

Calculation Of A Multi-Storey Building Unfinished Construction Established In A Seismic Area 8 Points.

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ABSTRACT

The work contains the results of a survey of a multi-storey administrative building of unfinished construction with subsequent reconstruction. The data obtained in the calculation of the building using the LIRA 9.6 software package have been verified.

Keywords:

seismic resistance, multi-storey, calculations, seismic areas, technical condition, impact, building construction, unfinished building.

Article Received: 18 October 2020, Revised: 3 November 2020, Accepted: 24 December 2020

INTRODUCTION.

Due to the lack of relevant technical regulations in the field of earthquake-resistant construction, the main regulatory document for design is KMK 2.01.03-96 "Construction in seismic regions" [1]. Methods and approaches to the calculation of buildings and structures for seismic effects are described in the literature [2, 3, 4]. At present, in accordance with [1], the linear-spectral theory of seismic resistance is used for structural calculations. As the name implies, it uses an initial seismic action set as a spectrum (acceleration versus frequency).

The increase in the number of storeys of buildings due to the aggravating shortage of land in urban areas and its rise in price, the change in seismic zoning maps of the territory of Uzbekistan towards an increase in the predicted intensity of seismic impacts and the number of seismically hazardous regions have transferred calculations of buildings and structures for seismic impacts into the category of frequently used ones. A large number of studies on the rationality of the use of various structural systems of multi-storey civil

buildings are aimed, as a rule, at assessing one or several structural parameters (number of floors, area, shape, etc.) and substantiating the optimal limits of their use, without considering the issues of their seismic resistance. In this connection, the assessment of the seismic resistance of various structural systems of multi-storey buildings is becoming increasingly important. Nevertheless, the question of choosing the optimality criterion and the research methodology itself remains open.

METHODS AND MATERIALS

The object of the research is the combined structural systems of multi-storey high-rise buildings.

Climatic characteristics of the object: Construction area - Tashkent city, seismicity - 8 points; the estimated seismicity of the site is estimated at 9 points, the capital of construction is class II, the class of durability is class II, the degree of fire resistance is class II, the base soils are taken non-planting with a design resistance $R = 20$ kPa, the soil category for seismic properties is II, groundwater is non-aggressive to concrete

normal permeability on Portland cement, the standard depth of soil freezing is 0.68 m, the depth of seasonal freezing of soils is 0.7 m, groundwater within the site has been opened at a depth of 2.8 m from the earth's surface.

General parameters of structural systems: In the plan, the building is rectangular with dimensions in the axes - 15×36 m. The foundation is monolithic reinforced concrete,

dimensions are 90×70 cm., Concrete for foundations is class B25. column grid - 3×6 and 6×6 m; section of columns - 40×40 cm; cross-section of the crossbar - 40×30 cm; floor slab thickness - 22 cm; wall panel thickness - 25 cm; floor height - 3 m; number of floors –8; material of supporting structures - concrete B 40, reinforcement A class III.



Photo 1 - Building façade.

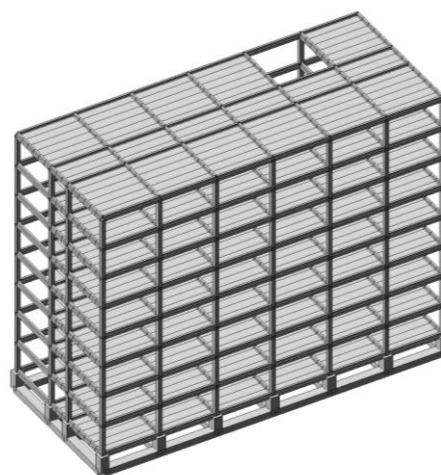


Photo 2 - General view. 3D model.

