

Walk-in Slide: AU 2014 Social Media Feed

1. Click on the link below, this will open your web browser

<http://aucache.autodesk.com/social/visualization.html>

2. Use “Extended Display” to project the website on screen if you plan to work on your computer. Use “Duplicate” to display same image on screen and computer.

Mining concrete- how to modify a concrete model for quantification and 4D simulation

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Class summary

From a General Contractors perspective, using concrete design models for quantity takeoffs can be a frustrating and sometimes futile exercise. Design models are seldom built to mimic site construction and more often than not, contain very little relevant embedded information. With some simple modification and customization, we can pull valuable information while facilitating downstream Navisworks 4D utility.

Key learning objectives

At the end of this class, you will be able to:

- • Learn how to quickly modify concrete models to represent actual construction in order to better ensure more accurate information
- • Learn how to create and add custom materials into existing families to automate formwork quantity extraction
- • Learn how to break up a concrete model to use in Navisworks software 4D simulations
- • Discover how custom parameters in Revit software can be capitalized on by Navisworks software search sets

Clark Builders

- <1B Volume in 2014
- Commercial, Industrial, Residential
- 75% DB – 20% CM – 5% DBB
- Self perform Concrete
- Partnership with Turner Construction since 2013



Outline

- Auditing the model
- Modifying the geometry
- Performing the QTO- workarounds

concrete volume and formwork contact area of: strip footings, pad/raft footings, core walls, one sided foundation walls, columns, slab on grade, suspended slabs, ramp walls and ramp soffit area.

- Dividing model up for a 4D
- Linking geometry into Navisworks Timeliner

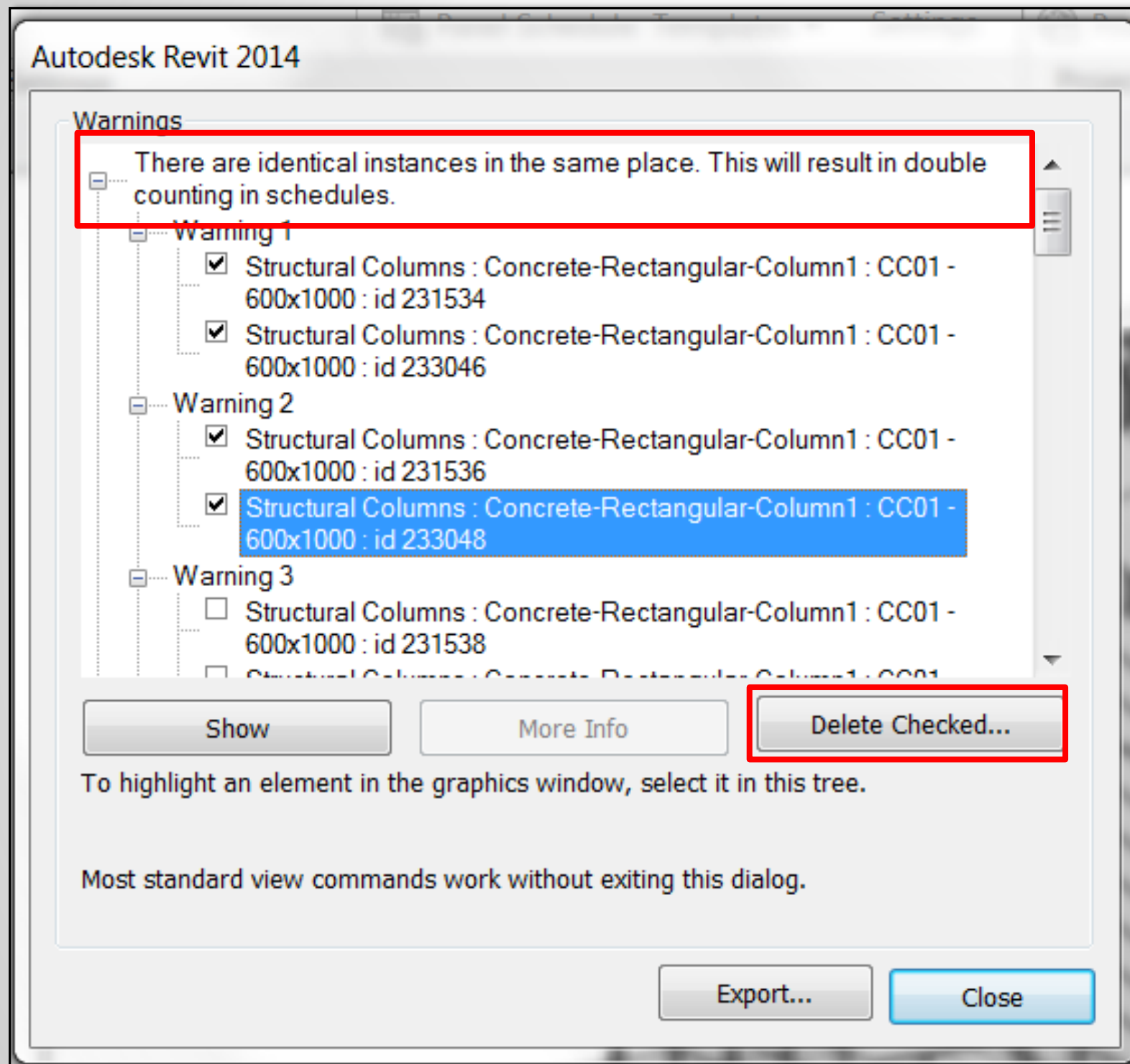
Auditing Geometry

Common issues

- Duplicated elements (columns, overlapping walls, beams...)
- Constraints
- Joined or Unjoined geometry
- Inconsistent Materials
- Family Categories



Warnings



Go through the warnings to find the duplicated elements that are not obvious in a visual check

Isolating hidden problems

Duplicated Family

Inconsistent materials

<FULL BUILDING CONCRETE>				
A	B	C	D	E
Family and Type	Count	Material: Area	Material: Volume	Material: Name
Basic Wall: 200mm CONCRETE WALL	14	1011 m ²	201.71 m ³	Default Wall
Basic Wall: 200mm CONCRETE WALL 2	1	13 m ²	2.60 m ³	Concrete
Basic Wall: 300mm CONCRETE WALL	480	13292 m ²	3986.28 m ³	Concrete - Cast-in-Place Concrete
Concrete-Rectangular-Column1	1	24 m ²	15.99 m ³	Concrete - Cast-in-Place Concrete
Concrete-Rectangular-Column1	1	24 m ²	15.99 m ³	Concrete - Cast-in-Place Concrete
Floor: 125mm CONCRETE	1	7592 m ²	949.12 m ³	Concrete - Cast-in-Place Concrete
Floor: 300mm CONCRETE SLAB	21	76138 m ²	22841.5 m ³	Concrete - Cast-in-Place Concrete
Floor: 450mm CONC SLAB	1	4228 m ²	1902.42 m ³	Concrete - Cast-in-Place Concrete
Foundation Slab: 1200mm RAFT FOOTING	1	388 m ²	465.25 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 300 x 900 DP BEAM	4	113 m ²	11.78 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 400 x 900 DP BEAM	1	24 m ²	3.22 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 400 x 900 DP BEAM	1	0 m ²	0.00 m ³	Default
M Concrete-Rectangular Beam: 600 x 550 DP BEAM	3	45 m ²	3.39 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 600 x 550 DP BEAM	2	0 m ²	0.00 m ³	Default
M Concrete-Rectangular Beam: 600 x 900 DP BEAM	35	101 m ²	0.00 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 600 x 900 DP BEAM	41	807 m ²	145.18 m ³	Default
M Concrete-Rectangular Beam: 800 x 1000 DP BEAM	6	438 m ²	82.47 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 1000 x 900 DP BEAM	6	207 m ²	31.93 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 1000 x 900 DP BEAM	2	32 m ²	8.38 m ³	Concrete, Cast-in-Place gray
M Concrete-Rectangular Beam: 1200 x 1700 DP BEAM	5	308 m ²	94.58 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 2400 x 1500 DP BEAM	5	710 m ²	268.99 m ³	Concrete - Cast-in-Place Concrete
M Concrete-Rectangular Beam: 2400 x 1500 DP BEAM	1	3 m ²	0.00 m ³	Concrete, Cast-in-Place gray
M Footing-Rectangular1: F2 - 3400x4000 x 1200 DP	74	3327 m ²	1207.68 m ³	Concrete - Cast-in-Place Concrete
Upstand1: Upstand	1	115 m ²	12.65 m ³	Default Wall
Upstand3: Upstand2	1	22 m ²	2.39 m ³	Default Wall
Wall Foundation: SF1 - 1400 x 900 DP	6	1295 m ²	0.00 m ³	Concrete - Cast-in-Place Concrete - 3

Organizing geometry

Project Parameters

Parameters available to elements in this project:

- 4D location
- Colour code
- Construction

OK Cancel

Custom Parameters

Properties

Floor
450mm CONC SLAB

Floors (1)

Constraints

Level	T/O M
Height Offset From Level	-960.0
Room Bounding	<input checked="" type="checkbox"/>
Related to Mass	<input type="checkbox"/>

Structural

Structural	<input checked="" type="checkbox"/>
Enable Analytical Model	<input checked="" type="checkbox"/>
Rebar Cover - Top Face	Interior
Rebar Cover - Bottom Face	Interior
Rebar Cover - Other Faces	None

Dimensions

Slope	
Perimeter	4226.3
Area	4227.1
Volume	1902.4
Thickness	450.0

Identity Data

Comments	
Mark	
Colour code	BLUE
Construction	SUSP
4D location	

Phasing

Phase Created	New
Phase Demolished	None

Material Takeoff Properties

Fields Filter Sorting/Grouping Formatting Appearance

Available fields:

- 4D location
- A
- Assembly Code
- Assembly Description
- Category
- Comments
- Cost
- Description
- Keynote
- Level
- Longitudinal Reinforcing
- Manufacturer
- Mark
- Material: As Paint
- Material: Colour code
- Material: Comments
- Material: Construction
- Material: Cost
- Material: Description
- Material: Keynote
- Material: Manufacturer
- Material: Mark

Scheduled fields (in order):

- Family
- Family and Type
- Construction
- Count
- Material: Area
- Material: Volume
- Material: Name
- Colour code

Add --> <-- Remove

Add Parameter... Calculated Value...

