

BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES

PRACTICAL APPLICATION OF THE METHODOLOGY FOR SUBSTANTIATING THE REMAINING SERVICE LIFE OF ENGINEERING STRUCTURES OF BUILDINGS AND FACILITIES

A. G. Shmelev, N. A. Drapalyuk, G. D. Shmelev

Annotation. The article considers the issues of practical application of the methodology of computational forecasting and justification of the remaining service life of engineering structures of operated buildings and facilities on the example of the *Levoberezhnaya* urban sewage station in the city of Voronezh. In accordance with the methodology of computational forecasting and justification of the remaining service life of engineering structures of operated buildings and facilities developed by the authors, forecasting is performed using several methods belonging to the following groups: expert, parametric and so-called *accurate* ones. The expert methods used by the authors include methods of linear and nonlinear forecasting based on generalized parameters of relative damage, physical wear and probable reduction of load-bearing capacity. The group of parametric forecasting methods used by the authors includes methods of linear and nonlinear forecasting for the occurrence of rolls, the development of corrosion of steel reinforcement, and changes in concrete strength. Among the *accurate* methods used by the authors in the work there are calculation methods: for the strength of the normal cross-section to the effect of bending moment, the strength of concrete along the inclined strip between cracks to the effect of transverse (shearing) force, along the inclined crack to the effect of transverse (shearing) force, for long and short-term crack opening. The last group of calculations is based on the use of forecast models from a group of parametric methods (rebar corrosion rate, concrete strength change, etc.). We summarized in tables the calculation results for each group of structures responsible for bearing capacity, spatial rigidity and mechanical safety of the structure. Based on the results obtained, we estimated the reduced and remaining service lives of each group of structures.

Keywords: survey results; remaining service life; engineering structures; buildings and facilities; forecasting methods.

ENGINEERING SYSTEMS AND SERVICES

ON THE EXPEDIENCY OF FREECOOLING IN THE CIRCULATING WATER SUPPLY SYSTEM IN THE LENINGRAD REGION

S. F. Kudashev, E. S. Lapin, R. S. Lapin

Annotation. In the article we present the results of the analysis of energy consumption in two closed circulating water supply systems. The first option is a system with a chiller installed outdoors with antifreeze as a carrier and a dry cooling tower; the second option is a system with a chiller in a warm room and a "winter start". An aqueous solution of propylene glycol is considered as an antifreeze. Calculations were carried out for the actual climatic conditions of the Leningrad region and the same temperature conditions of consumers. We calculated the energy consumption based on the conversion coefficient (*COP*) of both variants. *COP* is calculated taking into account the energy consumption of pumping stations (hydraulic modules). Based on the energy consumption of the equipment and the cost of electricity, we drew some conclusions about the expediency of using freecooling for the system in question.

Keywords: freecooling; chiller; dry cooling tower; freon; circulating water supply; propylene glycol; intermediate heat exchanger.

JUSTIFICATION OF THE MINIMAL OUTDOOR AIR REQUIREMENT IN VENTILATION SYSTEMS

D. V. Lobanov, I. I. Zvenigorodsky, S. A. Safonov, M. S. Kononova

Annotation. In the article we show some characteristics of modern methods for calculating the required air exchange, which consists in incomplete consideration of human physical parameters when determining the calculated air exchange. We justify the necessity of taking into account in public buildings not only the severity of the work performed, but also age, gender, and some other physical parameters of a person. The calculations are based on public buildings data where people are engaged in mental labor. Here we present data on oxygen consumption, carbon dioxide emissions, energy consumption and the required amount of supply air for people of intellectual work. The minimum and maximum values of the supply air are determined, taking into account age and the coefficient of physical activity.

Keywords: sanitary norm of outdoor air; coefficient of physical activity; minimum air exchange; air quality.