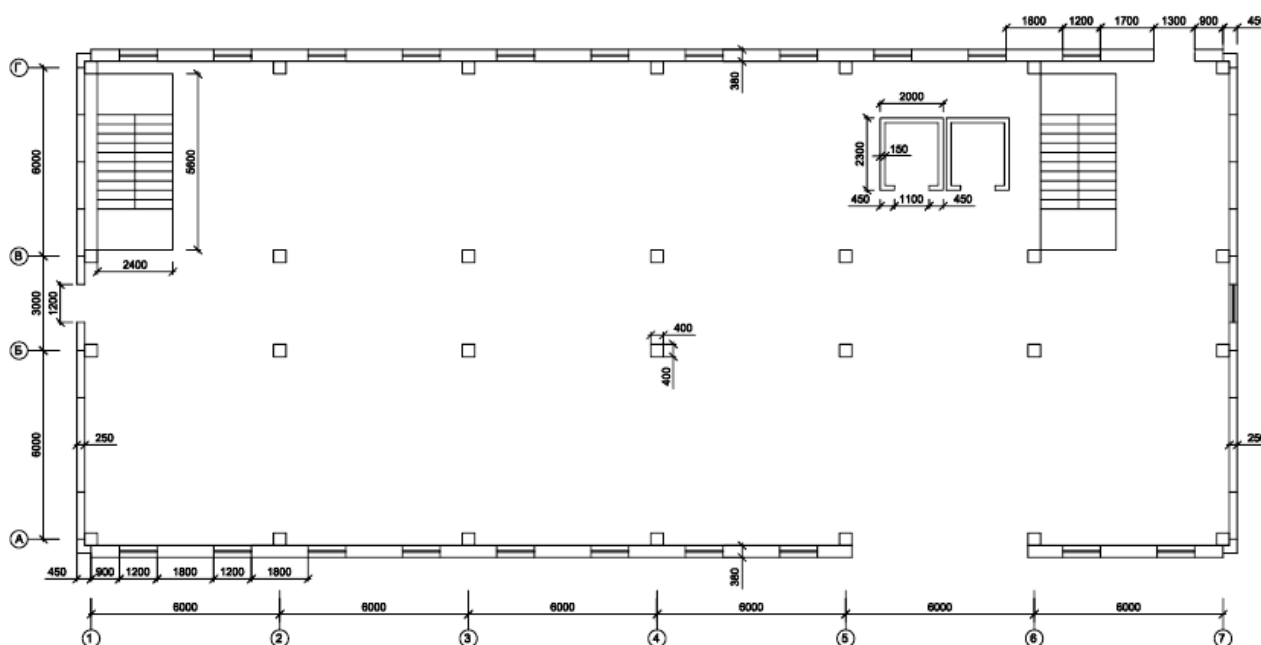


Photo 3 - First floor plan.

