BUILDING CONSTRUCTION, BUILDINGS AND STRUCTURES

ASSESSMENT OF STABILITY OF LOAD-BEARING STRUCTURES IN NUMERICAL SIMULATIONS

D. N. Kuznetsov, N. A. Ponyavina, D. I. Emelyanov, V. G. Sazykin

Annotation. Numerical calculations of the stability of building structures require development of effective criteria for evaluating results. It is advisable to evaluate the results of structural stability calculations with regard to the geometric shape of the loss of stability and purpose of the structural element. The article considers the possibility of applying a sequence of structural stability reliability coefficients in which the coefficient values are ranked in order of increasing consequences of structural failures in a building or structure's construction system. We consider an example of numerical stability calculation of a test design scheme for a steel frame of a car service building. We carried out the calculation of the stability of a test two-storey frame building system with the SCAD Office calculation package, and give the calculation results. As well we perform analysis of the first three geometric forms of stability loss of the test frame system. It is confirmed that the application of the scale of differentiated values of reliability coefficients to assess the stability of structures will allow us to achieve a higher theoretical accuracy of calculations, material capacity and reliability in the design of buildings and structures. The materials of this article can be useful in designing and improving calculation methods for building structures.

Keywords: stability assessment; stability loss; numerical simulation; reliability factor; safety factor; design theory; calculation methods.

EXPERIMENTAL STUDY OF THE WORKABILITY OF WOODEN BRIDGES UNREINFORCED AND REINFORCED WITH CARBON FIBER TAPE UNDER STATIC LOADING

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Annotation. The paper describes an experimental study of the performance of a wooden bridge beam of natural dimensions, reinforced and unreinforced with carbon fiber tape, under static load effects for two series of samples. Compliance of the characteristics of the carbon fiber tape used as the external reinforcement for the wooden bridge beam with the regulatory requirements has been experimentally confirmed. Based on the test results, graphs of the dependence of shear on load were constructed for the studied samples of wooden bridge beams. During the experiments it was found that the bearing capacity and strength characteristics of a sample of a wooden bridge beam reinforced with a carbon fiber tape are 1.5 times higher compared to unreinforced samples. The experiments were carried out at the Voronezh State Technical University in the laboratory for testing building structures of

the Center for collective use named after Prof. Yu. M. Borisov using a proven universal hydraulic testing machine INSTRON 600 kN and a tensile testing machine INSTRON 5982 for monoaxial static tensile (compression) testing of carbon fibers according to GOST 1497.

Keywords: performance; bridge beam; carbon fiber; reinforcement; static load; normal stress; shear; strain measurement sensor; deflection meter.

ENGINEERING SYSTEMS AND COMMUNICATIONS

INFLUENCE OF EXTERNAL SUNSHIELDING DEVICES ON THE POWER OF AIR CONDITIONING SYSTEMS

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Annotation. The article considers the possibility of reducing load on air conditioning systems through the use of protection devices for translucent external barriers of buildings. It is recommended to install removable external awnings for the warm period of the year. We carried out some calculations to determine the amount of heat transfer through translucent barriers for various geometric parameters of external sun protection devices. We established that the length of the projection of shielding devices should be determined by the recommendations of the manufacturers, since for the northeast, east, west and northwest directions the projection of the devices, in accordance with calculations using existing methods, can exceed 2 m. That not merely complicates their installation but also does not allow us to ensure the normative insolation of the premises. As a result of calculations, we determined that under the climatic conditions of the Voronezh region, awnings made of dark fabric 1.2 m long, fixed over windows with an area of 2.6 m^2, reduce the penetration of solar radiation into the premises in July with a south orientation by 96%, with a southwestern orientation by 86 %, with eastern and western ones - by 84% and with northeastern and northwestern orientation – by 83 %. We assessed the required power of installed air conditioners. It was revealed that the use of light-shielding devices makes it possible to reduce the required power of indoor and outdoor units of split and multi-split refrigeration systems by 1.3-1.6 times

Keywords: air conditioning; solar radiation; heat input; translucent barriers; insolation.

PROBLEMS OF MODELING HYDRAULIC REGIME IN THE DEVELOPMENT OF THE SANITATION SYSTEM SCHEME OF THE SETTLEMENT AND POSSIBLE WAYS TO SOLVE THEM

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Annotation. The paper presents the results of modeling sewage network of a settlement in the geoinformation complex Zulu 7.0. The article presents the main

methods for determining terrain and constructing longitudinal profile of the sewage network. This is due to the particular importance of the influence of the parameters of the depth of the pipeline on the technical and economic indicators, as well as the slope of the section under consideration and the material of the pipes affect the hydraulic characteristics. When performing hydraulic calculations in an electronic model, these parameters are of decisive importance. The analysis of the effectiveness of constructing models of the sewage network is carried out on the basis of the most common method of determining terrain using SMTM3 electronic maps, as well as on the basis of design data on the topographic survey of the area under consideration. As well we present a variant of the design calculation in the software complex and the time of work on determining coordinate points of the Earth's surface based on the use of the GNSS satellite system.

