April 2020 ABC-UTC Webinar Featured Presentation - PennDOT's First SPMT Bridge Move: Shaler Street Bridge		
#	**Questions**	**Responses**
	Design	
1	How do you address foundation issues / problems without disrupting the ABC process?	Having some flexibility in the construction schedule allowed for foundation issues to be resolved without disrupting the ABC process. Having several weeks between the demolition and move weekends allowed for any issues that might arise during construction to be resolved. We attempted to construct substructures prior to the Shaler Street closure, but where that wasn't possible, substructures were constructed after demolition. We had less concerns about traffic disruptions to Shaler Street versus SR 19 (which was the higher volume roadway) and were able to address any issues by extending the Shaler Street Closure without adding additional traffic impacts to SR 19. Since the substructures were being constructed onsite at the same time as the superstructure in the bridge staging area, the superstructure and substructure construction weren't interrelated at the time and could be addressed without delays overall.
2	Are there any new findings with UHPC (ultra-high-performance concrete) material properties for connections of full-depth deck panels (development length, etc.)?	No, UHPC and full-depth deck panels were not used on this project.
3	Did you utilize BIM (bridge information modeling) in your project for clearances, etc.?	No, BIM was not used for evaluating project clearances.
	Construction	

4	Can you discuss construction staging and how it affected the design of the bridge?	The construction staging/SPMT move affected design due to the available move path width. Due to the tight constraints of the project site and the buildings along the move path, we were limited on the length of span we could move. With Abutment 2 (the uphill abutment) being constructed below the existing structure between the existing pier and abutment, this somewhat dictated that the proposed pier and Abutment 1 be in nearly the same location as the existing substructure units and limited how much of the new substructures could be constructed prior to demolition. Placing two individual spans cast separately in the bridge staging area also led to providing a continuity connection at the pier to make the spans continuous for live load (SDCL connection).
5	How long was the bridge out of service from the start of demolition to restoration of traffic? Can you define it in steps?	The bridge was out of service for 71 days. The structure was closed for demolition on September 6th. SR 19 was closed September 6th thru 8th for demolition. The bridge move took place during the second SR 19 closure November 3rd thru 5th. Shaler Street was reopened on November 22nd.
6	How much time did ABC reduce conventional bridge construction for this project?	Construction time was reduced from about 6 months for conventional bridge construction to just under 2.5 months using ABC.
7	How was the time slot for the placement chosen?	The time slot for the bridge move had to align with completion of construction of the substructure units and also with the event schedule in the City of Pittsburgh, primarily the Pittsburgh Steeler schedule. With SR 19 being one of the main access routes to Heinz Field, the weekend closures could not impact Heinz Field events.
8	Were there any weather parameters that you had to consider in anticipation of the operation?	Yes, the heavy rains and high wind that were forecast for the original move dates (October 30-November 1) forced the move to be delayed to November 3rd thru 5th. The rains would have affected the temporary grading, and Mammoet indicated they would not move with winds higher than 26 mph.
9	Since bridge erection is typically contractor means and methods, how did the contract documents dictate that SPMTs would be used?	The special provisions for the project required that SPMTs be used for installing the new superstructure. This was also discussed at a pre-bid meeting for the project.
10	What was the total weight of each move or lift?	Each span weighed approximately 260 tons.

