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ANALYSIS OF THE EXPLOITATION PROPERTIES OF CONCRETE UNDER THE INFLUENCE OF MOIST ENVIRONMENTS

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Abstract: The issue of water absorption in cement-based materials is a globally pressing problem. The water absorption resistance of concrete is primarily dependent on its composition. One of the characteristics affecting the longevity of concrete is porosity, as well as external and internal factors. However, relatively large voids reduce the strength of concrete. The permissible air content is 2-3%. Water absorption worsens the properties of materials, increases average density, and decreases strength. The effect of water, humidity, cyclic freezing and thawing on cement-based materials causes a process of corrosion, leading to the degradation of the cement stone's structure.
Key Words: humidity, capillary, concrete, cement, strength, concrete durability, porosity, density, corrosion.

The issue of water absorption in cement-based materials is of significant global importance. Water absorption by mass is one of the key characteristics of concrete, and it is also linked to its frost resistance, corrosion resistance, and deformation properties. These main physical and technical indicators of concrete are determined by the water absorption value.

Primarily, the resistance of concrete to water absorption depends on its composition, but the following criteria can also be identified:

- **Type of cement**, as the use of cement with waterproofing properties, as well as expanding or contracting cements, ensures the stability of capillaries and allows the production of highly water-resistant concrete;
- **Quality of aggregates**, particularly the amount of impurities in them, as the adhesion of cement stone and aggregates depends on this;
- **Compaction quality**, as defects and heterogeneity create channels for water filtration;
- **Conditions for cement hydration**, which are necessary for achieving proper curing conditions.

Thus, the water absorption issue is critical because it leads to reduced strength, shortened service life, and material degradation.

The durability of concrete is influenced by both external and internal factors. The most common physical, mechanical, and chemical factors include: atmospheric effects, temperature changes, and the influence of aggressive raw materials.

One characteristic affecting the durability of concrete is porosity. Cement-based materials have a capillary-porous structure, which is an integral part of such materials.

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Microscopic pores are not particularly harmful to the structure, as they do not significantly affect density. However, relatively larger voids reduce the strength of concrete. The permissible air content is 2-3%, though in practice, it can reach 5% or even 6%.

Primarily, the ability of concrete to resist water penetration depends on its composition, but the following criteria can also be identified:

- **Type of cement**, as cement with waterproofing properties, as well as expanding or contracting cements, ensures the stability of capillaries and allows for the production of highly water-resistant concrete;
- **Quality of aggregates**, particularly the amount of impurities in them, as the adhesion between cement stone and aggregates depends on this;
- **Compaction quality**, as defects and heterogeneity create channels for water filtration;
- **Conditions for cement hydration**, which are necessary for proper curing;
- **Working conditions that exclude crack formation and opening**, since when cracks wider than 0.1 mm are present, capillary filtration increases for every 0.1 mm of crack width;
- **Special methods for blocking capillaries**, such as using polymer impregnation.

Thus, water absorption degrades the material properties, increases heat conductivity, raises the average density, and decreases strength. The effect of water, humidity, cyclic freezing, and thawing on cement-based materials initiates a corrosion process that disrupts the integrity of the cement stone's structure.

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