AUTODESK UNIVERSITY 2016

AR16698-L

Revit + FormIt 360 + Dynamo Studio = Awesome! – V1.1

Carl Storms – Senior Applications Expert
IMAGINiT Technologies

Learning Objectives

- Gain an overview of what's new with FormIt 360
- Learn how to use FormIt 360 as a team collaboration and design tool in real time
- Learn about the process to move from FormIt 360 into Revit
- Learn about the Dynamo Studio plus FormIt 360 Workflow

Description

This lab session will focus on some of the newer features of FormIt 360 mobile and web app, as well as tips and tricks to help with your Revit software and FormIt 360 workflow. With FormIt 360, you can create conceptual designs and massing studies right on your iPad, Android tablet, and phone (if you are daring), and on any computer with a web browser, or you can use FormIt 360 for Windows. You will learn tips and tricks to help with this design process, using some similar commands and processes you may already use in Revit software. This session will also look at what the cool and useful FormIt 360 Pro features enable, like real-time team collaboration on a design, whole-building energy analysis, and solar analysis. We will also explore the new Dynamo Studio software workflow within FormIt 360 for Windows. And we will spend some time focusing on taking your project from conceptual design all the way to construction documents with these 2 connected products (Revit software and FormIt 360 mobile and web app) without having to leave the RVT file format. This session features Revit and Dynamo Studio.

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Your AU Expert:

Carl Storms

Drawing on his nearly 20 years of experience in architecture, engineering, and construction, **Carl Storms** provides a practical and well-rounded understanding of Building Information Modeling (BIM) to clients. He's worked in residential and commercial architecture, as well as in construction, and he has over 5 years of teaching experience at the collegiate and industry levels. Beyond that, he's also done a bit of sales and marketing, which aid him in providing the business case for BIM to clients as well as helping them make the most of their collaboration, coordination, and design tools and processes.

Through implementations, instruction, mentoring, seminar presentations, whitepapers and more, Carl assists clients with the adoption of design technology and BIM processes. As someone who truly enjoys the process of building information modeling, Carl spreads his love of all things BIM via Twitter @theBIMsider, on his Blog www.thebimsider.com , or on Facebook at www.facebook.com/theBIMsider

Session Handout and Presentation

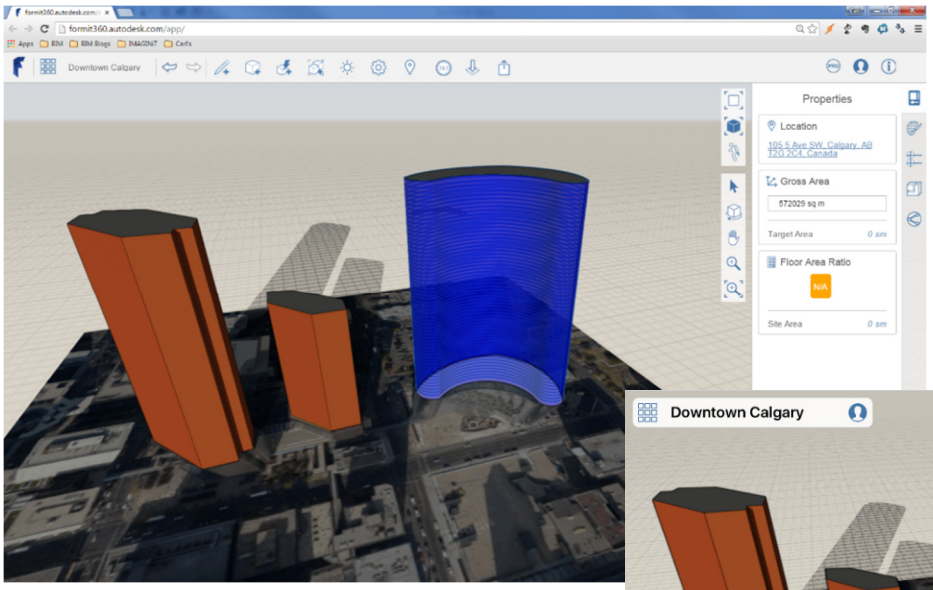
Get the most current PDF version of this handout and presentation using the Dropbox link below:
https://www.dropbox.com/sh/zg323ls3pi19tmw/AAAYpZbPiuGlHZeRS-cDqw3ra?dl=0

Table of Contents

FormIt 360

What is FormIt 360

Autodesk FormIt 360 can be used on the web, as a mobile app, or on your computer to help you capture building design concepts digitally anytime, anywhere ideas strike. Use real-world site information to help create forms in context and support early design decisions with real building data. Experience a continuous Building Information Modeling (BIM) workflow by synchronizing designs in the cloud for further refinement using Revit.

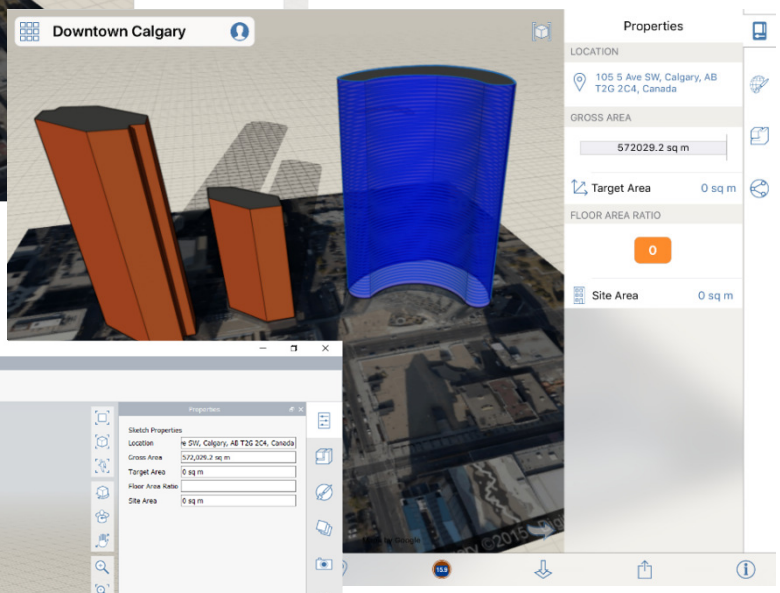


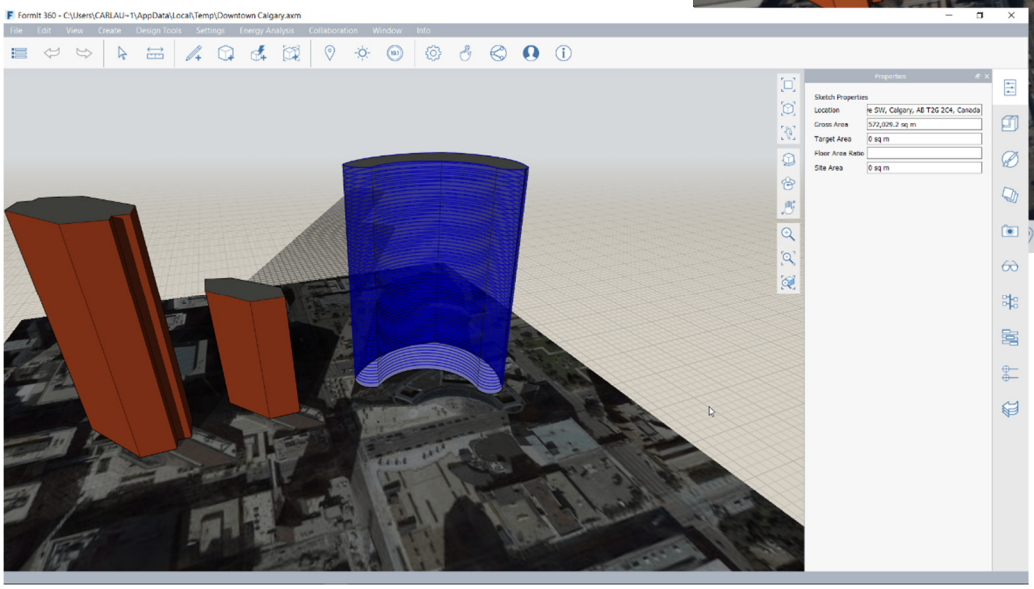
FormIt 360 Web

Running on Chrome Browser

FormIt 360 Mobile

Running iOS (iPad)





FormIt 360 Windows

Running on Windows 10 Laptop

How to get FormIt 360

- FormIt 360 comes for 3 platforms
    - Web
    - Mobile (iOS & Android)
    - Windows (Pro only)

FormIt 360 Web

- You can access FormIt 360 Web by browsing to the following web address: http://formit360.autodesk.com/
    - You can also find it by "Googling" FormIt 360
        - It should always be the top result
    - Works on the following Browsers:
        - **Recommended** for Chrome (33+) or Firefox (27+)
            - Is **OK** on Safari and Edge (new IE)
                - Does **NOT** work on Internet explorer (IE)

FormIt 360 Mobile

iOS

- This can be downloaded from the Apple App Store on your device, or from iTunes online
    - Autodesk FormIt 360
    - Requires iOS 8.0 or later

Android

- This can be downloaded from the Google Play App Store on your device, or from Google Play online
    - Autodesk FormIt 360
    - Requires Android 4.0 or later

FormIt 360 vs FormIt 360 Pro

- FormIt 360 comes in two pricing versions
    - Free (FormIt 360)
    - Paid (FormIt 360 Pro)
        - FormIt 360 Pro can be bought as a standalone subscription or is now available as part of the Autodesk AEC Industry Collection
- Both versions offer access to the web as well as both mobile apps (iOS and Android), however, the windows version can only be accessed with FormIt 360 Pro

FormIt 360

- The free version of FormIt 360 offers the following features
    - FormIt 360 for Web, iOS, and Android
    - 3D sketching, advanced geometry
    - Materials, layers, scenes

- Levels, area, location
- Revit import and export
- SketchUp import

FormIt 360 Pro

- The Paid version of FormIt 360 offers the same features as the free version, plus the bottom four additional ***features***
  - FormIt 360 for Web, iOS, and Android
  - 3D sketching, advanced geometry
  - Materials, layers, scenes
  - Levels, area, location
  - Revit import and export
  - SketchUp import
  - ***FormIt 360 for Windows***
  - ***Dynamo Studio integration***
  - ***Insight 360 analysis***
  - ***Autodesk material library***
  - ***Real-time collaboration***
- The cost depends on the subscription length you choose
  - Monthly = $40 USD
    - Paid Monthly
  - Quarterly = $115 USD (works out to about $38.33 per month)
    - Paid Quarterly
  - Yearly = $300 USD (works out to about $25 per month)
    - Paid Yearly

NOTE: pricing current as of Oct. 10th, 2016.

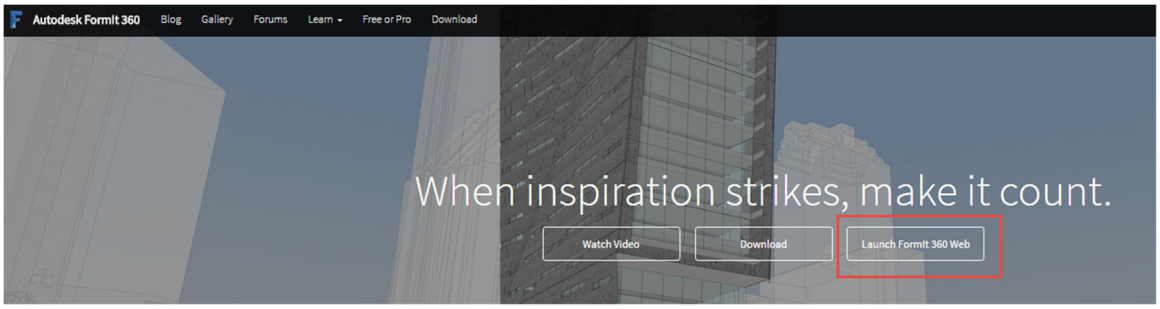
Mobile vs. Web (Battle of the Free)

- The FormIt 360 web version is the most powerful version of the two
  - It has the most features
  - It is also generally where new features appear first
- The FormIt 360 Mobile app for iOS is not as powerful as the web, but getting closer with each update
  - Missing some features and toolbars from the web
    - Does have most of the context menu options
  - New features for the Mobile platform appear on iOS before Android
- The FormIt 360 Mobile app for Android is the newest of the 3 options, and also the least powerful, however, frequent updates are making improvements
  - Missing some of the mobile features that are available on iOS
    - Does have most of the context menu options, that are available on the iOS version

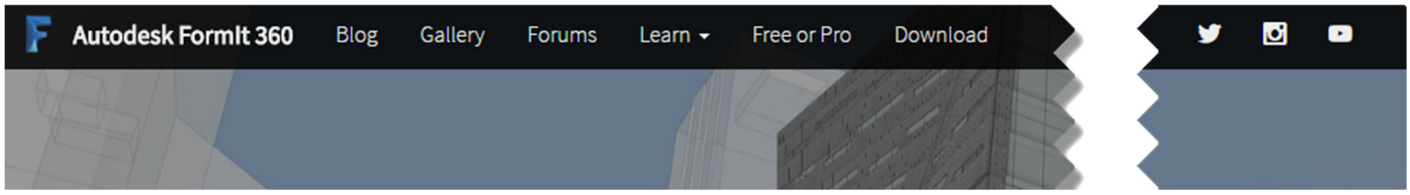
NOTE: The Windows version is the most powerful overall, but also only available as a Pro feature

FormIt 360 Overview

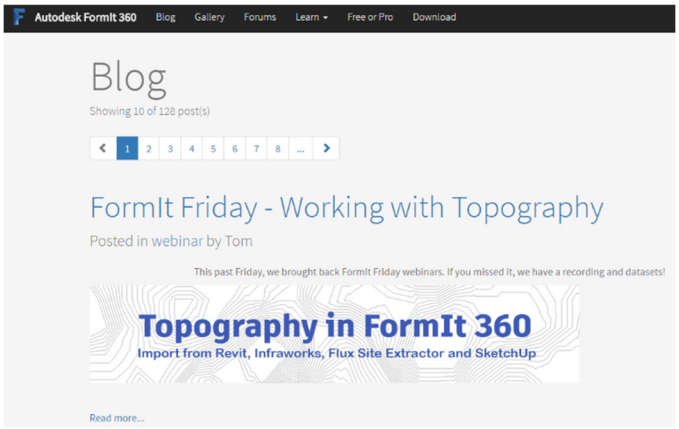
- Website: http://formit360.autodesk.com/
    - Can also just “Google” FormIt 360
    - Works on the following Browsers:
        - Recommended for Chrome (33+) or Firefox (27+)
            - Is OK on Safari and Edge (new IE)
                - Does NOT work on Internet explorer (IE)
    - You can launch the web version right from the landing page for the website



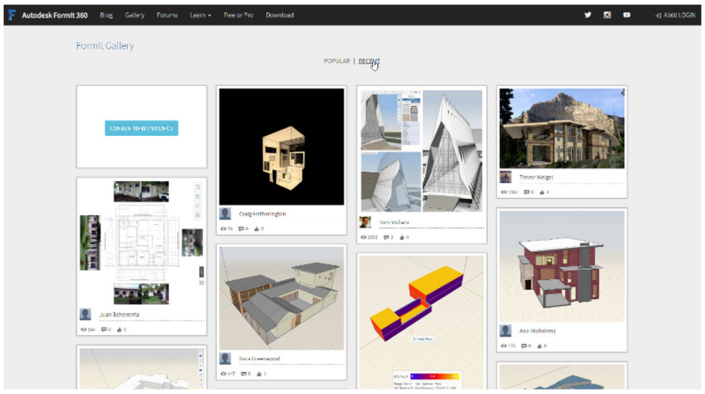
    - The webpage has 6 tabs across the top, as well as 3 social media icons for Twitter, Instagram & YouTube.



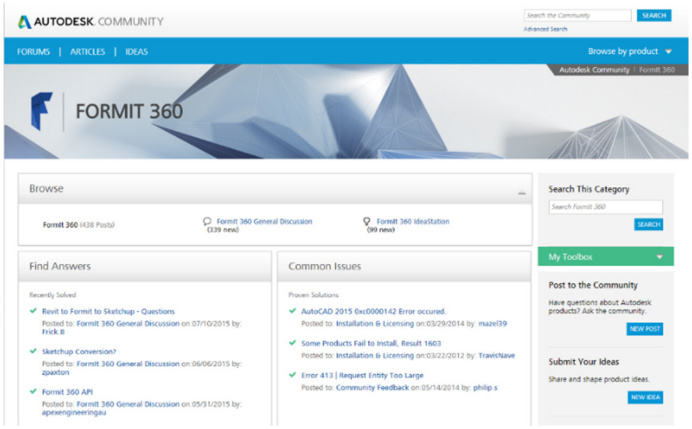
        - **Blog**
            - Takes you to the FormIt360 Blog



        - **Gallery**
            - This gives you access to the global gallery of FormIt 360 projects upload by users to the website

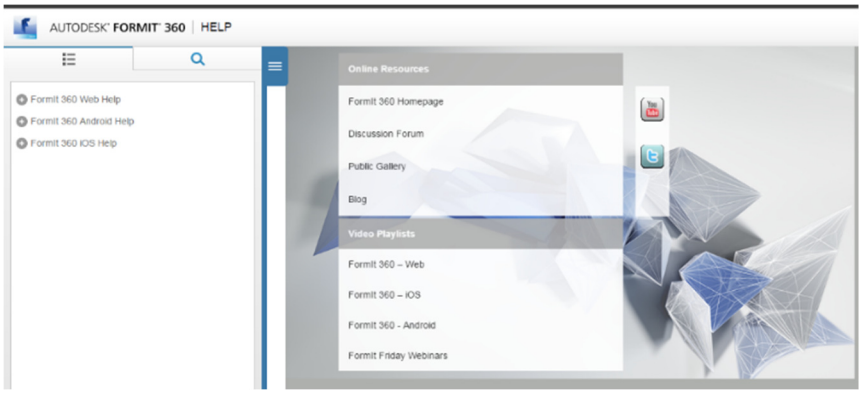


- **Forums**
  - This is a dedicated forum for all thing FormIt moderated by Autodesk



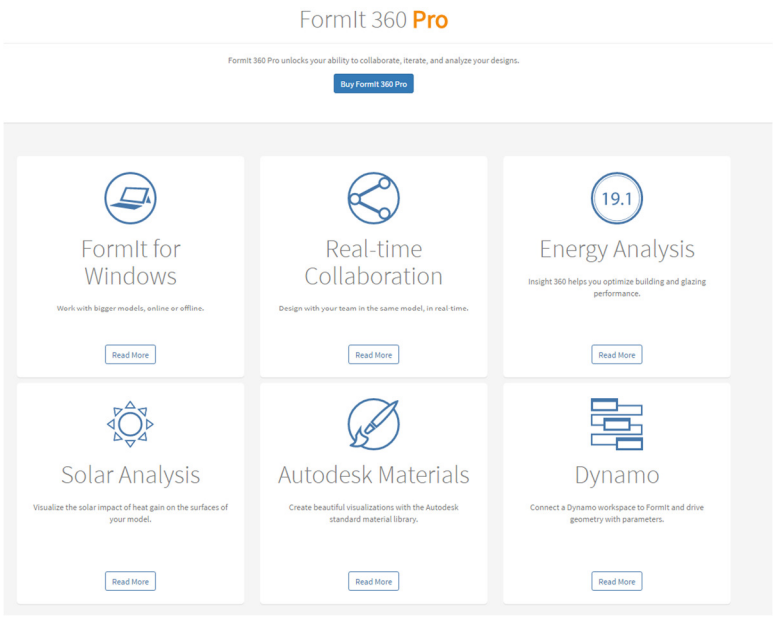
- **Learn** (this tab has 5 sub-categories)
  1. Video Tutorials
     - This will launch a series of 22 FormIt Snippets video direct in your browser

  2. Help Content
     - This is the help site for FormIt 360
     - It also has links to the FormIt 360 YouTube and Twitter sites.



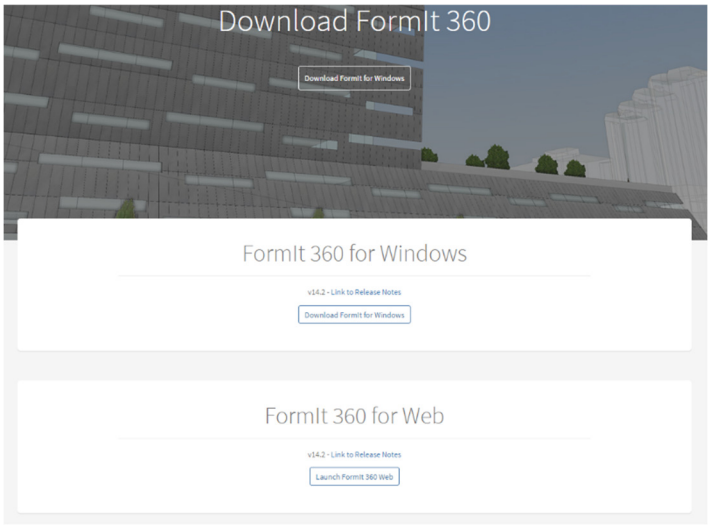
3. FormIt 360 + Revit
   - Your one stop location for all you need to know about FormIt 360 + Revit, includes workflows and downloads
4. FormIt 360 + Dynamo (Pro Feature)
   - Your one stop location for all you need to know about FormIt 360 + Dynamo, includes How to tips, and downloads
5. FormIt Friday Webinars
   - Where you can sign up for upcoming FormIt Fridays, as well as view past FormIt Friday videos

- **Free or Pro**
  - Information about the two purchase options for FormIt 360

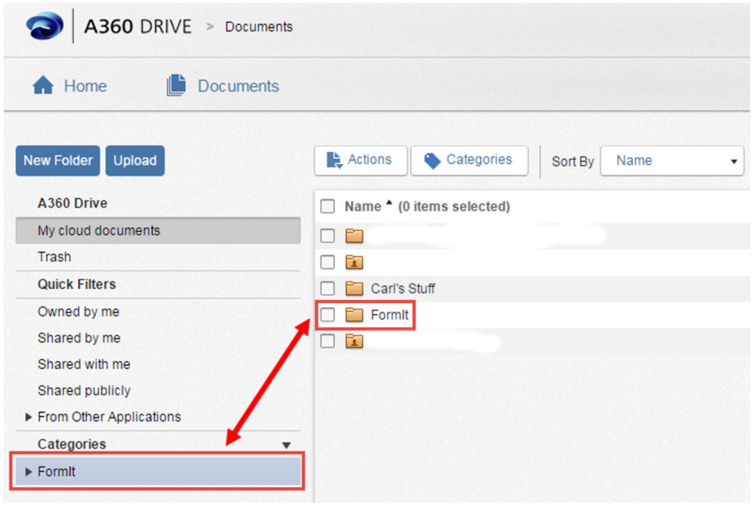


- **Download**
  - This is your one stop shop for all your FormIt 360 Download needs
    - FormIt 360 For Windows
    - FormIt 360 For Web (launch not download)

- FormIt 360 for iPad
- FormIt 360 for Android
- FormIt 360 for Revit (FormIt 360 Converter add-in)



- **A360 Login**
  - This logs you into your A360 Account
    - You need an A360 Account to use any version of FormIt 360 because <u>your</u> files are stored in the cloud in your A360 Drive account
  - The files from FormIt 360 are automatically saved in your A360 Drive account in 2 formats
    - **.axm** – this is the native FormIt 360 file format
    - **.rvt** – it also saves a converted version that can be opened in Revit



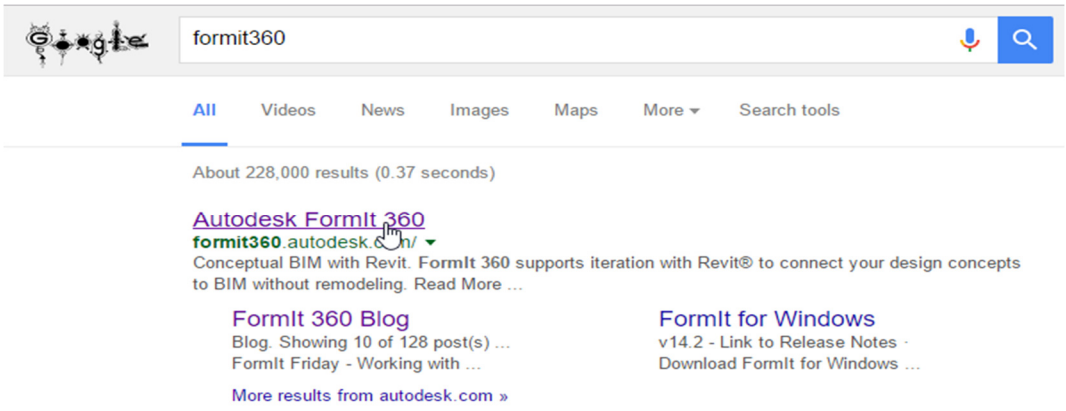
Exercises

Ex 1) Location

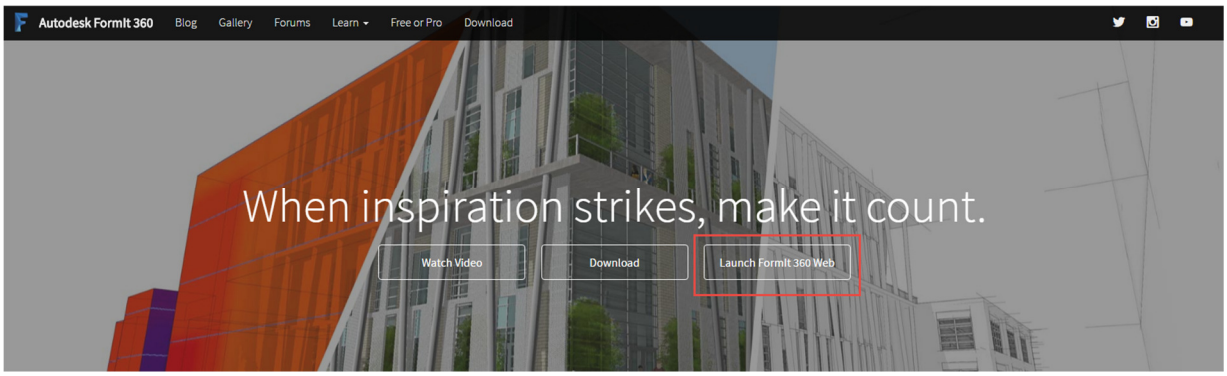
In this exercise, we will begin the process of creating a project in FormIt 360. For this exercise, we will be using FormIt 360 Web.

Task 1

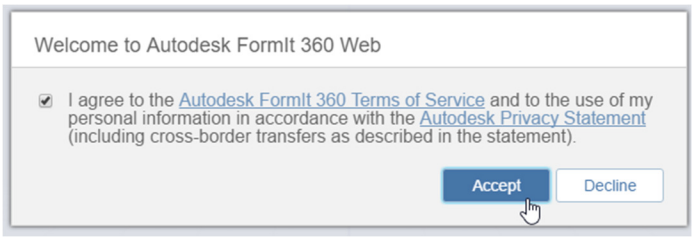
1. Begin by opening the Google Chrome web browser, and typing in "FormIt 360" in the search bar and hit enter. Then select the Autodesk FormIt 360 site (which is normally at the top of the list). You can also enter the web address: http://formit360.autodesk.com/ to reach the FormIt 360 Site.



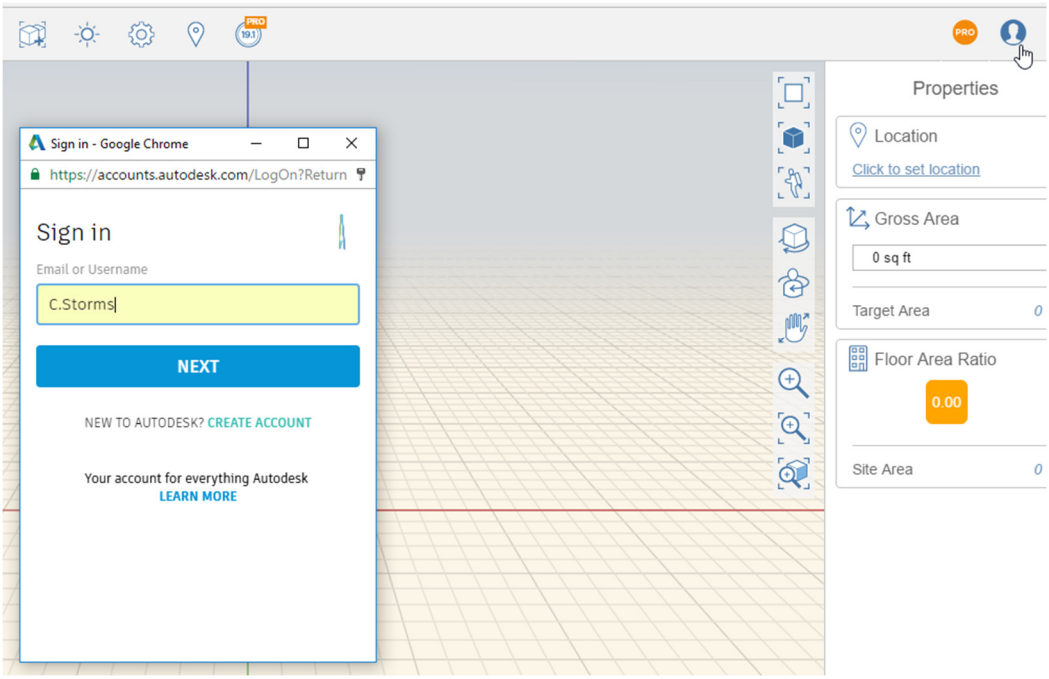
2. To launch FormIt 360 select the "Launch FormIt 360 Web" button from the landing page.



3. Accept the Terms of Service, and close the "What's new" & "Try FormIt 360 Pro" pop-ups.



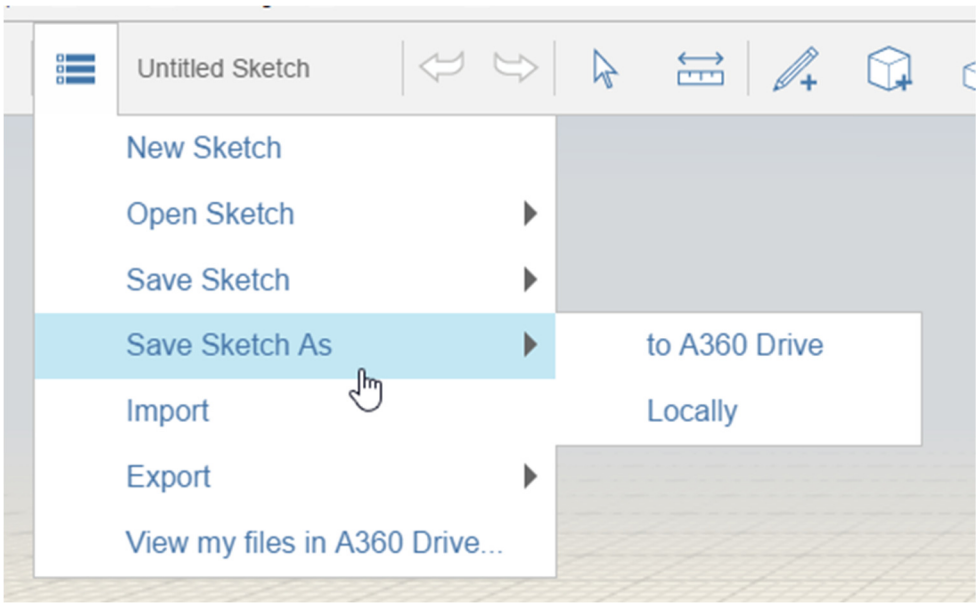
4. If you have an Autodesk ID, then you can sign in to save your work to your A360 Account. If you don't have an Autodesk ID that is fine, you can save your work locally on the computer desktop.



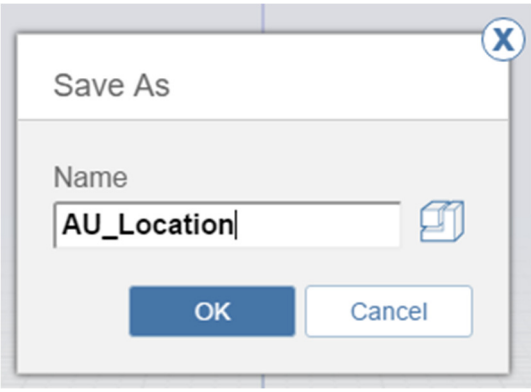
5. The first thing we will do is save the project using the name "AU_Location".

6. Select the menu icon

7. Then choose "Save Sketch As" and select your choice. If you don't have an Autodesk ID you will have to select "Locally".



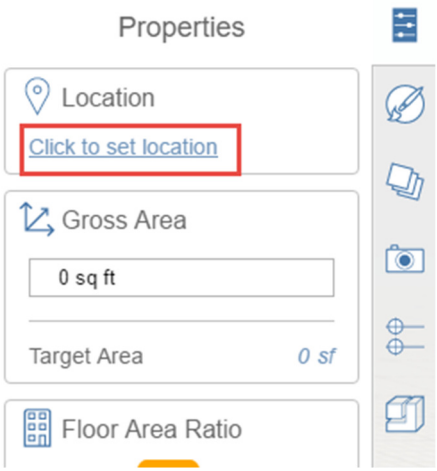
8. Enter the name “AU_Location” in the **Save As** dialog box.



Task 2

In this part of the exercise, we will set the project location. You can continue using your project from the previous task, or you can open **“AU_Location_T2_Start”** from the **Ex 1 folder** in the lab data set.

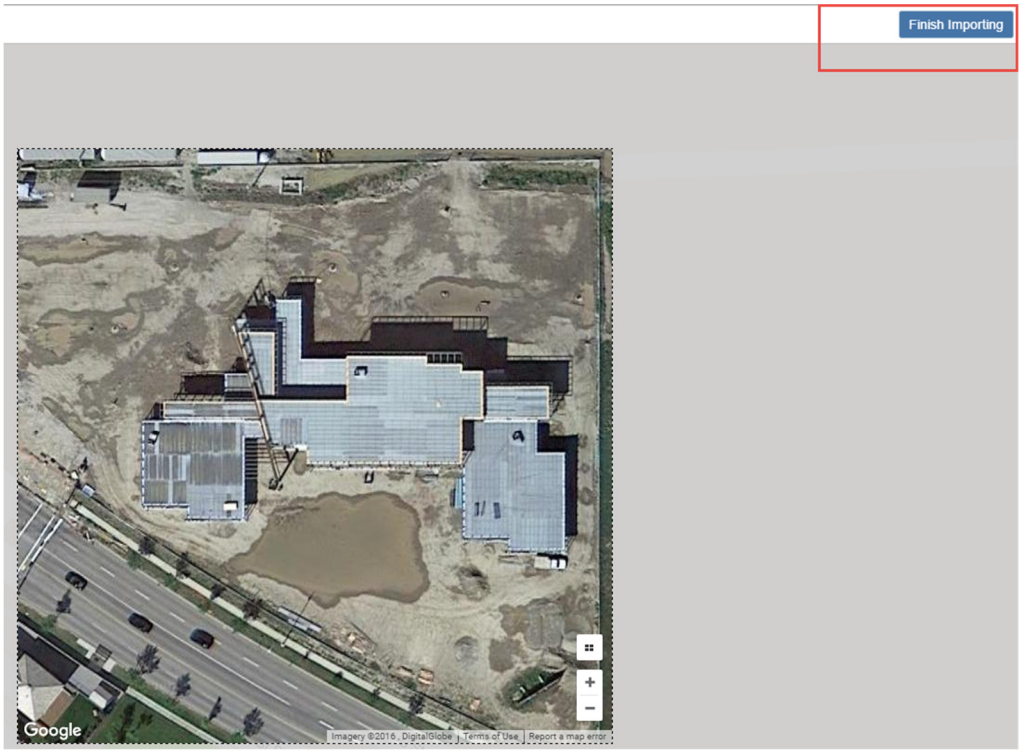
1. To set the project location we can “Click to set location” in the **Properties** tab on the right side of the screen.



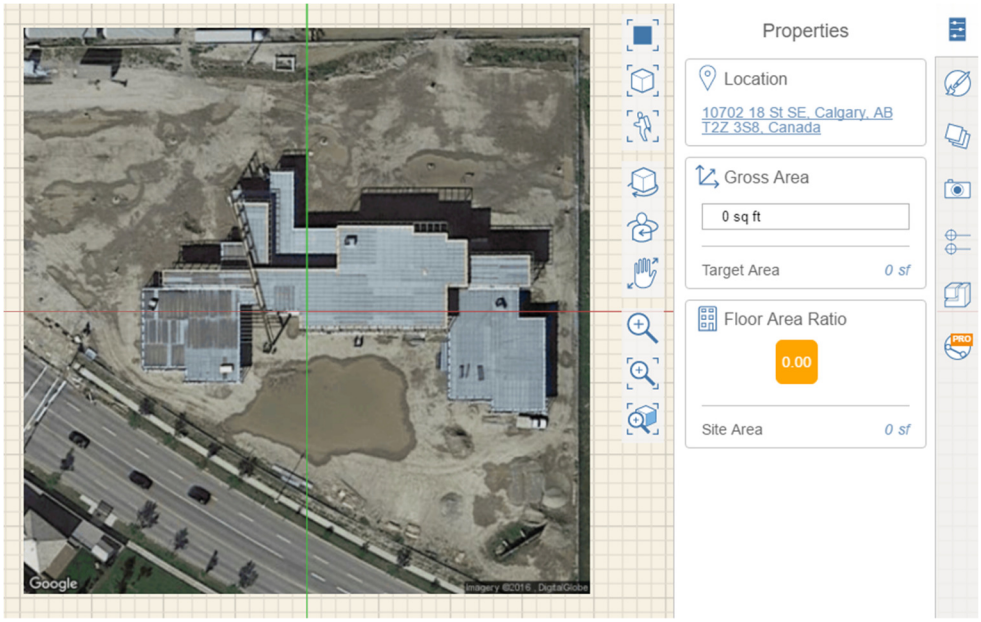
2. Next, we will enter the project address in the “Search…” window, then select “Import Satellite Image”.
   - The address to enter is: **10702, 18th Street SE, Calgary, AB, T2Z-3S8**

   Note: If you are not signed in with an Autodesk ID you won’t get any weather data.

3. Once the satellite image is visible you will need to resize the square around it to make sure the correct about of the image is visible. We want the image to show the complete building as well as the line of the fence at the top and right of the image. Once the image is cropped correctly select "Finish Importing" to bring the image into the project.



Once the image is on your project you should have something that looks like the image below.

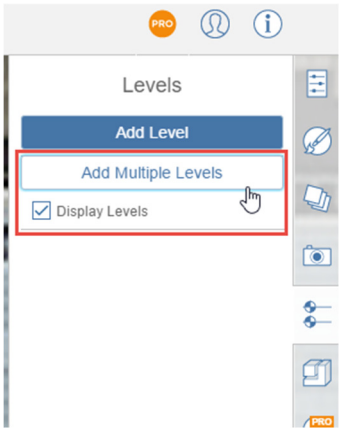


4. Now save the project locally.

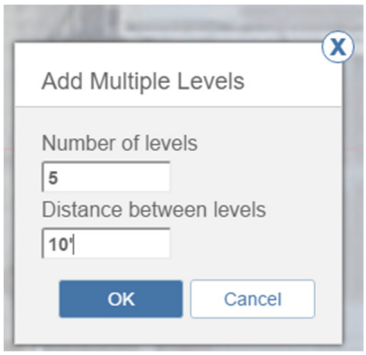
Task 3

In this part of the exercise, we will prep our project by setting levels and adding layers. You can continue using your project from the previous task, or you can open **"AU_Location_T3_Start"** from the **Ex 1 folder** in the lab data set.

1. We will begin by adding levels to our project, these levels will be carried over to Revit with the FormIt 360 model later one. Select the "Levels" tab on the right side of the screen, and choose **Add Multiple Levels.**

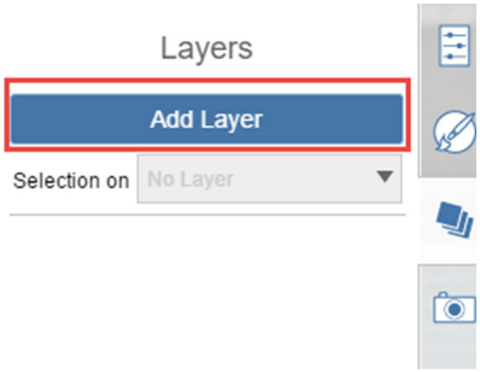


2. Create 5 levels that are 10' apart.

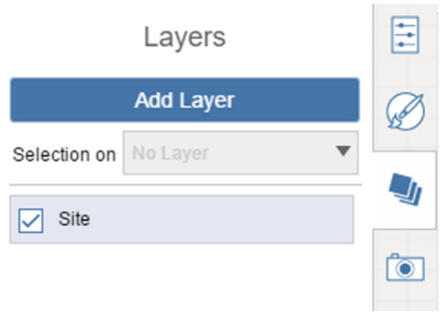


3. Now that the levels are created we can change the name and height of each level as needed by clicking on it. Update the level names and heights to match the image below.

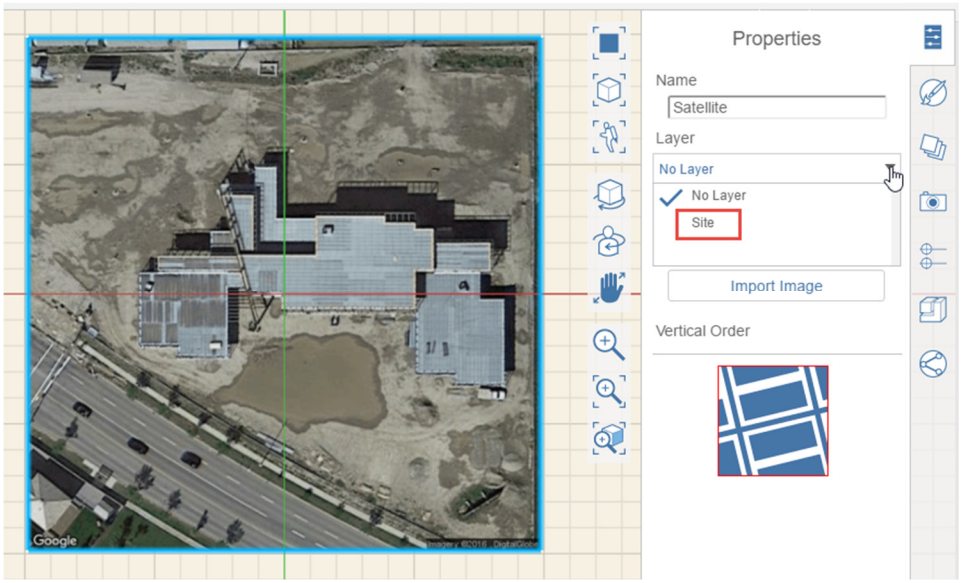
4. Next, we will add some layers to our project. Layers give you the ability to turn the objects that are part of a layer on and off in the project. We can begin by selecting the "Layers" tab on the right of the screen and choosing **Add Layer.**



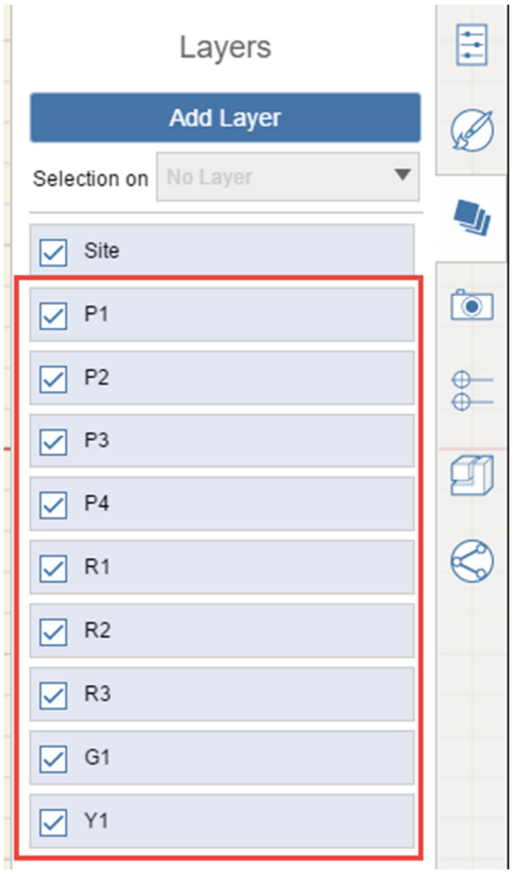
5. Name the first layer "Site"



6. Next, using the "select" icon  from the ribbon, we will select the background image. You can also select the image by double-clicking on it. Sometimes selecting an image can be difficult, using a window selection or picking an edge can help with this issue.
7. Once the image is selected go to the "Properties" tab and choose the *Site* layer from the **Layer** drop-down menu.



