AutoCAD 2016 Productivity Study

A comparison of AutoCAD 2016 and AutoCAD 2011

Commissioned by

AUTODESK.

By
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The performance results and statistical information reported in this paper were derived from tests commissioned by Autodesk and conducted over a controlled network using Autodesk® AutoCAD® 2011 software, Autodesk® AutoCAD® 2016 software, and a Dell Precision™ M3800 mobile workstation, performing selected operations designed to simulate day-to-day production tasks. As with all performance tests, results may vary based on machine, operating system, filters, and even source material. While every effort has been made to make the tests as fair and objective as possible, your results may differ. Product information and specifications are subject to change without notice. Autodesk provides this information “as is,” without warranty of any kind, either express or implied.

AutoCAD 2016 Productivity Study: A comparison of AutoCAD 2016 and AutoCAD 2011

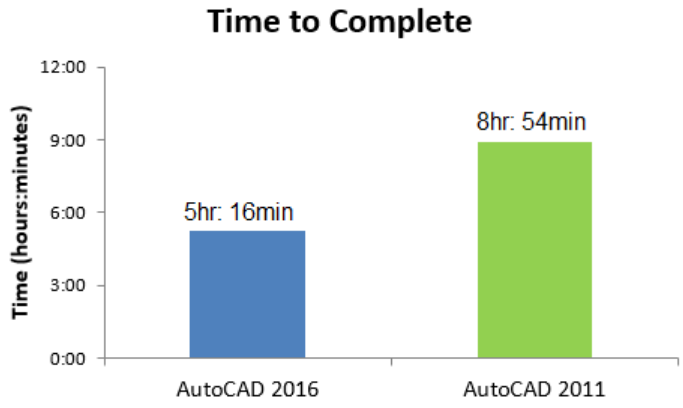
By David S. Cohn

Executive summary

The performance of a computer system is often measured using standard benchmarks. But actual user productivity is a much more difficult metric to gauge, since it often includes perceptions of the overall user experience and must account for differences in the methods employed while using the software.

In order to quantify the potential productivity improvement a typical user is likely to experience when upgrading to the latest version of Autodesk® AutoCAD® software, I devised a series of tests involving timing the repeated re-creation of a selection of drawings using both AutoCAD 2011 and AutoCAD 2016 software. The drawings used were judged to be representative of those that would be produced by typical AutoCAD users.

I performed the tests utilizing the features and functions I judged to be the most expedient means of producing the end result in each respective version of the software.



The results of the study were dramatic. It took nearly 9 hours to complete the five drawings using AutoCAD 2011 compared to 5.25 hours to complete the same five drawings using AutoCAD 2016. This represents time savings of more than 40 percent as a result of upgrading from AutoCAD 2011 to AutoCAD 2016, without any change in the computer on which AutoCAD was run. Overall productivity improved nearly 70 percent.

Although the actual productivity improvements likely to be achieved by a specific individual will vary based on the user's level of experience and the nature of the drawings being produced, I feel that similar improvements in personal productivity are likely, thanks to the new features and functions available in AutoCAD 2016, compared to AutoCAD 2011. The level of improvement in personal productivity is so significant that many users would find that it easily justifies the cost of upgrading their version of AutoCAD.

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Do new features result in increased productivity?

AutoCAD was first released in December 1982. Each release since then has offered numerous new features and functions that have contributed to improve the overall productivity and usefulness of the software beyond each previous release.

One could argue that by upgrading to the latest release, customers would actually save money because the features and functions of the new software would enable them to complete their work faster than would be possible had they used an earlier version of the software. Yet many customers skip releases for economic reasons.

Improvements in computer hardware technologies also continue at a rapid pace. The raw performance of today's Intel-based engineering workstations is more than 500 times faster than a typical personal computer used to run AutoCAD in 1982, on pace with Moore's law. Improvements in graphics processing outpace Moore's law, delivering ever-increasing power at more affordable price points.

The question becomes one of quantifying the actual productivity improvements a user could reasonably expect to achieve by upgrading from their old version of AutoCAD to the latest release, even if they continue to run the software on their existing computer.

Developing the study criteria

In the spring of 2015, Autodesk approached me to conduct a productivity study comparing AutoCAD 2016 to AutoCAD 2011. The study involved a selection of five drawing tasks designed to replicate how real AutoCAD users operate so as to reflect a realistic expectation of user productivity. The drawings used were typical of those produced by actual AutoCAD customers. The test required manually re-creating these drawings multiple times using both AutoCAD 2016 and AutoCAD 2011. These re-creations would utilize features and functions judged to be the most expedient method for producing the desired end results. The time required to create each drawing would be recorded using a stop watch and rounded to the nearest minute. The drawings would be created using both AutoCAD 2016 and AutoCAD 2011 on the same mobile workstation equipped with a 2.2GHz quad-core CPU, a solid state hard drive, 16GB of memory, and a discrete graphics accelerator.

After considering dozens of drawings produced by actual AutoCAD users, I selected five drawings that I judged would require a typical user anywhere from an hour to half a day to complete.

Each drawing was chosen based on a number of criteria designed to showcase one or more features of the software that did not exist in AutoCAD 2011 but were added in subsequent releases. While each drawing could certainly be produced using the features and functions available in AutoCAD 2011, the advanced capabilities added in subsequent releases would likely enable a typical user to produce the drawing faster using AutoCAD 2016.

Since the premise of the test was to determine how much time could be saved by using a new feature, the test itself was already predisposed to show that using AutoCAD 2016 is more productive than using AutoCAD 2011. However, since each of the drawings used in the study was originally produced using versions of AutoCAD predating the 2011 release, I concluded that the study would present a realistic analysis of the productivity gains a typical user could achieve.

