Cross Platform Unitized Curtain wall Design

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About the speaker

Nate Holland

Nate leads the Design Computation team at NBBJ where he’s in charge of driving both innovation and efficiency on project work. He is uniquely situated at the intersection of technology, architecture, human experience, and performance. His work as a designer and digital specialist on the Amazon Spheres, REI headquarters, and Rainier Square Tower continues to raise the bar for architecture in Seattle.

Learning Objectives

OBJECTIVE ONE

Learn different cross-platform design strategies to prepare for interoperability from day one

OBJECTIVE TWO

Learn how to create a reusable curtain wall rig with standardized parameters

OBJECTIVE THREE

Learn how to automate the instantiation of complex curtain wall modules in Revit using Dynamo-based data and data from cross-platform design models

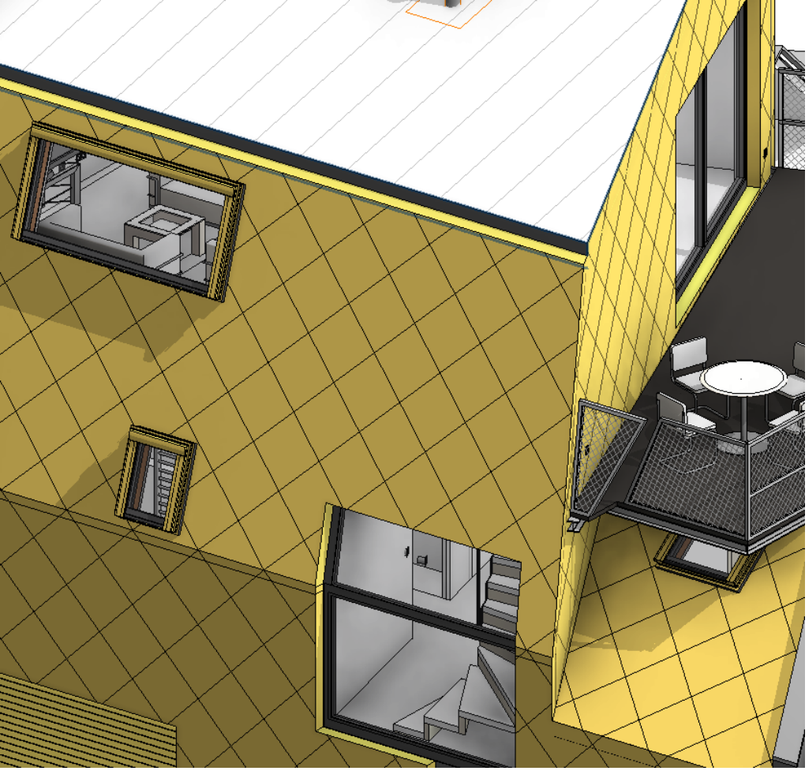
OBJECTIVE FOUR

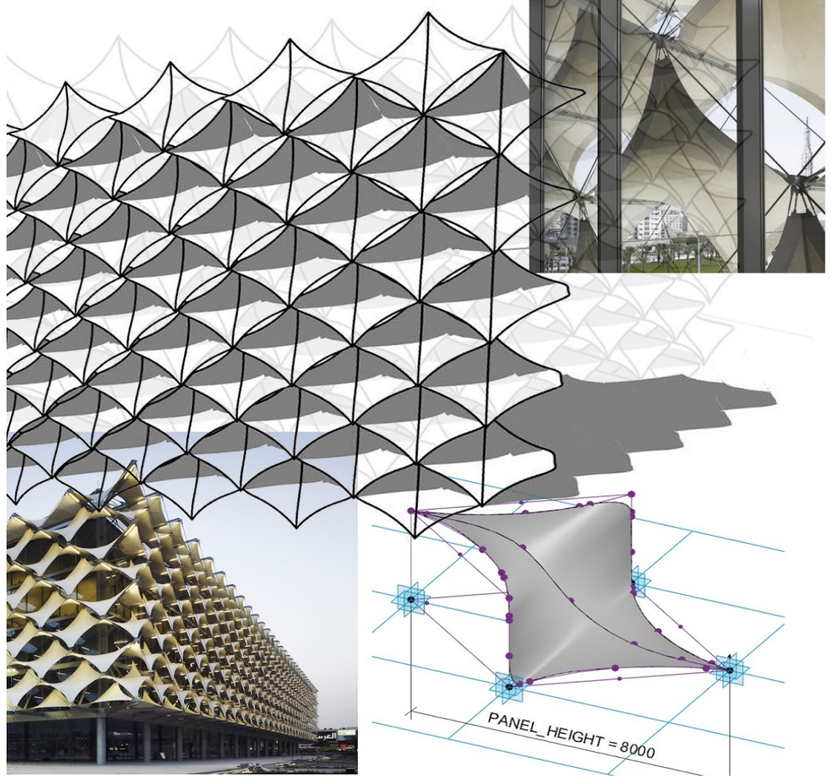
Learn how to build schedulable and tag-able assets into your curtain wall design

Why Curtainwall

- It’s a primary building design element
  - (with lots of changes throughout design)
- Used in most of our projects
  - (getting this right increases our efficiency)
- Modular Rationalization
  - (It’s a basic kit of parts assembled in different ways)


Start thinking like Revit





Walls with Windows

Easiest to drawn and update

Flexible profile geometry

No extraneous lines to deal with

Everyone can model this way

Adaptive Components

Easy to place with dynamo

Great for complex forms

Huge pain to edit manually

Requires advanced users

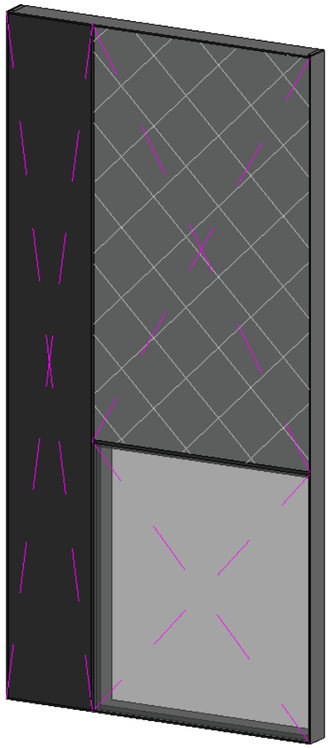
Revit Curtain Wall Tool

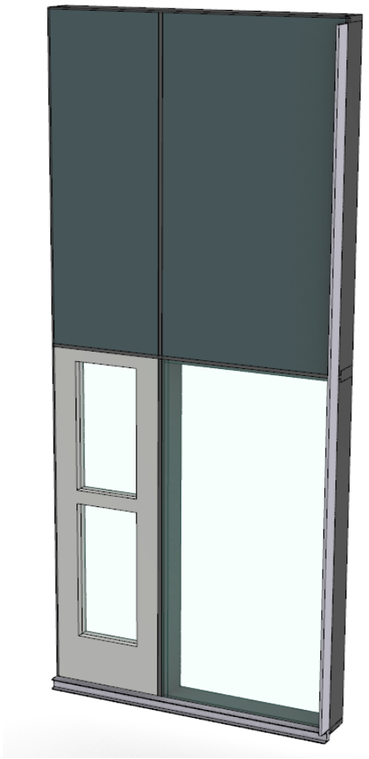
Easy to draw and understand

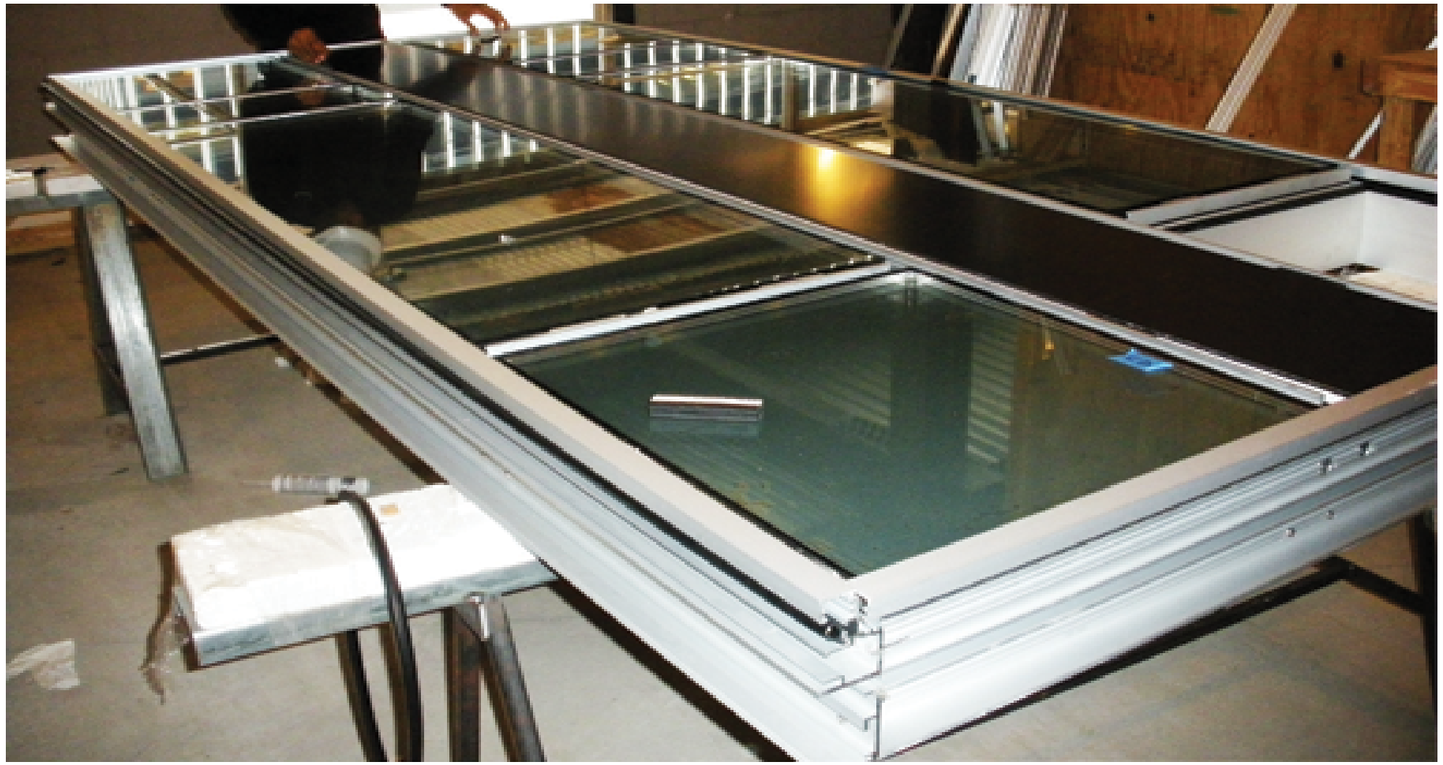
Advanced types are very flexible

Slow to build families

Most people can figure it out







Unitized Modeling to Match Fabrication

Unitized – each curtain wall panel represents a full prefabricated unit

Education – think through how its made

Documentation – provide information to fabricator that matches how they'll build it

Faster editing – fewer partial grid lines


Great so we’re going to use unitized Revit curtainwall to design, develop and document our façade, right?

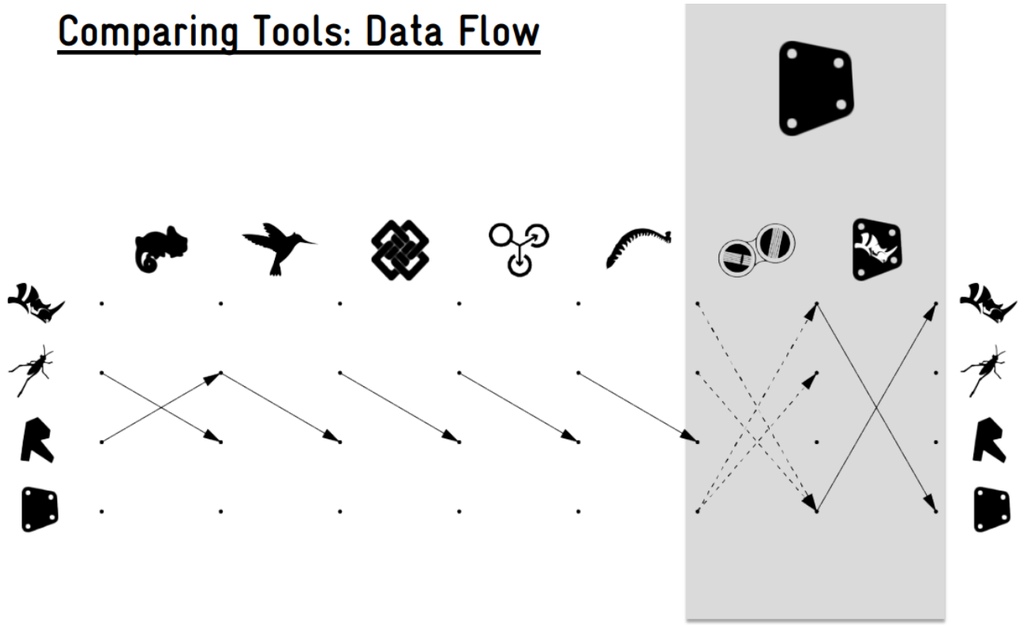
“Not so fast my friend..”

Not everyone prefers designing in Revit…

Each tool has different strengths…

Every project is inherently different…

What do we know about interop



Brian Ringley AU 2015

FLUX.IO

RIP 2018

Conveyor

speckle.
works

KONSTRU

The New guys

What do we know about interop

Blocks	Mesh	Revit – Dynamo – Forge – Rhino – Grasshopper	Import	Layers
Families	Nurbs	Sketchup – Unity – Formit – Max	Insert	Parameters
Components	Solids	Conveyor - Speckle - Konstru	Link	Meta Data

What do we know about interop

Blocks
Families
Components

Mesh
Nurbs
Solids

…it’s still freaking hard

Import
Insert
Link

Layers
Parameters
Meta Data

What do we know about interop

Blocks
Families
Components

Mesh
Nurbs
Solids

…it’s still freaking hard

Import
Insert
Link

Layers
Parameters
Meta Data

Interoperability is more than software tools and plugins…

We need a strategy

Parity in modeling technique

(good planning and starting point)

Templates and Examples

(the basics)

Documented workflows

(bringing expertise to the masses)

What does parity in modeling mean

One-One

Each object in model A has a corresponding element in model B

Approach

Modeling strategy is similar between each design program

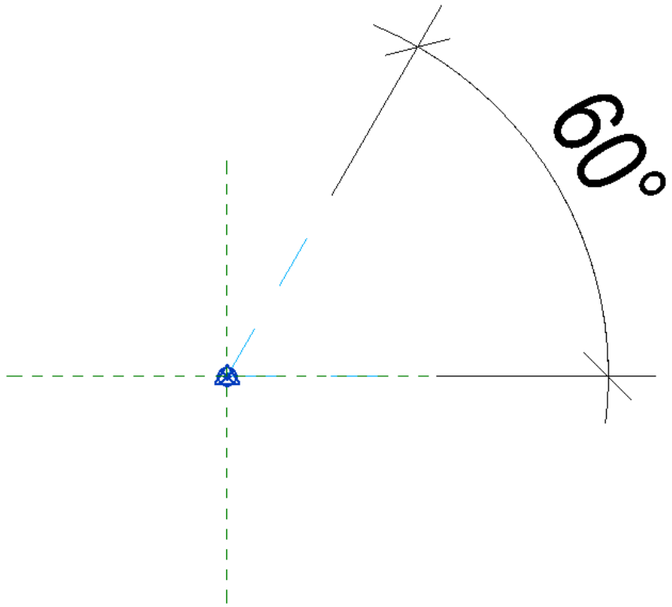
Reality

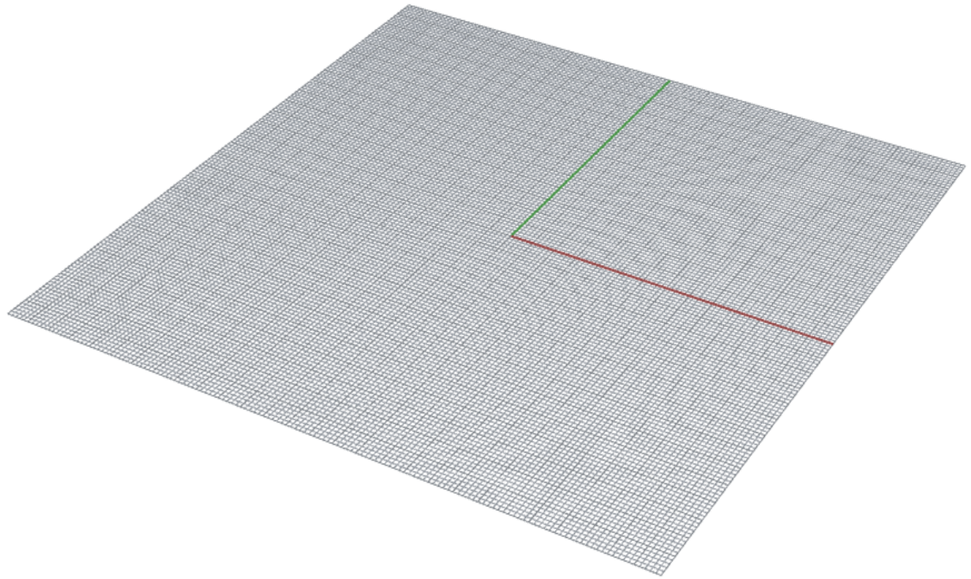
Modeled elements represent the way they will be constructed

