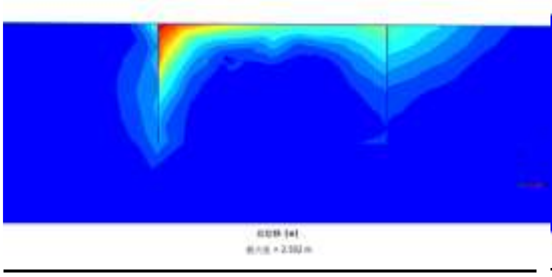
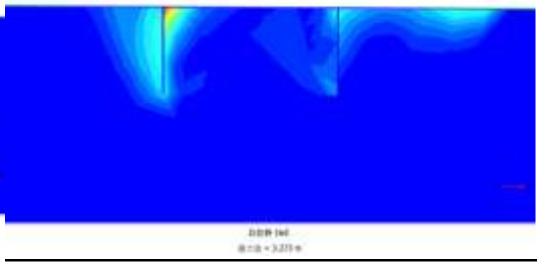
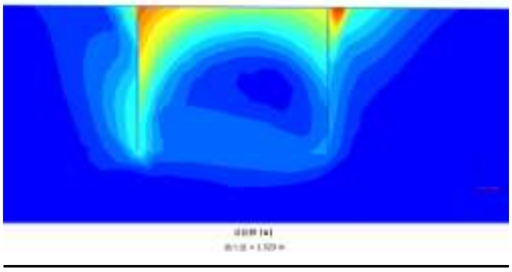


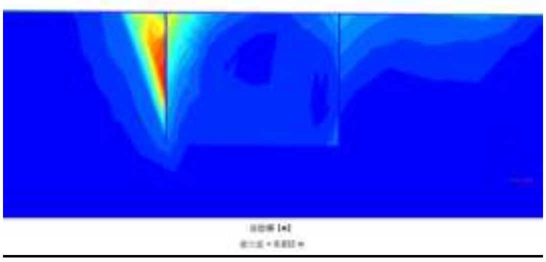
(a)Dl=12m, L/D=0.5



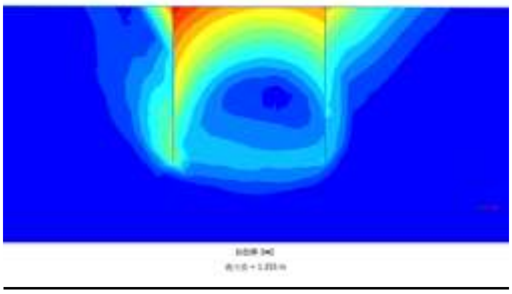
(d) Dl=24m, L/D=0.5



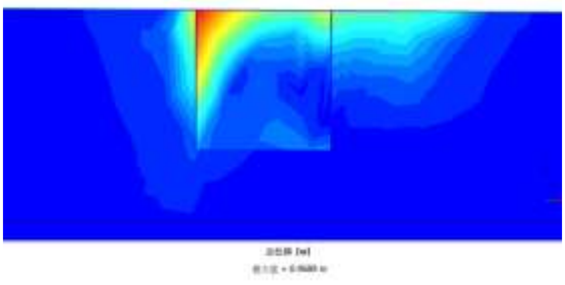
(b) Dl=12m, L/D=0.75



(e) Dl=24m, L/D=0.75



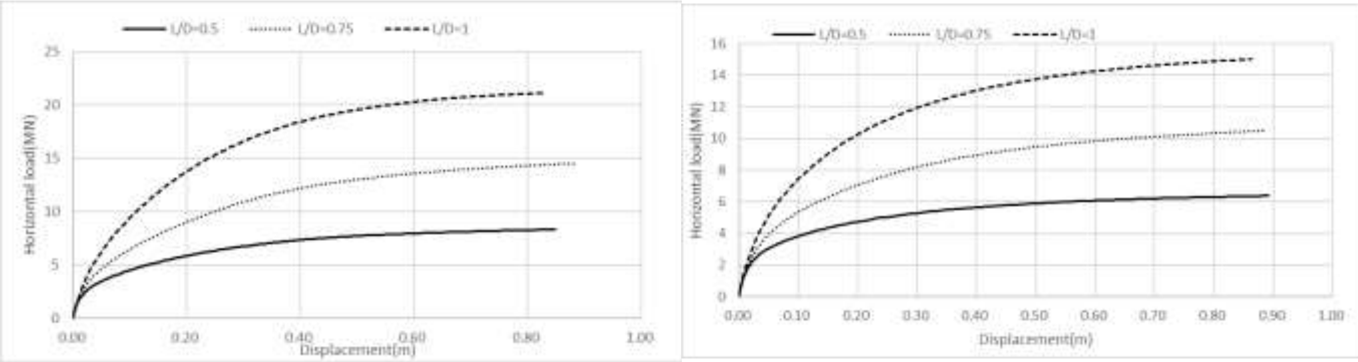
(c) Dl=12m, L/D=1



(f) Dl=24m, L/D=1

Fig. 7 In comparison to the displacement of the composite suction foundation upper lid diameter Dl=12m,24m with different bucket L/D when load eccentricity h=70m in dense sand

