

July 2017 ABC-UTC Webinar Featured Presentation: NCHRP 12-98, Part 2 - Dynamics of Bridge Systems

Q&A Session: Questions	Responses
PBSystems vs. PBElements	
Definition of Bridge systems	The FHWA definition is as follows: Prefabricated Systems are a category of PBES that consists of an entire superstructure, an entire superstructure and substructure, or a total bridge that is procured in a modular manner such that traffic operations can be allowed to resume after placement. Prefabricated systems are rolled, launched, slid, lifted, or otherwise transported into place, having the deck and preferably the parapets in place such that no separate construction phase is required after placement.
Instrumentation/data collection	
Methods of instrumentation and measurement type	The instrumentation used in the research will be covered in the presentation. Based on the results of the research, instrumentation of bridges should not be necessary if the proposed guidelines are followed.
Could you address some unexpected outcomes and difficult lessons learned situations?	Covered in the webinar.
Has anyone considered optic sensing for both the full ABC process and leaving them in- place for final bridge authority?	A number of bridges have had sensors installed. Personally, I believe that we are far enough along with ABC to not require this. ABC bridges function the same as conventional bridges. It is the basis for most of the detailing that we employ.
In Methodology to go from Research to Application	
In the testing is the SPMTs used a non-variable?	We looked at all SPMTs on the market and spoke with industry experts. The general make-up of SPMTs is similar with all manufacturers. The hydraulic leveling systems make them all act alike.
What methods are recommended to estimate dynamic stresses in bridge members during a bridge move with SPMT's?	Covered in the webinar.
The shape of the rough terrain plays a part in the dynamic response spectrum. Was any effort made to associate that shape with the response observed? I ask this since obviously there could be a different terrain response for every potential travel site.	The testing was designed to cover the myriad of different terrains. From this, the response spectrum was developed. This approach is similar to how response spectra are generated for earthquakes. They take a number of different earthquakes and ensure that the spectra covers all with a reasonable level of certainty.

On slide 28 - any consideration given to the velocity of the system in the equation?	The commentary in the guideline includes text to cover a case where one might specify a lower speed. In our opinion, this would only affect the vertical dynamics. The horizontal dynamics are primarily a function of the braking horsepower of the SPMT.
Dynamic Loads Effects from SPMTs	
What dynamics can we expect from STMP move?	Covered in the webinar.
Please describe the dynamic effects caused by SPMTs.	Covered in the webinar.
What movement of the SPMT creates the highest load effects?	They all generate large forces, but starting and stopping typically generates the largest accelerations.
Would the hydraulics/suspension of another transporter either from the same or different supplier provide same/similar/higher/lower results?	All transporters have similar suspension systems, therefore they should all behave similarly.
For a bridge move, transporters are hydraulically linked and isolated in groups (typically of three). Are their force effects from differential movements of the different groupings?	The accelerations are more a function of the propulsion system and braking systems, which is linked to the axle lines. Linking SPMTs simply adds more axle lines, more propulsion axles and more braking axles.
Are there different force effects in the case when the bridge is vertically lifted off the temporary supports compacted to when it's lowered onto it's final position? How does that vertical movement compare to the vertical movement when the transporter is moving down the road (horizontally)?	This was not studied, however based on review of actual move data, the setting dynamic accelerations and lifting dynamic acceleration are significantly less than those seen during the move.
What are the force effects when an SPMT tire blows or an axle/wheel buries itself?	This was not studied, however the hydraulics of the units should re-distribute the load upon loss of a tire. The shear number of tires in a typical bridge move would also help to lessen this effect.
How to make a realistic estimation of the falsework stiffness?	During the design process, the design engineer does not know the stiffness. In that case, the simplified equation can be used.
How about dynamics of moving modular units on back of trailers, such as girder plus deck?	The upcoming AASHTO ABC Guide Specifications cover this topic. A dead load factor value of 1.5 is recommended.
Does the pressure on the tires have any influence?	No. The hydraulic systems separate the platform from the ground.
Since the method is conservative about the acceleration applied to the structure, wouldn't it be necessary to consider the road slope as well in the calculation in the "emergency stop" situation?	The horizontal dynamics are primarily a function of the braking horsepower of the SPMT. Road slope would factor into the falsework design (it would generate horizontal dead load forces), but would not affect the dynamics. The dynamics would be the same.

