

**MODULAR CONSTRUCTION AND THE POSSIBILITY OF USING MODULAR
STRUCTURES FOR BUILDING EXTENSIONS**

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Abstract: The article is based on the analysis of a number of foreign and domestic scientific publications on the researched topic. The possibility of using modular structures, especially volumetric module-blocks, for building extensions during reconstruction is considered. It is noted that the use of transformable volumetric module-blocks significantly reduces transportation costs. Despite a number of disadvantages inherent in buildings made of modular blocks, the use of volumetric module-blocks is proposed as one of the promising options for energy-efficient reconstruction.

Keywords: extension, modular structures, volumetric blocks, energy-efficient reconstruction.

The use of modular structures is considered by many researchers as one of the priority directions in the construction of buildings and structures, including high-rise and unique buildings. Sustainable development of the construction industry, together with the resulting economic, social, and environmental benefits, allows active use of modular blocks in construction.

Not only the profitability of modular construction, but also the reduction of negative environmental impacts is achieved by reducing construction duration. These structures have become especially popular over the last five to seven years due to their energy efficiency, since individual structural modules and volumetric blocks are manufactured from energy-efficient materials. In addition, there are modules with ready-to-use finishing.

Despite the fact that scientific publications characterize modular construction as safe in terms of construction and installation works, some studies emphasize that modular construction has not been sufficiently studied from the safety perspective, and research has been conducted to identify the causes of accidents.

In general, the technology of construction using volumetric modules is not innovative. Back in the 1970s in the USSR, entire residential districts were built from reinforced concrete volumetric modules to solve housing problems.

Currently, many enterprises in Russia, including foreign companies, manufacture ready-made volumetric blocks for modular construction that meet modern design and energy-efficiency requirements.

The efficiency of using modular structures in building reconstruction through extensions is discussed in a number of scientific publications. In Finland, for example, a national research



program was conducted to study the concept of reconstruction and expansion of apartment buildings.

The use of modular structures is considered optimal for reconstruction works in confined urban conditions. The prefabrication method allows bringing the actual construction duration closer to the planned duration even under force majeure circumstances.

Some scientific publications note that designing and manufacturing volumetric modules of any dimensions is difficult because of the lack of transportation machinery with sufficient size and carrying capacity. This led to the development of transformable modular volumetric blocks made of lightweight steel thin-walled structures and sandwich panels from composite materials.

Construction practice shows that depending on module dimensions, one vehicle can transport from 4 to 10 transformable volumetric module-blocks.

Despite the listed advantages, buildings constructed from modular structures also have disadvantages, including:

- possible reduction in thermal insulation and strength characteristics after decades of operation;
- limitations in areas with high humidity and extremely low winter temperatures;
- the need for highly qualified installation workers.

In conclusion, the use of modular structures, especially volumetric module-blocks, should be considered one of the promising options for ensuring energy-efficient reconstruction. The main ways to improve organizational and technological solutions, as well as the energy efficiency of additional floors, are increasing the dimensions while simultaneously reducing the weight of modular elements through the use of composite materials.

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