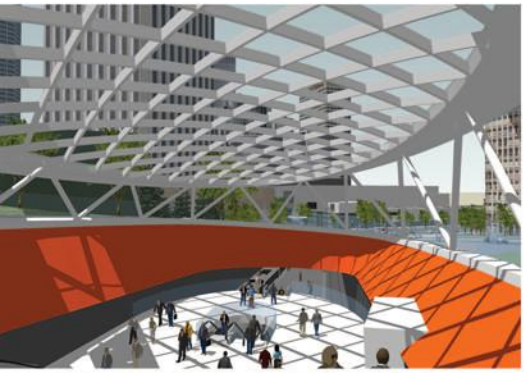
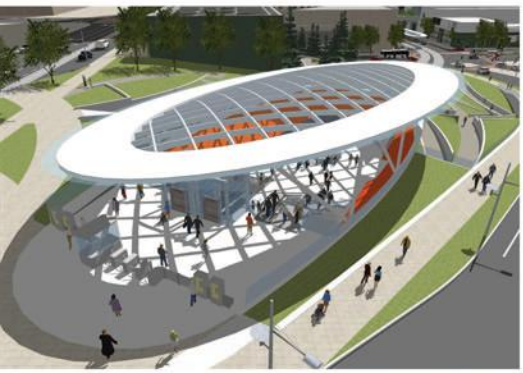
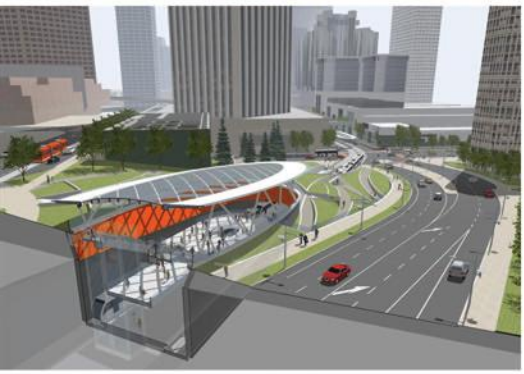
Q3 2014

AECbytes magazine

Analysis, Research, and Reviews of AEC Technology







SketchUp Pro 2014

Originally the product of a startup company, SketchUp was acquired by Google in 2006 and subsequently changed hands again in 2012 when it was acquired by Trimble. This review explores the key new features in SketchUp Pro 2014 and the increasing AEC-specific and BIM-related capabilities that are being added to it under the Trimble umbrella.

Also, in this Issue:

Case Study: Nikken Sekkei, Japan

Book Review: "BIM for Facility Managers"

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People Profile – Atul Khanzode, DPR

People Profile – Christopher Pynn, Arup

Firm Profile – KEO, Kuwait

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FROM THE PUBLISHER'S DESK

We live in a truly global world. And today, that's an understatement. Thanks to the Internet, information spreads virtually in seconds. A tweet here, a Facebook post there, and the word gets around. Everything from spreading information and organizing revolutions happens via the Internet these days. At AECbytes, we have been fortunate to have started off on the Internet before moving to print. Our readers are spread over 120 countries covering all major continents on this planet. We have been truly blessed to be able to reach tens of thousands of people around the world through our site.

With this third edition of the AECbytes magazine, we have attempted to reflect the diversity of our audience, particularly across international boundaries. This issue features a case study of Nikken Sekkei, a 2,400 person AEC firm headquartered in Japan providing architecture, engineering, planning, and construction management services in cities throughout the Asia-Pacific region. It was founded all the way back in 1990, giving it an incredibly long history in the AEC industry, and is currently ranked as the fourth largest firm in the world!

In the Firm Profile section, we feature KEO International Consultants, a 2,700 person multi-disciplinary professional consulting firm headquartered in Kuwait with offices in all the GCC (Gulf Cooperation Council) countries and projects all over Africa, Asia and Europe. With some of the most ambitious AEC projects, we believe that this part of the world has plenty to offer, both in terms of hands-on experience as well as future projects that can challenge the most promising AEC technologies.

In the People Profile section, we have the invaluable insights of two AEC Professionals from two extremes of the globe—Atul Khanzode, PhD, head of DPR's Construction's Consulting and Construction Technologies groups from the San Francisco Bay Area, and Christopher Pynn, Associate Principal with Arup's Melbourne Buildings Group from Australia.

On the technology front, our cover story is an indepth review of Sketchup Pro 2014. Despite being bounced around as a company, first as a startup, then as a part of Google, and now as a part of Trimble, Sketchup Pro 2014 continues to be the tool of choice for conceptual modeling in the AEC industry with its extremely intuitive and fluid interface. We will explore the increasing AEC-specific and BIM-related capabilities that are being added to it under the Trimble umbrella. In addition, we will look at Autodesk's rebranded A360 cloud solution, the latest updates from AEC Technology vendors, and the importance of performance analysis in architectural design.

We hope you enjoy this truly global issue of AECbytes magazine. Happy Reading and do send in your feedback!

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SketchUp Pro 2014

SketchUp has been on quite a ride since it made its debut at the AIA 2001 National Convention, where it wowed the audiences with its amazingly intuitive conceptual modeling capabilities. I had the opportunity to witness this first-hand and called it "a delightful new 3D modeling tool" in the Cadence AEC Tech Newsletter I was authoring at that time. While that publication is no longer in existence, here is my description of SketchUp at that show, and it still remains the raison d'être of the application.

> **"Very easy to use and a lot of fun, 3D forms are surprisingly easy to create and modify with SketchUp. Some neat features such as extended lines and profiles make the image seem more hand-drawn than computer-generated. This is exactly the kind of product an architect would like to use for design visualization, attested to by the large crowds the relatively small SketchUp booth attracted."**

Originally the product of a startup company, @Last Software, SketchUp was acquired by Google in 2006 and subsequently changed hands once again in 2012 when it was acquired by Trimble, where it joins other AEC-specific products including Tekla and Vico that are also now part of Trimble.

The main target audience of SketchUp continues to be anyone who needs to conceptualize a form in 3D, including professionals such as architects, builders, product designers, and engineers, as well as hobbyists, makers, and even middle-school and high-school students. The availability of a free version called SketchUp Make, which can be downloaded from the SketchUp website, makes it very easy for just about anyone to explore the use of the application and has contributed greatly to its popularity. There is also a paid version, SketchUp Pro, with additional functionality targeted towards professionals.

SketchUp is now on an annual release cycle, the current version being 2014. This review explores the key new features in SketchUp Pro 2014 and, in particular, the increasing AEC-specific and BIM-related capabilities that are being added to it under the Trimble umbrella. (For a more comprehensive overview, as well as a historical perspective on SketchUp's evolution, please see my earlier reviews of SketchUp 4, SketchUp 5, and Google SketchUp 6.)

Key New Features

One of the main improvements in SketchUp 2014 is a complete overhaul of the 3D Warehouse, the online repository for finding, storing and sharing SketchUp models, which now contains millions of models. It has been completely rebuilt from the ground up, making it easier for SketchUp users to search for a model (see Figure 1) or for components they can add to their model, create collections for organizing content, and share their models with others. The maximum size of models that can be uploaded and stored in the 3D Warehouse has been increased from 10 to 50 megabytes. AEC industry users will be especially benefitted by the growing number of Product Catalogs in the 3D Warehouse created and uploaded directly by their manufacturers, featuring a wide variety of fixtures and building components that can be added to a model.

Another new add-on is the Extensions Warehouse, which was introduced in the last release of SketchUp. It collects all the third-party extensions and plug-ins that have been developed using the SketchUp SDK (software development kit), making it easier for users to search, download and install the extensions they would like to use with SketchUp. Figure 2 shows an example of a search for extensions for SketchUp 2014 that are targeted towards the Construction industry and have capabilities for Reporting. Many of these extensions are free. The Extension Warehouse provides a home for the many custom modeling tools that have been created to work with SketchUp by third-party developers since 2004 using SketchUp's open and free API.

Figure 1. Finding a model of Falling Water, the famed residence designed by Frank Lloyd Wright, in the 3D Warehouse (top mage), downloading it, and subsequently opening it in SketchUp (lower image)

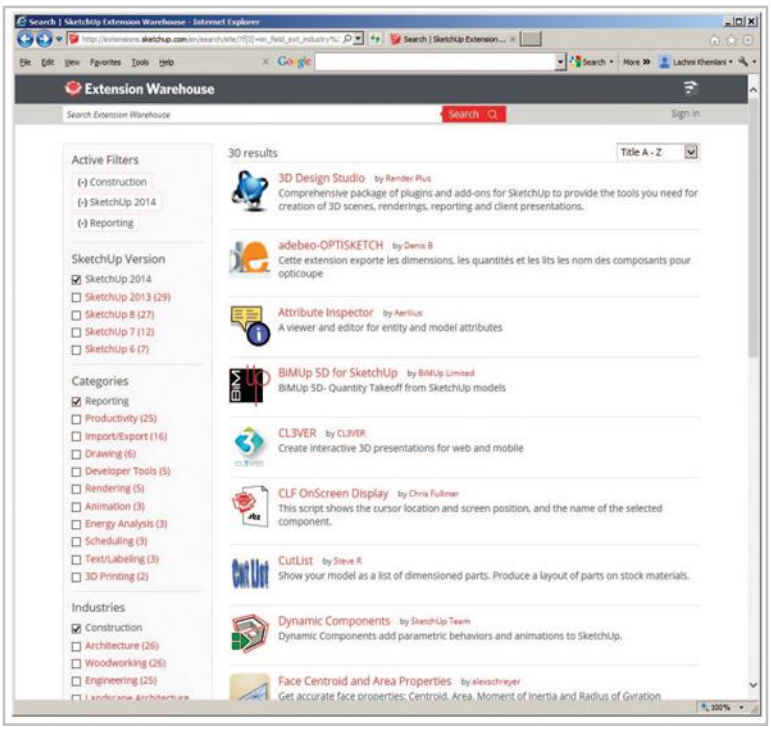

Figure 2. Searching the Extensions Warehouse for SketchUp add-on tools that provide Reporting capabilities for the Construction industry.

Now that SketchUp is part of Trimble, which is slowly but surely expanding its AEC footprint, some key new features have been added to SketchUp Pro to enhance its building modeling capabilities. There is a new "Classifier" tool that allows a classification type to be applied to a component or a group from a classification schema that has been imported into the model. The Architectural Design and Construction Documentation templates of SketchUp come with the IFC 2x3 schema loaded by default, and the application of this schema with the Classifier tool to a model component is shown in Figure 3. Other classification systems can also be imported into the model and applied using the Classifier tool. It should be noted that the classification can be applied to components modeled within SketchUp as well as to models imported from the 3D Warehouse and exploded into their individual components. Another related new feature is the ability to export a model in the IFC format for interoperability with other AEC applications, assuming, of course, that its individual components has been properly classified using the IFC 2x3 schema. We will explore the implications of this capability for the AEC industry in more detail in the next section.

Sketch Pro 2014 also adds some new capabilities to LayOut, the companion module that allows users to quickly create professional-looking design presentations and documentation sets from their SketchUp models. With LayOut, you can create drawing sheets with configurable title blocks, add perspective or orthogonal views of models, choose drawing scales, adjust line weights, apply different colors and styles to the displays, and add dimensions and annotations. To enhance the ability of LayOut to create construction documents in addition to presentation drawings, you can now add dimension strings, use Auto-Text tags, and insert Smart Labels that are automatically pre-populated with relevant text such as the name of a group or component, the area of a face, and so on. The model views placed in a LayOut document are still tied to the corresponding SketchUp model, allowing you to open it in from LayOut (see Figure 4). Also, when the model is changed, there is an option to update the corresponding model views placed in LayOut. The drawing sheets created in LayOut can be exported to PDF, JPG/PNG, or DXF/DWF when they are ready.

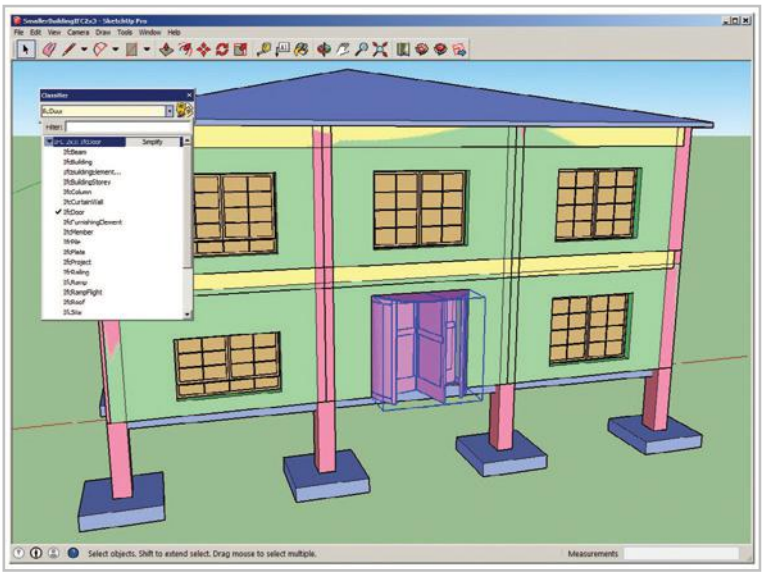

Figure 3. Using the IFC 2x3 schema with the Classifier tool to classify the objects in a building model in the IFC format.

Figure 4. A LayOut file containing five sheets of a SketchUp project, with the Elevations sheet open. You can click on a view and open up the corresponding model in SketchUp, as shown in the lower image.

SketchUp and BIM

The new Classifier tool in SketchUp Pro which allows any classification schema to be applied to a model greatly expands the scope and reach of the application, allowing it to capture more non-graphical data about model elements that can subsequently be harvested when needed. While this makes SketchUp Pro more useful in all of the different industries it is used in, the ability to tag any

modeled geometry with industry-standard object types makes SketchUp particularly helpful in AEC as it can now be part of the larger AEC workflow rather than a neat but isolated tool for conceptual building design. With the ability to apply the IFC 2x3 schema so easily to model elements and subsequently export the model in IFC format—which has become the de facto industry standard for interoperability—the SketchUp model can be well and truly interoperable with the growing number of AEC applications that work with the IFC format. An example is shown in Figure 5, where the model tagged with the IFC classification schema in Figure 3 is exported in IFC format and subsequently opened in Solibri Model Checker, one of the leading tools for checking and coordinating BIM models.

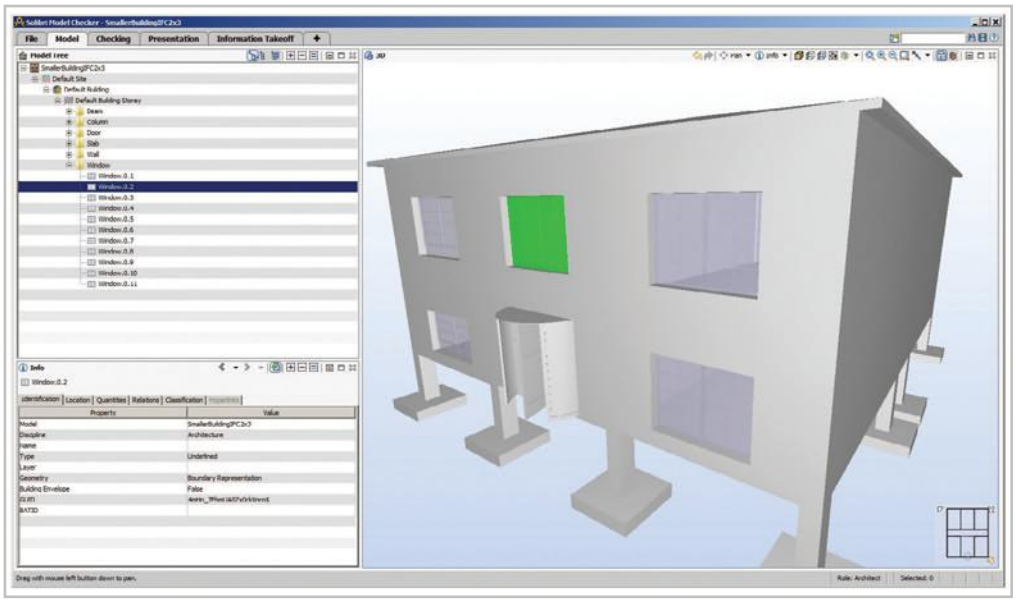

Figure 5. Exporting the model shown in Figure 3 in IFC format and opening it in Solibri Model Checker, where the object tree has been expanded and one of the windows is selected, showing the information associated with the object.

While this capability definitely enhances SketchUp's ability to become part of a BIM workflow, it raises the question of whether SketchUp can now be considered as a BIM application. While there are no tools for directly creating building components as you would find in other BIM applications, you could model any elements using SketchUp's intuitive modeling interface and simply designate them as walls, doors, windows, floors, and so on by selecting them and applying a building-specific classification to them. Also, given the large number of SketchUp extension tools and the power of its SDK, there probably are, or soon will be, plug-in tools that already encapsulate this capability, letting users create building components directly within SketchUp.

Thus, given that it is possible to create a BIM model with SketchUp, the other question before its AEC users is to what level of detail they should model in SketchUp before moving their building models to a more traditional architectural BIM application for further development. Do they even have to, or can they just remain in SketchUp and even create construction drawings from the SketchUp model using the expanded capabilities in LayOut? Given SketchUp's fluidity and ease of use—especially in contrast to the complexity of most BIM applications—this does seem like a very attractive proposition. But it does depend upon how much detail it is possible to have in a SketchUp model. And ultimately, it depends upon whether business practices in AEC evolve to the point where the construction of a building can be done primarily from a model (or models) without requiring detailed construction drawings to be created and submitted as part of the contract.

Not surprisingly, the use of SketchUp among many construction firms has gained in momentum, who are using it internally for a wide variety of benefits, including creating dimensionally-accurate, highly-detailed 3D models of the entire project to work off from, modeling specific details to clarify complex conditions and respond to RFIs, and creating project sequencing animations and site logistics plans. I described one such use of SketchUp in my article on AGC's Winter 2011 BIMForum, where Mortensen Construction showed how they were using SketchUp to create "virtual mockups"— stand-alone, highly detailed, 3D models of specific elements or systems of the building—for integrated work planning, construction sequencing, and team communication and collaboration (see Figure 6). The use of SketchUp in construction has mushroomed even more since then, especially under Trimble with its AEC focus. There is a whole section on SketchUp's website with case studies describing the use of SketchUp by other construction firms in addition to Mortenson Construction, including DPR, JE Dunn, and Turner Construction.

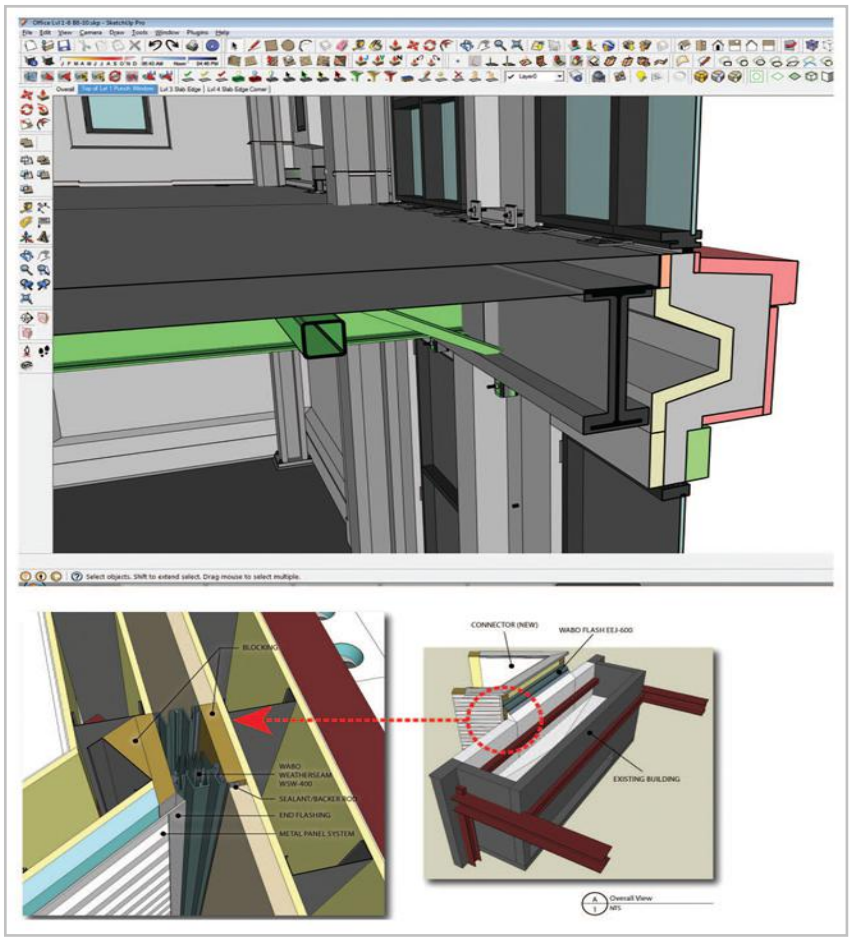

Figure 6. The use of SketchUp to create virtual mockups by Mortenson Construction, as presented at the AGC's Winter 2011 BIMForum.

Conclusions

With its acquisition by Trimble, SketchUp is now part of a larger AEC ecosystem than it was for the six years when it was part of Google, which, for all its might and technological prowess, is most definitely not an AEC-specific software vendor. SketchUp was launched at an AIA National Convention and over 60% of its users were always from the AEC industry, so it is coming back to its roots, so to say. This should be a welcome development for the AEC industry, given how easy and fun the application is to use, and how inexpensive. There is nothing to beat being free in order to try it out and get comfortable; and even the full professional version seems like a bargain at $590.

Going forward, it would be useful for SketchUp to continue expanding its BIM modeling capabilities and become fully integrated with other Trimble applications such as Tekla for structural engineering and Vico for construction management, so that Trimble can offer a complete multi-disciplinary platform for BIM. The ability to apply classification schemas to modeling elements and export to IFC is a great start; it would be helpful to also have the ability to import IFC files so that building models created in other applications can also be brought in for refinement or reference. Maybe Trimble can work on developing an AEC-specific module of SketchUp which not only includes this capability but also has additional tools for creating richer details in the building model so that it does not have to be moved to another BIM application for further development? Or is it too much to ask for SketchUp to continue to be so intuitive and easy to use but still become a BIM application? It's a challenge that should continue to keep the SketchUp development team busy for years to come.

