

CS124321

Construction Layout Workflows—BIM to the Field and Back

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Learning Objectives

- Learn how to use Point Layout with your Revit model to set up coordinate systems and create points for layout
- Understand how to work with your surveyor and project control points
- Become familiar with the hardware and tools are required for construction field layout
- Learn how to round-trip points from the model to the field with BIM 360 Glue and BIM 360 Layout

Description

It's time to leave your tape measure in the truck. Do you want to make the leap and lay out directly from your model in the field? What are the software workflows? How do you set up a Revit model for use with a civil or local coordinate system? What are the benefits of using Point Layout software in the field? We'll cover how to work with Point Layout in Revit software, BIM 360 Glue software, BIM 360 Layout iPad app, and your robotic total station. See live demonstrations of the software on real-world projects, and hear discussion of the processes involved in construction field layout. We'll be working with subcontractors and their models, and assisting their field-layout processes.

Speaker(s)

Jarrold is currently the BIM Manager for Tilden-Coil Constructors, Inc. He is tasked with improving accuracy, communication and coordination of the construction process through the use of Building Information Modeling tools focusing primarily on the Autodesk® Revit®, Navisworks®, BIM 360 Glue and BIM 360 Layout workflows. Jarrold has extensive experience in creating custom content, managing field to model workflows and over 22 years of design and construction experience in the AEC industry.

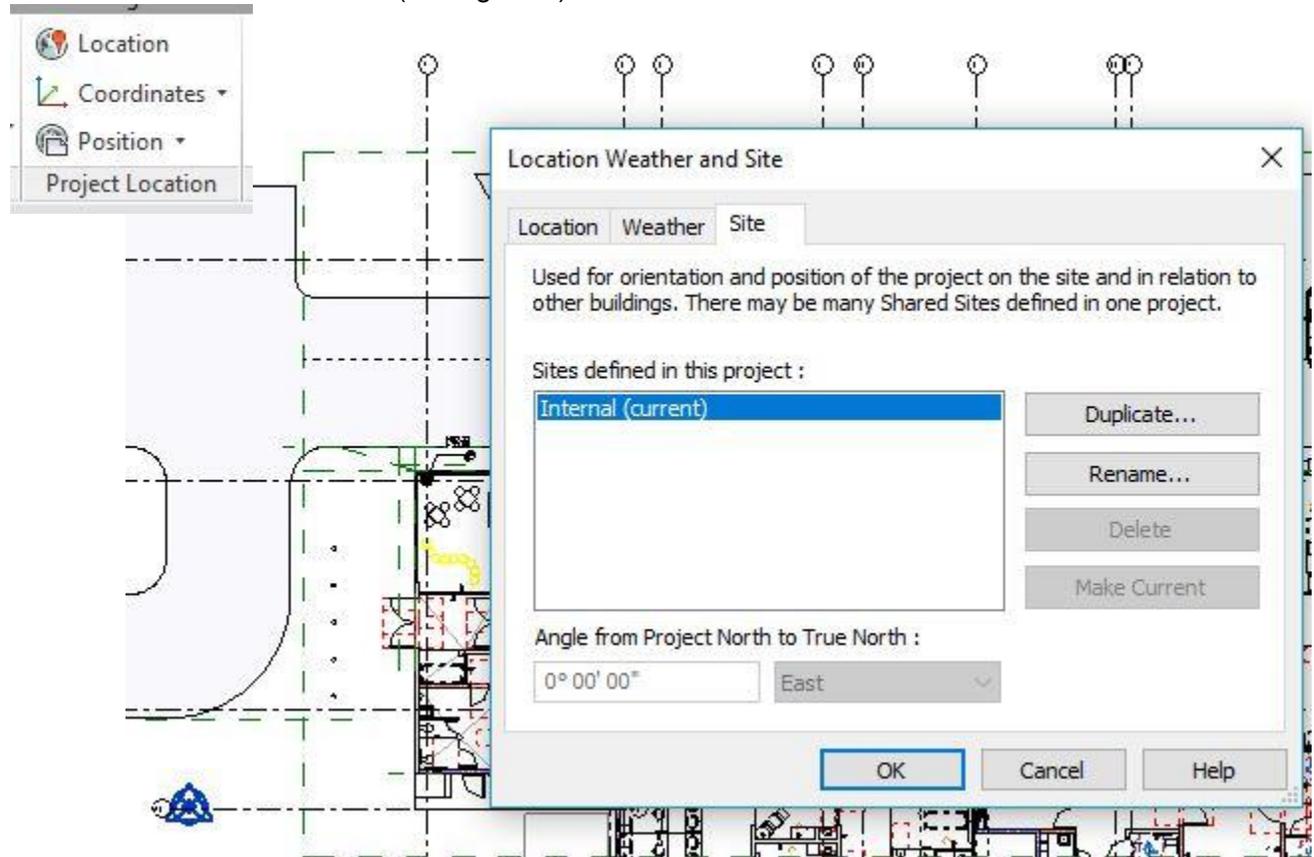
Joel is a BIM consultant using Revit MEP to support the entire building industry from as-built laser scanning and model creation to multi-discipline engineering, BIM coordination, fabrication, shop drawings, field layout and software development. With over 20 years' experience in 3d modeling, Joel has a wide perspective of the MEP workflow in our industry. Engineers, manufacturers and contractors alike have benefited from his diverse exposure through in-house training, content creation and 3d modeling services.

