Autodesk University 2007

Effective Collaboration with the Revit® Platform

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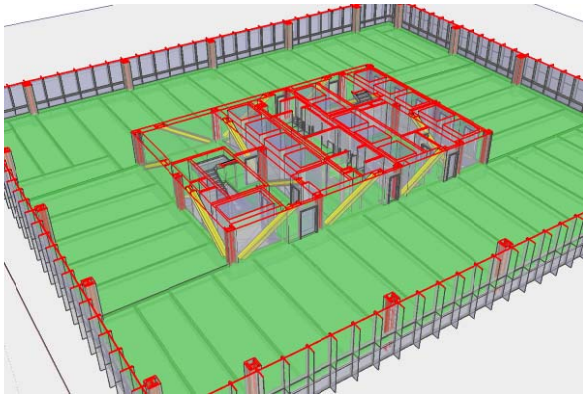
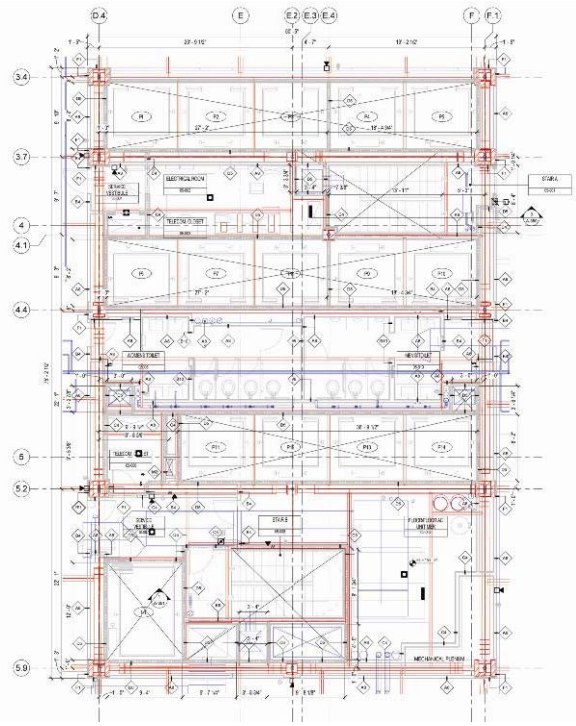
AB104-2P Bring the pieces together to complete the BIM puzzle! Learn the tools and techniques guaranteed to promote effective collaboration among architects, engineers, and other building-project participants. Learn how to manage your large Revit projects using linked models and how to work with others who may or may not be using Revit. This session features real-time demonstrations between two team members coordinating Revit Architecture, Revit Structure, Revit MEP, and AutoCAD software, and presents real-world examples with these formats and processes.





About the Speaker:
James is a practicing architect and Associate at Skidmore, Owings and Merrill (SOM). He has been the Digital Design Manager for SOM's Eastern U.S. offices since 2001 and has led the development of CAD standards, customization programming, training and education, and is a member of a firm-wide committee evaluating future technologies. These technologies include modeling, analysis and simulation tools to be used in a holistic BIM work process.

A Bachelor of Architecture graduate of the New York Institute of Technology, James is currently teaching Revit Professional at NYU, serving as the AUGI Revit Community Chair and is President of the New York City Revit User Group. He maintains a blog focused on various building information modeling tools at http://allthingsbim.blogspot.com and has presented to many audiences at conferences such as Autodesk University, the Construction Management Association of America and Vismasters DVMC.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Outline

Introduction
Review the goals and learning objectives of the class as well as a bit about the speakers and their experience.

Revit-to-Revit Collaboration Concepts
Overview of the principles of sharing Revit models using Revit Building, Structure and MEP including the concepts of Copy/Monitor, Interference Detection, Coordination Monitoring and Shared Coordinates.

Revit-to-Revit Procedures
Live dual-screen demonstration of the development and coordination of Architectural, Structural and MEP models including Copy/Monitor, Coordination Monitor and Interference Detection.

Using Other 3D Formats for Collaboration
Tips for integrating model data created with software other than Revit

Collaboration Using Navisworks

Learning Objectives / Expectations

Attendees will be better equipped to:

- Improve collaboration with teams using multiple Revit verticals;
- Understand the Revit linking process;
- Utilize Navisworks for collaboration;
- Efficiently manage information between linked Revit models.

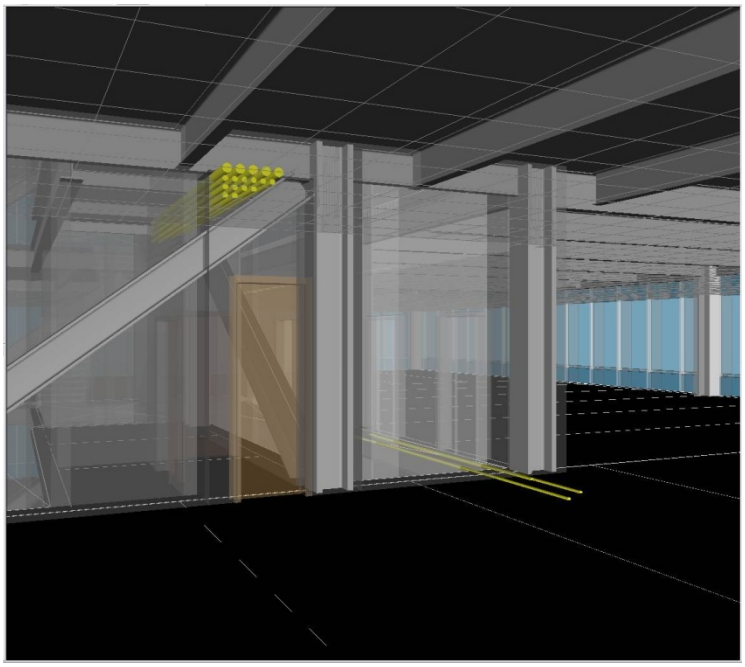
Introduction

Review the goals and learning objectives of the class as well as a bit about the speakers and their experience.