About the Author

Lachmi Khemlani is the founder and editor of AECbytes. She also consults extensively on the development and implementation of AEC technology, gives frequent presentations before both professional and academic audiences, and serves on juries for technology awards.

Lachmi completed her Ph.D. in Architecture at UC Berkeley, specializing in the application of computing technology to the building industry. Her thesis was focused on developing a computational representation of a building that could be analyzed and evaluated, in line with present-day BIM concepts. Her earlier credentials include a professional B.Arch. (Honors) degree from the Indian Institute of Technology, Kharagpur, India, and an M.Phil. in Architecture from the University of Cambridge, England. She worked on several design projects as a practicing architect in India and has taught CAD and 3D modeling for several years at UC Berkeley. In addition to writing in industry publications for several years, she has authored books on CAD and modeling. She continues to stay closely involved with the research community, recently serving on the editorial board of the journal, Automation in Construction, for which she continues to review journal submissions.

Toward an Architecture of Performance: Reconciling Performance and Design

Energy and daylight performance are becoming increasingly important in the AEC industry. Building energy codes and voluntary standards like LEED are becoming stricter and increasingly performance-based. Building owners are demanding performance as a way to reduce operating costs, increase building value, and improve productivity. And a growing number of architecture firms are signing on to voluntary goals like the 2030 Commitment.

But for many architects, the focus on performance comes with apprehensions and misgivings: that focus on performance will lead to poor design; that the architect will be further sidelined; that beauty and poetry and even livability will be sacrificed in the pursuit of quantitative results. Are ambitious performance goals compatible with good design? Are performance and design antagonistic, leading the architect in different directions? Or can they co-exist—perhaps even help one another?

These are some of the questions that the recent PER/FORM Live Design Competition brought to the fore. This first-of-its kind competition included an online round and a live event that unfolded at Pratt Institute's Manhattan campus in May. Competitors were tasked with designing a multi-family residential building on a site directly north of the High Line spur in Manhattan. Over the course of three live design rounds, they created conceptual models that were judged on both energy and daylight performance as well as beauty, conceptual strength, and contextual appropriateness. Sefaira's Real Time Analysis software provided competitors with real-time feedback on their energy and daylight metrics, allowing them to shape the building according to these constraints. The design challenge was to create a design that "both performs and inspires"—a synthesis of beauty and performance, in which both are made stronger.

As one of the competition's judges, I saw three very different approaches to achieving both excellent performance and high design: performance as subservient to design, design as subservient to performance, and performance as a partner in design. These approaches have important implications for the future of architectural practice—and, it turns out, important implications for the possibilities of performance and the quality of design.

Design Over Performance

Some entries showcased excellent design—conceptually engaging, visually exuberant, contextually appropriate—but disappointed when it came to performance, in some instances even eschewing obvious opportunities to improve their scores. It was as if these competitors had designed the building first, then assessed their performance and made minor adjustments.

The "design first, analyze later" approach is business-as-usual for most architects. Energy or daylight analysis is traditionally performed by consultants in the later stages of design (if at all)—at which point the overall design is largely established and the analyses either lead to small refinements, or require costly design changes.

This approach rarely leads to exceptional performance. That's because early design decisions about the form of the building, shape of the floorplates, and the amount and location of glazing have a huge impact on the overall performance of the building. No amount of late-stage fine-tuning can overcome a fundamentally poorly-performing design.

But there is perhaps a more foundational problem with the "design first" approach—one more central to the practice of architecture. Providing comfortable interior space is one of the most basic purposes of a building. This requirement should shape the building form as much as program or context, rather than be left as an afterthought. Good design, in this view, is a solution that simultaneously solves the multitudinous functions that a building serves—and performance is one of the most essential functions. Good performance is simply a matter of good design.

For most of architecture's long history as a profession, this view was arguably taken is a given. It was the combined upheavals of air conditioning, cheap energy, and the International style that freed architects from the constraints of thermal comfort. But this freedom proved a double-edged sword: at the same time that it liberated architectural form, it diminished architecture's meaning—and perhaps removed a vital source of inspiration and creativity as well.

"Building services … [are] essentially a mechanical compensation for the fact that the building [is] bad at what it was designed for," contends Bjark Ingels, founder of Bjark Ingels Group (BIG). "If we moved the qualities [of building services] out of the machine room and back into architecture's inherent attributes, we'd make more interesting buildings and more sustainable cities." (Bjark Ingels, as quoted in The Focus Magazine and Bustler.) The biggest casualty of the "design first" approach may not be performance, but design itself.

The idea that architects should be accountable for performance is a potentially radical shift, and could transform the profession and the design process. It begins with the proposition that the proper role of the architect is to engage with the mundane and functional as well as the sculptural and sublime—that the two should never have been separated.

Unfortunately, the designers' established toolkit for dealing with performance is severely lacking. Architects are designing a wide variety of building types in a wide variety of locations, using novel forms and building materials. In this context, rules of thumb can frequently point designers in the wrong direction. As architect Ara Massey wrote in the recent AECbytes article, "Performance Based Design: Why Real-Time Feedback is Better Than Intuition," performance analysis showed that "a number of assumptions that had seemed intuitive were actually wrong or at least sub-optimal," and that "three … commonly held rules of thumb in the industry … turned out to be wrong when I tried to validate them with energy analysis."

What's worse, rules of thumb are often prescriptive—restricting design rather than unlocking creative problem-solving. A rule of thumb might suggest 20% south glazing, but doesn't tell the designer what to do if they want additional glazing for views or aesthetic reasons, or if the building doesn't face due south, or if any number of other assumptions are not met. Only physics-based analysis can provide reliable guidance—and arguably creates new, more effective ways for the architect to engage with performance.

Performance Over Design

If architects do take performance seriously—as a core part of the design task—what does that mean for design? Will performance metrics drive design decisions to the exclusion of other important but less-quantifiable issues? Will analysis tools point architects toward a single optimum solution? Will all buildings look like cubes, with minimal surface area to minimize heat losses—or some other, equally uninspiring "optimum"? Will analysis make design a mindless process of optimization? When combined with emerging generative tools, does the ownership and authorship of design disappear? Are we headed toward a world in which algorithms generate options and evaluate them against predefined criteria?

These questions and many more like them emerged throughout the day of the live competition: during panel discussions with the jury and contestants; on a wall dedicated to on-going dialogue via Post-Its; during the heady conversations that scattered the hall and imbued the afternoon happy-hour with gravitas and restless purpose. They underscore the fears and concerns of a profession grappling with new expectations, new technologies, and what could become a seismic shift in focus.

The advantage of the PER/FORM event was that it didn't just raise these questions: it challenged designers to answer them, in real time, in front of all attendees. And the results appeared promising. Some of the entries in both the online and live rounds certainly fell victim to the "performance trap"—hewing too narrowly to the dictates of performance at the expense of an inspiring design. Too much solar gain? Add solar shades. Too little daylight? Punch a few more openings. Such moves are reactive, transactional—obeying a directive rather than interrogating the data, asking how the new information might inform the basic approach or the design concept. And the structure of the live event may have contributed to the problem: a three-hour timeframe provided little room for exploration or interrogation.

Yet overall, the jury was impressed by the wide diversity of responses that the requirements generated. Rather than lead to a single "optimized" design, as some had feared, the entries showcased a wide variety of solutions. What's more, many very different solutions performed equally well.

While it's tempting to think immediately of "optimization" when speaking of number-crunching calculation engines and hard metrics, in practice the true power of real-time feedback is the power of rendering visible the invisible. Like many complex, multi-faceted problems, there is no one correct answer to the problem of building performance—and the PER/FORM entries evidenced this in dramatic fashion. Rather than defining solutions, the performance feedback simply provided contestants with a new layer of information: data on the impacts of their design decisions. The design—the creative response-remained firmly in the hands of the designer.

Figure 1. Online round winning design by Kaveh Alagheband.

In fact, the new information enables architects to engage with performance in the same way that they engage with other aspects of the design problem: with program, occupant experience, urban context, and aesthetics: by testing ideas, seeing what works, discarding what doesn't, making trade-offs, finding synergies. Visibility grants the architect creative power: the ability to manipulate energy use and daylighting just as they manipulate building form. At its best, this approach opens a new dimension of design, and allows architects to find the elegant intersection where performance and beauty collide.

Performance Inspires Design

And so the central question remains: Can performance be compatible with beauty? And more than that, can it be a catalyst for beautiful forms? In many ways, this was the central goal and the challenge of the competition.

The winning entries of both the online and live rounds showcase different approaches to achieving this aim—but all are proof that performance can, indeed, inspire great architecture.

Online round winner Kaveh Alagheband created a dramatic cantilevered form to harvest daylight (Figure 1). His early studies revealed that, because of shading from surrounding structures, lower levels tended to have less daylight

and therefore more energy use for electric lighting. In response, he stacked most of the building program on the upper levels—creating both a striking architectural response and a building with excellent daylighting and low energy use.

Online round runner-up John Carruth found a building form that balanced daylight access, solar exposure, and envelope area (Figure 2). Narrow floorplates and well-shaded south-facing glass take advantage of passive solar design while maximizing daylight. A diagonal concrete wrapper provides shading from east and west sunlight while engaging provocatively with the High Line in a move that blurs the boundaries between public and private space.

Live round winner Junrui Wang created a low, deep form that allowed him to achieve the required square footage

Figure 2. Online round runner-up design by John Carruth.

with a minimal envelope area (an important energy-saving strategy); he then carved this form away to achieve good daylight and reveal a rough-hewn topography that extends the High Line's public space (Figure 3).

Live round runner-up John Campbell designed a modular, stepped building with plentiful outdoor space (Figure 4). The design uses self-shading to reduce cooling requirements, and minimizes glazed area—carefully positioning glazing for views and outdoor access, and shading glazing where it does occur. This strategy improved envelope efficiency and helped to compensate for the design's large exposed surface area.

Live round runner-up Andrew Herbst created a craggy, crystalline façade to clad a narrow floorplate, producing a design in which optimal glazing ratios and shading were the core elements (Figure 5). Excellent daylight and controlled south solar gains helped to drive down energy use.

The winners of the live round achieved an average Energy Use Intensity (EUI) of 30 — a 50% reduction from the median multi-family building in New York — in only three hours. Alagheband, winner of the online round, achieved an EUI of 22 — a 65% reduction, and below the ambitious 2030 Challenge target. Moreover, these results were achieved by adjusting building form alone—that is, without changing insulation levels, window properties, or HVAC systems from a code baseline. Such optimizations would likely open up even deeper energy savings.

In each of the winning designs, performance goals influenced the core concept, yielding a design parti rich with layered meaning and purpose—designs that simultaneously engaged in a robust discourse with the urban environment, provided excellent daylighting and views for building residents, and achieved energy performance that is nothing short of revolutionary. They demonstrate an approach to performance that is less about optimizations and number-crunching than it is about creative problem-solving and thoughtful, synthetic solutions.

Figure 3. Live round winning design by Junrui Wang.

Toward Performance-Based Design

Architects will have to continue to grapple with performance—what it means for the profession, the design process, and the built environment. It will take time and effort for architects to use performance feedback meaningfully, to understand it deeply enough to use it creatively, and to learn how best to balance hard metrics with qualitative criteria. Architectural practice will likely change, as will architectural education. But the experience of the PER/FORM Live Design Competition suggests

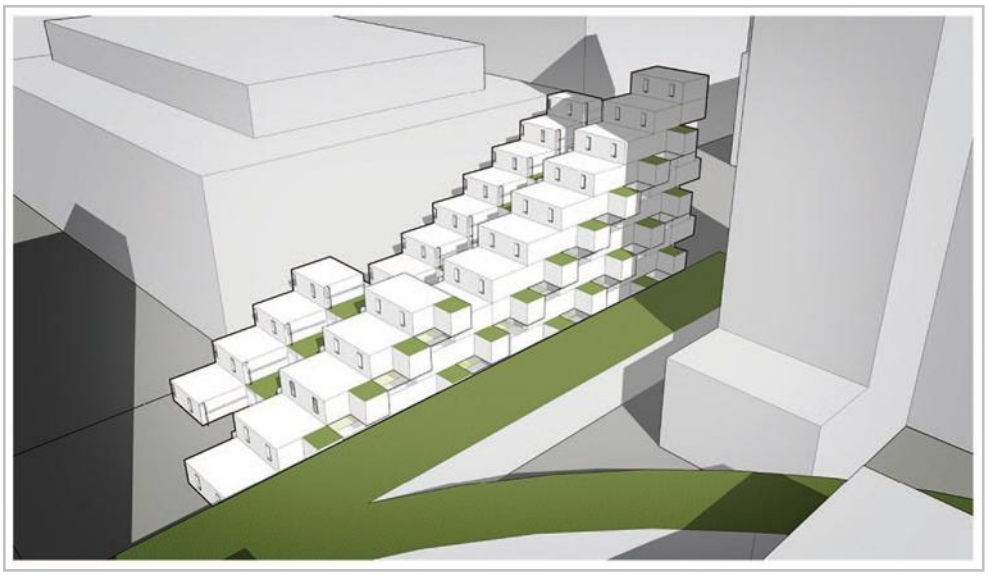

Figure 4. Live round runner-up design by John Campbell.

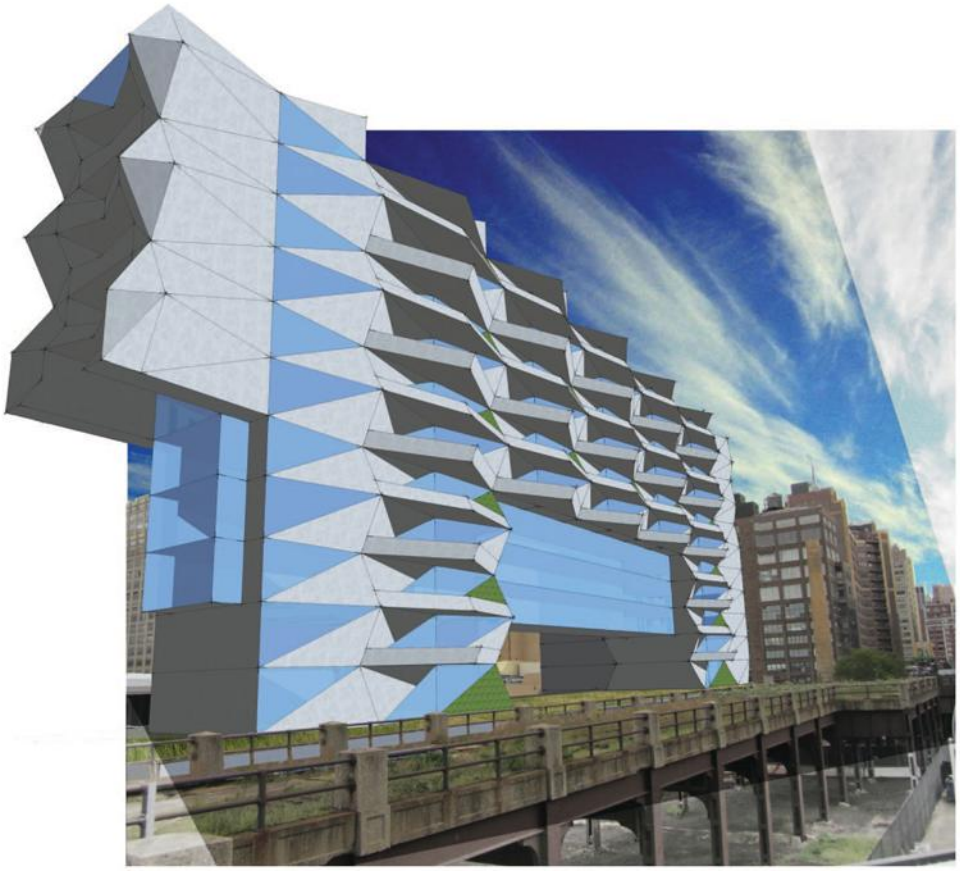

Figure 5. Another live round runner-up design by Andrew Herbst.

that architecture itself need not suffer—on the contrary, it may become richer and more inspired—and that the fundamental role of the architect as the synthesizer and visionary will not be compromised—in fact, it may be strengthened.

About the Author

Carl S. Sterner, Assoc. AIA, LEED AP, is a Senior Product Marketing Manager at Sefaira, where he works to create game-changing sustainable design software for architects. Prior to joining Sefaira, he worked for a number of architecture firms across the U.S., including the internationally-recognized firm William McDonough + Partners. His design work has centered on high-ambition sustainable projects, including multiple net-zero energy buildings and several LEED Platinum and Gold projects. His research has been published in The Journal of Green Building and was featured in New Directions in Sustainable Design (Routledge, 2011).

Feedback From the AECbytes Blog

Comments on SketchUp Pro 2014

Sketchup certainly has appeal from a usability perspective and because of its low price. However, anyone considering its use through the lifecycle of a construction project would do well to remember that there is more to buildings than architectural modeling, or even structural modeling. There would have to be a useful way to either model MEP systems within Sketchup or a very robust way to export to Revit MEP.

I'm not a fan of the slow pace of development of Revit MEP or the linked-model structure of Revit, but collaboration is the name of the game in building design and construction, and Sketchup is really an orphan right now. IFC remains a kludge for interoperability with Revit.

In AEC, we all need to work together, so we should choose platforms that encourage collaboration, rather than platforms that only give it a nod. If that's the Revit one platform to rule them all approach or each of us choosing the best in class, they have to work together in a meaningful way.

Jim Crabb

I agree with Jim. I'm working in a firm in Vietnam, which has concept team and project management team too. Were using SketchUp and CAD before, and now the new boss wants Revit. New Revit experts come and help us to step into the BIM world. But the collaboration nightmare began — construction of 24 storey building, different consultants, both local and overseas, different softwares and versions, and no national standard. We've failed a few times and are now trying it on some other projects with early DD phase only.

SketchUp works well for us from concept to construction. We actually don't use the new BIM functionality of SketchUp. Our current way to create and manage models is something like Revit to help MEP, Structure, and Landscape understand other disciplines. Some of them set up their own models in Revit. Quick and flexible SketchUp modeling saves us a lot of time when there is need to discuss design changes, new design options, site issues, new tender joins, etc.

Revit is a power software but SketchUp has its own place. It's not only for architecture visualization.

Minh Nguyen

Comment on Toward an Architecture of Performance: Reconciling Performance and Design

Performance-based design is clearly an excellent way to expose students to realistic constraints that will challenge their creativity to solve a multi-dimensional problem. The examples shown in this article are great examples of how the students responded to this challenge. However, in reality, there are other constraints that need to be considered: construction cost, building codes, maintenance cost are all important. I hope in the future that this contest can include a construction evaluation component so that the architects can benefit from this source of knowledge and consider off-site prefabrication as well as on-site opportunities.

Paul Teicholz

To view other comments on AECbytes articles as well as add your own, please visit http://aecbytes.wordpress.com. You can also send feedback to editor@aecbytes.com.

Nikken Sekkei: An AEC Technology Case Study from Japan

Lachmi Khemlani
Founder and Editor, AECbytes

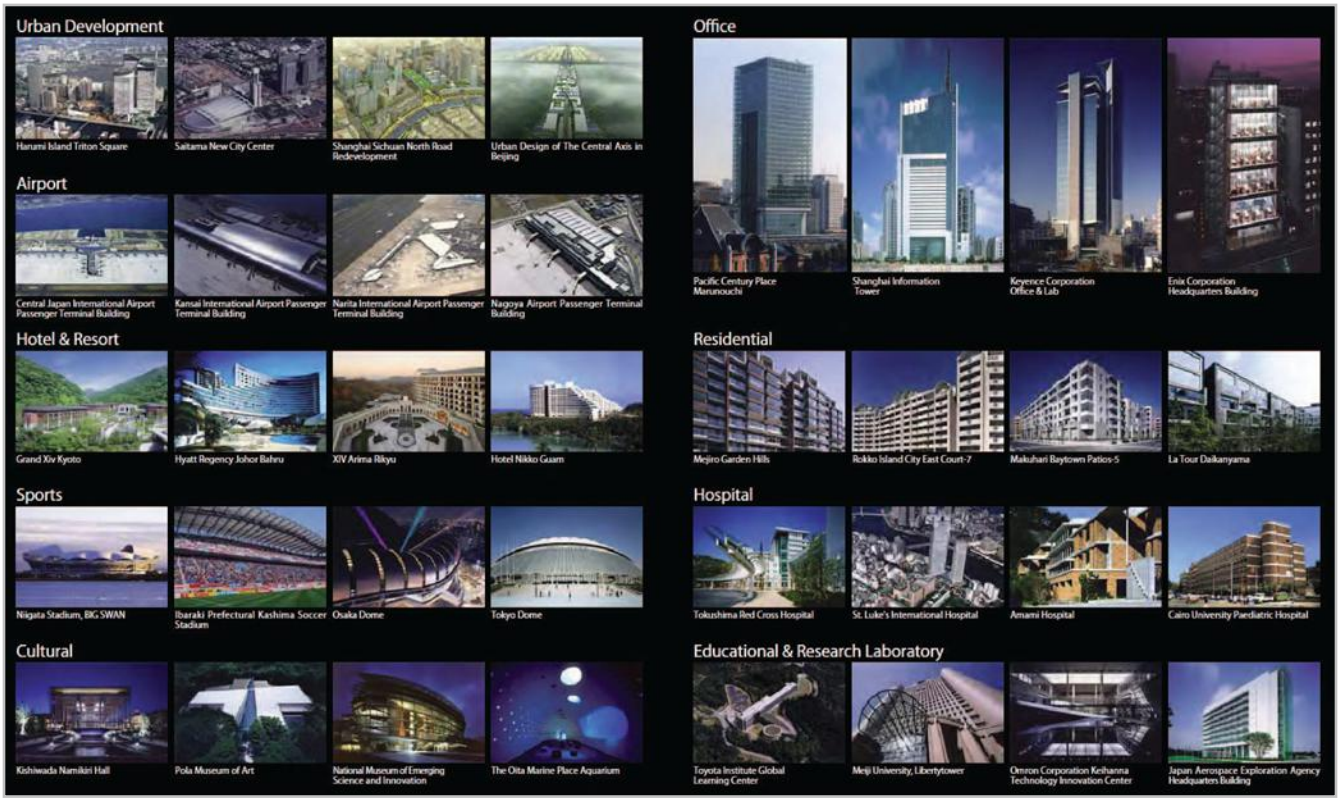

Figure 1. The spectrum of projects across the AEC industry by Nikken Sekkei. (Courtesy: Nikken Sekkei).

