March 2021 ABC-UTC Monthly Webinar:
San Antonio Street/Comal River Bridge Rehabilitation – Accelerated Schedule with Precast Elements

#	Questions	Responses
	Design	
1	How do you address alleged design issues from the contractor and fabricator?	There was constant communication between the contractor, fabricator, and engineer. Field issues were immediately sent to the Engineer of Record (EOR) to analyze and develop a solution. Great communication is the recipe for success.
2	What structural/non-structural elements could be precast? How is the design for precast different from the design for cast-in-place?	Precast elements included the bent frames, the beams, and the finials. There are a few more loading conditions to analyze due to shipping, erection, and connection design at the base.
3	Because the precast elements were a new design, how difficult and time consuming was the review of the project by TxDOT?	TxDOT was motivated to have the construction schedule accelerated; therefore, TxDOT was willing to expedite their review process to ensure success.
4	Was the load path altered? If yes, can you tell us how it was altered?	In the final condition, the load path is essentially the same as the contract plans. During the constuction stages, the load path is different than in the contract plans.
5	Was the precast bent frame designed using the strut and tie method?	No, the precast bent frame was not designed using the strut and tie method. The frame functions primarily as a truss, so members primarily carry axial loads, not flexure or shear.
6	How was the existing arch analyzed to ensure sufficiency?	We did not get involved in verifying the structural integrity of the arches. The arches were removed from the structural resisting system.
7	Were any serviceability calculations performed?	Yes, serviceability calculations were performed. Additional serviceability checks beyond the requirements of AASHTO were requested to ensure minimal cracking in the frame. These additional checks were coordinated with TxDOT.

	Construction	
8	Can you discuss needed Change Orders resulting from weather, changed field conditions, or traffic?	There were no other change orders related to weather or traffic conditions.
9	If Ultra-High-Performance Concrete (UHPC) was used, can you tell us if the state or local agency used a proprietary mix, or if they have standard specifications for this item?	We did not use Ultra-High-Performance Concrete (UHPC).
10	Were any of the components made out of structural lightweight concrete, or was everything "normal weight" concrete?	None of the components were lightweight concrete. We used regular concrete in all pieces.
11	Can you discuss any shipping weight limitations on delivery routes, maximum size for shipping, and maximum crane size for on-site lifting weights of the precast items?	There were no shipping weight limitations. The heaviest piece was the truss bent at 93 kips. The crane had a 250-ton capacity.
12	Were there any issues with transporting the precast elements to the site? What were the maximum size and weight of the precast elements?	There were no weight issues, just a 12-foot extra width permit.
13	What was your favorite part of construction? Are there any lessons learned that you want to share with the group?	It is fun when you think outside the box and see how precast makes it fast.
	Cost	
14	Can you tell us the cost of the project for design and construction?	The Engineer's Estimate was $4.5M. I do not have the information for the design cost.
15	What is the cost difference between ABC and conventional bridge construction?	In this particular case, very significant savings were achieved using ABC versus conventional bridge construction, probably 50%.

	Questions during Webinar	
16	How many years of service life will the bridge have after construction?	*Response from TxDOT:* TxDOT does not generally perform service life analyses for bridges of this type. By designing the new components according to the AASHTO LRFD Bridge Design Specifications, these components are expected to meet or exceed the 75-year service life associated with the specifications. Realistically, we expect far longer service life than that given the typical performance of such structures, particularly in Central Texas where the reinforced and prestressed concrete is not exposed to many chlorides. The design featured the reuse of the original existing pier and footing components, which do indeed have advanced age, and may need some form of maintenance/preservation over that term. A condition survey established the viability of the existing substructure. Generally on rehabilitation projects and historic structures, we do set a goal of avoiding intervention of 25 years, if feasible.
17	Was keeping the bridge as a one-way bridge considered and, if so, how much longer would it have lasted?	Keeping the bridge as a one-way bridge option was not considered because there are no other one-way city streets in New Braunfels. With the bridge being load posted, the bridge was still structurally sufficient.
18	With the rail cast on the sidewalk, did the rail have to be checked for an increase moment arm?	The rail did not need to be checked for an increased moment arm. The rail-to-sidewalk connection is a TxDOT standard connection detail and is designed for this condition.
19	Were the interior spans put on elastomeric pads?	Elastomeric pads were used under the beams at Abutment 1, Abutment 8 and Bent 5, which coincide with the expansion joint locations in the deck.

