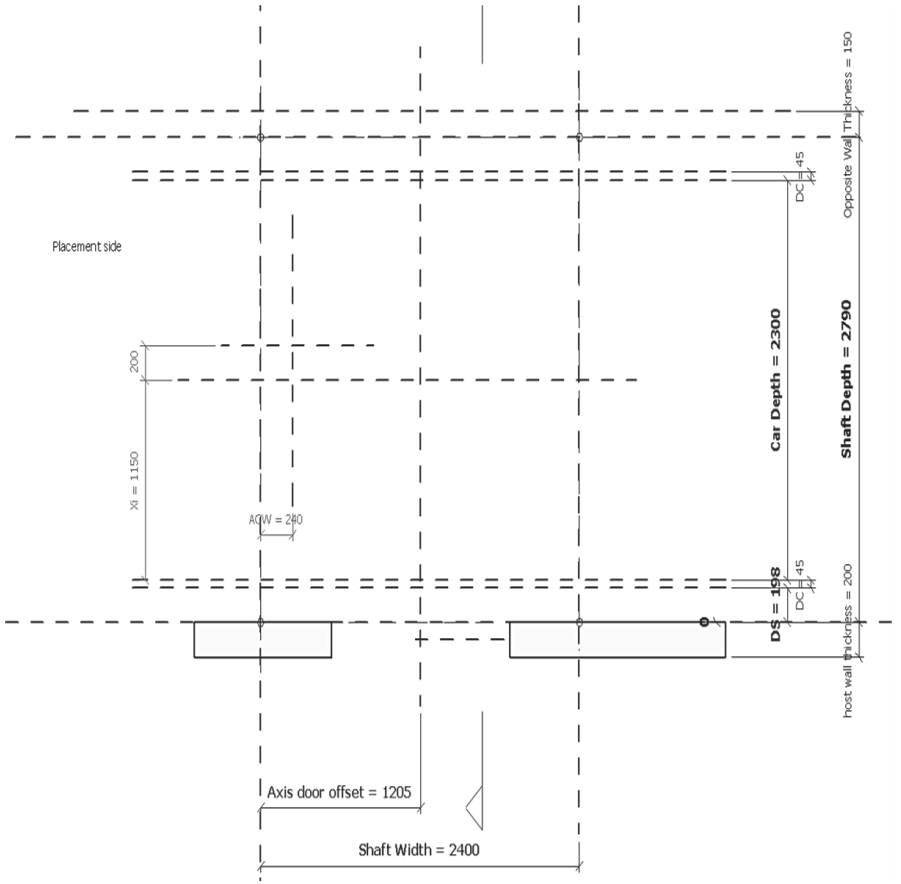
Types of family template

Standard- Stand alone
Wall-based
Ceiling-based
Floor-based
Roof-based
Line-based
Face-based

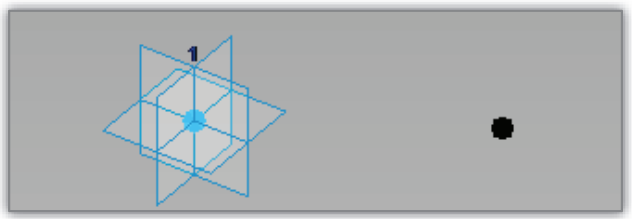
1.3 Create Parametric Skeleton

Following are the key components for creating parametric skeleton of a family in Revit :

- **Adaptive Family – Point**
- **Parametric Family – Reference Lines/Planes**
- **Constraints - Formulas**

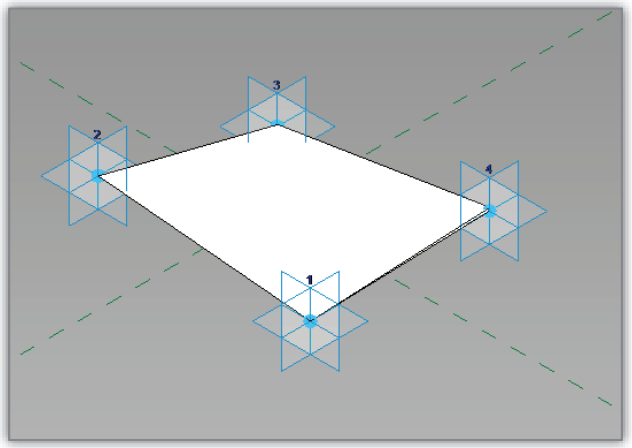


1.3 Create Parametric Skeleton



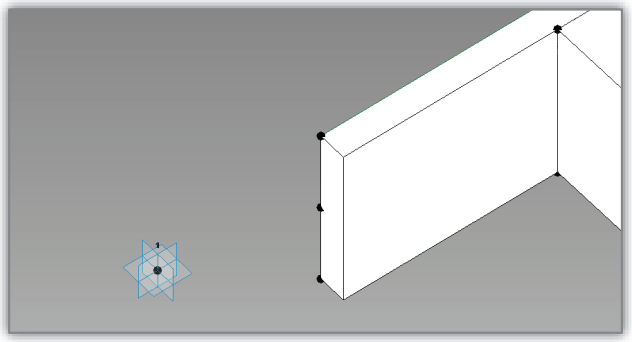
Adaptive points & Reference Points

- **Adaptive points** are created from **Reference points**.



- Adaptive components **can be related to more than one insertion point** and other points referenced to that insertion point.

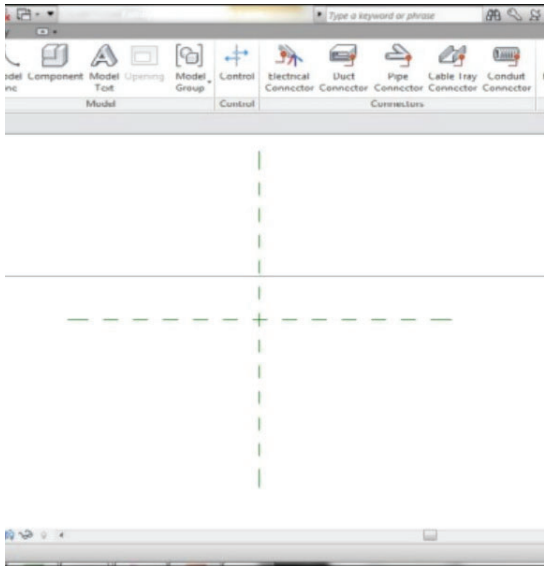
With this way, the adaptive component can grow differently depending on the specific position of those points.



1.3 Create Parametric Skeleton

Reference Lines & Planes

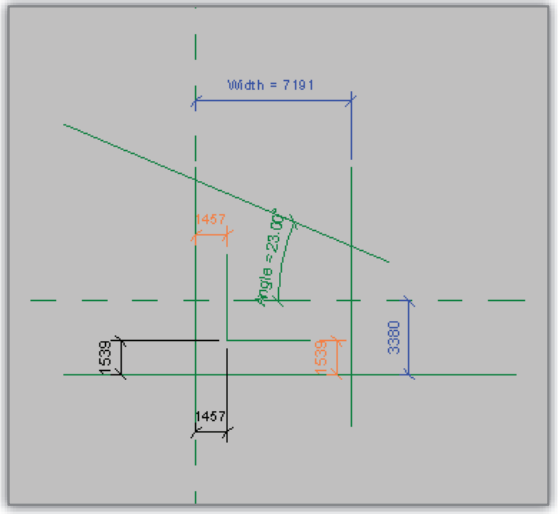
This **defines the Origin** & **set the location point** of the family when placing it in a project



Reference planes have a property called **"Is Reference"** that defines the behavior of the family when loaded into a project

You can specify the importance as per below:

- Strong Reference
- Weak Reference
- Not a Reference



It helps to set-up color for these reference planes to identify the difference.

1.3 Create Parametric Skeleton

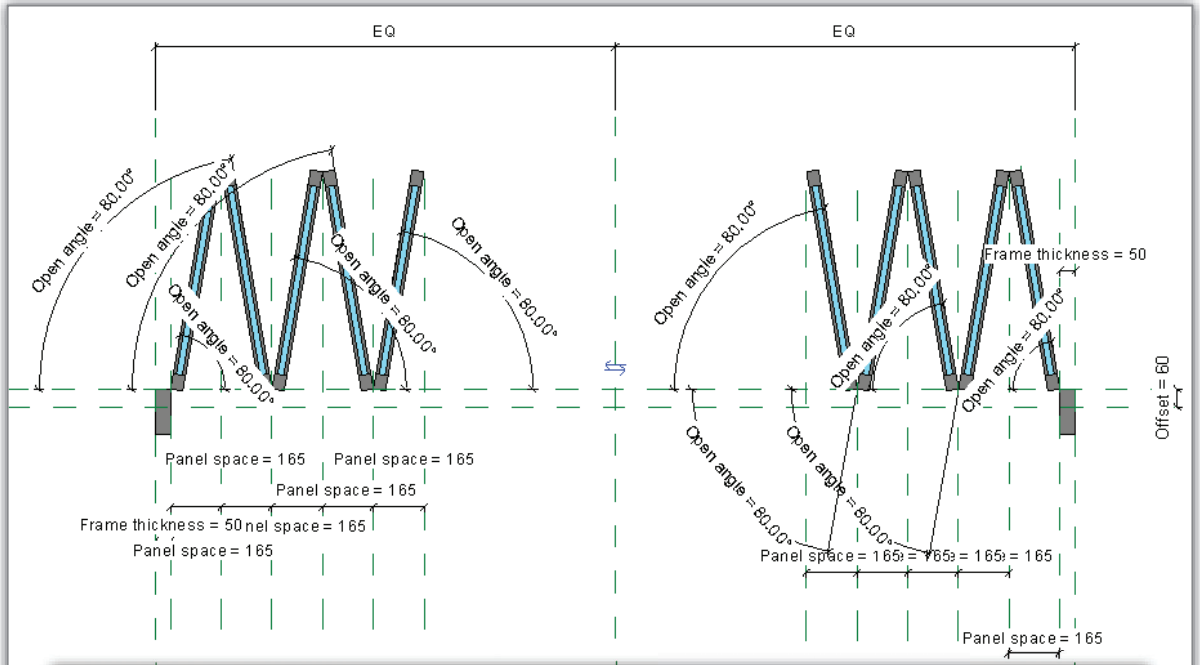
Constraints

To constraint is the state of being restricted or confined within prescribed bounds.

Formulas & Conditional statement are also useful when defining formulas for these parameters.

It usually follows the same structure in Revit:

IF (<condition>, <result-if-true>, <result-if-false>)



Panel height (default)	3950.0	= Height - Frame thickness
Panel bottom rail width	150.0	=
Open angle	80.00°	=
Width (report)	3000.0	=
Panel width (default)	725.0	= (Width - 2 * Frame thickness) / (No of right panels + No of left panels)
Panel thickness	40.0	=
Panel space (default)	165.3	= ((Panel thickness) * (sin(Open angle))) + (Panel width * (cos(Open angle)))
Offset	60.0	=

Stages of creating Revit Family

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- MAPPING PARAMETERS

3. Placement

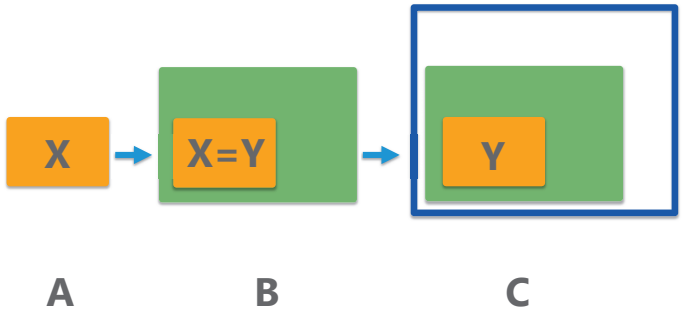
- ARRAY
- ADAPTIVE POINTS

Nesting…??!!

2. Nesting

When you manage your complex Families in this way, you gain more **control and flexibility.**

- Breakdown your object into basic parts & build them as separate Families.
- You can create families that feature interchangeable nested components when added to your models.

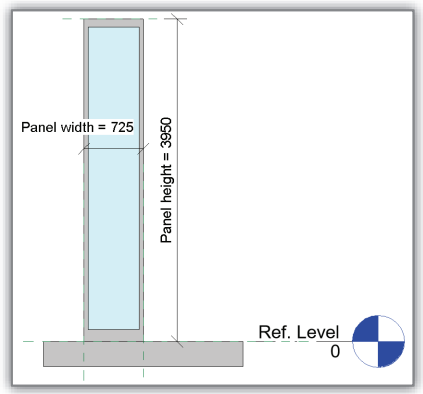


Use nesting if you need to **rotate, move or mirror an element parametrically** or make a **parametric array** in your family.

You can nest family A into family B and then in turn nest family B into family C and so on……

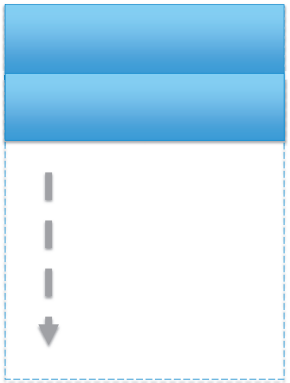
2.1 Mapping Parameters

- To control the **type of family** within a nested family, you create a family **type parameter** that can be either an instance or type parameter.
- After you label a nested component as a family type parameter, subsequently loaded families of the same type **automatically become interchangeable** without any further work.