Standards

Names, dimensions, and project organization are aligned between projects

Parity In Modeling: Coordinate Origins

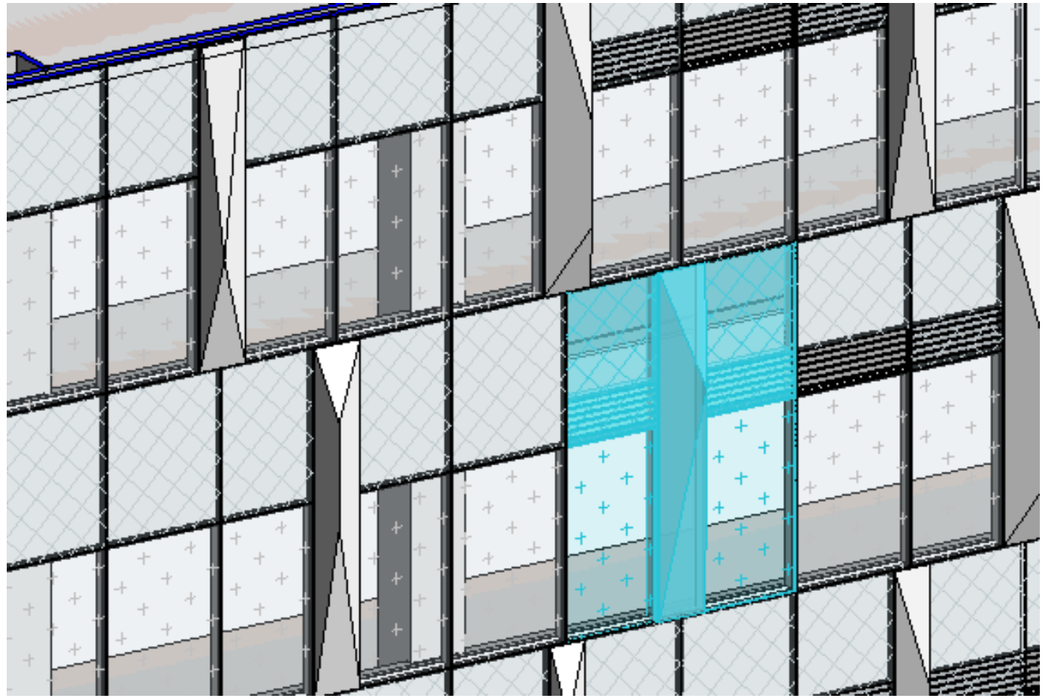




DO THIS FIRST!

(its easy)

Parity In Modeling: Revit

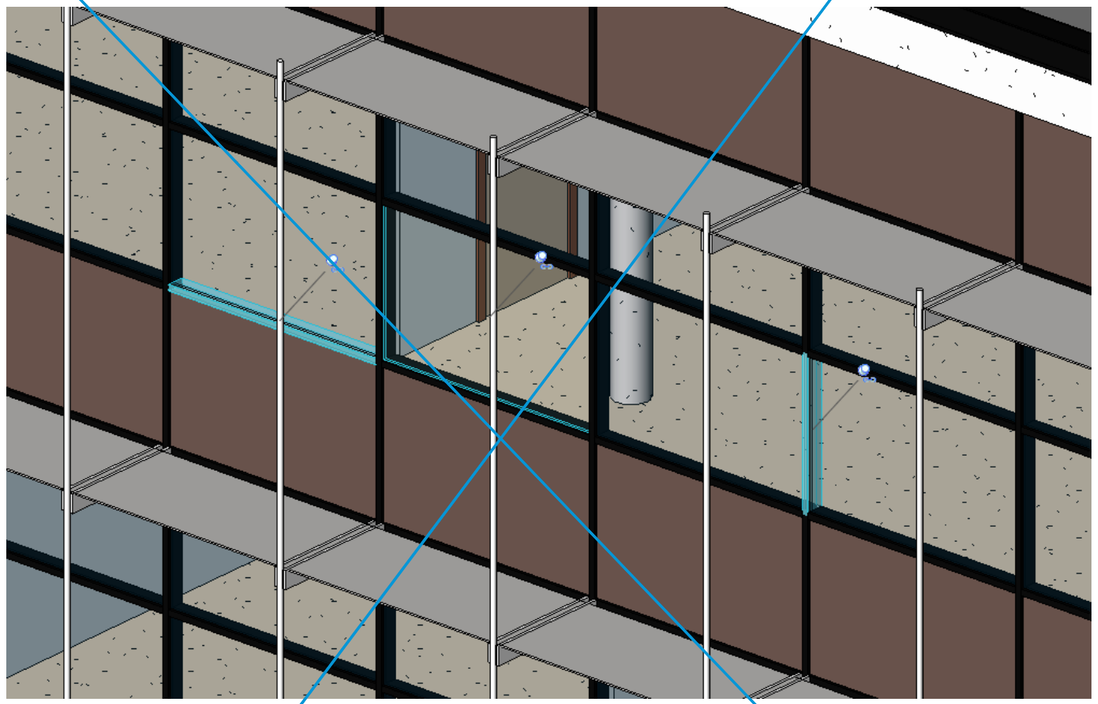


Model CW Unit as s single family

Half Mullion on each edge

Use consistent sub object categories

Use Consistent Parameter names



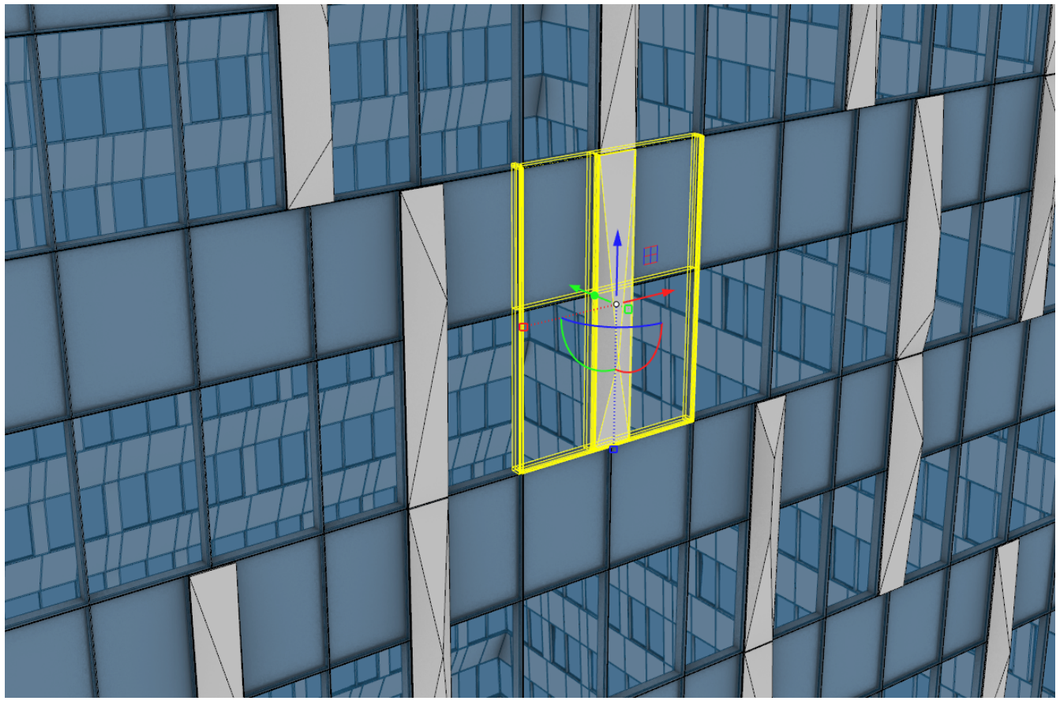
Do not Model curtain wall as individual pieces

Do not Assign Mullions to grid lines

Do not use hard to decipher names

Do not start from scratch each time

Parity In Modeling: Rhino

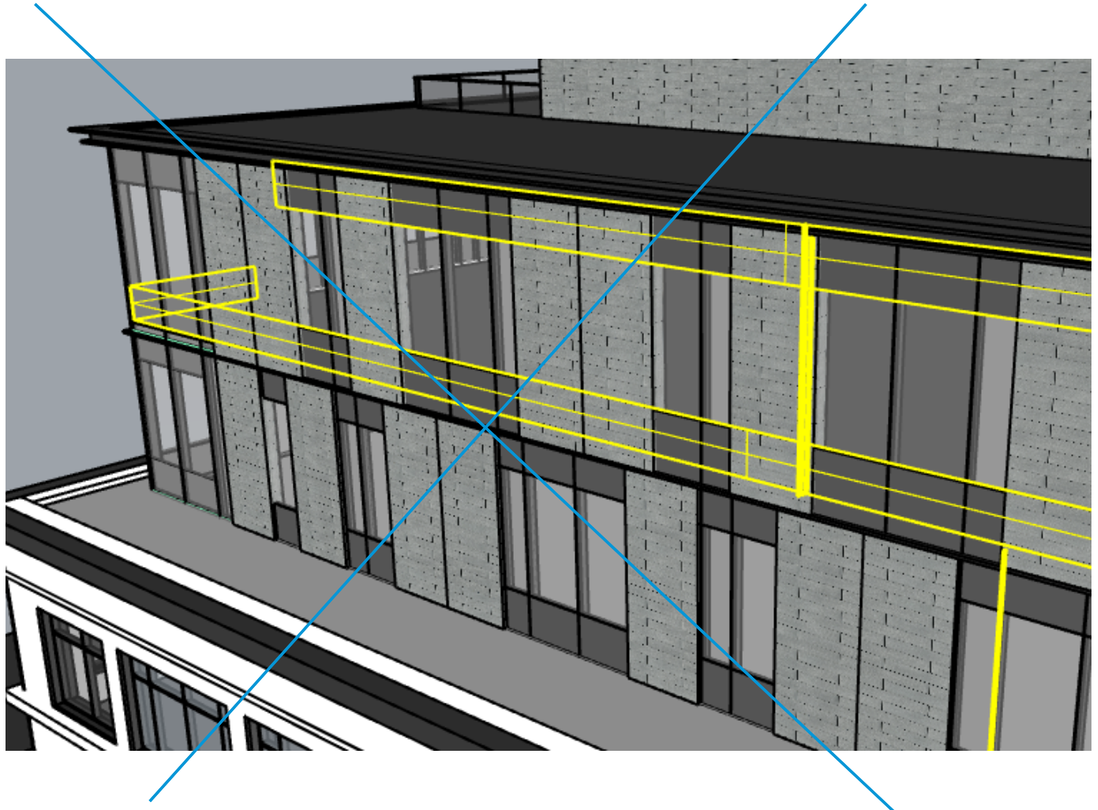


Model CW Unit independently as a Block

Simplify Geometry to reduce weight

Use consistent nested layers with assigned materials

Use nested blocks for repeated elements



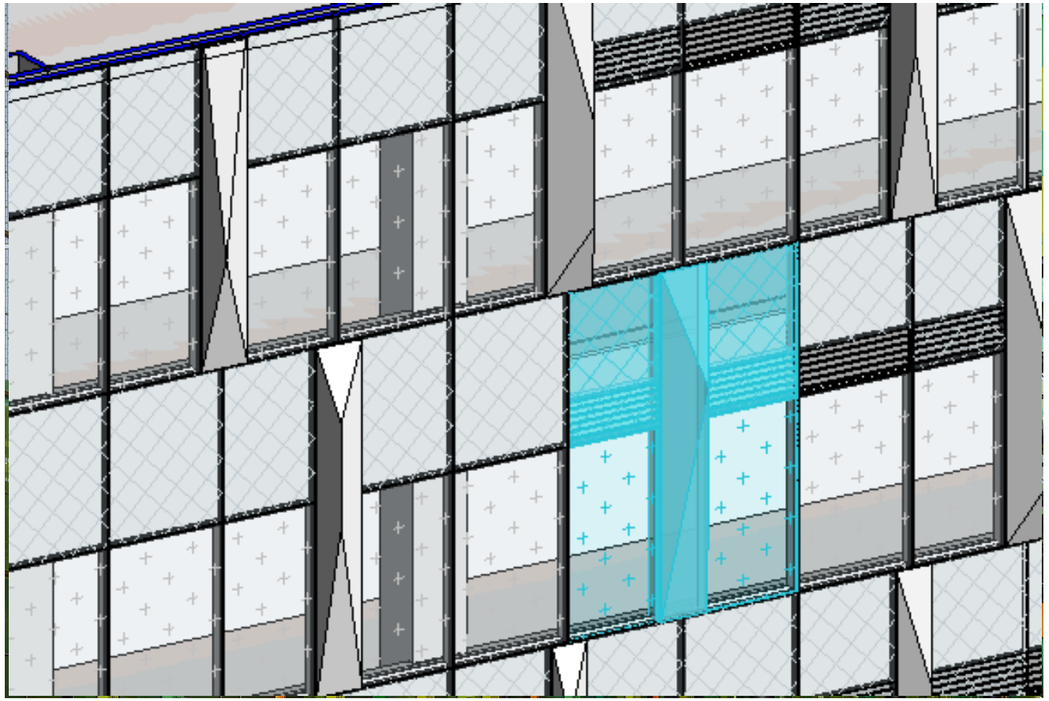
Do not model the whole façade as a single surface

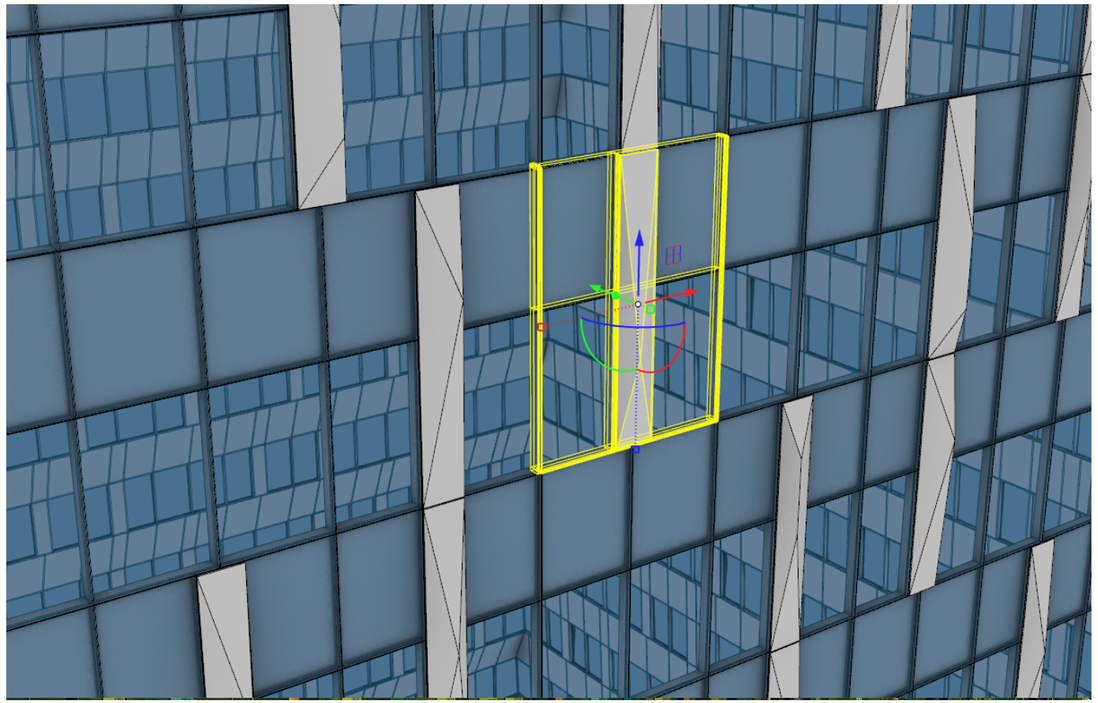
Do not build repeated elements individually

