



A comparison study between 2D and 3D slope stability analyses considering spatial soil variability

Liang Zhang

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Deterministic Analysis

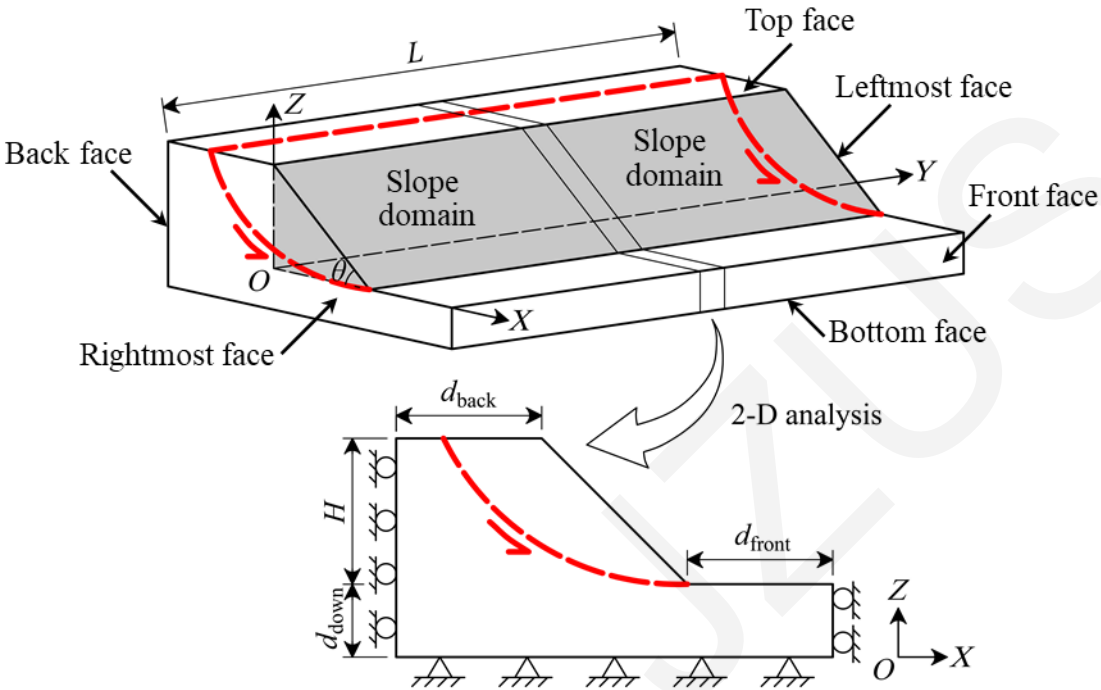


Fig. 1 Conventional 2D stability analysis of a 3D slope

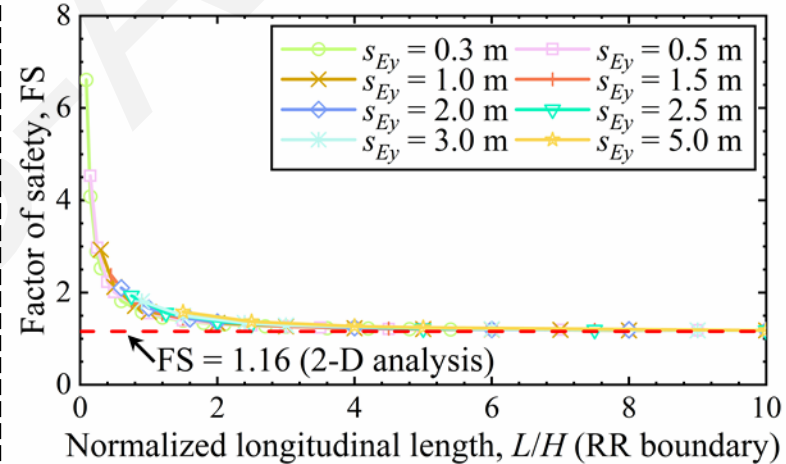
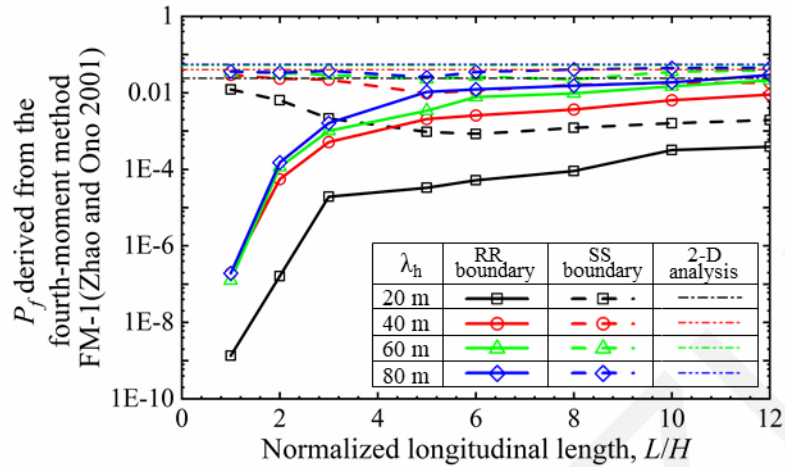
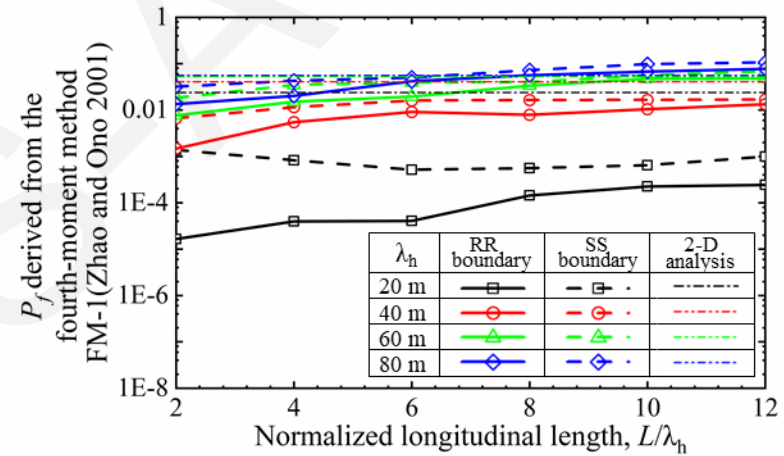


Fig. 2 The comparison between the 2D and 3D deterministic slope stability analyses with RR boundary ($H=10$ m and $\theta=45^\circ$)

Probabilistic Analysis



(a)



(b)

Fig. 3 The effect of the longitudinal length on the estimated probability of failure of the 3D slope ($H=10$ m, $\theta=45^\circ$, and $\lambda_v=4.0$ m): (a) normalized longitudinal length L/H ; (b) normalized longitudinal length L/λ_h

