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# ESTIMATION OF DYNAMIC LOADS ON A REFERENCE TRAIN WITH A PASSIVE SAFETY SYSTEM IN ITS COLLISIONS WITH AN IDENTICAL TRAIN AND A FREIGHT CAR

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New high-speed passenger cars for 1520 mm gage railways must be designed taking into account passive safety systems (PSSs) for collision protection. A PSS includes energy absorbing devices (EADs), which protect the passengers, the train crew, and the car structures from destructive impact loads. At the Institute of Technical Mechanics of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine, EADs of different absorbing capacities have been designed. The aim of this paper is to estimate dynamic loads on the PSS-equipped vehicles of a reference train in collisions whose scenarios are specified in the EN 15227 standard. In this paper, collisions of a reference train at 36 km/h with an identical train and with 80 t freight car are considered. The reference train consists of a locomotive and four cars whose end parts are equipped with EADs. A discrete-mass model of a head-on train collision is presented. What is new in the model is the force characteristic of an inter-car connection, which takes into account the operation of the locomotive and car push-back automatic couplers and EADs and the elastoplastic deformation of the vehicle structures. Two trains are considered: a 90 t locomotive with 50 t cars and a 123 t locomotive with 64 t cars. It is shown that the requirements of the European EN 15227 standard and the passive protection concept developed for a 1520 mm gauge high-speed passenger train are met if the locomotive, 50 t cars, and 64 t cars are equipped with EADs of energy absorbing capacity 0.95 MJ, 0.25 MJ, and 0.3 MJ, respectively. Locomotive and car EAPs with these values of the energy absorbing capacity have been designed.

***keywords:*** *locomotive-hauled high-speed passenger train, collision, passive safety system, energy absorbing device.*

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