

AutoCAD® Civil 3D® Performance Optimization

Speakers:

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CV419-2U How to increase performance in AutoCAD Civil 3D 2011

CV230-1C How to increase performance in AutoCAD Civil 3D 2011

CV416-1 How to increase performance in AutoCAD Civil 3D 2011

About the Speakers:

Josh is the Autodesk Global Technical Lead for AEC Civil Support. With over ten years in the civil and software design industry, he has been involved in a wide variety of civil engineering projects, and training and troubleshooting software. Prior to joining the Autodesk team, he worked on both public and private civil engineering projects ranging from roadway design to site development, to drainage and flood plan design. Since joining Autodesk, he has worked in Product Support where he has aided Subscription customers and resellers with troubleshooting for Autodesk® products. Josh holds both a B.S. in Civil Engineering and a master's degree in Business Administration from the University of Maine.

Jason has more than 15 years of experience in the land surveying and civil engineering industry. He has worked as a surveyor, designer, CAD manager, applications engineer, and consultant. Jason has worked with Softdesk®, AutoCAD® Land Desktop, and AutoCAD® Civil 3D since its inception. He is a co-author of *Mastering Civil 3D* and has contributed to many Autodesk Official Training Courseware titles. Jason is a popular AUGI CAD Camp and AU presenter where he shares his knowledge and passion for helping companies get the most out of their technology investment. Jason currently helps Autodesk customers worldwide as a Senior Civil Support Specialist in Autodesk® product support.

Introduction

A lot of businesses spend a considerable amount of time planning and implementing workflows to ensure they achieve the greatest efficiency possible during the design phases of a project. However, no matter how well thought out the workflow is, a better understanding of the application you are working with can always lead to further efficiencies.

Take any analogy you like; building a house, building a career, racing a car, and you will find they all start off with the same notion; 'To achieve the greatest results, you need to start with a solid foundation.'

That same concept holds true when working with AutoCAD Civil 3D. If you spend some additional time understanding the fundamentals of how the application works, you can increase its performance and build a stronger foundation for your workflow.

In the following pages we will look at several ways to optimize the performance of AutoCAD Civil 3D. We'll break it up into the following sections:

- **Optimizing your computer to run AutoCAD Civil 3D** – Understanding how your systems Operating System and hardware affects AutoCAD Civil 3D will allow you to make better purchasing decisions.
- **Changing the way you view your AutoCAD Civil 3D design** – I mean this in the literal sense. The styles and settings that you use to display the Civil objects in a drawing can have a big impact in the performance of the application.
- **Modify settings and other utilities** – There are several settings and features inside of AutoCAD Civil 3D that are there just waiting for you to take advantage of. However, if you are not utilizing them, you can increase performance by disabling them.

By the end you should be able to identify opportunities in your workflow to improve the performance of AutoCAD Civil 3D and increase the efficiency of your design process.

Optimizing your computer to run AutoCAD Civil 3D

For some people upgrading your computer may not be an option. However, for those with the opportunity, we will show how with just a few relatively inexpensive improvements, you can get AutoCAD Civil 3D performing like you have never seen it before.

In this section we will look at:

- Operating systems and memory (RAM)
- Hard drives
- Graphics cards
- Processors

Not all of these upgrades will provide the same benefit, and not every upgrade is suitable for every user; however, by the end of this section, you should be able to identify those that will provide you with the maximum return on your upgrade investment.

Operating systems:

By far the biggest return on your investment can be realized with an upgrade to a 64-bit operating system. This is true whether you are currently using AutoCAD Civil 3D 2010 or 2011, but most certainly true if you are using AutoCAD Civil 3D 2011. That is because AutoCAD Civil 3D 2011 is now a 64-bit application.

To understand why this is important, it is necessary to understand how the different operating systems allocate memory to applications such as AutoCAD Civil 3D. If you are not interested in the 'why', but would just rather know which operating system is best for AutoCAD Civil 3D, jump to the end of this section for the recommended operating systems.

