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METHODS OF INCREASING THE STRENGTH OF AERATED CONCRETE

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Abstract: *This article presents the results of experimental research, which describes the parameters and properties of the porous structure of aerated concrete based on industrial waste. Structurally optimal parameters representing the physical-mechanical, thermal-technical properties of external wall structures based on aerated concrete have been identified. The test results were carried out in research laboratories using aerated block structures with high porosity and optimal composition, and improved technology of autoclaved aerated concrete was proposed.*

Key words: *Aerated concrete beton, aerated concrete composition design, strength, porosity, thermal protection, technological methods.*

INTRODUCTION

As humanity strives for progress, so do techniques and technologies. That is why the demand for modern technologies is growing.

In the construction industry, as in all industries, it is important to use energy-saving materials, reduce costs, reduce the negative impact on the environment, the introduction and production of seismic materials.

In developed countries, by reducing the cost of building materials, attention is paid to the production of aerated concrete, increasing its heat, strength, moisture permeability [1]. This, in turn, makes it advisable to use aerated concrete fillers as they are cheaper.

Many foreign and domestic scientists have conducted scientific research in this regard. In particular, the results of laboratory tests showed that the quartz sand used as industrial waste consisted of the following indicators.

Use of heat-insulating effective building materials with an average density of 500-700 kg / m3 and structural cellular concrete with an average density of 800-1200 kg / m3 as energy-saving building materials, increase its economic efficiency in this regard. issues are becoming increasingly important.

M.A. Mikheev, B.F. Vasilev fully demonstrated the technology of aerated concrete barrier structures and its capabilities. In this case, the thermal conductivity of aerated concrete construction

7-10%, which allowed to eliminate the moisture formed on the inner surface of the structure.

K.F. Fokin, I.S. Sukhanov, Y.A. Matrosov, A.M. Protasevich, EA Soldatov The results of scientific research are aimed at improving the technology of aerated concrete and increasing its efficiency [1-3].

In these studies, with the help of mineral and organic additives, plasticizers, research was conducted on various properties of aerated concrete, strength, thermal protection, optimization of porosity, reduction of moisture.

RESEARCH METHODS AND TOOLS

Experimental studies and data processing were carried out according to GOST 23789-2018 in the following sequence:

The mixture was prepared in several ways according to the ratio of water content to cement mass.

The VS-GEO-NDT Suttard viscometer was installed horizontally.

3. The mixture was slowly placed in the cylinder and lifted when the cylinder was full.

4. The diameter of the spread of the mixture was determined and the thermal conductivity was checked accordingly.

After the completion of the laboratory analysis, it was studied to what extent the water-cement ratio affects the thermo-technical properties.

The moisture content of aerated concrete samples was determined using the DT-125G - Vlagometer according to the standard requirements of GOST 29027-91 (Fig. 1).

FIGURE 1. *DT-125G - Vlagomer*

Determination of the absolute moisture content of aerated concrete samples using the DT-125G - Vlagometer was carried out in the following sequence:

1. Cubed aerated concrete samples of 100x100x100 mm size were prepared and stored in laboratory conditions for 28 days.

2. The moisture content of the samples was determined sequentially.

3. The average humidity of several samples was determined and its effects on thermal technical properties were determined.

The necessary values of heat transfer coefficient of energy-efficient civil buildings external wall constructions for different climatic conditions of the Republic of Uzbekistan were implemented using "Base" computer programs.

Experimental studies were carried out using filler materials based on specified industrial waste, and laboratory tests using binding industrial waste materials using non-standard methods developed by scientific research specialists according to specified standards.

STUDY OF PHYSICAL, MECHANICAL AND HEAT-TECHNICAL PROPERTIES OF AERATED CONCRETE BETON

The experiment was performed using waste quartz sand as a gas block filler to perform the test processes. The fraction size of the sand used in the normal composition is 0.315-0.63 mm. The hypothesis put forward in the composition of the study is that the particle size fractions of this waste quartz sand are 0.16-0.315 mm. This in turn leads to an increase in the strength properties of aerated concrete. The samples were stored at constant temperature for 28 days to ensure uniform solidification. Compositions of mixtures Shown in Table 1.

