

BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES**INNOVATIVE ANCHOR FASTENING TECHNOLOGIES USING
PHOTOPOLYMER MATERIALS****S. V. Artyshchenko, D. V. Panfilov, A. G. Tchigarev, I. S. Dmitriev**

Annotation. The article considers current issues related to the field of anchor fastenings. We give some examples of innovative methods for modeling the behavior of such fastenings. In the paper we discuss the problem of polymerization of chemical anchors in various climatic conditions and temperature ranges. As a result we propose a comprehensive solution including the use of photopolymer materials. We also give calculated dependences of the polymerization rate on the types of emitters. It is shown that our method of fastening chemical anchors is capable of significantly expanding the temperature range of their application.

Keywords: chemical anchor; photopolymerization; photopolymer materials; radiation intensity; reaction rate.

**CONSIDERATION OF MATERIALS DEGRADATION DURING
VERIFICATION CALCULATIONS OF BUILDING STRUCTURES****G. D. Shmelev, A. N. Ishkov, M. S. Kononova**

Annotation. In the article we give the rationale for the need to take into account the process of degradation of materials and building structures when conducting surveys and performing verification calculations. We analyze the most important factors influencing the degradation process: operating loads, natural and climatic conditions, as well as aggressive environments. It is shown that calculations based on limiting conditions performed according to current regulatory methods do not directly take into account the development of degradation processes. Climatic influences that begin from the moment the structure is created and continue throughout the entire stage of its operation affect changes in the properties of materials, but current regulations do not take these changes into account in calculations. It is proved that various mathematical models, including multi-stage models, can be used to describe the degradation of materials. We propose the simplest mathematical models of degradation applicable in survey conditions. These models may help in practice to predict the current technical condition of structures and to prevent structural accidents.

Keywords: verification calculations; building structures; degradation; building materials; mathematical models; multi-stage models.

ASSESSMENT OF THE IMPACT OF FOUNDATION OPERABILITY ON THE RELIABILITY OF BUILDING STRUCTURES

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Annotation. In the article we substantiate the relevance of the assessment of technical condition of buildings in the old building stock. We assessed the performance of foundations, identifying the impact of their state on the reliability of building structures. We carried out a full-scale experiment of the technical state of the foundations using the example of a multifunctional administrative complex in the city of Moscow, built in 1930. The objectives of the study are to determine the strength characteristics of the foundations, to study the soils of the foundations, to identify defects and damage to the foundations, to determine the category of the technical state of the foundations. We as well describe the revealed defects and damages of bases and foundations. We present the results of instrumental studies of foundations (GPR inspection) and pile foundations (ultrasound examination). We also present the results of constructing a geolocation profile for the research facility on the basis of the example of a civil defense structure. We collected the geo-radar data and created a map of probable soil decompression and determined the parameters for ensuring the serviceability of foundations and, as a result, the reliability of building structures. Finally we give some recommendations for the elimination of identified defects and damages.

Keywords: technical supervision; foundations of buildings; pile foundations; structural defects; GPR inspection; ultrasound examination; technical state of structures.

ENGINEERING SYSTEMS AND SERVICES

INCREASING OF THE PRODUCTIVITY OF THE TECHNOLOGICAL SECTION IN THE MAIN OIL PIPELINE

A. A. Kuzmina, D. S. Burlutsky, N. V. Kolosova

Annotation. The article considers options for increasing the throughput capacity, methods of their implementation, applicability to specific cases, advantages and disadvantages. During long-term operation of the pipeline, under the influence of operational factors, the pipe material gradually deteriorates. The article considers the features of the most common methods for increasing the throughput capacity of the oil pipeline: construction of additional oil pumping stations (OPS); changing the capacity of the equipment inside the OPS, replacing the pump impellers; increasing the working pressure; construction of a new parallel line of the oil pipeline; construction of inserts and loops of various diameters; use of antiturbulent additives; cleaning the pipeline from asphalt, resin and paraffin deposits. To select

the most correct and profitable option for increasing the throughput, it is necessary to identify the features of each method and compare the pros and cons of all options.

Keywords: oil pipeline; looping; hydraulic losses; pumping station; anti-turbulence additive; pipeline insert.