Point Layout and your Revit models

- Aligning models / CAD files
- Survey information or known points on site
- Otherwise our model has no relation to our site

Plain and simple, it starts with good Horizontal Control. If it doesn't exist on your contract document Civil drawings, you will need to ask for it from your design team. Typically, we start with verification of the building grid systems. Dimensionally, does the Revit model match the dimensioned grid system on the plans? Once you have verified this you can request the horizontal control coordinates at specific grid intersections.

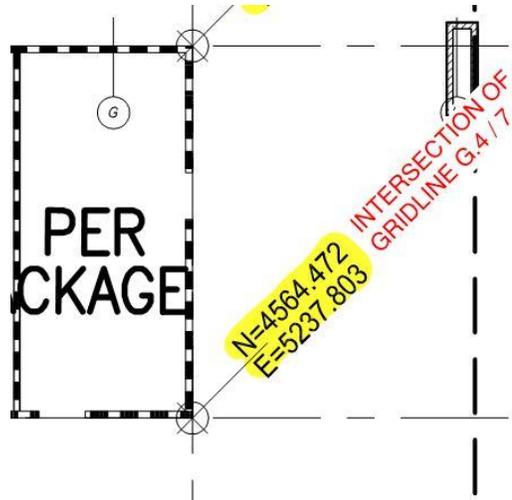
By default a Revit model has only one coordinate system setup in the template. This will be named "Internal" by default. You can confirm this by opening the – **Manage** tab— **Location** command- **Site** tab (see figure 1)



Here we can manage and setup multiple coordinate systems within the same Revit model. For example, we may use one coordinate system as the origin for our internal MEP BIM coordination process and another to orientate our building to a geospatial location such as the horizontal control typically found on the civil contract drawings.

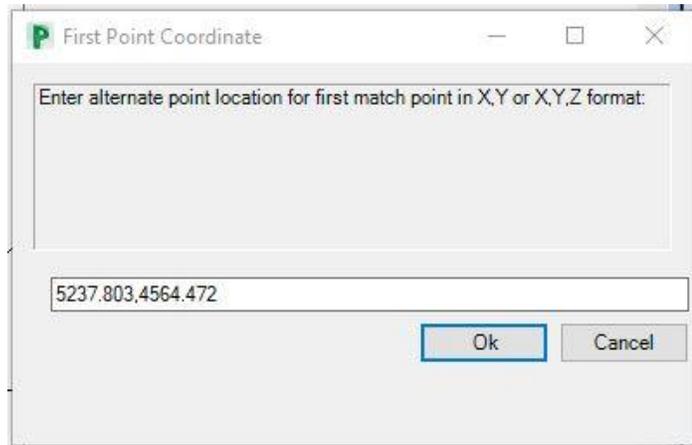
Using Autodesk Point Layout for the setup of our survey aligned coordinate system has the advantage of setting the True North orientation along with our Easting / Northing (X,Y) position all in one command.

