



Managing Large Projects in Revit® Architecture

Lonnie Cumpton - BIM Trainer, Friedmutter Group

AB100-1P In this session we will talk about what not to do, when dropping in a multi-\$billion, multi-million SF/M2, multi-use project into Revit.

About the Speaker:

Lonnie is an Architectural Engineering and Construction (AEC) technology subject matter expert with over 17 years of experience in consulting, designing, and selling. He has a complete understanding of building design and construction methods, and strong expertise with CAD and related technologies, as well as direct experience implementing, training, and integrating into AEC organizations. Lonnie is adept at assessing needs, defining requirements, troubleshooting, and resolving challenges. He is an articulate communicator with solid personnel management skills.



What is a large project?

Five ways to know you might be working on a large project.

1. If you say things like “let’s try and keep this phase under 5 million SQFT”. You might just be working on a large project.
2. When you’re talking about project costs and you round to the nearest 100 million or use the billion word. You just might be working on a large project.
3. So your tower is only 50 floors, but you have two, three, four or more. You just might be working on a large project on the Las Vegas strip.
4. You’re building families and to test them you have to insert them into a project and copy them 3000 times to understand how it will affect you project, just might be an indication that you are working on a large project.
5. You get asked how big your Revit file is, and to get the answer you required you to add 15 to 20 files sizes together and the total has a GB behind it, you just might be working on a large project.

Large multi-use projects are becoming more and more popular, managing them in Revit is a balance between what is needed to produce the deliverable and what is needed to gain the benefits of BIM. It is critical to understand at what point you need to start using some of the concepts of this session. It is important to take into consideration that the concepts discussed in this session are designed to maximize Revit performance as it relates specifically to extremely large projects. Although these concepts will not cause issues with smaller projects they may cause more effort than is needed and unbalance profitability for smaller projects.

The projects that were reviewed for this session range between 300 million to 12 Billion in construction dollars and millions of SQFT. The most important thing to keep in mind is that every project has a unique BIM Structure. How you approach the management of the project in Revit is nothing more than identifying the parts of the BIM structure and putting into place systems that support the project. If it sounds a little like the way you go about designing your projects then you’re probably on the right track.

To start the process let’s identify some of the things that you may want to consider when developing your BIM Structure.

What is the project type? Architecture make up, towers, podium, underground

What deliverables are required? Phases, construction schedule / method

Who makes up the project team? Location, skill set, technology used, bandwidth / connection size

What is the project schedule? How does it compare to other similar projects that you have done.


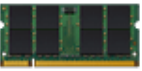




When you have your project kickoff meeting the BIM structure should be a big part of the process. You need to make sure that everyone on the team understands how and that you plan on using Revit. This is true for all projects but when you work on one of these large projects it is a requirement.





What kind of hardware will it take?

When you start considering doing large projects in Revit. It is critical to make sure you have the hardware to support the effort. We have broken the topic of Hardware into three general areas.

1. Workstation Configuration
2. Network Configuration
3. 64bit Revit

The general rule of thumb when working on a large project in Revit is you need very high performance hardware to support your effort. If you have ever bought hardware you will know you have tons of options and it is not always clear what the right direction may be. We have broken down the key areas to help in the process.

Workstation Recommendations		
Item	Min Recommended	Effect
	Intel Core Duo 2 2.4 GHz	Faster CPU, faster base operations.
	8GB	This will make or break you. If you don't have enough RAM you will not be able to open the project.
	250 GB SATA2	Faster drive, faster loading of local files.
	nVidia 8800	I was surprised how much the video card effects performance in Revit.
	Wide Screen	The more screens the slower the graphics performance but the more productive you are.
	Windows Vista x64	More driver support than XP64. And 64bit is a requirement for large projects.

