

From Prefab to Project Completion The Complete Revit and BIM 360 Workflow

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Learning Objectives

- Learn how to utilize Revit software's assembly and parts features (including the Structural Precast Extension) in producing fabrication models
- Understand the requirements involved in preparing fabrication models for use in BIM 360 Glue and BIM 360 Field
- Understand how to connect BIM 360 Field QA and commissioning activities with model-based workflows
- Learn how integrated data sources can be used for business intelligence and model analysis

Description

Revit software delivers a range of valuable toolsets for those contractors and subcontractors who want to further enhance their construction modeling workflows and explore opportunities in prefabrication. When coupled with BIM 360 software, Revit provides an integrated solution, letting teams connect design and fabrication with site execution and delivery. This session will cover a detailed workflow on the advantages of Autodesk's Revit Assembly and Part features (including the Revit Structural Precast Extension) for the development of coordinated fabrication models.

Beyond design, attendees will also learn about extending this workflow, taking fabrication models to the field using BIM 360 for quality control and material tracking. With the integration of Revit and BIM 360, we will also explore the benefits that this provides in connecting disparate data sources to provide transparency and real-time project control using business intelligence and model-based reporting.



Autodesk's Structural Precast Extension for Revit and the extended workflow

About the Speaker

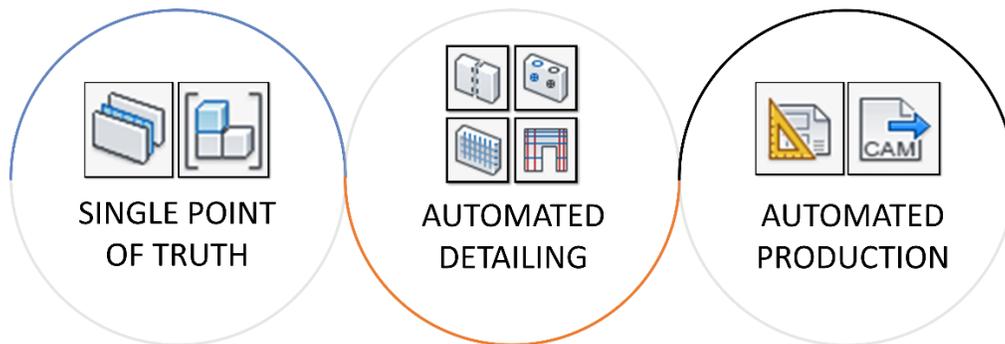
I am a BIM / VDC Manager with Hansen Yuncken, working alongside the businesses Innovation Group, called HYway. This team leads the development and implementation of the company's enterprise BIM initiative.

My role within the business is to lead the implementation of BIM technologies, whilst supporting the strategic BIM plan. This encompasses all business units, including preconstruction, design management, estimating, planning, and site management.

Prior to joining Hansen Yuncken, I have had many years of experience with Autodesk technologies and been actively involved in the implementation of various software's including, BIM 360 Field, BIM 360 Glue, Navisworks and Revit software at all levels of the business, and across various project sectors and scales.

Revit Precast Extension

Autodesk's Revit Structural Precast Extension was introduced as an add-in which was made available from the Revit 2018 release. This add-in extends Revit's capabilities in concrete modelling by providing users with a range of precast detailing elements suitable for both engineers and fabricators working on typical building projects in the precast industry.



The benefits of Revit's Structural Precast Extension

Leveraging from Revit's parts and assembly functionality, the Revit Structural Precast Extension supports construction modelling workflows by breaking structural engineer's models into discrete and accurate parts suited for fabrication, without compromising the original design intent. This supports balanced workflows for both consultant and subcontractor views, through parts visibility options, contained in a single model. The extension also combines related precast elements (structure, reinforcement, mounting parts and cast in elements) into Revit assemblies so that precast elements can be uniquely identified, classified and scheduled. Once finalized the extension can be used to fast-track shop drawing development and schedule production.

Whilst Revit Part and Assembly features have been available in Revit for a number of years, the power of the precast extension leverages from rules-based automation to streamline the generation of precast elements whilst leveraging from these features. The generation of precast element parts can be automatically split using predefined constraints configured via the

extension. Once split, users can automate the placement of mounting parts, reinforcement and customized fabric sheeting.

To complete the workflow, automated shop drawing production is available through the Revit Structural Precast Extension. This is fast tracked through using predefined drawing templates (customized to apply company standards), which contains relevant views and bill of materials. Automated fabrication is also available through CAM file exports in both Unitech (v5.2 and 6.0) and PXML (v1.3).

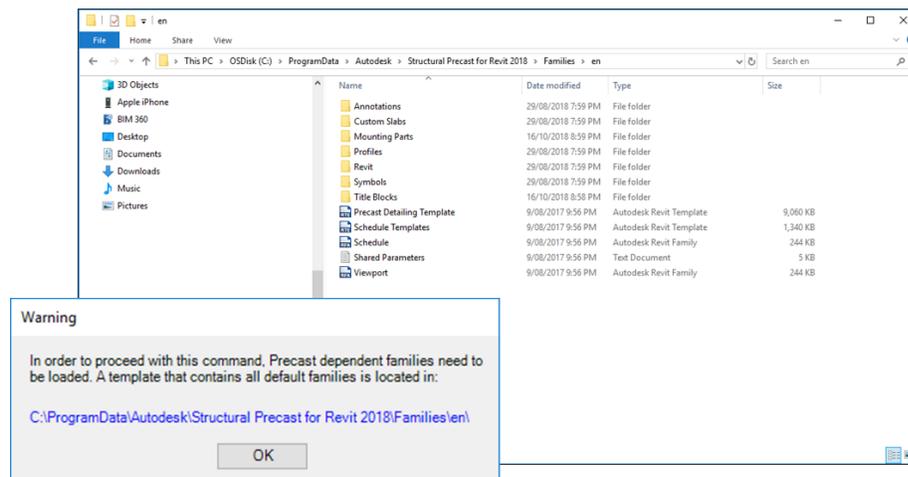
Whilst the extension is fairly new, it is a notable step in the right direction to support fabrication and automation workflows, whilst harnessing the benefits provided within Revit's parametric design engine.

The Process

To achieve efficiencies through the automation available in the Revit Structural Precast Extension, it is important to understand key workflows. Users need to understand how the tool can be configured to suit certain modelling/detailing requirements and the efficiency that these templates can provide to the precast detailing process.

Before you begin

When installing the Revit Structural Precast extension, it will ask the user to define a location for all templates and families when used with the extension. This includes annotations, custom slab types, mounting parts, profiles, rebar shapes, symbols and title blocks.



Default location for Revit Structural Precast templates and families

The extension maintains its own directory of families and templates that are used directly through the extension. This path can be changed afterwards but it is important that the new location contains three subdirectories which are named Families, GUI and Images.

Custom families can be created for use within the Revit Structural Precast Extension so that it can be loaded and applied when using the extension's configuration. These include:

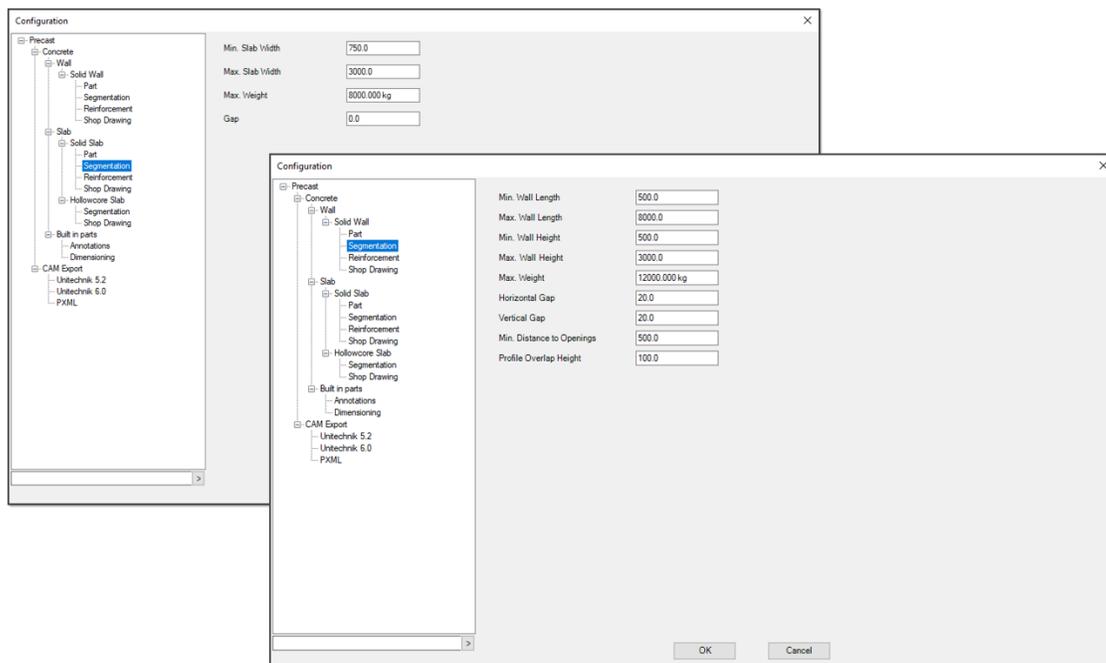
- Annotations
- Custom Slabs
- Mounting Parts
- Profiles
- Rebar Shapes
- Symbols
- Title Blocks

Segmenting Elements

Both structural walls and floors can be divided into configurable panels so that they can be included in precast assemblies. The Precast Split tool , enables users to bulk split a structural wall, floor or foundation slabs into several parts based on a predefined configuration.

When using this tool, it not only splits the overall element into several parts, it also creates an assembly which groups the wall for floor precast element along with connections, lifters and plates which can be used for documentation and fabrication.

Before you begin using the Revit Structural Precast split tool , users should configure the segmentation parameters for both walls and slabs. Should your precast methodology and design be different for certain areas of the building, this should be reconfigured each time before using the split tool .



