

# METHODS TO INCREASE THE MONOLITHIC CONSTRUCTION EFFICIENCY OF MULTI-STOREY RESIDENTIAL BUILDINGS

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<p><b>Received:</b> May 11<sup>th</sup> 2021</p> <p><b>Accepted:</b> May 22<sup>th</sup> 2021</p> <p><b>Published:</b> June 23<sup>th</sup> 2021</p>	<p>The construction volume of integral monolithic buildings is growing faster than other technologies for housing construction. Identifying and using factors that hinder the monolithic construction development can increase the monolithic construction efficiency by identifying methods that lead to a reduction in construction time, increase the structures quality under construction, capital costs productivity. This ensures the safety of human activities in seismically resistant, integral monolithic buildings. Decrease in labor costs of construction equipment and construction production. The research identified technical and economic indicators used to assess the construction effectiveness of multi-storey buildings and structures from cast monolith. Measures have been developed to reduce working hours and labor costs, and improve construction quality and cost-effectiveness.</p>
<p><b>Keywords:</b> Monolithic construction, efficiency, modern technologies, organizational, technological and economic solutions.</p>	

## INTRODUCTION:

The Integral monolithic reinforced concrete construction is currently one of the fastest growing industries not only in the construction industry, but in the world economy as a whole. Because these buildings are durable, earthquake resistant and reliable in safety of human activities. The growing volume of monolithic construction necessitates the transition to reliable high-speed technologies that ensure the quality and reliability of buildings and structures [1].

The monolithic construction efficiency of buildings and structures is determined by comparing the construction of buildings and structures with other technologies. Comparison of different construction technologies takes into account the construction reduction and operation costs of buildings and structures, construction labor costs, construction time, material costs and economic efficiency.

In modern construction, it is possible to build mainly buildings and structures from three types of materials: brick, monolith and panel. According to statistics, construction work in Uzbekistan in 2015 amounted to 25423,1 billion sums, and in 2020 - 87823,8 billion sums. If you look at the construction dynamics in Uzbekistan, the prefabricated houses construction has sharply decreased, and the monolithic buildings construction is growing rapidly from year to year. 55% of the constructed buildings are brick buildings, 42% are monolithic, 3% are prefabricated buildings [2]. Taking into account that the demand for multi-storey housing construction is growing today, the demand for monolithic construction will be high in the near future. This requires further improvement in this area and research on effective technological solutions.

## METHOD AND APPROACH

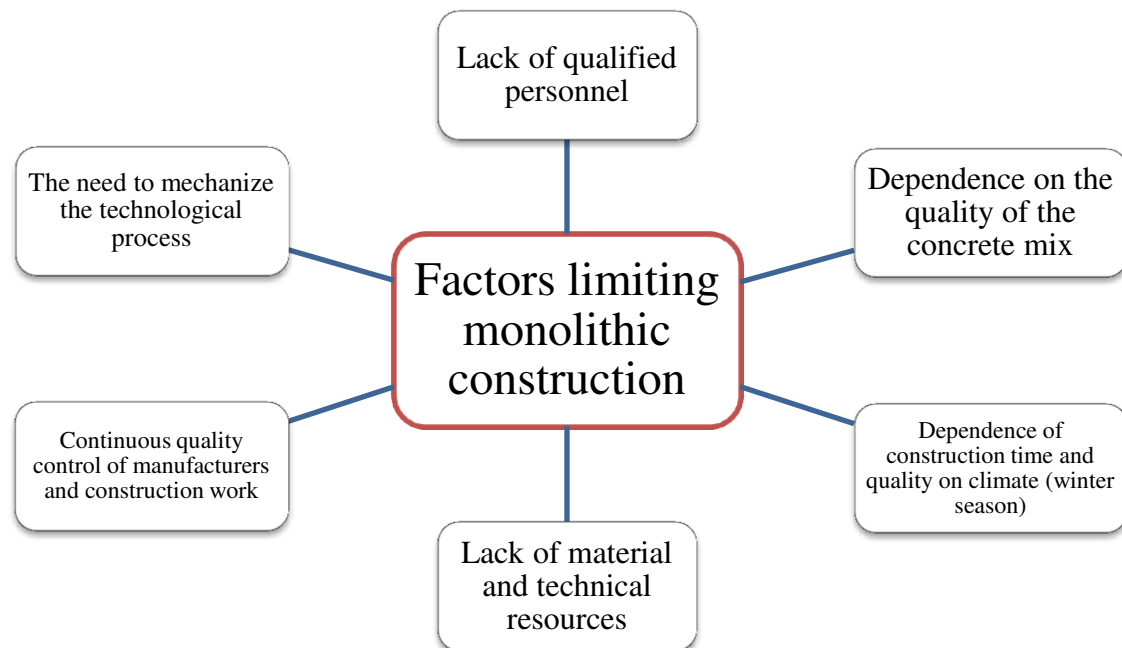
Directions for improving the monolithic construction efficiency of buildings and structures are determined by analyzing the main factors limiting the further growth of monolithic construction. These factors include outdated technologies in construction, expensive molds, increasing requirements for quality control of facilities under construction, and insufficient qualifications of construction workers and material and technical safety of the construction base. Methods have been developed to solve monolithic construction problems, and their implementation will increase the efficiency of monolithic construction.

