WORLD OF TRANSPORT AND TRANSPORTATION
Vol.11 (2013), Issue 3

ASSESSMENT OF THE LEVEL OF TRANSPORT INDUSTRIAL ENGINEERING PROCESSES

Apatsev, Vladimir I.

pp. 6 – 11

The generalized indices of productive efficiency become more and more important for transport systems. Those indices consider the set of the engaged resources and orientate the analysis followed by assessment to determination of the system level of productive process. The article describes some new approaches to the solution of such a problem at the example of railway stations. The suggested index is based on continuity principle which is closely linked to finite technical and economical results of activities of one mode transport systems. The index has also its own organizational economic sense, and that is important to assess industrial units and analyze their achievements.

Key words: transport systems, level of industrial engineering, railway stations, continuity of productive process, working stock index.

PRINCIPLES OF ORGANIZATION AND SIMULATION OF RAIL CAR MAINTENANCE PROCESSES

Bolotin, Mikhail M., Glazkov, Vladimir N., Vorotnikov, Valery G.

pp. 12 – 21

The authors substantiate the approaches towards assessment of stability and reliability of the processes of car repairs, the principles of industrial engineering in car repairs shed, and relevant mathematical and technological models. They show modes of solution of optimization problems by linear programming method, including computation of production plans, equipment operation, distribution of scheduled maintenance works, spare parts supply.

Key words: management theory, railway, automation, car maintenance, mathematical modeling, linear programming, stability of industrial process, technological reliability, indices of assessment, optimization.

COORDINATE MODELS OF TRACK TRAJECTORY

Matveev, Alexander S.

pp. 22 – 27

The author describes theoretical fundamentals, used to proceed with mathematical treatment of the results of measurements of parameters of technical conditions of the rail track. The calculations use different variants of assessment. The first one considers comparable data of two cycles of control. The second one proceeds with superposed, monitoring-based analysis of the indices received out of several measuring cycles with predetermined time intervals and dynamics (mobility) of the points of geodesic network.

The researches have been conducted in the framework of the project 11–08–13131-ofi-M-2011- RZD.

Key words: rail track, monitoring of technical conditions, assessment methods, coordinate and time parameters, theory of evaluation of repeatable measurements, mobility of geodesic network points, mathematical methods of data treatment, theorems, consequences.

FUNDAMENTALS OF CALCULATION OF STRESS STATE OF A SUBGRADE

Scheviev, Yuri L., Sidrakov, Andrey A.

pp. 28 – 31

In some experts' opinion evaluation of stress fields within under rail subgrade is accomplished with the help of formulae of mostly empiric character. This approach limits possibilities of exploring the processes of pressure wave propagation and of their interaction with soils at the moment of freight train motion along the rails. The article suggests a theoretical description of the studied dependencies and equations for numerical solution of the problems related to the processes within the stress fields of rail subgrade.

Key words: railway, embankment, rolling stock, ground body, under rail section, profile, stress state of subgrade, theoretical fundamentals of calculation.

ANALYSIS OF ALGORITHMS OF QUEUE PROCEEDING WITH DOWNWARD DELAY

Ignatov, Nickolay A.

pp. 32 – 37

The author analyzes features of queue proceeding algorithms with downward delay used in IPnetworks to ensure reliable services, describes comparative analysis of main specifications of CBWFQ algorithm conducted with the help of simulation models. The article demonstrates such computing indices there-of as mean queueing time of a packet, jitter effect, packet loss under different values of entry parameters. The conclusion is that S. J. Golestani method is efficient when a network is in normal mode, while in extraordinary mode (increased load) it is necessary to use a method of random selection of the classes of packets with CBWTQ algorithm.

Key words: communication system, theory of mass service, Golestani algorithm, IP-technology, simulated queues, LLQ, comparative analysis.

