

CI227336

Deliver a Plant project utilise Plant 3D, Civil 3D and Revit with BIM360 TEAM/Glue

Peggy Lin



Learning Objectives

- Setup the proper folder structure
- How to share the basic setting data
- How to deal with point cloud data
- Sharing the data between Revit/Plant 3D/Civil 3D in BIM360 TEAM
- How to use BIM360 Glue to create the federated model
- Project management tips and tricks

Description

- Learn how to implement a workflow that allow collaboration between multi geolocation and cross companies;
- Learn about the workflow that actively engage different stakeholders including engineers, designers and modelers
- Learn about the tips and tricks on how to get Revit/Plant 3D/Civil 3D to work seamlessly in BIM360 TEAM and BIM360 Glue
- This class is designed to assist you in building a new workflow for collaboration in your organization

Your AU Expert

Peggy Lin is a BIM Manager for Civil Infrastructure business line of AECOM. She works out of the AECOM Sydney office in Australia. She is a BIM and technology evangelist with 15 years of experience establishing BIM workflows and standards around content, training and interoperability. Her experience spans over multiple discipline projects including water, highway and rail. She is familiar with multiple software packages including Civil 3D, Revit, Plant 3D, Inventor, Navisworks, Infracore and 12D. Teamed up with her capability on programming in C# and dynamo enables her to create seamless workflow and implement BIM collaboration workflows in various civil infrastructure projects.

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The Challenge

- Design of 9 waste water treatment plant upgrades
- Design team consist 2 companies
- Design team located in 6 geolocations and 9 offices in Australia, New Zealand and South Africa
- The needs to engage other stakeholders in the projects

Tool List

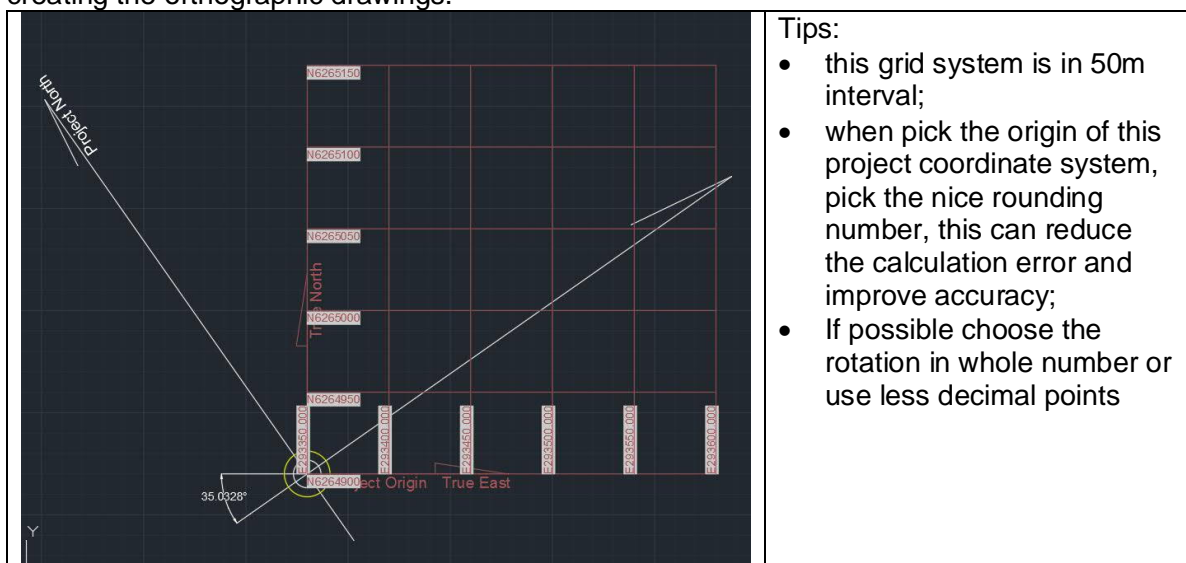
- BIM 360 TEAM
- BIM 360 Glue
- Autodesk Desktop Connector
- Revit 2018 & C4R
- Plant 3D 2018
- Civil 3D 2017

Why BIM 360 TEAM not BIM 360 Document Management?

- Plant 3D 2018 and Plant 3D 2019 currently only support BIM360 TEAM;
- Revit 2018.3 is the last product that support BIM360 TEAM, Revit 2019 only work with BIM360 next generation

Base Line:

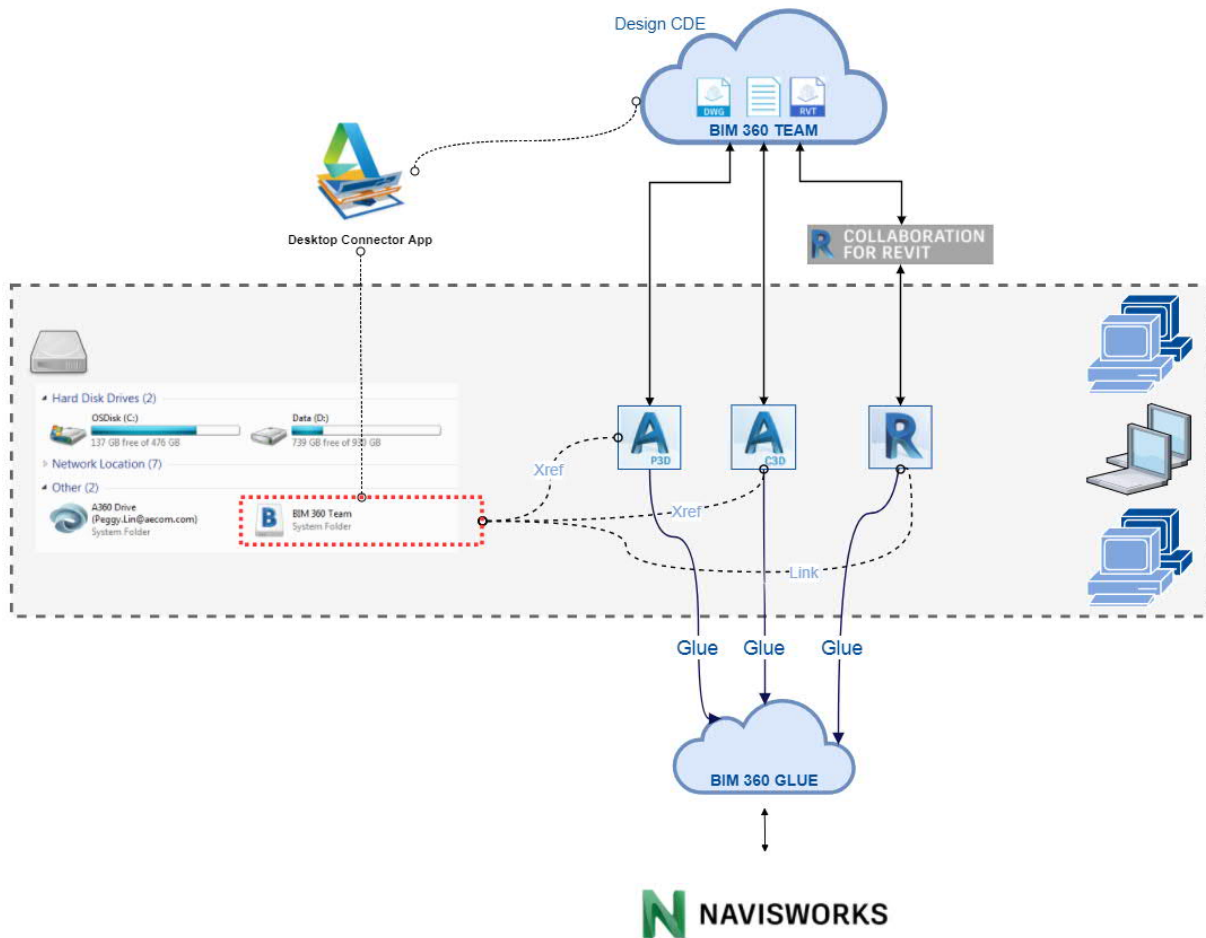
A project coordinate system that is closer to project site and rotated to align with most of the structures in the site is chosen for ease and accuracy of the model. This coordinate system is move and rotated away from original surveyed coordinate system. The movement to have this project coordinate system closer to project location is important for both Plant 3D and Revit. The rotation is good for Plant 3D which make it easier when routing the pipe and creating the orthographic drawings.



A federated Navisworks model should be created and geolocated correctly in surveyed coordinate system.

Project Setup Overview

Project Workflow / Structure



Project Technology Stack

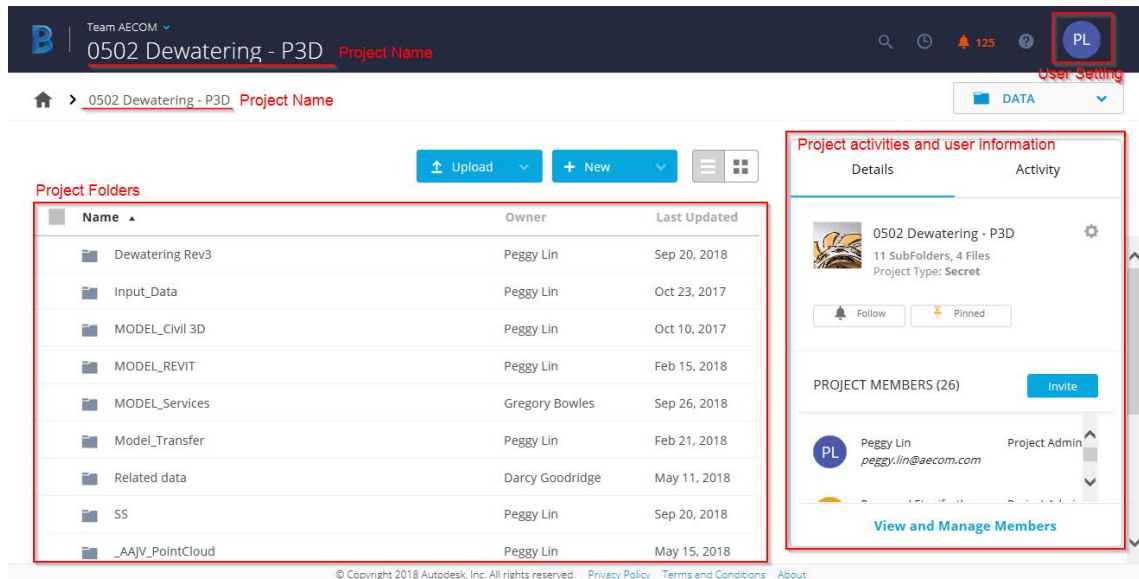
- BIM360 TEAM is the design Common Data Environment (CDE) – design files and models are saved and lived in BIM 360 TEAM;
- Plant 3D and Revit creates project directly from the software and saved in BIM 360 TEAM; Civil 3D is not yet integrated with BIM 360 TEAM, project is created locally and copied to BIM 360 TEAM;
- When a design model is created or updated, modeller glue the model to BIM 360 GLUE;
- A federated model is created by merging models within Navisworks or BIM 360 GLUE from glued individual models.

BIM360 TEAM and C4R

C4R and BIM 360 TEAM are different, but complementary. Both are cloud services. BIM 360 Team can be used by itself, without C4R, and is accessed through a browser.

