

CS501429

Autodesk Model Coordination for Design and Construction Streamlines Process

Edwin Bailey
Skanska

Learning Objectives

- Identify the benefits of cloud-based clash detection during design and preconstruction.
- Evaluate the pros and cons to fully cloud-based coordination with subcontractors.
- Apply best practices and lessons learned from real projects.
- Review current technical workflows for both design and construction coordination.

Description

Traditionally, teams rely on desktop tools for coordination (e.g., model visualization, clash detection and issue resolution), often leading to a convoluted process with limited access to information. Today, cloud-based tools like Autodesk Construction Cloud or BIM360 are available to streamline coordination and offer greater transparency for owners, designers, stakeholders and construction managers. Using real project examples, we'll explore how to replicate this workflow in the cloud so teams can run coordination and review clashes directly in Revit—without exporting files to Navisworks. We'll also preview the best Revit settings for publishing, sharing coordinates and building stories; demonstrate how to combine and align Revit and CAD files per level; illustrate how to view assigned issues and make changes in Revit; and review similar processes in Navisworks for those unable to transition fully to the cloud.

Speaker



Bio

Edwin Bailey joined Skanska's preconstruction team in 2017 and has proven himself to be a forward thinker in the use of new technology and data. As a Senior Preconstruction Tech Engineer, Edwin supports our project teams with innovative ideas for tracking and using data to

improve project outcomes. He also provides Building Information Modeling (BIM) and Virtual Design and Construction (VDC) resources for our projects. Edwin's contributions include early development of BIM during preconstruction, managing 3D coordination processes, assisting in constructability reviews and creating BIM turnover packages. He works closely with our owners and design teams to develop project-specific BIM implementation plans upon project award. Edwin holds a Bachelor's degree in Design Engineering and Technology from Weber State University and a Master's degree in Technology Commercialization (MSTC) from the University of Texas, McCombs School of Business.

Class Prerequisites

- Collaboration experience with owners, designers, stakeholders and construction managers
- Non-technical 3D users welcome
- 3D Navisworks or BIM 360 Glue experience beneficial but not required for more advanced users

Identify the benefits of cloud-based clash detection during design and preconstruction

Benefits of cloud-based model coordination

The biggest benefit of cloud-based model coordination is increased accessibility to all project stakeholders. Users don't need to install a desktop application or learn a complicated user interface. Navigation of 3D models is simple and requires no proficiency, which allows non-technical users to apply their expertise to the project. Additionally, if design is already using BIM360 or ACC to share files, it's an easy process to set up model coordination to automatically extract the latest model versions for clash detection. Separate folders can also be established to selectively copy models over on a recurring basis.

Evaluate the pros and cons to fully cloud-based coordination with subcontractors

PROs

- Better coordinated documentation
- Increased stakeholder participation and awareness
- Fewer RFIs during construction
- Less rework in the field
- Earlier constructability reviews
- Easier to use/learn than desktop applications
- No expertise required to navigate the 3D models

- Auto generate issue reports
- Email notifications and instant message type communications for issues
- See and Resolve assigned issues in Revit

CONs (Mmore like things to watch out for)

- The default {3D} Revit view is auto extracted unless otherwise specified in publish settings. Models extracted are WYSIWYG and items can get turned on and off in that view. It also gets deleted often in workshared files.
- Models have section box left turned on and crops the model.
- Publish settings can get turned on or off by other users and inadvertently switch to batch print vs model extraction.
- When multiple 3D models are extracted auto clash detection stalls. On one project, hundreds of detailed print views had small 3D sections on each sheet. The detailer accidentally added the sheets to the BIM 360 set that extracts models for clash detection. To avoid this interruption, remove the extra sheets from the publish set.
- Issues can become disassociated to a model when the file or view name changes.
- Only admins can see issues assigned to others. This limitation becomes problematic when you assign issues to an individual vs company.
- Levels don't work with CAD. I recommend splitting Revit files into views by level use subfolders for CAD.
- Two reports are needed for clashes, one grouped by company and another to show details with thumbnail image.
- Xrefed CAD files come in as one big object (ex. lights linked into electrical CAD level). Load files separately to resolve this issue.

Apply best practices and lessons learned from real projects

Projects

Alamo Culinary Arts – Preconstruction phase

TCCD Campus B1 & B2 - Preconstruction and Construction phases

1550 On the Green - Preconstruction and Construction phases



Alamo Culinary Arts

Increase collaboration

I will be presenting how to leverage Autodesk cloud-based tools for increased collaboration among all stakeholders of a building project, including best practices and lessons learned for design and construction model coordination. I'll talk about our beta experience in 2018 on our **Alamo Culinary Arts building in San Antonio**, when we first started using model coordination during the design phase on key projects. I'll also share recent project examples where we used model coordination with subcontractors on some of our largest commercial projects in Texas. We collaborated without needing to use a desktop application like Navisworks to run clash detection, which is currently an industry standard.

When we first started using model coordination, there was no way of assigning clashes or creating issues. This limitation meant that we couldn't use it for coordination with subcontractors. By taking screen captures and copying element IDs, we used it during the design and preconstruction phase of a project. As the software improved, we assigned issues on projects mentioned below.



TCCD Campus B1 & B2

From my perspective, each building is a functioning work of art that requires a team to build it. Each stakeholder contributes value to the overall outcome of the project, including the craftsman, construction manager, engineer, architect and owner. The better we all collaborate, the less roadblocks a project will have, and the higher the quality project we provide to the owner and building occupants.

Streamline coordination during both design and construction

In general, people have a hard time visualizing a mental picture of 2D construction documents. You may see design meetings where each discipline sits around a table with hard copies of their drawings and marks them up as they all try to create and coordinate a mental picture of the combined project. As great as it can be to all sit together around a table in person, with cloud-based technology you don't have to be in the same room. Everyone has near real-time access to project information. You have digital 2D documents that can be marked up virtually. In addition, each document is linked to its corresponding 3D discipline model. The team can combine discipline models and run clash detection early on in design and during construction coordination. Stakeholders can generate and assign issues and run reports. Each issue has its own instant messaging built in for enhanced communication that can be used as follow-ups from

group meetings. Model coordination allows for easy visualization, navigation, and a better understanding of design intent between all stakeholders. Skanska's preconstruction and operations experts take advantage of the 3D clash detection tool during design to provide constructability analysis and QC models data. Through assigned issues, active messaging, and automated reports, communication and accountability are enhanced. We utilize a similar cloud-based workflow when coordinating shop drawing models with our subcontractors. Our **TCCD Campus Buildings 1 & 2** projects were the first to utilize model coordination during both Precon and Construction phases.



TCCD Campus B1 & B2

Project team, from owners, designers, stakeholders, and construction managers

Skanska leverages cloud-based tools to increase collaboration, communication and transparency which builds trust among owners, designers, stakeholders and construction managers. Real-time access to information benefits all project stakeholders and helps ensure a more coordinated design, budget and improves overall project quality.

The cloud streamlines coordination and the flow of information and ideas. Quicker and better design and construction decisions are made when everyone has access to the information they need. You don't have to wait weeks for files to be updated, combined and shared. You can zero in on key issues and resolve them quickly without having to sift through old emails. Transparency is key to any project, and we've seen increased involvement from owners, better collaboration between design disciplines and increased project understanding between construction and design.

We used Autodesk's cloud tools on one of our most recent commercial development projects, a 28-story office tower in downtown Houston, **1550 on the Green** on which Skanska is both the owner and general contractor.



1550 On the Green

Owners, architects, engineers, and construction managers actively participated in 3D design model coordination to improve the quality of construction documents. There was also more interaction and feedback between subcontractors and all other stakeholders while coordinating the 3D construction models used for shop drawings. None of our team members had previously used Autodesk's model coordination, but they quickly picked it up and worked remotely across the country in the cloud.

