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LIGHTWEIGHT CONCRETES BASED ON POROUS AGGREGATES

Abdurahimov Abdukarim Abduhalimzoda
Teacher of Termiz State University
abduraximovabdukarim1996@gmail.com

ABSTRACT	KEYWORDS
Structural elements used in construction are required to serve for a long time, without losing their strength, integrity and serviceability under the influence of external forces without risk. The article envisages improving the properties of lightweight and fine-grained concrete and expanding its use in construction work.	light, porous, filler, strong, artificial, expanded clay, agloparite, composition.

LITERATURE REVIEW

World scientists have conducted many studies on these matters:
World scientists I.N. Akhverdova, A.A. Arelyana, G.A. Bujevica, A.I. Vaganova, G.I. Gorchakova, Yu.P. Gorlova, V.G. Dovjika, I.A. Ivanova, S.M. Iskovicha, I.A. Korneva, Yu.E. Kornilovicha, A.A. Kudryavseva, Yu.D. Nasievskovo, N.A. Popova, I.E. Putlyaeva, B.G. Skramtaeva, M. Z. Simona, N. Ya. Spivaka, Ya. Sh. Shteyna, M. P. Elinzona, A. Shorta, J. P. Valsa conducted scientific work.
Physico-mechanical properties of artificial pore fillers and lightweight concrete were also studied by scientists of our country: L.M. Botvina, B.A. Askarov, K.A. Akramov, U.A. Gaziev, N.A. Samigov, E.U. Kosimov, A.A. Tolaganov, S.A. Khodjaev, M.K. Tokhirov, Kh.K. Kamilov, T.T. Shakirov and others are conducting scientific and practical work and developing innovative technologies.

In the production of lightweight concrete, various pore fillers are used, including artificial ones - expanded clay, agloporite, perlite, slag pumice, etc., and natural ones - tuff, pumice, etc. lightweight concrete is mainly used to reduce the weight of walls and load-bearing structures. Therefore, the density of these concretes is particularly important. Depending on the density of concrete, ultra-light is divided into concrete with a density of 500-1800 kg/m3 and less than 500 kg/m3.

The strength of lightweight concrete can be from 2.5 to 30 MPa and higher. Light concretes are mainly divided into structural heat-retaining concretes with a density of 500-1400 kg/m3 and structural concretes with a density of 1400-1800 kg/m3.

Concretes are divided into compacted and ordinary types according to their elongation. They include ordinary concrete, in which the pores between the large aggregates of the cement mixture are filled with light or heavy sand, porous lightweight concrete, in which the pores of the cement mixture are filled with foam or other admixtures that generate gas, and lightweight concrete with large pores, without sand, the spaces between the grains are preserved. In construction, it is mainly used in lightweight concrete and fine-grained lightweight concrete with the size of large pore fillers of 20-40 mm[1].

Research method. The strength of lightweight concrete depends on the cement-water ratio in the concrete, because it mainly determines the strength of the cement stone. But porous aggregates have less strength compared to cement mixture due to their structural characteristics. The inclusion of pore fillers in lightweight concrete reduces concrete strength depending on their quantity and density.

The dependence of cement-water ratio on the strength of lightweight concrete can be seen in Figure1.

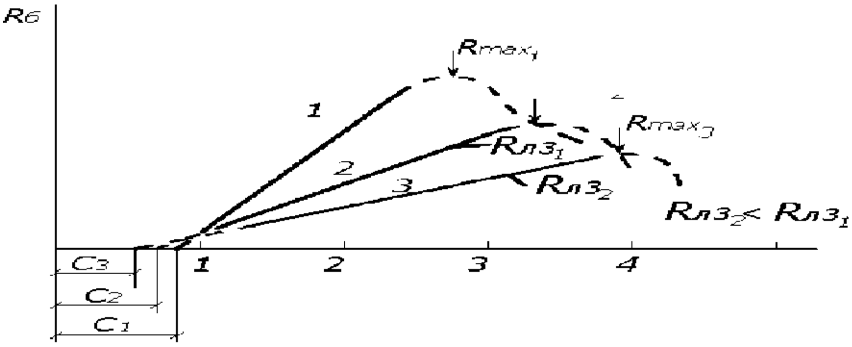

Figure 1.

Dependence of strength of ordinary (1) and light (2, 3) concretes with porous filler on water-cement ratio.

One of the main characteristics of lightweight concrete with porous fillers is that each large filler allows obtaining concretes with a certain strength. Concrete that has reached this strength does not cause a significant increase in strength even when the strength of the mixture is increased later (Fig. 1). R^f (Rp) dependence has two zones. In the first zone, an increase in the strength of the mixture leads to an increase in the strength of concrete, and here the effect of the cement-water ratio is manifested. Increasing the strength of the mixture in the second zone does not lead to an increase in the strength of concrete. This is due to the weakness of the filler and the brittleness of the cement thin frame.

Further increasing the strength of the mixture will not be appropriate from an economic point of view. In order to obtain light concrete of different grades, the strength of the filler should be selected in such a way that the consumption of cement is used effectively, that is, it is suitable for the concrete of the first zone. It is possible to prepare concretes suitable for the density of the second zone only when there is a demand according to the specific characteristics of concrete.

