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The BIM Balancing Act: Tilt the Scales in Your Favor

Implementing BIM to Drive Fabrication

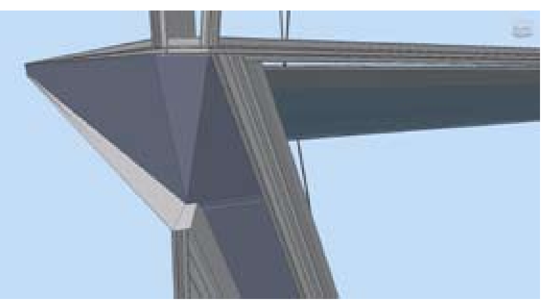
By Joe Williams, from Intertech Design, Inc.

IN JANUARY OF THIS year, a group of structutal engineers from the Advanced Building Design division at Intertech Design set out to accomplish a large task. They were to take a department of their parent company, Curtainwall Design Consulting™, and completely change the way they did business. CDC has a long history of providing proven solutions for the curtain wall and façade industry. They are well known around the globe with over 19 offices worldwide, allowing them to be a part of some amazing projects. Its principals are dedicated to delivering state-of-the-art solutions to their clients. Many of their divisions, including Intertech, have done so by implementing new technologies like Building Information Modeling (BIM).

It is Intertech's history and expertise with BIM that will allow them to assist their fellow workers in making the transition to a new way of working.

ADOPTION OF A NEW PARADIGM

CDC's Production department provides many services including fabrication drawings for façade system components. Previously all of this work was done using traditional 2D CAD.



Transitions like the one shown above were virtually "roughed-out" to prevent problems later in the project.

A separate view of the same transition area.

As building designs continued to get more geometrically complex, this job became more challenging and the need for designing in 3D increased.

This need was met by a select group of individuals that were able to digitally visualize tricky situations with basic 3D modeling. However, utilizing the model to produce fabrication documents was not possible. It was clear that a digital prototyping solution specific to the manufacturing industry was needed.

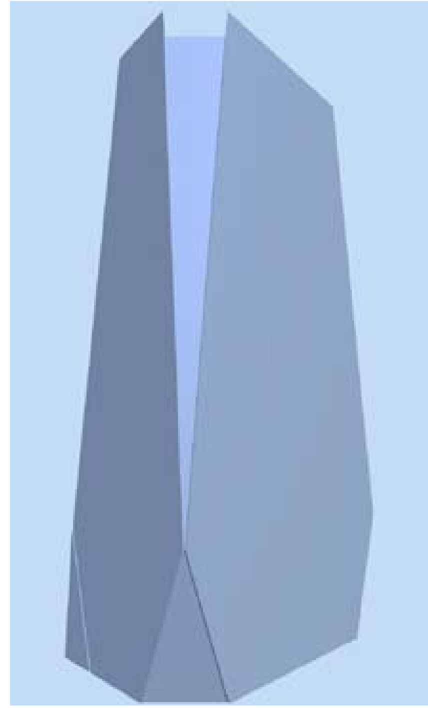
Getting various people to "buy in" to digital prototyping was not easy.

Clients were uneasy that it would not produce standard compliant results. Upper management was concerned about the costs of implementation and the delayed return on investment. Middle management struggled to find the best way to implement the technology into the flow of work, and no one wanted a losing horse on their team. The staff was overwhelmed with having to learn a new system, especially when some have been recognized as the best in the business at what they do. Each of these concerns had to be addressed continually throughout the initial stages.

One strong reason some in the building products industry have not been able to embrace digital prototyping is that most products currently available are best suited for industrial designers. Designing the types of façades CDC encounters each day does not follow the typical product development cycle. A majority of CDC's work is custom designed for each customer. Vendors, having realized the growth potential in the AEC market and that most software available lends itself to items that are mass produced, have added features like rapid frame builders and custom content libraries that have greatly increase the software's flexibility.

