

The role of a technical customer in organization of investment and construction activity at the stage of construction oversight

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Abstract. This document considers the main tasks promoting development of construction as a branch and defines the correlation of efficiency of using funds with the activity of the technical customer as a guarantor of completing the design and construction works with proper quality, within established periods and planned financing of the facility construction. The functions of the technical customer and developer are defined from the point of view of the law as well as reasonability of their simultaneous work in the form of various legal entities in organization of design and survey works. Goals and objectives of the construction oversight are determined in accordance with regulatory documents, on the basis of which the package of functional procedures of the construction control is identified. Organization and management model of the technical customer's activity at the construction oversight stage is developed in the form of network and linear diagrams aiding in establishing the conditions of the construction oversight function execution with account of assuring the quality of the finished product.

1 Development of the construction sector of the country

The construction sector is assigned one of the leading roles in economies of the developed and developing countries, where the strategic goals of development are determined by increasing the citizens' life quality level [1].

1.1 Development of construction as a branch

Construction as a branch develops within the modern state policy based on formation of a high level of safety and comfort of the living environment supported with high standards of living, efficient financial and economic, legal, technical, and organization and process mechanisms [2].

Creation of conditions for advanced, innovative and effective modernization of the construction sector underlies the efforts on improvement of programs for social and economic development, promotion of national security and spatial development of the

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country. This solves the problems of increasing the level of performance in the sector, increases the volume of construction works along with raising the level of the investment attractiveness, as well as the task of decreasing the building stock depreciation level, saving the budget funds when implementing the projects, and increasing the level of affordability and comfort of residence for the citizens.

Such challenges are the primary criteria for assessment of the state of the art of the sector, while the decisive influence is exerted by the substantiation of the adopted organization and process, economy and management solutions [3].

1.2 Effectiveness of using budget funds in construction

In the light of the past global economic crisis 2008-2009 and other known causes of slowing down of economy growth rates in the developing countries, the Governments of the countries of the Eurasian Economic Union and the European Union consistently take decisions concerning strategic planning, management improvement, enhancement of the efficiency of budget expenditure and state procurement, improvement of conditions of carrying out business activity [4, 5]. In this case, the pursuing of optimal budget policy in implementation of government-owned investment projects is determined by the work on search of the most rational economically justified solutions, including the construction sector.

2 Role of the technical customer at the stage of construction oversight

Economic efficiency of using funds in construction of buildings and structures begins from an effective, proper design, which is based on modern, cutting-edge, advanced equipment, streamlined organization and process solutions of construction operations [6].

Obviously, the efficiency of such multifaceted and multi-task work depends on coordinated work of all participants of the investment and construction activity (investors, developers, designers, contractors, operating organizations, etc.). However, the availability of cost items associated with fulfillment of the technical customer's functions in the design and estimate documentation is a guarantee of manufacture of construction products with appropriate quality and in established periods [7].

2.1 Functions of the technical customer and developer from the point of view of the law

The requirements of regulatory legal documents in the construction activity define the technical customer as the main participant of the investment and construction process [8]. At the same time, a number of regulatory documents does not define the functional responsibilities of the technical customer and the developer in full, and reasonability of their simultaneous work as different legal entities in organization of design and survey and construction works has not been completely uncovered yet [9].

2.1.1 The function of the developer

In the Russian Federation, the developer is a physical or legal entity who performs the following on the land plot owned by it:

- Construction, reconstruction, overhauls of capital construction facilities.
- Engineering survey.

- Preparation of design documentation for their construction, reconstruction, overhauls.

Therefore, in order to hold the status of the developer, one needs to own a land plot on the basis of any right.

All developers are equalized in their rights regardless of the basis for acquiring the right to the land plot, however the responsibilities of developers differ depending on this right, and also on the type of the facility, location of the site, etc. execution of the developer's functions does not require permits of self-regulated organizations, however the expenditures are comprised of the costs for site acquisition and maintenance [8].