Infrastructure Recommendations		
Item	Min Recommendation	Effect
	Windows 2003 x64 server dual processors	When running Vista x64 you will need at least 1 x64 server to connect printers.
	RAID 5 / 4TB space	Redundant fast storage has a profound effect on save to central times. Make sure you have Write Cache and a battery backup.
	1GB managed switch	We have found that the switch has an effect on save to central times. A good quality enterprise switch like HP, Cisco, or 3com will give you the best performance.
	WAN Accelerator	If you are working on a project in remote office a WAN accelerator is a must

64bit Revit

If you follow the hardware recommendations above then you will have a 64bit computer. To take advantage of the new OS you will also need to install the 64bit versions of Revit. You can get the 64bit versions of all the Revit family of projects from the subscription center web site.

<http://pointa.autodesk.com/local/enu/portal/signin.jsp>

64bit OS and application will allow you to get past the 4GB RAM limit in 32bit OS. What this means for Revit users is that if your project size is larger than 4GB when loaded into Revit you will be able to open the file and work. One general rule you can use to help define how much RAM you will need, is to take the size of you project file and multiply it by 20. This will give you a rough idea on how much RAM will be needed to load the file into Revit. On these large projects you will reach that 4GB barrier much fast than you might think. Although you may see some performance gains from the 64bit applications it is the ability to access more RAM that makes this move critical to working on large projects. It is also important to make sure your whole team is 64bit. If your model is big enough to require 64bit then anyone that loads that model will need the same requirements. If you are unable to make the move to a 64bit OS, then you will have to very careful about how you break you project up, use links and worksets.

Workstation Performance.

If you would like to test your workstations performance you can download the AUBench2009 file that Phil Read posted to AUGI at:

<http://forums.augi.com/showthread.php?t=71482&page=5>

When you run the bench mark you will get a spreadsheet that shows your results of each operation in seconds. Although this is not a test of large project performance it can give you a baseline to compare different configurations on. You can also use this same concept to answer other performance questions. Below are some of the results posted to the AUGI forums.

System Specs	Results
MacPro 2 x 3.0 GHz Daul-Core Intel Xeon 1,333 Mhz Dual Independent frontside buses. 16 GB Ram 250GB SATA Hard drive ATI Technologies Radeon X1900 64 bit Vista Business running in bootcamp Twin 23" Display	5 opening and loading the custom template 4 creating the floors levels and grids. 23 creating a group of walls and doors 49 modifying the group by adding a curtain wall 19 creating the exterior curtain wall 7 creating the sections 11 changing the curtain wall panel type 50 create 3d view and render 1 export all views 169 Total Time (Seconds)
Macbook Pro 17" @1920x1200 200Gb 7200RPM HDD T9500 2.6Ghz Dual Core 4Gb RAM (3Gb effective) 32-bit Windows Vista Ultimate on Bootcamp Nvidia Geforce 8600M GT 512Mb Virtual System Memory 8192Mb	6 opening and loading the custom template 11 creating the floors levels and grids. 33 creating a group of walls and doors 73 modifying the group by adding a curtain wall 30 creating the exterior curtain wall 12 creating the sections 16 changing the curtain wall panel type 103 create 3d view and render 2 export all views 286 TOTAL
MacPro 2 x 3.2 GHz Quad-Core Intel Xeon 1,600Mhz Dual Independent frontside buses. 8 gb of 800 Mhz DDR2 Ram 1 500GB SATA Hard drive gForce 8800 GT Video Card 64 bit Vista Business running in bootcamp Twin 23" Display	3 opening and loading the custom template 3 creating the floors levels and grids. 19 creating a group of walls and doors 44 modifying the group by adding a curtain wall 17 creating the exterior curtain wall 5 creating the sections 10 changing the curtain wall panel type 43 create 3d view and render 1 export all views 145 Total Time (Seconds)
Dell Precision WorkStation T7400 Windows XP64 Dual Core Xeon 3.4 X5272 6M L2,1600mhz 12g 800mhz RAM 10k RPM WD HD ATI FireGL V7600 w/dual 24" HP's	7 opening and loading the custom template 15 creating the floors levels and grids. 33 creating a group of walls and doors 59 modifying the group by adding a curtain wall 25 creating the exterior curtain wall 18 creating the sections 14 changing the curtain wall panel type 78 create 3d view and render 1 export all views 250 Total
Machine = 1 Quad Xeon - X3350 @ 2.66 Hz 8 GB RM Video-QuadroPro 1500 Windows Vista Business 64	4 opening and loading the custom template 8 creating the floors levels and grids. 26 creating a group of walls and doors 56 modifying the group by adding a curtain wall 23 creating the exterior curtain wall 10 creating the sections 13 changing the curtain wall panel type 55 create 3d view and render 2 export all views 197 Total

When is a good time to use links?

