Multi-user Collaboration with Autodesk Revit Structure Worksharing

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Autodesk® Revit® Structure Worksharing distributes the power of the Revit parametric building modeling environment across a project team, offering a range of collaboration modes - allowing teams to choose the best way to interact based on their workflow and project requirements. This white paper describes the capabilities of Revit worksets, offering techniques for firms to help ensure successful worksharing on Revit Structure building information models.

Starting a Multi-User Project

For many building projects that require more than one engineer or drafter, each member on the team is assigned a specific functional task. This involves simultaneously working on and saving different portions of the project. The first step in preparing for multiple users is to formally divide the Revit project into logical groupings of objects in a building project that are reserved for editing by a single user at a time.

About Worksets

In Revit, these groupings of the project are called worksets. A workset is a collection of building elements (such as walls, floors, foundation, etc.) in the project. When setting up worksets, considerations to take into account include:

- the team size
- the project size
- the team member roles (modeling versus drafting, discipline specific)

Establishing practical policies on how all team members access and create new worksets in the project will maintain performance for existing users and ease the process of introducing new team members to the project.

Structural worksets are typically defined (and divided) based on:

- Floorplan division at expansion/seismic joints or by a project construction phase division (when several engineers are involved and share responsibility for each division).
- Floors or groups of structural elements like foundations and columns, framing and braces (when several engineers are involved).
- Material expertise: concrete, steel, masonry, etc.
- Challenging areas requiring specific analysis (when several engineers are involved).
- Details and drawings (when drafters are involved).
- Discipline (when firms are involved in both structural and architecture, or structural and MEP, etc).

In the Revit Structure project, users have the option of checking out entire worksets or individual elements in a workset. All other team members may view these elements or worksets, but are unable to change them - preventing possible conflicts in the project. In this manner, the function of worksets are similar to External References (xrefs) in AutoCAD® software, but with the additional ability to propagate and coordinate changes between users.

Worksets are optimized to support teams working on a single building. For projects involving multiple structures arranged in a campus like manner, users can choose to link a set of distinct Revit Structure RVT files. Each individual building structure will then be organized with its own worksets.

Enabling Worksharing and Activating Worksets

To start using worksets, enable worksharing by choosing File >> Worksets in Autodesk Revit Structure. The first time this is done, Revit Structure will display a dialog screen allowing the user to set up the initial sharing of the project.

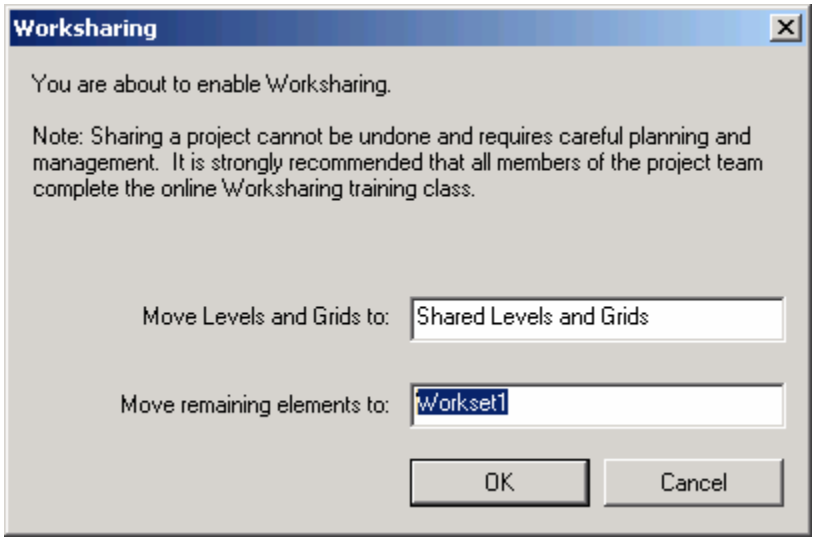


Figure 1

When worksharing is first enabled, all existing structural elements are grouped into one workset.

When worksharing is first enabled for a project, the following worksets are automatically created:

- **Views**: For each view, a dedicated view workset is created. It automatically contains the view's defining information and any view-specific elements such as text notes or dimensions. View-specific elements cannot be moved to another workset.
- **Families:** A family workset is created for each family loaded in the project.
- **Project Standards**: One workset is created for each type of project setting - Materials, Line Styles, etc.
- **Shared Levels and Grids**: This is a user-defined workset that initially contains grids and levels existing at the time the project is shared.
- **Workset1**: This is a user-defined workset that initially contains everything not included in the other worksets. After the project is shared, all structural elements in the project are contained in this workset.

