PHYSICAL AND MECHANICAL PROPERTIES OF CONCRETE UNDER CONDITIONS OF DRY HOT CLIMATE.

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Compressive and tensile strength. Hardening of concrete in a dry hot climate leads to a change in its strength compared to a similar characteristic obtained for concrete hardening under normal temperature and humidity conditions. These changes are mainly associated with the physical and chemical processes occurring in the hardening concrete during which determines the regularity of the manifestation of strength characteristics. The combined variable effect of temperature, solar radiation and low relative humidity leads to a change in strength.

In this case, the noted changes depend on the age of the concrete. To establish the nature of the change in the strength of concrete over time, the results of testing samples hardening in the open air under the influence of solar radiation and protected from solar radiation in the workshop after 7 days of wet storage of concrete in wet sawdust were analyzed. The samples were made in July, when the air temperature was 35 and humidity - 20%.

In table. 3.1 shows the results of experimental studies showing the kinetics of changes in the strength and deformation characteristics of concrete over time under short-term loading.

A comparative analysis of the data given in Table 1 shows that at the age of 28 days, concrete hardened in the open air under solar radiation reveals a shortage of cubic and prism strength within 5-10% in relation to concrete hardened in the workshop and protected from solar radiation. radiation.

The decrease in the values of these indicators, in all likelihood, is associated with the destructive processes occurring in concrete during its hardening in natural conditions of a dry hot climate.

At an early age of concrete in a dry hot climate at elevated temperatures, a more intensive increase in the strength of concrete occurs than under normal conditions. During the year, the increase in strength during storage in the open air under the influence of solar radiation reached 8%, in the workshop 11% of the strength of concrete in 28 days (Table 1).

At the same time, from the data in the table, one can also notice the absence of a significant increase in the strength of concrete in the latest hardening periods under natural conditions in a dry hot climate.

Tab .1

Условия твердения	Возраст бетона /сутки/	$R\,\frac{МПа}{\%}$	$R_b\,\frac{МПа}{\%}$	K_{BC}	$R_{bt}\,\frac{МПа}{\%}$	$E\,\frac{МПа}{\%}$	$\varepsilon_{bc} \times 10^{-5}$
Под влиянием солнечной радиации	28	$\frac{16.6}{100}$	$\frac{14.4}{100}$	0.86	$\frac{1.8}{100}$	$\frac{20400}{100}$	$\frac{125}{100}$
	60	$\frac{17.5}{106}$	$\frac{14.9}{103}$	0.85	$\frac{1.70}{0.94}$	$\frac{20600}{100.9}$	$\frac{128}{102}$
	180	$\frac{17.8}{106}$	$\frac{15.1}{104}$	0.84	$\frac{1.78}{0.98}$	$\frac{21000}{102}$	$\frac{133}{100}$
	360	$\frac{18.0}{108}$	$\frac{15.3}{106}$	0.85	$\frac{1.81}{100}$	$\frac{24600}{100}$	$\frac{136}{108}$
В тени	28	$\frac{19.8}{100}$	$\frac{17.5}{100}$	0.88	$\frac{2.03}{100}$	$\frac{24600}{100}$	$\frac{118}{100}$
В цеху t= 25…35℃ w= 65…70 ℃	60	$\frac{20.9}{105}$	$\frac{18.1}{105}$	0.86	$\frac{2.2}{108}$	$\frac{25200}{102}$	$\frac{120}{101}$
	180	$\frac{21.4}{108}$	$\frac{18.8}{107}$	0.87	$\frac{2.3}{113}$	$\frac{26000}{105}$	$\frac{123}{104}$
	360	$\frac{22.1}{123}$	$\frac{19.0}{108}$	0.86	$\frac{2.5}{123}$	$\frac{26400}{107}$	$\frac{126}{106}$

The increase in the prism strength of concrete exposed to solar radiation was less intense than the increase in the prism strength of concrete in the workshop and amounted to 6% per year, respectively. The prismatic strength of concrete during the year of being in a dry hot climate under the influence of solar radiation increased to a lesser extent than the cubic strength. Of practical interest are the results of determining the coefficient of prism strength Kvs. So, for example, according to SNiP 2.03.01-96, the Kvs value is assumed to be the same for light and heavy concretes and must be at least 0.72.

The obtained data on the coefficients of prism strength Kvs presented in Table 1 indicate some influence of hardening conditions. A decrease in the average value of Kvs to 8% was established during concrete hardening under the influence of solar radiation.

As follows from Fig. 1, the experimental data on the coefficient of prism strength of specimens in a dry hot climate in natural conditions do not coincide with the experimental points for concrete under normal conditions.

