

# Scheduling & Estimating Integration

## —5D BIM Case Study

**CLAYCO**

**Tomislav Zigo, AIA, CM-BIM, LEED AP+C, Vice President of VDC**  
**Liang Gong, PE, PMP, LEED AP+C, VDC Engineer**



# About the speaker



Tomislav Zigo

Vice President, VDC

Clayco inc.

St. Louis, Missouri, United States

Over the past two decades Tomislav has been an advocate of digital technology implementation as a researcher, designer and over past six years as a designer - builder. His experience includes work in the vanguard of BIM methodology implementation on large healthcare, institutional and industrial projects; research work in the field of Building Performance Analysis; optimization and use of mobile and immersive technology and mentorship positions in a number of local and national architectural firms during their transition toward BIM adoption. Currently he leads Clayco's VDC department and teaches at Washington University in St. Louis.



# About the speaker



Liang Gong

VDC Estimator/Engineer

Clayco

Chicago, Illinois, United States

Liang works as a VDC Estimator/Engineer at Clayco. Liang works directly with the company's preconstruction/estimating department and VDC to develop accurate detailed project takeoffs and utilizes various programs to assist with other aspects of our business as needed including project management, BIM development and coordination, 3 dimensional detail production and coordination with development of 3D models. Liang reviews and verifies accuracy and completeness of all project documents received and also analyzes and reviews bids, constructability review, and value engineering analysis for all projects received. Liang got his Master of Engineering Management degree from Duke University and Bachelor in Civil Engineering degree from Tianjin University, China.

# Contents

- Clayco and its current estimating platforms
- Logistics Tracking: Equipment Sets working with Dynamo
- VICO 5D demo for a healthcare project: **Top down** method
- VICO 5D demo for a residential project: **Bottom up** method
- Design versions comparison modes
- One click takeoffs for a structural model
- From Rhino to VICO
- Customized reporting template
- Estimating Platform Integration



VICO

Cash Flow

Rhino

BIM 360 Glue

BIM 360 Field

Barcode

VSP

Uniformat

Dynamo

Estimators

Python

Revit

Procurement

Architects

Risks

Naviswork

P6

Schedulers

Resources

Monte Carlo Simulation

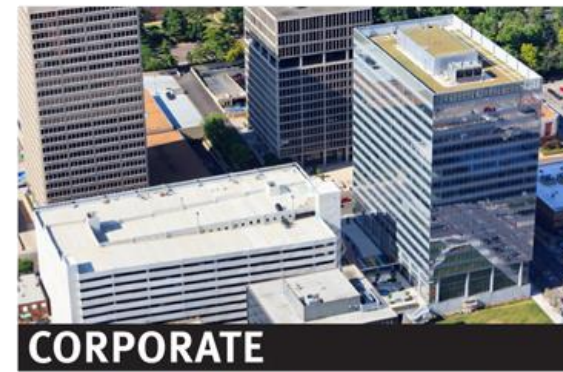
SQL



# Clayco

- Headquartered in Chicago
- Founded in 1984 as a Design-Build Contractor
- Revenue of over \$1.5B for 2016, \$1.8B in 2017
- ENR top 400 Contractors 2017 Rating #22
- Approximately 1800 employees
- National Diversification of Project Types
- Over 70 LEED Accredited Professionals / 45 LEED Certified Projects

## COMMERCIAL



## INDUSTRIAL



## INSTITUTIONAL





# Clayco - Structure



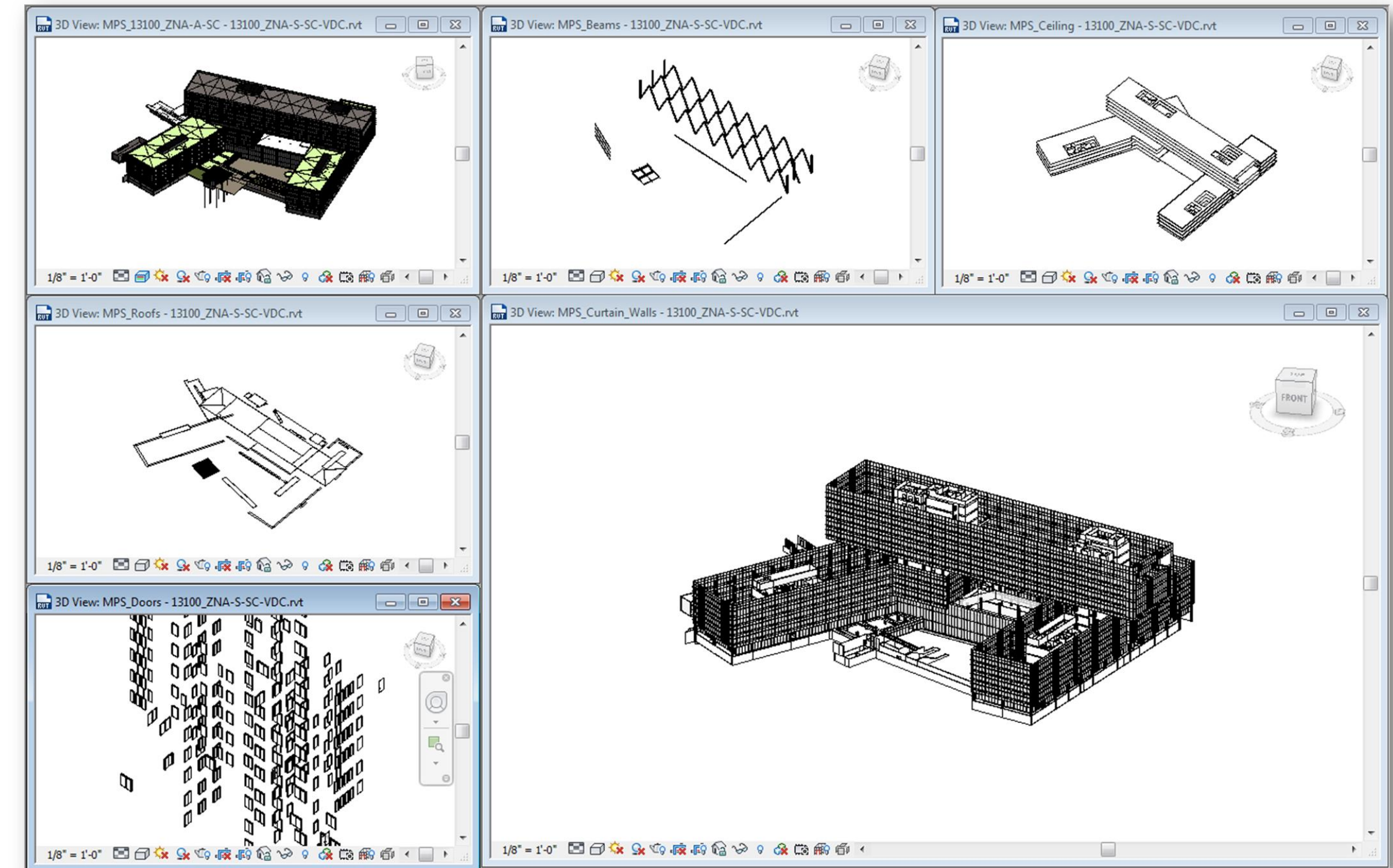


# Clayco Approach

- Determine clear **objectives**
- Recognize main **participants**
  - Architects / Engineers
  - Pre-Con
  - VDC
- Adopt **standards** (Uniformat, OmniClass, LOD requirements)
- Identify **collaboration** nodes (Clayco entities)
- Have the sense of **urgency**
- Establish **transparency**
- Sharing results / work product

# Feedback Loop

- Design team is working with building assemblies
- Associating family / type with the corresponding **assembly code**
- Maintaining consistency from project to project..
- Determining which Revit property needs to form the unique identifier
- Develop estimate centric design template
- Accompanied with the content plan development
- Heavy reliance on worksets and filters

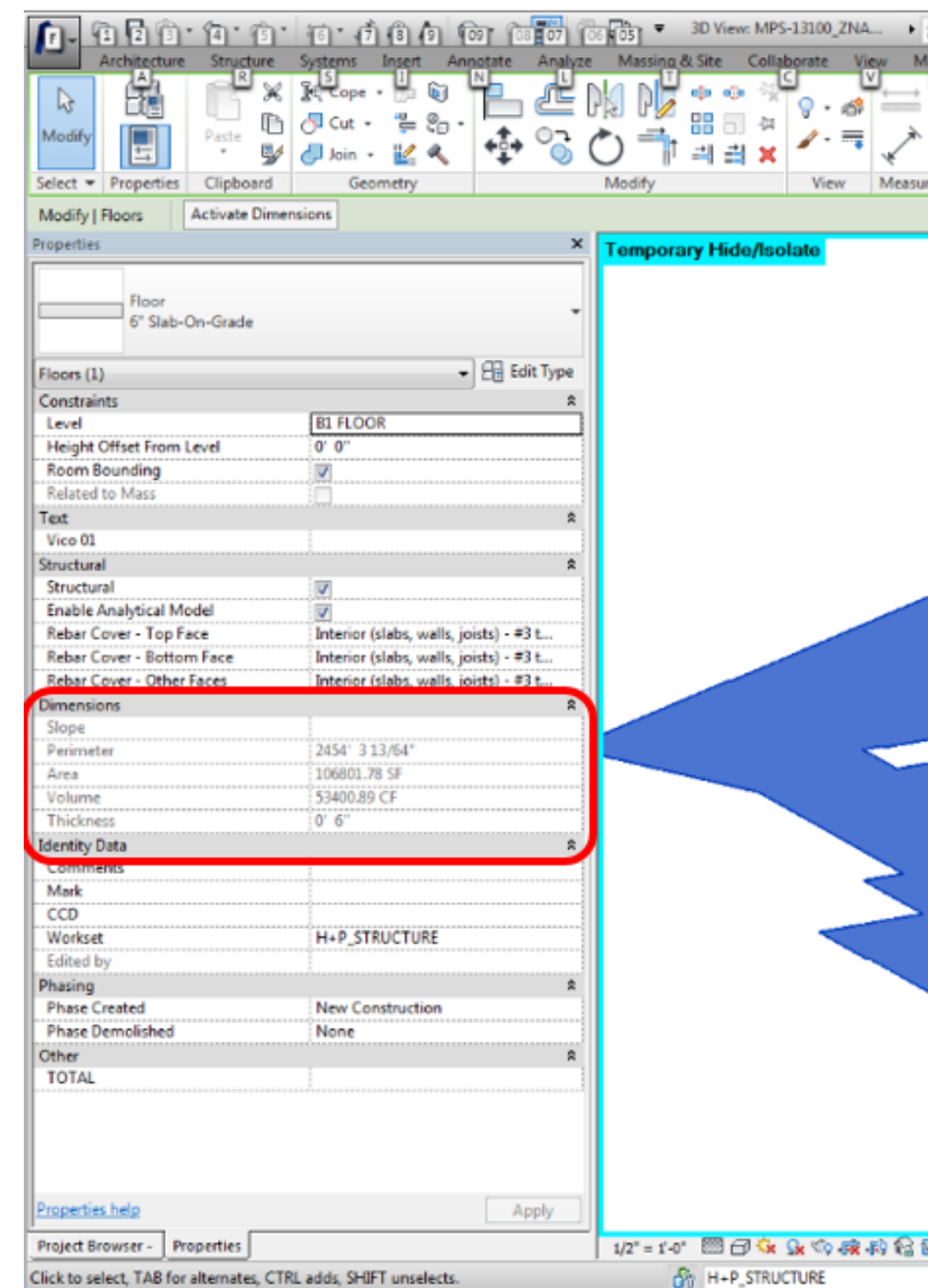


Name	Visibility	Projection/Surface			Cut		Halftone
		Lines	Patterns	Transparen...	Lines	Patterns	
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A1020.15-BORED_PILES	<input checked="" type="checkbox"/>						<input type="checkbox"/>
A1020.80.10-GRADE_BEAMS	<input checked="" type="checkbox"/>						<input type="checkbox"/>
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B1010.20.60-DECKING	<input checked="" type="checkbox"/>						<input type="checkbox"/>
A1010.10.21-FOUNDATION	<input checked="" type="checkbox"/>						<input type="checkbox"/>
A4020.10-SOG	<input checked="" type="checkbox"/>						<input type="checkbox"/>
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B1010.10.11	<input checked="" type="checkbox"/>						<input type="checkbox"/>
B1010.10.14-COLUMNS	<input checked="" type="checkbox"/>						<input type="checkbox"/>
B1010.10.31-DIAGONAL_B...	<input checked="" type="checkbox"/>						<input type="checkbox"/>



# Building Trust

- Architect and Engineers can build great models!
- Estimating is an art – form
- Every project is different
- Our templates are not IP (share)
- Trust but verify – twice at least
- Communicate
- Abandon “gotcha” approach
- Be transparent
- No software is perfect

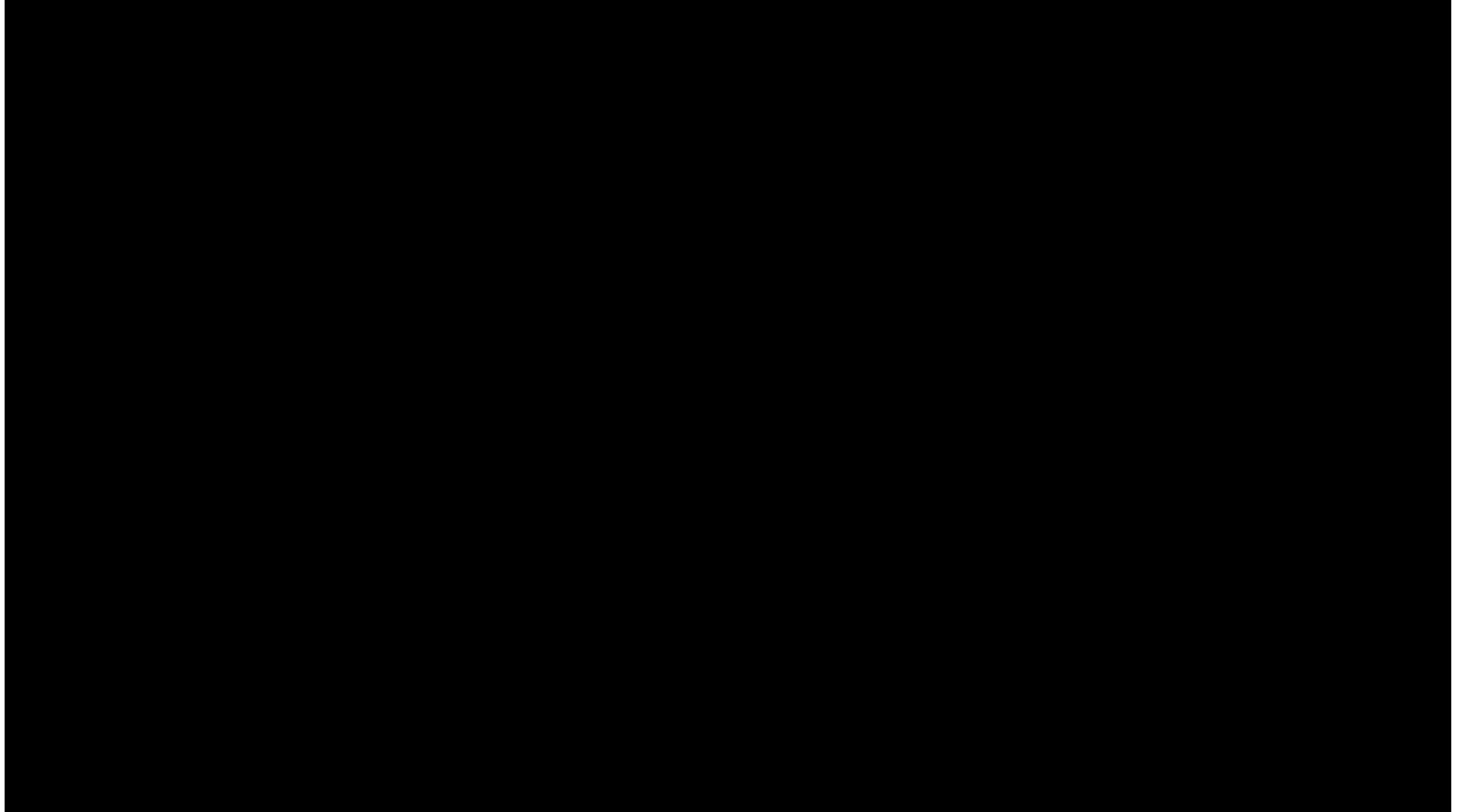


The screenshot shows the 'Takeoff Manager' window with a list of items and their quantities. A red box highlights a section of the table.

Info	Code	Name	Type	Count
		Net Volume	CU YD	319.9952
		Gross Volume	CU YD	320.2915
		Joint Horizontal Surface Area	SQ FT	0.0000
		Joint Vertical Surface Area	SQ FT	0.0000
		Piece Count	EA	4.0000
		Edge Length	FT-IN	879'
		Joint Length	FT-IN	0'
		Hole Edge Length	FT-IN	16'
		Hole Joint Length	FT-IN	0'
		A4020.10-12" Foundation Slab		8
		A4020.10-6" Slab On Grade		5
		Count	EA	5.0000
		Edge Perimeter	FT-IN	4258'-4 5/16"
		Hole Count	EA	6.0000
		Hole Perimeter	FT-IN	353'-4 1/8"
		Net Bottom Surface Area	SQ FT	127,973.4312
		Net Top Surface Area	SQ FT	127,973.4312
		Edge Surface Area	SQ FT	2,129.1788
		Hole Surface Area	SQ FT	1,420.8639
		Net Volume	CU YD	2,369.8789
		Gross Volume	CU YD	2,396.1912
		Joint Horizontal Surface Area	SQ FT	0.0000
		Joint Vertical Surface Area	SQ FT	0.0000
		Piece Count	EA	5.0000
		Edge Length	FT-IN	4258'-4 5/16"
		Joint Length	FT-IN	0'
		Hole Edge Length	FT-IN	353'-4 1/8"
		Hole Joint Length	FT-IN	0'
		B1010.10.14-W12X106		106
		B1010.10.14-W14X132		11
		B1010.10.14-W14X145		7
		B1010.10.14-W14X193		4
		B1010.10.14-W14X211		20
		B1010.10.14-W14X233		2
		B1010.10.14-W14X257		13
		B1010.10.14-W14X311		1
		B1010.10.14-W14X370		2
		B1010.10.14-W14X398		1
		B1010.10.14-W14X500		1



# *Herding Cats*



<https://www.youtube.com/watch?v=hx1jdgTs03U> “Best Cat Commercials EDS Cat Herders” from YouTube

Laws

Rules

Systems

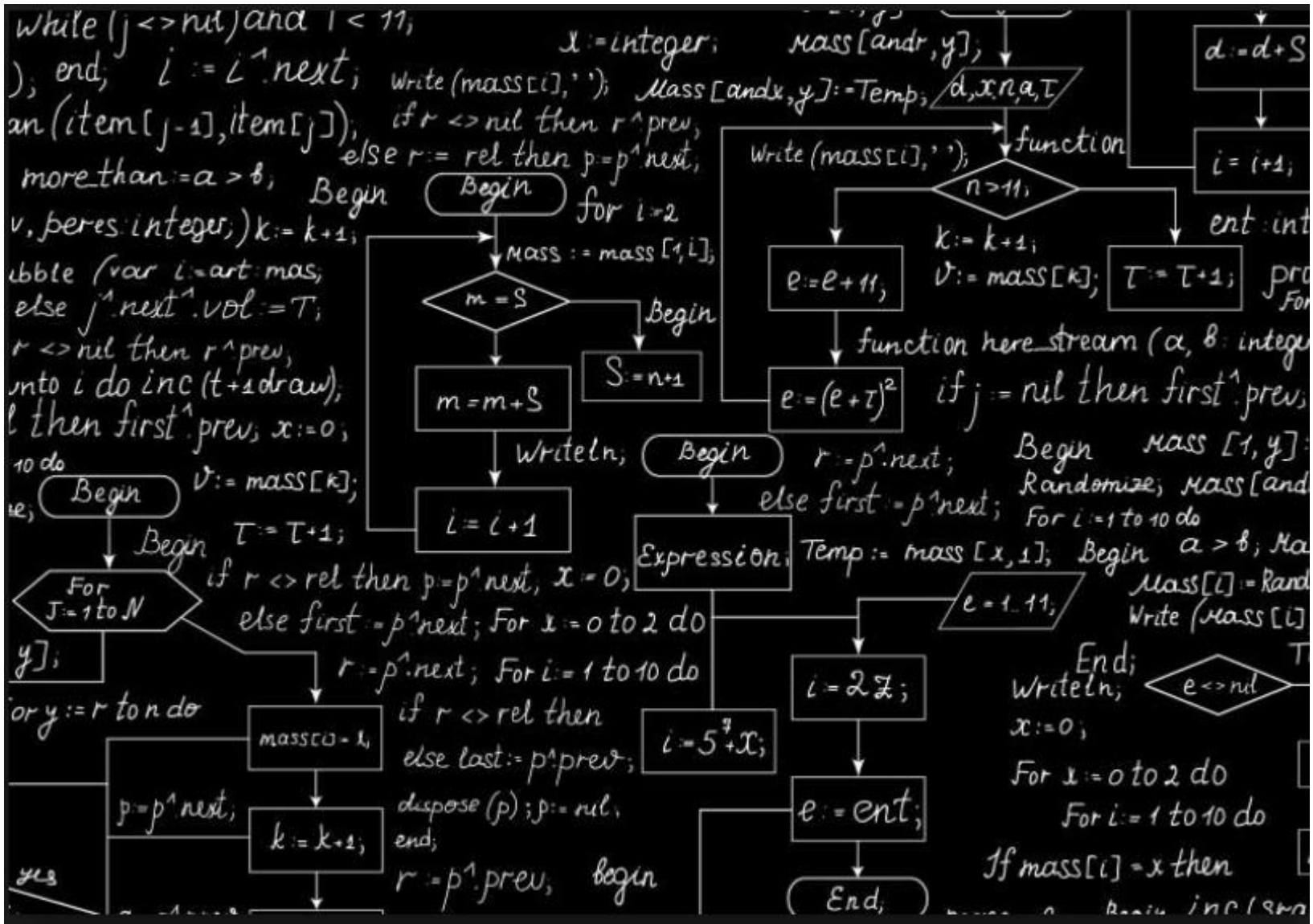


<https://www.foodallergy.org/life-with-food-allergies/newly-diagnosed/laws-and-regulations>

Automation

Logics

Algorithms



<https://priestlandscomputing.com/algorithms-2/>



To *think* as a **VDC** engineer





## Integrate Logistics\_Equipment Sets: Asset management



## Integrate Logistics\_Equipment Sets: Rooms into 5D Process

***Question 1: How to search Rooms in Revit?***

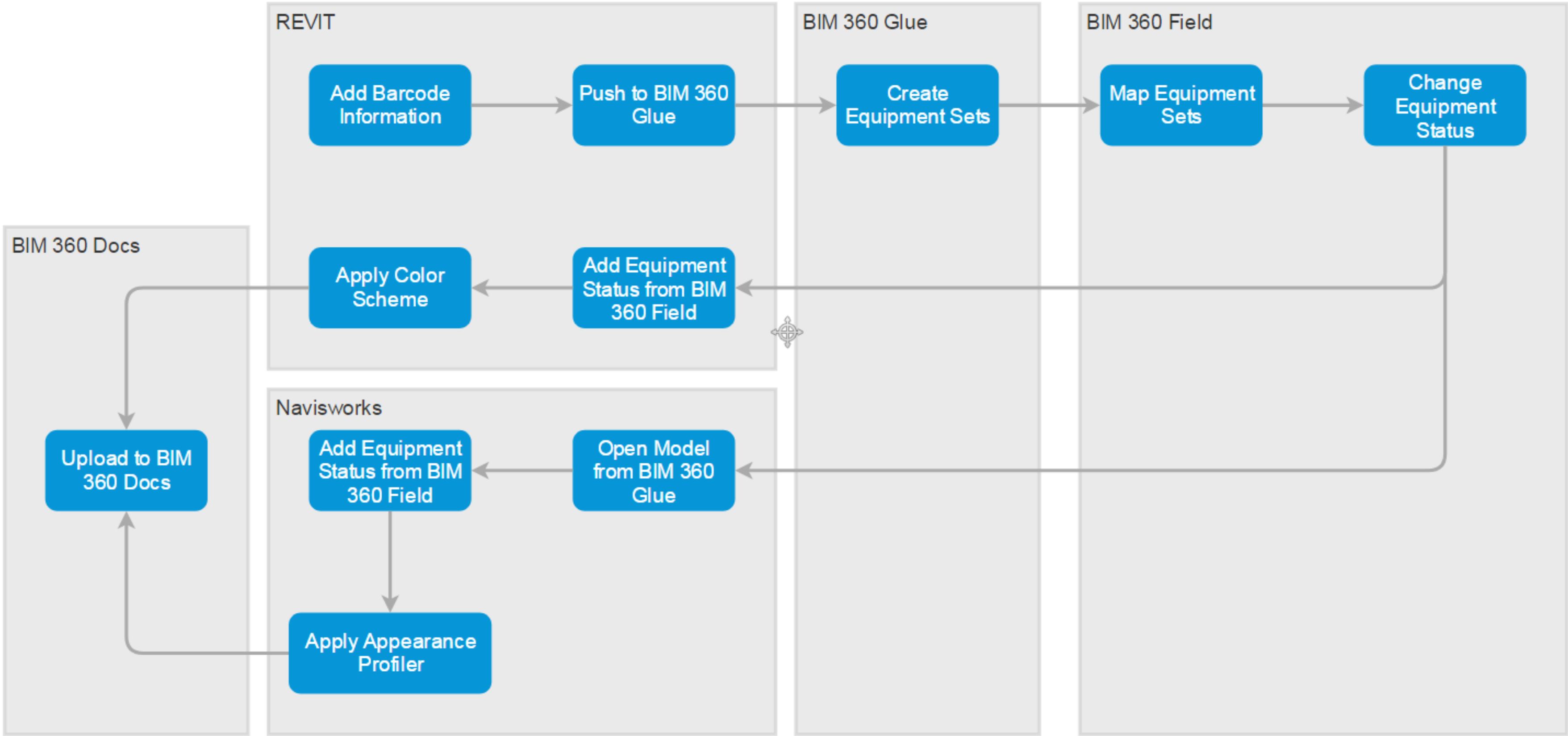
***Question 2: How to stand in center of a room when using “Show in Model”? (Out of a surprise)***





# Integrate Logistics\_Equipment Sets: Rooms into 5D Process

*Question 1: How to integrate Barcodes into Revit?*

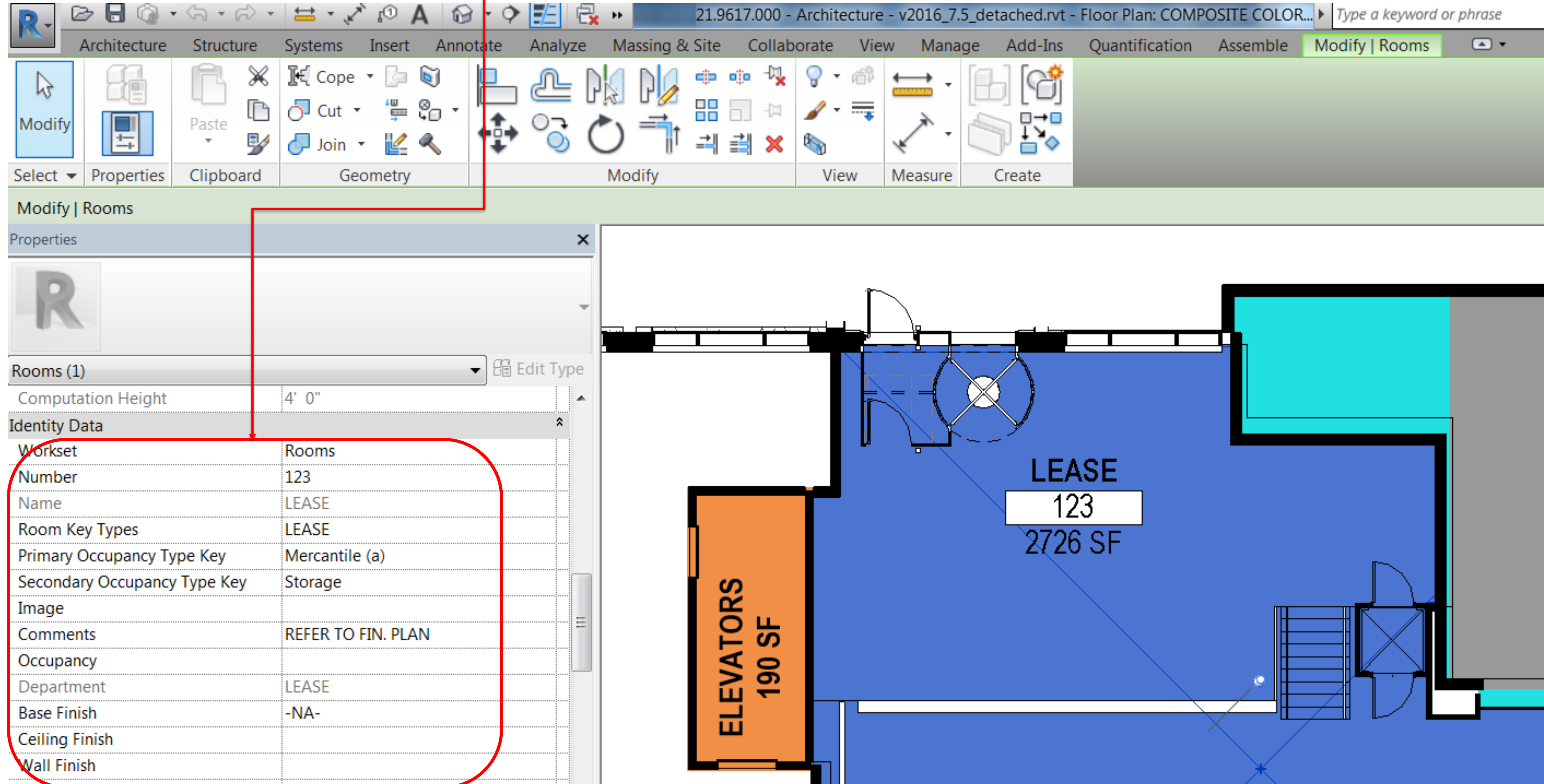




## Integrate Logistics\_Equipment Sets: Rooms into 5D Process

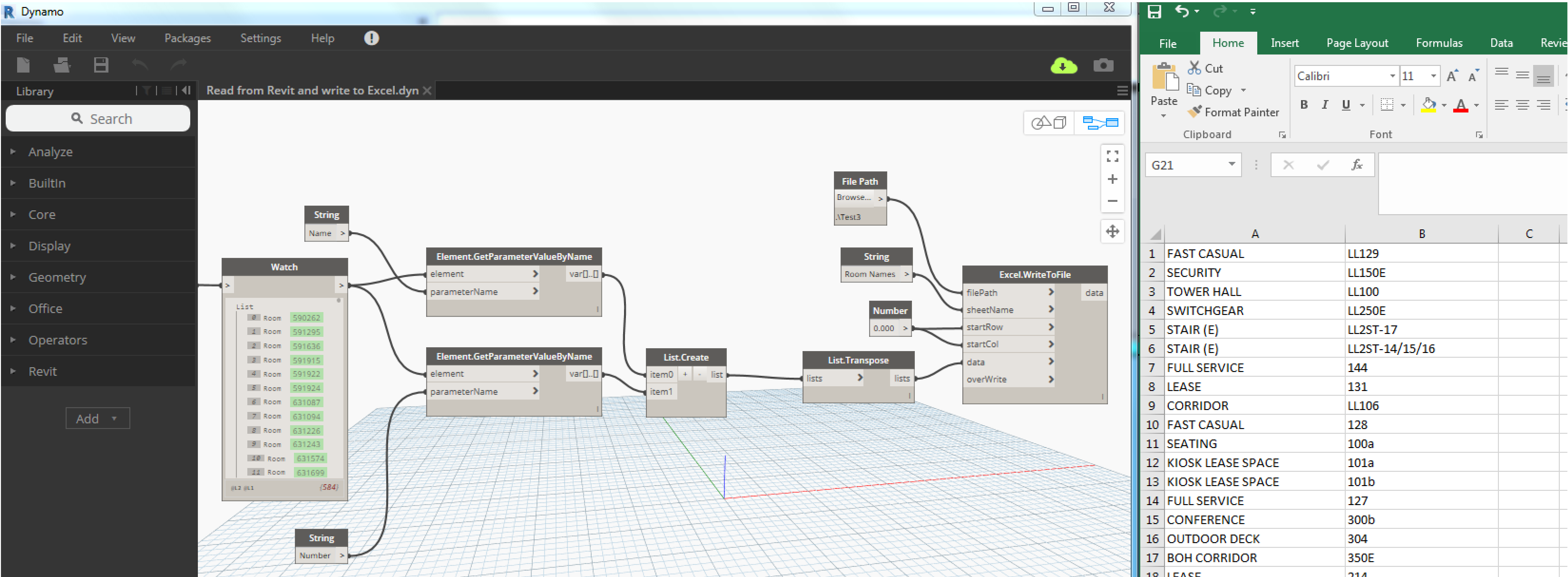
## Question 1: How to integrate Barcodes into Revit?

## No Barcode information



# Integrate Logistics\_Equipment Sets: Rooms into 5D Process

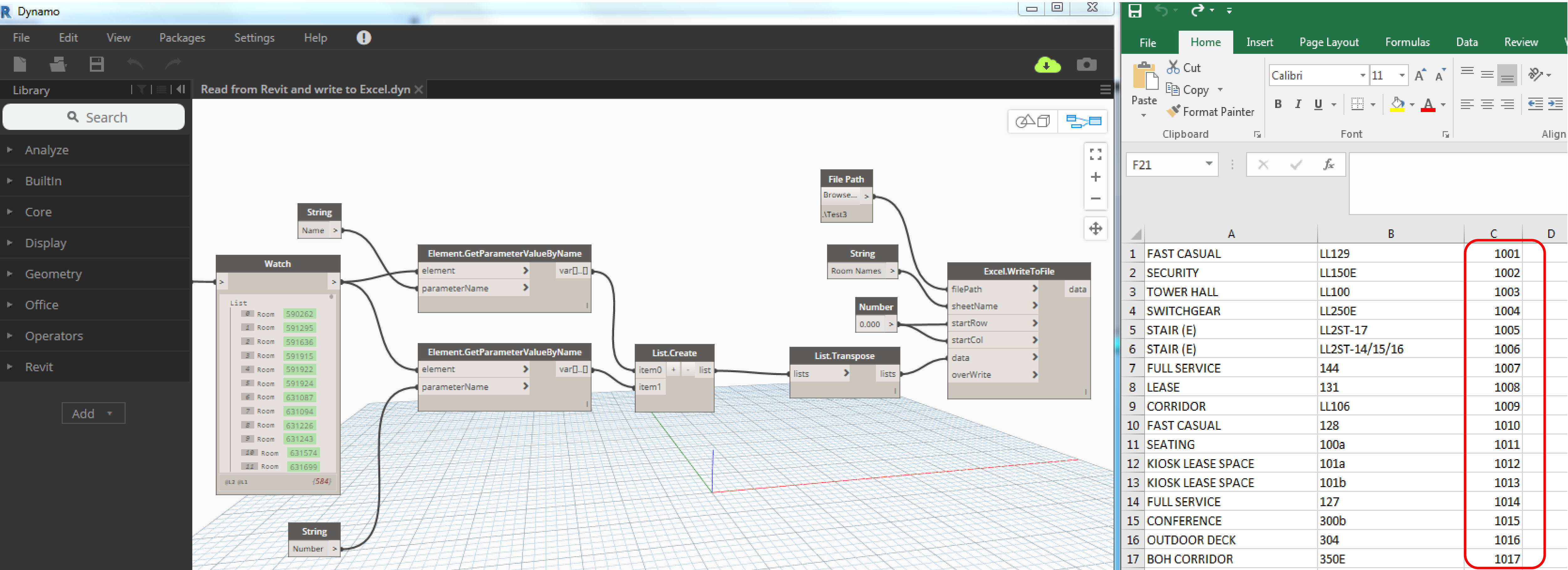
## Read from Revit and write to Excel – To grasp all the room information



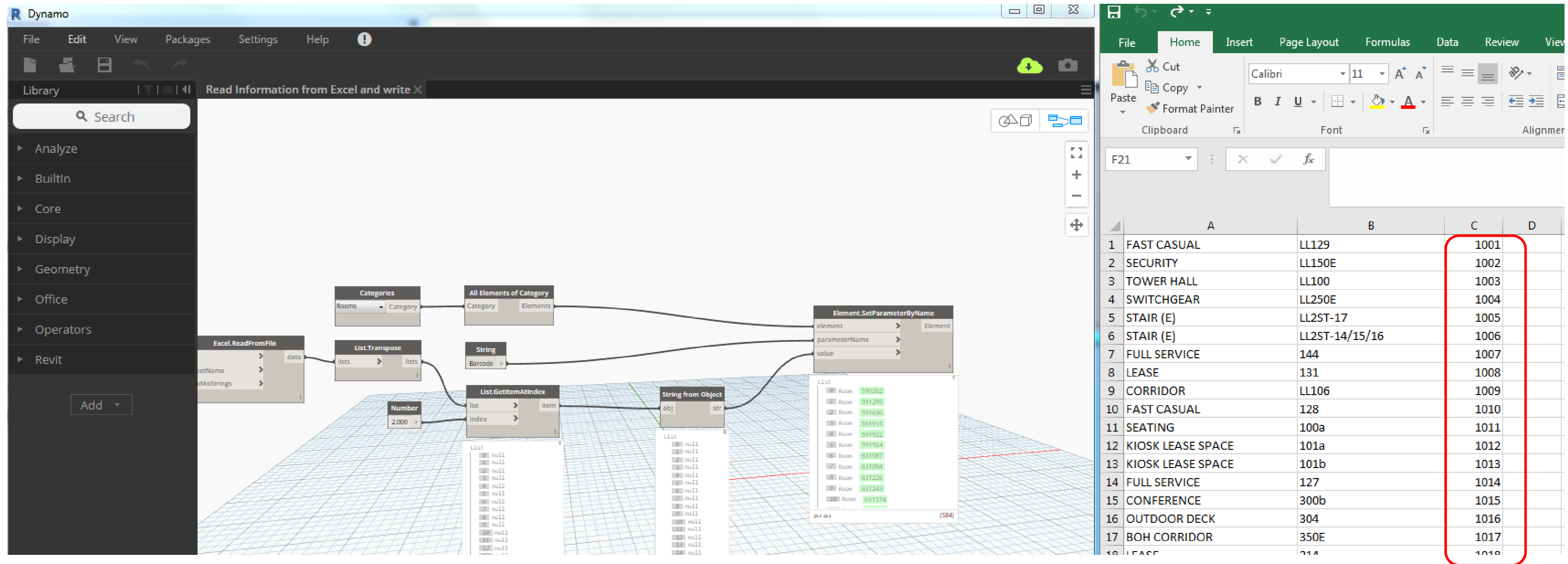


# Integrate Logistics\_Equipment Sets: Rooms into 5D Process

## Read from Revit and write to Excel – To grasp all the room information



## Read from Excel and write to Revit – Write Barcodes back to Revit





# Integrate Logistics\_Equipment Sets: Rooms into 5D Process

Barcode Added

Autodesk Revit 2017 - 21.9617.000 - Architecture - v2016\_detached\_detached.rvt - Floor Plan: COMPOSITE COLOR PLAN - LEVEL 01

Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Quantification Assemble Modify | Rooms

Modify Properties Clipboard Geometry Modify View Measure Create

Modify | Rooms

Properties

Rooms (1) Edit Type

Image	
Comments	REFER TO FIN. PLAN
Occupancy	
Department	LEASE
Base Finish	-NA-
Ceiling Finish	
Wall Finish	
Floor Finish	
Barcode	1094.000000
Edited by	
Design Option	Main Model

Phasing

Phase	Phase 1 - Base Building - New Constr...
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Analysis Results

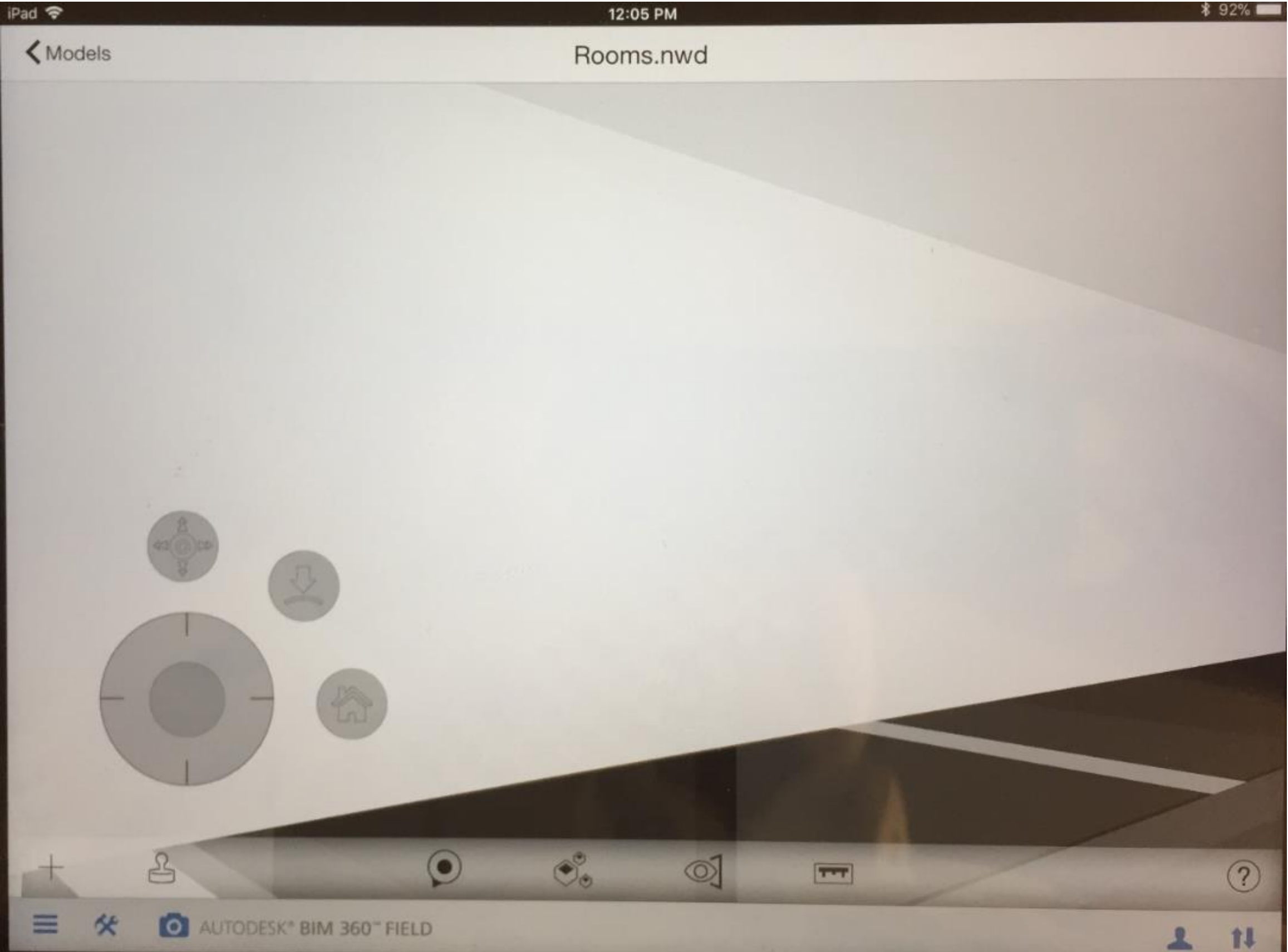
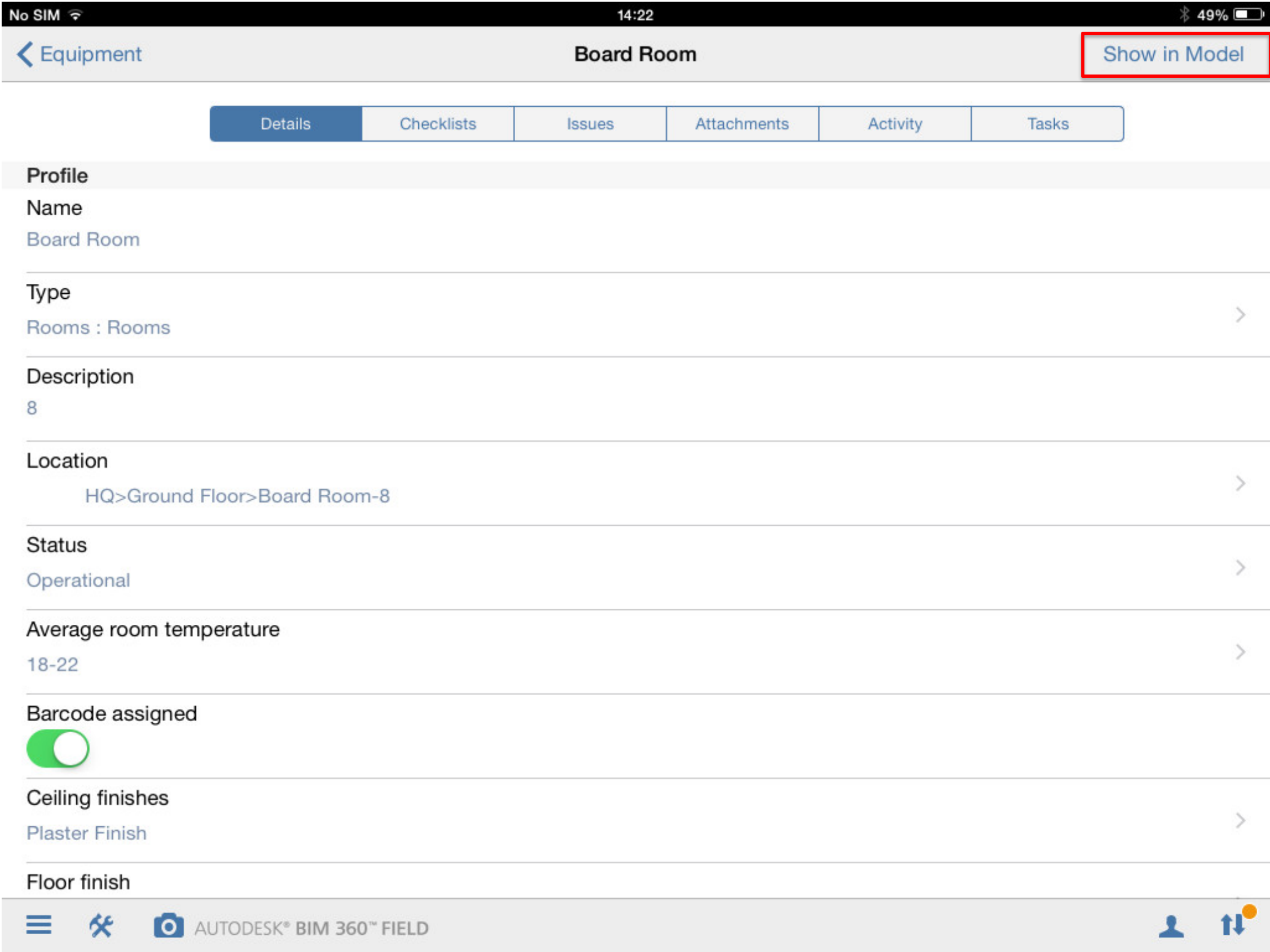
KE	
GE	

