RULES FOR DESIGNING RESIDENTIAL AND PUBLIC BUILDINGS IN EARTHQUAKE AREAS

t.f.f.d.(PhD) ***O.U.Yalgashev***,
(FVV Academy of the Republic of Uzbekistan)

Annotatsiya. *Ushbu maqola matnida karkas panelli, yirik panelli va hajmiy blokli turar-joy, jamoat binolarini loyihalash asoslari keng yoritilgan. Muhandislik geologik sharoitga bog'liq bo'lgan qurilish maydonlarining zilzilaviyligi hamda qurilish maydonining tuproq tarkibi ilmiy asoslangan. Zilzilaviy yuklanishning tasiri ko'rsatilgan yo'nalishlarda zilzilaviy xususiyati bo'yicha yer osti suvlarining ko'tarilishi va gruntning bo'kuvchanligi alohida hisobga olingan. Binolarning zilzilaga chidamliligini taminlash bo'yicha tadbirlar o'rganildi.*

Kalit so'zlar: *karkas panelli, turar-joy, jamoat, muhandislik, qurilish, zilzila, grunt, ball, cho'kish, choklar, yerto'la, poydevor, yuklanish.*

Аннотация. *В тексте данной статьи рассмотрены основы проектирования жилых и общественных зданий каркасными панелями, крупнопанельными и объемными блоками. Сейсмичность строительных площадок, которая зависит от инженерно-геологических условий, и состава грунтов строительной площадки научно обоснованы. На направлениях, где указано влияние сейсмической нагрузки, учитывают подъем подземных вод и податливость грунтов по сейсмическим характеристикам. Изучены мероприятия по обеспечению сейсмостойкости зданий.*

Ключевые слова: *каркасно-панельный, жилой, общественный, инженерный, строительный, землетрясение, грунт, забит, просадка, швы, подвал, фундамент, нагрузка.*

Annotation. *The text of this article discusses the basics of designing residential and public buildings using frame panels, large-panel and volumetric blocks. The seismicity of construction sites, which depends on engineering geological conditions, and the composition of the soil at the construction site, is scientifically substantiated. In the directions where the influence of seismic load is indicated, the rise of groundwater and the compliance of soils according to seismic characteristics are taken into account. Measures to ensure seismic resistance of buildings have been studied.*

Keywords*:* *frame-panel, residential, public, engineering, construction, earthquake, soil, clogged, subsidence, seams, basement, foundation, load.*

Existing regulatory rules in force in our country are widely used in the design of residential and public buildings with frame panels, large panels and volume blocks. When designing buildings for seismic regions, it is necessary to use the same type of prefabricated structures specially developed for these regions.

Buildings used in seismic regions are in a state of stress until an earthquake occurs, just like in regions with less earthquakes, so they must meet all requirements of use in accordance with the general building code. Only when an earthquake starts, i.e., when an additional external force is applied to the building, the reserve of strength designed in the design of the building is activated. Therefore, the load-bearing capacity of the building must be designed for the conditions of operation and the impact of stresses arising as a result of an earthquake.

Size planning of buildings, selection of structural solutions, construction materials and constructions, requirements of regulatory documents in the design and construction of individual structural solutions, technical regulations on the economical use of basic construction materials, as well as the normative rule of QMQ 2.01.03-96 "Construction in an earthquake zone" should be chosen according to.

Special requirements will be introduced for buildings to be built in areas with a seismicity of 7, 8, and 9 points.

When designing the above-mentioned buildings, it is necessary to follow the following:

- use of materials, structures, schemes that ensure the smallest values of seismic stress;
- it is usually necessary to adopt symmetrical structural schemes with equal distribution of strength and weight of constructions. In the plan, it is recommended to design the same height of the spaces located parallel to the right angle;
- it is necessary to place the junctions of buildings with prefabricated elements outside the region of stresses, to ensure the integrity and homogeneity of structures using large prefabricated elements;
- in multi-storey buildings, in prefabricated frames made of linear elements, it is necessary to combine beams with columns, ensure strength in their interconnected places.

Engineering - seismicity of construction sites depending on geological conditions (in points)

Table 1.

