The 2019 World Congress on
Advances in Structural Engineering and Mechanics (ASEM19)
Jeju Island, Korea, September 17 - 21, 2019

Choosing effective design solution for fixing offshore hydrotechnical structures to shelf ground

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ABSTRACT

Fastening of hydrotechnical oil-gas minning facilities to seabed soils in Caspian Sea aquatoriums is usually carried out by pile foundations. Sustainability of strength and stability during the design and construction of hydraulic structures requires to solve a number of theoretical and practical problems. Numerous static and dynamic tests (experiments) were carried out in the Caspian Sea aquatorium and in laboratory conditions to solve these issues.

The load-bearing capacity of piles on soils depends on the mechanical properties of the soil and on the immersion of the piles. The widespread use of pile foundations in the development of offshore oil and gas fields revealed the inconsistency of the domestic scientific methodological and regulatory framework for calculating their load-bearing capacity over the soil. Given the high prevalence of drilled-in and precast piles, in the present work, the main disadvantages and problems of scientific methodological and regulatory framework for their calculation are considered. For the combined drilled-in pile, the method for estimating the load-bearing capacity for soils is based on an incorrect assumption on the preservation of the hydrostatic pressure of the cement slurry on the walls of the well and after the hardening of the cement slurry, which leads to false results. For precast metal piles, an assessment of the load-bearing capacity according to the tables of building regulations does not correspond to reality and leads to large errors, and for depths of more than 35 m it is completely impossible. The dynamic method (building regulations) for predicting the load carrying capacity of precast piles of a small length with the driving parameter for offshore waters using mechanical and pile hammers gives results with unacceptable errors. For long piles, this method is not applicable at all.

The main causes of these shortcomings are analyzed, the corresponding scientific and methodological foundations of new methods for calculating the load-bearing capacity of pile foundations are developed. At the same time, using all laboratory data, a new calculation method providing reality of results is offered**.**

When studying the interaction of the offshore structure with a ground base through large-section bored piles with a hard core in the harmonic mode of vibration, we replace the rheological combined models we offer, which consist of an elastic spring and Newton's shock absorber (viscous damper), that depend on oscillation frequency. Design schemes of offshore structures are taken, as shown in Fig. 1, which offshore structures, through pile foundations, transmit harmonic vibrations to offshore subsoil bases.

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