AUTODESK UNIVERSITY 2013

Construction Modeling in Autodesk ® Revit® Structure: *Tips and Tricks for Construction Utilization*

Jeremiah Bowles – Black & Veatch Engineering

CR1506-L-P Construction and engineering professionals get hands-on training on how to transition from a LOD 300 to LOD 350 model for enhanced construction utilization. This lab and panel discussion demonstrates how to take full advantage of Autodesk Revit Structure software models using parts and assembly tools, rebar, parameter strategies, and advanced families to extend BIM into construction using Autodesk® Navisworks® Manage software to schedule, estimate, and use the Revit Structure model for shop drawings. We discuss the value of the engineering model and potential for contractors to use it in planning, sequencing, animation, location, detailed shop drawings, fabrication, and estimation. This lab features a Tilt-Up construction project example.

Learning Objectives

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

- Use vital engineering modeling tools that assist in estimation, fabrication, and construction assembly
- Explain how construction firms can take advantage of the engineer's model beyond traditional 4D animation and 5D estimating tools
- Take advantage of advanced techniques and strategies to easily control the engineer's model effectively
- Explain how engineering and construction firms can work together for mutual benefit-finding synergy

About the Speaker

Jeremiah works out of the CIO Group at Black & Veatch Engineering as a Corporate BIM Design & Construction Technology Manager & leader in innovation and productivity solutions for our experienced BIM & VDC group. He is also working to complete a MS in Project Management with an Emphasis in Construction Management at KU Graduate School of Engineering and is an Adjunct Instructor with JCCC. He is BIM a Autodesk & Technology Implementation specialists, with a diverse portfolio of experience in Architecture, Engineering & Construction since 1992. As an early BIM adopter and innovator he is always looking beyond the technology utilization norms and has focused on value delivery to his clients. His experience in team development, change management and business acumen allow him drive meaningful change at Black & Veatch. jeremiah.bowles@therevitcoach.com *@therevitcoach*

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Can contractors Benefit from Modeling in Revit

The success in using Revit in the BIM process is not the tool alone, but in the strategies and tactics in how we use the tool. The right tool with the appropriate strategy can go a long way to increasing productivity, ensure accuracy, & improve safety.

Some important QUESTIONS we must ask?

- When Should BIM be used?
- LOD's – What Should Be modeled?
- Where is the balance of Effort / Reward?
- Where is productivity lost?
- Do any synergies exist?
- What are the clients end deliverables?
- Should we re-invent the wheel 3 different times?
- Does the designer / A|E team have all the information?
- Does the Fabricator have all the information?
- What obstacles face our collaborative world of information exchange? <adversarial effect>

Immediate Benefits (a.k.a. Low hanging fruit)

Too much focus in Design & Construction is placed complaining what the technology can't do. Technology Implementation takes a crawl, walk, run, sprint approach. You must usually crawl well before you can walk, walk before you can run, etc.. One should not begin looking into the benefits of BIM in construction without grabbing the low hanging fruit, at least if they are concerned with profits and the key stakeholders.

Visualization

Contractors / Construction Engineers, take a walk around your "Virtual Project". Although you probably think you understand the project after pouring through a set of Construction / Contract documents you haven't seen it until you've seen it in BIM. Sometimes in creating a model from 2D documents you will find excellent insights into your project that were not captured in reading the plans but building the model.

Conflict Avoidance(a.k.a. "Clash Detection")

Although this is an obvious piece, it is important to run a clash in earlier design than at the construction bid. This class was intended to address joint venture opportunities and strategies in working together to leverage the A|E model for construction use, still don't forget to do a 3D clash detection. Once mastered you may also look at a 4D and 5D clash?

A|E & Contractor synergy: *The not so low hanging fruit*

The low hanging fruit may provide some immediate BIM success but getting a ladder to attain the "Not so low hanging fruit" can be a key differentiator between firms that do BIM and leaders in client value creation. Doing this requires planning and strategy between Engineering and Construction to provide mutual benefit. These next strategies are not easily attainable and require advanced BIM software knowledge and a lot of mutual trust, but with the correct understanding of the BIM Constructability workflow CM / Construction professionals can partner with A|E Firms to create synergy for downstream construction utilization of the model.

A|E Design Model	***Constructability Model***
Design Intent	*Means & Methods*
Building state completed	*Materials*
Structural Requirements	*Component Assembly*
Engineering Specifics	*Fabrication / Shop Dwgs*
Loads, connections	*Coordination*
Detail Concepts	*Scheduling*
Min. Component Req'd.	*Logistical Planning*
Proof of Concept	*Firefighting?*

There are distinct model differences: *The Tale of Two Models*

The A|E Model is not traditionally sufficient to construct from. There are also other items that may need to be constructed just to build the construction items that will stay in place. Suffice it to say, you will need to create your own model in addition to the A|E. Their model is called the ***Design Intent*** model; your model is called the ***Constructability*** model. This can be a hybrid of architecture and structure elements but will most certainly will be different than the Architects model. This model can utilize Revit Phasing to illustrate the construction phasing / break-out of work or you can embed parameters into the model components to do phasing inside Navisworks. I usually find that both are useful, especially when creating documents illustrating different phases.

Contractors must know and use Revit

Many construction professionals want to do BIM but find themselves doing "almost BIM" or even venturing into Hollywood BIM. Most of it is because they think learning the software is difficult and believe that they can't benefit from this model. Although some of this may be true, there

can be much gained for using these tools. Upon evaluation of their current process they are already doing these steps, just in different silos. Many of these tasks are done by different people and even different trade partners. Partnering with them to create the constructability model can have great success and avoid the model re-work and design.

5D Clash Detection

Should we be doing this? 5D Clash detection would be detecting elements that may cause the owner issues. This should have been done by the A|E but you will show the value of your services if you address this question.

Considerations:

- If you picked a different manufacture for equipment specified, did you check for required clearances?
- If there are filters or any other elements that require lift equipment, can you get access to these?
- Any other evaluation of commissioned elements?
- Construction equipment accessibility / safety!

3D Sections

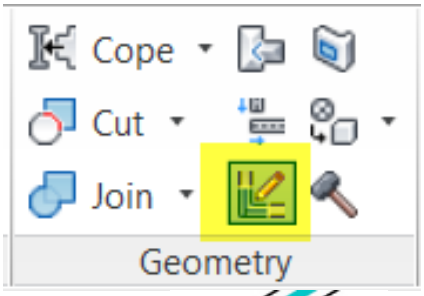
If you received a Revit model you most likely received a model with 2D Details and Sections. You may want to create some 3D sections to illustrate key elements like:

- Elevation Changes

Identify Assembly order, elements to be constructed first (Create 3D, static isometric to convey assembly order) Validate in 4D with Navisworks.

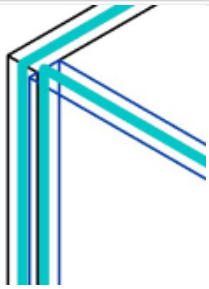
New Tools for use of Displaced elements exploded views.

Lab 1 - General Model Cleanup

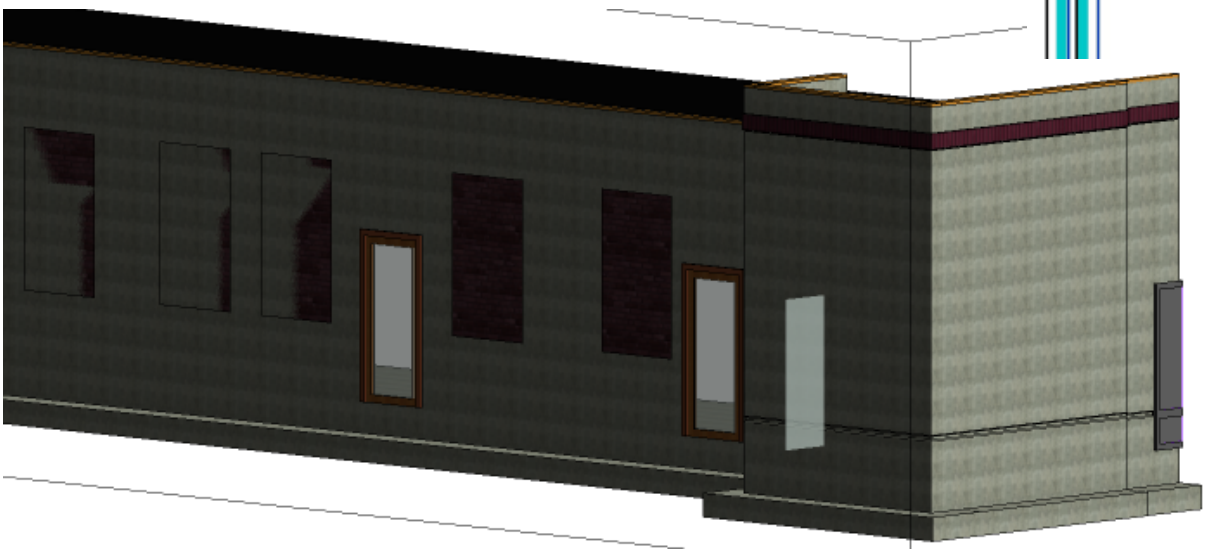


Wall Cleanups & Joins:

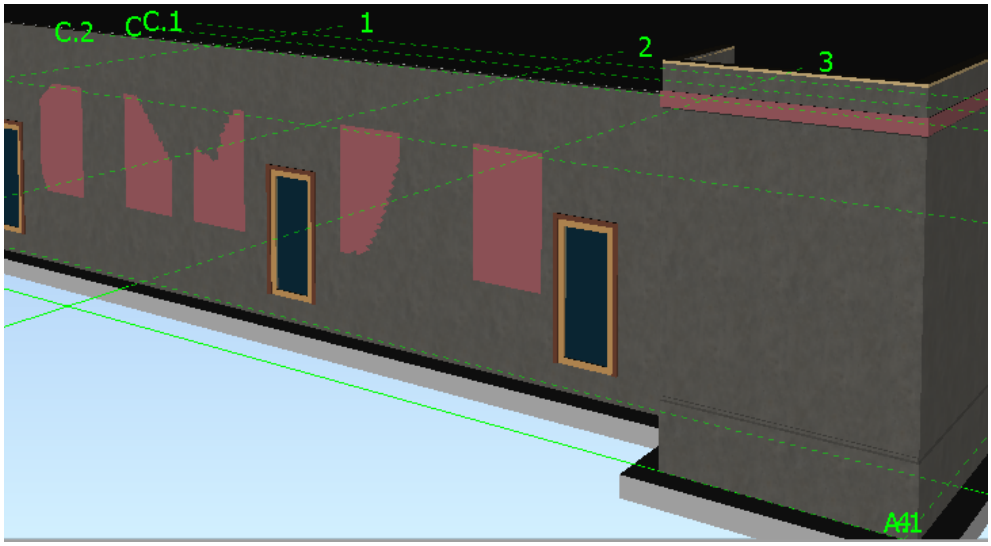
1. Wall – Clean-ups
- Before you begin breaking up your model with parts you will want to make sure your wall clean-ups are done before hand. If you are using the model for analysis, ensure that the walls are all "joining" Occasionally Architects or engineers will select disallow join, this will also make the analytical lines not join.



2. *Horizontal Wall Reveals* do not break with parts unless imbed into walls where they will divide.
3. *Embed Brick Walls* must be joined to void out existing walls.

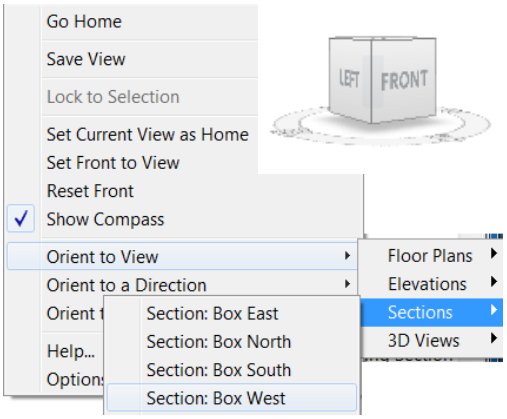


4. *Parts don't show properly in Revit & Navisworks when embeds not joined.*



Manageable View

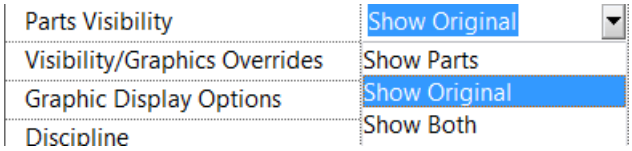
Break up project into smaller view or sections that are easier to manage.