Category of seismic properties of soil	**Grunts**	**The seismicity of the construction site when the seismicity of the district is as follows, in points**		
		7	**8**	**9**
1	2	3	4	5
I	1. Any rocky soils with water-saturated uniaxial compressive strength R>1 MPa or seismic wave propagation speed Vs>1700 m/s 2. Large crushed rock soils (large round stones and rock fragments) with seismic wave propagation speed Vp>2500 m/s and Vs>900 m/s	6	7	8
II	1. When saturated with water, the strength limit in uniaxial compression is R<1 MP a or the speed of propagation of seismic waves is	7	8	9

	Vp>1800 and Vs>600 m/s (irradiated and superirradiated) all types of rocky grunts. 2. Large broken rock soils with seismic wave propagation speed Vp>800 and Vs>500 m/s (cobblestone, gravel, crushed stone, coarse sand). 3. Sandy soils: - large and medium-sized gravel sands with seismic wave propagation speed Vp>500 and Vs>350 m/s, low moisture, porosity coefficient e < 0.7; - fine and dusty sands with seismic wave propagation speed Vp>400 and Vs>300 m/s, low moisture content, porosity coefficient e < 0.6. 4. Soil primers: - soils with solid-liquid index JL < 0.5 or seismic wave propagation speed Vp>900 and Vs>500 m/s; - sandy and loamy soils with the porosity coefficient e < 0.8 when the solid-liquid index JL < 0.5 or the speed of propagation of seismic waves Vp>500 and Vs>300 m/s; - fine soil soils (loamy soils, sandy loamy soils) with a solid-liquid index JL < 0.5, porosity coefficient e < 0.8 or seismic wave propagation speed Vp>500 and Vs>300 m/s , sandy soils and clays). 5. Bulk primers: - large fractured rocks with seismic wave propagation speed Vp>500 and Vs>300 m/s; - loamy and silt-soil soils that have become saturated with water and have a general deformation modulus EE0 > 12 MPa or seismic wave propagation speed Vp>500 and Vs>300 m/s.			
III	1. Sandy soils: - gravelly sands with a moisture level of Sr ≤ 0.5, a porosity coefficient of ≥ 0.7 and medium size; - propagation speed of seismic waves Vs ≤ 350 m/s, wet (Sr > 0.5) and water-saturated with porosity coefficient e < 0.7	8	9	>9

	(Sr > 0.8) large and medium gravel sands; - propagation speed of seismic waves Wet (Sr > 0.5) and water-saturated with Vs ≤ 300 m/s, porosity coefficient e < 0.7 (Sr > 0.8) fine and dusty sands, poorly hydrated (Sr ≤ 0.5), sands with a porosity coefficient e ≥ 6. 2. Soil primers: - solid-liquid index JL > 0.5 or propagation speed of seismic waves Soils with Vs ≤ 500 m/s; - porosity coefficient e ≥ 0.8 and e < 0.8 or propagation speed of seismic waves Sandy and rounded soils with Vs< 300 m/s; - when the solid-liquid index JL > 0.5, the porosity coefficient is ≥ 0.8 and is < 0.8 or the propagation speed of seismic waves Fine soil soils with Vs< 300 m/s (healthy soils, sandy loam soils, sandy soils and clays). 3. Bulk primers: - sandy loam and dusty soils with water-saturated general deformation modulus EE0 ≤ 12 MPa or seismic wave propagation speed Bc ≤ 300 m/s			

If the soil composition of the construction area is not the same, if it falls into the very inconsistent category in terms of seismic characteristics, if the soil layer around 10 m from the structure (counting from the leveling point) falls into this category, the sum of its thickness is more than 5 m 'has more.

During the use of the structure, the rise of underground water and soil permeability is determined depending on the characteristics of the soil (moisture, consistency).

For important structures and buildings under construction in 6-point seismic regions, seismicity should be calculated as 7 points in construction sites with III-class soil. In the absence of information on the consistency or moisture content of clayey or sandy soils, if the groundwater table

If it is more than 5 m, then it belongs to the III category in terms of seismicity. It is necessary to take into account the conditions that facilitate the development of plastic deformation in structural elements and their connections, while ensuring the overall strength of structures.

When designing buildings in seismic areas, the following should be taken into account:

a) intensity of the earthquake (in points);

b) earthquake recurrence rate.

The intensity and degree of recurrence of the earthquake should be taken according to the map of the population settlements in the earthquake zone, as indicated in QMQ 2.01.03-96.

It is recommended to determine the seismicity of the construction site based on seismic fogging. In places where there are no seismic micro-fogging cards, it is allowed to determine the seismicity of the construction site according to Table 1.

