

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

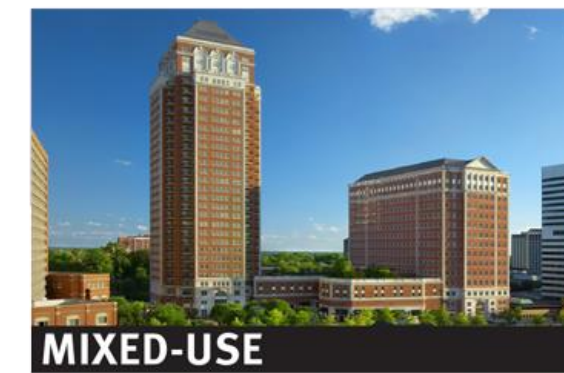
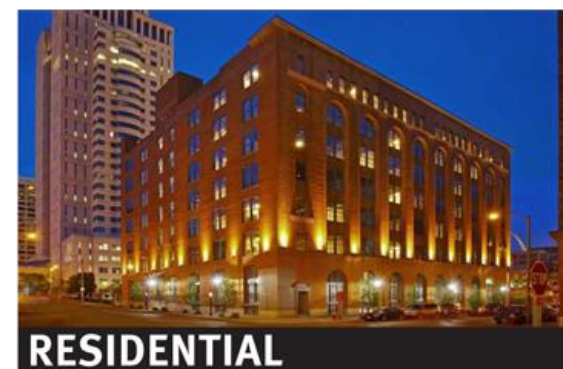
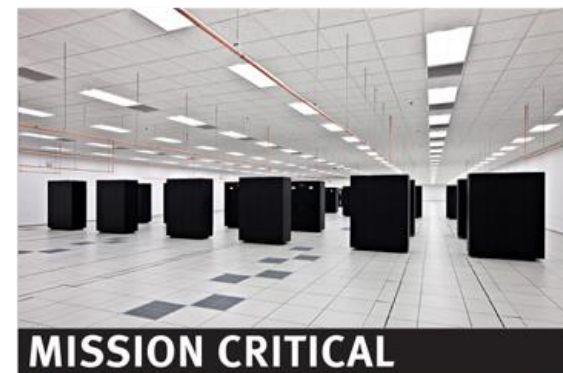
Monte Carlo Simulation

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

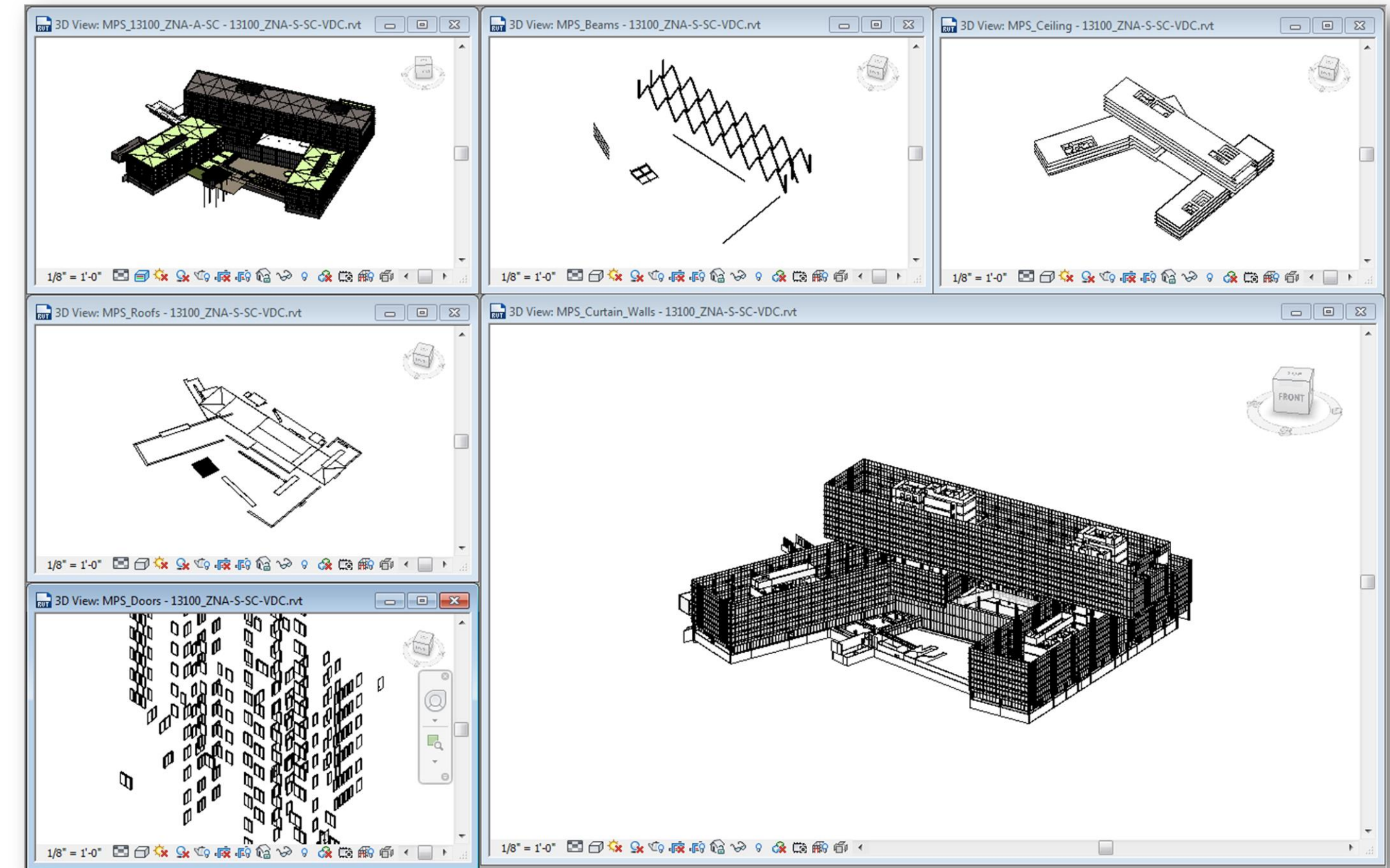


Clayco Approach

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

Feedback Loop

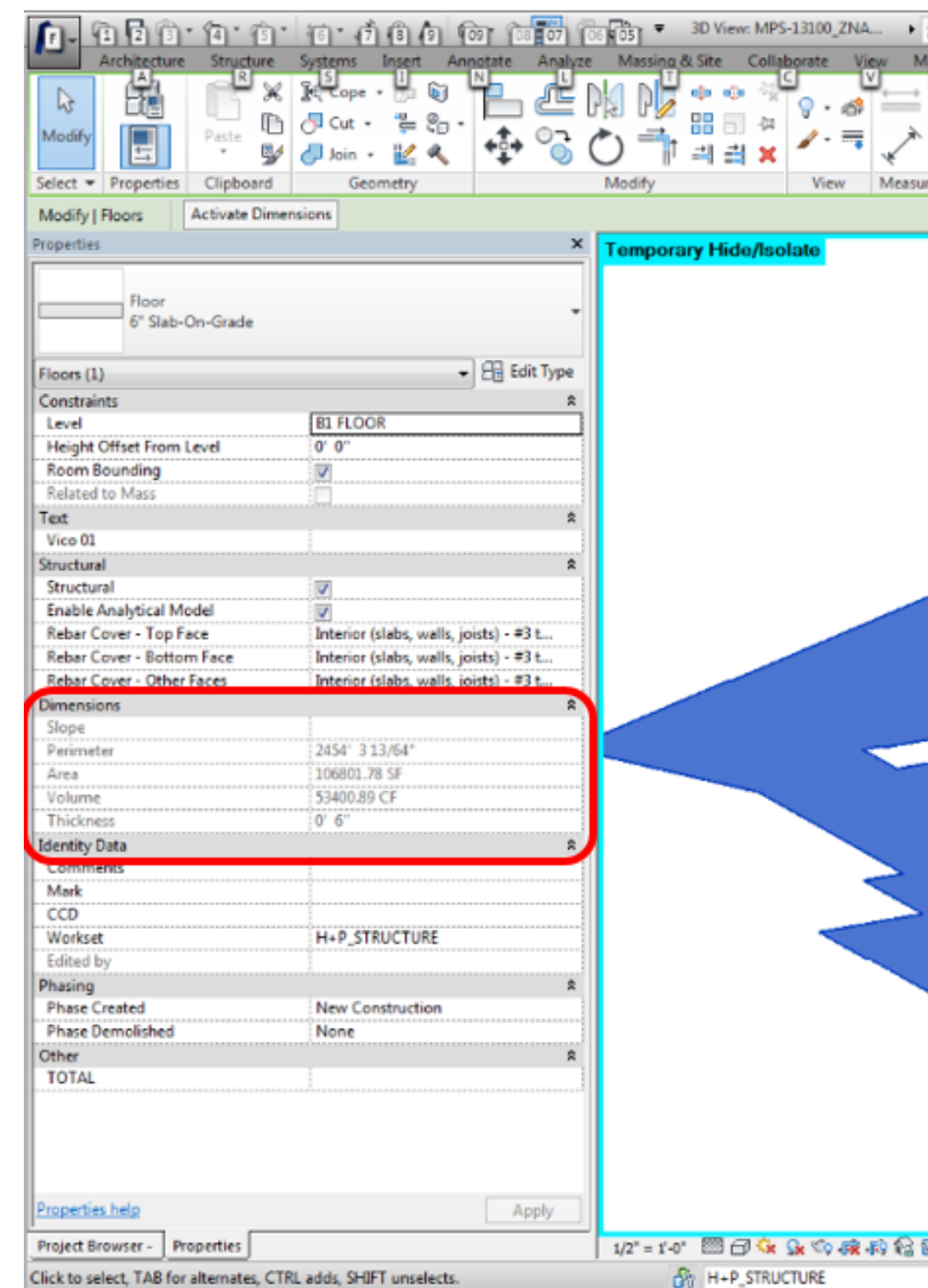
- Design team is working with building assemblies
- Associating family / type with the corresponding **assembly code**
- Maintaining consistency from project to project..
- Determining which Revit property needs to form the unique identifier
- Develop estimate centric design template
- Accompanied with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



Name	Visibility	Projection/Surface			Cut		Halftone
		Lines	Patterns	Transparen...	Lines	Patterns	
A1020.10-DRIVEN_PILES	☒						☐
A1020.15-BORED_PILES	☒						☐
A1020.80.10-GRADE_BEAMS	☒						☐
B1010.10.23-BEAMS	☒						☐
B1010.20.60-DECKING	☒						☐
A1010.10.21-FOUNDATION	☒						☐
A4020.10-SOG	☒						☐
A1020.70-PILECAPS	☒						☐
B1010.10.11	☒						☐
B1010.10.14-COLUMNS	☒						☐
B1010.10.31-DIAGONAL_B...	☒						☐

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 & 3D' window with a list of items and their quantities. A red box highlights the 'Net Bottom Surface Area' and 'Net Top Surface Area' rows.

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		10
		B1010.10.14-W12X72		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

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



Integrate Logistics_Equipment Sets: Asset management



Integrate Logistics_Equipment Sets: Rooms into 5D Process

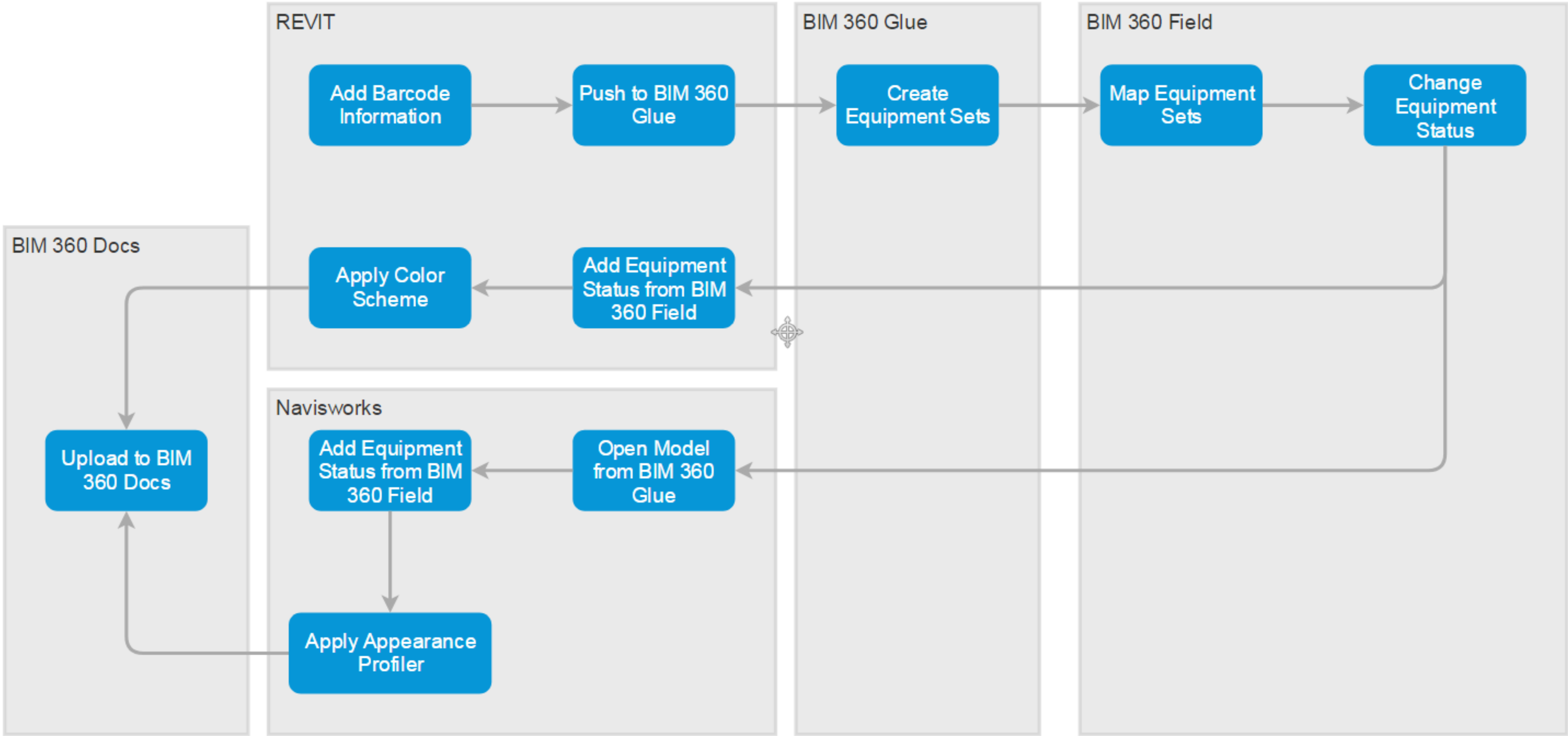
Question 1: How to integrate Barcodes into Revit?

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

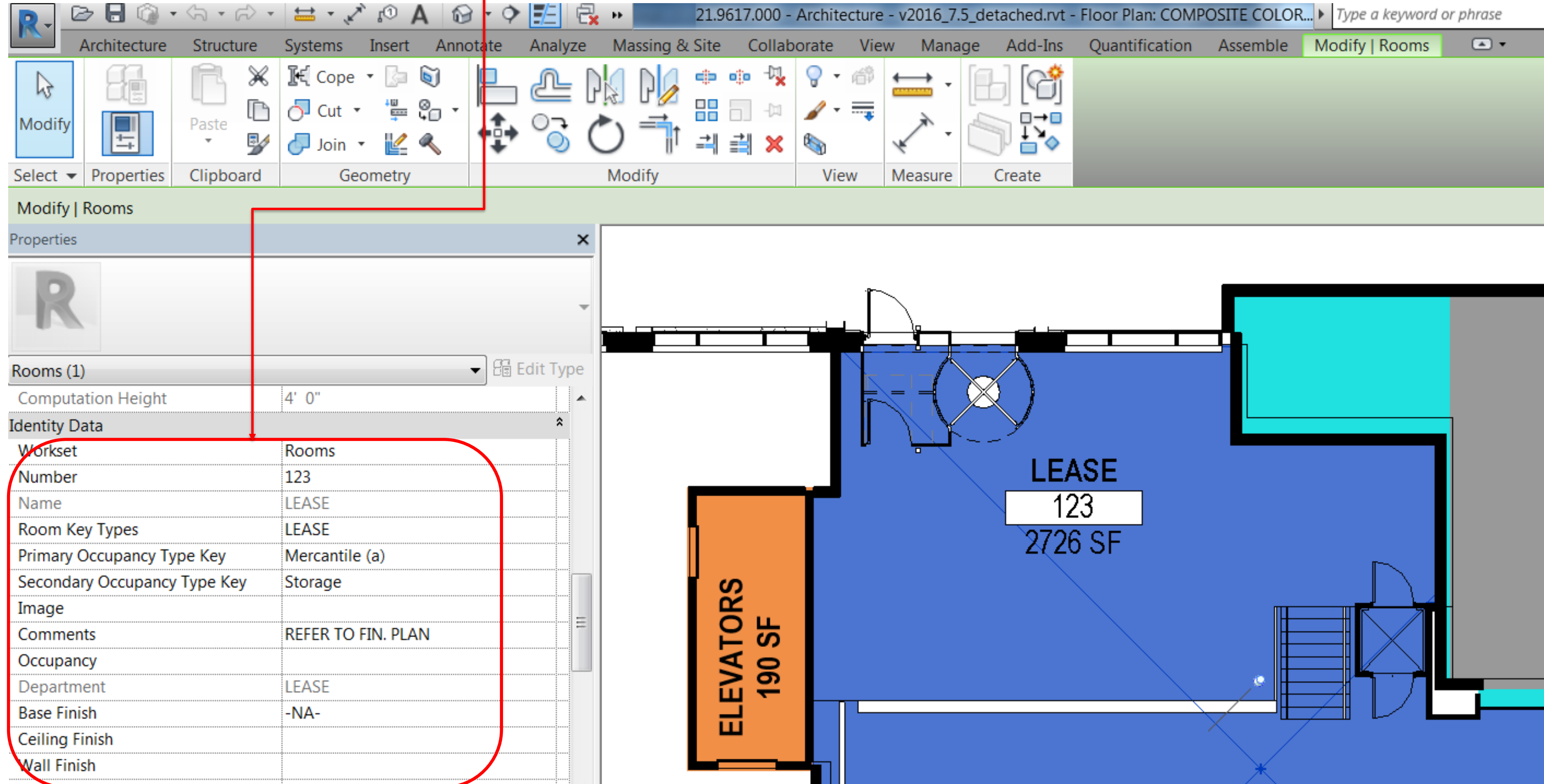
Question 1: How to integrate Barcodes into Revit?



Integrate Logistics_Equipment Sets: Rooms into 5D Process

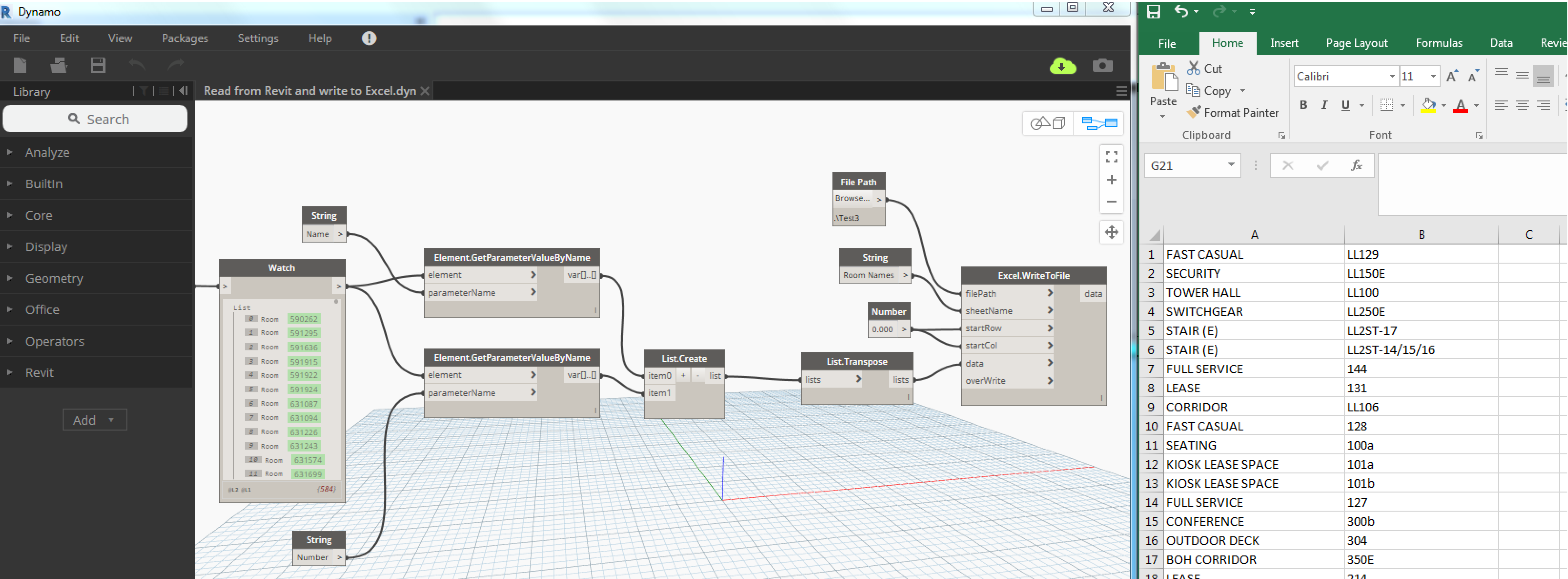
Question 1: How to integrate Barcodes into Revit?

No Barcode information



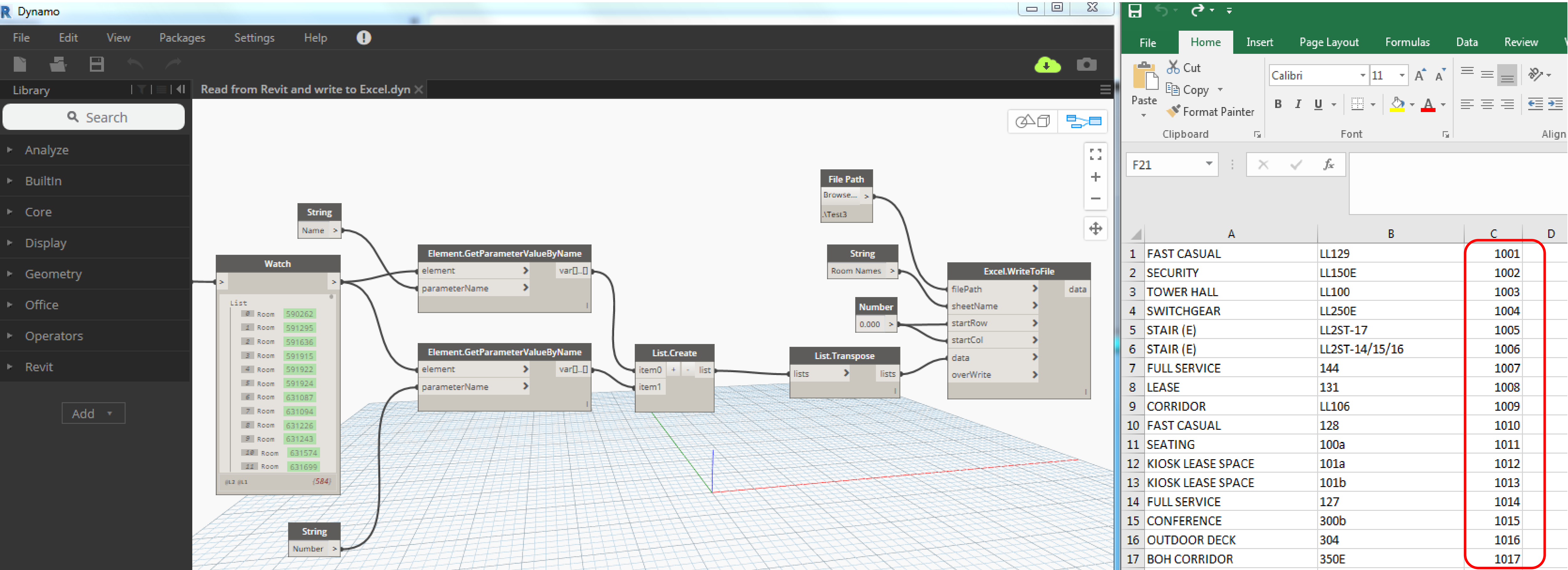
Integrate Logistics_Equipment Sets: Rooms into 5D Process

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

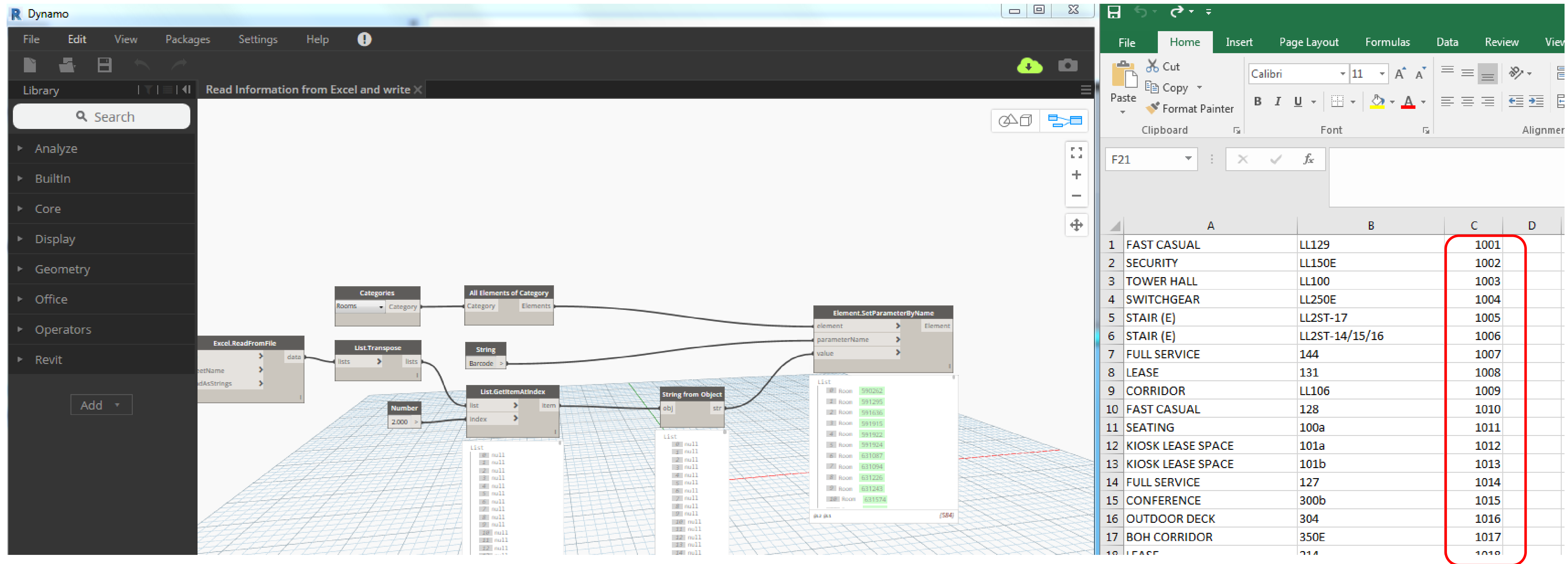


Integrate Logistics_Equipment Sets: Rooms into 5D Process

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

Select 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

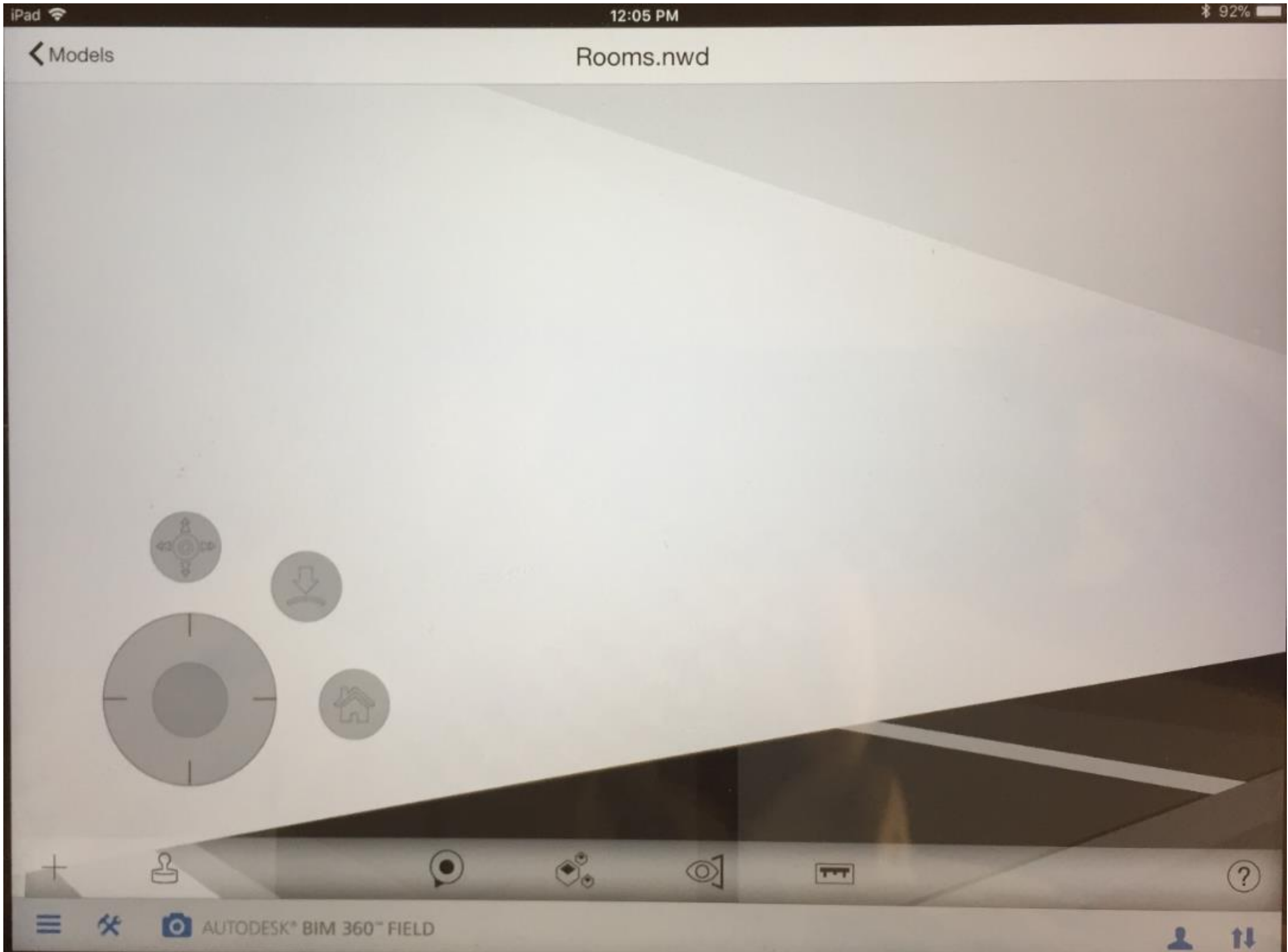
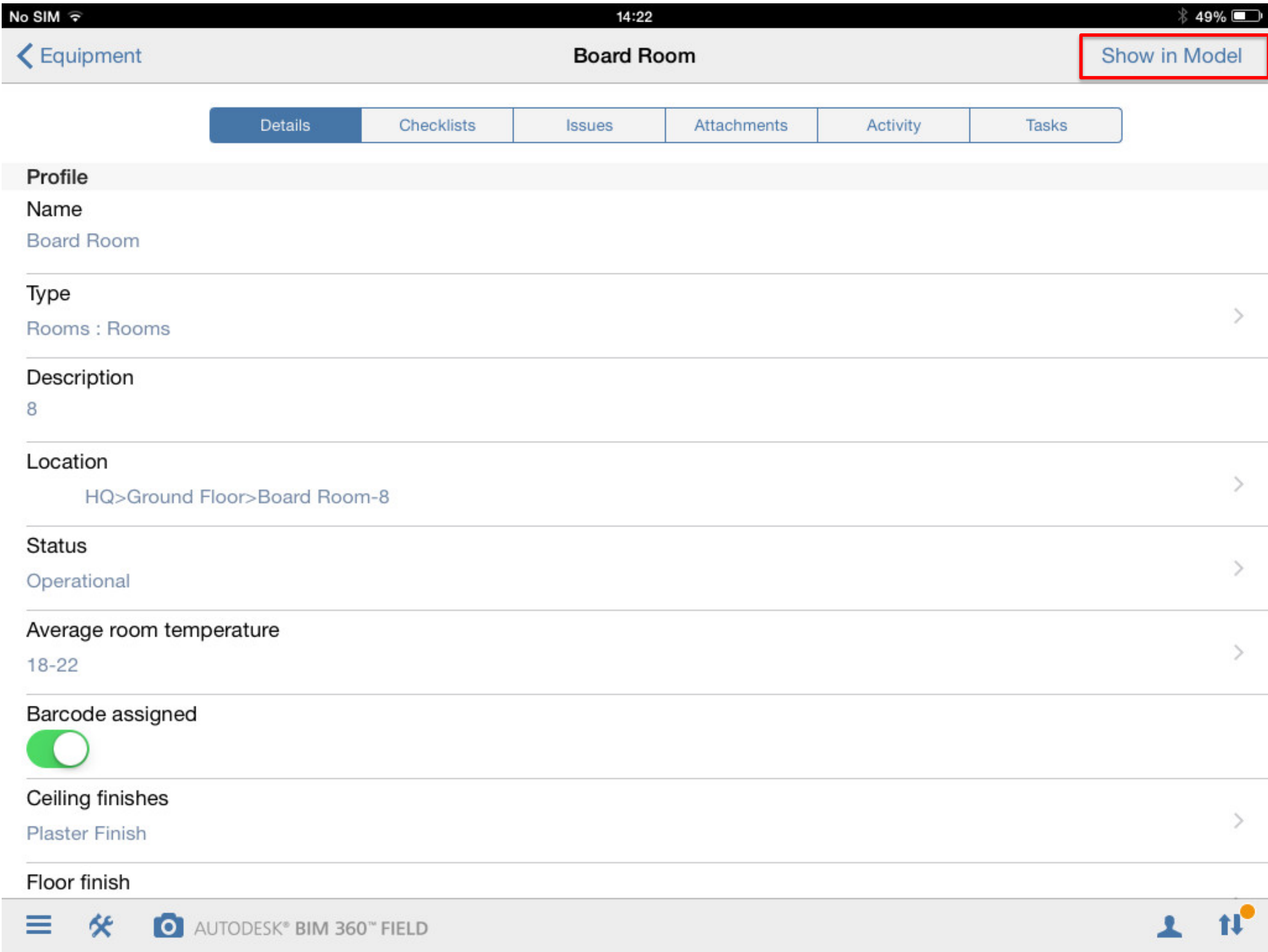
KE	
GE	

