

BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES

ASSESSMENT OF THE RISK OF COLLAPSE OF A BUILDING OR ITS PART ACCORDING TO THE VALUES OF CONTROLLED LURCH AND SUBSIDENCE

M. I. Fedotova, G. D. Shmelev, A. V. Zhukova

Annotation. In recent years, the term «mechanical safety of a building (structure)» has been introduced into the legislative and regulatory and technical literature. This term characterizes the state of the structures, when there is no unacceptable risk for technical condition of the structure. As controlled parameters for risk assessment, there are: destruction of individual load-bearing building structures or their parts; destruction of the entire building or its part; deformations of the unacceptable scale of structures, of foundation of a building and geological massifs of the adjacent territory; damage to a part of a building. This article discusses the issues of assessing the risk of a technical condition of buildings, depending on the development of deformations of an unacceptable scale. As deformations of the base of the building, we consider the normalized difference in limit relative subsidence and the maximum possible subsidence determined by SP 22.13330.2016 Foundations of buildings and structures. GOST 37931-2011 Buildings and structures. Rules for Inspection and Monitoring of the Technical Condition introduced boundary values for acceptable and unacceptable risks. It is proposed to compare these boundary values with the limiting deformations of the foundations of new facilities; limiting additional deformations of the base of the foundations of the reconstructed structures; limiting additional deformations of the foundations of surrounding buildings located in the zone of influence of new building sites or reconstruction areas. Based on specific examples, we determined graphical and mathematical dependences of the risk of a technical condition of a facility depending on the limiting relative difference in subsidence and the limiting maximum subsidence of soils at the base of buildings.

Keywords: mechanical safety; building; structure; accident; technical condition; risk, ultimate deformations; foundation; lurch; subsidence.

INFLUENCE OF CRACKS IN THE EXTERNAL WALLS OF THE BUILDING ON THEIR HEAT PROTECTIVE CHARACTERISTICS

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

Annotation. The article deals with issues related to the causes of cracks in the external building envelope. We have identified the following main reasons of cracks: force effects, temperature effects, internal shrinkage and deformation of materials in areas with different loads, uneven settlement in the «foundation soils – foundations» system, fatigue of the material coming from vibration. It is noted that the appearance

of cracks in the outer walls leads to the formation of cold bridges in their place. Being based on one of the current parameters for assessing the energy efficiency of residential buildings (reduced resistance to heat transfer of enclosing structures), we carried out a qualitative assessment of the effect of cracks with different opening widths on energy efficiency and the temperature and humidity regime of operation of external enclosing structures. The results of modeling cracks with different opening widths and different conditions for blowing through with outside air showed the likelihood of the formation of water vapor condensation zones inside structures in areas with cracks. In this case, the zone of possible condensation of water vapor, depending on the width of the crack opening and its blowing, is shifted from the outer layer of the building envelope to the inner layer. Taking into account the actual developments in the installation of insulation in buildings with cracks in the outer walls, we made a qualitative assessment of thermotechnical and temperature-humidity changes in structures.

Keywords: thermal protection; residential buildings; defects and damage; cracks; weatherization of walls.

ENGINEERING SYSTEMS AND COMMUNICATIONS

DETERMINATION OF THE VALUES OF CARBON DIOXIDE EMISSIONS FROM PEOPLE ENGAGED IN VARIOUS TYPES OF WORK

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

Annotation. We carried out the analysis of existing normative documents and reference literature used in the calculations related to the determination of gas emissions from people engaged in various types of work. We revealed an incomplete correspondence of gas emission values to the characteristics of the severity of the work performed for different kinds of activity taking into account the age of people and their anthropometric data. We determined estimated values of physical activity coefficients and gas emission values in accordance with division of people by age categories. We present the graphs of gas excretion for men of different ages performing light, medium, and heavy types of work. We compared the obtained values of gas emissions with the data of normative documents and reference literature for different categories of work. As a result we showed the relevance and necessity of taking into account the data on gas emissions from people, considering their age, anthropometric parameters and other conditions in the design of microclimate systems.

Keywords: human energy expenditure; gas emission; physical activity coefficient; carbon dioxide emission; human physical parameters; conditional human.

