

## **BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES**

### **COMPARATIVE ANALYSIS OF CONTEMPORARY SYSTEMS OF ESTABLISHING CIVIL DESIGN BUILDINGS**

**G. D. Shmelev, N. A. Fomenko, V. N. Gavrilova**

**Annotation.** The article examines the existing approaches to the construction of modern buildings. The variety of constructive systems of residential and public buildings being erected in the Russian Federation is shown. Positive and negative aspects of such constructive systems are considered: monolithic frame housing construction, monolithic building construction with the use of tunnel formwork, panel housing construction, panel-brick house construction, and technologies of prefabricated monolithic frame housing construction that appeared in the last few years. Using the example of two variants of the monolithic frame house-building system (SMCS) developed by the engineering company "SMKproekt", the main features of the prefabricated monolithic frame house-building are shown. The main structural assemblies of skeletons of precast-monolithic systems of the SQSD and the universal-house house-building system (UDS) of the assembly-monolithic series SMK-18 developed on its basis are presented. A detailed description of the design features of individual elements of the carcass, the nodes of their connection, as well as key technological operations for the assembly of prefabricated elements and the work on the reinforcement and homogenization of all the structural assemblies of the monolithic systems of the QMS and UDS are given. The main technical and economic indicators of monolithic-frame house-building and the universal house-building system of the prefabricated-monolithic SMK-18 series are compared. Based on the analysis and comparative indicators presented, conclusions are drawn about the effectiveness of the use of prefabricated monolithic civil engineering systems for civilian buildings.

**Keywords:** structural systems of buildings; frame house building; monolithic skeletons; prefabricated reinforced concrete frame; panel housing construction; bearing structures; nodes of interface structures. prefabricated housing construction.

### **ANALYSIS OF THE EFFICIENCY OF MANAGEMENT OF MULTI-QUARTER HOUSES BY THE EXAMPLE OF VORONEZH**

**E. S. Lopatina, P. E. Avdeev**

**Annotation.** The work investigates violations of the rules of technical operation and maintenance of housing stock by the number of applications of citizens living in different districts of Voronezh. A comparative analysis of the results of activities on managing the technical condition of residential apartment buildings by management organizations and homeowners' associations is presented. The data of statistics of complaints of the population on violations of the rules of

operation of common property, poor repair of engineering systems and other factors affecting the efficiency of building management are given. The key factors influencing the decision-making of the owners of apartment buildings when choosing the method of managing common property are systematized, as well as the choice of a specific managing organization: the technical condition of the housing stock, the effectiveness of the planned repair work, the percentage of eliminated violations, the activity of the owners. It is stated that the stimulation of the active population and the use of feedback from residents of apartment buildings can effectively identify problem areas in order to accelerate the response to public demands. One of the ways to increase the efficiency of managing multi-apartment buildings is to create a unified urban geoinformation system for monitoring the technical condition of the housing stock, which allows displaying current information on the condition of buildings, the results of organizations' activities related to their maintenance and repair, and facilitating the detection of violations of rules and norms of technical operation.

**Keywords:** apartment building; management company; homeowners' association; major repairs of buildings; technical condition; housing stock.

## **ENGINEERING SYSTEMS AND COMMUNICATIONS**

### **FEATURES OF DESIGN AND OPERATION OF VENTILATION SYSTEMS AT CATERING ESTABLISHMENTS**

**A. A. Mershchiyev, T. V. Zemlyanukhina**

**Annotation.** The perspective of ensuring the normalized microclimate parameters in rooms of different function at catering establishments is considered. The important role of the correct design and operation of ventilation systems of hot shops in creation of favorable operating conditions for employees, respect for technological norms for cooking process and also formation of optimum microclimatic indicators in lunch halls is shown. By authors it is established that a number of questions, connected with safe functioning and reliability of work of engineering systems, with providing the set microclimate and energy saving in hot shops, demand additional studying and study. On the basis of the analysis of specifics of ventilation of hot shops of the enterprises, the main mistakes which are made both at design, and at operation of ventilating systems have been allocated. In materials of article need of the organization of ventilation systems of air for catering establishments on the basis of studying of space-planning solutions of the building, the existing normative documents on design and construction of groups of the rooms which are a part of a complex is proved. Heterogeneity of distribution of values of temperatures, vrednost and thermal emissions on height of the room and need of increase in efficiency of the actions aimed at providing comfortable conditions in a working zone is revealed. The air exchange calculation algorithm considering various factors, and allowing to

organize comfortable parameters of a microclimate for service personnel and visitors is offered.

