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## FORMATION OF THE QUALITY MANAGEMENT SYSTEM CRITERIA IN REPURPOSING INDUSTRIAL FACILITIES

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**Abstract:** For decades, the principles of urban planning have not paid due regard to the specific features of industrial areas' location with account of the dynamic development of megalopolises that absorb such facilities and thus create destructive factors for the urban environment. Surrounded by residential, administrative, and office blocks, industrial areas lose their attractiveness to the city authorities in their function as main budget-forming and job-creating entities, as the development of civilization results in new requirements to the environment, increasing the cadastral value of the land, while the cost of labor in the central parts of large cities grows much faster than on the outskirts or in small towns, where the process of “absorption” of industrial areas by the urban environment is not so fast and intensive. The issue of repurposing manufacturing enterprises located in the central parts of cities, as well as quality control in implementing renovation of similar facilities is particularly acute for large cities, whose urbanization areas are continuously growing. This article deals with the study of the links between the process control and management structures, as well as information support for construction supervision in the Russian Federation and other countries, such as the United Kingdom, the United States, Germany, etc.; reveals the main features of the interaction between customers and general contractors in construction quality management; and justifies the need for development of an automated design system for construction quality management.

**Keywords:** industrial facility repurposing; process control structures; construction supervision; quality management system; computer-aided design system

### I. INTRODUCTION

Federal laws of the Russian Federation provide for the mandatory construction supervision at capital construction sites. The legislative base for ensuring construction safety includes the Town Planning Code of the Russian Federation [1], the Law on Technical Regulation [2], the Technical Regulations on the Safety of Buildings and Structures [3]. These regulations impose the obligations to supervise any construction activities on developers (customers). In the conditions of the country's market economy, the proposed procedure for construction supervision, namely: normalization of the customer's

expenses for construction supervision and the number of the customer's employees who are responsible for the construction supervision in accordance with the established procedure, is very rarely complied with in practice.

A correctly organized quality management system allows construction companies to reduce costs and improve their construction quality. This is confirmed by the experience of many Western countries. At the same time, foreign companies need to use such systems in the conditions of the growing technological and technical complexity of construction facilities, increasing the volume of work performed, including specialized work, using technical

personnel [4], building materials, and equipment from various countries [5–7]. Russian construction companies also face the same need. At the same time, it is necessary to formulate efficiency assessment criteria and choose methods for reviewing the existing approaches to construction supervision at repurposed facilities. Below is the description of how quality management systems are organized in foreign construction companies.

## II. RESEARCH METHODOLOGY

A theoretical analysis and summary of scientific literature, periodicals concerning construction supervision and quality management, including those in other countries, make it possible to assess the variability of the methods for implementing such supervision. This formation to the formation and research at the empirical level clarifies the essence of various factors and parameters of construction supervision adopted throughout the world. It includes the assessment of the quality and reliability criteria that combine various approaches of the state to the implementation of construction supervision and control [8].

The methodological function of the paradigm of this scientific research has not been studied or has been studied insufficiently. For this reason, the analytical methodology was adopted as the basis. This approach to the study of previous experience and comparison with existing scientific studies makes it possible to form an adequate unified information system, which can further be upgraded into a single management block. The study subject was the domestic and foreign experience in the formation of solutions for the construction supervision, established organizational structures in the field under study, as well as efficiency assessment requirements.

An analysis of the facts provided in the domestic and foreign scientific and regulatory publications allows us to discover objective regularities and formulate uniform principles, as well as methodological recommendations. However, such an analysis is of scientific importance only when it has a specific purpose. In our case, the main purpose of the analysis is to evaluate the effectiveness of applied construction compliance monitoring methods and methodologies used in Russia and abroad. The obtained results are documented, discussed, and further hypothesized.

## III. RESULTS AND DISCUSSION

### A. Construction Companies in UK

In the UK, the first requirement of a customer to a construction company is the work quality guarantee of the construction company, which is a written assurance that the contractor will apply an effective product quality control system. The system assumes providing special reports and documentation, carrying out inspections that allow obtaining objective information on the compliance of the work, equipment, and materials used with the requirements of regulatory and project documentation [9].

The construction contractor appoints its representative as

the quality manager. He supervises and coordinates the quality control system. The manager is accountable to the technical director of the construction company and has an appropriate staff of quality inspectors and supervisors. It is the responsibility of such manager to prepare and distribute quality compliance guidelines, determine the scope and nature of the quality control documentation. First of all, the manager must develop a quality control program for the work performed at each site. The program includes data on the organizational structure of the quality control system, the functions and responsibilities of the inspecting personnel, the supervision procedure, the procedure for receiving and using construction materials, the procedure of maintenance of essential documentation, etc. [10].

