UDK 37.02

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MODERN METHODS OF SEISMIC ISOLATION OF BUILDINGS AND CONSTRUCTIONS

Annotation: In modern design solutions, it is impossible to increase seismic resistance only by increasing the cross-sections, strength, and weight. The design may be stronger, but not necessarily cost effective, because both the weight and the inertial seismic load may increase even further.

Key words: modern design, seismic isolation, building, construction.

New effective methods of seismic protection are required. These methods involve changing the mass or stiffness or damping of the system depending on its displacements and speeds. Currently, more than 100 patented seismic protection designs are known.

At the moment, there are proposals for active seismic protection, including additional energy sources and elements that regulate the operation of these sources, but its implementation requires significant costs for installation and operation. This excludes the possibility of widespread use of active seismic protection for building structures. Below we consider special methods of passive seismic protection that do not use additional energy sources. These methods are divided into seismic suppression and seismic isolation.

Buildings supporting on rubber-metal parts are widely used abroad: in Japan, England, France. Studies of structures on rubber-metal supports indicate their high reliability, however, the cost of the foundations themselves turns out to be significant and can reach 30% of the cost of the building. A serious problem in the design of structures on elastic supports was the difficulty of ensuring their strength with significant mutual displacements of the seismically

isolated parts of the foundation. This was the reason for the widespread use of kinematic supports in the construction of seismic isolation foundations.

The principle of operation of this design is that during an earthquake the center of gravity of the supports rises, resulting in the formation of a gravitational restoring force. In this case, the vibrations of the building occur near the equilibrium position, and their initial frequency and period depend on the geometric dimensions of the supports used. It should be noted that the constructed foundations of this type do not have special damping devices, and with long-term impacts with a force of more than 8 points, according to the calculations performed, the building may fall from the supports. This indicates the danger of foundations on kinematic supports, if they do not provide additional damping elements. With a significant amount of construction of buildings and structures with seismic isolation on elastic kinematic supports, there are still no data on their behavior during earthquakes, and the destruction of such buildings that took place indicates the need for a detailed justification of their seismic resistance.

In the lower part of the building, between the bearing racks of the lower floor, tie panels are installed, which are switched off during intense seismic effects, when periods equal to or close to the period of free vibrations of the structure predominate in the spectrum of action. After switching off the panels, the frequency of free oscillations decreases, the period of oscillations increases, and the seismic load decreases. Under low-frequency impact, the period of natural oscillations of a building with bonded panels is much lower than the values of the prevailing periods of ground oscillations, so the resonance phenomena are weak and the bonded panels are not destroyed.

The use of switching links is most effective in the case when the frequency composition of the expected seismic impact is predicted with confidence. As disadvantages, it should be noted that after the destruction of disconnected connections during an earthquake, it is necessary to restore them,

which is not always practically feasible. In addition, as is known, in some cases, during an earthquake in its final stage, a decrease in the prevailing frequency of the impact occurs. As a result, the occurrence of secondary resonance and loss of the bearing capacity of building structures is possible. In this case, the application of constructive measures is required, which leads to additional construction costs. Conclusions Conventional measures for seismic protection of buildings and structures are reduced mainly to increasing the bearing capacity of elements and structures. Such seismic protection is carried out in accordance with the building codes "Construction in seismic regions" [4]. At the same time, the measures taken do not reduce seismic loads on buildings and structures, but only take them into account. In this article, modern methods of seismic isolation of buildings and structures were analytically considered.

Many of the presented models require further adjustments in calculations and design, theoretical and practical tests [5]. So, when designing buildings equipped with seismic isolation and dampers, it is necessary, in addition to the spectral calculation, to perform a direct dynamic calculation using instrumentally recorded accelerograms, which, in turn, increases the requirements for seismological forecasts for the construction site.

Thus, the use of seismic isolation and seismic suppression with proper design can significantly improve such characteristics as:

- reliability of buildings;
- safety and reliability of equipment;
- economic indicators of buildings;
- no need for restoration work after strong earthquakes;
- comfort for residents.

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