AUTODESK **UNIVERSITY** 2014

Follow the Bouncing "I" in BIM: Design to Build to Operations

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CO6467-L: Follow information as it traverses the construction project lifecycle from design to build to operations. Participants will learn how to link their Building Information Model (BIM) from authoring tools such as AutoCAD and Revit software to BIM 360 Glue for design coordination, then to BIM 360 Field for construction field execution. We will then review options for outputting information for operations and maintenance in a useful manner.

Learning Objectives

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

- Learn how to "Glue" your models into BIM 360 Glue software for design coordination.
- Learn how to link your BIM 360 Glue models to BIM 360 Field software for construction execution.
- Learn how to hand over information for operations and maintenance.
- Have a little fun!

About the Speaker

Matthew DePaolis is an expert in construction industry technology in particular the BIM 360 platform and associated workflows. His current role at Autodesk involves building the BIM 360 Global Services Organization. His background is in construction, mobile computing, information exchange technologies, and building services organizations from the ground up.

Prior to joining Autodesk, Matthew helped Vela Systems to revolutionize the construction industry by changing the way construction projects are managed and performance from the field.

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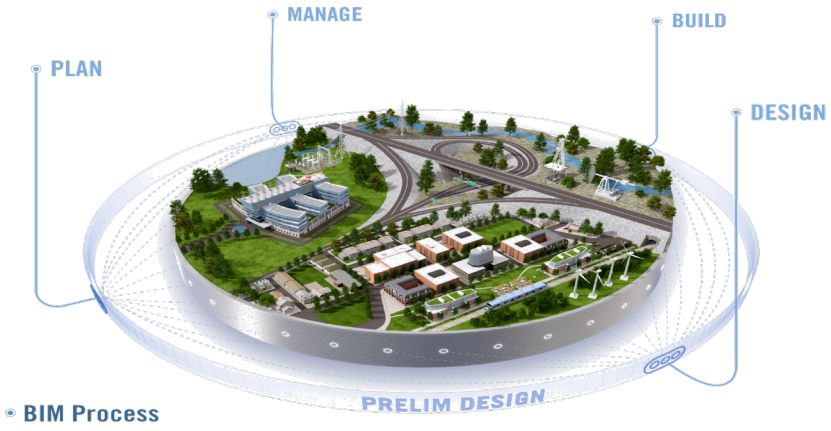
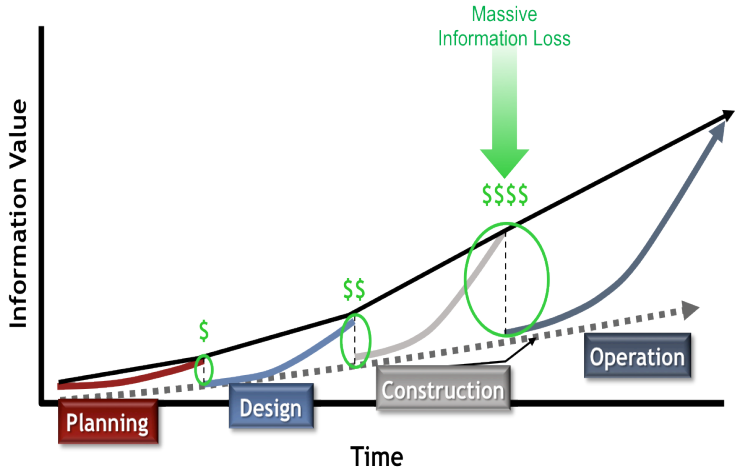
Introduction

Building Information Model. Most folks’ initial understanding of BIM is as a model or 3D design; heavily focused on the “M” (biM). While there is great value in a visual aid tool, the real opportunity and promise of BIM should have a much greater emphasis on the “I” (bIm).

Our challenge is to look at the construction project life-cycle more hollistically and understand how information evolves and flows not only from one stage of construction to another but also from one group of professionals with their own motives & experiences to another group of professionals with their own set of motives & experiences.



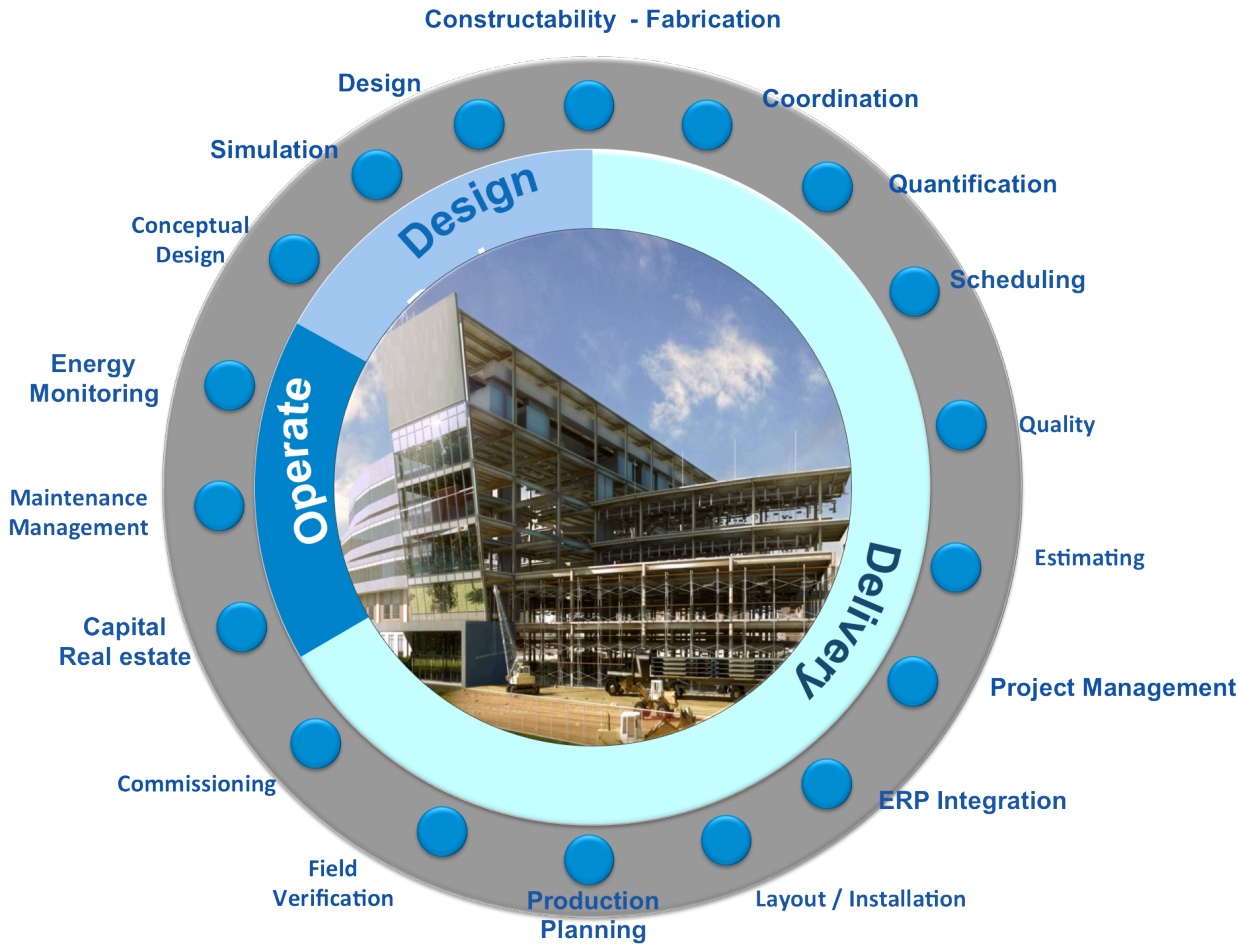


Source: BIM After Construction, Brigitta Foster, Sandia National Labs, 2010

As information, flows from one phase and group of professionals to another, there is a great risk and problem with how information and intent is lost from one phase to another. A 2010 NIST study shows that personnel spent US $4.8 billion during 2002 verifying that documentation accurately represented existing conditions, and another US $613 million transferring that information into a useful format.