The AEC profession is currently constrained by the necessity of a paper-based delivery process because the foundation of much of the industry's contract verbiage is based on centuries-old tradition and litigation avoidance. Some firms and industry groups have begun to take on the challenge of uprooting the status quo in an effort to deliver projects with greater complexity, accuracy and efficiency. Some examples include:

- Chuck Eastman/Georgia Institute of Technology + AISC (http://www.coa.gatech.edu/~aisc/)
    - New AISC contract model and data standard.
- Frank O. Ghery Partners – new contract model making the 3D digital building model the controlling dataset
- Singapore/Building and Construction Authority (http://www.corenet.gov.sg/)
    - Automated code-checking from digital building data
- International Alliance for Interoperability (http://www.iai-international.org)

This class has been designed to illustrate how the Autodesk Building Information Modeling platforms are allowing AEC professionals to enhance coordination of building components through better methods of communication and collaboration. We will focus specifically on the use of Revit Architecture, Structure and MEP as a collaborative design platform and their interoperability with Navisworks and other file formats.



Revit-to-Revit Collaboration Concepts

Overview of the principles of sharing Revit models using Revit Building, Structure and MEP including the concepts of Copy/Monitor, Interference Detection, Coordination Monitoring and Shared Coordinates.

Collaboration and Worksharing in a Revit to Revit environment can provide a significant amount of benefit in the area of coordination between disciplines. While the earlier components of this class have illustrated DWG- and DWF-based collaboration, this section will assume an all-Revit workflow.

Platform Guidelines

There are three distinct products in the Revit platform, each focused at a specific discipline.

- Revit Building – Architectural Design
- Revit Structure – Structural Design
- Revit MEP – Mechanical Electrical and Plumbing/Piping Design

It should be noted that effective Revit Collaboration is based on two parameters, the Platform Version and the Product Build.

Platform Versions

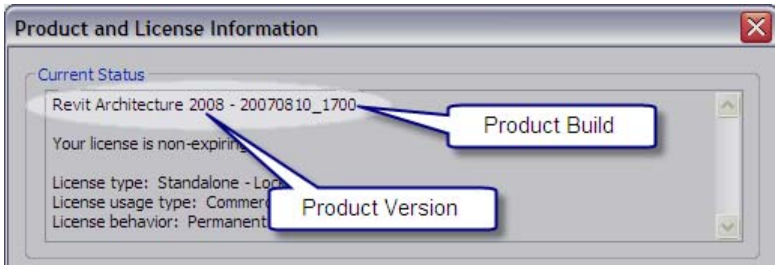
For efficient and effective collaboration as we will demonstrate in this example, each partner MUST be on the same platform version of Revit. The most recent platform versions would be:

Revit Building 8	Revit Structure 1	N.A.
Revit Building 8.1	Revit Structure 2	N.A.
Revit Building 9	Revit Structure 3	Revit MEP 1
Revit Building 9.1	Revit Structure 4	Revit MEP 1.1 (2)*
Revit Architecture 2008	Revit Structure 2008	Revit MEP 2008

** For the Revit 9.1 platform there were two compatible releases of Revit MEP. Revit MEP 1.1 refers specifically to the compatibility release of Revit MEP that was to synchronize with Revit Building and Revit Structure 4. This is not an official "branded" release of Revit MEP, but does refer to a specific build of Revit MEP 1.1 (build 20060810_2300). Revit MEP 2 is branded specifically as such and should be easily identifiable.*

Product Builds

It is recommended that within each product, all people collaborating be on the same build. Identifying what build you are using is very simple. Go to the **Help** menu and select **Product and License** Information. You will see a dialog box like this with the version and build information:



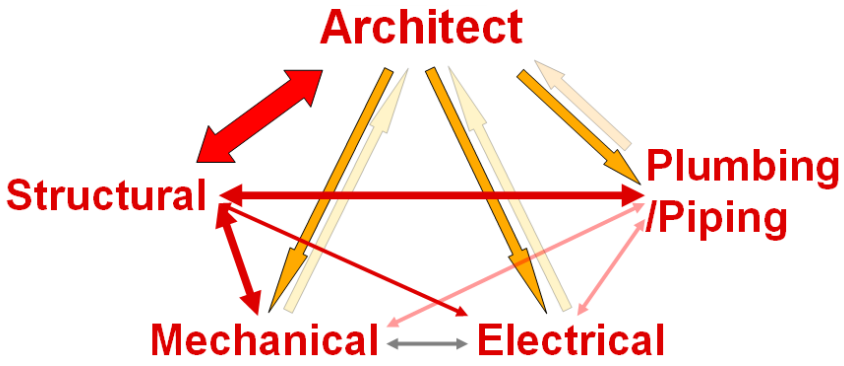
*Note: Within the same firm, it is **required** that all people working on the same project using work sharing be on the same build. Different builds can cause Save to Central issues.*

Workflow Scenarios

There are several possible workflow scenarios that might exist in a project. For the purposes of this example, we will speak specifically to the workflow between the traditional design team consisting of:

- Architect
- Structural Engineer
- Mechanical, Electrical, and Plumbing/Piping Engineers.

If we were to graph the traditional workflow between these disciplines, we would see something like this:



What this diagram illustrates is that the workflow in a typical design team is very complex. There are primary relationships (architectural to/from structural, architect to MEP) and secondary relationships (structural to/from mechanical and piping).

In addition, these relationships also can be further broken into physical and logical relationships. If we use mechanical and electrical as an example, we can see that making sure that a light fixture is not hitting the bottom of a duct is a physical relationship, while making sure that the electrical design properly accounts for the load of the heating coil in a VAV Box (being designed by the mechanical engineer) is a logical relationship.

It is the complexity of these possible workflow scenarios that makes this process prone to errors and a major source of coordination between the traditional design team. So what are the tools that can be used for collaboration between Revit products? There are three distinct tools that typically are used in a collaboration scenario:

1) Linked Models

Linking models together using the Revit link tools provides full visual fidelity to see what the other disciplines are doing. The important thing to understand is that this simple process provides the following benefits:

- Full 3D visual fidelity – The linked model will show the complete context of the other discipline's data allowing complete understanding of their geometry.
- Visual Control – The data in the linked model can be controlled and shown in any manner appropriate to the use. You can turn it on or off, half-tone the data, or enhance it with color or linetype.
- Support for Interference Check and Coordination Monitor – The next two tools all build on the platform of linked models and would not work without this base tool.