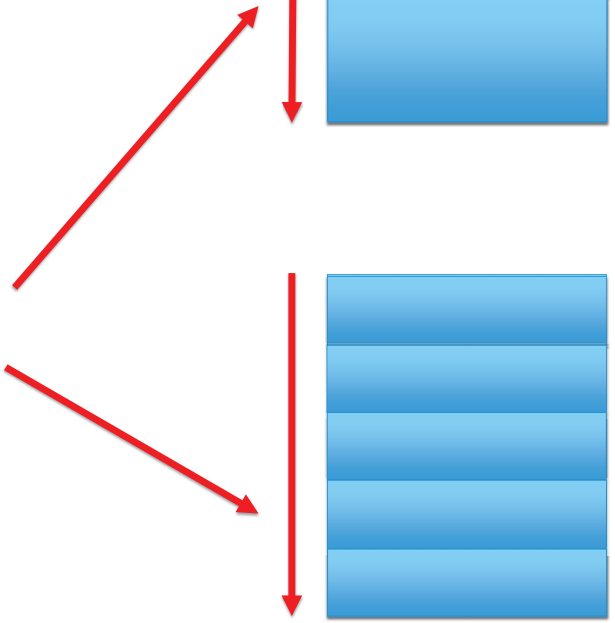


Variable – by constraints

Fixed



Array nested component



Stages of creating Revit Family

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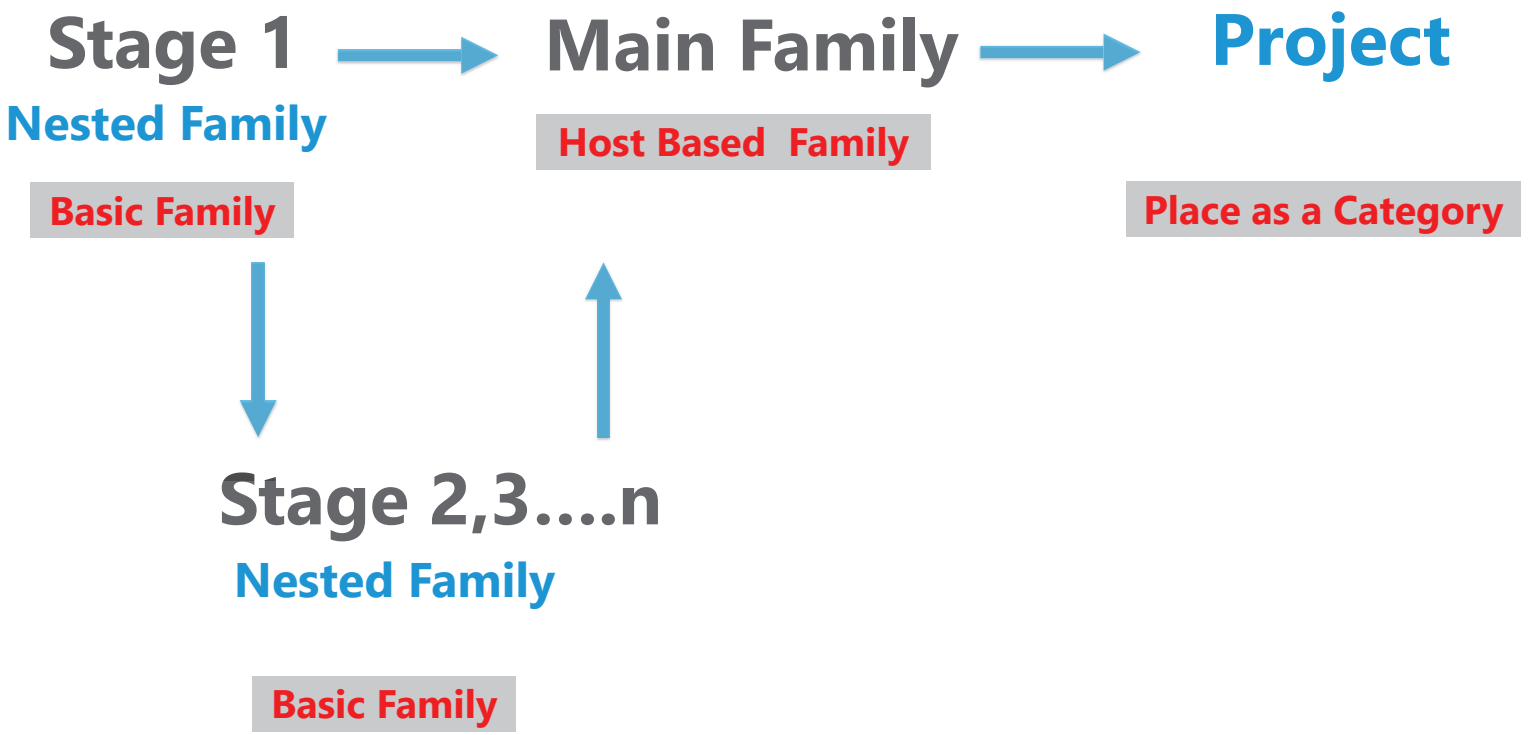
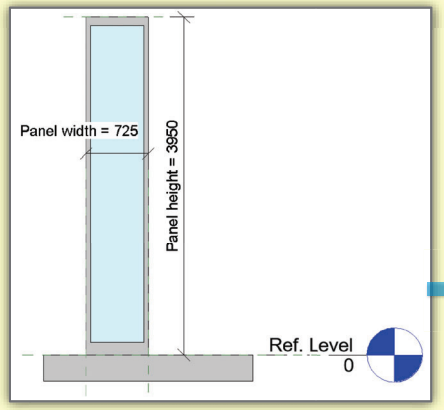
Parametric Family – Placement & Nesting



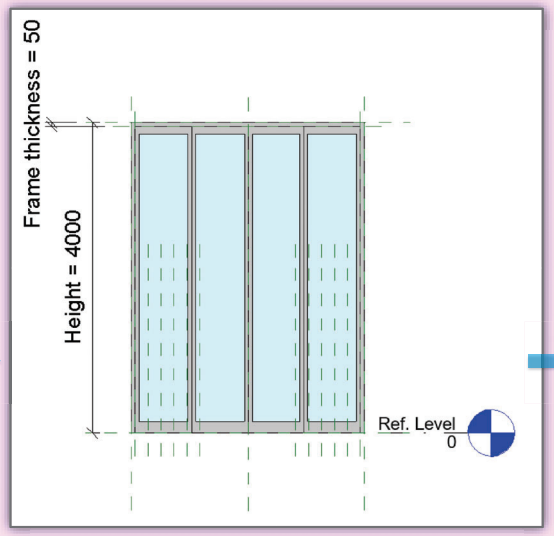
Parametric Family – Placement & Nesting

Stage 1
Nested Family



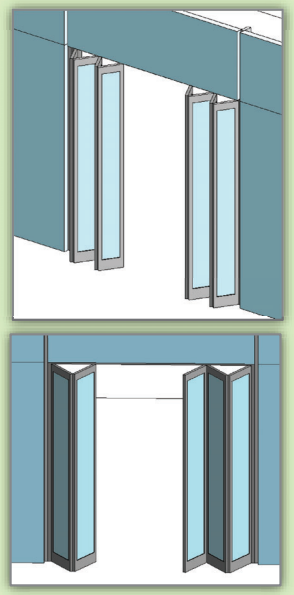
Basic Family

Stage 2
Family 1



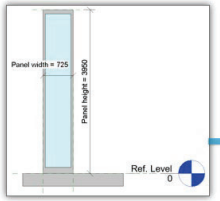
Host Based Family

Project

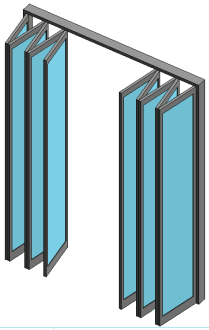


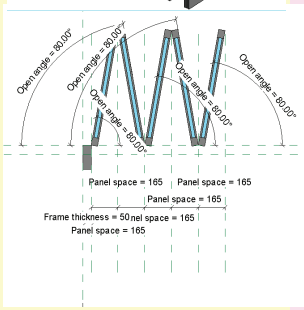
Place as a Category

Stage 1
Nested Family

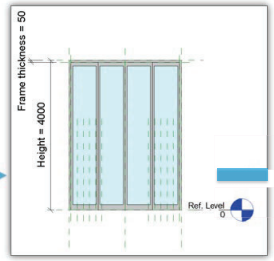


Basic Family





Stage 2
Family 1



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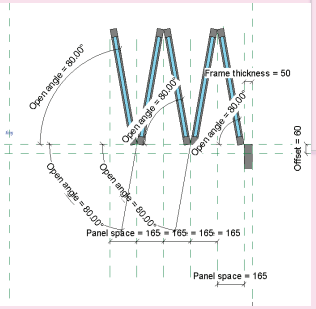
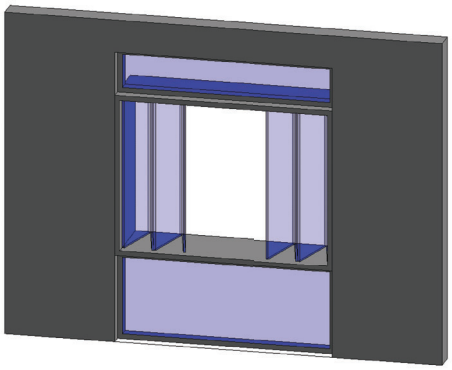


Stage 3
Family 1



Host Based Family

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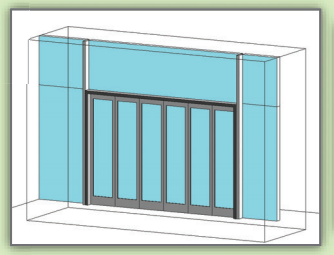
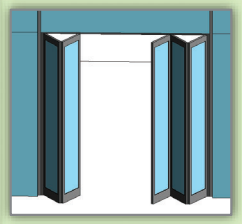
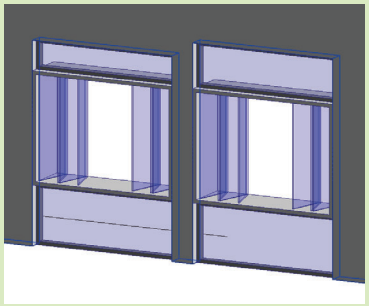


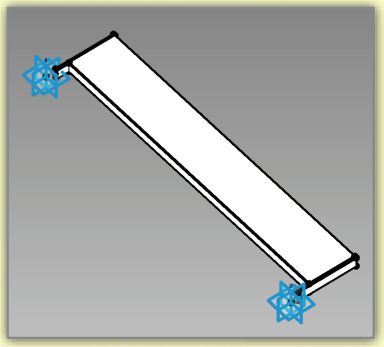




Place as a Category

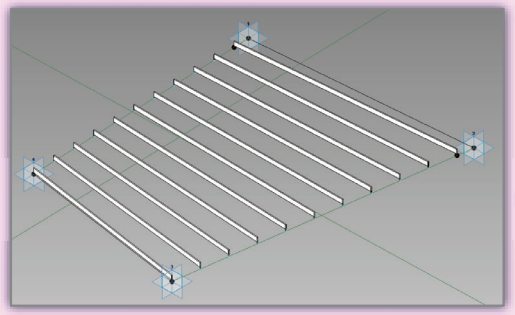
Adaptive Family – Placement & Nesting

Stage 1
Nested Family



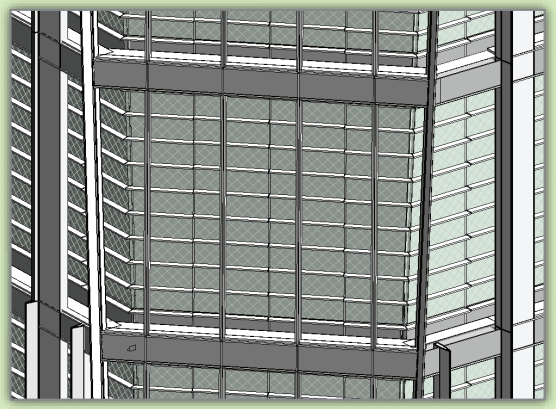
Basic Family

Stage 2
Family 1



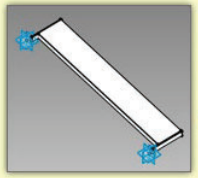
Pattern –based Family

Project



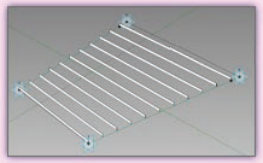
Place as a Category

Stage 1
Nested Family

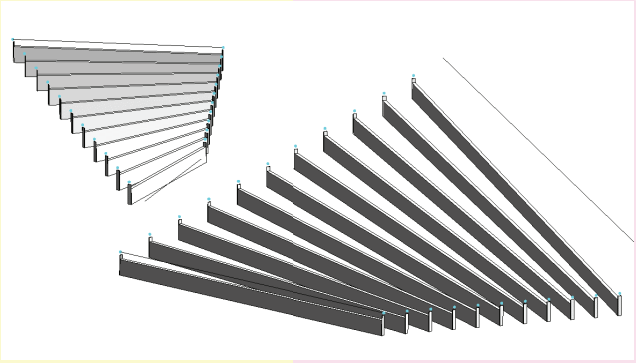


Basic Family

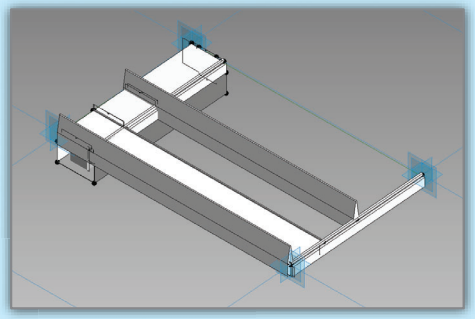
Stage 2
Family 1

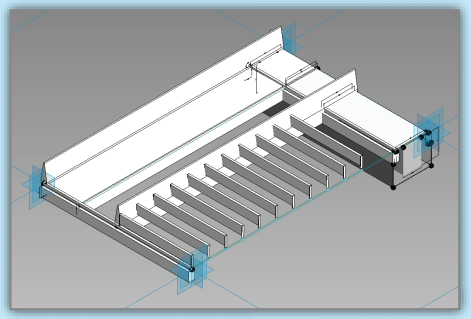


Pattern –based Family



Stage 3
Family 1





Host Based Family

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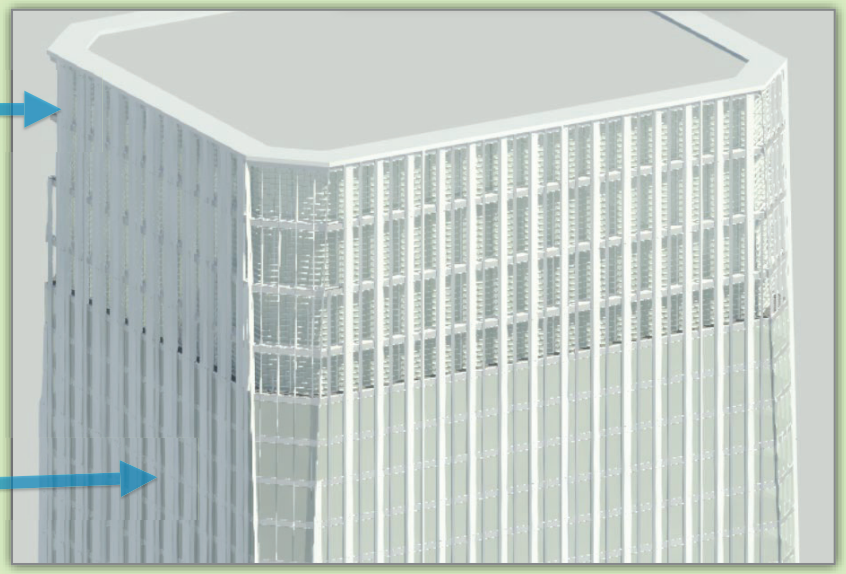