LATERAL DETERIORATION OF A RAIL HEAD AND STABILITY OF A WHEEL

Dimitrov, Andrey I.

pp. 38 – 42

The study is devoted to the impact of lateral wear and tear of the rail head on the resistance of a wheel against derailment. Particularly, are considered conditions of limit equilibrium of a wheel pair at different moments of its situation on the rails; method of determining of wheel stability index at different types of tracks and at different values of lateral deterioration of a rail head. The author puts forward a mathematical interpretation of interaction of the forces of wheels and rails and substantiates a conclusion that the evaluation of a stability of a wheel vehicle has a determinable dependence on angular load on rail heads.

Key words: railway, wheel, rail, interaction of forces, traffic safety, risk evaluation, index of resistance of the wheel against derailment, lateral wear and tear of a rail head.

METHODS OF DETERMINATION OF SATURATION FLOW OF A MOTOR WAY

Borovskoy, Alexey E., Shevtsova, Anastasia G.

pp. 44 – 51

The article reviews the methods, used in Russia to determine saturation flow while computing regime of traffic lights regulation for city motor roads. The authors have suggested a new tool of mathematical assessment of the desired quantity in order to achieve better quality of road signal regulation. The proposed method of determination of saturation flow as compared to classical and foreign methods, allows to take into account a larger number of parameters and to achieve a more exact result. The researchers have also tested the innovation model by using it at real street intersection and organized implementation of the study results in the framework of cooperation with municipal administration of the city of Belgorod. The study has shown that the optimum regime of traffic lights operation reduces car delays by 15–25%.

Key words: motor traffic, saturation flow, traffic lights, operation regime, basic value, operation efficiency.

VIBRATION MONITORING OF JOURNAL-BOXES

Martynov, Igor E., Ravluk, Vassily G., Mihalkiv, Sergey V.

pp. 52 – 57

The article describes possibilities to use instruments of probabilistic neural networks to classify technical conditions of the elements of frictionless bearings of rail rolling stock, analyzing vibration acoustics information, collected with the help of modern troubleshooting units. The authors show the features of operation and design of artificial neural network that results in identification of problems at 99,6% cases.

Key words: railway, rolling stock, frictionless bearing, axle-box, journal-box, artificial neural network, mathematical apparatus, vibration troubleshooting, monitoring, information, classification, systems of automatic troubleshooting, image, condition, state.

CONVERSION AND DISTRIBUTION UNIT FOR TRACTION POWER SUPPLY SUBSTATIONS

Pupynin, Vladimir N., Kalugin, Ivan G.

pp. 58 – 63

Intense development of power semiconductor units allows designing powerful arcless disconnection devices which could make a single set along with conversion units of traction substations. The authors suggest a promising design of conversion and distribution 3,3 kV unit for DC power traction substations, that has some technical and economic advantages. The circuit is realized with the help of controlled 12 pulse rectifier, built without cathode groups of cells in the second bridges of rectifiers. Three-phase switches of feeders are assembled on thyristors, and the cathodes there-of are electrically interconnected and create the terminals of direct current. The main elements of the unit are described and the algorithm of its operation is studied. Using the MATLAB software, the authors have created mathematical model of traction substation and simulated disconnection of a short circuit at one of the feeders of overhead catenary, while considering a traction load at the other feeder. To make better demonstration of the model, the results of simulation are shown as an oscilloscope pattern, where the process of disconnection is divided into several stages.

Key words: railway, systems of traction power supply, traction substation, contactless switches, thyristors, mathematical model, conversion and distribution unit.

RAISING OF POWER FACTOR OF ELECTRIC LOCOMOTIVE AT REGENERATIVE BRAKING REGIME

Melnichenko, Oleg V., Shramko, Sergey G., Linkov, Alexey O.

pp. 64 – 69

Electrical power scheme of rectifier unit of actuation based on thyristors has been unchangeable for more than 45 years. Analysis of electric locomotives' operation under the regenerative braking has shown that the use of thyristors in the arms of rectifier units of actuation, as well as the adopted methods of control are one of the causes of reduction of capacity factor of locomotives, using recuperative braking (till not more than 0,65 during operation). The article suggests changing of power circuit of rectifier unit of actuation, using new circuitry and control technique, which will allow to raise power factor of AC electric locomotive at recuperative braking by 5%.

