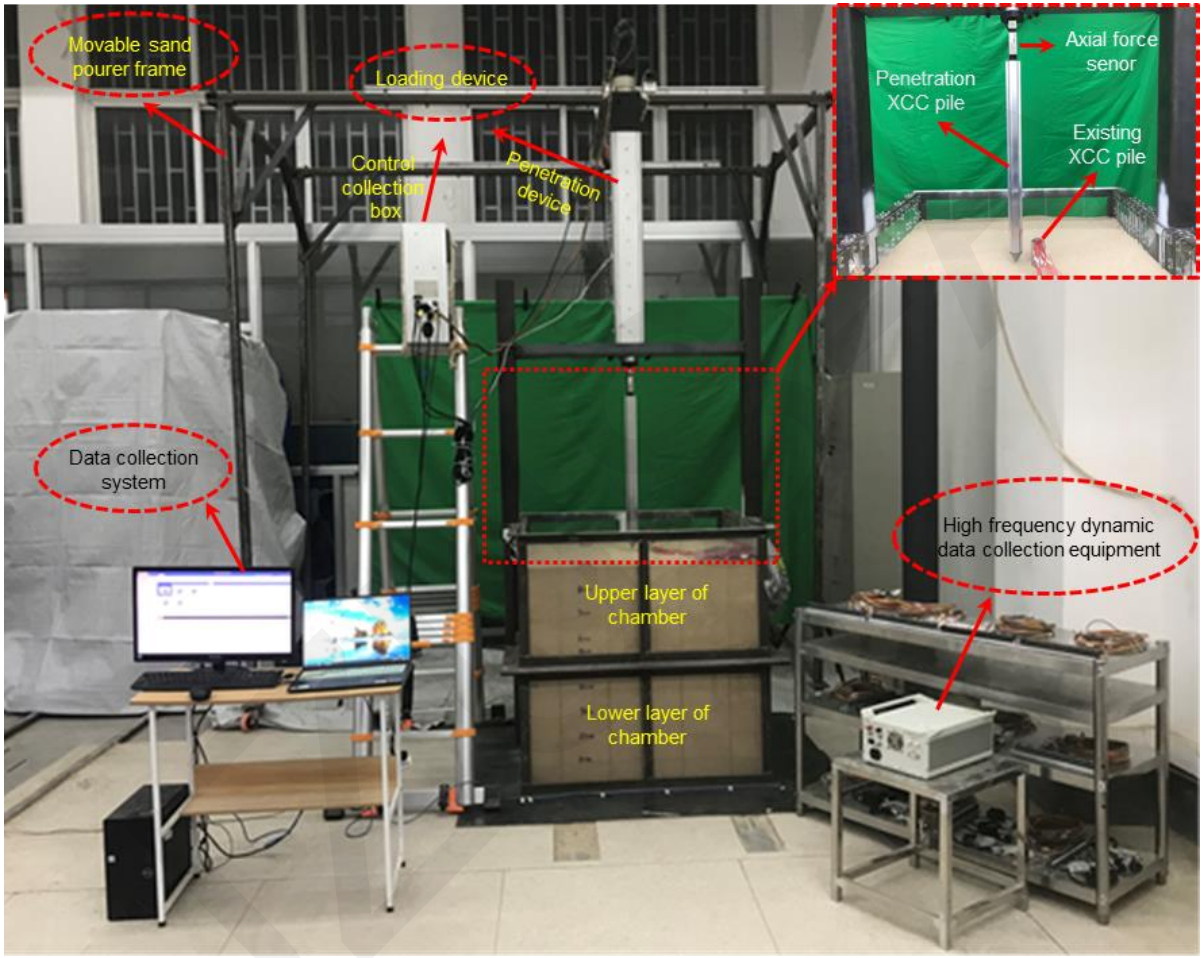
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Influence of the penetration of adjacent X-section cast-in-place concrete (XCC) pile on the existing XCC pile in sand