20	What is the life span of the new bridge having a new deck with existing substructure?	*Response from TxDOT* : The design featured the reuse of original existing pier and footing components, which do indeed have advanced age, and may need some form of maintenance/preservation over the 75+ year longevity of the new components. A condition survey established the viability of the existing substructure. Generally on rehabilitation projects and historic structures, we do set a goal of avoiding intervention of 25 years, if feasible. Given the existing substructure component condition and type, such intervention is expect to be minor in scope.
21	If the dowel bars tie the bent frame with cast-in-place keys, how can the joint filler function to allow the bent frame rotation?	Only three bent frames were required to allow rotation (Bent 2, 5 and 7). At those bents, Bars A (presentation slide 50) are not bonded to the frame. Instead, PVC pipe sleeves are cast into the frame and then bars are placed into the pipe sleeves. This ties the left key to the right key, but eliminates bond to the actual frame.
22	Were the precast elements a concern with regard to weight for lifting?	The contractor was not concerned with the maximum weight (93,000 pounds) of the precast elements.
23	What is the strength of the closure pour concrete used to establish the superstructure continuity? Did you have any special detail to ensure the closure will not be a future spall/cracking location? How is the fixed/expansion bearing location laid out?	Concrete used for continuity in the superstructure had f'c = 4000 psi, which matches the other parts of the deck concrete. The detail follows AASHTO provisions for continuous-for-live-load design. In addition, a National Highway Institute (NHI) design example provides guidance for designing this detail to account for positive moment due to girder creep. Using the following nomenclature (E = expansion, F = fixed, H = limited hinged), the end conditions were as follows: Abutment 1 (E), Bent 2 (H), Bent 3 (F), Bent 4 (H), Bent 5 (E), Bent 6 (F), Bent 7 (H), Abutment 8 (E).
24	Were the spandral columns attached to the beam superstructure in any way?	The spandral columns were not attached to the beam superstructure. There is an air gap of a couple inches (varies from column to column) at this location. Columns and arches no longer contribute to the structural system, and are there only for aesthetics.
25	How much did a precast bent frame weigh?	The precast bent frame weighed 93,000 pounds.

26	You presented the precast substructure and superstructure, but we didn't see the details of the foundations. Did you keep the same foundations? Did you ensure that the foundations were sufficient to carry the extra vertical loads and also the forces induced by the continuity configuration of the superstructure?	The original foundations were sufficient. This was determined by TxDOT prior to the re-design by the contractor's engineer. The original foundations were footings resting on solid limestone with an abundance of extra capacity. The loads induced by making the superstructure continuous were addressed primarily by releasing the rotation at specified bents so as to eliminate the locked-in thermal moments at the base of the frames. However, the force/moment that did exist at the fixed bents was checked to ensure that it did not adversely affect the arch, which resists the lateral load.
27	What type of bearings were under the strut, and were the bearing pressure and rotation stresses verified?	The bearing pad under the bent frame was a cotton duct pad. It has high compressible strength and is relatively inexpensive. The bearing stresses applied to the pad and the concrete under the pad were checked, including the effect of rotation.
28	Was using structural lightweight concrete an option for consideration when keeping the existing substructure, to help reduce the weight and to increase the live loads with a wider upper structure?	We are not sure whether TxDOT considered the use of lightweight concrete for the structure. The developed solution worked well with normal-weight concrete.
29	What investigation was done to assure the foundation was structurally adequate to support the increase in weight due to the change and increase in superstructure weight?	TxDOT performed the footing evaluation during project development. The existing arch is supported by the footings resting on solid limestone. The footings were determined to have adequate bearing capacity for the increased loading.
30	Can you please explain the connection between the bent frames and the original arches?	The bent frame is supported on a concrete build-up with a cotton duct bearing pad. Cast-in-place concrete key-struts were then cast on each side of the frame to provide lateral and flexural resistance.
31	It appears that there is a significant increase in live load and dead load reaction. How much capacity reserve does the existing foundation have?	TxDOT evaluated the existing foundations during project development. The existing arch is supported by the footings resting on solid limestone. The footings were determined to have adequate bearing capacity for the increased loading.