CALCULATION OF THE HEAT EXCHANGERS EFFICIENCY WHEN UTILIZING VENTILATION EMISSIONS FROM INDUSTRIAL PREMISES

A. S. Ovchinnikov, M. N. Zherlykina, S. A. Yaremenko, K. V. Garmonov

Annotation. We consider the issues of energy saving in the ventilation systems of industrial premises and boiler houses of housing and communal services through the utilization of the heat of the outgoing air. The article discusses the method of calculating the optimal parameters of the heat exchanger by the criterion of the minimum heat equivalent for air media, permissible value of the air velocity and efficiency of the heat exchanger. As an example we consider 2 varieties. The first variant is a rotary type of heat exchanger, in which there is a mixing of supply and exhaust air flows with a quantitative assessment of about 5%, which is unacceptable according to fire and explosion safety requirements for some facilities. The second variant is a plate heat exchanger of a countercurrent type to demonstrate the maximum possible efficiency indicators, in which there is no mixing of flows. We revealed a significant reduction in the consumption of traditional resources. We also performed a quantitative assessment of thermal resources for energy saving by months of the heating period. It is shown that a significant amount of thermal energy can be used for the needs of building engineering systems. It is recommended to improve the methods of selection of heat recovery equipment, taking into account the content of harmful substances in the outgoing air and the conditions of fire and explosion safety in the production room.

Keywords: energy saving; thermal energy; heat recovery; recuperator; ventilation; production room.

ANALYSIS OF THE HYDRAULIC REGIME OF THE HEAT NETWORK DURING THE PROSPECTIVE DEVELOPMENT OF A RESIDENTIAL AREA

D. N. Kitaev, S. G. Tulskaya, O. A. Kurochkina

Annotation. The article discusses the issue of an expedient option for the construction of a water heating network, taking into account the development of its configuration when connecting new buildings. The main method is modeling the hydraulic operating modes of the heating network, taking into account the connection of new subscribers. The object of the study is the water heating network of a residential area of the city. According to the development plan, there will be constructed 9 residential buildings, which are divided into 5 stages of construction. The first phase of construction involves 5 multi-apartment 16 floor buildings. The first stage has already been built, and the remaining buildings will be put into operation one per year. The problem is the fact that the heating network of the first stage of construction was designed without taking into account further development, i.e. it is

intended to supply the estimated amount of heat for only five buildings. To solve the problem, water heating networks of future development have been designed. When connecting buildings of the second and subsequent stages to the existing network, the flow rate will increase, and consequently, the hydraulic resistance, pressure losses and energy costs for transporting fluid will change. Based on the hydraulic simulation of the operating modes of the heating network, taking into account the commissioning of all construction phases, we calculated the cost of pumping the heat carrying agent and the cost of the project for reconstruction of the existing network with an increase in carrying capacity. We determined an expedient option for building a network according to an economic criterion.

Keywords: city development; heat network; hydraulic regime; reconstruction; operating costs; estimated cost.

OPTIMIZATION OF THE DESIGN OF A GAS RADIANT HEATER OF A DARK TYPE

E. S. Aralov

Annotation. The article considers the possibility of modifying a heating device, namely a gas radiant heater of a dark type, by adding additional elements into its design. The work involves analyzing various sorts of models of dark gas radiant heaters, and determining their advantages and disadvantages. I present the results of comparing the reflectivity of various metals, the choice of aluminum for the manufacture of a reflective screen is justified. I show the improved design of a two-zone gas radiant heater, present its scheme, describe the principle of operation, and determine the area of recommended effective use. Finally I make analysis of the impact of using an improved design on the efficiency of the heating system as a whole

Keywords: heating; microclimate; gas radiant heater; reflective screen; heat transfer.

FEATURES OF DESIGNING VENTILATION OF THE UNDER-ROOF SPACE OF ATTIC ROOMS IN KINDERGARTENS

D. A. Drapalyuk, N. A. Drapalyuk, M. S. Kononova

Annotation. We carried out the analysis of the influence of design features of pitched and combined roofs in the buildings of preschool educational institutions on the ventilation of the under-roof space. We established the main reasons leading to the increased formation of condensate in the under-roof space. We analyzed the existing approaches to the design of air exchange and ways of organizing air distribution in attic rooms. The method of calculating air exchange has been clarified, taking into account the influence of the air velocity in the under-roof space. The approach proposed by the authors is applicable, when calculating the air exchange of pitched

roofs of complex configuration to eliminate the defects that have arisen during the preschool institutions operation.