IMPROVING THE PROCESS OF AUTOMATED MONITORING OF MAIN PIPELINE SYSTEMS

G. S. Serikov, I. A. Serikova

Annotation. The article considers the technological problems of heat and gas supply related to the need for constant monitoring of main pipeline transport systems using mobile modules. Automation of the process of charging traction batteries of autonomous mobile modules for diagnosing the state of various objects using contactless energy transfer technology can significantly increase the functionality and flexibility of using remote sensing systems in the construction of closed heat and gas supply ecosystems. When using an automated system for contactless charging of traction batteries, it becomes possible to build the most functional complex for automatic maintenance of main pipeline systems. Various methods are presented to improve the accuracy of the mutual positioning of the receiving and transmitting inductors. The object of the study is a station for monitoring the condition of main pipeline heat and gas supply systems. The subject of the study is modeling and statistical analysis of the operation of the energy supply system of autonomous mobile modules. The goal of the work is to increase the efficiency and safety of monitoring of main pipeline systems. The developed proposals are aimed at improving the quality and safety of automated monitoring of main pipelines.

Keywords: main pipeline; monitoring; mobile module; contactless charging; automation; electric drive.

METHODS OF CALCULATION AND CONTROL OF RELIABILITY INDICATORS IN MAIN PIPELINES

A. S. Salieva, E. S. Aralov, K. V. Garmonov

Annotation. In the article we consider the methods of calculation and control of reliability of main pipelines taking into account modern approaches to technical condition management. We analyze the key factors influencing the reliability of pipeline systems, including corrosion processes, mechanical damage and probabilistic failures. We present the models of technical condition forecasting, residual resource calculation and failure probability assessment based on normal distribution. The paper describes as well the calculation dependencies for determining the cor-

rosion rate, residual pipeline wall thickness, strength and failure probability. Particular attention is paid to the use of digital twins in pipeline system reliability management. We show their structure, functions and capabilities, including condition monitoring, wear prediction, maintenance optimization and emergency simulation. We also consider examples of the implementation of digital twins in the world's leading oil and gas companies. The results of the study confirm that an integrated approach based on mathematical modeling, digital technologies and probabilistic failure analysis allows minimizing the risk of accidents, increasing operational safety and extending the service life of main pipelines.

Keywords: reliability; main pipeline; management model; digital twin; failure.

JUSTIFICATION OF THE NEED FOR CALCULATION OF AIR DISTRIBUTORS BASED ON AIR FLOW MODELING

D. V. Lobanov, I. I. Zvenigorodsky, S. A. Safonov, S. A. Solovyov

Annotation. In the article we analyzed incorrect selection of air distribution devices using the example of a project of a ventilation system for medical premises. Modeling of air distribution systems in a doctor's office is performed when installing a mixing ventilation. We present the results of the formation of jet flows in the room by various air distributors depending on the movement pattern, air flow range and final standardized mobility. We as well perform the analysis of the presented results of calculation and selection of air distribution devices. Finally, we describe the main recommendations for choosing an air movement installation pattern, location and size of air supply devices.

Keywords: air distributor; ventilation systems; air streams; air mobility; calculated air exchange.

HYDRODYNAMIC MODELING OF THE VERTICAL PIPELINE FLUSHING PROCESS

B. M. Kumitsky, E. V. Plaksina, A. I. Kalinina

Annotation. The article presents the results of a study of flushing vertical pipes used for domestic and drinking purposes (water supply and sanitation), in heating systems, transportation of petroleum products, etc. The solution to the problem under consideration is based on a hydrodynamic model of axisymmetric flow of Newtonian fluid from a vertical pipeline through a round bottom opening of adjustable cross-section. In this case, it is assumed that the pipe under study is completely filled with a viscous liquid, which is a continuous medium with a certain center of mass, the position of which changes during the axisymmetric out-

flow. Incompressibility of the simulated medium with a laminar flow regime without the formation of a funnel (a flat free surface) is also allowed, and the liquid during the flushing process rheologically behaves like a solid body. The analytical expressions obtained on the basis of such assumptions indicate the relationship between the speed of movement, the center of mass of the flushing liquid and its height in the pipe relative to the adjustable drain opening. In addition, we describe the dependence of the geometric parameters of the discharge opening cross-section on the height of the liquid column of varying viscosity. This makes it possible to control the flushing process of vertical pipelines.

Keywords: viscosity; center of mass; adjustable drain.

INFLUENCE OF UNDERGROUND WATER COMPOSITION ON FILTERS OF WATER INTAKE WELLS

I. Yu. Purusova

Annotation. The article provides a description of negative chemical processes caused by aggressive and corrosive properties of underground waters extracted in the Voronezh Region. It also provides a description of the process of formation of a fouling layer on water intake wells, caused by the presence of divalent iron and manganese in the water, which creates favorable conditions for the development of sulfate-reducing bacteria. The article presents the results of the assessment of groundwater at water-lifting stations obtained over a ten-year period at operating water-lifting stations using the Riesner index and the concentration of hydrogen ions in water pH. The article presents the summary results of the influence of the chemical composition of groundwater on the efficiency of the well filter at operating water-lifting stations with division by the type of groundwater. I as well give some recommendations for preventing a decrease in the flow rate of water intake wells at operating water-lifting stations.

