



Features of Destruction of Materials and Structures

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Abstract: During operation, most structures in buildings operate under loads. Damage is the initial stage of the destruction of individual structural elements, it is necessary to timely and accurately assess the nature and danger of damage to building structures. The study and classification of defects and damages makes it possible to take timely measures to eliminate structural defects and restore the building.

Keywords: destruction, operation, load structures, defects, aggressive environments, violation of the rules of operation, repair of buildings, measures to eliminate defects.

The destruction of structures is a macroscopic discontinuity of the composite material as a result of certain influences on it. Fracture often develops simultaneously with elastic or plastic deformation. Most concrete, stone and other products experience only minor plastic deformations until destruction.

During operation, most of the structures in the building work under loads that cause compressive stresses. As a result of the redistribution of stresses due to different orientations of crystal grains, as well as due to the presence in materials of heterogeneous composites having unequal crystal structures, in various sections of structures, regardless of the direction of the applied forces, tensile stresses will always be experienced, leading to the formation of microcracks. Defects of this kind in construction materials cause wear and tear and lead to destruction of building elements.

The theory of destruction of structures is based on physical, mechanical-mathematical, structural and physico-chemical explanations of the laws of mechanical destruction.

Damage is the initial stage of destruction of individual structural elements or individual sections of this element, i.e. loss of the original properties of structures or elements (Fig. 1).

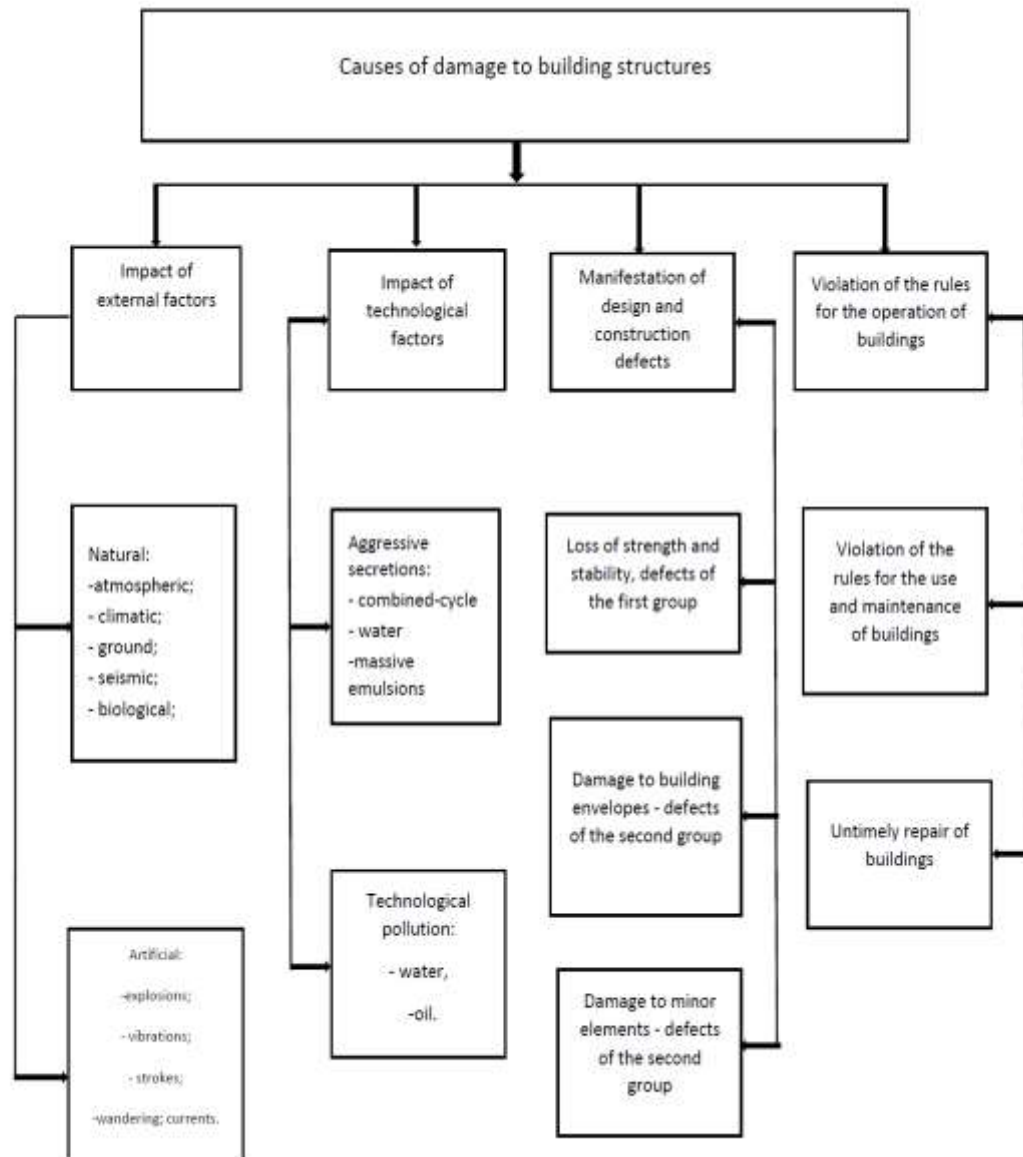


Fig.1. Causes of damage to building structures.

