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Increasing the Seism Resistance of Buildings

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ABSTRACT: Modern technologies by which the strengthening of building structures can be carried out using especially durable materials, in particular, carbon fiber. Carbon fiber is a high-strength, linearly elastic material that is used to increase the strength of building structures of almost any configuration and purpose. Strengthening them can be achieved by external reinforcement of structures with canvases, tapes or carbon fiber laminates.

KEYWORDS: seismic resistance, buildings, structures, reinforcement, deflections, structures, survey results.

I.INTRODUCTION

Seismic resistance - the ability of buildings and structures to withstand earthquakes with minimal damage. Seismic resistance of buildings primarily depends on its height, its weight as a whole, the structural system, which takes on the seismic impact of the regions where the object is being built, including microseismic regionalization.

Traditional methods and means of protecting buildings and structures from seismic impacts include a wide range of various measures aimed at increasing the bearing capacity of building structures, the design of which is carried out on the basis of norms and rules developed by domestic and foreign experience in construction that guarantee the seismic resistance of buildings and structures in areas with seismicity 7 , 8 and 9 points.

The design of buildings and structures in seismically hazardous areas begins with the observance of the general principles of earthquake-resistant construction, in accordance with which all used building materials, structures and structural schemes must provide the lowest seismic loads. When designing, it is recommended to adopt, as a rule, symmetrical structural schemes and to achieve a uniform distribution of the stiffness of structures and masses. In buildings and structures made of prefabricated elements, it is recommended to locate joints outside the zone of maximum effort, it is necessary to ensure the homogeneity and solidity of structures through the use of reinforced precast elements. [1]

Practice shows that the choice of space-planning schemes, their shapes and dimensions have a significant impact on the seismic resistance of buildings. The most preferred forms of structures in terms of plan are a circle, a polygon, a square and outlines similar to them in shape. However, such shapes do not always meet the planning requirements and most often a rectangular shape with parallel spans is used. If it becomes necessary to create complex shapes in the plan of a building, it is recommended to cut it along the entire height into separate closed compartments of a simple shape. Structural solutions of compartments during an earthquake must ensure the independent operation of each of them. This is achieved by the device of anti-seismic seams, which can be combined with temperature or sedimentary ones. Anti-seismic joints are made by installing paired walls, paired columns or frames, as well as by erecting a frame and a wall. [4]

In multi-storey buildings, an important role in their seismic resistance is played by the structures of interfloor ceilings and coatings, which work as diaphragms of cruelty, ensuring the distribution of seismic loads between vertical bearing elements. Prefabricated reinforced concrete floors and roofs of buildings must be monolithic, rigid in the horizontal plane and connected to vertical supporting structures. The side faces of panels (slabs) do not break along those lines where the greatest stress is created.

The most promising direction for increasing seismic resistance is seismic isolation of buildings. Foreign researchers have proposed various devices for seismic isolation systems and vibration dampers of structures. The

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following trend is observed: the first is the use of pure seismic isolation of buildings, which is usually arranged in the lower floors: rubber-metal supports of the most varied modifications, with low and high damping, with and without a lead core, using various materials. There are also pendulum-type sliding friction bearings. All these supports are widely used in the world.

The second direction is the use of damping (vibration damping),

which is constantly being improved. For high-rise construction, as a rule, a combination is used: seismic isolation is located in the lower floor, and damping is installed along the height of the building. Currently, a variety of dampers are used: metal, liquid, etc.

All building structures wear out over time. The condition of the supporting structures in some buildings, floor slabs, walls, etc. are in poor condition and their reconstruction is beginning to be urgent. Reinforcement of structures can be performed using two technologies: modern and traditional. Methods of traditional technology are used quite rarely, since a large expenditure of labor resources and time is required for work to increase the cross-sectional areas of working elements that receive loads. All these works make the structure cheap, but more cumbersome and less technological.

Modern technologies, which are used to strengthen the structures of the building, using especially durable materials, in particular carbon fiber. Carbon fiber is a high-strength, linearly elastic material that is used to increase the strength of building structures of almost any configuration and purpose. Strengthening them can be achieved by external reinforcement of structures with canvases, tapes or carbon fiber laminates. [2,3]

External reinforcement makes it possible to strengthen reinforced concrete structures, the replacement and repair of which is very expensive and often impossible due to the peculiarities of its elements. These include various industrial structures and installations, bridges and architectural monuments. Carbon fiber can be used to reinforce both compressive and tensile elements and elements that are in special operating conditions.

Carbon fiber can also be used to reinforce building structures that are made of metal and are eccentrically compressed or stretched. To mount the carbon fiber canvas or tape, first clean the metal surface and apply the mounting epoxy glue.

The carbon fiber webs are glued symmetrically to increase the stability of the steel plates. Timber structures can also be reinforced with carbon fiber webs and straps. Typically, tensile stress areas are reinforced; as a result, there is a risk of splitting along the fibers. Carbon fiber webs are usually simply glued to the surface or placed in pre-prepared rip cuts - when it is required to reinforce the wood structure without changing its appearance.

Reinforcement of brick walls, concrete elements with carbon fiber allows minimizing the violation of their integrity. Traditional methods use point reinforcements such as braces, anchors and profiles. Carbon fiber webs allow you to take good care of the intact parts of the structure and realize its existing strength reserves.

The first works that are carried out on the reinforced structures are of an analytical nature, i.e. first, the present technical condition of the building structures is assessed, defects are identified, and the suitability of these structures for further use is assessed. Then a detailed examination of the structures to be reinforced is carried out. At this stage, material samples are taken, deviations from the design dimensions, deflections and settlement of the foundation are measured, for verification calculations. And at the final stage, processing and verification calculations are performed.

A technical conclusion is drawn up, which contains the results of the survey of the building, photographic materials of the identified defects, verification calculations, as well as measurement drawings. Then a list of works to strengthen the building's structures is outlined.

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