



Scientific and technical journal.
The journal is published since 2013.
The journal is published 4 times a year.
№3(39), 2022
(August-September)

Editor-in-chief

V. A. Ilyichev *academician of the RAACS, Doc. Sc. Tech., Prof.*

Editor-in-chief assistants

S. G. Yemelyanov *corresponding member of the RAACS, Doc. Sc. Tech., Prof.*

V. I. Kolchunov *academician of the RAACS, Doc. Sc. Tech., Prof.*

Editorial committee

V. N. Azarov *Doc. Sc. Tech., Prof.*

E. M. Akimkin *Candidate. Sc. Socail.*

V. V. Aleksashina *Doc. Arc., Prof.*

I. A. Aseva *Doc. Sc. Phil., Prof.*

N. V. Bakaeva *Doc. Sc. Tech., Prof.*

T. Bock *Doc. Sc. Tech., Prof. (Germany)*

H. Brandl *Doc. Sc. Tech., Prof. (Austria)*

V. V. Bredihin *Doc. Sc. Econom., assoc. prof.*

W. D. Yu *Doc. Sc. Tech., Prof. (Taiwan)*

A. G. Bulgakov *Doc. Sc. Tech., Prof.*

A. A. Volkov *corresponding member of the RAACS*

Doc. Sc. Tech., Prof.,

V. A. Gordon *Doc. Sc. Tech., Prof.*

V. A. Egorushkin *Cand. of agricultural sc., assoc. prof.*

H. S. Yezhov *Doc. Sc. Tech., Prof.*

V. I. Ledenev *Doc. Sc. Tech., Prof.*

K. I. Liseev *Doc. Sc. Filos., Prof.*

V. V. Nedelin *Prof.*

N. Nikolov *foreign member of RAACS, Doc. Sc. Tech., Prof. (Bulgaria)*

V. I. Osipov *academician of the RAS, Doc. Sc. Tech., Prof.*

O. V. Pilipenko *Doc. Sc. Tech., Prof.*

O. V. Sergeychuk *Doc. Sc. Tech., Prof. (Ukraine)*

V. I. Telichenko *academician of the RAACS,*

Doc. Sc. Tech., Prof.,

V. V. Tur *Doc. Sc. Tech., Prof. (Belarus)*

N. P. Umnyakova *Doc. Sc. Tech., Prof.*

V. S. Fyodorov *academician of the RAACS,*

Doc. Sc. Tech., Prof.,

N. V. Fyodorova *Doc. Sc. Tech., Prof.*

R. Shah *Doc. Sc. Tech., Prof. (Germany)*

M. V. Shubenkov *academician RAACS, Doc. Arc., Prof.,*

I. L. Shubin *corresponding member of the RAACS,*

Doc. Sc. Tech., Prof.

Responsible for edition

A. G. Kolesnikov *Candidat Sc. Tech, assoc. prof.*

The edition address: 305040, Kursk, str. 50 let Octyabrya, 94

+7 (4712) 22-24-61, www.swsu.ru

E-mail: biosfera_swsu@mail.ru

Journal is registered in Russian federal service for monitoring communications, information technology and mass communications

The certificate of registration: **ИИ № ФС77-56639**

© Southwest State University, 2022

© Orel State University named after

I.S. TURGENEV, 2022

© Bryansk state engineering and technological university, 2022

© Research institution of construction physics under the RAACS, 2022

© Moscow State University of Civil Engineering

(National research university), 2022

© Volgograd State Technical University, 2022

BIOSPHERE COMPATIBILITY: HUMAN, REGION, TECHNOLOGIES

The founders

- Federal state budget educational institution of higher education «Southwest State University»
- Federal state budget educational institution of higher education «Orel State University named after I.S. Turgenev»
- Federal state budget educational institution of higher education «Bryansk State Engineering and Technological University»
- Research institution of construction physics under the Russian academy of architecture and construction sciences
- Federal state budget educational institution of higher education «Moscow State University of Civil Engineering (National Research University)»
- Federal state budget educational institution of higher education «Volgograd State Technical University»

Journal is included into the List of the Higher Examination Board of the Ministry of Education and Science of Russian Federation for the group of scientific specialties 2.1 – Building and architecture: 2.1.4, 2.1.7, 2.1.12, 2.1.13

Contents

Questions of the theory of biospheric compatibility of the cities and settlements

Ptichnikova G.A., Antyufeev A.V. City, region, biosphere: social, environmental and humanitarian impacts of hydropower construction..... 3

