SIEMENS
Ingenuity for life

Century-old railroad bridge gets modernized

A major railroad simplified and improved the speed of operation of a historic bridge with a solution combining a Siemens SIMATIC Controller and HMI Panels with a Siemens Integrated Drive System.

Abstract

To update a historic railroad bridge crossing a river that empties into the San Francisco Bay, Summit Signal, a railroad construction expert, called Serra, a Siemens valued partner and leading automation specialist. Together they devised a solution comprising a Siemens Integrated Drive System, controlled by a SIMATIC S7-1200F PLC and SIMATIC HMI key panels. The SIMATIC components met safety requirements without complicated and time-consuming programming, integration, and testing. Serra estimates it saved months and tens of thousands of dollars in engineering costs as a result of the safety-integrated features of the SIMATIC components and the Siemens TIA Portal software, which provided a common engineering framework. Not only did the Siemens solution help simplify and speed up the bridge's operations, but it also provided both companies with a ready solution to address comparable challenges of 4,300 other antiquated bridges across the U.S. with a similar truss design.

After more than 100 years, time to modernize

Thirty-six years before the world-famous Golden Gate Bridge opened, spanning the mile-wide entrance to the San Francisco Bay, the Northwestern Pacific Railroad built a 300-foot swing bridge across the nearby Petaluma River, where it empties into the Bay. Both the railroad and bridge are still in operation today, more than 100 years later.

Even after all this time, the railroad bridge – a Warren Truss design—works as designed: It remains parked in an open position on a small midstream island to allow passage for boats and barges until an east- or westbound train approaches; then it swings into place to allow the train to cross. After the train has cleared the span, the bridge swings back to open the river for navigation again.

While the bridge is considered historic, its fully manual operation certainly qualifies as historic too. When a train arrived in either direction, a bridge tender living in a small dwelling on the river bank would row a boat about 100 yards across the river channel, often against the Bay's monstrous tidal currents or storms, to swing the bridge closed.

Once at the bridge, the tender would climb a 20-foot vertical ladder, enter a tiny shack and, when inside, fire up a propane-fueled, Ford V-6 motor. He then used mechanical levers to engage the bridge gears and retract its wedges, putting the weight of the bridge on a ring wheel set, so it could swing around.

The motor would turn the bridge's gears, moving its 500 tons of steel into place. After the train had crossed, the tender would reverse the operation, shut down the engine, climb down the ladder, row back across the channel to his home, and await the next train. On average, this operation could take an hour or more and occurred six times a day, all year round.

A railroad bridge at a crossroads

When the most recent tender, in his 70s, passed away a few years back, the railroad's current operator decided the time had come to upgrade and electrify the bridge's mechanicals and controls. It called Summit Signal, one of the nation's leading railroad signaling contractors, to do the job.

Founded by President Pete Mihelcic and now with nearly 100 employees, Summit Signal has worked on all kinds of railroad construction projects. As its name suggests, the company focuses on signaling projects, such as railroad grade crossing repairs, replacements, and upgrades; railroad signal crossing design; conduit and communication systems; full signal system integration; and emergency signal knockdowns.

"In addition to replacing the tender and the bridge's totally manual operation, the railroad sought to improve the speed by which the bridge operated," Mihelcic says. "Along with meeting those goals, we had to ensure its safe operation, too. With a bridge like this, the consequences of something going wrong can be massive. So the controls had to be fail-safe and simple to understand and operate, even for people who use hammers to make things work."

Historic preservation was a high priority, too. "Because of the bridge's historic designation, another design priority was to preserve its aesthetics, so we couldn't put any exterior motors or boxes that could be readily seen," Mihelcic says. "In fact, we had to keep the small shed atop the bridge and the motor and propane tank inside, in case electricity went out. As a result, we had extremely limited space for a new drive train and controls."

Dividing project responsibilities

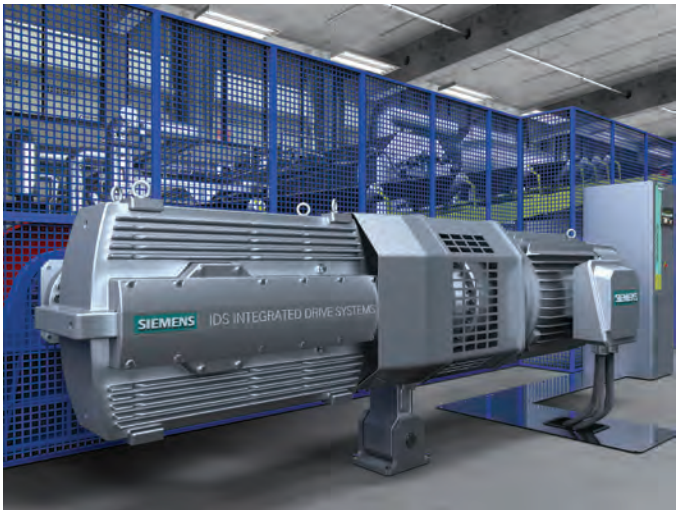
While Summit Signal oversaw the entire bridge upgrade project and handled the mechanicals upgrade, it tapped Serra, a longtime Siemens partner and automation expert, to upgrade the controls. "We had worked with Serra on smaller projects before and developed a great respect for their competencies and responsiveness," Mihelcic says. "We both seek solutions for our customers that provide the best long-term value and lowest total cost of ownership."