Keywords: sanitation system scheme; electronic model; longitudinal profile; depth of laying; throughput capacity; geoinformation complex; sewage network; hydraulic calculation.

SUBSTANTIATION OF TAKING INTO ACCOUNT THE COMPLEX OF HUMAN PHYSICAL PARAMETERS IN THE DESIGN OF VENTILATION SYSTEMS

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Annotation. We carried out the analysis of existing normative documents and methodical literature used in the calculations related to the determination of heat and gas emissions from people engaged in various types of work. We revealed incomplete correspondence of specific heat emission to the characteristics of the intensity of the work performed for different types of activity, sex and age of people. As well we specified characteristics determining the concept of a *reference* (*average*) person for whom heat losses are normalized. Estimated values of heat dissipation by age categories are determined too. Also we present the graphs of energy expenditures and their specific values for men and women of different ages performing the following types of work: intellectual work, light work, work of average intensity, hard work. We compared the obtained values of energy expenditures with the data of normative documents for different categories of work. In the end we show relevance and necessity of considering data on heat, moisture, gas emissions from people, taking into account their physical parameters and other conditions in the design of microclimate systems.

Keywords: human physical parameters; reference person; average person; ventilation design; energy input; heat output; carbon dioxide emission; oxygen consumption.

APPLICATION OF A JET HYDRODYNAMIC PUMP IN THE CAVITATION REACTOR OF A HEAT GENERATING PLANT AND SIMULATION OF FLUID FLOW IN IT

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Annotation. The article presents a description of the schematic diagram of a heat-generating installation used as a heat source in a heating system using a jet hydrodynamic pump. We formulated the main advantages of using heat-generating installation with a jet hydrodynamic pump. We consider a simulation model of the heat-generating plant channels. We made design calculations for various heat-generation element channel options. The results obtained allow us to conclude that the use of these installations and their further implementation are promising.

Keywords: cavitation reactor; hydrodynamic pump; cavitation; thermodynamic system.

CITY. RECONSTRUCTION, RESTORATION AND LANDSCAPING

ISSUES OF DEVELOPMENT AND REORGANIZATION OF RECREATIONAL AREAS OF VORONEZH-CITY

T. V. Mikhaylova, M. S. Kononova, E. V. Sazonov

Annotation. We carried out analysis of the existing problematic planning elements on the territory of Voronezh-city. We determined a reduction in the areas used for public green spaces. As well we identified the main types of recreational zones currently operating on the territory of Voronezh-city and its suburban area. We considered offers for revising the functional purpose in favor of the development of recreational zones of an urban settlement in some areas, with their subsequent integration into the planning structure of the city and into the system of the urban framework of public green spaces.

Keywords: recreational zone; functional zoning; territorial planning; urban settlement planning; public green spaces; landscape.

ECOLOGY AND SAFETY OF THE URBAN ENVIRONMENT

STUDY OF RELATIONS BETWEEN GEOMORPHOLOGICAL, TECHNOGENIC, LANDSCAPE FACTORS AND TRAFFIC NOISE IN VORONEZH-CITY

T. I. Prozhorina, S. A. Kurolap, P. A. Sukhanov

Annotation. The article describes the study of the dependence of equivalent noise indicators from motor transport in the city of Voronezh when changing geo-

morphological and technogenic-landscape characteristics of the territory. All research is based on application of natural measurements and construction of noise level models by means of software. The work includes: analysis of topography influence on noise propagation for two sites with decreasing absolute terrain heights; assessment of noise protective screens influence in formation of motor transport acoustic pollution level; research of green plantations influence on traffic noise propagation. As well we revealed experimental dependences of the equivalent traffic noise level on the topography, noise protection screens and green areas.

Keywords: traffic noise; topography; green areas; noise screens; equivalent noise level.

