



Getting the Most Out of BIM: The Secret Guide to VDC Apps

UNDERSTANDING THE BENEFITS AND IMPLEMENTATION OF SIX CATEGORIES OF BEST-IN-CLASS BIM APPS

With a seemingly endless array of building information modeling (BIM) software applications available, simply understanding what each actually does can be a daunting task. DPR's Andrew Fisher explains most BIM apps fall into six basic categories: authoring, coordination, visualization, analysis and measurement, sequencing, and estimating. In this paper, Fisher describes in layman's terms what each of these activities is and which applications DPR teams have found to be most successful.

Introduction

With great apps comes great responsibility to fully understand their capabilities, limitations and implementation. Project teams are increasingly embracing virtual design and construction (VDC) tools, and vast arrays of new software applications have been developed to meet that demand. VDC apps can be powerful in the hands of those who know how to use them effectively, making it worth the extra effort to better understand how these apps can—or should—fit into a project.

To name just a few benefits, when VDC apps are used correctly, project teams can improve productivity, reduce field clashes, enhance building documentation, and feed into management systems, which can result in lower long-term costs.

In light of these potential benefits, it can be tempting to think of software as the “silver bullet” to the many complex hurdles that project teams face in the AEC industry. But even the very best software is simply a tool and is only useful if the person (or team) who wields it, does so effectively.

Knowledge is Power

A technology-savvy owner is key to the successful implementation of VDC on a project. With a basic understanding of what VDC tools can do in the hands of a highly knowledgeable team, an owner can provide support and guidance to help reap the highest possible benefits.

Think of a whole project like a family trip to the beach. The goal is to relax together at the beach, but the “tool” for doing so is the car, and the “process” is the route you take. If the car breaks down or you make a wrong turn, it’s important for someone to know either how the car works to fix it, or the general surrounding geography to quickly get help and get back on track. If all the adults in the car have a similar base of knowledge, they can discuss the best course of action together. Of course, one driver who knows absolutely nothing may still eventually arrive at the beach, but it could take a very long time and end up being more expensive than necessary.

This paper discusses six of the primary functions of the software tools used at DPR, highlighting the “best value” apps, and explain the possible uses and benefits each can deliver to a project when implemented by an experienced team.

Authoring

An authoring application can be used to design a virtual building, object or landscape in three dimensions.

For many years, the only application in wide use was Autodesk® AutoCAD. When Autodesk acquired Revit, it needed a way to differentiate it from AutoCAD. Revit ties “real world” building information to each model element, hence the term “building information modeling” (BIM). In other words, a cylinder in the Revit model is not just a shape; it has dimension, material, and priority information associated with it. Revit was not the first application that worked this way, but it has become the preferred tool for architects and designers in the U.S.

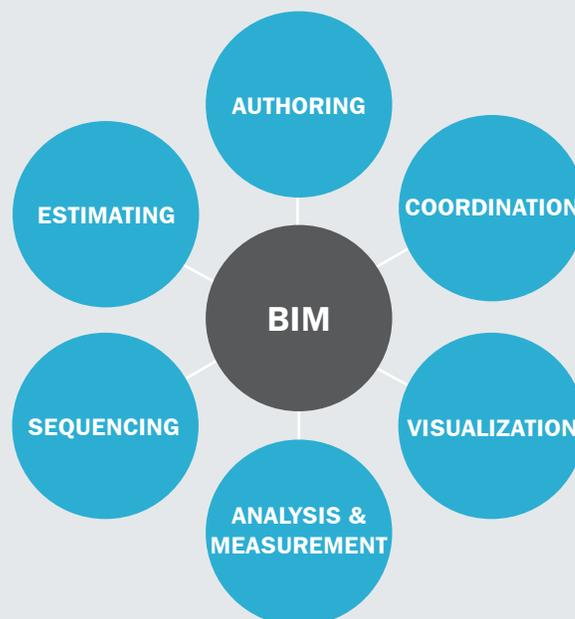
AUTODESK REVIT

Autodesk Revit is used at DPR in a few different ways, including:

- Modeling scope gaps, such as miscellaneous metals
- Creating 2D and 3D visualizations
- Creating shop drawings

Six Primary Functions

BIM tools can add value to a project in six major ways, and most applications support at least one of these activities.



BREAKDOWN

DPR's Self-Perform Work (SPW) drywall detailers also typically use Revit with an add-on application called Metal/Wood Framer to create wall framing elevation drawings.

Thanks to Revit Server applications, design team members can share models with each other in near-real time. Various designers working together may be using any one of three “flavors” of Revit. The three options are: Revit Architecture, Revit Structure, and Revit MEP for architects, structural designers and MEP system designers, respectively.

Autodesk recently released a version of Revit that includes all of the designer tools in one. This is the version now installed on DPR's BIM-enabled laptops.