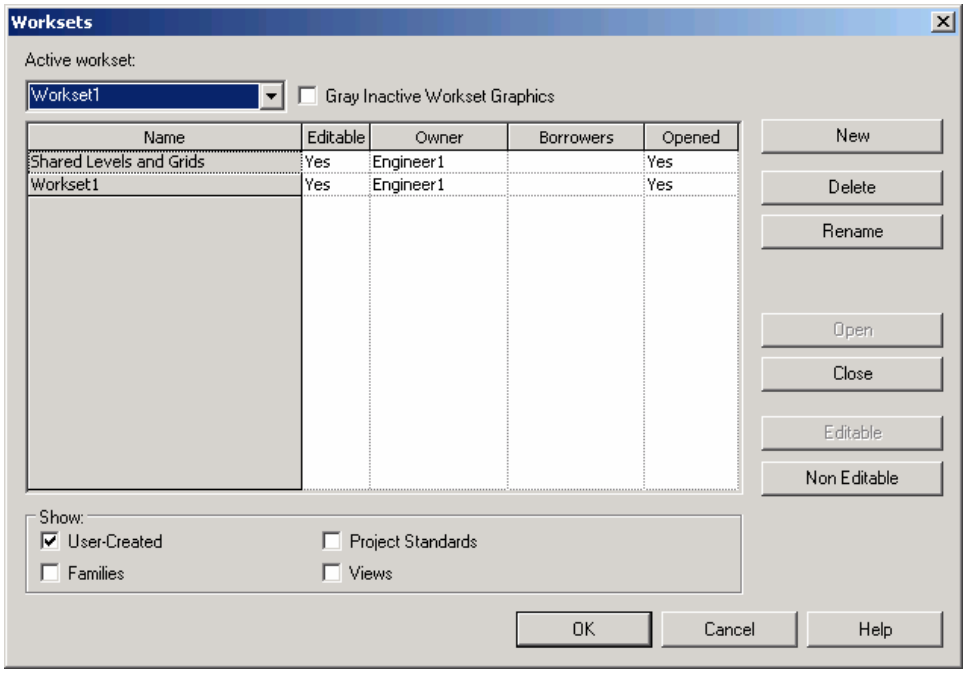


Figure 2

A standard group of worksets are created automatically when worksharing is first enabled.

The names for "Workset1" and "Shared Levels and Grids" can be changed at any time. View, Family, and Project Standards worksets may not be renamed.

Users can also specify an active workset. Newly created model elements are automatically placed in the active workset. Only user-defined worksets can be active. There is no need for the Views, Families and Project Standards worksets to be active because no model elements are created in them. Even though an unlimited number of users can work on Workset1, there are circumstances when you will want to create several worksets besides Workset1 (refer to the bulleted list of common structural worksets at the start of this section).

Worksets can be created at any time by clicking New in the Worksets dialog box. Worksets become available to the project team as soon as the user who created them saves his work to the Central file. Any modeling element can be moved to a different workset by changing the workset property in the Element Properties dialog box.

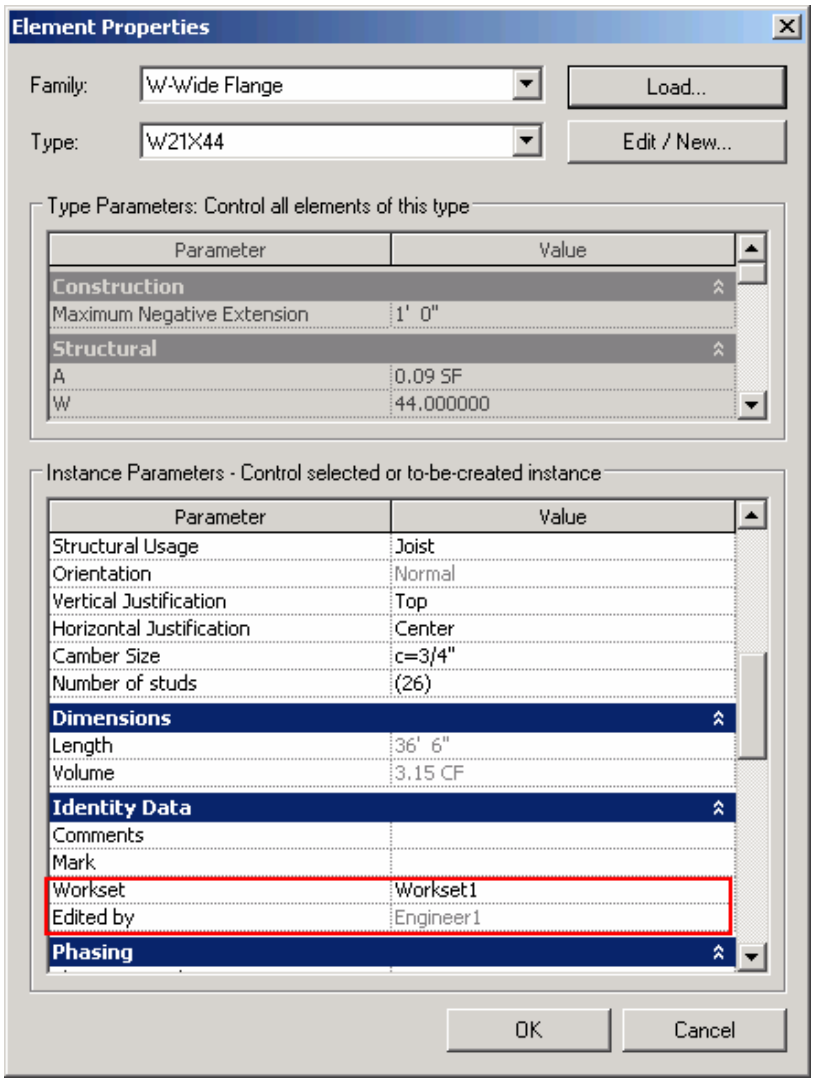


Figure 3

Elements can be moved to different worksets using the Elements Properties dialog box.

Creating a Central File

When worksharing is enabled, a "central file" is created the first time the project is saved. This central file stores the current ownership information for all the worksets in the project and acts as the distribution point for publishing work to the rest of the team. Users save their own local copies of the file, work locally, and then save changes back to the central file for other users to see their work.

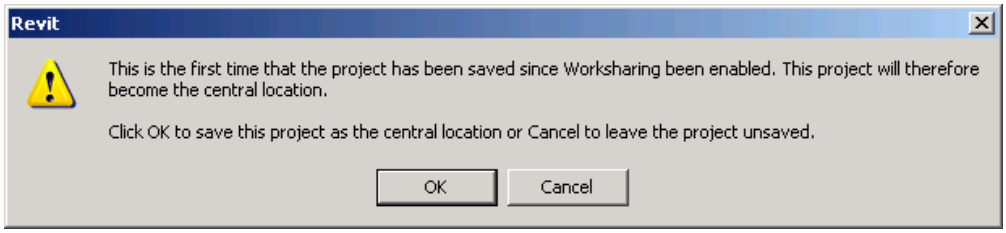


Figure 4

A central file is automatically created when worksharing is enabled.

Only one user can edit the central file at a time - therefore it is recommended that users do not work in the central file directly.

