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USE OF FOAM CONCRETE AS OVERLAPPINGS OFLOW-RISE RESIDENTIAL BUILDINGS

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Fo am concrete conquers the market of structural materials. It is quite natural, largely due to the surprising properties of this material. This research paper was performed in accordance with the concept of introducing perspective materials in to housing construction, reducing the proper weight of constructions, reducing both binder consumption and cost, improving the quality and reducing construction terms.The scientific significance of the results of the research is in opening up reserves for the reduction of the cost and material consumption in the manufacture of foam concrete compared to reinforced concrete.

The object of the research is foam-concrete plates with reinforcing by flexible reinforcing rod stock of class S500.

The aim is to define a possibility to use foam concrete plates with a volume weight of 600kg/m^3 executed with use of foaming agent on the basis of protein hydroisolate, for overlappings of residential buildings, in accordance with the load applied for of this kind; to compare the experimental and theoretical results of a research of durability of the bent reinforced elements from foam concrete.

In compliance with the objectives specimen's pieces in the form of plates of rectangular section in number of two pieces with section sizes of 262x600mm and 279x601mm, reinforced by with longitudinal rod stock with a diameter of 10 mm made of class S500 steel are designed and made. For a pull in gin order to exclude (anchoring violation) corners "No. 63" were welded on trailer sites of longitudinal fittings.

Experimental samples were made from concrete of one batter in a timbering of wooden boards with inner metal sheeting. Characteristics of exemplars are presented in tab. 2.

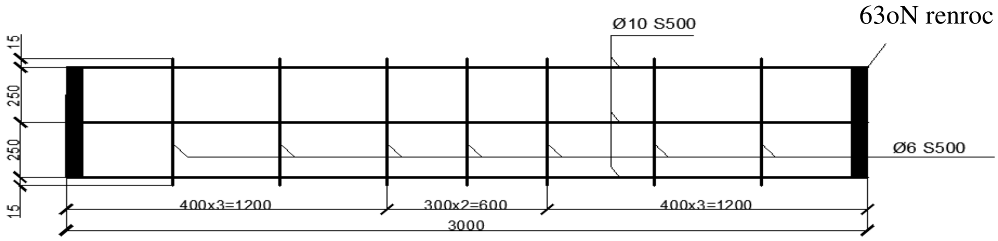

Figure 1.– Reinforcing mesh

Figure 2.– A photo of the reinforcing grid laid in a timbering

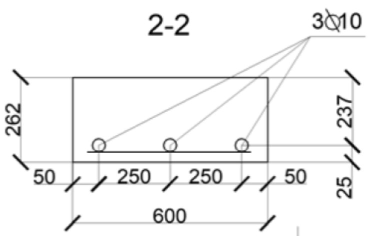

Figure 3. – Reinforcing of plates

Characteristics of experimental plates concrete. To define the physical-mechanical characteristics of the material, along with producing the main samples, control specimens of foam concrete were made in cubes with an edge size of 100 mm (8 pieces) and prisms with a size of 100x100x400mm (3 pieces).

A compression test of concrete prisms was conducted on the press with measuring the deformations on each of the sides. Prismatic durability of fck was determined by the relation between the tension-breaking load and the actual sectional area of a prism. The initial elastic modulus of concrete during compression was defined on the basis of measuring prism deformations. Similarly the cubical durability of concrete was defined $f_{c,cube}$.

Table 1. – Physical-mechanical characteristics of experimental plates concrete

Cubic strength of concrete $f_{c,cube}$, MPa	Prism strength of concrete f_{ck}, MPa	Modulus of elasticity of concrete E_c, MPa
0.781	0.625	11.27

Methods of conducting experimental studies. Testingtheexperimental pieces for bending was carried out by putting unit loadsin the form of cubes weighing 95 kg. Load on beams was applied in the form of four concentrated, symmetrically applied forces in relation to the force carrier. The distance between the points of force application is accepted as constant equalling to 750 mm. In the course of testingthe designs measurements were taken: the efforts of the formation and opening of cracks; the width of opening and the length of cracks; deflections in the middle of the span of plates.