How sensitive are the acceleration values? Is assuming 10% close enough for most cases?	I would not simplify it that much. Most answers will be close to 10 percent, but there are factors that have significant impact on this value. The percent of load on the SPMT is a big one. If you have an SPMT with say 40% capacity, the horizontal dynamic load would be twice the value of a 90% loaded SPMT.
How did you develop the acceleration spectrum curves from three different test set ups all of which had rigid falseworks?	The approach is similar to seismic engineering. We developed base shear accelerations. The stiffness of the falsework is accounted for in the design process.
Has the research considered possibility of using Isolation Bearings?	In theory, you could use isolation bearings in the falsework. The cost would be very high. In reality, the forces that we are generating are not that difficult to manage.
Weight Effects Dynamic Forces	
Does using lightweight concrete in structures that are moved have a significant effect on the dynamic forces during movement?	Yes. The mass of the structure is accounted for in the recommended procedure. Lower mass means lower forces acting on the bridge and falsework.
Benefits of using structural lightweight concrete verses normal weight concrete on ABC moves? More or less bridge deck cracking	Yes. The mass of the structure is accounted for in the recommended procedure. Lower mass means lower forces acting on the bridge and falsework.
Construction Loads combined with Other Loadings	
What precautions are take in construction if an earth quake event occurs?	The decision to design temporary works for seismic is up to owner. The probability of an EQ occurring during the short duration of construction is very small. The recently approved revisions to the AASHTO Guide for Temporary Works does cover this.
Have sloped paths been considered?	The horizontal dynamics are primarily a function of the braking horsepower of the SPMT. Road slope would factor into the falsework design (it would generate horizontal dead load forces), but would not affect the dynamics. The dynamics would be the same.
Would this be applicable to SPMTs rolled onto barges in water?	No. This is a special design that would need to be coordinated with the barge company. It would only be an issue with bodies of water that have potential for significant waves.
Design Example	
More design examples.	A design example is included in the presentation.
Have SPMT suppliers reviewed this material and concurred with the recommendations?	Yes. We have met with an industry expert, who is now a consultant. The results of the research are in line with that is typically "assumed" in the industry now.

Do SPMT suppliers apply their own dynamic impacts for their rigging used between the bridge and SPMT? If so, what are typical values and how does this research recommendations compare?	See response above.
How does the platform shock absorbers affects vertical acceleration?	The machines do not have shock absorbers. It is a hydraulic system. The hydraulics to offer significant damping. Essentially the hydraulic system is a large shock absorber.
Tires pressure have any influence?	No. The hydraulic systems separate the platform from the ground.
Ballasting the SPMT could be an option to reduce vertical acceleration as higher loads reduce it?	In theory, that could be done. It would be a contractor option. In reality, they use the smallest SPMT possible in order to keep costs down.
Lateral Slide	
In a lateral slide, from the stopping position, one end of the structure may move prior to the other end due to the hydraulics, friction, and stiffness, etc.... does this research take this into consideration as part of the recommended forces to apply?	We are recommending that a load factor be applied to the jacking load for this type of scenario. The recommended factor is 1.5
Would temperature effect the frictional forces significantly?	The research showed that friction is only affected by temperature extremes.
Why is soap being used to begin with, it can quickly dry out compared to a grease or oil? Is it more environmentally friendly? Will their be recommendations to AASHTO Construction Specification to not use soap?	The recommended specifications include grease and oil. Soap is listed as an alternate in the commentary. No values are given. If a contractor has experience with soap, they can use it.
How do the frictional values for the "lubricated pad" method compare to one that uses "rollers"?	Rollers tend to have lower friction, but not substantially lower.
Were recycling/reuse of lubricants studied?	No.
Is choice of a lubricant left up to the Contractor or will it be part of a specification?	The commentary in the guideline states that the Contractor may use any lubricant provided that they have experience with the lubricant and an understanding of the friction.
Did you say the friction tests were a t10 inches per sec? Seems very fast.	This is a value that has been used in past research. It is a mute point, because in all cases, the static friction controls.
Slide 51 - I suppose you might recommend the soap to clean up the grease / motor oil? Sounds like an opportunity for tree huggers to stage a sit-down strike on site.	The thought was that oils and grease are common materials on ALL construction sites. It would be hard to make that an issue.
Did you look into using synthetic oil?	No. We had to limit the number of variables to keep the testing matrix reasonable.

<p>When evaluating lubricants for slides, were the lubricants evaluated at differing temperatures? We had an experience where a very expensive lubricant was used and it congealed at the low temperatures 20 deg F that the slide occurred. The contractor opted to change to dish soap and had better results.</p>	<p>The proposed grease is specified in the AASHTO LRFD Bridge Construction specifications for sliding bridge bearings. Bearing manufactures recommended the use of this grease. Bridge bearings are exposed to extreme temperatures, therefore this grease should be sufficient. You can still use soap if you have a track record to go by.</p>
<p>Was any data from the Madison-Milton slide available for this study or other relatively recent Contractor designed slides?</p>	<p>We spoke with experts in the field. The results of our work was consistent with what is seen in actual projects. This was used as a double check. In general, the values specified in the guideline are conservative, which is good.</p>
<p>10 inch per minute?</p>	<p>This is a value that has been used in past research. It is a mute point, because in all cases, the static friction controls.</p>
<p>N/A</p>	
<p>Is there a benefit to paint faying surfaces on splice plates on a weathering steel bridge with non-slip critical bolts?</p>	<p>This question is not applicable to this webinar.</p>
<p>Is there any chance to talk about the methods to reduce the effects of vertical acceleration on the bridge foundations?</p>	<p>This is with respect to permanent foundation design. This is not applicable to this webinar.</p>