



AutoCAD, Architecture, and OS X:

An Analysis of the AEC CAD Market as It Applies to Macintosh Users

A Cyon Research White Paper
Prepared in Association with Architosh
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Executive Summary

AutoCAD dominates the AEC CAD market. This dominance has a profound impact on hardware- and software-buying decisions, even among devoted Macintosh users.

There are excellent companies that serve the Macintosh AEC community—notably Graphisoft, Nemetschek, and auto-des-sys—but the heavyweights of AEC, Autodesk and Bentley, abandoned the Macintosh and other platforms when it became clear that Windows would dominate the engineering workstation market.

Apple's OS X operating system and G5 computers have generated much interest and excitement. Macintosh users view this as a sign that Apple has regained a level of technical superiority over Windows/Intel. But many users in AEC are still unable to re-evaluate the Macintosh as a platform, because of the lack of AutoCAD for the Macintosh, and problems with the current state of file interoperability.

As a result, those who prefer Macintosh computers must still use Windows to remain competitive.

Architosh is a website serving the community of architects and designers with an interest in the Macintosh. More than 2,800 Architosh readers submitted their views on OS X and AutoCAD in response to an Architosh survey.

While the population of respondents was biased by self-selection with an interest in the Macintosh, the answers provide a detailed picture of their perceptions, including their buying intentions if an OS X version of AutoCAD were to become available.

This white paper summarizes those views, and presents our findings, along with our answers to the following three questions:

1. What is the nature of the current and prospective demand for AutoCAD on the Macintosh?
2. What are the prospects of Autodesk meeting that demand?
3. What alternatives to a Macintosh version of AutoCAD would meet the needs of the AEC design community?

Our conclusions:

1. There is a real demand for AutoCAD on the Macintosh. No other solution allows for complete bi-directional compatibility with AutoCAD without imposing constraints or a management burden on the architect's clients.
2. There are many obstacles to Autodesk releasing a Macintosh version of AutoCAD. They are not insurmountable, but raise the question as to whether Autodesk is willing to make that level of commitment.
3. It is clear from this survey that DWF alone would not meet the AutoCAD needs of the Macintosh AEC community.

AutoCAD and DWG in AEC

The global architecture, engineering, and construction (AEC) industry generates nearly \$3.5 trillion in annual revenue (per *Engineering News-Record*). Every dollar spent on design and engineering leverages \$2,500 in final-product value.

AEC design today is dominated by one software product, AutoCAD, the flagship product of Autodesk, Inc. of San Rafael, California. More specifically, the process is dominated by the AutoCAD file format, DWG. It is the lingua franca of AEC design; no competing computer-aided design (CAD) product can dare enter the market without addressing DWG compatibility.

DWG is a proprietary file format zealously guarded by Autodesk. It has been modified with almost every new release of AutoCAD. Most of Autodesk's competitors (as well as most members of the AutoCAD third-party developer community) participate in an industry consortium known as Open Design Alliance, which publishes DWG-compatibility code libraries for member use and has a reputation for software quality and consistency.

Nonetheless, by and large CAD users view the process of DWG translation with skepticism. Even among AEC firms who standardize on CAD platforms from Autodesk competitors such as Bentley Systems, Graphisoft, Intergraph, and Nemetschek, there are always copies of current and past releases of AutoCAD available in-house to test DWG file translations—and to fix them when they go wrong. Thus, use of AutoCAD is regarded as an unavoidable part of doing business in most construction projects. For several years, AutoCAD has been published solely for the Microsoft Windows platform.

“AutoCAD... is ubiquitous. We use it heavily in our workplace.”
--Architosh survey response*

AEC design is the union of many separate, highly technical disciplines, each with its own nomenclature, protocols, regulations, CAD depiction standards, and publication guidelines. A vibrant software industry supports these specializations with a wide variety of products that augment the basic CAD tools, for AutoCAD first and then maybe for a second CAD platform.

