State construction supervision during repurposing project implementation in the urban areas

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Abstract. The article discusses the mechanisms for optimizing the activities of state construction during the implementation of various investment and construction projects, including reprofiling, repurposing and reconstruction facilities. As a result, the authors provide a new dimension of quality system by several areas of criteria.

1. Introduction

The main technogenic hazard associated with the use of construction products is a technical or physical condition of capital construction projects that may cause material, social or economic losses or risks of consequences in the form of accidents or destruction.

The probability of negative consequences of construction projects operations is accounted for using quantitative and qualitative indicators that characterize such performance features (or properties) of research objects being examined as “reliability” and “safety”. Creating conditions for reliable and safe operations is a priority task for capital construction projects of any functional purpose [1].

Despite professional efforts, improvements in the regulatory framework and raising the level of technological effectiveness of construction processes, there is an apparent growth of the number of accidents in construction projects and the gravity of their consequences.

Accident consequences may include: direct economic losses (damage); profit deficiency due to delayed commissioning (or partial loss of designed capacity) of construction projects; excessive operational expenditures; premature physical or moral depreciation of construction products; deterioration of social and/or ecological conditions of the living environment [2]. The main causes of accidents are negative factors of various physical nature that are formed or revealed at various stages (periods) of the life cycle of construction projects.

Accident analysis for capital construction projects (of various functional purposes) shows that accident-caused situations are rarely if ever a consequence of a single negative factor, but occur as a result of interaction of a number of various negative factors (or groups of such factors).

Each of these factors individually may not necessarily lead to emergencies; however, in combination with other unfavorable factors (that may have arisen at the previous stages of the life cycle), they may have accident consequences [3].

The overall number of individual (currently known) unfavorable factors is quite high. It is obvious that over the time (against the background of stepping up of requirements to functional indicators and ways of formation of construction products), the number of individual factors will definitely grow.
Generally speaking, the effect of unfavorable factors (or groups of negative factors) can be identified as deterioration (partial or total loss) of the quality of construction products.

For example, an accident can be understood as a loss of quality that excludes any conditions of normal operations of a construction project in accordance with its initial functional purpose. Availability of defects or damage in the structure, utility networks or equipment is characterized as partial deterioration (partial loss) of the quality of a completed construction project that leads to escalation of (or adds to) material costs of ensuring (recovering) the required levels of functional efficiency [4, 5].

2. Materials and Methods
The task of ensuring the quality of construction products implies adequate improvement of the scientific foundation, a systemic approach, and management procedures (including supervision and control) for the quality of capital construction projects.

Such construction products as buildings and structures are an object-based environment with a long period of use (determined by their service life duration). The degree of correspondence between the actual values of reliability and functional efficiency of completed construction projects and the design or normative (regulatory) characteristics determines the quality of construction products.

The quality of construction is among the key determinants of consistency and development prospects of this industry (field of economic activity). Ensuring the reliability and quality indicators is a continuing vital task of entities involved in construction investment activities [6].

Raising the quality of construction products is a challenging multifaceted task to be accomplished using a systemic approach in the following main directions (for the main entities involved in construction investment activities):

Improvement in the conditions of development and efficient functioning of governmental forms of influence and stimulation methods in terms of:
• Rate setting;
• Standardization;
• Certification;
• Licensing;
• Governmental expert examination;
• Governmental supervision.

Creation of conditions for efficient functioning of non-governmental forms of influence and stimulation methods in terms of:
• Internal operational control by the contractor;
• Designer supervision by the design company;
• Engineering supervision by the customer;
• Construction quality monitoring by the investor (insurance companies, banks, private sector organizations).

Construction product quality (in terms of functional efficiency and reliability) should be predicted, achieved and ensured at each stage of the life cycle[7].

Figure 1 shows the structure of factors and criteria of the quality level of construction operations. The quality level determines to a great extent the level (rates) of competitiveness and is the main cost factor of construction products.
Accordingly, creation of conditions for ensuring the quality of construction products (with due account for possible changes in the standards and legislation) is an integrated task that can be efficiently accomplished only subject to a systemic approach to organization of interaction between the main entities involved in construction investment activities:

“Quality management means establishing, ensuring and maintaining the required quality level of products during their development, production and operation to be achieved by systematic monitoring of the quality and targeted impact on the factors that influence the quality”.

The systemic approach to construction product quality management implies the development, approval and implementation of a set of activities (technical, technological, economic, organizational works) associated with construction operation processes [8-9].
3. Results and Discussion

Quality improvement activities for construction products are developed in the following main directions:

- Timely modifications of and additions to design documents;
- Updating of provisions of standards and legislation;
- Development of new types of normative documentation with account for the current and future levels of the technological condition of the construction operations system;
- Raising the level of training and advanced training of engineering and construction staff [11-13].

Construction product quality management can be described as a functional system with defined functions (forecasting, planning, organization, control, accounting, analysis, expert examination, evaluation, licensing, and certification) regarded both as a process and an outcome. A function regarded as a process is a special type of managerial activities and a means of exerting influence on the construction operations quality. A function regarded as an outcome is an assessment of the quality level of construction products by the following groups of indicators:

- Intended use indicators;
- Reliability and safety indicators;
- Indicators of comfort, ergonomics and environmental friendliness;
- Aesthetic indicators;
- Technological efficiency indicators (of construction and operation);
- Indicators of unification, ease of manufacture;
- Information and legal indicators;
- Economic indicators;
- Social indicators [14-16].

The quality level of construction products is expressed by a system (computable combination) of individual (absolute) indicators and/or an integrated relative indicator (the ratio of an integrated quality indicator of construction products to the corresponding base level integrated indicator) [17-18].

Quality management is a part of a unified integral system of construction operations management at each level: governmental, departmental (industry specific), production (project). Quality assessment is an obligatory element of any level of the product quality management system [19].

Measures taken at the governmental level include: planning of the necessary indicators and supervision of compliance and development of quality improvement activities for construction products.

Construction products quality planning includes the development of standards and legal acts that regulate the composition, scope and quality of works and activities implemented in the main periods of the life cycle, as well as defining technical conditions of manufacturing construction materials, products and structures [20].

Supervision of conformity of construction products quality (stipulated by the design documentation) is implemented in the form of conformity inspections by governmental supervisory authorities. Conformity inspections ensure supervision of compliance with safety regulations for construction works and processes as well as fire protection, sanitary epidemiological and environmental regulations [21-22].

4. Conclusion

The outcome of quality management actions by governmental construction supervisory authorities is recognized to be ongoing, up-to-date, complete and objective assessment of conformity and issuing of recommendations for ensuring the stipulated quality level irrespective of the interests of any entities involved in construction investment activities.

In light of the foregoing, it can be concluded that an up-to-date approach to governmental construction supervision based on risk-focused criteria should be used as the framework for improving the quality and safety of construction products at all stages of their formation.
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