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# 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»
- Federal state budget educational institution of higher professional education «Volgograd State University of Architecture and Civil Engineering»

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G.T. AMBROSOVA, A.V.KRUGLIKOVA

## **IMPACT OF NATURAL CONDITIONS ON THE EFFICIENCY OF OPERATION OF WASTEWATER TREATMENT PLANTS**

*Today wastewater treatment plants (WWTPs) are calculated on temperature of the waste water coming to the inlet chamber without its cooling or heating up in the course to cleaning in open constructions: primary and secondary tanks and aerotanks. The mathematical models that are currently used for the calculation of structures and mechanical biological treatment, the liquid waste temperature are one of the most important indicators. The authors analyze current methods of major facilities calculating employed in the Russian Federation in designing sewage treatment complexes. The authors of this paper made an attempt to develop recommendations on the employment of mathematical models proven and widely used in thermal engineering which make it possible to predict the temperature changes in open facilities for a particular area of design to a fairly high degree at the stage of WWTPs design. For these purpose the authors of the article analyzed in details the work of several functioning WWTPs according to laboratory production supervision of these objects. The work of WWTPs efficiency evaluation was made on indicators of the initial and purified liquid waste during the different periods of a year, at the same time receipt of drains mode, the project technological parameters, and the technical condition of an object and level of its operation were considered. Was found out that in a case of approach of negative temperatures, the quality of the cleared drains, began to decrease slowly and reached the worst indicators in December-January when temperature of external air could fall to the minimum values (-40 or - 45°C). For today such work in the field of sewage treatment practically is not being done.*

**Key words:** temperature; wastewater treatment plant; aerotanks; cooling; heating.

T.F. ELCHISHCHEVA

## **HUMIDITY REGIME OF PREMISES OF BUILDINGS WITH PRODUCTION ENVIRONMENTS CONTAINING HYGROSCOPIC SALT**

*External walling premises of industrial buildings are often exposed to certain hygroscopic salts and mixtures thereof, which increase the sorption properties of wall materials, cause the waterlogging and reduce their moisture conditions of production of production facilities. Publications and sections in regulatory documents relating to the study was analyzed. It was found that up to the adoption of SP 23-101-2004 "Design Thermal protection of buildings" in the calculation of partial pressure of the saturated water vapor was taken into account only one kind of salt in indoor air at an internal temperature of 20 ° C, which is rarely possible in the real production. In the regulatory documents adopted later, SP 50.13330.2010 and SP 50.13330.2012, recommendations for determining the value of partial pressure of the saturated water vapor in view of the aggressive saline environment lacking. In the present study identified the need to consider not only the impact of individual salts, but in particular their mixtures, the ambient temperature and the type of salt, crystallizing from the solution in the humidity regime premises of industrial buildings. This is associated with significant difference between quantities of saturated partial pressure of the saturated water vapor of water vapor above aqueous solutions individual salts and their mixtures on the partial pressure of saturated water vapor above the water. The paper presents a procedure for engineering calculation of partial pressure of the saturated water vapor in the presence of in the indoor environment of salts and mixtures thereof, and different temperatures. Data for multicomponent solutions obtained by formulas adopted in analytical chemistry. The calculation results allow carrying out the selection of the type and thickness of the inner layers and the protective coating walls for the effects of aggressive environment.*

**Keywords:** humidity conditions, hygroscopic salts, crystal hydrates, exterior building envelope, the partial pressure of saturated water vapor.

