BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES

CONSIDERATION OF TECHNICAL, SOCIAL AND INDIVIDUAL ACCIDENT RISKS IN DETERMINING THE MECHANICAL SAFETY OF STRUCTURAL UNITS

G. D. Shmelev, D. A. Drapalyuk, I. V. Popova

Annotation. The article considers the author's approach to determining the mechanical safety of structural units, buildings and structures, taking into account several factors. The first is a change in the probability of failure of the main load-bearing structural units that make up the supporting skeleton of the building (foundations, walls, floors, roof), the failure of which can lead to emergency situations or collapse of part of the building or the entire building (structure) during prolonged operation. The second factor is an increase in the indicators of the risk of an accident of structural units over time to the values of unacceptable technical risk of an accident. The third factor is the appearance of an additional social risk from people being in the building if there are structural units that are on the verge of reaching an unacceptable technical risk of an accident. We propose an approach to assess the levels of social and individual risk for people located at a facility where an emergency situation may occur due to the collapse of structural units. We consider an approach to replacing the exponential model for predicting the probability of failure (accident). The structural unit is based on a linear model. It is proved that in the considered range of failure probabilities between the values of acceptable and unacceptable accident risks, linear and exponential models give almost identical results, differing in the eighth decimal place. To predict social and individual risks in the case of an accident related to the collapse of structural units, we propose linear models that are linked to a nonlinear model of the technical accident risk in structural units.

Keywords: structural units; buildings and structures; technical risk; social risk; individual risk; mechanical safety.

ENGINEERING SYSTEMS AND SERVICES

ANALYSIS OF HEAT AND ENERGY EFFICIENCY OF VARIOUS FORMS OF HEAT EXCHANGER PLATES

A. S. Kapystina, N. V. Kolosova

Annotation. In order to increase heat transfer in the design of heat exchanger plates, it is necessary to have elements of a corrugated surface that cause velocity pulsation in the inter-plate channel, violation of the boundary layer and its intensive mixing, which leads to an increase in hydraulic resistance. To reduce

these values and increase the efficiency of heat transfer, it is necessary to structurally improve the conditions of movement of working fluid. We have analyzed widely used designs of heat transfer plates in order to identify the most optimally operating model with a high heat transfer coefficient. Here we present the results of calculations of the main thermal energy and hydraulic parameters for seven heat exchange plate designs of varying shapes. We also provide graphical dependencies illustrating the calculation results.

Keywords: intensification of heat transfer; plates of the heat exchanger; mode of movement of the working fluid; thermophysical parameters of the liquid.

APPLICATION OF PASSIVE ACOUSTIC EMISSION METHODS TO DETECT PRE-EMERGENCY CONDITIONS IN CENTRAL HEATING SYSTEMS

E. S. Aralov, N. Ja. Marchukov, A. A. Mikhailov

Annotation. In this work we develop a theoretical model of the application of the passive acoustic emission method for detecting hidden leaks in central heating systems. The main focus is on analyzing the physical processes of acoustic signal generation during the flow of heat transfer fluid through microcracks, including jet turbulence, cavitation, and impact interaction. The model takes into account key parameters of heating systems, such as working pressure, pipe diameter, and the properties of heterogeneous signal propagation media. The mathematical modeling includes calculations of heat transfer fluid flow rate, vortex formation frequency, signal attenuation in building structures, and acoustic emission energy. Based on the analysis of the obtained dependencies, we determined the optimal frequency range of 30…80 kHz, which provides a compromise between noise immunity and signal attenuation. It was found that the method allows for the detection of defects as small as 0,2 mm with an accuracy of 10…15 cm. A comparative analysis with traditional diagnostic methods (thermal imaging control, moisture measurement, acoustic stethoscope) confirmed the advantages of the acoustic emission method in terms of localization accuracy, depth of control, and the possibility of early detection of defects. The results of the study can be used to create systems for diagnosing hidden leaks in residential buildings' central heating systems, which will allow for a shift from responding to accidents to predicting and preventing damage.

Keywords: acoustic emission; non-destructive testing; pipeline diagnostics; defect localization; frequency range; microcracks.

ANALYSIS OF THE RELIABILITY AND ENERGY EFFICIENCY OF HEATING SYSTEMS ON THE EXAMPLE OF HEATING NETWORKS IN BIYSK-CITY FOR THE 2024–2025 HEATING SEASON

A. V. Rukoleev

Annotation. The article presents a comprehensive study of the technical condition and operational characteristics of the centralized heating system in the city of Biysk-city based on the results of the 2024…2025 heating season. The study is based on an analysis of the parameters of the heat carrier, the amount of heat loss, the dynamics of accidents, the degree of physical deterioration of the pipelines, and the effectiveness of the repair and modernization measures implemented. The study shows that the harsh continental climate and high degree of deterioration of the engineering infrastructure create significant challenges for the heating network, with 312 reported damage cases and heat loss reaching 9…10 %. Despite compliance with temperature schedules, there has been an increase in the supply temperature and flow rate of the heat carrier during the coldest months, indicating possible hidden leaks and uneven distribution of heat flows. Special attention was paid to assessing the wear and tear of pipelines using an exponential aging model. It was found that the use of anti-corrosion technologies reduces the rate of metal degradation by more than two times and provides economic efficiency of up to 70…75 % compared to the complete replacement of pipes. I present the results of modeling repair work using the critical path method, which made it possible to optimize the duration of the heating campaign and identify critical operations. The results of this study can be used in the development of programs for the modernization of heating networks, improving the reliability of heat supply, improving tariff policies, and formulating strategies for the energy-efficient development of municipal infrastructure.