Thus, we can draw a conclusion that allocation of a separate legal entity would be reasonable for the function of the developer for implementation of the investment project from the point of view of risk minimization.

2.1.2 The function of the technical customer

In Russia, the functions of the technical customer are defined with the minimal list of authorities and responsibilities for such physical entity acting on the professional basis, or a legal entity, which are authorized by the developer and on behalf of the developer have the right to:

1. Conclude agreements for performance of engineering survey, preparation of design documentation, construction, reconstruction, overhauls of capital construction facilities.
2. Prepare assignments for performance of the specified types of works,
3. Provide entities who perform engineering survey and (or) preparation of design documentation, construction, reconstruction, overhaul of capital construction facilities with materials and documents necessary for performance of the specified types of works,
4. Approve design documentation,
5. Sign documents required for obtaining permission for commissioning of the capital construction facility,
6. Fulfill other intended functions.

The developer is entitled to perform the functions of the technical customer on its own, which follows from definition of the technical customer and is supported by the practice [8]. However, in this case, it will need to obtain a permit corresponding to the minimal list of works on the basis of an order, which incurs substantial costs associated with the need to comply with the minimal requirements, including the technically complex ones, highly dangerous and unique facilities [8, 10, 11].

Aside the requirements regarding the minimal number of employees with the profile education, periodic qualification upgrading, etc., each self-regulating organization (SRO) is entitled to set any additional requirements that do not limit competition, also for the material and technical part [9].

Costs for maintenance of the material and technical base (including costs for licensed software) depend on the company's profile. The cost of verifying the compliance with the ISO depends on the size of the company, on how formally and truly the corresponding certification lasting from several months to half year takes place, and amounts from USD 3,500–5,000 to USD 30,000–50,000, and the amount does not include deductions to the indemnification foundation, which for construction SRO depend on the volume of the contracts, under which a certain organization is going to work, and also on availability or unavailability of insurance, which ranges from USD 5,000 to USD 500,000 per one company [12, 13, 14, 17]. The experience of construction companies shows that optimization of these costs is possible during creation of a technical customer in the form of a separate compact dedicated company.

The responsibility of the technical customer to perform construction oversight is supported by the requirements, in accordance with which the contractor that has improperly performed works may not allege that the technical customer performed oversight and supervision of their execution, except for cases, when obligation to perform such oversight and supervision is placed on the technical customer by the law (8). Therefore, ignoring the obligations on oversight and supervision of the construction process by the technical customer can entail negative consequences for it, which points to the need in dividing the functions of the customer and the technical customer as a means for eliminating the risks of the customer's responsibility for improper supervision and oversight of work execution.

2.2 Goals and objectives of construction oversight

In accordance with the regulatory documents, the goal of construction oversight during construction of capital construction facilities is provision of high quality of construction and compliance with technical specifications of the customer of the building or structure under construction, and performance of the following activities by the customer:

- Checking the fullness and meeting the established terms of incoming inspection and accuracy of documenting its results by the contractor.
- Inspection of control activities performed by the contractor for meeting the rules of warehousing and storage of products used, and accuracy of documenting the results.
- Checking the fullness and meeting of the established terms of control of order and scope of process operations on construction of capital construction facilities and accuracy of documenting its results by the contractor.
- Certification of concealed works and the provisional acceptance of erected building structures influencing the safety of the capital construction facility, sections of utility networks together with the contractor.
- Checking the compliance of the completed construction facilities with the requirements of design and working documentation prepared on its basis with the results of engineering survey, requirements of the land plot development plan, technical regulations together with the contractor.
- Other activities aimed at performance of construction oversight provided by the law and (or) concluded agreement [15].

Therefore, for the technical customer, the stage of construction oversight starts immediately from notification of the construction supervision authorities and local government authorities about the start of the construction and continues till it is finished. Besides, the period of construction is determined by the plan of construction organization (PCO) [16].