2) Interference Checking

In many cases, the only workflow requirement is to know that items from another discipline are not interfering with your items. Interference checking can be a very significant tool for these reasons:

- Multiple Uses – You can interference check between categories within a single model or between linked models.
- Sufficiency – In many cases, the primary workflow is to know that things are not in interference with each other.
- Low Overhead – Since interference checking is something that is run completely "On Demand" it has lower impact on performance and system requirements.

3) Coordination Monitor

The coordination monitor is a very powerful tool in the Revit platform. Considered the most "intelligent" of the coordination tools, coordination monitor offers these benefits:

- Intelligent Bond – Using the coordination monitor, you can chose items from another model that you want to monitor for change, and the degree to which you want to monitor them.
- Multiple Modes – Often misunderstood, many people do not realize that there are two modes of coordination monitor – monitor only and copy/monitor. Using the correct mode can allow additional functionality flexibility.
- Geometry Creation – When used in the copy/monitor mode, you can actually create geometry from the linked file into the source file. In this mode, you will also be establishing a monitor relationship similar to above.

OK, these are the tools available to you. When to use each of these scenarios depends on the workflow requirements between the disciplines

Structuring your Project

Understanding the tools that are available leads to this topic, how to structure your models. Should we model in a single file? Or, separate the models based on discipline or another concern? There is one simple rule for how a model might be structured, the transmittal.

Think about that for a little bit, a transmittal is the means that you use to formally tell someone that there have been updates that they should respond to. A transmittal might be a formal transmittal; it might be an email, or maybe something as simple as a post-it note on a CD. However they are used, it is a good idea to separate your model(s) based on this simple thought.

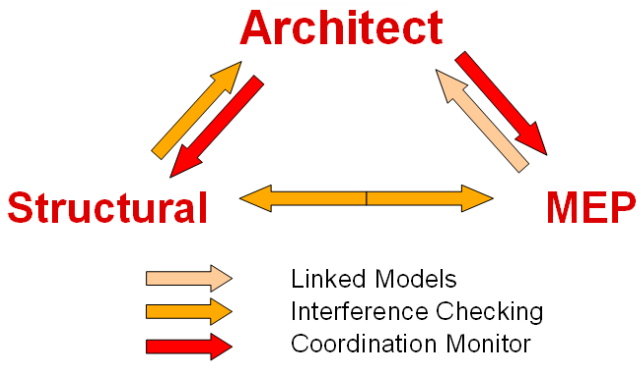
If this is something that you would notify another member of the team that there have been updates using any form of a "transmittal**", then it should be in a separate model.**

It is recommended that each discipline work in a separate model, and that they provide these models to the others on the team for collaboration. There has to be a hard deliverable point when the structural group responds to the changes in the architectural model, mechanical responds to architecture and structure, etc. etc.

Workflow Application

Now that we understand the potential workflows, the tools, and recommendations on how to separate our model(s), we are ready to start setting up collaboration on a project. What tool each discipline uses is based primarily on the requirement of each discipline from the others.

Note: The workflows discussed below are suggestions based on an assumed "typical" workflow. The tools and applications that you use might vary from project to project, and from firm to firm. You will have to determine those possibilities as they



This diagram represents suggestions for collaboration tools to be used between the disciplines.

Let's look at and analyze these suggestions and understand the reasons for these suggestions.

Architect - Structural Engineer

The relationship between the architect and structural engineer is becoming closer and closer as we strive for lighter structures and more innovative design. In many respects, structural engineers may be shaping the envelope as much as the architects. As such, this workflow may be considered the most crucial and should be bi-directional.

Architect to Structural Engineer – Coordination Monitor

By using the coordination monitor, the structural engineer is able to create a strong, intelligent link between the structural and architectural models. In doing so, he can easily track the changes in the architects model that will affect the structural design. He is also able to create geometry in his model using these tools, moving well down the path to having a structural model.

Structural Engineer to Architect – Interference Checking

The architect's requirement for the structural model is primarily to have the structure in context, and to know if the structure is interfering with the architectural elements. For this workflow, it is recommended that the architect link in the structural model and use interference checking.

Architect – MEP Engineer

The relationship between architecture and MEP is not quite as dynamic as architecture/structure, but represents specific opportunities to benefit from collaboration.

Architect to MEP Engineer(s) – Coordination Monitor

The MEP Engineer needs to link in the architect's model to have the architectural model for context and positional relationships for ceiling based items, and the avoid clashes. The Coordination monitor is used to copy/monitor in primarily the architects levels and rooms. These room objects take on the additional properties of the MEP model when copied in, properties such as light levels and air flow. Levels are required to copy/monitor the rooms.

MEP Engineer(s) to Architects – Linked Models

The architect's primary benefit from linking in the MEP model(s) is the ability to reference this geometry to show context in architectural drawings. There is not typically a strong need or benefit to using coordination monitor from MEP back to architecture.

Structural to MEP Engineer(s)

This relationship is almost always best served by cross linked models using interference checking. The most important aspect of collaboration between these disciplines is the early detection and correction of clashes.

Revit-to-Revit Procedures

Live dual-screen demonstration of the development and coordination of Architectural, Structural and MEP models including Copy/Monitor, Coordination Monitor and Interference Detection.

The chapter above covered the process recommendations in terms of general guidelines; in this section we will explore the workflows from the stand-point of detailed process recommendations.

Coordination Monitor Guidelines

When using coordination monitor, there are some general guidelines that should always be followed.

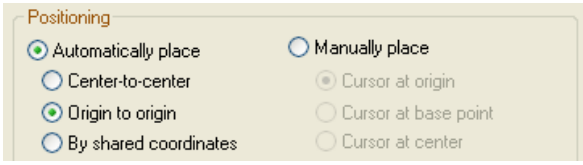
- Use the Copy and Monitor functions sparingly, and only when the linked result is specific to the coordination process. Unnecessary links and relationships can slow linked model performance substantially.
- When worksharing is involved, coordination monitor should be implemented as follows:
    - When the files exist on the same LAN and direct access is possible, coordination monitor should always be set up Central File to Central File. Updates should occur at a time when no one is working from a local file and access can be restricted.
    - When the files are being distributed to other consultants, make sure that the model has been opened and **detached from the central file** before distributing. This detached file should then be set up direct to the central file at the other discipline.
- Remember, certain relationships might be better as only a Monitored relationship, not a Copy/Monitor.

