RESEARCH ON THE MAIN DISADVANTAGES OF FORMWORK TECHNOLOGIES USED IN MONOLITHIC BUILDINGS

Jurayev Sanjar Mamatmurod ogli

Assistant, Termez State University of Engineering and Agrotechnologies

(E-mail: [sances2144@gmail.com)

Tel: +99893-075-17-96

Jalg`ashova Gulmira O`ktam qizi

Student, Termez State University of Engineering and Agrotechnologies

Tel: +99893-535-45-15

Annotation. *This article provides a comprehensive analysis of the technical and organizational disadvantages of traditional and modern formwork systems used in the construction of monolithic buildings. The characteristics of formwork materials, deformations occurring during their use, labor intensity, technological inconveniences, and safety issues are discussed in detail. In addition, proposals and recommendations aimed at reducing existing problems are developed.*

Keywords: *monolithic construction, formwork system, reinforced concrete, cost, deformation, safety, labor intensity, technological process.*

INTRODUCTION

In recent years, the monolithic construction system has been widely applied in urban development practice in Uzbekistan. Casting reinforced concrete structures in situ increases the strength of buildings, provides high seismic resistance, and ensures a long service life. However, the most critical stage of this process—the formwork system—causes numerous shortcomings due to various factors.

The quality of the formwork system determines the final appearance, accuracy, strength of the concrete structure, and the overall construction cost. Therefore, studying and eliminating its disadvantages is essential for achieving high-precision structures.

ROLE AND IMPORTANCE OF FORMWORK SYSTEMS IN MONOLITHIC CONSTRUCTION

A formwork system is a temporary structure that maintains the shape of a construction element until the concrete hardens. It performs the following functions:

* ensuring construction geometry;
* resisting concrete pressure;
* forming surface quality;
* maintaining accuracy of reinforcement placement.

Without high-quality formwork:

* concrete strength decreases;
* surface defects increase (settlement, voids, cracks);
* additional finishing works become necessary.

Typically, up to 30–40% of the total cost of monolithic construction is attributed to the formwork process.

TECHNICAL CHARACTERISTICS OF FORMWORK MATERIALS

Wooden Formwork. Advantages:

* Low cost and availability
* Easy to process
* Suitable for small projects

Disadvantages:

* Prone to deformation
* Absorbs moisture
* Cannot be reused many times

Metal Formwork. Advantages:

* High strength
* Reusable
* Resistant to high pressure

Disadvantages:

* Heavy weight

* Susceptible to corrosion

* High cost

Aluminum Formwork. Advantages:

* Lightweight

* Fast installation

* Smooth surface finish

Disadvantages:

* High price

* Expensive maintenance

* Can bend under excessive load

Plastic and Composite Formwork. Advantages:

* Lightweight

* Corrosion-resistant

* Does not accumulate dust

Disadvantages:

* Sensitive to temperature

* Low resistance to high pressure

* High cost depending on brand

TECHNOLOGICAL DISADVANTAGES IN THE FORMWORK PROCESS

Incorrect Calculation of Concrete Pressure

The pressure exerted on formwork during concrete pouring depends on the following factors:

* concrete temperature (increase in temperature leads to higher pressure);

* water-cement ratio;

* pouring speed;

* concrete setting time.

Consequences of incorrect calculations include:

* bulging of formwork panels;

* longitudinal or transverse cracking;

* opening of joints;

* leakage of concrete.

In practice, the most common mistake is underestimating or completely ignoring pressure calculations in column formwork.

Insufficient Supports and Props. If the spacing between wooden props exceeds standard limits:

* slab formwork bends downward;

* thicker concrete sections settle;

* surface levelness is compromised.

This issue is especially common in monolithic slabs with a thickness of 25–35 cm.

Improper Connection Between Formwork Panels. If gaps occur between modular panels:

* concrete leaks out;

* segregation forms at joints;

* surface roughness increases.

Common visible surface defects include:

* groove marks;

* crooked lines;

* voids.

ORGANIZATIONAL AND ECONOMIC DISADVANTAGES

Long Installation Time. Using traditional methods:

* column formwork: 3–4 hours;

* wall formwork: 4–6 hours;

* slab formwork: up to 1 day.

This extends the overall construction period by 10–15%.

High Demand for Skilled Labor

Under Uzbekistan's conditions, the shortage of qualified formwork workers at many construction sites leads to reduced quality.

Storage and Transportation Issues. Without proper storage facilities:

* wooden formwork deteriorates;

* metal formwork corrodes;

* plastic formwork becomes brittle under sunlight.

High Cost of Formwork Systems. Average cost of 1 m² of formwork (as of 2024):

* Wooden: 80,000–110,000 UZS

* Metal: 300,000–500,000 UZS

* Aluminum: 450,000–650,000 UZS

* Polymer: 350,000–500,000 UZS

PRACTICAL CASE STUDIES

Settlement of Slab Due to Defective Formwork

In a 12-story building in Tashkent, incorrectly installed wooden props caused slab concrete settlement of 18 mm.

