VOLODYMYR DAHL
EAST UKRAINIAN NATIONAL UNIVERSITY
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MANAGEMENT UKRTRANSBEZPEKA
IN LUHANSKAYA REGION

GLOBALIZATION OF SCIENTIFIC AND EDUCATIONAL SPACE. INNOVATIONS OF TRANSPORT. PROBLEMS, EXPERIENCE, PROSPECTS

THESES
OF INTERNATIONAL SCIENTIFIC CONFERENCE
3-12 May 2017
Dresden (Germany) - Paris (France)

ORGANIZING COMMITTEE

Executive editor: Chernetska-Biletska N., Head of Department "Logistics management and traffic safety on transport" of the Volodymyr Dahl East Ukrainian National University.

Recommended for publication by the Academic Council of the Volodymyr Dahl East Ukrainian National University (protocol № 9 from March 31, 2017)

Globalization of scientific and educational space. Innovations of transport. Problems, experience, prospects: thesis, 3-12 May 2017, Dresden (Germany) - Paris (France) / Executive editor: Chernetska-Biletska N. – Severodonetsk: Volodymyr Dahl East Ukrainian National University, 2017.

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- distribution the information leaflets, which contain information about dangerous road sections of the region, among drivers at the gas stations;

- development the Internet site named “Interactive map of emergency hazardous road sections in Zaporizhzhya region". This site will contain information with warning to drivers about the location of dangerous road sections of the region;

- to make a proposal to GPS map designers to include into maps information about dangerous road sections on the vehicle route along with the names and location of streets, road intersections etc.

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THE EVALUATION OF THE "DRIVER-LOCOMOTIVE" ERGATIC SYSTEM PERFORMANCE QUALITY

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According to the statistics [1], the proportion of the safe railway operation violations in the locomotive facilities is 31% of the total amount of the Ukrzaliznytsya. And on analyzing dangerous situations causes the human factor is 27%. These indicators prove that there is a significant reserve for improving safety of operation by minimizing human beings’ harmful impact on operating.

The criterion of the "driver-locomotive" ergatic system performance quality in control can be represented as the correlation between various quality indicators reflecting different properties of the system.

Complex criterion of the system quality defined in the form of:

$$K = \sum_{i=1}^{n} \gamma_i I_i , \qquad (1)$$

where γ_i is the weight coefficient of the i indicator I_i, $i \in [1, n]$;

n – number of partial criteria.

Each of the partial criteria is functionality

$$I_i = I_i\left(x, u, x_{зв}, x_{пу}, x_{кс}, q_{лб}, t\right) = I_i\left(\bar{X}\right), \quad (2)$$

where x is the vector of the locomotive technical state;
u is the control vector;
xse is the specifying effects vector;
xic is the initial conditions vector.
xfs is the vector of final state;
qlc is the locomotive crews work quality;
t is the time during which system is investigated.

The factors of utility given in the work [2, 3] are used as criteria. Parameters that characterize the utility of a decision taken by the system are the values of the emergency situation complexity, deviations from the schedule and power consumption for traction.

The utility of decision is defined in the three-dimensional coordinate system (Xec; G; Δt), where Xec is the emergency situation complexity, G is the energy consumption for the movement of trains, Δt is the deviation from the schedule. The utility of the action in this case will be determined by the length of the vector, deferred from the origin of coordinates to the point (Xec; Gi; Δti), which is determined by the forecasted value of the specified values in the result of a decision made by the system [4].

Thus the expression (1) can be substantiated and presented in the form of

$$K = \sum_{i=1}^{3} \gamma_i I_i \quad (3)$$

where I1 is partial criterion of safe railway operation; I2 is partial criterion of energy consumption for haulage of train; I3 is partial criterion for the on-time train performance; γi is weight coefficient of i-th partial criterion.

When operating locomotive decision making depends on many circumstances. It is proposed to determine the basic train control strategy that can be applied in various situations.

Control strategy is introduced as the set containing its characteristic parameters $s_l \in (\pi_1, \pi_2, ..., \pi_j)$, where π1 is the j-th indicator of the implementation of the strategy sl. There are functions $\pi_j = f(I_i)$ that determine the impact of each criterion on the performance of this control strategy. The influence of the value of a control quality criterion on the indicator πj characterizing each particular strategy is evaluated by comparing derivatives $\frac{d\pi_j}{dI_i}$. And the total impact of criterion Ii on the strategy si is taken as the arithmetic mean of the derivatives

$$A_{I_i/s_l} = \frac{\sum_{j=1}^{k_{s_l}} \frac{d\pi_j}{dI_i}}{k_{s_l}} \qquad (4)$$

where A_{I_i/s_l} is the magnitude of the Ii criterion influence on the sl control strategy;

is the number of sl strategy indicators.

So the absolute indicators of influence of each control quality criterion on the implementation of the particular control strategies are received.

To obtain the values of the weight coefficients when calculating control quality with different strategies it is necessary to use a well-known transition from absolute indicators to relative ones:

$$\gamma_i(s_l) = \frac{A_{I_i/s_l}}{\sum_{i=1}^{n} A_{I_i/s_l}}, \qquad (5)$$

where $\gamma_i(s_l)$ is the weight coefficient of the i-th criterion for the l-th strategy.

A_{I_i/s_l} is the magnitude of the Ii criterion influence on the sl control strategy;

$\sum_{i=1}^{n} A_{I_i/s_l}$ is the summary absolute value of all control quality n criteria influence on the implementation of the l-th strategy.

Thus, using different strategies the formal indicator of the train control quality has been obtained.

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