32	Was there any discussion regarding the precast beams to be arched rather than straight sections?	There was no discussion regarding arching the precast beams rather than having them straight. The original deck was thin and straight (level). It is my understanding that the design intent by TxDOT was to provide a thin beam to resemble the original deck.
33	Was rotation due to live load deflection a consideration when making the continuous connection over the bents and eliminating elastomeric bearings?	Rotation due to live load was a consideration in design. The connection detail was designed following AASHTO provisions for making the connection continuous for live load. The National Highway Institute (NHI) has a design example following AASHTO if a reference is desired.
34	How did you evaluate the adequacy of the footings for the new traffic loading, given the changes in the design truck loading?	TxDOT evaluated the existing footings during project development. The existing arch is supported by the footings resting on solid limestone. The footings were determined to have adequate bearing capacity for the increased loading.
35	Did the bridge width enlargement result in an increase in the foundation loading?	TxDOT evaluated the foundation loading due to the increased width during project development. The existing arch is supported by the footings resting on solid limestone. The footings were determined to have adequate bearing capacity for the increased loading.
36	For the continuity connection over the supports between box girders, were non-prestressed strands, rebar, or a combination of the two used for the hooked positive reinforcement?	Both hooked reinforcing bars and extended strand were used for the continuity connection in construction. However, we did not include the benefit of the strands in our calculations, and only used hooked bars in the design.
37	Although the external appearance shows an arch bridge, should the official bridge category show it as a precast box beam bridge?	*Response from TxDOT:* Yes, the bridge will be coded as having a prestressed concrete box beam bridge superstructure.
38	Was there any issue related to surface or shrinkage cracking after construction?	We are not aware of any issues related to surface or shrinkage cracking after construction.
39	As the bridge basically went from an arch to a box beam, were the vertical supports on the arches themselves necessary or left in for aesthetics only?	The original columns and arches do not participate in the structural resisting system. They are there only for retaining the appearance of the original structure.

40	What type of reinforcement coating (bare/black/epoxy/galvanized) was used in the precast elements, i.e., beams/bents/ etc.? As a 100% concrete structure deteriorates over time, our best approach is to remove the unsound concrete, tap into competent material, and cover with a non-shrink grout. Basically, covering the problem with dead load without regaining strength.	The location is in a very mild environment, with very low exposure to corrosive elements. Black steel (uncoated) Grade 60 reinforcing steel was used.
41	In the case of using cast-in-place concrete with precast structural elements, how did you consider the secondary effects due to shrinkage and time losses?	Assuming this question regards the continuity of the superstructure, the National Highway Institute (NHI) has a great example for designing this continuous-for-live-load detail. The example discusses accounting for creep camber, deck shrinkage, and other prestressed versus cast-in-place concrete attributes.
42	Did you use a slide-in method?	No slide-in method was used for this project.
43	You mentioned that you avoided problems with the haunch. Can you go over this again quickly?	The elevation differences between the top of beam (exterior girder) versus the top of deck (interior girder) were covered up with the sidewalk. The sidewalk was strengthened to function as a second cast-in-place concrete deck.
44	What size are the field bent bars at the base of the bents?	The field-bent bars at the base of the bents were #5 bar reinforcement.