A Case Study issued by: Siemens.

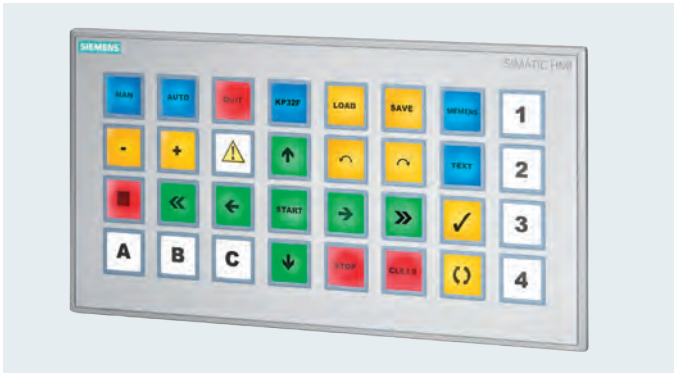
Serra's Engineering Manager Grant Schulz, who ran his company's part of the project concurs. "We proposed and developed a Siemens Integrated Drive Solution controlled by the SIMATIC S7-1200F PLC and HMI key panels because the amount of integration in the drivetrain and controls would simplify operations, save a ton of time in development and commissioning, and offered plenty of innovation potential for future needs," he explains. "Overall, the Siemens solution was the most cost-effective."

Digitalizing with Siemens Totally Integrate Automation (TIA)

Specifically, the Siemens Integrated Drive System comprises a 30 kW, 40 hp SIMOGEAR beveled gear motor capable of 48,000 pounds of torque per inch at 58 rpm, plus SIMOGEAR gearboxes, and SINAMICS G120 universal drives. Summit Signal designed the new drivetrain so it would mount out of sight under the track structure, preserving the bridge's visual aesthetics.



The SIMATIC S7-1200F controller and SIMATIC KP32F HMI key panels with PROFINET/PROFIsafe connectivity were chosen for two reasons. One was their relative operating simplicity; the other was they are part of Siemens Totally Integrated Automation (TIA) portfolio, programmable with the TIA Portal. Their compact size also helped them fit in the small space of the work shed, which they have to share with a back-up propane-fueled motor.



According to Schulz, both the TIA Portal common software engineering framework and the safety integrated features of the SIMATIC S7-1200 PLC were critically important to the project – not only to fulfill its strict safety requirements but also to meet a completion date that had been pulled in by three months.

"Had we been forced to use traditional, hard-wired safety controls, we would have faced several months of additional programming, integration, and pre- and post-commissioning testing that would have cost us tens of thousands of dollars," he says. "With the Siemens SIMATIC safety integrated features that come as part of the Siemens TIA portfolio and programmable in the TIA Portal, we ensured both our schedule commitments and profitability."

TIA Portal, key to project profitability – and a profitable future

Schulz credits the Siemens TIA Portal for enabling Serra, which has five employees, to work on much larger projects than it would otherwise be able to, and do so profitably. "The TIA Portal has allowed us to stay extremely competitive and tackle very large projects for such a small group as us," he says. "Fact is, the TIA Portal has helped us reduce our overall cost to our customers, while increasing our margins almost 75 percent. It's the primary reason we have worked in the black for the last two years."

Both Schulz and Mihelcic appreciate the potential for providing real-time, remote diagnostics and controls using the SIMATIC components. For now, due to the customer's operational specification, a train's engineer or conductor has to stop the train ahead of the river crossing, walk to the HMI keypad, then push a few simple buttons to swing the bridge into place. "There's a good chance in the not-too-distant future that this rail line will become a commuter line," Mihelcic says. "So for that to happen, the train would have to signal the bridge to close miles ahead of time and confirm its closure with the engineer."

Schulz also envisions the bridge's SIMATIC controls providing remote diagnostics of the performance and health of the Siemens Integrated Drive System in real time via wireless communications. "For example," he says, "if the system senses spikes in torque, that might indicate the bridge is encountering an obstruction or some other problem in its mechanicals. It can immediately alert both the railroad and us to the situation, so we can act fast to resolve the issue before it becomes a matter of safety or some costly repair."

To add these capabilities would take little time or cost, Schulz says, thanks to the flexibility and future-ready features in the SIMATICS S7-1200 PLC and the TIA Portal. "With the lion's share of the programming already done and in our TIA Portal library, it's really fast and easy to upgrade the functionality of the bridge's operation," he says.

A Case Study issued by: Siemens.

Even more, both companies are looking forward to adapting their Siemens solution for some 4,300 other antiquated truss railroad bridges across the U.S. “Now that we have a proven solution for these types of bridges,” says Mihelcic, “we can design and execute upgrades and retrofits using Siemens Integrated Drive Systems, SIMATIC components, and the TIA Portal in much less time and at a lower cost, which will improve our margins even more. We’re extremely excited about the many opportunities we have ahead of us.”

Siemens Industry, Inc.
5300 Triangle Parkway
Norcross, GA 30092

For more information, please contact
our Customer Support Center.

Phone: 1-800-241-4453
E-mail: info.us@siemens.com

usa.siemens.com/automation

Order No. AMCS-SUMMIT-0616
Printed in U.S.A.