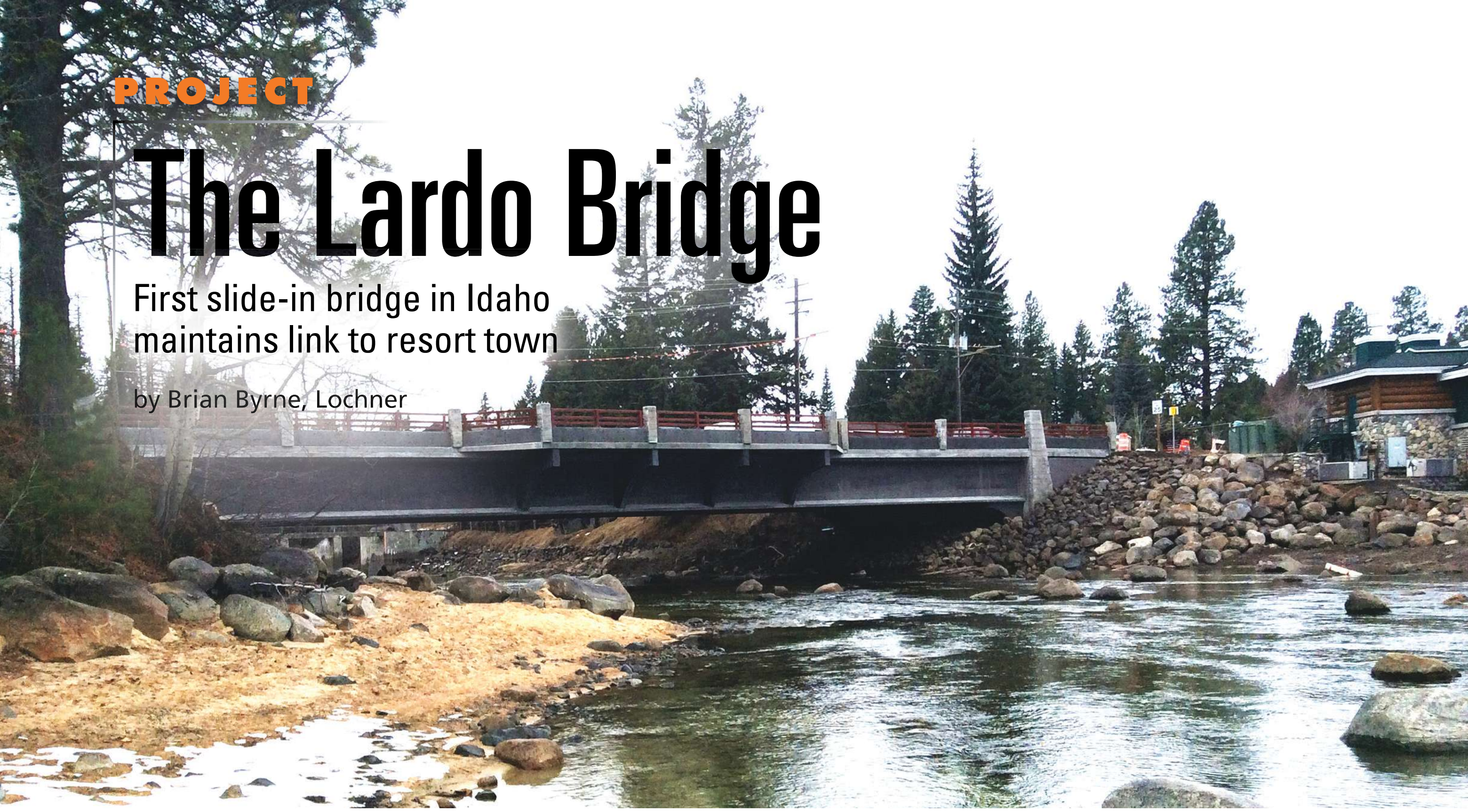
PROJECT

The Lardo Bridge

First slide-in bridge in Idaho maintains link to resort town

by Brian Byrne, Lochner



The completed north elevation of the Lardo Bridge. Photo: Ralph L. Wadsworth Construction.

The Lardo Bridge replacement, in the resort town of McCall, Idaho, is Idaho Transportation Department's (ITD's) first implementation of slide-in-bridge-construction (SIBC) technology for a permanent superstructure. It also was administered as their first federal aid design-build contract. The new single-span, 155-ft-long precast concrete girder bridge replaces an existing 80-year-old, five-span bridge carrying State Highway 55 (SH 55) over the North Fork of the Payette River at the outlet of Payette Lake.

McCall is a beautiful resort town of about 3000 permanent residents surrounded by the Payette National Forest and is reachable from Boise in just over 2 hours. SH 55 runs north into the busy downtown area of McCall and then cuts westerly along Payette Lake. Much of the lodging, restaurants, tourist attractions, and scenery are located along SH 55 and the Lardo Bridge is the connection between these points of interest. Therefore, detouring through-traffic during the peak tourist season was not acceptable for the replacement of the bridge.

