

THREE ELEMENTS TIMBERWORKS, INC.

Building residential works of art in timber with SolidWorks



Three Elements Timberworks uses SolidWorks 3D design software to automate the design and manufacture of its custom timber frames.

Using timbers for structural support, interior aesthetics, and exterior beauty is a centerpiece of architecture in America's Rocky Mountain West. Wood homes are very popular in the region because they complement the natural mountain setting and the rough-hewn spirit of the West. People who live in timber-framed homes have a passion for wood architecture—a passion matched by Three Elements Timberworks, Inc., the region's leading artisans in structural wood.

This Colorado timber frame contractor combines its expertise in timber joinery and wood framing construction with the latest design technologies to produce true works of residential art. The firm's advanced engineering-based approach to the design and assembly of hand-cut, custom timber frames—for interior and exterior residential and commercial projects throughout the Rocky Mountains—led owner Eric Seelig to investigate the application of 3D technology.

Three Elements once used AutoCAD® 2D design tools to support its design effort. However, several factors, including productivity improvement and capability growth, prompted Seelig to make the transition to 3D. "We were looking for a competitive advantage to set us apart from other timber framers," Seelig explains. "Not only were we looking for a more efficient virtual workshop where we could explore more contemporary timber-based designs, we also wanted to make greater use of other materials, such as steel and metal castings.

"We believed a 3D design system would allow us to automate design and manufacturing, as well as expand the range of structural designs that we produce," he adds. "We are a high-mix, low-volume manufacturer. The faster that we can deliver on a broad range of timber-based structures, the more successful we will be."

After evaluating the Pro/ENGINEER® and SolidWorks® 3D CAD systems, Three Elements chose SolidWorks design software because it is easy to use, accelerates production, and represents a better value. "SolidWorks provided the design capabilities that we needed to grow the business," Seelig says.

Challenge:

Accelerate the fabrication of timber structures to support home construction, while incorporating the use of metal and other materials to improve strength and design aesthetics.

Solution:

Implement SolidWorks 3D design software to automate design and manufacturing processes, add flexibility to process design changes, and increase design innovation.

Results:

- Shortened design cycles by 20 to 30 percent
- Cut development costs by 50 percent
- Reduced scrap and rework
- Increased innovation in timber design

3D streamlines structural timber design

Since implementing SolidWorks software, Three Elements has reduced its development time by 20 to 30 percent. For example, one project involved a timber-framed turret located at the top of a stair tower. The turret was comprised of eight individual prefabricated structural trusses surrounding a central post. The original architectural design called for a pitch of 33.69 degrees, but once construction began it became clear that the pitch needed to be 32 degrees.

"In the past, we would have had to redraw the entire turret," Seelig recalls. "Because SolidWorks is parametric, it was very easy to make this change. All eight trusses were identical, so we made a simple pitch change to one truss, which propagated to all the others. It would have taken about five days to redo the design in 2D versus about 20 minutes to make the change in SolidWorks."

Design automation drives productivity

Three Elements has leveraged SolidWorks software to build a library of truss designs and commonly used parts, such as fasteners, lags, and timber screws. Combined with SolidWorks design configuration capabilities, the parts library is helping the contractor to maximize design reuse and increase manufacturing productivity, greatly reducing scrap and rework.

On every project, Three Elements designers automatically export a bill of materials (BOM) from SolidWorks into an Excel spreadsheet. The BOM export, along with a sketch file that drives the design, is imported into the firm's manufacturing system. Three Elements has further automated the process of manufacturing setup for timbers of different lengths and thicknesses using design configurations.

Ted Master, head designer and project manager, says, "By automating design and manufacturing processes, SolidWorks has helped us cut development costs by 50 percent."

Advancing the use of additional materials

SolidWorks software also helps Three Elements increase innovation in timber frame design, particularly through the use of steel, metal, and other materials. While the company has long used metal brackets and components to construct trusses, it is now leveraging steel in new, creative ways.

"There was a time when we never would think of putting steel in any of our projects, and if we had to use metal for accomplishing complicated joinery, such as with huge snow loads, we'd try to hide it," Seelig points out. "Now, we're doing projects completely out of steel, like a fabricated stair rail—or choosing to expose metal for aesthetic effect, like a steel panel above a fireplace that we did in a barn outside of Aspen. The designers, architects, and construction managers that we work with realize that we have increased our capabilities, and they are taking advantage of them in creating innovative designs."

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Owner



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