Segmentation configuration for walls and floors

This configuration will control:

- Minimum and Maximum size constraints (wall height/lengths and slab widths)
- Maximum weight for the assembly
- Gap distance between assemblies
- Minimum distance between openings (for walls) before an assembly is created
- Height of the profile overlap for the horizontal split of wall assemblies

Once configured, the segmentation of a walls or floors can be completed in two ways from within Revit's Structural Precast tool:

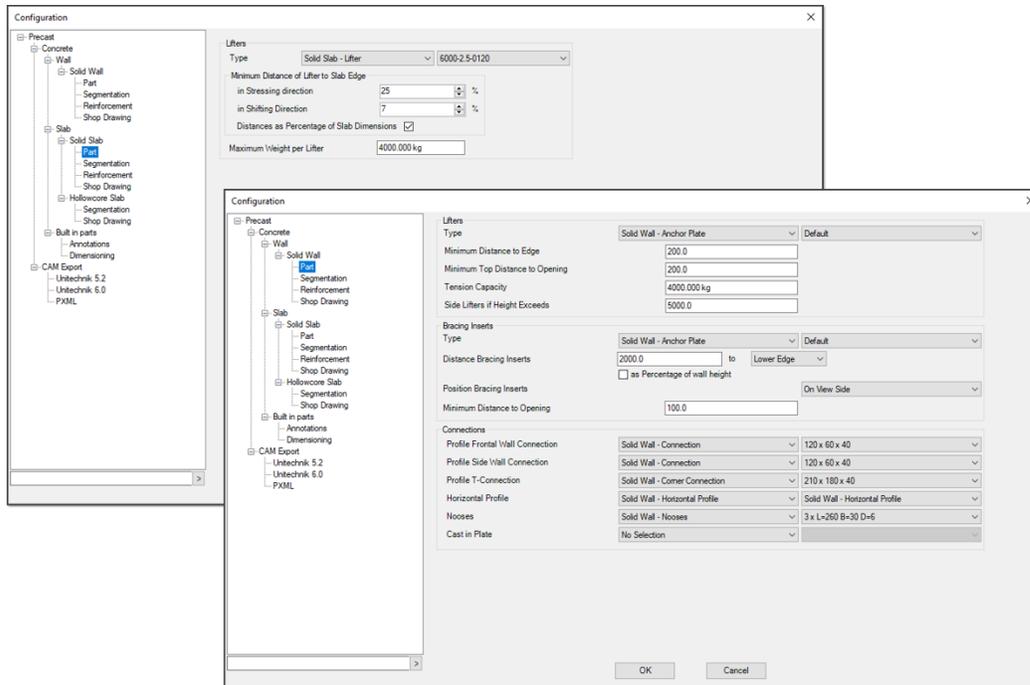
1. Select the Precast Split tool , select the wall or floor (enable multiple for selection of multiple elements) and then select finish to segment and create the assemblies.
 - a. If using this this method for floors, the properties will open asking the user to define as to whether they want a solid or hollow core slab.
2. Select structural elements from the model and then select the Precast Split tool .

It is important to note that if the wall boundary changes after the initial segmentation, the assemblies will update ignoring the configuration settings. To update these assemblies in alignment with the constraints users must select the assembly and then rerun the Precast Split tool .

If users want to apply a segmentation (and its associated configuration) to a subset of a wall boundary or slab, users can split the slab prior using Revit's standard parts tool before the segmentation tool is applied.

Embedding Parts for Bracing and Connections

When walls and floors have been split, mounting parts and connections can be defined so that they are included in the overall assembly. This can be configured so that when the segmentation tool is run, mounting parts and connections are also included in each individual assembly. Before you begin using the Precast Split tool , the parts for bracing and connections should be configured so that they are generally applied to all wall and floor precast elements.



Parts configuration for walls and floors

For both wall and floor precast assemblies, users can define settings for the placement of lifters in assemblies (through the configuration menu) once walls and floors have been segmented. Here the type of lifters, the minimum distance to the element edge (stressing and shifting direction percentage for floors) and capacity (tension and weight) can be defined for wall and floor assemblies. For walls, settings for openings and inclusion of side lifters can also be configured.

For wall assemblies, users will also be able to configure settings for the following:

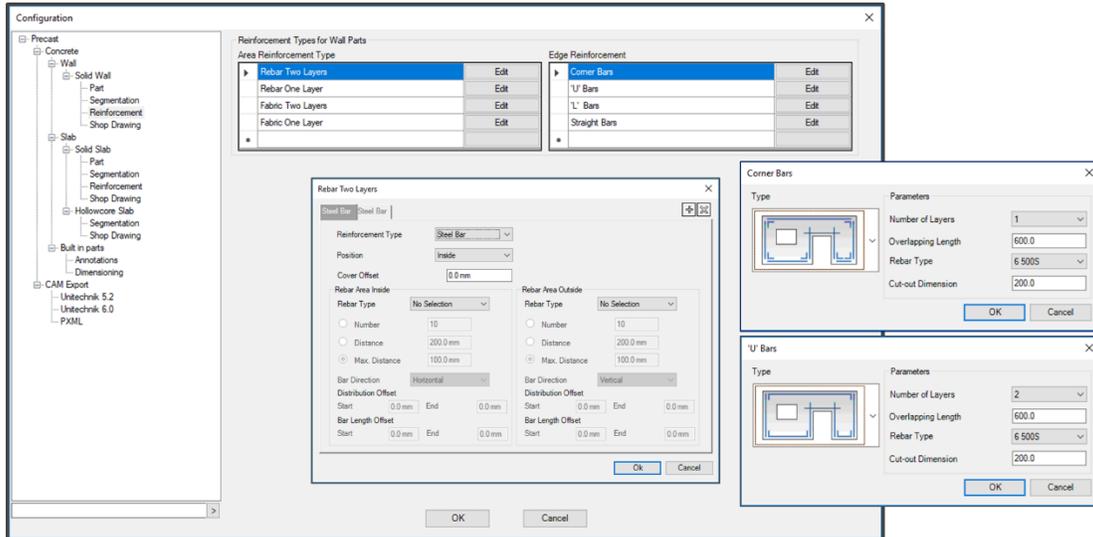
- **Bracing:** including types, positioning and distance of bracing inserts and minimum distance to openings
- **Connections:** including Front and Side of wall and T connections and associated profiles, Nooses and cast in plate.

Whilst these settings would be initially applied at the time of segmentation, they can be modified and or updated should the assembly and its host element be modified after the original segmentation. This can be done by selecting the assembly host, and then select the mounting parts  option under the Structural Precast Extension. When updating existing elements, a dialog  of success opens to display a summary which includes elements added, or parameters that were adjusted to meet the needs of assemblies currently defined in the project.

Placing Reinforcement

Once walls and floors have been segmented and grouped into assemblies, with bracing and connection parts assigned, reinforcement can then be placed into the structural element and its contained assembly. Before placing reinforcement, you will need to configure the settings for wall and floor reinforcement through the configuration  panel.

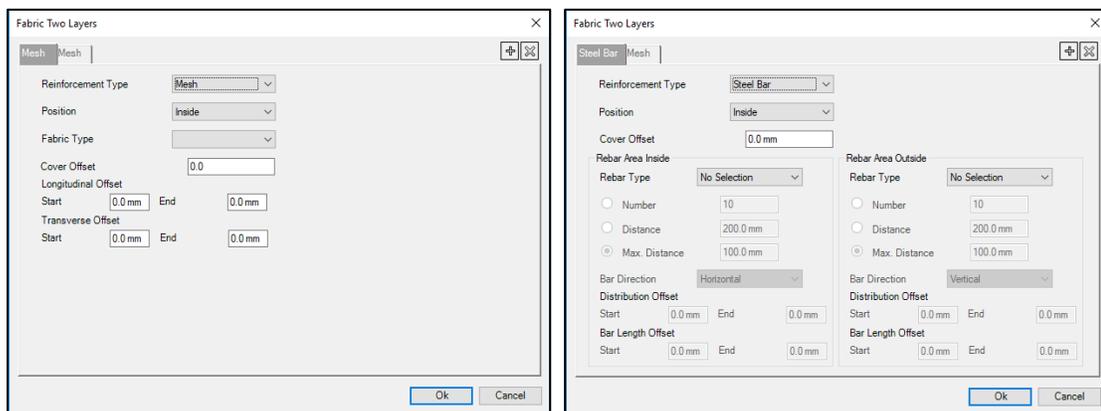
Reinforcement for Walls



Reinforcement configuration for walls

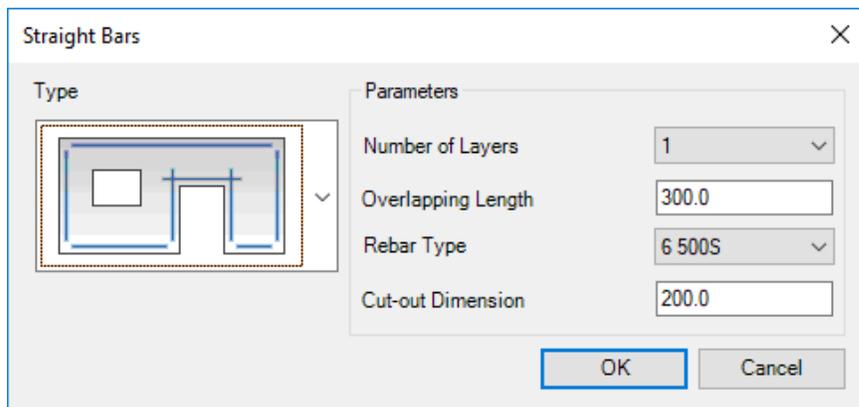
Under the Revit Structural Precast Extension configuration for precast wall's, users can control the settings for both area and edge reinforcement. Depending on the configuration, reinforcement for walls are populated based on the predefined wall thickness. Within the configuration options you can edit existing or created new reinforcement types (by entering a name in the row with the asterisk).

For precast wall area reinforcement, users can add/remove layers to the reinforcement type by selecting the add  or remove  layers option, and defining the reinforcement type (steel bars, mesh or truss), position (outside, inside or center) and cover offset of the host element. Each of the reinforcement layers has additional parameters for the reinforcement type selected.



Parameters for steel bars and mesh reinforcement

Users can customize or add precast wall edge reinforcement through the edit options and defining the wall edge reinforcement type, number of layers (up to 3) at the wall edge, overlapping lengths, rebar types and cut-out dimensions.

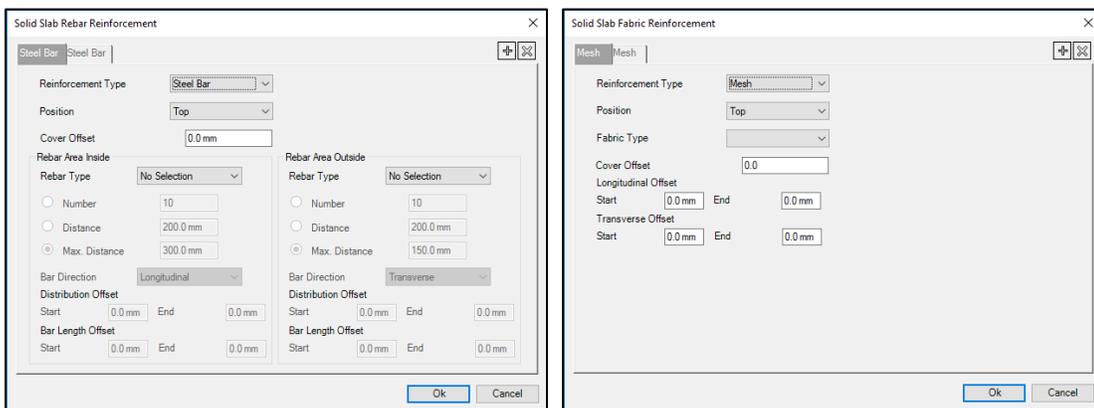


Edge reinforcement configuration

Reinforcement for Solid Slabs

Reinforcement for solid slabs is configured in a similar way to precast wall area reinforcement (as highlighted above). Whether you are adding a new area reinforcement type or editing an existing, users can configure the area reinforcement by adding  or removing  layers to the reinforcement type.

