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FULL REPLACEMENT OF FINE AGGREGATE OF CONCRETE
BY FOUNDRY WASTE

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Many regions are experiencing a shortage of natural sands that meet the requirements of modern standards. Sands with a grain size of 1,2...1,5 are often used for the manufacture of concrete. It inevitably leads to overspending of cement and a decrease in the quality of reinforced concrete structures.

In the current situation, the possibility of using foundry waste (FW) as a fine aggregate is of particular importance. In this connection, it will reduce the cost of concrete production, save industrial enterprises from the cost of garbage disposal in landfills, reduce the cost of basic products, and minimize the impact on the environment.

Experimental studies were carried out to determine the effect of the use of FW as a fine aggregate on the compressive cylinder strength of concrete at 28 days. The specimens were the following: cylinders with a diameter of 150 mm and a height of 300 mm; prisms with an edge of 150 mm and a height of 600 mm. The curing conditions for specimens were standard.

The tests showed that the compressive strength of concrete using FW as a fine aggregate is not lower than for normal weight concrete. It was also noted the increase in strength over time starting from an early age and up to 360 days.

In addition, the compressive strength of concrete with FW under low-cycle fatigue loading was not decrease, but could increase up to 5 % compared to a short term loading. This is due to the fact the upper limit of microcracking for concrete using FW as a fine aggregate is much higher (an average of 0,88) than for normal weight concrete (an average of 0,7).

It is important to note that progressive accumulation of plastic deformation in FW-concrete occurs as a consequence of only failure load. The development of creep deformations during low-cycle fatigue loading (the so-called time effect) was not critical and did not lead to gradual failure of the specimen. On the contrary, low-cycle fatigue loading contributes to the stabilization of plastic deformation and, as a result, a certain increase of strength.

Thus, according to the results of the studies, it can be concluded that concrete modified with FW as a fine aggregate can be used in the design of building structures. It can also be used for strengthening of compressive zone of flexural reinforced concrete elements.