The Mode of Deformation Status of the Offshore Pile Structures with Low-Rigid Raft Foundations

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ABSTRACT

The solution offered in the study is directed to taking into account joint operation of the spatial beam structures of offshore facilities and the pile foundations loaded by them. The content of this method is an application of a simple design beam model of piles which exactly describes behavior of a top part of actual piles affected by external loads in elastic setting.

KEYWORDS: spatial structure, foundation, piles, calculation.

INTRODUCTION

One of the most widespread structures of the marine oil-and-gas platform bases are spatial beam structures from steel. Similar structures, as a rule, are installed in nonfreezing water areas at maximum 500m depth to or at small depths in case of small thickness of an ice cover (Fig. 1).

Fig. 1. Oil platforms basing on spatial beam supporting structures

The piles of various types are applied as the base of such offshore structures most often (Fig. 2, a). Joint calculation of a spatial beam structure of a support with system of the piles transferring the load on the ground of the base is rather complicated and it requires application of the specialized program systems and the great deal of time.

Therefore at a stage of a preliminary choice of a variant of the base (configuration of the piles, a way of their immersing, length and cross-section) the simplified methods are applied, as a rule that consist in separate calculation of the top structure and the substructures. The spatial beam support is calculated independently, and then the bases are calculated on the basic reactions received from the top structure (Fig. 2, b).
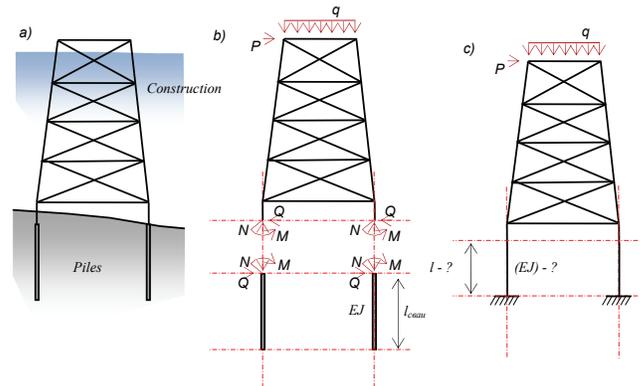

Fig. 2. Base of the platform
a) is a scheme; b) is a separate calculation scheme; c) is a calculation scheme including flexibility of piles

At the preliminary stages of calculation it is used to consider that the top structure should be separated from the substructure at the set-off level (Рис. 3, a). Thus top structure is calculated individually under condition of fastened supports of a spatial structure.

Then the calculated reactions of the supports are transferred to a set-off of the foundation and the substructures are calculated. Such method is rather simple and it allows to define the key parameters of the future foundation in order to go to more difficult testing calculation further.