Spectrum Journal of Innovation, Reforms and Development
Volume 08, Oct., 2022 | ISSN (E): 2751-1731
Website: www.sjird.journalspark.org

INVESTIGATION OF THE STRENGTH AND DUTNESS OF REINFORCED CONCRETE BEAMS WITH GLASS COMPOSITE REINFORCEMENTS

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Abstract
This article describes the analysis of the results of the research conducted on the study of the work of composite reinforced elements, which are widely used in the restoration of concrete structures in the buildings and structures currently being built in the Republic of Uzbekistan and in foreign countries.

Keywords: composite, basalt, concrete, flexibility, strength, messura, polymer.

Introduction

Currently, polymer composite fittings are used in road transport infrastructure facilities, where high electromagnetic fields are generated, in the chemical industry, water treatment and purification, land reclamation facilities, in the construction of seaports and pre-port structures, in urban engineering infrastructure facilities, metro mines. and tunnels, as well as construction, repair and reconstruction of load-bearing and barrier structures of buildings and structures.

The use of polymer composite reinforcements instead of steel reinforcements of reinforced concrete structures working in especially corrosive environments is a promising scientific direction.

In the development of the economy of the Republic of Uzbekistan, in the improvement of its material and technical base, it is important to put into practice the elements that have new constructive solutions and are economically effective based on theoretical and experimental research.

The use of flexible elements reinforced with composite reinforcements in industrial, residential, public buildings and engineering structures requires a scientific basis based on a new theory, confirmed by the results of experimental research. Appropriate recommendations and practical solutions should be developed based on scientific research.

To conduct experimental studies, test models-sample beams with a rectangular cross-section were prepared. Ordinary heavy concrete was used for the beams. Portland cement of the Turon cement plant in Beshariq district of Fergana region with an activity of 42.5 MPa was used as a binder for concrete. As fillers, quartz river sand from Akbarabad quarry, Kuva district, Fergana region, with a fraction of 5-15 mm and a bulk modulus of M2.25 was used. The composition of the concrete was chosen so that its cubic strength would have a compressive strength corresponding to class B25. Granite limestone was sieved, washed in a special device and then dried (Table 1). The consumption of materials for 1 m3 of concrete mixture is given in Table 1[1-11].

Table 1.Concrete composition for sample beams

T/R №	Name	Amount	Unit of measure
1	Portland cement M400 of "Turon" cement plant, Beshariq district, Fergana region	394	kg
2	Sheben	1197	kg
3	Quartz sand	495	kg
4	Water	212	litr
	Density of concrete:	2298	kg/m^3
	Concrete water/cement ratio (S/S)	0,54	

The materials were dosed with an accuracy of ±0.1 kg by weight. An electronic scale with high accuracy was used for this purpose. The results of the cube tests are presented in Table 2.

Table 2. Test results of cubes made of sample beam concrete, MPa

№	Code of beams	Age of concrete (days)	Edge of sample cubes, cm	Compressive strength of concrete, MPa	Strength of concrete		
					R_b, MPa	R_{bt}, MPa	E_b*10^{-3} MPa
1	2	3	4	5	6	7	8
1	BKPA -1	30	10	32,3	18,3	1,58	29,5
2	BKPA -2	30	10	30,4	17,3	1,51	27,5

Together with the beam samples, cubes with dimensions of 10x10x10 cm were prepared from the same mixture. After 28 days of storage under conditions of normal temperature t=20±20C and relative humidity φ=60-65%, the sample cubes were tested in a hydraulic press until failure under compressive force.