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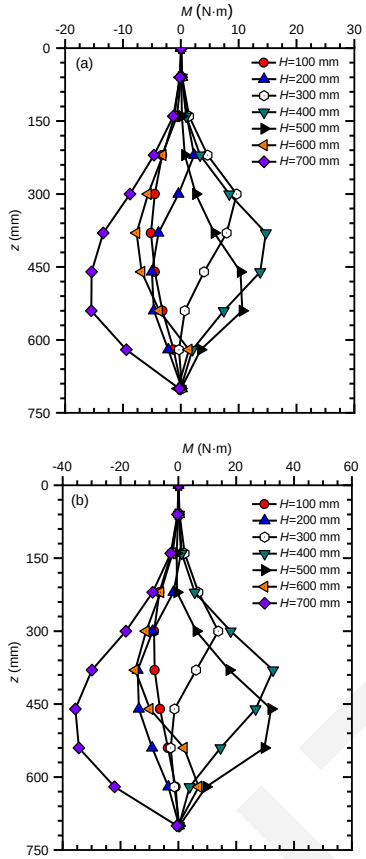
Overview of model test



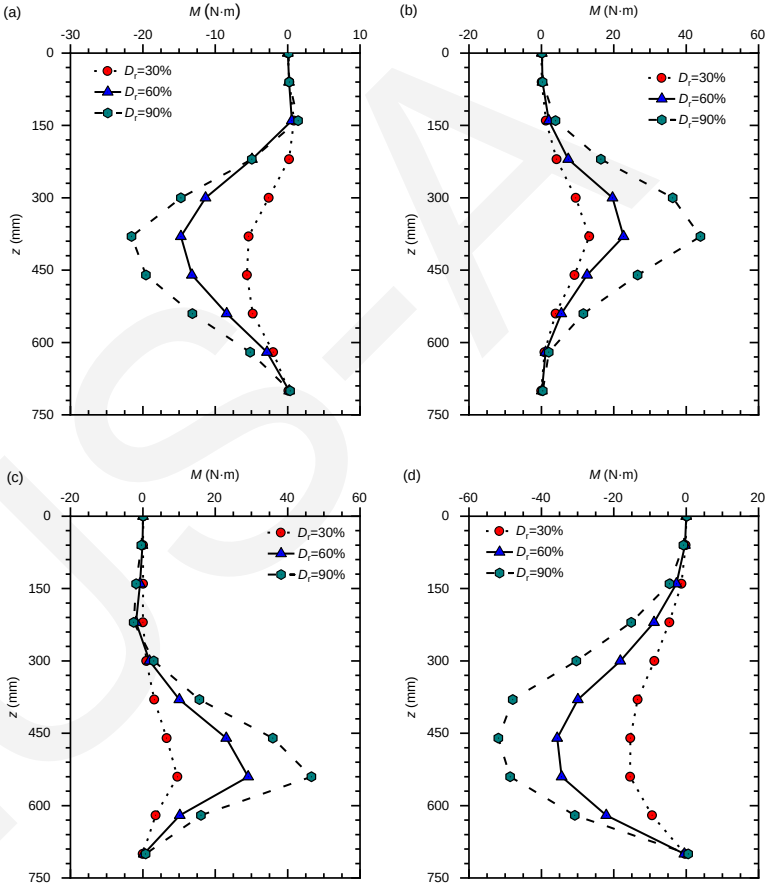
Schematic view of the test device

A series of small-scale 1*g* X-section cast-in-place concrete (XCC) pile-penetration model tests were conducted to study the effects of soil density and pile geometry on the lateral responses of an existing pile and the variations in surrounding soil stress.