Do not put everything on the same layer with unique materials

Do not misspell things

Parity In Modeling: Implications





Some sort of direct translation is now possible

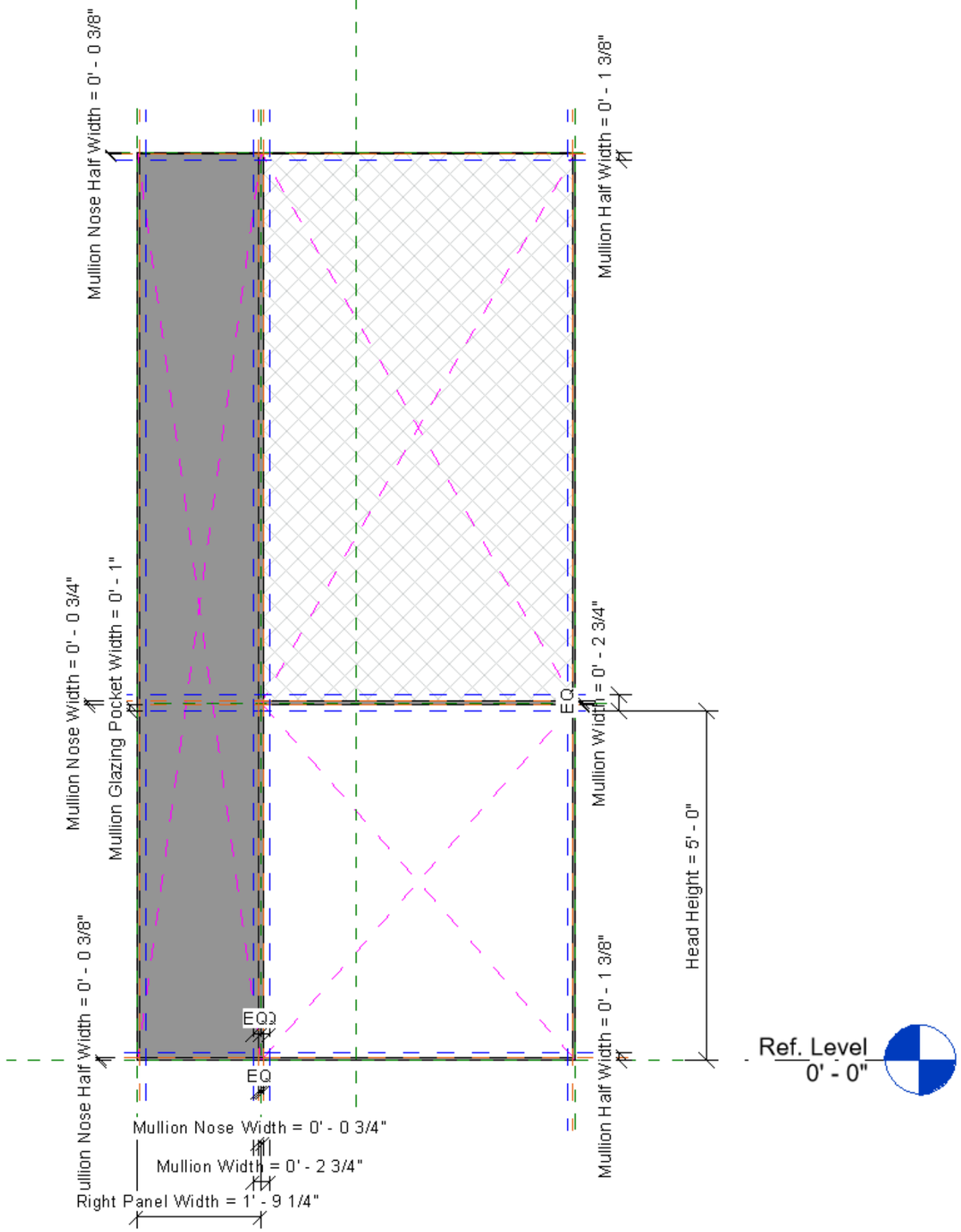
Documentation strategy is aligned with the design approach

“…but how do we achieve parity”

Templates and examples

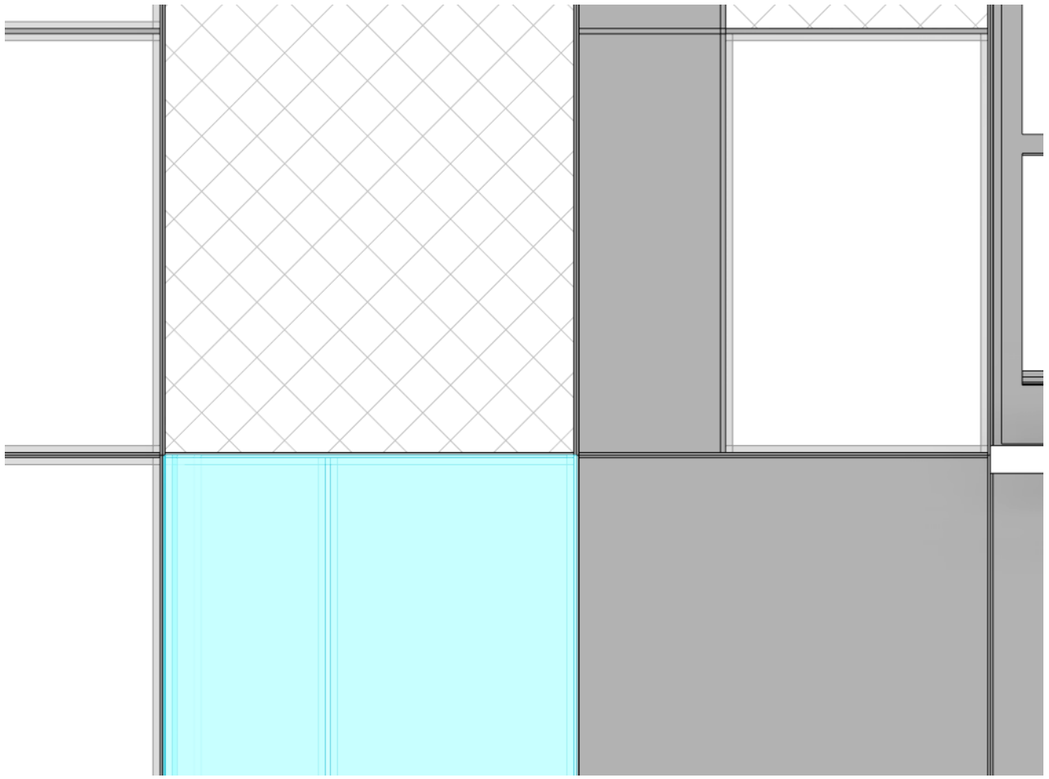
Our Revit Template

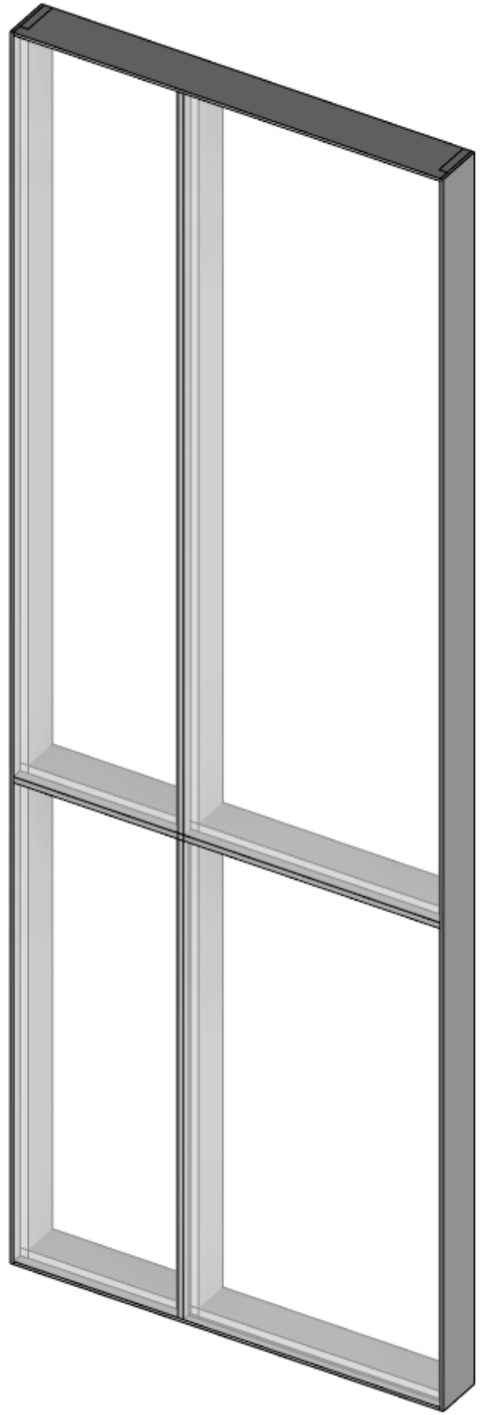
- Full CW Unit
- Half Mullions at the edges
- 3 types of reference planes
- Material Schedualability
- Nested families (operable windows + Mullions)
- Parameters (Naming)



