The relevance of improving the maintenance system of the railway track based on the efficient use of labor resources

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Abstract: The main purpose of the article is to explain the relevance of improving the maintenance system of the railway track based on the efficient use of labor resources. The maintenance of the track is occupied by a large team of track workers, and the solution of these tasks is largely determined by the extent to which, with the available means of mechanization, the contingent of track workers in terms of composition and qualifications corresponds to what is required to perform the necessary types and volumes of work on the current maintenance of the track.

Keywords: Railway track, improvement of the system, labor resources, contingent of trackers, track maintenance, ensuring safe and smooth passage of trains, track load

During the years of independence of Uzbekistan, the track facilities of "Uzbekistan temir yullari" joint-stock company have undergone many transformations related to the development of the railway network, the modernization of existing lines, and the introduction of new railway track designs.

Within the framework of the project, financed by the credit line of the Asian Development Bank, the Tashkent-Samarkand-Bukhara route was modernized. At the same time, the laying of the structure of the track structure on BF70 type sleepers with an intermediate rail fastening of the Pandrol Fastclip FC type with elastic (spring) clamps was started. In addition, sets of heavy-duty track machines from the Austrian company Plasser & Theurer were purchased.

Subsequently, the Tashkent-Samarkand-Bukhara line was transformed into the first section of high-speed and high-speed train traffic in Central Asia. High-speed traffic was organized using the trains of the Spanish company Talgo.

New railway lines Guzar - Boysun - Kumkurgan, Uchkuduk - Misken and Bukhara - Misken were built, with the construction of an earthen bed from dune sands, the Angren - Pap line with a tunnel 19.2 km long and with small radius curves.

Rails with differentiated hardening, increased hardness, and increased service life began to be used in the structure of the track superstructure. Turnouts on reinforced

concrete beams and turnouts with movable crosspiece cores have found mass application.

The main task of the track facilities is to ensure the safe and smooth passage of trains at set speeds with the optimal use of resources. The amount and type of resource necessary for the functioning of the railway track infrastructure is regulated by a set of regulatory and technical documentation, which must be up to date.

However, at present, the regulatory framework for the track facilities of “Uzbekistan temir yullari” joint-stock company has lagged behind the real state of the track structures, the technologies used, the ways of performing track work, etc.

The basic document of the track facilities, which establishes the criteria for the expenditure of material resources, by order No. 70N dated 09.11.1995 "On the transition to a new system of track facilities based on an increase in the technical level and the introduction of resource-saving technologies" approved the "Regulation on the system of track facilities" is outdated and does not reflects the BF70 type sleepers operated at “Uzbekistan temir yullari” joint-stock company with an intermediate rail fastening of the Pandrol Fastclip FC type, the presence of rails with differentiated hardening, the presence of Plasser & Theurer track machines, the presence of high-speed and high-speed train traffic, etc.

Another single document is Order No. 50N dated August 18, 1995 “On improving the organization, planning of work and stimulating the quality of the current maintenance of the track”, which is also outdated, which determines the norms of labor costs, the contingent of track fitters, the amount of labor resources required to complete the work packages according to the current content of the path.

Labor resources are the main ones in terms of ensuring the safety of train traffic and guaranteed reliability of railway track operation at all stages of its life cycle. Optimization of labor costs, taking into account the objective technical parameters of the superstructure of the track, requires a systematic approach, taking into account the costs of other resources necessary for the successful functioning of the entire track facilities. At the same time, an optimization mechanism should be implemented in the redistribution of limited resources for the materials of the superstructure of the track, for track mechanisms and tools, the costs for the timely implementation of the entire complex of track repairs over the life cycle of the track structure.

The solution of these issues, with research, calculations and analysis of the results, will provide opportunities to overcome the contradictions that have developed in the track facilities of “Uzbekistan temir yullari” joint-stock company in terms of substantiating the size and increasing the efficiency of using labor resources necessary to implement the most efficient current maintenance of the track with the achievement maximum technical effect and material interest of all participants in the production process. Relevant is the rationing and distribution of labor resources (between

subdivisions and within subdivisions), taking into account not only the real modern structures of the superstructure of the track, but also taking into account the timeliness of the repair of the track, the actually achieved indicators for increasing the resource of the main materials and structures of the railway track, as well as taking into account the intensity and speed of trains.

The aim of the study is to improve the railway track maintenance system based on the efficient use of labor resources.

