ABSTRACTS of D.Sc. and Ph.D. THESES

Selected abstracts of D.Sc. and Ph.D. theses submitted at Russian transport universities

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Basyrov, I. M. Organization of production of a transport company in the context of the use of differentiated train lengths. Abstract of Ph.D. (Eng) thesis [*Organizatsiya proizvodstva transportnoi kompanii v usloviyakh primeneniya differentsirovannykh dlin poezdov. Avtoref. dis… kand. tekh. nauk*]. Moscow, RUT publ., 2020, 24 p.

After carrying out analysis of the theory and practices of regular freight traffic in the Russian Federation and abroad it was determined that the most rational form of organizational and production development of terminal infrastructures located in places of non-public use is their transformation into specific transportation companies: container operators (CO). The features of transportation of goods in the segment of regular freight traffic are outlined. It was confirmed that the largest container operators are organizationally tied to the points of origin and destination of railway container flows (mainly to large seaports).

It has been determined that for a group of transport companies operating under «Client–Operator–Owner of non-public infrastructure» scheme, in order to attract customers, it is necessary to send container trains of differentiated lengths.

The negative factors affecting quality of transport services for cargo owners at the linear level and proposals for overcoming them with the help of CO are identified.

The modelling of the technological stability of CO has been carried out. In this study, technological sustainability is understood as the ability of a container operator to proceed with restructuring and subsequently with «reengineering» of business processes.

A mathematical model has been developed to solve the problem of planning the loading of complete container shipments on fitting platforms, taking into account the rational use of their loading length and extracting the maximum possible revenue from the sale of transport products in the form of an optimal loading option.

05.22.01 – Transport and transport and technological systems of the country, its regions and cities, organization of transport production. The work was performed at Russian University of Transport.

Dzhangiryan, A. V. Economic substantiation of transport construction projects with attraction of foreign investments. Abstract of Ph.D. (Economics) [*Ekonomicheskoe obosnovanie proektov transportnogo stroitelstva s privlecheniem inostrannykh investistii. Avtoref. dis… kand. ekonom. nauk*]. Moscow, RUT publ., 2020, 24 p.

The presented study, which was based on classical methods and systemic knowledge in the field of the investment process in the transport industry, systemized following study of voluminous research carried out by Russian and foreign scientists in this area, made it possible to solve a number of problematic scientific and practical problems.

Approbation of the described methodology on the example of projects in Armenia and Iran, implemented with the aim of increasing efficiency of JSC Russian Railways, attracting additional volumes of transit traffic, showed the consistency of the proposed approach. The conclusions made using classical methods were confirmed, however, the proposed author's system of approaches made it possible to see the nuances of the decision made and mark the line that would remain invisible without such an analysis. At the same time, in the presence of other external factors that can influence the behaviour of the investor, such a factorial analysis can change the outcome. In addition, the author noted the applicability of the approaches proposed in the study to implementation of Moscow–St. Petersburg high-speed rail project.

The effect of the use of the author's methodology, calculated during testing on the projects of the South Caucasus Railways and in Iran, made it possible to increase the depth of project development by 2,2 to 4 times, on average increasing the probability of attracting foreign investment by 70 %.

This technique can be widely used in design analysis, and the variables required for its use do not require non-trivial calculations.

The author has created a methodological basis for development of the topic of synchronization of foreign investment flows and methods for their redistribution between projects in national and foreign markets. Considering development and complication of relations between the subjects of transport construction processes, the need to provide an additional scientific base and refine the estimates seems to be an obvious consequence of ongoing processes. In addition, from the author's point of view, the focus of further research could also be placed on the study of methods of implementation of the model proposed by the author, of various variants of symbiosis of systemic and behavioural investment analysis.

08.00.05 – Economics and management of the national economy (economics, organization and management of enterprises, industries, and complexes: construction). The work was performed at Russian University of Transport.

Filippova, N. A. Improving the efficiency of cargo delivery for the North of Russia based on risk management. Abstract of D.Sc. (Eng) thesis [*Povyshenie effektivnosti dostavki gruzov dlya severa Rossii na osnove upravleniya riskami. Avtoref. dis... doc. tekh. nauk*]. Moscow, MADI publ., 2020, 42 p.

