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Ткачук А. А.
Столяренко О. В.

REDISTRIBUTION OF EFFORT BETWEEN BRANCH ELEMENTS OF THE FUEL FOUNDATION DEPENDING ON THE NUMBER OF FUELS

Вінницький національний технічний університет

Анотація

У даній статті проводиться аналіз та порівняння отриманих результатів математичного моделювання пальового фундаменту з варіюванням кількості паль у групі, при сталій довжині паль і сталому кроці паль 3 d. Визначення ступеню реалізації несучої здатності паль і ростверку у складі пальового фундаменту для кущів з різною кількістю паль.

Ключові слова: забивні палі, ростверк, несуча здатність, перерозподіл зусиль, осідання, напружено-деформований стан.

Abstract

This article analyzes and compares the results of mathematical modeling of the pile foundation with the variation of the number of piles in the group, with a constant length of piles and a constant pitch of piles 3d. Determining the degree of realization of the bearing capacity of piles and grilles in the pile foundation for shrubs with different numbers of piles.

Keywords: driving piles, grid, bearing capacity, redistribution of forces, subsidence, stress-strain state.

Introduction

The bearing capacity of piles in a group can differ significantly from the bearing capacity of a single pile (spray effect). The spray effect can be both positive (bearing capacity of a group of piles is greater than the amount of bearing capacity of single piles) and negative (bearing capacity of a group of piles is less than the amount of bearing capacity of single piles). This effect depends on the distance between the piles, the length of the piles and the type of soil.

Normative documentation in force in Ukraine recommends taking into account the joint work of the grille and piles, but does not provide any provisions and methods for its calculation, so the bearing capacity of the pile foundation is defined as the sum of bearing capacity of piles.

This paper aims to investigate the stress-strain state of the bush pile foundation from driven piles by mathematical modeling of pile foundation systems - the basis with the help of Plaxis software package when varying the number of piles in the group.

Presentation of the main material of the study

The results of mathematical modeling of the pile foundation from driven piles with the help of the Plaxis 3D Foundation software package, which models the work of piles in the soil quite correctly, were used to solve the set tasks. Variants of pile bushes with different numbers in the group in two types of soils are considered.

For modeling, driving piles made of concrete C20 / 25 (B25), 9 m long, with a cross section of 0.3x0.3 m were used.

The dimensions of the simulated soil massif are taken in the plan 30x30 m and at a depth of 40 m to minimize the impact of boundary effects on the settlement of pile foundations with different number of piles in the group are shown in Figures 5 and 6.