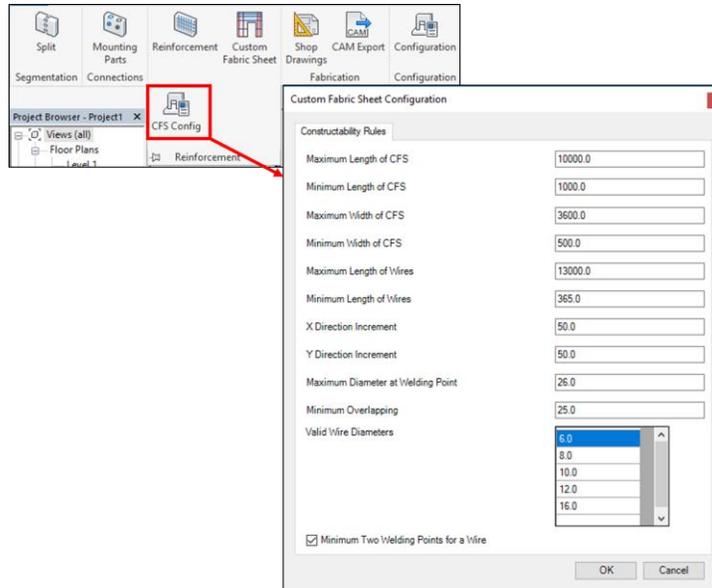
Once layers have been created users can define the reinforcement type (steel bar or mesh), position of the layer (top or bottom), cover offset and type (for rebar or mesh). Once selected there are several parameters that control how the reinforcement is to be applied once placed within the assembly.



Parameters for rebar and fabric reinforcement for slabs

Custom Fabric Reinforcement Sheets

Users can also create custom fabric sheets for unique reinforcement in precast floor or wall assemblies. To do this, guidelines must be defined using the custom fabric sheet configuration. It is important to note that rebar assemblies that do not meet these guidelines are not converted to a sheet.



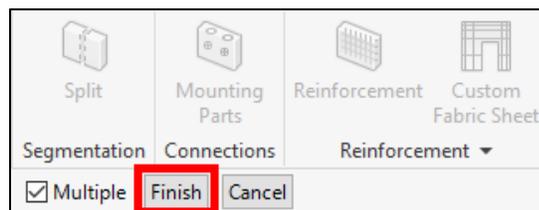
Custom sheet configuration

This option enables the user to sketch a rebar instance in a structural wall or slab, group it into an assembly and then convert it into fabric sheet. When using custom fabric sheets, it is important that the following applies:

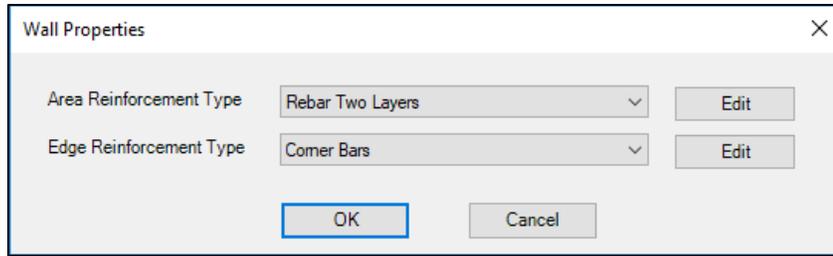
- Rebar meets all restrictions in the configuration
- Rebar sets will not generate into a custom fabric reinforcement sheet, only rebar instances
- All rebar must be sketched/placed in same plane
- Each rebar must be a single segment.

After configuring the various reinforcement types, reinforcement can be placed by selecting the reinforcement  tool. After this is selected users will be able to:

1. Select the wall or floor to add reinforcement. If reinforcement placement is going to be consistent across multiple elements, users can select the “multiple” option.



2. Select Finish to then choose the reinforcement type to apply to the selected element(s) once defined from the drop down.

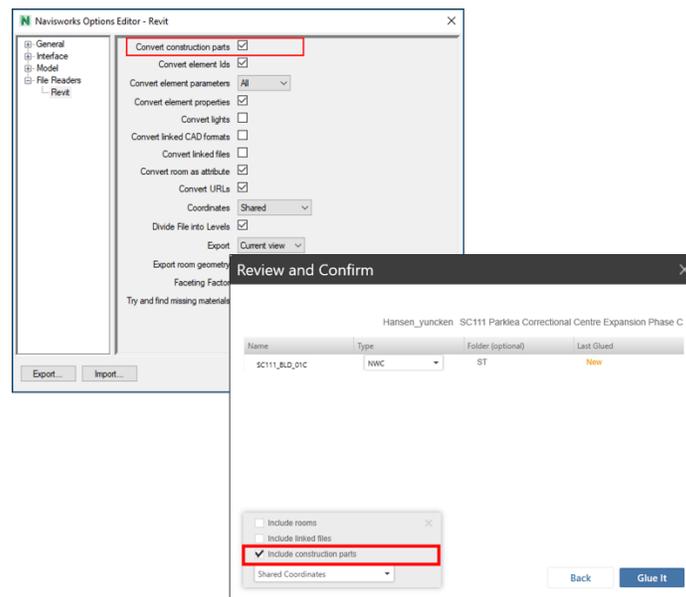


3. Once OK is selected, reinforcement will be applied to the selected elements.

Model preparation for managing QA and precast tracking

Following the development of precast elements using the Structural Precast Extension for Revit, it will develop a detailed model of fabrication elements using Revit parts and assemblies. If we want to use this model downstream in Quality Assurance and Conformance (QA/QC) and material tracking workflows, we need to ensure that we leverage from this level of detail where possible.

When exporting models from Revit for use in Navisworks and or BIM 360 Glue, we need to ensure that export options have been configured to include construction parts as part of the export.



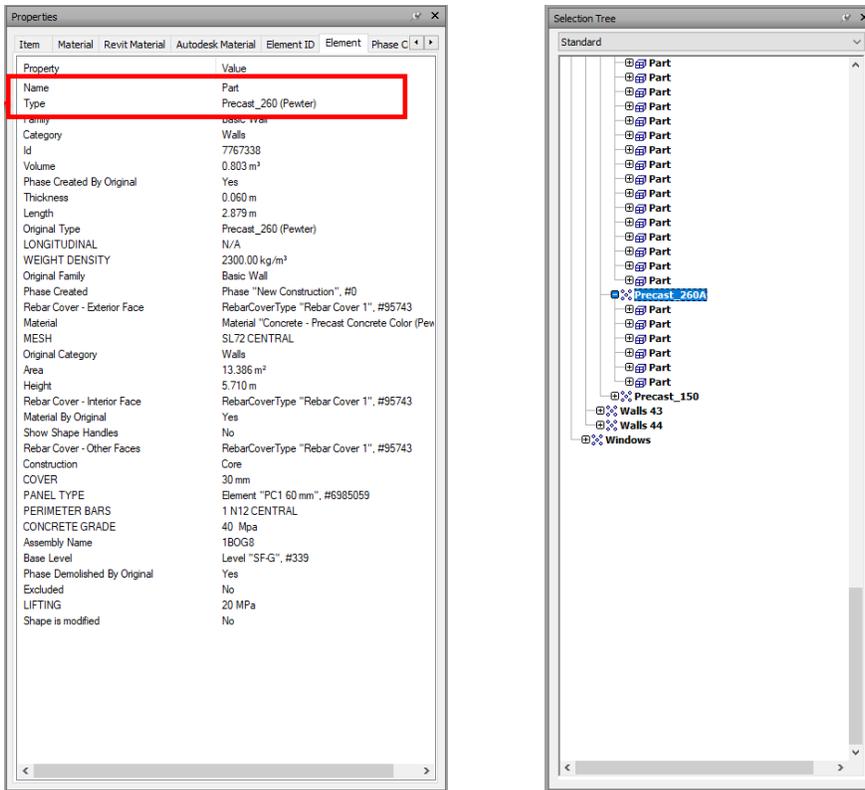
Navisworks and BIM 360 Glue Export Options

This will ensure that model elements are broken into parts as per the shop drawing model and that assembly information and part association are maintained with the exported model.

Part Information

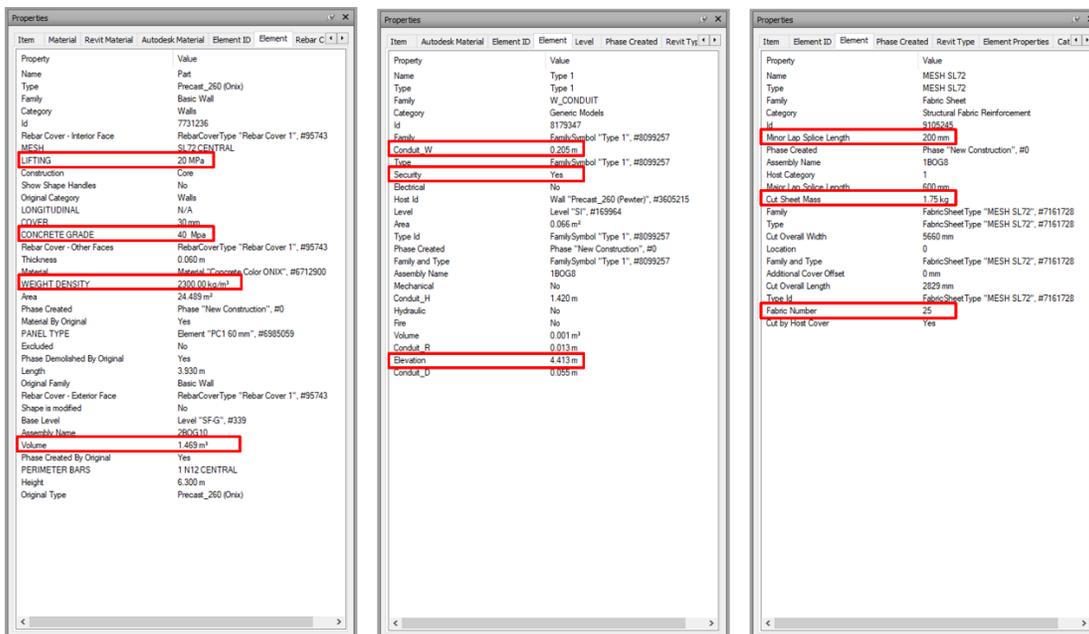
When models are exported to Navisworks or BIM 360 Glue with the construction parts option enabled, it breaks the overall design intent model and certain elements into smaller discrete parts (providing elements in Revit have been divided into parts). Revit parts are a subset of the original element and therefore retains a relationship to its host. When the host element is modified, associated parts are automatically updated and regenerated to align itself to the original host.

