

Star treatment for a mouse

Engineers accommodate threatened species in Colorado

The design and construction of the 560-ft bridge taking Fifth Street over I-25 and Plum Creek in Castle Rock, Colo., came up against severe environmental constraints. Plum Creek is the habitat of the Preble's Meadow Jumping Mouse, which is a threatened species protected since 1998 by the Endangered Species Act. Among other things, this act makes it unlawful to significantly modify the habitat in a way that would disrupt normal behavior patterns of the mouse, such as breeding, feeding or sheltering.

This federal constraint:

- Restricted the period of construction work in the habitat area to October through mid-April—the hibernation period of the mouse;
- Implied minimal size of construction equipment; and
- Called for longer spans to minimize the number of piers in the habitat area.

Two additional constraints affected the bridge design. The state did not permit a pier in the median of I-25, which was scheduled for rebuilding in the future. And the city wanted to keep the maximum grade of Fifth Street to 5% to avoid disruption to businesses and to make it possible for the handicapped to travel the pedestrian way via wheelchairs. This latter constraint required shallow girders to keep the bridge relatively low over the highway.

According to Douglas Wellock, project manager of the bridge's structural design for Range Engineering (now SEH Inc., Cheyenne, Wyo.), all of these constraints pointed toward steel as the material of choice for the bridge.

"We selected a three-span welded plate steel girder bridge with two end spans of 170 ft and a middle span of 220 ft," he said. "The girders are hybrid systems since we used HPS-70W high-performance steel on the flanges over the piers and M270 grade 50W webs.

"Additionally, we located one of the two piers in the wetlands of Plum Creek since the wetlands are not considered the habitat of the Preble's Meadow jumping mouse."

Wellock added that the design firm requested preliminary designs for the bridge from the National Steel Bridge Alliance in Chicago, which recommended certain design, detailing and fabrication measures to minimize the cost of the bridge. "Based on NSBA recommenda-

tions, we ended up with a four-girder bridge with girders spaced at 10 ft 9 in.," said Wellock. "The web depth over I-25 is 60 in., giving us the required 16 ft 6 in. clearance. Integral abutments eliminated the need for costly expansion joints. Installed cost of the steel was \$0.91 per lb, a very good price that can be credited to the NSBA suggestions. The total bridge cost came to \$76.40/sq ft."

The new HPS-70 weathering steel offers high strength, ductility and weldability—a great combination for steel bridges. The steel is slightly more difficult to drill, requiring sharp bits and ample lubrication.

Mill scale, which can be difficult to remove, must be sandblasted so that the steel weathers uniformly, especially in the dry Western climates.

"This was one of the first high-performance steel bridges in Colorado to open," said Wellock. "The lighter girders allowed more fabricators to compete for the project based on reduced crane capacity and shop space requirements. It also decreased shipping and erection costs. Our longest shipped piece was 116 ft, and each girder has four bolted field splices."

Wellock cited the following design criteria:

- American Association of State Highway & Transportation Officials Standard Specification for Highway Bridges, 16th edition;
- Load Factor Design; and
- HS-25 truck live load with sidewalk deflection limited to the span length divided 1000.

Because of the limits on deflection, the bridge required haunches over the piers. "Normally we don't want haunches because they increase the fabrication costs," said Wellock. "But to control the deflection caused by the heavy HS-25 truck we had to put haunches over the piers.

"We needed to get the steel up before the mice came out of hibernation. Egger Steel delivered in February, and it was up in a few days.

"To raise the girders, the erector first bolted two girders together—side by side—and then lifted them in pairs for increased stability." ■

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Information provided by SEH Inc., Cheyenne, Wyo.