8. Now we will create some additional Layers that will be used during the project. Please add all of the following layers after “Site” in the image below.



9. Save the project locally.

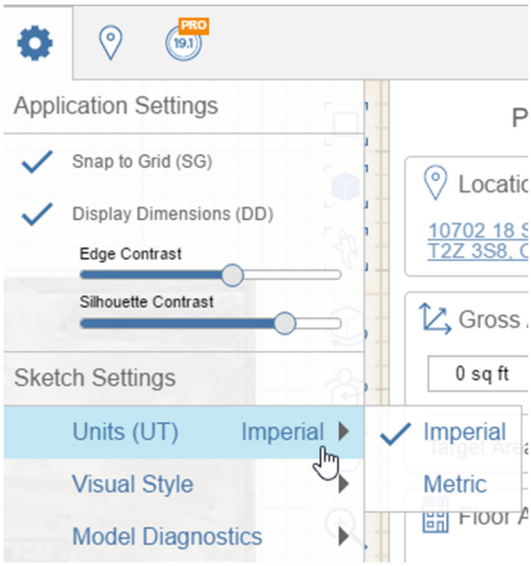
Ex 2) Building

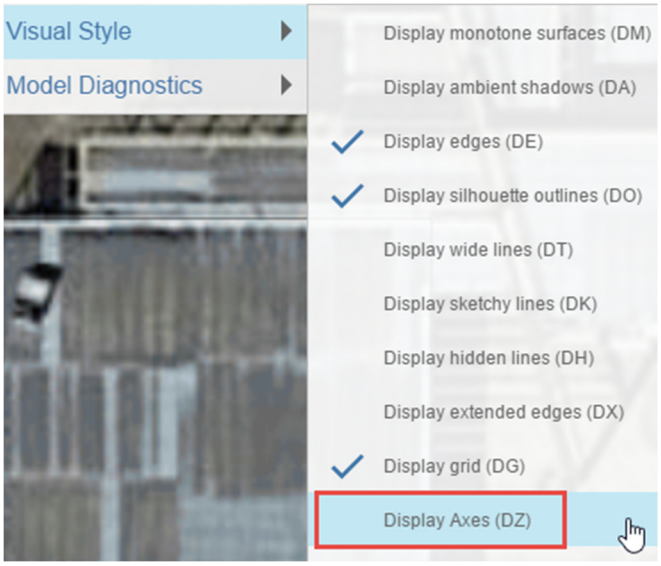
In this exercise, we will continue with our FormIt 360 project by creating the forms that will become our building. For this exercise, we will keep using FormIt 360 Web.

Task 1

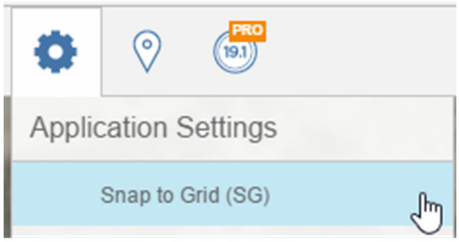
We will begin this task by using the imported Satellite image to trace and start creating our project building. You can continue using your project from the previous exercise, or you can open **"AU_Building_T1_Start"** from the **Ex 2 folder** in the lab data set.

1. We will begin by making sure our project units are correct for this project. Select the "Settings" icon  from the ribbon and confirm the Units are Imperial. While in 'Settings" you may also want to turn off the **Display Axes** to make your view a little cleaner (you can also use the Keyboard shortcut DZ).

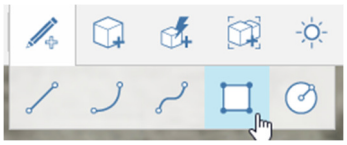




2. Now while still in the Settings tab also make sure the **Snap to Grid** is off, this can also be done by the keyboard shortcut **SG.** We will turn the Snap to Grid back on after we make our first shape.

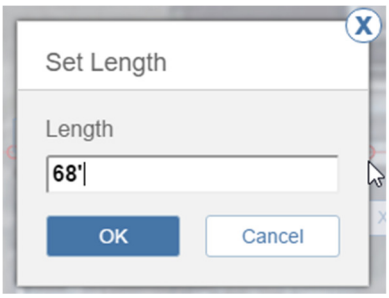


3. Let's begin by drawing a square for the bottom left corner of the building. Select the "Create Sketch" icon  to open up the drop-down menu. From the drop-down menu pick the "Rectangle" icon or us the keyboard shortcut **R**.

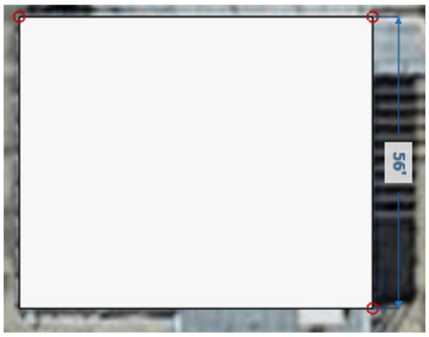


4. Start the rectangle in the corner as shown below.

5. Click on your starting location, and then move your cursor straight right. You will see a dimension displayed as well as a red line to let you know you are on the X-axis. Once you know you are on the X-axis hit the "Tab" key to bring up the **Set Length** dialog box, set the length to **68'.**

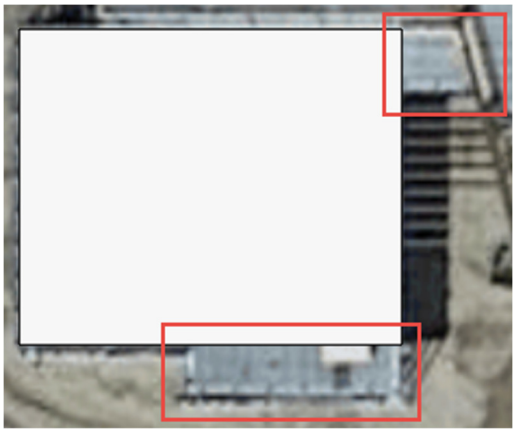


6. Continue creating the rectangle by moving your cursor straight down. You will see a dimension displayed as well as a green line to let you know you are on the Y-axis. Once you start moving the cursor down you can hit the "Tab" key again to enter a length of **56'.** When you are finished you will see a solid white rectangle.



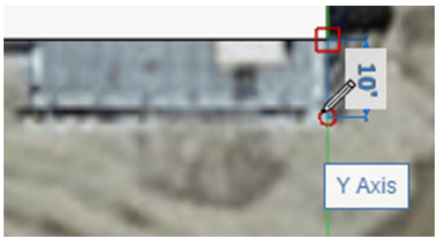
7. At this point we want to turn the “Snap to Grid” feature back on, to do this use the keyboard shortcut **SG**.

8. What we created is going to become the part of the building that goes on our “P1” layer from earlier. However, this section is not a rectangle so we still need to add two more areas to our rectangle before it is finished.



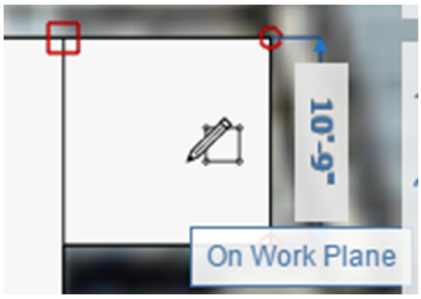
9. First, we will add the bottom area to the rectangle we just created. Select the “Create Sketch” icon  to open up the drop-down menu. From the drop-down menu pick the “Line” icon or use the keyboard shortcut **L**.

10. Pick the bottom right corner of the shape we just created, and draw a line straight down the Y-axis **10’.** Note the red square you see when you pick on the corner vertex of the existing rectangle.

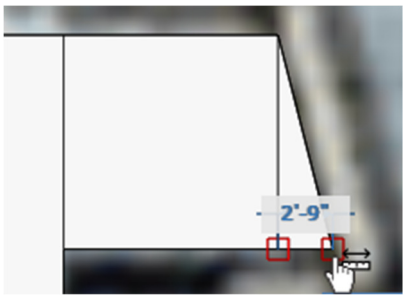


11. Finish drawing the shape by going **38’** straight left on the X- axis. Then **10’** straight up on the Y-axis again to finish the shape.

12. Now we will use a rectangle and a triangle (made with the line command) to finish our “P1” area in the top corner. Begin by using the rectangle command (from the ribbon or type **R**) to create a 10’9” square.

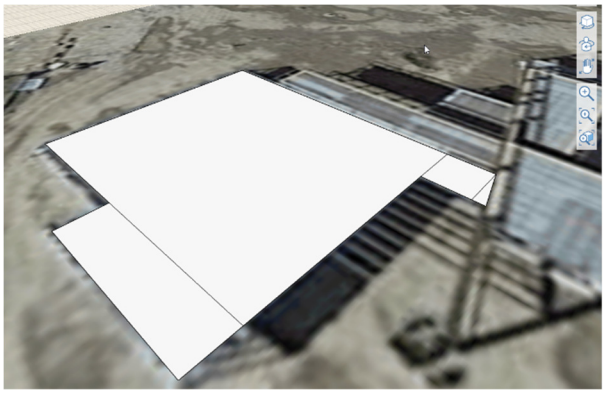


13. Then using the line command to draw a **2’9”** line from the bottom right corner of the square we just made moving right along the X-axis. Then finish the triangle by connecting the end of the line to the top right corner of our square.

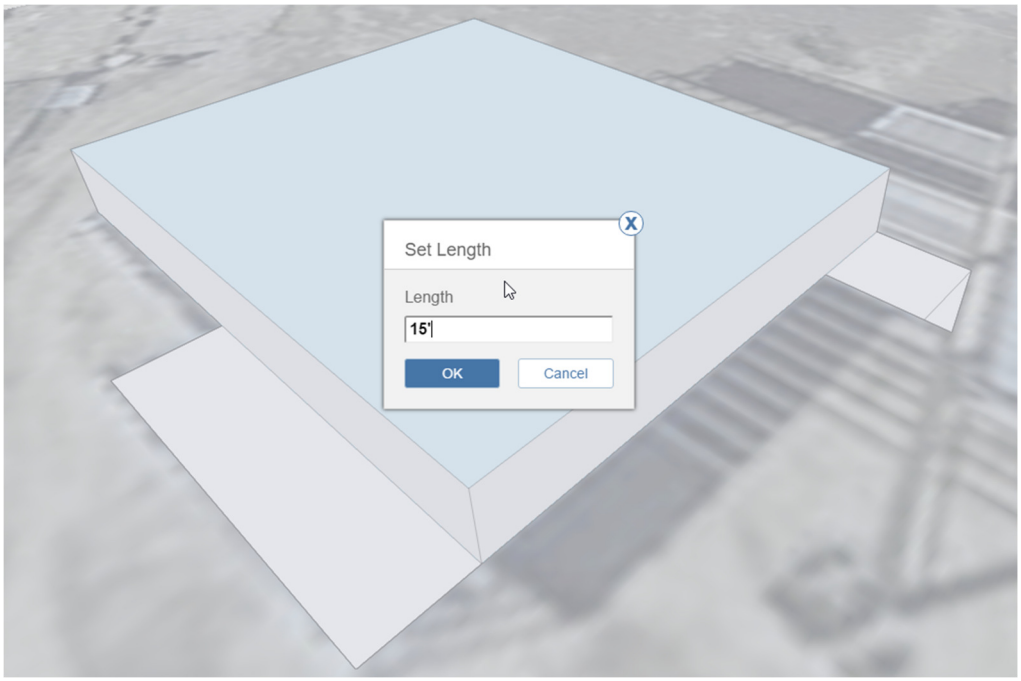


14. We now have all the parts of “P1” as four flat shapes. Now we need to give our shapes height and turn them into a single shape.

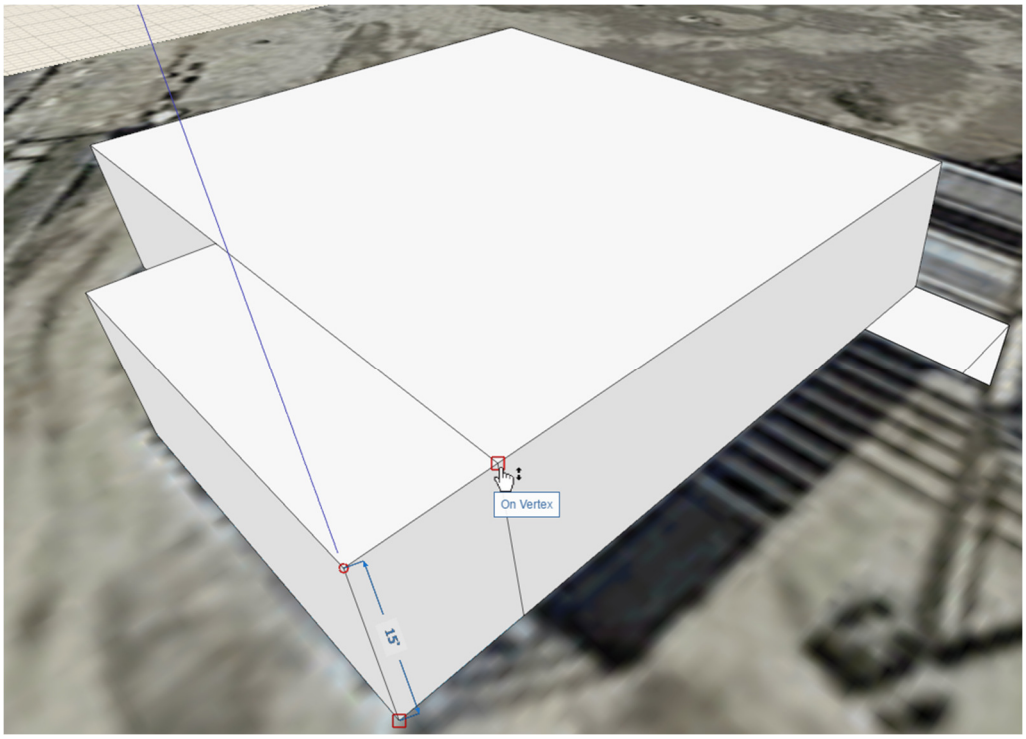
15. If you have been working from a top-down view, it would be helpful now to rotate your project view as it will be easier to view/work with 3D objects. You can do this by selecting the Orbit icon  on the navigation bar, or by holding down your right mouse button while moving the mouse.



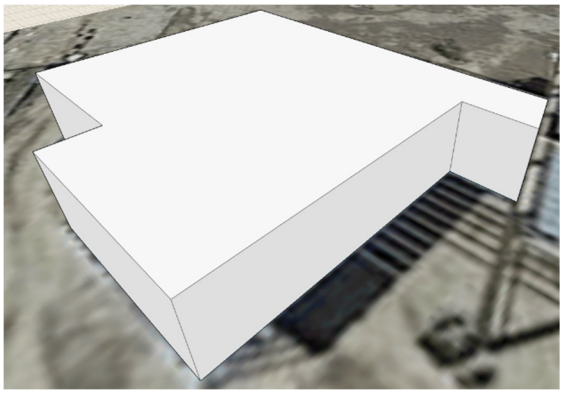
16. Once you have a view you like, then select the largest piece of “P1” with a single click, it will turn blue. Now by holding down the left mouse button and dragging upwards you can add height to the shape. The high of this and all pieces of “P1” should be **15’,** remember after you start moving the mouse to get the height you can hit the “Tab” key to enter the height in the pop-up.



17. Next, we can select the bottom rectangle with a single click and begin to drag it up. Because we know we want this to be the same height as the previous piece, we can pick on the nearest corner and FormIt 360 will automatically make the pieces the same height as well as joining them.



18. Repeat these steps with the last two pieces so we end up with one single **15'** high object as "P1".

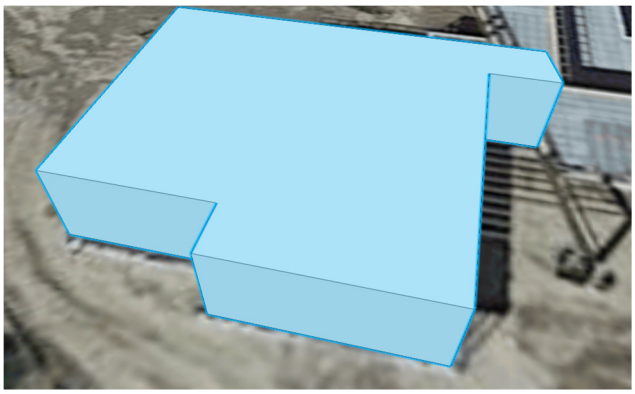


19. Save the project locally.

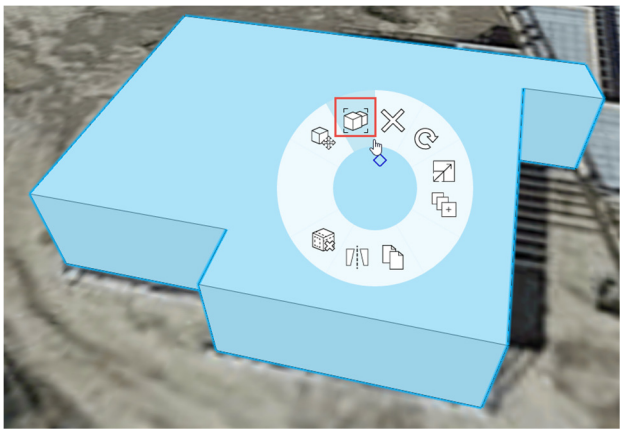
Task 2

In this task, we will work with groups and layers. You can continue using your project from the previous task, or you can open **"AU_Building_T2_Start"** from the **Ex 2 folder** in the lab data set.

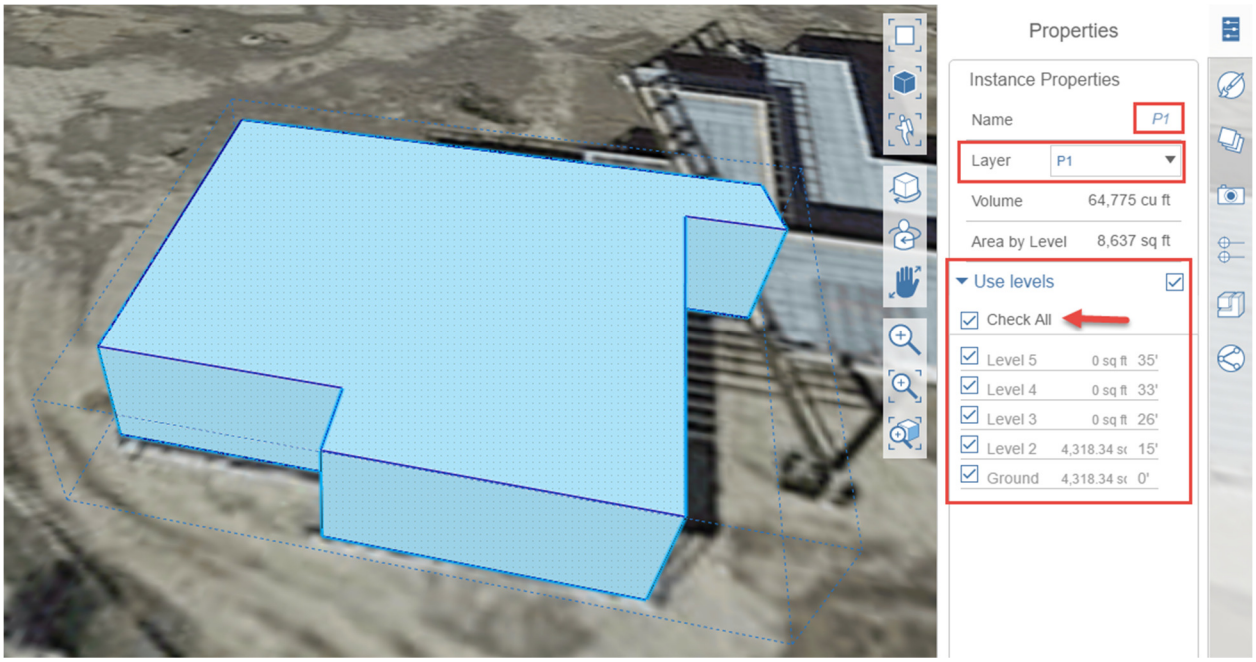
1. Before we put our "P1" piece of the building on the "P1" layer we need to group it. By grouping each "piece" of the building, they will not all morph together into one piece as we saw happen in task 1. To begin we can double-click on our "P1" building piece. You will see the entire object is highlighted (not just a face).



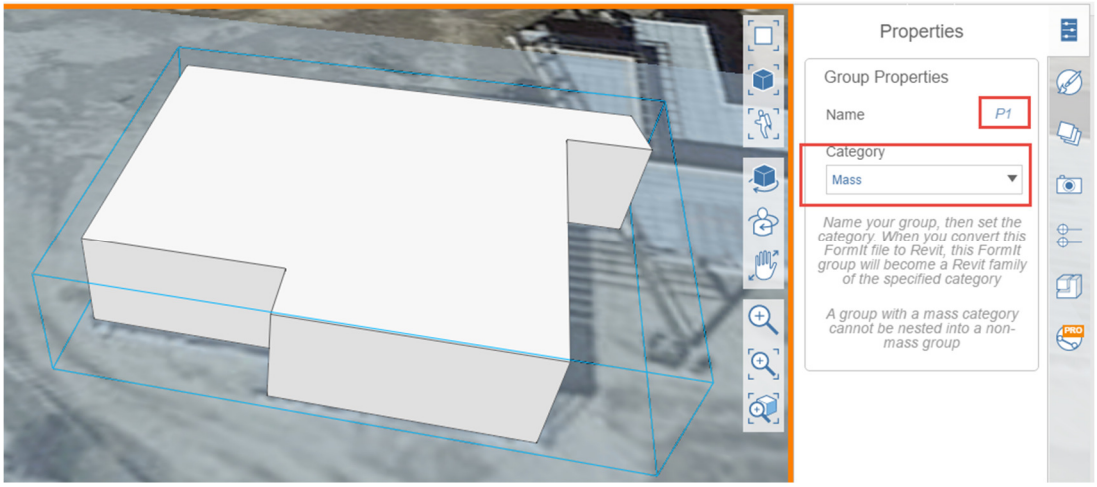
2. While the group is still selected, right-click your mouse to display the contextual menu. Then select the Group icon  from the menu, or you could use the keyboard shortcut **G**.



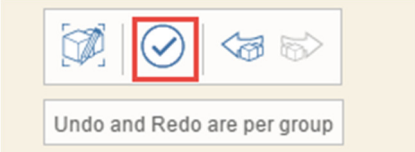
3. You will now see dots on the object as well as a dashed box around the group. While still in this state open the **Properties** tab if not already open. Here you can give the object a name (P1) as well as assign it a layer in the "Layer" pull-down menu. The last thing we need to do is put a check in the "Use levels" box, then make sure all levels are selected. Hit **Esc** to get out of the group command.



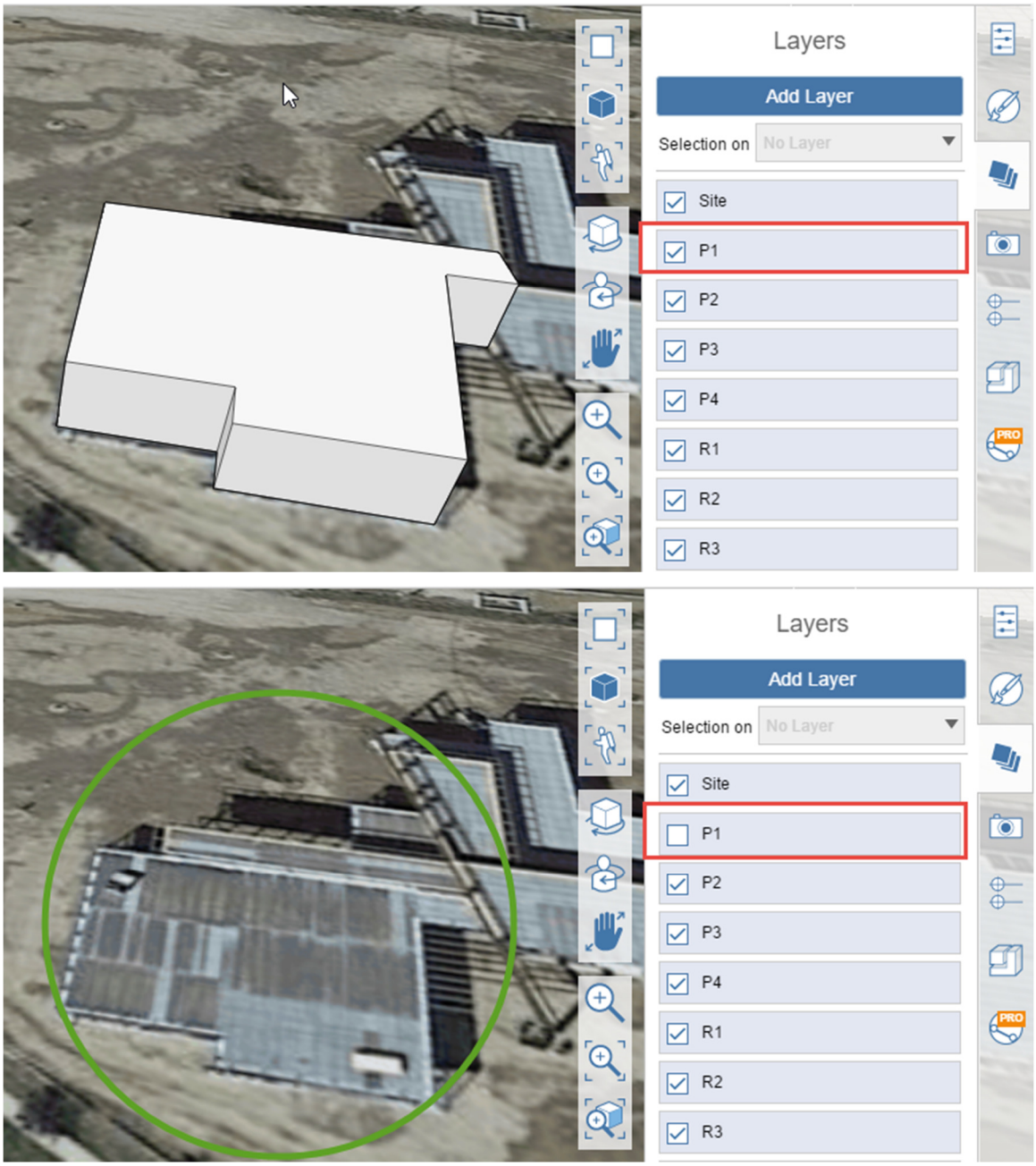
4. Now if you double click on the "P1" group you will see it opens the "Group Editor", this is how you can edit your groups. This is also where we can add a name to the group (not instance). Along with a name, we can also assign the group a Revit Category, which will become useful when the FormIt 360 content is imported into Revit. Please name the group "P1" and choice the Category default, *Mass* from the "Category" drop-down menu. You must be in the **Properties** tab to see the Group Properties.



5. To finish editing the group you need to pick the checkmark in the circle in the top left corner.



6. Next to make sure the layer works properly go to the **Layers** tab and uncheck and then re-check the P1 layer. The building should disappear and re-appear.

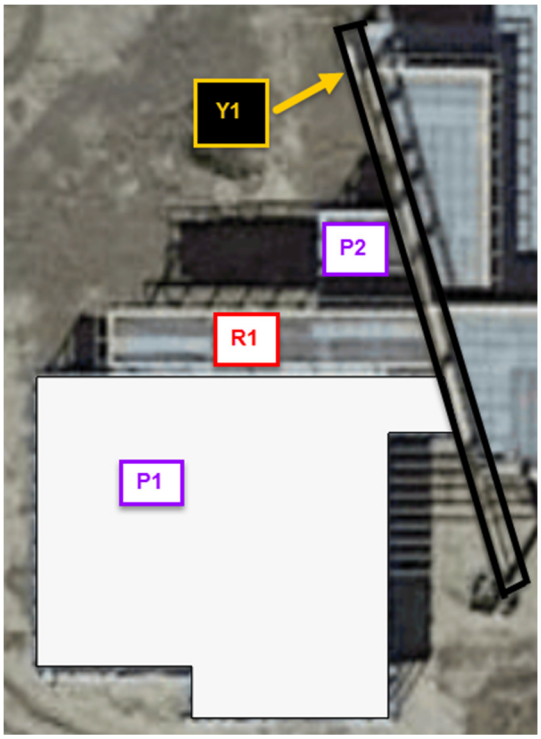


7. Save the Project locally.

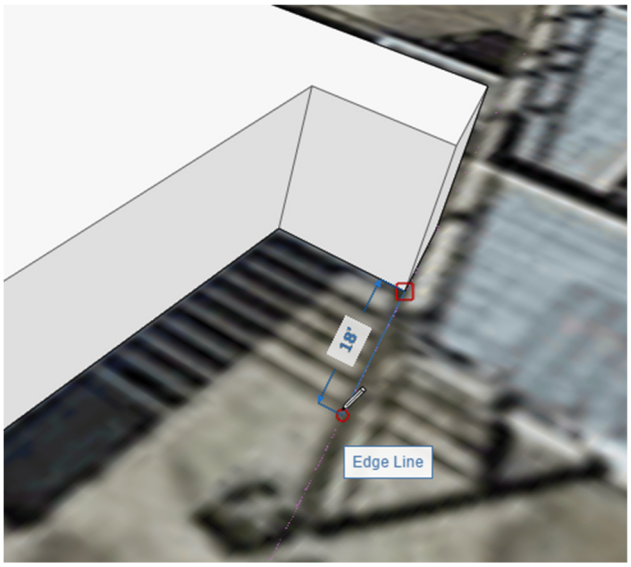
Task 3

In this task, we continue adding to our project building. You can continue using your project from the previous task, or you can open **"AU_Building_T3_Start"** from the **Ex 2 folder** in the lab data set.

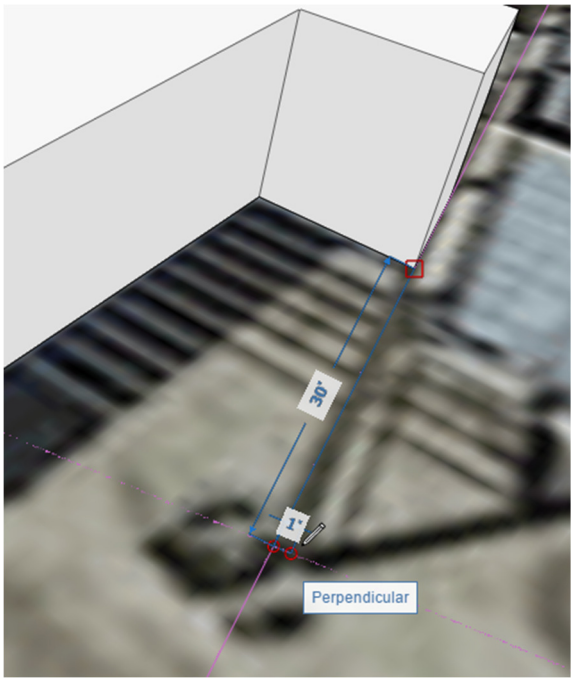
1. We will continue by adding three more pieces to our building, "R1" "P2" & "Y1"



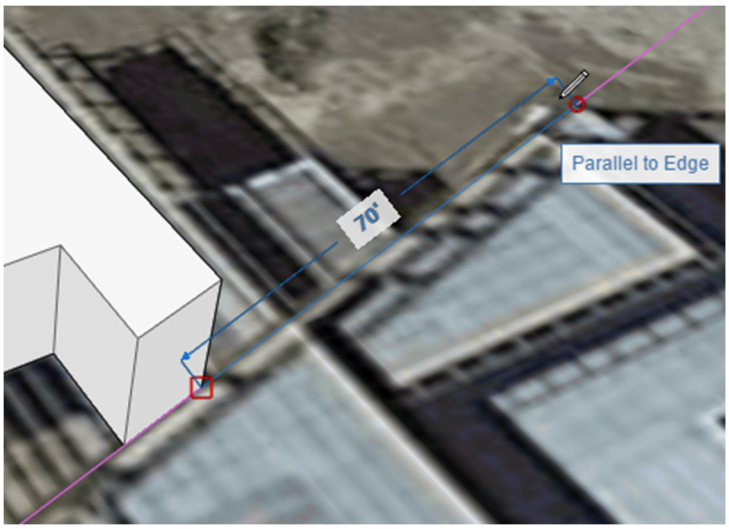
2. Start with the "Y1" piece. Using the Line command start at the bottom angled corner and draw a line **30'** south parallel to the angled portion of "P1". You will know when you are parallel when you see a magenta line appear.



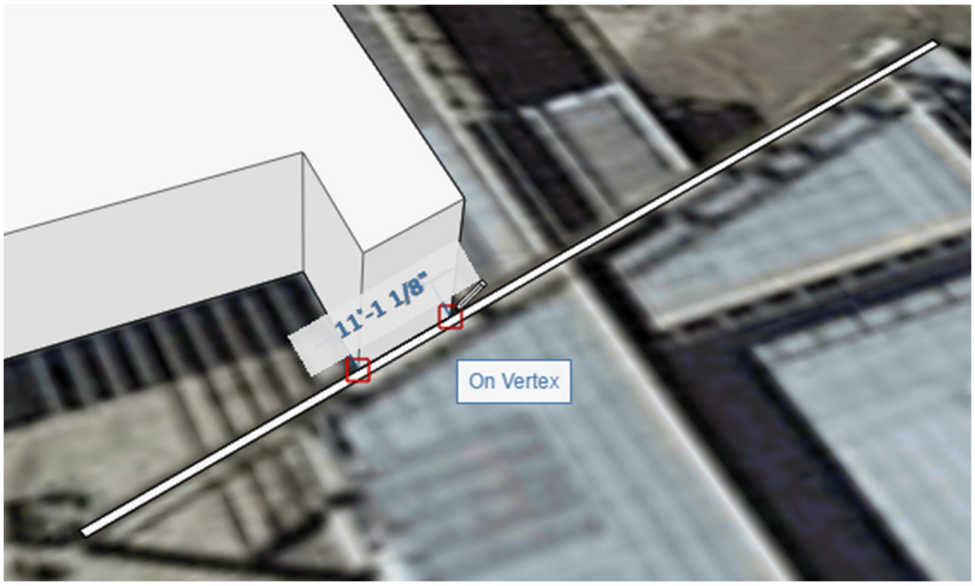
3. Next, you will draw a 1’ perpendicular line. Perpendicular lines are also shown as a magenta line.



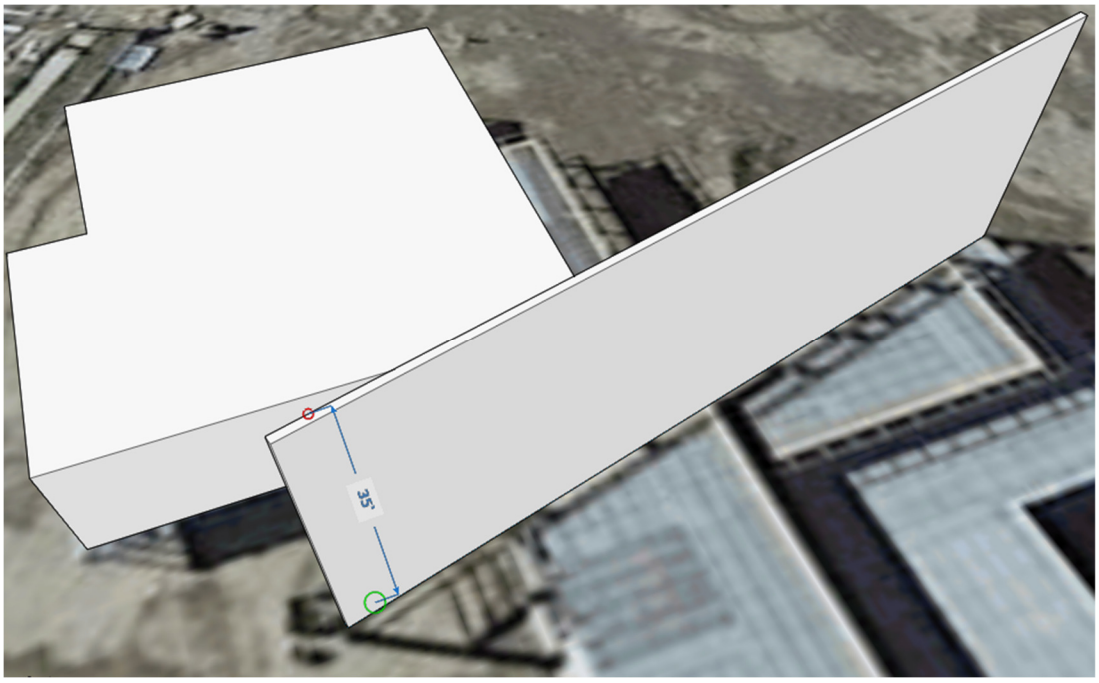
4. Hit the Esc key. Now we will draw a parallel line from the other angled corner, **70’** to the north.



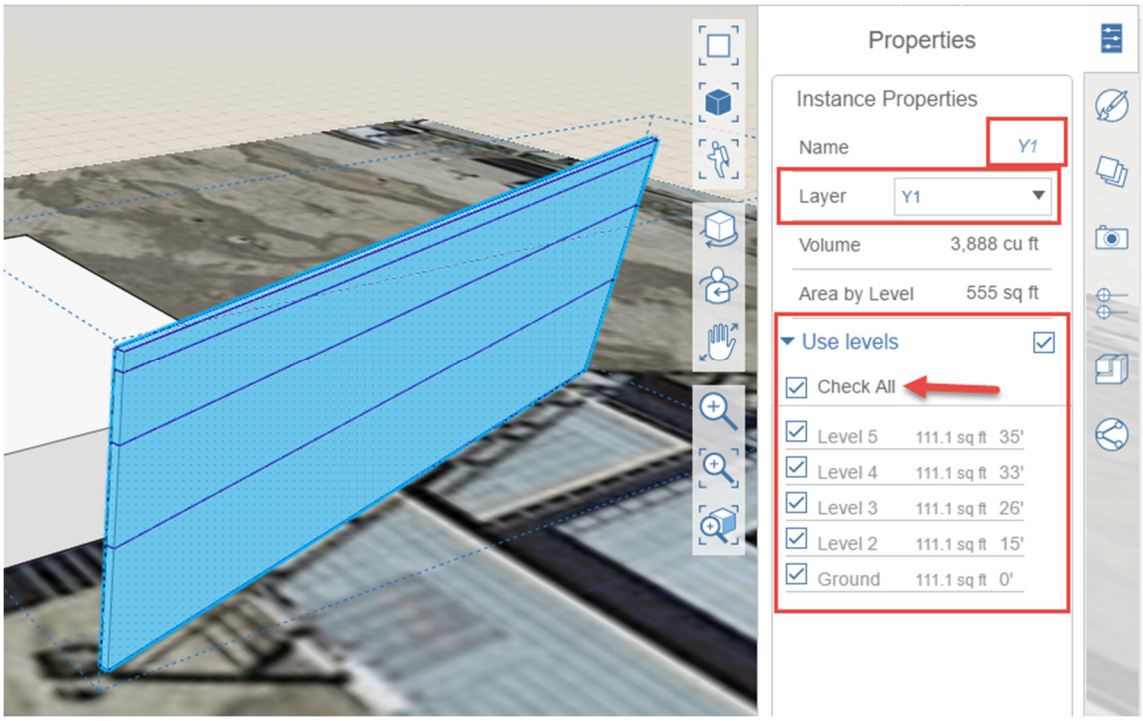
5. Again like last time, draw a **1’** perpendicular line at the end of the 70’ line you just created. Then connect the two ends to make the solid face that will become “Y1”. If you don’t get a solid, draw a line connecting your two starting points (the angled part of “P1”).



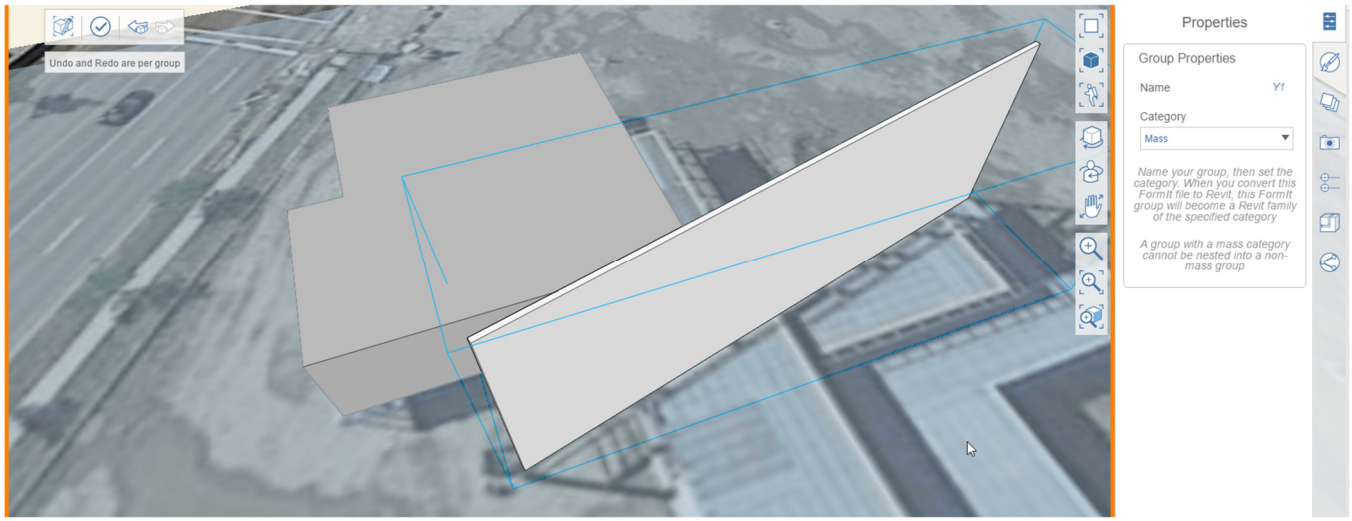
6. Single click on the solid surface and begin dragging it up to add its height, which will be **35'.**



7. Now we will make the object we just created a group, and add it to a layer, and make sure all levels are checked. The instance and group name will be **Y1**, and it will be put in layer **Y1.** To create the group, double-click on the object, and then right-click to be able to pick the group icon  from the contextual menu. Also remember to have the **Properties** tab open.



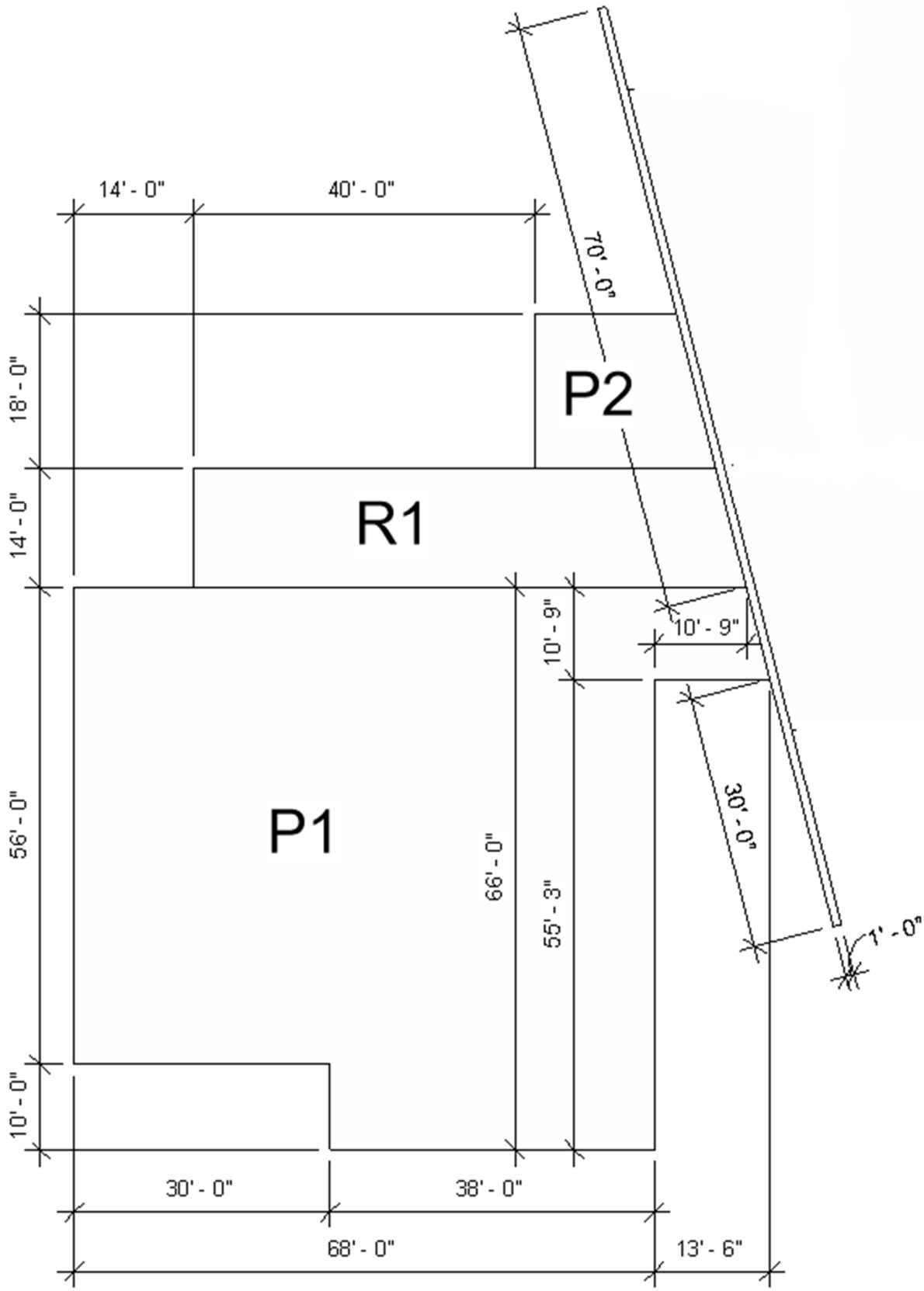
8. After creating the group "Y1" and adding it to later "Y1" you will need to edit the group (double-click) to give the group the "Y1" name and put in in the *Mass* category. Then finish by hitting the finish icon (circle with a checkmark in it).



