ABC-UTC March 2023 Monthly Webinar: Incremental (Longitudinal) Launching of Bridges		
#	**Questions**	**Responses**
	Pre-Webinar Questions	
1	What are the key aspects that make the bridge launching construction technique an accelerated bridge construction method?	Simple span bridges are a great example of why this construction method can be considered ABC. The span is prepared for launch behind the abutment. When the span is ready, it is launched in hours. Concrete bridges are launched in a near-to-final finished condition, and completion of the bridge requires minimal work before opening to traffic. Steel girders are launched without the deck; precast panels can then be placed on top of the steel structure, and the bridge completed.
2	Do you have any thoughts on why this method has not been utilized more in the United States?	Incremental launching is widely used all over the world. Years ago, other ABC technologies were widely used all over the world and were seldomly used in the U.S.; now they are common practice in the U.S. also. Preferences in terms of materials and construction technologies are rooted in historical, social, and economic factors, and they keep evolving. Hopefully, a few years from now, incremental launching will be seen more in the U.S. also.
3	For roadway infrastructure, what are the approximate boundaries to assume for roadway and construction easement?	It depends on the length of the bridge and the level of industrialization that is chosen for the project. At a minimum, it is preferable to have a one-span footprint behind the abutment to avoid concerns with overturning.
4	Can this technology be implemented on simple-span bridges?	Yes, it is an example of an application of ABC construction.

5	Can you clarify the significant difference in stresses at each section due to launching and final design, and achieving economical design?	During incremental launching, the static system keeps varying. Unlike in final design, during incremental launching each section will see both positive and negative bending. Therefore, incrementally launched bridges require more material than what is typically needed with other conventional erection methods. Cost of labor is a primary component of the construction cost of a bridge. For the incrementally launched construction method, the saving is on labor and construction equipment, not on materials.
6	Using this technology, what are the span weight balancing limits?	It depends on the material chosen (steel or concrete), the span length, and the launching equipment available. The optimal solution is a balance of all these items.
7	What is the overall/maximum weight of a typical incremental launch?	It depends on the launching equipment available for the project.
8	For this technology, what is the effectiveness of using fiber-reinforced concrete for bridge deck slabs?	The effectiveness of using fiber-reinforced concrete is the same as for any bridge erected with a ground crane.
9	What type of bearing pads or sliding elements are typically used during bridge launching activities?	Different launching bearings are used for concrete and steel bridges; this is because of the different weight and flexibility of the structure. For concrete bridges, launching bearings are typically made by a block of concrete, a layer of elastomer, a concrete or steel launch plate, a layer of polished stainless steel and Teflon pads. Launching bearings for steel bridges are more articulated; they need to provide long support to avoid stress concentration, and they need to be able to rock to accommodate the flexural rotations of the girders at the supports.
	Questions during Webinar	
10	Was the launching technique preferable over a self-launching gantry for the bridge in Scotland?	The bridge was too short for a cost-effective transportation, assembly, operations, and final dismantling of a self-launching gantry and a segment precasting facility. Incremental launching was the preferred option also because of environmental concerns.

11	On Slide 5, was launching permitted with live traffic below the bridge?	Not for this specific project, but there are several projects where live traffic under the bridge was permitted during incremental launching.
12	For forming segments, is it required to coat the soffit forms with some kind of grease or other bond-breaker?	The soffit form is lowered prior to launching; it does not require special treatment for launching.
13	After casting a segment and lowering the bottom soffit forms, is the just-cast segment supported continuously on the rails, or at discrete points?	It depends on the launching equipment; once the segment is ready, it can either be supported continuously or on discrete points.
14	Is the length of the nose set based on the span length, or is there a specific length for the nose and, in that case, the span length adapted accordingly?	The length of the nose is determined based on the span length, the structural weight, and whether it is used in conjunction with temporary piers or front cable stay systems.
15	Do you close the roads under the bridge sections during bridge launching?	Whether to close or not close the road under the bridge during launch is a preference of the local authority. Bridges have been incrementally launched for decades over live traffic.
16	How is the launching nose attached to the segment since it appears to require a strong moment-resisting capability?	It can be attached with post-tensioning to concrete bridges or with bolted connections to steel bridges.
17	What is the footprint size of the temporary bearing on the piers during launching, and is the pier cap size increased to accommodate the temporary bearings?	Different launching bearings have different footprints, but they typically do not require oversizing the pier cap.
18	Can the incremental launching construction method accommodate a horizontal radius (curved superstructure) and, if yes, what would be the threshold horizontal radius below which this construction method cannot be used?	Incremental launching accommodates horizontal constant radii very well; the threshold for the length of the radius depends on the site constraints. As far as I know, the tightest plan radius of curvature was 490 ft, in a launch application in the Italian Alps. Variable curvatures are not ideal but can be accommodated in conjunction with skidding.
19	What is the approximate weight per foot of a 4-lane bridge section?	It depends on the bridge. For steel structures we can estimate approximately 7% more steel weight than conventional erection methods, but it really depends on the local stability of unstiffened webs. For concrete we can estimate an approximate 5-10% increase of reinforcing and post-tensioning.