Construction sites with a steep slope angle greater than 150, near cliffs, severe disruption of the physical-geological process of rocks, soil subsidence, landslides, and floods are unfavorable from a seismic point of view. If it is necessary to build buildings on such sites, it is necessary to take additional measures to strengthen their foundations and strengthen building structures.

Construction works should be carried out only with the approval of the State Architecture and Construction Committee in places with a seismicity of more than 9 points.

When designing buildings for seismic districts, as a rule, it is necessary to use typical special constructions developed for these districts.

In the plan, it is recommended to design the buildings at the same height as right angles. The structural solutions of such buildings must work independently during earthquake vibrations.

Buildings should be isolated with earthquake-resistant seams in the following cases, if:

- if the building is complex;
- if the height of the building plots is 5 m or more.

It is allowed to build one-story buildings with a height of 10 m without earthquake joints with a seismicity of 7 points.

Anti-earthquake seams should separate the building along its entire height. The foundation can be seamless only if the earthquake seam is the same as the subsidence seam.

The distance between seismic joints and the height of the building should not exceed the following values:

Distance between seismic joints and building height

Table 2.

Load-bearing structure of the building	**By length (width), m.**	**Height, m. (number of floors)**
	7:8:9	7:8:9
Reinforced concrete frame	Not exceeding 150 m in accordance with the requirements of non-earthquake districts	In accordance with the requirements of earthquake-free districts
Large paneled walls	80 : 80 : 60	45/14:39/12 : 30/9
Block buildings without a frame	60 : 60 : 60	51/16:39/12 : 30/9

Earthquake joints are made by placing double walls or frames.

The width of the anti-earthquake seam is determined by calculating the direction of the seismic impact.

Earthquake joints in roof coverings and inter-floor coverings /cm/ are taken as multiples of 5 cm and are determined from the following expression:

A=D1+D2+2 sm (1)

where D1 and D2 are the largest displacements of two adjacent walls separated by earthquake joints in the calculated seismic transverse effect.

For buildings with a height of up to 5 m, the width of such seams should not be less than 0.3 cm. In very tall buildings, it is recommended to add 2 cm to the earthquake joints every 5 m.

Filling of earthquake joints should not destroy the interconnection of the building.

When designing stairs, it is required to leave a closed window in the outer walls. The number and location of stairs should be determined from the results of acceptance calculations performed in accordance with the chapter of QMQ on fire protection design standards of buildings and structures, but not less than one between earthquake joints.

Precast reinforced concrete coverings and inter-floor coverings of the building must be integrated in the transverse plane with single and longitudinal load-bearing structures.

The strength of prefabricated reinforced concrete roof coverings and inter-floor coverings should be ensured as follows:

- inter-floor coverings and joints between coverings and panels should be joined by pouring a cement mixture;

- the structure of the connection between the paneled walls and the frame elements, with the appearance of tensile and driving stresses at the seams, volume-blocks with inter-floor horizontal discs at the level of the ceiling slabs.

The side edges of inter-floor coverings and covering panels should be chamfered and chamfered. It should be assumed that the panels will have reinforcement pins or cast details for connection with the frame elements for connection with earthquake belts.

It is recommended to make the main elements similar to curtains with light large panels or frames and to connect them to columns and walls, and also to connect them to inter-floor coverings when the length is more than 3 m. They can also be attached with anchor pins and special bolts. It is not allowed to build the walls of a building with a height of more than 5 floors. Brick walls should be reinforced along their entire length at a height of not less than 700 mm with rods with a total cross section of not less than 0.2 cm2.

When designing the foundations of buildings in earthquake-prone areas, it is necessary to comply with the requirements of the chapter on the design of foundations of buildings and structures. Taking into account the scope of the earthquake, it is necessary to calculate the foundations according to the bearing capacity of certain compounds determined in accordance with the requirements of the QMQ and design based on the chapters of the QMQ on the design of buildings and structures in earthquake regions. In buildings with more than 5 floors, it is recommended to increase the depth of the foundations, taking into account the basement floor. Basement floors should be located symmetrically along the entire building or along the entire part of some section. It is necessary to build the foundations of buildings or a part of them on level ground. If strip foundations are built in different adjacent sections, then they are stepped from the deepest place to the higher part. The step should be steeper than 1:2, and its height should not exceed 60 cm. The strip foundations of the connecting sections must be the same at a depth of 1 m from the seam. Column foundations divided into sinking joints must be located at the same level.