V.V. STROKOVA, V.V. NELJUBOVA, M.D. RYKUNOVA, E.K. KALATOZI

## **PHYTOTOXICITY ASSESSMENT OF COMPOSITES WITH BIOCIDAL COMPONENTS**

*One of the biggest problems of our time is a rapid increase of consumer needs. This gives rise to an increase in production volumes, and as a result, an increase in the formation of industrial waste, which in turn violates the ecosystem balance, restore is not naturally possible. Among the most dangerous impacts of building materials include biological corrosion associated with the products of activity of microorganisms. With the expansion of the range of produced materials and products the biological agents adapt to new conditions and may render useless practically everything that man has created. The most dangerous microorganisms include mycelial fungi, the effects of the process which leads to disruption of the integrity of the microstructure of the material, reduce the operational period of constructions and facilities, deterioration of the aesthetic properties of the object and create the conditions for the formation of infectious disease outbreak indoors. Environmental immunity of materials is achieved mostly by incorporation of chemical remedies. In work results the effect of the composition of the samples with biocidal additives of different chemical bases on biopsitive composites with their application via toxicological rapid assessment based on the germination of seeds of cereals (Fitotest) It shows the trend of growth in seed in extracts with various concentrations of biocides. Marked growth of test cultures at all types of extracts. During the experiment, it was found that chosen concentration of biocide additives in the material do not have a toxic effect on the environment, which indicates the safety of the composites for the people and their invulnerability to the impact of pathogenic microorganisms.*

**Keywords:** biocorrosion, mold fungi, biocides, gypsum, cement, toxicity, fitotest.

D.A. LOBACHEV, V.Z. ABDRAKHIMOV, E.S. ABDRAKHIMOVA, S.N. PICHKUROV

## **THE USE OF ASH-AND-SLAG MATERIAL AND WASTE OF GOLD DEPOSITS IN THE PRODUCTION OF CERAMIC BRICKS**

*The ecological situation in Russia is characterized by a high level of human impact on the natural environment, significant environmental effects of past economic activity. In 40 regions of Russia 54% of the urban population are exposed to polluted air, sewage water is treated well enough in almost all regions of the country the condition of the land deteriorates.*

*Given that currently, natural resources on the verge of exhaustion, it is necessary to promote the involvement of waste production cycle for the manufacture of construction materials. This excludes exploration costs, construction and operation of open pits, are released significant land from the impact of negative anthropogenic factors.*

*In cost of building houses, the proportion of ceramic bricks is 15-25%. The cost of raw materials in the production of ceramic bricks sometimes up to 40-45%. In this regard, the problem of reduction in the price of raw materials in brick production in Russia is of particular relevance. One aspect of this problem is the use of industrial wastes in the production of ceramic materials.*

*For the first time with ash material and waste of gold deposits on the basis of beidellite obtained clay ceramic bricks, which is confirmed by patent of the Russian Federation. The obtained ceramic bricks corresponded to the marks M100-125. Currently, the efficiency of all industries should be assessed from the point of view of the balance between the weight of the main product and the volume of generated industrial waste. The use of waste materials in the production of ceramic materials will allow to disposal of waste, to save scarce traditional natural materials, to expand the raw material base of construction materials and will make a significant contribution to environmental protection.*

**Keywords:** ash-and-slag material, the waste of gold deposits, beidellite clay, ceramic brick.

N. LYUBOMIRSKIY, S. FEDORKIN

## SCIENTIFIC AND TECHNOLOGICAL PRINCIPLES RECYCLING CARBON DIOXIDE IN BIOPOSITIVE BUILDING PRODUCTS

*It is shown that one of the most effective ways of reducing the concentration of carbon dioxide in the atmosphere is the development and introduction of technology of building materials and products based on lime-containing compositions, in which the hydration is replaced by solidification astringent carbonation. Filler in the lime of the carbonate of hardening systems it is advisable to use the carbonate raw materials – fine wastes from the mining of limestone. The results of experimental studies to determine the optimum content of carbon dioxide in carbonizing artificially created environments and the regularities of formation of structure and properties of lime-calcium carbonate systems carbonate hardening. It is shown that by changing the composition, CO<sub>2</sub> concentration and the time of forced lime carbonation hardening of lime carbonate calcium system one can regulate the degree of portland particle carbonation and manage the structure and the properties of products, produced on their basis. The defining technological principles that manage the processes of forced lime carbonation and the products of lime based compositions are controlled CO<sub>2</sub> (40–60%) concentration in air-gas carbonated environment and the use of lime scrap as a filler. The use of tough crystallized marble-like limestone as a filler in limestone-calcium carbonate compositions gets one a water-resistant material in an hour of forced carbonation hardening, with the compression strength of 60 MPa with the average density of 2170 kg/m<sup>3</sup>. Compositions on the basis of less solid, partially over crystallized sedimentary rock with the average material strength of 2055 kg/m<sup>3</sup> have the compression strength of 54 MPa. Basic principles of resource saving, waste free production technology of biopositive building materials and items of forced carbonation hardening are defined. The realization of this technology gives quality, ecological building materials and items and solves global problems by reducing the waste and decreasing the greenhouse gas.*

**Key words:** food-grade, biodegradable construction materials, lime, limestone, carbon dioxide, lime-calcium carbonate system, carbonate, gypsum, carbonate technology.