At the same time, the customer appoints an authorized representative to check the effectiveness of the contractor's current quality control system. The authorized person has access to any necessary documentation certifying the work quality; is notified of all quality improvement measures; and inspects the construction site in-site (fig.1) [11].



Figure 1: Quality management system for construction in Germany

### B. Construction Companies in Germany

German construction companies implement the quality assurance system *Qualitätssicherungs system (QSS)*, the principle of which is to produce quality rather than control it after the work is done. The result of effective cooperation between the company's quality assurance department and construction supervision authorities and close interaction with production teams is a solid basis for low-quality prevention. The regulatory base of the quality assurance system is the ISO 9000 series of standards, and the main document is the quality assurance plan drawn up for the whole construction period. At production sites, the construction quality analysis of the work is carried out monthly, with an emphasis on identifying the rejection and rework causes.

The quality control system ensures continuous monitoring of all construction site areas, both at the construction site, enterprises, and suppliers of materials and equipment. All subcontractors and suppliers of building materials and equipment comply with the same principles.

The relevant operation of the quality control system is ensured by appointing an independent manager,

subordinated to the construction manager and responsible for the following activities (fig. 2):

- supervising operations to ensure that their quality meets the declared requirements;
- monitoring the implementation of all construction quality control measures;
- preparing quality assurance documentation;
- Supervising the training of the construction and erection company's employees.

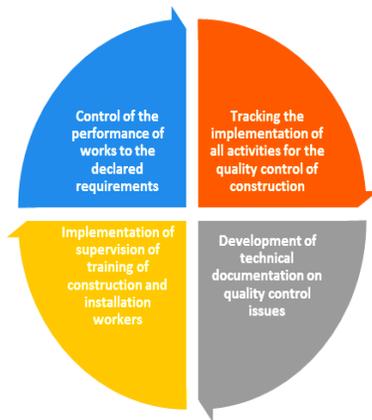


Figure 2: Interaction of construction quality modules

### C. The Quality Control Regulations

The quality control manager develops the quality control regulations, which are approved with the customer within 30 days after the contract is signed.

The regulations comprise the following sections (fig. 3):

- the quality control procedures;
- the supervisory personnel qualification requirements;
- the responsibility of each supervisor;
- the plan for inspections and quality control measures carried out by construction companies and subcontractors (like what, where, when and at what facilities);
- the list of necessary checks at the initial stage of the project;
- the memo to the construction quality control plan;
- the procedure for making changes by the quality control division employees in drawings, calculations, and its approval with the customer's representatives at the construction site.



Figure 3: The structure of the main criteria for insuring the quality of construction

### D. The Construction Quality Supervision

The contractor is not authorized to carry out construction and erection works, for which he has not obtained the customer's approval for the relevant quality control procedures. In the process of implementing quality management functions, the contractor shall transfer to the customer:

- on a daily basis, directions on the need for inspection 24 hours before the beginning of monitoring, as well as the results of previous quality control inspection;
- on a quarterly basis, the list of the most important performed quality control measures or items being performed.

The manager on a regular basis in coordination with the customer should hold meetings to discuss the construction quality assurance issues. The construction quality supervision is performed by an engineer assigned for each facility under construction. The engineer is subordinated to the quality manager and is guided by his instructions. The on-site quality inspector performs the following functions:

- input control of building materials, parts and structures;

- operational and acceptance control.

The inspector has the following authorities:

- to identify and document any issues associated with the work quality;
- to offer measures aimed at improving the construction quality;
- to require fixing existing defects [12].

The on-site inspector works jointly with the contractor, fulfilling the general task of facility construction.

The construction laboratory plays an important role in ensuring the quality control system's operation. The contractor ensures its functioning during the entire construction period. It is required to prepare a list of necessary tests for all types of materials, products, and structures, as well as all construction and installation works [13].

Quality improvement is the top priority item of the agenda of semi-annual and annual meetings of the company management. All these and other measures ensure improving the quality of construction of buildings and structures and significantly reduce costs for defect elimination and rework [11].

#### *E. Control of Building in Sweden*

According to the legislation of Sweden, it is the property owner's responsibility to comply with the construction regulations. A private independent person, the quality assessment engineer, acts instead of a state construction supervision inspector. The construction facility's owner can hire the engineer for the necessary period for an inspection check [11].

