NOVEMBER/DECEMBER 2017

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VPI: Transforming the Way Rebuilds are Delivered

Very different rebuild projects at two Midwestern mills both found success through Virtual Process Integration.

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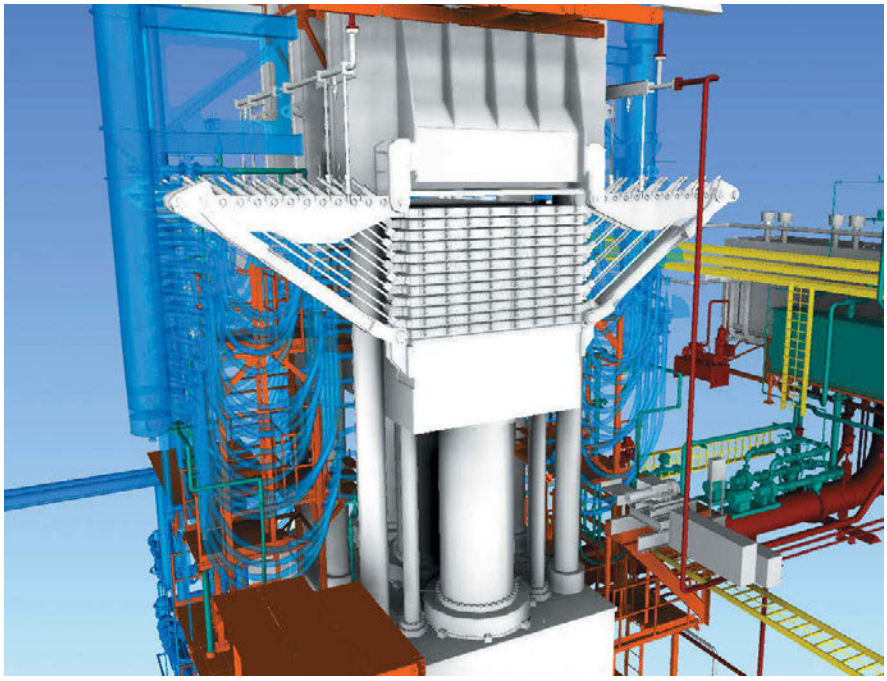

LP press equipment coordination and installation sequencing.

The 3D model, overlaid on the laser scan, as part of the LP project.

Collaboration. It's a word often overused today. However, when executed well, true collaboration can transform how business is done.

At Miron Construction, collaboration has transformed the way rebuilds are being delivered for several clients in the forest products and paper industries. The company is using new and existing technologies in a different way, pushing for all project stakeholders to be at the table at the onset of a project. This method is called Virtual Process Integration (VPI). Over the past five years, VPI has streamlined the design, prefabrication, and installation/construction process for several of Miron's clients, resulting in significant cost, material, and time savings.

VPI centers on the creation of a consolidated 3D model. Miron serves as the model integrator, and design/engineering and subcontractor disciplines contribute to this "living" 3D model. This technology decreases design errors by detecting clashes or interferences between elements of the equipment and the building. By identifying these clashes early, the entire team can address any issues and avoid costly changes that would have otherwise happened in the field. It also means that a great deal more of the project can be prefabricated offsite, increasing installation efficiency.

The users (such as operators and maintenance staff) are an integral part of the process and often add value to the design, ensuring that the building and equipment operate seamlessly at start-up. In terms of time saved, cost reduction, and overall predictability, the ROI can be substantial.

The following rebuild projects used elements of VPI, and it has transformed the way both organizations approach rebuilds.

PROJECT 1: LOUISIANA-PACIFIC

Louisiana-Pacific (LP) is a global leader in engineered wood products, manufacturing

wood framing, siding, OSB panels, and more. A project at LP's Hayward, WI, facility involved an extensive rebuild of an existing hydraulic press and lap siding line. All project players participated in the engineering, fabrication, and construction phases of the project, using 3D models as their basis. Moreover, all 2D installation drawings were created from the 3D models to ensure the model and drawings were accurate and retained their integrity.

Ultimately, the goal was to decrease the total installation time when compared to the traditional design/engineer/bid and construct method. Other goals included decreasing the overall project cost and reducing some of the duties that LP's lead engineer had taken on with previous non-VPI projects.

What Made This Project Unique?

Laser scanning and its integration with the 3D model were major contributors to the project's success. Laser scanning expedited the process of capturing and documenting existing building conditions. What formerly took days with a tape measure was now completed in hours with a laser scanner. This scan allowed the entire team to fully understand utility tie-ins and other facility infrastructure surrounding the actual equipment, as well as plan the installation of new equipment.

By integrating scans into the process, the existing press and lap line equipment were visually verified in a matter of hours, with much more accuracy than traditional methods. Laser scanning was also integrated into the 3D model for better design decision-making and earlier cost estimating.

In addition to scanning, another unique aspect of the project was the involvement of multiple trades much earlier in the process, before bidding occurred. All project stakeholders (specifically the engineer and MEP trades) participated in the 3D model coordination process to ensure the ideal fit of the equipment and to eliminate clashes. These multi-trade coordination meetings minimized field changes and duplication by fully coordinating the project before construction began.