1. Use *section boxes* of specific regions (Focus areas) or potential zones of work. Use your Default {3D} view and use the View cube to navigate to specific Section Boxes. *Right click* on section box and select Orient to view and find pre-defined views to orient to. (e.g. Box East, Box North…)
2. Dependent Views with "Match Lines" are good to break up project.

Create Different Part Views

Views have 3 view options:

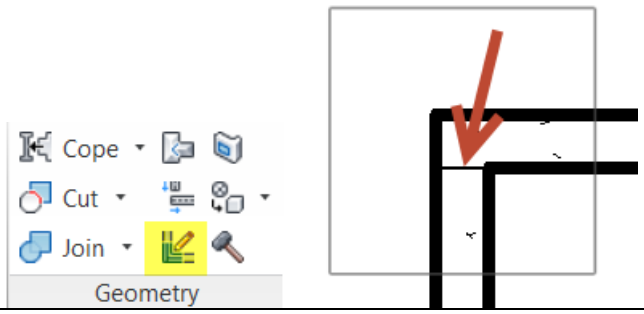
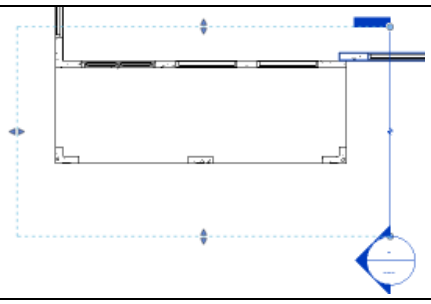


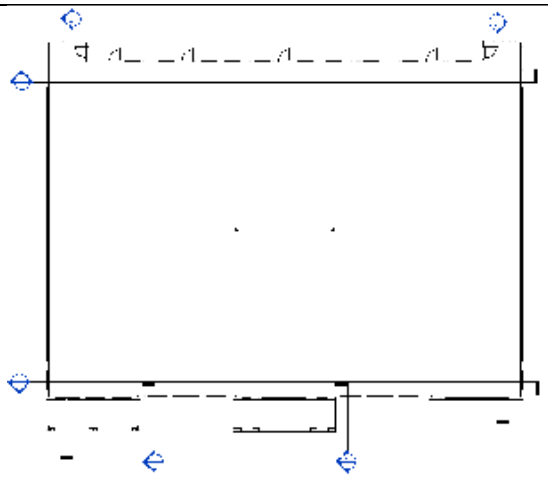
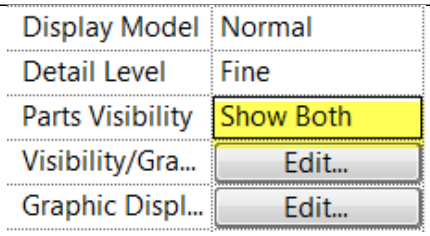
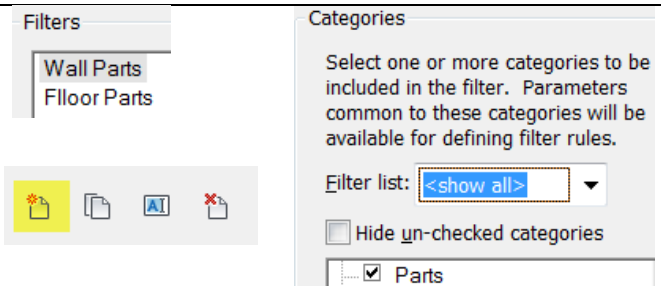
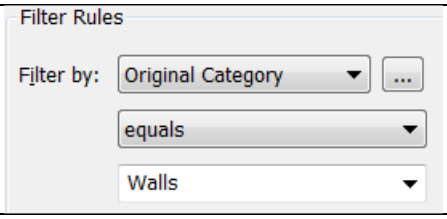
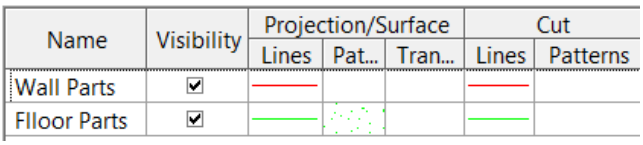
1. Show Parts *(Only parts will only show after you have enabled them and wall/floor/roof will disappear after you have removed them)*
2. Show Original – only shows walls.
3. Show Both (Recommend Differing Colors)

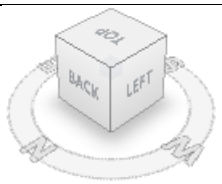
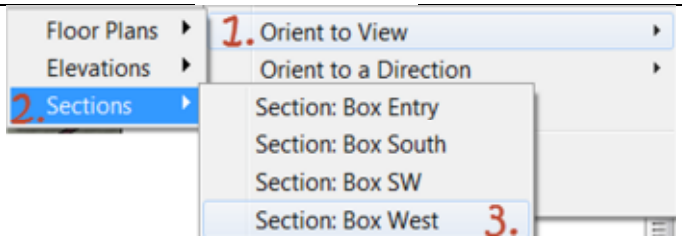
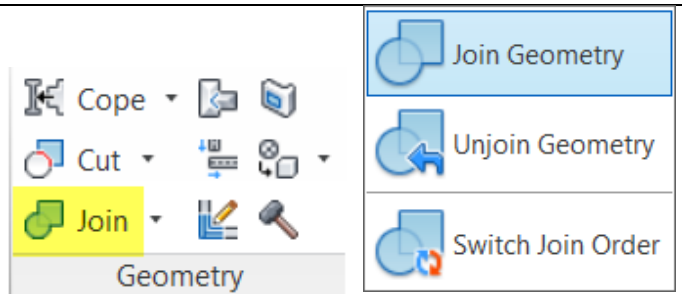
Set up a generic parts *view template* enabling your graphical overrides for parts to include:

4. Color filters for walls, floor & roofs.
5. Line overrides, etc. to differentiate what is a part and what is not.

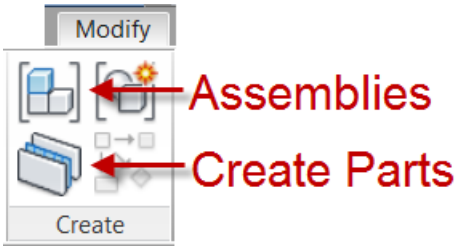
Lab 1 Steps

1	Open *Lab1_GeneralModelCleanup.rvt*	Folder for lab files located here: C:\Datasets\Tuesday\CR1506-L-P
2	Open up Level 1 floor plan and clean up the corners. Do this by selecting *Modify Wall Joins.* On the options bar you have the option Butt, Miter or Square off. Select Next to toggle through each selection. Make sure Butt is selected. Note: these walls are very simple, you may have walls that have multiple layers.	
	Create Manageable views.	
3	Create a section on the southwest entry and rename section view <u>Box SW</u> Note: Create Sections around the major areas of the model to break up the model in a more functional chunks of work.	

	Example: The remaining Sections are already created for you for ease of working.	
4	Duplicate Level 1 with detailing. Rename new view <u>Level 1 with Parts</u> In the new view change the Parts visibility parameter to *Show Both*. If you want the originals to disappear when parts are created select Show Parts.	
	Create Filters to differentiate parts between walls / floor, etc.	
5	Type VV / VG to open the visibility graphics for this view, go to the filter tab and select Edit / New to create a new filter. Create new Filter - > Name the first one Wall Parts Set the filter category to parts.	
6	Select the filter rules to equal parts. Repeat steps 5,6,7 for Floor Category.	
7	Add the newly created filters to the newly created view and cut and projection lines and surface patterns. Ensure your Part tag has similar colors.	
8	Save and create a view template	Right Click on view 

9	Open up the Default 3D view  on the *quick access toolbar*. Note: You don't need to create a bunch of 3D box views, just leverage the existing sections.	
10	Right Click on the View Cube Select Orient to view -> Sections -> Box West View This will assist us in our limiting what is viewed and help us focus on these elements.	
11	Navigate to west walls elevation or recent 3d View. Join thin-set brick walls to concrete walls. Select *Modify*, Join-> *Join Geometry* *Then Select*  *the thin-set brick and then the main concrete wall. Repeat to all thin-set brick on west wall.*	

Lab 2 - Construction Modeling Parts



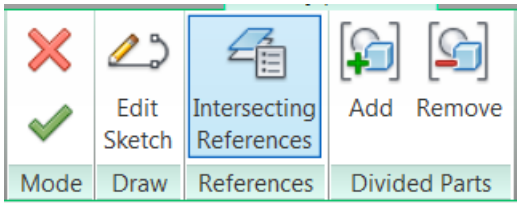
Creating Parts

Select Designers wall and Select Create parts.

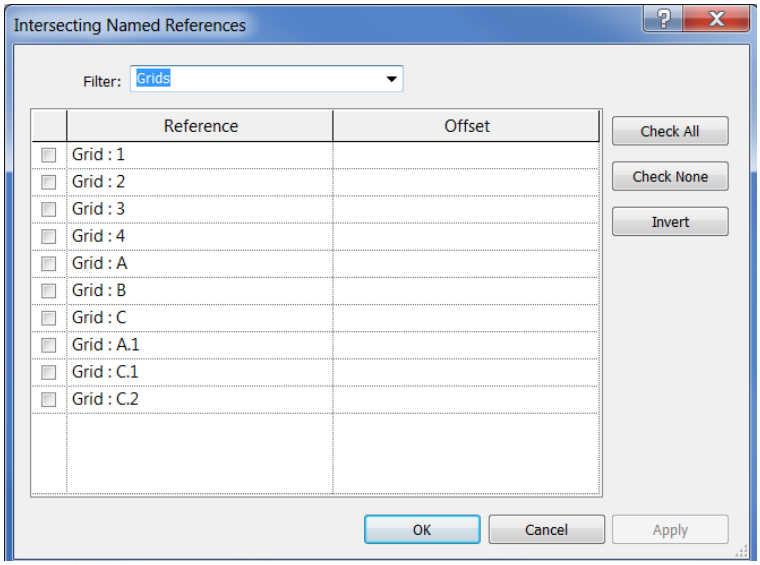
- Select wall / floor / roof - > Create part
- Or Select Create parts - > Select Multiple
- Parts with like materials join.

Divide Parts

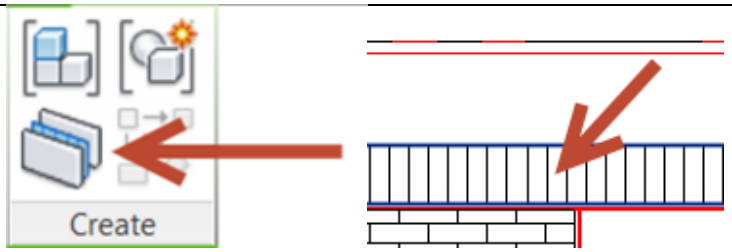
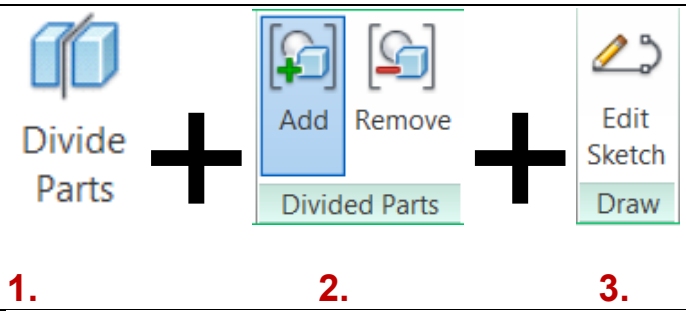
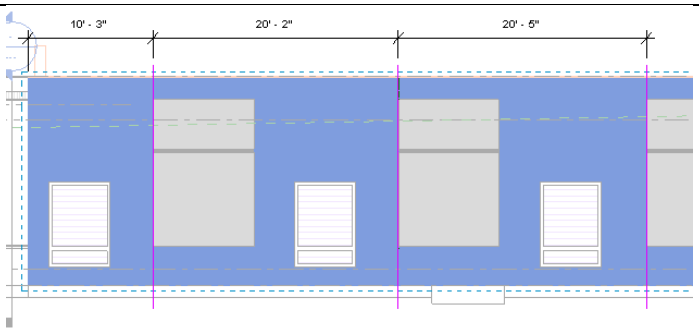
- Use intersecting References



