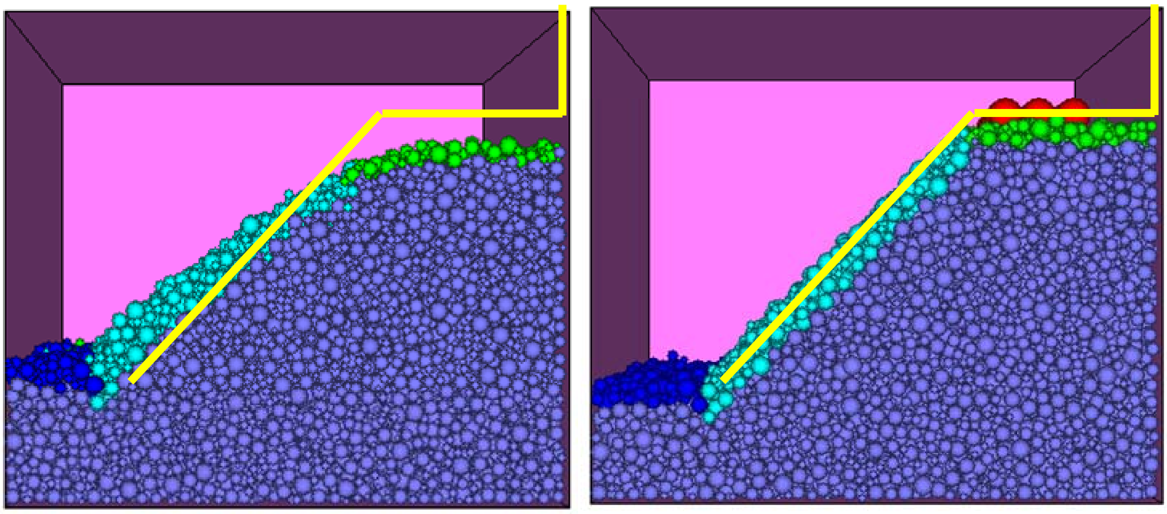
Reply to reviewer's comment

Reviewer 1

1. The original figure 11 gives the results for applied load equal to 2000N, for which both cases have failed. Such results cannot reflect the importance of bond strength, as the bond strength is completely destroyed by the applied load. We have revised the figure 11 to the one as shown below. For a bond strength of 6N, the slope has failed completely, but the slope remains stable if the bond strength is 60N. We suggest to replace the original Fig.11 with the updated Fig.11 for illustration.