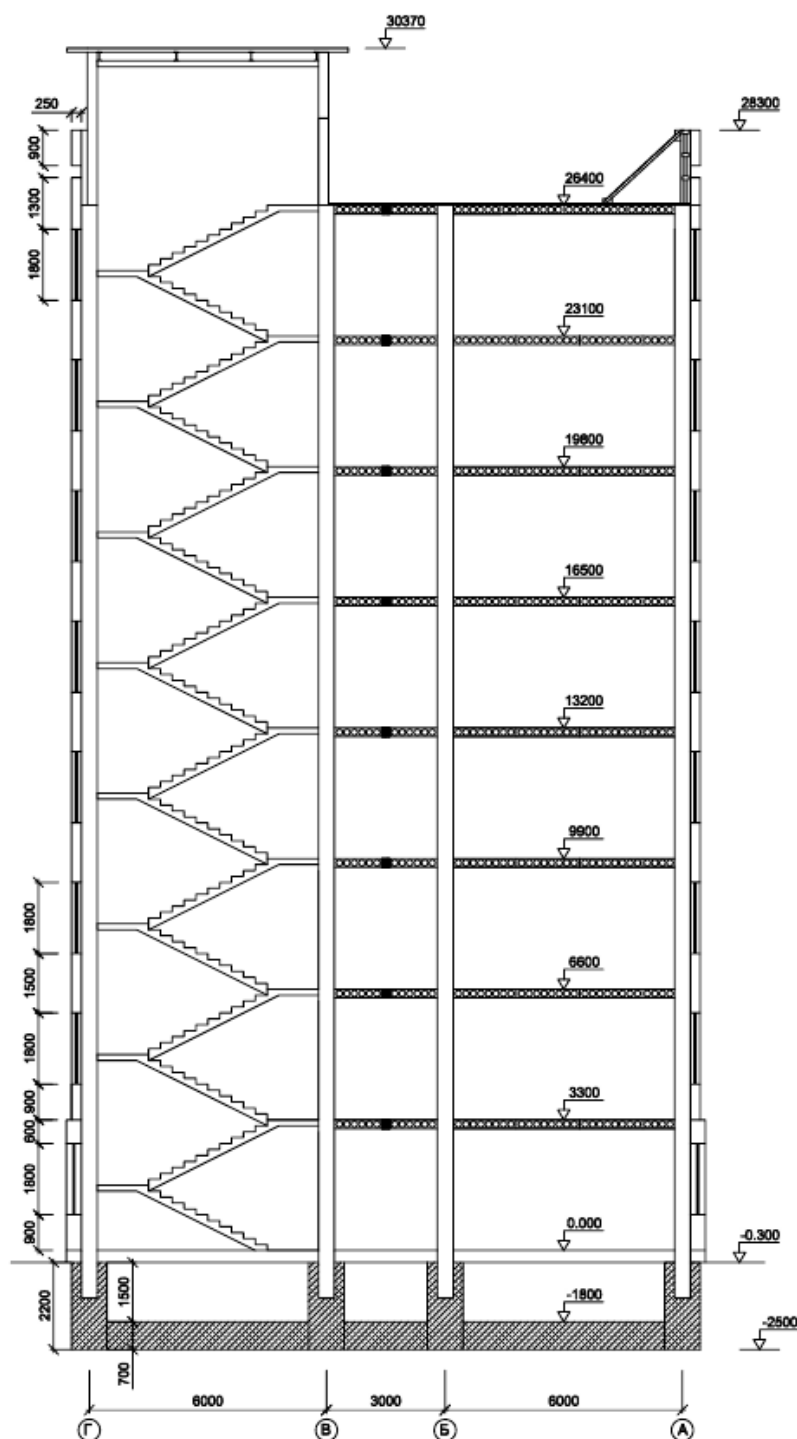


Photo 1 - Section of the building.

Calculation method. To accomplish this task, the SP LIRA 9.6 software package was used.

The calculation was carried out in accordance with KMK 2.01.03-96 for a design earthquake with an intensity of 8 points on the scale of PK LIRA 9.6. The number of vibration modes for all considered structural systems was automatically determined. Eigenvalues, periods and modal masses were determined for each of the

vibration modes. The sum of the effective modal masses taken into account in the calculation was at least 90% of the total mass of the system excited in the direction of the seismic action for horizontal actions and at least 75% for vertical actions. To automatically determine the required number of natural vibration modes, the Lanczos method is used together with the multifrontal method. The

maximum displacements, stresses, accelerations were calculated.

Research area limitations. All calculations were performed for the II category of soil. Since the main objectives of the study were to evaluate the operation of their own elements of structural systems of multi-storey civil buildings and analyze their stress-strain state, this study did not take into account the effect of the interaction of the building with the foundation soil.

Load 1. Actual weight $\gamma = 1.1$ Load 2. Constant load. slab weight $300 \times 1.1 = 330$ top layer (5cm) $125 \times 1.2 = 150$ brick. Partition. $100 \times 1.2 = 120 \Sigma = 600 \text{ kg / m}^2$

Load 3. Weight of the wall (panel) 400 kg / m^2 , Load 4. Long load $200 \times 1.2 = 240 \text{ kg / m}^2$, Load 5. Load from people $200 \times 1.2 = 240 \text{ kg / m}^2$, Load 6. Snow load $50 \times 1.4 = 70 \text{ kg / m}^2$, Load 7. Seismic X.