11	Were there two separate transporters that were employed during the move?	No, there was only one set of SPMTs used for the move. Span 2 was moved on the first day, then the SPMTs returned to the staging area and moved Span 1 on the second day.
12	Were there any unique MOT (maintenance of traffic) challenges with the installation?	Coordination with the events in the City of Pittsburgh with the construction schedule to find a suitable time for the SR 19 closures for demolition and the bridge move was the biggest challenge as several schedules had to align perfectly.
13	What pre-erection procedures were required for the contractor and inspection staff?	The spans had to be jacked prior to the move to get enough vertical clearance to move the SPMTs in below. Mammoet also had to approve the temporary grading compaction before the move. We also had several pre-move meetings and pre-move walk throughs along the travel path to make sure as many concerns were addressed ahead of time as possible.
14	What was included in the erection plan submittal to PennDOT?	The submittals included plans and design calculations for the temporary foundations and abutments in the bridge staging area, a grading plan for the move path and working drawings, calculations and procedures for the SPMT move system and support structure between the SPMTs and bridge. The working drawings also defined parameters for maintaining stability of the move system.
15	What obstacles / unexpected challenges were encountered, and how did you resolved them?	During the move there were several challenges including temporary grading width and elevation issues which were resolved by adjusting grading along the move path or placing plywood for the tires to travel over to prevent the grading from sluffing. There were also issues with a malfunction of the SPMT powerpack. Mammoet was able to reset the pack, and it was able to provide all functions except the ability to drive the wheels forward. The second line of SPMTs provided adequate power, and an excavator was used to assist the malfunctioning SPMT line to keep the move system aligned properly.
16	Who was the contractor's construction engineer, and what was the design fee for the construction engineering? Did you need a contractor rep on call during construction?	The contractor had several team members for construction engineering on the project. The bid items included an item for engineering for the SPMT-related component of the project which was bid at $40,000. Please contact Matt Cochran (mcochran@hwlochner.com) for additional/more specific information.

17	Can you discuss items learned and tips for future success with SPMT moves?	Lessons learned were addressed in the presentation.
18	Do you see PennDOT adopting this technique in more districts?	Yes, PennDOT will look for future locations to incorporate SPMTs, particularly in urban areas where significant user cost savings can be achieved. Also, PennDOT will look for future locations on Interstates and Interstate look-alikes where there is more available PennDOT-owned ROW for construction activities.
19	Can you address general claims and their disposition?	At this time there are no claims on the project.
	Cost	
20	How was the grant applied for and obtained?	The $400,000 grant was applied for in 2012 through the Federal Highway Administration's Innovative Bridge Research and Deployment (IBRD) Program to demonstrate new technologies.
21	What is the cost of this operation versus savings to total project cost? Do you have any guidelines on when is it cost effective to use SPMTs (self-propelled modular transporters)?	The total cost for the bridge without ABC would have been about $2.9 million and with ABC was $3.7 million. The total of the SPMT-related items was about $750,000 with the total net cost savings (user-cost savings) based on Road User Liquidated Damages (RULDs) coming in at about $2.2 million. For the use of SPMTs or ABC in general, the additional cost of the accelerated construction must be outweighed by the cost-savings to the users based on the reduced construction duration.
22	What was the cost difference for this bridge between conventional construction and SPMT-type construction? What were the cost savings to users? What was the cost and total savings for using SPMTs?	The total cost for the bridge without ABC would have been about $2.9 million and with ABC was $3.7 million. The total of the SPMT-related items was about $750,000 with the total net cost savings (user-cost savings) based on Road User Liquidated Damages (RULDs) coming in at about $2.2 million.
23	Without the FHWA grant, would this project have used SPMTs? Shouldn't ABC projects stand on their own merits based on user delay costs?	The total net cost savings based on RULDs was about $2.2 million. Factoring in the $400,000 for the grant, the project would still have been cost effective for using ABC.