[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

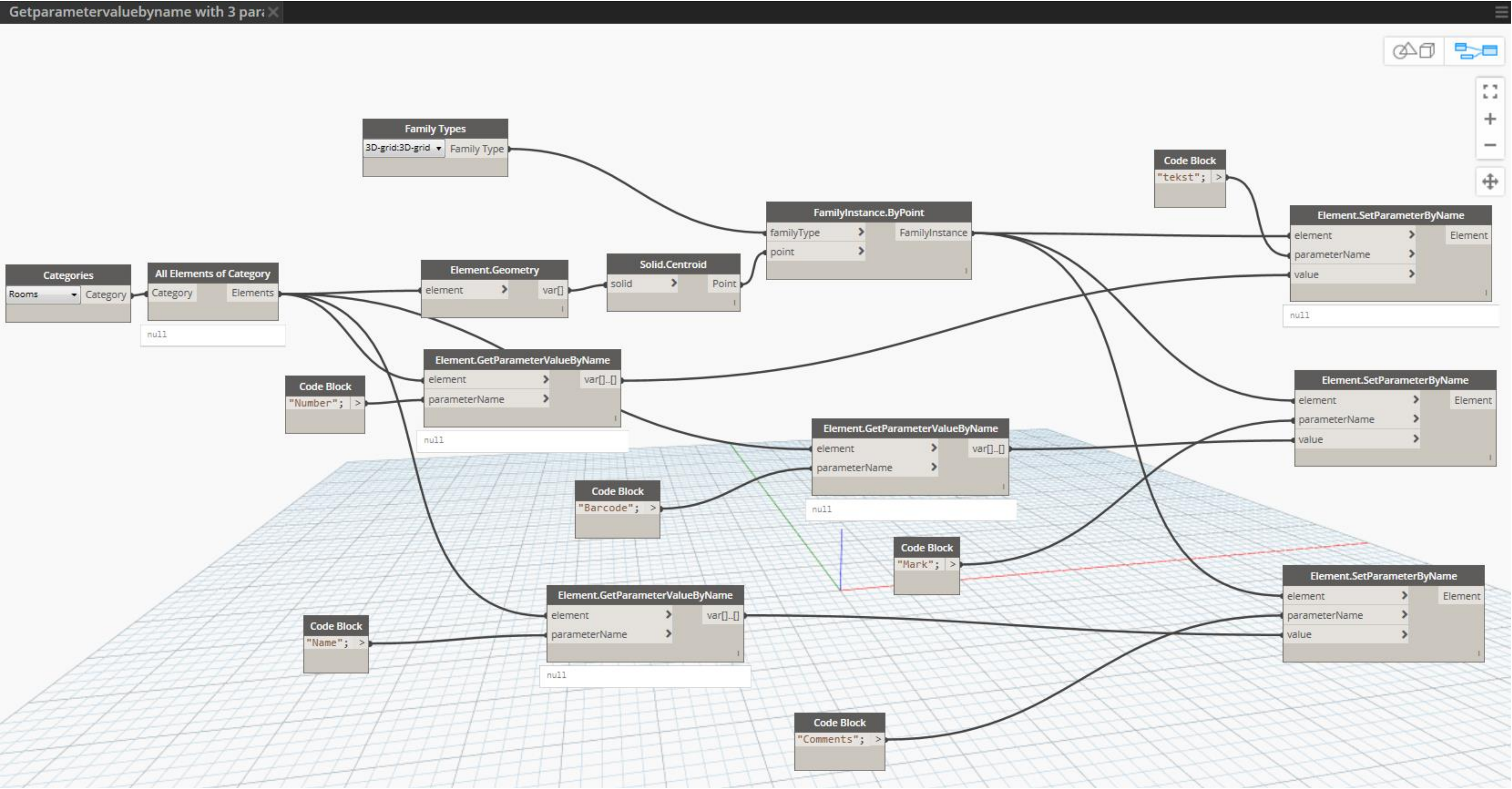
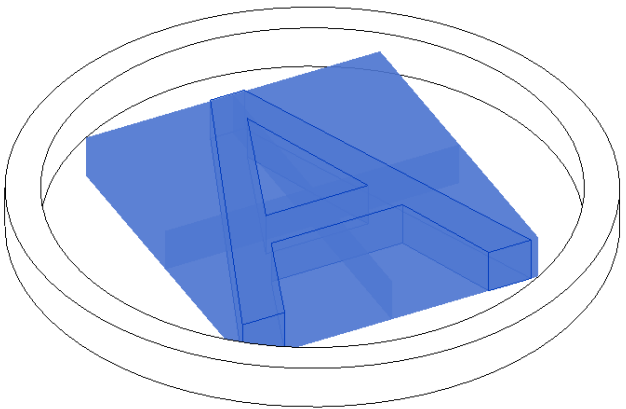
Question 2: How to stand in center of a room when using “Show in Model”?



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 →



Integrate Logistics_Equipment Sets: Rooms into 5D Process

	AUTODESK® BIM 360™ FIELD	161374_Willis Tower Repositioning ▾	Equipment											
Search Reset Close Add Edit Delete Print More Actions ▾														
Filter All Equipment ▾	Name	Barcode	Type	Description	Status	# Issues	# Open Issues	# Checklists	# Open Checklist	Manufacturer	Model Number	Date Created	Created By	Room Number
☐ ELEV MACHINE/CTRL LL320	ELEV MACHINE/CTRL LL320	1447.000000	Room		Completed	0	0	0	0			09 Apr 2018 5:32 PM		LL320
☐ PLANTED TERRACE 119G	PLANTED TERRACE 119G	1530.000000	Room		Delivered	0	0	0	0			09 Apr 2018 6:00 PM		119G
☐ VESTIBULE 132	VESTIBULE 132	1205.000000	Room		Delivered	0	0	0	0			09 Apr 2018 9:09 PM		132
☐ BOH LL350E	BOH LL350E	1116.000000	Room		Completed	0	0	0	0			09 Apr 2018 2:52 PM		LL350E
☐ TOWER HALL LL201	TOWER HALL LL201	1184.000000	Room		Installing MEP	0	0	0	0			09 Apr 2018 7:12 PM		LL201
☐ WOMEN LL150E	WOMEN LL150E	1236.000000	Room		Installing Drywall	0	0	0	0			09 Apr 2018 3:34 PM		LL150E
☐ IT 211	IT 211	1251.000000	Room		Ordered	0	0	0	0			09 Apr 2018 10:31 PM		211
☐ IT 126	IT 126	1104.000000	Room		Delivered	0	0	0	0			09 Apr 2018 8:37 PM		126
☐ ELEV PIT LL350E	ELEV PIT LL350E	1157.000000	Room		Completed	0	0	0	0			09 Apr 2018 3:02 PM		LL350E
☐ STAIR (E) LL2ST-13	STAIR (E) LL2ST-13	1369.000000	Room		Installing MEP	0	0	0	0			09 Apr 2018 5:01 PM		LL2ST-13
☐ BOH CORRIDOR 150E	BOH CORRIDOR 150E	1324.000000	Room		Delivered	0	0	0	0			09 Apr 2018 4:44 PM		150E
☐ IRR ROOM 148	IRR ROOM 148	1443.000000	Room		Delivered	0	0	0	0			09 Apr 2018 5:29 PM		148
☐ VESTIBULE LL136	VESTIBULE LL136	1408.000000	Room		Installing Drywall	0	0	0	0			09 Apr 2018 8:03 PM		LL136
☐ FULL SERVICE 227	FULL SERVICE 227	1024.000000	Room		Ordered	0	0	0	0			09 Apr 2018 10:11 PM		227
☐ FAST CASUAL	FAST CASUAL	1488.000000	Room		Delivered	0	0	0	0			09 Apr 2018 5:50 PM		
☐ JACKSON ENTRY 105	JACKSON ENTRY 105	1454.000000	Room		Delivered	0	0	0	0			09 Apr 2018 9:27 PM		105
☐ ELEC 115	ELEC 115	1179.000000	Room		Delivered	0	0	0	0			09 Apr 2018 9:00 PM		115
☐ ELEC LL350E	ELEC LL350E	1308.000000	Room		Completed	0	0	0	0			09 Apr 2018 4:32 PM		LL350E
☐ PLANTED TERRACE 119K	PLANTED TERRACE 119K	1534.000000	Room		Delivered	0	0	0	0			09 Apr 2018 6:05 PM		119K
☐ S12-S14 S12-S14	S12-S14 S12-S14	1032.000000	Room		Completed	0	0	0	0			09 Apr 2018 2:49 PM		S12-S14
☐ MECH LL205	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

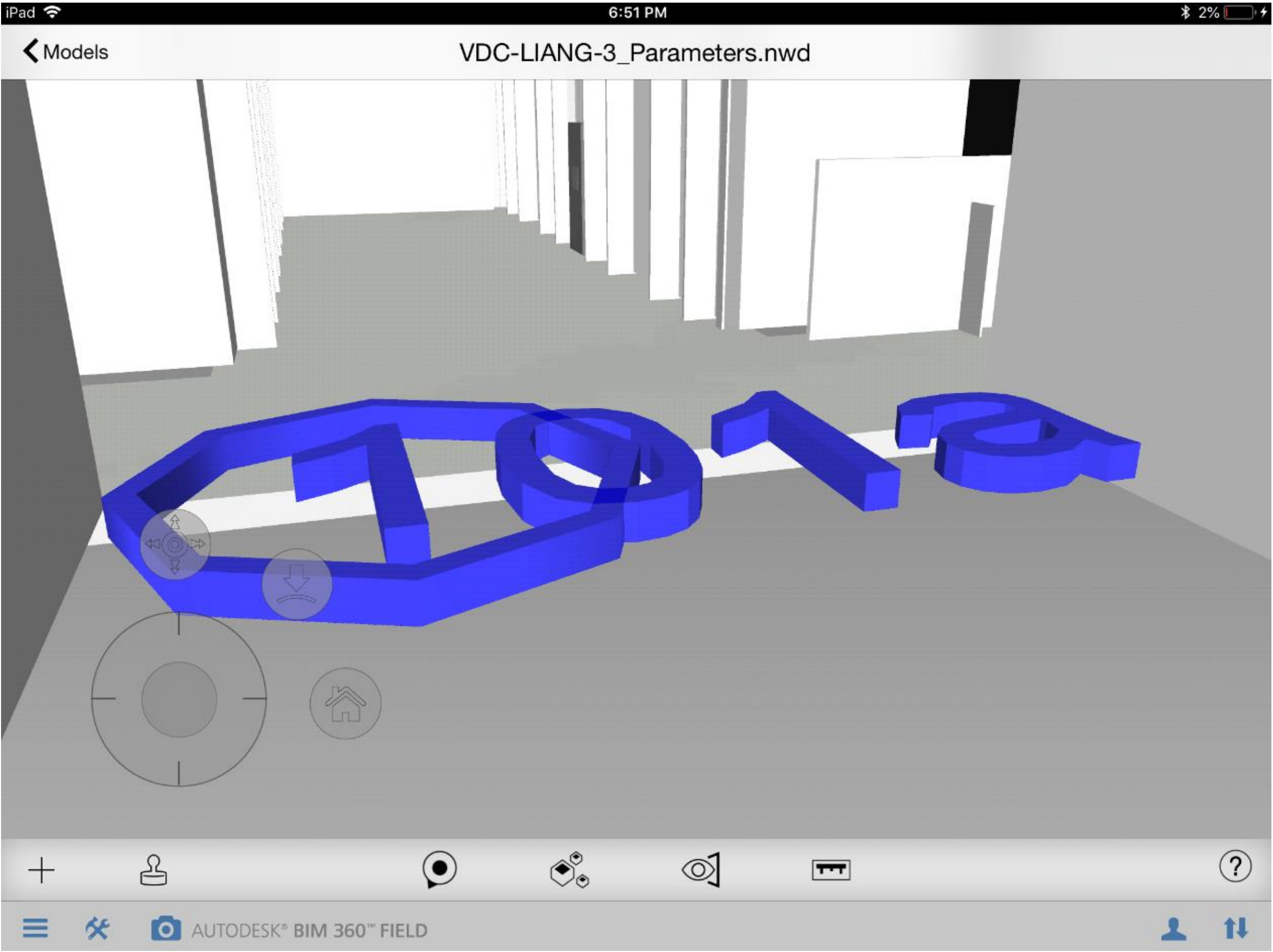
Room Number

Identifiers

Barcode

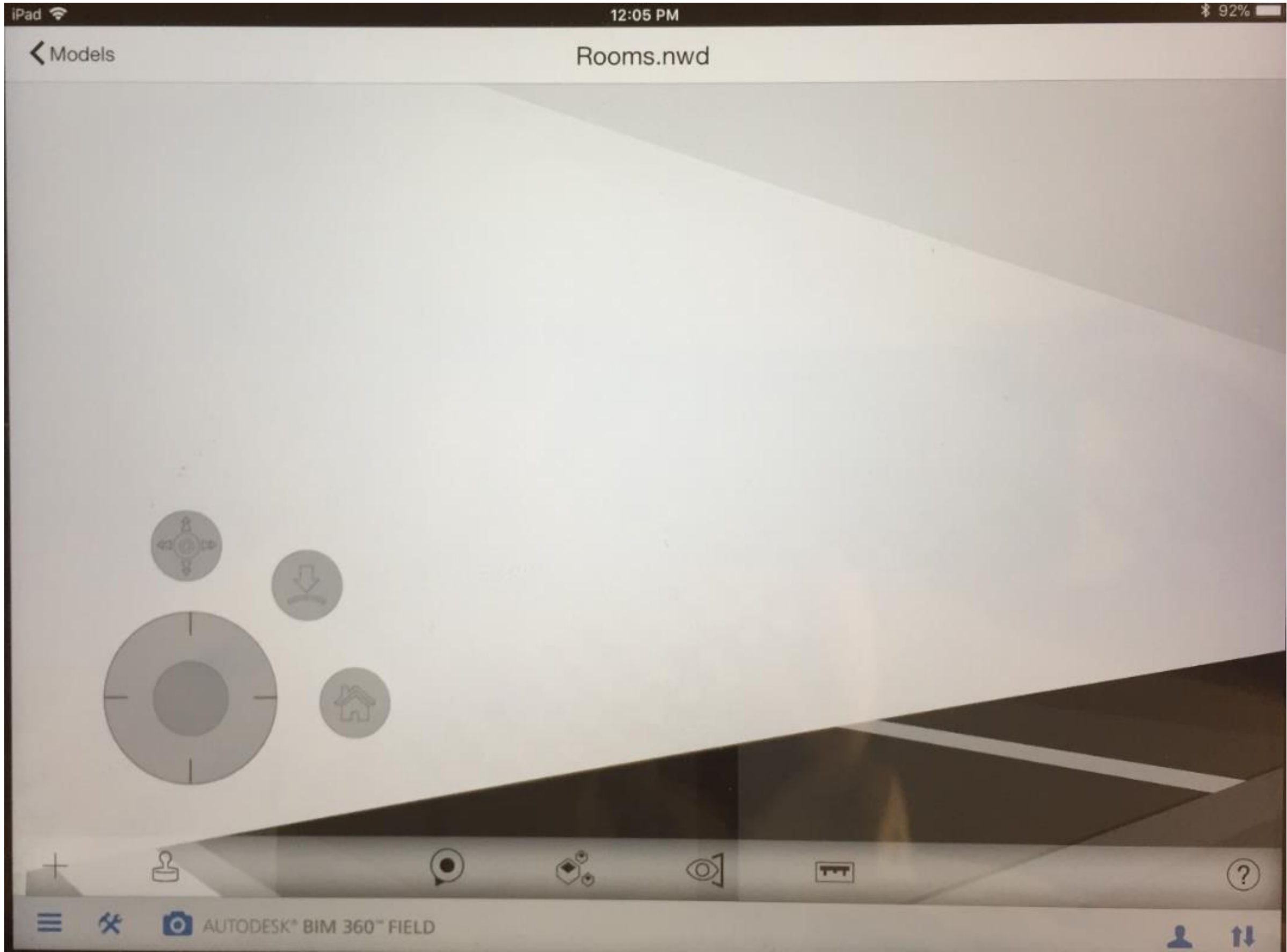
1012.0000000

AUTODESK® BIM 360™ FIELD

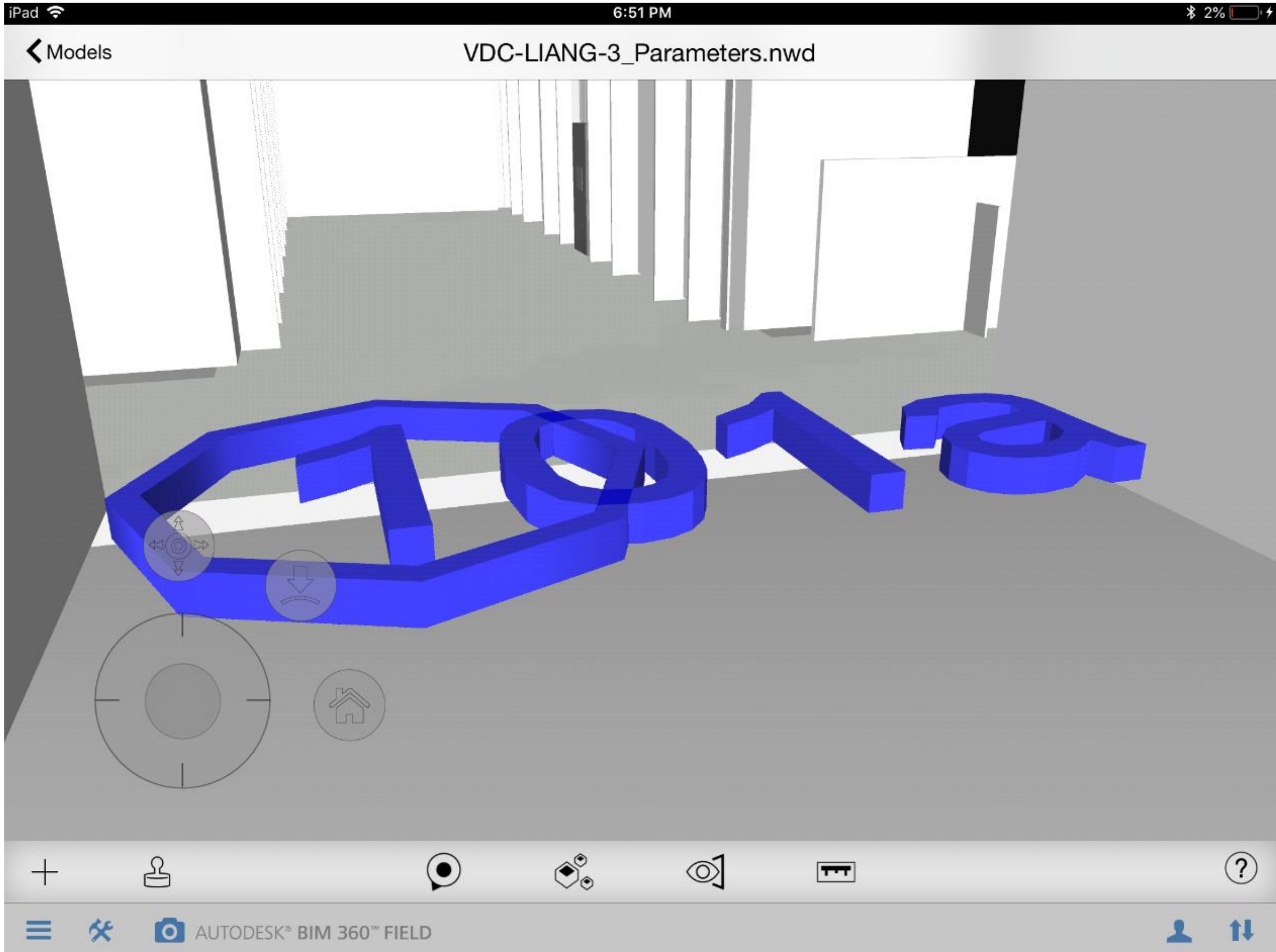


Question 2: How to stand in center of a room when using “Show in Model”?

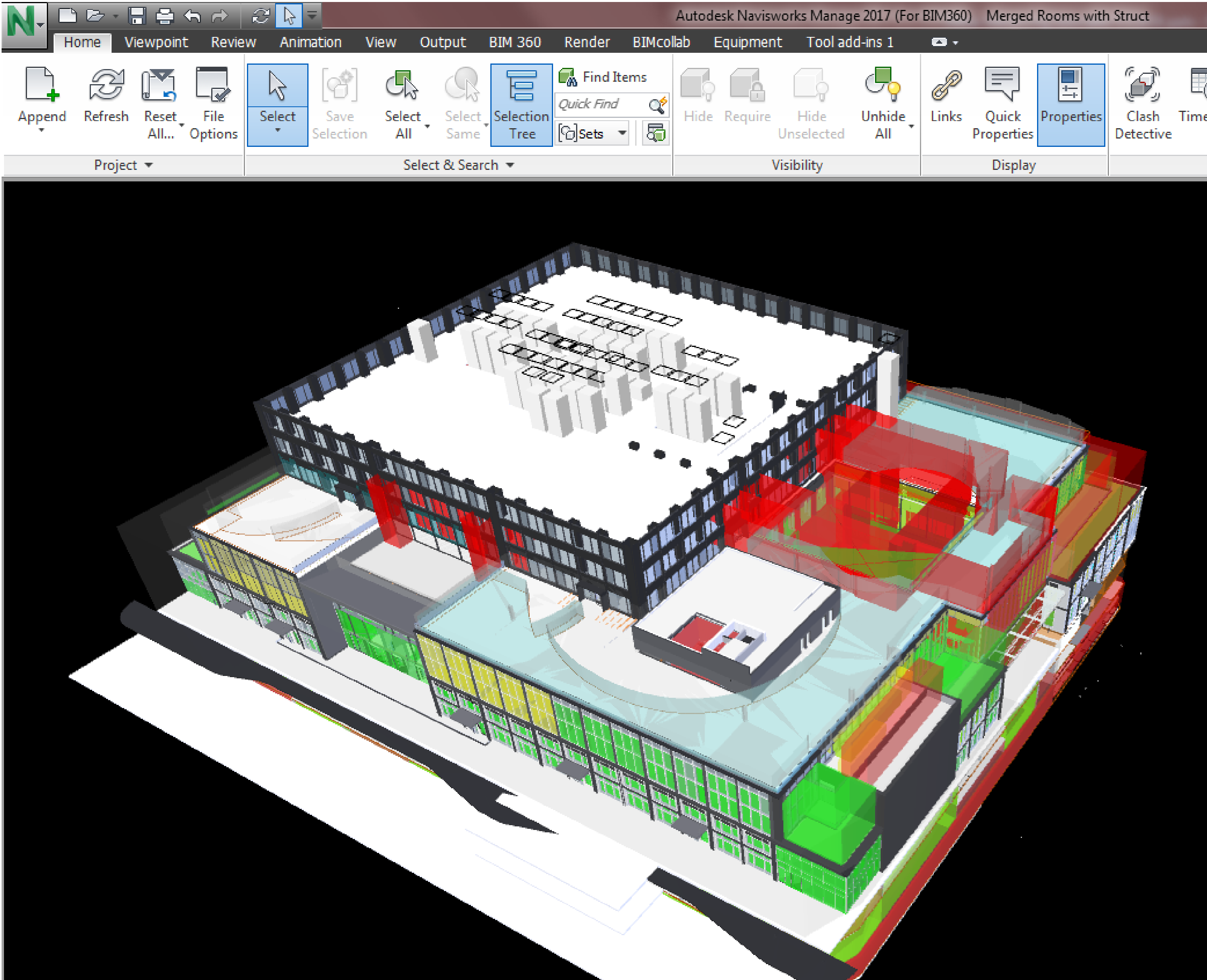
Before



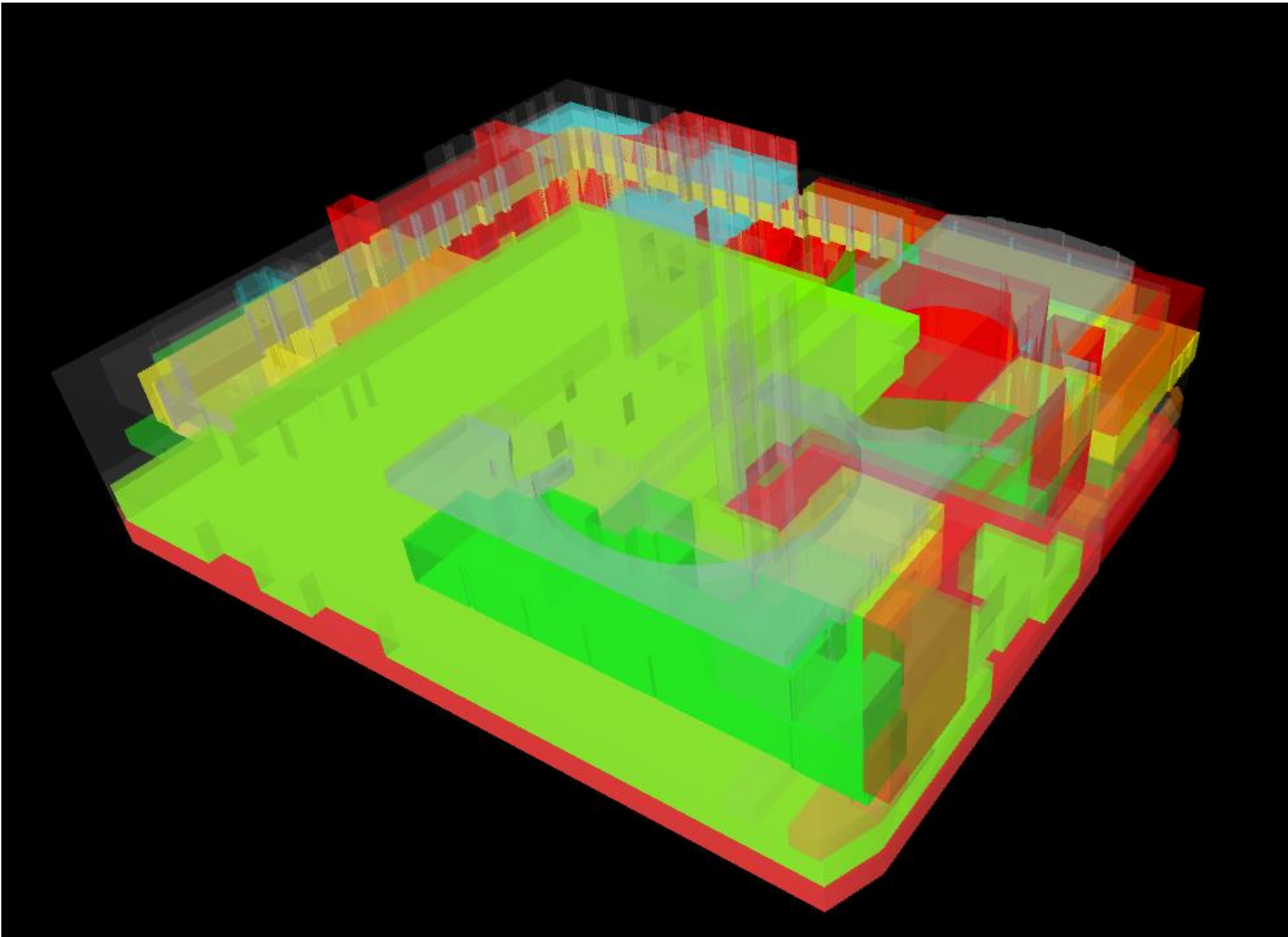
After

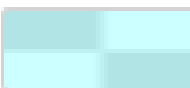


Integrate Logistics_Equipment Sets: Rooms into 5D Process



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

OK

Cancel

Publish Data (Advanced) ✕

(none)

