SEPARATE OVERHAUL AND LINK METHOD: COMPARISON OF TECHNOLOGIES

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ABSTRACT

On domestic railways, the technology of the link method of track overhaul is used. The most common on most foreign railways is the way of separate laying of the track superstructure. The article is devoted to a comparison of these two methods of performing overhaul. The technical, technological and economic indicators characteristic of the variants used are given, and an objective evaluation of the effectiveness of the link and separate methods in relation to Russian conditions is given.

Keywords: *railway, overhaul, technology, organization of work, separate method, link method, track machine, rail, track superstructure.*

Background. *The method of separate laying of the track superstructure (TSS) during construction, reconstruction (modernization) and overhaul is the most common on most foreign railways.*

The advantages of this method of laying TSS include the absence of the need to perform a number of works, for example, the remote assembly of links of a new rails and sleepers (RS), the replacement of old rails with inventory rails, and the inventory rails with new rails [1].

Objective. *The objective of the authors is to consider technologies of separate overhaul and link method.*

Methods. *The authors use general scientific methods, comparative analysis, evaluation approach.*

Results. *As an example, we consider the technology of separate overhaul of TSS by the complex P-95 of the Swiss firm Matisa (Pic. 1).*

In the conditions of closed section, the main technological operations involving P-95 are: delivery and unloading of rails to roadsides, the transfer of rail fastenings to the mounting position, cutting of ballast, planning and compaction of the slice of the ballast section, laying of new sleepers, sliding of new rails, loading of old rails, ballasting and alignment of the track, introduction of rails into the calculated temperature interval and welding to the length of the haul, final alignment and finishing of the track. On the section of separate overhaul (on new materials) 8 km long, the total work time is about 4,75 days [2].

The domestic technology of the link method of track overhaul with the use of a set of own track machines, deep cleaning of ballast by barreled machines with the loading of weeds on the train for the same time of 4,75 days allows us to perform work on a 10 km long section (Table 1).

Comparative analysis performed by the specialists of the Design Bureau (DB) and Russian Railways [3] shows that domestic technologies have about twice as high productivity of work with new materials, for example, in comparison with the analogous technology of P-95 complex of the firm Matisa (Table 1).

The picture of investments using various technologies of overhaul (K_n) (Table 2) convincingly confirms the non-competitiveness of the technology of separate overhaul at the moment. Investments in a new complex of equipment, for example, only for one operation «replacement of RS» amount to 993,02 million rubles. In the domestic technology, additional investment is not required.

Disadvantages of separate overhaul:

1. Low hourly capacity in comparison with the domestic technology of the link method (stacking cranes).

2. The need to create and equip building sites. In some cases – the inability to create them.

3. Low performance of the complex when working with APC fasteners (impossibility of automation).

4. Difficulties in implementing logistics supply processes.

5. Lack of conditions for rapid recovery of traffic in the event of an emergency critical situation.

6. Problems with winter laying.

7. The inevitability of large investments (purchase, repair, etc.).

8. The need to create an infrastructure for storing and renovating old materials.

9. Seasonal employment of personnel.

10. Increase in the number of welded joints in the field.

Advantages of separate technology:

1. Absence of RS assembly sites and storage of the track superstructure elements on PMS bases.

2. Laying the welded track without inventory rails.

3. Machined laying of TSS elements.

4. Laying in curves of small radius.

Table 1

Comparison of the performance of work on track overhaul with new materials (Kn) with various technologies

Parameters	Technology Variety		
	Complex P-95 of the firm Matisa (Switzerland)	Domestic technology	Complex TCM-60 of the firm Matisa (Switzerland)
Features of the technology	Closed haul	Closed haul	Closed haul
Work front	8 km	10 km	8 km
Duration of work	4,75 days	4,75 days	5,5 days
Working speed of the complex	70,2 m/h	87,7 m/h	60,6 m/h
Productivity average	350 m/h	700 m/h	350 m/h
Productivity maximum	550 m/h (with the fastening Pandrol-350)	850 m/h (regardless of the fastenings)	550 m/h (with the fastening Pandrol-350)

Pic. 1. The machine of the firm Matisa.