- Sketch Divisions (Extend Beyond Reference offset lines to break embedded profiles)



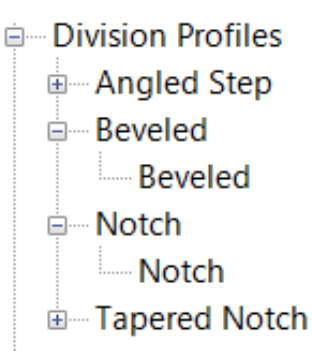
Lab 2 Steps

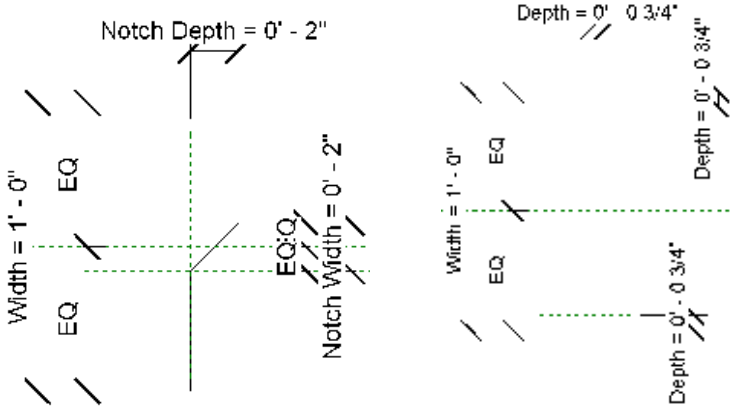
12	Select the west wall and select create Parts. This will open the *Modify|Parts* Dialog. Select *Divide Parts.* Repeat steps for the embed soldier course Brick.	
13	1. Select the west wall part and then Divide parts. 2. Set Work plane to exterior wall face. Then add the Embed soldier course brick part so that the sketch will cut / divide both at the same time. 3. Select Edit Sketch	
14	Draw Sketch-lines Note: make sure they extend beyond the tops and bottoms. Dimension from left end: 10'-3", 20'-2", 20'-5" Note: You may also select intersecting references like grids or reference planes if applicable.	

Lab 3 - Define Division Profiles

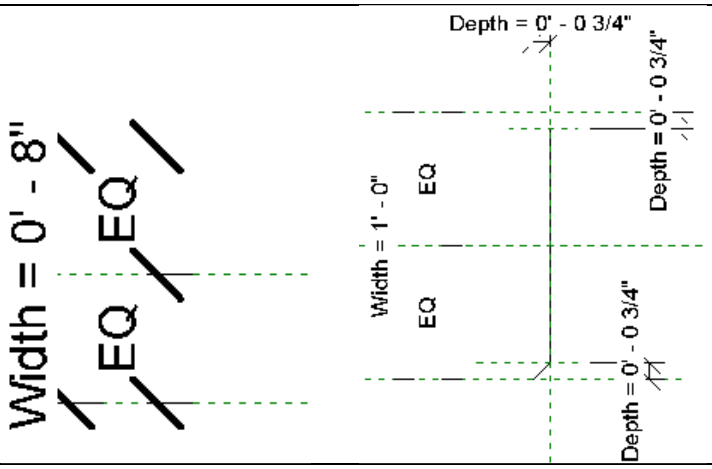
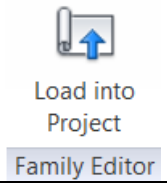
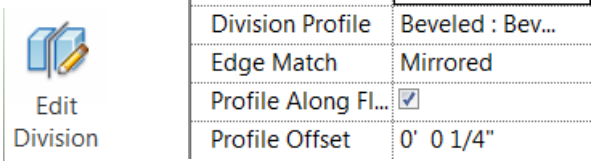
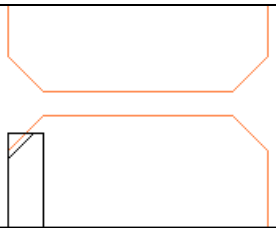
- Modify/Create Division -> Properties -> Set division properties
- Set Divider Gap
- Set Split Profile Types
- Define Edge Match (Complimentary, Mirrored, & Rotated.
- Check Profile Along Flip
- Profile Offsets (+ or -)
- New Profile Type (Division Profiles)

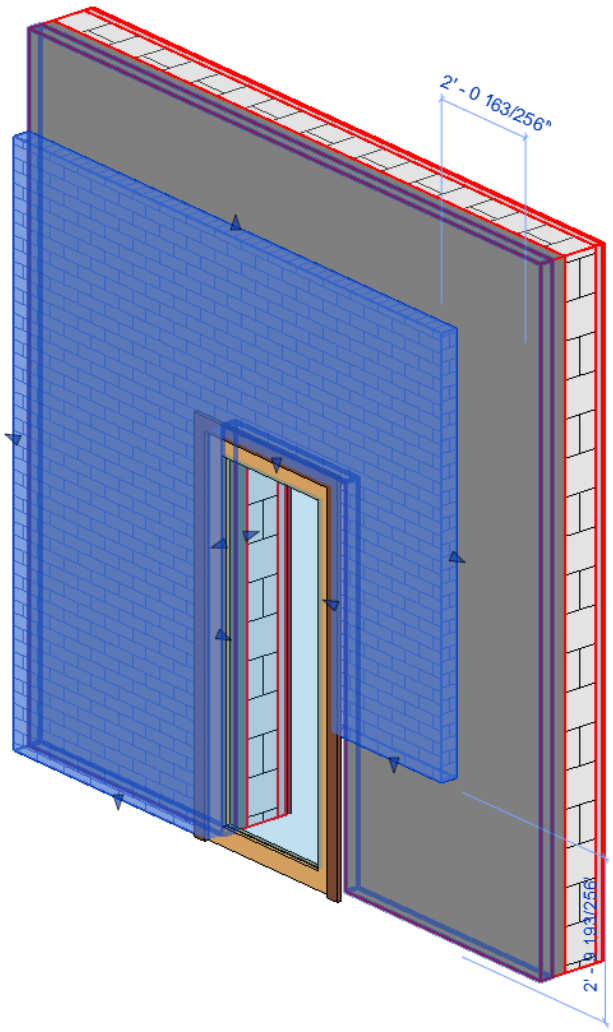
Constraints	
Divider gap	0' 0"
Dimensions	
Split Profile Type	Beveled : Beveled
Edge Match	Mirrored
Profile Along Flip	☐
Profile Offset	0' 0"





Lab 3 Steps

15	To create a division profile: New-> Family->**Division Family.rfa** (example) This is a new Family Category. Open the **beveled.rfa** Notice that the width is relatively controlled and not a parameter • Constraints (c/l front /back, Center l/r) • Top & Bottom "Strong References".	
	Load this family into the project.	 Notice under Families -> Division Profiles there is a new category with the new profile in it.
16	Select the West wall parts again and select edit divisions. Notice you can now select division profiles. Adjust Division Properties: Division Profile = **Beveled: Beveled** Edge Match = **mirrored** Profile Offset = ¼"	
17	Review the changes to the divisions.	



Lab 4 Modify Parts

- Enable Shape Handles
  - Per material Layers

Identity Data	
Comments	
Mark	
Show Shape Handles	☑
Original Category	Walls
Original Family	Basic Wall
Original Type	Exterior - Brick on CMU

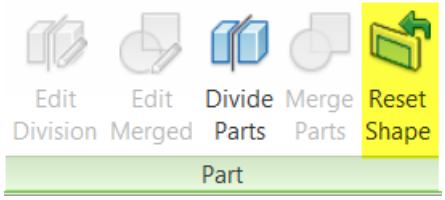
- Override Part Materials

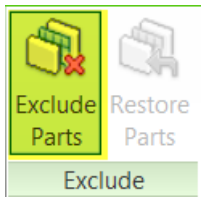
Material By Original	☑
Material	Brick, Common
Construction	Finish

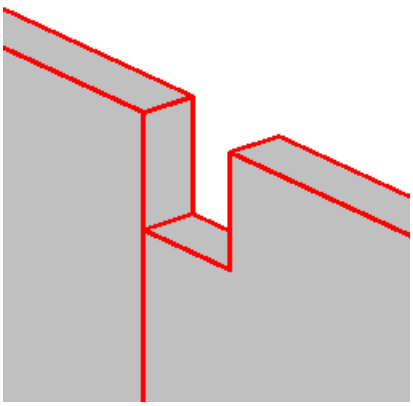
- Override Phases Created / Demolished

Phasing	
Phase Created	New Construction
Phase Demolished	None
Phase Created By Original	☑
Phase Demolished By Ori...	☑

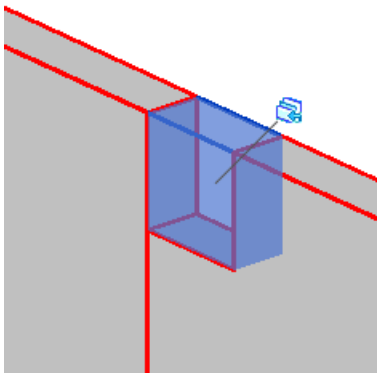
- Use Drag Handles to adjust to conditions fitting appropriate means and methods.
- Reset Shape if you want to revert to the original material.

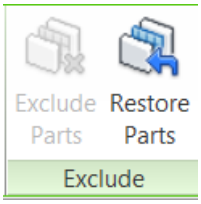




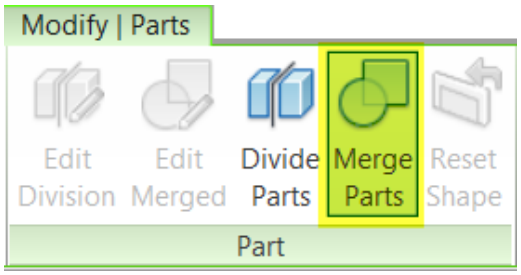


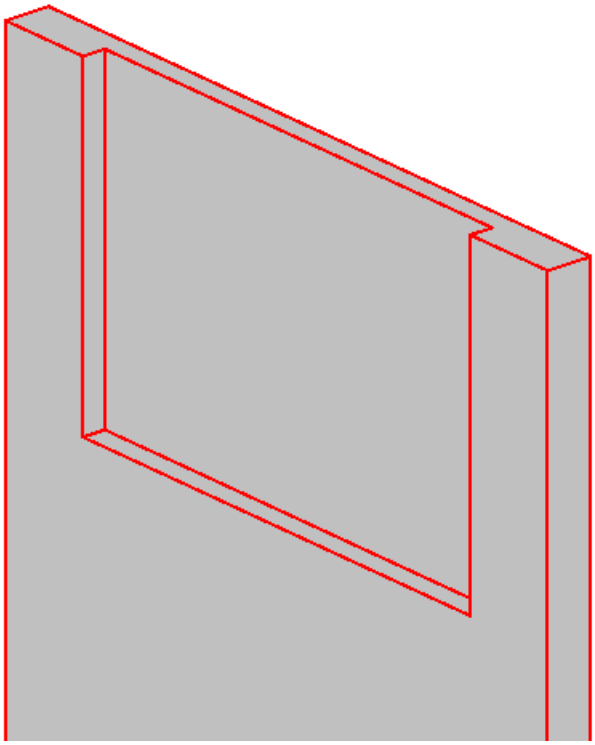
- Exclude Parts
- Restore Parts





- Merge Parts – Like type materials can be Merged,
  - Merged parts will be included in one material Estimate. (like materials)
  - Join walls included in one pour together.

