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## STRESS STATE OF STEEL-REINFORCED CONCRETE STRUCTURES OF THE ELEVATOR WORKING TOWER FLOOR STRUCTURES

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The application of steel-reinforced concrete structures in agriculture is only gaining popularity. This type of structure is used to solve certain specific problems. One of them is the design of separator floors structures of elevators working towers. During the operation of grain cleaning separators, dynamic loads are applied, which induce due to the plane-parallel movement of the sieves. These loads are periodic in nature, which can lead to resonance phenomena and vibrations, especially when installing several machines on the same floor. As a result of such oscillations, microcracks may appear in the concrete, which reduces the stability of the floors and the durability of the structure in general.

Steel-reinforced concrete floors demonstrate high resistance to dynamic loads due to a combination of rigidity and vibration absorption, which avoids resonance phenomena that often occur when placing heavy equipment, such as grain cleaning machines. The design of steel-reinforced concrete floors allows to significantly reduce the amplitude of oscillations, which has a positive effect on the stability of the equipment and reduces the risk of its damage.

During the design of the tower structures, several options were considered, and the optimal solution was chosen: a composite steel-concrete slab on a profiled

platform. This option was selected both in terms of material cost-efficiency and the ability to withstand dynamic loads from the cleaning machines. To connect the steel frame and concrete, stud bolts with a diameter of 16 mm were used. The main fastening and concrete reinforcement nodes are shown in Fig. 1.

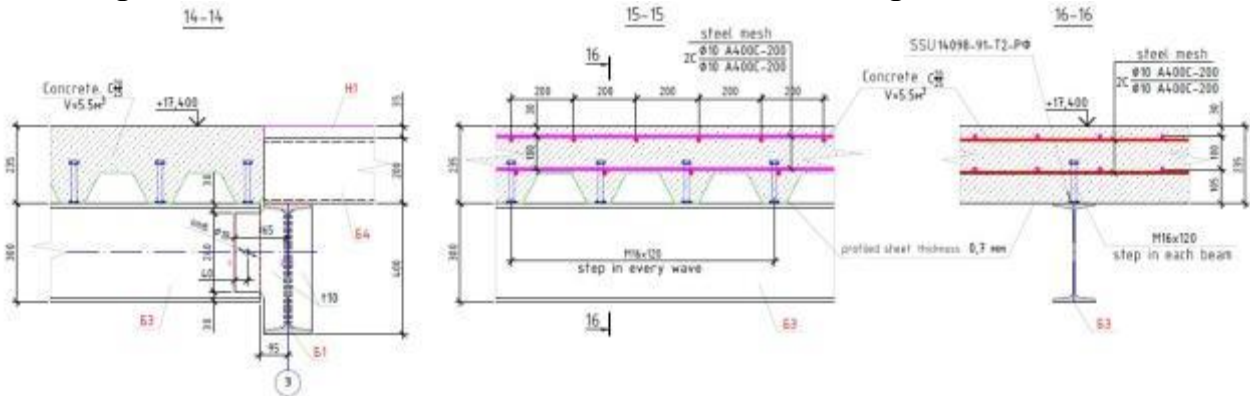


Fig. 1. Fastening and reinforcement nodes of the steel-concrete slab

During the study, additional calculations were conducted with a 10% reduction in the thickness of the steel-reinforced concrete slab. The analysis of the obtained data and the construction of a comparative graph (Fig. 2) revealed that the frequency of one of the natural vibration modes of the structure reached 5.05 Hz, which practically coincides with the vibration frequency of the grain cleaning machine.

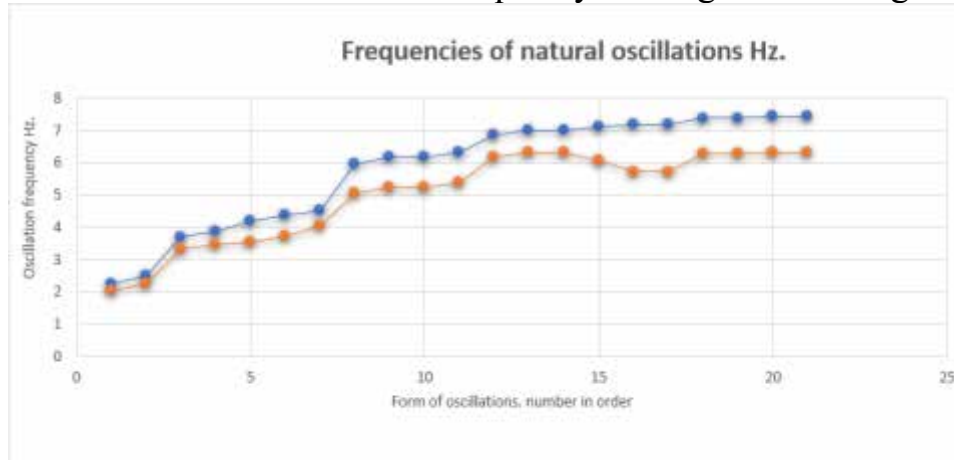


Fig. 2. Graph of the dependence of vibration frequency on the mode of oscillation

Thus, reducing the slab thickness by 10% induces a resonance phenomenon, which can significantly increase vibration amplitudes, leading to potentially hazardous dynamic effects on the structure and equipment. This highlights the critical importance of precise geometric parameter calculations during the design of slabs.

**Conclusions.** Through modal analysis, the natural frequencies and vibration modes of the structure were identified and compared with the operating frequency of the grain cleaning machines. A key design feature was the incorporation of steel-reinforced concrete floor on profiled platform, which offer high rigidity and excellent vibration absorption. This approach successfully minimized structural vibration amplitudes, prevented resonance phenomena, and ensured the stability of the

equipment. Reliable connections between steel elements and concrete were achieved using stud bolts with a diameter of 16 mm.

The scientific novelty of the study lies in the innovative application of steel-reinforced concrete floor on profiled platform for elevator working towers, considering variations in slab thickness and stud bolt diameters. A comprehensive methodology using modal analysis was introduced to assess and mitigate resonance risks. The findings demonstrate that these structural solutions effectively reduce vibration amplitudes, enhance structural reliability, and ensure long-term stability and

The structural design was executed using advanced software systems, including LIRA-FEM for detailed calculations and Autodesk Revit for modeling and information management. The results confirmed the optimality of the chosen

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