Place as a Category

DYNAMO for REVIT

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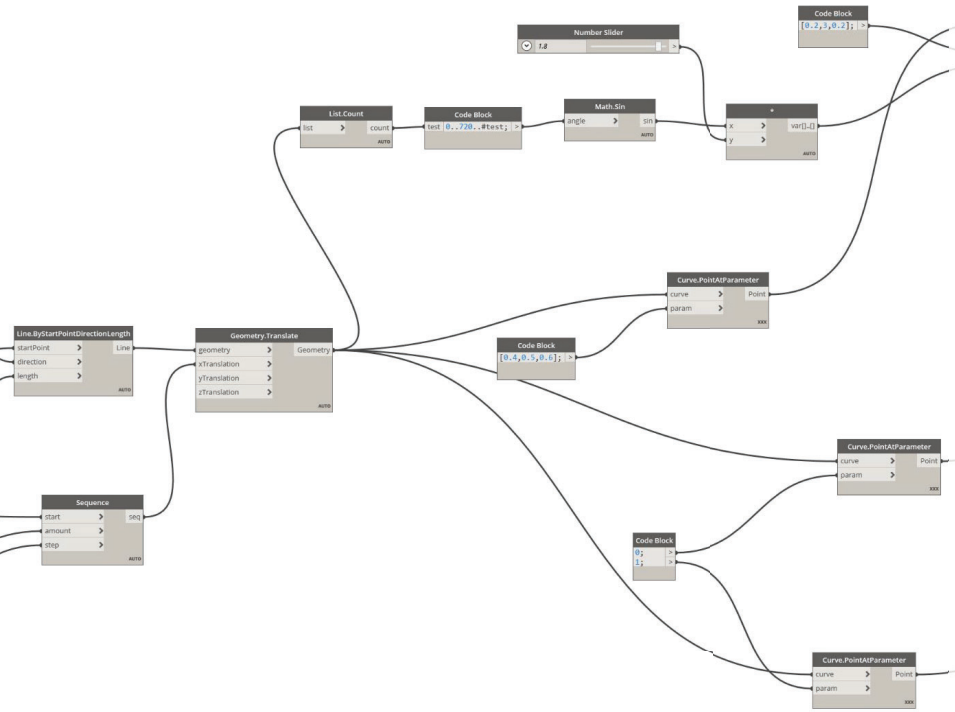


APPLICATIONS OF DYNAMO

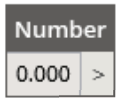
- Node Based, Intuitive, Visual Programing Tool
- Expand the capabilities of Revit
- Exchange Information with other Design Tools
- Generative Design & AI Capabilities
- Create parametric dependencies between multiple elements within Revit
- Automate and Expedite repetitive processes

DATA & TYPES

TEXT

- STRING

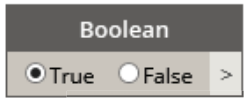
- NAMES
- DESCRIPTION
- CATEGORIES
- MARK
- TYPE MARK



NUMBERS

- *DOUBLE*
- *INTIGER*

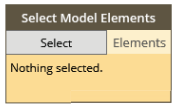
- LENGTH
- HEIGHT
- AREAS
- COUNT



BOOLEAN

- *TRUE/FALSE*

- ON / OFF
- YES / NO
- CONDITIONAL CALCULATIONS
- LOGIC OPEREATIONS



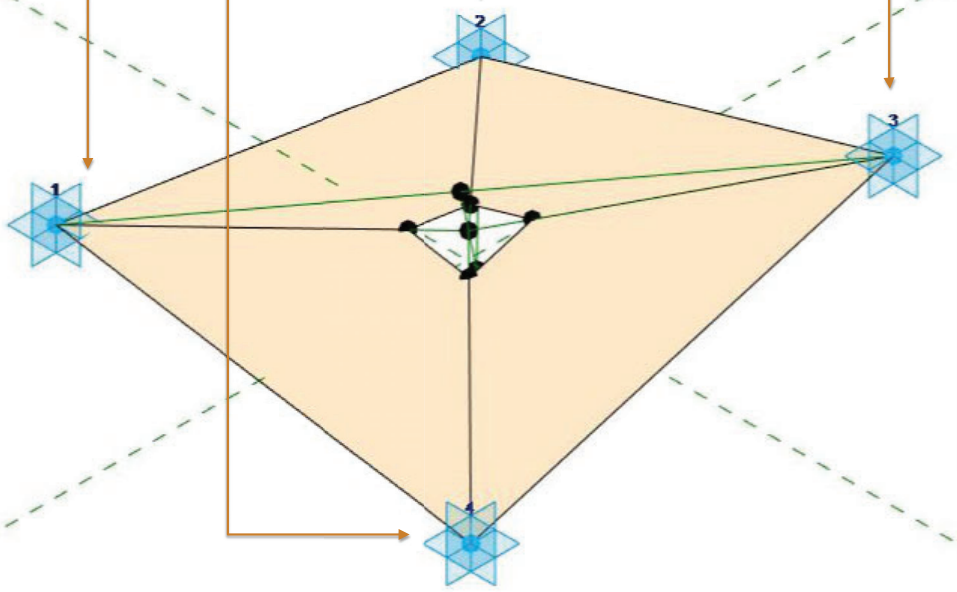
REVIT

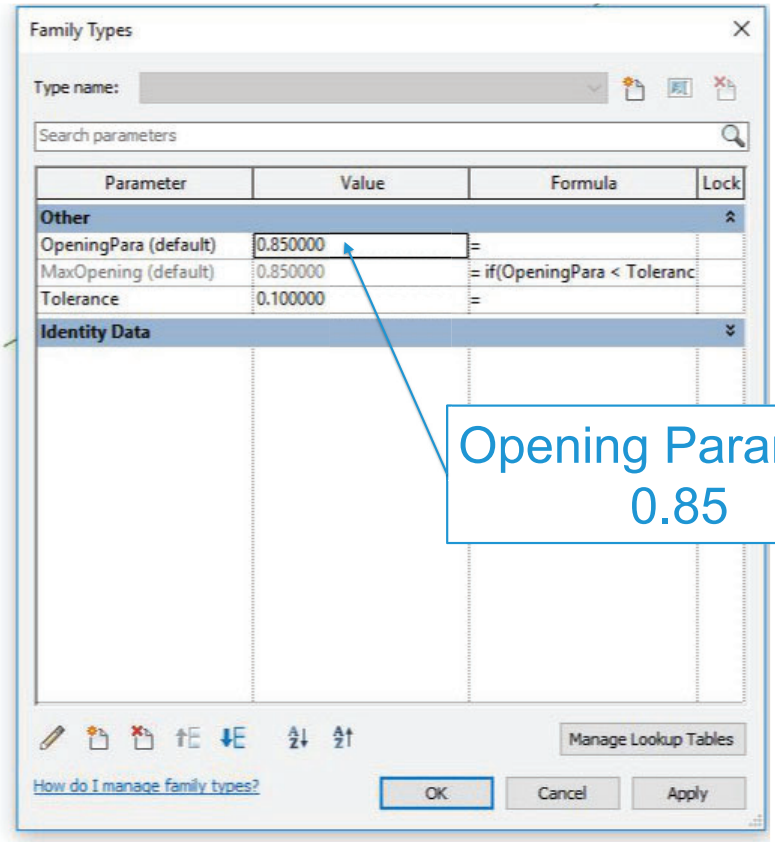
- *ELEMENTS*
- *CATEGORIES*
- *TYPES*

- SELECT OBJECTS IN REVIT
- EXTRACT INFORMATION FROM REVIT OBJECTS
- ASSIGN PROPERTIES TO REVIT OBJECTS
- MODIFY REVIT OBJECTS
- PLACE REVIT ELEMENTS