Keywords: air exchange; heat and humidity regime; under-roof space; relative humidity; air velocity.

TECHNOLOGICAL BASES OF DESALINATED WATER CONDITIONING FOR DRINKING WATER SUPPLY

Al-Amri Zaed Sadiq Abrahem, V. I. Shcherbakov, V. V. Pomogaeva

Annotation. The article is devoted to the problem of shortage of drinking water in some regions of the Russian Federation and in the countries of the Middle East. The relevance of the topic of research is due to the growing global problem of providing mankind with drinking water that meets the standards of quality and safety. The population of the Middle East region and, in particular, Iraq is experiencing a particularly acute shortage of good quality water. To solve these problems we carried out the analysis of modern methods of treatment and conditioning of water; identified the most effective methods, such as reverse osmosis and ion exchange. We developed a new scheme of structures and equipment for the conditioning of natural water, bringing them to the requirements of a centralized water supply. The scheme provides for enrichment of soft drinking water with calcium bicarbonate using filtration technology by preliminary carbonization of filtered water with carbon dioxide. The scheme as well provides for intensification of the calcination process by the use of two strong acids or the combined use of one strong acid and carbon dioxide. As a solution to the problem and as a result of the methods studied and the calculations made, we offer a technological project for a mobile double-circuit station for purification and conditioning of drinking water of a modular type with a capacity of 20 m^3 per day. We describe all the stages of technological processes of water conditioning and consider issues of the composition and dimensions of structures, equipment and parameters of the mobile station. The use of such a station is expected in areas remote from large cities in which there is no centralized water supply system. The operation of such stations solves several problems at once, primarily economic and epidemiological ones.

Keywords: desalination of natural water; conditioning; mobile station; calcium enrichment; ion-exchange resins.

HYDRAULIC REGULARITIES DETERMINING THE EFFICIENCY OF THE OPERATION OF DRAINAGE STACKS OF WATER DISCHARGE SYSTEM IN RESIDENTIAL BUILDINGS OF DIFFERENT NUMBER OF STORIES

V. Yu. Khuzin, V. V. Pomogaeva, A. V. Bahmetev

Annotation. We describe the principles of designing residential buildings of superior comfort. We assessed the design of the sewer system, which allows the most trouble-free operation, when air is ejected through an exhaust vent located on the roof of the building. We describe the features of laying engineering services by developers, with self-installation of sanitary appliances by homeowners. It has been established that the dismantling of sanitary appliances provided by developers leads to problems in the operation of the sewer system. Studies have been carried out on a real case of disruption of the domestic sewerage system in a multi-storey residential building. We revealed the design features of the complex. It has been established that two types of drainage stacks are used in the building: ventilated and non-ventilated. Experimental studies have been carried out to determine the causes of unpleasant odors entering apartments equipped with non-ventilated drainage stacks. As a result of the study, we determined the established types and designs of devices, identified the source of odors - a shower tray with a gulley equipped with a siphon with a hydraulic shutter of 24 mm high. We established the factors influencing the breakdown of the hydraulic seal as a result of exceeding the permissible value of vacuum in the stack. We analyzed the work of the air valve of the problem area of the sewer system. We determined the allowable vacuum value in the stack, taking into account the throughput of the unventilated stack and the estimated flow rate of the entrained air into the stack. Also we determined the minimum possible height of the water seal for the studied drainage stack. We offered a variant of solving the problem in a particular case under study. The results of experimental studies show that the selection and technological assessment of the operation of air valves must be carried out taking into account mass transfer and operational parameters, after performing a hydraulic calculation.

Keywords: drainage; sewerage system of a residential building; drainage stack; air valve.