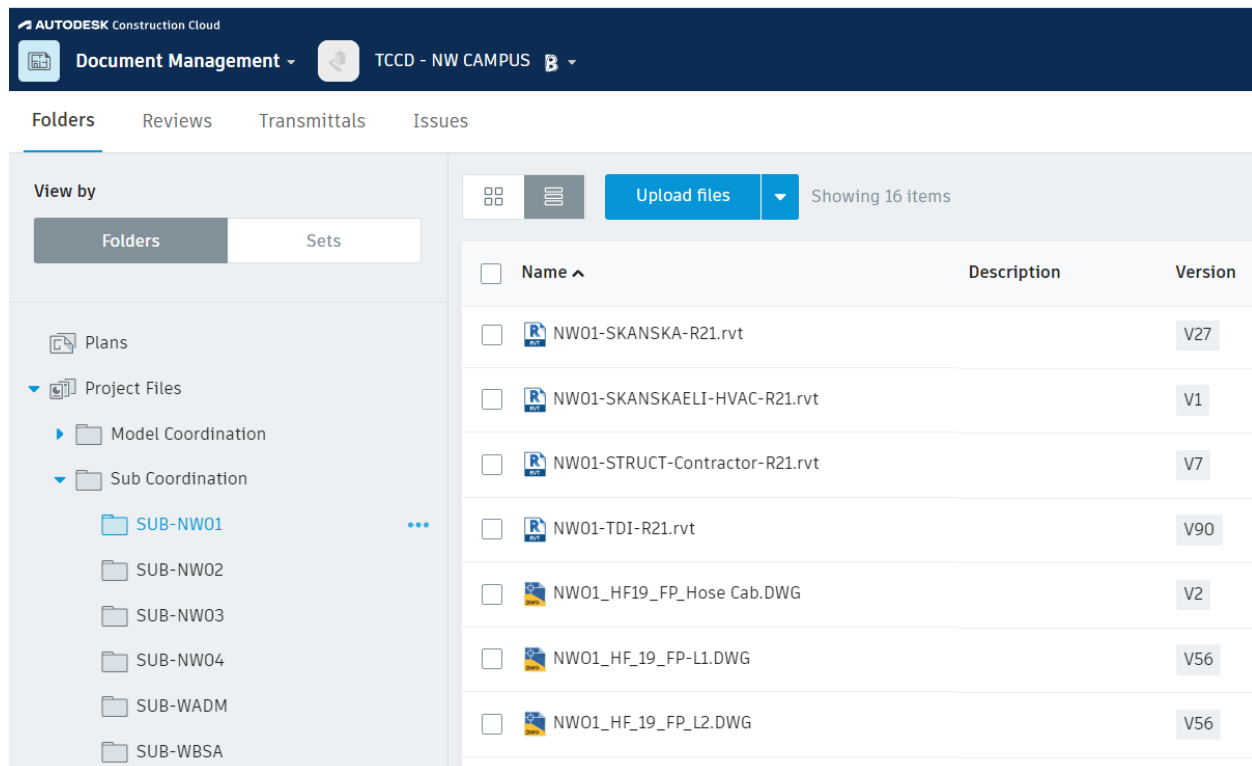
Model coordination is a game changer, because it simplifies the way we can collaborate as a team. More team members have greater access to the models in a simplified user experience. General users don't have to be gurus at 3D model navigation to use it. This advantage allows more industry experts to apply their knowledge and expertise to the project. Overall quality increases.

Review current technical workflows for both design and construction coordination

Set up and manage coordination spaces

Document Folders – are first set up under Document Management. This is where the project team will upload their model files. Models are auto extracted from these folders once you link the folders to a coordination space. Every time someone uploads a new version it can take a while before the new version shows up in model coordination. Multiple folders, subfolders, and corresponding coordination spaces can be set up.

We set up separate folders and coordination spaces for design and construction models . In the example below for **TCCD**, we used subfolders for each building on campus.

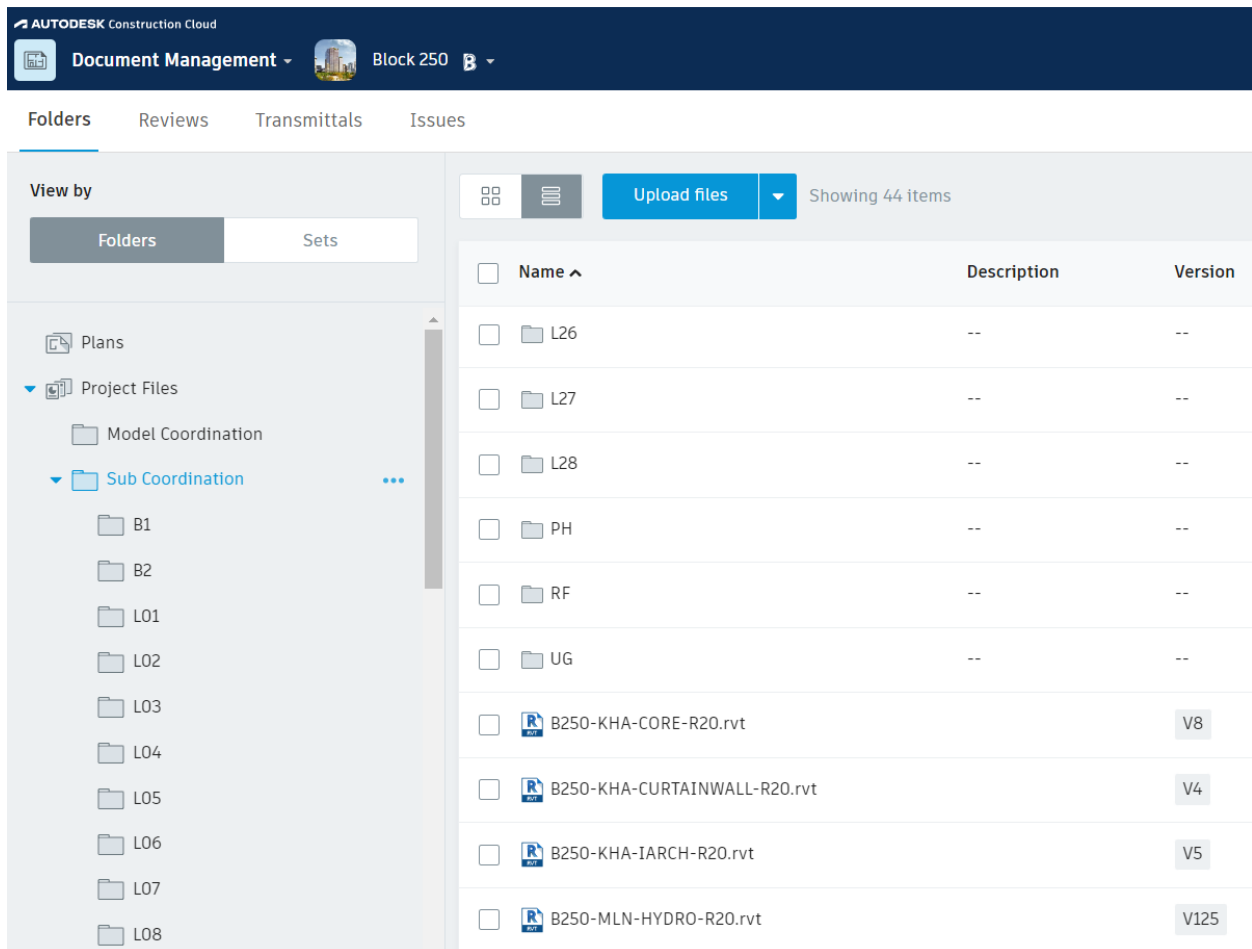


The screenshot shows the Autodesk Construction Cloud Document Management interface. The top navigation bar includes 'Document Management' and 'TCCD - NW CAMPUS'. The left sidebar shows a folder structure under 'Project Files' with 'Model Coordination' and 'Sub Coordination' folders. The 'Sub Coordination' folder is expanded, showing subfolders: SUB-NW01, SUB-NW02, SUB-NW03, SUB-NW04, SUB-WADM, and SUB-WBSA. The main content area displays a list of files with columns for Name, Description, and Version. The list shows 16 items, including RVT and DWG files with their respective versions.

Name	Description	Version
NW01-SKANSKA-R21.rvt		V27
NW01-SKANSKAELI-HVAC-R21.rvt		V1
NW01-STRUCT-Contractor-R21.rvt		V7
NW01-TDI-R21.rvt		V90
NW01_HF19_FP_Hose Cab.DWG		V2
NW01_HF_19_FP-L1.DWG		V56
NW01_HF_19_FP-L2.DWG		V56

TCCD Campus Folder Structure

On our Highrise project, **1550 on the Green**, we used a different folder structure. Design models and subcontractors still had separate folders, but we decided to create subfolders to organize 4 CAD files per level. We only created one coordination space for design with just Revit files and one for Construction models with subfolders for CAD. The Revit files stayed in the main Sub Coordination folder while the CAD files were in the subfolders since there were more of them than typically modeled per level.