ADAPTIVE COMPONENT

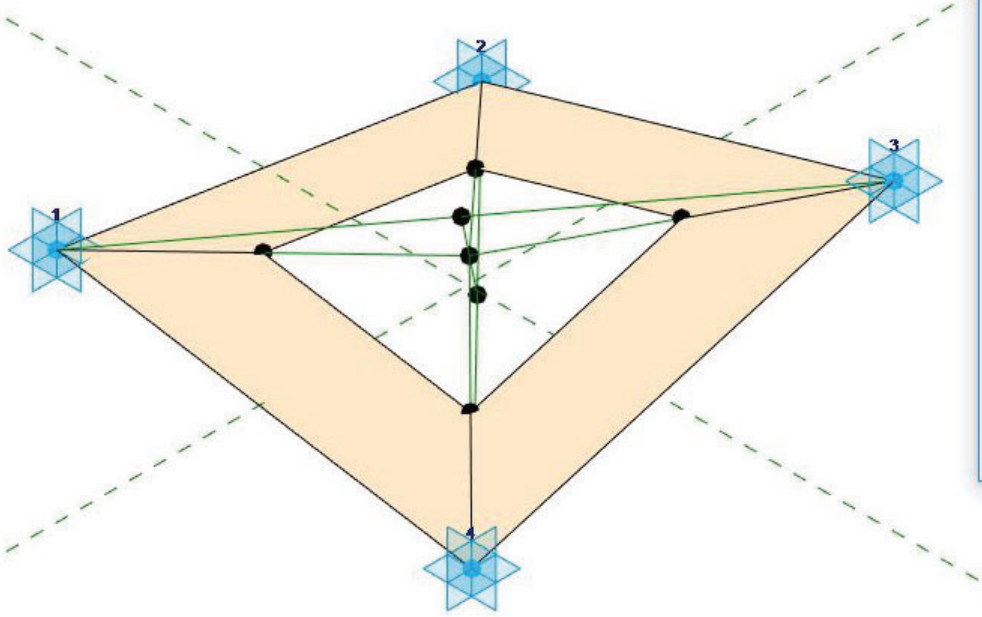
4 Adaptive Points

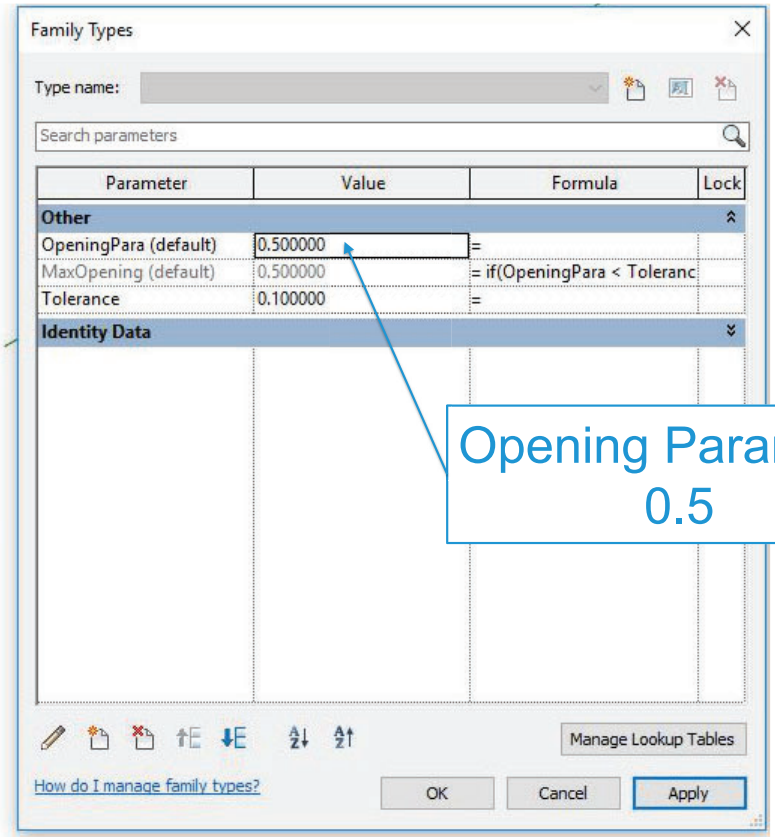




Opening Parameter
0.85

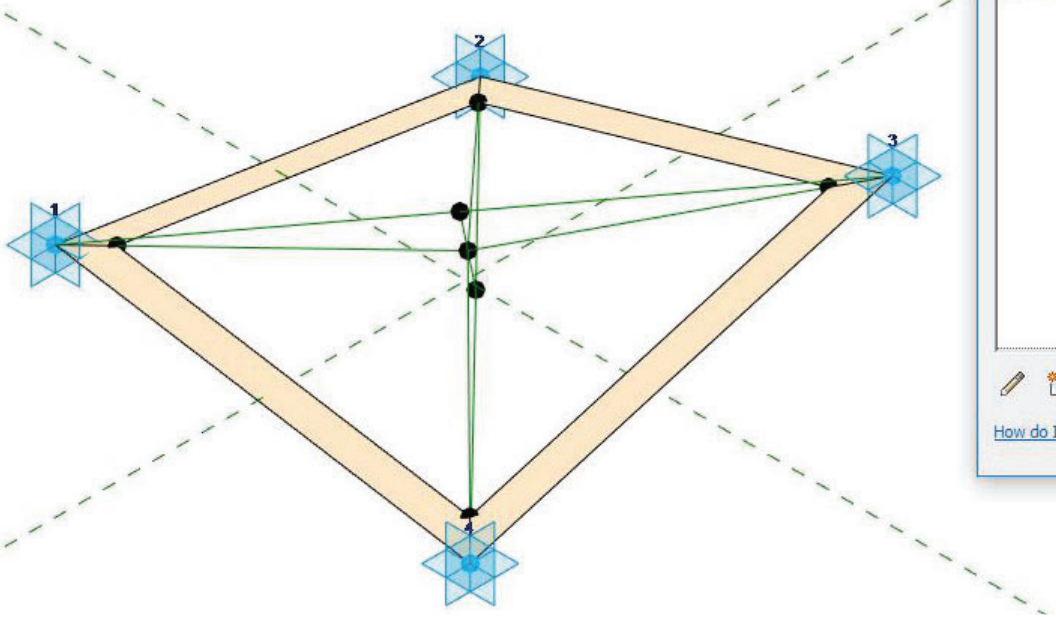
ADAPTIVE COMPONENT

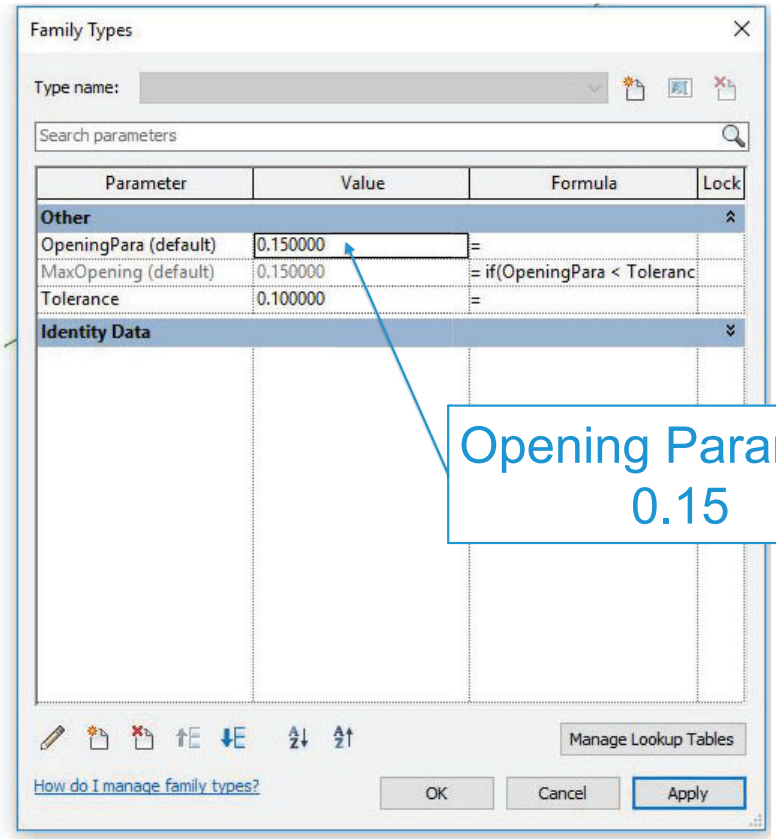




Opening Parameter
0.5

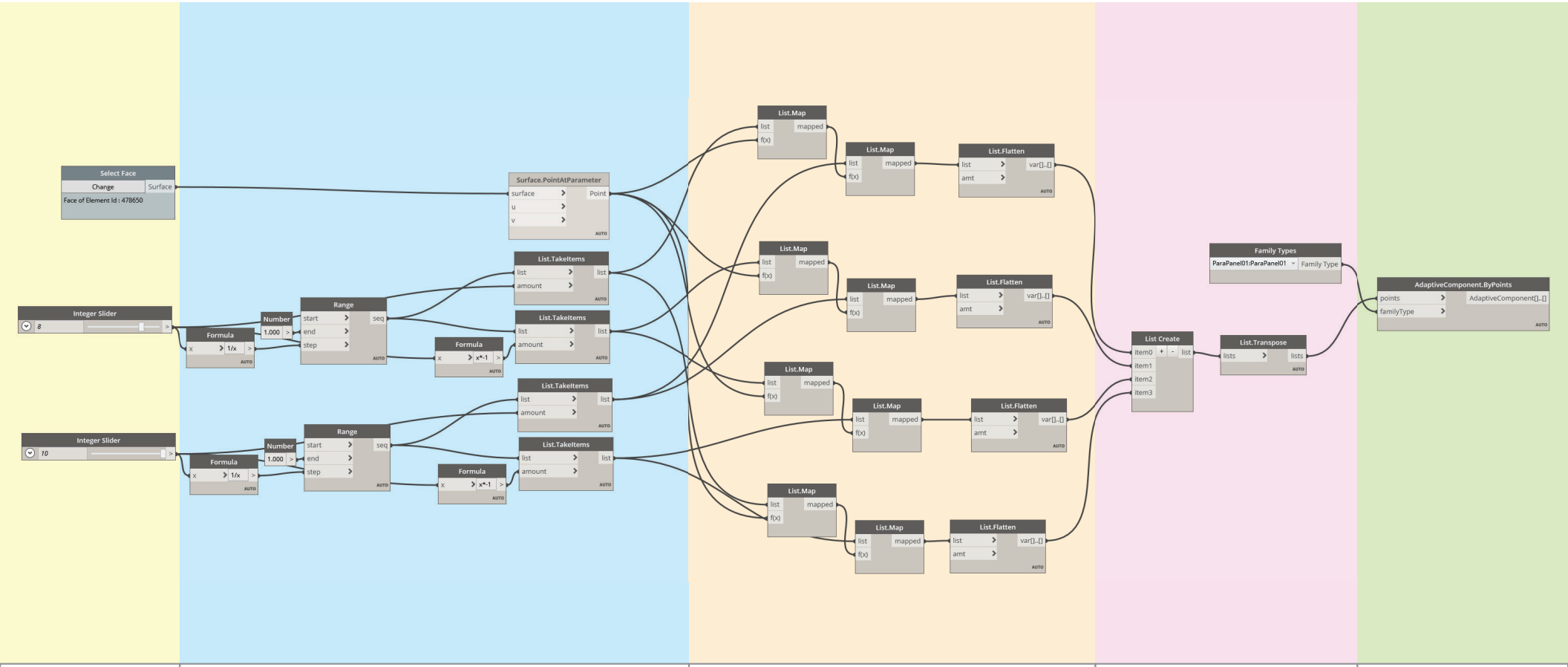
ADAPTIVE COMPONENT



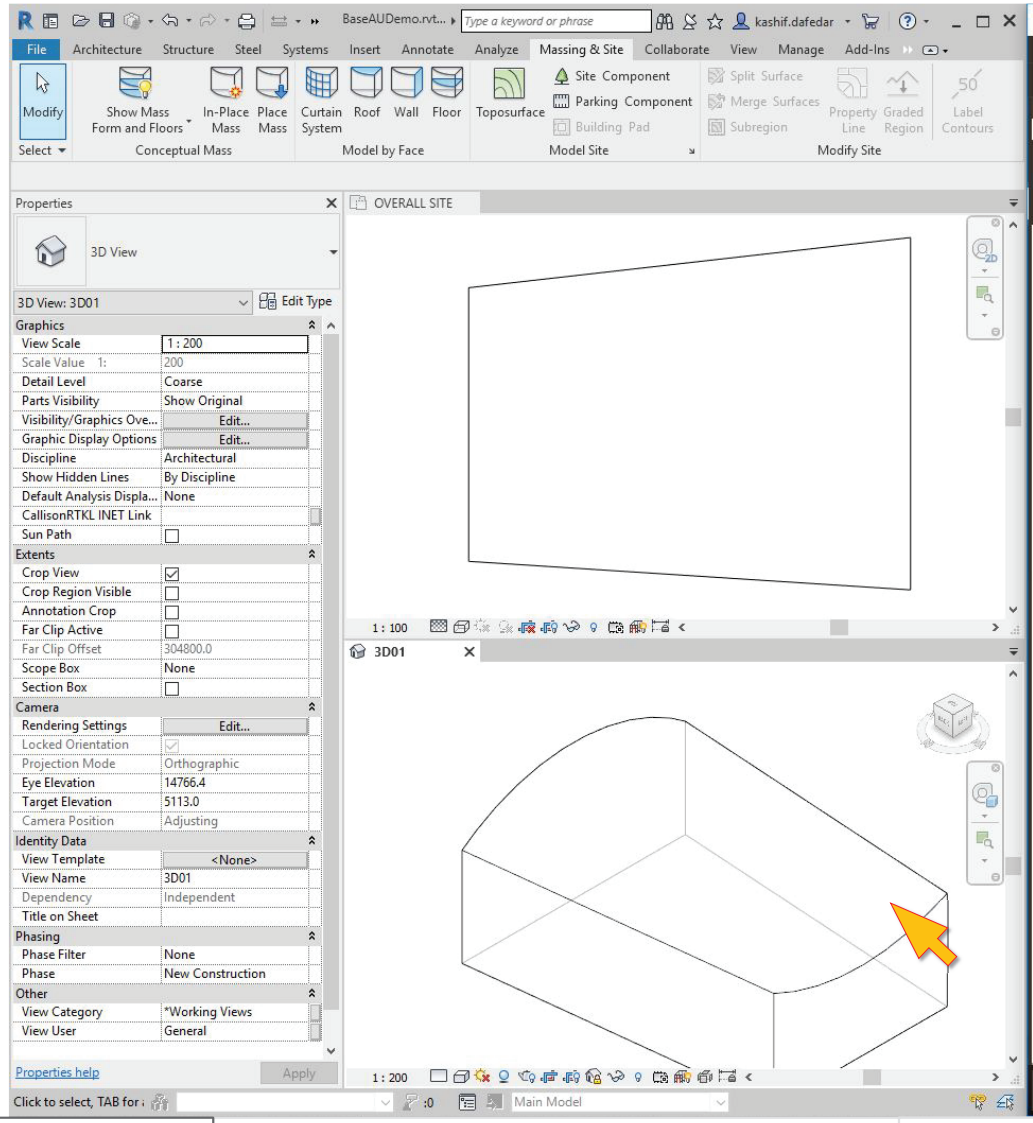


Opening Parameter
0.15

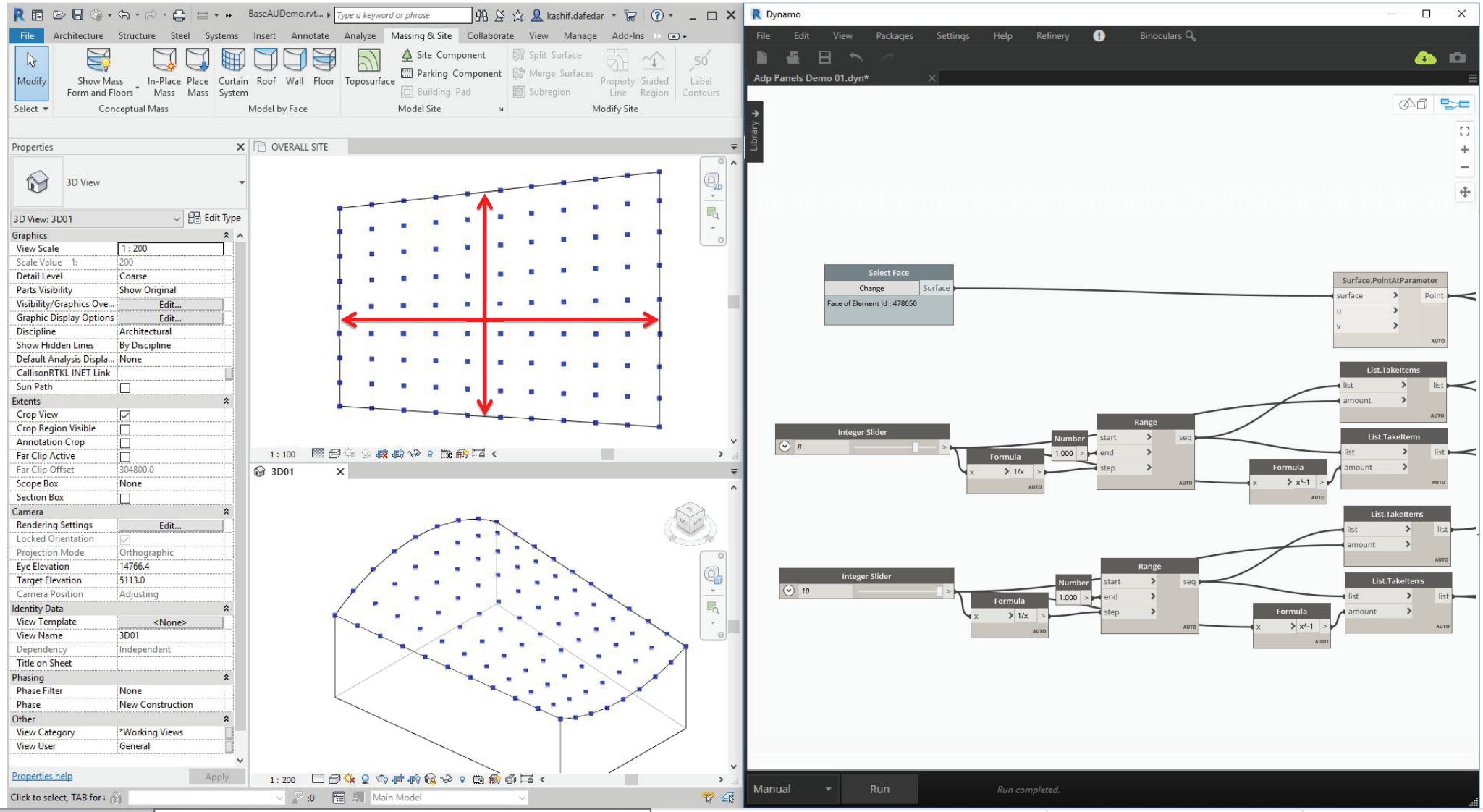
PLACING COMPONENT USING DYNAMO



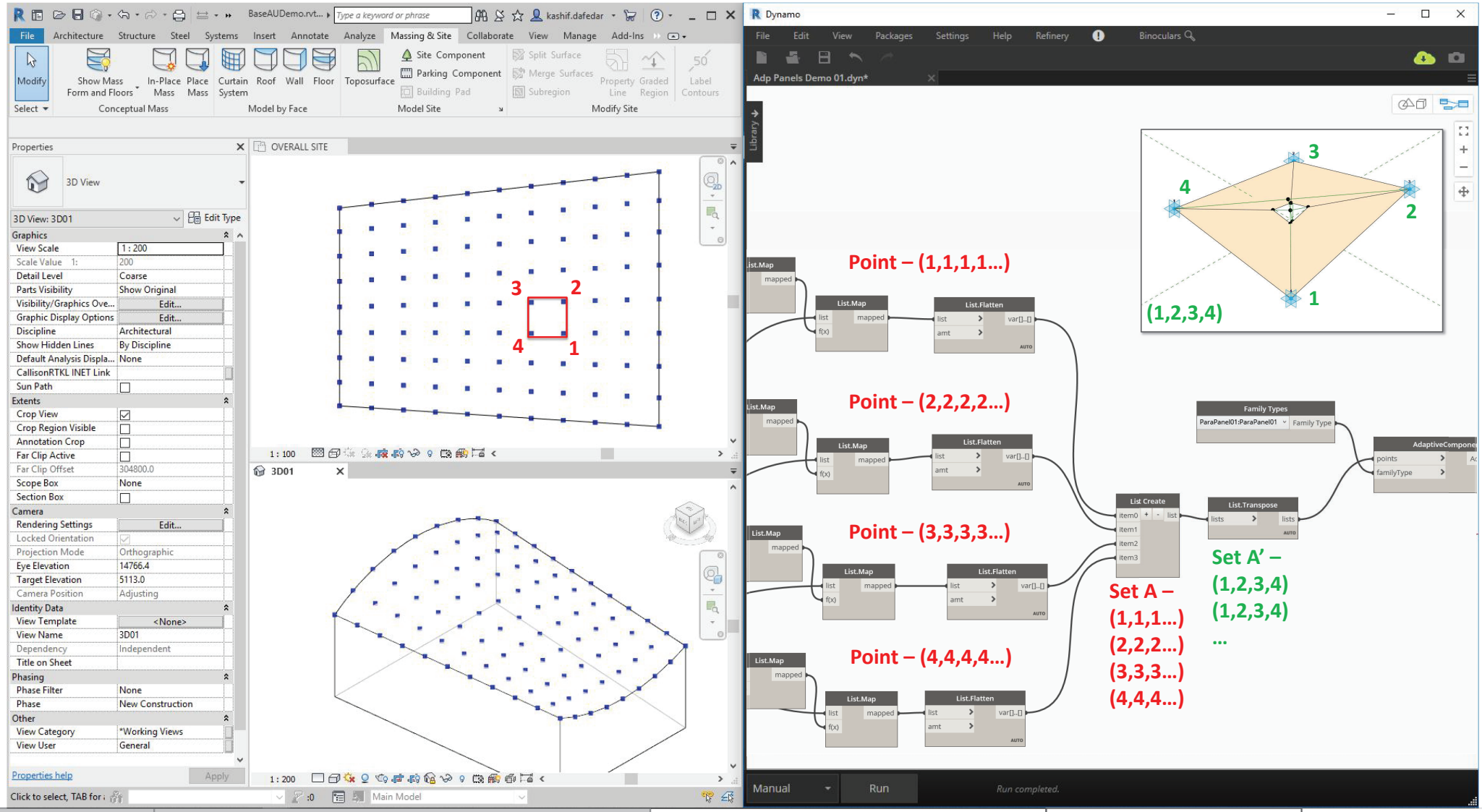
