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Democratizing Clash Detection with BIM 360 Model Coordination to Improve Design Quality

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Learning Objectives

- Understand Lonely, Hybrid and Democratized Clash Detection
- Learn about BIM 360 Design Collaboration and Model Coordination
- Learn how to setup Revit for BIM 360 Model Coordination
- Learn how to setup BIM 360 Design Collaboration and Model Coordination
- Setting up and working with clashes
- Working with Model Coordination Issues
- Learn best practices for collaboration and coordination

Description

Hear how AECOM used model coordination for a fast track airport project in Qatar that involved over 40 buildings, hundreds of project team members from numerous AECOM offices and thousands of clash reports. BIM 360 Model Coordination moves clash detection efforts beyond the BIM experts – Allowing designers, engineers, managers and other team members to review and access up-to-date model coordination information.

In this session learn how Model Coordination with BIM 360 can automatically clash project models and share coordination issues with the project team. BIM 360 Model Coordination can be used by any team member without the need for Revit, Navisworks or other specialized software. Model Coordination issues are managed by BIM 360 removing the need to distribute clash reports or manage Navisworks exports from your BIM software.

Speaker(s)

Dennis McNeal, AIA
Dennis is a licensed architect and BIM Manager for AECOM in Roanoke Virginia and alumni speaker at Autodesk University. At AECOM, Dennis guides BIM planning, standards, project setup and assists project teams with their design efforts. He is also responsible for training BIM staff, investigating new technology and promoting and refining project workflow improvements.

Prior to joining AECOM Dennis worked for Autodesk on the Revit development team.

AECOM Roanoke is a full-service architectural engineering firm specializing in healthcare and United States government projects worldwide. Projects are often large, complex with dispersed team members and increasing shorter delivery schedules. We have about 200 design professionals in our Roanoke office and often collaborate with some of the other 20,000 Buildings + Places staff of AECOM.

Matt Anderle

Matthew Anderle is the Building Information Modeling (BIM) director for Buildings + Places business line of AECOM, with focus on Americas. He is a BIM and technology evangelist with over 19 years of experience establishing global BIM workflows and standards around content, computational BIM, interoperability and BIM consultation as a service. His experience spans over multiple market sectors with emphasis on large healthcare facilities, data centers, aviation, government projects and science facilities. Mr. Anderle serves AECOM as leader in the advancement and efficient implementation of BIM processes for a variety of project types. He manages and directs large distributed project teams to successfully implement BIM collaboration workflows, enabling global offices to work as one entity.

Clash Detection – Lonely, Hybrid or Democratized?

Autodesk offers three primary options for clash detection: Navisworks, BIM 360 Glue & BIM 360 Model Coordination. Following is a quick overview and my classification for each.

Navisworks – Lonely Clash Detection 

Navisworks, the granddaddy of clash detection is a mature, fully capable tool for clash detection. Unfortunately, it requires an expert to manage and share issues and is standalone software that can't be shared by multiple users. For this reason, I'm calling Navisworks 'Lonely Clash Detection'.

BIM 360 Glue – Hybrid Clash Detection 

BIM 360 Glue combined with Navisworks straddles the divide between Lonely and Democratized clash detection. Clashes are 'glued' from Revit and setup/managed using a combination of BIM 360 Glue and Navisworks. This process allows greater collaboration than Navisworks but is more complex – Requiring a BIM 360 glue site, site management and multiple software tools.

BIM 360 Model Coordination – Democratized Clash Detection 

BIM 360 Model Coordination is disrupting legacy clash detection workflow by minimizing the need for expert involvement and allowing the project team to fully participate in reviewing clashes. Model Coordination is part of BIM 360 Docs, so it shares space with project models and the Design Collaboration review space.

AECOM Airfield Project – Democratized Clash Example

More Work/Less Time

In 2019 AECOM was awarded an airfield project consisting of more than 40 buildings and 2.5 million square feet and given 12 months to complete the design task. A similar project in 2017 was 1/3 the scope and completed in 12 months.

The airfield project has more than 300 team members from various geos – This was obviously a project for BIM 360 and one that needs to gain efficiencies wherever possible!

One important efficiency planned for the airfield project was BIM 360 clash detection.

Clash Detection – Share the Work

On this project Model Coordination was setup by the BIM Manager and managed by each discipline BIM Lead. Discipline BIM leads shared clash review tasks with each building team.

Democratized Clash Detection

Many Hands to Meet the Schedule

Using BIM 360 Model Coordination allowed this large task to be shared by many. Lonely or Hybrid approaches would have relied on one or two clash managers, overwhelming them and jeopardizing the project schedule.

Design Collaboration and Model Coordination

The precursor to clash detection is coordination & it's no secret that coordination is crucial for a successful project. If needed, help your team know the difference between coordination and clash detection and when to use them

Analog Coordination

Consider having early team meetings to discuss system routing and other coordination concerns before teams start modeling their systems. As the project develops, use Design Collaboration and Model Coordination.

BIM 360 Design Collaboration

BIM 360 Design Collaboration is where models are viewed and can be easily used by non-Revit staff, allowing insight into the model for the entire team.

Consider utilizing brief standup style meetings, using Design Collaboration to review models with the team.

Group Model Review

BIM 360 Model Coordination

BIM 360 Model Coordination is where clashes are reviewed and dismissed or assigned.

Consider inviting non-traditional clash reviewers to BIM 360 to participate in reviewing clashes – Managers, interns and any team member can contribute to clash reviews!

Setup Revit for BIM 360 Model Coordination & Design Collaboration

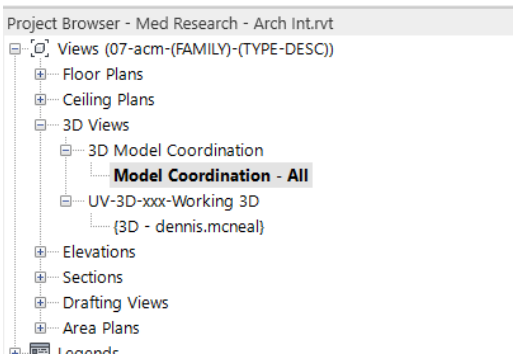
BIM 360 will utilize published views from your Revit models to drive Model Coordination and Design Collaboration content.

3D Revit Views

Setting up 3D views is critical for BIM 360 since only visible elements in your view are published. This WISIWIG approach allows you to filter elements from your view that you don't want to participate in clashes.

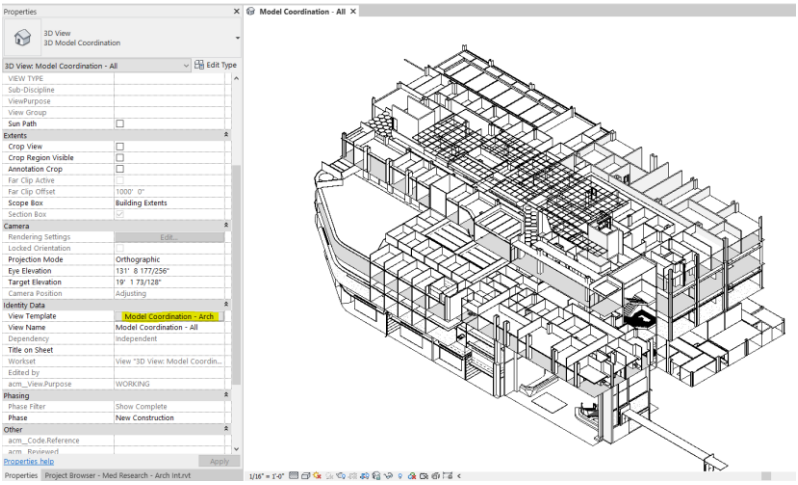
View Suggestions

Consider creating a Revit View Category specifically for model coordination and place the views you want to publish there. In our model you see the category is, '3D – Model Coordination' and the view name is prefaced with, 'Model Coordination – '.



Project Browser

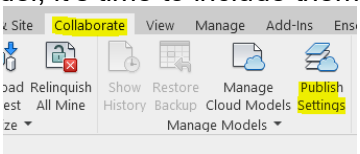
Create and apply a unique View Template for each Model Coordination view to provide allow control of what model elements are displayed in the view and you want to include in clash detection.



Model Coordination View

Revit Publish Settings

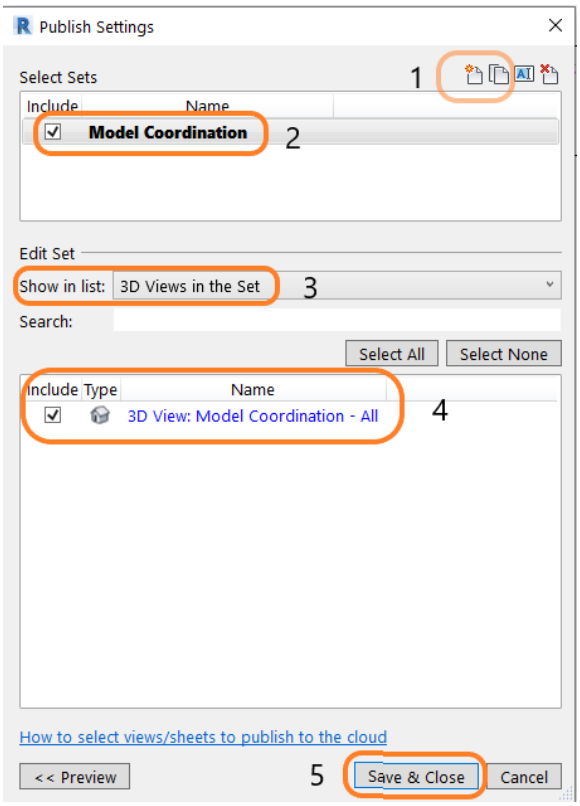
With clash views setup in your model, it's time to include them in Revit's publish settings.



