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Destruction of Composite Materials and Structures

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Abstract: During operation, most structures operate under loads. This article presents the causes of the destruction of building structures, as well as the study of defects and damage. Information about the possibility of predicting the danger of destruction is given.

Keywords : destruction, operation, structures, accelerated wear, defects, wear of buildings, deformations, classification of defects.

The destruction of the material 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 failure.

During operation, most structures operate under loads that cause compressive stresses. As a result of the redistribution of stresses due to different orientations of blocks and grains of crystals, 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, they will always experience tensile stresses leading to the formation of microcracks. . Such defects in the materials of structures are the cause of wear and tear in the destruction of building elements.

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

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

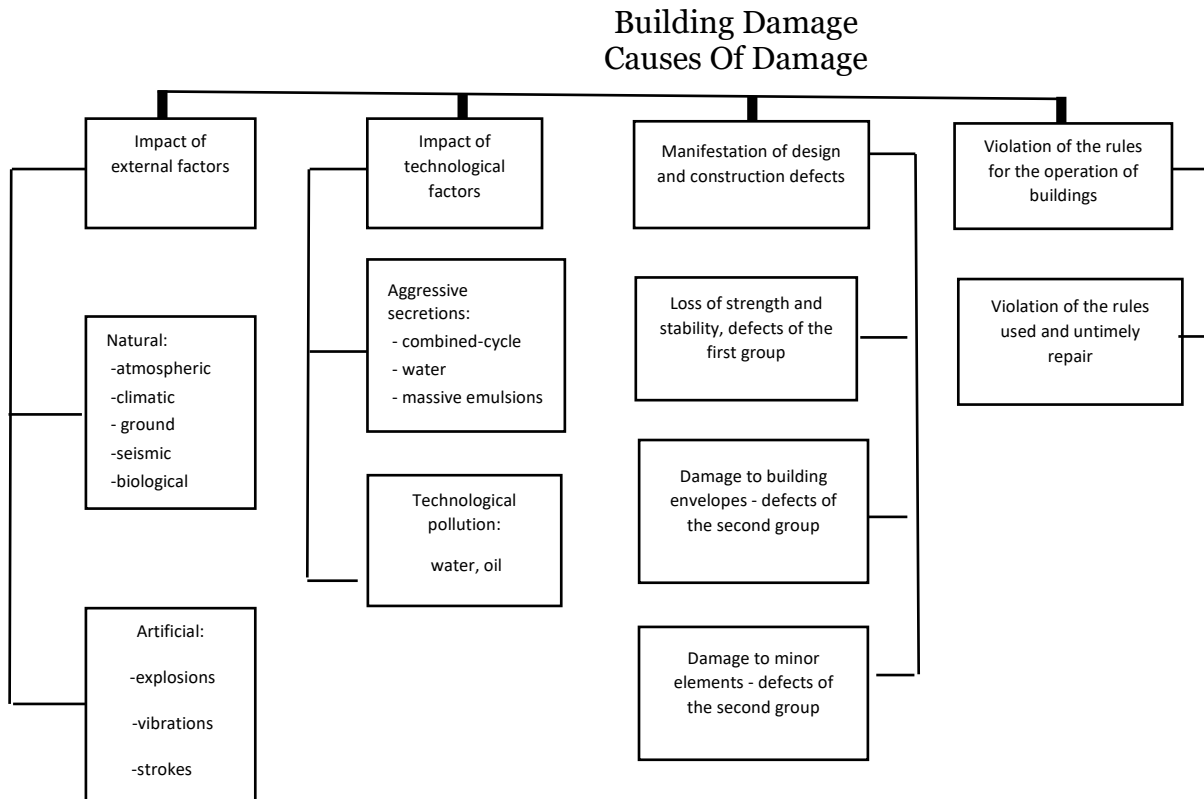


Fig.1. The nature of the destruction processes

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

- impact of external natural and artificial factors;
- the impact of internal factors due to the technological process;
- the manifestation of defects made during surveys, design, construction of the building;
- shortcomings and violations of the rules for the operation of buildings, structures and sanitary equipment . (fig.2)