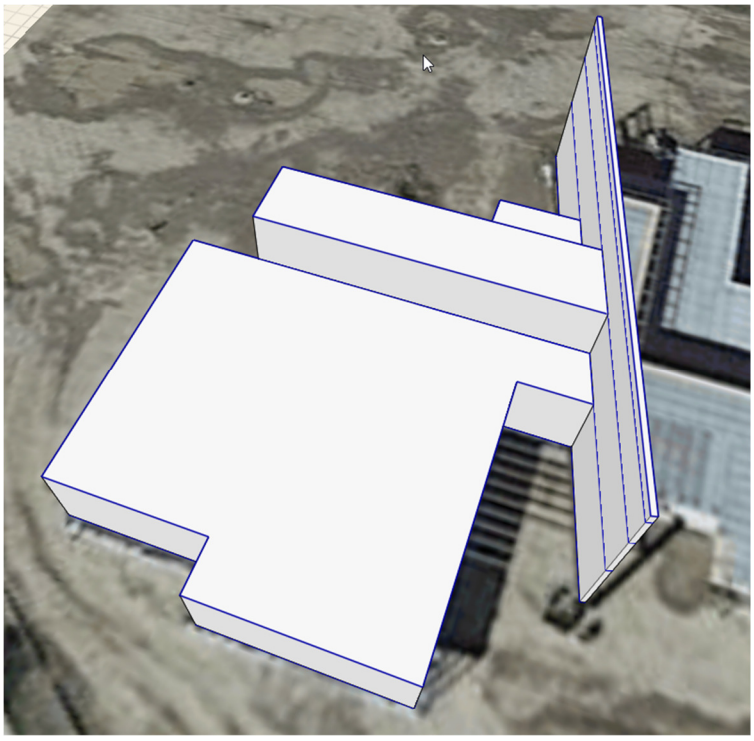
9. Using the same method create the "R1" and "P2" Building pieces using the information provided in the chart below:

Building Piece	**Height**	**Layer Name**	**Object Name**	**Group Name**	**Category**
R1	26'	R1	R1	R1	Mass
P2	15'	P2	P2	P2	Mass

10. As well as the dimensions on the following page


14' - 0"
40' - 0"
70' - 0"
18' - 0"
P2
14' - 0"
R1
10' - 9"
10' - 9"
56' - 0"
P1
66' - 0"
55' - 3"
30' - 0"
1' - 0"
10' - 0"
30' - 0"
38' - 0"
68' - 0"
13' - 6"

11. When you are finished your project should look something like the picture below. If you don't see the blueish purple level lines, use the keyboard shortcut **DL** to turn them on. Sometimes you need to turn them off and back on again for them to show.



12. Save the Project.

Bonus Task

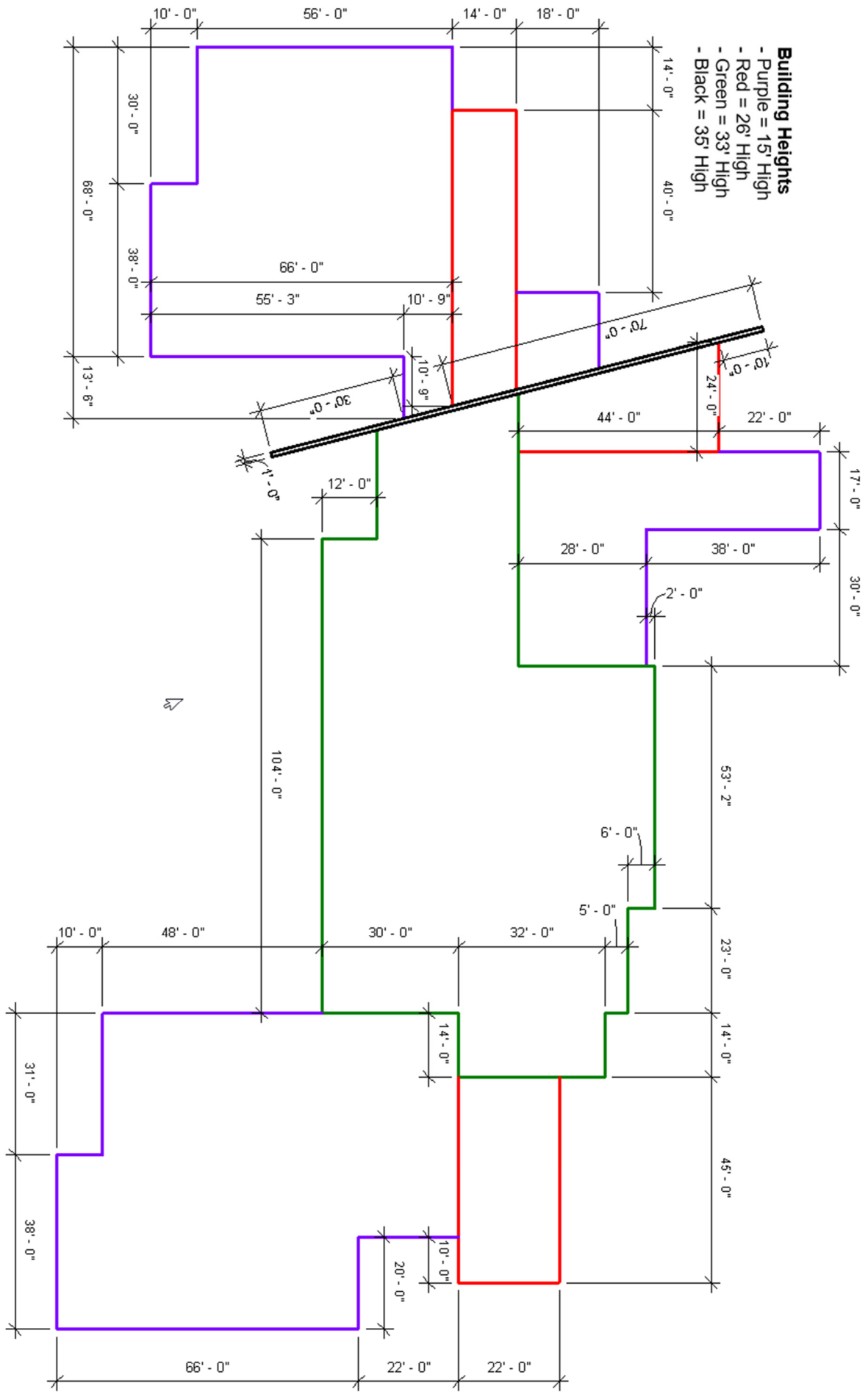
This is an optional bonus task for those ahead or wishing for some more practice after the session. In this task, we will finish our project building. You can continue using your project from the previous task, or you can open **"AU_Building_BT_Start"** from the **Ex 2 folder** in the lab data set.

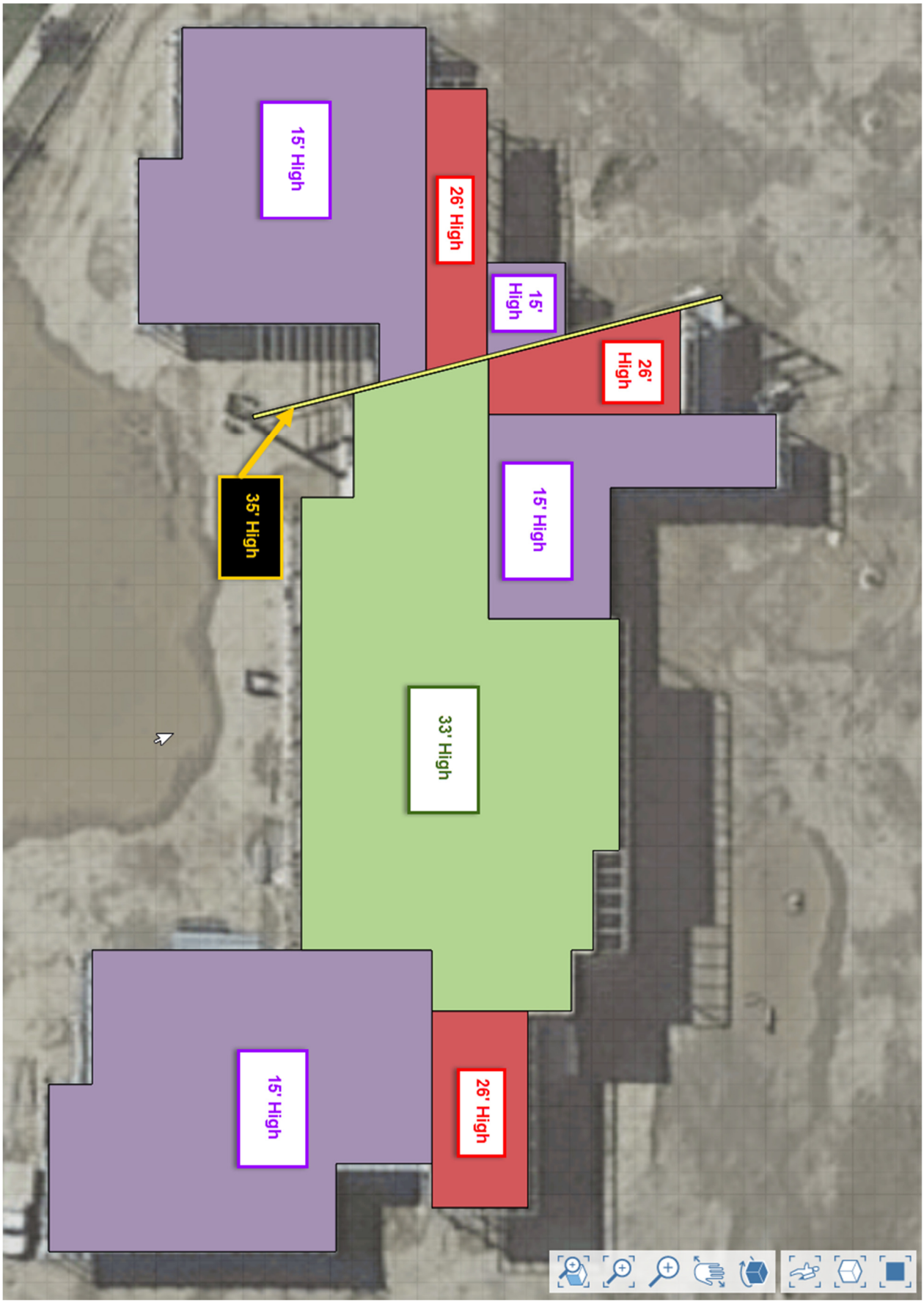
1. In this bonus task, you can use any method you wish to add the final 5 pieces to our building, as well as grouping them each individual and adding them to the proper layer.
2. The information on the final 5 pieces is listed in the chart below:

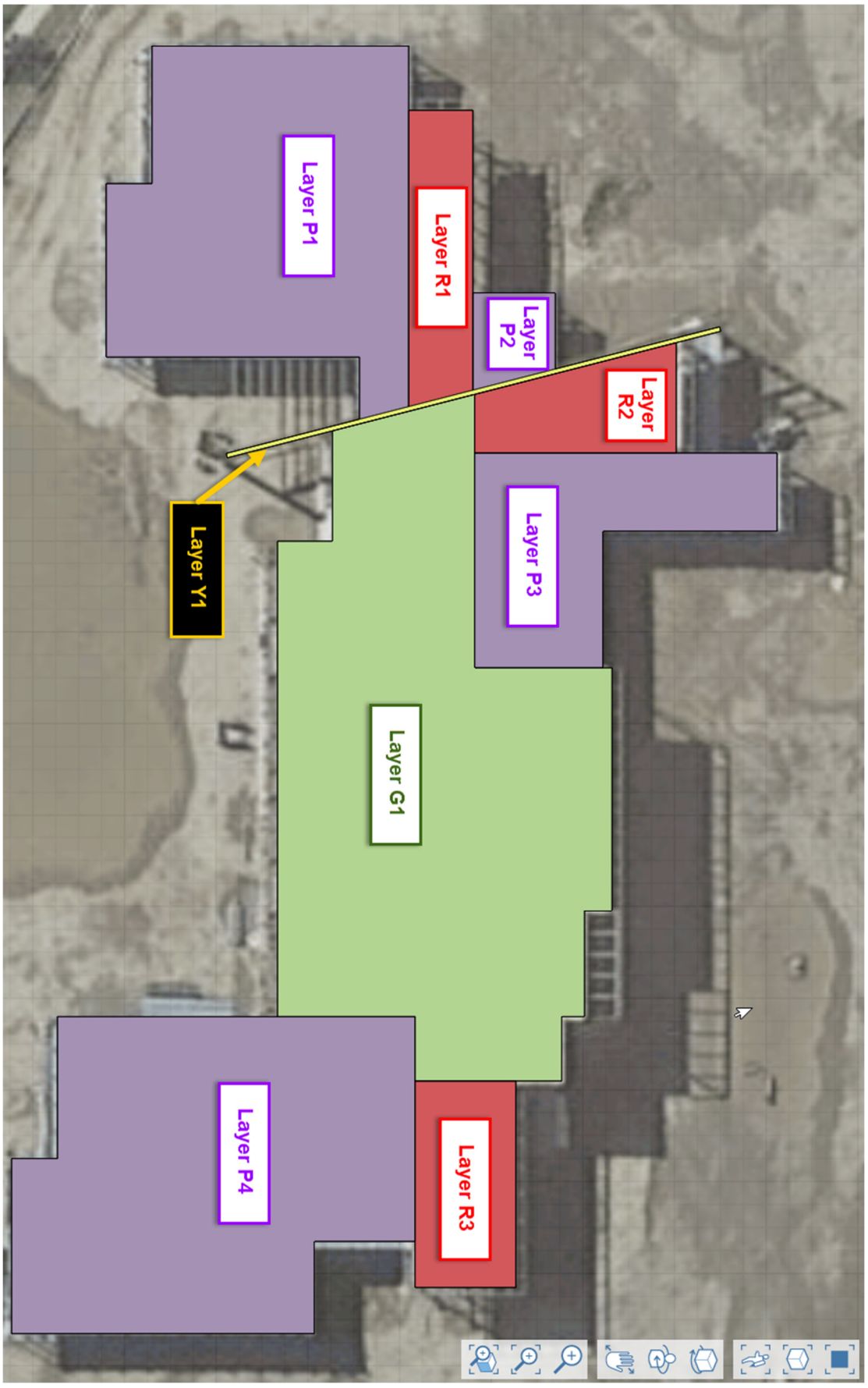
Building Piece	**Height**	**Layer Name**	**Object Name**	**Group Name**	**Category**
R2	26'	R2	R2	R2	Mass
P3	15'	P3	P3	P3	Mass
G1	33'	G1	G1	G1	Mass
R3	26'	R3	R3	R3	Mass
P4	15'	P4	P4	P4	Mass

3. The following 3 pages will provide dimensions, as well as clarity on the height of each piece and the layer it belongs to.

4. When you are finished save your project locally.


Building Heights
- Purple = 15' High
- Red = 26' High
- Green = 33' High
- Black = 35' High
10' - 0"
56' - 0"
14' - 0"
18' - 0"
30' - 0"
68' - 0"
38' - 0"
14' - 0"
40' - 0"
66' - 0"
55' - 3"
10' - 9"
13' - 6"
70' - 0"
30' - 0"
10' - 9"
10' - 0"
24' - 0"
44' - 0"
22' - 0"
1' - 0"
12' - 0"
17' - 0"
28' - 0"
38' - 0"
30' - 0"
2' - 0"
104' - 0"
53' - 2"
6' - 0"
5' - 0"
10' - 0"
48' - 0"
30' - 0"
32' - 0"
23' - 0"
14' - 0"
14' - 0"
31' - 0"
45' - 0"
38' - 0"
10' - 0"
20' - 0"
66' - 0"
22' - 0"
22' - 0"


15' High
26' High
15' High
26' High
35' High
15' High
33' High
15' High
26' High


Layer P1
Layer R1
Layer P2
Layer R2
Layer P3
Layer Y1
Layer G1
Layer P4
Layer R3

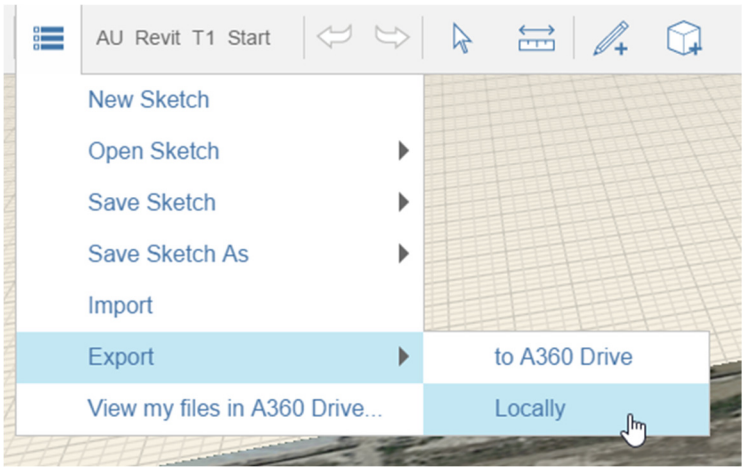
Ex 3) Revit

In this exercise, we will import our FormIt 360 project into Revit 2017. For this exercise, we will keep using FormIt 360 Web, and Revit 2017.

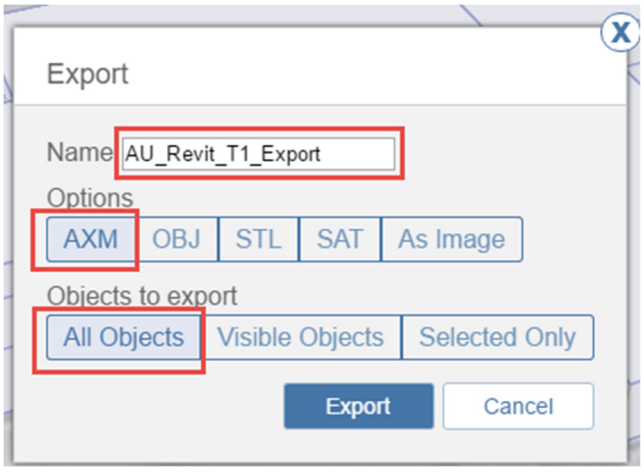
Task 1

For this task open **"AU_Revit_T1_Start"** from the **Ex 3 folder** in the lab data set.

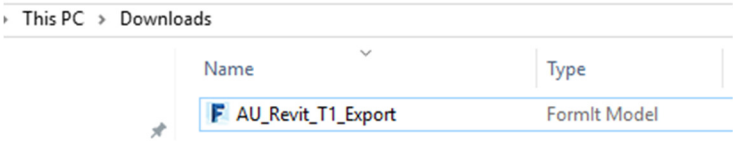
1. Once you have **"AU_Revit_T1_Start"** open in FormIt 360 Web, you will need to export the project locally to the computer so it can be imported into Revit. Select the "Menu" icon , then choose **Export** > Locally.



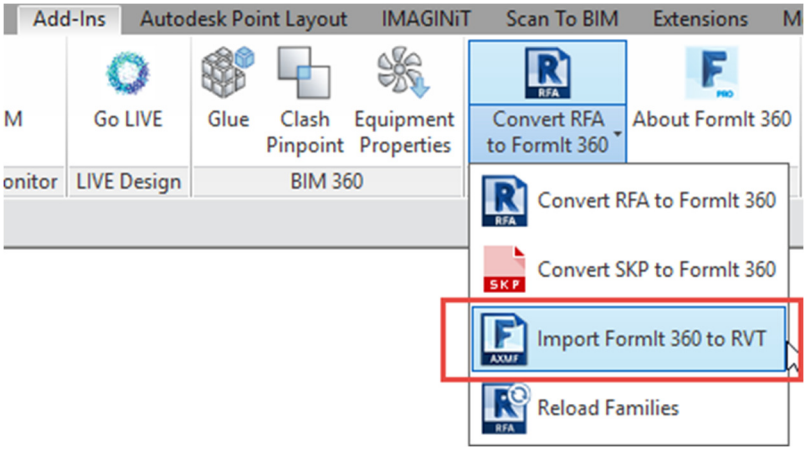
2. In the **Export** dialog box enter the following Name: *AU_Revit_T1_Export*. Next, choose "AXM" under the **Options** (this is the file format to be exported). Then for **Objects to export** we want to select "All Objects", then hit the Export button.



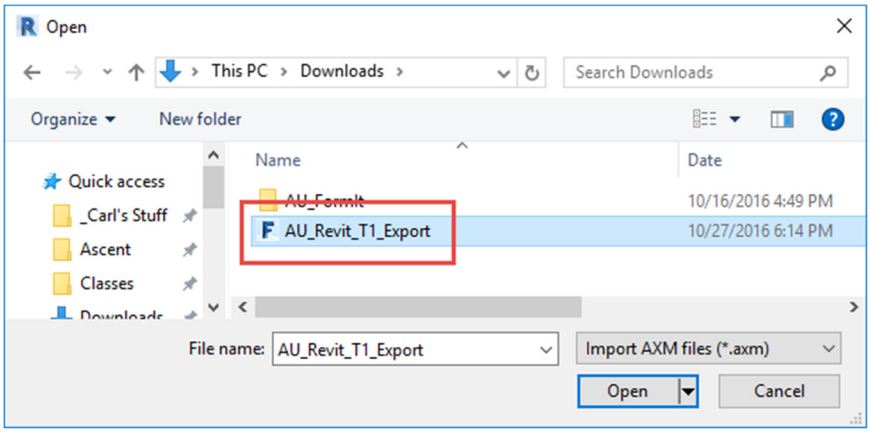
3. The AXM file will be downloaded to your computer with the name we gave it "AU_Revit_T1_Export".



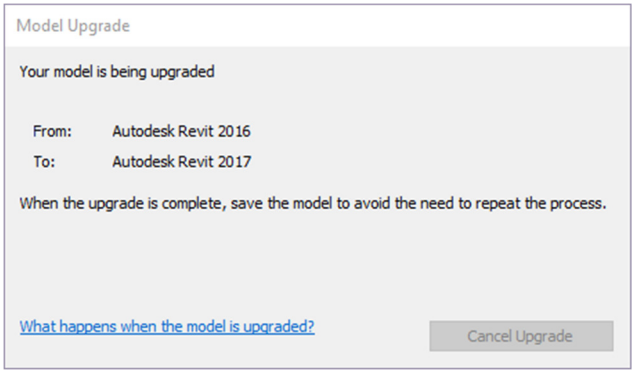
4. Now you will need to start Revit 2017. Once started, open up the Revit project called **"AU_Revit_T1_Start"** from the **Ex 3 folder** in the lab data set.
5. Now from the "Add-Ins" Tab locate the **FormIt 360 Converter** and from the pull-down menu pick *Import FormIt 360 to RVT.*



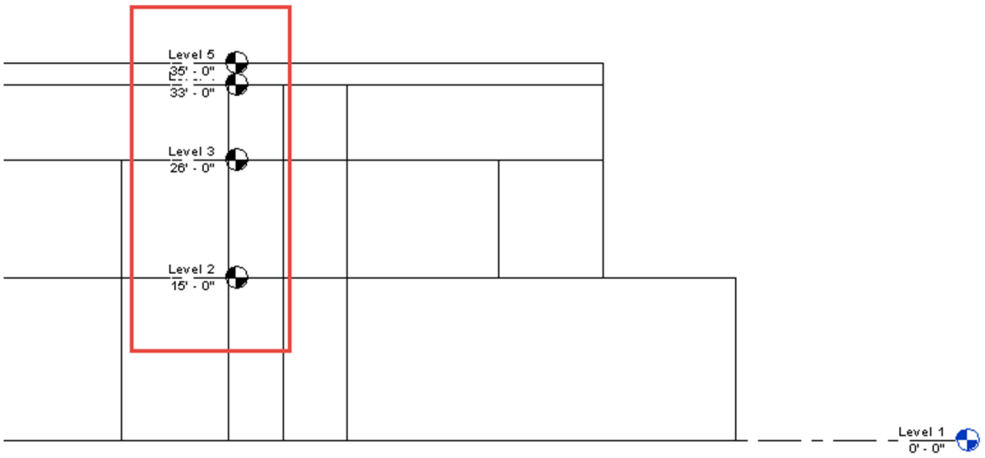
6. Navigate to where you stored the **AU_Revit_T1_Export** FormIt 360 file (.axm) and select it as the file to import. Begin the import process by hitting the **Open** button.



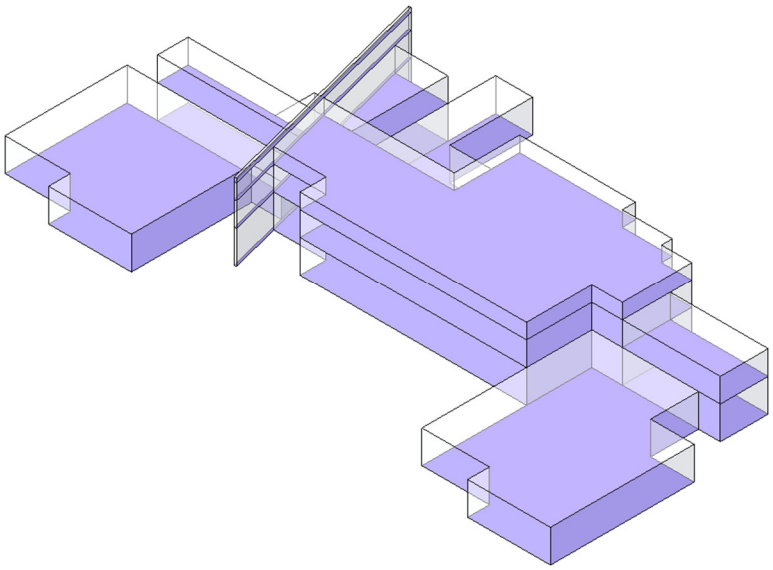
7. During the import process, you may see a warning that lets you know the Revit file is being upgraded from 2016 to 2017. This is fine just let it do its thing, it may appear 9 times, once for each group that is imported. When finished importing you may need to hit **ZA** to zoom out and see everything. Depending on the version of the FormIt 360 Converter you have you may not see the warnings.



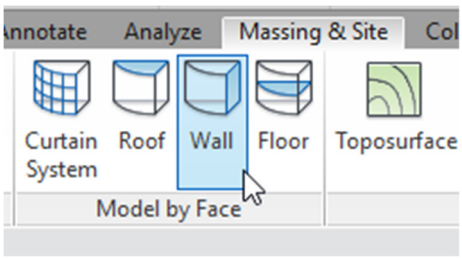
8. Once the FormIt 360 content is imported if you go to one of the existing elevations you will see that it created the levels at the heights we created them in the FormIt 360 project.



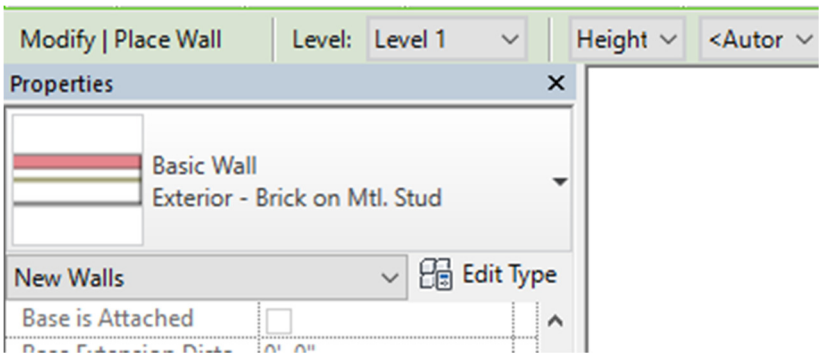
9. Now open up the default 3D view and you will notice that mass floors have automatically been created where they would exist based on the levels that came in with the FormIt 360 model.



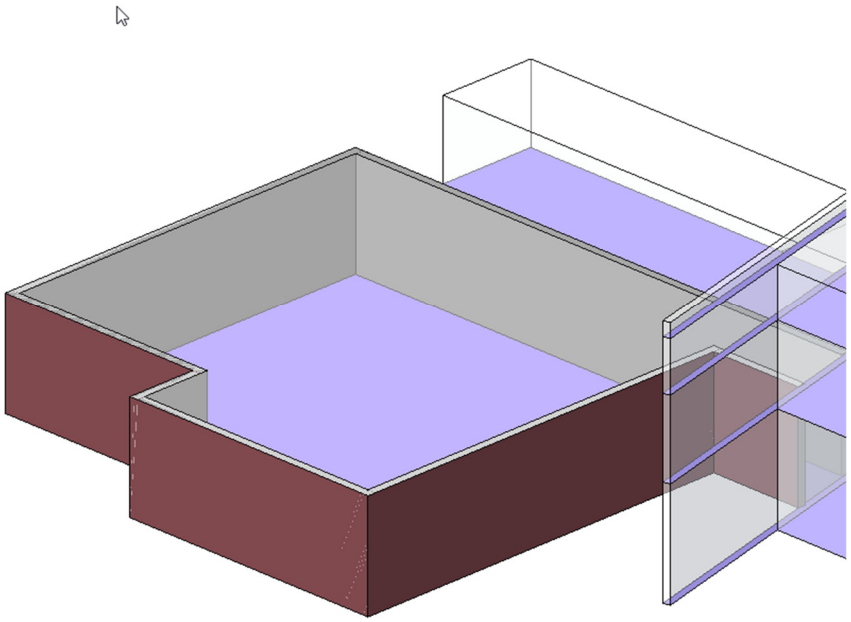
10. We can now start adding Revit walls to our imported model using the **Wall** tool in the *Model by Face* panel found in the "Massing & Site" tab.



11. Make sure you are still in the 3D view, then select the **Wall** tool in the *Model by Face* panel found in the "Massing & Site" tab. Now you will need to pick a wall type, for this exercise, we will us the "Exterior – Brick on Mtl. Stud" which is a Basic Wall.



12. Next, pick each of the walls that make up the "P1" group and they will become brick walls. There are 7 walls in total in the "P1" group.



13. Save the Revit project locally.

Bonus Task

This is an optional bonus task for those ahead or wishing for some more practice after the session. In this task, we will finish adding walls, as well as roofs and floors to our Revit file. You can continue using your project from the previous task, or you can open **"AU_Revit_BT_Start"** from the **Ex 3 folder** in the lab data set.

1. In this bonus task, you will finish adding walls, roofs, and floors to the rest of the groups that we imported in task 1.

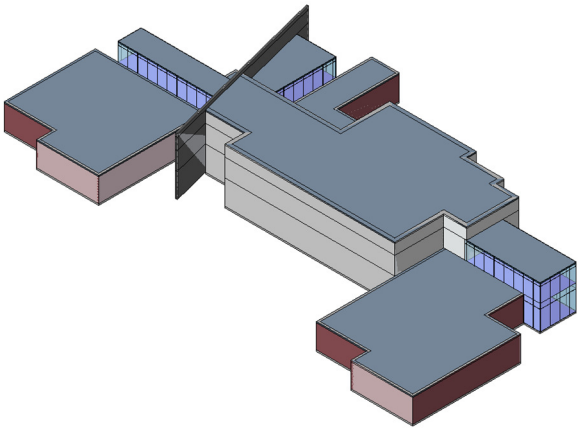
Note: The levels were created as heights for roofs, not as floor level heights. Because of this only add floors to level 1 (ground level), not to any of the other mass floors.

2. Use the chart below for information on which wall, roof, and floor types to use:

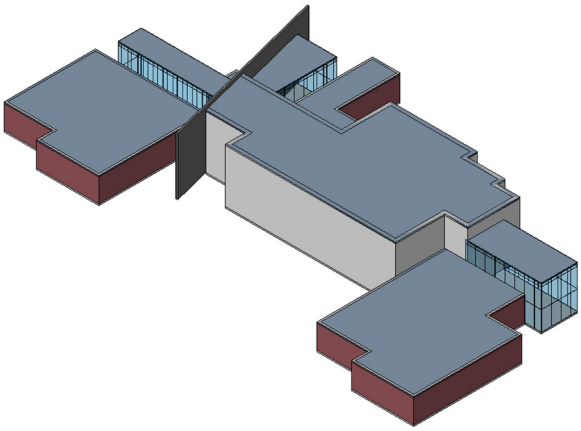
Group	Wall Type	Roof Type	Floor Type
G1	Basic Wall – Exterior – CMU Insulated	Generic – 9”	Wood Joist 10” – Ceramic Tile
P1	Basic Wall - Exterior – Brick on Mtl. Stud	Generic – 9”	Wood Joist 10” – Ceramic Tile
P2	Basic Wall - Exterior – Brick on Mtl. Stud	Generic – 9”	Wood Joist 10” – Ceramic Tile
P3	Basic Wall - Exterior – Brick on Mtl. Stud	Generic – 9”	Wood Joist 10” – Ceramic Tile
P4	Basic Wall - Exterior – Brick on Mtl. Stud	Generic – 9”	Wood Joist 10” – Ceramic Tile
R1	Curtain Wall – Exterior Glazing	Generic – 9”	Wood Joist 10” – Ceramic Tile
R2	Curtain Wall – Exterior Glazing	Generic – 9”	Wood Joist 10” – Ceramic Tile
R3	Curtain Wall – Exterior Glazing	Generic – 9”	Wood Joist 10” – Ceramic Tile
Y1	Basic Wall – Generic – 6”	No Roof	No Floor

Note: You may receive warnings that some lines are not straight or off axis. For this exercise, it is okay to just ignore them and carry on. For a real project, you may want to fix those before moving forward with the Revit model.

3. When you are finished save your Revit project.



With Masses on



With Masses off

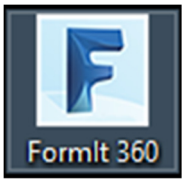
Ex 4) Dynamo

In this exercise, we will use a Dynamo script (graph) in FormIt 360 Windows that was been published to the web. For this exercise, we will be using FormIt 360 Windows, Dynamo Web, and Dynamo Studio.

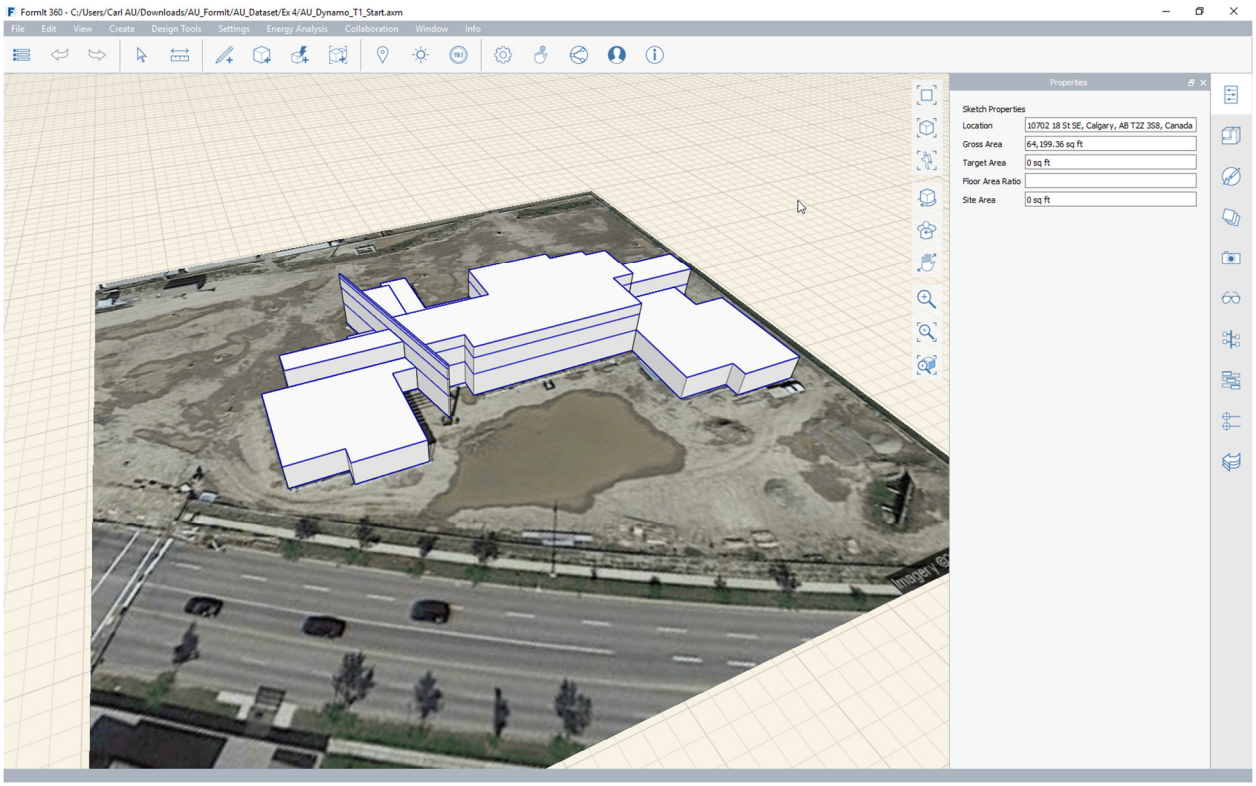
Task 1

For this task open **"AU_Dynamo_T1_Start"** from the **Ex 4 folder** in the lab data set.

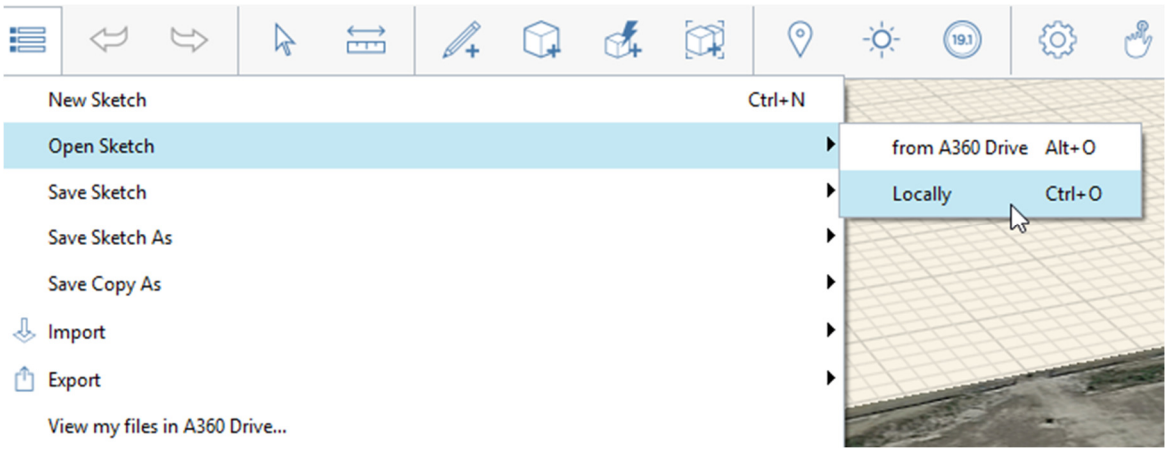
1. Begin by opening FormIt 360 Windows, you can do this by clicking on the FormIt 360 icon on the desktop.



2. FormIt 360 Windows looks, and functions similar to FormIt 360 Web, but because it is computer based it has more power and allows you to do some additional things. One of those additional things is working with Dynamo. You need to have a paid license of **FormIt 360 Pro** to have access to the Windows version.

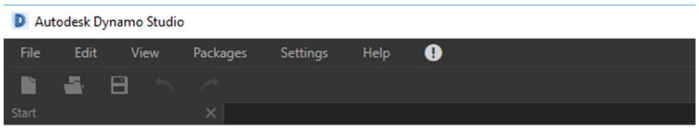


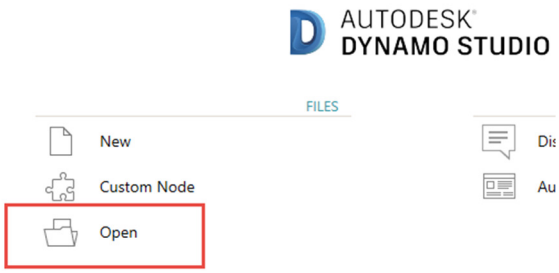
3. Once you have FormIt 360 Windows open, you will need to load **"AU_Dynamo_T1_Start"** from the **Ex 4 folder** in the lab data set. You can do this by selecting the "Menu" icon  in the top left corner of the ribbon. Choose **Open Sketch** > *Locally.* Then navigate to the lab data set to find the file, and click "Open".

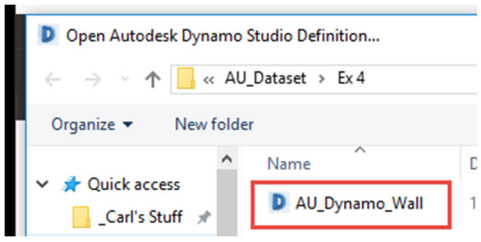


4. Now we are going to open Dynamo Studio to review the script (graph) we will be using in our FormIt 360 project. You can do this by clicking on the Dynamo Studio icon on the desktop.

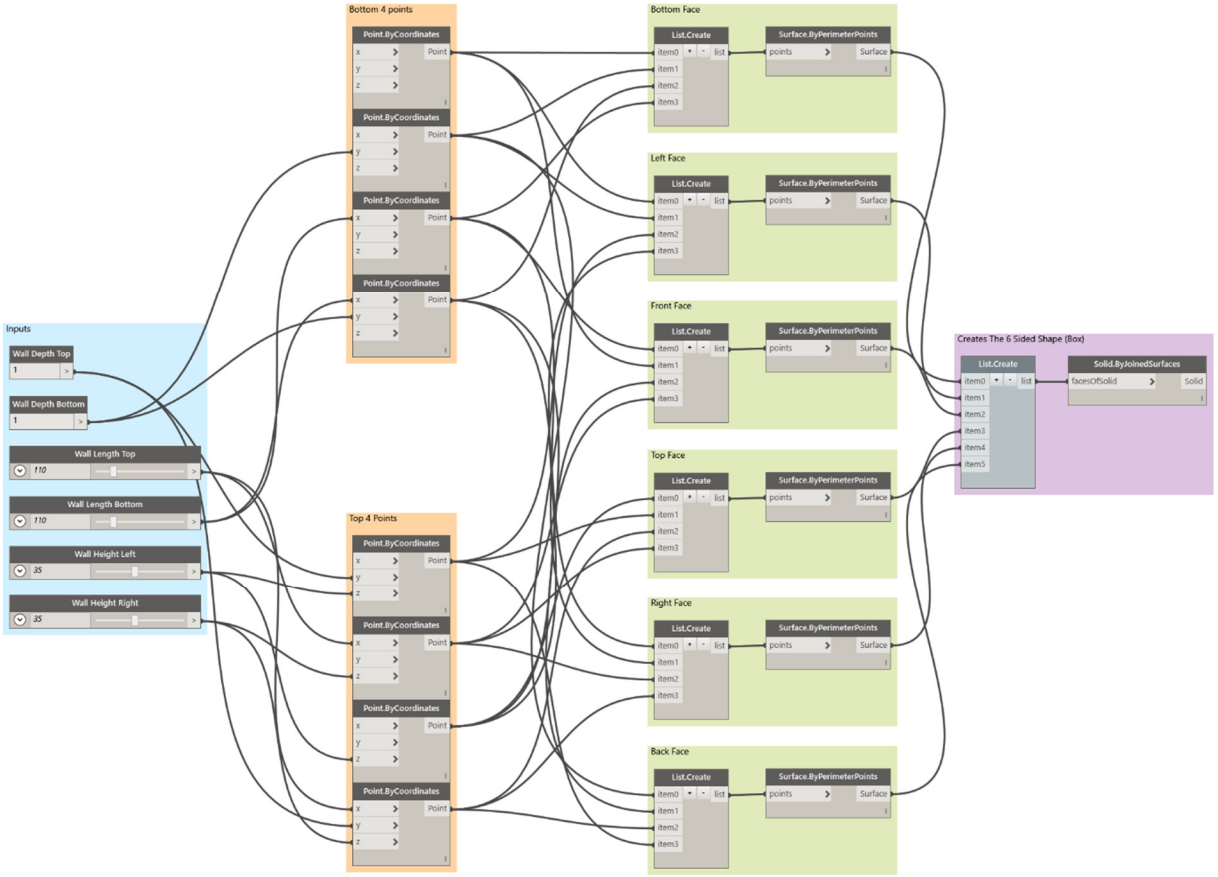
5. Click on the "Open" icon under **FILES** on the start page, then navigate to the **Ex 4 folder** in the lab data set and pick **"AU_Dynamo_Wall"**. The file extension for Dynamo graphs is .dyn.