Statistics of local slope failures

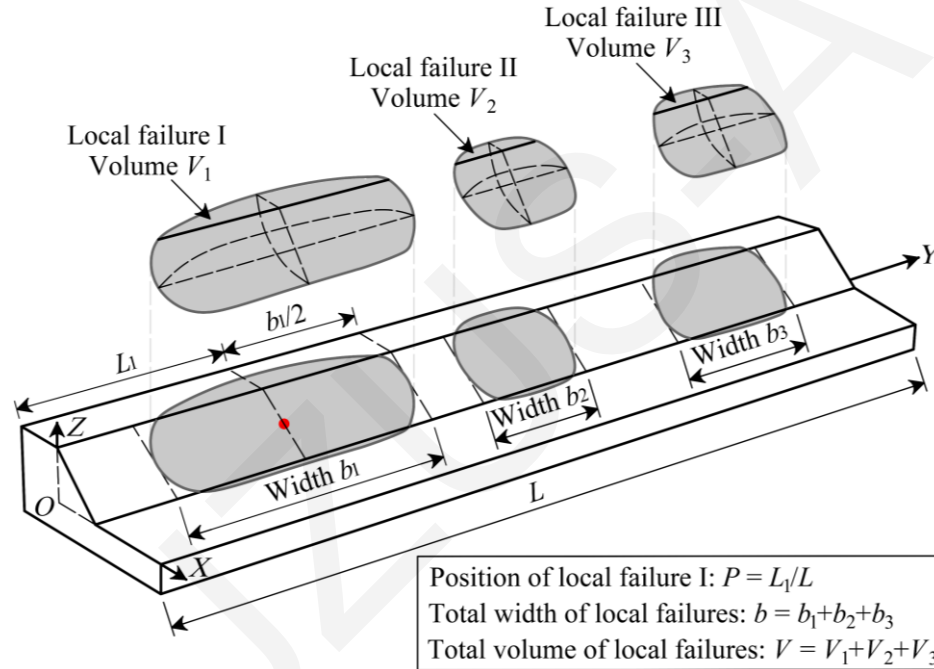
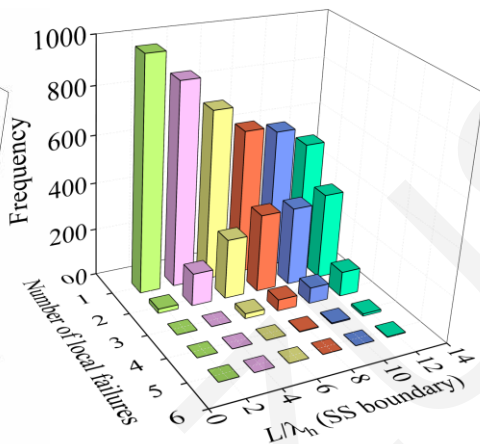
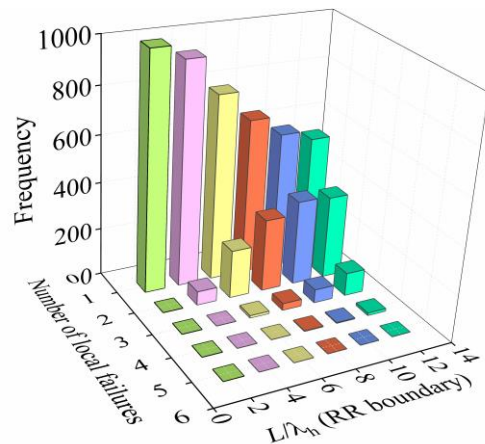
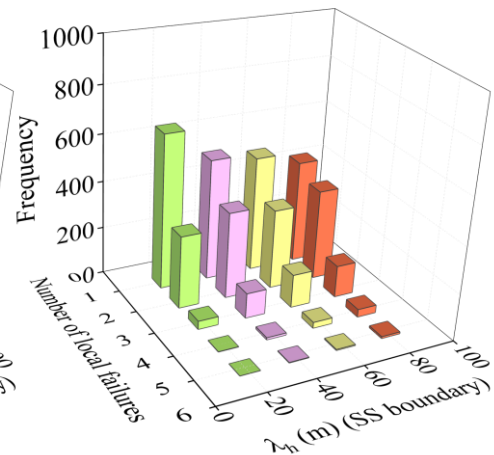
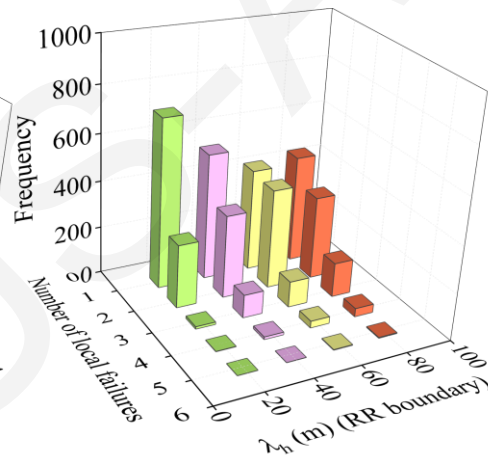


Fig. 4 The estimate of the characteristics of local slope failures in 3-D slope stability analyses