Architect to Structural Engineer – Coordination Monitor

The general process of an Architect and Structural Engineer coordinating would be outlined as such:

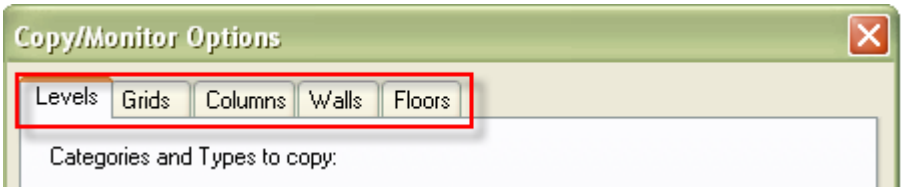
- The architect delivers a model to the structural engineer
- It is highly recommended that before creating a link, the structural engineer should open the architectural model and look at the model observing how the model is structured. Specific things to look for would be:
    - *What style are the grids and levels, will there be a need to substitute bubbles and annotations?*
    - *If the building has columns, how were the columns created (are they broken at levels or contiguous) and using what styles?*
    - Where are the walls that might be replaced by a structural wall, and how were they created? Can they be used through Copy/Monitor? What style were they created in?
    - What floor types were used and can they be replaced effectively through copy/monitor?
- The structural engineer begins a new file using an appropriate template file.

- A link to the architects file is creating using **File → Import/Link → Revit.** For any project that is not using a shared coordinate file, always use Origin to Origin for the Positioning as such



Note: Once the link is created, you might need to change visibility settings to see the architectural model in context.

- Now, the process of setting up the copy/monitor relationships should begin by selecting **Tools → Copy/Monitor → Select Link**. Select the linked architectural model. When you do so, the design bar will change to display the Copy/Monitor commands.
- Set the options for the Copy/Monitor based on your observations above. The options are located in 5 tabs as shown below:



Levels - In most cases, the difference between the location of a structural level and an architectural level dictates that you would probably not want to copy the levels into the file. This is a good case where you might want to create the levels in the file at the appropriate location and then simply use the monitor function to create a link between.

Grids – Copying in the grids is usually a strong workflow. You can use the options on these tabs to convert the grid bubbles used by the architect into those used by the structural engineer. It is also possible to add a prefix to the grid names. For instance, you could add the value "S-" in the prefix field and then grid "A" from the architectural model will come into the structural model as "S-A".

Columns – In many respects, this is one of the most important tools. First, the structural engineer can chose to replace any column in the architectural model with an appropriate structural column. In many cases, the architect might have allowed for structure and the structural engineer can now replace that with true structural components. And finally, you have the choice to split the columns by levels if the architect has modeled them as a single column and the structural engineer needs them split.

Walls – In the survey of the model above, the structural engineer should have identified wall components that will be required in the structural model. If the architect created the model correctly (with the walls broken as required) they can me directly copied in. If not, new walls might have to be created and then a monitor relationship established.

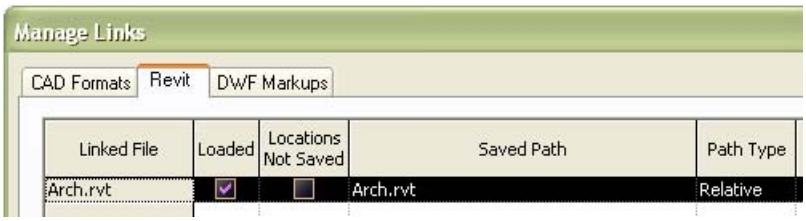
Tip: When creating the architectural model, break the walls where you would anticipate that the structural engineer would like to have them broken, and name your wall styles for these anticipated structural walls in a manner that makes them show at the top of the list. You can do this by adding a dash "-" or underscore "_" at the beginning of the wall style.

And finally, make sure that you select the check box for "Copy windows/doors/openings" so that you also get the appropriate openings for those components in the architectural walls.

Floors – Similar to walls, select the floors that you would like to have copied into the model. Again, make sure to select the checkbox to maintain openings.

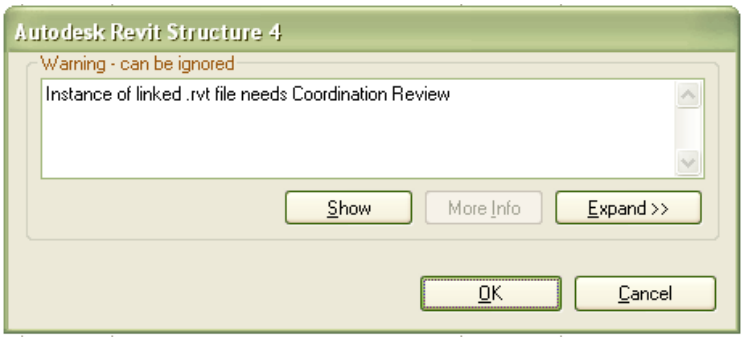
- Copy in the desired items using the guidelines above. It is important to note that you can freely change views while in the copy/monitor ensuring that you are in a view that is appropriate for the geometry being created.
- Where appropriate (levels for instance), use the monitor tool to establish a manual link

- After establishing these relationships and building the geometry, the structural engineer will continue modeling as required.
- When the architect delivers an updated model to the structural engineer, the engineer will update the link using the link manager. Invoke the link manager from **File → Manage Links**