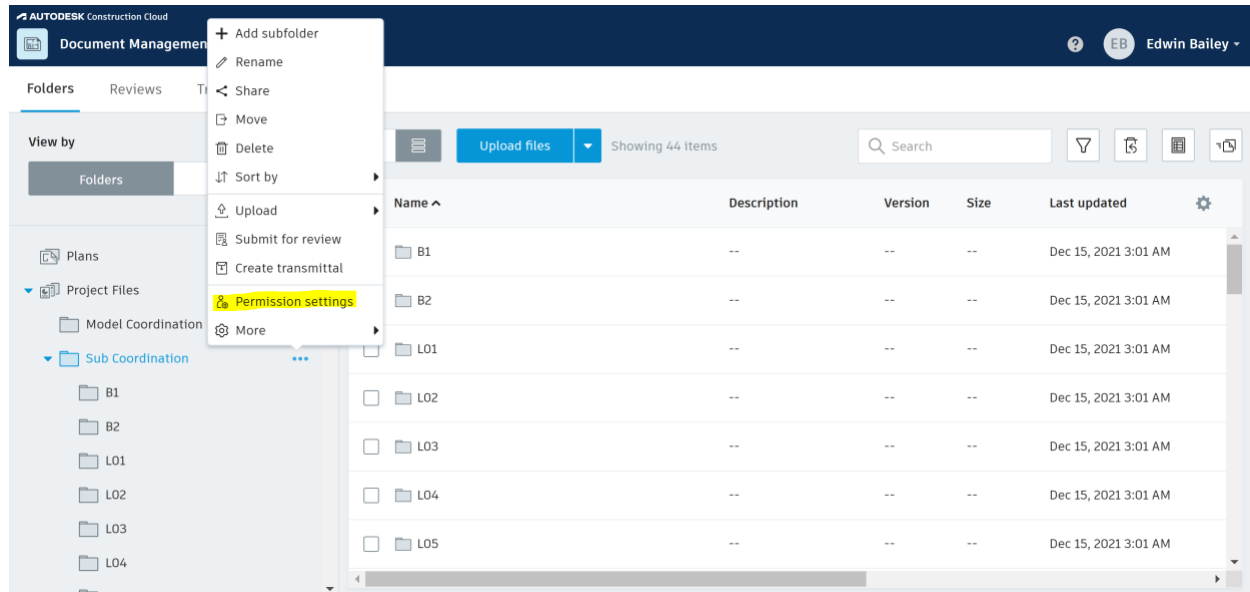
The screenshot shows the Autodesk Construction Cloud Document Management interface. The left sidebar displays a folder tree under 'Project Files' > 'Model Coordination' > 'Sub Coordination'. The main area shows a list of folders and files.

Name	Description	Version
L26	--	--
L27	--	--
L28	--	--
PH	--	--
RF	--	--
UG	--	--
B250-KHA-CORE-R20.rvt		V8
B250-KHA-CURTAINWALL-R20.rvt		V4
B250-KHA-IARCH-R20.rvt		V5
B250-MLN-HYDRO-R20.rvt		V125

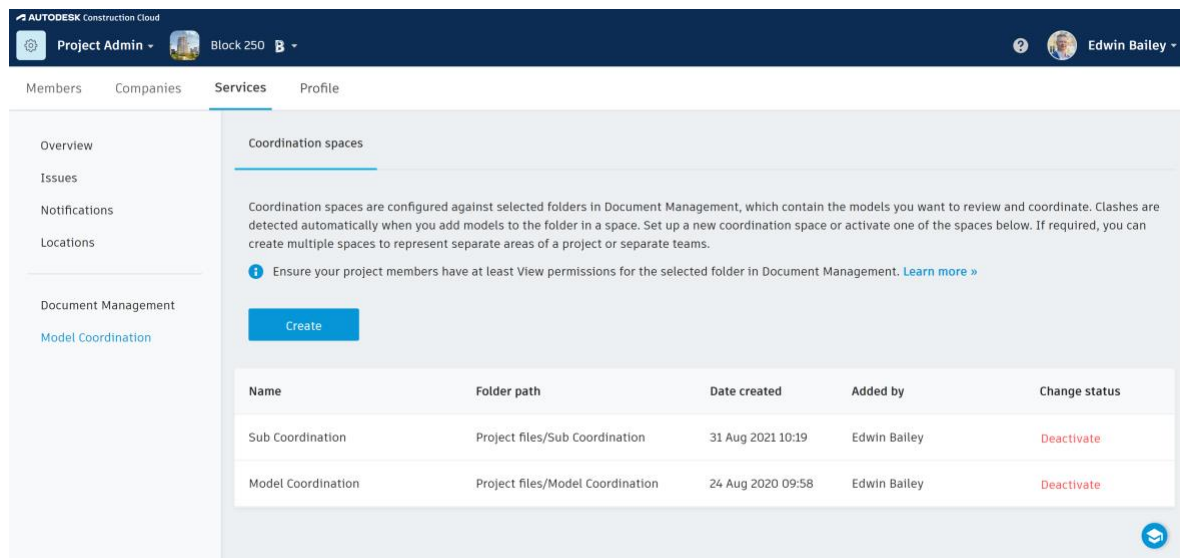
1550 On the Green Folder Structure

Permission Settings - different team members were given access to the folders by company under folder permissions. This option also gives access to the different coordination spaces that link to the folders. I'll typically use one of the two following options.

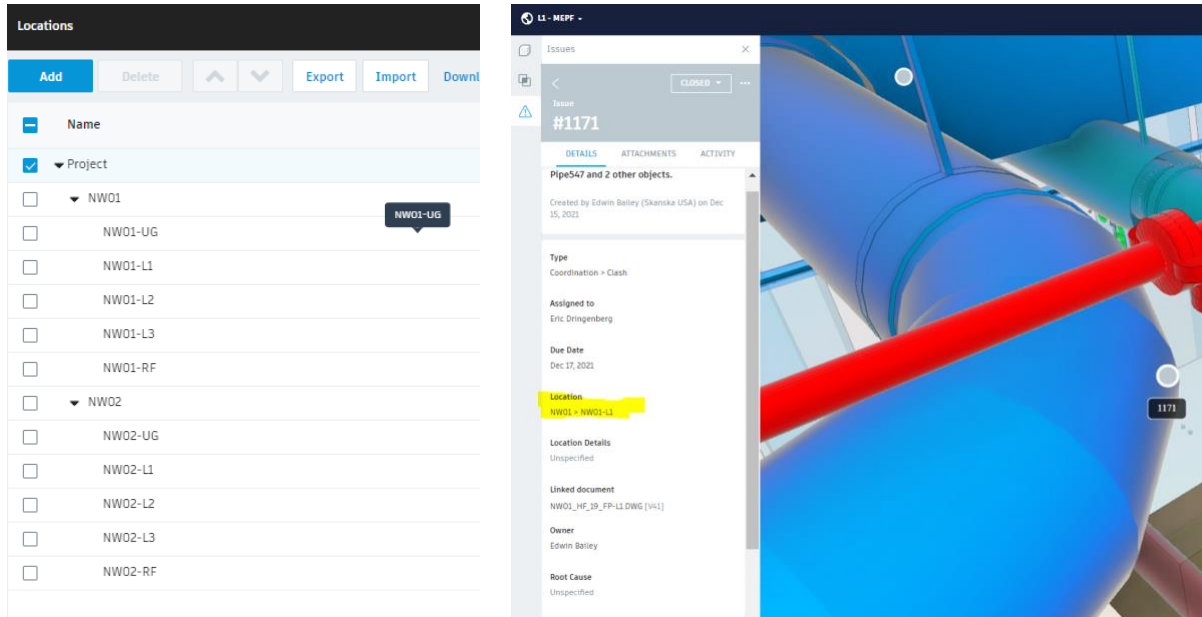
- **View + Download + Upload:** User/role/company may share their own documents with team members and view any other documents in that folder.
- **View + Download + Upload + Edit:** User/role/company may share their own documents with team members, view and edit any other documents in that folder and publish markups.



Coordination spaces - are set up under Project admin, Model Coordination, and linked to the subfolders created under document management for each building. Note: we typically use two coordination spaces for each building- one for design and one for construction coordination. If you have more than one building in a project, you can set up as many spaces as needed. I wouldn't recommend setting them up for levels or areas on a project unless it's really needed.