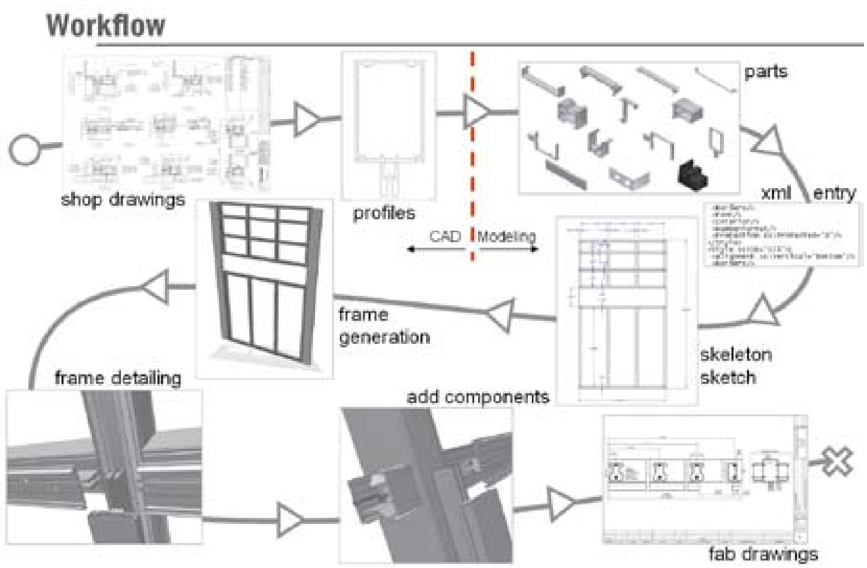
STARTING SMALL

Work began small to develop a method for utilizing these new tools. The employees chosen for the initial stage had been educated in 3D design and understood concepts such as relational databases. They had been exposed to a number of different software platforms and were able to begin producing immediately. This quick success was a vital part of easing managerial concerns. Parts from existing jobs were re-worked to produce digital prototypes. Some were of the average variety, while others represented the more complicated projects becoming more common. These examples were provided to clients and management to

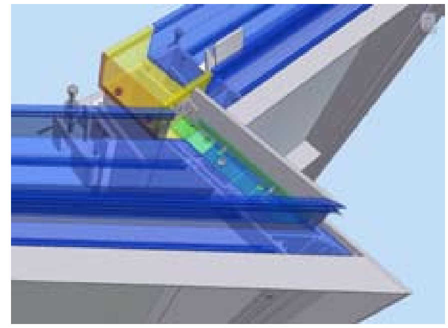


An image showing one of CDC's complex projects.

A rendering of the completed mockup model.



A slide from an internal training presentation outlining one of the developed workflows.



Complex sections of the models could be manipulated to allow for easy review by management.

demonstrate that digital prototyping software could produce similar results to 2D CAD.

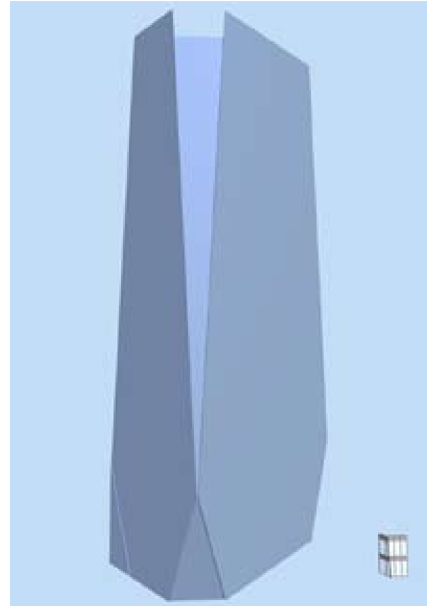
Eventually work on a pilot project began. A small test region of an actual building referred to as a performance mock-up was chosen. Its small size and simple geometry ensured a limited staff would be able to complete it successfully. A project manager from the production department at CDC oversaw the work of the engineers from Intertech. They were able to produce tangible results while the more experienced managers from CDC provided knowledge of the complex systems. Thankfully the CDC management had the foresight to see how this blend of people proficient with technology and those familiar with the end product would be a key contribution to the success of the pilot.

The company had originally tried unsuccessfully to implement this new technology by simply training a number of its staff. The knowledge of how the software worked was not enough. A process for how to integrate digital prototyping had to be engineered. Outsiders, those not involved in the day-to-day operations of the production, offered a fresh perspective and were less impeded by the desire to do things the way they used to be done. The BIM process involves changing your mindset. It incorporates dimensions of data non-existent in 2D CAD. A model has the potential to generate a Bill of Materials, or it may be passed on to an engineer for use in analysis, or to a fabricator to drive production equipment. Gone are the days of overriding dimensions in CAD so something "looks" right.

Some of the benefits are captured before the model gets downstream. Digital prototyping afforded CDC's management with the ability to validate and dissect designs in 3D with inexpensive review software before fabrication documents were produced. In addition, a number of transitional conditions were worked out in real time thanks to the ease of modeling and availability of custom created sections that could be interchanged. This approach of having a designer see the results of his ideas modeled instantly had never been done before at CDC.