Our Revit Template

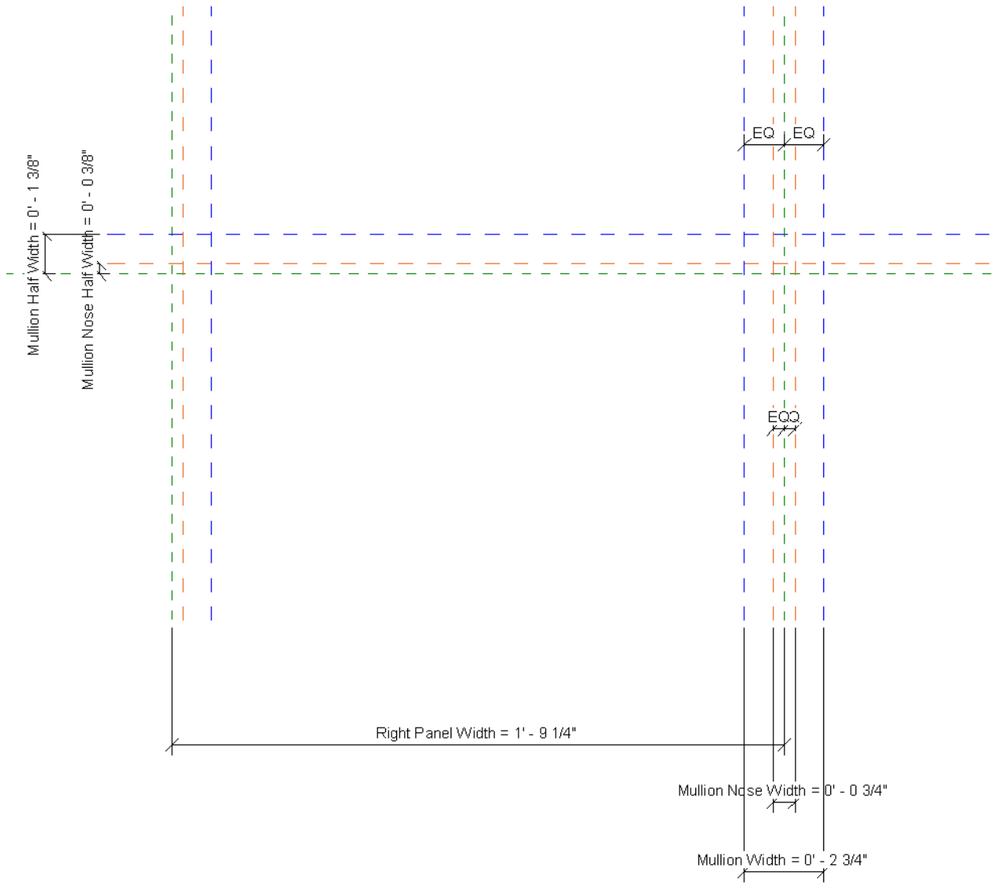
- Half Mullions at the edges

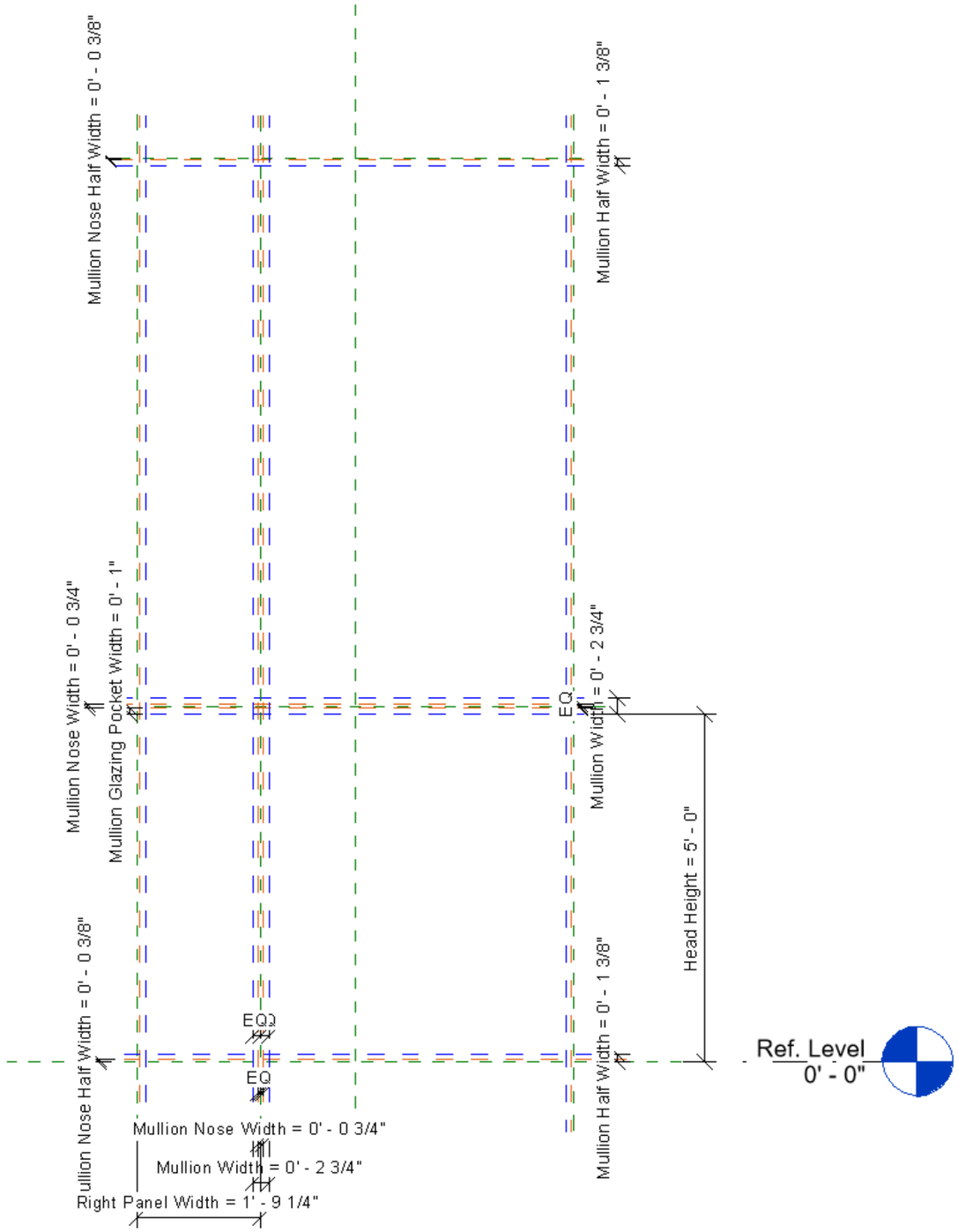




Our Revit Template

- 3 types of reference planes
- 3 sub object styles



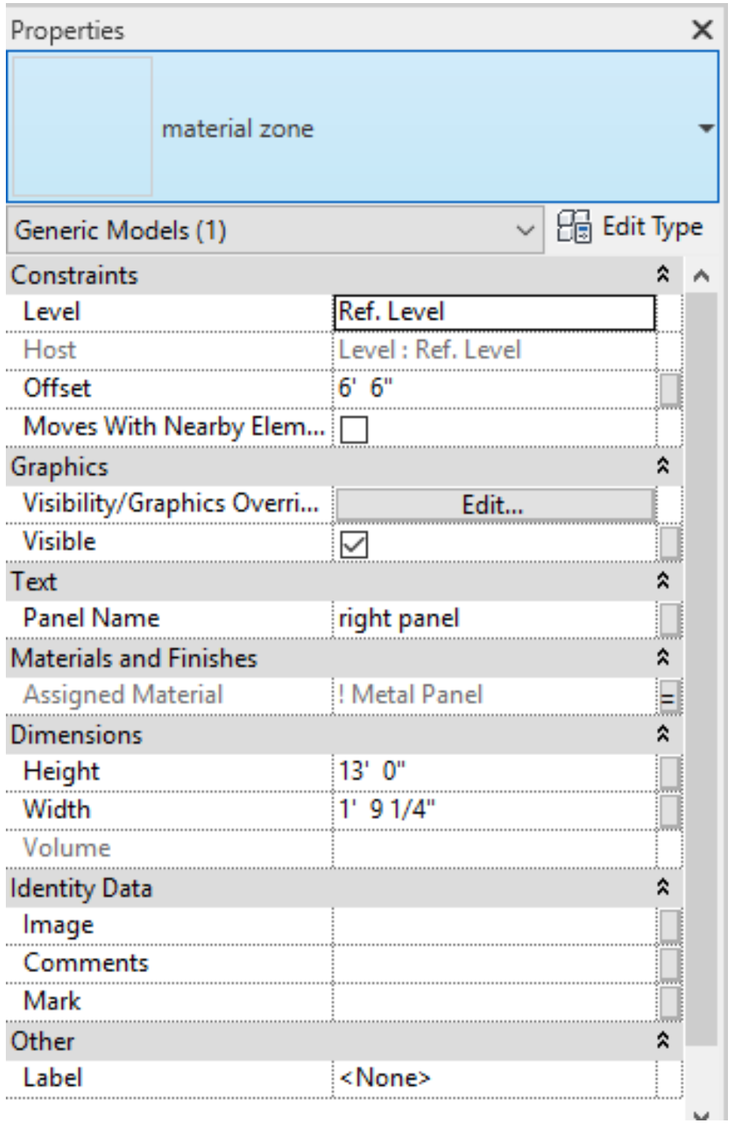


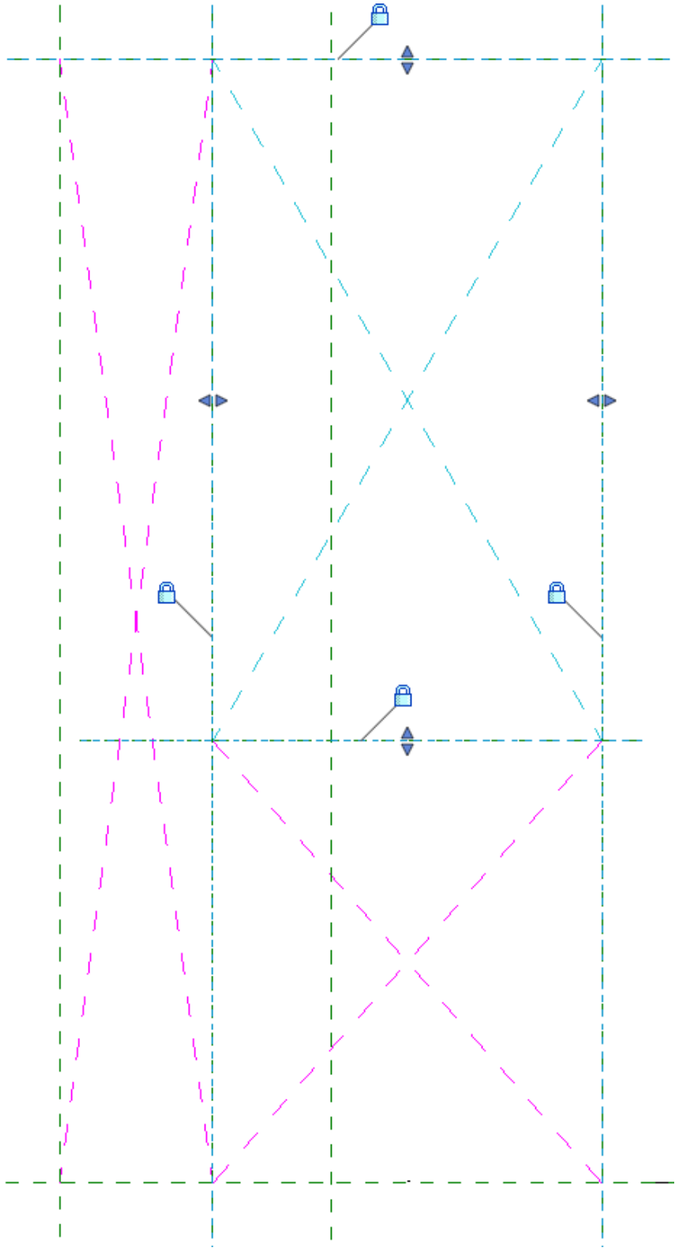
Our Revit Template

- Material Takeoff

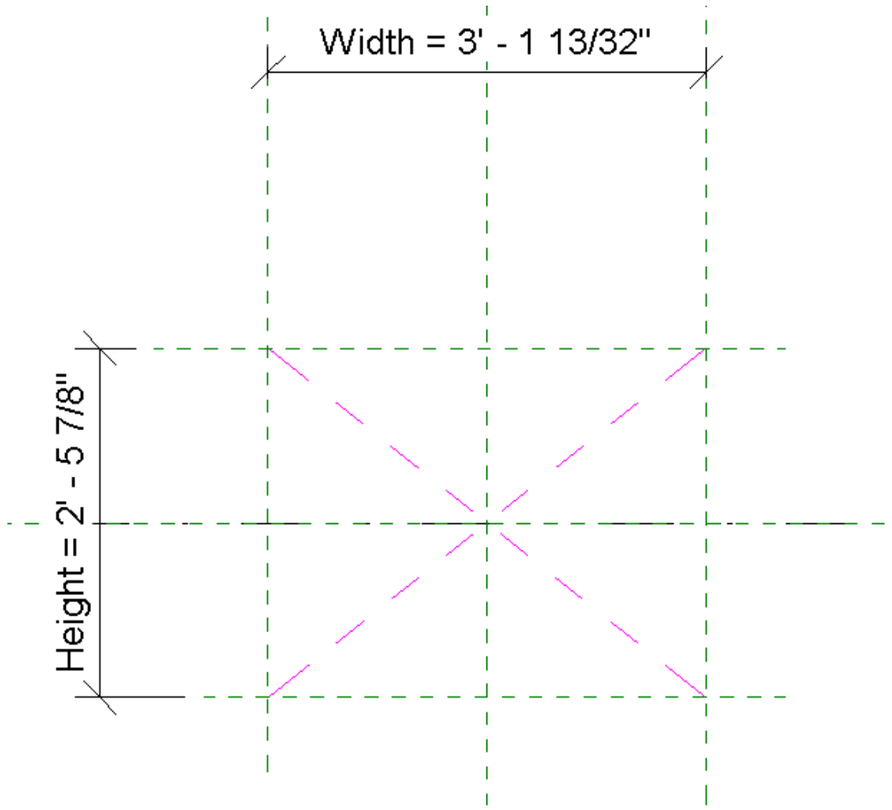
<CW Material Schedule>

A	B	C	D
Assigned Material	Height	Width	Area
! Glass - Spandrel	7' - 10 5/8"	4' - 11 5/8"	39 SF
! Glass - Spandrel	13' - 0"	5' - 0"	65 SF
! Glass - Spandrel	5' - 0"	5' - 0"	25 SF
! Glass - Spandrel	7' - 10 5/8"	3' - 2 3/4"	25 SF
! Glass - Spandrel	7' - 10 5/8"	1' - 9 1/4"	14 SF
! Glass - Spandrel	7' - 10 5/8"	3' - 2 3/4"	25 SF
! Glass - Spandrel	3' - 0"	5' - 0"	15 SF
! Glass - Spandrel	7' - 10 5/8"	3' - 2 3/4"	25 SF
! Glass - Spandrel	3' - 0"	5' - 0"	15 SF
! Glass - Spandrel	6' - 4 5/8"	3' - 0"	19 SF
! Glass - Spandrel	6' - 4 5/8"	2' - 0"	13 SF
! Glass - Spandrel	13' - 0"	1' - 9 1/4"	23 SF
! Glass - Spandrel	7' - 10 5/8"	3' - 2 3/4"	25 SF
! Glass - Spandrel	7' - 10 5/8"	3' - 2 3/4"	25 SF
! Glass - Spandrel: 14			355 SF
! Glass - Vision	7' - 10 5/8"	2' - 8 3/4"	22 SF
! Glass - Vision	13' - 0"	5' - 0"	65 SF
! Glass - Vision	7' - 10 5/8"	4' - 6"	35 SF
! Glass - Vision	2' - 0"	4' - 6"	9 SF
! Glass - Vision	7' - 10 5/8"	2' - 8 3/4"	22 SF
! Glass - Vision	5' - 1 3/8"	2' - 8 3/4"	14 SF
! Glass - Vision	5' - 1 3/8"	2' - 8 3/4"	14 SF
! Glass - Vision	5' - 1 3/8"	4' - 6"	23 SF





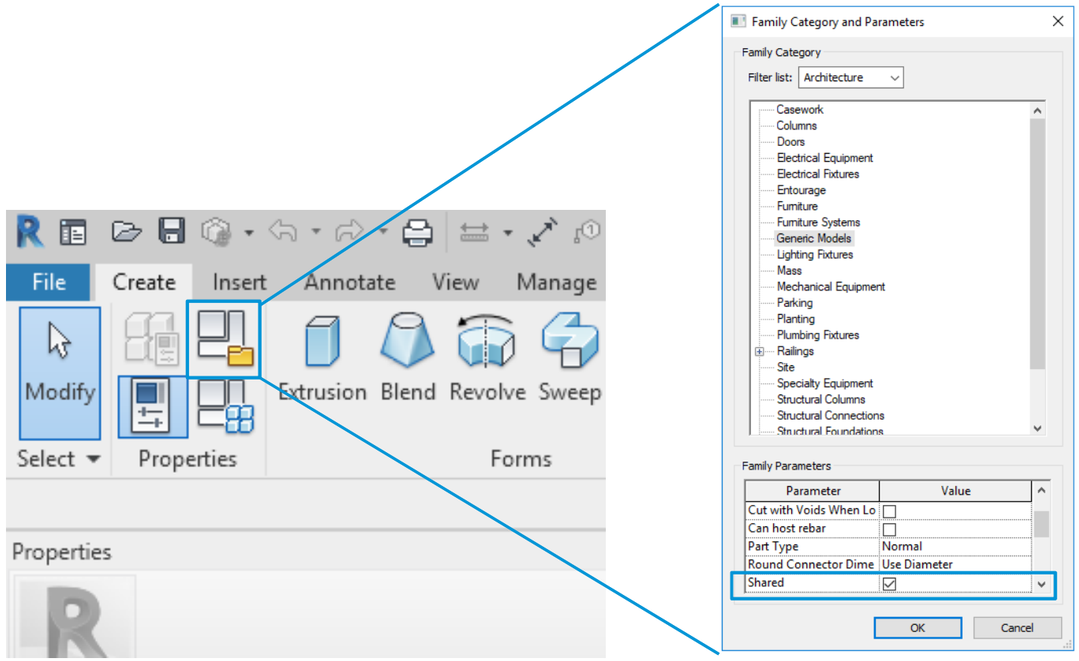
Our Revit Template



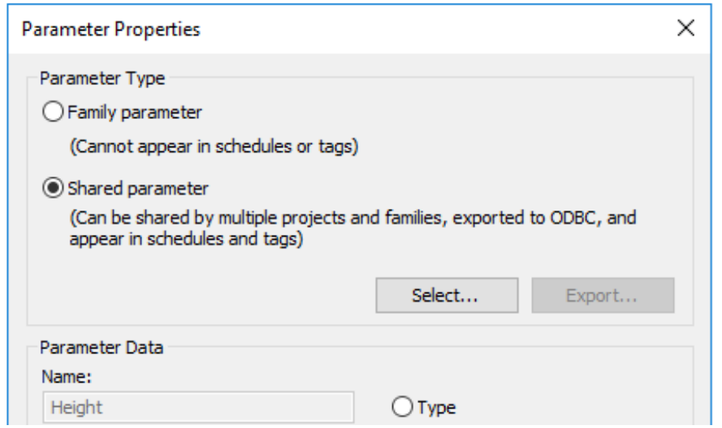
Generic Model Family

Reference planes

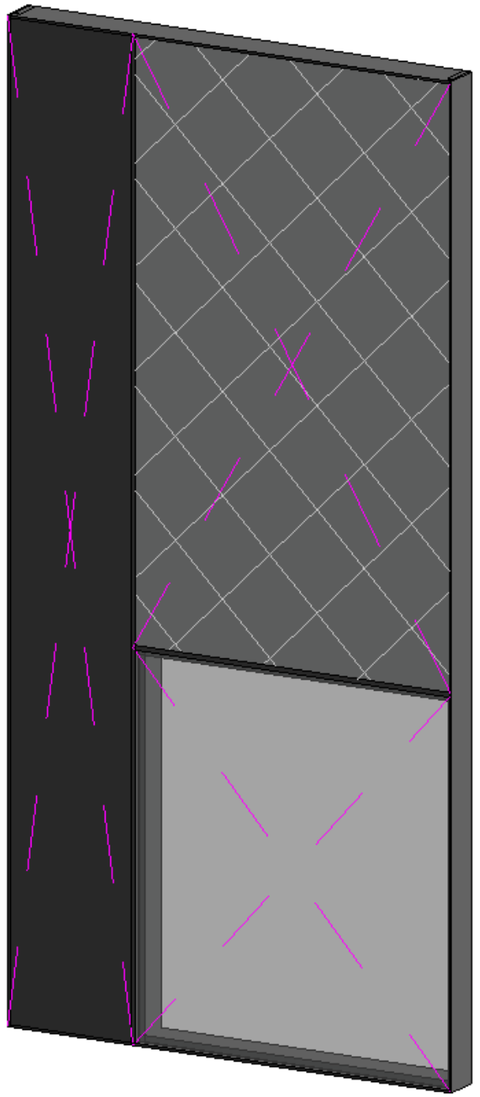
Model lines – with custom object style



Don’t forget to share the parameters (two places)



Our Revit Template



Mostly helper parameters

Typical users should avoid these

Generally set up once per project

Materials– names vary by panel configuration

Set the dimensions and character of the panel

Hide the insulation for vision glass or include it behind opaque panels

Family Types

Type name: Metal Panel right Spandrel over Vision

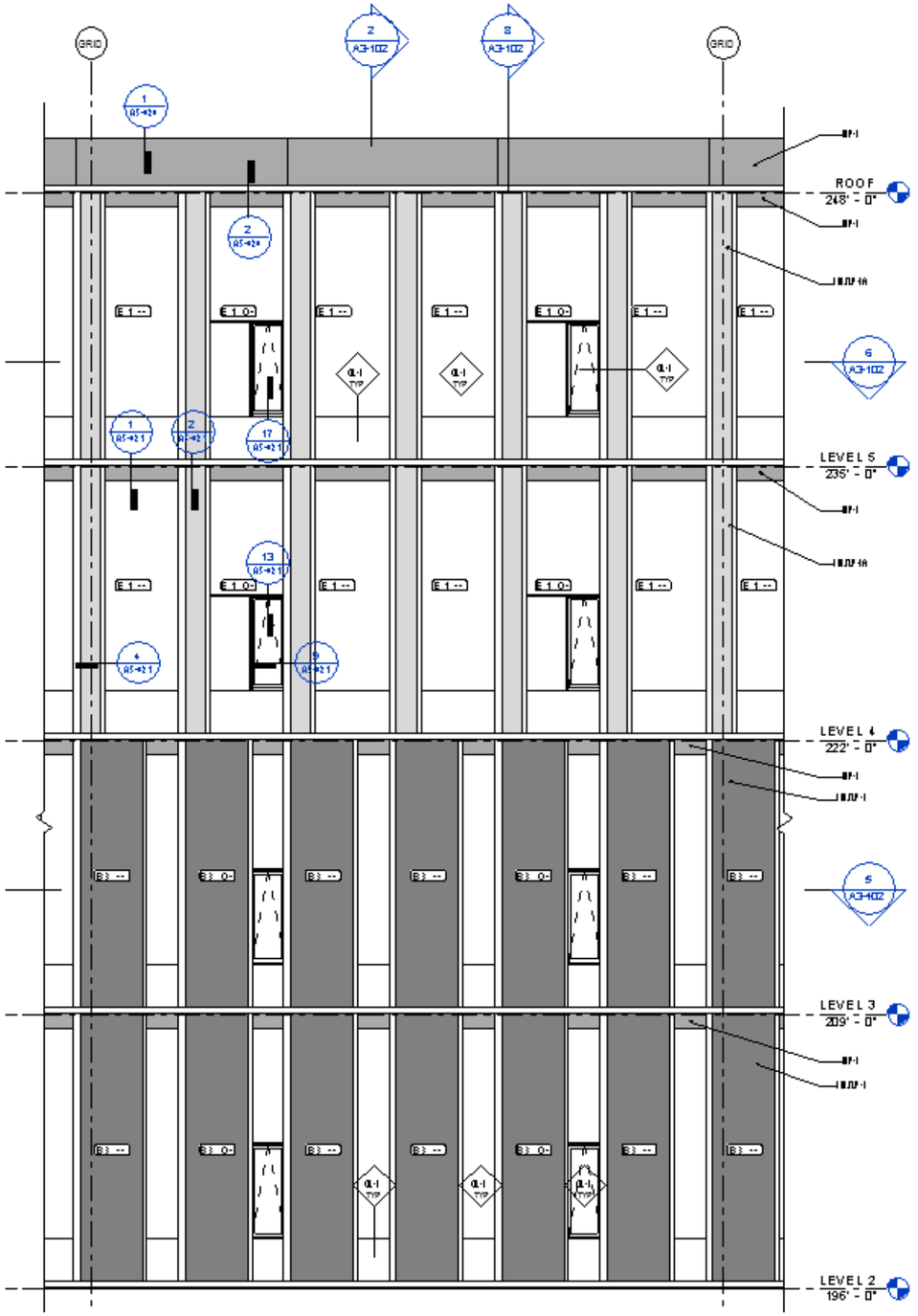
Search parameters

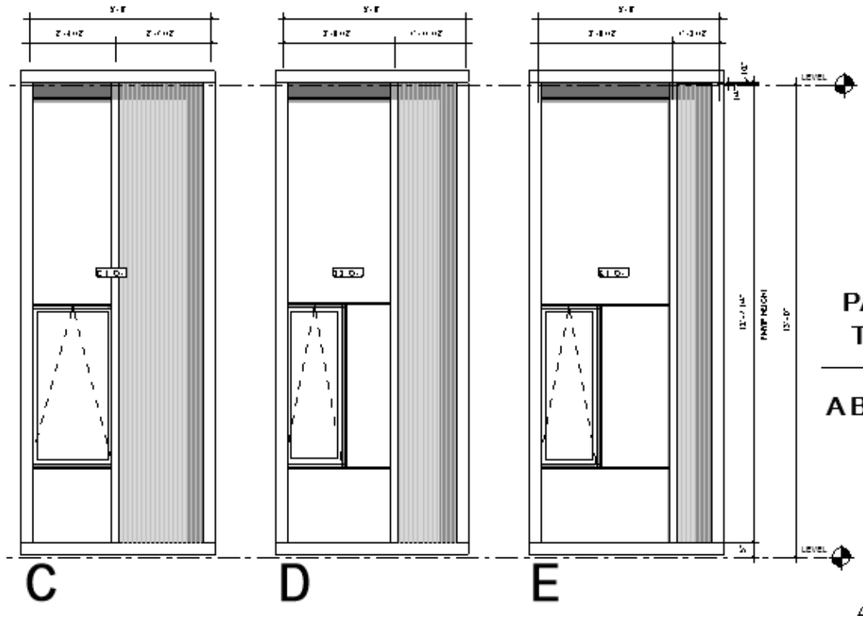
Parameter	Value	Formula	Lock
Construction			
Construction Type		=	
Glazing Thickness	0' 1"	=	☐
Insulation Thickness	0' 3"	=	☐
Mullion Angle Left (default)	-180.00°	= if(Left Mullion Is Corner, -225°, -180	☐
Mullion Angle Right (default)	-180.00°	= if(Right Mullion Is Corner, -225°, -18	☐
Mullion Corner Offset Left (default)	0' 0"	= if(Left Mullion Is Corner, 0' 0 3/16",	☐
Mullion Corner Offset Right (default)	0' 0"	= if(Right Mullion Is Corner, 0' 0 3/16"	☐
Mullion Glazing Pocket Depth	0' 1 3/8"	=	☐
Mullion Glazing Pocket Width	0' 1"	= Mullion Half Width - (Mullion Nose	☑
Mullion Half Width	0' 1 3/8"	= Mullion Width / 2	☑
Mullion Nose Half Width	0' 0 3/8"	= Mullion Nose Width / 2	☑
Mullion Nose Width	0' 0 3/4"	=	☑
Mullion Width	0' 2 3/4"	=	☑
Mullion Depth	0' 6 1/4"	=	☐
Mullion Depth Calculated	0' 6 1/4"	= Mullion Depth + Sill Depth	☐
Materials and Finishes			
Finish		=	
Insulation Material	Spandrel Insulation	=	
Mullion Material	Mullion Material	=	
Lower Left Panel Material	! Glass - Vision	=	
Right Panel Material	! Metal Panel	=	
Upper Left Panel Material	! Glass - Spandrel	=	
Analytical Properties			
General			
Facing Orientation (default)		=	
Head Height	5' 0"	=	☐
Left Mullion Is Corner (default)	☐	=	
Right Mullion Is Corner (default)	☐	=	
Right Panel Width	1' 9 1/4"	=	☐
Sill Depth	0' 0"	=	☐
Visibility			
Lower Left Panel Insulation Visibility	☐	=	
Right Panel Insulation Visibility	☑	=	
Upper Left Panel Insulation Visibility	☑	=	
Identity Data			