[Properties help](#) Apply

Project Browser - 21.9617.000 - Architecture - v2016\_detached\_detached.rvt

- #LEASE PLAN - LEVEL 03
- #LEASE PLAN - LEVEL 04
- #LEASE PLAN - LOWER LEVEL 01
- #LEASE PLAN - LOWER LEVEL 02

**Question 2: How to stand in center of a room when using “Show in Model”?**

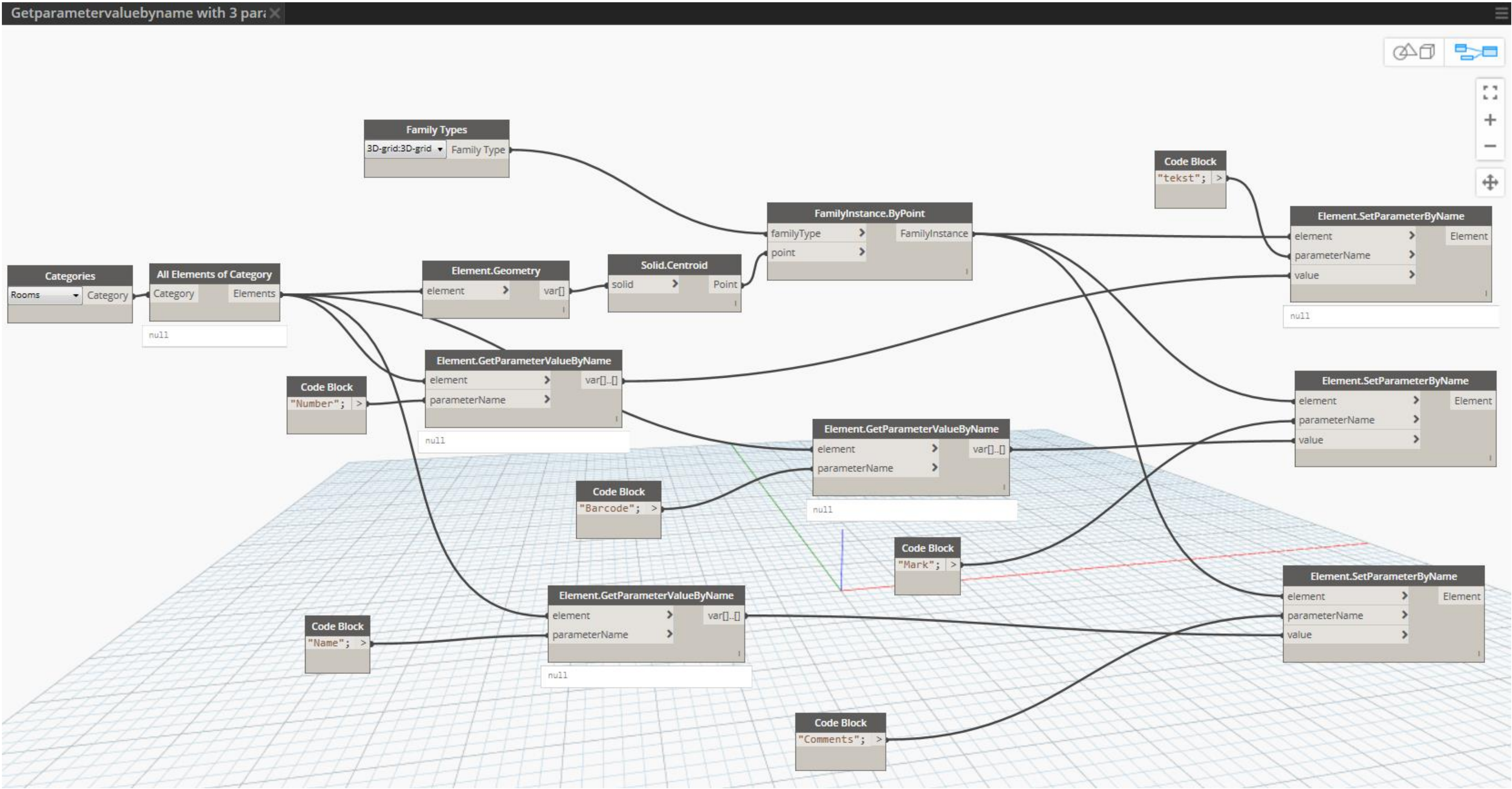
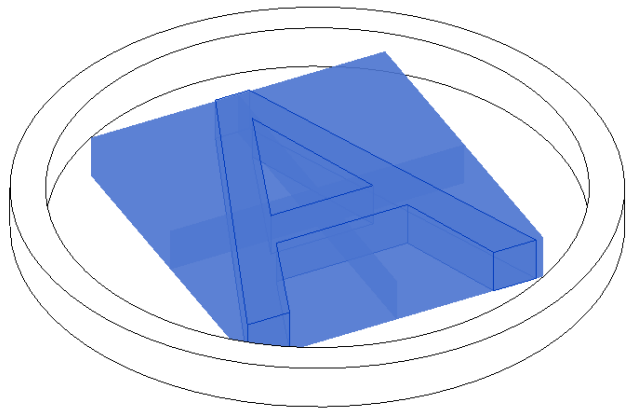


**Where is the room?**  
The room is hidden by a wall or floor



Room name, room number and barcode are transferred to the associated 3D tag and then to 360 Field by expanding scripts.

← Solution →





# Have a deeper look at the logics behind

C:\Users\gongl\Desktop\Getparametervaluebyname with 3 parameters.dyn - Sublime Text (UNREGISTERED)

File Edit Selection Find View Goto Tools Project Preferences Help

helloworld\_start.py mbox-short.txt label1ZA1949V0396337823[1].gif MyFirstPlugin.addin Getparametervaluebyname with 3 parameters.dyn

1 <Workspace Version="1.3.2.2480" X="-603.551735715752" Y="153.903343775309" zoom="0.770919432123772" ScaleFactor="1" Name="Home" Description="" RunType="Manual" RunPeriod="1000" HasRunWithoutCrash="True">

2 <NamespaceResolutionMap />

3 <Elements>

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5 <DSRevitNodesUI.ElementsOfCategory guid="cb01dd6d-5871-4892-8dd8-3666b6f16b0f" type="DSRevitNodesUI.ElementsOfCategory" nickname="All Elements of Category" x="120.224346457764" y="150.065885077676" isVisible="true" isUpstreamVisible="true" lacing="Disabled" isSelectedInput="False" IsFrozen="false" isPinned="true">

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7 </DSRevitNodesUI.ElementsOfCategory>

8 <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="4098d6cd-ae02-4bc6-aa86-b4ee328cdf30" type="Dynamo.Graph.Nodes.ZeroTouch.DSFunction" nickname="Element.GetParameterValueByName" x="763.832609740575" y="235.535154327453" isVisible="true" isUpstreamVisible="true" lacing="Shortest" isSelectedInput="False" IsFrozen="false" isPinned="true" assembly="RevitNodes.dll" function="Revit.Elements.Element.GetParameterValueByName@string">

9 <PortInfo index="0" default="False" />

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13 <DSRevitNodesUI.FamilyTypes guid="8cfe252f-e2e7-40c5-aaf0-f82992f1f966" type="DSRevitNodesUI.FamilyTypes" nickname="Family Types" x="682.377603820748" y="-72.3810238249708" isVisible="true" isUpstreamVisible="true" lacing="Disabled" isSelectedInput="True" IsFrozen="false" isPinned="false" index="450:3D-grid:3D-grid" />

14 <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="a42a0453-2781-4869-a6d2-69b4f58e5e97" type="Dynamo.Graph.Nodes.ZeroTouch.DSFunction" nickname="Element.Geometry" x="759.690073413124" y="115.755428731724" isVisible="true" isUpstreamVisible="true" lacing="Shortest" isSelectedInput="False" IsFrozen="false" isPinned="false" assembly="RevitNodes.dll" function="Revit.Elements.Element.Geometry">

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21 <PortInfo index="0" default="False" />

22 <PortInfo index="1" default="False" />

23 </Dynamo.Graph.Nodes.ZeroTouch.DSFunction>

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30 <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="b1100b68-deac-44db-bdd7-b9e42be699c3" type="Dynamo.Graph.Nodes.ZeroTouch.DSFunction" nickname="Element.GetParameterValueByName"

Line 2, Column 29

Tab Size: 4 Plain Text



## Integrate Logistics\_Equipment Sets: Rooms into 5D Process

B

AUTODESK® BIM 360™ FIELD

161374\_Willis Tower Repositioning > Equipment

Search

Reset

Close

Add

Edit

Delete

Print

More Actions

Filter

All Equipment

Name

Type

Description

Location

Level 1 (L1) x

Include sub-locations?

Status

all

Custom Properties

Manufacturer

Name	Barcode	Type	Description	Location	Status	# Issues	# Open Issues	# Checklists	# Op Chg	Ma	Model Number	Date Created	Cr	Room Number
<input type="checkbox"/> ELEV MACHINE/CTRL LL320	1447.000000	Room			Completed	0	0	0	0			09 Apr 2018 5:32 PM		LL320
<input type="checkbox"/> PLANTED TERRACE 119G	1530.000000	Room			Delivered	0	0	0	0			09 Apr 2018 6:00 PM		119G
<input type="checkbox"/> VESTIBULE 132	1205.000000	Room			Delivered	0	0	0	0			09 Apr 2018 9:09 PM		132
<input type="checkbox"/> BOH LL350E	1116.000000	Room			Completed	0	0	0	0			09 Apr 2018 2:52 PM		LL350E
<input type="checkbox"/> TOWER HALL LL201	1184.000000	Room			Installing MEP	0	0	0	0			09 Apr 2018 7:12 PM		LL201
<input type="checkbox"/> WOMEN LL150E	1236.000000	Room			Installing Drywall	0	0	0	0			09 Apr 2018 3:34 PM		LL150E
<input type="checkbox"/> IT 211	1251.000000	Room			Ordered	0	0	0	0			09 Apr 2018 10:31 PM		211
<input type="checkbox"/> IT 126	1104.000000	Room			Delivered	0	0	0	0			09 Apr 2018 8:37 PM		126
<input type="checkbox"/> ELEV PIT LL350E	1157.000000	Room			Completed	0	0	0	0			09 Apr 2018 3:02 PM		LL350E
<input type="checkbox"/> STAIR (E) LL2ST-13	1369.000000	Room			Installing MEP	0	0	0	0			09 Apr 2018 5:01 PM		LL2ST-13
<input type="checkbox"/> BOH CORRIDOR 150E	1324.000000	Room			Delivered	0	0	0	0			09 Apr 2018 4:44 PM		150E
<input type="checkbox"/> IRR ROOM 148	1443.000000	Room			Delivered	0	0	0	0			09 Apr 2018 5:29 PM		148
<input type="checkbox"/> VESTIBULE LL136	1408.000000	Room			Installing Drywall	0	0	0	0			09 Apr 2018 8:03 PM		LL136
<input type="checkbox"/> FULL SERVICE 227	1024.000000	Room			Ordered	0	0	0	0			09 Apr 2018 10:11 PM		227
<input type="checkbox"/> FAST CASUAL	1488.000000	Room			Delivered	0	0	0	0			09 Apr 2018 5:50 PM		
<input type="checkbox"/> JACKSON ENTRY 105	1454.000000	Room			Delivered	0	0	0	0			09 Apr 2018 9:27 PM		105
<input type="checkbox"/> ELEC 115	1179.000000	Room			Delivered	0	0	0	0			09 Apr 2018 9:00 PM		115
<input type="checkbox"/> ELEC LL350E	1308.000000	Room			Completed	0	0	0	0			09 Apr 2018 4:32 PM		LL350E
<input type="checkbox"/> PLANTED TERRACE 119K	1534.000000	Room			Delivered	0	0	0	0			09 Apr 2018 6:05 PM		119K
<input type="checkbox"/> S12-S14 S12-S14	1032.000000	Room			Completed	0	0	0	0			09 Apr 2018 2:49 PM		S12-S14
<input type="checkbox"/> MECH LL205	1210.000000	Room			Installing MEP	0	0	0	0			09 Apr 2018 7:13 PM		LL205

**Question 2: How to stand in center of a room when using “Show in Model”?**

Equipment

3D-grid

Show in Model

Details

Checklists

Issues

Attachments

Activity

Tasks

Profile

101a

Location

Status

Installing Metal Studs

Manufacturer

Model Number

OmniClass

Room Name

KIOSK LEASE SPACE

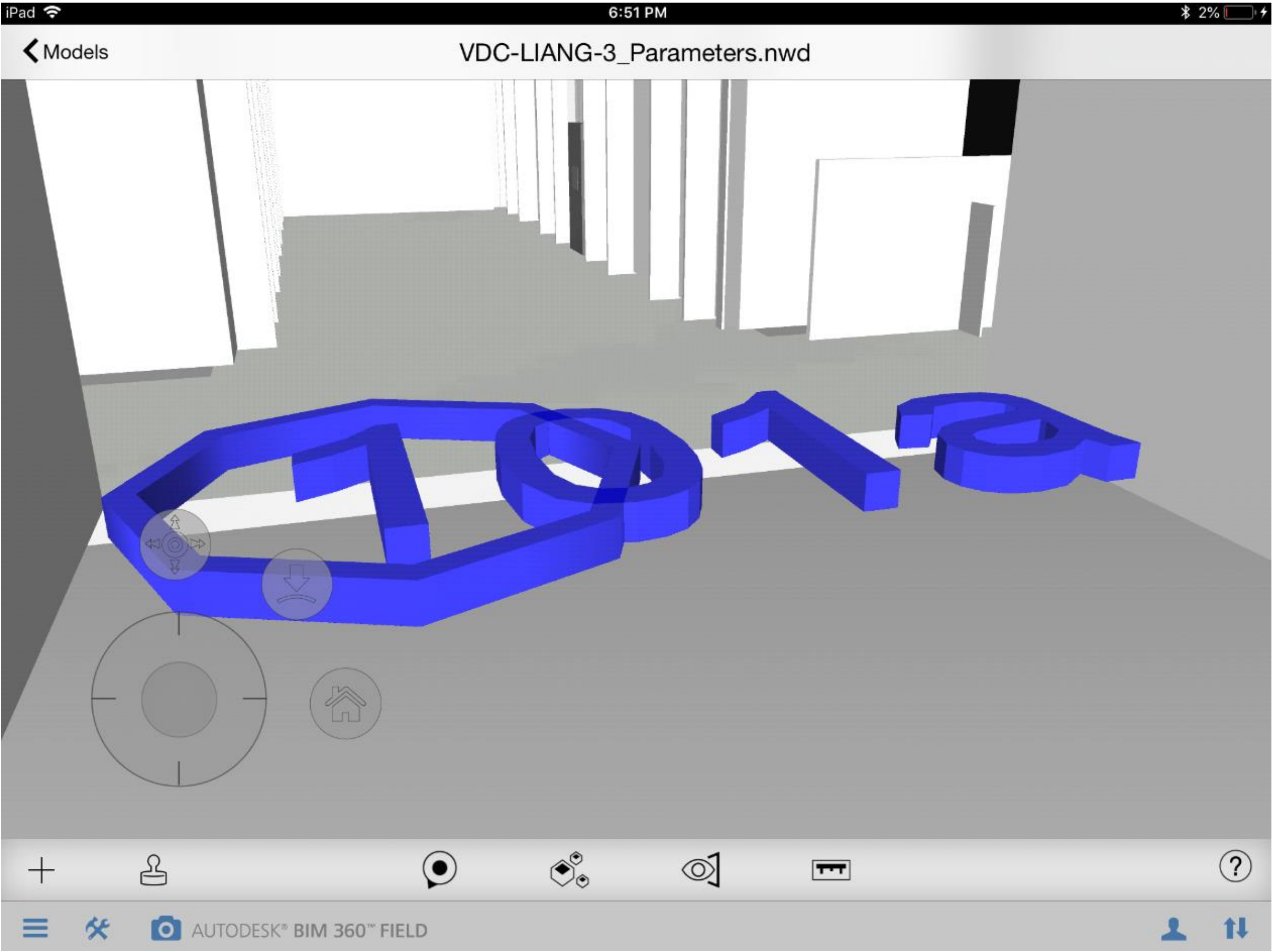
Room Number

Identifiers

Barcode

1012.0000000

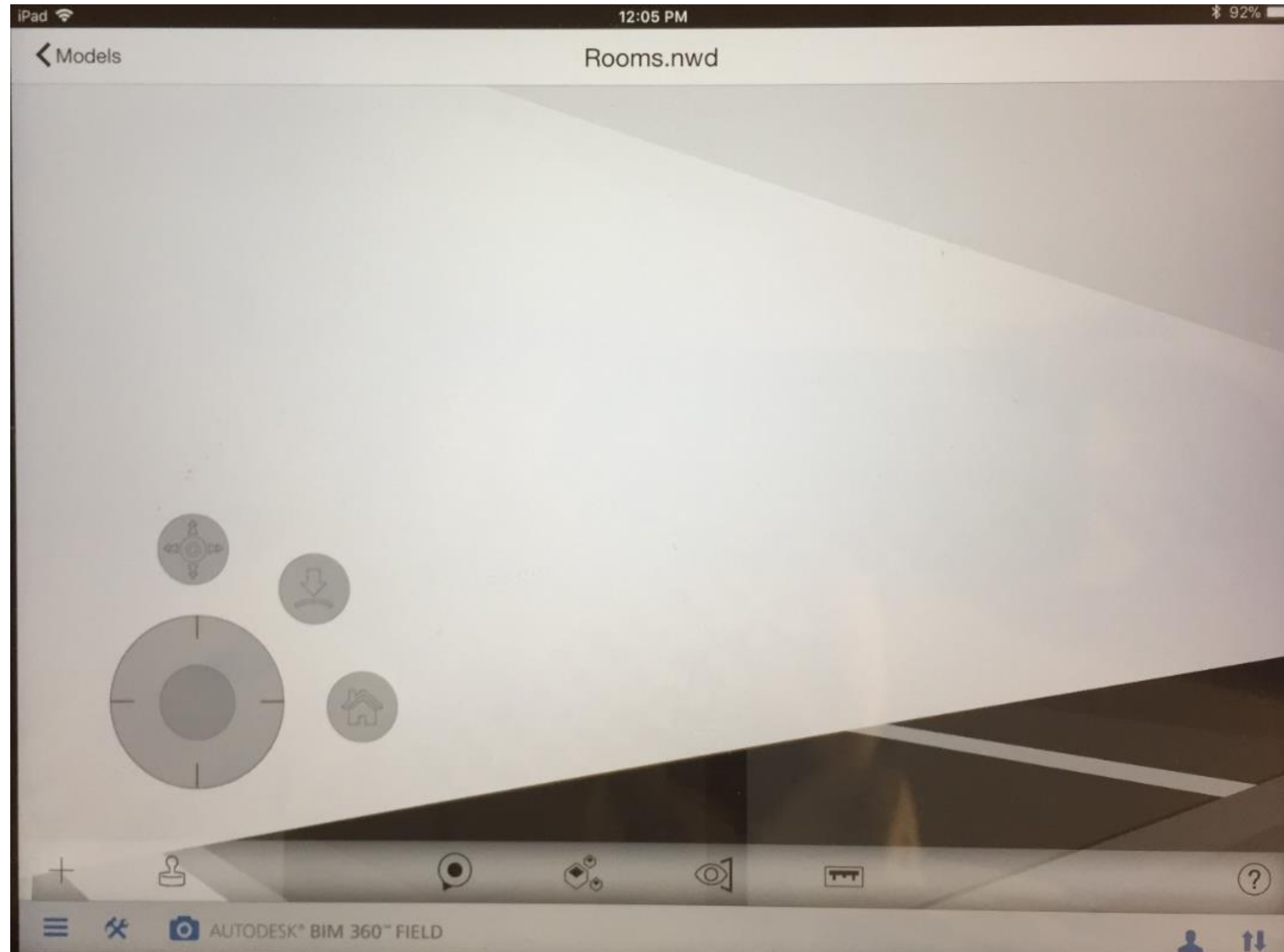
AUTODESK® BIM 360™ FIELD



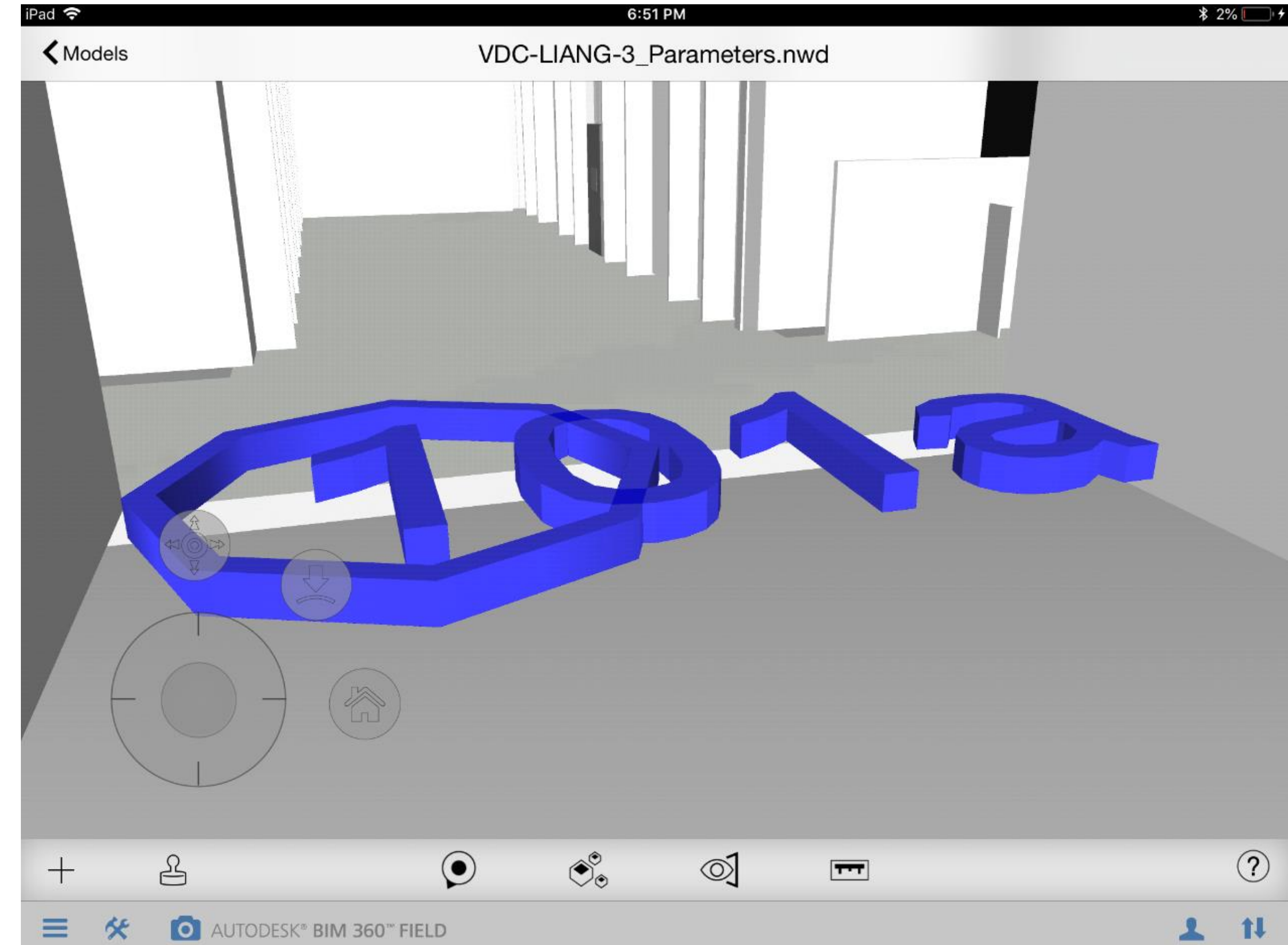


**Question 2: How to stand in center of a room when using “Show in Model”?**

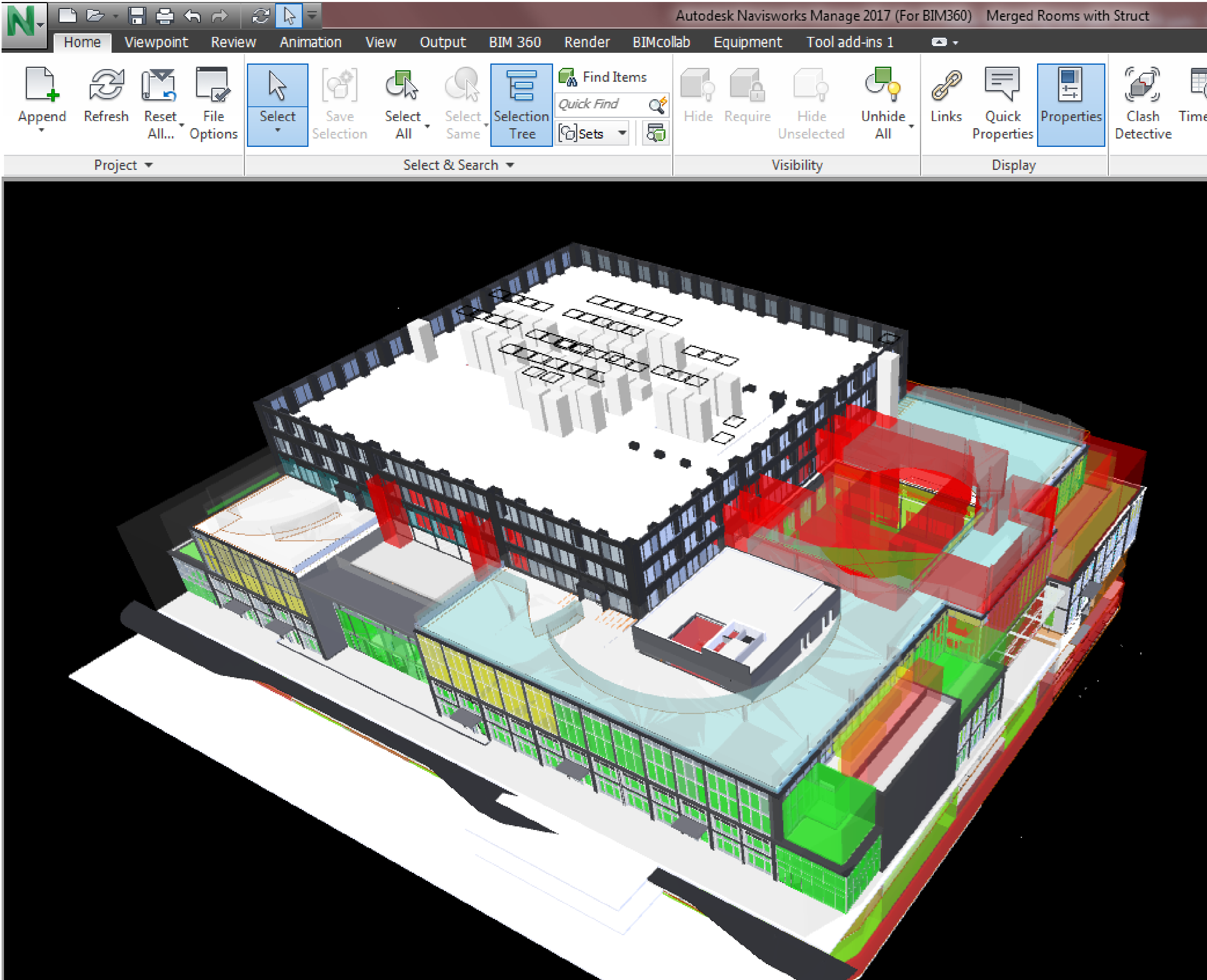
**Before**



**After**

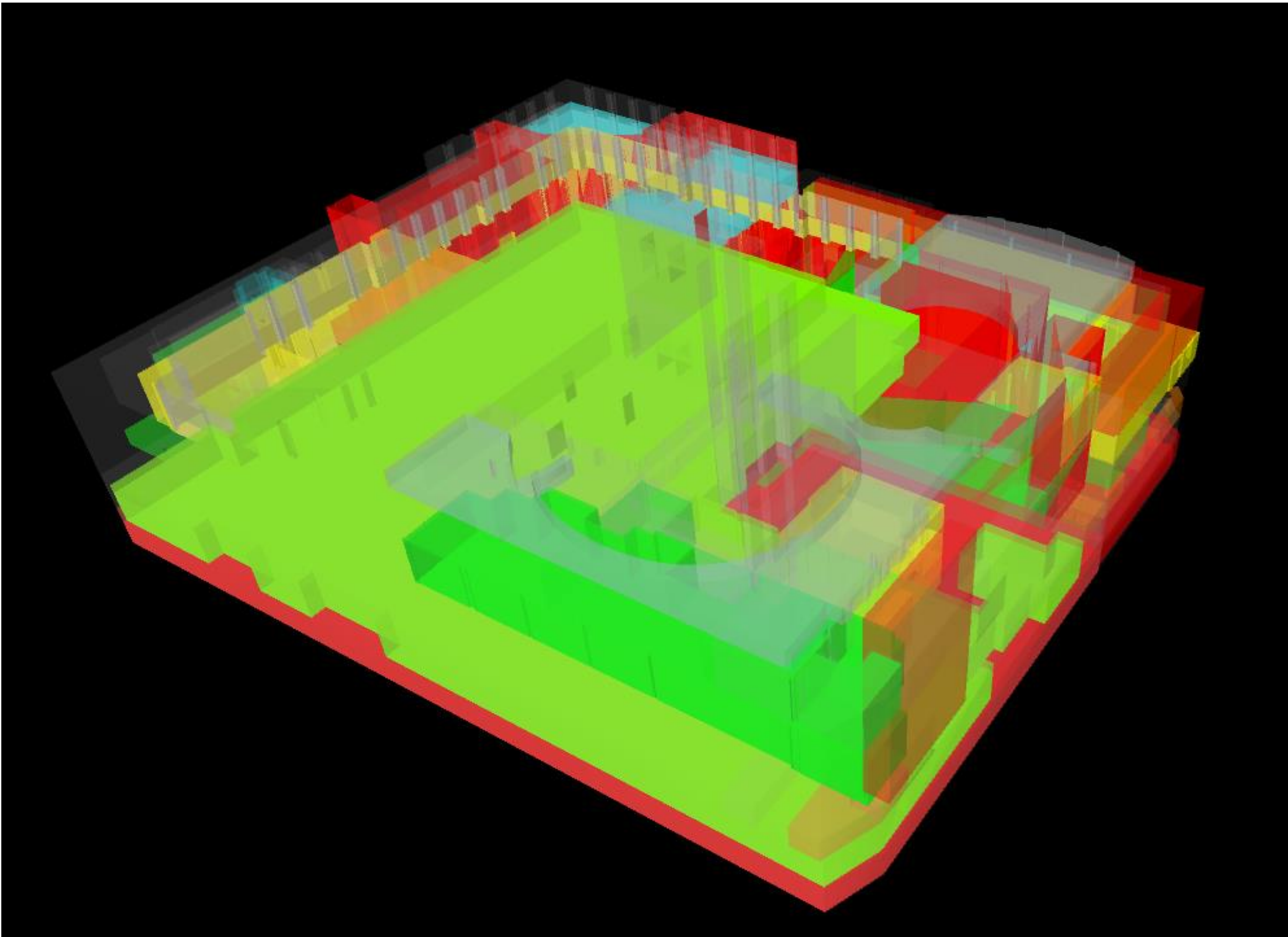




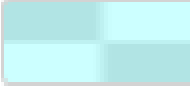




# Integrate Logistics\_Equipment Sets: Rooms into 5D Process





# Integrate Logistics\_Equipment Sets: Rooms into 5D Process



Selector		
BIM 360: Status equals "Planning"		80
BIM 360: Status equals "Ordered"		50
BIM 360: Status equals "Installing MEP"		50
BIM 360: Status equals "Installing Drywall"		50
BIM 360: Status equals "Completed"		50



# Integrate Logistics\_Equipment Sets: Rooms into 5D Process

Publish Data (Advanced) ✕

(none)

Save As Template

Select Element

All / None

☐ Air Terminals

☐ Casework

☐ Ceilings

☐ Columns

☐ Communication Devices

☐ Curtain Panels

☐ Curtain Systems

☐ Curtain Wall Mullions

☐ Data Devices

☐ Doors

☐ Electrical Equipment

☐ Electrical Fixtures

☐ Entourage

☐ Fascias

☐ Floors

☐ Furniture

☐ Generic Models

☐ Lighting Fixtures

☐ Mass

☐ Mechanical Equipment

☐ Parking

☐ Plumbing Fixtures

☐ Railings

☐ Ramps

☐ Roofs

☐ Security Devices

☐ Site

☐ Slab Edges

☐ Specialty Equipment

☐ Stairs

☐ Structural Columns

☐ Structural Framing

☐ Wall Sweeps

☐ Walls

☐ Windows

Standard Parameters

Advanced Parameters

OKCancel

Publish Data (Advanced) ✕

(none)

Save As Template

Select Element

Standard Parameters

Advanced Parameters

Search advanced parameters

✕

Display: AllPrimarySecondaryRecent

Clear all

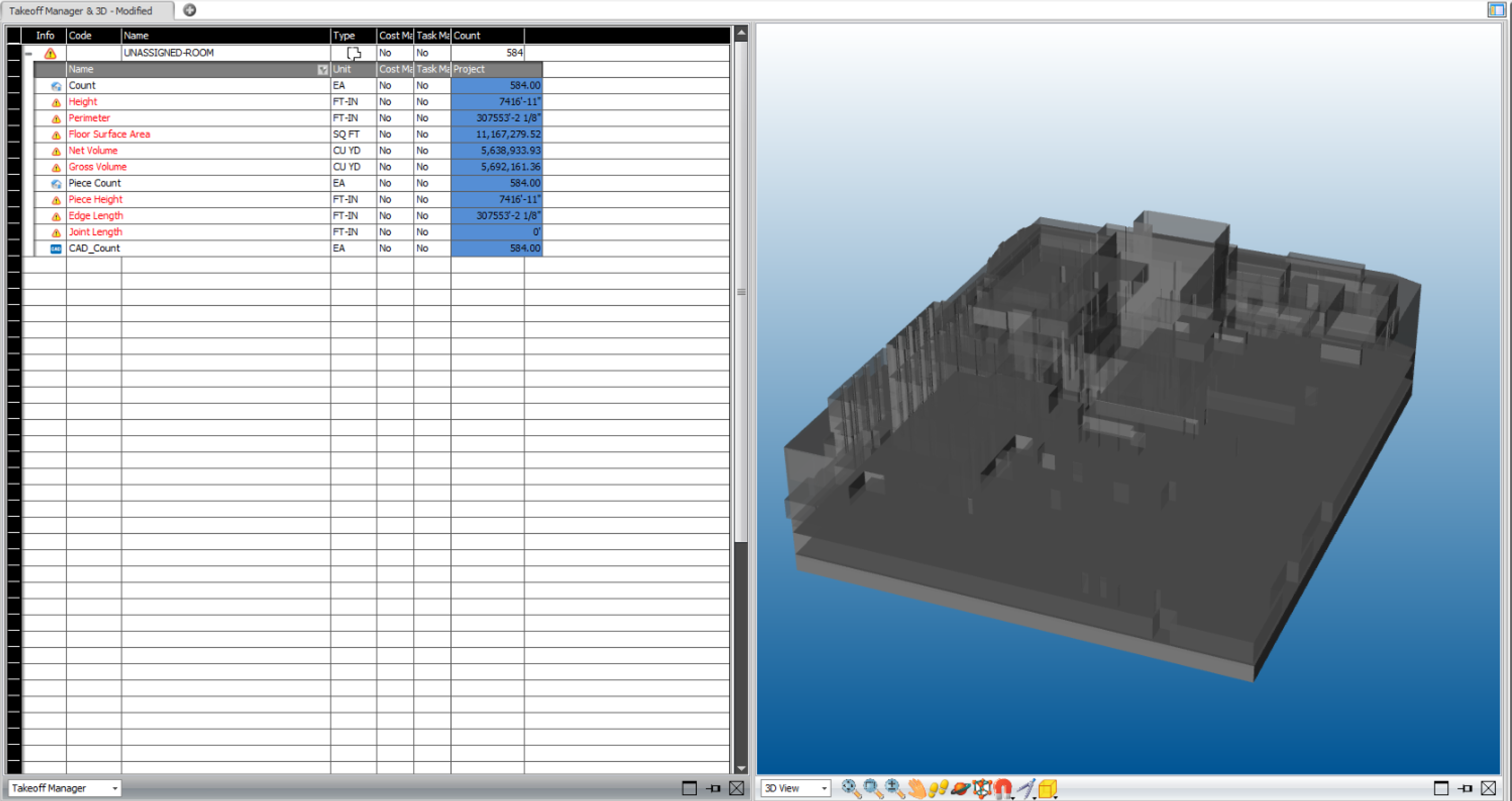
Displaying 33 of 1025

☐ % discharge directly to outside

☒ Barcode

☐ Base Finish

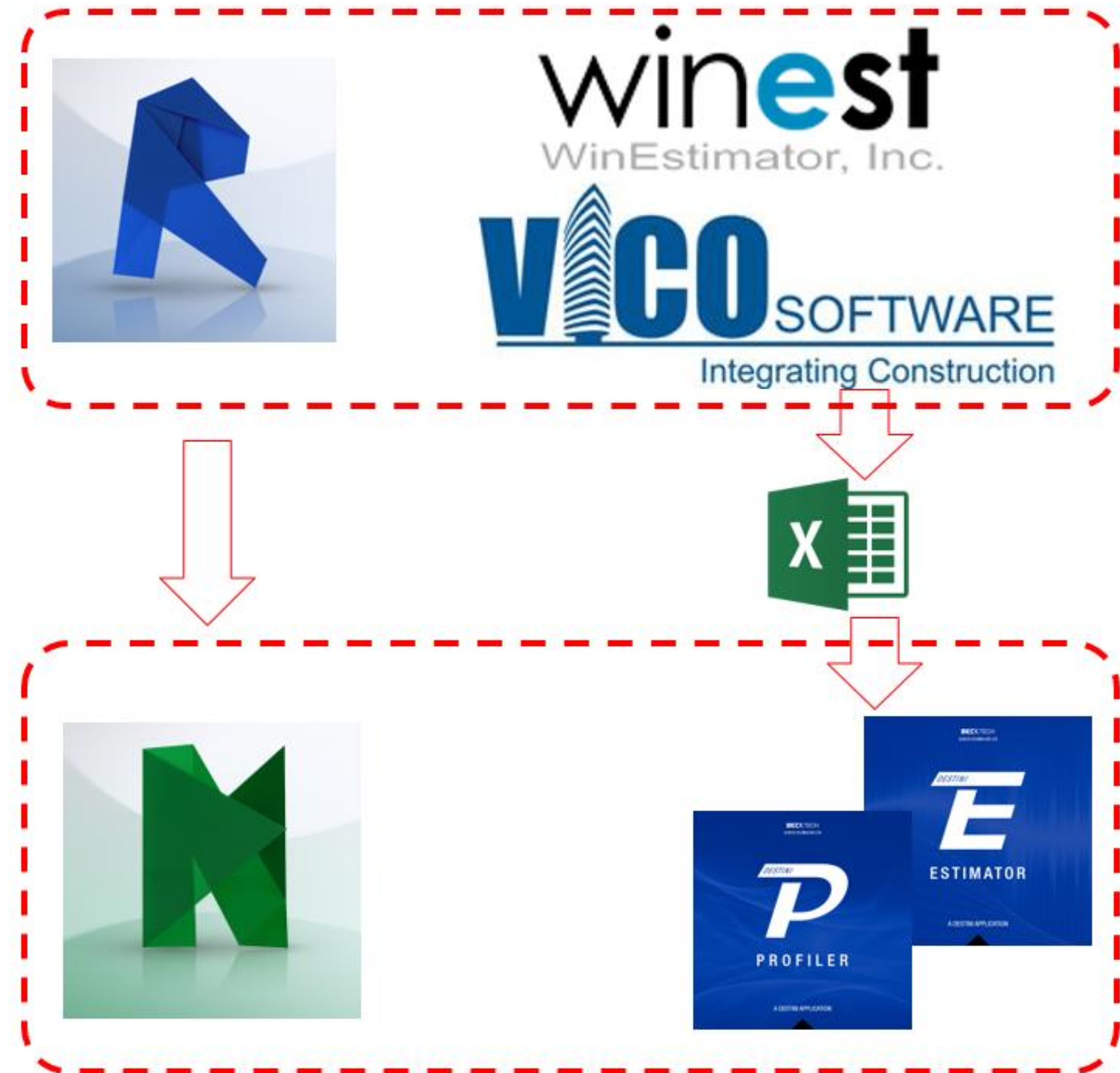
# Integrate Logistics\_Equipment Sets: Rooms into 5D Process





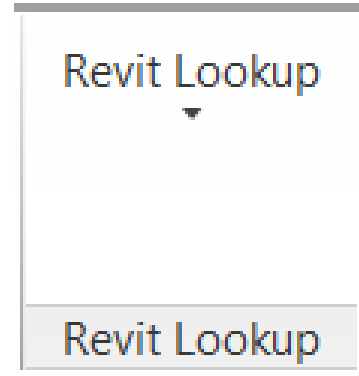
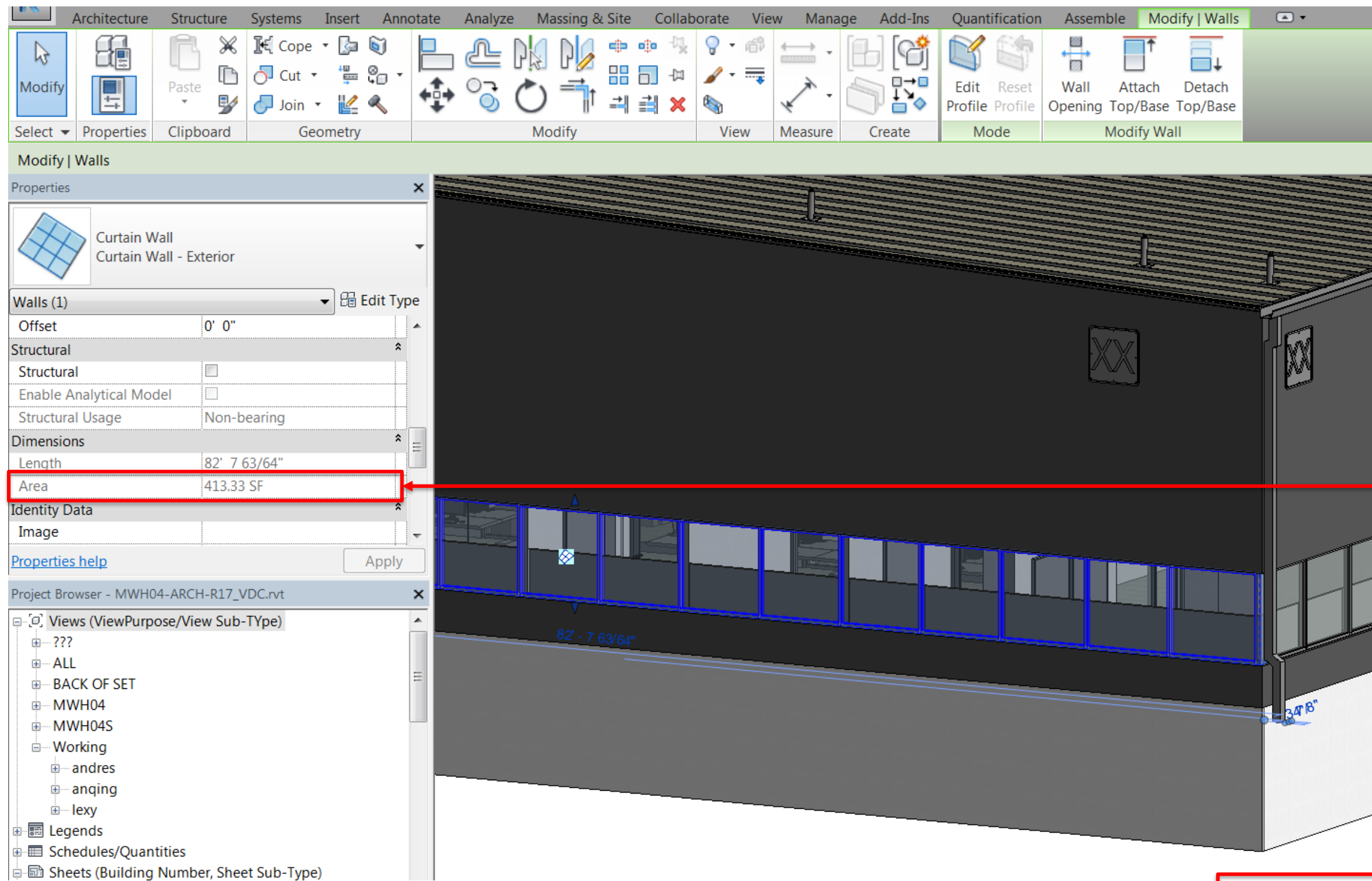
# Current Platforms

- AUTODESK – TRIMBLE
  - AUTODESK – BECK
  - ORACLE – P6
- 
- Same modeling practice
  - Similar take – off logic
  - Different levels of integration
  - Very capable – different process logic
  - Different learning curve
  - Race to full cloud integration...