In order to eliminate additional biases in the design of the study, such as improvements in speed simply due to increasing familiarity with the sample drawings, the sample drawings were produced first using the 2016 release of the software and then produced using AutoCAD 2011, tilting any such improvements in the favor of the older release. Each drawing was also reproduced in each release several times and only the fastest times were ultimately included in the results.

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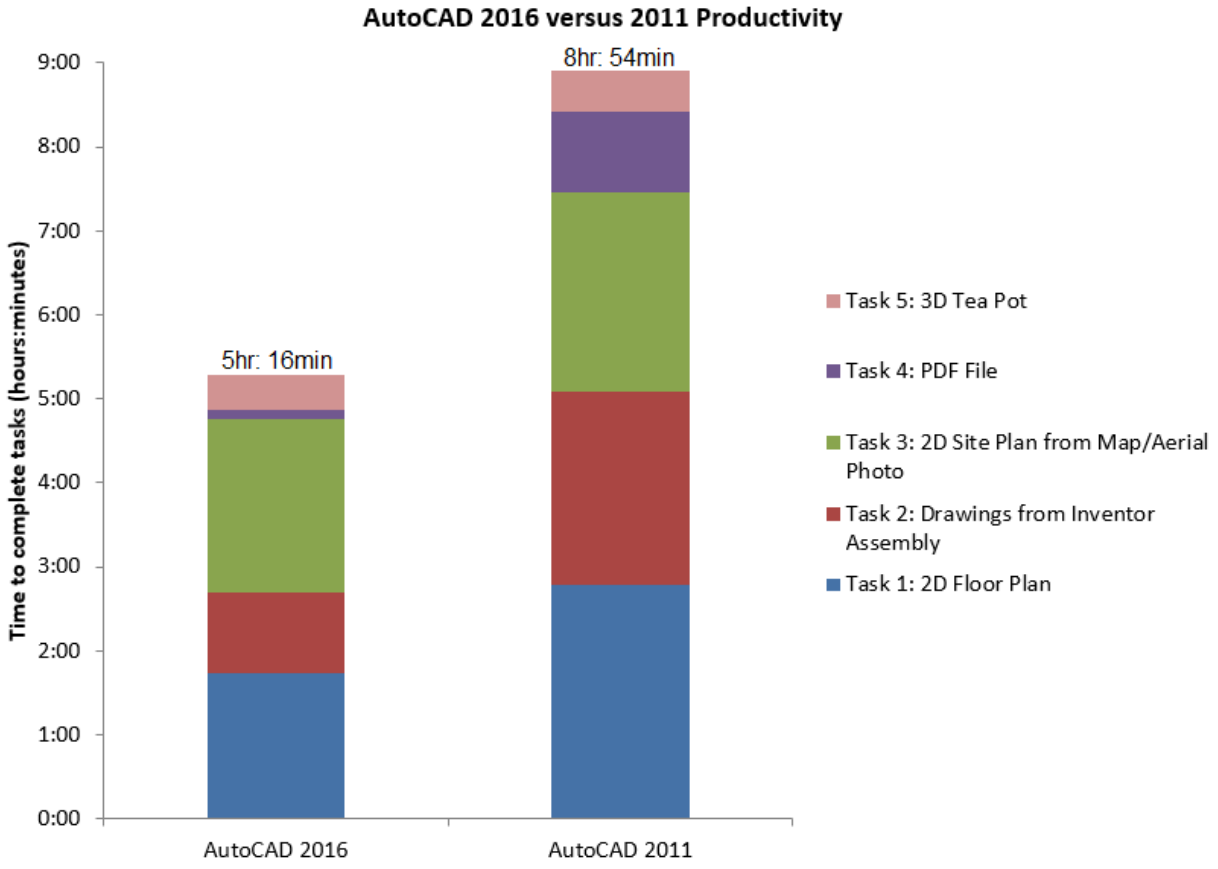
In spite of focusing on new features, I expected to see only modest reductions in the time required to produce the drawings in the newer release. I did not expect to see dramatic improvements in overall user productivity. Most CAD drawings consist of lines, arcs, and circles, and I reasoned that there have been very few changes that would improve the speed at which a typical user would be able to create or modify the objects that represent the majority of a typical drawing. After all, how much faster can you draw a line?

Dramatic results

The results of the study were more dramatic than I expected. It took 8 hours: 54 minutes to complete all five drawings using AutoCAD 2011, compared to 5 hours: 16 minutes to complete the same tasks using AutoCAD 2016 on the same Dell Precision M3800 mobile workstation, a time savings of 41 percent for tasks representative of the types of drawings typically created and edited using AutoCAD. On individual tasks that focused on specific aspects of the software, the time required to produce the drawings went down anywhere from 14 to 87 percent.

The following chart illustrates the cumulative improvement in overall productivity, represented as the total time required to complete the five sample drawings in AutoCAD 2016 compared to AutoCAD 2011.



Time to complete all five drawing tasks in AutoCAD 2016 versus AutoCAD 2011.

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The study in detail

The AutoCAD 2016 productivity study compared the time required to produce a collection of five different drawings multiple times using both AutoCAD 2016 and AutoCAD 2011, using the features and functions judged to be the most expedient method for producing the desired end result. The time required to create each drawing was recorded using a stop watch and rounded to the nearest minute. Results were recorded for two different scenarios:

- AutoCAD 2016 run on a Dell Precision™ M3800 mobile workstation running Windows® 7
- AutoCAD 2011 run on the same Dell Precision M3800 mobile workstation running Windows 7

Each drawing task required many common AutoCAD commands. But each was selected because certain aspects of the drawing would expose the potential time savings that could be achieved by using features and functions not available in AutoCAD 2011 but added to subsequent releases and therefore available to someone using AutoCAD 2016.

