CONTROL OF SANDY SOILS COMPACTION BY THE METHOD OF DYNAMIC PROBING DURING THE VERTICAL PLANNING OF BUILDING SITE

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ABSTRACT

Представлені результати контролю якості влаштування зворотної засипки методом динамічного зондування зондом, що дозволяє пристосовуватись до зміни міцності ґрунтів по глибині зондувальної свердловини і, тим самим, більш ефективно визначати в ґрунтовому масиві шари, що мають різні фізико-механічні властивості.

The article deals with the results of the quality control of the reverse covering by the dynamic testing method with a sonde, which allows to adjust to the ground durability changes according to the depth hole and to effectively determine the layers with different physico-mathematical properties.

KEY WORDS

dynamic penetration, backfilling, sand moisture

The construction site for building № 109 МРК- 3 of the residential district "Obolon" in Kyiv is located on the flood plain of Dnieper right bank. The area is composed of hydraulic alluvial sands. The hydraulic fill thickness on the site is about 5 м.

In the course of construction, there was a necessity to transfer the sewer, and for this reason it was dug up and drawn from the trench excavated for the full thickness of the filled-up ground. After the sewer removal, the trench was filled up with the same sand and layer-by-layer compacted. Then it was necessary to check the quality of sand compaction in the place of digging up.

The compaction of backfilled sand was monitored by means of a manual probe manufactured in SE DerzhdorNDI [1] for a depth from 4,3 m up to 4,7 m until the probe cone entrance into a layer of muddy tight saturated fine-grained dark-grey sand of natural occurrence. Totally six trial boreholes of 27.0-m common length were drilled.

In the process of work the samples of soil were taken to determine its physical and mechanical characteristics and to carry out its compaction in compliance with GOST 22733-77 [2]. The results of such compaction are shown in Fig. 1 presenting the nomogram of the correspondence between the porosity coefficients of fine grained slightly wet and wet sands and the value $P_{д}$ of conditional dynamic resistance to cone penetration

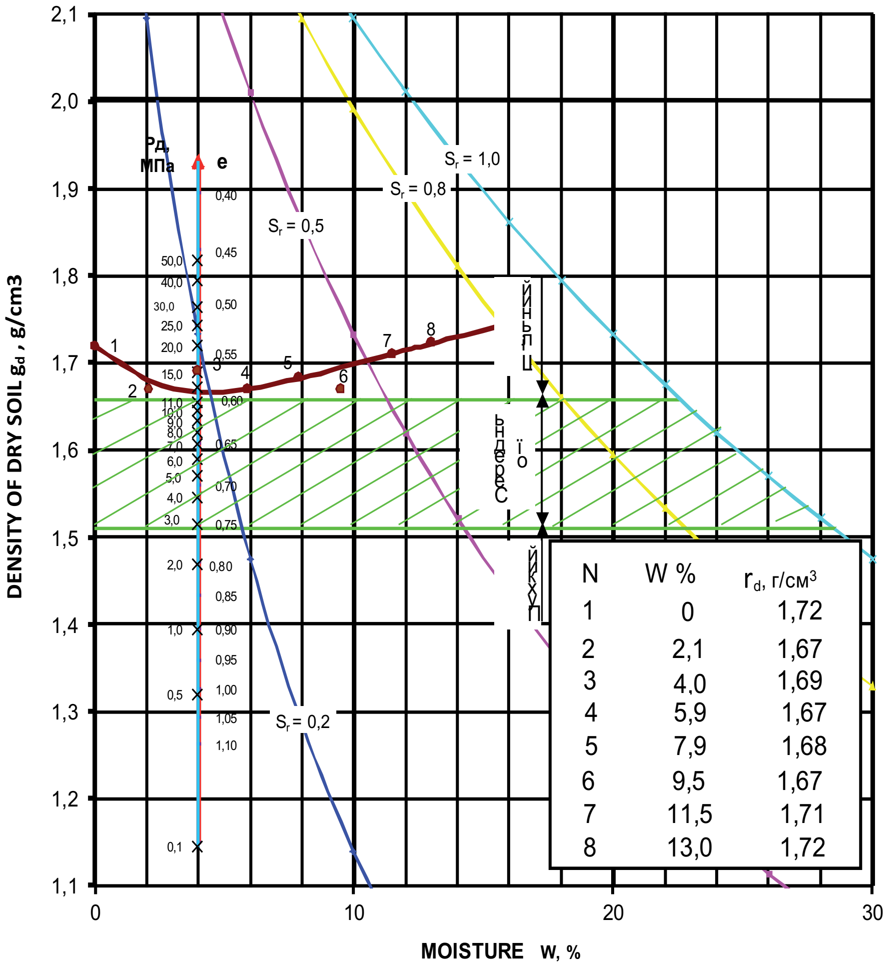

Fig.1. Nomogram for the determination of the compaction of fine grained low wet and wet sand and characteristics of standard compaction in compliance with GOST 22733-77.

