Closure to "Radial Consolidation Analysis using Delayed Consolidation Approach" by Pankaj Baral, Cholachat Rujikiatkamjorn, Buddhima Indraratna, Serge Leroueil, and Jian-Hua Yin

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The authors appreciate discusser's interest in this research and his comments and suggestions.

Clarification regarding analytical models and results

The Authors confirm that only radial consolidation was considered in the original paper while the vertical consolidation was ignored as the ratio between the length of vertical drain and equivalent unit cell diameter is more than 10 for all case studies (see earlier paper by Rujikiatkamjorn and Indraratna, 2007). The Authors agree that the dissipation of excess pore water at the shallow depth would be influenced by vertical drainage, but this effect on overall consolidation is generally insignificant for long drains. Rates of settlement and excess pore pressure dissipation will be slightly faster when vertical drainage is considered at the shallow depth, if the drains are relatively short.

Clarification about Depth of PWP measurement for Muar embankment

Many thanks for pointing out the actual depth of pore water pressure measurement for Muar Clay embankment. It is indeed 11.2 m (Indraratna and Redana, 2000) and it was mistakenly written in the figure caption as 3 m. The authors apologize for this error.

Clarification about surface settlement

Fig 12b and Fig 13 are from two different sites of Second Bangkok International Airport, Thailand. Fig 12b indicating the measured settlement of 1.25 m at the end of monitoring period is from TS2 location, and Fig 13 is from TS3 location. The subsurface settlement profiles were not available for TS2 and therefore TS3 area was used to validate the sub-surface settlement.

Clarification Regarding Hypothesis

As discussed by Indraratna (2017), various case studies have shown that excess pore water pressures do not always dissipate as fast as one expects when vertical drains are installed, even when the load remains constant or removed. Mandel-Cryer effect, high lateral yielding

characteristic of most visco-plastic soils, strain rates and chemical precipitation and bio-clogging (bacterial) in the vicinity of piezometers can contribute to this phenomenon. In this paper an attempt was made to explain this phenomenon using the framework of hypothesis B through: (a) the increase in effective stress due to delayed consolidation caused by the viscosity of clay, and (b) the change in preconsolidation pressure due to strain rate as shown in Fig. 4. These are the key differences between the current model and the those of Yin and Graham (1989) and Indraratna and Redana (2000). Although the settlement predictions are similar, the current model can simulate the retarded pore pressure dissipation much better, which has been often been a trend observed in the field, yet not captured in many of the past studies adopting ideal drain conditions.

Ballina Case Study: The Authors have similar opinions regarding the poor measurement of time-dependent pore pressure. Ballina is town located on acid sulphate soils, i.e. there is oxidisable pyrite in the shallow ground leaching sulphuric acid catalysed by certain bacteria strains thriving in the floodplains (high organic content). Indraratna et al. (2017) showed that partial clogging of piezometers with time caused by chemical precipitation (e.g. iron oxides), acidophilic anaerobic bacteria-induced gas bubbles (cavitation), acid corrosion of measuring tips and growth of bio-slimes would inhibit the rate of pore pressure dissipation. In this regard, the measured results alone may not be sufficient to confirm the validity of the model.

Second Bangkok International Airport (SBIA) and Muar clay embankment: Although the differences in terms of excess pore pressure predictions among three model are relatively small (less than 4 kPa), the current model still provides a significantly better agreement with the field measurements.

The Discusser has provided some interesting case history data. The Authors will make an attempt to analyse that data in a future publication, and certainly not within the scope of this Discussion.

References

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