- Using BIM 360 TEAM, member of BIM 360 TEAM can create any number of projects. Users from other organizations including other design parties and clients can then be invited into BIM 360 TEAM to collaborate in those projects.
- Documents of [many type](#) can be uploaded to a project and shared amongst the various project members. BIM 360 Team, however, does not allow for direct editing of the documents. Using BIM 360 Team alone, users must first download any document they want to edit, then upload the edited copy when finished.
- Autodesk formats like DWG, DWF and RVT files are viewable in BIM 360 Team, which also includes basic mark-up capabilities.
- To collaborate a Revit project, C4R is needed. C4R includes a plugin for Revit that allows users to initiate Revit work-sharing in the cloud, utilizing the BIM 360 Team Project as the repository of the Central file(s) that are created by C4R.

BIM360 TEAM Interface



The screenshot displays the BIM360 TEAM interface for a project named "0502 Dewatering - P3D". The interface includes a navigation bar with the Autodesk logo, the team name "Team AECOM", and the project name. A "User Setting" button is highlighted in the top right corner. Below the navigation bar, there are "Upload" and "New" buttons. The main content area is divided into two sections: "Project Folders" and "Project activities and user information".

Project Folders

Name	Owner	Last Updated
Dewatering Rev3	Peggy Lin	Sep 20, 2018
Input_Data	Peggy Lin	Oct 23, 2017
MODEL_Civil 3D	Peggy Lin	Oct 10, 2017
MODEL_REVIT	Peggy Lin	Feb 15, 2018
MODEL_Services	Gregory Bowles	Sep 26, 2018
Model_Transfer	Peggy Lin	Feb 21, 2018
Related data	Darcy Goodridge	May 11, 2018
SS	Peggy Lin	Sep 20, 2018
_AAJV_PointCloud	Peggy Lin	May 15, 2018

Project activities and user information

Details | Activity

0502 Dewatering - P3D
11 SubFolders, 4 Files
Project Type: Secret

Follow | Pinned

PROJECT MEMBERS (26) | Invite

PL Peggy Lin
peggy.lin@aecom.com | Project Admin

View and Manage Members

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BIM 360 Glue

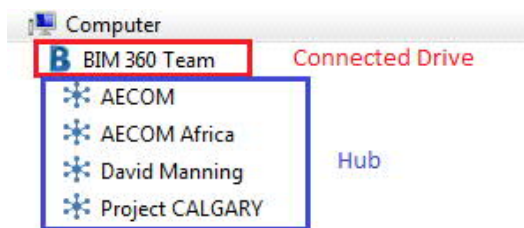
BIM 360 Glue is a cloud service, can be considered as Navisworks on the cloud.

Autodesk Desktop Connector

- Autodesk desktop connector replicates the documents and folder structures in BIM 360 TEAM in your machine, or a **connected drive**. You can manage files in the data

source through the connected drive, just as you can do to any other folder on your machine.

- Changes made in the connected drive are automatically uploaded to BIM 360 TEAM;
- The connected drive mirrors the structure of the connected data source. While the structure is replicated in the connected drive, the files are not downloaded until they are opened.
- You can open and add files through the connected drive, similar to how you access and modify files and folders using Windows® Explorer on Windows® or Finder on macOS®. The changes are replicated in the data source.



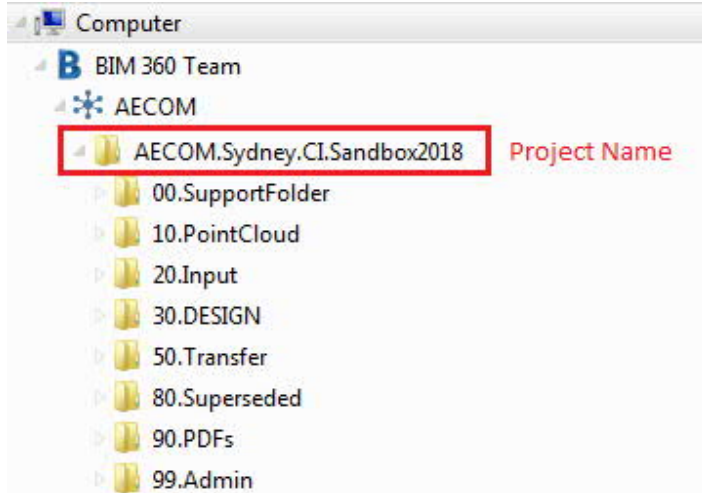
Connected Drive — This is the parent local drive for the Desktop Connector service. All hubs, shared projects, and respective folders and files are contained under this drive. The icon representing the connected drive indicates the data source it is connected to.

 for Fusion 360;

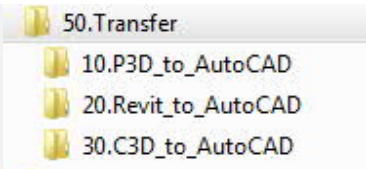
 for BIM 360 TEAM

Hub * or * — This node represents a hub. Hubs are team groups that have been created in the data source to help organize projects. Expand the hub node to view and manage your project folders and files. Changes made in the hub are automatically synchronized with the corresponding hub in the data source. Note: On Windows®, when moving or modifying files, all file references are automatically maintained.