3 Organization and management model of technical customer's activity at the stage of construction oversight

3.1 Development of the organization and management model

3.1.1 Package of functional procedures for construction oversight

It is appropriate to pay special attention to functional procedures in the activity of the technical customer when carrying out the stage of construction oversight of construction progress, which can be presented as an organization and management model including a package of functional procedures with indication of their average duration (Figure 1):

- Notification of construction supervision authority of the construction start (formulae 1)

$$t = 0.01t_n \quad (1)$$

Where t — mean time necessary for mastering the type of work under consideration at this stage, $t \in [0, t_n]$, where t_n — the mean type required for technical supervision of construction, with account of combination of these functions and the construction period:

- Approval of work performance schedule, $t = 0.02t_n$,
- Control of meeting the work performance schedule, $t \in [0.02t_n, t_n]$,
- Approval of the list of persons performing technical supervision, $t = 0.02t_n$,
- Definition of a procedure for maintenance of technical and as-built documentation, $t = 0.03t_n$,
- Oversight and technical supervision of construction, correspondence of scope, cost and quality of the works with the designs, cost estimates and contract prices, $t \in [0.03t_n, t_n]$,
- Agreement of the list of planned material suppliers, $t = 0.02t_n$,
- Inspection of licenses and certificates of contractors and suppliers of materials, $t = 0.03t_n$,
- Acceptance, accounting, storage, pre-installation revision and transfer of equipment and other material and technical resource for installation and performance of works, $t = 0.03t_n$,
- Agreement with the relative companies about a procedure for installation, testing and registration of process lifting mechanisms and equipment, $t = 0.03t_n$,
- Certification of concealed works and provisional acceptance of critical structures, $t \in [0.01t_n, t_n]$,
- Conclusion of agreements and control over performance of erection supervision and commissioning operations, $t = 0.02t_n$.

Figure 2 shows linearization of the organization and management model of the technical customer's activity during technical supervision.

It is worth noting that the function of the technical customer at the stage in question includes acceptance of claims for quality from consumers and presentation of claims to contractors (suppliers) in accordance with the law and guarantee obligations (guarantee terms are specified in the agreement).

Pursuant to order the solution on temporary shutdown of the facility (with exception of state-owned facilities) and source of funds for covering the costs associated with temporary shutdown of the facility shall be taken by the developer (technical customer). Consequently, temporary shutdown of the facility is also a part of the functional procedures at the stage of technical supervision performed by the technical customer's department.

When taking a decision about suspension of construction and temporary shutdown of the facility, representatives of the technical customer shall send a notification to the state construction supervision authorities and local government authorities. In this case, the technical customer shall bring the facility and the territory used for its erection to the condition ensuring strength, stability and safe-keeping of the structures, equipment and materials, and also safety of the facility and the construction site for population and the environment [18, 19].

3.1.2 Building of the model in the form of network and linear diagrams

Organization and process model of the activity of the technical customer during construction oversight is design in the form of the network and linear diagrams are represented at the figure 1, 2.

