The state-of-the-art centrifuge modelling of geotechnical problems at HKUST

香港科技大学土工离心机先进模拟技术在岩土工程中的应用

Citation: Charles W. W. NG, 2013. The state-of-the-art centrifuge modelling of geotechnical problems at HKUST. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 15(1):1-21. [doi:10.1631/jzus.A1300217]

Key objective

To illustrate the role of state-of-the-art geotechnical centrifuge modelling in addressing complex geotechnical problems

Key methodology

Using the state-of-the-art geotechnical centrifuge at HKUST, which is equipped with advanced simulation capabilities including the world's first in-flight bi-axial (2D) shaker and an advanced in-flight four-axis robotic manipulator

Major aspects investigated

1. To investigate the effectiveness of vertical soil extraction on correction of building tilt
2. To study effect of collapse of a tunnel on an adjecent existing tunnel
3. To understand effect of excavation on performance and capacity of pile
4. To reveal failure mechanisms of loose fill slopes subjected to a rising ground water table and seismic loading

Key conclusions (1)

- Building tilt could be effectively reduced by vertical soil extraction.

- Due to tunnel collapse, the most significant increase of bending moments in its adjacent existing tunnel occured at the springline, with the maximum percentage of 228%.

- Pile capacity after excavation can either increase or decrease, depending on roughness of the soil-pile interface. Ultimate shaft resistance of low friction piles reduces in proportion to the vertical stress relief resulting from excavation. On the other hand, the capacity of high friction piles increases after excavation, due to increased horizontal stress acting on the pile as a result of dilation at the rough soil-pile interface.

Key conclusions (2)

- Static liquefaction/ fluidisation of a poorly-graded loose fill slope due to a rising ground water table was successfully simulated. In contrast, only non-liquefied slide was observed in well-graded loose fill slopes when they were subjected to a rising ground water table.

- The bi-axial shaking test with a peak horizontal base acceleration of about 0.3*g* did not result in flow liquefaction of a loose CDG slope. This implies that CDG slopes are likely to be stable under the proposed design earthquake peak ground acceleration ranging from 0.08 to 0.11*g* in Hong Kong.