RECORD LENGTH PRECAST BEAM Ensures Project Meets Deadline

by Donald P. Merwin

Single-span design of nearly 182 ft on a 60-degree skew replaces bridge on major Oregon highway over railroad tracks in less than seven months

Faced with twin challenges of a long span and short construction time to design and build a replacement bridge to carry a busy highway over an active railroad in Chemult, Oregon, project engineers turned to precast, prestressed concrete girders to create the best solution.

One of 11 bridges in a design-build project for the Oregon Department of Transportation (ODOT), the structure features a single-span precast, prestressed concrete design. That approach avoided activity near the main line of the Union Pacific Railroad and sped up construction as well, according to Terry Stones, lead engineer from David Evans and Associates Inc. of Salem, Oregon, the design-build engineering firm.

The precast design eliminated any need for intermediate bents, allowing the contractor, Hamilton Construction Company of Springfield, Oregon, to stay clear of the railroad track, which carries both freight and passenger trains and remained operational during construction. A new roadway alignment was added to the plans, leaving the existing bridge in place during construction. The old three-span bridge was considered structurally deficient and too narrow, with practically no shoulders. It had two intermediate piers, which designers wanted to avoid by using the longer precast concrete design.

"The three-span design left significant concerns about the falsework adjacent to and above the rail mainline," Stones adds. A single span nearly 182 ft long would be needed to cross the tracks at a 60-degree skew and it would have to be constructed quickly enough to open to traffic in less than seven months.

New Casting Bed Provides Solution

Fortunately, the precast manufacturer, Morse Bros. Inc., of Harrisburg, Oregon, had just installed a new casting bed that could fabricate bulb-tee beams up to 96 in. deep and 190 ft long. It was just what was needed for this project.

The final design called for seven precast, prestressed concrete bulb-tee beams, each with a 90 in. depth and a length of 183 ft-3 in., the longest ever used in Oregon bridge construction. Each beam has a top flange width of 5 ft, a bottom flange width of 2 ft 6 in. and contains fifty-six 0.6-in.-diameter strands. Beam spacing was at 6 ft-10 in. The beams were cast with concrete having a specified compressive strength of 9000 psi at 28 days and 7000 psi at prestress transfer.

The beams, each weighing 93 tons and two-thirds the length of a football field, were delivered one at a time on a transporter with 13 axles with the rear units steered remotely by an operator in the truck. The spans were transported from the Morse facility in Harrisburg, near Eugene in the western part of the state, along the 125-mile delivery route over the Cascade Mountains to the bridge site on U.S. 97 midway between Bend and Klamath Falls near the center of the state.

profile **U.S. 97 OVER UNION PACIFIC RAILROAD TRACKS**/ CHEMULT, OREGON

ENGINEER David Evans and Associates Inc., Salem, Ore.

PRIME CONTRACTOR Hamilton Construction Co., Springfield, Ore.

PRECASTER Morse Bros. Inc., Harrisburg, Ore.

Beams weighing 93 tons each were driven about 125 miles to the job site on 13-axle transporters.

Once at the site, the beams were erected by two 350 ton cranes, lifting them from the delivery trucks parked on the existing bridge that was adjacent to the new construction.

The $970,000 budget included $289,000 in precast concrete elements, but did not include roadwork or retaining walls. The cast-in-place concrete deck carries two 12-ft-wide traffic lanes and two 10-ft-wide shoulders.

The end bents of the new bridge were aligned parallel to the railroad's main line to minimize the span length, according to Stones. Achieving that necessitated a 60-degree skew for the bridge. Extensive mechanically stabilized earth (MSE) walls were used to contain the roadway embankment, with the bridge supported on steel piles driven within the MSE fill. The wall facing was created with large precast concrete blocks that were economical, durable, and quick to construct. "By using the MSE walls and the large skew, the span length was reduced to 181 ft 9 in., and the 90-in.-deep precast, prestressed bulb-tee beams became the best solution for this site," he says.

Both the design and the beam fabrication proceeded quickly, Stones adds. "That speed allowed the fabricators, contractors, and designers to use their creative abilities efficiently. The use of the precast concrete beams allowed the contractor to stay on schedule and within budget. The very long beams soared over the railroad tracks and avoided the need for intermediate supports."

Precast Aided Late Start

The seven-month construction window was created "because we were late getting in," according to Stones. That helped make the decision for precast concrete because, he notes, "it was readily available and could be constructed very quickly. Time was of the essence."

Each of the 11 bridges had its own challenges, Stones notes. "Although many of the bridges on this project were unique or complex, this one in particular stands out," he says. "This bridge was significant because its beams are the longest single-piece precast, prestressed concrete beams in the state. The greater length developed by Morse "opens the door for the construction of precast, prestressed concrete beams that would break all previous length records. With this new and exciting possibility, the designer, contractor, precast manufacturer, and client teamed together to develop the best solution for this site."

Long Life Expected

Keith Kaufman, chief engineer for Morse Bros., notes that many bridges in Oregon are using precast as "the material of choice. It shortens the schedule and reduces cost." It also provides significant durability. The expected life span of the new structure, he notes, is at least 75 years and probably as much as 125 years.

The Chemult bridge is one of about 365, built during the 1950s and 1960s, that the Oregon DOT is examining for replacement, according to Steve Narkiewicz, consultant project manager for the state.

"We're replacing some bridges, repairing some, and doing nothing with others that are not in bad shape," he says. "A lot of the new ones are using precast concrete, depending on the length of the span. As the span gets longer, the beams become deeper and the amount of vertical clearance is critical. The depth for the Chemult bridge measured 90 in.—that's a deep beam—but it was within the vertical clearance limitations because the roadway was well above the railroad tracks."

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The bridge over the Union Pacific Railroad at Chemult, Oregon, was constructed with seven precast, prestressed concrete beams, each 183 ft-3 in. long, the longest ever used in the state.

SINGLE-SPAN PRECAST, PRESTRESSED CONCRETE/ OREGON DOT, OWNER

BRIDGE DESCRIPTION Two traffic lanes with 10-ft-wide shoulders, with cast-in-place concrete deck and 60-degree skew

STRUCTURAL COMPONENTS Seven precast, prestressed concrete bulb-tee beams, each 183 ft-3 in. long and 90 in. deep spaced at 6 ft-3 in.

BRIDGE CONSTRUCTION COST $970,000.