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ESTABLISHING THE PARAMETERS OF SOLAR CHAMBERS FOR HEAT TREATMENT OF PRODUCTS MADE OF HEAVY CONCRETE FROM THE STANDPOINT OF PHYSICAL PROCESSES TAKING PLACE IN CONCRETE

Usmonov Farkhod Bafoevich,
Andidate of Technical Sciences, Associate Professor of the Department
Construction of Buildings and Structures» BITI.

ABSTRACT:

On the basis of experimental studies, the optimal technological parameters of the solar chamber have been established, such as the filling factor of the chamber with freshly laid concrete, the distance from the top of the concrete to the bottom of the solar coating from the position of the best heating and the increase in the strength of concrete in the solar chamber by ensuring the daily turnover of forms, as well as the physical processes taking place in it.

Keywords: concrete, concrete mix, helioca mera, helium coatings, shrinkage, plastic shrinkage, dehydration, strength, heat treatment, solar thermal treatment.

INTRODUCTION:

Studies carried out at NIIZhB [1] indicate the importance of taking into account the filling factor of their freshly made concrete mixture (Кzap) and the distance from the upper surface of the concrete to the bottom of the helium coating (δпр) during heat treatment in solar chambers; - heat-insulating expanded clay concrete has an ambiguous effect on the thermal and mass transfer processes taking place in concrete.

In the case of solar thermal treatment of heavy concrete in solar chambers, this issue is even more relevant, since if, in addition to strength indicators, there are also requirements for products made of structural and heat-insulating concrete for residual moisture, i.e. the need for drying, then for products made of heavy concrete it is necessary to create hardening conditions with a maximum, close to 100% relative humidity in order to minimize the physical destructive processes caused by a dry hot climate [2,3,5]. To establish the parameters of solar thermal treatment of heavy concrete in solar chambers in order to obtain high-quality products, we compared the conditions of solar thermal treatment, when in the first case, δпр = const and Кzap are variable and, in the second case, Кzap = const and δпр variable.

The characteristics were compared: maximum dehydration rate, moisture loss by the end of the drying period (ΔW / W), on samples 10x10x10 cm with Mot.p. = 10-1 the maximum value of plastic shrinkage ((Δl) / l), on samples 10x10x10 cm with Mot.p = 10 m-1, daily maturity of concrete (S, deg.h), daily compressive strength of concrete (Rszh), compressive strength of concrete at the age of 28 days, hardened during the first day under compared conditions. The results measurement scheme is shown in Fig. 1.

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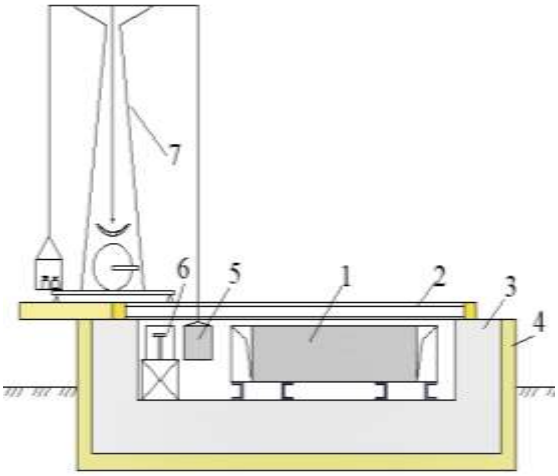
The experiments were carried out on concrete of the composition 1: 2.82: 3.99 (W/C = 0.65) with the following components: Navoi Portland cement M400, granite gravel F_r = 5-20 mm, quartz sand M_{kr} =2.24. The results of the experiments are summarized in Table-1 and in Fig. 2.

From table -1 it can be seen that while maintaining $\delta_{пр}$ = 2 cm = const, a change in K_{zap} in the range from 0.2 to 0.5 does not lead to destructive consequences during hardening of concrete in a solar chamber, since J, located in close within the limits leads to such a slight dehydration (5-6.5%) and plastic shrinkage (0.38-0.52 mm / m) that the samples hardened for 1 day. under these conditions in the solar chamber, then at the care post until the critical strength of the relative moisture loss $\mathbf{R_w^{kr}}$, and then hardened for up to 28 days under natural conditions, basically showed a strength equal to or exceeding $\mathbf{R_{28}^{nh}}$, At the same time, concrete gained 50- 58% $\mathbf{R_{28}^{nh}}$, at day-old age.