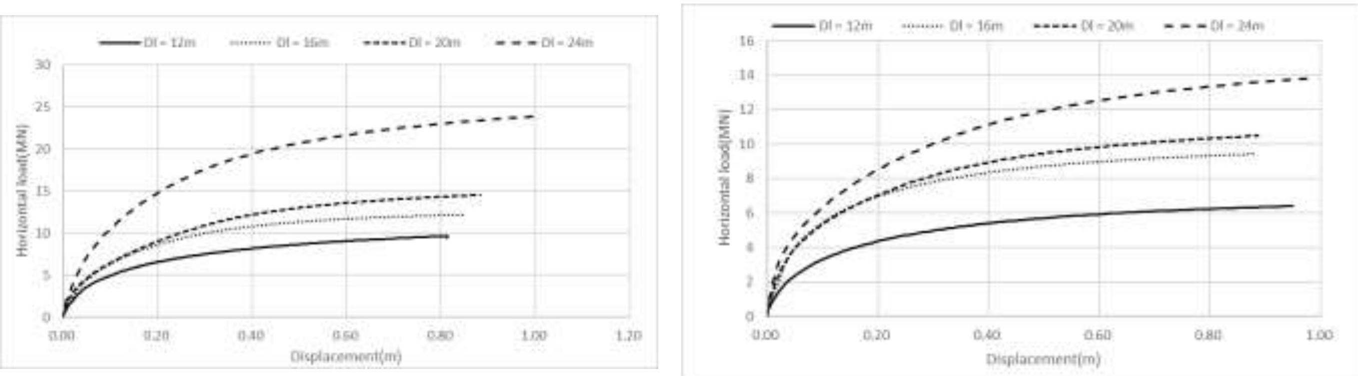
Fixed h=30m and D1=20m, variation of lateral capacity under different bucket length (L=6m, 9m, and12m; and L/D=0.5, 0.75, and 1) is shown in Fig. 8. Whether the soil condition is dense or medium dense, we can find the lateral capacity increases with increasing of bucket length. At the displacement 0.8m, the lateral capacity increases about 63.5%~72.9% when the bucket length increasing from 6m to 9m. For the case increasing from 9m to 12m, the capacity increases about 44.1%~46.9%.



(a) in dense sand (b) in medium dense sand

Fig. 8 Horizontal load–displacement interaction diagram (upper lid diameter Dl=20m，load eccentricity h=30m，with different bucket length)

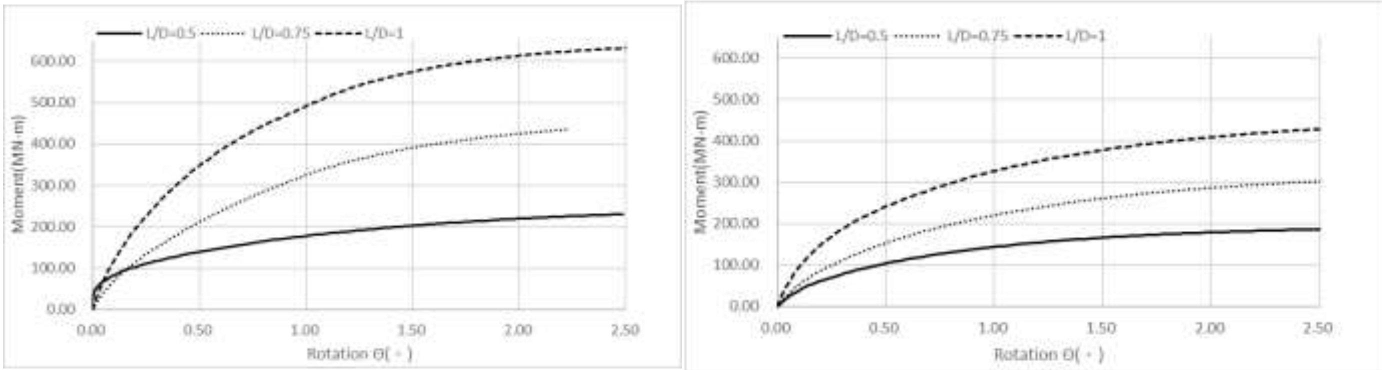
Fixed h=30m and L=9m, variation of lateral capacity under different lid diameter (Dl=12m,16m, 20m, and 24m) is shown in Fig. 9. As shown in the figure, the lateral capacity increases with increasing of lid size. At the displacement 0.8m, the lateral capacity increases about 25.8%~49.7% when the bucket length increasing from 12m to 16m.