Edit... Delete

Select available fields from: Multiple Categories

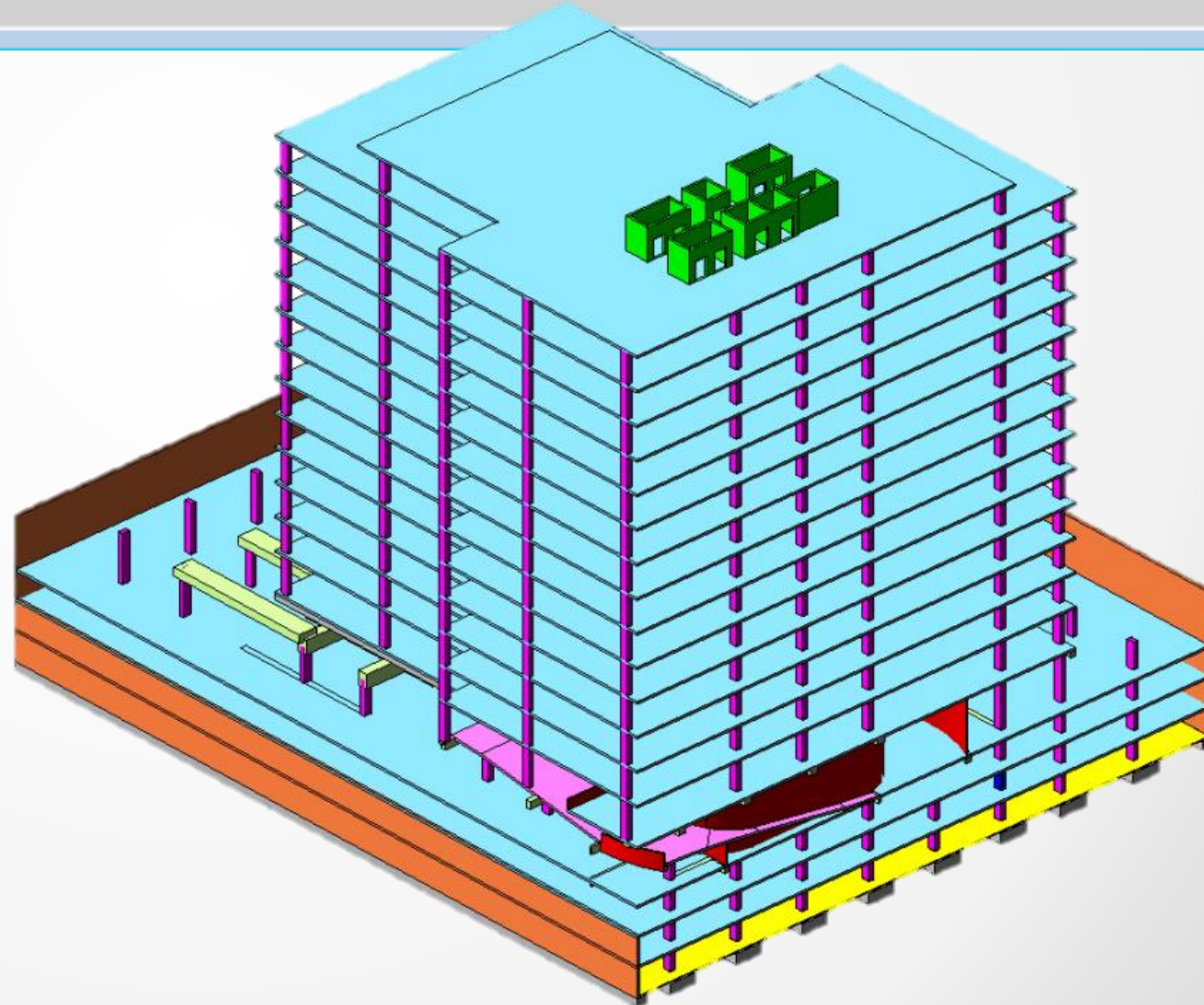
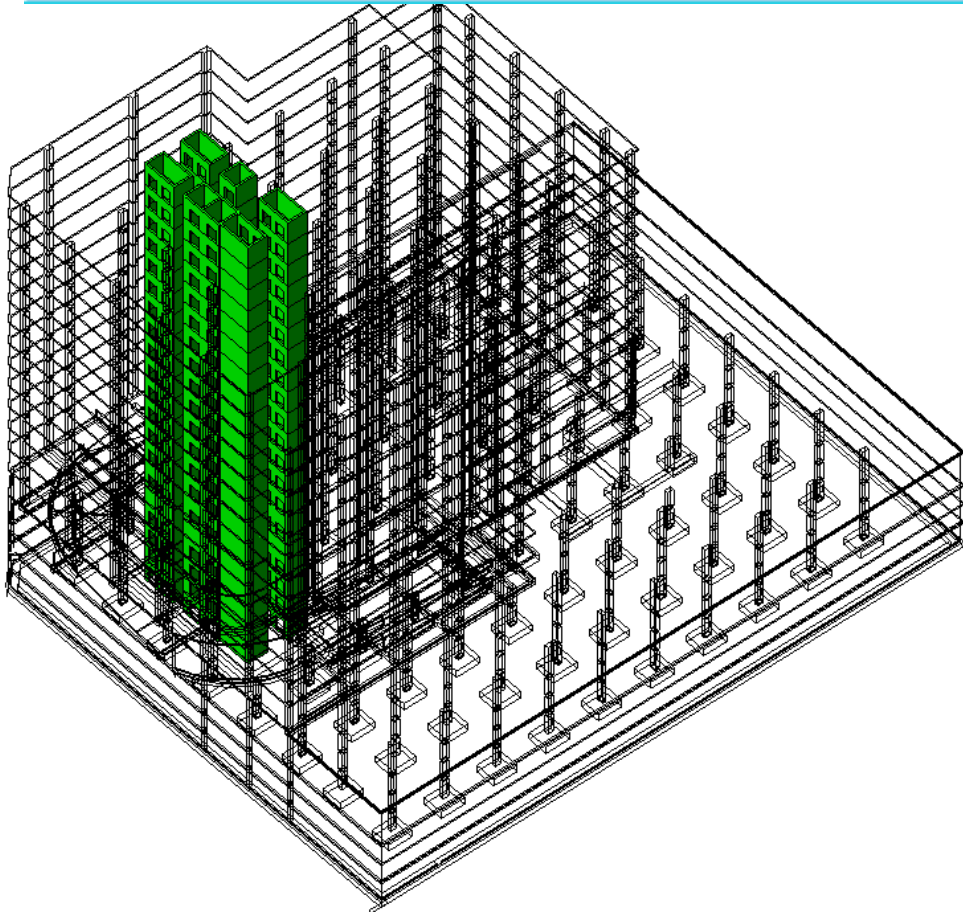
☐ Include elements in linked files

OK Cancel Help

Organizing geometry

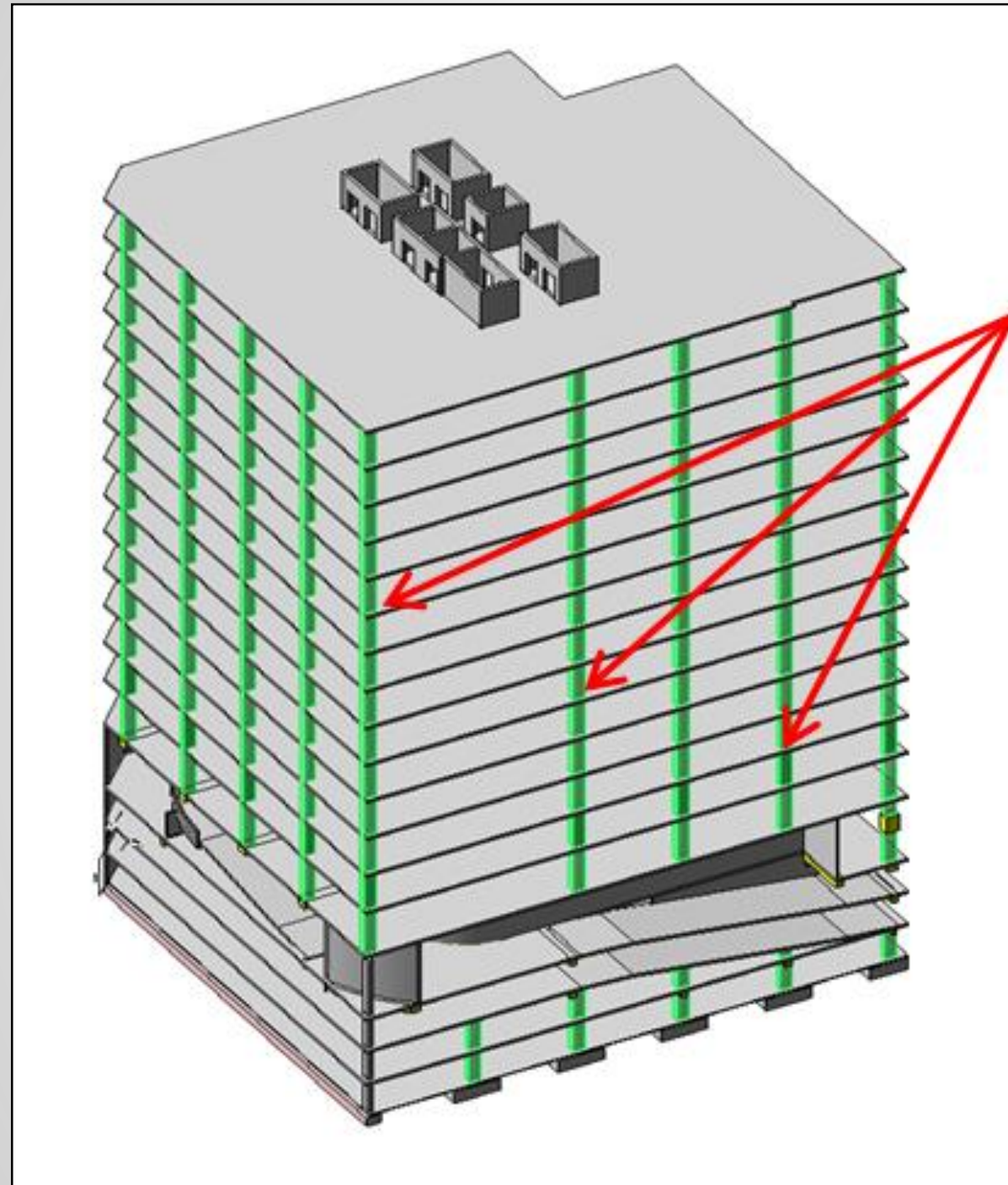
Window Title: Schedule: CORE WALLS - RTC

<CORE WALLS>				
A	B	C	D	E
Family and Type	Construction	Material: Volume	Material: Name	Colour code
Basic Wall: 300mm CONCRETE WALL	CORE WALLS	2180.36 m³	Concrete - Cast-in-Place Concrete	GREEN



Custom Parameters

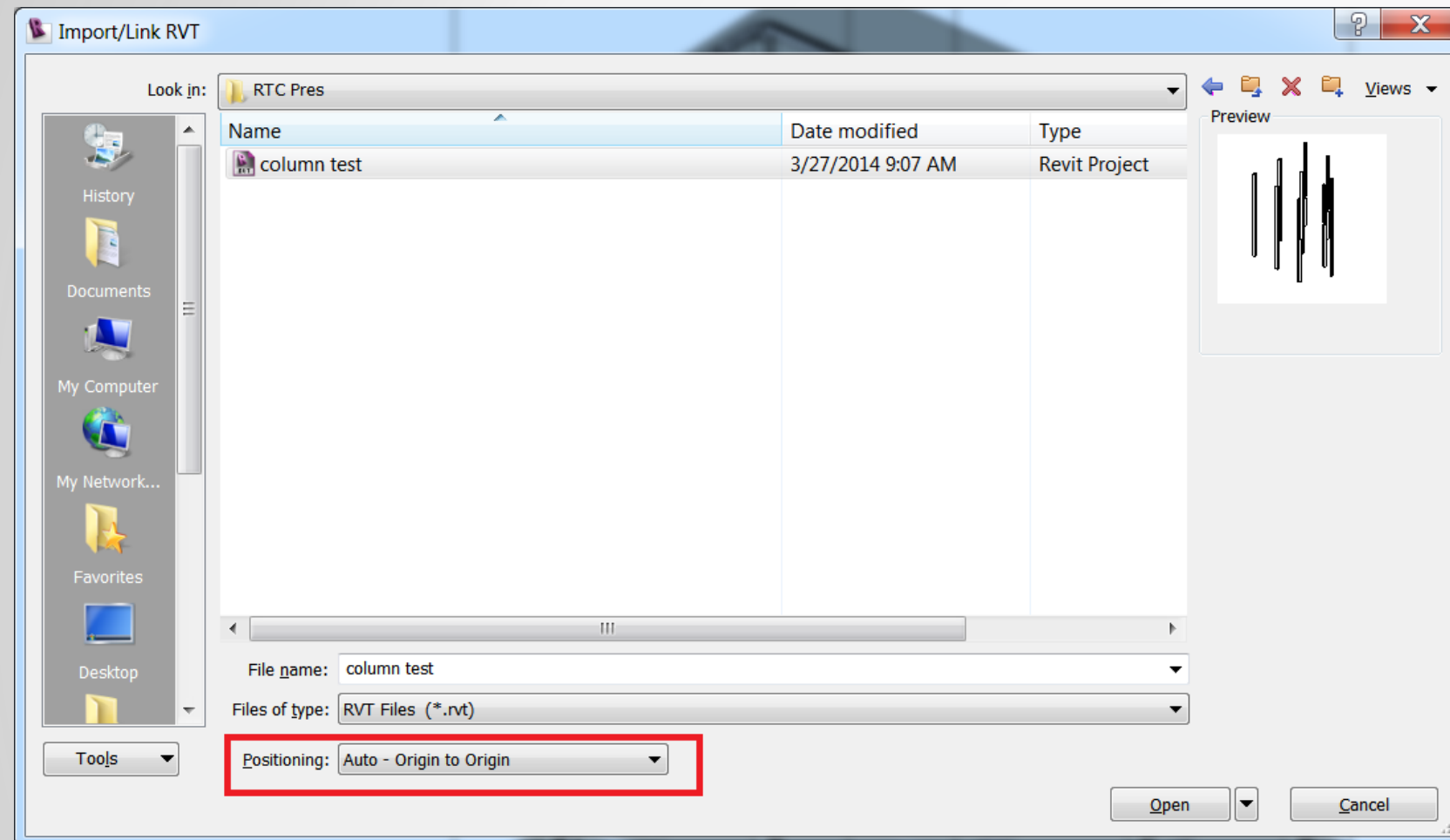
Modifying geometry - Columns



Columns that run the full height of the building show up fine in the 2D views, but will throw off quantities

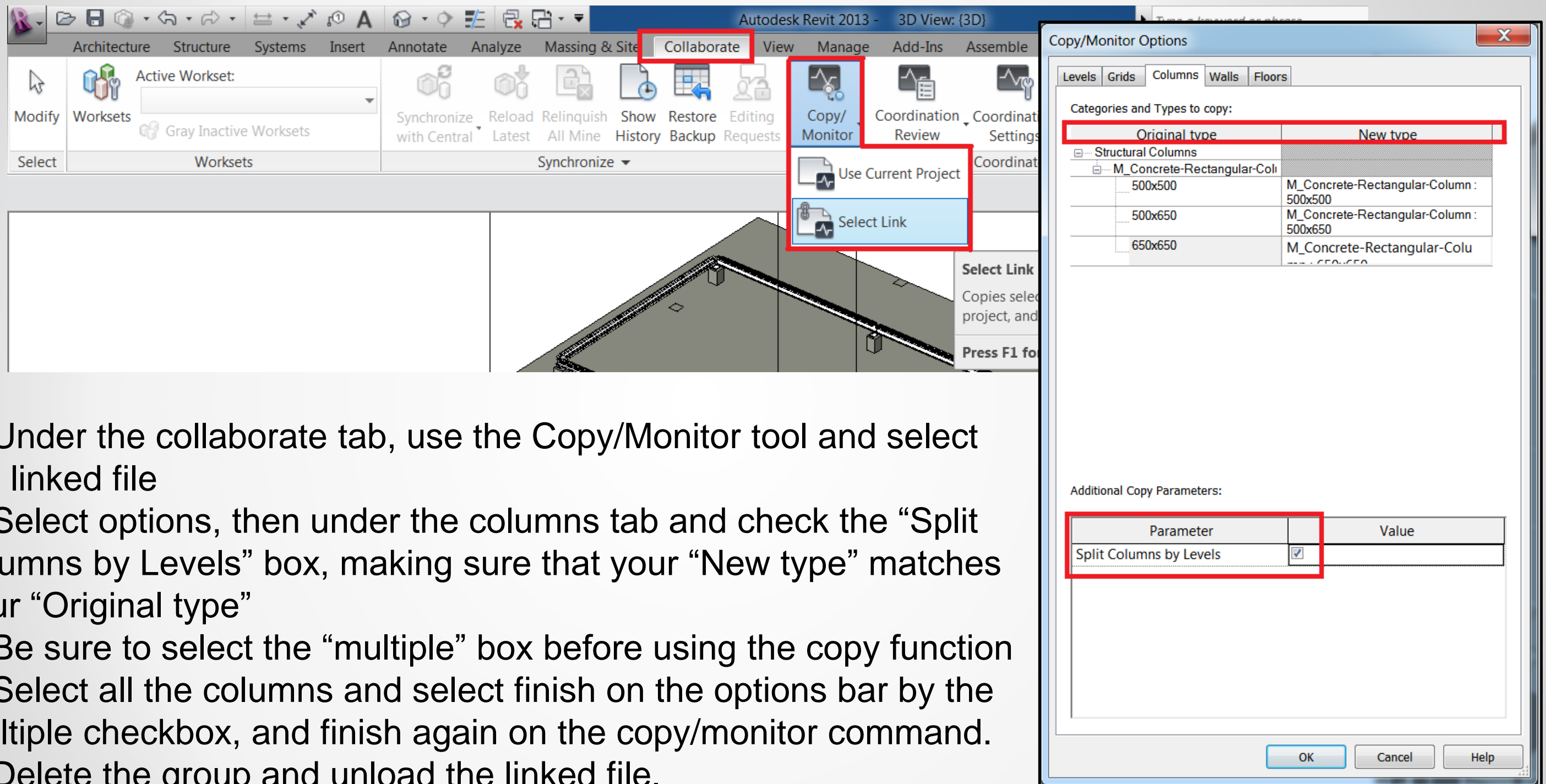
1. Volume of Concrete and area of formwork are both affected
2. Geometry is insufficient for 4D analysis