Сейсмическое воздействие (Узбекистан, КМК 2.01.0...

Поправочный коэф. для сейсмических сил: 1.00

Коэффициент ответственности сооружения: 1.00

Коэффициент учета повторяемости землетрясений: 1.20

Коэффициент этажности сооружения: 1.30

Коэффициент регулярности: 1.00

Коэффициент сейсмичности площадки: 0.50

Индекс региона: II

Категория грунта: II

Декремент колебаний: 0.30

☒ Учет изменений от 01.04.2004г.

Направляющие косинусы равнодействующей сейсмического воздействия:

CX: 1.0000 CY: 0.0000 CZ: 0.0000

$CX^2 + CY^2 + CZ^2 = 1$

✓ ✗ ?

Формирование динамических нагрузок из стат...

Сформировать матрицу масс на основании:

☒ - загрузки (код 1)

☐ - плотности элементов (код 2)

№ динамического нагружения: 8

№ соответствующего статического нагружения: 6

Коэф. преобразования: 0.5

Сводная таблица:

№ дин. з...	№ стат. ...	Коэф.	Код
7	1	0.9	1
7	2	0.9	1
7	3	0.9	1
7	4	0.8	1
7	5	0.5	1
7	6	0.5	1
8	1	0.9	1
8	2	0.9	1

Добавить Удалить Изменить

✓ ✗ ?

Load 9. Seismic along the Y-axis

Design load combinations

When forming the DCF table, after choosing from the list of required norms, the values of the parameters and coefficients of the DCF are set for all loadings of this problem.