McCall's tourist season extends from Memorial Day through Labor Day and picks up again from Thanksgiving through New Years for snowmobilers and skiers. With SH 55 as the main route along the lake, ITD wanted to minimize delays on SH 55. Therefore, ITD let this project as a design-build with A + B bidding to encourage the design-build teams to minimize construction durations and minimize impacts to the peak tourist season. To maintain connectivity along SH 55 between lodging, restaurants, and recreation areas, both lanes on the existing bridge remained open during the summer while the new structure was built to the side. The superstructure and stub abutments were slid in the fall before tourists returned for winter outdoor activities.

Superstructure and Belvedere

The structure's out-to-out width is generally 54 ft, which is 16 ft wider than the existing bridge. The clear opening between abutments met the 152-ft requirement for hydraulics, and resulted in a single-span length between centerline of bearings of 155 ft with no skew. The superstructure consists of six, 90-in.-deep, Utah bulb-tee (UBT-90), precast, prestressed concrete girders. The bridge has an asymmetric cross section with a wide cantilevered mid-span viewing platform, which was termed a belvedere, allowing

The concrete girders also provide an aesthetic that compliments, rather than distracts, from the natural scenic setting.

profile

THE LARDO BRIDGE / MCCALL, IDAHO

BRIDGE DESIGN ENGINEER: Lochner, Meridian, Idaho and East Hartford, Conn.

PRIME CONTRACTOR: Ralph L. Wadsworth Construction, Draper, Utah

PRECASTER: Forterra Structural Precast (formerly Hanson Structural Precast), Salt Lake City, Utah—a PCI-certified producer pedestrians to stop and enjoy the vista of the lake and surrounding mountains.

The request for proposal (RFP) required the belvedere to be a minimum of 50 ft long and cantilever 8 ft out beyond the 10-ft sidewalk on the north side. To support this design load, corbels spaced at 15 ft 4 in. centers were cast against the exterior face of the bulb-tee girder. In line with the corbels, 12-in.-thick intermediate concrete diaphragms were provided in the first bay backed up by 6-in.-thick intermediate concrete diaphragms in the adjacent four bays.

To accommodate the eccentric loading of the belvedere slab overlook, an asymmetrical girder arrangement was provided. The typical section layout was analyzed with a grid model to determine the distribution of loads from the overlook. The girders in the two northern bays are spaced at 7 ft 6 in. on center and the next three bays are 10 ft 4 in. The normal deck overhang is 3 ft on the north side and 5 ft on the south side.

The viewing platform is created by cantilevering from the edge girder at mid span. Photo: Ralph L. Wadsworth Construction.

During the proposal phase of the project, we looked carefully at a structural steel option for the superstructure; however, the precast concrete UBT-90s were significantly less expensive. The concrete girders also

Belvedere overlook with concrete patterns in sidewalk. Photo: Lochner.

provide an aesthetic that compliments, rather than distracts, from the natural scenic setting.

Girder Transportation and Erection

Transportation of girders was a significant concern with their 156 ft 6 in. length, their weight at 168,000 lb each, and their depth of 7 ft 6 in. The precaster is located near Salt Lake City, Utah, and the girders were to be transported more than 500 miles to the site, up through the mountains. To accomplish this, a somewhat less direct route was taken to the project site to minimize superelevations, tight curves, and grades. For several of the tightest curves, oncoming traffic had to be stopped in advance to allow the truck to navigate the girder through the turn. For the delivery of the last girder, a self-propelled truck with a low-clearance cab supported the back end of the girder and helped to negotiate the curves and turns.

To set the girders, two cranes were used with one placed behind the east abutment and the other placed just off the northwest corner of the bridge, wedged up near the Shore Lodge resort. Each girder was delivered to the north side of the existing bridge, with one-way alternating traffic prior to the girder pick.

Cranes picking the first 156-ft 6-in.-long precast concrete beam. Photo: Ralph L. Wadsworth Construction.

Substructure

Based on the minimum hydraulic opening, the new abutments were nearly in line with pier 1 and 4 of the existing bridge. In order to build the new abutments below the existing structure, we needed to increase the span length, which was unpalatable due to the increased costs for our design-build team. We therefore decided to construct the nearly 6-ft-tall, cast-in-place concrete abutment stems on temporary steel falsework to the north of the existing bridge. The top of the temporary falsework was at the high water level, and so a temporary cofferdam consisting of super sacks (gravel-filled bags) and pumps kept the construction zone dry when the lake levels were high during the summer.