Modifying geometry - Columns



1. Select and group all the columns you want to split.
2. Find the group you just created in the Project Browser and save it as a separate rvt. file
3. Link that rvt. file into your project making sure it's positioning is origin to origin

Modifying geometry - Columns



The screenshot shows the Autodesk Revit 2013 interface with the 'Collaborate' tab selected in the ribbon. The 'Copy/Monitor' tool is highlighted in the ribbon. The 'Copy/Monitor Options' dialog box is open, showing the 'Columns' tab. The 'Categories and Types to copy' section is expanded, showing a list of 'M_Concrete-Rectangular-Col' types. The 'Original type' and 'New type' columns are highlighted. The 'Additional Copy Parameters' section is also visible, with the 'Split Columns by Levels' checkbox checked.

4. Under the collaborate tab, use the Copy/Monitor tool and select the linked file

5. Select options, then under the columns tab and check the “Split columns by Levels” box, making sure that your “New type” matches your “Original type”

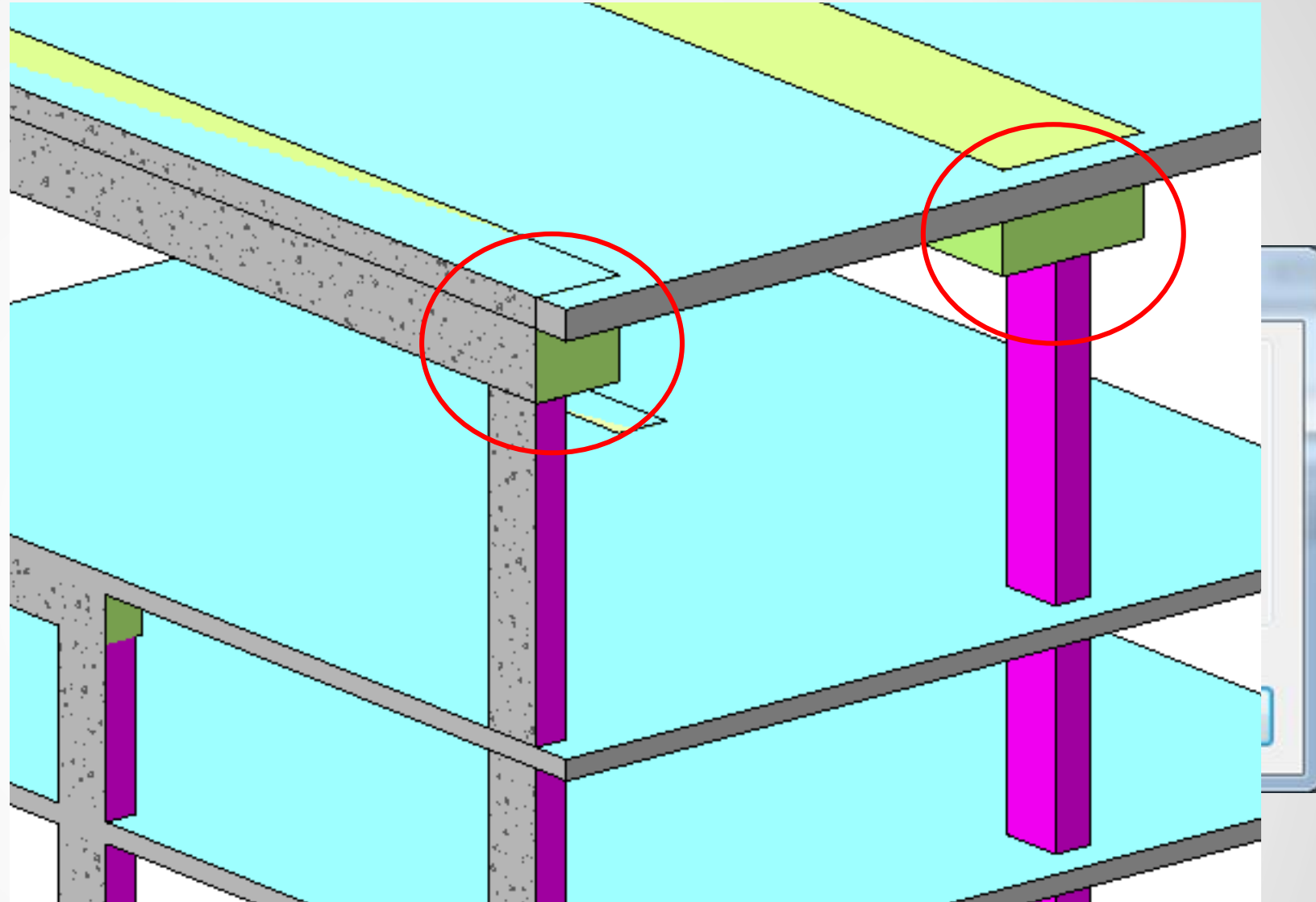
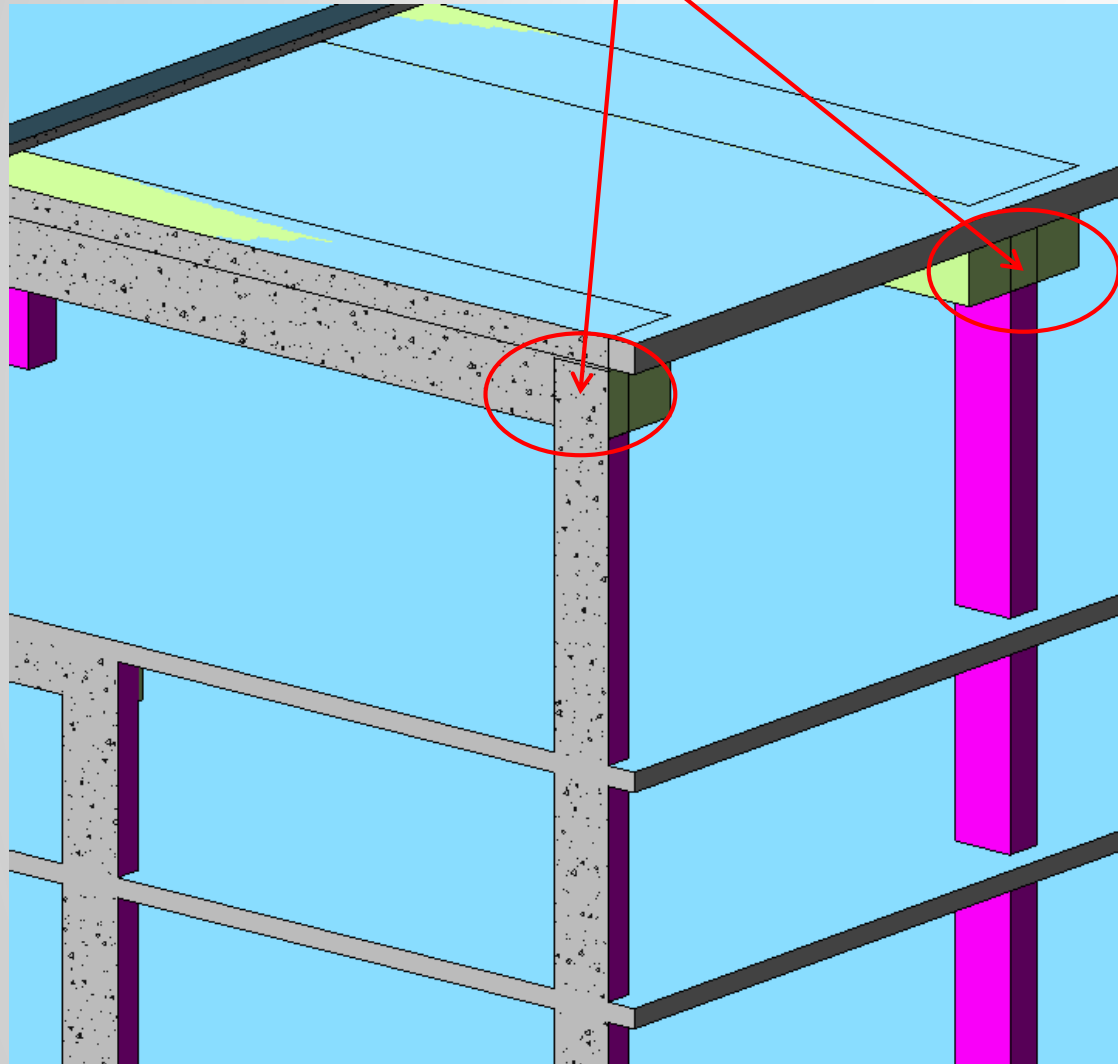
6. Be sure to select the “multiple” box before using the copy function

7. Select all the columns and select finish on the options bar by the multiple checkbox, and finish again on the copy/monitor command.

