ABC-UTC 2023 In-Depth Web Training: Precast Substructures		
#	**Questions**	**Responses**
	Module 3: Louisiana's Precast Erection for Lake Pontchartrain Bridge Safety Bay Substructure	
1	What constraints do precast substructures alleviate?	Precast substructures can be used for many reasons, depending on the size, location and site-specific aspects of the project. These include: Access restrictions (minimize labor and increase worker safety by not having to tie cages and form and pour concrete using temporary platforms over water or in busy urban traffic); Schedule constraints (speed erection by casting components in advance and delivering to site when needed; minimize onsite labor and component construction durations); Better quality control through the use of shop fabrication; Worker and/or user safety considerations by minimizing onsite construction activities and lane shutdowns and detours.
2	What are the main, including logistical, challenges to implement precast substructures?	Challenges for precast substructures depend on the specific component: (1) Foundations such as driven piles are common but require significant installation time. If soil conditions permit them and scour is not an issue, precast footings may be an attractive option. (2) Columns are typically easy for a contractor to fabricate cages, form and cast in place so there needs to be a compelling reason for them to use precast, such as schedule acceleration, minimizing lane/traffic shutdowns or access/safety considerations during construction for workers and/or vehicle users. (3) Precast caps are probably the easiest component to substitute for cast-in-place construction. These can be incorporated generically in the Contract Plans by the EOR (Engineer of Record) on a design/bid/build contract or more specific to Contractor means and methods on a design/build or CMGC (Construction Manager / General Contractor) contract, or as the Contractor's specialty engineer during construction. (4) The biggest challenge to incorporating precast substructures involves the use of design/bid/build contracting methods because the Contractor and his preferred means and methods are unknown. Ultimately, the decision to use precast substructures is made by the contractor so alternative delivery methods or incorporation after letting are the best vehicles for their use.

	Questions during Module 3	
3	On Slide 16, what is the purpose of the cast-in-place cap splice?	Because the safety bay structure consists of a two-girder deck unit on top of a single-pile foundation, it is not sufficiently stable without being connected to the existing structure at either the deck level or pile cap level. Because a deck connection would require the Contractor to drill and grout bars into the existing deck over the entire 1008-ft length of the safety bay, the Contractor preferred to connect the new caps with the existing pile caps as follows: (1) drill and grout straight or headed bar dowels into the existing caps; (2) lap horizontal bars from the new cap with dowel bars and cast a closure joint between the two caps.
4	Was it more cost effective to use prefabricated circular piles than using drilled shafts?	Drilled shafts are often not practical for water environments because they need to be cased from the top of the water level to a depth below the mudline where the soil layers are stable enough to permit drilling and excavation of spoil without risk of the hole collapsing or the sides degrading during cage placement and casting. Where soils consist of granular material, silts or clays that permit driving without reaching refusal prior to the necessary bearing or lateral pile lengths being achieved, driven piles are generally preferable at lake and river sites. Such was the case for Lake Pontchartrain. (Driven piles may also be preferable in soil conditions that benefit from densification due to vibration and lateral displacement of the soil resulting from the installation process.)
5	Have underwater inspections shown any signs of deterioration at the joints between the precast pile elements?	Since the 1980s, approximately 3000 of the piles on the two bridges have been wrapped with fiberglass and epoxy due to deterioration of the joints and pile walls. The pile wall thicknesses have been increased with each successive project for durability reasons (4 inches on the 1950's southbound bridge, 5 inches on 1960's northbound bridge and 6 inches on the Safety Bay project). Underwater inspections, though difficult due to limited visibility in the murky water, have been made throughout the years and repairs have been made as required. It is not feasible to inspect below the mud line. Fortunately, as one gets below the splash zone and deeper into the water and eventually into the mud, oxygen levels drop, which minimizes the potential for deterioration of the post-tensioning due to corrosion. With the majority of spans being simple and relatively short, lateral bending is not a major consideration so the maximum tensile stresses in the piles occur during the driving process.

6	How can we adjust the final top elevation? Should we adjust at the pile, bent, or deck level?	It is best to determine required top-of-deck construction elevations based on roadway alignments, profiles and cross-slopes (and as-built survey data for existing structures), then work down to determine the required elevations for each component (cap, bent, girder, deck) but allowing for adjustments at any or all steps during construction, as necessary. Piles should be driven to (or cut off at) the appropriate elevation. (Note: It may be advantageous to set top of pile or shaft slightly below its desired elevation since it is easier to adjust elevations up, rather than down, in subsequent stages.) Caps will need to be set on temporary brackets or supported on top of piles using shims or other devices to ensure proper placement elevations. As with tops of piles, bent caps may be set slightly lower than desired to allow for upward adjustment during subsequent steps. If bearing seats are to be cast-in-place, this allows for additional elevation adjustment. If the seats are precast with the caps, it may be necessary to use steel bearing shim plates under the bearings in order to raise them. If the deck will be cast-in-place, this allows one additonal opportunity to make elevation adjustments after placing the beams/girders. However, once you get to superstructure erection, it gets increasingly more difficult to make elevation adjustments.
7	Did the existing and new decks line up well vertically, or was additional effort needed after the rails were cut off?	Although it was necessary to make adjustments at each bent location to ensure proper vertical alignment of the new deck units with the existing spans, overall span levels matched relatively well between structures. However, because the southbound structure required a horizontal cut to remove the existing barrier and curb, it was necessary to build up or grind local areas of the cut surface to provide a smooth transition. The northbound structure required a vertical cut through the deck to remove the barriers, so horizontal alignment of the 1-inch open joint was more difficult to achieve than vertical alignment between the two structures.
8	What was the interface roughness for the inside surface of the cylinder pile at the cap / pile connection, and how was it achieved?	No special treatment was performed on the inside surface of the piles at the cap/pile interface connection. The cast-in-place plug with reinforcement cage was sufficient to restrain cap rotation without concern for slippage, particularly given the simple-span, neoprene bearing support and linear footing/cap configurations.