

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

### **REFINEMENT OF SETTLEMENT CALCULATION IN UNDER-REAMED FRICTION PILES UNDER AXIAL COMPRESSION IN THE SOIL BASE**

**V. S. Utkin, L. A. Sushev, S. A. Solovev**

**Annotation.** The article describes the design scheme of a friction pile with under-ream, taking into account the new approach to the friction forces distribution on the pile lateral surface. On this basis, the new method is presented for calculating pile settlement caused by elastic deformations of the pile material. A decrease in the values of the friction pile settlement was revealed due to elastic deformations according to the new design equation, compared with the values of the pile settlement obtained according to SP 24.13330.2011 “Pile foundations”. The reduction of the elastic settlement of the pile is achieved by taking into account the friction forces (positive and negative) on the pile lateral surface. The proposed approach will allow to reasonably reduce the cost of pile structures when determining their performance by the value of the pile draft, especially in cases with a large pile length, hollow piles and piles made of a material with a small modulus of elasticity.

**Keywords:** friction pile; under-ream of the pile; settlement; elastic deformations; axial compression.

## **ENGINEERING SYSTEMS AND COMMUNICATIONS**

### **ON THE POSSIBILITY OF USING FORCED SUPPLY VENTILATION SYSTEM AS AN AIR CURTAIN**

**V. M. Kireev, V. A. Minko, A. S. Grinchenko, V. E. Kireev**

**Annotation.** For a number of reasons retail and office premises with a separate entrance on the ground floors of the building have recently gained a wide popularity. The main feature of these premises is low attendance; therefore, the operation of a separately installed heat curtain will be effective but impractical. At the same time, these rooms must have a supply ventilation to maintain the required microclimate parameters. Thus, the article offers to use the forced supply ventilation as an air curtain in these types of premises, in addition to performing its main function. Due to the air supply with certain parameters above the doorway, in some cases it is possible not to use the thermal air curtain as a separate energy-intensive device. We offer to implement this task through organizing some air exchange scheme, without increasing its required performance. As a result of the analysis, it was revealed that air distribution can be performed with ready-made standard air distribution devices that harmoniously fit into the interior. An adapted calculation of the air distribution grid is presented to achieve this goal. In this article we present the results of the

study, which make it possible to assess the possibility of using the proposed technical solution for the most standard case.

**Keywords:** supply ventilation system; heat curtain; air curtain; public premises; energy efficiency.

## **ASSESSMENT OF ENERGY AUDIT EFFICIENCY IN THE HEAT SUPPLY SYSTEM OF THE EDUCATIONAL BUILDING NO. 1 (SAMARA STATE TECHNICAL UNIVERSITY)**

**A. N. Branfileva**

**Annotation.** The paper presents the results of the energy audit of the educational building No. 1 of Samara State Technical University (SamSTU). A generalized method for calculating heat losses based on heat transfer formulas is presented, as well as a method for studying a single-pipe heating system. The results of calculating heat losses through building enclosing structures (walls, windows, coverings, floors) are presented. For each classroom on floors 1-4, the required power of heating devices was calculated and the power of currently installed heating devices was estimated in terms of the required and consumed energy. It is established that the amount of heat consumed is 10...20 % higher than the calculated amount. We issued the recommendations for adjusting the power of heating devices in order to bring it to the calculated levels, which allowed reducing heat consumption up to 20 %. Also, studies of the attic space and mains of heating system were conducted, and it was found that the efficiency of thermal insulation of the mains is lower than acceptable. We made calculations required to select the optimal insulation thickness for each pipeline diameter, which saved another 4 % of the total heat loss. As a result of the energy audit, other recommendations were made to improve the single-pipe heating system.

**Keywords:** energy audit; calculation of heat losses; single-pipe heating system; heating devices; required power of heating devices; coefficient of thermal insulation efficiency.

## **IMPROVING LIGHTING REGIME IN PREMISES OF MUNICIPAL PRESCHOOL EDUCATIONAL INSTITUTIONS WITH THE PURPOSE OF INCREASING ENERGY EFFICIENCY**

**A. S. Gulbinas, D. N. Shirokova**

**Annotation.** We consider the main problems associated with maintaining and improving quality of the lighting regime and increasing energy efficiency in the main premises of kindergartens. The task is to determine theoretical connection between energy-efficient measures for lighting, carried out in buildings, and the qualitative and quantitative indicators of the lighting installation. To analyze the methods for assessing light environment in the premises of preschool educational institutions, a

model of universal interaction of elements in the lighting system was developed. A comparison of methods for determining energy efficiency of lighting systems of existing lighting installations is given. Based on the model, a method for determining the specific electricity consumption for lighting needs for each room is proposed. This method depends on the space-planning and operational characteristics of the room, actual level of lighting in the room as well as features of lighting installations. In conclusion we offer different options of possibilities for improving lighting regime.

