ABC-UTC September 2021 In-Depth Web Training: Development and Implementation of the Connecticut DOT ABC Program			
Module	**#**	**Questions**	**Responses**
1		**Early ABC Projects at the Connecticut DOT**	
	1	What were the lessons learned from the first precast deck panel projects?	You need to account for the fact that nothing is fabricated perfectly, and you need to have adjustability. This is done through a grouted haunch and closure pours at the ends of the spans. Also, good detailing is very important if you want to get good performance.
	2	How have the bridges performed over the years?	So far, all of our ABC projects are performing as good or better than conventional construction.
	3	How was the ABC program initiated? Is there dedicated funding for the ABC program?	ABC is part of the normal practice in Connecticut. There is no separate dedicated funding for ABC.
	4	For Seymour Viaduct, was the asphalt wearing surface removed on the entire bridge prior to replacing spans, or was the new deck set at the same elevation as the existing wearing surface to allow traffic flow during the week?	The entire wearing surface was removed prior to start of construction and replaced at the end of the season. The new deck was set at the same elevation.
	5	On projects that included roadways below, what precautions were used to ensure they were not affected and traffic was protected?	Standard protection methods were used. For deck replacement projects, timber sheilding between girders is common. Overhang work is typically done during off-peak hours with lane closures.
	6	Were there any issues with deck panels lying on multiple girders in terms of weight distribution?	The leveling bolts are used to set grade and provide relatively equal load distribution. This is done by torquing each leveling bolt to approximately the same value.
	7	The shear key blocks were grouted after post-tensioning. Is buckling of the deck system possible upon post-tensioning and before the shear keys are engaged? If yes, what measures were considered to prevent this?	This issue was studied. The weight of the panels easily prevents the panels from buckling upwards.

	8	Assuming that you performed the post-tensioning after grouting the shear stud blockout, what are the advantages/disadvantages for this sequence? What is your recommendation for sequencing?	Post-tensioning after composite action would create a positive bending moment on the girders below, which it typically not desirable. The recommended sequence is to establish composite action after the post-tensioned connections are made.
2		**Development of the CTDOT ABC Decision Matrix**	
	9	How did you set the weight factors for the matrix?	The matrix was tested on multiple project types. The weight factors were modified to get a "reasonable" result, consistent with the goals of the program. High importance was placed on the "user impact" and "construction cost" variables through differential weighting, consistent with the Connecticut DOT priorities to mitigate traffic impact to the traveling public and highlight cost in the evaluation of ABC/conventional bridge construction alternatives.
	10	Why do you not calculate actual user costs?	User costs are not money you can spend, so applying them to a cost decision process has limited value. Our major concern was to clearly identify variation in user impact between conventional and ABC methodology, the comparative results of which are fed into a ratio-method based ABC decision matrix rating table for generation of ABC project favorability ratings.
	11	How long does it take to fill out the matrix?	It can vary from a few hours to a few days, depending on the traffic information that needs to be gathered, construction cost differences between ABC and conventional construction, and construction duration differences between ABC and conventional construction.
	12	Does the Connecticut DOT consider life cycle costs and modelling when determining the best solution rather than simply initial cost?	Yes, typically life-cycle costs are compared for the various design alternatives investigated during preliminary design.

	13	How do you estimate the cost of ABC projects such as cost based, historical prices, etc.?	There are a number of significant factors that affect ABC costs, including: - How fast is fast - Complexity of the project (type of ABC) - Site conditions (access) - Risks for the Contractor - Disincentive clauses - Need for specialized equipment All of this is considered along with historical bid information.
	14	What various levels of the Connecticut DOT were involved with the creation of their ABC Decision Matrix?	The Matrix was developed by a select committee of bridge, traffic, and construction engineers with review by several mid-level managers.
	15	Is there a better way to model the detour delay time since the majority of traffic, if not all traffic, will not be driving from one abutment to the other?	You need to use a certain amount of judgement based on your knowledge of the location. Trip origin and destination data could be gathered, if warranted, before completing the decision matrix to be used to generate a more accurate determination of user impact.
	16	Is there a weight that would be applied for the detour analysis in the immediate area? For example, the example was offered that for the bridge in Tolland, traffic was not going to be traveling over the bridge anyway even though the detour scenario was shown to have a user impact of -400%.	See answer to Question 15. The key is to look at the detour time and consider how realistic it is, and what are the origin and destinations of typical travelers. This process is not totally cookie cutter. Designers are encouraged to use logic in making adjustments to the ADT associated with the detour routes, where necessary, in calculating the user impacts for ABC and conventional alternatives.
	17	In the spreadsheet, do you directly account for accidents in the corridor? Does the number of accidents in the corridor influence the decision to use ABC?	The estimates for congestion take this into account to some extent, but we do not specifically account for accidents as they do not happen every day. For high-profile projects, we have had a tow truck on site 24/7 to clear accidents quickly should they occur.