This association is retained when exported for use in Navisworks or BIM 360 Glue as part elements contain information about the original host family, and in the selection tree hierarchy all related parts are grouped under the family type collection node.



Associated host element meta data and model tree hierarchy

When using the Revit Structural Precast Extension, and exporting models using construction parts, it provides the user with a higher level of detail for structural and cast in elements. These parts all contain associated metadata (e.g. area, volume, height, width etc.) applicable for the part type that is associated within the precast assembly.

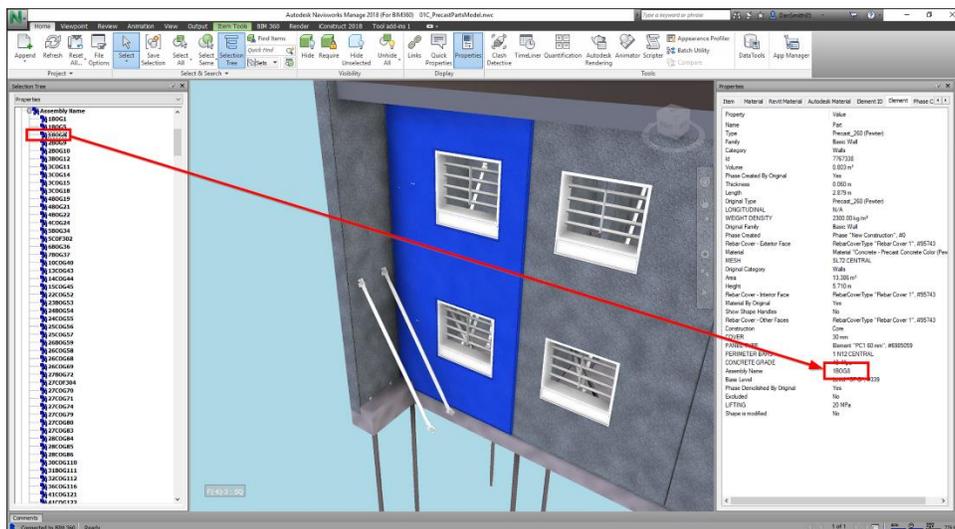


Part element information and related cast-in elements

Part and Assembly Information

The use of assemblies supports the precast modelling process by grouping unique element combinations into a common unit (parts and other categories). When it comes to shop drawing production, the use of the assembly feature is designed so that all grouped elements can be tagged and scheduled as one unit within the assembly category. Additional features within the assembly tool can assist with automated shop drawing production.

When elements are grouped through the assembly function, and the model is exported to Navisworks or BIM 360 Glue (with construction parts enabled) the associated assembly name is stored within the part or element as a property to show its association to a broader group.



Assembly name shown for a selected part

With this associated information contained as a property, it allows users to find/select other related elements using search functionality in Navisworks or BIM 360 Glue, or through using the selection tree properties search in Navisworks.

With the breakdown in parts and its associated information, this model can provide additional advantages when used in conjunction with Navisworks' quantification tool for measuring assembly quantities. When this model is used downstream (covered below) for QA and material tracking, this functionality can support various general contractor administration activities including estimating, engineering and progress claim management.

The Challenge with Parts

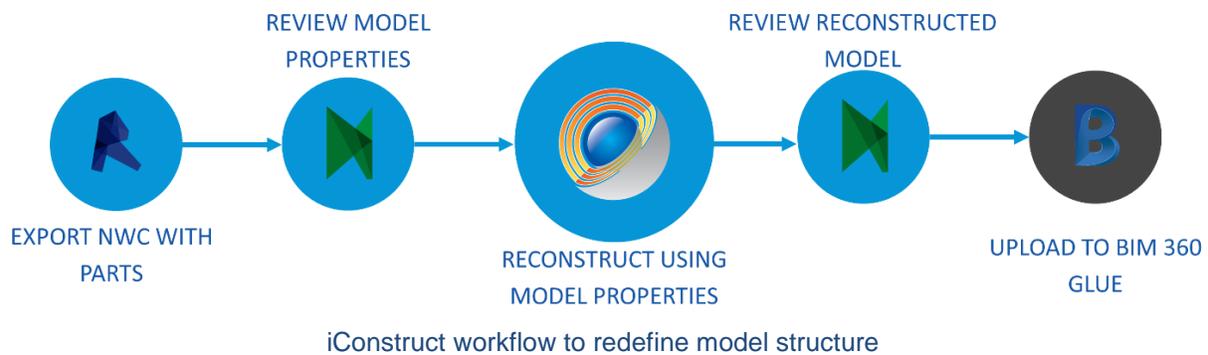
Whilst working with parts and assembly models provide distinct advantages, whether it be through the streamlined production of shop drawings or through detailed model interrogation during delivery, it can present challenges when used in other areas.

Due to the default process in which model structures are developed through the Navisworks and BIM 360 Glue export, the selection tree hierarchy usually does not represent the assembly to part relationship (particularly when dealing with Revit parts and assemblies). This presents a challenge to users, particularly if there is intent to use the model downstream for QA assessments and material tracking of the assembly.

To overcome this, users should investigate workflows which address the challenge with relational hierarchies, whilst retaining the information that this developed during the Structural Precast modelling process in Revit.

One explored, and proven workflow that has been adopted on projects is the use of an add-in software for Autodesk Navisworks called “iConstruct”. This software provides a range of utilities, however its “Reconstruct” tool provides a method that allows users to redefine model structures to suit its intended use without compromising the quality of model that has been developed to date.

The key element to this workflow is that models are actually ‘cleaned’ up in Navisworks before it is uploaded to BIM 360 Glue and then downstream into BIM 360 Field.



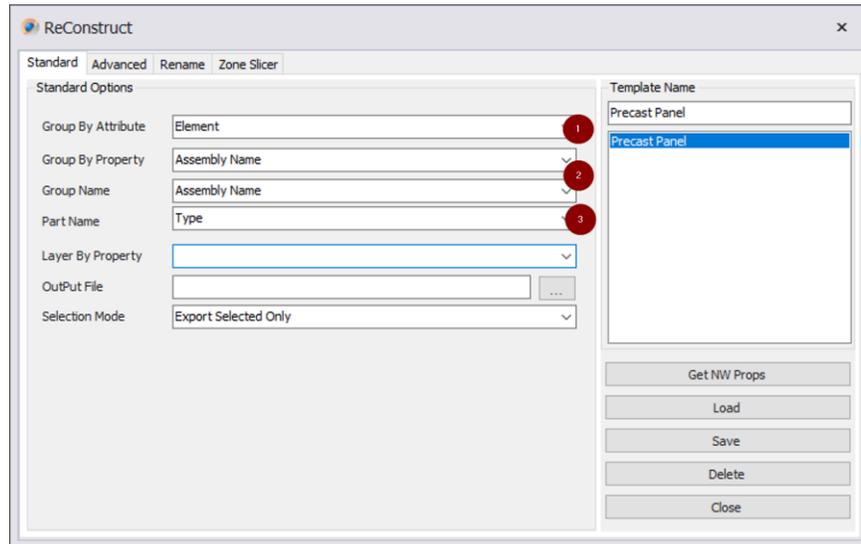
Reconstructing Models

The Reconstruct tool enables users to leverage from properties contained within elements in the Navisworks model to shape and redefine the model hierarchy into three key levels:

1. Layer
2. Group
3. Part

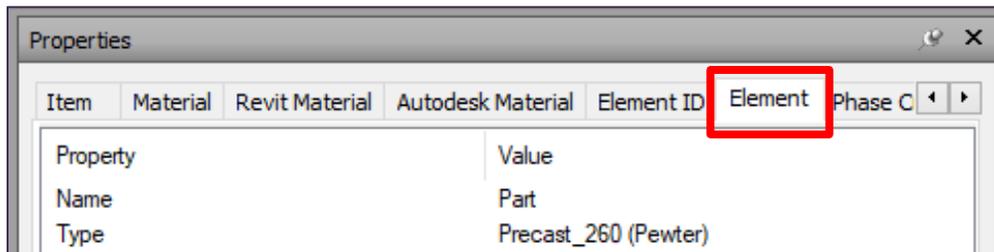
These three levels represent the default nodes that are available and consistent across models opened/converted in the Navisworks platform. This hierarchy, and the properties used to define it, is controlled through the general configuration of the Reconstruct tool. Different configurations can be saved as templates so that they can be applied on updated models or other models (i.e. disciplines) that may be required to be processed through Reconstruct. When the tool is run, iConstruct will generate a new .nwd file based on the configuration.

There are a few key steps that need to be completed in order to complete a basic configuration in Reconstruct:



iConstruct's standard configuration

1. Select the attribute tab (example below) that contains all properties used in the Reconstruct process.

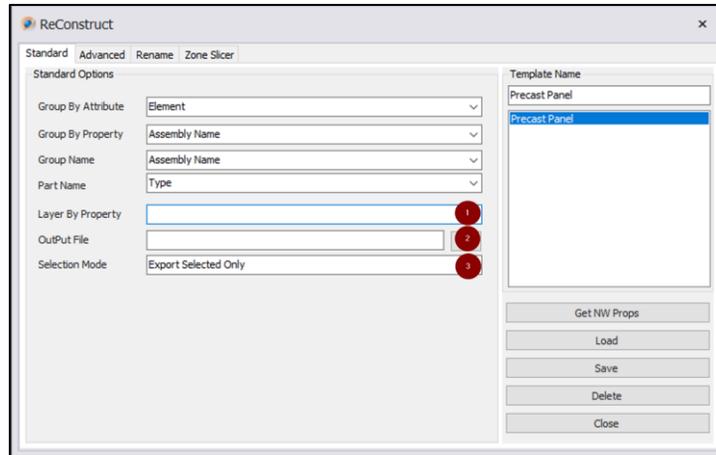


Attribute tabs in Navisworks

Should properties exist across multiple attribute tabs, iConstruct's Integrator tool can be used to consolidate multiple properties from different attribute tabs into a single attribute tab.

