# High Temperature Effects on the Dynamic Strength of Concrete

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**Abstract**

The practice of design and operation of reinforced concrete structures has shown that the load-bearing elements of the building frame in the general life cycle are performing under different combinations of loads. The study of performance of reinforced concrete elements under dynamic loads reveals the most important features of concrete and reinforcement under such effects. Many scientists from around the world have studied the dynamic properties for concrete and reinforcement before and based thereon have developed the methods for calculating reinforced concrete elements. The increase in the number of man-made emergencies poses more and more tasks for designers to study performance of elements under various combinations of loads and often with their high-high values.

The study of knowledge of fire resistance of structures has led to the development of standards for the calculation of the structural elements of a building in each country. But, as practice has shown, the combination of dynamic loads with fire conditions leads to more serious consequences, and the lack of knowledge of the issue does not allow us to develop a general method of calculation and include them in regulations.

This study focuses on the investigation of the properties of concrete under dynamic loadings in fire conditions and the implementation of the results in the calculation of reinforced concrete structures as well.

The pilot research has been conducted to assess the dynamic strength of concrete for high-temperature effects. Concrete cubes (150 mm side) and prisms with dimensions of 100*100*400 mm have been tested in normal and fire conditions under dynamic loadings with loading time of 0.4 and 0.1 seconds. The experiments were carried out in standard temperature conditions up to 9000.

It is known that dynamic hardening factor for concrete, equal to the ratio of dynamic strength to static, in normal conditions is greater than one unit.

Under fire conditions, the value of dynamic concrete hardening, depending on temperature and loading speed, ranges from 0.4 to 0.8. Failure to take this fact into account at the design stage for buildings of a higher level of responsibility, where it is legally required to take into account the particular combination of loads, may lead to irreversible consequences. The study has shown that the issue of studying performance features for concrete and reinforced concrete elements already loaded with a quiescent load during extra dynamic loadings

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is relevant and one of the most important tasks in the field of construction. Recording a sharp change (decrease) in the dynamic strength of concrete fundamentally changes the generally accepted considerations for the fire resistance of reinforced concrete structures, thus leading to the anticipatory onset of the limit state according to the R criterion – to the bearing capacity.

**Keywords:** Concrete, dynamic loading, dynamic hardening factor, dynamic strength, fire conditions