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Investigation of KPP-5 Rail Fastener Elastic Deformation

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ABSTRACT

For a long period of operation, a number of shortcomings have been identified in KPP-5 fastener that is mainly due to an intensive decrease of pressing force of the rail on sleepers. This leads to the appearance of frequent cases of track displacement and fastening elements failure. To verify such hypothesis, the process of power work of KPP-5 fastener during railway track operation was researched. The technique and practical means of controlling the power work of KPP-5 fastener are developed. The influence of various factors of the rail pressing force on the sleeper is determined. The main influence is conditioned by under-rail wear (50.4%). The obtained results made it possible to formulate recommendations for the improvement of KPP-5 fastener where the methodology and practical means of controlling the power work of KPP-5 fastener were proposed. At the same time, it allows increasing the reliability and safety of the rail track during the entire overhaul period.

Keywords: Rail track; rail fastener; pressing force; elastic deformation; KPP-5.

INTRODUCTION

One of the strategic tasks related to the introduction of high-speed train traffic is to ensure reliable operation of rail fasteners. The common type of fasteners operating on the railways of Ukraine [1], Poland [2], Byelorussia [3], Kazakhstan [4] is KPP-5 fastener as shown in Figure 1. About 5 thousand km of main railways have been laid on the territory of Ukraine. This type of fastener is the prototype of Polish rail fastener SB-3.

The KPP-5 rail fastener has some advantages at the initial stage of operation. These advantages are easy installation and dismantling of the railway components; absence of threaded connections; a small quantity of parts (only seven parts and none with a thread); low metal consumption (≈5 kg). But after a long period of operation of KPP-5 fastener, a number of shortcomings have been identified. They are mainly due to the intensive decrease of pressing force of the rail on the support (sleepers) [1]. Initially, this problem arose at Odessa Railway (Ukraine), when non-abutment rails displacement took place while this type of fastener was used. At present, KPP-5 fastener is replaced by a new one, when any of its elements are out of order as they are not subject to repair [1].

of monitoring are the basis for the development of regulatory documentation for monitoring and maintenance of the railway track equipped with KPP-5 fastener.

The urgent issue of the present is the development of regulatory documentation on the technology of power work monitoring and railway track maintenance, where KPP-5 fastener is used. This is possible when the track is equipped with the device mentioned above, which can determine the elasticity of the terminal and the pressing force of the terminal of KPP-5 fastener on the rail. It improves the reliability of the rail track during the entire overhaul time. This study offers a challenge for its wide use at European railways and open possibilities for its further improvement.

CONCLUSION

The investigations were carried out using the tracking device for measuring the pressing force of the rail on the support (sleepers). According to the research results, several factors impact the change in pressing force of the rail on the support (sleepers). The main factors are: wear of the under-rail gasket (50.4%), the location of the axes of the anchor holes relative to the under-rail area of the sleepers (29.8%), the terminal weakening (26.2%) and the terminal assembly- dismantling process (6.6%).

The reliability of the power work of KPP-5 fastener can be increased in many ways. For example, with the development of a new terminal design with increased pressing force or a new design of under-rail gasket. For the time being, the authors have been intensively researching the improvement of the under-rail gasket to extend its operating life. Preliminary results obtained by the authors allow increasing the service life of the gasket for 800-1000 million t. of gross passage.

During manufacture of reinforced concrete sleepers of SB-3 type, it is necessary to establish strict monitoring and precision of manufacturing technology of anchor solidification in the sleeper’s body. This avoids possible divergences in the centering of axes of the anchor holes relative to the under-rail base of the sleeper.

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