#### *F. Control of Building in United States*

In the United States, the work of district building supervision and control authorities is organized within the framework of the legal statement of the construction permit. According to the civil law, the construction permit is a license agreement between the technical regulation parties, in which an authorized person of the state authority, being an employee of the construction supervisory authority, is the licensor, and the real estate owner or his representative in the person of the developer, designer, or the contractor is the licensee. According to such an agreement, the licensor grants the right for construction production (or to perform certain actions with respect to existing products) to the licensee according to the construction documentation that the licensee has submitted to the licensor for verification and approval. The building permit, like any other civil transaction, imposes certain responsibility on the transaction parties. By signing the building permit application, the facility owner (or his agent) undertakes to comply with the requirements of construction codes and rules, which means following the procedures and instructions of the supervisory authority, to notify timely the construction control authority personnel about the facility's readiness for inspections, to allow inspectors to access the construction site without

encumbrance and assumes other obligations [14].

By approving the facility owner's application, the supervisory authority undertakes to carry out activities aimed at ensuring the compliance with the construction legislation, including the construction documentation verification, for the purpose of issuing the construction, erection, or other permit and for regular inspections [15, 16].

#### *G. Control of Building in Georgia*

In Georgia, the construction supervision by the customer is voluntary. The voluntary supervision is provided by the developer. However, in case of violations of fire safety rules, rules for the safe use of construction machinery and mechanisms, labor protection and safety regulations, the liability is born by the developer or, during the operation of the completed facility, by the facility owner. Since the owner or developer is interested in reducing the legal risks caused by accidents or incidents at work due to non-compliance with the construction laws and relevant regulations and standards, developers and owners contract qualified construction control professionals. Such professionals can be designers or experts who have been officially registered in the register of experts of the Ministry of Economic Development of Georgia, and thus authorized to inspect real estate [11].

#### *H. Control of Building in New Zealand*

In New Zealand, construction supervision is also a non-mandatory procedure. But obtaining a construction permit is accompanied by inspections. Based on the project specific features, the authorities issuing the construction permit states the purpose and number of inspections required during the facility construction. The facility owner or his authorized representative, if the owner has entrusted this duty to him, are responsible for organizing such inspections. The owner is obliged to timely notify the inspector about the facility's readiness for inspection and provide him with unhindered access to the facility during the hours determined by the inspector. Inspections are usually carried out within 24–48 hours after the inspector receives a notification of the facility's readiness for the inspection. That is, the developer is interested from the beginning to ensure a high quality of the construction [17].

#### *I. The Construction Quality Supervision in the USSR*

In 1921 in the USSR, the only owner of construction facilities and the customer was the government, which controlled the entire procedure of construction contracting. In 1938, the Construction Committee was formed and subordinated to the Council of People's Commissars of the USSR; its authority included the project and construction management, development of production and budget norms, and technical regulation of the industry. The Committee existed until 1939, and thereafter its functions were transferred to the USSR People's Commissariat of Construction (Narkomstroy).

The USSR People's Commissariat of Construction was to perform all special, construction, and erection works,

supervise the construction quality, and deliver facilities ready for commissioning to customers.

The experience of foreign construction companies shows that the quality control system allows shortening the facility construction period and reducing construction costs due to lowering the number of deviations from the project.

#### IV. CONCLUSION

In the Russian Federation, the construction control procedure is based on both the Town Planning Code [1] and the Government Order "On the Construction Supervision Procedure Applied in the Construction, Reconstruction, and Overhaul of Capital Construction Facilities" (hereinafter, the Construction Control Procedure) [18]. At the current stage of the construction industry development, the proposed construction control procedure in the conditions of the country's market economy, namely: normalization of the customer's expenses for construction control and of the number of the customer's employees who, according to the established procedure, are responsible for the construction control, is rarely complied with in practice. With the existing construction supervision procedures and the growing scale of construction, this results in an increasing number of accidents in the construction of buildings and structures, as well as construction defects [19, 20].

One of the ways to solve this problem is to develop an automated design system for the construction quality management procedure, which would make it possible to evaluate and improve the process of construction supervision.

