

BIM and DWF

This white paper explores how DWF™ technology extends the building information modeling (BIM) design process and facilitates the sharing of the consistent, coordinated information that comes from a building information model. Even when the design data needs to be shared outside the design team - with clients, contractors, city planners or other constituents in the review cycle that aren't Revit users or even CAD users.

About DWF

Studies suggest that the number of people needing to consume versus create design information is about 10 to 1. DWF was created for those information consumers. The DWF technology platform was developed by Autodesk in 1996 for creating purpose-built applications for design-centric workflows. Its function is to distribute and communicate design information to anyone needing to view, review, print, or access it for any purpose – without losing critical data and without these people needing to know or even have the native design software. A free* DWF Viewer is available from Autodesk and as of October 2006 more than 12 million people have downloaded it.

DWF files are *published* designs. They're not the original design model and they can't be edited - only marked up. Sometimes referred to as "light geometry," DWF files can carry very large data sets in a very compressed format, much smaller than the original design files. A gigabyte-sized design file can be compressed to a DWF file that's small enough to email – making the Internet a viable replacement for overnight mail or couriers.

The ability to publish to the DWF file specification is embedded in all Autodesk design applications, including the Revit® software platform. Revit users can publish their design data - multisheet drawing sets *and* the 3D model - in a single print-ready, password-protected DWF file.

How do imaging formats like TIFF, JPEG, or PDF compare to DWF? They don't capture the intelligence in a design model because they're basically just 2D images of 3D models and lack the attributes necessary for sharing design information. Or, like Adobe® Acrobat® 3D, they only capture the visual aspects of the model, and don't include the rich set of metadata available as part of the model, whereas DWF retains the 3D model geometry and intelligent design data of the original design model. They can even be used to transmit information to other applications such as facilities management or cost estimating.

BIM and DWF

DWF files are not building information models. Instead, they are a mechanism for publishing information from the building information model and sharing that information with extended teams. In fact, the coordinated, consistent, and reliable information delivered by BIM is the foundation for the value DWF can deliver in a building design workflow.

Revit models can be published and shared with non-Revit users: with the GC early on in the process to do constructability reviews, with the client to visualize the design, with a subcontractor to solicit pricing information, and so on.

The Revit user controls how a model is published to DWF – and thus exactly what information is shared. For example, you could publish a DWF file that contains just the electrical drawing set and the electrical model components together with the architectural underlay.

As mentioned earlier, DWF files are published models that can't be edited - but they can be interrogated. They're accurate representations of a model; someone viewing the DWF can measure distances, areas, and angles - snapping to model geometry. For instance, a building inspector could measure the area of a room or the distance between two electrical wall sockets.

Properties associated with building components are also transferred to the DWF. In the DWF Viewer, the user selects an object - a door, for example - and can see all the properties associated with that object: the door size, its fire rating, the frame material, associated hinges, and so forth. Perhaps it's a custom-order door requested by the client. The architect can add specification information to the Revit model, such as acceptable manufacturers and part numbers, etc. All this information is transferred via DWF, which is ultimately viewable by the builder for estimating - without any information being lost along the way.