Earlier this year, I visited Tokyo, Japan, for the launch of Graphisoft's new BIMcloud offering, and while I was there, I also had the opportunity to visit some of the leading design and construction firms in Japan to find out how they were deploying technology solutions in their practices. One of these was Nikken Sekkei, a 2,400 person firm providing architecture, engineering, planning, and construction management services that was founded all the way back in 1990, giving it a long history in the AEC industry. The firm is headquartered in Tokyo, with additional locations in several cities in Japan as well as in cities throughout the Asia-Pacific region, where most of its projects are located. It is currently ranked as the fourth largest firm in the world.

To date, Nikken Sekkei has completed over 20,000 projects in more than 200 cities around 50 countries, spanning across the entire spectrum of AEC, as show in Figure 1. It has won a whole slew of design awards, hardly surprising given the quality of its architecture, some of which is shown in more detail in Figure 2.

Overview of Technology Use

Being such a large and reputed company with so many on-going projects, it is not surprising that Nikken Sekkei is fairly advanced in its implementation of AEC technology, which includes not only BIM applications but a whole host of additional tools for architecture, structure, and MEP, for design, documentation, simulation, and analysis. The complete map of all the applications used at Nikken Sekkei is shown in Figure 3. These include applications that are well known all over the world such as ArchiCAD, Revit Structure, Tekla, Solibri, and 3ds Max, as well as more regional and local applications such as Midas GEN (a Korean building engineering software) and Cadwell Tfas (a Japanese local MEP application). Some of the applications Nikken Sekkei uses were also developed internally, such as Building3D for structural analysis. I was impressed to find that in addition to energy, lighting and ventilation analysis, which are quite common now, Nikken Sekkei also does acoustic analysis and pedestrian traffic analysis, both of which have yet to see widespread implementation, even in the US. Most of the connections between applications shown in Figure 3 are enabled through the open-standard IFC file format.

With regard to its BIM implementation, Nikken Sekkei has been using BIM for the last 10 years and standardized on it 3 years ago. It went through an intensive 3 to 4 year BIM evaluation process before it decided on ArchiCAD as its main BIM application. Not only did it find Graphisoft easy to work with and more than willing to customize

ArchiCAD to better suit its requirements (along with those of the Japanese market in general), Nikken Sekkei also found Graphisoft's vision of OpenBIM enabled by IFC very compelling, as it resonated with its own philosophy, approach, and processes. As mentioned earlier, the IFC format was critical to integrate all of the different applications used at Nikken Sekkei, so unequivocal supports of IFC was one of the main criteria the chosen BIM application had to satisfy.

Even though Nikken Sekkei has standardized on ArchiCAD as its main BIM application, it uses a whole host of specialized tools for different tasks, as shown in Figure 3. For example, it uses Rhinoceros and its Grasshopper plug-in extensively for conceptual design, especially for freeform and algorithmic design studies. It did use SketchUp for conceptual design in most cases in the past, but now prefers to do this in ArchiCAD itself, with the introduction of tools such as Shell and Morph that bring expanded design freedom and enable forms to be quickly conceptualized. The advantage of using ArchiCAD at the earliest design stage is that the project stays within a BIM environment and automatically derives all its benefits including generating 2D documentation from the model. For projects using Rhino, Nikken Sekkei has developed a custom converter from Rhino to ArchiCAD, which not only converts the model but maintains a live connection between them. Figure 4 shows a project with a complex interior façade for which Rhino was used with its Grasshopper plug-in to study parametric design variations.

Figure 2. Some of Nikken Sekkei's iconic projects, including commercial buildings, stadiums, museums, libraries, and urban design. (Courtesy: Nikken Sekkei).

Internal and External Collaboration

Since Nikken Sekkei uses ArchiCAD as its primary BIM application, it uses ArchiCAD's built in Teamwork module for design collaboration, which in conjunction with Graphisoft's BIM servers, enables synchronous, real-time collaboration between the multiple members of a design team. (This capability was described in depth in my review of ArchiCAD 13.) Nikken Sekkei's Teamwork configuration for its Japanese offices is illustrated in Figure 5, showing the BIM servers where the complete and up-to-date BIM models of projects are maintained and the individual ArchiCAD clients in different offices where users work on local copies of the model, which are continuously synchronized with the master models on the server. Average project sizes range from 100 MB to 2 GB, and typically, about 10 users are online at any given time working synchronously on projects in this manner.

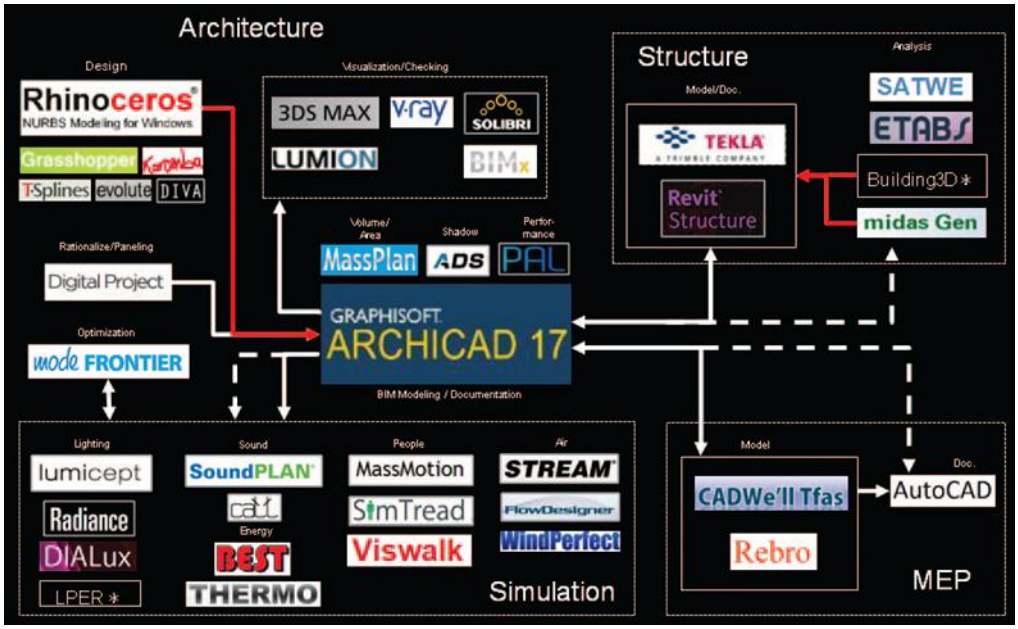

Figure 3. A chart of all the different software applications used in Nikken Sekkei. (Courtesy: Nikken Sekkei).

For collaboration with outside consultants and contractors, 2D documentation is still the norm as it is required by contract, and the use of ArchiCAD makes it easy to derive 2D drawings from the model (see Figure 6). Nikken Sekkei also provides 2D DWG for those who require drawings electronically. For those using 3D models, it can provide, if required, 3D DWG, IFC, PLN (ArchiCAD native file format) and any other 3D format, but these are for reference purposes only. BIM is not yet the norm in Japan. While the Japanese government requires BIM to be implemented on its own projects, there is no country-wide mandate for BIM or the prevalence of BIM standards. This makes it difficult to find partner firms conversant with creating and using BIM models.

For design coordination, Nikken Sekkei prefers to continue using ArchiCAD instead of a more common application like Navisworks, as it enables the architect to react more quickly to conflicts that are identified and make the necessary changes within ArchiCAD itself, since it is also the main authoring application. Other disciplinary models can be brought into ArchiCAD as reference models, making it very convenient to use as a design coordination tool.

Construction and Beyond

Nikken Sekkei continues its use of BIM whenever possible. It is often deeply involved in construction management, depending on the contract, and for this, it uses BIM for detailed design on site. On some projects, BIM data is even directly fed into CNC machines to automate the production of building components; for example, lumber was cut automatically using

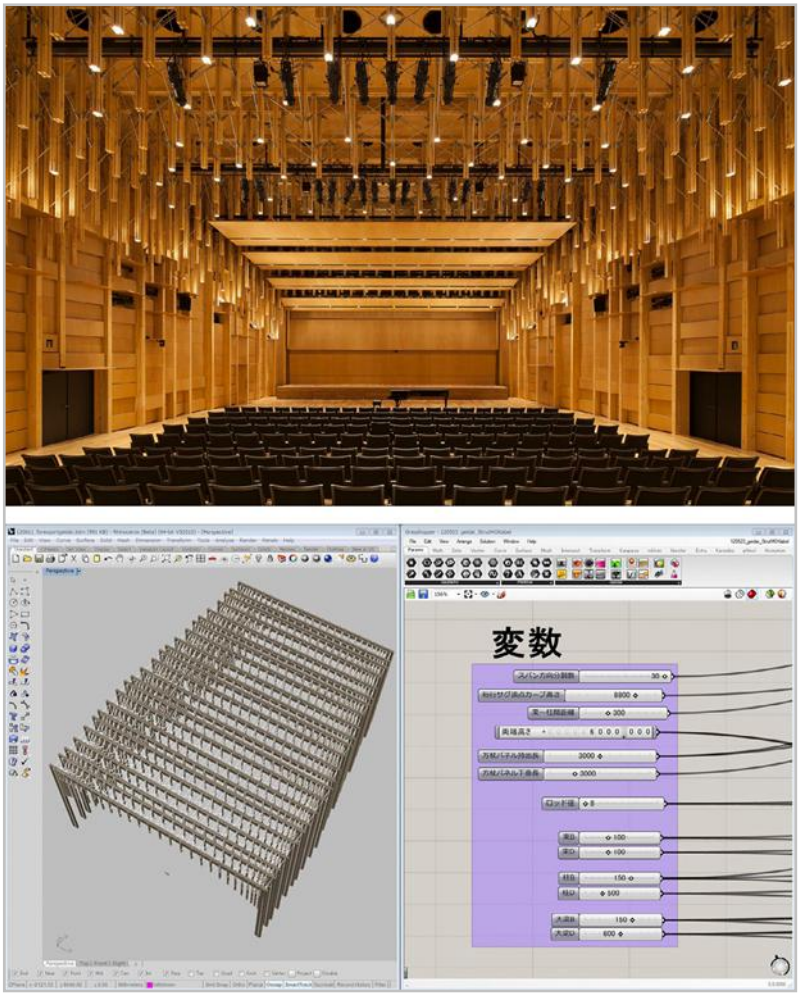

Figure 4. Use of Rhino and Grasshopper for parametric design studies of a music hall project with very specific acoustic criteria that had to be satisfied. (Courtesy: Nikken Sekkei).

3D data for one project. When it is involved in the construction, it updates the BIM model to make it an as-built model, which could potentially be used for facilities management when the building is completed and occupied.

While Nikken Sekkei is not yet involved in operations and maintenance, it would like to continue the usage of BIM in FM tasks in the future, so it is actively researching and investigating the possibilities.

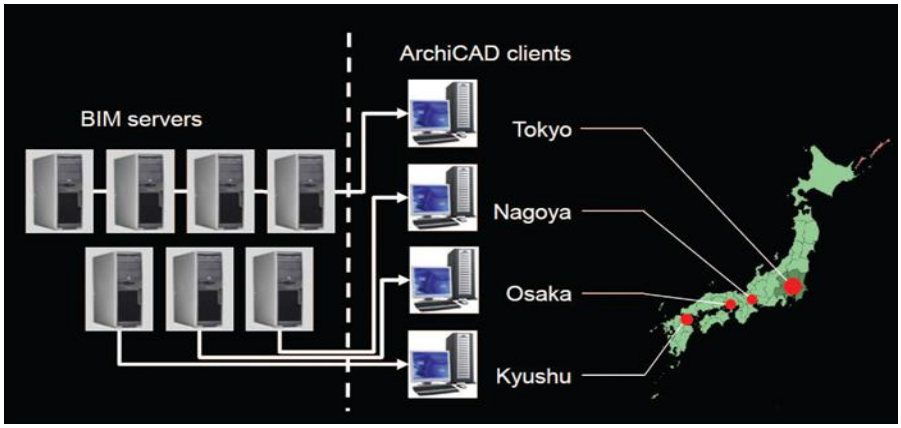

Figure 5. Using ArchiCAD's Teamwork and BIM server for synchronous design collaboration. (Courtesy: Nikken Sekkei).

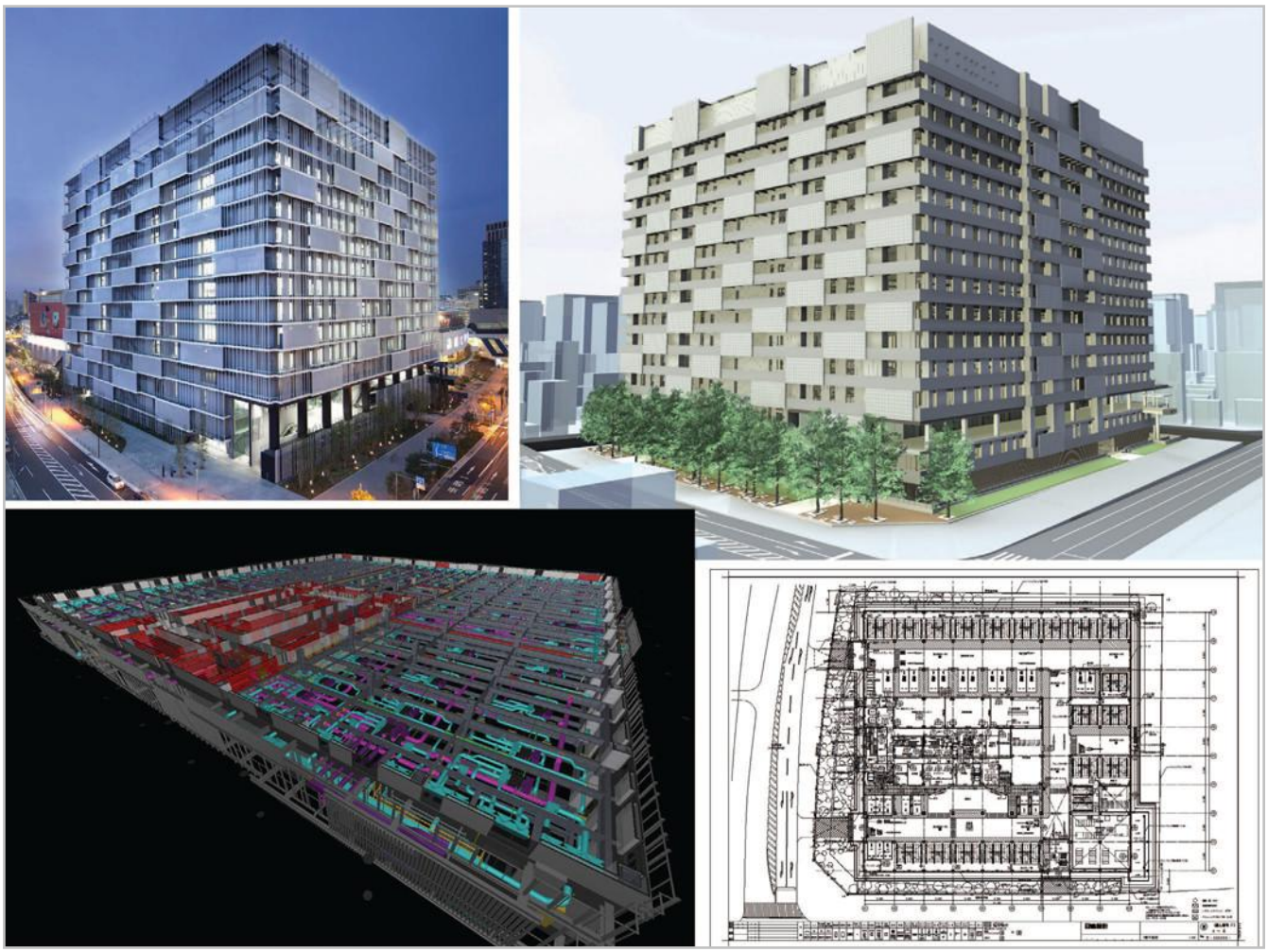

Figure 6. A recent office building project, its BIM model, the multi-disciplinary model of one floor, and one of the documentation sheets showing a floor plan derived from the model. (Courtesy: Nikken Sekkei)

About the Author

Lachmi Khemlani is founder and editor of AECbytes. She has a Ph.D. in Architecture from UC Berkeley, specializing in intelligent building modeling, and consults and writes on AEC technology. She can be reached at lachmi@aecbytes.com.

People Profile

Christopher Pynn, Associate Principal within Arup's Melbourne Buildings Group, shares his perspective on AEC technology in this People Profile.

Christopher Pynn

Associate Principal,
Melbourne Buildings Group
Arup

"The inadequacy of software vendors to accept that interoperability of data is the key to the success of BIM rather than just the model is, in my view, holding the industry back …"

What is your educational and professional background?

My training and career have focused on the structural engineering industry. I've been with Arup for 24 years—delivering large infrastructure projects and MEP coordination design roles—giving me an all-round experience of construction and building engineering. I've spent ten years based in the UK and in Singapore, and I'm currently on my fourth year in Australia, so my experience is broad and I've had the pleasure of working in many countries.

I started out as a trainee technician with Arup in Manchester and studied civil engineering for 5 years before graduating as a structural technician.

What is your current role? What are the main projects you are involved with?

I currently have three roles. I am an Associate Principal within Arup's Melbourne Buildings Group where I am responsible for overseeing the implementation of BIM, both internally and externally, across the Australasia region. In addition, I also hold two global roles, the first being the co-leader of the firm's global BIM implementation task force and the second a role in leading our digital environments skills network globally.

Aside from the global BIM implementation leadership, my current project role focuses on developing and managing the overall BIM strategy and management on the New Perth Stadium. This is a sub-consultancy role that I am undertaking on behalf of Brookfield Multiplex.

When and how did you get interested in AEC technology?

I have been using AEC technology since my early days as a technician but my interest really developed around the late 90s, when I saw the introduction of 3D modeling into AutoCAD and the birth of Rhino. This was around the time I moved to Singapore, where I spent four years working on the North East MRT (Mass Rapid Transit) project coordinating services in 2D. I vowed at the end of the project never to do that again in 2D, and so I began my journey into BIM.

How much of what you do today is related to AEC technology in some form?

I see the application of technology as key to Arup's future in engineering and so technology impacts all aspects of my work. Whether project delivery or leading the firm's BIM champions, technology is at the heart of what I do.

From your vantage point, what do you see as some of the main technological challenges facing the AEC industry today?

The biggest technological challenge facing the industry today is around understanding the importance of standardizing data structures. The inability of software vendors to accept that interoperability of data is the key to the success of BIM rather than just the model is, in my view, holding the industry back. Accessibility and consistency of that access, along with making data relevant to the users, are areas where I believe software developers are missing an opportunity.

Our industry constantly has to grapple with an ever increasing number of software creations, each creating potentially more confusion rather than clarity. We are continuing to see companies acquiring multiple products, all of which tends to confuse the problem further. Other than these, we have all the normal challenges such as model size, latency, bandwidth, machine hardware requirements increasing, and there are legal and cost issues related to the use of the cloud. I could go on.

I feel the software industry should focus on helping move the construction industry forward first rather than focusing on strategies purely aimed at selling software, which appears to be the case. The software companies' approach is counter-productive.

How do you see AEC technology evolving in the future?

We will continue to see the development of cloud services and computing with a move to web-based modeling technology that are not platform specific, so increasing accessibility to the models and associated data will be vital. The merger of BIM and GIS, provoked by the acceptance of their overlap and complementary status, will take place. With Big data and analytics developments, there will be increased focus on connectivity and measuring of how we use our data, enabling engineers to learn more from what we do.

If you had a wish list for AEC technology, what would it be?

- Focus on the data, interaction, exchange and visibility of it.
- Increase Point cloud data usability.
- Establish IFC as the industry standard for BIM data structure,
- Eradicate 2D drawing markup tools and PDF tools.
- Create more integrated workflows across design, fabrication, construction and handover.
- Improve design systems to lessen the reliance on computer performance and memory provision.

AEC Technology Updates, Fall 2014

This article captures the semi-annual update of the main developments from AEC technology vendors in the last six to seven months, following the AEC Tech Updates article that was published in the Spring. It provides an overview of several new product releases including the 2015 version of Vectorworks Architect, the Eleventh Edition of Newforma Project Center, version 8 of form•Z, and version R5 of Vico Office, now a Trimble product. It also looks at the dramatic news of Trimble acquiring Gehry Technologies; the entry of Dassault Systèmes into the AEC industry with its "Façade Design for Fabrication" tool; VisualARQ, a Rhino plug-in that gives it BIM capabilities, enabling this very popular application for conceptualizing buildings with complex, organic forms to fit more smoothly in an AC workflow; progeCAD Architecture, an IntelliCAD-based application that allows a BIM model to be created in a familiar AutoCAD-like environment; the release of the free version of BIMReview, which allows models to be opened, reviewed, and visualized for design coordination; and finally, the introduction of real-time daylighting visualization and analysis in Sefaira's Revit plug-in tool.