#### V. REFERENCES

- [1] Federal Law of the Russian Federation "Urban Development Code" of December 29, 2004 №190-FZ. 2004. Consultant Plus. Retrieved from: [http://www.consultant.ru/document/cons\\_doc\\_LAW\\_51040/](http://www.consultant.ru/document/cons_doc_LAW_51040/) Last Accessed 2019/09/02.
- [2] Federal Law of the Russian Federation "On Technical Regulation" of 27.12.2002 № 184-FZ. 2002. Consultant Plus. Retrieved from: [http://www.consultant.ru/document/cons\\_doc\\_LAW\\_40241/](http://www.consultant.ru/document/cons_doc_LAW_40241/) Last Accessed 2019/10/08.
- [3] Federal Law of the Russian Federation "Technical Regulations on the Safety of Buildings and Structures" dated 30.12.2009 № 384-FZ. (2009). Consultant Plus. Retrieved from: [http://www.consultant.ru/document/cons\\_doc\\_LAW\\_95720/](http://www.consultant.ru/document/cons_doc_LAW_95720/) Last Accessed 2019/09/28.
- [4] Lapidus, A. A. 2017. Formation of professional orientation of specialists in the field of construction on the basis of analysis of their employment in various sports. Theory and practice of physical culture. 5, 33-34.
- [5] Reiner-Roth, S. 2019. The artful repurposing of industrial wastelands. Retrieved from: <https://archinect.com/news/article/150137995/the-artful-repurposing-of-industrial-wastelands> Last Accessed 2019/10/02.
- [6] Chan, H. 2019. Adaptive reuse of industrial buildings – 7 brilliant ideas. Retrieved from: <https://assetsamerica.com/adaptive-reuse-industrial-buildings/> Last Accessed 2019/10/08.
- [7] Adelman, J. 2019. Refinery shutdown could mean new life for 1400 waterfront areas. The Philadelphia Inquirer. Retrieved from: <https://www.inquirer.com/news/philadelphia-refinery-complex-real-estate-land-use-port-housing-remediation-20190626.html> Last Accessed 2019 0831.
- [8] Afanasyev, A.A. 2017. Efficiency of pipe-concrete structures in the construction of frame buildings and structures. Construction and reconstruction. 4, 111-120.
- [9] Lapidus, A.A. 2016. Forming the integral potential of organizational and technological solutions through decomposition of the main elements of the construction project. Bulletin of MGSU. 12, 114-123.
- [10] Topchiy, D. V. and Tokarskii, A. Ya. 2017. Increase of organizational and technological reliability of the objects of re-profiling in the implementation of construction supervision. Science and Business. 10 (76), 15-19.
- [11] Seryh, A. 2010. Technical regulation in construction. Analytical review of world experience. SNIP Press, Chicago. Retrieved from: [http://iccg.com.ua/wp-content/uploads/2016/04/techno\\_reg\\_stroi\\_world.pdf](http://iccg.com.ua/wp-content/uploads/2016/04/techno_reg_stroi_world.pdf) Last Accessed 2019/09/12.
- [12] Topchiy, D.V. andSkakalov, V.A. 2017. Structural and functional modeling of multi-level and multi-criteria links of organizational, technological, managerial structures and information support in the implementation of construction control during the conversion of industrial facilities. Prospects of Science. 10 (97), 44-50.
- [13] Afanasyev, A. A. 2016. Pipes for construction of frame buildings. Academia. Architecture and construction, 2, 113-118.
- [14] Oleinik, P.P. 2016. Conditions for ensuring the comprehensive production of earthworks. Scientific Review. 14, 239-243.
- [15] Billington, M.J. 2007. The building regulations: Explained and Illustrated. Blackwell publishing, Oxford.
- [16] Billington, M.J. 2005. Using the Building Regulations: Administrative Procedures. Elsevier Press, Amsterdam.
- [17] Ministry for the Environment. New Zealand Government.2008. A beginner's guide to resource and building consent processes. Retrieved from: <https://www.kaikoura.govt.nz/assets/Docs/Services/Building-Consent/resource-and-building-consent-processes.pdf> Last Accessed 2019/10/08.
- [18] Decree of the Government of the Russian Federation of June 21, 2010, No. 468 "On the procedure for conducting construction control in the construction, reconstruction and overhaul of capital construction projects". 2010. Russian Business Newspaper, 760 (27) Retrieved from: <https://rg.ru/2010/07/27/kontrol-dok.html> Last Accessed 2019/09/04.
- [19] National Association of Builders (NOSTROY).Monitoring of accidents and incidents. Retrieved from: [http://nostroy.ru/information-disclosure/monitoring\\_proishestviya/](http://nostroy.ru/information-disclosure/monitoring_proishestviya/) Last Accessed 2019/09/25.
- [20] Reizenbuk, K., Sarapulova, T., Shchedrin, S., Shchedrina I. 2019. Application of distributed computing in developing architecture of intelligent information system for automated stock exchange trading. Journal of Advanced Research in Dynamical and Control Systems. 5, 44-49.