Environmental monitoring, humanitarizing balance and rationing

Shubin, I.L., Strongin, A.S. Key factors of influence of engineering equipment of buildings on carbon footprint indicators 12

Sborshchikov, S.B, Zhuravlev, P. A. Organizational schemes of reengineering territories and buildings 21

Suzdaleva, A.L., Tskhovrebov, E.S. Development of the system of natural and anthropogenic complexes as a factor of ensuring environmental safety of territory..... 31

Sysoeva, E.V., Slesarev, M.Y., Gelmanova, M.O. Analysis of pm2.5 fine particle dispersion under different scenarios of urban greening 45

Biosphere technologies

Gavrish, O.P., Derbasov, N.M., Gavrish, V.M., Morozov, A.G. The use of cavitation effect in the production of organic fertilizers..... 60

Problems and programs of regions development

Korobeinikova, A.E. The influence of wind protection measures on the reduction of aeration discomfort on the example of the rocky microdistrict of the city of Murmansk..... 70

Ecological safety of construction engineering and municipal services

Pchelenok, O.A., Abramov, A.V., Yakovleva, S.N., Kozlova, N.M. Regularities of formation of toxic decay products of agrochemicals and their influence on air quality in urbanized territories 81

Leptyukhova, O.Yu., Kukin, D.Yu. Use of land in areas with special conditions of use in housing construction..... 91

Shestakov, N.I., Chertes, K.L., Tkach, E.V. Comparative analysis of biopositiveness of design solutions of objects of the road and transport complex..... 106

The cities developing the person

D'yachkova, O.N., Mikhailov, A.E. Methodology for estimation of recreational load on local parks..... 123

Dear authors! 136

G.A. PTICHNIKOVA, A.V. ANTYUFEEV

CITY, REGION, BIOSPHERE: SOCIAL, ENVIRONMENTAL AND HUMANITARIAN IMPACTS OF HYDROPOWER CONSTRUCTION

The article reveals the problem of taking into account the negative impact of hydropower facilities on the biospheric resources of the region, in general on the quality of the human environment, as well as on the sustainable development of cities and rural settlements. The authors propose approaches to assessing this impact in the development of territorial planning documents. The substantiation of the obtained results is carried out on the example of the impact of the Volzhskaya water-power plant on the natural complex of the region, as well as cities and towns of the Lower Volga region in the Southern Federal District of the Russian Federation. The article proposes economic and environmental-technological approaches to reduce the negative impact of HPPs.

Keywords: cities, settlement system, natural complex, biosphere, territorial planning, hydraulic structures, Volzhskaya water-power plant

I.L. SHUBIN, A.S. STRONGIN

KEY FACTORS OF INFLUENCE OF ENGINEERING EQUIPMENT OF BUILDINGS ON CARBON FOOTPRINT INDICATORS

Reducing the carbon footprint is one of the most important tasks of our time, the solution of which will bring us closer to an acceptable level of anthropogenic impact on the biosphere. The legal prerequisites for the development of the climate agenda in the country, the development of climate projects and energy-saving technologies in all segments of the economy are being created. Engineering equipment of buildings is a major consumer of materials and energy resources, makes a significant contribution to greenhouse gas emissions. The development of a scientifically based method for predicting the carbon footprint will allow to formulate requirements for engineering equipment at all stages of the life cycle of the building. The classification of building elements that form the "carbon footprint" is carried out. The key factors of the influence of engineering equipment of buildings on the carbon footprint indicators are analyzed.

It is noted that due to the warming of the climate, the role of cooling systems in the structure of energy consumption of the building is increasing. The environmental efficiency of refrigeration systems is determined by a combined indicator that takes into account direct and indirect greenhouse gas emissions. For an objective comparison of refrigeration systems, it is proposed to use energy consumption indicators reduced to the consumption of primary fuel. A comparative calculation of the carbon footprint with various options of the refrigeration equipment in a shopping and entertainment center is carried out. Refrigeration machines with full and partial heat recovery in an air-cooled condenser (an option for heating water for hot water supply), as well as without heat recovery, are considered. It is shown that heat recovery improves the environment by reducing carbon dioxide emissions by 1.9 ÷ 2.2 times.