Drawing task #1

The first task represents a typical two-dimensional drawing that might be produced using AutoCAD—a floor plan of a medical clinic. In addition to having to draw walls, doors, and windows on their appropriate layers, this drawing also requires the addition of dimensions to fully annotate the drawing as well as the creation of numerous blocks to represent furniture and plumbing fixtures and the subsequent insertion of those blocks at the proper locations in the drawing. Figure 1 shows the completed task #1 drawing.

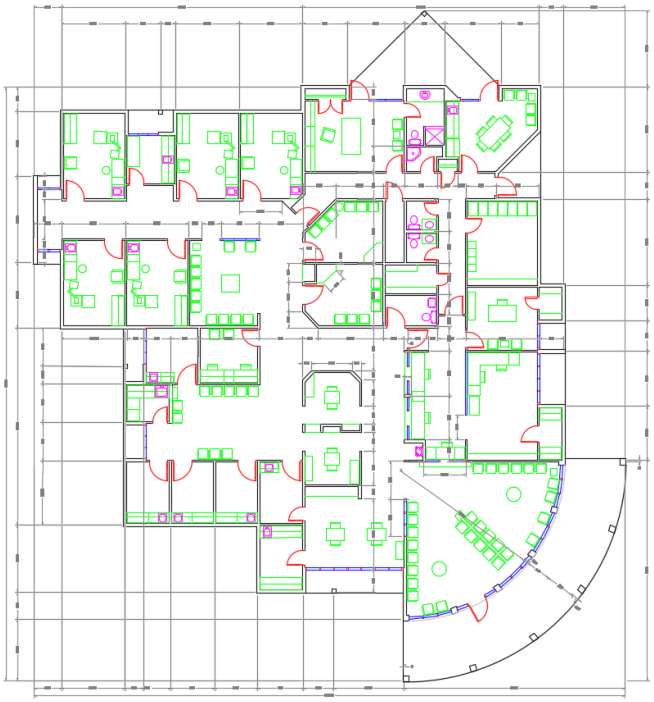

Figure 1: Task #1 completed two-dimensional floor plan of a medical clinic.

In comparing AutoCAD 2016 to AutoCAD 2011, I had anticipated productivity improvements in a number of areas:

- The creation and placement of dimensions would be faster in AutoCAD 2016 thanks to the new dimensioning command, which enables users to create multiple types of dimensions using a single

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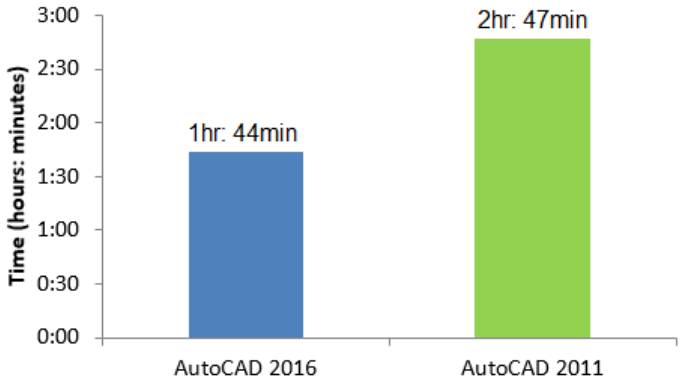
command without having to restart that command, compared to using different dimensioning commands for each type of dimension being created. In addition, those dimensions would automatically be placed onto the correct layer in AutoCAD 2016, whereas in AutoCAD 2011, the user would need to use layer control to place those dimensions on the proper layer.

- The insertion of blocks would be faster in AutoCAD 2016 as a result of being able to use galleries instead of the block insertion dialog box.
- Associative arrays could be used in AutoCAD 2016 to create some furniture layouts versus non-associative arrays in AutoCAD 2011.
- Groups could be used to duplicate repetitive collections of furniture layouts.
- The Select Similar tool could be used to speed object creation in AutoCAD 2016.

This drawing took 2 hours: 47 minutes to complete using AutoCAD 2011. The same drawing took only 1 hour: 44 minutes to complete using AutoCAD 2016 on the same mobile workstation, a time reduction of 38 percent.



Task #1: 2D floor plan.

AutoCAD 2016 was more efficient in the creation of the task #1 drawing than AutoCAD 2011, largely thanks to the new dimensioning command added to AutoCAD 2016 as well as improved block insertion capabilities afforded by the gallery feature introduced in the previous release. Associative arrays and improved group capabilities also proved quite helpful.

Drawing task #2

The second task was the recreation of several sheets of two-dimensional drawings of a three-dimensional model of an arbor press assembly that had originally been created using Autodesk® Inventor® software. This model was not actually created in AutoCAD, but rather exploited the program's ability to import an Inventor model.

Since AutoCAD 2011 does not have the ability to import files directly from Inventor, the arbor press model was first opened in Autodesk Inventor and saved as an SAT file. That file was then imported into a new AutoCAD 2011 drawing. Since Inventor files can be imported directly into AutoCAD 2016, however, this intermediate step was not required. Instead, the Inventor assembly file was imported directly into a new AutoCAD 2016 drawing.

In both versions, once the 3D model had been imported into model space, three separate layouts were created. A custom border and title block was created and saved as a block, with appropriate attributes to fill in the title block with data such as scale, part number, and sheet number. This title block was inserted onto each layout, and then appropriate views were created for each of the seven major assembly components. The first layout showed an isometric view and orthographic views of the completed assembly with each part labeled, as well as a bill of materials showing the part number, quantity, part name, description, and material. The other two layouts showed

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2D orthographic views of individual parts at appropriate scales, complete with dimensions. Several parts also included section and detail views. Two of these sheets are shown in Figure 2.

