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STRESS-STRAIN STATE OF FIBER REINFORCED CONCRETE BEAMS

Abstract: The article presents the results of laboratory research on the stress-strain state of fiber reinforced concrete beams dispersed with reinforced concrete and basalt fibers.
Key words: reinforced concrete, beam, stress, strain, basalt fiber, flexure, strength, dispersed reinforcement.
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Introduction

Basalt fiber is a complex of continuous basalt fibers of a certain length. Basalt fiber is derived from a variety of rocks, such as basalt, basanites, amphibolites, gabrodiabases, or mixtures thereof, which are chemically similar. The production of basalt fibers is based on the production of basalt solution (mixture) in smelting furnaces and its free flow through special devices. Melting point is 1450⁰C. The advantages of basalt fiber for disperse reinforcement are that it has high strength as well as does not stretch under the influence of stresses, is resistant to chemical, corrosion and thermal effects of the external environment, changes in temperature and voltage direction, as well as cost not too expensive[1-6].

Many scientists have studied the mechanical properties of fibrous reinforced concrete based on basalt fibers. However, the results are scattered and can be explained by differences in the amount, quantity, and technology of fibers used. Kudyakov K.L. [3] states that the addition of basalt fibers to concrete increases the maximum values of deformation during compression and elongation, and at the same time increases the plasticity of the material collapse[7-17].

Research and analysis of scientific studies show that flexible fiber-reinforced concrete structures based on basalt fibers have not been sufficiently studied. Therefore, it is advisable to conduct experimental studies on the stress-strain state of flexible fiber reinforced concrete beams with basalt fibers.

RESEARCH METHODOLOGY

Reinforced concrete beams for dispersed reinforcement have a density of 2650 kg / cm³, fiber diameter 17 μm, fiber length 10; 30 mm basalt fibers were used. An overview of the fibers used in the study is shown in Figure 1.

Figure 1. Basalt fibers

Six series of beams were prepared and laboratory tests were performed to study the stress-strain state of fiber reinforced concrete beams. The first series of reinforced concrete beams are made of concrete without basalt fibers. The rest of the series of fibro-reinforced concrete beams are made of basalt fibers of different sizes and lengths.

The cross-section dimensions of reinforced concrete and fiber-reinforced concrete beams, as well as the diameters and lengths of the reinforcement used, are shown in Figure 2.

Figure 2. An overview of sample beam reinforcement.

Dispersed reinforced concrete beams with reinforced concrete and basalt fibers were formed using a hydraulic press of OKS-1671M brand, modernized by the authors, with a load capacity of 400 kN. The layout of the samples on the test device is shown in Figure 3.
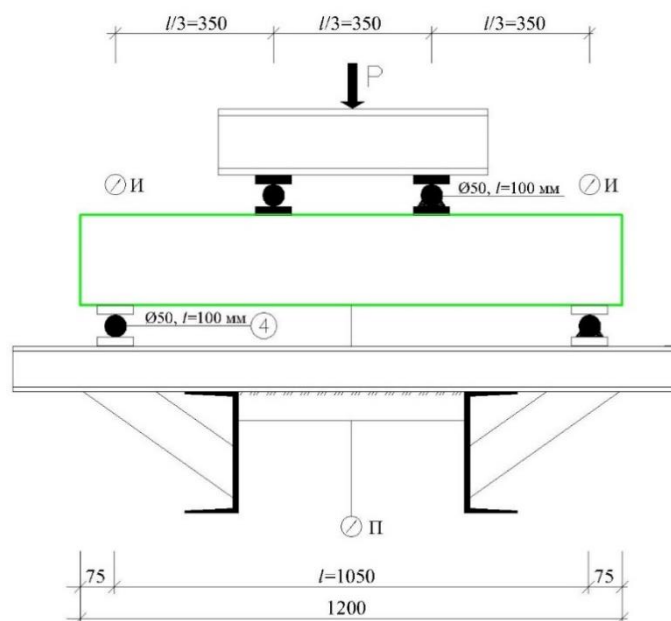

Figure 3. View of the sample on the test device.

In order to measure the deformation of the beams, specially prepared metal pins were attached to the compressible and elongated parts of the beams. Holes were made in the metal studs. One of the bars has a clock-type indicator and the other has a messura.

To determine the stress-strain state of the concrete, the cross-sections of the side beams were measured using a portable messura (Figure 4) using clockwise indicators with an accuracy of 0.01 mm at a base of 300 mm.

