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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Babenko, G. N. Method of assessing the effect of cargo on a helicopter's external suspension on its controllability during flight operation [*Metod otsenki vliyaniya gruza na vneshnei podveske vertoleta na ego upravlyaemost' v protsesse letnoi ekspluatasii*]. Abstract of Ph.D. (Eng) thesis. Moscow, MSTU CA, 2019, 18 p.

A method has been developed for evaluating the impact of a cargo on an external suspension (ES) of a helicopter on its controllability during flight operations, which, unlike the known approaches, provides an extension of the flight modes available for research and reduction in time and cost of research.

For the first time, using the example of Mi-8 helicopter, analytical dependences of relative control efficiency on cargo parameters and flight mode were obtained, providing the flight crew with an opportunity to quickly evaluate changes in the helicopter's flight characteristics, which is necessary to ensure the required level of flight safety during aircraft operations and air transportation with cargo on ES.

Quantitative data were obtained characterizing the impact of cargo parameters and ES as a whole on controllability of Mi-8 helicopter, on the basis of which proposals were made to supplement flight manual in terms of performing aviation operations and air transportation with cargo on an external suspension.

Specialty 05.22.14 – Operation of air transport. The work was performed at Moscow State Technical University of Civil Aviation.

Kalyuzhny, N. A. Methodology to optimize placement of transport interchange hubs in the system of urban passenger transport [*Metodika optimizatsii razmeshcheniya transportno-peresadochnykh uzlov v sisteme gorodskogo passazhirskogo transporta*]. Abstract of Ph.D. (Eng) thesis. St. Petersburg, PSTU publ., 2019, 16 p.

A model of transport interchange hubs in the system of urban public passenger transport of agglomerations was developed, theoretically and experimentally based on the analysis of changes in passenger traffic values depending on waiting time of passengers at the entrance of metro stations and suburban railway.

For the first time, the effect of changing the waiting time of passengers at the entrance of metro stations and suburban railways on functioning of the urban passenger transport system in terms of passenger flow distribution was established.

Analytical dependences of the passenger flow speed within public transport on the value of this passenger flow are obtained, taking into account the carrying capacity of rolling stock.

The concept of «transport hub stability» has been introduced as the main numerical criterion for assessing potentially significant transport and transfer hubs.

The concept of the coefficient of influence of the magnitude of delay on the size of the passenger flow K_{pass} has been introduced.

Specialty 05.22.01 – Transport and transport-technological systems of the country, its regions and cities, organization of production in transport. The work was performed at Emperor Alexander I St. Petersburg State University of Transport.

Petrushin, A. V. The technology of routing the railway in areas with high seismicity [*Tekhnologiya trassirovaniya zheleznoi dorogi v raionakh s vysokoi seismichnost'yu*]. Abstract of Ph.D. (Eng) thesis. Moscow, RUT publ., 2019, 24 p.

A classification of slope areas according to soil type, geometric parameters of construction of the roadbed and categories by seismic properties has been developed.

The dependence of the geometrical parameters of design of the roadbed on steepness of the slope for soils belonging to different groups by seismic properties has been established.

Analytical dependences of the most rational decisions were obtained on adjusting the axis of the road in the longitudinal profile and plan in slopes to ensure uniformity of the main roadbed in areas with high seismicity.

A technology has been developed for designing lines on slope sections under conditions of high seismicity and a method has been proposed for determining the effectiveness of anti-seismic measures taking into account the probability of earthquakes.

Specialty 05.22.06 – Railway track, survey and design of railways. The work was performed at Russian University of Transport.

Shepel, A. S. Improvement of methods for substantiation of schemes of station necks [*Sovershenstvovanie metodov obosnovaniya skhem stantsionnykh gorlovin*]. Abstract of Ph.D. (Eng) thesis. St. Petersburg, PSTU publ., 2019, 16 p.

