BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES

RELIABILITY, DURABILITY AND SERVICE LIFE OF BUILDINGS AND THEIR STRUCTURAL COMPONENTS

G. D. Shmelev, A. N. Ishkov, N. A. Maleva

Annotation. Presents an analysis modern terminology in the field of reliability and durability of building structures, presented in the special literature, as well as regulated by the current regulatory documents of the Russian Federation. The absence of a unified approach to understanding the terms «durability», «reliability» and «probability of trouble-free operation» of building structures has been established. Identified duplication of definitions of the terms «durability» and «reliability» of building structures. The analysis shows that for «construction objects» the terms «durability», «reliability» and «probability of failure-free operation» are absolutely identical and, if they differ from each other, then only in minor nuances of linguistics of the Russian language. The authors of this article proposes refined definitions of the terms «reliability», «durability» and «probability of failure-free operation» of building structures and building materials. The term «durability» is recommended to refer to construction materials, and the term «reliability» to construction products, structures, as well as buildings and structures. The term «durability» the authors propose to understand the ability of building materials and soils to maintain mechanical, physical, chemical and technological properties and to ensure the normal operation of building structures, buildings and structures during the entire service life. The definition of the term «reliability» is proposed to be stated in the following edition - the ability of a construction object to perform the required functions during the entire period of normal operation. The term “probability of failure-free operation” is recommended to be interpreted as the probability of normal operation until the appearance of the first critical failure of supporting structures. The conclusions and recommendations presented in this paper can be used by expert communities in the field of technical construction and forensic expertise in the development of technical opinions.

Keywords: service life; durability; reliability; construction object; building structures; normal operation; overhaul.

ASSESSMENT OF THE CURRENT STATE OF THE PRODUCTION OF BUILDING MATERIALS AND PRODUCTS IN THE VORONEZH REGION

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Annotation. The complex assessment of the current state of production of main types of construction materials in the Voronezh region during 2005…2017 is carried out. The list of the systemically important enterprises of the industry is submitted

and the analytical description of the territorial scheme of their placement with the instruction on positive sides and the available shortcomings is given. Data on dynamics of production of cement, lime, precast concrete, small-pieces wall materials and nonmetallic materials in the territory of the region are provided. Characteristic of change of production capacities of the industry and volume of production in 2017 in comparison with 2013 is stated. The main reasons for decrease in the outputs and increase in level of wear of processing equipment of the industry of construction materials of the region are shown. On the basis of the carried-out SWOT analysis which allows to estimate in a complex strong and weaknesses and also also possibilities of the industry are perspective, the most significant problems of branch development are revealed. At the same time as the major factors causing development of the industry of construction materials the geographical location of the region, a condition of production base, investment attractiveness of the industry, security of citizens with housing, specifics of a source of raw materials, training, development of transport and engineering infrastructure were considered. By results of the carried-out assessment the general purpose and actions for increase in efficiency of functioning of the industry of construction materials of the Voronezh region are formulated.

Keywords: construction materials; dynamics of production; feature of the market; technological level of the enterprises.

ULTIMATE LOAD ON FRICTION PILES ON SOIL BASE BEARING CAPACITY WITH NEGATIVE SKIN FRICTION

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Annotation. Friction piles design on soil base bearing capacity is regulated by SP 24.13330.2011 «Pile foundations». The piles design is based on friction forces on pile lateral surface as a result of the pile «failure» (movement) and on reaction under the pile tip, which accepted for different soil types by tables 72 and 73 in SP 24. Firstly, the soil resistance forces $f(x)$ and R cannot reach the ultimate values at the same time. Secondly, the piles failure (movement) is not allowed in the structure and taking into account this condition by the introduction the safety factors introduces uncertainty in the results of piles design and behavior. Third, there are negative frictional forces at the piles lower end (tip) as a result of soil base reaction to the pile that are not taken into account in the SP 24. In this regard, the article presents the different approach to the pile design in soil base, in which the pile failure is not allowed and taken into account the friction forces on the lateral surface on the pile lower end in contrast to the existing method of piles design by SP 24.13330.2011. The approach consists in a piles test by measuring piles deformations reveals the pile place (section) along its length, where the deformation of the pile is equal to zero. This section divides the friction forces into upward forces at the pile top and downward forces at the pile bottom. The latter are caused by the reaction at the pile tip and the soil pressure. They are directed downwards and therefore called negative

friction forces. The description of these forces is given through the reaction at the pile tip in compression, the lateral pressure of the soil and other factors of individual origin. From the equation of equilibrium of all forces on the pile, we can find the length at the calculated value of the load or the ultimate load on the pile by the soil base bearing with replacing the stress at the pile tip with the value of ultimate design stress of the soil base. The problem lies in the non-traditional definition and consideration of the negative friction forces at the pile lower end and determining the pile length to ensure efficient use of the soil base bearing capacity. As a result, the article presents the design formulas, the examples of evaluation the pile bearing capacity and comparing the results of the pile design by existing standards.