Consequences:

* additional floor leveling cost: 6.5 million UZS;

* labor costs: 4 million UZS;

* project delay: 3 days.

Concrete Leakage Due to Cracked Wall Formwork

In Surkhandarya region, gaps between old metal wall panels caused concrete leakage, resulting in large surface cavities.

Consequences:

* repair cost: 1.3 million UZS;

* reduction in wall strength by 8–12%.

RECOMMENDATIONS FOR ELIMINATING DISADVANTAGES

Use of Standardized Modular Formwork. Advantages:

* installation and dismantling speed increases by 40–60%;

* standardized panel dimensions reduce defects.

Inspection Using 3D Laser Scanning. Laser-based inspection ensures:

* deviation reduced to 1–2 mm;

* ideal alignment of surfaces.

Widespread Use of Polymer Composite Panels. These panels are:

* lightweight;

* moisture-resistant;

* reusable up to 200 cycles.

Control of Concrete Pouring Speed

Optimal pouring speed: 1.2–1.6 m/hour.

Excessive speed leads to:

* increased pressure;

* risk of formwork failure.

Engineering Calculation of Formwork

Concrete pressure is calculated using the formula:

$$P = \gamma \times H \times C$$

where:

γ — density of concrete;

H — pouring height;

C — coefficient considering temperature, speed, and concrete composition.

CONCLUSION

Based on the extended analysis, the following conclusions were drawn:

* Formwork systems are the most labor-intensive and critical stage of monolithic construction.

* Traditional wooden formwork, although economically affordable, does not meet modern quality and strength requirements.

* Deformation, misalignment, and gaps between panels reduce the plasticity, density, and strength of monolithic structures.

* Modern modular aluminum, composite, and plastic formwork systems reduce labor intensity, improve quality, and accelerate construction timelines.

* Measures such as mechanization, laser inspection, and accurate pressure calculation can reduce technological errors by 60–80%.

* Updating formwork systems and training skilled personnel are the most important factors in improving monolithic construction quality.

REFERENCES

1. Жураев, С., & Беккамов, М. (2022). КЛАССИФИКАЦИЯ ВИСЯЧИХ МЕТАЛЛИЧЕСКИХ КОНСТРУКЦИЙ (ТРОСОВЫХ И МЕМБРАННЫХ) ПОКРЫТИЙ. O'ZBEKISTONDA FANLARARO INNOVATSIYALAR VA ILMIY TADQIQOTLAR JURNALI, 2(14), 997-1002.

2. Жураев, С., & Сатторов, К. (2023). Расчет Тросовых Висячих Покрытий В Пк Лира. Periodica Journal of Modern Philosophy, Social Sciences and Humanities, 16, 119-123.

3. Жўраев, С. ИМОРАТЛАРИНИНГ (2023). АЛИШЕР АРХИТЕКТУРАСИ. НАВОИЙ ДАВРИ O'ZBEKISTONDA FANLARARO INNOVATSIYALAR VA ILMIY TADQIQOTLAR JURNALI, 2(16), 142-146.

4. Turayev, S., & Sanjar, J. (2023). ZILZILA VAQTIDA BINO VA ZAMIN GRUNTLARINING O'ZARO TA'SIRI. Finland International Scientific Journal of Education, Social Science & Humanities, 11(2), 410-414.

5. Sanjar, J. (2023). DEVELOPMENT OF CULTURE AND ENTERTAINMENT PARKS. American Journal of Pedagogical and Educational Research, 9, 49-52.

6. Жураев, С., & Тураев, Ш. (2023). ДВУХПОЯСНЫЕ ПРЕДВАРИТЕЛЬНО НАПРЯЖЕННЫЕ СИСТЕМЫ. IJODKOR O'QITUVCHI, 3(29), 77-81.

7. Жураев, С., & Сатторов, К. (2023). ТЕРМИНОЛОГИЯ И КЛАССИФИКАЦИЯ ВИСЯЧИХ И ВАНТОВЫХ МОСТОВ. Innovations in Technology and Science Education, 2(9), 197-206.

8. Хурсандов, Э. Ў. (2024). ЭГИЛУВЧИ ЭЛЕМЕНТЛАРНИ ҲИСОБЛАШ ВА УЛАРНИНГ АФЗАЛЛИКАРИ. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 47(5), 73-76.

9. Mamatmurod ogli J. S. et al. QURILISH BOSH PLANI, MATERIAL VA KONSTRUKSIYALARNI OMBORLARGA JOYLASHTIRISH //ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ. – 2024. – Т. 47. – №. 5. – С. 66-72.

10. Mamatmurod ogli J.S. et al. ASOS, PODEVORLAR VA ORAYOPMALARNI KUCHAYTIRISH VA ULARNING MONTAJ SAMARADORLIGINI OSHIRISH //ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ. – 2024. – Т. 47. – №. 5. – С. 54-59.