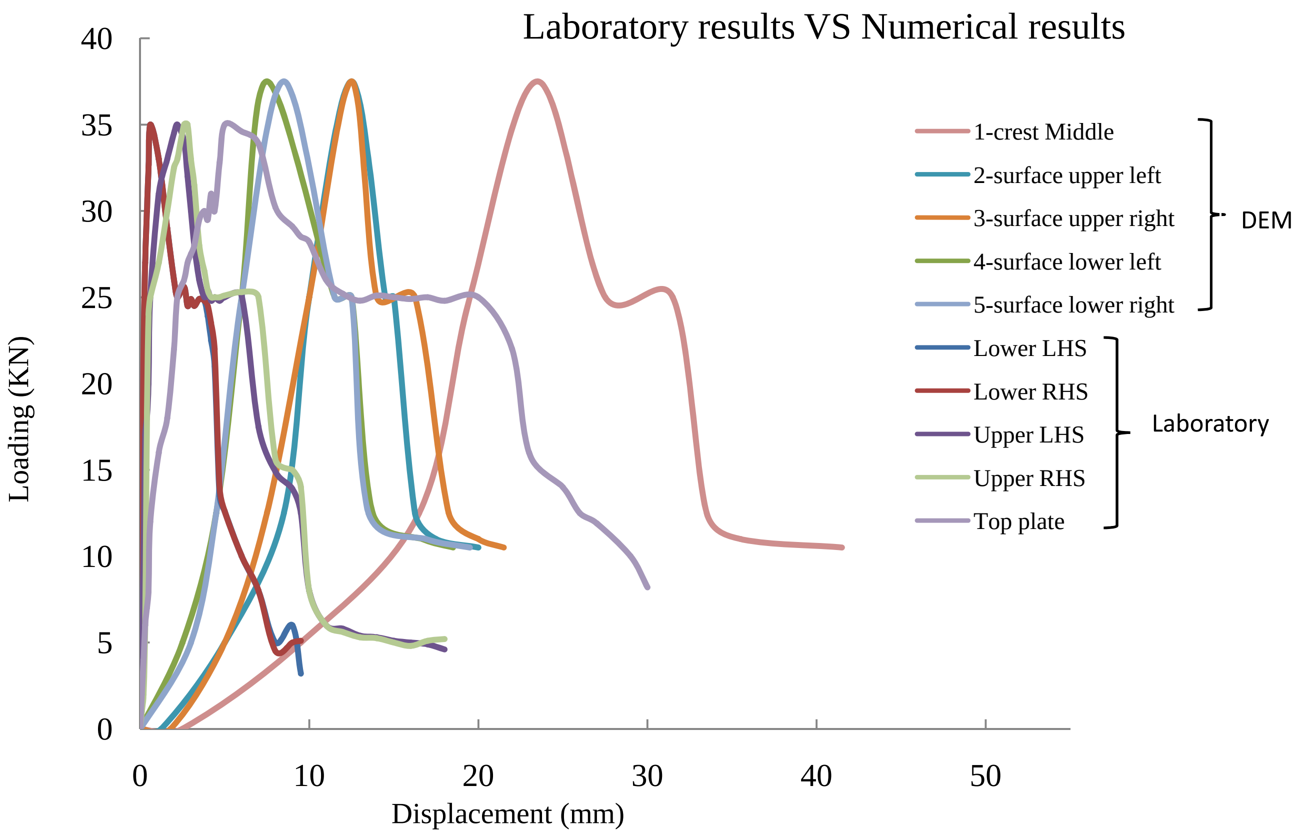
(a) Case 1: bond strength = 6N (b) Case 2: bond strength = 60N

Figure 11Eventual failure of two modeling cases under loading raft in XY direction(with external load 500N)

- 2 and 3. We have looked at the laboratory and numerical results again. Such discrepancy indicates that for the laboratory test, the failure and deformation are more locally confined which is however not reflected in the numerical results. We have also used Flac3D to simulate the problem, and qualitatively, the results from Flac3D agree with that from PFC3D, and in fact, the corners settle more during loading in Flac3D than PFC3D. We suspect that the soil is stiffer and more brittle than expected, which is supported by the high friction angle as obtained from several direct shear tests. We admitted that this is a limitation of the numerical modeling, and also possibly the constitutive model that we have employed. From many load test results on site, we also find that the settlement are usually more locally confined while continuity based or even distinct element method produce a greater influence zone in the analysis. We have tried to vary various parameters like wall friction, stiffness and others, but the corners from the numerical computation still move which is different from the tests. For the local result near to the test plate, the behavior can however be reproduced nicely by tuning the parameters.

4. The authors have many papers published in the field of LEM and SRM, and several books about slope stability or related numerical methods. For LEM and SRM, they are more suitable to the ultimate limit state where the full strength of the system is mobilized. After initiation of failure, LEM is no longer applicable. On the other hand, SRM is not suitable to model the present problem when there is large displacement or even separation of the soil mass. We choose DEM for the present problem because this method is more suitable for post-failure analysis which appears in the present test. Up to the initiation of the failure stage, LEM and SRM are actually more convenient to be used than DEM.