URBAN PLANNING. RECONSTRUCTION, RESTORATION AND LANDSCAPING

REORGANIZATION OF PRODUCTION ZONES IN URBAN SETTLEMENTS ON THE EXAMPLE OF VORONEZH CITY

E. E. Burak, Yu. A. Vorobieva, A. A. Mershchiev, P. A. Barzenkova

Annotation. The article is devoted to the issues of redevelopment of the production zones of the city of Voronezh. We substantiate the necessity of increasing the efficiency of the use of existing urban areas through the integrated development of territories through the reorganization of production zones. We determine the measures to develop the functional planning structure of the urban district of Voronezh city to use production areas. We present the location of production areas in the central and middle parts of the city, which are planned to be reorganized. We identified problems in achieving the goal of improving the efficiency of the territory use when using land plots intended for industrial development and for other purposes. On the example of the Kominternovsky district of Voronezh city, we substantiate the prospects for the reorganization of production zones to attract investment. We confirm the necessity of the land reclamation as part of the redevelopment project of the production zones.

Keywords: production zones; functional zoning; redevelopment.

ECOLOGY AND SAFETY OF THE URBAN ENVIRONMENT

MODELING OF RESOURCE-SAVING HANDLING WITH SOLID MUNICIPAL WASTE

T. G. Sereda, S. N. Kostarev, Yu. A. Kochinov, T. V. Kochinova

Annotation. The article shows that one of the most acceptable mechanisms for preventing the negative impact of waste, which creates a high level of environmental hazard for the natural environment and the life of the population, is a new approach to the concept of "waste". Here, "waste" is understood as the subject of environmental, commodity-money and other types of legal relations and the transition of the entire system of handling obsolete, used products to the technical-socio-economic system. This system can be defined as follows: Resource consumers-Technology-Secondary and commodity resources (RTS). This system is managed using the mechanisms of economic and legal regulation. Here, secondary resources and alternative (inexhaustible) energy sources will be the subject of public relations, which will contribute to the sustainable development of the Russian economy as a whole. The structure of the technical-socio-economic system has been developed, on the example of which the material flows of secondary commodity resources are shown. As part of the state task for calculating the standards for the accumulation of solid

municipal waste in the Perm Territory, the percentage of components suitable for recyclables was determined. Classification of MSW in the studied samples according to the degree of biodegradation of MSW was carried out in order to determine the further scheme of the waste stream movement. With the help of Kolmogorov system of equations, the probabilities of transitions in the existing and new scheme of movement of secondary resources are determined.

Keywords: system analysis; waste; MSW; life cycle; secondary energy and raw materials; unrecyclable resources; natural resources.

EXPERIMENTAL STUDY ON THE SELECTION OF THE LOAD FOR A COMBIFILTER TO INCREASE THE EFFICIENCY OF THE WASTEWATER TREATMENT PROCESS

A. A. Shirniekh

Annotation. The intensification of water purification stages is becoming more and more relevant. The volume of discharge of contaminated wastewater is about 30% of the total volume of discharge, which is carried out by enterprises with various economic activities. Intensification of the filtration process will improve the quality of discharged water due to the prevalence of the use of this stage. This result is possible due to the use of a mixing chamber inside the filter housing with preliminary dosing of the coagulant. Inside the chamber there are two bowls in which two different stages of coagulation take place. In the first bowl, there is a kinetic coagulation of colloids, for which mixing is necessary. To ensure high-quality mixing, a series of experiments was conducted to select the best mixing load, where the optimal size of the load, material and its volume were determined. The mixing load will act not only as mixing elements, but also as an additional phase interface. The selected load will ensure optimal conditions for the flow of the first stage of coagulation.

Keywords: water treatment; coagulation; filtration intensification; mixing chamber; mixing load.

ECONOMICS AND ORGANIZATION OF CONSTRUCTION ANALYSIS OF THE COST DISTRIBUTION FOR COMPLETE OVERHAUL OF APARTMENT BUILDINGS ON THE EXAMPLE OF THE VORONEZH REGION

A. S. Fomina, M. S. Kononova

Annotation. The article considers distribution of costs for complete overhaul of residential buildings located in settlements of the Voronezh region. We distribute the studied buildings by periods of construction and number of floors. We offer the

distribution of estimated costs for complete overhaul by the studied groups of buildings and by individual types of work. We present histograms showing the results of the statistical processing of data on the buildings under study. We determine the costs for the repairs of structural elements of the building, as well as for the repairs of certain types of engineering services. As well we carried out the analysis of the distribution of costs for various types of work, depending on the number of floors and the year of construction. We also formed some recommendations on the use of available data on the work carried out when planning work within the framework of regional complete overhaul programs.

Keywords: complete overhaul; estimated cost; distribution of costs.