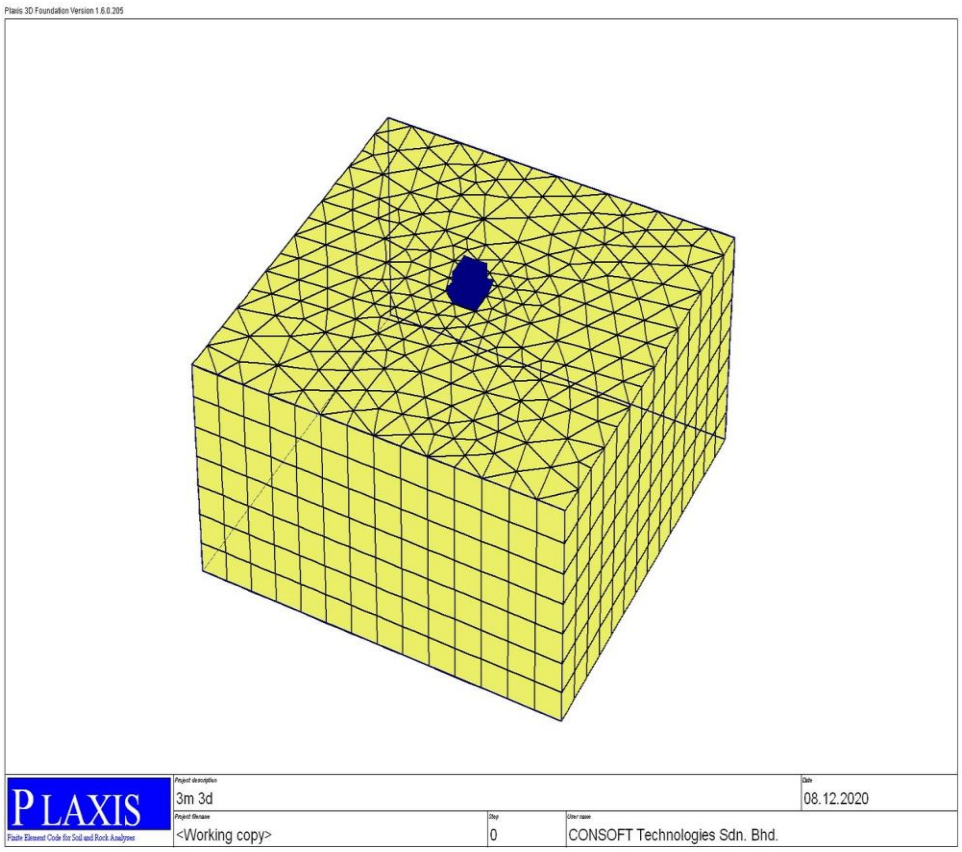


Fig. 5 - Calculated model of soil mass

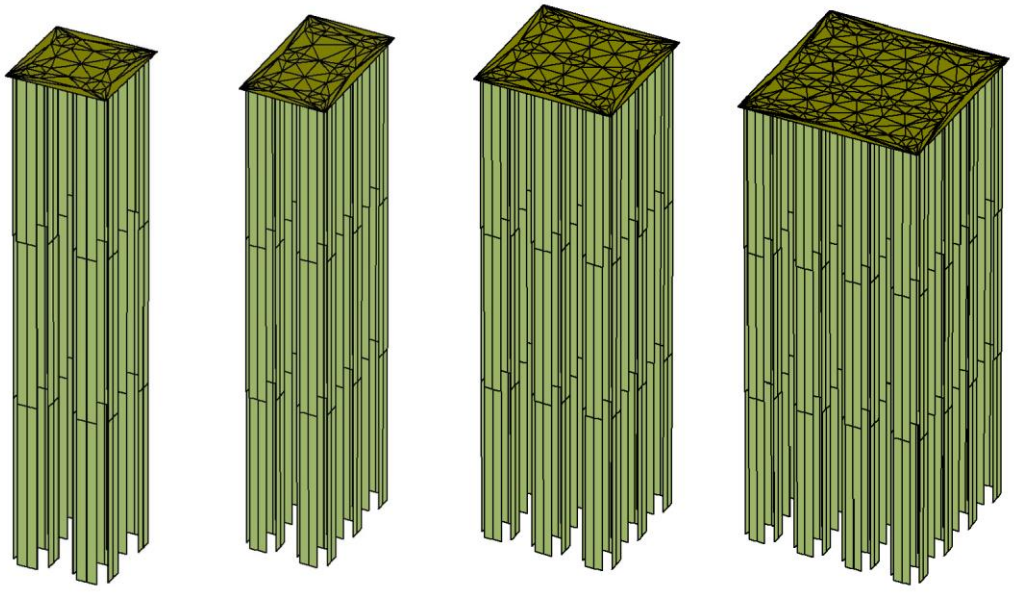


Fig. 6 - Estimated models of columnar pile foundation at 4, 6, 9 and 16 fields in the group

The following phases of work were taken into account when modeling the work of the pile foundation:
- work of the soil layer without foundations (initial phase);
- installation of a columnar pile foundation (first phase);
- operation of the columnar pile foundation under the action of vertical load (second phase).

The magnitude of the load on the model increased until the amount of subsidence was 10 cm.

At a constant step of piles 3d voltage is distributed along the entire length of the piles, including the work of the pile space, but this inclusion depends on the number of piles in the group. As you can see, with a small number of piles, the soil between the pile space is less involved in the work. The soil moves under the grille and in the area of the lower ends of the piles. As the number of piles increases, the intensity of soil movement in the interpile space increases and approaches the value of soil movements under the grille. Thus, with a large number of piles, the entire soil pile begins to move as a whole. Based on this, we can assume that the piles in the middle of the bush with a large number of piles can not fully realize their load-bearing capacity and the efficiency of piles in the group with increasing number of piles will decrease.