The tensile strength of concrete exposed to solar radiation is less than the tensile strength of concrete in the workshop. This can be explained by an increase in air temperature and a decrease in its relative humidity. Tensile strength at the age of 28 and 360 days when stored outdoors under the influence of solar radiation, respectively, is lower by 12% and 14% than the tensile strength of concrete located in the workshop. The significant difference between the tensile strength of concrete hardened in a dry hot climate and under normal conditions is the result of stresses from temperature and humidity gradients, leading to stress in concrete. The change in the strength of concrete in a dry hot climate is the result of the influence of cyclic daily and seasonal changes in temperature and humidity of the environment.

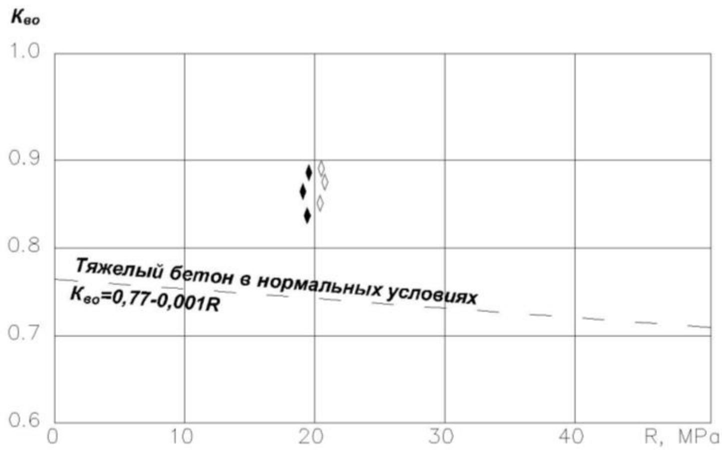

Fig.1 Coefficient of prismatic strength of concrete in a dry hot climate.

--- under solar radiation.

--- in a dry hot climate in the shop;

If the increase in the strength of concrete over time under normal hardening conditions is of a continuous increasing nature, then this is not observed here due to the influence of the external environment, which gives some features to the ongoing physical and chemical processes in the concrete structure. In a dry hot climate, in addition to temperature, low relative humidity affects concrete. This causes a change in the hygrometric state of the concrete. Under the influence of solar radiation, the strength changes to a greater extent than for concrete protected from direct sunlight.

Figure 2 shows the experimental values of the compressive strength of concrete under the influence of solar radiation /3/ and in the workshop /4/ The regularity of the increase in the strength of heavy concrete under normal conditions according to the logarithmic dependence is also shown,

$$R_{\tau} = R_{28} \cdot \frac{lg\tau}{lg28} \qquad (1)$$

Где R_{τ} – strength of concrete aged .

strength of concrete at the age of 28 days. age of concrete, days.

The estimate of the increase in the strength of concrete according to formula (1) was derived based on the analysis of extensive experimental data obtained for concretes of various strengths, hardening under normal conditions.

Experimental data obtained in work /73/ in relation to concrete hardening under normal conditions also correspond to the established theoretical regularity according to (1).

However, in dry hot climates, the compressive strength is less than in normal conditions. The greater the effect of dry hot climates on concrete, the greater the divergence of concrete strength values compared to normal storage.

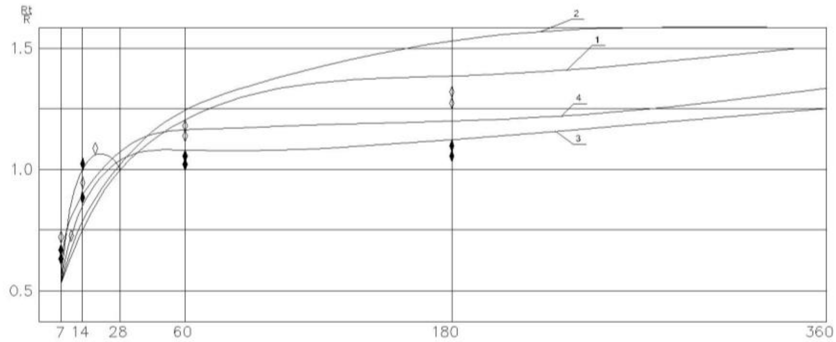

Fig2 The nature of the change in the strength of concrete over time during hardening under normal conditions and in a dry hot climate.

1 and 2 - according to the logarithmic dependence for concrete with a strength of 20 and 15 MPa under normal conditions;

3- under the influence of solar radiation (dark dots);

4- in a dry hot climate in the workshop (light dots)

The strength of concrete also depends on the time of year of manufacture.

Thus, under natural conditions, the strength of concrete is significantly affected by the season of its preparation, the degree of completion of the hydration process, and the hygrometric state of concrete at the time of application of the load.

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