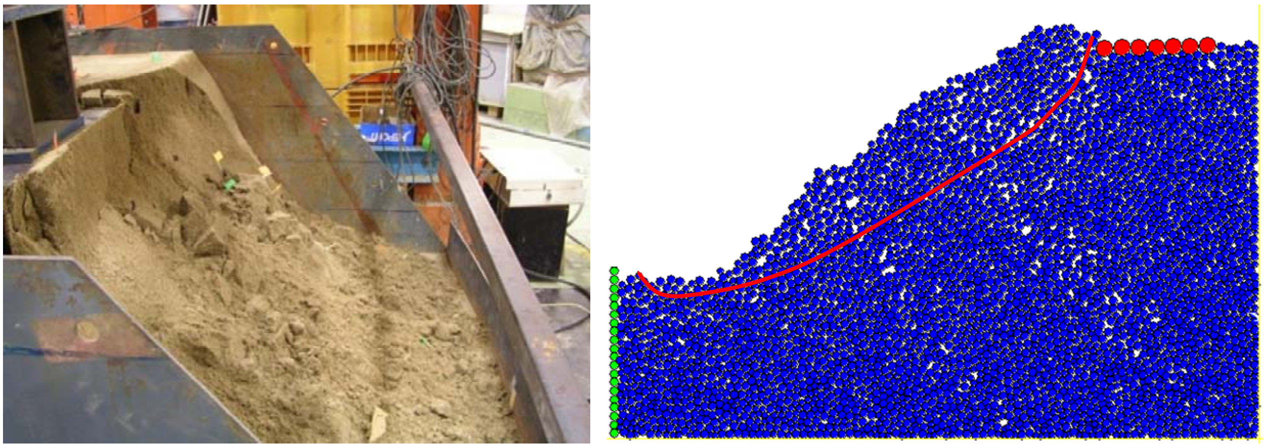
5. Up to present, DEM is still mainly limited to qualitative instead of quantitative analysis (see hundred of papers in DEM and also papers by the authors). The authors have tried to use the best parameters in the DEM analysis, and have only carried out minor tuning of the input parameters to give the results in Figs. 8 to 13. Although the results in Fig.16 cannot match very well with that from Fig.7 quantitatively (not bad matching), qualitatively, the results are not bad. The comparisons between the laboratory and numerical results are shown in the revised Fig.16 for easy comparisons.



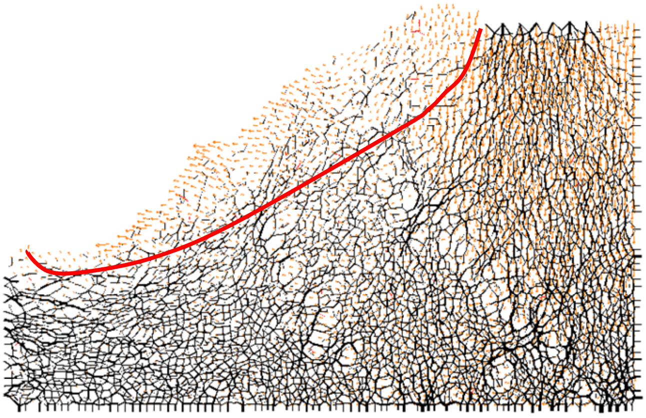
➢ Figure 16 Loading force against displacement curves of the slope at different measuring points from Laboratory and Numerical results

Technical Corrections:

1. The figures in the original Word file for Fig.3 and 4 are correct. It is interchanged in the pdf production, and we have noticed about such mistake. Very sorry for that.
2. The failure mechanisms are marked by the equivalent slip surface similar to that by LEM and SRM. The slip surface is determined from the velocity/displacement for all the particles. It is noticed that there is a narrow band of particles where the movement is significantly more than the adjoining particles, and the locus of this band is drawn as the slip surface.



(a) Laboratory test of slope (b) DEM displacement vector with failure line



(c) Displacement vector and contact forces with failure line

Figure 15 Side view for the final failure from laboratory test and DEM modelling