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Emergency repairs restore damaged bridge ahead of schedule

Following a devastating nor'easter in April 2007, residents and business owners in the townships of Pittsgrove and Salem County, N.J., found their community lake reduced to a vast muddy field. The Rainbow Lake dam, which carries Rte. 56 over the dam spillway and is vital to the local economy, had been breached, resulting in an 80-ft-long collapse of the entire roadway embankment.

The collapse not only forced residents and daily commuters to find other east-west travel routes, it depleted the 91-acre lake, which is part of a state Wildlife Management Area and a popular recreation spot. The lake is used for fishing, boating, swimming and bird watching. It also is a habitat for bald eagles, which rely on the water's fish population for food.

The owners of the 25 residential lots surrounding the lake feared that the loss of this environmental and recreational resource would diminish the real estate value of their waterfront properties. The damage also presented a difficult challenge to community businesses, several of which were still repaying loans following the destruction from Hurricane Floyd in 1999. Shops and businesses would potentially see devastating results if customers were unable to get through to their locations or if drive-by traffic were reduced.

Rapid recovery

The New Jersey Department of Transportation (NJDOT) quickly responded to the situation, working closely with residents and business owners to address concerns regarding the effects on local commerce and commuting. The agency assured the local government that it would immediately launch plans for a fast-track schedule of demolition, design and construction for the dam's repair.

Having tasked the consulting firm of Dewberry with a number of emergency bridge repair projects in the past, NJDOT again called on the company's engineers to design the new bridge and roadway and to assist with environmental permitting and utility relocation planning.

The team focused on extensive community outreach during and after the design process. Meetings with local officials helped to ensure that the disruption to area businesses would be minimized during construction. Dewberry also helped to establish the emergency detour route, addressing business owners' concerns for a southerly route that would enable drivers to pass through the commercial area.

At the request of the local government and businesses, the detour included new signage and the installation of temporary signalization at three intersections. This issue was particularly challenging because construction on the Rte. 56 Bridge over the Maurice River, approximately 2 miles east of the Rainbow Lake Bridge, was scheduled to begin shortly after the dam breach occurred. The team's complex detour route and signage scheme allowed both projects to proceed concurrently, with minimal disruption to commuters, businesses and residents.

Water modernization

The rapid response then focused on the design and rebuilding of the bridge and spillway. The existing structure was a single-span bridge with six timber sluice gates. Each of the gates in the existing structure was approximately 4 ft wide and controlled by stop logs that had to be inserted and removed manually. Because of the relatively small spillway width for the lake, the water surface elevation behind the spillway would rise rapidly with increased rainfall. The New Jersey Department of Environmental Protection (NJDEP) was forced to employ individuals responsible for adjusting the stop logs in an often-futile effort to stabilize the lake elevation and prevent the lake from overtopping the road and dam.

Removal of the existing spillway, bridge and damaged roadway/dam required close coordination between Dewberry, NJDOT and South State, the emergency demolition contractor. Working with the temporary diversion and demolition plans, which included interim soil-erosion and sediment-control measures, the team also interacted almost daily with the NJDEP. South State began its relocation and demolition work less than three weeks after the dam breach. The company also installed two 60-in. reinforced concrete diversion pipes to ensure positive stream flow around the construction zone.

The construction of a new 200-ft-long semicircular spillway, a 110-ft-long two-span bridge and a restored dam and roadway enabled NJDOT to resolve the spillway problems and return the beautiful lake to the community. The longer spillway and

bridge, constructed by J. Fletcher Creamer & Sons, create a more stable lake elevation that will ensure that Rainbow Lake will not overtop the dam and roadway, which had occurred frequently in the past, for storms of 100-year frequency or less.

The project required 650 linear feet of AZ-19 sheeting around a sealed cofferdam. A total of 118 50-ft-long pipe piles and 200 ft of straight web sheeting were installed in the 110-ft-diam. semicircular ogee spillway. Approximately 1,600 cu yd of concrete were used within the spillway, and 8,000 sq ft of reinforced concrete apron slabs were used within the arch. The bridge required 28 prestressed box girders with 650 cu yd of concrete for the substructure, deck and approaches.

The spillway is located adjacent to and directly upstream from the new bridge. The repaired roadway accommodates one 12-ft lane and one 8-ft shoulder in each direction. To ensure that construction could proceed on the expedited schedule, the bridge was designed to accommodate a tangential alignment located on a curved roadway, resulting in a minimum eastbound shoulder width of 6 ft 8 in. at the bridge. This represented a significant improvement to the 4-ft 6-in. shoulder that was carried in each direction by the existing structure.

The project also included relocating all utilities to the westbound side of the road and construction of a new concrete

boat launch owned by NJDEP. The new launch, along with the removal of surrounding aggradation, has helped to create a more enjoyable boating, swimming and fishing experience for visitors to the lake.

The installation of a mechanical sluice gate on the east side of the spillway enables NJDEP to regulate the lake level more closely. A new aluminum fish ladder, attached to the western bridge abutment and west side of the spillway, ensures that migratory fish are able to swim upstream through the bridge and spillway without harm. The dam and spillway design was provided by the consulting firm of McCormick Taylor.

The entire design process, from kick-off, the assembly of the team and preliminary demolition planning through final contract plans, specifications and estimates were completed in only four weeks. Several strategies contributed to meeting the compressed schedule: rapid mobilization (borings, for example, were complete within 48 hours of notification to proceed); constant communication and coordination with all of the key agencies, including NJDOT, NJDEP and the Federal Highway Administration; expedited reviews (NJDOT reviewed the final plans within just four hours); and shop drawings that were typically processed by Dewberry in just two days rather than the agreed-upon five-day schedule.





Left: The Rainbow Lake dam was breached, resulting in an 80-ft-long collapse of the entire roadway embankment. Above: The bridge was designed to accommodate a tangential alignment located on a curved roadway.

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Document dashing

From an administrative perspective, the team also devised ways to streamline the contracting and project documentation processes. For example, the contracting industry agreed to let NJDOT advertise the project with concept plans and a project description. Final plans and specifications were provided via an addendum just 10 days prior to the bid deadline. NJDOT received seven bids, with J. Fletcher Creamer & Sons' low bid coming in below Dewberry's estimate. The contract also was advertised with 20 lump-sum items—the first of its kind for NJDOT. These items included the abutments, the pier, the spillway, the deck and pavement.

"The Dewberry team truly met the challenge thrust upon them by the NJDOT—delivering contract documents for advertisement in less than four weeks," said Mike Kasbekar, P.E., a project manager with NJDOT. "Even though the design was completed on an extremely accelerated basis, the number of issues arising during construction was minimal."

Construction of the new bridge and spillway began in June 2007 and was substantially completed by the following October. Traffic resumed on Nov. 2, well in advance of the originally targeted date of Dec. 24.

"Dewberry worked closely with us in an emergency situation to help restore the quality of life for the town's residents," said Kasbekar. ●

Sears is director of water resources in the Bloomfield, N.J., office of Dewberry.

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