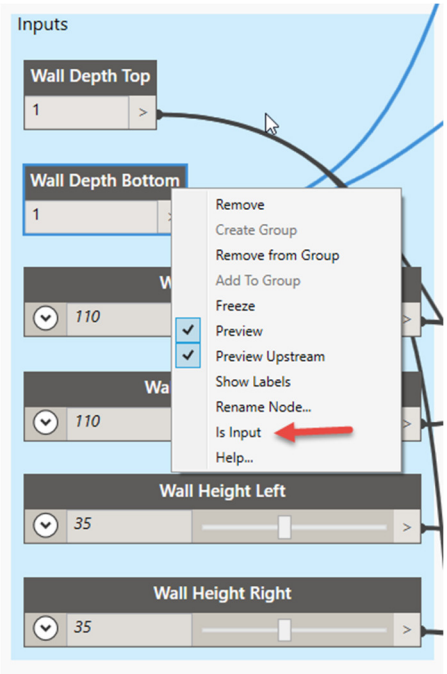




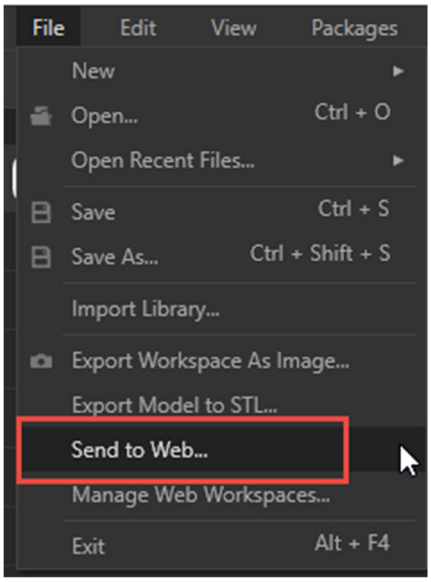
6. Now you will see the script or graph, which is a bunch of nodes connected with wires, that we will use in FormIt 360 Windows. At first glance, these scripts (graphs) can seem complicated and confusing. This is what makes working with Dynamo inside FormIt 360 so nice, you don't have to worry about trying to figure any of it out.



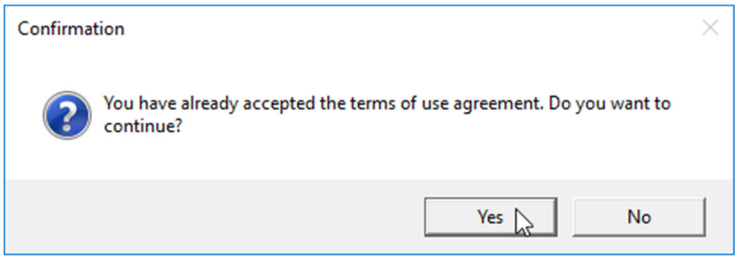
7. If you zoom into the blue group called inputs, just scroll your wheel on the mouse forward to zoom in. These are the inputs that we can be given access to within FormIt 360 Windows to control the shape. If you notice there are 6 inputs, however only 5 will be visible in FormIt 360 Windows. That is because we don't want the **"Wall Depth Bottom"** to be changed inside FormIt 360 Windows. If you right-click on this node you will see that **"Is Input"** is not checked (like the Preview and Preview Upstream is).



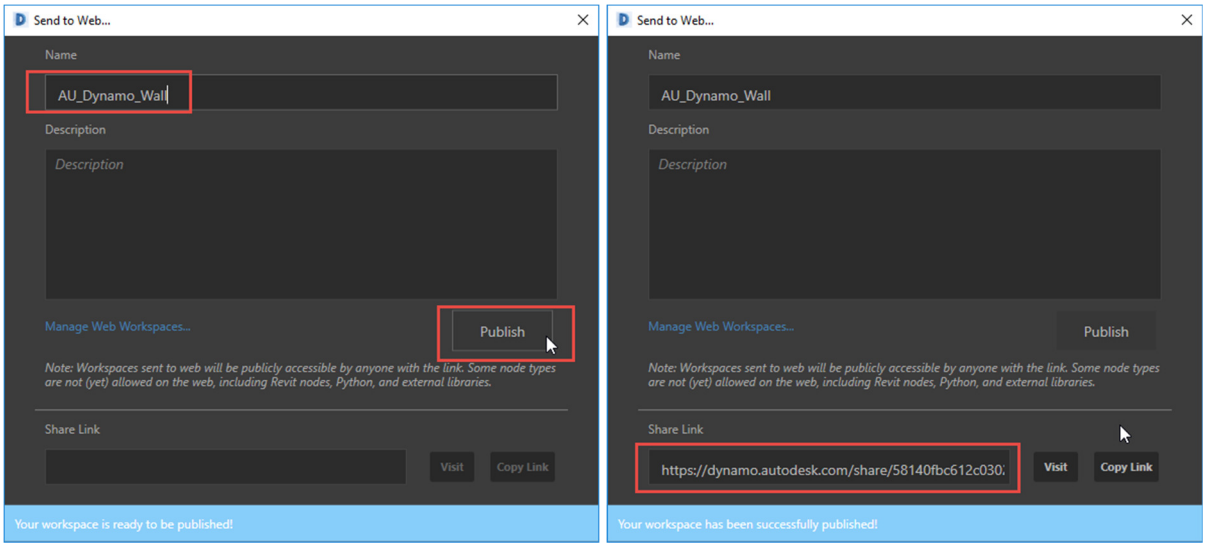
8. This dynamo graph is all ready to be sent to Dynamo Web so we can use in inside FormIt 360 Windows. To do this we select **Send to Web…** in the File menu on the top left corner of the ribbon. You will need to be signed into your A360 account for this to work.



9. You will need to hit “Yes” on the Confirmation pop-up first.

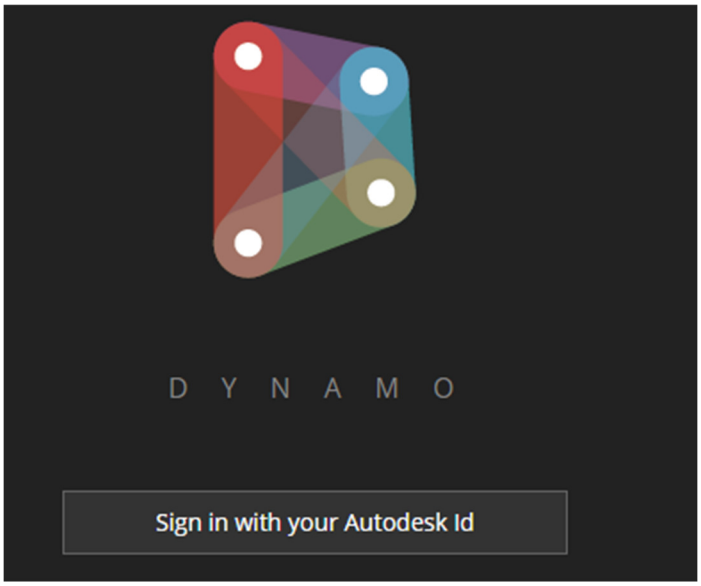


10. The last thing before the graph is published is to give it a name, we will use **"AU_Dynamo_Wall".** You can add a description as well if you wish. Then to finish hit the **Publish** button. Once published you will be able to share the link using the **Copy Link** button.

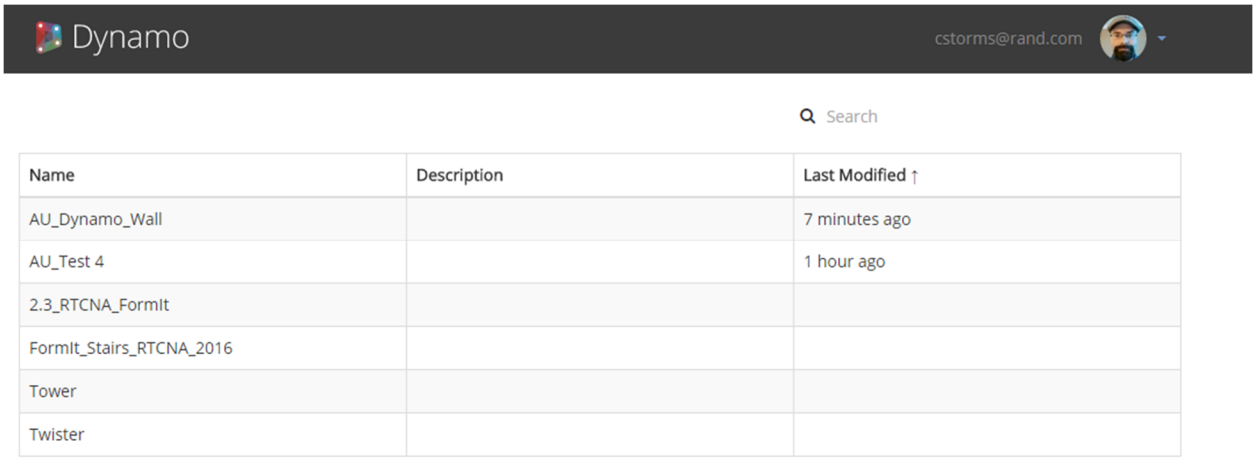


11. If you hit the Visit button it will take you to the Dynamo Web, website. You can also reach that site using this URL: http://dynamoreach.com/manager.html

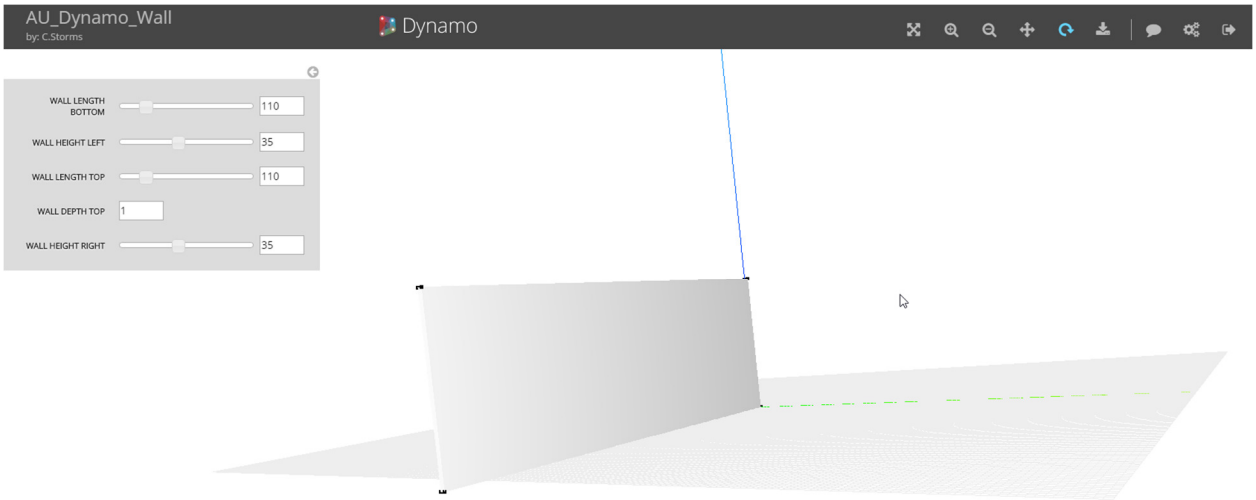
12. You will need to sign into your A360 Account to access Dynamo Web.



13. Depending on how you got to Dynamo Web you may see the "Manage" page which will show all your published graphs.



Or you may see the graph you just published (if you hit the Visit button after publishing).



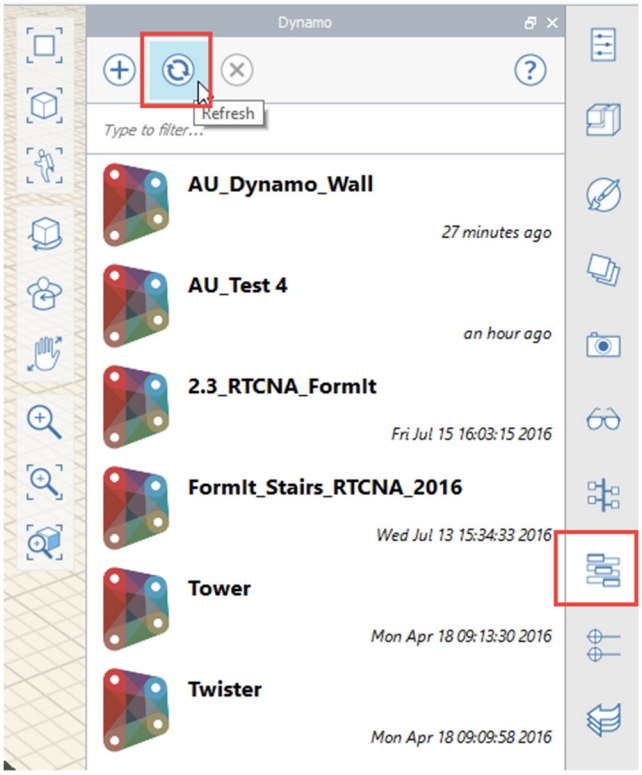
Task 2

For this task open **"AU_Dynamo_T2_Start"** from the **Ex 4 folder** in the lab data set.

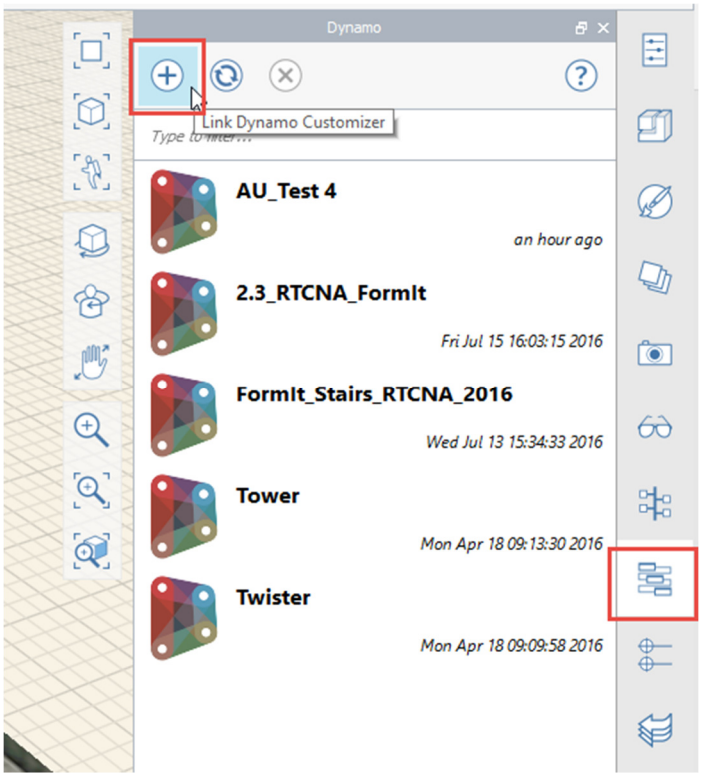
1. You can close Dynamo Web, and Dynamo Studio now, if they are not already closed. Then return to the model we opened in FormIt 360 Windows in task 1. If you don't have that open, then you can open **"AU_Dynamo_T2_Start"** from the **Ex 4 folder** in the lab data set.

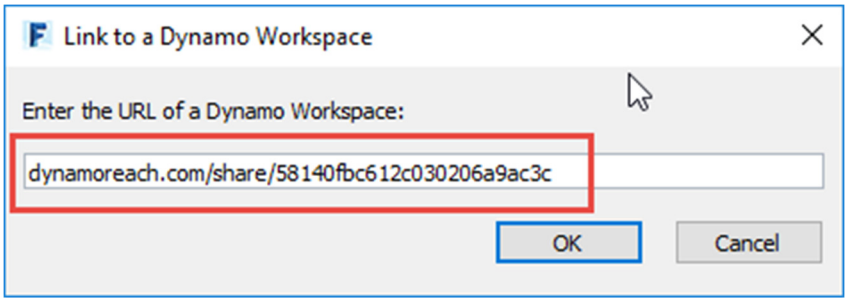
2. At this point, if you have not already you will need to sign into your A360 account so that FormIt 360 Windows can access the Dynamo graph we just published. You can also use the following link to access a public version of the graph:
   https://dynamoreach.com/share/58140fbc612c030206a9ac3c

3. Open the Dynamo tab on the right side within FormIt 360 Windows and hit the "Refresh" icon and see if the graph that we just publish appears (if it's not already visible).

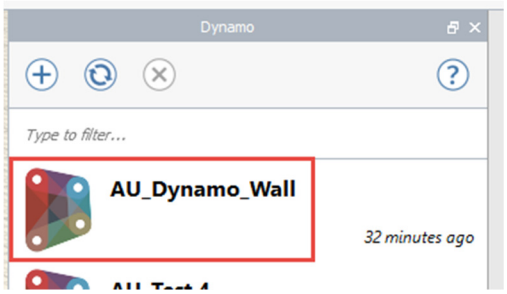


4. If this doesn't work you can hit the "Add" icon  and enter the URL of the Dynamo Workspace, which is: https://dynamoreach.com/share/58140fbc612c030206a9ac3c then hit **OK.**

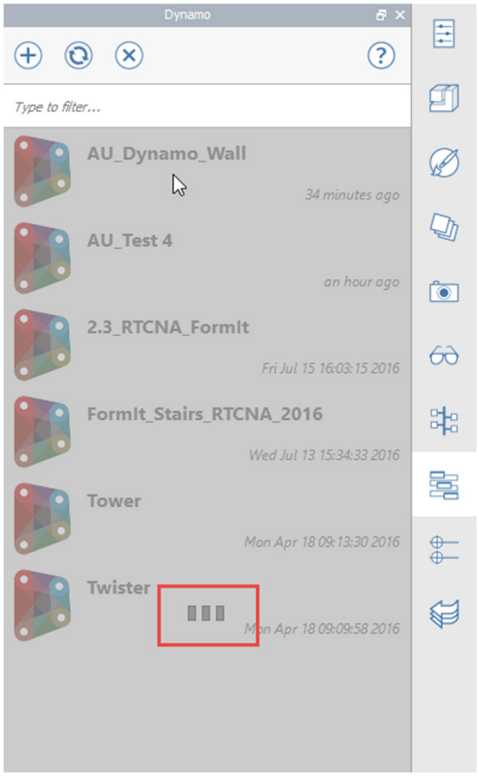




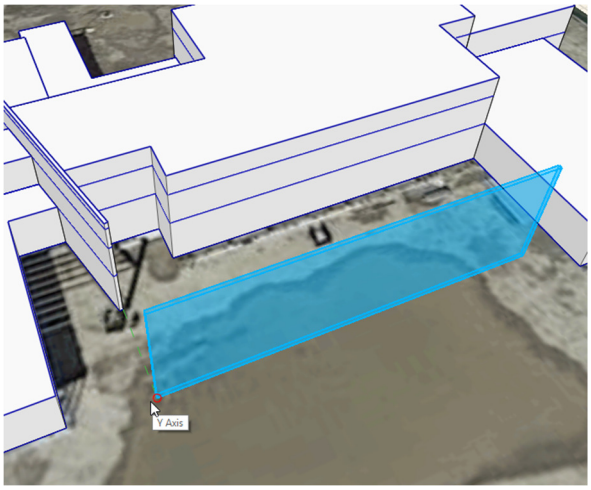
5. Once the graph is available you will see “AU_Dynamo_Wall” in your **Dynamo** tab list of graphs.



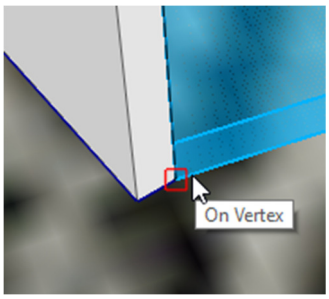
6. Now click on the graph and wait for it to load, you will see 3 grey dashes flashing during the loading process.



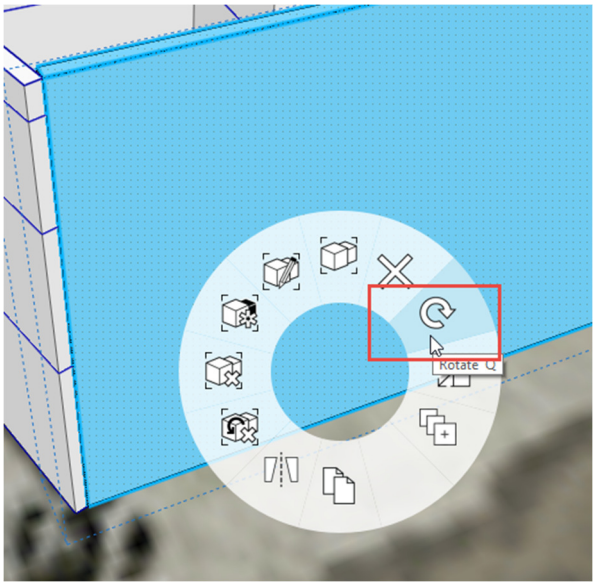
7. When the grey dashes go away you will have the wall we created on the end of your cursor to be placed in the model.



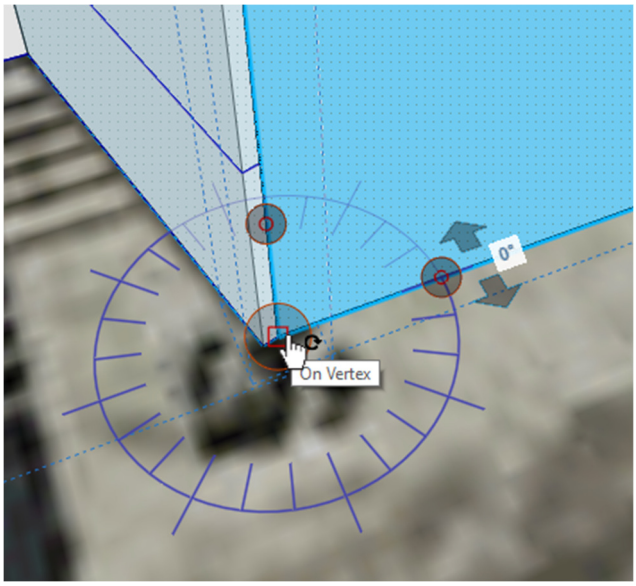
8. You will want to select the bottom right corner of the “Y1” group.



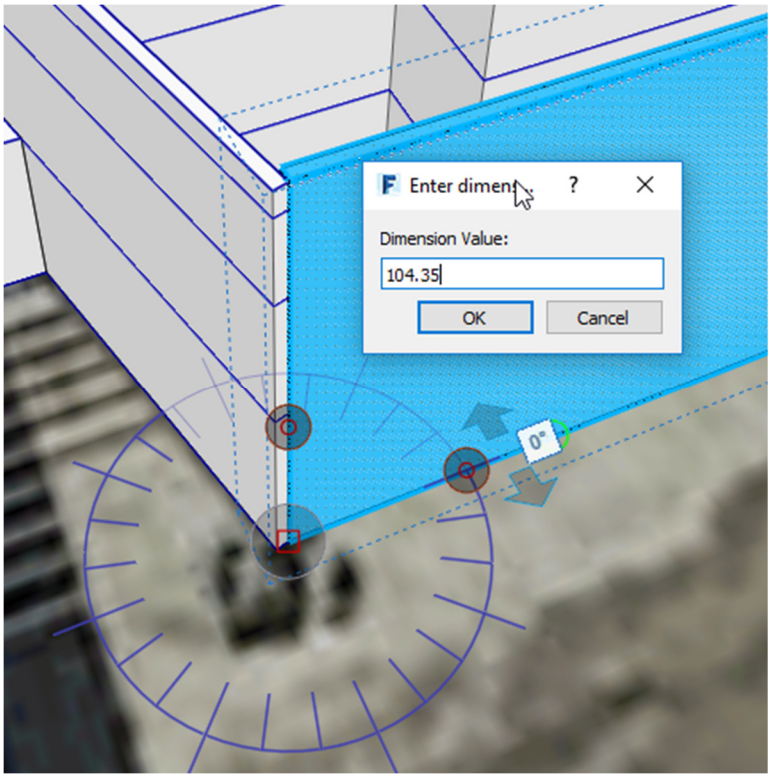
9. While still selected right click and pick the “Rotate” command from the contextual menu.



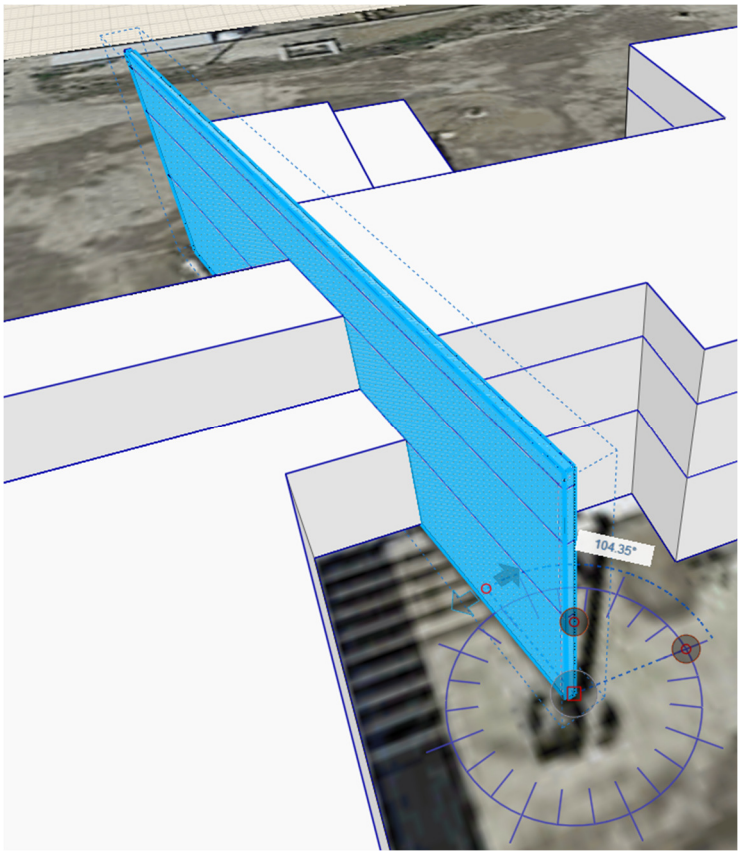
10. Move the Rotate circle to the same point you used to insert the wall.



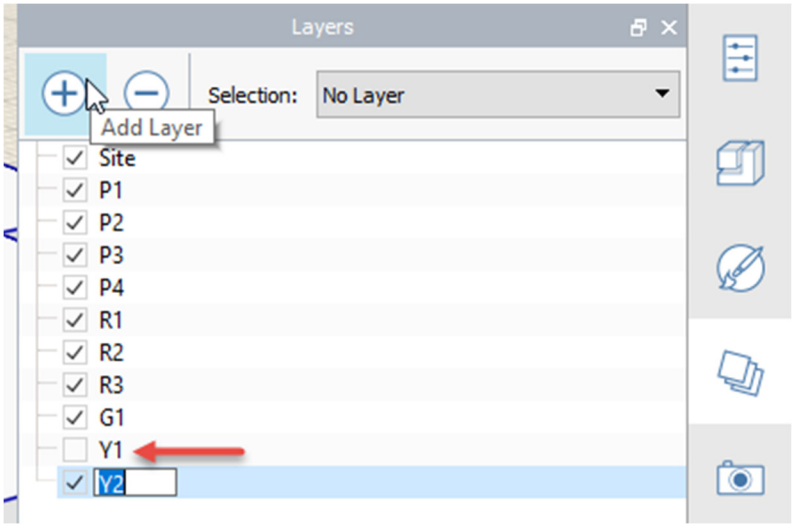
11. If you click on the 0 degrees or hit the tab key the Dimension Value box will pop up and you can put in the value of **104.35.**



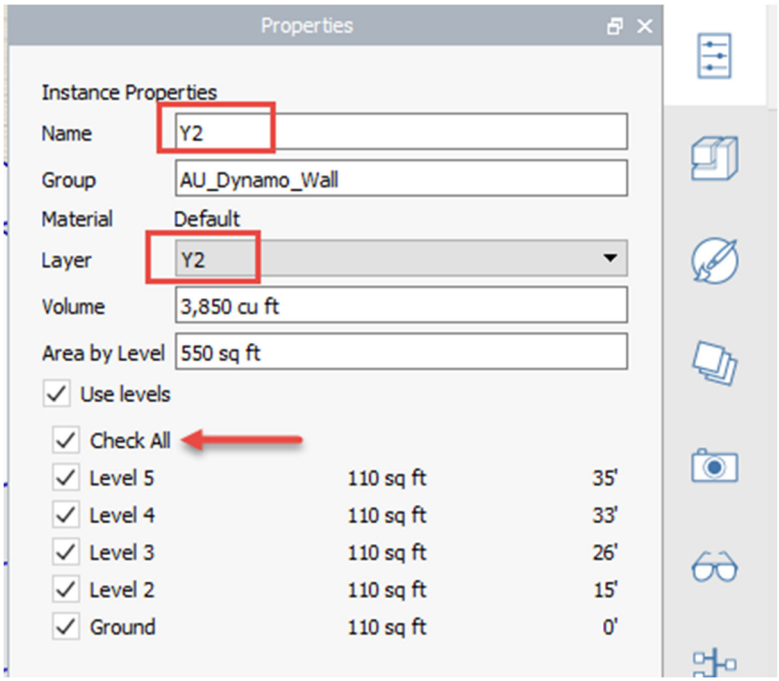
12. When you hit “OK” the wall should rotate to be aligned (or somewhat close to aligned) with the original “Y1” wall.



13. Now we will add a new layer to our project to put the wall on, we will call the layer “Y2”. While in the layer tab we can also turn off “Y1”.



14. The wall came in as a group, so if we single click on the wall we can add it to layer “Y2” as well as name it “Y2”. Don’t forget to all check “Use levels” and make sure **Check All** is checked. You need to be in the Properties tab to do this.

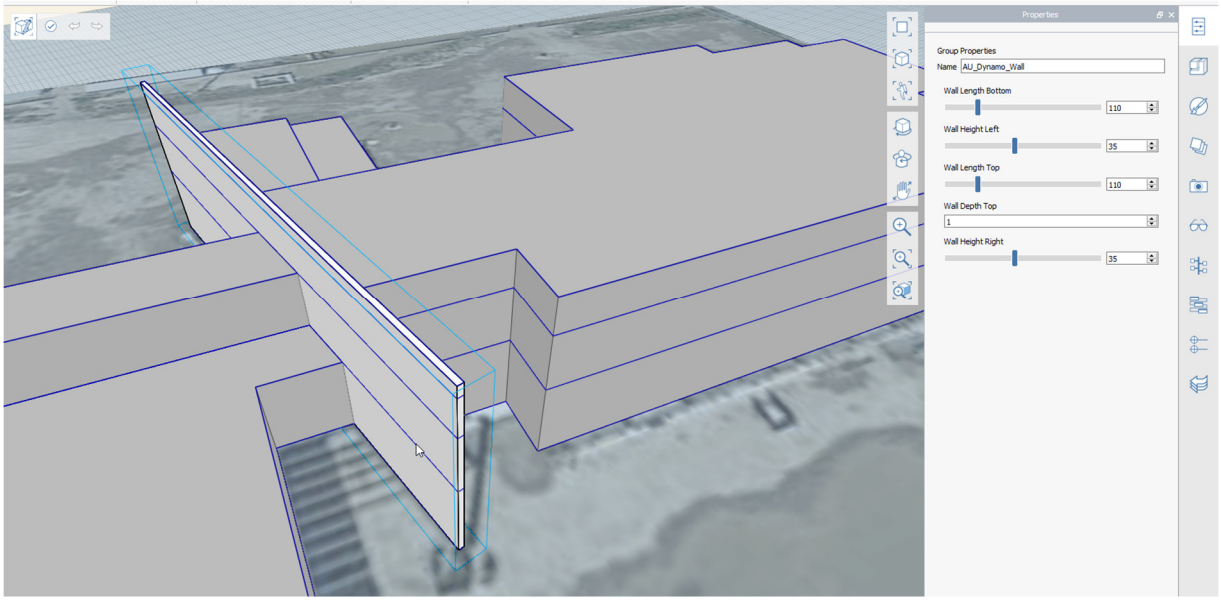


15. Now save the model locally.

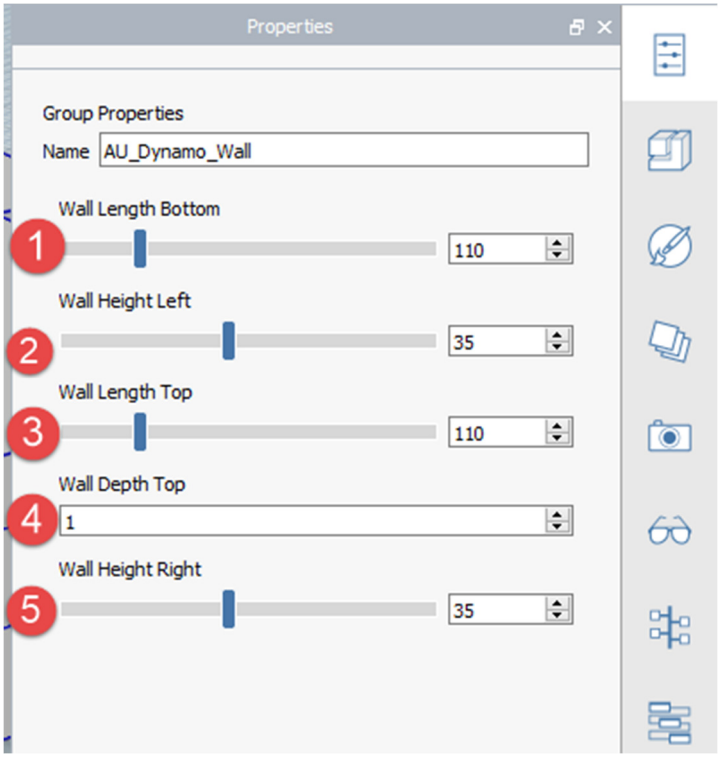
Task 3

In this task, we will do the fun stuff and start playing with the Dynamo graph we imported. You can continue using your project from the previous task, or you can open **"AU_Dynamo_T3_Start"** from the **Ex 3 folder** in the lab data set.

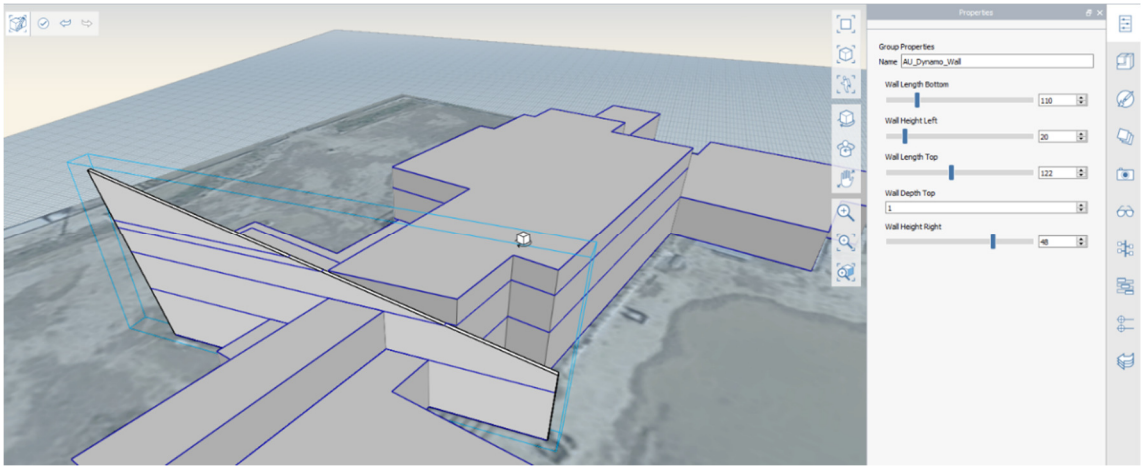
1. The wall (Y2) that came in from Dynamo is a group inside FormIt 360 Windows. To access the inputs, we need to edit the group, which means we need to double-click on "Y2" (the wall). You need to be in the Properties tab to see the inputs after you have double-clicked on the wall (opened the group editor).



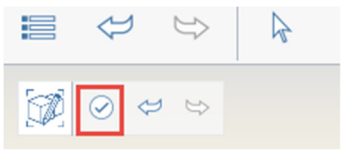
2. If you look closely you will see that there are only 5 of the 6 dynamo inputs displayed.



3. Now experiment with the sliders and number inputs to see how it changes the wall and overall look of the model. While the changes are being computed you will see the 3 grey dashes again.



4. When you are finished experimenting, you will need to close the group editor by hitting the circle with the checkmark in it up in the top left corner.



5. Now save the model locally.

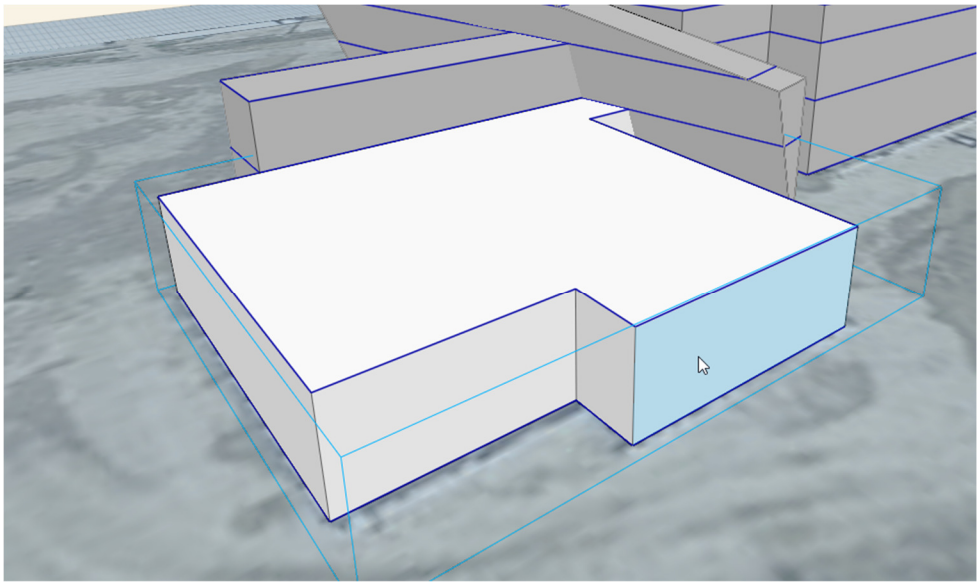
Ex 5) Building Update

In this exercise, we will continue the development of our FormIt 360 Building. For this exercise, we will be using FormIt 360 Windows.

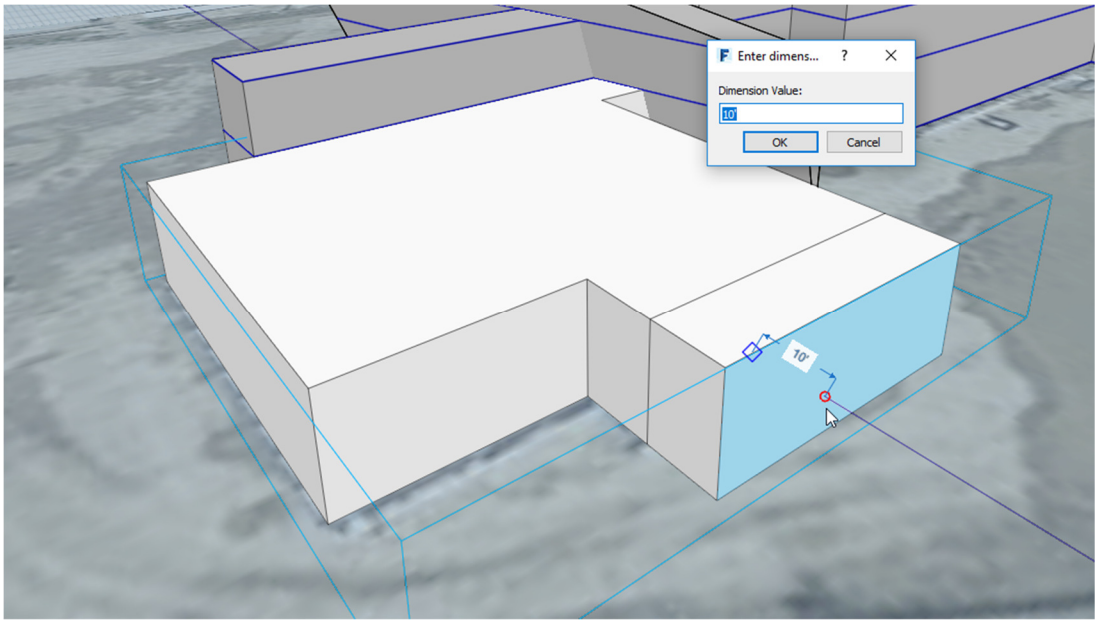
Task 1

You can continue using your FormIt 360 Model from the previous exercise, or you can open **"AU_Building_Update_T1_Start"** from the **Ex 5 folder** in the lab data set.

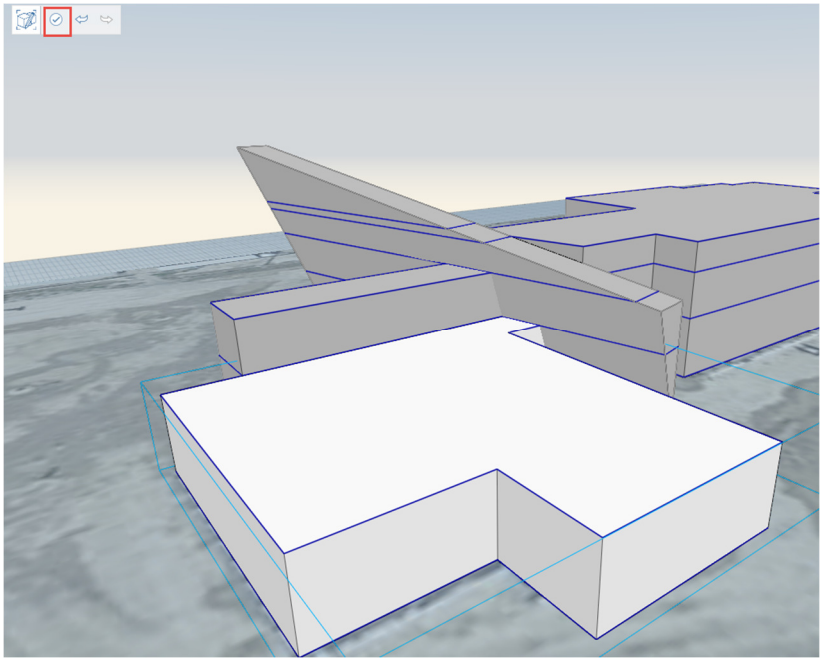
1. Once the model is open we will begin by making some changes to the size and shape of our building. Start by double-clicking on the group "P1" (the first piece of the building we made) this will allow us to edit the group.



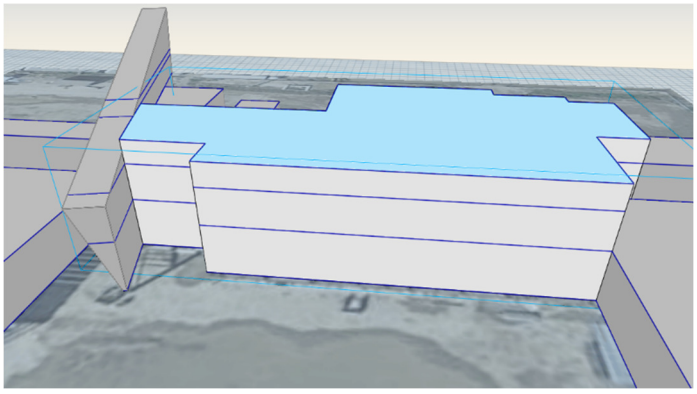
2. Now single click on the wall highlighted in blue above and pull it out **10',** remember you can hit the "Tab" key to open out the Dimension Value box.



