Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 2458-9403
Vol. 4 Issue 10, October - 2017

Reinforced Concrete Beams With Organize Cracked Under Long-Term Loading

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***Abstract*—This paper deals the research allowed to estimate influence with organize cracked in reinforced concrete beams on their stiffness and crack resistance under long-term loading.**

Keywords—Organize Cracked, Reinforced Concrete beams, Deflection, Flexure, Stiffness, Crack Resistance, Long-term Loading.

I – INTRODUCTION

In department of reinforced concrete NSUACE (Sibstrin) the last year have been carried out of experiment research of process deformation reinforced concrete structure with pre-organized cracks under short-term loading [1;2]. This is direction occurred of analysis result deformation process reinforced concrete structure with cracks in the framework of energy theory resistance of reinforced concrete. [3;4]. Purpose of recent research – revealing of deformation feature beams without organize cracked and pre-organize cracked under long-term loading.

II – EXPERIMENTAL INVESTIGATION

For carried out of research we prepared two series of beams such as cubes, prismatic, eight form. All elements have made the same composition of concrete, with singly reinforcement rebar and geometrical dimensions for every types of specimens.

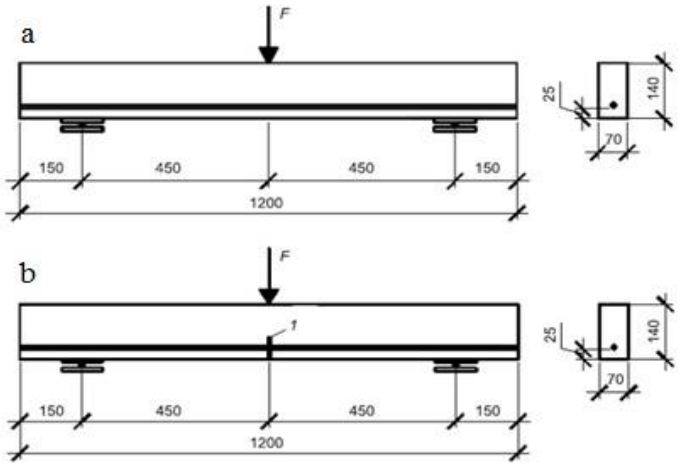
First series of beams were tested under short-term loading, second series of beams – under long-term loading.

All specimen have made from fine-grained concrete with strength the corresponding grade C20($f_c' = 11,5MPa$). Reinforcement rebar in grade A400 (f_y=235MPa) with diameter 8 mm. Organize cracked formed installing galvanized steel plate with thickness 0,5 mm and height 20 mm at reinforcement rebar in maximum zone of bending moment.

III – ANALYTICAL INVESTIGATION

Beams in series 1, 2 calculated on concentrated load application force F in center of beam. Singly reinforcement rebar, protection layer – 25 mm (figure 1).

Under static of long-term loading was applied using specially designed installation, which is a cable pulley system, a total multiplicity of 1: 5.55. Photograph set up shown in figure 2.



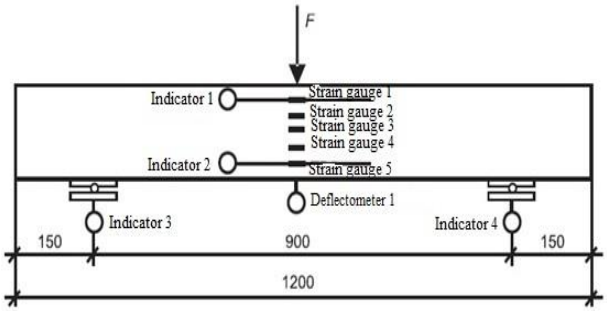
Figure–1: Scheme of reinforced concrete beams: a – without organized cracks; b – with organized cracks; 1 – organized cracks

Figure–2: Overview of test setup for long-term loading

Registration for deflections of beams used Aistova deflect meter with division 0,01 mm. Settlement of support was measured using dial indicator with division 0,01 mm. Relative of deformation was fixed strain gauges with base 25 mm, and dial indicator type with division 0,001 mm and base 260 mm as well.

For valuation of strength properties of concrete cubes, prisms and the eights form in day of carrying out test of beams have been tested as well. Tests of cubes for the 28th days from the moment of production of a structure for a concrete accessory assessment are carried out (according to the accepted classification).

Support of beams took the hinge with free displacement of one support along an element axis. The scheme of arrangement of mechanical devices and strain gauges was present in figure 3.



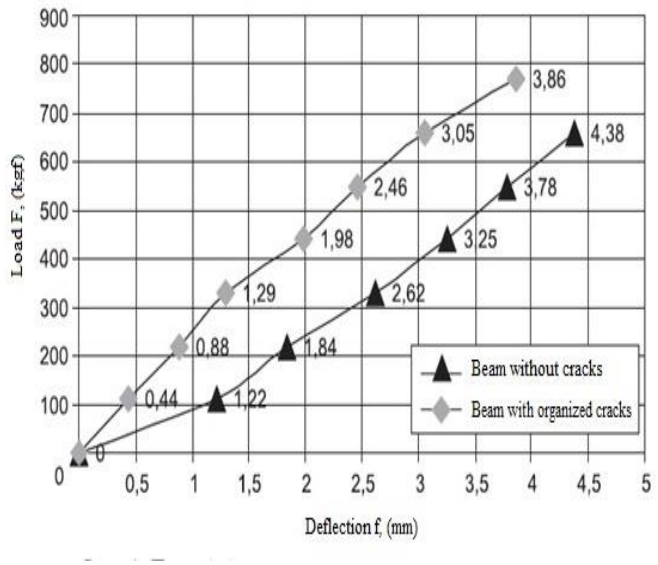
Figure–3: Scheme of location indicators and strain gauges on both sides of the beam