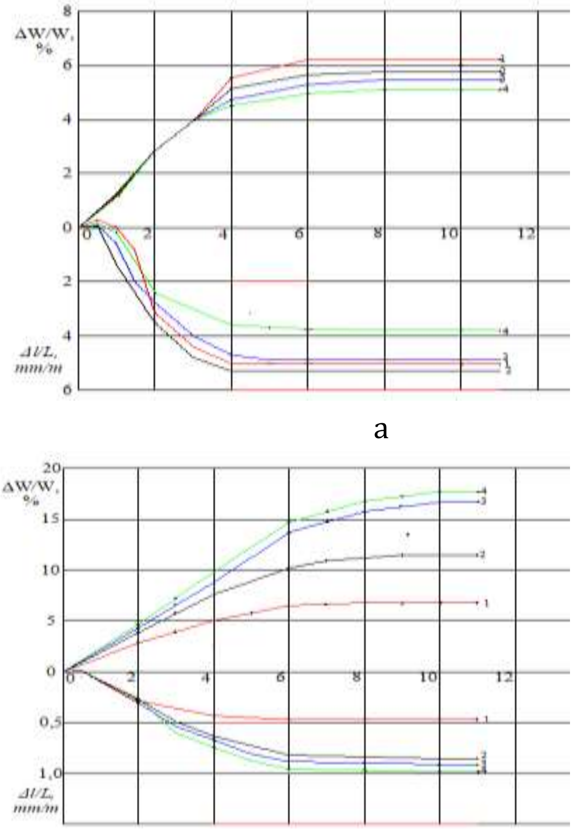


Fic. 1. Fragment of measurement of moisture loss and the amount of plastic shrinkage of concrete. 1- concrete hardening in the solar chamber; 2- SWITAP cover; 3-thermal insulating solar chamber, concrete walls 150 mm thick; 4- heat-insulating glass wool layer 8-10 cm thick; 5 - a sample for studying the dehydration of concrete slurry; 6 - a sample for studying the plastic shrinkage of freshly laid concrete; 7-scales.

Table 1. Characteristics of heavy concrete during their solar thermal treatment in a solar chamber

№ p/p	K_{zap} cameras	δ_{pr}, cm	J, кг/(м^2 ch)	ΔW/W, %	Δl/l, mm/m	S, hail • hour	R_{com} 1 days МПа	R_{com} at the age of 28 days МПа	R_{28}^{nh}, МПа
1	2	3	4	5	6	7	8	9	10
1	0.5	2	0.2	5.9	0.52	1191	17.5	30	30.2
2	0.4	2	0.2	6.0	0.5	1131	15.97	39.5	28.7
3	0.3	2	0.22	6.5	0.5	1169	13.8	25.6	24.8
4	0.2	2	0.22	5.0	0.38	1159	13.3	26.6	27.3
5	0.3	5	0.3	11.6	0.86	1239	12.8	27.8	30.2
6	0.3	10	0.35	17.4	0.93	1242	11.4	22.3	25.1
7	0.3	15	0.45	18.16	0.94	1225	13.3	26.8	28.2

Even when creating a distance between the concrete surface and the bottom of the helium coating of 5 cm at K_{zap} = 0.3, a seemingly insignificant change in J = 0.3 (in comparison with 0.2-0.23) leads to a significant increase in moisture loss of -11.6% and plastic shrinkage 0.86 mm / m, daily strength was 42% $\mathbf{R_{28}^{nh}}$, and the strength of heliothermally treated concrete at the age of 28 days was 92%$\mathbf{R_{28}^{nh}}$. A further increase in the distance $\delta_{пр}$ up to 10 and 15 cm at K_{zap} = 0.3 = const, leads to an aggravation of the flow of physical processes in the freshly laid concrete mixture, which led to a shortage of compressive strength at the design age while maintaining all other technological aspects of the norms [4], constituting 5-7% to loosening of the concrete structure and other consequences. The research data indicate that during the solar thermal treatment of heavy concrete in the solar chamber, it is necessary to create special hardening conditions, limiting both the distance from the surface of the freshly laid concrete to the bottom of the solar coating and the filling factor of the chamber with the freshly formed concrete mixture.



a

b

Fig. 2. Dehydration and plastic shrinkage of freshly laid concrete hardened under various conditions: a - δпр = 2 cm = const, Кzap - variable, incl. 1 - K_{zap} = 0.4; 2 - K_{zap} = 0.5; 3 - Kzap = 0.3; 4 - K_{zap} = 0.2; b - K_{zap} = 0,3 = const, δпр - variables incl.
1- δ_{pr} = 2 cm; 2- δ_{pr} = 5 cm; 3-δ_{pr} = 10 cm; 4-δ_{pr} = 15 cm

Such a limit should be $\delta_{пр}$ = 2-5 cm and K_{zap}≥0.2, which create a moisture-saturated zone between the upper surface of the concrete and the bottom of the heliopathing providing a favorable condition for concrete hardening and strength gain at day-old age 50-60% R_{28}^{nh} . The research data indicate that during the solar thermal treatment of heavy concrete in the solar chamber, it is necessary to create special hardening conditions, limiting both the distance from the surface of freshly laid concrete to the bottom of the solar coating and the filling factor of the chamber with freshly formed concrete mixture. Such a limit should be δпр = 2-5 cm and $К_{zap}$ ≥ 0.2, which create a moisture-saturated zone between the upper surface of the concrete and the bottom of the helium coating, which provides a favorable condition for hardening of concrete and gaining strength at a daily age of 50-60% R_{28}^{nh}.

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