Resiliency Webinar – Questions and Answers

The questions submitted during the webinar follow with answers that our speakers have provided.

1. So the damage to the roadway that happens after a flood event occurs when traffic is opened up to it and the subgrade is saturated? Flexible pavements withstand the damage less favorably than rigid pavements due to the higher wheel pressures? Indiana

   Essentially yes. The flooding supersaturates the support layers, which cause them (the support layers) to lose strength. When the Flexible pavement is loaded, it still delivers that high load to the underlying layers, but in their weakened state, it overstresses the pavement (subgrade stain and/or asphalt strain). If the pavements were not loaded in this weakened condition, there would be no damage (or little). It's the loading in the weakened state that causes the damage. This is in contrast to concrete where the concrete is carrying the load, and the inundation does not impact that.

2. Saludos a Jim desde Chile!! Su amiga, Gabriela Eguiluz, Chile

   Hola Gabriela – hay much tiempo que no hablar contigo. Esperando que toda esta bien. Mucha brazos y besos.

3. 1930s were far worse regarding forest fires. Iowa

   I have no reference to the 1930 forest fires; and as such, this may be true. The sources I used were:

   1. USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II:
   2. Patrick Gonzalez, UC Berkeley forest ecologist and climate change scientist, https://www.capradio.org/articles/2020/09/03/wildfires-in-california-will-continue-to-get-worse-climate-change-experts-explore-why/
   3. https://www.insider.com/west-coast-wildfires-map-of-biggest-fires-color-coded-2020-9#:~:text=More%20than%2085%20large%20wildfires,California's%20biggest%20wildfire%20season%20ever

   One aspect that I am sure is different is the economic extent of the damage due to the expanded Wildland–Urban Interface and the increased population in contact with the fires.

4. 4 day soak is not enough for some clay soils as certain clay soils can lose more than 50% of strength under saturation. Maryland

   Agree. Each soil will behave differently due to their make up (mineralogy, particle size, plasticity). That is why the report looked at so many different soils. Some hardly change at all, while others lost strength dramatically.

For more information, see *Comparison Between Soaked and Unsoaked CBR*, Sathawara Jigar K & Prof. A.K.Patel; International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974

5. Two years back we did a study in Cincinnati to investigate the effect of flooding on pavement performance. Most pavements along the river belt was either composite or PCC. When the water receded, we noticed little damage to pavement. We did DCP tests and tested core samples. Agree with your findings. Ohio

   This is great information and feedback. Thank you. I would love to see a report if one is available.

6. Isn't the development of more resilient foundation layers a key to the solution. In Houston the resilient foundation layer (Cement Treated Base) saved the concrete pavements during Harvey. TTI performed testing to verify that the base layer was not affected by the sustained flooding. Texas

   I agree with your statement that the more resilient (e.g. stiff) foundation layers can be part of the solution. As stated during the presentation, anything that stiffens up the pavement system should lead to a more flood resistant pavement.

   However, I disagree with the assessment that the CTB saved the concrete in Houston. CRCP's are by nature, a very stiff pavement systems and the pressure delivered by loads to the underlying support is always going to be very low. The CTB's just make them even lower.

   It is also important to note there are other concrete pavement structures in Houston. Most of the city and county concrete pavements are JRCP and are on an aggregate base (and there are 1000s of miles of them). These pavements also survived Harvey without damage.

   Similarly, the pavements evaluated in the other studies (LA, Australia) were jointed pavements on aggregate base and the same conclusion of "little or no damage" were found.

   In conclusion, based on what I have seen, having any concrete pavement type as the top surface layer will provides a high degree of resiliency because it spreads the loads out overt a large area. A CTB will stiffen the system and make it more resilient but is not necessarily needed under a concrete pavement.

   For an asphalt pavement, a CTB or FDR with cement is a great option for stiffening the system. See these studies

   1. Structural Study of Cold Central Plant Recycling Sections at the National Center for Asphalt Technology (NCAT) Test Track, Brian K. Diefenderfer, Ph.D., P.E., Benjamin F. Bowers, Ph.D. (VTRC), Miguel Díaz Sánchez, David H. Timm, Ph.D., P.E., Auburn University, http://www.virginiadot.org/vtrc/main/online_reports/pdf/17-r9.pdf
   2. Comparison of Full-Depth Reclamation with Portland Cement and Full-Depth Reclamation with No Stabilizer in Accelerated Loading Test, David Jones, Rongzong Wu, Stefan Louw, https://doi.org/10.3141/2524-13

7. Are you looking at the ultra strength materials (UHPC, compressive on the order of 30,000 psi) for their resiliency? Texas

   We have not looked at UHPC materials. I am sure they would perform, but I am not sure they would perform any better. Well-designed concrete pavements seem to do well as is. It may be interesting to see how a UHPC would work as an thin overlay, but it would have to be tested, and compared to standard concrete overlays on both on a performance and cost basis.

8. Can we use this presentation to illustrate others, and make them conscious of the importance of considering the resiliency of a pavement? Florida, Wagner Vieira, vieirawagnerc@gmail.com

   Yes – please feel free to use as you see fit. Please acknowledge the source.

9. How thick is a typical concrete overlay? Texas

   Unfortunately, Texas does not do many concrete overlays. The Texas examples were "new or original pavement construction." Using concrete overlays as a hardening technique of existing pavements is just getting started.

   Earlier webinars in this program covered overlays in detail and are available to watch at https://cptechcenter.org/webinars-and-videos/#overlay