IV – COMPARISION OF PREDICTIONS AND EXPERIMENTAL RESULTS

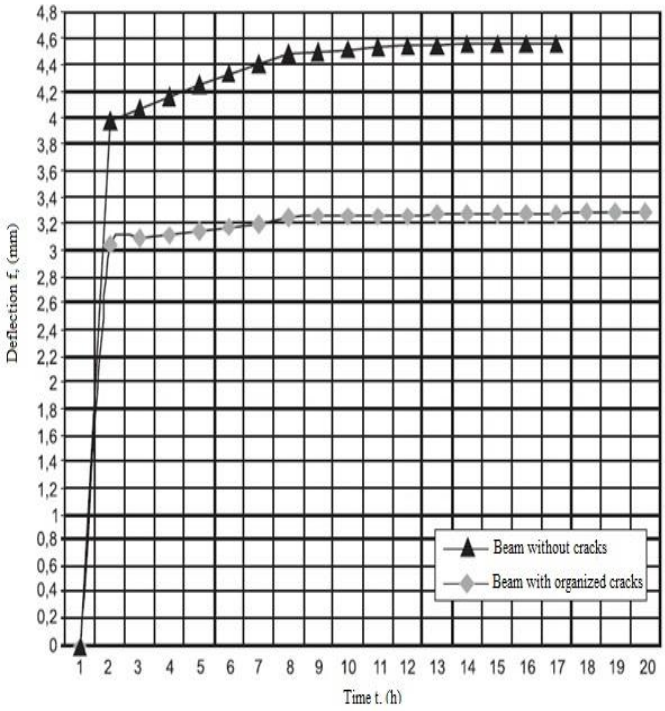
Reinforced concrete beams were tested in static load by short-term and long-term loading, which making 88% from fracture loading. Steps on 111 kgf putted short-term loading. Long-term loading was carry out 4 days using weights 20 kg to destructive specimen.

During the tested, the continuous observation of the behavior investigation specimens (the appearance of cracks, having pricked out and other damages).

As a result of processing of experimental data schedules of deflections for beams without organized cracks and with pre-organized crack, one concentrated force were tested under short-term shown in figure 4 and long-term loading shown in figure 5.



Figure–4: Deflection of beams under short-term loading



Figure–5: Deflection of beams under long-term loading

TABLE 1 – THE VALUE OF DEFLECTION IN BEAMS WERE TESTED UNDER LONG-TERM LOADING

№ of specimen	Time t, h	Defle-ction f, mm	№ of crack, unit	Height of cracks, cm	F, kgf
Specimen 1 (with organized cracks)	0	0	4	0.7	706
	0.17	3.04	9	3.7	
	0.33	3.09	9	3.9	
	0.5	3.11	9	4.1	
	1	3.14	10	4.4	
	2	3.19	10	4.5	
	3	3.24	10	4.5	
	24	3.25	10	4.6	
	25	3.25	10	4.6	
	26	3.25	10	4.6	
	27	3.25	10	4.63	
	28	3.255	10	4.63	
	58	3.27	10	4.7	
	59	3.27	10	4.7	
	60	3.27	10	4.75	
	62	3.27	10	4.9	
	86	3.275	10	4.9	
	87	3.28	10	4.9	
	88	3.28	10	5	
	89	3.28	10	5	
Specimen 2 (without organized cracks)	0	0	2	1.2	706
	0.17	3.98	11	4.2	
	0.33	4.07	11	4.8	
	0.5	4.16	12	5.2	
	1	4.25	12	5.4	
	2	4.33	12	5.4	
	3	4.40	13	5.5	
	24	4.48	13	5.5	
	25	4.50	13	5.5	
	26	4.52	13	5.55	
	27	4.54	13	5.55	
	28	4.55	13	5.55	
	58	4.55	13	5.6	
	59	4.555	13	5.6	
	60	4.56	13	5.6	
	62	4.56	13	5.7	
	86	4.56	13	5.7	

V – DISCUSSION OF RESULTS

Composed the table changing of deflections and height of crack in time. For the beams tested under long-term loading, the following has been established.

Beams without organized cracks were formed 13 cracks; fracture occurred after 86 hours from the time of loading. The maximum deflection has made 45.6 mm, the maximum height of crack – 57 mm. Deformation of beams were characterized by smooth reduction of the compression zone eventually, but considerable turn of sections in the course of deformation. Fracture has happened in section under the applied force.

The beams with pre-organize cracked was cracks formed 10; fracture occurred 89 hours after application of the load. The maximum deflection of 32.8 mm, the maximum height of the crack - 50 mm. Deformation of the beams were characterized by smooth reduction of the compressed zone with time and insignificant rotation of the cross sections in the deformation process. The fracture occurred in a force of application section.

VI – CONCLUSIONS

Based on the experimental investigation described in this paper, the following conclusion can be drawn:

The reported of investigations show that the character of the deformation of beams with stochastically cracks "softer character deformation," was absent (or insignificant) dynamic oscillations.

The results of tests reinforced concrete beams have shown that, beams organize cracked during long-term loading and have lower deflection and curvature in contrast to beams with stochastically generated cracks.

The height of compressed zone during long-term loading beams with the organized cracks decreases more smoothly and the sections rotate during deformation is insignificant character in contrast to the beams without organized cracks.

The strain in the tension zone in the beams with the organized cracks 37%, and the height of the crack is 14% less than in beams with stochastically generated cracks.

The results showed that the installation of organized cracks may have an economically effects.

VII – REFERENCES

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