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Rationale for Choosing the Type of Traction Rolling Stock for the Enterprise of Industrial Transport

D. Kozachenko[1], M. Dovbnia[2], O. Ochkasov[3], V. Serdiuk[4], A. Shepotenko[5], A. Keršys[6]

[1]*Dnipropetrovsk National University of Railway Transport named after academician V. Lazaryana, ac. Lazaryana str, 2, 49010, Dnipro,Ukraine, E-mail:kozachenko@upp.diit.edu.ua*

[2]*Dnipropetrovsk National University of Railway Transport named after academician V. Lazaryana, ac. Lazaryana str, 2, 49010, Dnipro,Ukraine, E-mail: dovbnia@diit.edu.ua*

[3]*Dnipropetrovsk National University of Railway Transport named after academician V. Lazaryana, ac. Lazaryana str, 2, 49010, Dnipro,Ukraine, E-mail: abochkasov@ gmail.com*

[4]*Dnipropetrovsk National University of Railway Transport named after academician V. Lazaryana, ac. Lazaryana str, 2, 49010, Dnipro,Ukraine, E-mail: serdiuk@ diit.edu.ua*

[5]*Dnipropetrovsk National University of Railway Transport named after academician V. Lazaryana, ac. Lazaryana str, 2, 49010, Dnipro,Ukraine, E-mail: Sthorn@ua.fm*

[6]*Kaunas University of Technology, Studentu st. 56, 51424, Kaunas, Lithuania, E-mail: arturas.kersys@ktu.lt*

Abstract

Shunting locomotives are used to carry out shunting and clean-up operations on the routes of most private and state enterprises of industrial transport in various spheres of activity. In most cases, the power of these locomotives significantly exceeds the pre-determined volume of works, especially if the work has cyclical nature.

One of the options for solving the problem of transportation for owners of small industrial enterprises, grain elevators and other similar enterprises may be the presence of their own traction rolling stock. Moreover, its technical and economic characteristics must fully comply with the conditions and volumes of shunting/clean-up operations of the enterprise.

Definition of the most rational type of traction rolling stock should be carried out taking into account the available track infrastructure of the enterprise, volumes and organization of shunting and clean-up operations, organization of the system and production cost of maintenance and repair.

The authors proposed a technique of comparative analysis of technical and operational indicators for the utilization of various types of traction rolling stock using traction calculation methods and ways to organize the operational performance. This will allow the owner of the industrial enterprise to choose the type of traction rolling stock (locomotive, locotractor or steam-accumulator locomotive), which most closely comply with the conditions of a particular enterprise. At the same time, the company's cost reduction for operation of the traction rolling stock is ensured.

KEY WORDS: *shunting operation; rolling stock; locomotive; locotractor; steam-accumulator locomotive; traction calculation; technical and operational indicators*

1. Introduction

An important condition for improving the efficiency of freight transportation by railway is reduction in expenses for shunting operations performed at loading and unloading stations and on approach tracks. One of the key factors at the same time is the choice of technical means for performing shunting operations, first of all shunting locomotives. In this regard, the choice of parameters of shunting locomotives, depending on the operational aspect of major and industrial railway transport, is an urgent task.

The contemporary fleet of shunting locomotives of the PJSC Ukrzaliznytsia public carrier and industrial enterprises in Ukraine actually includes three types of diesel locomotives with an electric or hydraulic transmission, an adhesive weight 45, 90 and 100-120 tons and a power from 370, 550 and 736-883 kW, respectively. The larger part of the shunting locomotives of Ukrainian enterprises was built up to 1990, and today a significant problem is their deterioration, which reached 96%. The renovation of the locomotive fleet at the enterprises is usually carried out through the acquisition of locomotives that were in operation. In this case, small and medium-sized diesel locomotives such as TGM23 and TGM4 of different series, are replaced by more powerful diesel locomotives TGM6A, TEM2. As a result, the share of shunting locomotives with an adhesive weight of 90-100 tons and a power of 735 kW. and more exceeded 70% [3]. Also, there are cases when small-scale enterprises use diesel locomotives with electric transmission CHME3 and TEM7, which were designed for operation at the major railway stations or enterprises of the mining and metallurgical complex. Such a redistribution of the structure of the diesel locomotive fleet leads to a significant reduction in the efficiency of locomotives usage. The data of the enterprises show that at present diesel locomotives are used extremely irrationally, both by the basic parameters - adhesive weight and power, and by time-of-use. The

the adhesive weight of the traction rolling stock and the coefficient of adhesion:

$$F_p \le 1000 \cdot P_{aw} \cdot \psi$$

here ψ - adhesive coefficient of driving wheels of traction rolling stock with rails.