The width of opening of slanting cracks was measured in the places where they crossed the rod stock of longitudinal fittings with MPB-2 microscope with a precision of 0.05 mm.

In the middle of plates span measuring of points movement with an accuracy of 0.01 mm with a flexometer 6 PAO was taken, measuring of points movement over support of plates was also taken to define and exclude settling of the design support and to receive the immediate value of deflections.

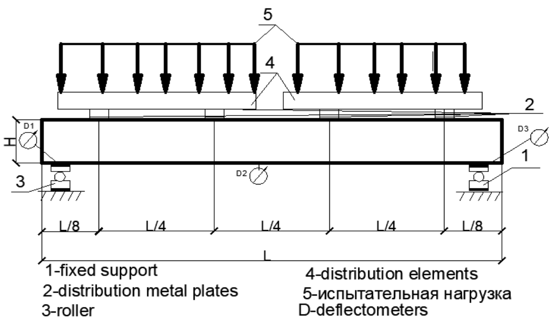

Figure 4. – Diagram of experimental pieces testing

At the initial stages mainly normal cracks were formed in the centre of plates as well as in the areas of combined application of the deflection moment and cross force around the support point. The emergence of cracks was observed at the fourth stage of loading, with 370kgf (3.7 kN) at that moment. The width of the opening was <0/05mm. Later in the process of testing the cracks opened up to the ninth stage while applying additional loads - 704 kgf (7.04 kN). The width of the opening was between 0.1mm and 0.25mm.

After this stage of loading the speed of the opening slowed down or stopped, while new cracks emerged and opened.

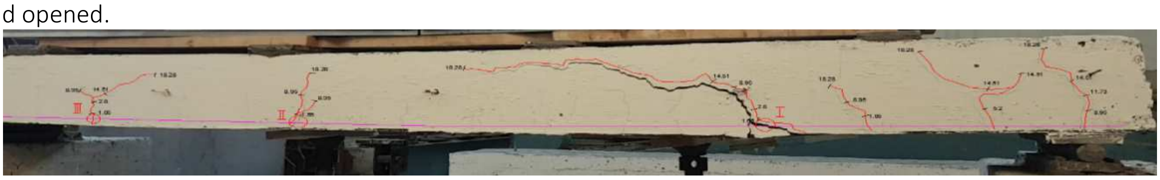

Figure 5. – A photo of PTM-1 after the test

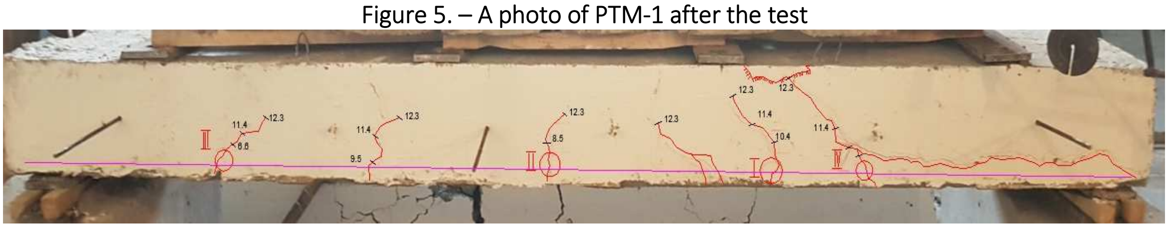

Figure 6. – A photo of PTM-2 after the test

Figure 7. – A photoof concretecrumbling with anchorage cornneraround the support point

Table 2. – Durability and crack resistance of plates.

Code of beams	Geometrical sizes, mm					Experienced cross forc-es, kn			P_{crc}/P_u	$P_{0.4}/P_u$	Destruction type
	b	d	h	L/4	$L_{эф}$	P_{crc}	$P_{0.4}$	P_u			
PTM-1	600	237	262	750	3010	1.65	13.58	15.43	0,09	0,84	2
PTM-2	601	254	279	750	3011	3.7	10.45	11,4	0,271	0,857	1

Notes: 1. Destruction types:
1 – Smashing of concrete over top of aslanting crack;
2 – Aconcrete crumbling around the support point

Table 3. – Ratio of experimental and calculated values of plates.