COLLABORATE > PUBLISH SETTINGS

In the Publish Settings dialog shown in the image below:

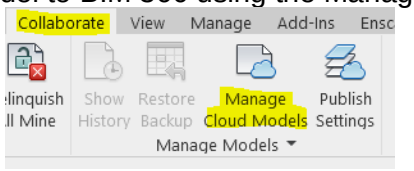
1. Create a Model Coordination Set
2. Select it
3. Edit the Set to include '3D Views in the Model'
4. Select the 3D Views you created for clash detection
5. Save & Close



PUBLISH SETTINGS

Publish Model to BIM 360

You can directly publish your Model to BIM 360 using the Manage Cloud Models tool.



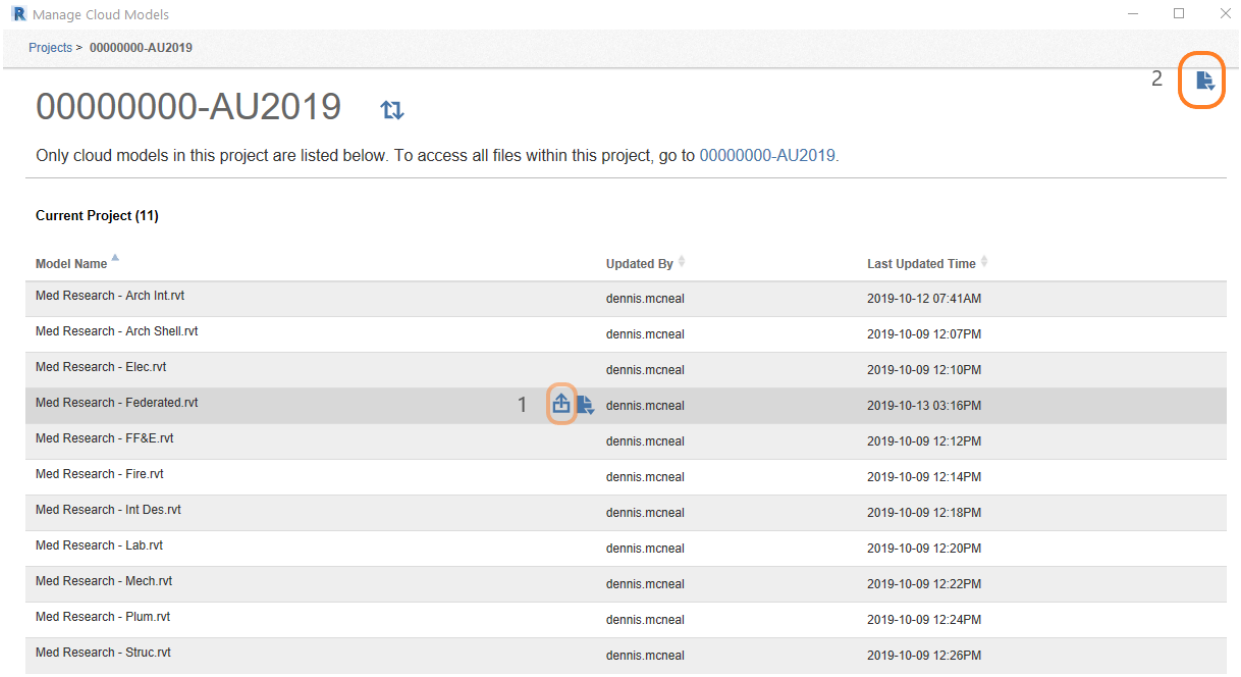
COLLABORATE > MANAGE CLOUD MODELS

SELECT PROJECT

Publish Options

Manage Cloud Models supports publishing a single model or all models

1. To publish a single model: Hover over the model you wish to publish & select the Publish Latest tool
2. To publish all models: Select the Actions dropdown tool from the upper right of the dialog & select Publish All



PUBLISH SINGLE OR ALL MODELS

If you find BIM 360 working unexpectedly – Things like minor display issues or a tool not working, try switching Browsers. Firefox or Chrome are your best bet.

Viewing and Verifying Published Models

Publishing models to the BIM 360 cloud will require some time – That varies depending on your internet speed and size and number of models. Once published, models can be viewed in BIM 360.

BIM 360 Models

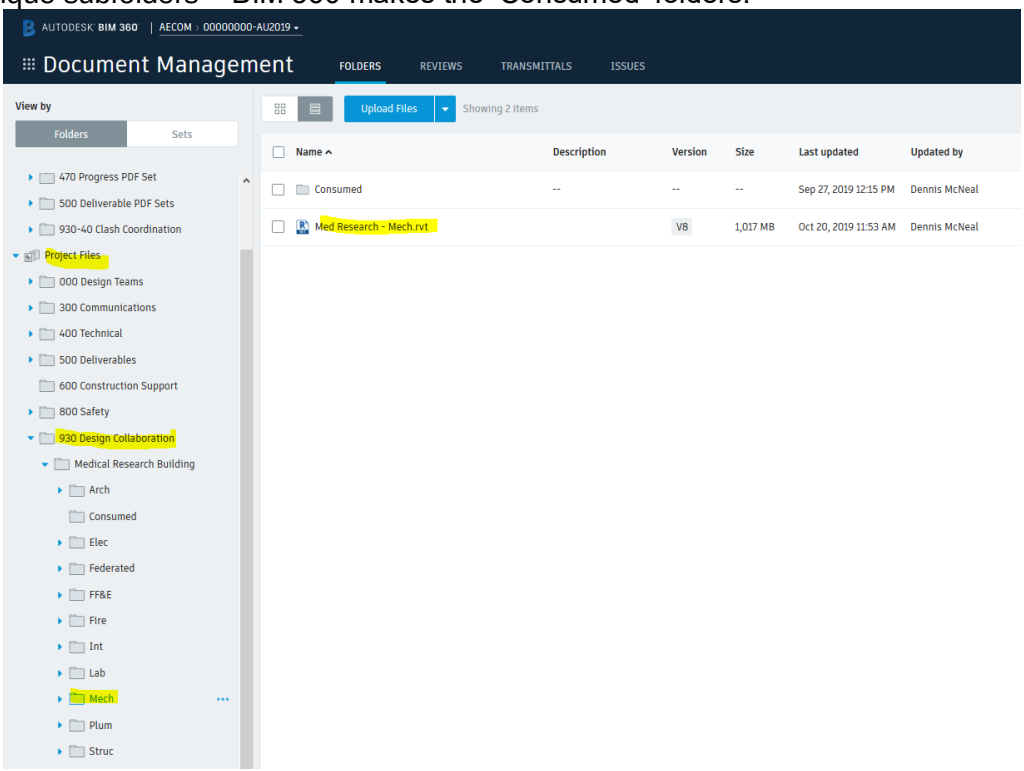
BIM 360 Folders

All BIM 360 projects have Plans and Project Files folders. Subfolders can be configured as desired.

Project Files Folder

Models always publish to a BIM 360 **Project Files** folder – This folder structure is configurable, so your projects folder structure might vary from what's shown below.

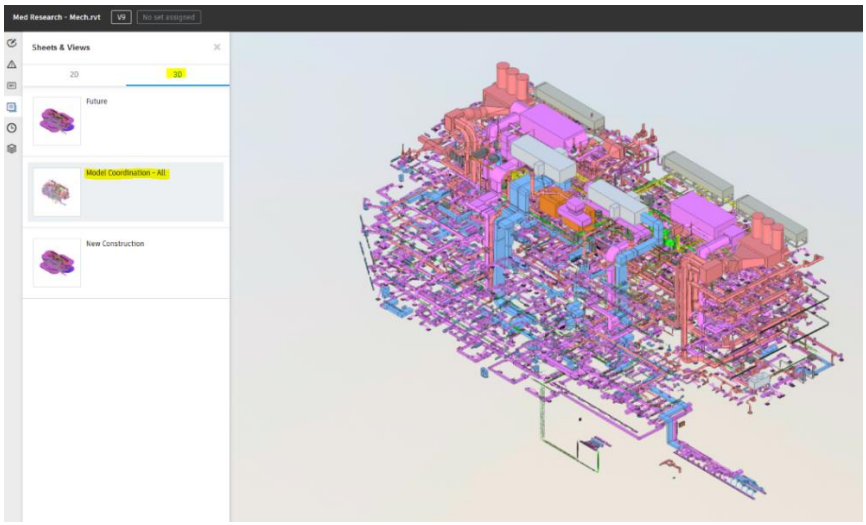
View published models by browsing to the Project Files folder or subfolder of your project. This location was determined when Revit created the cloud model. The image below shows the project model in the Mech folder – We chose to place discipline models in unique subfolders – BIM 360 makes the 'Consumed' folders.



BIM 360 MODEL FOLDERS

Select the model name to view the model's published views. The default is 3D and you can toggle to 2D as well.

