August 2020 ABC-UTC Webinar Featured Presentation: Lake Pontchartrain Causeway Bridge & Safety Bay Construction, Past & Present		
#	**Questions**	**Responses**
	Design	
1	What determined the need for the safety bays?	Safety bays were needed because of the lack of shoulders on both the Northbound and Southbound bridges, and the fact that disabled vehicles do not have a place to pull over, potentially causing accidents.
2	How did you determine where to locate the shoulder turn-outs along the Causeway?	The shoulder turn-outs were placed between the existing crossovers to maximize their effectiveness.
3	What were the major environmental challenges for this new construction?	Pretty similar to the existing bridge -- prestressed piles in brackish water, storm surge, light vessel impact, and sea level rise. Fortunately, the bridge deck is about 16 feet above mean water level, so deck durability near the splash zone is not an issue.
4	Were there any structural analysis aspects to this project?	The prestressed girders and deck were designed using conventional girder design software. The caps were designed using hand methods, including conventional beam design and strut-and-tie analysis. Pile capacities were determined by the geotechnical engineer based on past plans and driving records (where available) and a test pile program conducted at the start of the project.
5	What surge and lateral wave force analysis was utilized to counter bouyancy and racheting of the wider deck profile?	Because the deck is approximately 16 feet above water level, it was not necessary to perform a lateral wave force analysis. This decision was borne out by the performance of the existing structures and documented storm events over the past 65 years. As an added precaution, three large diameter holes were placed in each end diaphragm of the safety bay spans in order to expel trapped air should water levels rise where bouyancy is a concern.

6	Please describe the owner's consideration of aluminum bridge decking in the early stages of this project and its potential use.	That concept was abandoned due to potential problems with women's high-heel shoes getting stuck in the open grid floor.
7	Were there any foundation improvements for this project? Have you used ABC techniques for construction of the foundations?	At each bent, the contractor chose to use a single 54-inch-diameter spun-cast cylinder concrete pile rather than three square concrete piles. The precast cap with a rebar cage was lowered onto the hollow pile and grouted into place for a solid connection. All of this was done working from the barge away from traffic.
8	What was the bonding method of the old to new concrete for this project?	Headed bars were used to connect the existing caps to the new caps, with a closure pour made of normal concrete with f'c of 4500 psi. Headed bars are a proprietary product; therefore, the contractor submitted the manufacturer's test data showing that they met the necessary design loads.
9	What was the longest bridge before yours?	Prior to the Causeway Bridge opening to traffic on August 30, 1956, some of the longest continuous highway bridges in the U.S. were as follows: • Watson-Williams US 11 Bridge over Lake Pontchartrain, Louisiana (5 miles long) [opened in 1928]; • San Mateo Bridge in San Francisco, California (7 miles long) [originally built in 1929 and replaced in 1967]; • Seven Mile Bridge in the Florida Keys, Florida (7 miles long) [originally built as a railroad bridge in 1912, converted to a highway bridge in 1938, and removed from service in 1982]; • Sunshine Skyway Bridge over Tampa Bay, Florida (5.5 miles long) [opened in 1954 and replaced in 1987]
	Construction	
10	Can you discuss unintended consequences of design and/or construction decisions for this project?	Not necessarily a consequence, but we did have to overcome the existing bridge movement. Over the years, most existing spans have moved a little vertically, longitudinally, and transversely. We had to accommodate this through existing bearing pad replacements and adjusting locations of the longitudinal deck joints.

11	Please describe the pile foundation design and construction such as pile driving equipment (hammer, lead, template, etc.).	Foundations were driven 54-inch-diameter spun-cast cylinder concrete piles. Piles were installed with barge-mounted cranes. Temporary templates were installed and supported by four temporary steel pipe piles. The 54-inch-diameter pile was then erected into the template and driven using leads and either a hydraulic or diesel pile-driving hammer.
	Maintenance	
12	What are the main maintenance issues with the bridge?	The main maintenance issues are related to either the two double-leaf bascule bridges or some of the electrical and camera operations.
13	How have the original spun-cast cylinder piles performed durability wise, and is the Lake mostly freshwater?	The original piles have a thinner wall thickness, 4 inches and 5 inches on the Southbound and Northbound bridges, respectively; however, they have done well considering the brackish water in the lake. Some of them have been wrapped at the splash zone. New piles have a 6-inch wall thickness.
	Cost	
14	How and what claims were addressed, if any?	There were no claims. Generally, claims are not made in a CMAR contract.
	Questions during Webinar	
15	How did you overcome the environmental permitting process while using the CMAR and ABC, specifically in regard to the timeline?	Permits were not very restrictive and did not cause any delays in the project. The only cause for delays was adverse weather conditions, which were ample in the lake area.
16	Does this bridge have much of a vertical profile? I was thinking in terms of the transverse joint fit-up at each pier.	The bridge is generally flat, with the exception of a couple of high level locations for marine traffic and bascule bridges.
17	What does GNOEC stand for?	GNOEC stands for the Greater New Orleans Expressway Commission.
18	Was the cast-in-place joint between the precast and existing bent cap poured using normal f'c concrete?	The cast-in-place joint between the precast and existing bent cap was poured using normal strength concrete, f'c = 4500 psi.

