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Analysis of the Work of Under-Rail Gaskets in the Conditions of Railways of Uzbekistan

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Abstract: *The article examines the work of a sub-rail gasket made of rubber material and made an analysis of its different thicknesses in the regions of Uzbekistan.*

Keywords: *The upper structure of the track, sleeper, roadbed, high-speed train traffic, under-rail lying.*

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INTRODUCTION

A railway track is a complex engineering system that includes various elements, such as rails, sleepers, fasteners, a ballast layer, an earth bed. The work of each of them as a whole and separately determines the reliability of the track and the safety of train traffic [1, 2, 3].

A significant role in ensuring the stable operation of the railway track and the safety of train traffic is played by rail fasteners, which should guarantee a reliable connection of the rails with the sleepers. The stability of the rail track depends largely on the quality and reliability of the rail fasteners and their elements, especially when moving trains with high speeds and axial loads [4].

As a result of changes in the physical and mechanical properties of the soil and an increase in the vibration frequencies under the influence of vibrodynamic forces, various deformations and destructions occur in structures [5].

We developed a similar strengthening of the embankment of the roadbed in [6], to ensure the stability of high embankments of the roadbed on relatively weak soil bases during high-speed train traffic [7].

MAIN PART

In connection with the development and implementation of new structures of the upper structure of the track (reinforced concrete sleepers, block sub-rail bases, a trackless track), the functions of rail fasteners and the requirements imposed on them have expanded.

When using reinforced concrete sleepers to reduce the rigidity of the path, which can be achieved mainly due to intermediate fasteners, it was necessary to supplement the fasteners with special elastic (shock-absorbing) elements.

The intermediate fastening, in addition, should provide the possibility of adjusting the position of the rail threads in height, and on the block base – and in the width of the track.

The operational conditions that have developed on the main highways – a combination of high load-bearing capacity with large axial loads, harsh climatic conditions significantly complicate the work of the fastening unit. Thus, non-metallic elements of fasteners on these highways wear out relatively quickly and require replacement more often than the service life of reinforced concrete sleepers expires. Hence, along with the need to use more wear-resistant insulating fasteners, technological requirements should be fully taken into account.

With the current maintenance of the track in winter, due to a number of reasons (uneven heaving of the roadbed and ballast layer, accumulation of residual deformations under the influence of passing trains, etc.), there is a need to correct the track in the profile. With wooden sleepers and crutch fastening, these deviations are eliminated by laying gaskets under a metal lining. In fasteners for reinforced concrete sleepers and in separate fasteners with screw attachment of linings for wooden sleepers, it is necessary to provide for the possibility of adjusting the position of the rails in height within 15-20 mm. This requirement is particularly important on lines with a long winter period. Gaskets for adjusting the position of the rail should be made of practically rigid materials (for example, wood plastics); with a thickness of 2, 4, 6, 8 mm, they will allow to ensure the slopes of the bends of the track in accordance with current regulations without violating the equilasticity of the track.

On sections of track with reinforced concrete sleepers and blocks, the elasticity of the rail thread in the vertical and horizontal planes is formed mainly due to intermediate bonding. By introducing rubber shock absorbers and spring elements into the attachment unit, it is possible to reduce the stiffness of the track with a reinforced concrete sub-rail base to a level close to that which occurs with wooden sleepers.

To design an intermediate rail fastening unit, it is necessary to ensure the ratio of the elastic characteristics of its individual elements, at which the requirements of a certain elastic closure of the system and its minimal change under the influence of rolling stock wheels must be met.

Rubber gaskets have gained preference over wood gaskets, since they not only resist wear and the appearance of residual deformations for a long time, but also retain their elastic properties for a longer time. They have such a magnitude of elastic compression at which the tension forces created with the fasteners fall slightly. This circumstance contributes to the stable position of the rail threads.

Rubber gaskets with a thickness of 2.5–3 mm have already been used on domestic, American and French railways on wooden sleepers in order to reduce mechanical wear of sleepers and protect them from increased moisture and rotting in under-rail areas. Domestic and foreign experience suggests that the introduction of such gaskets on load–stressed sections will extend the service life of sleepers by about 7 to 10 years.

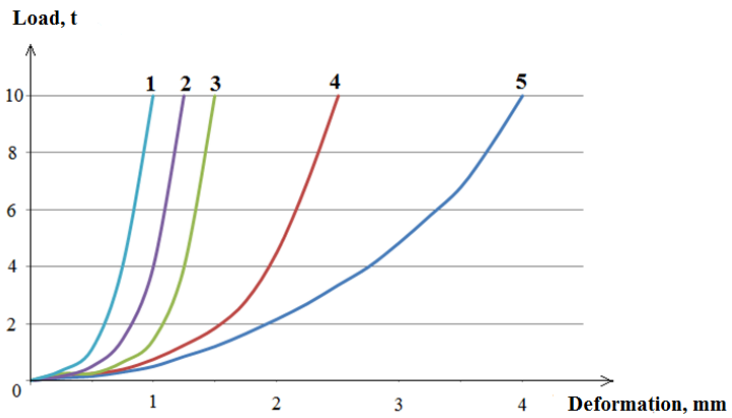

Fig.1 Graph of rubber deformation depending on the dynamic load for gaskets with a thickness of 1-7 mm; 2 – 14 mm; 3 – 21 mm; and static for gaskets with a thickness of 4 – 14 mm; 5 – 28 mm.

It should be borne in mind that the elasticity of rubber gaskets is variable and depends on a number of factors. The most important of them are the characteristics of the load causing deformation and the temperature at which loading occurs. With increasing load, the stiffness of the gaskets tends to infinity and with significant loads, the rubber can work as an absolutely rigid body.

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