2. Define the property name that will be used to group related geometry, and the display name that will be used for the group node following the Reconstruct process. These values do not necessarily have to be the same value if one property better defines the unique group vs a display name (e.g. Assembly ID vs Assembly Type)
3. Choose a part name to define the part node in the selection tree. Reconstruction will automatically find all the default geometry nodes in the Navisworks hierarchy, group by one of its properties and then assign a new property name if defined.

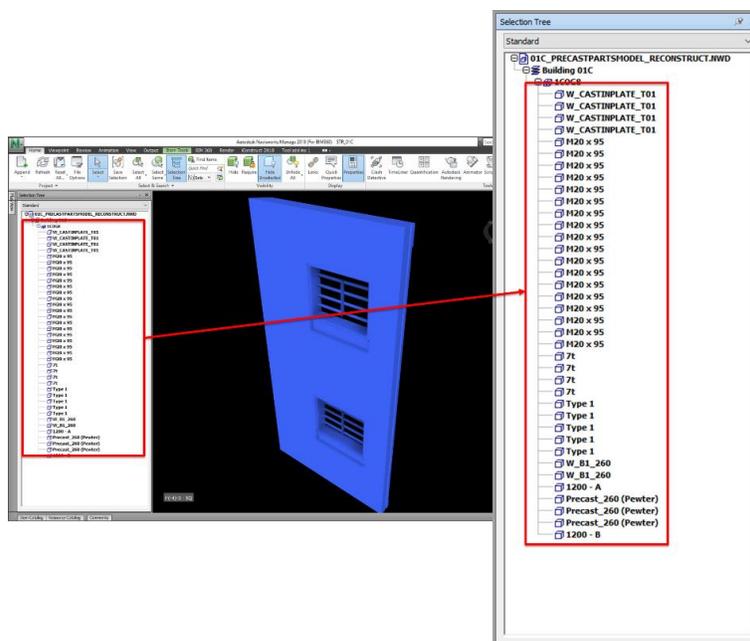
Whilst these key steps are fundamental for redefining a new model structure, there are a few optional configurations that should be considered in order to establish a basic configuration in the Reconstruct tool:



iConstruct's standard configuration

1. If the model needs to be separated into layers, a property will need to be defined. This could be useful if you have a higher-level category that you may want to group assemblies by (e.g. building, level, zone etc.). If you chose not to define layer value, you can create a default layer name which will be applied to the whole model.
2. A default output file name can be defined for the newly created model. This should be configured if you are going to run the same process on a model as it is progressively developed and updated. If you do not configure this option, you will be prompted to create a new file name.
3. The selection model controls what elements of the model is included in the Reconstruct routine as iConstruct generates a new model. These options include; the whole model, selected elements only or visible elements only.

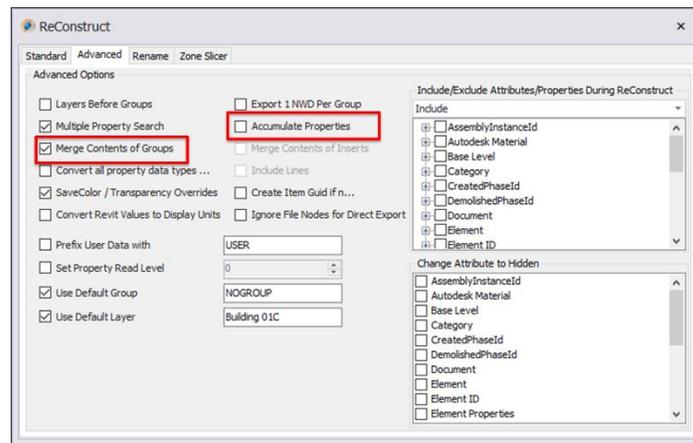
Once configured, the process is run, and a new reconstructed model is generated. The new model should represent the group and item relationship as defined in the configuration.



An example of a Reconstruct model

This new hierarchy works well if you want to use the model for downstream workflows, particularly if you choose to integrate with BIM 360 Glue and Field for QA and material tracking. The cleaner model structure makes it easier when it comes to mapping assemblies and related information between the model and BIM 360 Field. This structure removes the ambiguity around assemblies in Navisworks/BIM 360 Glue, as dealing with one object and related geometry creates less chances of generating duplicate equipment records.

Whilst this structure is cleaner, when interrogating models in BIM 360 Glue (particularly on the iPad), the default selection resolution is set to last object, so users will still be selecting assembly parts by default until they navigate up the tree hierarchy to the assembly. If you want to make this cleaner and simpler for the operator there are a few advanced options in the Reconstruct tool which can assist.



Reconstruct's advanced configuration menu

These options include:

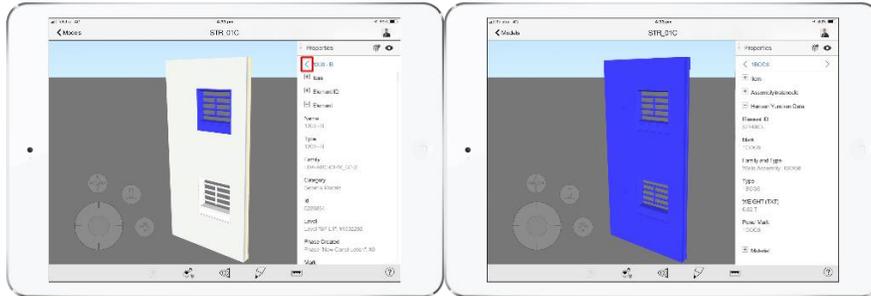
1. Merge Contents of Groups, which effectively merges all geometry listed under the object into one item of geometry (which in this case would represent the assembly in its entirety)
2. Accumulate properties, effectively sums numeric values contained in the geometry and totals it at the parent level.



Example of a Reconstruct model after merge contents is enabled

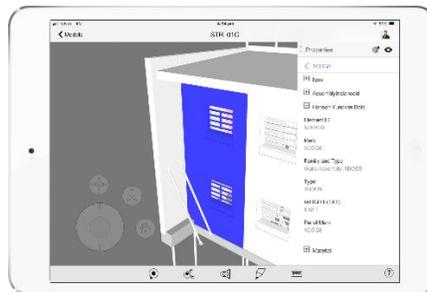
When these models are uploaded to BIM 360 Glue, and effectively shared with BIM 360 Field, it will ultimately change the experience for users interrogating and working with assemblies. If you

choose not to merge contents of groups, the assembly level can be found by navigating up to the parent level.



Example of navigating up to the parent level (i.e. assembly) in a reconstructed model

If you choose to merge contents of groups, the assembly level will be the default selection.



Default selection for a merged model in Reconstruct

If you want to manage the information included for assemblies and/or include additional information that may not necessarily be captured during the development of shop drawing models, it may also be worth looking into iConstruct's datalink tool. This will allow you to append additional information to model elements through a data connection to Excel, Access or SQL connections.

Preparing your Model in BIM 360 Glue

In order to connect model-based workflows with BIM 360 Field for QA and Tracking, we need to leverage from the data integration that is available with its partnering product BIM 360 Glue. This integration allows us to leverage from design intent or shop drawing models, and the information contained, to populate our equipment lists in BIM 360 Field. If established properly, we can also use the model to assist us in interrogating / auditing field-based activities to ensure compliance and accuracy in our process.

In order to achieve this, there are a number of key activities that need to be completed in BIM 360 Glue before we can integrate with BIM 360 Field, and also improve usability once the integration is complete.

Uploading Models

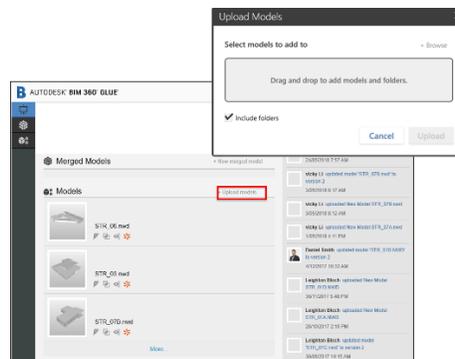
Once models have been developed and ready for use in construction, we need to ensure that the latest revisions are uploaded and available in BIM 360 Glue. If BIM 360 Glue is being used for coordination during design development and preconstruction processes, this exercise will be relevant to all design teams.

Uploading via BIM 360 Glue Desktop

After being added to a project on BIM 360 Glue for the first time, it will download and install the BIM 360 Glue desktop client. This can also be downloaded separately (US <https://b4.autodesk.com/desktop> or EMEA <https://b4.eu.autodesk.com/desktop>).

When installed, this client can be used for reviewing models, performing clash tests and generating equipment sets (covered below) for BIM 360 Field integration. The BIM 360 Glue desktop application should be used for all administration activities including uploading models.

To add models, users can select the add model's icon from the project dashboard screen, or through the model's menu.



Uploading models through BIM 360 Glue desktop

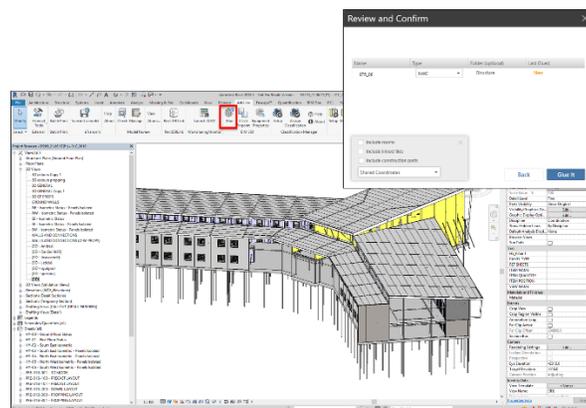
BIM 360 Glue shares the same file [format support](#) as Navisworks, as it normalizes all design formats into the Navisworks format after the model has been uploaded. In order to upload models, users will need Full or Limited access permission levels.

Once models have been prepared using Navisworks and iConstruct (highlighted above), you will need to use this method in order to upload your models to BIM 360 Glue. When uploading models, it is suggested that you retain a consistent model naming convention that does not change and/or include model versioning. This will ensure that BIM 360 Glue handles revision control, and when using it to manage equipment sets (see below) we do not lose any mapping and are able to update as required when new revisions are issued.

Uploading via BIM 360 Glue Add-in

Models can also be uploaded directly from the authoring application when working in Revit and AutoCAD platforms, through the BIM 360 Glue export add-in. This add-in can access through the BIM 360 Glue desktop application.

After selecting the Glue option, users will be prompted to select the project that they wish to export to, the 3D view of the model that will be exported and settings that will be applied for the export. When using this option, it is suggested that a 3D view is generated with the view name aligned to the model naming convention as this will streamline model upload and ensure consistency for future uploads.



BIM 360 Glue export option in Revit

This method is the best option if you want to use BIM 360 Glue for design coordination and or provide additional models to set context with the assemblies in a federated set.