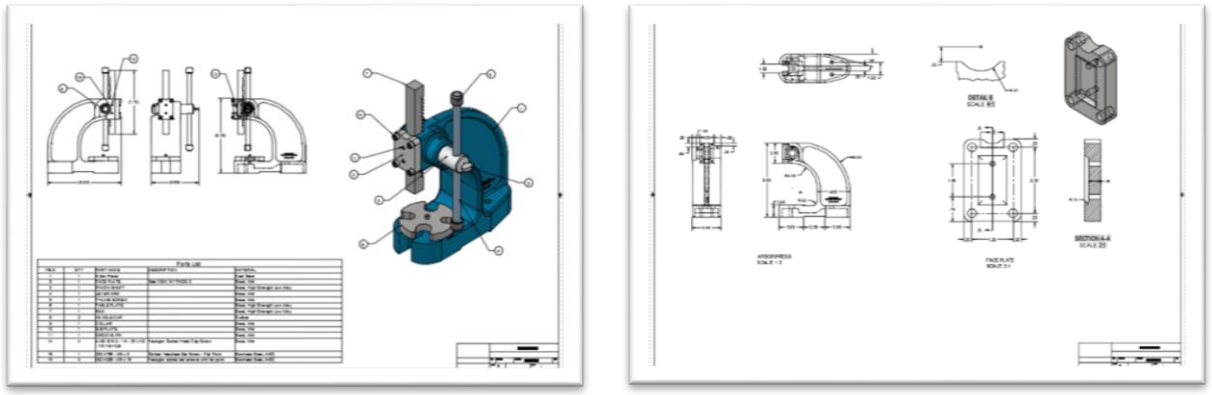
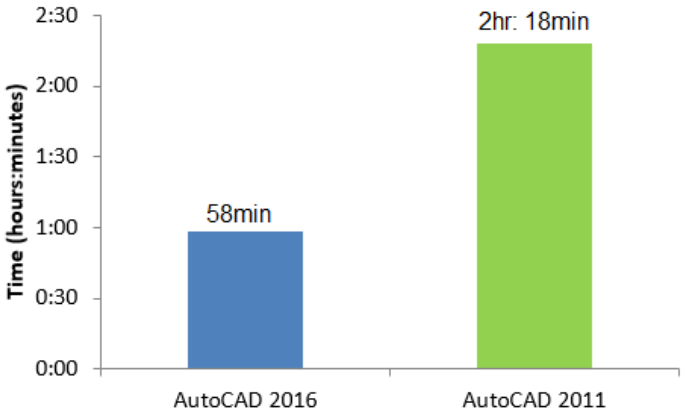


Figure 2: Completed task #2 drawing—a 3D mechanical assembly with separate sheets for individual parts.

Thanks to the improved functionality in AutoCAD 2016 compared to AutoCAD 2011, I anticipated productivity improvements in a number of areas:

- The task of initially importing the Inventor assembly model into a new drawing would be faster and easier in AutoCAD 2016 since the Inventor file could be imported directly, whereas in AutoCAD 2011, the file had to first be exported to an intermediate format before it could be imported into a new drawing.
- The use of drawing views in AutoCAD 2016 would make it much easier to create the orthographic, section and detail views compared to having to use section planes and the Flatshot tool in AutoCAD 2011.
- Adding dimensions would be faster in AutoCAD 2016 thanks to the new dimensioning command in AutoCAD 2016 compared to having to use multiple dimensioning commands to create different types of dimensions in AutoCAD 2011. In addition, those dimensions would automatically be placed onto the correct layer in AutoCAD 2016, whereas in AutoCAD 2011, the user would need to use layer control to place those dimensions on the proper layer.

This drawing took 2 hours: 16 minutes to complete using AutoCAD 2011. The same drawing took only 58 minutes to complete using AutoCAD 2016 on the same workstation, a time reduction of 58 percent.



Task #2: Drawings from an Inventor 3D mechanical assembly.

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While all of my assumptions proved true, the time required to import the SAT file into AutoCAD 2011 was not significantly different from the time required to import the native Inventor assembly into AutoCAD 2016. Once the model had been imported, however, the time required to produce the two-dimensional layouts was significantly shortened in AutoCAD 2016 thanks to the ability to create drawing views. I was also able to add dimensions more quickly in AutoCAD 2016 thanks to the new dimensioning command, which anticipates the type of dimensions required and lets you place multiple types of dimensions without having to restart the command. In AutoCAD 2016, dimensions are also placed onto the appropriate layer automatically. In addition, had any changes been made to the 3D model, those changes could have been reflected almost immediately in the orthographic drawing views in AutoCAD 2016, whereas in AutoCAD 2011, each orthographic view would have to have been updated individually by recreating the flatshot view or updating the block generated using the Section Plane tool.

Drawing task #3

The third drawing task was the creation of a site plan showing the parking layout for a regional hospital based on an aerial photo or map underlay. The aerial photo would first be inserted into a new AutoCAD drawing and then geometry added by tracing over this underlay. The resulting drawing shows the footprints of existing buildings, the extent of all on-site parking, and the individual parking spaces. Figure 3 shows the completed task #3 drawing.