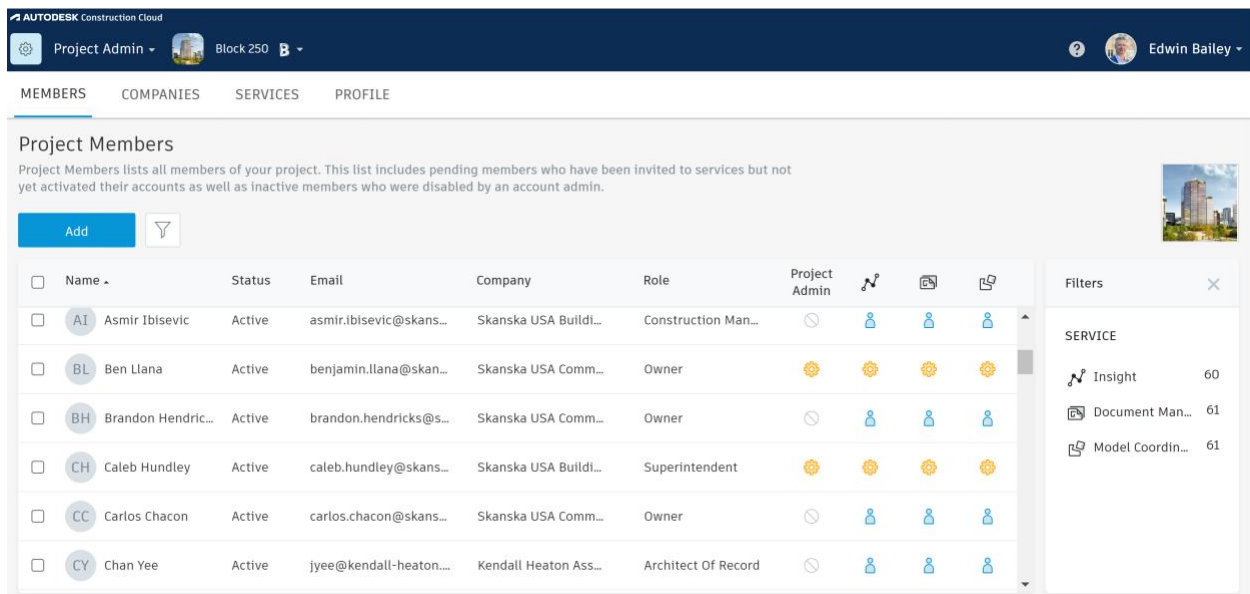


Locations – are a great way to group and filter assigned issues for reports. They must be set up in the Project Admin settings, under Services, under Model Coordination, under Locations, before you can use them as a dropdown menu when creating issues. Yes, they are hidden.



The left screenshot shows the 'Locations' settings page. It has a table with columns 'Name' and 'Project'. Under 'Project', there are two expandable sections: 'NW01' and 'NW02'. Each section contains a list of location names with checkboxes. A tooltip for 'NW01-UG' is visible. The right screenshot shows an issue detail view for issue #1171. The issue title is 'Pipe547 and 2 other objects'. It was created by Edwin Bailey (Skanska USA) on Dec 05, 2021. The type is 'Coordination > Clash'. It is assigned to Eric Dringenberg. The due date is Dec 17, 2021. The location is highlighted as 'NW01 - NW01-L1'. The location details are 'Unspecified'. The linked document is 'NW01_HF_19_FP-L1.DWG (V41)'. The owner is Edwin Bailey. The root cause is 'Unspecified'.

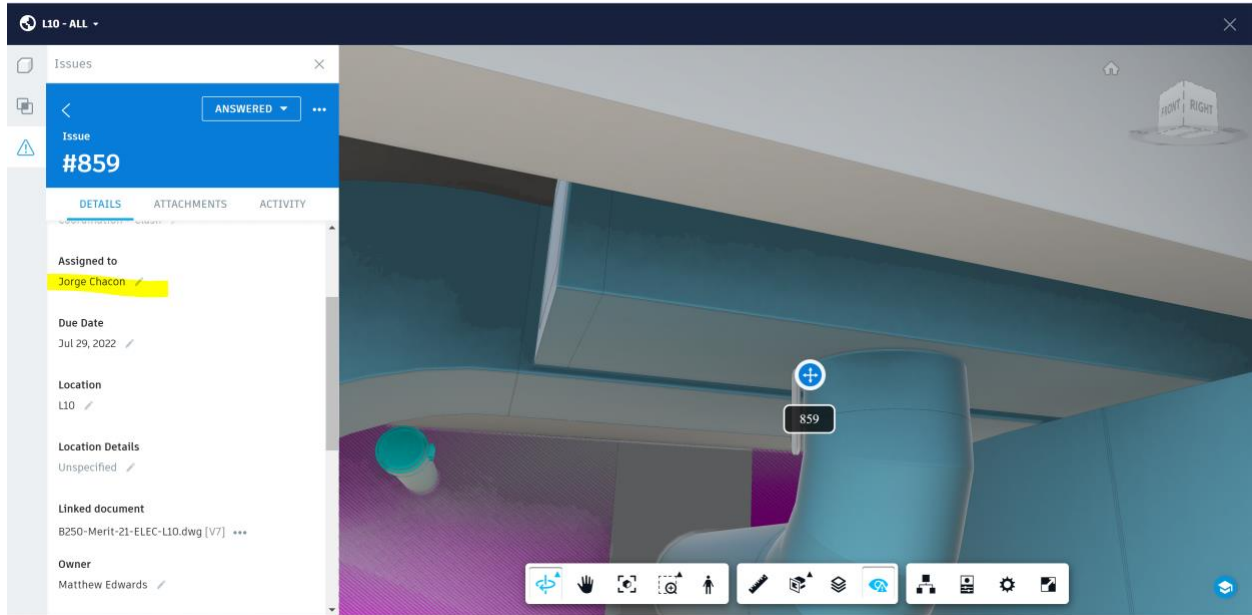
Members and Companies – make sure you set up each member with a company, role, and turn on each service/module to which they need access. Note that you might need a super admin to first add new users to your company account admin before they can be added to the project. It's a two-step process.



The screenshot shows the 'Project Members' page in Autodesk Construction Cloud. The page header includes 'Project Admin', 'Block 250', and the user 'Edwin Bailey'. The main content area is titled 'Project Members' and includes a description: 'Project Members lists all members of your project. This list includes pending members who have been invited to services but not yet activated their accounts as well as inactive members who were disabled by an account admin.' Below this is a table of members with columns: Name, Status, Email, Company, Role, and Project Admin. The table lists seven members: Asmir Ibisevic, Ben Llana, Brandon Hendricks, Caleb Hundley, Carlos Chacon, and Chan Yee. To the right of the table is a 'Filters' panel with a 'SERVICE' section showing counts for 'Insight' (60), 'Document Man...' (61), and 'Model Coordin...' (61).

Name	Status	Email	Company	Role	Project Admin
AI Asmir Ibisevic	Active	asmir.ibisevic@skans...	Skanska USA Buildi...	Construction Man...	
BL Ben Llana	Active	benjamin.llana@skan...	Skanska USA Comm...	Owner	
BH Brandon Hendric...	Active	brandon.hendricks@s...	Skanska USA Comm...	Owner	
CH Caleb Hundley	Active	caleb.hundley@skans...	Skanska USA Buildi...	Superintendent	
CC Carlos Chacon	Active	carlos.chacon@skans...	Skanska USA Comm...	Owner	
CY Chan Yee	Active	jyee@kendall-heaton...	Kendall Heaton Ass...	Architect Of Record	

Assign Issues - individually vs by company vs by role. When you assign an issue, an email notification is sent out. If you have many users per role or by company, it's best to assign them individually. That way you're not spamming everyone with access to the project.