	Questions during Webinar	
24	What type of concrete was used on the bridge deck, normal weight or lightweight structural concrete? Mix Design specifics - psi requirements, water/ cement ratio? Specification requirements for the concrete? Curing specification requirements? Shrinkage specification requirements?	PennDOT's standard Class AAAP Cement Concrete was used for the deck. The mix is a normal-weight concrete with a 28-day strength of 4 ksi. Cement factor (lb/cy): 560 min to 640 max; Max WC Ratio lb/lb: 0.45; Min Compressive Strength (psi): 3,000 7-day and 4,000 28-day. PennDOT requires a 14-day water cure with a double layer of burlap for curing covers. After the 14-day water cure and 3,500 psi are reached, the burlap is removed and plastic is placed for 7 days to slow the drying process. PennDOT requires permeability testing (AASHTO T 277) and shrinkage testing (ASTM C157) for mix design acceptance. All Class AAAP information can be found in Section 704 of PennDOT Publication 408. Placement requirements can be found in Section 1001.
25	Why did you have to build the bridge on grade in the bridge farm and not build it level and then tilt?	The bridge was constructed on the 14% grade in the bridge staging area so that elevations in the permanent bridge location could be mimicked in the bridge staging area to minimize the chances of mis-alignment when the spans were set in their permanent location.
26	What grant program did the money come from and what does the FHWA look for when selecting projects?	The $400,000 grant was applied for in 2012 through the Federal Highway Administration's Innovative Bridge Research and Deployment (IBRD) Program. The program selected projects to promote innovative designs, materials, and construction methods in the construction, repair, and rehabilitation of bridges and other highway structures.
27	What is the purpose of the temporary road gravel, and how did this impact the MOT (maintenance of traffic)?	Due to the existing grades and cross slopes of the SR 19 roadway surface, the temporary grading was required to maintain stability of the move system and provide a level surface (transversely) for the wheels to travel on. The stroke of the SPMTs was primarily used to keep the trailer beds level longitudinally.
28	What type monitoring system or sensors were used during the move, and what is the fixity of the bearings?	The superstructure itself was monitored using a system of string lines attached to the superstructure. Due to the tight constraints of the project site, the string lines were difficult to monitor and in the future an electronic system that can be monitored remotely should be considered. Mammoet also monitored the move system with a level, hydraulic pressures and maintaining chain tension between the SPMTs to ensure proper alignment was being maintained.

29	Are the plans available on PennDOT's Engineering and Construction Management System (ECMS) for review?	Yes, plans are available on ECMS (ECMS No. 96562).
30	If you were to propose another project for this application, would anything change in desirable site characteristics?	When selecting a site, grades along the proposed move path should be evaluated relative to stroke limitations of SPMTs to determine temporary grading requirements for the move path. Choosing a site where minimal or no temporary grading is required would allow the move to occur more quickly with less time and cost for preparation and clean-up. Selecting a site where substructures could be built prior to demolition or off alignment would also minimize the closure of the structure being replaced. Additionally, sites that have a large, open laydown area within existing right-of-way nearby for the bridge staging area should be considered. Locations such as overhead bridges on an interstate would be an example of such a site, where there is a large amount of open space that is already within existing right-of-way.
31	Are there many contractors with the know-how and equipment required for SPMT projects in North America? How many bidders were on the Shaler Street project?	There are multiple heavy-move contractors throughout the United States that have been involved in transportation projects. The SPMT technology is used frequently in the oil and gas and energy industries; these companies seem to be expanding into the transportation sector more frequently. There were five prime contractors who bid on the project. Please contact Matt Cochran (mcochran@hwlochner.com) for additional/more specific information.
32	What was the factor of safety on the SPMT capacity versus load?	The temporary supports between the SPMTs and the superstructure were designed using AISC LRFD methodology. The SPMTs themselves had a Factor of Safety of 2 based payload capacity. The stability of the system is also critical and was evaluated by a proprietary software program. Parameters for maintaining stability are listed on the working drawings which allow the operator to monitor hydraulic pressures during the move so that limits are not exceeded.
33	What was the PennDOT Road Users Liquidated Damages (RULD) imposed on the contractor to limit closure on the northbound and southbound lanes?	The RULDs were $1,900 per hour for each hour that SR 19 remained closed beyond the allotted time restrictions.

34	How did the installation of the tension continuity plate attaching the top flange of girders go? Did you have any challenges with it?	The holes in half of the tension flange continuity plate connection were field drilled to allow for minor deviations in alignment of the spans.