EUROPEAN JOURNAL OF LIFE SAFETY AND STABILITY (EJLSS)
ISSN 2660-9630
www.ejlss.indexedresearch.org Volume 13, 2022 ||

Study of the Properties of Liquid Light Concrete with Disperse Reinforced with Glass Fiber

Kuldashev Kh.
assistant professor, Samarkand State architectural-civil engineering institute

Abstract: *The article describes the experiments and results obtained on the dispersed reinforcement of fine-grained lightweight concrete with fiberglass, as well as the areas of application of such concretes.*

Keywords: *Glass fiber, dispersed reinforcement, lightweight concrete, mixing, compaction, strength, bending, compression, elongation, penetration, contact, layer, binder, fiber, cement, expanded clay, stress, filler, adhesion.*

Date of Submission: 04-12-2021 ***Date of Acceptance: 11-01-2022***

Introduction:

It is known that in order to obtain lightweight concrete that meets the requirements, targeted formation of the concrete structure will be required. Because the structure of concrete characterizes its properties. That is, the strength and other characteristics of the concrete will depend on the characteristics of the contact layers. The formation of contact layers begins when the concrete mix thickens.

At present, it is possible to increase the compressive strength of lightweight concrete to 55-60 MPa by increasing the activity of binders, reducing the water-cement ratio, the introduction of various plasticizers and the application of modern technologies of compaction of concrete mixes. However, the characteristics of concrete, such as bending-tensile strength, cracking, remain one of the unsolved problems. If the difference between the compressive and tensile strengths of concrete is reduced to a relative 15-20%, then metal consumption can also be significantly reduced [1].

Materials:

Disperse fibrous materials (fiber) are added to increase the properties of concrete, such as brittleness, tensile strength, abrasion resistance. Glass fiber is one of the dispersed fibrous fibers used for micro-reinforcement of concrete and cement stone matrix, which radically differs from the composition and properties of the concrete matrix, changing the strength and other parameters of the structure.

The fiberglass embedded in the concrete acts as a true micro-reinforcement for the cement matrix, as in conventional reinforcement, and interconnects the components of the micromatrix to form an integral skeleton. That is, the elongation generated in the structure absorbs the stresses and prevents the concrete matrix from cracking. Because the contact zone between the cement stone and the aggregates is a weak element of the concrete structure.

The high heat resistance and resistance to alkali of fiberglass, very high tensile strength (even higher than the strongest steel reinforcement) expands its field of application. The fact that fiberglass has good adhesion (mutual molecular adhesion) to concrete requires that it can be used as a dispersed reinforcement in concrete. Because such a dispersed reinforced structure prevents the formation of microcracks in concrete.

As a result of the joint work of the material (cement stone) matrix and the dispersed fibers, the defects of the material are filled by the positive properties of the dispersed fibers. When the concrete mixture is reinforced with glass fibers, its viscosity condition improves, the occurrence of volumetric penetration cracks is sharply reduced. That is, while the concrete is in a plastic state, it prevents the formation of internal microcracks due to fiber adhesion.

Methods:

Glass fibers have an average diameter of 0.1-0.5 mm and a length of 5-15 mm, and their difference from other, for example, metal fibers is that glass fibers do not form a negative cathode effect in concrete and do not corrode. Metal fibers with a diameter of 1 mm in size correspond to several hundred glass fibers, and their specific surface area is 10-15 times larger than the surface of metal fibers. Its specific gravity is about three times less than that of metal. This means that fiberglass is consumed in concrete up to 3-4 times less than metal fibers in concrete. Since glass fibers have a strong adhesion to the cement stone matrix in concrete, no additional modification of their surface is required. Also, the coefficients of thermal expansion of cement stone and glass fibers are close to each other. Therefore, lightweight concretes reinforced with glass fibers are highly effective when used in structures that are constantly exposed to the external environment.

Based on the above, special experiments were conducted in the experimental scientific laboratory №5 of the Samarkand State Architectural and Construction University to study the strength properties of fine-grained lightweight concrete reinforced with glass fibers dispersed [2].

For the preparation of experimental concrete samples used clinker Portland cement of JSC "Kyzylkumtsement". Its activity is -38.9 MPa, water demand -29%, actual density -3.1 g / cm3, specific surface area -2950 cm2 / g. Claydite sand was used as a fine aggregate. The pile density of sand is 800 kg / m3, the modulus is 3.5, the porosity is 48%. Glass fibers used as dispersed reinforcement had a diameter of 0.1-0.5 mm, from which fibers with a length of 5-15 mm were prepared and 2% of the volume of the concrete mix was obtained.

