INTRODUCTION

Today, a new method of project delivery is emerging. Through new digital platforms, companies like A. Zahner Company are setting the example for how early insight from fabricators and installers, and an integrated supply chain, can significantly reduce rework on highly complex projects. When the experts responsible for fabrication and installation can provide insight early in the design process, and all parties have the tools they need to collaborate closely throughout, construction waste can be reduced. Owners are realizing the benefits of collaborative AEC teams include not only reduced waste, but also stronger adherence to schedules and reduced costs.

Collaboration is improving through use of tools such as the cloud-based 3DEXPERIENCE® platform from Dassault Systèmes. This 3D-based modeling solution brings teams from multiple organizations, small and large, widely-distributed geographically, together to create a single, live source for project creation. By ensuring all project stakeholders are on the same page from design through execution, owners gain tremendous transparency into a project’s feasibility, and all AEC parties have access to the knowledge they need to successfully speed projects to market.
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ZAHNER: IMPROVING AEC EFFICIENCY THROUGH FACADE DESIGN INTEGRATION

A. Zahner Company is challenging the traditional role of a fabrication company on an AEC project and delivering significant value in the process.

Based in Kansas City, Missouri, Zahner has a long history in the sheet metal fabrication industry, dating back to 1897 when it was founded by Andrew Zahner. The company has undergone several transformations through the years, providing a variety of sheet metal solutions.

In the 1980’s, L. William Zahner took the reins as the fourth-generation CEO of the family business. The company moved beyond producing standard systems to exploring architecture as art, just as the design world was beginning to explore new technology-based design solutions.

Exploring New Capabilities
In the late 1990s, Zahner began working with Gehry Partners as a consultant, manufacturer, and installer on their team’s complex projects. “Digital capabilities started to develop in the 1990s, so we were able to engineer products much more effectively,” says Ed Huels, Director of IT / VDC Services, Zahner. “It allowed us to define our building structures and create much more complex geometries than we could do using pen and paper.”

The company found its niche using parametric design to develop architectural designs. By developing dynamic methods to output shop files, the company was able to accurately fabricate highly complex geometries in the shop.

“At the end of the day Zahner’s core business is as a fabricator, so being able to design those buildings with confidence and a high degree of precision was very important and allowed us to succeed in that market,” Huels says.

As complexity becomes standard in construction, there’s one area in this evolving industry that could benefit from simplification: the relationship and communication clarity between owners, architects, and contractors.

Need for New Relationships
Design-assist and design-build relationships—in which specialty subcontractors become involved at the outset of the design process—are becoming a necessity for complex projects. By bringing certain subcontractors into the process early, designers can reduce component rework and mitigate connection errors in the field.

Design teams typically bring Zahner onto projects early in the design phase to help prove that the architect’s concept is both buildable as well as feasible. It also allows the design team to discover potential problem areas and develop design solutions.

Traditionally, the AEC industry is built on a downstream relationship between owner, architect, and general contractor. “That needs to be redefined because there are so many stakeholders who have expert knowledge how things should be done,” Huels says. “Expecting the design team to be experts who are able to sign off on everything—this doesn’t seem to work anymore.”

Huels sees one solution: “Legally and contractually, the AEC Industry needs to change from a 2D world to a 3D world.”
**Instilling Trust**

Zahner uses Dassault Systèmes’ solutions to improve collaboration among all parties involved on a project and provide a high level of transparency to the designer and owner. It also enables Zahner engineers to easily address problem areas and conflicts early on in the process and to demonstrate the feasibility of various design features at the earliest stages of a project.

Although all of Zahner’s work is done in the 3D environment, contractually the company is still required to produce a 2D drawing that is outdated virtually the moment it’s produced. “We rely on the model and what it tells us. If we can instill that level of confidence and way of operating in the industry as a whole, I think that could improve everybody’s processes” Huels says. He adds, “If we could make the 3D model the contract document itself, that would go a long way toward improving the industry.”

**PETERSEN AUTOMOTIVE MUSEUM: HOW DESIGN-ASSIST MODELS ARE REVOLUTIONIZING FAÇADES**

Supply chain integration enables project teams to produce a façade twice—first completely in 3D, then in the shop—actually moving complex buildings to completion more quickly and efficiently.

Kohn Pedersen Fox (KPF), the designer of the Petersen Automotive Museum in Los Angeles, brought Zahner onto the project during its early stages to prove to the owner that the proposed façade—a complex swirling structure of stainless steel ribbons—would indeed be possible to fabricate. The fabrication team began and lived in a 3D world from the start.

“We took the architect’s surface information and built out all of the parts based on their original 3D model,” says Shannon Cole, Senior Project Engineer at Zahner. The project called for the design of 26-foot long unitized pieces that spanned from one anchorage point to another.

“For the structural design, we laid out a wire frame and provided this to our structural engineer for analysis,” Cole explains. “This wire frame was then used to fabricate not only our scope, but the structural steel as well. Because [the architects] did their detailing in separate software, the next step towards actually building this was to bring it into our CATIA® model as a cross-check to verify that they were providing the required geometry.”

Cross-checking geometry enabled Zahner engineers to accurately verify that each of the more than 300 unique ribbons were correct. The team relied on Dassault Systèmes’ CATIA brand solutions to create knowledge patterns that could be adapted for each element.

