USE OF SOLAR ENERGY IN HARDENING OF CONCRETE

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Abstract: *This article presents the results of experiments on physical and mechanical properties of the physical processes that occur during the hardening of concrete in dry hot climate seasons and issues of reducing and eliminating their negative effects.*

Key words: *dry hot climate, evaporation, plastic shrinkage, concrete maintenance, ambient temperature, continuous evaporation.*

In natural conditions with high ambient temperature and very low humidity, the delayed start or failure to take care of the poured concrete at the initial time, causes a violation of the physical and mechanical properties compared to the concrete that hardens under the standard requirements, and ultimately causes a decrease in the strength of the concrete. [1 .2.3.4.5.6.9.13.16.18.20].

Climates that have adverse effects on concrete curing is the continuous evaporation on the exposed surface of concrete. Continuous evaporation of moisture from freshly placed concrete in hardening concrete always depends on continuous evaporation j (kg/m ^{2} s), Δm-concrete weight, Δτ-weight lost over time and F-evaporating surface, which is expressed as follows:

$$j = \frac{1}{F} * \frac{\Delta m}{\Delta \tau} = const$$

In this interval, the exchange of external balance has the greatest value, causing continuous evaporation on the surface of concrete, which at this time does not correspond to the internal balance of concrete . As a result, there is a break between the complete transfer of moisture from the inner layers of concrete to its surface (evaporative surface moisture transfer). This, in turn, is the size of the evaporation area, the pressure of the vapor released from the surface , as well as the speed of movement of the environment [2.13.18.24.28.29.33.35.36].

Results of the experiment showed that in concrete that has not been maintained or insufficiently maintained since the initial period, dehydration (evaporative moisture loss) occurs in the amount of 50-70% of the total water consumption spent on the concrete during the first day. Most importantly, this indicator occurs within 6-7 hours from the initial period. Evaporation, which occurs at a large rate in such an interval, has a negative effect on the densification and interconnection of newly emerging internal structures in concrete. Reduces moisture content enough for cement particles to fully bond with water. As a result, the cement-water ratio is disturbed and its cross-linking significantly deviates from the standard requirement level or stops completely. As a result, the premature loss of moisture in the hardening concrete causes the specific density of the concrete to change dramatically.

Continuous evaporation causes significant initial shrinkage in concrete, radical changes in its physico-mechanical structure in dry and hot climates. During the initial hardening of concrete, plastic shrinkage occurs when the new concrete solution is in a soft state that has not yet hardened. As a result, it causes the appearance of small cracks and other small defects on the surface of the concrete being formed.

Conducting research in natural conditions is mainly aimed at fulfilling the equality $(\frac{\Delta l}{l})_{max} * f_{(j)}$. Some separate experiments were carried out at different times of the year, sometimes for 6-7 months (Fig. 1).

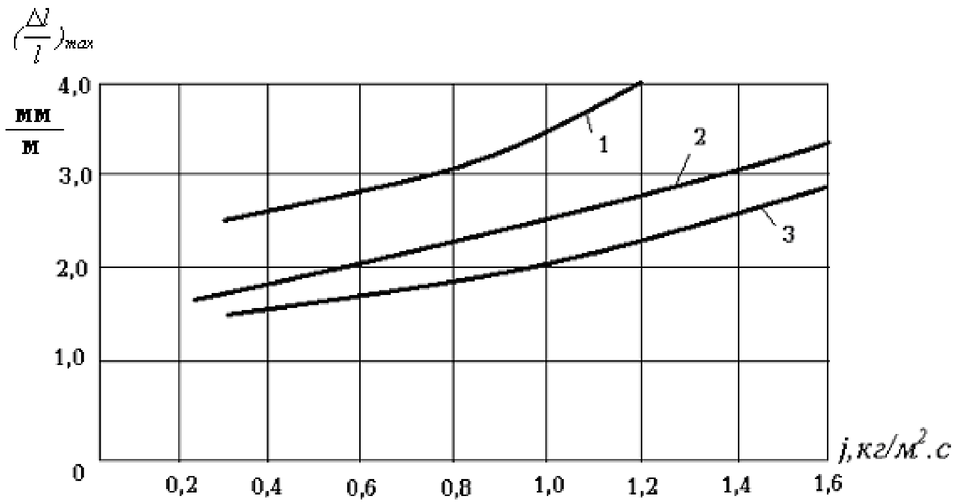

Fig. 1. The amount of plastic shrinkage resulting from continuous evaporation depends on the amount of water used for concrete hardening.

Experiments have shown that plastic shrinkage occurs significantly after 2.5-3.0 hours in concrete hardening in dry and hot climate conditions, and it continues imperceptibly in concrete stored in standard conditions in later periods. In such conditions, the water absorption index of hardened concrete decreases by 8-10 times, and the frost resistance decreases significantly.

The results of the experiment showed that it is necessary to take care of the concrete surface hardening in dry and hot climates with certain coatings or special coatings that create a hermetic dense condition on the surface. In this case, the gap layer between the concrete surface and the coating is of great importance. That is, the larger the space between them, the greater the dehydration in the upper layer of concrete. As a result, the "plastic shrinkage" of concrete is also $(\frac{\Delta l}{l})_{max} = f_{(i)}$greater [3.6.7.9.11.18.19.25.28.30.34].

the experiment, the types and descriptions of the used materials were changed. The effect of wind was not taken into account. The results of the experiment showed that the plastic shrinkage occurring in the hardening concrete in dry hot climate conditions depends on the amount of water leaving its surface, i.e. "evaporation". If the non-stop evaporation indicator - *j is 0.2* $0.3 \le j \le 1.0 \div 1.1$ kg/m ^{2} hours in the following intervals , $\div (\frac{\Delta l}{l})_{max}$ amount is the same or changes imperceptibly and this value $j \ge 1.1$kg/ When m is ^{2} hours, we observe that the $(\frac{\Delta l}{l})_{max}$ indicator gradually increases (Fig. 2).