A.T.DVORETSKY, AV.SPIRIDONOV, M.A. MORGUNOVA

## INFLUENCE OF RUSSIAN FEDERATION CLIMATE AND THE ORIENTATION OF THE BUILDING FOR SELECTION OF STATIONARY SOLAR SHADING DEVICES

*With a view to efficient screening of translucent structures in the cooling period of buildings and with depending on the total amount of solar radiation the Russian Federation territory is proposed to divide onto 5 zones. The first zone - 900 kWh / m<sup>2</sup> or less; The second zone - more than 900 to 1000 kWh / m<sup>2</sup>; the third zone - more than 1,000 to 1,100 kWh / m<sup>2</sup>; fourth zone - over 1100 to 1200 kWh / m<sup>2</sup>; fifth zone - more than 1,200 kWh / m<sup>2</sup>.*

*The geometry of apparent motion of the sun across the sky (solar geometry) is based on all the ways of forming rational fixed shading devices - namely, the geometric model of insolation on the surface of the Earth during the day, which is the daily sunlight cone. Using the daily sunlight cone is the basis of all methods of forming shading devices, as well as the majority of methods of determining the insolation duration.*

*To determine the parameters of shading devices that depend on the orientation of the energy efficiency buildings, and influence on thermal and light comfort facilities the daily sunlight cone is encouraged to use.*

*For each latitude at a point on the Earth's surface we can define the following parameters: the angular height of the sun at noon, the azimuths of sunrise and sunset, times of sunrise and sunset using daily sunlight cone. These parameters are defined for Simferopol.*

**Keywords:** climatic zoning, solar geometry, daily sunlight cone, shading devices.

V.P. SINTSOV, V.A. MITROFANOV, A.V. SINTSOV

## PECULIARITIES GAS TRANSITIONS THROUGH MOUNTAIN RIVERS OF THE CRIMEA

*The peculiarity of laying of gas pipelines in mountainous areas consists that when crossing a flood plain of the mountain rivers it is necessary to consider possible sites of a flood and formation of jams at support of transitions in flood spring months. For achievement of an effective objective, determination of the most effective constructive solution of gas transition through the mountain rivers, computer models of gas transitions which cornerstone frame, frame, arch and guy designs are are developed. In case of configuration of models overall dimensions of transitions in the vertical and horizontal planes of their conditions of transportation of dispatch brands by a road transport were considered. Loads of models of transitions are divided into two categories: weight and caused by impact of the environment (not weight). Variable loadings are divided on long and short-term - technological, wind, and special - dynamic from wind and seismicity. Loadings were modeled in the form of a packet of concentrated forces. The settlement scheme, purpose of zhestkost, consolidation of movements, loadings were set in the editor «The settlement scheme. Lira 9.6». Further in the post-processor «LIRA. STK» are picked up sections of the bearing elements in each computer model. Results of calculation are received visually in the editor «The graphical analysis. Lira 9.6» in the form of mosaics of movements of nodes from the settlement combinations of loadings (SCL) which consider all possible combinations of the operating loadings. On the basis of the obtained data the mass of each of spatial computer models is calculated. Comparison of results for transitions by flight of 60 meters determined the easiest design – guy transition. Intermediate values of weight at frame transition. However analysis of design features of a frame design of transition: smaller height of designs of transition (on a support - 3,5 m, in flight cross section is 1,7\*2,0 m); possibility of the device of spatial dispatch brands of factory production; joining of dispatch brands on the building site on high-strength bolts through flanges; the smaller size of a raspor in opiraniye points, and as a result the bases, smaller on dimensions, allowed to accept it as the main decision for further development. Enlarging nodes were designed on high-strength bolts, and for the purpose of decrease in level of tension in flanges additional edges are in addition established and the quantity of bolts in comparison with settlement by results of calculation is increased were are designed and there are in a stage of a construction of a design of four transitions by flight 52, 62 and 72 meters.*