The use of collaboration tools (such as the BIM 360 platform) give us an opportunity to build a more holistic process where by information is built and enriched throughout the construction project life-cycle; from one team to the next. Tightening collaboration and access to information reduces the loss of information and intent from one stage of construction to the next.

The key here is that the tools (i.e. software) are just an enabler; what is important is that your team’s have re-factored and improved your old (or non-existent) processes for defining information exchange across the project life-cycle to leverage these new tools.



Let’s follow the “I” in bIm as it bounces across the project life-cycle from design to build to operations…

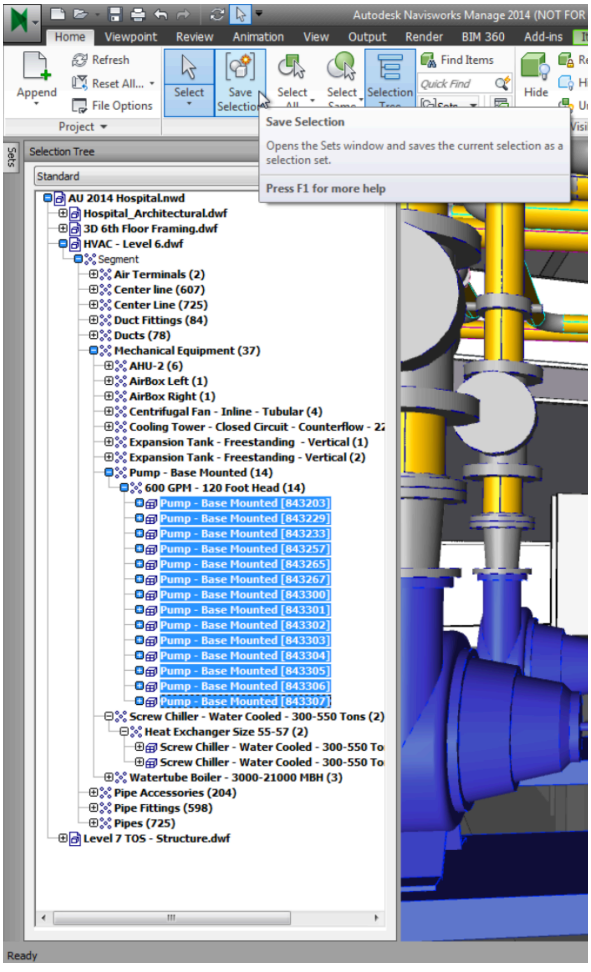
A. "Glue" your models into BIM 360 Glue software for design coordination.

Use your model authoring tool of preference, Glue accepts over 50 file formats. You can upload a local model directly into Glue or you can use one of the BIM 360 Glue plug-ins to "Glue" your model directly from from AutoCAD, Revit, or Navisworks.

For the sake of this lab, we are simply going to Glue an .nwd model file from within Navisworks to try and keep everyone on the same page. That said, if you're a bit more adventurous and you brought your own model you can follow the same instructions with your model. Additionally, I'll make sure you have access to your lab site for the next two weeks after the lab if you want to run through the exercise with your own model after today.

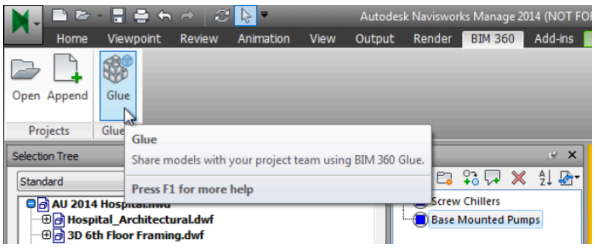
TIP: BIM 360 Glue is compatible with over 50 file types:
https://b4.autodesk.com/file_compatibility.html

0. Plan ahead… this is the most important step. Some things to discuss with your team ahead of time:
    a. Identify which objects that will be tracked through design to construction to operations.
    b. Identify what information needs to be captured during design, construction, or operations phases. Ask:
        i. Where does this information come from?
        ii. Where does information need to go?
        iii. Where will it be stored?
        iv. Who and when will it be captured?
    c. For each asset that is to be tracked, identify what property will uniquely identify the asset / object. We will call this our **map-key**. It is critical that we give forethought to our map-key ahead of time.
1. Open the model "AU 2014 Hospital.nwd" in your lab data-set with Navisworks Manage.
2. Optionally you can build a "set" (selection or search) that comprises the objects that represent the assets to be tracked. This can also be done from within Glue.
3. In this exercise we'll build a selection set for the 14 base mounted pumps. Open Selection Tree, select 14 base mounted pumps and then click "Save Selection". Name selection "Base Mounted Pumps". For this set we are going to use "ID:Name" as the unique identify attribute:property.



IMPORTANT TIP: you need to have a separate "set" for each group of assets that have:

a. Different attribute:properties that are to be tracked.
b. Different attribute:property that represent the uniquely identifying map-key.

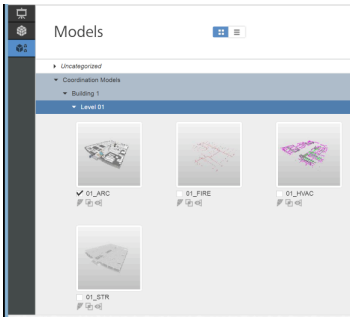


4. "Glue" model. Under the "BIM 360" tab, select "Glue" it.
5. You will be prompted "Sign In" with your BIM 360 Glue credentials. At the beginning of the lab you will be assigned a two digit unique number. Below "##" represents that number:
   a. Email: AU2014Construction+##@gmail.com (i.e. AU2014Construction+99@gmail.com)
   b. Password: Construction##

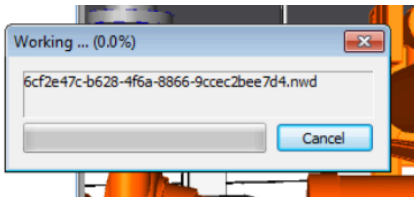
6. You will be asked to select the Glue Project site that the model is to be "Glued". We have set you up with your own BIM 360 Glue project site named "AU 2014 Lab ##".

NOTE: you could be associated with many Glue Accounts or Projects at the same time in a real-world environment.

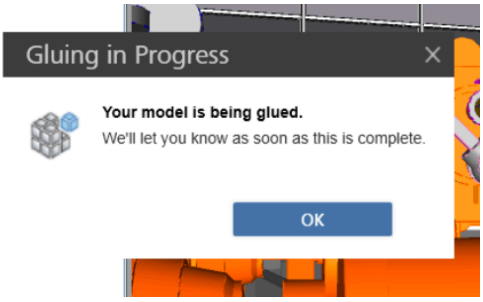
7. You have the opportunity to select what "Folder" the model file can be uploaded into. Select the "Models" folder for our example. Then select "Glue It" button!



NOTE: in your real-world projects, setting up a folder structure within Glue will help you to organize your models. It is best practice that you setup your model files and Glue project site folder structure to be broken down by Building > Floor > and then Discipline as depicted in this example.