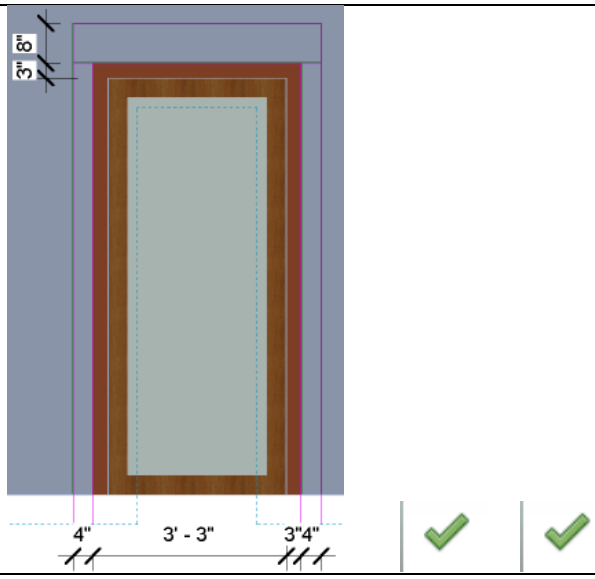


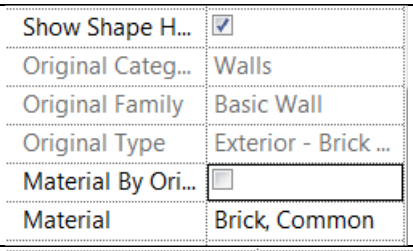
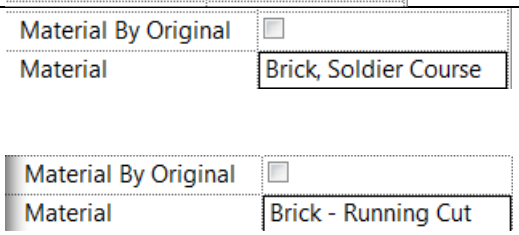
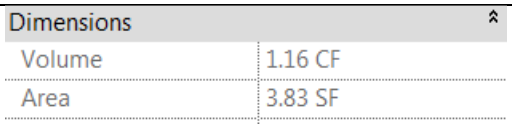
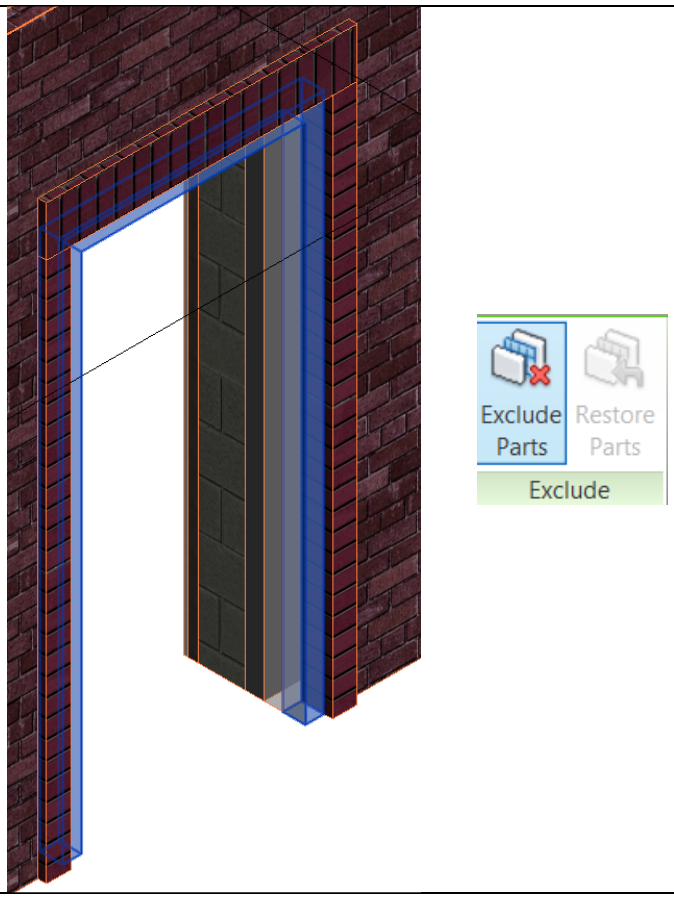


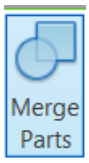
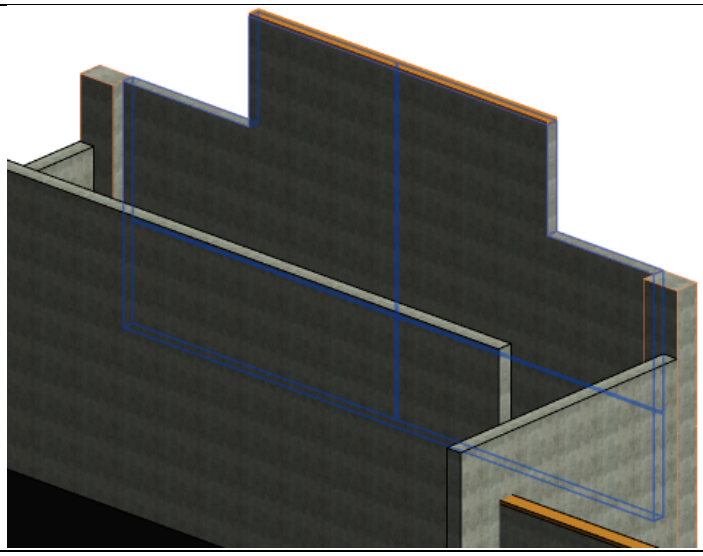
- Notes:
  - Wall Reveals Will divide with Parts

Wall Sweeps (not hosted) will not divide or be turned into parts. They can however be included in wall assemblies. Suggest hosting horizontal profiles in wall or redraw.

Lab 4 Steps (Modify / Override Parts)

18	Navigate to the *Modify Parts Callout* on the floor Plan. Select the walls and then Create parts. Open the 3D Parts view and orient to the Modify Parts Callout	
19	Many times the design model doesn't detail properly the correct material take-off that a construction estimator would use. Select edit divisions and draw a line around the door frame as shown in the adjacent picture. You will need to set the work plane to front as before. Ensure that you extend the lines to the bottom dashed reference lines to make the appropriate cut. Finish the division's edits.	

20	Select the Top and side pieces and override their parts properties. Enable the Select Show Shape Handles properties and select *Material By Original*.	
21	Select the Lintel piece and override the material to be *Brick, Soldier Course* Select the other two side pieces and override material to be *Brick - Running Cut*	
32	Use the Shape handles to pull the brick out a few inches. Notice the properties will report the new volume and area but will not change the thickness.	
33	Select the door and hide it in view. Then select the brick that is around the door frame and select *exclude parts*. This is how you remove parts that are different in the construction model than what the design model reflects. Notice: Do not delete the part, you can Restore parts that were excluded before	

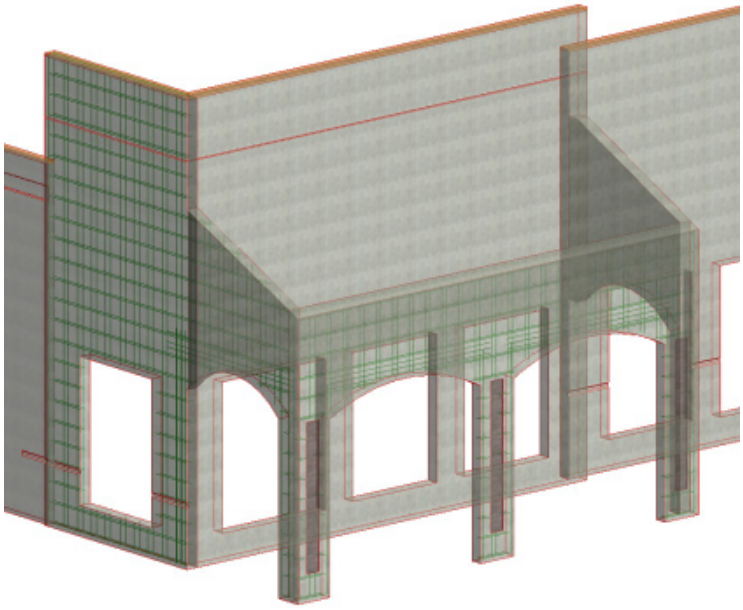
34	Navigate to the back side of the front entry. Select the different thickness walls and select *merge parts*. Note: These will include the material take-off's together to include a proper volume in any given assembly. 	

Lab 5 - Modeling Rebar (See other AU Labs on Rebar)

Wall / Rebar Settings

Description	Setting
1 - Tilt-1 1/2" Exterior	0' 1 1/2"
1 - Tilt-3/4" Interior	0' 0 3/4"
2 - Parts offset	0' 2 3/8"

1. Rebar isn't associated to the part, but the wall.
2. Define Cover settings for whole wall.
3. Draw specialty rebar first then add whole rebar next.
4. Cover settings will only apply to parts, when defining boundary, use offset and lock it to the edge of the part.
5. Rebar will accommodate openings for doors etc. but does not consider the profile edits unless you incorporate these into your wall. These are associative but not identical giving the designer better coverage.
6. Rebar is not dynamically tied to your wall, if you edit the profile or top / bottom, it will not follow these edits. Use pick lines with lock for better success.
7. If your wall has an exterior finish (brick, airspace, etc. You may want use the Additional (Exterior / Interior) Cover offsets <instance based>
8. Thin set brick walls must join geometry to concrete walls to void out material. Walls will be separate parts.
9. Create a View with Parts & Rebar only to facilitate Adding to Assembly views.

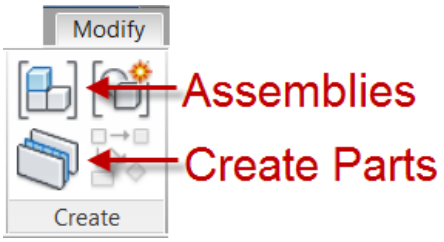


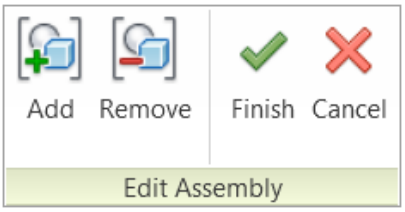
AUGI Wish list: Option for when parts are divided in walls / slabs, etc. that the rebar is divided accordingly.

Lab 6 - Create Assemblies

Multiple elements combined that maintain independent views, schedules, tags and can & filters.

- Combine several objects into assemblies
- Manipulate elements as a single unit
- Each assembly is a separate assembly type
- Place instances of assemblies
- Changes are tracked as the model changes
- Assemblies consume parts, parameters, and associate to parts.
- Collect and pass data into Navisworks for simulation.



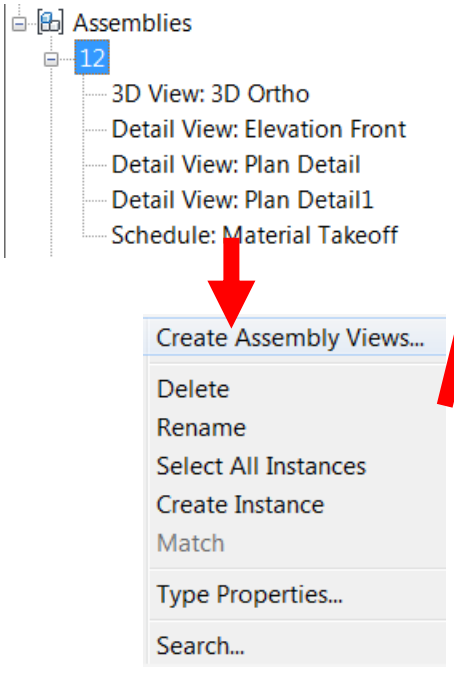


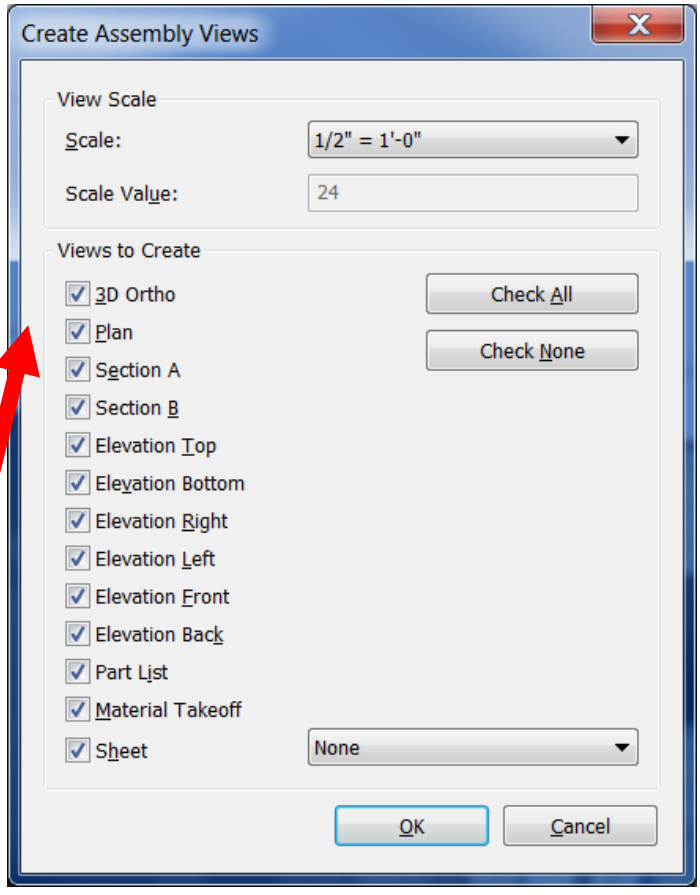
Using Assemblies

- Separate editable, tagged, schedules, and filtered
- Generate sheet and assembly views
- Shop Drawings, clarity drawings, slab plans, form layouts.
- Grouping like type objects