Out of the box, Revit also does visualization, eco-effective design analysis, and may report on interference (clashes) between linked models. Revit data can be exported and reviewed for estimates and simple quantities.

Besides Autodesk Revit, DPR has licenses for the following authoring tools: AutoCAD, ArchiCAD, SketchUp Pro, Tekla Structures, Rhino, and Inventor. Any of these may be used to create models.

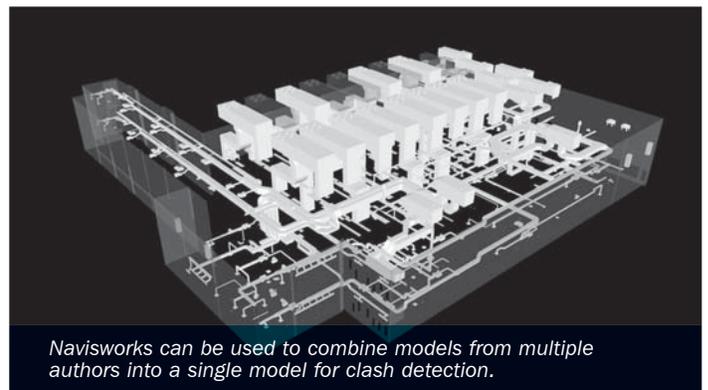
Coordination

Review tools that can compare models are critical to reduce time and materials waste and rework. The use of Autodesk Navisworks to check and compare models has provided construction managers and general contractors immediate cost savings over any previous method of design review. In situations where models have been created in other applications and are available for review, it would be a mistake not to use a coordination tool such as Navisworks.

AUTODESK NAVISWORKS MANAGE & AUTODESK BIM 360 GLUE

Considering the many designers who are involved in the model and their various roles, it's easy to see where their designs might conflict. One designer makes models of pipes for waste and water, another creates the air ducts, a third models the floors, walls and ceilings, and a fourth details the structural elements (not to mention low voltage, fire sprinklers, pneumatic tubes and everything else). Navisworks Manage is DPR's preferred tool for clash detection—the process of reviewing all the models for any conflicting overlap.

In the world of BIM, an individual 3D item is called an “element.” When two or more different elements occupy the same space, Navisworks can report the conflict as a “hard clash.” The tool can also run a “duplicates” check of a single model to see if the problem is actually that two people have modeled the same item in exactly the same space.



Why is clash detection so important? Because once it's time to build in the field, it's physically impossible to have two things in the same exact space. This means that an unresolved clash in the model would force a field crew to either make modifications, which takes time and could have unintended consequences later down the line, or stop work because the clash can't be easily resolved.

There are two important parts of clash detection where construction experience and knowledge are critical.

- The first is when using the tool to check for instances where model elements may be too close together. The software calls this a "soft clash." Making a decision about a soft clash requires knowledge about exactly what is being constructed and how, and how the building will operate.
- The second—and probably most overlooked—aspect of model coordination is the "human factor" of deciding who must rework their design. When a clash appears it means at least one party must go back and change their model, which was labored over and believed finished. The process of creating a highly accurate BIM is one part technology and three parts negotiation.

Autodesk BIM 360 Glue is one of several new applications that present model data that is stored on a "private cloud." These sorts of applications are gaining popularity because they don't require a powerful computer to operate—just a connection to the data. Glue has many of the same features found in Navisworks and will run on just about any computer or on an iPad.

In addition to Navisworks and Glue, model coordination can also be done using Solibri Model Checker, Bentley Navigator or Tekla BIMSight.

Visualization

Visualization tools are capable of creating photo-realistic images or animations of a proposed project that are easily understood and informative. High-end visualization is often thought of as the domain of the designers, yet it can also be useful for construction. One popular tool called Lumion was added to DPR's ever-growing list of applications when Hardin Construction joined DPR in 2013.

LUMION

Models created in an authoring tool (such as Autodesk Revit) can be accessed with Lumion. Lumion allows a user to add many interactive, animated elements, as well as life-like textures and details to the basic model. The resulting visuals are very compelling for presentations to a variety of audiences, and Lumion report is easy to quickly learn and use. DPR even has an interest group called Lumion Corner to share models and tips on Yammer.

Besides Lumion, there are many other options available for creating visual content, including Autodesk 3DS Max Design, Autodesk Maya and Graphisoft BIMx. AR Media (an add-on for SketchUp) produces specialized graphic content. Many of the authoring applications have the ability to produce very good visual content as well.

Analysis & Measurement

These tools analyze a proposed design for code or environmental impacts. Many analysis and measurement apps are highly specialized and can check for quality and conformance to very specific requirements. But they require a thorough knowledge of relevant regulations and how they apply to the project in order to “ask” the right questions and in turn, get the right data. For example: Are restrooms designed for ADA compliance? Were the emergency exit routes drawn with the necessary clearances?