**Keywords:** designs of gas transition, method of a final element, spatial settlement computer model.

V.T. SHALENNYI, K.A. LEONENKO

## IMPROVED ERGONOMICS OF MASONRY DUE TO THE PHASED REDUCTION OF ENERGY AND LABOR OF MASONS

*Besides the generally accepted indicators of competitiveness of building technologies offered to consider as the energy component of the labor of workers. The basis of the paper is hypothesis that there is a relationship between the severity of the labor and energy costs, and through the development and implementation of small-scale mechanization, work on the construction of structures made of small blocks and bricks will be less time-consuming.. Total energy consumption by the construction design is defined as the amount of energy consumption for certain manufacturing operations and recreation. Been compared between the two technologies: masonry of brick and masonry block, followed by the introduction of technological solutions that enhance energy efficiency, namely: the mounted crane with a winch on the terminal units, mechanized means of paving and mortar workplace. The constructive solutions that allow to reduce energy consumption and improve the ergonomics of the process of masonry. Using the proposed method takes into account the energy consumption of the workers, as the criterion of the severity of the labor performed, comparing technologies with each other based on the severity of labor at the stage of justification of investments and adapt the most labor-intensive operations by selecting an alternative technology, or by introducing means of mechanization. Our developments: crane with a winch on the terminal units; crane with the supports rolling and movable along it, will expand the technological capabilities for the production of stone works on the device of walls of masonry and small blocks, so it becomes possible partial mechanization of work on masonry, moreover, due to chocks, there is a possibility a significant increase in load capacity due to fixation of the horizontal design of the building.*

**Keywords:** energy efficiency; Labour severity; mounted crane; method of estimating energy and labor costs.

B.I. SHILIN, A.A. ULIANOV

## **DEVELOPMENT OF POROUS STRUCTURE MODEL OF FIBROUS MATERIALS OF FILTERS OF VOLUMETRIC TYPE FOR CLEARING OF SURFACE WATER**

*The article considers the problem of developing a mathematical model of the pore structure of fibrous materials filters volumetric for surface water treatment from mechanical impurities. Purification of surface and industrial fluids from the contained suspended solids is how to improve the environment and to remove impurities that hinder the technological process, reduction of wear of the equipment. The main methods for purification of liquids from mechanical impurities are division in the field of mass forces (gravity or centrifugal), filtration. The purification of liquids from mechanical impurities by filtering is implemented in the filters of various designs with the passage of the cleaned fluid through the filter septum. The subtlety of cleaning is determined by the retention of the filtration partition. For the construction of the filtering partitions with different fineness of screening required development of a mathematical model of the pore structure of fibrous materials filter type surround, which helps to clear the surface water.*

*Based on the analysis of statistical data and combine the physical (capillary) and a geometric model of the developed probabilistic model of the pore structure of a fibrous material on a priori known values of porosity and average fibre diameter with the random distribution of fibers in the material adequately describing the porous structure and which allows to calculate the real porous membrane and its hydraulic and filtration characteristics.*

*The resulting model can be used to determine the optimum porous structure during its formation and allows to calculate the main hydraulic and filtration characteristics of porous partitions without conducting extensive and time consuming laboratory tests is the basis to predict the performance of filter systems in operating conditions as for the homogeneous pore structure and variable porosity of the depth filter septum, which is especially important for sewage treatment process filters the volumetric type, occurring with gradual clogging of pores.*

**Keywords:** pore structure, filtration, physical (capillary) model, geometric model, mathematical model.

I.A. ASEVA

## **SOCIAL TECHNOLOGIES AS INFLUENTIAL FACTOR OF TECHNOSCIENCE AND SOCIETY DEVELOPMENT**

*In the article the maintenance of the concept «social technologies» is considered from the point of view of sociology and philosophy of science, characteristics of social technologies are selected as certain way of human activity connected with various risks. Social technologies are analyzed, proceeding from judgment of their essence and functions: firstly, as developed a detailed sequence of actions, the experience of the successful solution of socially significant problems; secondly, as specific human activity, aimed at optimizing the social processes, public organizations and institutions; thirdly, as mechanism of social reflection that allows the society to recognize their own problems, risks and prospects, to find internal social dimension optimality metamorphosis.*

*Applications of social technologies are comprehensive: involvement of non-professionals to research, political forecasting, monitoring of civil, ethical review of new scientific developments, etc.*

