DECEMBER 11, 2019
Wednesday, December 11, 2019
5:30 PM (1.0 PDH)

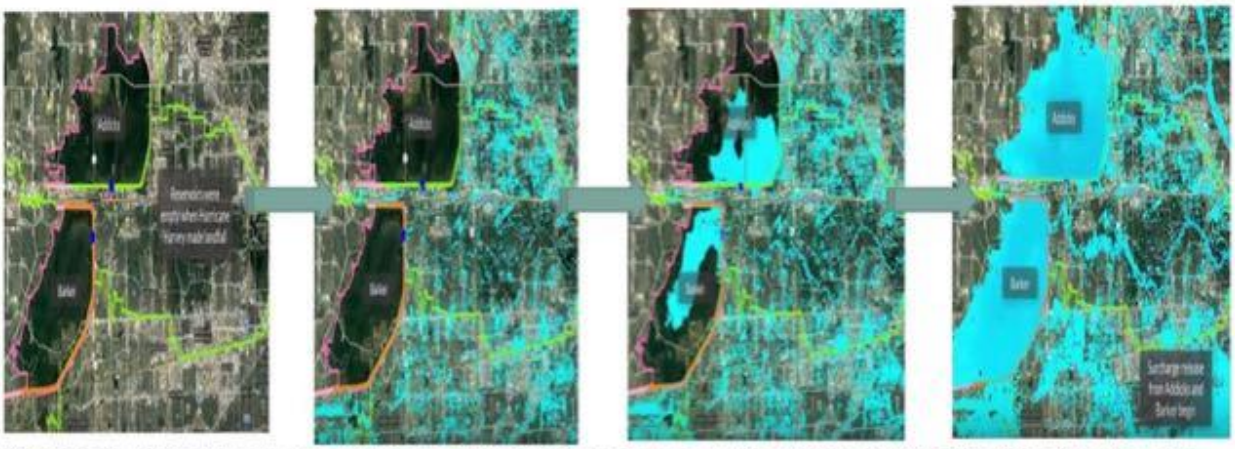

Figure 1 Progression of Flood Water from Flood Control Network into the Road Network during Hurricane Harvey (Source: USACE)

PRESENTATION
5:30 PM (1.0 PDH)

Title : **The Interplay among Soil Condition, Transportation Network and Flood Control Network during Flooding Events**

Speakers : Dr. Robert L. Lytton, P.E. w/ *Texas A & M*, and Bahrulla Abdulla w/ *Texas A & M*

Dr. Lytton is an FPA Fellow, FPA Structural Committee Member, Professor of Civil Engineering in the Zachry Civil Engineering Department of the Texas A&M University, and a Licensed Professional Engineer in Texas. He has earned a BSCE in 1960 and an MSCE in 1961, both from University of Texas, Austin. He then served two years active duty in the US Army as a construction engineer followed by two years in Houston working for a consulting engineer. Then he went back to UT-Austin to complete his Ph.D. in Civil Engineering in 1967. After teaching at UT and spending time in Australia, Dr. Lytton came to Texas A&M in 1970 where he continues to teach and supervise undergraduate and graduate students today in the Zachry Civil Engineering Department.

Dr. Lytton is internationally recognized for his work in the study of the effect of expansive soil on foundations and pavements, having given presentations on the subject worldwide, recently as the keynote speaker at the 2nd Transportation Research Congress in Beijing, China in May 2017. The same Research Congress hosted a symposium that was named in his honor, called The 2nd Transportation Research Congress Symposium in Honor of Robert L Lytton. In August 2017, at the International Conference in Philadelphia, Pennsylvania, ASCE s Transportation and Development Institute (T&DI) bestowed its 2017 Francis C. Turner Award on Dr. Lytton for his advancements and innovation of pavements design and construction. He has over 500 publications to his credit, more than 200 of which are in refereed journals.

Dr. Lytton has selflessly presented to this FPA forum on an annual basis at least 17 times and he has also presented in past FPA seminars.

Bahrulla Abdulla is a senior Ph.D. student in the Zachry Department of Civil Engineering at Texas A & M University. He conducts research on critical infrastructure resilience, especially road network resilience against flooding events, using graph-theory based methods. Prior to joining Texas A & M University, he worked as a research assistant on an MIT-Masdar Institute (of Khalifa University of Science and Technology) collaborative research project in Abu Dhabi, where he earned his M.Sc. degree in engineering systems and management in July 2014 and continued Ph.D. research in Interdisciplinary Engineering until July 2017.

