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LOSS OF PLASTICITY BY CEMENT SYSTEMS DURING TIME

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ABSTRACT

The article presents, in the conditions of concrete supply to the place of laying and the production of concrete placement in a block in hydraulic engineering, such that slowing down the time of loss of plasticity and setting of concrete mixtures is of considerable interest. In this regard, an attempt was made to model these processes to a certain extent in relation to large-scale hydraulic engineering. Mortars were prepared on various cements and their plasticity was determined at different times by measuring the diameter of the spreading of the mortar cone. Measurements were taken every hour. In the intervals between determinations, the solutions were stored in metal cups at a temperature of -28-300 and a relative humidity of 60%. The results of these studies are shown in Table 1.

TABLE 1 LOSS OF PLASTICITY OF CEMENT SYSTEMS OVER TIME (MORTAR 1: 3)

itive type	Dosage %	The plasticity of the solution (under the line, the diameter of the spread in the axis under the line in%) after holding for					
		0	1	2	3	4	5
1	2	3	4	5	6	7	8
No additive	-	20 100	12,2 61	12,5 62	12,3 62	12,3 62	_-__ -
SZhK C7-C9	0,10	21,3 100	20,8 98	20,3 95	20,6 97	19,5 92	18,5 87
SZhK C10-C16	0,10	22,3 100	21,3 95	22,8 102	22,1 99	21,8 98	21,5 95
SZhK C17- C20	0,1	21,4 100	23,4 105	22,2 100	21,2 95	19,4 87	18,0 81
Cube leftovers	0,2	22,1	19,1	18,0	17,1	16,4	15,4

		100	89	84	80	77	72
OP	0,2	22,1 100	22,1 100	22,1 100	20,3 92	19,7 89	18,6 84
No additive	0,1	12,9 100	11,3 88	11,5 89	11,2 86	11,2 86	
SZhK C7-C9	0,1	13,6 100	13,5 99	10,5 99	13,2 97	12,9 95	
SZhK C10-C16	0,1	13,5 100	13,5 100	12,9 95	13,0 96	13,0 96	
SZhK C17-C20	0,2	13,3 100	13,3 98	13,0 98	12,7 96	12,2 92	
Cube leftovers	0,2	13,5 100	13,3 99	13,2 98	13,0 97	13,0 97	
OP		22,1 100	22,1 100	22,1 100	20,3 92	19,7 89	

As can be seen from the data presented, surface-active additives, having a flocculating effect on cement systems and increasing their resistance to delamination, at the same time significantly slow down the loss of plasticity of the systems. The thixotropic handling capability of surface-active cement systems is especially noticeable in hard mortars and concretes. The smallest loss of plasticity is achieved with the introduction of bottoms, the largest with the addition of FFA fractions C10-C16 and oxidized petrolatum. Solutions with these additives retain a sufficiently high plasticity even after three hours of exposure to air. Similar results were obtained with concrete mixes. It is known that the homogeneity of the concrete mix largely determines the physical and technical properties of the hardened concrete. In hydraulic structures, the homogeneity of the concrete is especially important. The homogeneity or uniformity of concrete depends on many factors and varies significantly during one work shift at the same construction site. The most important factors on which the homogeneity of concrete depends are the plastic-viscous properties of the concrete mixture, the type and nature of the operation of the mixing equipment, the methods and conditions for transporting and placing concrete in the structure.

Since surface-active additives make it possible to actively regulate the plastic-viscous properties of concrete mixtures, work was undertaken to clarify the effect of surfactants on the homogeneity of concrete and a relationship was established between the homogeneity of concrete and its compressive strength. To determine the homogeneity of concrete mixtures, a method specially developed by the laboratory of cement-concrete materials of the IISS was used to determine the homogeneity of various cement systems, since the existing methods and the criteria adopted for assessing the degree of homogeneity of powder and suspension mixtures used for the manufacture of various building materials allow indirectly, not objectively enough, and only with the expense of a large amount of time, to judge the homogeneity of the mixtures achieved in the mixing process, the subsequent stratification of the main components during transportation and molding, to evaluate the efficiency and optimal parameters of the existing and newly created mixing equipment. This method for determining homogeneity is based on the use of one of the mixture components colored with special luminescent substances. To prevent the erasure of the phosphor from the surface of the reduced component during the mixing process and its transition into the mixture, a water-insoluble light-yellow homogen was chosen; fixing on the surface of the powder under study was carried out using waterproof adhesives, for example, VF-4. For coloring 1 kg. Powder requires 2 g of phosphor. The labeling component is introduced into the test mixtures in an amount of 0.05-0.1% of the weight of dry components.