Select Face	Identify UV-Grid Count	Pick Points	Cluster Points Per Panel	Place Element



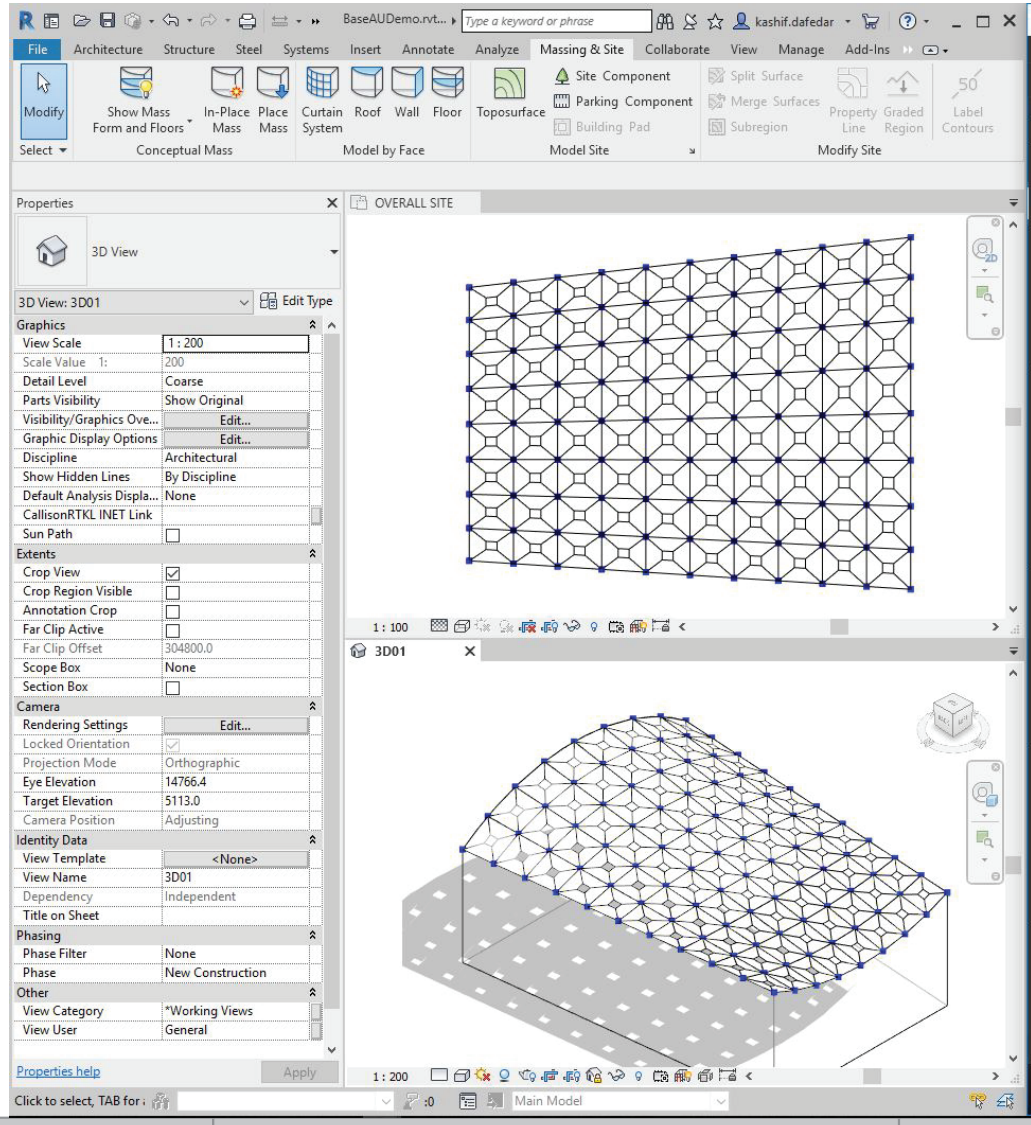
Select Face | Identify UV-Grid Count | Pick Points | Cluster Points Per Panel | Place Element



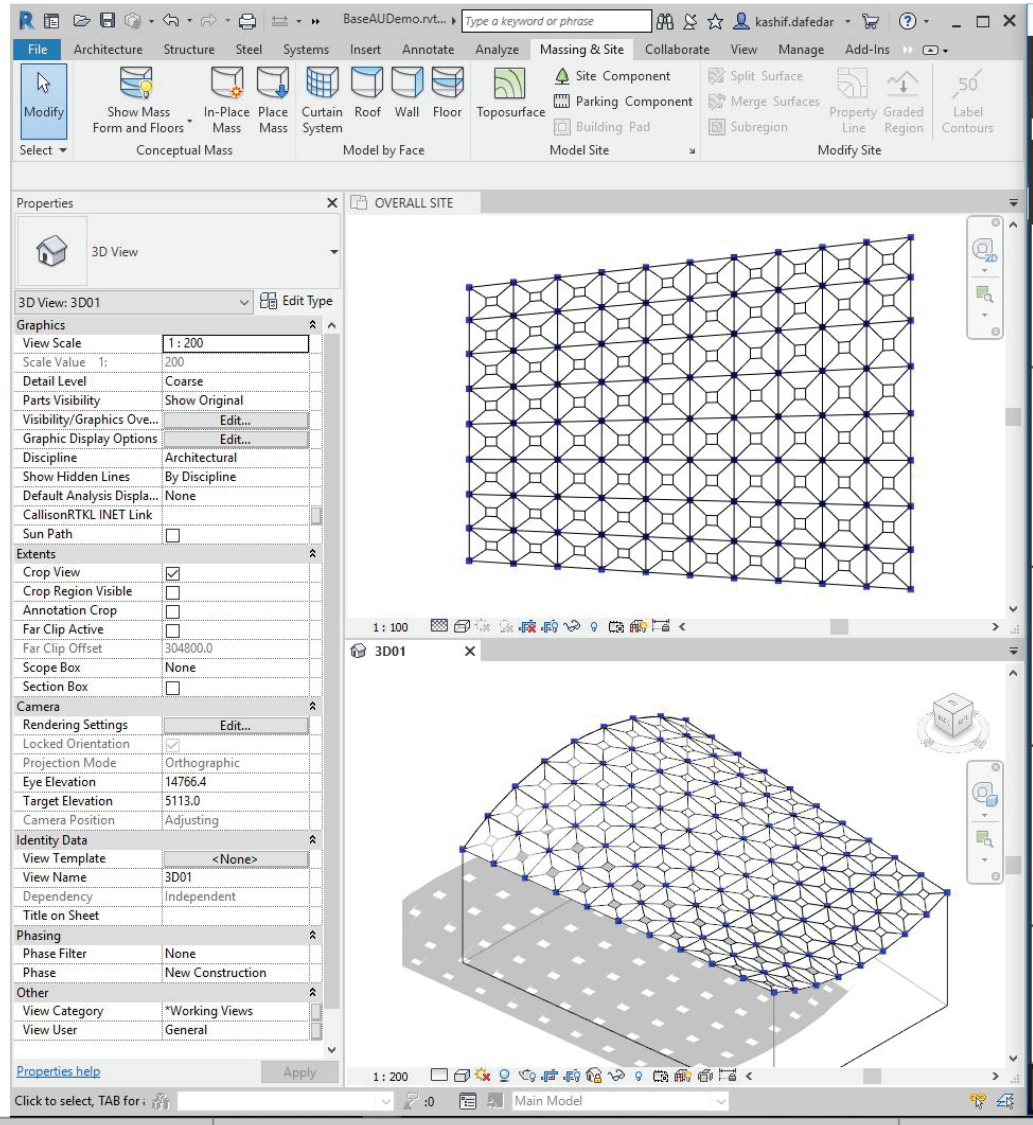
Select Face | Identify UV-Grid Count | Pick Points | Cluster Points Per Panel | Place Element

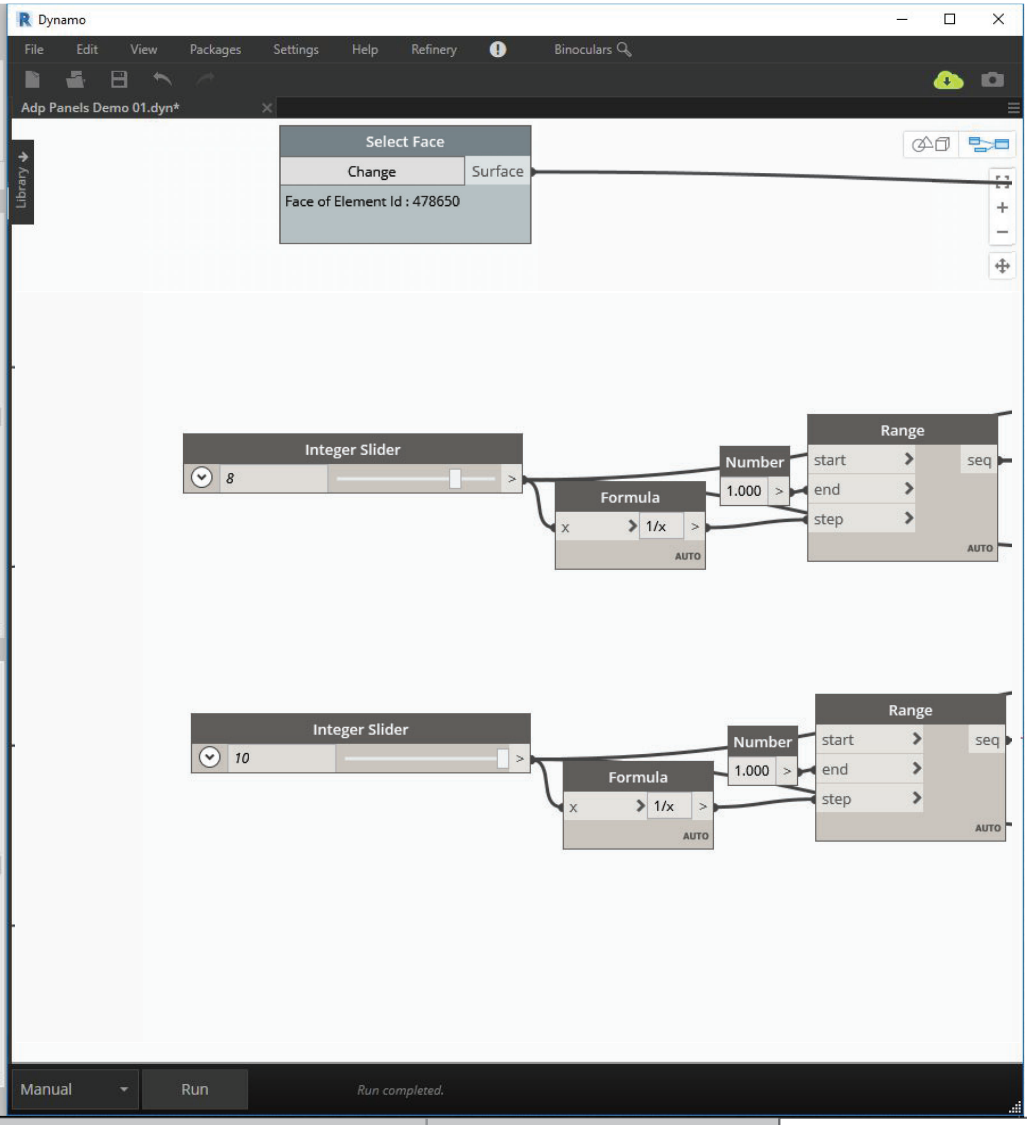


Select Face	Identify UV-Grid Count	Pick Points	Cluster Points Per Panel	Place Element