As you work on large projects in Revit you will quickly come to the realization that links are one of the keys to pulling off a large project. Like most things links can make a large project possible but at the same time setting up links the wrong way will stop a project dead in its tracks.

- Breaking up a project into links

We have seen a number of different strategies for breaking projects up and each concept seems to have pros and cons. The key is to look closely at staffing and deliverables. Deliverable should drive what model contains the sheets for that deliverable. Staffing will drive how the model is broken up based on access and speed of accessing model information. Using both staffing and deliverables as the bases of you model division is a clean way to strategize the best places to break up your model. If you are not using Revit 2009 64bit then you must add model size to the strategy. In Revit 32bit as a general rule you want to keep your model sizes under 300MB. In Revit 64bit you can estimate you max file size by taking you RAM amount and dividing it by 20. An example of this would be:

8GB RAM /20 = 400MB max file size

Although the 20x concept works for files that are directly loaded into Revit, files that are linked do not seem to take as much RAM when they are linked.

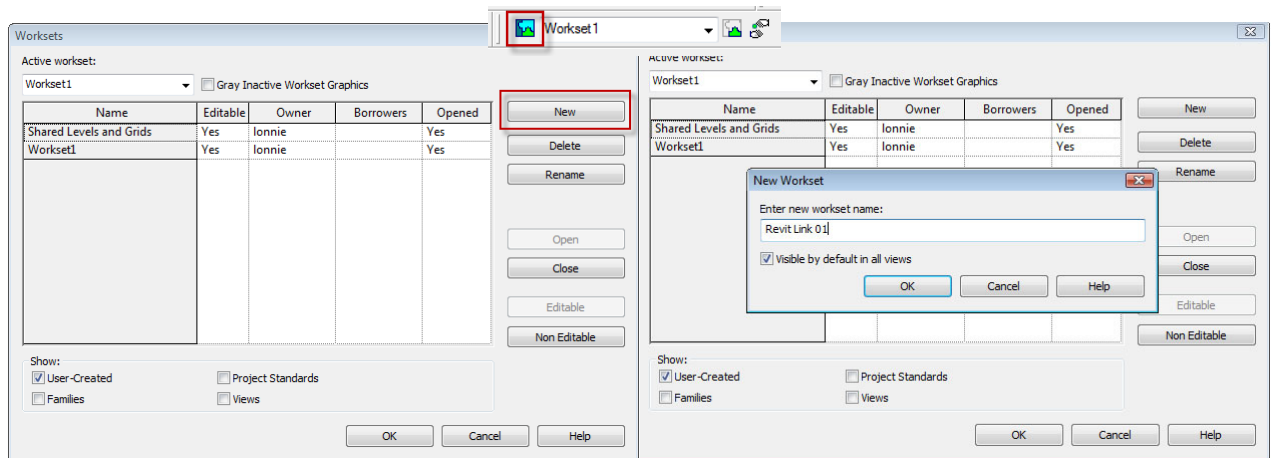
Deliverable rules to consider: Deliverables can be an easy way to consider were to make model breaks. If your project is divided into a core and shell delivery schedule then creating two models one for the core and another for the shell is an easy division. The primary thing is to keep the deliverable package in the model were the objects are that need to be edited for the deliverable. Most of the large projects have a very fast project schedule that requires you to produces several packages over the course of the project. Identifying the project schedule and understand the deliverables can then be used to define the model break locations.

