

DECEMBER, 2008 MEETING

Wednesday, December 10, 2008

TECHNICAL PROGRAM

How to Use the PTI-3rd Edition To Design Foundations in Houston

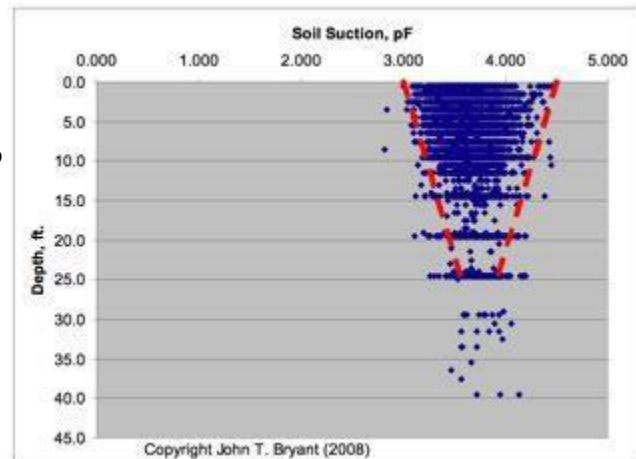
Speakers: Professor Robert L. Lytton, Ph.D., P.E., of Texas A&M University, Bryan TX, Tel. No. 979-845-9964, John Bryant, Ph.D., P.G., P.E., President of Bryant Consultants, Inc., Carrollton TX, Tel. 972-713-9109 and Dean Read, P.E. of MLAW Consultants and Engineers, Austin, Tel. 512-835-7000

PRESENTATION SUMMARY

To an audience of about 70 at the HESS Club in a special 2-hour meeting, Bob Lytton, John Bryant and Dean Read co-presented, "How To Use The PTI-3rd Edition To Design Foundations In Houston". Their presentations were in response to a request from FPA members to cover practical applications of the PTI 3rd Edition Manual to the design of slab foundations in the Houston area, particularly the just-published light-blue manual that includes the first and second addenda combined with the original 2004 3rd Ed. publication.

An overview of the three presentations:

- Bob Lytton summarized PTI's "Design of Post-Tensioned Slabs-on-Ground" design procedure and explained the nationwide criteria that had to be addressed in developing the procedure.
- John Bryant addressed the type of soils and associated geotechnical issues commonly encountered in Houston.
- Dean Read addressed the changes to the structural portion of the design procedure and how it affects the design of foundations in Houston.



Dr. Lytton, Honorary FPA Life Member, Professor of Civil Engineering in the Zachry Civil Engineering Department of the Texas A&M University and a Licensed Professional Engineer with a Ph.D. in Civil Engineering from UT Austin, gave an overview of the Foundation Design Principles for Post-Tensioned Foundations in Houston. He discussed the challenges the PTI slab-on-ground committee had in developing a procedure that fits the entire country given the wide variety of minerals in our soil, varying climatic factors, varying soil fabric (cracking), soluble sulfates, gilgals, varying loads, different foundation structures, etc.

Dr. Lytton said PTI used the mechanistic-empirical approach in developing their procedure in the late '70's, publishing "Design of Post-Tensioned Slabs-on-Ground" 1st Ed. in 1980 and the 2nd Ed. in 1996. The 3rd edition, published in 2004, came about in response to information gained in a TxDOT study. He noted the two worst types of movement were accounted for in the procedure:

- (1) Edge Drying, due to trees, and
- (2) Edge Wetting, due to over watering or poor drainage.

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

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

[December 2007](#)

[December 2006](#)

[December 2004](#)

[August 2003](#)

[August 2002](#)

[August 2001](#)

Dr. Bryant, a licensed professional engineer, a licensed professional geologist and president of Bryant Consultants, Inc. who has earned a Ph.D. in Civil Engineering, an MS in Geography, a BS in Geology and another BS in Civil Engineering presented details of the soils, moisture and site condition elements of the PTI 3rd Edition as applied to the Houston area.

Good points made by Dr. Bryant included:

- Addendum 1 was issued in 2007 because the original 3rd edition was too conservative.
- Addendum 2 was issued in 2008 as a completely new manual from the original 3rd edition, this one with a light blue cover whereas the original 3rd edition's cover was orange.
- The new definition of Expansive Soil is now either a) the weighted PI is at least 15, the weighted passing #200 sieve is more than 10% and the weighted finer than 5 microns is more than 10%, or b) EI is more than 20.
- The same test data that were required for the 1st and 2nd edition procedures are all that are required for the 3rd edition. No additional tests are required, and suction testing is **not** required.
- The only required additional input is the Fabric Factor (F_f).
- Y_m is **not** the same as Potential Vertical Rise (PVR) and it is **not** the expected differential deflection of the foundation. The actual (measured) differential deflection of the foundation should always be **less than** Y_m.
- The typical range of suction change is 1.5 pF for most conditions, from say 3.0 (wet) to 4.5 (dry). Extreme suction limits are 2.5 to 6.0 pF.

To download a copy of Dr. Bryant's slide presentation, click [here](#).

To read a summary of the previous FPA presentation by Dr. Bryant, please click:

[May 2003](#)

Mr. Read, FPA member, a licensed professional engineer with BS and MS degrees in Civil Engineering and president of Geostructural Tool Kit, the company that licenses the VOLFLO and PTISlab software used for designing foundations per PTI 3rd Edition. He presented details of the applied loads and structural approaches for slabs in the Houston area; showed ways that the PTI 3rd Edition procedure can be used to make the design process simple, fast and successful for designing foundations in Houston.

Mr. Read said now all four BRAB foundation types are addressed in PTI:

1. Unreinforced
2. Lightly Reinforced (for temperature cracking, PI < 15)
3. Reinforced and Stiffened (for PI > 15)
4. Structural (Y_m > 4", or there are steep slopes, say 1:4, or there are large amounts of fill)

Good points made by Mr. Read included:

- The newly published light-blue manual (PTI 3rd Ed. with 2nd Addendum) **must be used beginning 1 Jan 09**. However the foundation design engineer can still use PTI 2nd Ed. after this date if the geotechnical report was issued prior to this date and it only provided PTI 2nd Ed. design parameters.
- Perimeter loads were clarified: where perimeter loads vary by more than 25%, use the heaviest load for center lift and the smallest load for edge lift.
- If the shape factor (SF) is more than 24, clarifications are now given on how to address this.
- Long narrow rectangles should not govern the design.

- The allowable shear stress has been increased by 40%
- E_m and Y_m have been reduced
- Stiffness coefficient reduced from 18,000 to 12,000
- Cracked section capacity coefficient (new in 3rd Ed.) was reduced from 0.9 to 0.5 in the 2nd addendum.
- Differential deflection computation replaced by minimum stiffness requirement
- Minimum allowed rib width was reduced to 6 inches
- Removed E_{soil} (soil creep modulus) variable from the equations, incorporating Kent Wray's original 1000 psi value in the new equations.
- Do not use short term loads such as wind, snow, seismic and some live loads.
- The PTI equations already include a 40 psf LL and 65 psf DL. Do not include when considering superimposed loads for beam bearing calculations.
- Though the 3rd Ed. now allows the engineer to use part of the slab to contribute to beam bearing area, this should not be done in Houston and other areas where the soils are softer and the geotechnical report dictates minimum beam penetration (say 12") to achieve the specified design bearing capacity.

To download a copy of Mr. Read's slide presentation, click [here](#).