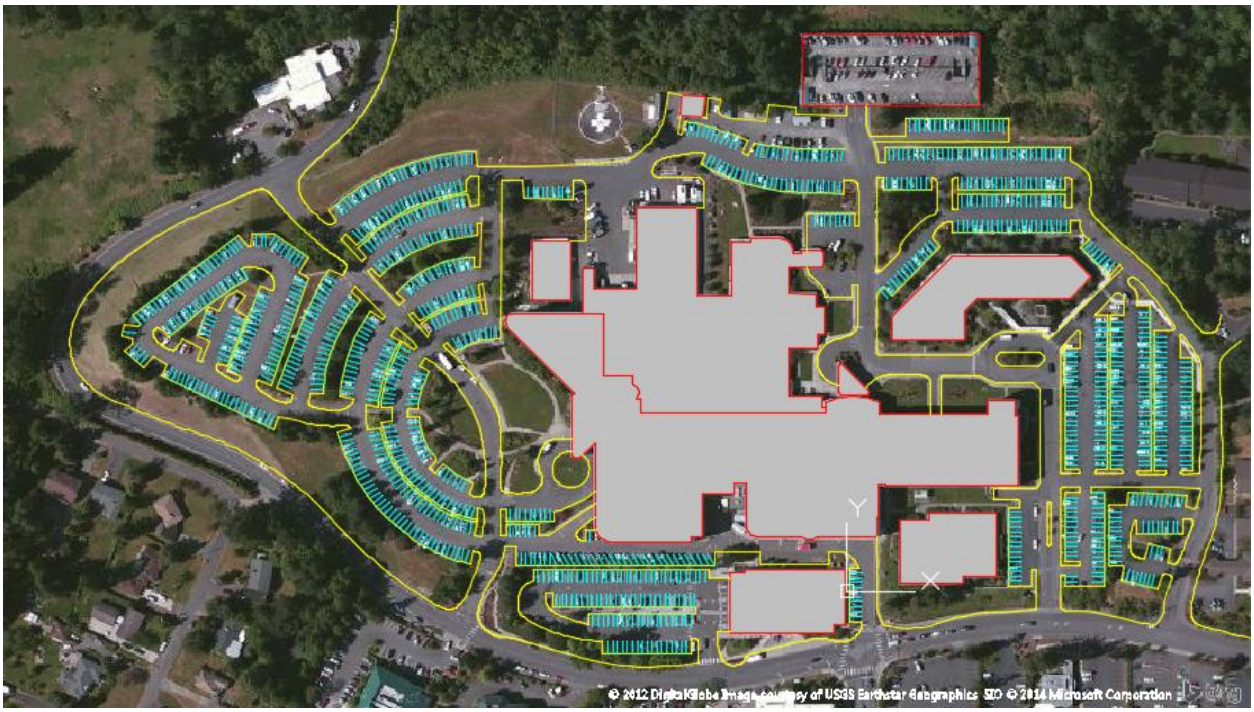

Figure 3: Completed task #3 drawing—a site plan/parking layout for a regional hospital.

In comparing AutoCAD 2011 to AutoCAD 2016, I had anticipated productivity improvements in a number of areas:

- The Geographic Location tools in AutoCAD 2016 would make it much faster and easier to add the aerial photograph to the AutoCAD drawing, versus having to first capture and import an image of an aerial photograph and then scale it appropriately in AutoCAD 2011.
- The ability to use associative path arrays would shorten the amount of time required to create parking layouts in AutoCAD 2016 versus having to use the Measure command with a block in order to lay out parking spaces in AutoCAD 2011.

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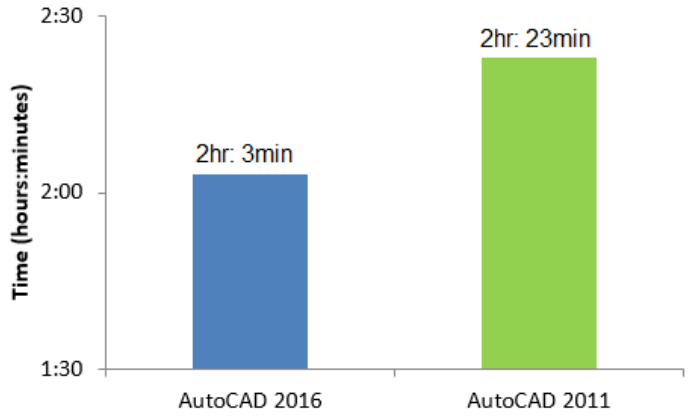
This drawing took 2 hours: 23 minutes to complete using AutoCAD 2011. The same drawing took 2 hours: 3 minutes to complete using AutoCAD 2016 on the same workstation, a time reduction of 14 percent.



Task #3: A 2D site plan.

The Geographic Location tools in AutoCAD 2016 made it much easier to locate and position an aerial image of the project site in a new AutoCAD drawing. That image was also automatically scaled to match the drawing scale. When working in AutoCAD 2011, a similar aerial photograph had to first be captured from an online map service, saved as a bitmap image, inserted into a new AutoCAD drawing, and then scaled to match the drawing scale.

While the same methods were used in both AutoCAD 2011 and AutoCAD 2016 to draw the building footprints and the extents of the paving, the Path Array tool in AutoCAD 2016 proved to be a much faster way to create the individual parking spaces. Since that tool did not exist in AutoCAD 2011, the Measure command was used instead.

Drawing task #4

The fourth drawing task involved attaching a PDF file as an underlay and then simulating typical steps a user would perform to use that underlay as the basis for creating new geometry, including zooming in and out to magnify small details, panning to work in different areas of the drawing, and using various commands to add new geometry snapped to the underlying PDF file.

AutoCAD's performance when working with PDF files has been significantly improved in the 2016 release. In order to obtain the most accurate analysis of the productivity improvement resulting from the enhanced program performance, the exact steps performed were captured and then played back as a script, so that the same steps would be performed in the same order in both AutoCAD 2011 and AutoCAD 2016. Several different PDF files were used to perform this analysis. While the actual time required to perform the automated steps varied for each PDF file used (based on the file size and complexity of the individual PDF file), the percentage of performance improvement achieved when comparing AutoCAD 2016 to AutoCAD 2011 was similar for each PDF file used in this task. Figure 4 shows a PDF file typical of those used in this task.