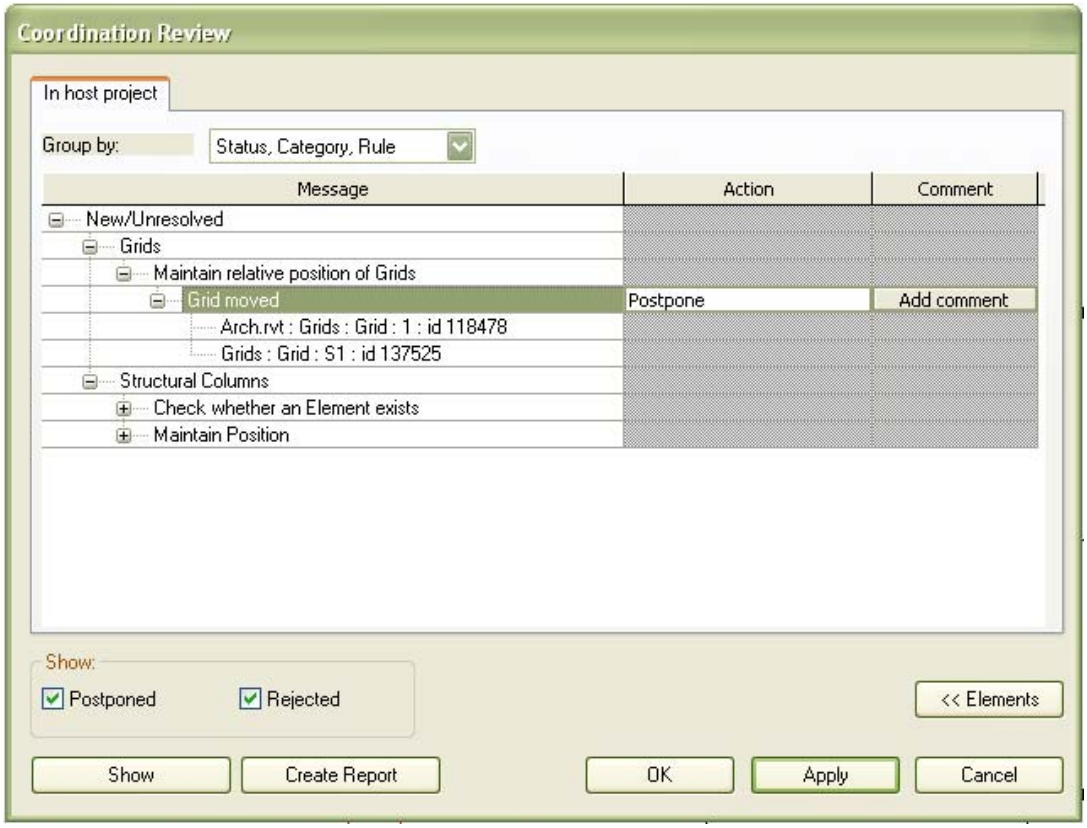
Select the linked file and then Reload.

- If the model has changes to the items that you either copy/monitored or simply monitored, you will see this message:



- Warnings can occur because of these violations:
  - An original monitored element from the linked project changed.
  - A copied monitored element in the host project changed.
  - Both the original monitored element and the copied element changed.
  - The original element in the linked file was deleted.
  - The copied element in the host file was deleted.

In order to see what has changed, select **Tools → Coordination Review → Select Link.** Select the linked in architectural model and you will see a dialog box detailing each of the changes.



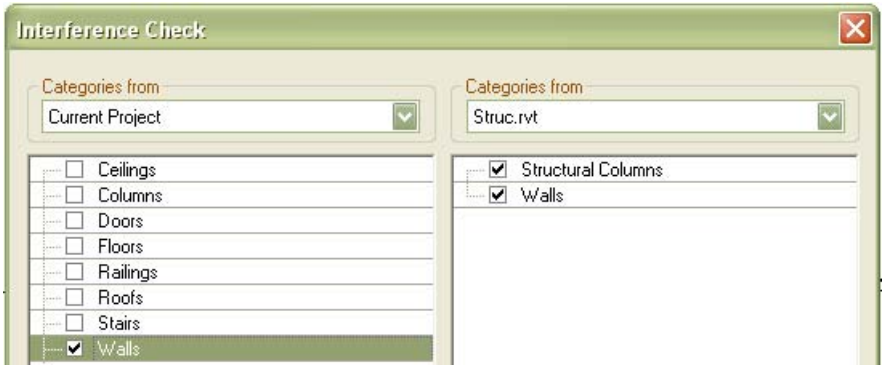
For each of the changes listed above, one of these actions can be taken:

- **Do nothing:** take no action on the element. Changes the message status so that it can be filtered out or considered later.
- **Reject (in a host project tab only):** there is a difference between an element in the host file and its associated monitored element. The change made to the element in the host file is incorrect, and a change has to be made to the associated monitored element.
- **Accept difference (in a host project tab only):** accepts the change made to the element and updates the relationship. For example, if a pair of grids was 200 mm apart, and one was moved to 300 mm away, the change would be accepted, and the relationship would now be set to 300 mm.
- **Modify, Rename, Move:** The command name changes based on the action. If the name of the monitored element has changed, the command reads Rename. If a column or level is moved, the command is Move. If a grid is changed or moved, the command is Modify

Structural Engineer to Architect – Interference Checking

Once work on the structural model progresses to the point that the structural engineer is ready to deliver a model back to the architect, the architect will typically link that model in as above, and then use interference checking to see if an interference has been created.

- The structural engineer delivers a model to the architect
- A link to the structural engineer's file is creating using **File → Import/Link → Revit.**
- The architect can check for interferences by selecting **Tools → Interference Check → Run Check.** This will display the interference checking dialog box:



- Notice that you can select a categories from the current project on one side, and then categories from the linked in model from the other side.

Once the links have been established the architect can re-check interferences each time the structural model updates.

Architect to MEP Engineer(s) – Coordination Monitor

There are typically two items that would be copied from the Architects model; Levels and Rooms. Rooms are the main component of sharing between the disciplines, and levels are required to link in the rooms.

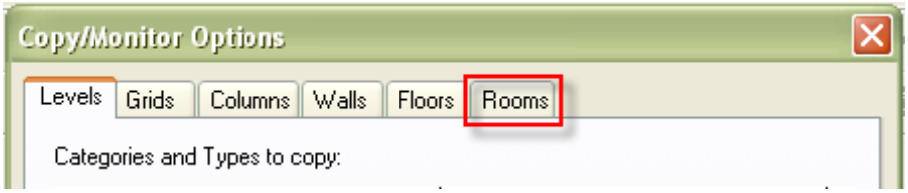
The specific process is somewhat different from the architecture/structure relationship, and would be as follows.

