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UTJECAJ VRSTE AGREGATA NA ČVRSTOĆU LAGANIH BETONA

EFFECT OF AGGREGATE TYPE ON STRENGTH OF LIGHTWEIGHT CONCRETE

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Prethodno priopćenje

Sažetak: *U članku je predložena tehnologija pripravka laganog betona parcijalnom zamjenom gustog poroznog punila (agregata) te korištenje odvojene vezivne tehnologije pripremljene u mikserima visoko brzinske aktivacije.*

Ključne riječi: *Granit, kompozitni beton, lagani beton, mehaničkokemijska aktivacija*

Preliminary communication

Abstract: *Article represents a technology preparation of lightweight concrete by partial replacement of dense porous filler (aggregates) and the use of separate bonding technology prepared in high-speed activation mixers.*

Key words: *composite concrete, granite, lightweight concrete, Mechanochemical activation*

1. INTRODUCTION

One of the area of mass industrialization, industrial and civil building is a monolithic structure that allows the improvement of quality of floors and ceilings, as well as lower non-recurring costs of setting up a production base [1, 2, 3]. Regarding that, currently in construction practice is a specific volume of precast reinforced concrete in use and clearly is in favor of the latter [4]. In practice, industrial floors and ceilings are made of heavy concrete. Strength of concrete should not be less than 30 MPa.

In our opinion, promising shows itself use of lightweight concrete in the construction with an average density of 1850 ... 2100 kg/m^3, in which a part (portion) is replaced by dense aggregate porous expanded clay gravel [5]. The use of lightweight concrete classes B25 ... B30 expedient practical in almost all designs of buildings. Lightweight concretes reduce the average density of the concrete on the 400 ... 550 kg/m^3, which is an average of 20-25%. This reduces the load on the foundation base, reduces the amount of reinforcement, cost of foundation structures and transportation costs.

2. EXPERIMENTAL STUDY

Lightweight concrete has been achieved by partial replacement of crushed granite by expanded clay with gravel. The study used crushed granite quarry *Gnivanskogo Vinnytsia* region with a bulk density of 1375 kg/m^3 and expanded clay with gravel 5-20 mm fractions and clay Odessa plant with a bulk density of 540 kg/m^3, treated with silicone fluid NGL – 94 as the fine aggregate usees quartz sand *Pershamaiski Odessa* region with M_{cr}=2.5. The binder used Portland clean with specific surface 400 m^2/kg, strenght of 48 MPa. For plasticizing mixture used Deluent No 3 in the amount of 1% of the binder.

The concrete mixture was prepared by separate technology, for which the cement slurry after activation in high-speed mixer was mixed with fine and coarse aggregate in the concrete mixer.

Ready-mixed concrete was controlled without activating the binder due to the necessity to determine the state of mechanical activation of compressive strength of concrete. Investigations were carried out on 15-point-like five-factor plan "triangles on the square." As the mixed factors are ground basis, specific surface factors vary in the range of 350 ± 100 m^2/kg provided v1 + vi + vi = 1 (v1 = 250 m^2/kg; v2 = 350 m^2/kg; v3 = 450 m^2/kg). Independent formulation-technological factors have been taken:

- The content of expanded clay gravel mixed aggregates "crushed granite - expanded clay gravel" (X4 = 50 ± 25%);
- Ground fire clay content in the binder (X5=20±10%).

The plasticizer additive mixture in a concrete breaker used P-3 in an amount of 1% (on dry substance) of the weight of the binder.

3. THE RESULTS OF STUDY

Experiment plan and varying levels and mixed formulation-technology factors are given in Table 1.

Graphical dependencies showing the effect of composite and formed-technological factors on concrete with mechanically activated and without mechanically activated binder are shown in Figure 1.

Table 1 Experimental design and varying levels

Stage of plan	Levels of coded variables					Natural values of variables				
	mixed			technological process		mixed			Technological process	
	v_1	v_2	v_3	v_4	x_5	S, m^2/kg	S, m^2/kg	S, m^2/kg	Share of expanded clay gravel, %	Share of ground fireclay, %
1	1	0	0	-	-	250	-	-	25	10
2	0	1	0	-	-	-	350	-	25	10
3	0	0	1	-	-	-	-	450	25	10
4	0,5	0,5	0	-	0	250	350	-	25	20
5	0	1	0	-	+	-	350	-	25	30
6	0,5	0	0,5	-	+	250	-	450	25	30
7	1	0	0	0	+	250	-	-	50	30
8	0	0	1	0	+	-	-	450	50	30
9	0,5	0	0,5	0	0	250	-	450	50	20
10	0,333	0,333	0,333	0	+	250	350	450	50	10
11	1	0	0	+	-	250	-	-	75	10
12	0	1	0	+	-	-	350	-	75	10
13	0	0	1	+	-	-	-	450	75	10
14	0	0,5	0,5	+	0	-	350	450	75	20
15	0,5	0,5	0	+	-	250	350	-	75	10

