PENNSYLVANIA STATE ROUTE 147 BRIDGE DECK REHABILITATION

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With 25,000 state-owned bridges, Pennsylvania has the third-largest number of bridges in the nation. The average age of bridges on the state system is 50 years old. Despite a record level of investment since 2003, the state has the largest number of structurally deficient bridges in the nation—nearly 6000 statewide. Like many State Departments of Transportation (DOT) in northern climates, the Pennsylvania DOT (PennDOT) is faced with significant deterioration of concrete bridge decks, due in part to the use of deicing salts. The funding for addressing the deterioration has not been able to keep up with the necessity to repair the structures.

The federal American Recovery and Reinvestment Act (ARRA) of 2009, with its infusion of federal dollars to use at the state level for infrastructure projects, provided PennDOT the opportunity to repair some of these bridge decks. Pennsylvania transportation officials made the decision to spend the federal money on improving the service life of bridge decks. Previous methods for repairing bridge decks included methyl methacrylates to seal cracks, concrete toppings, and concrete toppings with high quantities of silica fume. All have advantages and disadvantages. PennDOT chose a newer innovation—a thin polymer concrete overlay (TPCO)—where a low-modulus epoxy sealer is applied to the concrete deck surface, followed by a fine aggregate broadcast (Fig. 1).

The ideal structure for this type of repair typically has minimal spalling and may have cracked silica fume or high-density overlays with no failure of the surface itself. The intended use of polymer overlays is to place them on structures that are not seriously deteriorated and require minimal deck repair, thus preserving structures that are still very serviceable. Historically, just northern rim states were using TPCO. Now, over 43 states are specifying TPCO. The primary reasons for their use are skid resistance and chloride resistance to help preserve the bridge deck. Long-term proven durability and rapid installation are also keys in the selection of this technology over previous materials. A TPCO system was used on numerous bridge decks in Pennsylvania in 2009, including the State Route 147 Bridge.

The State Route 147 Bridge handles 30,000 vehicles per day. The 15-year-old deck on this bridge was structurally sound. It was in need of a surface treatment, however, to repair minor spalls and hairline cracks. The epoxy sealer was selected to aid in protecting against water infiltration and chloride ions. The flint rock aggregate was broadcast to improve safety through better skid resistance. The system needed to be easy to apply and maintain with fast turnaround time and little interruption to traffic. The anticipated benefit is for the bridge deck to be preserved for another 10 to 15 years.

The surface was prepared to an ICRI Concrete Surface Profile (CSP) of 4 using shotblast equipment (Fig. 2). A wheeled magnet bar was used to collect excess metal shot. Blowers and

Fig. 1: Flint rock aggregate broadcast into epoxy for nonslip surface

Fig. 2: Ride-on shotblast machine. The magnet bar on wheels to the left is collecting excess metal shot

sweepers were used to collect all remaining debris. A plural pump was used to dispense the proper ratio of Part A and B of the epoxy resin (Fig. 3). Once mixed thoroughly, the epoxy resin was spread on the deck (Fig. 4). After the epoxy resin completely covered the concrete surface, No. 8 flint rock was broadcast into the epoxy using an automated aggregate blower and by hand (Fig. 5). The aggregate was spread in a vertical position to ensure proper spread rates and not to make waves in the driving surface. The aggregate was broadcast to refusal. After the overlay properly cured, the excess loose aggregate was removed. The process was repeated with a second lift (Fig. 6).

For approximately 60,000 ft^2 (5575 m^2) of bridge deck, 4800 gal. (18,170 L) of low-modulus epoxy was used. Additionally, 180,000 lb (81,650 kg) of No. 8 flint rock was broadcast into the epoxy.