Plant project folder structure

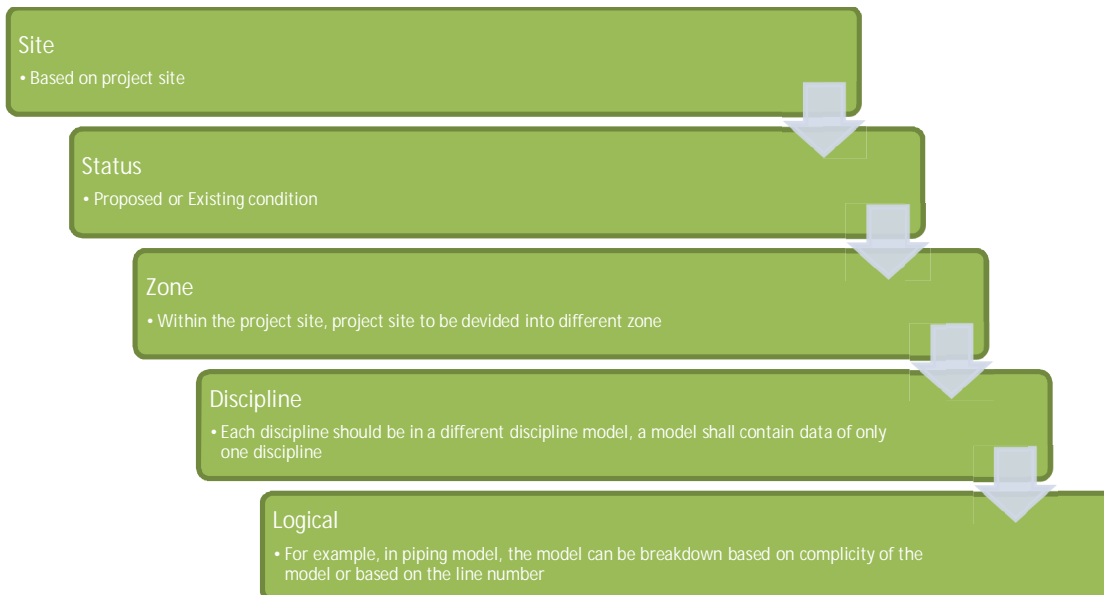


Folder	Sub-Folder	Purpose / Usage
00.SupportFolder	<ul style="list-style-type: none"> ▲ 00.SupportFolder <ul style="list-style-type: none"> ▷ 00.Catalogue ▲ 10.Settings <ul style="list-style-type: none"> ▷ 10.Navisworks Settings ▷ 20.Scripts ▷ 30.ProjectGrid ▷ 20.ToolPalettes ▷ 30.CAD_Supprot 	Support Folder for all general setting data including <ul style="list-style-type: none"> - All Plant 3D Catalogues used in the project - All project settings – including Navisworks, project grid file and scripts used in the project - Project P&ID Tool Palettes based on client standard - CAD support files – including Title blocks, ctb, lin, dwt, rfe files
10.PointCloud		Folder to save all Point Cloud files
20.Input		Any design inputs
30.DESIGN	<ul style="list-style-type: none"> ▲ 30.DESIGN <ul style="list-style-type: none"> ▷ 10.Revit ▷ 20.Plant3D ▲ 30.Civil3D <ul style="list-style-type: none"> ▷ 10.MODEL ▷ 20.DRAWING 	Folder for all design models <ul style="list-style-type: none"> - Save Revit model in Revit; - Save Plant 3D files in Plant 3D; - Save Civil 3D files in Civil 3D

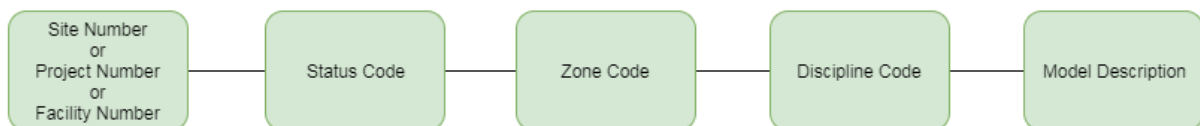
50.Transfer 80.Superseded 90.PDFs 99.Admin		Transfer folder used to keep the latest version of exported model from Revit, Plant 3D and Civil 3D
		Folder for administrative tasks, including BIM execution plan, drawing registers, etc

Model breakdown and naming convention

For ease of model management, models are to be segregated based on the following hierarchy. The following breakdown will be finalized within 2 weeks of award of contract.



Based on this breakdown structure, the model naming convention as follow:



Use BIM360 Glue to create the federated model

Terminology

Term	Remark
BIM 360 GLUE web browser	View, but not upload
BIM 360 GLUE plug-in	There are plug-in for Revit, AutoCAD and Civil 3D. Navisworks 2012 – 2015; Navisworks 2016 and above has BIM 360 GLUE installed when the software is installed.
BIM 360 GLUE desktop app	Create folder, upload files, delete the files

BIM360 GLUE functions

- Glue the individual model into BIM 360 Glue from either authoring software or upload through the BIM 360 GLUE desktop app.
- BIM 360 GLUE is for viewing the model, run clash detection and comment;
- Those models are uploaded into “Model” folder;
- A merged model can be created within Navisworks or in BIM 360 GLUE desktop app;
- A nest merged model cannot be created using BIM 360 GLUE
- You can glue the model directly to BIM 360 Glue from Revit, Plant 3D and Civil 3D via BIM 360 Glue plug-in. You can upload the model to the BIM 360 Glue from BIM 360 Glue desktop app directly;
- Create merged model using browser or Navisworks Simulate/Manager, this merge file has a file extension as .nwg; This nwg file remember your search set, views and profiler, but those information is not accessible in BIM360 Glue.
- View the model from browser directly
- Since it is Navisworks on the cloud, you can navigate the model, do measurement, review the model, running clash detection directly in Glue
- However, you are not able to create search set in Glue, and you can not push the search set you created in Navisworks into Glue.

Folder structure in BIM 360 Glue

Folder structure used in BIM 360 GLUE should reflect the folder structure defined for the project. The example below shows the hierarchy that reflected the model breakdown structure.