8. Delete the group and unload the linked file.

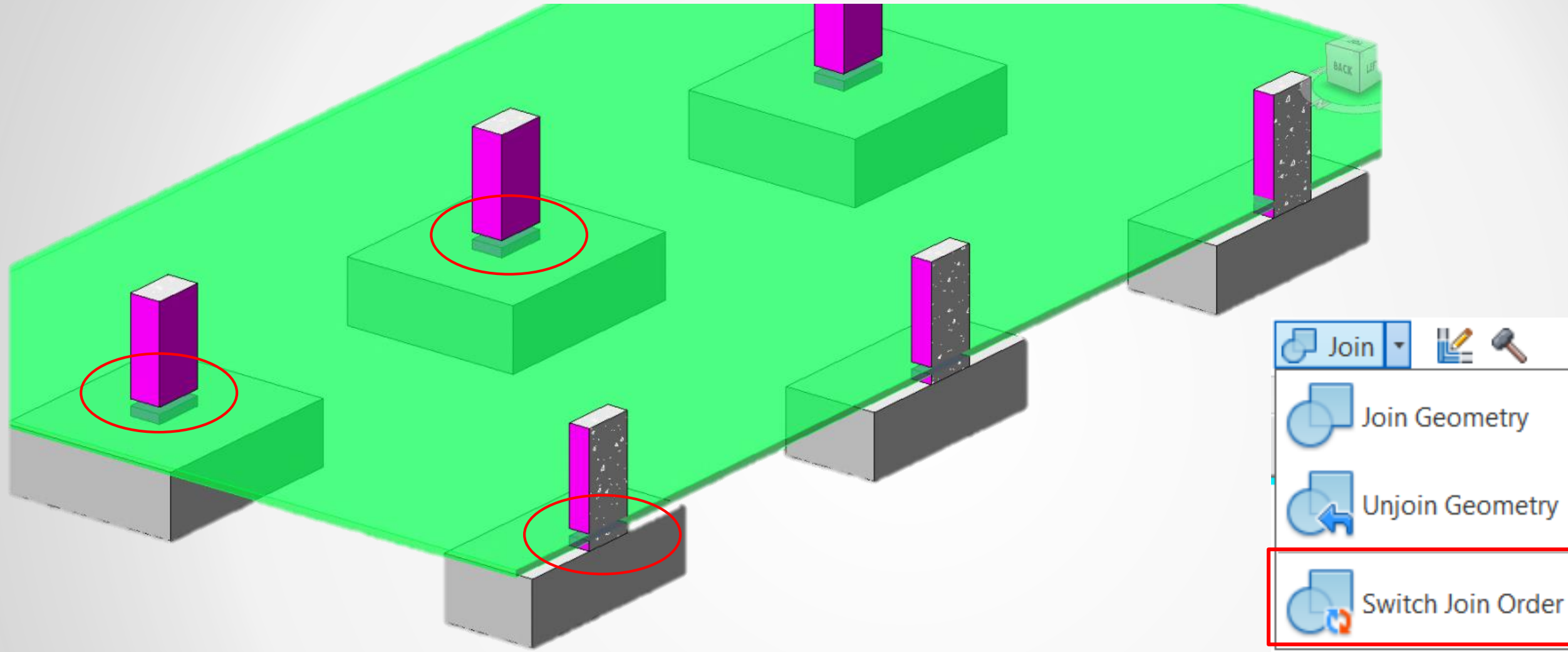
Modifying geometry - Columns

Column constraints default to top of slab



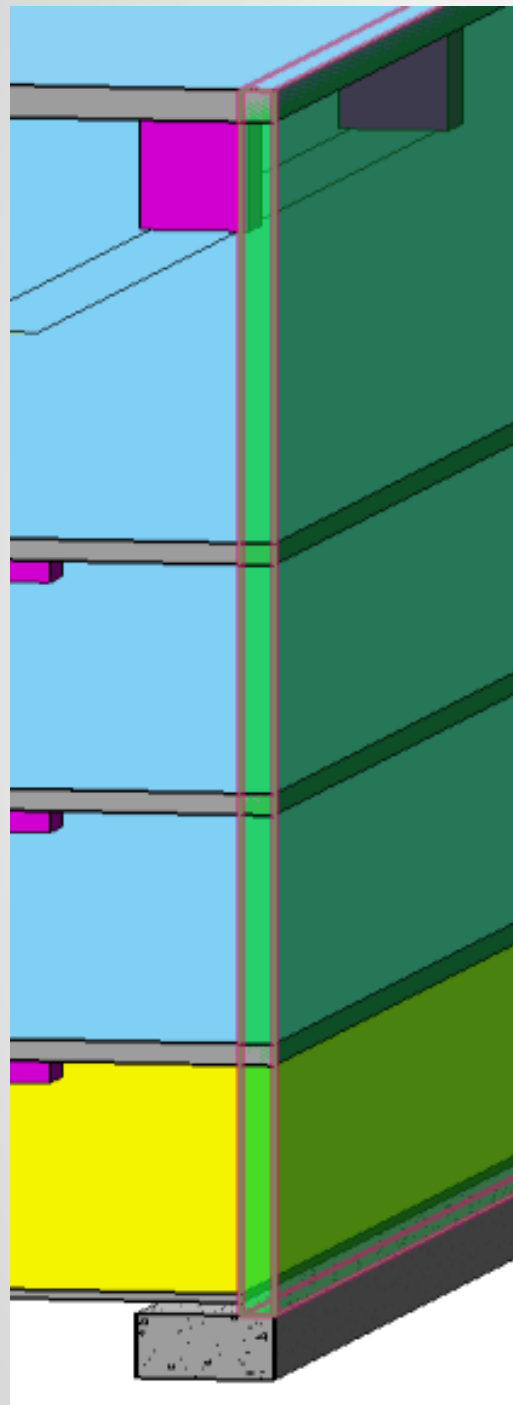
1. Detach column if attached to slab/beam
2. Set top offset lower than bottom of beam
3. Attach Top to beam

Modifying geometry - *Columns*



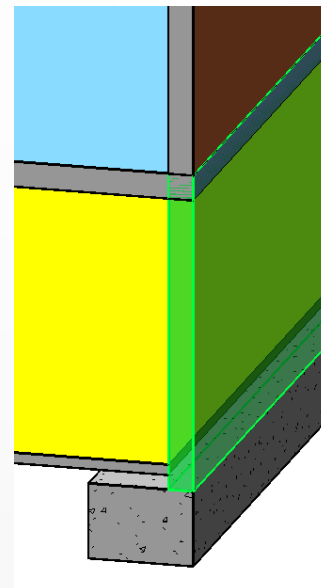
1. Switch join order
2. Grab a coffee...

Modifying geometry - *Walls*

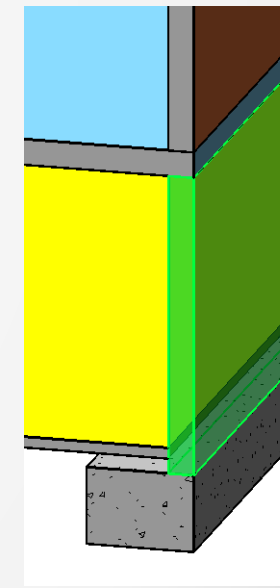


Walls that run the full height of the building show up fine in the 2D views, will not throw off quantities if geometry is joined properly, but again is insupportable for 4D analysis later.

