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Effect of cemented soil properties on the behavior of pre-bored grouted planted nodular piles under compression

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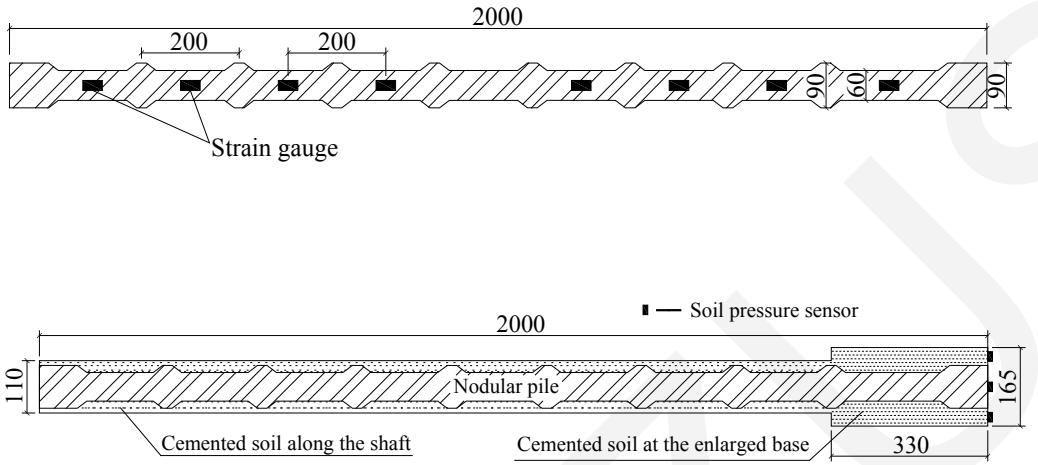
Model test preparation



Schematic of model nodular pile

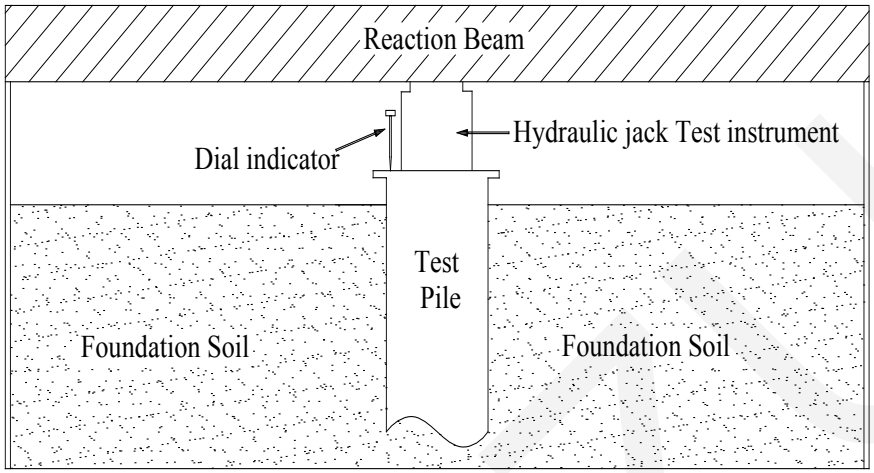
- A 90(60)-mm nodular pile was adopted in the test, and the entire length of the model pile was 2000 mm.
- The diameter of the cemented soil along the pile shaft was 110 mm. The diameter of the enlarged cemented soil base was 165 mm, and the height of the enlarged base was 330 mm.
- Eight groups of strain gauges were attached to the nodular pile shaft to measure the axial load during a static load test. Three soil pressure sensors were equipped beneath the pile tip to measure the tip resistance.

Model test preparation

Photograph of the test chamber

- The 1.8 m×1.8 m×2.5 m test chamber was adopted in the model test.
- The foundation soil was filled layer by layer such that the thickness of each soil layer was 0.1 m after compaction.
- The homogeneity of the foundation soil was examined after each soil layer was compacted completely.
- The strength of the cemented soil along the shaft was 1.21 MPa, and the strength of the cemented soil at the enlarged base was 16.02 MPa in this test.

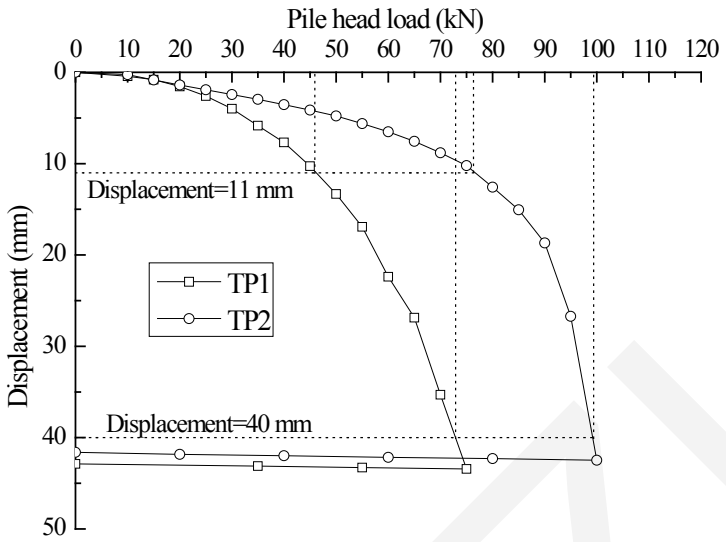
Static load test



Schematic of static load test

- The static load test was carried out after the cemented soil was cured for 28 days.
- The static load test was applied according to the local specification in China (JGJ 106-2014), and the slow maintained load method was adopted for the model test.
- The static load test should be terminated when the pile head displacement is larger than 40 mm.

Model test results



Load-displacement curves of test piles

- The behavior of PGPN pile was obviously improved when the strength of the cemented soil around the pile was increased.
- For each soil layer, the ultimate skin friction of TP2 was larger than that of TP1, and the degree of increase was in the range of 1.06-1.36-fold.
- The tip bearing capacity of TP2 was also better than that of TP1.

Conclusions

- The ultimate compressive bearing capacity of the PGPN pile increased by 36% when the strength of the cemented soil along the shaft increased from 0.706 MPa to 1.21 MPa, and the strength of the cemented soil at the pile base increased from 11.10 MPa to 16.02 MPa.

- The ultimate skin friction of the PGPN pile increased by 1.06-1.36 times when the strength of the cemented soil along the pile shaft increased from 0.706 MPa to 1.21 MPa, and the shearing modulus of the soil around the pile also increased in several soil layers.

- The ultimate tip bearing capacity of the PGPN pile increased by 1.42 times when the strength of the cemented soil at the enlarged base increased from 11.10 MPa to 16.02 MPa.