Design and preconstruction coordination process

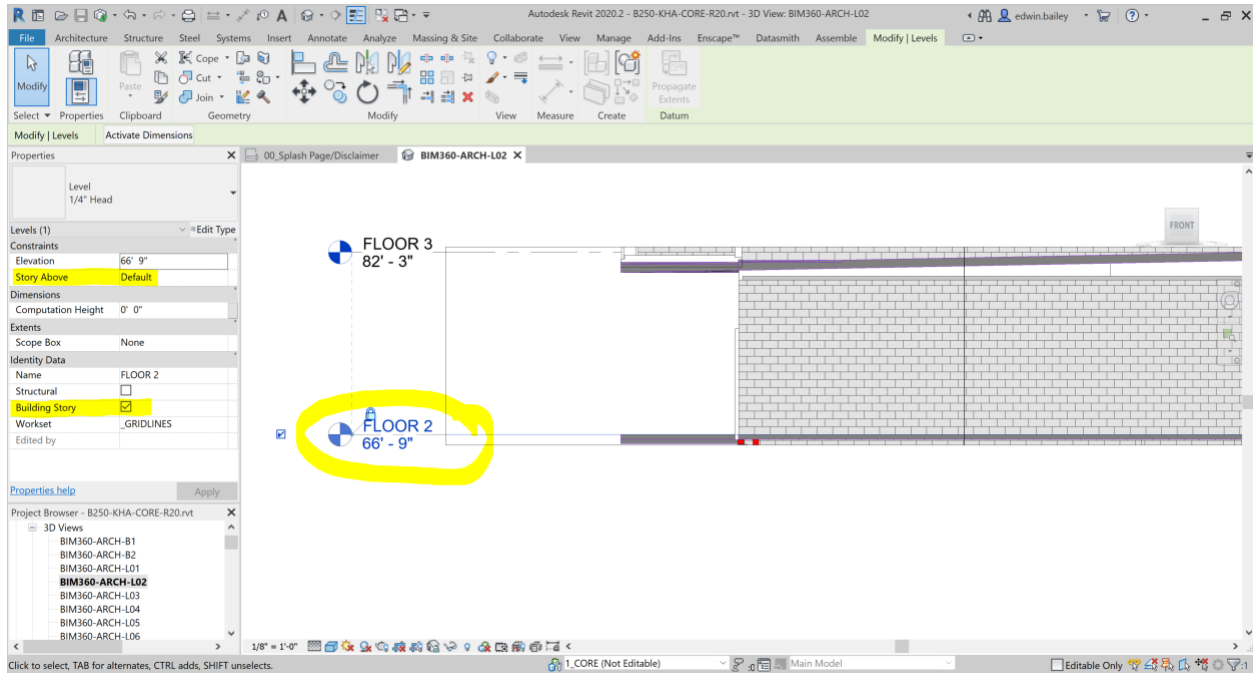
File Types - typically used in Revit models only but can vary. If everyone on design is using Revit, then the project is easier to set up. You don't have to break the model up by levels or areas. All you need is a single model per discipline. MEP files that have more than one discipline should have separate views set up and extracted using publish settings in Revit. Otherwise you'll only get a single model automatically extracted from the default {3D} view.

Model Views - WYSIWYG, Links, Worksets, Section boxes, Phases, Options, Categories and other visibility settings all effect what model geometry is extracted from the Revit files. Unless otherwise specified in publish settings, the default {3D} view will be extracted.

Aligning Revit models - use Shared Coordinates in Revit before uploading. Typically based on the architecture model used to align with civil. It can sometimes be very far away from the project origin, which is fine.

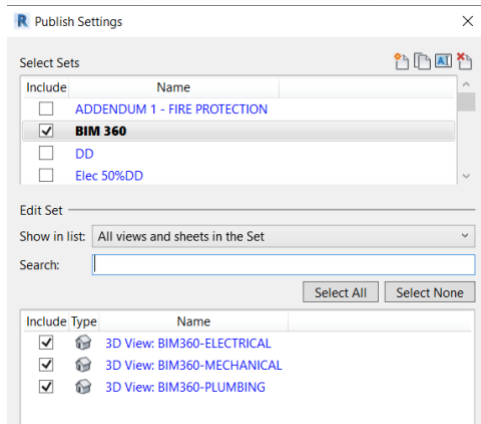


Levels and Building Stories – it's better if each discipline uses the exact same names for levels in each file. If an extra level is required for modeling purposes that isn't an actual building story, you should specify under the level parameters that it isn't a building story. Only levels that are building stories can be used to automatically section the models by level. You don't want to have thin slices of your building.



Revit Level Settings – Uncheck building story for all levels that aren't true building stories.

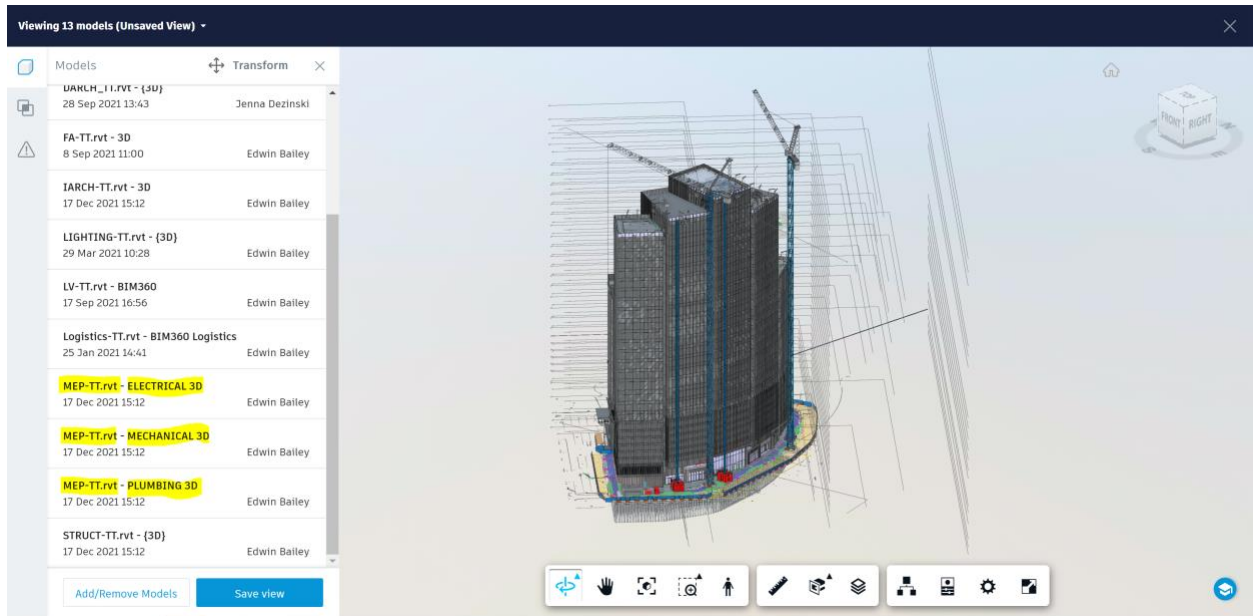
Publish Settings – create a BIM360 or ACC Set depending on which version you are using, then save your views. Make sure the checkbox next to the set and views remains checked. Sometimes someone on your team might not understand the publish settings and edit them when printing sheets, so make sure everyone on your team knows to leave settings as is. Even if you are only extracting one model view per file, I recommend setting up a view vs relying on the default {3D} view, which I find to be problematic. Again, create separate views for each discipline in a single file.



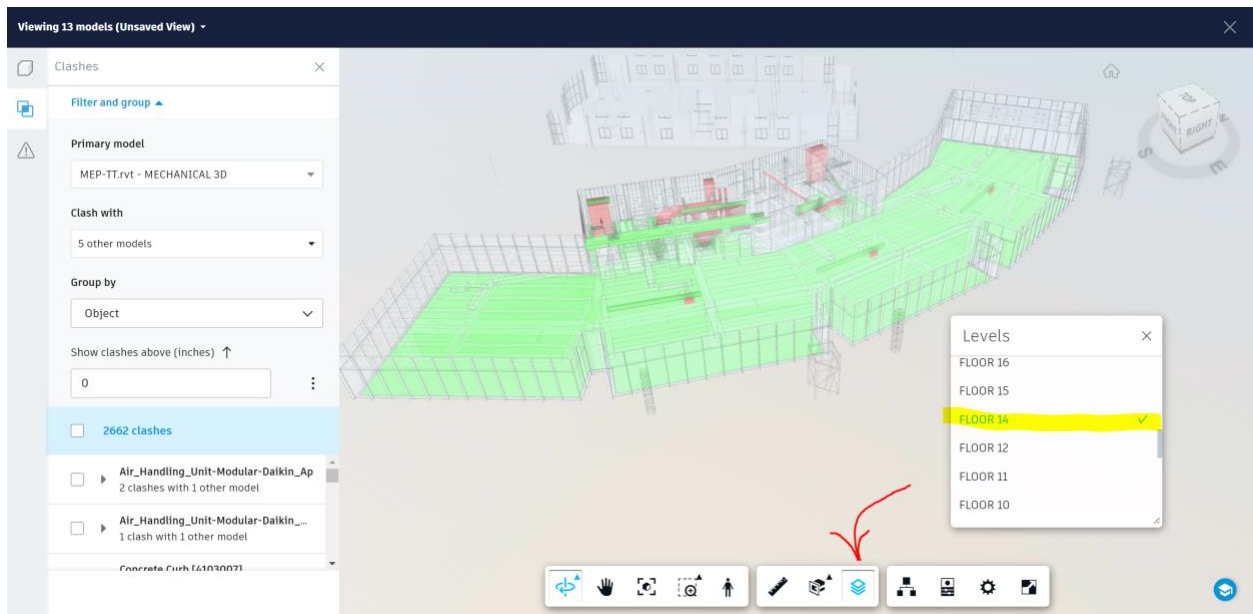
Revit Publish Settings – Notice checked boxes for set and views.

