proceed on with the project would be to realign the tunnel," Moonin says.

Although the design of the realigned tunnel had not been completed at press time, the plan under consideration involves veering off at an angle of 20 or 25 degrees from the current tunnel path to circumvent the area of disturbed ground before reconnecting to the original alignment. After the most recent breach, Vegas Tunnel Constructors conducted additional borings in an effort to find a better path for the initial section of tunnel. "The actual point of reconnection and the length of the deviation from the original alignment have not yet been determined," Moonin says.

On February 25 the SNWA's board of directors approved a change order in the amount of approximately $39.5 million for the Lake Mead Intake Number 3 contract. Although the negotiated price for the change order was $44 million, roughly $4.5 million has already been paid through the SNWA's builder's risk insurance policy. The change order also extended the completion date for the project by 593 calendar days. In return, Vegas Tunnel Constructors has assumed all liability associated with the project until the TBM begins operating.

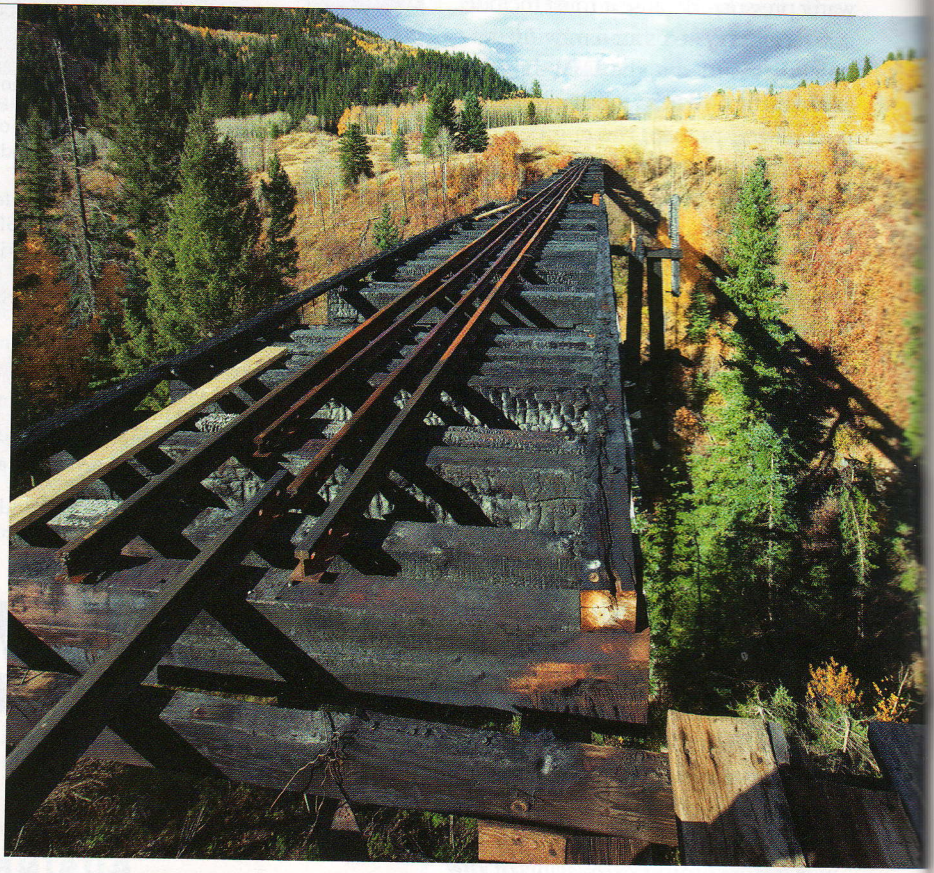
Although unfortunate, the situation is not altogether surprising to the SNWA, which conducted significant geotechnical investigations before work began. "Some faulting and shear zones were expected in the underground construction," says Marc Jensen, p.e., the director of engineering for the SNWA. "We just didn't know exactly where they would be and how large they would be."