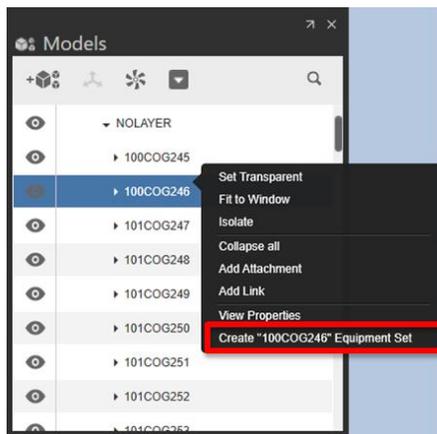
If you use this option with the intent for tracking assemblies, workflows will need to be addressed in where the design intent model can be used (with assembly information) as opposed to the detailed shop drawing model.

Generating Equipment Sets

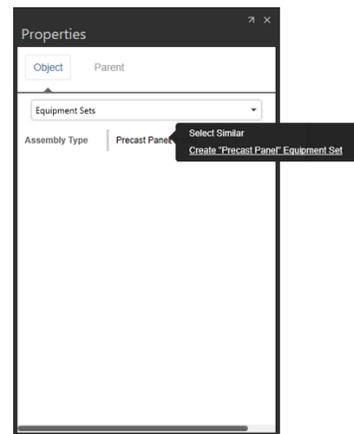
Equipment sets are groups of objects in the BIM 360 Glue model that share common or the same property. Its purpose, primarily in BIM 360 Glue, is to control the modelled elements in BIM 360 Glue that will be integrated with BIM 360 Field and its equipment module. In doing so, it essentially establishes a data connection where model data is shared to the equipment list, and when field data is collected, shared back into the BIM 360 Glue model. It is important that equipment sets are properly established with common groupings to ensure that the equipment mapping process (covered below) is simple and that when information is exchanged between the two platforms, it is accurate and relevant.

Equipment sets can be created in two ways:

1. Select a sample object from within the model tree, and create an equipment set from the sample. This option is good if you need to create an equipment set for a specific equipment type.
2. Choose a property from a selected object, and generate an equipment set for elements sharing the same property. This option is good if you need to create an equipment set of multiple elements in the same category and or system.



Equipment sets using the model tree



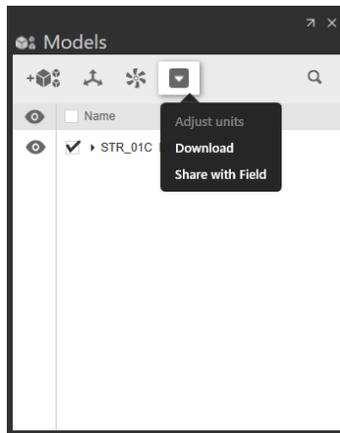
Equipment sets using a nominated property

When generating equipment sets it is important to consider how many types of elements may be grouped to ensure a streamlined and consistent mapping process. If we can group common elements as part of this process, users need to identify as to whether a grouping property exists in the model. If it does not exist, it should be specified as part of the model development plan.

Sharing the Model with BIM 360 Field

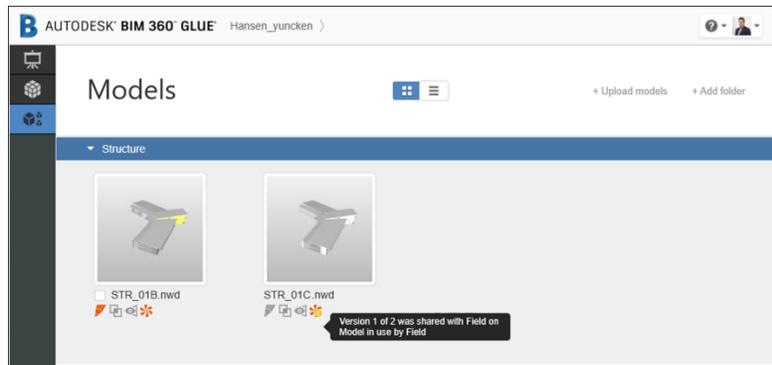
It is important to note that equipment sets can be created in models and or merged models in the BIM 360 Glue platform. If you want to display context surrounding the mapped equipment sets, it may be best to establish this in a merged model environment.

Once equipment sets have been established in the model, it is then ready to be shared with BIM 360 Field. This option is only available to users on BIM 360 Glue who have project administration user permissions. To share a model, there is an option available in the model tree dialogue window which enables the sharing. This will share the current version of the model or merged model and the equipment sets contained.



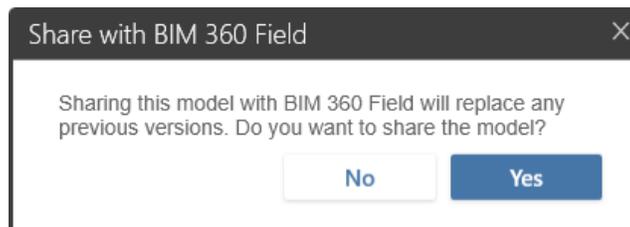
Sharing a model with BIM 360 Field

When models are updated, they will not be automatically shared with BIM 360 Field until the user re-shares the latest revision of the model or merged model. This provides project administrators with the ability to audit and review model data in later revisions before it is shared with BIM 360 Field.



Status showing version of model shared with BIM 360 Field

If you are re-sharing a model with BIM 360 Field, you will be prompted to update. Updated models in BIM 360 Glue should only be re-shared (as a priority) if additional geometry and or meta data has been added that impacts the equipment mapping, and field validation process.



Notification shown before re-sharing and overwriting an existing version

It is important to note that additional equipment sets can be added to the specific version of the model / merged model that has been shared and have this made available in BIM 360 Field without needing to re-share the model.

Preparing Views for use in BIM 360 Field

After a specific version of the model or merged model has been shared with BIM 360 Field, users can prepare the model in BIM 360 Glue with specific views to assist users when opening it in BIM 360 Field. This will make it easier for validation, interrogation and data capture. Users can create the following views in BIM 360 Glue and have them automatically available in BIM 360 Field without needing to re-share the model.

View Option

Benefit

Viewpoints



Whilst there is the ability to use the map feature on the BIM 360 Glue iPad app to navigate around the project, creating default viewpoints can help users on the BIM 360 Field app orientate themselves to certain positions on the project. Hiding elements in this view also makes it easier to identify elements for validation and inspection.

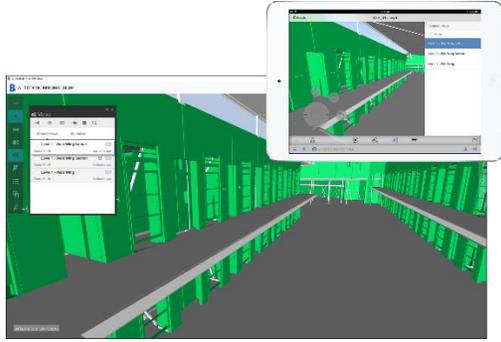
Sections



Creating section views using the BIM 360 Glue desktop application, will carry through to the BIM 360 Field application. This option is particularly useful if users are working on larger multi-story projects, and or where there are areas of confined spaces where site teams may need to interrogate the model for validation and data capture.

Colour Coding Elements

Creating color coded views can be useful for highlighting elements of different types and categories. When it comes to QA, commissioning and material tracking, this



feature is quite powerful for color coding elements based on:

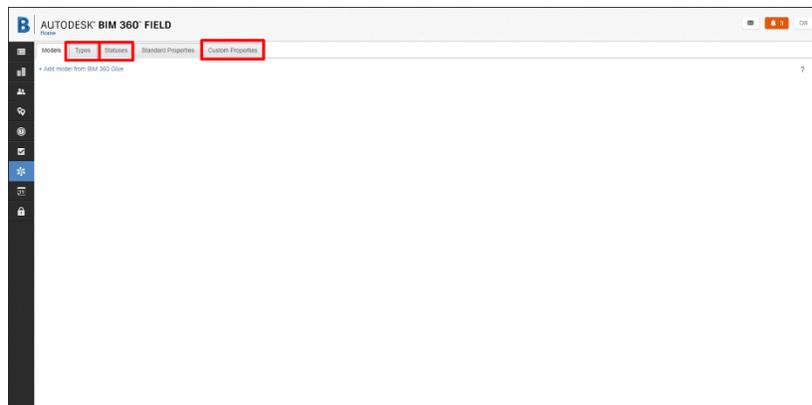
- Status of equipment in BIM 360 Field
- Equipment included in equipment sets requiring data capture
- Elements with open issues or checklists from BIM 360 Field

Working with Models in BIM 360 Field

Once the models have been prepared in BIM 360 Glue, we can begin integration with BIM 360 Field to generate equipment lists using the BIM 360 Glue model data. To ensure the integration is effective and aligned to Field processes, there are a number of administration activities that need to be conducted in order to support the workflow for users in the field. If configured properly, we can achieve both quality assurance and material tracking outcomes through a simplified workflow.

Customising Equipment Settings

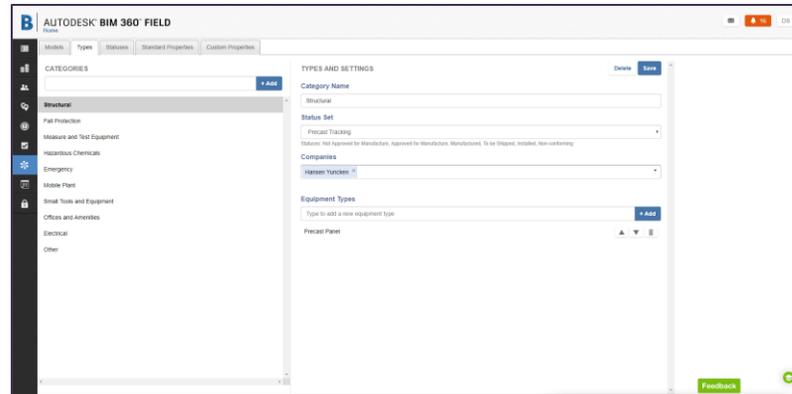
Through project administration access, there are several configuration options for managing equipment in BIM 360 Field. These settings can control the types of equipment that are managed, how they are tracked, who has access to manage/edit the equipment and any other meta data that needs to be captured through the fabrication and installation process. This is managed through the Type, Status and Custom property settings in the equipment administration.



BIM 360 Field equipment settings

Managing Equipment Categories and Types

Equipment categories are used for grouping common or related equipment types and controlling the status settings (below) and permission levels for accessing / viewing different equipment types.



