Field and model investigations into the influence of age on axial capacity of displacement piles in silica sands

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Abstract
The axial capacities of piles driven in silica sands are known to grow over the months that follow installation, long after all driving-induced pore pressures have dissipated. However, there is uncertainty over the processes that govern the observed setup and how they may vary from case to case. This paper evaluates three hypotheses against evidence from updated field test databases and laboratory investigations with highly instrumented and pressurised model piles. Potential influential factors are considered including: pile and sand particle sizes, installation style, access to free water, test conditions and external stress change cycles. Laboratory local stress measurements support the hypothesis that moderation, over time, of the extreme stress distributions developed during installation is a key contributor to capacity growth, while field tests confirm the action of enhanced dilation near the shaft. However, field and laboratory piles show paradoxically different ageing trends. The paper proposes that the fractured but compacted sand shear zone that forms around pile shafts during installation leads to setup being far more significant with large field driven piles than in model tests.