1. Have your horizontal control coordinates available for this step.
 - a. You will need at least two points or grid intersections with coordinates you can enter when asked. – *Tip: It is best to use two points at diagonally opposite ends of your building for this process.*

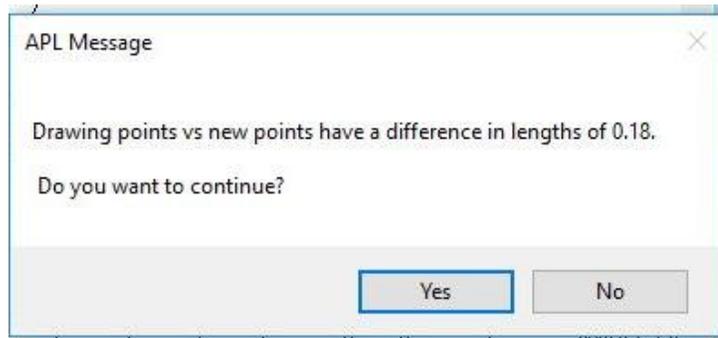


2. From the **Autodesk Point Layout** ribbon in Revit, choose the **Setup panel** and the **Coordinates** command.

- a. After choosing your project Units (typically Decimal Feet), next choose Workplane based snapping.
- b. Select your first Grid intersection that you have coordinates values for and enter them in X,Y (Easting / Northing) coordinate order. For the example in the image above at Gridline intersection G.4 and 7 they will be entered as shown.
- c. Now select your second match point or grid intersection. Again enter the coordinates in X,Y order.



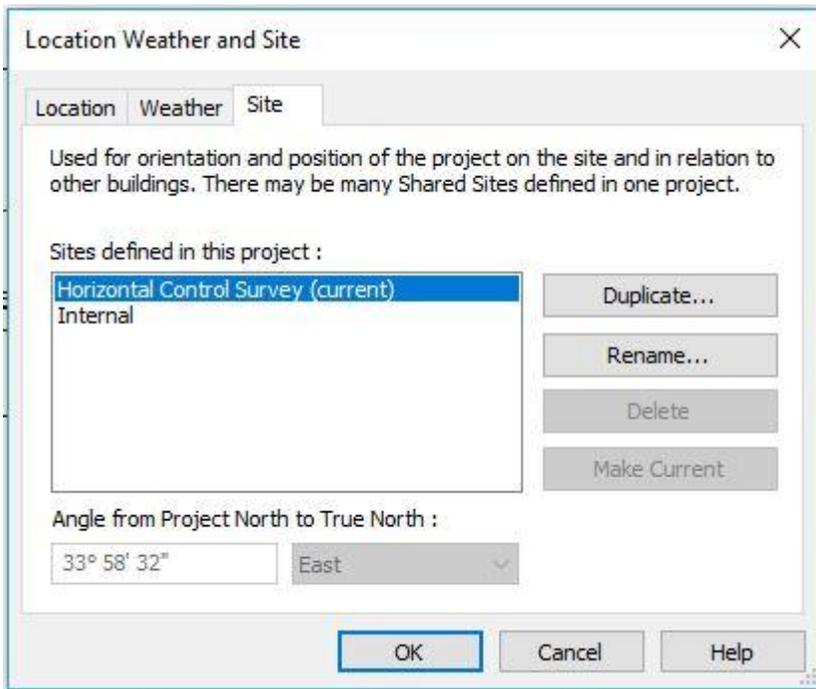
- d. If the points you chose match in distance, no errors will be received, and you will get a dialog box allowing you to name this new coordinate system. However, if the points chosen do not match in distance, APL will display a message showing the difference. In the example shown here, 0.18 feet is approximately 2-1/8" inches which is outside an acceptable tolerance. Either the coordinates you have for the grid intersections are not accurate or the gridline layout in your Revit model is incorrect