From the comparison of mosaics of vertical deformations for sandy and clay soils in fig. 7 and 8 indicate the same qualitative nature of the involvement of the interpile space in the work of the group. That is, the general pattern of reducing the implementation of the bearing capacity of piles with increasing their number in the group remains unchanged regardless of the type of soil.

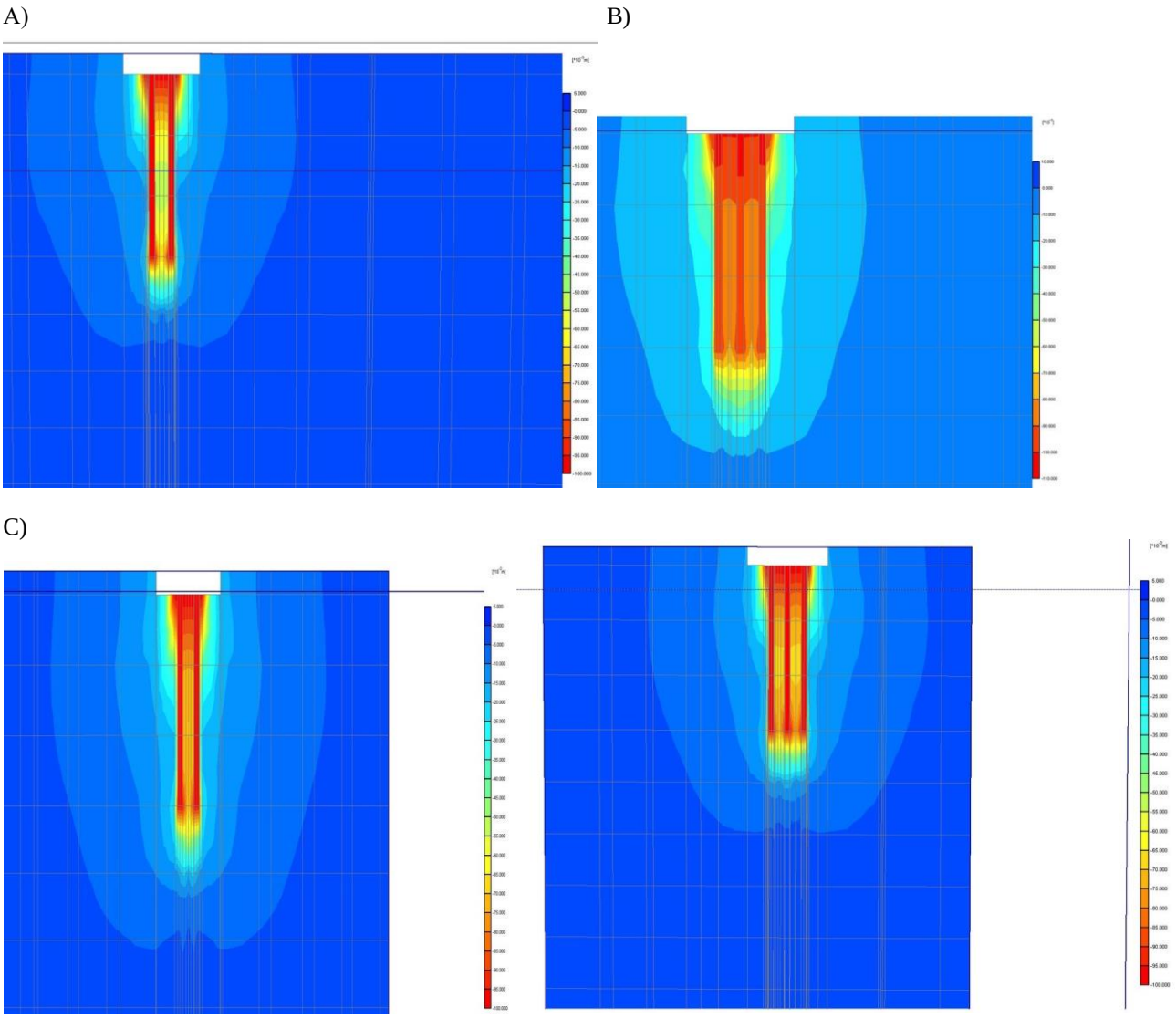
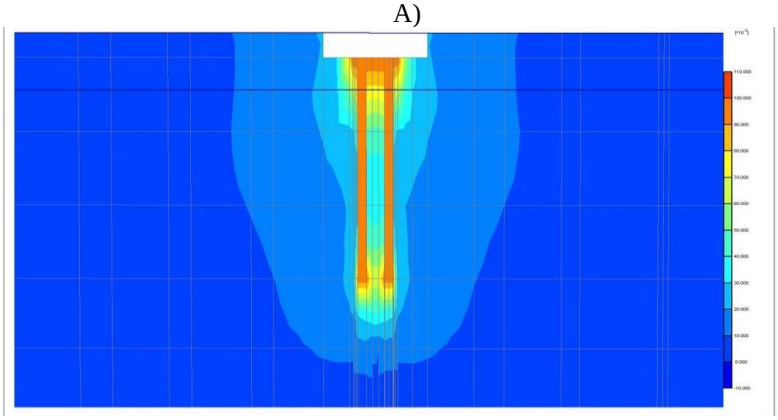
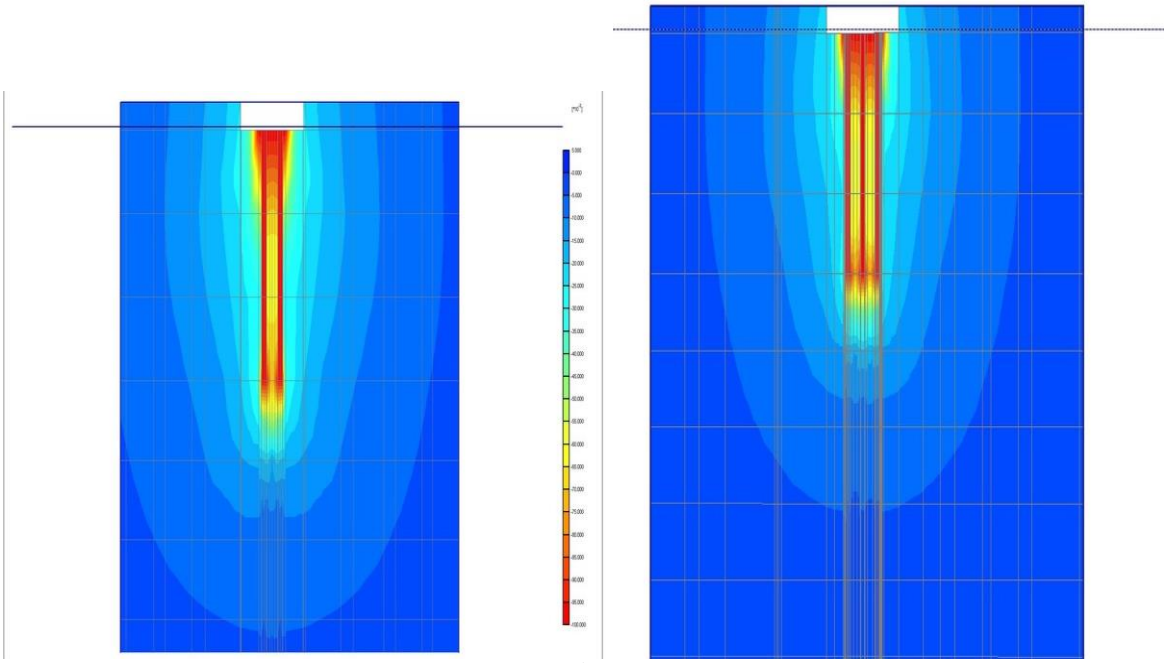


