Utah highway bridge project uses massive girders

The Interstate 15 (I-15) Technology Corridor project is a $430 million design-build project in Utah County, Utah. The Technology Corridor is also known as the Silicon Slopes because of the increasing number of technology-based businesses moving there and is one of the fastest-growing areas of the state. The project is managed by the Utah Department of Transportation (UDOT), which ranked it number one in importance for 2018 because it is considered critical to developing this region.

The project involves widening segments of I-15 between Salt Lake City and Spanish Fork from four lanes to six lanes; redesigning interchanges; and adding new frontage roads, new bike and pedestrian connections, and new and reconstructed bridges at cross streets and railroad crossings. The Technology Corridor project is set to be completed in 2020.

One element of the project is a bridge, part of which contains what are now the third-longest single-component beams in the nation. At 203 ft (61.9 m) each, they are only slightly shorter than similar bridge beams in place in Orlando, Fla., and Seattle, Wash. As a point of reference, they are 18 ft (5.5 m) longer than the height of the Leaning Tower of Pisa (which is 185 ft [56.4 m] tall). The typical bridge beam length for Utah bridges is about 145 ft (44.2 m).

Salt Lake City–based Forterra Structural Precast is responsible for the precast concrete work on the whole Technology Corridor project.

"We are producing, shipping, and erecting 284 girders ranging in size from an AASHTO Type I to the UBT98s that are 203 ft [61.9 m] long," says Lee Wegner, sales and project manager with Forterra. UBT98 is one of UDOT's working standards for bridge girders. "We have a total of 31 UBT98s that are 203 ft long, 98 in. [2490 mm] deep, and weigh 225,000 lb [102,000 kg] each." Each beam is 4 ft 1 in. (1.2 m) wide.

Obviously, designing, producing, delivering, and installing beams of this size comes with a number of challenges.

In terms of design, Wegner says that the biggest challenge was creating a 203 ft (61.9 m)–span–length girder that would meet UDOT's design requirements and stay within the physical capacities of Forterra's Salt Lake City facility, in terms of factors such as concrete strengths and casting bed strand capacity.

A 203 ft (61.9 m) long girder weighing 225,000 lb (102,000 kg) is shipped 27 mi (45 km) from Forterra Structural Precast in Salt Lake City, Utah, to the Interstate 15 Technology Corridor project. Courtesy of Forterra Structural Precast.

Erecting the extremely large girders for the Interstate 15 Technology Corridor project in Utah County, Utah, required a complicated two-crane placement. Courtesy of Forterra Structural Precast.

Wegner says that the technology to make beams this long did not even exist until a few years ago. Each of the prestressed concrete beams contains sixty-eight ½ in. (13 mm) diameter steel cables running down the middle of them, and each one of those cables has been pulled to a prestress force of about 44,000 lb (20,000 kg). That equates to a total of about 3 million lb (1.4 million kg) of prestressing force within each beam.

> *"The technology to make beams this long did not even exist until a few years ago."*

Once the steel cables were stretched and stressed, the concrete was poured around them and allowed to cure. The facility utilized a high-strength concrete that was able to be cured to the required strength overnight. Once it was cured, the cables were cut, allowing the resulting force to be introduced into the concrete.

Design and production came with their challenges, but transportation was filled with even more challenges. "Planning and scheduling delivery has definitely been a big consideration," Wegner says. "The girders weigh 225,000 lb [102,000 kg] each, and with a length of 203 ft [61.9 m], they are not easily transportable."

In addition, handling and shipping stresses needed to be taken into account. To address these concerns, the production facility utilized eight external prestressed stands on the top flange of each girder to stabilize and strengthen it laterally during transportation and installation.

"Special transportation had to be scheduled and planned well in advance," he says. The trailers that moved the beams to the project site 27 mi [45 km] from the production facility were 16 ft [4.9 m] wide and took up two lanes of traffic. "They traveled the major north-south route through the Wasatch Front, and this required extensive planning and coordination," he says. "Highway patrol and flag cars assisted in providing a two-lane-wide caravan to the project site."

The trailers with the girders convoyed along the interstate at about 20 mph (33 km/hr), displaying "oversize load" signs, and Utah Highway Patrol troopers, with the assistance of plenty of flaggers, worked hard to make sure that motorists, who would typically be driving over 60 mph (99 km/hr) on that thoroughfare, had sufficient warning and time to slow down as they approached the trailers hauling the girders. It took about two hours to transport the girders from the production facility to the bridge jobsite.

Once on location, installation was the next challenge. "Logistics and weights required a complicated two-crane placement, requiring special planning for picking points and girder stabilization," Wegner says. "Once the girders were in place and braced, the temporary stabilization strands had to be detensioned and removed."

—William Atkinson