- e. Also, this new coordinate system can be found in the **Location** command as mentioned at the beginning of this section – see image below

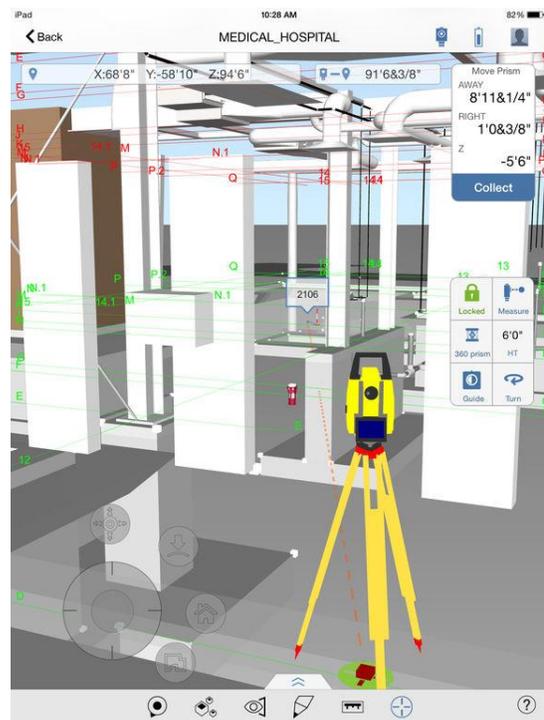
Results of using APL to setup up the coordinate syste

- New coordinate system is defined in the Revit project along with the True North rotation.
- This coordinate system will be used when importing and exporting points from your Revit model through APL
- Points from your own total station instrument or the surveyor on the project will import and export seamlessly



Digital Construction Layout and the Hardware

- (3) Basic Tools
 - Data Collector / Field controller / iPad



- Sensor / Total Station / Instrument / Electronic Transit Theodolite w/ a distance meter

