IDENTIFYING DEFECTS IN LARGE DIAMETER BORED PILES – CASE STUDIES

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Inroduction

Construction of deep bored piles requires adequate quality assurance measures to ensure that the pile is free of major defects and can safely carry the design loads. The paper presents pile quality assurance tests implemented for two case studies of large diameter piles installed in the Indo-Gangetic Alluvium.

Case study - 1

One of India's tallest residential towers is being constructed in Uttar Pradesh, not very far from the Yamuna River. The development includes construction of a 66-story residential tower rising about 240 meters above grade and has two basements extending about 9 m depth. The foundation system was a piled-raft system supported by 298 bored piles of 1 m diameter extending to 48 m depth. The authors carried out a rigorous quality assurance program to ensure foundation quality and performance in-situ, including low-strain pile integrity tests (PIT), static and high-strain dynamic pile load tests, as well as pile coring.

PIT results suggested large variations in pile impedance, including cross-sectional area, with depth. Many of the piles revealed a weak toe signal, suggesting the presence of "muck" at the pile bottom. Pile cores through some piles confirmed the findings of PIT. Four static pile load tests carried out to 10-11 MN test load indicated total pile settlements of 50-65 mm at the final test load. Six dynamic load tests were carried out using a 200 KN drop weight. The test was effectively used to re-assess the safe load carrying capacity of the piles and to design the piled-raft.

Case study - 2

A commercial building complex in Delhi with three basements and six upper storeys was planned as a top-down construction. The 1600 mm diameter bored piles were installed to 47.5 m depth below the ground level (32 m below basement level). After pile installation, excavation was carried out for the basements. The basement slab level was planned at 15.5 m depth. The portion of the pile above basement level was designed to act as a column. Each pile was designed to carry a safe load of 14.23 MN.

Pile integrity tests and high-strain dynamic load tests indicated poor shaft quality, low ultimate pile capacities and the possibility of a "soft pile toe". Osterberg (O-cell) Bidirectional Load Cell test carried out on one pile also indicated significantly low allowable safe working pile capacity.

Excavations carried out on site revealed poor pile concrete quality, exposed reinforcement and voids in the piles.

Closure

The quality assurance program executed at the project sites revealed glaring inadequacies in the foundation construction, and possibly helped avert a major catastrophe. The authors are strongly of the opinion that foundation design is incomplete without a well-planned, comprehensive foundation testing program executed by independent agencies of technical repute.