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ANALYSIS METHODS FOR DETERMINING CONCRETE WATER

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Showing different ways to determine water resistance of concrete. Describe their main characteristics identified positive and negative points. The necessity of a new method of determining the water resistance of concrete.

Modern construction is unthinkable without concrete. 2 billion m3 per year – that is today the world volume of its application. This is one of the most popular building materials, which largely determines the level of civilization. However, concrete – the most sophisticated artificial composite material which can have quite unique properties. It is used in various operating conditions, in harmony with the environment, has an unlimited resource base and relatively low cost. To this should be added to high architectural construction expressiveness, the relative simplicity and availability of technology, the possibility of widespread use of local raw materials and disposal of anthropogenic waste during manufacturing, low energy consumption, environmental, safety and reliability. That is why concrete, without a doubt, will remain the main structural material in the foreseeable future.

All this is possible not only to create and master the production of new types of concrete, but also significantly expand the range of materials used in construction: concrete construction, special, heat-insulating, chemically resistant, strain, radiation protection, roads, waterworks, etc. [1].

Concrete mix for making watertight structures have to be prepared from aggregates of dense rock. The best result is achieved in this case by using gravel. It requires less water and is well within the concrete mix. For high-strength concrete structures should be used rubble. Properly selected particle size distribution of aggregates provides water resistance of concrete. Sand and gravel (gravel) alone should have particle size distribution according to GOST 2780-50 and GOST 2781-51 [2, 3].

Professor B.G. Skorotaev the selection of watertight concrete structures proposed increase in sand content, thereby increasing the density of concrete. In this case, increased connectivity of concrete mix, there are small water separation and good workability. According to his research, we recommend that the mixture of aggregates with a high content of sand (45 – 55%). The greatest strength of the concrete is achieved when the content of the sand in an amount of 35% in the aggregate mixture [4].

Need to know that the sand should be of medium size. Fine sand has a large overall surface area, thus increasing amount of water required for mixing concrete. Close same sand will create a large-sized pores in the concrete structure, which is also a negative impact on its waterproof.

Also factor in the density of the concrete structure and, consequently, the water leakage is a water-cement ratio. With increasing the amount of cement concrete bundle decreases, the density increases, and hence the water resistance of the concrete. With the increase in water decreases the strength and water resistance of concrete, so gauging the concrete mix should take the least amount of water.

According to studies to determine the optimal water-cement ratio, conducted by Professor M.G. Davidson, for waterproofing concrete mixture should have a water-cement ratio of 0,40 – 0,45 [5].

Type of cement has a significant effect on the water resistance of concrete. Cements used finer grind. In this case, the cement paste will have a high water resistance, which is caused by low water separation (sedimentation), small and evenly distributed pores and a high degree of hydration [5].

For watertight concrete prof. S.D. Okorokov suggested the following sequence of application of various types of cement, in order to increase the waterproof effect: aluminous cement, Portland cement, pozzolana cement, slag cement [6].

The most effective are pozzolana cement and slag cement. Aluminous cement was also less widely used, since the water demand of cement, aluminous somewhat higher than portland cement, and is 25 – 28%, as it is

less durable, as compared with Portland cement, raw materials for its production is limited, and price is 5 – 6 times higher [7].

There are the following methods for determining the water resistance of concrete:

A method for determining the water resistance of concrete, "wet spots", according to which samples are attached, and a cylindrical shape is sealed in special cages, fed in steps of 0.2 MPa water pressure on one of the end surfaces of each sample by holding the pressure at each stage for a predetermined time until the emergence on opposite end surfaces of the filter characteristics of these samples in the form of droplets of water or wet spots, and for taking appropriate waterproofing pressure value of 0.2 MPa at a reduced [8].

This method has several disadvantages. The method has considerable complexity, since the tests should be subjected to at least six samples. Unreliability tightness samples lead to additional errors and repeated tests. Feed pressure 0.2 MPa stages are very rough and cause additional systematic errors reaching 10-30 %. Because the level of 0.2 MPa may be omitted as well as the values of the waterproof 0.1, 0.3, 0.5, etc. For example, instead of 0.3 MPa waterproofness by this method must be adopted either 0.2 or 0.4 MPa instead of 0.5 MPa – either 0.4 or 0.6 MPa. Tests by this method are very durable - at every stage of retention time is 16 hours, but in general, such as waterproof 0.8-1 MPa test duration is 7-8 days. In this test it should be conducted around the clock and using expensive compression settings, as well as requires the involvement of operators for a long time. The disadvantage of this method is the use of sample and only a cylindrical shape and only one diameter (150 mm).