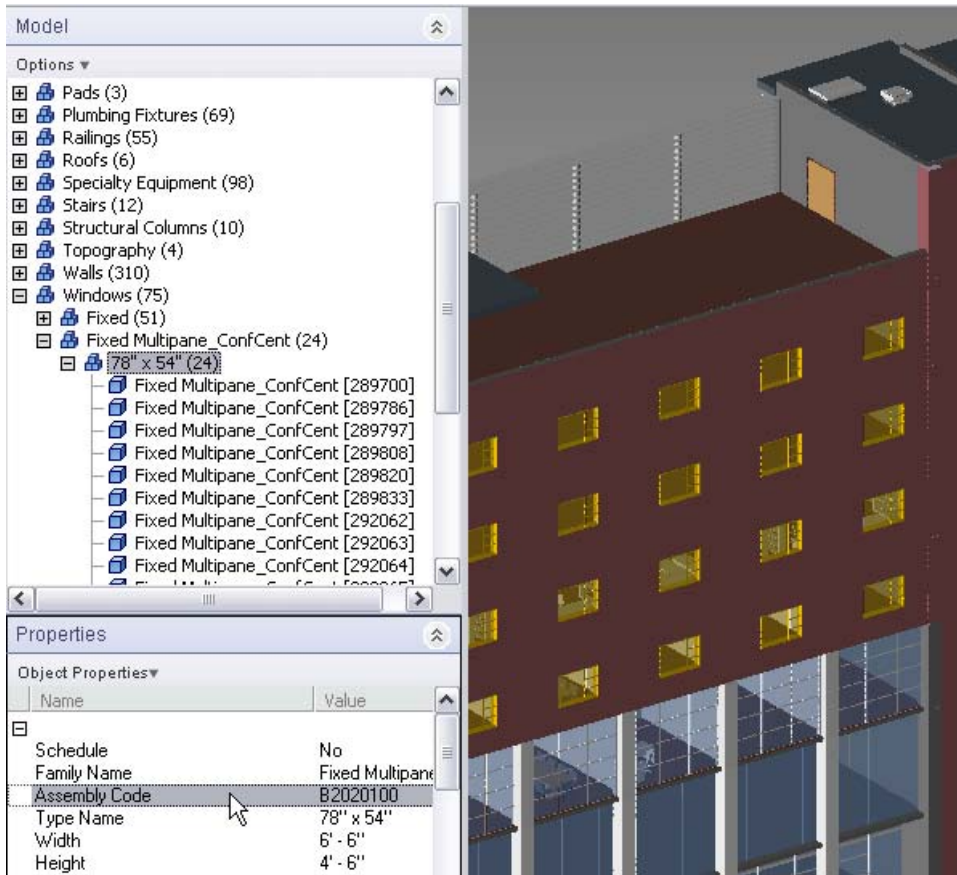


Figure 1: Properties associated with Revit building components are transferred to the DWF when the building information model is published.

The DWF Viewer provides powerful 3D viewing capabilities as well, allowing users to navigate through saved 3D views and specify the presentation mode: shaded, edges only, or shaded with edges. The model can be rotated around one axis or spun about in any direction. Users can also isolate, cross-section, and hide building model components.

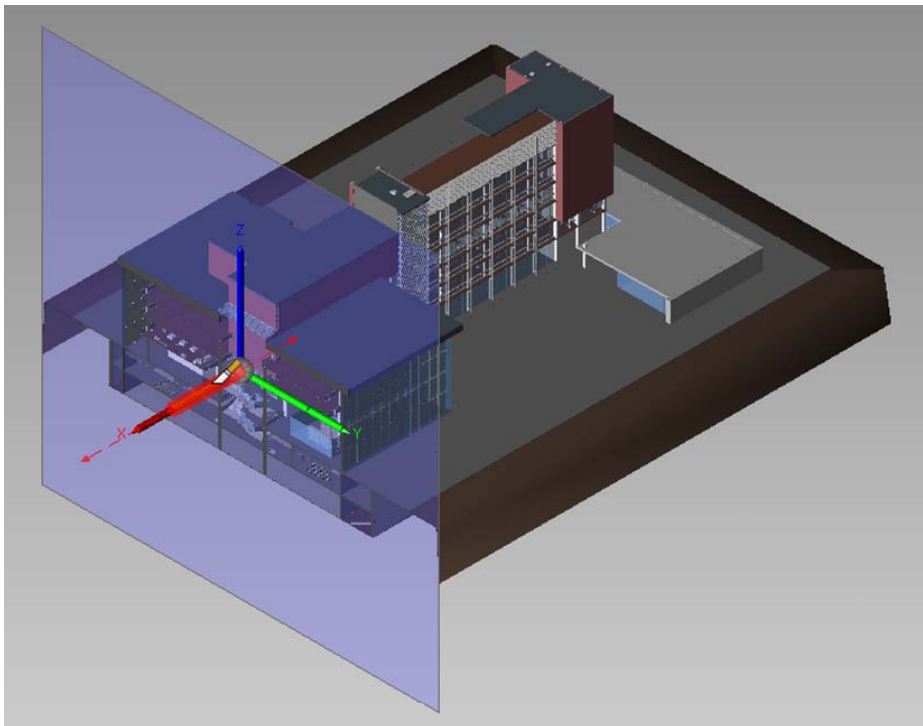
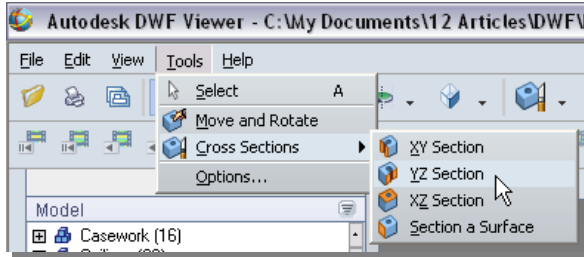