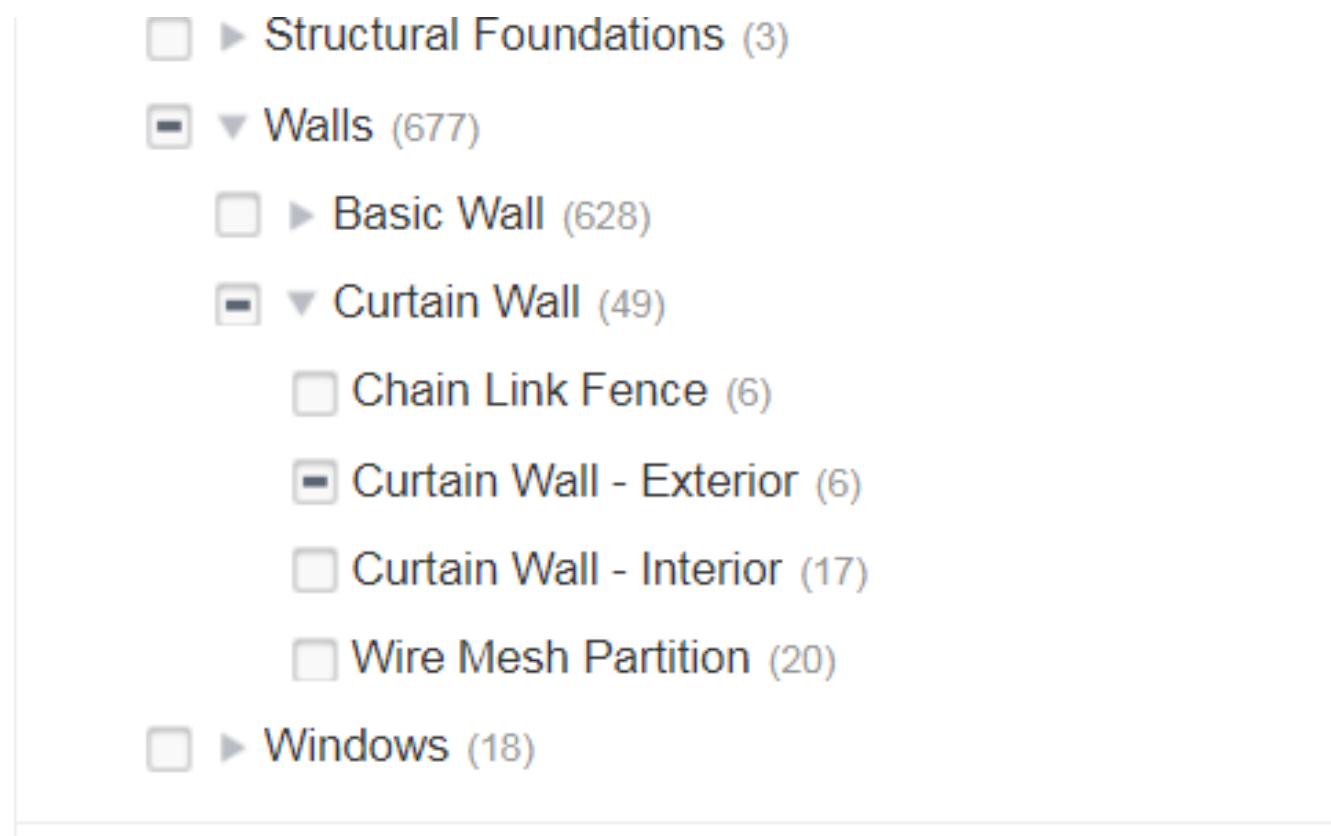


# Why SqFt is Different?

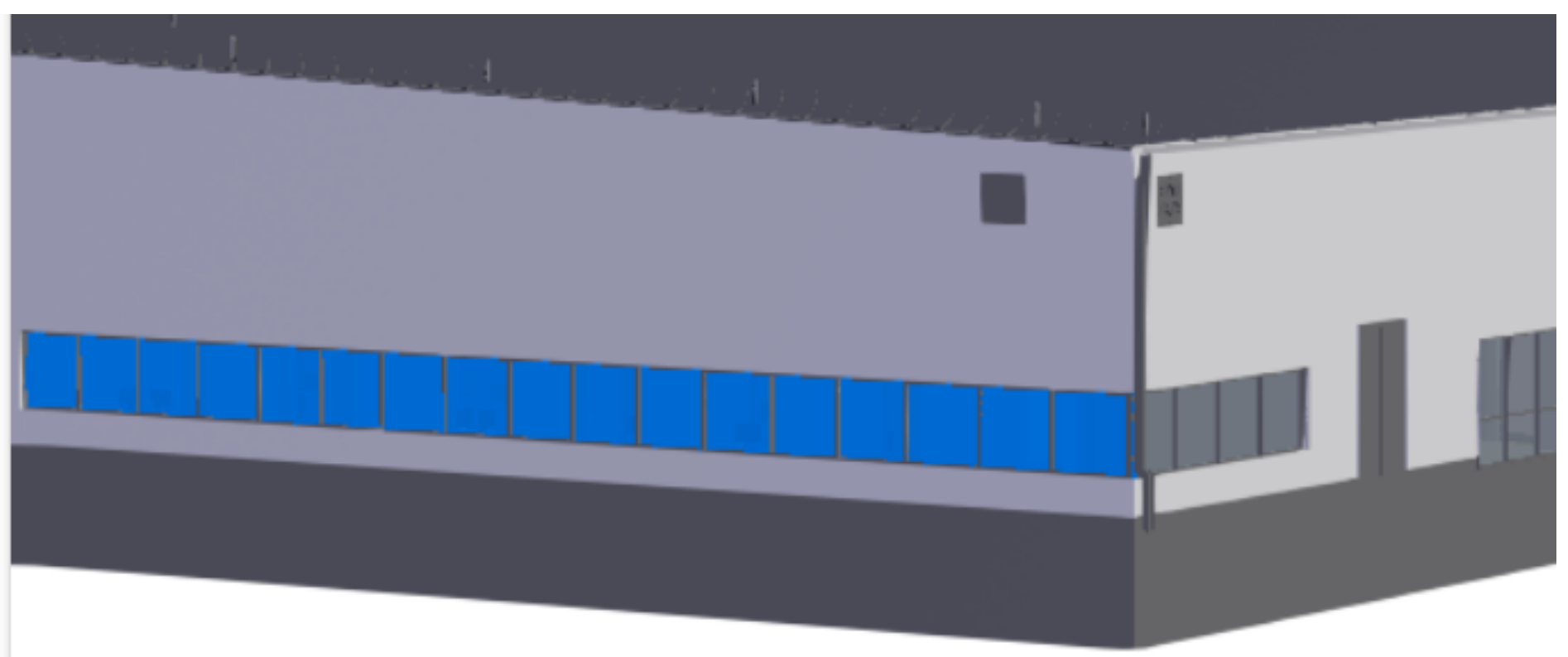


Revit

Assemble

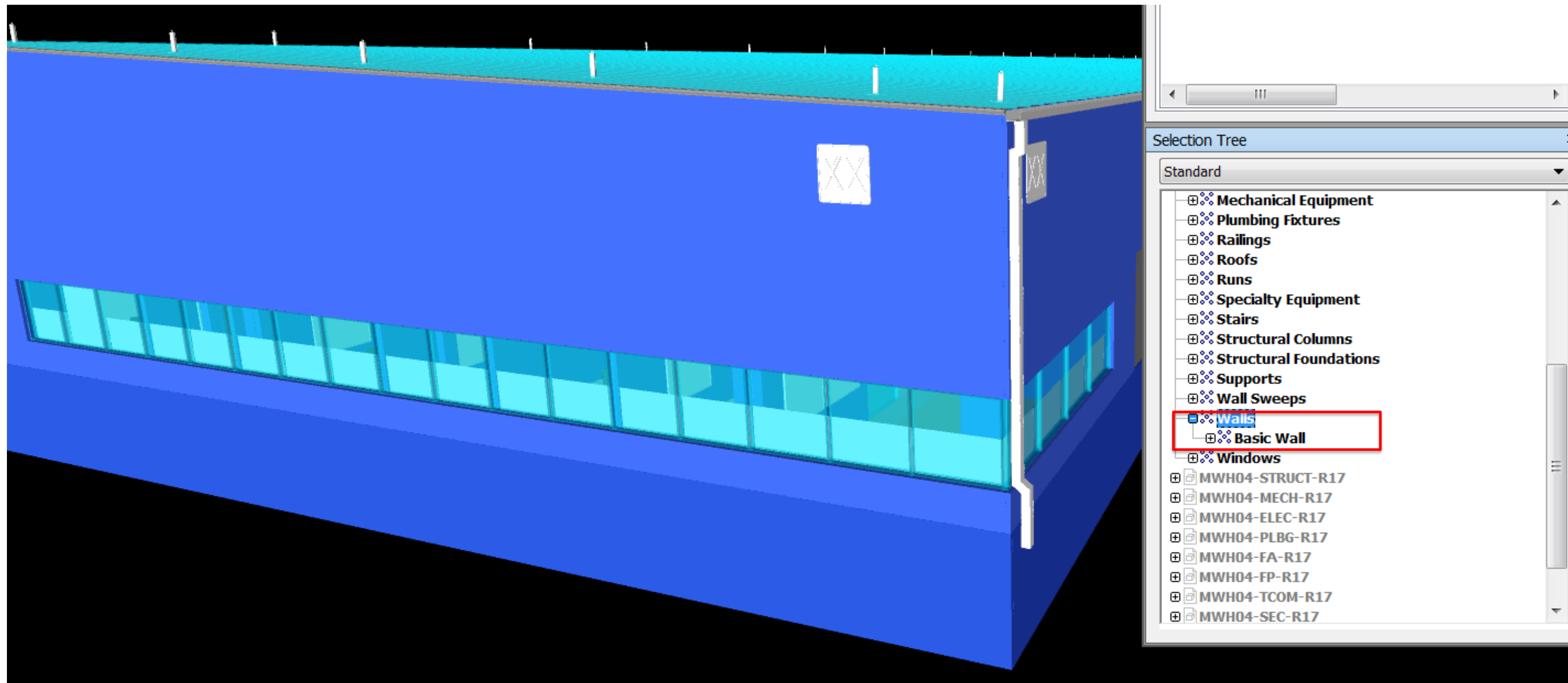
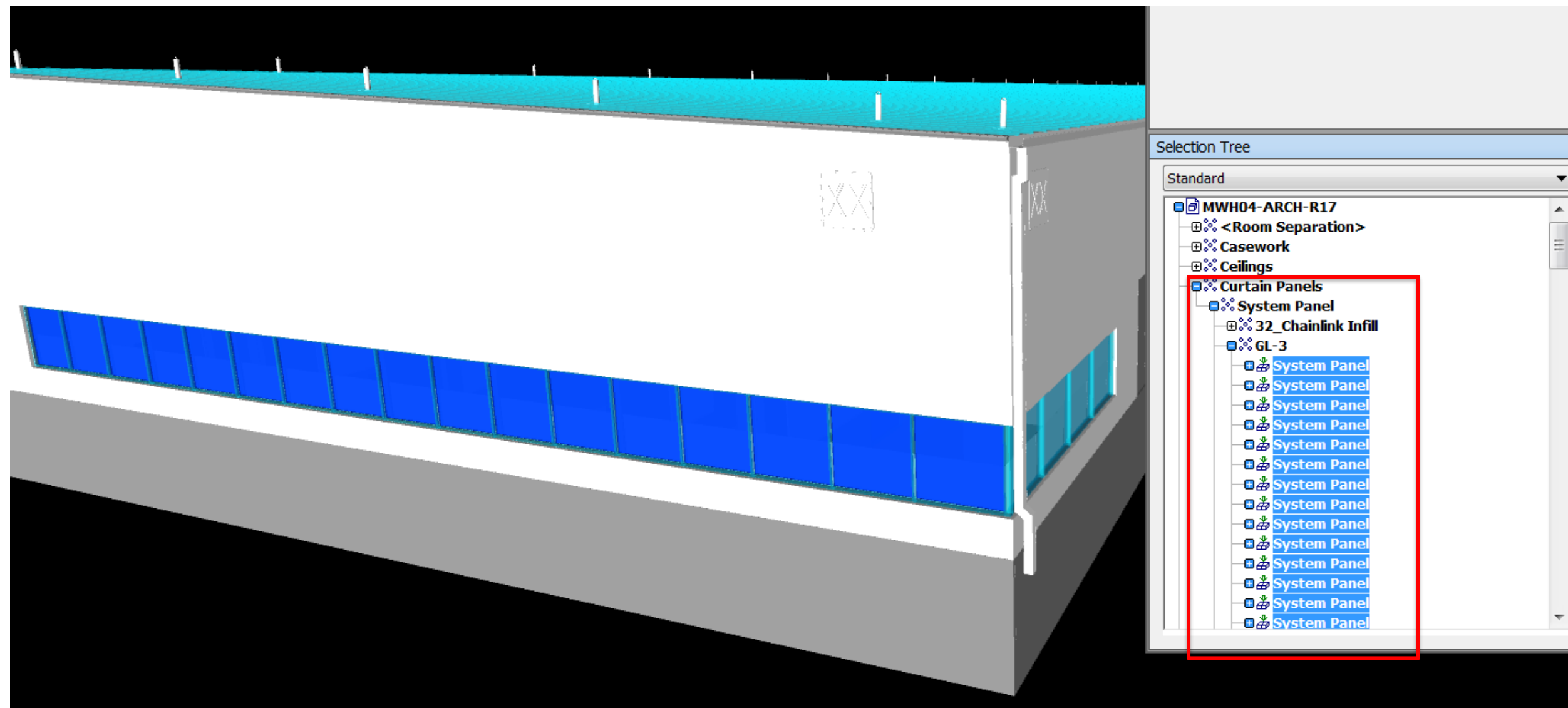


<input type="checkbox"/>	Walls : Curtain Wall : Curtain Wall - E...	1,167.15	SF
<input checked="" type="checkbox"/>	5425564	413.33	SF
<input type="checkbox"/>	5426695	209.02	SF
<input type="checkbox"/>	5770905	96.89	SF
<input type="checkbox"/>	5770976	275.70	SF
<input type="checkbox"/>	5770996	72.63	SF
<input type="checkbox"/>	7640341	99.58	SF
<input type="checkbox"/>	Walls : Curtain Wall : Curtain Wall - Int...	1,507.64	SF

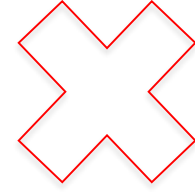


## From Revit to Naviswork

The curtain wall instances are hosts to other instances where their geometries have been usurped. Because there is no geometry, the curtain walls will not exist in the NWC.

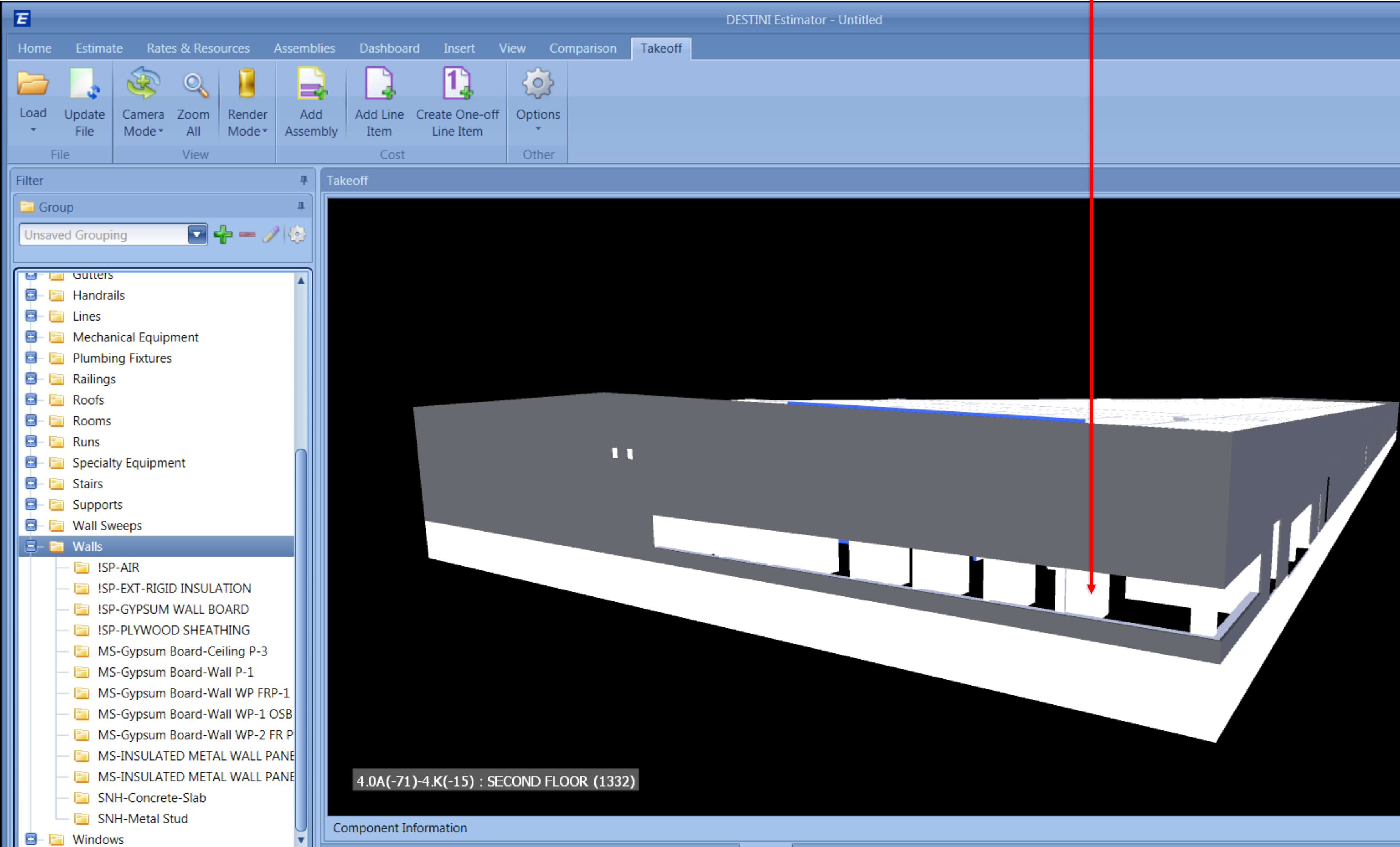






# From Naviswork to DEstimator

The curtain wall are not even shown under Walls





VICO

04 - Takeoff Manager

1 Project Setup

View Dashboard

Define Settings

Edit Tags

Import from Excel

Compare & Update

2 Model Management

Model Register

3 Takeoff

Takeoff Model

Takeoff Pad

Manage Takeoff

4 Reports

Create Reports

Takeoff Manager & 3D

Info	Code	Name	Type	Mappe	Count
+		Wall Sweep: Wall Protection - 4ft (W		No	2
+		Wall Sweep: Wall Protection - 8ft (W		No	2
+		B10-03_3000_Concrete_Rectangula		No	6
+		B10-03_3000_Concrete_Rectangula		No	1
+		B10-05_1200_AISC_HSS_Pipe-Colur		No	10
+		Curtain Wall: Wire Mesh Partition		No	20
+		Curtain Wall: Chain Link Fence		No	6
+		Curtain Wall: Curtain Wall - Exterior		No	6
		Name	Unit	Mappe	Project
		Count	EA	No	6.00
		Piece Count	EA	No	6.00
		CAD Net Surface Area	SQ FT	No	1,167.15
		CAD_Count	EA	No	6.00
+		Curtain Wall: Curtain Wall - Interior		No	17
+		Rectangular Mullion: Standing Seam		No	1495
+		Rectangular Mullion: Wire Mesh Fram		No	798
+		Rectangular Mullion: Fence Post		No	56
+		Rectangular Mullion: Storefront Mullio		No	427
+		Rectangular Mullion: Storefront Mullio		No	3
+		Rectangular Mullion: Storefront Mullio		No	1
+		Empty System Panel: SNH-Empty Pa		No	1541
+		System Panel: 32_Chainlink Infill		No	194

File Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins **Modify | Walls**

Modify Select Properties Clipboard Geometry Modify View Measure Create Mode Modify Wall Selection

Save Load Edit

Modify | Walls Activate Dimensions

Properties

Curtain Wall  
Curtain Wall - Exterior

Walls (6) Edit Type

Constraints	
Base Constraint	T/ FIRST FLOOR
Base Offset	
Base is Attached	<input type="checkbox"/>
Top Constraint	Unconnected
Unconnected Height	
Top Offset	-0' 6"
Top is Attached	<input type="checkbox"/>
Room Bounding	<input checked="" type="checkbox"/>
Related to Mass	<input type="checkbox"/>
Materials and Finishes	
Material Color	
Vertical Grid	

[Properties help](#) Apply

Project Browser - 1708739 MWH04-ARCH-R17\_VDC.rvt

- Structural Beam Systems
- Structural Columns
- Structural Foundations
- Structural Loads
- Walls
  - Basic Wall
  - Curtain Wall
    - Chain Link Fence
    - Curtain Wall - Exterior
    - Curtain Wall - Interior
    - Wire Mesh Partition
  - Stacked Wall
    - EXT-BRICK ON CMU-STL STUD
- Windows
- Groups
- Revit Links
  - MWH05-ARCH-R17.rvt
  - MWH0405-ELEC-R17.rvt

Temporary Hide/Isolate

1/8" = 1'-0"



VICO added all curtain walls together under one TOI

On/Off

Takeoff Manager & 3D

	Info	Code	Name	Type	Cost Ma	Task Ma	Count																									
			Curtain Wall: Curtain Wall - Exterior		No	No	6																									
			<table><thead><tr><th>Name</th><th>Unit</th><th>Cost Ma</th><th>Task Ma</th><th>Project</th></tr></thead><tbody><tr><td>Count</td><td>NR</td><td>No</td><td>No</td><td>6.00</td></tr><tr><td>Piece Count</td><td>NR</td><td>No</td><td>No</td><td>6.00</td></tr><tr><td>Surface Area</td><td>M2</td><td>No</td><td>No</td><td>108.43</td></tr><tr><td>CAD_Count</td><td>NR</td><td>No</td><td>No</td><td>6.00</td></tr></tbody></table>	Name	Unit	Cost Ma	Task Ma	Project	Count	NR	No	No	6.00	Piece Count	NR	No	No	6.00	Surface Area	M2	No	No	108.43	CAD_Count	NR	No	No	6.00				
Name	Unit	Cost Ma	Task Ma	Project																												
Count	NR	No	No	6.00																												
Piece Count	NR	No	No	6.00																												
Surface Area	M2	No	No	108.43																												
CAD_Count	NR	No	No	6.00																												
			Curtain Wall: Curtain Wall - Interior		No	No	17																									
			08_B_Double Flush Door 1: B_FRP_E_GWB_0_4		No	No	2																									
			08_B_Double Flush Door 1: B_HM_I_GWB_60_4		No	No	4																									
			08_X_Roll-Up Door_Wall Mounted: E_STL_0_Mc		No	No	5																									
			08_X_Roll-Up Door_Wall Mounted: I_STL_0_Mc		No	No	5																									
			08_A_Single Flush Door: A_FRP_E_GWB_0_36		No	No	40																									
			08_B_Double Flush Door 2: B_FRP_E_GWB_0_3		No	No	32																									
			08_A_Single Flush Door: A_HM_I_GWB_0_36in		No	No	32																									
			08_A_Single Flush Door: A_FRP_E_GWB_1_36		No	No	3																									
			08_A_Single Flush Door: A_FRP_E_GWB_0_42		No	No	19																									
			Door-Curtain-Wall-Single-Fence Gate: Door-Cu		No	No	2																									
			Compactor Door: 48" x 48"-C1020310		No	No	4																									
			08_G_Glass Door: 08_G_Glass Door		No	No	2																									
			08_B_Double Flush Door 1: B_HM_I_GWB_0_36		No	No	7																									
			08_B_Double Flush Door 1: B_HM_I_GWB_60_3		No	No	4																									
			08_B_Double Flush Door 1: B_HM_I_GWB_0_36		No	No	36																									
			Door-Opening MWH: 84" x 124"		No	No	20																									
			Door-Opening: 60" x 120"		No	No	15																									
			08_B_Double Flush Double Swing Door: B_HM_		No	No	7																									
			08_B_Double Flush Double Swing Door: B_HM_		No	No	1																									
			expansion joint: 12" x 21.5' EJ INT		No	No	4																									
			Security Portal: 5'-0"-B2030300		No	No	4																									
			08_G_Glass Door: 08_G_Glass Door_Int_AL		No	No	11																									
			08_A_Single Flush Door: A_HM_I_GWB_0_48in		No	No	2																									
			08_A_Single Flush Door: A_HM_I_GWB_60_48		No	No	2																									
			08_A_Single Flush Door: A_HM_I_GWB_60_48		No	No	2																									
			08_A_Single Flush Door: A_HM_I_GWB_0_40in		No	No	1																									
			08_A_Single Flush Door: A_HM_I_CMU_0_36in		No	No	2																									
			08_G_Glass Door: 08_G_Glass Door_Int		No	No	3																									
			08_FOC_Glass Door_mwh45: 08_G_Glass Door		No	No	2																									
			08_E_Swing Door w. Glazing: E_HM_I_GWB_3		No	No	2																									
			22_Sink_Kitchen-Double_Counter mtd: INTEGR		No	No	2																									
			22_WaterFountain_Wall: 22_WaterFountain_V		No	No	2																									
			Drain_Trench-12_Inch_Wide_Reveal-Zum-288		No	No	12																									

File

Architecture

Structure

Systems

Insert

Annotate

Analyze

Massing & Site

Collaborate

View

Manage

Add-Ins

Modify | Walls

Modify

Properties

Clipboard

Geometry

Modify

View

Measure

Create

Mode

Modify

Activate Dimensions

Properties

Curtain Wall

Curtain Wall - Exterior

Walls (1)

Edit Type

Structural

Enable Analytical Model

Structural Usage

Non-bearing

Dimensions

Length

25.1964

Area

38.399 m<sup>2</sup>

Identity Data

Image

Comments

Mark

Room Finish Tag

Design Option

Main Model

Phasing

Properties help

Apply

Project Browser - 1708739 MWH04-ARCH-R17\_VDC.rvt

Structural Beam Systems

Structural Columns

Structural Foundations

Structural Loads

Walls

Basic Wall

Curtain Wall

Chain Link Fence

Curtain Wall - Exterior

Curtain Wall - Interior

Wire Mesh Partition

Stacked Wall

EXT-BRICK ON CMU-STL STUD

Windows

Groups

Temporary Hide/Isolate

38.399 m2

19.418

9.252 m2

SUM = 108.432 m2

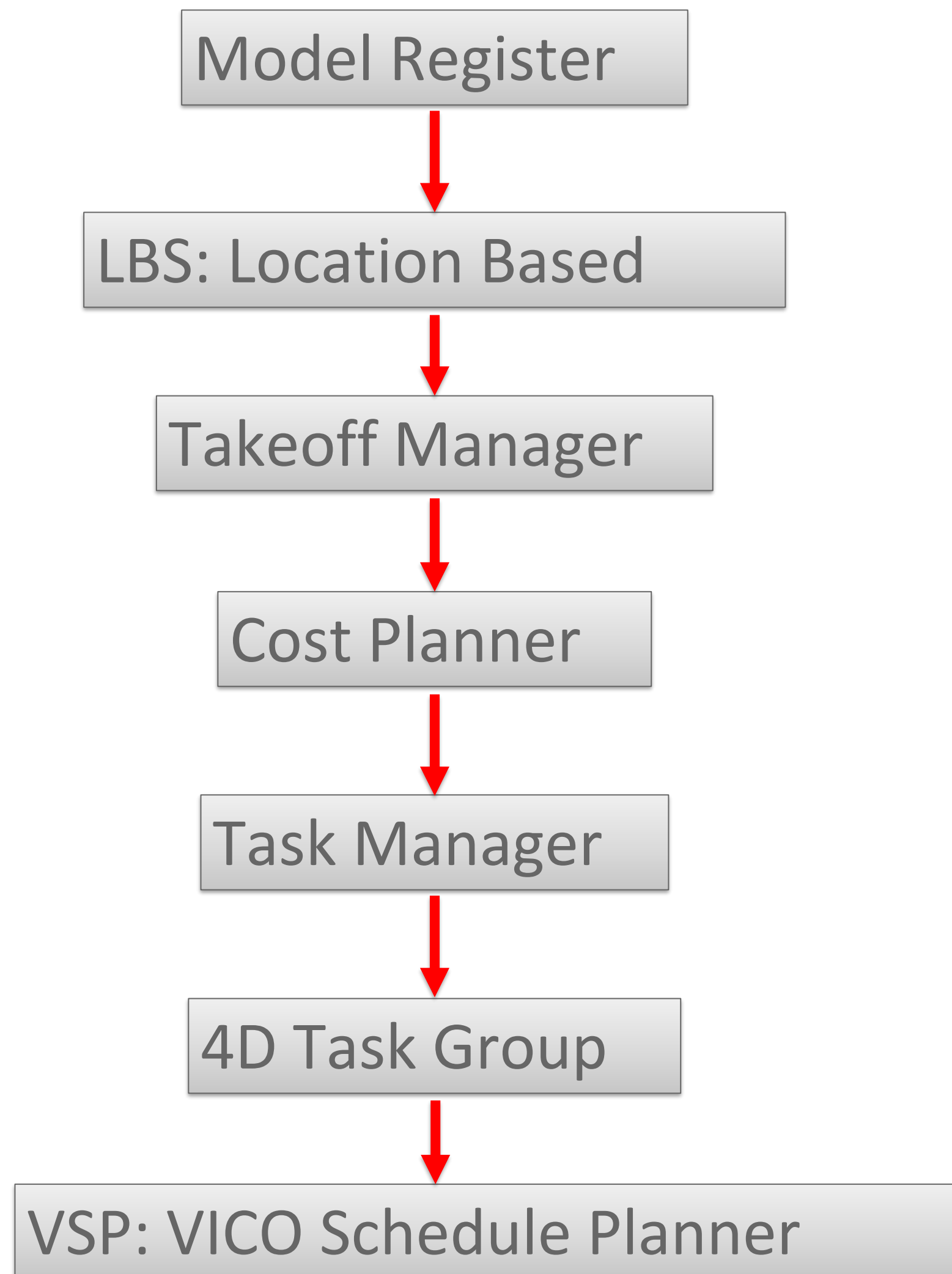
9.001 m2

6.748 m2

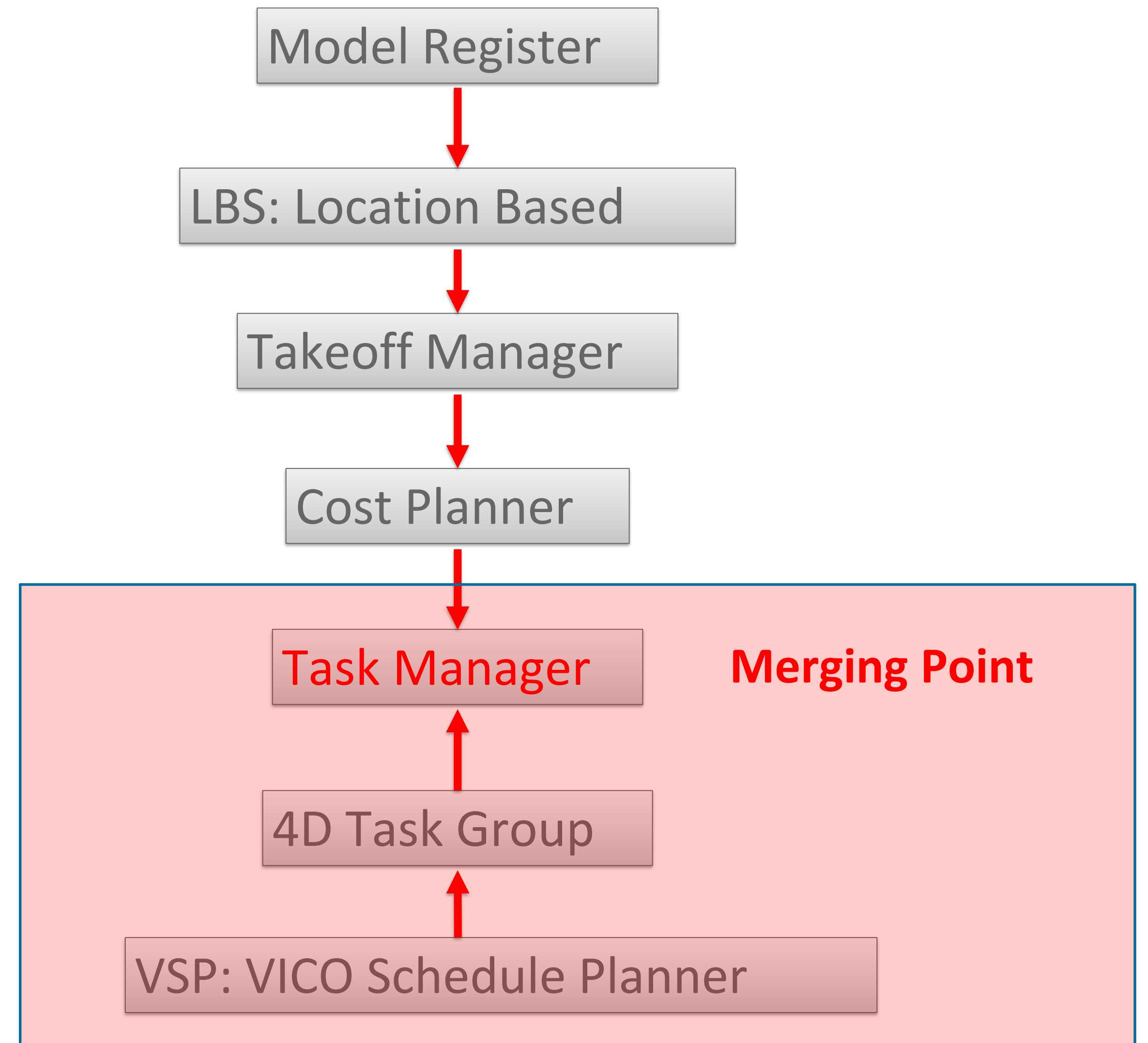
25.614 m2



## 5D Top-down



## 5D Bottom-up







THE ART & SCIENCE OF BUILDING



## 5D Top-down

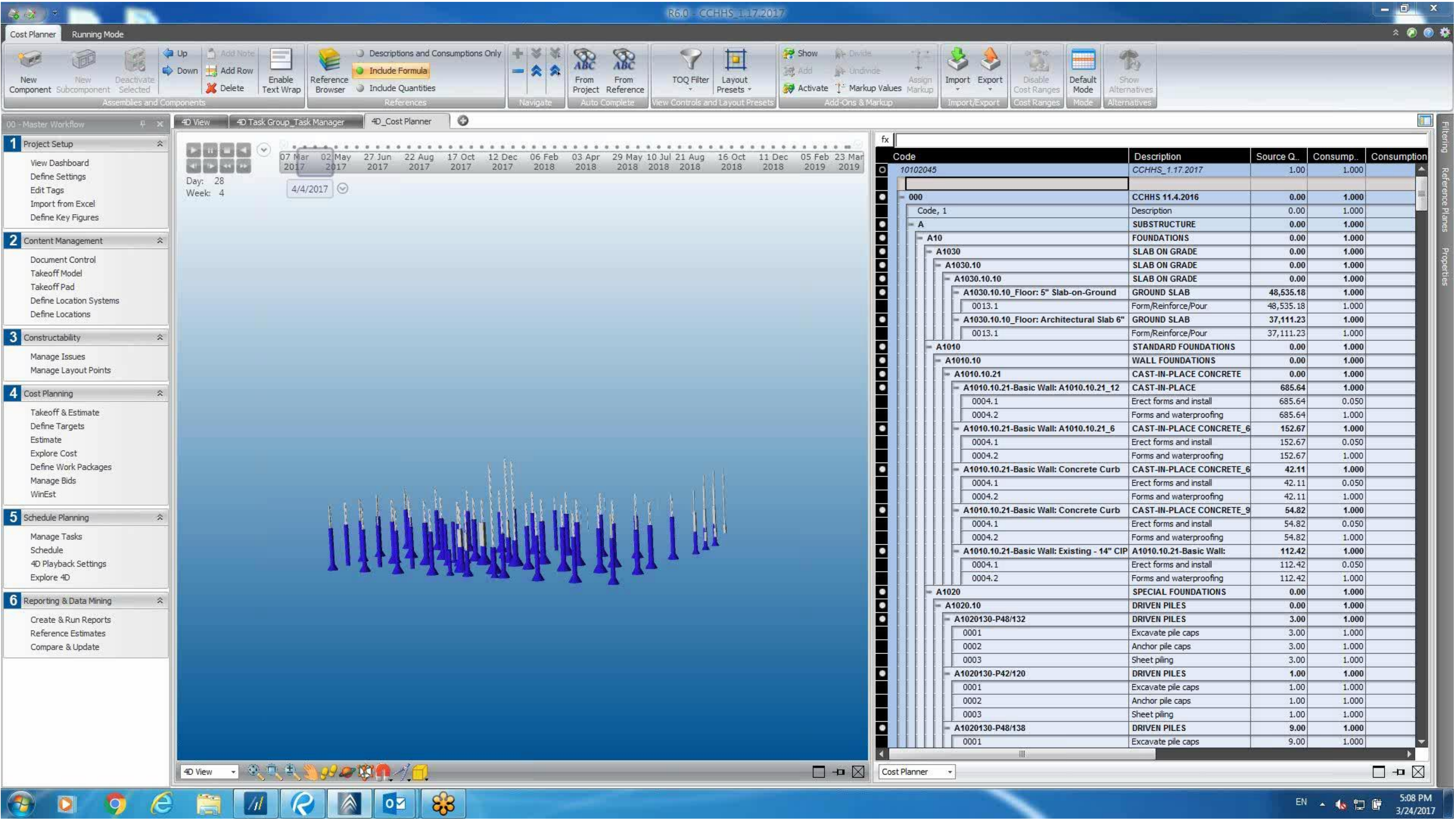
Cook County and the Cook County Health and Hospital Systems have hired Clayco, Inc., as the developer and design/builder to program, design and construct the new nine (9) story, 282,000 square foot Central Campus Health Center (“Center”).

The new Center will be constructed with a structural steel braced frame erected upon a belled caisson foundation. It will feature stand-alone MEP systems with air cooled rooftop units and hot water VAV reheat. The exterior will be enclosed by a combination of curtain wall and unitized GFRC panels.

The project is targeting LEED Silver Certification. It has an approximate budget of \$108.5 million and a 3rd quarter of 2018 completion date.