With the integration of the scan and the 3D model, Miron was able to:

- Identify the ideal location for the equipment, including utility connections
- Identify existing building and equipment constraints
- More efficiently produce installation dimensions without costly visits to the jobsite
- Build the project electronically and analyze it prior to construction

4D Time-Lapse

As always, time was of the essence throughout the entire project, especially as final placement and alignment of equipment occurred, which often required around-the-clock staffing. To aid in this effort, the team created a 4D time-lapse of the rebuild and new equipment installation. This time-lapse confirmed the accuracy of the installation schedule and educated all of the installing trades on their role in the installation sequence. The process used a cloud-based solution that synchronized information between all stakeholders. This ensured information was accurate and up to date, and any engineering or installation changes were addressed immediately. Rework in the field can account for as much as 15 percent of a project's cost, but that was avoided on this project through accurate coordination.

In addition to scanning, the Miron team used a FARO Laser Tracker to validate the existing press plug line, center of the press, and layout of new plug reference lines for all new equipment. The challenge was to take highly critical connection points and positions of existing equipment tie-in points and make them actual in the virtual model.

By integrating the laser scan, collaborating with the entire project team using 3D models, and using laser tracker technology for alignment purposes, the project team eliminated wasted time and materials in the installation phase of the project. Over 95 percent of the contingency on this project was saved due to the avoidance of clashes/interferences between the building and equipment systems.

The lead engineer for LP reports that, for every interference between two or more systems, the average cost to fix is about four times the cost of installation without an interference. This engineer was so impressed with the cost, time, and overall improvements that he requested Miron develop custom VPI standards for the LP organization.

Miron Makes Top 100

Miron Construction Co., Inc. is a private company headquartered in Neenah, WI, with four regional offices in Wisconsin (Madison, Wausau, Milwaukee, and Eau Claire) plus one in Cedar Rapids, IA. In May 2017, the fast-growing company was ranked at #87 (based on 2016 revenue of US$898 million) on the "Top 400 Contractors in the United States" list published by *Engineering News Record (ENR.)* Miron puts more work in place in the state of Wisconsin than any other contractor (based on Midwest revenues), according to *ENR Midwest*'s 2016 "Top Contractors" list. Miron also provides pre-construction, construction management, design-build, industrial, and general construction services nationwide. Visit *www.miron-construction.com*.

PROJECT 2: CONFIDENTIAL CLIENT

A global company in the pulp and paper industry (the Owner) approached Miron looking for an alternative way to deliver a paper machine rebuild at its mill.

Like LP, this rebuild project benefited from using laser scanning to capture the existing equipment and building conditions. But this project team also needed to integrate the existing 3D model with the new equipment and systems. The typical process was to use an existing 2D CAD file that had been duplicated over and over as the mill made facility changes over the years. (This method often leads to inaccurate existing equipment and building layouts that unfortunately make their way to installation, resulting in costly changes in the field.) In this case, VPI eliminated inaccurate existing conditions and paved the way for the Owner, the engineer, suppliers, and trade contractors to design and fabricate with confidence.

Tech-Enhanced Collaboration

For the Owner, this process integrated several technologies never brought together before, including the use of surveys, scanning, and alignment equipment, as well as 3D models developed by the engineer, OEM, and trade contractors.

As the 3D models developed—often daily—all stakeholders received the very latest models through a fully synchronized web-based system. Weekly model review meetings allowed the team to discuss and resolve coordination-related issues and the hierarchy of system

For Project 2, the 3D fabrication model was overlaid on the laser scan.

The compiled model for fabrication coordination for Project 2.

routing. Integrated design models allowed the Owner's lead engineer to direct changes early.

Thanks to the VPI approach, a clash-free design model set the project up for success. The beauty of this process is that it did not end with design. Rather than the design model being further developed, trade contractors were engaged early in the process to develop fabrication models for the purposes of creating the installation drawings. This also allowed the Owner's lead engineer to visualize and inspect exactly how systems would be installed within the existing conditions. In one instance, the heat exchanger was relocated multiple times until its final placement was accepted. This design change occurred over a period of days, not weeks, eliminating wasted time on this project.

As is the case with most projects like this, time was of the essence. In order to visualize and plan the down and rebuild, the project team linked the 3D model to the shutdown schedule (creating what is known as a 4D schedule). During multiple pre-shutdown scheduling meetings, this 4D schedule/time-lapse allowed the project team to visualize the schedule updates, allowing for faster and more efficient decision-making. With the time-lapse, the team had the ability to walk through the entire shutdown duration in four-hour increments.

SUMMARY

The use of VPI on these projects promoted collaboration, stimulated innovation, and enabled better and faster decision-making. The project teams experienced efficient installation of systems and equipment and enhanced alignment accuracy, all while delivering lower project costs and minimizing costly downtime. The significance of this process will have far-reaching effects on both organizations as they pursue future projects.

"I think the [VPI] program is very good, and definitely cutting edge," commented Mike Kershaw, regional engineering manager at LP. "I've been fortunate to be a part of it. The system has been working well for us. I know it has resulted in a better quality product, and has definitely saved us some money on rework costs and schedule delays."

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