- The architect delivers a model to the MEP engineer
- It is highly recommended that before creating a link, the MEP engineer should open the architectural model and look at the model observing how the model is structured. Specific things to look for would be:
    - What style are the grids and levels, will there be a need to substitute bubbles and annotations?
    - Did the architect create rooms in the model? What settings are typical in those rooms?
- The MEP engineer begins a new file using an appropriate template file.
- A link to the architects file is creating using **File → Import/Link → Revit.** For any project that is not using a shared coordinate file, always use Origin to Origin for the Positioning.
- Now, the process of setting up the copy/monitor relationships should begin by selecting **Tools → Copy/Monitor → Select Link**. Select the linked architectural model. When you do so, the design bar will change to display the Copy/Monitor commands.

Levels – In Revit MEP, Levels are required to copy/monitor Rooms. Therefore, you should copy the rooms into your MEP Model

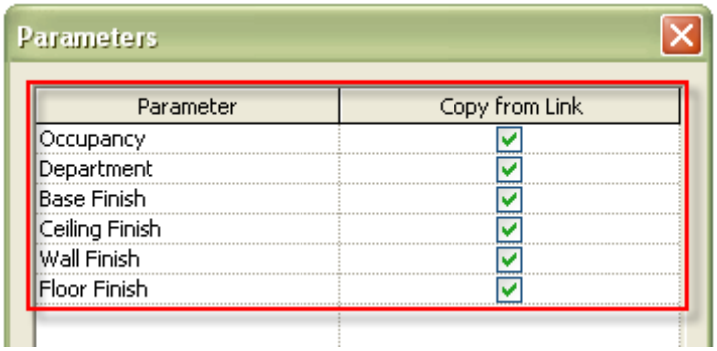
Grids, Columns Walls and Floors – Generally, you will not need to copy/monitor these items into your model.

Rooms – Note that there is a 6th tab in Revit MEP, Rooms. Rooms are the key relationship between the architects' and MEP Engineers' models.

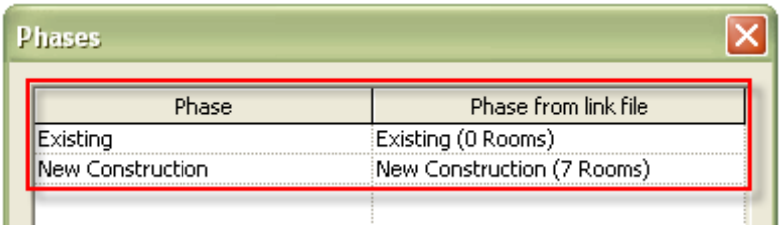


Copying *Rooms* is a different process as noted below:

- You **must** copy the levels into the model first.
- Once the levels have been copied, select **Options** from the design bar and set the room options:
- Under Parameters, select the parameters that you would like to bring in from the rooms in the architects' model.



- Select Phases to set the options for phasing. In most cases you will simply make them sync as below:



- Once these options have been set, then select **Copy Rooms** from the design bar to add the rooms to the Revit MEP project.

Now your projects are linked, you can begin the modeling process.

For more information on using Revit MEP with file linking for analysis, read the Autodesk White Paper "Building Performance Analysis Using Revit" written by Kyle Bernhardt and the Revit MEP team. It is available here: http://images.autodesk.com/adsk/files/building_performance_analysis_using_revit.pdf

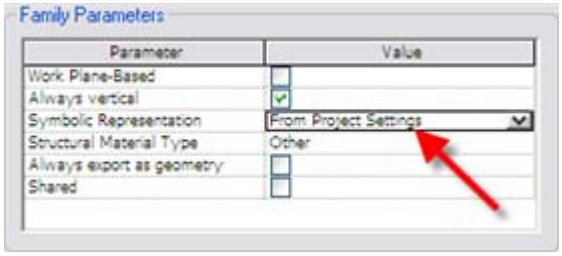
Using Other 3D Formats for Collaboration

Tips for integrating model data created with software other than Revit

If you happen to be collaborating with others who may be using software such as AutoCAD, Bentley, Archicad or Solidworks, there are still methods to share information effectively in the Revit project.

DWG/DGN/DXF/SAT – Three-dimensional data can be used from CAD-based applications such as AutoCAD MEP or Bentley Structural; however, for proper use the data cannot simply be linked into a project. There are two ways to include such data:

- Create an in-place family making sure to select an appropriate family category such as Structural Framing for a structural model. [**Note: For mechanical models, do not select the Mechanical Equipment category as it will not cut the geometry. Instead, select Generic Models.]** While in family mode, import the DWG/DGN/DXF file. After importing, finish the family and adjust its location as required. The model will be displayed and cut correctly, but will not display any parametric properties such as steel member sizes.
- Create a component family. This method is similar to that mentioned above, but makes it slightly easier to manage the imported data. If you use a Structural Framing family template, make sure to specify the Symbolic Representation as "From Project Settings" or the family may not display and cut properly.



Limitations to using the family method:

- DGN data must be in V7 format, which is an older format. Autodesk does not support the use of V8 or XM format files, so Bentley users must save down to V7 format for use in Revit.
- Interference checking does not detect clashes with linked CAD geometry. If you need more than a graphic representation of collaborative data, try the IFC importing method below.

IFC - An easier and more robust way to collaborate with non-Revit formats is through the use of IFC (Industry Foundation Class) import. Most BIM-enabled programs today are IFC compliant and can export IFC files. If you can work with your collaborative constituents to receive exported IFC files, you can integrate it with your Revit project as follows:

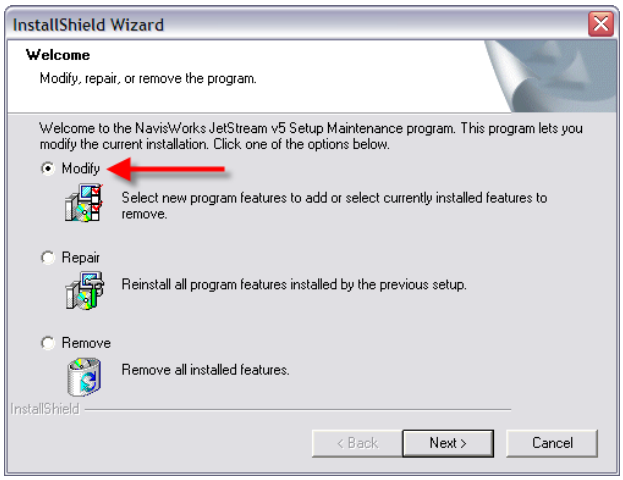
- From the File menu choose Import > IFC… This will create a NEW project file – you cannot link an IFC file directly into an existing Revit project.
- Once the IFC import is complete, save the Revit project and link it into your existing project.
- You can use interference checking with this method. It will also be easier to navigate as the imported IFC data is generated as native Revit elements.