Figure 2:

The DWF Viewer can display cross sections of building information models. For example, click Tools >> Cross Sections >> YZ Section (above) and the section will be automatically placed along the Y and Z axes. The cross section can then be controlled in a variety of ways by using the section control grips to rotate, move, and slide the section plane in the model (left).

Beyond these viewing capabilities, DWF is also at the core of the Autodesk® Design Review software (formerly Autodesk® DWF™ Composer) – a completely digital way for a team to review, mark up, and track changes to sheet sets and building models.

Digital Design Review

Autodesk Design Review facilitates electronic review cycles by taking the building information model published to digital DWF files from Revit and tracking redlines to those DWF files. By minimizing paper, reviewers can reduce errors and minimize the risk of using inaccurate or out-of-date information during the review process.

Autodesk Design Review allows reviewers to measure and mark up the design (as published in the DWF), making their comments and notes in the context of the design. The software automatically keeps track of all markups. In this fashion, the input from all participants in the review cycle – CAD or non-CAD savvy, internal or external, at the construction site or down the hall – is “added” to the building information model and communicated directly back to the originator. Additional information can also be added to

the DWF – information like JPEG renderings, Microsoft® Word-based specifications, project timelines, etc. DWF becomes the lightweight container for that information, distributing it to participants in the design review process as needed.

The DWF format preserves all markup information, so comments or changes noted during the design review phase can be imported and tracked directly in Revit, enabling round-trip design review. The Revit user can systematically walk through a review set, navigating the markups for fast, easy revisions.

Examples of processes that could benefit from digital design review abound: sharing design data for pre-construction reviews, permit granting process for cities and municipalities, digital RFI process, or publishing designs to subcontractors for costing. The list is endless.

Let's look at one specific example of a company's sharing design data from a building information model: a construction company using BIM to better communicate the built environment.

Build Smarter, Build Better

J.E. Dunn Rocky Mountain, part of J.E. Dunn Construction, is a commercial general contractor with expertise in construction management, program management, and design/build projects. With offices in Denver and Colorado Springs, J.E. Dunn Rocky Mountain has over 270 employees in the region. In 2005 they put in place over \$205 million of work, with roughly \$280 million under contract for 2006.

J.E. Dunn Rocky Mountain uses Revit to enhance their pre-construction and estimating services, their construction visualization, the automated field layout for their self-perform concrete and rough carpentry work, and their subcontractor coordination. They typically receive drawings from the design architect and then create their own construction models within the Revit application. A Revit user since 2005, they use DWF files to communicate building data in two opposite directions: with their design firms, and with their field construction personnel.

To enhance the level of understanding of the project that they're building and reduce construction mistakes, they often publish 3D views of the Revit model to share with construction personnel on site. Rodd Merchant, Quality Assurance and Building Information Modeling Manager, gives this example. "We'll have a foreman on a job site, who's getting ready to pour a 60-foot section of wall. To help him understand exactly what he's building, we publish just that wall with all of its components to DWF, and then email the file to the foreman. He can look at it on his laptop in the construction trailer and really "see it" - spin it around, peel back sections, and query components for property information."