Based on approaches to integral joint functioning of production systems and the natural environment, theoretical provisions have been developed that contribute to solving the theoretical and applied problem of increasing efficiency and reliability of functioning of traffic flows, which is of great national economic importance for development of the North of Russia and the economy as a whole based on risk management.

Based on developed theoretical-methodological and scientific-methodological provisions, scientific methods, models, experimental research and management proposals of an innovative orientation, scientific-methodological and practical methods of organizing effective and biosphere-joint traffic have been created.

In the course of the research, the tasks set in the work were solved:

• The main features of organization of transport services in the northern regions of Russia; factors influencing reliability of functioning of the multimodal transport system of the «northern delivery» [seasonal, during the period of more favourable weather conditions, forwarding of goods to the northern territories] were defined, studied, and classified. The composition and structure of the modes of transport involved in transportation of goods within northern delivery were analysed, the features of organization and functioning of the multimodal transport system are classified.

• A mathematical model was developed and regularities of seasonal fluctuations in air temperature were obtained based on the application of the theory of Markov processes using statistical data from the All-Russian Research Institute of Hydrometeorological Information – World Data Center, Obninsk, for more than 100 years. Based on the developed model, a software has been created to predict the start and end of the operation of winter roads for northern regions of Russia. With the use of this software, measures were developed to reduce the risks arising in the process of transporting goods, which, according to experts, will increase the volume of freight traffic on winter roads by 10–20 %. In addition, a method and software were proposed for calculating the lower and upper confidence limits of the end and beginning of ice phenomena. The paper presents data on the beginning and end of ice phenomena on the Lena River near the village of Vizirny for the period from 1975 to 2012. These data were used to test the methodology, which makes it possible to predict timing of the beginning and of the end of navigation on northern rivers. The use of the forecast of timing of ice phenomena in planning the transportation of goods, according to the estimates of the specialists of the enterprises where the program was tested, will reduce time for transportation of goods by 10–15 %.

• The impact of risks on reliability and efficiency of the transportation and technological process of transporting goods to the northern regions of Russia in a multimodal transport system was studied. The risks arising for transportation and technological process of multimodal transportation of goods were identified, classified, and ranked. A risk

assessment model was developed using factor analysis and considering the requirements of GOST [national standard] R51901.1-2002, which made it possible to increase reliability of the processes of transporting goods by 10–15 %. Typical scenarios for implementation of the transportation and technological process in a multimodal transportation system were developed, depending on the identified significant risks.

• The structure of the organizational and managerial model of the management system of the transport and logistics centre was developed, taking into account the complex automation of the basic functions of dispatching control of transportation of goods within the northern delivery and the possibility of monitoring implementation of planned tasks. The developed structure includes a scheme of information exchange within the dispatch control system of transportation and technological processes of the northern delivery based on the use of telematic, information, navigation control technologies to increase reliability of cargo transportation. The proposed measures will help to reduce possible risks both by reducing the likelihood of occurrence of identified adverse events, as well as by reducing the consequences if they occur. The developed structure was taken as a basis for development and implementation of a transport and logistics centre based in the enterprises of JSC ZDK Lenzoloto, Bodaibo and LLC Shipping Company Vitim-Les, Kirensk.

• A method for constructing a digital model of the transport network infrastructure based on the use of geoinformatics methods was developed. The methodology includes a digital description of the route elements for each mode of transport. Route elements can be presented on an electronic map of the area using geographic information technologies. The practical use of the model makes it possible to organize continuous monitoring of movement of vehicles on the routes.

• A methodology was developed for automated generation of operational information and of reporting forms on the current state and results of the process of transportation of goods within the northern delivery based on the use of artificial intelligence methods. The methodology provides a display of the operational situation on the route considering possible risk situations and other features of the route.

A feature of the developed new approaches is the use of telematic information generated by on-board software and hardware located on controlled vehicles.

A methodological basis was developed to increase the level of automation of the basic functions of dispatch control over transportation of goods by road in mixed multimodal traffic. The methodology proposes to use the digital infrastructure of the northern delivery control system, which is a necessary element and basis for functioning of a modern transportation management system.

The main goals of creating an automated satellite navigation system for dispatching cargo transportation in the North of Russia were identified.