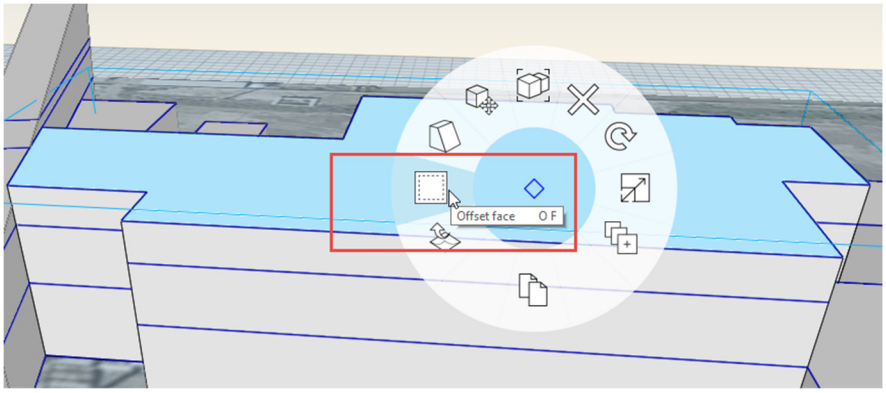
3. Click Esc to exit the command and then close the group editor by hitting the circle with the checkmark in it in the top left corner.



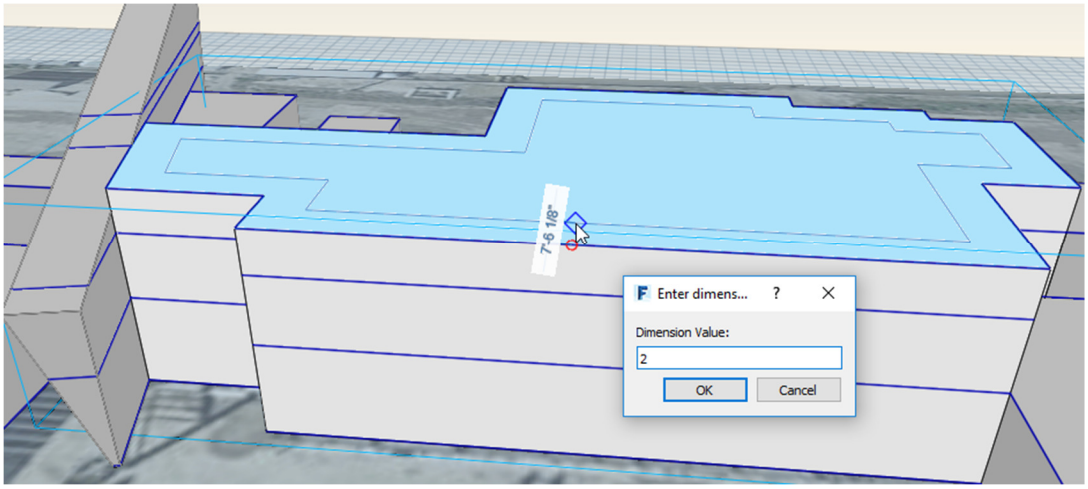
4. Next, we will edit the “G1” group, navigate to this part of the building and double-click to open the group editor.

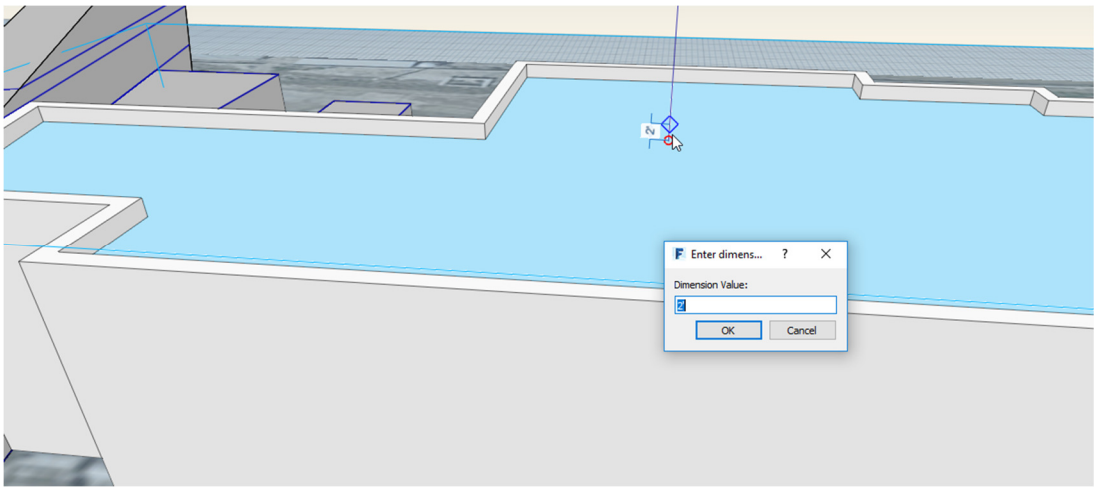


5. With the top of the group selected we can right-click to see the contextual menu, from which we will pick the **Offset face** tool.

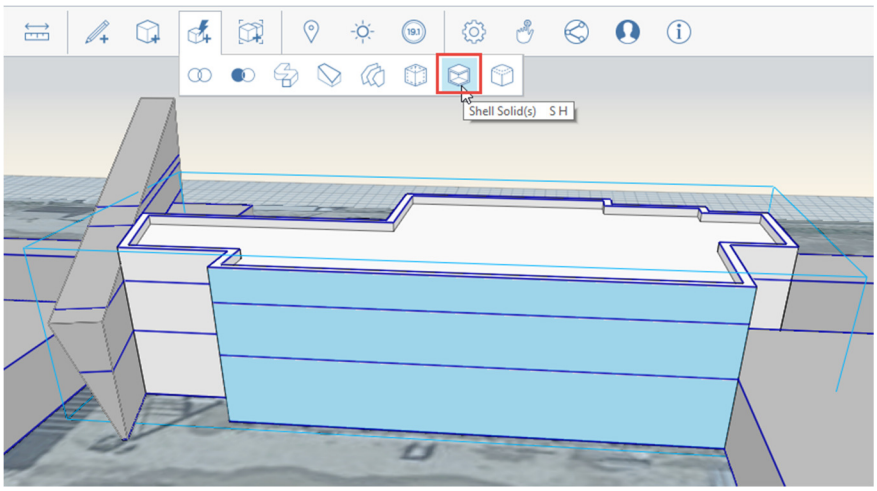


6. Next we enter an offset of **2'** using the tab key, and finally, we select the new inside area and push it down **2'** to create a parapet.

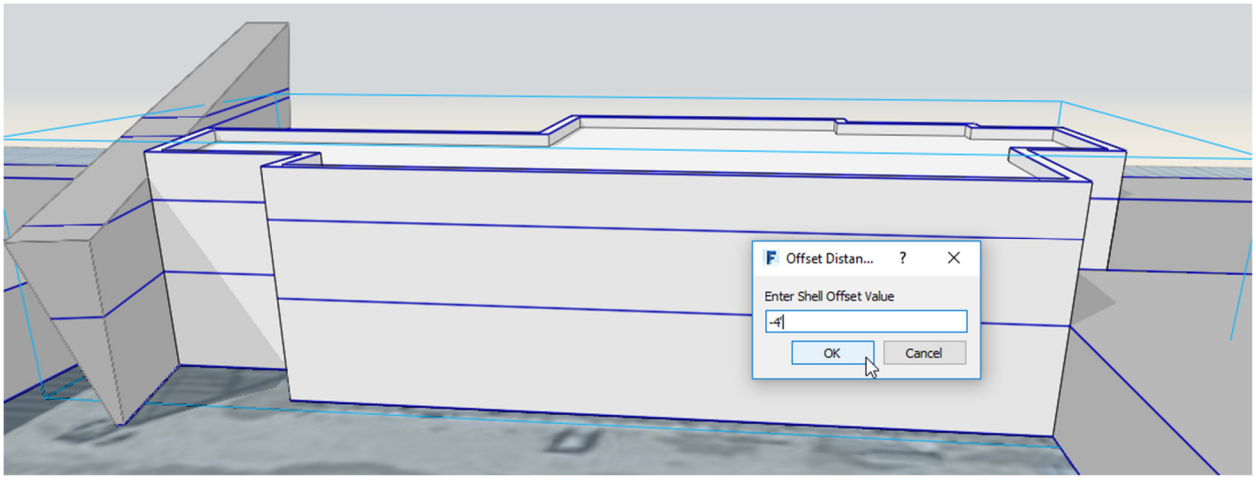




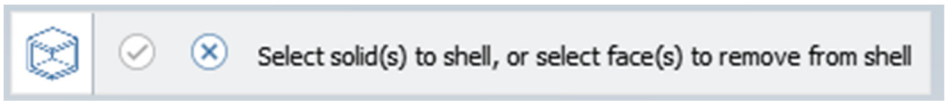
7. We will continue to work in group "G1" but now on the face shown below. For this we will use a command found in the "Advanced Modeling Tool" drop-down menu, you can find these tools under this icon  . We will be using the Shell Solid(s) tool  .



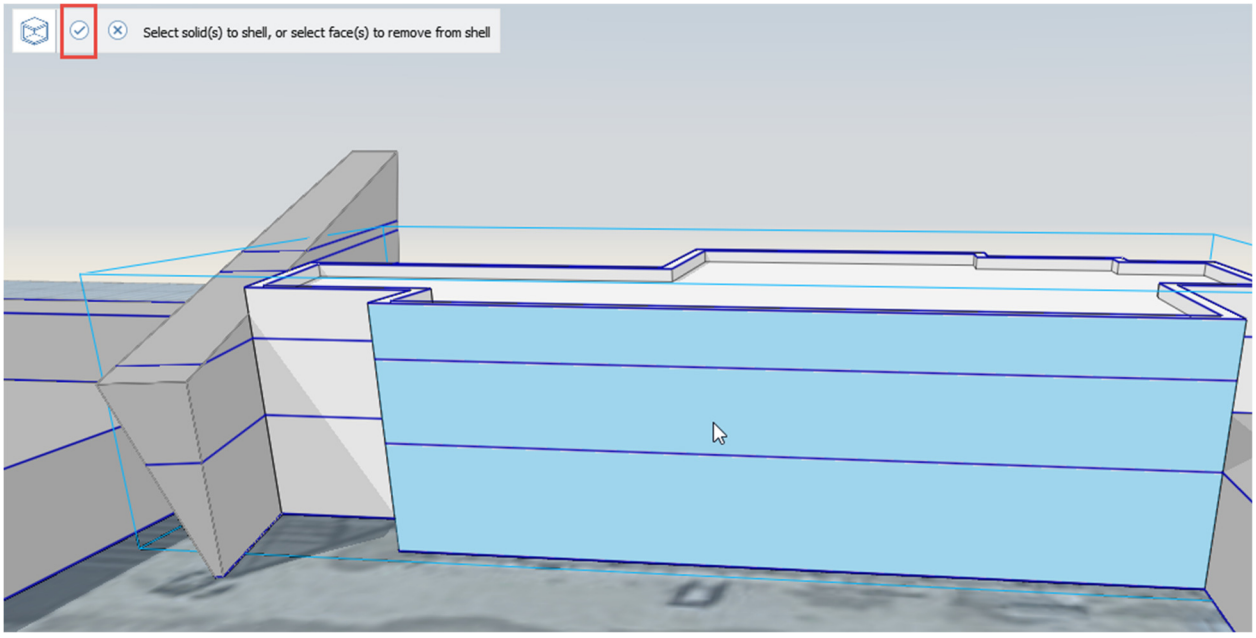
8. After selecting the Shell Solid(s) tool you will be prompted to “Enter Shell Offset Value” use a value of **-4’**, then click **OK.**



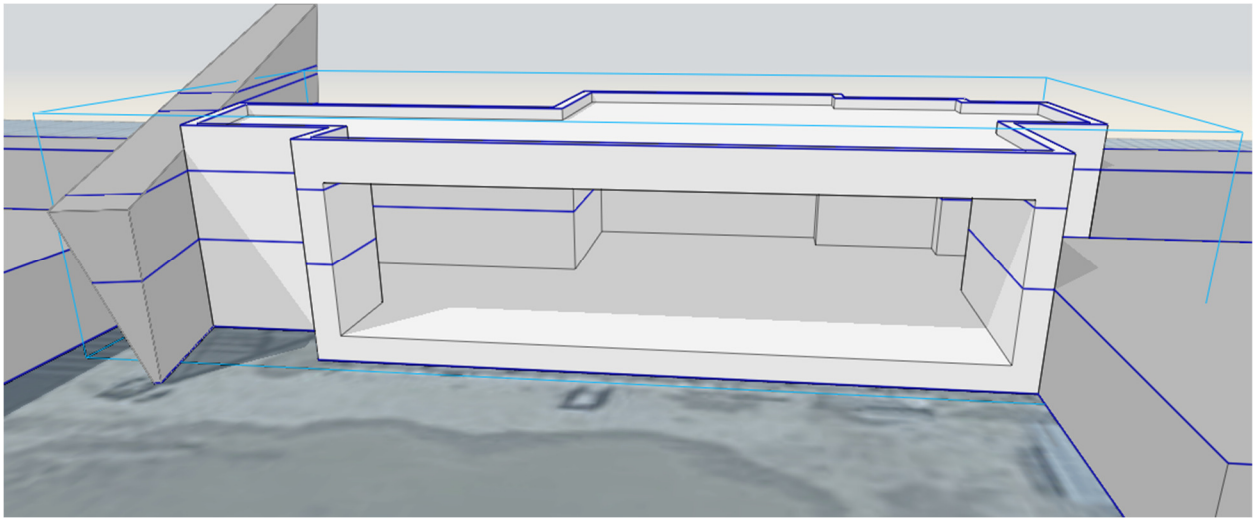
9. After hitting **OK** you will see a new menu pop up in the top left corner.



10. Now you can select the front face and it will turn blue, then hit the circle with the check mark in it to finish the command.

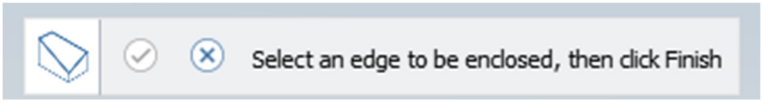


11. You should now see something like what is shown below.

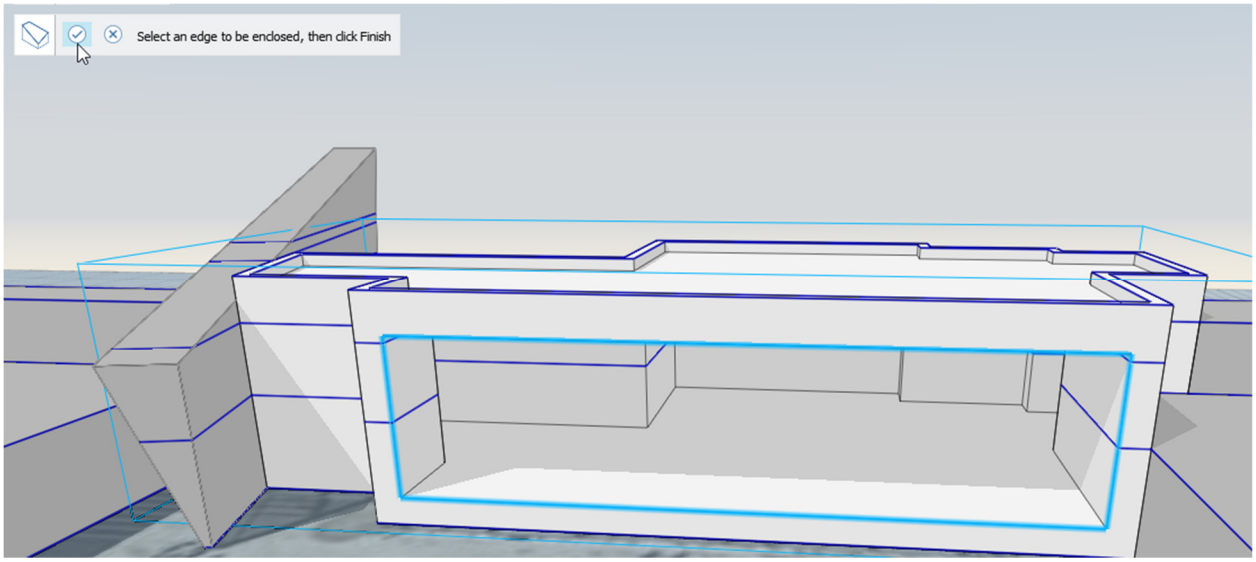


12. We are going to do one more thing with this group. Go back to the "Advanced Modeling Tool" drop-down menu, you can find these tool under this icon  . This time we are going to use the Cover tool  .

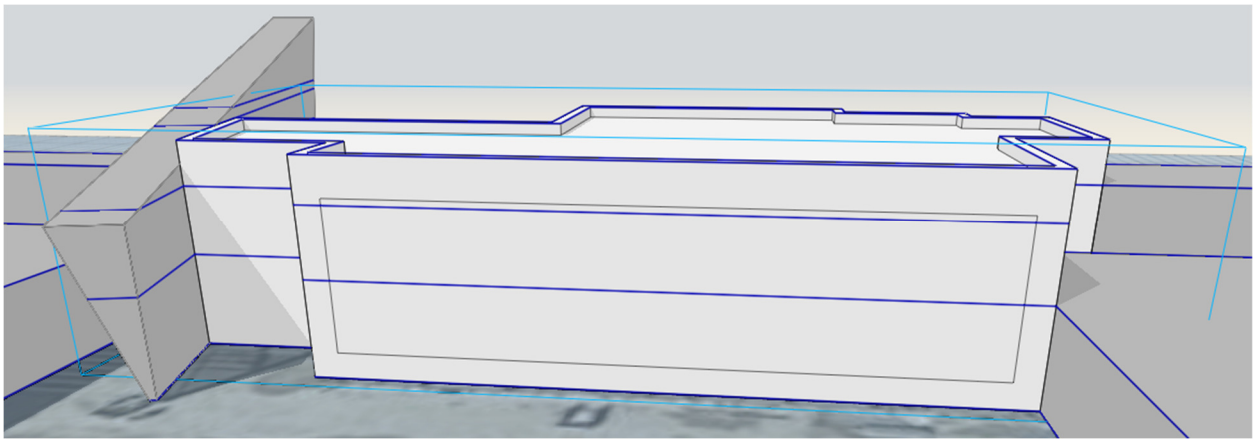
13. After picking the "Cover" tool you will see a new menu appear in the top left.



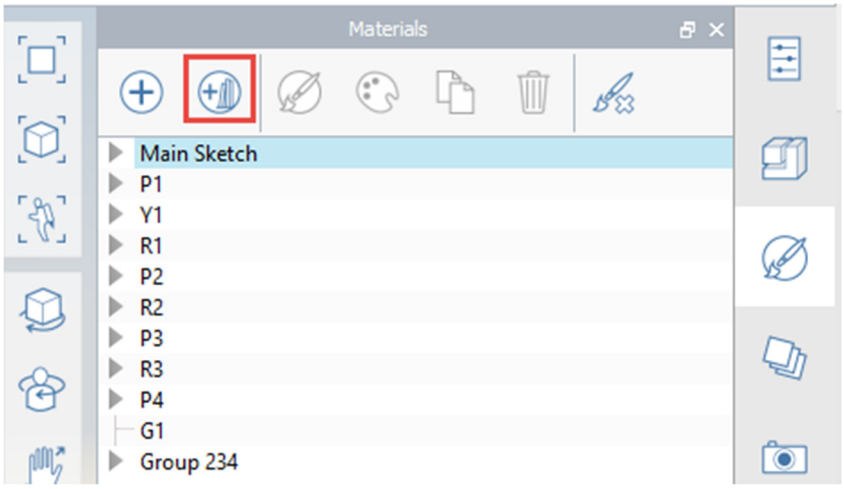
14. Now you will select the 4 edges of the opening in the face we just made.



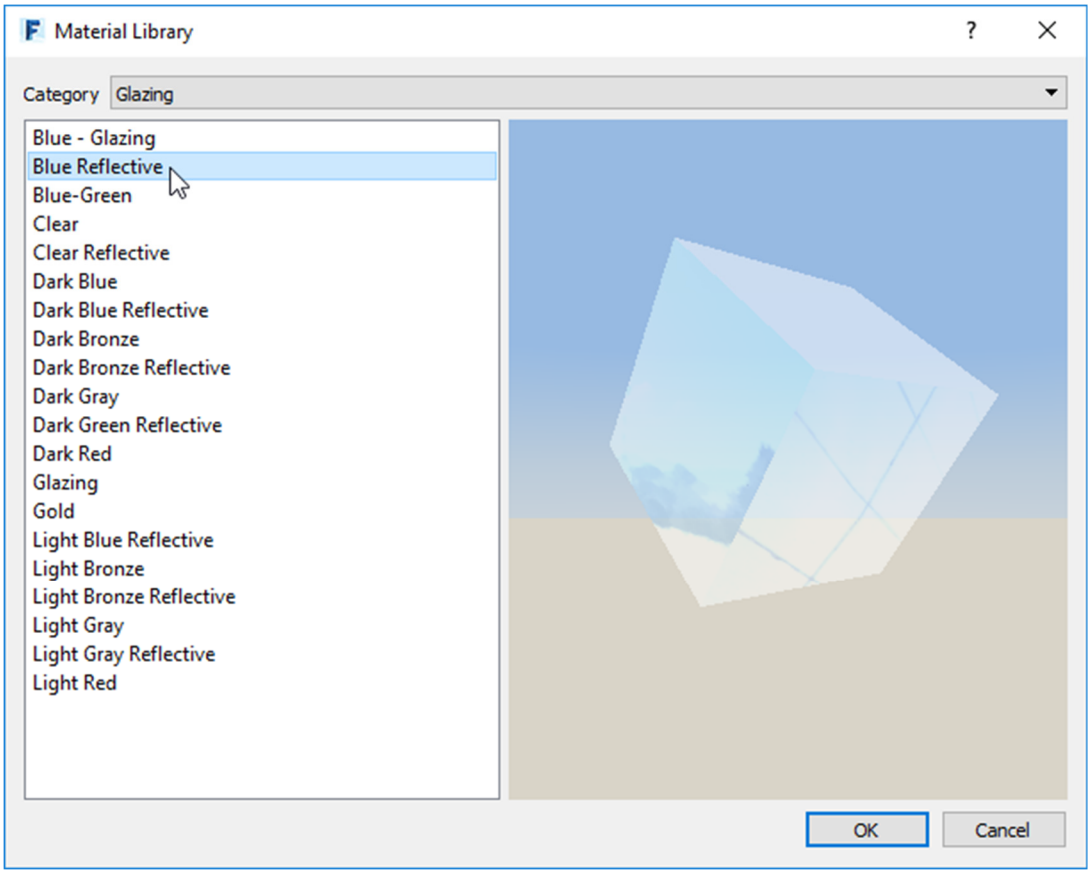
15. After the edges are selected pick the circle with the checkmark in it to finish the command.



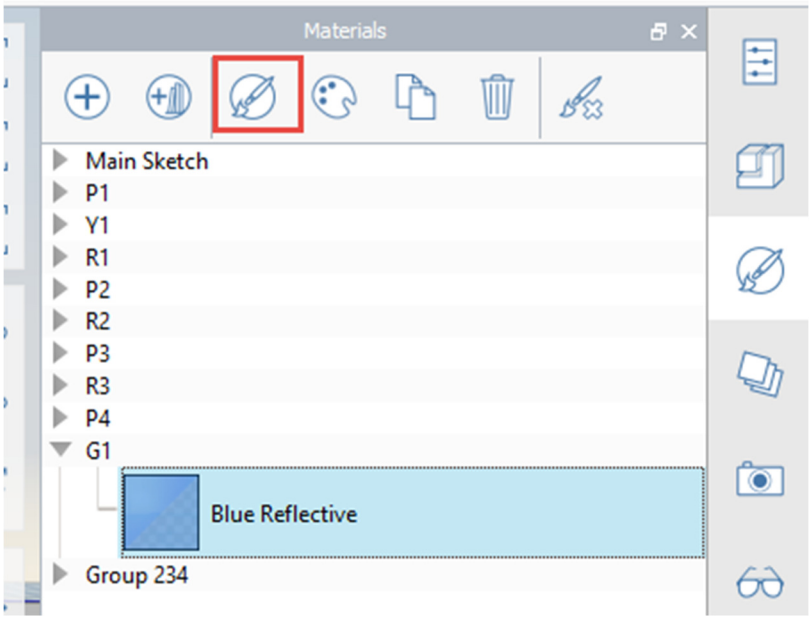
16. The last thing we will do with the group is change the material of the “Cover” we just created to be a glazing that is see-thru. To do this we need to be in the **Materials** tab, then select the “Import Material from Library” button.



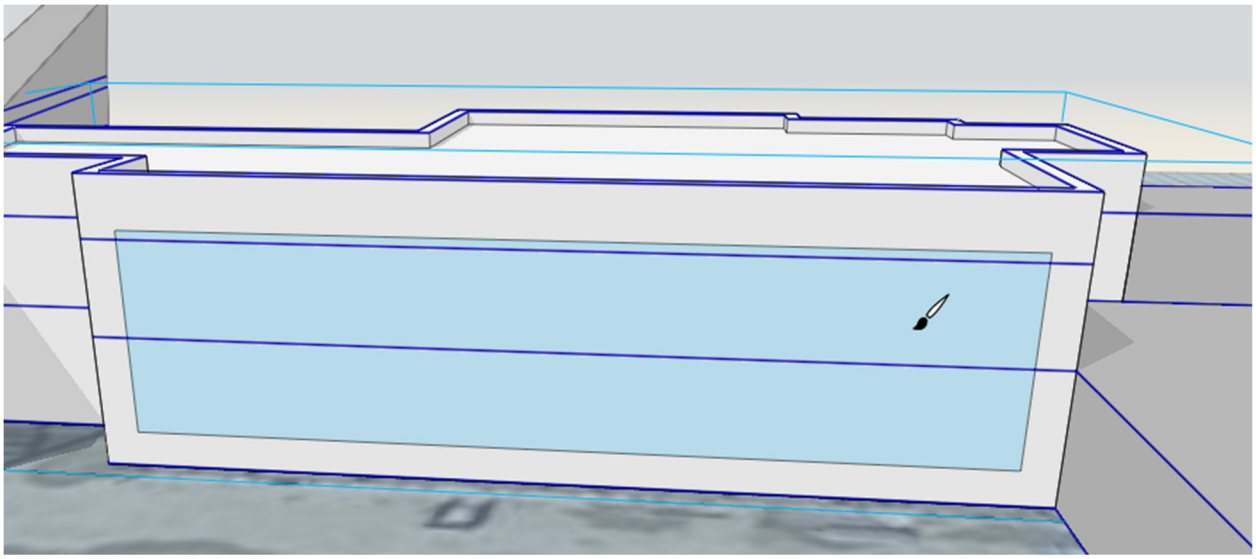
17. From the Material Library choose **Glazing** from the “Category” drop-down menu. The pick the **Blue Reflective** material, then hit **OK.**



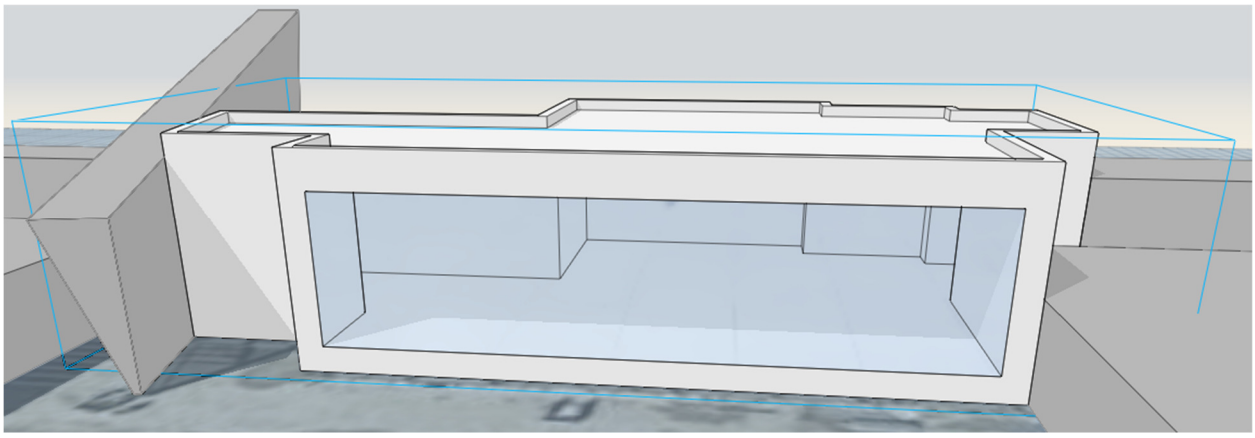
18. Now the “Blue Reflective” material will appear in the **Materials** tab. Next, you need to pick the new material which will now give you access to the “Apply Material” icon  .



19. Once you selected the “Apply Material” icon all you need to do is paint the cover we created earlier.



20. The result will be a see-thru “window”. To view it better use the keyboard shortcut **DL** to turn off the levels.

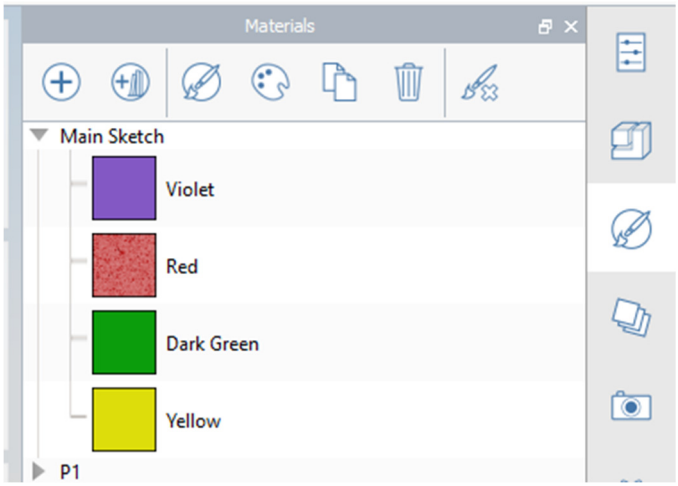


21. Finish by hitting the circle with the checkmark in it to close the group editor, and then save the model locally.

Bonus Task

This is an optional bonus task for those ahead or wishing for some more practice after the session. In this task, we will add materials to all of the groups in the project. You can continue using your project from the previous task, or you can open **“AU_Building_Update_BT_Start”** from the **Ex 5 folder** in the lab data set.

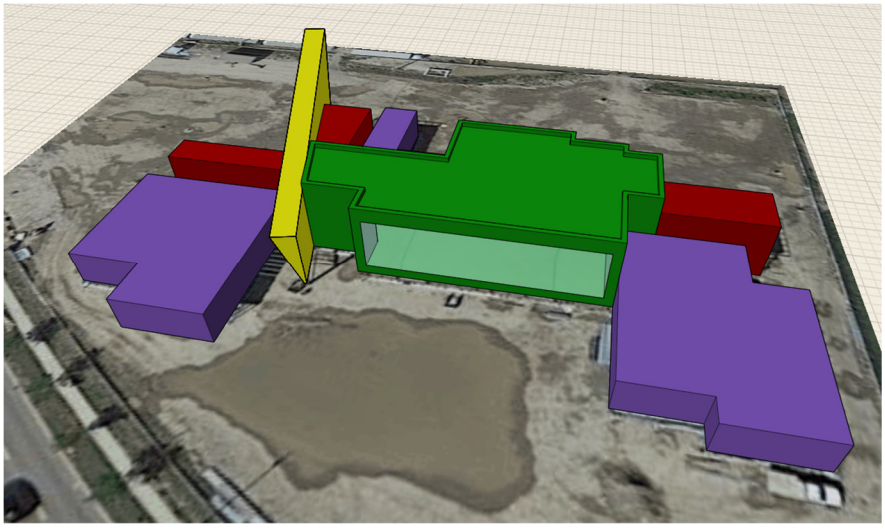
1. In this bonus task, we are going to be applying materials (painting) all the groups in our project. We will need to import the following 4 materials from the **Wall Paint** “Category”, using the same process we just did in task 1 above.



2. Now go ahead and **Apply Material** or paint all of the groups in the project using the chart below to know which material to apply to which group.

Group	**Material**
G1	Dark Green
P1	Violet
P2	Violet
P3	Violet
P4	Violet
R1	Red
R2	Red
R3	Red
Y1	Yellow

3. When you are finished your model should look something like the picture below.



4. Save your model locally.

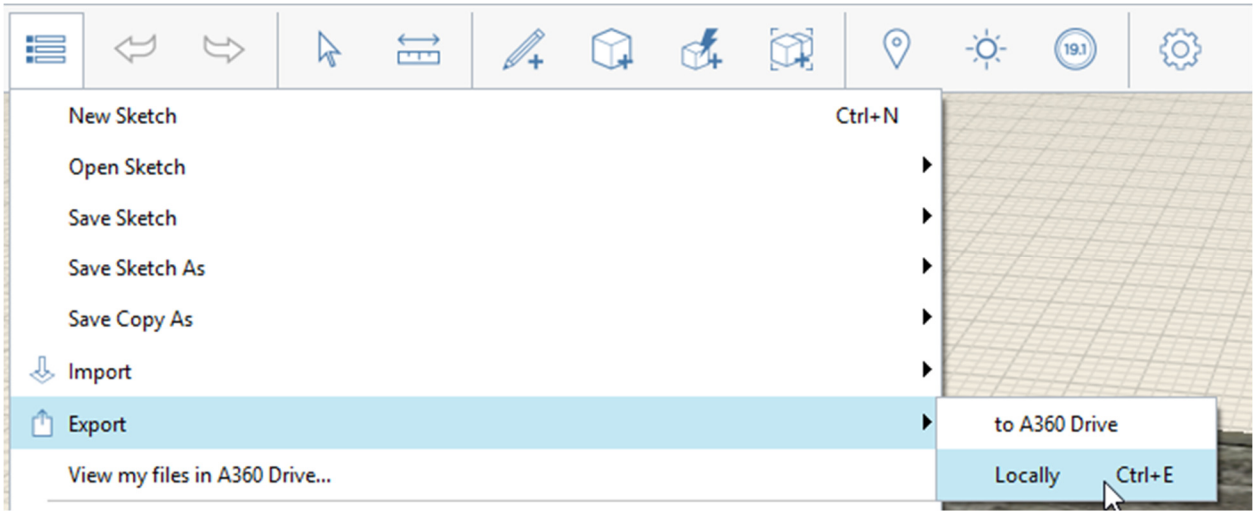
Ex 6) Revit Update

In this exercise, we will import our updated building from FormIt 360 into Revit 2017, then use that to update our existing Revit file. For this exercise, we will keep using FormIt 360 Windows, and Revit 2017.

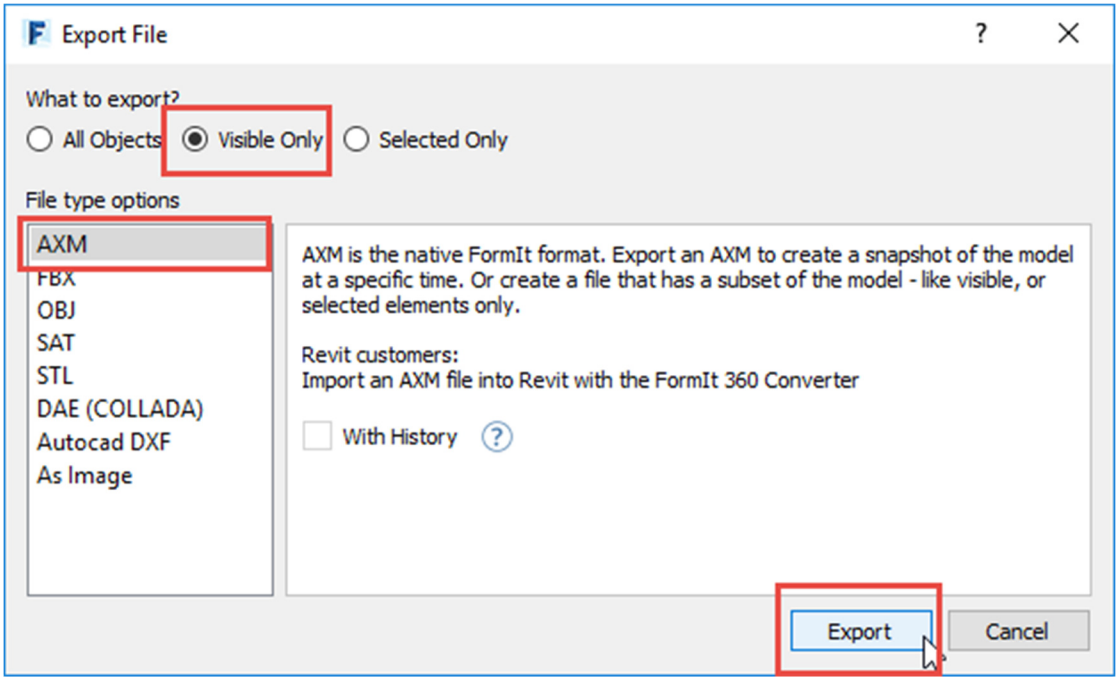
Task 1

For this task open **"AU_Revit_Update_T1_Start"** from the **Ex 6 folder** in the lab data set.

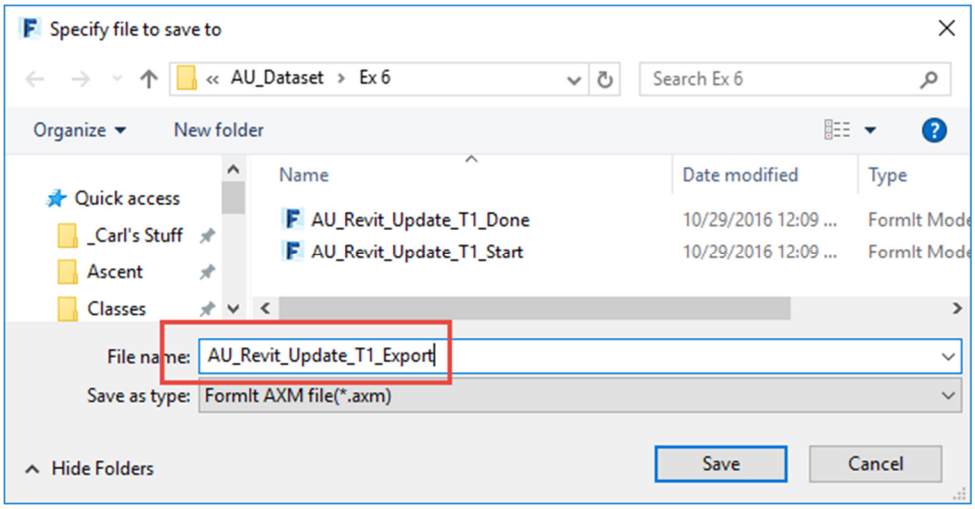
1. Once you have **"AU_Revit_Update_T1_Start"** open in FormIt 360 Windows, we will need to export the project.



2. This time when we export we want to select "Visible Only" so we don't bring in the original "Y1" wall, just the new Dynamo "Y2" wall. Once "Visible Only" and "AXM" are selected hit **Export**.

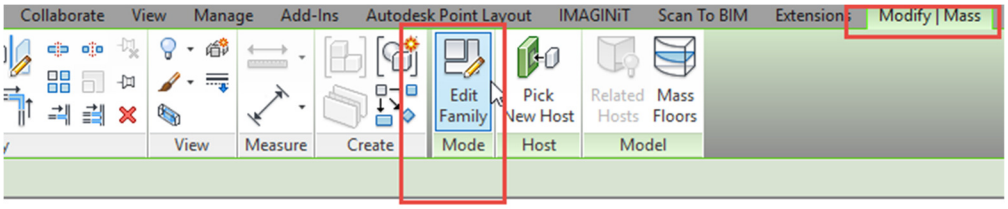


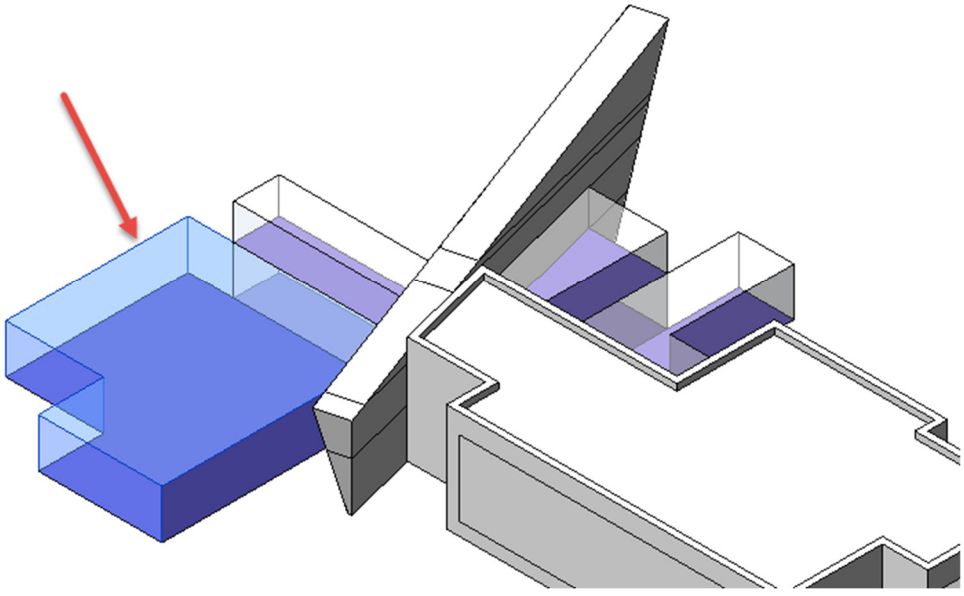
3. Save the file as: **AU_Revit_Update_T1_Export.**



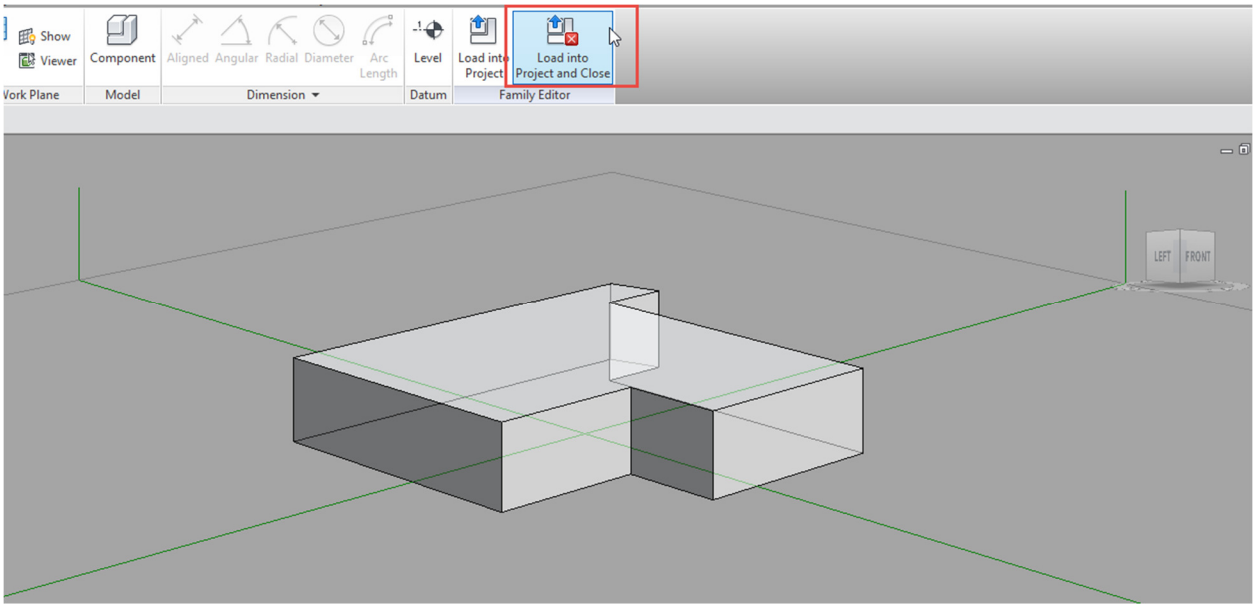
4. If not already open, open Revit 2017. Once Revit is open you will need to load **"AU_Revit_Update_T1_Existing"** from the **Ex 6 folder** in the lab data set, then also open **"AU_Revit_Update_T1_New"** from in the same folder. This Revit file already contains the FormIt 360 AXM file we just exported.

5. Make sure you are currently in the **"AU_Revit_Update_T1_New"** Revit model. Once in that model select the "P1" mass group. Then from the **Modify | Mass** contextual tab select "Edit Family".