Key words: electric locomotive, railways, alternate current, power circuit, regenerative braking, recuperative braking, rectifier unit of actuation, capacity factor.

PROCESS OF SERVICE BRAKING OF A CAR

Zotov, Viacheslav M., Zotov, Nickolay M., Fedin, Alexey P.

pp. 70 - 73

Service braking of a motor car supposes that tire scrubbing will be minimized or zero limited. But this process causes some material losses for technics that some prefer not to speak about. The mathematical model elaborated by the authors, numerical experiment and full-scale testing are the basis for wording of instructions for drivers how to brake on different types of pavement and road surfaces. The values determined within calculated model might reduce wear and tear of tires, braking disks, other material damages.

Key words: car exploitation, service braking, mathematical model of a process, numerical experiment, fullscale testing, material losses reduction, pavement types.

EXPERIMENTAL MONITORING OF SECTIONS OF VARIABLE STIFFNESS

Zamuhovskiy, Alexander V., Merenchenko, Constantine V.

pp. 74 – 82

Growing attention to the development of highspeed railways has accentuated some technical problems. Particularly one can witness changing attitude towards some special track constructions which are sections of variable stiffness. The article describes the results of experiments conducted by the department of track and track facilities of Moscow State University of Railway Engineering in the zone of interfacing of subgrade and artificial structures. The authors proceed with simulation of high-speed train motion at the interface sections, studying dynamic features and operation conditions. They suggest measures of amelioration of structures, taking into account the reducing of stiffness of the track on bridge abutments and raising of the stiffness at the approaches to other structures, in order to reduce the loading of the subgrade and track.

Key words: rail track, valuable stiffness, variable stiffness section, zone of interface, subgrade, artificial structure, experiment, simulation.

OPTIMIZATION OF TRANSPORTATION COSTS IN BUSINESS LOGISTICS

Mirotin, Leonid B., Lebedev, Evgeny A., Ryzhkov, Andrey A., Bulatnikov, Evgeny V.

pp. 84 – 89

Main streams of growt h o f efficiency of transportation services consist in implementation of the concept of transition from physical carriage (transportation) to transport logistics services. The authors present arguments in favor of overcoming of contradictions, related to existing ideas on criteria of quality and assortment (types) of activities from the point of view of the economics and business. Using the examples of Krasnodar region and Moscow they demonstrate rational and less expensive variants of commercial cooperation between consignors and consignees of the goods. They also put forward some recommendations how to reduce transportation costs per unit of final product taking into consideration optimization of transport and logistics processes.

Key words: motor transport, economics, transportation process, operation, optimization, criteria, transportation service, transport logistics system, efficiency, costs, cycle, business.

CHOICE OF LANDS FOR TERMINAL LOGISTICS STRUCTURES

Nikiforova, Marina S., Samulkin, Alexander S.

pp. 90 – 95

The construction of terminal logistics centers constitutes one of the strategic goals of transport development. The choice of lots of land for those centers requires criteria that will be well adapted to market conditions, including dominant economic factors, related to property relations, cadastral price and other factors. The authors suggest the approaches of solution of such problems, including algorithms of comparative analysis of the variants of location of the transport logistics centers, assessment criteria series, weighted criteria values, the resulted effects.

Key words: transportation, terminal logistics center, construction, lot of land, type of property, price, choice criteria, economic dominants, comparative analysis.

