УДК 550.834

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SEISMIC RESISTANCE OF A MULTI-STOREY FRAME-FRAME BUILDING TAKING INTO ACCOUNT THE SEISMIC ENERGY SUPPLY OF THE BASE, BEARING FRAME AND DAMPERING DEVICES

Аннотация: The article discusses the issue of assessing the seismic resistance of reinforced concrete frame frame buildings at the elastoplastic and plastic stages of the stress-strain state, taking into account the absorption of seismic energy by the pliability of the base, the supporting frame and damping devices.

Ключевые слова: Building, strength, seismic resistance, elastoplastic stage, plastic hinge, seismic energy absorption coefficient.

When calculating buildings (structures) for seismic effects can be used;

a) a dynamic calculation method for real or synthesized seismic effects typical for the construction area;

b) spectral method of calculation for seismic (conventional static) loads, determined for ideally elastic systems in accordance with the instructions in clause 2.13 [1].

For buildings (structures) with fundamentally new, constructive solutions of buildings with a height of more than 40m, it follows, and when designing objects of mass construction with a height of up to 40m, it is recommended to use the dynamic calculation method according to clause 2.6.a [1].

The choice of a structural system, design and calculation of buildings (structures) for

real or synthesized seismic inactivity should be carried out with the participation of a research organization specializing in earthquake-resistant construction [1].

When calculating according to clause 2.66, the calculated seismic load in the selected direction, applied at point K and corresponding to the i-th tone of natural vibrations of the building (structure), is determined by the formulas:

$$S_{iк} = K_0 K_п K_{эт} K_р S_{oik} \quad (1)$$

$$S_{oik} = \alpha Q_k W_i K_\delta \eta_{ik} \quad (2)$$

where S_{oik} - inertial force determined under the assumption of elastic deformation of structures;

a - coefficient determined according to table 2.7 depending on the seismicity of the construction site;

O_k- the weight of the building (structure), referred to point K of the design scheme (Figure 2.1), determined taking into account the design loads on the structure, in accordance with clause 2.1 [1];

W_i- spectral coefficient determined according to clause 2.16;

K_δ- dissipation coefficient, determined according to clause 2.16;

$K_р$ - коэффициент регулярности, определяемый по п.2.25;

K_0- the coefficient of responsibility, taken according to table 2.3;

$K_{эт}$- coefficient depending on the number of storeys of a building (structure), determined according to clause 2.17;

η_{ik}- - coefficient depending on the form of natural vibrations of the building (structure) on the 1st run and the location of the load on the design diagram, determined according to clauses 2.18, 2.19;

$K_п$- the coefficient of accounting for the recurrence of earthquakes, taken according to Table 2.4 [1].

Analysis of normative documents and manuals for calculating the seismic resistance of buildings showed that the calculations do not take into account the absorption of seismic energy by the base, damping devices and the supporting frame [1; 2; 3].

The authors propose to introduce into the formulas (2 and 3) the norms of the

seismic energy absorption coefficient $К_{п.э.}$.

Seismic energy absorption coefficient Kp. should be determined by the generalized formula

$$К_{п.э.} = К_{п.\ э.\ о} * К_{п.э.д} * К_{п.э.к} \quad (1.3)$$

where

$К_{п.\ э.\ о}$— empirical coefficient of energy absorption by the base of the building;

$К_{п.э.д}$ – empirical coefficient of energy absorption by damping devices, if any;

$К_{п.э.к}$ – empirical coefficient of energy absorption by the frame, load-bearing walls of a building and structure. According to the idea presented, $К_{п.э.к}$ should grow with the growth of the floor of the building.

The authors continue research to detail the qualitative and quantitative values of the seismic energy absorption coefficient. $К_{п.э.}$

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