Save As Template

Select Element

Standard Parameters

Advanced Parameters

Search advanced parameters

✕

Display: All Primary Secondary Recent

Clear all

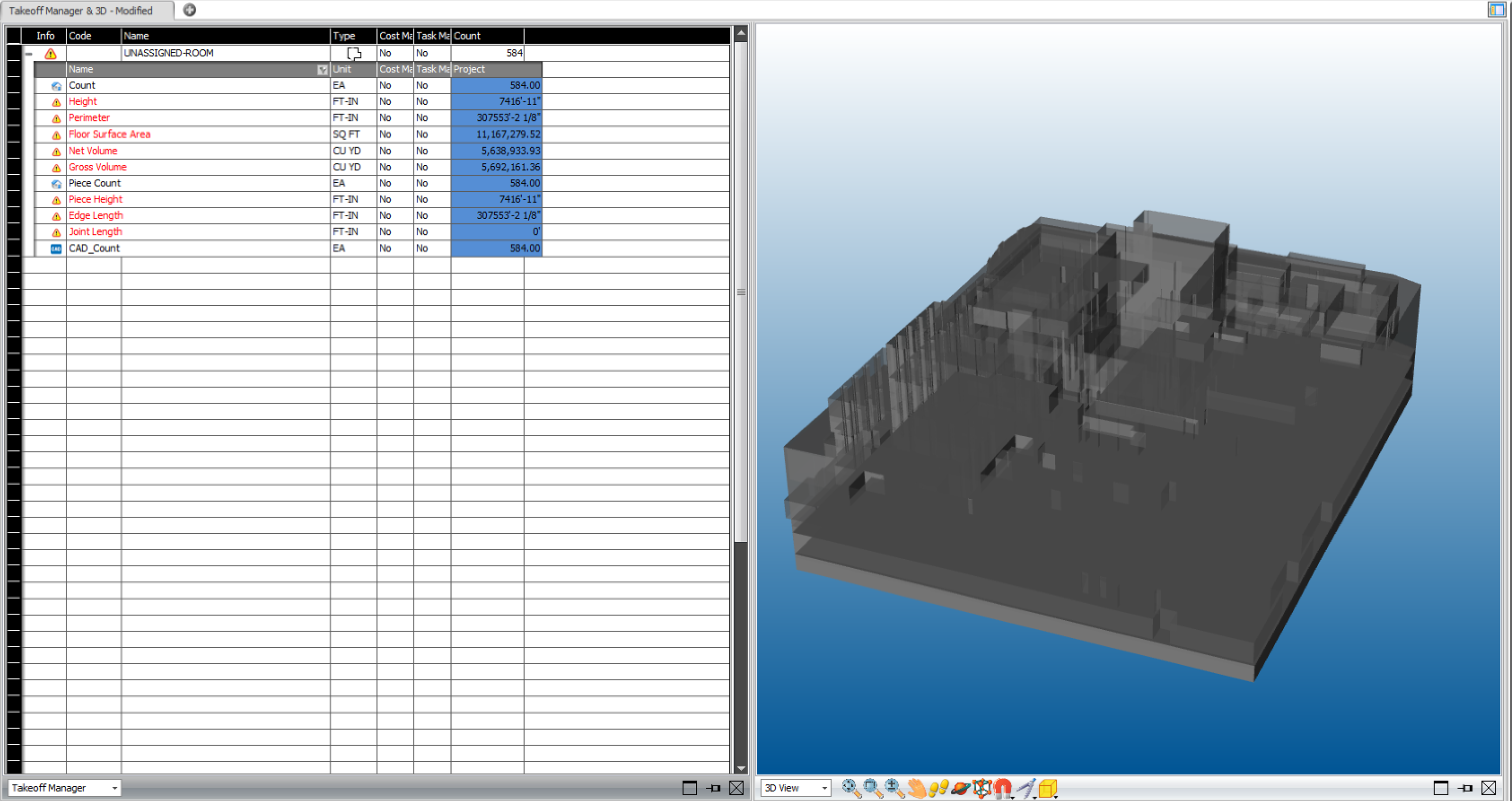
Displaying 33 of 1025

☐ % discharge directly to outside

☒ Barcode

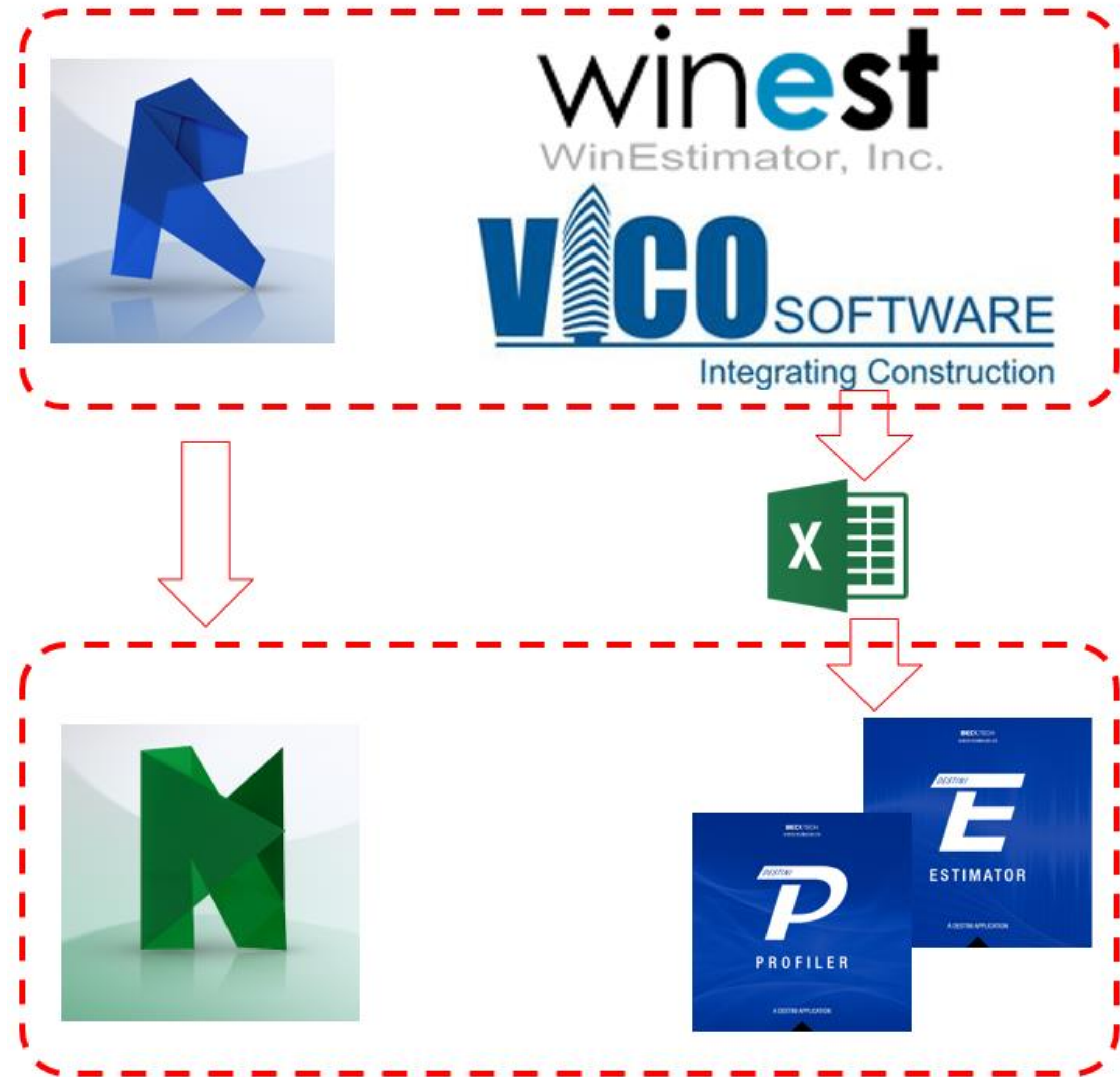
☐ Base Finish

Integrate Logistics_Equipment Sets: Rooms into 5D Process

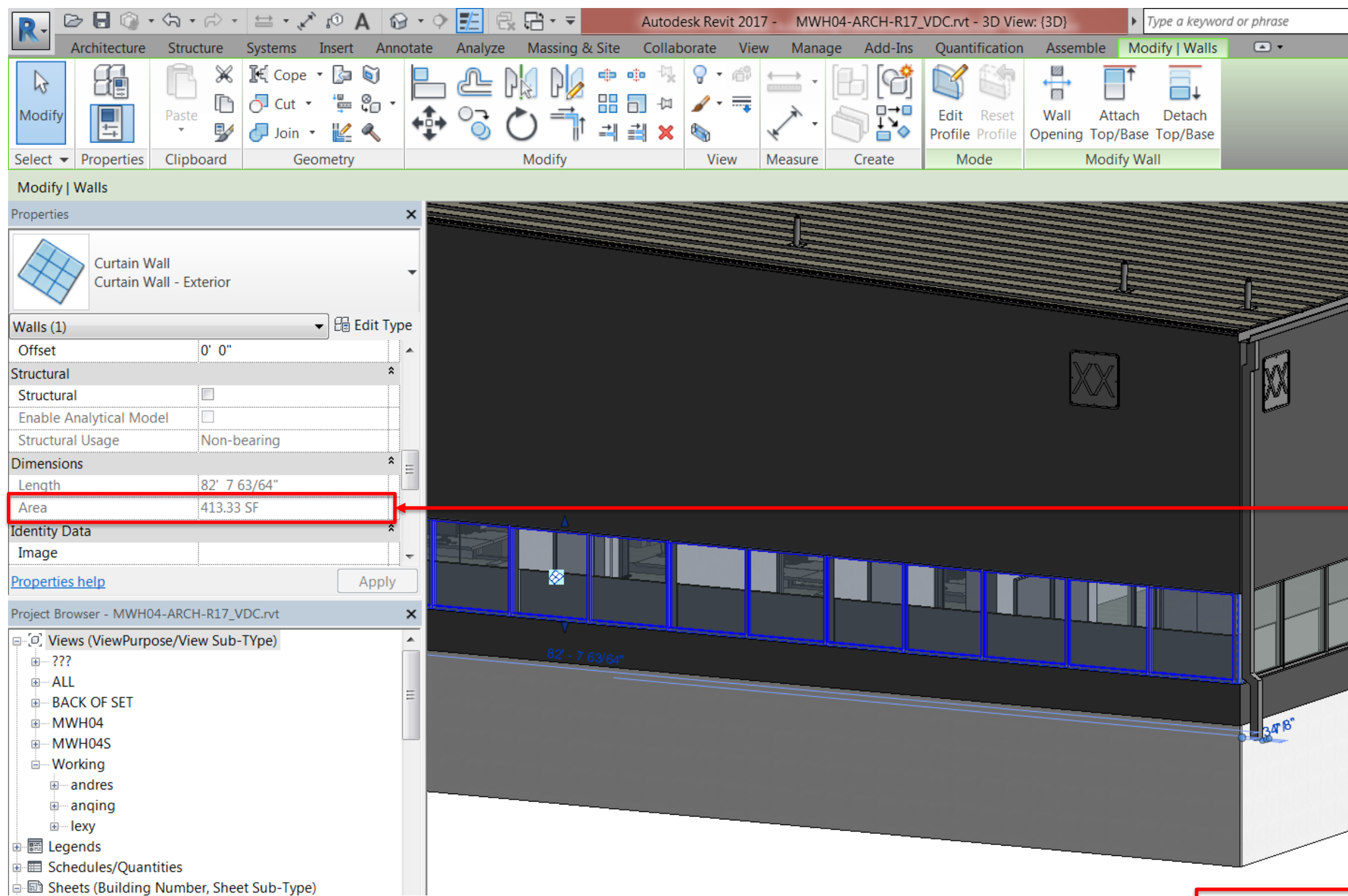


Current Platforms

- 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 Lookup

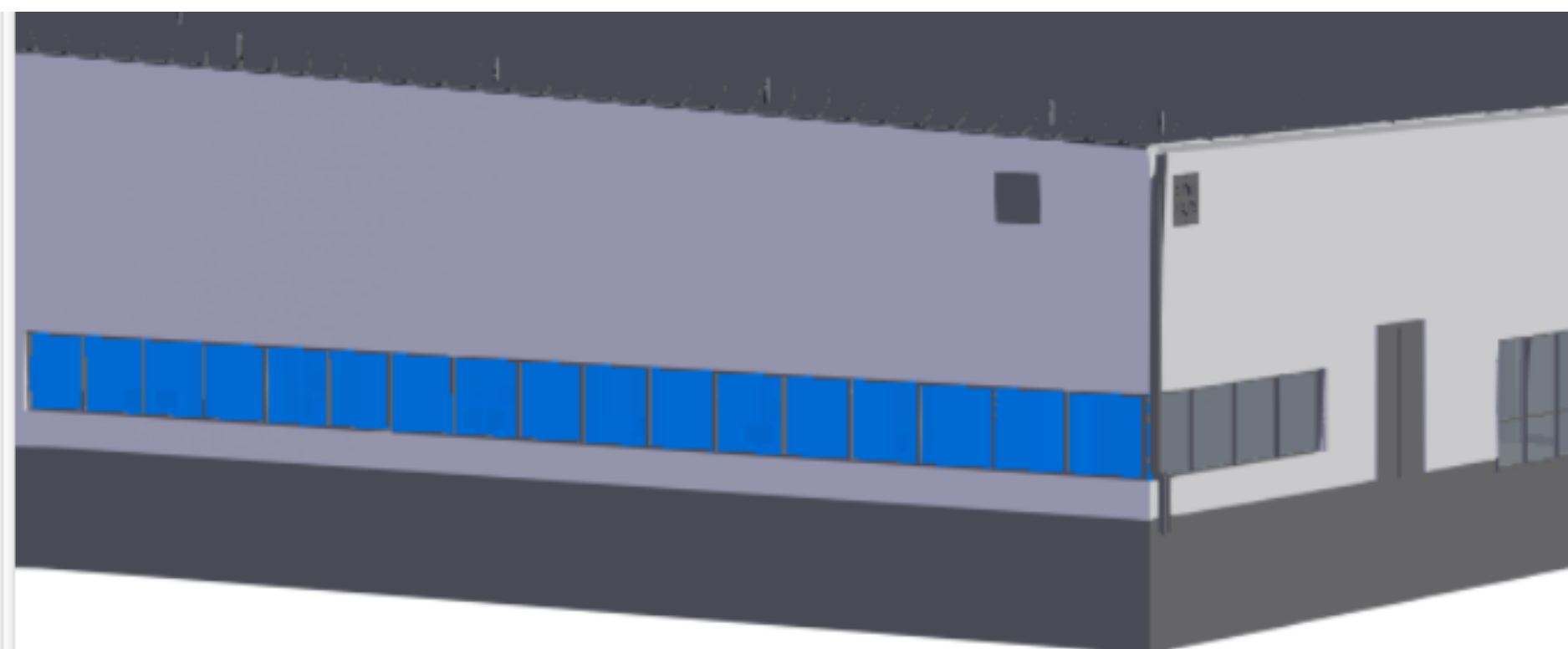
Revit Lookup

Revit

Assemble

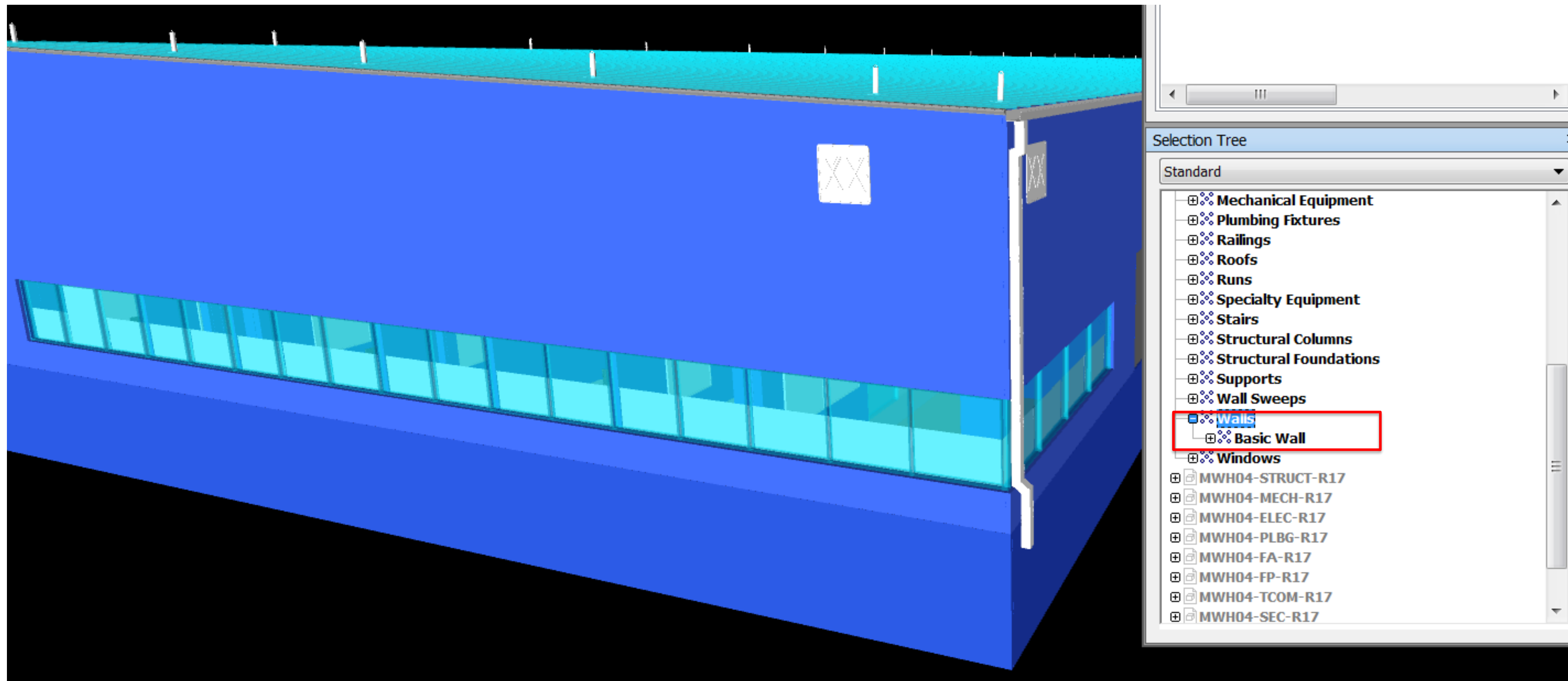
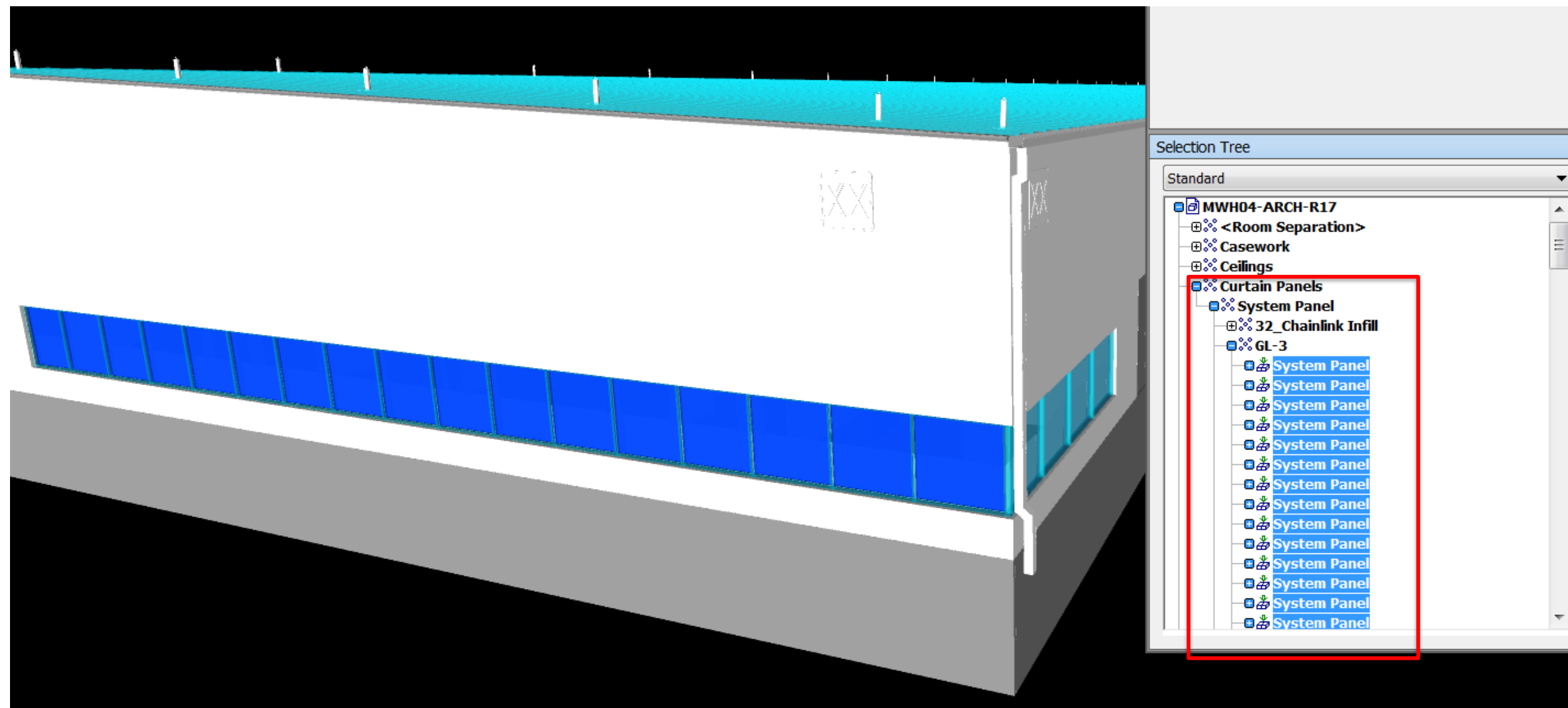
- ☐ ► Structural Foundations (3)
- ☒ ▼ Walls (677)
 - ☐ ► Basic Wall (628)
 - ☒ ▼ Curtain Wall (49)
 - ☐ Chain Link Fence (6)
 - ☒ Curtain Wall - Exterior (6)
 - ☐ Curtain Wall - Interior (17)
 - ☐ Wire Mesh Partition (20)
- ☐ ► Windows (18)

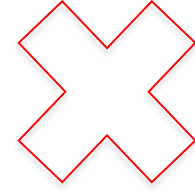
	Walls : Curtain Wall : Curtain Wall - E...	1,167.15	SF
☒	5425564	413.33	SF
☐	5426695	209.02	SF
☐	5770905	96.89	SF
☐	5770976	275.70	SF
☐	5770996	72.63	SF
☐	7640341	99.58	SF
☐	► Walls : Curtain Wall : Curtain Wall - Int...	1,507.64	SF



From Revit to Naviswork

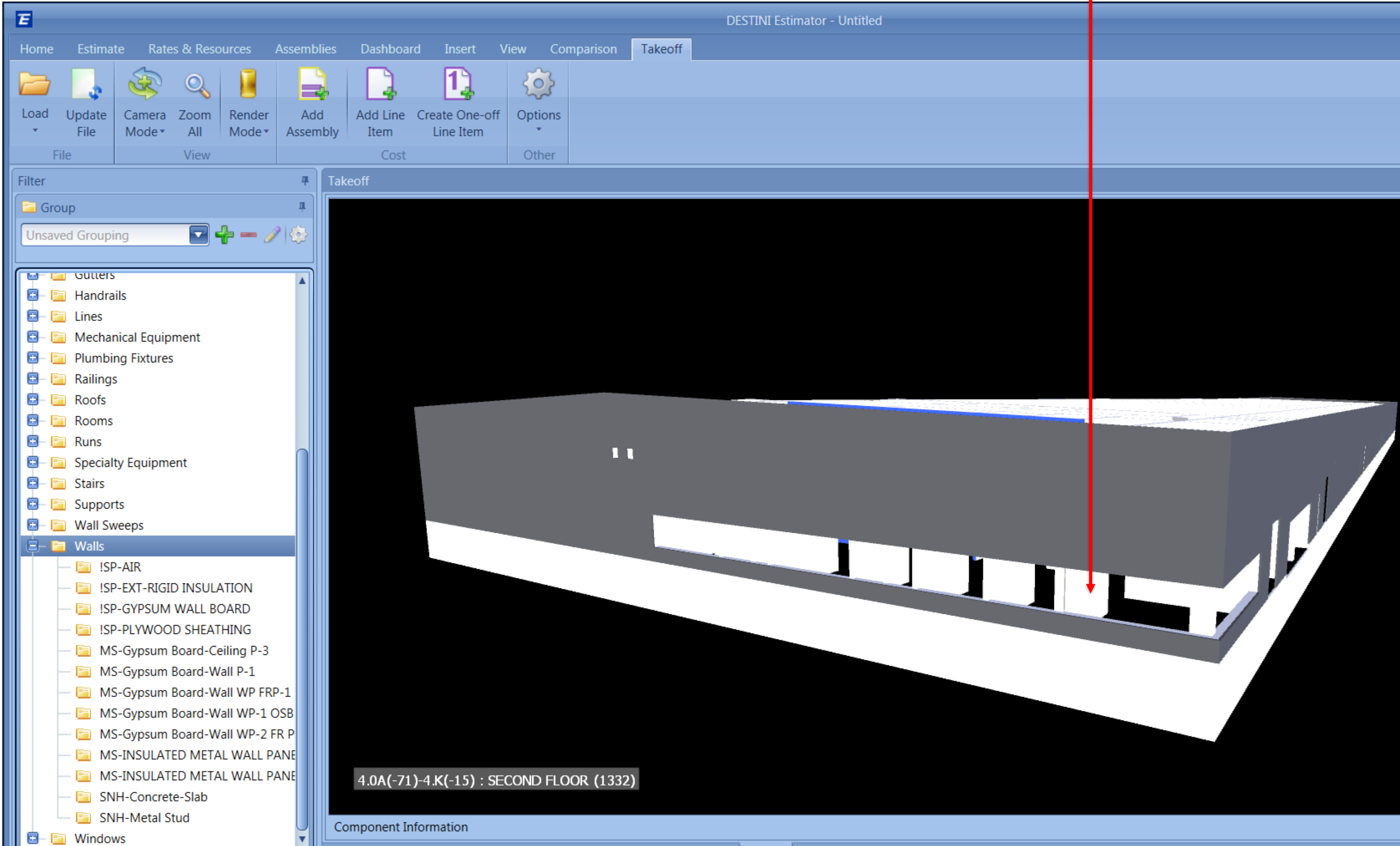
The curtain wall instances are hosts to other instances where their geometries have been usurped. Because there is no geometry, the curtain walls will not exist in the NWC.





From Naviswork to DEstimator

The curtain wall are not even shown under Walls



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

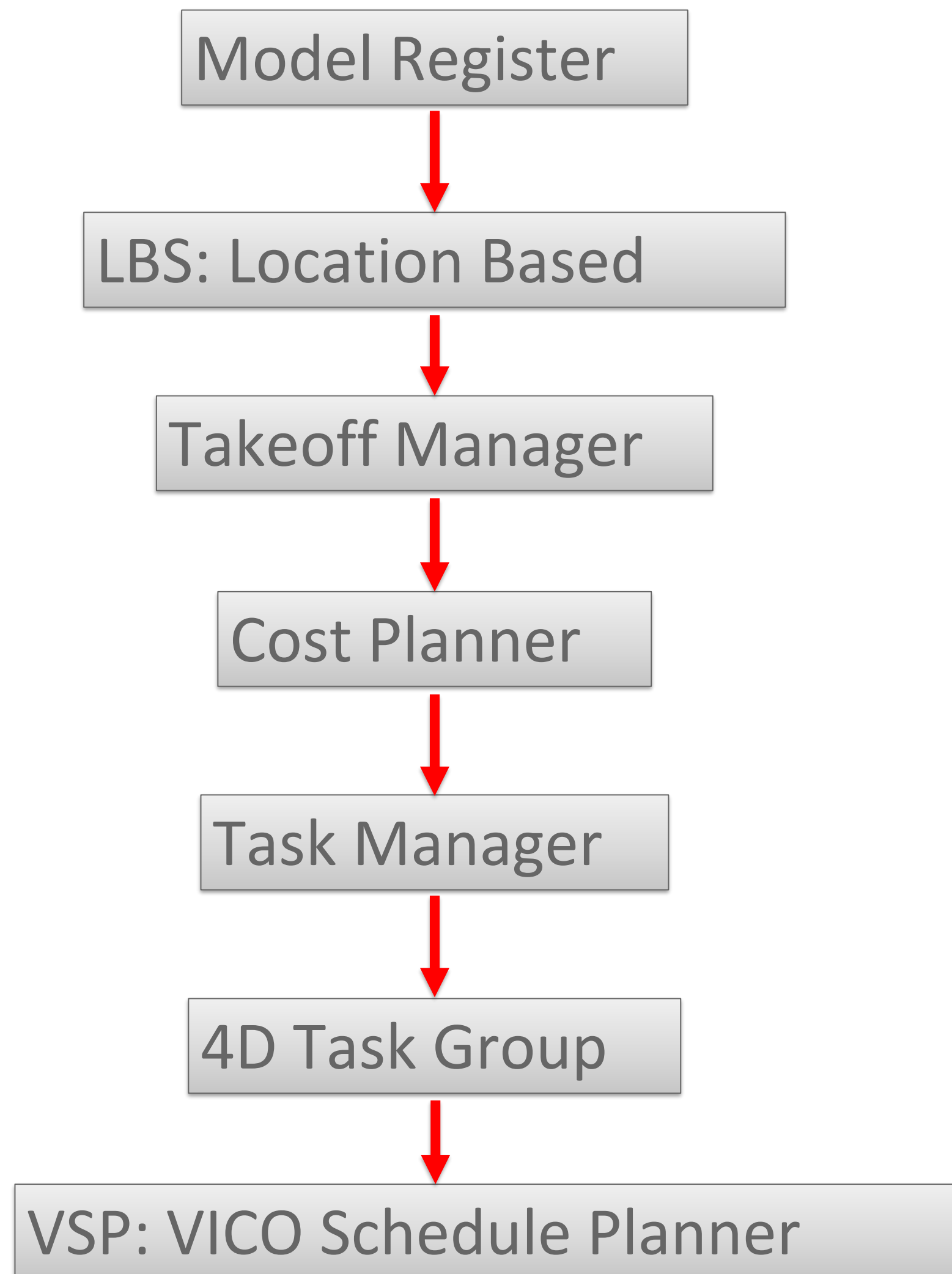
4 Reports

Create Reports

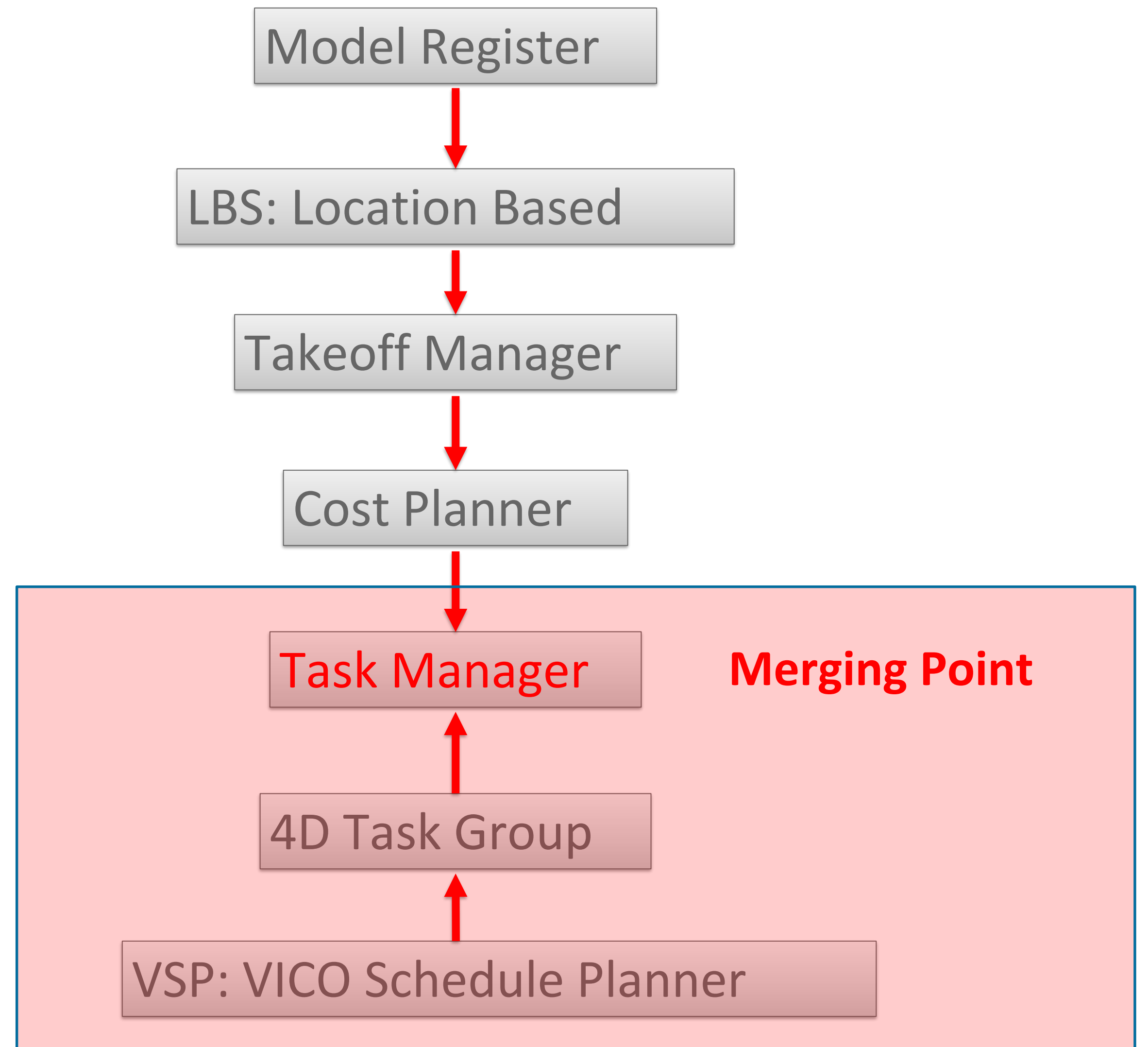
Takeoff Manager & 3D

	Info	Code	Name	Type	Mapped	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	Mapped	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	

5D Top-down



5D Bottom-up





THE ART & SCIENCE OF BUILDING



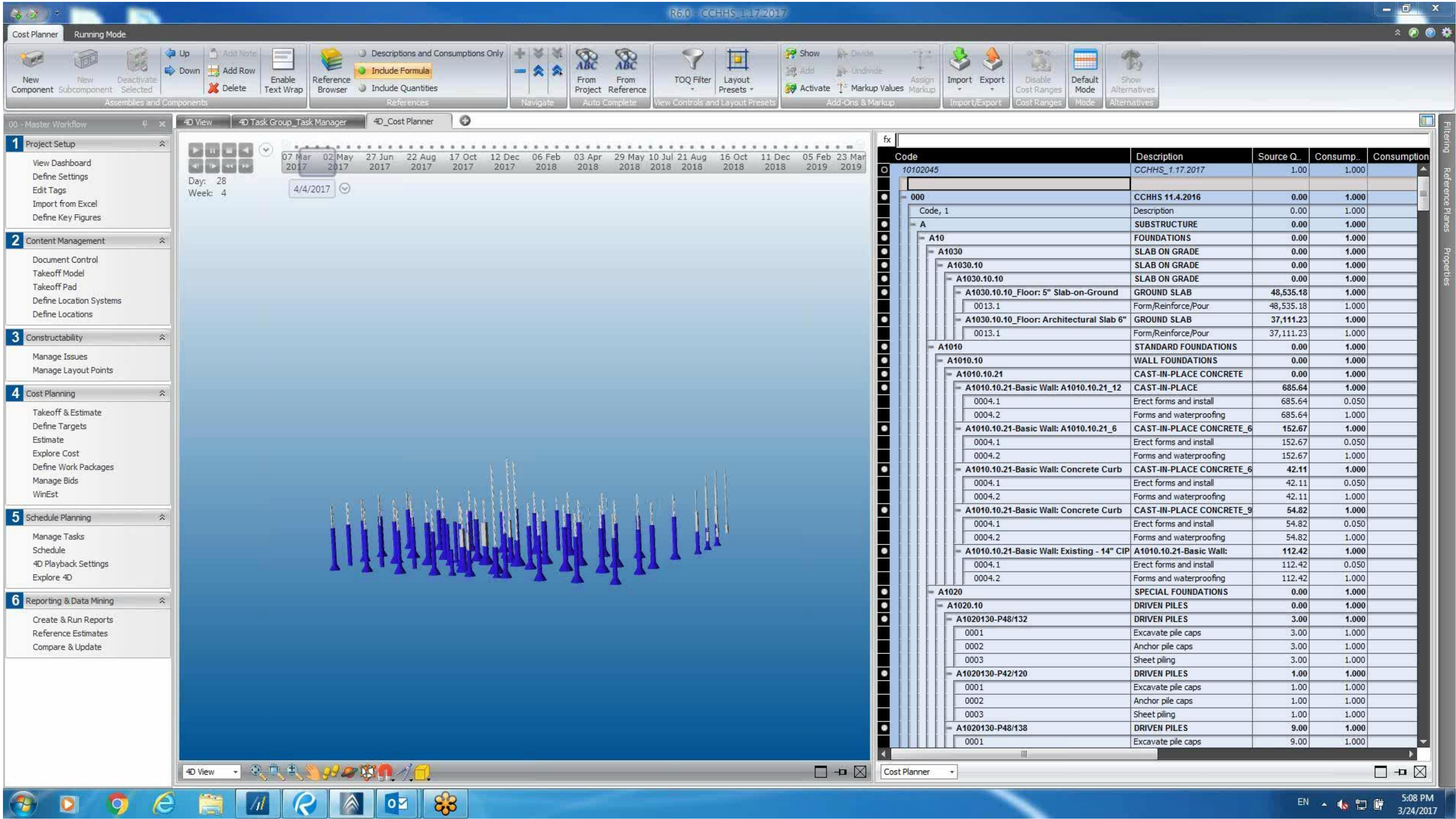
5D Top-down

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.

