Problems of organizing and conducting engineering surveys in construction

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Abstract. The authors studied and reviewed a brief history of regulatory documentation in the field of engineering surveys. The mechanism of quality control work is described. The problems in the organization of engineering surveys are identified. Suggestions to improve the system for providing engineering surveys with various types of resources are given.

Introduction
The engineering surveys organization for construction in Russia was carried out on the basis of a regulatory framework in the 90s of the twentieth century. The requirements for various types of engineering surveys were regulated by the sets of rules, territorial and departmental building codes, state standards and normative legal acts. In 2003, with the issuance of the Federal Law “On Technical Regulation”, the existing regulatory documents were abolished as mandatory for exploration enterprises. A system of self-regulation in construction was formed, the standards of which became mandatory for management in the field of engineering research.

Main part
The relations developing in the process of the exploration works organizers activity with the participants of the investment and construction process have become more complex and diversified, resulting in the need to analyze the key problems for geotechnical surveys in Russia today [1].

The results of design and survey activities of any kind and complexity must meet both the quality standards imposed by the state and the customer’s requirements. This is especially necessary to control, based on the purpose of the building or structure, which will be rebuilt on the basis of the survey.

Engineering surveys are carried out on the basis of a contract that is concluded between its parties after a certain tender has been held. These works performance quality control is carried out by the customer, and the materials extracted in the course of conducting engineering and geological surveys go through a procedure of a mandatory examination in accordance with the current legislation of Russia [2]. Its effectiveness is insufficient without the production process control by uninterested organizations, which cannot be called internal quality control services created by the customers. The concealment of violations or possible deviations occurring in the process of engineering and exploration activities can be excluded when recruiting the services of a supervisor who is a subject to a system of penalties and maintaining a high level of personal reputation [3].
One of the key engineering surveys organization problems for construction in the Russian Federation is the lack of timely and constant funding. Its beginning in practice is more often marked by the construction process beginning, when the necessary means are allocated. The surveys often do not precede the design and complex of construction and installation works, construction machines and survey equipment work at the site at the same time, the money for work is transferred to the contractor when the latter does not have even time. A sad example is the situation with the Olympic facilities in Sochi, where construction started from the retaining wall, in which the main component of the project’s finances was laid, and no surveys were carried out during the design works. The survey companies mostly work as subcontractors. Financing that does not come from the budget to the customer, does not reach the performers working at dumping prices in a competitive environment. It dictates the need for monthly expenses for consumables, periodic updating of survey equipment and its maintenance. The customer company responsibility level can be increased by including the mandatory conditions in the participation in tenders - the absence of debts to pay the contractors to the previous projects [1].

This leads to the following key problem of organizing the search - an insufficient number of large survey companies, independently, i.e. directly operating and performing research and development (Figure 1) [5]. Despite the government’s policy of supporting small and medium-sized businesses (SMBs), the industry formed by the engineering survey enterprises is small in number. 92% of them belong to micro and small businesses, 4% each fall to medium and large ones. The practice of combining design and design work by the customer into one position, provided for by the RF Civil Code, became widespread and cut off all the organizations working only in the field of the research from the rest of the work, allowing them to share the role of subcontracting organizations.

In the field of engineering surveys there is no unified regulatory framework – Building Codes and Regulations II-02-96 “Engineering Surveys for Construction. The main provisions” and the updated version of the joint venture 47.13330 contradict each other and complicate the joint work of the performers and customers, as well as control bodies.

![Figure 1. The number of design and survey organizations performing research and development by year](image-url)
Also, the quality of engineering surveys is influenced by the unlicensed software use. Such actions violate the existing legislation and lead to criminal, administrative and civil liability. During the inspections, the work in an organization using the unlicensed programs becomes more complicated, since all the equipment is taken for examination. Such a company can easily lose partners, lose a tender, get a considerable fine and imprisonment. The risks of work are increased gradually because a hacked software does not have the opportunity to contact a technical development company for technical information. Externally, the results of the processed data look satisfactory, but are not reliable. Repeated surveys involve more and more costs. Hacked software works with errors occurred during hacking, and does not meet the requirements necessary for the safe exploration activities implementation [6].

Finally, the competitiveness is among engineering research organizations based on a seemingly reasonable selection method based on the principle of choosing a cheaper organization. Engineering-geological work falls on the first percent of the construction and installation work cost and in a competent execution can save not only the construction cost, but also the operation cost. However, the State Expertise analysis data reflects the poor quality of engineering surveys, including due to the unsatisfactory justification of the design schemes when working with hazardous geological processes.

Consideration of survey activities from the point of view of international ISO 9001: 2008 QMS as a systematic approach at all its stages - collection of basic data, expertise, interaction with SROs, various companies - is to obtain the products with guaranteed quality. For all the processes, the criteria involved in monitoring are highlighted. Further development has two branches: the examination notes correction or the occurrence of an insured event with an appeal to an SRO or an insurance company.

Suggestions for improving the system for the engineering surveys providing with various types of resources.

1. Attracting the outsourced services not involved in the manipulations carried out when performing an exploration work between the customer, the contractor and related participants to the quality control system of the final product.
2. Building an algorithm for the client company interaction with the participants in the investment and construction process, aimed at reducing the unsecured financial resources of the companies. Control of the financial assets guaranteed timely transfer implementation to the account of the contractor conducting the research for the specific object construction. This will reduce the financial risks of the survey work.
3. The rational increase in funds sent by the company to the consumables used, control over the technical base serviceability used in the survey work and the existing machines maintenance in order to increase the executing company competitiveness in the market in terms of work at dumping prices.
4. Application in the course of the software survey work having a valid license and resources of references to software development companies in order to obtain qualified reference information. This will prevent the actual risks of the exploration work unreliable results and the cost of their possible elimination.
5. The contractor organization choice by the previous orders successful implementation history criterion, rather than the reduced final cost of work.

Summary
The study of the work quality control mechanism, the engineering surveys organization identified problems allowed us to formulate the proposals for improving the system for providing the engineering surveys with various types of resources.

References
[1] Nehaj R, Molotkov G, Rudchenko I, Grinev A, Sekisov A 2017 Algorithm of Composing the Schedule of Construction and Installation Works (IOP Conference Series: Earth and Environmental Science) 90 (1) 1-8.
[2] Lantsova I V 2012 *Quality Control Engineering Surveys: Pros and Cons* (Engineering Surveys) 4 30-33
[3] Sizov A V, Boyarko G Yu 2014 *Supervising as a Tool for Quality Control of Engineering Surveys* (Engineering surveys) 13-14 100.
[4] Sekisov A N, Degtyareva O G, Samsonova N V, Grigoryan M N 2018 *Development of the Methods Improving the Production Costs Formation Process* (International conference on Construction and Architecture: theory and practice of industry development (CATPID-2018). Trans Tech Publications, Switzerland) 931 1210-1213.
[5] Surinov A E, Baranov E F, Bezborodova T S, Bobylev S N 2018 *Russian Statistical Yearbook* (Rosstat, Moscow).
[6] Pigin A P 2010 *Do not Create Problems or Risks of Using Unlicensed Programs when Conducting Engineering Surveys in Construction* (Real Estate Cadastre) 3 (20) 104 - 105.