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МЕТОДЫ ПРОВЕРКИ И МОНИТОРИНГА СЕЙСМИЧЕСКОЙ ПРОЧНОСТИ ЗДАНИЙ

METHODS FOR CHECKING AND MONITORING THE SEISMIC STRENGTH OF BUILDINGS

Аннотация. В статье приведены основные сведения о методах и средствах, используемых в настоящее время при надстройке дополнительных этажей к существующим зданиям, оценке сейсмостойкости зданий, рекомендуемых к реконструкции, и определении резервов повышения их сейсмостойкости. В основной части статьи подробно рассказывается о методах учета сейсмических нагрузок при увеличении этажности зданий для организаций, изучающих техническое состояние зданий и сооружений, действующих на территории Республики Узбекистан.

Ключевые слова: реконструкция, оценка прочности, надежность эксплуатации, усиление фундаментов, кирпичных стен, железобетонных плит, колонн, балок и металлоконструкций, восстановление надежности.

Abstract. The article provides basic information about the methods and tools currently used when adding additional floors to existing buildings, assessing the seismic resistance of buildings recommended for reconstruction, and determining the reserves for increasing their seismic resistance. The main part of the article describes in detail the methods for accounting for seismic loads with an increase in the number of storeys of buildings for organizations studying the technical condition of buildings and structures operating on the territory of the Republic of Uzbekistan.

Key words: reconstruction, strength assessment, reliability of operation, strengthening of foundations, brick walls, reinforced concrete slabs, columns, beams and metal structures, restoration of reliability.

Introduction: The organization of repair, reconstruction, increase in the number of floors, reconstruction of existing residential buildings, industrial enterprises, social-household and cultural buildings in order to meet the requirements of the present time becomes a state-level policy. This problem requires solving issues such as changing the shape and size of buildings, replacing or strengthening structures, and if possible increasing the number of floors. Perfect repair and reconstruction of buildings and structures in the cities of our country is being carried out rapidly. Perfect repair and reconstruction of existing buildings, reconstruction

of industrial enterprises with modern equipment compared to new construction is done many times cheaper. There are many buildings and structures for reconstruction in the three large cities of Fergana region, Fergana, Kokan and Margilon. Existing buildings in the city of Fergana can be divided into the following periods depending on the time of construction. Capital construction plays an incomparable role in the socio-economic development of any country. In our country, great attention is paid to the development of this sector of the economy at the state level. Many buildings and structures were built in our country during the years of independence.

In the Republic of Uzbekistan, special attention is paid to the issues of reconstruction of existing production enterprises, their technical re-equipment, reconstruction and beautification of factories and their territories based on modern requirements, creation of favorable conditions for workers and employees working in them. a large amount of funds are allocated to these works from the state budget and extra-budgetary sources.

Decrees of the President of the Republic of Uzbekistan, laws adopted by the Oliy Majlis and the Senate aimed at further development of the construction industry, decisions of the Cabinet of Ministers, orders and orders of line ministries have developed specific measures aimed at solving these issues and are being put into practice.

The main part: Decision No. PQ-4794 of the President of the Republic of Uzbekistan dated July 30, 2020 “On measures to radically improve the system of ensuring seismic safety of the population and territory of the Republic of Uzbekistan”, Republic of Uzbekistan As can be seen from the decisions of the Cabinet of Ministers of June 30, 2021 No. 405 “On the assessment of the seismic strength of buildings and structures and the introduction of the system for the formation of electronic technical passports”, this issue is considered to be of national importance.

In recent years, Uzbek scientists in the field of seismology have focused their main fundamental ideas and practical scientific research on the development of specific targeted measures to protect the population and regions from seismic risk and their implementation [1].