**Keywords:** life quality; light environment; energy efficiency; natural and artificial lighting; lighting hygiene; lighting regime; biologically and emotionally efficient lighting; model of universal interaction of elements.

## **ANALYSIS OF EXPERIMENTAL SAMPLES OF DEVICES FOR PRODUCING FRESH WATER FOR AUTONOMOUS WATER SUPPLY SYSTEM USING SOLAR ENERGY**

**V. V. Mironov, E. A. Zhernakov, Yu. A. Ivanyushin, D. V. Mironov**

**Annotation.** Water and energy resources are among the most important factors in the development of human society. The demand for energy and safe water is growing. In regions with a shortage of fresh water, its production is often accompanied by the combustion of hydrocarbon resources, which negatively affects the environment. The aim of this work is to develop an energy-efficient environmentally friendly technology for the desalination of seawater and the production of fresh water, through its forced evaporation with subsequent moisture condensation. The process of obtaining fresh water is due to pre-saturated air in a closed thermodynamic cycle. The paper presents the thermal balance of modular installations. We offer experimental studies of the performance of two variants of desalination plants. Their comparison with each other and with theoretically possible productivity were carried out. The productivity of the technologies is sufficient for the autonomous supply of drinking water to individual settlements and for the cultivation of plant foods by the hydroponic method.

**Keywords:** water desalination; solar energy; autonomous water supply system; moisture condensation; hydroponics.

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

### **ANALYSIS OF URBAN PLANNING ASPECTS OF EDUCATIONAL ORGANIZATIONS DISTRIBUTION ON THE EXAMPLE OF VORONEZH CITY**

**P. A. Barzenkova, M. A. Vasilyeva, Yu. A. Vorob'eva, A. S. Volokh**

**Annotation.** The article is devoted to the issues of educational organizations distribution in the conditions of the existing urban development of Voronezh city. The concepts of availability and accessibility of educational institutions are described, the choice of methods for their calculation used in the work is substantiated. The results of the analysis of the accessibility and availability of school educational institutions of Voronezh city in accordance with the current codes and standards, as well as the specifics of calculating indicator of the maximum permissible level of territorial accessibility of schools in accordance with the local standard of urban planning are presented. Regularities of accessibility of city schools have been revealed both in historically developed districts under reconstruction conditions and in new high-density residential neighborhoods under construction. The uneven distribution of educational institutions in the structure of Voronezh is explained. The conditions and possibilities of designing general educational organizations in conditions of a lack of territory are evaluated. We provide the substantiation thanks to which it is possible to reduce the building area of the school without violating the current regulatory requirements. We consider the disadvantages of this approach, its consequences for the micro district. As well we offer possible solutions to the existing problems.

**Keywords:** educational organizations; school designing; pedestrian accessibility; open spaces planning.

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

### **ON TECHNOLOGY OF REMOTE MONITORING OF LIGHT POLLUTION IN CITIES**

**B. A. Popov, N. B. Khakhulina, N. A. Drapalyuk**

**Annotation.** The paper raises the problem of the complex influence of lighting on the state of urban ecosystems. Scientific and practical urban planning tasks are identified, which requires knowledge of the optical parameters of the urban environment. Examples of the negative impact of excessive lighting and ill-conceived spectral compositions on the health of humans and other living creatures are given. An approach to the analysis of the illumination parameters of urban areas is presented. The analysis of the possibilities of photogrammetric methods for monitoring the parameters of light pollution in cities is carried out. The possibility of analyzing the optical characteristics of the light field from color and black-and-white images is described. A method of photogrammetric recording of the parameters of light pollution in cities is proposed. The article describes the improvement of the reliability of the analysis of digital information about the optical parameters of territories using standards.

**Keywords:** light pollution; urban ecosystem; urban environment; illumination; photogrammetry; remote monitoring; decoding technics.

# AN EFFECTIVE WAY TO ELIMINATE THE ENVIRONMENTAL IMPACT THE LEACHATE OF SOLID WASTE LANDFILLS ON THE GEOSPHERE

**R. A. Agakishiev, I. V. Zhuravleva, N. N. Zlobina**

**Annotation** The filtrate of solid waste landfills is toxic, it can have 200 times more chemical oxygen demand than sewage. Deterioration of the ecological state of the environment due to landfills negatively affects human health, leads to dangerous diseases and even death. Before being discharged into the natural environment, the filtrate of solid household waste requires cleaning from pollutants with bringing them to the maximum permissible concentration for discharge into water bodies. In order to select an effective method of cleaning contaminants for the landfill projected in the city of Bobrov, Voronezh Region, the composition of waste water, well-known methods of treatment were analyzed. We compared the quality of high-turbidity wastewater treatment at various plants and proposed a technological scheme for a complex for the treatment of the leachate of a solid waste landfill, developed by OAO "ArkonLOS", which showed high purification efficiency and the use of treated water for irrigation of solid waste maps, which excluded the discharge of untreated wastewater into water bodies. The reagent-free complex provides waste-free cleaning of the solid waste filtrate, reduces the concentration of contaminants in the body of the landfill and the geosphere, provides disinfection and removal of inactive sludge, which can be successfully used in national and agriculture, construction. The complex is fully automated, the quality of cleaning complies with the standards of the World Health Organization (WHO). The block-modular complex is located in a standard container and has a mobile design. A favorable microclimate for the technological process and service personnel is maintained inside the container. All of the above facts allow us to assert the effectiveness and reliability of the decision and recommend the use of the complex for such landfills of solid waste in the Voronezh and other regions.