Equipment category and type settings

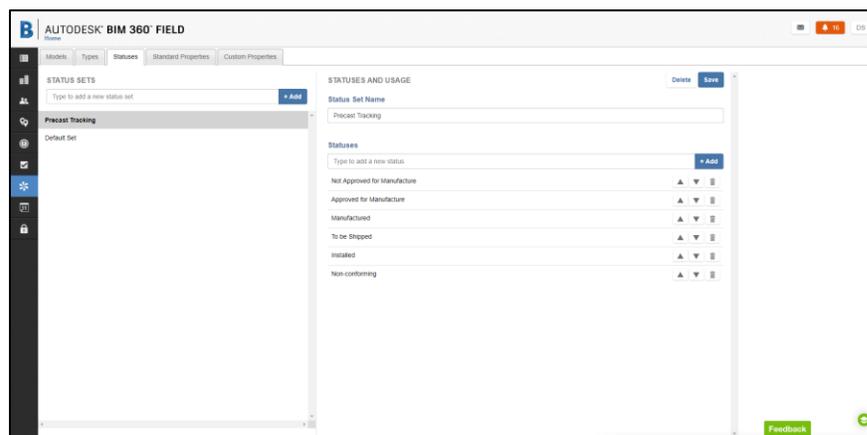
Once a category name has been saved, administrators can begin adding equipment types to the category. For every equipment type, users can add custom properties (covered below) which will be applicable for each equipment record of that type.

Permission levels can be set for the equipment category by defining the companies that can view and/or access equipment records under this category. These permission levels are particularly important in the QA and material tracking workflows should users wish to provide access to the supply chain to collect and manage records.

Status Sets (covered below) can be applied per equipment category, which allows us to specify unique status sets that aligns with material tracking workflows relevant to the discipline / category.

Defining Equipment Status

Different equipment statuses in BIM 360 Field are grouped by status sets. These sets should be set up and aligned with fabrication and installation workflows for different disciplines. Thought should be given to how these sets are created to ensure they are aligned and can be applied to the various equipment types (covered above).



Equipment status settings

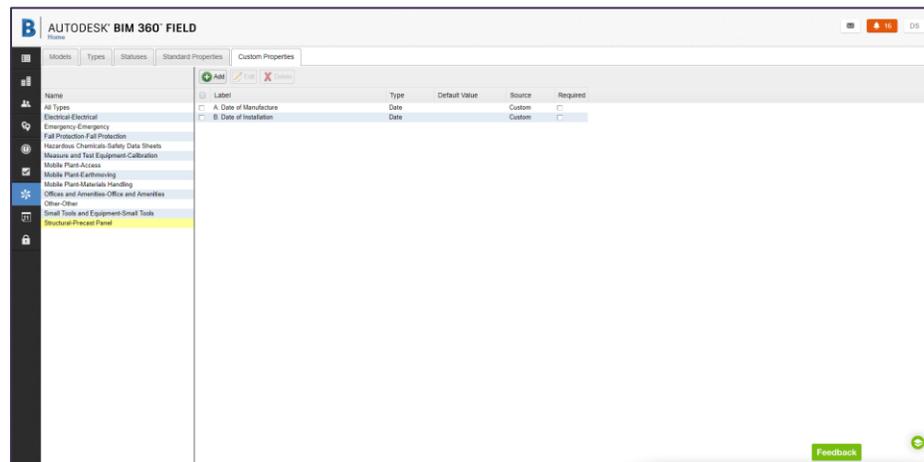
Once status sets have been created, administrators can begin adding the different statuses to the set. These statuses can be re-ordered to suit the logical sequence, making it easier for users when marking off equipment. When adding a status, administrators should consider how the status will be used for measuring progress through reporting outputs.

Defining Equipment Properties

Through the equipment administration in BIM 360 Field, there are two types of properties that can be configured for equipment types:

- Standard properties - out of the box and applicable to all equipment types
- Custom properties - applicable to all or specific to an equipment type

Should additional meta data need to be collected against equipment item(s), administrators can add a custom property (text, date, signature, numeric etc) for all or specific types, and make them mandatory or optional.



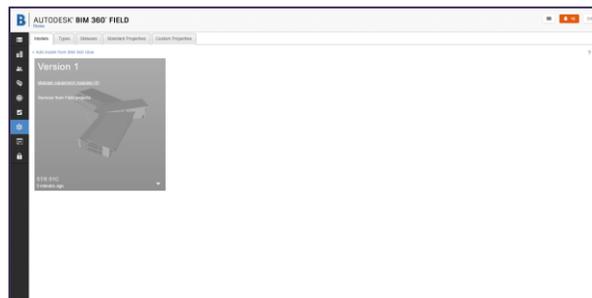
Custom equipment properties

Adding custom properties are important to BIM 360 Field workflows for a number of reasons:

1. It allows for the collection of additional metadata for elements to support QA and commissioning workflows, which may be important in assisting project management or end handover deliverables.
2. When integrating with BIM 360 Glue models and wanting to extract model metadata into the equipment list, these custom properties need to be established prior so that the model has something to map to (covered below).
3. If specific reporting outputs (e.g. trends, status) want to be achieved, custom properties may be required in order to collect the right information, so it can be integrated with model and business intelligence reporting outputs (covered below).

Integrating BIM 360 Glue Models

As covered above, we can integrate with BIM 360 Glue models that have been shared with BIM 360 Field. These “shared” models can be added to the BIM 360 Field project under the “Model” area in the Equipment administration. It is important to note that only project administrators in BIM 360 Glue and Field can share and connect to models, so it is important that users are given the appropriate permissions to configure the project properly. To maintain control and accuracy in the mapping/integration process, it is important to limit administration access to those key personnel who will be integral to establishing the workflows correctly. For example, you may limit administration to the BIM / VDC Manager in BIM 360 Glue and QA Manager for BIM 360 Field.



Connecting shared models.

To connect to a model, administrators will need to select the project which contains the shared model(s) and then select the model name that they wish to connect with. It is important to note that shared models can only be connected with once to avoid duplication and inaccurate records. Once a model has been connected, the equipment mapping process can begin.

The equipment mapping process involves a number of steps, which needs to be completed for each equipment set that exists in the BIM 360 Glue model:

1. **Equipment Set** – When starting the process, you can configure mappings per equipment set. When you select an equipment set, the following configurations below will apply to all elements contained in the set.
2. **Equipment Type** – The elements contained in equipment sets, need to be mapped to a specific equipment type in BIM 360 Field. The type defined here, impacts the properties that the model can be mapped to in step 4 below.
3. **Unique ID** – This step defines the value to use as the Unique ID between the BIM 360 Glue object and the BIM 360 Field equipment record. There are two options:
 - a. **Standard** - uses the element ID or GUID or the model object. This option is relevant if the model has been locked down and is unlikely to change
 - b. **Advanced** - allows you to define a model property as the unique ID. This option is good if a unique ID schema has been defined for the project and the model is likely to progressively develop as the BIM 360 Field process commences.
4. **Model Properties** – This allows the administrator to define the model properties that need to be extracted and what equipment property in BIM 360 Field it relates to. It is important that any custom properties (above) are defined before you complete this step.

5. **Equipment Properties** – This step will enable information collected against equipment properties in BIM 360 Field to be mapped back to the model as new object properties. The values defined here will be important in assisting the Quality and Commissioning process, any model-based reports (covered below) and as built handovers should they be required in the project.

Once completed, BIM 360 Field will begin extracting the information from the model and begin populating equipment records with the associated properties. This mapping process can always be modified after the first pass, but it is important that the unique ID is retained from the onset to prevent duplicate records and or incorrect data. If the model has been updated with new properties that need to be reflected in BIM 360 Field, the model or merged model needs to be re-shared in order for the changes to be applied. Any information that is collected in BIM 360 Field will automatically be applied to the model if equipment properties have been defined in the configuration.

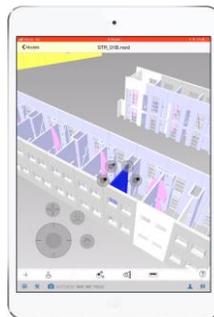
Conducting QA and Tracking Progress

Once the equipment has been mapped from the BIM 360 Glue model and data extracted into the equipment lists, users can begin performing QA activities and tracking progress of equipment items. Because of the integration of the model and equipment lists, there are several ways that users can access and interrogate equipment to perform related inspections and collect information.

Model Interrogation

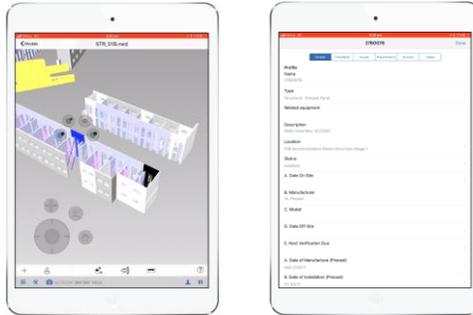
The model viewer in the BIM 360 Field iPad app shares similar feature sets to those of BIM 360 Glue. Due to its simplicity, users will be able to interrogate shared models directly in the field during QA activities with features like:

- User friendly navigation with common iPad figure gestures or joystick control
- Model interrogation with ability to hide or isolate elements and view its associated BIM 360 Glue model data



BIM 360 Field model interrogation features

The one key difference in the BIM 360 Field model viewer is that it enables users to navigate back to the item in the equipment list (should this be a mapped item). This workflow will support efficiencies in QA and tracking activities as the visual aspect associated with the shared model, makes it easier for users to identify relevant items of equipment whilst directly in the field.

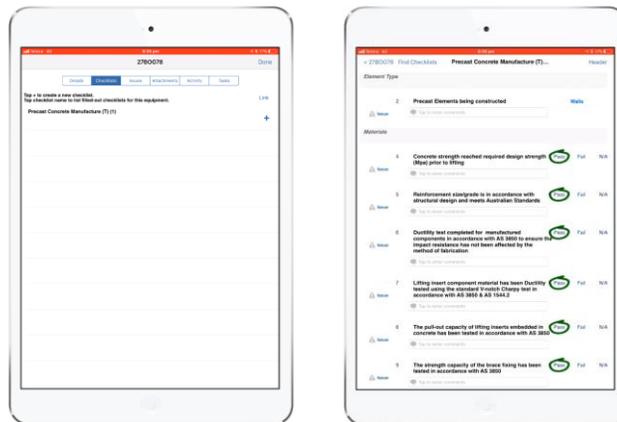


BIM 360 Field model equipment interrogation feature

Managing Quality Assurance

The equipment functionality in BIM 360 Field allows for the linking of documents (e.g. pdf and images) and BIM 360 checklists and issues. This functionality supports QA processes by associating all relevant documentation and relevant information to the element itself, providing a single source of truth at the point of handover.

When planning for QA, administrators should look at linking all relevant QA checklist templates to related equipment types as soon as equipment lists are generated. This will promote consistency in applying and completing the right checklists as part of the fabrication and installation process. The checklist templates should be developed in a structure that ensures supporting information is collected and that any non-conformances that are generated through the inspection process are linked to the equipment.