Statistics of local slope failures



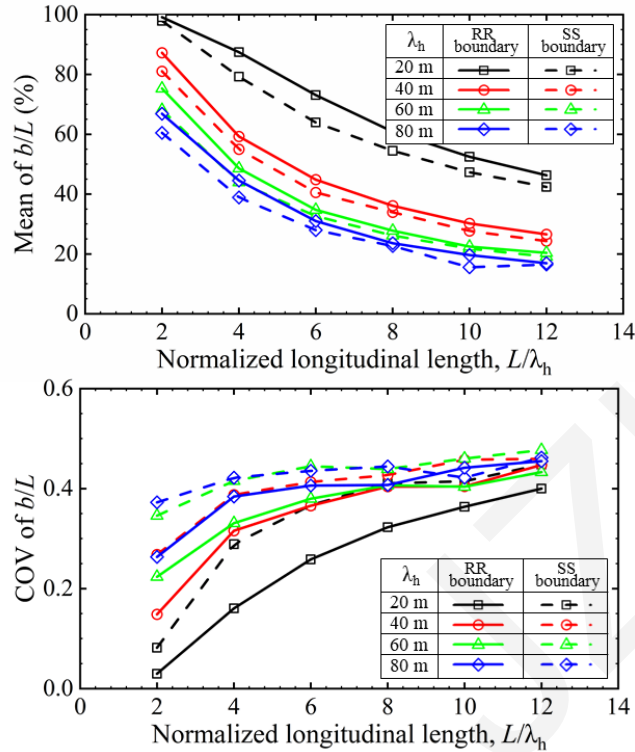
(a)



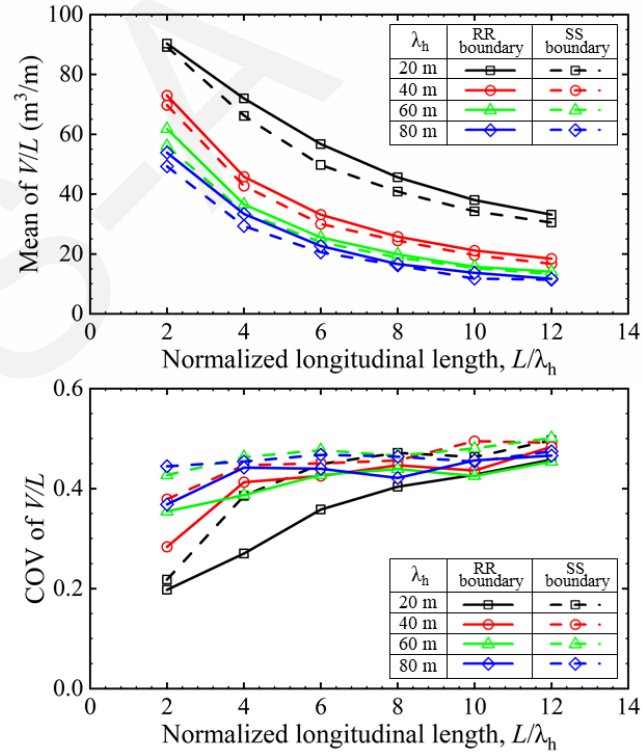
(b)

Figure 5. The effect of input parameters on the number of local failures ($H = 10$ m, $\theta = 45^\circ$, and $\lambda_v = 4.0$ m): (a) $\lambda_h = 40$ m; (b) $L/\lambda_h = 12$

Statistics of local slope failures



(a)



(b)

Fig. 6 The effect of input parameters on the statistics of the normalized total width and volume of local failures ($H = 10$ m, $\theta = 45^\circ$, and $\lambda_v = 4.0$ m): (a) normalized total width; (b) normalized total volume