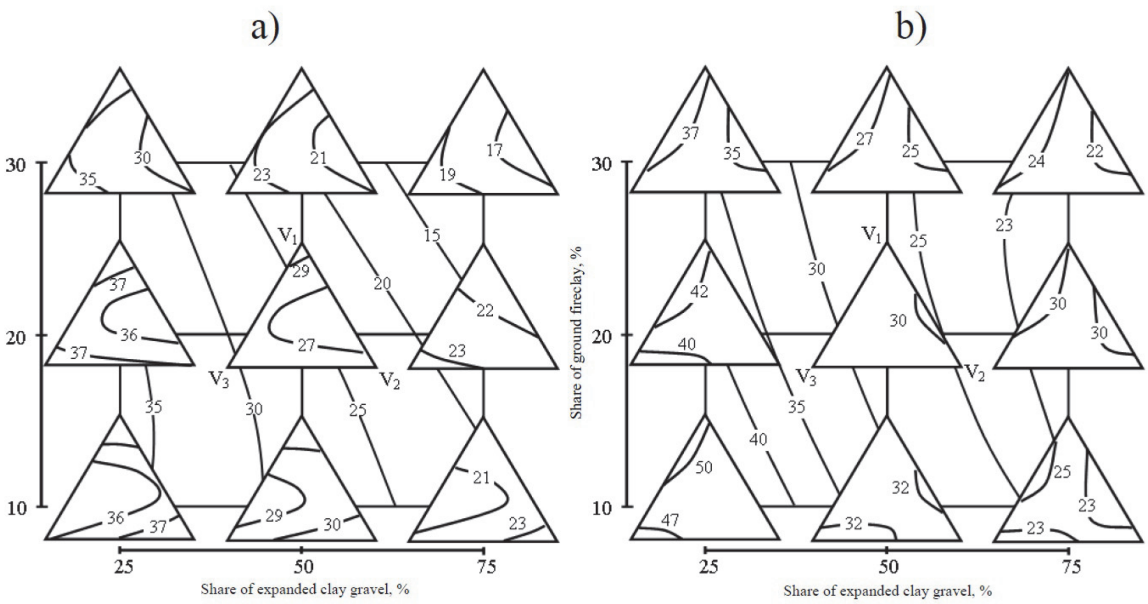

Figure 1 Effect of formulation and technological factors on Rcom of composite concrete
a) – control
b) – concrete on mechanically activated binder

Analysis of dependency shows that if we increase the number of expanded clay gravel then the concrete strength decreases. So we can say that if Rcom concrete on mechanically activated binder with a content of 25% expanded clay gravel mixes with aggregates of "crushed granite - expanded clay gravel" is 50.2 MPa, when the content of 75% expanded clay gravel makes compressive strength of 24.6 MPa. Concrete on binder without mechanical activation increases expanded clay gravel from 25 to 75% and at the same time reduces the strength of the concrete from 38.6 to 23.8 MPa.

By fixing mixed factors on the specific surface area (v1 = 1; v2 = 0; v3 = 0), we obtain a graph reflecting the effect of the content of expanded clay gravel on the compressive strength of concrete (Fig. 2).

In general, mechanochemical activation binder increases the strength of the concrete as compared to the control samples. The degree of increase in concrete strength on mechanically activated binder compared to the one without mechanical activation are strongly influenced by the amount of filler and expanded clay gravel.

4. CONCLUSION

It was established by conducting an experiment that the introduction of the heavy concrete hydrophobic expanded clay gravel produces lightweight concrete average density of 2000 kg/m^3 to 1850 kg/m^3 and the strength of 29 MPa to 25.6 MPa. Mechanochemical activation binder produces concrete with the same average density with a compressive strength of 34 MPa to 30.5 MPa.

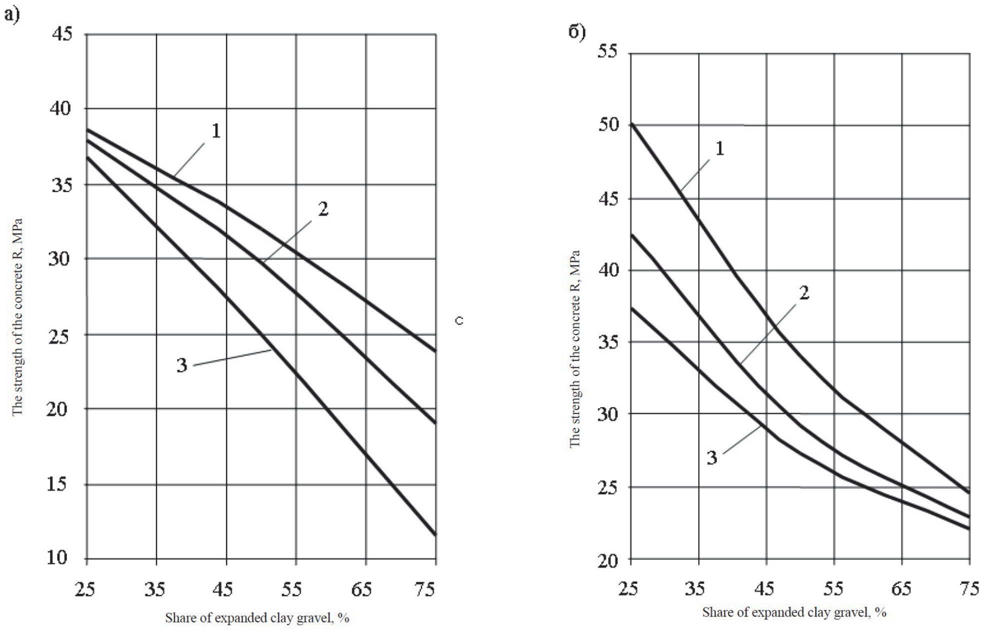

Figure 2 Effect of the number of expanded clay gravel for concrete strength:
a) without mechanical activated binder
b) mechanical activated binder;
1,2,3 - ground fireclay content respectively 10%, 20%, 30%

4. CONCLUSION

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