Vectorworks Architect 2015

Vectorworks has just announced the next version of its product family, which includes Vectorworks Designer, Architect, Landmark, Spotlight, Fundamentals and Renderworks. The English-language version will start shipping later this month, and the worldwide roll-out, including localized versions in nine additional languages,

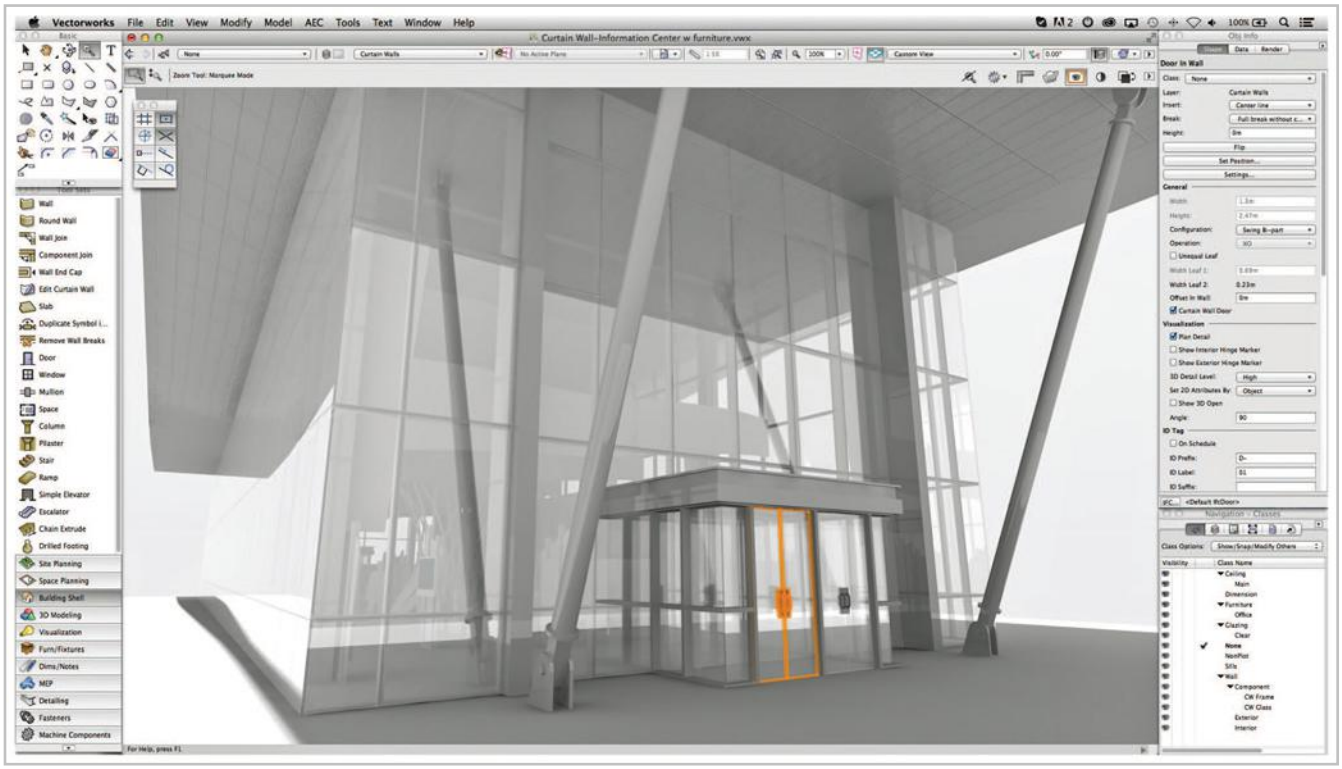

Figure 1. Inserting a door in a curtain wall using the new Curtain Wall tools in Vectorworks Architect 2015.

will continue through to mid-2015. A crucial update for the entire Vectorworks 2015 product line is support for 64-bit throughout the applications—as opposed to only for rendering as in the previous version—enabling designers to handle larger projects and improve overall performance and stability. Several improvements have also been made to the graphical features including faster wireframe rendering and planar graphics, smooth animations to improve the 3D context for view transitions, more efficient import of meshed objects and smoother display, and the ability to easily control the display of colors, shadows, and textures.

For Vectorworks Architect, which has continued to add BIM capabilities to the point where it can be regarded as a full-fledged architectural BIM application, the 2015 release includes many additional improvements: dedicated curtain wall tools that allow direct modeling and editing of panels and glazing, making it easier to create a curtain wall with a custom configuration or align it to existing geometry (Figure 1); enhanced stair tools for creating more complex layouts; several improvements to space objects, including the ability to define the boundaries in different ways for area calculations for different jurisdictional standards (Figure 2); the ability to constrain building elements such as walls, slabs, and columns to a level without creating additional design layers, enabling elements such as mezzanines and split-level designs to be modeled more fluidly; a new COBie option for IFC export to better support facilities management workflows; support for the STEP format and DXF/DWG/DWF improvements; and support for tasks such as cropping and enabling/disabling snapping for PDF files.

I was especially impressed by the improvements to the Wall tool in Vectorworks Architect 2015, which now allows rectangular walls to be created quickly with two clicks, automatically takes care of overlapping walls and wall joins, allows wall segments to be easily removed, and allows wall segments to be closed to enclose a space by simply pressing the "K" key. It makes for one of the smoothest and fastest wall creation processes I have seen in any BIM application.

Newforma Project Center 11th Edition

Another key new AEC product release is the Eleventh Edition of Newforma Project Center, Newforma's flagship project information management (referred to as PIM) and

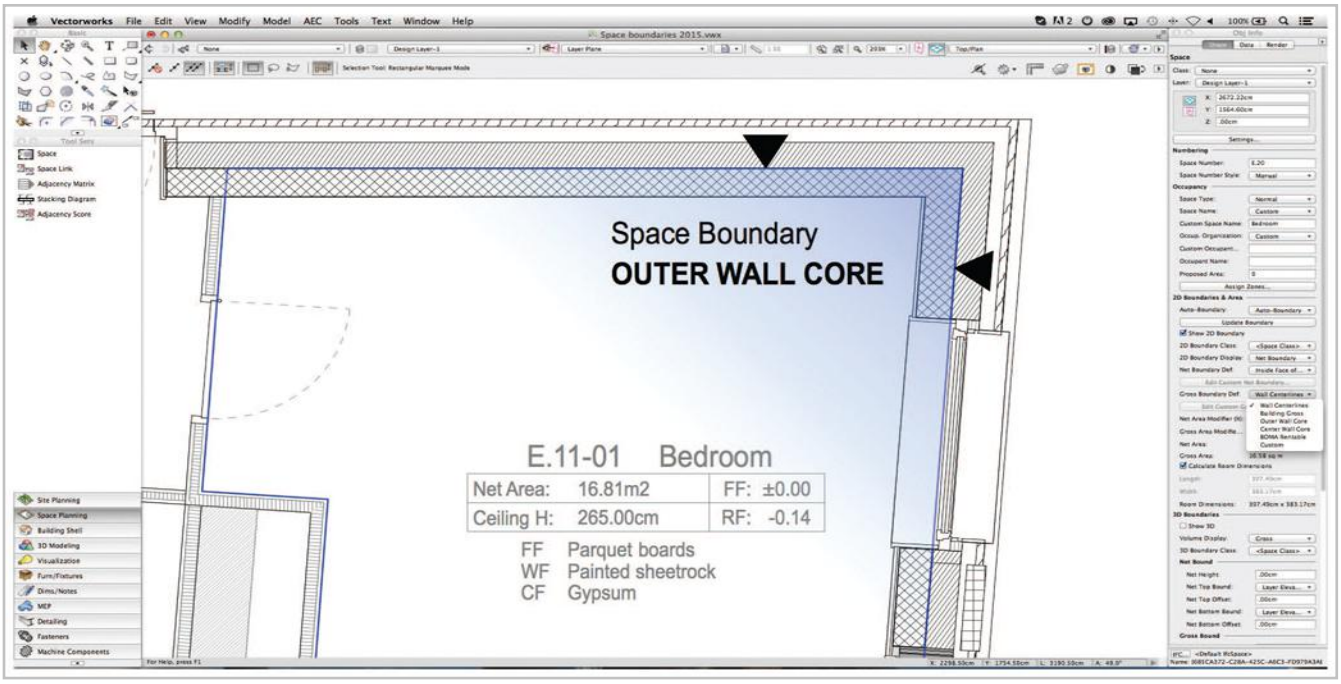

Figure 2. Specifying where the wall boundary should be for calculating the area of a space in Vectorworks Architect 2015.

collaboration application. It includes several enhancements including improved support for cloud storage, new integration with Bentley's ProjectWise solution, improved Revit integration, Viewer improvements, and many more. For cloud storage support, there two levels of integration: one is access and delivery of project files that are stored on services such as Box, Drop Box, and Google Drive; and the second is deeper integration, including the ability to index and manage files, with providers of more secure and managed cloud storage services including Nasuni and Panzura that are being widely adopted among AEC firms. This essentially means that Newforma Project Center can now also work with project files that are stored on the cloud in addition to those on a company's servers.

The integration with Bentley's ProjectWise is also a critical development in Newforma's mission to be able to work all project data, no matter where it is located. As evidenced by the recent AECbytes research report on ProjectWise, it remains the top solution for organizing, managing, and sharing AEC project data, and Newforma's ability to work with the project information contained within ProjectWise will make it much more accessible to users. Acting like a layer, Newforma Project Center provides a unified interface for viewing all the project data, as if through a "single pane of glass." In addition to viewing, users can also index, search, and manage project data, wherever it resides, all from a single point of access.

Newforma Project Center continues to build upon the Revit integration it first introduced in the Eighth Edition of the application and which it has continued to expand in every subsequent release. The Eleventh Edition adds a new PDF driver that provides additional PDF capabilities to that which come with Revit, including the ability to publish both single and multi-sheet PDFs, and set the publish order from Revit parameters (Figure 3). There is also the ability to easily publish sheets from Revit to Newforma's Document Control, with the sheet meta-data being automatically synchronized and populated. And, of course, support has been extended to the latest 2015 release of Revit.

Additional enhancements include new Package support for organizing electronic sheet sets, making it easier to define who the package should be issued to, track when the package is received, and organize record documents by discipline or other criteria (Figure 4). Shared folders have been introduced in the external collaboration module, Info Exchange, to make it easier to share documents with project team members. Also, files can now be transferred to Newforma Info Exchange directly through email, without even requiring Newforma Project Center to be launched. The Newforma Viewer has new markup tools for dimensioning, creating leader lines, and onscreen text editing. Improvements have also been made to the Newforma Model Viewer (which was reviewed in

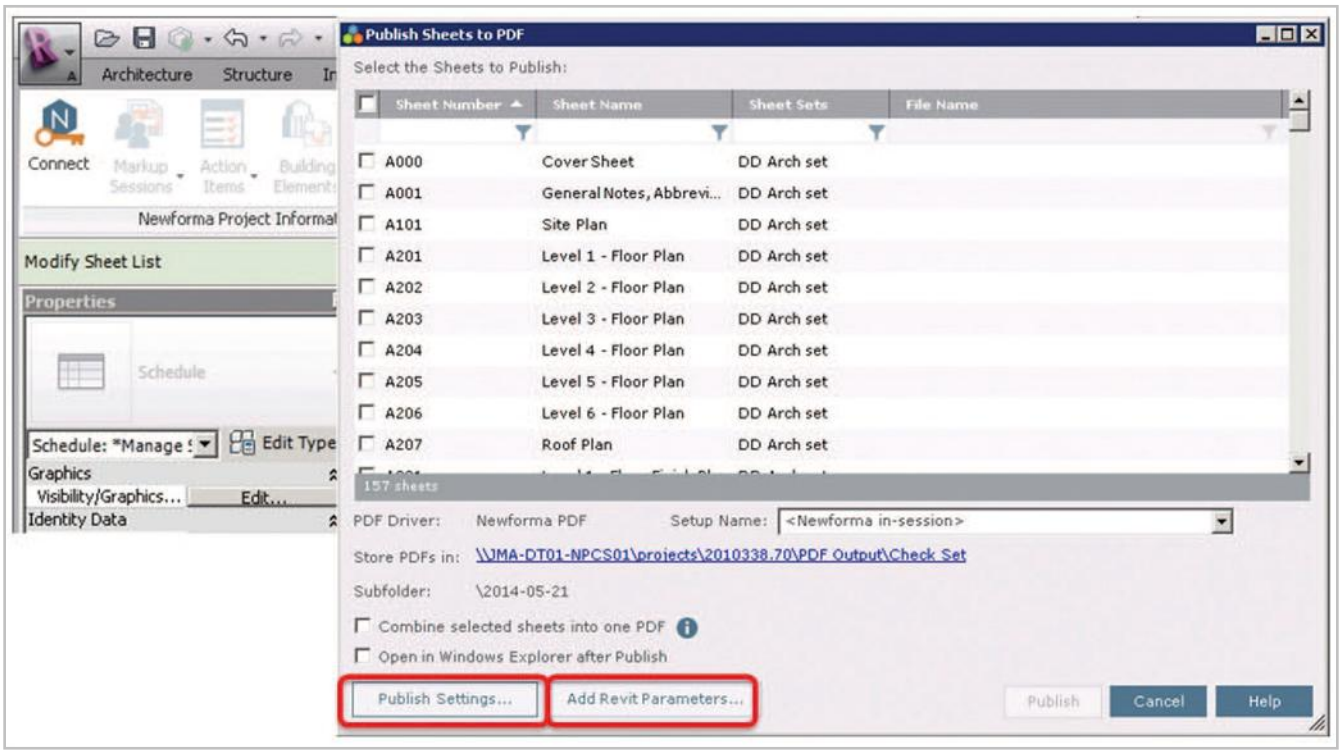

Figure 3. The new PDF driver for Revit added by the new release of Newforma Project Center enhances Revit's PDF sheet publishing capability.

AECbytes last year), with a new Measure tool, the ability to add users more easily to projects, improved tag support from Revit, and overall usability. The management of action items, a key component of Newforma Project Center, has been improved; projects can be created more quickly and easily; there is improved multi-office support

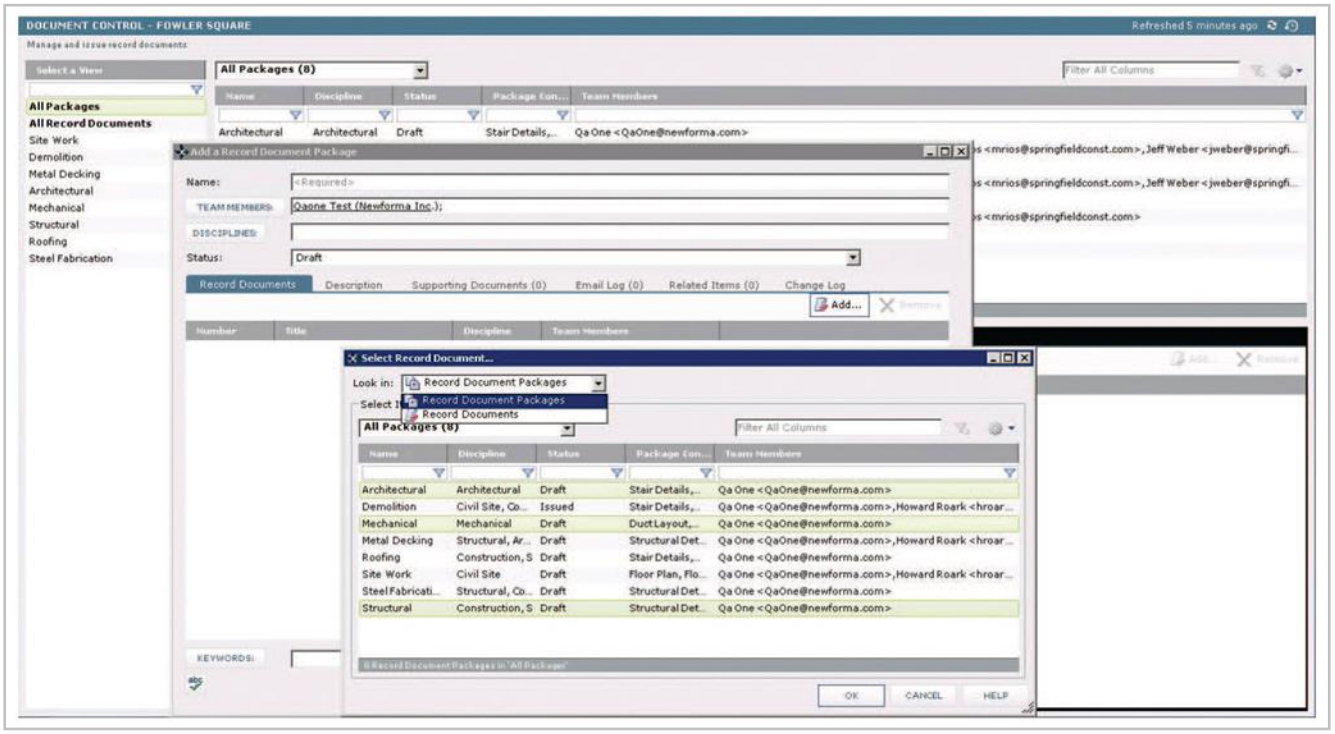

Figure 4. The new Package support in Newforma Project Center Eleventh Edition.

with better scalability and the ability to maintain remote servers efficiently; and several security enhancements have been made, including improved password security and administrative control.

Trimble: A New Acquisition and Vico Office R5

As I pointed out in my review of SketchUp Pro 2014 earlier this month, its owner, Trimble, is slowly but surely expanding its portfolio of AEC technology applications. In addition to SketchUp, it had also previously acquired Tekla and Vico. Just last week came the dramatic news that Trimble was acquiring Gehry Technologies, best known as the technology firm that emerged from Frank Gehry's design firm, with which it continues to be closely associated. (See the AECbytes Archived article, Technology at Work at Gehry Partners.) I assumed that the acquisition meant that Digital Project, the CATIA-based high-end BIM application developed by Gehry Technologies (which was one of the seven BIM applications comprehensively reviewed in the BIM Evaluation Study Report) would now be part of Trimble's portfolio. But it turns out that Digital Project was not part of the acquisition and has been spun off as a separate company. Trimble's acquisition, however, does cover

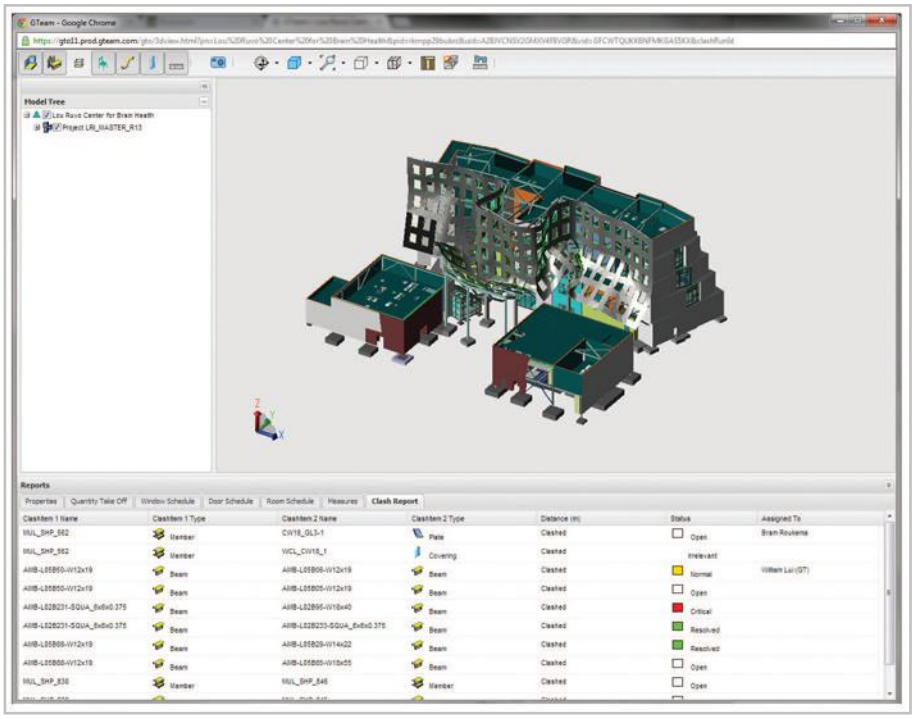

Figure 5. Gehry Technologies' GTeam collaboration software is now part of Trimble.

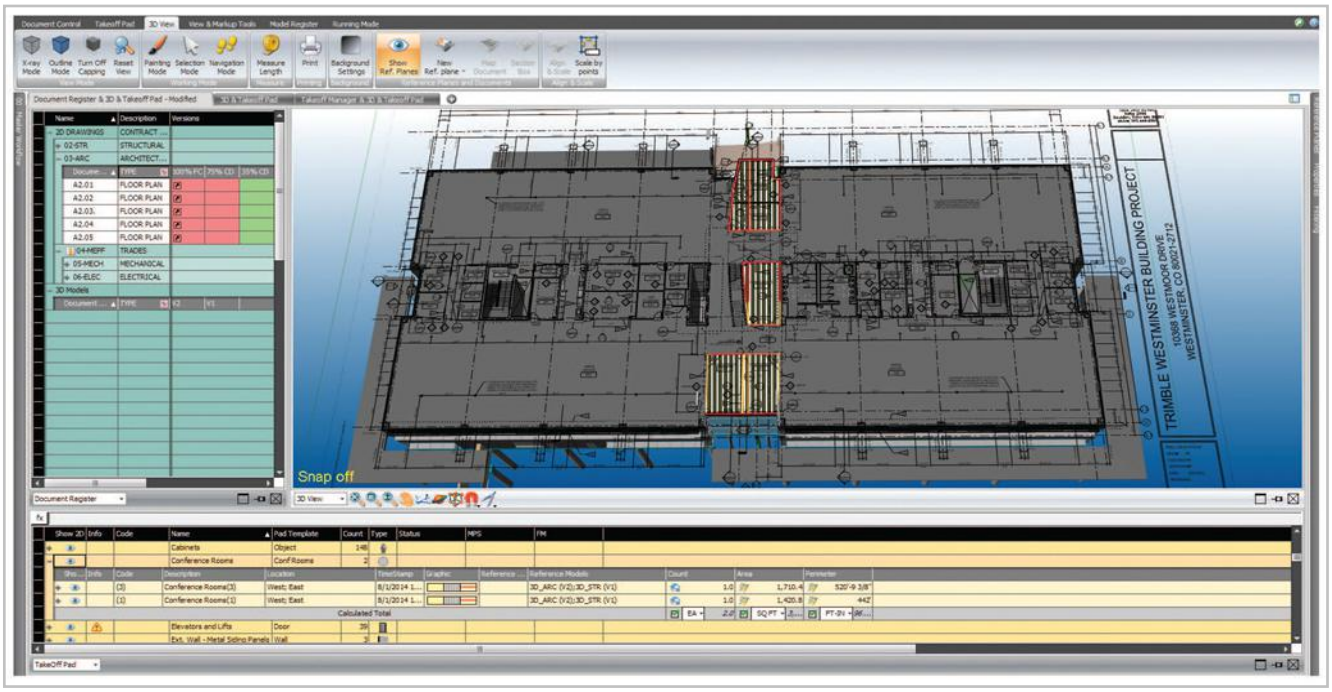

Figure 6. The interface of Vico Office which enables scheduling, estimating, and constructability analysis of BIM models.