20	Is friction an issue for the design in term of forces transmitted in a concrete structure when the friction is higher than expected?	Launching bearings are designed to minimize the effects of friction. When properly evaluated and accounted for, friction forces are not an issue.
21	In the case of a prestressed superstructure, can we use this construction method for precast box girders such as in the case of using the balanced cantilever construction method, or do the concrete box girders need to be cast in place with this construction method?	We can use precast box girders with special attention to the variation of stresses in the joints between segments.
22	What are common construction issues encountered using this method, and the typical fixes to those issues?	Some of the common construction issues are possible delays due to an inexperienced crew taking longer than expected to get familiar with the construction process, and possible unexpected weather-related delays in non-weather-protected construction sites.
23	What kind of bearings are used to accommodate the bridge launching and final support?	Bridges are launched on launching bearings and then placed on final bearings at the end of the launch. There are several different types of launching bearings. The ones for concrete girders are simpler and rely on the advantages of moving a heavy structure; the ones for steel girders tend to be more articulated.
24	How many contractors are able to implement this technology, and where are they located?	Contractors that operate globally tend to have good experience with incremental launching; local contractors may be less experienced, but they likely already own most of the equipment needed and the construction operations are simple, repetitive, and on ground. The learning curve is very fast even for crews that might be less experienced than others.
25	For checking the stability of the piers during the launching, what longitudinal force do you consider at the top of the pier? Do you consider the weight of the segment launched multiplied by the friction value? If so, what would be the value of the friction coefficient? Would it be 20 percent for concrete to concrete construction?	Friction forces are considered during launching, but they are minimized by the launching bearings. 5% is a reasonable approximate value that can be used for design. 10% for lateral guides.
26	On Slide 28, why does the high-level cable-stayed bridge deck look wavey?	Those are the deck deflections prior to final tensioning of the upper pylon stay cables.

27	Were most of these bridge launches anticipated as the method of construction, or were they left to the contractors to decide the methodology?	A little bit of both. Launched bridges are designed to be launched. In some cases, it was the owner's preference; in other cases, it was the design-build team's preference.
28	Can you discuss the methods of analysis for launching steel bridges? Do you model the bridge span at various support conditions? Are there any recommendations on how refined the model for the launch needs to be?	The steel-only superstructure is modeled at different support conditions. The extra computation effort is easily handled by most finite element software. At launch completion, the structure is investigated in the same way that bridges built with cranes are designed.
29	During the launching, there are steps where the superstructure is cantilevered (negative moment) when the launching nose doesn't reach the pier yet, and then when the launching nose reaches the intermediate pier, the configuration of the superstructure evolves (no cantilever configuration anymore). How do you proceed with the post-tensioning tendons? Do you stress some tendons that will work for the negative moments, and then deactivate these tendons after reaching the intermediate pier?	During launching, the post-tensioning is designed to produce a compressive stress uniform throughout the section; in this way, whether the tension stress is in the top or in the bottom of the section, the design stress limits are satisfied. The final continuity post-tensioning is applied at launch completion.
30	Is design-build or design-bid-build the preferred contracting method for an incremental launching bridge project?	There isn't a preferred contracting method. The only design parameters that affect launching structurally are the length and stiffness of the launch nose, which can easily be communicated from the designer to the constructor.
31	Have there been failures during construction utilizing the incremental launching method?	This construction method has been around since the 1960s. Like for most construction techniques, over the years there have been some failures and also applications less successful than others, but in a marginal number compared to the successful stories.
32	Incremental launching would require complete road closure construction most of the time, which may not be an option. Can this method accommodate maintenance of traffic during construction, and how would it be accomplished?	Incremental launching doesn’t require closure of traffic. Its application with live traffic is common. Where the preference is to have a road closure, there is no need to close the whole road, just the portion where launching is active; all other adjacent lanes can remain open.

33	When launching a bridge along a profile grade, would you recommend launching uphill (which increases required thrust forces) or downhill (which increases the need for a braking system to avoid runaway)?	The best solution is project based; it depends on site constraints and equipment available. Bridges have been successfully launched both downhill and uphill. Higher grades, whether positive or negative, translate to more demand on the launching equipment. Launching uphill reduces the concern of possible mechanical failures of the braking system but also requires the availability of larger thrust systems.
34	You noted additional rebar, steel, etc., in the superstructure for the launching. Is there additional strengthening needed for the bridge piers? If so, does that vary significantly between short and tall piers?	Pier design has to account for longitudinal forces due to friction in the construction phase. In some cases, depending on the size of the loads that the piers will see during their service and ultimate life, piers may need additional reinforcing due to incremental launching; alternatively, they can be temporarily braced.
35	Can you incrementally launch a bridge over railway traffic?	Yes, it has been done numerous times in several countries.
36	Can you describe the different types of surveying that are carried out during launching to ensure that deflection remains within tolerance? Is surveying different between steel and concrete bridges?	Several survey markers and level control bolts are applied to every segment to control the geometry and the alignment. Markers are also placed on the top flanges of the launching nose. Surveying of concrete and steel bridges requires the same type of measurements.
37	How do you push the segments?	There are several thrust systems commonly used to push the segments. The three most common types are: prestressing jacks and strand cables or drawbars, rear thrust hydraulic cylinders, and reaction beams and friction launchers.
38	What is the relative cost of launching projects compared to SPMT or lateral slide projects? Do you know of launching projects that have cost comparison data between different ABC methods?	It is really challenging to compare construction costs between countries with different labor cost and safety standards.
39	For incrementally launched bridges, can the launch be reversed to make adjustments during construction?	The launch can be reversed when using friction launchers. Friction launchers may pull the bridge back immediately.

40	Is superelevation on curved girder bridges a problem for incrementally launched construction?	It is not; the superelevation is at the deck slab level, while a launched bridge is supported at the bottom of the webs during launching, and the cross-section can vary.
41	Can you explain why a kingpost support system was not used in many of the examples shown in the presentation?	Kingposts are rarely used on steel bridges and almost never used in precast concrete bridges because of their complexity and intrinsic risks.