Development of a Method for Measuring the Layered Moisture State of Concrete and Various Bases

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ABSTRACT

To determine the resistance of concrete, an automatic AC bridge with a digital counter P5058 with a measurement limit of 10 Ohm to 3.9 MΩ was used. The study of mass transfer processes under the conditions of layer-by-layer concreting using dry mixes is of great importance for finding the optimal options for the method being developed and for choosing approaches to control the process of structure formation of such a complex system as mixed concrete - dry concrete mix - soil base.

Taking into account the difficulty of determining moisture content by direct sampling of shots, when a special stop of the hydration process is required, the work focused on the development of remote methods for measuring moisture content.

Keywords: concrete, mass transfer, resistance, optimal, soil, dimensions.

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as a basic method, the conductometric method was taken as the least affected by the measuring network on the result of determining the resistance and allows the use of sensors of small dimensions, which is necessary to eliminate distortions in the process of moisture transfer.

To determine the resistance of concrete, an automatic AC bridge with a digital counter P5058 with a measurement limit of 10 Ohm to 3.9 MΩ was used. In order to localize the effect of water films along the sides of the mold on the

measurement results, the electrodes were made of insulated copper wire with partial removal of the insulation of the inner part of the conductor (Fig. 1).

The electrodes were arranged in pairs along the horizontal layers and at a distance of 20 mm from each other and between the layers, which made it possible to judge the change in the resistance in the volume of the layer.

To calibrate the method at the first stage of methodological study, measurements were carried out together with sampling of concrete at contact of the closed and dry layers to determine the moisture content by 3-fold alcohol treatment and subsequent drying in an oven. However, this method of determining the dependence W = f (R) turned out to be, firstly, laborious, since associated with the selection of a large number of samples; secondly, sampling itself from the contacting layers with the required moisture step, which is difficult to predict at any given time, turned out to be difficult to implement.

In this regard, at the second stage, the development of the conductometric method, measurements were carried out on concrete, mixed with a known amount of moisture, which provided the moisture content of the mixture 1, 2, 4, 6 and 8%.

Calibration results are shown in Fig.2. The scatter of data on resistance by layers at one initial moisture content is from 6 to 30%. At the same time, the differences in the value of the determined humidity according to the constructed calibration curve do not exceed 16%.

Such an error in the calibration of the conductometric method was accepted as acceptable, since in the case of sampling millet from contacting concrete layers, the scatter of moisture data reaches 30%.

To assess the effect of hydration and structure formation processes on the results of conductometric measurements, the determination of the resistance of concrete layers was carried out after 3, 5 and 24 hours from the moment the mixture was mixed. The data obtained turned out to be located on curves equidistant to the curve for the initial state of the mixture after it was placed into the mold.