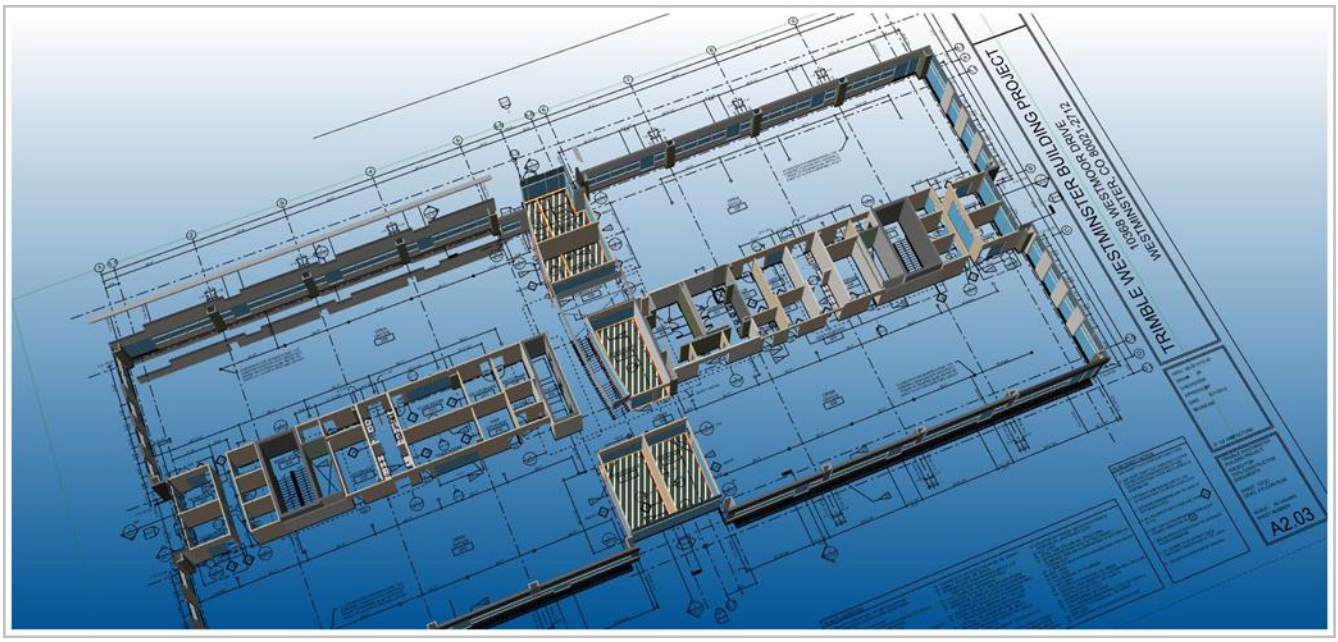

Figure 7. The 2D/3D hybrid takeoff capability in Vico Office R5.

GTeam (Figure 5), the collaboration software developed by Gehry Technologies (see this AECbytes article for an overview), and its consulting services.

An additional AEC technology related development for Trimble was the release of the new version of Vico Office last month. Vico started off in 2004 being a Graphisoft application focused on extending BIM to construction, and was then spun off to a separate company before being acquired by Trimble in 2012. Vico Office continues to be a "BIM for Construction" application with the ability to transform 3D BIM design models into intelligent construction-specific data models that can be used for scheduling, estimating, and constructability analysis. Originally developed to work with ArchiCAD (when it was part of Graphisoft), Vico Office has evolved into a BIM-neutral platform to which multiple types of Building Information Models can be published, synthesized, and augmented with cost and schedule information (Figure 6). Given that there aren't that many dedicated applications for BIM in construction, it is not surprising that Vico Office is being implemented by several leading general contractor and construction management firms around the world including AECOM, Klorman, Turner, Hensel Phelps and others.

The new version of Vico Office, R5, features several enhancements. A new on-screen takeoff feature, Takeoff Pad, has been introduced, which allows users to extract quantities in any required way. The 2D Quantity Takeoff tool allows the creation of linear, area and count based quantities from 2D PDF drawings, and takeoff can also be performed in a 2D/3D hybrid environment (Figure 7). Another new feature is Running modes, which have been introduced as a way to better interact with the model and as a visual presentation supplement. It offers multiple viewing modes for model-based estimating, facilitating improved communication of cost/budget status to the owner. Since cost additions vary from company to company, Vico Office R5 includes cost add-on and markup capabilities to add flexibility for GC/CMs who require multiple markups and additions to the base estimate in order to get to a gross total for submission. New web services have been introduced that allow the Vico Project Server to connect to other applications and integrate with third party applications (e.g., ERP, Procurement). IFC support has been expanded allowing for six ways to group models using IFC properties. There are usability improvements in the Location Breakdown Structure (LBS) feature, allowing users to carve out spaces (e.g.,1st floor, 2nd floor), split floors, colorize zones and utilize ID prefixes for automating and visualizing location-based quantity generation. All of these improvements are designed to better enable the software to improve predictability, reduce risk, manage cost, and optimize schedules on large, complex building projects.

Other Key Technology Updates

Another established company that is making forays into the AEC industry is Dassault Systèmes, which has, until now, been primarily focused on the high-end MCAD

industry (automotive and aerospace) with leading solutions like CATIA and Solidworks. The company recently launched a new AEC software called "Façade Design for Fabrication," which allows buildings to be quickly conceptualized with façade design details including the shape, pattern, and structure (Figure 8). The design model can also be quickly extended to shop drawings and BOMs (Bill Of Materials). The new solution is built on Dassault Systèmes' cloud-based 3DEXPERIENCE platform, which is intended to allow AEC companies to collaborate across concept, design, engineering, fabrication and construction teams. The company's well-demonstrated strength, expertise, and success in the MCAD industry bodes well for its development of solutions for the AEC industry.

The aforementioned updates related to both CATIA and Frank Gehry bring to mind Rhino, a NURBS-based 3D modeling application that is very popular for conceptual design in architectural firms, especially for buildings with complex, organic forms (Gehry Partners uses both CATIA and Rhino). It is very often referenced in presentations at the annual SmartGeometry conferences, which typically highlight innovative architectural

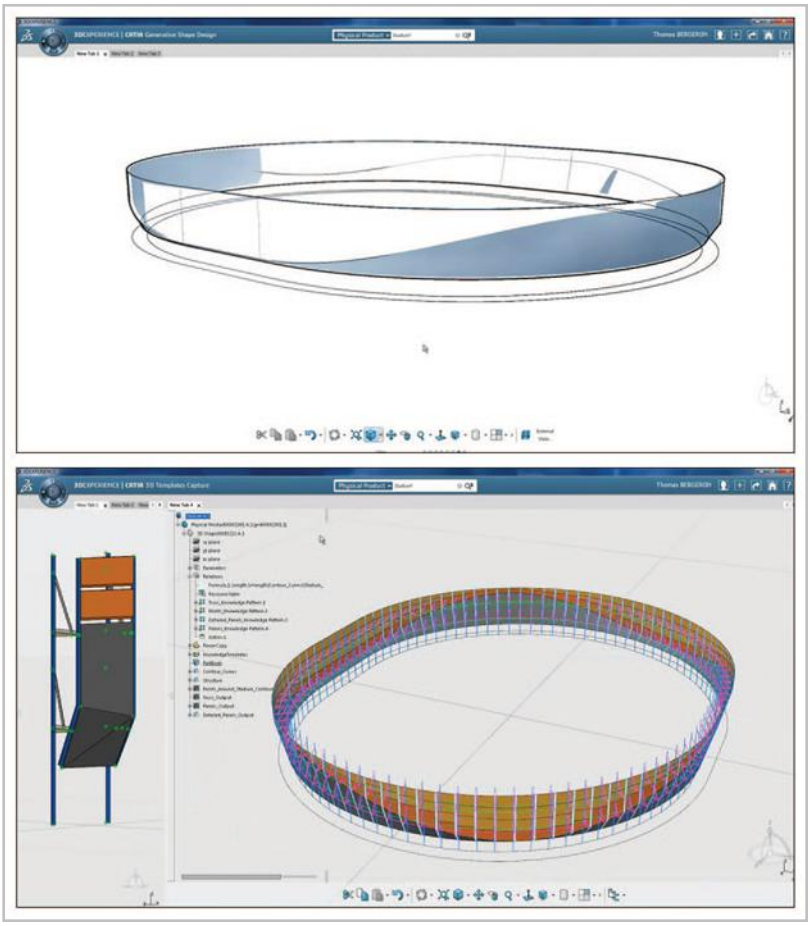

Figure 8. An initial stadium sketch and the detailed façade design of it using Dassault Systèmes' Façade Design for Fabrication solution.

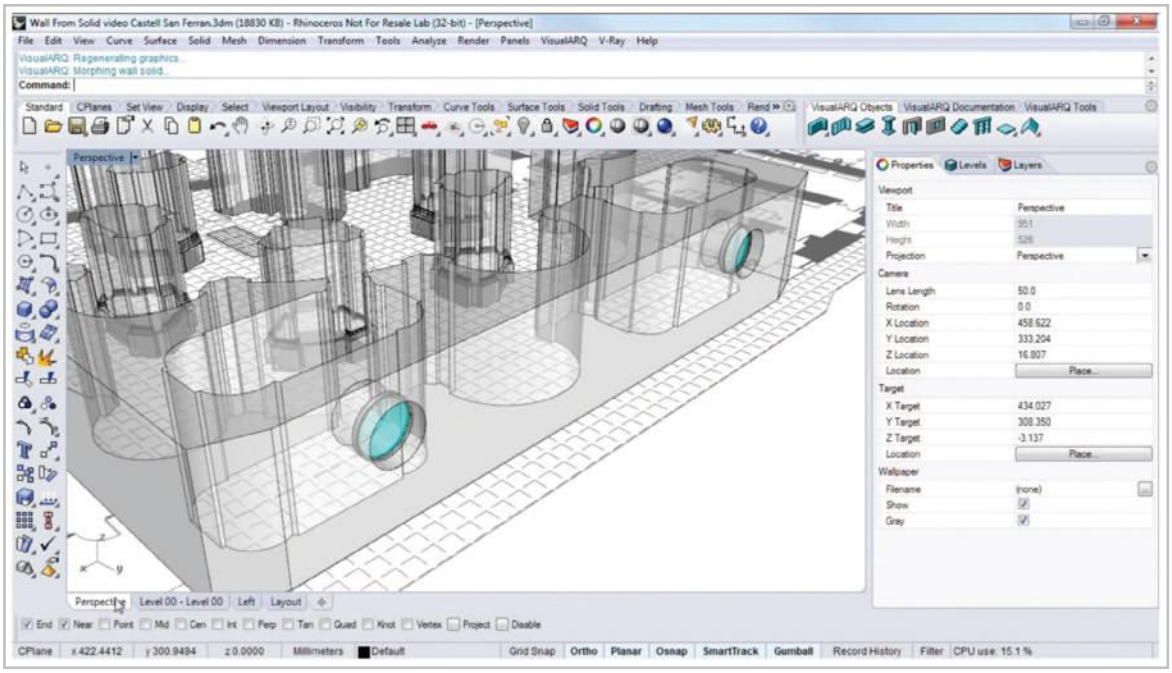

Figure 9. Using the VisualARQ plug-in to Rhino to quickly add windows to Rhino objects designated as walls.

and structural design tools, technologies, and methods. While Rhino is a general-purpose modeling tool, there are plug-ins to Rhino to make it more AEC-specific and BIM-like. I wrote about one such plug-in that was exhibited at the AIA 2010 Expo; I recently became aware of another one called VisualARQ. It is fully integrated into Rhino and allows it to be used just like any architectural BIM application, with the ability to create a model using building components such as walls, floors, slabs, roofs, doors, windows, stairs, beams, columns, levels, and so. All the powerful Rhino tools can be brought in for editing these components, applying textures, and rendering the model. Any complex and freeform objects created with Rhino tools can be designated as building components and behave accordingly, as shown in Figure 9, where windows are inserted in Rhino objects designated as walls. As you can see, it would be very difficult, if not impossible, to achieve this with another BIM application, but it is extremely easy with VisualARQ. It also includes the ability to create 2D documentation from the 3D model, and to export the model in IFC format so it can used in other AEC applications.

Another 3D modeling application, but one which is well-established in the AEC industry, is form•Z, and a new version of that has just been released. form•Z 8 introduces subdivision modeling that enable it to create unique organic forms, an example of which is shown in Figure 10. Such a model starts from a simple base cage that can be dynamically manipulated and reformed with the new subdivision suite of tools with operations like grow, stretch, bridge, squeeze and offset. These tools are also useful for quickly smoothing or softening a facetted model. Subdivision models are parametric, allowing for continued manipulation as well as dynamic control of the surface resolution. Also, they can be converted to NURBS for additional manipulation and evaluation using form•Z's extensive set of NURBS tools. Other key new features in form•Z 8 include new interactive rendering with real-time ambient occlusion, bump mapping, soft shadows, and multi sampling.

In previous articles, I have written about the IntelliCAD-based 4M suite of BIM applications that include IDEA for architectural design and FINE-MEP for building services. Another similar product is progeCAD Architecture, which is also built on the IntelliCAD engine and allows a BIM model to be created in a familiar AutoCAD-like environment. It includes all the standard capabilities a user would expect from an architectural BIM application such as

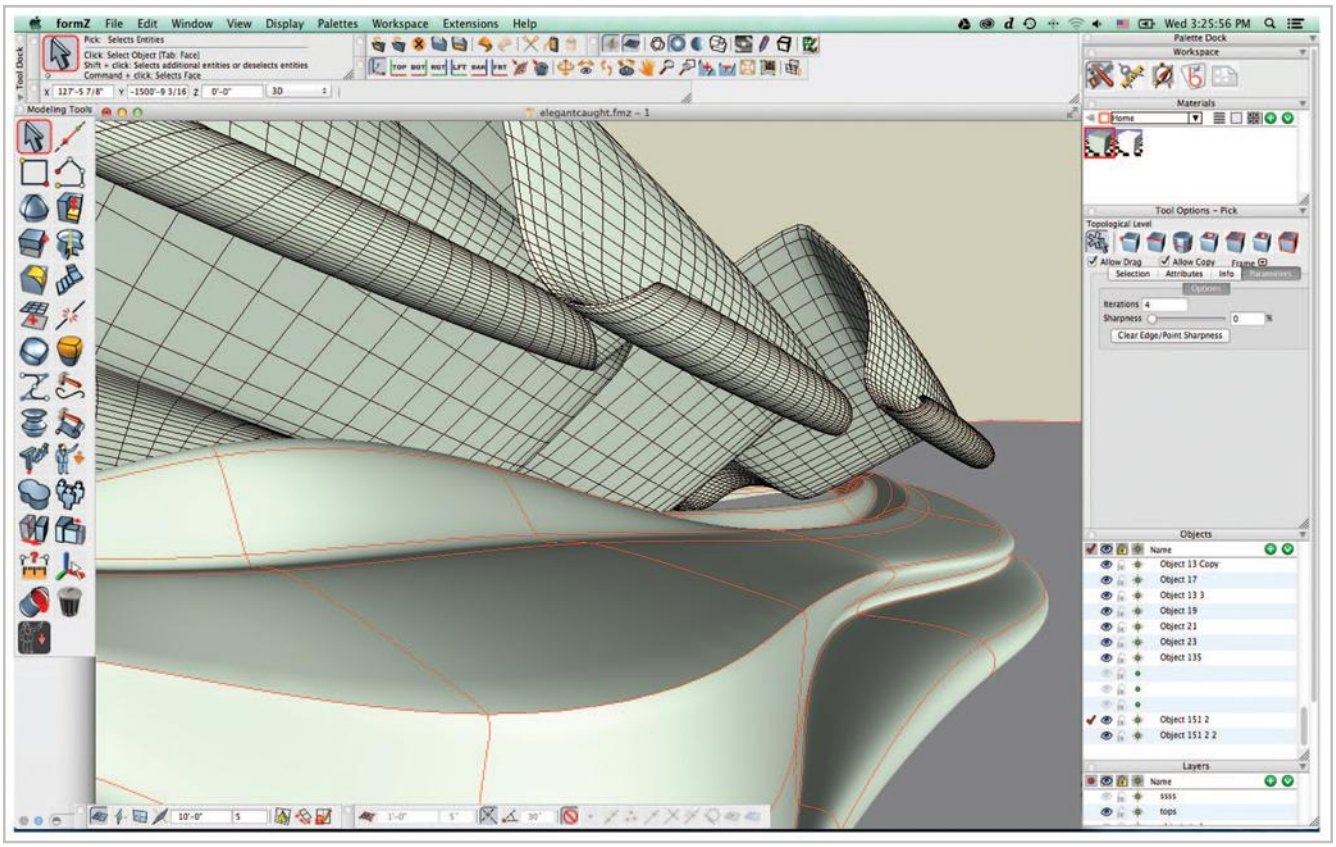

Figure 10. The new subdivision modeling capabilities of form•Z 8 allow free-form shapes to be more readily created.

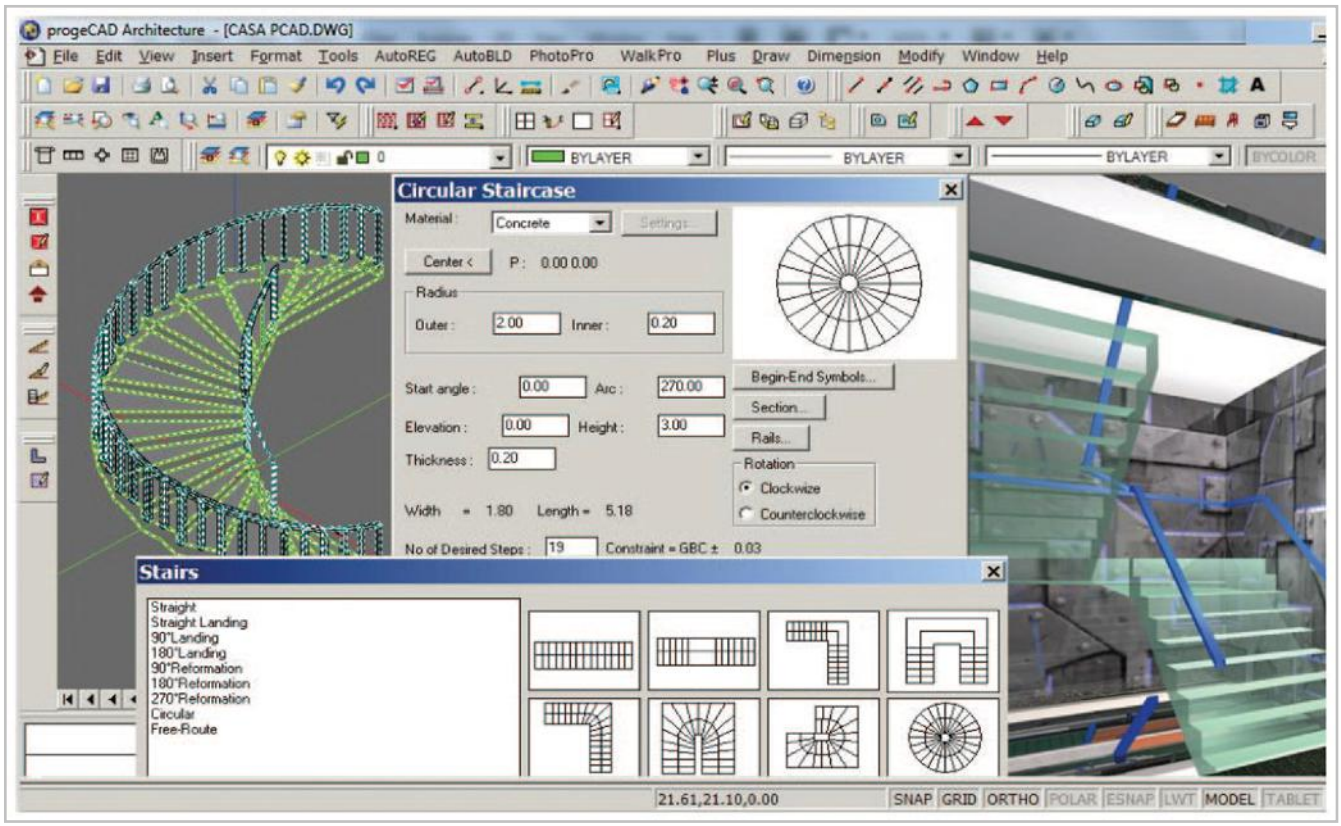

Figure 11. Creating an architectural model in the AutoCAD-like environment of progeCAD.

creating parametric architectural objects that interact intelligently with other components (Figure 11), working directly in 3D, viewing the impact of all modifications immediately, and being able to derive 2D documentation directly from the model. Because it is built on IntelliCAD, progeCAD Architecture also provides the tools typical of the advanced DWG environment, including ACIS 3D solid modeling, high quality photorealistic rendering, animation creation, material maps, CTB and STB print files support, and free 2D and 3D block libraries. The 2014 version of the application that was released a few months ago adds IFC support, which allows it to work with other AEC applications and gives it further legitimacy as a BIM application

And finally, there are some new updates on solutions I have written about recently. In my last AEC Tech Updates article, I provided an overview of the AEC-specific project review and BIM collaboration solution, BIMReview, which allows users to open, view and manipulate BIM models from various authoring tools, check for clashes, and share review and coordination information with others in the construction field (Figure 12). The low cost and ease of use of the application have made it a compelling alternative to more expensive and complex design collaboration tools, along with features such as IFC import/export and the ability to enrich BIM model data. A free version of the application, BIMReview Lite, is now being released, which allows models to be opened, reviewed, and visualized. It can thus be used as a visual communication tool by anyone on the project team without any outlay of project funds.