The cast-in-place pile caps are located immediately outside of the existing bridge footprint so that the piles could be driven and the concrete for the pile cap was placed while traffic was

IDAHO TRANSPORTATION DEPARTMENT, OWNER

BRIDGE DESCRIPTION: A single-span, 155-ft-long, precast, prestressed concrete beam bridge

STRUCTURAL COMPONENTS: Six UBT-90, bulb-tee girders, composite with an 8-in.-thick concrete deck; fully integral with stub abutments with post-tensioning to span between cast-in-place pile caps placed in the four quadrants

BRIDGE CONSTRUCTION COST: $3.2 million

AWARDS: ACI Intermountain Chapter "2015 Excellence in Concrete Award" and ACEC of Idaho "2014 Engineering Excellence Award"

Construction of west abutment stem wall on temporary falsework, adjacent to the Shore Lodge. Photo: Ralph L. Wadsworth Construction.

maintained on the existing alignment. The abutments do not have a flexural connection to the pile caps. This decision was made to allow the slide-in of the bridge to occur more smoothly and to simplify the connection.

As the stem wall is relatively short, flexural demand is easily accommodated by the 3 ft width of reinforced concrete. The bridge is restrained from nonthermal movement through the use of external shear keys, passive soil pressure, and friction between the pile caps and the abutment shoes. There are no elastomeric bearings below the abutments. In this manner, the bridge acts much like a three-sided culvert or stiff leg structure, albeit with a much longer span.

Each abutment stem wall is designed to span the 47 ft 6 in. distance between the pile-cap centers. Straight post-tensioning bars were used to supplement the nonprestressed reinforcement in the 5 ft 10 in. deep stem. The jacking force of the permanent post-tensioning was calibrated so that it supported 90% of the dead load of the structure, ensuring that the abutments wouldn't have an upwards camber that could have hindered the bridge slide. Four 1$^{3}/_{8}$-in.-diameter, Grade 150, post-tensioning bars are placed in the abutment stem and provide 540 kips of force after losses.

On the bottom of the abutment stem, four 12-in.-high blockouts were set to allow vertical jacks to be placed. The blockouts also create five concrete "shoes" that were the primary points of contact for the bridge during the slide operation. The leading and trailing edges of the shoes are beveled to help ride up and onto the elastomeric slide pads. Stainless steel plates are cast into the bottom of the concrete shoes.

Once the existing bridge was demolished, a 2-ft-thick concrete "slide slab" was constructed to span between the pile caps and provide a surface upon which the bridge was to be slid. Concrete ledges were designed and detailed to extend from the pile cap and support the ends of the slide slab. However, the slab is primarily supported by soil.

A substantial concern during design was that as the structure was moved onto the slide slab, the supporting soils would settle and slow down the slide process. In order to mitigate this potential, the option of driving some piles to support the slide slab was discussed. However, this option was thought to be too costly and would require an additional mobilization of the pile-driving equipment. The existing wood-pile-supported pier cap from the old bridge was left in place.

However, the slide slab was not centered on the pile cap and so there was concern that the back side would differentially settle, twisting the slide slab and creating an uneven surface for the bridge slide. Instead, we found that the most effective solution was to over-excavate behind the existing pier caps and to place flowable fill, which improved the soil and load distribution. The slide slabs were then built on top of the flowable fill. Ultimately, there was no observed settlement and this method was successful.

Once the bridge was slid into its permanent location, wingwalls were cast in place. Dowels extended from the abutment stem and diaphragm to tie into the wingwalls. Two layers of tar paper were set below the wingwalls before casting to create a slip plane and accommodate thermal movement.

Project Aesthetics

Due to the project setting in a resort community, an aesthetics plan was required to be developed with the city of McCall. Given the tight time schedule for this design-build project, the progression of the design had to accommodate changes to some of the bridge elements and their geometry.

Last girder in place on abutment stem wall. Photo: Ralph L. Wadsworth Construction.

Fortunately, the elements that were most heavily influenced by aesthetics decisions were also those that were among the last to be constructed.

The parapet rail was mounted on a 2-ft-tall by 10-in.-wide concrete rail. These parapets meet TL-2 crash testing requirements and have been borrowed from a standard Virginia Department of Transportation detail. The parapets are broken up by 16- by 16-in. concrete pedestals that are spaced at roughly 22 ft centers along the edge of the deck. Down-facing lighting is provided in the pedestals for both safety and accent. Additionally, pole-mounted light fixtures will be selected and installed by the city on eight of the pedestals.

Tapered concrete monuments are provided at each abutment to visually anchor the bridge, with the top extending 6 ft 6 in. above the sidewalk. The city of McCall chose a board form finish for the abutment monuments and pedestals with a relief depth of 1 in. and a different finish for the parapet faces.

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For additional photographs or information on this or other projects, visit www.aspirebridge.org and open Current Issue.

EDITOR'S NOTE

This article has been taken in part from a paper written for the 2015 International Bridge Conference, IBC-15-82, which discusses the bridge slide aspects in more detail.