Code of beams	Maximum load, kN (test data)	V_{RDCT}	V_{SD}	M_{rd}	M_{sd}
PTM-1	18,28	1,551	0,914	15,43	9,63
PTM-2	13,3	1,592	0,65	11,4	11,04

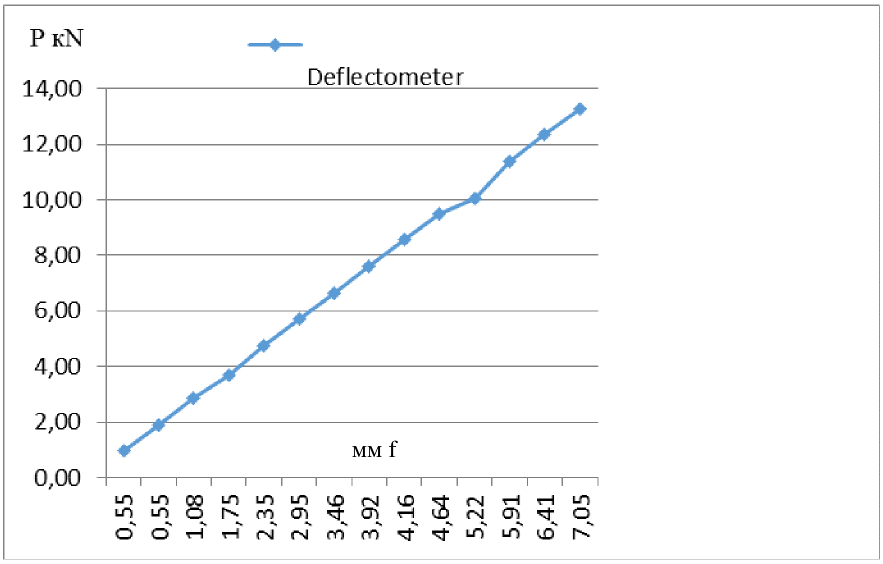

Figure 8. – Relation of a deflection to the load onPTM-2

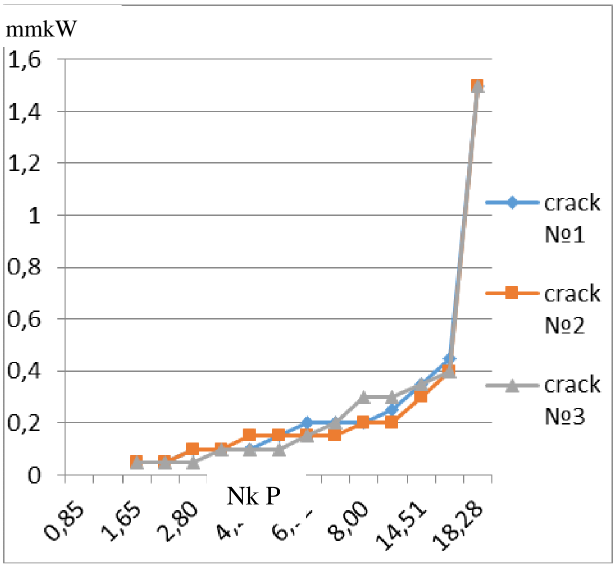

Figure 9. – Relation of the width of crack opening to the load onPTM-2

Based on theconducted calculation on the action of cross forces, according to the method used to calculate heavy concrete, it was revealed that the cross force arising in the section of both samples doesn't give a complete convergence with the theoretical data; the practical test data bearing ability appeared up onthe theoretical data by 10-55%. A crack opening of more than 1.5 mm was accepted as a criterion of destruction. A study of the regulatory base and methods of calculation for light (cellular) concrete is required.

The main conclusions

1. Plates made of foam concrete can be used as overlappings of low-rise residential buildings.

2. The methods used for calculations of heavy concrete give poor convergence of the results when calculating designs from light concrete and foam concrete.

3. The actual carrying capacity exceeded the theoretical assumption by 1.1 - 1.6 times.

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