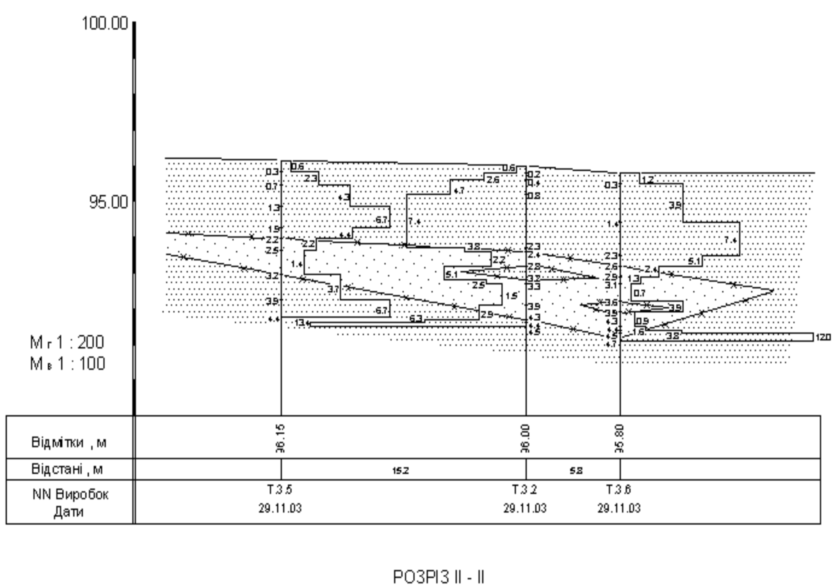

Fig.2. Determining the layers of various compaction.

expressed in MPa, which allows to perform on the sections the additional visual analysis of the backfill compaction quality along its entire depth.

The sand moisture at the time of surveying is $W_{пр}$=4,35%. The results of a standard compaction show that the more wet such sand is, the better its compaction goes. On the other hand, it is well compacting in an absolutely dry state as well, but this is practically impossible for the conditions of production. At the same time a minor difference between maximum and minimum values of ρ_d indicates that the moisture value is not very principled here. The only thing that matters is that the compaction will be carried out in general. The analysis of the sand grain-size distribution shows that it is uniformly graded (C_v=1,88) and fine grained sand, which approaches to the medium-grained sand by its composition. The continuous diagrams of the soil penetration resistance were constructed based on the dynamic sounding data after their statistical processing. Some of the diagrams are shown in Fig. 2.

Key:

Розріз II – II – Section II - II

Відмітки, м – Elevations, m

Відстані, м – Distances, m

NN Виробок – Excavation numbering

Дати - Dates

The variation coefficient for the individual values of Рд parameter in intervals sorted out along the trial boreholes depths does not exceed 25%.

The special feature of used equipment is the possibility of its adaptation to soil state variations along the trial borehole depth by means of changing the hammer drop height. So, for passing the hard, well-compacted soil layers (for instance, sands) the hammer should be dropped from the bigger height, and when entering into poor-bearing soil layers the height of dropping should be lowered. Those heights shall be strictly fixed. For the used equipment there are four fixed heights of dropping.

The method of processing the data obtained during cone penetration tests differs somewhat from the recommendations of GOST 19912-81 [3] as well. Thus, after the reduction of soils penetration resistance values to the common scale for various heights of hammer drop the so called dot curve is constructed. The penetration resistance is indicated on the curve for every 10 cm of the borehole depth, which makes the determination of soil layers differing by their strength more efficient. Based on the determined layers, the average values of their penetration resistance and coefficients of such values variations are calculated. Based on the average values of $P_д$ MPa in layers, the generalized continuous diagrams of the soils penetration resistance (shown in Fig.2) are constructed for the boreholes. The long-term experience of the use of described above equipment and method at various road construction projects proves their high efficiency in solving numerous tasks regarding soils compaction quality and assessment of banks and natural slopes stability.

As the analysis of constructed sections shows, the compaction of the backfilled upper part is good enough for the depth of 2.5...3.0 m. In compliance with Fig.1, sand in this layer has an average density from ρ_d=1,52 g/cm^3 up to 1,62 g/cm^3. An exception to this is the upper part of this layer not only because of the impossibility to apply the dynamic probing data to the depth up to 0.3 m, but as a result of the breakage of a road roller, which compacted sand. Therefore the compaction process was not completed at the time of inspection, but this can be easily corrected. The backfill bottom part is compacted significantly worse. There the layer of the thickness from 0,7m up to 2,0m, in which sand is in a soft state and the density of dry soil can be not only less than 1,52 g/cm^3, but also less than 1,40 g/cm^3, remains.

The zone of soft sand is marked out on the section in Fig.2.

So, based on the carried out survey the conclusion is drawn that the backfill lower part is not compacted very well, which in the process of continuous flight auger piles installation can lead to a significant waste of cement-concrete mix.

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