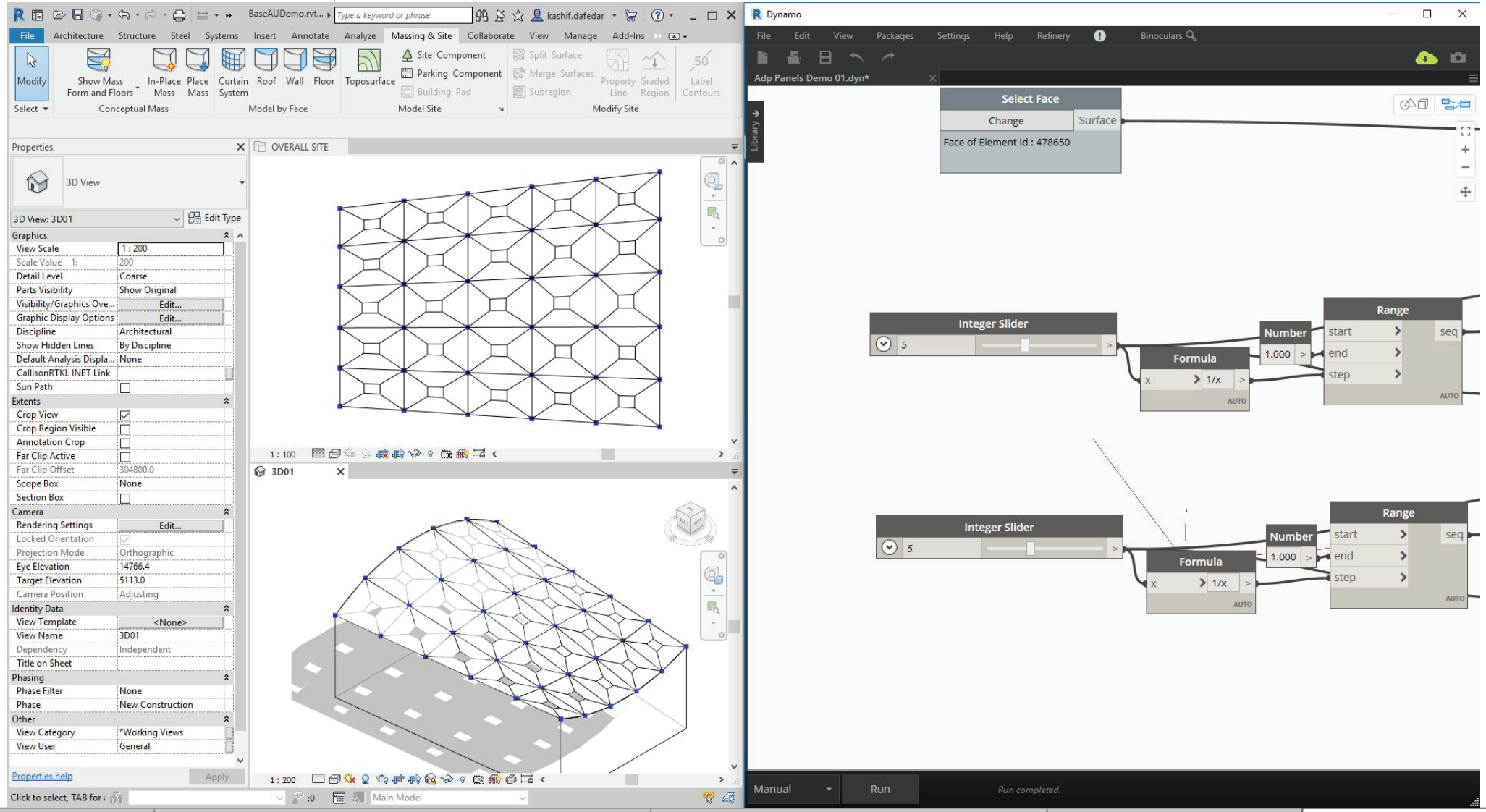


Select Face	Identify UV-Grid Count	Pick Points	Cluster Points Per Panel	Place Element



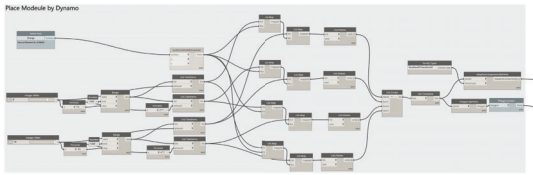


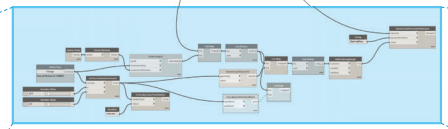
Select Face	Identify UV-Grid Count	Pick Points	Cluster Points Per Panel	Place Element

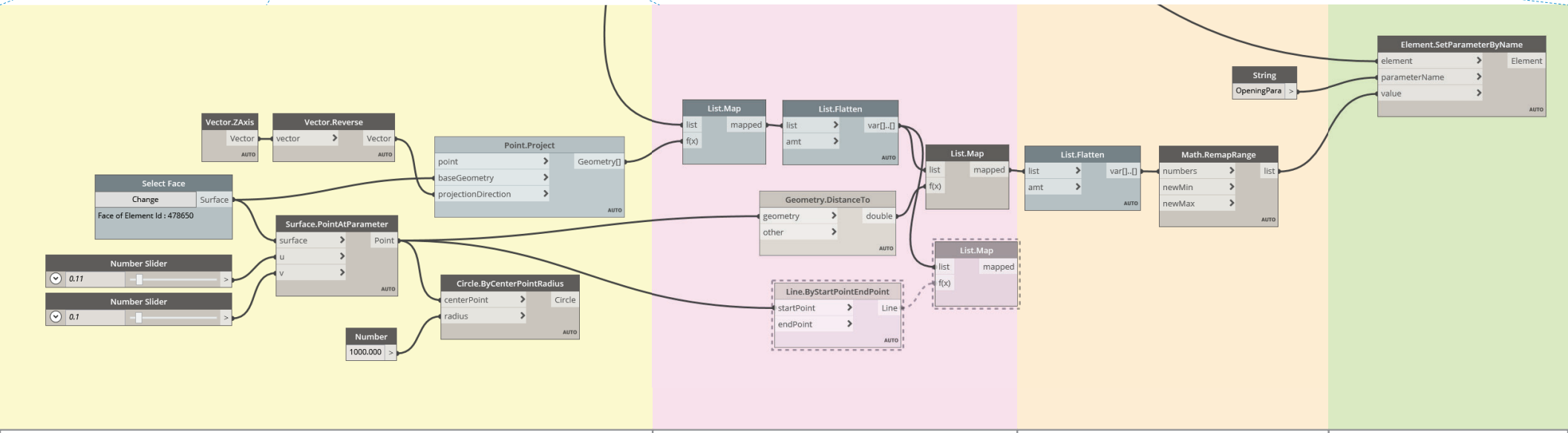


Select Face | Identify UV-Grid Count | Pick Points | Cluster Points Per Panel | Place Element

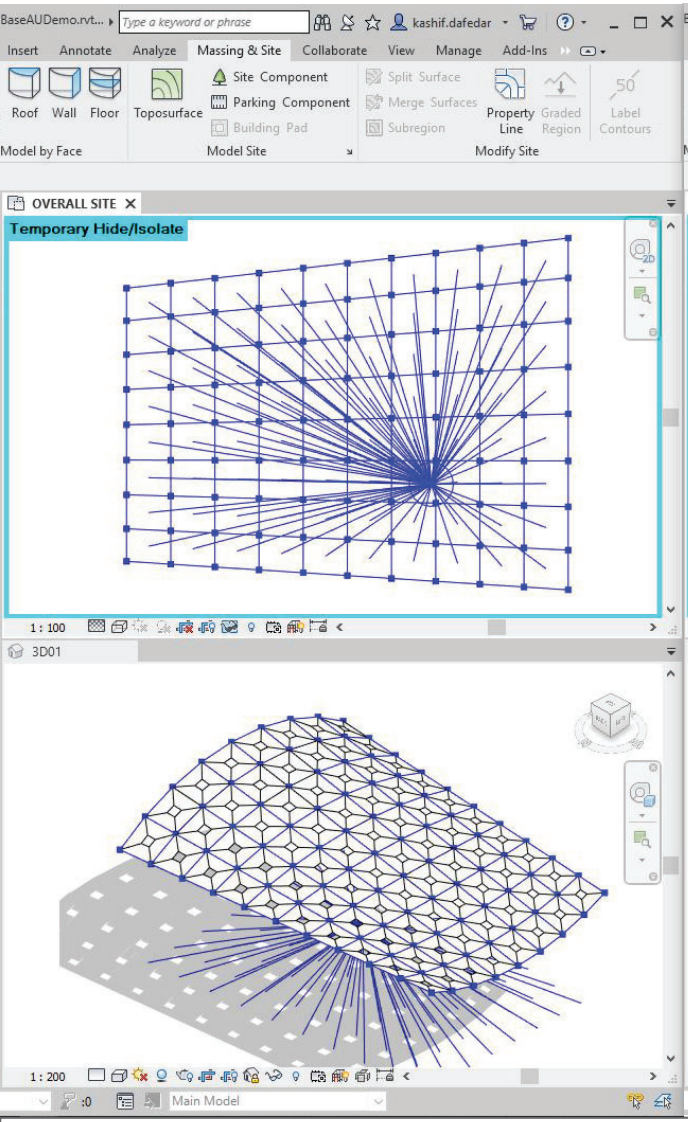
INFLUENCE COMPONENTS WITH DYNAMO

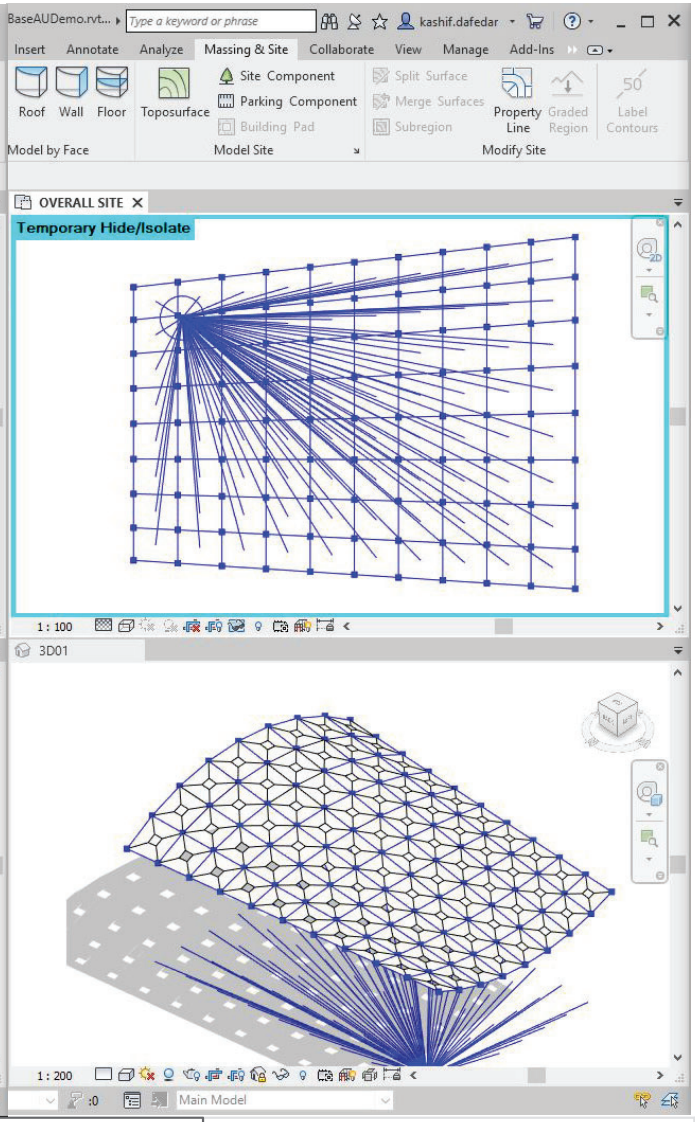


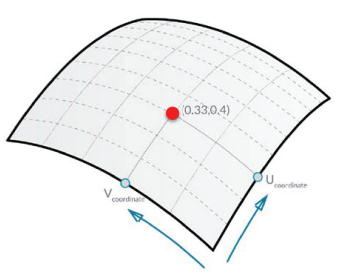


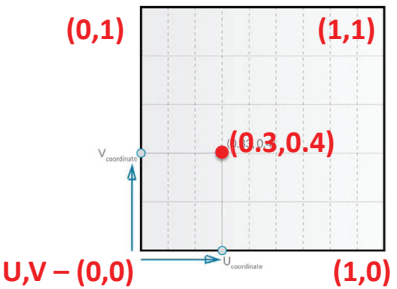


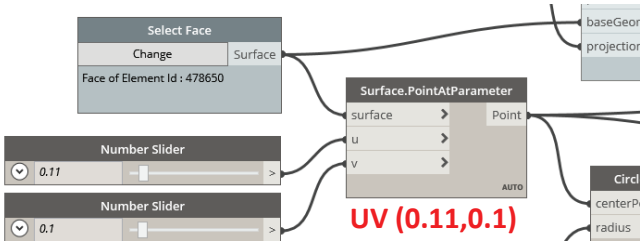
Identify or Pick Point	Distance Between Point & Panel	Remap Numbers	Influence Panel