Fig. 7 - Mosaics of vertical deformations of the soil under the load of pile foundations with the number of piles: a) 4 pcs; b) 9 pieces; c) 6 pieces for sandy soil

A)



B)



C)

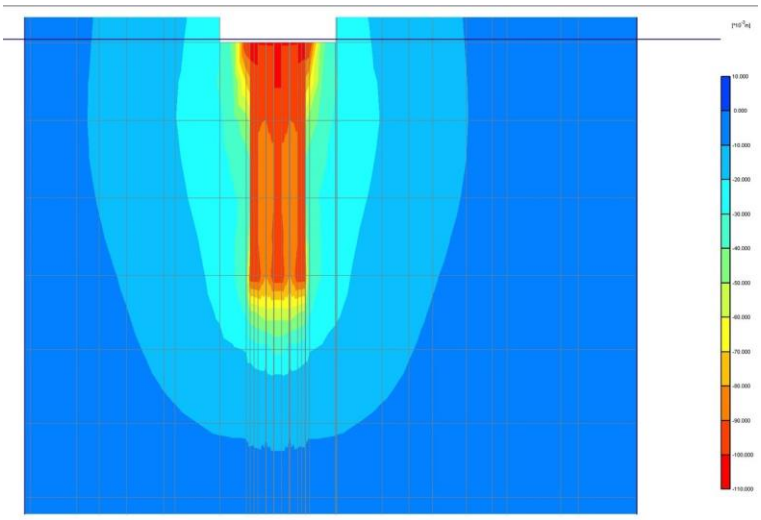


Fig. 8 - Mosaics of vertical deformations of the soil under the load of pile foundations with the number of piles: a) 4 pcs; b) 6 pieces; c) 9 pcs. for clay soil

In fig. 9 - 10 presents the results of graphs of sedimentation-load dependence, determined by mathematical modeling for experimental pile foundations.