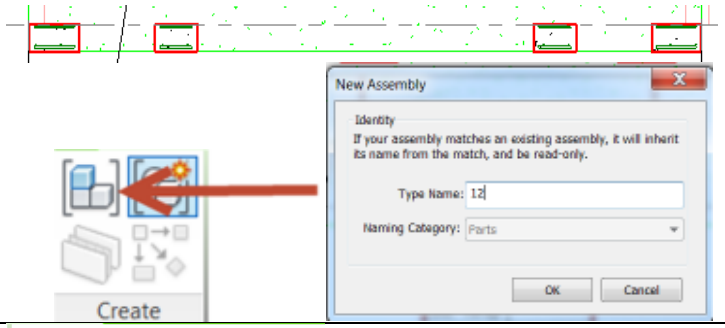
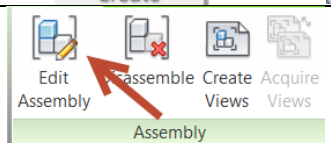
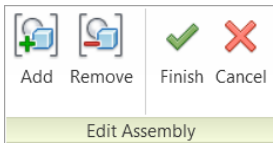
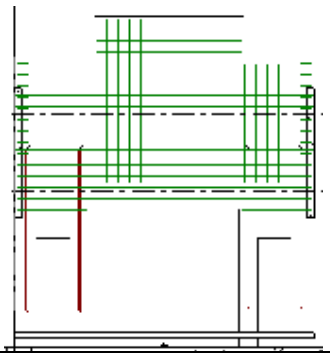
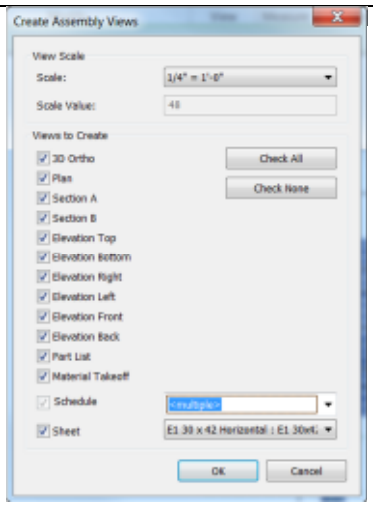
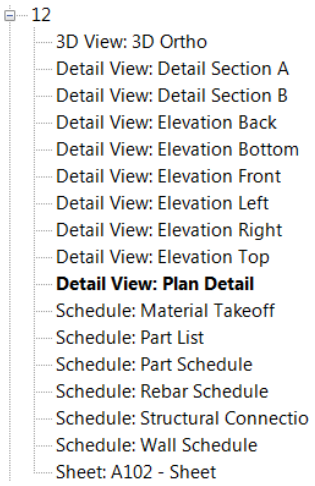
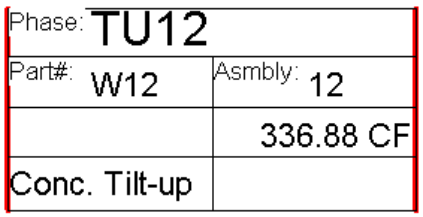
Creating Assembly Views

- Select Assembly in Browser and
- Views area automatically created
- Automatic Materials Take-off



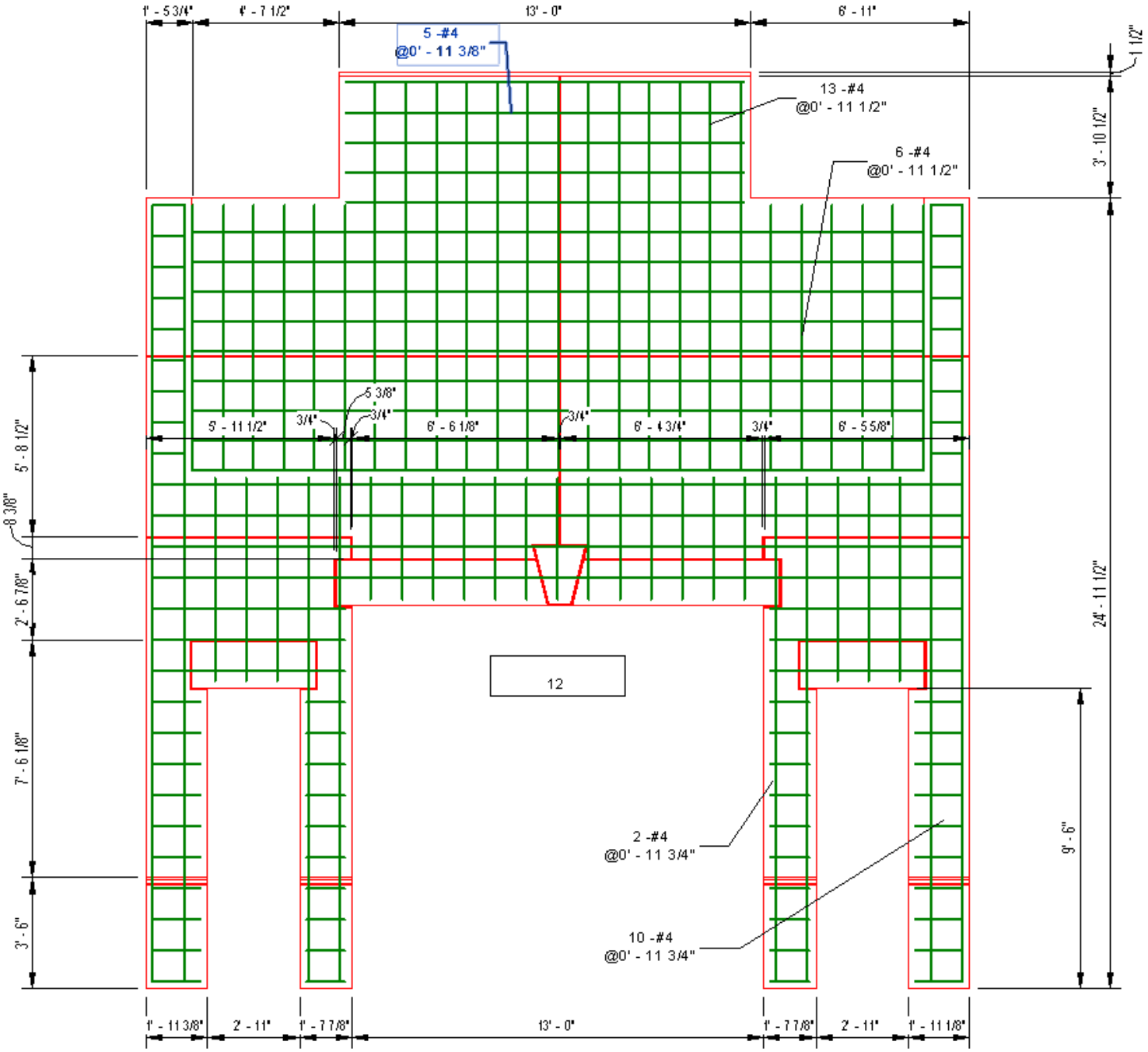


Lab 6 Steps (Creating Assemblies)

35	Open the Dr. Ali.rvt file. Navigate to the Center entry and select one of the walls parts. Then select Create Assemblies to create a wall assembly of these parts. (Name it the assembly **12**)	
36	Select Assembly and then select Edit Assembly. Like Groups you now you can add the rebar and other wall parts that were joined. Open up the front entry section to add the rebar, and bracing.	  
37	While assembly is still selected select Create Views and create multiple views, including Schedules. Note: Every item that is added to assembly can be scheduled; this is automatic, including sheeting a drawing. Navigate on the browser to the Assemblies, find Assembly 12 and look at all the assets associated to this assembly. (i..e sheets, ISO, Plan, Scheduled Take-off's.) Delete what you will not need.	 
38	Examine the Part Tag for the Front Entry panel. By including the Assembly number in the Part tag and tagging all the parts you can ensure each is assigned to an assembly. You can also pull Quantities from this tombstone. You can also give this a Phase ID that corresponds to you Construction Schedule.	**Intelligent Tags** Planning data can be captured in parts and assemblies.  These parameters can be consumed into Navisworks intelligently. **Note: Quantities = Schedule Duration**

Lab 7 - Documenting / Tagging Assemblies *(No Lab Exercise - Information Only)*

- Tag Rebar Segments / Spacing.
- Document Rebar layout, openings, and reveals from *Assembly Views.*



Lab 8 – Schedules; Rebar, Parts by Assemblies

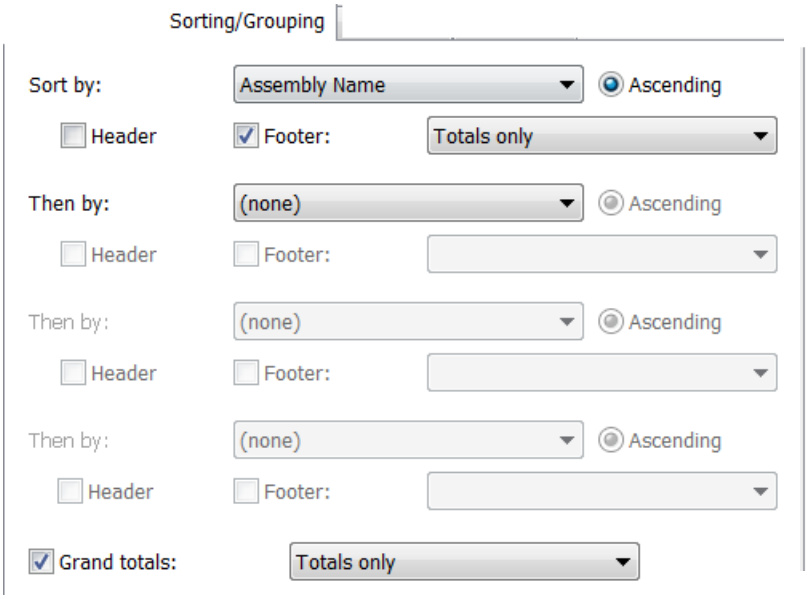
(No Lab Exercise - Information Only)

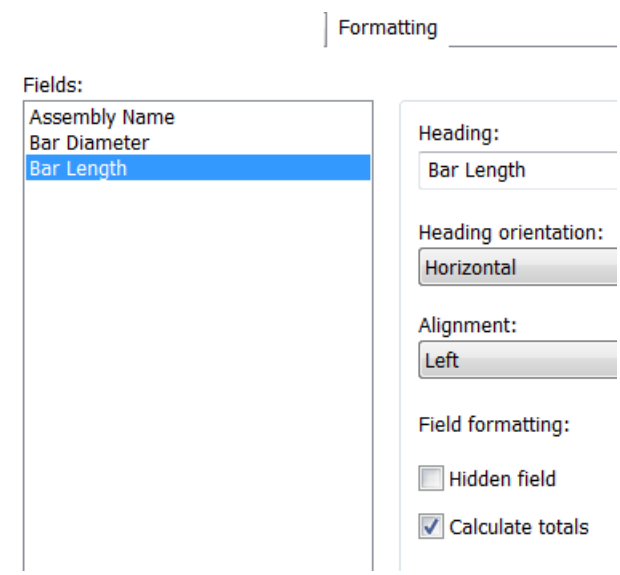
Rebar Schedule

Assembly Name	Bar Diameter	Bar Length
12	0' - 0 1/2"	416' - 4 1/4"
		416' - 4 1/4"
19	0' - 0 1/2"	464' - 3 1/8"
		464' - 3 1/8"
20	0' - 0 1/2"	516' - 0 1/4"
		516' - 0 1/4"
21	0' - 0 1/2"	74' - 6 1/4"
		74' - 6 1/4"
		1471' - 1 3/4"

Rebar Schedules

1. Not Included in Assembly Views (Separate)
2. Rebar schedules itemize every instance.
3. For QTO itemize by assembly name to estimate bar size length per assembly.
4. Sort by Assembly Name, provide totals by footer and give grand totals per Settings below.
5. All fields requiring tot als select calculate totals during formatting.