05.22.10 – Operation of road transport. The work was performed at Moscow Automobile and Road Construction State Technical University (MADI).

Mansour Alaa Eldin Mohamed Abdelgafar Ibrahim. Numerical method for calculating static and dynamic loads of bending circular plates. Abstract of Ph.D. (Eng) thesis [*Chislenniy metod rascheta izgibaemykh kruglykh plastin na staticheskie i dinamicheskie nagruzki. Avtoref. dis... kand. tekh. nauk*]. Moscow, MGSU publ., 2020, 25 p.

Methods for calculating plates with various types of boundary conditions under the action of various types of loads, including strip, cyclic, have been developed. For this, the generalized equations of the finite difference method (FDM) proposed by R. F. Gabbasov were used. To a certain extent, the construction of these techniques can be considered as a further development of FDM.

The developed techniques were verified on test problems and numerically investigated for convergence. It is shown that the obtained solutions of the problems have good accuracy, practically converge with the results by the finite element method (FEM) and the known analytical solutions with a sufficiently small partition. The solutions obtained based on the developed techniques quickly converge as the difference grids become denser.

According to the proposed algorithms, tables and macros for calculating round plates on a computer using Mathcad and Microsoft Excel were compiled. They make it possible to design round plates under various types of boundary conditions regarding the action of static and dynamic loads, thus, the investigated algorithms are simply programmed and executed on a computer.

It is planned to develop similar algorithms and implement methods for calculating circular plates on an irregular grid based on generalized FDM equations under other influences: temperature loads, nonharmonic dynamic loads (*pulsation*).

05.23.17 – Construction mechanics. The work was performed at National Research Moscow State University of Civil Engineering. The defence took place at Russian University of Transport.

Veselova, A. S. Evaluation of quality of technical operation of railway automation and telemechanic systems. Abstract of Ph.D. (Eng) thesis [*Otsenka kachestva tekhnicheskoi ekspluatatsii system zheleznodorozhnoi avtomatiki i telemekhaniki. Avtoref. dis... kand. tekh. nauk*]. Moscow, RUT publ., 2020, 24 p.

In conditions of limited production resources and availability of new, previously unavailable opportunities for automated collection and analysis of large volumes of various statistical information, it is necessary to improve the methods of planning and managing production processes for operating transport infrastructure based on risk management.

By analysing the risks of loss of train-hours due to failures of technical devices of railway automatics and telemechanics (RAT), it is possible to manage reliability of the infrastructure, including planning production processes, assessing the necessary resources, as well as assessing quality of technical operation of RAT facilities, in terms of quality of services provided by railway transport.

The paper proposes a model for assessing the risk of a failure in ensuring the required level of readiness of technical means of railway equipment, depending on provision of the production process of maintenance and repair with necessary labour and other resources, presence of a volume of work, the occurrence of which is of an accidental or unregulated nature. The proposed model is based on application of the generalized structural method using functional networks.

A nomenclature of indicators and a methodology for a comprehensive assessment of activities of linear enterprises and structural units of the automatics and telemechanics have been developed, based on an assessment of risks associated with unsatisfactory quality of services in transportation of goods and passengers by railway transport.

The proposed method makes it possible to apply in practice a number of organizational and managerial decisions to improve reliability of assessment of production activities. This assessment considers the impact of the current state of railway facilities on the transportation process and, as a consequence, on the level of infrastructure services provided to ensure safe and reliable train transit, taking into account technical and technological requirements for railway facilities on railway lines of various classes and specializations.

The paper proposes a method for assessing and proceeding with comparative analysis of functional safety of industrial processes in the automatics and telemechanics units using probabilistic analysis of the potential hazard rate as a random variable.

It is proposed to calculate the planned interval values of the potential hazard rate based on decomposition of production processes to the level of individual operations with the subsequent use of functional networks with numerical characteristics obtained on the basis of statistical data on the results of identified safety violations on the railway network.

The paper contains recommendations on the use of expert assessments to analyse the impact of provision of production processes with resources (labour, material resources, etc.) on the values of the potential hazard rate to control train traffic safety.

05.22.8 – Management of transportation processes. The work was performed at Russian University of Transport.

Compiled by N. OLEYNIK ●