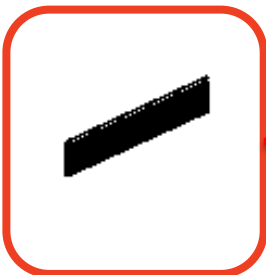
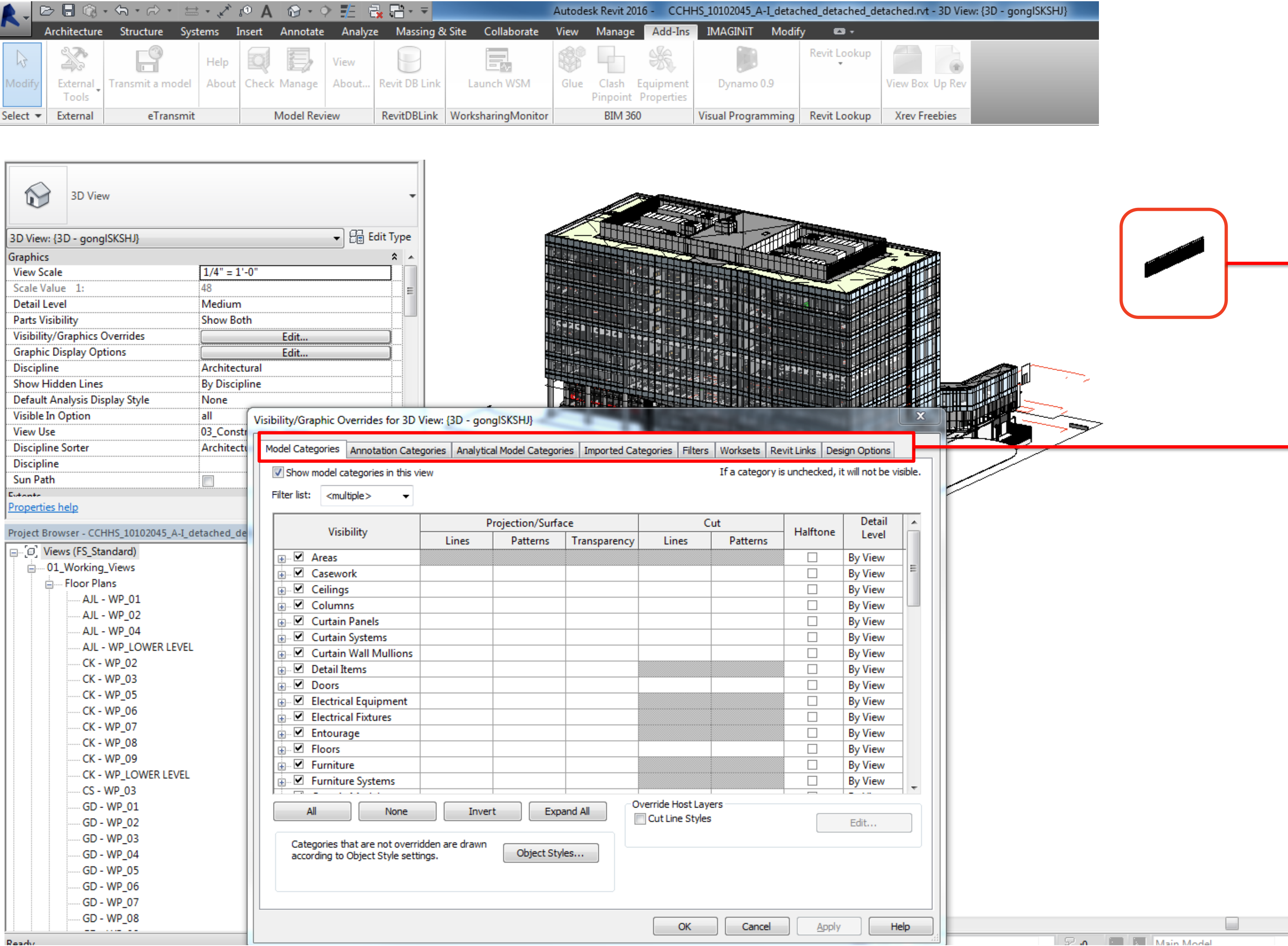
# 5D Top-down: Explore 5D



See attached video



# 5D Top-down: Revit Export



Make sure no **floating objects** are presented in view.

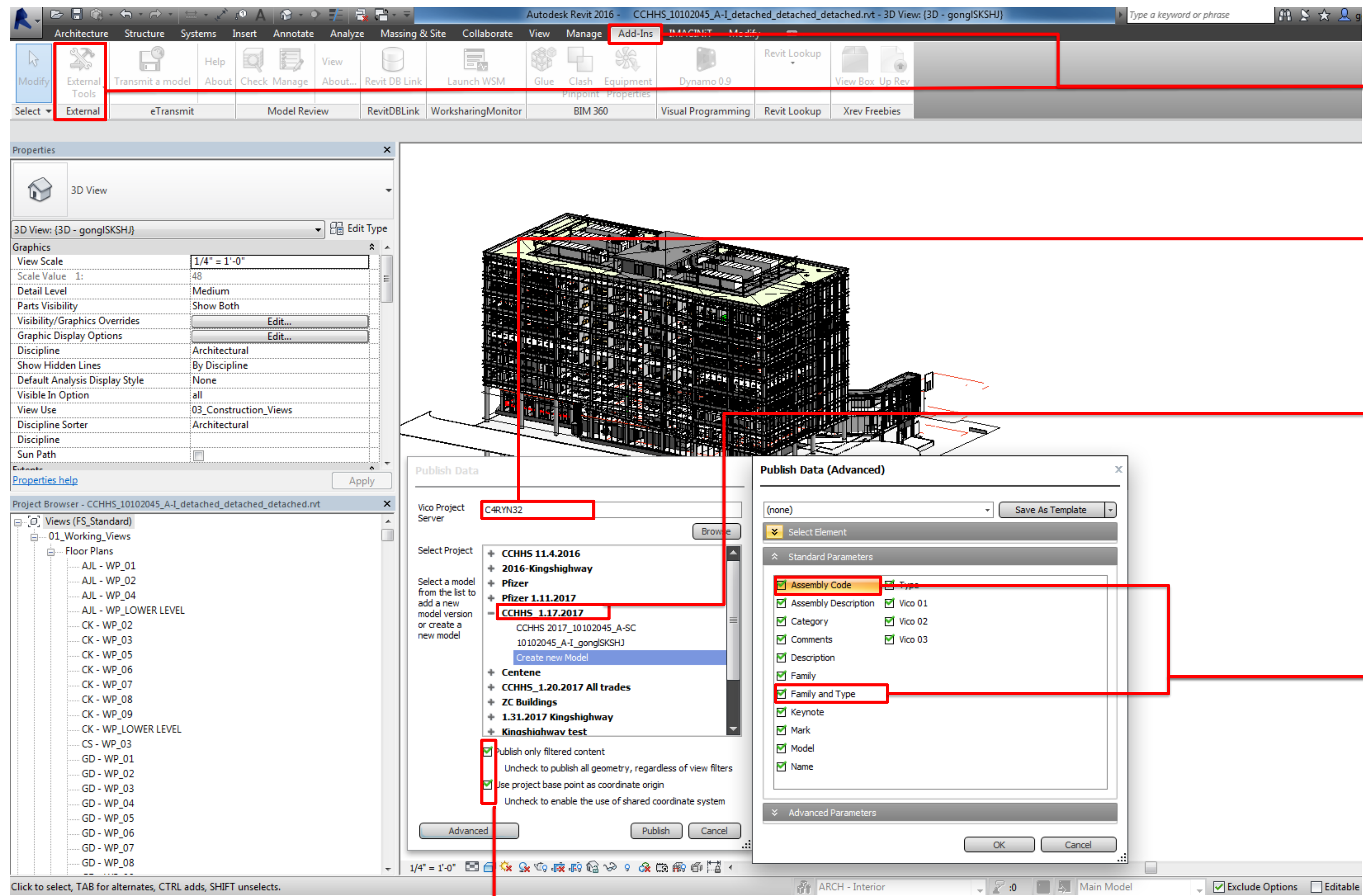
Check **Visibility Overrides** in Revit.

Only visible objects will be exported into VICO.

Shortcut: VV



# 5D Top-down: Revit Export



VICO Add-in is located at Revit – Add-ins – External Tools – Publish to VICO office

Export to the estimator's computer name.

Set up new project CCHHS in VICO. CCHHS will be listed on the projects in the Publish Data window.

Make sure **Assembly codes** and **Family and Type** are checked. The structure of VICO is based on Unifomat Elemental Classification. Attached please find the Unifomat file.

Make sure these are checked.

# 5D Top-down: Revit Export

ASTM Uniformat II Classification for Building Elements (E1557-97)			
Level 1 Major Group Elements		Level 2 Group Elements	Level 3 Individual Elements
A	SUBSTRUCTURE	A10 Foundations	A1010 Standard Foundations A1020 Special Foundations A1030 Slab on Grade
		A20 Basement Construction	A2010 Basement Excavation A2020 Basement Walls
B	SHELL	B10 Superstructure	B1010 Floor Construction B1020 Roof Construction
		B20 Exterior Enclosure	B2010 Exterior Walls B2020 Exterior Windows B2030 Exterior Doors
		B30 Roofing	B3010 Roof Coverings B3020 Roof Openings
C	INTERIORS	C10 Interior Construction	C1010 Partitions C1020 Interior Doors C1030 Fittings
		C20 Stairs	C2010 Stair Construction C2020 Stair Finishes
		C30 Interior Finishes	C3010 Wall Finishes C3020 Floor Finishes C3030 Ceiling Finishes
D	SERVICES	D10 Conveying	D1010 Elevators & Lifts D1020 Escalators & Moving Walks D1090 Other Conveying Systems
		D20 Plumbing	D2010 Plumbing Fixtures D2020 Domestic Water Distribution D2030 Sanitary Waste D2040 Rain Water Drainage D2090 Other Plumbing Systems
		D30 HVAC	D3010 Energy Supply D3020 Heat Generating Systems D3030 Cooling Generating Systems D3040 Distribution Systems D3050 Terminal & Package Units D3060 Controls & Instrumentation D3070 Systems Testing & Balancing D3090 Other HVAC Systems & Equipment
		D40 Fire Protection	D4010 Sprinklers D4020 Standpipes D4030 Fire Protection Specialties

## UNIFORMAT

UNIFORMAT II ELEMENTAL CLASSIFICATION FOR BUILDIONG SPECIFICATIONS, COST ESTIMATING, AND COST ANALYSIS



# 5D Top-down: Project Settings

00 - Master Workflow

1 Project Setup

View Dashboard

Define Settings

Edit Tags

Import from Excel

Define Key Figures

2 Content Management

Document Control

Takeoff Model

Takeoff Pad

Define Location Systems

Define Locations

3 Constructability

Manage Issues

Manage Layout Points

4 Cost Planning

Takeoff & Estimate

Define Targets

Estimate

Explore Cost

Define Work Packages

Manage Bids

WinEst

5 Schedule Planning

Manage Tasks

Schedule

4D Playback Settings

Explore 4D

6 Reporting & Data Mining

Create & Run Reports

Reference Estimates

Compare & Update

Project Settings

Task Manager\_Cost Planner

TO 3D CP

LBS\_3D

Takeoff Manager\_3D\_Takeoff Pad

Model Register\_3D

4D Task Group\_Task Manager

Project Details

Code

10102045

Name

CCHHS\_1.17.2017


Type

Healthcare

Address

1950 W Polk St, Chicago IL, 60612, USA

Logo



Clear

Browse

Customer Information

Company

Clayco

Contact

Tomislav Zigo

Email

zigot@claycorp.com

Address

35 E Upper Wacker Dr, Chicago IL, 60601, USA

Generate Logs

Show Log File

Show Error History

Trimble Connect

Trimble Connect Server URL

Trimble Connect Region URL (Optional)

Default WinEst Estimate Link

File Name

X ...

Work Packages

Hard Lock 'Contracted' Work Packages

☒

Project Settings

Units of Measurement

System

Imperial

Length

feet and inches

Area

square foot

Volume

cubic yard

Update TOQ Units

Decimal Places

Cost Values

2

Measurement

2

Consumption Values

3

Layout Points


2

Quantity Data

2

Color Scheme and Reference

Project Color Scheme



Project Reference

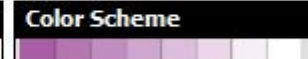
Server Name

C4RYN32

Browse

Project Name

Color Scheme



3D View Background Color

Solid Color

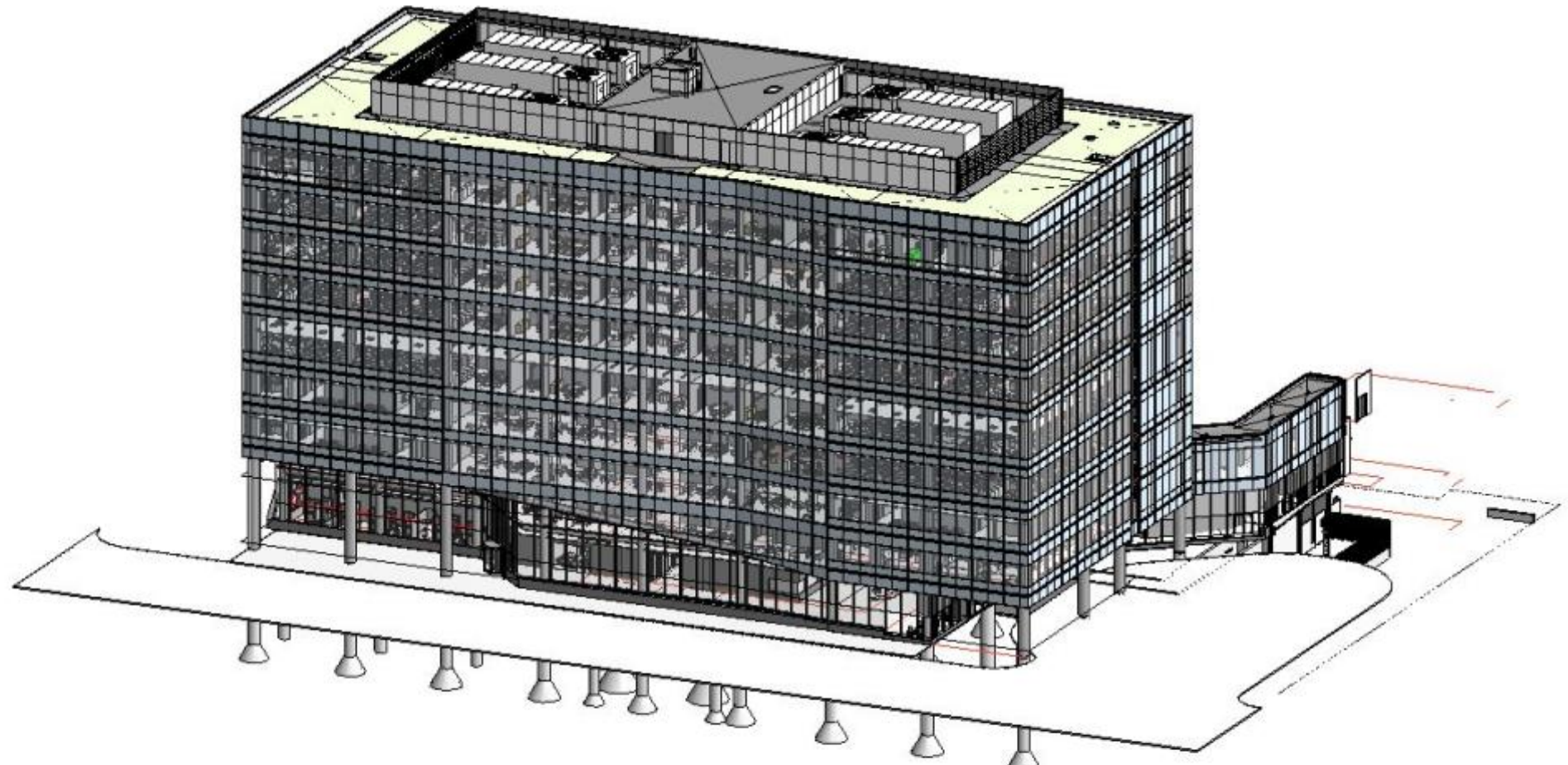
255, 255, 255

Gradient

255, 255, 255

0, 85, 149

Project Image



Clear

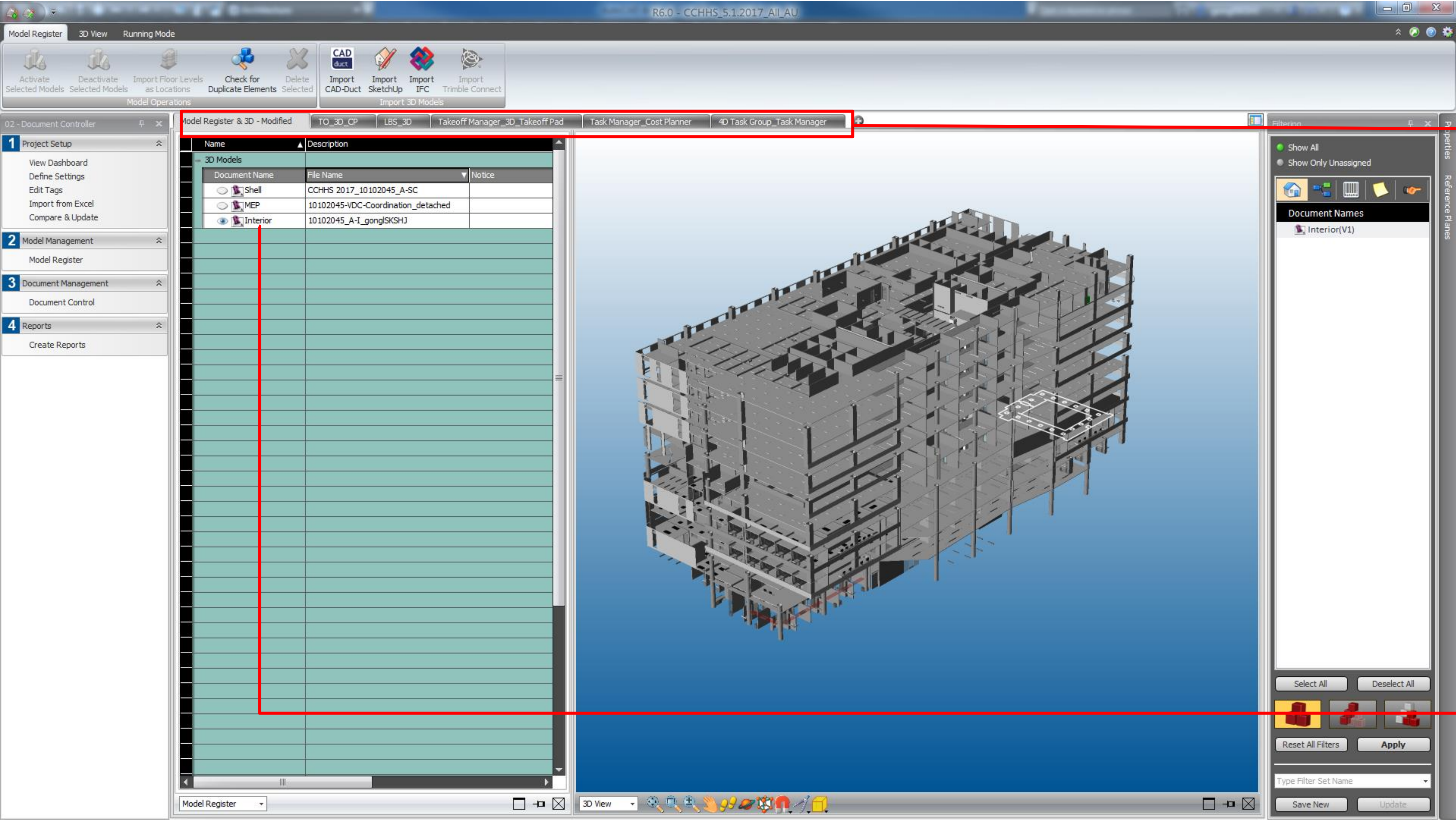
Browse

Customized combined window views

Project basic information



# 5D Top-down: Model Register



Suggested customized combined window views: Model Register\_3D, LBS Manager\_3D, Takeoff Manager\_3D View\_Cost Planner, Takeoff Manager\_3D View\_Takeoff Pad, Task Manager\_Cost Planner, 4D Task Group\_Task Manager.

Revit exported model (Shell, interior, MEP, etc. ) will be listed here. Select the model for takeoff and right click to activate. Only selected model will be shown in the 3D View.



# 5D Top-down: LBS (Location Based Schedule Manager)\_3D View Vertically

The divided zones in this module will facilitate categorizing the following takeoffs and scheduling based on locations.

1 Project Setup

View Dashboard

Define Settings

Edit Tags

Import from Excel

Define Key Figures

2 Content Management

Document Control

Takeoff Model

Takeoff Pad

Define Location Systems

Define Locations

3 Constructability

Manage Issues

Manage Layout Points

4 Cost Planning

Takeoff & Estimate

Define Targets

Estimate

Explore Cost

Define Work Packages

Manage Bids

WinEst

5 Schedule Planning

Manage Tasks

Schedule

4D Playback Settings

Explore 4D

6 Reporting & Data Mining

Create & Run Reports

Reference Estimates

Compare & Update

Project Settings

Model Register\_3D

LBS\_3D

TO 3D CP

Takeoff Manager\_3D\_Takeoff Pad

Task Manager\_Cost Planner

4D Task Group\_Task Manager

	1	2	3	4	Elevation	Cut	View Depth
Project					-160'	4'	0'
SUP					-160'	4'	0'
Penthouse					34'-6"	4'	0'
Level 9					18'-5 1/2"	4'	0'
Level 8					4'-11 1/2"	4'	0'
Level 7					-8'-6 1/2"	4'	0'
Level 6					-22'-1/2"	4'	0'
Level 5					-40'-1/2"	4'	0'
Level 4					-53'-6 1/2"	4'	0'
Level 3					-67'-1/2"	4'	0'
Level 2					-82'	4'	0'
Level 1					-100'-5"	4'	0'
Foundation					-160'	4'	0'

3D View

3D View

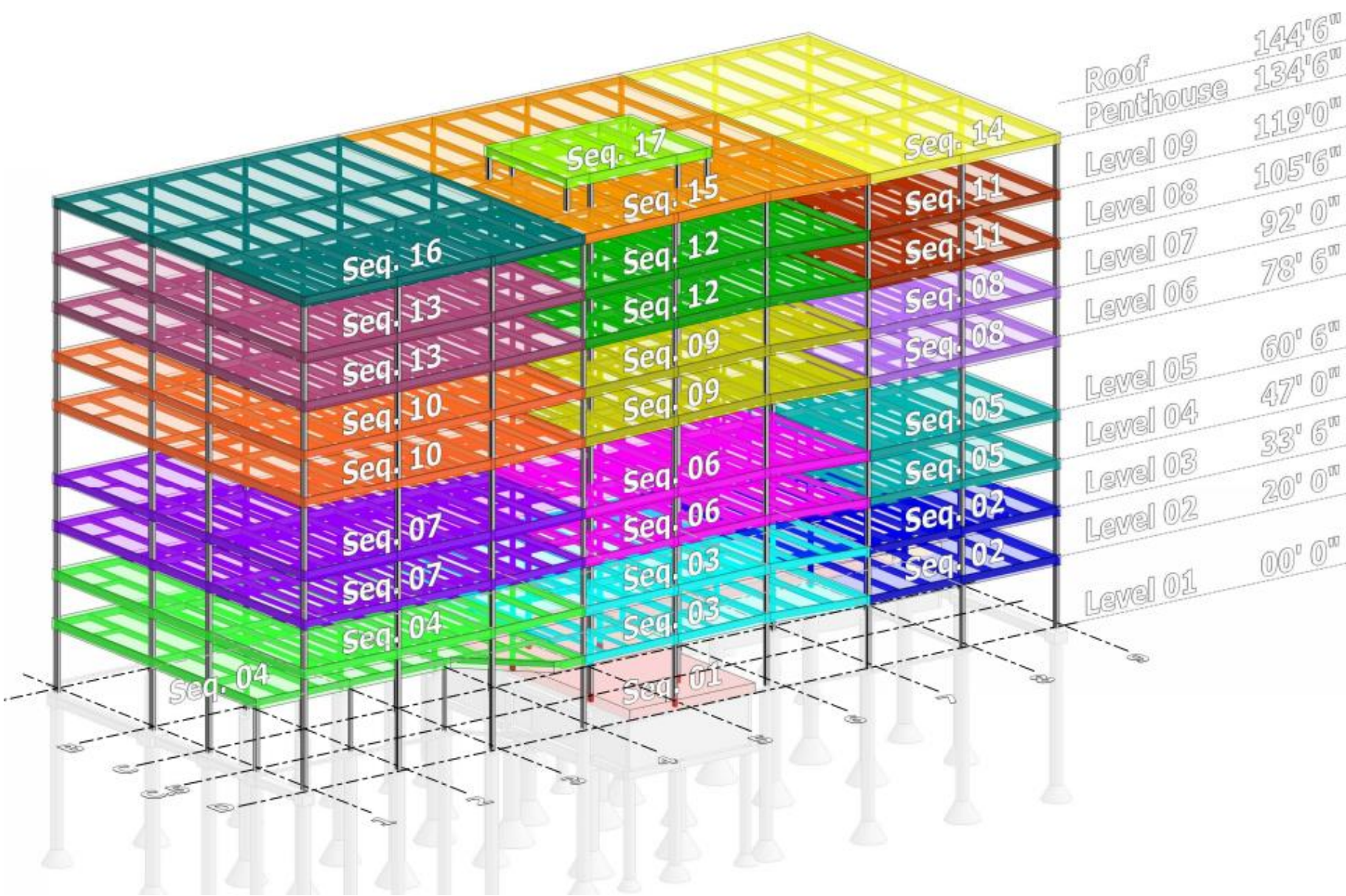
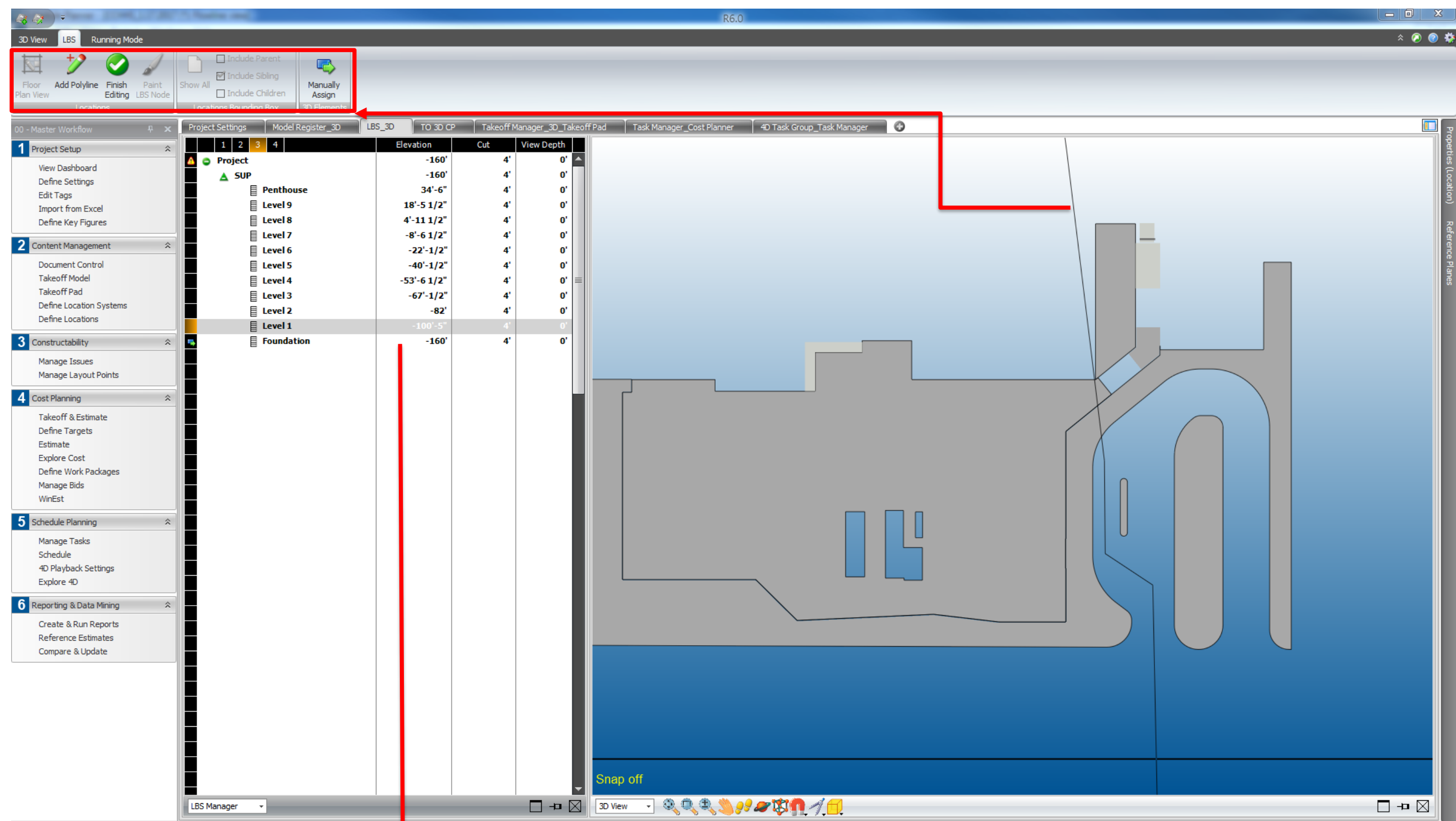
**Filtering:** filter the types to be shown exclusively in 3D view. Properties: click on object to see its quantities information

Right click on each level: 1) Define level Z value from 3D model 2) Manually assign 3D elements



# 5D Top-down: LBS (Location Based Schedule Manager)\_3D View Horizontally

The divided zones in this module will facilitate categorizing the following takeoffs and scheduling based on locations.



Right click on each level to access Floor Plan View.  
In Floor Plan View, Polylines can be drawn to divide  
zones based on project's needs.



## 5D Top-down: Takeoff Manager\_3D View\_Cost Planner

TOIs (Takeoff Items) are organized by **assembly codes** and **family and types**. That is why these two parameters must be exported from Revit.

The screenshot displays the Takeoff Manager software interface, which is used for construction cost estimation. The interface is divided into several sections:

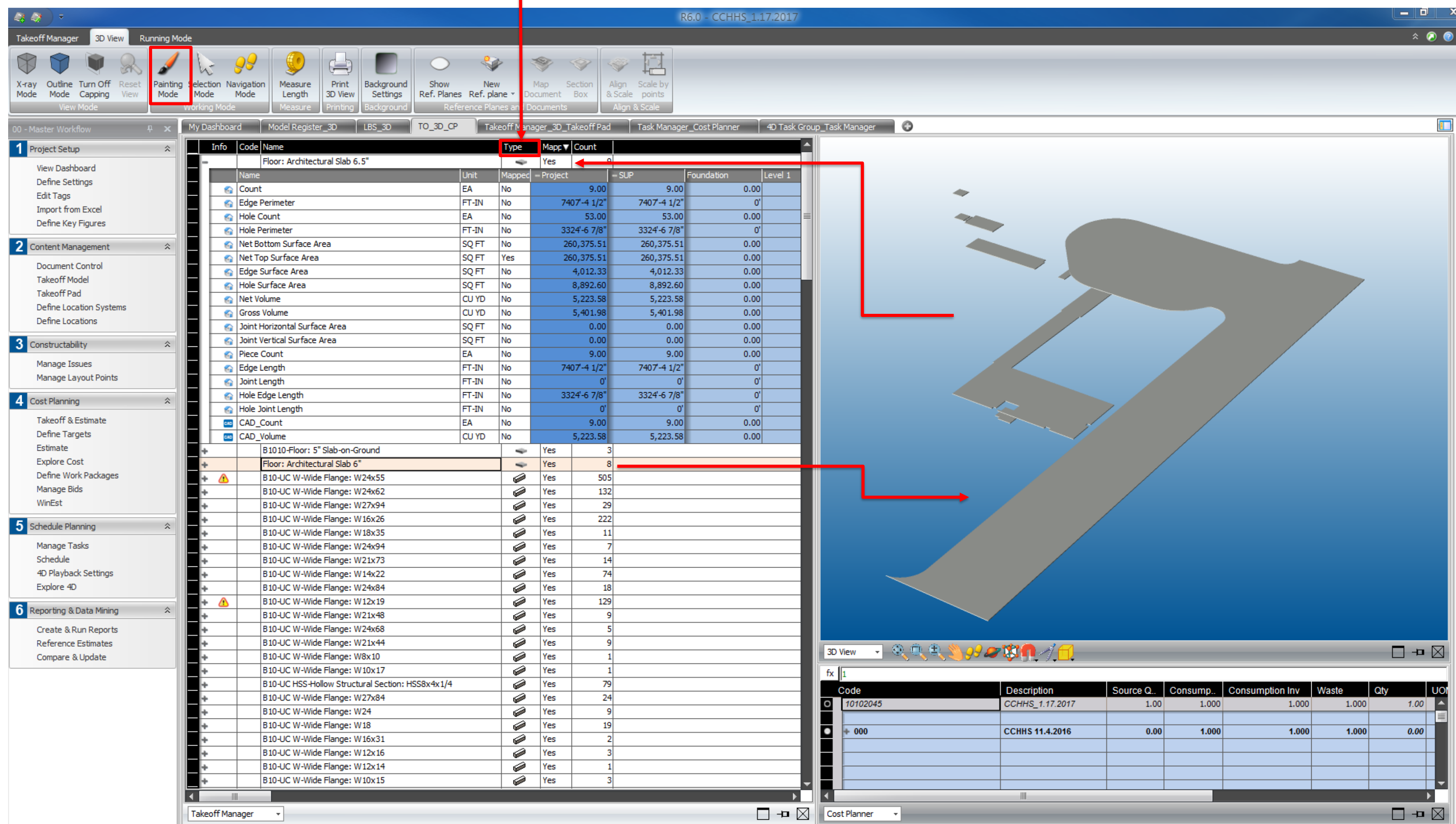
- Top Bar:** Shows the current project name "00 - Master Workflow" and the active tab "Takeoff Manager\_3D\_Takeoff Pad".
- Left Panel:** Contains a navigation menu with sections:
  - 1 Project Setup:** View Dashboard, Define Settings, Edit Tags, Import from Excel, Define Key Figures.
  - 2 Content Management:** Document Control, Takeoff Model, Takeoff Pad, Define Location Systems, Define Locations.
  - 3 Constructability:** Manage Issues, Manage Layout Points.
  - 4 Cost Planning:** Takeoff & Estimate, Define Targets, Estimate, Explore Cost, Define Work Packages, Manage Bids, WinEst.
  - 5 Schedule Planning:** Manage Tasks, Schedule, 4D Playback Settings, Explore 4D.
  - 6 Reporting & Data Mining:** Create & Run Reports, Reference Estimates, Compare & Update.
- Main View:**
  - Top Table:** A list of items with columns: Info, Code, Name, Type, Mapped, Count. It lists various construction items like "A1020130-Drilled Pier + Bell: TP54/156" and "B1080.10.50-Assembled Stair: B1080.10.50\_Steel\_Pan\_Stair Ch".
  - Bottom Table:** A detailed cost breakdown table with columns: Name, Unit, Mapped, = Project, = SUP, Foundation, Level 1. It includes rows for "Count", "Length", "Net Reference Side Surface Area", "Net Opposite Reference Side Surface Area", "Top Surface Area", "Bottom Surface Area", "Ends Surface Area", "Reference Side Opening Surface Area", "Opposite Reference Side Opening Surface Area", "Net Volume", "Gross Volume", "Joint Horizontal Surface Area", "Joint Vertical Surface Area", "Piece Count", "Piece Length", "CAD\_Count", "CAD\_Length", and "CAD\_Volume".
- Right Panel:**
  - 3D View:** A 3D model of a building structure, showing a pink wall and a blue roof.
  - Cost Planner:** A table showing cost data for a specific item (10102045) with columns: Code, Description, Source Q., Consump., Consumption Inv, Waste, Qty, UOM.

Red arrows indicate the flow of data from the 3D model to the item list and then to the cost breakdown table.

Quantity parameters are calculated under TOI. Data are divided by zones defined in previous LBS Manager. Click on Net Reference Surface Area, the corresponding area will be highlighted in pink in the 3D View.

## 5D Top-down: Takeoff Manager\_3D View\_Cost Planner

**TOIs types** include Beam Rectangular, Column Rectangular, Curtain Wall, Curtain Wall Frame, Curtain Wall Panel, Door, Equipment, Light Fixture, Object, Pipe Fitting, Railing, Roof, Slab, Stair, Wall and Window.



# Painting Mode

allows to allocate (add and deduct) the Takeoff Quantities to different Takeoff Items. New TOI can be created by right click in the Takeoff Manager.



# 5D Top-down: Takeoff Manager\_3D\_Takeoff Pad

Takeoff Pad is a breakdown of TOI in Takeoff Manager

1 Project Setup

View Dashboard

Define Settings

Edit Tags

Import from Excel

Define Key Figures

2 Content Management

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Takeoff Model

Takeoff Pad

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Define Locations

3 Constructability

Manage Issues

Manage Layout Points

4 Cost Planning

Takeoff & Estimate

Define Targets

Estimate

Explore Cost

Define Work Packages

Manage Bids

WinEst

5 Schedule Planning

Manage Tasks

Schedule

4D Playback Settings

Explore 4D

6 Reporting & Data Mining

Create & Run Reports

Reference Estimates

Compare & Update

Info

Code

Name

Type

Mapped

Count

B10-UC W-Wide Flange-Column: W 12x65

Yes

7

B10-UC W-Wide Flange-Column: W 12x79

Yes

3

B10-UC W-Wide Flange-Column: W 12x53

Yes

14

B10-UC W-Wide Flange-Column: W 12x40

Yes

3

B10-UC W-Wide Flange-Column: W 12x58

Yes

2

B10-UC W-Wide Flange-Column: W 18x130

Yes

8

B10-UC W-Wide Flange-Column: W 12x120

Yes

8

B10-UC W-Wide Flange-Column: W 12x87

Yes

12

B10-UC W-Wide Flange-Column: W 12x96

Yes

2

B10-UC W-Wide Flange-Column: W 14x159

Yes

1

B10-UC Concrete-Rectangular-Column: 48"x48"

Yes

1

B10-UC Concrete-Rectangular-Column: 39" x 39"

Yes

1

B10-UC HSS-Hollow Structural Section-Column: HSS10x10x5/8

Yes

6

B10-UC W-Wide Flange-Column: W 10x39

Yes

2

B10-UC Concrete-Rectangular-Column: 24"x24"

Yes

8

B10-W-Wide Flange-Column: W8x31

Yes

6

B10-UC HSS-Hollow Structural Section-Column: HSS5x5x5/16

Yes

1

B10-UC HSS-Hollow Structural Section-Column: HSS6x6x1/4

Yes

9

B10-UC HSS-Hollow Structural Section-Column: HSS8x8x5/16

Yes

3

B10-UC HSS-Hollow Structural Section-Column: HSS8x8x5/8

Yes

1

B10-UC HSS-Hollow Structural Section-Column: HSS4x4x1/4

Yes

3

Curtain Wall: Curtain Wall - SWS E

No

6

Curtain Wall: Curtain Wall - SWS F

No

6

Curtain Wall: Curtain Wall - SWS TBD

No

10

Curtain Wall: Curtain Wall - SWS B

No

3

Curtain Wall: Curtain Wall - Penthouse Louver

No

66

Curtain Wall: Curtain Wall - Penthouse

No

4

Curtain Wall: Curtain Wall - MP01

No

3

Curtain Wall: Curtain Wall - MP01 on CMU

No

1

Curtain Wall: Curtain Wall - SWS A'

No

3

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_44x84\_HM\_HM

Yes

3

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_36x84\_HM\_WD

Yes

370

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_36x84\_HM\_HM

Yes

34

C1030.10-DOOR\_F\_Double: C1030.10\_F02\_36x84\_HM\_WD

Yes

8

Name

Unit

Mapped

Project

= SUP

Four

Count

EA

Yes

8.00

8.00

Width

FT-IN

No

50'-8"

50'-8"

Height

FT-IN

No

57'-4"

57'-4"

Perimeter

FT-IN

No

216'

216'

Element Surface Area

SQ FT

No

363.11

363.11

CAD\_Count

EA

No

8.00

8.00

C1030.10-DOOR\_F\_Double: C1030.10\_F02\_36x84\_HM\_HM

Yes

8

C1020210-Revolving-StanleyRush-1500: 4 Panel

Yes

1

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_44x84\_HM\_WD

Yes

16

C1030.10-DOOR\_F\_Double: C1030.10\_F02\_44x102\_HM\_HM

Yes

1

A1020130-Drilled Pier + Bell: P48/132

Yes

3

3D View

Running Mode

New TOI

New TOI Component

New TOQ

Delete Selected

Linear

Area

Deduct

Get Perimeter

Count

Manage TO Pads

Apply Default Formula

Navigate

Quantify All

Quantify by Element type

Quantify Selected

Update Quantities

00 - Master Workflow

1 Project Setup

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3 Constructability

4 Cost Planning

5 Schedule Planning

6 Reporting & Data Mining

Reports

Model Register\_3D

LBS\_3D

TO\_3D\_CP

Takeoff Manager\_3D\_Takeoff Pad

Task Manager\_Cost Planner

4D Task Group\_Task Manager

Info

Code

Name

Pad Template

Count

Type

Curtain Wall: Curtain Wall - SWS E

Curtain Wall

3

Curtain Wall: Curtain Wall - SWS F

Curtain Wall

1

Curtain Wall: Curtain Wall - SWS TBD

Curtain Wall

3

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_44x84\_HM\_HM

Door

3

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_36x84\_HM\_WD

Door

370

C1030.10-DOOR\_F\_Single: C1030.10\_F01\_36x84\_HM\_HM

Door

34

C1030.10-DOOR\_F\_Double: C1030.10\_F02\_36x84\_HM\_WD

Door

8

Sho...

Info

Code

Description

Location

TimeStamp

Graphic

R...

Count

Width

Height

Pa

(3)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

(2)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

(4)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

(8)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

(1)

C1030.10-DOOR\_F\_Double...

Project; Fo...

3/23/2017 ...

1.00

6'-4"

7'-2"

(5)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

(6)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

(7)

C1030.10-DOOR\_F\_Double...

Project; Le...

3/23/2017 ...

1.00

6'-4"

7'-2"

Calculated Total

EA

8.00

FT-IN

50'-8"

FT-IN

57'-4"

C1030.10-DOOR\_F\_Double...

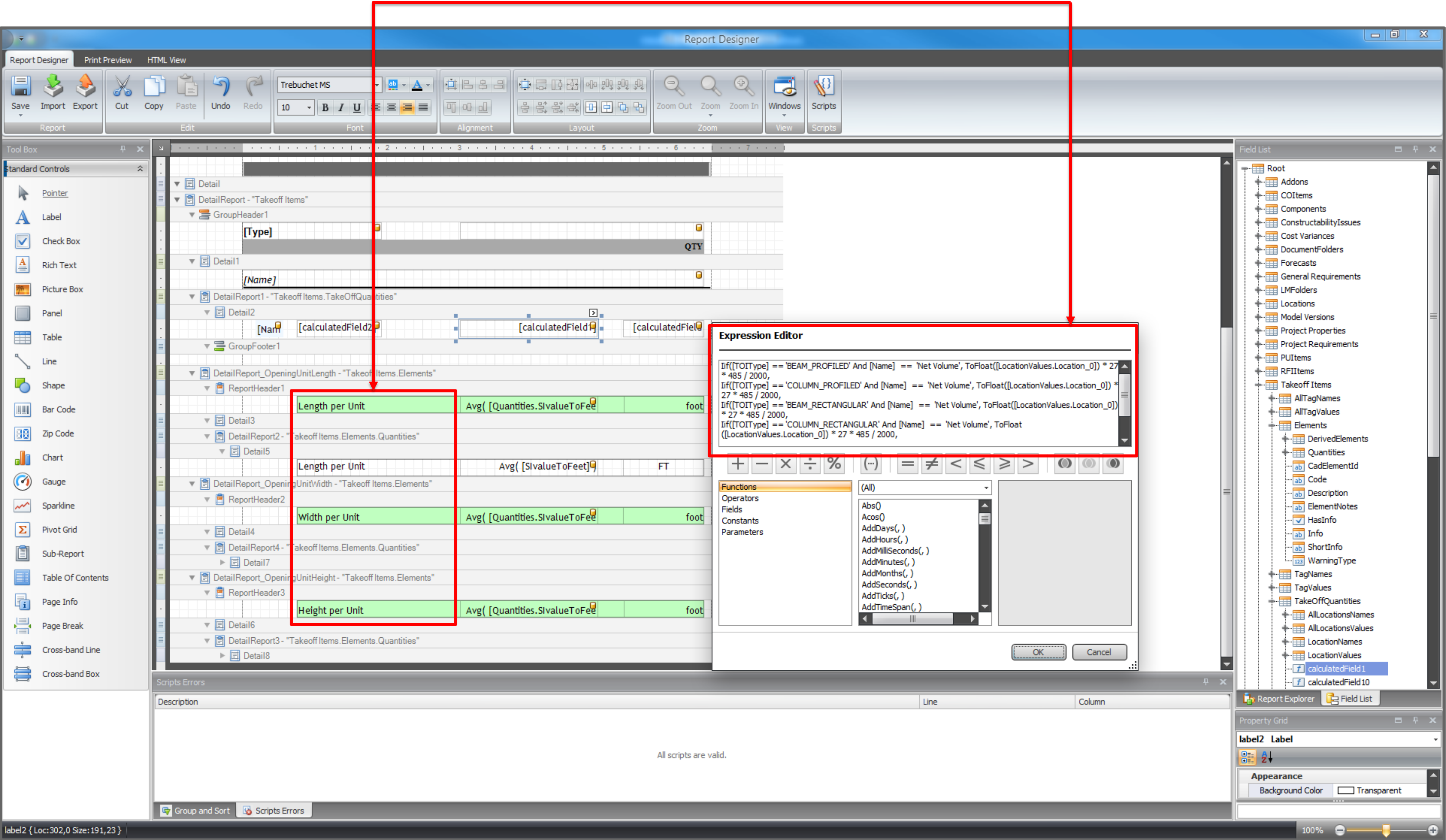
Door

8

Take the HM door TOI as an example, the total Width and Height in Takeoff Pad equals to the Width and Height in Takeoff Manager

# 5D Top-down: Creating Takeoff Report

Please see the attached customized Clayco quantity takeoff report template. Besides the TOQ in Takeoff Manager, customized TOQ can be created in Expression Editor.