Scheduling Parts

- Create Schedules for Parts
- Associate with Assembly Name
- Sort by Material to break up into different materials.

Wall Parts

Assembly Name	Mark	Panel#	Area
Air			
			132 SF
Brick, Common			
19			5 SF
19			5 SF
19			5 SF
			81 SF
Concrete Masonry Units			
			132 SF
Concrete, Cast-in-Place gray			
	22		327 SF
023	23		471 SF
21	21		332 SF
20			237 SF
17	17		403 SF
19	19		159 SF
18			56 SF
			173 SF
			332 SF

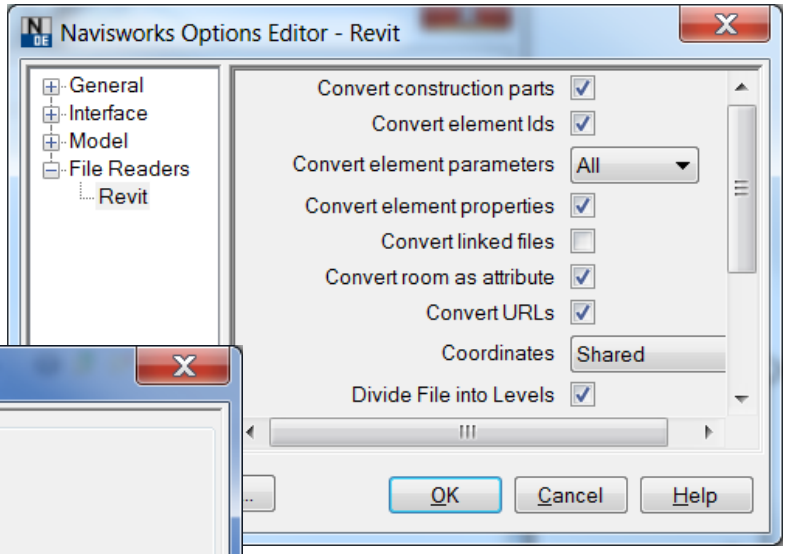
Additional Assembly Workflow Ideas

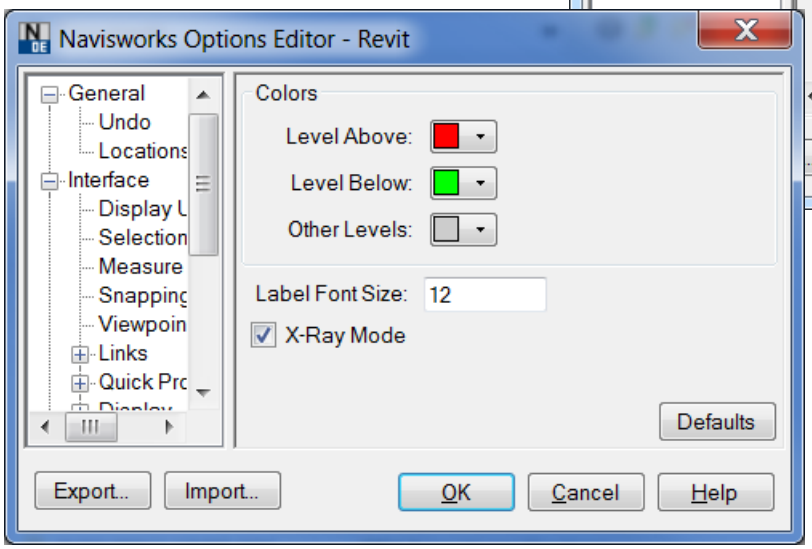
- Place & locate structural embeds plates from beams, joists, and braces into assemblies.
- Place & locate beam pockets into assemblies.
- Place and locate lift plates / devices for tilt-up and pre-cast walls into assemblies
- Locate & Place Bracing into assembles.
- Take all assembly components and add custom simulation parameter to consume in Navisworks.

Lab 9 - Consuming Revit Data to Automate Navisworks Manage

Setting Export Settings for Navisworks

- Select
  - Convert Construction Parts
  - Convert element Id's
  - Convert element properties (all)
  - Convert element properties
  - Coordinates (if defined select)
  - Divide File into Levels
- Grid settings



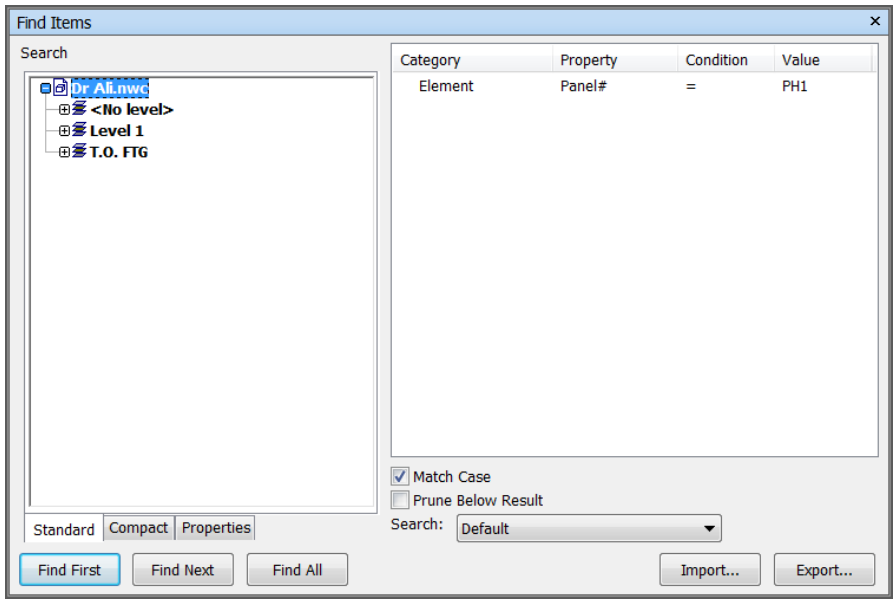


Note: Create an Export View for exporting Revit files to Navisworks nwc (Cache files)

Establish Default Search Sets

Use parameter based search sets to filter and consume Revit data to avoid manual set-up.

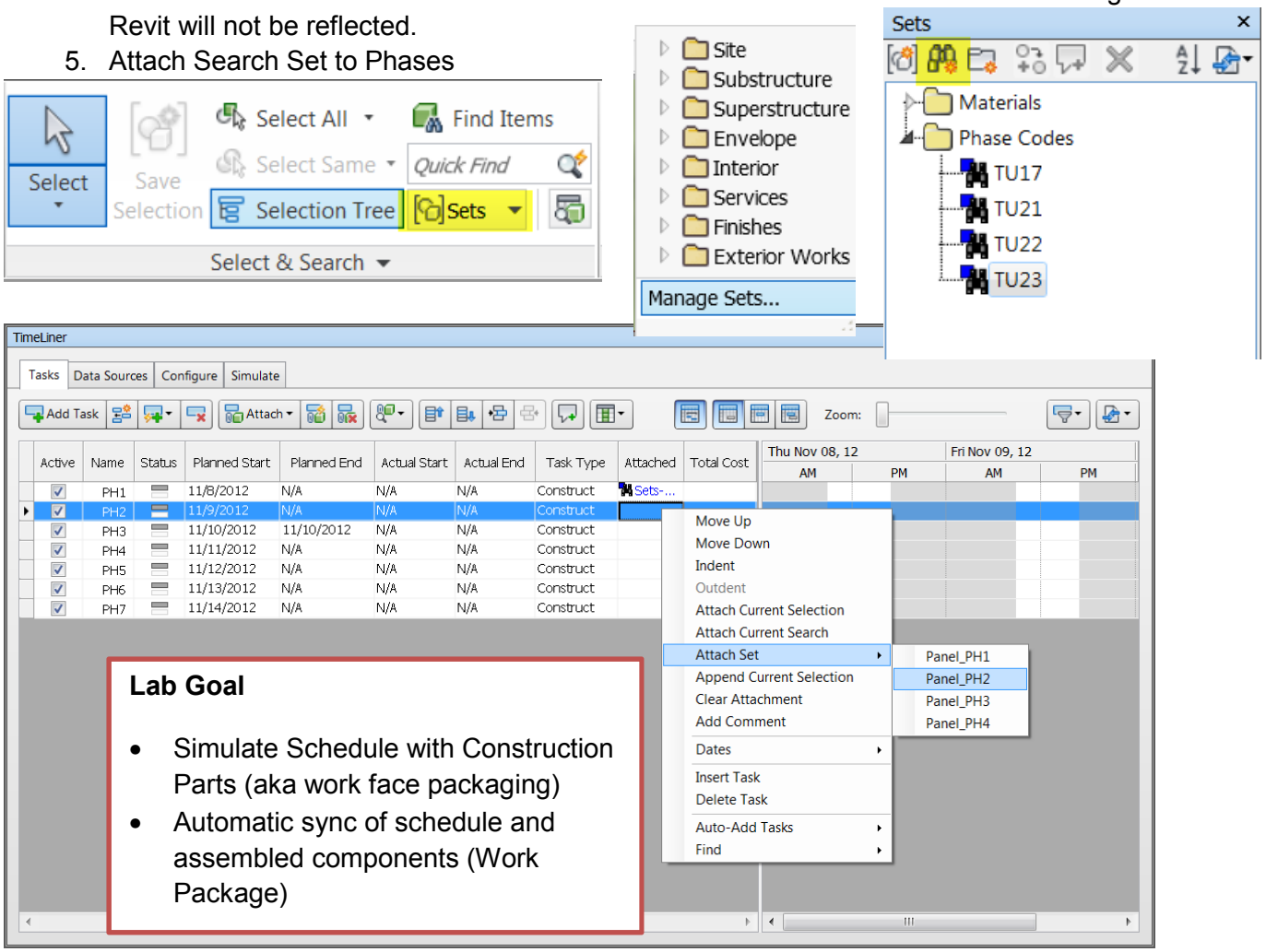
- Material Search
- Phase Code Search
- Misc. Filters



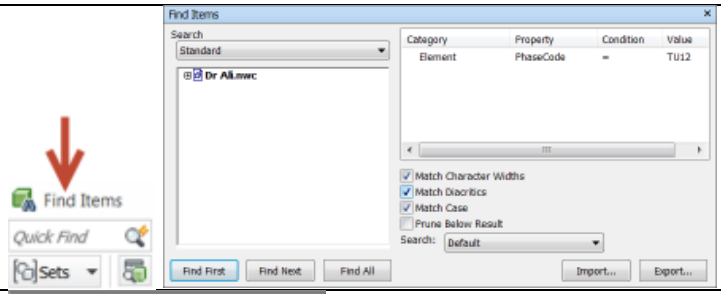
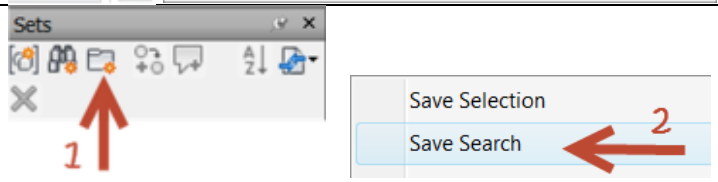
Workflow (Parametric Search)