After determining the cubic strength of concrete, the prismatic strength corresponding to it was calculated according to the expression Rb=0.75R, and its tensile strength was calculated according to the formula $R_{bt}=0.5\sqrt[3]{R^2}$ [12-16]

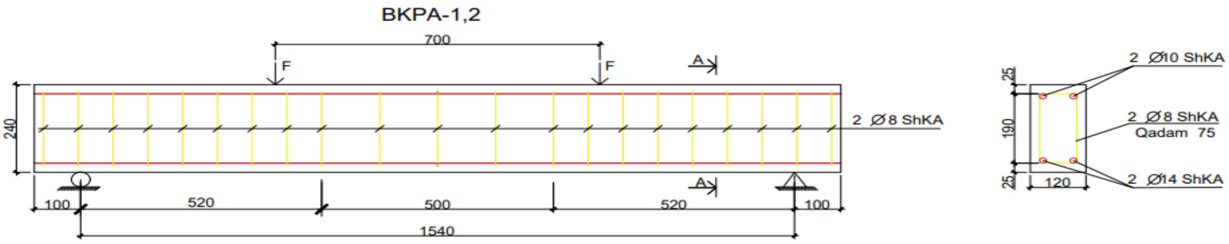

Figure 1. Schemes of reinforcement and loading of sample beams.

To achieve the set goal, it was necessary to carry out the set tasks. For this, experimental and theoretical studies were required.

Beams equipped with composite reinforcements with cross-sectional dimensions of 12x24 cm and length of 174 cm were prepared for experimental research. The beams were made in wooden molds. The inner surface of the molds was covered with metal sheets. As working fittings, 2Ø14 ShKA reinforcements were placed in the tensile area, 2Ø10ShKA reinforcements were placed in the compression area, and Ø8ShKA reinforcements were placed in 7.5 cm increments as clamps (Fig. 2.2). The composite reinforcements for the tie rods were welded to the longitudinal reinforcements with mild steel wires. Reinforcement wedges were installed and fixed in the formwork at the project site. Beam samples were made of B25 heavy concrete. Together with the sample beams, cubes of 6 and 9 pieces with a size of 10x10x10 cm were made from the same concrete at the same time. Concrete volume equal to 0.25 m3 was prepared in a concrete mixer and poured into molds and compacted using a vibrator.

The beam samples and cubes were kept in the mold for 5-7 days, then they were released from the molds and stored in laboratory conditions until the test. The first cubes were tested 28 days after molding. Then, directly before testing the beams, their cubic strength was determined. After 28 days, according to the results of the cube compression test, it was determined that the concrete of the sample beams corresponds to B25 compressive strength classes. Tests were conducted on a 50-ton hydraulic press. Cubes were tested until failure. The tests were performed based on the requirements of GOST 10180-2012 according to the standard method. The test results are presented in Table 3[17-21].

Table 3.

Beton turi	Qotish sharoiti	Beton yoshi, sutka	R, MPa	R_b, MPa	R_{bt} MPa	E_b*10^3, MPa	ε_{bn}	γ_{bn}	W, %
Oddiy og‘ir	Tabiiy sharoitda	28	29	18	1,55	27,5	205	0,82	3,6

The dimensions of the sample beams prepared for the experiment, the interval of application of the loads acting on the sample beams, the classes of concrete used and the number, diameter of longitudinal tensile and compressive reinforcements, transverse reinforcements (clamp) number and diameters are given in Table 5.

4-jadval.Main characteristics of sample beams.

Namuna №	Namuna to ‘sin shifri	Dimensions, sm			Reinforcement			Yuklar oralig‘i, cm	Betonning loyihaviy sinfi
		b	*h*	h_0	Ko‘ndalang armatura (xomutlar)	Bo‘ylama cho‘ziluvchi	Bo‘ylama siqiluvchi		
BKPA -1		12	24	21,5	2Ø 8 ShKA	2Ø 14 ShKA	2Ø 10 ShKA	70	B25
BKPA -2		12	24	21,5	2Ø 8 ShKA	2Ø 14 ShKA	2Ø 10 ShKA	70	B25

The beams were mounted on 2 hinged supports of the stand for testing samples. One of the hinges is fixed and the other is movable. The distance between the forces was 700 mm, and

the distance from the supports to the load was 420 mm. The distance from the base to the edge of the beams is 100 mm. The load was delivered by means of a 40-ton hydraulic jack. For this, dividing traverses were used.
Before starting the tests, initial measurements were recorded for all fixtures installed on the sample beam. These indicators were accepted as "conditional zero". The download was given slowly in several stages. The step load was approximately 10% of the calculated breaking load. After loading at each stage, it was waited for its stabilization for 20 minutes.
Measurements were recorded after each phase load and at the end of the phase. Schemes of placement and installation of measuring devices and devices on sample beams during the experiment are presented in the following figure (Figure 5)[22-26].