Keywords: friction piles; soil design stress; friction forces; bearing capacity; design load; negative skin friction.

METHODOLOGY OF TECHNICAL CONDITION ASSESSMENT, FORECASTING AND JUSTIFICATION OF REMAINING SERVICE LIFE OF BUILDING STRUCTURES

G. D. Shmelev, M. S. Kononova, N. A. Maleva

Annotation. The description of the main provisions of the methodology for assessing the technical condition, design prediction and justification of the residual life of building structures developed in the framework of the survey and assessment of the residual service life of the buildings of the buildings of the Left Bank city sewer pumping station in Voronezh is given. In developing the methodology, the requirements of the existing regulatory and technical documents for the inspection of buildings and structures are taken into account. The basis of the computational forecasting methodology is the previously published work of the author. The method of computational forecasting is based on the following methods: expert, parametric, the method “load - bearing capacity” and the method “load - strain”. The key sections of the methodology are described, which are devoted to: the defining parameters of structures and the criteria for their evaluation; methods for predicting residual life of building structures.

Keywords: building structures; assessment of technical condition; residual service life; the pro-gnosis model; methods of forecasting.

ENGINEERING SYSTEMS AND COMMUNICATIONS

AIREXCHANGE OF THE MULTIPURPOSE UNIVERSAL SPORTSCOMPLEX

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Annotation. In article the question of importance of ventilation in a multipurpose sports complex is brought up. Ventilation is intended for removal of pollutants, supply of external (fresh) air to the room and for withdrawal of the allocated

vrednost. The main objective in this article to find out need of accounting of a factor of release of harmful substances when calculating air exchange for the sports facility in which versatile sports on one platform will be combined. If occupations take place in the room with the increased concentration of harmful substances, then the health of engaged will worsen considerably, and together with it also exacerbation of chronic diseases is possible. For health at sports activities of people can benefit only to the room with comfortable conditions of a microclimate for this reason it is necessary to pay special attention to this process. In materials of article need of the organization of ventilation systems for a sports complex on the basis of the existing normative documents on design, studying of space-planning solutions of buildings and also a type of trainings is proved.

Keywords: sports room; air exchange; ventilation, harmful substances, air quality, carbon dioxide

THE CHOICE OF HEATING SYSTEM FOR BUILT-IN RESIDENTIAL BUILDING PUBLIC ROOMS

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Annotation. Various types of heating systems and methods of laying pipelines used for built-in and attached rooms are considered. Advantages and disadvantages of various water heating systems are given. The comparative characteristic of various schemes of horizontal systems of water heating is carried out. It is shown that during the construction or reconstruction of the built-in-attached premises it is advisable to use horizontal two-pipe water heating systems with the upper wiring of highways for heating. It is proved that it is advisable to lay the supply line under the windowsill, and the reverse – at the floor. This saves heat and pipe material.

Keywords: horizontal systems of water heating; two-pipe and one-pipe; laying of pipelines.

INVESTIGATION OF THE DEFORMATION CHARACTERISTICS OF THE U-SHAPED COMPENSATOR, MADE OF THE THERMOSTABLE POLYETHYLENE PIPELINE

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Annotation. The investigations of the operating mode of the U-shaped compensator made of a polyethylene pipeline (PE-RT brand) using finished fittings of a socket type for welding as fittings have been carried out. The theoretical and experimental dependences of the elastic deformation force of compensators of various diameters and geometrical sizes are given. Recommendations on the design and location of fixed supports on pipelines are given. Experimental studies of the deformation characteristics of a U-shaped compensator made from a thermostable poly-

ethylene pipeline showed that, unlike steel compensators, there is a significant difference in the values of elastic deformation forces (in some cases more than twice) at different temperatures of the heat carrier. With increasing thermoplastic temperature, its mechanical properties change, in particular, the elastic deformation modulus and, consequently, the elasticity of radial compensating devices decrease. This in turn affects the design of fixed supports in the direction of simplifying and cheapening production. The results obtained can be used as reference data when designing compensating devices, designing fixed supports of polyethylene pipelines operating in heat networks with parameters up to 95 °C.

Keywords: U-shaped compensator; movable and fixed supports; force of elastic deformation.