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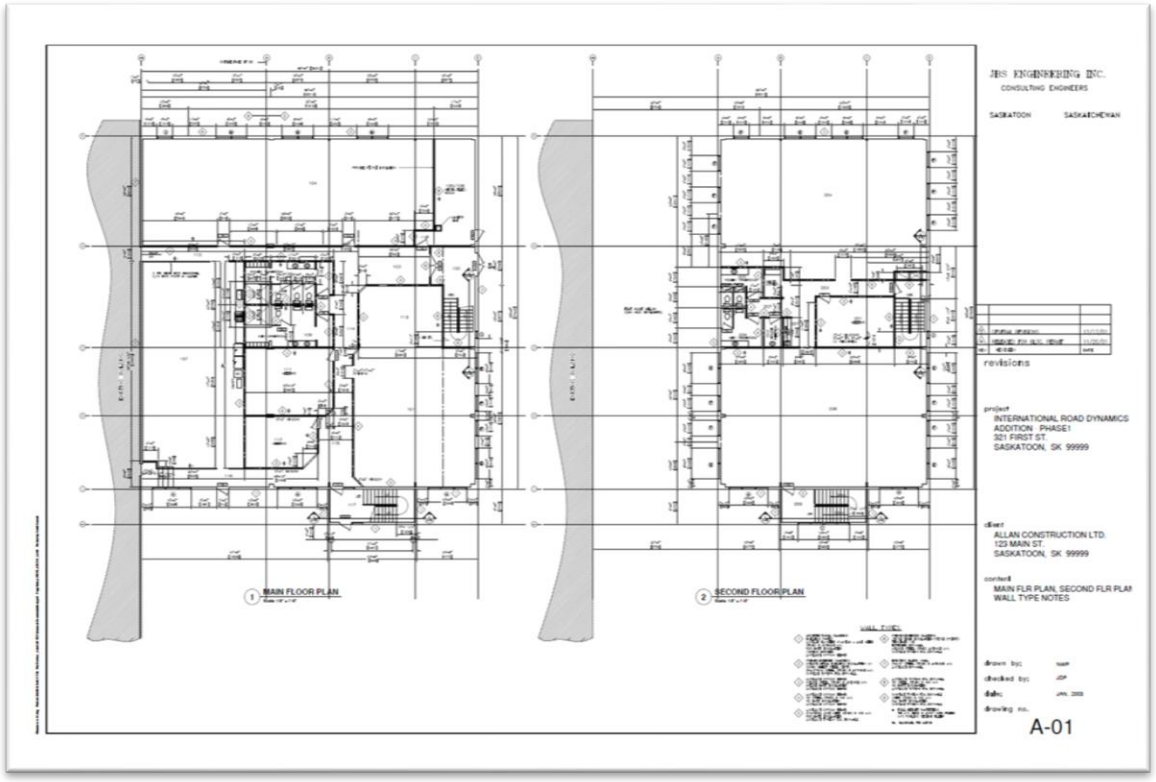
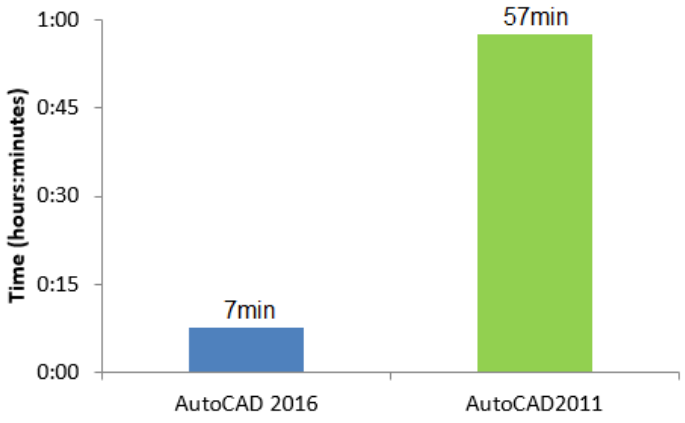


Figure 4: Completed task #4 drawing—creating new geometry by snapping to an attached PDF file.

For the PDF file chosen as the representative sample, this task took 57 minutes to perform using AutoCAD 2011. The same task required only 7 minutes to complete using AutoCAD 2016, a time reduction of 87 percent.



Task #4: Geometry created on top of a PDF underlay.

The performance of AutoCAD 2016 is significantly improved when working with large PDF files that have been attached and used as an underlay. Panning and zooming operations are completed much more quickly and the program's response when snapping to geometry within the PDF file results in significant improvements in user productivity.

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Drawing task #5

The fifth drawing task was the creation of a three-dimensional model of a ceramic teapot. This task scenario was designed to highlight some of the improved surfacing, solid modeling, and rendering capabilities of AutoCAD 2016 compared to AutoCAD 2011. The three-dimensional model of the teapot was created by first creating two-dimensional curves and then using those curves to revolve the main body of the teapot. The spout was created by lofting interior and exterior profiles along a path. And the handle was created by sweeping a profile along a path. Boolean operations were then used to combine solids and subtract the hollow interior of the teapot and spout. A simple table was also created and materials were mapped onto the teapot, table, and floor. Lights were then added to the model, which was then rendered and saved as a bitmap image. Figure 5 shows the completed task #5 drawing.

Figure 5: Completed task #5 drawing—a rendered image of a 3D teapot modeled using AutoCAD.

In comparing AutoCAD 2016 to AutoCAD 2011, I had anticipated productivity improvements in two very specific areas:

- The new rendering engine in AutoCAD 2016 provides a simpler way to render in AutoCAD that can produce better results and often produces them faster than the previous rendering engine.
- The ability to combine both solid and surface modeling in AutoCAD 2016 compared to using only solid modeling in AutoCAD 2011.