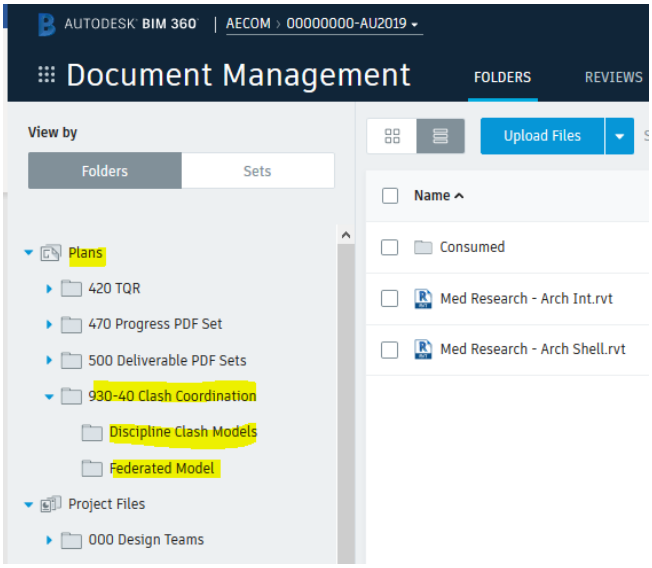
Revit's Publish Settings determines what views display in the 2D & 3D categories. BIM 360 automatically adds the 'New Construction' view



PUBLISHED 3D VIEW EXAMPLE

Plans Folders

Plans folders are also found under Document Management, are customizable so they can be made to emulate your standard local network folder. For Model Coordination you will need at least one folder for coordination models. My example shows two subfolders under a Clash Coordination folder.



BIM 360 PLANS FOLDERS

Design Collaboration uses your published models but models for Model Coordination must be copied to your designated Plans ‘clash’ folder

Design Collaboration

Design Collaboration uses your published models and can be used to view the latest or a previous version of your models. Before using Design Collaboration you will need to create Teams

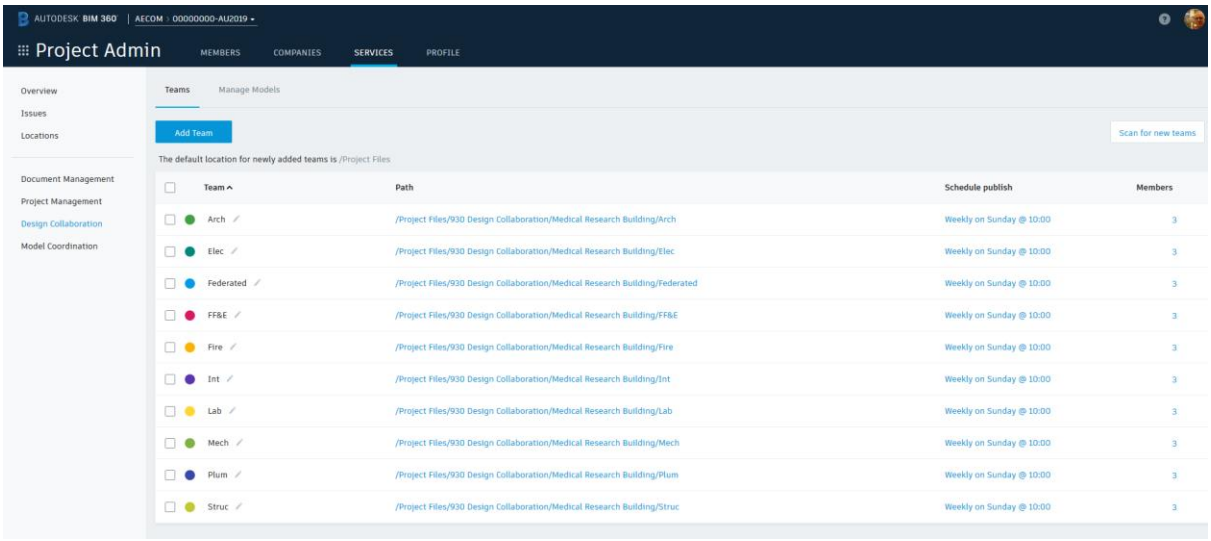
CREATING TEAMS

To create a Team, go to Project Admin > Design Collaboration & select the Add Team button

Each Team will require a team name, a path where the published design models are found & optionally a scheduled publish date

- Consider setting up a weekly date and time to publish the latest versions of you models using Schedule Publish

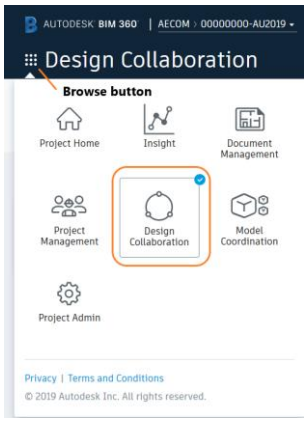
The image below shows the teams I made for our project – One Team for each discipline plus a team for the federated model



TEAMS

VIEWING A MODEL

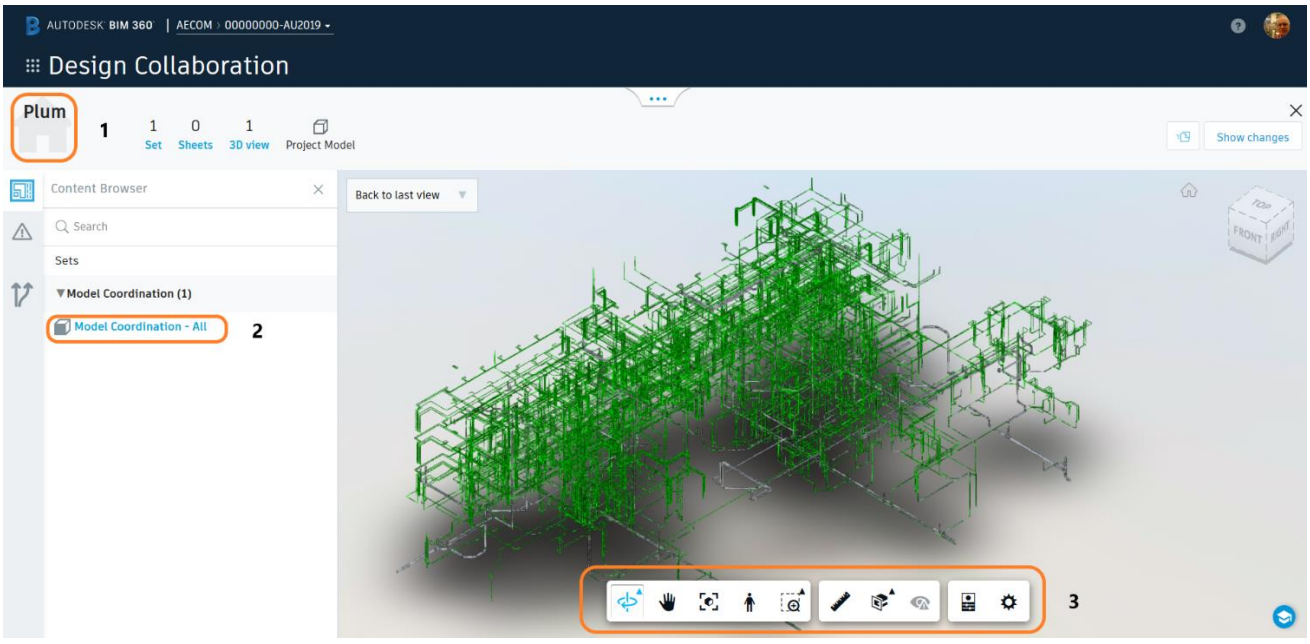
Navigate to Design Collaboration by selecting ‘Design Collaboration’ from the browse button



BROWSE TO DESIGN COLLABORATION

The image below shows a version of our plumbing model

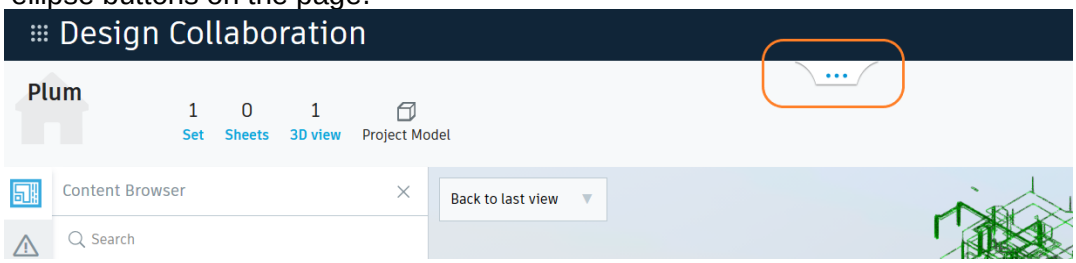
1. The Team is shown in the upper left corner of the screen
2. The view displayed is identified in the Content Browser
3. Navigation & Review tools help you and your team review the model



DESIGN COLLABORATION VIEW OF PLUMBING MODEL

MODEL VERSIONS

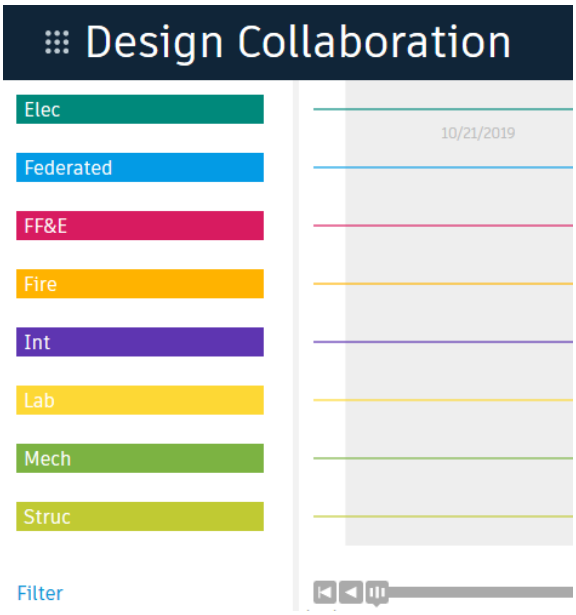
To see published model versions of your model or other shared models, select the ellipse buttons on the page.