TABLE 1.

The amount of waste sand in the study

№	Titles	Amount of waste sand (relative to ordinary sand),%
1	Typical content	0
2	1-Content under study	6
3	2-Content under study	12
4	3-Content under study	18

Analysis of the data obtained showed that the inclusion of "industrial waste quartz sand" in the composition of the aerated concrete mixture in the amount of 16% of the mass of sand allowed to obtain aerated concrete with increased strength. However, when 6% waste sand is added to the 2-Content under study, the value of the quality coefficient is much higher than when the 1-Content under study is 12% and 18% from the aerated concrete.

Aerated concrete blocks were prepared according to this composition and the analysis of its strength properties is shown in Figure 1.

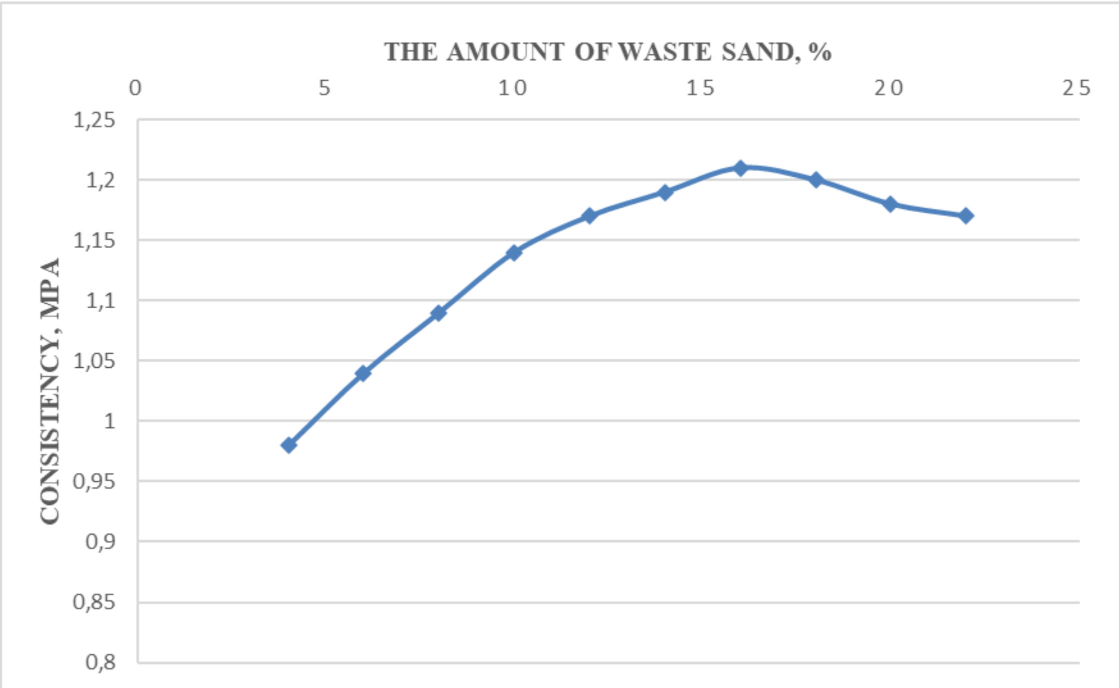

FIGURE 1. *Influence of aerated concrete on the strength properties of industrial waste*

Aerated concrete blocks of D500 brand were selected for laboratory research. The mutual appearance of the samples in the production plants and research laboratories of the prepared aerated concrete blocks is as follows (Figure 2).