Расчетные сочетания усилий

Строительные нормы: СНиП 2.01.07-85

Номер загрузки: 1 | Загрузка 1 Собст вес

Вид загрузки: Постоянное (0) | По умолчанию

N группы объединяемых временных загрузок: 0

Учитывать знакопеременность: ☐

N группы взаимоисключающих загрузок: 0

NN сопутствующих загрузок: 0

Коэффициент надежности: 1.10

Доля длительности: 1.00

Ограничения для кранов и тормозов: Кран ☐ Тормоз ☐

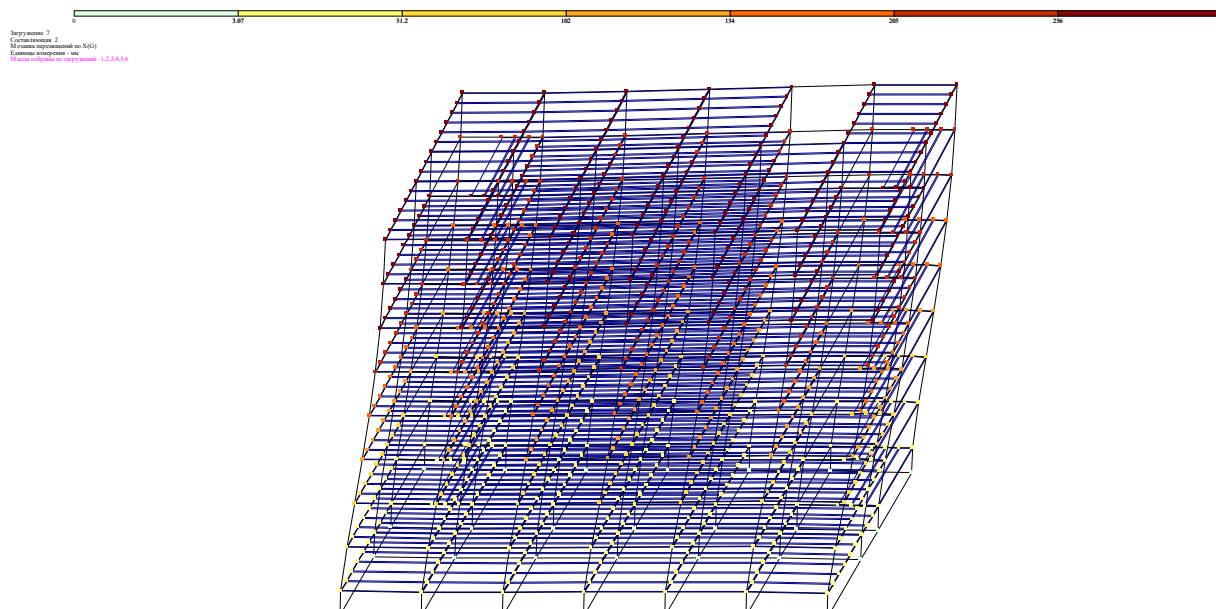
Коэффициенты для РСЧ

#	1 основ.	2 основ.	Особое
1	1.00	1.00	0.90
2	1.00	1.00	0.90
3	1.00	1.00	0.90
4	1.00	0.95	0.80
5	1.00	0.90	0.50
6	1.00	0.90	0.50
7	0.00	0.00	1.00
8	0.00	0.00	1.00

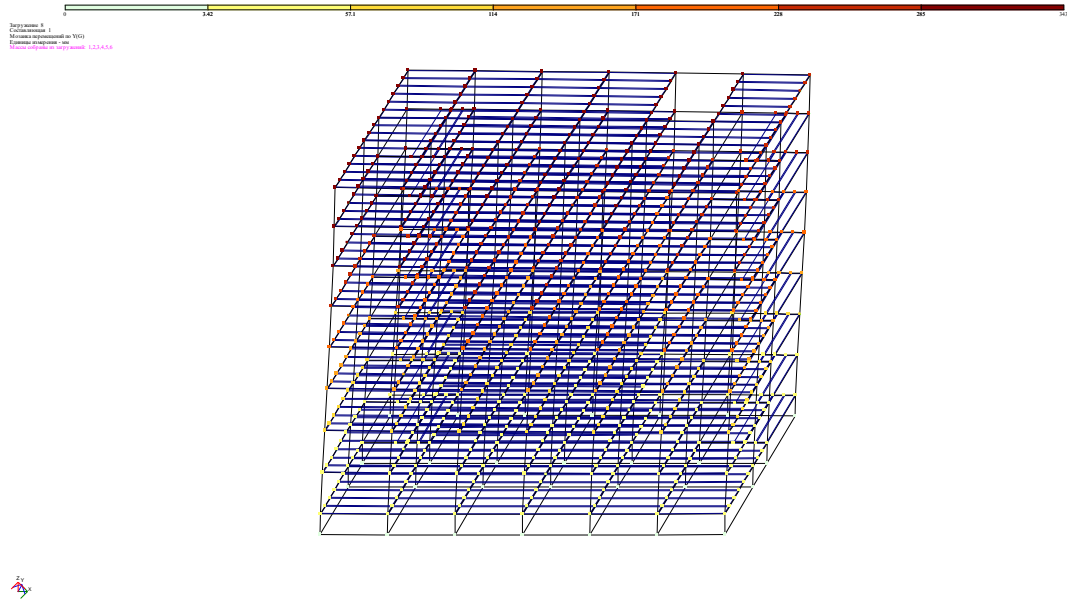
Сводная таблица для вычисления РСЧ:

№.	Имя загрузки...	Параметры РСЧ	Коэффициенты РС
1	Загрузка ...	0 0 0 0 0 0 1.10 1.00	1.00 1.00 0.90
2	Загрузка ...	0 0 0 0 0 0 1.10 1.00	1.00 1.00 0.90
3	Загрузка ...	0 0 0 0 0 0 1.10 1.00	1.00 1.00 0.90
4	Загрузка ...	1 0 0 0 0 0 1.20 1.00	1.00 0.95 0.80
5	Загрузка ...	2 0 0 0 0 0 1.20 0.35	1.00 0.90 0.50
6	Загрузка ...	2 0 0 0 0 0 1.40 0.35	1.00 0.90 0.50
7	Загрузка 7	5 0 1 1 0 0 1.00 0.00	0.00 0.00 1.00