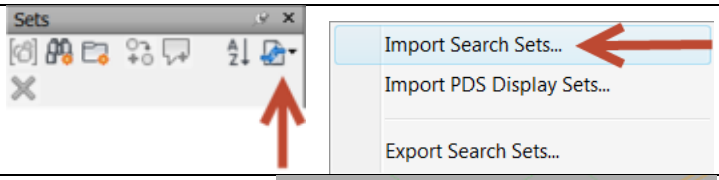
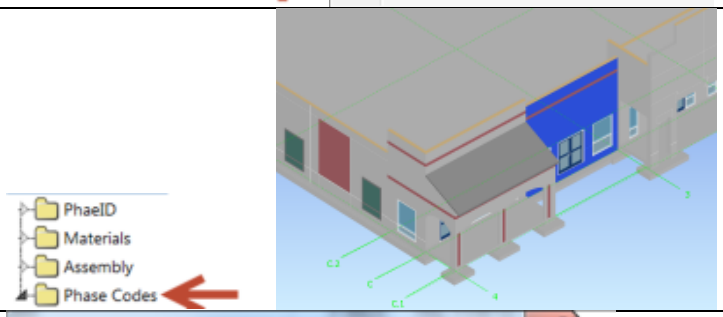
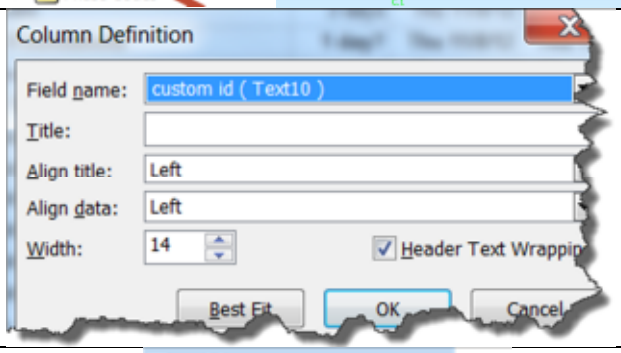
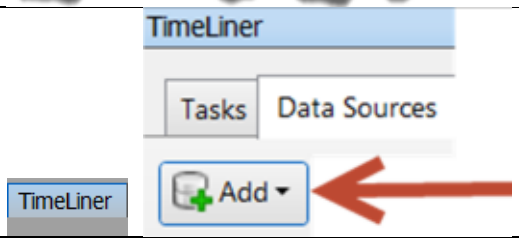
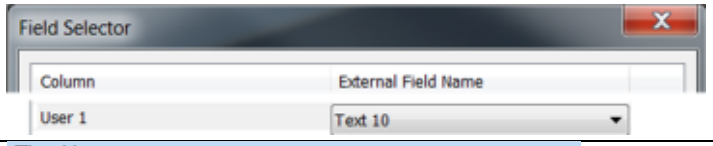
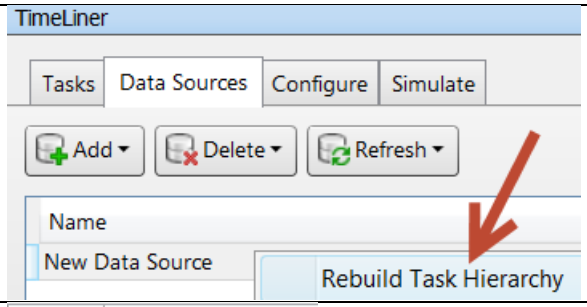
1. Use *find items* tool to search for Revit Parameters for category select *<Element>*, Property *<Parameter name>*, condition <=>, Value (select desired value)
2. Select find all (to verify selection.

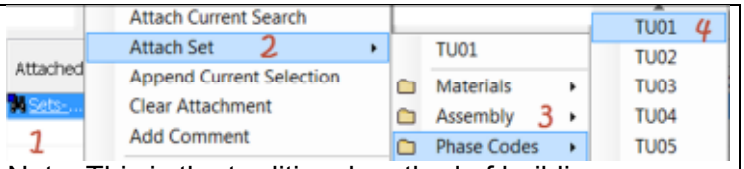
3. Open Sets - > Manage Sets
4. Select Save Search to save a search set. Note Do no Save a selection set as changes in Revit will not be reflected.
5. Attach Search Set to Phases



Lab 9 –Exercise (Consuming Revit Data to Automate Navisworks Manage)

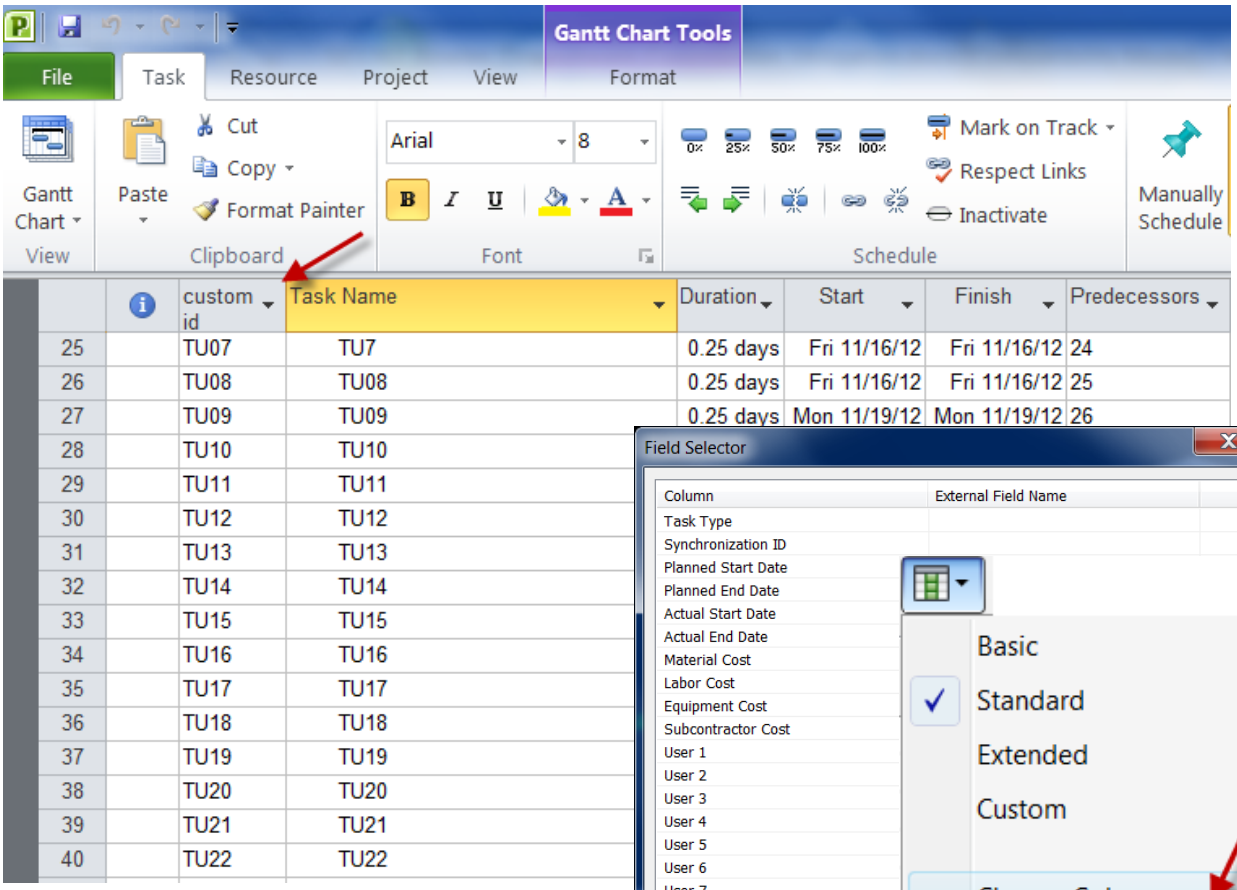
39	Open Navisworks Manage and open the Dr_Ali.nwf file. Open Find Items to establish a group of elements. For category select <element>, for property <Phase Code>, for Condition <=>, for Value <TU12>	
40	Open up the search Sets and create a new folder <PhaseID> Right Click -> Select Save search and drag drop into PhaseID folder.	

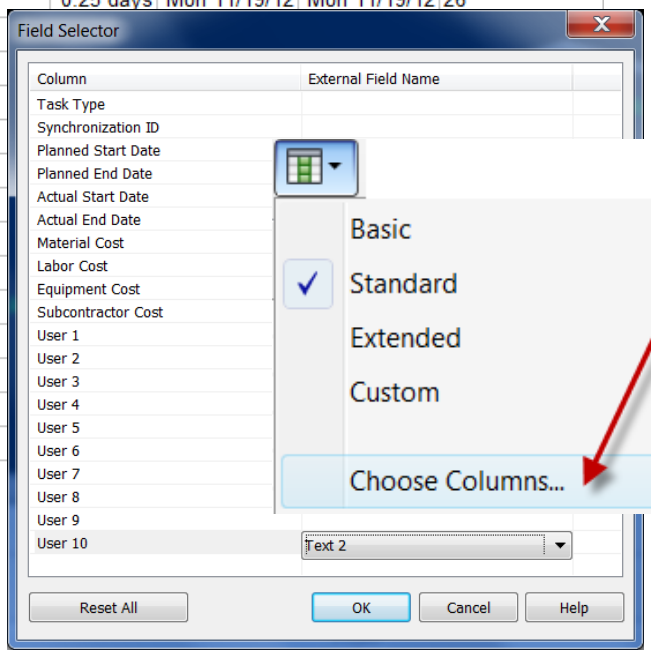
41	You can also import previously created search sets. Import the **TU PHASE CODES.xml**	
42	Go through the Folder of **<Phase Codes>** and verify selection of the different assemblies	
43	Open up Microsoft Project Open **Dr Ali.mpp** project schedule. Double click at the top of the custom id column to identify the custom field name. (Important for NavisWorks mapping)	
44	Back in Navisworks Manage &/or Simulate Select Timeliner tab at the bottom of the page and then select add MS Project 2007-2013. Select **Dr Ali.mpp**	
45	In the *Field Selector* navigate to **User 1** and select Text 10 to map the Custom field in MS Project into Navisworks to utilize.	
46	Right click on the *New Data Source* and select *Rebuild Task Hierarchy* to add this schedule to the tasks.	
47	Next you will want to move User1 column over near the task.	

48	Attach model elements against the search sets by matching *PhaseCode* parameter to the corresponding search sets. This would map each searched set to the item in the schedule.	 Note: This is the traditional method of building a schedule against model elements.

Lab 10 - Automating Simulation Selections

With the proper planning there can be synergy between Project Schedule and Shop Drawings / Revit Drawings. Depending on the planning software you can create a unique custom variable that can be also identified in Revit to map to the project schedule then automated through the Rules editor in Navisworks.

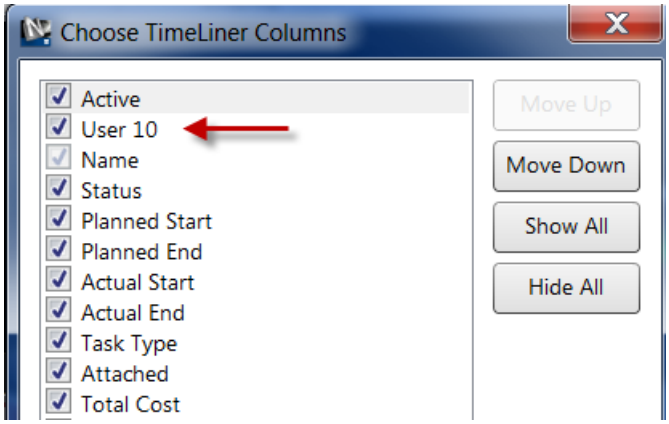




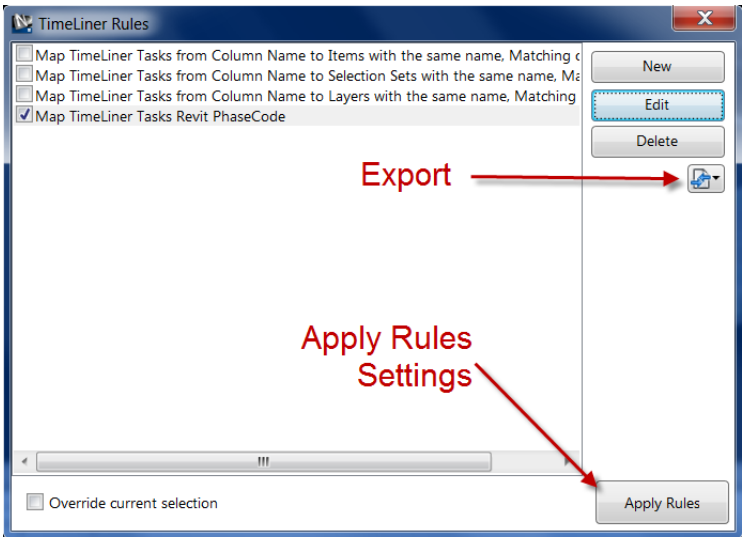
Create a custom Phase ID field in your project in whichever planning software you prefer.

