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## Specifying your Revit Workstation

Put your money in the right places for optimal performance.

By Robert Green, *Cadalyst* Contributing Expert



Are you using Autodesk® Revit® for building information modeling (BIM) design? If not, will your company move to Revit in the future? And if your company won't be designing in BIM, will you need to provide building component data; mechanical, electrical, and plumbing (MEP) layouts; or palletized equipment or load summaries to outside architects, structural engineers, or heating, ventilating, and air conditioning (HVAC) engineers who do use Revit? Pondering these sorts of issues forces CAD users to think about how their computing environment will change to support BIM usage.

Besides the obvious software and training issues that BIM use raises, you also will need to deal with hardware issues such as:

- What operating system should I be using?
- What processor core(s) will I need?
- How much memory will I need?
- What type of graphics processor will I need?
- What configuration guidelines can I use to get the best performance for the money?

These questions are tough to answer because different companies use Revit so differently. In this issue of *Workstation Innovation News*, I'll endeavor to give you the information you'll need to plan a hardware environment for your BIM future.

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## Autodesk's Revit Specifications

Want to know what kind of hardware is required for Revit? Well, why not start with what Autodesk recommends?

### Minimum System Recommendations for Revit

A trip to the [Autodesk web site](#) reveals the detailed minimum and performance configuration recommendations for Revit tools.

A close perusal of these minimum requirements for Revit could be for almost any desktop or laptop machine running Windows XP 32-bit operating systems purchased in the last three years. Given my workplace experience with these types of machines, attempting to run Revit with these minimum requirements may work in a training room environment but won't work well for production.

### 64-Bit Performance System Recommendations

Microsoft Windows 7 64-bit Enterprise, Ultimate, Professional, or Home Premium<sup>4</sup>  
Quad-core Intel® Xeon® Processor (2.50-GHz, 2X6M L2, 1,333-MHz) or equivalent AMD processor<sup>1,3</sup>  
8 GB of RAM (or more)  
5 GB of free disk space  
1,280 x 1,024 true-color monitor  
1 GB (or more) DirectX 9-capable graphics card with Shader Model 3  
Microsoft Internet Explorer 7.0 (or later)  
Microsoft Mouse-compliant pointing device  
Download or installation from DVD  
Internet connectivity for license registration

Although these specifications certainly are more aggressive, newer workstations with more modern, Intel Xeon 5500 series<sup>1,3</sup> processors offer dual sockets that support multiple quad-core<sup>1</sup> processors and much more memory for Revit users who take on more aggressive projects.

## Specifying Revit Workstations

To get guidance on how to best configure and purchase a workstation for Revit, I asked HP Technical Consultant Frank Deming about his experiences with a variety of Revit clients running HP Z Workstations with Intel processors. Our conversation covered a lot of ground and proved to be very educational in understanding the inner workings of today's workstations for Revit (or other high-end 3D CAD

systems).

#### HP System Recommendations for Revit

Priority One: Cores. Equip your system with as many as cores as your application needs with the highest speed you can afford.

Priority Two: Memory. Fill all slots with as much dual-rank (2-, 4-, or 8-GB) memory (use the same type in all slots) as you can afford.

Priority Three: Graphics. Use an Autodesk-certified graphics accelerator that fits your rendering and output needs.

Priority Four: Disk. Use 7,200-rpm SATA format disks unless large-volume rendering is required.

Operating system. You must use a 64-bit operating system to deliver maximum memory performance.

To learn more about HP system recommendations, consult its [workstation finder tool](#).

Robert Green (RG): How important are the workstation's various subsystems (processors, memory, graphics, and disk) in helping Revit to perform optimally?

Frank Deming (FD): Working with a number of customers, we've found the order of importance of the HP Z Workstation subsystems seems to be memory first, CPU a close second, the graphics card a distant third, followed by disks.

*"We've found the order of importance of the HP Z Workstation subsystems seems to be memory first, CPU a close second, the graphics card a distant third, followed by disks."*

### System Memory (RAM)

RG: Given the primary importance of memory with respect to performance, how much memory does Revit really need?

FD: Revit is the most difficult Autodesk app to size correctly because customer demands are so different. What we do know is that the size of the project files in use determines the amount of memory used by Revit as it runs. A safe estimate is to multiply the project file size by 20 to obtain the memory run-time requirements — being aware that linked projects also add to these memory requirements. Users should estimate their project sizes for the next three years to arrive at a memory size that will serve them over the life of a new HP Z Workstation.

RG: So a 200-MB Revit project would use approximately 4 GB (200 MB x 20) of memory without rendering or other subprocesses running?

*"A 200-MB Revit project would use ~4 GB (200 MB x 20) of memory without rendering or other subprocesses running."*

FD: Correct.

RG: Given that various processors have different memory architectures, what's the best way to allocate memory for dual-channel (number of memory slots divisible by two) and three-channel (number of memory slots divisible by three) architectures?<sup>5</sup>

FD: For HP Z Workstations with two-channel architectures, simply fill all available channels with dual-rank (2-, 4-, or 8-GB) rather than single-rank (1-GB) memory modules. For three-channel architectures, you should still fill all available memory channels with dual-rank memory but make sure that all channels are balanced by using the same size memory in all channels. To push memory even higher, you can use quad-rank (16-GB) modules, but the speed of the memory will be

somewhat slower due to lower frequency ratings.<sup>5</sup>

RG: So it seems like a good rule of thumb is fill all channels with the same type of memory as opposed mixing types or leaving some channels empty, right?

FD: Correct.



Screen image courtesy of Autodesk

## CPU Parameters

RG: So what about the central processing unit (CPU) cores on HP Z Workstations? What is the optimal number of cores to use?

