MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
VOLODYMYR DAHL EAST UKRAINIAN NATIONAL UNIVERSITY
Department "Logistics management and traffic safety in transport»

RPE "ZARYA"

REGIONAL BRANCH «DONETSK RAILWAY»
PJSC «UKRZALIZNYTSIA»

EASTERN INTERREGIONAL DEPARTMENT
OF UKRTRANSBEZPEKA

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

Certificate UkrISTEI 302 of April 23, 2021

THESIS OF XIII INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE

21-26 May, 2021
Vlora (Albania)

ORGANIZING COMMITTEE

Recommended for publication by department "Logistics management and traffic safety in transport", Volodymyr Dahl East Ukrainian National University (protocol 24 from May 13, 2021)

Globalization of scientific and educational space. Innovations of transport. Problems, experience, prospects: thesis, 21-26 May, 2021, Vlora (Albania) / Executive editor: Chernetska-Biletska N. – Severodonetsk: Volodymyr Dahl East Ukrainian National University, 2021.

CONTENTS

5. Dia, H. An object-oriented neural network approach to short-term traffic forecasting. Eur. J. Oper. Res. 2001, 131, 253–261. [CrossRef]
6. Huang, W.; Song, G.; Hong, H.; Xie, K. Deep architecture for traffic flow prediction: Deep belief networks with multitask learning. IEEE Trans. Intell. Transp. Syst. 2014,15, 2191–2201. [CrossRef]

DETERMINATION OF VERTICAL LOADS OF THE BEARING STRUCTURE OF A FLAT CAR WITH VISCOUS RESTRAINT IN THE LONGITUDINAL BEAMS

Fomin O.[1], Vatulia G.[2], Lovska A.[2]
[1]*State University of Infrastructure and Technologies,*
[2]*Ukrainian State University of Railway Transport*

The competitiveness of the rail industry in the transportation market can be maintained by putting into operation innovative rail vehicles. It must be noted that designers should pay special attention to the bearing structure of a rail vehicle [1 – 3], especially, to their multi-functionality, i.e. capability to perform several functions.

Moreover, one of the widespread problems is provision of the fatigue strength of the bearing structure of a car; particularly it refers to long-base cars, such as flat cars due to the periodic cyclic loads in the vertical and longitudinal planes. It causes damage of the bearing structure of a car. Therefore, the designing of these cars requires the measures aimed at higher fatigue strength of the bearing structure by implementing innovative solutions.

Thus, a decrease of the dynamic loading on the bearing structure of a flat car and an increase of the fatigue strength during operational modes can be reached through application of viscous elements in the bearing structure. These viscous elements were placed in the longitudinal beams of the frame. It requires replacement of the main longitudinal beams of the frame with the U-profile beams covered with a horizontal sheet. The inside part of the profile was filled with viscous material. The dynamic loads to the bearing structure of a car were extinguished by the viscous resistance forces emerging in the main longitudinal beams of the frame.

The dynamic loads of a flat car with viscous restrain in the longitudinal beams were determined by the mathematic modelling. All the im-

provements were implemented for a 13-7024 flat car which was taken as the prototype. The research was made in the plane coordinates.

A flat car was taken as a system of three solid bodies: the frame and two 18-100 bogies with suspension groups with specific rigidity and the relative friction coefficient. The study included motion of an empty car over a joint irregularity.

It was assumed that the viscous restraint in the longitudinal beams of the frame of a flat car was activated at the forced oscillations of a car, thus it did not impact the natural oscillations of the bearing structure.

The mathematical model was solved in the MathCad software. The accelerations on the bearing structure of a flat car were about 2.1 m/s^2 (≈ 0.2g), and they did not exceed the allowable values [4, 5]. The allowable accelerations on the bearing structure were taken equal to 0.75g ("allowable" motion).

The accelerations in the areas of support of the bearing structure on the bogies were about 0.45g, and the accelerations of the bogies were about 0.8g.

The research conducted will help engineers to design innovative rail vehicle structures, decrease their dynamic loads in operation, and, thus, improve the fatigue strength and increase the rail transport efficiency.

References:

1. Fomin O. Improvements in passenger car body for higher stability of train ferry / O. Fomin, A. Lovska // Engineering Science and Technology an International Journal, 2020, Vol. 23, Issue 6. – P. 1455–1465. https://doi.org/10.1016/j.jestch.2020.08.010
2. Vatulia G. L. Rationalization of cross-sections of the composite reinforced concrete span structure of bridges with a monolithic reinforced concrete roadway slab / G. L. Vatulia, O. V. Lobiak, S. V. Deryzemlia, M. A. Verevicheva, Ye. F. Orel // IOP Conference Series: Materials Science and Engineering. 2019, Vol. 664, 012014. doi:10.1088/1757-899X/664/1/012014
3. Rakshit U. Study on Longitudinal Forces of a Freight Train for Different Types of Wagon Connectors / U. Rakshit, B. Malakar, B. K. Roy // IFAC-PapersOnLine, 2018, Vol. 51 (1). – P. 283 – 288. doi: https://doi.org/10.1016/j.ifacol.2018.05.074
4. Vagoni vantazhni. Zagalni vimogi do rozrakhunkiv ta proektuvannya novikh i modernizovanikh vagoniv koliyi 1520 mm (nesamokhidnikh): DSTU 7598:2014, 2015. – 162 s.
5. Vagony gruzovye. Trebovaniya k prochnosti i dinamicheskim kachestvam: GOST 33211-2014, 2016. – 54 s.