ECONOMICS AND ORGANIZATION OF CONSTRUCTION

ECONOMIC INDICATORS OF THE INTRODUCTION OF AN INTELLIGENT ELECTRICITY METERING SYSTEM ON THE EXAMPLE OF THE TERRITORIAL GRID COMPANY «GORELECTROSET-VORONEZH»

A. A. Litvinov, M. S. Kononova, A. A. Kononov

Annotation. We carried out the analysis of the structure of the electricity distribution and sales market. Then we described the functions and relationships of the main facilities of the electric power industry with consumers of electric energy. As well we present the composition of the legal relations of the electricity sales market, taking into account the current legislation, on the example of the Voronezh region. The shortcomings of the existing structure of relationships between grid organizations that guarantee suppliers and consumers are described. That leads to the need for the maintenance of an accounting service that performs the functions of periodic monitoring of the correctness of meter readings transmission. Calculations were carried out to determine the costs of a territorial grid organization associated with the maintenance of the accounting service. We calculated the capital and operating costs for the installation of «intelligent» meter devices for all serviced consumers on the example of *Gorelektroset-Voronezh*. We demonstrated a significant reduction in operating costs due to a reduction in staff. The economic efficiency of the transition to an "intelligent" accounting system is justified, the payback period of it is less than 3.5 years.

Keywords: electric power industry; territorial grid organizations; electric energy accounting; electric energy transmission tariff.

ECONOMIC JUSTIFICATION OF FORMING MACHINES SETS FOR ASPHALT-CONCRETE WORKS IN ROAD CONSTRUCTION

V. A. Zhulay, Yu. N. Spasibukhov, A. N. Shchiyenko

Annotation. The article deals with the issues that arise at the stage of laying asphalt concrete mixtures while constructing a highway. We describe examples of organization and work schedule of a set of machines when laying asphalt concrete mixture at a real facility. We carried out the analysis of the productivity ratio of the main and auxiliary machines and determined the consequences of changing their optimal balance. We offer some measures to ensure the normal operation of a set of machines for laying asphalt concrete mixture. As well we formulate the conditions for the formation of machines sets for laying asphalt concrete mixture by a contractor in modern economic conditions. The key feature of these conditions is the need to include into the set of machines those ones that are on the balance sheet of the contractor, even if they are not optimal in terms of their technical and economic characteristics.

Keywords: road construction; laying of asphalt concrete mixtures; composition of a set of machines; productivity.

ORGANIZATIONAL, TECHNICAL AND METHODOLOGICAL PREREQUISITES FOR PROFESSIONAL TRANSFORMATION IN HOUSING AND COMMUNAL SERVICES

L. N. Chernyshov

Annotation. The article presents the prerequisites for the transformation of the personnel potential in housing and communal service enterprises. These changes in the industry are due to organizational, technical and technological shifts associated with extensive appearance of high-tech equipment and intelligent systems at the facilities of capital construction. It is noted that in the indicated conditions the evolution of professions occurs much faster. Today not performing functional duties but achieving final result is the focus of basic requirements to the employee. The author offers a solution to the problem of adapting qualifications that exist at present on the labor market to the requirements of the technological revolution. This solution involves implementation of the National Qualifications System initiatives, the main function of which is to introduce new professional standards into the field of labor and education.

Keywords: intellectual technologies; housing and communal services; educational program; professional standard; direction of training; qualification requirements; quality of education.

FEATURES OF THE INFLUENCE OF DOCUMENTARY ACCOUNTING OF TOLL MATERIAL ON THE FINAL ESTIMATE OF THE INITIAL MAXIMUM CONTRACT PRICE FOR CONSTRUCTION FACILITIES

E. N. Karpushko, M. S. Antonova

Annotation. The increase in the number of enterprises that use the system of processing of the customer's materials (tolling materials), while committing to fully return the recycled materials, while undertaking to fully return the recycled materials or use them in the construction process determines the need to develop clear guidelines, rules, regulatory documents reflecting the specifics of the construction industry. In most cases, the work performed from tolling materials allows the customer to shorten the execution time or save the cost of construction and installation work. The studies carried out during the writing of the article are aimed at identifying features of accounting for toll materials to be supplied when determining cost of construction or installation work, or while registration of acts of work performed. In the publications of the authors, there are different points of view on the theoretical interpretation of the content of the concepts «tolling materials», «contract estimate», «initial maximum contract price», as well as modern positions on the application of concepts in the construction industry. We analyzed legal aspects, accounting, as well as regulatory documents governing relationship between the customer and the contractor. We paid a special attention to the concept of «tolling», as an example of the use of materials on a give-and-take basis abroad. We present the advantages and disadvantages of the use of tolling materials for the customer and the contractor. As well we developed recommendations on the inclusion into the terms of the contract of information on the supply of the contractor with materials for fulfilling construction.

Keywords: construction contract; tolling materials; contract estimate; tolling; customer; contractor; accounting.