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STUDY OF THE EFFECT OF DRY-HOT CLIMATE ON THE FORMATION OF CEMENT CONCRETE STRUCTURE

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Abstract:
The effect of dry - hot climatic conditions on newly laid cement concrete coverings on highways is the effect of cement concrete coating on project leveling.

Keywords: concrete pavements, highway, conservative, high temperature, chemical additives.

Introduction

The increase in the strength of cement concrete depends in many respects on the temperature-humidity conditions. The most favorable conditions for the growth of concrete strength are considered to be storage of concrete initially at a low positive temperature and then at normal or high temperature.

Acceleration of concrete hardening in natural conditions can be achieved by the following methods: use of highly active and fine-grained cements; reducing the water/cement ratio due to the use of plasticizers and superplasticizers; increase cement consumption; use of chemical additives that accelerate solidification.

According to the conclusions of many researchers, high temperature leads to an increase in the initial strength of concrete, and a decrease in the final strength. The reason for this is that due to the formation of a relatively dense shell around the cement particle being hydrated under the influence of high temperature, it becomes difficult for water to enter the cement particle and the hydration process slows down, and in some cases it stops completely.

Determining the retention period of cement in dry-hot climate is of practical importance. Below are the results of research conducted in this direction (Table 1).

As can be seen from the table, an increase in temperature leads to a significant reduction in the period between the beginning and end of the hardening period of cement. The holding period of the cement mixture prepared in the composition of 1:3 is much shorter than that of cement porridge, and the period for the concrete mixture is even shorter.

Table 1 **Change of the hardening period of cements depending on the temperature**

Type of cement	Temperature ^0C	Hardening time, hours - min	
		the beginning	The finishing
Portland cement	70	0-40	0-55
	50	1-00	2-00
	30	1-45	2-45
	15	3-00	6-10
	5	4-45	14-40
	0	8-00	25-35
Slag portland cement	70	1-05	1-45
	50	1-45	2-45
	30	2-15	5-40
	15	3-55	10-45
	5	5-20	23-15
	0	7-45	37-25

In a dry-hot climate (high temperature and low air humidity), the water mixed during concrete hardening starts to evaporate rapidly.
Hydration of water necessary for cement hydration adversely affects the process of hardening and structure of newly laid concrete and reduces its quality and durability.
In dry-hot climates, as a result of evaporation of water mixed from freshly laid concrete, interconnected pores are formed in the concrete, which lead to the defect structure of the concrete. As a result of the evaporation of the mixed water, the cement hydration process does not take place completely and the concrete does not get the required strength.
In order to improve the deformation and physical-mechanical properties of concrete, it is necessary to prevent the evaporation of water mixed with it during the hardening process.
One of the main problems in concrete work in dry hot climates is to reduce or eliminate various physical destructive processes at the beginning of the concrete hardening process. One of these problems is the formation of elastic sag in freshly laid concrete, resulting in cracks (cracks) in the concrete.
As a result of uneven distribution of water mixed in concrete and its evaporation from the capillary-pore body under the influence of high temperature, large impermissible shrinkage deformations are formed and cracks and other defects appear in concrete [1].
Rapid dehydration of hardening concrete in a low-humidity environment adversely affects the hydration mechanism of cement stone, causing large elastic and general shrinkage and the formation of cracks in devices.
In a dry hot climate, elastic shrinkage in concrete is one of the main factors of physical destructive processes (having a negative effect on concrete structure) and deterioration of physical and mechanical properties [2].
As can be seen from the above, due to the fact that the elastic shrinkage that occurs in concrete hardening in dry hot climates has a negative effect on the concrete structure, this issue should be given serious attention.
Dry hot climate greatly affects the formation of the concrete structure and the speed of its hardening. Accelerating the hardening of concrete by various methods and making it strong

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enough to withstand the effects of the climate will lead to a well-formed concrete structure. The temperature and humidity conditions listed in Table 1.5 should be taken into account when designing the concrete mixture for dry and hot climates. It is necessary not only for the hardening of the structure, but also for the steps of preparing the mixture, laying it and laying it on the mold or formwork [3].

Table 2 **Temperature and climate conditions of Uzbekistan.**

Time	Air temperature, °C	Humidity, %	Wind speed, m/s	Concrete mixing temperature, °C	Hydration of moisture, $g/m^2.h$
In the morning	22-25	44-63	1-6	35-42	733 - 820
During the day	32-39,5	40-46	4-7		1013-1172
In the evening	35-38	32- 48	4-8		960 - 1002
Night	19-23	49-72	2-4		220 - 500

Based on the average values of a large number of experiments, data on the increase in strength of concrete made of cements of different types and brands at temperatures from 1 ^{0}C to 40 ^{0}C are presented in Table 3. The results in the table are obtained on the basis of samples made of concrete mixture with a flowability (cone subsidence) of 1-3 cm.

Table 3 Relative compressive strength of concrete at different curing temperatures change in consistency.

Cement type and brand, concrete brand	Hardening time of concrete, A day	The relative strength of concrete at the following values of the average hardening temperature (^{0}C) (in % compared to the design strength)					
		1	5	10	20	30	40
Based on 400 grade Portland Cement 300 grade concrete	1	5	9	12	23	35	45
	2	12	19	25	40	55	65
	3	18	27	37	50	65	77
	5	28	38	50	65	80	90
	7	35	48	58	75	90	100
	14	50	62	72	90	100	-
	28	65	77	85	100	-	-
400 based on slag portland cement 300 grade concrete	1	3	6	10	16	30	40
	2	8	12	18	30	40	60
	3	13	18	25	40	55	70
	5	20	27	35	55	65	85
	7	25	34	43	65	70	100
	14	35	50	60	80	100	-
	28	40	60	80	100	-	-

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