The statistical regularities of duration of train and shunting movements through the elements of the station neck are studied. A model of necks is

proposed as of devices with a deterministic number of channels based on the input parameters: «number of design channels», «number of operational channels», «movement accuracy». A modernized method of substantiation of the station neckline schemes has been developed, taking into account the processes of movement, their mutual influence, intra-day irregularity of movements and containing assessment of the effectiveness of the neck reconstruction based on the proposed ratio «part of income attributable to increasing the throughput capacity of the rail section».

Specialty 05.22.08 – Transportation process management. The work was performed at Emperor Alexander I St. Petersburg State University of Transport.

Silyuta, A. G. Improving the efficiency of a diesel engine power plant by expanding the range of diesel operation modes when using an electronic control system [*Povyshenie effektivnosti raboty silovoi ustanovki teplovoza putem rasshireniya oblsti rezhimov raboty dizelya pri primenenii elektronnoi sistemy upravleniya*]. Abstract of Ph.D. (Eng) thesis. Moscow, JSC VNIIZhT, 2019, 19 p.

A refined mathematical model of the working processes of joint work of the piston part of a diesel engine with supercharging units has been developed. The model differs from the existing ones by the fact that when the calculation scheme is supplemented with devices for bypassing the working fluid and detailing the filling, purging and release processes, the author suggests using equality of the specified and actual total mass flow rate of the diesel working fluid instead of equality to the unit of the differential pressure in the characteristic sections of the gas-air duct.

A set of design and experimental studies showed that when regulating the diesel locomotive characteristics and implementing electronic control of a high-performance diesel engine, the required performance of the power plant, regulated by the delivery specifications, is ensured throughout the entire range of atmospheric conditions without the use of working medium bypass systems.

Specialty 05.22.07 – Rolling stock of railways, train traction and electrification. The work was performed in Joint Stock Company Research Institute of Railway Transport.

Skutin, D. A. Stability of the superstructure in curves using a vertically located geogrid [*Ustoichivost' verkhnego stroeniya puti v krivykh s ispolzovaniem vertikal'no raspolozhennoi geosetki*]. Abstract of Ph.D. (Eng) thesis. Yekaterinburg, USURT publ., 2019, 20 p.

A new design of the track in curves with the use of a vertically located geogrid has been proposed.

The required installation sites for a vertically located geogrid in the ballast for new construction, reconstruction, overhaul and medium repairs of the track, as well as on the current track maintenance sites have been determined.

For the first time, the effectiveness of use of a vertically arranged geogrid in design of the track superstructure to increase the lateral stability of the rail-sleeper grid in the ballast prism has been proved.

The proposed retaining design of track superstructure allows to increase the lateral stability of the railway track in curved sections by 17–26 %, thereby increasing traffic safety, as well as reducing the cost of the current maintenance of the track in the curves.

When using a vertically located geogrid, the sleeper diagram in curves with a radius of less than 1200 meters to the sleeper diagram on straight lines is reduced, which leads to a reduction in the cost of building per 1 kilometer of the curve by 3,9 %.

The use of a holding structure in the form of a vertically arranged geogrid reduces the size of the ballast section (shoulder width of the ballast section, thickness of the ballast under the sleeper) in curves with a radius of less than 1200 m and, as a result, reduces the amount of ballast used to keep the rail-sleeper grid in a stable state to 20 %

Specialty 05.22.06 – Railway track, survey and design of railways. The work was performed at Ural State University of Railway Transport.

Smerdin, A. N. Improvement of the system of current collection of main electric railways in the conditions of high-speed and heavy haul traffic [*Sovershenstvovanie sistemy tokos'ema magistralnykh elektricheskikh zheleznykh dorog v usloviyakh vysokoskorostnogo i tyazhelovesnogo dvizheniya*]. Abstract of D.Sc. (Eng) thesis. Omsk, OSTU publ., 2019, 43 p.

A multi-element model of a current collector with elastic-viscous bonds was created, characterized by the fact that distribution of aerodynamic and dissipative forces, as well as inertial characteristics, are implemented element-wise.

A method for determining instantaneous and average values of contact pressure has been developed, based on previously obtained data on speed of movement, spatial arrangement of wires and stiffness of the contact network along the length of the section, while an artificial neural non-linear autoregressive network is used as a universal approximator of contact depression.

