Reply to discussion by Li on “An analytical approach for the prediction of single pile and pile group behaviour in clay” by Brian B. Sheil, and Bryan A. McCabe

The authors welcome the discussor's comments on the paper. Additional information requested by the discussor is provided below.

Analysis of skin friction load transfer

The discussor correctly notes that the skin friction load-transfer model of Sheil and McCabe [1] does not consider the post-peak strain softening behaviour of the skin friction load transfer. The advantage of the proposed model is that it may be calibrated against stress-strain curves derived from routine soil elemental testing. This contrasts with alternative models documented in the literature, including the model highlighted by the discussor [2], which require calibration against the actual load-transfer curves measured in experimental or field testing. The development of a robust model capable of *predicting* strain-softening behaviour based on elemental testing only is therefore considerably more involved than simply fitting to the measured response.

It should also be noted that the post-peak load-displacement behaviour is rarely of interest from a design viewpoint where the focus is primarily on limiting group settlement. Even for groups with flexible or very long piles, where the upper portion of the pile shaft may exhibit post-peak load-transfer due to progressive failure, the integrated pile group behaviour is usually governed by the load-transfer behaviour at greater depths and therefore the influence of strain-softening on the overall group response is negligible. In light of this, the authors deem the omission of post-peak softening to be a reasonable simplification.

The authors agree with the discussor that the determination of the limiting slip displacement, y_{crit} , at the pile-soil interface is nontrivial and is dependent on a number of pile/soil parameters. The value of 5 mm adopted for y_{crit} was based on field measurements reported by Broms [3], fell within the measured bands of 3 mm – 7 mm reported by Liu et al. [4] and gave the best match to the case histories examined in the paper. This value has been widely adopted for the modelling of single piles in the literature, e.g. Lee et al. [5], Cho et al. [6] Jeong et al. [7], Lee et al. [8] and Lam et al. [9].

Analysis of base resistance load-displacement response

The final point relates to the hyperbolic model adopted to describe the load-displacement response. It should be noted that the only difference between the present model and the model most commonly adopted in the literature relates to the curve-fitting term in Eq. D2, i.e. $(1-R_{bf} \cdot P_b / P_{bu})$. This term was modified as $(1-R_{bf} \cdot P_b / P_{bu})^2$ by the authors to (i) improve the

nonlinearity of the base load-displacement response as observed in field tests [10] and (ii) increase the sensitivity of the parameter R_b . The reliability of any curve-fitting model is dependent on (i) the data used in the calibration, and (ii) the fit to the data. Given that the present model provided a good fit to the data, the reliability of the two models will be similar and more dependent on the measurements used in the calibration exercise.

References

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