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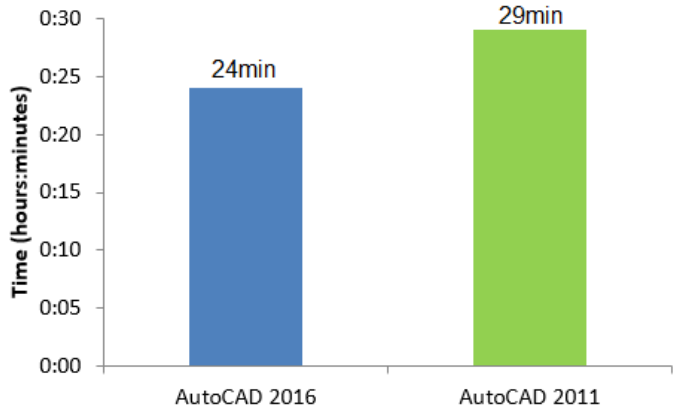
This task took 29 minutes to complete this task using AutoCAD 2011, including the time required to apply materials, add lights, and render the scene. The same task took only 24 minutes to complete using AutoCAD 2016 on the same mobile workstation, a time reduction of 17 percent.



Task #5: Create and render a 3D model.

The ability to combine both solid and surface modeling in AutoCAD 2016 made it much faster and easier to create the base curves on which the teapot was modeled compared to working solely with solids in AutoCAD 2011. AutoCAD 2016 was also able to complete the rendering faster and produced higher-quality results thanks to its new physically-based path tracing rendering engine, compared to the Mental Ray rendering engine in AutoCAD 2011.

Since this task also included rendering as a final step, it is also worth mentioning that I could have saved additional time by using the cloud-based rendering capability available in AutoCAD 2016. When rendering on the local computer, AutoCAD is unavailable for other tasks until the rendering is complete, a process that took anywhere from just over 5 minutes to nearly 10 minutes for this task. When using AutoCAD 2011, I had no choice but to wait until the rendering was completed. But had I used cloud based rendering in AutoCAD 2016, I could have performed other tasks in AutoCAD while waiting for the rendering to be completed online.

Working with Point Clouds

A point cloud is a set of data points placed within a three-dimensional coordinate system. Point clouds are typically derived from raw data gathered by using a 3D scanner to obtain points from things such as buildings, topography, or manufactured items, and often contain millions of individual points. Once a point cloud has been attached to an AutoCAD drawing, it can be used as the basis for constructing geometry to represent existing or “as-built” conditions, or as the basis for modifications or additions.

AutoCAD 2011 was the first version of the program to support point clouds. Users could attach and display point clouds created from 3D scanning devices, but were limited in that the program could only display a maximum of 1.5 million points at a time. In addition, once attached, the only way to use a point cloud to construct geometry was to use the node object snap mode to snap to individual points. Considering the huge number of points within a typical point cloud, this was not very practical.

AutoCAD’s point cloud capabilities have been significantly enhanced in AutoCAD 2016. For example, AutoCAD 2016 can recognize groups of points in a point cloud that represent planar and cylindrical surfaces and provides new object snap modes that enable users to snap to

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geometry within a point cloud—such as the nearest point on a plane, the centerline of a cylindrical segment, a corner formed by three planar segments, and so on.

AutoCAD 2016 also enables users to create geometry directly from point clouds. For example, you can extract the line corresponding to the edge between two planar segments in a point cloud or the centerline of a cylindrical segment. Users can also cut sections through a point cloud and then extract 2D geometry from point cloud segments. Point clouds also now support Dynamic UCS, enabling users to draw on the face of a point cloud similar to the way they can draw on the faces of other 3D AutoCAD objects.

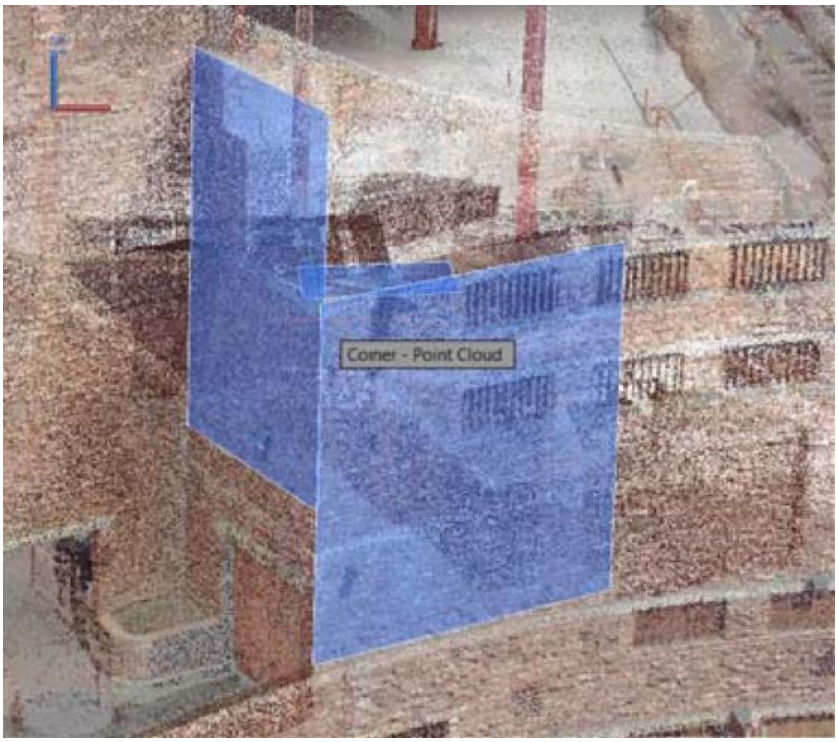

Figure 6: AutoCAD 2016 enables users to snap to geometry within point clouds.

Since it is often difficult to see AutoCAD geometry when working with point clouds (because the points can partially obscure the CAD geometry), AutoCAD 2016 also enables users to control the transparency of point clouds. Users can also save and restore named cropping states and control the visibility of individual scans and scan regions, providing methods for isolating specific areas or objects within point clouds.