ABSTRACT : There are essential and interwoven relationships between different critical sectors in a city. Even though they are not especially evident during the normal functioning period of the critical sectors, their relationship oftentimes becomes known after a series of cascading failures during a disruptive event. This presentation will be a demonstration of the network interdependence among transportation, flood control networks, and soil conditions during and after an extensive flooding event. These sectors are closely related because, when an extreme rainfall event occurs, most of the time, the flood control infrastructure will first function as the drainage system to collect the rain fallen in other places and channel them to the appropriate outlets (sea, reservoirs or rivers). When the flood control network reaches its capacity, the excessive flood water propagates to other locations like road networks, as shown in **Figure 1**, above.

What' s more important, during these events, there usually are significant changes in the configurations of the surface soil on the land. Excessive water causes the soil to be saturated, reduces the cohesion between the soil and its foundational structures, which leads to the lateral or vertical movement in the soil in or around the flood control network. Accompanied by a wide variety of dislocated objects, these accumulated objects cause a significant reduction in the water-carrying capacity of the flood control network and building foundations. **Figure 2** below shows the locations in the flood control network (bayous, channels, and creeks) for which maintenance was requested during Hurricane Harvey.

The compromised flood control networks cause fluvial flooding events, which in return cause the roads to be inundated and closed for both passenger and service vehicles.

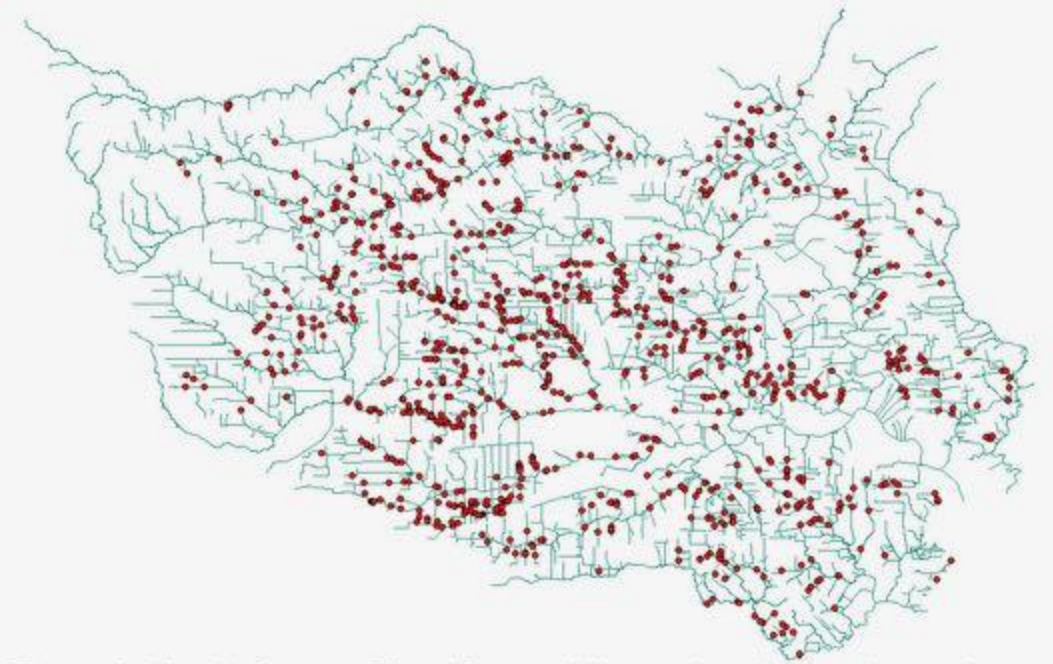

Figure 2 Harris County Flood Control Network and Locations where a Request for Service was Submitted during Harvey (Source: HCFCD)

Figure 3 shows the road network in Harris County and the locations where TxDOT reported road closures during the hurricane Harvey.

