Discussion of

"Investigation of Soil Arching with Centrifuge Tests"

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The authors are to be congratulated on an interesting and valuable insight into arching behaviour. However, the 'normalised loading' in Figures 10 and 11 of the original paper (at the points of 'Minimum Load' and 'End of Test') does not seem appropriate. The plots show results for various values of H/B, with corresponding systematic variation of $p/p_0 = p/\gamma H$.

Equations 10-13 of the original paper all indicate significant proportionality of $p/\gamma H$ to B/H. This indicates that normalisation as $p/\gamma B$ is likely to be appropriate. Figures D1 and D2 show $p/\gamma B$, for comparison with Figures 10 and 11 of the original paper. It can be noted that any significant dependency on H/B which is now observed is only for the methods which give conspicuously high results compared to the experimental data. The remainder of the results now show a relatively limited range of normalised values, largely independent of H/B, and agreeing reasonably well with the experimental data. Thus this method of normalisation seems more appropriate.

It is also possible to draw comparison with arching in a piled embankment. Using the terminology introduced by Hewlett & Randolph (1988), the trapdoor predominantly considers failure at the ‘crown’ of an arch. In piled embankments, failure ‘at the pile cap’ (punching into the base of the embankment) can also be a significant factor, particularly where the pile caps are small compared to the pile spacing and/ or embankment height (eg. Zhuang et al, 2012).

Table D1 shows comparison of ‘minimum load (experimental data)’ in Figure D1 with some piled embankment studies, excluding data related to failure ‘at the pile cap’. The studies include two- and three-dimensional scenarios (2D and 3D), and centrifuge and Finite Element (FE) modelling.

The 2D values tend to be lower than 3D, which is perhaps not surprising since it could be argued that the 2D arch would be ‘stronger’. The Centrifuge values tend to be lower than FE, which potentially corresponds to cautious selection of strength ($\varphi' = 30^o$) in the FE analyses. However, in general correspondence is encouraging, and seems to confirm the analogy between the trapdoor and piled embankment scenarios for failure at the ‘crown’ of an arch.

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Table

Table D1 – Comparison of results in Figure D1 with piled embankment studies

	2D		3D	
Source	Figure D1	Zhuang et al (2010)[1, 2]	Ellis & Aslam (2009)[1]	Zhuang et al (2012)[1]
Modelling	Centrifuge	FE	Centrifuge	FE
Min load $p/\gamma B$	0.32-0.36	0.40-0.64	~0.4-0.6	0.48-0.70

Notes

1: Studies for piled embankments – *B* taken as equivalent to clear spacing between adjacent pile caps, values for 'failure at pile cap' not included.

2: Original paper uses normalisation by centre-to-centre spacing (rather than clear spacing)

Figures

Figure D1 – Alternative normalisation compared to Fig 10 in the original paper (coarse sand)

Figure D2 – Alternative normalisation compared to Fig 11 in the original paper (glass beads)

