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DESIGN OF MIXTURE FINE GRAIN CONCRETE

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Abstract:

The actual connection of the application of fine-grained concrete to the production of bored piles with the urban program for the renovation of the central districts of the city is given, information is provided on the methodology for designing a fine-grained concrete composition for the construction of bored piles; describes the problem of manufacturing fine-grained concrete directly on the construction site and a proposal for its solution; the substantiation of application of fine-grained concrete mixes is given; it is indicated the possibility of achieving a better composite with careful control of the creation of its matrix at all levels, the factors affecting each level of hardening of the concrete mixture and the characteristics of the composite are listed.

Keywords: Fine-grained concrete, application, composition, characteristics, mixing of concrete.

Improvement of structural properties of soils for the bases of buildings of the old buildings, urban roads, transport tunnels, subway lines and stations, collectors, etc. in a megalopolis like St. Petersburg is a long overdue and extremely important problem as to increase the longevity and reliability of structures, exclude deformations and failure of buildings under technological impacts of the development of underground urban infrastructure, and to withdraw historical buildings and architectural monuments of the central part of the city from the avg.

However, until now, the use of fine-grained concrete prepared directly at the construction site for bored piles in weak water-saturated dusty-clay soils has been insufficiently studied and carried out largely intuitively, due to which the use of this technology has been limited.

To justify the use of fine-grained concrete mixtures it is necessary:

- use the data of the available engineering and geological surveys at the construction site;
- use design solutions for the application of fine-grained concrete mixtures at the construction site.

Improvement of the method of selecting the composition and preparation of fine-grained concrete at the construction site will improve the quality of bored piles and the efficiency of their use to solve various complex geotechnical problems.

Concrete mixtures are prepared using cements, aggregates, additives and water, the requirements for which are given in GOST 26633-2015 "Concretes of heavy and fine-grained", as well as in standards and specifications (TS) for the materials of specific types [1].

Fine-grained concrete is a material that has a number of features and its properties differ significantly from conventional concrete made with the use of coarse aggregate. Because of this, in some cases, its use is more appropriate.

The use of fine-grained concrete for bored piles has a number of advantages over conventional concrete.

However, it should be taken into account that fine-grained concrete is very demanding on the quality of components and observance of proportions.

The method of designing the composition of fine-grained concrete has a number of features in comparison with existing ones [5]:

- when assigning the required cement-water ratio (C / V), the type of concrete mixture by its workability is taken into account, which determines the way of forming products and structures;
- uses the physical concept of forming a dense structure of concrete mix (cement batter fills the voids between the grains of aggregate and creates on its grains, D/V, features aggregate and takes into account the degree of compaction of concrete mix)
- takes into account not only the coarseness, but also the shape of aggregate grains through the value of its specific surface.

Numerous experimental data show that the compressive strength of fine-grained concrete, in addition to C/H, cement activity and aggregate quality,

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is affected by many other factors, such as the workability of the mixture, curing conditions of concrete, the presence and amount of active mineral additives, etc. [5]. Along with this, a significant influence on the properties of fine-grained concrete also has a method of compaction of the mixture.

It is known that the improved structure ensures durability, i.e., resistance to all influences with sufficient care of the building elements during the stipulated service life. A distinctive feature of concrete is a pronounced heterogeneous structure with the size of individual components differing by 104 or more times. It is implied that each structure of the lower (microscopic) level is a component of a structure of a higher scale (macroscopic) level, allocating into a separate intermediate binding level "interface surface".

By controlling the creation of the matrix at all levels, it is possible to achieve a higher quality composite with the same materials, production technologies and curing conditions. Accordingly, it is possible to distinguish the factors influencing each level in particular and the characteristics of the composite as a whole.

1. Water-cement ratio. The structure of the cement stone establishes the phase composition of the new formations, the characteristics of the pore and capillary system and reveals the relationship between these structural components. Clinker materials interact differently with water.
2. Amount of plasticizing additive. Nanomodifying additive is an aqueous solution of modified polycarboxylate esters. Due to the double dispersing effect, the introduction of a superplasticizer can reduce water absorption, improve workability and increase the persistence of concrete mix, and thus increase the compressive strength and frost resistance. The absence of chlorides in the additive eliminates efflorescence on structures. With increasing the amount of plasticizer at the same flow rate of water, increases the flow of concrete mixture, but at a certain point the setting time of the concrete mixture increases.
3. Order of introduction of components into the mixture. Fillers in concrete require a large amount of water. By introducing water with plasticizer into the dry mixture (cement + filler), finely ground fillers precipitate droplets of water necessary to lubricate the aggregate and larger cement particles and obtain the desired workability.
4. Portland cement grade. For high-strength concrete, Portland cement and Portland cement with high-strength mineral additives are recommended. Using, for example, grade 400 and improving the properties of the composite by various factors at a certain point, the strength class of concrete will not be able to exceed the n-th value, as the cement is not highly active.
5. The content of tricalcium aluminate C3A in Portland cement. In traditional heavy concretes is normalized to 8% according to GOST, because, operating in this range, reduces the rate of reaction and limits the formation of loose structure of low strength. However, when using carbonate aggregates (limestone, calcite, dolomite), the strength of the cement stone is many times higher than with quartz, granite and other silicate minerals and rocks. Hydroaluminates in the contact zone fuse with the surface of the aggregate and a very strong reliable bond is formed. The same processes occur in the pores and capillaries.

In order to determine the rational formulations and working doses should be carried out on a pilot site or pilot piles.

CONCLUSIONS.

The use of technical mineral raw materials by the mining industry can solve a number of important problems of the mineral resource complex of the country and improve the environmental situation.

The attractiveness of technical raw materials is due to the fact that they are located in industrially developed areas, they are located in peripheral conditions, the crude rock mass is largely de-isolated, which dramatically reduces the cost of development.

The creation of new decorative materials gives impetus to the development of various architectural solutions and interior design, design and decorative and fine arts.

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