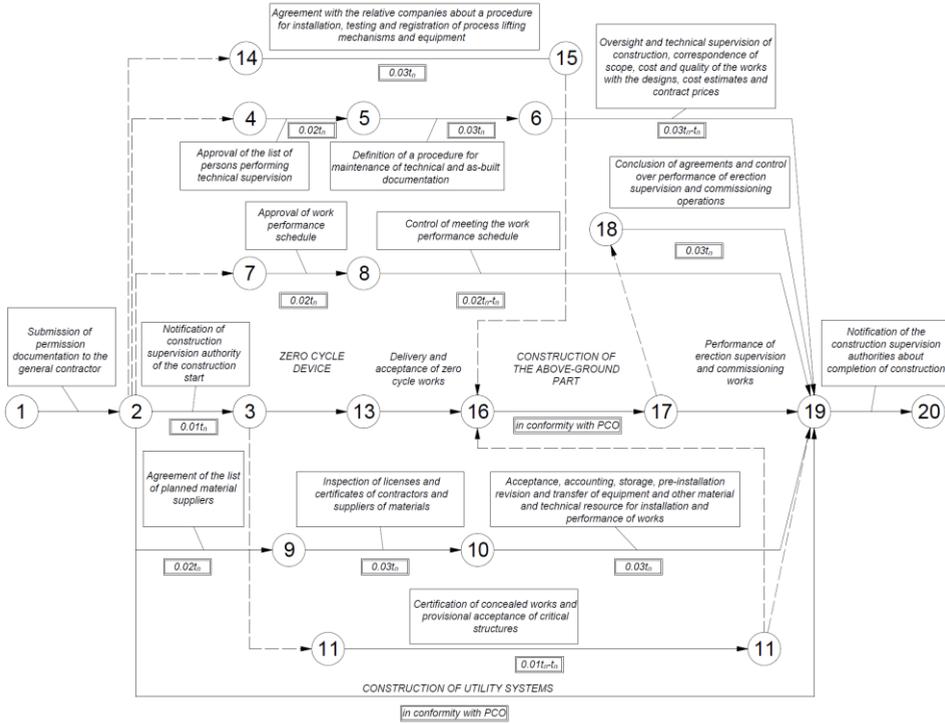


Fig. 1. The organizational managerial model of the technical customer’s activity during construction oversight in the form of the network diagram.

<i>i</i>	Functional procedures	<i>t_n</i> months	0.05 <i>t_n</i>	0.1 <i>t_n</i>	0.15 <i>t_n</i>	0.2 <i>t_n</i>	0.25 <i>t_n</i>	0.3 <i>t_n</i>	0.35 <i>t_n</i>	0.4 <i>t_n</i>	0.45 <i>t_n</i>	0.5 <i>t_n</i>	0.55 <i>t_n</i>	0.6 <i>t_n</i>	0.65 <i>t_n</i>	0.7 <i>t_n</i>	0.75 <i>t_n</i>	0.8 <i>t_n</i>	0.85 <i>t_n</i>	0.9 <i>t_n</i>	0.95 <i>t_n</i>	<i>t_n</i>	
1	Notification of construction supervision authority of the construction start	0.01 <i>t_n</i>	█																				
2	Approval of the list of persons performing technical supervision	0.02 <i>t_n</i>	█																				
3	Approval of work performance schedule	0.02 <i>t_n</i>	█																				
4	Control of meeting the work performance schedule	0.02 <i>t_n</i> - <i>t_n</i>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
5	Definition of a procedure for maintenance of technical and as-built documentation	0.03 <i>t_n</i>	█																				
6	Oversight and technical supervision of construction, correspondence of scope, cost and quality of the works with the designs, cost estimates and contract prices	0.03 <i>t_n</i> - <i>t_n</i>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
7	Definition of a procedure for maintenance of technical and as-built documentation	0.02 <i>t_n</i>	█																				
8	Inspection of licenses and certificates of contractors and suppliers of materials	0.03 <i>t_n</i>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
9	Acceptance, accounting, storage, pre-installation revision and transfer of equipment and other material and technical resource for installation and performance of works	0.03 <i>t_n</i>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
10	Agreement with the relative companies about a procedure for installation, testing and registration of process lifting mechanisms and equipment	0.03 <i>t_n</i>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
11	Certification of concealed works and provisional acceptance of critical structures	0.01 <i>t_n</i> - <i>t_n</i>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
12	Conclusion of agreements and control over performance of erection supervision and commissioning operations	0.02 <i>t_n</i>																					█

Fig. 2. The organizational managerial model of the technical customer’s activity during construction oversight in the form of the linear diagram.

4 Conclusions

The completed study shows that:

1. In selection and justification of rational organization structures and methods for oversight in construction, it seems reasonable that the developer and technical customer, whose functions differ, were different legal entities. The expenditures for support of the activity of two companies separately performing the functions of the developer and the technical customer, as well as possible risks, prove to be lower than those for performance of the activity of the developer and the technical customer by the same entity.
2. Modeling of the technical customer's activity at the stage of construction oversight will allow shortening the erecting time of a capital construction facility and assuring the quality of the finished products in the established periods and within the planned financing.

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