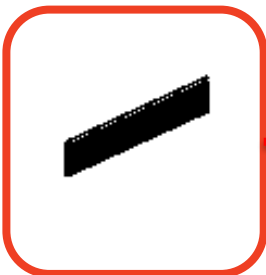
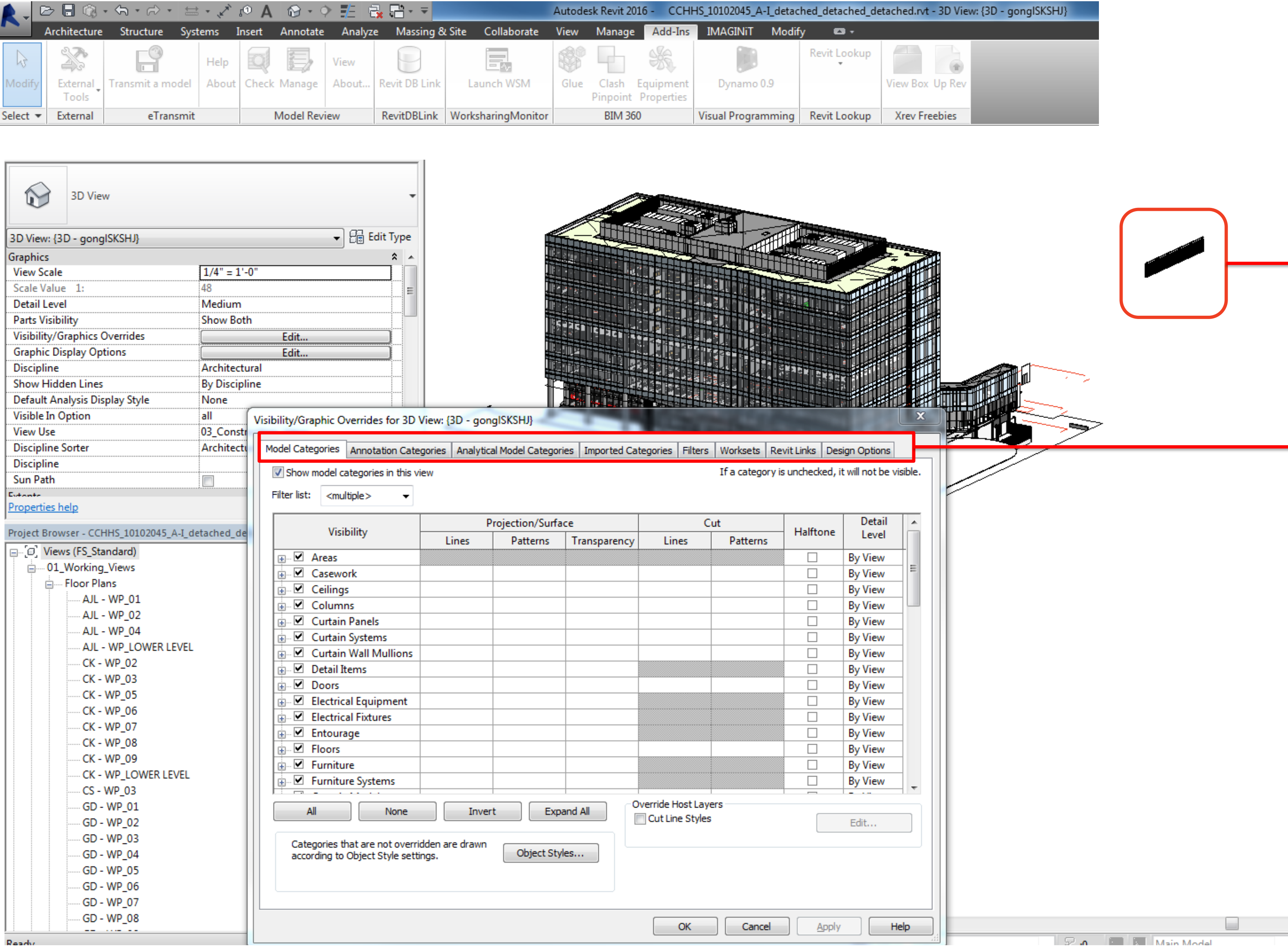
The project is targeting LEED Silver Certification. It has an approximate budget of \$108.5 million and a 3rd quarter of 2018 completion date.

5D Top-down: Explore 5D



See attached video

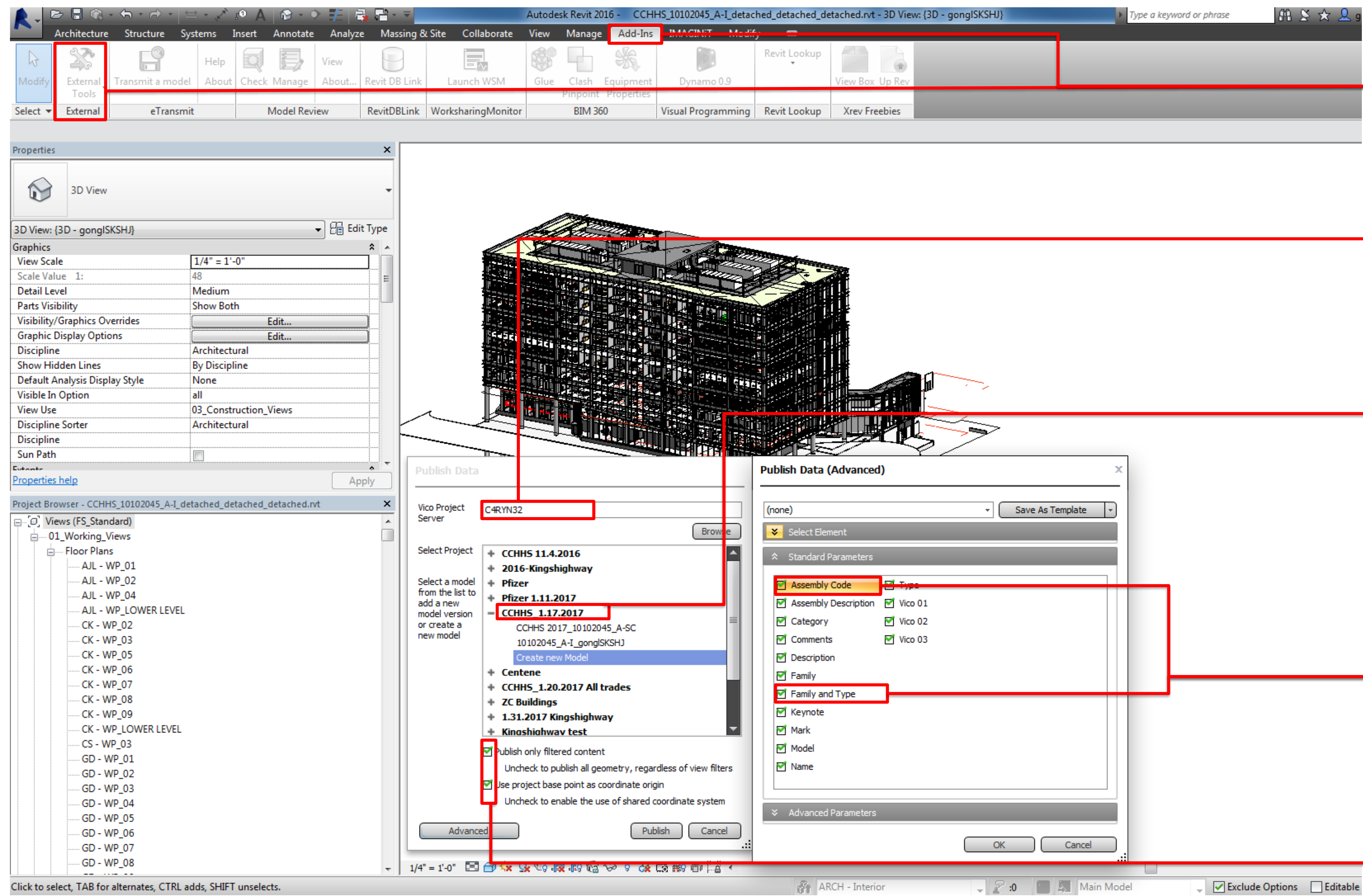
5D Top-down: Revit Export



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

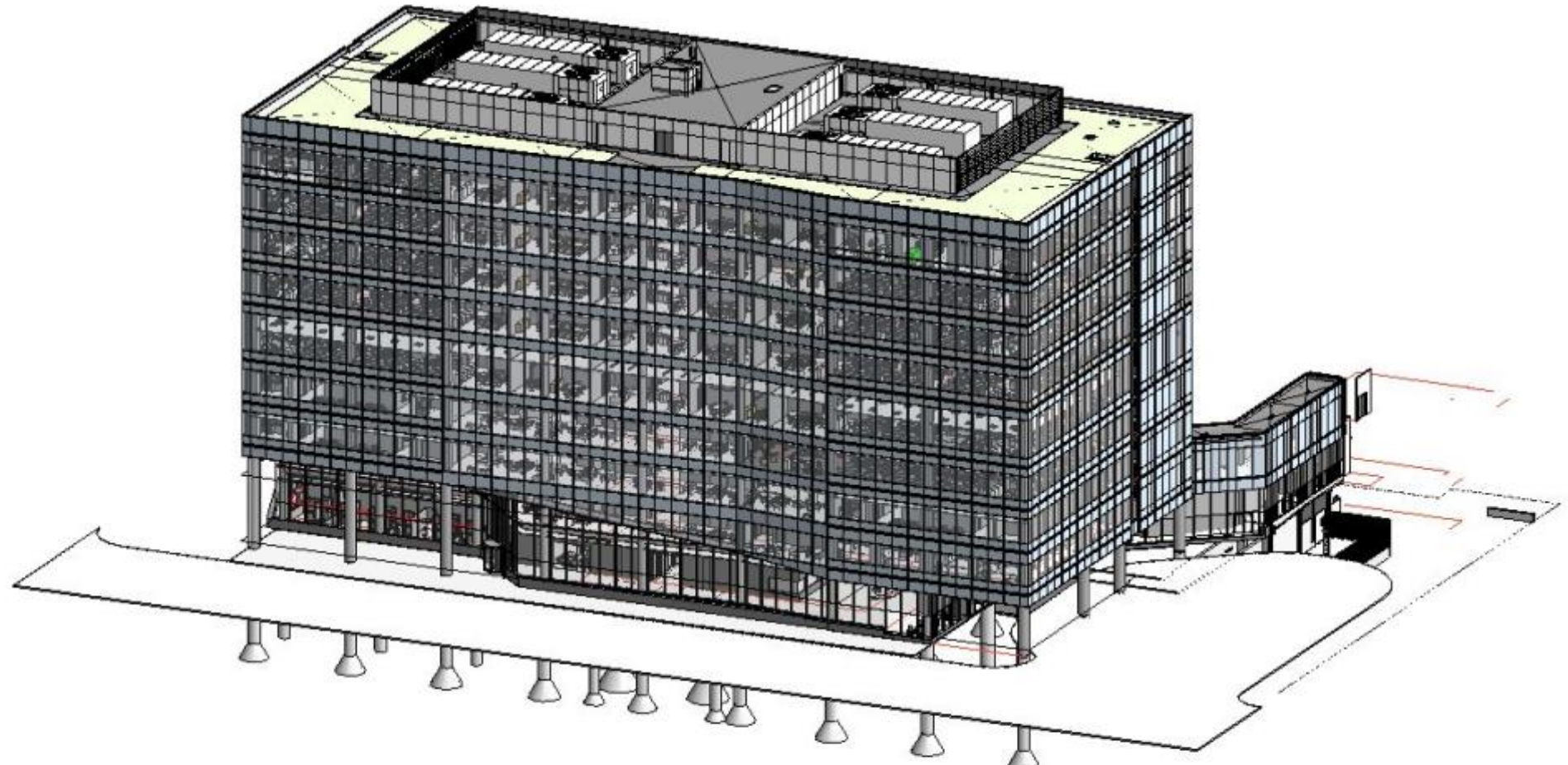
255, 255, 255

Gradient

255, 255, 255

0, 85, 149

Project Image



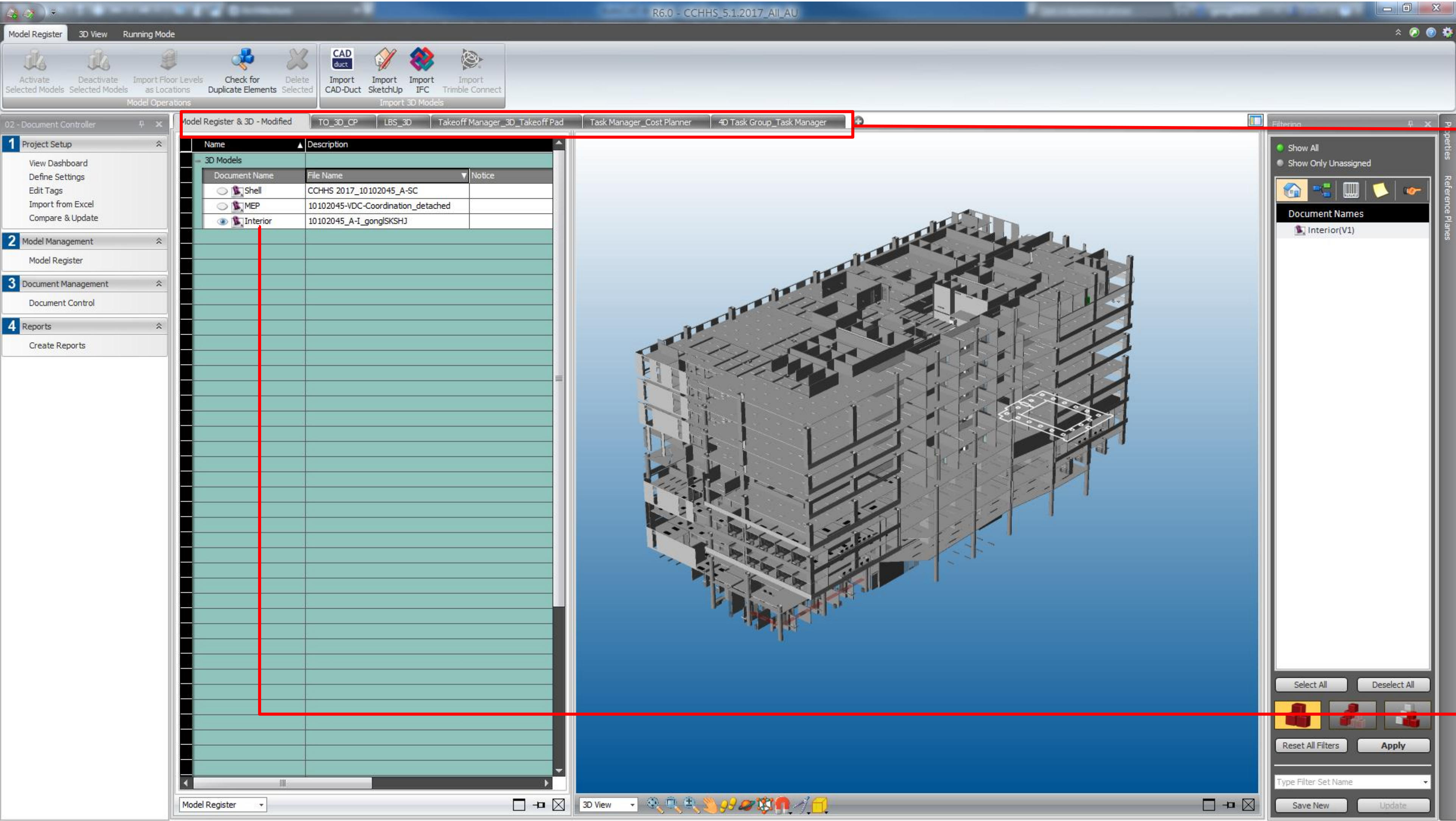
Clear

Browse

Customized combined window views

Project basic information

5D Top-down: Model Register

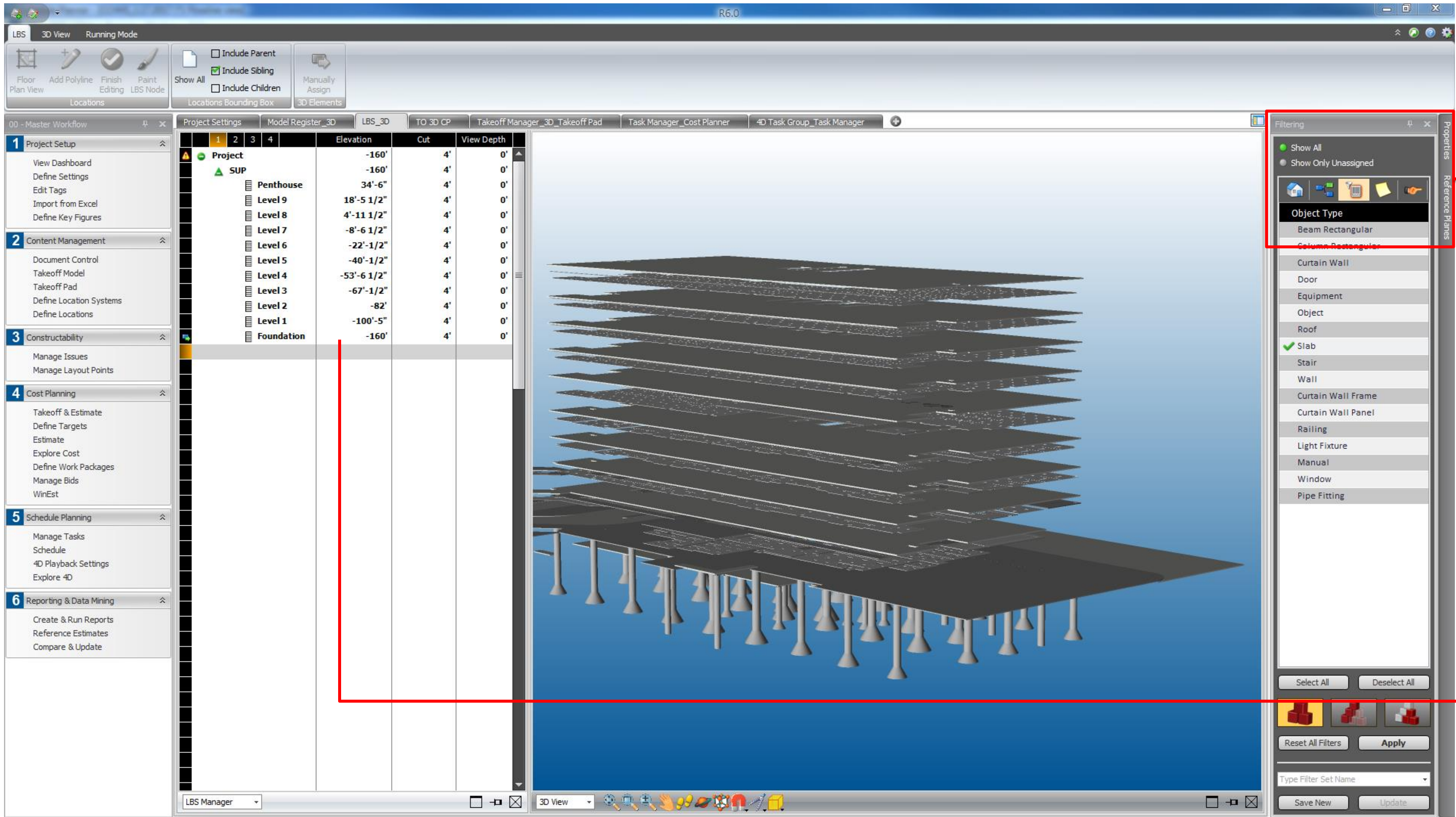


Suggested customized combined window views: Model Register_3D, LBS Manager_3D, Takeoff Manager_3D View_Cost Planner, Takeoff Manager_3D View_Takeoff Pad, Task Manager_Cost Planner, 4D Task Group_Task Manager.

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.

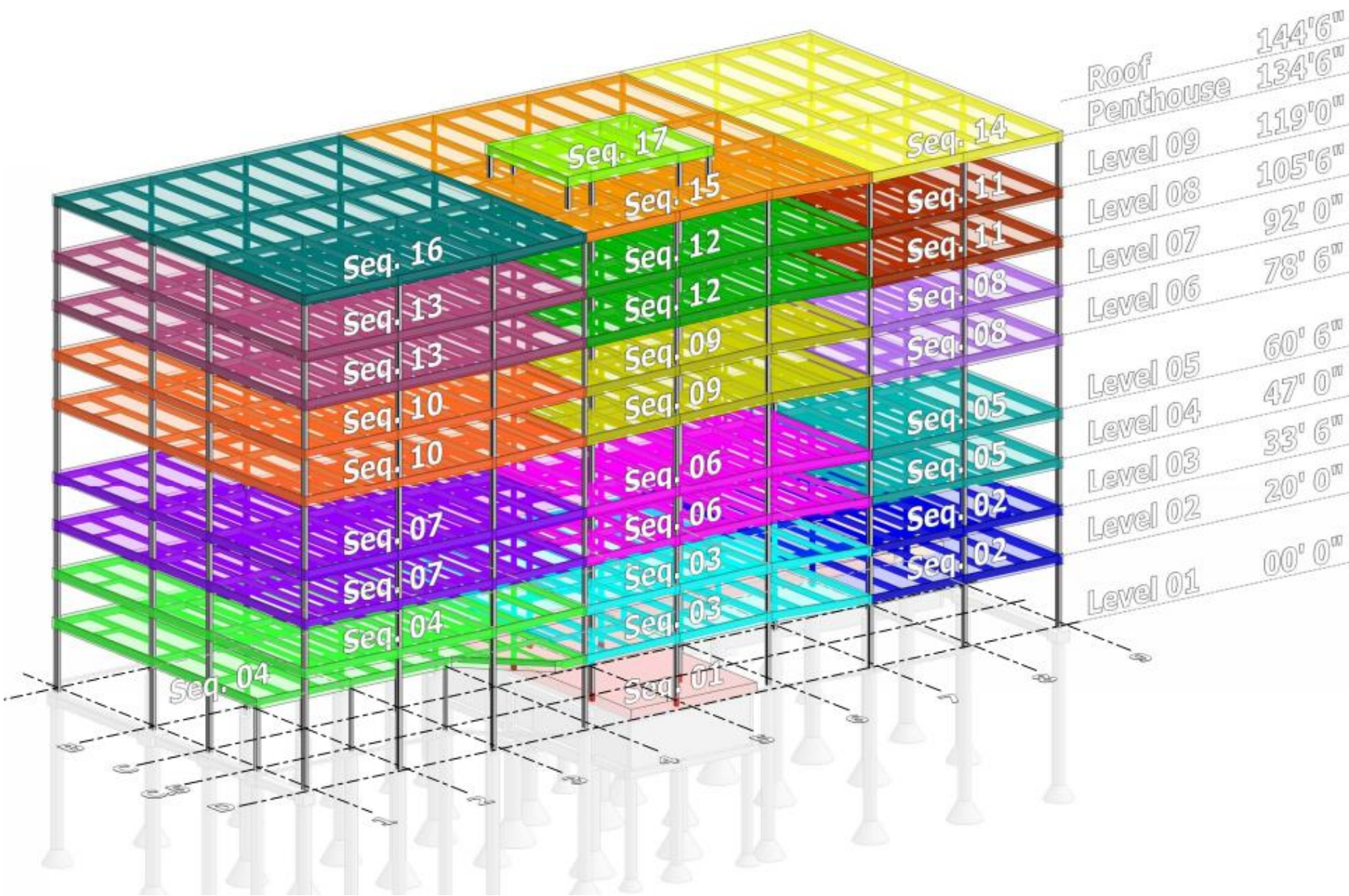
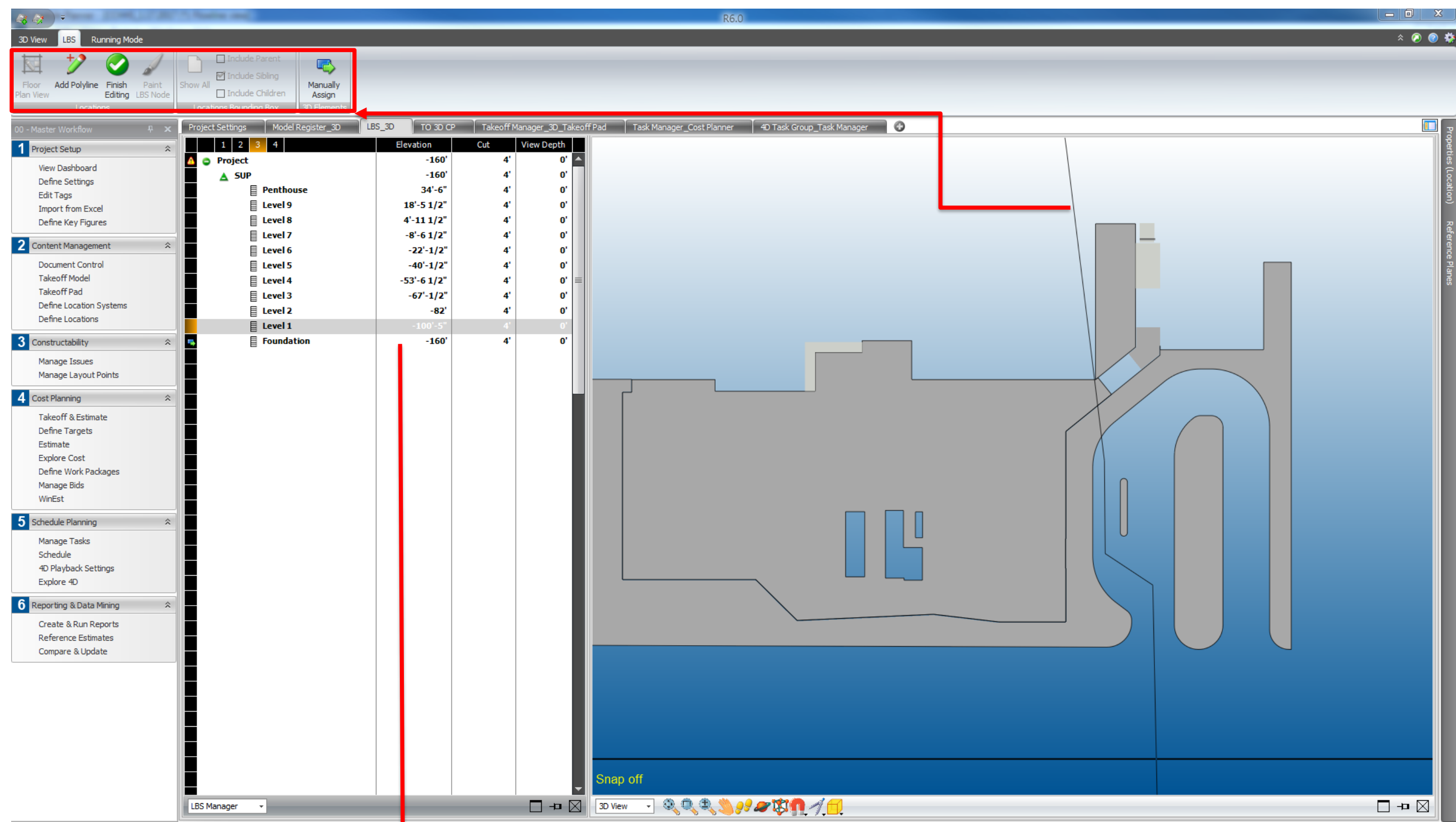


Filtering: filter the types to be shown exclusively in 3D view. Properties: click on object to see its quantities information

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.