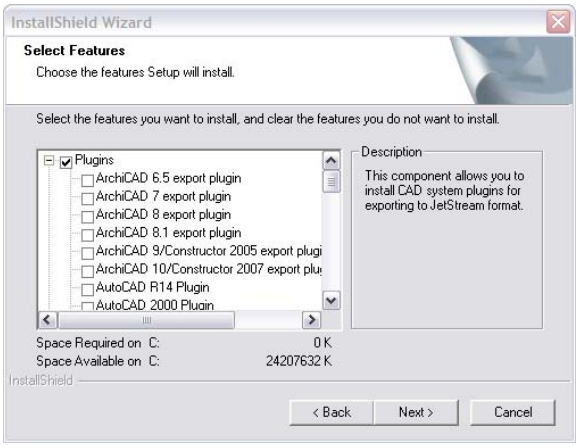
Collaboration Using Navisworks

Navisworks is a lightweight model viewer which includes robust tools for clash detection and 4D simulation. While there are no modeling tools native to the software, it can open and combine a wide variety of 3D file formats. Navisworks JetStream is a suite of tools which include the following modules:

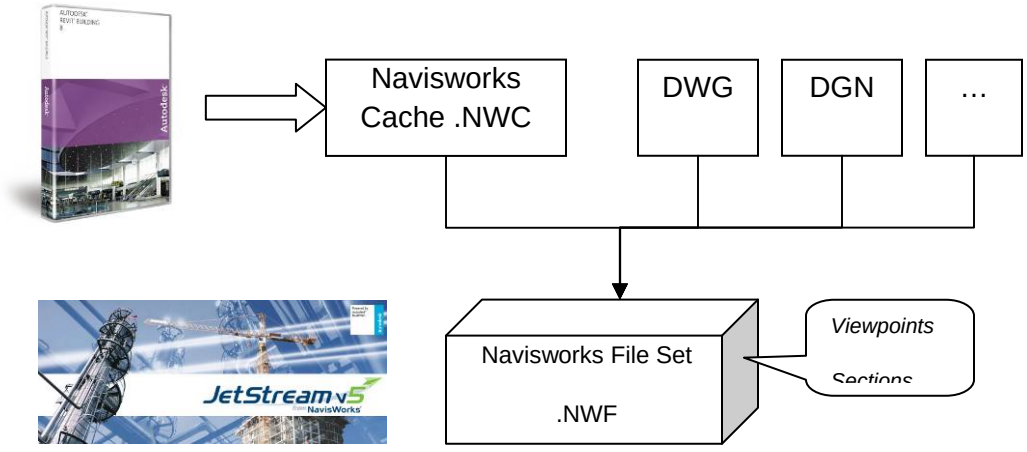
- Roamer – The core platform for combining model geometry
- Clash Detective – As its name implies, detects 3D clashes
- Timeliner – Simulation of 4D schedules using project geometry
- Presenter – Application of realistic materials and lighting

After Navisworks is installed on a workstation, integrated file exporters can be added by opening the Control Panel, selecting Add/Remove Programs and modifying the Navisworks JetStream installation.





For Revit, this process will create an External Command called “Navisworks JetStream V5.” The exporter will generate a Navisworks Cache File (NWC) which can be opened directly in Roamer.



Within JetStream Roamer, you can open a variety of 3D CAD formats (see Appendix A for a list of supported files). Simply use **File-Open** and select one or more supported files. To add another file to the collaborative file set, use **File-Append**. If you need to combine two Navisworks filesets, use **File-Merge**.

When working in JetStream, it is possible that others may be working on the CAD files you are currently reviewing. For example, if you are coordinating various disciplines on a project, then you may have an

overall .nwf file referencing numerous design files. During the iterative stages of the project, any member of the design team could potentially be modifying their CAD files. To ensure the data you are reviewing is current, JetStream provides a refresh function to reload any files that have been modified since commencing the review session. This feature does not reload all of the files you have loaded, merely those modified since last opening them.

Each file has its own units and when appending more files to the scene, each file is automatically scaled to match the units of the first file loaded into the scene. Each file type has a default unit associated with it that it uses when loading files of that type. You can change this associated unit in the **Units** tab of the **Global Options** dialog. However, once a file is loaded, you can change its unit scaling using the **Edit, File Units and Transform** function.

Output

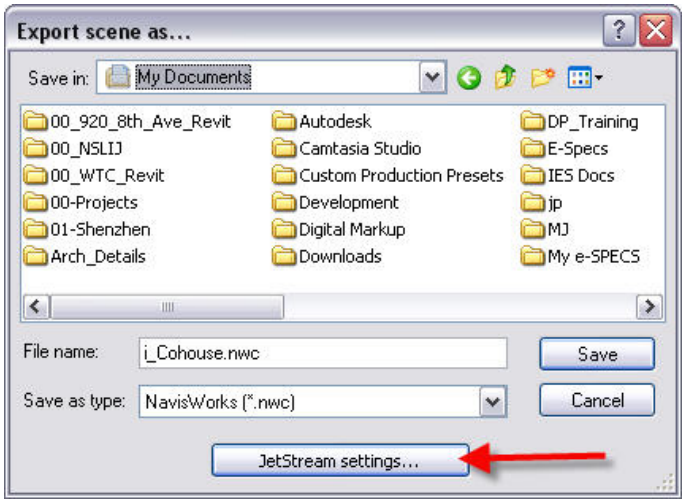
Snapshots of the model can be exported as still images in the following formats: JPG, PNG, BMP. Animations or Timeliner sequences can be exported to AVI files. You can also print any current view to a system printer. In the Clash Detective plug-in, clash reports can be exported into HTML format.