Tip: Worksharing increases the complexity of the Revit system administration and file management. Therefore, don't enable worksharing until the central file is at a point where more than one person needs to work on it at the same time.

To create a central file for a project:

- Open a Revit Structure project and select File >> Workset to enable project sharing.
- An explanation dialog box appears showing the default workset names. If desired, rename the worksets and click OK. The Worksets dialog box will be displayed showing the effects of any name changes. Click OK.
- From the File menu, choose Save As.
- In the Save As dialog box, give the file a name and directory location. Choose the ‘Options’ button and ensure that the "Make this the Central location after save" option is automatically selected. This option is always automatically selected for the first save after worksets have been enabled.

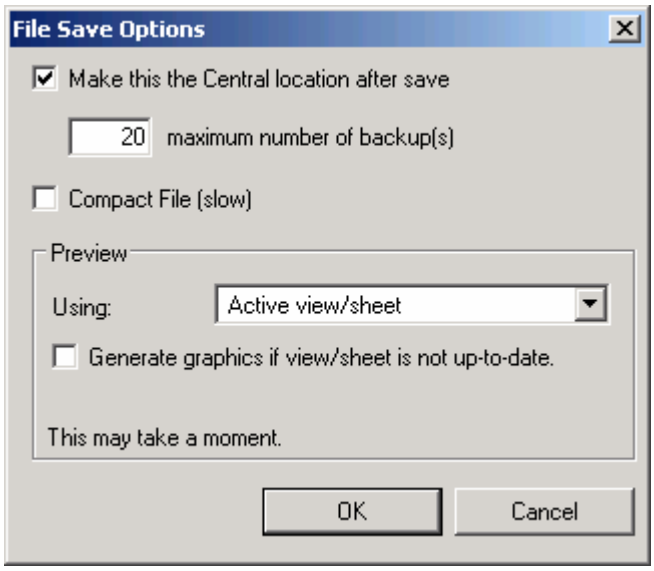


Figure 5

When worksets are first enabled, the option "Make this the Central location after save" is automatically selected.

Tip: When a shared file is first saved, Revit creates a directory with the project name followed by “_backup”. This directory contains the backups for the central file. Successive backup versions share as much element information as possible and therefore are incremental (not equal in size to the entire project). To preserve their backups, users should not delete or rename these folders or files.

Saving, Sharing and Synchronizing Work

Once project sharing is enabled, team members adding and changing elements in worksets save their work to a local file on the network or their own hard drive, and publish work to the central file whenever they choose. They can update their local files at any time with the latest changes other team members have published. This ability to see changes by "reloading" is similar to an AutoCAD xref workflow.

To save their own local copies of the central file, users should:

- Open the Central file.
- Select File >> Save As.
- In the Save As dialog box, give the file a name and a local directory location.

When a user creates or opens a local file of a shared project, it can saved two ways:

1. Save – This saves changes to the local file for safekeeping before the changes are published back to the rest of team. Use the save reminders available in Autodesk Revit Structure to make sure work is saved regularly.
2. Save to Central – This publishes work by saving changes back to the central file.

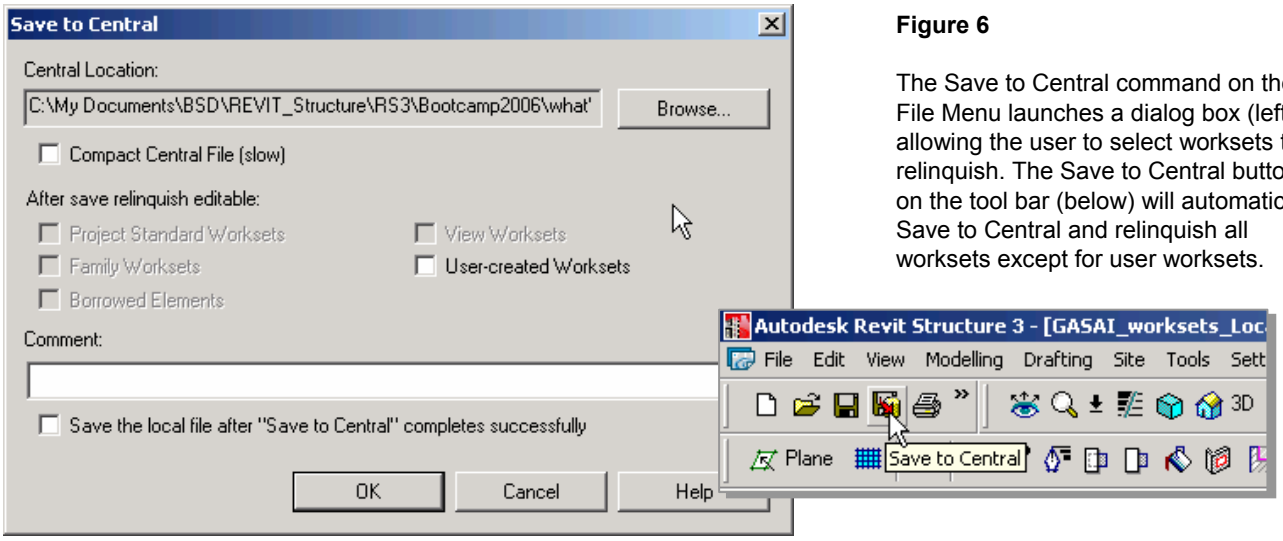


Figure 6

The Save to Central command on the File Menu launches a dialog box (left), allowing the user to select worksets to relinquish. The Save to Central button on the tool bar (below) will automatically Save to Central and relinquish all worksets except for user worksets.