- **32-bit Operating Systems** – Whether you are working with AutoCAD Civil 3D 2010 or 2011, if you are running a 32-bit operating system, you are limited to the amount of virtual memory available to the application. This is because 32-bit operating systems reserve 2GB of RAM to run the operating system and other peripheral software, such as video drivers. That means that all other applications, such as AutoCAD Civil 3D, are limited to whatever is left over. Moreover, the operating system will limit what is left over to 2 GB per application. When the memory usage of the application exceeds the amount of physical memory (RAM) available, it will utilize the hard drive as 'virtual memory'. However, the maximum amount of memory available on a 32-bit operating system is 4 GB.
- **64-bit Operating Systems** – When you're running a 64-bit operating system you will see noticeable improvements. This is because 64-bit operating systems are not limited to the 4 GB ceiling of the 32-bit operating systems. This means more memory can be allocated to applications such as AutoCAD Civil 3D. However, it is important to note that AutoCAD Civil 3D 2010 is a 32-bit operating system. This means that it is still limited to only 4 GB of memory. AutoCAD Civil 3D 2011, on the other hand, is a 64-bit application and the only limit is the amount of slots in your mother board to fit sticks of memory. That is why a 64-bit operating system is the best investment you can make for improving performance in AutoCAD Civil 3D.

- Large Address Aware (/3GB Switch)** – I would be remiss if I did not mention the option to make a 32-bit operating system large address aware. That is to say, you can bump up the memory available to an application on 32-bit operating system to 3 GB. However, remember that the operating system is still limited to 4 GB of total memory, so you are only leaving 1 GB of memory to run the operating system and the peripherals. This is commonly referred to as ‘enabling the /3GB switch’ and requires modifications to operating system variables at startup. More information and instructions for enabling the /3GB switch can be found in the following links:
<http://usa.autodesk.com/getdoc/id=TS1071001>
<http://msdn.microsoft.com/en-us/library/ff556232.aspx>
- Windows XP** – Windows XP was first released in 2001 and is still the most popular operating system in the world. However, this operating system has some disadvantages over its current Microsoft successors, Windows Vista and Windows 7. Its primary disadvantage, when it comes to running applications such as AutoCAD Civil 3D, is the way in which it allocates its memory. When AutoCAD Civil 3D is performing complex tasks such as grading and corridor processing, the program desired large amounts of contiguous memory. That is to say, it is looking for large sections of uninterrupted memory. Unfortunately, Windows XP allocates memory like the black squares on a checkerboard, a little bit here and there, and leaves little of this contiguous memory.
- Windows Vista and Windows 7** – I’m going to mention these two operating systems together, as they share the same benefit over Windows XP. The primary benefit of these operating systems is their memory management. These operating systems greatly reduce the fragmentation of memory and provides larger amount of contiguous memory for applications. They do this by sequentially loading applications into memory and avoiding the checkerboard pattern seen in Windows XP. That being said, Windows 7 is preferable over Windows Vista due to other efficiencies in the operating system.

So, we have discussed the benefits of a 64-bit operating system over a 32-bit, the /3GB switch, Windows 7 over Windows Vista and Windows Vista over Windows XP. By now you can probably list the order of preferable operating system configurations, but let me do that for you.

Recommended Operating Systems (decreasing preference)
Windows 7 64-bit
Windows Vista 64-bit
Windows XP 64-bit
Windows 7 32-bit; /3GB switch
Windows Vista 32-bit; /3GB switch
Windows XP 32-bit; /3GB switch
Windows 7 32-bit
Windows XP 32-bit

Hard Drives:

Beyond ensuring that you have enough hard drive space for the application to install and run, you will also want to consider the data transfer rate. Faster data transfer rates will help decrease the time it takes to open AutoCAD Civil 3D and load and save drawings that are stored locally. Additionally, a faster transfer rate can increase performance when utilizing the hard drive for virtual memory (see discussion regarding memory under 32-bit Operating Systems above). 10,000 RPM SATA hard drives are available and are relatively inexpensive.