19	What is the material used in the closure pour? Were any reinforcement bars spliced between the existing and new superstructure?	Headed bars were used to connect the existing caps to the new, with a closure pour made of normal concrete with f'c of 4500 psi. Headed bars are a proprietary product; therefore, the contractor submitted the manufacturer's test data showing that they met the neccessary design loads.
20	What was the length of the cap splice with headed bars?	The length of the cap splice bar was 1 foot, 6 inches.
21	How were the existing barriers dismantled?	The two bridges have different barrier sections that required modification of the installation sequence to accommodate removal. On the Southbound bridge, the existing barriers were removed with a horizontal sawcut at the deck elevation after the safety bay spans were in place; this operation was performed at night and did not require lane closures on the existing bridge. On the Northbound bridge, the safety bay spans were erected after the existing barrier was removed the same night via a vertical sawcut near the gutterline; this operation required a single-lane closure on the existing bridge. Approximately two spans were erected per night for the Northbound bridge.
22	At what level of sea level rise will the bridge be over-topped?	These bridges will not be over-topped by the normal sea level rise which will be only a few feet. However, that will be different than a surge effect caused by a major hurricane; even under such conditions, the elevations of these bridges have generally kept them out of the surge levels under extreme conditions.
23	Why didn't you consider using taller barriers instead of adding shoulder lanes?	On the Southbound bridge, barriers have been retrofitted to address the barrier performance at TL-4; however, that does not address the problem with lack of shoulders and not having room to store stranded vehicles.
24	Who took the risk for the cost of the Advanced Work Packages that occurred prior to the execution of the Construction Contract?	The risk was taken by the owner; however, all of that material would have been tranferred to the low bidder had the project been let to competitive bid.

25	Did all the precast piles have the same length?	No, some of the precast piles were shorter due to the variation in the soil conditions, and others had to be cut off at refusal.
26	How did the Contractor foster a transparency culture?	The team work started on the right path from the beginning to the end.
27	How many new bents/piles were added with the 57 million dollar budget?	A total of 12 bays (6 per bridge). 18 spans per bay for the Southbound bridge, for a total of 19 bents x 6 = 114 bents, and 12 spans per bay for the Northbound bridge, for a total of 13 bents x 6 = 78 bents. A total of 192 bents for the project. With one pile per bent, there are 192 piles for the project.
28	How did you make sure the new piles were placed in the correct location?	Accurate placement of the piles was accomplished using a pile-driving template. Each template was supported by 4 temporary driven piles.
29	What percentage of the length of the bridge now has safety bays?	Less than 1.2 miles per bridge, about 5 percent of the nearly 24-mile-long bridge.
30	Could the shoulders be retrofitted to a full lane along the entire bridge length in the future?	Yes, but we are a long way from that day. Good idea, however.
31	What was the age of the precast beams and slab when the slab closure pour was cast?	The deck closure pour was abandoned in favor of a 1-inch-wide longitudinal joint between the new and the old deck.
32	Do you see this solution being replicated in the U.S. on other long bridges, and what are the limitations with this method?	Yes, depending on accident rates and history and if the bridge lacks shoulders. The limitation may be the remaining useful life of the bridge. The less life, the lesser return on investment.
33	Did you use a special mix design for the closure pour concrete (like non-shrink concrete)?	Plans called for structural concrete f'c = 4500 psi for the closure pour between the old and new bent cap.
34	Was it considered to make this a one lane, one shoulder bridge?	No; even though the idea sounds good, the traffic volume will not support it.
35	Is there any chance of making the entire system three lanes in each direction in the future?	Maybe; although due to extremely high cost, it is highly unlikely at this time.

36	Were there any design considerations to build within the two bridges?	Construction means and methods did not support building between the two bridges.
37	What was the design capacity of the 54-inch-diameter cylinder piles?	The maximum pile load was 235 tons service; however, these piles are capable of handling very high stresses. In pure compression, near 1400 tons; however, much less than that when combined with bending moment. You may refer to PCI's P/M curves for prestressed concrete piles.
38	Is the water that accumulates on the deck drained directly into the lake? If not, how do you maintain the drainage pipes?	The water that accumulates on the deck is allowed to drain directly into the lake with open drains.