MATHEMATICAL MODELING OF LOADING OF AN EXPLOSION-PROOF VALVE IN VENTILATION SYSTEMS

S. A. Yaremenko, O. I. Gaidash, M. N. Zherlykina

Annotation. The article presents the features of the design of energy supply facilities of housing and communal services. It has been revealed that external influence of natural and man-made origin can cause development of an emergency situation at an industrial facility. The article describes the origin and development

of the shock wave and its consequences at industrial facilities. Attention is focused on the ventilation system as the object most affected by the shock wave. To ensure the safety of industrial facilities, we propose the installation of explosion-proof valves. We also demonstrate the boundary conditions for the operation of explosion-proof valves. Besides, we present the results of mathematical modeling of a linear polynomial equation of state. In the ANSYS LS-DYNA numerical simulation environment, a two-dimensional task is set, at the first stage of which the distance from the initiated charge is determined. We performed a numerical study on two scenarios, namely with and without the installation of an explosion-proof valve. We present the results of the study of dependence of pressure on time when approaching to the valve and we also show the results of the study of dependence of pressure on time on the sensors. As a result of numerical simulation of the loading of a ventilation universal explosion-proof valve by a shock wave, we have established the expediency of its application.

Keywords: ventilation; explosion-proof valve; safety; shock wave; sensor; numerical experiment.

IMPROVING THE ACCURACY OF GASES HEAT CAPACITY CALCULATION

D. N. Kitaev, O. A. Kutsygina

Annotation. When calculating and designing heat engineering devices, accurate calculation of the heat capacity of the working fluid is a primary task that affects the value of the amount of heat and the characteristics of the equipment. At present, approaches to calculating heat capacity that do not provide maximum adequacy of the results obtained continue to be used. For methane, air and water vapor, approximation equations of true isobaric heat capacity from temperature in positive temperature ranges are presented in the form of polynomials, mainly of the 8th and 9th degree, providing maximum accuracy of approximation. The obtained equations allow increasing the accuracy of engineering calculations, avoiding errors associated with the linear approximation of the nonlinear functional dependence of heat capacity on temperature.

Keywords: heat capacity; approximation; optimization; heat engineering; heat generating units.

TREATMENT OF URBAN WASTEWATER SLUDGE IN METHANE TANKS

I. V. Zhuravleva, V. V. Pomogaeva, S. Y. Tkachev

Annotation. The article considers the issue of the use of methane tanks in the wastewater sludge treatment scheme, taking into account the quantitative and

qualitative composition of sludge. The main method is to simulate the mode of operation of methane tanks sequentially in thermophilic and mesophilic modes. The object of the study is a two-section methane tank. We consider the environmental problems of sludge disposal, using the example of an urban wastewater treatment plant, its developed scheme with a capacity of 28.2 thousand m³ per day, and pollution analysis. It is proposed to provide biocoagulation with excess activated sludge to improve sedimentation abilities of sludge in the primary settling tank. We describe the main parameters of sludge of primary sedimentation tanks, taking into account biocoagulation. We determined the main parameters for the joint treatment of primary sludge and excess sludge in methane tanks with phase separation. We calculated the main indicators of the anaerobic stabilizer depending on the amount of sludge formed at the station in primary and secondary sedimentation tanks. The use of a methane tank for sludge treatment is justified, depending on the effect of the mechanical cleaning unit. We as well present the design scheme of the developed methane tank and the temperature ranges of sludge treatment in it. Also, we show the scheme of the work of the methane tank, taking into account the intensification of its work. We also describe the principle of operation of the main and auxiliary equipment of the methane tank. We as well recommend how to improve the sewage sludge treatment scheme for biological treatment plants of urban wastewater. We consider a sludge treatment method, which will allow us to secure the formed sediment and to obtain biogas, reducing the specific resistance of the filtration sludge after the methane tank. We propose a method of recycling sludge from a methane tank to obtain soil.

Keywords: methane tank; biogas; sewage sludge; sedimentation tank; phase separation.