The process by which design information is shared among AEC professionals is best described as “fragmented.” Each step in the AEC process (including conceptual design, architectural detailing, structural engineering, construction detailing, and final documentation) requires access to the design information, yet the ability to allow all users

* Throughout this report, quotations from Architosh survey participants will be presented to reinforce the discussion and recommendations. See the section entitled “The Architosh Surveys” for details.

simultaneous access to the design information is in its infancy. AutoCAD benefits by having DWG as the unifying “pipeline” for communication across the disciplines.

The Macintosh in AEC

The Macintosh has historically been very popular among architects. In some countries, at the height of Apple’s appeal, the Macintosh’s share of the architectural market was near 50%. However, it went through a period of rapid decline in the mid-1990’s, as first Autodesk and then Bentley Systems dropped the Macintosh OS as a supported operating system.

Architosh claims that the US market share for Apple in architecture stands today at about 15%—higher in cities such as Boston, Los Angeles, and San Francisco where Apple use is generally higher than the national average. Additionally, recent Architosh information obtained from cross-platform AEC developers report that architectural market share for Apple remains as high as 40% in some European countries.

Developer statistics by Architosh show that software choices for Macintosh-based architects have increased over the last three years by as much as 20%. While the number of tools for construction documentation (CAD and BIM) has not increased over the last four years, notable new AEC software available for Macintosh-based professionals include programs such as SketchUp (@Last Software), Maya (Alias Inc.), and Piranesi (Informatix), suggesting that the Macintosh platform has strengthened its reputation in pre- and post-visualization work for AEC.

It should also be stated that while it is true both Autodesk and Bentley exited the Macintosh OS market in the mid-90's, other major CAD and architectural visualization applications have remained on the platform. These include market-leading programs such as ArchiCAD, form•Z, and VectorWorks (originally known as MiniCAD).

The dominance of AutoCAD in AEC is such that few firms—and fewer educational institutions—are comfortable operating an AutoCAD-free environment. Firms and individual professionals who use Macintosh computers face a tough choice: work on a minority platform and feel somewhat professionally isolated, or move to the Windows environment for some or all of their work, and give up the ease-of-use and the graphics superiority that have historically been the Macintosh’s core strengths.

“I am about to enter graduate studies in landscape architecture. Though I now use VectorWorks and feel it is competitive in abilities with AutoCAD, most universities require AutoCAD. If I want to continue to support the Macintosh platform, I need to be able to run AutoCAD.”

“When the professor tells a class of 50 not to buy a Macintosh because of no support for industry-standard software, that hurts the Mac... and Apple just lost another 50+ customers forever because when students

go out and buy a \$5,000 Wintel package, they have too much invested to ever go to anything else.”

“I run a consulting company and have painfully helped many design clients do the Mac-to-Windows shift strictly because of AutoCAD. Many of those clients now regret the move, but feel stuck because they rely on AutoCAD for their businesses. If AutoCAD were available for OS X ([and] my experience [tells me] there would be demand for [both] the full and LT versions), I know several companies [that] would switch to the Mac and buy the Mac version.”

The Architosh Surveys: Macintosh Users Speak Out on the Need for AutoCAD on OS X

For the past three years, Architosh, the Web-based news and information site for Macintosh users in architecture, has been conducting surveys. The two most recent Architosh surveys ask architects and other AEC professionals to explain their interest in an OS X version of AutoCAD. Both Macintosh and Windows users have been responding to the survey.

Realistically, the surveys should be called petitions. Respondents were those who chose to answer the survey questions, and were not scientifically selected. The results of the two surveys paint a detailed and informative picture of the needs and perceptions of AEC professionals with a strong interest in the Macintosh platform.

“It was a real shock when I realized I could not purchase any form of AutoCAD for my Mac. It seems a terrible shame that those of us who have to use AutoCAD for business purposes that the PC has won out so completely.”

“It's a big problem that the most creative computer platform doesn't support the largest CAD application in the world.”

“Not having AutoCAD has kept my company's owner from changing over to the Apple platform.”