In the design of pile foundations, it is necessary to take into account reinforced concrete pile columns, in which the load-bearing function (the lower tip of the pile) should be selected from undispersed rock, wetter coarse gravel and sandy hard clay soil. The length of driving the lower end of the piles into such lands (except for rocks) should not be less than 1-2 m, depending on the nature of the soil. If the piles are driven into loose ground, the depth of the bottom of the pile into solid ground should not be less than 2 m, and if driven into moderately dense ground, it should not be less than 1 m. The part of the piles that touch the ground should not be less than 4 m. The pile cap must be completely buried in the ground. Under the load-bearing walls, they should be placed at the same level in a row. The top of the pile should be very tightly connected with the cap, taking into account the seismic loading.

The moisture insulation layer of buildings should be made of cement mixture.

Measures to ensure the earthquake resistance of buildings are determined based on the estimated earthquakes specified in Table 3.

Table 3.

№	**Description of the building**	**Seismic calculation of the construction area, points**		
		7	8	9
1	2	3	4	5
1	Residential and public buildings, except for those specified in paragraphs 2-5	7	8	9
2	List of extremely responsible buildings approved by the office or ministry with the approval of the State Architectural Construction Committee	8	9	9x
3	Buildings where the damage will have serious consequences (large and medium-sized railway stations, indoor stadiums, etc.)	7xx	8x	9xx
4	Buildings that are required to operate during earthquake relief (electricity and water supply system, fire depot, fire extinguishing system, etc.)	7xx	8xx	9xx
5	Non-fatal destruction of expensive equipment and temporary buildings	Excluding the effect of an earthquake		

x The building is designed to carry the load according to the calculated seismicity multiplied by an additional factor of 1.5.

xx The building is designed to carry the load in accordance with the calculated seismicity multiplied by an additional factor of 1.2.

In conclusion, the main task of construction production in our country should be industrialized, the level of preparation of construction structures and details should be increased in the enterprise, and the assembly of structures and buildings from structures should be expanded in practice. One of the solutions to this problem is the development of the transition from the construction of large-block houses to the construction of large housing complexes. Volumetric blocks are rarely used in earthquake regions. The measures described above should be used in the design of volume-block buildings for districts with a seismic strength of 7 and more points.

According to the conducted researches, it is necessary to design volume-block buildings for earthquake districts on the basis of structural schemes without a frame, in which columns consisting of volume-blocks stacked on top of each other should be accepted as a system of structural vertical struts. Earthquake impact can be widespread in all directions. They take into account the static weight and are assumed to act horizontally in the direction of the longitudinal or transverse axes of the building. The effect of seismic loading should be taken into account separately in the indicated directions.

REFERENCES

1. QMQ 2.01.03-96 Construction in seismic areas. Committee for Architectural Construction of the Republic of Uzbekistan, 1996.
2. UZLITTI AJ. Rukovodstvo po proektirovaniyu zhilyx i obshchestvennyx zdaniy jelezobetonnym karkasom, vozvodimyx seismicheskikh rayonov. Stroyizdat, 1970.
3. Instruction po proektirovaniyu construction panelnyx zhilyx zdaniy. Gosgrajdanstroy. M. Stroyizdat, 1978.
4. Polyakov S.V. Proektirovanie seismicheskikh zdaniy. M. Stroyizdat, 1971.
5. Polyakov S.V. Seismicheskie konstruktsii zdani. M. High School, 1983.
6. Bondarenko V.I. Projection of civil buildings and seismic districts. T. TashPI, 1988.
7. Albomy typovykh construction and connection frame-panelnykh and krupnopanelnykh daniy.
8. 2.06.11-04 Construction in seismic districts. Hydrotechnical facilities. Committee for Architectural Construction of the Republic of Uzbekistan, Tashkent,
9. SHNQ 2.08.02-09* Public buildings and structures. Committee for Architectural Construction of the Republic of Uzbekistan, 2009
10. QMQ 2.03.05-13 Steel devices. Design standards. Committee for Architectural Construction of the Republic of Uzbekistan, 2013.
11. QMQ 2.03.01-96 Concrete and reinforced concrete structures. Committee for Architectural Construction of the Republic of Uzbekistan, 1996.
12. QMQ 2.01.07-96 Loads and impacts Committee of the Republic of Uzbekistan for Architectural Construction, 1996
13. SHNQ 2.08.01-19 Residential buildings. Ministry of Construction of the Republic of Uzbekistan - Tashkent, 2019.