NAVIGATE PUBLISHED MODELS

After selecting the ellipse tool, you will see A timeline for Shared and your current model

Selecting ‘Shared’ will show all available models



Selecting the white triangle of your current model will display a detailed timeline of model versions

Selecting any of the nodes along the timeline will display that version of the model in the viewer

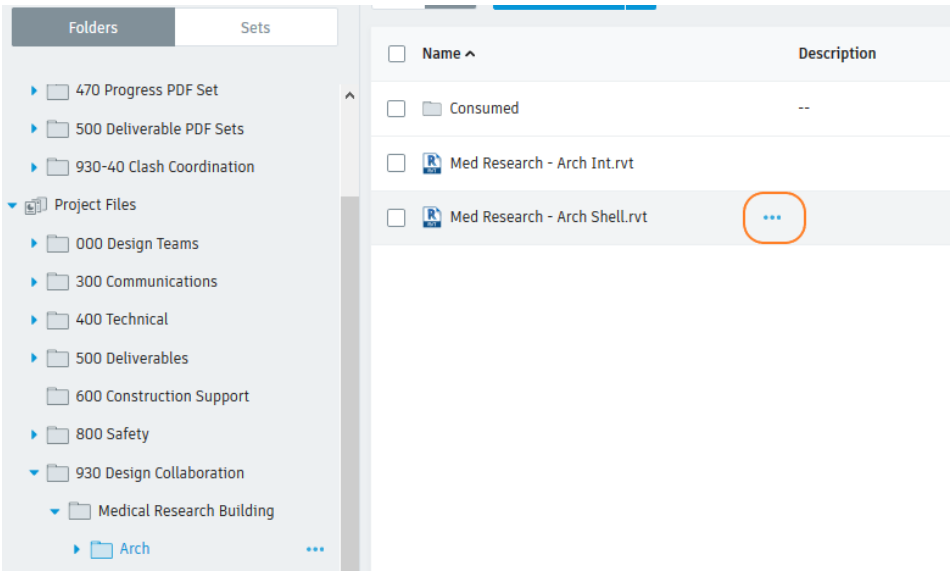
Model Coordination

Consider publishing your models before copying them to your Plans clash folder to assure you have the latest version for clashing.

Copying and Posting Clash Models

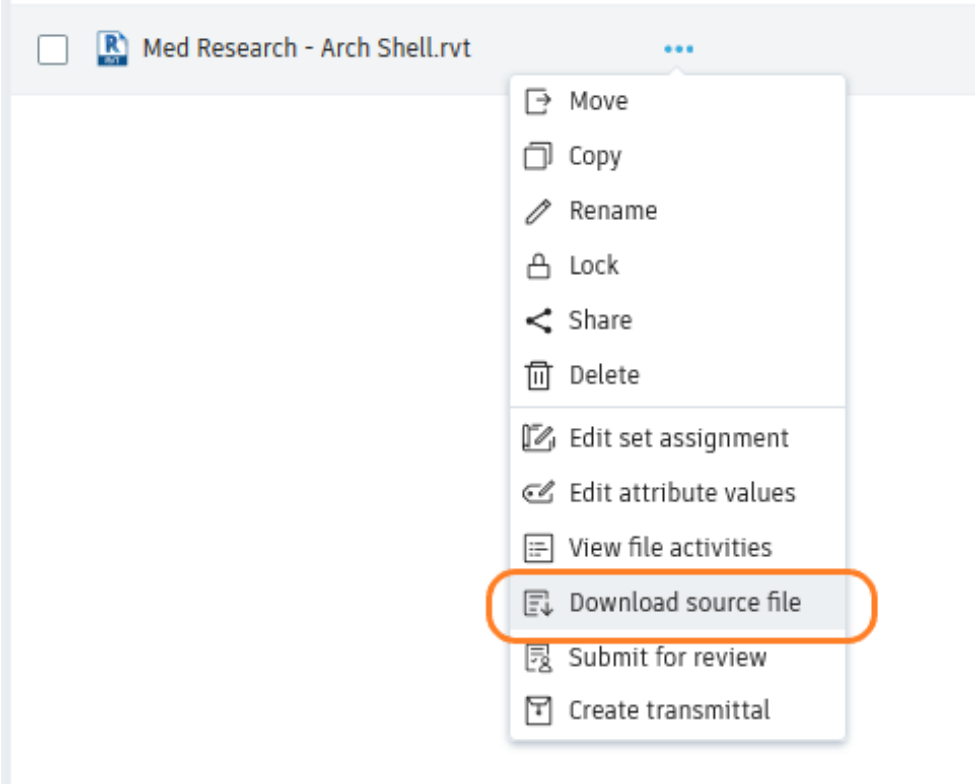
Copy Model(s)

Go to a folder in Document Management where your published models live. When you hover over a model, notice the ellipse buttons that display next to the description column



HOVER TO DISPLAY ELLIPSE BUTTON

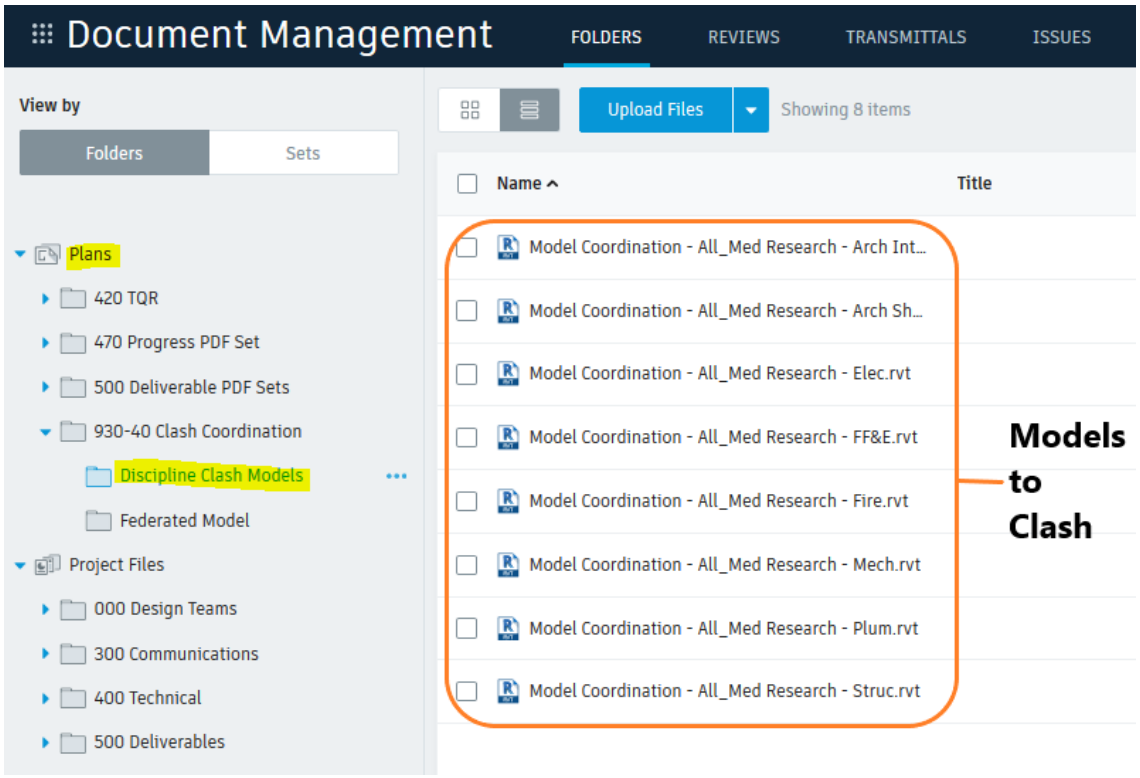
Select the ellipse control and pick Download source file – Save the file to a temporary location



DOWNLOAD SOURCE WILL COPY THE FILE + ALL LINKED FILES

Posting Models

Now we will post our models to the clash folder by first navigating to a clash folder under Plans and copying the models we downloaded to that folder. Verify that you have all models needed for Model Coordination



CLASH MODELS

The difference between models Design Collaboration and Model Coordination is how the models are updated.

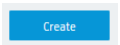
- Design Collaboration models update when published
- Model Coordination files are updated when copied

Setup Clash Models

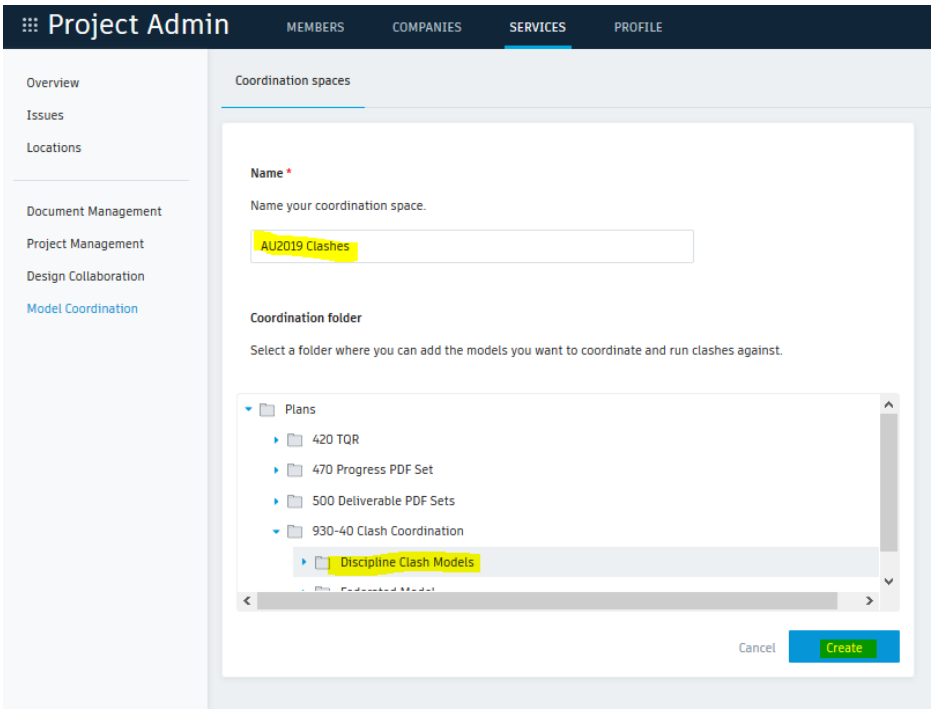
With the models you need in your Plans clash folder you're ready to setup Model Coordination

Setup Coordination Space

Before BIM 360 can clash your models, you need to create a Coordination Space. The Coordination Space needs a name and for you to specify the folder where your clash models are found.