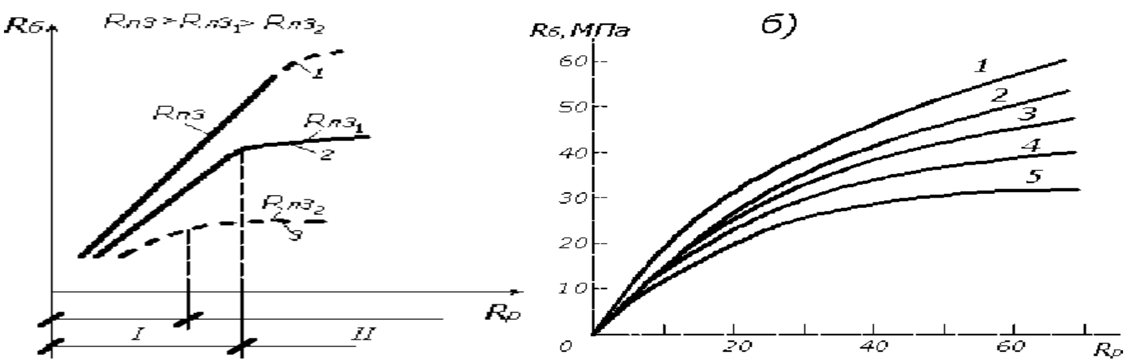

Figure 2. Effect of gravel and mixture strength with expanded clay on the strength of expanded clay concrete.

The strength of lightweight concrete is mainly affected by the content of large porous fillers or their concentration, and the amount of fillers in concrete, their strength, and the ratio of cement mixture to strength. In the case of a cement mixture, which usually has a relatively high strength, an increase in the amount of filler will reduce the strength of the concrete. The maximum strength of concrete depends on the optimal amount of filler when the cement mixture and concrete strength are the same. Figure 2. The effect of the amount of light filler on the concrete strength f (R*K- expanded clay strength in the cylinder) [2].

When determining the composition of lightweight concrete with porous filler, attention is paid to all three characteristics of the effect of the filler on strength. Therefore, the calculations are performed not with a specific formula or graph, but based on a series of table values and clarifying coefficients that take into account these characteristics.

Porous fillers also affect the deformation properties of lightweight concrete. As the deformability and amount of filler increases, the modulus of viscosity of concrete decreases.

Another of the main properties of lightweight concrete is their thermal conductivity, which, in turn, affects the resistance of barrier structures determines the thickness. As the density of concrete increases, the thermal conductivity of concrete increases (Fig. 2.1). An increase in the amount of light fillers in the composition, a decrease in density leads to a decrease in the thermal conductivity of concrete, in particular, the thermal-physical properties are improved. is considered one of the qualities. Lightweight aggregates have a significant water demand, they draw a certain amount of water from the cement mixture when they are included in the concrete mix. This process continues more intensively during the first 10-15 minutes when the concrete mixture is being prepared. Here, the amount of water absorbed depends on the composition of the concrete mixture: in fluid and mobile concrete, the water-cement ratio is important, and this amount increases, and on the contrary, the amount decreases in thick concrete mixtures, where the water-cement ratio is less important.

Water consumption is increased in order to alternate the effect of water demand of pore fillers and to maintain the mobility of the concrete mixture. The degree of increase in the water demand of the concrete mixture depends on the amount of light fillers and their water demand: the more the amount of filler and the water demand, the more water consumption will be required to obtain a suitable, dynamic concrete mix. The water-requiring property of the pore filler has a significant effect on the water-retaining property of the concrete mixture, prevents stratification of cast and ready-mixed concrete, and also creates a basis for the use of mixtures with a high water-cement ratio. These properties are of great importance in the production of structural-heat-insulating lightweight concrete. Porous fillers have more water exchange properties with cement paste than other dense fillers, so they affect the processes of its composition. At the first stage, the pore fillers absorb moisture and form a strong and tight bond in the layer between the cement stone and the fillers. In the second stage, due to the reduction of water, the porous aggregates begin to return the absorbed moisture, and the necessary conditions for hydration are created in the cement stone. Due to the extreme unevenness of the surfaces of light aggregates, they adhere well to cement stone, and due to the deformability of the aggregate, negative conditions affecting the composition of cement, such as the settling of cement stone and the appearance of microcracks, are reduced.

As a result, the cement stone in the lightweight concretes filling the pores will have the required density and homogeneity, and with this feature, it will be possible to use them in reinforced concrete structures and in some aggressive environments.

Due to the fact that the surface of porous gravel and sand has an irregular shape, the intergranular spaces in the mixture increase. In order to fill these voids and insert cement paste between the grains, in order to obtain non-layering and easy-to-work concrete mixtures, 1.5-2 times more cement paste is used compared to ordinary concrete [3].
Fillers with a lot of pores are treated with hydrophobizers or other substances that create a thin film on the surface of the particles, a thin inner layer, in order to reduce the water demand of the concrete mixture and reduce the consumption of cement, as well as to improve other quality levels of the concrete obtained on the basis of the porous fillers. However, since such measures increase the cost of concrete, they must be carried out on the basis of technical and economic calculations. In order to lighten the structure of buildings, it is to improve the composition of lightweight and heat-insulating concrete using lightweight fillers.

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