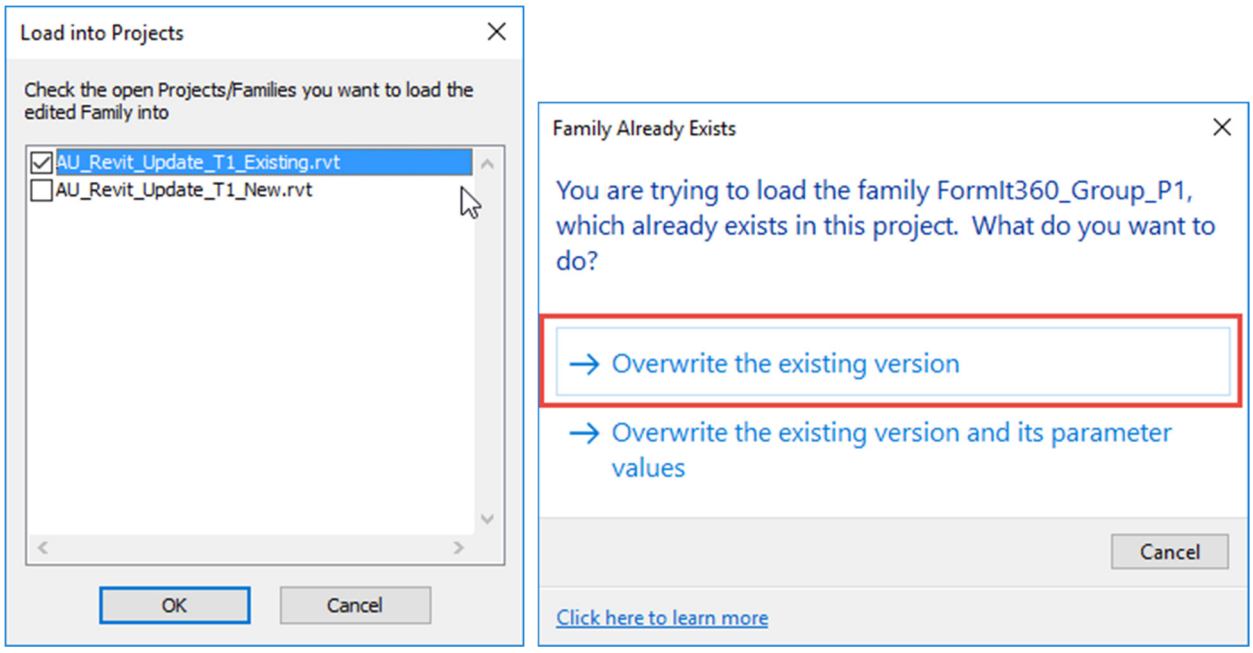




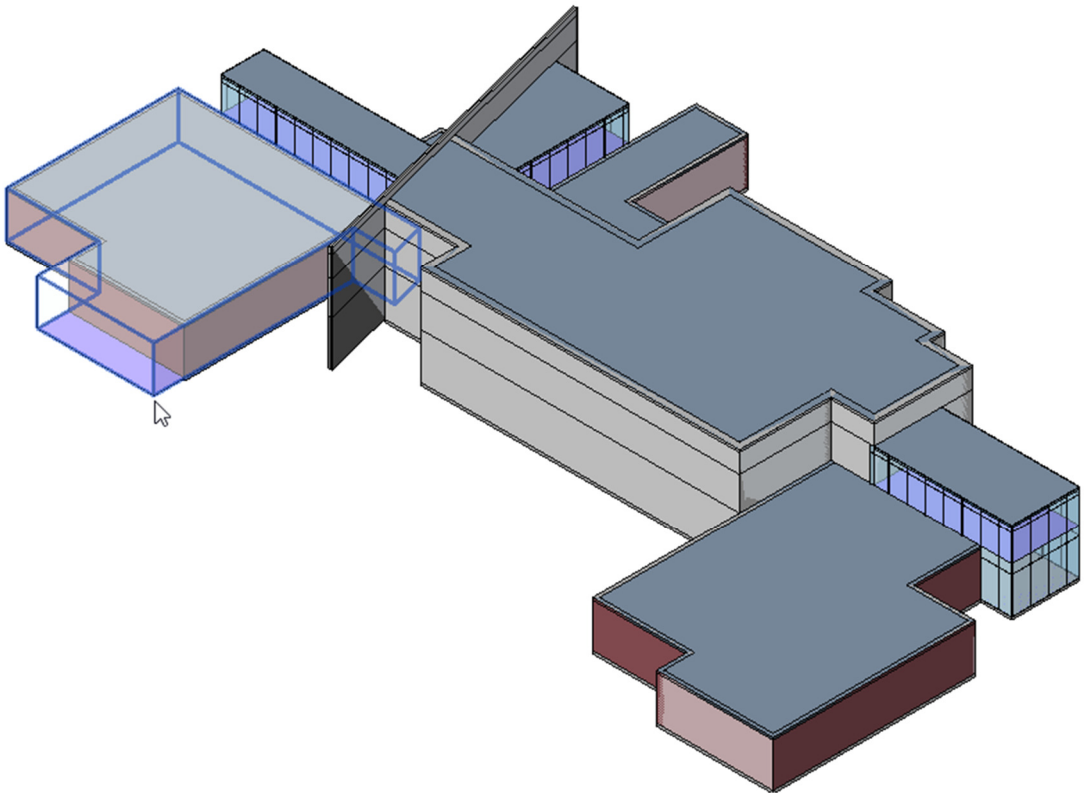
6. This will open the **Family Editor**, and all we need to do now is pick the “Load into Project and Close” button.



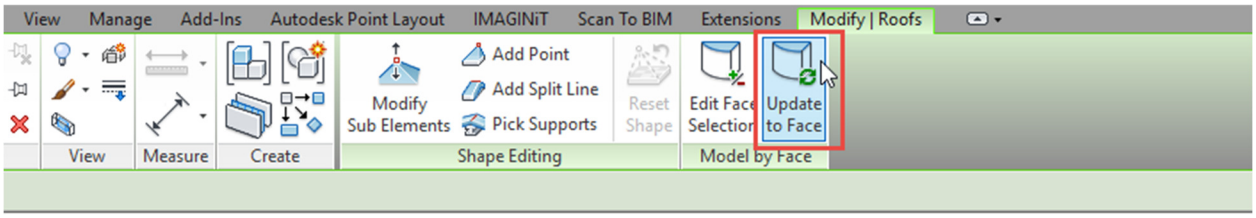
7. When the “Load into Project” box appears select **AU_Revit_Update_T1_Existing.rvt** and hit **OK**. At this point, the Revit model **AU_Revit_Update_T1_Existing** will open and a “Family Already Exists” box will appear, in this box pick *Overwrite the existing version*.

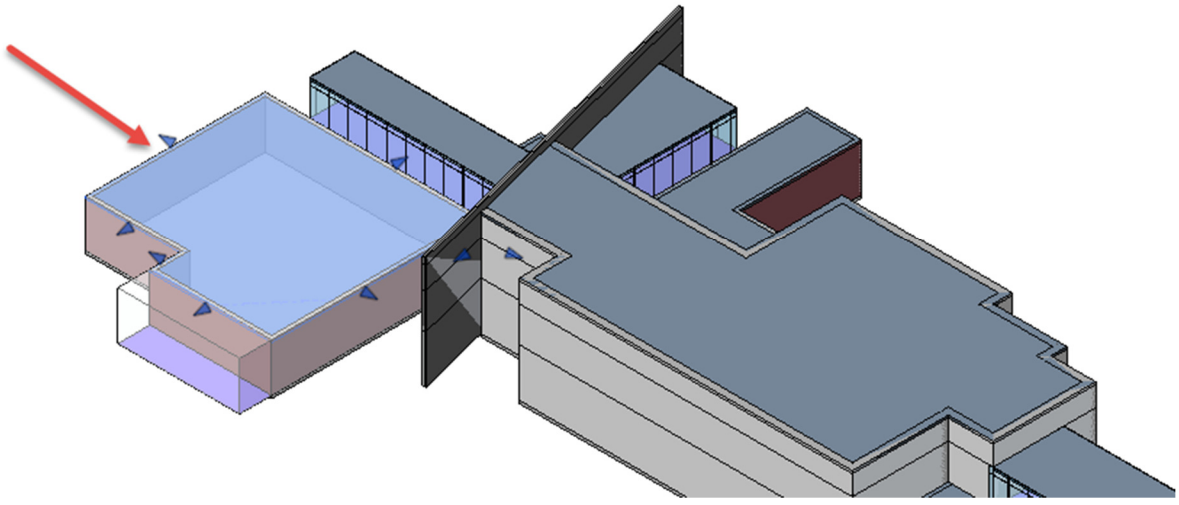


8. The new mass will replace the old original mass, and you will be able to see that the new mass is bigger. You will also notice that the Revit walls, roof, and floor did not automatically update with the new mass.

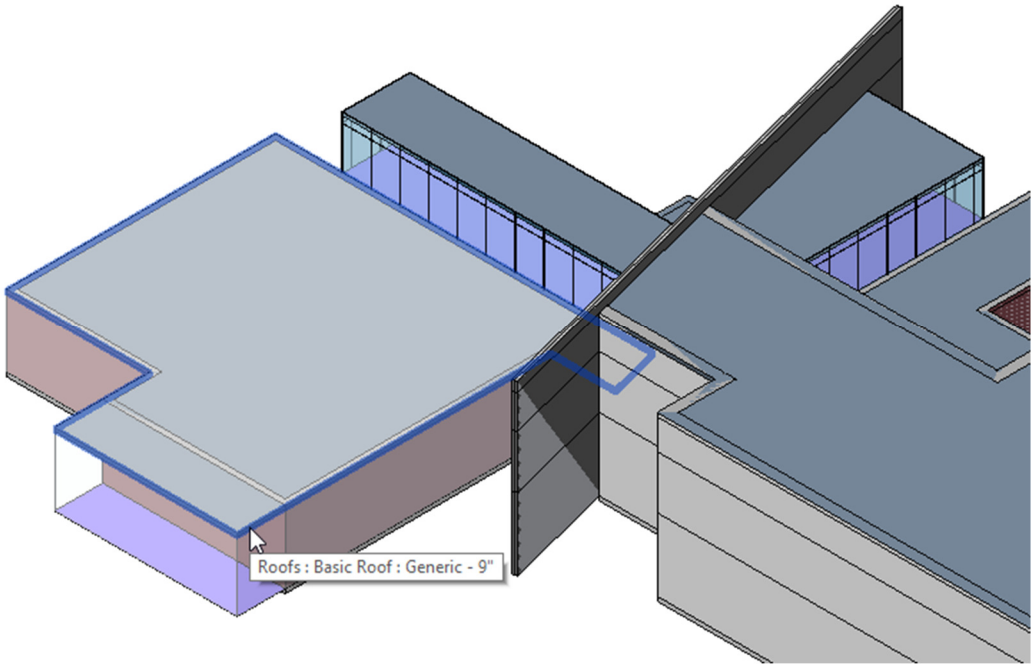


9. To update these Revit elements, you need to select them one at a time and use the “Update to Face” tool, which appears in the **Model by Face** panel of the element type you choose. Let’s start with updating the roof.





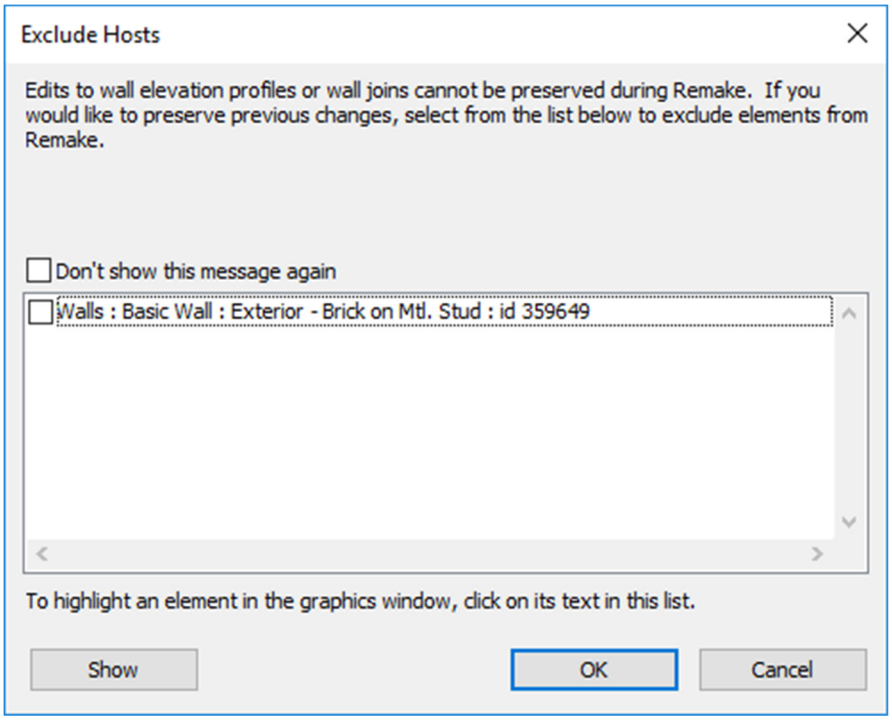
10. What the updated Roof looks like in the Revit model after being updated.



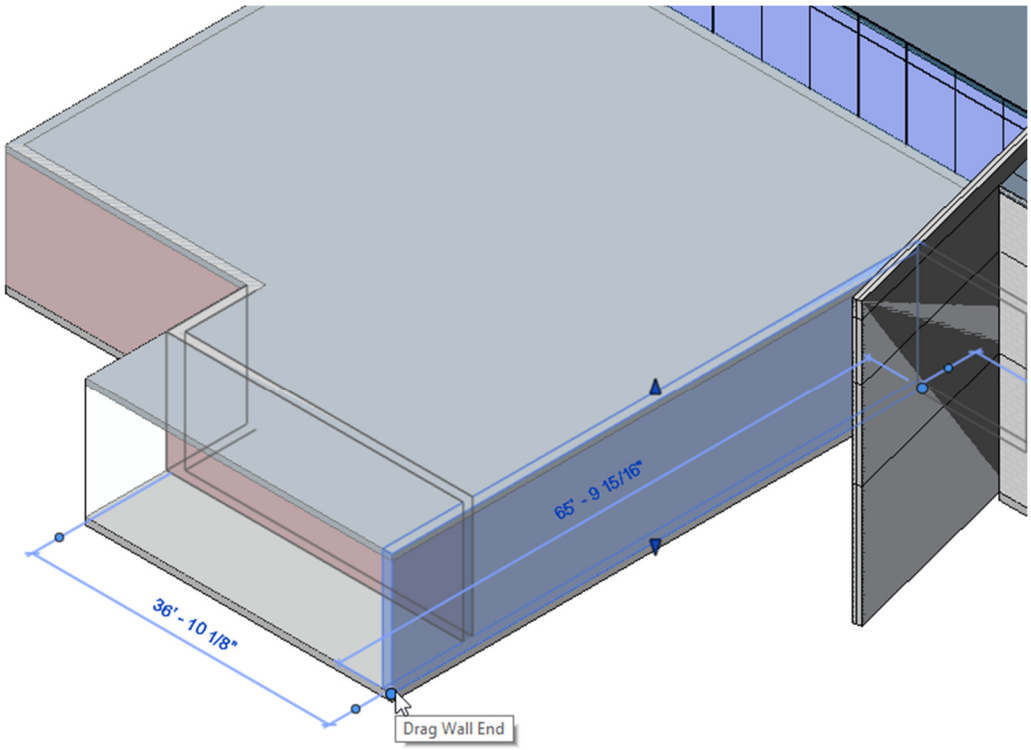
11. Continue the process with the Floor and 3 Walls.

12. You may notice when doing the walls that you get a warning that pops up like the one shown below. This method of updating the Revit model is more of a workaround than an exact science, and sometimes it is just easier to delete the old element and create a new one.

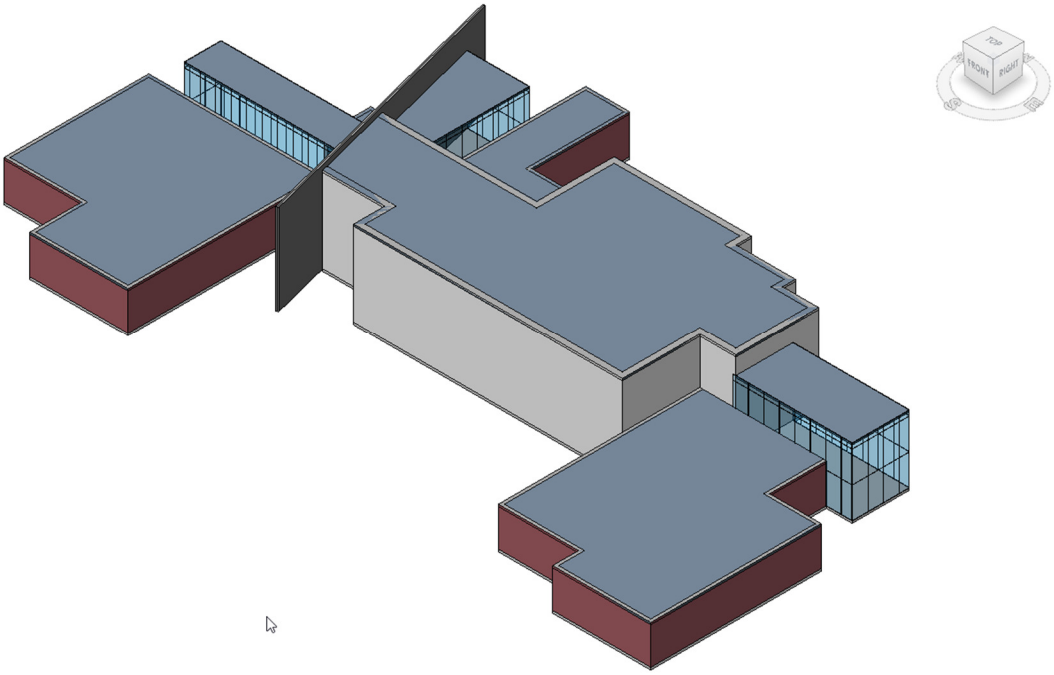
Note: if you delete an element, like a wall that has dimensions or other annotation attached to it you will lose that dimension and/or annotation.



13. If you want to keep the element (and any annotation associated with it) check the box beside the element you want to keep to exclude it. Then you will have to update the element, in this case, a wall, manually within Revit using a method of your choice. In the example below I just dragged the wall to align with the floor edge below.



14. When the Revit floor, roof and 3 walls for Group “P1” have been updated save your project.



Appendix A – The Basics

In this appendix we will cover some of the basic features and how to use them in FormIt 360. The examples will be done using the web version.

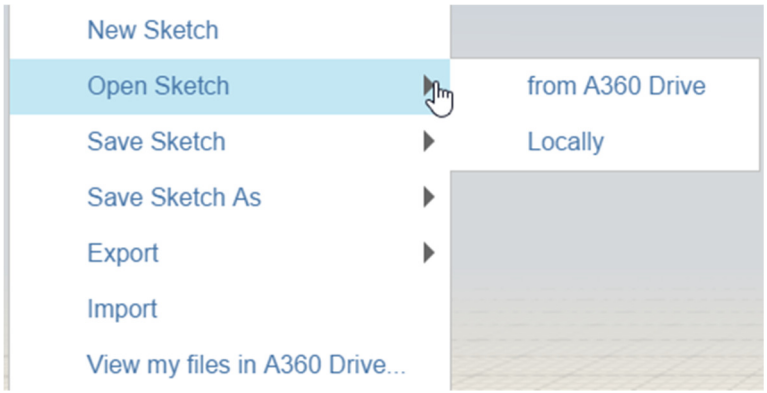
FormIt 360 Web

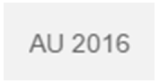
User Interface

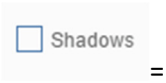
Action Bar

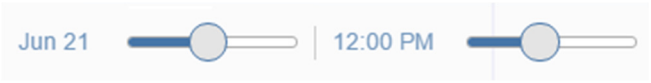
- The action bar is found at the top of your screen. The tools in the action bar will help you create, edit, and share content (shortcuts in brackets)

  -  = Open/Save



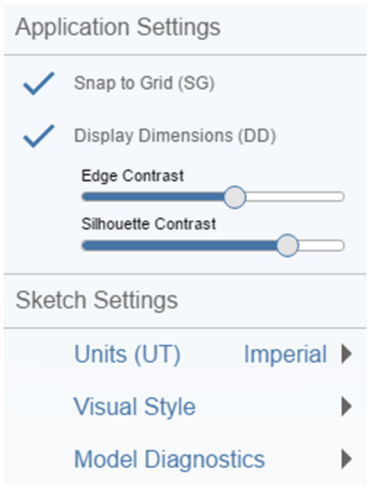
  -  = Current model name
  -  = Undo (Ctrl+Z) and Redo (Ctrl+Y)
  -  = Selection
  -  = Measure
  -  = Create Sketch
    -  = 3D Sketch (L), Arc (A), Spline (S), Rectangle (R), Circle (C)

-  = Create Primitives
  -  = Create Cube (Alt+B), Create Dome (Alt+D), Create Pyramid (Alt+P), Create Cylinder (Alt+C), Create Roof (Alt+R)
-  = Advanced Modeling Tools
  -  = Join two solids into one, Cut a solid from another, Sweep (SW) a profile along a path, Cover (CV) open geometry by selecting edges, Loft (LO) connect multiple Profiles or edges, Offset Solids, Shell Solids, Fillet
-  = Groups
  -  = Create Group (Alt+G), Edit Group (EG) Make unique (Alt+U), Ungroup (Alt+U), Ungroup All (Alt+A), Ungroup Model (UM)
-  = Sun and Shadows (DS)
  - 

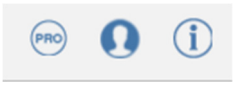
= Turn shadows on or off
  - 

= Date and Time
  - 

= Solar Analysis (Pro Feature)
-  = Settings



-  = Location
-  = Energy Analysis (Pro Feature)

- At the far right end, you will find the User Identity, Help Bar 
  -  = Obtain access to Solar Analysis, Energy Analysis, Autodesk Material Library, and Collaboration features
  -  = Login to A360 to store and share your sketches
  -  = FormIt 360 Help

Navigation

- You can use the Navigation tools on the navigation bar, normally docked on the right side of the screen (shortcuts in brackets)

= Top View (ZT)

= View 3D (ZD)

= Fly-through Mode (FT)

= Orbit (Right Click Mouse Drag)

= Pan (Middle Mouse Drag)

= Zoom (Middle Mouse Scroll)

= Zoom to Fit (ZZ)

= Zoom to Selection (ZS)

Palette Bar

- The Palette Bar appears on the right side of the screen. Click one of these icons to open a side palette to display building properties, materials, layers, scenes, levels, a content library, and collaboration tools.

= Properties

= Materials

= Layers

= Scenes

= Levels

= Content Library

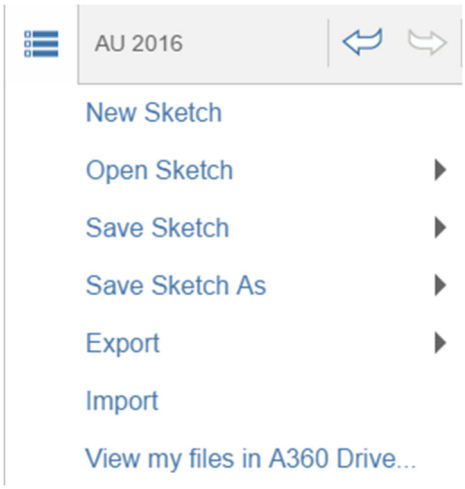
= Share (Collaboration – Pro Feature)

Selection

- Once you have a solid if you single click on a face you will select the face
  - You will also see the area of the face in Properties
- If you double click on the face you will select the solid
  - You will also see the volume of the solid in Properties
- If you single click on an edge you will select the edge
  - This will also tell you the length of that edge in Properties
- You can also select a vertex by single clicking on it (a corner point)
- If you draw a line, you can also hover over it and the select it with a single click

How to save

- Create a project
- Give it a name
  - Open the “Open/Save” button and choose your save option



- You have two save options
  - to A360 Drive
  - Locally

- By default, all files are saved to your A360 Drive account
  - These files are available to you on all versions of FormIt 360
    - Web
    - iOS
    - Android
    - Windows (Pro Feature)
  - A360 Drive accounts are **free**

- To open a file, you repeat the same process as saving
  - You have options for opening a fail
    - to A360 Drive
    - Locally

Creating Masses and Forms

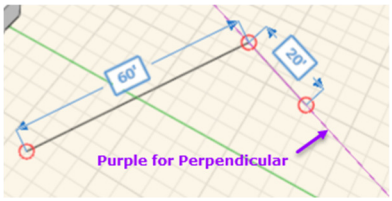
3d Sketching and Snapping

- A red circle lets you know you are ground snapping to the grid snap intervals
- Axis Colors
  - Red Axis = X
  - Green Axis = Y
  - Blue Axis = Z

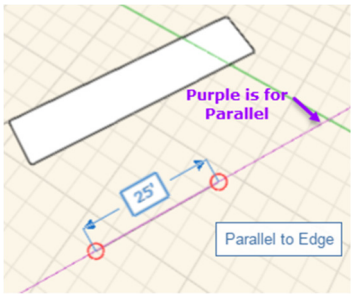
- A Purple dashed line will let you know you are aligned with origin point and can close your shape
- "**Shift locking**" is when you hold down the shift key and the axis line you are on gets dark. Then your mouse can wonder and remote snap to a point, whiteout losing your location on the axis line you made dark
- You can also get a remote snap similar to Snap Tracking in ACAD by moving your mouse to the snap location and wait for the tooltip to be displayed.
    - Once it has been displayed you will see a purple dashed line along the axis you are traveling back to your remote snap location (90 degrees only).

3d Sketching and Snapping

- You can draw on faces using any of the tools from the "Create Sketch" menu
    - You can even draw across openings with a face if required
- If you have snapped on an edge you will see a green circle
- When you are on a midpoint you will see the red triangle midpoint symbol
- **Drawing Parallel and Perpendicular Lines if off Axis**
    - If you want to draw off grid you can do so, and still be able to have parallel and perpendicular line
        - After drawing the first line of your rectangle as you start moving in the perpendicular direction you will see a solid purple line when you are perpendicular



            - You should also get a tool tip that pops up to say you are perpendicular
        - Parallel lines will work the same way as the perpendicular above, just on a parallel line.

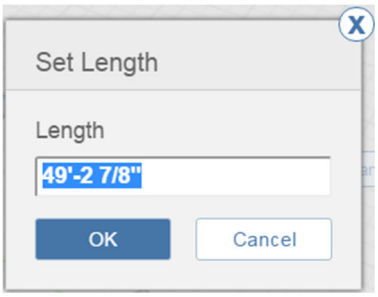


    - If you want you can also force FormIt to draw a line as parallel or perpendicular
        - Start drawing your line
            - Then hover over the line you want to be parallel or perpendicular

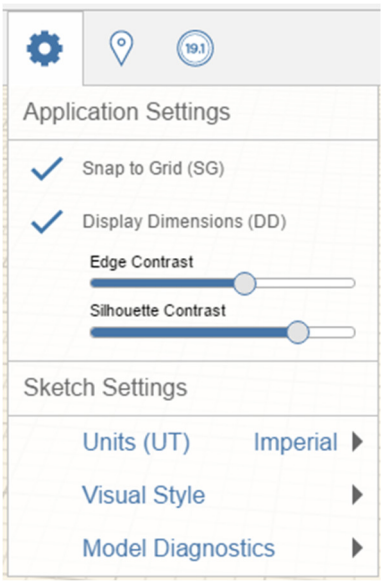
- After you have hovered over the line, you will see the Purple solid line as your guide for a line that is either parallel or perpendicular

Dimensions

- When you see a dimension while drawing you can click on it to enter a number
- If you don't want to click on it, you can also hit the Tab key and the same dialog box opens to enter the line length



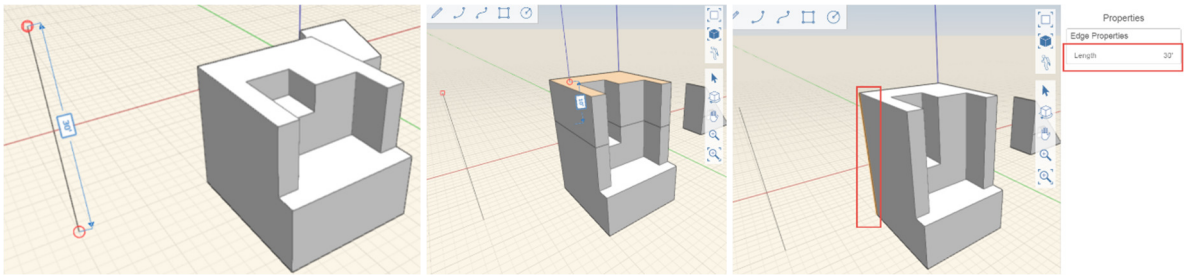
- If you want to turn off the dimensions you can hit "DD" to turn them off
  - The same shortcut will turn them back on "DD"
- You can also control the visibility of the dimensions under the settings tab on the ribbon
  - Uncheck "Display Dimensions"



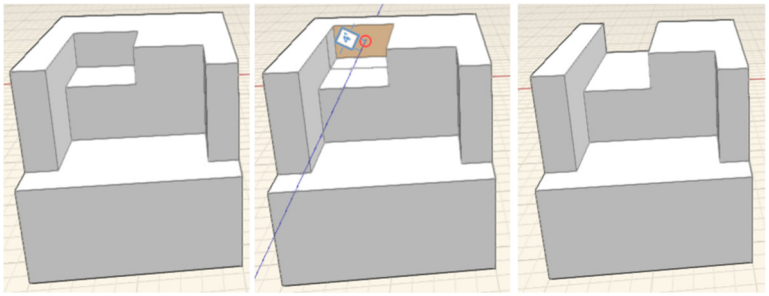
Drag Face and Snapping

- You can drag a face by selecting it (single click) and pulling (up/out) or pushing (down/in) to where you want.
  - You can edit the dimension to assign the face its end location
  - You can also hover over another parallel face and assign the face you are pulling the same dimension

- This hover trick (remote snapping) can also work with other points (not just parallel faces, midpoints are a good example
- This also works with lines you draw as a reference to have an exact dimension



- Another trick is to "push" a face until it disappears from the model

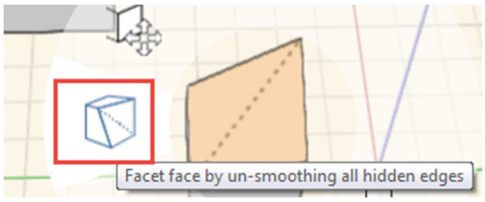


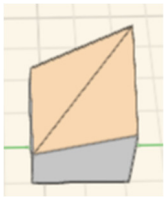
Drag Edge

- If you select an edge you can drag it to change your geometry
  - It is a good idea to use the "Shift Lock" command when doing it

Drag Vertex

- Click once to select vertex, click again to start dragging it
- You can also drag a corner to drag it up
  - At a certain point, you will see a facet after dragging a corner
    - If you don't see the facet you can hover over the face and a dashed line will show where a facet would go
    - Right click and select the facet option and the facet will now be visible and you can select the new faceted face and drag it





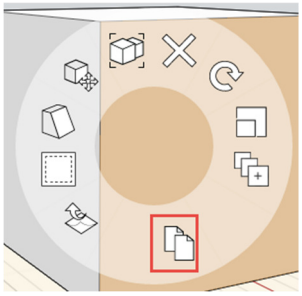
Move Tool

- The move tool is the default tool after you select something in FormIt
- Once you have selected the object you wish to move (by double clicking it)

    - Then click again at the point you wish to use to start the move and you will see a red square.
    - Now move the object in the direction you wish, and click again to complete the command
        - Use shift lock to stay on an axis
- After you have moved your object you can define the move distance by editing the dimension
- You can also move multiple objects at the same time by holding down Shift as you select

Copy and Paste

- These commands are found on the context menu
    - When you select an object and right click you have the copy option

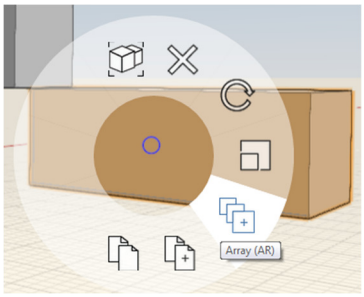


    - After an object has been copied to the clipboard when you right click you will see the paste option

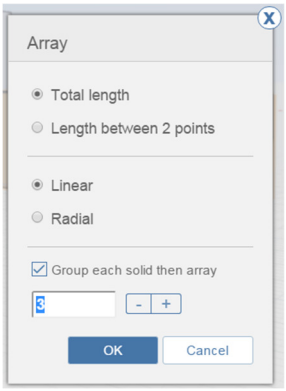
- These commands can also be done use CTRL + C and CTRL + V
- A 3rd way to copy and paste is a "Quick Copy" which is useful because you can specify the start and insertion points of your object
    - Once you have selected the object click to start the move command
    - Then while in the move command hold down CTRL
        - This will allow you to make a copy of the object, which will have an insertion point the same as the point you clicked on to start the move command
- **Note:** You can copy and paste faces and edges as well as objects on FormIt

Array Tool

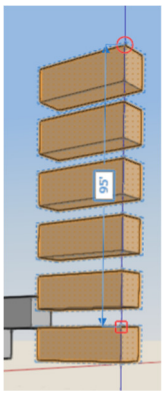
- After selecting the object to be arrayed, right click to select "Array" from the context menu



- After selecting the array from the context menu a dialog box will appear with your choices for the array command



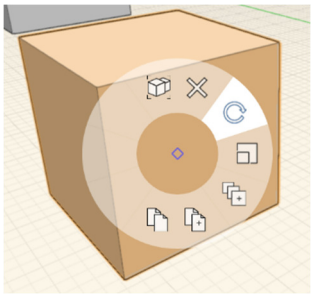
- Once you have made your choices, click to begin the array
    - You can array in the X, Y, Z Axis or Diagonal
    - When happy with the array click again the end the command



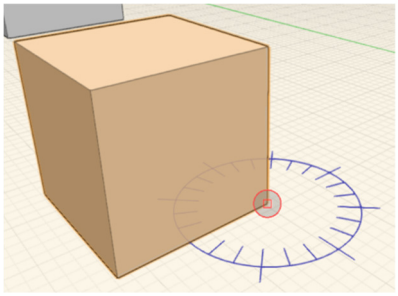
- **Note:** You can array faces and edges as well as objects in FormIt

Rotate Tool

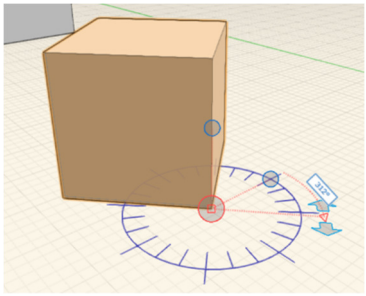
- Select the object you want to rotate, once selected right click and choose “rotate” from the context menu



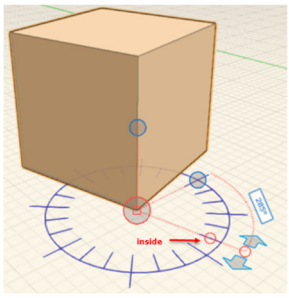
- Once in rotate mode you will see a protector on your cursor
  - The first click will set the center of the rotation



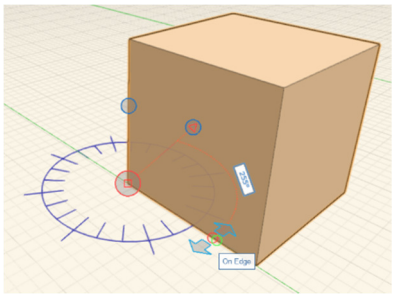
  - Then you can move the rotation by moving the blue arrows
    - If you move outside of the protractor you snap only at axis lines



    - If you move inside the protector you snap in 15 degree increments



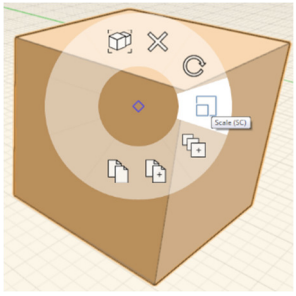
  - You can also set one of the blue circles which sets a reference angle for the rotation



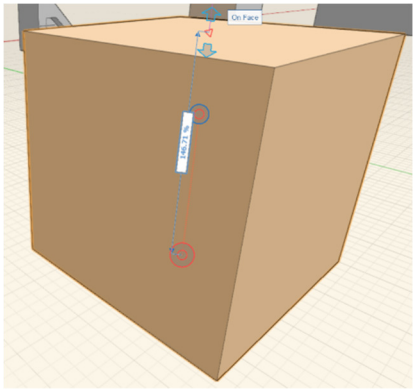
- You can click on the dimension at any point during the rotation to enter an exact angle
- **Note:** You can rotate faces as well as objects in FormIt

Scale Tool

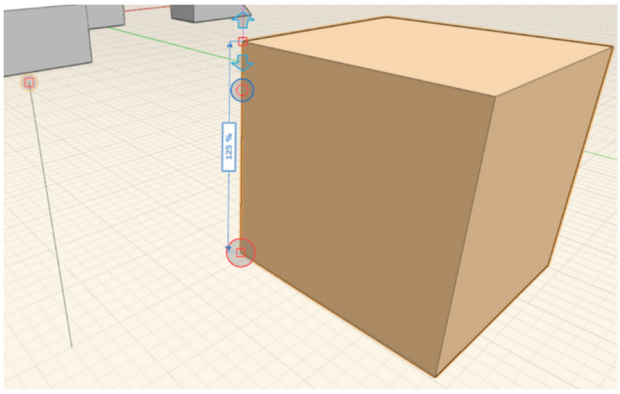
- The scale tool in FormIt is a grip tool, with a red grip at the bottom center of the object and a blue grip at the center top of the object
    - You can begin the command by selecting an object, then right clicking and selecting the scale option in the context menu



    - If the default center location is fine, you can select the blue grip and as you drag it the object will scale



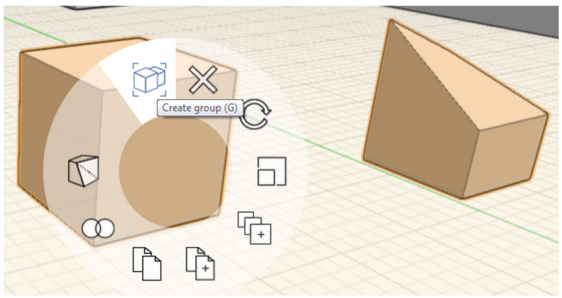
    - You can also move the location of the grips so that you can scale based on a reference object or line



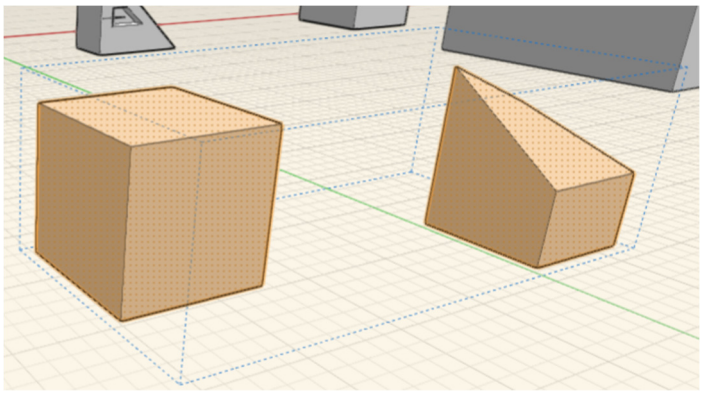
- **Note:** You can scale faces as well as objects in FormIt

Groups

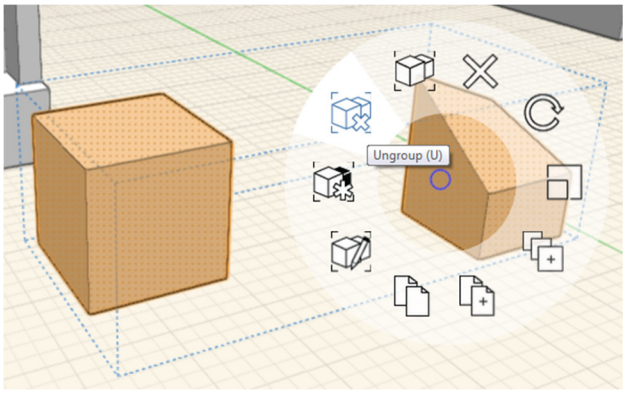
- There are 2 ways to create groups in FormIt
  - Option 1: Double click to select one object
    - Hold down shift and double-click to select the 2nd object
    - Then right click and select “Group” from the context menu



    - When the objects are grouped then now move as a group

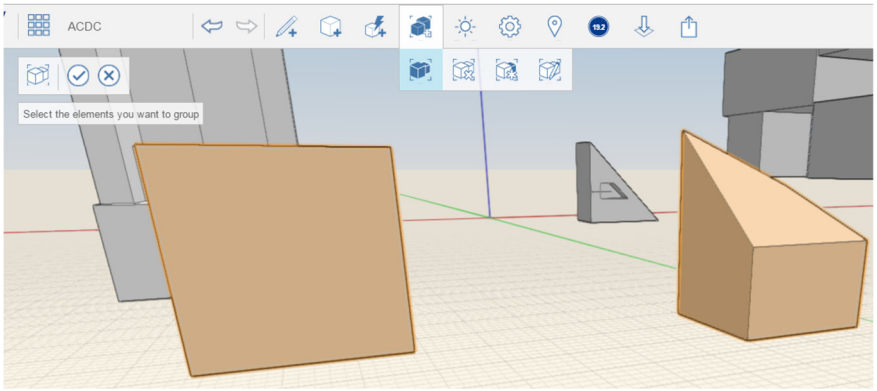


    - You can ungroup by right-clicking on the group and select the “Ungroup” option from the context menu

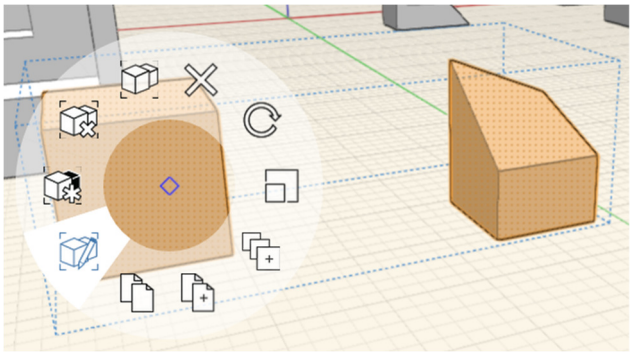


- Option 2: Ribbon menu

  - When you select the “Create Group” you are put into a selection mode 



  - When you are done selecting click the check mark to create the group
- When you need to edit the group you can right click and select the “edit group” option from the context menu
  - This will put you into group edit mode and you can only edit objects that are part of the group.