Keywords: carbon footprint, engineering equipment, energy consumption, refrigeration, global warming potential

S.B. SBORSHCHIKOV, P. A. ZHURAVLEV

ORGANIZATIONAL SCHEMES OF REENGINEERING TERRITORIES AND BUILDINGS

The article is devoted to the formation of organizational schemes for the reengineering of territories and development. It is stated that the effectiveness of the implementation of the investment program and construction projects for the transformation of territories and buildings depend on the quality of organizational solutions of reengineering. The main components of the organizational solution of reengineering of territories and buildings are investigated: organizational forms and factor of placement, organizational scheme of management and resource supply. The specifics of the interaction of participants in investment and construction activities within the engineering management scheme are analyzed. The variants of the functioning of the construction organizer are considered, including: the engineering structure of the developer or the owner of the capital construction object, an independent engineering company and a division of an engineering company. It is indicated that the above options differ in the complexity and scale of the tasks to be solved within the framework of reengineering of territories and development.

Keywords: investment program, investment and construction project, reengineering of territories and buildings, management and organization of reengineering, organizational schemes of reengineering, resource provision, pre-investment stage.

A.L. SUZDALEVA, E.S.TSKHOVREBOV

DEVELOPMENT OF THE SYSTEM OF NATURAL AND ANTHROPOGENIC COMPLEXES AS A FACTOR OF ENSURING ENVIRONMENTAL SAFETY OF TERRITORY

The paper reveals the author's idea of preventing this negative impact by organizing special buffer zones between residential and protected natural territories, within the boundaries of which a nature-like, resource-saving way of life is carried out - natural and anthropogenic complexes. The object of the study was the process of preventing, reducing the level of negative impact of life support facilities on the state of the environment of residential and natural territories. The study is also dictated by the need to clarify the specifics of the legal regulation of the use of land for the purposes of placement, development of natural and anthropogenic objects. The purpose of the work was the formation of a concept, conceptual apparatus, methodological approaches in the field of implementation of mechanisms for the creation and long-term development of a system of natural and anthropogenic complexes as a factor in ensuring environmental safety of regions, the transition of the national economy to a resource-saving technological way of sustainable development. The objectives of the study are: disclosure of the legal regulation of the concept of "natural-anthropogenic object" defined in the Federal Law "On Environmental Protection"; establishment of principles, mechanisms, requirements and recommendations for the creation, protection, reconstruction, development of natural-anthropogenic objects and their complexes as an interconnected natural-technical system for rational use natural resources, restoration of biological diversity, provision of favorable living conditions for the population, environmentally safe development of natural and residential territories. The research methods determined: system analysis, systematization, classification, qualification, exposure, composition, integration. Based on the results of the study, the basic principles of the creation and development of natural and anthropogenic complexes were formed, their composition, structure and stages of formation were determined. The target indicators of ecological resource, socio-economic efficiency of functioning of natural and anthropogenic objects and their complexes of interregional, regional and local levels are presented. The results of this work can be used in the development of strategies and concepts, long-term plans and programs for the development of rural, urban, natural territories, recreational, recreational recreation areas of the population. As a practical implementation of the research results, a draft of the national standard PNST-2022 "Natural and anthropogenic objects and complexes" was developed, planned for inclusion in the National Standardization Plan for 2022, proposals were made for the development and expansion of the legal framework establishing requirements for the placement, organization, operation of these facilities.

Keywords: natural and anthropogenic objects and complexes, region, resource conservation, residential area, complex development of territory, environmental safety, life support, secondary resources

E. V. SYSOEVA, M. Y. SLESAREV, M. O. GELMANOVA

ANALYSIS OF PM_{2.5} FINE PARTICLE DISPERSION UNDER DIFFERENT SCENARIOS OF URBAN GREENING

High rates of urbanization and motorization of the population have led to a significant problem of dustiness of the urban air environment with fine particles PM_{2.5}, which are among the most dangerous air pollutants. One of the effective ways to solve the problem of dustiness of large cities by PM_{2.5} particles is landscaping urban areas. The objective of this study is to develop a dust pollution simulation model in ENVI-met software enabling to assess concentration of fine PM_{2.5} particles in the city atmosphere taking into account the influence of meteorological characteristics, construction parameters, urban landscaping, for four scenarios of territory landscaping, assessment of their effectiveness in PM_{2.5} trapping and analysis of dispersion schemes of fine PM_{2.5} particles under various scenarios of urban territory landscaping in order to improve environmental safety of the territory. The ENVI-met calculation results revealed that scenarios with flat landscaping (lawn, "green" roofs) lead to a decrease in PM_{2.5} concentrations to 2-4 µg/m³ compared to the scenario without landscaping. In the scenario with flat and volumetric landscaping (trees) the reduction of fine particles in some areas reaches 10 µg/m³, but in some places the PM_{2.5} concentration increases due to the change of wind flow direction and reduction of its speed due to obstacles in the form of trees. Thus, landscaping of urban areas is an effective tool to reduce dust pollution in order to ensure and improve the environmental safety of the urban environment, maintaining the health and well-being of the urban population.