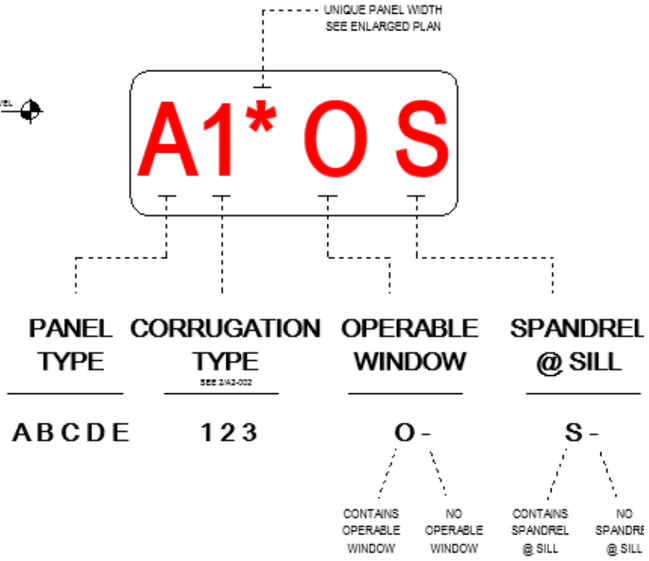
Manage Lookup Tables

How do I manage family types?

OK Cancel Apply



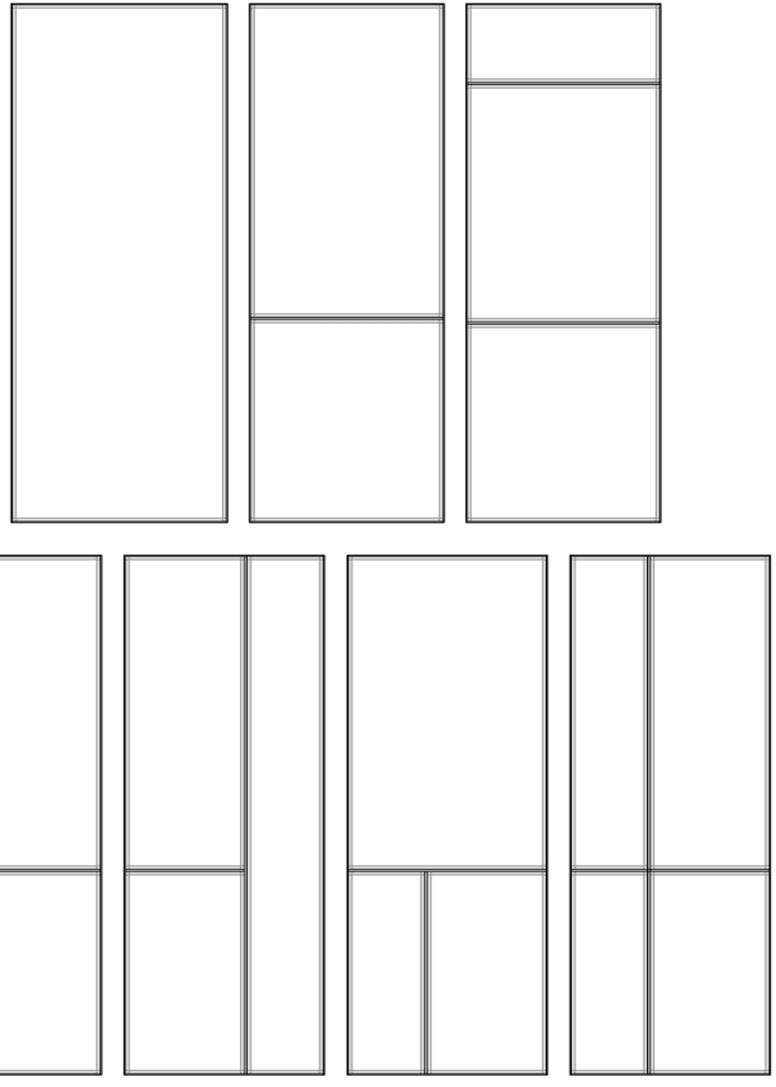


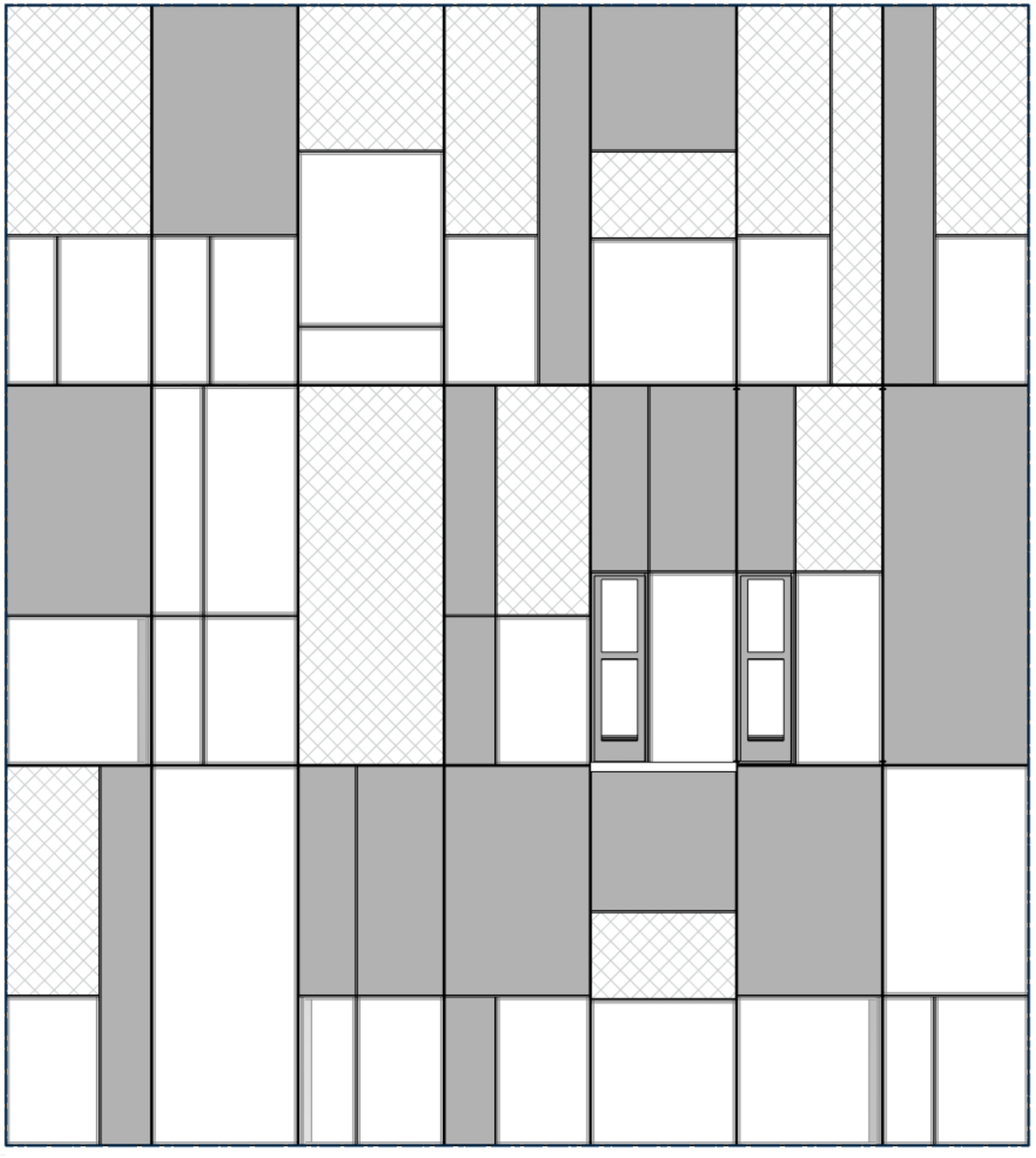


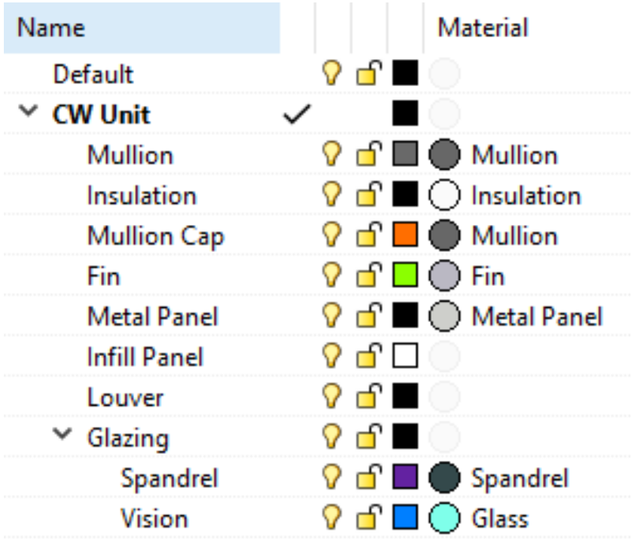
Tagged Types

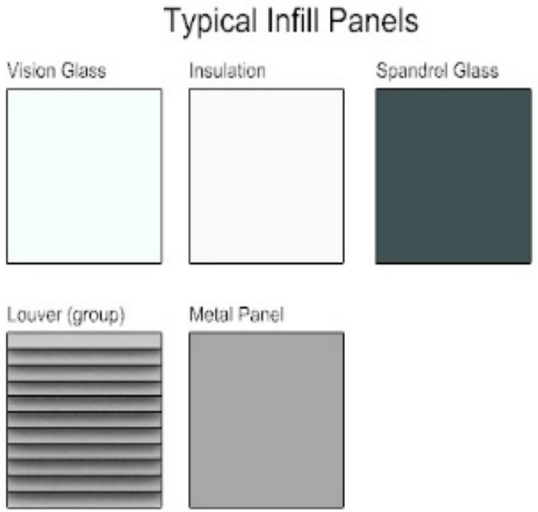
- Repeated kit of parts
- Simplifies non-regular patterns
- Easy identification of unique elements
- Shared type param's as labels

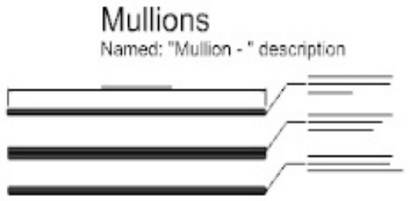
Our Revit Template(s)

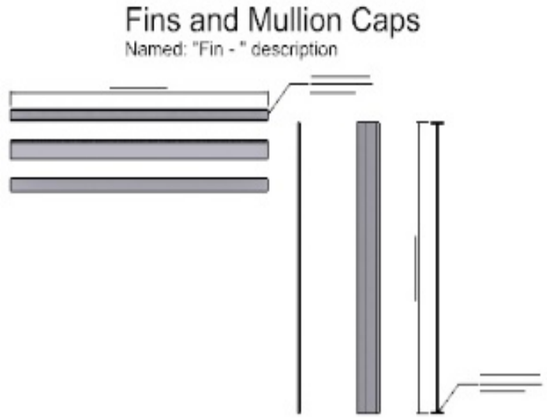












Our Rhino Template

Full cw unit as block

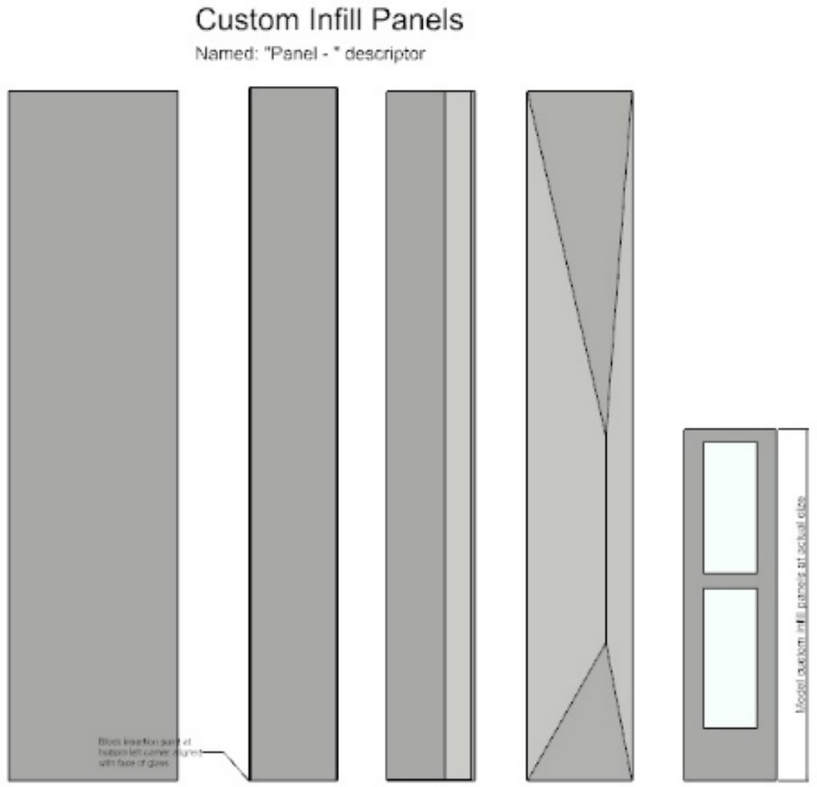
Example infill panels from past projects as Blocks