In addition to these standard formats, additional export formats are available such as Google Earth (.KML) and Autodesk Design Web Format (.DWF).

For exporting tools, go to **File-Export…**

Integration with Revit

The Navisworks JetStream installation will automatically create an External Tool for Revit. From Revit, select **Tools-External Tools-Navisworks JetStream** to export the model in NWC (Navisworks Cache) format. Select the JetStream Settings button to adjust the export:



Navigation

There are nine navigation modes to control how you move around the main navigation view – six camera-centric modes and three model-centric modes. In a camera-centric mode, the camera moves within the scene, whereas in a model-centric mode, model moves inside the scene. For example, the **Orbit** and **Examine** modes essentially do the same thing, except that **Orbit** moves the *camera* around the focal point and **Examine** moves the *model* around the focal point. Movement in each mode is based on the cursor keys, the **Shift** and **Control** keys and mouse drags. The mouse wheel is also supported, allowing quick and easy zooming or tilting, depending on the current navigation mode.

Note: Dragging with the left mouse button while holding down the **Control** key performs the same actions as dragging with the middle mouse button, which is useful if you only have a two-button mouse.

The **Shift** and **Control** keys modify the movement, for example holding down **Shift** in **Walk** mode speeds up movement, and holding down **Control** in this mode, glides the camera left/right and up/down.

Walk Through

Walk mode enables you to walk through the model on a horizontal plane ensuring that "up" is always "up".

To walk through a model go to **Viewpoint, Navigation Mode, Walk** or click **Walk** on the **Navigation Mode** toolbar.

Dragging the left mouse button, or using the cursor keys, spins the camera left and right and moves it forwards and backwards. Holding down the **Shift** key speeds up this movement. Holding down the **Control** key glides the camera left and right and up and down. As walk mode is camera-centric, this mode differs from the normal pan mode in that the camera is moved rather than the model.

Spinning the mouse wheel tilts the camera up and down.

Orbiting

The orbit mode enables you to orbit the camera around the model, ensuring that "up" is always "up". The camera always orbits around the focal point of the model.

Dragging the left mouse button, or using the cursor keys, rotates the camera around the model. Holding down the **Shift** key or spinning the mouse wheel, temporarily puts this mode into normal **Zoom** mode. Holding down the **Control** key glides the camera left and right and up and down. As walk mode is camera-centric, this mode differs from the normal pan mode in that the camera is moved rather than the model.

Examine

The examine mode enables you to rotate the model about.

To examine a model go to **Viewpoint, Navigation Mode, Examine** or click **Examine** on the **Navigation Mode** toolbar.

Dragging the left mouse button, or using the cursor keys, rotates the model about.

Holding down the **Shift** key or spinning the mouse wheel, temporarily puts this mode into normal **Zoom** mode. Holding down the **Control** key, temporarily puts this mode into normal **Pan** mode.

If the mouse is moving when you let go of the button, the model keeps spinning! Click on it to stop.

Holding the Shift key allows you to zoom in and out.

Turntable

The turntable mode enables you to spin the model around the up vector. This navigation mode behaves as though the model is sitting on a turntable, ensuring that "up" is always "up".

To use the turntable go to **Viewpoint, Navigation Mode, Turntable** or click **Turntable** on the **Navigation Mode** toolbar.

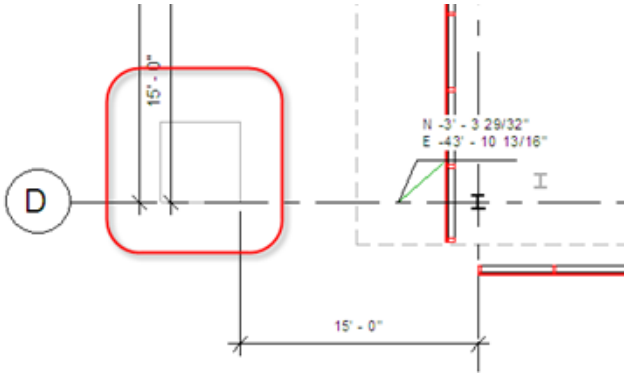
Dragging the left mouse button left and right, or using the left and right cursor keys, spins the turntable left and right respectively. Holding down the **Shift** key or spinning the mouse wheel, temporarily puts this mode into normal **Zoom** mode. Holding down the **Control** key, temporarily puts this mode into normal **Pan** mode.

Spinning the mouse wheel, or using the up and down cursor keys, tilts the turntable up and down, like the tilt bar.

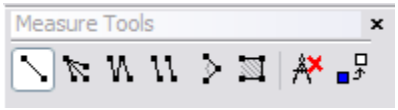
* - When using CTRL with Walk Through to pan up and down, make sure you don't have Collision Detection on or you won't be able to travel to another level.

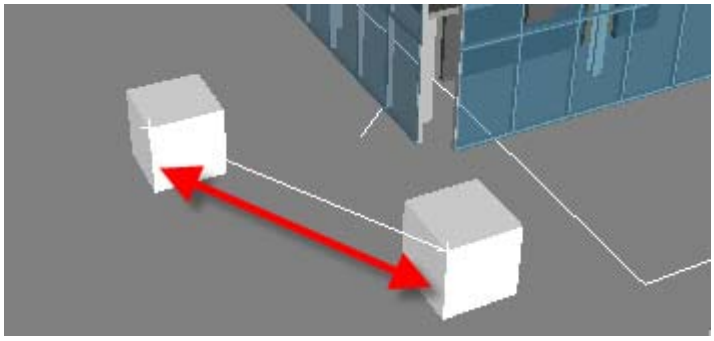
Spatial Coordination

To align several models in Navisworks which may not be aligned in the same coordinate system, create a simple spatial coordination component family and place it in all models at a common reference point outside the building.



Turn on the measuring tools (Tools – Measure). Make sure that snapping is enabled under the global options for measuring and use the Point to Point tool as shown below:





Choose two matching corners of the spatial coordination cube in the exported data to establish the measured difference between the files.

As shown below, select one of the models from the Selection Tree window and click on Transform Objects in the measuring toolbar. This will move the models into the correct position.