All of these new capabilities make it practical to use point clouds as the basis for creating AutoCAD geometry. I attempted to develop a drawing task in which I would use a point cloud as the basis for creating 3D geometry in both AutoCAD 2011 and AutoCAD 2016. However, due to the differences between the rudimentary point cloud capabilities in AutoCAD 2011 and the significantly enhanced capabilities in AutoCAD 2016, I was unable to obtain a point cloud file that could be attached to both versions. Ultimately, there was no way to do a practical comparison between the point cloud capabilities of AutoCAD 2011 and AutoCAD 2016. The enhancement to the point cloud capabilities in AutoCAD 2016 represent a dramatic leap in functionality.

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About the system used for testing

The five task drawing scenarios were completed on the same computer platform, using both AutoCAD 2011 (suggested retail price of $3,995 when first introduced) and AutoCAD 2016 (suggested retail price of $4,195 as of the testing date).

A Dell Precision M3800 mobile workstation was used to perform all tests. That workstation, equipped with a 2.2GHz Intel Core i7-4702HQ quad-core CPU, 16GB of RAM, an NVIDIA Quadro K1100M graphics board powering a 15.6-inch backlit LED panel with a resolution of 3200x1800 pixels, and a 512GB solid state hard drive, had a suggested retail price of $2,887 when it was first introduced in the spring of 2014.

Figure 7: The tests were all performed on a Dell Precision M3800 mobile workstation.

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Productivity improvement

In every test scenario, the time required to complete the drawing was reduced when using AutoCAD 2016 compared to creating the same drawing using AutoCAD 2011, in spite of the fact that the tasks involved drawing and editing typical AutoCAD drawings rather than compute-bound operations such as rendering or analysis. (For task #5, a finished rendering was included as part of the process). The results were then used to calculate the time saved, using the following formula:

$$\text{Percent time saved ACAD2011 to ACAD 2016} = \frac{\text{ACAD 2011 time} - \text{ACAD 2016 time}}{\text{ACAD2011 time}}$$

Those times are summarized in the following table.

	AutoCAD 2011	AutoCAD 2016	Time reduction
Task 1	2 hours: 47 minutes	1 hour: 44 minutes	38%
Task 2	2 hours: 18 minutes	58 minutes	58%
Task 3	2 hours: 33 minutes	2 hours: 3 minutes	14%
Task 4	57 minutes	7 minutes	87%
Task 5	29 minutes	24 minutes	17%
TOTAL	8 hours: 54 minutes	5 hours: 16 minutes	41%

In addition to looking at the results in terms of the time savings, they can also be expressed in terms of productivity or measured output, using the following formula. A reduction of 20 percent in the amount of time required to complete a task equals a 25 percent improvement in user output.

$$\text{Productivity improvement ACAD2011 to ACAD2016} = \frac{\text{ACAD2011 time} - \text{ACAD2016 time}}{\text{ACAD2016 time}}$$

For example, on task #2, the time required to complete the drawing decreased from 2 hours: 18 minutes using AutoCAD 2011 to just 58 minutes using AutoCAD 2016, a time reduction of 58 percent. That results in a productivity improvement when using AutoCAD 2016 of 138 percent, or better than 2 times the output compared to AutoCAD 2011. The respective productivity improvements are summarized in the following table.

	AutoCAD 2011	AutoCAD 2016	Productivity improvement
Task 1	2 hours: 47 minutes	1 hour: 44 minutes	61%
Task 2	2 hours: 18 minutes	58 minutes	138%
Task 3	2 hours: 23 minutes	2 hours: 3 minutes	16%
Task 4	57 minutes	7 minutes	661%
Task 5	29 minutes	24 minutes	21%
TOTAL	8 hours: 54 minutes	5 hours: 16 minutes	69%

Therefore, when expressed as productivity improvement, the test results show that users can improve their current output by 69 percent (or 1.69 times) as a result of upgrading from AutoCAD 2011 to AutoCAD 2016 without any change in the computer on which AutoCAD is run.

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Conclusions

The results of this productivity study were both dramatic and conclusive—AutoCAD 2016 is significantly more productive than AutoCAD 2011. When creating typical drawings, the use of new features and functionality introduced since AutoCAD 2011 resulted in time savings ranging from 14 to 87 percent, with an average time savings of 41 percent. This equates to individual productivity gains ranging from 16 to 661 percent, with an average overall productivity improvement of 69 percent.

While different individuals will likely experience varying degrees of improvement, depending on the nature and complexity of the drawings and their skill levels, similar levels of improvement are achievable. Enhancements to the AutoCAD user interface so yields a more satisfying user experience.

Many users would be able to get more work done faster as a result of moving from AutoCAD 2011 to AutoCAD 2016. The amount of improvement likely to be recognized is so significant that many users would conclude that it easily justifies the cost of upgrading.

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About the Author

David Cohn is the Technical Publishing Manager at 4D Technologies, where he develops the CADLearning® courses and eBooks for AutoCAD and other Autodesk products. He has more than 30 years of hands-on experience with AutoCAD as a user, developer, author and consultant. He has been benchmarking computer hardware and software since 1985 and has published hundreds of articles and reviews as a contributing editor to *Desktop Engineering* magazine, the former publisher and editor-in-chief of *CADCAMNet* and *Engineering Automation Report*, and the former senior editor of *CADalyst* magazine. He is also the author of more than a dozen books about AutoCAD. A licensed architect, David was also one of the earliest AutoCAD third-party software developers, creating numerous AutoCAD add-on programs. He has also taught college-level AutoCAD courses and is always a popular presenter at Autodesk University.

This productivity study was performed at the request of Autodesk, which funded this work.

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