Graphics Cards:

Autodesk works with graphics hardware vendors to ensure certain graphics cards will support many 3D display features in the latest versions of AutoCAD based products. Autodesk lists these graphics cards as 'Certified' in the Graphics Hardware List. You can also find and download drivers for all of the graphics cards in this list. Using a certified graphics card will enable the 3D graphic enhancements and improve performance when using the orbit functionality and applying materials to objects.

Processors:

When looking at multiple or multi-core processors your options may appear abundant, but the benefits may not have the anticipated return on your investment. This is because, for the most part, AutoCAD Civil 3D runs as a single process.

Since AutoCAD Civil 3D runs as a single process, it will not utilize more than one processor. However, having multiple processors does enable you to run multiple other processes (anti-virus, firewalls, etc.) and applications (Word, Excel, Outlook, etc.) on separate processors and provide a more dedicated processor for AutoCAD Civil 3D. So, if you are a user who multitasks throughout the day and has many other applications open at once, you may see added benefits in multiple or multi-core processors.

Also, I said that AutoCAD Civil 3D runs as a single process, for the most part. There is an exception where using multiple or multi-cores can have a significant benefit. That exception is rendering. If you do a lot of rendering, particularly on larger drawings, you will want to consider multiple or multi-core processors. Here you might see as much as a 250% decrease in render time.

Changing the way you view your AutoCAD Civil 3D design

With many things in life there is a ‘right way’ and a ‘wrong way’ to do things. However, when working with AutoCAD Civil 3D, it isn’t always so black and white. Just as there are best practices for your workflow; there may be some tactics that you can implemented to improve the performance in your day to day work in AutoCAD Civil 3D.

In this section we will look at improving performance through:

- Display settings
- Surface modeling
- Corridor modeling

As you will note that not all of these recommendations are suitable for all stages of design or for all deliverables. However, implemented during the correct stages in your project’s life cycle, they may save you noticeable design time.

Display settings:

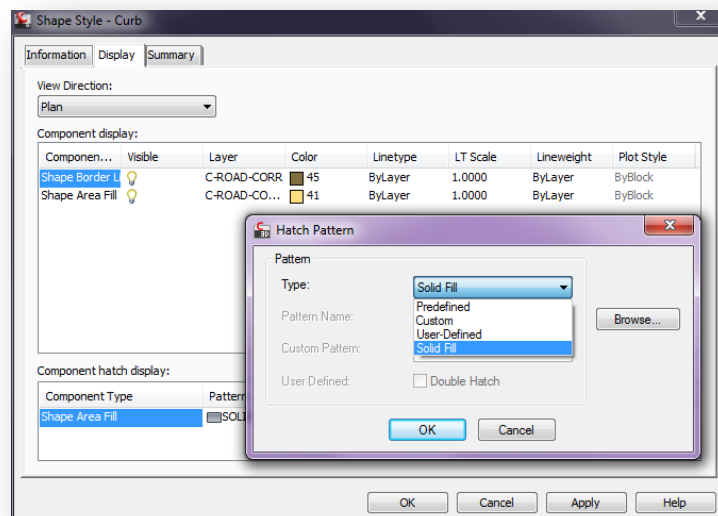
As indicated by the title of this section, we are going to look at ‘changing the way you view your AutoCAD Civil 3D design’. And I don’t mean this metaphorically. We really do need to take a look at the way your design looks on your screen.

As you are probably well aware, AutoCAD Civil 3D provides you with lots of options on how to view and label objects like corridors, profiles, surfaces and pipes. But did you know that utilizing some of these options can have an impact on your drawings performance?