Navigate to Project Admin > Services > Model Coordination & select the blue 

button to make a Coordination Space. I made one called **AU2019 Clashes** and selected the folder with our clash models



Create a Coordination Space

BIM 360 creates your Coordination Space and makes it active automatically. If you need multiple Coordination Spaces, just repeat the above steps to make unique folder and name your new Coordination Space

Automatic Cloud Clashing

BIM 360 will automatically clash models when placed in the folder specified by an active Coordination Space

Model coordination results are not available immediately. The time required to see results will vary depending on the size and quantity of models being clashed

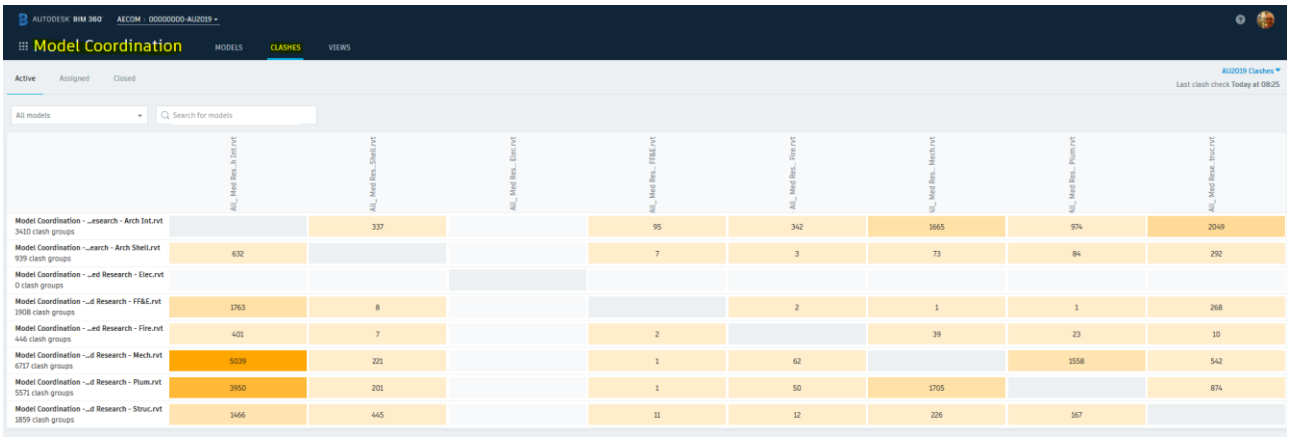
Working with Model Coordination

Working with Clashes

Go to Model Coordination > Clashes to see the clash matrix BIM 360 has generated from your models

Clash Matrix

The clash matrix is a one-to-one evaluation of all models from your Coordination Space. The largest number of clashes is represented by a darker color cell containing the number of clashes

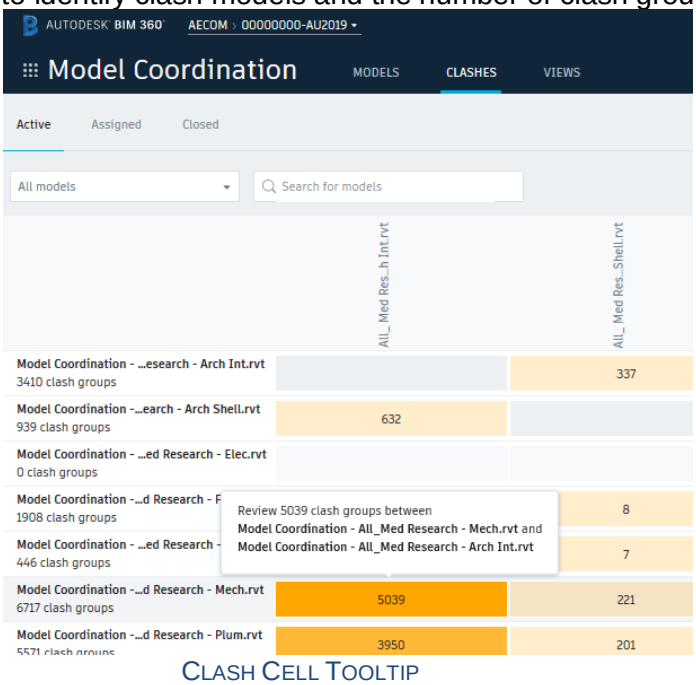


Model Clash Matrix.

- Initially the number of clashes will probably appear daunting but it's important to jump in and start evaluating. At this point you have a great opportunity to share this task with other team members – Many hands make for light work!

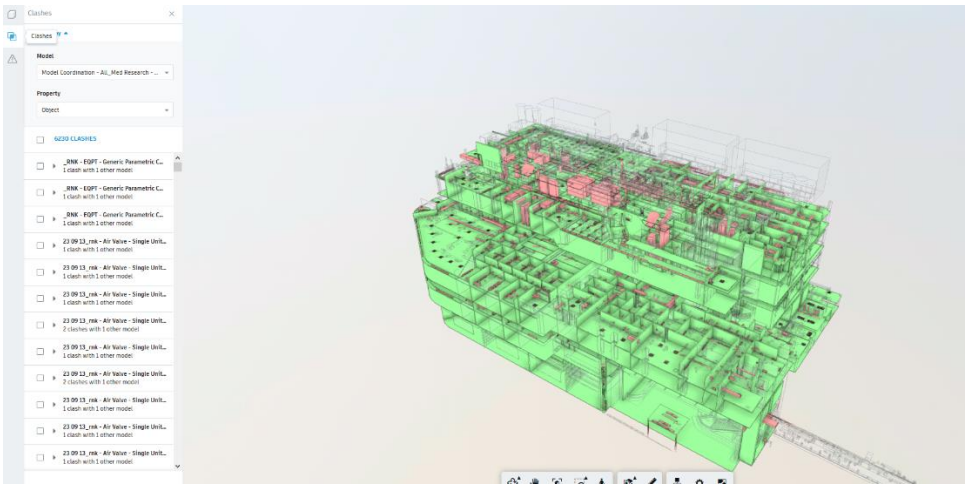
View Clashes

Hover over a cell to identify clash models and the number of clash groups



CLASH CELL TOOLTIP

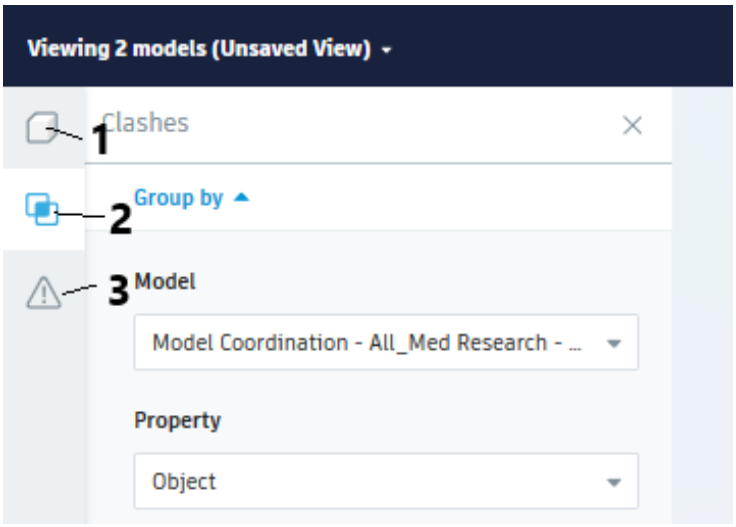
Select a cell to view clash groups. Clashes are listed in the left column and displayed in the viewer.