There is also a key update from Sefaira, an early stage performance analysis application, which introduced real-time daylighting visualization and analysis in its Sefaira for Revit plug-in last month (Figure 13). Next week, Sefaira will include real-time energy analysis capabilities as well in its Revit plug-in tool, allowing architects to better assess trade-offs between energy and daylight at the early design stage if they are using Revit, equipping them to make more informed performance-related design decisions. Recall that Sefaira also has a SketchUp plug-in that provides real-time performance analysis inside of the SketchUp design environment. Also, Sefaira is almost entirely cloud-based and can therefore provide analysis results in a matter of minutes, making it easier for the designer to go through multiple iterations until a satisfactory result is achieved.

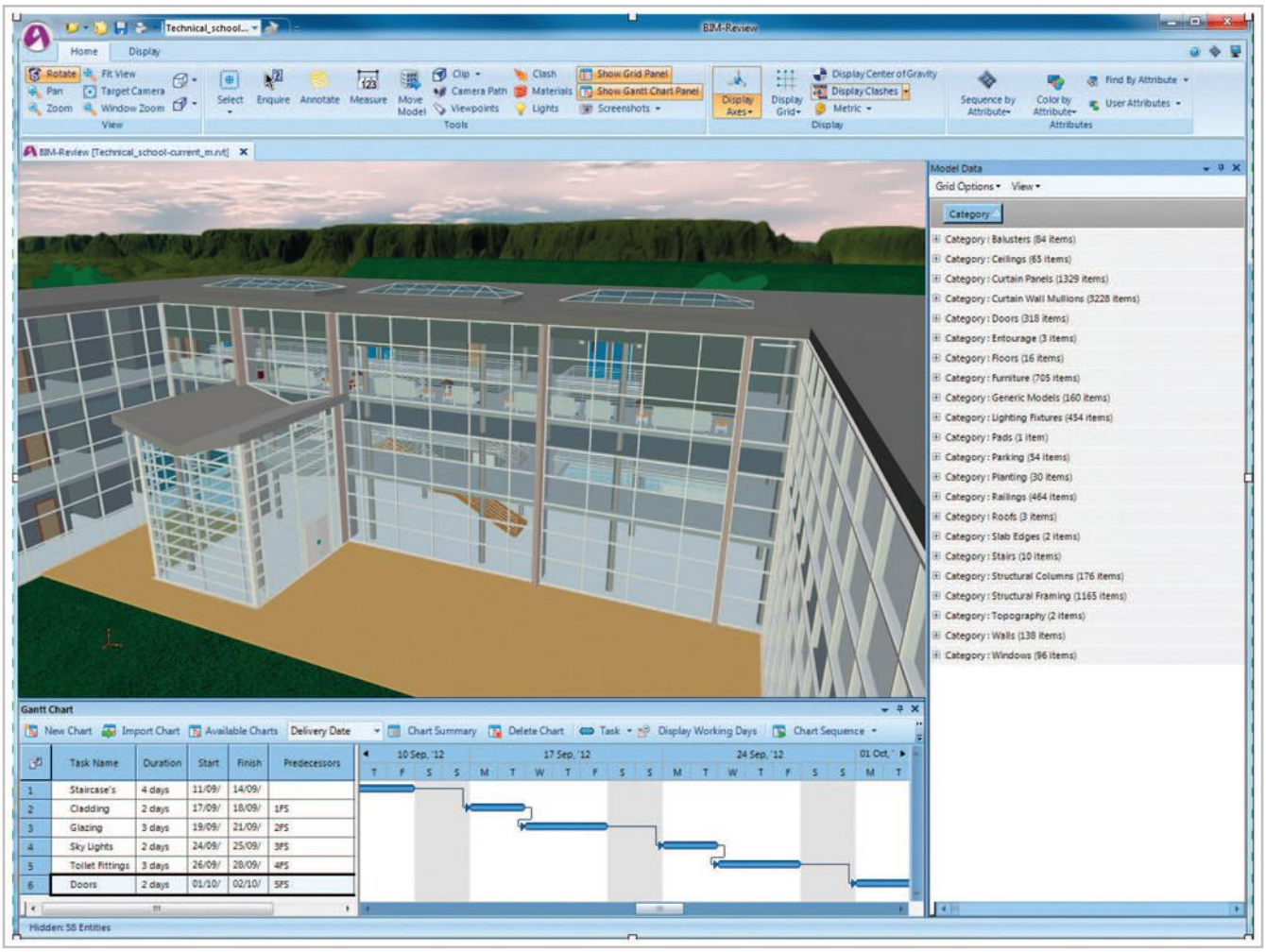

Figure 12. Using BIMreview for model aggregation, design review, and construction scheduling.

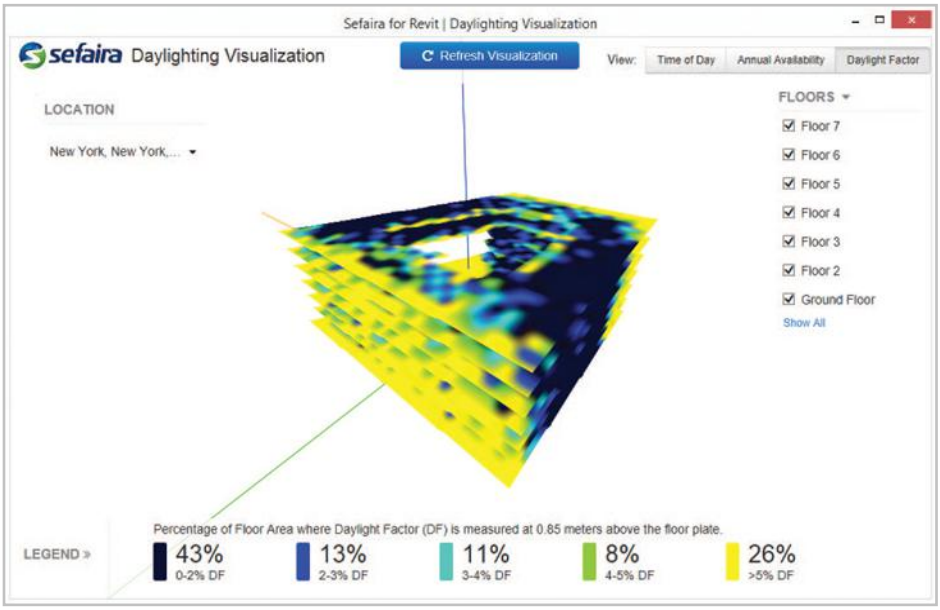

Figure 13. Real-time daylighting visualization within Revit using the Sefaira for Revit plug-in.

This concludes the Fall 2014 update for AEC Technology solutions. It is a testament to the growth and dynamism of the AEC technology industry that there is always so much to cover in these updates. The next one is planned for Spring 2015. Stay tuned!

About the Author

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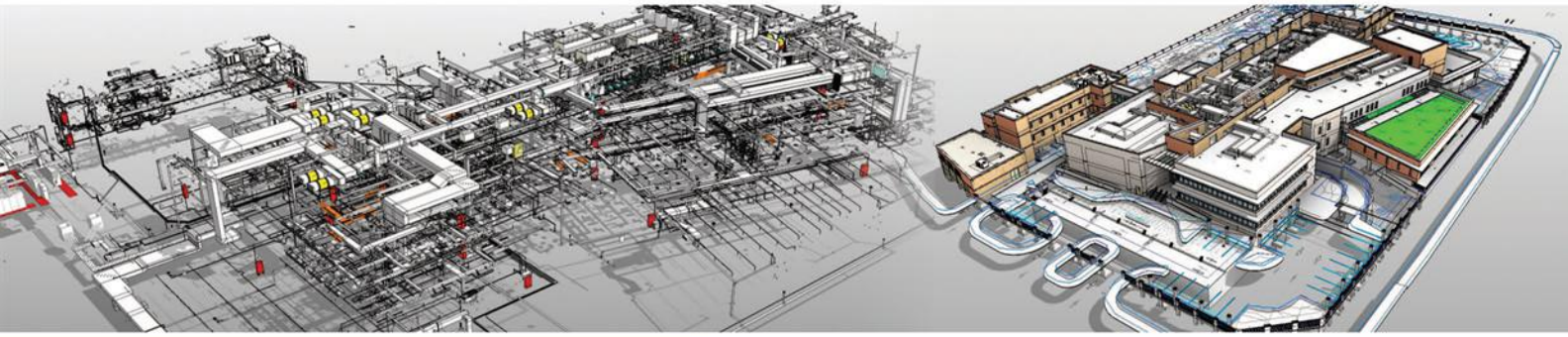
Firm Profile



KEO

KEO International Consultants, a global provider of Planning, Architectural Design, Civil Engineering, Sustainability and Project Management services, shares its perspective on AEC technology in this Firm Profile.

What is the history and background of the firm?

KEO is a multi-disciplinary professional consulting firm founded in 1964 with close to 2,700 staff and has offices in all the GCC (Gulf Cooperation Council) countries, and with experience in project delivery that includes Africa, Asia and Europe. KEO's extensive capabilities are structured to provide the following: full spectrum of project management services, master planning, infrastructure and building engineering, architectural design, quantity surveying services, landscape architecture, and sustainability consultancy. KEO is one of the largest privately held AECO/PMCM firms and is consistently ranked in ENR's list of the top 200 International Design Firms as well as the top 20 International Project Management firms.

What is the firm's current focus?

KEO's focus is on continued growth across all of the core services it offers, improving and enhancing consistent quality delivery of the services it provides and deeper investment into the capabilities of its professional staff. Specifically, KEO is focusing on rail which seems to be a priority in all GCC countries. From a technology point of view, KEO has fully embraced the BIM methodology which is now being utilized as the standard in the delivery of projects across the whole firm, integrating all the disciplines and the processes of project delivery. A key focus has been the integration of knowledge into the daily way of working that incorporates the project management role, design stages, and construction stage through to operations and maintenance, to create increasingly efficient collaborative workflows.

When did the firm start using AEC technology, and how is it being used today? How important is AEC technology to the firm?

KEO began investing in AEC technology as far back as the 70's with mainframes connected to terminals using structural engineering software. Then in 1982, KEO converted to the use of AutoCAD, with decentralized yet networked CAD stations, that were also integrated to Management Information Systems. The evolution of drawing on paper to drawing on computer in the history of AEC technology essentially left the working process unchanged.

Today KEO uses parametric modeling software not only to visualize in 3D, but to gain the ability to extract information such as quantities, specifications and phasing, all from the same model. With BIM, all information is now connected and integrated where a change made in one place is now reflected in all other documentation. For example, if a door is deleted from a wall in the model, this change is automatically updated in the specifications, quantities and costing information. The size and complexity of a project becomes irrelevant "from the point of view of the computer processing" and updating the information.

The development of "all information connected" leads to economies in scale, where in effect, even larger and more complex projects do not necessarily require more staff. Less staff will be able to produce a better product by being able to spend more time in activities such as design and engineering with better, automated coordination leading to fewer RFIs and change orders on site, ultimately resulting in reduced construction costs.

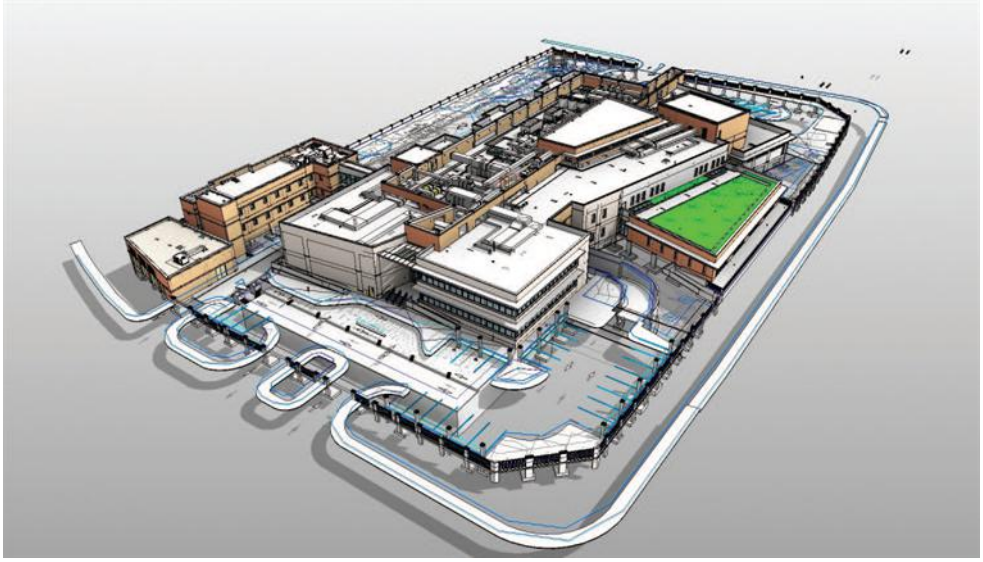
Up until fairly recently, technology has been a supporter of business essentials. KEO has always taken a business-driven approach to figure out new and innovative ways to leverage technology to support how it does business. For the first time, technology is driving business strategy, rather than the other way around. Take, for example, the development of parametric modeling software. Progress has led to where a technology has allowed the industry to become more efficient. The model is created once but used many times by different stakeholders, and we produce an integrated set of information with a combination of 3D visuals of components with relevant information and better coordinated product.

This development has resulted in technology changing the fundamentals of how KEO does business through

Conceptual design of an urban master plan.

greater collaboration during the early stages of a project, changing the process and workflows in how its disciplines interact with each other, and increasing its knowledge base for better decision making.

Therefore for KEO, it is vital to the firm's future that it is 100% BIM fluent and proficient. There is no going back to any other way of project delivery. Innovation is key in KEO, and BIM technology is one of the drivers of innovation into the future.



All designs at KEO are now done using BIM.

Does the firm have a specific approach and/or philosophy to AEC technology? If so, what is it?

KEO has always believed that to compete as one of the top professional consulting firms, technological capabilities together with the best possible professional staff was going to continue to set it apart. Its approach is to ensure that technology is used as effectively as possible by automating processes and workflows, increasing knowledge and intelligence, consequently assisting the staff to be more efficient and more productive.

Continual learning and 24/7 support forms the backbone of utilizing technology in KEO's daily operations. The key is to provide, through technology, support whenever required. Assistance comes in many forms, from the availability of online tutorials, relevant tips and tricks, pop up processes and workflows to staff with knowledge and experience in the vicinity.

One of the fundamental changes in how the firm makes progress on projects is how collaboration is accomplished and the level of information that is now available at a much earlier stage of a project. Initial collaboration has altered phasing and deliverables, impacting the fee structure of the project. Because a digital model of the project is being built, more detail is required at an earlier stage, resulting in a shift in KEO's fee distribution to the earlier design phases.

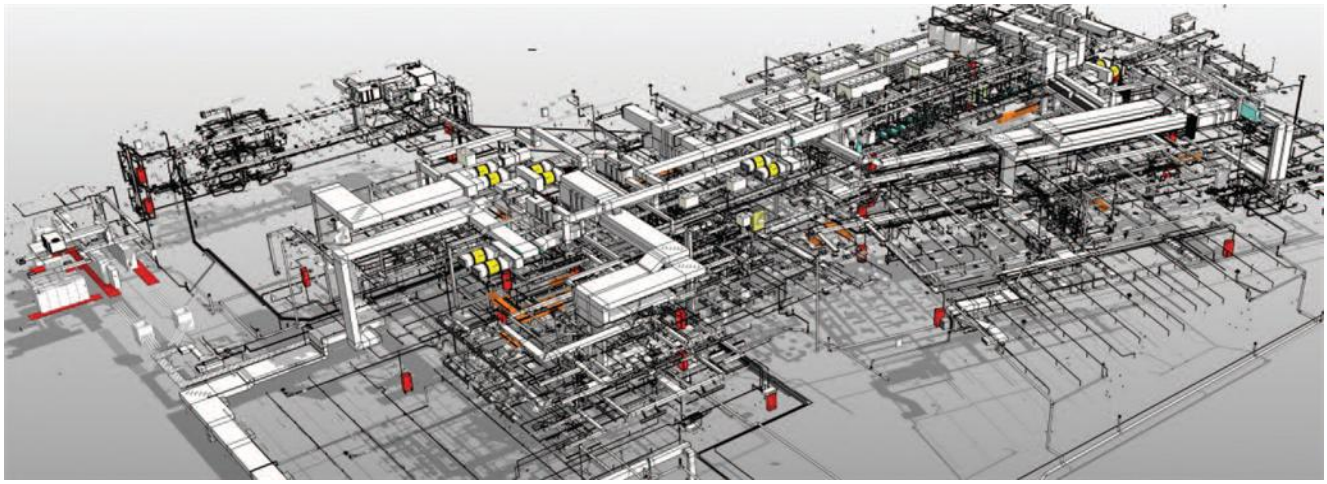
The concept of design phases and related information provided in the deliverables has been forever altered. Design phases and their deliverables were based on the decision-making process and the information presented at particular milestones. Fee structures were historically based on the amount of work achieved at certain milestones with built in allowances for changes made by the design team, client and other stakeholders.

Today the face of collaboration has changed where more project stakeholders are demanding to be involved much earlier than previously usually required. In today's world of project delivery, contractors and those handling operations and maintenance, can be involved from the very beginning, providing input, and therefore ensuring that the best and most cost effective decisions are made.

Today's technology allows the firm to effectively view and model the entire lifecycle of a project in a more efficient manner and it also adds the ability to manage budgets and costs. This information can prove invaluable when clients are searching for ways to introduce value engineering to their projects. The multiple components of information contained within the model are the key to its success. To enable the most accurate information to be collated resulting in the best end product, collaboration between stakeholders is imperative.

What are some of the main challenges the firm faces in its implementation of AEC technology?

The main challenge of implementing technology is dealing with resistance to change, having the right mindset, to get staff to understand how technology allows them to work, what technology can be used for, using the right technology for the right purpose, and learning how to use the technology in an efficient and productive way.



The use of technology allows KEO to developing coordinated multi-disciplinary BIM models for design and construction,

One challenge is training, where using technology in the correct way is in itself a continuous education process since the methodology is enhanced according to technological developments. For professional staff, continuous learning is required to ensure productive use of technology.

The other challenge is hardware, where the demands set by the continually evolving software affect both specifications of the computers and their cost, not to mention the size of the models created that contain more and more information. It is clear that the trend is towards 'cloud" based processing, but the challenge in this area is the speed and reliability of the Internet connection.

How does your firm see AEC technology evolving in the future?

Total collaboration in the cloud is the next step in the evolution of AEC technology. All project data will be worked on in the cloud and accessible from anywhere through any device. This includes processing power so that no longer are powerful individual workstations required in offices. New forms of devices will be developed known as wearable technology which will allow us more freedom to create and manipulate data unrestricted by the setting of office environments. On site, design charettes will take on a whole new perspective where a team of experts will together be able to produce a design and show the client in an augmented reality environment instantaneously.

If your firm had a wish list for AEC technology, what would it be?

The outcome of technology evolving at an exponential rate leaves the development of software and hardware becoming fragmented. There is an immediate requirement in the industry for a set of integrated tools that work as a coherent whole, flowing throughout each step of a project lifecycle used by all stakeholders. The efficiency of how we work and the technology we use is directly related to the ease in which information flows between different stakeholders using different apps. How easy is it, for example, to use, combine and work on GIS data, CAD data, BIM parametric models, various structural and MEP analysis tools, specifications, costing information that work in a multi-directional fashion so that a change in one place is reflected all the way down the line without the need of human intervention at one stage or another?

Any additional information/observations/ insights on AEC technology implementation that the firm would like to share?

In the same way the baristas at Starbuck's know to brew your favorite drink as you enter their premises and make your way to the counter using the geo location information in your smartphone, similarly, a smart building can sense your approach via your ID card, activating systems as you pass by. When you enter your office, it will be the ideal temperature and you will be greeted by your electronic PA running through your messages and morning appointments.

Soon, technology will be like the air that you breathe. It's all around you; you can't see it; you can't hear it; you can't feel it, but you can talk to it, and you need it in order to operate properly. Technology will be natural, intuitive, intelligent, smart and knowledgeable. Technology will be integrated into our daily lives to such an extent that we will take for granted that it exists.

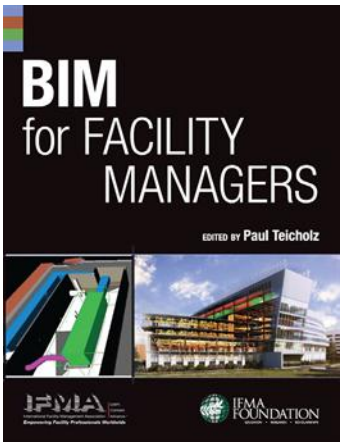
Book Review

BIM for Facility Managers

The book *BIM for Facility Managers* was published last year, yet it remains the only book on the topic of BIM in FM, despite the fact that the topic is of vital importance, not just to the professionals working in the AEC/FM industries, but the vast majority of human beings who inhabit some kind of building structure practically every minute of their lives. Who wouldn't like their buildings to be smarter, more responsive, better maintained and easier to fix when something breaks down? While there are already initiatives by leading technology companies like Intel and Cisco to make homes smarter and more connected—commonly popularized by the term "Internet of Things"—the only way to achieve this effectively is to start at the beginning, when buildings are designed and built, and let their intelligent underpinnings run through to their operations and maintenance.