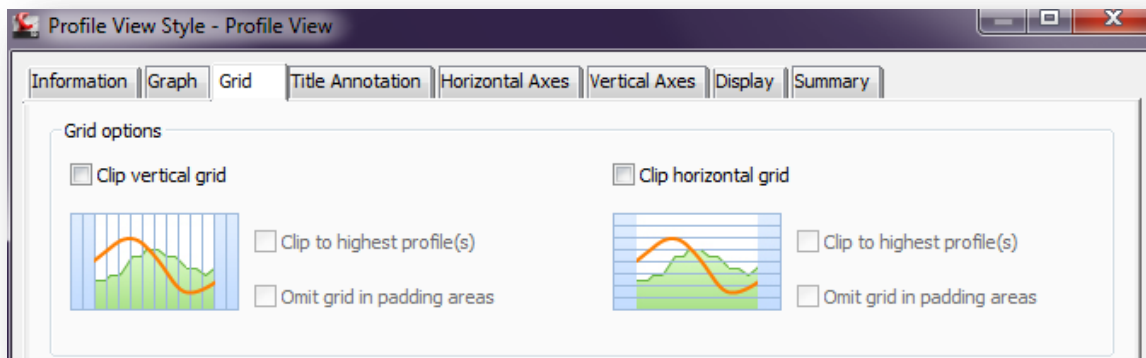
As a general rule, the more ‘details’ or ‘special options’ you use, the greater the memory impact your drawing is going to have. That being the case, you may want to consider utilizing different styles for your design and production phase.

Now, let’s take a look at some of these details and special options that you should be aware of.

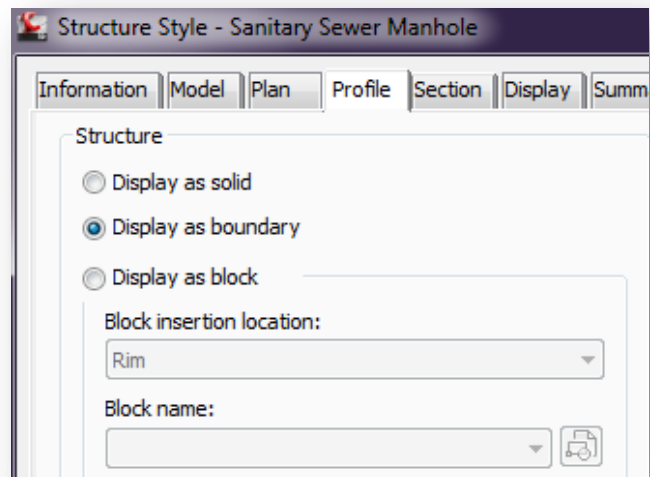
- **Corridor design** – When setting up shape styles for subassemblies, it may be tempting to use special hatch patterns such as Concrete for curbs or Gravel for base. However, hatching takes additional memory when determining the hatch boundaries, scale and rotation for the pattern. Instead, consider not using any fill (turn off visibility of Shape Area Fill), or at a minimum a Solid Fill.



- **Profile views** – A few releases back, AutoCAD Civil 3D introduced the option to clip profile grids. While this feature was introduced out of necessity, it also has had noticeable impact to those who use it. Computing where the grid is to be clipped vertically and horizontally has been shown to be 4 times slower than not using these settings. So, if you need to display your profile with the clipped options, wait until your production phase to implement it.