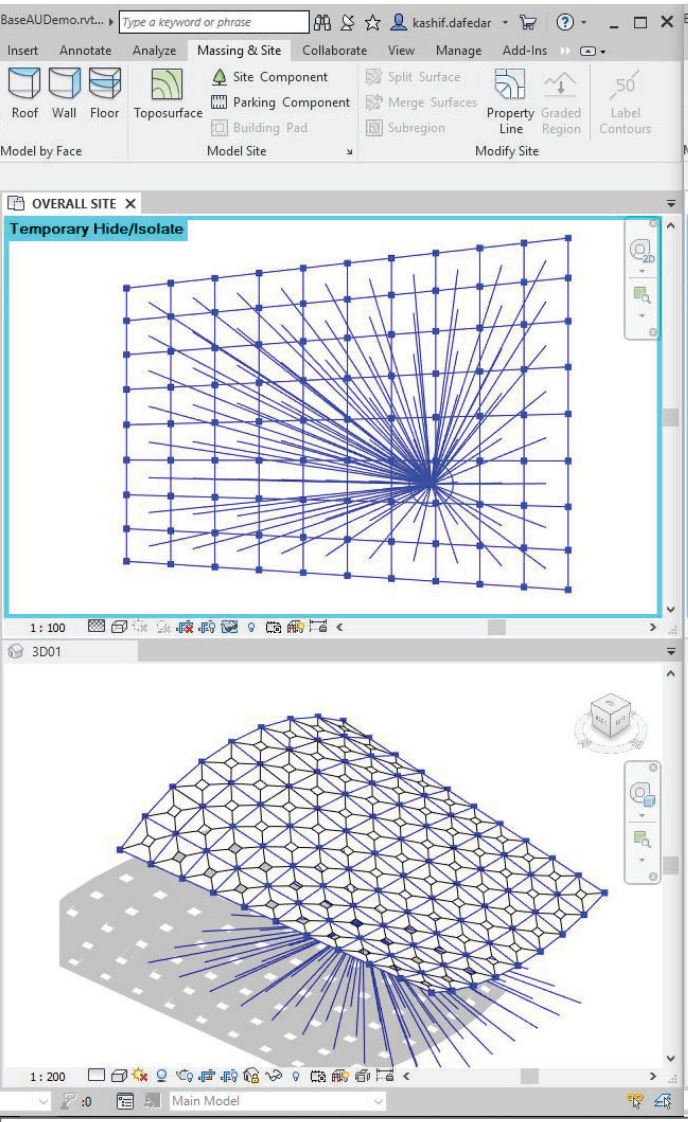


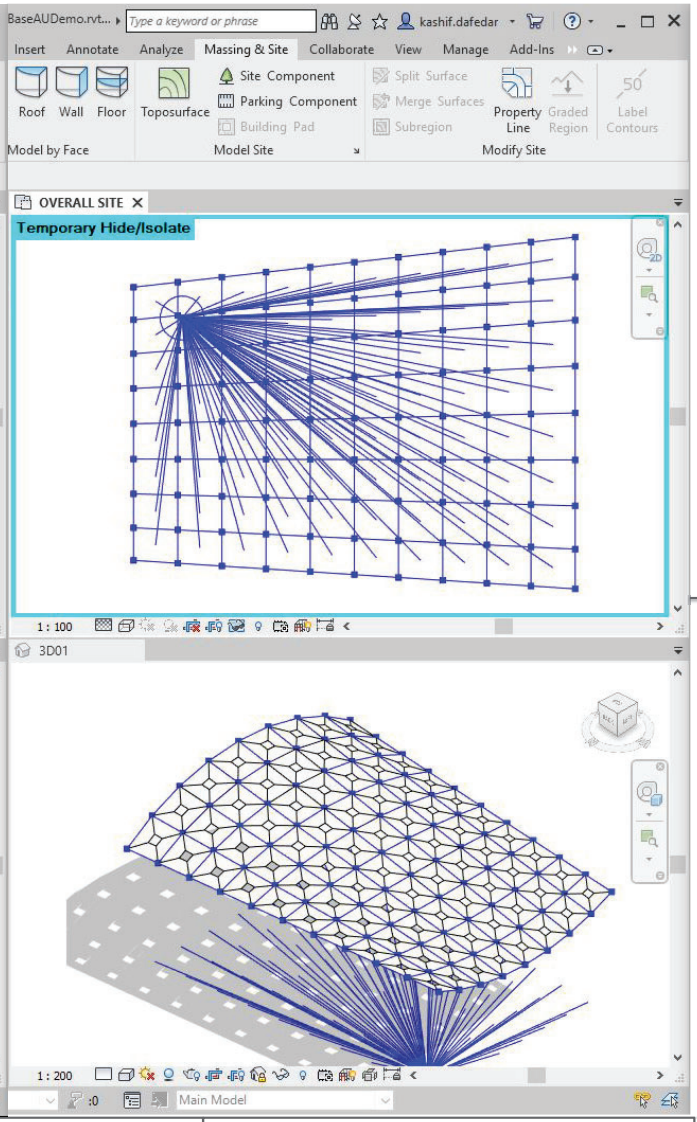
Identify or Pick Point

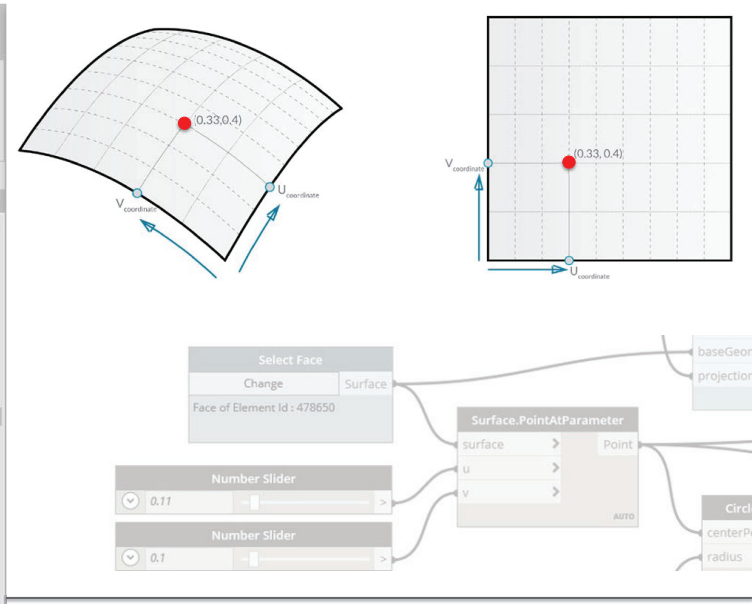
Distance Between Point & Panel

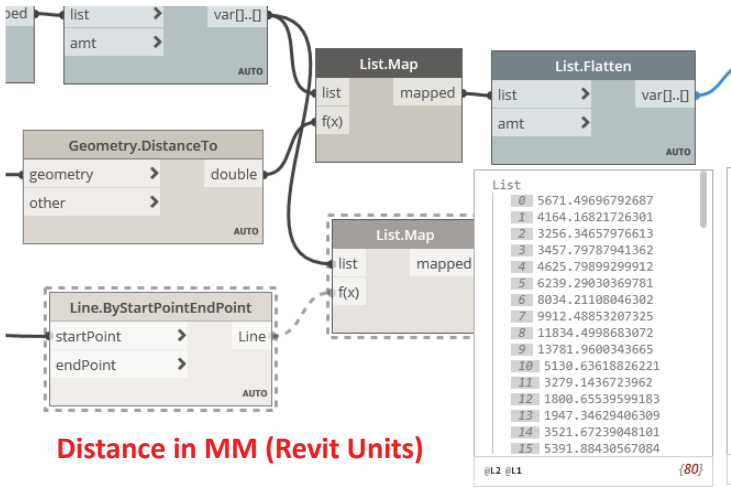
Remap Numbers

Influence Panel



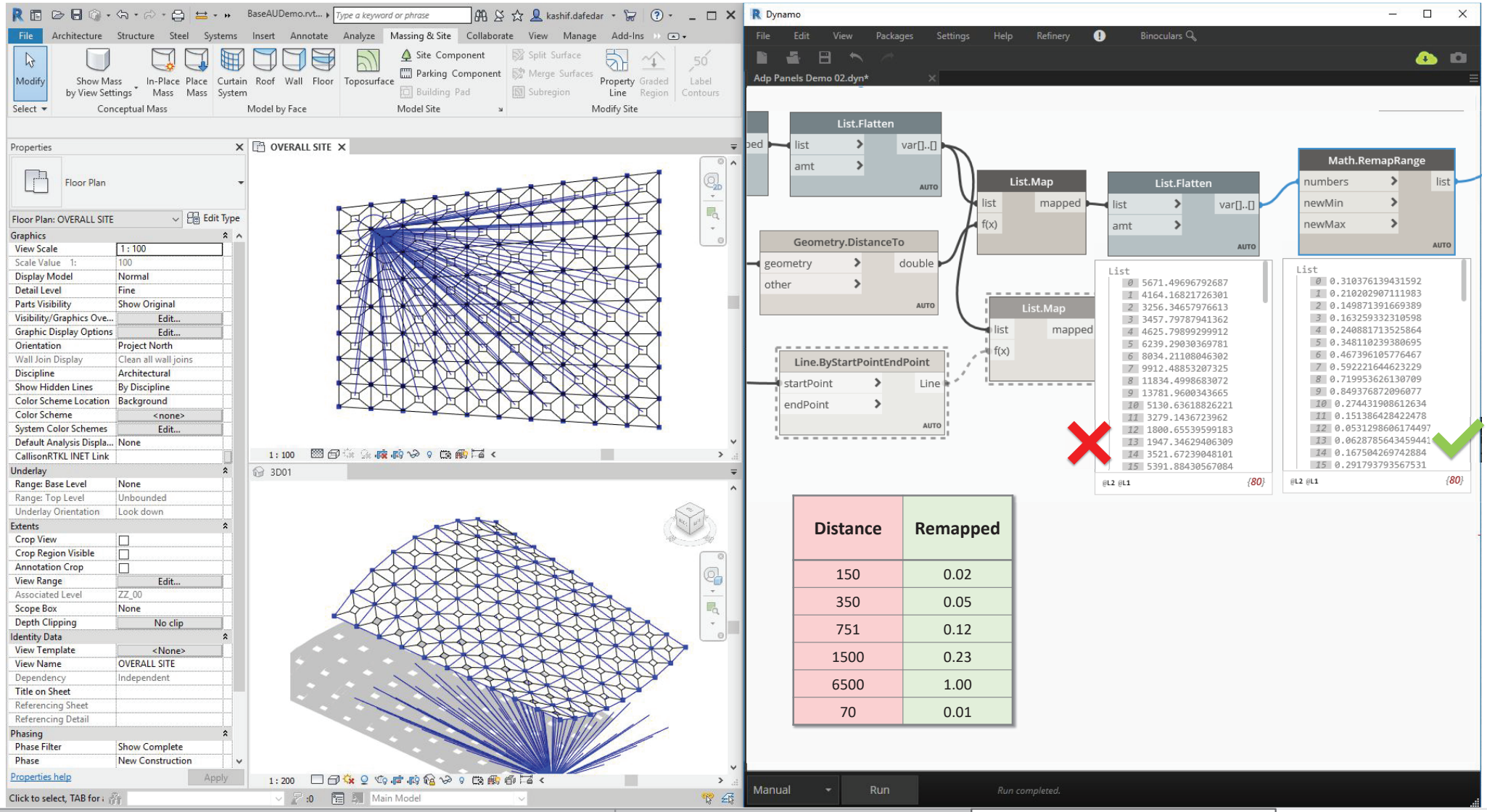






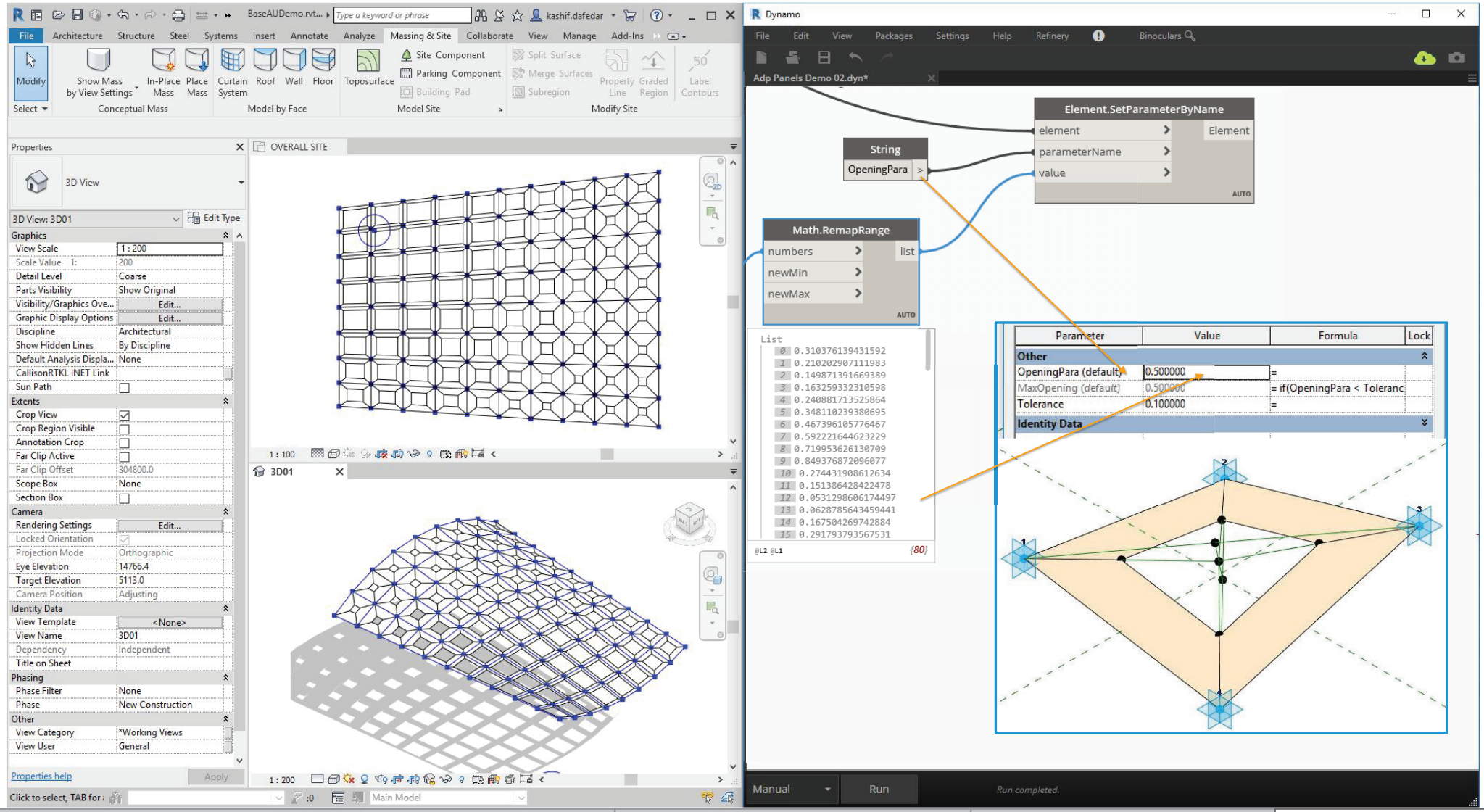
Distance in MM (Revit Units)