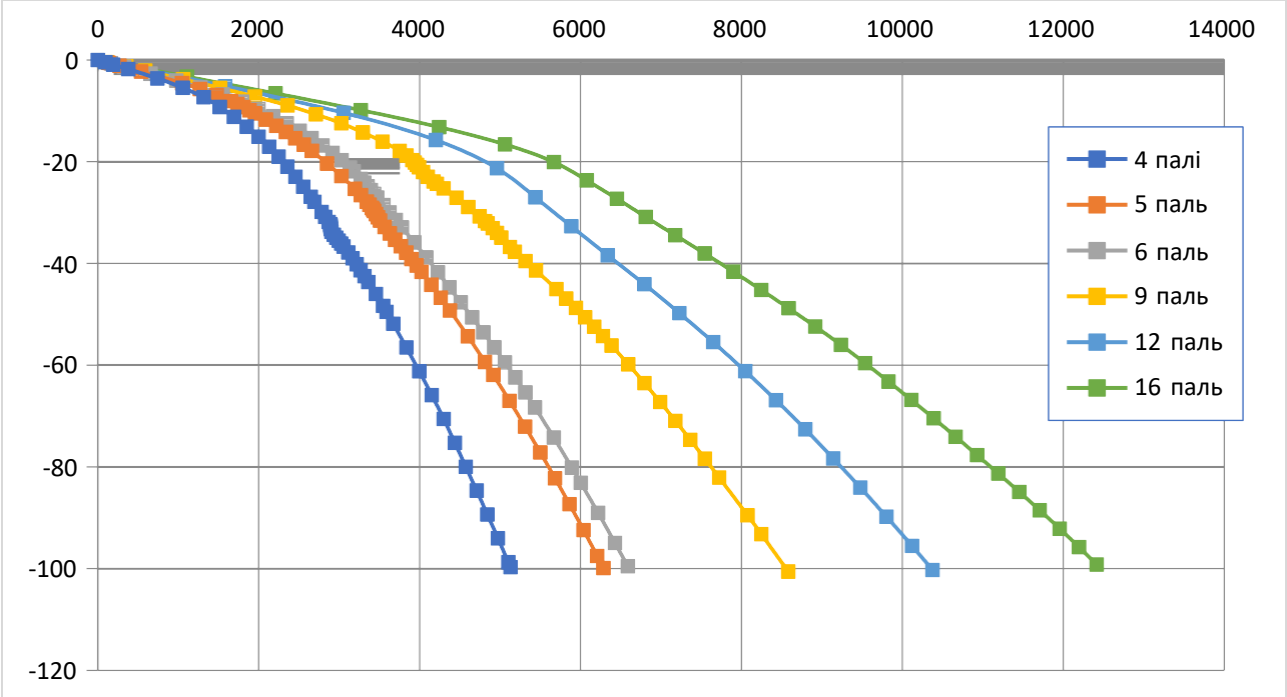


Fig. 9 - Graphs of load-subsidence dependence for pile foundations in sandy soil

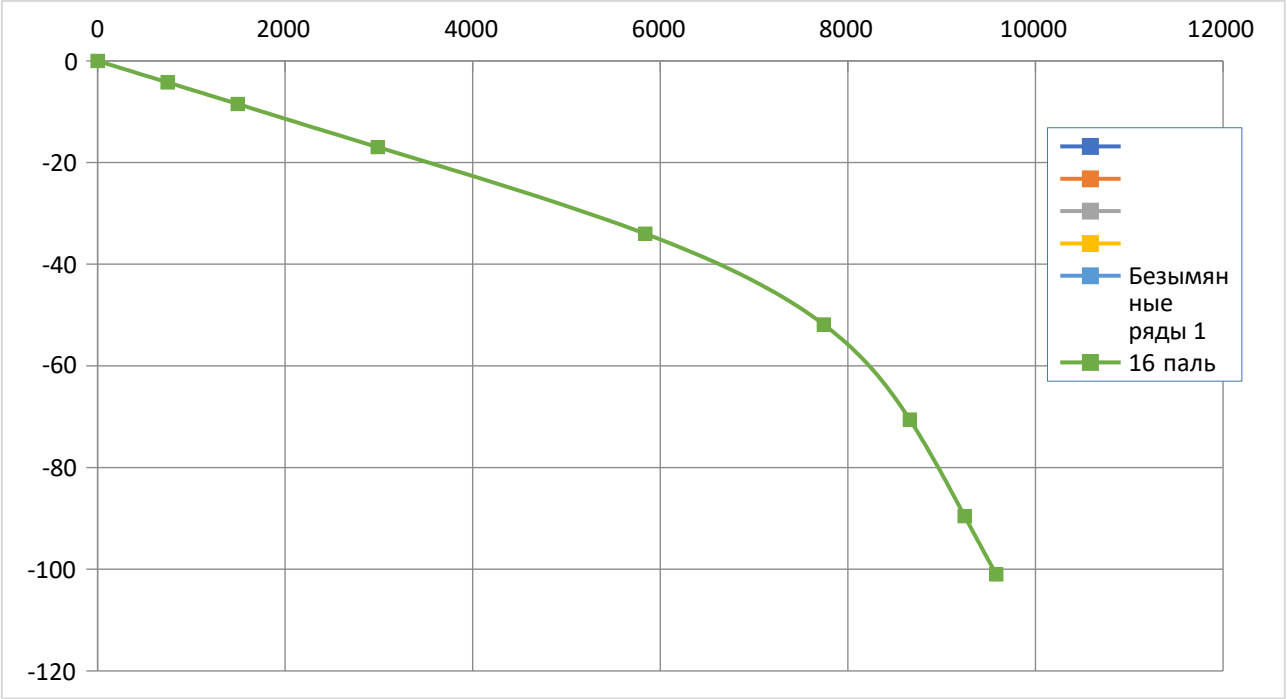


Fig. 10 - Graphs of load-subsidence dependence for pile foundations in clay soil

In fig. 11 shows the dependence of the bearing capacity of the bush on the number of piles in the group at different soils (for the bearing capacity is taken as the load during the subsidence of the bush 100 mm).