Among the construction technologies of buildings and structures, the advantages of monolithic construction are as follows [3]:

- high rate of construction of buildings and structures;
- resistance to adverse environmental factors and high durability of constructions (more than 100 years);
- low material consumption compared to brick buildings and structures;
- the return on assets in the use of construction machinery is high due to the replacement of manual labor with mechanized labor;
- reduction of the decoration cost of buildings due to high-quality concreting when using modern formwork;
- free design and non-standard facade solutions.

For most of the technical and economic indicators, the buildings and structures construction in the monolithic method has advantages over brick and panel technologies [4,5]. As the number of existing molds increases, the monolithic buildings and structures efficiency increases as the number of floors increases.

As a result of the analysis, the problematic factors that need to be taken into account to increase the construction efficiency of buildings and structures in the monolithic method are shown in Figure 1.



**Figure 1. Factors limiting the monolithic construction development.**

Many construction organizations do not have the appropriate material and technical base (modern concrete pumps, molds, concrete mixing machines) and the appropriate personnel base (workers, engineers). The technological complexity of the construction process of facilities from monolithic reinforced concrete affects the high risk of non-compliance with construction deadlines.

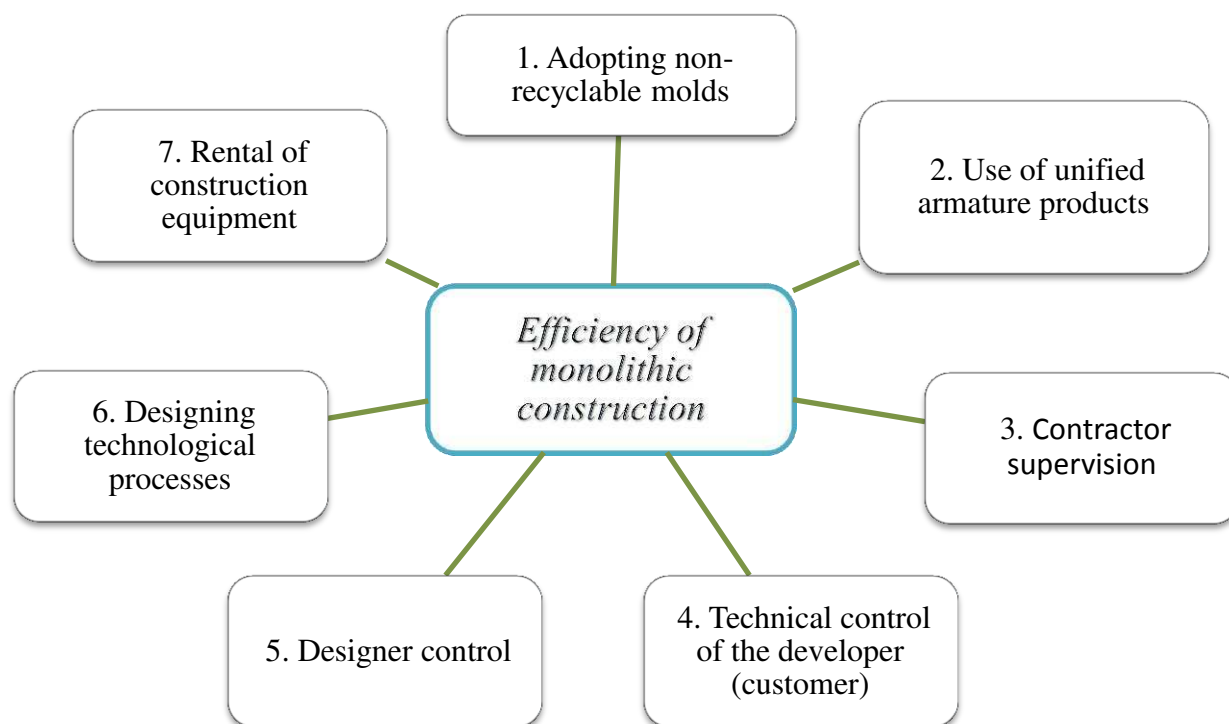
The increase in the work volume on quality control of work is due to the large number of operations that require rapid control and the additional labor costs in attracting qualified professionals to perform the work.

The high labor cost of monolithic buildings and structures construction requires the use of complex mechanization of technological processes. Monolithic construction uses a large number of semi-finished products, building materials, factory-made products, structures and equipment. The rational formation of a the machines complex in construction and the organization of transport mechanisms in construction are of great importance, as the share of transport costs in the average industry now exceeds 20% of construction production costs [6].

