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DETERMINATION OF THE DYNAMIC CHARACTERISTICS OF FREIGHT WAGONS WITH VARIOUS BOGIE

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Abstract. In most cases, dynamic characteristics determine the wagon maintenance cycle, traffic safety, reliability and durability performance. The main dynamic indicators include the vertical K_{vd} and horizontal K_{hd} dynamic coefficients as well as the stability coefficient K_s, which determines the wheel flange resistance to derailment. The article compares dynamic indications for three different types of bogies. There were no tangible differences observed for all the three different types of bogies running at a speed of 40 to 120 km/h on a direct tangent rail section. Nevertheless, there is a realistic potential to improve the dynamic indicators of a freight wagon by rationalising suspension unit parameters.

Keywords: dynamic indicators; bogie; suspension; wagon; model; spring.

Introduction

As we know, dynamic indicators are the main criteria of dynamic characteristics which determine the mode of operation of rolling-stock. They must take into account modern trends in the manufacturing of railway wagons all over the world (Ten, Myamlin 2010) and also meet requirements of normative documents (Normy Dlya Raschyota… 1996). Researchers of many countries have made great efforts in studying the derailment mechanism and train running safety, but the train derailment phenomenon remains far from being resolved and there are still many reports on serious accidents caused by derailment. Therefore, the mechanics of wheel/rail interaction and derailment deserves further investigation in order to guarantee the safe operation of trains (Steišūnas *et al.* 2013). Studies on the subject cover wheel flange climb derailment and wheel impact derailment. First, it is assumed that the wheel flange climb process is quasi-static, then the flange climb derailment criteria are derived through analysing the forces exerted on the wheel-set. The calculations indicate that the results of the classical method are more conservative compared with the results of the analytic method for the diagnosis of wheel-set derailment (Zeng, Wu 2008). Criteria for the evaluation of the safety of railway vehicles in terms of derailment are reviewed. In the case of quasi-static wheel climb derailment, the current safety criteria are available. Recently, oscillatory wheel load fluctuations of considerable amplitude have been observed on Shinkansen vehicles running at high speed, but there were no established evaluation methods for the dynamic derailment under such a specific condition (Ishida, Matsuo 1999).

In the design of freight wagons, increasingly more attention is given to the task related to engineering development of carriages and assessment of their dynamic characteristics that depend on the type and design, also considering axial loads; and ensuring that dynamic and driving characteristics meet the conditions that influence the track, as well as stability and value of frame forces. A carriage must be universal; its size must allow swapping over carriages in service; it must be fully uniform in respect of parts of the set; both its design and manufacturing technology must be simple (in order to minimise costs of production and maintenance of these carriages); operation must be technically efficient.

The analysis of the impact made by various types of carriages on main dynamic indicators of driving safety of freight wagons, open-top freight wagons in this case, was performed in this paper in relation to the follow-

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