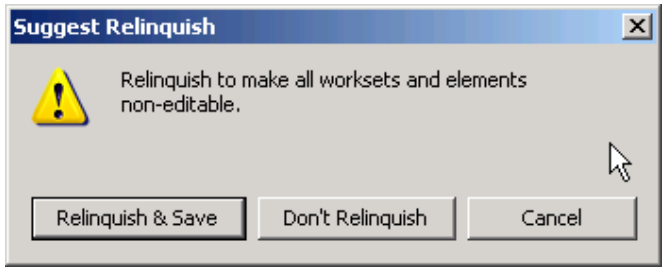


Figure 7

Users are asked to relinquish all worksets and elements when saving a local file - making those elements editable for other users.

After saving changes to the central file, all other team members can then see those changes by selecting File >> Reload Latest. If the central file has changed since the last time a user saved, Revit Structure will automatically reload the latest versions of work from the team. Be sure to save a local file after saving to the central file - so that the local and central files are in sync.

Tip: An important aspect of worksets - critical to the success of worksharing - is the reliance on users to stay synchronized with other team members by frequently pushing their work to the central file and refreshing their local file from the central file!

Workset Tools

Adding Elements to Worksets

New elements can be added to any workset at any time, even if the user creating the element doesn't own the workset. These newly added elements can be modified until the user decides to save them to the central file. The Save to Central button in the toolbar relinquishes all worksets and borrowed elements, implicitly granting permissions to other users to work on these elements.

Once an element has been saved to the central file, Revit Structure Worksharing allows any user to change it - as long as someone else doesn't assume "editability" of the element. If another user "makes an element editable", it is reserved for editing only by that user and cannot to changed by any other user until it is "relinquished" (see description and example below).

Even if the editing of a workset is restricted to a single user (ie the workset is editable only by that user), there are still several actions available to other users:

- Users can create new types (such as floor, wall, component, etc.) as well as view-specific elements (such as dimensions).
- Users can edit the newly created types in the Properties dialog box. However, once the changes have been saved to the central file, the properties of the newly created types are no longer editable until the corresponding Project Standards workset is editable (as is the case for all existing types).

As previously described, use the Save to Central button to relinquish automatically or use the Save to Central dialog (accessed via the File menu) to relinquish Project Standards, View, and Family worksets so that these worksets are available to others on the project.

Making Elements or Worksets Editable

After a project is shared, a user can only make changes to worksets or elements that are editable by that user (exceptions noted above). To make an element or workset editable, simply edit the element or right click to get the context menu and then choose Make Element Editable or Make Workset Editable.

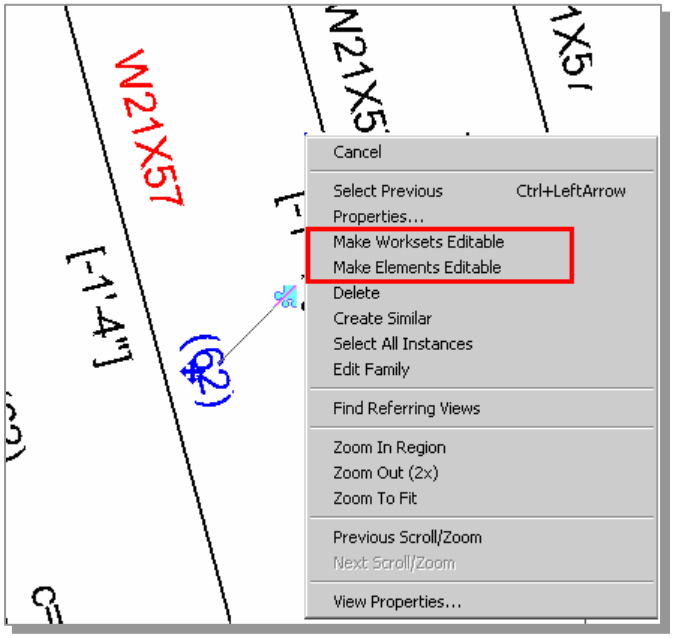
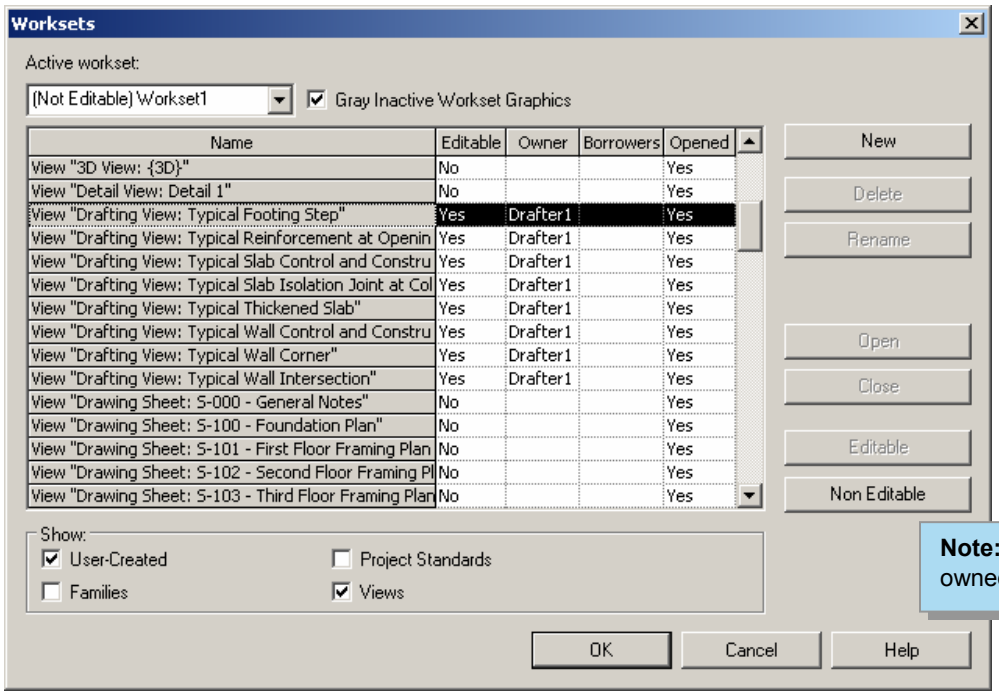


Figure 8

When clicking on an element to change its properties, a blue “puzzle” shape icon appears if the element is not editable. A user can then decide to make the element or workset editable.