Staffing rules to consider: Staffing can be a very important consideration for model breaks. Every company has methods about how they staff projects. In a perfect world your team would all be located in the same office and you would have the same team for the length of the project. In the real world we often change team members from day to day or week to week. They may be in one office or they may be scattered in multiple offices. You should think about the flexibility you may need and arrange your models to maximize your need. Try and keep objects that are in use by a team local to that team. For example if you divide your model into a Core and Shell Model (CSM) and a Interior Architecture Model (IAM), then staff the project team were the group accessing the CSM is separate to the team that is working on the IAM. This is true whether the team is in one location or if they are in two separate locations. When one team is continuously opening the other team model to adjust it your teams will become frustrated. If the teams are in different locations this will become even more obvious as the save times will be very long over the WAN. The team size should also be considered. As you work on larger projects the files get much bigger and save times become a concern. In general we ask all project team members to save to central once an hour. Scheduling these save times becomes a real need to keep the team from saving on top of each other. On larger projects a save to central can take 5 to 15 minutes. If you have 4 people on a team and it takes 15 minutes to save to central with scheduling they can work without too much trouble. Adding another 2 or 3 team members to that 4 can become much more frustrating. The "Worksharing Monitor for Revit" (WM) is a critical tool in these situations. You can get the WM from the Autodesk subscription web site. It will tell you who is accessing your central file and if they are saving to central and how long that save will take. This monitoring tool is essential when work on large projects.

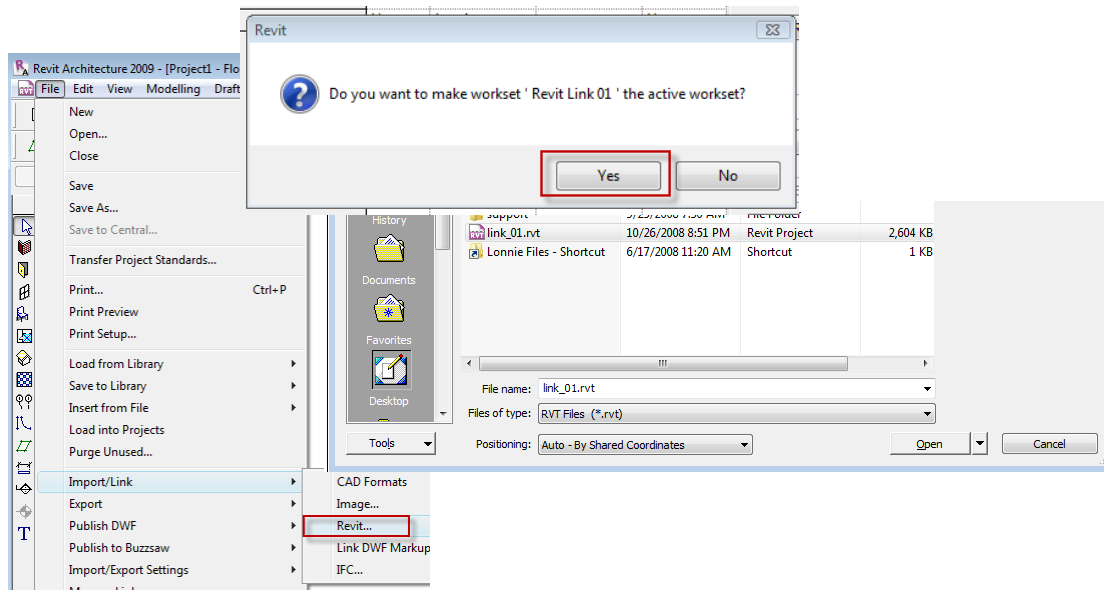
- Using worksets and links

One key to working with links in Revit is understanding how worksets and links work together. You will find that unloading and reloading links will cause several problems in your project. To prevent this you can use worksets in combination with links. It works somewhat like layers and xrefs did in AutoCAD.