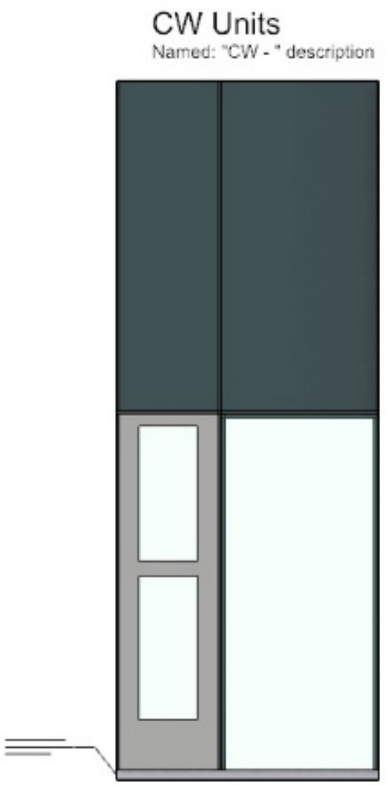
Standard Mullion profiles as Blocks

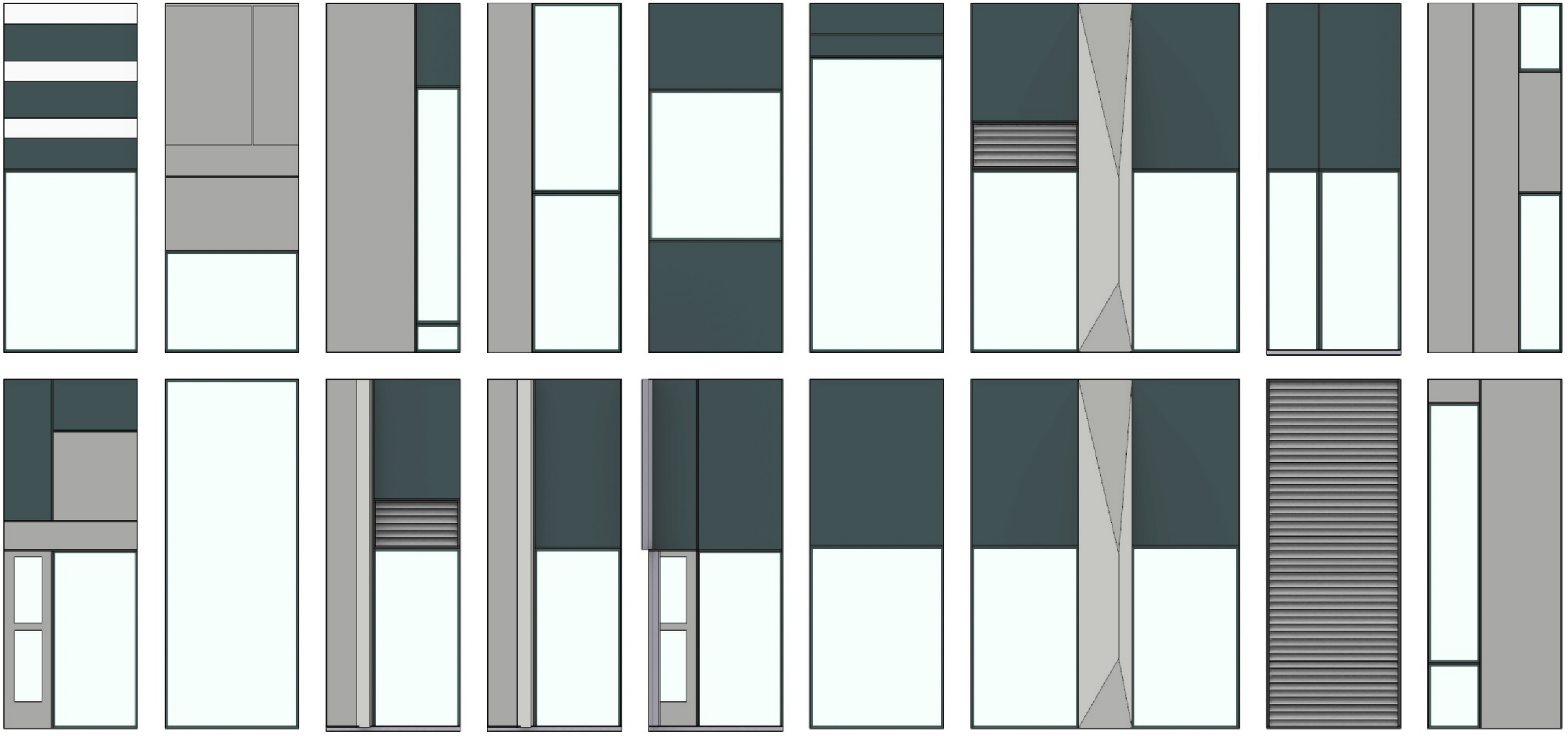
Standard Fins and Mullion Caps as Blocks

Layer structure

Materials







Putting the aligned model strategy to work

WHY ARE YOU MOVING BETWEEN PROGRAMS?

VISUALIZATION, DOCUMENTATION, ANALYSIS?

WHAT DO YOU ACTUALLY NEED?

DATA, GEOMETRY, BOTH?

Types of Interop

Complex

Straight forward

LINK INSERTION

Geometry from one program is displayed in another with visibility controls (Layers, Categories, Materials, etc.)

DIRECT BUILD

New native geometry is created with translated data from the previous model (Names, Params, etc.)

PARAM SETTING

Existing model elements are linked between two programs. As values and data change in one they are updated in the other

CLOUD MODEL

All elements and geo are connected and changes that happen in either program are made in the other

Frequent

As Needed

Hypothetical Building X

Again think like Revit

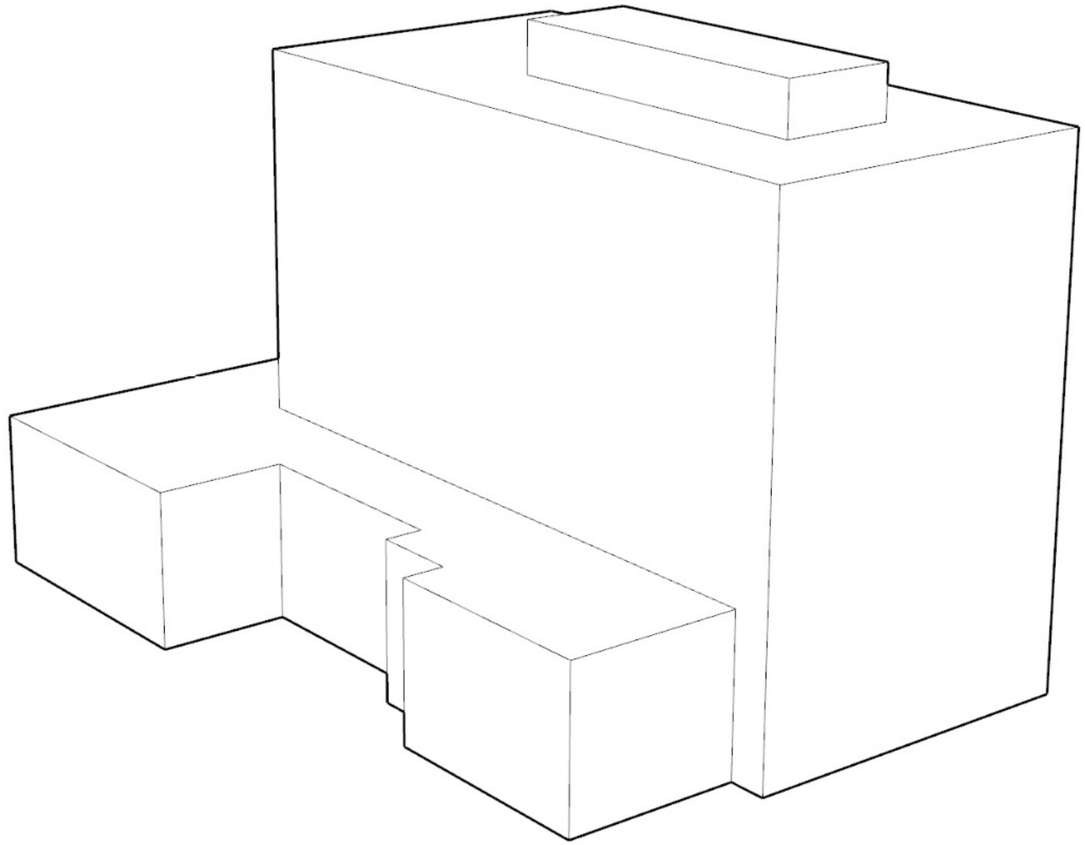
- Grid line spacing, justification, Panel types

Then think beyond what revit does natively

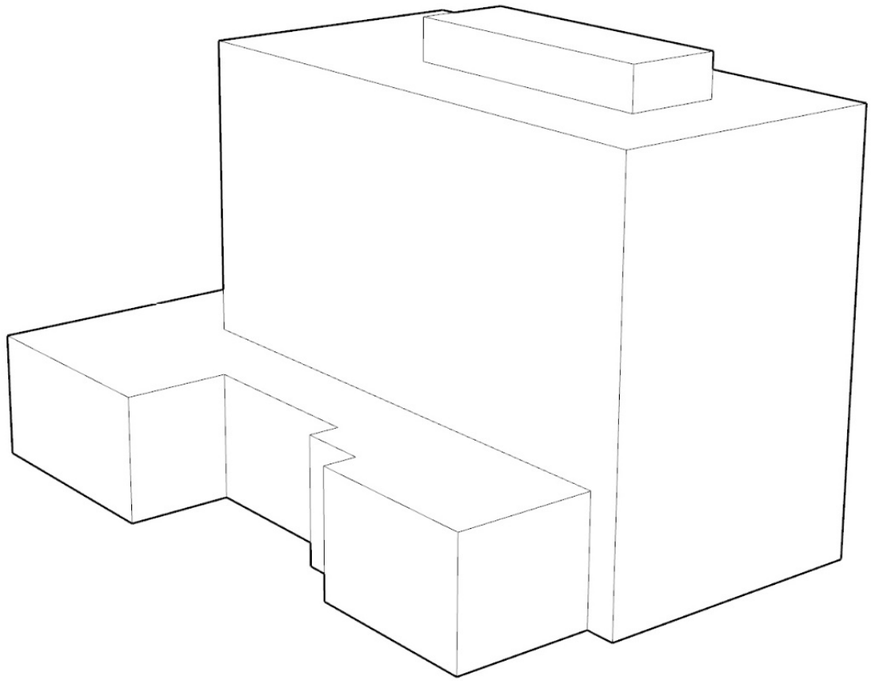
- Complex panel Patterns
- Painting on façade types
- Family types by jpg

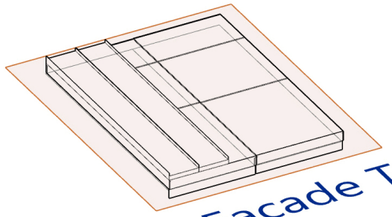
Dynamo, Grasshopper, C# enable ultimate control

- Built around Revit thinking so its compatible between platforms
- Making the process user friendly is the last piece of the puzzle