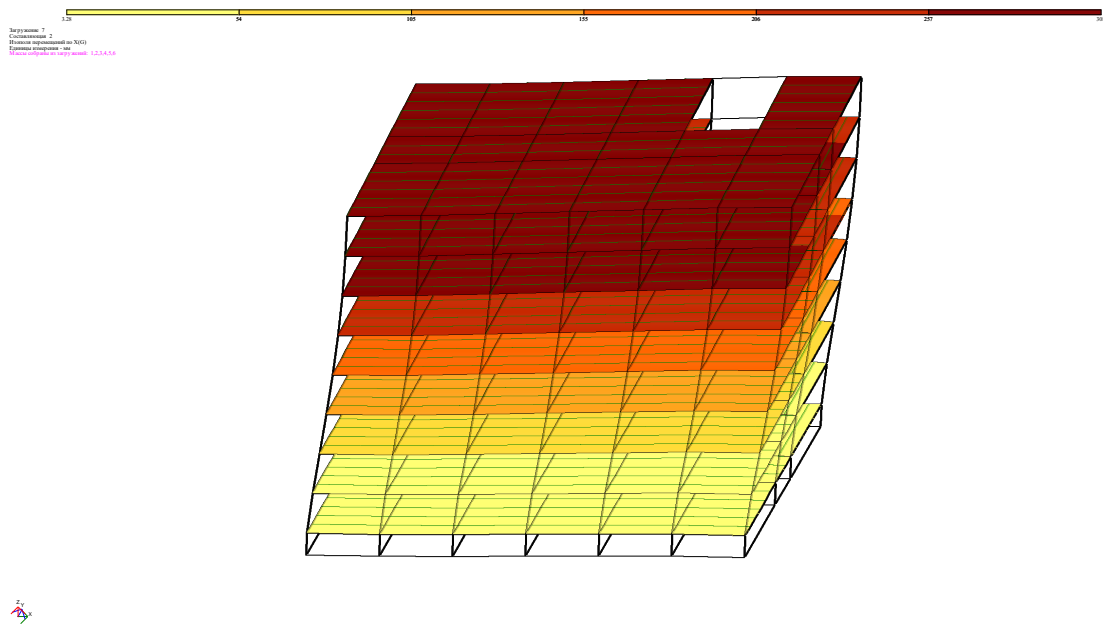
RESULTS



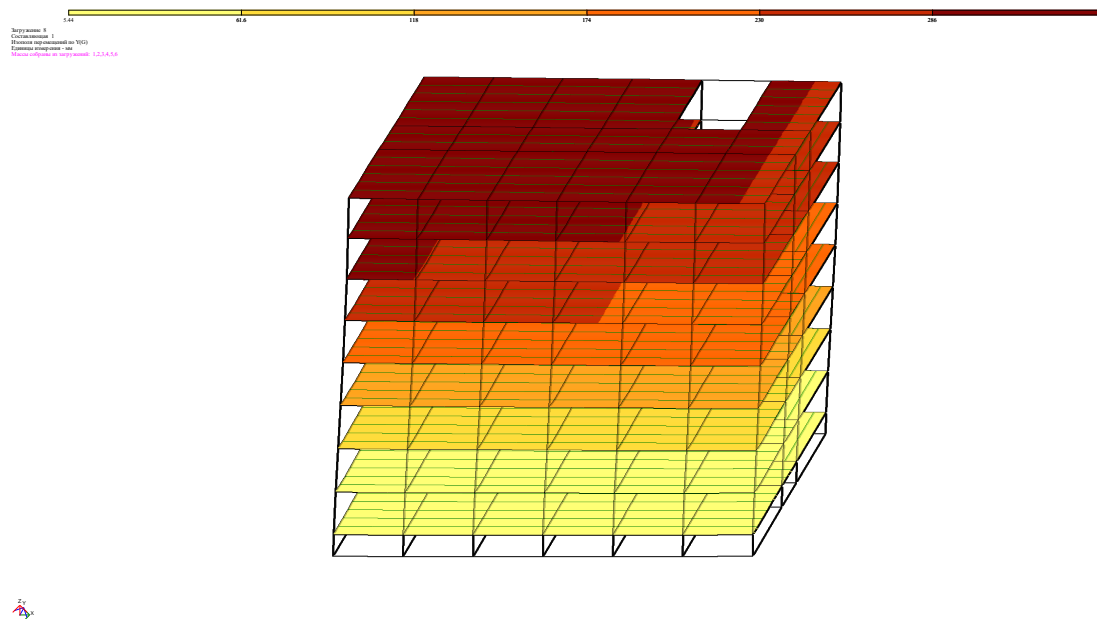
Displacements from seismic in X direction