8. Your model is now being packed up and uploaded to the Glue server. You'll be prompted that the system is "Working". Once the model is sent to the Glue server, it will take some time to process and become available in your Glue project environment. During this time, you'll be prompted that "Gluing in Progress." You can click "OK" to close this prompt. When complete you will be prompted again that the model has been Glued properly.



9. Don't forget to save the model and then you can close Navisworks.

Congratulations… you've Glued your model so it is available for design coordination.

TIPS: BIM 360 Glue resources to help you get going:

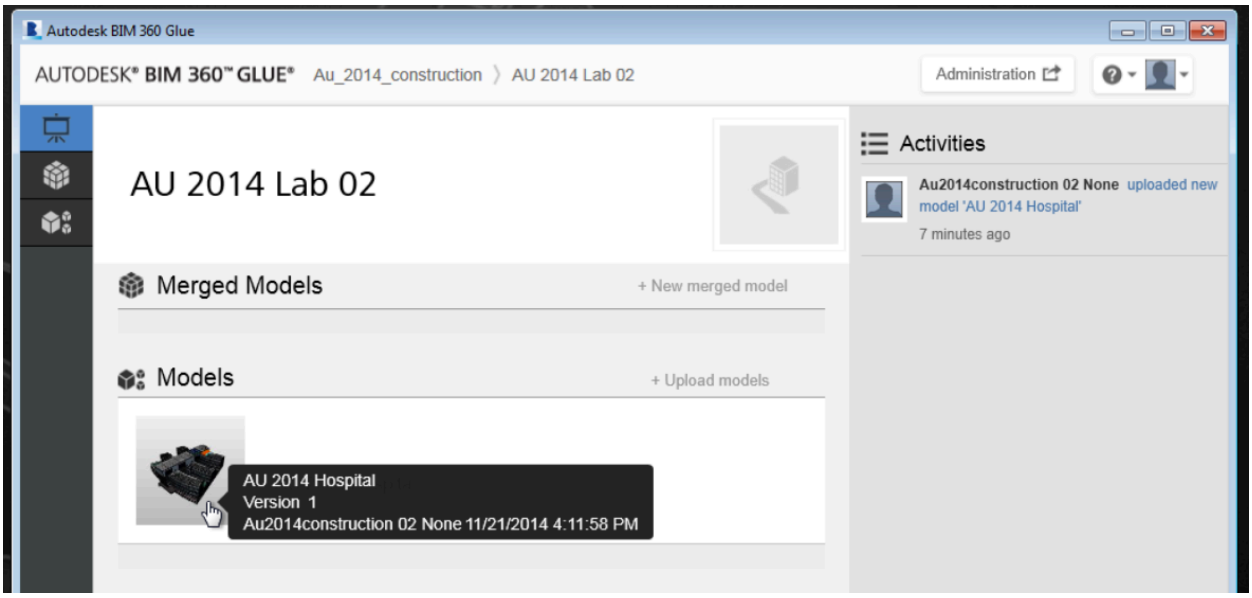
- BIM 360 Glue Help: http://help.autodesk.com/view/BIM360/ENU/
- Video playlist of BIM 360 Glue workflows: http://www.youtube.com/playlist?list=PLY-ggSrSwbZoZy7HnxhXX8RuE5kYMDu7p
- Video depicting the design review workflow in Glue: http://knowledge.autodesk.com/support/bim-360-glue/learn-explore/caas/video/youtube/watch-v-5xmG7SN-E8w-feature-youtube-gdata.html
- You can install Glue add-in apps for Autodesk Navisworks, Revit, AutoCAD, and AutoCAD Civil 3D. Here is a link to the latest add-ins: https://b4.autodesk.com/addins/addins.html
- Here is a useful link discussing how to prepare your model files for coordination: http://knowledge.autodesk.com/support/bim-360-glue/learn-explore/support/bim-360-glue/learn-explore/caas/video/youtube/watch-v-UuJ5Y7yGI1Q-feature-youtube-gdata.html
- Some information on selection and search sets:
    - How to create selection and search sets in Navisworks: http://knowledge.autodesk.com/support/navisworks-products/getting-started/caas/CloudHelp/cloudhelp/2015/ENU/Navisworks/files/GUID-84BCC17E-551F-4F9B-ADBC-66875CDADEB0-htm.html?v=2015
    - Article discussing benefits of search sets over selection sets: http://beyonddesign.typepad.com/posts/2012/07/search-sets-vs-selection-sets.html

B. Share your BIM from BIM 360 Glue to BIM 360 Field.

1. Launch the BIM 360 Glue client installed locally on your computer by clicking on the BIM 360 short-cut on your desktop.

NOTE: a BIM 360 Glue web portal also exists. You will interact with the web portal as a host or project administrator. Additionally, a simplified set of functionality has been built into the web browser making it ideal for "Reviewer" role users. For the purposes of our lab, all host and project administration has been completed so we only need to use the local client installed on our computers.

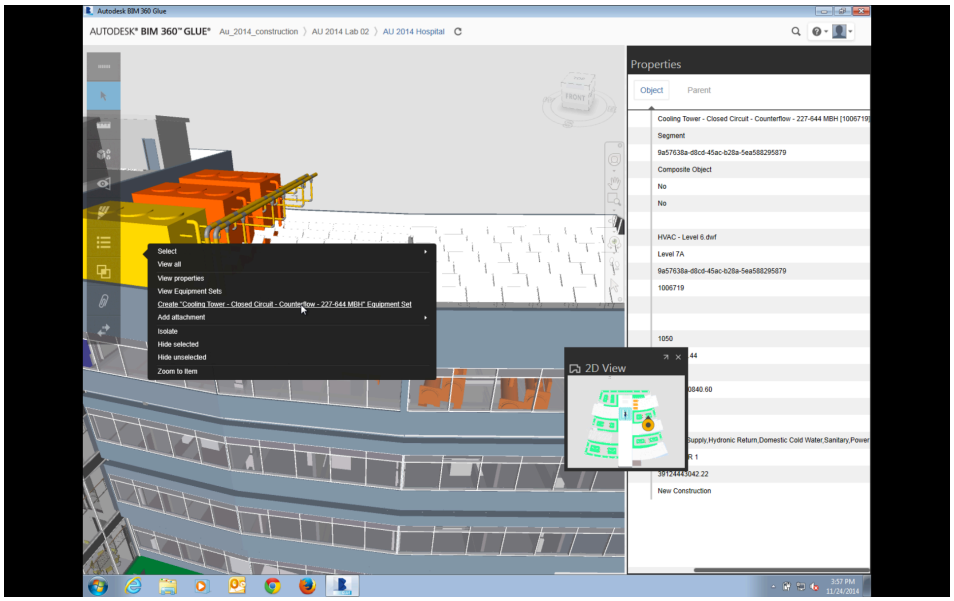
2. Login using your Lab credentials (same as logging into Navisworks plug-in):
   a. Email: AU2014Construction+##@gmail.com
   b. Password: Construction##
3. Select the only project listed "AU 2014 Lab ##".
4. Under models, select to open the model you Glued from Navisworks "AU 2014 Hospital" (once it has completed being Glued).