Today, ensuring the seismic safety of the population and the territory of the republic and reducing losses by preparing in advance for earthquakes in seismically active zones with a high probability of earthquakes determines the strategic development of the republic in many ways. The research conducted in the field of seismology is aimed at determining the nature of earthquakes, in which it is necessary to determine the laws of manifestation of earthquake detectors, to study the propagation of seismic waves according to the mechanisms and parameters of the earthquake center and their characteristics in the geological environment, various to determine the location of the foci of formation of earthquakes on the seismically active earth faults of the level, the regional variation of the seismic risk and the variation of seismic vibrations depending on the ground conditions on the surface of the earth and their attenuation along the distance, and the seismicity of the regions at different levels focused on risk assessment.

PF-144 of the President of the Republic of Uzbekistan of May 30, 2022 “The concept of improving the system of ensuring seismic safety of the population and territory of the Republic of Uzbekistan until 2025” includes the population living in the seismically active zones of the Republic, various types of buildings and structures and engineering It consists of determining and implementing scientific-practical, programmatic and organizational work until 2025, while determining the strategic directions of protecting infrastructures from seismic risk. It is envisaged that the implementation of the concept will enable the sustainable socio-economic development of Uzbekistan and the rational distribution of available resources in emergency situations. Development of a method of considering seismic loads when increasing the number of floors of buildings

in all regions of Uzbekistan. Preparation of recommendations for ensuring the availability of strength resources and seismic priority and safety.

Methods of work: In the complex of these methods, it embodies all the recommendations and calculation works given in the consideration of seismic loads when increasing the number of floors of buildings. The aim is to improve the design quality, reduce the seismic strength of buildings, errors, and time spent in the design. The Republic of Uzbekistan is located in a seismic area, and under the influence of seismic activity, great economic damage can be caused to buildings and our Republic. In particular, Tashkent region and Fergana valley are considered to be regions where earthquakes are repeated more often than other regions of our Republic. These regions are densely populated, and many production enterprises are also located in these regions. Construction of multi-storey residential buildings for the population, increasing the number of floors through the reconstruction of old buildings is also being carried out rapidly in seismic areas.

As can be seen from these data, when adding additional floors to existing buildings, assessing the seismic strength of buildings recommended for reconstruction, and determining reserves to increase their earthquake resistance, it is one of the most urgent issues today. A superstructure is the addition of one or more additional floors to buildings. It is cost-effective while increasing the useful area in buildings:

- eliminates the need for additional land area;

- reduces financial costs;

- does not require solutions to problems related to a number of activities in the construction process:

- construction of foundations, construction of external walls,

- the superstructure does not require improvement works in the area where the building is located;

- constructions of various types and functions are used in capital construction (taking into account the requirements of urban planning standards):

- attics of multi-apartment houses are actively used in densely populated cities: similarly, the third floor of a townhouse, duplex, quadrohaus, lanehouse

- an additional floor of an administrative or office building increases the useful area of the building;

- adding extra floors in industrial buildings allows to increase the production capacity.

During the reconstruction of buildings by adding an additional floor, changes in the dimensional and planning solutions of the object are observed:

- height;

- number of floors;

- area;

- size.

Buildings that are going through their service life, adding floors to the superstructure can be done with or without strengthening the structures in the existing building (without loading the existing foundation, with the possibility of using a separate foundation for the superstructure).

There are the following types of superstructures:

- building additional floors on top of the existing constructions of buildings;

- building mansards;

- creation of small rooms and recreations on the functionally operated roof;

Options for structural solutions of superstructures:

- new additional floor walls repeat walls of existing floors;

- replacement of internal load-bearing walls with columns in the superstructure;

- to consider a separate frame system for the superstructure;

- execution of superstructures on separate supports;

- installation of progon or trusses with high load carrying capacity between fences;

- a combination of all the solutions listed above.

Superstructures, i.e. raising individual parts or all parts of the building, are carried out in accordance with the norms of urban planning and taking into account the changing operational situation.

Based on their structural features, superstructures can be divided into three types: simple, modified and non-loading.

