THE PRINCIPLE OF UNIFORM DISTRIBUTION OF SEISMIC FORCES, WHICH CAN BE ACHIEVED THROUGH SYMMETRICAL AND UNIFORM DISTRIBUTION OF MASSES AND UNITS IN THE PLAN VIEW OF BUILDINGS

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Abstract: In this article talks about the principles of uniform distribution of seismic forces, which can be achieved through symmetrical and uniform distribution of mass units in the plan view of buildings.

Key words: earthquake, seismic force, symmetrical force, bending moment, statically unsaturated system, horizontal force, vertical structures, monolithic frame.

The form (form) of the building should be as simple and elegant as possible. The results of the study of the consequences of the earthquake showed that buildings with a circular or square plan, a rectangle close to a square shape, that is, a rectangular building with the dimensions of the sides that do not differ much and without protruding parts, were the least damaged. Due to the fact that the walls and other structural elements of such buildings are equal or close to each other in different directions, such buildings are equally resistant to the impact of horizontal seismic force in all directions (Fig. 1).

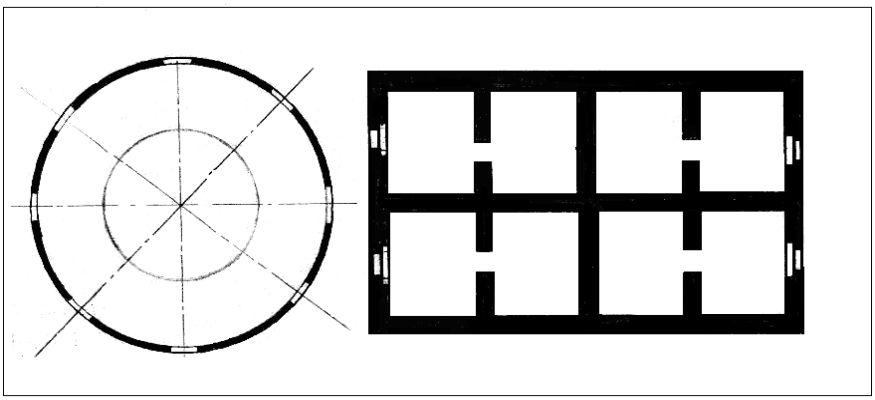

Figure 1. A building plan that ensures even distribution of seismic forces during an earthquake.

If this condition is not fulfilled, i.e. local or one-sided gathering of masses is allowed, then the seismic forces will create dangerous torsional moments for the buildings. An example of this is the building plan in the picture below (Fig. 2).

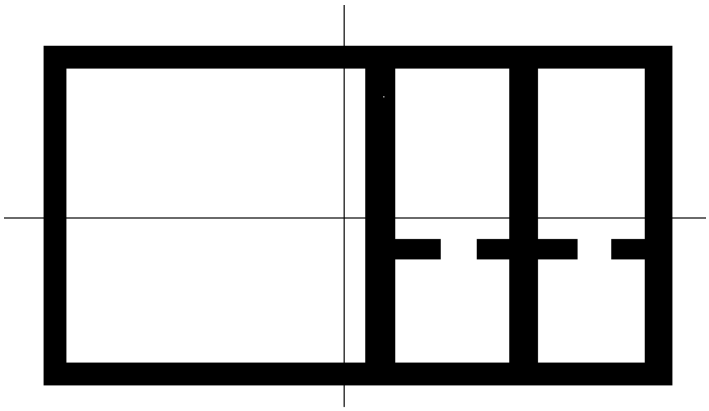

Figure 2. Symmetrical building plan that does not meet the requirement of earthquake resistance.

If the internal walls of the buildings are longitudinal or transverse in plan, they should continue to the end. If the wall of the building is not continuous in plan, the separated (detached) wall can break it during an earthquake by striking (thrusting) the adjacent wall. As we have said above, if the building project is evenly distributed and symmetrically located in the plan of the building, regardless of the structure (frame frame) (monolithic or composite), the building will work synchronously during an earthquake. Observational results have confirmed that buildings with circular, regular polygonal, square (or similar) or rectangular shape in plan are less damaged during an earthquake compared to complex plan buildings. If it is not possible to make the buildings simple in plan according to the requirements of architecture or operation, in these cases, it is necessary to divide the buildings into square, rectangular and other simple-shaped parts by means of anti-seismic joints.