The Worksets dialog box (launched from the worksets icon in the worksets toolbar or by selecting File >> Worksets) can also be used to make a workset editable. Simply select a workset and click the Editable button.



Note: Each workset can only be owned by one user at a time!

Figure 9

The Worksets dialog box can be used to make a workset editable by a specific user.

The Worksets dialog box and the workset toolbar also contain a box to specify the active workset - the workset into which new modeling elements are placed. The active workset does not have to be editable. To make a workset non-editable, select the workset in the Workset dialog box and choose the Non Editable button. Elements that a user has directly changed will be kept as borrowed. Users can also change the editability in the Save to Central dialog box (accessed via the File menu).

If someone else in the team owns the element or workset that a user is trying to make editable, the user receives a warning (see Figure 10).

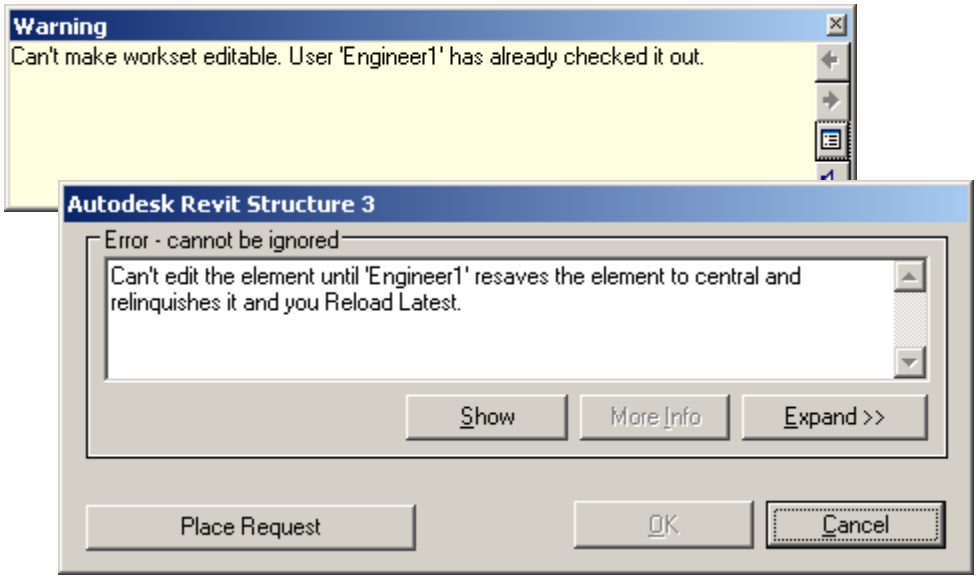


Figure 10

Warning messages, alerting a user that a workset (top) or an element (bottom) is already checked out by another user and cannot be edited.

Element Borrowing and Editing Requests

In a Revit Structure project, a user can borrow elements from worksets that are not editable by that user via "element borrowing" - the process of making elements editable "on the fly" by obtaining permission from either the central file or directly from the users who own those worksets.

On attempting to make an element editable, Revit Structure automatically grants the request if no other user has that element editable. Otherwise Revit Structure posts a message to the requesting user - advising the user to seek permission from the owner controlling the workset (or the element is an element has previously been borrowed).

For example, user 'Drafter1' tries to edit a structural beam element owned by another user and is told that 'Engineer1' owns the element (Figure 11). Drafter1 must notify Engineer1 of the request via email or instant messenger - there is no automatic notification of the request (Figure 12). Engineer1 checks his/her Editing Requests from the File menu or the worksets toolbar (Figure 13).

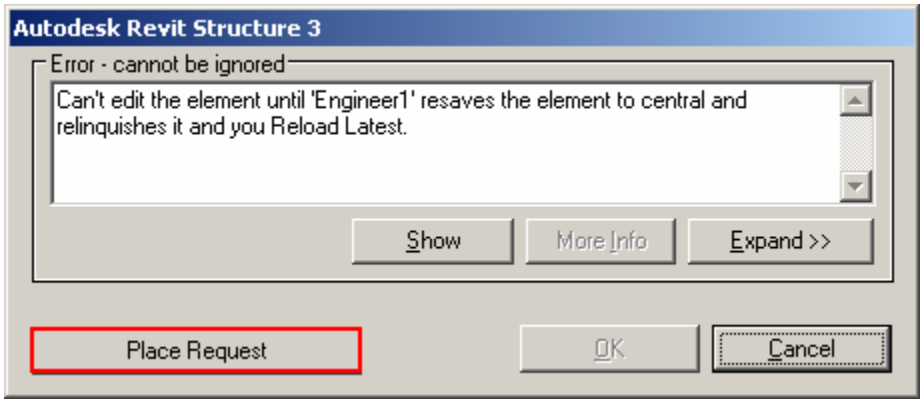


Figure 11

User 'Drafter1' is told that user 'Engineer1' owns the element the drafter needs to edit. The drafter places a request to the engineer to relinquish control of the element.

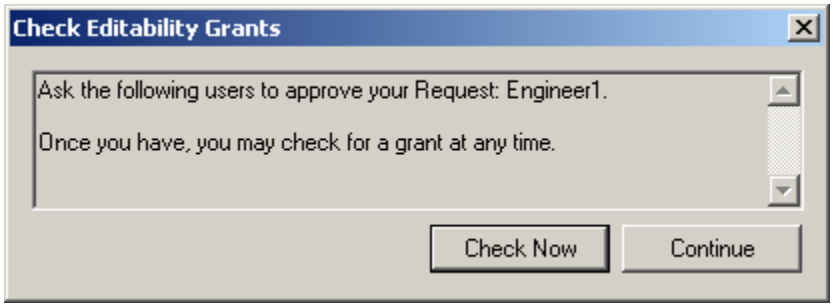


Figure 12

After placing an editing request, Drafter1 is advised to contact Engineer1 (via phone, email, etc) about the request.