THE DEFINITION OF ENERGY EFFICIENCY MECHANICAL VENTILATION WITH EMISSIONS

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Annotation. The description of features of work of systems of local exhaust ventilation with indication of their advantages and shortcomings is given. The factors determining the efficiency of exhaust systems are listed. The assumptions made in determining the calculated air exchange are formulated and the significance of the energy components of the system is justified. The measures to bring the system to the energy-oriented level are defined. The scheme of the ejector-ventilation unit for removal of significant gas mixtures from the room is proposed, which provides for the use of an ejector instead of a high-performance fan in an explosion-proof design. A methodical approach is presented, which takes into account the factors required to establish rational energy and environmental characteristics of local exhaust and supply ventilation systems of industrial enterprises with the division of emissions of harmful chemicals.

Keywords: ventilation; ejector; energy efficiency; industrial ventilation; mechanical ventilation.

CITY. RECONSTRUCTION, RESTORATION AND LANDSCAPING

URGENCY OF THE USE OF WARRANT TERRITORIES IN TOWN PLANNING ON THE EXAMPLE OF THE CITY OF VOLGOGRAD

N. V. Korosteleva, V. A. Dolganov, D. I. Azizov

Annotation. The article is devoted to the justification of the relevance of the use of ravine areas for urban purposes. To achieve this goal, the main problems and advantages of their development in cities were considered and options for possible use were determined depending on the characteristics of ravine areas. Particular attention is paid to the ravine areas of Volgograd. The article analyzed the ravine

fund for a number of criteria: by its location in the structure of the city; on the parameters of ravines; on the options for their urban use. On the example of Volgograd, the necessity of using ravines in the territorial development of the city is substantiated. For clarity, the most striking examples of urban planning use of ravine areas in Volgograd and other cities of the Russian Federation are considered.

Keywords: ravines; urban development; housing; landscape and recreational facilities; transport infrastructure.

ROAD TRANSPORT, AGRICULTURE AND CONSTRUCTION MACHINES

THE ACTUALITY OF THE CONSTRUCTION OF A TRANSPORT AND TRANSMISSION KNOT IN THE CITY OF VOLGOGRAD

N. V. Korosteleva, V. A. Basov

Annotation. The main transport problems of the city of Volgograd are considered. The General information of the existing situation of the transport infrastructure of the city as a whole is given and the situation in its southern part is considered in more detail. Based on the analysis of the urban situation of the city of Volgograd recommendations for solving existing transport problems are proposed. In particular, to solve the problem, the idea of building a transport interchange hub (TPU) in the Krasnoarmeysky district of the city of Volgograd was put forward. Its construction will improve the efficiency of the transport system of the district and the city as a whole.

Keywords: transport interchange hub; street and road network; capacity; transport infrastructure.

ECONOMICS AND ORGANIZATION OF CONSTRUCTION

INNOVATIVE MODERNIZATION OF MUNICIPAL INFRASTRUCTURE IN FINANCING TERMS ON THE BASIS OF PUBLIC-PRIVATE PARTNERSHIP

O. G. Shalnev, M. A. Shibaeva, E. Y. Okolelova

Annotation. Authors consider the approach to the modernization of public infrastructure with the involvement of private investment. The goals and tasks that need to be solved in the framework of improving the quality of public services are formulated. The ways of attraction of money for financing of actions for reconstruction and modernization of objects of municipal infrastructure are analyzed. The description of mechanisms of public-private partnership for attraction of private investments in the sphere of utilities is given. The implementation of this mechanism is designed to ensure maximum efficiency of operation and construction of public

infrastructure. Considered and analyzed the foreign experience of financing the modernization of public utilities. The cluster approach of the organization of work of housing and communal services as one of the directions providing modernization of municipal infrastructure and improvement of quality of utilities is offered.

Keywords: modernization; municipal infrastructure; housing and communal services; financing; public-private partnership.

EVALUATION OF TECHNICAL AND ECONOMIC EFFICIENCY OF TRANSPORTATION OF SOLID COMMUNAL WASTE

M. S. Kononova, E. A. Kryuchkova, A. K. Episheva

Annotation. The analysis of the situation in the field of collection and transportation of municipal solid waste in cities is carried out. The example of Voronezh shows the irrationality of waste disposal schemes associated with the uncontrolled conclusion of contracts between organizations serving buildings and transport companies. It is proposed to use specific fuel consumption per unit of mass of transported waste as a criterion for choosing an economically and environmentally validated option. This parameter will depend on the route length and fuel characteristics of the specialized transport. It is shown that the value of the route length may vary depending on the load capacity of the vehicle, the location of the transport base or intermediate assembly point. On the example of a residential district, route maps for several options for waste disposal using equipment with different capacity are developed, the results of the calculation of specific fuel consumption are given. The proposed criterion is recommended for use by regional operators to make an informed decision when concluding contracts with transport companies.

Keywords: municipal solid waste; domestic waste; waste collection and transportation; transport company; waste management; regional operator.