*Particularly acute becomes the use of social technologies in the convergence of nano-, bio-, info- and cogno-technologies which largely determine the characteristics of being a modern society. The article marked by three major social technology of analysis and evaluation of scientific and technological innovation: social and humanitarian expertise to which attracted experienced professionals, crowdsourcing, using the public network thinking resources, and the RRI, an approach to build an interactive process of interaction between the public and scientists for review ethical acceptability, sustainability and social desirability of the innovation process.*

*It is offered to consider social technologies in a projection to processes formation of an anthropo-technosphere as the social institute of innovations and social creativity, diagnostics, tactics and the strategy of social development capable, from our point of view, for broad humanitarian examination of discoveries and technological developments.*

*The publication was prepared with the support of RSF, grant project №15-18-10013 «Socio-anthropological dimensionsof convergent technologies».*

**Keywords:** Sociology of Culture, Sociology of Science, social technologies, technoscience, civil monitoring, crowdsourcing, civil examination, socio-humanistic examination, public participation public engagement, RRI-approach.

S.G. SHEINA, E.V. MARTYNOVA

## **PROJECT «ENERGY EFFICIENT CITY» AS THE BASIS OF THE CONCEPT OF «SMART CITY»**

*Conservation of natural resources and a favorable climate in the world for current and future generations can be achieved by resolving the contradictions between the aspiration for sustainable economic situation and the preservation of healthy ecological conditions.*

*Development of towns and cities must be carried out taking into account the creation of conditions for sustainable development capable to provide energy-efficient economic development, improving people's welfare, ecosystem preservation and saving non-renewable energy resources for future generations. The basis of sustainable development is the rational environmental management- the system of interaction of society and the nature answering to problems of production development and biosphere preservation. A great contribution to the transition to a sustainable path of development both for country in general, and for cities can make energy saving. At present, in modern cities there is an acute challenge between the needs of urban residents and natural-resource potential of the territories.*

*To implement the principles of sustainable development it is necessary to revise the existing approaches to the energy use in cities. To this aim, by the regulatory documents of Russian Federation characteristic actions for energy-saving developed and approved and have been implemented in cities of Russia in the framework of the pilot project «Energy-efficient quarter». The next step is to create energy-efficient cities, able to satisfy their energy needs, taking into account their long-term development. The concept «Energy-efficient City» is closely linked with environmental sustainability of its components and covers not only the aspects of energy efficiency, but also issues of ecological sustainability and safety of people.*

**Keywords:** *energy efficiency, energy conservation, sustainable development, energy-efficient city, urban development, reconstruction.*

E.V. SCHERBINA, E.V. GORBENKOVA

## **EVALUATION OF FACTORS THAT ENSURES A SUSTAINABLE DEVELOPMENT OF RURAL SETTLEMENTS**

*The article contains the testing results of the method for evaluating rural settlements development. The proposed method based on the evaluation method of qualimetric analysis, which provides a quantitative index determining – «rural settlement's development index», varying from zero to 100 and determining the rural settlements' sustainable development level, which allows giving a comprehensive assessment to the situation and/or variant of territorial development planned to implement. The peculiarity of this method is that it reflects the basic principles, the indicator's system and the calculation algorithm of the integral index of a rural settlement's development level, including social, economic, urban planning and ecological factors. Quantitative and qualitative indicators characterizing the transport connectivity, housing conditions, social services access, ecological conditions, engineering, landscaping and area's safety used for estimation. The method approbation is in the form of project experiment based on the Republic of Belarus rural settlement and the reasonable criteria system for evaluating the rural settlements' development level. The method includes the following steps: selecting the type and number of rural settlements; collecting and processing the initial data; calculating the development index for each settlement; ranking the rural settlements; comparative analyzing the results. Currently, a unified method for assessing the environmental conditions is not available. Therefore, the authors propose using the ecological classification scale of the rural settlements' territories status for determining the absolute values of ecological indicators. In accordance to this scale, the quality of the territory is estimating from low (0 points) to high (3 points). The ecological factors influence to a rural settlement's development level identified during the course of project experiment.*

**Keywords:** *rural settlement, agro-town, sustainable development, environmental factors, rural settlement's development index, qualimetric estimate.*