	18	Do you consider impact to businesses in the decision process?	The ABC decision matrix format does not specifically address business concerns impacted by a bridge project. However, potential impacts to businesses as a result of bridge construction projects are carefully considered and could rightfully influence a final ABC decision. Business reaction to an ABC bridge project proposal would typically play out during the public involvement process after the ABC rating analysis has been completed but before a final project ABC decision has been made.
3		**Simplified Method for Calculating Road User Delays in ABC Projects**	
	19	Can we use a more sophisticated user delay process?	The users can dive as deep as they want. We feel that a simple process during preliminary design is adequate. If desired, a more detailed process can be employed.
	20	At what point in the project development process should this process be used?	We suggest that the process be used during preliminary engineering after a structure type study has begun. It is important that the ABC evaluation be done before public outreach and Design Approval. The bridge construction methodology alternative favored by the owner should be presented to the public, chief elected officials, and emergency first responders before a final decision is made.
4		**Detailed Project Example 1 – ABC Decision Process, with Positive ABC Decision**	
	21	The project has longitudinal post-tensioning. Would you consider the use of UHPC on the project?	Yes. It should be understood that UHPC may not work for weekend work, as it takes a few days to achieve the high strength.
	22	How did the actual project traffic management compare to the estimates?	The estimates were accurate and perhaps a little conservative, as drivers will tend to avoid a construction site, thereby reducing the actual ADT at the site.

	23	Can you comment on observations related to the curing specifications in projects used by the Connecticut DOT?	Our research has shown that curing can be reduced with high strength mixes used for ABC connections. As strength increases, the permeability decreases, thereby reducing the need for long-term curing. This continues to be a subject that we are investigating and considering.
	24	How were the skewed ends handled relative to the deck panels?	Skew can very much complicate the detailing, especially with post-tensioned panels. There was ample time to pour triangular closure pours to complete the deck.
	25	Have you had to contend with considering lead-based paint abatement on the top flanges of girders in your analysis of the time needed for conventional deck replacement construction versus doing offsite remediation with ABC?	Typically, girder tops in Connecticut are not painted. If they were painted, we have a specification for localized paint removal.
5		**Detailed Project Example 2 – ABC Decision Process, with Negative ABC Decision**	
	26	Why was the ABC cost higher for this project when compared to the other example?	The use of modular decked beams required the use of large cranes.
	27	Why was the Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS) used?	The Connecticut DOT was looking for candidate projects for this technology. This site was chosen because the new abutments could be built under the existing bridge without interfering with traffic.
	28	Can we get the specification for GRS-IBS (Geosynthetic Reinforced Soil Integrated Bridge System) from the CTDOT?	The Connecticut DOT specification is based on the FHWA GRS-IBS guide documents. The 2018 AASHTO LRFD Guide Specifications for ABC also contain construction specifications.
	29	Were there any piles under the end bent cap that supports the GRS-IBS superstructure?	No. The soils in the area were favorable for a shallow foundation. In theory, you could install a pile-supported slab under a GRS abutment.
	30	Is the backfill stepped for the GRS-IBS abutment?	Yes. This is based on the FHWA guide documents. This is an added benefit to this system.

