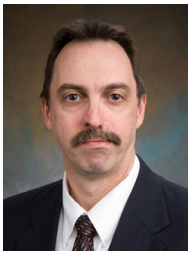
BIM in the Real World

EDITED BY GEOFF WEISENBERGER

Revit Structure appears to be leading the pack in terms of building information modeling software, and some of its users share their thoughts.


Tom Bartolomucci


Alexander Baumel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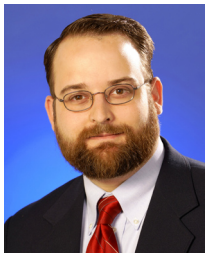

Will F. Ikerd II


Atul Khanzode

ALLOW ME TO REPEAT A STATEMENT THAT HAS BEEN MADE AD NAUSEAM: BIM IS HERE TO STAY.

Does this mean that all structural engineering firms are using building information modeling on all projects? Certainly not. But a survey conducted in 2008 by the Structural Engineering Institute's BIM Committee, in collaboration with the Structural Engineers Association of Texas' IT Committee, indicates that more than half of structural engineering firms at least have BIM software at their offices. Further, approximately 65% of the respondents said that they think they will have to use BIM to meet client needs within the next two years; almost 80% said within the next five years. (The survey was sent to more than 15,000 SEI members and received more than 700 responses.)

Tekla Structures and Bentley Structural were two of the top programs; 9% and 13.5%, respectively, of firms that said they own BIM software have these programs. But the most-owned program by a significant margin was Autodesk's Revit Structure at 60%.

Below, representatives from a handful of firms using the latter program weigh in on its pros and cons, its interoperability with other packages, and BIM use in general.

Is Revit Structure/BIM in regular use at your firm?

Bartolomucci: We have already implemented and used Revit Structure for about two years on many projects. Revit has been used on a majority of structural projects and several architectural projects. We are attempting to use Revit on all projects as scope and budgets allow.

Khanzode: Revit/BIM is in regular use at DPR, and we are using it on about 70 total projects across the company. As a national builder of projects for the advanced technology, health-care and life sciences markets, a majority of our work is highly technical, including data centers, pharmaceutical manufacturing facilities, and hospitals. For these types of technical projects with complex systems, Revit/BIM has proven to add a lot of value, especially resolving issues early and enhancing productivity out in the field.

Participants

Hanson Professional Services Inc.	Tom Bartolomucci, **P.E., S.E.** Vice President
Robert Silman Associates	Alexander Baumel, Engineer Justin Den Herder, Engineer
Harley Ellis Devereaux	James A. Corsiglia, **P.E., S.E.** Principal
HDR Architecture, Inc.	Randy Karl Hagens, **AIA, P.E.** Vice President, Structural Team Leader
Raymond L. Goodson Jr., Inc. (RLG) Consulting Engineers	Will F. Ikerd II, **P.E.** Director, Integrated Project Delivery Department
DPR Construction, Inc.	Atul Khanzode, **P.E.** Director of Virtual Building

Corsiglia: We have been working in a 3D/BIM environment for more than a decade and use Revit Structure exclusively for our BIM platform. Structurally speaking, we do 95% of our work in the Revit/BIM environment, and we balance our projects with minimal CAD documentation.

Baumel and Den Herder: Robert Silman Associates (RSA) has been using Revit Structure for about two years in both our New York and Washington D.C. offices. Currently, both offices only use Revit when requested to do so by a client.

Ikerd: Raymond L. Goodson, Jr., Inc. (RLG) uses Revit Structure regularly, with some legacy projects still in AutoCAD. My role as Director of RLG's Department of Integrated Project Delivery (IPD) is to guide the implementation of BIM tools like Revit to facilitate downstream use of our models with a multitude of different applications.

Hagens: We began with Revit Structure version 4 when it first became available. Initially, only a few smaller projects were completed with the software. We produced plans and a very limited quantity of details with the Revit Structure software; the bulk of the detail work was done with AutoCAD. When Revit Structure 2008 became available, we started working with much larger projects and did more detailing inside of Revit. In 2008, we completed a couple of smaller projects with all design details completed wholly within Revit Structure, without the help of AutoCAD. All whole building projects are now being started in Revit Structure. Renovation projects involving small structural modifications remain in AutoCAD or Microstation, depending on prior work with the client. To date, we are attempting all types of institutional buildings in Revit in order to test the state of the technology.