**Keywords:** solid waste landfill; drainage; filtrate; purification; ultrafiltration; sediment; polyelectrode reactor; permeate; hydrosphere.

## ROAD TRANSPORT, AGRICULTURE AND CONSTRUCTION MACHINES

### SUSTAINABLE DEVELOPMENT OF TERRITORIES AND ITS ENVIRONMENTAL COMPONENT IN THE IMPLEMENTATION OF THE SMART CITY PROJECT

**O. A. Sotnikova, E. A. Ryazantseva, R. A. Sheps**

**Annotation.** This article raises the problem of sustainable development of territories in the implementation of the Smart City project. One of the main components

of urban development is the environmental component. In this paper, the authors identify the main parameters for assessing environmental situation in an urbanized environment in order to make optimal management decisions. The dependencies that allow us to justify the information model of monitoring the state of the environment are considered. The main and dominant components of emissions and their sources are identified. Voronezh motor transport is considered to be the dominant source of emissions in the city. It is proposed to supplement and refine the existing mathematical model.

**Keywords:** urbanized territories; smart city; sustainable development; management; motor transport; ecology.

## **ECONOMICS AND ORGANIZATION OF CONSTRUCTION**

### **ECONOMIC JUSTIFICATION OF THE COLD RECYCLING TECHNOLOGY CHOICE IN THE REPAIR OF HIGHWAY AND ROAD SURFACES**

**V. Yu. Verbin, V. M. Dudin**

**Annotation.** In construction and major repairs of highways, a complex mechanized method is widely used, which is based on the use of modern technology, equipment and mechanisms. At the same time maximum productivity, minimum cost and optimal terms of work production are achieved. There are some approaches to the technologies choice for performance of construction and repair work. One of them is an economic comparison of different technologies, which allows you to take into account the most complete set of factors that affect the construction process. The application of this approach to the technology choice for major repairs of the highway surfacing is considered in this work. The technology of cold recycling is offered as an innovative one. We offer the order of actions that precede the choice of a particular technology, being based on the calculations performed when comparing different technologies for a particular road section.

**Keywords:** road surfacing; repair; cold recycling; economic analysis.

### **ECONOMIC INDICATORS OF ELECTRIC POWER COMPLEX DEVELOPMENT OF THE REPUBLIC OF SOUTH OSSETIA**

**K. N. Savin, A. V. Shelomentsev, V. V. Jabiev, O. V. Korobova**

**Annotation.** The article is devoted to the peculiarities of the functioning and development of the energy sector of the Republic of South Ossetia. The main institutional reserves for the development of the industry are analyzed, and measures are proposed to maintain the facilities of the energy complex in its working state, taking into account the financial assistance provided by the Russian Federation. The possibilities of building small hydroelectric power plants that can provide new enterprises

with the necessary energy capacity and act as backup generating electric energy facilities on the territory of the Republic are considered. In addition, the possibilities of selling electricity to the foreign market, taking into account alternative sources of electricity, at a reasonable economic tariff are analyzed. Conclusions are drawn about the main prospects and trends of providing the Republic with electricity, which is the basis of economic security and a key factor of political stability in the region until 2030.

**Keywords:** the Republic of South Ossetia; economy; budget; electric power; housing and communal services; economic security; essential services.

## **EFFECTIVENESS EVALUATION IN MODELING TECHNOLOGY OF COMPLEX MECHANIZATION SCHEDULING IN ERECTION PROCEDURE OF THE BUILDING FRAME**

**A. S. Sharova, S. I. Vakhrushev**

**Annotation.** This article examines the organizational and technical preparation of construction production by the equipment at the installation stage of the specified object. The efficiency of construction scheduling is substantiated by using the optimization of complex mechanization. In the course of selecting optimal complex of construction machines for the installation of the building frame in conditions of complete certainty, a network graph is developed. To find the most favorable version of events computational tools were used. The criteria for the solution of the problem of optimization of mechanization correspond to the given unit costs for the installation of one ton of steel structures. Based on the results of the calculation, the optimal solution was revealed. On the basis of the study of the complex mechanization optimization of construction, the improvement of the quality of the design work in the development of the schedule is discussed.

**Keywords:** optimization of complex mechanization; complex of machines; network graph; Dijkstra's method; given unit costs; information modeling.