

## The Effects of Time and Cyclic Loading to the Axial Capacity for Offshore Pile in Shallow Gas

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**Abstract :** An offshore platform was installed in 1977 at about 260km offshore West Malaysia at the water depth of 73.6m. Twelve (12) piles were installed with four (4) are skirt piles. The piles have 1.219m outside diameter and wall thickness of 31mm and were driven to 109m below seabed. Deterministic analyses of the pile capacity under axial loading were conducted using the current API (American Petroleum Institute) method and the four (4) CPT-based methods: the ICP (Imperial College Pile)-method, the NGI (Norwegian Geotechnical Institute)-Method, the UWA (University of Western Australia)-method and the Fugro-method. A statistical analysis of the model uncertainty associated with each pile capacity method was performed. There were two (2) piles analysed: Pile 1 and piles other than Pile 1, where Pile 1 is the pile that was most affected by shallow gas problems. Using the mean estimate of soil properties, the five (5) methods used for deterministic estimation of axial pile capacity in compression predict an axial capacity from 28 to 42MN for Pile 1 and 32 to 49MN for piles other than Pile 1. These values refer to the static capacity shortly after pile installation. They do not include the effects of cyclic loading during the design storm or time after installation on the axial pile capacity. On average, the axial pile capacity is expected to have increased by about 40% because of ageing since the installation of the platform in 1977. On the other hand, the cyclic loading effects during the design storm may reduce the axial capacity of the piles by around 25%. The study concluded that all piles have sufficient safety factor when the pile aging and cyclic loading effect are considered, as all safety factors are above 2.0 for maximum operating and storm loads.

**Keywords :** axial capacity, cyclic loading, pile ageing, shallow gas

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