Abstract

The main aim of this doctor's thesis was the assessment of the impact of hydrostatic pressure on selected properties of underwater concrete during curing process.

The theoretical part of the dissertation presents the general characteristics of concrete placed under water. The conditions and the environment in which it is placed and serves have been characterized. The methods of selecting the composition of underwater concrete were presented, taking into account the requirements and guidelines of applicable regulations and information available in the literature. A lot of attention was also paid to the topic of the repairs of the elements of underwater concrete structures, in particular to the repair efficiency indicated by the level of adhesion between repair concrete and concrete substrate.

The experimental program was divided into three parts. The first one, essential part was the assessment of the effect of hydrostatic pressure on selected properties of underwater structural concretes. The second part of research concerned the assessment of changes in the structure of the surface layer and the internal layers of underwater repair concrete exposed to hydrostatic pressure. The final research task included determining the effect of material modification of the composition of underwater repair concrete on its properties. Especially the adhesion of repair concretes to horizontal and vertical surfaces of the substructure under the conditions of hydrostatic pressure was analysed. The composition of underwater concrete was modified with an admixture of styrene-acrylic polymer and polypropylene fibers.

Simulation of conditions for placing and curing of underwater concrete under hydrostatic pressure in laboratory conditions was performed with the use of a special research apparatus, whose main element is a pressure chamber, unique on a global scale. A methodology for testing repair concretes used in a horizontal and vertical joints was developed. The positive influence of hydrostatic pressure on the mechanical properties of the tested underwater concretes in the first 7 days of maturation and on the structure of the tested concretes in the subsurface layer was proved, which confirmed the assumed theses. Results obtained during the laboratory tests and their detailed analysis allowed the development of guidelines for the design of underwater concrete composition for structural and repair concrete as well as recommendations related to the preparation of the surface of marine concrete elements located under the water before the repair.

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