

## DECEMBER 2012 MEETING

Wednesday, December 12, 2012 (1.0 PDH)

### TECHNICAL PROGRAM:

#### Design of Pavements on Expansive Clay Subgrades

**Speaker:** Robert L. Lytton, Ph.D., P.E. Professor of Civil Engineering at Texas A&M University, Bryan TX, Tel. No. 979-845-9964

Dr. Lytton is an Honorary FPA Life Member, 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 with a Ph.D. in Civil Engineering from the University of Texas (1967). He is internationally famous for his work in the study of the effect of expansive soils on foundations, having given presentations on the subject worldwide. Dr. Lytton has selflessly presented to this forum at least 10 times in the last 11 years and has also presented in past FPA seminars.

### PRESENTATION SUMMARY

The early work in the field of pavement design on expansive clay subgrades was done by Chester McDowell of the Texas Highway Department (now called the Texas Department of Transportation) whose pioneering work was first published in 1956 in the Highway Research Record of the Highway Research Board. In subsequent work, McDowell established the criterion for the design of pavements on expansive clays which was that the Potential Vertical Rise should not exceed 1 inch. Enough subgrade soil should be removed and replaced with inert soil to reduce the Potential Vertical Rise to one inch or less. These criteria proved to be too stringent for some of the more active clay zones in large metropolitan areas of Texas, leading to a 20-year long monitoring study of the roughness of pavements on expansive clays and the proposal of a new design criterion which is based on the measured roughness.

The study was completed with a design project conducted at Texas A&M which developed a design program that combines the new criteria and the AASHTO criteria for traffic roughness for both asphalt and concrete pavements. The program is called WinPRES (Windows for Pavement Roughness on Expansive Soils) and it permits the designer to try a wide variety of design options including inert and stabilized layers, vertical and horizontal moisture barriers and includes the effects of vegetation at the edge of the pavement in meeting the desired design criteria. These criteria are based on the 20-year long monitoring study and require that the pavement must remain within a maximum specified roughness over an extended performance period of several decades. Case studies with the new design criteria have shown that it is usually possible to make substantial reductions in the McDowell requirements for removal and replacement. Design must also account for the longitudinal shrinkage cracks that develop at the edge of pavements and are more closely spaced toward the edge than toward the center. This can be handled with a stabilized base course beneath the shoulders or the use of geosynthetics to resist the cracking that reflects upward from the shrinkage cracks in the actively shrinking sub grade.

During the presentation Dr. Lytton presented the ideas and observations that went into the design procedure of WinPRES. He also demonstrated the program and its use for designing pavements including the manipulation of a variety of inputs, parameters and outputs. Dr. Lytton made a number of observations during the course of the demonstration. He pointed out that suction does not need to be measured since suction limits are well established. Vertical moisture barriers embedded below the edges of the pavement had the greatest benefit for reducing movement. All of input used during the WinPRES demonstration was based on published data that is readily available on the internet. Dr. Lytton has very generously offered to provide a complimentary copy of the WinPRES software on request. Please contact Dr. Lytton at the email address listed: [r-lytton@civil.tamu.edu](mailto:r-lytton@civil.tamu.edu)



**Guardrail between pavement lanes  
on expansive clay subgrade  
IH37, San Antonio, Texas (c. 1974)**

To view Dr. Lytton's slide presentation, [click here](#)

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

[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