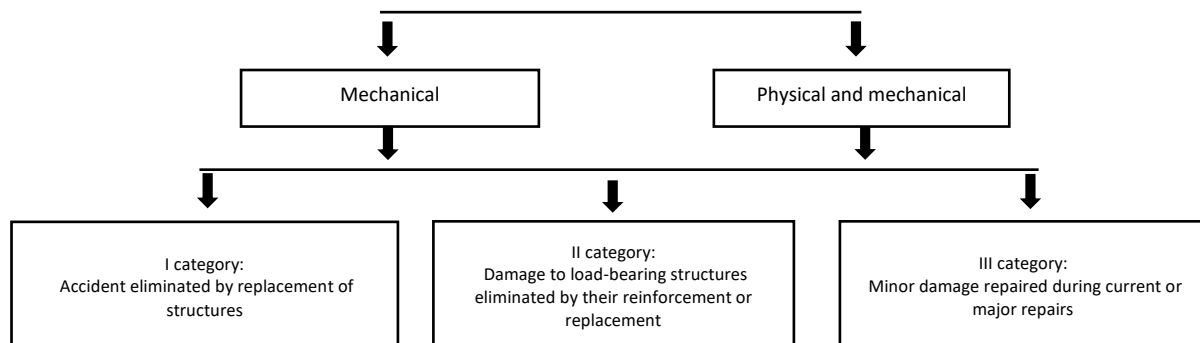


Fig.2. Damage to buildings during operation



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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; the impact of electric current, biological processes.

Most often, buildings and structural elements 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 - 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 reinforcement or replacement;
- 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 structures (insufficient or correct reinforcement, low concrete strength, contaminated aggregates, violation of the concrete mix laying technology, etc.), since 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).

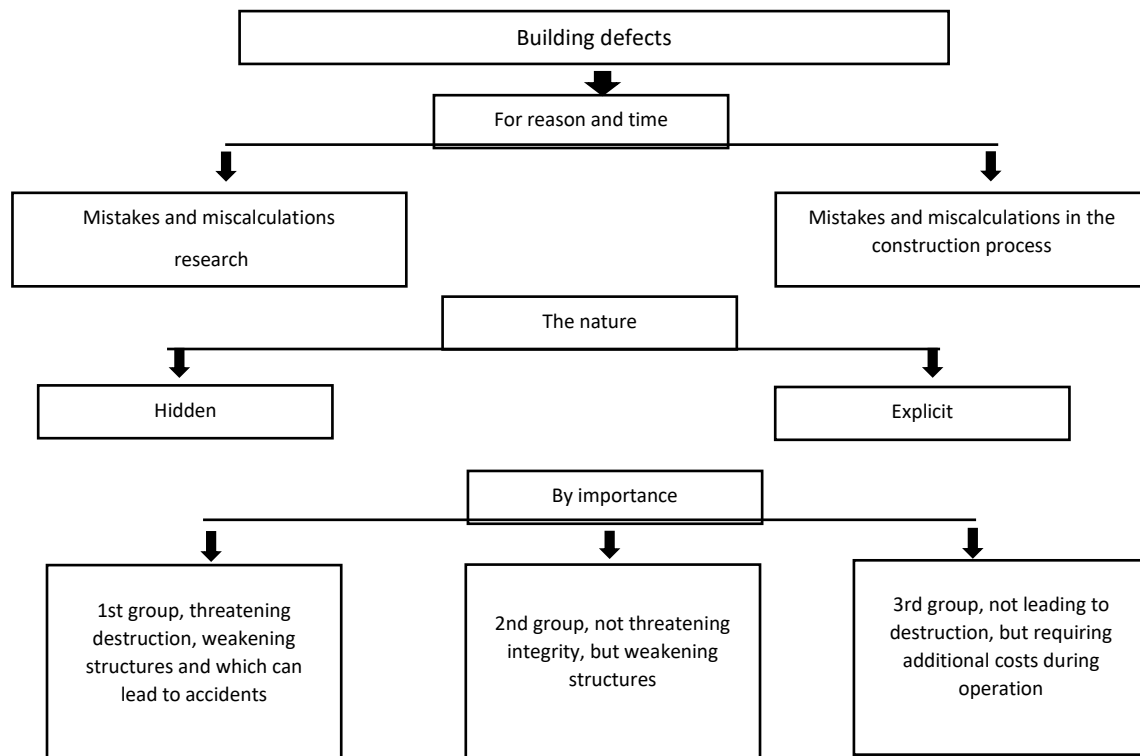


Fig.3. Classification of building defects

By danger, defects are divided into three groups:

- defects that can lead to an accident, such defects must be immediately eliminated;
- defects that do not threaten the integrity of buildings, but reduce the performance and weaken the structures of buildings, they must also be eliminated;
- 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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