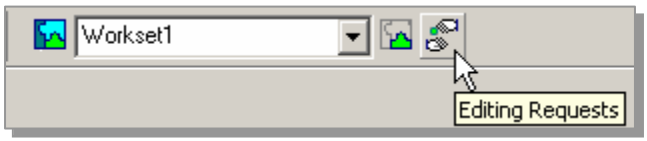


Figure 13

Engineer1 checks the Editing Requests.

A users who owns elements or worksets can decide to grant or deny requests in the Editing Requests dialog. In this example, Engineer1 reviews the request from Drafter1 and decides to grant the request (Figure 14). Drafter1 is automatically notified that the request has been granted (Figure 15).

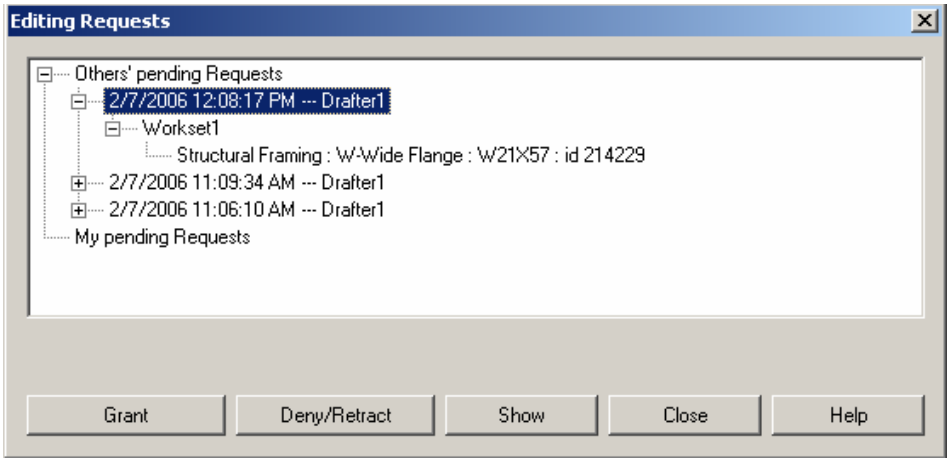


Figure 14

Engineer1 reviews the request from Drafter1 to edit the beam and grants request.

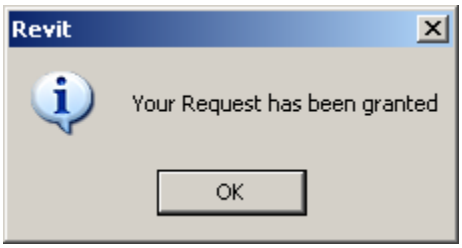


Figure 15

Drafter1 is notified that the editing request has been granted.

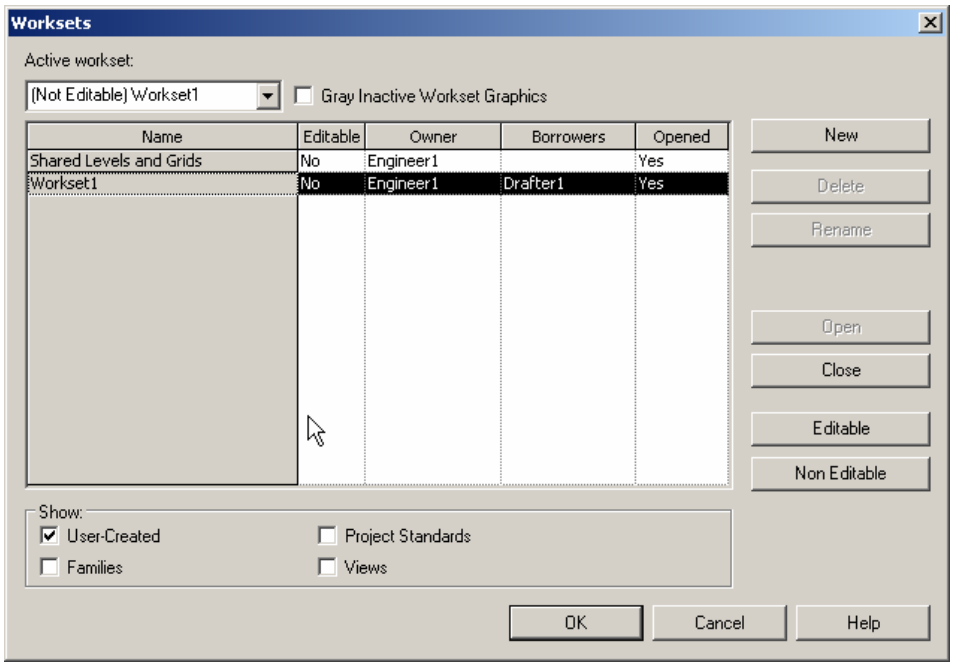


Figure 16

Drafter1 is now listed as borrowing elements from the workset owned by Engineer1.

The Worksets dialog box displays the editability of a workset - listing the owner as well as any "borrowers" of elements from that workset. In this example (Figure 16), although Engineer1 still owns Workset1, Drafter1 is now shown as being a borrower (of elements from that workset).

View Worksets

In a Revit Structure project, every view generates a special workset containing the view's defining information and all elements specific to that view. Below are several key points relating to these special view worksets:

- Unlike user-created worksets, view worksets cannot be made active since Revit Structure controls what information they contain.
- Since each view resides in its own workset, interference is minimized. One user's view changes will not affect any other user.
- View-specific elements are placed in the correct view workset regardless of the current active workset. This helps maintain correct project organization and avoids wasted time.
- Elements in view worksets are made editable automatically as needed or entire view worksets can be made editable by: using an option in the context menu in the Project Browser; right-clicking on view-specific elements; or from the Workset dialog box.