Key words: air pollution, motor vehicle emissions, fine particles PM_{2.5}, CFD modeling, ENVI-met, greening, green roofs, urban planning, urban environmental safety

O.P. GAVRISHI, N.M. DERBASOV1, V.M. GAVRISHI, A.G.MOROZOV

THE USE OF CAVITATION EFFECT IN THE PRODUCTION OF ORGANIC FERTILIZERS

Organic fertilizers are local type fertilizers and their use is necessary for the long-term preservation of soil fertility. At the moment market value of organic fertilizers does not exceed several percent, although in the 70-80s of the 20th century a serious scientific base was developed on the use of organic fertilizers as a technique for human impact on increasing the nutrient cycle in nature and the surrounding biosphere.

Article describes two-stage technology for producing organic fertilizers from biohumus. This technology is also useful for the turf, sapropel, leonhardite and other raw materials. The positive effect of application of cavitation reactors for producing humates is confirmed. Also, the grainsize analysis, growth of water-soluble fraction after the cavitation treatment and variations of pH-level were investigated.

Keywords: biohumus, vermicompost, cavitation, organic fertilizer, biosphere compatibility

A.E. KOROBEGINIKOVA

THE INFLUENCE OF WIND PROTECTION MEASURES ON THE REDUCTION OF AERATION DISCOMFORT ON THE EXAMPLE OF THE ROCKY MICRODISTRICT OF THE CITY OF MURMANSK

Urban development and sustainable development of territories in the Arctic zone of the Russian Federation is an urgent and important task facing modern urban planners [1,2,3]. This attention is largely due to the development of the Northern Sea Route (NSR) and its port cities [3]. To develop these cities means to provide comfortable living conditions for local residents and visiting specialists. However, given the harsh climate in the Arctic zone of the Russian Federation, this task requires a more thoughtful approach [4]. Modern urban planning approaches developed for flat areas with a relatively comfortable climate cannot be applied to sloping areas without deterioration of the quality of the habitat [5]. The comfort of the living environment is influenced by many factors, and one of them is the aeration regime. Previous studies have revealed the features of the formation of the aeration regime of residential development on the sloping territories of Arctic settlements, as well as to test the results obtained in a design experiment to assess the aeration regime of the Skalny microdistrict in the city of Murmansk [6]. However, in order to create the aeration comfort of the existing building, a project of wind protection measures is needed, which will reduce the proportion of uncomfortable zones. The presented study examines the issue of the impact of wind protection measures on reducing the share of uncomfortable in residential areas in the sloping territories of the Russian Arctic. The results obtained can be applied to the development of territory planning projects and improvement projects of Arctic settlements, as well as to adjust the aeration regime of existing residential development in Arctic cities.

Keywords: AZRF, Murmansk, aeration regime, wind protection measures, comfort of the living environment, slope territories, CFD modeling.

O.A. PCHELENOK, A.V. ABRAMOV, S.N. YAKOVLEVA, N.M. KOZLOVA

REGULARITIES OF FORMATION OF TOXIC DECAY PRODUCTS OF AGROCHEMICALS AND THEIR INFLUENCE ON AIR QUALITY IN URBANIZED TERRITORIES

In connection with the emerging trend of withdrawing agricultural land from circulation and their active development, the task of assessing the air quality of urban areas is relevant. It is shown that it can be solved by numerical methods, however, this requires preliminary experimental data on the concentration of harmful substances in the air. This problem is solved on the example of the territory of the city of Orel. Experimental data were obtained on the concentration of hydrogen chloride and hydrogen cyanide in the air, which are formed in the soil as a result of the decomposition of organochlorine pesticides and enter the atmosphere through a biological filter. According to the data obtained, during the first month after the introduction of the pesticide, a gradual increase in the concentration of gaseous substances in the air is observed according to a law close to polynomial. As a result, by the end of the first month of the experiment, the concentrations of hydrogen chloride and hydrogen cyanide in the air exceed the MPC values and are: on the territory of agricultural land $c_{\text{HCl-c}} = 6 - 7.5 \text{ mg/m}^3$, $c_{\text{HCN-c}} = 0.8 - 1.3 \text{ mg/m}^3$, on the territory of residential development: $c_{\text{HCl-g}} = 3.8 - 5.2 \text{ mg/m}^3$, $c_{\text{HCN-g}} = 0.3 - 0.35 \text{ mg/m}^3$. In the next 60 days, a decrease in the concentration of these substances is observed according to a law close to polynomial, and in the following days - to a linear one.