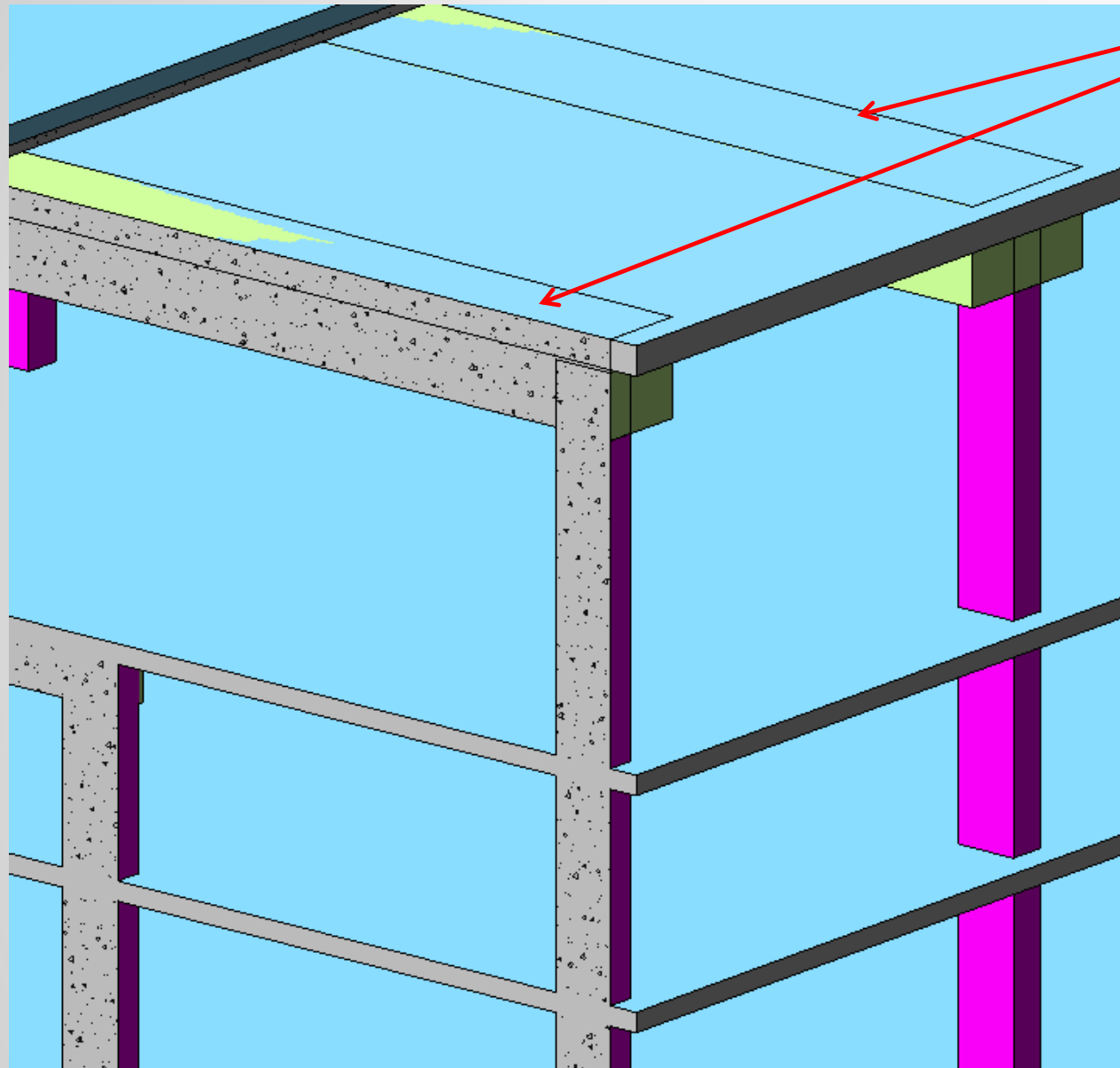
Can be solved with **Split** tool



And modifying the constraints



Modifying geometry



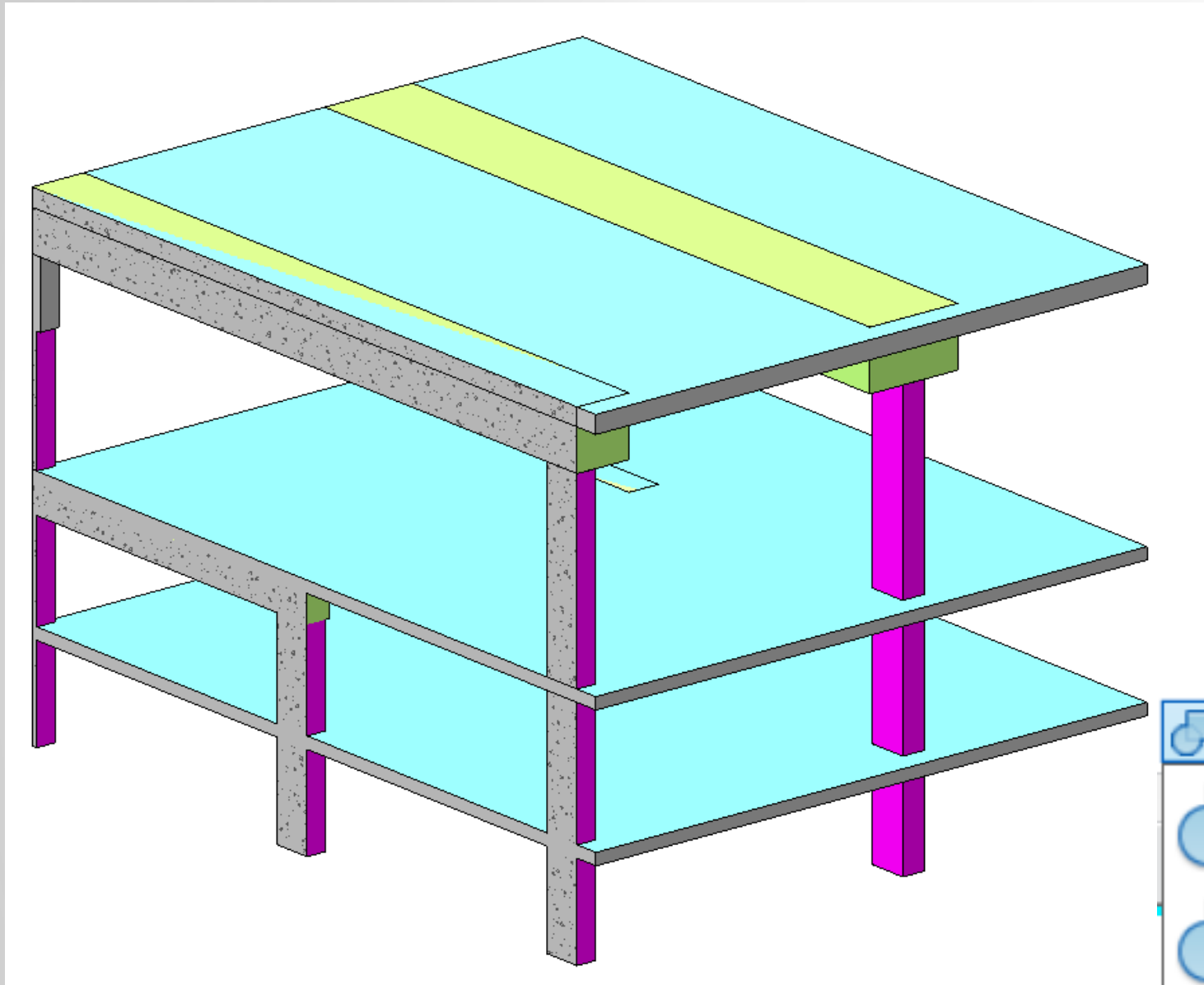
Beams not joined with slab

Beams

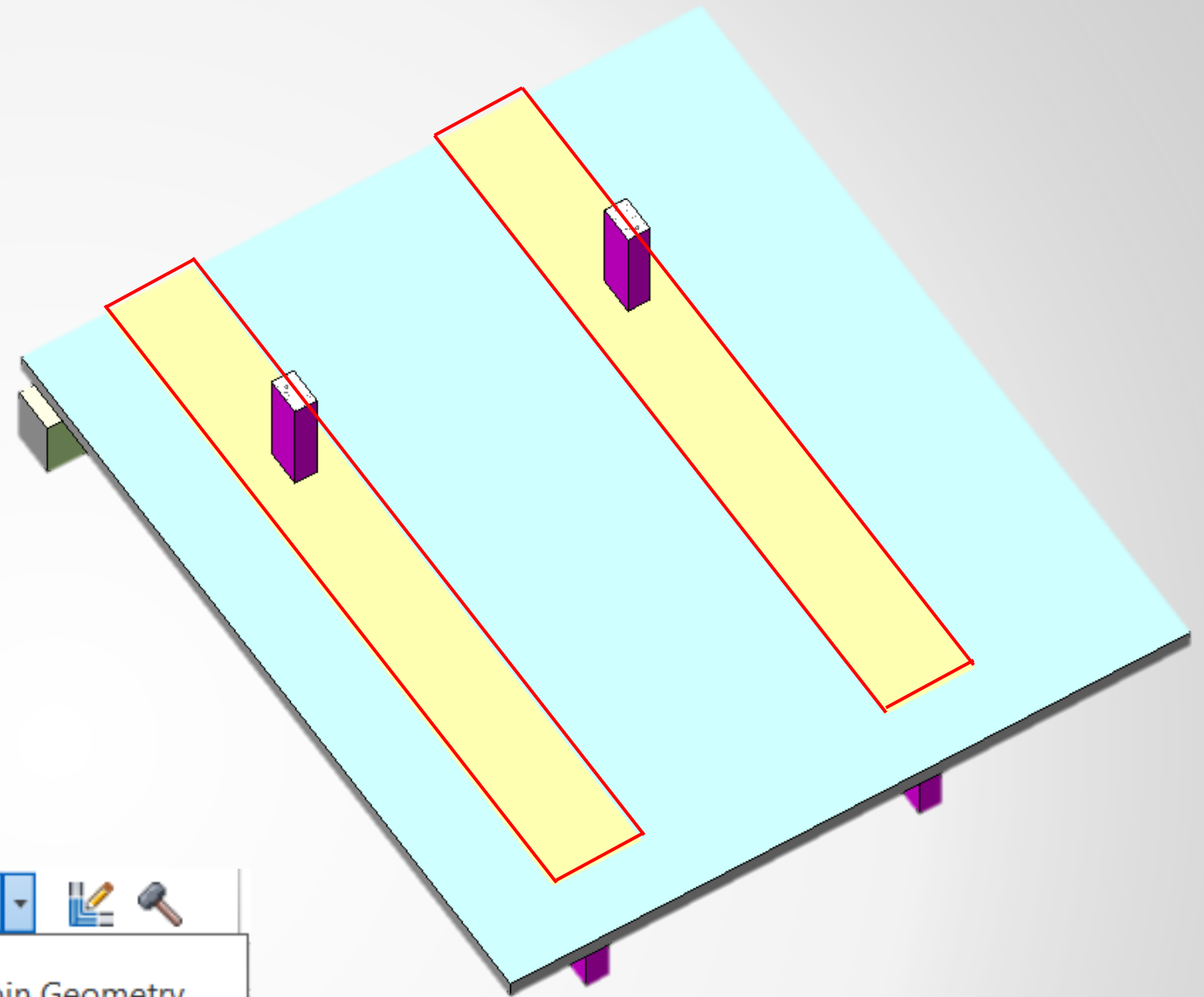
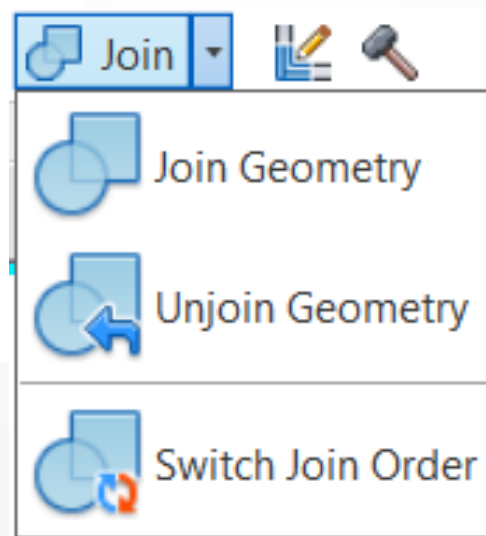


<http://www.peri-usa.com/index.cfm>

Modifying geometry



Beams



1. Join Geometry
2. SWITCH JOIN ORDER!

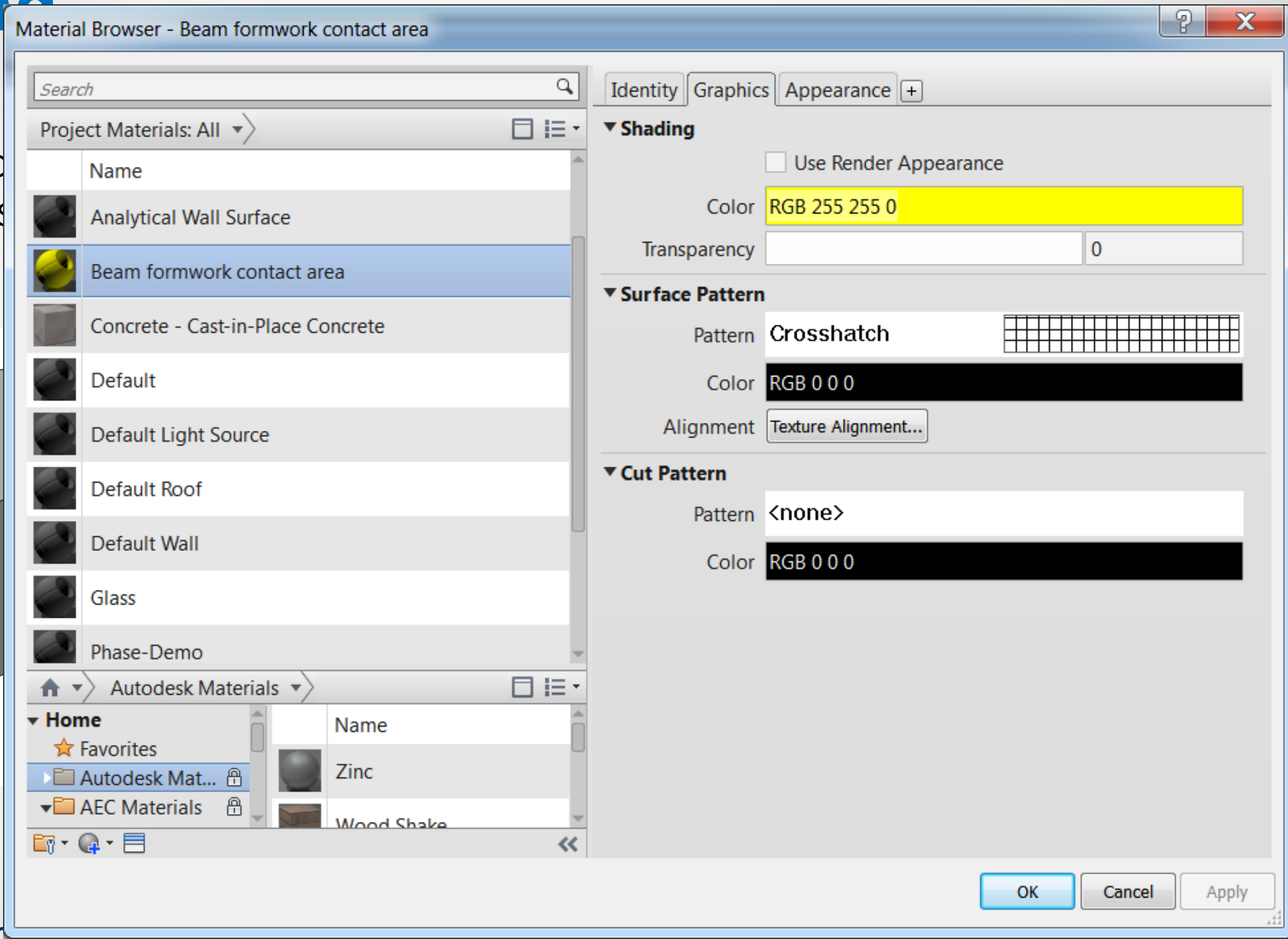
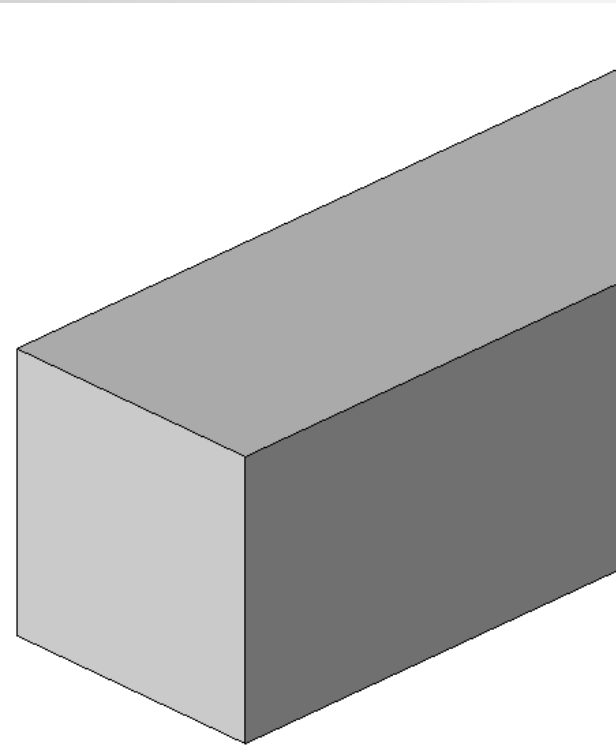
Quantifying

FULL BUILDING CONCRETE					
A	B	C	D	E	F
Family and Type	Construction	Count	Material: Volume	Material: Name	Colour code
Basic Wall: 200mm CONCRETE WALL	RAMP WALLS	15	204.31 m³	Concrete - Cast-in-Place Concrete	RED
Basic Wall: 300mm CONCRETE WALL	CORE WALLS	460	2180.36 m³	Concrete - Cast-in-Place Concrete	GREEN
Basic Wall: 300mm CONCRETE WALL	ONE SIDED FOUNDATION	20	1804.18 m³	Concrete - Cast-in-Place Concrete	ORANGE
Concrete-Rectangular-Column1: CC01 - 600x1000	COLUMNS	811	1817.56 m³	Concrete - Cast-in-Place Concrete	MAGENTA
Concrete-Rectangular-Column1: CC01 - 800x1000	COLUMNS	186	535.93 m³	Concrete - Cast-in-Place Concrete	MAGENTA
Floor: 125mm CONCRETE	SLAB ON GRADE	1	942.90 m³	Concrete - Cast-in-Place Concrete	YELLOW
Floor: 300mm CONCRETE SLAB	RAMP SLAB	3	289.29 m³	Concrete - Cast-in-Place Concrete	PINK
Floor: 300mm CONCRETE SLAB	SUSPENDED SLAB	17	21567.22 m³	Concrete - Cast-in-Place Concrete	BLUE
Floor: 450mm CONC SLAB	SUSPENDED SLAB	1	1947.55 m³	Concrete - Cast-in-Place Concrete	BLUE
Foundation Slab: 1200mm RAFT FOOTING	RAFT SLAB	1	465.25 m³	Concrete - Cast-in-Place Concrete	GREY
M Concrete-Rectangular Beam: 300 x 900 DP BEAM	BEAM	4	11.71 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 400 x 900 DP BEAM	BEAM	1	3.22 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 600 x 550 DP BEAM	BEAM	3	5.86 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 600 x 900 DP BEAM	BEAM	41	144.77 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 800 x 1000 DP BEAM	BEAM	6	81.07 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 1000 x 900 DP BEAM	BEAM	6	56.16 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 1200 x 1700 DP BEAM	BEAM	5	95.53 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Concrete-Rectangular Beam: 2400 x 1500 DP BEAM	BEAM	5	321.07 m³	Concrete - Cast-in-Place Concrete	LIGHT GREEN
M Footing-Rectangular1: F2 - 3400x4000 x 1200 DP	PAD FOOTING	74	1207.68 m³	Concrete - Cast-in-Place Concrete	GREY
			33681.60 m³		

Concrete volume

Quantifying

- Beam formwork contact area
- A faster option is using



Formwork Beams

Quantifying

$$2(W \times ST) + 2(L \times ST) \times \text{Count} = \text{slab to beam contact}$$



