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МЕТРОЛОГІЯ ТА ІНФОРМАЦІЙНО-ВИМІРЮВАЛЬНА ТЕХНІКА

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DETERMINATION AND DIAGNOSIS OF CONSTRUCTION MATERIAL QUALITY CONTROL PROBLEMS

The presented article discusses the problems of quality control of construction materials. As we know, the quality of construction materials is one of the most pressing issues at the moment. Quality control means checking whether the quality indicators of goods meet the requirements of the adopted technical normative documents (standards, specifications, etc.). Quality control – set of quality indicators of the material is to check compliance with the requirements. This article also studies analysis of recent research and publications, the effectiveness of quality control methods and structure of functional diagnostics of quality control system. One of the most important areas of quality control is the diagnosis of control problems. Diagnostics – the identification and study of features that characterize the condition of building, structures of buildings and structures in order to identify possible deviations and prevent violations of the normal mode of operation. There are two main types of diagnostics, functional and systematic diagnostics. The main directions of functional diagnostic are described in tabular form. The structure of concrete is also considered here. Execution of concrete structures is a complex process that includes various activities. The basic principle of the development and the application of quality control system during the execution of concrete structures is the process approach. Defining the processes, identification and interaction of sub-processes are performed with the objective of quality monitoring and control that are required in order to achieve concrete structures' specifications. Quality control system in the area of execution of concrete structures must also comply with national acts, rules, regulations and standards that are essential for concrete structures design, execution and concrete production. The analysis of specific compositions is presented in terms of diagnosing that structure.
Keywords: *quality control, functional diagnostics, systematic diagnostics, quality control assessment methods, construction materials, concrete structure.*

Аллахвердиєва Нурана Махяддин кизи. Визначення та діагностика проблем контролю якості будівельних матеріалів. *У представленій статті розглядаються проблеми контролю якості будівельних матеріалів. Як відомо, якість будівельних матеріалів на даний момент є однією з найактуальніших проблем. Під контролем якості розуміється перевірка відповідності показників якості товару вимогам прийнятих технічних нормативних документів (стандартів, технічних умов і ін.). Контроль якості – набір показників якості матеріалу для перевірки відповідності вимогам. У статті також проведений аналіз останніх досліджень і публікацій, проаналізована ефективність методів контролю якості та структура функціональної діагностики системи контролю якості. Одним з найбільш важливих напрямків контролю якості є діагностика проблем контролю. Діагностика – виявлення і вивчення ознак, що характеризують стан будівлі, конструкцій будівель і споруд з метою виявлення можливих відхилень і запобігання порушень нормального режиму експлуатації. Існує два основних типи діагностики: функціональна і систематич-*

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на. Основні напрямки функціональної діагностики описані в табличній формі. Тут також розглядається структура бетону. Виконання бетонних конструкцій – це складний процес, що включає в себе різні види діяльності. Основним принципом розробки і застосування системи контролю якості при виконанні бетонних конструкцій є процесний підхід. Визначення процесів, ідентифікація і взаємодія підпроцесів виконуються з метою моніторингу і контролю якості, які необхідні для досягнення технічних характеристик конкретних конструкцій. Система контролю якості в галузі виробництва бетонних конструкцій також повинна відповідати національним законам, правилам, постановам і стандартам, які необхідні для проектування, виконання та виробництва бетонних конструкцій. Аналіз конкретних композицій представлений з точки зору діагностики цієї структури.
Ключові слова: *контроль якості, функціональна діагностика, систематична діагностика, методи оцінки контролю якості, будівельні матеріали, бетонна конструкція.*