(a) in dense sand (b) in medium dense sand

Fig. 9 Horizontal load–displacement interaction diagram (L/D=0.75，load eccentricity h=30m，with different upper lid diameter Dl)

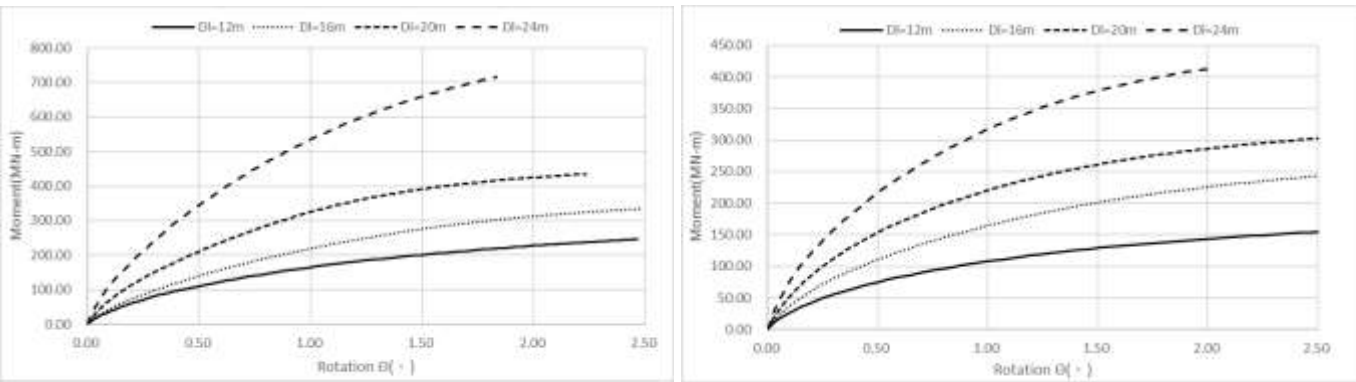
If we assume h=30m and D1=20m, the moment versus rotation relationships under different bucket length (L=6m, 9m, and12m; and L/D=0.5, 0.75, and 1) are shown in Fig. 10. Increasing the bucket length also increases the bending resistance of the bucket. Under the same moment (M=150MN-m), the rotation angle under bucket length of L=6m, L=9m, and L=12m is 0.6, 0.3 and 0.14 degree, respectively.



(a) in dense sand (b) in medium dense sand

Fig. 10 Moment–rotation interaction diagram (upper lid diameter Dl=20m，load eccentricity h=30m，with different bucket length)

The relationships of moment versus rotation of the foundation with h=30m and L=9m under various lid size (Dl=12m,16m, 20m, and 24m) are shown in Fig. 11. The figures showed the bending moment resistance of the foundation increases with increasing of the lid size, whether in medium dense sand or dense sand. Based on Figs. 10 and 11 we can find that the bending moment resistance of the foundation is improved by increasing the size of the lid or the length of the bucket.



(a) in dense sand (b) in medium dense sand

Fig. 11 Moment–rotation interaction diagram (L/D=0.75，load eccentricity h=30m，with different upper lid diameter Dl)

5. CONCLUSIONS

In this paper, a proposed composite foundation in medium dense sand or in dense sand subjected to combined loading is investigated using numerical simulation. The conclusions based on the results of the numerical studies can be drawn as in the following:

1. The rotating center of the foundation appeared to be higher under larger applied moment resulted from larger eccentricity. In addition, the lateral capacity of the foundation decreases when the bending.
2. Based on the variation of the effective normal stress on either side of the bucket, higher normal stress was observed below rotating center due to higher passive soil pressure. However, the effective normal stress above the rotating center appeared to be linearly increased along depth. In addition, the rotating center of the foundation appeared to be higher with increasing of the lid diameter (Dl).
3. Based on the failure mechanism of the composite foundation with D1=12m, the foundation not only inclined under combing loading but also displaced in the horizontal direction. The soil condition on the right side of the bucked appeared to be passive failure while on the left side bucket appeared to have separation between soil and bucket. Above the rotating center of the bucket, passive failure was observed. For the composite foundation with D1=24m, uplifting of the soil was observed on the right side of the lid. In addition, passive failure was observed on the left side of the bucket. The rotating center of the D1=24m case was higher than that of the D1=12m case, which indicated that the composite foundation has higher bending moment resistance than that of the conventional bucket foundation.
4. The lateral capacity of the composite foundation improved with increasing lid diameter or bucket depth. The foundation rotating degree became lower with increasing of lid diameter or bucket depth. Hence, the bending moment resistance of the composite foundation was also increased.

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