Figure 4. view of the messura.

ANALYSIS AND RESULTS

Longitudinal elongation and compressive deformations of concrete do not have large values at the initial loads, and their variation increases almost in a straight line. Elongation deformations of concrete reached $\varepsilon_{fb}= (32-45) \cdot 10^{-5}$ compressive deformations of concrete $\varepsilon_{fbt}= (17-23) \cdot 10^{-5}$ when the force reached 30 kN on reinforced concrete beams of series I. Elongation deformations of concrete $\varepsilon_{fb}= (12-20) \cdot 10^{-5}$ compression deformations of concrete reached $\varepsilon_{fbt}= (8-12) \cdot 10^{-5}$ values when the force reaches 30 kN in sample II reinforced concrete beams.

Elongation deformations of concrete reached $\varepsilon_{fb}=(150-160) \cdot 10^{-5}$ compressive deformations of concrete $\varepsilon_{fbt}=(47-50) \cdot 10^{-5}$ when the amount of load reached $F_{ult}(0,8-0,9)$. Elongation deformations of concrete in series II reinforced concrete beams $\varepsilon_{fb}=(130-145) \cdot 10^{-5}$ compressive deformations of concrete up to $\varepsilon_{fbt}=(28-45) \cdot 10^{-5}$.

Sample III series Elongation deformations of concrete when the amount of destructive force in fiber-reinforced concrete beams reaches $F_{ult}(0,2-0,3)$ $\varepsilon_{fb}=(13-28) \cdot 10^{-5}$ compressive deformations of concrete $\varepsilon_{fbt}=(8-14) \cdot 10^{-5}$ achieved values. Elongation deformations of concrete in series IV reinforced concrete beams $\varepsilon_{fb}=(14-20) \cdot 10^{-5}$ Compressive deformations of concrete $\varepsilon_{fbt}=(10-17) \cdot 10^{-5}$ (Figures 5-8).

Elongation deformations of concrete in series III samples reached $\varepsilon_{fb}=(130-140) \cdot 10^{-5}$ compressive deformations of concrete $\varepsilon_{fbt}=(28-32) \cdot 10^{-5}$ as the loading stages approached the destructive force. Elongation deformations of concrete $\varepsilon_{fb}=(115-132) \cdot 10^{-5}$ compression deformations of concrete up to $\varepsilon_{fbt}=(31-35) \cdot 10^{-5}$ were found in the IV series sample fibro-reinforced concrete beams.
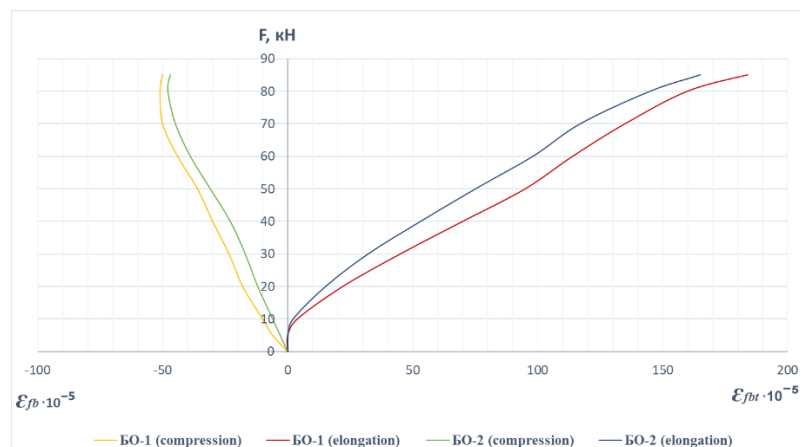