Controlling Workset Visibility

Once a project has been shared, the View Visibility/Graphics dialog box gets another Tab that lets users control which worksets are visible in a view. If a user is sure that the elements of a particular workset should not appear in a particular view, it is recommended that the user turn off visibility of that workset in that view. This allows the project to display the view faster - because Revit Structure does not need to sort which elements in that workset should be displayed.

When creating a new workset, a users can control whether (by default) the new workset will be visible or invisible in each view. Users can still change the visibility in each view individually using the View Visibility/Graphics dialog box.

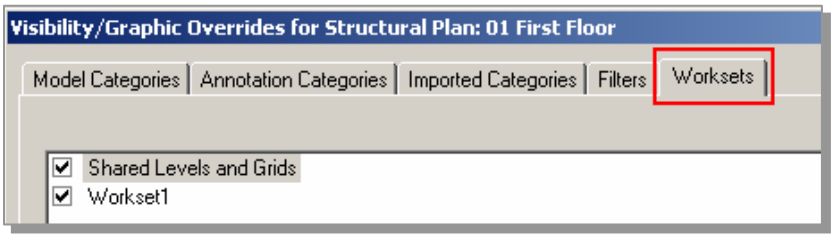


Figure 17

Users can control the visibility of worksets in a view using the Visibility/Graphics dialog box.

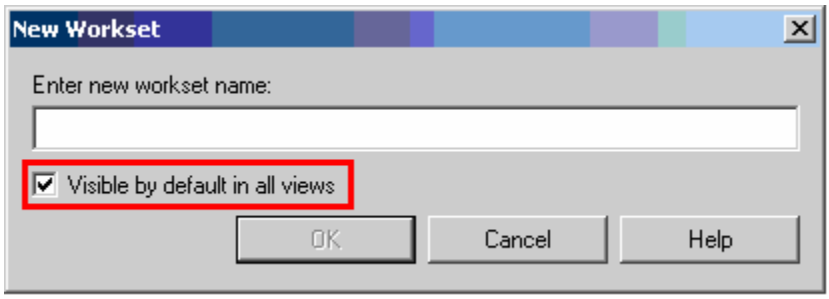


Figure 18

Users can also control the default visibility of new worksets.

Tip: Long-term performance is improved if worksets are not visible by default (unless they need to be). Team size usually increases as projects progress from design to documentation stages. As new team members create worksets for their own use, the worksets they add often won't need to be visible by default. Another way to achieve the performance effects of limiting visibility is by using Selective Open with worksets.

Selective Open

Worksets are a convenient way to control overall visibility in a project. Users can select which worksets are open or closed. Elements in closed worksets are not displayed in any view. Therefore, the display-related performance of the Revit Structure project can be improved by opening only those worksets required for a user's particular task.

Users can open or close worksets at any time. In an open file, use the Worksets dialog box and select worksets to open or to close by using the Open and Close buttons to change their status. When opening a file, select one of the following options in the Open Worksets box to control which worksets are opened:

- “All” opens all worksets.
- “Specify” opens user-selected worksets.
- “Last Viewed” opens worksets that were open when file was last closed.
- “Editable” opens all worksets editable by you.

Note that all worksets can be opened or closed regardless of their editability status.

Visually Distinguishing the Active Workset

To assist users in determining which workset is active and which elements are in it, there is a command that grays out all elements that are not in the active workset. This helps prevent users from adding elements to an undesired workset.

To gray out elements in inactive worksets, click Gray Inactive Workset Graphics on the worksets toolbar or select the Gray Inactive Workset Graphics check box in the Worksets dialog box. Temporary elements, such as temporary dimensions and controls, do not display in gray. The command has no effect on printing.

Eliminating Permissions from a Central File

There may be times when a user wants to open the central file without worrying about permissions or being connected to the live database. For example: when showing the file to a client, or opening a file from a consultant, or printing a document set to verify that all default view templates are applied.

In this situation, open the local project file with the Detach from Central option selected. The file is opened but no longer "remembers" its own path, its central path, nor any permissions. It acts as though it is a newly created file with newly enabled worksets. Save to Central commands are disabled. The Save command makes it a new central file.

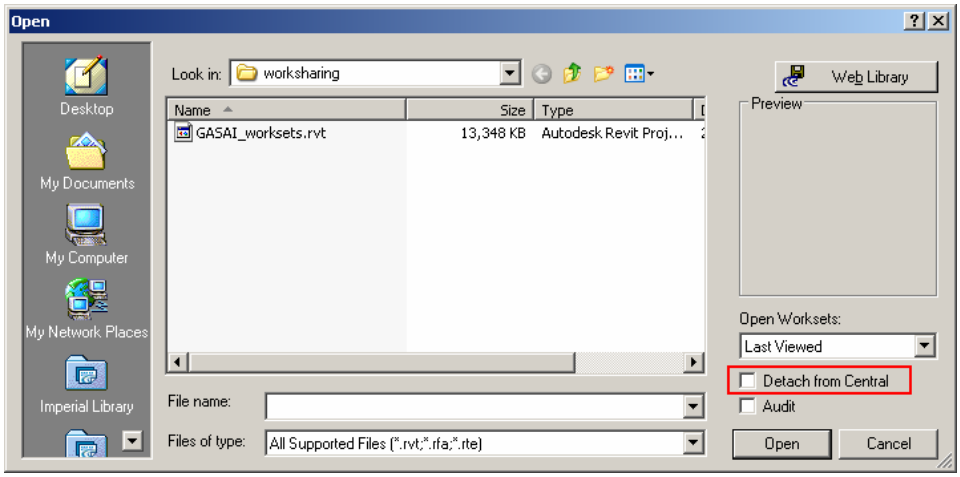


Figure 19

When opening a local project file, users can select Detach from Central--eliminating the live connection to the central database.

Frequently Asked Questions

Can I Move the Central File?