Statistics of local slope failures

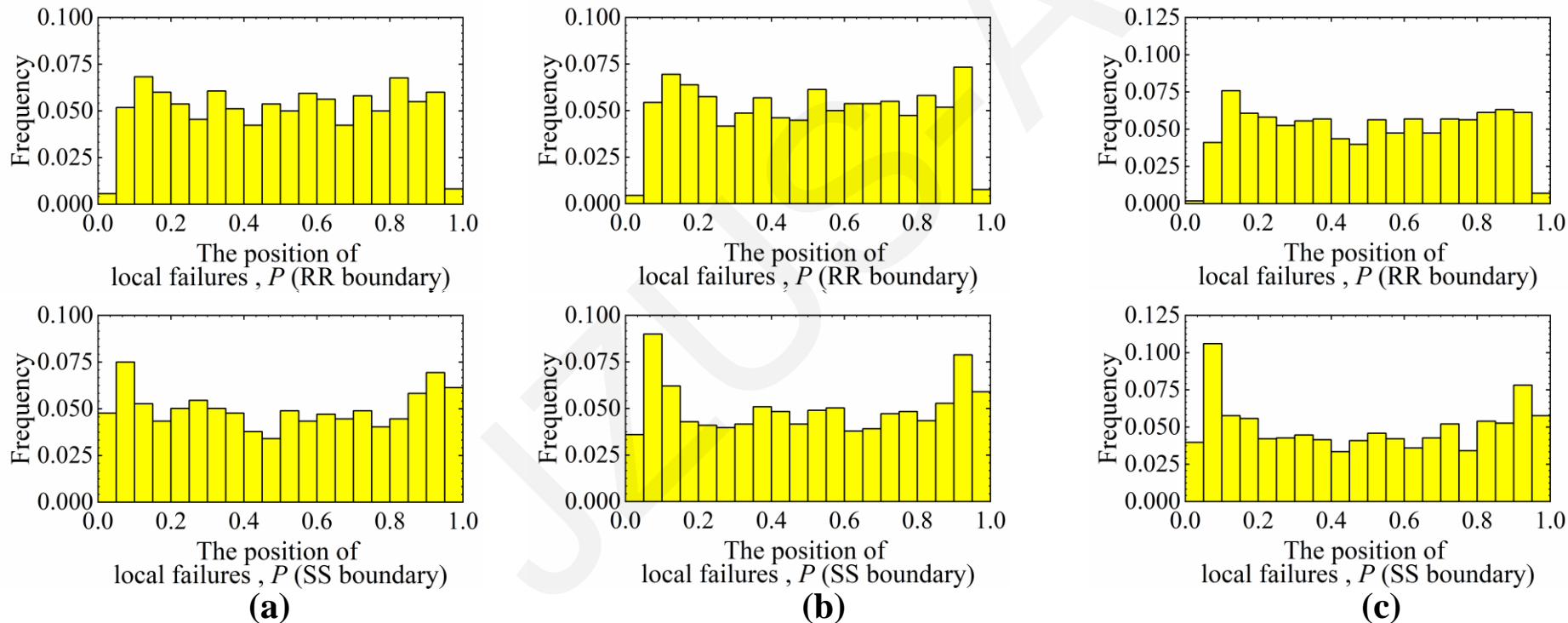


Figure 7. Histograms for the positions of local failures along the longitudinal direction ($H = 10 \eta$, $L = 480$ m, $\theta = 45^\circ$, and $\lambda_v = 4.0$ m): (a) $\lambda_h = 40$ m; (b) $\lambda_h = 60$ m; (c) $\lambda_h = 80$ m

Conclusions

- The difference in the computed probabilities of failure, between 2D and 3D analyses, **decreased** with the slope **longitudinal length** and the **horizontal scale of fluctuation** (of soil properties)
- The probability of failure obtained from the 3D analysis was more sensitive to the **horizontal scale of fluctuation** than did its 2D counterpart.
- In the context of the 3D probabilistic slope stability analysis, the probability of failure obtained with the **RR boundary** was found to be **smaller** than that obtained with the **SS boundary**.
- The **multiple local failures** distributed along the slope longitudinal direction (caused by the existence of the weak zones) were found to be a factor that could explain the **difference** in the computed failure probabilities between 2D and 3D analyses.

Thanks for your attention.