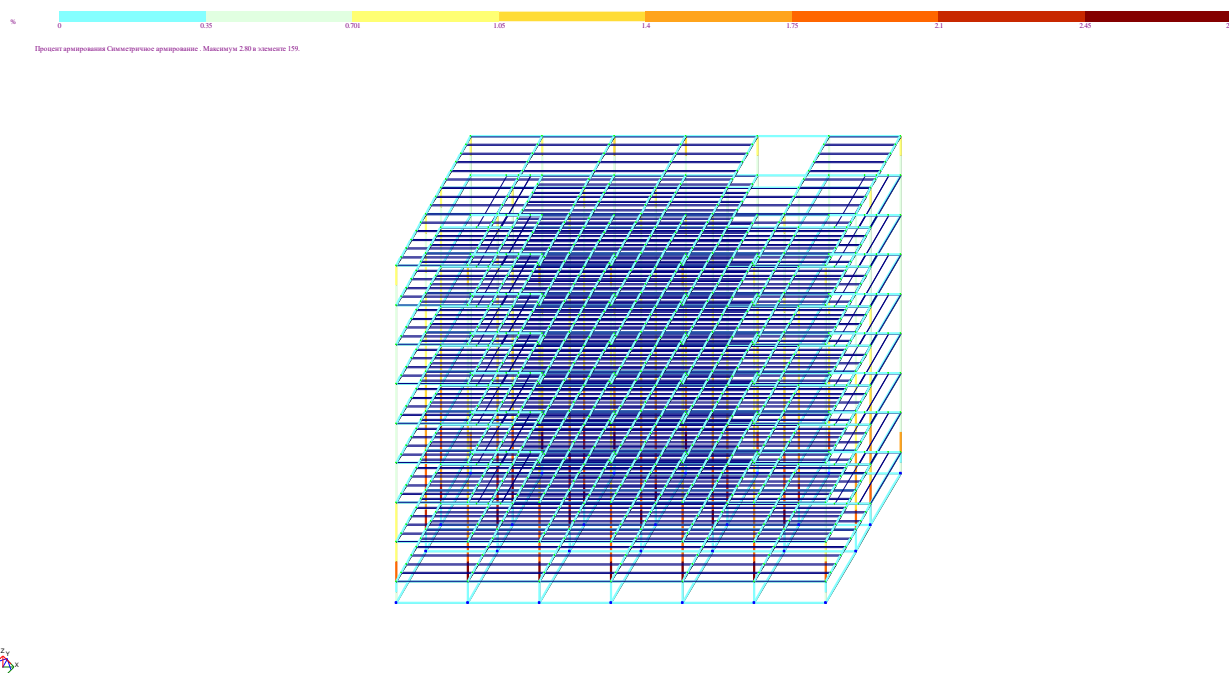
Displacements from seismic in the Y direction