For MMT-3, the curb weight with equipment is not exceeding 13.0 tons. We assume approximately 10.0 tons of adhesive weight, in view of the fact that a part of the mass will be transferred to the rails through the rollers of combined motion.

According to [8, 9], we take ψ = .75. The coefficient of adhesion for the pneumatic wheel-rail pair is higher than a metal wheel-rail pair (0.22-0.24). It is 0.68-0.85 for dry and 0.35-0.45 for wet rails. On the icy rails the coefficient of adhesion of pneumatic wheels with the rale drops to 0.15).

As a result of the calculations, we determined the permissible number of cars in the shunting train, shown in Fig. 1.

Based on the effective power of the traction rolling stock and the calculated number of cars, the zones of the most efficient application of different types of traction rolling stock were obtained. Visually, the zones of the most effective application of various types of traction rolling stock for specified conditions of shunting/clean-up operation are shown in Fig. 2.

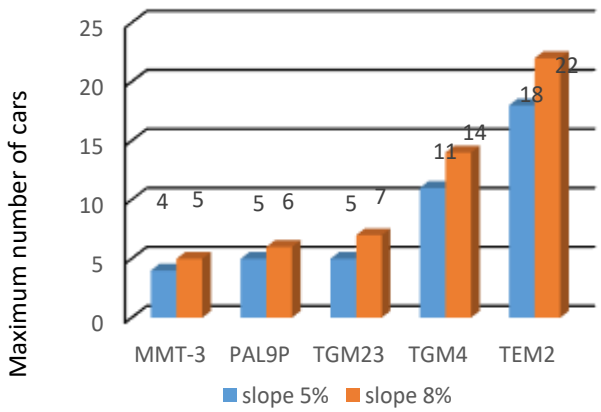

Fig. 1 Maximum number of cars when performing shunting/clean-up operation depending on the type of traction rolling stock

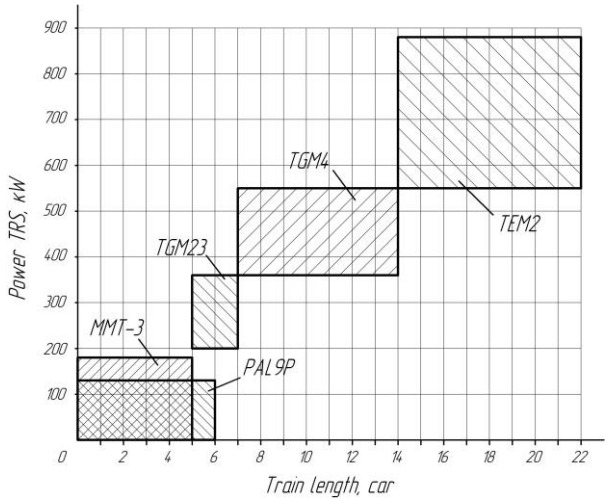

Fig. 2 Areas of the most effective application of different types of TRS for the given conditions of shunting/clean-up operation

3. Conclusions

Characteristic features of railway transport operation both in Ukraine and in the world is the aging of traction rolling stock, which provides execution of the shunting operations at loading and unloading stations and industrial enterprises. The renovation of the shunting locomotives fleet in Ukraine is usually carried out through the acquisition of locomotives of more powerful series that were in operation at other enterprises. It leads to noncompliance of their characteristics with operating conditions and increase in operating costs. In this regard, the issue of ensuring approach tracks with average and low volumes of operation by traction rolling stock is relevant.

Using the methods of traction calculations, a comparative analysis of the most common and perspective types of traction rolling stock for shunting/clean-up operations was carried out. Authors determined the areas of the most effective application of different kinds of traction rolling stock depending on the length of trains with which shunting are performed. The obtained results allow carrying out preliminary assessment of expediency for using the various types of traction rolling stock to perform shunting operation.

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