Takeoff Manager

3D View

Running Mode

Linked to Selected

Unlinked to Selected

Isolate

Auto Zoom

Auto Reveal

On/Off

View Mode

00 - Master Workflow

1 Project Setup

2 Content Management

3 Constructability

4 Cost Planning

5 Schedule Planning

6 Reporting & Data Mining

Project Settings

Model Register_3D

LBS_3D

TO_3D_CP

Takeoff Manager_3D_Takeoff Pad

Task Manager_Cost Planner

4D Task Group_Task Manager

TO 3D CP

Info	Code	Name	Type	Mapped	Count
	A1020130	Drilled Pier + Bell: TP54/156		Yes	4
	A1020130	Drilled Pier: P36		Yes	2
	A1020130	Drilled Pier + Bell: TP36/78		Yes	7
	A1020130	Drilled Pier + Bell: TP36/72		Yes	3
	B1080.10.50	Assembled Stair: B1080.10.50_Steel_Pan_Stair Ch		Yes	10
	B1080.10.50	Assembled Stair: B1080.10.50_Steel_Pan_Stair Ch		Yes	3
	B1080.10.50	Assembled Stair: B1080.10.50_Steel_Pan_Stair Ch		Yes	2
	C1010.10.50.C3	Basic Wall: C1010.10.C3_C3		Yes	197
	A1010.10.21	Basic Wall: A1010.10.21_12		Yes	20
	C1010.10.B3	Basic Wall: C1010.10.B3_B3		Yes	1410
	C1010.10.50.A1	Basic Wall: Exterior Knee Wall		Yes	2
	C1010.10.J8	Basic Wall: C1010.10.J8_J8		Yes	8
	C1010.10.50.F4	Basic Wall: C1010.10.G4_G4		Yes	129
	C1010.10.50.B8	Basic Wall: C1010.10.B8_B8		Yes	3
	C1010.10.50.D4	Basic Wall: C1010.10.D4_D4		Yes	147
	B2010.20.50	Basic Wall: B2010.20.50_XT_Wood-6_Steel_Stone		Yes	2
	C1010.10.50.A2	Basic Wall: C1010.10.A2_A3		Yes	10
	C1010.10.50.F4	Basic Wall: C1010.10.G6_G6		Yes	29

Name	Unit	Mapped	Project	SUP	Foundation	Level 1
Count	EA	No	29.00	29.00	1.00	
Length	FT-IN	No	858'-9 5/16"	858'-9 5/16"	37'-5 7/8"	14
Net Reference Side Surface Area	SQ FT	Yes	10,136.97	10,136.97	483.81	
Net Opposite Reference Side Surface Area	SQ FT	No	10,136.97	10,136.97	483.81	
Top Surface Area	SQ FT	No	495.00	495.00	0.00	
Bottom Surface Area	SQ FT	No	325.83	325.83	21.57	
Ends Surface Area	SQ FT	No	531.32	531.32	15.26	
Reference Side Opening Surface Area	SQ FT	No	2,320.00	2,320.00	0.00	
Opposite Reference Side Opening Surface Area	SQ FT	No	2,320.00	2,320.00	0.00	
Net Volume	CU YD	No	219.01	219.01	10.45	
Gross Volume	CU YD	No	219.01	219.01	10.45	
Joint Horizontal Surface Area	SQ FT	No	0.00	212.72	21.57	
Joint Vertical Surface Area	SQ FT	No	0.00	0.00	0.00	
Piece Count	EA	No	29.00	40.00	1.00	
Piece Length	FT-IN	No	858'-9 5/16"	1041'-11 5/8"	37'-5 7/8"	18
CAD_Count	EA	No	29.00	29.00	1.00	
CAD_Length	FT-IN	No	858'-9 5/16"	858'-9 5/16"	37'-5 7/8"	14
CAD_Volume	CU YD	No	219.01	219.01	10.79	

	C1010.10.50.F4	Basic Wall: C1010.10.F8_F8		Yes	1
	C1010.10.50.C3	Basic Wall: C1010.10.C6 - 4 HOUR - 2X 3/4"		Yes	6
	C1010.10.50.C3	Basic Wall: C1010.10.C2_C2X 2		Yes	126
	C1010.10.50.C3	Basic Wall: C1010.10.C8_C8		Yes	12
	C1010.10.50.D4	Basic Wall: C1010.10.D6_D6		Yes	16
	B2010.20	Basic Wall: Metal_Backpan_0.25		Yes	2
	A1010.10.21	Basic Wall: A1010.10.21_6		Yes	10
	C1010.10.50.A1	Basic Wall: Exterior Knee Wall 2		Yes	4
	C1010.10.50.A1	Basic Wall: Exterior Knee Wall - Concrete		Yes	16

3D View

3D View

fx 1

Code	Description	Source Q.	Consump..	Consumption Inv	Waste	Qty	UOM
10102045	CCHHS_1.17.2017	1.00	1.000	1.000	1.000	1.00	
000	CCHHS 11.4.2016	0.00	1.000	1.000	1.000	0.00	

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.

Takeoff Manager

3D View

Running Mode

X-ray Mode

Outline Mode

Turn Off Capping

Reset View

Painting Mode

Selection Mode

Navigation Mode

Measure Length

Print 3D View

Background Settings

Show Ref. Planes

New Ref. plane

Map Document

Section Box

Align & Scale

Scale by points

00 - Master Workflow

My Dashboard

Model Register_3D

LBS_3D

TO_3D_CP

Takeoff Manager_3D Takeoff Pad

Task Manager_Cost Planner

4D Task Group_Task Manager

1 Project Setup

2 Content Management

3 Constructability

4 Cost Planning

5 Schedule Planning

6 Reporting & Data Mining

Info	Code	Name	Type	Mapp	Count
Floor: Architectural Slab 6.5"					
		Name	Unit	Mapped	Project
		Count	EA	No	9.00
		Edge Perimeter	FT-IN	No	7407'-4 1/2"
		Hole Count	EA	No	53.00
		Hole Perimeter	FT-IN	No	3324'-6 7/8"
		Net Bottom Surface Area	SQ FT	No	260,375.51
		Net Top Surface Area	SQ FT	Yes	260,375.51
		Edge Surface Area	SQ FT	No	4,012.33
		Hole Surface Area	SQ FT	No	8,892.60
		Net Volume	CU YD	No	5,223.58
		Gross Volume	CU YD	No	5,401.98
		Joint Horizontal Surface Area	SQ FT	No	0.00
		Joint Vertical Surface Area	SQ FT	No	0.00
		Piece Count	EA	No	9.00
		Edge Length	FT-IN	No	7407'-4 1/2"
		Joint Length	FT-IN	No	0'
		Hole Edge Length	FT-IN	No	3324'-6 7/8"
		Hole Joint Length	FT-IN	No	0'
		CAD_Count	EA	No	9.00
		CAD_Volume	CU YD	No	5,223.58
		B1010-Floor: 5" Slab-on-Ground	Yes	3	
		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: W24x68	Yes	5	
		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	

3D View

Cost Planner

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

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

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

Reports

Model Register_3D

LBS_3D

TO_3D_CP

Takeoff Manager_3D_Takeoff Pad

Task Manager_Cost Planner

4D Task Group_Task Manager

Properties (Takeoff Item)

Filtering

Reference

Planes

Snap off

3D View

fx

Show 2D

Info

Code

Name

Pad Template

Count

Type

Curtain Wall: Curtain Wall - ...

Curtain Wall

3

Curtain Wall: Curtain Wall - ...

Curtain Wall

1

Curtain Wall: Curtain Wall - ...

Curtain Wall

3

C1030.10-DOOR_F_Single: ...

Door

3

C1030.10-DOOR_F_Single: ...

Door

370

C1030.10-DOOR_F_Single: ...

Door

34

C1030.10-DOOR_F_Double: ...

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

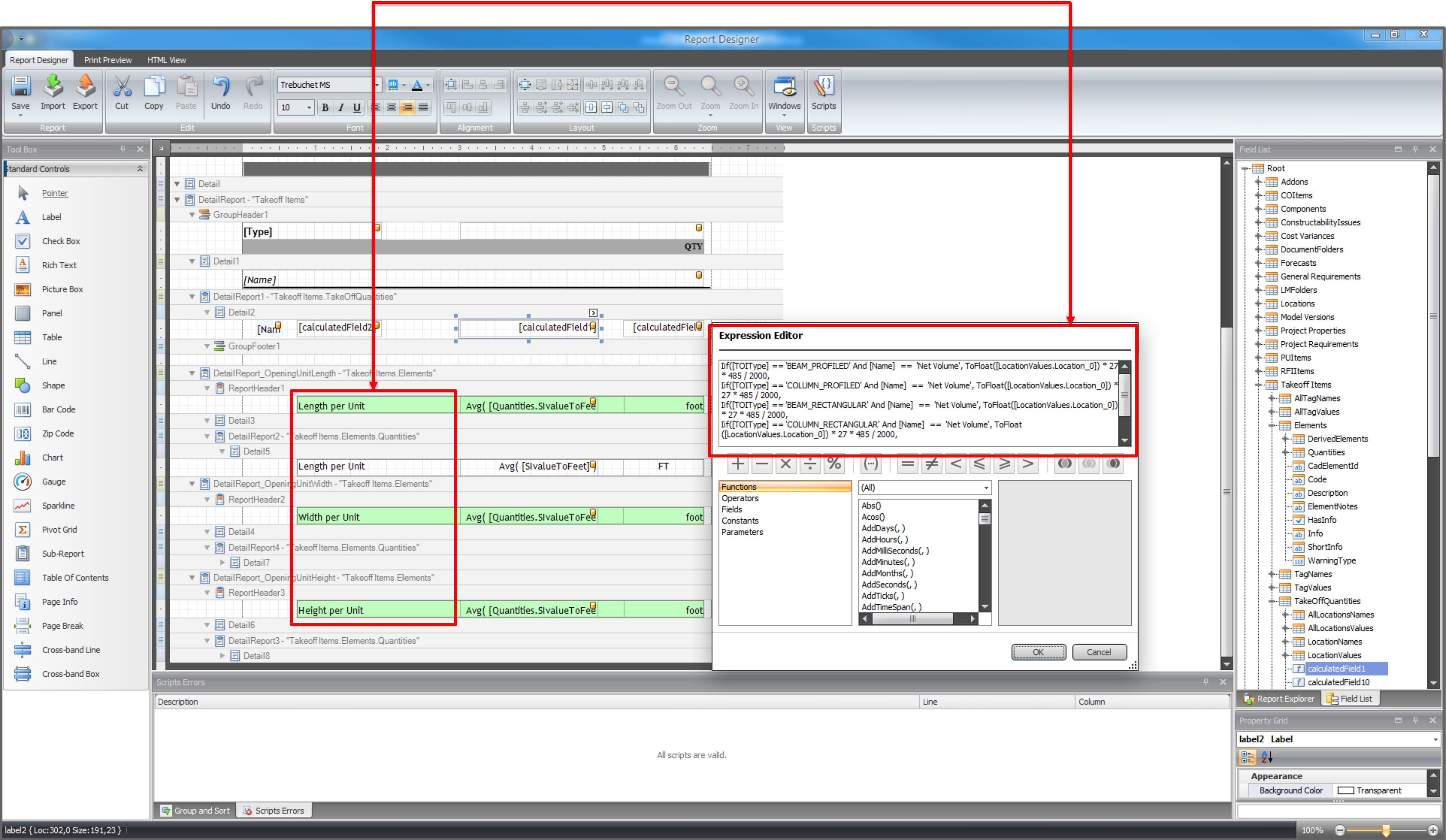
Takeoff Manager

TakeOff Pad

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

The screenshot displays the CCHHS 1.17.2017 software interface, which is used for cost planning and takeoff management. The interface is divided into several main sections:

- Top Bar:** Shows the software version "R6.0 - CCHHS 1.17.2017" and various navigation and tool icons.
- Left Panel:** Contains a "Cost Planner" tab and a "Takeoff Manager" tab. The "Takeoff Manager" tab is active, showing a list of items with columns for "Info", "Code", "Name", "Type", "Mapped", and "Count".
- Main Window:** Displays a detailed list of items, including "Floor: Architectural Slab 6.5\"", "B1010-Floor: 5\" Slab-on-Ground", and various "B10-UC W-Wide Flange" items. The "B10-UC W-Wide Flange: W24x55" item is highlighted.
- Formula Editor:** A dialog box is open, showing the formula "B1010-Floor: 5\" Slab-on-Ground.Net Top Surface Area" and its evaluated value of 48,535.18. The editor includes a "Functions" list and a "Syntax" section.
- Bottom Panel:** Shows a detailed cost breakdown table with columns for "Code", "Description", "Source", "Consumption", "Consumption Inv", "Waste", "Qty", "UOM", "Unit Cost", and "Base Cost". The table lists various structural elements like "SUBSTRUCTURE", "FOUNDATIONS", "SLAB ON GRADE", "GROUND SLAB", "STANDARD", "SPECIAL FOUNDATIONS", "SHELL", "SUPER STRUCTURE", "FLOOR CONSTRUCTION", "FLOOR STRUCTURAL", and "STRUCTURAL COLUMNS".

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 Unifomat Elemental Classification. Attached please find the Unifomat 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

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 Syst...

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 Minin

Create & Run Reports

Reference Estimates

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

fx Parent.Quantity

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
000	CCHHS 11.4.2016	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 Driver 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

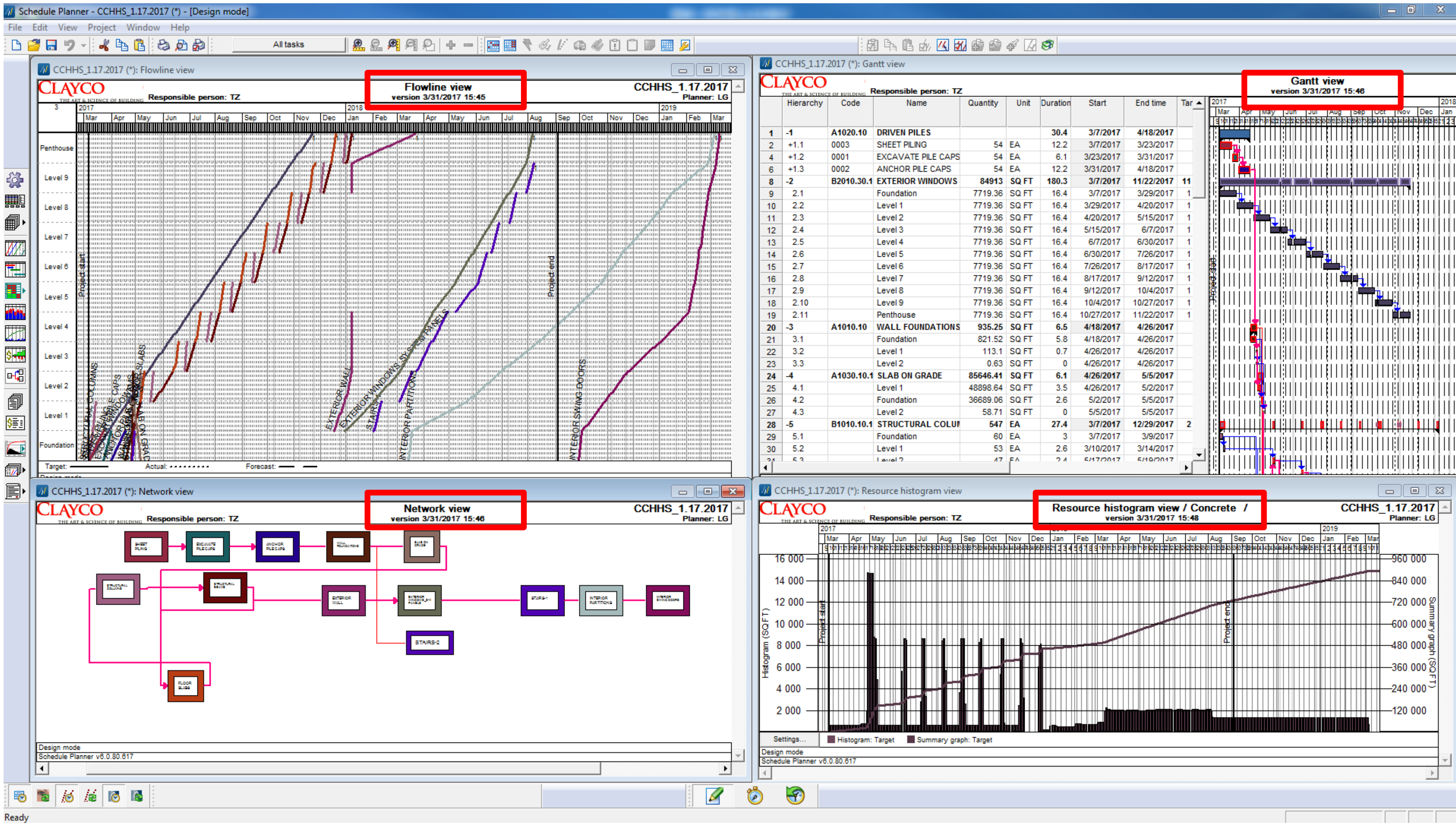
Code	Name	Work	Duration	Location System
A 1020.10	DRIVEN PILES		30.38	SUP
0001	Excavate pile caps	48.60	6.08	SUP
0002	Anchor pile caps	97.20	12.15	SUP
0003	Sheet piling	97.20	12.15	SUP
A 1010.10	WALL FOUNDATIONS	52.38	6.55	SUP
B 1010.10.10	STRUCTURAL COLUMNS	218.80	27.35	SUP
B 1010.10.20	STRUCTURAL BEAMS	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

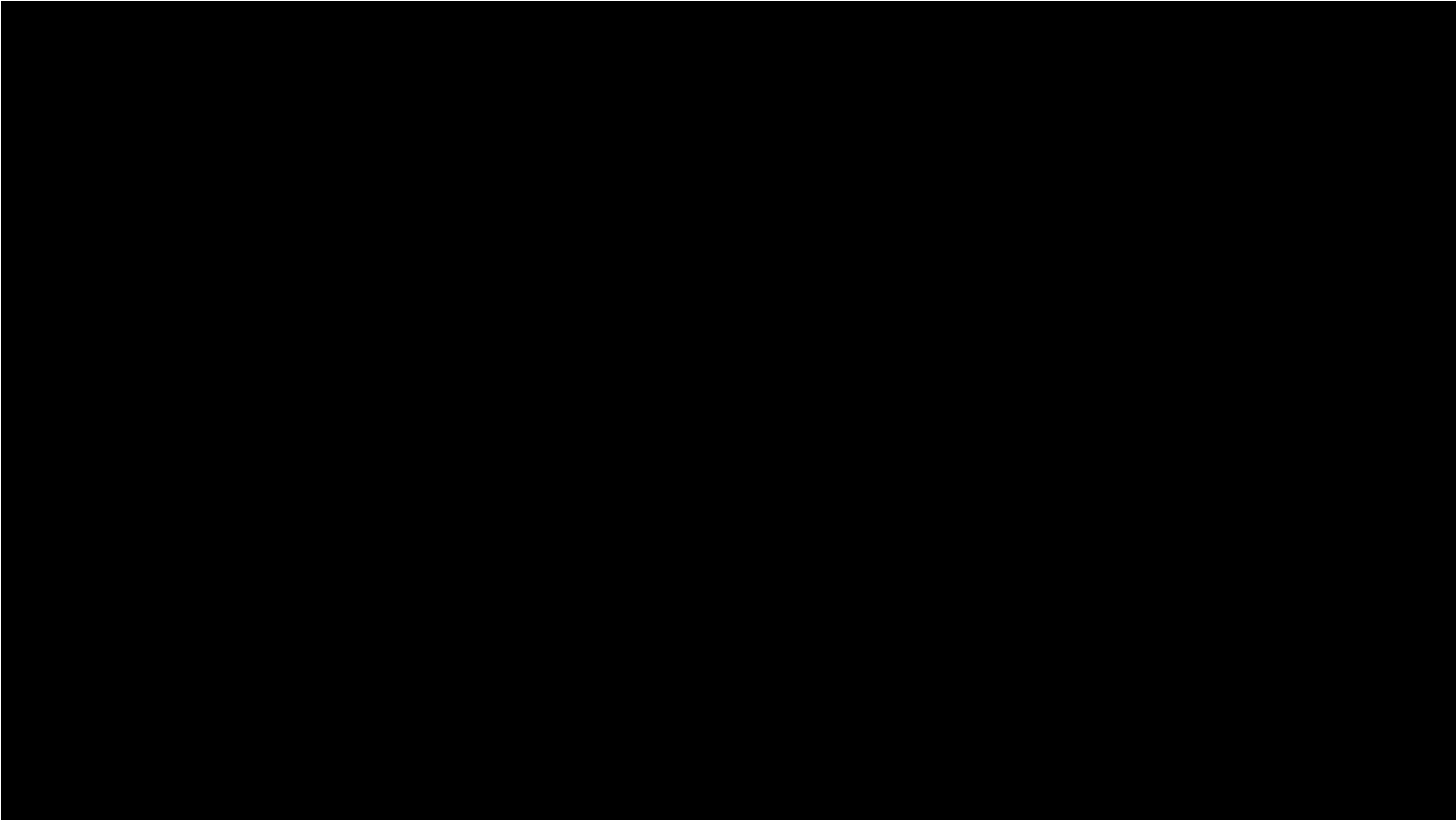
100 Kingshighway will be a 36-story, luxury apartment tower overlooking Forest Park.

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.

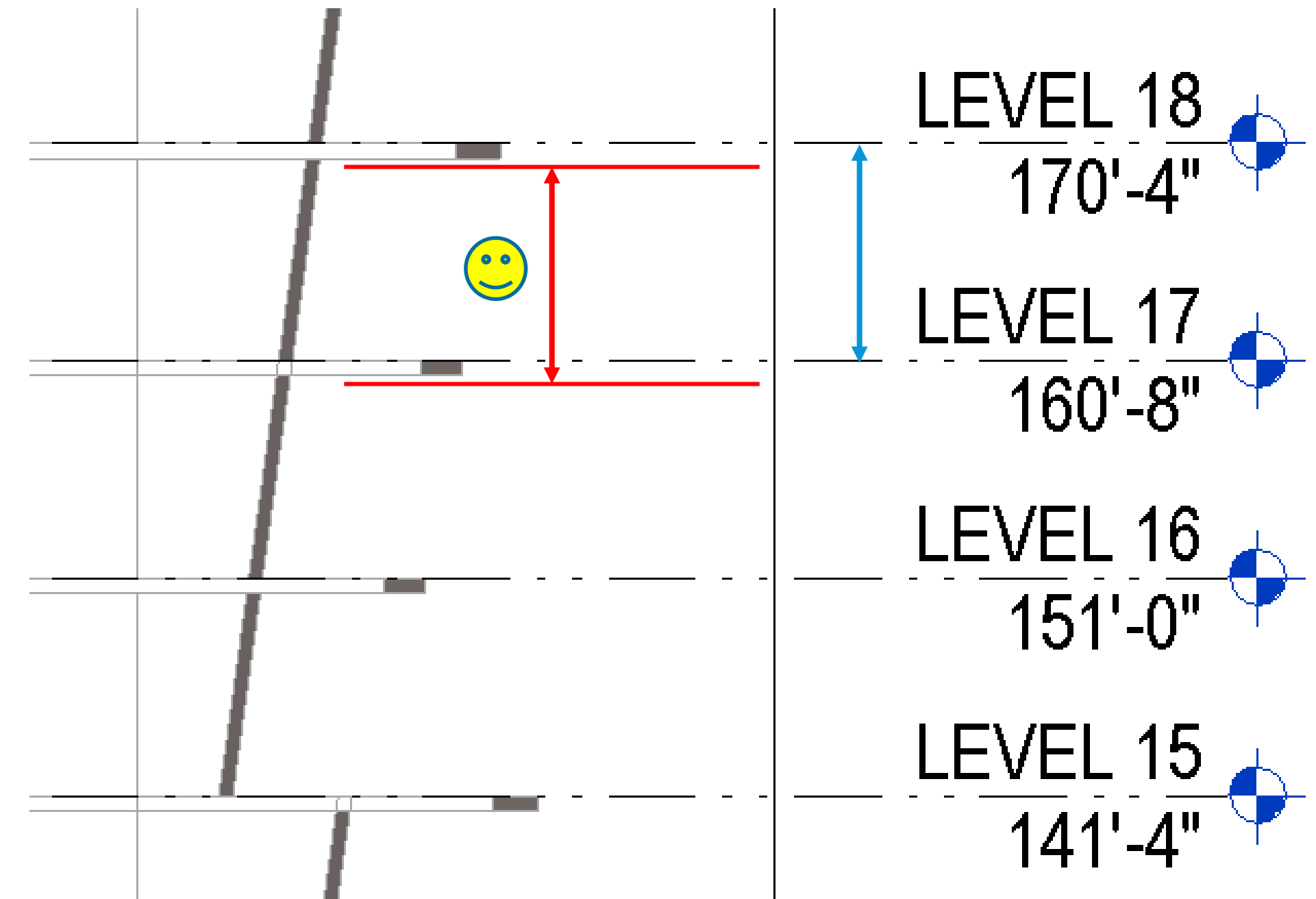
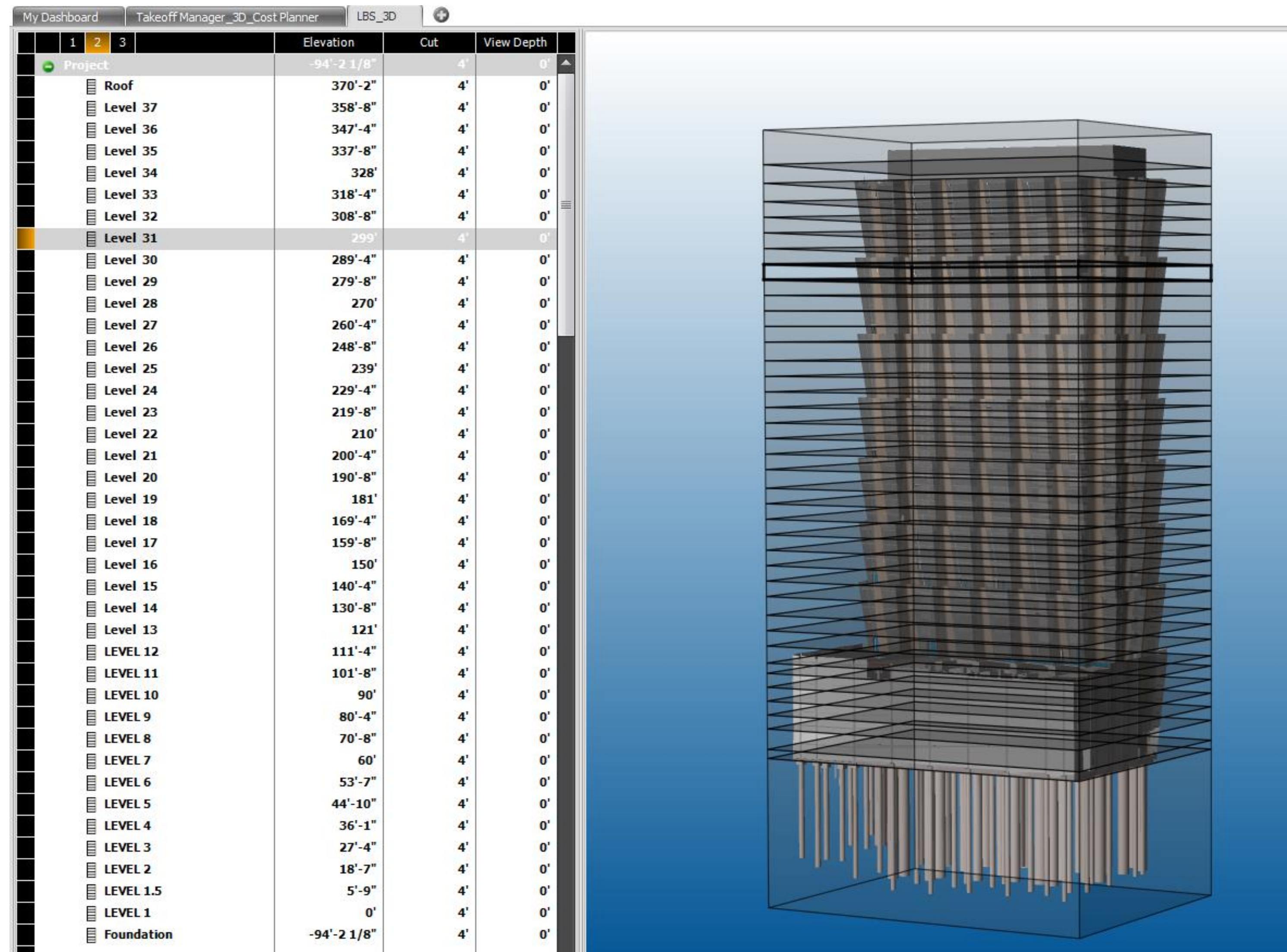


5D **Bottom-up:** Workflow_Explore 5D



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

Primavera P6 Professional R16.1 : ONEHUNDREDKINGSHIGHWAY-1 (ONE HUNDRED KINGSHIGHWAY PROJECT)

File Edit View Project Enterprise Tools Help

Activities

Layout: KO_Clayco Standard 11x17 Month w/o BL Filter: All Activities

Activity ID	Activity Name	Start	Finish	At Completion Duration
ONE HUNDRED KINGSHIGHWAY PROJECT				
100	KINGSHIGHWAY	16-Oct-17 A	26-Aug-20	729.0
MILESTONES				
	PRECONSTRUCTION	16-Oct-17 A	04-Dec-19	542.0
	CONSTRUCTION	20-Nov-17 A	20-Jul-20	677.0
	SITE CONTROL	20-Nov-17 A	11-Jul-18	162.0
	FOUNDATIONS	19-Mar-18 A	26-Jul-18	91.0
SUPERSTRUCTURE				
19	TOWER CRANE	15-Jun-18	26-Jun-18	8.0
20	ELEVATOR CORE (3 LIFTS)	06-Jul-18	09-Aug-18	25.0
21	CONCRETE GROUND LEVEL	26-Jul-18	22-Aug-18	20.0
22	CONCRETE PARKING LEVEL 2	23-Aug-18	18-Sep-18	18.0
23	CONCRETE PARKING LEVEL 3	19-Sep-18	09-Oct-18	15.0
24	CONCRETE PARKING LEVEL 4	10-Oct-18	30-Oct-18	15.0
25	CONCRETE PARKING LEVEL 5	31-Oct-18	20-Nov-18	15.0
26	CONCRETE LEVEL 6-AMENITY	21-Nov-18	28-Dec-18	25.0
27	CONCRETE LEVEL 7	31-Dec-18	14-Jan-19	10.0
28	CONCRETE LEVEL 8	15-Jan-19	25-Jan-19	9.0
29	CONCRETE LEVEL 9	28-Jan-19	06-Feb-19	8.0
30	CONCRETE LEVEL 10	07-Feb-19	15-Feb-19	7.0
31	CONCRETE LEVEL 11	18-Feb-19	25-Feb-19	6.0
32	CONCRETE LEVEL 12	26-Feb-19	05-Mar-19	6.0

2017

2018

2019

General Status Resources Codes Relationships Notebook Steps Feedback WPs & Docs Expenses Summary Predecessors Successors

Activity 16 Phase 3 Occupancy (Floors 28-36) Project ONEHUNDREDKINGSHIGHWAY-1

Predecessors

Driving	Activity ID	Critical	Activity Name	Relations	Lag	Total Float	Start	Finish
Yes	205	Yes	INSPECTIONS Floors 28-PH	FF	0.0	-19.1	26-Jun-20	24-Jul-20