Folders
▼ 60286134 - 0502 - Dewatering
▶ ST0009-Liverpool
▼ ST0014-Wollongong
▶ ST0014-00
▶ ST0014-01
▶ ST0014-02
▶ ST0014-03
ST0014-04
▶ ST0021-West_Hornsby
▶ ST0023-Glenfield
▶ ST0027-Shellharbour
▶ ST0040-Hornsby_Heights
▶ ST0046-Penrith
▶ ST0064-Winmalee

User management

Once a project is created in BIM360 GLUE, users can be invited to the project via “Project Members” page.

User Type	What this user can do?
Account Admin	All tasks in BIM360 GLUE including project level admins, model management, view management, mark-up management, clash management
Project Admin	Limited project level admins, but all other tasks
Full Member	Can add and delete own model, all functions in views, mark-up tasks, can preform most of clash task except delete the ability to delete project clash results
Limit Member	Can only add and view models, can create views and see all saved view, full functions in markups, can run, view and modify clash detection
Reviewer	Full function on mark-up tools and view model and views

For details of user rights information, refer to this [link](#).

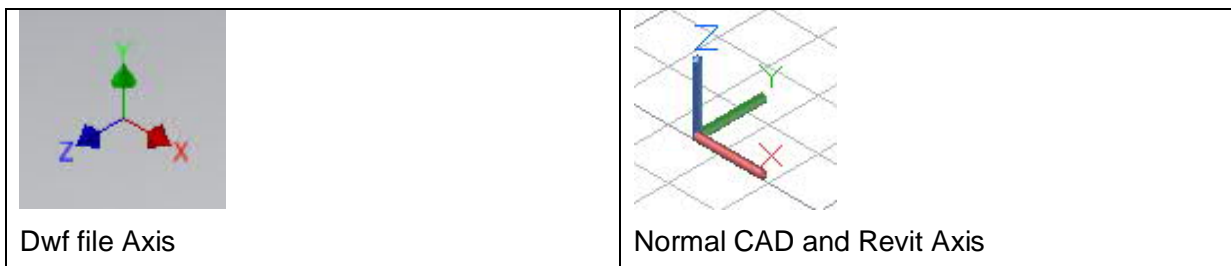
Export plant 3d model to BIM 360 GLUE

Plant 3D model glue to BIM 360 GLUE directly from Plant 3D. The result of this is the same as attach Plant 3D model directly to Navisworks. For some reason, only selected few are displayed

in Navisworks. Which means that if you customised the database and included the extra WBS data required, it will not display in Navisworks.

To work around with this, instead of glue the model directly from Plant 3D, export it as 3ddwf file. Then glue this 3ddwf file via BIM 360 GLUE desktop app. **Detail**

The only issue with this methodology is that when exported as 3ddwf, AutoCAD Plant 3D automatically rotate the model's UCS along X axis for 90 degree, resulting the Z axis of the model in normally where Y axis is. This is not going to work with other models in Navisworks as the all other model has Z axis vertically up.



This would not be a big deal if the model within Plant 3D didn't applied with any coordinate system change. However, in general, most of Plant project will applied with a coordinate system move and rotation as stated previously.

To solve this issue, the methodology I used is to create a Navisworks plug-in that rotate the model twice. First rotate the model Z axis back to its normal state, and then apply this project coordinate shift so it located correctly in the so call world coordinate system.

Alternatively, you can calculate the true rotation of the model mathematically.

Deal with point cloud data

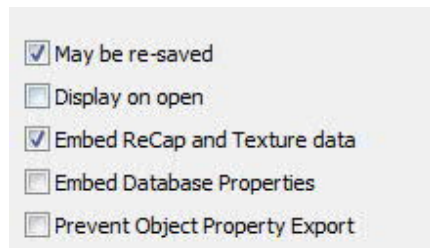
Scanning

- Leica P20 Scanner
- Scanned at 3.1mm @10mm resolution and registered using Resection on site
- Approx. 40+ scans, 3-4 days scanning and 1 week processing per site
- Processed using Leica Cyclone 9.1 and extract geometry as 3D solid, all output as dwg files

Work with point cloud data

- Create folder on your machine at a common drive that everyone in the team have, most commonly C drive. To make it consistent with the BIM360 TEAM, create a same folder under the C drive. In this case, "**C:\10.PointCloud**";
- Copy all Point Cloud files from BIM360 TEAM under **10.PointCloud** folder to local folder created in previous step.
- For Civil 3D, Plant 3D and Revit user, directly reference to those files in C drive;
- In order to work and share the point cloud within the team, you will need to do the following: In Navisworks, append rcs file from the C drive directly and published as an nwd file, then upload this nwd file via BIM 360 Glue desktop app to the correct folder in BIM 360 Glue

project. When publish, you need to make sure the option of “Embed Recap and Texture data” and “May be re-saved” is ticked.