What are the challenges with using Revit Structure/BIM?

Bartolomucci: The main challenge in implementing BIM is accepting a change in the design and delivery processes—not just the new software. One of our challenges is providing education and training on BIM to our employees.

Khanzode: One particular challenge is that the purpose you want to use the model for determines how you build it and what you get out of it. If we are able to get involved with the design team earlier on in the process, we can collaboratively determine what purpose the model gets used for and then build the model to meet that purpose. This is especially true for model-based estimating. The other challenge we are facing is use of models on large projects and how to share information in a networked environment.

Baumel and Den Herder: The biggest challenge with using Revit is training engineers and drafters on the program and ensuring that they are familiar enough with the program to use it efficiently on projects. While few of our employees have used Revit extensively before, it has a relatively fast learning curve, especially for those who know AutoCAD or who have experience with other 3D modeling software. Once the design team begins using Revit on a project, coordination between the consultants is easy and efficient. Revit helps locate coordination discrepancies—for instance, between a structural element and a mechanical duct—and brings it to the user's attention.

Ikerd: Challenges related to linking Revit with structural analysis applications and also with detailing applications include: slab definitions, top of steel definitions, member axial rotation definitions, material specifications and naming conventions, original location of objects, and material tolerances. The models typically account for the world as it should be and not the way it might be, with all the different conditions with various tolerances.

Hagens: We have learned that approaching a product like Revit Structure with a CAD mentality will greatly limit success. Revit Structure is not a drafting program; it is a documentation modeling program from which drawings and other information can be extracted. This can be a difficult concept for both technicians and engineers to grasp largely because our typical deliverable has been either a printed set of drawings or PDF files of drawings. We have historically thought about an output in terms of two-dimensional lines.

However, to build a correct Revit Structure model, we must think in terms of assembling objects that are, in effect, multi-dimensional—not just 2D or 3D, but objects that have a rich set of characteristics that can be used for more than just graphical purposes.

A significant challenge within the workflow is deciding how much detail to put into the documentation model. Within a multi-dimensional model, it is easy to overdo it. Just because we have the capability to model nearly every component in the structural system, do we actually need to do so? Or, more importantly, is it required by our contract? Beyond defining the actual workflow and training, the detail in our deliverables will need to be further defined as BIM becomes more mainstreamed. Whether the model will be used for material take-off or just collision detection will impact the required amount of detail in the documentation model, the cost to produce that model and, ultimately, the contract documentation for construction.

What other structural or detailing software packages do you generally use as part of your workflow, and how do they interact with Revit Structure or your other BIM package?

Bartolomucci: We use RISA Building System linked with Revit Structure for integrated design and analysis with minimal compatibility issues.

Khanzode: We use Revit Architecture, Revit Structure, Tekla Structures, NavisWorks, and VICO.

Corsiglia: We regularly export, via CIS/2, to RISA and RAM Structural Systems. Additionally, we import fabricators SDS/2 files into our system as well as NAVIS works for coordination.

Over the last two years we have been relatively successful in bi-directional linking between the BIM and analytical platforms. Modeling and showing the information only once and having the information be replicated in multiple platforms is extremely efficient for engineers.

Baumel and Den Herder: Other than AutoCAD, we use a variety of different analysis programs, including RISA-3D, RAM Structural System, SAP2000, and SAFE. We use proprietary third party software that allows users to export models from Revit into RISA-3D and RAM. This

can save up to 50% of the time it would otherwise take to build both a Revit model and a separate analysis model. While the model exports are not flawless and usually require touch-ups to ensure accuracy, they definitely save a large amount of time when modeling and analyzing buildings with complicated geometries.

Ikerd: Tekla and SDS/2. While we do not have them in-house, we do look for others that use them to share models with.

Hagens: We use RAM Structural System, RAM Advanse, ETABS, and SAFE as our primary analysis and design programs. However, we currently are only able to link RAM Structural System and ETABS to Revit Structure.

Regardless of where the workflow starts, we have found that the models must be extremely accurate in their connectivity in order to prevent analysis errors. We have also found the need to limit the workflow to one full cycle of transferring information between models. Beyond one full cycle, unnecessary errors creep into the analytical model due to changes in the documentation model that are a part of normal design development. With current technology, we find it more efficient to maintain two separate models after the initial analysis and design is reported to the Revit Structure model. In time, we hope the links and analytical program databases will be smarter about communicating with the documentation model, thus enabling an ongoing link between the models.