View naming – I like to add a prefix like ACC or BIM360 to each Revit view along with the discipline like Arch, Struct, Mech, Plum, Elec, etc. It makes it easy to add to the published set and can be used to identify which models belong to who in Model Coordination. Example: ACC-ARCH, or BIM360-MECH.

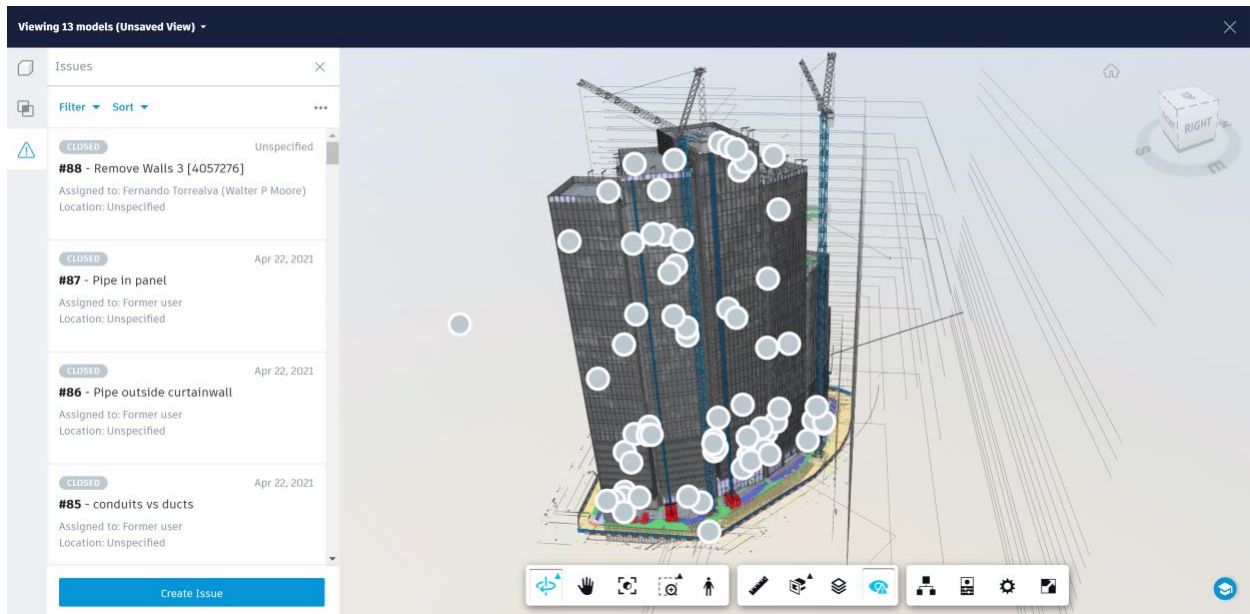
Coordination workflow – skip using the clash matrix and set up a view with all combined models. Once all the models are loaded, go into clash mode, set the primary model you want to see clashed with all other loaded models. Note that you can turn off and on which models you want to see clashed with the primary model without having to fully unload them. When you uncheck secondary models, they get ghosted in the view, meaning you don't need multiple views for each clash set or scenario. Simply change your primary model and which models for which you want to show clashes. The clashes are grouped by primary model. I try to set the primary model as the one that I know will get most of the clashes assigned to that discipline. Example: Set the mechanical duct model as primary and the structural model as secondary since most issues require the duct relocate out of the structure. It also presents the Revit element ID closer to the top of the description for the primary model. Additionally, you can use the level tool to automatically section all the models by level. Model coordination uses the levels from whichever Revit model happens to be first in the order, so that's why it's important for consistency of levels and building stories between Revit files.



Design Coordination Models Combined – Notice MEP models are separated from a single file.



Clash Mode isolated by Revit level.



Issues Mode – Showing resolved issues not isolated by level

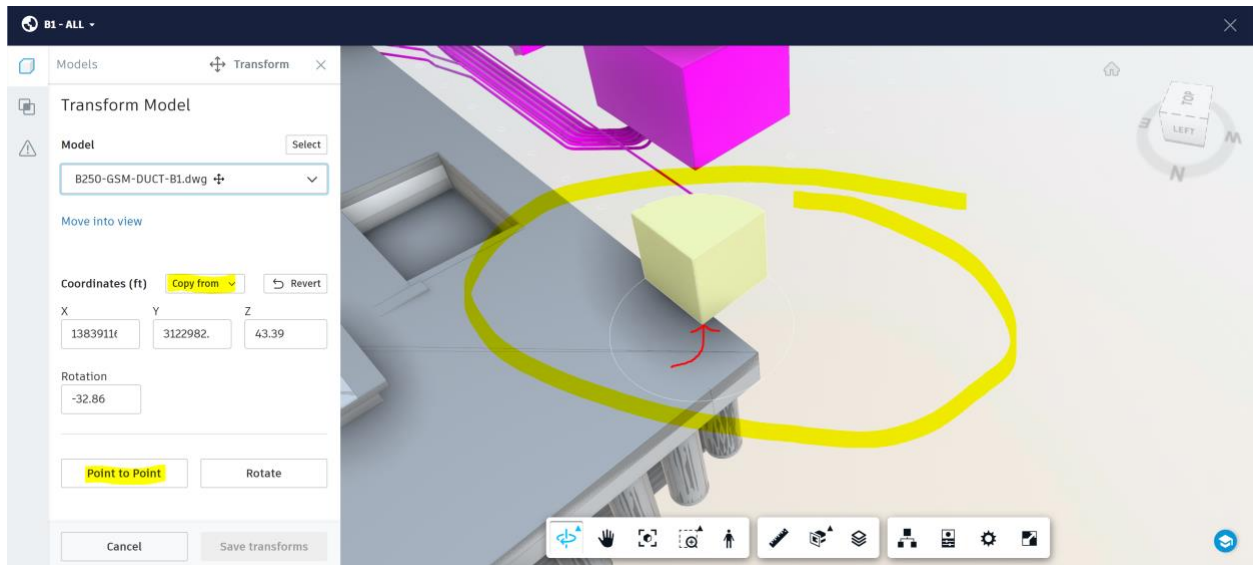
Construction coordination process

File Types - Revit, AutoCAD, and other 3rd party modeling software.

Folder structure – remember to create subfolders for each level if your building has many levels to keep things organized, because CAD-based models are typically generated by level.

Aligning Revit Models - use Shared Coordinates to make sure all Revit models align in Model Coordination.

Align CAD based files – you have two options available here. Don't have all the CAD-based files modeled aligned to the shared coordinate from Revit, because it makes it difficult when linking them into Revit. Instead, model them so that they align to Revit using the internal or project base point. Then, when in model coordination, use the transform tool to align the models to the shared coordinate origin. It helps to set up some 3d cubes at the origin points. Use the point-to-point tool to align your first model per discipline. Then use the copy tool to copy the settings to additional model levels. Don't copy settings between disciplines since the scales might not all be the same. It might re-scale the models instead of aligning them. This problem can happen when files are authored in different tools.



3D cubes at origin points, Use Point to Point to align the first CAD file, then Copy from for all the others for each discipline.

Revit file naming and Views

Use “B1” for Building 1 in file names.

Revit file name example. Central files only, no local versions with user names in the file name, please fill in your **company name**.