As the results of the analysis show, the obtained values can be used for numerical modeling of the processes of pollutant migration in the air in the numerical solution of the equations of the PHREEQC model.

Keywords: air quality, urban area concentration of hydrogen chloride, concentration of hydrogen cyanide.

O.YU. LEPTYUKHOVA, D.YU. KUKIN

USE OF LAND IN AREAS WITH SPECIAL CONDITIONS OF USE IN HOUSING CONSTRUCTION

The article discusses the possibilities of using land plots intended for the integrated development of the territory and located within the boundaries of zones with special conditions for the use of the territory, in order to accommodate residential development. The authors analyzed the limitations of certain types of zones with special conditions for the use of the territory in order to determine the possible types of permitted use of land plots. A method is proposed for taking into account the limitations of the functional use of land plots that are simultaneously located within the boundaries of several zones with special conditions for the use of the territory, by selecting the types of permitted use of land plots that are acceptable for use. The result of the conducted research is a list of types of permitted use of land plots that can be assigned to a land plot located within the boundaries of one or more zones with special conditions for the use of the territory.

Keywords: urban planning, zones with special conditions for the use of territories, types of permitted use.

N.I. SHESTAKOV, K.L. CHERTES, E.V. TKACH

COMPARATIVE ANALYSIS OF BIOPOSITIVENESS OF DESIGN SOLUTIONS OF OBJECTS OF THE ROAD AND TRANSPORT COMPLEX

When choosing a design solution for road transport facilities, a feasibility study and analysis of the impact of environmental aspects on the environment are required. The article considers the fundamental possibility of using the hierarchy analysis method to evaluate the numerical parameter of biopositivity when choosing the type of reinforcement of cones of bridge structures. The main purpose of this study is to develop and apply methods for calculating the numerical indicator of biopositivity, taking into account the criteria of environmental assessment, as well as testing the proposed methodology on known design variants of road transport facilities. As an object for calculation, various variants of structures for strengthening the soil cones of embankments of bridge structures are presented. A group expert assessment was carried out in the analysis of the weight of biopositivity criteria. To assess the degree of closeness of the relationship between the criteria of biopositivity, the concordance coefficient was used, the obtained value of which indicates the existing relationship between the opinions of experts. It has been established that the criteria associated with vibration exposure and emissions into the atmosphere have the highest values. The method of pairwise comparison was used to calculate the parameters of biopositivity according to the selected criteria with the establishment of the weight of each of them. According to the values obtained, a graphical interpretation of the results obtained and a summary table of estimated indicators are presented. According to the results obtained in the work, the most effective variant of the type of strengthening the cones of bridge structures was established, in terms of minimal negative impact on the environment. Using the presented methodology, it becomes possible to evaluate the biopositivity indicator comprehensively and use it in justifying the choice of design solutions for road construction facilities.

Keywords: Road transport complex, biopositivity criteria, environmental assessment, hierarchy analysis method, pairwise comparison method, global environmental impact, embankment cones of bridge structures

O.N. D'YACHKOVA, A.E. MIKHAILOV

METHODOLOGY FOR ESTIMATION OF RECREATIONAL LOAD ON LOCAL PARKS

Ensuring universal access to safe, accessible and inclusive green spaces and public spaces, especially for women and children, the elderly and persons with disabilities, is enshrined in the 2030 Agenda for Sustainable Development (Goal 11, Target 11.7).

The objects of study are local parks located in residential areas of the city. The subject of the study is socio-demographic and natural-ecological indicators that determine the recreational load.

When a number of conditions are met, the mathematical expectation is calculated as the sum of the probabilities of the action performed based on a comparative analysis of the relative values of the system of parameters. The application of the technique makes it possible to bypass the difficulties that may arise in the absence of absolute indicators for assessing the recreational load.

The developed methodology is relevant for decision makers at the stages of the life cycle of urban green spaces, to determine the degree of their workload and planning the development of natural areas.

Keywords: *urban planning, urban economy, sustainable development, park, availability, recreation, ecology, open data, load*