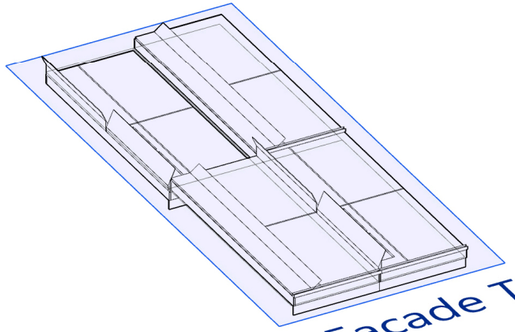


Hypothetical Building X

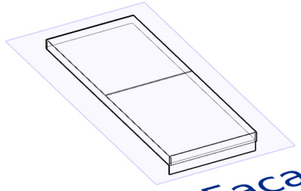




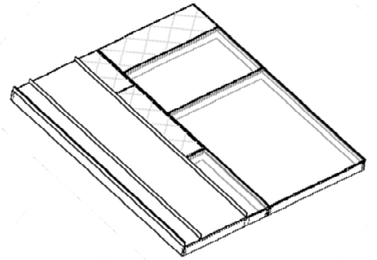
Facade Type0

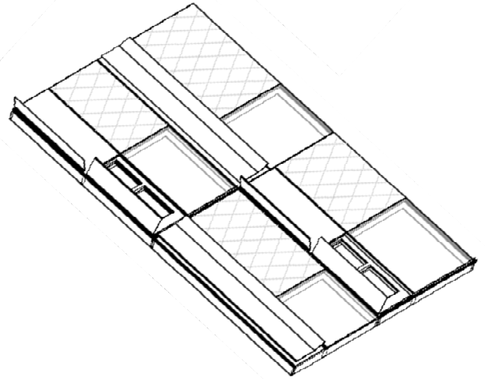


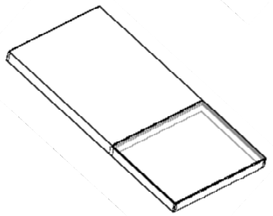
Facade Type1

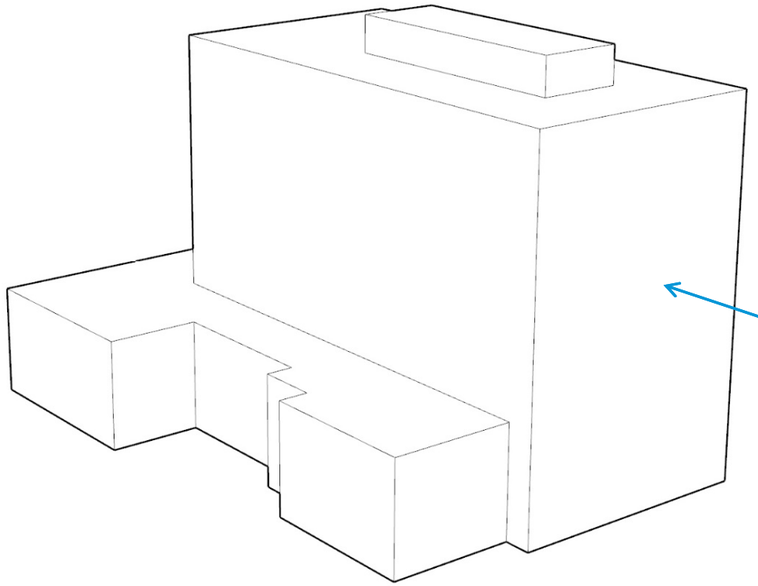


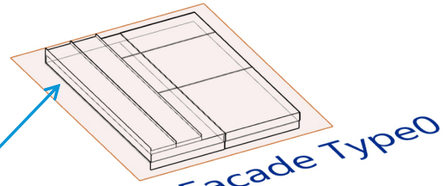
Facade Type2

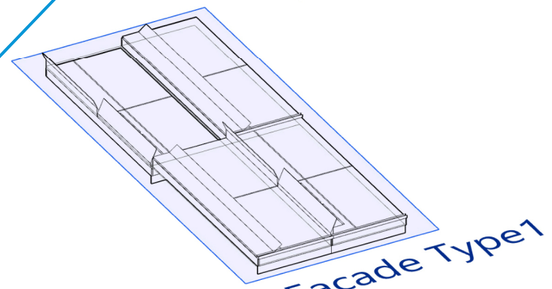


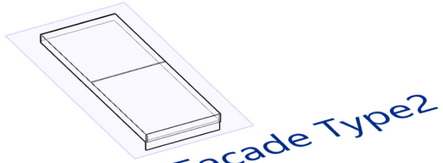


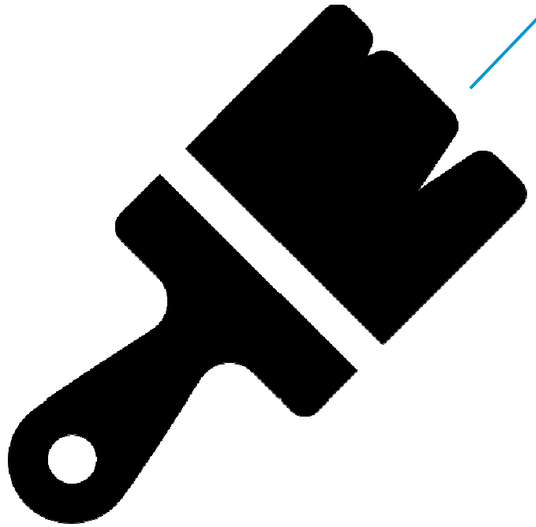


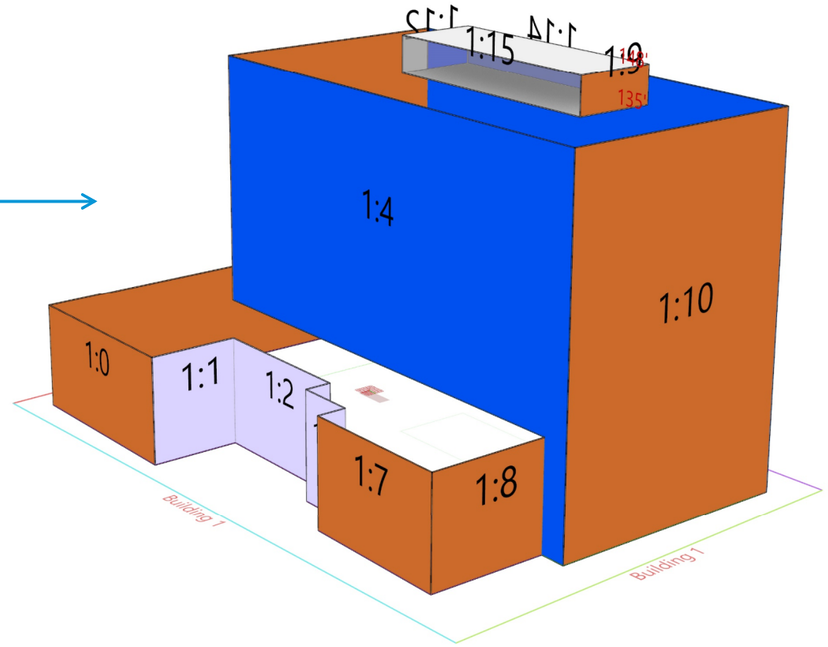










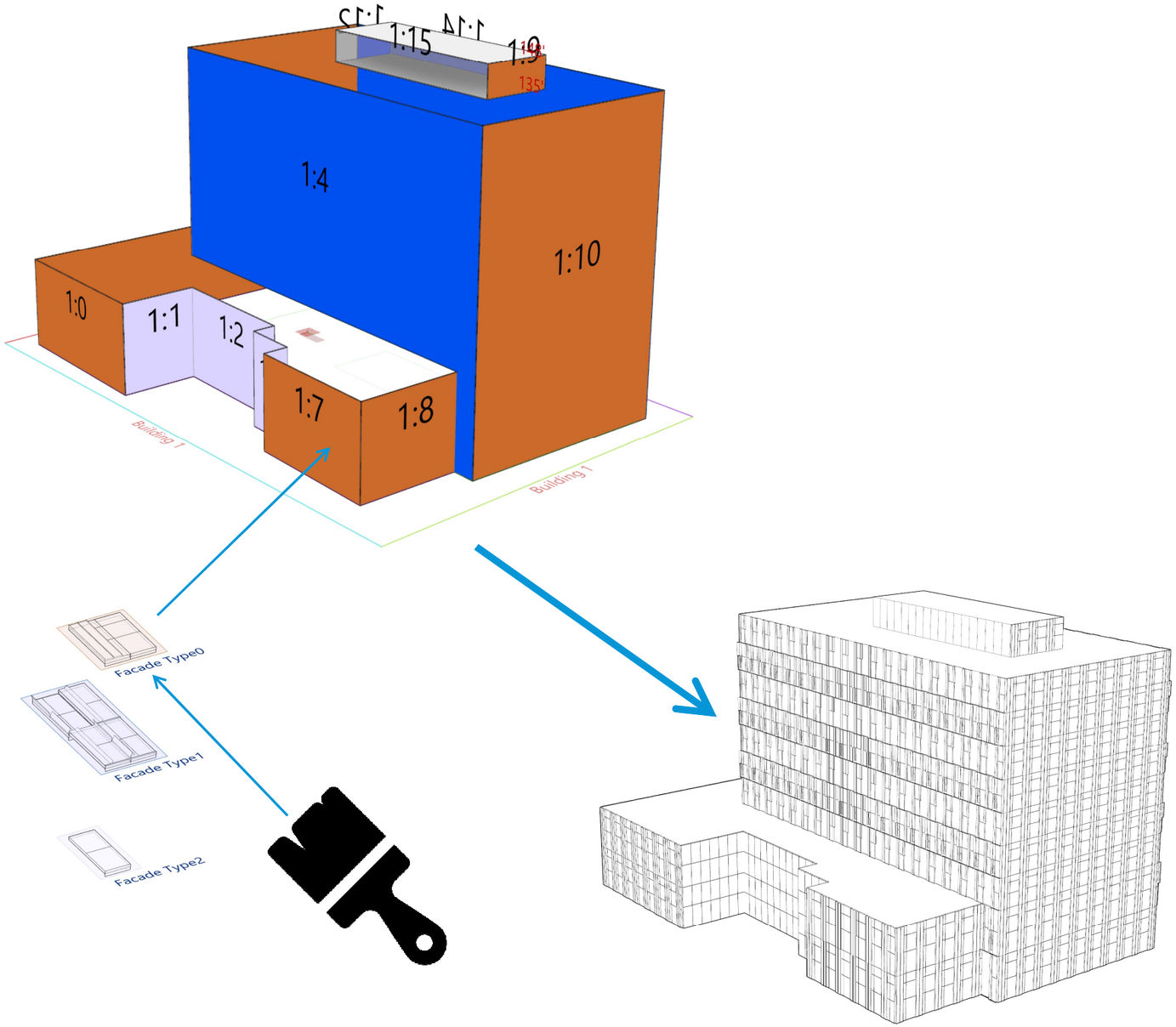


Façade Painter

Designer friendly UI

Rapid ideation

Complex patterns

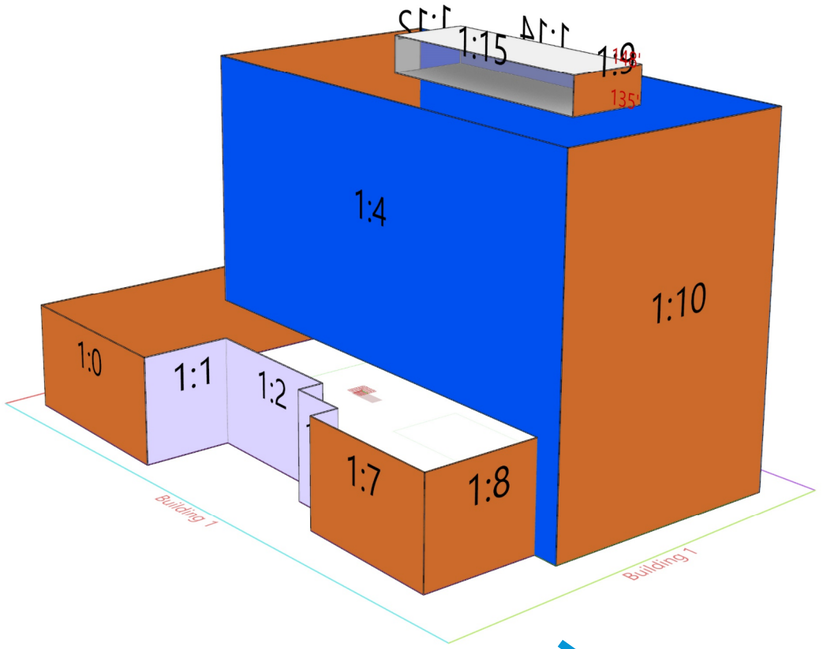


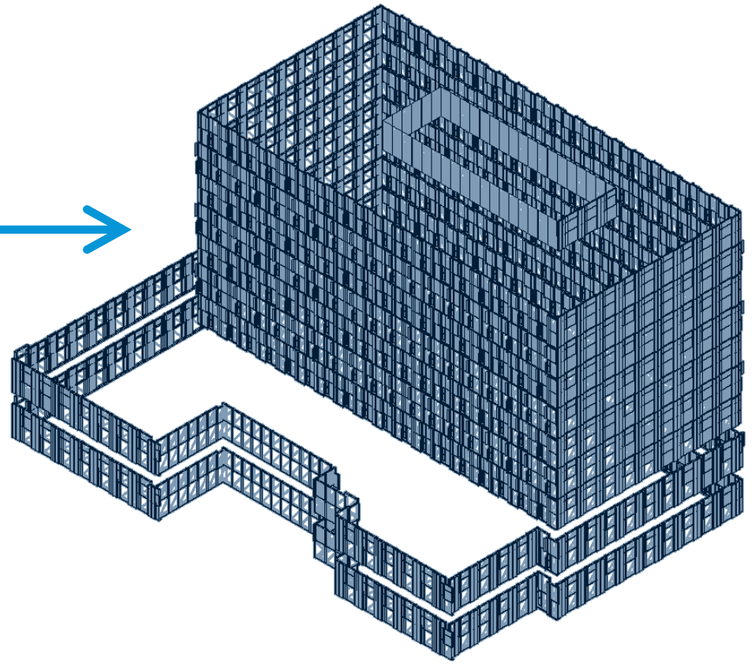
Design Model

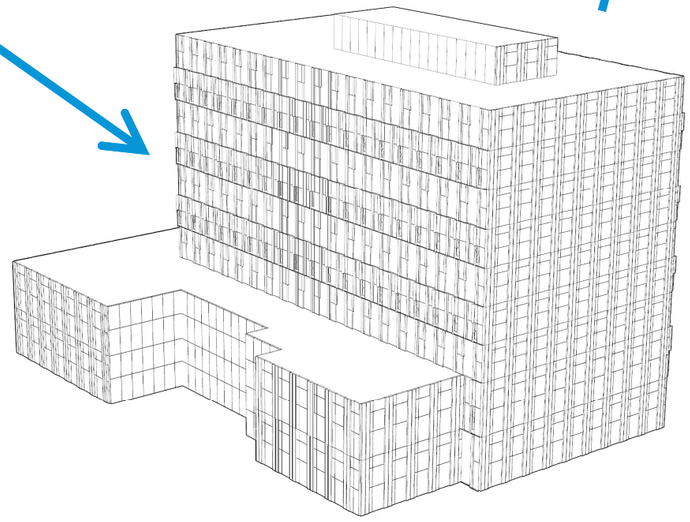
Interactive

Flexible

Quick







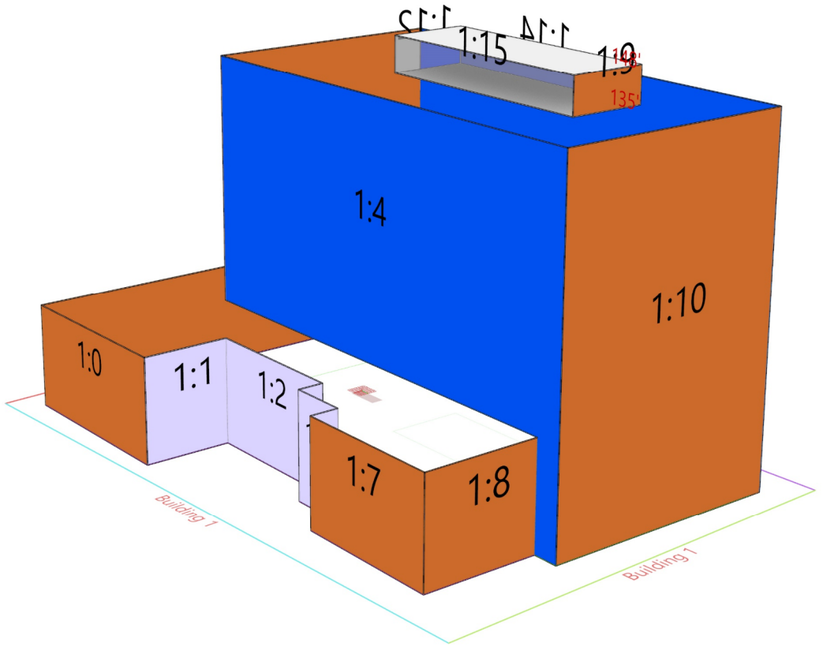
Link for Visualization

Bake Blocks: (future updates)

Export as .SKP: (so it can be linked)

Model In Place : Wall (so it cuts in plan/section)

Link CAD: (so materials can be edited)

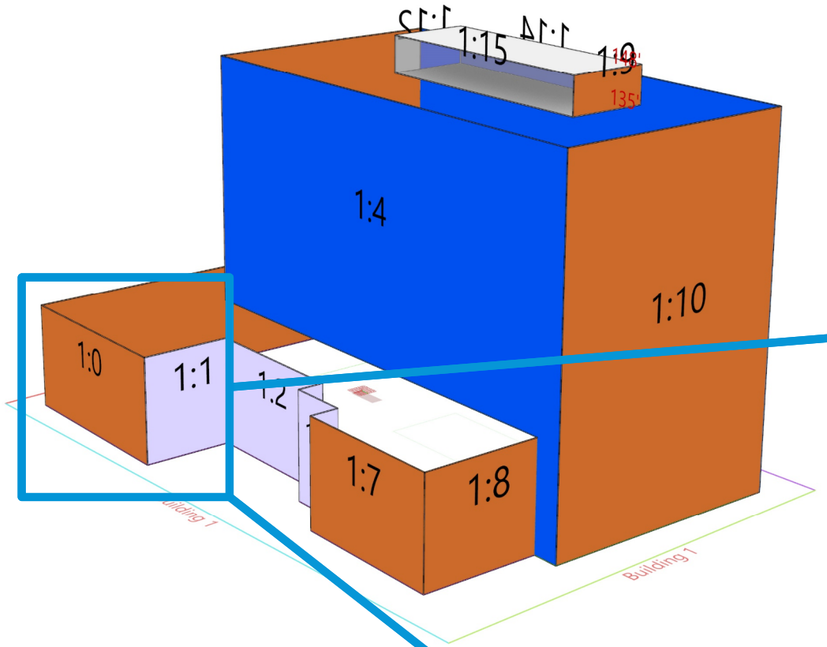


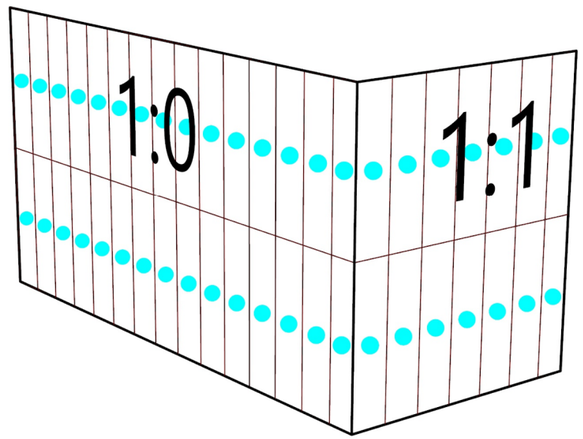
We can do better

Why Interop? Develop and Document

What do we want?

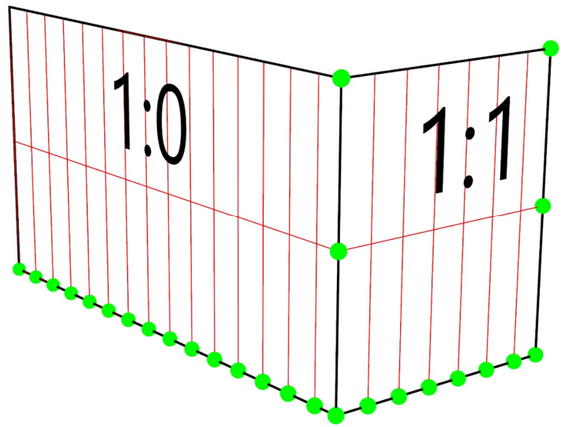
- New Revit Walls
- Aligned Curtain Gridlines
- Automated Panel Types
- Automated Parameters
- Material Takeoffs