A simple superstructure (Fig. 1,a) is a continuation of the building in height, the internal structure of the building, load-bearing walls and other foundations with preserved dimensions. Most of all traditional two-story buildings are built with one- or two-story superstructures, taking into account the technical condition of the foundations and walls. The building height can be increased by 1-2 additional floors in buildings with superstructures built 10 years and earlier. Such constructions are carried out in the course of exploitation, when the foundation is compacted, the foundations are in satisfactory condition, and the walls and supports are satisfactory[5-7].

Superstructures that change the structural schemes of the building (Fig. 1, b) are a way to transfer the additional load, that is, the weight of the additional floor under construction, to reduce the main load-bearing elements of the existing building, to a less loaded or unloaded structure. is done with Such superstructures are recommended when it is not possible to reach the required size of the superstructure in a simple way, it is confirmed by checking the technical condition of the building. Figure 1.b shows the outline plan of the building where the superstructure will be built. Impact loads are received by longitudinal load-bearing walls. In superstructures, loads of additional floor coverings fall on transverse walls. Thus, the mass of the superstructure is evenly distributed throughout the building: all walls are raised, but the load of the superstructure cover falls on the less loaded transverse walls.

The construction scheme allows to increase the superstructure floors to 3-4 floors.

The load-bearing core of superstructure floors has two structural options. Superstructure floors can form a platform that can have any constructive solutions (Fig. 1,c).

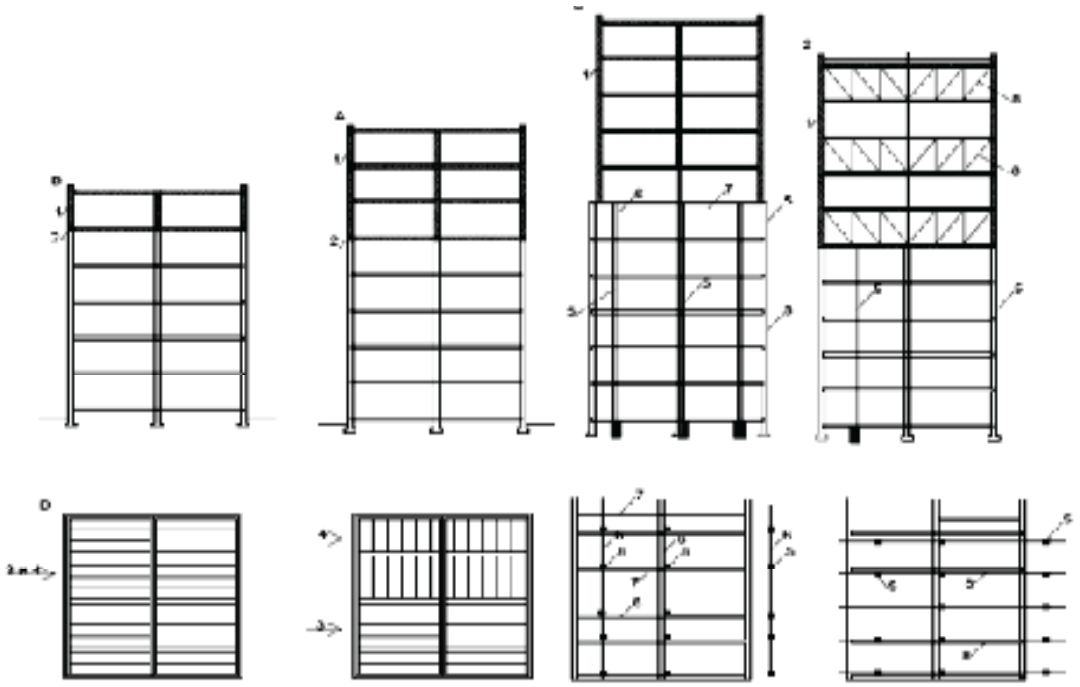
In addition, load-bearing elements installed on columns in the form of beams, trusses, frames are used on each floor (Fig. 1, g).

Thus, the additional structure of the object means any type of reconstruction. During its implementation, the functional modification of the capital construction department takes place:

1. the number of floors in existing or autonomous structures increases due to the construction of one or more additional floors;

2. the main classifications and all parameters will change;

3. the load on the foundation increases.



