DETERMINATION OF DEFORMATIONS OF FRAME BUILDINGS MADE OF REINFORCED CONCRETE STRUCTURES AFTER A FIRE

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Abstract. *This article provides information on the specifics of post-fire inspection of buildings made of reinforced concrete structures, their sequence, and the various deformations that can occur.*

Keywords: *reinforced concrete structures, deformations, fire, surveys, assessment, temperature.*

Introduction. Fires in buildings and structures pose a serious threat to their stability and operational safety. This is especially true for frame buildings made of reinforced concrete, since reinforced concrete has high fire resistance, but is subject to destruction under prolonged exposure to high temperatures. After a fire, a thorough diagnosis of the structures is required to assess the extent of damage, determine deformations and make decisions on the possibility of restoration or demolition.

During a fire, reinforced concrete structures are subject to thermal and mechanical impacts. The main consequences include:

Loss of concrete strength - at temperatures of 300 - 500 °C, the cement stone is destroyed, and above 600 °C , there is complete discoloration and destruction of the structure.

Loss of adhesion between reinforcement and concrete - due to thermal expansion of the reinforcement and the formation of cracks.

Exposure of reinforcement - due to chipping of the protective layer of concrete (slippage, swelling).

Formation of cracks and deformations - in the form of deflections, tilts and delaminations.

Main types of deformations

After a fire in reinforced concrete frame buildings, the following types of deformations may be observed:

Deflections of floor slabs and beams ;

Deviation of columns from the vertical ;

Expansion of cracks in connection nodes ;

Swelling and cracking of the concrete surface ;

Plastic and residual deformations of reinforcement .

Methods for determining deformations

A comprehensive inspection of reinforced concrete structures after a fire includes the following stages:

1. Visual examination

Allows you to identify surface damage - cracks, chips, traces of overheating (reddening, discoloration, charring), deformation of elements.

2. Geodetic survey

Used to determine the deviations of load-bearing elements from the design position. Allows you to identify column tilts, deflections of floors, displacements.

3. Thermal imaging diagnostics

Allows you to assess the presence of internal voids and areas of low density in the concrete mass, which is typical for areas damaged by thermal exposure.

4. Non-destructive testing methods

Ultrasonic method - determines the strength of concrete based on the speed of wave passage.

Sclerometric method (Schmidt hammer) - measures the hardness of the concrete surface.

Radiation methods - reveal hidden cracks and voids.

Flux-probing - used to determine the location and condition of the reinforcement.

5. Laboratory analysis of samples

If necessary, cores are taken to determine the strength characteristics of concrete (compression, adhesion to reinforcement, density, etc.).

Classification of damage

Depending on the nature and extent of damage, structures are classified as:

Slightly damaged - minor cracks and deformations, acceptable for further use after minor repairs.

Moderate damage - requires reinforcement of structures, restoration of the protective layer of concrete, injection filling of cracks.

Severely damaged - significant deformations, destruction of concrete and reinforcement, require dismantling or complete replacement of elements.

Effect of fire on load-bearing capacity. Fire can significantly change the design characteristics of materials. Thus, the residual strength of concrete can decrease to 30-50%, especially with prolonged exposure to temperatures above 600 °C. Reinforcement also loses strength properties and plasticity. This requires re-calculation of the structure taking into account changes in characteristics.

Recommendations for recovery:

Removal of damaged areas of concrete followed by restoration using special repair compounds;

Reinforcement of carbon elements with plastic or metal clamps;

Injection crack repair;

Restoration of the protective layer of concrete and anti-corrosion protection of reinforcement;

In case of severe deformations – complete replacement of structural elements.

Conclusion. Assessing the deformations of reinforced concrete frame buildings after a fire requires a comprehensive approach, including visual, instrumental and laboratory methods. Accurate diagnostics allows us to determine the residual load-bearing capacity of structures, assess the possibility of their restoration and ensure further safe operation of buildings.

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