FD: This is very application-, and sometimes usage-, specific. For AutoCAD-based products, you could say a two-core CPU like the Intel Core i5 in our Z200 Workstation is optimal; however, for other CAD applications or if any significant amount of time is spent rendering designs, then four or more cores and the Intel Xeon is a must. Another consideration is throughput of a system and not just performance. If a user is running multiple tasks, one actively in the foreground and some analysis running in the background, four to eight cores (or more) can be a recommendation.<sup>1,2,3</sup>

RG: I usually tell my clients to buy the number of cores they need, with the fastest processing rate they can afford, and then put as much memory in as practical — my logic being that you can always upgrade memory later but not the processors. Is that sound advice?

*“Buy the number of cores you need — with the fastest processing rate you can afford — and then put in as much memory as is practical.”*

FD: It is.



Screen image courtesy of Autodesk

## Operating System and Graphics Issues

Autodesk's 4-GB memory and 1,280 true-color graphics requirements for Revit are met easily by even three-year old laptop machines with embedded graphics running 32-bit Windows operating systems. With so much more graphics resolution and memory available using 64-bit operating systems and modern graphics processing unit (GPU)-based video/rendering cards, I wanted to ask Frank about these issues.

RG: With all these cores and memory, we have to run 64-bit operating systems given the 4-GB maximum memory for 32-bit operating systems. I'm seeing a lot of Windows 7\* 64-bit<sup>4</sup> in the field in the past year — is there a certain level of memory where Windows 7 64-bit starts to run CAD better?

FD: Innately no. However, related to throughput the answer is yes. If you are running multiple applications, let's say several Autodesk apps, Outlook, and a browser, then enough RAM to allow the majority of each app to reside in memory can make a big difference in the user experience.

As an example of a poor experience, I recently ran several browsers, multiple Microsoft applications, and one Autodesk application on a 4-GB equipped 64-bit Windows 7<sup>4</sup> laptop. Total run-time memory requirements of all the apps were typically just more than 6-GB, so switching between any of the applications was a tedious experience. In this case, I was overextending the capabilities of the laptop, but that's how I need to work, so I'll be giving myself an upgrade this spring.

I do want to stress that modern web sites, as well as CAD, are RAM hungry and getting worse. All that graphical richness comes at a cost, both for CPUs and particularly memory.

### Autodesk Recommended Graphics Cards

For recommended graphics hardware and frequently asked questions (FAQ) documents, visit the [Autodesk Revit Architecture Services & Support](#) page.

RG: Speaking of graphics, what is the memory impact of the GPUs in the high-end graphics cards available today?

FD: Typically there is no impact on system memory with a 64-bit operating system. However, 32-bit Windows (XP, Vista<sup>4</sup>, and 7<sup>4</sup>) systems do lose working

RAM to the graphics card. The graphics card adds additional size to the system's memory-mapped I/O (MMIO) region, which leads to a 2-GB user memory size, unless the /3GB and /USERVA switches are applied. This is one of the main reasons to move to a 64-bit OS — the user gets a much fuller use of the RAM in a system.

RG: The HP Z200 Workstation uses Intel's embedded graphics to save the cost of an add-on GPU based graphics card. How does this affect machine performance?

FD: Intel's embedded graphics solutions, which are actually on the CPU, do use system RAM instead of having dedicated video memory. The embedded graphics processor's RAM usage is user selectable, to a degree, but will always take RAM away from core processing tasks and will always be slower due to memory access over the PCI-Express system bus architecture.



Screen image courtesy of Autodesk

## Disk Systems

Finally, I wanted to get Frank's opinion about how various disk systems could assist Revit's performance. I specifically wanted to see if multidisk systems using RAID or solid state disks (SSDs) were worth their additional expense.

RG: What are the performance differences for single- and multiple-disk configurations and controller technologies such as RAID<sup>6</sup> as opposed to the standard SATA drives in most HP Z Workstations?

FD: RAID 0 is useful for data-intensive applications such as large data-set mechanical finite-element analysis (FEA) applications. RAID can be particularly helpful with some of the Autodesk Media and Entertainment products that perform video and film editing because three or more RAID 0 disks can be used.

RG: So it sounds like most normal Revit users can stay with conventional SATA disks unless they're doing energy analysis or substantial rendering or animation tasks and put their money in faster cores with more memory?

FD: Correct.

RG: What about SSD technology?

FD: My own use, SSD with standard MCAD technologies have shown little

improvement in application performance — there just is not that much disk I/O activity to make a difference. There are definitely indications of good boot-time performance with SSD, but boot-up is an infrequent action for most desktop users.

## Wrapping Up

I hope this detailed discussion of how to configure your workstations for optimal Revit performance will help you better plan your hardware budget. Simply knowing how to prioritize cores, memory, graphics systems, and disk systems can go a long way toward getting the greatest amount of Revit performance for every HP Z Workstation dollar you spend. I hope you found the discussion as interesting as I did.

*Authors note: I'd like to personally thank Frank Deming from HP for taking so much time to share his configuration expertise.*

### About the Author

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Robert provides CAD implementation, consulting, and programming services for a variety of companies throughout the United States and Canada. He holds a degree in mechanical engineering from the Georgia Institute of Technology and is the author of *Expert CAD Management: The Complete Guide*. Reach him via his web site at [www.cad-manager.com](http://www.cad-manager.com).

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- (5) Each processor supports as many as two channels (HP Z200/HP Z200 SFF) or three channels (HP Z400/HP Z600/HP Z800) of DDR3 memory. To realize full performance, at least 1 DIMM must be inserted into each channel. To get full 6-channel support, two processors *must* be installed.
- (6) SATA hardware RAID is not supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID. Please visit <http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00060684/c00060684.pdf> for RAID capabilities with Linux. HP Z200 does not support RAID 10 Because of drive-bay limitation.

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