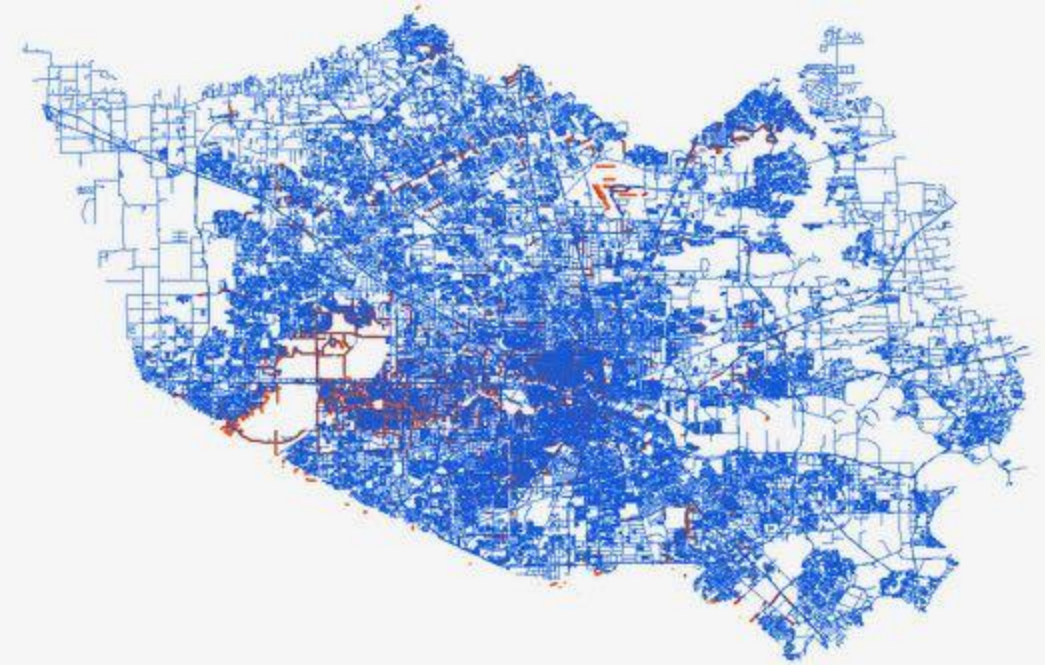

Figure 3 Harris County Road Network and Locations where Road Closure was Reported during Harvey (Source: TxDOT)

This presentation will examine the cascading failures among soil movements, reduction (compromisation) of the capacity of flood control networks and closure of the transportation systems. These findings provide information for critical decisions about emergency management, land use, flood control, transportation planning, emergency management, flooding levels, and latent damage to buildings and other structures in Houston, which will occur over an extended period of time after the inundation event.

WHO SHOULD ATTEND

ANYONE that experienced Hurricane Harvey's fury or aftermath, or that of another major flood. This presentation will be interesting and understandable for the non-technical audience as well as for civil engineers, hydraulic engineers, geotechnical engineers, foundation design engineers, forensic engineers, developers, building contractors, city, county and state engineers, infrastructure planners, and others interested in the network interdependence among transportation, flood control networks, and soil conditions during and after an extensive flooding event and in learning more about possible latent damage that could still occur in Harris County because of the 2017 flooding caused by Hurricane Harvey.

PAST PRESENTATION SUMMARIES

To read summaries of previous FPA presentations by Dr. Lytton, please click:

December 2018 - GIS Map of Equilibrium Suction as Controlled by the Soil and Vegetation
December 2017 - Designing Bases and Subgrades for Better Pavement Performance
December 2016 - Design of Drilled Shafts in Expansive Soils. Part 3

December 2015 - Edge Cracking in Pavements on Expansive Soils: Causes and Countermeasures
December 2014 - Methylene Blue Test of Soil Properties: A Rapid and Accurate Field Test
December 2013 - Design of Drilled Shafts in Expansive Soils. Part 2
December 2012 - Design of Pavements on Expansive Clay Subgrades
December 2011 - Design of Drilled Shafts in Expansive Soils
December 2010 - Effects of Trees on Foundations
December 2009 - Contrasting Design Approaches for Slabs-on-Ground and Raised Floor Foundations on Expansive Soils
December 2008 - How to use the PTI-3rd Edition to Design Foundations in Houston
December 2007 - Design of Structures to Resist the Pressures and Movements of Expansive Soils
December 2006 - Revisitation of Expansive Soils
December 2004 - Case Studies of Residential Foundation Movements in Southern Houston Area
August 2003 - How to Run Soil Suction Tests
August 2002 - Shallow Slope Failures and Suction from Vegetation
August 2001 - Methods to Aid Structural and Geotechnical Engineers in Designing Slab-on-Grade