The first survey focuses specifically on gauging the desire for an OS X version of AutoCAD; the second measured the depth of that interest by asking a variety of questions about the number of users in the firm, how AutoCAD would be deployed in the organization, and possible purchasing plans based on the availability of AutoCAD on OS X.

Each respondent represents an average of 5.3 seats, for a total representation of 14,130 seats. More than 70% of respondents say their company needs and wants a full version of AutoCAD on OS X; 23% said an AutoCAD viewer would be adequate. Of those who want AutoCAD, 80% want a full version, rather than AutoCAD LT.

Fully 50% of respondents (representing 7,000 seats) say they would dump their Windows machines if AutoCAD came to the Macintosh; 69% said AutoCAD on OS X would increase their purchases of Macintosh computers.

Approximately one-half of the petition responses represent architectural firms or individual architects, a small percentage of which also practice interior design. Education represented the group with the second-highest response rate (13%). Surprisingly, civil engineers constituted nearly 10% of the respondents. *

Of all respondents:

- 40% said AutoCAD on OS X would replace another CAD product (on Macintosh, Windows, or Unix)
- 36% said AutoCAD on OS X would “supplement” another CAD product
- 1.5% said AutoCAD on OS X would eliminate a Unix CAD machine
- 43% said AutoCAD on OS X would increase AutoCAD licenses in their firm
- 20% said AutoCAD on OS X would simply shift AutoCAD licenses to the Macintosh

“I am a structural engineer who works with many architectural offices, where we do all other office work on the Macs but we have PC's to run AutoCAD. There is a very large market for architects who would prefer to support only one system and have AutoCAD on their Macs.”

“I am an architectural engineer. Architects are visual people; engineers are technology people. Apple computers appeal to many visual architects who think of both form and function. Technologically inclined people like myself recognize the shortcomings of the Windows OS and appreciate all that is good about the Mac OS, especially its defensibility against viruses, high level of user accessibility, and superior stability. I see a very large market for AutoCAD on OS X, given the number of offices like mine, running inferior Windows machines.”

“When Apple sees AutoCAD on the Mac, they will see 100 more CPU sales per year through me.”

* Civil engineering is a discipline within AEC where Autodesk does not enjoy the same near-monopoly status as it does in building construction. Bentley Systems is a significant player, with 47 of 50 state departments of transportation standardizing on Bentley's MicroStation and various add-ons such as GEOPAK or Infracore, both now owned by Bentley. We believe the primary interest of the civil engineers who responded to the survey is either in the use of Unix-based analysis tools or visualization.

AutoCAD on the Macintosh: Opportunities and Barriers to Entry

If Apple wants to gain significant market presence in AEC, it must directly address the fact that AutoCAD and its nearly ubiquitous DWG file format represents the primary barrier to entry. The extent to which Apple can extend AutoCAD's current hegemony into the OS X environment will define any possible gain in Apple's AEC market share.

To complicate matters, DWG hegemony represents the past and present of AEC, but not necessarily its long-term future. In particular, the rise of building-information modeling (BIM) and its need for a rich 3D data environment make the long-term continued use of DWG questionable. The key CAD applications currently available for the Macintosh (Graphisoft ArchiCAD, Nemetschek USA VectorWorks) are technology leaders in BIM; their ability to gain market share is restricted by the perception of the larger AEC marketplace that DWG must lead the way before BIM can gain ascendancy.

Recent events indicate that the thought-leaders in architecture are beginning to look favorably on building-information modeling as the logical next step for architectural design technology. BIM was the main topic at a recent three-day conference, Technology in Architectural Practice, sponsored by the American Institute of Architects. Firm principals were well represented among attendees at this year's conference, which generally draws IT managers and CAD enthusiasts from architecture firms. The overall message from firms presenting at the conferences was that BIM is not a matter of "if" but a matter of "when" and "how."

Widespread adoption of BIM in AEC requires that Autodesk communicate a consistent, long-term transition strategy to its user base. Autodesk's original strategy of saying, "Autodesk Architectural Desktop is the present and Autodesk Revit is the future," generated more resentment than mind-share among AutoCAD users.