ВКРА-1,2

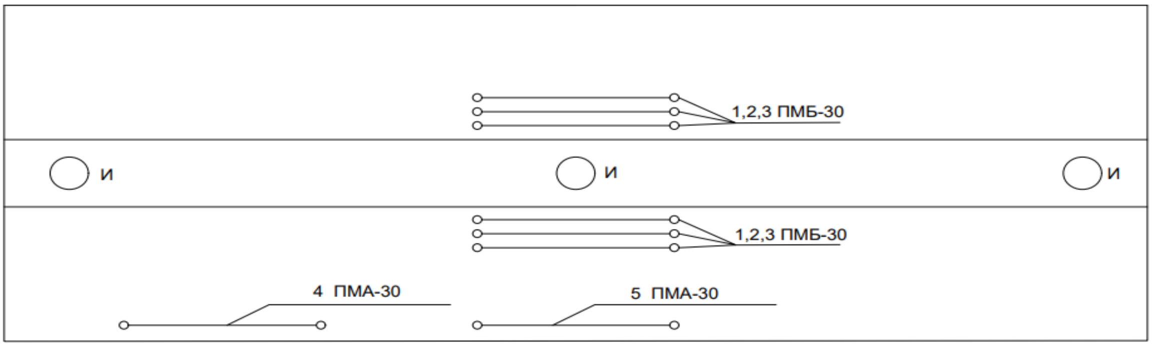

Figure 2. Layout and installation schemes of measuring devices and devices on sample beams; PMA-30-portable gauge for measuring deformations in reinforcement (base 300 mm); PMB-30 portable gauge for measuring deformations in concrete (base 300 mm); I- clock type indicator;

Deformations of concrete and reinforcement, coolness of beams, crack generation time (load) and opening width were measured until samples failed. The value of the load was recorded from the manometer of the jack. After the load reached the specified value, the valve of the jack was closed and kept at this value for 15-20 minutes. After the indicators were recorded through the devices, the load of the next stage was given. In this way, the tests were continued until the samples failed.
Results of the research: After the tests, the location of the cracks was determined, the height of the cracks was measured by photographing the samples, the distances between them were determined, the protective layers of the working fittings were determined and the working height was measured.
During the test, the deformations of concrete and reinforcements, the time of formation of normal and oblique cracks and the amount of load, the stiffness of the beam were measured and recorded.
Deformations are measured on a 300 mm base using a portable measuring instrument with clock-type indicators with an accuracy of 0.01 mm, deflections are measured at three points of the beam - between the spans and supports using clock-type indicators with an accuracy of 0.01 mm was measured. The deformations of the tensile and compressive reinforcements, as well as the concrete compressive zone, were measured at three predetermined points on the cross-section height on a 300 mm base.
During the experiment, the surface of the sample beams was carefully inspected at each stage, and when the first cracks appeared, they were immediately marked and recorded, and their width was measured. At the same time, the value of the load achieved was also determined.