Meanwhile, construction of the intake riser in Lake Mead has continued unabated. Begun last summer, the work has involved excavating a pit in the lake bed in which the intake riser will be installed. In January Vegas Tunnel Constructors completed the fabrication of a reinforced-concrete structure that will form the bottom half of the riser. Built on the bank of Lake Mead, the structure will be floated by barge to the pit and lowered into place. The upper half of the intake will be of prefabricated steel. Eventually, the tunnel to be constructed by the TBM will connect to the bottom of the intake riser. —JAY LANDERS

BRIDGES

Scenic Railroad to Repair Fire-Damaged Crossing

On June 23, 2010, a stray cinder from a coal-powered steam locomotive ignited a 127-year-old railroad trestle in the rugged backcountry of northern New Mexico. Fortunately, the flames were quenched before completely engulfing the bridge, which serves one of the few narrow-gauge railroads still operating in North America. Rather than replace the noteworthy structure, the railroad plans to rehabilitate and preserve it.



The Lobato Trestle, constructed in 1883, was damaged but not destroyed by fire last year. Engineers determined that those elements untouched by the fire remained in good condition.

ROGER HOGAN

The Lobato Trestle, erected in 1883, is one of two large steel trestles on the Cumbres & Toltec Scenic Railroad, which winds for 64 mi along the border between Colorado and New Mexico. The narrow-gauge line, formerly known as the San Juan Extension of the Denver & Rio Grande Railroad, was built in the late 19th century to tap the booming gold and silver mines of the San Juan Mountains. The railroad is listed in the National Register of Historic Places and has been recognized as a landmark by ASCE in its Historic Civil Engineering Landmark Program.

The trestle is 100 ft tall and 310 ft long and carries a 3 ft wide track across a creek 3 mi north of Chama, New Mexico. Two steel plate girders, each approximately 50 in. deep, form the backbone of the bridge. Its six spans—five 54 ft long and one 40 ft long—are supported by five steel bents bearing on masonry piers. Each bent consists of two legs that spread outward for lateral stability. In many ways, the trestle is typical of the railroad crossings of its day except for one unusual characteristic: it lacks longitudinal cross bracing between the bents. The cross bracing is unnecessary because the deck girders are solidly connected end to end, says railroad historian Vernon J. Glover, of Rio Rancho, New Mexico.

After the fire, engineers from the offices of HDR, Inc., in Omaha, Nebraska, and in Cincinnati inspected the trestle to assess the damage. The flames destroyed most of the timber rail ties and damaged the main girders on five of the six spans, says Todd Riley, P.E., the project manager for HDR. The engineers were surprised to find that the portions of the bridge not affected by the fire, for example, the bents, were in very good condition, observes Riley.

The rehabilitation project will begin in April, weather permitting, and is expected to take less than 30 days, says Nick Quintana, a spokesperson for the Cumbres & Toltec Scenic Management Corporation, which operates the railroad. The states of New Mexico and Colorado, private donors, and the corporation itself will fund the roughly $2.1-million project. The railroad, now a popular tourist attraction, is expected to reopen in time for the summer season.

Although not well known, the Lobato Trestle occupies a significant place in the history of American bridge building, notes Quintana. The crossing and its longer, higher counterpart on the same railroad, the Cascade Trestle, were both designed by Charles Shaler Smith, a prominent 19th-century bridge engineer. The Lobato Trestle was built by the Keystone Bridge Company, which was owned and founded by Andrew Carnegie.

Charles Shaler Smith, mourned at his death, in 1886, as one of the greatest bridge engineers in the United States, is best known for his innovative continuous truss bridges, including rail crossings on the Kentucky, Mississippi, and St. Lawrence rivers. His Kentucky River bridge, which stood from 1876 to 1912, is believed to be the first American bridge to be constructed using the cantilever method. Smith also designed the eastern approach to the celebrated Eads Bridge, in St. Louis. For more information on Smith's career, see "C. Shaler Smith," by Francis E. Griggs, Jr., F.ASCE, which appeared in the March/April 2010 issue of ASCE's *Journal of Bridge Engineering* (pages 196–209). —JEFF L. BROWN

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