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THE IMPACT ON PEOPLE AND FACILITIES OF AIR FLOW CAUSED BY HIGH-SPEED TRAIN TRAFFIC

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Abstract

Railway track and people are near the moving train experiencing airflow pressure arising from the movement of high-speed trains, the amount of which depends on the speed of air flow. The distribution of airflow from simulations speed train movements of the axisymmetric body in a variety of forms of the head and the tail section of the . The train is considered as a unit, consisting of axially symmetric bodies. The research results allow you to set the speed of the distribution area of the air flow, the minimum safe distance finding people near a passing train and requirements for physical and mechanical properties of the individual components.

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Keywords: high-speed train traffic, airflow, airflow velocity zone, distribution of airflow.

1.Introduction

Ensuring the safe movement of high-speed trains, trouble-free operation of all infrastructure of high-speed railways is the main requirement to such objects when they are created. The high degree of security is laid in the design phase, provided the construction and operation is realized in the course of high-speed rail. Consider some of the security issues on high-speed railways, pledged at the design stage.

2. Problem

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When driving high-speed and high-speed trains through the involvement in the movement of the air flow creates overpressure which may have a negative impact on the elements of the railway infrastructure (booths, travel, people, land, buildings, railway stations, etc..). Therefore, the study of influence of streams generated by trains at speeds of over 200 km / h, is an urgent task to ensure railway safety.

Since the 70s of the twentieth century in many countries, both theoretically and experimentally investigated the aerodynamics of high-speed trains, which are the purpose of: obtaining aerodynamic data on the nature of the air flow (speed and direction of the vector), arising from the movement of high-speed trains; assess their impact on devices and installations of the railway infrastructure; to study their effects on people and the maintenance personnel in the vicinity of a passing train, as well as the surrounding nature .

Empirical studies of the aerodynamic resistance to movement of the train, using a wind tunnel and model trains made it possible to establish the dependence of the aerodynamic resistance of the speed, shape of the head and the tail of the wagons the train traffic conditions (in a tunnel or open terrain), type of train (for a TGV train, the ICE) [1, 2, 3].

The aerodynamic characteristics of high-speed trains in the tunnel made it possible to determine the amount of air pressure on the walls of wagons (window and door glazing, including double-decker coaches), to improve the design of wagons, to prevent their destruction [1, 2, 3, 15].

Theoretical and experimental studies of the interaction of the moving speed trains with objects located along the railroad tracks and the trains (high-speed or freight) moving on a parallel path (toward or in the same direction) allowed to establish (recommend) a secure distance finding passengers on high or low station platforms, prevent tipping freight containers [3, 4, 5, 16, 17, 20, 21]. It was found that the pressure pulse caused by trains, extending towards each other in the open area can lead to structural problems in the trains themselves.

Research results C.Baker allowed to understand the physics of the formation of aerodynamic flows in all parts of the moving speed of the train; ensure the safety and comfort of passengers; develop measures to reduce the aerodynamic resistance to movement of the train [6, 7, 8, 9].

One of the negative phenomena, which occurs during the passage of high-speed trains, is "flying rubble" where particles of crushed stone are "lifting" during the passage of trains. This phenomenon occurs when the combination of mechanical and aerodynamic forces generated during the passage of high-speed trains make gravel particle to overcome the force of gravity. Influencing Factors on the "flight of rubble" includes aerodynamic conditions, screen effects and atmospheric conditions. Experimentally investigated the air flow, aerodynamic effects and adverse events occurring at a moving speed train, in particular the release of gravel on the track and rail deformation [10, 11, 18].

With the variety of studies the aerodynamics of high-speed trains, the problem of interaction of high-speed trains and high-speed rail infrastructure remain unsolved. This primarily requires theoretical justification of the velocity field and aerodynamic pressure around the moving high-speed train.

3.Elaboration of mathematical models

The study of air flow distribution and the determination of its velocity along a moving high-speed train, the train was carried out on the model, which is made up of a locomotive and $2n$ wagons. The locomotive and the cars are provided as axially symmetric body with a streamlined tail portion and the head moving in the compressible (acoustic) medium [19].

For definiteness, we assume that the locomotive and all cars have the same cylindrical shape, consisting of a circular cylinder, and the same circular cones in the initial and final sections (Fig. 1).

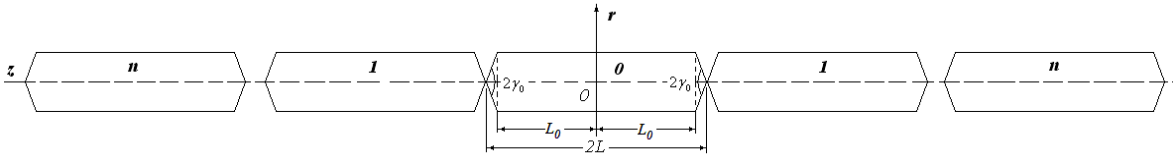

Fig.1. Driving the train with a locomotive and wagons.