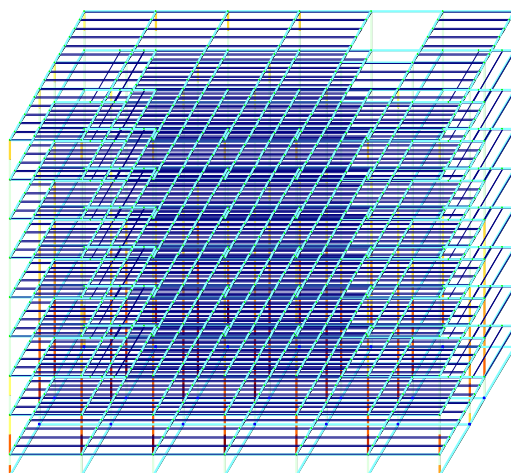
Mosaic of displacement from seismic in the X direction



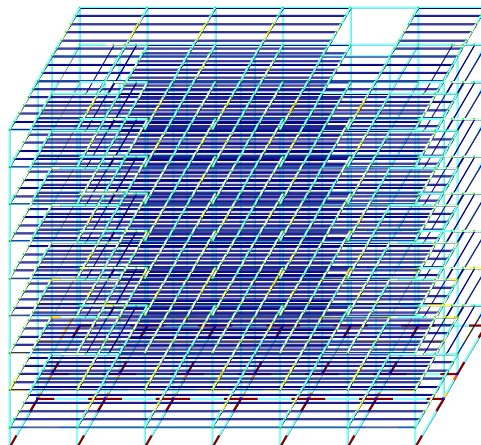
Mosaic of displacement from seismic in the Y direction



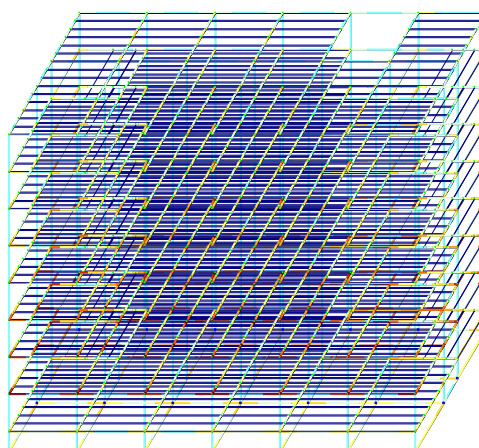
Percentage of building reinforcement
(symmetrical reinforcement)



Column reinforcement
Corner fittings



Reinforcement horizontal structures



Percentage of building reinforcement
(asymmetrical reinforcement)

The calculation results show that the reinforced concrete-frame system of the frame walls of the bearing walls develops large accelerations. Accelerations are 43% lower on average than systems with a large number of load-bearing walls.

CONCLUSION

Based on the results of the study, an analysis of the structural systems of multi-storey office buildings was carried out. The calculation was carried out in accordance with KMK 2.01.03-96 for a design earthquake with an intensity of 8 points on the scale of PK LIRA 9.6.

A longer period of oscillation reduces the dynamic effect of the impact on the building. According to the results of the calculation of accelerations, it can be seen that in systems with a small number of load-bearing walls, the lowest accelerations develop.

For frame-wall systems, the maximum accelerations are on average 43% lower than in the other three systems with a large number of load-bearing walls.

Based on the results of the research, the following conclusions were made:

1. There is a significant discrepancy in the bending moments in the bearing zone (up to 43%) near column 7 / B. Large values of these efforts arise with subsidence foundations.

2. In vertical bearing elements (columns), the values of the longitudinal forces have a smaller discrepancy (no more than 17%).

3. In the foundation slab, an increase in bending moments is observed during subsidence soil of the base (up to 38%).

4. Based on the results of the research carried out, the reinforcement of load-bearing structural elements of multi-storey buildings will be the most rational.

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