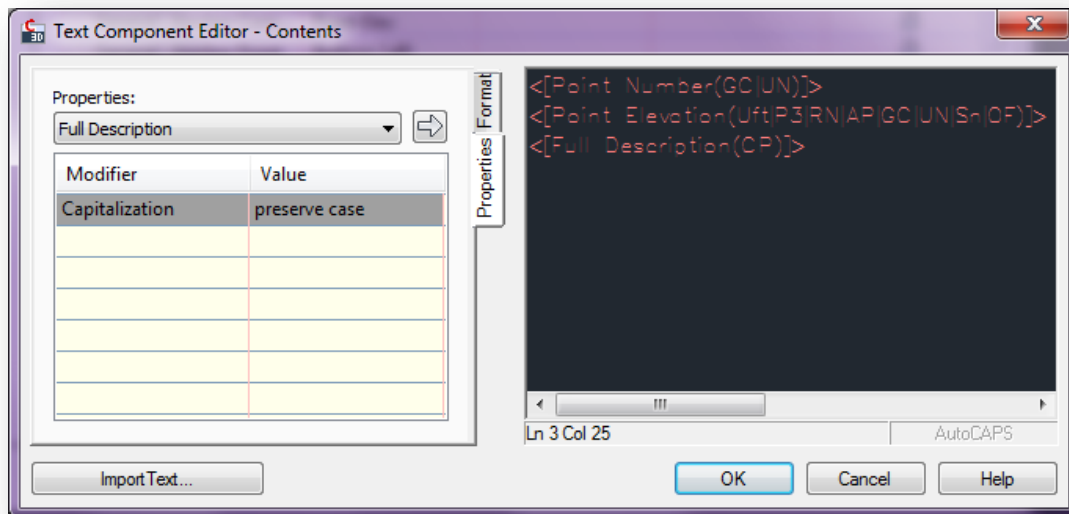


- **Pipe network parts** – When considering how to display pipe network parts (pipes and structures) in a drawing, there are a number of feature options that can have an impact on the performance. As a general rule, less is better. If you need some of these options, wait until your production phase to implement them.
 - **Hatching** – These option settings are found under the Plan, Profile and Section options for the Pipe Styles.
 - **Clean up** – The 'Clean up pipe to pipe connections' option for pipes in plan view.
 - **Masking** – The feature to 'Enable part masking' for structures in plan, profile and section views.
 - **Display** – How you choose to display your structures in profile and section views. 'Display as boundary' is optimal.



- **Labeling** – As you might imagine, the best labels, when it comes to performance, is NO labels. If it were that simple, you could move on and my job here would be done. However, it is almost never that simple. What you can do, however, is to limit their use, or at least the features used, during certain phases of your design. So, here are the important factors to consider.

- *Visibility* – When you don't need to display labels, set the Label Visibility to 'false'. You can then easily turn them back on when you need to display them.
- *Label features* – Avoid the use of rotation, borders and plan readability. More features equal more computations.
- *Dragged state* – When applicable, avoid using dragging your labels. Limiting the leader and the offset computation can help.
- *COGO points* – Use Point Markers instead of labels when you can. If you must label, apply multiple label attributes to a single component, rather than utilizing multiple components.

