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ОЦЕНКА ВЛИЯНИЯ ЛОКОМОТИВА НА ДАТЧИКИ КОНТРОЛЯ ДВИЖЕНИЯ ПОЕЗДОВ
EVALUATION OF THE INFLUENCE OF THE LOCOMOTIVE ON TRAIN CONTROL SENSORS

Abstract: The scientific novelty is presented by the models of driving freight trains with different masses of trains, organized by three-section mainline (train) locomotives and the methodology for substantiating the main kinematic parameters of the movement of freight trains on a virtual hilly section of the railway track for various operating conditions. Practical significance are numerical values and dynamics of changes in the kinematic parameters of the stopping process at the intermediate and final stations, as well as regression equations for their definition in the range of the freight train mass variation interval accepted by the authors. The results of the research obtained by the authors can be implemented in the practice of work by specialists of the operation shop of the locomotive complex of the Uzbek railways in substantiating the effectiveness of locomotives in real conditions of organizing rail transportation of goods.

Keywords: research, result, freight train, diesel locomotive, railway, parameter, siding

Introduction

Recently, there has been a significant increase in the volume of railway transportation of cargo by locomotives of electric and diesel traction on high-speed sections of railways.

At that, to a greater extent implementation indicated volume of freight traffic is carried out by the main diesel locomotive fleet of «O'zbekiston temir yo'llari» Joint-stock company, basis for the current moment for movement locomotives are used, which can be assembled from different sectional components, which further forms the basis for research, in order that not only for speed traffic, but also for high-speed traffic, to maximize the effect of diesel locomotives in transportation, ensuring movement on diesel traction in real conditions, in any operating conditions [1].

The study [2, 3, 4] shows that by modeling a simplified traction power supply system, based on the analysis and simulation of the process of passing the neutral inserts of the contact network by an electric locomotive, it is possible to avoid the magnitude of overvoltage, at which it will be possible to increase the voltage during the phase separation process, which will significantly reduce the threats to the safe operation of the electric train along the route [5].

The authors of research [6] recommend a model and algorithm for optimizing the choice of train route for daily planning of freight rail transportation by redistributing the car traffic, taking into account the time of delivery and departure of goods between successive trains, which will reduce the total travel time of a freight train and ensure timely delivery of goods. Analysis of the presented works [7, 8] indicates the degree of study of the problem of substantiating the efficiency of using various transport systems by increasing operational reliability, further improvement of repair production and provision of opportunities to reduce the consumption of fuel and energy resources for train traction [9].

Materials and Methods

Therefore, the purpose of this study is to clarify the kinematic parameters along the path of movement, speed and travel time of freight trains, taking into account the time for acceleration – deceleration in the process of organizing their stop at an intermediate and the terminal station of a virtual hilly section the high-speed railway, where organizational and technological operating conditions are assumed to be similar to real ones.

To implement and achieve the results of the research goal, the following tasks have been resolved:

- a review of scientific research on the effectiveness of the use of different types of transport systems in operating conditions was performed;

- models for driving freight trains with different masses and a constant number of axles in train sets were developed, organized by three-section mainline (train) freight locomotives on a virtual hilly section of the railway;

- a traction calculation was performed for the investigated locomotives during the movement of the indicated freight trains with and without stops on a given virtual section of the account;

The object of the study was freight trains with the same number of axles and different train weights, mainline freight locomotives, consisting of three sections, and a straightened track profile of a virtual hilly railway section of the second type by complexity. The subject of the study is the speed and time of movement of a freight train, taking into account the analysis of the features of its stopping process at intermediate and final stations of a given, studied section of the railway for various masses and a constant number of train axles [1, 2].

Design features, technical parameters, traction characteristics, energy and performance indicators of the studied freight diesel locomotive, as well as the characteristics of the straightened track profile of a virtual hilly section of the railway are covered in detail in [2, 3].

The conducted studies have shown that the control of parameters consisting of three sections and reliable control, in the principal electric scheme, in the section control panels, in the start preparation system, interface connections, in diesel engine start, and, accordingly, a fire alarm, changes have been made to improve the diesel locomotive.

$$w_b = \frac{w_b^I \bar{Q}_L \sum w_{bj}^{II} Q_j}{\bar{Q}_L \sum Q_j}, \quad (6)$$

$$w_b^I = 24 + 0.396V_a + 0.045V_a^2 \quad (7)$$

w_b^I is main specific resistance to movement of the locomotive, N/t

$V_a = V_n + V_{n+1}/2$ is average train speed in the selected interval, m/s;

w_{bj}^{II} is main specific resistance to the movement of cars of this type, taking into account their actual load, N/t;

$$w_b^{II} = 7 + \frac{30+3.6V_a+0{,}324V_a^2}{q_o}, \quad (8)$$

q_o is axial load, t.