<BEAM SCHEDULE>

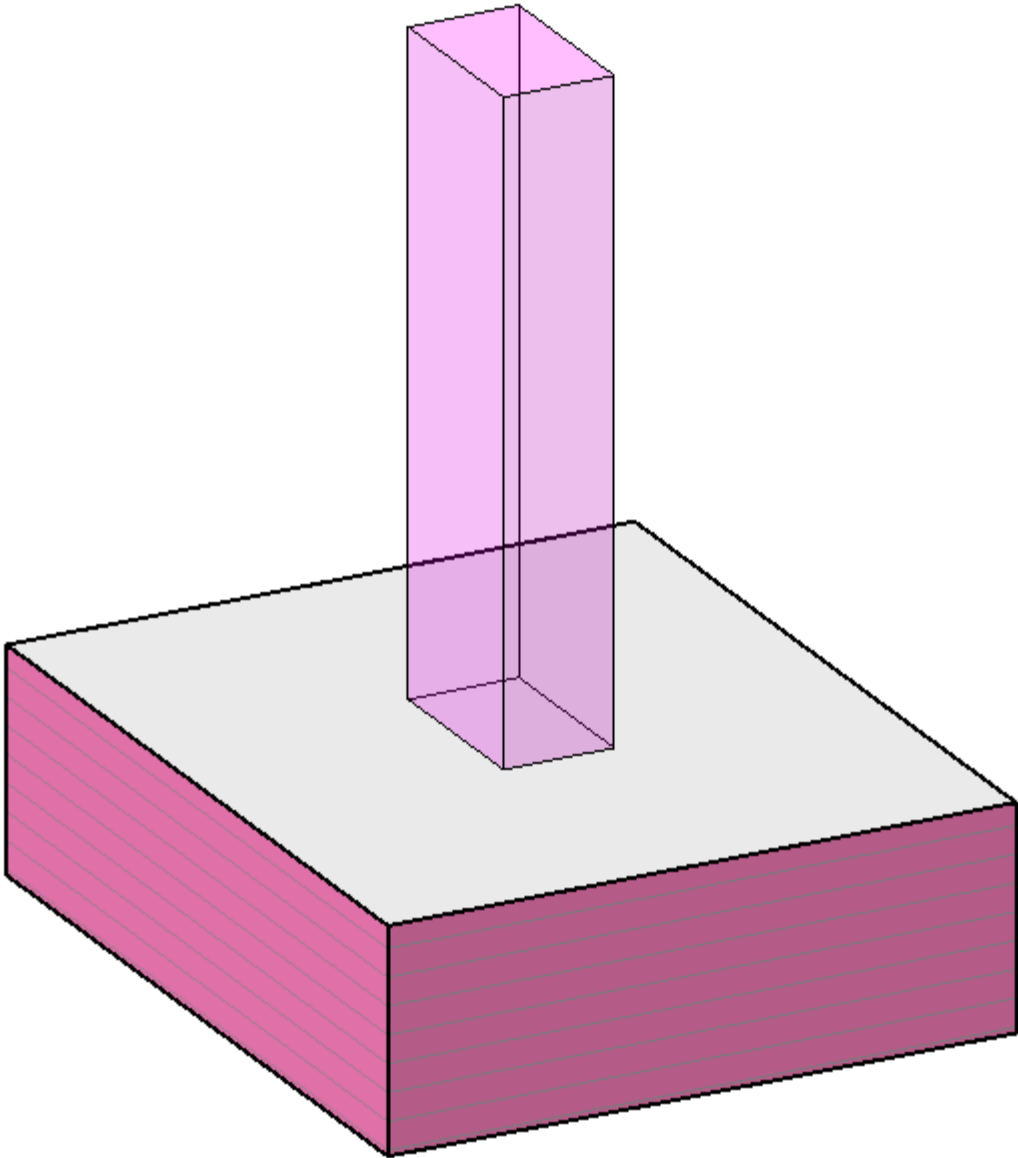
A	B	C	D
Family and Type	Count	Length	slab to beam contact
M Concrete-Rectangular Beam: 300 x 900 DP BEAM	5	54.14 m	32.64 m ²
M Concrete-Rectangular Beam: 400 x 900 DP. BEAM	1	9.23 m	5.78 m ²
M Concrete-Rectangular Beam: 600 x 550 DP. BEAM	3	23.86 m	14.67 m ²
M Concrete-Rectangular Beam: 600 x 900 DP. BEAM	42	336.07 m	202.02 m ²
M Concrete-Rectangular Beam: 800 x 1000 DP. BEAM	6	117.03 m	70.51 m ²
M Concrete-Rectangular Beam: 1000 x 900 DP. BEAM	6	72.42 m	44.05 m ²
M Concrete-Rectangular Beam: 1200 x 1700 DP BEAM	5	50.91 m	31.26 m ²
M Concrete-Rectangular Beam: 2400 x 1500 DP BEAM	5	94.77 m	58.3 m ²

<http://www.peri-usa.com/index.cfm>

Formwork Beams

Quantifying

A		F	
Construction		Comments	
COLUMNS	68	TO FLOOR	
COLUMNS	8	TO FLOOR	
COLUMNS	74	TO FLOOR	
COLUMNS	11	TO BEAM	
COLUMNS	59	TO FLOOR	
COLUMNS	10	TO BEAM	
COLUMNS	53	TO FLOOR	
COLUMNS	2	TO FLOOR	
COLUMNS	40	TO FLOOR	
COLUMNS	82	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	41	TO FLOOR	
COLUMNS	47	TO FLOOR	
COLUMNS	47	TO FLOOR	
COLUMNS	47	TO FLOOR	
COLUMNS	34	TO FLOOR	
Grand total: 916			



or contact
network)

contact

Formwork Columns

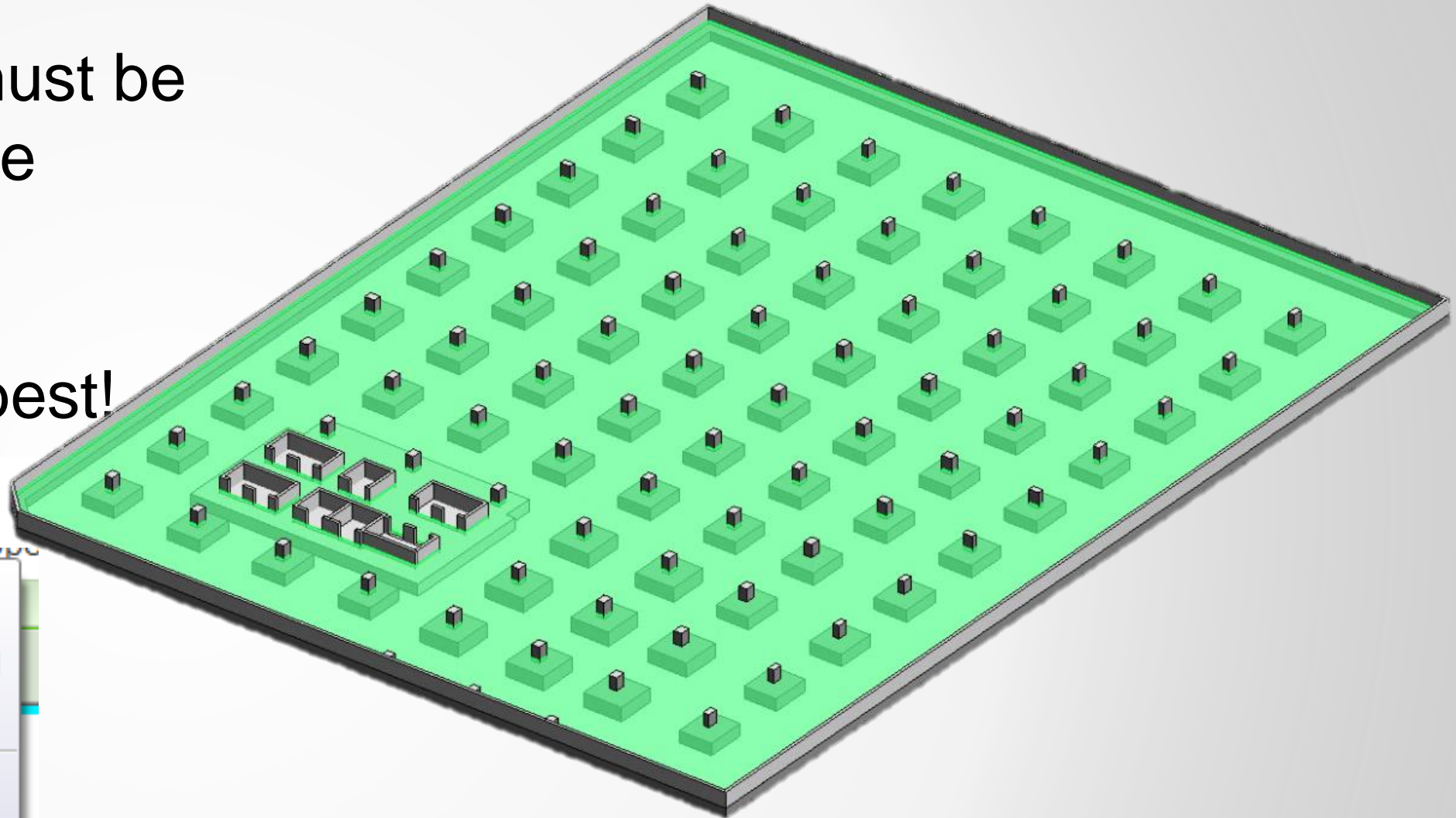
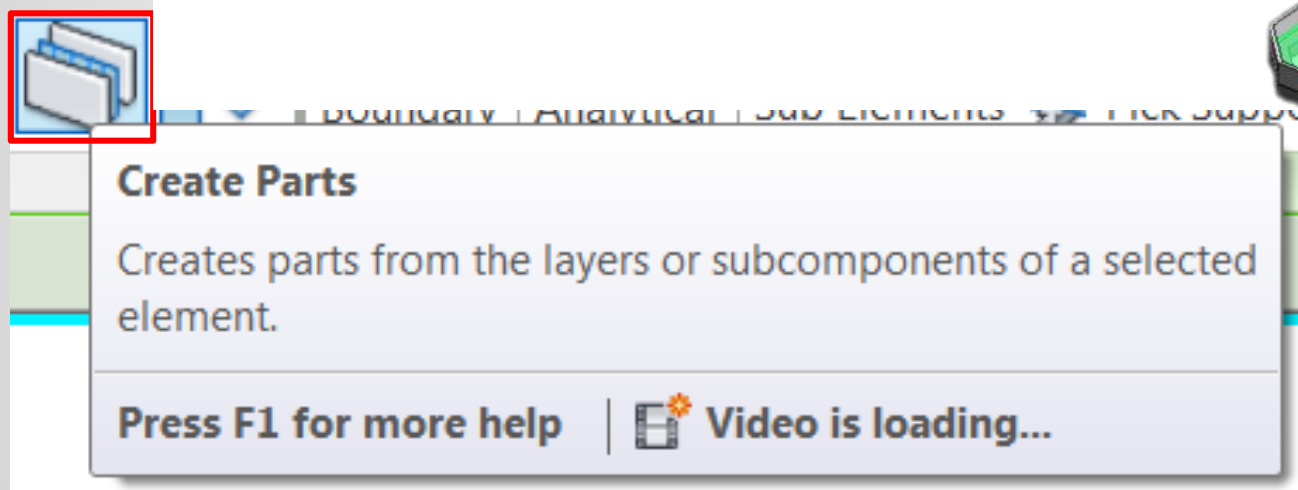
Quantifying

<BEAM FORMWORK CONTACT AREA>			
A	B	C	D
Family and Type	Count	Material: Name	Material: Area
<COLUMN FORMWORK CONTACT AREA>			
A	B	C	D
Family and Type	Count	Material: Name	Material: Area
M Concrete-Rectang			
M Concrete-Rectang			
M Concrete-Rectang			
M Concrete-Rectang			
M Concrete-Rectang			
M Concrete-Rectang			
M Concrete-Rectang			
M Concrete-Rectang			
Concrete-Rectangular-Column1: CC01 - 600x1000	811	Column formwork contact area	9703 m ²
Concrete-Rectangular-Column1: CC01 - 600x1000	486	Column formwork contact area	8482 m ²
<PAD FOOTING FORM CONTACT AREA>			
A	B	C	D
Family and Type	Count	Material: Name	Material: Area
M Footing-Rectangular1: F2 - 3400x4000 x 1200 DP	66	Pad footing formwork contact area	1172 m ²
M Footing-Rectangular1: F2 - 4000x4000 x 1400 DP	8	Pad footing formwork contact area	179 m ²
			1351 m ²

- **Strip footing** = $2 * (\text{Length} / 1 \text{ m}^2 * \text{Foundation Thickness})$
- **Core walls** (two sides of area) = $(\text{Area} / 1) * 2$
- **1 Sided Foundation walls** = Area (system family is one sided by default)
- **Suspended slabs** = Area (as long as geometry is joined right)