Users can always move the central file, by following this procedure:

1. Make sure all team members publish their work to the current central file location by selecting File >> Save To Central, so that no work is lost as a result of changing the central file. When saving, have each team member relinquish their worksets by checking all options to relinquish worksets after saving.
2. Using Windows Explorer, move the file to the new location. Be sure to use *move*, not *copy* - if the old file is left behind, some team members may continue to work with it by accident.
3. Open the file that was just moved. A dialog box will appear stating that the central location is changing.

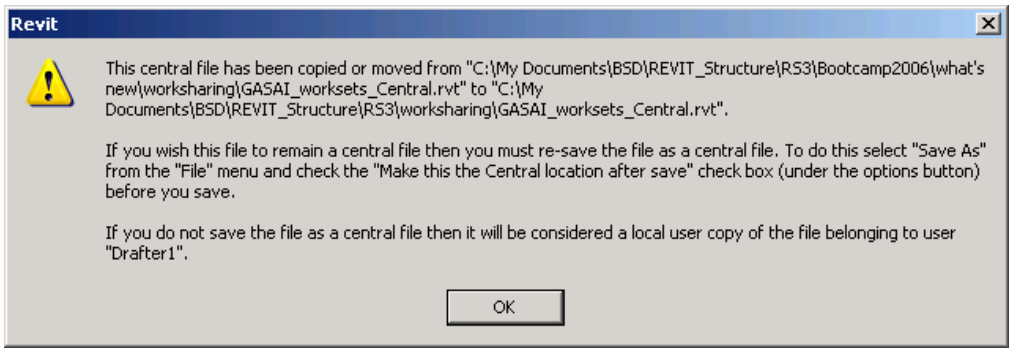


Figure 20

When moving the central file, the user is warned that the central file's location is changing.

Dismiss the dialog box and continue:

4. From the File menu, choose Save As to re-save the file over itself (using the same name and path), ensuring that the "Make this the Central location after save" option under the Options button is selected.
5. A new central file is created, but most of the worksets not editable (some worksets may still be editable by the current user). Since all the work has been published, each team member should create a new local file. Each user can do this by opening the new central file, making necessary worksets editable, and then using Save As to make a new local file.
6. If a user discovers that there is a local file with some work that was not published in time to the old location, publish it to the new location by choosing Save To Central from the File menu, and specify the new central file location through the Browse option. Users must do this before any other changes are saved to the new central location.

Note: The backup folder in the new location contains backups only for work done after the file was moved.

How Do I Use the Central File to Start a New Project?

To create an independent copy of the central file, open the original, then Save As to a new location. Check the "Make this the Central location after save" option under the Options button. This new file will not exchange information with the original.

Can Multiple Users Work Remotely?

Multiple users can work on the project when they are away from the office or otherwise unable to access the network location of the central file. Follow this procedure to take work to a remote location (such as one's home) on a PC or laptop:

1. Make the needed worksets editable while still at the office and on the network.
2. Work on the project at the remote location proceeds as it would in the office. Elements in editable worksets can be modified and new elements can be created in any workset. (New elements can also be created in any View or Project Standards workset, even if they aren't editable).

When back in the office - and on the network - the user can then Save to Central to publish the work done remotely back to the central file.

Users can also work remotely provided they have high speed network access (through means such as a VPN) to the central file. Alternatively, a user can transfer (via Zip disk or other means) their local file to someone with network access, who can then publish changes back to the central file, reload the latest version from the central file, and transfer the updated file back to the remote user for continued work. Working remotely over VPN can cause performance problems and is not recommended for larger projects. Another option is to use Remote Desktop to access an extra onsite computer where the local file is kept.

Tip: If a user needs to modify worksets that are not editable, making the worksets "Editable at Risk" is *not* recommend. If another user (with dynamic access to the central file) has changed the same element as the remote user and published those changes back to the central file, the remote user will *not* be able to save his changes back to the central file when he returns to the office and is on the network again. In that situation, the remote user will lose *all* his changes. One suggestion is to ask a colleague who is in the office with access to the central file to start a session of Autodesk Revit Structure using the remote user's name and make that workset editable for the remote user. This will guarantee that no other user can make it editable.

Final Recommendations

Finally, here is a list of recommendations to help you work more efficiently:

- Name worksets clearly
- Use proper visibility settings
- Do not create too many unnecessary worksets
- Do not create worksets for view specific elements
- Do not make worksets editable to add geometry
- Make sure the proper workset is active when creating new elements
- Reduce a workset's size for enhanced performance
- Return the elements you borrow
- Avoid opening the central file
- Save your work frequently
- Include comments when saving

Summary

Building information modeling with Autodesk Revit Structure is proving itself on a range of structural engineering projects. Firms are also finding that Revit Worksharing provides the necessary range of collaboration features for their project design teams - customized to suit the size of their project and their unique design requirements.

Autodesk Revit Worksharing can be used across all Autodesk Revit applications; Revit Structure for structural design, Revit Building for architecture, and Revit Systems for MEP engineering. Firms and project teams with any combination of these applications can collaborate more effectively by sharing their building information models using Revit Worksharing.

About Autodesk Revit

The Autodesk Revit platform is Autodesk's purpose-built solution for building information modeling. Applications such as Autodesk Revit Structure, Autodesk® Revit® Building, and Autodesk® Revit® Systems built on the Revit platform are complete, discipline-specific building design and documentation systems supporting all phases of design and construction documentation. From conceptual studies through the most detailed construction drawings and schedules, applications built on Revit help provide immediate competitive advantage, better coordination and quality, and can contribute to higher profitability for architects and the rest of the building team.

At the heart of the Revit platform is the Revit parametric change engine, which automatically coordinates changes made anywhere — in model views or drawing sheets, schedules, sections, plans… you name it.

For more information about building information modeling please visit us at *http://www.autodesk.com/bim*. For more information about Autodesk Revit and the discipline-specific applications built on Revit please visit us at *http://www.autodesk.com/revit*.

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