TRANSITIONING TO A FULL-SIZE PROJECT

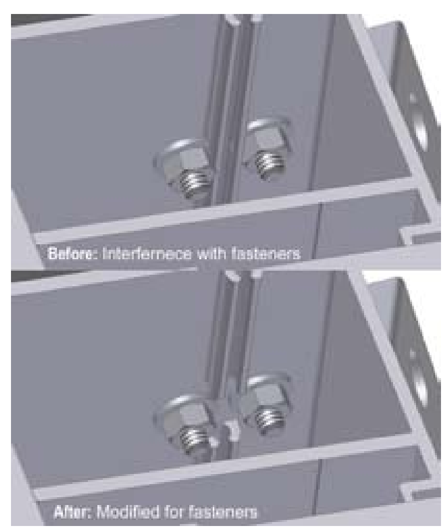
Generally the consensus for moving into the next phase of implementation is to gradually increase the size and scope of projects. CDC increased the size of the next project by 450 percent from the pilot phase. This should come with a disclaimer: "attempt at your own risk." For CDC this was justified because the actual building chosen was based on the mockup from the pilot project. This kept the engineers,



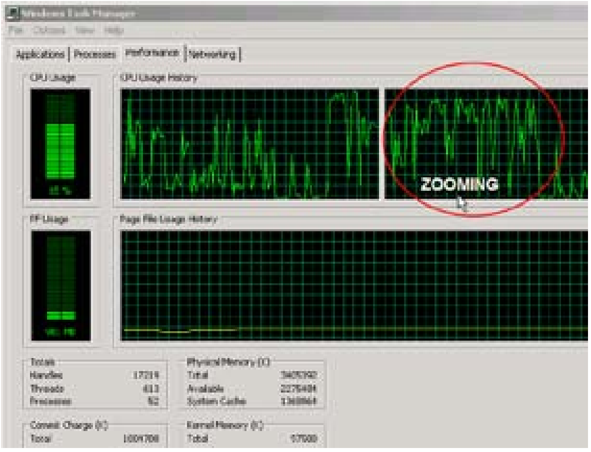
A graphic representation of the difference in size between the mockup and the building.

who were less familiar with façade design, from having to learn a new system. This decision was not without fault.

The first challenge would be training additional staff to make up for the increase in work. Rather than hire outside educators, internal staff was used to develop an accelerated training program that focused on aspects of the software specific to the job. As progress was made and as workers gained confidence, additional skills could be learned. Once again, the engineers from Intertech combined with staff at CDC that had a strong knowledge of the project. Some aspects of the workflow remained unchanged. A decision and compromise had to be made as to how much to model. In the



Many fasteners when inserted as shown on the shop drawings, interfered with other members. Digitally prototyping the curtain wall revealed these issues before they became problems in the field.



A screen capture showing the load on the CPU from simply zooming on a complex model.

end, minor elements like gaskets were left out in favor or fasteners which were shown to provide valuable feedback.

The next challenge was computer hardware. The new software required strong processors, video cards, and fast, reliable network connectivity.

The typical 2D CAD workstation was not up to the task. This demand for resources was driven by a huge increase from the pilot phase in the number of models and their complexity. Certain aspects of the project had to be handled by specially designated computers capable of processing difficult tasks. These tasks included assembling units to form a completed wall, or modifying many members in a single step.

CLOSING THOUGHTS

This article had originally been intended to highlight the use of a digital model to drive fabrication machinery. This is one of the many downstream benefits of digital prototyping. The final file can be read into a machine and produce an accurate working part saving up to 30 percent of production time. This benefit however is just one of the many available when using a digital prototype. More important is the steps required to implement such technology and the mindset that must accompany the new software. In the end, the simple action of building something digitally gives you a profound new understanding of your design. Many of the designers would later remark how actually seeing the system modeled was much like having their light bulb turned on during their first site visit.

Integrating digital prototyping into a business is not without difficulty, but there are many resources that can make the transition a smoother one. Software resellers offer support and guidance that no book or forum could replace. Industry events like seminars or user groups are great places to share ideas or get advice. The atmosphere at such events are surprisingly open and the opportunity for learning is great. If you have any questions or comments about the article or the projects mentioned, please contact the author at jwilliams@idise.com.

Joe Williams, EIT is a structural engineer and digital solutions specialist for the Advanced Building Design department at Intertech Design, Inc., which is a charter member of NBIMS. He is a member of SEAoT's State IT Committee on BIM in Structural Engineering. He has assisted in developing presentations on BIM & sustainable design technology for SEI's Structures Congress, and AGC's national BIM Forum. Additionally, he has assisted at Autodesk's national conference on the topic of integrated structural engineering and BIM. Mr. Williams has a Master of Science, Architecture from Mississippi State University, with a focus in digital design and design visualization. His Bachelor of Science was in Civil Engineering from the University of Memphis, with a focus in Structural Engineering.