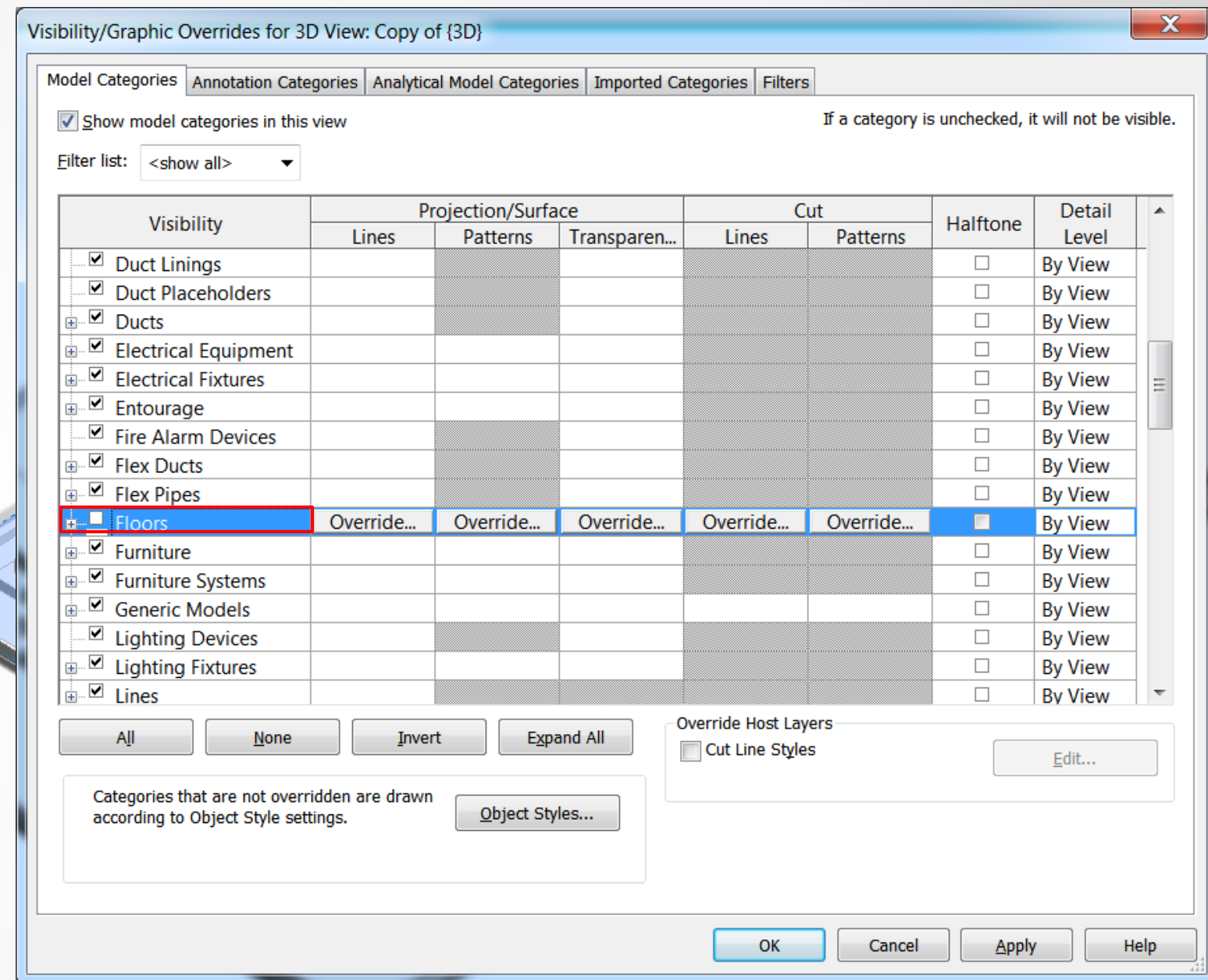
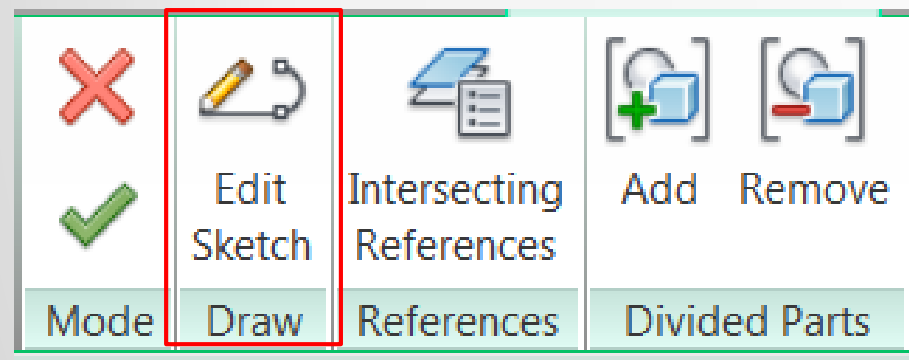
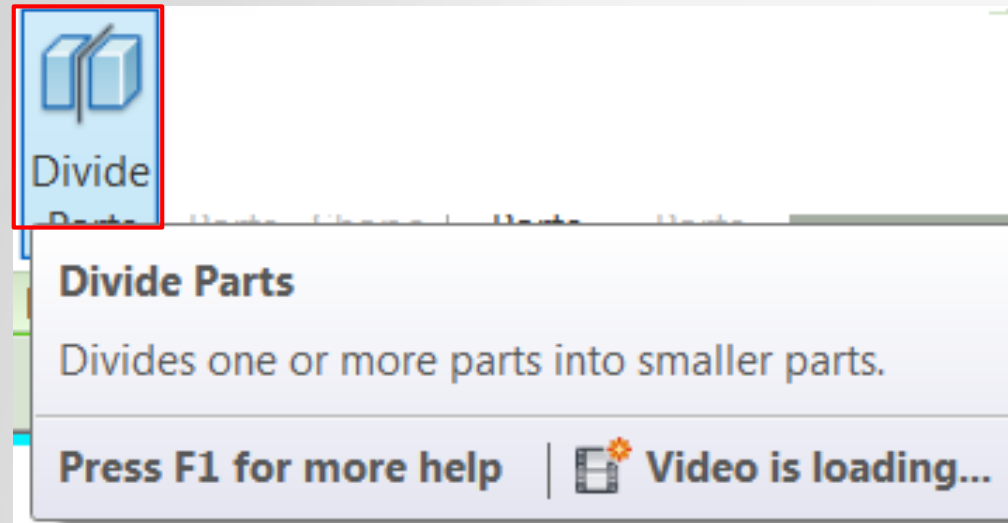
Separating geometry

- For a 4D analysis geometry must be broken up and identified before exporting into Navisworks.
- For this, the parts tool works best!



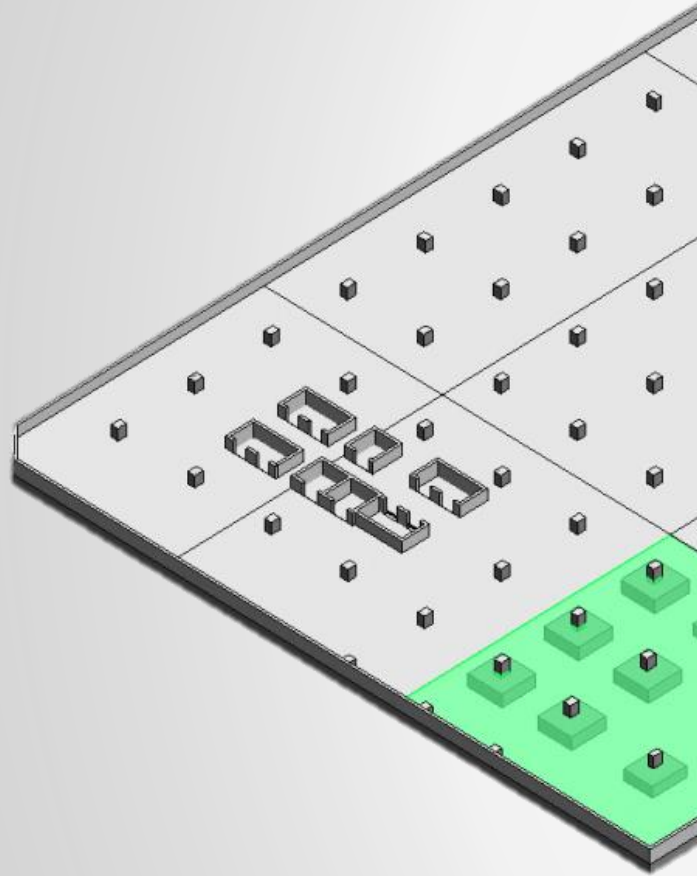
Slab Pours

Separating geometry

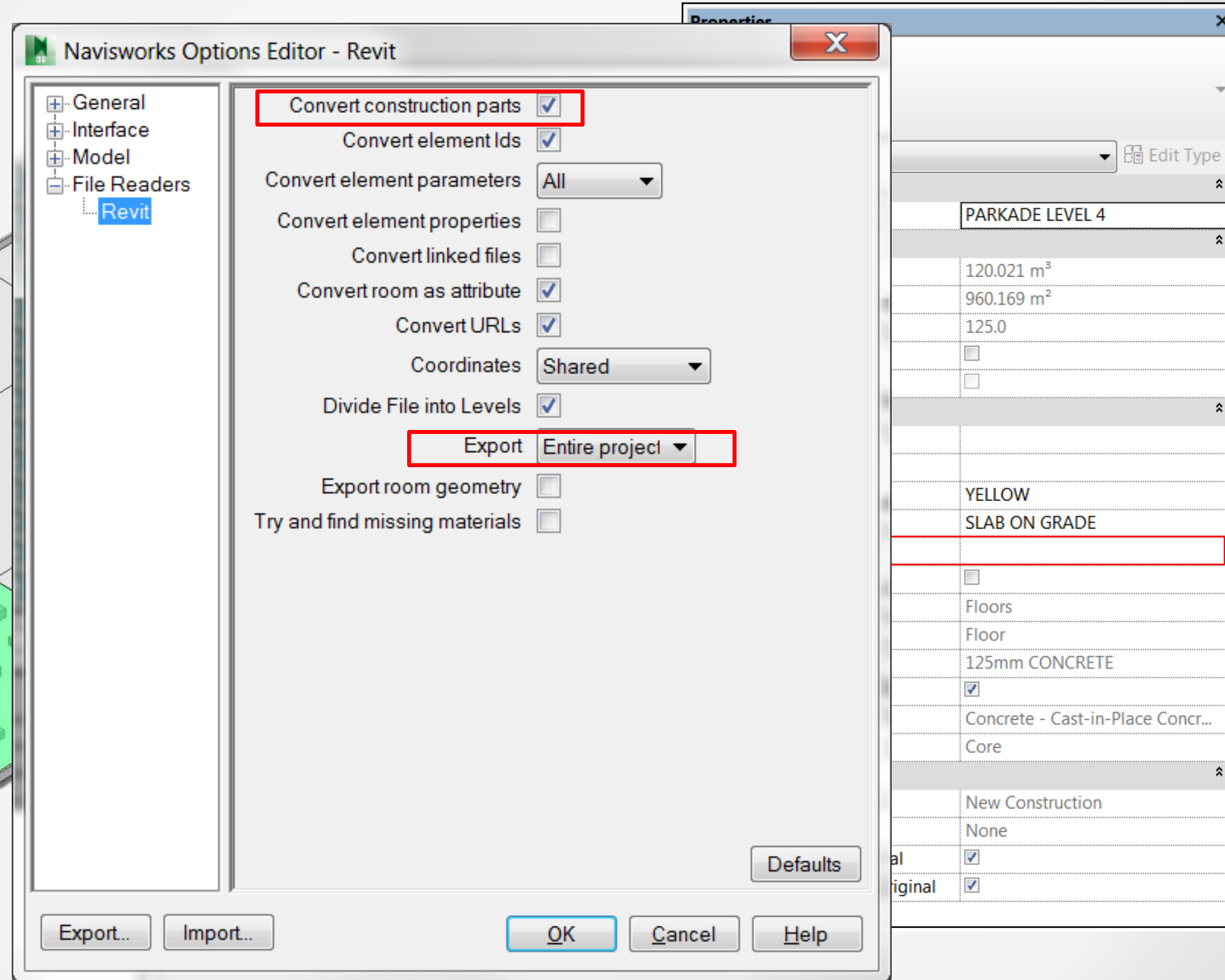


Slab Pours

Linking to Navisworks

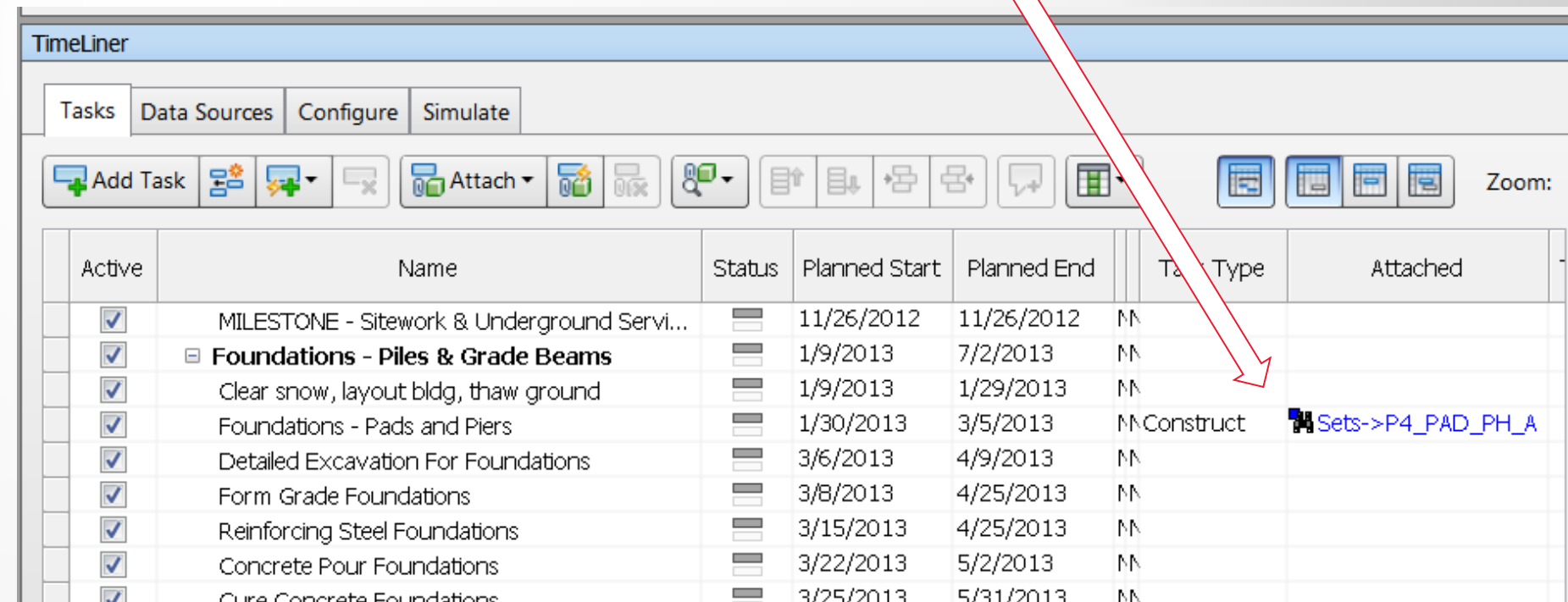
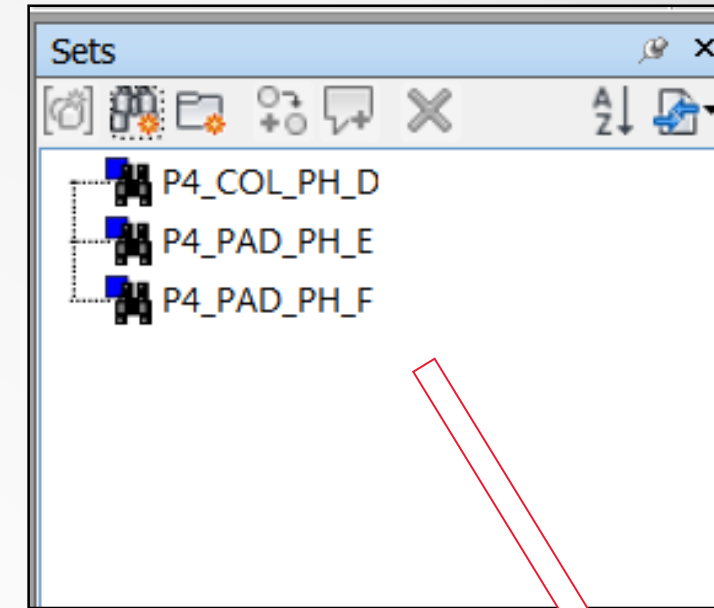
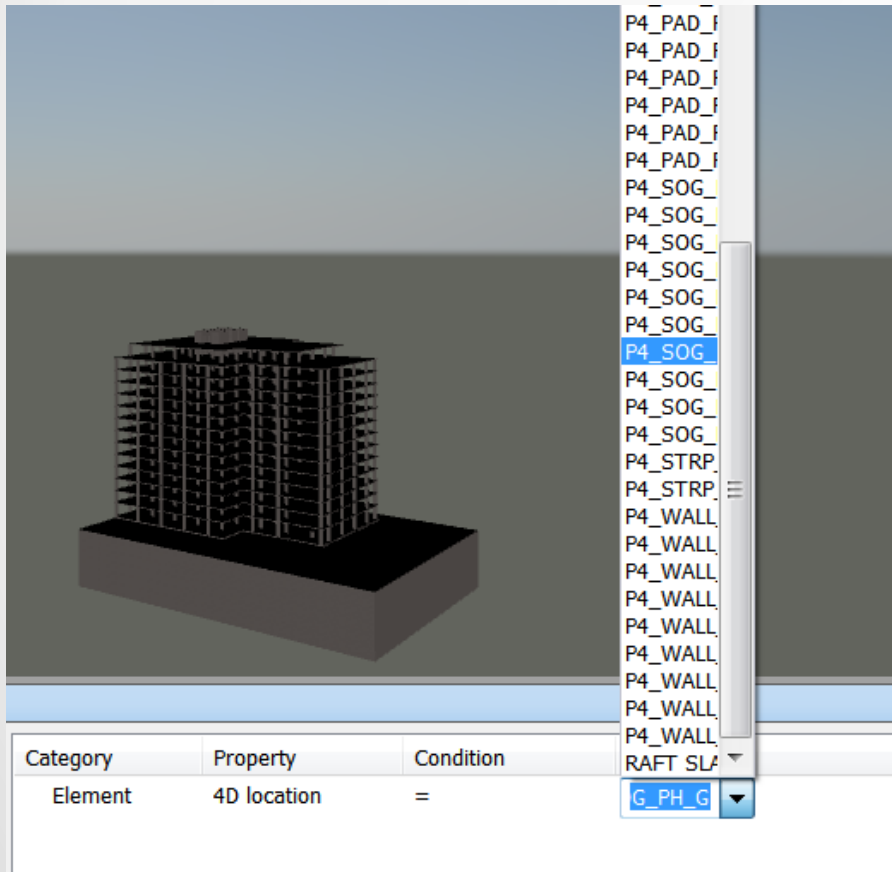


