

November 1, 2018

Mr. Rob McFee, P.E.
Director of Engineering and Infrastructure
Beaufort County, SC

RE: Design Build for Broad River Fishing Pier Rehabilitation

Dear Mr. McFee,

The following narrative provides an executive summary of the work conducted on the Broad River Fishing Pier between 2014 and 2018. The purpose of this letter is to distill several years of testing, engineering, and construction documentation into a format that can be used by future consultants, contractors and Beaufort County officials in order to gain a comprehensive understanding of the Broad River Fishing Pier Rehabilitation Project. This letter provides an overview of the completed work to date, and the key points of the project are outlined in the following pages in bulleted form. For detailed information regarding the methodology used in the evaluation and preservation of the structure, we encourage future stakeholders to read and review our previously submitted deliverables for the project.

2014

- Beaufort County issued RFP092314 - Design Build for Broad River Fishing Pier Rehabilitation. The RFP required a guaranteed not to exceed maximum price proposal covering approximately 17 bulleted items. Of these bulleted items the most significant elements were:
 - Developing the repair program (engineering and plan development)
 - Clearly stating and certifying the load capacity of the structure.
 - Engineer's estimate on lifespan
 - Classification/Prioritization of repairs
 - Price proposal
- The project was awarded to the O'Quinn Marine Construction, Inc. (OMC) and McSweeney Engineers, LLC.

2015

- In February, Beaufort County Engineering issued the design build team a notice-to-proceed for providing a condition assessment of the structure in order to aid in developing a path forward in to develop an appropriate and economical rehabilitation of the structure.
- In order to provide Beaufort County a Condition Assessment of the structure as noted above, the design build team accomplished the following:
 - Complete above and underwater inspection of the structure

- Petrographic and compressive strength testing of concrete core samples taken in four locations throughout the superstructure
- Comprehensive review of all available design documents regarding the structure
- Load Rating Analysis
- A summary of the 2015 Condition Assessment is as follows:
 - Extensive spalling was observed throughout the bottom of the prestressed concrete spans (Spans 1 through 19). Approximately 80 percent of the spalling was located on outermost 10 spans. In most cases these spalls exposed reinforcing steel and prestressing strands. The exposed steel exhibited heavy corrosion with significant or total loss of section.
 - The piles and pile caps generally exhibited cracks with rust staining within the tidal zone.
 - The steel H-pile stingers at Bents 8 and 9 were exposed a maximum of 10 in. The exposed H-piles exhibited heavy scale and rust nodules. A review of the design documentation revealed that the stingers were 3 ft long; therefore, approximately 2 ft of embedment into the limestone remained.
 - Petrographic testing of the concrete cores estimated 4.8 lb/cy or 1261 ppm of chloride content. This level of chloride content is above the threshold generally accepted for initiation of steel corrosion at 500 ppm. Therefore, the design build team concluded that regardless of the method chosen, corrosion of the internal reinforcing steel was likely to continue.
 - Compressive strength testing of the concrete cores ranged between 5100 and 6200 psi. Design plans indicated a final girder release strength of 5000 psi. Therefore, the design build team concluded that no reduction in the original concrete design strength had occurred.
 - The design build team used all of the information presented above to load rate the superstructure. The load rating was performed using LEAP Conspan software and was peer-reviewed by a national engineering firm. The results of this analysis indicated that the superstructure could support a 60 PSF live load combined with a 20,000 lb two-axle vehicle. The design build team recommended limiting the vehicle load to 15,000 lbs which is consistent with a Type I ambulance used by Beaufort County.
 - All of the information presented above was used to generate an alternatives (and cost) analysis that ranged from do-nothing, to extensive repair, to demolition of the outer 10 spans.
 - At the direction of Beaufort County, the design build team generated a repair plan that consisted of extensive repairs using shotcrete throughout the entirety of the structure.
 - Due to cost, this repair plan was not implemented.
 - The design build team, in conjunction with Beaufort County, came to the conclusion that the best value to Beaufort County was to provide yearly above and underwater monitoring of the structure. At that point, the goal of the project became the preservation of the existing capacity of the structure, in order to extend its lifespan and safe use by the public.

2016

- Routine above water and underwater structure evaluations were conducted in late spring.
- The above water inspection revealed a minor increase (approximately 10%) in the level of spalling on the bottom of the prestressed and reinforced concrete beams supporting the superstructure.
- The underwater inspection revealed an increase in steel H-pile stinger exposure at Bents 8 and 9. In addition, stinger exposure was detected at Bents 6 and 7.
- The design build team recommended ongoing monitoring of the structure.
- Directly following Hurricane Matthew in October, the team conducted a post storm event structural evaluation. The evaluation revealed a slight increase in spalling and cracking of the concrete beams, as well as, minor increase in stinger exposure. The team concluded that any increase in deterioration of the structure could be attributed to the age of the structure as opposed to damage from the storm.
- The design build team recommended ongoing monitoring of the structure.

2017

- Routine above water and underwater structure evaluations were conducted in late spring.
- The above water inspection revealed a very slight increase in the level of deterioration of the prestressed and reinforced concrete girders.
- The underwater inspection revealed that the condition of the piles, pile caps, and exposed stingers had remained relatively unchanged.
- A comparison of previous inspections revealed that although the beams had continued to slightly deteriorate, there was no acceleration in the rate of deterioration. Therefore, the design build team recommended moving forward with a repair/preservation plan for the structure.

2018

- Early in the year the design build team began generating repair/preservation concepts for the structure. Several different alternatives were considered in order to preserve the capacity of the girders and piles.
- Routine above water and underwater structural evaluations were conducted in late spring.
- The results of the inspections revealed the least amount of change in the superstructure and substructure conditions when compared to the preceding years.
- Following the routine inspection evaluation, the design build team was directed to finalize and implement repair and preservation methods at the structure.
- After careful review of the alternatives and approval by Beaufort County, the design build team developed the following plan for structural preservation:
 - Substructure repairs were limited to Bents 8 and 9 and consisted of:
 - The installation of 16 fiber reinforced pile jackets

- Jackets extended from the exposed limestone layer at the base of the piles to approximately 4 ft above the channel bottom and fully encapsulated the exposed steel H-Pile stingers.
 - Each jacket was filled with welded wire mesh and high-strength cementitious grout.
 - The installation of the underwater repairs was monitored and approved by the engineer-of-record.
- Superstructure repairs were limited to Spans 1 through 10 and consisted of:
 - Chipping and removing loose concrete
 - Removing and cutting broken prestressing strands
 - Pressure washing of beams and application of zinc-rich primer to the ends of exposed prestressing strands
 - Application of grout over the ends of the exposed prestressing strands
 - Application of Sika 903 FerroGard. This product is a corrosion inhibiting impregnation for hardened reinforce concrete. This product was applied to the entirety of the beams and underside of the deck.
 - Installation of Sika 705L, a water-repelling penetrating sealer specifically designed for concrete substrates
 - The implementation of these repairs was reviewed and approved by the engineer-of-record and Beaufort County.

Conclusion

The preceding sections show that several years of comprehensive structural evaluation were used in the generation of the repairs that were implemented in 2018. The design build team firmly believes that the implemented repairs provide the best value to Beaufort County residents; especially considering the structure's age and condition. It is difficult with any reasonable degree of accuracy to state the life expectancy of the structure. However, it is likely that continued inspection and minor repair will extend the life of the structure many more years. With this understanding, we recommend continual annual above and underwater inspections be conducted in order to evaluate the condition of the structure, integrity of repairs, and the need for additional preservation methods.

Very truly yours,



William Barna, P.E.