

# UTILIZING ABC TECHNIQUES FOR AN EMERGENCY BRIDGE REPAIR ON THE GARDEN STATE PARKWAY

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## ABSTRACT

Bridge No. 112.1NO is a three-span, simply supported, multi-stringer structure that carries the Garden State Parkway (Parkway) northbound outer roadway over Middletown-Lincroft Road. A backhoe carried on a flatbed trailer impacted the 36-foot long center span superstructure in November 2017, causing irreparable deformation of the east fascia and first interior stringers and damaging the adjacent diaphragms as shown in Figure 1. Following the temporary stabilization of the bridge by the on-call emergency services contractor, HNTB and the New Jersey Turnpike Authority (Authority) adapted Accelerated Bridge Construction (ABC) methods to rapidly replace the damaged superstructure in a single weekend.



Figure 1: Stringer Impact Damage

## ABC SOLUTION NEED

The Parkway is one of the busiest toll roads in the country and conventional construction methods using long-term duration lane closures for the permanent work would significantly disrupt traffic. An ABC solution was selected to minimize interruption. The ABC work activities were scheduled in a 67-hour high intensity construction cycle (HICC) from 10 am Friday to 5 am the following Monday and required closure of two of three lanes on the Parkway outer roadway in addition to the underpassing local roadway. Due to the roadway's high traffic volume, the HICC was scheduled for April 2018 during a limited weekend timeframe to avoid the peak travel season summer shore traffic. Two prefabricated bridge units (PBUs), each comprised of two steel stringers and a reinforced concrete deck, were proposed to replace the damaged members as shown in Figure 2.

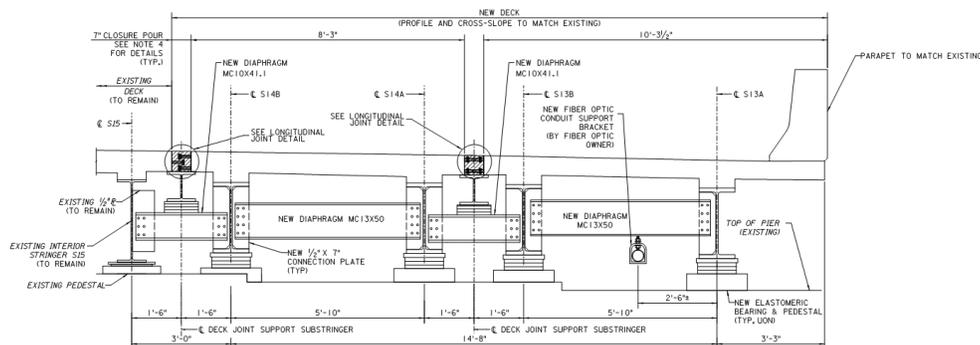


Figure 2: Proposed PBU Replacement Cross-Section

## MAINTENANCE AND PROTECTION OF TRAFFIC

Bridge No. 1121NO is situated in the section of Parkway that is split into an outer (local)-express (inner) lane configuration for both northbound and southbound travel directions. The design of the project's maintenance and protection of traffic scheme included the installation of portable variable message signs at strategic locations to provide customers with advance notification of the upcoming work. The signs also served to direct traffic not exiting the northbound outer roadway south of the bridge to the inner roadway during construction. The ability to shift traffic from the outer to the inner roadway was advantageous and minimized customer impacts.

## CONSTRUCTION SEQUENCING

The contractor performed advance work to maximize productivity during the HICC including the installation of four of the eight new elastomeric bearings. The contractor's construction sequence was as follows:

- Partial demolition of existing deck, stringers, bearings, and parapet and removal of debris
- Preparation of pier seats and installation of remaining bearings
- Installation of PBUs, sub-stringers, and intermediate diaphragms (See Figure 3)
- Installation of grout in longitudinal closure pour joints (See Figure 4), membrane waterproofing, and asphalt wearing surface

Cast-in-place parapet construction was performed within a closed shoulder behind temporary barrier subsequent to the weekend HICC. Deck joint areas were temporarily plated and paved with asphalt. Asphaltic plug joints were installed during a future maintenance contract.



*Figure 3: PBU Erection*



*Figure 4: PBU Longitudinal Closure Pour Grouting*

## **CONSTRUCTABILITY CONSIDERATIONS**

Constructability issues were addressed during design to maximize contractor productivity in the limited working timeframe. The design philosophy emphasized time saving measures including the following:

- Designing advance work that could be performed by the contractor prior to the weekend HICC
- Detailing and material usage conducive to rapid construction
- Designing PBU details and dimensions to expedite contractor erection activities
- Performing a detailed investigation of existing structure geometry to prevent PBU fit issues

### **Advance Work**

PBU stringers were located to avoid conflicts with the existing members where feasible, allowing the contractor to install several of the new bearings in advance of the weekend closure. The bearing masonry plates were set on anchor rod leveling nuts to permit rapid and accurate installation of the superstructure units and eliminate time-consuming concrete pedestal forming and curing. The areas below the masonry plates were packed with non-shrink grout.

### **Erection**

The PBUs were limited in width to control weight and provide the contractor with greater flexibility for crane size and placement during erection. The parapet was constructed in place to reduce the fascia unit pick weight, improve handling during erection, and ensure accurate geometric tie in with the existing parapet in adjacent spans. Sub-stringers were installed beneath the longitudinal joints to act as a closure pour form, provide additional support for the grout, and alleviate potential future grout cracking.

### **Fit**

The existing deck consisted of cast-in-place reinforced concrete overlaid with a thick variable depth asphalt wearing surface resulting from past roadway reprofiling. A coring program was implemented to determine the asphalt thickness and top of concrete deck profile/cross slopes. In conjunction with the coring program, a top of deck surface and appurtenant features survey was performed to accurately tie the new construction to existing and prevent fit issues.

## **LESSONS LEARNED**

The sub-stringer detail was requested by the contractor, however installation proved to be difficult due to fit issues. Since the sub-stringer was not necessary given the designed joint reinforcement, the detail should be removed from future projects of a similar type without detrimental effects on bridge performance or service life.

## **CONCLUSIONS**

The application of ABC techniques to an emergency bridge repair project on the Garden State Parkway proved to be tremendously successful for the New Jersey Turnpike Authority, continuing their tradition of providing excellent service. The contractor completed the repair work and opened the lanes twelve hours ahead of the anticipated schedule. As one of the busiest toll roadways in the Northeast, the use of conventional construction methods would have resulted in long-term lane closures and extensive delays for Authority customers traveling through the work zone. Instead of a construction period spanning multiple weeks, the bridge repairs were largely completed in a single weekend, limiting travel impacts and helping to ensure the safety of Authority customers, employees, and the project's contractor.