Identify or Pick Point	Distance Between Point & Panel	Remap Numbers	Influence Panel

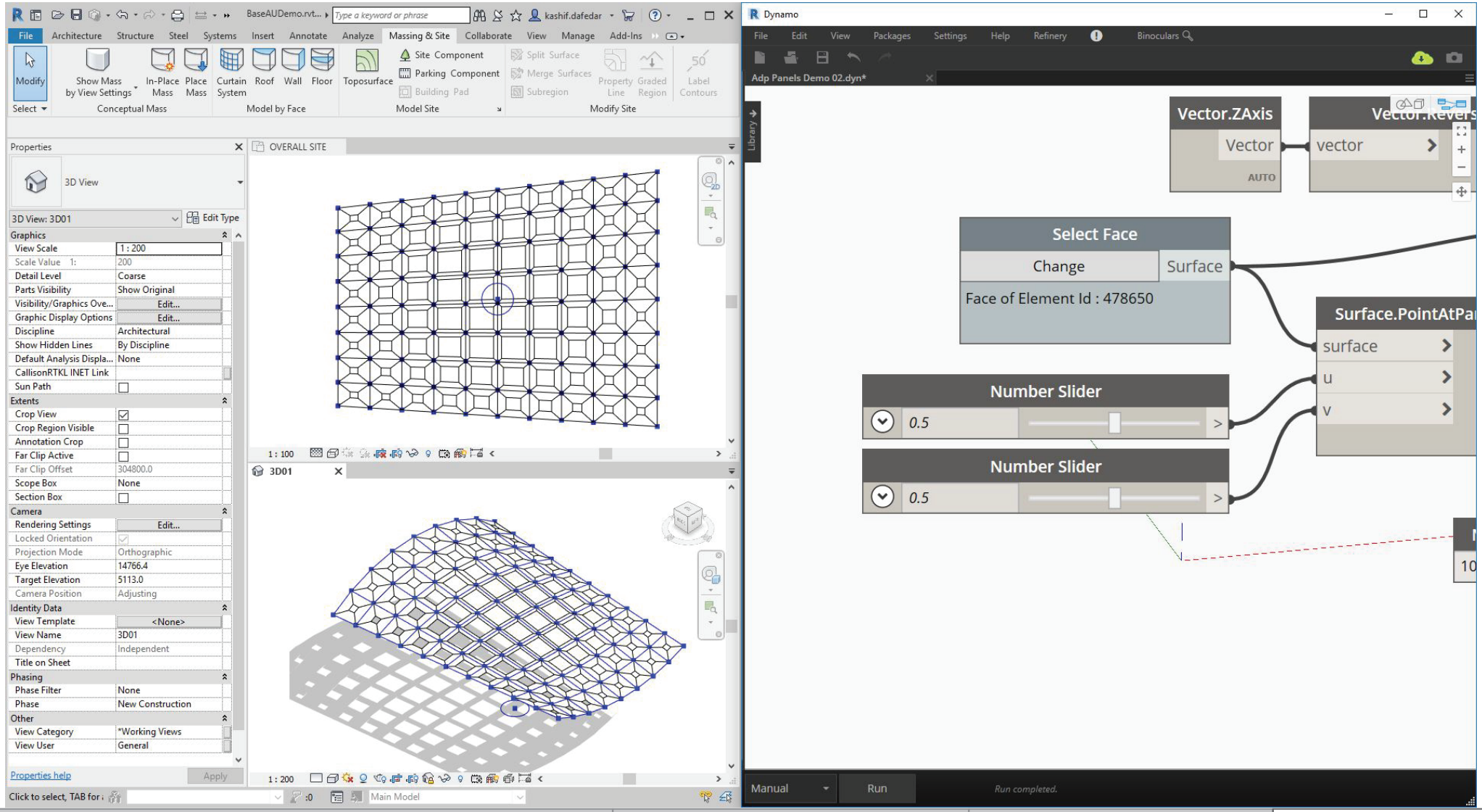


Distance	Remapped
150	0.02
350	0.05
751	0.12
1500	0.23
6500	1.00
70	0.01

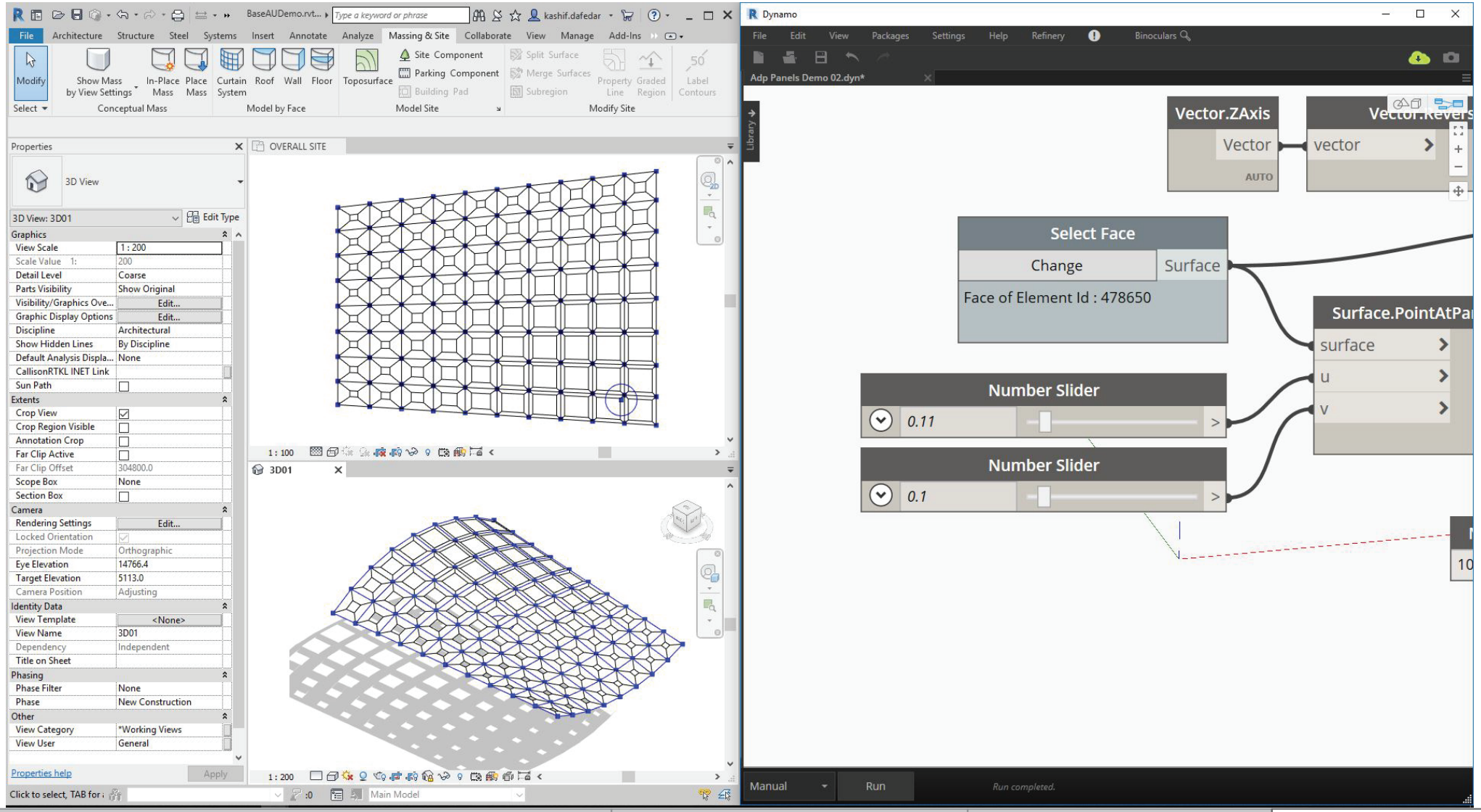
Identify or Pick Point | Distance Between Point & Panel | Remap Numbers | Influence Panel



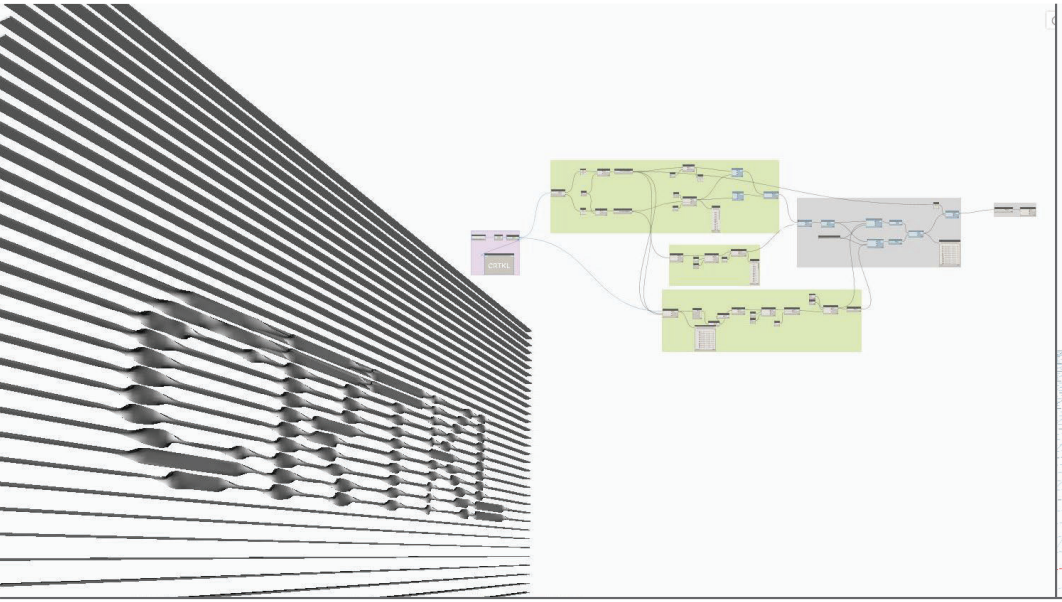
Identify or Pick Point | Distance Between Point & Panel | Remap Numbers | Influence Panel

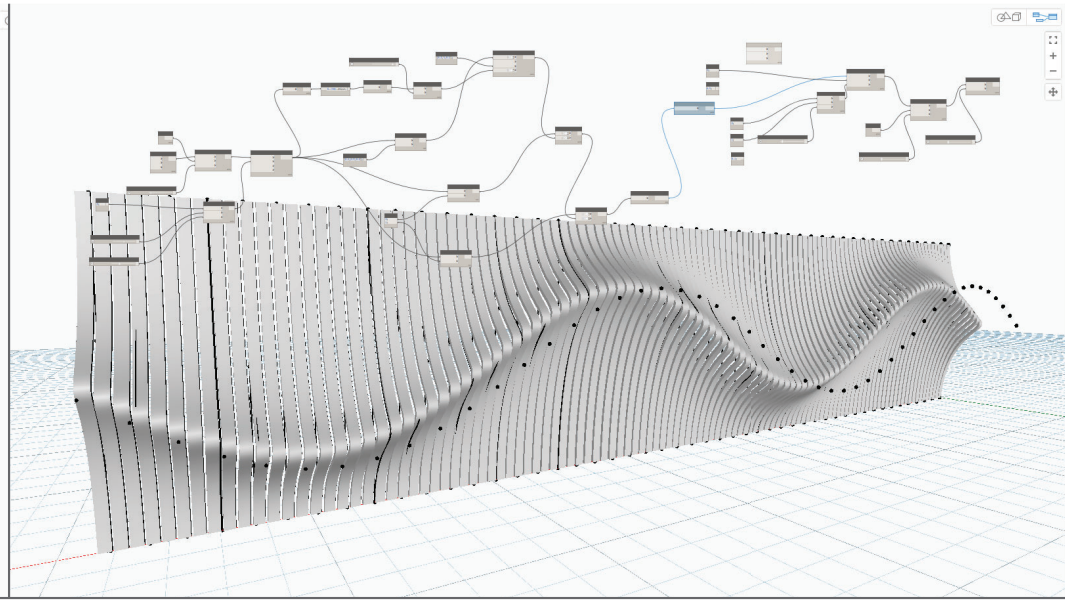


Identify or Pick Point | Distance Between Point & Panel | Remap Numbers | Influence Panel



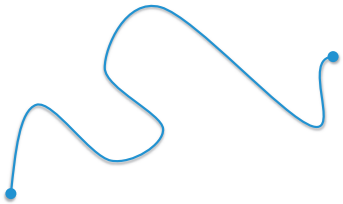
Identify or Pick Point	Distance Between Point & Panel	Remap Numbers	Influence Panel





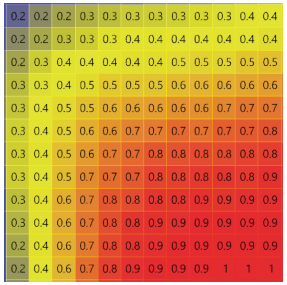
Attractors & Influencers

POINTS



CURVES

OBJECTS



ANALYSIS

IMAGES

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But start with making something...