GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 10, Issue 1, Jan. (2022)

SCIENTIFIC AND TECHNICAL DEVELOPMENT IN CONSTRUCTION

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ABSTRACT

The aim of the study is to create a parametric model, using which it will be possible to formulate a program of measures carried out during the scientific and technical support of construction (STSC) for each specific object, as well as increase the efficiency of construction production by preventing unaccounted indicators during design. The uniqueness of this model lies in the fact that it adapts to the conditions of any object of high-rise construction. As a result, it will be possible to simulate a set of measures for the implementation of STSC for each unique object. Since the construction of a unique high-rise building requires the use of STSC, the question arises of the application of various methods and methods at each object. The unique high-rise buildings and structures considered within the framework of the STSC are unique, therefore, each needs to apply its own parameters relevant to a particular facility. For example, we can say that any parameter associated with the monitoring of the bases will be different for each object, since the ground conditions for each building under construction are different. To create a model, a number of parameters were selected that are most necessary for inclusion in the STSC regulation for the construction of unique high-rise buildings, and each parameter has its own criterion that varies depending on changes in the characteristics of the construction object. All parameters are either related to actual data on the construction object, such as: air temperature, soil conditions, material of load-bearing structures, etc., or depend on and are regulated by the regulatory documents of the Russian Federation. In this case, one can avoid the subjective opinion that occurs when using the method of expert assessments. Also, avoiding the method of expert assessments can reduce the time spent on the study itself, obtaining a result, and making a forecast.

Keywords: scientific and technical development, construction, parametric model.

INTRODUCTION

In recent years, in connection with the increasing volume of construction of high-rise buildings, the relevance of such a line of activity as scientific and technical support of construction is growing. In comparison with technical supervision, which has the task of monitoring the activities of contractors, the NTSS has both an applied and a scientific approach, namely, it develops and implements new construction methods, as well as modern materials, in order to obtain maximum efficiency and save money and labor costs in the construction and installation work.

Modern construction is characterized by the use of new, more advanced, design solutions, materials, structures and technologies, the development of the specialization of performers and the associated large number of participants in the construction process. In these conditions, along with a competent organization of pro duction and thoughtful coordination of the

interaction of performers, effective control over the timely introduction of technical innovations, strict adherence to technological discipline, all quality requirements for the materials and structures used at the facilities becomes crucial.

The very definition of Scientific and technical support sounds like this - (NTSS) - a complex of scientific and analytical, methodological, informational, expert-control and organizational work carried out by specialized organizations in the process of research, design and construction of construction objects to ensure the quality of construction, reliability (safety , functional suitability and durability) of buildings and structures, taking into account the applied non-standard design and technical solutions, materials and structures.

The main problem: the construction of unique high-rise buildings (buildings above 100 meters) is an extremely complex and responsible process, any inaccuracies in the work can lead not only to significant destruction, but also to the collapse of the structure. Based on the above, additional control within the framework of scientific and technical support during construction and installation work is a necessary measure.

Purpose of the study: to develop a system for the formation of organizational and technological measures for the implementation of scientific and technical support for construction. To achieve this goal, the task is to form a list of parameters affecting the improvement of safety and efficiency in the construction of unique high-rise buildings and structures, within the framework of scientific and technical support of construction.

RESEARCH OBJECTIVE

1. Study of documentation regulating scientific and technical support;
2. Studying the experience of conducting scientific and technical support during the construction of unique high-rise buildings in the city of Moscow;
3. Determination of general parameters for objects of unique construction;
4. Develop a universal parametric model to assess the effectiveness and feasibility of using parameters for unique high-rise buildings and structures within the framework of scientific and technical support for construction;
5. Approbation of the developed parametric model at a unique construction site;
6. Obtaining the results of the study.

The principle of determining parameters and developing an algorithm:

1. Analysis of the implemented NTSS at the objects of unique high-rise construction;
2. Determination of the general parameters of maintaining scientific and technical standards for the objects of unique high-rise construction;
3. Compilation of a list of general parameters and criteria for unique high-rise construction objects;
4. Assignment of weights to criteria based on the analysis of objects and regulatory documents;
5. Development of an algorithm for calculations;
6. Calculation of the effectiveness of the application of organizational and technological measures.

To implement the set task, a parametric model has been developed within the framework of the study, with the use of which it will be possible to form a program of measures carried out with scientific and technical support for the construction of the NTSS for each specific object, as well as to increase the efficiency of construction production by preventing unaccounted indicators during design.

The uniqueness of this model lies in the fact that it adapts to the conditions of any highrise building object. As a result, it will be possible to simulate a set of measures for the implementation of NTSS for each unique object.

Since during the construction of a high-rise unique building, it is necessary to apply NTSS, the question arises of the use of various methods and methods at each object.

Unique high-rise buildings and structures considered in the framework of the NTSS are unique, therefore, each one needs to apply its own parameters that are relevant specifically for a particular object.

For example, we can say that any parameter associated with monitoring the foundations will be different for each object, since the soil conditions for each building under construction are different.

To create a model, a number of parameters were selected that are most necessary for inclusion in the regulations on STSS when erecting unique high-rise buildings, and each parameter has its own criterion, which changes depending on changes in the characteristics of the construction object. All parameters are either related to the actual data on the construction object, such as: air temperature, soil conditions, material of supporting structures, etc., or depend and are regulated by the regulatory documents of the Russian Federation. In this case, it is possible to avoid subjective opinion, which takes place when using the method of expert assessments. Also, avoiding the method of expert assessments allows you to reduce the time for the study itself, obtaining a result and making a forecast.