Insert Parameter in Navisworks and move to front. First add project from schedule and select the preferred User Column for the Phase ID and map it to the External Field Name.(note: this may have been renamed in the planning software), you may need to find this through trial and error if you can't open the project planning software.

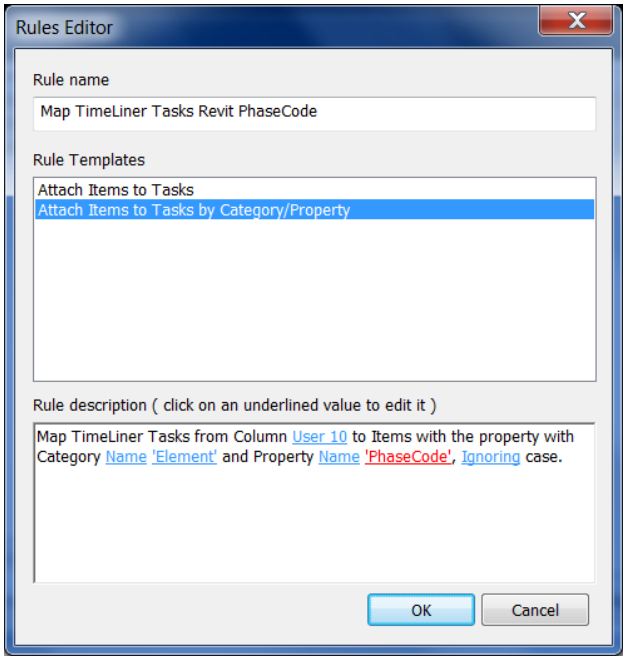
Choose Column for which you want to map the specific parameter. This tool is found on the timeliner task bar. This may automatically be added or may need to be added to existing projects.



Auto-Attach Using Rules will enable you to map the elements via parameter vs. creating individual search / selection sets. You will want to give it a name different than the other Auto-Attach rules.

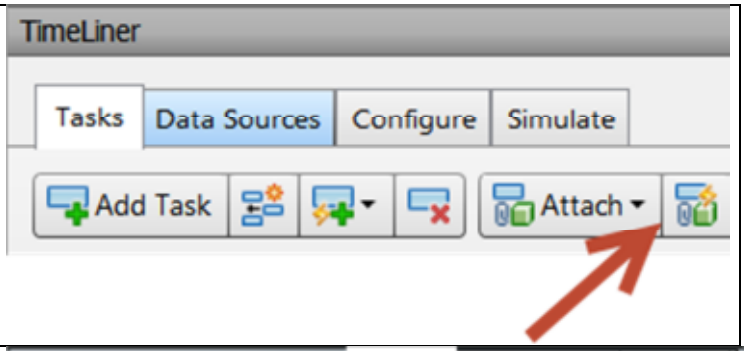
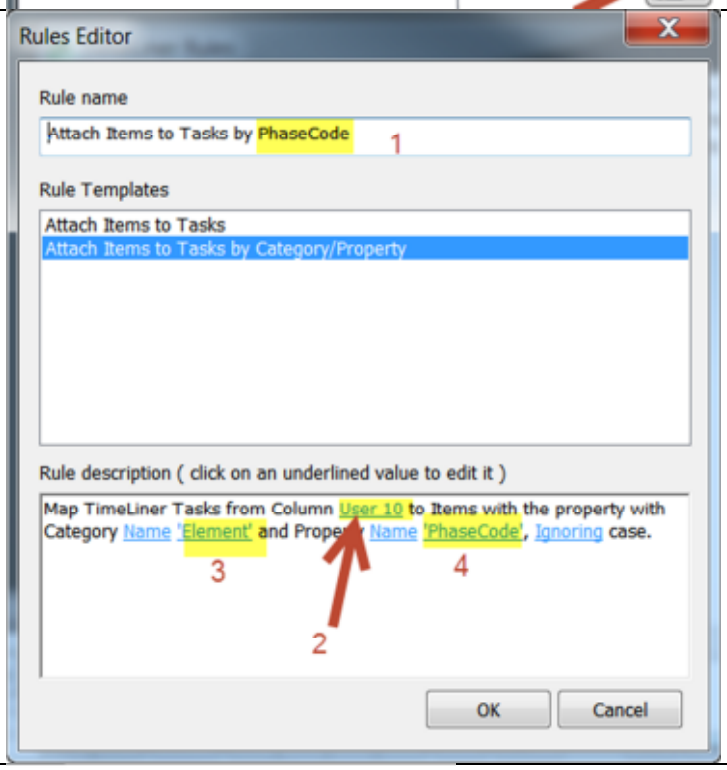
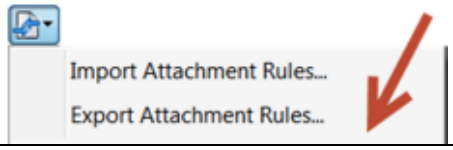


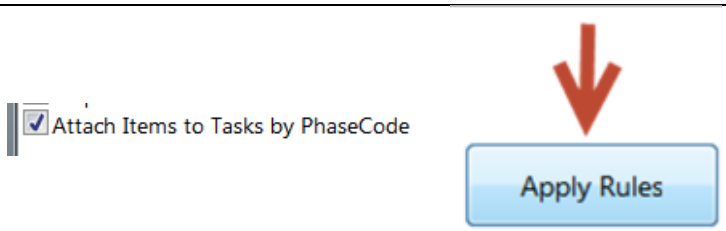
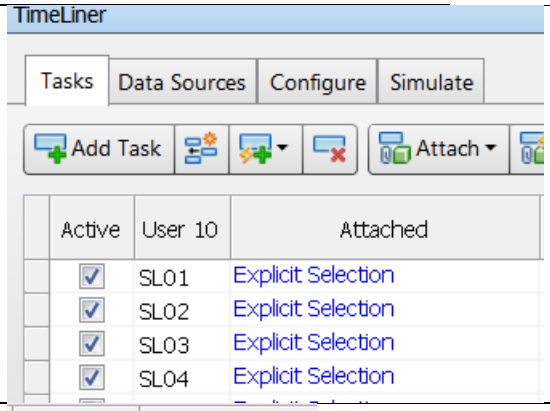
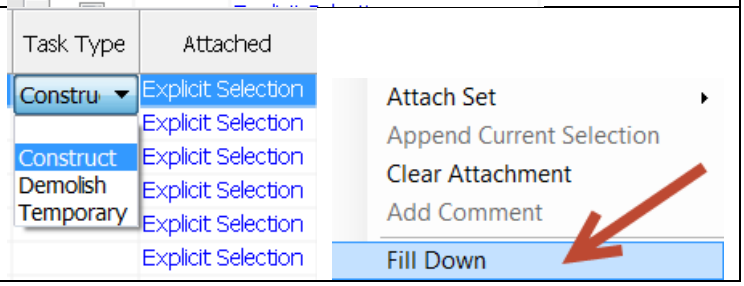
Use the Attach Items to task by Category / Property. You can select the Navisworks *Column* to map with specific properties (similar to find items with search name) This will automate the selection of items that have the previously identified parameters for PhaseCode in Revit. Once created *apply rule* settings. You may want to export these settings for future use or standardization in your organization.



Verify your Project Schedule to ensure that there are explicit selections and don't forget to make sure your task types are selected (i.e. Construct, Demolish, etc.)

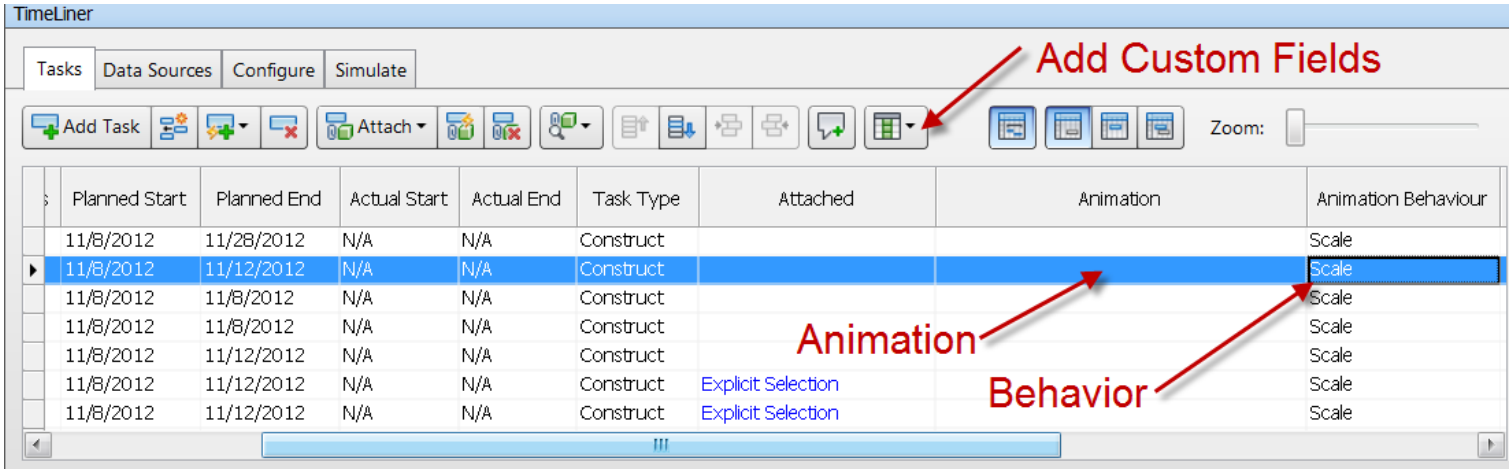
Lab 10 –Exercise *(Automate Simulation Selection)*

49	In TimeLiner we want to select Auto - attach using rules. Note: This will eliminate the need to create individual search / selection sets to map to scheduled items. As long as the parameters are the same, they will map.	
50	Select **New** to create a new Rule as one does not exist in this project.	
51	In the Rules Editor change:: 1. Change the *Rule name* to say Attach Items to Tasks by PhaseCode 2. Change the *Column* to be the Custom column that is being mapped from MS Project: User 10 3. Change the *Category* name to filter by Element. 4. Change the Property Name to “PhaseCode” This will create a new rule that can use this parameter information we used previously to create search sets that automatically map the elements to the schedule. Select OK to finalize the newly created rule.	
52	Select Export to export this rule for use in future projects. This creates an xml file that can be re-imported.	

53	To apply the rules to the schedule create a checkbox on the Rule and select Apply Rules	
54	Verify that the rules were applied to the schedule as mapped. Run the simulation to validate selection and logic. If you want to shuffle the deck, just change it in Revit and the changes will filter through in Navisworks.	
55	Go to the Task Type Column for the new selections and Select *construct*. Then shift select the other columns and select *fill down*. Simulate the schedule.	

Lab 11 Animate areas of greatest concern *(No Lab Exercise - Information Only)*

Many times animations can be a very trick and complicated avenue for simulation. Even though clients enjoy a good dog and pony show, it is important to demonstrate / animate areas of the greatest concern. This may be simulation of egress, 4D clashing, complicated areas, stacking / demolishing sequences, temporary construction etc. Logistical issues are not always shown in plans but should be not only demonstrated but somehow documented. Navisworks can communicate these weekly elements without the need of plans. Animations can be added to the construction schedule and are not always found on the schedule task bar, remember to add these to your schedule in these complicated areas or egress studies.



AU2013 Resources:

SE1588-L - **The Prolific Potential of Parts**

FB1846 - **Precast Concrete Industry Extensions for Autodesk® Revit® Structure 2014**

FB2971 - **Modeling Precast Concrete to a Shop Drawing Level Using Autodesk® Revit® Structure**

FB2457 - **Autodesk® Inventor® and Autodesk® Revit® Structure for Precast Structures**

SE1669 – **Generation of Rebar Objects Using Results from Analysis and Design**

SE3142-L - **Modeling Reinforcement and Creating Shop Drawings in Autodesk® Revit® Structure**