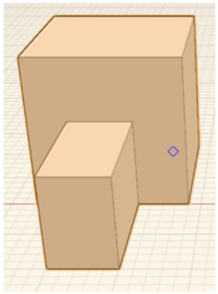


- When you are done editing click the check mark

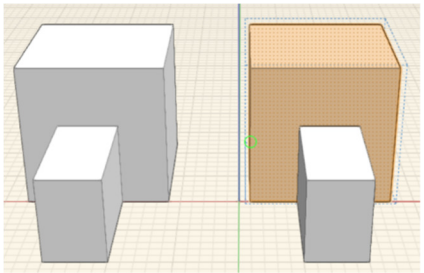
- **Note:** You can also edit the group by double-clicking on it, and finish editing the group by double-clicking
- **Note:** There are also 3 keyboard shortcuts for groups
  - Group = G
  - Edit Group = E
  - Finish Group = F

Groups and Sketching

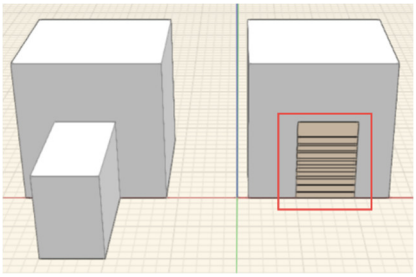
- Grouping is one the most important parts of using FormIt
  - 2 reasons why
    - Grouping separates objects
      - If you sketch on the face of an object and then pull that sketch into a new object the two objects become one



      - If you grouped the original object first, then doing the same sketch and pull action will keep the two objects separate



- Note when sketching on the face of a grouped object you may see some distortion in the sketch area, this is normal

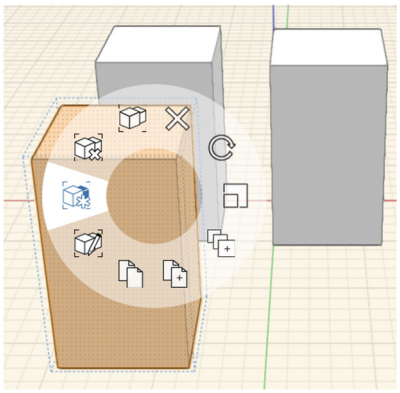


Groups and Repeating Units

- Grouping is one the most important parts of using FormIt
  - 2 reasons why
    - Grouping separates objects
    - Groups can allow you to repeat objects
      - If you copy an object that has been grouped it becomes an instance of that group
        - FormIt automatically groups objects that are arrayed
    - If you hover over an instance of a group and hit the Tab key you will then select all instances of that group

Making Groups Unique

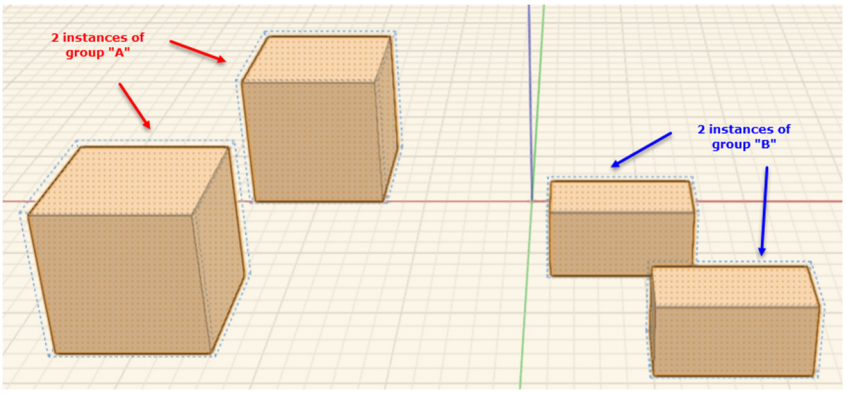
- If after creating several instances of a group, you then want one (or more) to be different you can do this by making the object you want to be different "Unique"
  - You do this by selecting the object and right click to select "Make Unique"



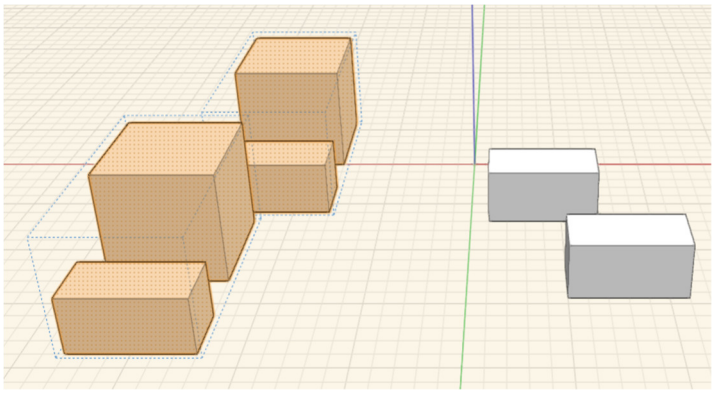
  - Once you have made the object unique in remain a group, but it can now be edited independently from the other group it was originally part of

Nested Groups

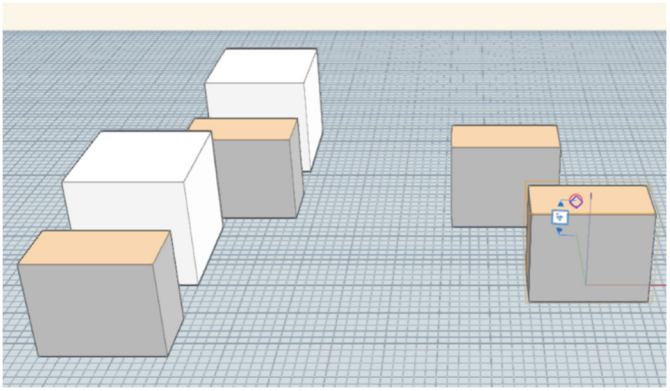
- Once you have at least 2 different groups, you can start "nesting" groups inside other groups



- You do this by copying a group to the clipboard (CTRL + C)
- Then you edit another different group (double click)
  - Once inside edit mode for the copy you can paste (CTRL +V) the first group from the clipboard
  - Click finish to end editing the group and you now have a nested group



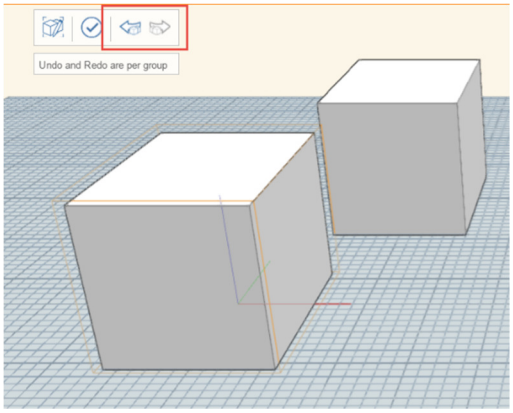
- The neat thing about nested groups is even though they are all part of a single nested group the still update with their original group instances



- **Note:** if you edit the nested group from the ribbon option you can choice which group within the nested group you want to edit

Undo

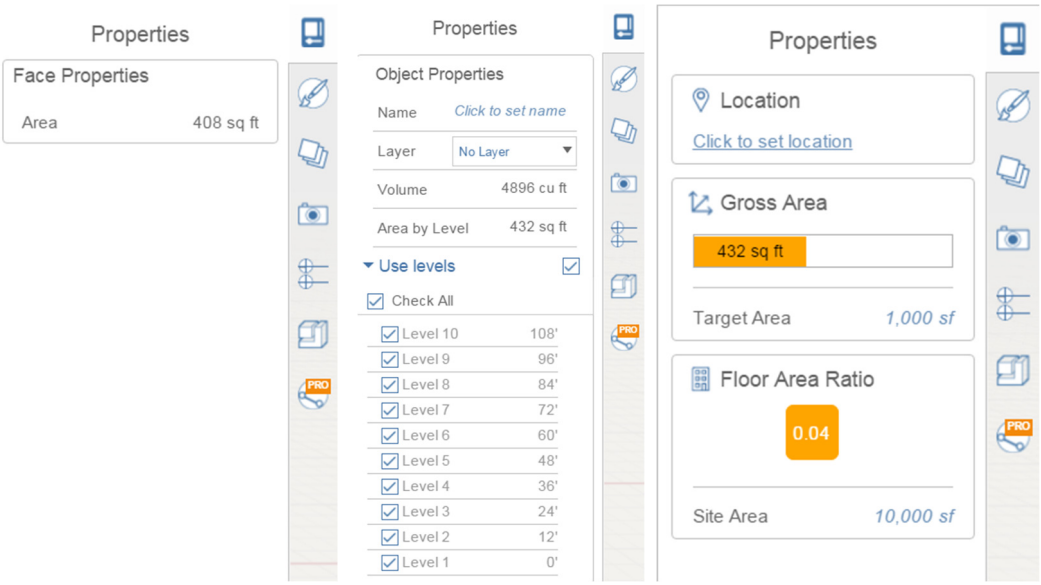
- When working with groups there are 2 separate undo commands
    - The first undo is the normal undo from the ribbon 
    - The other undo is for when you are editing things inside group edit mode



- **Note:** Each different undo only undoes operations done within the mode where it is located, meaning if you made a change in group edit more you can only undo it in group edit mode
- **Note:** CTRL + Z will work as a keyboard shortcut for both types of undo

Properties

- Click on the palette handle to reveal, or hide the “Properties Palette”
- Using the “Properties Palette” you can manage things like the object’s
    - Location
    - Name
    - Level Settings
    - Layer it is on
    - View Information
        - Gross Area
        - Target Area
        - Face Area
        - Area by Level
        - Floor Area Ratio
        - Site Area
        - Volume

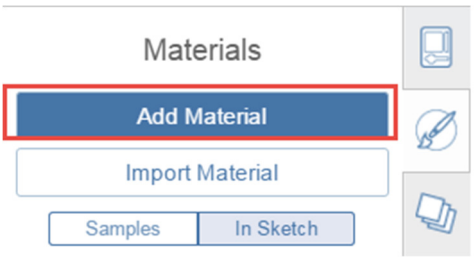


Materials

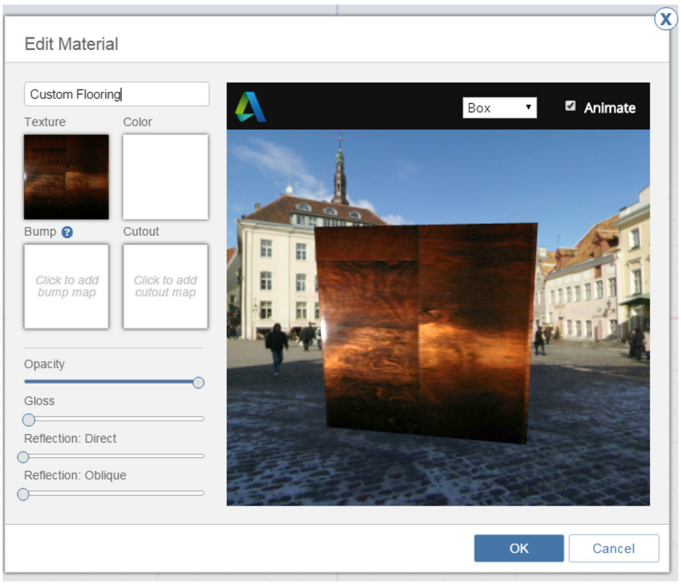
- Use the "Material Editor" to create new materials to use in your scene. The "Material Editor" can make materials appear the way you want them to appear. The texture, color, and other properties of materials can be modified to your specification. You can create your own materials based on custom bitmap files.

Create a Material

- To create a material, you need to click the Add Material Button



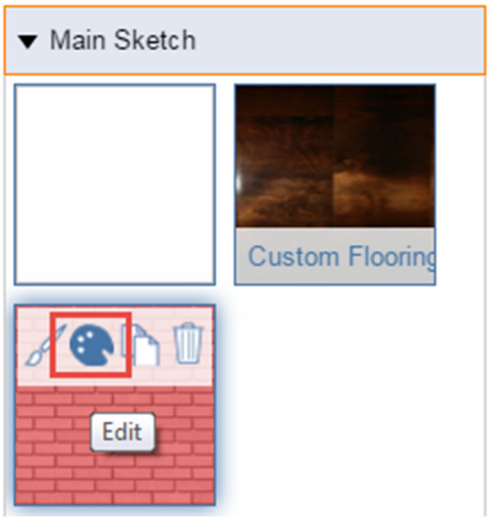
  - Then From the "Edit Material" window, make the necessary changes to the material properties.



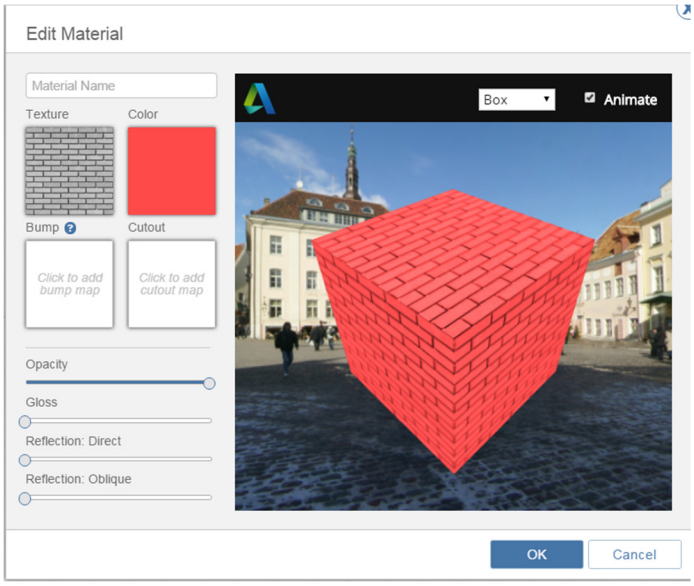
- Click OK to save the changes to the material.

Edit a Material

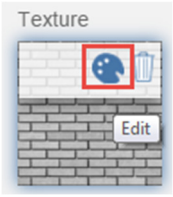
- To edit a material, begin by selecting the material you wish to edit.
  - The pick the “Edit” icon.

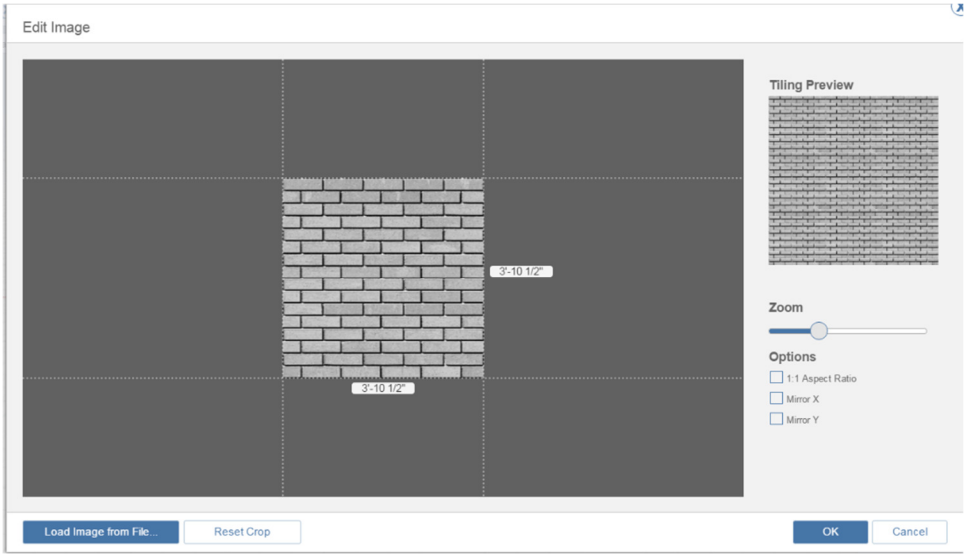


  - This will open up the “Edit Material” window

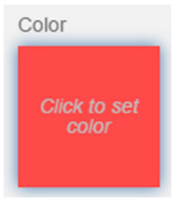


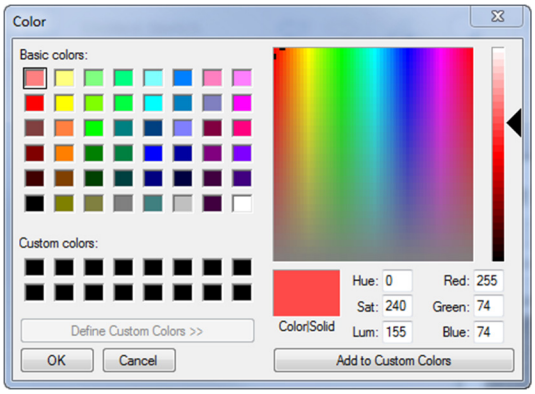
- From this window, you have 9 properties which you can change and update
  - **Name**: To help identify the material
  - **Texture**: Textures are images loaded from your local drive. Once imported, you can crop, and edit the horizontal and vertical scale of the texture.
    - You can access the "Edit Image" window by clicking on the edit icon on the texture.





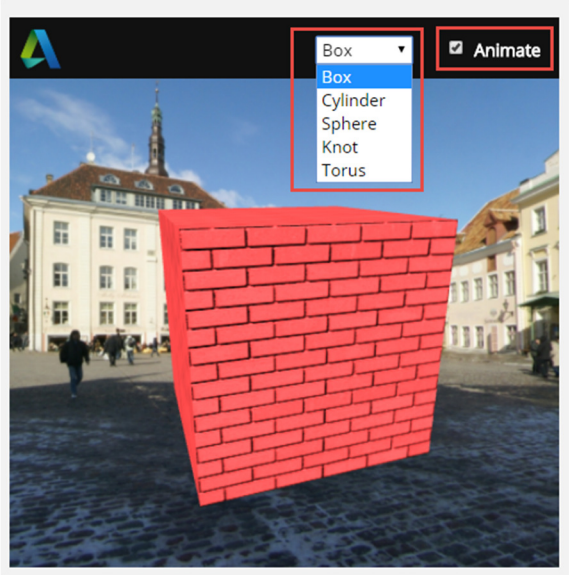
  - **Color**: When a material has both texture and color, the two are manipulated together.
    - You can access the "Color" window by clicking on the color box.





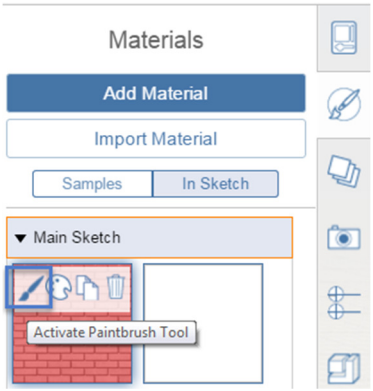
- **Bump**: Load a texture to apply bumpiness based on the image.
- **Cutout**: Load a black and white bitmap. The white areas will appear solid and the black areas will be transparent.
- **Opacity**: A higher value means the material will be more transparent.
- **Gloss**: A higher value will add a shiny gloss effect to the material.
- **Reflection Direct**: A higher value will increase the amount of reflectivity visible when looking directly at a face.
    - like looking at your reflection in a pool of water
- **Reflection: Oblique**: A higher value will increase the amount of reflectivity visible when looking at a face from an oblique angle.
    - like seeing a reflection in a TV screen when viewing from an angle

- You can see your updates and changes to the material in the preview window to the right
    - You can see the preview image in 5 different forms
    - You can also see the preview animated or still

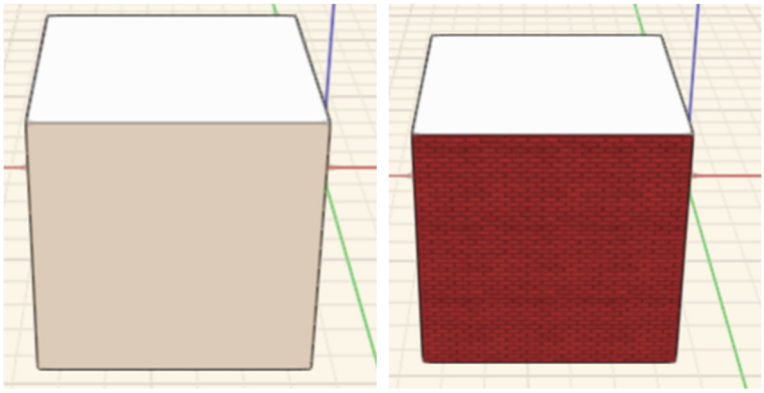


Apply a Material

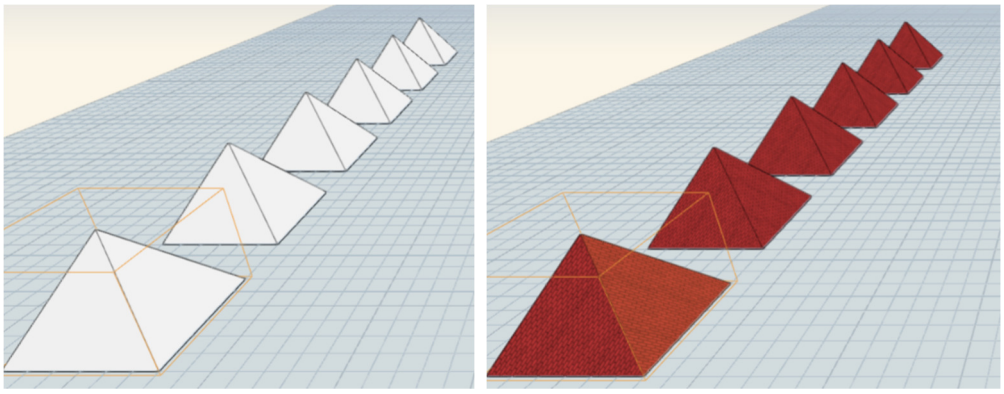
- A material can be applied to a face, an entire object, or a group
  - Click the tab on the right side of the screen and click the icon for the Material Editor.
  - Hover the mouse pointer over the material you wish to apply.
  - Select the Paintbrush icon.



  - Click on the face to apply the material to a single face. Double-click to apply the material to an entire object.



- You can apply material to a group the same way you would apply it to a non-grouped object. However, there are 2 ways you can apply it to a group:
  - **Group Instance**: If you want to apply a material to an entire group **AND** you do not want that material to be applied to other instances of the group, you can paint the group instance the normal way
  - **Group Definition**: If you want the material to be applied to **ALL** instances of the group, first edit the group and then apply the material the normal way. The material will then appear under a heading with the name of the group.

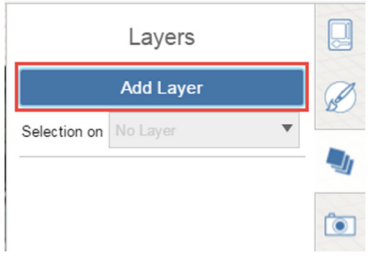


Layers

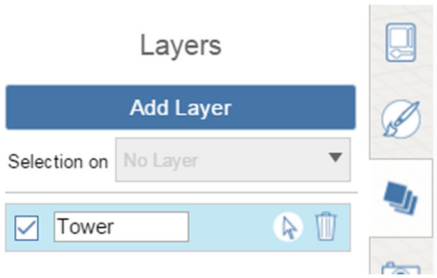
- Don't think of layers in FormIt 360 like you would layers in ACAD, but more like layers in Photoshop.
  - You will use the layers to control the visibility of individual objects.

Creating Layers

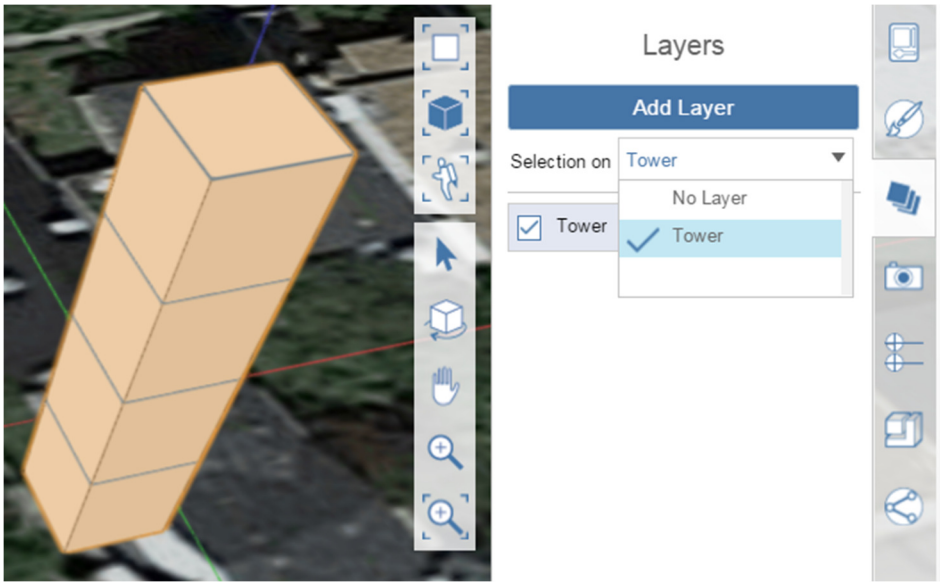
- Begin by clicking "Add Layer" in the Layer palette to create a new layer



  - Then double click on the name to rename the layer.

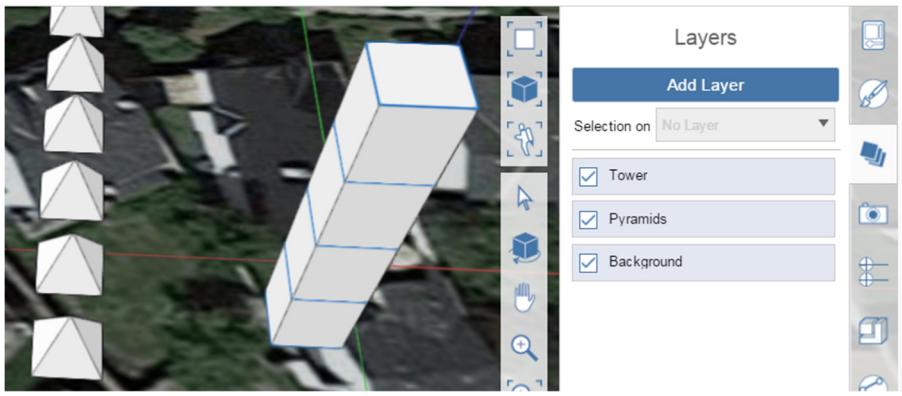


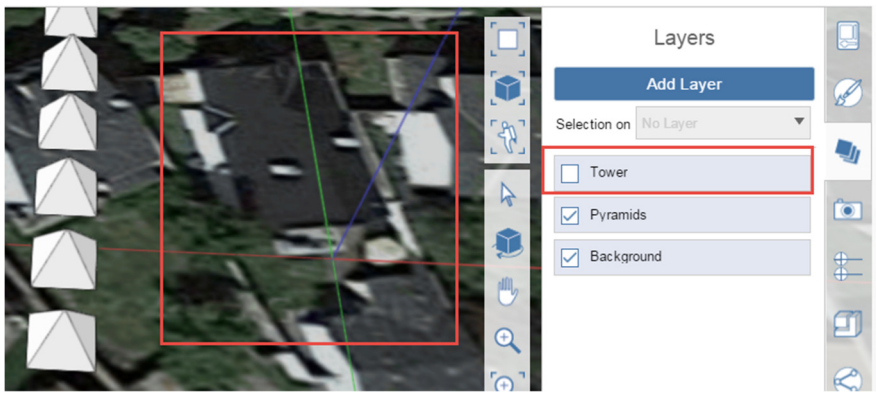
  - Now to add objects to the layer, select one or more objects in the scene and then choose the desired layer from the "Selection on" drop down list.



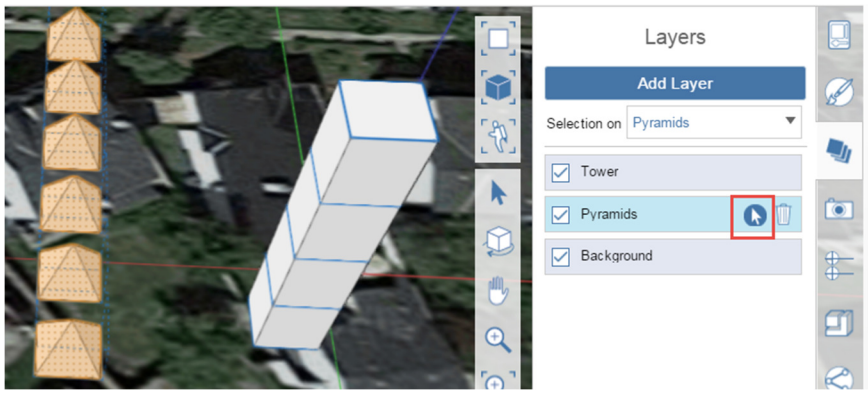
How to use Layers

- You can turn the layer visibility off by unchecking the checkbox next to the layer name.

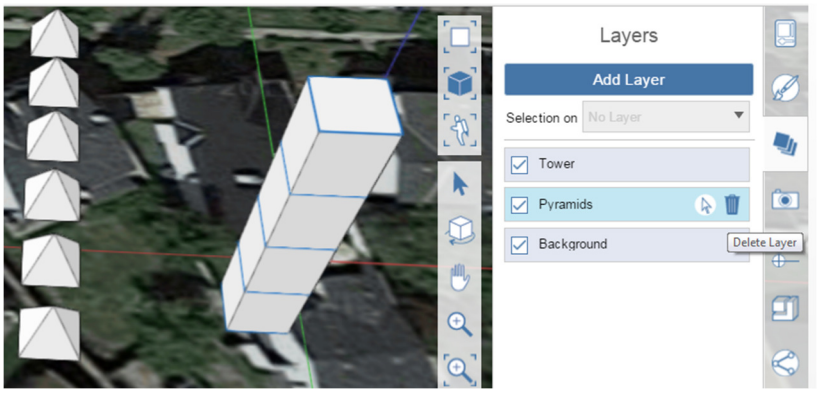


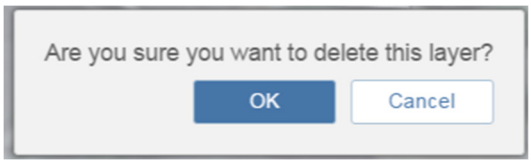


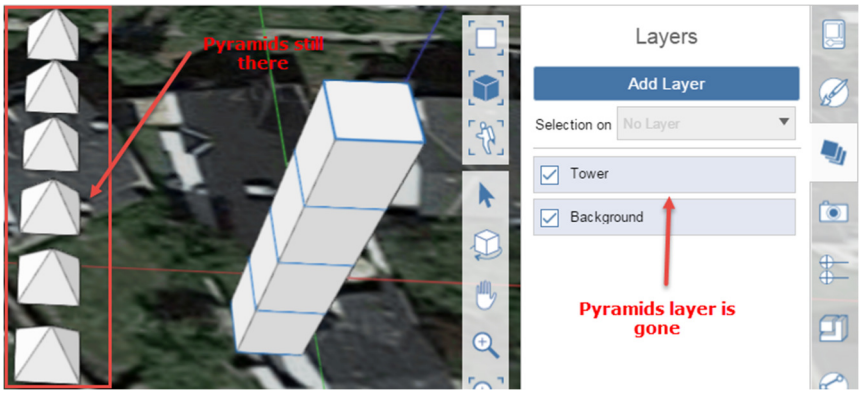
- You can also select all objects on the layer by clicking the selection icon next to the layer name



- If you want to delete a layer you can click the trash icon next to the layer name.
  - Only the layer, not the objects assigned to the layer, will be deleted.





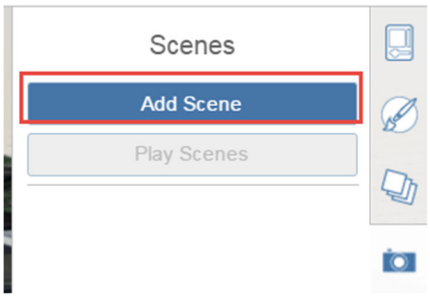


Scenes

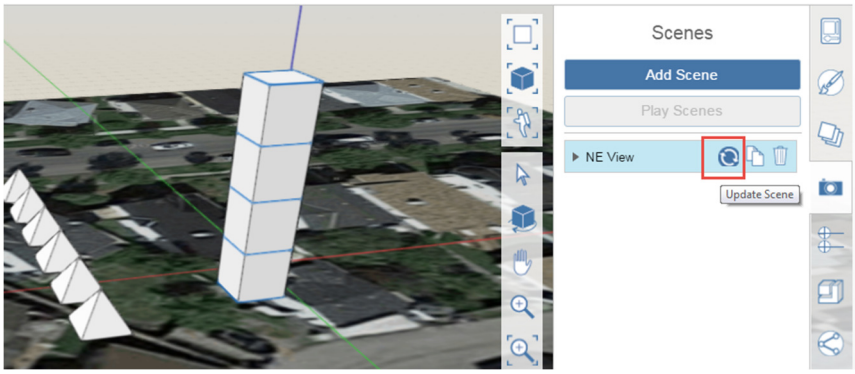
- The “Scenes” feature allows you to create scenes and then be able to navigate back to them as saved viewpoints.

Create a Scene

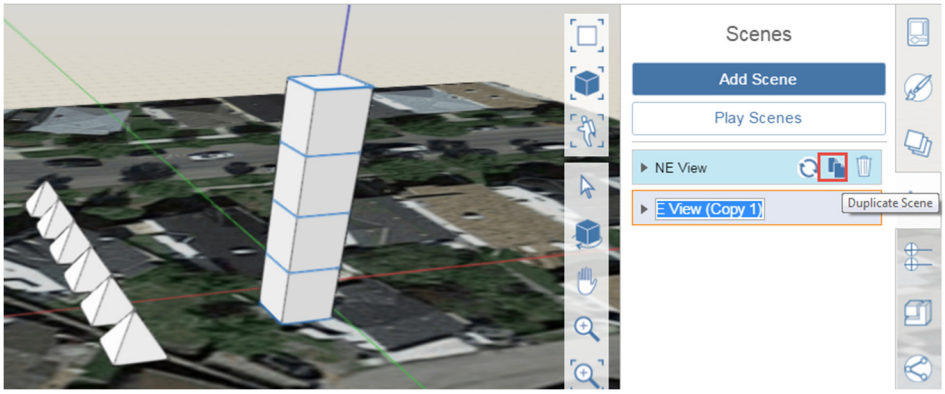
- Start by clicking the "Add Scene" button in the Scenes palette.
  - This saves 4 features of the current view
    - Camera Position
    - Layer State,
    - Sun Position
    - Visual Styles



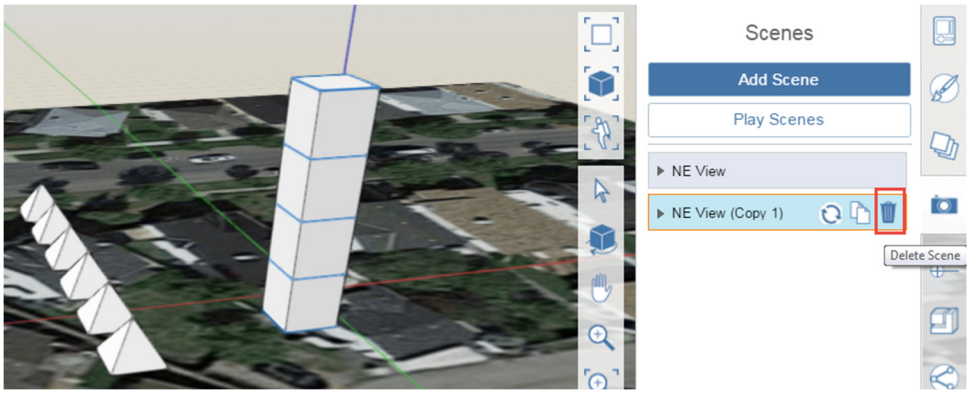
- Double-click on the scene name to rename the scene.
  - Click the "Update" button to update the scene based on the currently visible viewpoint and settings.

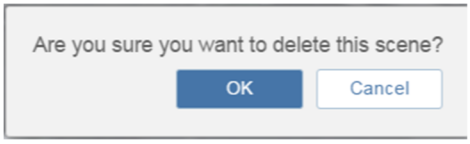


  - You can create a copy of the scene by hitting the "Duplicate" button

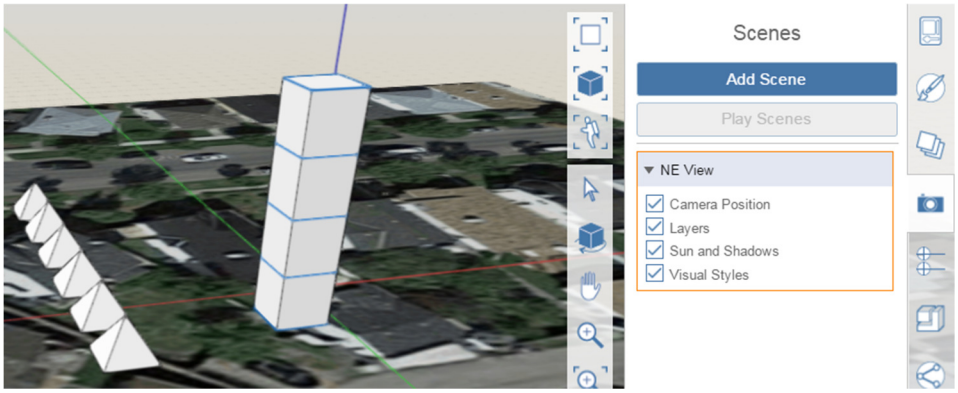


  - Click the Delete button to delete the current scene.



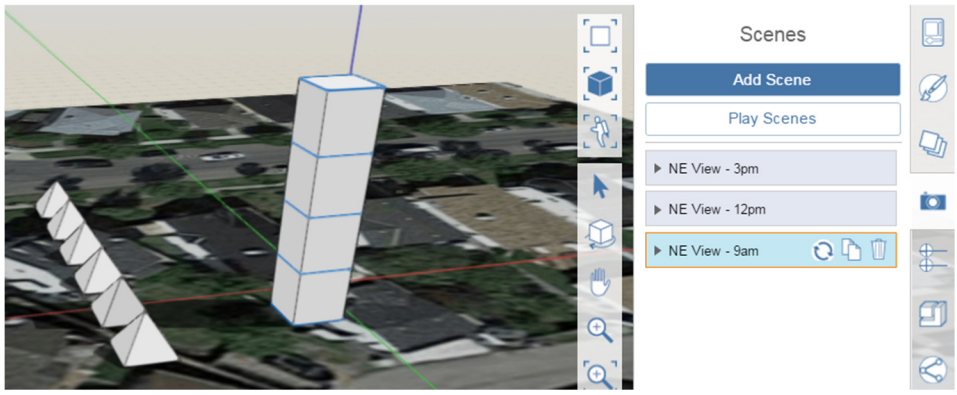


- You can use the check boxes under each scene to determine whether or not camera position, layer state, sun position, or visual styles will be applied to the scene.

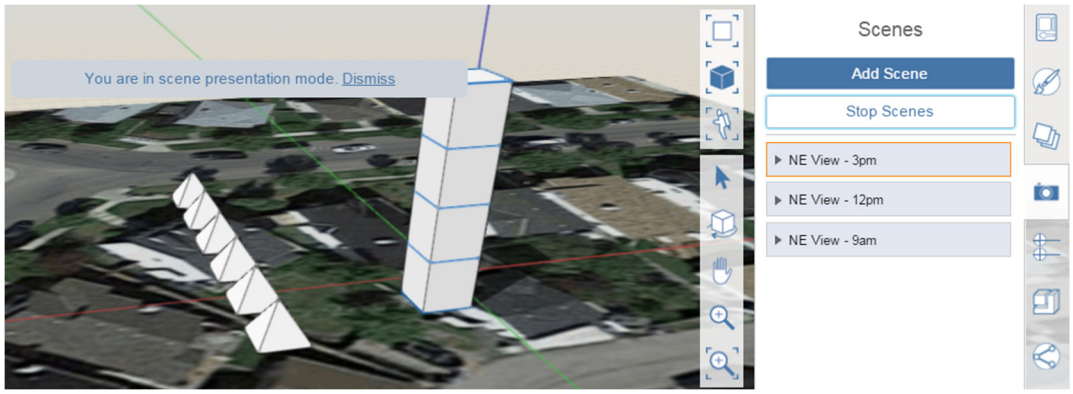


Play Scenes

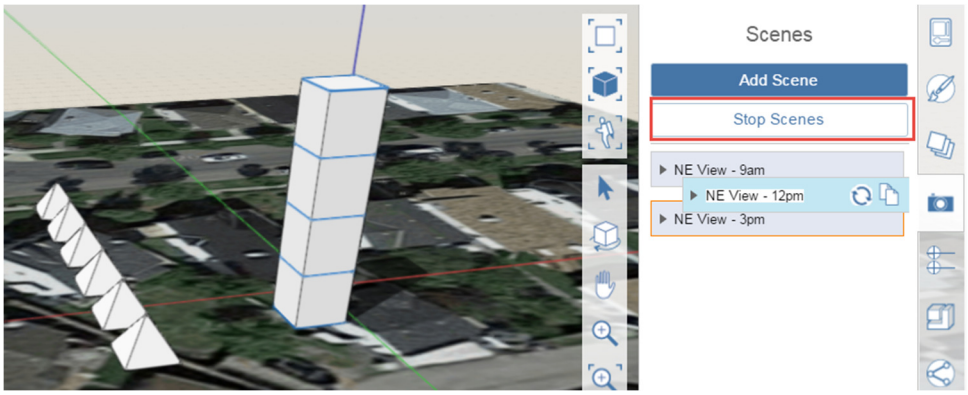
- To view a scene, click on a scene to navigate to it.



- You can create a “Slide Show” by clicking “Play Scenes” to automatically play through each scene.

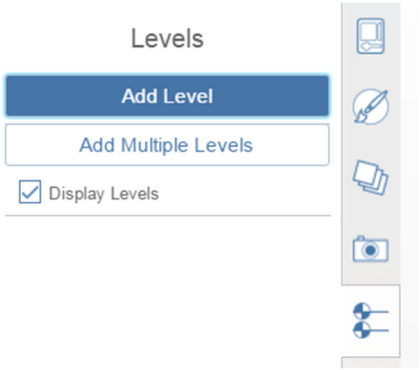


- The scenes are played in order from top to bottom in a continuous loop until you click "Stop Scenes".
- The "Scenes" can be dragged up or down in the order as needed

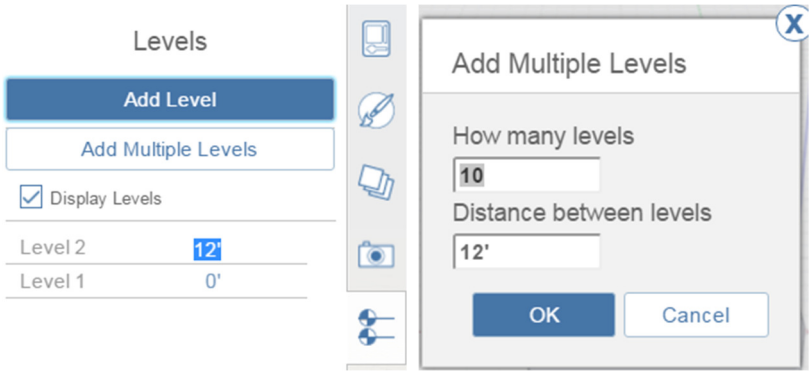


Levels

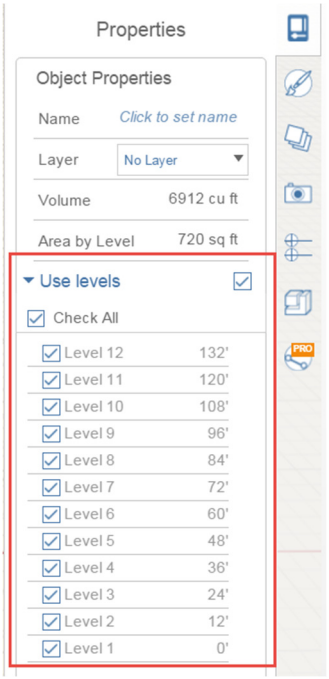
- To set the level datum's for the entire sketch, click on the Levels tab on the right-side palette.



- You can add levels 1 at a time, or multiple levels at once
- Hover over the level text and click the blue dimension value to specify the elevations of each level.



- Then, control the levels that are applied to each object in the Properties tab.



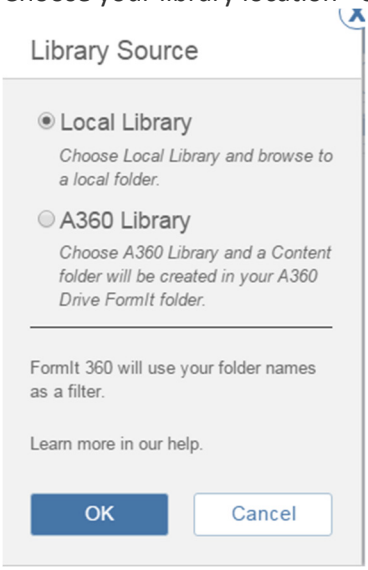
Content Library

- Use a personal library of frequently used elements like furniture, building elements, or material base files.
  - You can store previous projects, site files, or even Revit families or SketchUp files you have converted using the FormIt 360 Converter Add-in.
  - Your content library can be stored and linked to from a local folder (in a DropBox Sync folder for instance), or an A360 Drive.

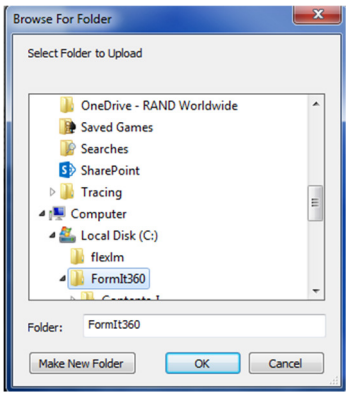
Link a Content Library

- You begin the linking process by clicking on the “Link Library” button
  - This can be found in the “Content Library” button on the Palette Bar.

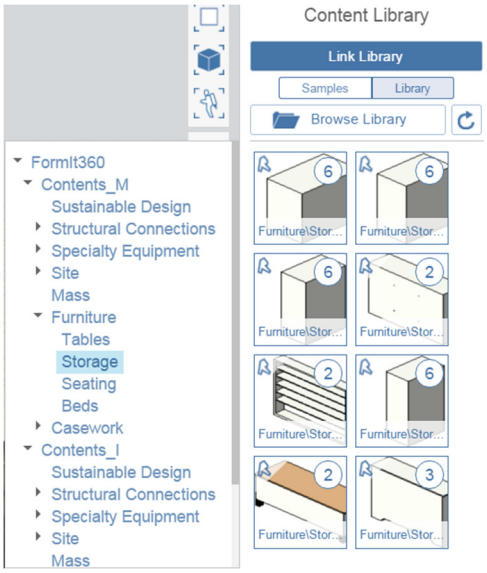
- Choose your library location - either on your local drive or on an A360 Drive.



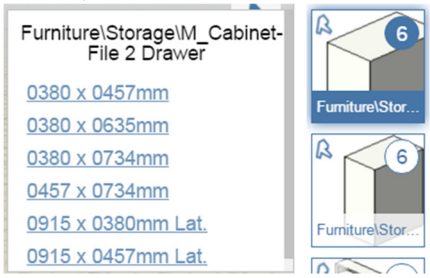
- Browse with the file navigation dialog to your top-level content library folder.