EVALUATION OF THE EFFECTIVENESS OF A COMPLEX BIOCIDE FOR POOL WATER

D. O. Polovneva, M. I. Vasilenko

Annotation. Environmentally friendly and safe disinfection solutions, namely polymer ionogenic biocides based on synthetic high-molecular polyguanidines, have recently been increasingly offered as an alternative solution for pool water treatment. Such substances include polyhexamethylene guanidine hydrochloride (PGMG-GC), which has a wide spectrum of prolonged biocidal action in the water temperature range of 0...30 °C and pH 6...9. The paper presents the results of studies on the identification of algicidal, fungicidal, bactericidal properties of a biocidal multifunctional agent (BMS) based on guanidine derivatives in the temperature range of 20...45 °C, taking into account its possible use for outdoor swimming pools, especially in southern countries. The high biocidity of the concentrated solution has been experimentally proven in relation to unicellular algae that cause *water blooming*, enterobacteria, often found in pool waters, and microscopic fungi that inhabit surfaces at elevated temperatures and humidity.

Keywords: pool water; ambient temperature; disinfection; biocide; bactericidal activity; fungicidity; algicidal activity.

CITY. RECONSTRUCTION, RESTORATION AND LANDSCAPING

FORMATION OF A QUALITY RECREATIONAL ENVIRONMENT OF MULTIFUNCTIONAL SPORTS COMPLEXES BASED ON THE VELODROME ARENA (THE CITY OF BRYANSK)

V. V. Kokorina, E. V. Zolotareva

Annotation. The article discusses methods of forming a high-quality and attractive recreational environment using the example of a project for the territory of a multifunctional sports complex based on a velodrome-arena in the city of Bryansk. When designing the landscaping of the recreational area of the sports complex, we took into account different age categories of visitors and strived to create a comfortable, accessible and multifunctional space. The following functional areas have been identified: an event area, quiet recreation areas for visitors and staff, a sports area with playgrounds for various purposes, parking zone. The modular grid method described by the famous landscape designer John Brooks was used in the design. The essence of the method is that the contours of all functional zones of the designed space and landscaping elements fit into a grid of squares superimposed on the site plan. For a harmonious connection between the territory and the main building, the size of the side of the modular square must be equal or proportional to any dominant element of the building (the distance between columns, the width of the window opening, etc.). As a result, several variants of the landscaping project of the multifunctional sports complex were obtained. This article presents the most successful variant from the authors' point of view, in which the boundaries of functional zones were delineated using straight, diagonal and arcuate lines. To delimit functional zones and emphasize the main directions of movement, row plantings of trees and shrubs were used, emphasizing the geometric layout of the territory.

Keywords: recreational area; multifunctional sports complex; velodrome-arena; eco-positivity; landscape architecture; modular grid; landscaping; improvement.

INTRODUCTION OF SMART TECHNOLOGY IN THE PROCESS OF COMPREHENSIVE URBAN DEVELOPMENT RECONSTRUCTION

A. A. Fedorovskaya, E. S. Kalaicheva, L. Y. Sarkisyan

Annotation. The main goal of the presented article is to define the concept of integrated urban development reconstruction, taking into account the environmental aspect and the introduction of *smart city* technology. The object of the research is the technology used to create a *smart urban* environment. The first stage of the study is to analyze the experience of implementing technology to create a *smart* and *green* urban environment. The next stage is selection of possible options for the use of smart technology to improve the environmental situation of the Oktyabrsky district in the city of Rostov-on-Don. This area is bounded by the streets: Taganrogsкая, Vavilova, Timoshenko, Oganova. Then we carried out the analysis of the ecological situation of the selected reconstruction area. At the final stage, we calculated the IQ index of the city of Rostov-on-Don for the current state and after the introduction of *smart city* technology.

Keywords: smart city; reconstruction; comprehensive reconstruction; city; urban development; environmental risk; city development index; city *IQ*; smart technology.