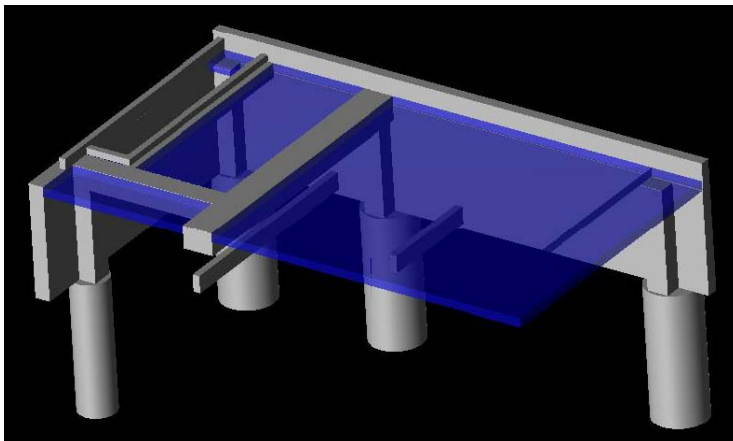


Figure 3:

J.E. Dunn Rocky Mountain uses DWF files to communicate building data to their field construction personnel, such as this DWF which displays two corner walls sitting on drilled pier foundations (the structural slab is highlighted in blue).

DWF also increases their level of communication with designers and speeds up the RFI process. For example, in their construction model they find an interference conflict. Rather than sending paper to the design team, they now publish the pertinent part of the model to DWF, use Autodesk Design Review to highlight and annotate the conflict, and send that RFI sketch off to the architect for a response. The digital process speeds up the effort on their end and gives the architect a clearer understanding of the RFI (a picture is worth a thousand words) producing an extremely quick turnaround time - sometimes minutes versus what used to be days - and reducing the number of change orders.

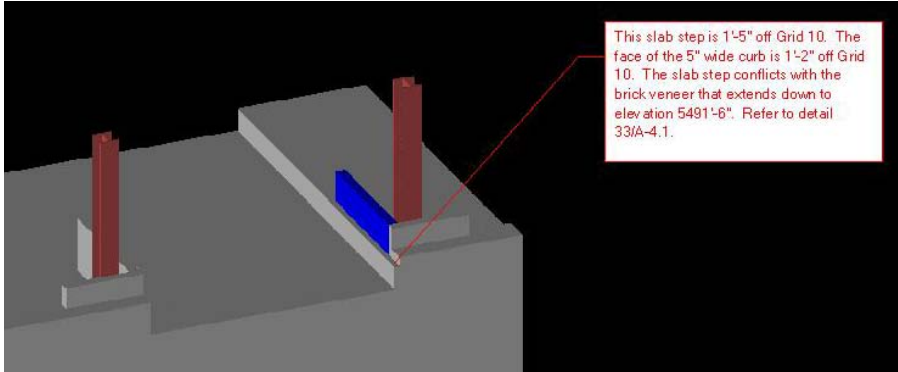


Figure 4:

J.E. Dunn Rocky Mountain also uses DWF files to increase its level of communication with designers and speed up the RFI process.

“The richness of the Revit building information model and its visualization capabilities allows us to gain a much better understanding of what we’re building,” states Merchant. “Using DWF coupled with Autodesk Design Review allows us to quickly and easily share that understanding with all the constituents in the building process: the architects who are designing the building, the client who’s paying for the building, and the workers on site who are actually building the building.”

Summary

Our global economy, fierce competition in the building industry, and increasingly complex building processes are driving firms to seek more efficient and effective methods of collaboration – inside and outside the firm. Publishing building information models using the DWF file specification is a better way to communicate a building design and can lead to faster review cycles, more complete RFI processes, and a decrease in ECOs. It's all about getting the right information to the right people - accelerating the design review process and putting design information in the hands of the people who need it.

About Revit

The Revit platform is Autodesk's purpose-built solution for building information modeling. Applications such as Revit® Architecture, Revit® Structure, and Revit® MEP built on the Revit platform are complete, discipline-specific building design and documentation systems supporting all phases of design and construction documentation. From conceptual studies through the most detailed construction drawings and schedules, applications built on Revit help provide immediate competitive advantage, better coordination and quality, and can contribute to higher profitability for architects and the rest of the building team.

At the heart of the Revit platform is the Revit parametric change engine, which automatically coordinates changes made anywhere — in model views or drawing sheets, schedules, sections, plans... you name it.

For more information about building information modeling please visit us at <http://www.autodesk.com/bim>. For more information about Revit and the discipline-specific applications built on Revit please visit us at <http://www.autodesk.com/revit>.

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