

About promising areas of scientific research in terms of scientific and technical support

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Abstract. The article examines current issues of NTS in construction, focusing on research conducted since 2019. The authors highlight the problems, the developed roadmap for the development of the NTS, research in the field of NTS t will also be focused on promising areas, taking into account current trends towards reducing mandatory requirements in regulatory documents.

Introduction

Scientific and technical support (NTS) in accordance with [1] «is a complex of research, methodological, expert, control, information-analytical and organizational-legal work performed by specialized research organizations in the process of research, design, construction, operation, reconstruction or dismantling of construction facilities to ensure their reliability, safety, functional suitability and durability».

NTS is provided by specialized research organizations, the main activity of which is both scientific and technical and design, as well as scientific activities, as well as having qualified staff, including scientific staff and possessing specialized equipment and licenses for calculation complexes necessary for the performance of work.

Based on the experience and established approaches [1-3], scientific and technical support is carried out in order to ensure compliance with the requirements for reliability and mechanical safety of the facility, quality control, confirmation of compliance of project documentation according to the regulatory documentation and solving complex scientific problems. In addition, the scope of work of the NTS provides for solving problems of optimizing design solutions, forming a "second opinion", methodology of work.

1. An integrated approach to scientific and technical support

The most effective way, both in terms of ensuring the requirements for reliability and mechanical safety of the facility, and in terms of optimizing design solutions, is an

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integrated approach to scientific and technical support, the main ones are described in Table 1.

Table 1. Advantages of an integrated approach to scientific and technical support.

NTS Stage	Advantages
NTS of research	Comprehensive study of the construction site with the identification of its features Identification of non-compliance of the composition and scope of surveys with the requirements for objects of the 3rd geotechnical category. The possibility of choosing the optimal solution for the modification of foundations and foundations. Timely passing of the state examination of project documentation
NTS before designing	Clarification of loads on the object, including: vibration, seismic, wind and snow loads
NTS of design	Ensuring the reliability and safety of the designed object, reducing the influence of the human factor, limitations and assumptions of the calculation complexes on the calculation results. The possibility of optimizing design solutions in terms of the material capacity of structures (reinforcement, dimensions of elements) according to the specified criteria of reliability and safety Detailed calculation justification and scientifically-based approaches to solving non-standard tasks Formulation of tasks and determination of the scope of work at the stage of maintenance of construction processes.
NTS construction	Improving the quality of construction processes. Development of solutions for the settlement of emergency situations in terms of reliability and safety of the facility. Making informed decisions in case of deviations from the design documentation and regulatory requirements that do not lead to a halt in construction. Conducting an audit of working and executive documentation in order to optimize solutions.

Also, for the purposes of the customer, scientific and technical support can:

1. Comprehensively and in conjunction to help with the solution of non-standard issues. To involve specialists of various profiles in the discussion.
2. Timely identify problematic situations and hidden errors. To prevent the need to adjust the results of surveys and project documentation at a later stage.
3. Think, analyze and propose an action plan.
4. Perform a more accurate calculation justification in "heavy" software complexes.
5. To work out alternative design solutions and recommendations based on modern scientific approaches, experimental and scientific research data.

2. Research in terms of NTS.

MGSU has been researching various aspects of NTS 2019. In particular, in article [4, 5], the main problematic issues were formulated in terms of regulatory requirements for NTS, and in article [2], a roadmap "Main directions for the development of NTS" was developed, according to which work in this direction has been carried out so far. Including in 2022, a draft set of rules, which is currently undergoing the approval procedure [6].

The main sections [6] regulations have been created taking into account the previously identified problematic issues in terms of regulatory requirements for NTS, contradictions were resolved in terms of requirements for organizations that have the right to implement NTS, requirements for the composition and volume of NTS and quality control, directions of NTS. Table 2 contains information on the composition and content of the set of rules.

Table 2. Information on the composition and content of the set of rules [6].

Sections	Name	Table of contents
1-4	Preface, introduction Scope of application Normative references, terms and definitions, abbreviations	A list of objects and life cycle stages that are subject to the regulations.
5-7	General requirements Organization of NTS Directions of NTS	Standards for organizations engaged in NTS, and the established procedure for interaction during the execution of work
8-12	NTS organizations-technical support of engineering surveys NTS of design NTS of construction Requirements for NTS programs Requirements for reporting documentation on the results of NTS	Goals, objectives, scope of work of NTS at various stages of the object's life cycle
Adj.A	Requirements for the scope of NTS and quality control	The composition of mandatory NTS works depending on the characteristics of the object
Adj.B	Standard form of technical specification for NTS surveys and design	Standard form of technical specification for NTS
Adj.C	Recommended content of reporting documentation on the results of NTS surveys, design and construction	List of sections and recommended content of reporting documentation on the results of NTS
Adj.D	Recommended scope of work on technical monitoring in the framework of NTS of construction	Scope of work of the NTS of construction when performing various types of SMR
Adj.E	Tips on the structure and design of accounting documentation based on the results of calculations of building structures and foundations.	Recommendations on the design of a calculation and explanatory note

Taking into account current trends aimed at reducing mandatory requirements in regulatory and technical documents and reducing special technical conditions, the responsibility of specialists involved in the preparation of project documentation, construction and expertise will increase. This will also lead to stricter requirements for methodological work to ensure that design parameters and other structural characteristics of buildings or structures comply with safety standards. This, in turn, leads to an increase in the role of NTS in the process of ensuring the reliability and safety of decisions made, forming a "second opinion", defining and applying the methodology of work. Additionally, the involvement of technical support in justifying design decisions and the non-use of documents included in the voluntary list, in accordance with Part 6 of Article 15 [7]. Substantiation of compliance with the project values and characteristics of the building or structure with safety requirements, as well as because the proposed measures to ensure its safety should be supported by one or more of the following methods:

1. Research data;
2. Modelling scenarios of occurrence of natural hazards, including in case of an unfavourable combination of natural hazards and phenomena and (or) man-made impacts;
3. Calculations and/or tests performed in accordance with certified or otherwise approved methods;
4. Assessment of the probability of occurrence of dangerous natural processes and natural phenomenon, as well as man-made impacts.

3. Conclusions.

Based on the above, NTS currently represents an effective tool for ensuring the requirements for reliability and mechanical safety of an object, as well as for solving high-tech problems arising in the design and construction process. Promising areas of research that take into account the trends in the development of the construction industry include:

1. The possibilities of NTS can be used to determine compliance with current regulatory and technical requirements, substantiate deviations from the normative documentation of voluntary application and identify deficiencies in the requirements of regulatory documentation.
2. NTS to ensure the safety of the object, in addition to mechanical safety (fire safety requirements, requirements for a safe level of environmental impact of buildings, and other requirements).

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