Fortunately, BIM (building information modeling) is here and has made significant inroads in the design and construction phase of a building. It is universally acknowledged by AEC firms as the go-to technology for their current and future projects and there is a whole plethora of BIM authoring tools, add-ons, plug-ins, books, articles, training, and other resources for AEC professionals to rely on as they make the transition from the old 2D-centric CAD technology to the new 3D-based BIM technology. The benefits of using BIM are now so well-known that they don't have to be re-hashed to convince firms to adopt BIM. After all, why would anyone be still using a typewriter when it's so much faster and easier using a word-processing application on a computer? In the same way, BIM is universally acknowledged as the way forward for AEC firms when it comes to designing and constructing buildings.

However, when it comes to the ongoing operation and maintenance of those very buildings, the unequivocal faith in BIM is not yet there, and there are only a very limited number of resources—both online and in print—for facilities managers interested in learning more about this technology and applying it to their work. AECbytes itself has just published one article in the last several years on this subject ("BIM for Facilities Management", Sep 2011), and even this was mostly about the software rather than about the process. The book *BIM for Facility Managers* is intended to fulfill precisely this gap. Edited by Paul Teicholz—one of the most active, respected, and well-known academics in the AEC technology industry who founded Stanford's CIFE and served as its director for several years—under the aegis of the International Facility Management Association (IFMA), *BIM for Facility Managers* covers a lot of ground. It not only makes the case for the application of BIM to FM for owners, developers, and facilities managers, but also sheds light on the various aspects of implementing it in practice, such as the GSA (General Services Administration) guidelines for BIM in FM, the emerging COBie (construction operations building information exchange) standard that is especially geared towards BIM-based facilities management, some of the software that supports BIM/FM integration, and a set of six real-life case studies showing the processes and challenges involved when attempting to apply BIM to FM. The different chapters in the book are authored primarily by working professionals and researchers in the field, so the content strikes a good balance between what's possible now, what's being done, and what's coming ahead.



While the benefits of BIM implementation are obvious to anyone in the building industry conversant with it, there is still a case to be made for it for those not very familiar with it in the FM field, and the book makes this well. It cities examples such as the oft-quoted 2004 NIST study that highlighted the steep cost of interoperability in the AEC/FM industry, and actually calculates and presents an approximate ROI for undertaking BIM-FM integration, which makes the case for it even stronger. It also devotes an entire chapter to discussing the legal and contractual

issues related to the use of BIM models provided by the architect or contractor for facilities management, important in any professional field governed by contracts such as AEC/FM. It addresses both liability and intellectual property concerns such as the accuracy of what is in the model, its contractual status, who owns the model, if there will any increase in risk because of the use of BIM, and so on, all of which would be of prime concern to the owner of a facility considering BIM-FM integration.

For owners looking to move forward with using BIM for FM, there is an extensive overview of the GSA guidelines for this field, which have been developed over several years and represent the most comprehensive approach to linking BIM to FM requirements. These guidelines have been implemented on actual projects, three of which are presented as case studies, helping owners to better understand how to go about their own implementations and what are the issues and challenges they are likely to encounter. Additional understanding is enabled by a chapter on COBie that provides a detailed description of what exactly this standard is and how it can be used to collect building data from a BIM model for input to an FM system. As of now, COBie is the only standard specifically developed for BIM FM integration and it is important for anyone in the FM field to have a working knowledge of it.

BIM for Facility Managers also includes six real-life case studies that document BIM-FM integration for a variety of public and private owners, giving us a good idea of the current state of the art of the application of BIM to FM. Given that the field is still relatively new, the case studies are more of a record of the difficulties and frustrations that accompanied these early efforts than a compilation of "success stories" per se. They provide us with a candid picture of what it's really like out there. But rather than be discouraging, the book makes it clear that these kinds of "growing pains" are bound to be there in any field, and the many benefits that await the field of FM when the BIM-FM integration becomes stronger are compelling enough to make us persist in this endeavor.

Overall, *BIM for Facility Managers* succeeds in its intent to "provide a thorough and consolidated guide for professionals and students in the building industry to learn about the significant owner benefits that can be obtained from BIM-FM integration and how to achieve these benefits." It is a must-have resource that anyone working or studying in the AEC/FM industry should have readily available to refer to, as it can provide an indepth understanding of the essential underpinnings of the field that would be difficult to find elsewhere. With several case studies of BIM-FM integration on GSA and other public and private projects, the book provides a good mix of the theoretical with the practical, of not just what you need to know but also how to apply it.

It is important to note that *BIM for Facility Managers* is not a guide to BIM in and of itself or a guide to FM per se, or even about FM technology in general—there are so many FM-specific applications for various tasks such as space allocation, asset management, inventory control, etc. It assumes a working knowledge of BIM and of FM, and is most likely to benefit FM professionals (and students) who know about the basic premise of BIM and would like to apply it in their work (or research) to improve it.

The only really major quibble I had about this book was that all the six case studies that were presented were ones in which Revit had been used as the BIM application. It would have been useful to see how FM was being done even with the use of other BIM applications like ArchiCAD and Bentley AECOsim, and this one-sided view was quite disappointing, especially given the focus on interoperability and the open standard, COBie, for BIM-FIM integration. Also, it would have been helpful to include a "cheat sheet"— a quick reference guide— summarizing what FM professionals need to do to take advantage of BIM in their practice. What do they need to ask for? What software should they use based on the BIM application generating the model? And what are the main steps involved? While the book provides an extensive amount of background and information on BIM-FIM integration, distilling this to specific do's and don'ts—admittedly far from easy—would, I think, be invaluable to speed up the application of BIM in FM. And finally, a really minor issue: there are several references to the colors used in charts and diagrams while explaining concepts, but these cannot be seen because of the black-and-white format of the book. Hopefully, this error can be resolved in a future edition of the book.

For now, *BIM for Facility Managers* does a good job of reminding us that although the field of BIM in FM is relatively new and that the software and standards that are needed for BIM-FM integration are still in the early stages of development, we can speed up the development and implementation of the technology by learning everything we can about it. It is only through the sound understanding of an underlying concept that new ideas based on it can be created and executed; similarly, we will see the use of BIM extending to FM only after the FM industry has fully understood the theoretical underpinnings and practical applications of the technology, both of which are addressed in this book.

About the Author

Lachmi Khemlani is founder and editor of AECbytes. She has a Ph.D. in Architecture from UC Berkeley, specializing in intelligent building modeling, and consults and writes on AEC technology. She can be reached at lachmi@aecbytes.com.

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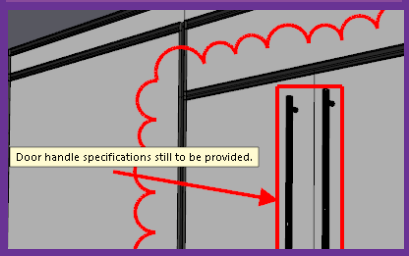

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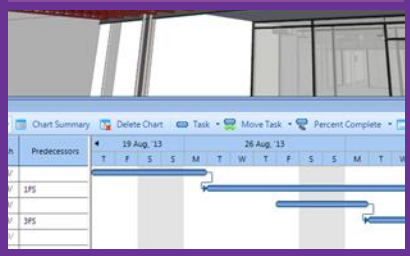

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People Profile

Atul Khanzode

Director of Construction Technologies
DPR Construction

"I see a lot of really smart and dedicated people who are initially attracted to our industry getting burnt out because they get frustrated with the archaic ways we do things …"

Atul Khanzode, PhD, head of DPR's Construction's Consulting and Construction Technologies groups, shares his perspective on AEC technology in this People Profile.

What is your educational and professional background?

I have completed my PhD in Construction Engineering and Management at Stanford University focused on the application of Integrated Practice, Virtual Design and Construction and Lean Construction methods in the AEC industry. I have also completed a Masters Degree in Civil and Environmental Engineering from Duke University.

I currently lead DPR Construction's Consulting and Construction Technology Groups. I have spent all my career in Construction. I worked for my family's Construction Business in Heavy Civil Works in Central India and have been working with DPR Construction in the US for the last 17 years, starting as a Project Engineer doing a variety of technically challenging projects in Healthcare, Life Sciences and Advanced Technology market sectors.

What is your current role? What are the main projects you are involved with?

I currently lead DPR Construction's Consulting and Construction Technology Groups. In this capacity, I get to work with really smart people to promote the use of VDC methods and tools and integrated practices on our projects, so we can produce predictable results and lasting value for our owners. I am also responsible for our technology initiatives and investments. I am currently involved in a large project for a confidential client and also involved in multiple innovation initiatives within the company.

When and how did you get interested in AEC technology?

I got interested in AEC technology when I was an undergrad and working for my family's construction business in India. Over a few summers, I did shop drawing detailing in AutoCAD and also developed an Excel based application so my dad could do his estimates a lot quicker than what he was doing at that time. My undergrad thesis was on LISP application to automate the production of rebar shop drawings. I have always believed that technology has huge potential in improving our industry and have worked on this all my professional life. My current role at DPR provides me with an excellent opportunity to work with owners, subcontractors and our own employees to make real change in the way things are done in our industry.

How much of what you do today is related to AEC technology in some form?

Almost everything I do today has some form of AEC technology associated with it. My observation is that we need to connect technology with people and make it accessible to more people in our industry for it to make a real change.

From your vantage point, what do you see as some of the main technological challenges facing the AEC industry today?

I feel like our processes have not evolved to take advantage of what technology can offer us. We are still too fragmented across our industry to take advantage from a life cycle value perspective of what technology offers us today. I see new business models and project organization approaches emerging which can make significant improvement to our industry in terms of quality, safety, productivity and predictability. Technology itself is evolving and I see more automation being adopted across our industry and the continuing evolution of tools being used to predict building performance.

How do you see AEC technology evolving in the future?

I see a lot more dramatic shift in terms of the use of technology for automation and better prediction of building performance. The rapid evolution and affordability in cloud computing will allow us to develop deeper insights into problems that we were not able to tackle before, such as optimization of a building structure across multiple attributes. I also see a great need for professional education in our industry so that the professionals who have deep knowledge of the building process can take advantage of what the technology already offers.

If you had a wish list for AEC technology, what would it be?

It is that we as a profession take pride and initiative in fixing our fragmented process to a more collaborative and integrated approach based on trust, so that we can take advantage of what technology enables today and play a meaningful role in developing high performing buildings that are sustainable and fun to work in. As Prof. John Kunz and Martin Fischer of Stanford / CIFE, who I consider to be my mentors, would say, "We in the AEC industry are responsible for the Physical Wealth in the world," and we need to fix the way that is being achieved today.

Any additional information/ observations/insights on AEC technology that you would like to share?

I see a lot of really smart and dedicated people who are initially attracted to our industry getting burnt out because they get frustrated with the archaic ways we do things, just because we have done it that way for a long time. If we want to continue to attract the talent we need for our industry, we are going to need to change the way we do things. Fortunately, I see a lot of good things happening in the industry: everything from entrepreneurs starting interesting startups; to technology vendors building interesting products; to owners, general contractors, designers and subcontractors thinking of different ways to bring efficiencies to the project delivery process; and finally, academia building up the resource pool of students that will be the leaders of the future. I hope that continues.

Autodesk's Rebranded A360 Cloud Solution

It has been close to three years that Autodesk launched its cloud initiative called Autodesk 360 to serve as the umbrella for all its cloud-based services, which in the early days, included a rendering service for Revit called Autodesk 360 Rendering; energy analysis in the form of an updated version of Green Building Studio as part of Autodesk 360 Simulation; structural analysis using its Robot Structural Analysis engine; and several mobile apps for design and construction targeted towards AEC firms (see the article on Autodesk University 2012). It subsequently added Autodesk FormIt, a conceptual design tool for the iPad, to Autodesk 360, as well as two new cloud-based services for design collaboration and construction field management, BIM 360 Field and BIM 360 Glue respectively. In 2013, Autodesk continued to add more features and functionality to its cloud offerings as well as strengthen their integration with its desktop products and create additional cloud-based services for the AEC industry such as InfraWorks 360 for infrastructure design, urban planning, and civil engineering (see the recent article, Extending BIM to Infrastructure).

In addition to being the umbrella for all its cloud services (not just for AEC but for the MCAD and the M&E industries as well), Autodesk 360 also has a project management and collaboration tool at its front end, which until now, was available as a technology preview, free for anyone to try out. Last week, Autodesk launched the commercial release of its cloud offering, now called A360. This article explores the interface and functionality of the rebranded product—the platform as well as the tool—and looks at how it compares to other cloud-based project management and collaboration solutions in AEC.

The Autodesk A360 Platform

The rebranded Autodesk A360 continues to be marketed by Autodesk as a cloud computing platform to help users improve their design, visualization, simulation, and collaboration processes. It provides storage space for project documents—models, drawings, and any other type of file—to be uploaded in an online repository called A360 drive, from where it can accessed by other team members, clients, and even the public at large, if required. Being on the cloud, the project data can be accessed from any device, including tablets and phones for which there are dedicated A360 mobile apps (almost a requirement these days!). A centralized front end to the platform, in the form of the A360 tool, allows users to set up and manage project teams, upload project documents, view project data, search, and communicate with other team members.

There are two versions of A360, the free version and the paid version, which is called A360 Team. The free version provides the ability to create a single project with the total storage limited to 5 GB. In contrast, A360 Team is priced at $10 per member per month on an annual subscription and allows multiple projects to be created with 10 GB of storage. Additional storage can be purchased if required. As is obvious from its name, A360 Team is specifically intended for collaboration and allows multiple team members to be part of a project, provided, of course, they also have a paid subscription. It also comes with some in-product training and basic support, in contrast to the free version which relies on community resources for getting product information and clarifying questions.

The benefits to using a platform like Autodesk A360 for project management and collaboration are already well known to the AEC industry, given the boom of AEC project collaboration portals in the dotcom era of the early 1990s. While most of these are now defunct, the benefits they espoused are still very much true: Given the diversity of project team members—in their location, background, expertise, and tools—that need to work

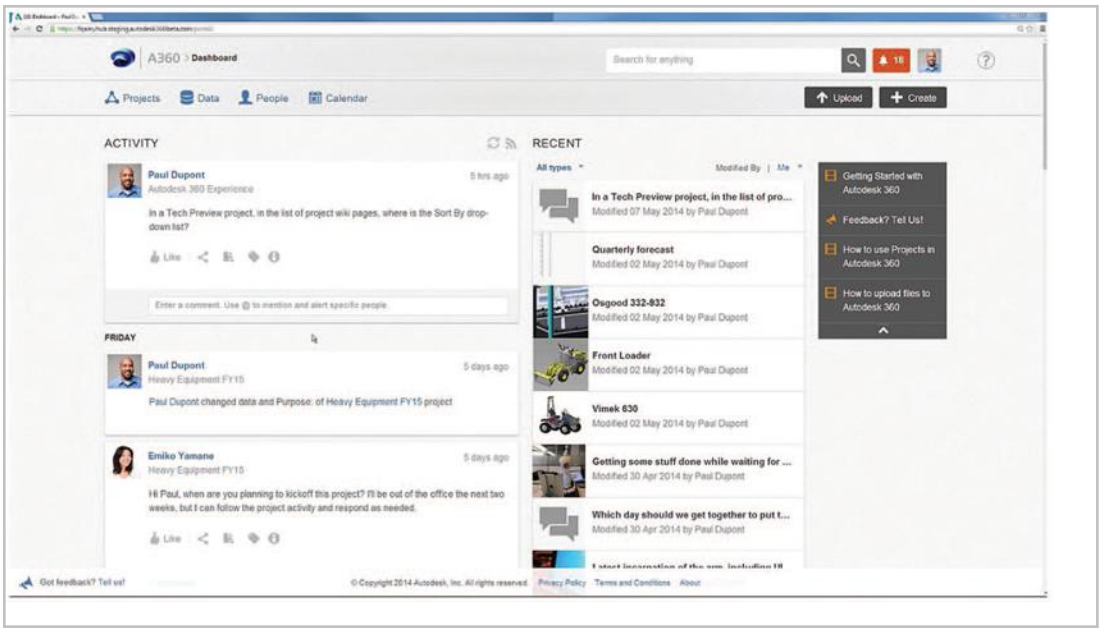

Figure 1. The A360 Dashboard, showing the recent Activity stream, and allowing access to the projects, data files, team members, and the project calendar. (Courtesy: Autodesk)

together on a project, cloud-based project management and collaboration services like Autodesk A360 allow them to communicate, organize and manage their processes, and share information more easily and efficiently, which can lead to better quality in the final product.

The Front-End Autodesk A360 Tool

While the Autodesk A360 cloud platform is itself quite nebulous and difficult to illustrate, it is certainly possible to take a closer look at the centralized front end to the platform, the A360 tool. Once you create an account and log in, you can create projects and upload files to them, organizing the files into folders, if required, as well as apply tags and categories to documents to make them easier to search. There is a built-in viewer for previewing documents—it natively supports most Autodesk CAD and BIM formats as well as several third-party formats, along with image formats such as JPEG and GIF and general business formats such as Word, Excel, PDF, etc. Other project members can be invited to join the project by specifying their email addresses, an essential aspect of the portal since this is, above all, intended for collaboration.

Additional interface features that add to ease of use include a project dashboard that provides quick access to all information including projects, data files, team members, and the project calendar (see Figure 1); the ability to "pin" a project to the Home screen if it is frequently used; an automatic Activity stream that captures all the actions of the user; a project calendar that can be used to schedule project deadlines and meetings; and a Wiki that is helpful for discussions and sharing knowledge.

Let's look at the Viewer in more detail, as it has some nifty features. I took A360 out for a test drive, and Figure 2 shows the test project that I created to which I invited another user, AECbytes Sales, whose account I have access to. I uploaded a number of different files types to

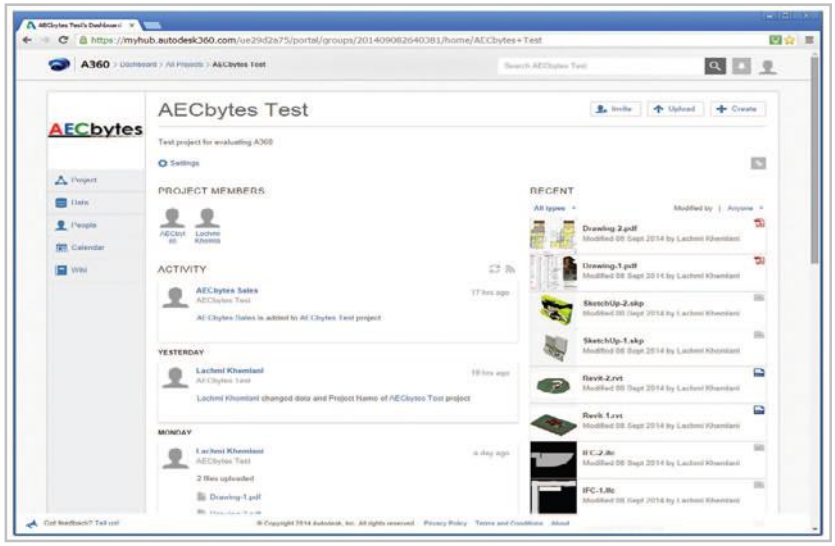

Figure 2. The Dashboard of the test project I created in A360.

test out the viewer, including some Revit files, SketchUp models, IFC files, PDFs, an image file, as well as models from ArchiCAD (PLN format) and Bentley AECOsim (DGN format), as shown in Figure 3.

In order to open a file in the Viewer, it has to be clicked. The Revit files, as expected, worked like a charm. It takes a while to load, but once it is in the Viewer, there are options for zooming, panning, and spinning it, and even exploding it, with a slider to control the amount by which it explodes. While the latter ability is more useful in the MCAD field to show the individual components a product is made of, there is the option to explore the Model Structure, which is helpful for building models (see Figure 4). Also, for a Revit model with included sheets, as in the sample file, you can actually view the individual sheets as well, as shown in Figure 5.

The real test was in the handling of the other file formats. The PDF and image files opened in the Viewer without any issues—one of the PDFs was a multi-page PDF and it allowed you to navigate through the pages. The IFC files, which I had exported from Solibri Model Checker, were also fine, which is commendable. You could click on an element and see some basic information about it, as shown in Figure 6. The SketchUp files, while they could be opened in the Viewer, had the orientation messed up with the base slab vertical rather than horizontal. And for the Bentley and ArchiCAD files, they could not be read at all, and when clicked, you were provided with the option to download them, if required.

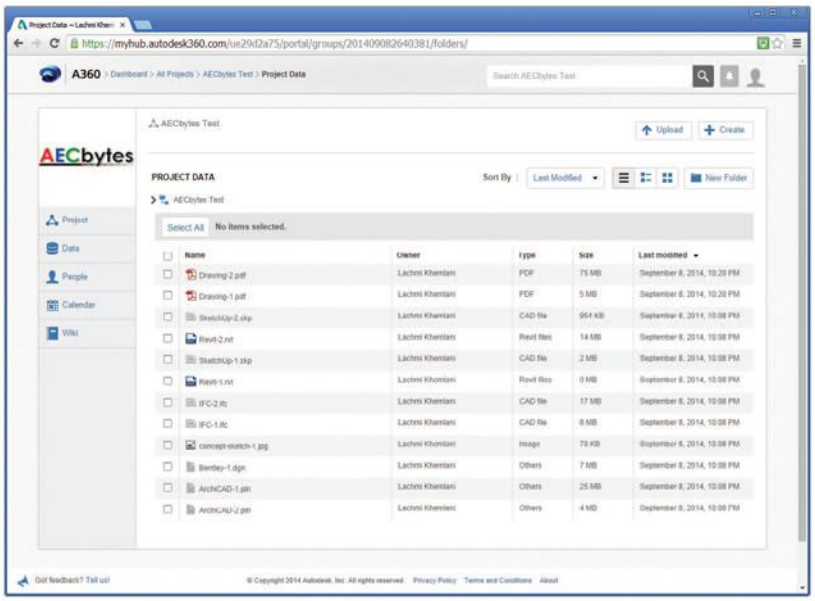

Figure 3. The different file types uploaded to the test project.

It should be noted that the Viewer displays a single model or file only—it does not have any Navisworks-like model aggregation capability. Also, the uploaded files do not maintain a "live link" to the original files; if they are modified, they need to be uploaded again to see the changes. A360 works best in Chrome, Safari, and Firefox browsers, but not very well in Internet Explorer. The tool is supposed to have a "Deep search" capability that can find information even within a file, drilling down to the details of the individual components; however, I didn't find this be true for model components, only for labels in the PDF documents. And finally, I did not find the quality of the model display in the Viewer to be very good. Users would have to continue to rely on dedicated rendering applications for high-quality visuals. But for the purpose of design collaboration, the quality was definitely adequate.