Another problem of monolithic construction is that the construction speed of buildings and structures depends on weather conditions, as the whole production process is directly related to the concrete hardening. The monolithic buildings and structures construction requires the use of accelerated methods of achieving the concrete mixes and concreting technologies strength in winter.

## RESULTS AND DISCUSSION.

Figure 2 shows the introduction of organizational, technological and economic solutions aimed at reducing working hours, reducing labor costs, improving economic efficiency and quality of buildings under construction in order to overcome the problems of monolithic construction and increase efficiency.



**Figure 2. Methods to increase the monolithic construction efficiency**

1. Adoption of non-recyclable molds. The technology of any molding device is to create a wall shape by building the mold and delivering concrete to the finished form. Permanent molds do not require disassembly, the heat-insulating material serves as the mold itself, resulting in a concrete wall with the required thermal conductivity [7]. The use of fixed molds combines several operations in a single technological cycle, reducing construction time and simplifying facility construction.

2. Use of unified armature products. In addition to the high-quality formwork and concreting process in the monolithic construction process, high-quality steel reinforcement carcass, grids play an important role. In the monolithic structures construction, a lot of time is spent on weaving the reinforcement carcass, which combines flat grids of complex volume on several hundred rods of different diameters and lengths. The use of unified reinforcement products allows to reduce costs, increase construction efficiency, quality and reduce the reinforcement work time [3].

3. Contractor supervision. In the acceptance and inspection of erected monolithic structures, it is important to carry out quality control of the concrete mix, which is carried out through the comprehensive application of testing and control methods. In order to prevent the construction of substandard monolithic structures, the contractor must carry out quality control of the delivered concrete in accordance with the requirements of the standards, technical specifications or technical certificates specified in the design documentation. In the construction process of monolithic buildings and structures, continuous quality monitoring of concrete during maintenance and heat treatment to ensure the monolithic structures quality, processing the results using mathematical statistics and probability theory, as well as technological design taking into account the specifics of construction conditions [8].

4. Technical control of the developer (customer). The quality indicators of the standardized concrete mix, the scope and timing of the work performed by the contractor must be monitored by the developer (customer) during the work as part of constant technical control over compliance with the contract and the construction schedule. [9].

5. Designer control. Designer control is one of the elements of a construction quality control system [10]. The author-architect ensures that the design solutions comply with the construction and installation work performed at the facility, the requirements of building codes and regulations, and the work technology. Project organization control makes contractors responsible for the buildings and structures quality under construction.

6. Designing technological processes. Creating and designing a technological map allows engineers and technicians to develop individual schedules of builders' work in each shift, indicating the time for each operation. This work result will be the development of the usual molding and concreting processes, the work schemes, the number of builders working in this process and the design of technological processes for the construction period.

7. Rental of construction equipment. The technological complexity of monolithic construction and mechanization of technological processes emphasize the problem solution of equipping the construction industry.

Currently, the use of special vehicles in the construction industry plays an important role, and its modernization and implementation issue is very relevant. In recent years, the construction projects and constructions development, especially in the direction of the use of integrated cast monolithic construction technologies for the buildings construction, has a positive impact on the market of construction machinery and equipment [11]. The high cost of construction equipment does not allow many construction companies to purchase it at their own expense.

Taking into account their limited resources, construction equipment can be purchased by construction organizations on a lease or rental basis for the construction of monolithic buildings and structures.

8. Professional development of construction workers. The task of increasing the monolithic construction efficiency cannot be solved without qualified personnel. In many examples of low-quality construction products, it is observed that engineers and technicians of construction industry enterprises are incompetent and inexperienced, when there are various instructions, technologies, standards and descriptions of SS standards. Insufficient attention paid by both production workers and the state to improving the labor force quality will not lead to the desired results even after the production modernization [12]. Training of concrete workers, reinforcement workers, carpenters-assemblers and other construction workers is one of the main directions of increasing the construction production efficiency.

According to the research, the total construction time will be reduced by 15% to 30% due to the shortcomings elimination in the monolithic buildings construction, in particular, due to the careful organization of work technology. This will reduce the labor costs of self-employed workers and reduce costs economically.

### CONCLUSION.

The study identified factors that limit the growth rate of buildings and structures construction from cast monolithic monolith. Styles are proposed, which implementation together increases the monolithic construction efficiency, including:

- reduction of construction time due to the use of non-recyclable molds, technological mapping and training of construction workers;
- improving the quality of constructions due to the contractor's access control, designer's technical and architectural control;
- increase asset profitability and reduce labor costs through the use of construction machinery leasing or rental.

In addition, the construction of integral monolithic buildings will ensure seismic resistance and safety of human activities.

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