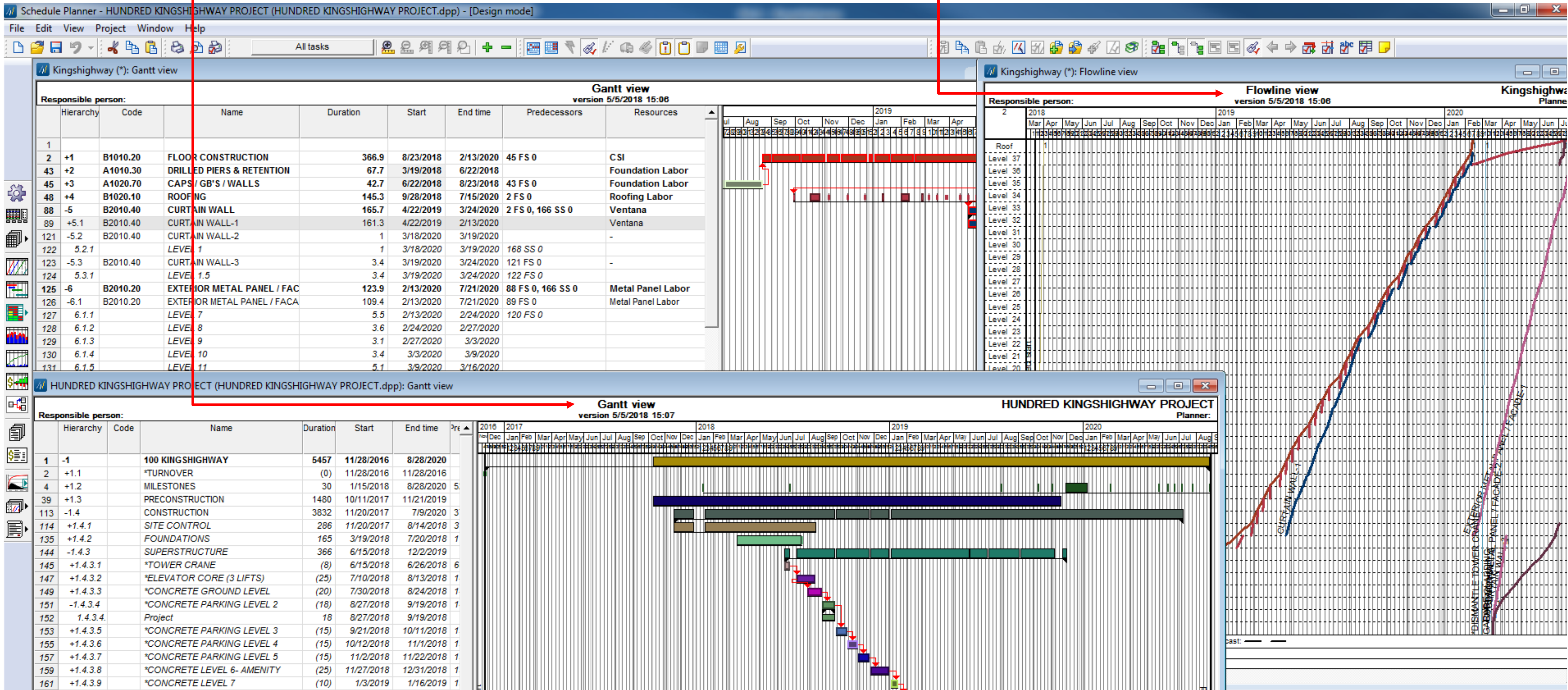
Successors

Driving	Activity ID	Critical	Activity Name	Relations	Lag	Start	Finish
No	128	Yes	FINAL COMPLETION	FS	0.0		26-Aug-20*
Yes	95	Yes	SUBSTANTIAL COMPLETION	FF	0.0		25-Jul-20

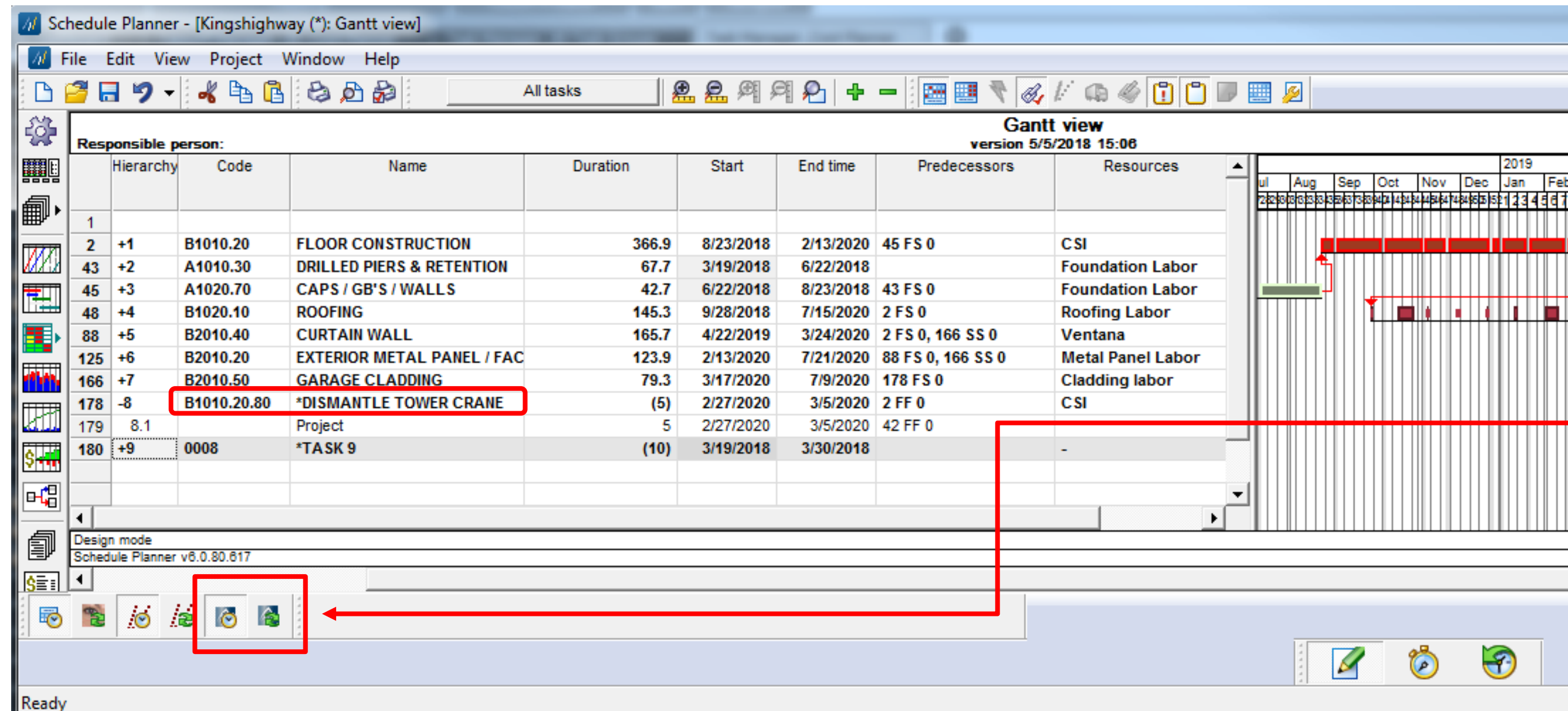
5D Bottom-up: Import XML into VSP and Map it to the existing project

Imported original XML schedule

VICO project DPP schedule



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

My Dashboard

Takeoff Manager_3D_Cost Planner

Task Manager_4D Task Groups

Task Manager_Cost Planner

	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	

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



Schedule Planner - [Kingshighway (*): Gantt view]

File Edit View Project Window Help

All tasks

Gantt view

version 5/3/2018 10:23

	Hierarchy	Code	Name	Duration	Current duration	Start	Current start time	End time	Current end time	Date of the latest actual	Latest actual	Suspension days	Predecessors	Reso
1														
2	+1	B1010.20	FLOOR CONSTRUCTION	366.9	0	8/23/2018	9/27/2018	2/13/2020	3/24/2020				45 FS 0	-
43	-2	A1010.30	DRILLED PIERS & RETENTION	67.7	0	3/19/2018	5/3/2018	6/22/2018	8/10/2018					-
44	2.1		Foundation	67.7		3/19/2018		6/22/2018						-
45	+3	A1020.70	CAPS / GB'S / WALLS	42.7	0	6/22/2018	8/10/2018	8/23/2018	10/12/2018				43 FS 0	-
48	+4	B1020.10	ROOFING	145.3	0	9/28/2018	11/7/2018	7/15/2020	8/20/2020				2 FS 0	-
88	-5	B2010.40	CURTAIN WALL	165.7	0	4/22/2019	4/22/2019	3/24/2020	5/7/2020				2 FS 0, 166 SS 0	-
89	-5.1	B2010.40	CURTAIN WALL-1	161.3		4/22/2019		2/13/2020						-
90	5.1.1		LEVEL 7	3.7		4/22/2019		4/26/2019		4/28/2019	100%	0	16 FS 0	-
91	5.1.2		LEVEL 8	4.4		4/26/2019		5/2/2019		5/3/2019	100%	0		-
92	5.1.3		LEVEL 9	4.9		5/2/2019		5/9/2019		5/9/2019	100%	0		-
93	5.1.4		LEVEL 10	6.4		5/9/2019		5/17/2019		5/17/2019	100%	0		-
94	5.1.5		LEVEL 11	6		5/17/2019		5/28/2019		5/30/2019	100%	0		-
95	5.1.6		LEVEL 12	4.4		5/28/2019		6/4/2019		6/4/2019	100%	0		-
96	5.1.7		Level 13	4.8		6/4/2019		6/11/2019		8/30/2019	100%	0		-
97	5.1.8		Level 14	5.2		6/11/2019		6/19/2019		9/18/2019	100%	0		-
98	5.1.9		Level 15	6.4		6/19/2019		6/27/2019		11/20/2019	100%	0		-

Task status

version 5/3/2018 10:33

Level	Start	Finish	Actual Start	Actual Finish	Target Start	Target Finish
Level 17	6/19	6/19	6/19	7/4	7/12	4/8
Level 16	6/19	6/19	6/19	6/27	7/4	4/3
Level 15	5/29	5/29	5/29	5/29	5/29	3/27
Level 14	5/1	5/10	5/10	5/13	5/13	3/24
Level 13	4/22	5/1	5/1	5/2	5/2	3/19
LEVEL 12	4/12	4/22	4/22	4/23	4/23	3/16
LEVEL 11	3/27	4/12	4/12	4/12	4/12	3/3
LEVEL 10	3/15	3/27	3/27	3/27	3/27	3/9
LEVEL 9	3/6	3/15	3/15	3/18	3/18	2/27
LEVEL 8	2/26	3/6	3/6	3/7	3/7	2/24
LEVEL 7	2/1	2/26	2/26	2/28	2/28	2/13
LEVEL 6	1/10	2/1	2/1	2/12	2/12	4/3
LEVEL 5	2/21	1/10	1/10	1/14	1/14	4/1
LEVEL 4	1/30	12/21	12/21			3/30

FLOOR CONSTRUCTION

ROOFING

CURTAIN WALL

EXTERIOR METAL PANEL / FACADE

*DISMANTLE TOWER CRANE

Current week: 18 2018

☒ Follow calendar ☐ Overscore ☒ Use colors ☐ Show slanting task names ☐ Show free Locations ☐ Show prerequisites warnings

The task has not begun

The task is in progress

The task is in progress, but running late

There is no task for this position

The task has not begun, running late

On time and paused

Late and paused

Target start date

Actual start date

Target finish date

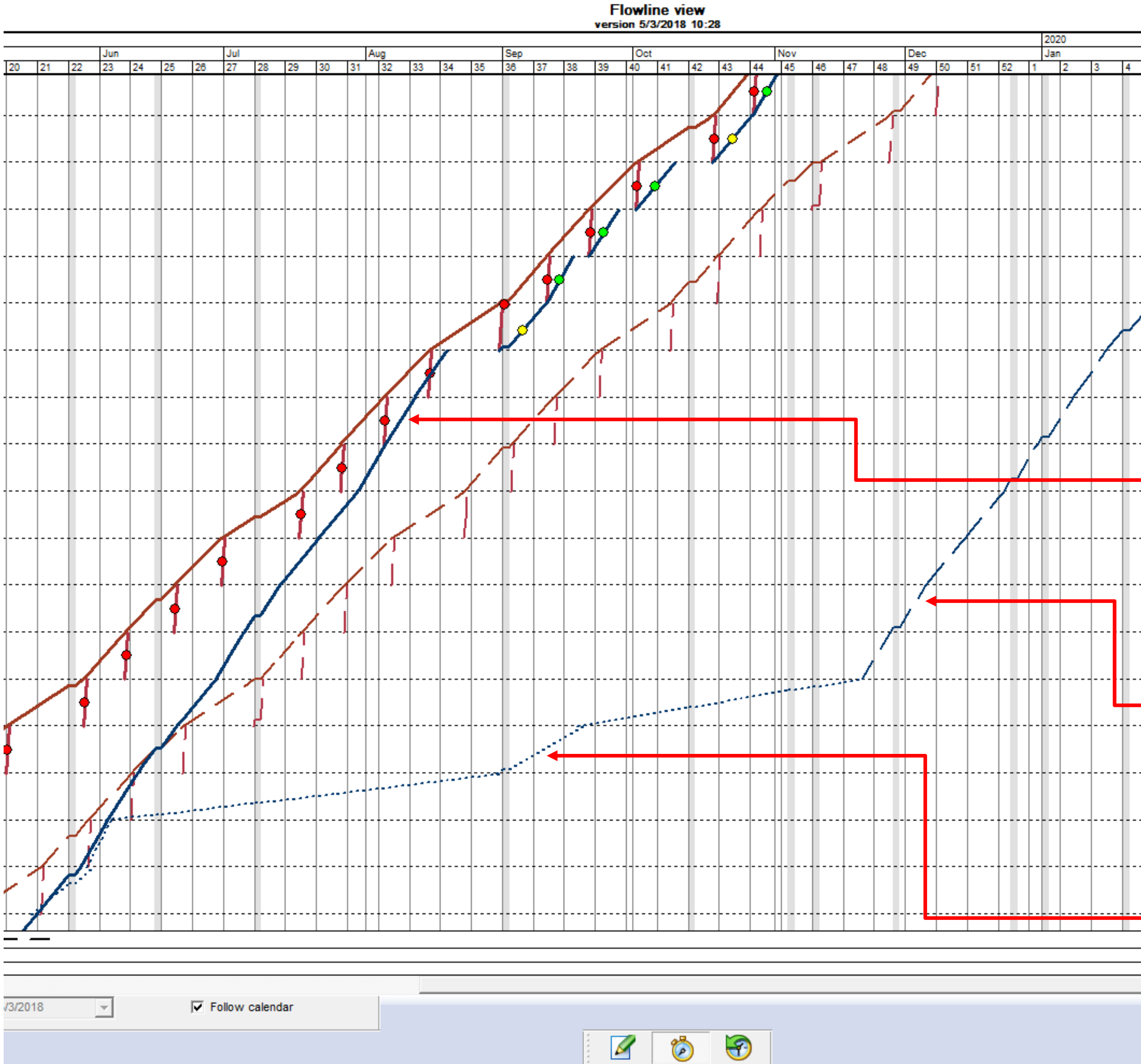
Actual finish date

Control mode

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 Target vs Forecast)

Target: _____ Actual: Forecast: _____

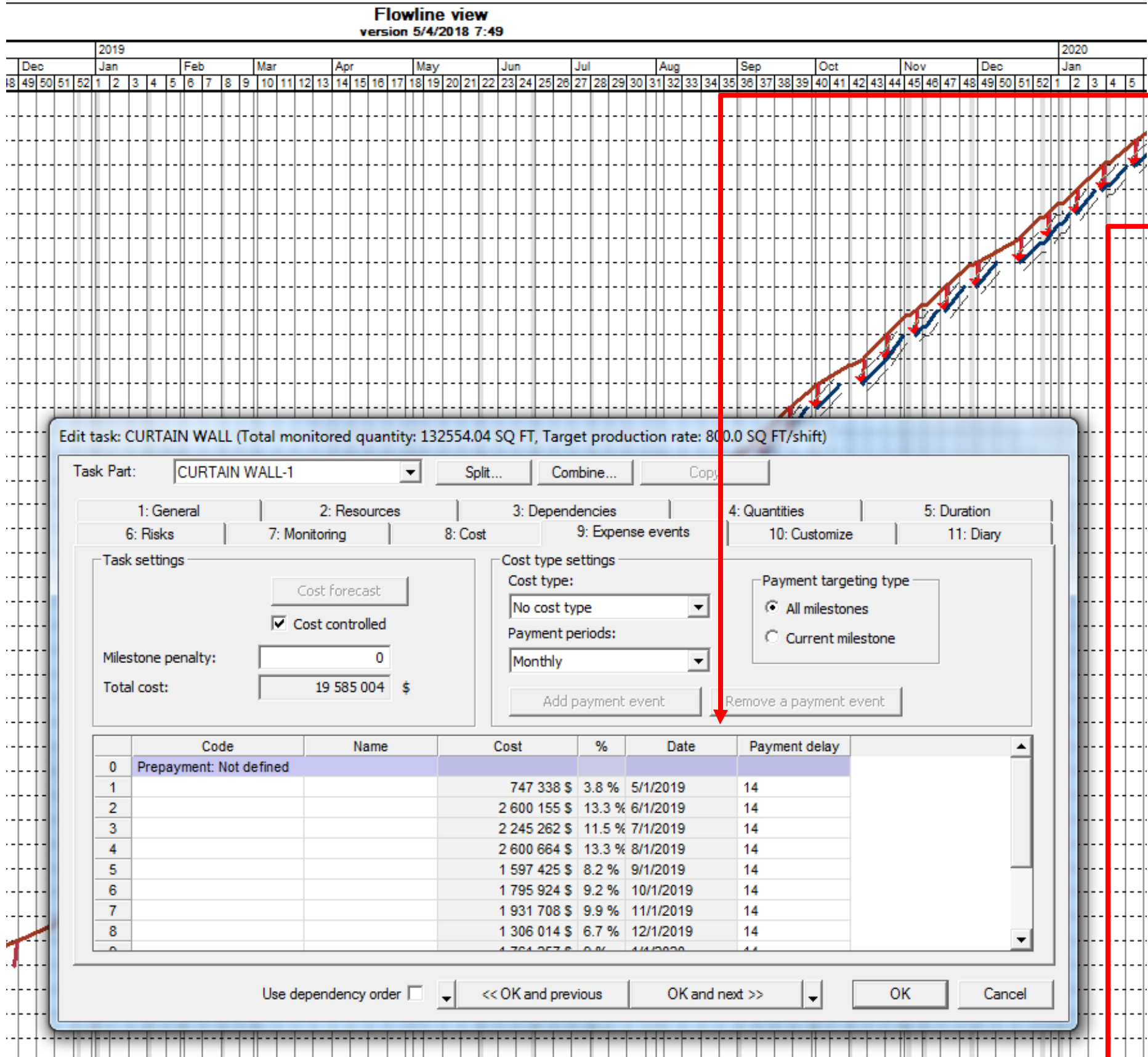


Target: enables the planned schedule which we are targeting

Forecast: takes all actualized data to generate a comparative model

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

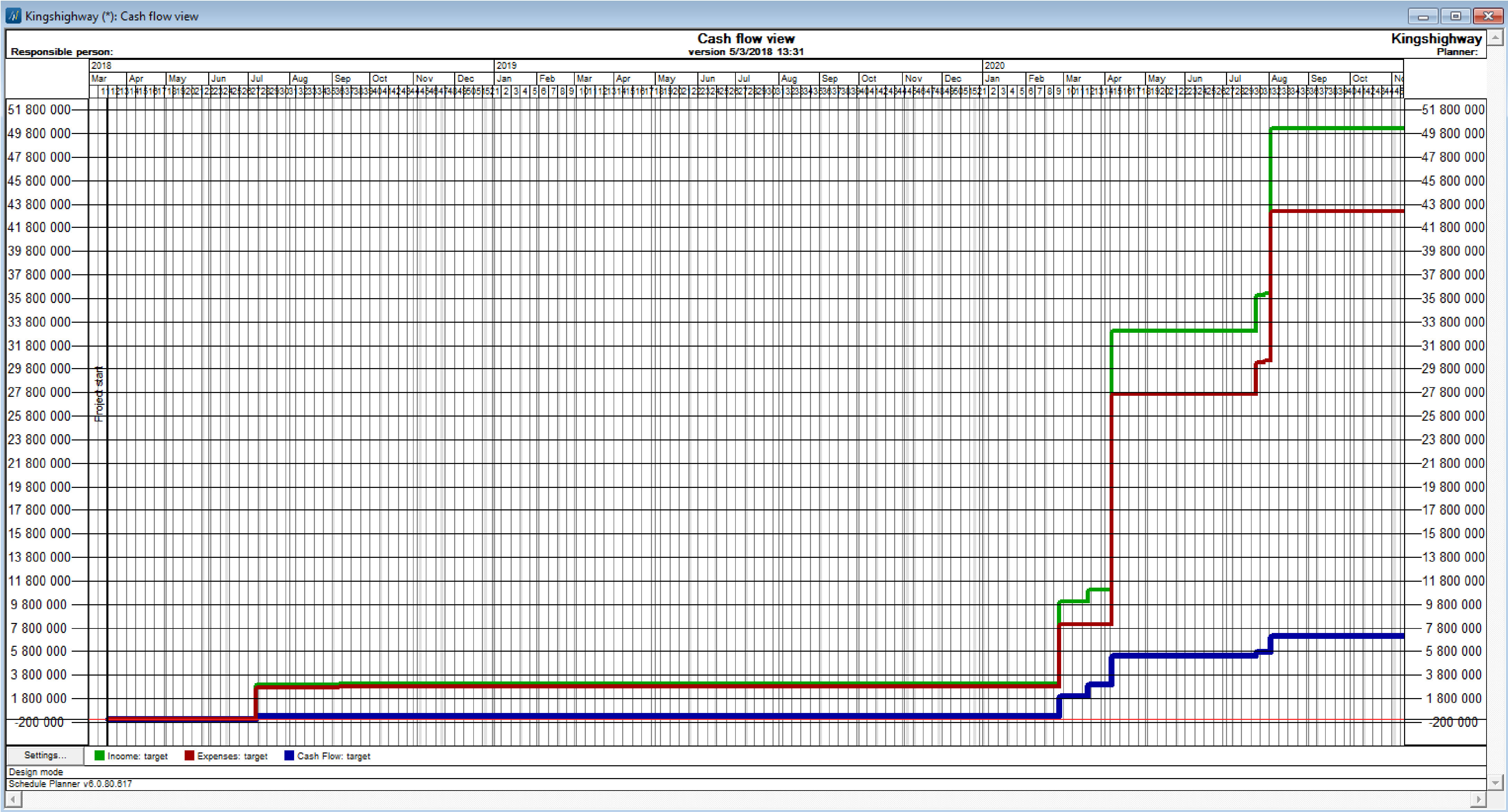
5D Bottom-up: Expense and Income



- 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.

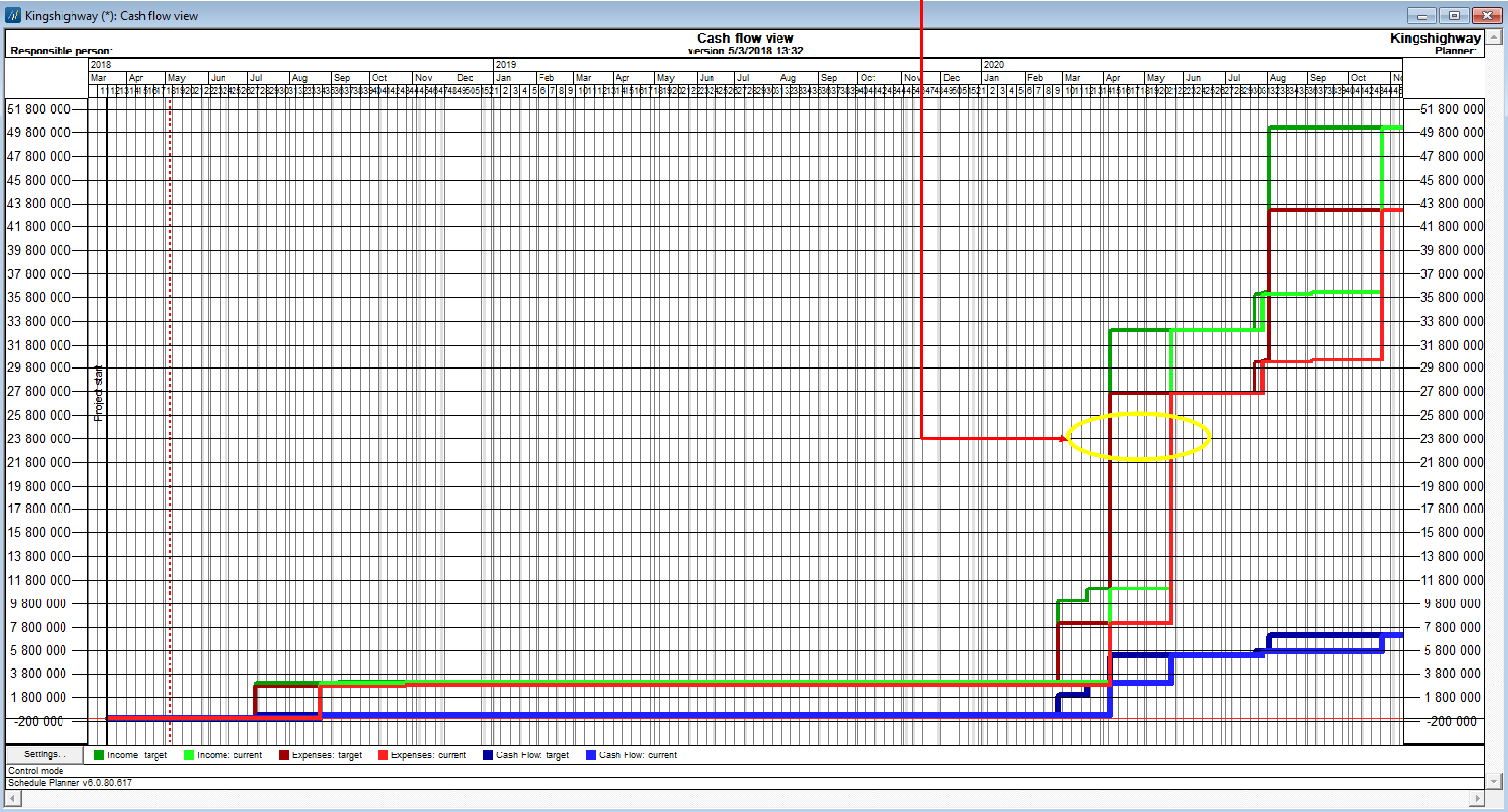
Schedule Planner - [Kingshighway (*): Payment table]				
File Edit View Project Window Help				
All tasks				
Income events				
Task	Date	Payment delay	Target sum (\$)	Current sum (\$)
DRILLED PIERS & RETENTION (100%)	6/22/2018	14	3 000 000	3 000 000
CAPS / GB'S / WALLS (100%)	8/23/2018	14	50 000	50 000
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

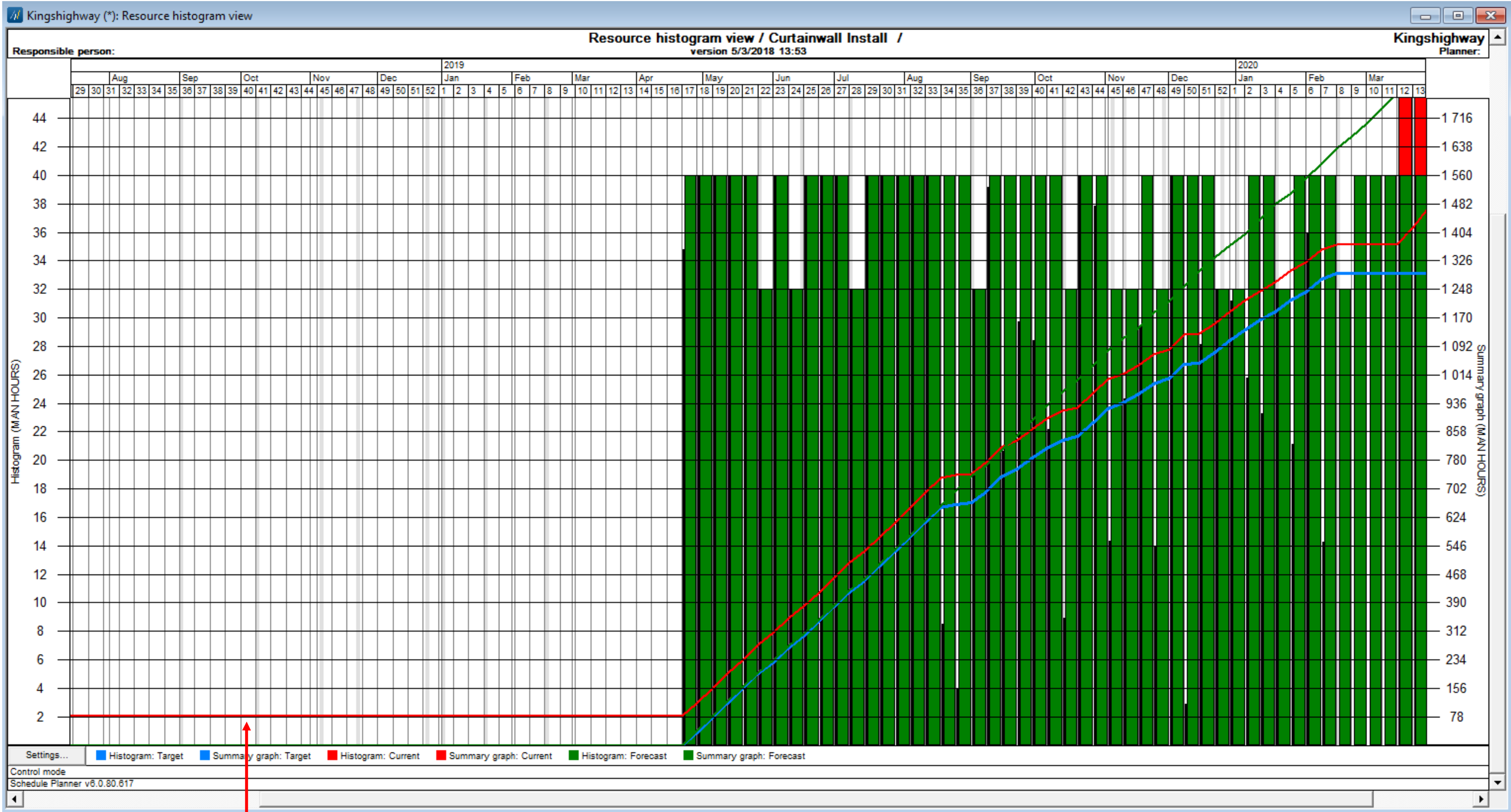
The screenshot shows a 'Resource histogram filter' dialog box. At the top, there is a 'Filter' section with a dropdown menu set to 'Curtainwall Install', and 'Remove' and 'New' buttons. Below this, the 'Name' field is 'Curtainwall Install' and the 'Unit' dropdown is 'MAN HOURS'. A second 'Filter' section contains a 'Show' group box with four checkboxes: 'Resources' (checked), 'Quantity resources', 'Costs', and 'Tasks'. Below the checkboxes 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	☒	☒	☒	☒	☒	☒	☒	☒
2		☐	☐	☐	☐	☐	☐	☐	☐