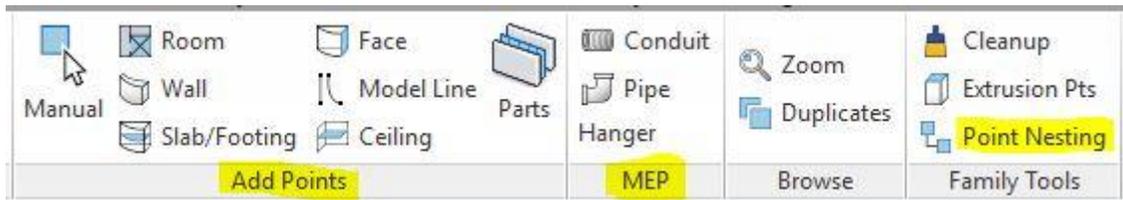


- Prism / Surveying reflector



Points In... Points Out – Revit to BIM 360 Glue to BIM 360 Layout

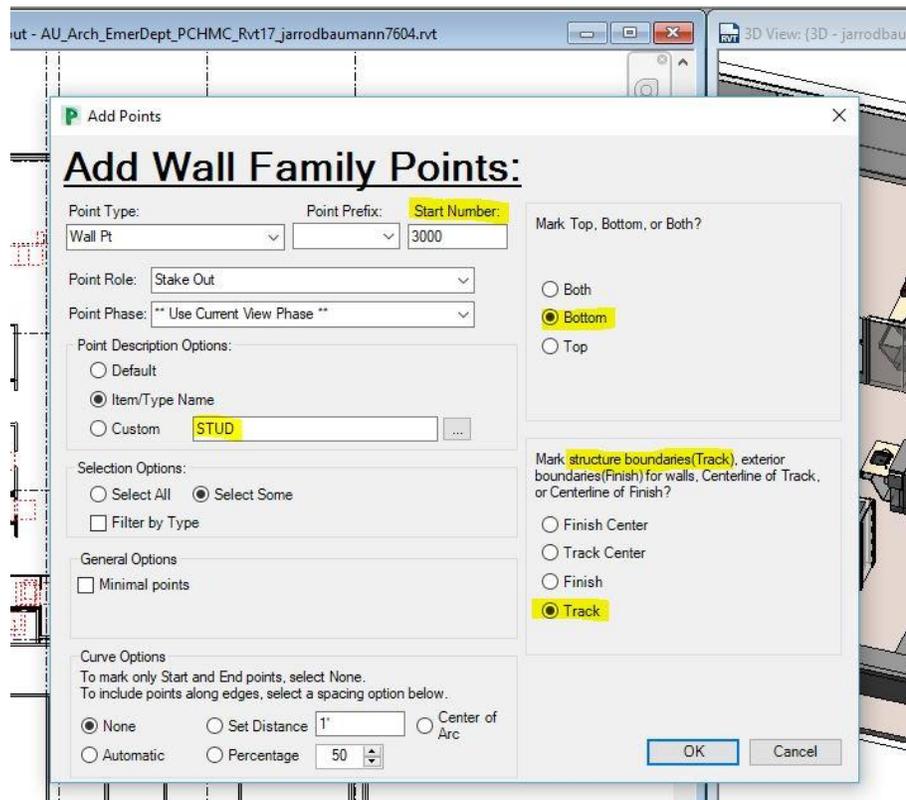
Autodesk Point Layout provides numerous options for creating points from your Revit Geometry. From a basic “Manual” point and click to add a point in the model or automated point layout tools such as walls, slab/ footing edges, ceilings etc. For layout of repeated installation features such as MEP hangers, we can even nest a point family inside our hanger family geometry for example.



Workflow Example – Adding wall points and Syncing to BIM 360 Glue

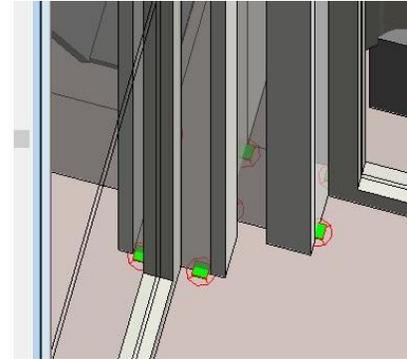
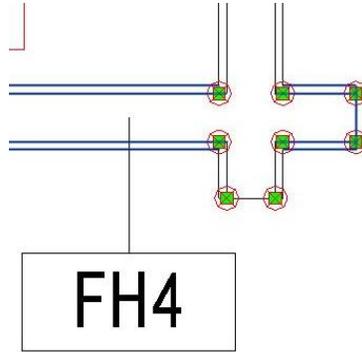
It is beneficial to know that points can be added into linked Revit models as well. These linked models, do not have to share the same coordinate system as the host model where we setup our Horizontal Control. If points are added into a model and the model is linked into our parent/ site model, those points will export or upload to BIM 360 Glue through the linked file.

1. Open the Architectural model with wall layouts.
 - a. From the **APL** tab in the **Add Points** panel, choose the **Wall** command
 - b. Numerous options for where to add the points along with parameter data can be chosen now. To layout the stud face of the wall or core layer as we know it in Revit, choose the “**Track**” option. After entering a starting point number and any description options we are ready to select walls. Choose **OK**



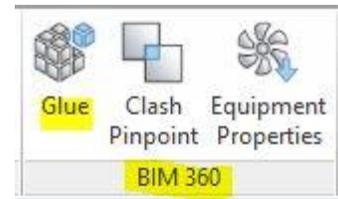
2. Using a floor plan or 3d view, you can immediately begin selecting walls to add our layout points to. When finished adding walls, choose Finish from the options menu. APL will points to all selected walls.