Keywords: underground water; filters of water intake wells; Riesner index.

URBAN PLANNING. RECONSTRUCTION, RESTORATION AND LANDSCAPING

RELEVANCE OF CREATING MULTIFUNCTIONAL ROAD SERVICE ZONES IN VOLGOGRAD REGION

N. V. Korosteleva, D. V. Polonskiy

Annotation. The uneven formation and arrangement of transport infrastructure in various regions of the Russian Federation slows down the development of the country's economic space. The transport system of the Volgograd region, due

to its favorable geographical position and tourist potential, is an important element of the transport infrastructure of the entire state. As a priority area for improving the condition and increasing the competitiveness of the transport infrastructure of the Russian Federation, in our article we highlight the problems of organizing roadside service. The article considers the prerequisites for the need to improve the condition and increase the competitiveness of the transport infrastructure of the Volgograd region by solving problems in the organization of roadside infrastructure. As an important element to improve the quality of roadside service, we propose to create multifunctional road service zones. Based on the analysis of world experience, we prove the importance of introducing multifunctional road service zones into the transport infrastructure of the region. We also assessed the current state of the roadside infrastructure of the region, identified the main shortcomings and weaknesses and offered recommendations for improving the situation. These proposals will increase the competitiveness of the transport infrastructure of the Volgograd region and contribute to the development of the economic space of the Russian Federation.

Keywords: transport system; roadside infrastructure; roadside service; multifunctional road service areas.

ECOLOGY AND SAFETY OF THE URBAN ENVIRONMENT

DETERMINATION OF STANDARDS FOR THE ACCUMULATION OF MUNICIPAL SOLID WASTE FROM PUBLIC FACILITIES ON THE EXAMPLE OF THE PERM REGION

T. G. Sereda, S. N. Kostarev

Annotation. We conducted a series of studies of waste streams to determine the standards for the formation of municipal solid waste. We used the example of two settlements: over 500 thousand and less than 300 thousand people in the Perm Region back in 2020. We studied 18 categories of public facilities. We determined the average annual volume and mass indicators of municipal solid waste (MSW) flows. We also carried out a comparative analysis of the calculation units by categories of public facilities in comparison with the current regional regulations; we as well compared measured MSW flows with existing standards. The results obtained in the work can be useful for conducting a general analysis of the dynamics of MSW formation in the context of a pandemic and self-isolation of the population.

Keywords: municipal solid waste; waste accumulation standards; categories of public facilities.

MONITORING OF ACOUSTIC EFFECTS FROM TRANSPORT USING CIVILIAN UAVs

D. A. Sokolov, E. I. Golovina, T. V. Ashikhmina

Annotation. In recent years, the use of unmanned aerial vehicles (UAVs) has become a popular means of observing territories. The paper explores the possibility of using UAVs to monitor noise and vibration in railway transport. To achieve this goal, we considered the scheme of such a device, and developed its route for monitoring a certain area. We as well proposed a method for conducting acoustic and vibration monitoring using UAVs, which allows for accurate measurements from a flight altitude. Also, we give a description of the measurement methodology, the results of which present an accurate sound picture of pollution from moving traffic in the studied area. We concluded that there is a need to use UAVs to monitor noise and build acoustic maps when it comes to transport use.

Keywords: unmanned aerial vehicle; noise monitoring; acoustic map; sound pollution.

ECONOMICS AND ORGANIZATION OF CONSTRUCTION

CONCEPT OF LEAN MANUFACTURING AND MANAGEMENT, ANALYSIS OF ITS IMPLEMENTATION

S. V. Artyschenko, A. I. Kolosov, I. V. Belenko, K. E. Fefelova

Annotation. Modern methods of decision making, management and manufacturing are becoming increasingly relevant in a highly competitive environment. The market is changing rapidly, consumer demands are increasing, companies are forced to adapt and introduce innovative approaches to management and manufacturing. Lean manufacturing and management concepts, along with innovative approaches, emphasize process optimization and efficiency improvement. This article examines the basic principles of lean manufacturing, its connection with the Toyota Production System (TPS), as well as other modern techniques that help companies make the most informed and effective management decisions. The article may be useful to managers, researchers and students interested in modern methodologies in manufacturing and management, as well as the implementation of lean concepts in various industries.

Keywords: lean manufacturing; production management; production system.