Result and Discussion

On fig. 1 and fig. 2 respectively shows the numeral values and are given dynamics of the kinematic parameters of the stopping process – graphs for the distance that freight trains travel at the stations intermediate and final, and graphs of the speeds movement of freight trains as a result of the completion of acceleration and at the time of the start of braking at these stations. The graphs of the time of the freight train along the route of the rolling stock during braking and acceleration (in starting pulling away off) at the intermediate item (station) and the arrival station is shown in Fig. 2.

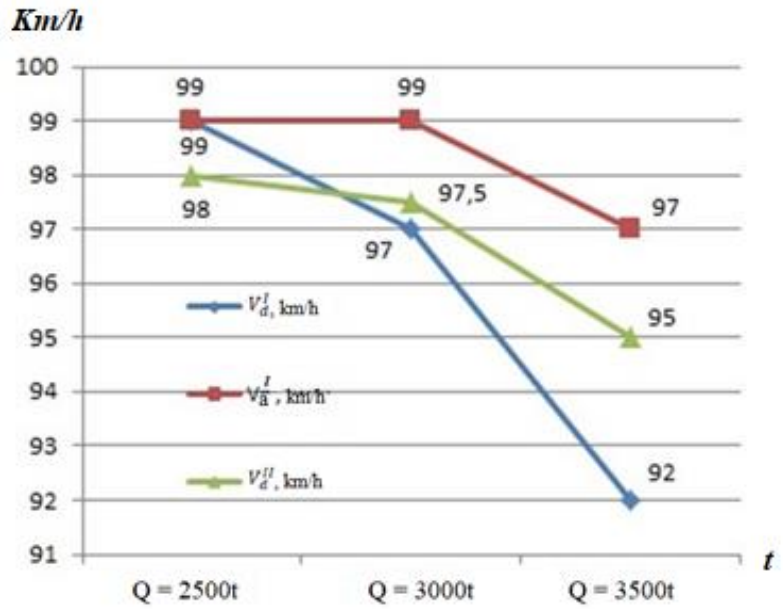

Fig. 1. Dynamics of changes in the speed movement of freight trains during braking and acceleration at the intermediate station and the arrival station

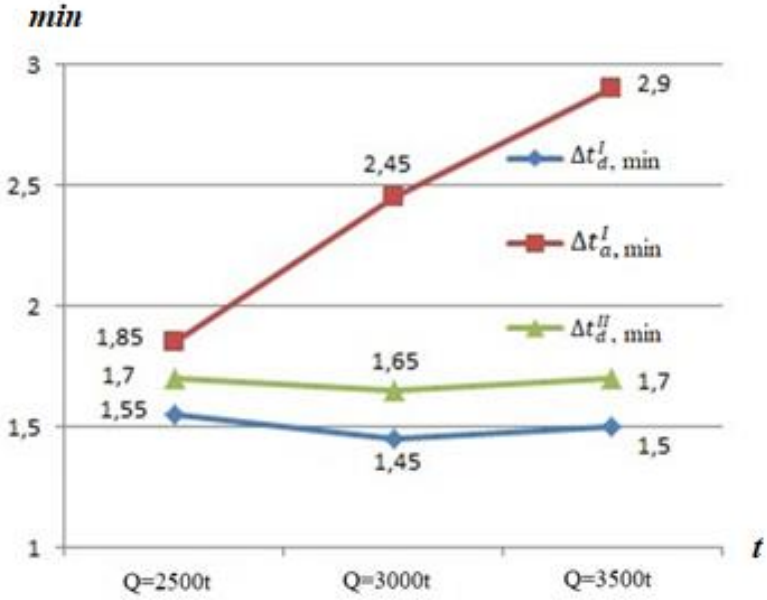

Fig. 2. Travel time of a freight train during braking and starting off at intermediate station and arrival station

Conclusions

Based on research carried out, the authors obtained following results:

- graphic dependences (histograms) and fluctuation rates of main kinematic parameters of movement a freight train in accepted range of changes in mass trains stops at intermediate and final stations of a virtual hilly section of a high-speed railway are obtained.

- regression equations were compiled to determine of length path, values speed and travel time of a freight train for different masses of trains at stops on a virtual hilly section of a high-speed railway.

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