Determination of the distribution of the labeled component in the mixture can be carried out visually or using a photoelectronic installation. The fastest and most accurate determination of homogeneity is obtained using a photoelectronic installation, which includes an MBS-2 stereoscopic microscope, a photomultiplier, and an electronic scaler.PS-10000. The principle of operation of the installation is reduced to measuring a part of the luminous flux reflected from the considered area of the surface.

The magnitude of the reflected monochromatic luminous flux and the metering rate of the PS-10000 device under optimal operating conditions of the entire installation are linked by a linear relationship [9]. In the general case, when studying the surface of a mixture containing n components, each of which has the same reflection coefficient at all its points, depending only on the wavelength of the light wave, the counting rate is linearly related to the area occupied by each component in the area under consideration. The ratio of the area occupied by any component to the area of the entire area bounded by the diaphragm is called the surface content of this component in the area under consideration.

To study the homogeneity of the mixture at a given technological stage of its processing, a sample was taken, on the surface of which a grid was applied, after which the sample was illuminated with an ultraviolet spectrum.

When visually determining the surface content, the number of points (for example, luminescent grains of sand) was counted, and when working on the photo electronic one on the site under consideration. Studies of the distribution of the number of sites by the volumetric content of components have been established. That with sufficiently large measurements of the area exceeding the size of the particles, in the particular case the size of the aggregate, this distribution obeys the normal law. The normal distribution, as is known, is determined by two parameters: the mean X and the standard deviation of the random variable δ [22].

The parameter X indicates whether the center of the grouping of the random variable "x", and the parameter δ, being the standard deviation, characterizes the spread of the values of the quantity "X".

Thus, the standard deviation of the volumetric content, calculated for a site in m cm2, can serve as a quantitative and objective characteristic of the uneven distribution of a given component in a mixture. In fig. Figure 1 shows the normal distribution curves of the marked sand in the concrete mixture typical for this method. Kryva I refers to a concrete mix made in 1500 liters, a free fall concrete mixer, and roofing 2 refers to a mix made in 1000 liters, a forced-action concrete mixer with additional selection devices.

As follows from this graph, the heterogeneity of the concrete mix on a conventional mixer is about 12%, while the mix on the mixer has a heterogeneity of 5.7%.In fig. 1 is a graph showing the effect of the duration of movement on the homogeneity of the concrete mixture and the strength properties of concrete; the construction of such curves for any mixing unit will allow you to choose the optimal duration of mixing, taking into account the obtained strength characteristics of concrete.

Special studies were carried out to establish the effect of surface active additives on the homogeneity of concrete. It is known that minor deviations from the optimal water-cement ratio from the optimal, which often occur in the production of hydraulic concrete, reduce the homogeneity of concrete and its water resistance, frost resistance and other properties.

As our studies have shown, surface-active additives in concrete mixtures under intense mechanical stress have a plasticizing effect, and in a calm state and even with weak shaking they exhibit a special "flocculating" effect, causing the formation of coagulation structures, increasing the "hardness" of the concrete mixture and its value ultimate shear stress. Therefore, concrete on hydrophobically plasticized cements is better mixed in mixing units, much less delamination during transportation and disposal, especially in the case of compaction using deep vibrators, which are characterized by strong local impact. The results of these studies are translated in Table 1. number of sites percentage

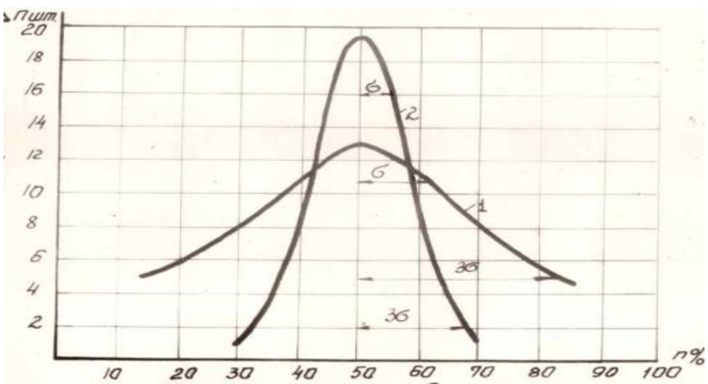

Figure: 1. Influence of the mixing method on the homogeneity of the concrete mixture: 1-Concrete mix prepared in a free fall concrete mixer. 2-Concrete mix prepared in a forced-action concrete mixer with additional vibration devices.

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