B1-Company-R20.rvt

- An individual 3D view for BIM360 must be generated for each trade by level. Offset your 3D section boxes to 1ft above and below top and bottom levels
- When creating a 3D view tailored for BIM360 ensure that the detail level is set to '**Fine**'. This will allow for the full size of the matter being modeled to be displayed.

Follow the below naming convention to fill in the **Xs** for trade:

Ductwork-**DUCT**

Hydronic Piping-**HYDRO**

Plumbing-**PLUM**

Fire Protection-**FP**

Electrical-**ELEC**

Fire Alarm-**FA**

Name BIM 360 views per level with no spaces between the dashes. Add all these views to a Publish Settings Set in Revit. **We are going to create and extract Revit model views per level for each discipline.**

BIM360-XXXX-UG

BIM360-XXXX-B2

BIM360-XXXX-B1

BIM360-XXXX-L01

BIM360-XXXX-L28

Combined Revit File Name and BIM360 Views as shown in BIM360 once extracted.

B1-Company-R22.rvt - BIM360-XXXX-UG

B1-Company-R22.rvt - BIM360-XXXX-L01

DWG or IFC naming convention

Replace “22” with your CAD file version.

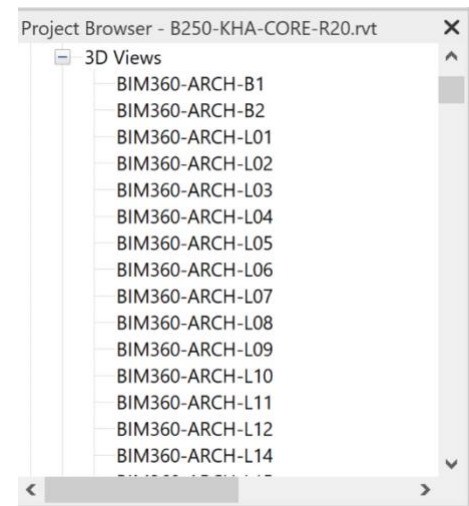
B250-Company-22-XXXX-UG.dwg

B250-Company-22-XXXX-B2.dwg

B250-Company-22-XXXX-B1.dwg

B250-Company-22-XXXX-L01.dwg

B250-Company-22-XXXX-L28.dwg



Coordination workflow – skip using the clash matrix and set up a “View” for each level with all combined models. Like the Design coordination workflow above, once all the models are loaded, go into clash mode, set the primary model you want to see clashed with all other loaded models. The main differences between workflows are how you section the models by level. For design coordination we use the automatic level tool. For construction, we subdivide the Revit models per level like the CAD files and use Views to curate sub lists of model files per level. If you don’t want to subdivide the Revit files, you can try a combination of using Views “model lists” and the Level tool. Remember, you can switch which model is primary vs secondary model, so you only need a saved public view for each level with all models turned on. We try to create assigned issues before the meetings but jump in and out of clash mode, regular model mode and the list of assigned clashes. Filters work great for isolating which clashes to focus on during meetings. Most meetings are held virtually with team members across the country on many of our projects. It’s easy for each member to quickly share their screen when talking about issues they might have found within the models and views.

AUTODESK Construction Cloud

Model Coordination - Block 250 B

Edwin Bailey

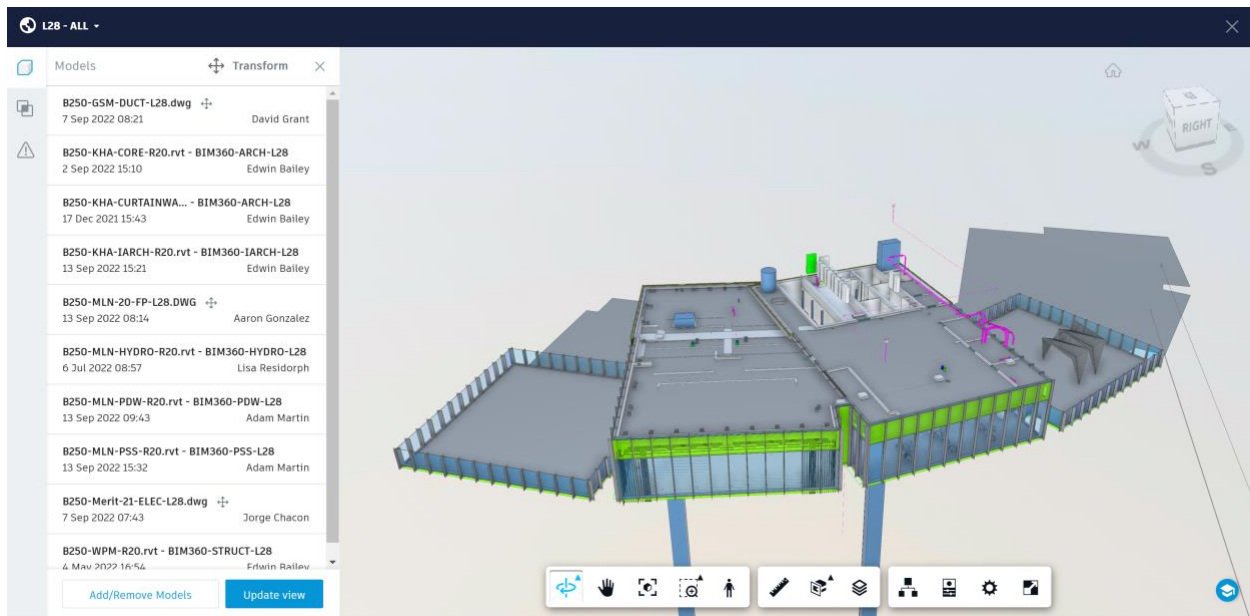
Sub Coordination

Last clash check 13 Sep 2022 16:02

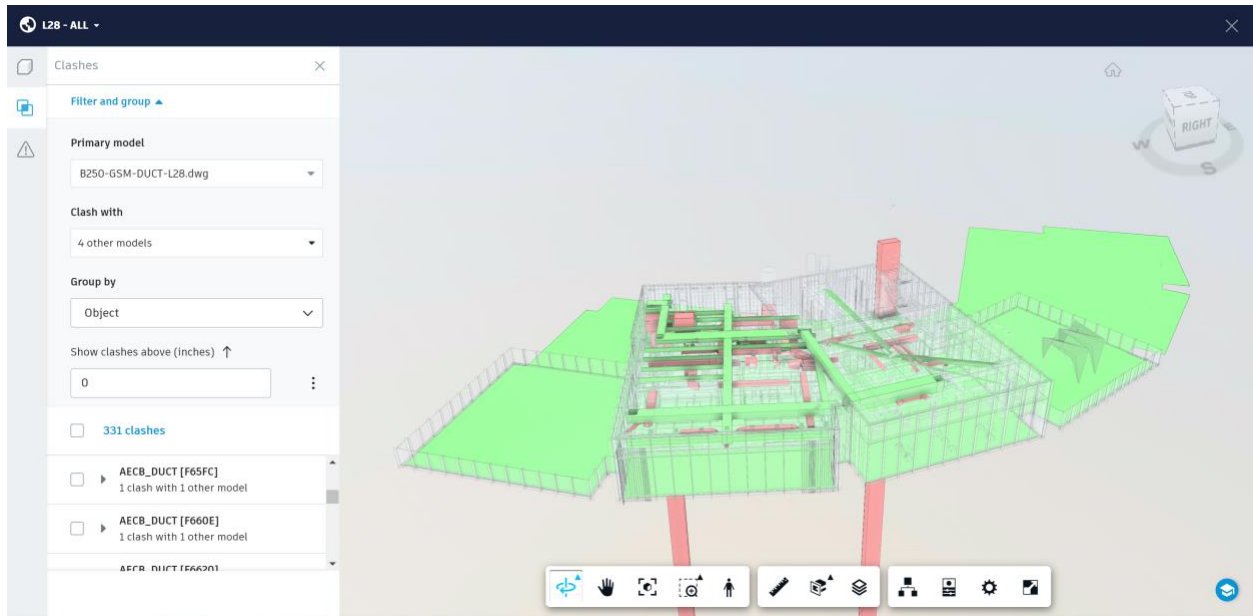
Title	Created by	Updated on	Privacy
RF - ALL	Edwin Bailey 6 Jun 2022 16:35	6 Jun 2022 16:35	
L28 - ALL	Edwin Bailey 6 Jun 2022 16:34	7 Sep 2022 10:26	
L27 - ALL	Edwin Bailey 6 Jun 2022 16:33	6 Jun 2022 16:33	
L26 - ALL	Edwin Bailey 6 Jun 2022 16:32	6 Jun 2022 16:32	
L25 - ALL	Edwin Bailey 6 Jun 2022 16:31	6 Jun 2022 16:31	
L24 - ALL	Edwin Bailey 6 Jun 2022 16:30	6 Jun 2022 16:30	
L23 - ALL	Edwin Bailey 6 Jun 2022 16:29	6 Jun 2022 16:29	
L22 - ALL	Edwin Bailey 6 Jun 2022 16:29	6 Jun 2022 16:29	
L21 - ALL	Edwin Bailey 6 Jun 2022 16:28	6 Jun 2022 16:28	
L20 - ALL	Edwin Bailey 6 Jun 2022 16:27	7 Sep 2022 10:22	
L19 - ALL	Edwin Bailey 6 Jun 2022 16:26	7 Sep 2022 10:21	