In buildings, anti-seismic joints are carried out by installing load-bearing double walls, in frame buildings by means of double frames. Anti-seismic seams separate buildings (except the foundation) into individual parts and it is done along the entire height. From an economic point of view, it is possible not to weld on the foundation.

The width of anti-seismic seams is selected depending on the height of the building. The width of the anti-seismic joints is selected in such a way that each part

can vibrate without hitting each other during an earthquake. The height is 5m. in buildings up to, the width of such seams should not be less than 3 cm. In buildings taller than that, the width of the seams is increased by 2 cm every 5 m. The width of the anti-seismic joints must not be smaller than the sum of possible horizontal displacements due to the vibration of both parts.

If we assume that the building is a cantilever fixed to the ground, it is known that the maximum value of the bending moment arising from the transverse shear force and horizontal forces occurs at the base level.

It is possible to reduce the values of the bending moment and transverse force at the top points of the building between the center of the base and the point of application of the equal force effector. The value of horizontal forces is proportional to the mass of structures, and it is possible to reduce the value of horizontal forces by reducing the specific weight of structures. In addition, the value of seismic forces can be achieved by increasing the elasticity of load-bearing vertical structures.

In order to achieve the value of seismic forces by reducing the specific weight of structures, the following conditions must be met:

a. reducing the specific weight of structures by using materials that can effectively use their strength and thermo technical properties as load-bearing structures;

b. moving technological processes using heavy machines and mechanisms to the lower floors (if possible, to the first floor), placing warehouses and other similar rooms on the first floor (Fig. 3).

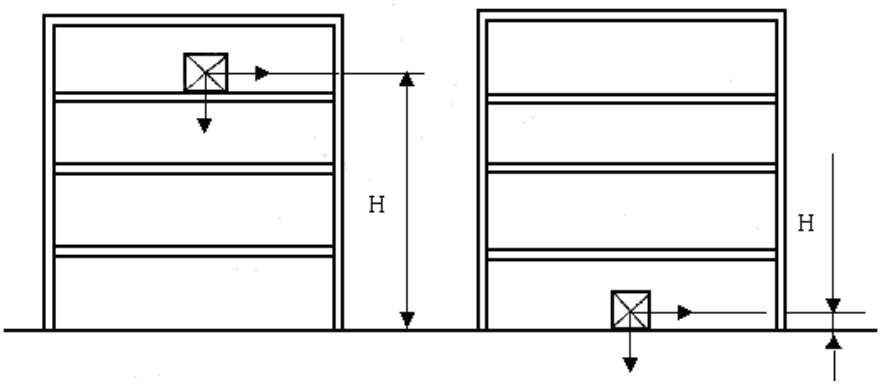

Figure 3. Reducing the seismic impact by placing the main technological processes and warehouses in the buildings on the first lower floor.

c. replacement of bridge-type cranes, which are placed on beams under the crane in columns in a one-story building, with a crane designed to walk on rails on the floor (Fig. 4);

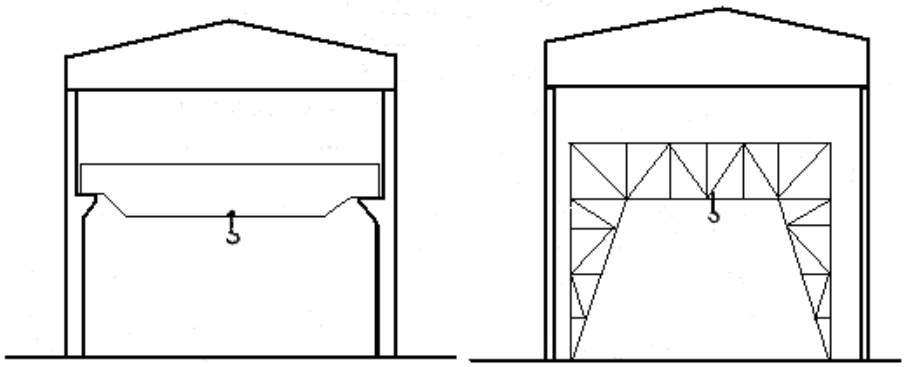

Figure 4. Reducing seismic impact by replacing overhead cranes with floor cranes.

In frame-frame buildings, the frame itself is a spatially invariant system, and evenly distributed steps and frames characterize them with uniform uniformity.

Frame structures are often statically uncertain systems. Therefore, the local damage caused by the formation of plastic hinges in individual elements does not lead to the damage of the whole system. This is the reason for the high load-bearing capacity of this type of construction.

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