In December 2003 Autodesk responded by launching a software bundle, AutoCAD 2004 and Autodesk Revit 5.1. This is similar to the company's successful bundling of AutoCAD Inventor with Autodesk Mechanical Desktop for mechanical engineering. We expect Autodesk to continue this process with the next version of Autodesk Revit, and to release additional software tools to help users manage the transition from AutoCAD to Revit.

Another immediate stumbling block to Macintosh market growth in AEC is the varying importance that AutoCAD on OS X represents to the two companies involved. We believe that AutoCAD on OS X would be a "killer app" for the worldwide design community, with the potential to gain thousands of seats for Apple. But this importance is for Apple only. For Autodesk it would represent a marginal increase in sales, which probably would not justify the multi-million-dollar expense of creating an OS X version.

Apple could choose to subsidize the work required to bring AutoCAD to OS X, but such a move would antagonize those AEC CAD developers who already publish Macintosh

products. A modest, incremental strategy of aiding the role of AutoCAD and DWG in the Macintosh world would seem to be more realistic, and, we believe, has already begun.

On September 9, 2003, Autodesk and Apple jointly announced that DWF 6, the latest version of Autodesk's "Design Web Format" for viewing and printing AutoCAD data, would be made available for OS X. For Macintosh AEC users, the good news is two-fold: First, Autodesk is working with Apple to port the Autodesk Express Viewer to OS X. This means that a true Autodesk product for reading and printing AutoCAD-created data will again be available on the Macintosh. Second, Autodesk will provide a DWF Developer's Toolkit in OS X format.

Third-party developers will be able to create applications that can both read and write to the DWF format, with Autodesk's blessing. As Autodesk increases the functionality and the data-type richness of DWF, this new relationship means that such benefits will immediately be available to Macintosh users.

Assuming the survey population is directly representative of AEC Macintosh users, an extrapolation of the Architosh survey data suggests that nearly one-quarter of Macintosh users in AEC would be satisfied by the release of an Autodesk-based file viewer; the other three-quarters want full drawing capability. Thus, Apple and Autodesk can use the number of downloads of Autodesk Express Viewer for OS X to gauge further interest in Autodesk products on the Macintosh.

Beyond the release of DWF, both Apple and Autodesk need to articulate a vision for the future role of AutoCAD and DWG in the OS X environment. Existing Macintosh-using architects and other AEC professionals must know that there is a future for their technology of choice, and that their continued use of the Macintosh is viable in the long term.

Such a detailed articulation of strategy is not normal policy for either Apple or Autodesk. Both firms show a reluctance to discuss plans for their products in more than broad and vague terms. But AEC users who wish to remain (or become) Macintosh users need solid information in order to make realistic decisions. A "strategic vision for AEC" white paper from Apple explaining a step-by-step plan would be well received by the marketplace.

Marketplace reaction to the release of DWF for OS X will be a telling factor. The existing Macintosh AEC community needs to embrace DWF if there is to be any future at all for Autodesk applications on the Macintosh. While an OS X port of AutoCAD may never be economically justifiable to Autodesk, there may be enough demand for the company to bring next-generation applications (such as a rumored Autodesk Revit) to OS X.

Autodesk is enthusiastically marketing DWF to its existing user base, which suggests to us that a long-term strategy is in place to move the marketplace away from DWG and toward a new, more robust CAD data environment. Such a move could put OS X and Windows users on even ground, if Apple and Autodesk continue to work together toward such a goal.

Alternatives and Options to AutoCAD on the Macintosh

It is clear there is considerable demand for AutoCAD on the Macintosh. No other solution allows for complete bi-directional compatibility with AutoCAD without imposing constraints or a management burden on the architect's clients.

The factors that stand in the way of Autodesk releasing a Macintosh version of AutoCAD are both economic and technical. In a time when Autodesk is reducing employee head-count by hundreds, it seems highly unlikely the company will launch a new technology initiative for the possible return AutoCAD on the Macintosh would give.