The CATIA software also enabled Zahner engineers to export and manufacture the parts. As Cole explains, “From CATIA, we had basic scripts that would export all the files to our shop in .dxf format. That’s what gets cut on our factory floor.”
While the process of designing each ribbon was fairly complex and required design expertise, the fabrication and installation process was much simpler. “Essentially, we’re building it twice,” explains Cole. “We build it once using CATIA, and then we build it again on our shop floor. So it’s important to get everything right when we build the design in the model, so that the fabrication and installation processes flow smoothly.”

This process of “building it twice” is executed in a managed structured engineering practice, similar to what you might find in the construction field.

“We had a limited number of senior engineers who worked on this at the conceptual phase, and when production began, we were able to bring in additional junior engineers who could smoothly transition into producing the additional system design work. The model allowed them to quickly release a lot of parts to production based on the rules and knowledge patterns that were used,” Cole says.
In nature, “chrysalis” refers to the metallic-gold shell that encases a butterfly’s metamorphosis. Like its namesake, the Chrysalis Amphitheater in Merriweather Park, Maryland is making a bold transformation.

The futuristic band shell, designed by Marc Fornes of THEVERYMANY, features a dual-curved steel and aluminum shell over a concrete base. From curved tubes to custom shingles, the project is a wide-ranging, geometric display made up of many unique panel-types.

The model kept installation simple as well. “One of the most fantastic things about this is that there were a hundred parts unique to each and every one of these panels, but the way everything fit together for these elements, the parts checked each other,” Cole says.

The installation team used jigs to ensure the location of critical points on the product. From there, the finish skins simply had to have their corners come together correctly to demonstrate accuracy. “Everything went up in the field fantastically well,” Cole says. He attributes the accuracy to reliance on and trust in a 3D model. “Even when there were problems, the model allowed us to identify them early, we knew exactly what we were getting into at every step.”
Shannon Cole, Senior Project Engineer at Zahner, is responsible for transforming an artist’s design into a realized form. “We’ve been using Façade Design for Fabrication for modeling in some form or another for over a decade. The 3DEXPERIENCE platform brings the CATIA application to the next level,” says Cole. “What we love about the 3DEXPERIENCE platform is the way that it adds other functionality available to us through Dassault Systèmes’ ENOVIA® Project Management, to improve our ability to collaborate all the way through the supply chain.”

The company, along with the entire Chrysalis project team, has brought the amphitheater project to life in a virtual world. Using collaborative modeling tools, they were able to make decisions quickly, resulting in positive impacts on schedule and budget.
To manage the complex geometries and ensure everything fits together in the field, the shell has been developed from the ground up in a 3D environment. The Chrysalis will be the first major project for Zahner engineers to run on Dassault Systèmes’ 3DEXPERIENCE platform. Having used the company’s CATIA software for many years, the 3DEXPERIENCE platform brings multiple software packages together on a cloud-based system, increasing visibility for stakeholders, and empowering collaboration between teams. According to Cole, older software once constrained fabricators, since those tools were imagined with the architect in mind.

**Coordinating Throughout**

Cole notes that the Chrysalis project presents a challenge in that, even though Zahner is contracted by the owner, the subcontractor must coordinate closely with the project’s general contractor who is performing the site work and laying the concrete pad. “Coordination between us will be critical,” Cole says. “It’s important to show them how we envision this being erected.”

For example, through a tab in the 3DEXPERIENCE dashboard, Zahner has been able to easily coordinate concrete embed locations with the general contractor.

“This way we get high level of agreement from the general contractor that, yes, that’s the concrete slab they’re going to build, and we can ask for base plates to be in those locations,” Cole says.

**Improving Collaboration**

“We’re giving access to the owner and architect to let them know where we are and how things are moving forward because design is a tricky process—it’s not always linear and straightforward. Decisions that seem relatively small can have big impact, so transparency helps people see why you’re agonizing over, for example, a single clip and why it’s important to you,” Cole says.

For example, as the façade team explores how the shingled skin appearance will be achieved and how it might look in its finished state, Zahner is able to post photos on the dashboard to demonstrate what they’re aiming to achieve. That helps bring new team members up to speed, and makes the owner a more integrated part of the team.
Transforming the Process
Between the Chrysalis’ limited reliance on 2D drawings and its high level of transparency, the project demonstrates the transformation taking place in the AEC industry. “The interconnectivity across disciplines—upstream and down, from design through fabrication, installation and analysis—is huge for our industry,” Cole says.

This collaborative virtual design not only helps to engage all AEC team members, giving them all a high stake in the finished project, but it takes full advantage of all of the knowledge available from the full team throughout the life of the project.

CONCLUSION
The use of parametric design is poised for continued growth, particularly as tomorrow’s architecture students enter the field already knowledgeable in cutting-edge software solutions. As a result, buildings are certain to become more complex. At the same time, owners continue to seek ever-faster speed to market at a reduced price tag.

Projects such as the Chrysalis Amphitheater and the Petersen Automotive Museum are living proof that collaborative project delivery and supply chain integration can prove hugely successful for AEC professionals and owners. Fully integrated supply chains may become more common in the future as a solution for further boosting knowledge sharing. For now, however, those companies that adopt the tools that support this approach are likely to stand out in the marketplace for the tremendous benefits they can provide.

For more information about the technology used to power Zahner’s projects, and solutions enabling end-to-end collaboration across AEC teams, contact Dassault Systèmes.

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