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Yusupov A.R.

Candidate of Technical Sciences, Associate Professor,

Fergana Polytechnic Institute. Uzbekistan. Fergana

CALCULTING EARTHQUAKE RESISTANCE AND EARTHQUAKE RESISTANCE OF REINFORCED CONCRETE FRAME BUILDINGS USING THE LIMIT EQUILIBRIUM METHOD

Annotation: the article discusses the issues of calculating the seismic resistance and seismic stability of reinforced concrete frame-frame bearing systems using the method of marginal equilibrium. If we imagine the seismic resistance and seismic resistance of a seismically safe building or structure in the form of concentrated circles, then inside the circle there is a circle of the real normative seismic resistance of the object. Numerous surveys of the technical condition and seismic resistance of real construction sites, conducted by the author in order to develop reconstruction projects, showed excessively huge reserves of seismic bearing capacity of buildings designed and erected in strict accordance with the requirements of current building codes and regulation

Keywords: construction, building, seismic resistance, seismic resistance, method, calculation, limit state, spatial rigidity, plastic hinge.

Introduction

Initially, it is advisable to focus on the concepts of seismic resistance and seismic stability of buildings and structures. Seismic resistance is the ability of building structures, buildings and structures to withstand calculated seismic loads and deformations, while maintaining their operational properties within the limits provided for by current building codes and regulations, as well as technical regulations. Seismic resistance is the ability of building structures, buildings and structures in general, to withstand the strongest earthquakes with

minimal damage (destruction of individual load–bearing elements of buildings and structures is allowed [4].

Materials and methods:

This includes empirical methods such as modeling, fact-finding, experiment, description and observation, as well as theoretical methods such as logical and historical methods, abstraction, deduction, induction, synthesis and analysis, as well as methods of heuristic strategies. The research materials are: scientific facts, the results of previous observations, surveys, experiments and tests; means of idealization and rationalization of the scientific approach.

If you present the seismic resistance and seismic resistance of a seismically safe building or structure in the form of concentrated circles, then the circle of the real normative seismic resistance of the object is located inside the circle. seismic resistance of an object Seismic resistance means the real ultimate resistance of a structural system to strong seismic influences and includes all the resources of the seismic bearing capacity of a building and structure. As noted above, seismic resistance determines the ability of building structures, buildings and structures to withstand calculated seismic loads and deformations, while maintaining their operational properties within the limits provided for by current building codes and regulations, as well as technical regulations. Numerous surveys of the technical condition and seismic resistance of real construction sites conducted by the author, in order to develop reconstruction projects, showed excessive huge reserves of seismic bearing capacity of buildings designed and erected in strict compliance with the requirements of current building codes and regulations [8].

The main prerequisites for the optimal design of buildings and structures in seismically active regions, calculation and construction of seismically safe buildings should be reduced to increasing the reliability of calculations for seismic resistance, convergence of the boundaries of the areas of seismic

resistance and seismic stability of the type of structures under consideration. The seismic stability of an object primarily depends on its height and weight as a whole, the structural system that takes over the seismic impact, the seismic regions where the object is being built, including microseismic zoning. Since geological faults may exist in areas of low seismic activity, which may pose an increased geodynamic danger to individual objects, especially high-rise buildings.

Results and discussion:

To ensure the optimality of design solutions for construction projects in regions of high seismicity (more than 8 points), it is necessary to develop new calculation methods. To study the actual operation of structures in conditions of strong earthquakes, it is necessary to study structural systems at a stage close to the limit, taking into account the accumulation and development of damage over time. In the problems of seismic resistance, the economic criteria of optimality are also important, on the basis of which the degree of antiseismic reinforcement can be selected, ensuring a given level of reliability of the structure with minimal costs for eliminating the consequences of an earthquake. At the same time, one of the main tasks is to determine the degree and extent of damage to load–bearing structures in conditions of possible earthquakes, which necessitates the study of buildings in conditions of real earthquakes. Therefore, it is very important that the technical and physical conditions of seismic resistance of buildings and structures are evaluated at the rigid-plastic stage of deformation of steel reinforcement and, accordingly, taking into account the descending branch of the concrete resistance diagram. The theory of calculation is based on the prerequisites, assumptions and limitations of the Limit equilibrium Method, which are given in classical form in the books by A.A. Gvozdev "Calculation of the bearing capacity of structures using the limit equilibrium method" [1] and S.M. Krylov "Redistribution of forces in statically indeterminate reinforced

concrete structures" [2]. It should be noted that in these works the situations with regard to static loads and displacements are considered.