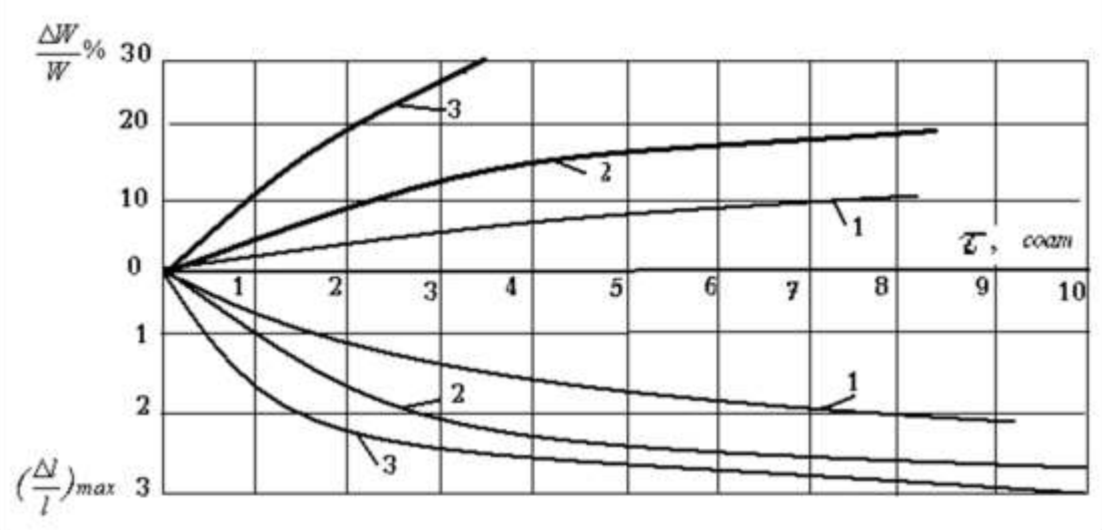

Fig. 2. In continuous evaporation of concrete (*j*, kg/m ^{2} hours) its plastic shrinkage and

show water inside 1. ***if*** ***_ _ _j = 0.077; 2. if j =0.28; 3. if j =0.65***

The increase in the rate of evaporation from the surface of the hardening concrete, if it is greater than the indicator of 1.0-1.1 kg/m ^{2} h, then it causes an increase in the value of $(\frac{\Delta l}{l})_{max}$, *which, in our opinion, significantly increases the value of* j -value, the condition in concrete and in very small spaces depends on the appearance of the voltage indicator.

Once again, it can be said that the amount of "plastic subsidence" caused by continuous evaporation ÷remains unchanged in the interval of $0.2\ 0.3 \le j \le 1.0 \div 1.1$ kg/m ^{2} hours , but the significant indicator of its rate of occurrence is the quantity *j* clearly defines [3].

Therefore, the larger the value of - *j* , the faster the "plastic subsidence" that occurs in it (Fig. 3).

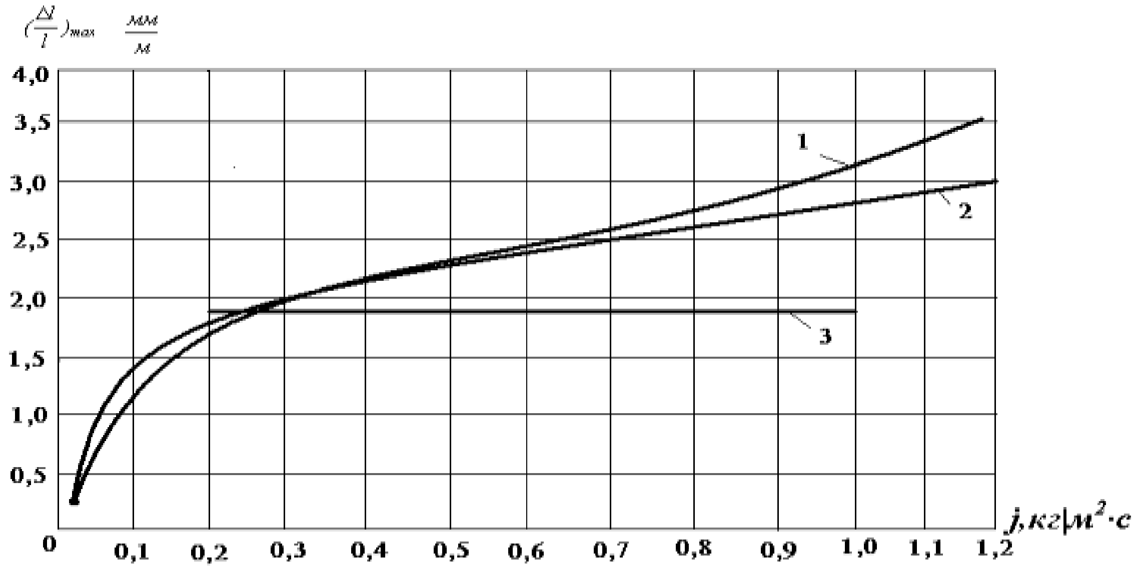

Figure 3. The amount of bonding in the largest plastic shrinkage caused by continuous evaporation of concrete: *j, kg/m* ² ·*s* according to the results of experiments in 1) and 2)-different series . 3) Results determined by [1].

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