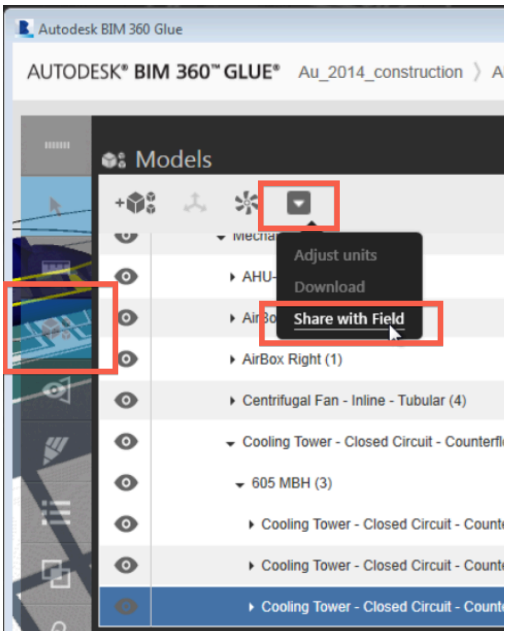
TIP: You can upload your own models directly into your lab project using the "+ Upload models" button as opposed to using the "Glue" plug-in directly from Navisworks or your authoring software.

5. With your model open you can use the solution for Design Coordination; iterating over model updates through the Design and Preconstruction phases. When ready for Field Execution, you might want to build an additional "set" that includes assets that you wish to be tracked in BIM 360 Field (note: this will be used in addition to any sets you've already built in Navisworks). For this lab, we'll build a set to track the 3 cooling towers on the NE wing rooftop.
   a. Navigate to the cooling towers using your navigation tool of choice (from right panel) or from the home view it's easy to navigate over if you choose the Zoom Window tool.
   b. Use the selection tool (toolbar on the left), to select any of the cooling towers.

TIP: Navigation in BIM 360 Glue: http://help.autodesk.com/view/BIM360/ENU/?guid=GUID-A25EDAB0-DB1A-46A3-8F7D-35F1D55D3531

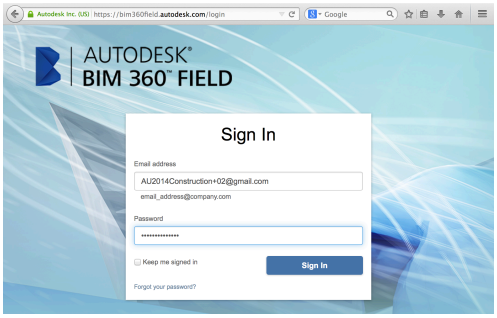


c. Right click any of the three cooling towers and choose to "View properties". We see the "Name" property uniquely identifies these assets. We'll use this as our map-key.
d. Right click the cooling tower and choose to *Create "Cooling Tower – Closed Circuit – Counterflow – 227-644 MBH" Equipment Set*.
e. Name your Equipment Set. You can leave the default for this lab.
f. Select the "Models" icon from the left panel.
g. In the "Models" tree, select "More Options" icon and select "Share with Field". You'll be warned that sharing this model will replace any prior versions of the model in Field. Say "Yes".

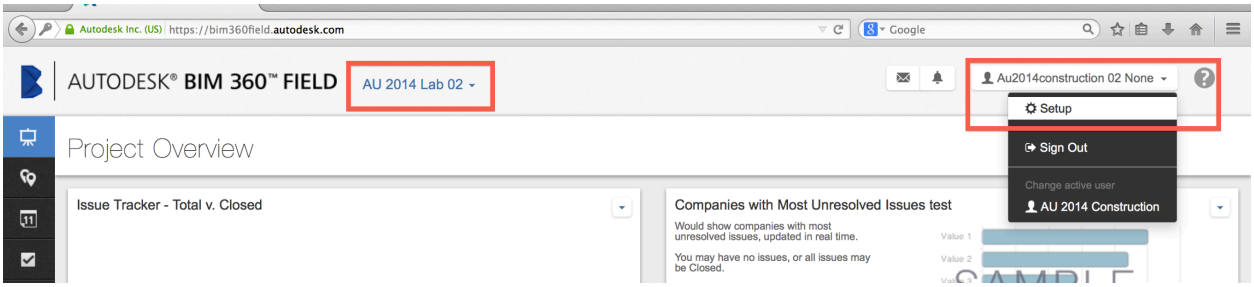


You're model with additional equipment set has now been shared with BIM 360 Field.

C. Map your model object attributes to BIM 360 Field equipment properties.

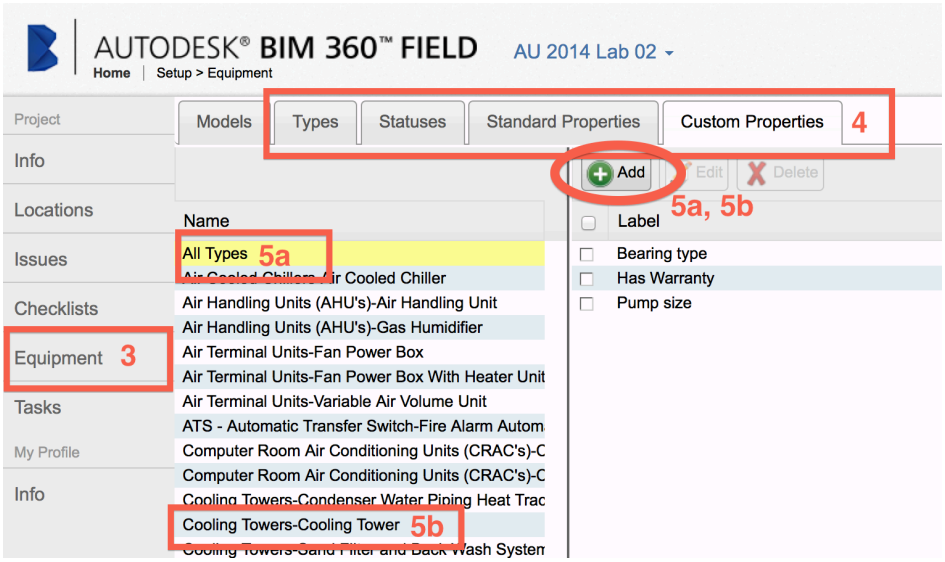


1. Launch the BIM 360 Field web portal. Open your web-browser of preference (I’ll use Mozilla Firefox in these instructions) and navigate to the url: https://bim360field.autodesk.com/
2. You are already setup in the system as a project administrator on your project “AU 2014 Lab ##” which will be defaulted to when you first login. Go to the project setup page by clicking on your user



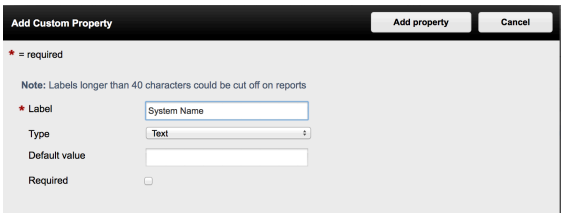
name on the top right “Au2014construction ## None” → “Setup”.

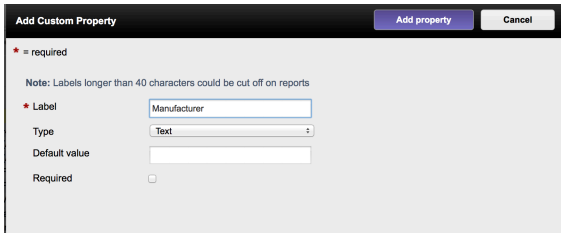
3. You want to manage the project equipment module, so on the left panel click on “Equipment”.
4. Make sure the structure of the assets you want to track are setup (before adding any equipment records). The proper equipment “Types”, “Statuses”, and “Standard Properties” have all been setup for our project already but let’s add your own custom properties by selecting the “Custom Properties” tab.