Revit Template

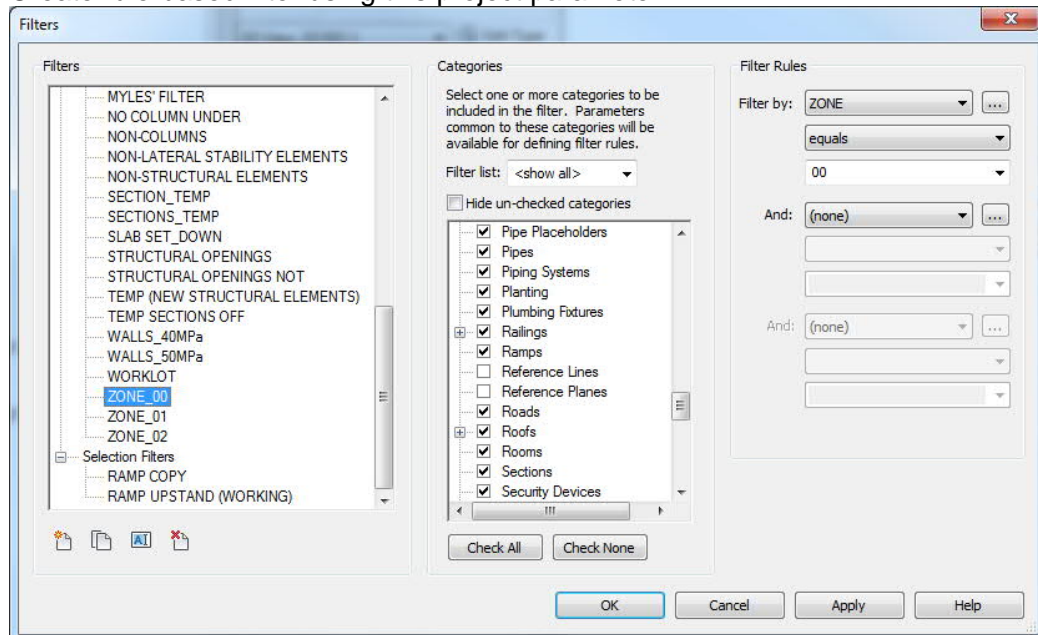
Model planning

Two approaches on Revit model management in a Plant project, depending on the size and complicity of the project:

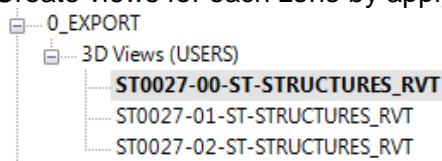
- Multiple zone model in one Revit model
- One Revit model per zone

Multiple zones model in one Revit model

1. Create a project parameter named “ZONE”, and apply to related model elements;
2. Create rule-based filter using this project parameter



3. Create views for each zone by applying filters at view on each zone.



Visibility/Graphic Overrides for 3D View: ST0027-00-ST-STRUCTURES_RVT




Model Categories | Annotation Categories | Analytical Model Categories | Imported Categories | Filters

Name	Visibility	Projection/Surface			Cut		Halftone
		Lines	Patterns	Transparen...	Lines	Patterns	
ZONE_01	<input type="checkbox"/>						<input type="checkbox"/>
ZONE_02	<input type="checkbox"/>						<input type="checkbox"/>
ZONE_00	<input checked="" type="checkbox"/>						<input type="checkbox"/>

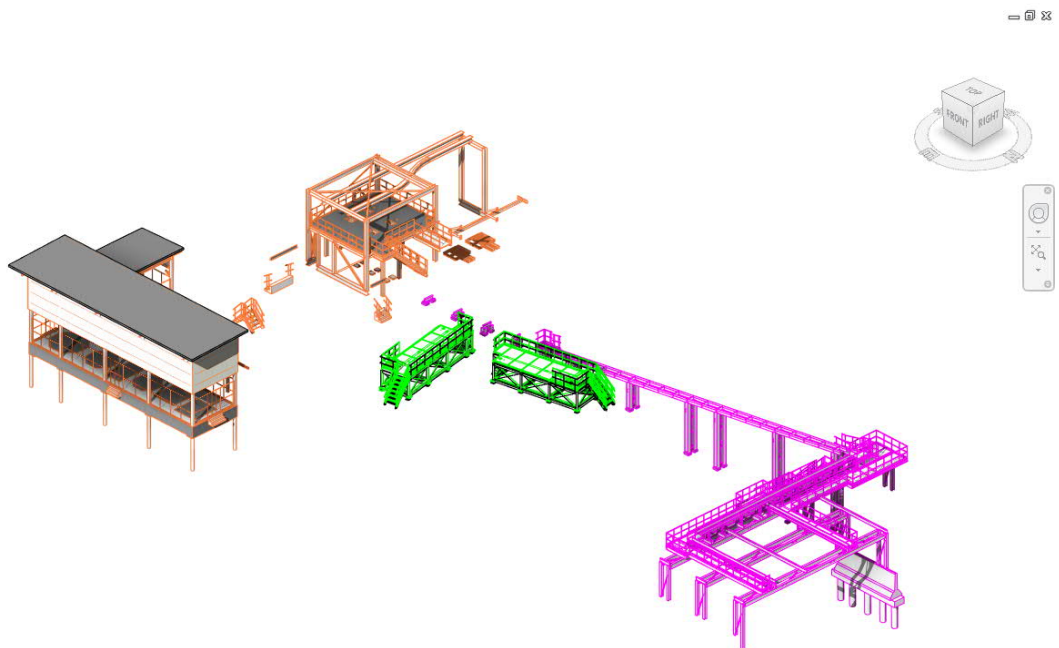
4. Use similar method to create checking view to make sure the data is applied correctly.

Visibility/Graphic Overrides for 3D View: Model Zone Checking

Model Categories | Annotation Categories | Analytical Model Categories | Imported Categories | Filters

Name	Visibility	Projection/Surface			Cut		Halftone
		Lines	Patterns	Transparen...	Lines	Patterns	
ZONE_01	<input checked="" type="checkbox"/>						<input type="checkbox"/>
ZONE_02	<input checked="" type="checkbox"/>						<input type="checkbox"/>
ZONE_00	<input checked="" type="checkbox"/>						<input type="checkbox"/>