**Keywords:** catering establishments; heatreceipts; moisture receipts; hot shop; lunch hall; ventilation.

## **ENSURING ENERGY SAVING OF AIR CONDITIONING SYSTEM OF PUBLIC CATERING ENTERPRISES**

**M. N. Zherlykina, T. V. Shchukina, E. I. Lobov**

**Annotation.** Some peculiarities of systems of automatic regulation of air environment parameters in air conditioning systems for public catering establishments are considered. To analyze the energy efficiency achieved in different operating conditions, the construction areas were selected and their climatological description was performed. The table of statistics on loading of a dining hall of a dining room of a public catering is resulted. The presented processes on the J-d diagram of moist air characterize the change in the parameters of the internal air in accordance with the number of visitors. The calculation of air exchange for the assimilation of apparent and total heat, as well as moisture emissions, shows that, depending on the time of day, the flow rate can vary from 11 to 27 thousand  $\text{m}^3 / \text{h}$ , reaching its maximum only from 13 to 14 hours. Given that the rest of the time, a small congestion of the hall, automatic regulation can achieve significant energy savings for processing of fresh air. In accordance with the justified regulation of the supply of fresh air to the dining hall, graphs are constructed with the hourly expenditure of cold for different cities. Economic indicators of reducing payment for resources are provided with automatic adjustment of the supply air parameters, including its consumption depending on the number of visitors to the dining hall.

**Keywords:** automatic air regulation system; air conditioning system; common dining room; dining room; schedule for loading the dining hall; energy saving; J-d diagram; economic justification.

## **FLOW INSTABILITY IN THE RAINWATER DRAINAGE SYSTEM**

**V. F. Babkin, E. V. Drozdov, E. A. Zavalina**

**Annotation.** The paper deals with the oscillatory process, which starts in the rainwater drainage system while changing the free-flow and pressure regimes. The mechanism of the occurrence of self-excited flow oscillations in the system of water duct – surface runoff inlet when filling the pipe close to unity has been proposed. It is shown that the change of flow regimes in drainage pipes occurs when the flow rate and the water level in the surface runoff inlet change. The presence of a sharply unsteady, oscillatory process in the drainage pipes, provided at the entrance with surface runoff inlets, is explained by the existence of a closed section of two-digit

depths in the waterways in the region of their filling, close to the full one. The characteristic features of the development of the self-oscillating process in drainage pipes are described and stability analysis of the flow is given. As an example, an oscillatory process in a reinforced concrete pipe with a diameter of 250 mm and a length of 20 m is considered. The capacity of the pipe is calculated depending on the depth of the water in the surface runoff inlet, and the stability analysis of the stationary mode of the joint operation of the "surface runoff inlet - drainage pipeline" system is carried out. The boundary of the flow instability region in the rainwater diversion system and the flow rate range are established, at which the occurrence of a highly unsteady oscillatory process in the drainage pipes is possible.

**Keywords:** rainwater drainage system; surface runoff inlet; flow stability; unsteady flow of wastewater.

## **IMPROVING THE EFFICIENCY OF THE VENTILATION OF VEGETABLE STORES OPEN TYPE IN THE SUGAR BEET INDUSTRY**

**S. M. Koltsov, M. N. Zherlykina**

**Annotation.** The storage period of sugar beet is dependent on the efficiency of the ventilation system, designed to maintain the parameters of storage of root crops. The authors outlined the main parameters of sugar beet storage. The term «vegetable storehouse of an open type» is proposed. The scheme of air supply in the vegetable store is considered. The technical solutions for the organization of air supply to the sugar beet embankment are reviewed. The results of the operation of the system of uniform ventilation of the embankment of root crops are considered, the advantages and disadvantages of the system are determined. The need to conduct tests to determine the coefficient of local resistance of outlets at the air duct is identified. A technique for experimental investigation is proposed for finding the coefficient of local resistance of a group of outlets located on the duct section.

**Keywords:** vegetable store; open vegetable storehouse; ventilation system; ventilation of the embankment; storage of raw materials; sugar beet.