ALL CLASHES

Three icons in the upper left of your page will allow you to:

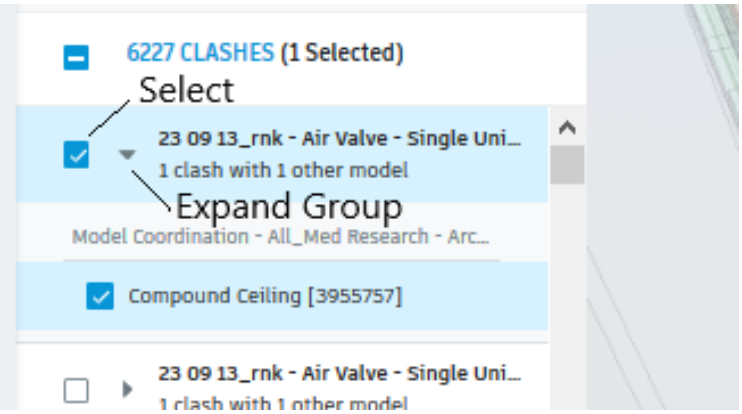
1. Switch to Model View
2. View Clashes (default)
3. View Issues



CLASH VIEW CONTROLS

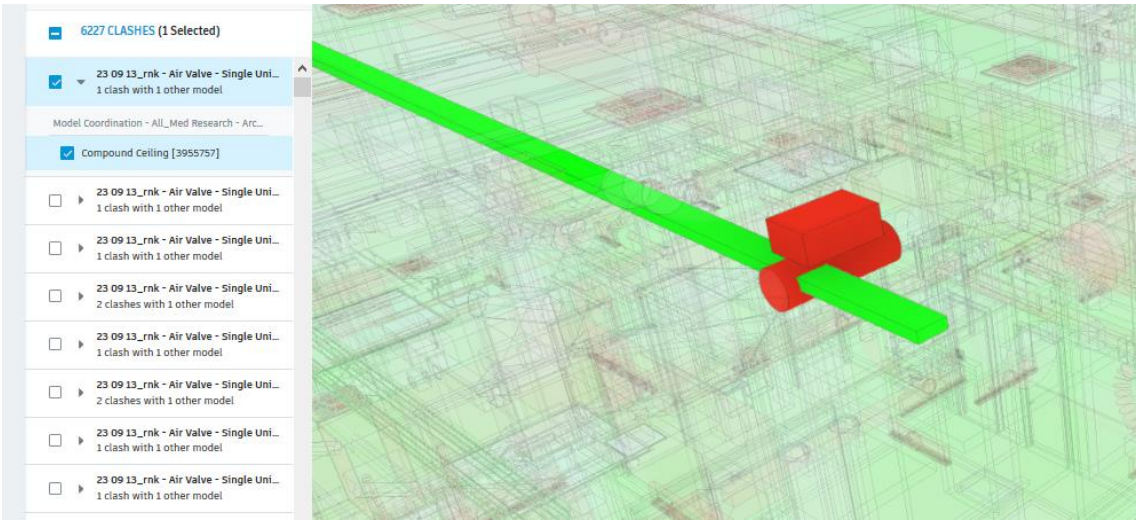
View a clash by:

1. Selecting a clash group
2. See additional information by expanding clash group



CLASH GROUP CONTROLS

When a clash group is selected, the graphics window highlights the clash. The image below shows a mechanical device clashing with a ceiling



CLASH GROUP

Vetting BIM 360 Clashes

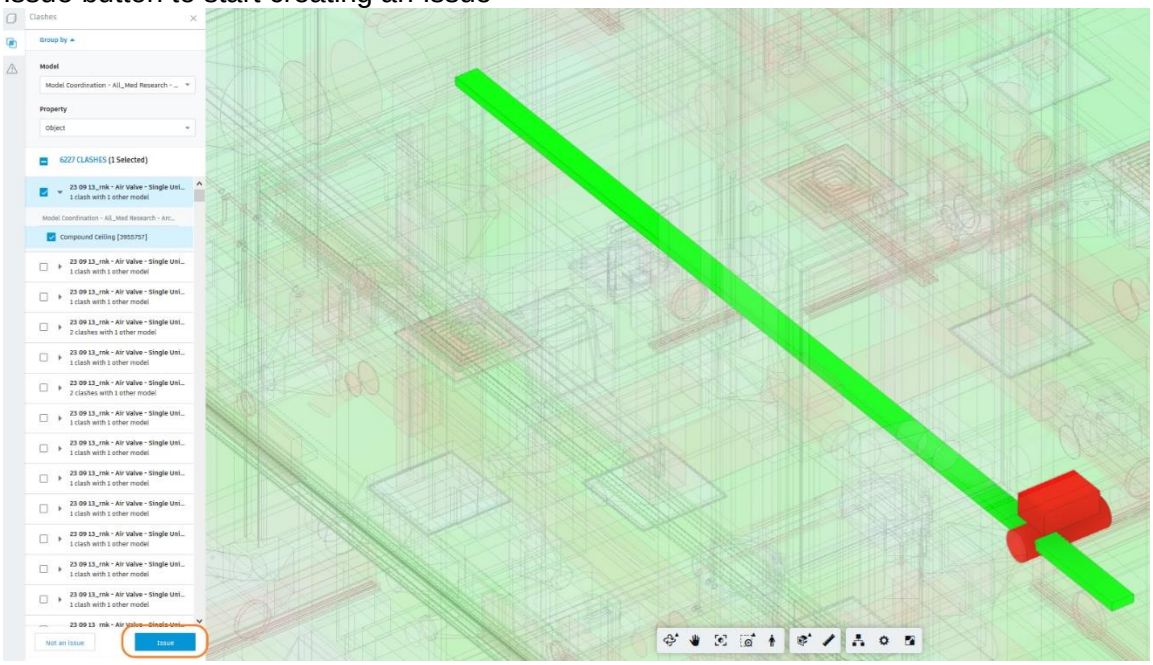
The reality of current clash detection tools is that you (a human) needs to review clashes to determine if the clash is an Issue or a false clash. Many of the 'clashes' found by BIM 360 are expected and will not considered an issue.

What determines a clash varies depending on context. For example, it's not normally expected for design models to always have an element cut to allow passage of another – IE: A duct through a wall whereas a construction model might desire the wall cut to accommodate the duct. Clash detection simply compares one elements' geometry to another in space & if they touch, considers that a clash.

A major part of the effort for clash detection is vetting the true clashes from the false ones. Our job is to clear away the false clashes so we can identify clashes that need to be addressed in the Revit model(s).

Creating an Issue

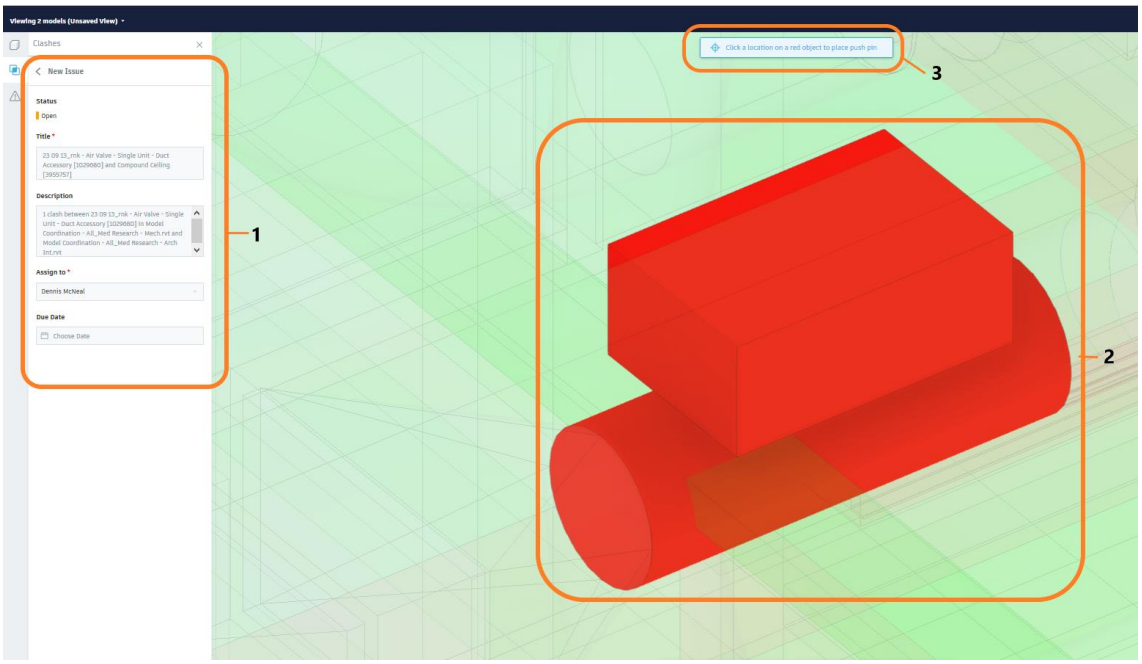
Once you've verified that a clash group represents a real clash, it's time to create an Issue. The image below shows a clash. With the clash group selected, pick the Blue Issue button to start creating an Issue



CREATE AN ISSUE

A New Issue is started and:

1. Issue data appears in the left column
2. In the graphics screen on of the clash group elements is highlighted
3. A tooltip displays reading "Click a location on a red object to place a push pin



NEW ISSUE

Your New issue requires the 'Title' and 'Assigned to' fields to be complete. Check the values & modify as needed. Pick the red element and then select the Create button to complete creation of the Issue.

After your Issue is created you are returned to the Clashes page. Repeat until you have created all Issues.