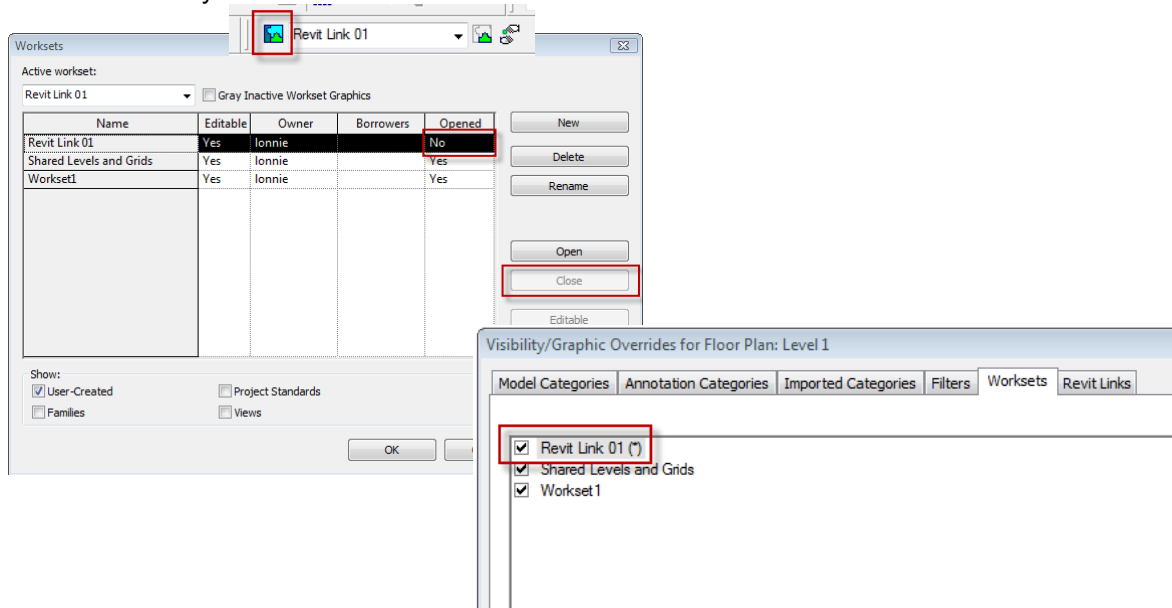
You want to first create a new workset for your link.



After setting the new workset current you then can to link your file into Revit.



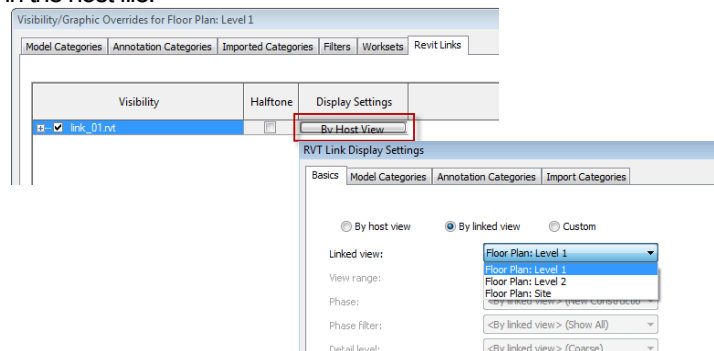
This effectively will place the link onto the workset. The results of this are that if you close the workset, you are effectively removing the link from memory. This also will allow you to effect the visibility of the link by turning off the workset visibility in the view.



When linking your models you can also use the specify option in the open tool. This will let you link a specific workset or group of worksets into your model. For example, if you have a podium model and you are linking your tower model into it you most likely do not need all of the floors of the tower to get the needed backgrounds for your coordination efforts. When you build your tower model you can put all of the lower floors on a workset or group of worksets allowing you to load only what is needed during the linking process.

- Visibility controls when using Links

When you link projects or parts of project into other Revit project you often have a need to make a view in the host file look exactly as it appears in the linked file. This becomes very important when you want view specific information to show up in the host file. This is often needed to show annotation that is the linked file in the host file.



This works with Plan, Elevations and Section.

How important are families on a large project?

When working on large projects in Revit you are always fighting an ever expanding file size. Families are one place that if left unchecked your project size will grow out of control. On these large projects it is very common for a family to be copied 100's or 1000's of times, so every KB counts. In this section we will give you some guidelines to consider as you build your families.