Description of the problem. The problem of quality is especially relevant in the stages of development of the country's economy and especially in the construction industry [1]. The quality of construction products being a very large and complex concept depends on many factors such as the quality of the resources used, following the production technology, qualification of workers, etc. Product quality control means the determination of quality indicators, preparation, production and operation of the product through systematic control and purposeful influence on the factors affecting its quality [2]. According to ISO 9000:2015, quality is defined as «the degree to which internal characteristics meet a number of requirements» [3]. The quality of construction materials and products, the development of norms and standards, the design of the construction site, the construction and installation work, the preparation of construction materials, parts and structures are formed [4]. During the research, the requirements for high quality of construction materials and products in building complexes have been shown. Attention has been paid to the number of defects affecting the structural safety of the building and structures under construction. Poor quality of construction products is one of the main problems in the construction industry. There are several reasons for this situation in the construction market [5]. The effectiveness of quality control is ensured by the timely impact on the controlled entity in order to obtain the required results. The impact is due to the functional freedom of the control structure of the enterprise and the activity of the external environment and the interaction of information between the organization. Since quality control applies to all subsystems, it seeks to ensure that these systems are quality-oriented. The dynamics of economic development remains a key factor in ensuring the continuous improvement of production processes. In the mid-1960s, Japanese scientists systematizing number of quality management means have chosen, seven methods from them and called them «seven Japanese methods of quality control analysis of the production process» [6]. By means of these seven methods, applying mathematical statistics, a quantitative criterion of quality that can be achieved by the participants of the production process of all production cycles of the product has been analyzed.

The control process reflects the purpose of detecting certain data, deviations from the given parameters, the causes of these deviations and the analysis of their compliance with the new requirements after their elimination [7].

Analysis of recent research and publications. One of the most important areas of quality control is the diagnosis of control problems, i.e. the identification, recognition, evaluation and recording of existing problems of the quality control system. Diagnostics identifies existing faults in the control system and, as a result, allows make the most appropriate control decisions. In the diagnostic process, first of all, it is necessary to study the condition of the main control subsystems, data support, document flow, workflow, interaction and order to eliminate the identified violations. There are two main types of diagnostics in relevant sources:

• Functional diagnostics is used when there are obvious deficiencies in specialized functions, and some of them involve diagnostics.

• Systematic diagnostics involves continuous research of the technical and economic condition of the enterprise [8].

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The main directions of functional diagnostics are as follows:
• production diagnostics;
• environmental diagnostics;
• diagnosis of financial functions;
• personnel diagnostics;
• innovation diagnostics;
• diagnostics of security functions [9].

The structure of functional diagnostics of quality control is presented in the following figure, its main components are described. All segments of diagnostics are interconnected. Each stage is a reporting point for the next stage. Thus, functional diagnostics is the study of the transition from one segment to another, which ensures the maximum detection of possible problems.

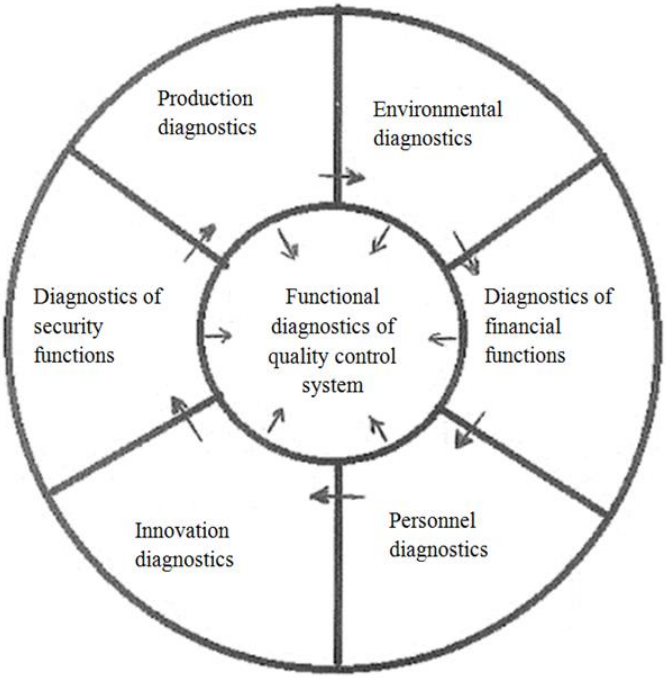

Figure – Structure of functional diagnostics of quality control system

Purpose of the article is identifying and analyzes the main problems of quality control, the quality of construction materials, the structure of the diagnostics of the quality management system have been offered, its main aspects have been considered.