Research objectives:

- study of the current state and prospects for the use of labor resources of the track facilities;
- substantiation of the optimal number of track fitters in the divisions of track distances to perform work packages on the current maintenance of the track;
- improving the structure of track distance units, taking into account the increase in the efficiency of using all types of labor resources;
- analysis of the activities of the divisions of the distances of the path in the process of improving the use of labor resources;
- development of criteria for evaluating the efficiency of resource use;
- development of indicators to assess the efficiency of resource use.

The object of the study is the railway tracks on the section Rzd, No. 3-Jizzakh 1 of the Tashkent-Samarkand railway line.

The subject of the study is modern methods and technology for improving the maintenance system of the railway track based on the efficient use of labor resources.

The practical results of the study are as follows:

- to substantiate the optimal number of track fitters in the divisions of track distances to perform work packages on the current maintenance of the track;
- to improve the structure of the divisions of the distances of the path, taking into account the increase in the efficiency of the use of all types of labor resources;
- develop criteria for evaluating the efficiency of resource use;
- develop indicators to assess the efficiency of resource use.
- determine the technical and economic efficiency of methods for optimizing the use of labor resources.

The scientific significance of the research results is characterized by the substantiation of the experimental research methodology, mathematical models and theoretical calculations, the development of a set of criteria and indicators for assessing the efficiency of resource use.

The practical significance of the results of the study lies in the development of a set of criteria and indicators for assessing the efficiency of resource use, for improving the railway track maintenance system based on the efficient use of labor resources.

In modern conditions of construction and operation of railways in Uzbekistan, the introduction of resource-saving technologies that ensure the extension of the effective service life of technical equipment is becoming increasingly important. This applies to the greatest extent to the track economy, which is the main element of the railway infrastructure, in which more than 50% of the cost of fixed assets is concentrated.

The development and improvement of the operation of railway transport, an increase in its efficiency can be ensured with a high level of railway track reliability, improvement of the railway track maintenance system based on the efficient use of labor resources.

The current maintenance of the railway track ensures the safety and smoothness of the movement of trains at the established speeds. At any time of the year, the path must comply with the technical conditions and standards for its maintenance. The maintenance of the track is occupied by a large team of track workers, and the solution of these tasks is largely determined by the extent to which, with the available means of mechanization, the contingent of track workers in terms of composition and qualifications corresponds to what is required to perform the necessary types and volumes of work on the current maintenance of the track.

The contingent is regulated by one of the most important standards in the track facilities.

The only document for determining the contingent of track fitters is Order No. 50N dated August 18, 1995 “On improving the organization, planning of work and stimulating the quality of the current maintenance of the track”, which determines the amount of labor resources required to complete the work packages for the current maintenance of the track.

These norms basically satisfy the requirements for them, however, there are a number of provisions, but which they need to be further improved, taking into account both the past shifts in the technique and organization of the track facilities, and the prospects for their development.

In the track facilities, differentiated norms for the consumption of labor for work on the current maintenance of the track have been introduced on all railways of “Uzbekistan temir yullari” joint-stock company.

The main purpose of these norms is that they annually determine the required contingent of labor for the current maintenance of the track, the contingent determines the wage fund, which makes up the bulk of the operating costs for the track facilities.

For the main tracks, the following factors are taken into account by the norms: the type of rails, the type of ballast and the load density. In addition to these general factors, in the note to the table of standards, it is possible to take into account ten more particular factors related to the design of the track (curves of small radii, long rails, reinforced concrete sleepers, jointless track), to operating conditions (track in tunnels,

suburban sections with heavy train traffic, sections with high-speed traffic, heavily clogged) and to a delay in the overhaul of the track. In an implicit form, the norms take into account two more factors - the loss of working time for the passage of trains, as well as the time for the performance of state duties and for vacations.

Correction coefficients are also provided for the norms, which take into account the level of mechanization of work on the current maintenance of the track and the increase in norms in areas where track detours are abolished. The norms for station tracks are equal to the norms for the main tracks with the lowest traffic density, i.e. from 6 million tkm per 1 km per year and below, depending on the category of station tracks.

Thus, many factors are reflected in the current standards, which also allow taking into account local conditions at travel distances. However, the subsequent addition of coefficients to take into account new factors would further complicate the use of the norms, moreover, not all factors can be expressed in terms of coefficients. Therefore, a new methodological approach is needed to improve the norms, which is the basis of the content of this work.

The main issue of improving the current norms of labor costs for the current maintenance of the track is to bring them into line with the required, which first of all requires establishing a connection between the current maintenance of the track and the types and timing of its repair. Such a connection will be the basis for a rational system of repairs and maintenance of the track, with their mutual combination with the greatest technical and economic efficiency.