The technical requirements are equally substantial. There is no such thing as a simple "port" of software from the Windows to the Macintosh environment. Autodesk has invested heavily in recent years on Windows-specific technology innovations, and would have to find ways to recreate them with OS X.

These obstacles are not insurmountable, but raise the question as to whether Autodesk is willing to make that level of investment. In Cyon Research's opinion, the likelihood is low that a Macintosh version of AutoCAD will appear on the market soon. However, we do know that Autodesk and Apple are actively engaged in discussions at the highest level as to how best to serve their respective users.

A Macintosh version of Autodesk's Revit has been seen, and may have a chance of reaching the market. While Revit does not address a requirement for full AutoCAD interoperability, it does represent Autodesk's next generation for architecture and thus has considerable appeal. We have observed activity among large, forward-thinking firms to convince their clients that Revit compatibility should be the new requirement, rather than AutoCAD compatibility.

It is clear from the Architosh survey that DWF alone would not meet the AutoCAD needs of the Macintosh AEC community. Other possibilities, short of the release of AutoCAD for OS X, might include:

- Autodesk may develop a Macintosh product that is interoperable with AutoCAD, even if it is not AutoCAD-based. We deem this unlikely.
- Autodesk may release Revit on the Macintosh, with "trusted interoperability" with AutoCAD.
- A company other than Autodesk may come to market with an AutoCAD-interoperable clone, as has happened in the past in the Windows environment.
- Existing CAD vendors in the Macintosh market may re-engineer their file formats to improve interoperability with AutoCAD. (An example in the Windows-based CAD environment is when Bentley Systems addressed the need for DWG

interoperability by redesigning the file format of their MicroStation CAD program in 2001.)

- Macintosh CAD vendors may educate their users' clients to the benefits of their software that outweigh the costs of conversion into and out of AutoCAD file formats.
- Increased reliance on industry foundations classes, technology designed by the International Alliance for Interoperability, diminishing the need for AutoCAD compatibility.

Final Thoughts

The AEC project lifecycle, as practiced throughout the world today, requires baseline DWG compatibility for a high percentage of projects. Though many applications support DWG, none that are available for the Macintosh work in a DWG-centric fashion. Thus it is not simply the lack of AutoCAD per se, but rather the lack of DWG-centric AutoCAD-oriented tools that creates a problem for architects, engineers, and other construction professionals who use Macintosh computers.

The current initiative by Autodesk and Apple to bring Autodesk's DWF file-viewing technology to the Macintosh OS X operating system addresses the lack of DWG-centric tools for ancillary applications, where downstream users need the data created by architects and other construction-design professionals, but it does not address the ability to create the original design information on the Macintosh in a DWG-centric fashion.

Were any vendor—Autodesk or a competitor—to come to market with a full-function CAD product that provided high-fidelity DWG-centric operation and an AutoCAD-type user interface, it would prove compelling to Mac users. But in the long run, it would not be enough.

A DWG-centric software tool with an AutoCAD-type interface is necessary but not sufficient. Macintosh users ultimately will want more than today's AutoCAD. They want a user interface that is OS X Aqua, not Windows AutoCAD. The AEC community would be best served if Autodesk, Apple, and other interested vendors work to create the future of architectural design with strategies and products that bridge the present gap and provide a smooth transition to next-generation, post-DWG AEC design products.

About Cyon Research...

Cyon Research Corporation provides consulting and analysis for engineering technology markets. Cyon Research provides key information, research, analysis, and consulting to its clients worldwide. Current products by Cyon Research include: CADwire.net, a leading provider of online news and analysis; COFES: The Congress on the Future of Engineering Software; Engineering Automation Report; A-E-C Automation Newsletter; Extranet News; and The CAD Rating Guide™. More information can be found at www.cyonresearch.com, 301-365-9085.

No funding for this white paper was provided by any vendor. Watch for additional Cyon Research analysis of segment-specific value propositions.

About Architosh...

Architosh (www.architosh.com) is the world's leading computer information source for Macintosh-based AEC/CAD/3D professionals and related designers worldwide, serving more than 25,000 unique readers monthly in more than 70 countries around the globe.



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