When operating buildings and structures, it is important to assess the nature and danger of structural damage. Causes causing damage and then destruction of buildings:

- impact of external natural and artificial factors;
- impact of internal factors caused by technological processes;
- manifestation of defects made during surveys, design, construction of buildings;
- shortcomings and violations of the rules for the operation of buildings, structures and sanitary equipment .

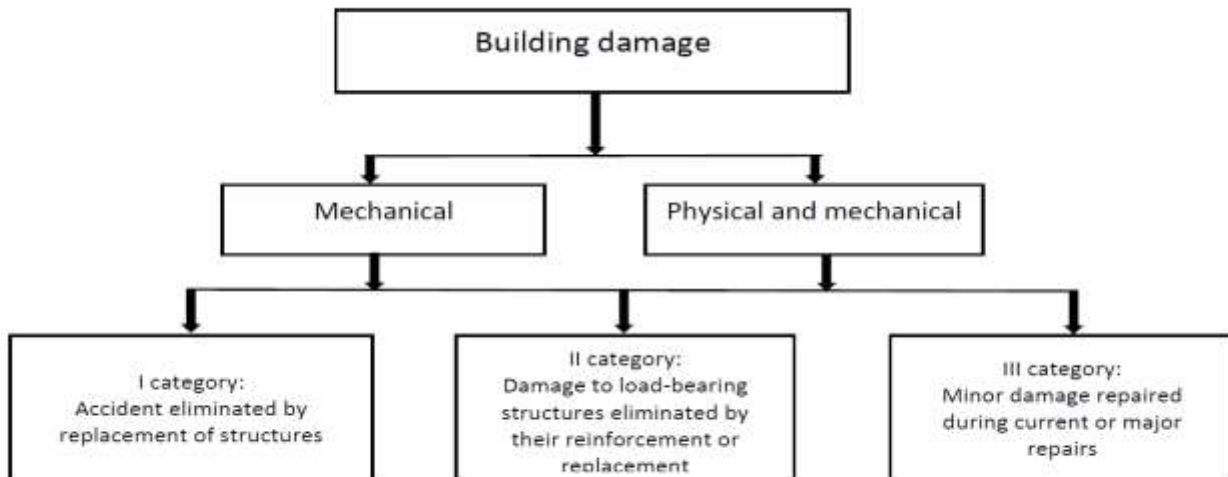


Fig.2. Damage to buildings during operation

Destruction depending on the nature of the processes are:

- mechanical – application of extra-calculated loads – equipment, basement soil deformations, seismic impacts; mechanical influences;
- physico-chemical - this is oxidation, corrosion caused by solutions of salts, acids, alkalis, ground moisture; exposure to electric current; biological processes.

Most often, the structural elements of the building fail prematurely from the total impact of the above factors. Three categories of damage can be distinguished according to the degree of destruction:

- emergency nature caused by defects in design, construction, natural phenomena, earthquakes - showers, snowfalls, floods, as well as violations of the rules for the operation of buildings and structures;
- destruction of load-bearing structures caused by external and technological factors, violation of operating rules. Such violations are not emergency and are eliminated during major repairs by strengthening or replacing structures;
- destruction of minor elements (falling out of plaster, individual tiles of the cladding), eliminated during current repairs.

To ensure the high quality and reliability of buildings, it is necessary to strive to prevent defects. This is all the more important since the elimination of defects is often associated with significant economic losses.

A defect is a non-compliance of a design with certain parameters, regulatory requirements or a project. So, if the thickness of the masonry seams is overestimated, this is a defect, and its collapse is then damage due to a defect in the seams.

The most dangerous defects and damages are in the bases and foundations, in the walls, i.e. in the main load-bearing structures (insufficient or incorrect reinforcement, underestimated concrete

strength, contaminated aggregates, violation of the concrete mix laying technology, etc.), as their manifestation leads to deformations and destruction of the entire building. Defects and damages in partitions and other non-bearing structures are less dangerous, but they significantly reduce the performance of premises or buildings as a whole. Common defects in reinforced concrete structures include small (up to 2-3 cm) shells and through voids. They occur in hard-to-reach places for careful vibrating, when using worn-out formwork. Deep sinks are dangerous for load-bearing structures, especially if they are not removed immediately, but only covered with a protective layer of mortar. It is also important to assess the danger of through voids; if necessary, reinforced concrete clips should be arranged with injection of a polymer-cement mortar into them.