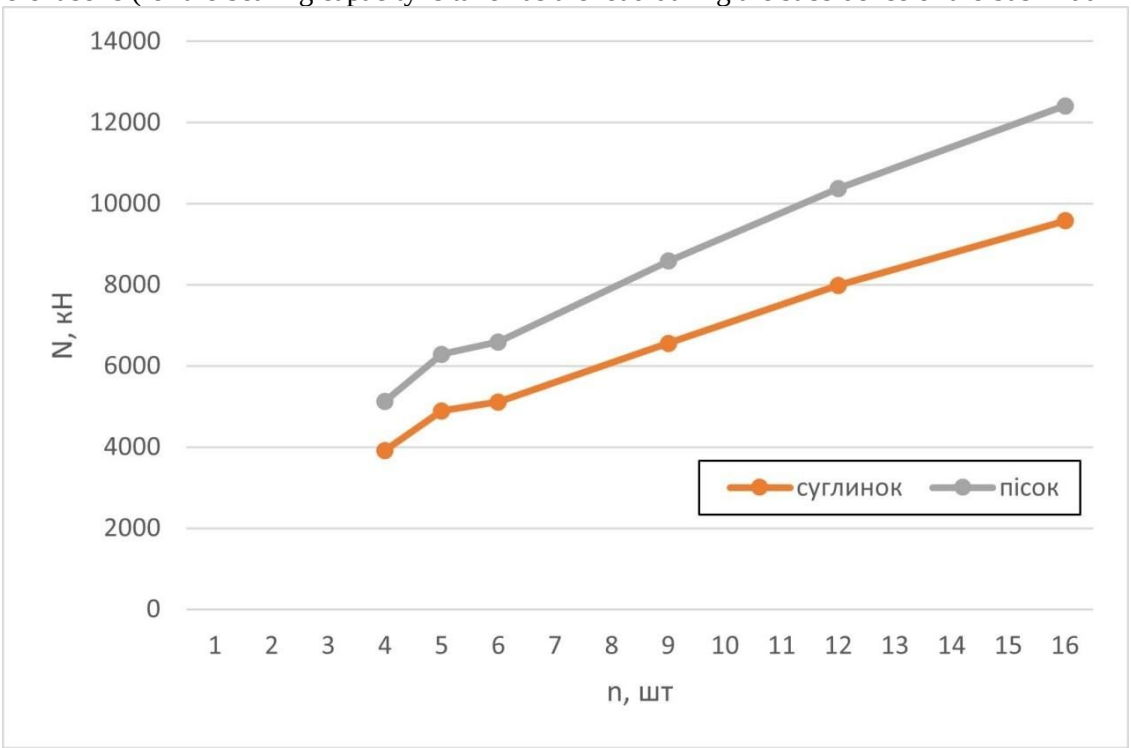


Fig. 11 - Graphs of the bearing capacity of the bush on the number of piles in the group at different soils

The figures show that an increase in the number of piles in the group leads to an increase in its bearing capacity, but this increase is not proportional to the increase in the number of piles. This once again confirms the

hypothesis of incomplete realization of friction on the side surface of piles in bushes with a large number of them.

Conclusions

Based on studies of the redistribution of forces between the elements of the pile groups with different numbers of driving piles, the following conclusions can be drawn:

- as the number of piles in the group increases, both piles and grilles perform worse.
- piles as a part of a bush are realized not completely at quantity of piles of 12-16 pieces.
- the share of grid work in the pile foundation increases with decreasing number of piles.
- the type of soil (sandy or clay) does not significantly affect the redistribution of forces between the elements of the pile group.
- The results of determining the bearing capacity of piles in the software package Plaxis 3D Foundation should be used in project practice to adjust the values determined theoretically by the recommendations of the norms.

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Tkachuk Alina Andreevna - student of group 1B-20b of the Faculty of Civil Engineering, Construction and Ecology of Vinnytsia National Technical University, Vinnytsia, e-mail: alinatkachukk@gmail.com

Столяренко Оксана Василівна кандидат педагогічних наук, доцент кафедри іноземних мов Вінницького національного технічного університету oksanny-81@ukr.net

Stoliarenko Oksana Vasylivna Candidate of Pedagogics, Associate Professor at the Department of Foreign Languages oksanny-81@ukr.net