Lateral response of the existing pile



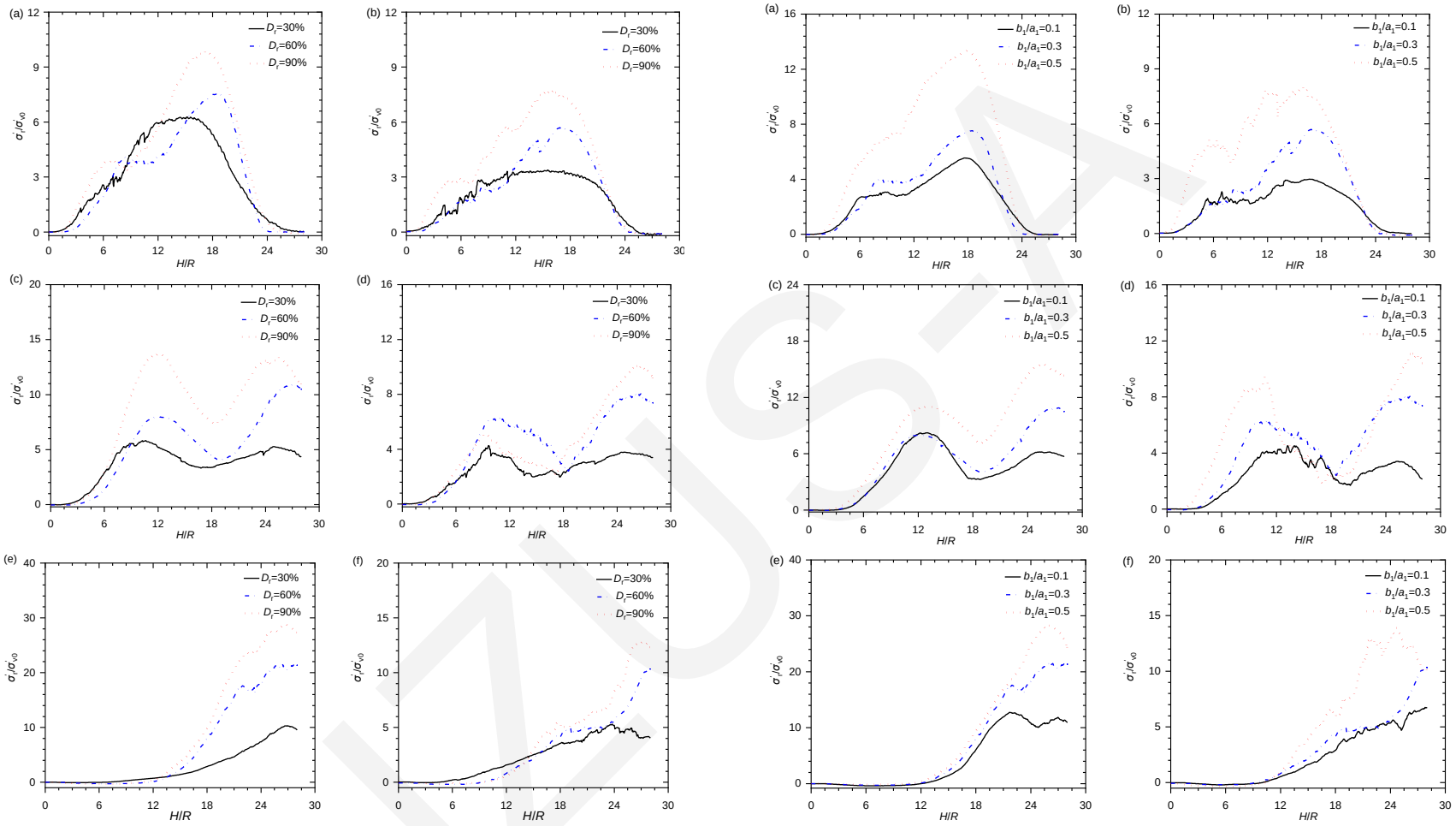
Bending moment profiles of the existing pile during penetration of the adjacent pile



Comparison of the bending moments of the existing pile during the penetration

The existing XCC pile exhibits different bending patterns during the penetration of an adjacent XCC pile. The relative density (D_r) and cross-section geometry (b_1/a_1) have significant effects on the lateral response of the existing pile. The bending moment increases with increasing D_r and b_1/a_1 for a given H.