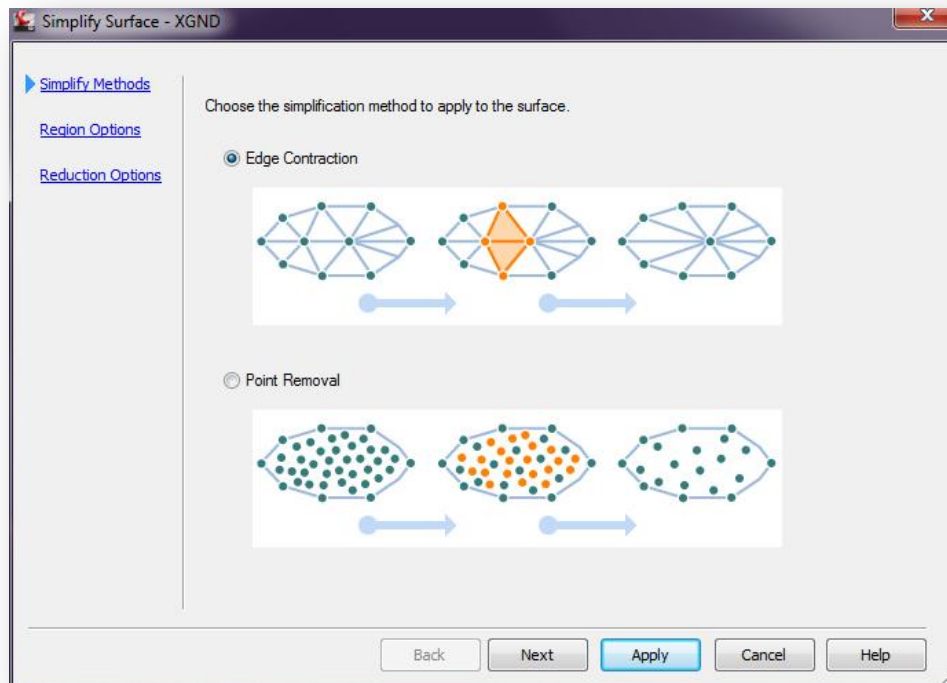


Surface modeling:

As with the other display options that we have looked at, with surfaces, the more you display and the more options you use, the larger impact it will have on performance. The good news, however, is that even if you aren't displaying the information, you can still consume it for tasks, such as building corridors, profiles, sections, etc. But also consider the data and way you build that surface.

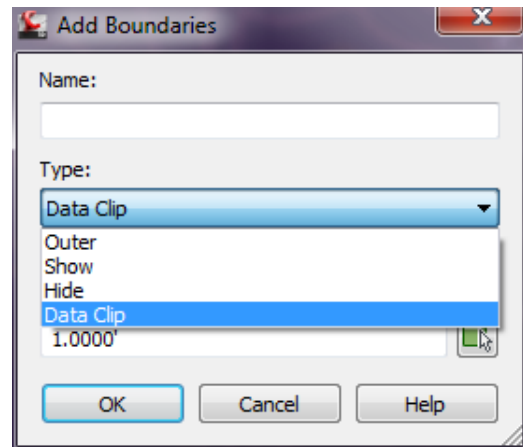
- **Source data** – The information you use to build your surface and how you use it can have a great impact on the performance of your drawing. Consider some of these options when working on different phases of your project.
 - *DEM vs. TIN* – DEM and Grid surfaces require a 1/6th of the memory of a TIN surface (16 vs 96 Bytes / Point). DEM surfaces may be a better option for preliminary design or large scale analysis of watersheds or larger corridor or pipeline design.
 - *Point Data* – Utilizing external point files to build a surface, rather than COGO points. COGO points are additional objects in the drawing that increase your file size.
 - *Snapshots* – Surface Snapshots will speed up the rebuild of a surface when an external file is used. However, the consequence of this is a larger drawing file.
 - *Filter points* – When importing point files with more points than needed, use the filtering options found under the Point File Formats setting.

- *Point Density* – Similar to filtering points, the Point Density setting controls the number of points display when working with point clouds.
- *Simplify Surface* – Use this Edit Surface feature to eliminate unnecessary points from your surface. This can increase performance without sacrificing accuracy.



- **Working with surface data** – Just as important as the data you use is the way in which you use it. There are many options that are available that allow you to increase the performance of your drawing, while maintaining the accuracy.
 - *Create surface using contour data* – Instead of working with surfaces made from points, create a new surface using the contours from the point surface. This may result in some accuracy loss, but it may be a lot less than you think.
 - *Crop contours* – Before creating a new surface from ALL of the contours in your drawing, consider if they are all necessary for the project/phase you are working on. If not, use the Crop option under AEC Modify Tool on the right click menu.
 - *Minimize flat areas* – This option, which corrects flat areas created when building surfaces from contours, should be used only at the end of your surface editing process, if you are using multiple batches of contours.
 - *Surface boundaries* – Use surface boundaries to limit the data used to calculate the surface. The information outside the boundary remains for later use, if needed.

- *Data clip boundaries* – Limits what is used to create the surface to within the data inside the boundaries.
- *Surfaces masking* – Limit what is displayed by masking part of the surface. This reduces display processing time, yet still allows you to consume the masked data.
- *Cropped surfaces* – Define an area of an existing surface to create a new surface with links back to the parent. Great for working with smaller areas within a larger site.
- *Contours* – A general rule, the more you display the greater the performance hit. So, choose to display less contours, or no contours, when given the option.