A probabilistic model of current collection system is created, its structure, determined using the Bayes–Dirichlet evaluation function, is formed taking into account the changing input data set, including data on the failures that occurred and the weather factors accompanying them.

The method of experimental studies of interaction of current collectors with contact hangers on operating lines has been improved. When determining the values of contact pressing, the angular accelerations of measuring runners installed on carriages with an increased stroke are taken into account.

An improved method of load tests of current collectors with regard to cooling by the oncoming air flow is proposed. When determining the heating indices, movement of contact points along the surface of the skids is taken into account.

Improved technologies have been proposed for detecting contact disturbances in determining the reduced mass and checking for stability of current collectors to separation in laboratory conditions. The signals from accelerometers are used to obtain the motion characteristics of the system of moving frames, runners and measuring beam.

A method of processing the results of aerodynamic tests of current collectors on operating lines obtained under various external conditions has been developed and experimentally verified. The aerodynamic forces recorded synchronously with the data on the actual density of the medium are corrected using the proposed coefficient.

A method of experimentally determining the speed of propagation of transverse mechanical vibrations in a contact wire using video surveillance tools is suggested, which does not require interruptions in the train schedule.

Specialty 05.22.07 – Rolling stock of railways, train traction and electrification. The work was performed at Omsk State Transport University.

Trifonov, A. V. The influence of the tribological conditions of rails on interaction of wheels of rolling stock and the track [*Vliyanie tribologicheskogo sostoyaniya rel'sov na vzaimodeistvie koles podvizhnogo sostava i puti*]. Abstract of Ph.D. (Eng) thesis. Moscow, RUT publ., 2019, 24 p.

Using the developed mathematical models of spatial oscillations of the section of movement of a freight locomotive and a freight car, the influence of possible variants of the tribological state of the contact surfaces between wheels of the rolling stock and rails on the interaction of wheels of rolling stock and rails has been studied. Based on the analysis of the results obtained, a variant of the tribological state of the contact surfaces between wheels of rolling stock and rails in the curves is proposed, which provides the most effective interaction of wheels of rolling stock and rails according to the criteria aimed at reducing the lateral impact of wheels of rolling stock on rails and wear factors.

The rational coefficients of friction on the contact surfaces between wheels of rolling stock and rails in the curves under the terms of implementation of traction and braking of rolling stock are proposed.

The appearance of the effect of reducing the moment that prevents the rotation of the first set of wheels and bogie in the curve from the use of combined lubrication of rails is substantiated.

Technical solutions regarded as inventions are proposed referring to an all-weather rail-lubricating device, including for the use of combined lubrication, to various types of lubricants with the possibility of installation on various types of rolling stock.

Specialty 05.22.07 – Rolling stock of railways, train traction and electrification. Work performed at Russian University of Transport.

Umarov, Kh. K. Decision making in substantiating the strengthening of the capacity of the railways of Uzbekistan under conditions of uncertainty of baseline information [*Prinyatie reshenii pri obosnovanii usileniya moshcnosti zheleznykh dorog Uzbekistana v usloviyakh neopredelennosti iskhodnoi informatsii*]. Abstract of Ph.D. (Eng) thesis. St. Petersburg, PSTU publ., 2019, 17 p.

A mathematical model has been proposed for forecasting the freight traffic of a railway, based on the use of its value dependencies on the studied economic factors (China's GDP and GDP of Central and South Asia).

The main factors of uncertainty and risks that influence decision-making in justifying strengthening of the capacity of the railways of Uzbekistan in order to attract transit cargo flows between China, Central and South Asia are identified. The degree of sustainability of the decisions made when the GDP growth rate changes, was found.

The paper proposes a stage-by-stage enhancement of the capacity of Angren–Pap railway line with the aim of attracting transit cargo flows that are transported between China, Central and South Asia.

Specialty 05.22.06 – Railway track, survey and design of railways. The work was performed at Emperor Alexander I St. Petersburg State University of Transport.