5. Result:



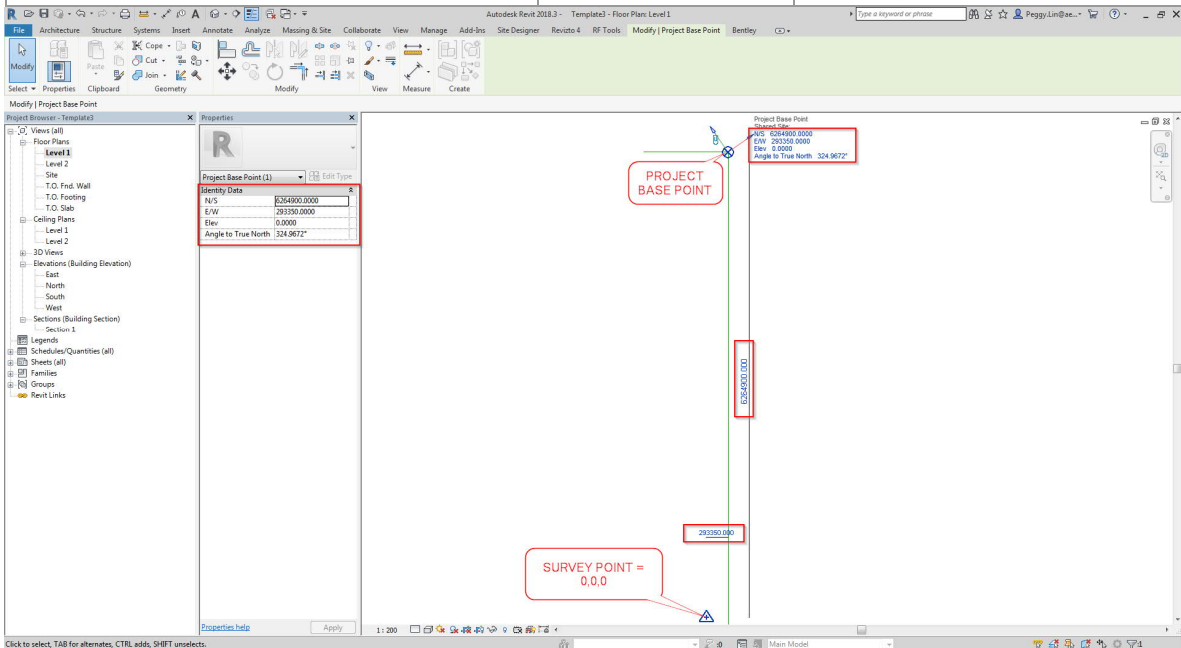
Setup Coordinate System in Revit

When project start, a project coordinate system should be defined around the site. This project coordinate system should be selected in such way where is it close to project site and orientated so that the most of structure within the site will be parallel to the X axis of the project coordinate system.

Use the project coordinate system defined to set up the project coordinate system in Revit

- Set project unit as meter;
- Leave Survey Point at Point (0,0,0) and make sure it is locked;
- Set project base point using the information based on CAD

CAD	Revit	Example
Northing (= Y)	N/S	6264900
Easting (= X)	E/W	293350
Rotation (If anti clockwise 35.0328)	Rotation	360- 35.03208 = 324.9672



Sharing the data between Revit/Plant 3D/Civil in BIM360 TEAM

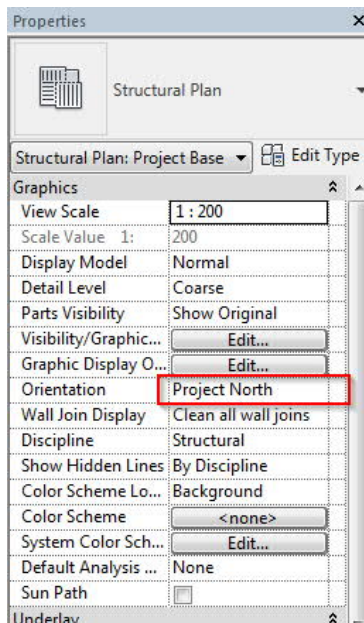
Data export

- Use AutoCAD dwg file as the media for all three software;
- Since Plant 3D and Civil 3D both create AEC object rather than vanilla AutoCAD object. These object is not editable on other software other than its authorizing software. To be used by other software package, model created in Plant 3D and Civil 3D need to export as normal AutoCAD dwg file. Use **EXPORTTOAUTOCAD** command and export the file to Transfer folder;

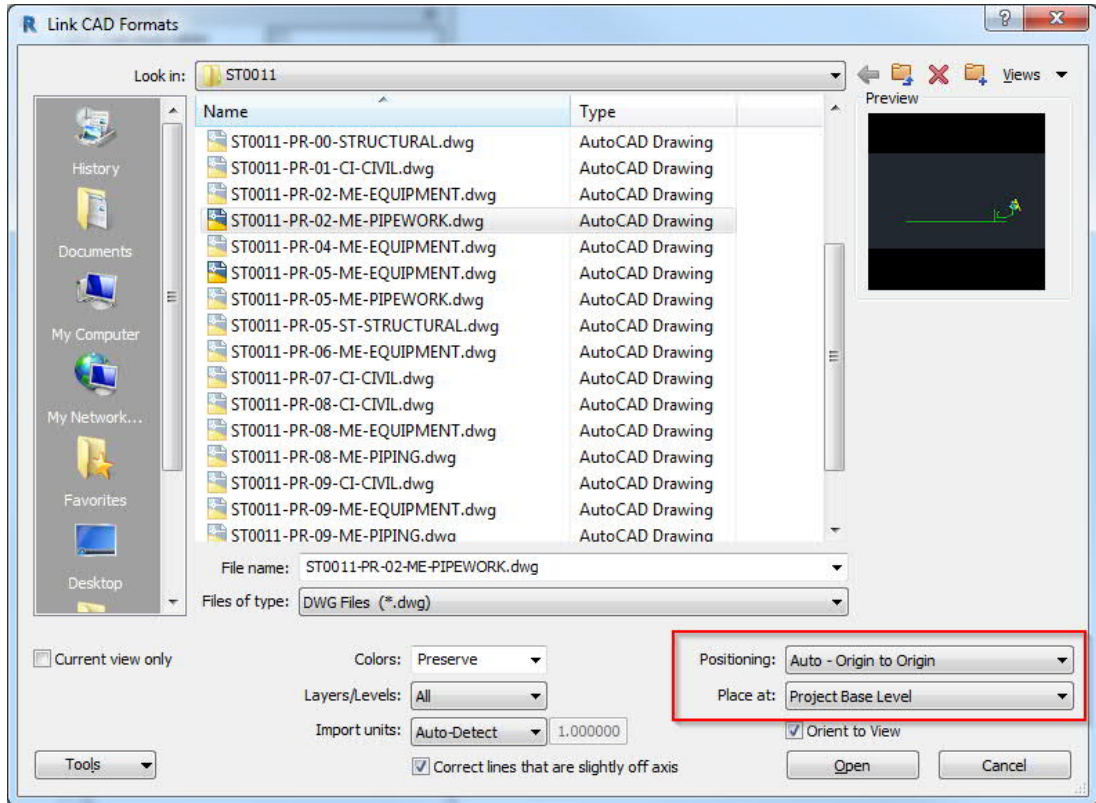
- When export Revit model as AutoCAD 3D model:
 - Must be exported as ACIS solid not Polymesh; and
 - Export in millimetre and in Project internal coordinate system