5D Top-down: Creating Takeoff Report

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2		CCHHS Takeoffs											
3													
4													
5		Code 1	Code 2	Code 3	Code 4	Code 5	Code 6		Code 7		Description	Unit	Quantities
6		#1000									Alternatives		
147		C									INTERIORS		
148			C10								Interior Construction		
149				C1010							Fixed Partitions		
150					C1010.10						INTERIOR FIXED PARTITIONS		
151							C1010.10.50				METAL STUD FRAMING		
152									C1010.10.50.C3-C1010.10.C3_C3		METAL STUD FRAMING_C3	SQ FT	44,547.42
153									C1010.10.50.D4-C1010.10.D4_D4		METAL STUD FRAMING_D4	SQ FT	6,555.29
154									C1010.10.B3-Basic Wall: C1010.10.B3_B3		METAL STUD FRAMING_B3	FT-IN	1,289.87
155									C1010.10.B6-Basic Wall: C1010.10.B2_B6		METAL STUD FRAMING_B6	SQ FT	1,969.32
156									C1010.10.50.F4-C1010.10.F4_F4		METAL STUD FRAMING_F4	SQ FT	49,076.60
157									C1010.10.50.A2-C1010.10.A2_A2		METAL STUD FRAMING_A2	SQ FT	1,654.24
158									C1010.10.50.A2-Basic Wall: Exterior Column		Column Wrap	SQ FT	1,440.04
159									C1010.10.50.A1-Exterior Knee Wall		FURRING STUD	SQ FT	1,909.69
160									C1010.10.A3-Basic Wall: Column Cover Walls		FURRING STUD	SQ FT	298.09
161								C1010.10.J8			CMU		
162									C1010.10.J8-C1010.10.J8_J8		CMU_J8	SQ FT	6,480.75
163				C1030							INTERIOR DOORS		
164					C1030.10						INTERIOR SWING DOORS		
165								C1030.10-C1030.10_F01_44x84_HM_HM			SWING DOOR_44x84_HM_HM	EA	3.00
166								C1030.10-C1030.10_F01_36x84_HM_HM			SWING DOOR_36x84_HM_HM	EA	6.00
167								C1030.10-C1030.10_F02_36x84_HM_HM			SWING DOOR_36x84_HM_HM	EA	34.00
168								C1030.10-C1030.10_F01_36x84_HM_WD			SWING DOOR_36x84_HM_WD	EA	12.00
169								C1020210-4 Panel			REVOLVER	EA	1.00
170								C1030.10-C1030.10_F02_44x102_HM_HM			SWING DOOR_44x102_HM_HM	EA	1.00

# 5D Top-down: Takeoff Manager\_3D View\_Cost Planner

1 Project Setup

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Takeoff Model

Takeoff Pad

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WinEst

5 Schedule Planning

Manage Tasks

Schedule

4D Playback Settings

Explore 4D

6 Reporting & Data Mining

Create & Run Reports

Reference Estimates

Compare & Update

Info	Code	Name	Type	Mapped to	Count
		Floor: Architectural Slab 6.5"		Yes	9
		B1010-Floor: 5" Slab-on-Ground		Yes	3
		Count	EA	No	3.00
		Edge Perimeter	FT-IN	No	3094'-3/16"
		Hole Count	EA	No	5.00
		Hole Perimeter	FT-IN	No	230'-4 9/16"
		Net Bottom Surface Area	SQ FT	No	48,765.39
		Net Top Surface Area	SQ FT	Yes	48,535.18
		Edge Surface Area	SQ FT	No	1,280.28
		Hole Surface Area	SQ FT	No	1,325.40
		Net Volume	CU YD	No	748.04
		Gross Volume	CU YD	No	762.79
		Joint Horizontal Surface Area	SQ FT	No	0.00
		Joint Vertical Surface Area	SQ FT	No	0.00
		Piece Count	EA	No	3.00
		Edge Length	FT-IN	No	3094'-3/16"
		Joint Length	FT-IN	No	0'
		Hole Edge Length	FT-IN	No	230'-4 9/16"
		Hole Joint Length	FT-IN	No	0'
		CAD_Count	EA	No	3.00
		CAD_Volume	CU YD	No	747.47
		Floor: Architectural Slab 6"		Yes	8
		B10-UC W-Wide Flange: W24x55		Yes	505
		B10-UC W-Wide Flange: W24x62		Yes	132
		B10-UC W-Wide Flange: W27x94		Yes	29
		B10-UC W-Wide Flange: W16x26		Yes	222
		B10-UC W-Wide Flange: W18x35		Yes	11
		B10-UC W-Wide Flange: W24x94		Yes	7
		B10-UC W-Wide Flange: W21x73		Yes	14
		B10-UC W-Wide Flange: W14x22		Yes	74
		B10-UC W-Wide Flange: W24x84		Yes	18
		B10-UC W-Wide Flange: W12x19		Yes	129
		B10-UC W-Wide Flange: W21x48		Yes	9
		B10-UC W-Wide Flange: W21x44		Yes	9
		B10-UC W-Wide Flange: W8x10		Yes	1
		B10-UC W-Wide Flange: W10x17		Yes	1
		B10-UC HSS-Hollow Structural Section: HSS8x4x1/4		Yes	79
		B10-UC W-Wide Flange: W27x84		Yes	24
		B10-UC W-Wide Flange: W24		Yes	9
		B10-UC W-Wide Flange: W18		Yes	19
		B10-UC W-Wide Flange: W16x31		Yes	2
		B10-UC W-Wide Flange: W12x16		Yes	3
		B10-UC W-Wide Flange: W12x14		Yes	1
		B10-UC W-Wide Flange: W10x15		Yes	3

FormulaEditor

Associated Location System: SUP

Code	Desc..	Value	Unit
B10-UC W-Wide Flange: W...			
B10-UC W-Wide Flange: W...			
B10-UC W-Wide Flange: W...			

Enter formula

$$B1010-Floor: 5" Slab-on-Ground.Net Top Surface Area$$

Preview

B1010-Floor: 5" Slab-on-Ground Net Top Surface Area

48,535.18

Evaluated

Functions

AVERAGE

COUNT

MAX

Standard

Math

Logical

Description

Syntax

Hide Functions

OK

Cancel

Code	Description	Source Qty	Consump...	Consumption Inv	Waste	Qty	UOM	Unit Cost	Base Cos
10102045	CCHHS_1.17.2017	1.00	1.000	1.000	1.000	1.00		0.00	
000	CCHHS 11.4.2016	0.00	1.000	1.000	1.000	0.00	Unit	0.00	39
A	DESCRIPTION	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	691
A10	FOUNDATIONS	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	691
A1030	SLAB ON GRADE	0.00	1.000	1.000	1.000	0.00	-	0.00	616
A1030.10	SLAB ON GRADE	0.00	1.000	1.000	1.000	0.00	-	0.00	616
A1030.10.10	SLAB ON GRADE	0.00	1.000	1.000	1.000	0.00	-	0.00	616
A1030.10.10_Floor: 5"	GROUND SLAB	48,535.18	1.000	1.000	1.000	48,535.18	SQ FT	7.20	349
0013.1	Form/Reinforce/Pour	48,535.18	1.000	1.000	1.200	58,242.21	SQ FT	6.00	349
A1030.10.10_Floor:	GROUND SLAB	37,111.23	1.000	1.000	1.000	37,111.23	SQ FT	7.20	267
A1010	STANDARD	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	59
A1020	SPECIAL FOUNDATIONS	0.00	1.000	1.000	1.000	0.00	-	0.00	15
B	SHELL	0.00	1.000	1.000	1.000	0.00	-	0.00	33
B10	SUPER STRUCTURE	0.00	1.000	1.000	1.000	0.00	-	0.00	12
B1010	FLOOR CONSTRUCTION	0.00	1.000	1.000	1.000	0.00	-	0.00	12
B1010.10	FLOOR STRUCTURAL	0.00	1.000	1.000	1.000	0.00	EA	0.00	10
B1010.10.10	STRUCTURAL COLUMNS	0.00	1.000	1.000	1.000	0.00	EA	0.00	2

Map TOIs from Takeoff Manager to Cost Planner by dragging the TOQ and dropping to the Source Qty. The mapping routine will be shown in the formulas under Source Qty.

The estimates structure in Cost Planner is organized by **Assembly codes** in Uniformat Elemental Classification. Attached please find the Uniformat file.



# 5D Top-down: Task Manager\_Cost Planner

Task Manager provides the interface for defining Tasks and for mapping cost assemblies and components (labor, material, and equipment) to these Tasks using drag-and-drop.

Task Manager

Cost Planner

New Task

New Summary Task

Insert Copied Tasks

Promote Task

Demote Task

Delete Selected

Selected Only

Unassign Selected

Task Driver Settings

Show Mapped

Timing

Production Planning

Quantities

Default Mode

Sort

Navigate

00 - Master Workflow

Reports

Model Register\_3D

LBS\_3D

TO\_3D\_CP

Takeoff Manager\_3D\_Takeoff Pad

Task Manager\_Cost Planner

4D Task Group\_Task Manager

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WinEst

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Explore 4D

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Compare & Update

Code	Name	Work				
A 1020.10	DRIVEN PILES					
A 1010.10	WALL FOUNDATIONS	52.38				
B 1010.10.10	STRUCTURAL COLUMNS	218.80				
B 1010.10.20	STRUCTURAL BEAMS	605.60				
B 1010.10.50	STAIRS	691.87				
B 2010.20.10	EXTERIOR WALL	582.98				
B 2010.30.10	EXTERIOR WINDOWS	1,606.14				
B 2010.30.20	EXTERIOR WINDOWS_System Panels	1,464.53				
C 1010.10.50	INTERIOR PARTITIONS	1,954.76				
C 1030.10.10	INTERIOR SWING DOORS	883.00				
Code Description Qty UOM Hrs/UOM UOM/Hr Work						
C 1030.10-C1030.10_F01_44x84_HM_HM	SWING DOOR_44x84_HM_HM	3.00	EA			
C 1030.10-C1030.10_F01_36x84_HM_HM	SWING DOOR_36x84_HM_HM	8.00	EA			
C 1030.10-C1030.10_F02_36x84_HM_HM	SWING DOOR_36x84_HM_HM	34.00	EA			
C 1030.10-C1030.10_F01_36x84_HM_WD	SWING DOOR_36x84_HM_WD	378.00	EA			
C 1020210-4 Panel	REVOLVER	1.00	EA			
C 1030.10-C1030.10_F02_44x102_HM_HM	SWING DOOR_44x102_HM_HM	1.00	EA			
C 1030.10-C1030.10_F01_44x84_HM_WD	SWING DOOR_30x120_HM_HM	16.00	EA			
0012.1	Install hollow metal door	32.00	HR	1.00	1.00	32.00
0012.2	Hollow metal door material	16.00	EA			
A 1030.10.10	SLAB ON GRADE					97.64
B 1010.20.10	FLOOR SLABS					259.72
Code Description Qty UOM Hrs/UOM UOM/Hr Work						
B 1010.20.10_Floor: Architectural Slab 6.5"	Cast-In-Place	260,375.51	SQ FT			
0014.1	Cast-In-Place Concrete_Subcontractor	273,394.28	SQ FT	0.00	1,052.63	259.72

Code	Description	Source..	Consumption	Cons..	Waste	Qty	UOM	Unit ..	Base Cost
10102045	CCHHS_1.17.2017	1.00	1.000	1.000	1.000	1.00		0.00	0.00
Code, 1 Description 0.00 1.000 1.000 1.000 0.00 Unit 0.00 0.00									
A	SUBSTRUCTURE	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	691,490....
B	SHELL	0.00	1.000	1.000	1.000	0.00	-	0.00	33,886,3...
B10	SUPER STRUCTURE	0.00	1.000	1.000	1.000	0.00	-	0.00	12,624,...
B1010	FLOOR CONSTRUCTION	0.00	1.000	1.000	1.000	0.00	-	0.00	12,303,9...
B1010.10	FLOOR STRUCTURAL FRAME	0.00	1.000	1.000	1.000	0.00	EA	0.00	10,663,6...
B1010.20	FLOOR SLABS	0.00	1.000	1.000	1.000	0.00	-	0.00	1,640,36...
B1010.20.10	Cast-In-Place	0.00	1.000	1.000	1.000	0.00	-	0.00	1,640,36...
B1010.20.10_Floor: Architectural Slab 0014.1	Cast-In-Place	260,375.51	1.000	1.000	1.050	273.39...	SQ FT	6.00	1,640,365.69
B1080	Stairs	0.00	1.000	1.000	1.000	0.00	-	0.00	320,773...
B20	EXTERIOR VERTICAL	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	21,261,...
B2010	EXTERIOR WALLS	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	495,534...
B2010.20	EXTERIOR WALL	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	495,534...
B2020	EXTERIOR WINDOWS	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	20,766,...
B2020.30	EXTERIOR WINDOW WALL	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	20,766,...
C	INTERIORS	0.00	1.000	1.000	1.000	0.00	-	0.00	4,459,2...
C10	Interior Construction	0.00	1.000	1.000	1.000	0.00	-	0.00	4,459,2...
C1010	Fixed Partitions	0.00	1.000	1.000	1.000	0.00	-	0.00	4,194,33...
C1030	INTERIOR DOORS	0.00	1.000	1.000	1.000	0.00	EA	0.00	264,960...
C1030.10	INTERIOR SWING DOORS	0.00	1.000	1.000	1.000	0.00	EA	0.00	264,960...
C1030.10-C1030.10_F01_44x84_HM_HM	SWING DOOR_44x84_HM_HM	3.00	1.000	1.000	1.000	3.00	EA	590.00	1,770.00
C1030.10-C1030.10_F01_36x84_HM_HM	SWING DOOR_36x84_HM_HM	8.00	1.000	1.000	1.000	8.00	EA	590.00	4,720.00
C1030.10-C1030.10_F02_36x84_HM_HM	SWING DOOR_36x84_HM_HM	34.00	1.000	1.000	1.000	34.00	EA	590.00	20,060.00
C1030.10-C1030.10_F01_36x84_HM_WD	SWING DOOR_36x84_HM_WD	378.00	1.000	1.000	1.000	378.00	EA	590.00	223,020...
C1020210-4 Panel	REVOLVER	1.00	1.000	1.000	1.000	1.00	EA	5,360.00	5,360.00
C1030.10-C1030.10_F02_44x102_HM_HM	SWING	1.00	1.000	1.000	1.000	1.00	EA	590.00	590.00
C1030.10-C1030.10_F01_44x84_HM_WD	SWING	16.00	1.000	1.000	1.000	16.00	EA	590.00	9,440.00
0012.1	Install hollow metal door	16.00	2.000	0.500	1.000	32.00	HR	120.00	3,840.00
0012.2	Hollow metal door material	16.00	1.000	1.000	1.000	16.00	EA	350.00	5,600.00

Tasks can be added by  
1) a single task by subcontractor Or  
2) self-performing labor work and material supplied

Task Drivers  
are defined by adding hours/unit (consumption rate) or units/hour to cost component

# 5D Top-down: 4D Task Group\_Task Manager

4D Task Group allows to create a movie for different task groups. Map the tasks from Task Manager to 4D Task Group by dragging and dropping under each subcontracting category. Pick the colors to represent each of the major task categories for that Sub.

4D Task Groups

New 4D Group Set

Manage 4D Group Sets

Add 4D Group

Delete Selected

Unassign Selected

Show Mapped

4D Group Sets

Mapping

00 - Master Workflow

1 Project Setup

View Dashboard

Define Settings

Edit Tags

Import from Excel

Define Key Figures

2 Content Management

Document Control

Takeoff Model

Takeoff Pad

Define Location Systems

Define Locations

3 Constructability

Manage Issues

Manage Layout Points

4 Cost Planning

Takeoff & Estimate

Define Targets

Estimate

Explore Cost

Define Work Packages

Manage Bids

WinEst

5 Schedule Planning

Manage Tasks

Schedule

4D Playback Settings

Explore 4D

6 Reporting & Data Mining

Create & Run Reports

Reference Estimates

Compare & Update

Reports

Model Register\_3D

LBS\_3D

TO\_3D\_CP

Takeoff Manager\_3D\_Takeoff Pad

Task Manager\_Cost Planner

4D Task Group\_Task Manager

Code	Name	Behavior	Color	Transparency
Foundation		Build		0%
A 1020.10	DRIVEN PILES			
0001	Excavate pile caps			
0002	Anchor pile caps			
0003	Sheet piling			
A 1010.10	WALL FOUNDATIONS			
Structural steels		Build		0%
B 1010.10.10	STRUCTURAL COLUMNS			
B 1010.10.20	STRUCTURAL BEAMS			
Exterior facade		Build		00%
B 2010.20.10	EXTERIOR WALL			
B 2010.30.10	EXTERIOR WINDOWS			
B 2010.30.20	EXTERIOR WINDOWS_System Panels			
Concrete slabs		Build		0%
A 1030.10.10	SLAB ON GRADE			
B 1010.20.10	FLOOR SLABS			
Interior		Build		0%
B 1010.10.50	STAIRS			
C 1010.10.50	INTERIOR PARTITIONS			
C 1030.10.10	INTERIOR SWING DOORS			

4D Task Groups Group Set Building Simulation

Code	Name	Work	Duration	Location System
A 1020.10	DRIVEN PILES		30.38	SUP
0001	Excavate pile caps	48.60	6.08	SUP
0002	Anchor pile caps	97.20	12.15	SUP
0003	Sheet piling	97.20	12.15	SUP
A 1010.10	WALL FOUNDATIONS	52.38	6.55	SUP
B 1010.10.10	STRUCTURAL COLUMNS	218.80	27.35	SUP
B 1010.10.20	STRUCTURAL BEAMS	605.60	75.70	SUP
B 1010.10.50	STAIRS	691.87	86.48	SUP
B 2010.20.10	EXTERIOR WALL	582.98	64.06	SUP
B 2010.30.10	EXTERIOR WINDOWS	1,606.14	180.31	SUP
B 2010.30.20	EXTERIOR WINDOWS_System Panels	1,104.53	158.59	SUP
C 1010.10.50	INTERIOR PARTITIONS	1,954.76	244.34	SUP
C 1030.10.10	INTERIOR SWING DOORS	883.00	110.00	SUP
A 1030.10.10	SLAB ON GRADE	97.64	6.10	SUP
B 1010.20.10	FLOOR SLABS	259.72	32.47	SUP

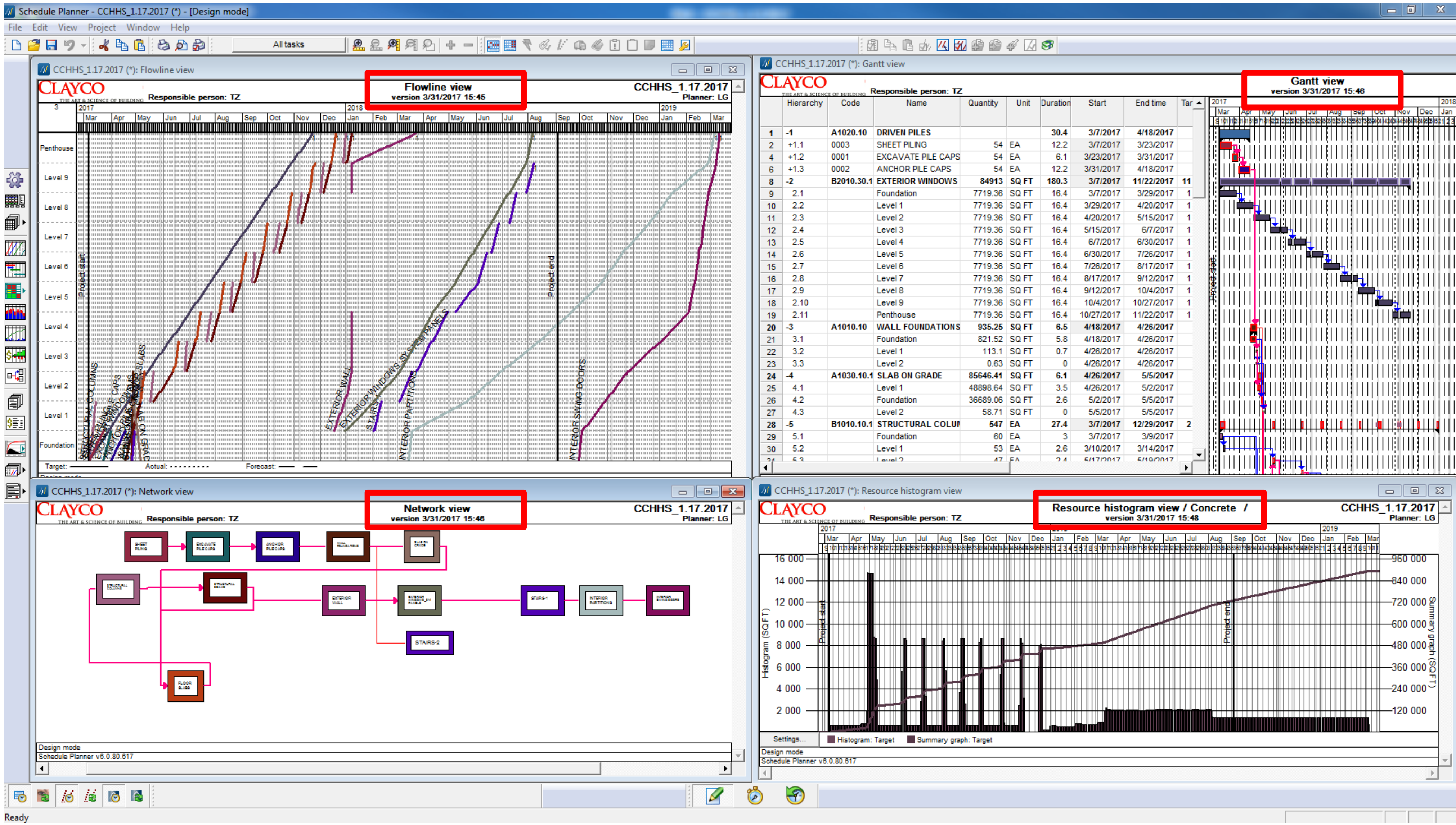
Task Manager

Define colors to present different tasks in the following 4D schedule simulation.



# 5D Top-down: Schedule Planner

Views to define task sequence: Network View → Flowline View → Gantt View → Resource View







THE ART & SCIENCE OF BUILDING

## 5D Bottom-up

100 Kingshighway will be a 36-story, luxury apartment tower overlooking Forest Park.

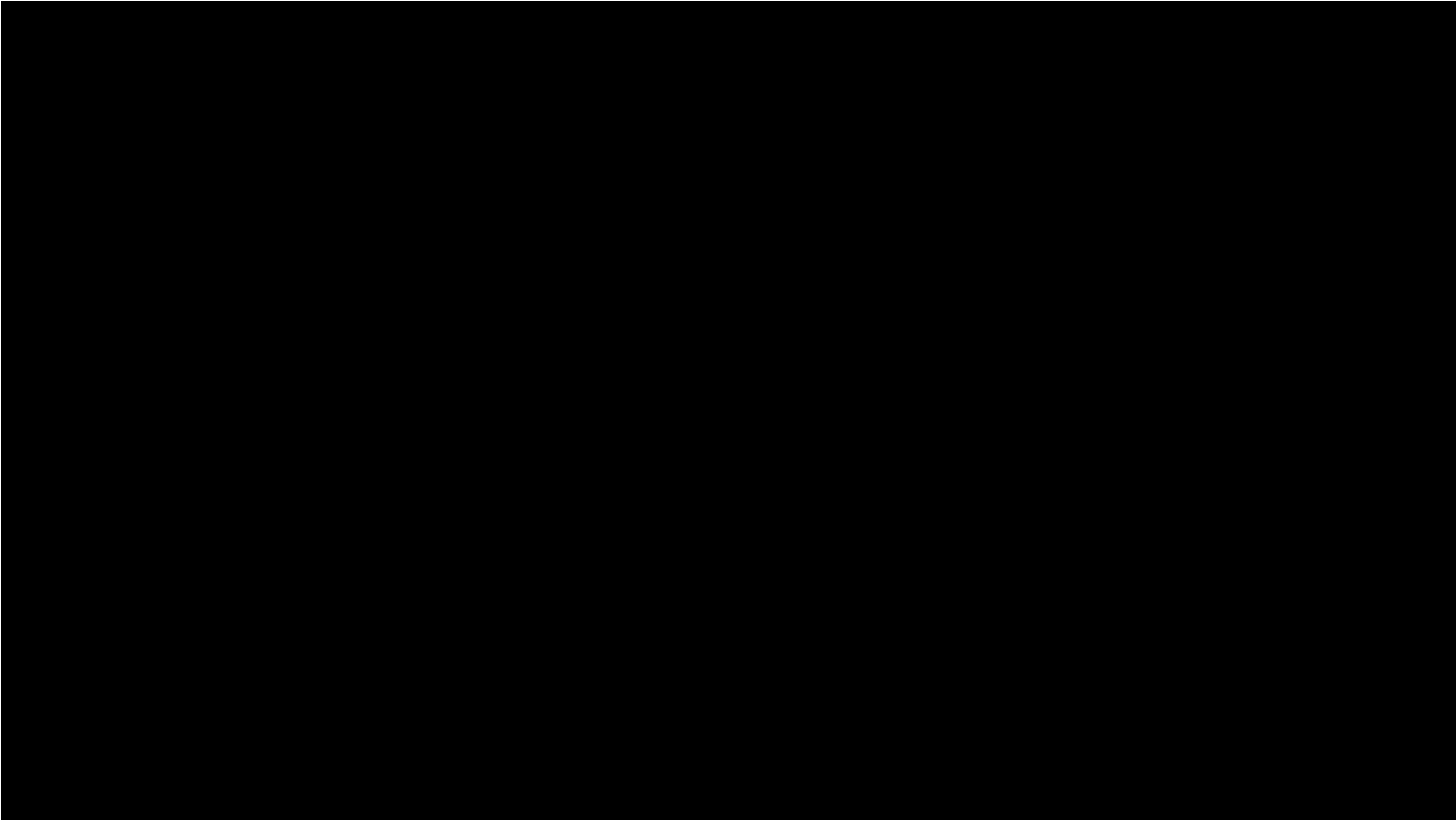
Once complete, tower will be tallest residential building in the city of St. Louis. Along with the building's size, another striking feature will be the project's incredible modernist exterior, designed by Studio Gang. The large expanses of glass facade are intended to give the building's residents a range of natural lighting and sweeping views of the park and city. Clayco's subsidiary, Ventana was selected to design, manufacture, and install the exterior window systems.

The base of the tower will be a mix of retail space, apartment amenity space, and parking. The parking garage will have a 185-vehicle capacity. Concrete Strategies is providing the reinforced concrete structure. The tower itself will contain 316 apartment units. The project broke ground in the Spring of 2018.



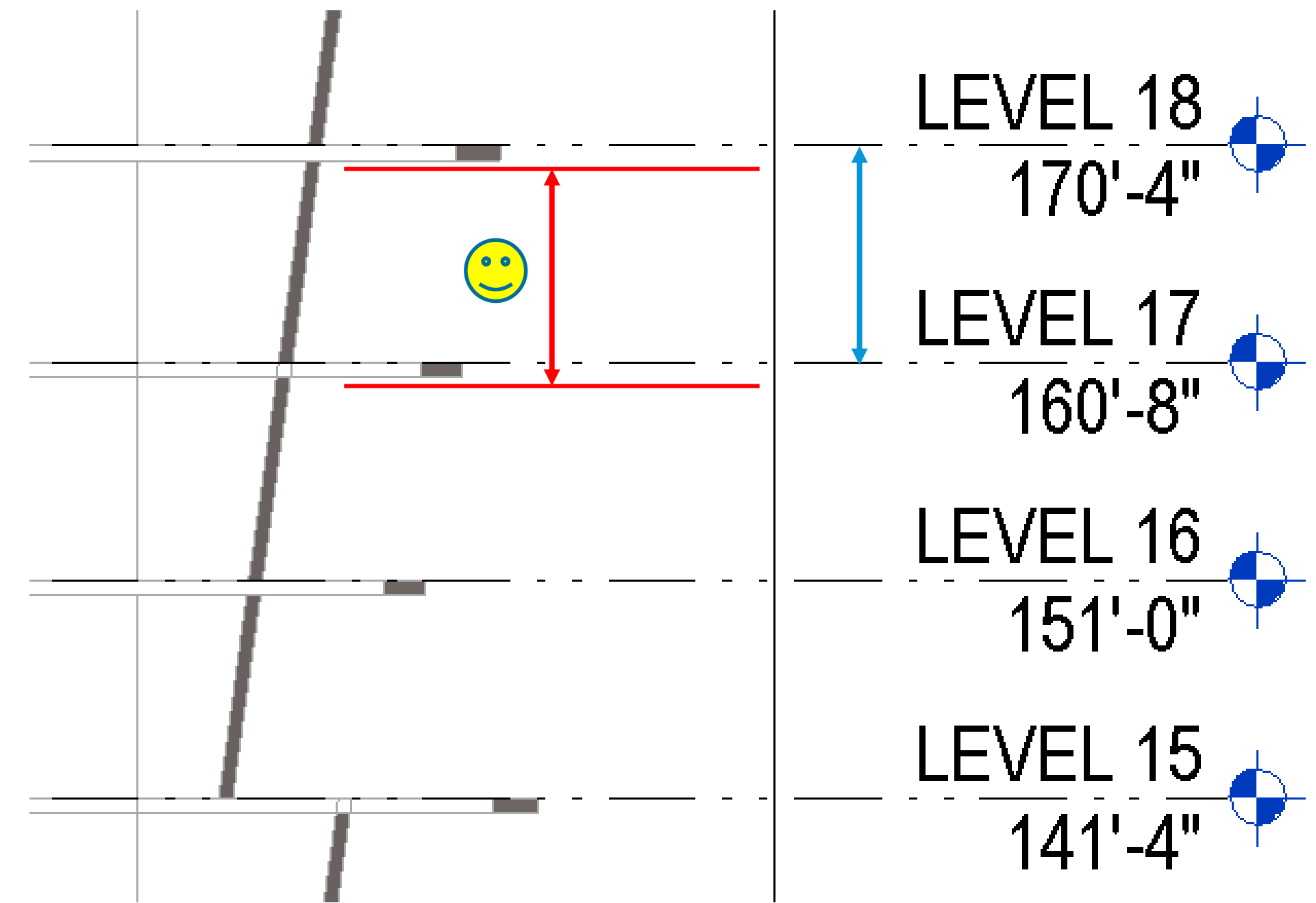
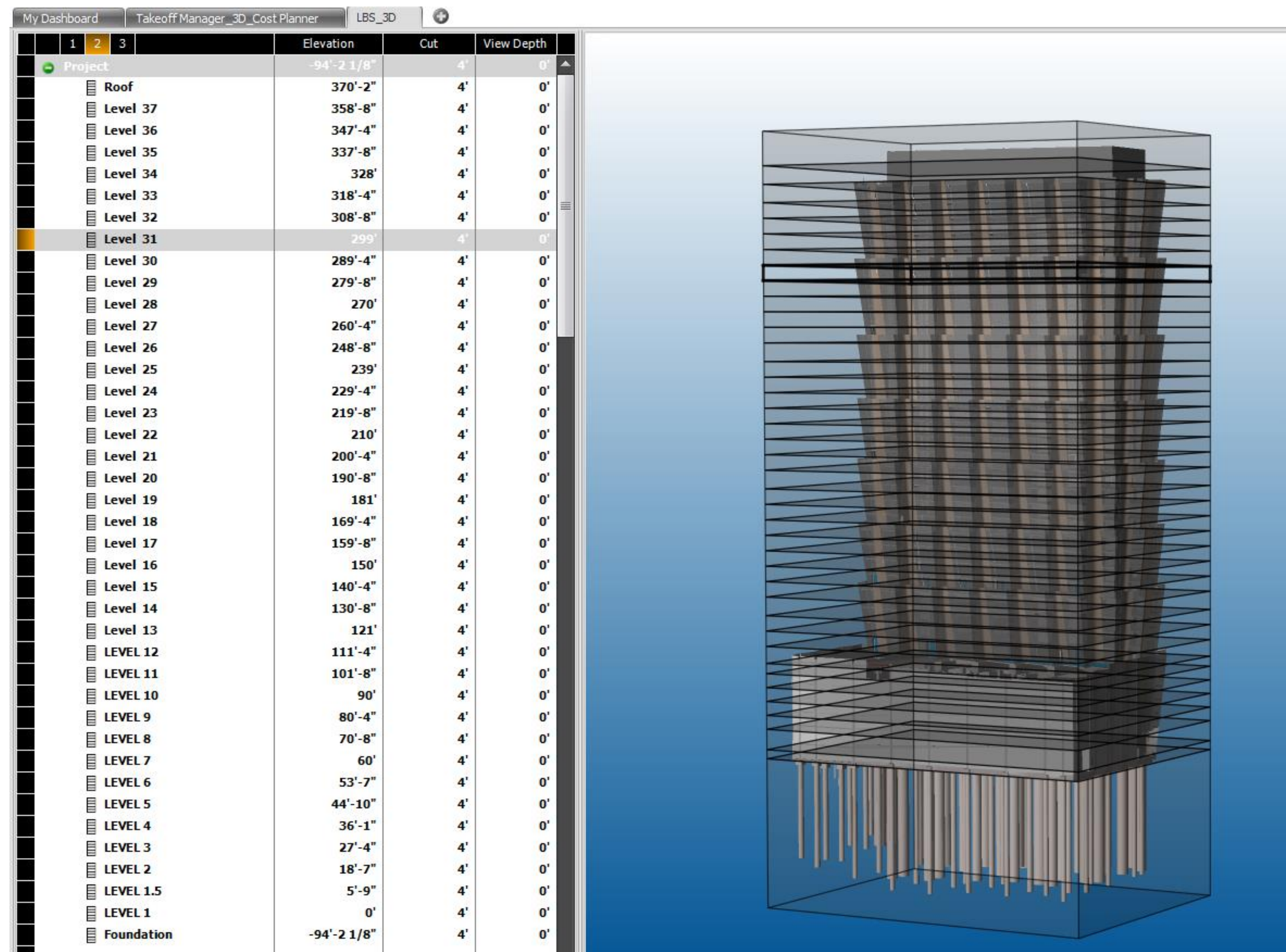


5D **Bottom-up:** Workflow\_Explore 5D



See attached video

# 5D Bottom-up: LBS Slicing Floors





# 5D Bottom-up: Takeoffs and Costs

Takeoff Manager

3D View

Cost Planner

Running Mode

New TOI

New TOQ

Add

Inline Note

Restore Quantities

Delete Selected

Takeoff Items

Default Mode

Navigate

TOI Builder

Quantify All

Quantify by Element type

Quantify Selected

Update Quantities

Quantification

00 - Master Workflow

My Dashboard

Takeoff Manager\_3D\_Cost Planner

1 Project Setup

2 Content Management

3 Constructability

4 Cost Planning

5 Schedule Planning

6 Reporting & Data Mining

Info	Code	Name	Type	Mapped	Count
+		B10-Concrete Rectangular Beam (MKA): PTB2		Yes	2
+		B10-Concrete Rectangular Beam (MKA): B2		Yes	4
+		B10-Concrete Rectangular Beam (MKA): PTB3		Yes	2
+		B10-Concrete Rectangular Beam (MKA): PTB4		Yes	1
+		B10-Concrete Rectangular Beam (MKA): PTB5		Yes	1
+		B10-Concrete Rectangular Beam (MKA): PTB1		Yes	1
+		B10-Concrete Rectangular Beam (MKA): B3		Yes	2
+		B10-HSS-Hollow Structural Section (MKA): HSS6x6x1/2		Yes	39
+		B10-Concrete Rectangular Beam (MKA): B1		Yes	2
+		B10-Concrete Rectangular Beam (MKA): B5		Yes	1
+		B10-Concrete Rectangular Beam (MKA): B4		Yes	1
+		B10-HSS-Hollow Structural Section (MKA): ESB (HSS6x4x1/4)		Yes	123
+		B10-Concrete Rectangular Beam (MKA): B7		Yes	1
+		B10-HSS-Hollow Structural Section (MKA): HSS6x4x1/2 (Flat)		Yes	2
+		B10-HSS-Hollow Structural Section (MKA): HSS10x6x1/2		Yes	1
+		B10-LL-Double Angle (MKA): 2L4x4x1/2		Yes	5
+		B10-HSS-Hollow Structural Section (MKA): HSS9x7x5/8 (FLAT)		Yes	4
+		B10-Concrete Rectangular Beam (MKA): B6		Yes	2
+		B10-HSS-Hollow Structural Section (MKA): HSS8x6x5/16 (FLAT)		Yes	6
+		B10-HSS-Hollow Structural Section (MKA): HSS6x4x1/4		Yes	66
+		B10-HSS-Hollow Structural Section (MKA): HSS8x6x1/2 (FLAT)		Yes	48
+		B10-HSS-Hollow Structural Section (MKA): HSS16x4x1/2 (FLAT)		Yes	6
+		B10-W-Wide Flange (MKA): W18x65		Yes	6
+		B10-HSS-Hollow Structural Section (MKA): HSS10x6x5/8 (FLAT)		Yes	10
+		B10-HSS-Hollow Structural Section (MKA): HSS8x8x5/8		Yes	10
+		B10-HSS-Hollow Structural Section (MKA): HSS10x8x5/8		Yes	2
+		B10-Concrete-Rectangular-Column (MKA): C16 - 24x24		Yes	3
+		B10-Concrete-Rectangular-Column (MKA): C15 - 18x18		Yes	24
+		B10-Concrete-Rectangular-Column (MKA): C12 - 24x36		Yes	6
+		B10-Concrete-Rectangular-Column (MKA): C11 - 30x42		Yes	3
+		B10-Concrete-Tapered_Angle Driven Custom: C4 - 18x54 - 81.45 deg		Yes	4
+		B10-Concrete-Tapered_Angle Driven Custom: C4 - 18x48 - 81.45 deg		Yes	16
+		B10-Concrete-Tapered_Angle Driven Custom: C4 - 18x48 - 81.3 deg		Yes	8
+		B10-Concrete-Tapered_Angle Driven Custom: C5 - 18x54 - 81.45 deg		Yes	5
+		B10-Concrete-Tapered_Angle Driven Custom: C5 - 18x48 - 81.45 deg		Yes	20
+		B10-Concrete-Tapered_Angle Driven Custom: C5 - 18x48 - 81.3 deg		Yes	10
+		B10-Concrete-Rectangular-Column (MKA): C11 - 30x36		Yes	2
+		B10-Concrete-Rectangular-Column (MKA): C11 - 24x30		Yes	2
+		B10-Concrete-Rectangular-Column (MKA): C11 - 24x24		Yes	2
+		B10-Concrete-Tapered_Angle Driven Custom: C3 - 18x48 - 81.45 deg		Yes	1
+		B10-Concrete-Tapered_Angle Driven Custom: C3 - 18x42 - 81.45 deg		Yes	3
+		B10-Concrete-Tapered_Angle Driven Custom: C3 - 18x36 - 81.45 deg		Yes	1
+		B10-Concrete-Tapered_Angle Driven Custom: C3 - 18x24 - 81.3 deg		Yes	1
+		B10-Concrete-Tapered_Angle Driven Custom: C3 - 18x18 - 81.3 deg		Yes	1
+		B10-Concrete-Tapered_Angle Driven Custom: C3 - 30x48 - 81.45 deg		Yes	1
+		B10-Concrete-Tapered_Angle Driven Custom: C8 - 18x48 - 84.4 deg		Yes	1

3D View

fx 1

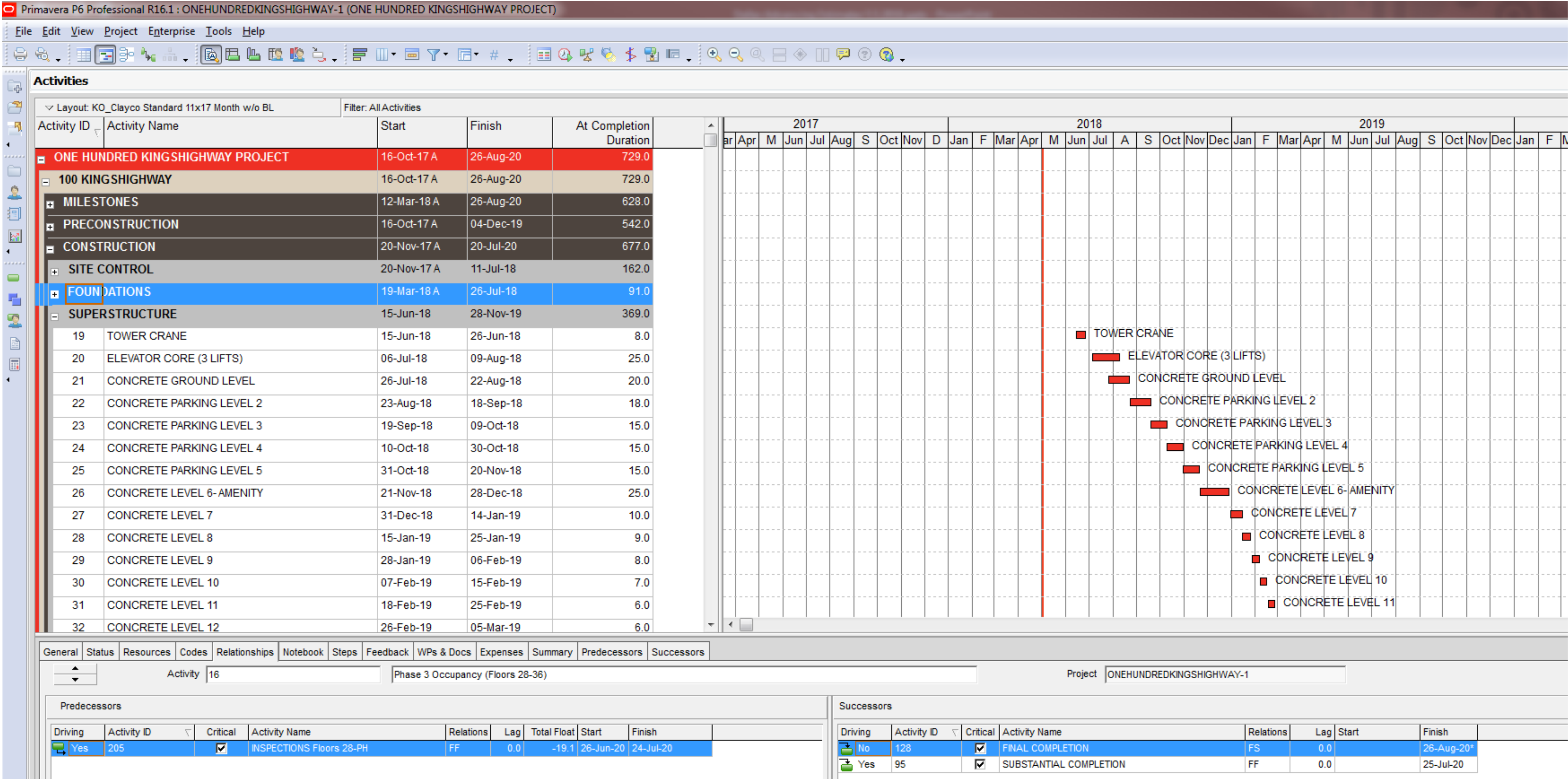
Code	Description	Source..	Cons..	Consu..	Waste	Qty	UOM	Unit ..	Base Cost	Cost/Par..
000	Kingshighway	1.00	1.000	1.000	1.000	1.00		0.00	0.00	
A	Substructure	1.00	1.000	1.000	1.000	1.00	-	2,765,...	▲ 2,765,8...	
A10	Foundations	1.00	1.000	1.000	1.000	1.00	-	2,765,...	▲ 2,765,8...	2,765,...
A1010.30	Column	1.00	1.000	1.000	1.000	1.00	-	2,731,...	▲ 2,731,0...	2,731,...
A1020130-Concrete-Pile-Round - Custom: DS7A	Round Pier	1,187.10	1.000	1.000	1.050	1,246.46	CU YD	560.00	698,015.92	698,015.92
A1020130-Concrete-Pile-Round - Custom: DS5A	Round Pier	408.63	1.000	1.000	1.050	429.06	CU YD	560.00	240,275.70	240,275.70
A1020130-Concrete-Pile-Round - Custom: DS7	Round Pier	671.48	1.000	1.000	1.050	705.06	CU YD	560.00	394,831.40	394,831.40
A1020130-Concrete-Pile-Round - Custom: DS4	Round Pier	471.09	1.000	1.000	1.050	494.65	CU YD	560.00	277,001.36	277,001.36
A1020130-Concrete-Pile-Round - Custom: DS6	Round Pier	916.86	1.000	1.000	1.050	962.70	CU YD	560.00	539,113.69	539,113.69
A1020130-Concrete-Pile-Round - Custom: DS5	Round Pier	404.01	1.000	1.000	1.050	424.21	CU YD	560.00	237,557.18	237,557.18
A1020130-Concrete-Pile-Round - Custom: DS2	Round Pier	264.91	1.000	1.000	1.050	278.15	CU YD	560.00	155,766.03	155,766.03
A1020130-Concrete-Pile-Round - Custom: DS3	Round Pier	320.49	1.000	1.000	1.050	336.51	CU YD	560.00	188,445.62	188,445.62
A1020.70	Pier Caps	1.00	1.000	1.000	1.000	1.00	CU YD	34,85...	▲ 34,851.58	34,851.58
B	Shell	1.00	1.000	1.000	1.000	1.00	-	40,38...	▲ 40,385,...	
B10	Superstructure	1.00	1.000	1.000	1.000	1.00	-	5,452,...	▲ 5,452,6...	5,452,6...
B20	Exterior	1.00	1.000	1.000	1.000	1.00	-	34,93...	▲ 34,932,6...	34,932,6...