## **CITY. RECONSTRUCTION, RESTORATION AND LANDSCAPING**

### **EVALUATION OF WIND CONDITIONS COMFORT IN HIGH-RISE RESIDENTIAL DEVELOPMENT**

**I. V. Popova**

**Annotation.** The regulation of the wind regime is the most important architectural and climatic task, which is solved at the urban level. The possibility of creating favorable aeration conditions depends on the wind climate of the construction area

and the planning solution of the building. When building and reconstructing the urban environment in accordance with the current urban planning standards for buildings with a height of more than 40 m, it is necessary to provide wind protection devices, for the development of which the assessment of the wind regime is required. The modeling of microclimatic conditions of the territory of the modern 17...25-storey residential complex located on the left Bank of the Voronezh city, in the program complex ENVI-met 4.2 was performed. The estimation of comfort, related to the action of wind, was carried out on the indicators of maximum, minimum wind speed, variability of wind speed and the proportion of the territory with unfavorable wind speeds. The results of the simulation of the wind regime of the site showed that around high-rise buildings there is a strengthening of the wind and the formation of zones of turbulence, and from the leeward side of buildings with extended length facades facing the main wind direction, a wind shadow is formed. Based on the analysis of the results, General recommendations on the improvement of the territory in order to reduce the adverse effects of wind are proposed.

**Keywords:** residential development; microclimate; temperature and humidity regime; wind regime.

## **ECOLOGY AND SAFETY OF THE URBAN ENVIRONMENT**

### **ASSESSMENT OF THE IMPACT OF WASTEWATER LEFT-BANK TREATMENT FACILITIES ON THE QUALITY THE WATERS OF THE VORONEZH RESERVOIR**

**T. I. Prozhorina, T. V. Nagih**

**Annotation.** The Voronezh reservoir belongs to the main water body of the city of Voronezh. Despite its importance, there is an annual increase in human impact on the reservoir. One of the main sources of pollution of the water area of the Voronezh reservoir is the discharge of insufficiently treated water from the left-Bank treatment facilities (LLC «LOS»). The content of pollutants discharged from wastewater into the Voronezh reservoir exceeds the MPC for suspended substances, sulphates, nitrites, phosphates, copper, zinc, etc. The paper presents the data of monitoring the chemical composition of water samples from the Voronezh reservoir in the period from 2017 to 2018. The authors compared the background indicators (500 m above the source of pollution) with the indicators of water quality in samples taken directly at the discharge site and 1000 m below the sources of pollution. The results of the studies showed that there is an increase in the actual concentrations of pollutants in water samples taken below the wastewater discharge. This indicates an increasing anthropogenic load and deterioration of the water quality of the Voronezh reservoir under the influence of discharges of the city's left-Bank treatment facilities. Technological measures for the reconstruction of old or construction of new treatment facilities of the city of Voronezh will help to prevent degradation of the Voronezh reservoir, as well as to increase the efficiency of wastewater treatment.

**Keywords:** single samples; chemical composition; wastewater; priority pollutants; source of pollution; background values; water salinity; General hardness.

## **EXPERIMENTAL MODELING OF THE SPREAD OF HARMFUL SUBSTANCES EMITTED FROM PETROL STATIONS**

**N. V. Bakaeva, K. V. Garmonov, M. N. Zherlykina**

**Annotation.** The issue of the spread and impact of harmful substances from the gas station on the nearby construction is currently insufficiently investigated. The study of the process of distribution of harmful substances in situ causes some difficulties. It is shown that compliance with the laws of aerodynamic similarity allows to simulate the dispersion of harmful substances from the gas station in the aerodynamic chamber. All conditions providing similarity of the phenomena in the model and in nature are considered in detail. The conditions that ensure the compliance of processes in nature and in the model are geometric and physical similarity, equality of initial, boundary conditions and process-defining criteria that must be presented to the profile of the flow velocity incident on the building to ensure the similarity of the flow in the zone of aerodynamic shadow and the propagation of impurities in it. The aerodynamic chamber simulates the process of gasoline vapor propagation from the breathing tube of the tank with fuel to the gas station (volume-50 m<sup>3</sup>), when it is filled with gasoline AI-92 from the tanker, and the effect of harmful substances on a 9-storey residential building located at a distance of 50 m. The authors propose a method of experiment in the wind tunnel, which allows to consider the spread of harmful substances from the gas station to the nearby buildings and to determine the value of their concentrations. The use of the method will allow to predict the degree of impact on the environmental safety of the city in the construction of gas stations, to assess the impact of harmful substances from sources of air pollution of gas stations at any point and at any distance. With the help of tests in the wind tunnel, it is possible to assess the effectiveness of the implementation of the planned activities to reduce the negative impact of harmful substances from the gas station.