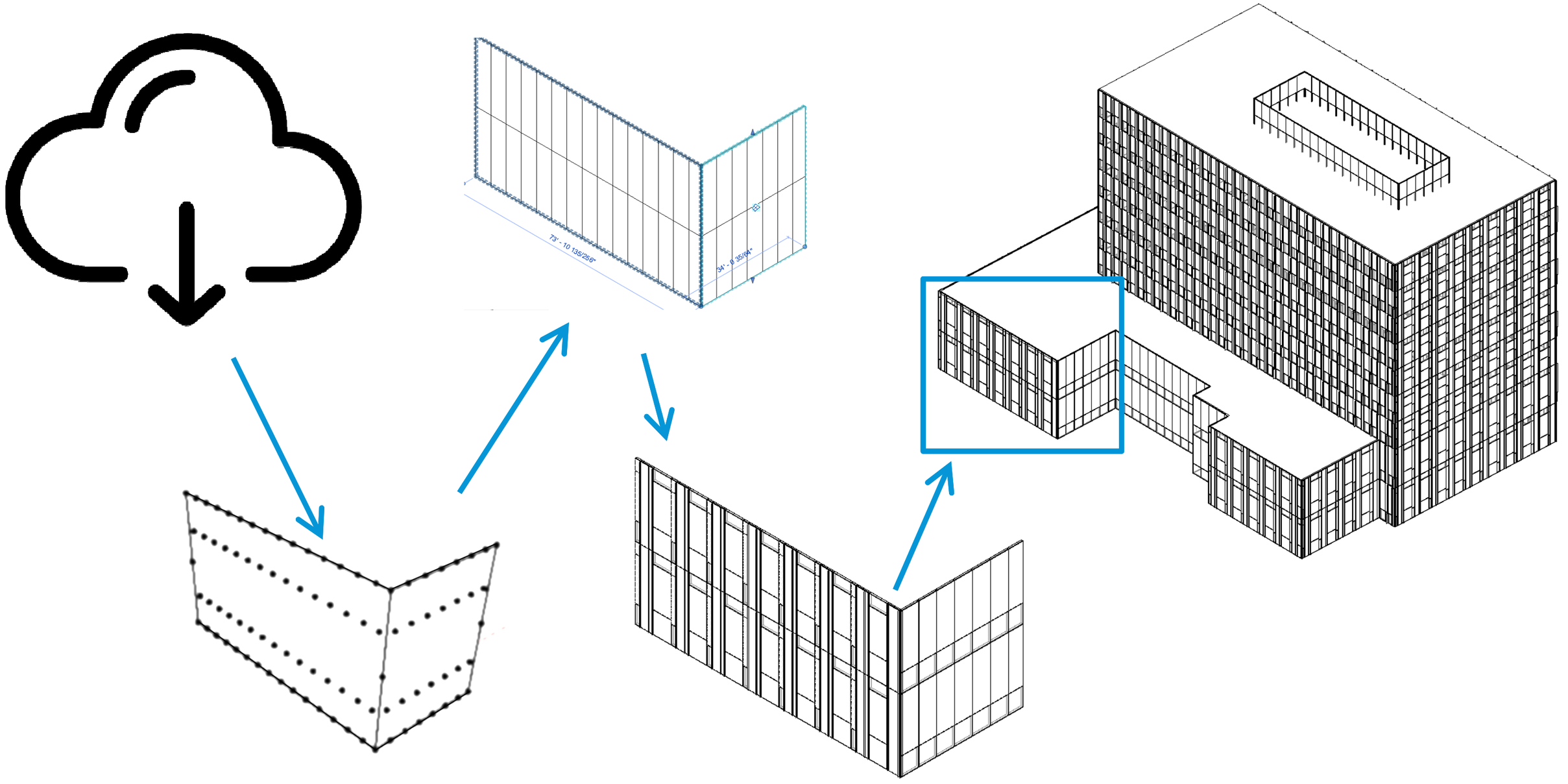
Panel center points

Panel Type and Data



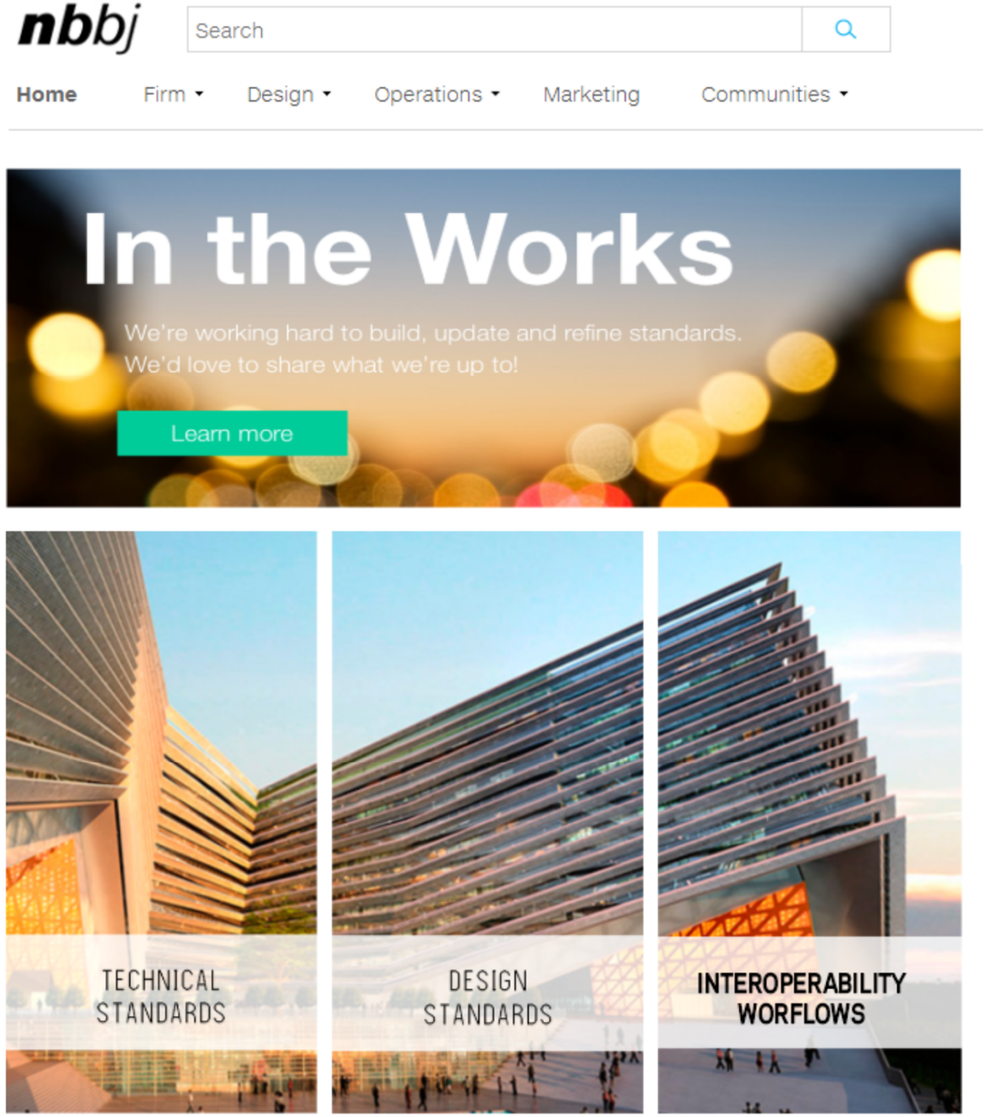
Wall Profile as Polyline

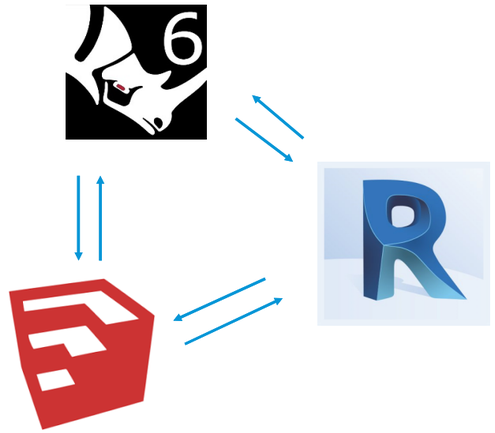
Grid line endpoints


73' - 10 135/256"
34' - 0 35/64"

Yes, but is that process repeatable?

Documented Workflows





- Videos
- Examples
- PDFs
- Contact info

Early Engagement

- Each Phase
- Scope
- Tools
- People
- Workflows
- Opportunities

PHASE 1
PROSPECT/PROJECT SETUP DP CHECKLIST
TIME: 15 MINUTES

Sacramento Courthouse/ CA
Project Name / Location

101405.00
Project Number

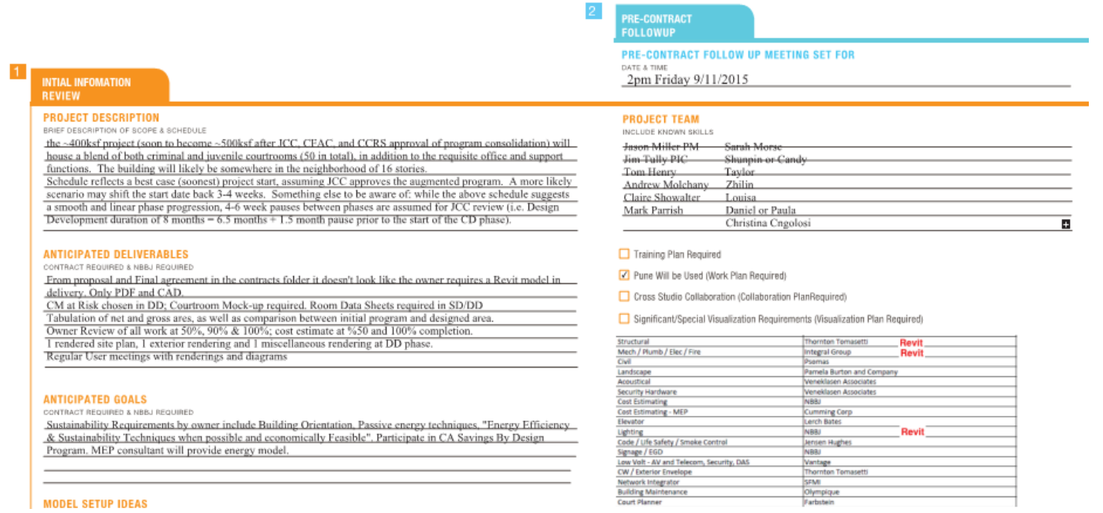
SEA31
Studio

Jason Miller
Project Manager

10/1/2015
Project Start Date

02/17 CD - 10/1/21 Completion
Project Completion Date

Anne Gustavson
BIM Leader



1 INITIAL INFOMATION REVIEW

PROJECT DESCRIPTION
BRIEF DESCRIPTION OF SCOPE & SCHEDULE
the ~400ksf project (soon to become ~500ksf after JCC, CFAC, and CCRS approval of program consolidation) will house a blend of both criminal and juvenile courtrooms (50 in total), in addition to the requisite office and support functions. The building will likely be somewhere in the neighborhood of 16 stories.
Schedule reflects a best case (soonest) project start, assuming JCC approves the augmented program. A more likely scenario may shift the start date back 3-4 weeks. Something else to be aware of: while the above schedule suggests a smooth and linear phase progression, 4-6 week pauses between phases are assumed for JCC review (i.e. Design Development duration of 8 months = 6.5 months + 1.5 month pause prior to the start of the CD phase).

ANTICIPATED DELIVERABLES
CONTRACT REQUIRED & NBBJ REQUIRED
From proposal and Final agreement in the contracts folder it doesn't look like the owner requires a Revit model in delivery. Only PDF and CAD.
CM at Risk chosen in DD; Courtroom Mock-up required. Room Data Sheets required in SD/DD
Tabulation of net and gross ares, as well as comparison between initial program and designed area.
Owner Review of all work at 50%, 90% & 100%; cost estimate at %50 and 100% completion.
1 rendered site plan, 1 exterior rendering and 1 miscellaneous rendering at DD phase.
Regular User meetings with renderings and diagrams

ANTICIPATED GOALS
CONTRACT REQUIRED & NBBJ REQUIRED
Sustainability Requirements by owner include Building Orientation, Passive energy techniques, "Energy Efficiency & Sustainability Techniques when possible and economically Feasible". Participate in CA Savings By Design Program. MEP consultant will provide energy model.

MODEL SETUP IDEAS

2 PRE-CONTRACT FOLLOWUP

PRE-CONTRACT FOLLOW UP MEETING SET FOR
DATE & TIME
2pm Friday 9/11/2015

PROJECT TEAM
INCLUDE KNOWN SKILLS

~~Jason Miller PM~~	~~Sarah Morse~~
~~Jim Tully PIC~~	~~Shunpin or Candy~~
~~Tom Henry~~	~~Taylor~~
Andrew Molchany	Zhilin
Claire Showalter	Louisa
Mark Parrish	Daniel or Paula
	Christina Cngolosi

- ☐ Training Plan Required
- ☑ Pune Will be Used (Work Plan Required)
- ☐ Cross Studio Collaboration (Collaboration PlanRequired)
- ☐ Significant/Special Visualization Requirements (Visualization Plan Required)

Structural	Thornton Tomasetti	Revit
Mech / Plumb / Elec / Fire	Integral Group	Revit
Civil	Psomas	
Landscape	Pamela Burton and Company	
Acoustical	Veneklasen Associates	
Security Hardware	Veneklasen Associates	
Cost Estimating	NBBJ	
Cost Estimating - MEP	Cumming Corp	
Elevator	Lerch Bates	
Lighting	NBBJ	Revit
Code / Life Safety / Smoke Control	Jensen Hughes	
Signage / EGD	NBBJ	
Low Volt - AV and Telecom, Security, DAS	Vantage	
CW / Exterior Envelope	Thornton Tomasetti	
Network Integrator	SFMI	
Building Maintenance	Olympique	
Court Planner	Farbstein	

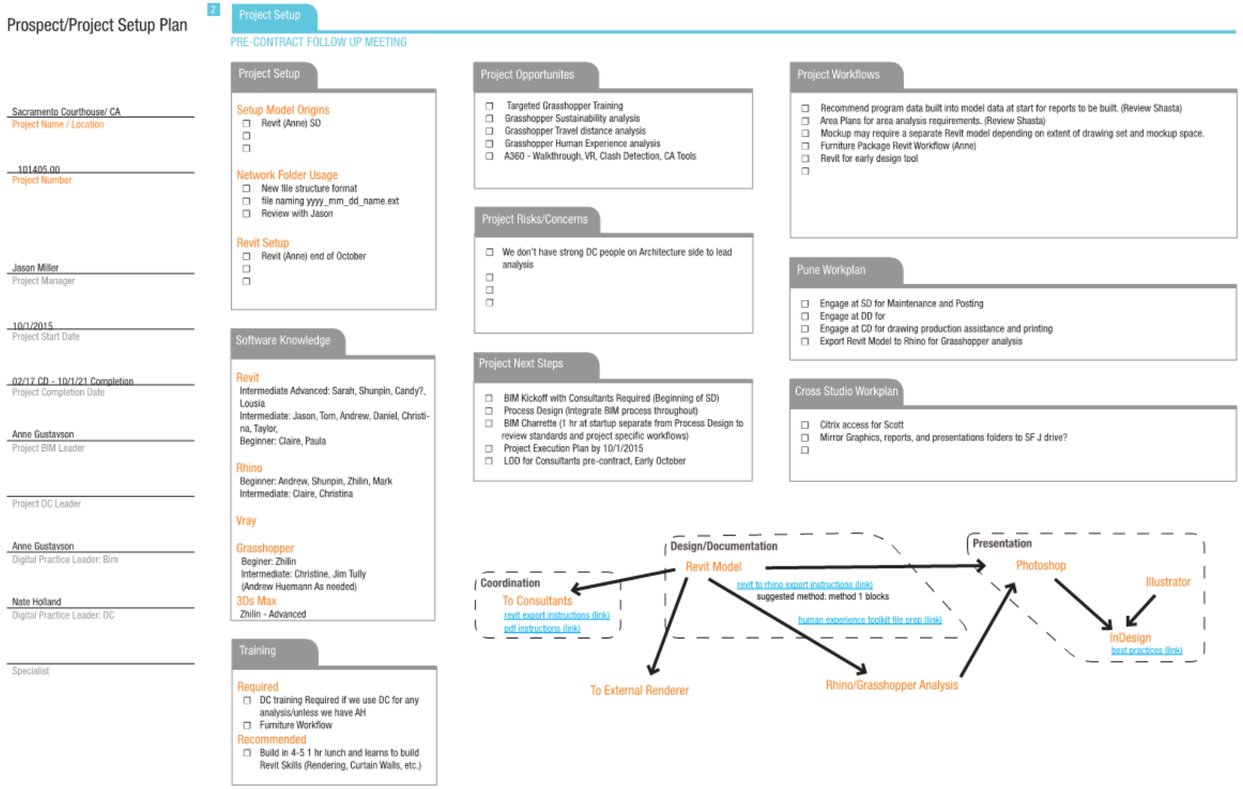
Notes

8-12 per week for BIM leadership, consistently throughout the project. Project Setup estimated 30 hours. (expectation-wise, I need 25% of my time to respond to Revit needs on other projects.)

-Pre-Contract LOD before contract signed w/consultants (2 hrs)
-BIM Startup Meeting will be required with Consultants at project startup. Review file sharing and coordination workflow. (4 hrs prep and 1-2 hour meeting)
-BIM Process should be integrated into Process Design (I Should attend the whole thing to build on plan, with 30-60 minute summary at the end)
-1 Hr. BIM Charrette at Project Startup to review standards and Project specific workflows.
-BIM L&L: 4-5 one hr sessions for team skill building.

-Your current list of team members does not contain anyone with strong DC skills. Recommend setting targeted goals and incorporate team training to support Andrew Huemann's efforts. Energy Modeling will be done by the MEP consultant, so anything we would need to do would be more lightweight.

FTE REQUIREMENTS
ek (more @ Setup)
'TE REQUIREMENTS
cussion
EAD FTE REQUIREMENTS
ll cover



Prospect/Project Setup Plan

Sacramento Courthouse/ CA
Project Name / Location

101405.00
Project Number

Jason Miller
Project Manager

10/1/2015
Project Start Date

02/17 CD - 10/1/21 Completion
Project Completion Date

Anne Gustavson
Project BIM Leader

Project DC Leader

Anne Gustavson
Digital Practice Leader: Bim

Nate Holland
Digital Practice Leader: DC

Specialist

2 Project Setup

PRE-CONTRACT FOLLOW UP MEETING

Project Setup
Setup Model Origins
☐ Revit (Anne) SD
Network Folder Usage
☐ New file structure format
☐ file naming yyyy_mm_dd_name.ext
☐ Review with Jason
Revit Setup
☐ Revit (Anne) end of October

Software Knowledge
Revit
Intermediate Advanced: Sarah, Shunpin, Candy?, Lousia
Intermediate: Jason, Tom, Andrew, Daniel, Christi-na, Taylor,
Beginner: Claire, Paula
Rhino
Beginner: Andrew, Shunpin, Zhilin, Mark
Intermediate: Claire, Christina
Vray
Grasshopper
Beginer: Zhilin
Intermediate: Christine, Jim Tully (Andrew Huemann As needed)
3Ds Max
Zhilin - Advanced

Training
Required
☐ DC training Required if we use DC for any analysis/unless we have AH
☐ Furniture Workflow
Recommended
☐ Build in 4-5 1 hr lunch and learns to build Revit Skills (Rendering, Curtain Walls, etc.)

Project Opportunites
☐ Targeted Grasshopper Training
☐ Grasshopper Sustainability analysis
☐ Grasshopper Travel distance analysis
☐ Grasshopper Human Experience analysis
☐ A360 - Walkthrough, VR, Clash Detection, CA Tools

Project Risks/Concerns
☐ We don't have strong DC people on Architecture side to lead analysis

Project Next Steps
☐ BIM Kickoff with Consultants Required (Beginning of SD)
☐ Process Design (Integrate BIM process throughout)
☐ BIM Charrette (1 hr at startup separate from Process Design to review standards and project specific workflows)
☐ Project Execution Plan by 10/1/2015
☐ LOD for Consultants pre-contract, Early October

Project Workflows
☐ Recommend program data built into model data at start for reports to be built. (Review Shasta)
☐ Area Plans for area analysis requirements. (Review Shasta)
☐ Mockup may require a separate Revit model depending on extent of drawing set and mockup space.
☐ Furniture Package Revit Workflow (Anne)
☐ Revit for early design tool

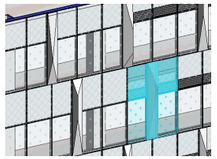
Pune Workplan
☐ Engage at SD for Maintenance and Posting
☐ Engage at DD for
☐ Engage at CD for drawing production assistance and printing
☐ Export Revit Model to Rhino for Grasshopper analysis

Cross Studio Workplan
☐ Citrix access for Scott
☐ Mirror Graphics, reports, and presentations folders to SF J drive?

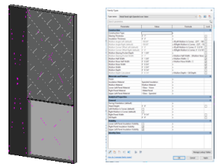
Recap

Nate Holland

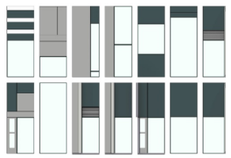
Cross Platform Curtain wall



Model Parity

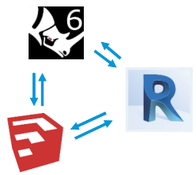


Revit Templates



Rhino Templates

Why Interop – What do you want



Document workflows

Thoughts Questions?

e: nholland@nbbj.com

t: @_NateHolland

in: Nate Holland