# 5D Bottom-up: Export P6 Schedule into XML File



Schedule was originally built up by scheduler in P6

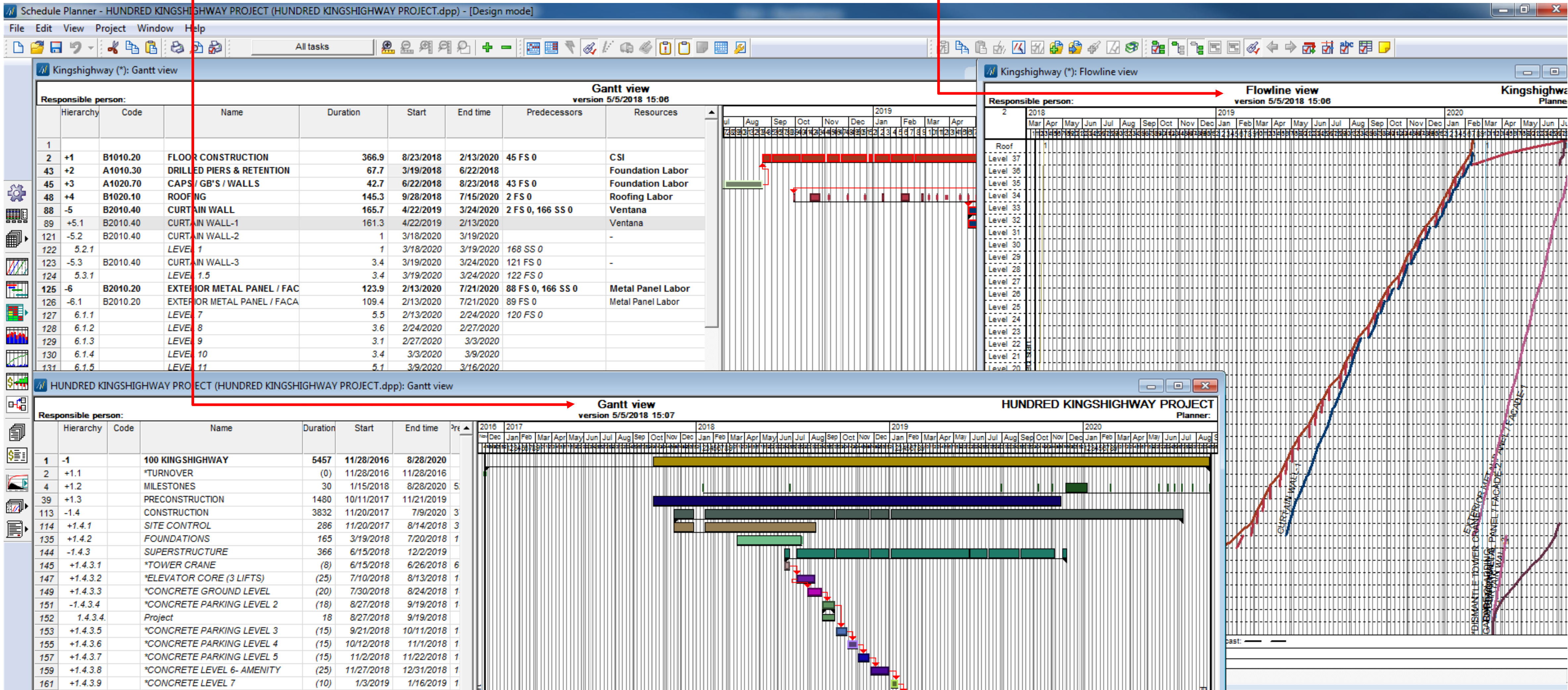




5D Bottom-up: Import XML into VSP and Map it to the existing project

Imported original XML schedule

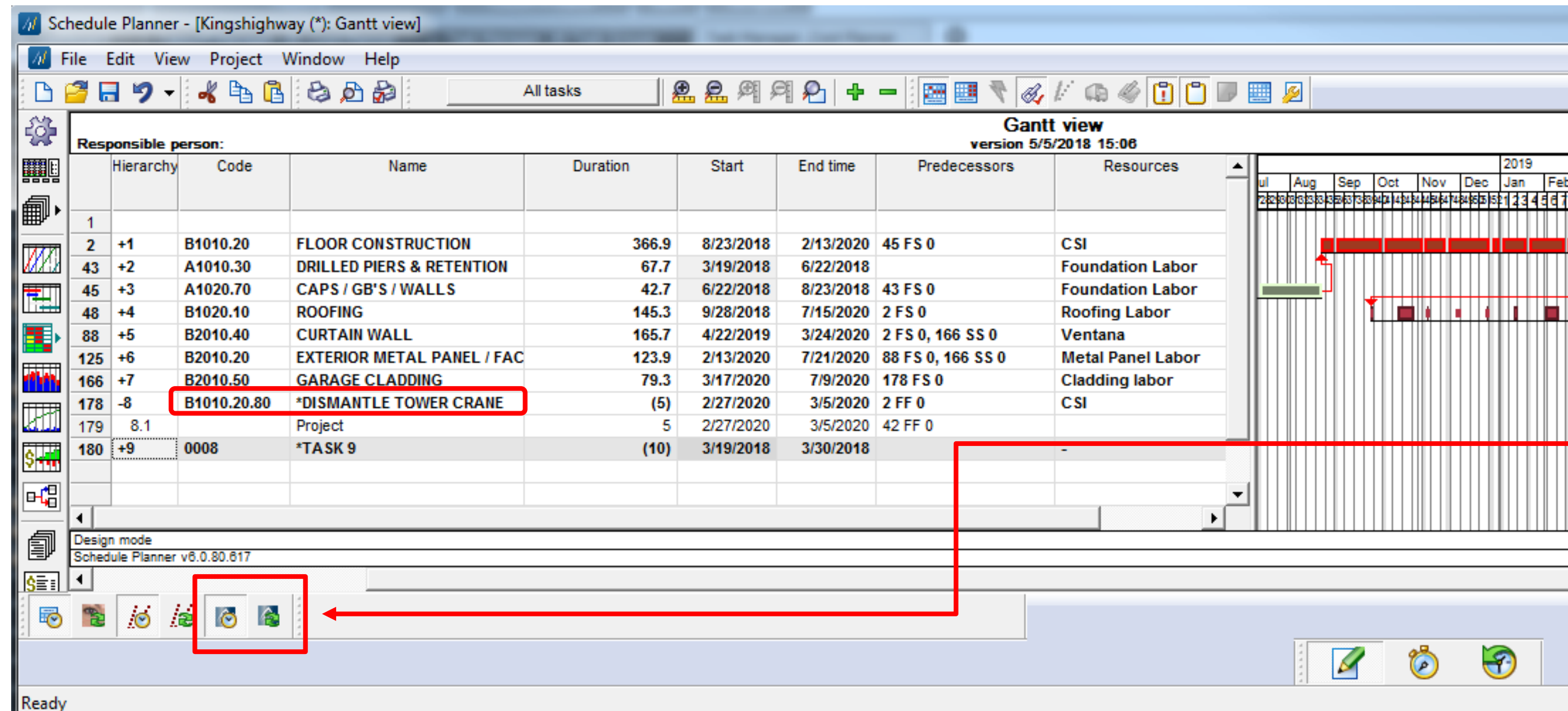
VICO project DPP schedule





## 5D Bottom-up: Costs and Tasks

## Merging Point: Task Manager



## - Synchronize VSP Schedule with VICO Office

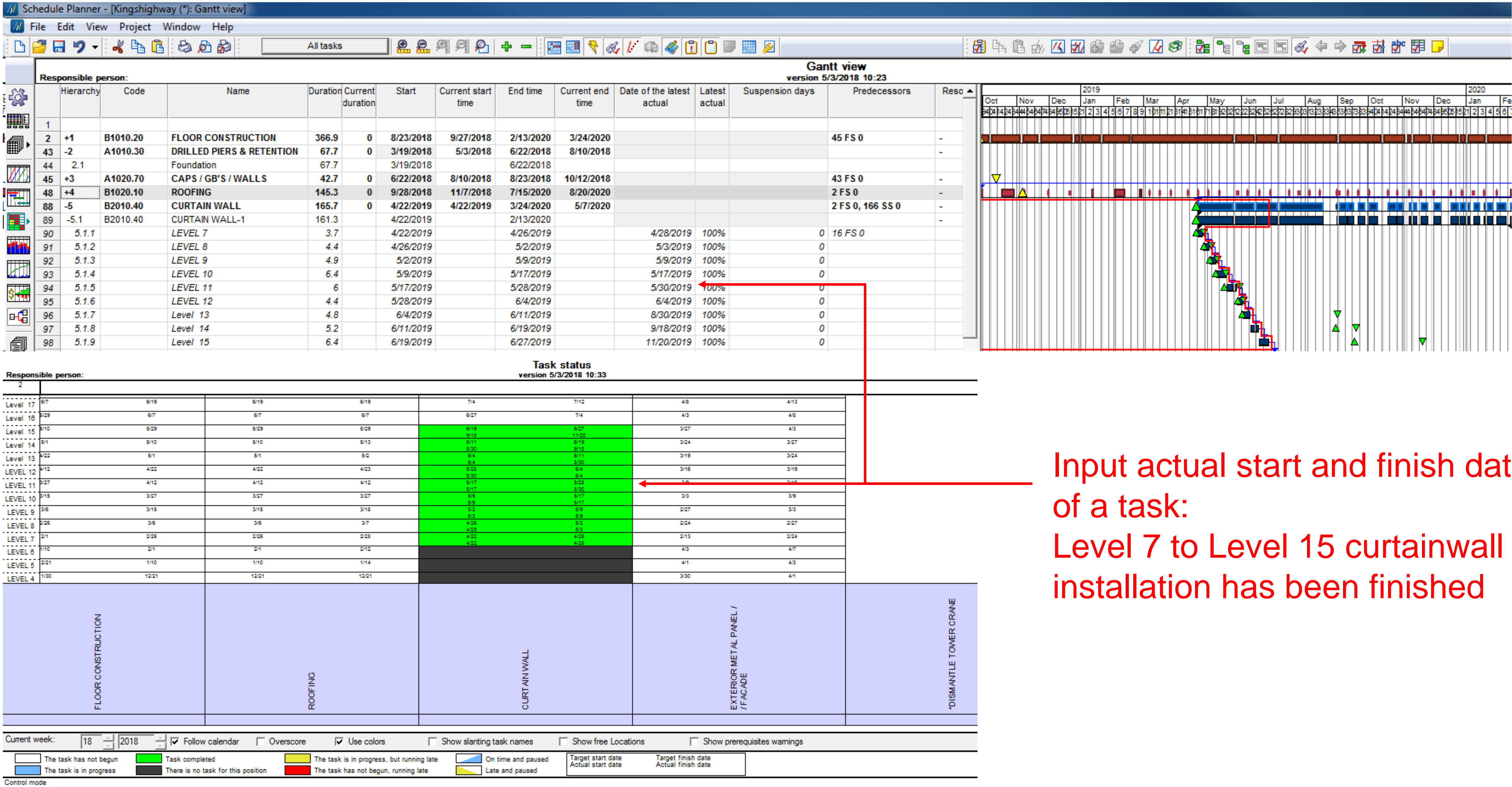
Map cost assemblies and components (labor, material, and equipment) to Tasks using drag-and-drop

Code	Name	Work	Duration
B1010.20	Floor Construction	2,935.59	366.95
A1010.30	DRILLED PIERS & RETENTION	541.87	67.73
A1020.70	CAPS / GB'S / WALLS	341.68	42.71
B1020.10	ROOFING	1,162.35	145.29
B2010.40	CURTAIN WALL	1,325.54	165.69
B2010.20	EXTERIOR METAL PANEL / FACADE	991.10	123.89
B2010.50	GARAGE CLADDING	634.13	79.27
B1010.20.80	Dismantle Tower Crane	5.00	
0008	Task 9	10.00	

Code	Description	Sour..	Cons..	Consum..	Waste	Qty	UOM	Unit Cost	Base Cost	Cost/Par..
000	Kingshighway	1.00	1.000	1.000	1.000	1.00		0.00	0.00	N/A
A	Substructure	1.00	1.000	1.000	1.000	1.00	-	2,765,858...	2,765,8...	N/A
B	Shell	1.00	1.000	1.000	1.000	1.00	-	40,385,32...	40,385,...	N/A
B10	Superstructure	1.00	1.000	1.000	1.000	1.00	-	5,452,671...	5,452,6...	5,452,671....
B20	Exterior Enclosure	1.00	1.000	1.000	1.000	1.00	-	34,932,65...	34,932,6...	34,932,651...
B2010.40	Fabricated Exterior	1.00	1.000	1.000	1.000	1.00	-	19,585,00...	19,585,...	19,585,003...
	C-AGM_Glass 8p: C-AGM_Glass 8p		1.000	1.000	1.000	117,64...	SQ FT	150.00	17,647,339...	17,647,339...
	K-AGM_Glass 8p-OP: K-AGM_Glass 8p-OP		1.000	1.000	1.000	14,905...	SQ FT	130.00	1,937,664.62	1,937,664...
B2010.20	Panels	1.00	1.000	1.000	1.000	1.00	-	12,671,23...	12,671,...	12,671,238...
	B2010-Basic Wall: Metal Panel_6"		1.000	1.000	1.000	78,54...	SQ FT	160.00	12,567,434...	12,567,434...
	B2010-Basic Wall: Metal Panel_2"		1.000	1.000	1.000	741.46	SQ FT	140.00	103,803.94	103,803.94 /
B2010.50	Mansory at Garage	0.00	1.000	1.000	1.000	0.00	SQ FT	0.00	2,676,4...	2,676,408....
	B2010-Basic Wall: Generic - 8" Masonry		1.000	1.000	1.000	13,989...	SQ FT	90.00	1,259,019.99	0.00 / SQ...
	KH-AGM_Metal Parking Screen 16P:		1.000	1.000	1.000	566.24	SQ FT	80.00	45,299.36	0.00 / SQ...
	KH-AGM_Metal Parking Screen: KH-AGM_Metal		1.000	1.000	1.000	17,151...	SQ FT	80.00	1,372,088.98	0.00 / SQ...

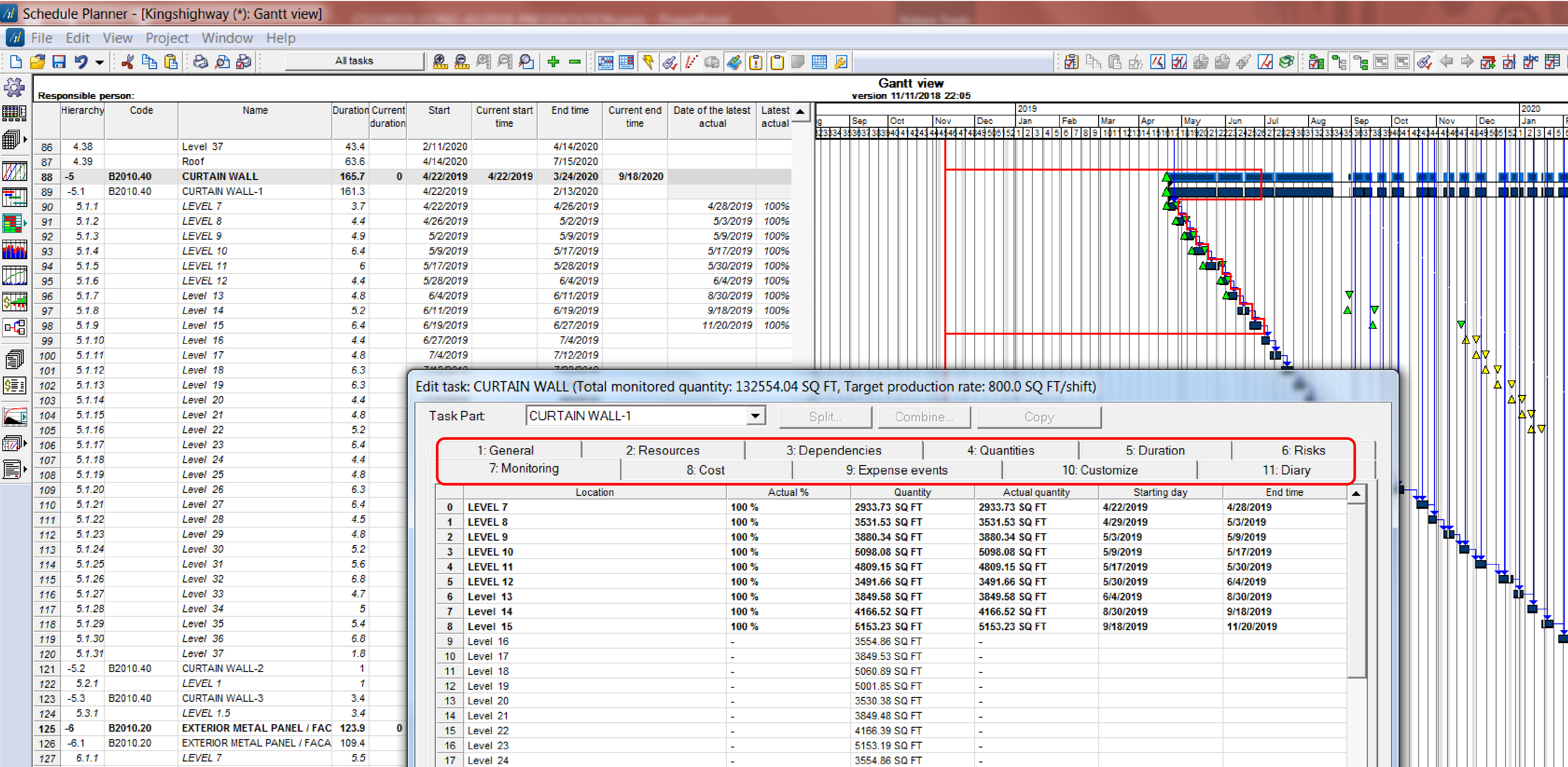


5D Bottom-up: Control Mode vs Planning Mode (Actual vs Scheduled vs Forecast)



Input actual start and finish date of a task:  
Level 7 to Level 15 curtainwall installation has been finished

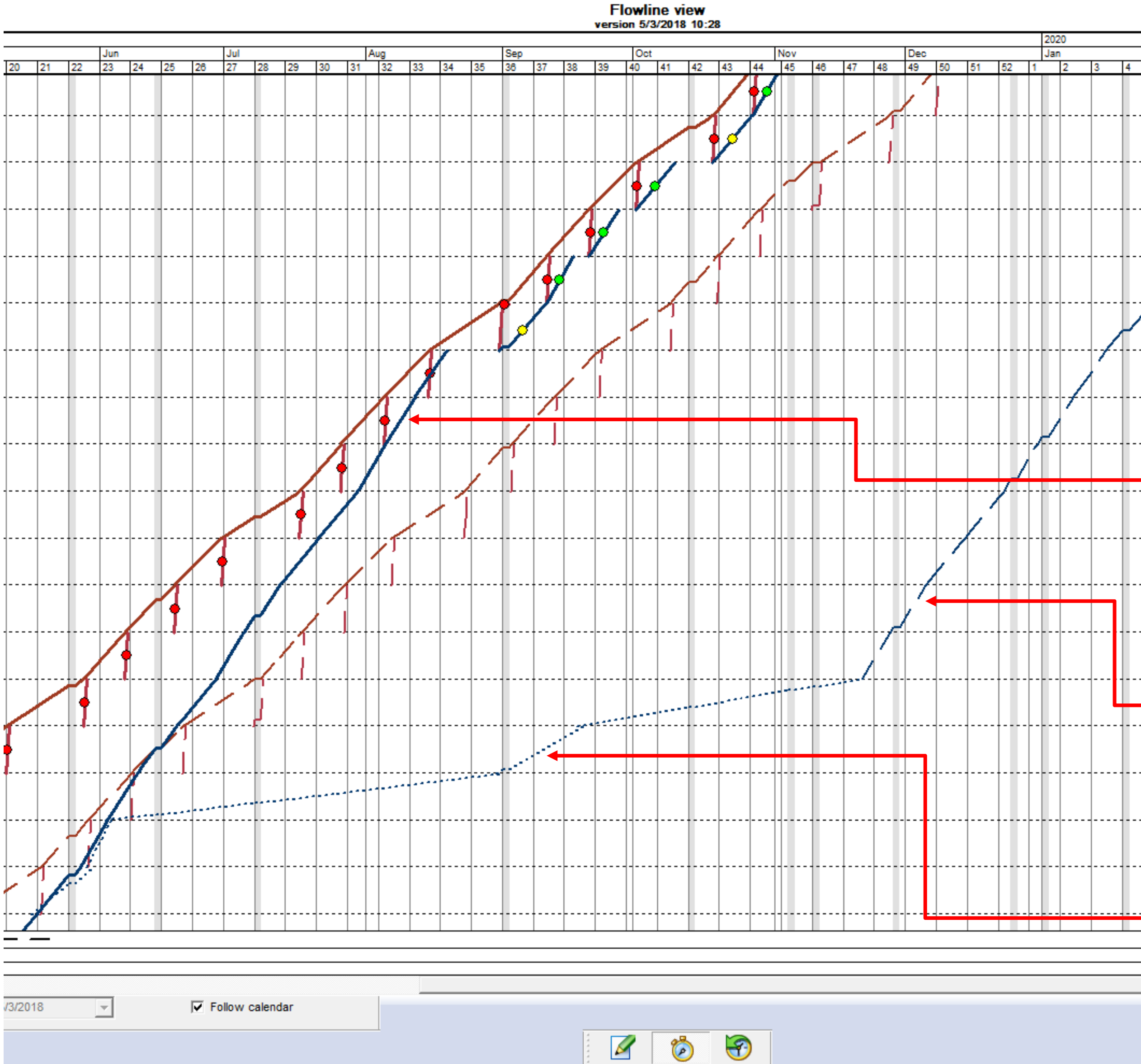
# 5D Bottom-up: Control Mode vs Planning Mode (Actual vs Scheduled vs Forecast)





# 5D Bottom-up: Control Mode vs Planning Mode (Actual vs Target vs Forecast)

Target: \_\_\_\_\_ Actual: ..... Forecast: \_\_\_\_\_

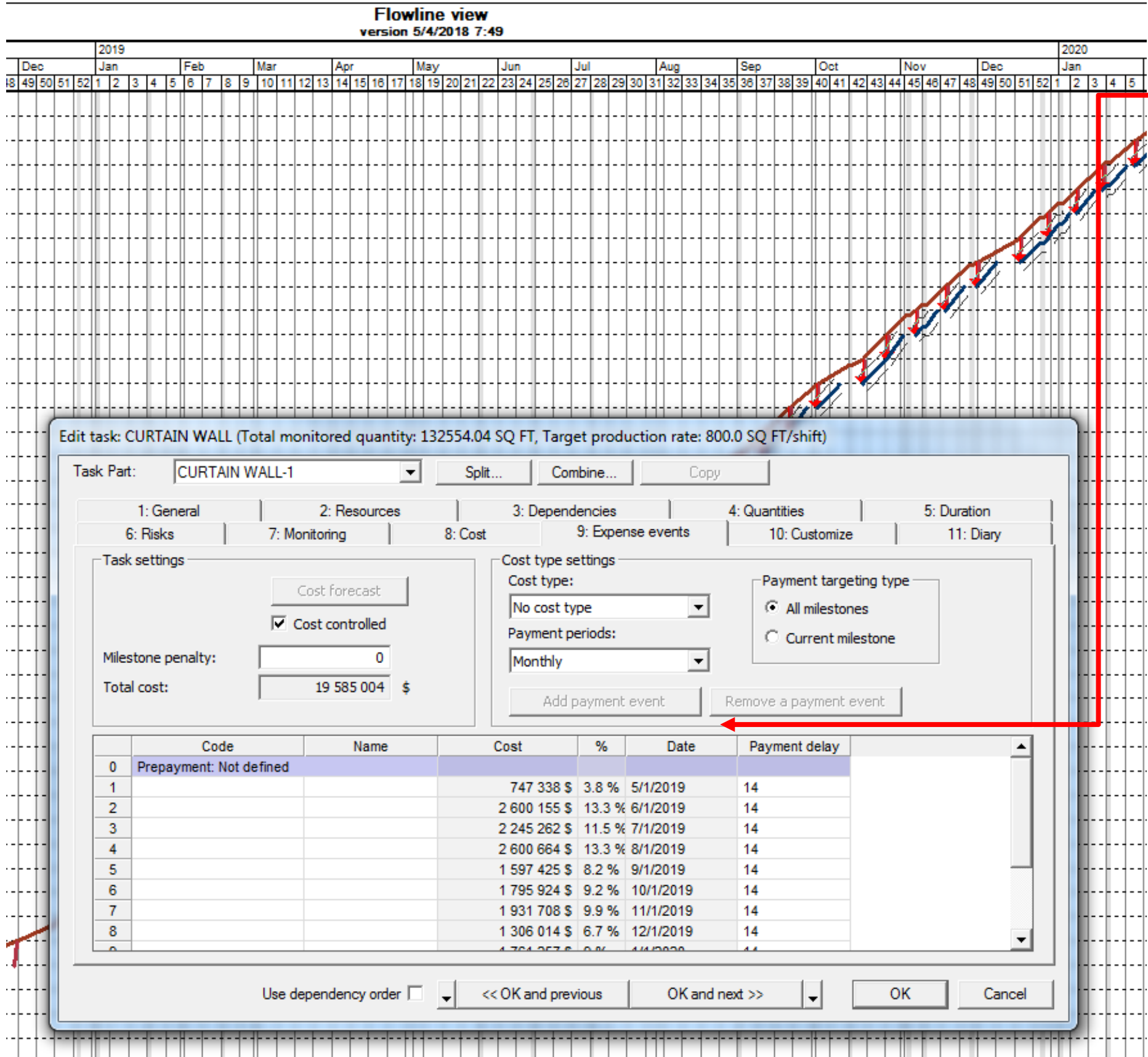


**Target:** enables the planned schedule which we are targeting

**Forecast:** takes all actualized data to generate a comparative model

**Actual:** a reflection of the current plan including all detailed tasks

# 5D Bottom-up: Expense and Income

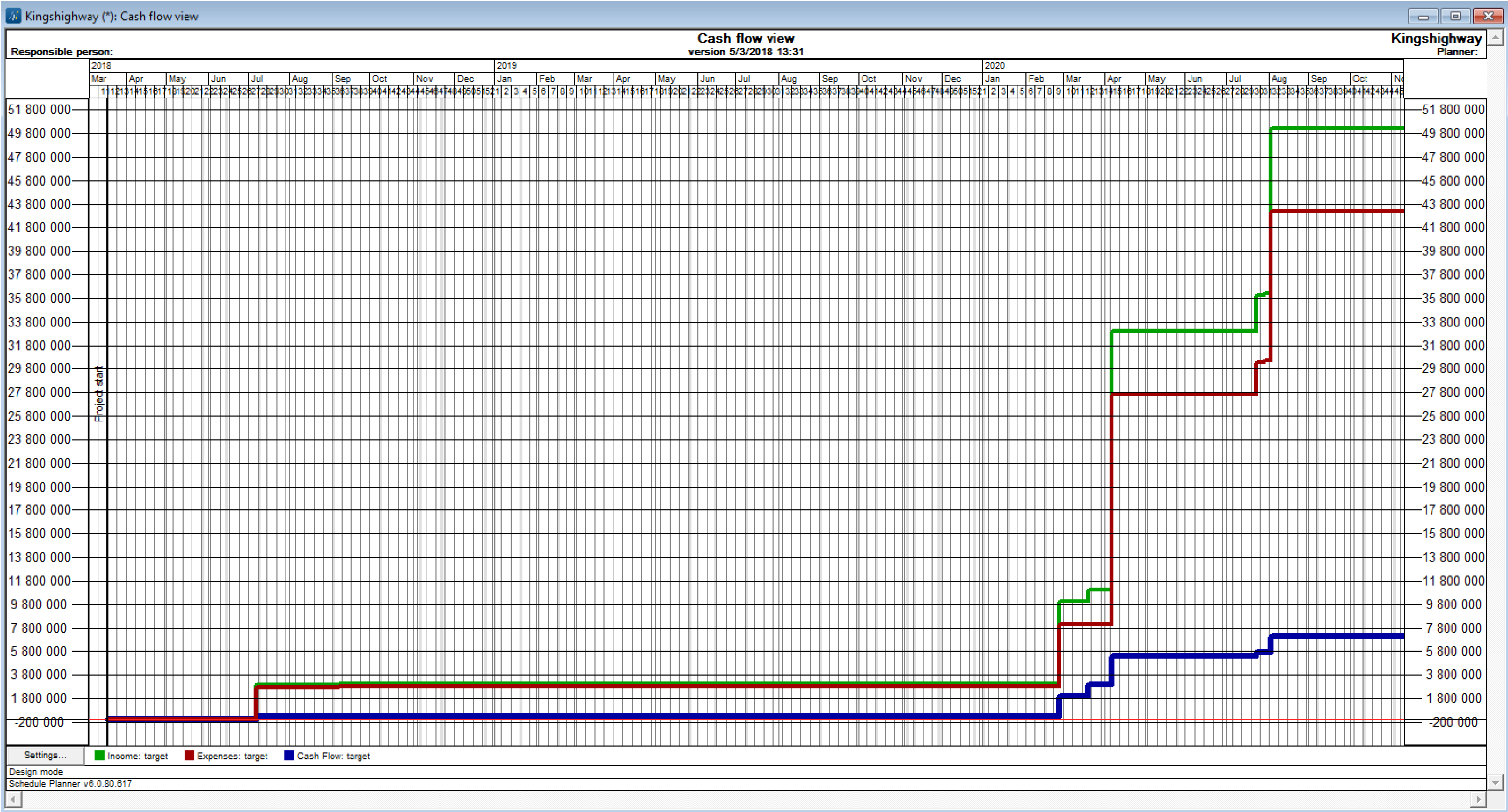


- Define **payments to subcontractors** under Expense Events.
- Define **income from owner** under Income Events.
- Provides a basis for accurately forecasting and controlling the net cash for a project.
- Provides a firm link to completion of locations progressively through a project.

Income events				
Task	Date	Payment delay	Target sum (\$)	Current sum (\$)
DRILLED PIERS & RETENTION (100%)	6/22/2018	14	3 000 000	3 000 000
CAPS / GB'S / WALLS (100%)	8/23/2018	14	50 000	50 000
Floor Construction (100%)	2/13/2020	14	7 000 000	7 000 000
Dismantle Tower Crane (100%)	3/5/2020	14	1 000 000	1 000 000
CURTAIN WALL (100%)	3/24/2020	14	22 000 000	22 000 000
GARAGE CLADDING (100%)	7/9/2020	14	3 000 000	3 000 000
ROOFING (100%)	7/15/2020	14	200 000	200 000
EXTERIOR METAL PANEL / FACADE (100%)	7/21/2020	14	14 000 000	14 000 000

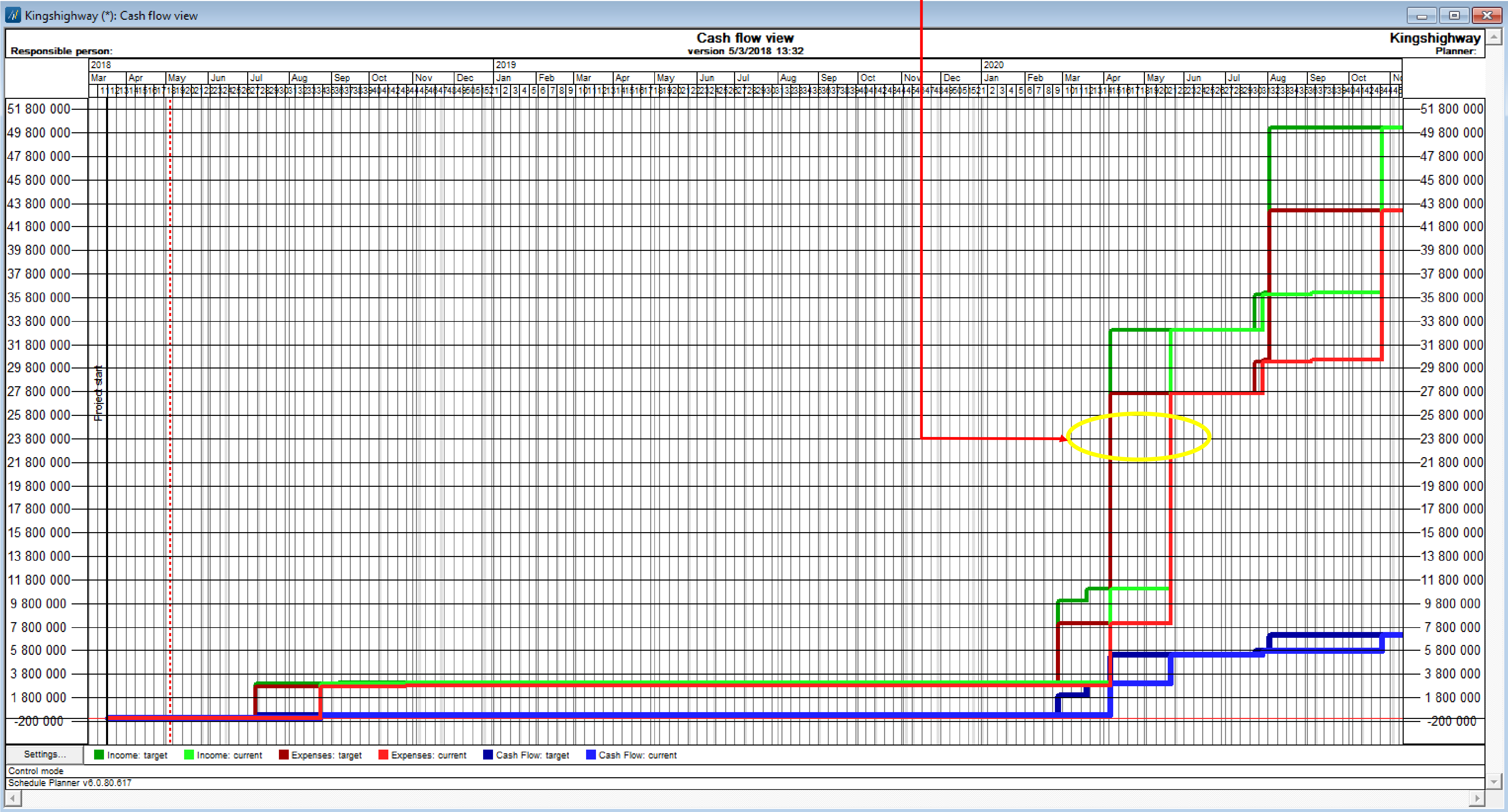


# 5D Bottom-up: Cash Flow \_ Target



5D Bottom-up: Cash Flow \_ Target vs Current

Curtainwall installation is delayed





## 5D Bottom-up: Resource Histogram

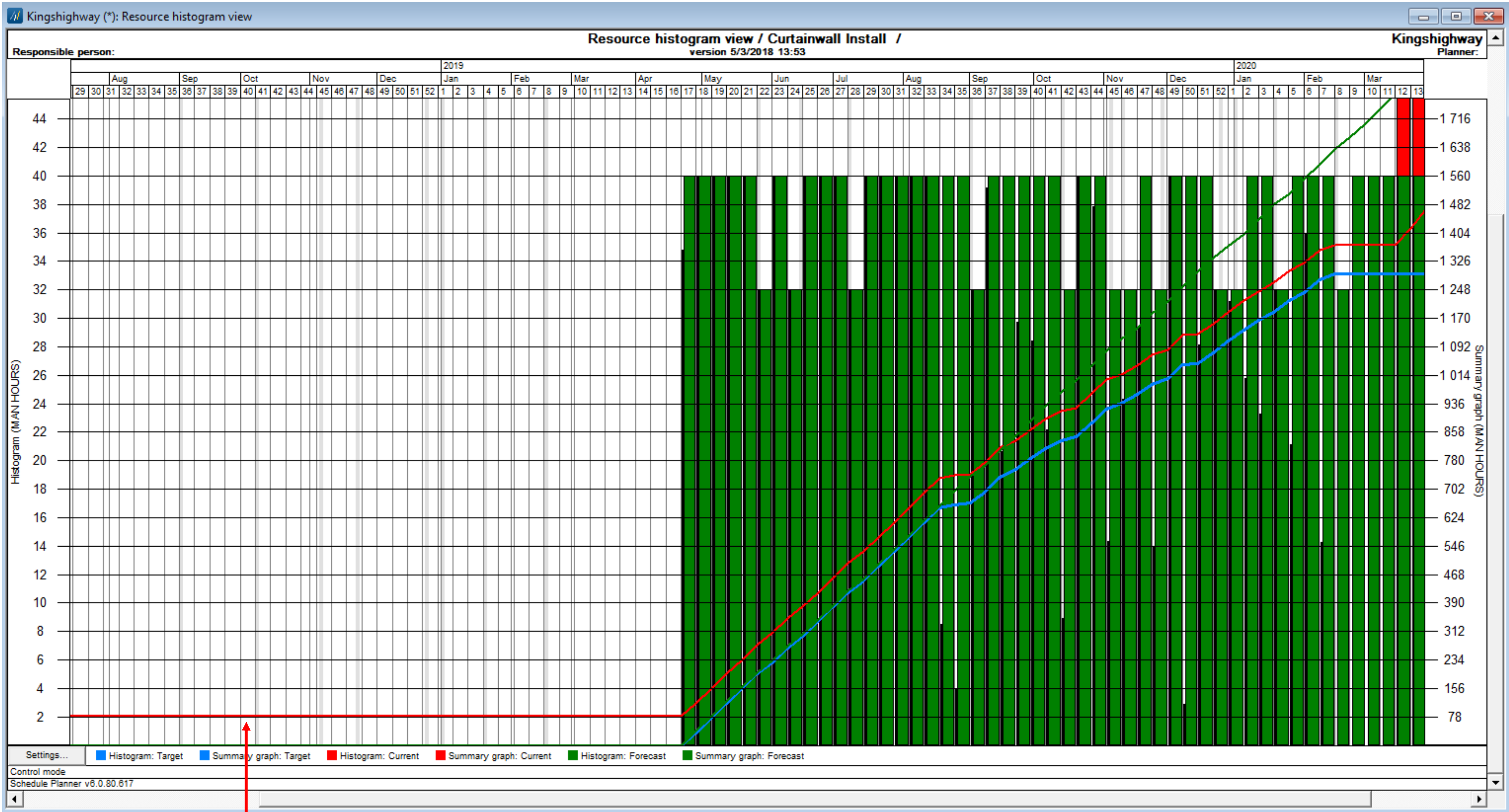
The screenshot shows a 'Resource histogram filter' dialog box. At the top, there is a 'Filter' dropdown menu with 'Curtainwall Install' selected, and 'Remove' and 'New' buttons. Below this, the 'Name' field contains 'Curtainwall Install' and the 'Unit' dropdown is set to 'MAN HOURS'. A second 'Filter' section contains a 'Show' group box with four checkboxes: 'Resources' (checked), 'Quantity resources', 'Costs', and 'Tasks'. Below the 'Show' group are two list boxes: 'Cost types' (containing '<Empty>') and 'Suppliers' (containing '<Nothing>', 'Cladding Sub', 'CSI', 'Foundation Sub', 'Metal Panel Sub', 'Roofing Sub', and 'Ventana', with 'Ventana' selected). At the bottom are four buttons: '<< Previous', 'Next >>', 'OK', and 'Cancel'.