**Keywords:** wind tunnel; contaminants; gas stations; concentration.

## **ECONOMICS AND ORGANIZATION OF CONSTRUCTION**

### **TECHNO-ECONOMIC PERFORMANCE RADIATOR HEAT DISTRIBUTING DEVICES IN HEATING SYSTEMS OF RESIDENTIAL BUILDINGS**

**Y. V. Telyuk, M. S. Kononova**

**Annotation.** The organization of individual accounting is an effective method to stimulate consumers to rational use of the consumed heat. In vertical heating systems, it is possible to organize individual accounting using radiator distributing devices, which allow distributing of the total payment for heating in proportion to the amount of heat consumed. The review of the existing models of radiator distributing devices is undertaken, their varieties with different functionality are selected. The calculations of the payback period of the use of radiator distributing devices in conjunction with thermostatic valves are performed. The calculations were carried out on the example of a five-storey residential building. At the same time, the following parameters were changed: relative heat consumption; the share of heating devices equipped with distributing devices; the tariff for thermal energy. Graphs illustrating the dependence of the payback period on the variable parameters are drawn. It is established that for climatic conditions of Voronezh it is economically expedient to consider application of radiator distributing devices if not less than 80% of heating devices in the building are equipped with them.

**Keywords:** radiator heat distributing devices; individual accounting of heat consumption, heat saving.

## **COMPARISON OF THE TECHNO-ECONOMIC INDICATORS OF THE OPTIONS FOR THE RECONSTRUCTION OF THE INTERNAL-QUARTER SYSTEM OF HEAT SUPPLY**

**E. A. Sheina, E. O. Volkhova, Y. V. Telyuk**

**Annotation.** The existing structure of centralized heating systems with central heating points (CHP) is characterized by a number of disadvantages. One of the possible ways to improve the performance of these systems is the transfer of heat exchangers for heating hot water from central to individual heat points (IHP). In the conditions of the existing building, the decision on the transfer of heat exchangers should be justified by technical and economic calculations. The paper compares two options for the reconstruction of the heating system of the residential group. The first option assumes for major repairs and modernization of the existing structure (with CHP). The second option is related to the transfer of heat exchange equipment in the IHP of buildings. The capital costs, including the costs of the equipment of heating points and the replacement of the thermal network, are calculated. The operating costs of the compared options include the cost of electricity for the circulation of the coolant in the thermal network and the cost of heat losses. The final comparison of the options is based on the calculation of the reduced costs. As a result, for the considered residential group in the conditions of reconstruction, the first option with the preservation of the existing structure of heat supply was economically feasible.

**Keywords:** heat supply system; central heating point; hot water supply heat exchanger.

# THE RULES OF INSPECTION OF CHANGE OF DOCUMENTATION WHEN CARRYING OUT THE CAPITAL AND CURRENT REPAIR OF A MULTI-QUARTER RESIDENTIAL HOUSE

**A. V. Vorotyntseva, A. S. Ovsyannikov, V. A. Bolgov, D. A. Kazmina**

**Annotation.** At present, the issue of checking budget documentation for the organization and conduct of work on capital and current repairs is very important. According to the authors of the article, and it relies on the definition of legislative provisions, the report on the funds spent on capital and current repairs of multi-apartment houses should be made according to the same rules as the report on the use of budget funds for repair work, i.e. To rely on the existing estimate-normative base. In general, this article will make it possible to clarify certain stages in the execution of the audit of the estimate documentation, starting with a survey of the house for clarification of the types of work and volumes required for the implementation, before determining it to a certain algorithm for compiling the estimate documentation. The article contains the rules on which the estimate is to be compiled and an emphasis is placed on the typical mistakes made by contractors' contractors in drafting it, attention is paid to the main aspects used in checking the estimate documentation for the repair work when conducting a capital or current repair of an apartment building.

**Keywords:** overhaul; maintenance; homeowners' association; apartment building; estimated documentation; exchange-regulatory base.