MEMO: In step A0b you identified what information needs to be capture and tracked at each stage of the construction project life-cycle. By creating a custom property per type of equipment in BIM 360 Field you are defining what attributes are either populated from your BIM or are captured while out in the Field during build execution.

5. We want to add two custom properties, the first will get populated from existing model object attributes, the second will get populated by the construction team in the Field and be pushed back into the model.
   a. For all equipment regardless of type, we want to track a text property “System Name”: select “All Types” and click the “+ Add” button. Label the property, select type “Text”, and click “Add property”.
   b. For just the Cooling Tower type assets we want to add a property to represent the “Manufacturer”. Select equipment category – type “Cooling Towers-Cooling Tower” and click the “+ Add” button. Label the property, select type “Text”, and click “Add property”.

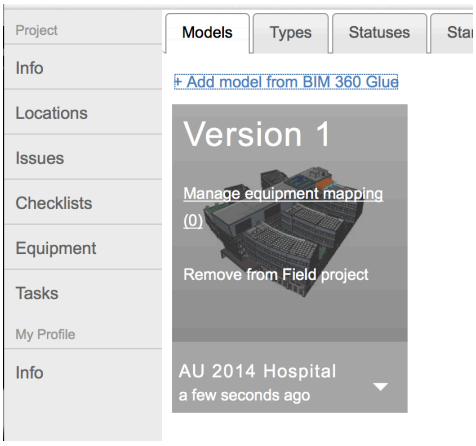




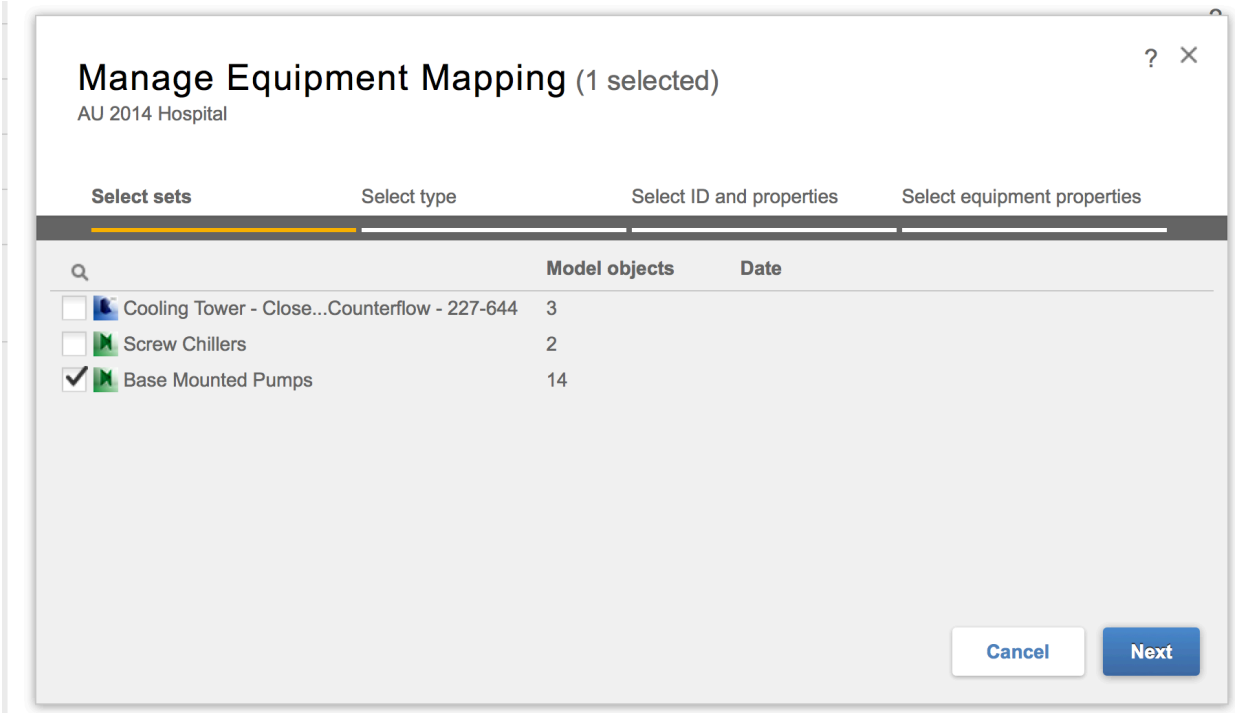
6. Now that we’ve defined how our BIM 360 Field equipment records are structured, we’ll add the actual equipment records by pulling them in from objects in our BIM that belong to the “sets” we built.

MEMO: for teams who do not have a BIM or sophisticated enough model, the project team could add equipment records manually or through excel import but these assets won’t be automatically associated with a model object.

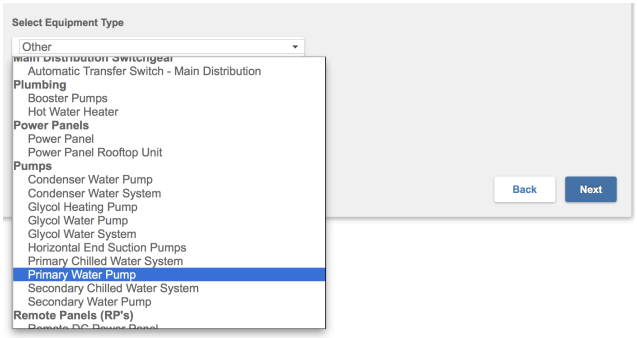
7. Still under the “Equipment” setup section, click back to the “Models” tab and select “+ Add model from BIM 360 Glue”.
8. Select the Glue project “Au_2014_construction > AU 2014 Lab ##” and model “AU 2014 Hospital” (note: these are the only ones that you currently have access to so they will default). Click “OK”. You will be prompted that “Model is processing…”.
9. Once complete, you can hover over the model image and select to “Manage equipment mapping (0)”.’

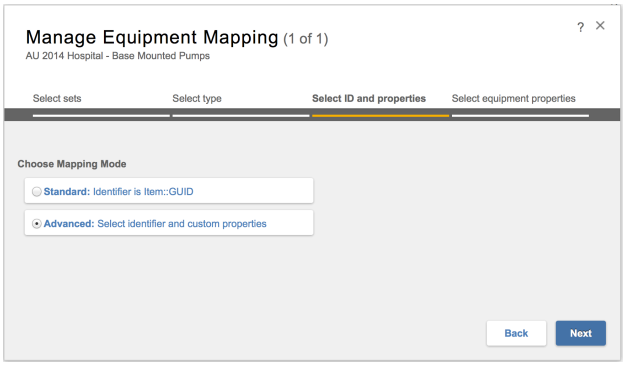


NOTE: the “(0)” represents the number of sets that have already been mapped.