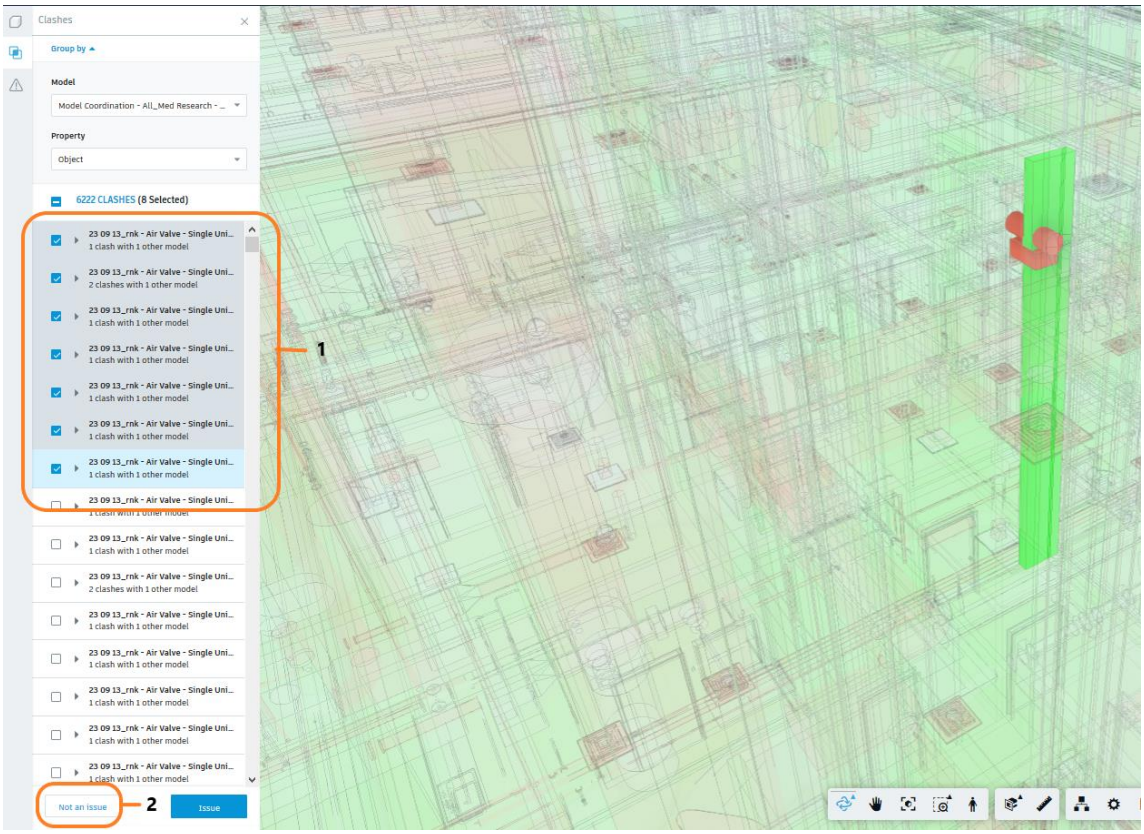
Clearing a Clash Group – Not an Issue

As mentioned previously many clashes won't be considered clashes by the team and need to be dismissed.

Once a clash is dismissed as Not an Issue it remains dismissed unless the element position changes

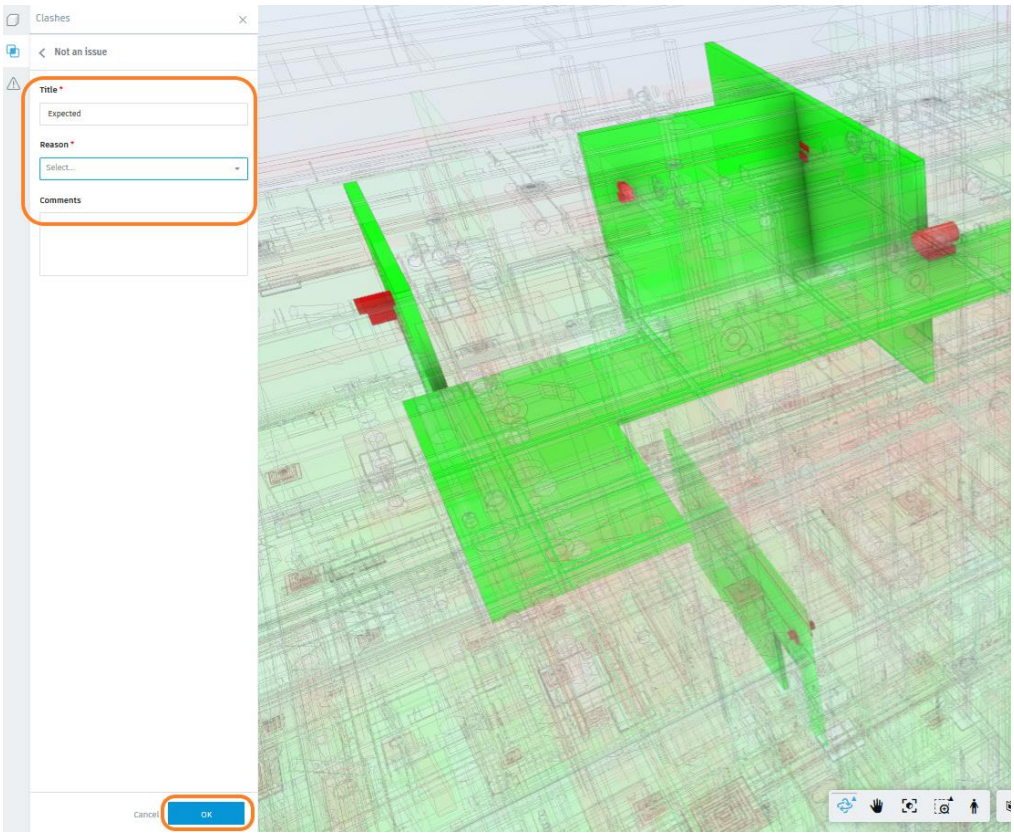
In the image below I've selected 7 'clashes' that I want to dismiss.

1. All Clash Groups are selected
2. Select Not an Issue button



NOT AN ISSUE

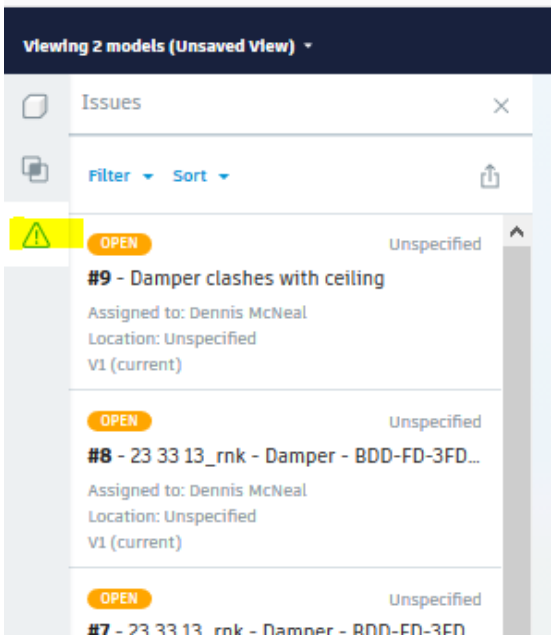
The Not an Issue page displays – Provide a ‘Title’ and select a ‘Reason’ that most closely matches or select Other to provide additional information. Pick OK to complete the Not an Issue task.



COMPLETE – NOT AN ISSUE

Working with Issues

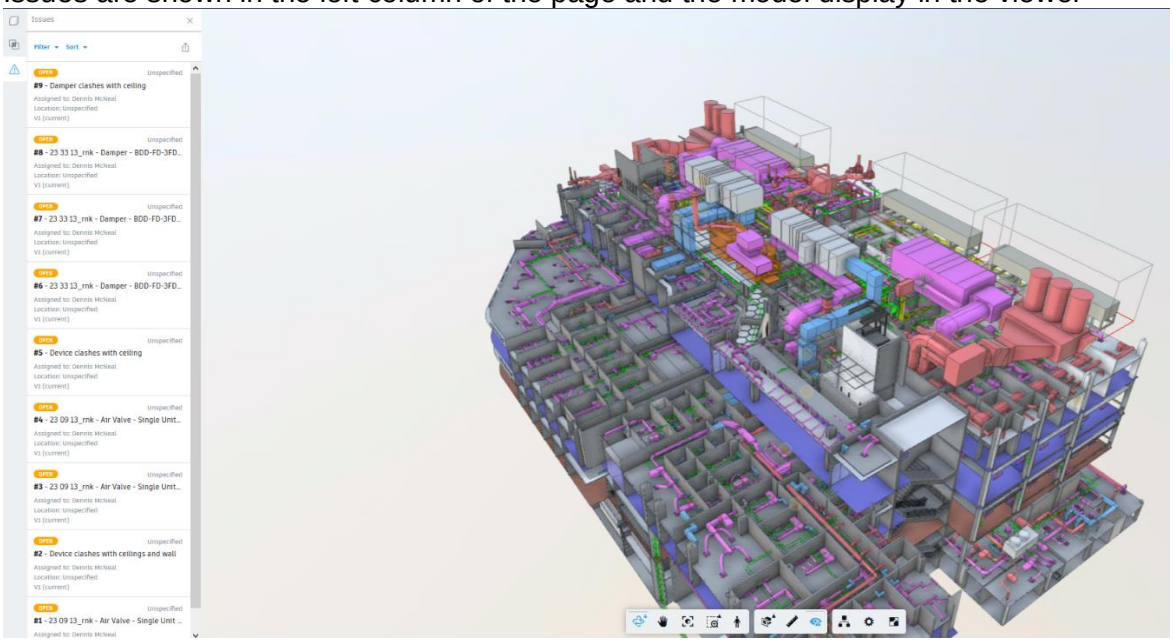
Issues can be seen in the Model Coordination space by selecting the Issues button on the upper left side of the page.