Figure 5. Average relative compressive and elongation deformations of concrete in series I ordinary reinforced concrete beams
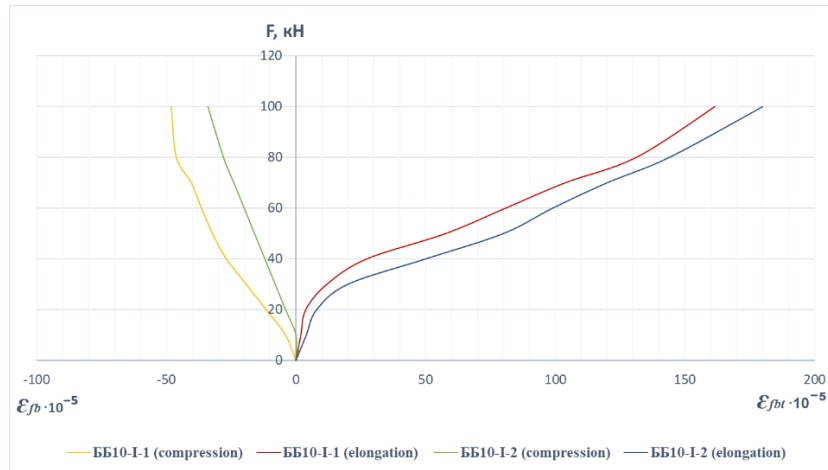
Figure 6. Average relative compressive and elongation deformations of concrete in series II fiber reinforced concrete beams
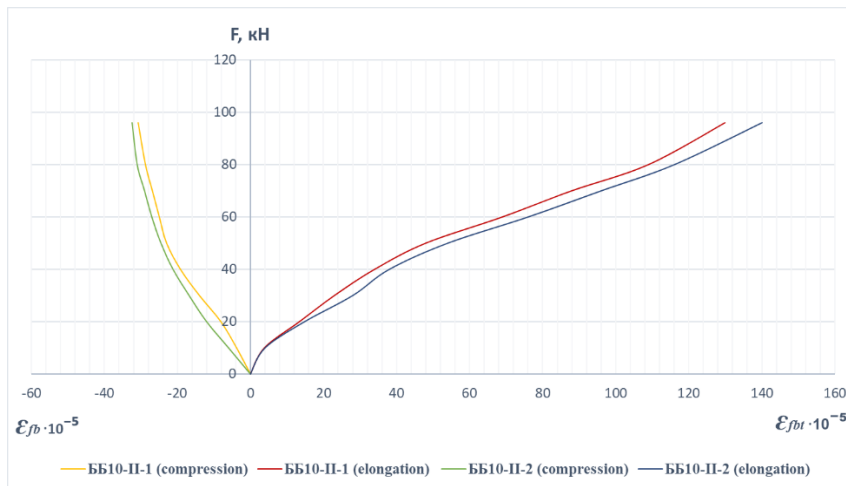

Figure 7. Average relative compressive and elongation deformations of concrete in series II fiber reinforced concrete beams
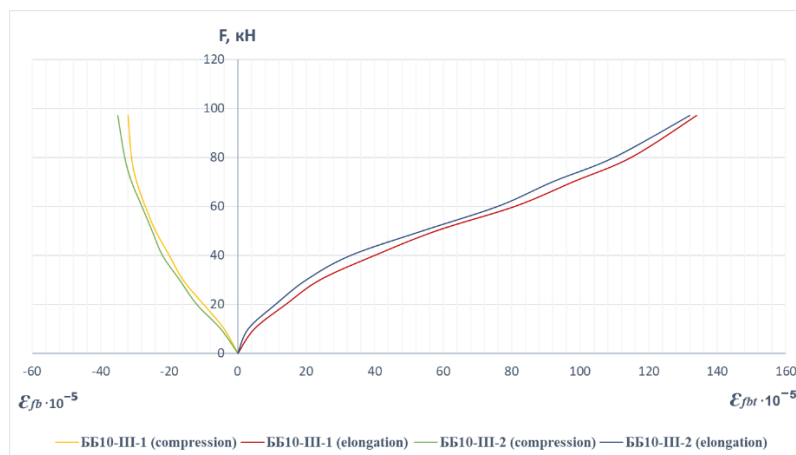

Figure 8. Average relative compressive and elongation deformations of concrete in series II fiber reinforced concrete beams

CONCLUSION

Experimental studies of sample beams have provided new data on the nature of the stress-strain state of fiber reinforced concrete beams and the strength of normal sections. Basic fiber-reinforced concrete beams have shown high strength, high load-bearing capacity, high tensile strength, and stiffness compared to ordinary reinforced concrete beams.

The addition of basalt fibers to concrete in the range of 0.1-0.3% allows more efficient use of regular reinforcement. It also has the effect of increasing the load-bearing capacity of fiber reinforced concrete beams, which are subject to bending and increasing it by an average of 10-19% compared to control samples.

References:

1. Razzakov, S.J., & Martazayev, A.Sh. (2021). "Mechanical properties of basalt fiber concrete", *International Journal of Advanced Research in Science, Engineering and Technology,* Vol. 8, Issue 9.