model.b360.autodesk.com/projects/bbf7b577-0682-4edb-82c1-23cf8bc0f59f/_viewer

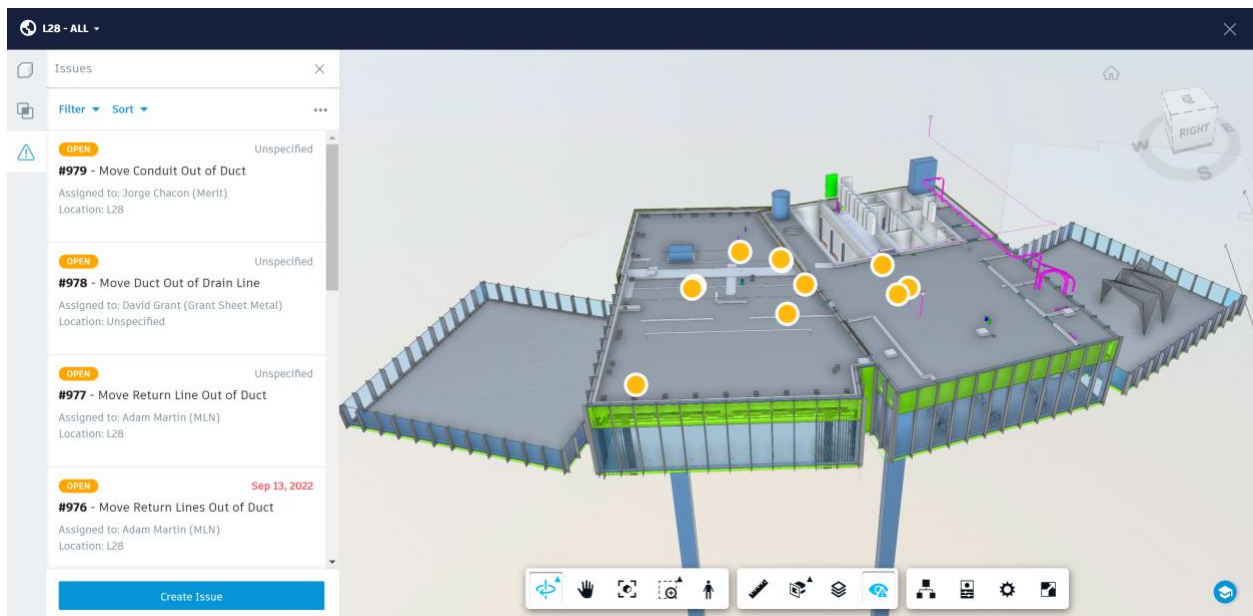
Model Coordination Views – “Model Lists by Level”



Regular Model View Mode – Notice list of models



Clash Mode – Notice Primary model vs Clash with currently four other models.

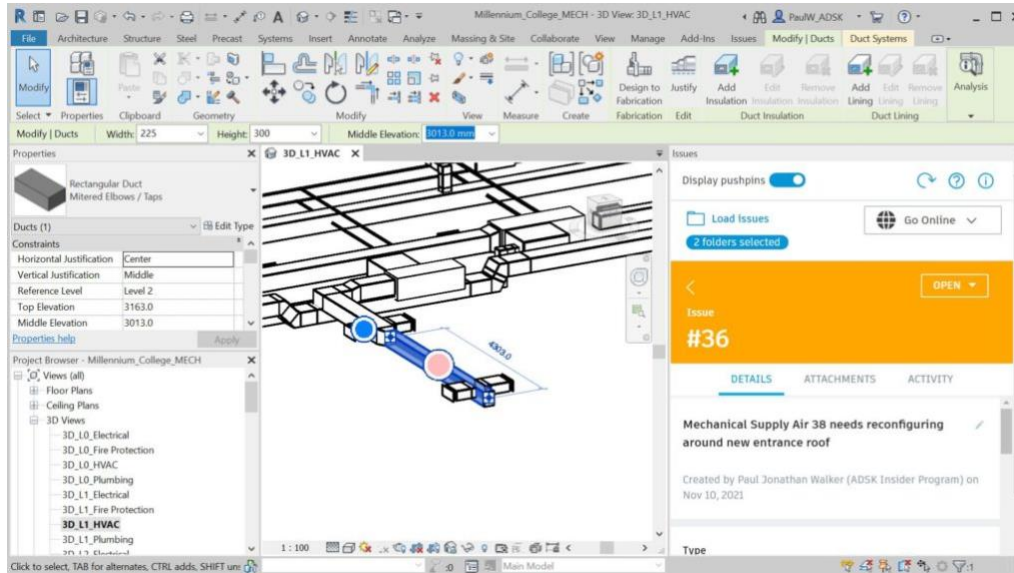


Issues Mode – Great for starting meetings on what needs to be worked on

Issues plugins for Revit and Navisworks

The **Revit** plugin is found product updates in the link below:

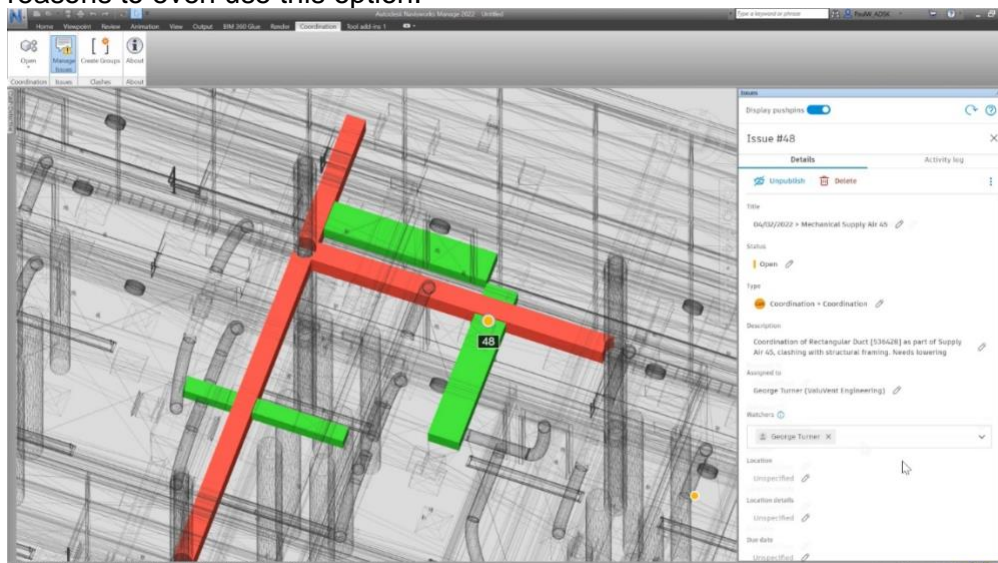
<https://manage.autodesk.com/products/updates>



The **Navisworks** Plugin is currently found here:

apps.autodesk.com/NAVIS/en/Detail/Index?id=5155805354033590972

I generally push the teams to use the browser-based solution over the Navisworks plugin. I feel like it is a legacy crutch. Personally, I haven't really used Navisworks since 2018. I'm not saying it still doesn't have a place, but I genuinely feel it's now mostly unnecessary. You have the option of creating issues within Navisworks, but the clash grouping is so much better in the online version, and we hold all our meetings based in the browser version too. There are limited reasons to even use this option.



Thank you!