- Family Creation Guidelines
 - 3D or Not 3D - Before creating any family you need to answer the 3D or not to 3D question. This is a simple question that often does not get asked and you end up with several families that have 3D elements that never get used. When you are working on large projects you need to ask this question carefully every family that you make 3D is bigger than a simple 2D family. If the 3D is not needed you need to remove it from your family so your project can be as small as possible.
 - 2D Representations – Even if you create a 3D family take the time to create 2D representations for Plan and Elevation views. Make sure that the 3D only shows up in the 3D views. This will speed up you model in your 2D Views.
 - Parametric Families – It is very common to create a single family that represents several sizes of that object. To do this you have to make parametric families. These type of families place a greater computational burden on the model than static families. Consider carefully whether a family needs parametric flexibility and confine that flexibility to necessary adjustments.
 - Hosted families that cut - Families which cut their hosts consume significant computing resources on regeneration when compared to families that reside on a given surface without cutting the host. A simple example of this is a typical can light fixture. These get used all over your project. On one project the count was over 5000 times. Consider if you have the fixture cut the ceiling that is 5000 holes in the ceiling that have to be calculated for every time your model regenerates. Simply removing the cut out of the family will make a major impact of model speeds. Take careful consideration before adding a cut to the host on you families.
 - DWG solids – It is common practice to take 3D DWG solid models into families and use them in Revit as families. This is very bad practice if you doing large projects. These DWG based families are big, slow and cause several issues in large project files. With this in mind you need to be very careful about download families and using them in your project.
 - Where possible, avoid arrays and formulas.
 - In-place Families - Create a family component instead of in-place families for repetitive components. When an in-place family is copied (which may itself be problematic), it makes an entirely new entity each time, as opposed to referencing the type information from the first instance. This can cause your project size to grow rapidly.
 - Families or Groups - Families require fewer resources than groups. Use families instead of groups, where possible. Groups are very powerful, but updating large quantities of group instances consumes significant computing resources. Even when using a table and chair to create a grouping that is repeated. It is well worth the time to insert the chair and table into a family and use it in the project.

How do you work with a team that is using AutoCAD

On almost every project team you will have at least one team member that is still using AutoCAD. Using AutoCAD files in your Revit model can be a fast way to get work out the door, but is also a fast way to make your model unwieldy, fat and slow.

Exporting AutoCAD files from Revit

Creating a separate view for exporting is key when working with team member that will be using AutoCAD. You may want to consider creating a separate export view for each of your consultants. This is important whether they are using AutoCAD or Revit. By creating a separate view you are able to set the visibility specifically the way the consultant needs to see the information. For example a structural engineer wants to see a completely different set of objects then the MEP engineer. This should be done for each level that you are going to be exporting.

Bringing AutoCAD files into Revit

1. Cleaning the AutoCAD file

AutoCAD file typically contains more information than is needed for you to review or coordinate your design. So it is very important to clean the AutoCAD file before you bring it into Revit. It will be a challenge to get your team to follow this process because it may seem like a lot of extra work up front and the results of not doing so will not be noticed until later.

- Open the .dwg file in AutoCAD - Turn off or freeze all the layers you do not need in Revit. (The layer off or layer freeze command in the express tools are an easy way to accomplish this task.)
- Move everything to one layer - You may choose not to do this step but remember every layer from an AutoCAD file will create line types etc. in your Revit file. For this reason to make your AutoCAD files as clean as possible change the layer of the entities to layer zero.
- Remove hatches – Hatches especially dense hatches can be very heavy in Revit so if possible remove all your hatches.
- W Block – Using the W Block command will allow you to create a new file by selecting the elements from the current file. Now you can import or link the .dwg file into your Revit model.

2. Linking and Worksets

As with linking anything into Revit it is a good idea to first create a workset , set that workset current, and then link your file. This will give you load and visibility control at the workset level.

3. Importing into a family

Many organizations have started importing the .dwg's into a family and then loading the family into their project. This gives great visibility and insertion control over your .dwg information but can make the updating of that information difficult.

4. AutoCAD file management

Just like in the days when we used AutoCAD the management of the AutoCAD files that you were using in your Revit model need to be managed properly. With that in mind you need to keep a location in your project folder where all .dwg's that are linked are stored. You may want to add extra folders to keep track of versions of the AutoCAD files.