SOLIBRI MODEL CHECKER

DPR has found that Solibri is the best app for analysis and measurement. Solibri is a model-checking tool like Navisworks Manage, with the added functionality of logic/rules-based checking. For example, if the project is subject to specific codes and regulations, a rule set in Solibri could analyze the model and detect any inherent code violations.

As a technical builder, DPR feels it is imperative to remain familiar with automated model checking tools such as Solibri. Solibri goes beyond checking for clashes: It analyzes a model for clearances relevant to the project type and location.

Besides Solibri Model Checker, DPR uses Autodesk Vasari and Green Building Studio to check design or actual building data against predicted results. Cyclone can process laser scan data into a useful basis for BIM. Finally, Autodesk Robot is a structural analysis tool that is also available.

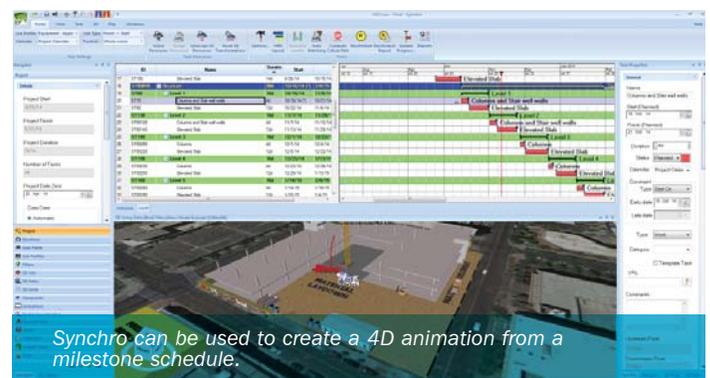
Sequencing

Generally, this category represents any application that can take a process or construction sequence and display it visually, clarifying the proposed schedule and helping to put everyone on the same page. Any application that animates a 3D model over time is called a 4D modeling tool; it uses schedule data to visualize the actual process of building in the field.

SYNCHRO

Synchro produces detailed animations and visualizations of a construction sequence and works well with other scheduling tools. For example, Synchro can read information from Primavera, attach it to elements in the model, and quickly generate an animation. 4D animations are extremely useful to help a team communicate and understand what is going to happen—and when—in the field.

DPR also uses Autodesk Navisworks to create animation from a timeline, similar to Synchro. The Vico Office Suite has some schedule-based model abilities. The use of scenes in SketchUp is a simple, manual way to show a sequence. Inventor Publisher can be used to show the inner workings of an assembly.



Estimating

Software that can report on quantities and predict costs is often referred to as 5D software. It's not science fiction—in our industry, the dimension of cost is the “fifth dimension.”

VICO

Vico uses DPR's proprietary cost-control database and provides its own native model objects as a replacement for any that aren't sufficient in an author's design models. Vico can read most types of models, and is among the most thorough model-based calculation and cost-estimation tools currently available. The native model components help with accurate cost estimates.

In addition to Vico, DPR continues to make use of Innovaya Visual Estimating for estimates. A tool called On-Screen Takeoff is a great alternative for estimators when reviewing PDF drawing sheets.



Conclusion

The applications outlined in this paper represent a sampling of some of the current market leaders in each category of VDC apps. This list will continue to evolve, like everything in the fast-paced world of software development. New and improved apps will continue to roll out that offer additional capabilities and benefits tailored to an ever-changing marketplace.

It is critical that every member of the building team—from the subcontractors to general contractor to designers to ultimately, the owner—work to stay educated about what specific apps can do and how they best benefit the overall project outcome. DPR regularly offers training and encourages team members to learn about new and emerging apps to effectively use them to deliver the best value, highest quality project possible.

For owners, the payoff in understanding more about the benefits and tradeoffs of individual BIM apps is clear. With understanding comes enhanced vision and insight into how highly knowledgeable teams use these tools to create more efficient and productive work processes and ultimately, better projects. This knowledge helps owners know what to look for and what questions to ask as they select teams to build their facilities, both now and in the future.

85%

Percentage of DPR projects that use virtual design and construction tools before work in the field even begins.



GETTING THE MOST OUT OF BIM AUTHOR

Andrew Fisher, LEED® AP O+M, is the BIM applications engineer for DPR Construction. He is a seasoned project coordinator with 10 years of AEC industry experience from the design side. Andrew earned degrees from UC Berkeley in Architecture and Legal Studies, and is one exam away from becoming an architect. A top innovator at DPR Construction, Andrew is passionate about emerging technologies, such as 3D printing and augmented reality.

DPR Construction is a forward-thinking national commercial general contractor and construction management company based in Redwood City, CA, which specializes in technically complex and sustainable projects for advanced technology, life sciences, healthcare, higher education and corporate office markets.

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