- Figure 1.1. Types of additional floor (superstructure) and their structural schemes: a-ordinary superstructure; b- the same, the structural scheme has been changed; v – the same, on the base platform; g- the same, floors with inter-beams (trusses, frames); d - constructive schemes of cuts and plans; 1- superstructure floor; 2- single-wall belts; 3 – general scheme of the existing building; 4 - superstructure floor layout scheme; 5- superstructure columns; 6- Head beams of the base platform; 7 – secondary beams; 8 - wall beams of superstructure floors

- When reconstructing with an additional floor - a superstructure, it is necessary to check the technical condition of the object's structures, and it is necessary to clarify the following points:

- - strength of soil under the effect of additional load;

- - tolerance of existing load-bearing structures and foundations to increased loads;

- - the need to strengthen foundations;

- - the actual state of structural elements of structures and engineering communications:

- - facade;

- attic and roof structures;

- places of laying pipes, elements of the ventilation system of the building, etc.;

- the potential danger that the additional floor is located next to the planned reconstruction object;

- hotel complexes, public buildings and business centers, but excluding:

- near the streets and roads in the settlements

- in historically significant areas and near them

- new construction is carried out in the territories regulated by the state;

- railway stations, transport facilities and transport stations - except for the following;

- near the road network;

- in the territory of residential complexes;

- in places where construction works are regulated;

- Buildings and structures of industrial enterprises located near residential buildings and places of rest and in places of public opinion;

- Objects of social importance used on the basis of funds allocated from the local budget;

- other objects.

Methods of reconstruction of low-rise, i.e., 4-5-story buildings in Fergana region were analyzed in the study of the method of considering seismic loads in increasing the number of floors of buildings. These buildings have reached the end of their service life according to the norms of perfect repair and reconstruction, but most of such buildings have enough reserves and meet the load resistance. They suffered spiritual decay. All these indicators mean that buildings can be reconstructed[2-3].

When increasing the number of floors of buildings, that is, during reconstruction, it is necessary to choose the most optimal solution to the following issues:

- to achieve the maximum increase of the useful area with the minimum expansion of the construction area;

- modernization of engineering networks;

- improvement of the architectural appearance of facades;

- ensuring earthquake resistance.

Solving seismic safety problems is one of the most important tasks of socio-economic development of seismically active regions. Each seismic activity is characterized by socio-economic and ecological consequences according to its natural parameters. The level of disasters depends on many factors: the parameters of the earthquake that took place, the seismic level of the building, the probability of secondary side effects, the readiness of the state authorities for immediate rescue and restoration work, etc. Thus, under any circumstances, especially when reconstructing buildings after their service life by increasing the number of floors, it is necessary to ensure that the seismic strength of the building is within the specified standards.

In the reconstruction of existing buildings in the Fergana region, the provision of seismic resistance specified in the norms was studied. When increasing the number of floors of existing buildings through reconstruction, it is promising to build superstructures, especially taking into account seismic loads and the seismicity of the area. For this reason, the seismic resistance of the "building-superstructure" system was studied when increasing the number of floors of buildings that are passing their service life. In the course of research, the seismic resistance of the existing buildings together with the superstructure was assessed [1-4].

Basics of ensuring seismic priority and safety of buildings:

On May 30, 2022, the President's Decree on "Measures to further improve the seismic safety system of the Republic of Uzbekistan" was adopted.

Nowadays, issues of ensuring the seismic safety of buildings and structures occupy a leading place in constructions in world practice. In this regard, some progress has been made in the developed countries of the world, special attention is being paid to the development of structural solutions and anti-seismic measures and improvement of calculation methods to ensure strength and earthquake resistance in the design of buildings and structures.

It is known that Uzbekistan is one of the active seismic regions. That is why the construction of buildings and structures and their earthquake resistance issues are always relevant. These issues were taken into account in the above Decree of the head of our state. A number of important tasks have been set before the officials and experts, which must be solved and fulfilled.