Presentation of the main material. Unlike other areas, the construction sector has some differences, especially in the provision of resources. Security in construction is related to a particular object, its quality and nomenclature. In addition, many of the resources provided for in the projects are used as stockpiles as they enter the construction site. In general, the goal of quality control is the efficient use of material and technical resources and the implementation of strategic management decisions.

In this paper, the structure of concrete is reviewed, and the analysis of concrete components is presented from the viewpoint of diagnosing that structure. The diagnosis of a complex concrete structure entails the identification of concrete components – such as aggregate, paste, pores, etc. – and the estimation of concrete quality, existing damage, and possible causes of failures. The most effective methods for concrete diagnosis, such as microscopic image analysis, are briefly described. The importance of quantitative results of material analysis and image processing is highlighted. Let’s discuss some quality control elements through concrete materials. For instance, aggregate is the most voluminous component of concrete, however, depending on the desired concrete properties, the mass of aggregate in concrete represents about 3.5 to 7.5 times the amount of cement used to bind it into a solid concrete composite. The quality of the aggregate and its chemical and mineralogical nature depend on its prior exposure to the environment and that during processing. These factors determine the micro-

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structure of the aggregate [10]. Beside of aggregates, the water-to-cementitious-material or binder influences considerably the concrete strength, especially the total porosity of the concrete. It is assumed that approximately every additional percentage of pores corresponds to a 5 MPa decrease in the compressive strength [11]. Diagnosis of above parameters helps in the estimation of the concrete damage level and the prediction of the concrete's remaining service life.

In the diagnostic process, it is necessary to draw conclusions about the quality of performance of the function of providing resources for construction. These include the quality and uninterrupted supply of imported resources, the formation of volumetric reserves for the continuation of work, the provision of warehouse operations in accordance with all standards.

Human resources as the most important factor of production, reflect the resources of socio-economic development of the organization. All these parameters have a direct impact on the quality of construction work.

The following can be noted as diagnostic indicators of quality control in the context of personnel management:

- employee turnover ratio;
- average salary of an employee;
- average rank (category) of the employee;
- the share of consumption per employee for the repair of waste products;
- cost of professional development (education) per employee.

Systematic diagnostics of the enterprise, in its turn, allows to identify problem areas of quality control from the point of view of the team and employees, which is important for concentrations to ensure consistency in the priority of the problems, actions that will require linking financial investments, as well as finding solutions and efforts.

The diagnostic process should generally take into account the impact of external and internal environmental factors on quality. External factors, are competitors, pricing policy, demand, the state of the regional economy, etc. but internal factors, are resource supply, equipment quality, human resource professionalism, etc. Management of these factors within the organizational structure of the enterprise and within the boundaries of the quality control system is a key issue. By identifying the status of the identified factors in a timely manner and directing the work to the right source, it is possible to eliminate its negative effects and of course, its consequences.

In the field of quality control of construction materials, the following factors can be attributed to:

- level of human resources;
- level of organization of construction production in the field and technical-organizational training of construction production as a whole;
- quality of design estimates and progressive design decisions;
- quality of resources used - materials, structures and details;
- level of industrialization of construction;
- quality control system within the company;
- compliance of production technology and construction conditions.

Conclusions:

As a result, it is almost certainly that diagnostics of construction production and quality control of construction materials, is a tool that, provides the followings, if it is available and necessary:

- clarification of the main results of activities in the field of quality control of construction products;
- determination of the availability of advanced production technologies, the results of research and studies (patented inventions, industrial designs, etc.), the application of these studies and the organization of construction production;
- defining the goals and objectives of quality control management;
- in general, ensuring the efficient use of materials and human resources that ensure the quality characteristics of construction products;
- diagnosis of qualitative parameters is the most important issue in achieving its desired strength and durability of materials and it is tailored also in the estimation of the damage level and the prediction of the material's remaining service life.

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