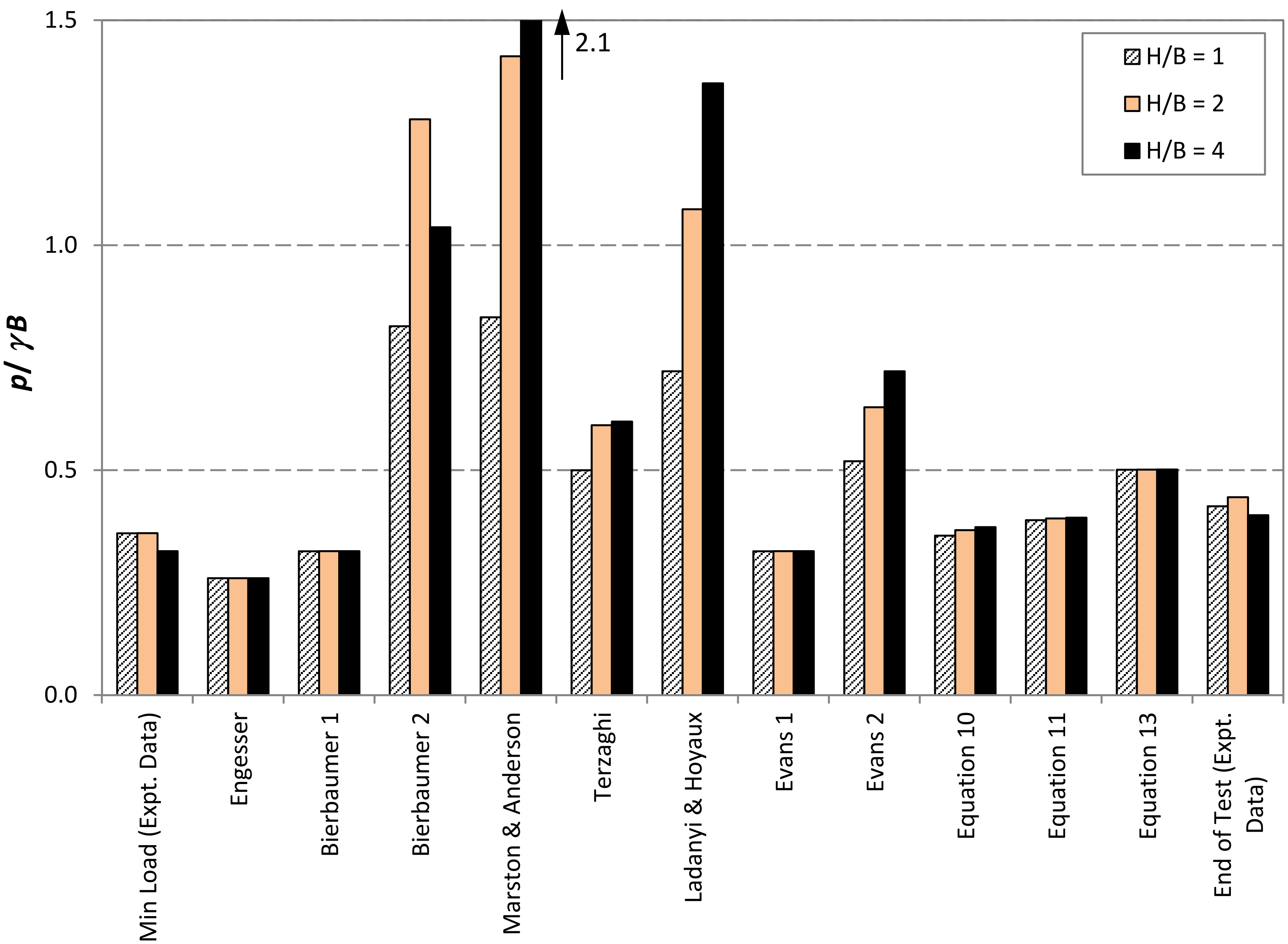

Figure D1 - Alternative normalisation compared to Fig 10 in the original paper (coarse sand)

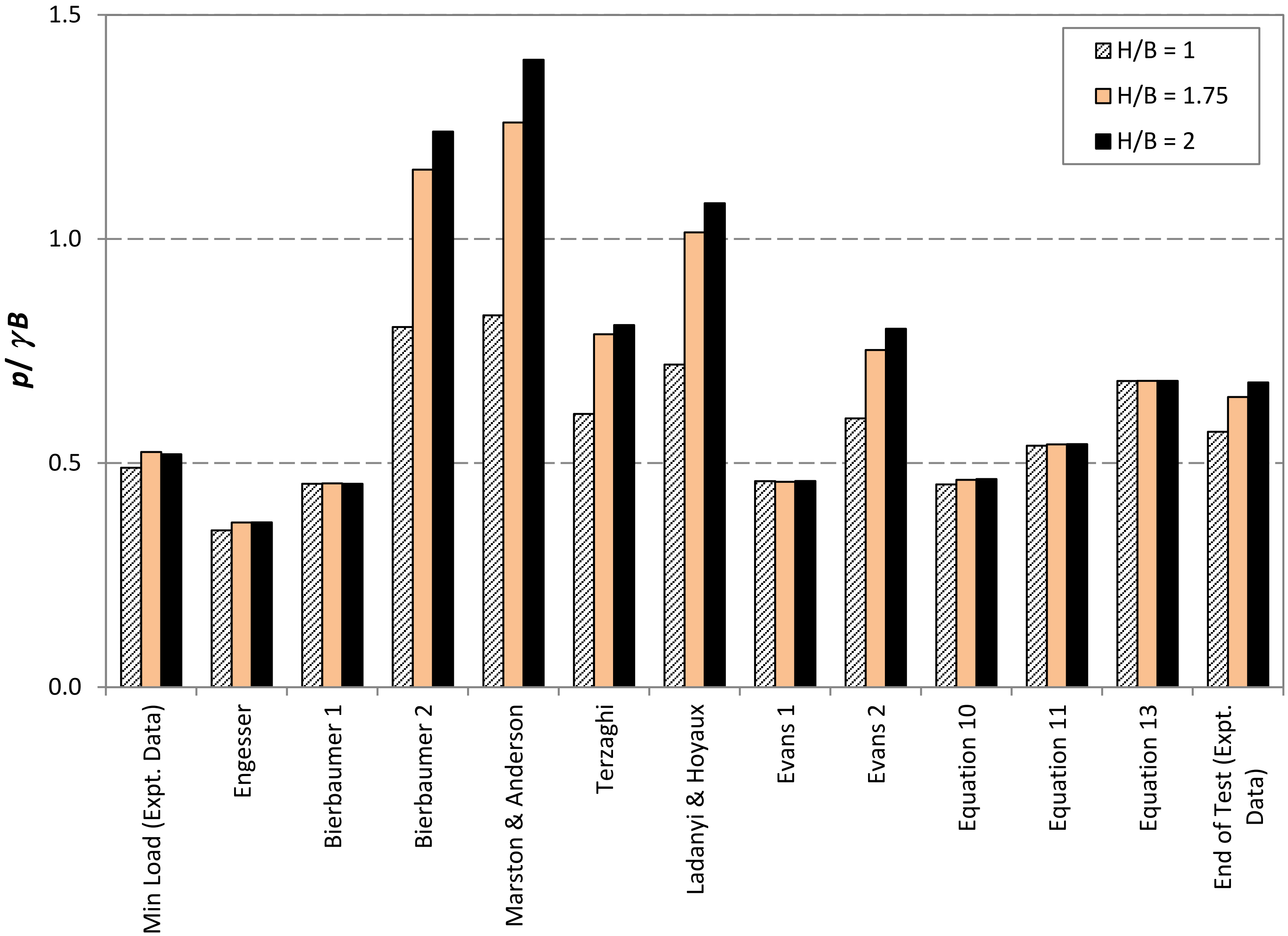

Figure D2 - Alternative normalisation compared to Fig 11 in the original paper (glass beads)