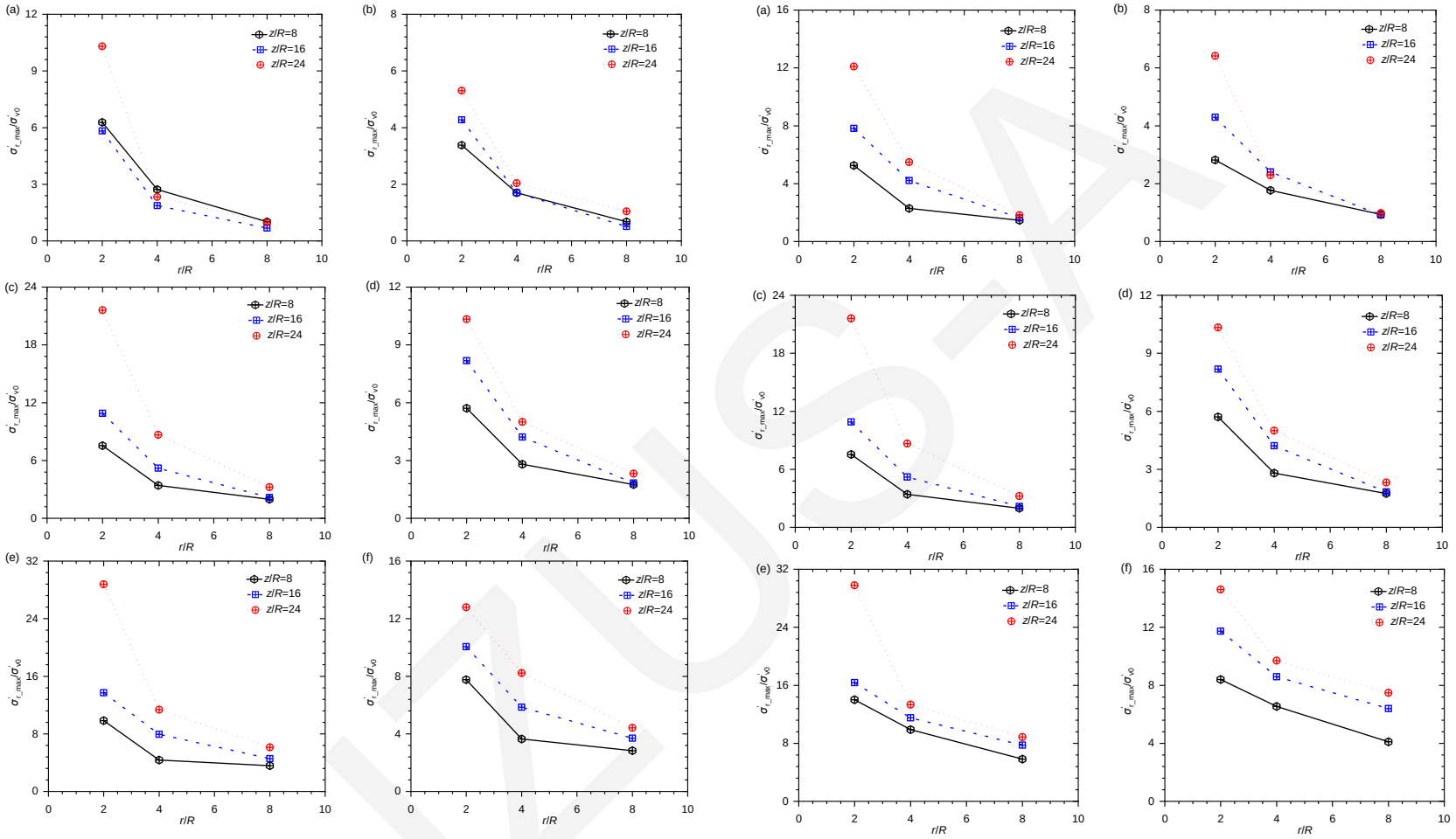
Development of soil stress around existing pile



Variation of σ'_r/σ'_{v0} with H/R at r/R=2 away from the pile axial during the adjacent XCC pile penetration: (a) z/R=8, strong axis profile; (b) z/R=8, weak axis profile; (c) z/R=16, strong axis profile; (d) z/R=16, weak axis profile; (e) z/R=24, strong axis profile; (f) z/R=24, weak axis profile

The variations of the radial stress of soil around the existing pile with the penetration depth at various measurement depths show different patterns during the penetration. In addition, compared with penetration in free-field soil, the variations of the radial stress do not show the "*h*/*R* effect" because of the shading effect of the existing XCC pile.

Development of soil stress around existing pile



Relationship between $\sigma'_{r_max}/\sigma'_{v0}$ and r/R during the penetration

The peak of radial stress $\sigma'_{r_max}/\sigma'_{v0}$ decreases exponentially with increasing radial distance r/R. The decay index of $\sigma'_{r_max}/\sigma'_{v0}$ with r/R in loose sand (D_r=30%) is larger than those in medium-dense and dense sands (D_r=60% and 90%). The peak of radial stress at the same soil location exhibits an increasing trend with the increase of b_1/a_1.