	31	What material was used for the backfill of the GRS-IBS abutment?	You can use different materials. Typically, we use an open-graded stone mix to facilitate compaction and installation.
	32	How did the construction industry view your ABC program? Did contractors provide any feedback or propose any changes?	In general, the contracting community has been supportive of ABC in Connecticut.
6		**Overview of ABC Projects in Connecticut**	
	33	Why do most of your projects involve superstructure elements?	In many cases, the substructures are in satisfactory condition.
	34	What are the advantages of using steel for your modular decked beams?	The advantages are reduced weight, flexibility of geometry (camber, skew), and thinner beams. Reduced weight is a major factor with regard to shipping and handling of the elements.
	35	What is the most commonly used ABC method on the Connecticut DOT projects? How successful has this ABC method been?	The use of Modular Decked Beams made with steel beams has been the most common form of ABC used in Connecticut and has been very successful. The reasons include: - They can accommodate any geometry. - They are lighter weight when compared to equivalent precast options. - We can achieve very thin superstructures to improve vertical clearance under the bridge. - They can be built quickly (as little as a weekend). - They do not require specialized equipment for construction.
	36	Are there any preferred foundation alternatives that the Connecticut DOT has used or plans on using for their ABC projects?	We use both deep and shallow foundations. We have had some pushback on precast footings due to weight issues and leveling issues. We are looking to use more cast-in-place footings for this reason.
	37	Do you think we will see more advanced high-strength materials such as high performance concrete finding use in ABC in the future?	UHPC is already being used typically for closure pours between modular decked beams.

	38	How does the AASHTO minimum span-depth ratio work with the precast ABC bridges?	The most common form of ABC is to use emulation, where we emulate cast-in-place construction with precast. We essentially reverse engineer a cast-in-place bridge in precast. Based on this, the same approach is used as with non-ABC construction.
	39	How often is Building Information Modeling for Bridges (BIM for Bridges) / 4D Modeling employed on ABC Projects?	The Connecticut DOT is not requiring this yet; however, we see this approach being used in the future.
	40	In your opinion, what is the best ABC bridge deck system: partial-depth deck panels or full-depth deck panels?	The Connecticut DOT does not use partial-depth precast deck panels. It is our understanding that both work well provided that good detailing practice is used.
	41	What are your thoughts on how construction automation and computational design expand the ABC horizon?	At this time, we do not see this technology playing a significant role; however, this may change as the technology expands.
	42	What have been your biggest lessons learned using prefabricated bridge units (PBU's)? Has the Connecticut DOT used UHPC for the longitudinal joints on bare deck projects?	We have had highly successful projects built with Modular Decked Beams (PBUs). To date, we have not built a PBU bridge with UHPC joints and a bare deck, although we are aware of this approach being used in states like New York. The Connecticut DOT uses the European model of protecting decks with high-quality membrane waterproofing systems and asphalt overlays. We have a track record dating back to the 1960s with this system and have had very good results.

	43	Which ABC technique was the hardest to implement and get contractor buy-in in your state?	We have had very good Contractor buy-in from the start. Our contractors as a whole, are now experienced in ABC and understand its benefits. Sometimes, Contractors have proposed to switch to specific components of the bridge such as footings from precast to cast-in-place concrete while proceeding with precast segments for the remainder of the bridge substructure elements. Very infrequently, a contractor may request a wholesale change from ABC to conventional construction methodology. If contractors can show through a work plan accepted by the Department that the their proposed construction methodology can be fit within the prescribed construction window, the methodology substituion is generally accepted. In all cases, such contractor requests are considered on a case-by-case basis and generally accepted as long as the construction window is not changed.
	44	Would these ABC methods be applicable in colder regions, say Alaska, where site access is always limited in winter?	In our opinion, this situation is perfect for ABC. By reducing construction time with prefabrication, the amount of work spent in the field should allow for more construction in a short construction season. Another reason to consider prefabrication is for remote sites that may be far from concrete batch plants. Precasting reduces the amount of concrete required for construction.
	45	What are the shipping limits in regards to length, width, and weight for modular decked beams (two beams cast together with a composite deck and transported to the site)?	In Connecticut, we limit length to 120 ft and weight to 120k. We can exceed these limits in certain cases. Weight is typically higher than 120k for longer units, but this is approved on a case-by-case basis. We typically limit width to 12 ft, but this can also be exceeded in special cases.
	46	How do you convince the public that ABC is not effective everywhere when convenience is so important today?	If the analysis of the construction shows no significant impacts to traffic, the public generally will not have an issue with the construction. We have found the public to be more receptive to severe short-term traffic flow impacts associated with ABC projects than moderate but prolonged traffic impacts associated with conventional construction.