Link CAD Model in Revit

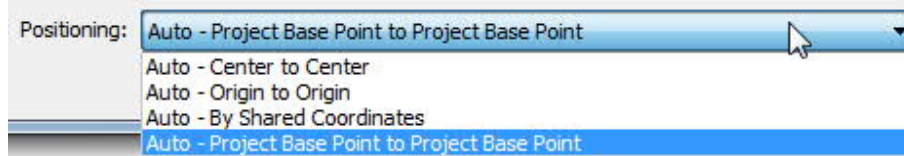
- In any plan view, with view in set to “*Project North*” other than True North;
- Make only the project base point is visible and survey point is not visible.

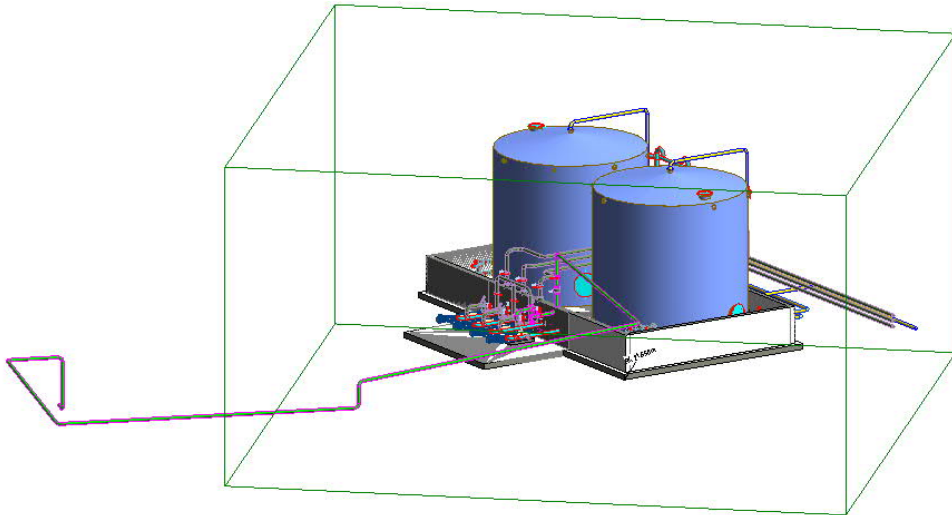


- When linking the model, make sure the following settings are applied:
 - Make sure *Positioning* set to “Auto – Origin to Origin”;
 - Set the *Place at* to “Project base Level”

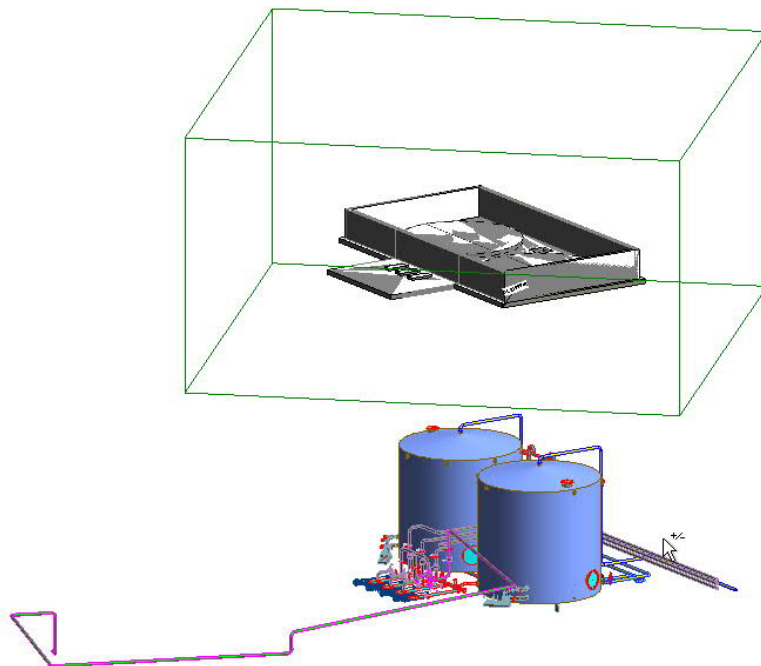


Link Revit Model to Revit





Use origin to origin result in



Linked xref in Plant 3D

In Plant 3D link the model directly through Autodesk desktop connector virtual drive as how you usually use xref.