When the value of the given load reached about 85-90% of the breaking load, the measuring devices were removed, the sample was loaded until it broke, and the nature of its breaking was monitored. In the sample beams, the failure occurred along oblique sections.
During the experiment, the failure of the samples occurred at values close to the calculated loads, in all cases it was noted that the experimental load differed from the calculated load by 10-20% on average.
After the experiment, the samples were removed from the stand, placed in a separate place, and the crack map was drawn and photographed. It was noted that the location of the cracks in the beams, their sizes, and the width of the opening were very similar and close to each other.
In cases where the damage started from the tensile reinforcement, it was found that the compressive zone concrete was crushed. When the failure occurred along oblique sections, a situation close to failure occurred in the area of pure bending.
In most of the samples damaged by slope sections, the value of the given force (0.9-0.95) after reaching the Kult values, the connection nodes of the longitudinal reinforcements and the shearing of the compressive areas of the beam occurred. observed.
In order to measure the deformations that occur under force in longitudinal composite reinforcements, during the preparation of the sample beams, clamps made of steel pipes with a wall thickness of 2-2.2 mm were attached to the tensile and compressive reinforcements. Ø5mm holes located in opposite directions are opened in the clamps. Over the holes, Ø5mm nuts were welded to the pipe-clamp using an electric arc. After the clamp was put on the composite armature, a short Ø5mm screw was screwed to the armature until it was firmly tightened from the inside. On the outside, the same Ø5mm long bolt was screwed freely. The long bolt is pushed out 2-3 cm from the hole opened in the sample beam mold. A soft wire of Ø1-2mm was densely wound on the part of this bolt with the armature up to the inner surface of the mold and covered with a thin plasticine coating. After the beams were molded and concreted, after 5-6 days they were released from the molds and the wires wrapped around the long bolts of the device were removed.

Reinforcement indicators of sample beams

A sample beam password	Armaturalanishi											Distance between loads,	Coefficient of longitudinal reinforcement μ_f, %	Ko'Transverse reinforcement coefficient μ_{fw}, %
	Transverse (vertical clamps)	Homutlar's step, S_{fw}, mm	R_{fw}, MPa	A_{fw}, sm^2	Bo'ylama cho'ziluvchi	R_f, MPa	A_f, sm^2	Bo'ylama siqiluvchi	R_{fs}, MPa	A_{fc}, sm^2			
BKPA- 1	2Ø 8	75	20 0	1.01	2Ø 14	49 0	3,0 8	Ø 10	10 0	1.5 7	7 0	1,07	0,118
BKPA-2	2Ø 8	75	20 0	1.01	2Ø 14	49 0	3,0 8	Ø 10	10 0	1.5 7	7 0	1,07	0,118

Before testing the beams, the long bolts were removed and replaced with Ø10mm bolts with a Ø5mm groove at one end. These poles have special holes (cores) where the indicator rod is drawn, and portable measuring rods are drawn into it, and the deformations of the longitudinal reinforcement were measured on a 300 mm base. Devices in the form of clamps were installed in such places on the longitudinal reinforcements. In this case, the distance between the beams was 300 mm, and they were located in the middle of the pure bending zone and the shear zone[27-29].

Conclusions:

- the load-carrying capacity of single-reinforced flexural concrete elements with fiberglass rods is very close to that of similarly reinforced steel-reinforced elements;
- it is noted that the load-carrying capacity of the elements reinforced with double-reinforcement scheme with composite reinforcements is lower than the load-carrying capacity of elements reinforced with steel reinforcements according to the same scheme, and this situation means that the compressive strength of the composite reinforcement is low explained by being;-shishaplastik kompozit armaturali egiluvchi beton elementlarda yoriqlarning ochilish kengligi po‘lat armaturali it is noted that it is significantly higher (larger) than that of the elements, which is explained by the fact that the composite reinforcement has a small modulus of elasticity (~4 times);
- in flexible concrete elements with composite reinforcement, the stiffness is greater than that of elements reinforced with steel rods, this situation is explained by the fact that the modulus of elasticity is low in basalt plastic and glass plastic reinforcements; however, it was noted that at the level of normative loads, the amount of slack in flexural concrete beams with composite reinforcement is at the level of requirements for reinforced concrete structures.

