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The object of the study is the processes of occurrence, perception, and redistribution of loads in the brake shoe of a freight car bogie during braking. In order to ensure the safety of the movement of freight cars, a study of the uneven load on the bogie shoe of the model 18-100 freight car was carried out. A mathematical apparatus was built to determine the strength of the brake shoe, taking into account the uneven load transmitted to it from the brake pad. In this case, the brake shoe was considered in the form of a frame with variable stiffness. It was established that the stresses that occur in the shoe exceed the permissible ones. To test the proposed mathematical apparatus, a computer simulation of the strength of the brake shoe was carried out. In this case, the finite element method, which is implemented in SolidWorks Simulation, was used. The difference between the results obtained by mathematical modeling and computer simulation was 5.7 %.

A feature of the research results is that they make it possible to determine the moment of resistance, and accordingly, the stresses that act in the shoe along its length. This will make it possible to design its fundamentally new structure at the subsequent stages.

The field of practical application of the reported results is the engineering industry, in particular, railroad transport. The conditions for the practical application of the research results are to ensure the strength of the shoe during braking of the rolling stock in operation.

The study will contribute to advancements in improving the reliability of the braking systems of bogies, as well as ensuring the manufacturability and maintainability in the construction, operation, and repair of the components of the mechanical part of brakes for the new generation freight cars

Keywords: freight car, brake shoe of a car, stressed state of the shoe, transport mechanics, traffic safety

DETECTING THE INFLUENCE OF UNEVEN LOADING OF THE BRAKE SHOE IN A FREIGHT CAR BOGIE ON ITS STRENGTH

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1. Introduction

The development of railroad transport under the current conditions of a competitive environment requires the creation of prerequisites for the improvement of its components [1–3]. In this case, special attention should be paid to the mechanical part of brakes, as one of the most responsible from the point of view of traffic safety. It is important to say that the uneven wear of brake pads exerts a significant impact on the efficiency of rolling stock brakes. In turn, this affects the strength of the shoes in which they are fixed.

When braking, the contact forces of pressure on unevenly worn pads are distributed eccentrically along the reduced braking friction area; because of this, significantly greater frictional forces are concentrated on unevenly worn parts of the pads and intense frictional heat generation is concentrated. This circumstance becomes the reason for the destruction of the pads under the conditions of operation of freight cars and leads to both damage to the brake shoes and the occurrence of malfunctions on the rolling surfaces of wheels due to contact with the brake shoes.