- Resource Histogram allows using historical actualized data to **trend** resource quantities, resource hours, quantities and cost in the future.
- Resource Histogram allows us to determine the potential risks of resource or quantity over or underage

# 5D Bottom-up: Resource Histogram

Number of hours needed by week

Total number of hours



Curve line: **Accumulative** number of hours



## 5D Bottom-up: Risks

### *Risks*

1. Starting Risk
2. Duration Risk
3. Resource Beginning Risk
4. Resource Come Back Delay
5. Production Factor Risk

Risk management includes planning continuous work, using buffers and being proactive to prevent delays

## 5D Bottom-up: Risk Simulation

Risk Simulation is used to validate the reliability of a schedule and to optimize the schedule to find the optimal trade offs between cost and time under conditions of uncertainty

- Monte Carlo Risk Simulation is a tool to model and identify problem in the schedule
- Results can be used to alert the GC to make proactive decisions
- Monte Carlo Risk Simulation provides a probability calculation to access each of the 5 risk categories



## 5D Bottom-up: Risk Simulation

# Monte Carlo Risk Simulation: How to assign risk levels (variabilities) to tasks (variables)

Kingshighway: Risk levels

Hierarchy	Name	Start of schedule task		Schedule task duration (%)		Beginning risk		Come-back delay		Production factor distribution		Dependencies
+1	*TASK 9	Zero	0/0/0	Zero	100/100/100	Zero	0/0/0	Zero	0/0/0		0/0/0	
-2	DRILLED PIERS & RETENTION	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	Intermediate	0.7/1/1.3	
-2.1	DRILLED PIERS & RETENTION	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	Intermediate	0.7/1/1.3	
2.1.1	Foundation	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	Intermediate	0.7/1/1.3	
-3	CAPS / GB'S / WALLS	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	High	0.5/1/1.5	- (FS)
-3.1	CAPS / GB'S / WALLS	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	High	0.5/1/1.5	
3.1.1	Foundation	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	High	0.5/1/1.5	
3.1.2	LEVEL 1	Intermediate	-5/0/10	Intermediate	80/100/150	Low	0/0/20	Low	0/20/40	High	0.5/1/1.5	
-4	FLOOR CONSTRUCTION	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	- (FS)
-4.1	FLOOR CONSTRUCTION	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.1	Foundation	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.2	LEVEL 1	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.3	LEVEL 1.5	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.4	LEVEL 2	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.5	LEVEL 3	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.6	LEVEL 4	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.7	LEVEL 5	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.8	LEVEL 6	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.9	LEVEL 7	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.10	LEVEL 8	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.11	LEVEL 9	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.12	LEVEL 10	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.13	LEVEL 11	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.14	LEVEL 12	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.15	Level 13	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.16	Level 14	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.17	Level 15	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.18	Level 16	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.19	Level 17	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.20	Level 18	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.21	Level 19	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.22	Level 20	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.23	Level 21	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.24	Level 22	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.25	Level 23	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.26	Level 24	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.27	Level 25	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.28	Level 26	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.29	Level 27	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.30	Level 28	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.31	Level 29	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.32	Level 30	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.33	Level 31	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.34	Level 32	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.35	Level 33	High	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	
4.1.36	Level 34	Hiiah	-10/0/15	Low	90/100/120	Intermediate	0/20/40	Low	0/20/40	Intermediate	0.7/1/1.3	

Settings

☒ Show distributions

Show schedule task risks

# 5D Bottom-up: Risk Simulation

Simulation: Kingshighway

Iterations:  times

Calculate results for:

	Milestone	Foundation	LEVEL 1	LEVEL 1.5	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
1	End point	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

◀

▶

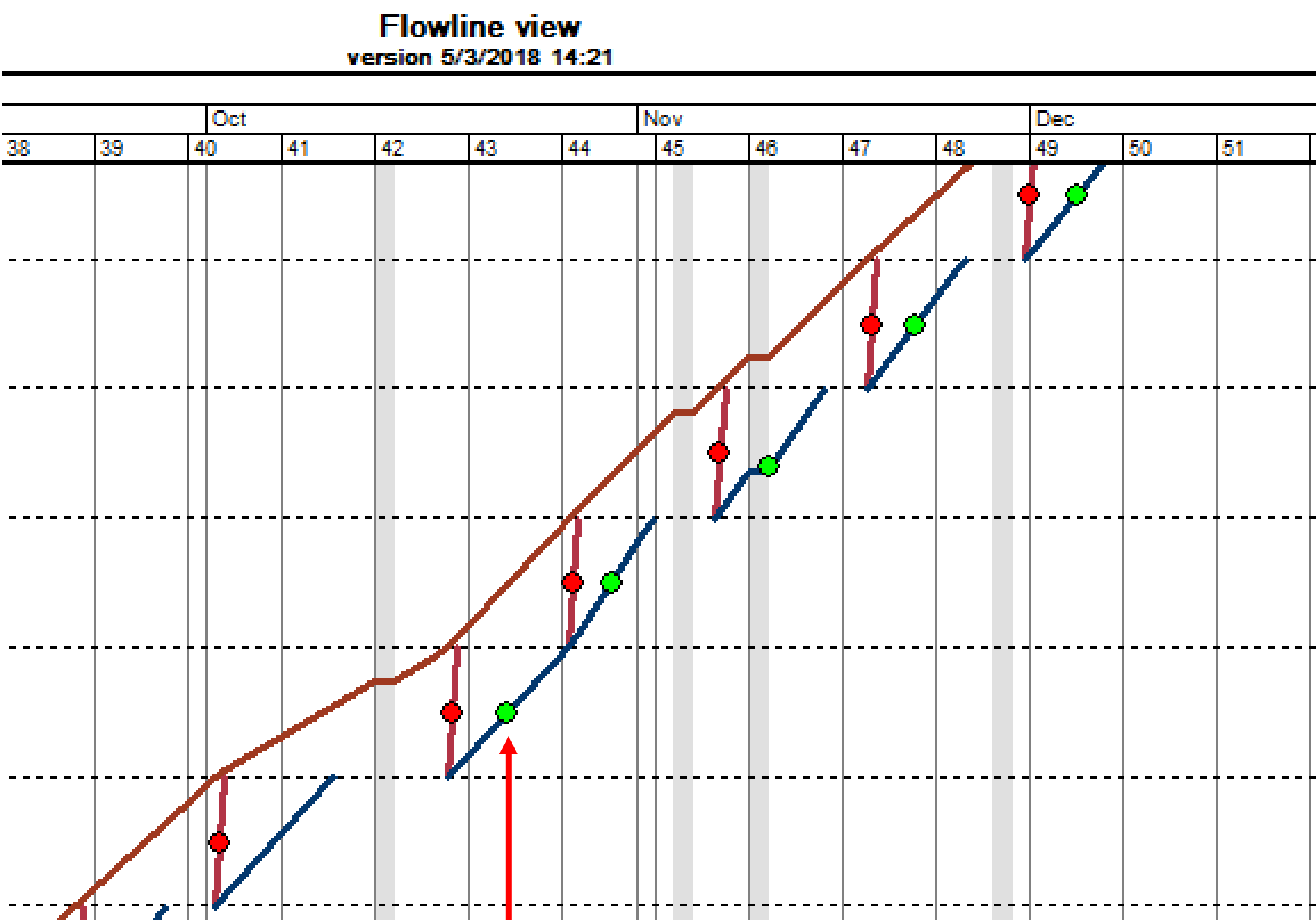
Delete row

Simulator settings

Simulate

Cancel

Define Iterations



30%  
Install curtainwall

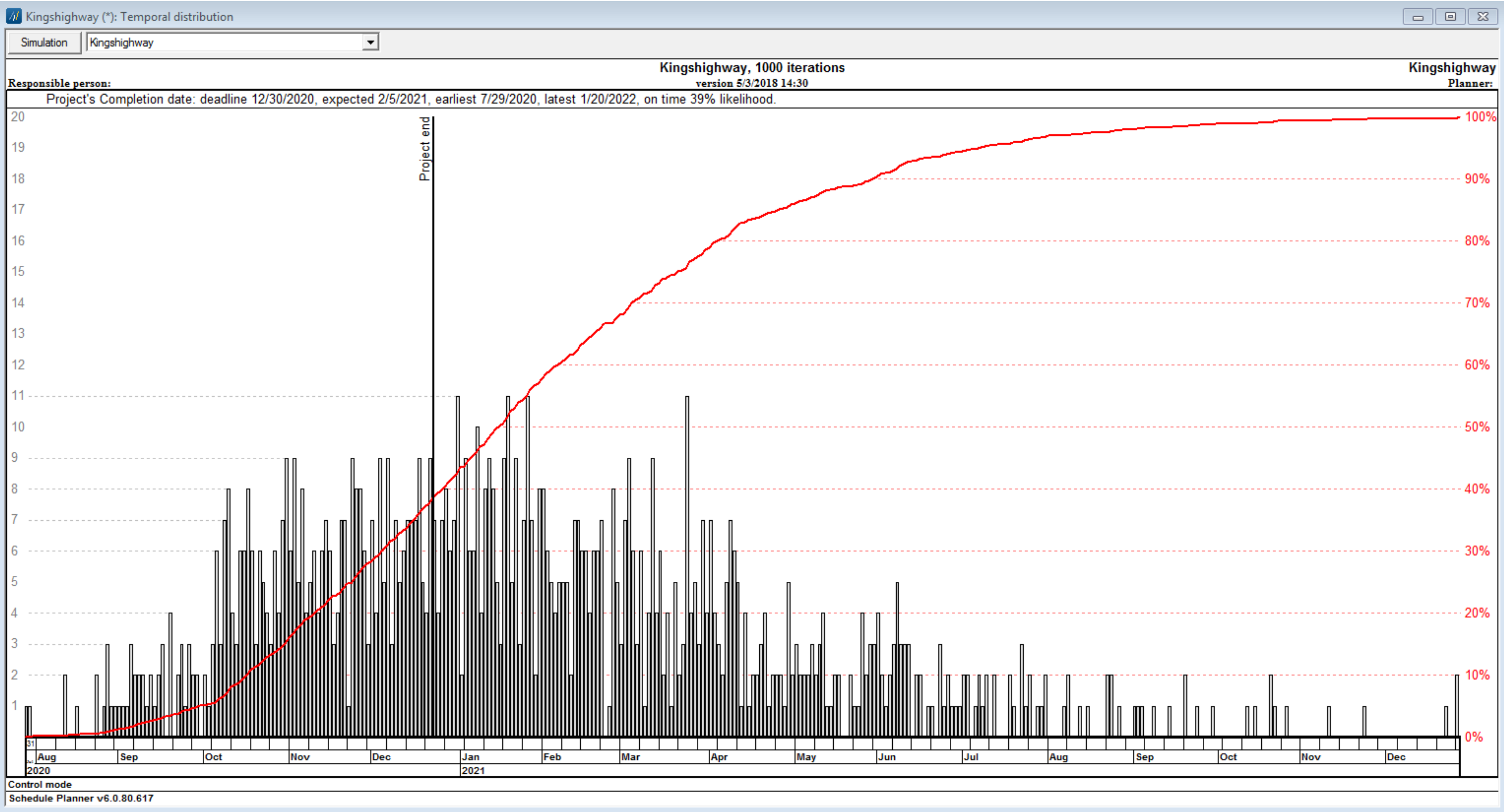
Percentage of risk that  
location can occur



# 5D Bottom-up: Risk Simulation\_Temporal Distribution

Verticals: Probability of completion at a specific day

Curve: Probability of completion before a specific day (accumulatively)



Conclusion: Very Risky. Need to introduce buffer to optimize schedule

## 5D Bottom-up: Risks

### ***Actions:***

- We use the probability values to assess the schedules areas of most risks
- By using this data we can determine how we can use our optimization tools
- We can add buffer, change resource amounts, make tasks ASAP, combine tasks and split tasks



## 5D **Bottom-up**: Logistics-Procurement Tasks: Bill of Quantities

### ***Questions***

Why do we plan logistics?

When to deliver materials?

How many deliveries are required?

Time and resources needed for receiving and hauling?

What is the lead time before production can start?

### ***What are procurement tasks?***

A procurement task is composed of the organization of materials or subcontractor work packages that are able to be ordered from a supplier. The following must be finished before a task can commence:

- Design
- Planning accurate task schedule
- Document and Call for tender
- Bid evaluation
- Contract
- Deliver order

# 5D Bottom-up: Logistics-Procurement Tasks: Bill of Quantities

Kingshighway (\*): Bill of quantities

Target bill of quantities

Task type: 

Procurement

Structure/method view

Resource view

Cost type

Hierarchy	Approved	Code	Name	Quantity	Unit	Cost type	\$ / units.	\$	Social cost\$	Consumpt	Man hours	Resources
+1	<input type="checkbox"/>		Procurement task1				0	34 852			342	
-2	<input type="checkbox"/>	CW	CW Procurement				147.75	19 585 004			1326	
2.1	<input type="checkbox"/>	C-AGM_Gla	Glass	117648.9	SQ FT		150	17 647 339	0	0.01	1176	
2.2	<input type="checkbox"/>	K-AGM_Gla	Glass	14905.11	SQ FT		130	1 937 665	0	0.01	149	
3	<input type="checkbox"/>	Design Cha	Procurement task 4				0	0			0	
-4	<input type="checkbox"/>	Piers	Piers Procurement				560	2 731 007			542	
4.1	<input type="checkbox"/>	A1020130-I	Round Pier	278.15	CU YD		560	155 766	0	0.1111	31	
4.2	<input type="checkbox"/>	A1020130-I	Round Pier	228.51	CU YD		560	128 116	0	0.1111	27	
4.3	<input type="checkbox"/>	A1020130-I	Round Pier									
4.4	<input type="checkbox"/>	A1020130-I	Round Pier									
4.5	<input type="checkbox"/>	A1020130-I	Round Pier									
4.6	<input type="checkbox"/>	A1020130-I	Round Pier									
4.7	<input type="checkbox"/>	A1020130-I	Round Pier									
4.8	<input type="checkbox"/>	A1020130-I	Round Pier									
-												
1	<input type="checkbox"/>	B10-Concre	Rectangular									
2	<input type="checkbox"/>	B10-Concre	Rectangular									
3	<input type="checkbox"/>	B10-Concre	Rectangular									
4	<input type="checkbox"/>	B10-Concre	Rectangular									
5	<input type="checkbox"/>	B10-Concre	Rectangular									
6	<input type="checkbox"/>	B10-Concre	Rectangular									
7	<input type="checkbox"/>	B10-Concre	Rectangular									
8	<input type="checkbox"/>	B10-Concre	Rectangular									
9	<input type="checkbox"/>	B10-Concre	Rectangular									
10	<input type="checkbox"/>	B10-Concre	Rectangular									
11	<input type="checkbox"/>	B10-Concre	Rectangular									
12	<input type="checkbox"/>	B10-Concre	Rectangular									
13	<input type="checkbox"/>	B10-Concre	Rectangular									
14	<input type="checkbox"/>	B10-Concre	Rectangular									
15	<input type="checkbox"/>	B10-Concre	Rectangular									
16	<input type="checkbox"/>	B10-Concre	Rectangular									
17	<input type="checkbox"/>	B10-Concre	Rectangular									
18	<input type="checkbox"/>	B10-Concre	Rectangular									
19	<input type="checkbox"/>	B10-Concre	Rectangular									
20	<input type="checkbox"/>	B10-Concre	Rectangular									
21	<input type="checkbox"/>	B10-Concre	Rectangular									
22	<input type="checkbox"/>	B10-Concre	Rectangular	93	CU YD		300	27 901	0	0.3333	31	
23	<input type="checkbox"/>	B10-Concre	Rectangular	12.7	CU YD		300	3 811	0	0.3333	4	
24	<input type="checkbox"/>	B10-Concre	Rectangular	106.75	CU YD		300	32 025	0	0.3333	36	
25	<input type="checkbox"/>	B10-Concre	Rectangular	9.28	CU YD		300	2 785	0	0.3333	3	

Total hours in the schedules = 2209 (27.8%) Free hours = 5723 (72.2%) Total hours = 7932

BoQ Method Costs = \$ 22 350 862 (51.8%) Free costs = \$ 20 800 318 (48.2%) Total costs = \$ 43 151 181

Create procurement task

View methods

View resources

Create procurement tasks

Find

Move to Summarytask

Editing procurement (Total monitored quantity: 132554 SQ FT)

General

Quantity data

Events

Dependencies

Diary

Hierarchy	Name	Delay (weeks)	Symbol	Target starting date	Actual starting date	Responsible person
1	Planning needed	3		Week 2/2019		<no selection>
2	Call for tenders	3		Week 5/2019		<no selection>
3	Tender	3		Week 8/2019		<no selection>
4	Contract	3		Week 11/2019		<no selection>
5	Delivery order	3		Week 14/2019		<no selection>

<< ok and previous

ok and next >>

OK

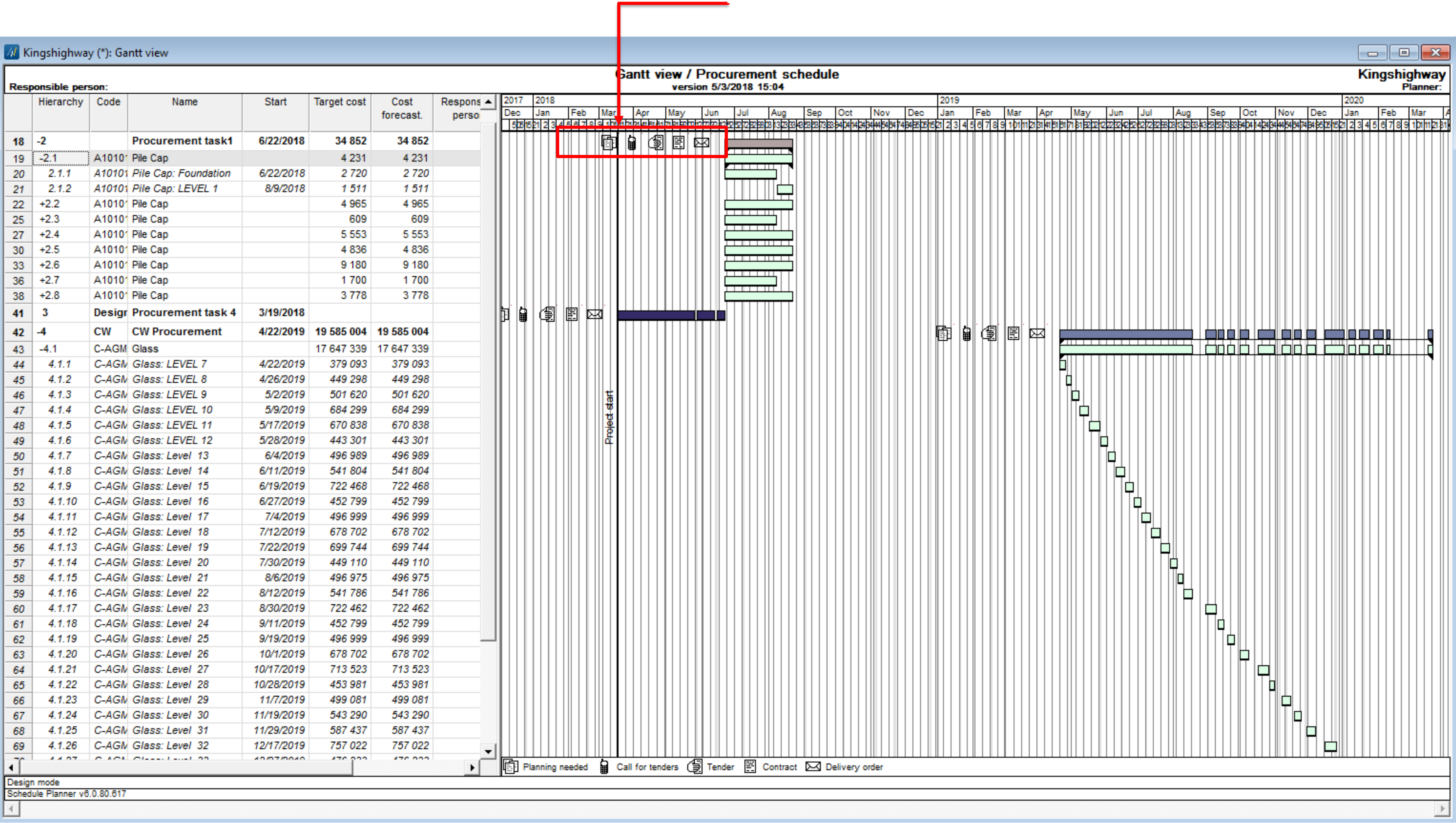
Cancel

- Pull the procurement tasks to scheduled activities
- Calculate durations for Just In Time Delivery



# 5D Bottom-up: Logistics-Procurement Tasks: Bill of Quantities

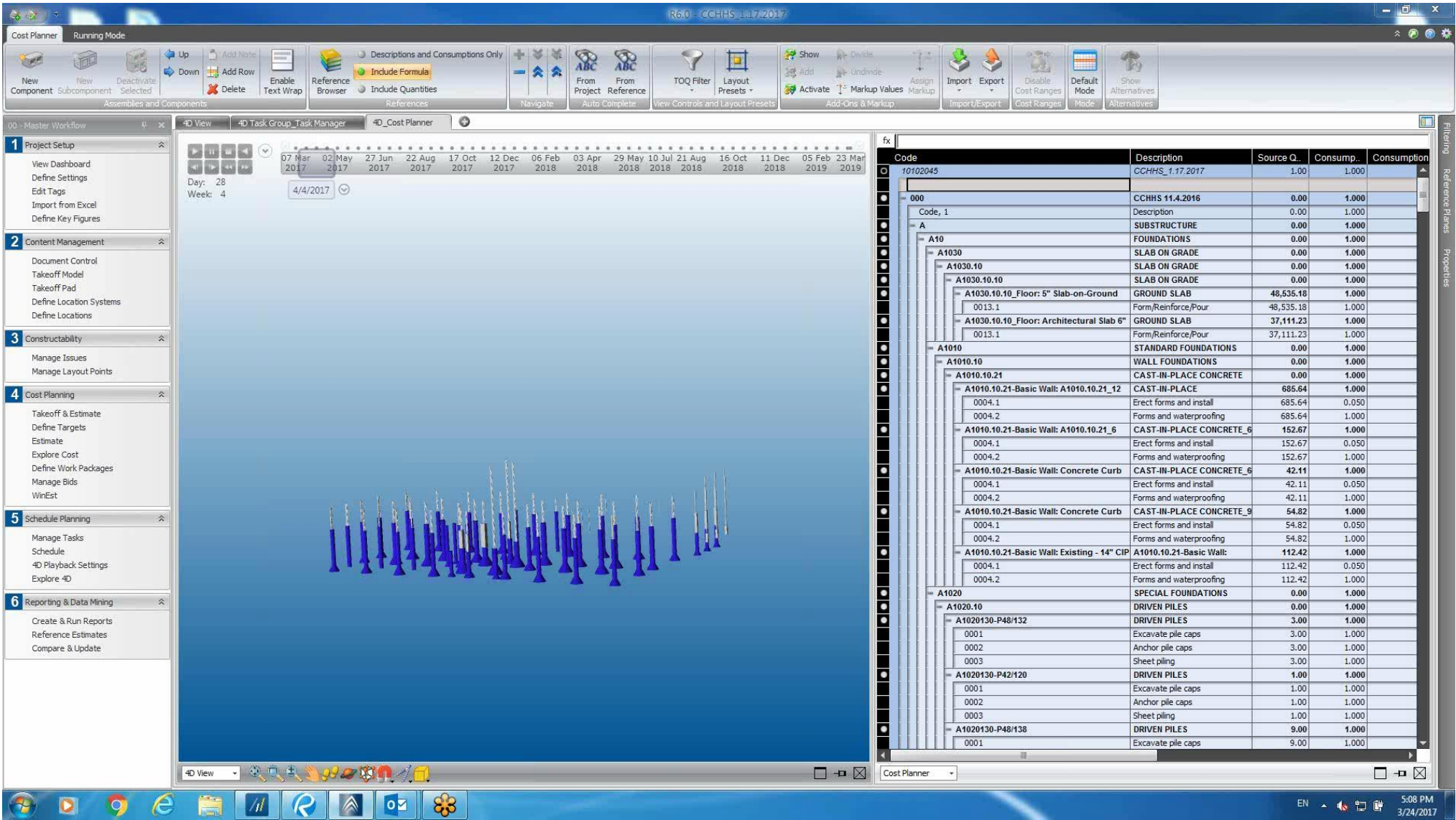
Drag and drop icons to suit the schedules as required to be completed



- Procurement milestones are used to identify time considerations to begin a task
- VSP pulls milestones to the commencement of the task

# 4D & 5D integration

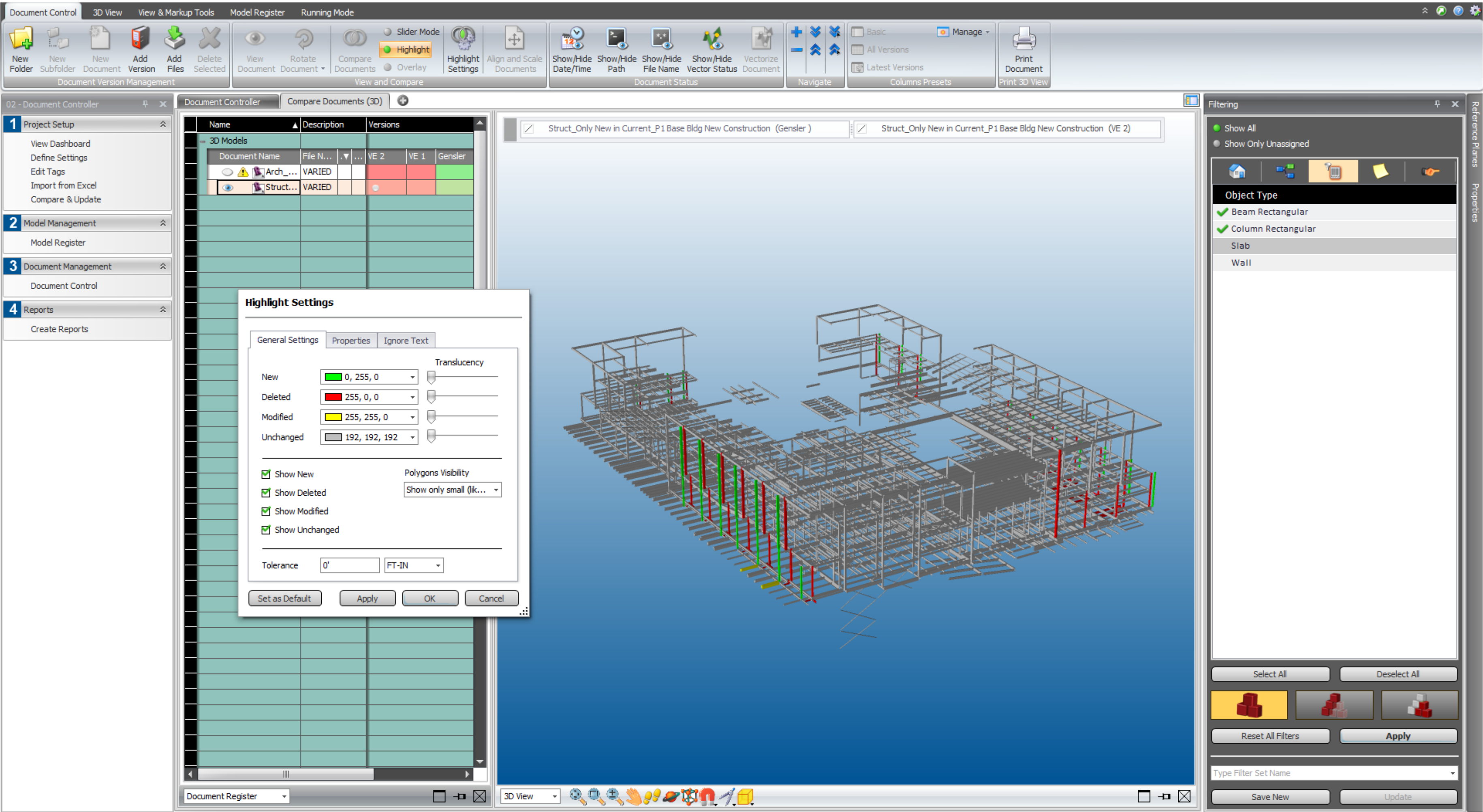
- Location Based **Schedule Manager** facilitates categorizing takeoffs, estimates and scheduling based on 3D locations.
- **Cost Planner** sets up estimates with formulas under Source Qty by mapping TOIs from Takeoff Manager.
- **Task Manager** lays out tasks by mapping cost assemblies and components (labor, material, and equipment) from Cost Planner.
- **Task Groups** allows to create 4D animations by mapping the tasks from Task Manager.
- **Schedule Planner** defines task sequence with Network View, Flowline View and Gantt View.



5D integration (Animation on left side and Cost Planner on right side)  
See attached video for animation

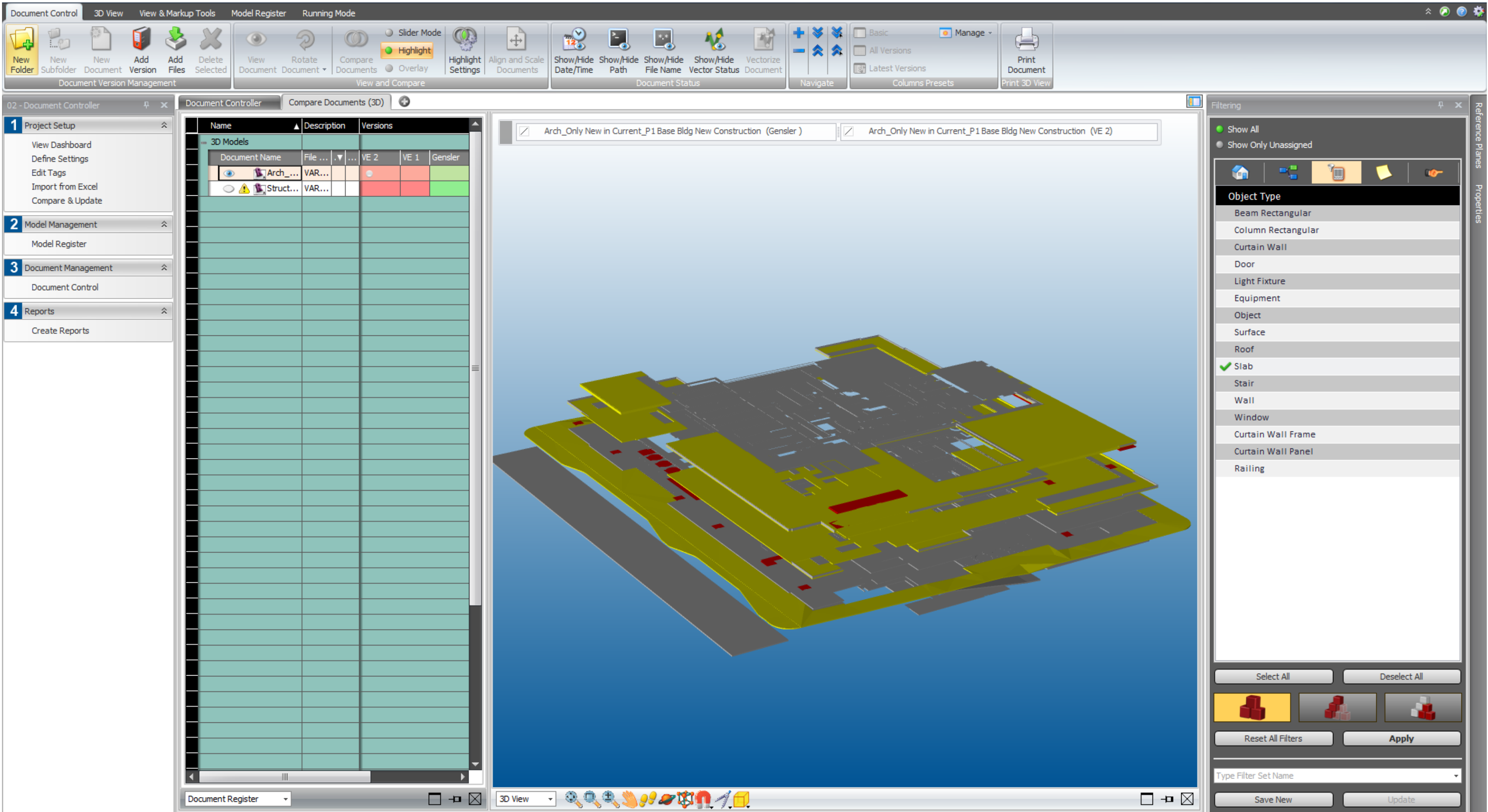


# Comparing Alternatives (Highlight Mode)



Structures\_Design Versions Comparison

# Comparing Alternatives (Highlight Mode)



Architectures\_Design Versions Comparison



# Comparing Alternatives (Highlight Mode\_2D)

Document Control

3D View

View & Markup Tools

Model Register

Running Mode

New Folder

New Subfolder

New Document

Add Version

Add Files

Delete Selected

Document Version Management

View Document

Rotate Document

Compare Documents

Highlight

Highlight Settings

Align and Scale Documents

View and Compare

Show/Hide Date/Time

Show/Hide Path

Show/Hide File Name

Show/Hide Vector Status

Vectorize Document

Document Status

Navigate

Basic

All Versions

Latest Versions

Columns Presets

Manage

Print Document

Print 3D View

02 - Document Controller

My Dashboard

Compare Documents (2D)

1 Project Setup

View Dashboard

Define Settings

Edit Tags

Import from Excel

Compare & Update

2 Model Management

Model Register

3 Document Management

Document Control

4 Reports

Create Reports

Name	Description	Versions
A440	A440.pdf	
A441	A441.pdf	
A450	A450.pdf	
A451	A451.pdf	
A452	A452.pdf	
A453	A453.pdf	
A454	A454.pdf	
A455	A455.pdf	
A456	A456.pdf	
A457	A457.pdf	
A460	A460.pdf	
A461	A461.pdf	
A462	A462.pdf	
A463	A463.pdf	
A500	A500.pdf	
A501	A501.pdf	
A502	A502.pdf	
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A608	A608.pdf	
A609	A609.pdf	
A610	A610.pdf	
A700	A700.pdf	
A701	A701.pdf	
A702	A702.pdf	
A710	A710.pdf	
A711	A711.pdf	
A712	A712.pdf	
A713	A713.pdf	
A714	A714.pdf	
A715	A715.pdf	

A200Bp2 (100)

A200Bp2 (80)

Print Setup

Select Saved Print Settings or Define New

Printer Settings 1

Save

Save As

Delete

Use Printer

\\dtcprintp01\DTG-13 East

Properties

Orientation

Portrait

Landscape

Export to PDF

Output Folder

Select folder where to save PDF file

Export to Multi-page PDF

Document and Version

Document

A001; A100; A101; A101M; A102; A103; A10

Select Documents

Version

Latest Version

Comparison (Optional)

Print Comparison

Version

Penultimate Version

Document

Select Document

Version

Print Options

Scale

Custom

1 Inch

=

1

Units

Scale Line Weight

Fit to Page

Print Clouds and Cloud Notes

Print Clouds from All Comparison Modes

Print Preview

Print

Cancel

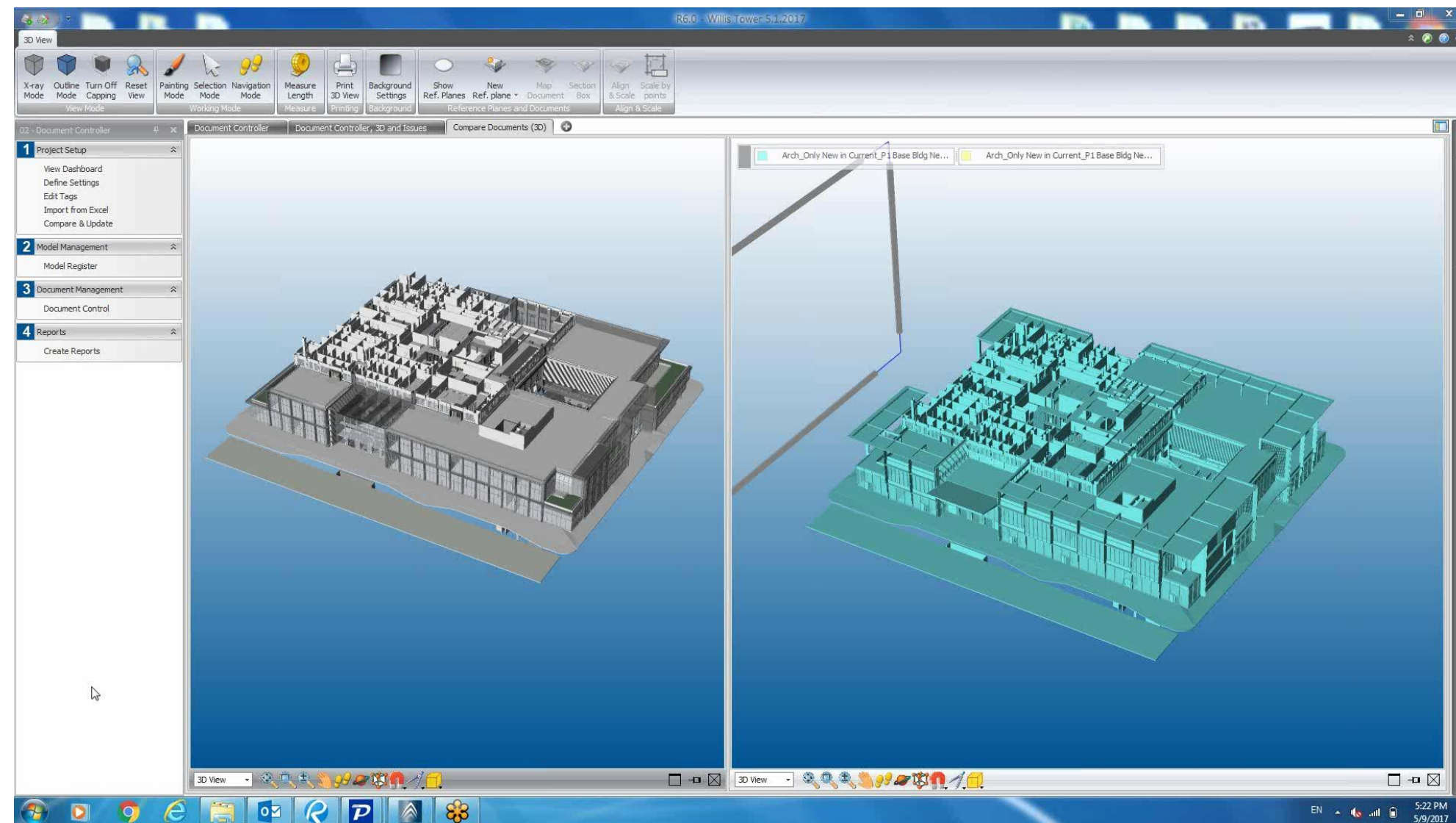
Document Register

3D View

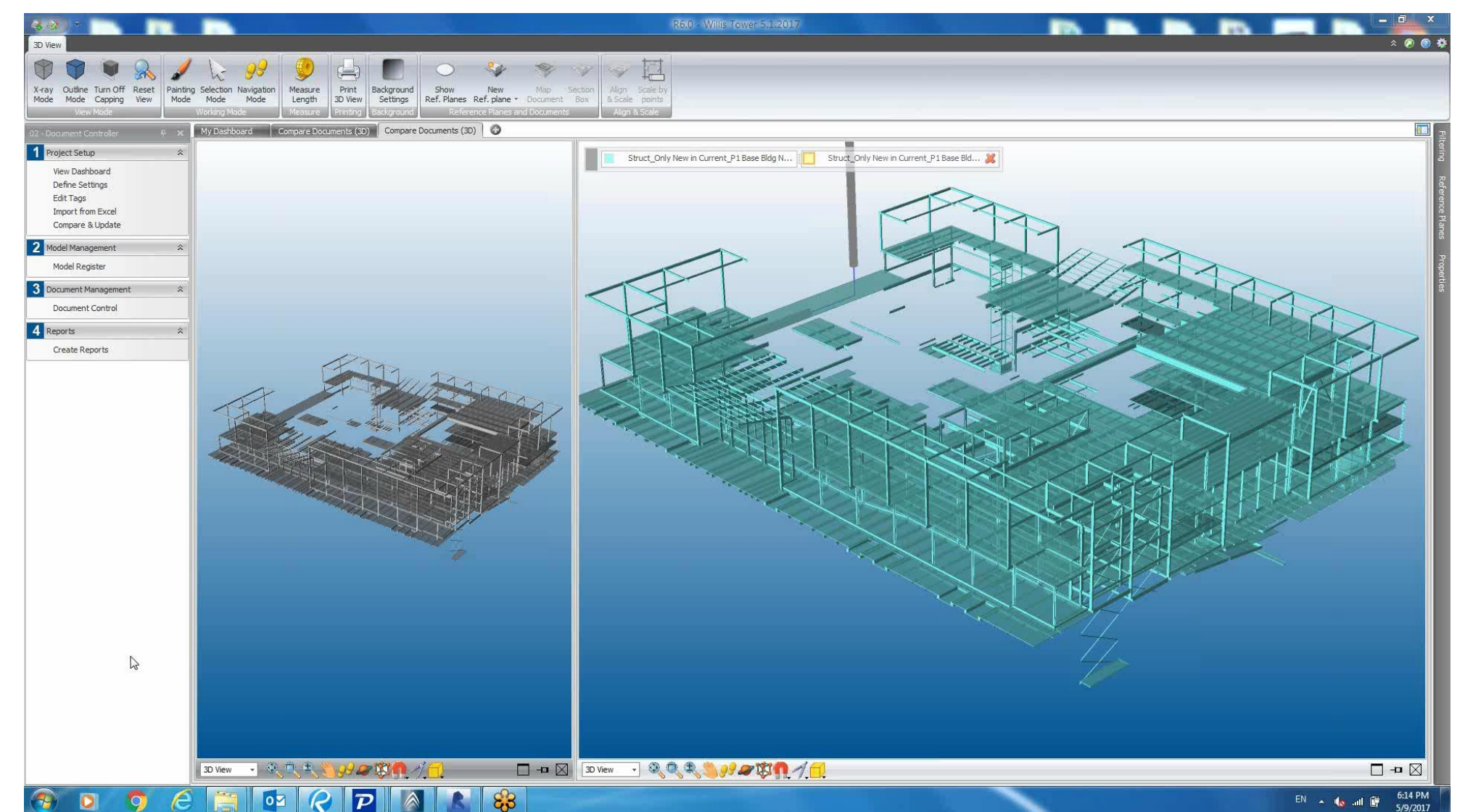
Create batch report in few seconds



# Comparing Alternatives (Sliding Mode)



Architectures\_Design Versions Comparison



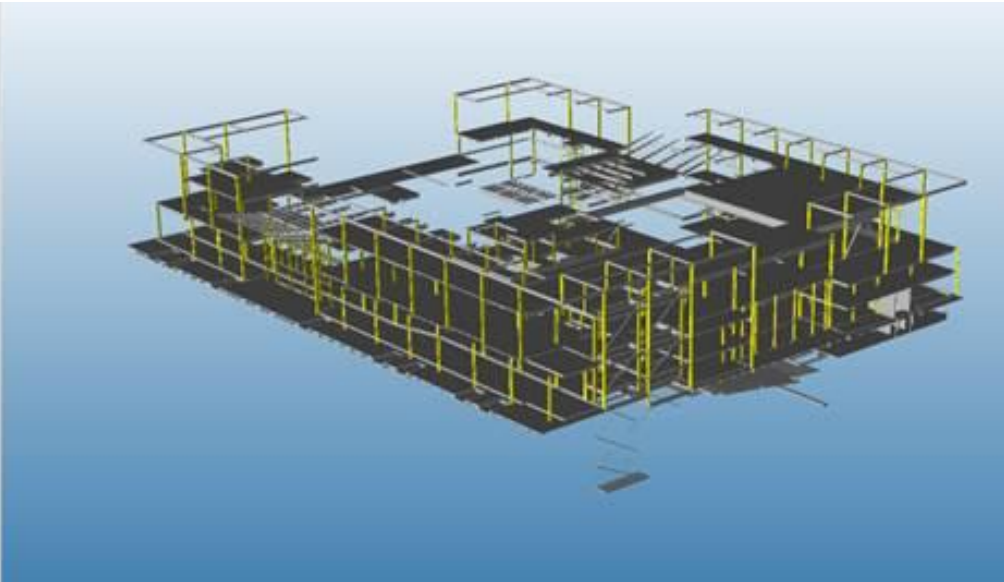
Structures\_Design Versions Comparison



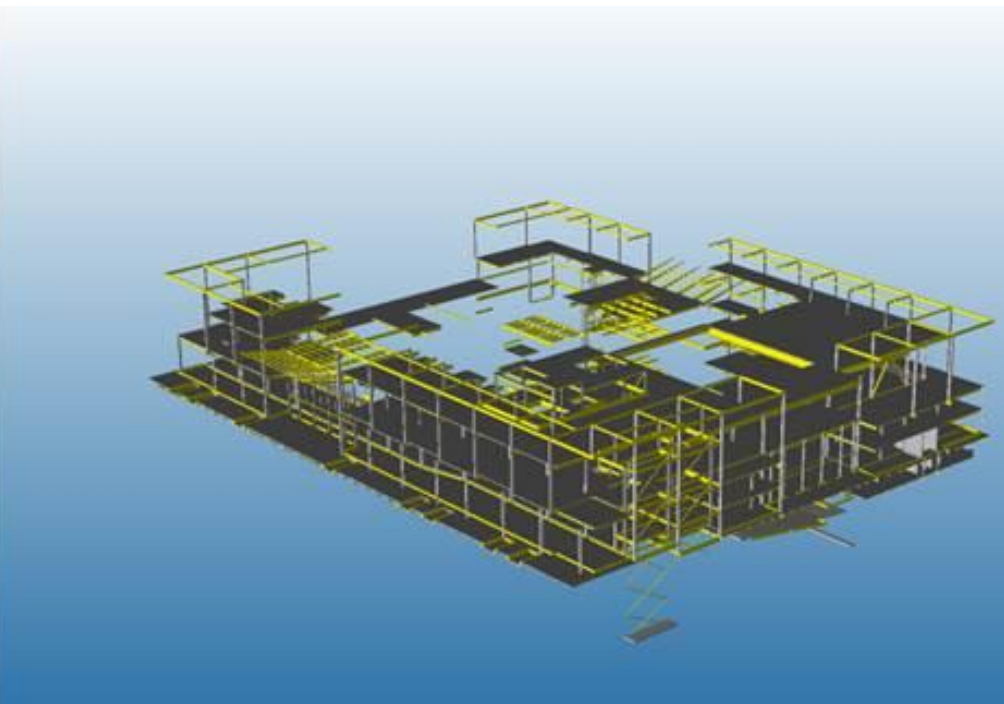
# Fast Takeoffs\_Podium Structural Model