1) 2)

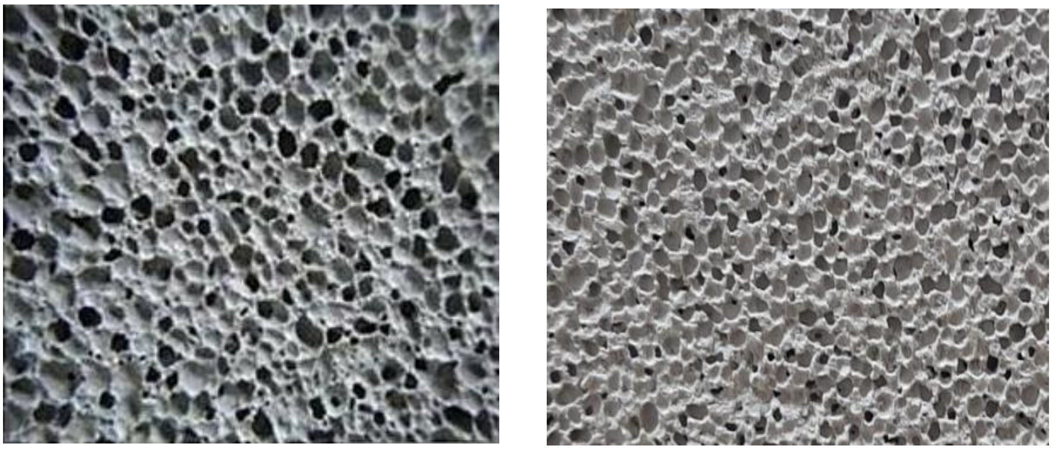

FIGURE 2. *Surface view of aerated concrete samples of D500 brand (1) production organization gas block, (2) research laboratory gas block sample.*

The optimum thickness of the aerated concrete mix was determined in Suttar and the block samples were stored under the same conditions for 28 days until the humidity reached 5%. The samples were tested using a porosimeter to determine the porosity structure as a function of the water-cement ratio. According to the results of the study, the samples with the best characteristics were identified.

Analysis of the results of scientific research in autoclaved aerated concrete structures in research laboratories and production organizations showed that the amount of water in the material has a significant impact on its thermal and technical properties, strength.

The characteristics of aerated concrete samples of industrial organizations in accordance with GOST 10180-2012 are given in Table 2.

TABLE 2.

Characteristics of aerated concrete in traditional composition

№	Average density, kg/ m^3	Strength R_{ya}, Mpa	Porosity P, %	Thermal conductivity of aerated concrete in the dry state λ_0[Вт/(м · ^{0}C)]
1	544	0,822	67,6	0,129
	545	0,825	68,0	0,13
	546	0,828	68,3	0,132
2	562	0,983	66,0	0,138
	560	0,985	66,4	0,14
	559	0,988	66,8	0.143
3	550	0,939	67,3	0,121

	552	0,940	67,8	0,125
	553	0,942	68,1	0,128
4	561	0,962	66,9	0,12
	558	0,964	67,1	0,121
	556	0,967	67,3	0,124

The technology for the production of autoclaved aerated concrete was tested in the conditions of production organizations. For this purpose, aerated concrete blocks were prepared in accordance with the technology developed by D500 compositions [3-5].

The results of experimental tests conducted in the research laboratory of the Tashkent State University of Transport are given in Table 3.

TABLE 3.

Characteristics of aerated concrete under study

№	Average density, kg/ m^3	Strength R_{ya}, Mpa	Porosity P, %	Thermal conductivity of aerated concrete in the dry state λ_0[Вт/(м · ^{0}C)]
1	550	1,06	65,8	0,12
	552	1,08	66,0	0,121
	553	1,09	66,3	0,122
2	561	1,16	64,7	0,129
	563	1,19	64,4	0,128
	567	1,21	64,1	0,125
3	553	0,97	66,1	0,114
	557	0,98	65,8	0,118
	559	1,01	65,3	0,12
4	559	1,14	64,8	0,113
	561	1,17	65,1	0,116
	562	1,19	65,6	0,118

A comparison of the average density, strength, and porosity of non-autoclaved aerated concrete samples determined by the proposed standard methods showed that the average density difference was (2-5)%; strength - (8.5 - 13.4)%; in terms of porosity - (1 - 3.5%).