PRODUCTIVITY RESOURCES OF EXCAVATOR AND TRUCK COMPLEX

Griaznov, Mikhail V., Kolobanov, Sergey V.

pp. 96 – 102

The problem of defining of the productivity of excavator and truck complexes is especially important for open-cast mines. Different technologies are used for mining, depending on capacity and depth of occurrence, volumes of extraction of the rocks. Frequently the less expensive costs are ensured by the variants of extraction and loading of the minerals by excavators of cycle action and by further carriage by dumptrucks from the stripping front to the storehouse or to the mine dump. The studied scientific task is by its nature rather a transport problem as it is solved via optimization of transportation processes. The authors substantiate a method of calculation of productivity of excavator and truck complex containing dump-trucks of small capacity (less than 30 tons) and excavators with small capacity bucket (less than 2 cubic meters). The nomogram of productivity of excavator and truck complex, achieved on the basis of well-known study methods and calculation techniques, can be applied first of all at the stage of construction of open-cast mines. The use of the suggested instruments of the control of overburden transportation efficiency will help to adjust the plans of mining at Miheevsky mine and to reduce prime cost of copper ore extraction.

Key words: transportation process, productivity, economics, industrial engineering, excavator and truck complex, transportation of overburden, dump-trucks, channel of delivery, efficiency calculation, time study, resources assessment.

COMPREHENSIVE DEVELOPMENT OF TRANSPORT INFRASTRUCTURE IN INDUSTRIAL REGIONS

Shmulevich, Mikhail I.

pp. 104 – 109

The author analyzes main problems, occurring during pre-project studies on transport systems of large industrial regions, displays weakest points in the infrastructure of transport centers, analyzes variants of freight traffic organization; studies possibilities to enlarge capacity and operation abilities of stations and stages, potential of sorting and preparation of empty cars in the zones of mass loading. Special attention is drawn to comprehensive development of infrastructure of main and industrial transport in large nodal points.

Key words: region, transport nodal point, industrial region, rail station, infrastructure, freight flows, capacity, comprehensive development, pre-project works.

SYSTEM OF DECISION-MAKING SUPPORT FOR PRIVILEGED SHIPS

Sedova, Nelli A.

pp. 110 – 115

The described system of decision-making support is intended for navigators and takes into account International Regulations for Preventing Collisions at Sea as well as the recommendations of Good Practice Guidance. The researcher has established a list of questions and answers for a communication of a control system with the users, and the variants of conclusions that a navigator finally receives. The article describes the semantic network and productive rules of the developed system for privileged vessels, demonstrates a decision making tree, and the results of a testing of system features of the suggested model.

Key words: sea transport, sea navigation, collision prevention regulations, automatic control system, semantic network, privileged vessel, burdened vessel, linguistic ambiguity, testing.

ENTERPRISE MANAGER'S INFORMATION SYSTEM

Malafeevsky, Artiom A.

pp. 116 – 121

Public transport supposes the use of a wide range of information technologies, but the existing information systems of enterprises do not prove to take into account the features of this kind of transport. Providing for total presence of electronic networks and typical computer guided management patterns, the author formulates approaches to structuring and step-by-step development of the models of relevant information systems, and suggests utility-orientated indices of those models.

He describes the methods for development of information system intended for managers of passenger traffic enterprise, using mathematical models which enclose comprehensive and multidimensional understanding of economic efficiency. The choice of variants is determined by different business tasks and the goals of growing profitability and quality of passenger services.

Key words: information system, decision-making support, public transport, passenger traffic, neural network, DSS, OLAP, utility functions, economic efficiency.

MULTI-PURPOSE DECISIONS RAISE TRANSIT CAPACITY

Ageev, Roman V.

pp. 122 – 127

Maintenance of positive dynamics during formation of wagon flows and traffic control is one of permanent tasks of a railway network. The author describes analysis of individual freight cars allocation by the stations of freight operations. This analysis serves to improve the existing system of planning. The results allow not only to state the limitations of technological capacity of freight stations, but to suggest rational management decisions. They are intended to enhance the transit capacity of car flow, scheduling of loading, multi-purpose methods of operation of the trains along the route.

Key words: railway, car flow allocation, freight traffic, loaded car, empty car, route, transit, cargo handling, fright station, train formation.

OPTIMAL SCHEME OF ROUTING FOR SINGLE WAGON LOAD TRAIN

Baturin, Alexander P., Nikitin, Pavel V.

pp. 128 – 134

The authors consider methods to find optimal scheme of routing for single wagon load trains for different railway sections. Three variants of allocation of a pair of such trains and consequences of stoppage of the wagons at the stations of loading and unloading are considered. Those variants are studied from the point of view of the advantages for traffic control. The comparison of computed data gives opportunity to make certain conclusions on the selection of a scheme that gives better results and less car stoppage.