ISSUES PAGE

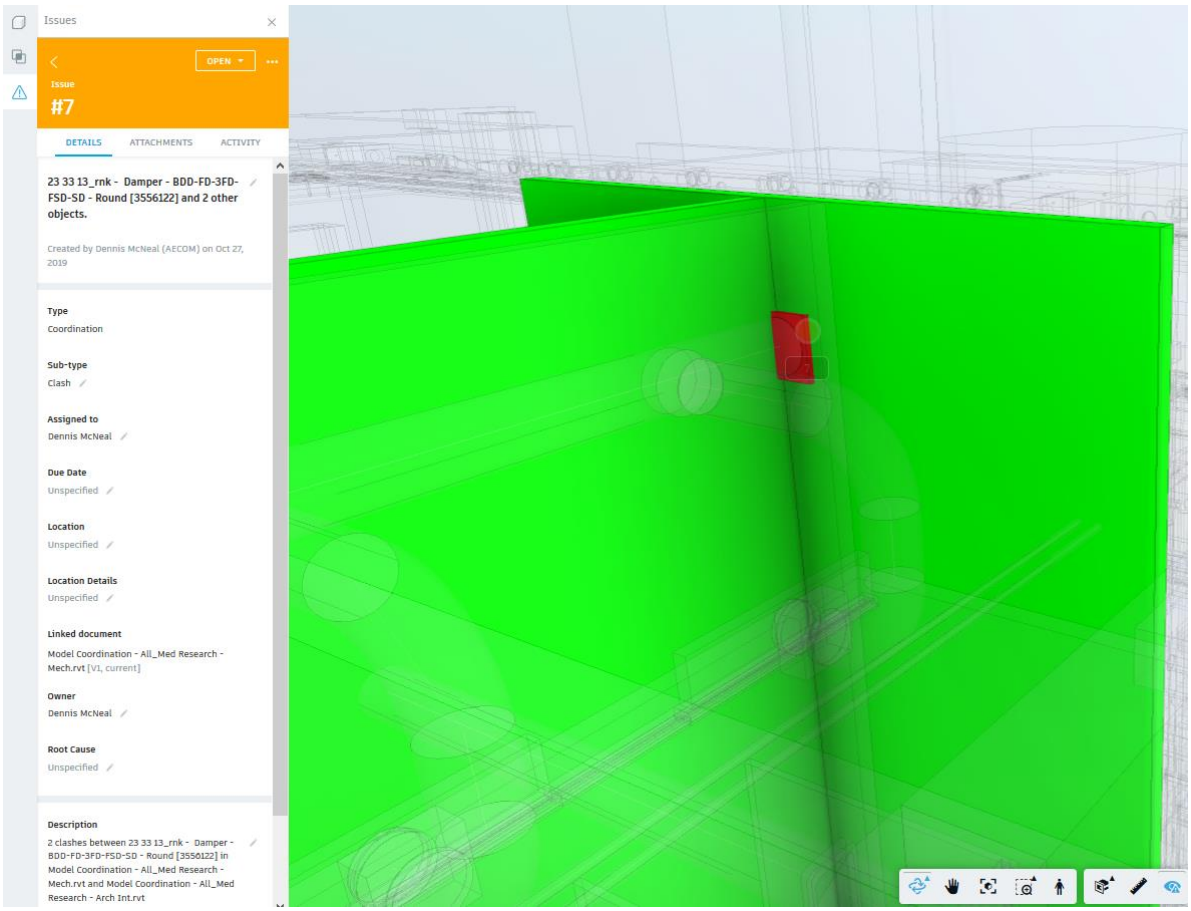
Viewing an Issue

Issues are shown in the left column of the page and the model display in the viewer



ISSUES

Select an Issue and Issue details and graphics are displayed on the issue page



ISSUE

Editing an Issue

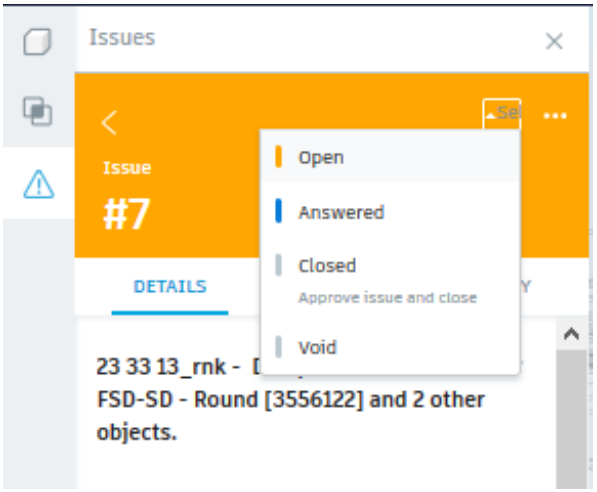
Team members should use the Issue page to edit their issues

Common controls are located at the top of the Issues pane:

1. Navigate back by selecting the navigate button
2. Change the Issue status by selecting the status button
3. Print a PDF

ISSUE CONTROLS

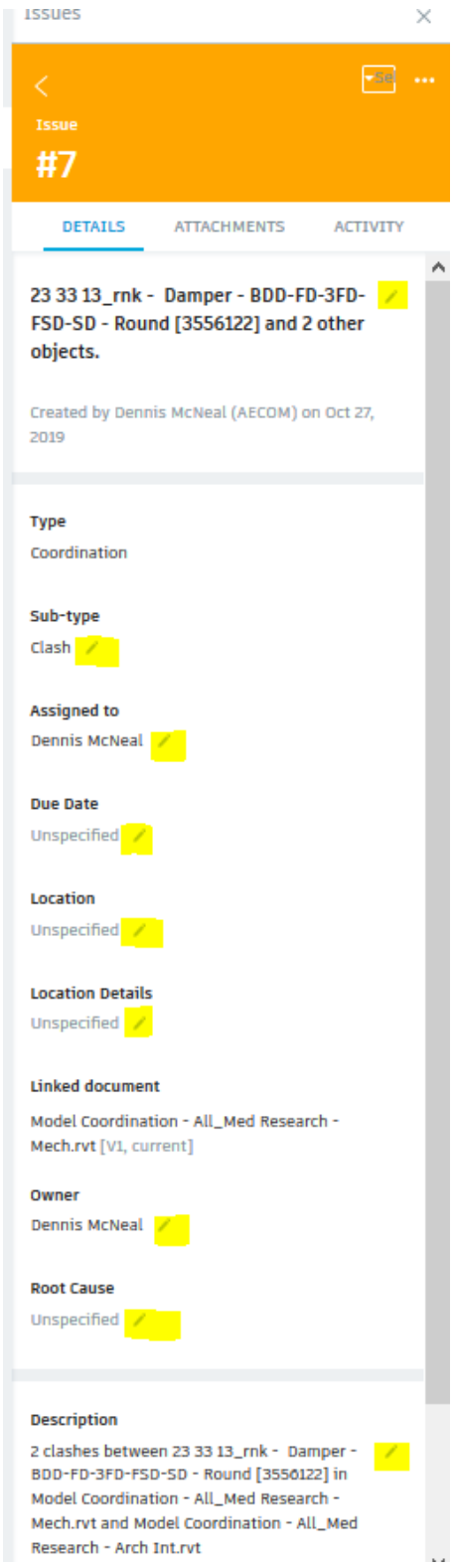
Issue status dropdown allows the user to change the status



ISSUE STATUS OPTIONS

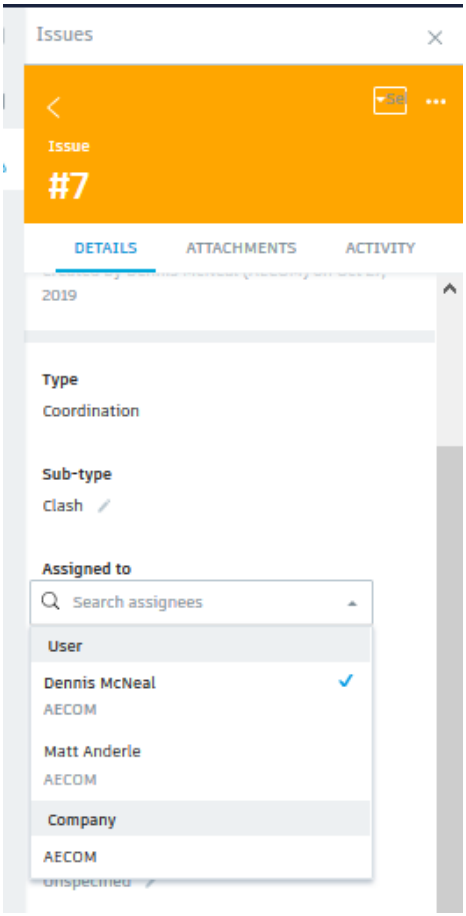
- Avoid changing an issue to ‘Closed’ that has been corrected in the BIM model(s). Subsequent clash model versions should automatically clear the clash – If not, it wasn’t resolved!

Any Issue detail with a pencil icon can be edited



EDITABLE ISSUE DETAILS

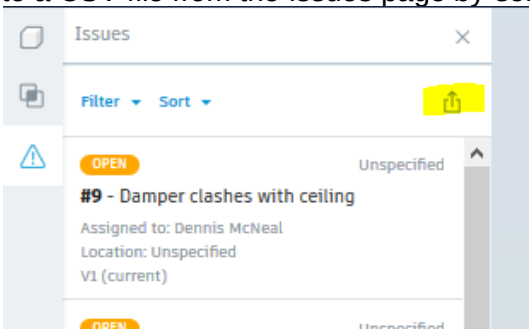
A common edit to change the ‘Assigned to’ team member. When selected, the dropdown will show all Project Members



EDIT ASSIGNED TO

Exporting Issues

Issues can be exported to a CSV file from the Issues page by selecting the Export button



ISSUE EXPORT BUTTON

The CSV export can be saved or opened with Microsoft Excel.

Summary

BIM 360 Model Coordination can expand the roles of coordination and clash detection to the wider team, allowing views and interaction of the BIM model by all project members.

Best Practice Suggestions

Organize a team that's committed to building coordinated models

Start using Design Collaboration and Model Coordination early in the project and continue throughout to assure creation of high-quality models

Democratize Collaboration and Coordination!

Integrate Design Collaboration into your regular project meetings.

Invite team members that might not typically be involved in BIM activities to BIM 360 & encourage them to use the collaboration and coordination tools.

Promote active discussion and resolution of clashes within the team.

Share the heavy lift of clash issue review with multiple team members to start democratizing Model Coordination!