The value of the norms is also determined by a number of other factors, such as, for example, different climatic zones, axial loads of the rolling stock, which should also be taken into account in the subsequent stages of improving the norms as the material accumulates when solving the main issue - the relationship of norms with terms and types of track repairs.

Each of the elements of the superstructure of the track, as well as all of it as a whole, depending on the specific conditions, has its own service life. For example, for a track with wooden sleepers, the service life, or duration of "life", of the superstructure is the period between two adjacent major repairs.

During this period, usually measured in years, the track passes through all stages of gradual aging associated with the time factor (for example, rotting sleepers), gradual wear associated with the impact of trains. To ensure the smooth and safe movement of trains, it is required that the track be continuously kept within the established technical conditions and norms. Therefore, as the upper structure of the track ages and wears out, labor costs and funds for its current maintenance increase.

The disadvantage of the current differentiated labor consumption rates for work on the current maintenance of the railway track is that they do not take into account the

time factor and the missed tonnage, and therefore do not take into account changes in the state of the track caused by its aging and deterioration. nose. In addition, this violates their connection with the norms for the frequency of track repairs, which are based on the time factor. Only through it can the relationship between labor costs for current maintenance and the frequency of track repairs be established.

The volume of work on the current maintenance of the track of any design depends on the traffic density, i.e. on the annual volume of traffic, which characterizes the operating conditions of the track. The current differentiated norms take into account such dependence. At the same time, labor costs in man-years for the current maintenance of 1 km of track of a certain design in a given year can be expressed by the formula:

$$N=a+bQ^n \quad (1)$$

Where, *a* - labor costs for work not related to the movement of trains;

b - specific labor costs, related to the unit of cargo intensity, for work caused by the movement of trains;

Q - is the traffic density of the section in a given year, on which the track of this design lies;

n - is an indicator that determines the nature of the influence of load intensity on labor costs.

The definition of labor costs according to formula (1) does not contain a time factor expressed in years or in tonnage missed over a number of years, and therefore labor costs with *Q* unchanged will remain constant throughout the entire life of the track superstructure. In addition, they can be interpreted in different ways, depending on what meaning will be put into the coefficient b. If the coefficient b characterizes the structure of the upper structure and its condition (new, little worn, worn, heavily worn), then the problem becomes uncertain, since the state of the track changes every year. In this case, each time it is necessary to establish to which state of the path the coefficient b belongs.

It is possible, for example, to attribute the coefficient *b* to some “average” state of the superstructure of the track for the entire period of its service (such a concept of the coefficient, apparently, is applicable to the current differentiated rates of labor consumption for work on the current maintenance of the railway track); in this case, there will be significant errors in determining the labor costs for the current maintenance in the initial and especially in the final periods of the existence of this structure. From this it follows that this coefficient can only characterize the structure of the track and cannot characterize the state of the track; it must be unique and the same for all structures. This condition is satisfied only by the path of the new elements of the upper structure.

Thus, expression (1), as not related to the time factor, would be correct to call the

initial value of the norm of labor costs for the current maintenance of the track of a certain new design, characterized by the coefficient b_1 and laid on a section with a traffic density Q. Moreover, the traffic density is taken for the year preceding laying, or for the year of laying the topsides.

In the process of operation, from the very first year, to the initial value of the labor cost rate, the costs associated with the time factor - $Л$ and with the corresponding total traffic volume - T, and not with subsequent annual values of cargo density - Q. should be added annually to the initial value of the labor cost rate. you can set the following expression for the total labor costs for these jobs, taking into account the time factor:

$$N= a + b_1Q^n + cЛ^m + dT^p \ (2)$$

Where, $a + b_1Q$ - is the initial value of the labor cost rate;

c - is a coefficient expressed in fractions of the norm per one year and related to work, the volume of which increases only with time;

$Л$ - the number of years since the laying of the upper structure of the track during its overhaul;

d - is the coefficient expressed in fractions of the norm per 1 million tons of cargo and related to work, the volume of which increases from the missed tonnage;

T - is the tonnage in million gross tons passed along the route since its overhaul. This value can also be expressed in years:

$$T = Q_{cp}ЛI$$

Where, Q_{cp} - is the average traffic density for $Л$ years;

m and p - are indicators that determine the nature of the influence of time $Л$ and the tonnage T missed along the way on labor costs.

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