Key words: railway, control, routing, single wagon load train, traffic scheduling, car stoppage

SIMULATION MODEL OF A PROCESS OF SUBSCRIBER CONNECTION

Malikova, Olga N.

pp. 136 – 139

The article is devoted to the problems of simulation of business processes of a communication unit at the example of Murom regional communication center of JSC Russian Railways. The simulated model of a phone subscriber connection allows

analyzing of the costs and time losses of the staff, as well as optimizing the roles and composition of the participants. The described variant is universal and can be used in any regional communication center. It is rather comfortable to monitor business operations in automatic mode and might be integrated into more global model patterns of enterprise management.

Key words: railways, enterprise management, communication center, imitation models, business process, simulation environment, phone subscriber, time spending, working hours.

MULTIMODE PASSENGER TRAFFIC IN MEGALOPOLIS

Kovalenko, Alexander N.

pp. 140 – 144

The studied problems concern transport services to Moscow residents, outlook for Moscow metro development, rail infrastructure, commuter trains and transfer stations. The special attention is paid to multimode passenger traffic that comprehensively uses different modes of transport to deliver residents to destination points. The author suggests criteria of assessment to substantiate variable proposals as well as gives examples of efficiency evaluation for complex technical transportation systems that are widely operated in capital area.

Key words: multimode traffic, rail infrastructure, passenger flow, megalopolis, transfer hubs, «small ring», transport system, efficiency, coordination council.

MOTOR VEHICLE AND ECOLOGY: INTERDEPENDENT FACTORS

Morozov, Gennady P.

pp. 146 – 153

The studies on the impacts of motor cars on the environment are one of the permanent tasks of transport sciences. There is an on-going process of changing and toughening of the requirements for the level of air pollution by harmful substances of diesel and petrol engines. Ecological standards concerning motor fuel are becoming higher. But even taking into consideration all positive changes, the indices of exhaust fume are still critical. The author shows the interdependence between ecological and engineering factors, argues in favor of promising directions of engineering research that are deemed to make closer the new ecological standards and the new capacities of road vehicles.

Key words: motor road transport, ecology, engine, fuel, environment, exhaust fume, air pollution, ecological standards, prevention of toxic exhaust emission, neutralizers.

LITHOLOGICAL PROFILING WITH GROUND-PENETRATING RADAR

Pupatenko, Victor V., Suhobok, Yuri A.

pp. 154 – 161

The article assesses developments of a method of achieving of a deepened profiling of an environment, which is strongly differentiated by speed parameters and built by sub horizontal layers, with the help of geo radar profiling and geo radar scanning. The authors have elaborated an iterative algorithm of selection and refinement of hodograph curve of reflected and main waves, of determination of the features of layers. The authors show the results of experimental testing of the method, and suggest some conclusions concerning possible use of the method for monitoring of transport structures.

Key words: engineering geophysics, ground-penetrating radars, geo radar profiling, geo radar scanning, ground profiling, time profiling, bed (sheet) speed, quadratic velocity, reliability of infrastructure.

SYSTEM OF FIRE SAFETY FOR CIVIL AVIATION

Bochkarev, Alexander N., Bochkarev, Ilya A.

pp. 162 – 167

The article is devoted to the complex system of fire and aviation safety at the civil aviation ground structures and at the planes. The authors analyze the range of fire extinction tools and devices in the airports as well as organization of preventive and salvage operations during emergency situations. The authors underline the role of fire prevention and salvation teams, of aviation teams training in order to develop skills to prevent the fire, to conduct correct operations on board of the plane if emergency occurs.

Key words: aviation, air planes, fire safety, fire and salvage team, fire extinction devices, system of fire extinction.