Keywords: heat supply; operation; accidents; tariff; wear and tear; anti-corrosion protection; network planning.

NUMERICAL AND ANALYTICAL STUDIES OF THE STRENGTH CHARACTERISTICS OF THE EXPLOSION-PROOF VALVE ELEMENTS OF VENTILATION SYSTEMS

S. A. Yaremenko, O. I. Gaidash, R. V. Garmonov, M. N. Zherlykina

Annotation. The article presents a description of the purpose of explosion-proof valves in ventilation systems. It focuses on the strength characteristics of the valve design and their impact on the reliability and durability of ventilation systems in energy- and resource-supplying facilities in the housing and communal services sector. It was revealed that the main elements of the ventilation duct closure device that bear the maximum load during its activation are the horizontal

pipes. The article presents a 3-D problem of determining the maximum pressure at acceptable values of the residual deformation of the valve pipe, which was solved using the ANSYS LS-DYNA numerical simulation software. We determined the values of the pressure at the inlet and outlet of the explosion-proof valve, at which the residual deformation does not exceed the specified values. As a result, it is established that under this load, the structure of the explosion-proof valve will retain its original geometry. We present the results of 3D modeling of the pipe loading and the calculation of the shock wave front pressure at different points in time. It was established that when an explosion-proof valve is installed, the maximum shock wave pressure is fixed when approaching the first sensor, and the peak pressure at the second sensor drops by more than 90 %. We also analyzed the case of an explosive fire incident and the absence of an explosion-proof valve in the ventilation system. As a result, the pressure drop in the pipe was no more than 10 %. So we confirmed the necessity of use of an explosion-proof valve to increase the system's reliability in the event of an explosive situation and prevent damage to the system components caused by the shock wave.

Keywords: ventilation; explosion-proof valve; safety; sensor; pipe; pressure.

REUSE OF WASH WATER AND SLUDGE TREATMENT AT THE IRON REMOVAL STATION

A. V. Bakhmetyev, V. Yu. Khuzin

Annotation. In the article we present the qualitative characteristics of groundwater, highlight one of the main challenges associated with its use which is elevated iron content. Standard iron removal procedures result in the formation of sludge, which worsens the environmental situation in the area where treatment facilities operate. This paper presents an analysis of options for iron removal plant sludge disposal and proposes the most effective method for natural disposal in areas without a stable frost or arid climate. We propose some design measures to improve iron removal plants, aimed at extending the service life of sludge dewatering facilities.

Keywords: iron removal; sand trap; sump; sludge tank; drainage; water outlet; sludge humidity; suspended solids concentration.

GROUNDS OF CONSTRUCTIVE SOLUTIONS FOR RESTORATION OF PERFORMANCE AT THE PRIMARY SEDIMENTATION TANK

K. I. Chizhik, I. Yu. Purusova

Annotation. In the article we analyzed damage to the radial primary sedimentation tank at sewage treatment plants, caused by long-term operation. The

overall dimensions, material of the supporting structures, and damage sustained during operation of the primary sedimentation tank were taken from technical reports. A visual inspection of the reinforced concrete structure of the primary sedimentation tank revealed damage and deformations affecting the tank's operational reliability. It was determined that the seal had to be restored, and some measures to extend the service life of the primary sedimentation tank were badly required. A procedure for concreting the inner bowl of the sedimentation tank was determined. In the article we present the results of modeling using the LIRA-ESCS software package, demonstrating the distribution of soil pressure on the outer wall of the sedimentation tank and the distribution of water pressure on the inner walls of the sedimentation tank.

Keywords: primary sedimentation tank; reconstruction; pressure on walls; concreting; reinforcement.

URBAN PLANNING. RECONSTRUCTION, RESTORATION AND LANDSCAPING

ANALYSIS OF GREEN ROOF SYSTEMS IN MODERN URBAN PLANNING: ASSESSMENT OF EFFICIENCY AND OPPORTUNITIES FOR USE IN VOLGOGRAD-CITY

N. V. Korosteleva, D. A. Izvekov

Annotation. The article is devoted to studying the potential of green roof systems as a tool for the ecological optimization of the urban environment in the specific climatic conditions of Volgograd-city. The relevance of the work is determined by the need to adapt urban infrastructure to extreme climate events and the deficit of green spaces in conditions of high residential density. We conducted a comparative analysis of the three main types of green roofs: intensive, extensive, and semi-intensive. We established their functional, operational, and economic characteristics, which determine the areas of rational application. We identified optimal application spheres for each type, considering structural loads and the required maintenance level. A special attention is paid to the adaptation potential of various phytocenoses to the complex climatic conditions of the Volgograd region, characterized by sharp temperature fluctuations, prolonged drought periods, and significant wind load. We considered additional benefits of the technologies, including increased biodiversity, noise absorption, and improved urban aesthetics. We developed practical recommendations for the implementation of green roof technologies in Volgograd-city. As a result we propose an assortment of plant species and engineering-structural solutions ensuring the durability and stability of green roofs in the region's conditions.