What challenges do you experience with using CIS/2—and what are the workarounds?

Bartolomucci: In the past, Hanson has used SDS2 Global Review when interacting with fabricators. However, we are currently testing the ability of Revit Structure to import CIS/2 files from a fabricator to our system.

Khanzode: We are aware of the CIM Steel Exchange standards (CIS/2) and sponsored a workshop to bring steel detailers and designers together in the western U.S. to speed the process of data transfer using this format between design and construction team, and we anticipate using this method of exchange on one of our upcoming projects. We see a lot of promise in this and know of success stories of others using it and hope to do our first few pilots in 2009.

Corsiglia: We have not experienced any difficulties in exporting to CIS/2. The last project we exported was an atrium infill, sandwiched between three buildings, with irregular expansion joint locations.

Ikerd: From my perspective, for simple buildings, the model is approximately 80% good on the other side on transfer (non-scientific number, here). However, if you are working with a good team, the 20% that needs to be "fixed" in the model after transfer should be easily identified. There is value in transferring the models even though it is not perfect. The most important aspect of integrated project delivery from my perspective is understanding people/communication first, then process/understanding, followed by technology and tools. Communication with the team of designers, fabricators, detailers, erectors, and general contractors is the most important "workaround" with any use of technology, and especially BIM when leveraging CIS/2.

Hagens: We do not actively use CIS/2. However, our Omaha and Chicago offices recently tested the waters on conducting "paperless" shop drawing reviews with a similar detailing/fabrication software solution. The idea was to conduct on-screen reviews of the fabricator's detailing model. Though the process has merit, we found the software package to lack significant communication and tracking tools to convey the designer's comments and concerns to the fabricator. The idea has great merit, but the current software tools do not mesh well with engineering professional practices. In time, we think the evolution of these transfer options will develop features to better fit with the structural engineer's changing workflow.

BIM has been a frequent topic in MSC in recent years. "Practical BIM" in particular provides some more insight on BIM adoption and use. This article appeared in the 11/07 issue of MSC, and you can find it at ***www.modernsteel.com.*** MSC

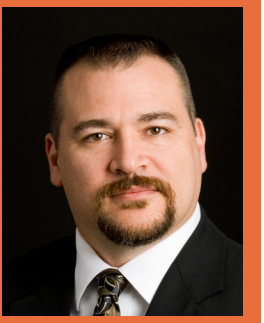
Autodesk, Inc.
http://www.usa.autodesk.com
Bentley Systems, Inc.
http://www.bentley.com
Tekla, Inc.
http://www.tekla.com

For a complete list of structural engineering/BIM software providers, visit MSC's online Product Directory. Go to www.modernsteel.com and click Product Directory on the right.

Working with CIS/2

Revit Structure 2009 has the ability to import and export CIS/2 files via the Revit Extensions tool. This free tool is an add-on from Autodesk, and must be installed separately from Revit Structure. In our experience, there are a couple of situations where one would want to integrate CIS/2 with Revit Structure. The first situation would be importing a CIS/2 file from an analysis program. In many structural engineering firms, a 3D model is first created in an analysis program. Rather than recreating this model in Revit Structure, the CIS/2 Import function can be used to bring in the all-ready created model. Though this will save modeling time, it may be necessary to modify the imported grids and levels. In addition, complicated geometry may not come in properly, so a thorough check of the imported model should be done.

A second situation would be exporting a CIS/2 file from Revit Structure for use in a steel detailing model. This would save the time and cost of recreating the structural steel framing from scratch. As with importing a CIS/2 model into Revit Structure, the steel detailer must carefully review the imported model to confirm that it accurately represents the structure. Particular attention needs to be paid to geometry, member orientation, and proper import of member shapes. It may be necessary to use a conversion file, which translates the names of structural shapes from one program to another. CIS/2 is an easy and convenient means of getting structural steel information into and out of Revit Structure. The transfer of data, however, is not perfect and the engineer should closely verify the information that is exchanged.



– Joseph M. Ales Jr., Ph.D., P.E., Principal, Walter P Moore