OUTLOOK FOR BALASTLESS TRACK

Zamuhovsky, Alexander V.

pp. 168 – 172

The author defines rational spheres of the use of ballastless track, its advantages and disadvantages. Analysis of calculations results and of dynamics features has allowed to substantiate the increasing level of requirements concerning construction and maintenance of the geometry of the ballastless track. The author argues in favor of reducing of the stiffness of the track in necessary cases and proposes engineering techniques to achieve it. He determines criteria limiting the interoperation of force, necessary to design the sections with interface of the sectors with different stiffness. The article describes different approaches to the choice of numerical values of parameters of balastless track and transitional sectors of variable stiffness. The conclusions allow to impartially assess the outlook for balastless technology for the network of high speed railways.

Key words: railway, artificial structures, balastless track, optimal stiffness of the track, limiting criteria, impact of the forces, track for high speed trains, operation safety .

IMPACT OF KNOWLEDGE CONTROL ON TRAINING QUALITY

Ponomarev, Valentine M., Volkov, Andrey V., Lisienkova, Alla V.

pp. 174 – 179

The main causes of occupational traumatism in JSC Russian Railways are studied from the aspect of the impact of human factor on the safety of organization of industrial processes. The necessity to improve the quality of the staff advanced learning is revealed and grounded. The authors have determined optimal volume of tests which allow the required level of veracity of assessment and decisions. Theoretical conclusions were approved through expert studies. The proposed techniques minimize probability of partial approach from behalf of the managers.

Key words: professional training, training quality, knowledge control, testing, methods, programs, expert assessment, human factor, computerized testing.

HORIZONTAL COORDINATION

Shapkin, Igor N., Samoylova, Irina M.

pp. 180 – 183

The problems of research and educational centers are considered by the authors from the aspect of strategic development of higher education. Using the example of

cooperation of Moscow University of Railway Engineering and JSC Russian Railways, the authors study possibilities of extending of R&D on the basis of modernized forms of organization and university traditions. The proposed approach envisages improvement of training of research and academic staff, of students' stages, of all the system of training of future professionals of railways.

Key words: railways, higher education, research and educational center, university traditions, innovative development, fundamental researches, applied sciences, mutual interests.

CORPORATE COMPETENCIES OF HOLDING COMPANY STAFF

Kozyrev, Valentine A., Sokolova, Julia S.

pp. 184 – 190

The authors review the trends of scientific assessment of personnel and analyze their impact on modern goals of holding structures. They describe the model of corporate competencies approved in JSC Russian Railways and the techniques of their evaluation in assessment centers.

Key words: holding company, railway, staff, personnel, manager, model of corporate competencies, management skills, assessment of corporate competencies level, assessment center, management efficiency.

IN ORDER TO AVOID AUXILIARY POSITION

Pugina, Lydia V.

pp. 206 – 210

Attending the guidelines for development of mathematical education which are now prepared, it is important to review the approaches to mathematical training from the very beginnings of technical schools, to remind the main trends of curriculum development. The article is devoted mostly to the progressive leaders of higher technical schools and their views regarding mathematical training in the period of 19th and early 20th century.

Key words: mathematics, education, science, politics, methods of training, engineering school, concept of development of mathematical education, dominants of study programs, historical experience.

ATTENDING INNOVATION DECISIONS

Sotnikov, Evgeny A.

pp. 212 – 214

Lemeshko V . G., Shapkin I . N. Innovation Technology at Railways (theory, practices, outlook). Monograph. Moscow, VINITI RAN, 2012, 446 p.

The reviewed book is devoted to innovation technology in the sphere of traffic control, of railway stations and hubs practices in the period of structural changes in Russian railways. The authors analyze the advantages of train operations, prospective model of rail services market, optimization of operation of rolling stock and locomotives of railways, dispatching control and logistic followup of goods carriage. The monograph is intended for the specialists of rail traffic, dispatching, operation, as well as for researchers, professors of higher schools and Ph.D. students.

Key words: innovation, railways, theory, practices, technology, traffic process, modernization, logistics, intelligent systems, management, control.