Impact Factor: 9.9 ISSN-L: 2544-980X

FACTORS AFFECTING THE COMPOSITION AND PROPERTIES OF LIGHTWEIGHT CONCRETE

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Abstract. *The article presents information on the factors influencing the composition and properties of lightweight concrete with porous filler.*

Keywords: *: porous fillers, lightweight concrete, reinforced concrete, expanded clay, strength, mesostructure, density.*

It is known that the most important technological factors affecting the formation of the microstructure of cement stone, which determine its physical and mechanical properties, are the chemical and mineralogical composition, the fineness of the particles, the water-cement ratio, and the setting conditions. For the cement-sand mesostructure, in addition to the listed factors that determine the microstructure of cement stone, important controlled factors include the composition of the mixture, the granulometric and mineralogical composition of the sand, the shape of the grains, the structure of the surface of the particles and their properties [1].

Depending on the composition of fillers in concrete, their structures are divided into three types. The first type of fillers does not have partitions, that is, the amount of mixture in the composition exceeds the volume of spaces between the fillers. I.M. Frenkel called such a structure a "fluid" filler structure. This situation is characterized by the fact that the properties of fillers have little effect on the properties of lightweight concrete, and the properties of concrete are determined according to the properties of the mixture.

With an increase in the concentration of fillers, the thickness of the layers of the cement-sand mixture decreases until the particles begin to bind and form a very dense structure, which significantly affects the properties and, first of all, the strength of concrete. This type of structure was considered to be the second type of densely packed structure of particles.

In the third type of structure, a structure with large voids is formed due to the fact that the spaces between the fillers are not completely filled with sand-cement mixture. Theoretical ideas about different types of structures allow to design the concrete composition and obtain concrete with the desired properties using the relationships specific to each case [2,3].

Structural theory is generally calculated for heavy and light concretes, that is, for concretes consisting of dense and porous fillers, as well as determining the water-cement ratio. At the same time, it seems that it is not enough to take into account the characteristics of the above argument in order to

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control the properties of the concrete mixture and concrete, as well as to optimize its composition. The volume concentration φ of large fillers and the share of small fillers in the total volume p are also important characteristics [2]. Both of these properties have a very close relationship that significantly affects the technological and physical-mechanical properties of concrete. This is confirmed by the above thoughts about three types of concrete macrostructures, classified according to the composition of large aggregates.

The main properties of lightweight concrete (density, strength, deformability, durability, strength and durability) depend on many factors, in particular: the brand and amount of binders, granularity, strength and density of fillers, degree of compaction of the concrete mixture, its hardening conditions, different addition of additives and other factors [5, 6, 7,].

Keramzite filler construction is effective when using highly activated Portland cement (class 500-600) and light filler with a strength of 5.5-6 MPa, and as a result of experiments, a technology for obtaining concretes of B20-B30 class with an average density of 1800kg/m3 was developed. [8]. However, portland cement consumption reached 480-500 kg/m3.

Increasing the grade and amount of cement in the process of designing the concrete composition does not give much opportunity to improve its strength. It was found that by adding light aggregates of the same strength and type, concrete with a certain limit strength can be obtained [6].

Research shows that the strength of concrete depends on the strength of lightweight aggregates added to it.

The issue of the granularity of aggregates in lightweight concrete has always been one of the most difficult issues in concrete technology. Most of the research in this field is aimed at obtaining the most economical mixture with the fewest voids.

It was determined that all sizes of lightweight aggregates (small, large and medium) should be added to concrete in certain proportions.

Experiments show that concrete strength is affected by factors such as types of concrete components, technological processes of mixture preparation, and hardening conditions.

One of the main properties of concrete depends on the value of cement mixture with fillers. Many scientists have studied this property of mixtures and fillers. It was found out from these researches that the connection of the mixture and filler grains and the strength of this connection area are important in the formation of the concrete structure and affect the strength and deformation properties of concrete.

O. Ya. Berg [9] and other researchers believed that the weak points of some types of concrete are not the connection of sand grains with cement stone, but primarily the connection of large aggregates with cement. Since the bond is much higher than the viscosity for most cements, increasing the viscosity of the cement stone with aggregates is one way to increase the strength of any type of concrete.

J.Farran [11] stated that mechanical bonding between cement stone and aggregates due to unevenness of surfaces, ionic bonding due to the expansion of crystal lattices of aggregate and cement stone, and the presence of a liquid phase between cement stone and aggregates divided into types such as capillary coupling.

The bond strength between cement stone and various fillers is at a high limit, and the tensile strength of cement stone is considered one of the main factors determining the strength and deformation properties of concrete.

According to the researches of Hasanov B. and others, the strength of lightweight concrete using concrete preparation technologies such as pouring and densifying the concrete mixture, adding crushed mineral and chemical additives and superplasticizers, and the correct selection of steam heat treatment modes and it was found that it is possible to increase the deformation properties.

Another way to increase the strength of concrete is to prepare a thick concrete mixture, which can be achieved by reducing water and binders to a certain limit in accordance with the rules for preparing the mixture. The density of lightweight concrete is also significant. It was found that the strength is reduced by 20% without full compaction up to 5%, and by two times when undercompacted up to 10%.

According to the results of the study of the deformation of the pore fillers surrounded by cement stone, the hypothesis of their effect on increasing the initial compression and elasticity of concrete was put forward. It was determined that the initial compression of concrete is based on the penetration of the mixture [1,2,4].

The effect of initial compaction can be negated by the formation of small penetration cracks in the cement stone. A.A. Kudryashev [10] determined that the penetration of expanded clay concrete under normal hardening conditions is about 2-2.5 times more than ordinary heavy concrete.

Based on the above research, it can be noted that the specific properties of pore fillers affecting the physical-mechanical, deformation and strength properties of lightweight concrete are: strength, porosity structure, surface condition, graininess, etc. The structure and properties of lightweight concrete are significantly influenced by the properties of large fillers and mixture components, their interrelationship and influence.

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