Takeoff Objects	Quantities	Units
Beams_New Construction	2,881	ton
Columns_New Construction	304	ton
Slabs_New Construction	226,072	sqft

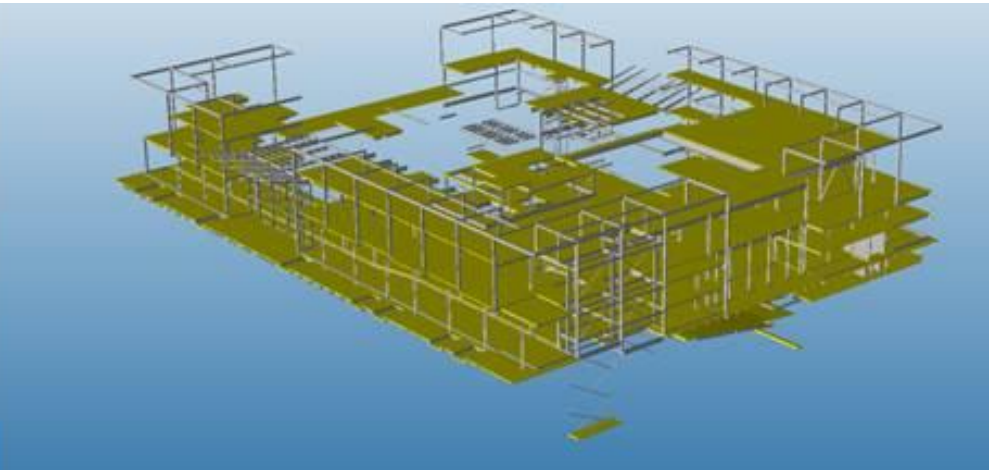
+	B10-W-Wide Flange-Column: W14X74	No	17
+	B10-W-Wide Flange-Column: W12X65	No	45
+	B10-W-Wide Flange-Column: W14X159	No	10
+	B10-HSS-Hollow Structural Section-Column: BUC20X14X1/2	No	15
+	B10-W-Wide Flange-Column: W14X109	No	6
+	B10-W-Wide Flange-Column: W14X90	No	17
+	B10-W-Wide Flange-Column: W14X68	No	3
+	B10-W-Wide Flange-Column: W12X96	No	1
+	B10-HSS-Hollow Structural Section-Column: HSS20X12X1/2	No	25
+	B10-W-Wide Flange-Column: W14X233	No	3
+	B10-W-Wide Flange-Column: W12X79	No	1
+	B10-HSS-Hollow Structural Section-Column: HSS20X8X1/2	No	13
+	B10-HSS-Hollow Structural Section-Column: HSS20X12X1/2	No	7
+	B10-W-Wide Flange-Column: W14X193	No	4
+	B10-HSS-Hollow Structural Section-Column: HSS16X4X1/2	No	6
+	B10-Rad Hanger: 1" ROD	No	18
+	B10-W-Wide Flange-Column: W14X120	No	2
+	B10-HSS-Hollow Structural Section-Column: HSS4X4X1/4	No	70
+	B10-_TT_Plate-Column: 18" X 4.5" SOLID BAR	No	8
+	B10-_TT_Plate-Column: 9" X 4.5" SOLID BAR	No	5
+	B10-HSS-Hollow Structural Section-Column: HSS12X12X1/2	No	3
+	B10-HSS-Hollow Structural Section-Column: HSS6X6X1/2	No	32
+	B10-Concrete-Rectangular-Column2: Encasement 24x24	No	22
+	B10-W-Wide Flange-Column: W14X132	No	1



+	B10-W-Wide Flange: WBX10	No	5
+	B10-W-Wide Flange: W40X211	No	2
+	B10-HSS-Hollow Structural Section: HSS20X12X1/2	No	29
+	B10-HSS-Hollow Structural Section: HSS14X10X1/2	No	32
+	B10-HSS-Hollow Structural Section: HSS14X6X1/2	No	26
+	B10-HSS-Hollow Structural Section: HSS20X12X5/8	No	8
+	B10-_TT Plate Girder: BG	No	3
+	B10-W-Wide Flange: W40X277	No	1
+	B10-W-Wide Flange: W24X117	No	3
+	B10-Plate: 36" x 2.5" SOLID BAR	No	8
+	B10-W-Wide Flange: W24X101	No	1
+	B10-WT-Structural Tee: WT12X52	No	2
+	B10-WT-Structural Tee: WT12X73	No	2
+	B10-W-Wide Flange: W33X130	No	2
+	B10-W-Wide Flange: W30X211	No	2
+	B10-HSS-Hollow Structural Section: HSS9X9X3/16	No	10
+	B10-HSS-Hollow Structural Section: HSS2X1-1/2X1/8	No	20
+	B10-W-Wide Flange: W14X30	No	1
+	B10-W-Wide Flange: W18X97	No	1
+	B10-W-Wide Flange: W44X335	No	1
+	B10-W-Wide Flange: W14X68	No	2
+	B10-W-Wide Flange: W40X431	No	1
+	B10-Concrete-Rectangular Beam: Encased Beam2	No	14
+	B10-Plate: 27" x 4.5" SOLID BAR	No	6
+	B10-Plate: 6'x3" SOLID BAR	No	111
+	B10-Plate: 18" x 4.5" SOLID BAR	No	1
+	B10-_TT_Tapered_Plate_30: 30" x 4.5" - 6" X 4.5" SOLID BAR TAPERED	No	6
+	B10-_TT_Tapered_Plate: 27" x 4.5" - 6" x 4.5" SOLID BAR TAPERED	No	6
+	B10-Plate: 9" x 4.5"	No	10



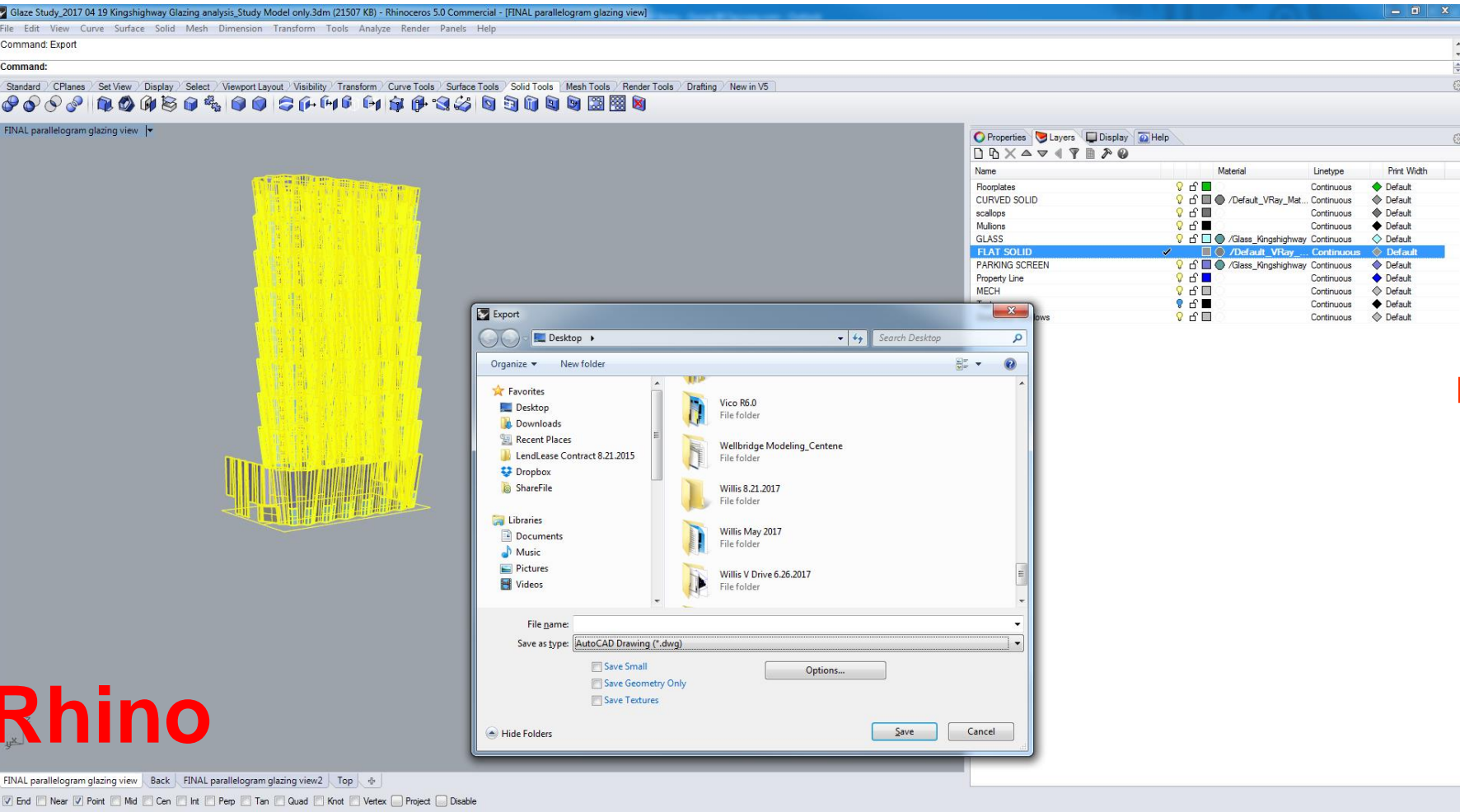
+	B10-W-Wide Flange-Column: W14X132	No	1
+	B1010-Floor: 3 1/4" LWC over 3" Verco N	No	33
+	A1010110-Wall Foundation: Bearing Footing - 3'-0" x 1'-3"	No	3
+	B1010-Floor: 36" Mat Foundation	No	1
+	B1010-Floor: 3" LWC over 2.5" Verco N	No	4
+	B1010-Floor: 5" LWC over 3" Verco N 2	No	9
+	B1010-Floor: 4 1/4" LWC over 3" Verco N 2	No	5
+	B1010-Floor: 5 1/4" NWT over 2" Metal Deck	No	3
+	Floor: Generic 3"	No	2
+	B1010-Floor: 12" Concrete SOG	No	6
+	B1010-Floor: 5 1/4" NWT over 3" Metal Deck	No	1
+	B1010-Floor: 8.5" Concrete	No	2
+	B1010-Floor: 3.25" Concrete	No	1
+	B1010-Floor: 6" Concrete	No	2
+	B1010-Floor: 2 1/2" LWC over 3" Verco	No	1
+	B1010-Floor: 8" Concrete	No	1



VE Structural model Takeoffs Willis Tower												
File Home Insert Page Layout Formulas Data Review View Developer Add-Ins BLUEBEAM Team Tell me what you												
Clipboard Font Alignment Number												
N13												
Willis Tower 5.3.2017												
BEAM_RECTANGULAR 2,880.44												
QTY												
B10-_TT_Tapered_Plate: 27" x 4.5 - 6" x 4.5" SOLID BAR TAPERED												
Length 214'-13/16" feet and inches												
Weight 27.24 Tons												
B10-_TT_Tapered_Plate_30: 30" x 4.5" - 6" X 4.5" SOLID BAR TAPERED												
Length 215'-1 9/16" feet and inches												
Weight 30.31 Tons												
B10-_TT-Plate Girder: BG												
Length 45' feet and inches												
Weight 5.11 Tons												
B10-_TT-Plate Girder: PG 1												
Length 417'-6" feet and inches												
Weight 90.42 Tons												
B10-_TT-Plate Girder: PG 2												
Length 105' feet and inches												
Weight 27.89 Tons												
B10-_TT-Plate Girder: PG 3												
Length 60'-4 15/16" feet and inches												
Weight 8.05 Tons												
B10-_TT-Plate Girder: PG 4												
Length 200' feet and inches												
Weight 68.29 Tons												
B10-Concrete-Rectangular Beam: Encased Beam1												
Length 77'-4 1/2" feet and inches												
Weight 88.72 Tons												
B10-Concrete-Rectangular Beam: Encased Beam2												
Length 463'-1/16" feet and inches												

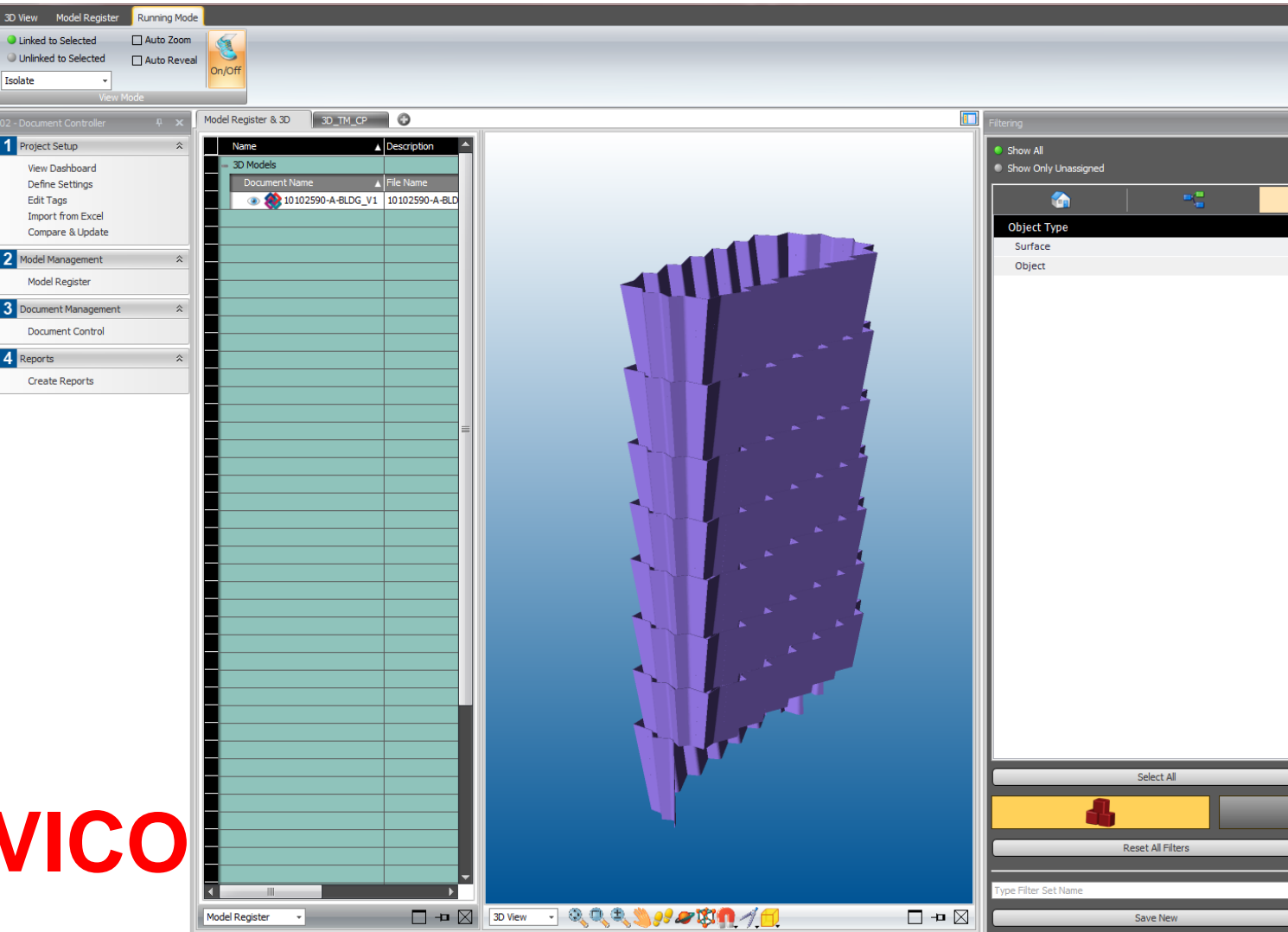


# Rhino Model imported to VICO



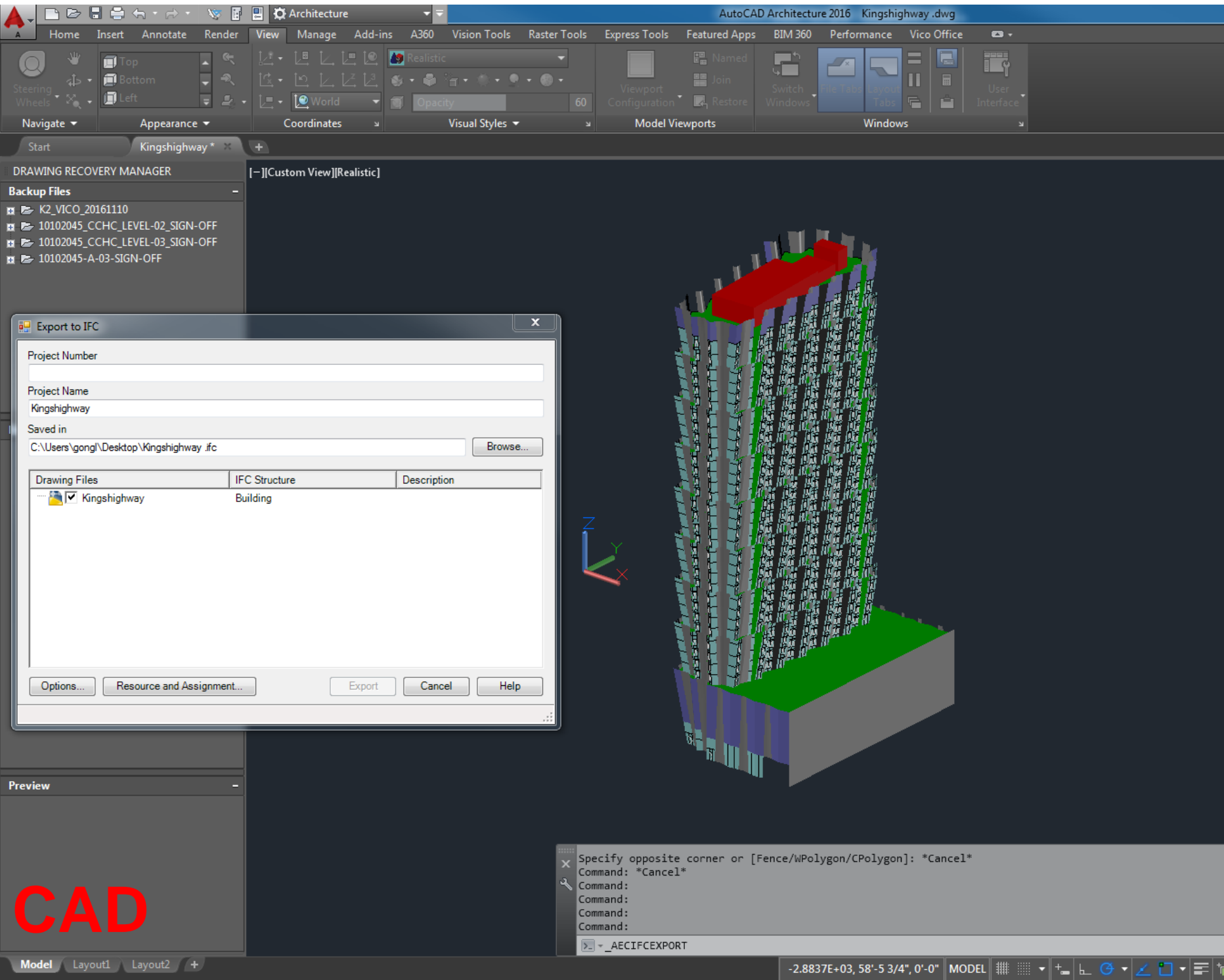
Rhino

Rhino converting to CAD



VICO

CAD converting to IFC and then IFC Importing to VICO



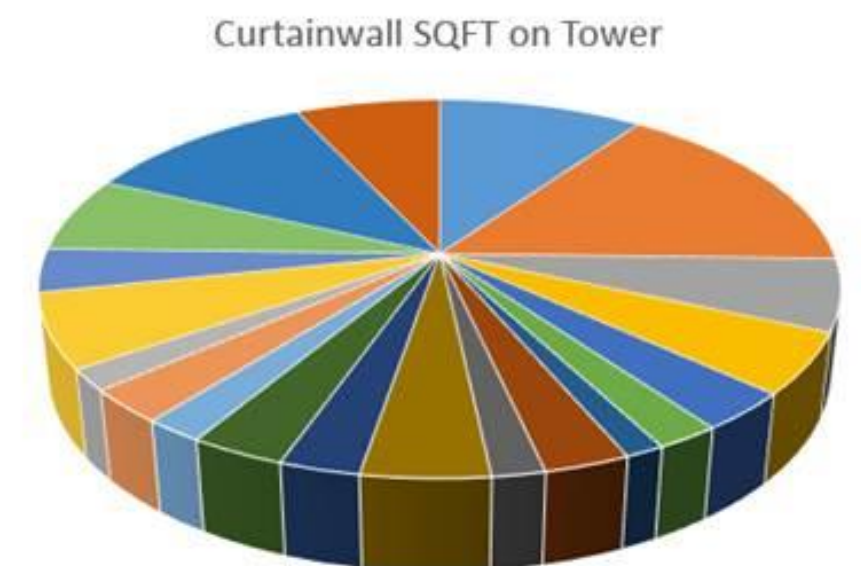
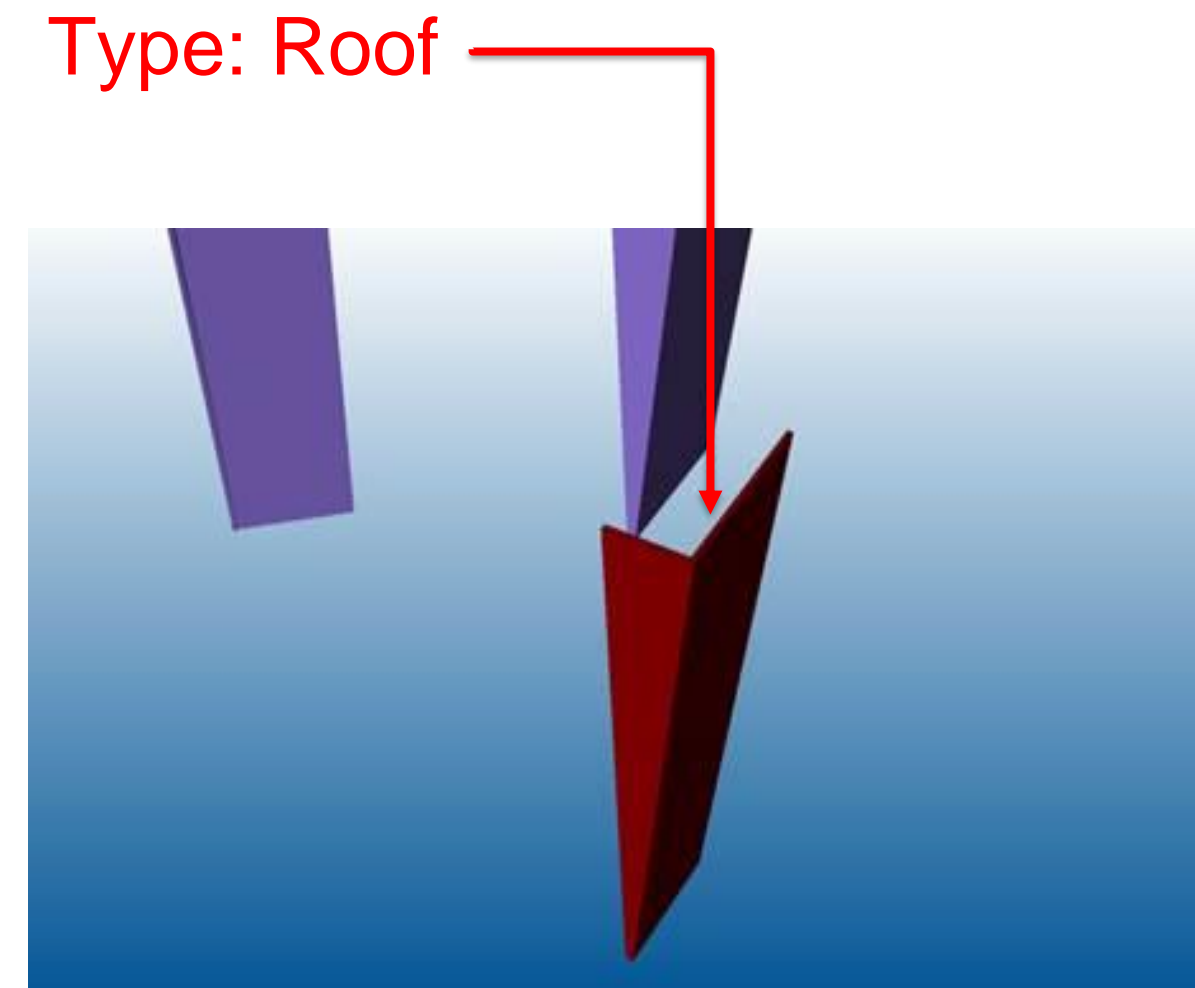
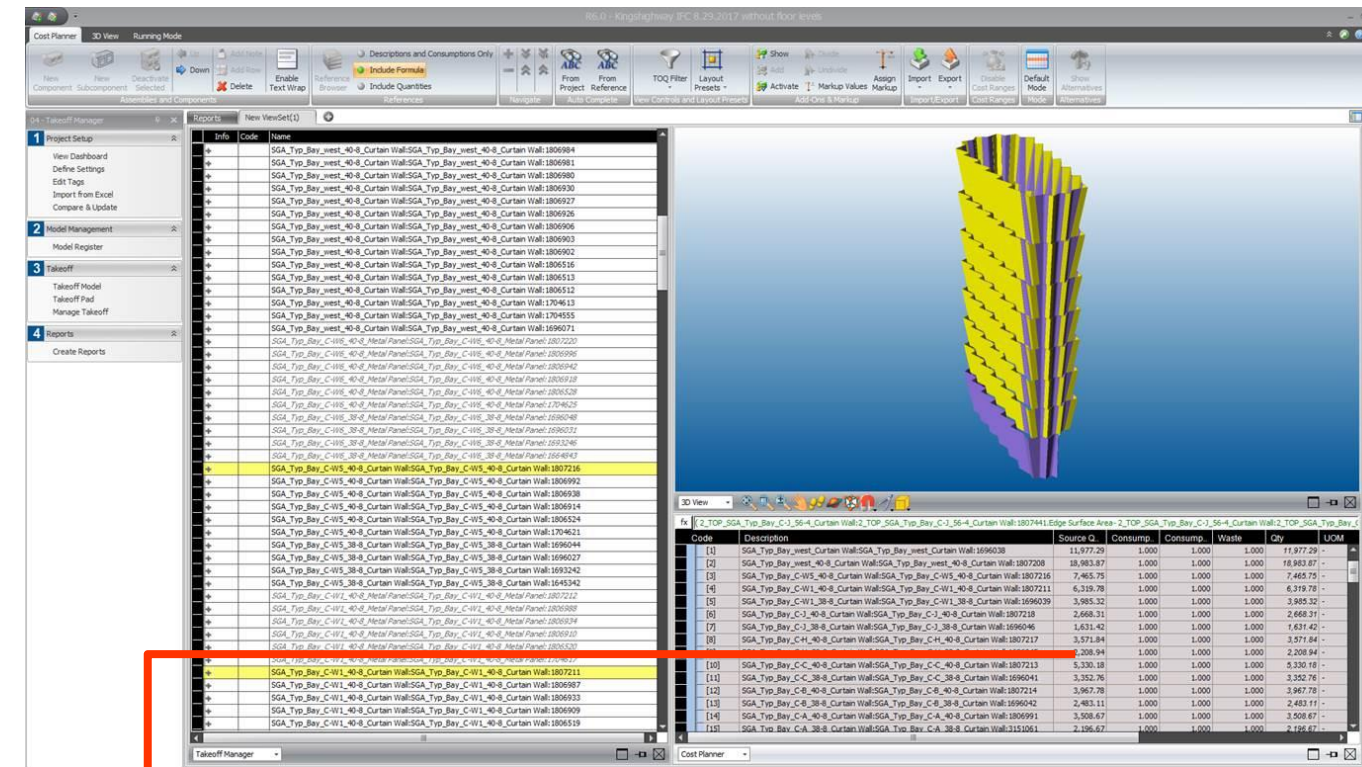
CAD



# Rhino Model Converted to VICO

**Total curtainwall area on tower is 121,805 sqft.**

## Use formula to define quantities as desired



**FormulaEditor**



Associated Location System: -

Code	Description/Quantity	Value	Unit
✖	SGA_Typ_Bay_west_Metal Panel:SGA_Typ_Bay_west_Metal Panel:1298685		
✖	SGA_Typ_Bay_west_Curtain Wall:SGA_Typ_Bay_west_Curtain Wall:1300345		
✖	SGA_Typ_Bay_west_Metal Panel:SGA_Typ_Bay_west_Metal Panel:1300346		
✖	SGA_Typ_Bay_west_Metal Panel:SGA_Typ_Bay_west_Metal Panel:1300347		
✖	SGA_Typ_Bay_west_Curtain Wall:SGA_Typ_Bay_west_Curtain Wall:1300348		
✖	SGA_Typ_Bay_west_Curtain Wall:SGA_Typ_Bay_west_Curtain Wall:1629978		
✖	SGA_Typ_Bay_C-W1_38-8_Curtain Wall:SGA_Typ_Bay_C-W1_38-8_Curtain Wall:1630025		
✖	SGA_Typ_Bay_C-W1_38-8_Metal Panel:SGA_Typ_Bay_C-W1_38-8_Metal Panel:1631655		
✖	SGA_Typ_Bay_C-C_38-8_Curtain Wall:SGA_Typ_Bay_C-C_38-8_Curtain Wall:1633121		
✖	SGA_Typ_Bay_C-B_38-8_Curtain Wall:SGA_Typ_Bay_C-B_38-8_Curtain Wall:1634578		
✖	SGA_Typ_Bay_C-W5_38-8_Curtain Wall:SGA_Typ_Bay_C-W5_38-8_Curtain Wall:1645342		
✖	SGA_Typ_Bay_C-H_38-8_Curtain Wall:SGA_Typ_Bay_C-H_38-8_Curtain Wall:1649325		
✖	SGA_Typ_Bay_C-J_38-8_Curtain Wall:SGA_Typ_Bay_C-J_38-8_Curtain Wall:1649326		
✖	SGA_Typ_Bay_C-C_38-8_Metal Panel:SGA_Typ_Bay_C-C_38-8_Metal Panel:1659128		

LBS	Quantity
-----	----------

Enter formula

### Preview

f <sub>x</sub> =	(SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Edge_Surface_Area-SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Two_Edge_Surface*(SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Count-1)))/2	((SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Edge_Surface_Area-(SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Two_Edge_Surface*(SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Count-1)))^2.0000000000000000))/2.0000000000000000)
------------------	---	--


	Curtainwall Modules	SQFT
[1]	SGA_Typ_Bay_west_Curtain Wall:SGA_Typ_Bay_west_Curtain Wall	11,977.29
[2]	SGA_Typ_Bay_west_40-8_Curtain Wall:SGA_Typ_Bay_west_40-8_Curtain Wall	18,983.87
[3]	SGA_Typ_Bay_C-W5_40-8_Curtain Wall:SGA_Typ_Bay_C-W5_40-8_Curtain Wall	7,465.75
[4]	SGA_Typ_Bay_C-W1_40-8_Curtain Wall:SGA_Typ_Bay_C-W1_40-8_Curtain Wall	6,319.78
[5]	SGA_Typ_Bay_C-W1_38-8_Curtain Wall:SGA_Typ_Bay_C-W1_38-8_Curtain Wall	3,985.32
[6]	SGA_Typ_Bay_C-J_40-8_Curtain Wall:SGA_Typ_Bay_C-J_40-8_Curtain Wall	2,668.31
[7]	SGA_Typ_Bay_C-J_38-8_Curtain Wall:SGA_Typ_Bay_C-J_38-8_Curtain Wall	1,631.42
[8]	SGA_Typ_Bay_C-H_40-8_Curtain Wall:SGA_Typ_Bay_C-H_40-8_Curtain Wall	3,571.84
[9]	SGA_Typ_Bay_C-H_38-8_Curtain Wall:SGA_Typ_Bay_C-H_38-8_Curtain Wall	2,208.94
[10]	SGA_Typ_Bay_C-C_40-8_Curtain Wall:SGA_Typ_Bay_C-C_40-8_Curtain Wall	5,330.18
[11]	SGA_Typ_Bay_C-C_38-8_Curtain Wall:SGA_Typ_Bay_C-C_38-8_Curtain Wall	3,352.76
[12]	SGA_Typ_Bay_C-B_40-8_Curtain Wall:SGA_Typ_Bay_C-B_40-8_Curtain Wall	3,967.78
[13]	SGA_Typ_Bay_C-B_38-8_Curtain Wall:SGA_Typ_Bay_C-B_38-8_Curtain Wall	2,483.11
[14]	SGA_Typ_Bay_C-A_40-8_Curtain Wall:SGA_Typ_Bay_C-A_40-8_Curtain Wall	3,508.67
[15]	SGA_Typ_Bay_C-A_38-8_Curtain Wall:SGA_Typ_Bay_C-A_38-8_Curtain Wall	2,196.67
[16]	3_SGA_Typ_Bay_west_51-10_Curtain Wall:3_SGA_Typ_Bay_west_51-10_Curtain Wall	7,703.25
[17]	3_SGA_Typ_Bay_C-W5_51-10_Curtain Wall:3_SGA_Typ_Bay_C-W5_51-10_Curtain Wall	4,522.49
[18]	3_SGA_Typ_Bay_C-J_51-10_Curtain Wall:3_SGA_Typ_Bay_C-J_51-10_Curtain Wall	7,829.81
[19]	2_TOP_SGA_Typ_Bay_west_56-4_Curtain Wall:2_TOP_SGA_Typ_Bay_west_56-4_Curtain Wall	13,639.70
[20]	2_TOP_SGA_Typ_Bay_C-J_56-4_Curtain Wall:2_TOP_SGA_Typ_Bay_C-J_56-4_Curtain Wall	8,457.75
	<b>TOTAL</b>	<b>121,804.68</b>

- SGA\_Typ\_Bay\_west\_Curtain Wall:SGA\_Typ\_Bay\_west\_Curtain Wall
- SGA\_Typ\_Bay\_west\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_west\_40-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-W5\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_C-W5\_40-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-W1\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_C-W1\_40-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-W1\_38-8\_Curtain Wall:SGA\_Typ\_Bay\_C-W1\_38-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-J\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_C-J\_40-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-J\_38-8\_Curtain Wall:SGA\_Typ\_Bay\_C-J\_38-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-H\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_C-H\_40-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-H\_38-8\_Curtain Wall:SGA\_Typ\_Bay\_C-H\_38-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-C\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_C-C\_40-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-C\_38-8\_Curtain Wall:SGA\_Typ\_Bay\_C-C\_38-8\_Curtain Wall
- SGA\_Typ\_Bay\_C-B\_40-8\_Curtain Wall:SGA\_Typ\_Bay\_C-B\_40-8\_Curtain Wall



# Reporting

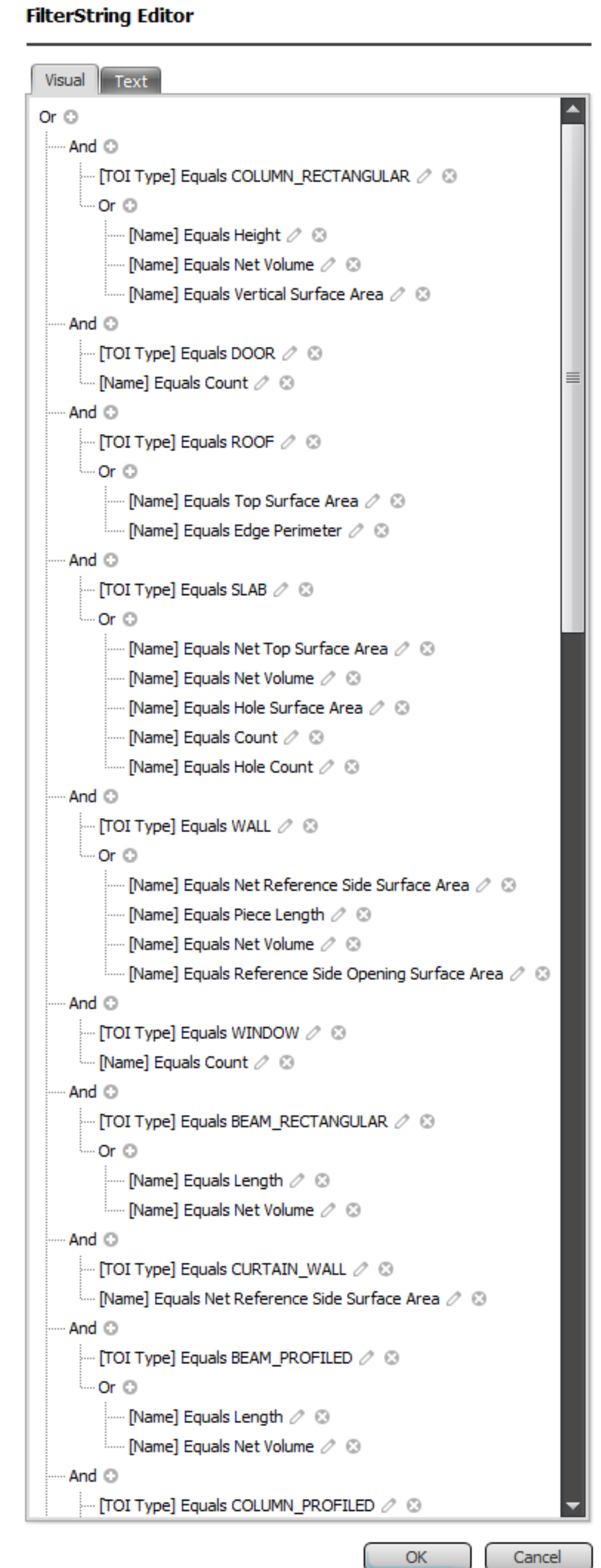
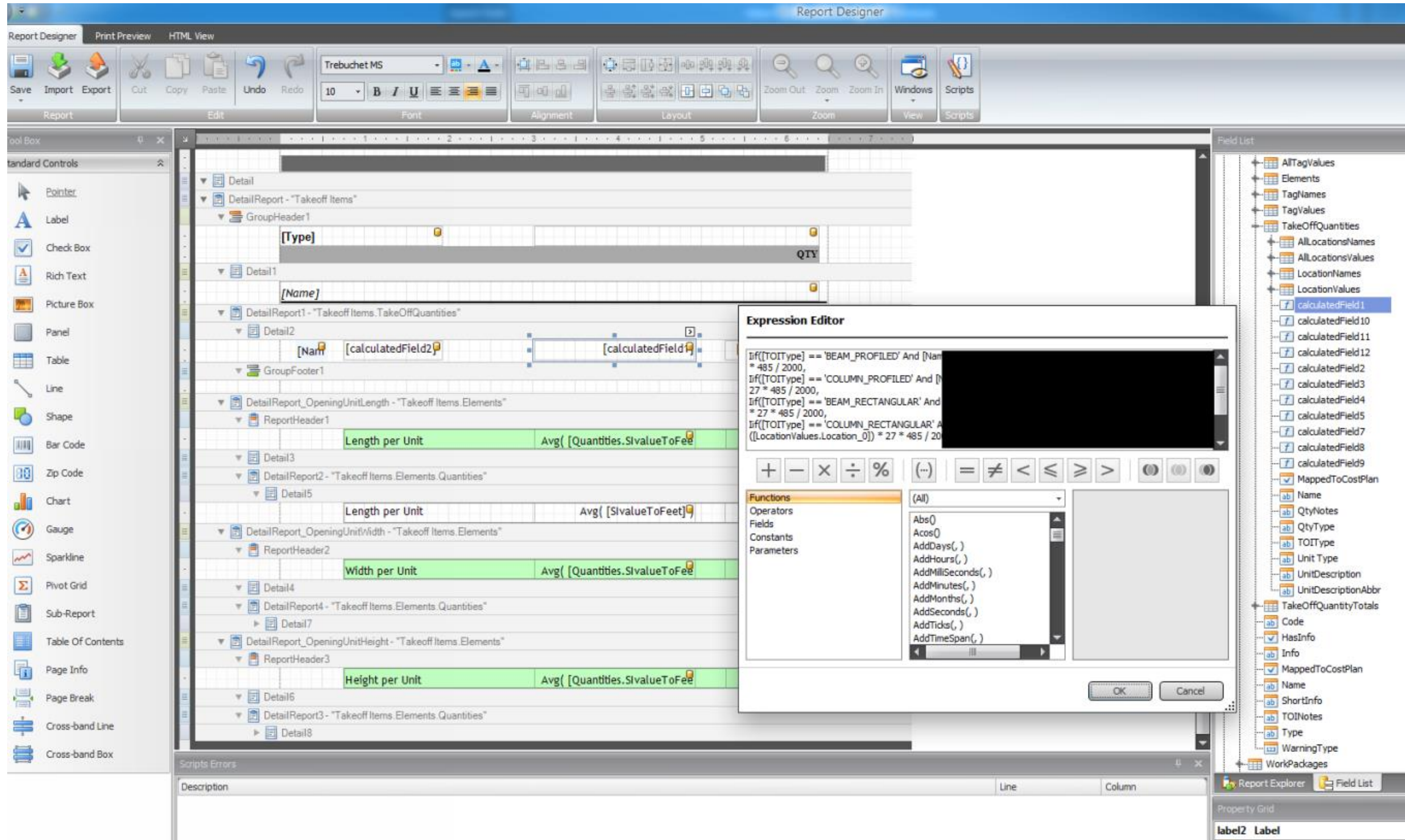
- Construction grade quantities
  - Steel
  - Concrete
  - Partitions
  - Finishes
- Comparison report
  - Unified models database
  - Quantity reporting
  - Associated cost reporting
  - Visual verification
- Quantity push to estimating platform

<div>Zurich North America HQ</div> <div><div>CLAYCO</div><div>THE ART &amp; SCIENCE OF BUILDING</div></div> <div>Version1 - 13100_ZNA-S-SC-VDC</div>		
BEAM_PROFIED	3,238.66	Tons
QTY		
B1010.10.23-HSS12X6X5/16		
Count	72.00	count
Length	1145'	feet and inches
Weight	18.75	Tons
B1010.10.23-HSS18X6X1/4		
Count	6.00	count
Length	165'	feet and inches
Weight	2.91	Tons
B1010.10.23-HSS6X6X5/16		
Count	32.00	count
Length	320'	feet and inches
Weight	3.36	Tons
B1010.10.23-W12X14		
Count	431.00	count
Length	5042'-3 3/8"	feet and inches
Weight	31.94	Tons
B1010.10.23-W16X26		
Count	51.00	count
Length	1415'-9 3/16"	feet and inches
Weight	17.20	Tons
B1010.10.23-W18X119		
Count	44.00	count
Length	1326'	feet and inches
Weight	71.33	Tons
B1010.10.23-W18X35		
Count	14.00	count
Length	315'	feet and inches
Weight	5.11	Tons
B1010.10.23-W18X40		
Count	2013.00	count
Length	69645'-9"	feet and inches
Weight	1,309.98	Tons
B1010.10.23-W18X55		
Count	78.00	count
Length	2184'-3 7/8"	feet and inches
Weight	56.13	Tons
B1010.10.23-W18X86		
Count	299.00	count
Length	8760'-1 3/8"	feet and inches
Weight	352.55	Tons
B1010.10.23-W21X50		
Count	406.00	count
Length	11704'-11 3/4"	feet and inches
Weight	272.18	Tons
B1010.10.23-W24X68		
Count	17.00	count
Length	502'-5 7/16"	feet and inches
Weight	15.97	Tons

QTY		
B1010.10.23-HSS12X6X5/16		
Count	72.00	count
Length	1145'	feet and inches
Weight	18.75	Tons



# Customizing Report Items



# Scheduling & Estimating Platform Integration

- Ability to create Master assemblies
- No more corrupted Excel Formulas
- Estimates according to industry standards
  - Masterformat 95, 2004
  - Uniformat 2010
- Historical Cost modeling
- Support for the unlimited WBS and Locations
- P6 development



**Q & A**

**Thank You!**





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