

## DECEMBER 2006 MEETING

December 13, 2006

### TECHNICAL PROGRAM

#### Re-Visitation of Expansive Soils

Speaker: Dr. Robert Lytton, P.E. of Texas A&M University, Bryan, TX, Tel: 979 845-9964

#### PRESENTATION SUMMARY

To a room of about 75, Dr. Lytton, Professor of Civil Engineering in the Zachry Civil Engineering Department of the Texas A&M University and a Licensed Professional Engineer holding a Ph.D. in Civil Engineering from the University of Texas, gave a slide presentation entitled, "Re-Visitation of Expansive Soils".

Dr. Lytton presented some new site investigation and laboratory techniques as well as design concepts that have been developed, which will make the job of designing foundations on expansive soils more reliable in the future than they have been in the past.

Dr. Lytton first spoke of TxDOT's new procedure developed under him at TAMU that is replacing the antiquated PVR method published by TxDOT in 1956 for use in the design of pavements. While the sophisticated but easy to use software developed ("WINPRES") is not available to the public, Dr. Lytton believes it will be before too long.

Dr. Lytton presented some of TAMU's output on the FEA program developed under him to determine more accurate moments, shears, deflections, etc. of slab-on-grade, presented in detail to the FPA in [August 2001](#) Dr. Lytton countered a misconception in the industry that a post-tensioned slab-on-grade can no longer carry moment after it cracks. He demonstrated through his calculations that a foundation retains significant load carrying capacity after cracking by relieving itself as it settles onto the supporting grade below. His example calculations are presented in his [slide presentation](#) slide nos. 18-27. The Post-Tensioning Institute presented similar calculations in PTI Technical Note No. 6, August 1995.

Dr. Lytton discussed another misconception that pier bells can contribute to uplift resistance via bearing on the annulus. He pointed out that the pier must vertically deflect 5 - 10% of the shaft diameter before the annulus bearing is engaged, meaning the engineer is usually better off designing with straight shafts where uplift is a concern.

In his slide nos. 31-32, Dr. Lytton presented curves that help geotechnical and structural engineers determine skin friction on pier shafts so that proper anchoring depths below the movement active zone can be evaluated. He stressed the importance for geotechnical engineers to log root fibers, showing an example of severe cracks in the soil fabric (see photo this page) that were caused by trees roots. He said these cracks allow rapid movement of moisture to great depths of expansive clays; a phenomenon sometimes overlooked by the geotechnical engineer in providing structural design recommendations.

Dr. Lytton showed several suction examples. One example showed that even though the site had extremely high suction ( $pF=4.5$ ) below 3 ft, the moisture active zone was only 3 ft because vegetation roots could not extend below 3 ft since the suction was at the wilting point. Dr. Lytton spoke on the recent research of sulfate swell in which at certain sites containing sulfates, adding lime to the clays makes the soil more expansive rather than less expansive.

He demonstrated new methods using data from the TRCC (not USDA) that allow the geotechnical engineer to check for the possibility of sulfates at the site. If the TRCC maps showed the possibility of sulfates, the geotechnical



engineer would need to use a magnetometer to verify the presence of sulfates. He also referred the engineer to TTI Research Report No. 3929-1F. Dr. Lytton noted that over time, the sulfates have tended to collect in valleys.

Finally, Dr. Lytton gave examples of how Plasticity Index (PI) can be misleading in identifying expansive soils, particularly if the type of clay particles is not identified. He showed examples of Chlorites and Halloyites that are highly expansive even though these clays had a PI less than 15%.

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

***Prior to his presentation, Dr. Lytton was presented with a plaque commemorating his being the FPA's first honorary life member in recognition of his many contributions to the association and the industry.***

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

[December 2004](#)

[August 2003](#)

[August 2002](#)

[August 2001](#)

**[PAST PRESENTATIONS \(click here\)](#)**