List of References

1. Abobakirova Z. A., Bobofozilov O. Ispolzovanie shlakovых vyajuщix v konstruktsionnых solestoykix betonax //international conferences on learning and teaching. – 2022. – T. 1. – №. 6..
2. Abobakirova, Z. A. (2021). Regulation Of The Resistance Of Cement Concrete With Polymer Additive And Activated Liquid Medium. The American Journal of Applied sciences, 3(04), 172-177.
3. Asrorovna A. Z. Effects Of A Dry Hot Climate And Salt Aggression On The Permeability Of Concrete //The American Journal of Engineering and Technology. – 2021. – T. 3. – №. 06. – S. 6-10.
4. Abobakirova Z. A. Regulation Of The Resistance Of Cement Concrete With Polymer Additive And Activated Liquid Medium //The American Journal of Applied sciences. – 2021. – T. 3. – №. 04. – S. 172-177.
5. Akhrarovich A. X., Mamajonovich M. Y., Abdugofurovich U. S. Development Of Deformations In The Reinforcement Of Beams With Composite Reinforcement //The American Journal of Applied sciences. – 2021. – T. 3. – №. 5. – S. 196-202.
6. Goncharova N. I., Abobakirova Z. A., Kimsanov Z. Technological Features of Magnetic Activation of Cement Paste" Advanced Research in Science //Engineering and Technology. – 2019. – T. 6. – №. 5.
7. Kimsanov Z. O., Goncharova N. I., Abobakirova Z. A. Izuchenie texnologicheskix faktorov magnitnoy aktivatsii tsementnogo testa //Molodoy uchenый. – 2019. – №. 23. – S. 105-106.
8. Goncharova N. I., Abobakirova Z. A. RECEPTION MIXED KNITTING WITH MICROADDITIVE AND GELPOLIMER THE ADDITIVE //Scientific-technical journal. – 2021. – T. 4. – №. 2. – S. 87-91
9. Goncharova N. I., Abobakirova Z. A., Mukhamedzanov A. R. Capillary permeability of concrete in salt media in dry hot climate //AIP Conference Proceedings. – AIP Publishing LLC, 2020. – T. 2281. – №. 1. – S. 020028.

10. Umarov, S. A. (2021). Development of deformations in the reinforcement of beams with composite reinforcement. Asian Journal of Multidimensional Research, 10(9), 511-517.
11. Умаров, Ш. А. (2021). Исследование Деформационного Состояния Композиционных Арматурных Балок. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 60-64.
12. Abdugofurovich, U. S. (2022). BONDING OF POLYMER COMPOSITE REINFORCEMENT WITH CEMENT CONCRETE. Gospodarka i Innowacje., 24, 457-464.
13. Абдуллаев, И. Н., Умирзаков, З. А., & Умаров, Ш. А. (2021). Анализ Тканей В Фильтрах Систем Пылегазоочистки Цементного Производства. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 16-22.
14. Davlyatov, S. M., & Kimsanov, B. I. U. (2021). Prospects For Application Of Non-Metal Composite Valves As Working Without Stress In Compressed Elements. The American Journal of Interdisciplinary Innovations Research, 3(09), 16-23.
15. Умаров, Ш. А., Мирзабабаева, С. М., & Абобакирова, З. А. (2021). Бетон Тўсинларда Шиша Толали Арматураларни Қўллаш Орқали Мустаҳкамлик Ва Бузилиш Ҳолатлари Аниқлаш. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 56-59.
16. Набиев, М. Н., Насриддинов, Х. Ш., & Кодиров, Г. М. (2021). Влияние Водорастворимых Солей На Эксплуатационные Свойства Наружные Стен. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 44-47.
17. Сон, Д. О., & Халимов, А. О. (2021). УПРАВЛЕНИЕ МЕТРОЛОГИЧЕСКИМИ РИСКАМИ КАК ОСНОВА ДЛЯ УВЕЛИЧЕНИЯ КАЧЕСТВА ПРОДУКЦИИ. Экономика и социум, (2-2), 202-210.
18. Бахромов, М. М. (2020). Исследование сил негативного трения оттаивающих грунтов в полевых условиях. Молодой ученый, (38), 24-34.
19. Бахромов, М. М., & Раҳманов, У. Ж. (2020). Проблемы строительства на просадочных лессовых и слабых грунтах и их решение. Интернаука, (37-1), 5-7.
20. Mirzaeva, Z. A. (2021). Improvement of technology technology manufacturing wood, wood with sulfur solution. Asian Journal of Multidimensional Research, 10(9), 549-555.
21. Мирзаева, З. А. К., & Рахмонов, У. Ж. (2018). Пути развития инженерного образования в Узбекистане. Достижения науки и образования, 2(8 (30)), 18-19.