3. You should now see the points added in your floor plan and 3d view. The point family is a Generic Model family category. Tip: Create a filter that will allow you to color your point family in various views for easy identification. These can even differentiate between the wall point type.



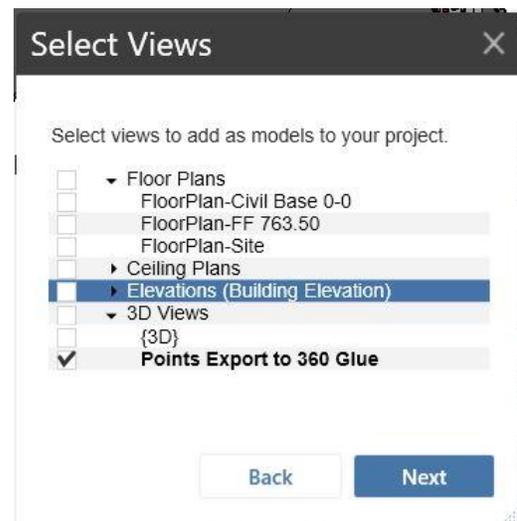
4. Save the Architectural model and re-open your parent / site model with this model linked in. The points that are nested in the linked architectural model will export to BIM 360 Glue.
5. Using a 3d view, confirm the linked model as well as the desired categories (Generic Models for points) are visible. Depending upon how much geometry you desire to see on your iPad (data collector), you can use a section box to minimize the amount of geometry exported to Glue. For example, you may want to create an individual 3d view for each floor level of the building. This will depend upon your field workflow preferences and how much you are laying out at any given time.

6. From the **Add-Ins** tab in the **BIM 360** panel, choose the **Glue** command. If not already signed in, you will be prompted for your login credentials and the choose your Host name. Choose the project for the model you are working on.

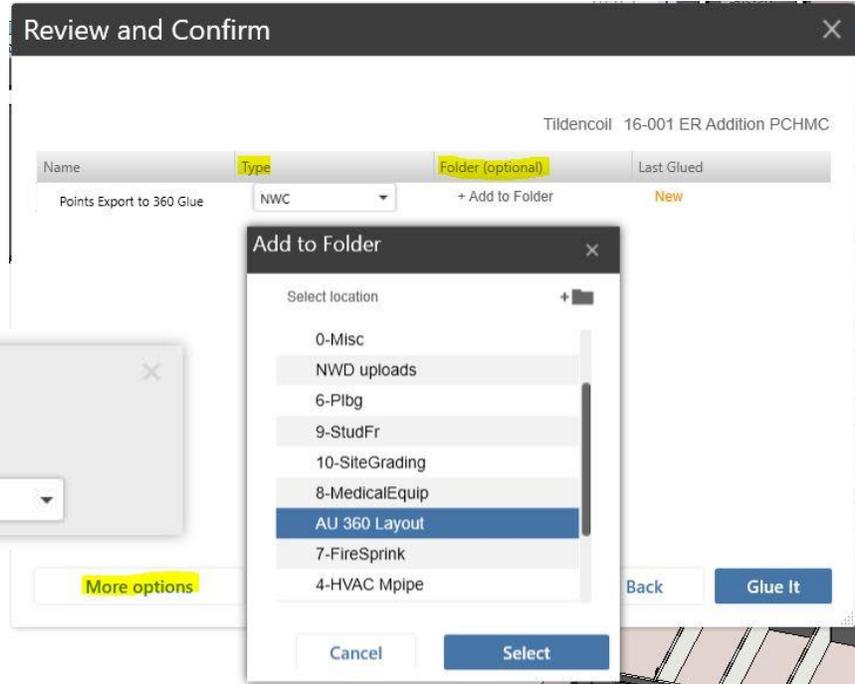


- a. At the **Select Views** dialog box, choose the 3d view that you had setup in the previous steps. Tip: If your 3d view is the active view before starting this command, it will automatically be chosen in the Select Views window. Also, naming your 3d view to reflect the name you want the model to display on BIM 360 will save you a step.
- b. You can now choose the filetype you wish to export this model view as. Either .NWC (Navisworks cache) or DXF file type is available. Also important, be sure to specify the following settings:

- i. **Folder** – choose a folder where you will keep your models exported with points for layout in the field
- ii. Select the **“More options”** button – Be sure to specify **“Include linked files”** and **“Shared Coordinates”**
- iii. The shared coordinate system that will be used on upload to BIM 360 Glue is whichever coordinate system is set current in the **Location** command **Site** tab as we

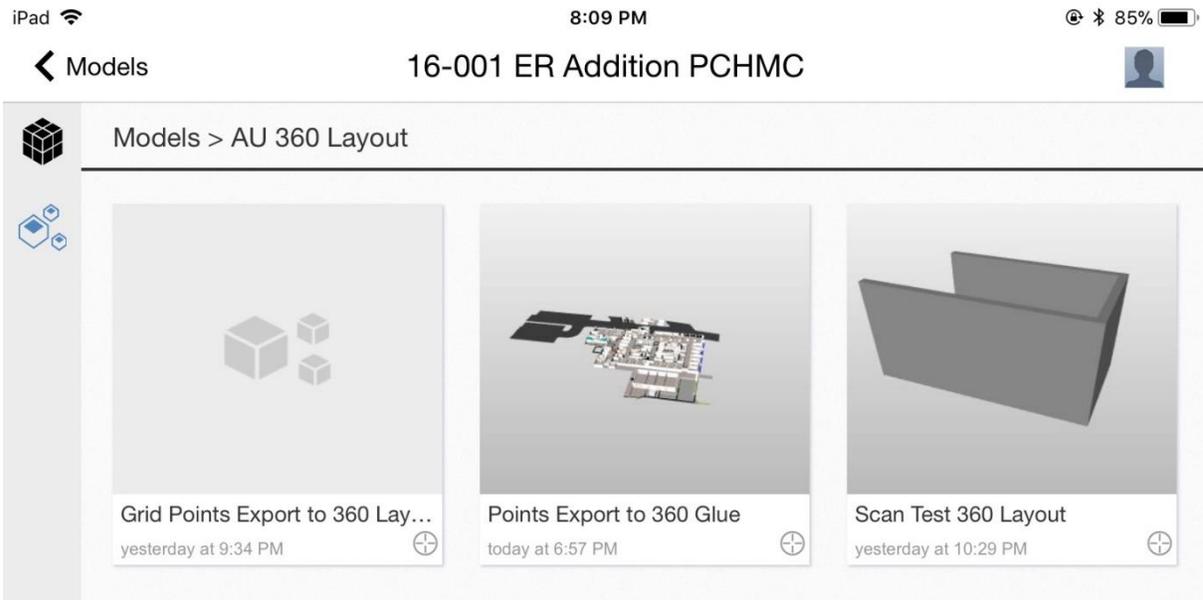


learned at the beginning of this handout. This is important because whatever control points you will be syncing your total station instrument to in the field, will only align with the Horizontal control coordinate system we



setup at the beginning.

- c. Once all your settings are correct, choose **“Glue It”**
- d. Revit will now export to the views selected to .NWC format and upload to Glue. You will receive a confirmation dialog box letting you know the upload was successful and that your model is in the process of gluing.
7. We are now ready for the field! Use your data collector (iPad) and launch the BIM 360 Layout app to confirm the model was posted successfully. It is also good practice to download the model locally to the iPad from Glue



8. After logging in, navigate to the project where you exported the model to Glue. Open the model.
9. Once the model is open, you can select the layout points icon on the bar at the bottom of the screen. This will begin the layout process. You are ready to connect to your total

station instrument via wifi and begin the setup to sync up to your control points and layout points in the field.

10. You can also collect existing or as-built points from the field. After doing so, the newly collected points can be synced back up to BIM 360 Glue via the iPad app once you have an active internet connection.
 - a. Once the new points are synced to Glue, you can use the **Import Points** command from the **APL tab** to bring those as-built points into your Revit model.