Slab Pours



Linking to Navisworks

- Existing MS Project or Primavera schedule
 - Utilize search sets to attach geometry
 - Search sets will retain selection if Revit model is updated

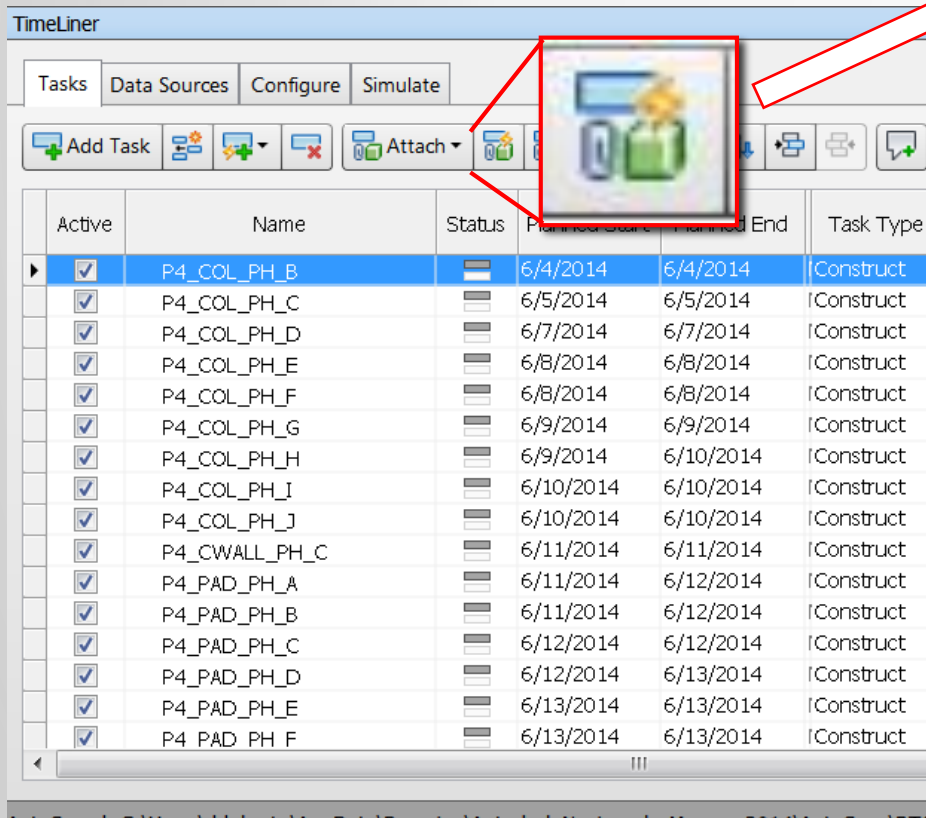
A screenshot of the TimeLiner window in Navisworks, showing a table of tasks and their associated search sets. A red arrow points from the "Sets->P4_PAD_PH_A" link in the "Attached" column to the "Sets" window.

Active	Name	Status	Planned Start	Planned End	Task Type	Attached
<input checked="" type="checkbox"/>	MILESTONE - Sitework & Underground Servi...		11/26/2012	11/26/2012	MM	
<input checked="" type="checkbox"/>	Foundations - Piles & Grade Beams		1/9/2013	7/2/2013	MM	
<input checked="" type="checkbox"/>	Clear snow, layout bldg, thaw ground		1/9/2013	1/29/2013	MM	
<input checked="" type="checkbox"/>	Foundations - Pads and Piers		1/30/2013	3/5/2013	MM Construct	Sets->P4_PAD_PH_A
<input checked="" type="checkbox"/>	Detailed Excavation For Foundations		3/6/2013	4/9/2013	MM	
<input checked="" type="checkbox"/>	Form Grade Foundations		3/8/2013	4/25/2013	MM	
<input checked="" type="checkbox"/>	Reinforcing Steel Foundations		3/15/2013	4/25/2013	MM	
<input checked="" type="checkbox"/>	Concrete Pour Foundations		3/22/2013	5/2/2013	MM	
<input checked="" type="checkbox"/>	Cure Concrete Foundations		3/25/2013	5/31/2013	MM	

Linking to Navisworks

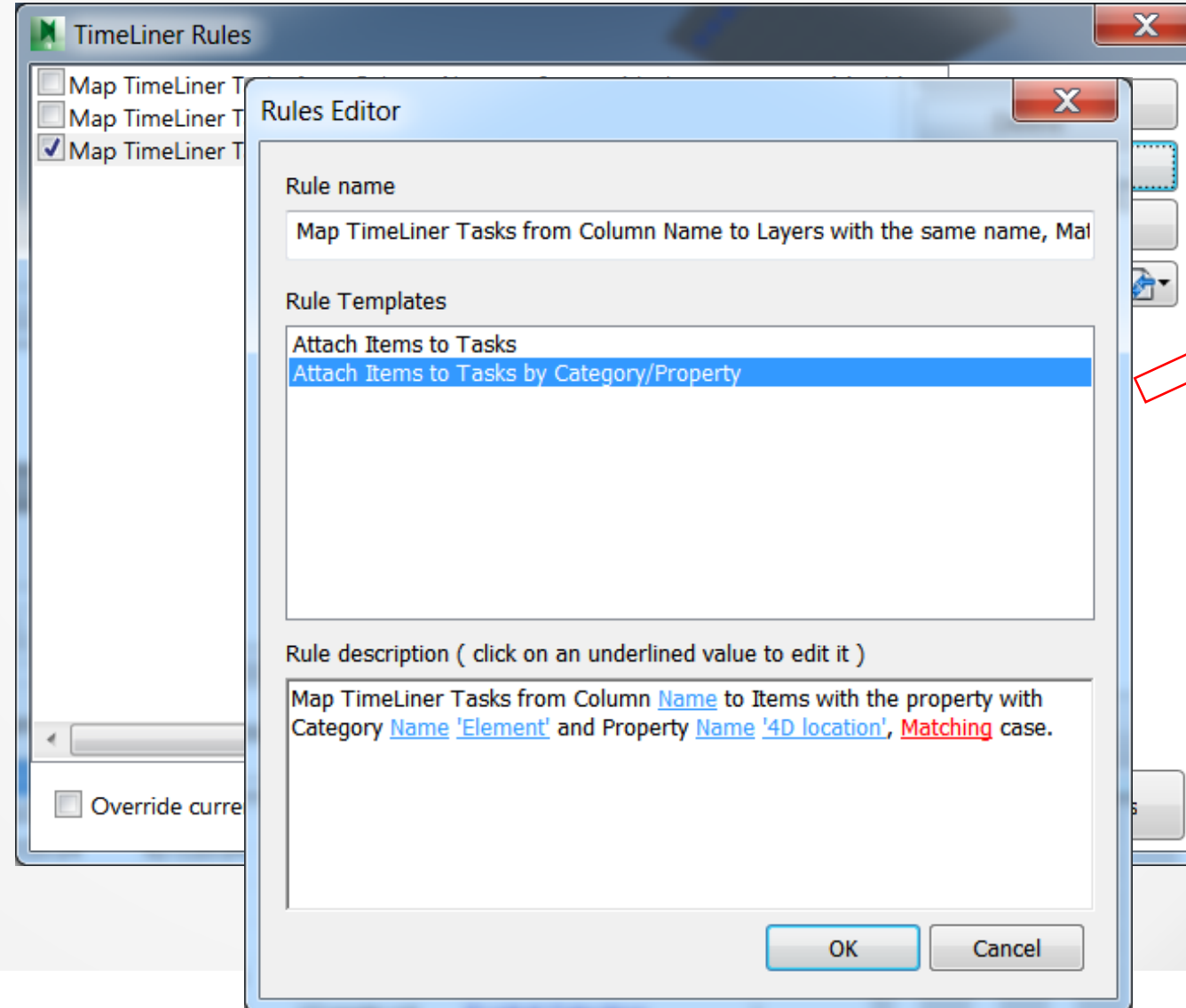
- Create new schedule tasks and durations
 - Utilize **auto-attach using rules** to expedite 4D creation

Task names match **4D location** names



Active	Name	Status	Planned Start	Planned End	Task Type
<input checked="" type="checkbox"/>	P4_COL_PH_B		6/4/2014	6/4/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_C		6/5/2014	6/5/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_D		6/7/2014	6/7/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_E		6/8/2014	6/8/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_F		6/8/2014	6/8/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_G		6/9/2014	6/9/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_H		6/9/2014	6/10/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_I		6/10/2014	6/10/2014	Construct
<input checked="" type="checkbox"/>	P4_COL_PH_J		6/10/2014	6/10/2014	Construct
<input checked="" type="checkbox"/>	P4_CWALL_PH_C		6/11/2014	6/11/2014	Construct
<input checked="" type="checkbox"/>	P4_PAD_PH_A		6/11/2014	6/12/2014	Construct
<input checked="" type="checkbox"/>	P4_PAD_PH_B		6/11/2014	6/12/2014	Construct
<input checked="" type="checkbox"/>	P4_PAD_PH_C		6/12/2014	6/12/2014	Construct
<input checked="" type="checkbox"/>	P4_PAD_PH_D		6/12/2014	6/13/2014	Construct
<input checked="" type="checkbox"/>	P4_PAD_PH_E		6/13/2014	6/13/2014	Construct
<input checked="" type="checkbox"/>	P4 PAD PH F		6/13/2014	6/13/2014	Construct

Auto attach



Name	Attached
P4_COL_PH_B	Explicit Selection
P4_COL_PH_C	Explicit Selection
P4_COL_PH_D	Explicit Selection
P4_COL_PH_E	Explicit Selection
P4_COL_PH_F	Explicit Selection
P4_COL_PH_G	Explicit Selection
P4_COL_PH_H	Explicit Selection
P4_COL_PH_I	Explicit Selection
P4_COL_PH_J	Explicit Selection
P4_CWALL_PH_C	Explicit Selection
P4_PAD_PH_A	Explicit Selection
P4_PAD_PH_B	Explicit Selection
P4_PAD_PH_C	Explicit Selection
P4_PAD_PH_D	Explicit Selection
P4_PAD_PH_E	Explicit Selection
P4_PAD_PH_F	Explicit Selection
P4_PAD_PH_G	Explicit Selection
P4_PAD_PH_H	Explicit Selection
P4_PAD_PH_I	Explicit Selection
P4_PAD_PH_J	Explicit Selection
P4_SOG_PH_A	Explicit Selection

Session Feedback

- Via the Survey Stations, email or mobile device
- AU 2015 passes given out each day!
- Best to do it right after the session
- Instructors see results in real-time



Questions?