◀

▶

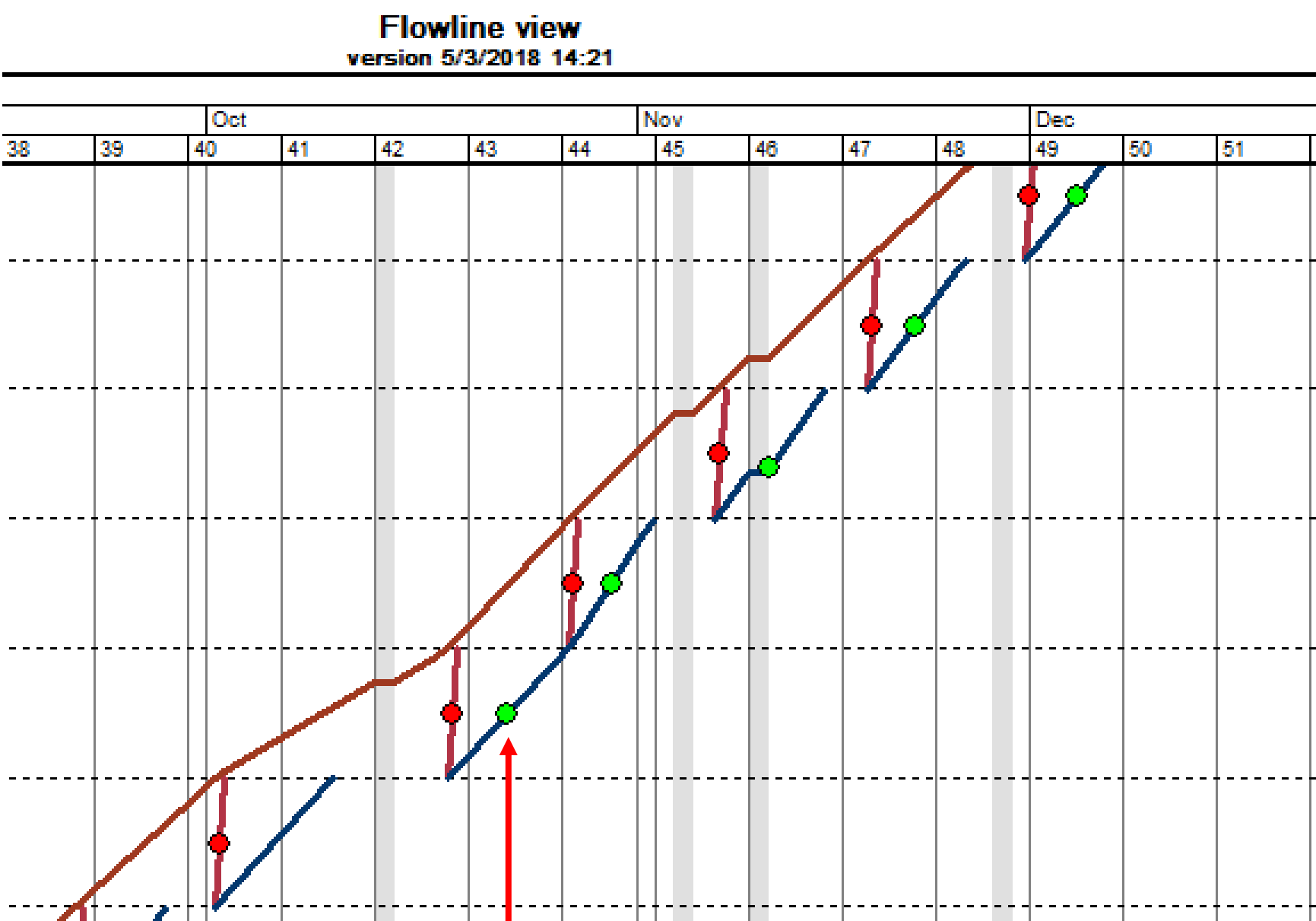
Delete row

Simulator settings

Simulate

Cancel

Define Iterations



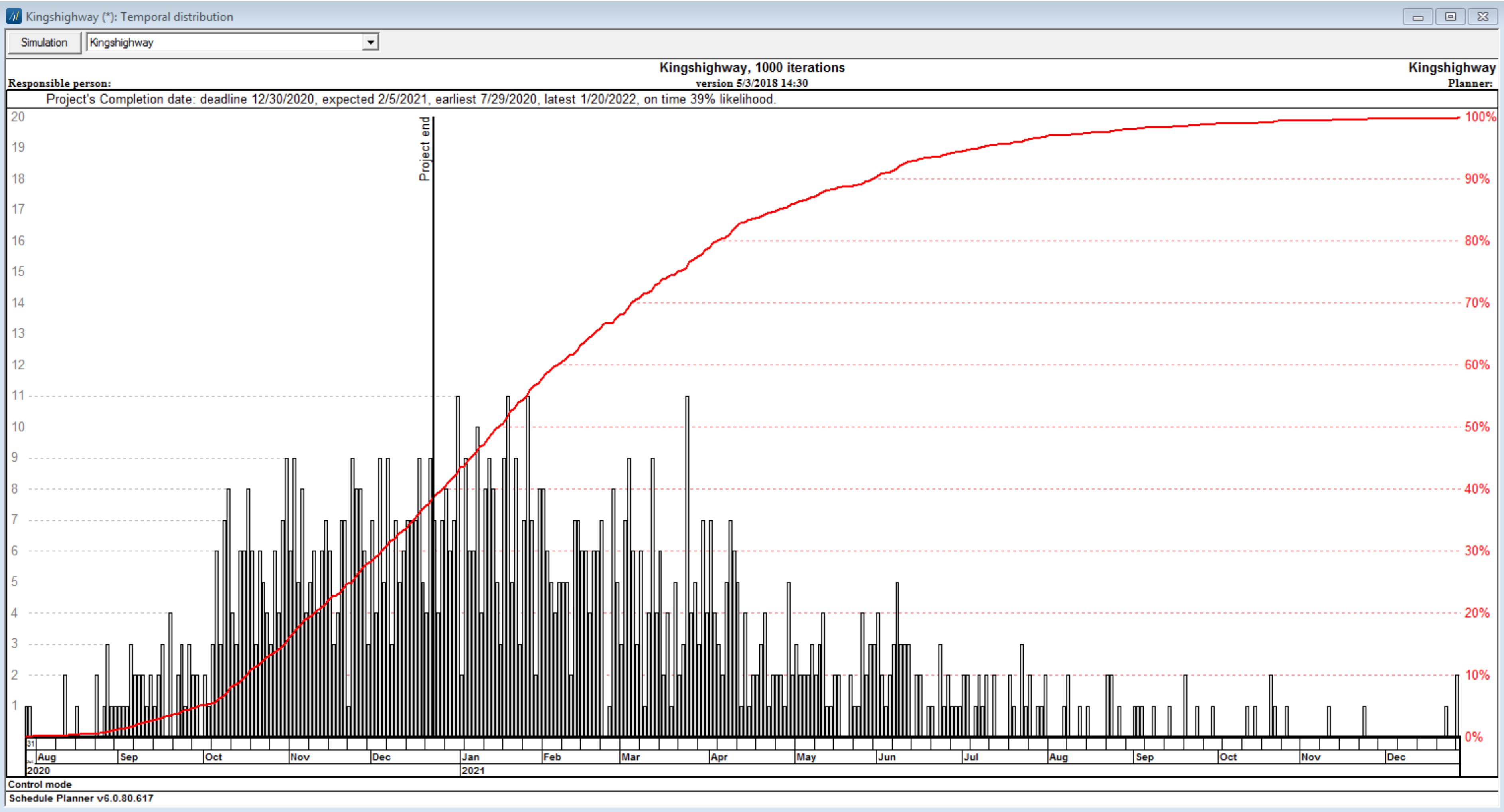
30%
Install curtainwall

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	☐		Procurement task1				0	34 852			342	
-2	☐	CW	CW Procurement				147.75	19 585 004			1326	
2.1	☐	C-AGM_Gla	Glass	117648.9	SQ FT		150	17 647 339	0	0.01	1176	
2.2	☐	K-AGM_Gla	Glass	14905.11	SQ FT		130	1 937 665	0	0.01	149	
3	☐	Design Cha	Procurement task 4				0	0			0	
-4	☐	Piers	Piers Procurement				560	2 731 007			542	
4.1	☐	A1020130-I	Round Pier	278.15	CU YD		560	155 766	0	0.1111	31	
4.2	☐	A1020130-I	Round Pier	228.51	CU YD		560	128 116	0	0.1111	27	
4.3	☐	A1020130-I	Round Pier									
4.4	☐	A1020130-I	Round Pier									
4.5	☐	A1020130-I	Round Pier									
4.6	☐	A1020130-I	Round Pier									
4.7	☐	A1020130-I	Round Pier									
4.8	☐	A1020130-I	Round Pier									
-												
1	☐	B10-Concre	Rectangular									
2	☐	B10-Concre	Rectangular									
3	☐	B10-Concre	Rectangular									
4	☐	B10-Concre	Rectangular									
5	☐	B10-Concre	Rectangular									
6	☐	B10-Concre	Rectangular									
7	☐	B10-Concre	Rectangular									
8	☐	B10-Concre	Rectangular									
9	☐	B10-Concre	Rectangular									
10	☐	B10-Concre	Rectangular									
11	☐	B10-Concre	Rectangular									
12	☐	B10-Concre	Rectangular									
13	☐	B10-Concre	Rectangular									
14	☐	B10-Concre	Rectangular									
15	☐	B10-Concre	Rectangular									
16	☐	B10-Concre	Rectangular									
17	☐	B10-Concre	Rectangular									
18	☐	B10-Concre	Rectangular									
19	☐	B10-Concre	Rectangular									
20	☐	B10-Concre	Rectangular									
21	☐	B10-Concre	Rectangular									
22	☐	B10-Concre	Rectangular	93	CU YD		300	27 901	0	0.3333	31	
23	☐	B10-Concre	Rectangular	12.7	CU YD		300	3 811	0	0.3333	4	
24	☐	B10-Concre	Rectangular	106.75	CU YD		300	32 025	0	0.3333	36	
25	☐	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 >>

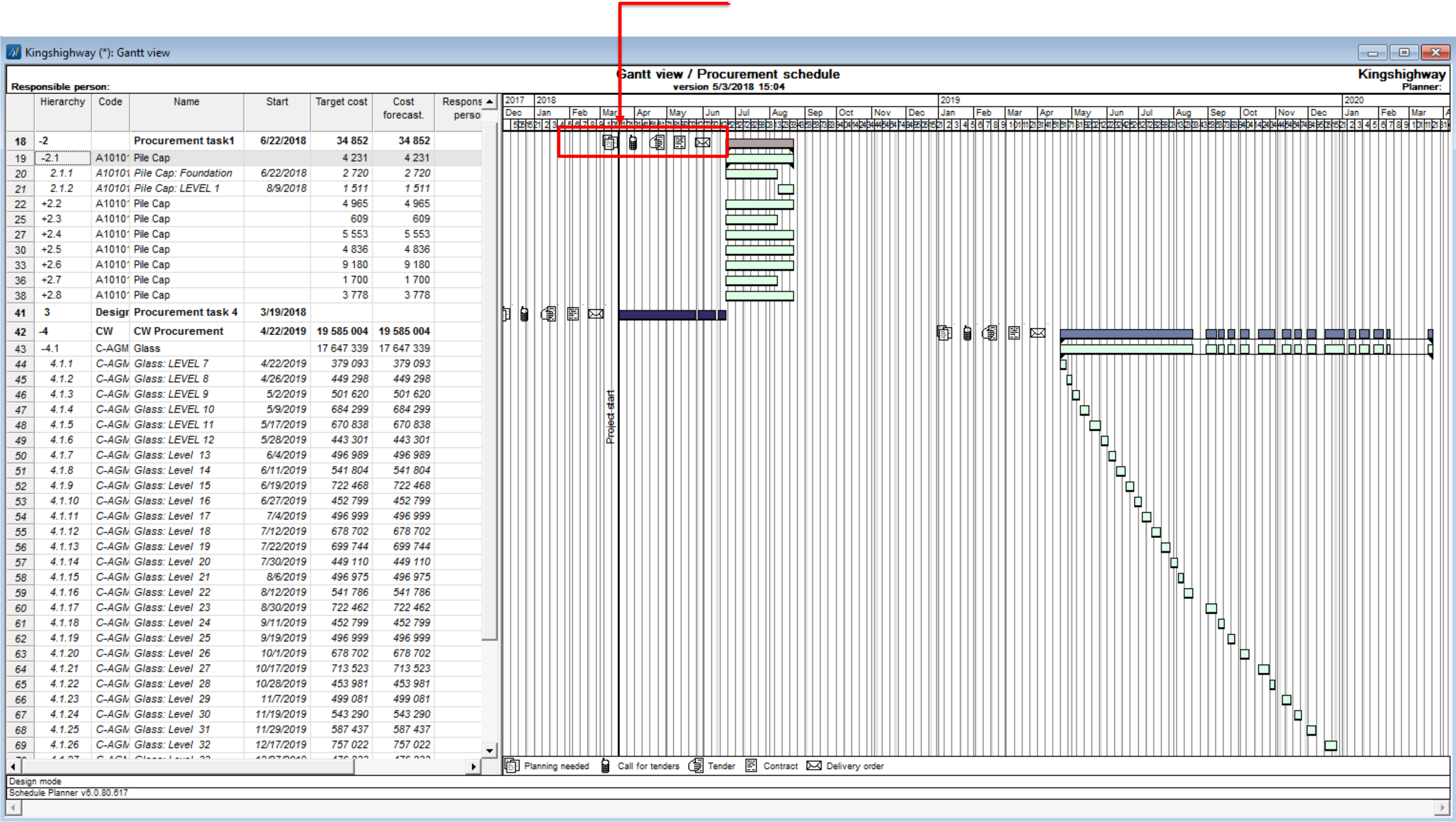
OK

Cancel

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

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

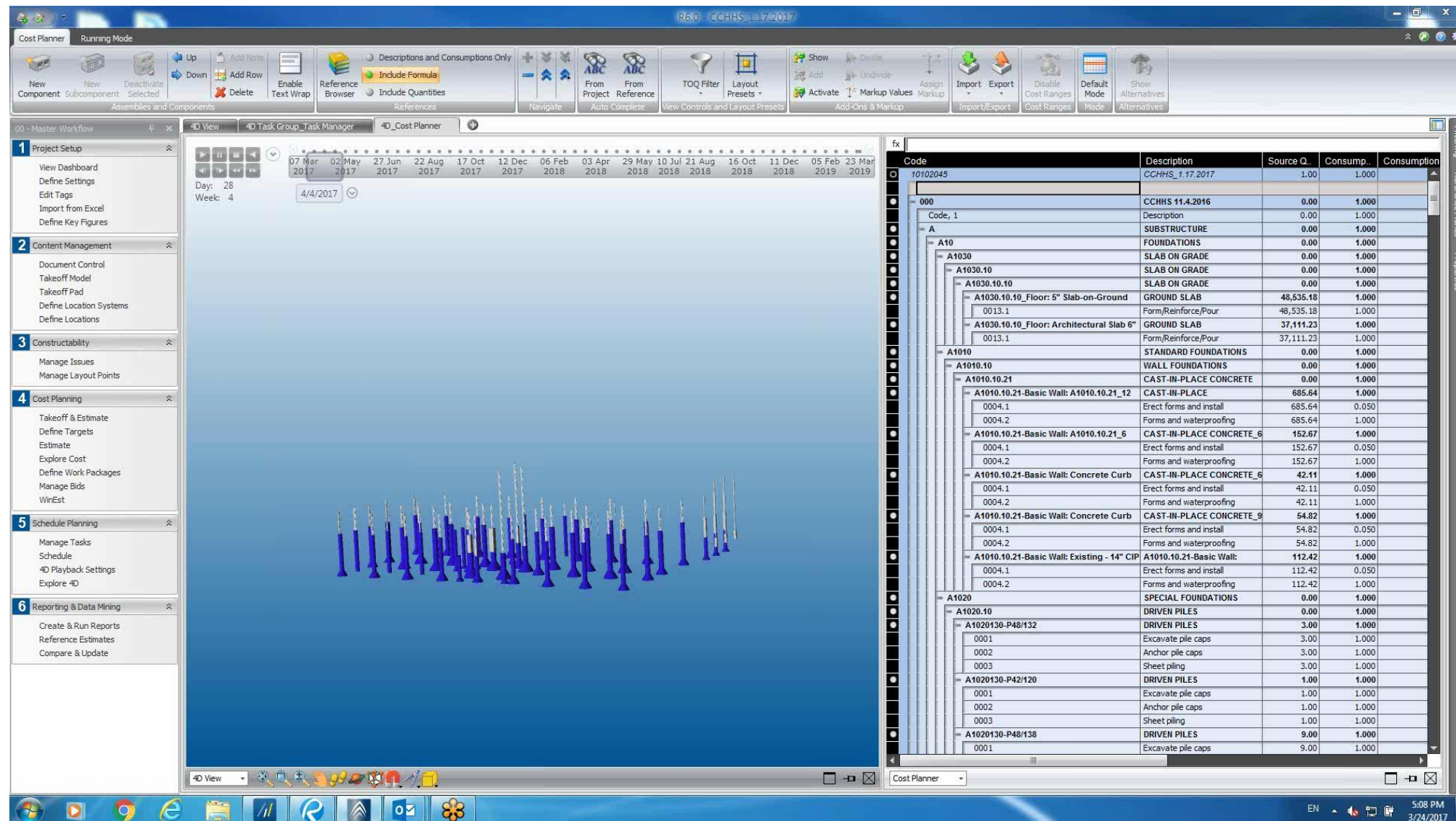
Drag and drop icons to suit the schedules as required to be completed



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

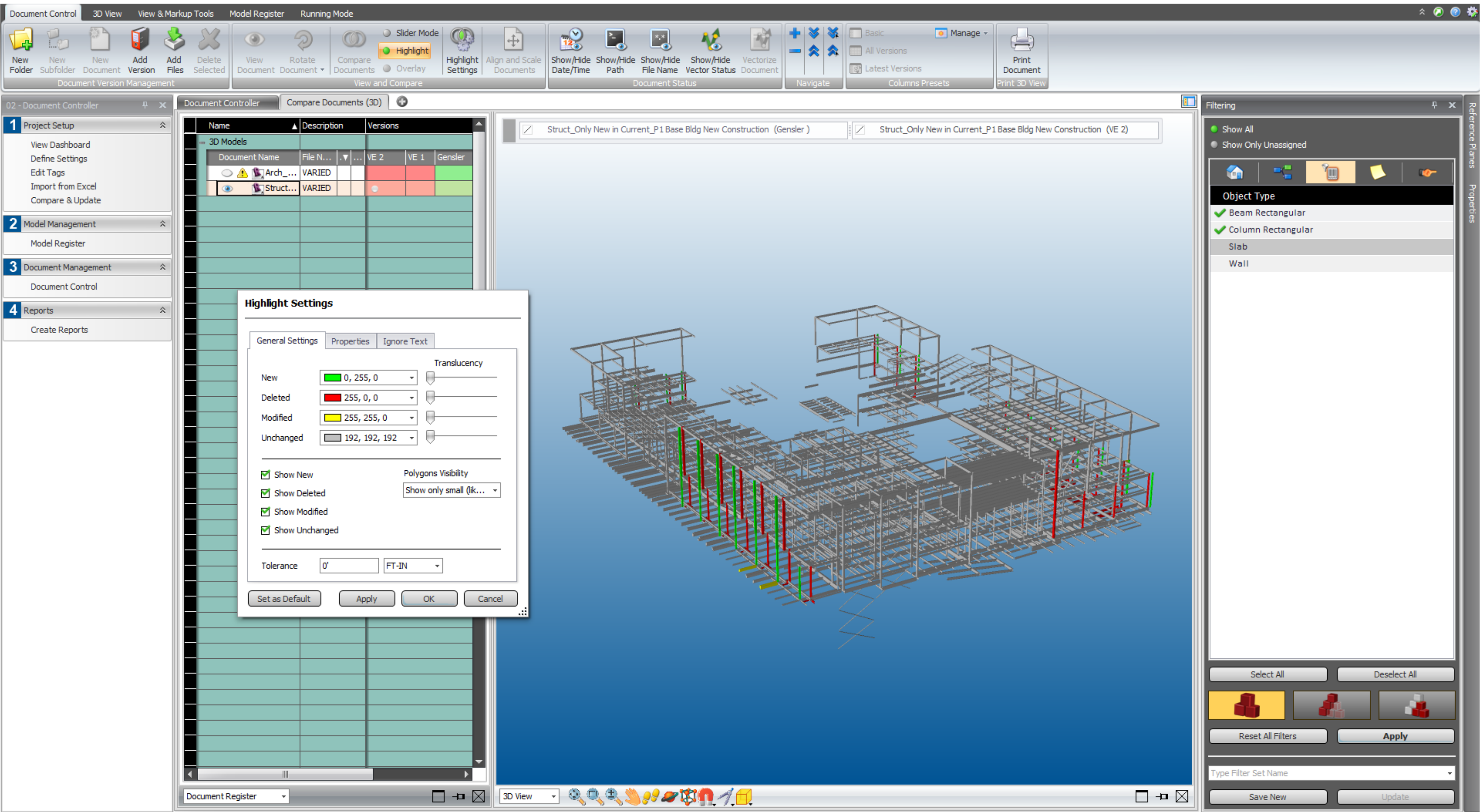
4D & 5D integration

- 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.
- See video below for demo.



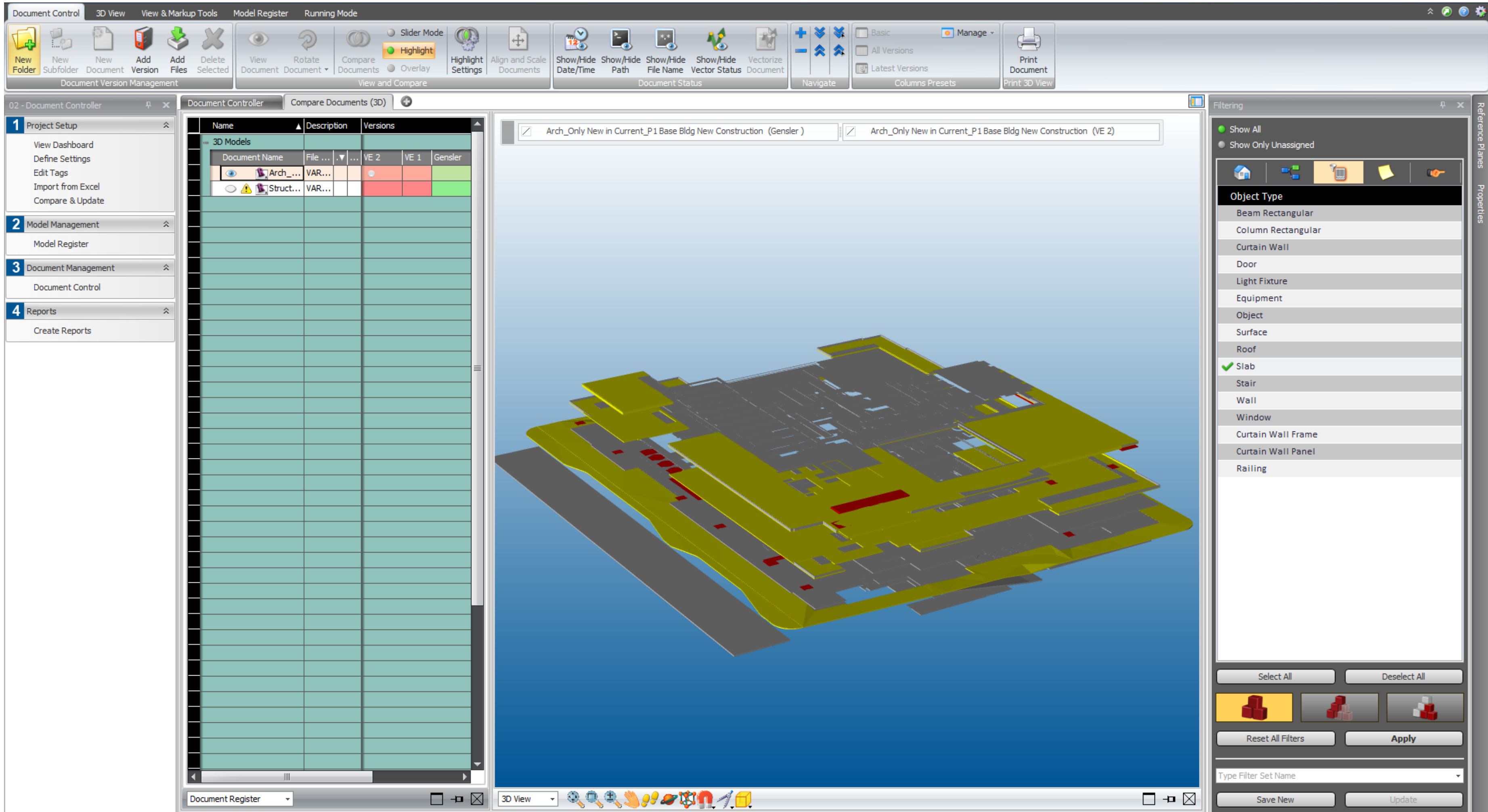
5D integration (Animation on left side and Cost Planner on right side)
See attached video for animation

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	
A503	A503.pdf	
A511	A511.pdf	
A512	A512.pdf	
A513	A513.pdf	
A600	A600.pdf	
A601	A601.pdf	
A602	A602.pdf	
A603	A603.pdf	
A604	A604.pdf	
A605	A605.pdf	
A606	A606.pdf	
A607	A607.pdf	
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

\\dtcprint01\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; A104

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

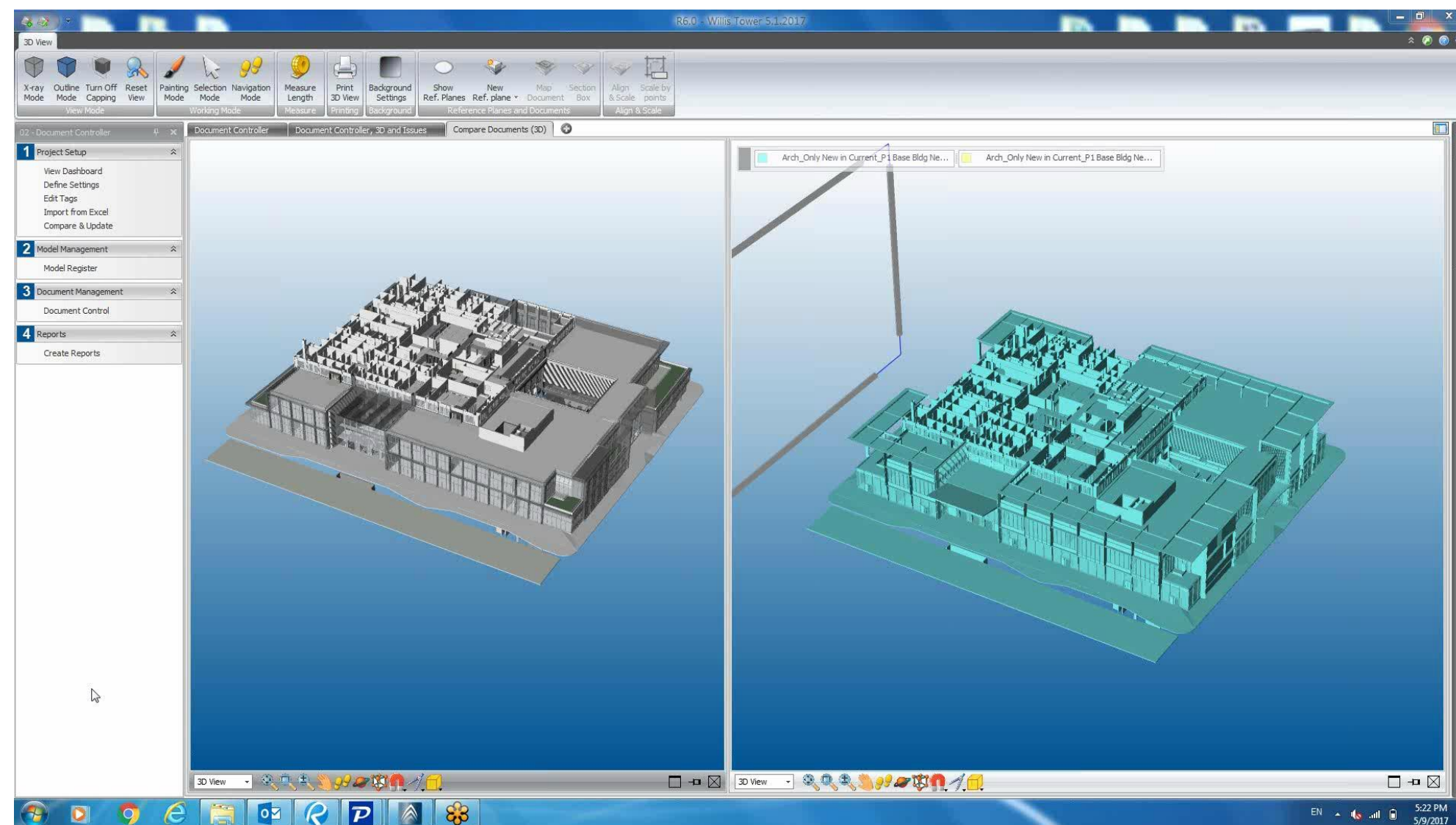
Cancel

Document Register

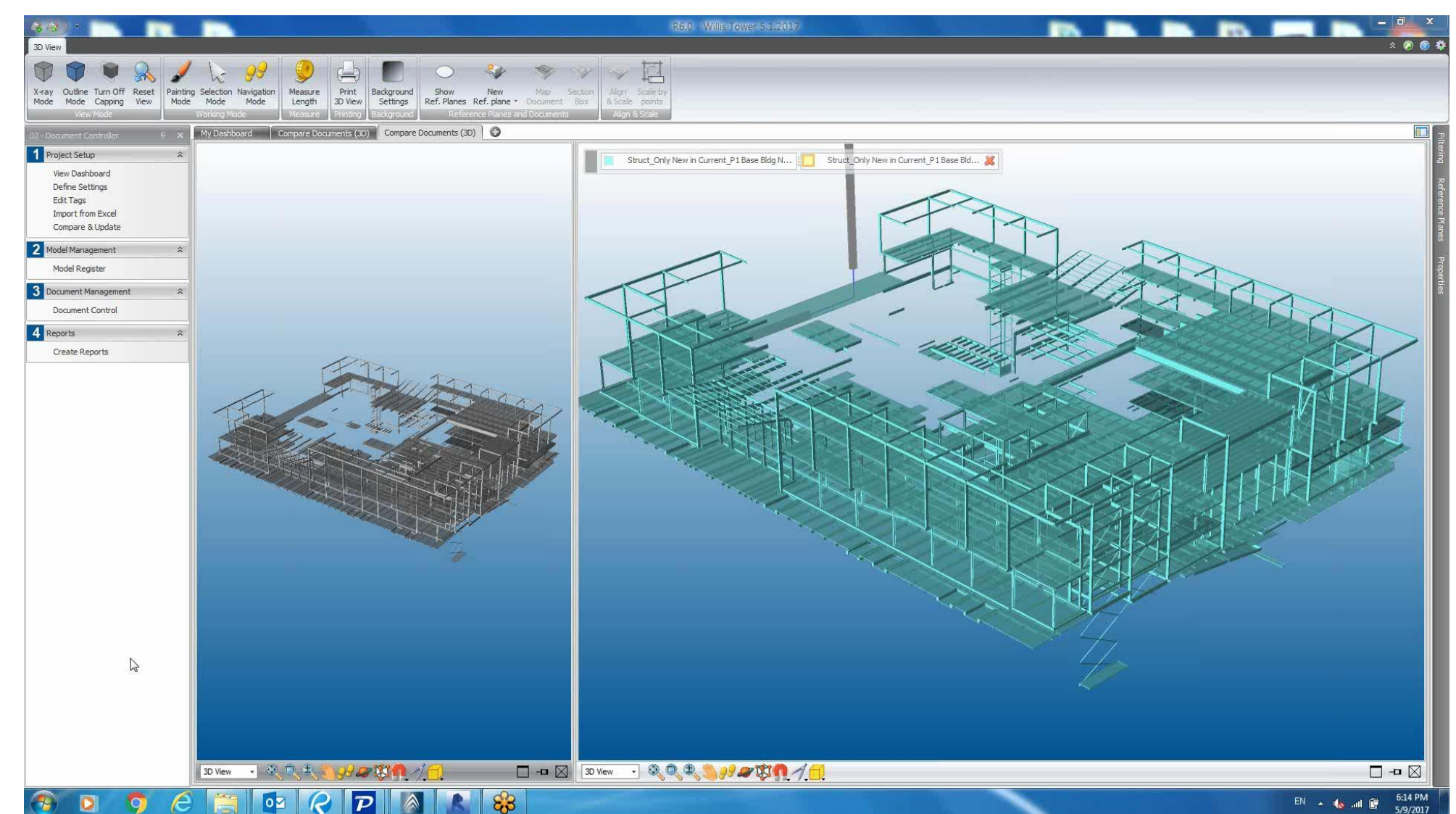
3D View

Create batch report in few seconds

Comparing Alternatives (Sliding Mode)