Method of rapid determination of water resistance of concrete in his breathability, whereby the surface of the lower (by hypothesis forming) the ends of the samples – cylinders or cubes flange mounted camera vacuumizing device coated with a sealing ring harness mastic. With said device creating under pressure in the chamber is not less than 0,064 MPa, determined by a drop in vacuum pressure chamber penetration value of air resistance of concrete and concrete water is determined by a predetermined calibration relationship between water resistance and resistance to air penetration concrete [9].

This method has the following disadvantages:

Used to test samples may have different humidity, that is a different degree of filling pores with water, which leads to a different strength of concrete penetration of air. Because this deviation of the measured values of the waterproof resulting from calibration curve reaches 15-20%. The very same calibration dependence has an error of 10 – 15%, as the air is not like water on the appearance of its properties such as surface tension, viscosity, and thermal expansion.

Establishment of the calibration dependence is a long and time consuming process, as it requires engaging the base method [8]. This situation is compounded by the fact that the relationship should not be one. They want to install as much as controlled concrete compositions, as the method is supposed to apply calibration dependence established only for a specific relation between aggregates and cement in concrete. Thus the discussion method is not precise enough, and its use requires a preliminary, labor-intensive and time-consuming tests to establish the calibration dependences. As a result, the total error determination waterproofness by this method is not less than 30%.

A method for determining water resistance of concrete, including water saturation water samples, drying them to constant weight to determine their water absorption and water resistance to finding tabulated statistical dependence between water resistance and water absorption [10].

The disadvantages of this method are the high accuracy, which reaches 40% and a substantial length thereof, up to 7 days.

High error method is primarily caused by the fact that the water resistance is proportional to the capillary, and not the total porosity of the material, which corresponds to the absorption of water. The total porosity is generally 1.3 – 1.5 times the capillary. Additionally, if the same capillary volume may be characterized by a porosity different pore size distribution and, therefore, various water filtration resistance under pressure, which is waterproof. This method also does not account for this.

Considerable duration of the process is due to the need for a complete saturation with water samples and their subsequent drying to constant weight (requirement determining water absorption according to GOST 12730.3). Duration of implementation of each of these operations is approximately 4 days.

A method for determining water resistance of cementitious materials, which comprises drying the samples to constant weight, waterproofing their side surfaces, water saturation, determination of water absorption and water resistance calculation in terms of saturation of the mortar and the rate of water absorption of the [11].

The disadvantage of this method is the large error, reaching 30%, and increased the duration of its implementation, reaching 5 days.

The large error in the method is due to the fact that water resistance is proportional to the capillary, and not the total porosity of the material, which corresponds to both water saturation and water absorption (see above

analysis of the previous method). Furthermore, an additional source of error is the saturation of the sample through an end surface of the sample state and a porosity which is not quite adequate and porosity of the material in the sample. Increased duration of carrying out this method due to the same factors that are listed in the foregoing assay method.

In Polotsk State University the work on the development of a method for determining water resistance of concrete with high marks for waterproof W18 – W20, trademarks frost resistance F200 – F400 is carried out.

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CHOICE OF METHOD OF INCREASING THE WATER RESISTANCE OF CONCRETE

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The article shows various ways to improve the water resistance of concrete. Their main features are described, positive and negative sides are identified. Ways to improve the water resistance of concrete can be divided into two groups. The first includes activities involving the use of different materials for waterproofing. Without changing the degree of water resistance of concrete, it protects against the penetration and impact of groundwater and process water. The second group of special device eliminates the waterproofing layer and provides for increased water resistance of concrete.

The last decades of the twentieth century were marked by significant advances in concrete technology. In those years there were widespread and new modifiers for concrete binders, active mineral additives and fillers, reinforcing fibers, new technological methods and methods for building composites. At the turn of the century greatly enriched understanding of the structure and properties of concrete, the processes of structure formation, the opportunity to predict the properties and characteristics of the active material management, successfully developing computer-aided design of concrete and automated process control.

Today a lot of different types of concrete are used in the construction, and the creation of new concrete intensively continues. Concrete is widely used in residential, industrial, hydraulic, energy and other types of construction.

Concrete, being the most striking representative of a wider class of materials – construction composites hydration hardening projected on the basis of a single material, gives a new impulse to create layered, thin-walled, and other specialized types of building structures of the new generation [1].

Concrete has high mechanical properties: durability, fire resistance, easy adaptability to almost any form. But it also has disadvantages, which primarily relates it watertight. Under the pressure of groundwater there is usually underground part of industrial, civil and public facilities. Seepage of water into structures (hydraulic facilities, tanks, pools, tunnels, basements, dams, etc.) can cause serious consequences. Therefore, improving the water resistance of concrete is an urgent task.