



Laboratory Investigation on Interaction of the Pile Foundation Strengthening System with the Rebuilt Solid Pile-Slab Foundation

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Abstract

The article presents the results of laboratory studies of pile model foundations in order to determine the effectiveness of the method proposed by the authors for its reconstruction in pile-tile foundation with preliminary pressing and cementation of the soil base. The studies were carried out on small-scale wooden models of foundations in the conditions of a soil paste. The models of foundations were subjected to vertical static loading in a laboratory tray with a diametrical transparent wall. The program of experiments was provided for determination of precipitation of the models: pile foundations without strengthening, with strengthening in the form of reconstruction from the combined foundation and with strengthening in the form of reconstruction into the combined foundation with preliminary stress of the soil base in the span part. Vertical and horizontal movements in the soil mass were also recorded by a contactless method (PIV) in every stage of model loading. On the basis of experimental measurements digital processing of data of sediments and displacements is performed, for drawing plots of sediments, epures and isolines of displacements in the soil base. The main result of the research is confirmation of the high efficiency of the proposed method of strengthening pile foundations due to the maximum use of pre-pressed soil base resources in spans between pile rows. It has been found that compression (pre-stress) significantly reduces soil deformability and allows to include it in operation without additional deformations. The use of pre-compaction reduced the precipitation of the model combined foundation by almost 40%, relative to the combined without compaction. The results of the research open the possibility to develop new methods of strengthening pile foundations from the point of view of effective inclusion in the operation of the soil base in the span part, due to its preliminary tension.

Keywords: Strengthening the Buildings; Soil Deformations; Soil Bed; Pile Foundation; Combined Pile-Slab Foundations (CPSF).

1. Introduction

Rational use of financial and material resources through renewal of residential buildings and urban development makes it possible to save the housing facilities and increase the usable floor area by reconstructing the facilities (40-70%). It is necessary to enumerate the main reasons which cause the need to strengthen the foundations and harden the foundation soils. The following classification is used in this research (Pronozin et al. 2019 [1], Utenov et al. 2017 [2], Khomyakov et al. 2017 [3]):

1.1. Reconstruction of Buildings

Reconstruction of buildings including major repairs, adding storeys, and increased foundation loading.

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