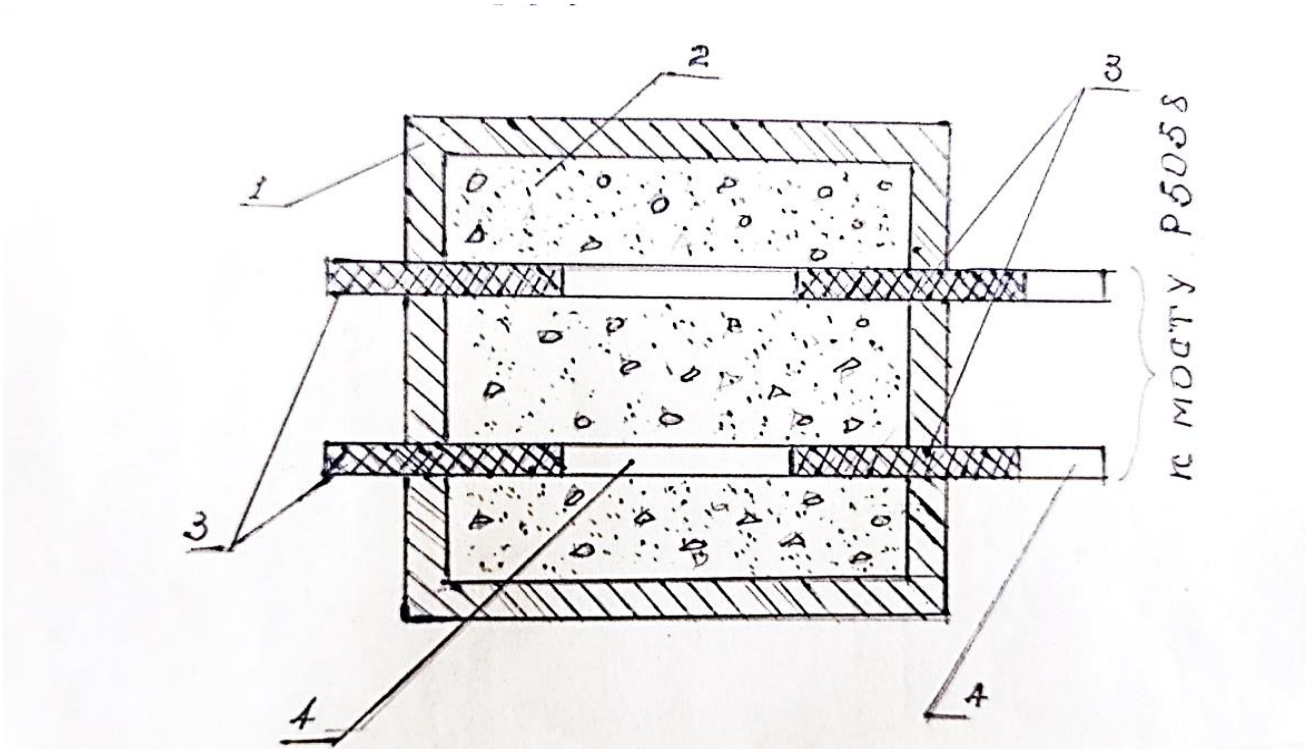

Fig.1. Form for conductometric measurements 1-board; 2 - concrete; 3 - isolated part of the electrode; 4 - non-insulated part of the electrode.

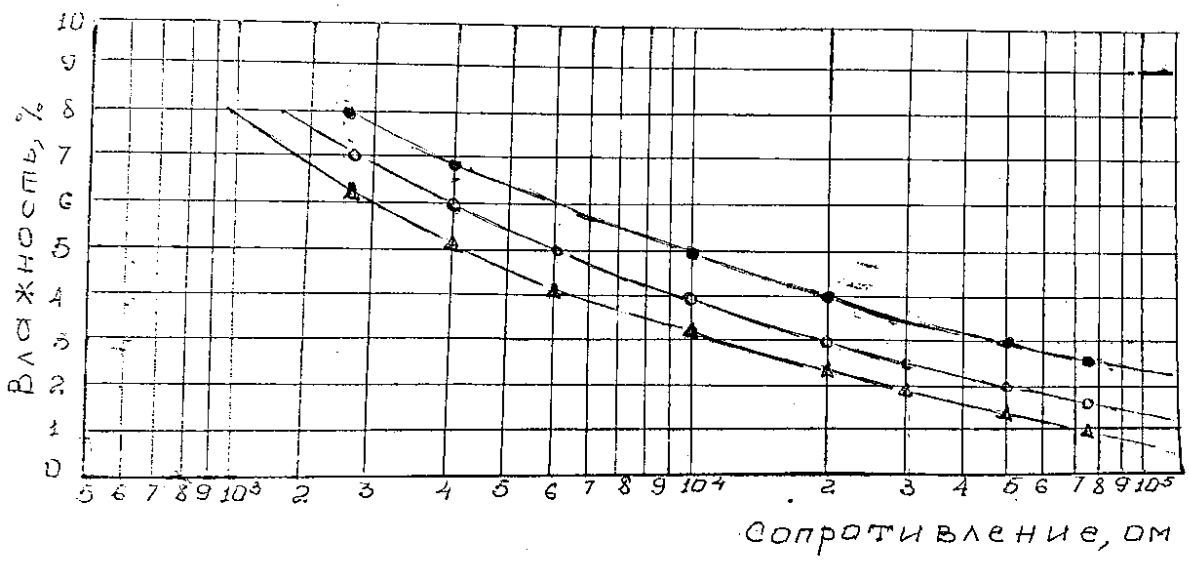

Fig.2. Dependence of concrete resistance on humidity 1 - at the age of 24 hours; 2 - at the age of 5 hours; 3 - aged h.

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