Results:

Based on the above descriptions of the concrete components, the composition of lightweight concrete with the addition of ordinary (conventional) and glass fibers was determined for the experiments and experimental samples (cubes, prisms and beams) were prepared. The samples were tested in a hydraulic press at 28, 60, 90 and 120 days of age of the concrete. During the testing of the samples, the loading rate was 0.1 MPa / sec (three samples of each content were tested) [3, 4].

According to the experiments obtained, the cubic strength of lightweight concrete (simple composition) at 28, 60, 90 and 120 days is 14.33, respectively; 14.57; 14.81 and 15.31 MPa, respectively. At present, the cubic strength of lightweight concrete with the addition of glass fibers of the same composition on the above-mentioned days is 19.48, respectively; 19.98; 20.78 and 21.49 MPa, respectively. At the same time, it was observed that the cubic strength of lightweight concrete dispersed with fiberglass increased by 33-38% compared to the normal composition.

The prismatic strengths of concrete were determined by testing concrete prism samples. According to the obtained experiments, the prismatic strengths of lightweight concrete (simple composition) recorded in the above days are 12.71, respectively; 13.41; 13.67 and 14.93 MPa, respectively. At the same time, the prismatic strengths of lightweight concrete with the addition of fiberglass to the same composition on the above-mentioned days are 16.63, respectively; 17.52; 18.62 and 19.77 MPa, respectively. At the same time, the prism strength of lightweight concrete dispersed with fiberglass increased by 30-34% compared to the usual composition.

Discussion:

The bending and tensile strength of concrete at 28 days was 2.86 MPa for normal content and 3.58 MPa for glass fiber. The increase in strength is 25% compared to normal content [5].

From the above, it can be concluded that fiberglass binds the bonds between cement and fillers to form additional strong carcasses in the structure. That is, lightweight concrete reinforced with dispersed glass fibers has the following advantages:

- reduction of volumetric penetration deformation during hardening of concrete, its strength, cracking, etc. increase in properties is achieved;
- opportunities for efficient use of fiberglass industry waste will be expanded;
- saves on materials, including structural fittings;
- high-tech production, ie in the manufacture of products and structures, dispersed reinforcement of concrete is carried out directly on concrete screeds.

Conclusion:

Based on the conducted experiments and the obtained results, it can be noted that by dispersive reinforcement with glass fibers it is possible to obtain fine-grained lightweight concrete with high strength and other performance requirements. Such concretes can be used effectively in thin-shell space constructions, engineering structures exposed to aggressive environments, and energy-efficient residential and public buildings.

References:

1. Kuldashev X., Saidmuratov B.I., Gulomova X.A., Berdikulov A. Prospects for the use of dispersed reinforced fine-grained concrete in construction. "Problems of Architecture and Construction". Scientific and technical journal. Samarkand, SamDAQI. 2014, №4. 62-65 b.
2. Kuldashev X., Rahmatov D., Shamsiev M. Disperse reinforcement of fine-grained concrete with fiberglass. Materials of the XIII Republican scientific-practical conference on "Intellectual potential in the integration of education, science and industry is an important factor in the development of the country." Part II. Samarkand, SamDAQI. 2016. 136-138b.
3. KuldashevKh., IbragimovKh., Mannatov B. Protection of seismic-stabilty large-panel buildings. EUROPEAN JOURNAL OF LIFE SAFETY AND STABILITY.VOL.5 (2021). 2021-06.01. http://ejlss.indexedresearch.org/index.php/ejlss/index.
4. Kuldasheva A., KuldashevKh. Durability characteristics of concrete adixed with wollastonite mineral. EUROPEAN JOURNAL OF LIFE SAFETY AND STABILITY.VOL.5 (2021). 2021-06.01. http://ejlss.indexedresearch.org/index.php/ejlss/index.
5. KuldashevaA.Kh. Experimental studies of the strength properties of concretes based on wollastonite raw materials. MGSU Bulletin, 2011, No. 7, p. 627 - 630. ISSN 1997-0935. vestnikmgsu@.mgsu.ru. , http://www.iasv.ru. , http://www.mgsu.ru.
6. KhKuldashev. Research of light-weight concrete properties on base wollastonite addition //Middle European Scientific Bulletin. – 2021. – T. 8. https://cejsr.academicjournal.io/index.php/journal/article/view/166.