2. Razzakov, S.J., & Martazayev, A.Sh. (2021). "The Effect of the Length and Amount of Basalt Fiber on the Properties of Concrete". *Design Engineering* (2021): 11076-11084.

3. Kudyakov, K.L. (2018). *"Strength and crack resistance of bent concrete elements with basalt fiber and rod glass composite reinforcement under static and short-term dynamic loading".* Tomsk.

4. Abdurahmonov, S. Je., Martazaev, A. Sh., & Jeshonzhonov, Zh. B. (2017). Treshhiny v zhelezobetonnyh izdelijah pri izgotovlenii ih v nestacionarnom klimate. *Vestnik Nauki i Tvorchestva*, №. 2, pp. 6-8.

5. Razzakov, S. Zh., Il`ina, L. V., & Holmirzaev, S. A. (2018). Temperaturnye deformacii betona v uslovijah suhogo zharkogo klimata. *Trudy Novosibirskogo gosudarstvennogo arhitekturno-stroitel`nogo universiteta (Sibstrin),* T. 21, №. 3, pp. 22-30.

6. Razzakov, S. Zh., & Holmirzaev, S. A. (2017). Vlijanie karkasnogo usilenija na naprjazhenno-deformirovannoe sostojanie dvuhjetazhnoj postrojki iz maloprochnyh materialov. *Stroitel`naja mehanika inzhenernyh konstrukcij i sooruzhenij*, №. 4, pp. 43-49.

7. Abdurahmonov, S. Je., Martazaev, A. Sh., & Mavlonov, R. A. (2016). Treshhinastojkost` zhelezobetonnyh jelementov pri odnostoronnem vozdejstvii vody i temperatury. *Simvol nauki*, №. 1-2, pp. 14-16.

8. Nasriddinov, M. M., Martazaev, A. Sh., & Vakkasov, H. S. (2016). Treshhinostojkost` i prochnost` naklonnyh sechenij izgibaemyh jelemenov iz betona na poristyh zapolniteljah iz ljossovidnyh suglinkov i zoly TJeS. *Simvol nauki*, №. 1-2, pp. 85-87.

9. Abdurahmonov, S. Je., et al. (2018). Treshhinoobrazovanie i vodootdelenie betonnoj smesi v zhelezobetonnyh izdelijah pri izgotovlenii v rajonah s zharkim klimatom. *Vestnik Nauki i Tvorchestva*, №. 2, pp. 35-37.

10. Martazaev, A. Sh., & Jeshonzhonov, Zh. B. (2017). Voprosy rascheta izgibaemyh jelementov po naklonnym sechenijam. *Vestnik Nauki i Tvorchestva*, №. 2 (14), pp. 123-126.

11. Vakkasov, H. S., Fozilov, O. K., & Martazaev, A. Sh. (2017). Chto takoe passivnyj dom. *Vestnik Nauki i Tvorchestva*, №. 2 (14), pp. 30-33.

12. Martazaev, A. Sh., Fozilov, O. K., & Nosirzhonov, N. R. (2016). Znachenie raschetov staticheskogo i dinamicheskogo vozdejstvija nazemljanye plotiny. *Innovacionnaja nauka,* №. 5-2 (17), pp. 132-133.

13. Razzakov, S., & Raxmannov, B. (2021). *Technologistsi rigging works using synthetic slings.* Zbirnik naukovih prac`. ΛΟΓΟΣ.

14. Razzakov, S. J., Abdullayev, I. N., & Raxmanov, B. K. (2021). Components of deformation and failure of synthetic woven tapes. *Scientific-technical journal*, T. 4, №. 2, pp. 23-28.

15. Tursunov, N. S., & Razzakov, S. J. (2020). Metal wooden spatial rod construction from composition wooden elements. *Journal of Tashkent Institute of Railway Engineers*, T. 16, №. 4, pp. 78-82.

16. Razzakov, S. Zh., et al. (2020). *Izuchenie tkackoj konstrukcii sinteticheskih lent dlja gruzozahvatnyh prisposoblenij.*

17. Razzakov, S. J., & Kholmirzaev, S. A. (2017). Influence of frame work strengthening on the stress-strain state of two-storey buildings of low-strength materials. *Structural Mechanics of Engineering Constructions and Buildings*, №. 4, pp. 43-49.

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