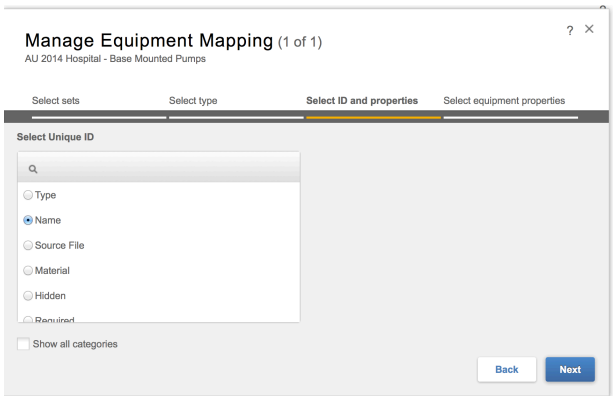


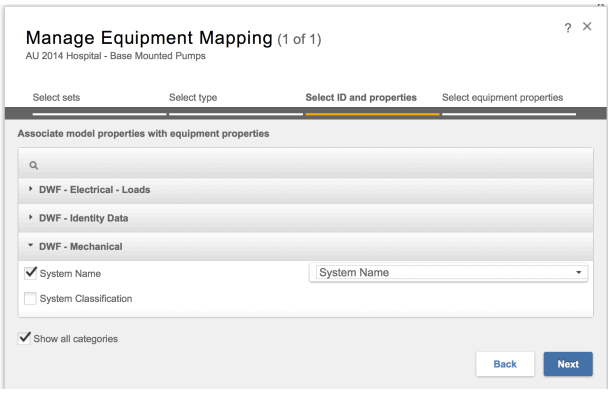
10. We want to map the Navisworks "Base Mounted Pumps" set (14 model objects) first.
    a. Select the checkbox to the left of the set and click "Next".
    b. Select the proper equipment type "Primary Water Pump" and click "Next".





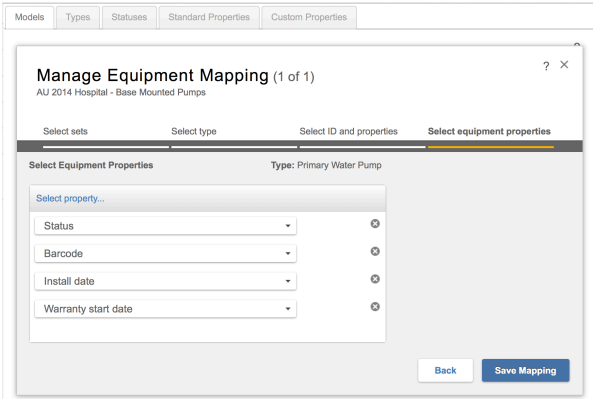
    c. We've decided that our map-key (Identifier) will be the "Name" property (not the standard Item::GUID), so select "Advanced" mapping mode and click "Next".
    d. Select "Name" as the Unique ID (map-key) and click "Next".





e. Select what model properties will populate existing BIM 360 Field equipment record properties. We want to pre-populate all equipment records with the proper "System Name" so:
   i. Click the "Show all categories" checkbox
   ii. Under model category "DWF – Mechanical" select "System Name" checkbox and choose to associate it with the BIM 360 Field Equipment record custom field "System Name" (that you just created).
   iii. Click Next.

f. Now the other way, choose what information captured at the point of construction in BIM 360 Field will be automatically updated back into the model file for these objects.
   i. Click "Select property…" select "Status" field.
   ii. Click "Select property…" select "Barcode" field.
   iii. Click "Select property…" select "Install date" field.
   iv. Click "Select property…" select "Warranty start date" field.



g. Select to "Save mapping".
h. You will be prompted with the status of mapping.

MEMO: by completing this mapping, you have just done a couple things:

- You have defined
  - What map-key will be used to link the BIM object with the proper BIM 360 Field Equipment record.
  - You have defined what information will flow from the BIM to the BIM 360 Field equipment record.
  - You have defined what information will flow from the BIM 360 Field equipment record back to the BIM.
- You have auto-created a BIM 360 Field Equipment record for every BIM object associated with this set. For "Search" set's, any object dynamically added to this set will auto-create another corresponding BIM 360 Field Equipment record.

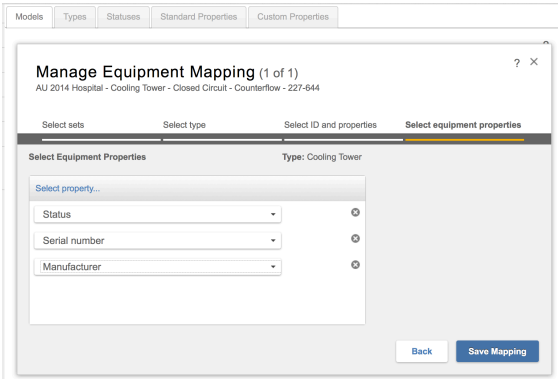
11. We now want to map the Glue "Cooling Tower …" Set (3 model objects). The same way.
    a. Hover over the model image and select to "Manage equipment mapping (1)".
    b. Select the checkbox to the left of the set and click "Next".
    c. Select the proper equipment type "Cooling Tower" and click "Next".
    d. We've decided that our map-key (Identifier) will be the "Name" property (not the standard Item::GUID), so select "Advanced" mapping mode and click "Next".
    e. Select "Name" as the Unique ID (map-key) and click "Next".

f. Select what model properties will populate existing BIM 360 Field equipment record properties. We want to pre-populate all equipment records with the proper “System Name” so:
   i. Click the “Show all categories” checkbox.
   ii. Under model category “DWF – Mechanical” select “System Name” checkbox and choose to associate it with the BIM 360 Field Equipment record custom field “System Name” (that you just created).
   iii. Click Next.

g. Now the other way, choose what information captured at the point of construction in BIM 360 Field will be automatically updated back into the model file for these objects.
   i. Click “Select property…” select “Status” field.
   ii. Click “Select property…” select “Serial number” field.
   iii. Click “Select property…” select “Manufacturer” field (this is the custom field you added that only appears for equipment records of type “Cooling Tower”.

h. Select to “Save mapping”.

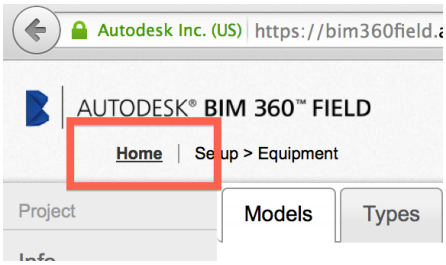
i. You will be prompted with the status of mapping.



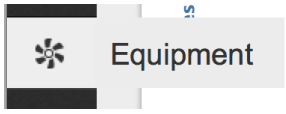
You’ve just mapped and created BIM 360 Field equipment records for all the assets you want to track!

D. Manage the BIM 360 Field equipment records through the build phase.

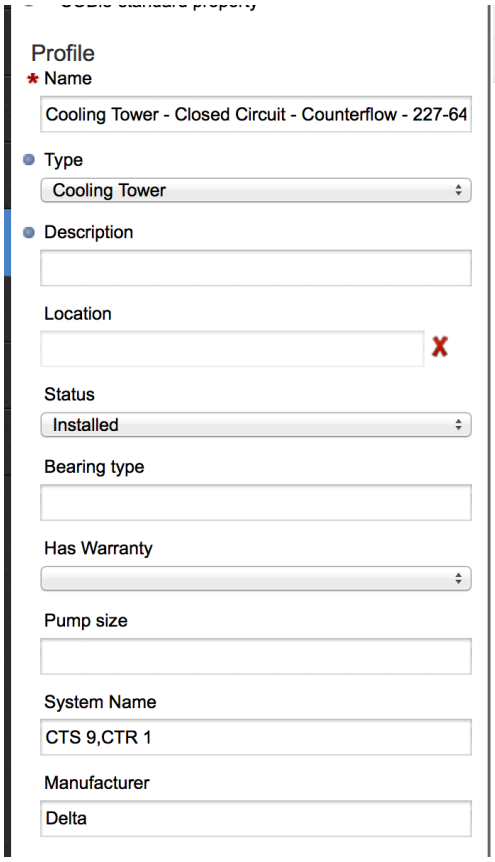
As a construction teammate, you can now manage these equipment records (in a 2D or 3D workflow). As an example you can:

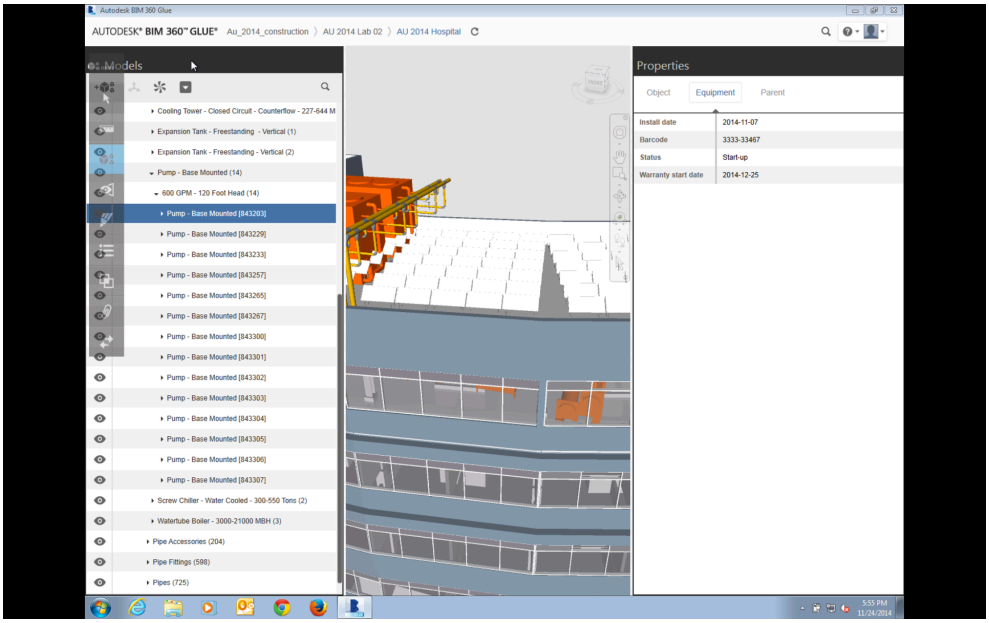


1. In BIM 360 Field web-portal, go to your home-page by click “Home” in the top bread-crumb trail.
2. From the home-page, select the “Equipment” module icon on the left panel.



3. From the equipment list page, you’ll find an equipment record for each of the assets in the “Cooling Tower” and “Pump – Base Mounted” sets. Select the “Cooling Tower - Closed Circuit - Counterflow - 227-644 MBH [1006719]” equipment record and click “Edit” button.
4. From the equipment details form, note that the “System Name” is prepopulated from the model. Update any of the fields selected to be pushed back into the BIM for this set (Status, Serial number, Manufacturer) once populated in the field.
5. Click “Back to Equipment”.
6. From the equipment list page, select equipment record “Pump - Base Mounted [843203]” and click the “Edit” button.
7. From the equipment details form, note that the “System Name” is prepopulated from the model. Update any of the fields selected to be pushed back into the BIM for this set (Status, Barcode, Install date, Warranty start date) once populated in the field.
8. DONE… you’ve populated asset information from the point of construction. To verify that this was completed, you can view your model back in BIM 360 Glue as follows:
   a. Go back to your BIM 360 Glue client with the model file open.
   b. Select the “Cooling Tower - Closed Circuit - Counterflow - 227-644 MBH [1006719]” and the “Pump - Base Mounted [843203]” model objects.
   c. Right click and select to “View properties”.





MEMOs:

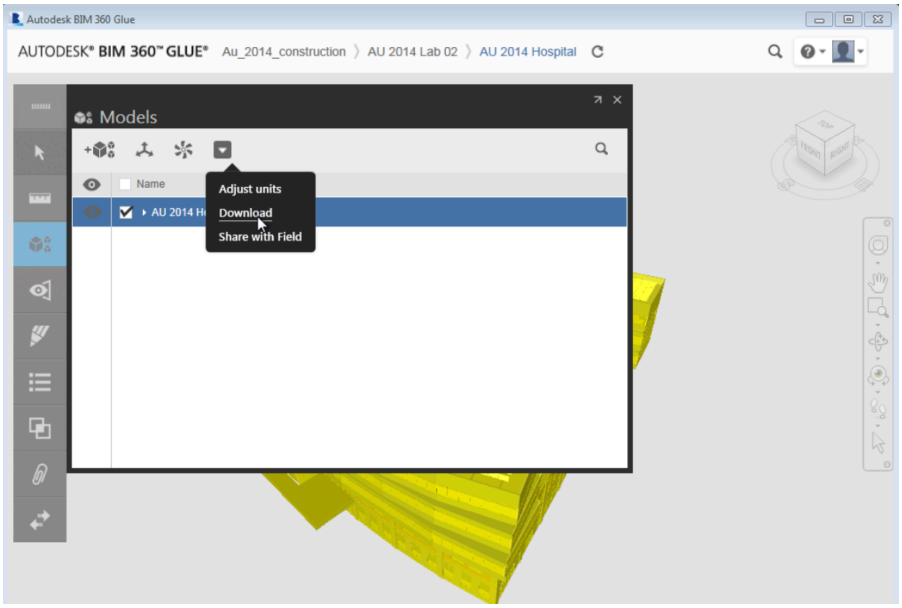
- We have updated asset information at the point of construction. That information now exists in a 2D environment and is linked to our BIM in a 3D environment.
- When updating information at the point of construction, a typical BIM 360 Field user will interact with the Field Equipment records from the mobile iPad application where they can in fact optionally bring up the BIM and navigate through as a visual aid. I’ll show this in our demonstration. For the sake of this lab, we weren’t able to equip everyone with an iPad (sorry ;-)) so have simply updated the equipment records through the web portal.

TIP: The BIM 360 Field knowledge center has a wealth of resources to get you started in your use of BIM 360 Field: http://knowledge.autodesk.com/support/bim-360-field

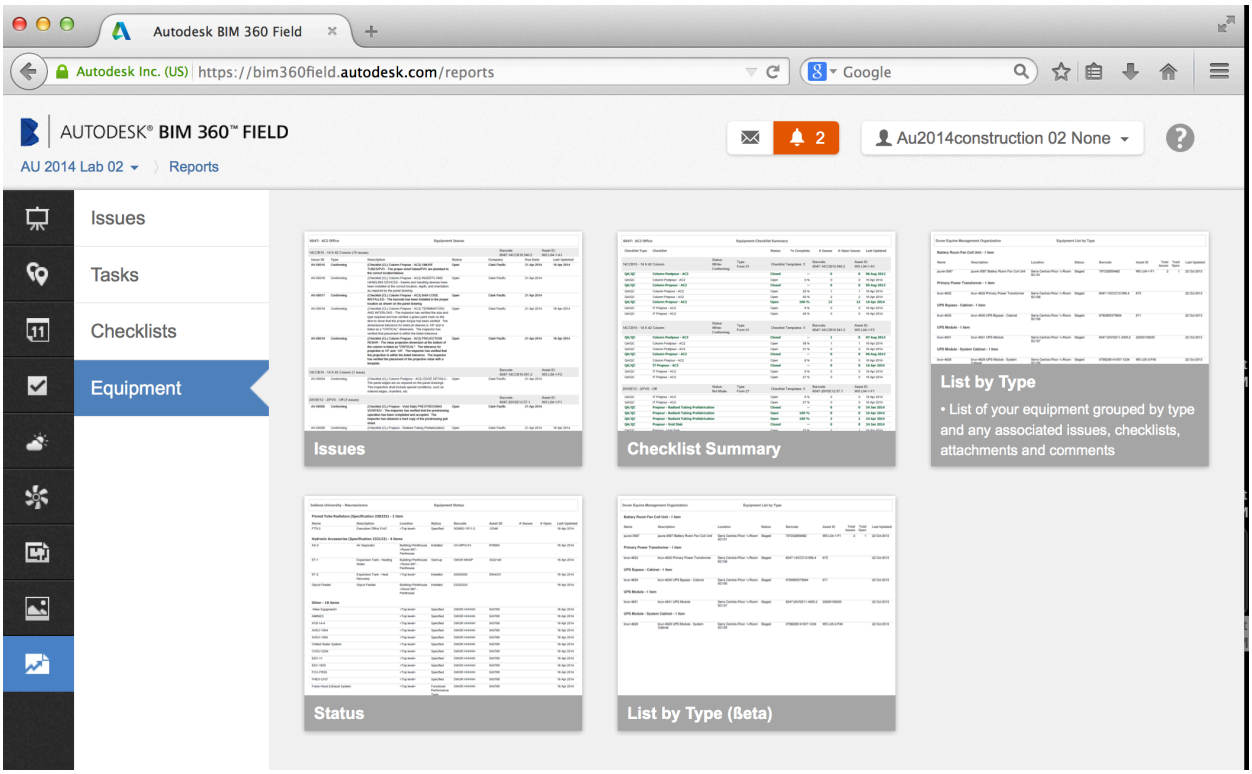
E. Prepare information for construction handover to operations.