Architectures_Design Versions Comparison

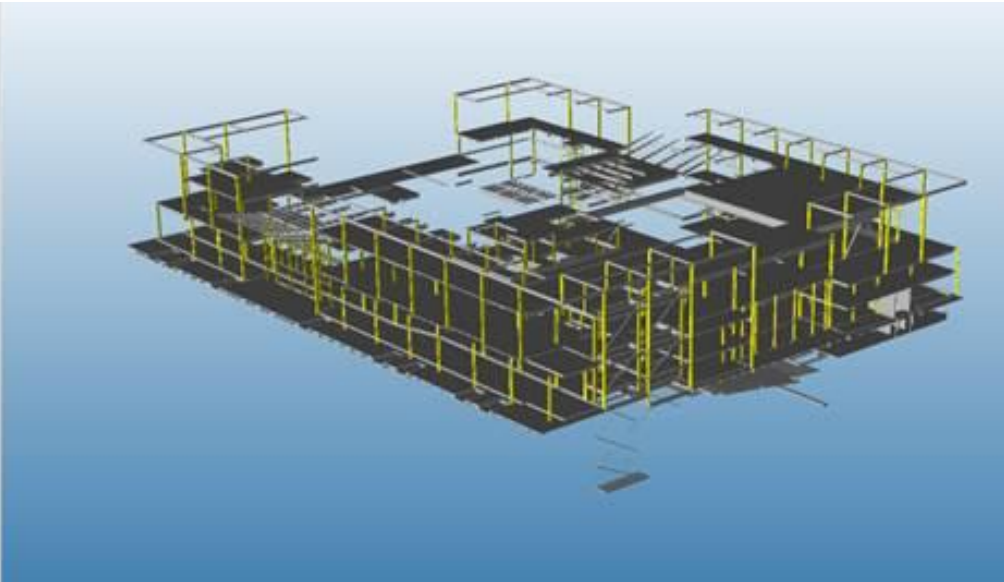


Structures_Design Versions Comparison

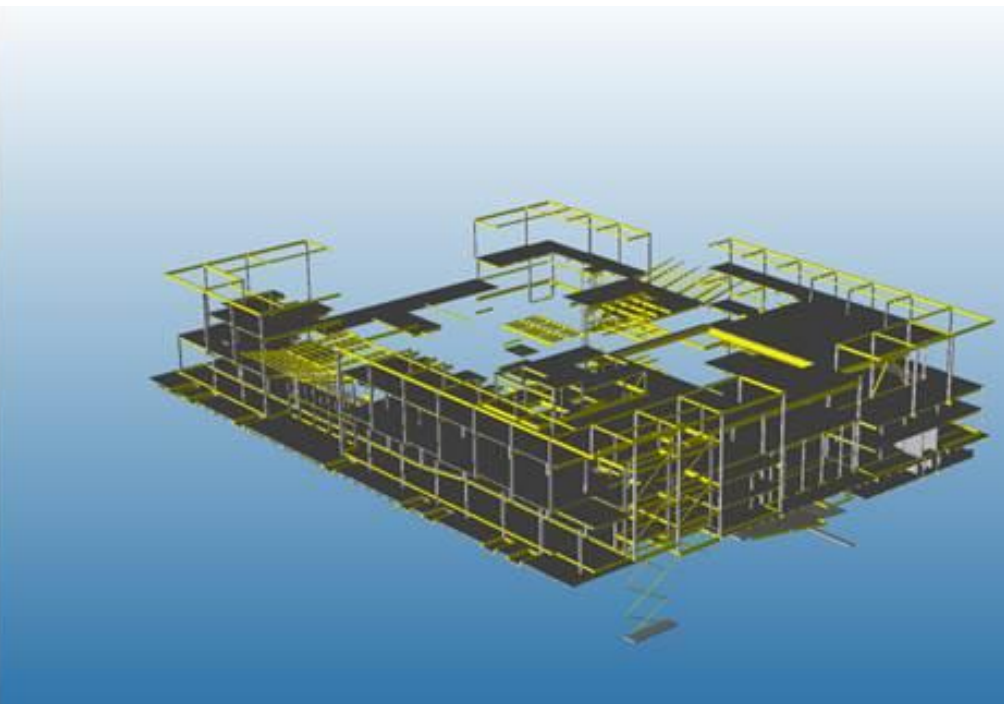
Fast Takeoffs_Podium Structural Model

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

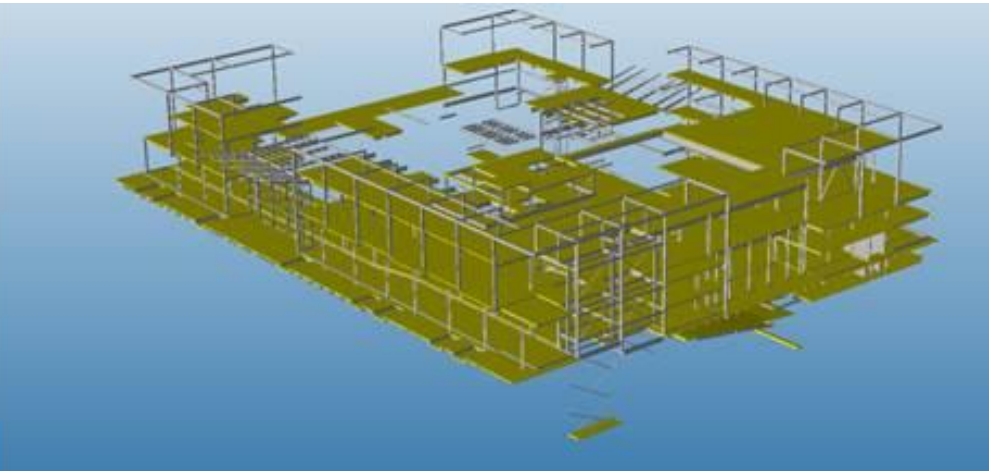
+	B10-W-Wide Flange-Column: W14X74	No	17
+	B10-W-Wide Flange-Column: W12X65	No	45
+	B10-W-Wide Flange-Column: W14X159	No	10
+	B10-HSS-Hollow Structural Section-Column: BUC20X14X1/2	No	15
+	B10-W-Wide Flange-Column: W14X109	No	6
+	B10-W-Wide Flange-Column: W14X90	No	17
+	B10-W-Wide Flange-Column: W14X68	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

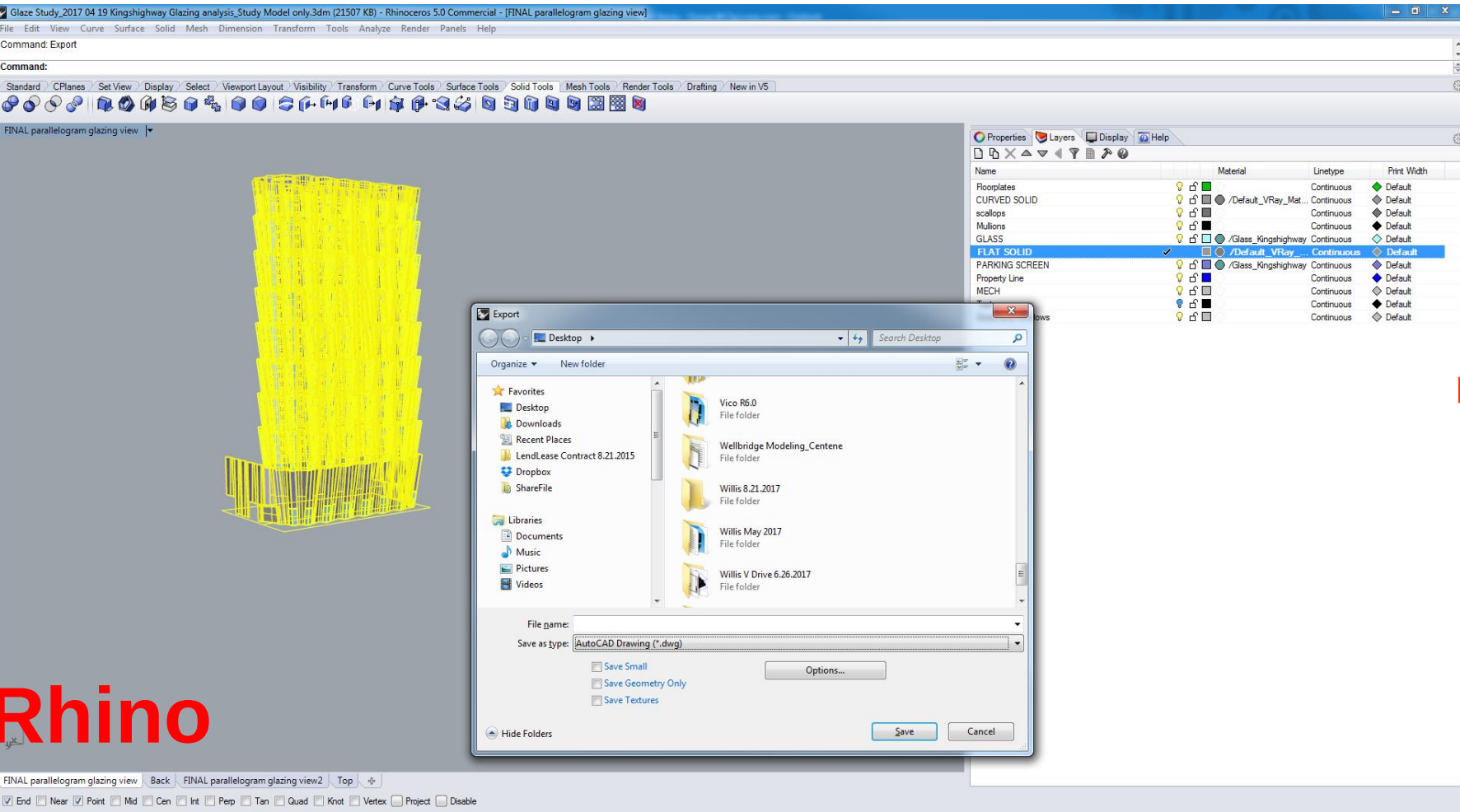


+	B10-W-Wide Flange-Column: W14X132	No	1
+	B1010-Floor: 3 1/4" LWC over 3" Verco N	No	33
+	A101010-Wall Foundation: Bearing Footing - 3'-0" x 1'-3"	No	3
+	B1010-Floor: 36" Mat Foundation	No	1
+	B1010-Floor: 3" LWC over 2.5" Verco N	No	4
+	B1010-Floor: 5" LWC over 3" Verco N 2	No	9
+	B1010-Floor: 4 1/4" 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



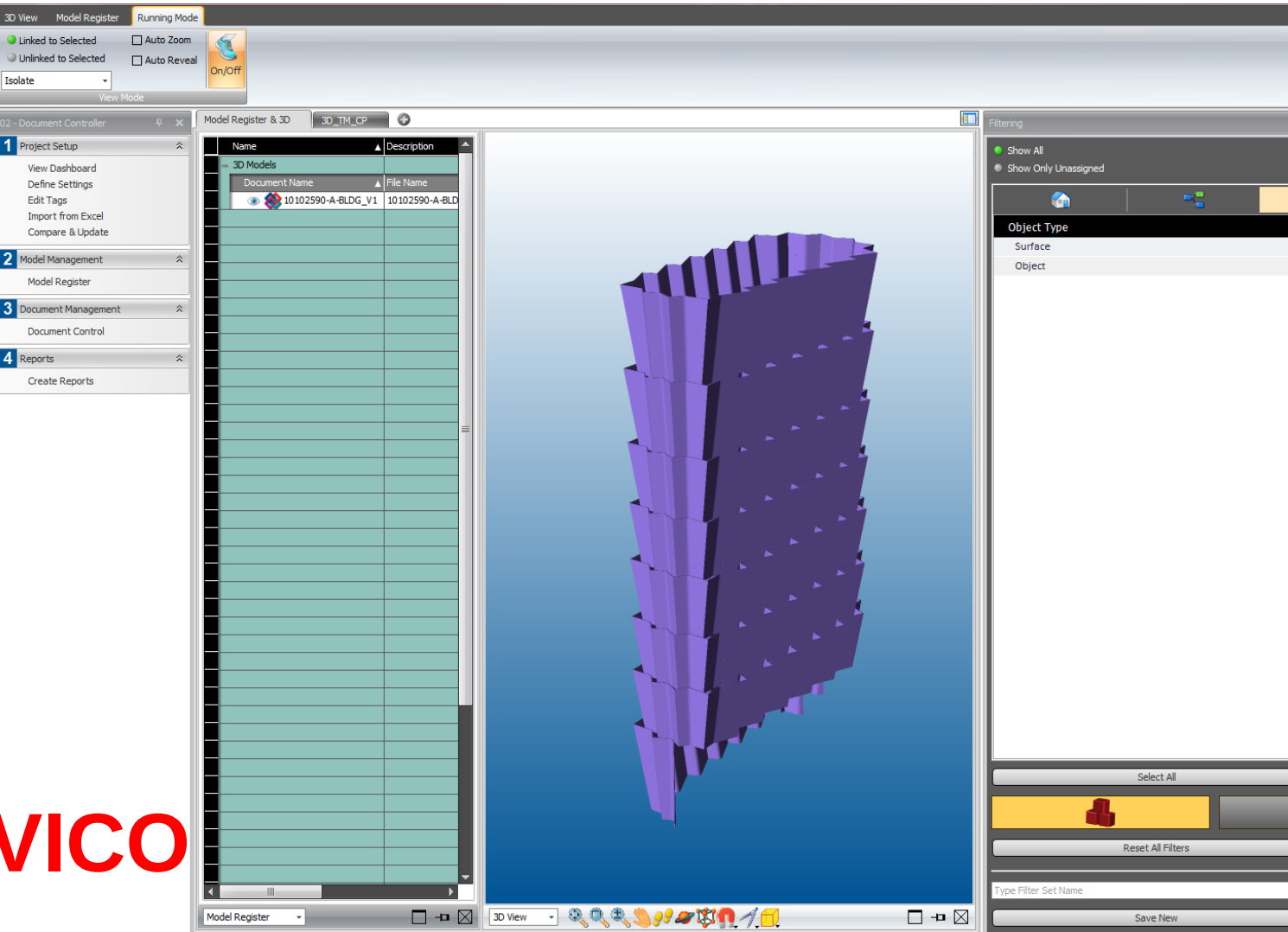
VE Structural model Takeoffs Willis Tower												
File Home Insert Page Layout Formulas Data Review View Developer Add-Ins BLUEBEAM Team Tell me what you												
Clipboard Font Alignment Number												
N13												
Willis Tower 5.3.2017												
BEAM_RECTANGULAR 2,880.44												
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



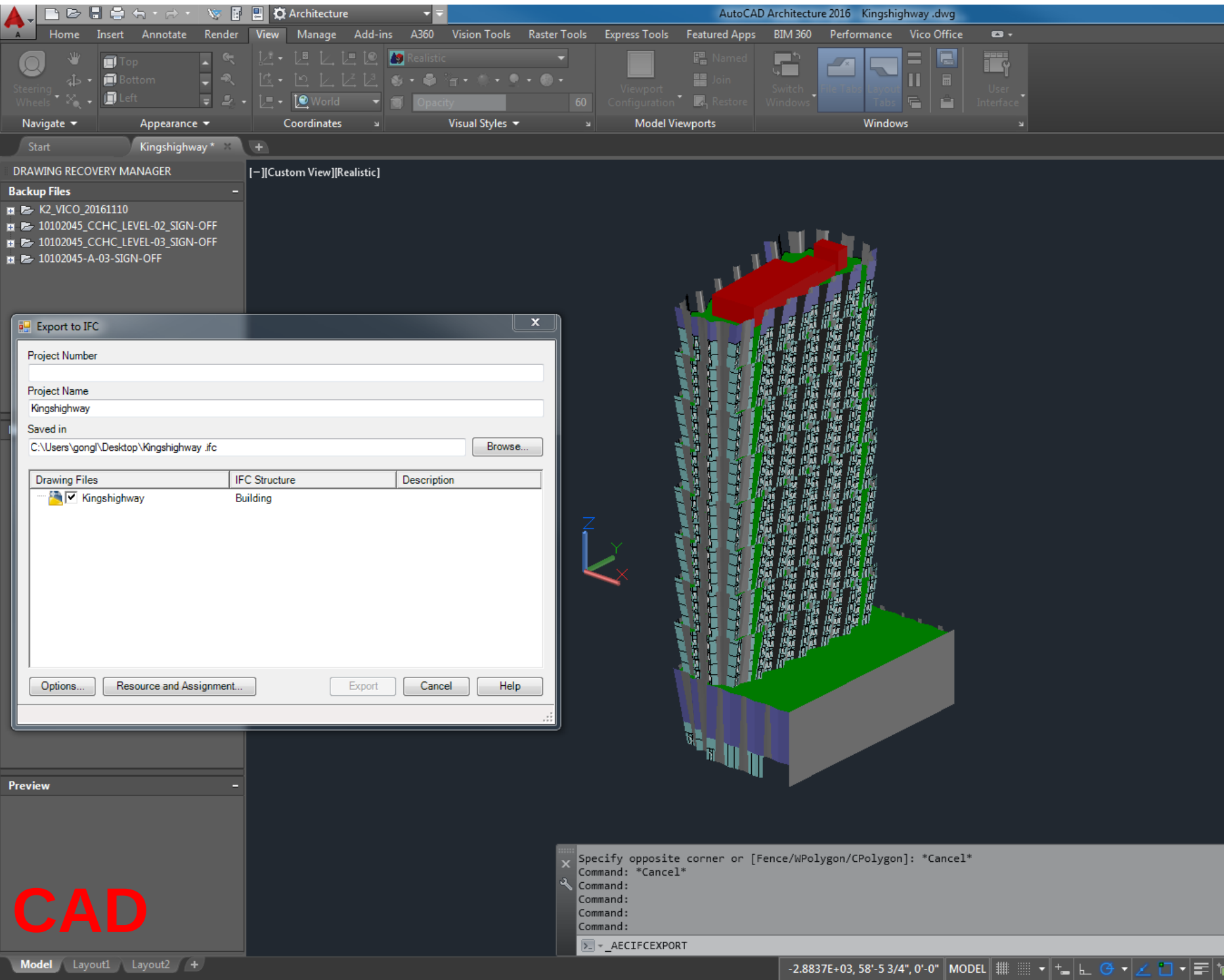
Rhino

Rhino converting to CAD



VICO

CAD converting to IFC and then IFC Importing to VICO

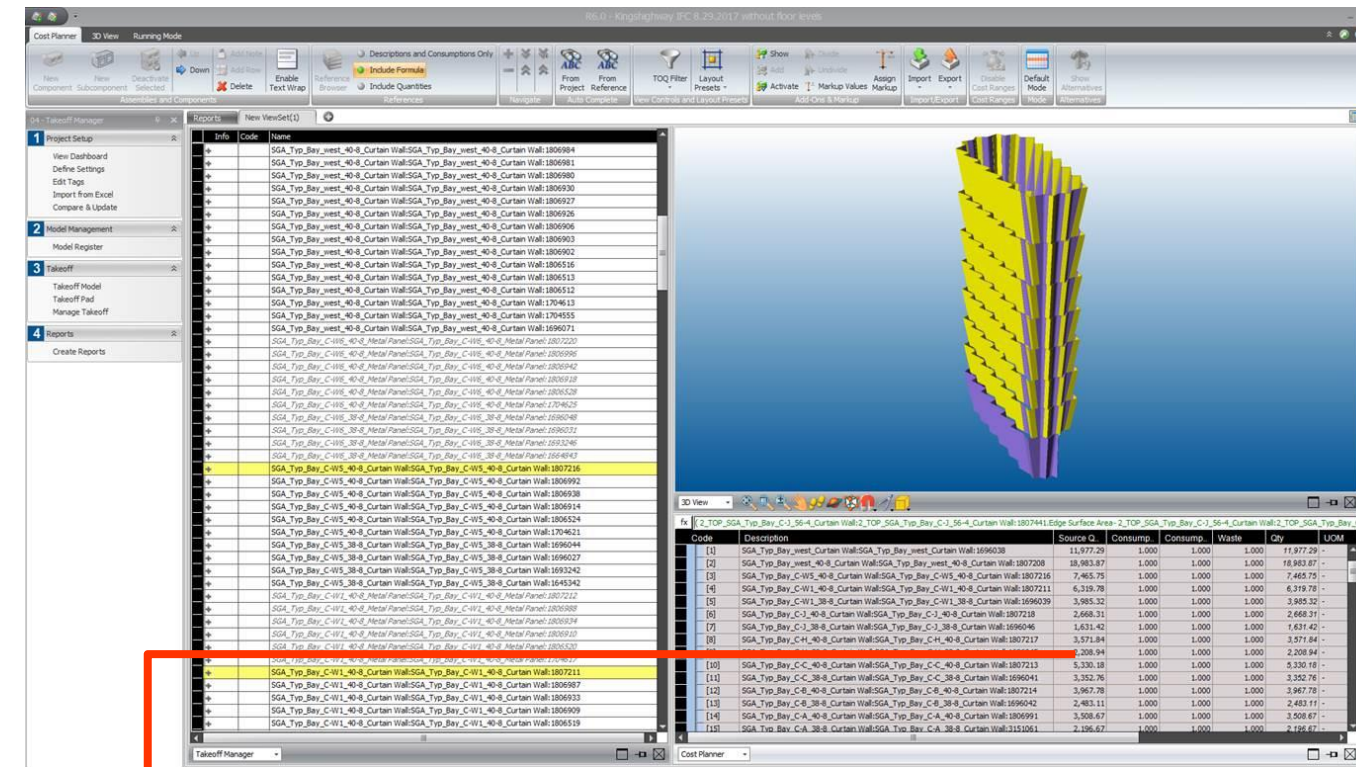


CAD

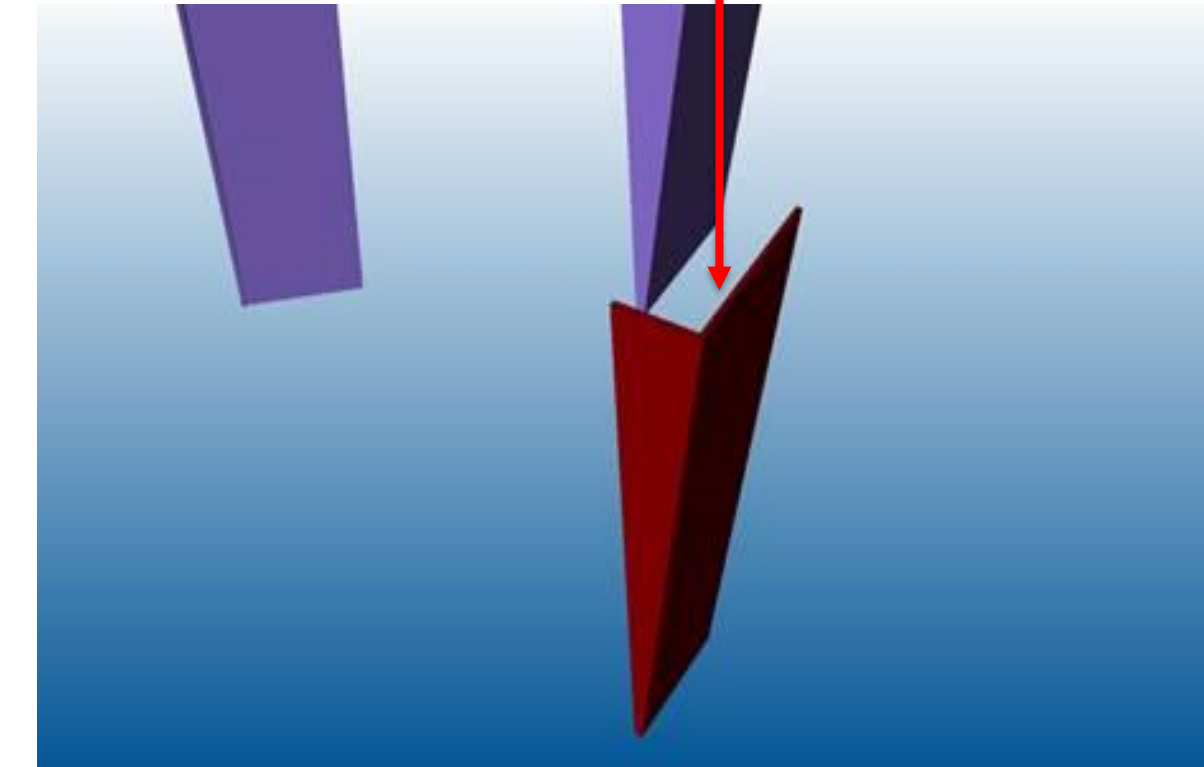
Rhino Model Converted to VICO

Total curtainwall area on tower is 121,805 sqft.

Use formula to define quantities as desired



Type: Roof



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
☒ Project	18,983.87

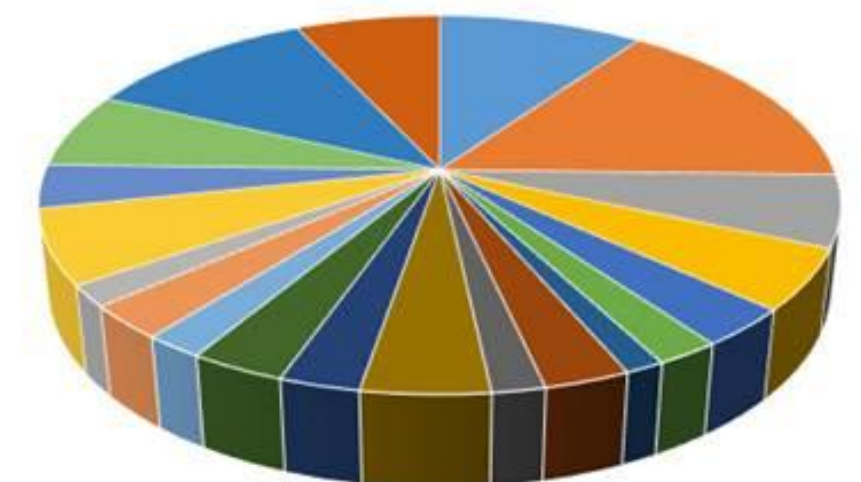
Enter formula

Preview

$f_x = \frac{(SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.EdgeSurfaceArea - SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Two_Edge_Surface * (SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Count-1))/2}{(SGA_Typ_Bay_west_40-8_CurtainWall:1807208.EdgeSurfaceArea - SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Two_Edge_Surface * (SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Count-1))/2}$	$\frac{(SGA_Typ_Bay_west_40-8_CurtainWall:SGA_Typ_Bay_west_40-8_CurtainWall:1807208.EdgeSurfaceArea - SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Two_Edge_Surface * (SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Count-1))/2}{(SGA_Typ_Bay_west_40-8_CurtainWall:1807208.EdgeSurfaceArea - SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Two_Edge_Surface * (SGA_Typ_Bay_west_40-8_CurtainWall:1807208.Count-1))/2}$
--	--

	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
	TOTAL	121,804.68

Curtainwall SQFT on Tower



- 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

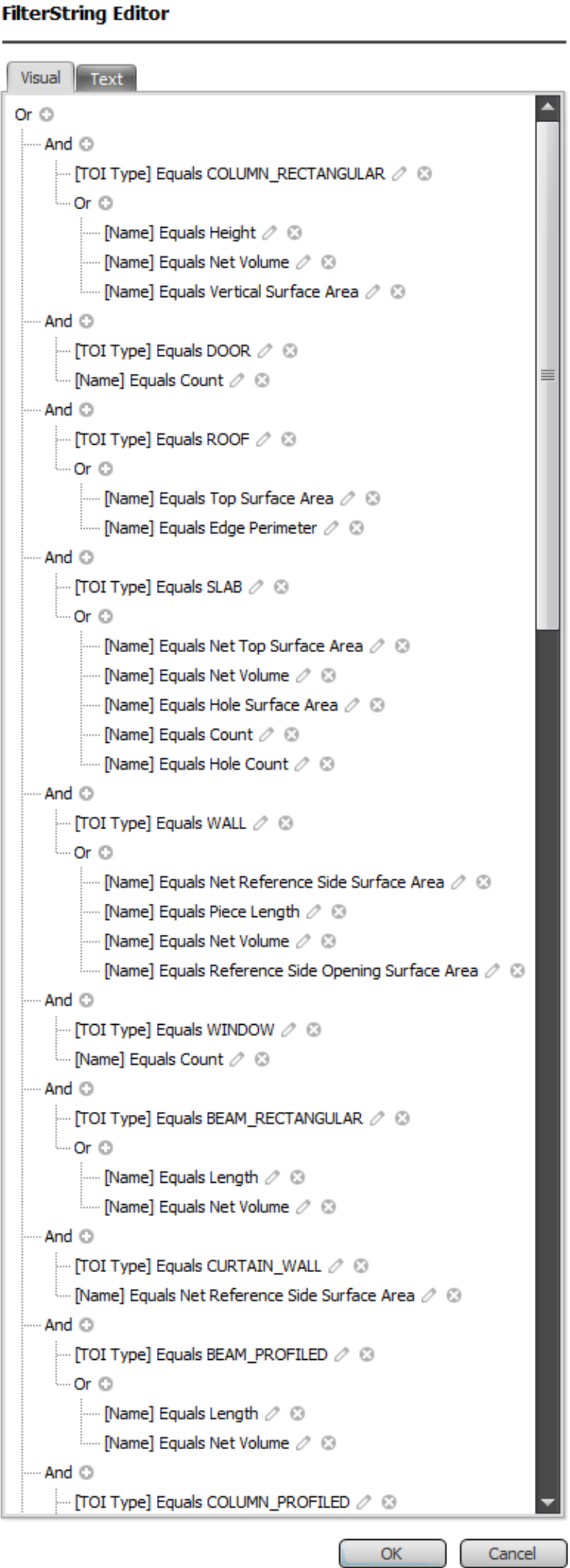
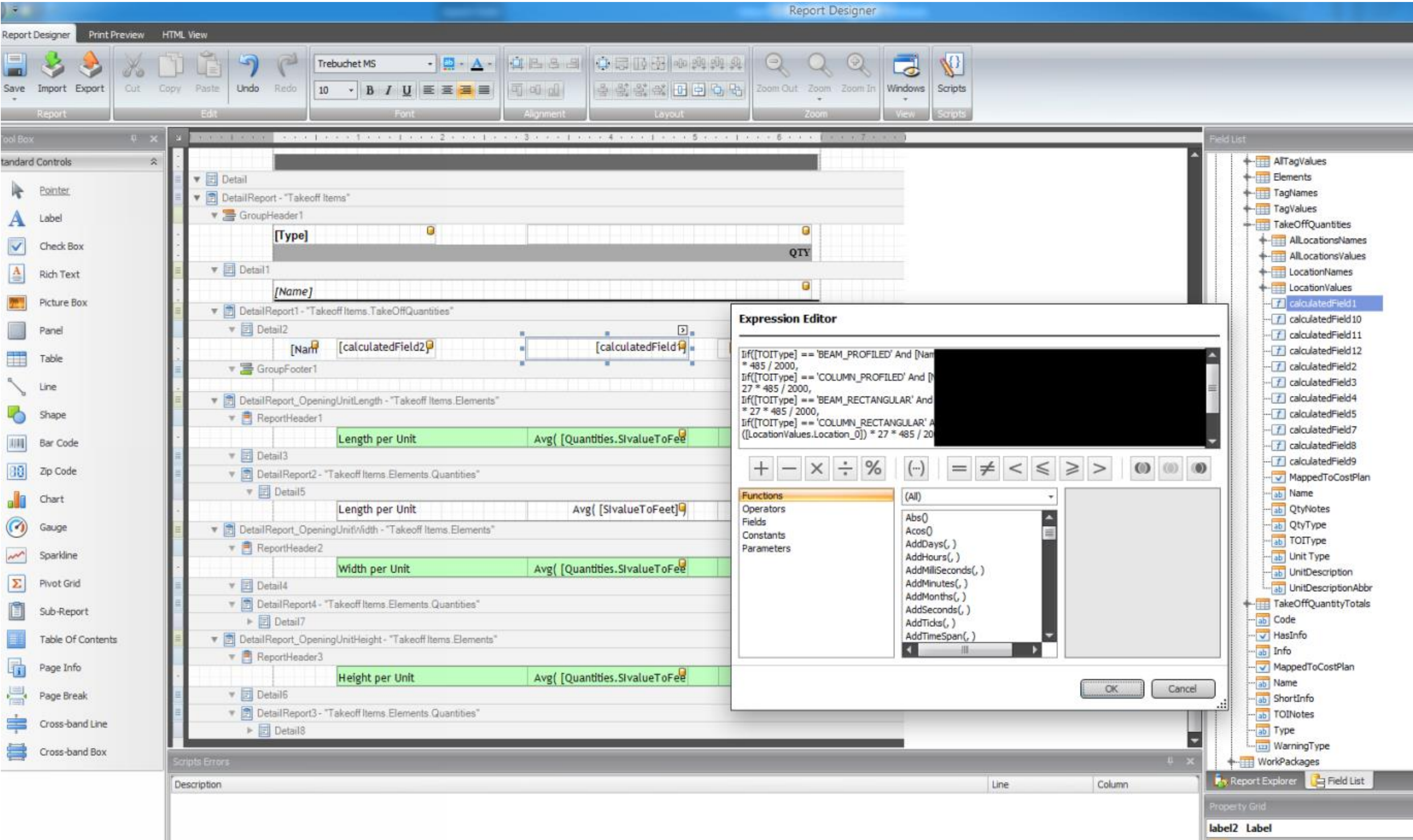
Reporting

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

Zurich North America HQ  CLAYCO THE ART & SCIENCE OF BUILDING Version1 - 13100_ZNA-S-SC-VDC		
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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