Discussion of "Load Transfer Curve Analyses of Drilled Shafts Using Crosshole Sonic Logging Test" by Won-Taek Hong, Seung Yong Shin, Min-Chul Park, Jong-Sub Lee and Myung Jun Song

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As a recent study (Fellenius 2017) reconfirmed, reliable prediction of drilled shaft (bored piles) performance has not yet become part of the geotechnical community's toolbox. This means that roughly one-half of the drilled shafts are overdesigned while the other half is not perfectly safe. Under such circumstances, engineers are compelled to take recourse to full-scale load testing. Such tests, when performed on instrumented piles and well documented, provide invaluable addition to the state of the art. Within this context, the authors have certainly made a useful contribution. Still, there are several items in this paper that call for clarification:

1. Information about the concrete used for casting the pile is incomplete. Such properties as compressive strength, consistency, w/c ratio, and type of additives are essential when describing the construction process.
2. Using the P-wave speed, as determined in crosshole ultrasonic testing, to calculate the (Young's) modulus of elasticity, is a proven method (Amir et al. 2014). However, the authors used the naïve method, i.e. dividing the access tube spacing at the pile top by the first arrival time (FAT). However, this can lead to serious inaccuracies stemming from the following factors:
   a. Young's modulus can vary with depth (Amir et al. 2014),
   b. Tube spacing may vary with depth due to construction imperfections, and
   c. The error in FAT readings may be more than 10% (Amir et al. 2004).

   The preferred method is to divide the pile length into sections of a few meters each. For each section plotting the spacing of all tube combination versus the respective FAT values and performing a linear regression on the results. The resulting slope is the best guess for the wave speed (Fig. 1).
3. The authors distinguish between the moduli at small strain and large strain. However, this is incompatible with Fig. 6 in the original paper in which the stress–strain plot is a perfectly straight line from the origin up to twice the stress at the bi-directional (BD) cell. Conversely, because the elastic modulus of concrete depends on the strain rate (Shen and Lu 2008), the relevant distinction should be between the static E_s and dynamic E_d moduli. Popovics (2008), among others, suggests the following relationship between the two parameters:

$$E_s(\mathrm{GPa}) = 1.197E_d - 15.43$$

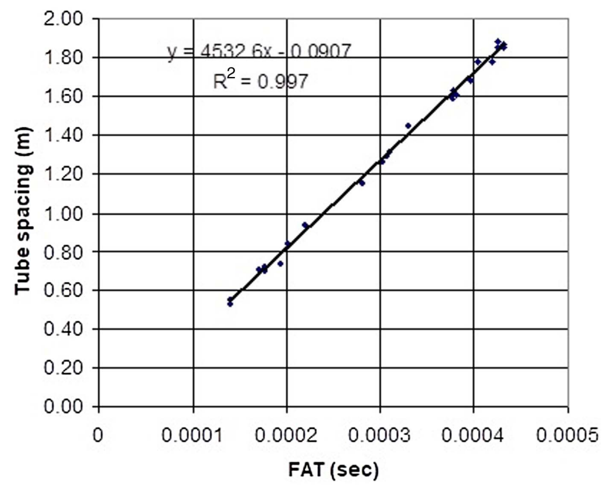

Fig. 1. FAT versus tube spacing. (Reproduced with permission from Amir et al. 2004.)

There are a few notes of more editorial character:

- In Fig. 6 of the original paper, the authors have confused strength and stress. The vertical axis title should apparently be "compressive stress" instead of "compressive strength f'_c." The same is true eight lines lower down.
- The use of five significant digits or even six (pile stiffness calculated as 246,386 MN) is inappropriate in geotechnical engineering because it may give newcomers a false sense of high accuracy.
- Eqs. (5) and (6) of the original paper are physically consistent only for a specific set of units, but these are omitted.

References

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