In particular, to expand the possibility of full monitoring of the territory of the republic due to the increase of automated complex-prognostic stations, to ensure permanent connections of the national seismic observation

network with the stations included in the global system of international seismic observations, to develop science and education in the field and regulating the activities of preparing the population and state bodies for action in earthquakes, strengthening control of the earthquake resistance of newly constructed buildings and structures, water reservoirs and hydrotechnical facilities has become a vital necessity.

The decree also sets personal responsibility and accountability for the first heads of state bodies to ensure the timely and effective implementation of the measures defined in the well-thought-out concept and "roadmap". In addition, to the Ministry of Space Research and Technology under the Cabinet of Ministers, the Academy of Sciences, Emergency Situations, Higher and Secondary Special, Innovative Development, Construction, Housing and Communal Services, Water Management, Transport and related departments the task of eliminating existing problems in the field is set.

At the same time, from September 1, 2022, to introduce the procedure for obtaining conclusions on earthquake resistance for objects belonging to category IV hazard factor (objects with the highest hazard factor), which are planned to be newly built in seismically active zones of our republic, 1 and starting from October, the practice of carrying out multi-apartment houses in the territory of the republic for earthquake resistance testing will be launched, and according to the results of the testing and the results, the seismic weak and Another aspect worthy of recognition is that the procedures for submitting proposals for the gradual construction of new housing in place of multi-apartment housing with signs of emergency have been established to the local state authorities.

Starting from 2023, serial construction of buildings and structures with a height of 9 floors or more in the seismically active zones of the republic is planned or selected, in order to increase the earthquake resistance, ensure their quality, and eliminate defects in advance, using vibrodynamic equipment or modern digitized instrumental equipment. investigation is underway [4-9].

Improvement of the design, construction and operation of seismically resistant buildings and structures is unthinkable without qualified personnel. Training and retraining of personnel in this direction is inextricably linked to the activities of specialized higher education institutions. In this regard, as stipulated in the Decree, starting from the 2022/2023 academic year, Namangan Engineering-Construction Institute and Fergana Polytechnic Institute will start the practice of training personnel in the educational specialty "Earthquake resistance of buildings and structures", Namangan Engineering - the establishment of the "Seismic Protection of Buildings and Structures" educational and scientific laboratory at the Institute of Construction, which is designed to assess the technical condition of buildings and structures in terms of earthquake resistance, conduct scientific research on active seismic protection methods, and at the Turin Polytechnic University in Tashkent " The opening of the educational specialty "Seismic strength of historical monuments" and the opening of the educational-scientific laboratory "Assessment of earthquake resistance of reservoirs and hydrotechnical structures" under the national research university of the Institute of Irrigation and Agricultural Mechanization Engineers of Tashkent was the occasion.

In conclusion: it can be said that the effective implementation of this Decree plays an important role in ensuring the seismic safety of buildings and structures in our country. Many potential risks are avoided. The level of preparedness of the population and management bodies in the prevention of losses will increase, in this direction, the development of science and education, the system of training high-potential personnel will enter a new stage.

Therefore, in order to take into account the seismic loads in the increase in the number of floors of the buildings that are passing the service life, it is necessary to develop volumetric-planning and structural solutions that are fully responsive to their long-term use at the design stage: the selection of strong, mature and durable materials need; it is necessary to

take measures to protect them from the atmosphere, moisture - temperature, technological effects, to ensure the load-bearing capacity of the structure in various adverse effects of loads.

Increasing the earthquake resistance of buildings and structures with an increased number of floors can be achieved by optimizing their structural scheme, enlarging assembly elements, and reducing nodes and joints.

In order to ensure the suitability of buildings and structures during the entire accounting service period, they must be subjected to technical inspections and inspections from time to time, timely elimination of defects, current and capital repairs, quality maintenance is required. Complete elimination of defects identified as a result of technical inspection in time, restore the working capacity of load-bearing structures, ensure their reliability, maintain the performance indicators of buildings and structures at the level of normative requirements, and ensure their safe use for a long time. serves as collateral.

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