Table 2

Comparison of investments (in modern prices) with the use of various technologies of overhaul (Kn) at the example of P 95 of the firm Matisa and domestic technology

Parameters	Investments when replacing RS	
	By the complex P-95 of the firm Matisa (Switzerland)	By domestic technology
Machine-combine	Machine: P-95 1 pcs.– 772,56 mln rub.	By available machines: UK 25/21; USO; MPD; Bulldozers; Motor graders and others
Complex of setting sleepers according to diagram (SDG)	SDG – 29,1 mln rub. required 2 pcs.– 58,2 mln rub.	
Special platforms for transportation of reinforced concrete sleepers	1 platform – 8,54 mln rub. required 19 pcs.– 162,26 mln rub.	
TOTAL investments	993,02 mln rub.	Additional investments are not required

Table 3

Comparison of costs (in modern prices) for repair and maintenance of equipment of one complex

Indicators	Costs for repair and maintenance of one complex	
	For complex P-95 of the firm Matisa (Switzerland)	For domestic technology
Total costs	2,482 bln rub.	1,158 bln rub.
Maintenance	More expensive by 264,91 mln rub.	Compared with domestic equipment
Average repair	More expensive by 529,82 mln rub.	
Overhaul	More expensive by 528,82 mln rub.	

5. Fewer staff.

6. Reducing the number of economic trains.

Structural and technological issues

In the construction of the machine-combine for separate overhaul there are no operations for deep cleaning of the ballast.

There is no composition for accumulation of weeds and contaminants. The technology of their export outside the front of works is not provided for.

The design of the machine-combine is designed for transportation of packages of new sleepers in the volume of approximately 150 running meters in one car. At a length of 8 km, about 56–58 such cars are required.

Preliminary (rough) calculations show that the total length of only two trains for transportation of sleepers will be 1700–1800 m! And this is apart from the length of the combine and all other machines used in the technology of separate overhaul: two railroad trains for new and old-fashioned rails, deep ballast cleaning machines with weed control compounds, hopper dispensers, ballast planners, etc.

The approximate total length of the economic train in the parking mode at separate points of contiguity to the front of the work will be up to 5 km. In the operating mode, this length is likely to increase by 1,3–1,5 times. This creates very great difficulties in organizing the transportation process both in the area of repair work and in the whole at the test site.

In the technology of separate overhaul when performing operations to replace rails, there is no operation for discharge of temperature stresses (within the length of the free span of the combine machine, for example, for the complex P95 of the firm Matisa, approximately 24 m in length) in the dismantled rails after they have been removed from sleepers.

Preliminary discharge will not give a proper effect in the conditions of Russia, because in the presence of a sharply continental climate and a temperature drop of 10–15°C or more between the beginning of work and their continuation, a positive result is not expected. So, the probability of ejecting the dismantled rails is very high.

Comparative indicators of costs for the use of track machines for the link method and separate overhaul are presented in Table 3.

Thus, at the stage of preliminary calculations it is established that the total cost of maintenance of new technology of separate track overhaul will be more expensive by 1,325 bln rub. or about 53 mln rub. a year.

Conclusions. *The available materials for comparison of both technical and cost parameters of the technology of separate track overhaul using the example of the complex P95 of the firm Matisa and the technology of the link method using the domestic set of track machines show that at the moment the technology of separate overhaul is uncompetitive for the conditions of the Russian Federation.*

However, when solving urgent problems of modernization of the national track vehicle fleet, the technology of separate overhaul, which has become widespread on most foreign railways, deserves attention. It can become an effective addition to the existing domestic technology of the link method. Meanwhile a research is needed to find the areas of the most expedient use of this method of building and repairing railways, taking into account the organizational features of the transportation process, as well as the climatic and geographical characteristics of our country.

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Article received 23.06.2017, accepted 06.02.2018.