There are several options for handing asset information over to operations in a format that is actually useful. The handover process may vary from one owner to another or from one asset to another. Here are some options:

1. Deliver a Building Information Model, rich with asset information from the point of construction. You can download your updated BIM out of BIM 360 Glue.
   a. Open your model file in BIM 360 Glue.
   b. Select the “Models” button.
   c. Select the checkbox next to the model to downloaded (“AU 2014 Hospital”)
   d. Click the more options arrow and select “Download”



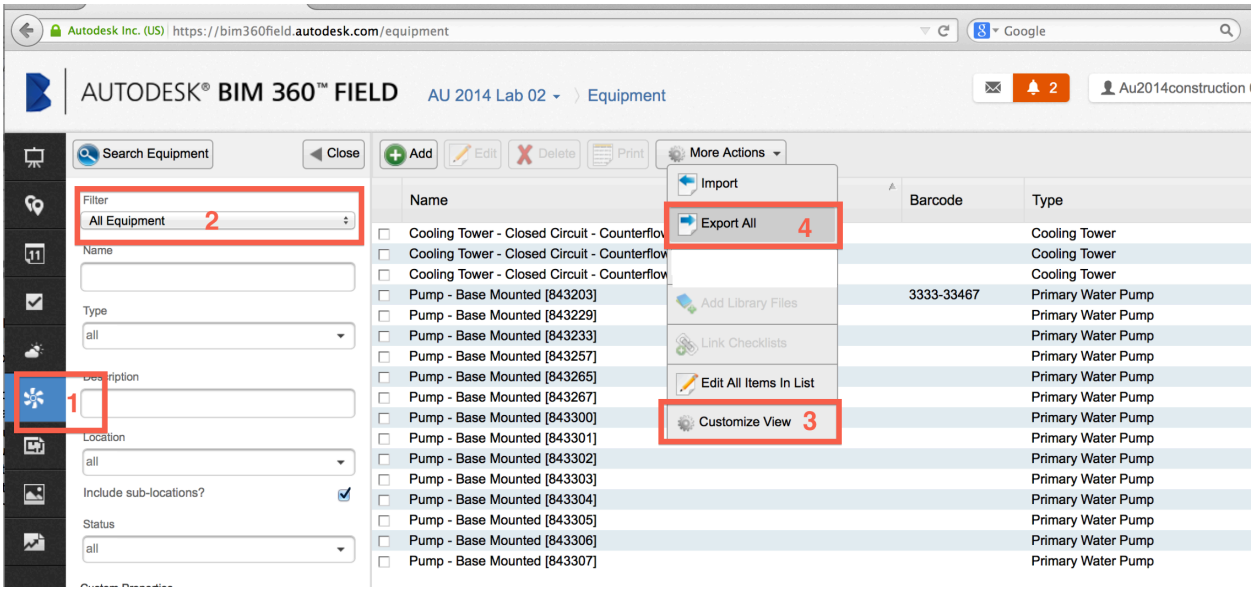
2. For a basic .PDF 2D handover, you can run the BIM 360 Field Equipment Details report. This will include all asset attributes and optionally: any checklist inspections, issues, and/ or photo attachments. This option is the most basic. Very quickly your team is able to save out to an electronic (and searchable) structure. Often teams leverage these reports in supplement to their traditional asset binders.
   a. Open the BIM 360 Field web-portal (https://bim360field.autodesk.com/).
   b. On the project home-page, click on the Reports button in the left toolbar.
   c. Select the “Equipment” reports.
   d. Select the “List by Type” report.



   e. You can choose how the report will be output:
      i. traditionally folks will select Output Format = “PDF”.
      ii. Under Filters, if you only want to report on particular equipment records, you can filter down.
      iii. Under Extras, you optionally choose if you will display photo attachments (and what size), whether checklists will be output (and at what level of detail), and whether comments, custom properties (like our customer properties System Name and Manufacturer), issue details, and signatures will output.
3. Another simple handover format is to export the equipment list information to excel (.CSV). This option is common if teams want to load the equipment information into another facilities or asset management system (or other such DB). This export will include all asset

attributes (but no attachments, checklists, or issues). Some teams have used this option to merge asset information into a COBie compatible format.

a. Open the BIM 360 Field web-portal (https://bim360field.autodesk.com/).
b. On the project home-page, click on the Equipment button in the left toolbar.
c. From the Equipment List page you can search / filter down to only the set of equipment you are interested in exporting.
d. Click on "More Actions" and "Customize View" to select what attributes will be exported.
e. Click on "More Actions" and "Export All" to export equipment list to excel.



4. Programmatically: the BIM 360 platform has a built-in API architectural layer which allows individuals to write web calls to GET or POST information to the BIM 360 system to another system or DB including the BIM 360 Glue model viewer component. Here are some resources to get started with BIM 360 Glue and Field APIs:
   - BIM 360 Glue
     - API Documentation: http://bim360.autodesk.com/api/
     - SDK and Sample Code: http://bim360.autodesk.com/api/doc/getstarted.shtml
     - Sample integration with project management system (CMIC): http://youtu.be/LSeJd6ioHC0
   - BIM 360 Field
     - Getting started with APIs: http://support.velasystems.com/link/portal/15108/15138/Article/79/Getting-Started-with-APIs
     - Basic API Documentation: http://support.velasystems.com/link/portal/15108/15138/Article/77/Basic-API-Documentation

  - Library APIs: http://support.velasystems.com/link/portal/15108/15138/Article/78/Library-API-Documentation
  - Task APIs: http://support.velasystems.com/link/portal/15108/15138/Article/227/Task-API-documentation
  - Equipment APIs: http://support.velasystems.com/link/portal/15108/15138/Article/169/Equipment-API-Documentation

MEMO: Here are some additional sites that you can use to stay plugged into the BIM 360 user community

- Blogs:
  - Beyond Design: http://beyonddesign.typepad.com
  - The 360 View (includes lots of information around data integrations): http://the360view.typepad.com
- BIM 360 Community Portal: http://www.autodeskbim360.com/
- BIM 360 Community Forum (need to have valid user login): http://forums.autodesk.com/t5/bim-360/ct-p/2025