So as not to interrupt traffic flow completely during construction, one lane of traffic was treated at a time (Fig. 7). By using an epoxy broadcast system and not the re-topping options, weeks were saved in the construction schedule. It took 12 days

Fig. 3: Plural pump dispensing proper ratio of epoxy Parts A and B

Fig. 4: Spreading epoxy with a notched squeegee

Fig. 5: Applying flint rock by aggregate blower

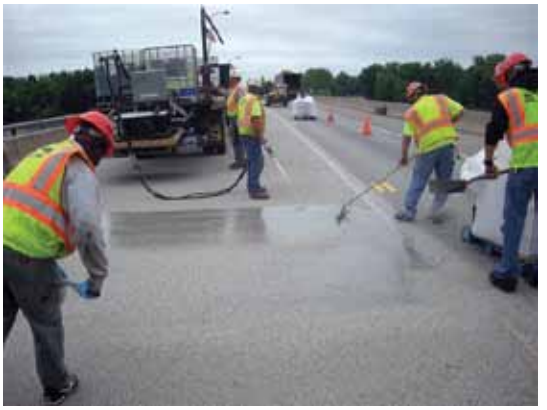

Fig. 6: Applying the second lift of TPCO

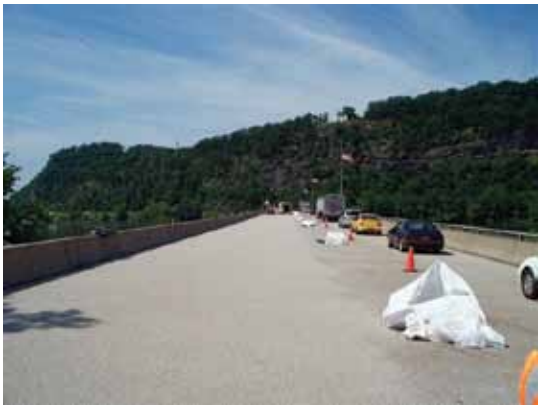

Fig. 7: One lane of traffic was treated at a time

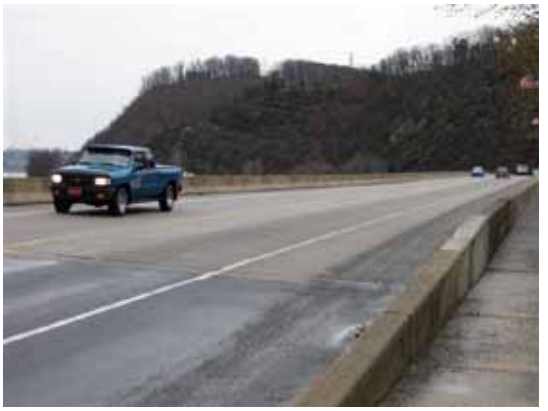

Fig. 8(a): Completed TPCO

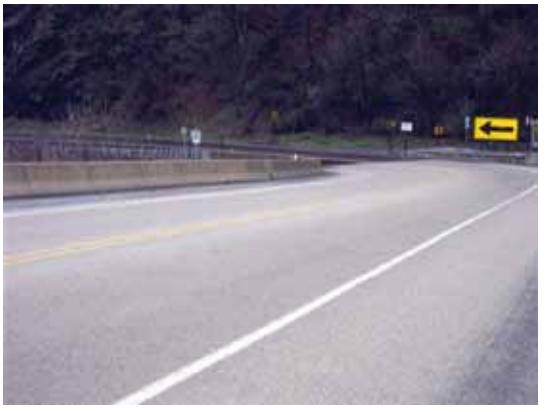

Fig. 8(b): Completed TPCO

to complete the project, delayed only occasionally by Mother Nature.

The objectives of rapid turnaround time with minimal impact to traffic flow were realized while the performance criteria for 15-year extended service were achieved. This system is becoming more popular with state DOT offices for using ARRA monies for infrastructure repair (Fig. 8(a) and 8(b)).

Pennsylvania State Route 147 Bridge

OWNER
PennDOT
Northumberland, PA

REPAIR CONTRACTOR
HRI, Inc.
State College, PA

MATERIAL SUPPLIER
The Euclid Chemical Company
Cleveland, OH

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