PROJECT

Evans Mill Pond Pedestrian Bridge Replacement

by William J. Castle, Childs Engineering

View of the original bridge superstructure looking west, with the concrete spillway to the left and the pond to the right. All Photos: Richard Parisi.

On June 20, 2020, the Camden County Department of Parks in New Jersey retained a bridge consultant to perform an inspection of the pedestrian bridge over Evans Pond at Challenge Grove Park in the borough of Haddonfield, N.J. Above- and underwater inspections were conducted to assess the condition of the structure and determine the necessary repairs or reconstruction required to support pedestrians and park vehicles.

The existing pedestrian bridge was constructed circa 1913. Although there are no records available, it is assumed that the adjacent earthen dam, concrete spillway, and steel sheet-pile wall were built at the same time. The pedestrian structure was a 20-ft-wide, 33-ft-long single-span bridge with 10 steel I-beams and a 3-in.-thick timber deck. The superstructure was supported by concrete abutments with adjacent steel sheet-pile retaining walls on the downstream embankments and a concrete weir on the upstream side. There was also a concrete slab between the abutments for scour control from the upstream dam.

Inspection

Inspectors found that the concrete substructure was in good condition, with only minor abrasion and random hairline cracking. However, the superstructure was in critical condition, with moderate to severe corrosion, and holes in the webs and flanges at various locations on all of the steel beams. The bridge was closed due to the severe deterioration of the beams. The timber deck, parapets, and railing were found to be in overall poor to serious condition. Based on the inspection findings, it was recommended that the bridge remain closed until

New prestressed, precast concrete slab beams are installed.

profile

EVANS MILL POND PEDESTRIAN BRIDGE / HADDONFIELD, NEW JERSEY

BRIDGE DESIGN ENGINEER: Childs Engineering, Hainesport, N.J.

PRIME CONTRACTOR: Walters Marine, Ocean View, N.J.

CONCRETE SUPPLIER: L&L Redi Mix Concrete Inc., Southampton, N.J.

PRECASTER: Jersey Precast, Hamilton, N.J.—a PCI-certified producer

OTHER MATERIAL SUPPLIERS: Deck reinforcement: J.M. Ahle, South River, N.J.; stone facing: Quarry Cuts, Parker Ford, Pa.; solar-powered bollards: First Light Technologies, Victoria, BC, Canada; railing: Susan R. Bauer Inc., Ringwood, N.J.

The completed superstructure replacement features a stamped concrete deck, decorative bridge railings, and lighted bollards. The concrete features a gray cobblestone pattern on the deck flanked by a boardwalk pattern on the sidewalks.

extensive repairs or rebuilding of the superstructure could be completed.

Project Design

The engineering analysis and rehabilitation design of the Evans Mill Pond Bridge began in mid-2021, the completed plans were sent out to bid in July 2021, and construction was completed in early 2022. The bridge design consultant reviewed several different design approaches and decided to remove the existing superstructure down to the concrete abutments. The concrete parapets on the abutments were to be partially removed; otherwise, the abutments were in good condition and required only superficial repairs. The top of the abutments would need to be cut down to accommodate the new superstructure, and the new bridge seat would be coated with epoxy waterproofing.

A dam safety permit was required because portions of the substructure and adjacent retaining walls are considered to be part of the dam. Given the presence of the dam, maintaining the horizontal and vertical clearances was an important design priority. The existing concrete abutments were to remain in place and the underclearance elevation was to remain the same; these decisions maintained the overall waterway opening, which simplified the approval process.

Construction had to progress with no interruption of the waterflow at the dam and no impact to the two overflow pipes at the secondary spillway just past the wingwalls on the west side of the bridge. Construction staging and access also had to be carefully considered to avoid damage to the dam. Adjacent prestressed concrete slab beams were chosen for the superstructure because they could maintain the required clearances and offered the advantages of durability, low maintenance costs, and simplicity in erecting the beams over the waterway with access from the adjacent roads.

New Superstructure

The design criteria for the project were based on the American Association of State Highway and Transportation Officials' *AASHTO LRFD Bridge Design Specifications*[1] and the current edition of the New Jersey Department of Transportation's *Standard Specifications for Road and Bridge Construction*.[2] The new superstructure is composed of adjacent prestressed concrete slab beams with a stamped, minimum 3-in.-thick cast-in-place concrete deck and sidewalk. The single-span bridge consists of a 12-ft-wide roadway and 4-ft 1-in.-wide sidewalks with steel bridge railings on both sides. The length of the new superstructure is the same as the previous superstructure, and is supported by new elastomeric bearings on the existing abutments with only minor modifications. Anchor dowels are

Elevation view of new bridge taken from the pond side. Decorative stone facing runs along the existing parapets on the bridge approaches and extends down the outside face of the abutments and wingwalls.