- Choose a Content File



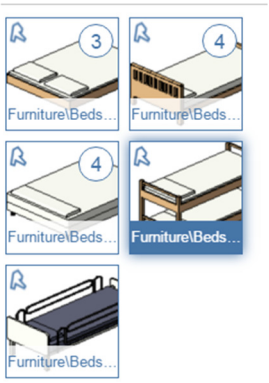
- If the content is a converted Revit Family you may see a number in the top right corner, this number is the amount of family types in the family



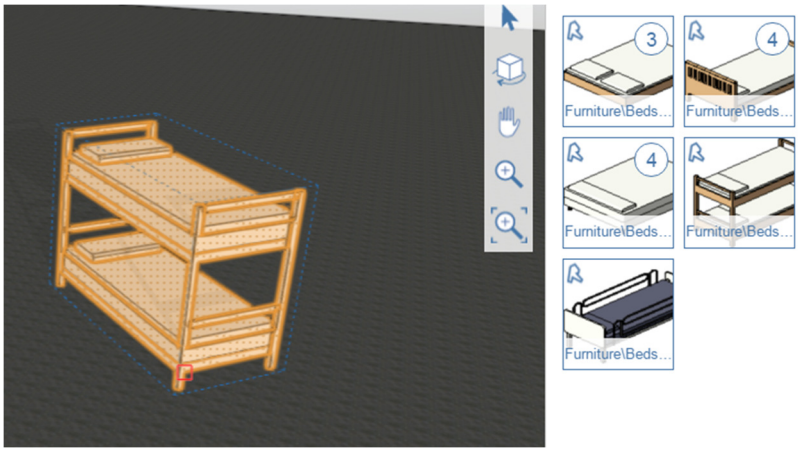
- **Note:** If you have linked your library locally, and then start a new FormIt 360 Web session, you will need to re-link the Content Library.

Place Content

- Use the data from a content library file in a design.
  - Hover your mouse over a thumbnail image



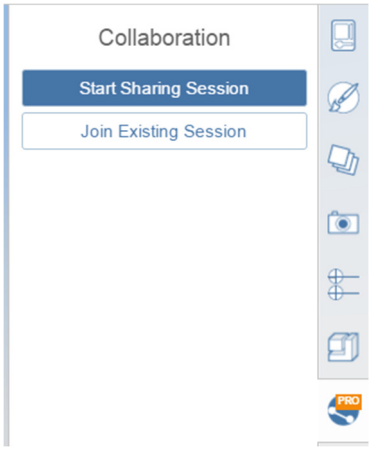
  - Drag and drop the content onto the canvas, or click the thumbnail, move the mouse onto the canvas, and then click again to place.



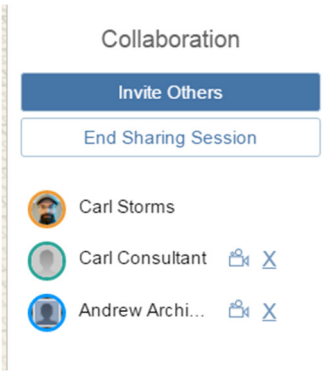
FormIt 360 Pro Features

Collaboration

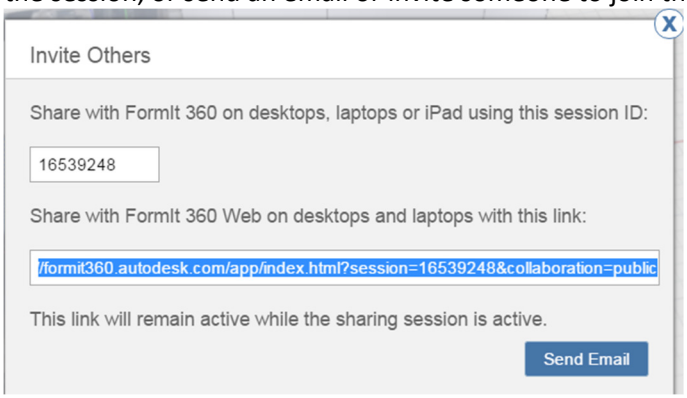
- With the Collaboration feature, you can work simultaneously with others on the same sketch
  - There are no worksets, or element locking in FormIt so people can be working on the same element in the model at the same time (however, this is not the best workflow)
  - You begin the collaboration process by starting a "Sharing Session"
    - This can be found inside the "Share" button on the Palette Bar.



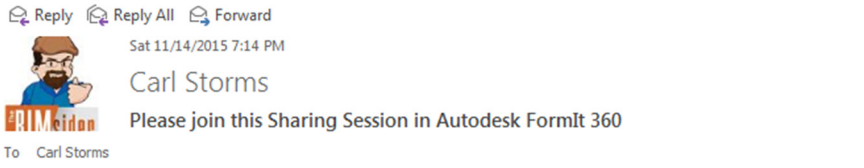
  - Once you have started the session you can invite others to join
    - This can be found inside the "Share" button on the Palette Bar after a session has been started



- This will bring up a dialog box that will allow you to share a session ID, a link to the session, or send an email or invite someone to join the session.



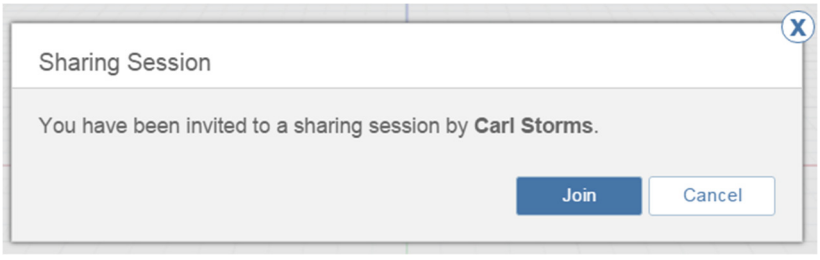
- To become part of a "Sharing Session" you need to accept an invitation, by clicking the link or input the Session ID on your iPad



Please join this Sharing Session in Autodesk FormIt 360!

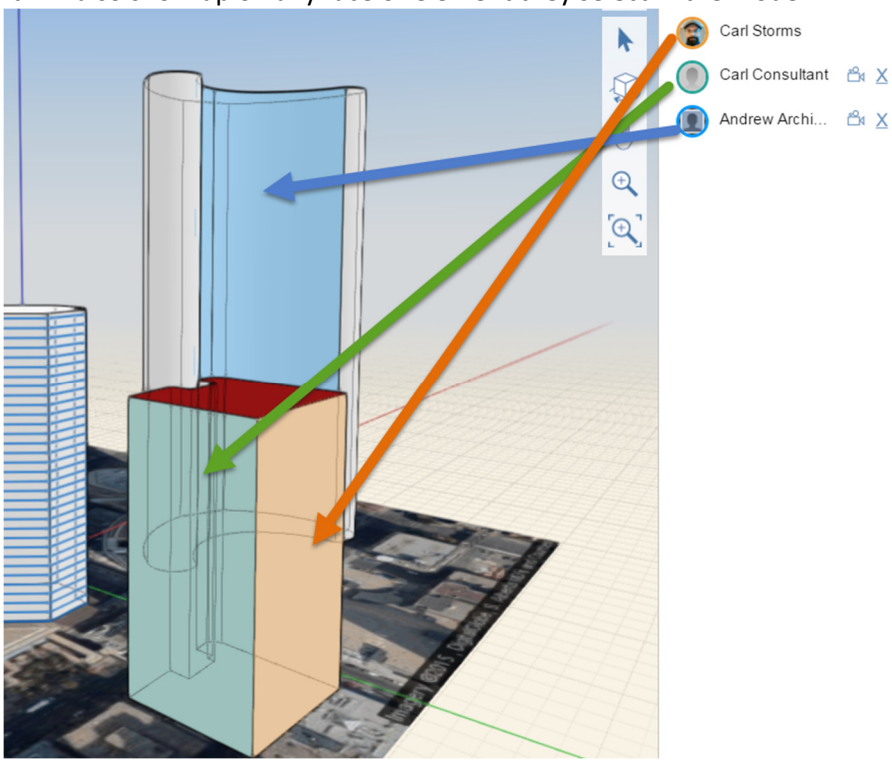
Share with FormIt 360 on desktops and laptops or on an iPad using this session ID
Session ID: 72cf54b3

Share with FormIt 360 Web on desktops and laptops with this link
Session Link: http://formit360.autodesk.com/app/index.html?session=72cf54b3&collaboration=public

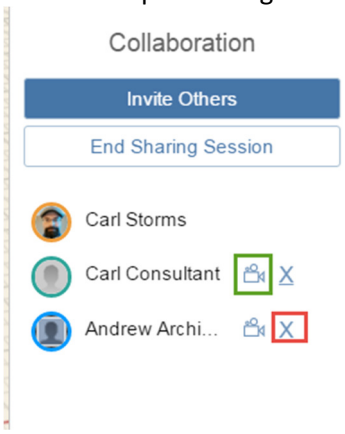


- During a "Sharing Session" each participant will have their own color which will be used to represent them during the session in interaction with others.

- This color will be around their profile/avatar in the Collaboration palette
- It will also show up on any face or element they select in the model



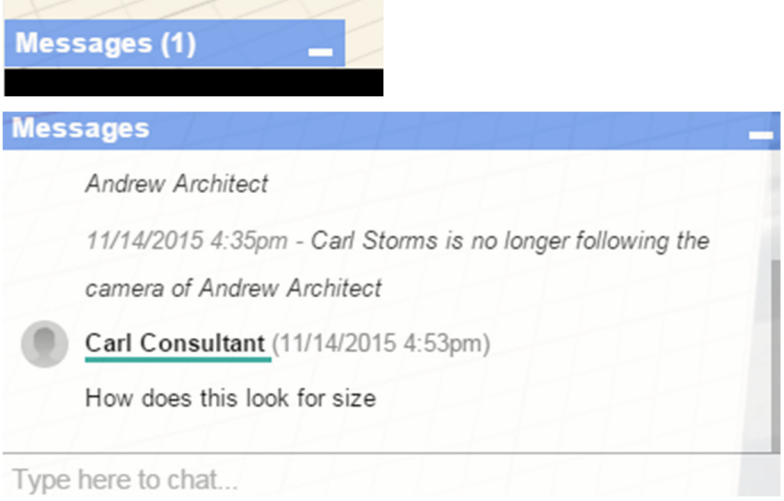
- You can also "Follow" someone's camera during a sharing session
  - This allows you to see what is happening in the model from that person's camera view
  - This is also a useful way to take someone on a walk through of your model
    - To activate this feature simply select the camera icon beside the person's name you wish to follow.
    - You can stop following the camera by selecting the "X"



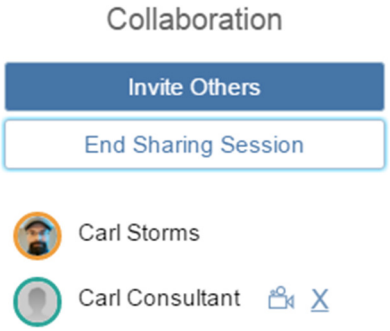
    - You can also continue to work in the model even if you are following someone's camera

- There is also a built-in "Messages" feature that allows you to chat real-time while you are collaborating in the model

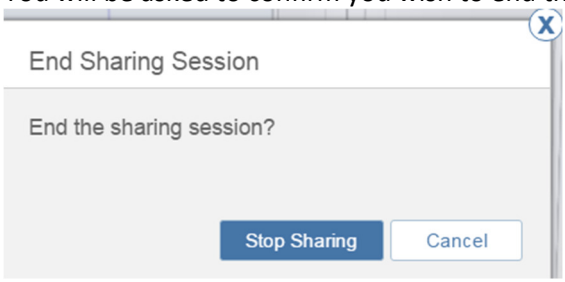
- The “Messages” dialog box is in the bottom left corner and will tell you how many new messages you have when you don’t have it open.



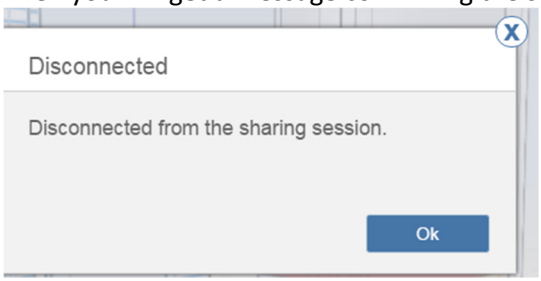
  - You can end the collaboration process by hitting “End Sharing Session”
    - This can be found inside the “Share” button on the Palette Bar.



    - You will be asked to confirm you wish to end the session



    - Then you will get a message confirming the session has been ended

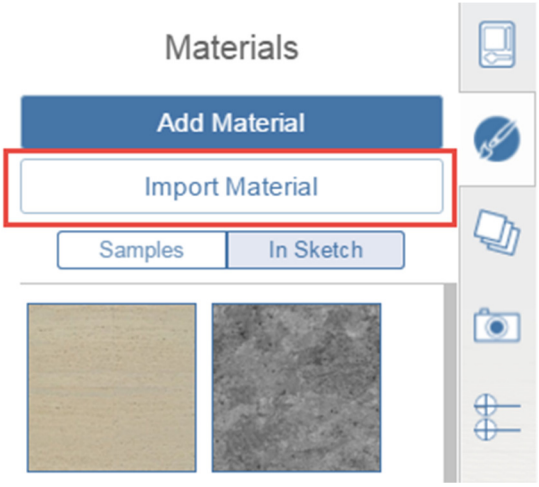


- **Note:** You must be a FormIt 360 pro subscriber to start a “Sharing Session”, however, you don’t need to be a subscriber to join a session.

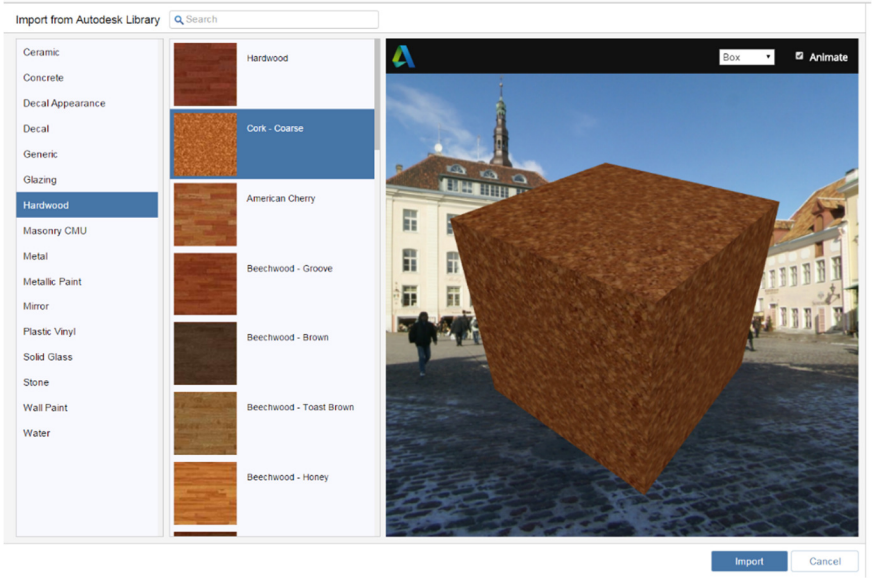
- **Note:** When you join a session you are added as a "collaborator" when you leave a session as a guest collaborator, a copy of the sketch will **NOT** be saved to your A360 account.

Autodesk Material Library

- As a Pro subscriber, you will be able to import materials from the Autodesk Materials library.
  - Click the Import Material button.
    - This can be found in the "Materials" tab on the Palette Bar.

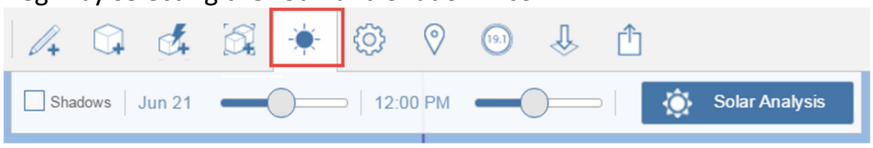


  - From the Import Material, browse or search by name to select a material to import into the scene and click OK.
    - Note: these materials are stored on the Autodesk cloud, so you don't have to "import" them from your local Revit material library.
  - Once Imported the material can be applied and edited like any other material in your Model



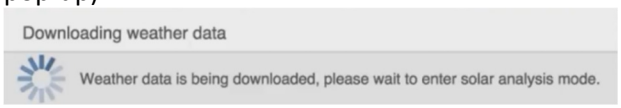
Solar Analysis

- With Solar Analysis you can visualize the amount of solar radiation that your model receives.
  - Begin by selecting the "Sun and Shadow" icon

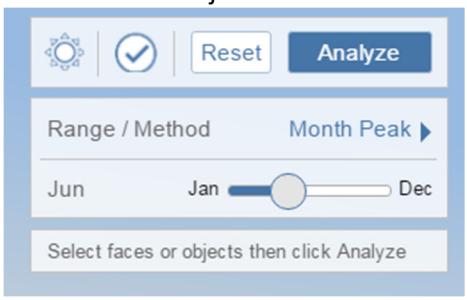


  - Then click on the Solar Analysis button

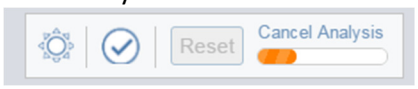
    - The first time you do a Solar Analysis on a site the program will download the weather data for that site (sometimes this happens so fast you don't see the pop-up)



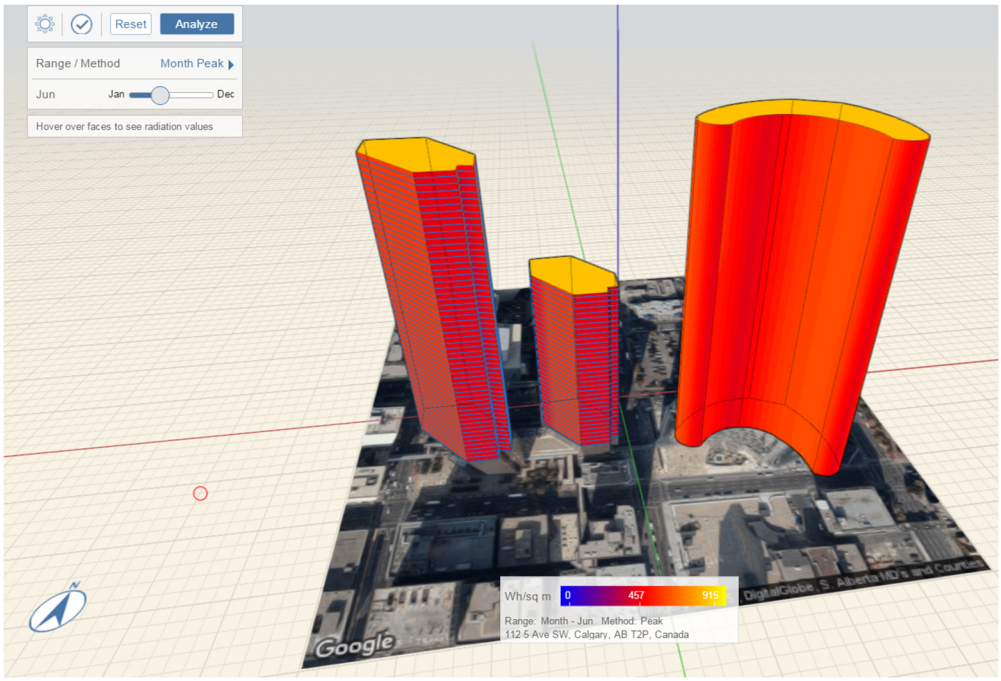
  - Now select an object or face



  - Click Analyze



  - View the results



- Click the "Month Peak" symbol to toggle between Month Peak or Year Cumulative.

  - Change between Month Peak, which gives the peak solar insolation value in BTU/sq ft (or Wh/sq m) for each month, and Year Cumulative, which gives the total insolation in kw/Sq m. Month Peak is useful for developing a shading strategy for the building façade. Year Cumulative is useful for determining the potential for photovoltaic cells.
- Move the Slider to vary the time of year

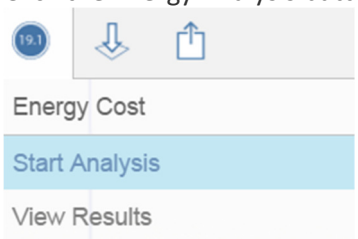
  

- When done reviewing select the circled checkmark to finish

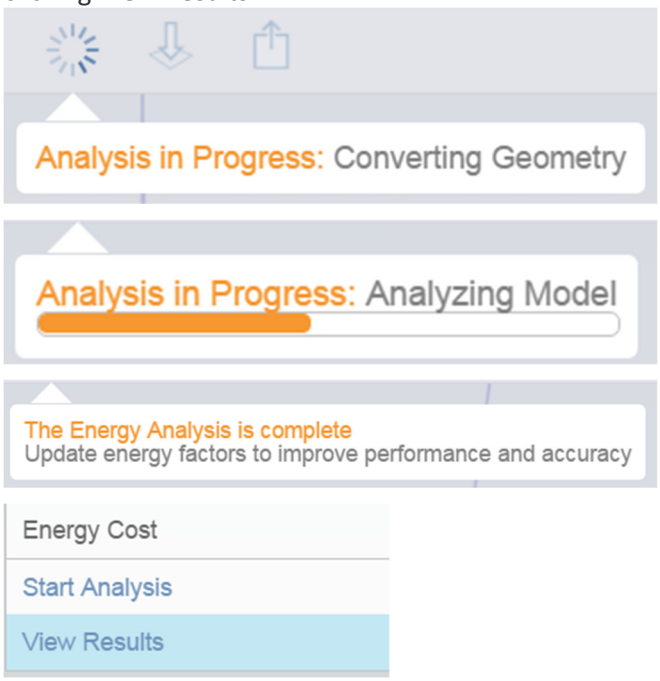
  

Energy Analysis

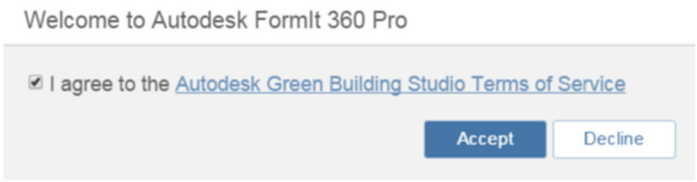
- Evaluate factors that affect building performance, such a wall insulation and HVAC efficiency. The FormIt 360 Pro Energy Analysis feature allows you to better understand how your design will perform based on a number of factors.
  - To get started, you must first set a Location for your project and have at least one solid object with Levels applied
  - Click the Energy Analysis button to start the analysis process.

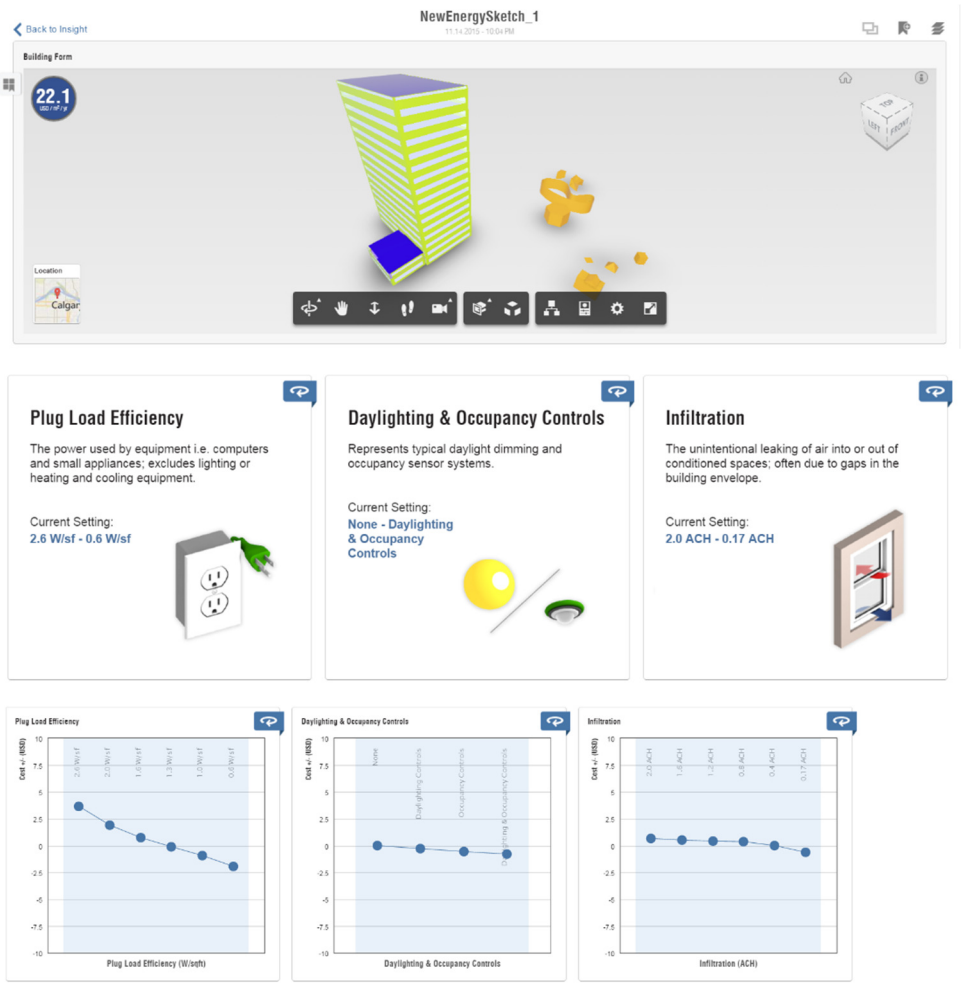
- The model will be converted and sent to the Green Building Studio for analysis. When the results are ready, you will receive an email. Open the Energy Analysis Dashboard by clicking View Results



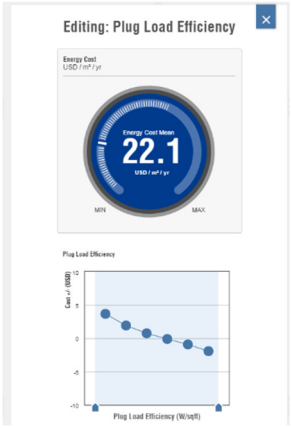
  - You will also get a pop-up to agree to the Green Building Studio terms



- The Energy Analysis Dashboard now contains a 3D view of the energy model, a history of previous runs, and the Energy Cost Range (ECR). The range shows the mean, minimum, and maximum energy cost from batch runs of whole building energy simulations for a range of typical design and operational factors. The ECR also includes the Architecture 2030 benchmark for your project. This benchmark provides a way to understand the relative performance of your project by comparing to this popular target. The Architecture 2030 benchmark is calculated as a percentage (currently 60%) of real historical building energy use gathered from extensive surveys. The ECR contains and is ultimately driven by individual factors, each of which relates to different aspects of building features that influence building energy use.



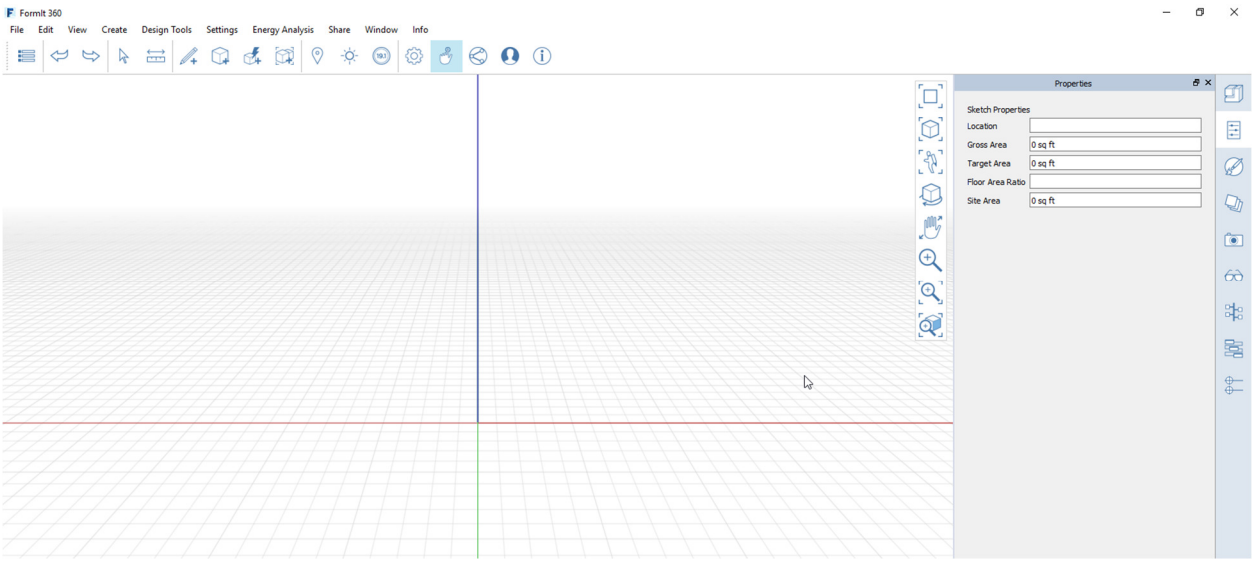
- When you open a Factor Widget, you can vary the factors to see how it affects the Energy Cost Mean



FormIt for Windows

- With a FormIt 360 Pro subscription you have access to the Windows app where you can:

- Work with bigger, more complex models.
- Connect to A360 Drive and web services - or work without an internet connection.
- Collaborate in real-time, customize toolbars, palettes, and shortcuts.
- Windows touch-enabled devices use your finger, stylus, mouse, and keyboard as inputs.
- Import SKP and SAT directly, link a Content Library from A360, local, and network drives.



Dynamo

- With a FormIt 360 Pro subscription you can connect a Dynamo Studio script to the Windows app:
  - Create a parametric model in Dynamo Studio and send it to the web for viewing.
  - Connect the Dynamo script's URL to FormIt 360 for Windows.
  - Drag and drop the Dynamo content into your FormIt model and access the same Dynamo parameters.
  - Save your FormIt file with the Dynamo content in it and continue editing it in the future.
  - The Dynamo content is treated as FormIt content and can be painted with materials, copied, deleted.

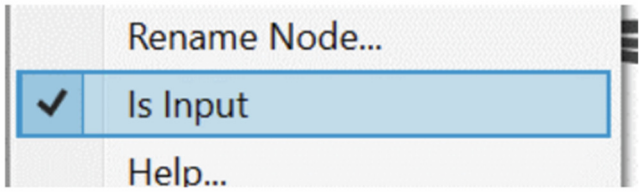
Things you should know about Dynamo & FormIt 360

Inputs

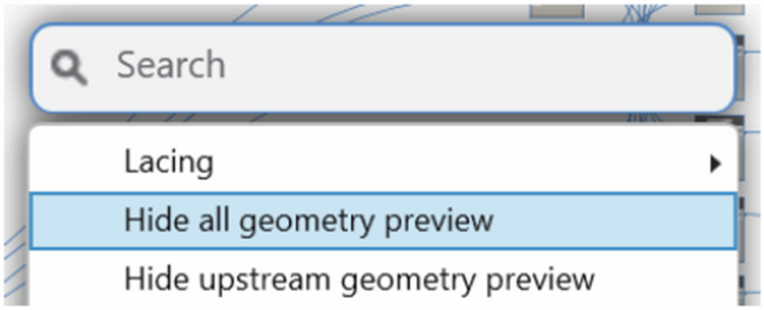
- To work with Dynamo Studio, Dynamo Web, and Dynamo in FormIt 360 you need to be aware of a few basics.
  - Legal inputs for use in FormIt 360 are the basic visual scripting inputs like
    - Number input
    - String input
    - Number Slider with value range
    - Boolean (True / False toggle)

Outputs

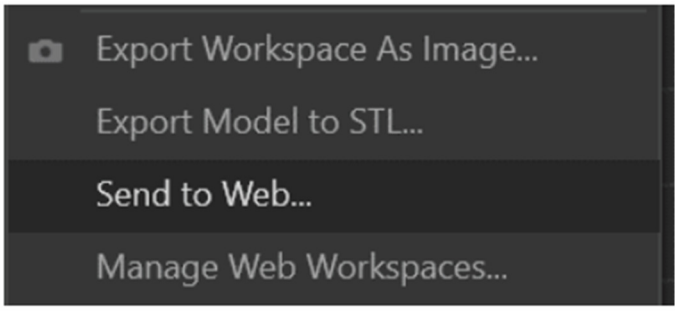
- The output of Dynamo for use in FormIt 360 is different from the output of Dynamo for use in Revit. You're basically creating raw geometry. In the future, this will be expanded, but for now – What you see is what you get.
    - What appears in FormIt 360 is raw Dynamo geometry
        - Solid, Surface, Cuboid, etc…
    - Right click on an input node and find "Is Input"
        - If you **DON'**T want this to appear in FormIt 360, then uncheck "Is Input"
        - Minimize inputs for clarity in FormIt 360 – so uncheck a lot of these



    - To keep the graph clean – hide construction geometry
        - Window select everything behind your output nodes
        - Right click off into space
        - Click "Hide all geometry preview"



    - When you are finished with your Dynamo graph you need to "Send to Web…" to be able to use it in FormIt 360
        - "Send to Web…" is the basic publishing step to share your Dynamo graphs
            - File menus > Send to Web…

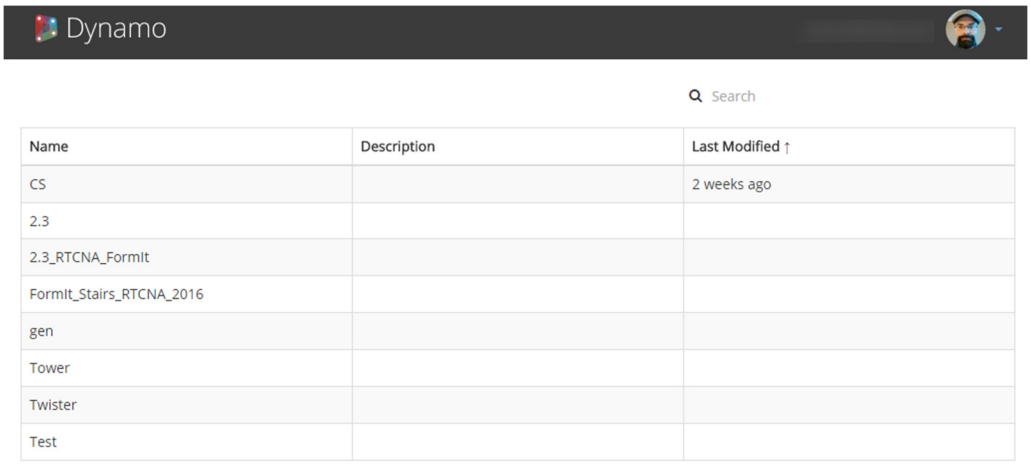


Dynamo Web

The Dynamo web app is a web viewer where the Dynamo parameters are visible and editable, but the overall graph and nodes are not.

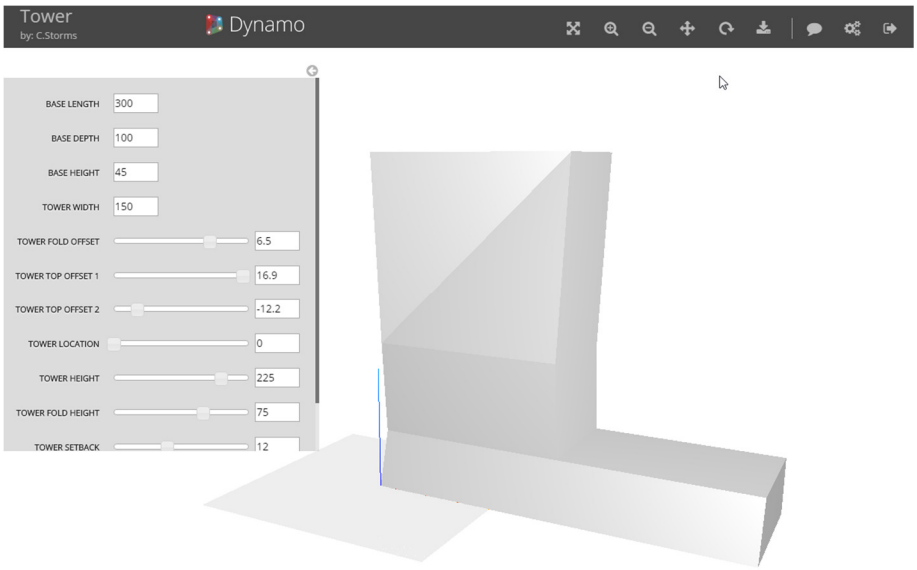
Preview

- When you send your Dynamo graph to the web, it automatically appears in your Dynamo Reach manager, which is tied to your A360 account. Now you can open and view your graphs. You can share your graphs out to a wider audience by sending a URL. The recipient needs an A360 account to view your parameters.
    - Open Chrome and navigate to http://dynamoreach.com/manager.html
    - Click on the graph you wish to open
    - The script (graph), once published, lives in your manager until you delete it.



Options

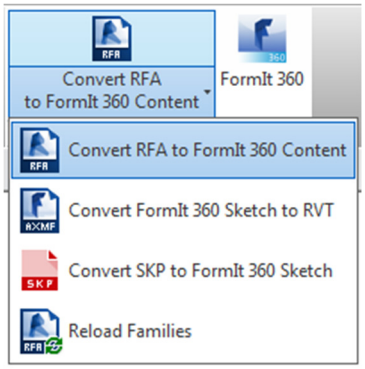
- Advantages of this interface are to include others into the process, explore options, and access your graphs from any web browser (including your phone!)
    - No creating, or adding nodes here, just previewing results
    - Changes to the underlying script (graph) require you to republish to the web
        - At that point, you can either give a new name or version
        - Or republish with the same name to overwrite
    - Find desired states or most relevant parameters to edit in FormIt 360



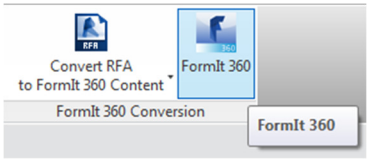
FormIt 360 Converter Add-in for Revit

How it Works

- The FormIt 360 Converter Add-in for Revit will let you do the following:
    - Convert RFA files for use in FormIt
        - These maintain their Revit category and identity, this means they can be converted back to an RFA later
        - Only the following Revit categories are currently supported
            - Casework
            - Entourage
            - Furniture
            - Furniture Systems
            - Generic Models
            - Parking
            - Site
            - Specialty Equipment
            - Mass
    - Convert FormIt 360 Sketch to RVT file
        - This will convert the FormIt 360 Sketch (AXM) geometry in an RVT format and place it into the currently open RVT file
        - Groups that are assigned a category in FormIt 360 will be placed as a family (RFA) within the RVT file with the same category
            - You can change theses new families with any other family from the same category using the type selector
    - Convert SKP files to make them usable in FormIt 360
    - Replace FormIt 360 Content with Revit Families
        - This will replace a “family” (think of it as a placeholder) you made in FormIt 360 with an RFA from Revit
            - This will replace all of the FormIt 360 families of the type you selected



- You can also launch the FormIt 360 website directly from the add-in by selecting the "FormIt 360" Button



How to install the FormIt 360 Converter Add-in for Revit

- Navigate to the FormIt 360 Download page on the website (Download)
  - Pre-requisites
    - A windows PC with Revit 2015, Revit 2016, or Revit 2017
    - Windows 7,8 and 10 are supported
  - Download comes as a Zip file
    - Click "Keep" when the download is finished
    - Unzip to a single directory
  - Double click the "FormIt360ConverterSetupForRevit2015.exe" (or 2016, 2017 version)
    - Open the folder "FormIt360ConverterSetupForRevit2015" (or 2016, 2017 version)
    - For best results use "Run as Administrator" option (right click menu)
- **Note:** The FormIt 360 Converter Add-in for Revit come pre-installed with Revit 2017.

Appendix B

FormIt 360 Keyboard Shortcuts

Command	Shortcut(s)
Application Settings: Display Dimensions	D, D
Application Settings: Snap to Grid	S, G
Collaboration: Invite to Session	C, I
Collaboration: Join Session	C, J
Collaboration: Start Session	C, S
Display: Ambient Shadows	D, A
Display: Axes	D, Z
Display: Back faces	D, B
Display: Edges	D, E
Display: Extend Lines	D, X
Display: Grid	D, G
Display: Group bounding boxes	B, B
Display: Hidden Lines	D, H
Display: Monotone Surfaces	D, M
Display: North Arrow	D, N
Display: Shadows	D, S
Display: Silhouettes	D, O
Display: Sketchy Lines	D, K
Display: Thin Edges	D, T
Display: Watertight Issues	D, W
Draw: Arc	A
Draw: Circle	C
Draw: Line	L
Draw: Rectangle	R
Draw: Spline	S
Edit: Copy	Ctrl+C
Edit: Delete	Delete
Edit: Paste	Ctrl+V
Edit: Preferences...	
Edit: Redo	Ctrl+Y
Edit: Redo	Ctrl+Shift+Z
Edit: Reset Axes	R, Z
Edit: Set Axes	S, Z
Edit: Undo	Ctrl+Z
Energy Analysis: Cancel Insight	
Energy Analysis: Generate Insight	
Energy Analysis: View Insight	
File: Export Image...	
File: Export Model To...	Ctrl+E
File: Import 3D Model...	Ctrl+I
File: Import Image...	Ctrl+Shift+I
File: New	Ctrl+N
File: Open A360...	Alt+O
File: Open...	Ctrl+O
File: Save As to A360...	Shift+Alt+S
File: Save As...	Ctrl+Shift+S
File: Save Copy...	Ctrl+S, Ctrl+C
File: Save to A360...	Alt+S

Command	Shortcut(s)
File: Save with History...	Ctrl+S, Ctrl+H
File: Save...	Ctrl+S
Group: Edit Group (Context Menu)	E
Group: Edit Group (Toolbar)	Alt+E
Group: Finish Group Action	F
Group: Group (Context Menu)	G
Group: Group (Toolbar)	Alt+G
Group: Make Unique (Context Menu)	M, U
Group: Make Unique (Toolbar)	Alt+M
Group: UnGroup (Context Menu)	U
Group: UnGroup (Toolbar)	Alt+U
Group: UnGroup All (Context Menu)	U, A
Group: UnGroup All (Toolbar)	Alt+A
Group: UnGroup Model	U, M
Help: About	
Help: Check for Formlt 360 Updates	
Help: Formlt 360 Blog	
Help: Formlt 360 Gallery	
Help: Formlt 360 Videos	
Help: Get Support	
Help: Help	
Help: What's New	
Levels: Display Levels	D, L
Levels: Use Levels	U, L
Prevent materials on back side faces	
Primitive: Cube	Alt+B
Primitive: Cylinder	Alt+C
Primitive: Dome	Alt+D
Primitive: Prism	Alt+R
Primitive: Pyramid	Alt+P
Prototype: Display mouse/grid status	
Selection Filter: Edges	E, S
Selection Filter: Faces	F, S
Selection Filter: Groups	G, S
Selection Filter: Solids	S, S
Settings: Large Buttons	
Sketch Settings: Toggle Unit Type	U, T
Solar Analysis: Analyze	A, A
Solar Analysis: Enter/Exit Solar Analysis Mode	S, A
Solar Analysis: Exit	
Solar Analysis: Reset	
Tools: Array	A, R
Tools: Cover	C, V
Tools: Cut Geometry (Context Menu)	C, C
Tools: Cut Geometry (Toolbar)	C, G
Tools: Enable Touch	E, T
Tools: Enable Touch	T, M
Tools: Extrude Edges	E, E

Command	Shortcut(s)
Tools: Fillet	F, I
Tools: Information	
Tools: Join Geometry (Context Menu)	J, C
Tools: Join Geometry (Toolbar)	J, G
Tools: Lasso Select	L, L
Tools: Loft Edges	L, O
Tools: Measure	M
Tools: Measure Angle	M, A
Tools: Merge Edges and Vertices	M, E
Tools: Mirror	M, I
Tools: Multi-Move	M, M
Tools: Offset Edges	O, E
Tools: Offset Face	O, F
Tools: Offset Solid	O, S
Tools: Reverse Faces	F, F
Tools: Rotate	Q
Tools: Run Script from Editor	
Tools: Scale	S, C
Tools: Select	Space
Tools: Set Location	S, L
Tools: Shell	S, H
Tools: Smooth Edges	S, E
Tools: Sweep	S, W
Tools: Taper Face	T, F
Tools: Unsmooth Edges	U, E
View: 3D View	Z, D
View: Blue theme	
View: Default theme	
View: First Person Fly-Through	F, T
View: Orbit Camera	
View: Pan Camera	
View: System theme	
View: Toggle Perspective	
View: Top	Z, T
View: Zoom All	Z, A
View: Zoom All	Z, E
View: Zoom All	Z, Z
View: Zoom All Images	Z, I
View: Zoom Camera	
View: Zoom In	
View: Zoom Out	
View: Zoom Selection	Z, S
Window: Design Toolbar	H, D
Window: File Toolbar	H, F
Window: Floating Navigation Toolbar	H, B
Window: Main Menu	H, M
Window: Navigation Toolbar	H, N
Window: Operations Toolbar	H, O

Command	Shortcut(s)
Window: Settings Toolbar	H, C
Window: Sketch Toolbar	H, K
Window: Solids Toolbar	H, P
Window: Standard Toolbar	H, T
Window: Status Bar	H, S
Window: View Toolbar	H, V