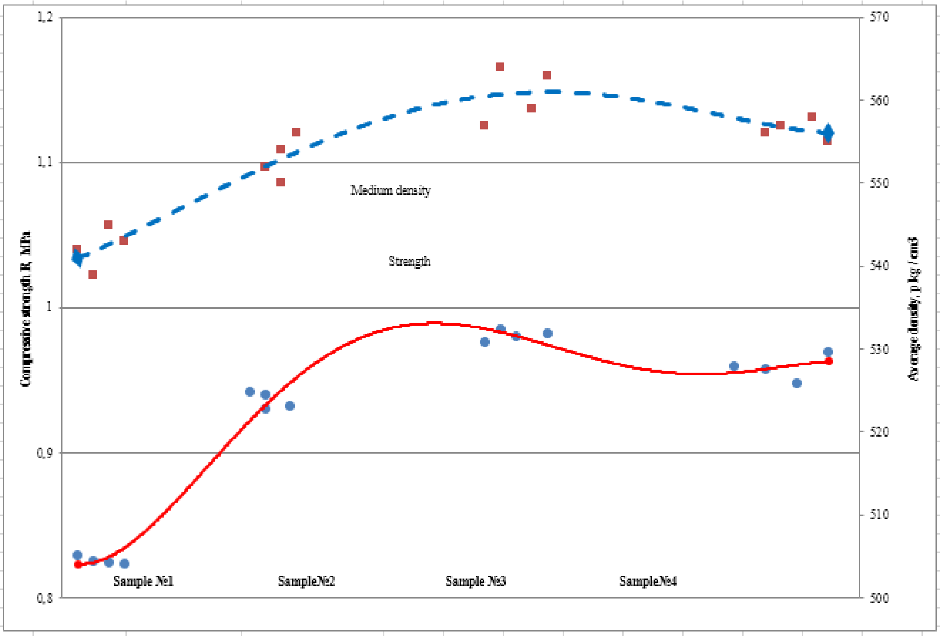

FIGURE 2. Research results of aerated concrete samples

The waste sand in the samples taken from this graph is much stronger due to the fine dispersion of its particles, but its average density is aggravated by 8-10%.

Research has shown that the porous structure of aerated concrete can be improved by taking into account a number of factors, improving the thermal and structural properties and obtaining many real practical results from the analysis of the literature, optimizing the porous structure of concrete and its application in thermal insulation buildings of III degree. successfully applied technological methods have been developed. The amount of chemical structure of aerated concrete blocks has led to an improvement in its strength, porosity, moisture, density, durability, frost resistance, thermal and technical properties [7-8].

TABLE 4.

Technical characteristics of non-autoclaved gas units obtained on the basis of different technologies in different conditions

Composition, production conditions, technology	Aerated concrete brand		
	D500		
	Characteristics of aerated concrete		
	Strength R_{ya}, MPa	Porosity P, %	Thermal conductivity of aerated concrete in the dry state λ_0[Вт/(м*^{0}C)]
Features of gas blocks in the production organization	0,86	71,1	0,129
Features of the proposed gas block	1,12	70,5	0,12

Analysis of the results of scientific research conducted on autoclaved aerated concrete structures in research laboratories and production organizations showed that the porosity of the material has a significant impact on its thermal and technical properties, strength [9].

CONCLUSION

1. According to the results of the research laboratory and the developed method, the risk of dangerous cracks of porous autoclaved non-autoclaved gas blocks produced by 1-3%, 3-6% improvement in thermal conductivity was observed.
2. It is possible to increase the strength of the proposed gas units by 20-23%.
3. The results of the experimental research laboratories showed that when the gas block was formed using waste sand, its cost was reduced by 5-7%.

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