Construction defects are violations of the technical conditions for the production of works, incorrect selection of materials, their unjustified replacement during construction.

According to the results of the examination and analysis, characteristic defects can be divided into: hidden, invisible during external examination and obvious (Fig. 3).

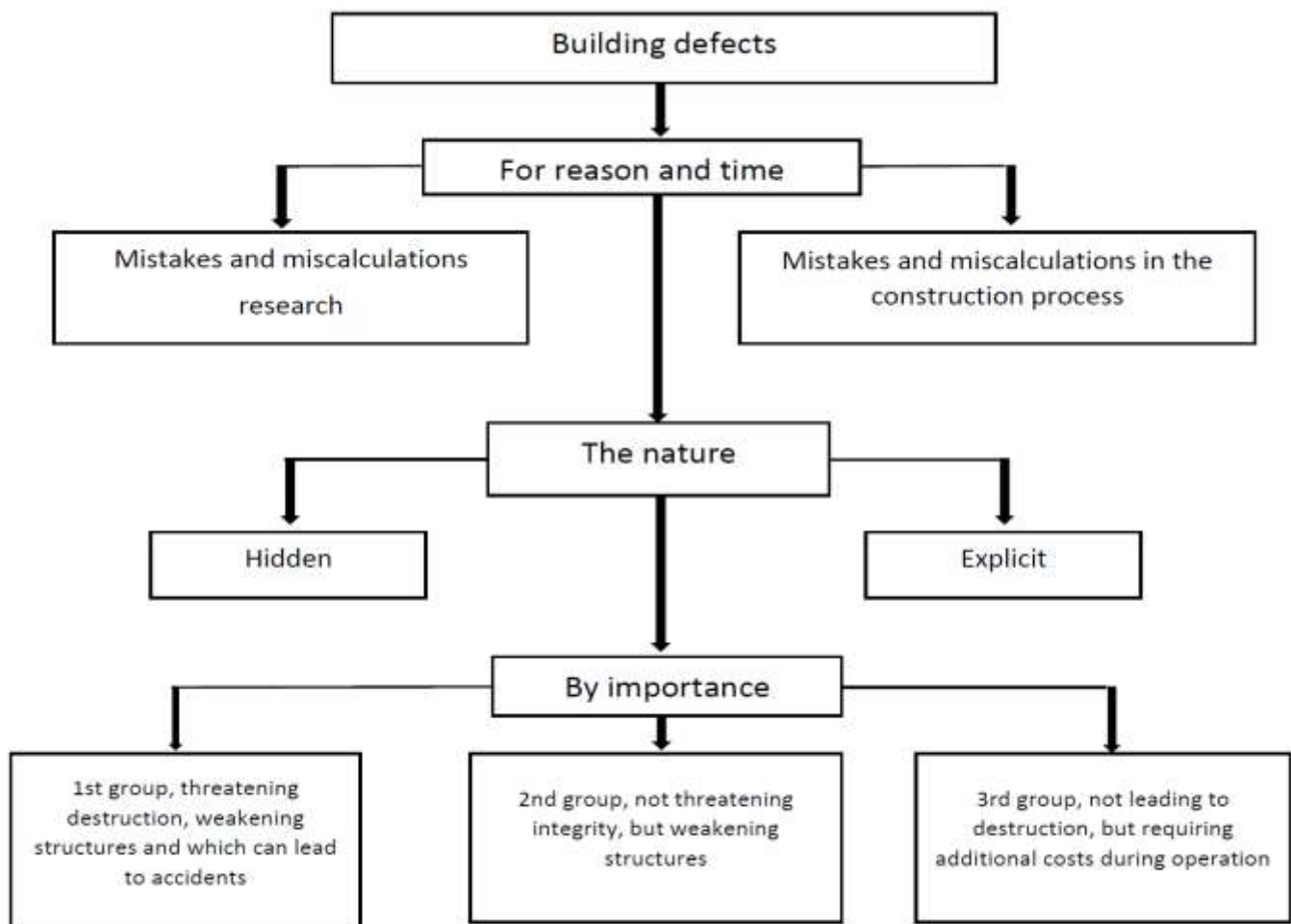


Fig.3. Classification of building defects



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By danger, defects are divided into three groups:

- 1 - defects that can lead to an accident, such defects must be immediately eliminated;
- 2 - defects that do not threaten the integrity of buildings, but reduce the performance and weaken the structure of buildings, they must also be eliminated;
- 3 - defects that do not lead to the destruction of buildings, but reduce their performance and require additional operating costs.

The study and classification of defects and damages makes it possible to reasonably predict their possible danger of destruction and take timely measures to localize or eliminate them, and also help to prevent repeated errors in design and construction.

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