EVALUATION OF THE EFFECTIVENESS OF METHODS FOR COMBATING CHESTNUT LEAF MINERS (*CAMERARIA OHRIDELLA* DESHKA ET DIMIC) AT LANDSCAPING FACILITIES IN THE CITY OF OREL

N. A. Shiryaeva, E. A. Korenkova, Zh. G. Silaeva

Annotation. Currently, it has been shown that the main cause of damage of urban green spaces is invasion. The chestnut leaf miner is a serious threat to chestnut vegetation. In the Orel region, this invasive species, as well as the damage it causes to horse chestnut, have been a serious problem for the region for the last 10...15 years. The aim of the work was to evaluate the effectiveness of the *Locustin* insecticide for the control of chestnut leaf miner (*Cameraria ohridella* Deshka et Dimic) on plantations of *Aesculus hippocastanum* L. at the facilities of landscape architecture in the city of Orel, namely in the arboretum of the Orel State Agrarian University, Pobedy blvd. The method of use is stem injections. The dose is 5 ml per plant, the number of treatments is once in the budding phase (mid-May). The assessment of damage to the leaves of horse chestnut by chestnut leaf miner was carried out on a scale developed by S.A. Tribel and O.N. Gamanova. The plantings were assessed visually, according to the condition of the crown and the damage to the leaves of the horse chestnut. The frequency of observations is 10

days. The first observations were made on June 20, 2023. We present the results of the assessment of the vital condition of trees in the arboretum of the Orel State Agrarian University and Pobedy blvd. In a result, the effectiveness of the Locustin insecticide was established, when the area of leaf damage was 2.5 times less than on control specimens without treatment. The maximum protective effect from the use of the insecticide was noted in the early stages of vegetation (June).

Keywords: landscaping facilities; chestnut leaf miner; stem injection; *Aesculus hippocastanum* L.; *Cameraria ohridella* Deshka et Dimic.

ECOLOGY AND SAFETY OF THE URBAN ENVIRONMENT

SPATIO-TEMPORAL ANALYSIS OF ATMOSPHERE STABILITY PARAMETERS IN THE CENTRAL PART OF THE RUSSIAN PLAIN

L. M. Akimov, E. L. Akimov

Annotation. The article describes the spatial and temporal features of the main factors determining the dispersion of impurities in the atmosphere in the central part of the Russian Plain. The research methods are based on the geoinformation method of analyzing data from temperature and wind sensing of the atmosphere of meteorological stations located in the central part of the Russian Plain. We have determined the spatial and temporal patterns of the distribution of weak (calm) winds (0...1 m/s), as well as surface and elevated inversions in cold and warm periods and for the year as a whole. We proved the dominant role of atmospheric circulation in the spatial and temporal patterns of distribution of the main factors of pollutant dispersion in the atmosphere, as well as the significant influence of the physical and geographical characteristics of the territory. During the year, the probability of formation of a surface-based inversion varies from 30...35 % in the central part of the Russian Plain, which is due to radiation cooling of the underlying surface. In the east of the central part of the Russian Plain, the probability of formation of a surface inversion reaches up to 40...45 % due to the influence of the Siberian anticyclone in winter. The predominance of a stable state of the atmosphere with frequent inversions is characteristic of winters there.

Keywords: atmospheric stability; inversion; atmospheric stratification; wind distribution; meteorological conditions.

ECONOMICS AND ORGANIZATION OF CONSTRUCTION

THEORETICAL ASPECTS OF THE IMPORTANCE OF JUSTIFICATION OF TARIFFS FOR MAINTENANCE AND CURRENT REPAIR OF MUNICIPAL UNITARY ENTERPRISE OF THE CITY OF VLADIVOSTOK

N. S. Samarina, A. A. Grevtsova, I. A. Kim, D. S. Ulyanova

Annotation. The availability and quality of housing and communal services have a key role in determining the living standards of the population and are recognized as a strategic task for the development of social infrastructure. Theoretical justification of tariffs for housing and communal services has a vital role in the formation of pricing policy of any municipal unitary enterprise of housing and communal services. In the conditions of functioning of such enterprises it is especially important to accurately calculate the cost of services so that they were both affordable to the population and covered the costs of maintenance and current repair of the apartment building. This article considers theoretical aspects of the importance of justification of tariffs for maintenance and current repair on the example of Vladivostok *Tsentrallyy* municipal unitary enterprise. We present and analyze the approaches to determining the composition of tariffs for maintenance and current repair of housing; and we as well highlight the advantages and disadvantages of each approach.

Keywords: maintenance and current repair; municipal unitary enterprise; theoretical justification of tariffs; management company; housing and communal economy.