Linked BIM 360 Field checklist template and completed version

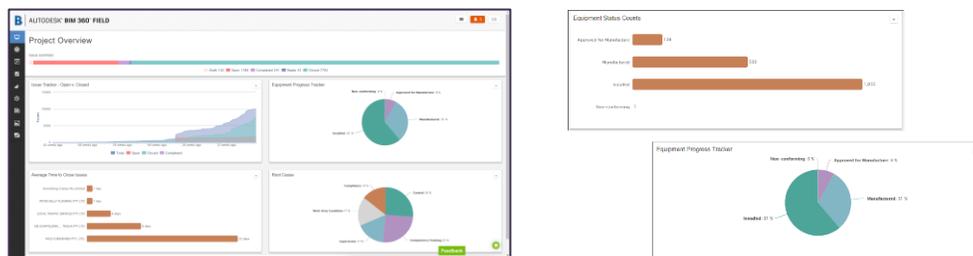
By linking the appropriate checklist templates to equipment, it can be used as a benchmark to measure compliance with required QA inspections. This can be measured through reporting outputs (covered below) or quite simply through the checklist list view in BIM 360 Field web.

The Value of Reporting and Business Intelligence

The development of a structured workflow, and collection of organized information can provide extreme value when it comes to reporting and true business intelligence. With the ability to share models from BIM 360 Glue to a central BIM 360 Field database, it provides a range of reporting options that can vary from detailed project reports to enterprise level analytics.

BIM 360 Field Dashboards

The BIM 360 Field web platform provides administrators with the ability to set up some simple dashboards on the project landing screen to provide a snapshot on the current project status. These can be configured and set up under one of the four dashboard widgets.



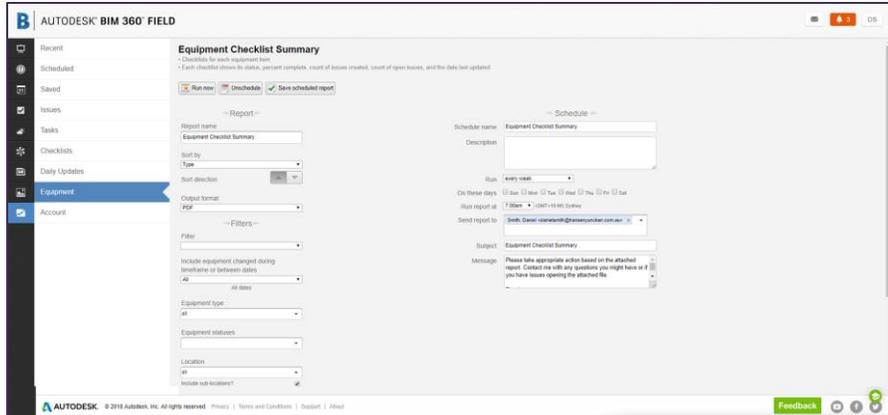
BIM 360 Field dashboards

The dashboards can be configured to provide a high-level report on information captured through issues, checklists, equipment and task features. When measuring progress and performance for QA and material tracking, there are a couple of dashboards that should be configured:

- **Equipment dashboard** – these dashboards track progress and can be configured to show progress by percentage or counts. They can also be filtered to only show specific equipment types and/or updated within a specific time frame.
- **Checklist conformance dashboard** – this dashboard can be established to display conformance rates of QA inspections. The dashboard can be filtered by specific checklist templates and those created within a specific date range.

BIM 360 Field Reports

The BIM 360 Field reports tool provides a range of various report templates for equipment and checklist records. This can be used to provide detailed reports including all associated information and attached records.



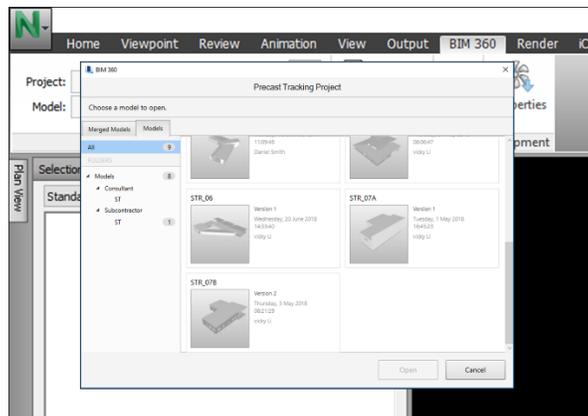
BIM 360 report configuration and schedule settings

When setting up a report, users can configure the report template by using a range of filters to include equipment and checklist records by certain types, date ranges, status, attachments and other contained information. When the report is run, users will have the ability to download and view the report or forward the report on to other users on the project.

Should these reports need to be accessed on a more common basis, these reports can be scheduled to run on a frequency and sent to a distributed user list.

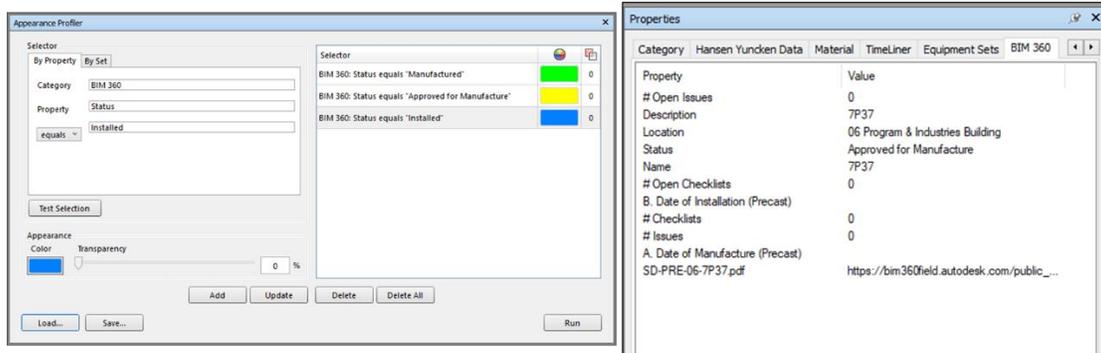
Model Progress Reporting

When BIM 360 Glue models are shared with BIM 360 Field and properties have been mapped, any of the equipment properties (providing they have been mapped to the model) will be available in the BIM 360 Glue. Access to this information also extends to Navisworks when BIM 360 Glue models are downloaded through the BIM 360 extension. These models can be downloaded by logging into the project and selecting the model that has mapped equipment sets.



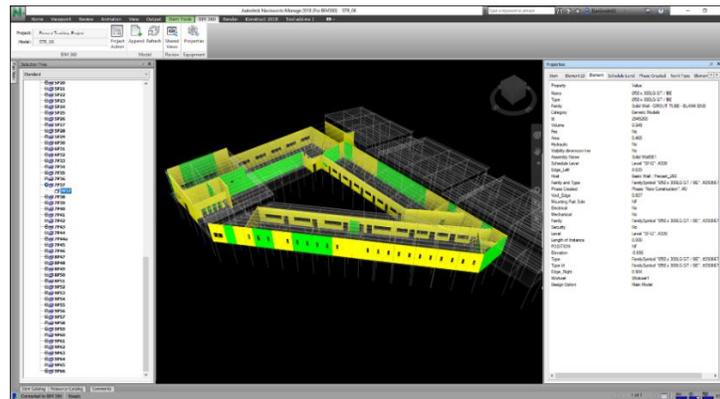
Accessing BIM 360 Glue models via Navisworks

Once the model has been downloaded, all mapped BIM 360 Field properties can be imported into the model in Navisworks by selecting the equipment import icon under the BIM 360 tab. These properties will appear under a new 'BIM 360' attribute tab which can then be used for auditing and interrogation. Any attachments added to equipment items in BIM 360 Field will appear as a public URL under the BIM 360 attribute tab in Navisworks.



BIM 360 Field properties in Navisworks and the appearance profiler

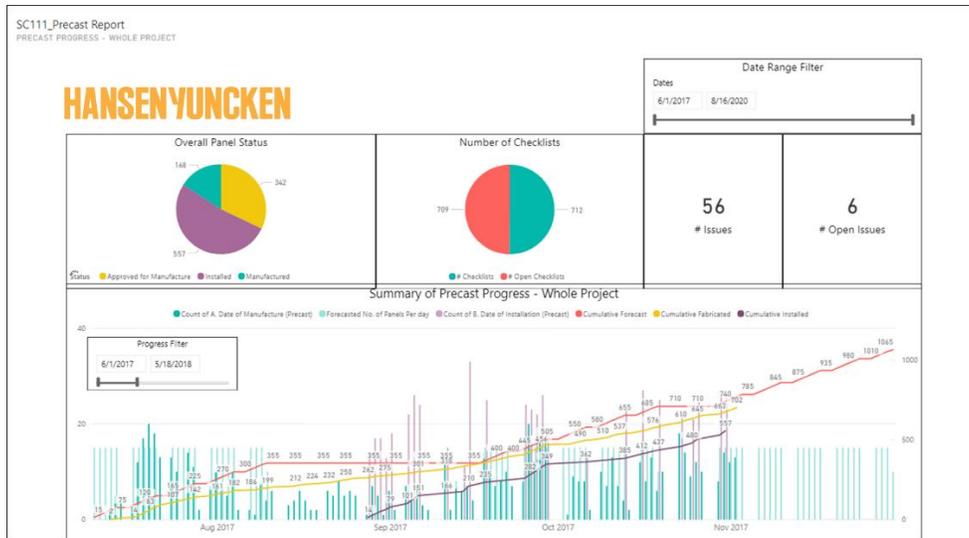
Once the properties have been imported, users can configure the appearance profiler to color code the model based on the variables of a specific property. This can be useful for demonstrating snapshots of current progress during material tracking, and/or any areas that may have open issues or checklists as part of the QA process.



Appearance Profile color coding elements based on current status.

Custom Reports and Integrated Business Intelligence

Whilst there are several reporting options available through BIM 360 Field or through using mapped properties in BIM 360 Glue and Navisworks (through appropriate color coding toolsets), there may be requirements to develop more specific project reports or to integrate reporting outputs into an Enterprise Management System.



Customized dashboard using PowerBI and BIM 360 Field REST API

One of the benefits of BIM 360 Field is that it provides a central source of truth for all equipment and QA related information. To access this data for customized reports or for integration with Enterprise Management Systems, BIM 360 Field provides a full API (REST) which enables developers to pull and push data from an external database. By leveraging from these API's we can aggregate information into a common database that enables us to develop customized project and or enterprise reports through the use of external Business Intelligence applications such as PowerBI or Tableau.

For further information on the BIM 360 Field API please visit the following links;

- <https://bim360field.autodesk.com/apidoc/index.html>