Corridor modeling:

For those who have worked with corridors, especially those with complex corridors, you may be aware of the process time required to rebuild. While we have come a long way with it comes to processing the extraordinary amount of information contained within a corridor, the time spent waiting for a rebuild can really add up. Here are a few tricks to speeding things up.

- **Rebuild Automatically** – While the rebuild automatically options is handy while editing your corridor, it also slows down your drawing open time. With this option selected, each time you open your drawing the corridor gets rebuilt. This could explain delays while opening drawings with large corridors.
- **Region Controls** – If you have a large corridor that you are working on, but your current efforts are focused around a certain portion of that corridor, use your region control options. By turning on and off certain regions of your drawing you can avoid unnecessarily processing the entire corridor. When you are finished with your particular edits, turn on all of the regions and process the entire corridor.
- **Cross sections** – When creating cross sections for a corridor, create them in a separate drawing using data references and xrefs. Adding a lot of cross sections to a drawing that already contains a corridor can impact the performance of that drawing considerably. Instead, create a data shortcut to the alignment and xref the corridor drawing. Now you can create the cross sections without hindering performance.

Modify settings and other utilities

Beyond what you can purchase for hardware and how you can change your workflow in AutoCAD Civil 3D, there are still some performance saving ‘tricks’ that you can apply. Here are a list of other settings and utilities you might want to consider.

AutoCAD settings:

- **Layout caching** – The system variable LAYOUTREGENCTL controls how the different layouts and model space are cached. To optimize the performance, we recommend setting the LAYOUTREGENCTL value to 1. This will cache the graphics for the model space and the current layout only.
- **Proxygraphics** – Proxygraphics are necessary when sharing drawings with other AutoCAD-based products. However, the drawing size is greatly affected by this setting. An increase in drawing size of 70% or more is not unexpected, depending on the amount of AEC graphics in the drawing. To optimize performance, we recommend setting the PROXYGRAPHICS system variable to 0 (off).
- **Display configuration** – Displaying 3D surfaces can be extremely taxing on memory. For the most part, your 3D configurations are defined by your graphics card and driver, however, there are a couple of settings that you may want to modify.
 - *Adaptive degradation* – This setting, found by running the 3DCONFIG command, controls the trigger and degradation order of items in the drawing. You may find better performance with this setting turned off.
 - *Dynamic tessellation* – Also found under 3DCONFIG > Manual Tune, you will find the Dynamic tessellation option. With this option deselected, surface tessellation is not cached for different zoom levels. Instead, perform a REGEN when you reach the desired zoom.

Other:

- **Uninstall Vault Client** – Whether or not you use Vault, Vault Client is installed when you install AutoCAD Civil 3D. If you are not utilizing Vault, save memory by uninstalling Autodesk Vault 20XX (Client) from Add or Remove Programs.
- **Disable AutoCAD Map 3D** – As with Vault, whether you use it or not, the AutoCAD Map 3D functionality is loaded each time you start AutoCAD Civil 3D. To disable this, follow the instructions in the ‘[How to disable the autoload of Map 3D files to improve performance](http://usa.autodesk.com/getdoc?id=TS13390398)’ technical solutions: <http://usa.autodesk.com/getdoc?id=TS13390398>
- **Autodesk Performance Monitor** – Here is a neat little tool, available currently only from Autodesk Labs, which allows you to monitor the virtual memory used by your AutoCAD-based products. While it will not necessarily increase the performance of your application, it will allow you to see what sort of improvements you are seeing from some of the recommendations in this paper.

Conclusion

AutoCAD Civil 3D is a complex tool, which requires a solid platform to run on and some understanding of how it works. Hopefully, with these tips, you will be able to fine tune and optimize your experience.