The quasi-spatial frame model proposed by us for calculating the seismic stability of reinforced concrete frame-frame and frame-link buildings and structures at the elastic-plastic and plastic stages of the stress-strain state, as in addition to the classical assumptions of the limit equilibrium method, is based on the following hypotheses, prerequisites and assumptions:

the concrete of the stretched zone does not work, the tensile stress is perceived by the reinforcement; in the ultimate equilibrium state, the concrete of the compressed zone works elastically or plastically, and the dependence between stresses and deformations is nonlinear, contrary to Hooke's law, the descending branch of the concrete deformation diagram is included in the work;

in oscillatory processes, the stretched and compressed cross-section zones of the constituent elements and the reinforced concrete frame as a whole change periodically and acquire an alternating character, as a result, even compressed zones work with cracks and damage, the working height of stretched and compressed fittings should be determined minus the protective layers of longitudinal working fittings on both sides;

real buildings due to inelastic deformations and cracking will move away from resonance, this hypothesis has a fundamentally important, fundamental character when choosing the form of oscillation by which the destruction of the building occurs; in any form of destruction from the effects of forces and forced displacement, the exhaustion of the bearing capacity of a building or structure occurs according to a scheme according to which a minimum of energy (work) is spent internal efforts of the load-bearing frame. Here, when it comes to the dynamic nature of destructive influences, preference, the dominant position is given to the basic tone (the first form) natural vibrations of the building [6];

A quasi-spatial frame, i.e. a flat frame loaded across the width of the cargo area by forces in orthogonal planes with respect to the considered design frame, is accepted as the main design scheme [3].

THE MAIN CONCLUSIONS

1. In the regulations of modern design, the calculation of buildings and structures for the action of seismic loads is carried out in strict accordance with the current state building codes, standards and rules obtained in normal and inclined sections of structures that operate in the elastic stage. Special coefficients of working conditions have been adopted, taking into account the features of seismic impact, the soil base and the structural structure of buildings and structures. Despite these clarifications, this approach remains as a conditionally elastic static method for calculating buildings for seismic impacts [8].

2. Numerous surveys of the technical condition and seismic resistance of real construction sites conducted by the author, in order to develop reconstruction projects, showed excessive huge reserves of seismic bearing capacity of buildings designed and erected in strict compliance with the requirements of existing building codes and regulations [5].

3. The proposed method for calculating the seismic resistance and seismic resistance of reinforced concrete frame buildings takes into account the joint action of forces located in the planes of the longitudinal frames and parallel to them, and also, in the calculation of longitudinal frames, the joint action of forces located in the planes of the transverse frames and parallel to them is taken into account.

4. When the load-bearing capacity is exhausted, i.e. the seismic resistance of reinforced concrete frame-frame and frame-link buildings and structures, the forces caused by the introduction of forced deformations and displacements into

the system, which created torsion and displacement from the frame plane in the sections of the frame frames, are completely removed.

5. A complete redistribution of forces in the design plane of the frame is realized. as mentioned above, in the ultimate equilibrium state, a complete redistribution of forces occurs, as a result of the formation of plastic hinges, the static indeterminacy of the reinforced concrete quasi-spatial calculation frame is resolved.

6. The bending moment in the design nodes of the frame reaches their maximum plastic values and becomes constant with further deformations of a plastic nature.

7. This allows that in the ultimate plastic equilibrium state, the calculated multi-storey frame can be conditionally divided into statically definable floors and racks using the section method.

8. For the considered truncated part of a static definable frame (for the left or right, for the upper and lower parts), it is possible to create conditions for the equilibrium of external and internal forces, this allows you to detail and analyze the seismic stability of any horizontal and vertical section of the supporting frame of a building separately [7].

References:

1. Гвоздев А.А. Расчет несущей способности конструкций по методу предельного равновесия. Сущность метода и его обоснование. Стройиздат, 1949. - 280 с.

2. Крылов С.М. Перераспределение усилий в статически неопределимых конструкциях, - М,,: Стройиздат, 1964. - 168 с.

3. КМК 2.01.03-19. Строительство в сейсмических районах.

4. Юсупов А.Р. Инженерные решения реконструкции здания «Мадрасаи Мир» в городе Каканд. "Экономика и социум" №11(102) 2022. www. iupr.ru.

5. Тожиев Р.Ж., Юсупов А.Р. Ражабова Н.Р. Қурилишда метрология, стандартлаштириш ва сертификатлаштириш. Дарслик. Т., “Ёш авлод”, 2022, 464 б.

6. Юсупов А.Р. Эвристические стратегии интеллектуального образования. "Экономика и социум" №11(102) 2022. www. iupr.ru y.

7. Юсупов А.Р. Оценка сейсмостойкости и сейсмоустойчивости железобетонных каркасных зданий и сооружений методом предельного равновесия. "Экономика и социум" №11(102) 2022. www. iupr.ru.

8. КМК 2.01.03-19. Строительство в сейсмических районах