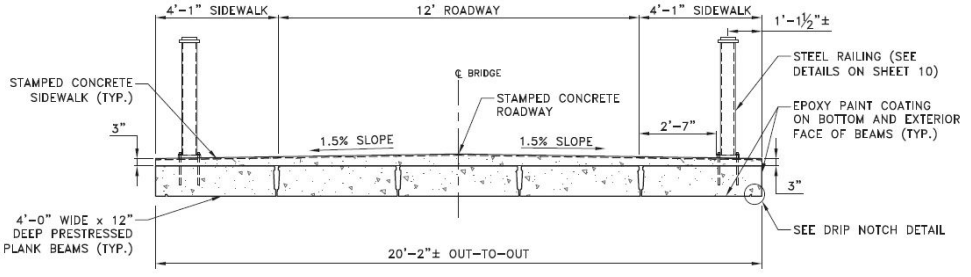
CAMDEN COUNTY PARKS AND RECREATION, OWNER

BRIDGE DESCRIPTION: Single-span, 32-ft 9-in.-long bridge constructed of five adjacent precast, prestressed concrete slab beams with a 12-ft-wide roadway and 4-ft 1-in.-wide sidewalks on both sides.

STRUCTURAL COMPONENTS: Existing reinforced concrete abutments; five 4-ft-wide, 12-in.-deep precast, prestressed concrete slab beams; and a 3-in.-thick, noncomposite cast-in-place reinforced concrete deck.

BRIDGE CONSTRUCTION COST: $310,000

General elevation view of new bridge taken from the pond side, looking southwest. Decorative stone facing runs along the existing parapets on the bridge approaches and extends down the outside face of the abutments and wingwalls.



Bridge typical section showing the 12-ft-wide roadway and 4-ft 1-in.-wide sidewalks with steel bridge railing on both sides. All Figures: William J. Castle.

used for the beam connections to the substructure, with one end considered fixed and one expansion.

Each of the five precast, prestressed concrete slab beams is 4 ft 0 in. wide, 32 ft 9 in. long, and 12 in. deep. The beams are connected using grouted shear keys and transverse tie rods. The precast concrete slab beams are designed to accommodate an H10 truck live load for park vehicles and a pedestrian live load of 75 lb/ft^2, as required by the owner. The shallow-depth, adjacent prestressed concrete slab beams were designed with a minimum concrete compressive strength of 6800 psi at transfer and 8000 psi at 28 days, and seven-wire Grade 270 prestressing strands—14 strands for the interior beams and 20 strands for the fascia beams. The noncomposite cast-in-place concrete deck is 32 ft 9 in. long and 20 ft 2 in. wide. The deck is 3-in. thick, required a minimum concrete compressive strength of 4000 psi, and is reinforced with welded-wire reinforcement.

The texture and color of the stamped concrete deck and sidewalks were approved by Camden County, which wanted the bridge aesthetics to blend into the park environment. The concrete features a gray cobblestone pattern on the deck flanked by a dark gray boardwalk pattern on the sidewalks. The steel bridge railings are coated in a black matte zinc coating and anchored into the concrete deck and slab beams. Solar-powered bollards are located on both ends of the new structure. New decorative stone facing was installed along the existing parapets on the bridge approaches and extends down the outside face of the abutments and wingwalls.

Conclusion

The contractor had to ensure that there were no adverse effects to the dam during construction and no operational or flow disruptions. Using prestressed concrete beams simplified the reconstruction of the bridge superstructure and helped control the final costs of the project. In addition, the aesthetics of the bridge complement the surrounding park area. The bridge was completed within time and on budget and opened for use in May 2022.

References

1. American Association of State Highway and Transportation Officials (AASHTO). 2020. *AASTHO LRFD Bridge Design Specifications*. 9th ed. Washington, DC: AASHTO.
2. New Jersey Department of Transportation (NJDOT). 2019. *Standard Specifications for Road and Bridge Construction*. Trenton: NJDOT. https://www.nj.gov/transportation/eng/specs/2019/pdf/StandSpecRoadBridge_20190528.pdf.

William J. Castle is a licensed professional engineer with Childs Engineering in Hainesport, N.J., and a recognized leader in marine structural engineering.

The Evans Mill Pond Pedestrian Bridge site plan showing the adjacent earthen dam, concrete spillway, and steel sheet-pile walls.