Another option that the Viewer provides is to share a file with anyone using a public link. This means that anyone with the link can view (or download, if the permission to do so is provided) the document without having an Autodesk account.

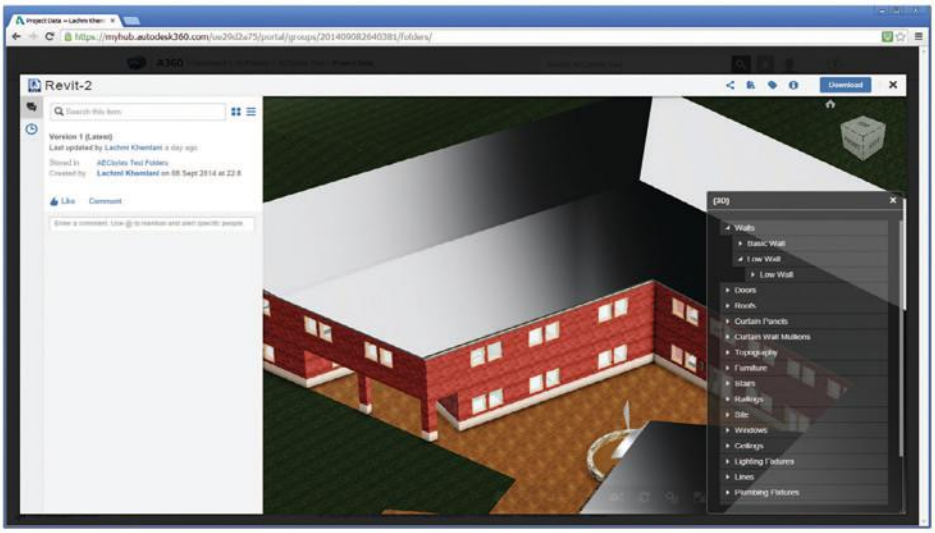

Figure 4. The ability to explore the model structure of a Revit model in the A360 viewer.

Competitive Landscape

Autodesk 360—relaunched as A360—does not purport to be an "industrial strength" collaboration and project management solution for the design and construction of a building, let alone the entire lifecycle. From that perspective, it is a far cry from the comprehensive project information management and collaboration capabilities of an application like Newforma Project Center, which started off being more focused on architecture and engineering but has now expanded to meet the needs of construction professionals as well as building owners, with capabilities for managing submittals, transmittals, RFIs, punch list items, etc. It also has a plug-in for "deep integration" with Revit that can read the model data in Revit and allow it to be managed and integrated with the project information management tasks and processes that are being conducted in Newforma Project Center. (see last year's review of Newforma Model Viewer). Newforma also recently launched the Newforma Project Cloud for the application of its project information management and collaboration capabilities to projects hosted on the cloud.

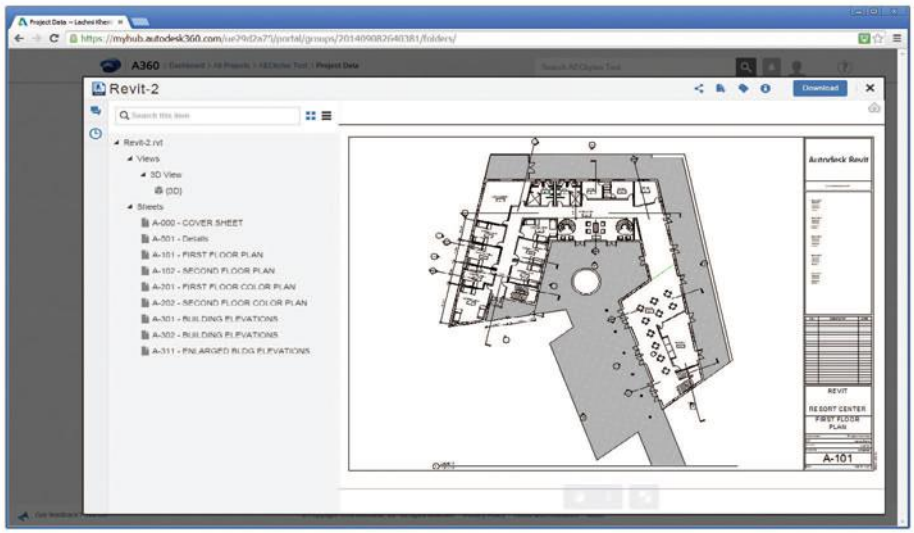

Figure 5. Viewing one of the sheets included in the same Revit model.

A360 also does not come close to the data management and collaborative capabilities of Bentley's ProjectWise and Autodesk's own Vault Collaboration AEC, which were compared in last year's research report on these two applications. Both solutions manage project data and organize the relationships between files, and can be deployed either internally on a company's servers or on an external cloud. One of the interesting findings that emerged from the report was that ProjectWise is used for managing project files even when Revit, rather than Bentley's AECOsim Building Designer, is used as the BIM solution for a project.

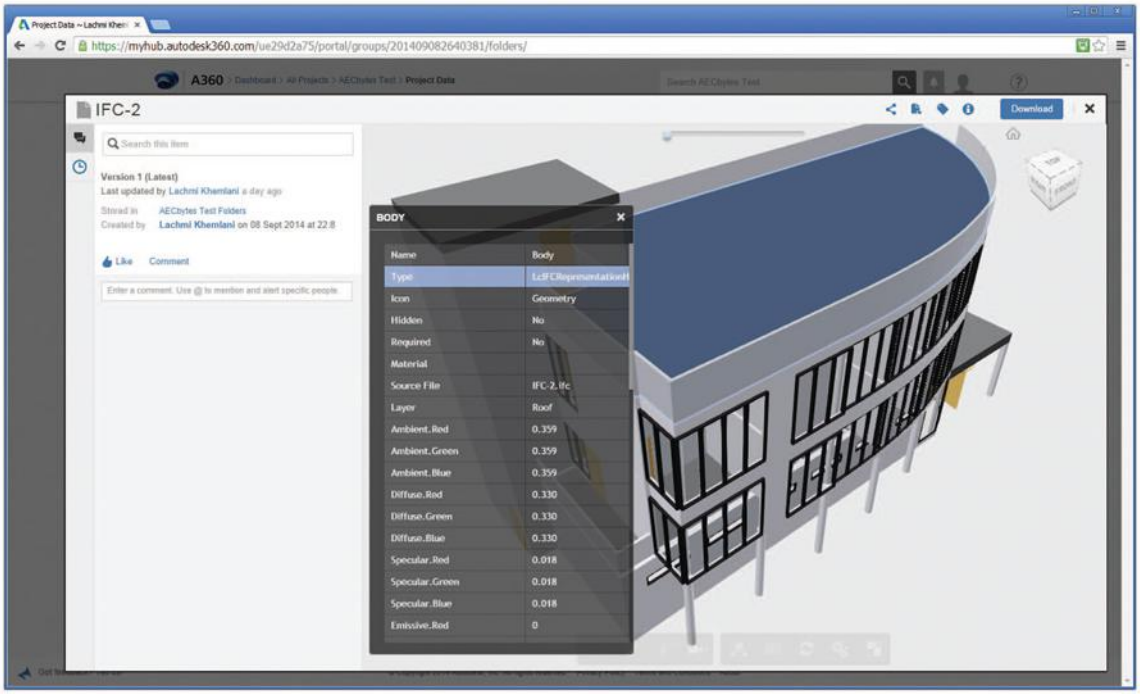

Figure 6. Exploring the model structure of an IFC file in the A360 viewer.

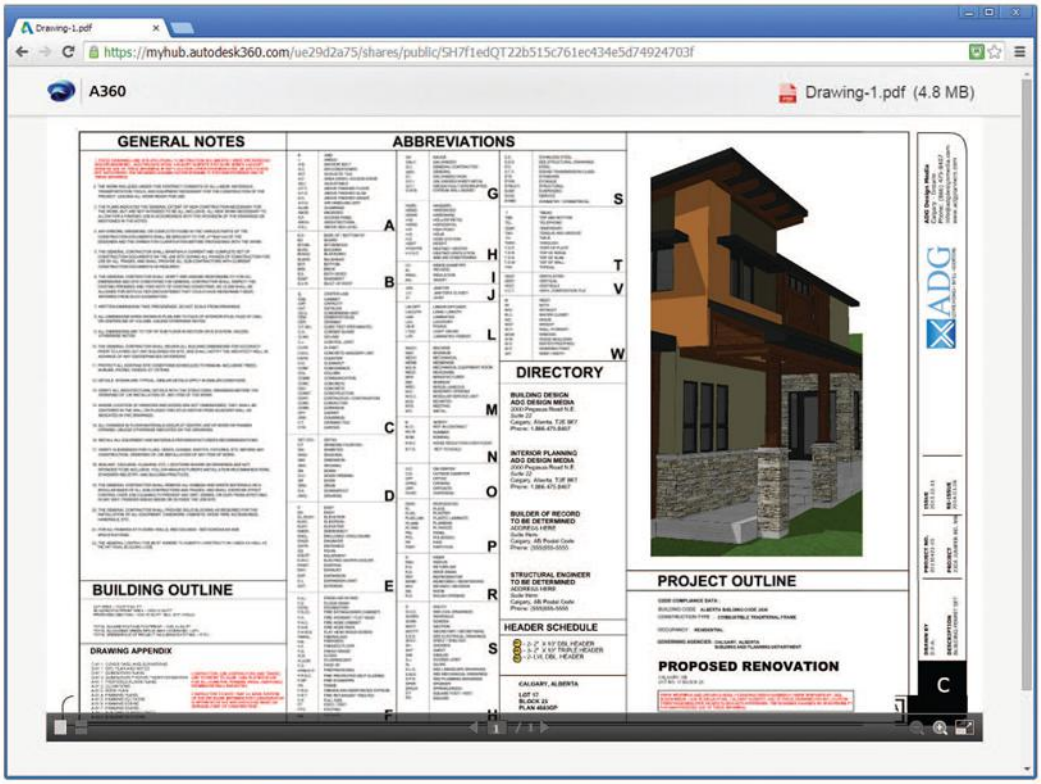

Figure 7. Accessing a public link to a document from the test project that was sent to a non-Autodesk account.

Another solution worth comparing A360 to is Graphisoft's BIMcloud solution, which was launched earlier this year, for model-based collaboration in ArchiCAD (see the article, Graphisoft's New BIMcloud). While BIMcloud does not have any document management capabilities in and of itself, it does come with the nifty iPad app, BIMx Docs, for reviewing the 3D models as well as the 2D documentation of a project. (See the AECbytes review of BIMx Docs for a detailed overview.) Then, of course, there are other applications for online document management, web collaboration and project management such as Aconex, Asite, Assemble, EADOC, ProjectTalk, PlanWell, etc., to name a few.

Thus, it is difficult to pinpoint what makes A360 compelling for the AEC industry. It presents an easy-to-use tool for creating and sharing projects with some added functionality for creating project calendars, wikis, etc., and I can see it being used on a smaller scale by individuals and smaller companies for quick design collaboration and communication to supplement their main collaboration application but not replace it entirely. In its current avatar, A360 seems more geared towards the MCAD industry with its ability to explode models into parts, and in fact, most of the promotional material for A360 presented by Autodesk contains MCAD examples (such as Figure 1).

Conclusions

The biggest thing going for A360 at this point seems to be the fact that it comes from Autodesk, which is currently the leading AEC software vendor. It does not even have the ability for the additional cloud services that Autodesk offers, such as renderings, energy analysis, structural analysis, etc., to be pulled in directly to work with the project models stored on the A360 cloud. There isn't a lot of information available yet on the new service and how exactly it works (which made this article a difficult one to research and write). It is not clear if Autodesk is positioning A360 to eventually replace its own data management solutions like Vault, Buzzsaw, and Constructware (does that still exist?) or whether it is intended to supplement them. I hope the next time Autodesk rolls out a new solution, especially something as fundamental as a cloud service platform, it will put in a lot more effort into making it more cohesive, coherent and compelling.

About the Author

Lachmi Khemlani is founder and editor of AECbytes. She has a Ph.D. in Architecture from UC Berkeley, specializing in intelligent building modeling, and consults and writes on AEC technology. She can be reached at lachmi@aecbytes.com.

Vendor Updates

What's New from
AEC Technology Software Developers

Lighting Analysts, Inc.

ElumTools, the lighting calculation add-in for Autodesk Revit now allows surface reflectances to be assigned by Revit Category as well as by material. This important addition to ElumTools can dramatically simplify your lighting calculation work flow. The ability to assign reflectance to a Revit category permits a generic reflectance to be used for a wide ranging number of surfaces such as all ceilings, walls and floors. Other categories can be simplified as well such as all furniture, HVAC and stairs for example.

Watch our video on YouTube to see how it works: https://www.youtube.com/watch?v=EP-plIFWLUk&list=PLMTy0mxe-Cdlop1q09StocvMuVZZKYZ2t

Sefaira

Sefaira's Real Time Analysis comes to Revit, providing rapid performance feedback on energy and daylighting

Sefaira announced that it now delivers real-time energy analysis within Autodesk® Revit. With the Sefaira for Revit plugin, architects can now use powerful cloud computing to assess tradeoffs between energy and daylighting performance and make performance-based design decisions directly within their design environment. Sefaira's rapid feedback matches the workflow and fast pace of the architectural design process and also provides benchmarks for energy targets such as the 2030 Challenge.

Andre Carvalho, BIM Manager at Diamond Schmitt Architects said, "Being able to try different building performance scenarios at early stages in Revit allows us to pin down the orientation and envelope of the building very early in the design process and avoid the costly and time consuming model changes that would have happened otherwise."

http://sefaira.com/news/

4M

FineFIRE new release 14.2 for Fire Fighting BIM Design

4M announces the new release of FineFIRE (v.14.2) which meets the needs of any pipework network (tree systems, gridded, looped or any combination) and completely fulfills the latest NFPA13 standards for fire protection, as well as the European Norm EN12845. The calculation environment has been significantly enhanced, specifying automatically the sprinkler spacing and locations according to the classification of hazard, the determination of the area covered per sprinkler, as well as the determination of the hydraulically most unfavorable and favorable operation areas.

Moreover, in this new release all the parts of the installation equipment are calculated in detail (i.e., pump selection capable to supply the flow & pressure of most unfavorable and most favorable areas, suction pipe calculation, NPSH calculation, tank size calculation etc.) and with close respect to analytical tables and curves. FineFIRE belongs to the 4M BIM MEP Suite, which integrates the 4MCAD engine seamlessly with the FineFIRE calculation module.

For more info see at: http://www.4msa.com/FineFireENG.html

Autodesk

Change the way you look at your work—and your world—by coming to Autodesk University this December. You'll find an entire year's worth of learning, certification, and networking with people from a wide range of industries and backgrounds. You'll get a better sense of where the industry is heading. And you'll see how information, collaboration, and the latest technology for BIM can help you work smarter.

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BIMReview lite

AceCad Software will now deliver a FREE version of BIMReview with functionality to enable effective review and visual communication through BIM models.

The latest installer will now include a FREE lite version which is still easy-to-use for construction project collaboration.

BIMReview lite can be used across the construction project. Users of BIMReview lite can improve their workflow by opening BIM models and associated data from multiple CAD authoring tools to consolidate effective review and visual communication with others in the construction supply chain.

BIMReview lite is an efficient way to help our users review and visualise BIM models more effectively across teams and improve their project workflow. And the best thing is, it's FREE.

Online video tutorials make it easy for anyone to get started visualising and communicating with BIM models.

BIMReview lite can be downloaded for free at www.bim-review.com

Nemetschek Vectorworks

Nemetschek Vectorworks, Inc. develops Vectorworks® software, a line of industry-specific CAD and BIM solutions that allows designers to advance their ideas from concept through completion. More than half a million users around the world have realized their visions with Vectorworks.

NEMETSCHEK Vectorworks

We offer software solutions that are perfect for the AEC industry, beginning with Vectorworks Architect. Using the robust Parasolid® 3D modeling engine, Vectorworks Architect can tackle even the most complex models, and the program's BIM capabilities help streamline costs, analyze materials, and increase energy efficiency. The software also offers efficient documentation, easy file translation, and superior 2D graphics. For design professionals who work across multiple disciplines, Vectorworks Designer features customized tools for the AEC, landscape, and entertainment industries. Add Renderworks®, our integrated rendering application based on the CINEMA 4D render engine, to either program to create stunning images and animations that artistically communicate your design ideas to stakeholders.

www.vectorworks.net

Bentley

Read how Building Studio embraced BIM workflows to ensure design quality while maximizing productivity, using AECOsim Building Designer and ProjectWise.

http://www.bentley.com/en-US/Solutions/Buildings/Case+Studies

vintoCON

www.archifm.net at BIM Forum Portugal, 2014

Being the Gold Sponsor of the event, this year archifm.net gained even higher visibility at the BIM Conference, BIC 2014 (www.bimforum.com.pt/index.php/en/) held in Lisbon recently. Over its permanent expo booth and a separate workshop, archim.net was also presented at the conference plenary session through a distinguished keynote speech from Mr. Kazuki Matsuoka representing Toda Corporation, a large Japanese client of vintoCON. During his presentation, Mr. Matsuoka introduced their BIM FM system based on archifm.net and customized for their specific requirements. This project is an excellent example to demonstrate the way of going beyond boundaries with a carefully designed BIM FM system: over the usual FM functionalities archifm.net is also used for monitoring CO2 footprint thus gaining importance not just in the 6th dimension but even further, in the energy management segment.

EADOC

At EADOC we are redefining "collaborative" in Project Management software. We are excited to invite you to visit us at CMAA National Conference 2014 on October 19-21 in San Francisco, CA to show you why.

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- MEET Michael Warriner of Carollo Engineers and Ron Perkins of HDR among others to see how they are using best practices in project management.
- Preview EADOC's new User Interface that is currently under development
- EAT & DRINK some of the best food, beer, and wine San Francisco has to offer.
- PLAY with EADOC's software at our demo stations or partake in a round of Bocce Ball on the patio.
- LEARN how EADOC is the only solution in Project Management truly integrating the entire project team at our Support Stations.

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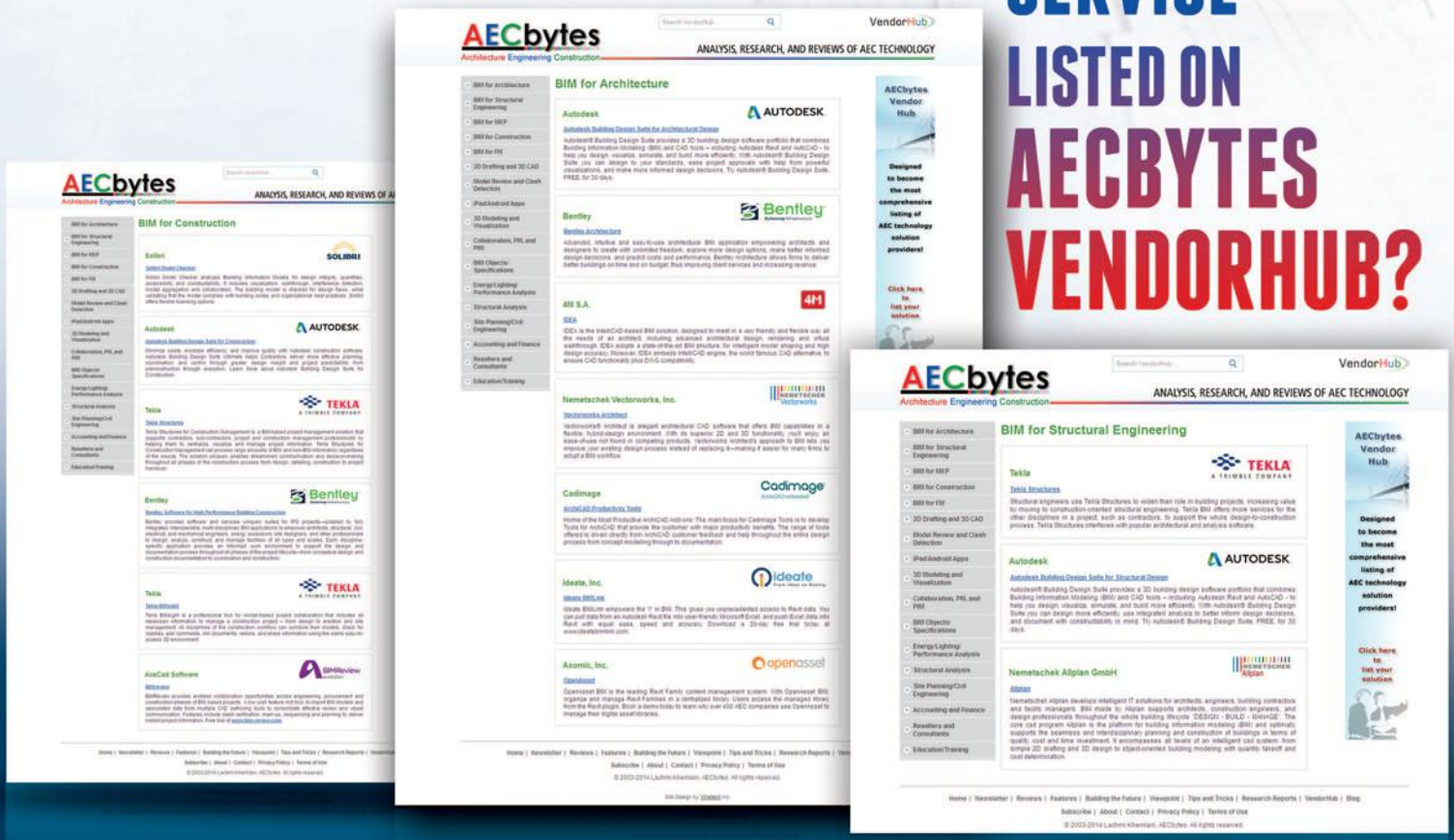

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