As part of the study, the most important and necessary parameters were identified to ensure full control over the construction of unique high-rise buildings, as well as to increase the efficiency and reduce the project implementation time. These parameters were selected by analyzing scientific and technical support, already implemented projects of unique highrise construction, as well as on the basis of existing regulations governing construction in the Russian Federation. The list of analyzed objects is presented in Appendix A. Based on this analysis, the most vulnerable spots in the construction of unique high-rise objects were identified, leading to a decrease in safety and efficiency.

Each parameter has its own criterion, which is divided into several sampling options depending on the physical, geological and time conditions in which the building is being erected.

The main parameters and criteria of the NTSS are:

1. **Geophysical monitoring of soil mass beyond the contour of retaining walls.**

When performing work of the zero cycle under difficult soil conditions, it is necessary to monitor the state of soil masses, since when changing or occurring the movement of soil particles, a shift of retaining walls not fixed in time can occur. As a result of the beginning of soil movement, the

stability of the retaining wall decreases, it loses its design position and gives a roll. In this case, the collapse of the retaining wall is not excluded, as well as the ingress of groundwater through the formed cracks.
Criterion: category of complexity of engineering and geological conditions, according to SP 22.13330.2016 Foundations of buildings and structures.

2. Hydrological monitoring of soil masses near the pit.

Since the construction of high-rise buildings is associated with the large and weight of building structures, underground water located near the construction site, under the influence of exerted pressure on the ground, can change their characteristics. When monitoring the movement of groundwater, it is possible to track and in time to predict a change in the direction and occurrence of groundwater and take measures. With uncontrolled movement of water, under the influence of pressure from building structures, ground water can flood the pit.

Criteria: Gradation of soil conditions by the nature of anthropogenic impact.

3. Set of concrete strength

The most responsible work in the construction of a high-rise building is the laying of concrete in the foundation structure, since the foundation is the responsible supporting structure of the future building. Concrete is laid non-stop in order to avoid the formation of cold concrete joints and thereby weaken the structure. Since the process of curing with concrete is associated with the hydration reaction, and heat is generated during the hydration of concrete, a large amount of heat will be released when pouring and curing with concrete at large volumes, and as a result, a large temperature gradient with the surface of the structure. This situation will lead to the formation of cracks and chips in the structure.
Criteria: concrete curing period.

4. Diagnostics of the technical condition of machines and mechanisms at the construction site.

To achieve high adaptability in the work on the construction site, a large number of construction equipment are used. The most important are hoisting gears. In the construction of buildings with a height of more than one hundred meters, special and sometimes unique lifting mechanisms are used. To ensure smooth operation, as well as timely preparation for the replacement of equipment used, it is necessary to monitor the technical condition of each machine and mechanism.
Criteria: technical condition of machines and mechanisms for the entire period of operation.

5. The height of the building.

To reduce the time of work while increasing the height of the job, high-tech tooling is used, such as self-moving formwork, protective screens and technological scaffolding. With the

increase in the level of the installation horizon to increase the pace of construction, as well as the quality of work, it becomes necessary to provide for the use of the necessary additional equipment.
Criterion: elevation of the installation horizon.

6. Conclusion of an agreement on project support with expertise.

Unique buildings go through a long process of agreeing on all applicable design solutions, since the legislation of the Russian Federation does not regulate the development of unique buildings in detail, in the vast majority of all projects there is a need to develop special technical conditions for a unique high-rise building being built. In this case, the development and passage of expertise is sometimes delayed for a long time. Since during the construction process it may be necessary to amend the design documentation, and this entails a repeated examination, which means an adjustment of the building permit, the construction period may be delayed, and therefore the costs of the project will increase.

7. Systematization of executive documentation

When performing work in accordance with the Urban Planning Code of the Russian Federation, an organization performing construction and installation works must maintain a set of executive documentation and submit for examination to the supervisor assigned to the facility. In the case of unique high-rise buildings, the number of production processes required for survey reaches a significant amount. Systematization of the process of examination and storage of executive documentation will make it possible to reduce the time required for verification of executive documentation by construction control and o ther bodies responsible for maintaining quality and safety during work.
Criterion: completeness of executive documentation.

8. The introduction of information modeling in the production of work

Currently, when designing unique buildings, there is a process of transition from twodimensional design systems to information design standards. Since the development of unique projects is increasingly carried out using information models, it becomes necessary to implement BIM standards directly on the construction site at key stages of the work. These stages include: work below the zero cycle, construction of the aerial parts, special work.
Criterion: the presence of a project developed using an information model.

9. Implementation of access control systems (access control and management system)

The construction of unique high-rise buildings is associated with the daily presence of a huge number of workers and materials at the facility. To control and systematize information on the daily movement of workers, it is ne cessary to apply a system of control and management of access to the construction site. It is especially important to apply this system at the stage of the highest workload of the construction site, namely when performing work below zero, during the construction of the aboveground part of the building, during special works, as well as during finishing work.

Criterion: period of construction.

RESULTS

As a result of the calculation, on the basis of the sampling, an actual percentage of efficiency equal to fifty was obtained. The obtained actual percentage of efficiency is greater than the indicator of the norm of efficiency, and therefore, we can conclude that the activities that will be carried out as part of the scientific and technical support during the construction process will be effective and appropriate.The result of the work was the developed parametric model for assessing the effectiveness of the application of the system of scientific and technical support for the construction of unique high-rise buildings.

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