Keywords: green roofs; urban environment; ecological infrastructure; exploited roofs; energy saving.

THE INFLUENCE OF MONUMENTAL ART ON THE FORMATION OF COLORISTICS, FIGURATIVE EXPRESSIVENESS AND IDENTITY OF THE URBAN ENVIRONMENT

I. A. Mironova

Annotation. The article examines the synthesis of monumental art and architecture through the prism of the transformation of urban space, its colour environment, image-bearing expressiveness and identity. First, I consider the main reasons for the destruction of the image-bearing expressiveness of Russian historical cities and the blurring of their recognizable, characteristic features. The metamorphoses of the colour environment are analysed as one of the basic characteristics of the image-bearing expressiveness of the city. I as well investigatee ehe role of monumental art in shaping the identity of the city. I also consider examples of modern coloristic transformations of urban space in the context of the formation of its image-bearing characteristics and identity. Conclusions are drawn about the direct influence of monumental painting on the colour environment of the city, its image-bearing expressiveness and identity. There are two opposite marginal states in which monumental painting either participates in the creation of a unique colour environment, cultural identity and image-bearing characteristics, or destroys them. The emphasis is placed on the need to make adjustments to the regulatory framework in the field of architectural and urban planning and regulation, as well as on the need for further scientific and theoretical understanding of the formation of image-bearing expressiveness and identity of urban space in modern conditions from the perspective of its coloristic transformations.

Keywords: monumental art; coloristic transformations; image-bearing expressiveness; identity of the urban environment.

ECOLOGY AND SAFETY OF THE URBAN ENVIRONMENT

ASSESSMENT OF ECOLOGICAL AND CLIMATIC RISKS OF THE THERMAL REGIME OF THE CITY OF VORONEZH

L. M. Akimov, E. L. Akimov

Annotation. We have comprehensively analyzed the thermal regime of the climatic seasons in Voronezh-city, taking into account the trends towards global temperature rise. The research is based on the analysis of daily data from stationary atmospheric observation posts in Voronezh-city. The research was carried out using graphoanalytical and probabilistic methods for analyzing complex bioclimatic indicators that assess the ecological and climatic risks of the thermal regime of the atmosphere. We assessed the comfort of weather conditions in winter on the basis of the Bodman climate severity assessment index. In the article we

present graphical dependencies illustrating the distribution of the main bioclimatic indicators by seasons. We as well analyzed the dynamics and the nature of the direction of changes occurring with the studied parameters.

Keywords: weather; temperature; comfort; bioclimatic index.

ECONOMICS AND ORGANIZATION OF CONSTRUCTION

ECONOMIC AND LEGAL ASPECTS OF MECHANISMS FOR REDUCING «CONSUMER EXTREMISM» IN THE REAL ESTATE MARKET

L. N. Chernyshov, T. A. Goncharenko

Annotation. The article deals with the problem of deviations from project documentation during the construction of real estate, leading to increased operating costs and the emergence in the real estate market of the practice of abuse of law by legal entities and individuals offering services for identifying construction defects in the interests of apartment owners. We analyzed the reasons for the deviations, the behavior of private and public customers during the acceptance of facilities for operation, as well as the activities of operating organizations, as a way to control the quality of construction. It is noted that the replacement of building materials and components that do not affect the safety of the building structure is not reflected in the executive and operational documentation transferred to the legal owner, but has a significant impact on the forms and methods of organizing the operation of buildings and structures to ensure the design period of their effective functioning. We also considered different forms of evasion of construction organizations from fulfilling obligations to eliminate identified "shortcomings". We as well substantiated the necessity of strengthening control over the fulfillment of project solutions and of improving the quality of construction and legislative regulation of the amount of penalty as a measure of collecting funds from construction companies.

Keywords: affiliated management companies; construction quality; penalty; consumer extremism; real estate market.

STORYTELLING AS A METHOD OF PRELIMINARY CLASSIFICATION OF PROBLEM SITUATIONS AND A SYSTEMIC TOOL FOR FORMING CORPORATE CULTURE AND MANAGEMENT

S. V. Artyshchenko, A. I. Kolosov, S. A. Yaremenko, O. V. Lendova

Annotation. The paper explores the concept of storytelling as a management

method that enhances and expands the capabilities of traditional approaches. The article analyzes how storytelling can be effectively used to form and strengthen corporate culture, increase employee engagement and loyalty, as well as to broadcast the company's strategic vision and values. It is noted that based on the totality of its properties and characteristics, storytelling can be considered as one of the methods that involves a preliminary classification of problematic situations. Special attention is paid to the potential of this method, which can become a key element of system management, able to link strategic goals with real actions and semantic content within the organization, playing an important role in creating a strong and sustainable corporate culture.

Keywords: storytelling; personnel management; narration; management; corporate memory; corporate culture.