USC 338.47:656.2 ***M. P.Singaevskaya***

IMPACT OF ECONOMIC AND OPERATIONAL CONDITION OF THE TRACK INFRASTRUCTURE ONRAILWAY TRANSPORT HAULAGE ENHANCEMENT

Abstract:*There are studied the factors reflecting the economic and operational condition of the track infrastructure that affect the railway transport haulage enhancement*
Keywords: *track infrastructure, economic and operational condition, operational activities*

I. *Track infrastructure facility (hereinafter TIF) is an engineering construction, designed for trains passing through it at the determined speed and in the given directions. Its technical and operational condition directly affects the carrying and traffic capacity of railways.*

II.*TIFare on the balance of the track facilities of railway transport of Ukraine. Its mission is to provide the needs of the transportation process at the lowest operating costs and infrastructure security [1, 2].*

Participating in transportation, the activity of the track infrastructure enterprises (hereinafterTIE) is estimated by a whole system of indicators, which originated from the formation of the track management system [3].

III.*Under reform of the sector the existing performance indicators are added with one more indicator - the amount of the necessary investment in the TIF. The fixed assets reproductive processes not fully guaranteed by depreciation fund are aimed to acquire the more advanced designs, to promote the development of high-speed traffic, to split the rail lines into freight and passenger ones.*

In this case, the feasibility of investment is determined by taking into account the effect implementationnot only in the track economy, but also by other participants of the transport market [4].

IV.*Under the long-term economic conditions, when it is necessary to establish the TIF charge, the guiding criterion affecting the charge amount will be TIF operational cost. It is determined bothat TIE, and at the related fields (for example, when calculating the train movement resistance on the sections with defective and weak TIF).*

Based on the foregoing, the purpose of this article is to identify the factors that reflect the economic and operational condition of the track infrastructure affecting the railway transport haulage enhancement.

Taking into account the modern technologies aimed at improving the effective implementation of preventive repair track works (ППРПРРRTW) ofTIFit is possible to choose the cost leadership strategy.

The operation cost of 1 km of track per year is affected by the following parameters[]:expenditures on personnel involved in the TIF operation; operating costs of track equipment and machinery used for the maintenance work; depreciation of fixed assets, taking into account the length of their life cycle; general production costs of TIE.

There are various methods of determining the TIF life cycle cost: normative, analytical, graphic-analytical. When using the normative method the guiding criterion is the TIF standard operation time, taking into account the regulated list and timing of PRTW. The analytical method is based on determination of the actual state of TIF taking into account the operational factors that affect the timing and intensity of PRTW. This is due to the fact that the standard indicators of *service lifedo not take into account the TIF differentiation under the terms of their use on the straight, curved track sections, as well as atascend, descent and adjacent to the station tracks.*

Graphic-analytical method is a graphical integration of the initial costs, operating costs and PRTW costs with discounting. Here, on the abscissa at scale we plotthe gridcharacterizing the TIF operation time intervals, and on the ordinate we plot the cost figures. Then we plotTIF capital investment level. Then the valuesof operating costs and PRTW corresponding to each year of TIF operation atset scale.There is a possibility of the actual cost accounting for current maintenance, depending on the section cargo density, its dynamics (taking into account the section density dynamics curve), TIF depreciation, as well as PRTW costs, depreciation costs and expenses associated with the train movement resistance.

Taking into account the large number of workers engaged atTIE and labor-intensive maintenance and repair of TIF, the most important effectiveness criterion is labourproductivity. At present we can use three methods to determine the labour productivity of TIE. The first one is based on the indicator and is the output per one employee of the enterprise. The second oneis the cost in man-hours per unit of goods produced at the enterprise. The third oneisthe comparison of average annual actual availability of workers with the planned workforce of the enterprise.

The result of TIE operation is to ensure that the transportation participantsare provided with the required capacity of railway lines. Therefore, the most important indicator of the quality of TIE work is reduction of interruption and train delay losses. These losses arise as a result of work on maintenance and PRTW ofTIF. These losses are manifested in the form of current operating costsof transportation participants (train-hour losses, increased rolling stock repair and depreciationcosts, increased cost for train and locomotive crews, fuel, electricity) [5] and capital investment in rolling stock (closing of haul leads to the needed reruns - increased wear of rolling stock, capacity loss - reduces the intensity of operating activities - reduces turnover of cars, locomotives –leads to deficit of rolling stock).

Taking into account the high material consumption ofTIF (in average TIF handles about 35 thousand tons of material resources per year) themost important is the use of advanced maintenance technologies and the TIF structure materials that increase their service life and reduce the need for their acquisition. Therefore, there is one more criterion characterizing the TIE performance - consumption of material resources per unit of production of the enterprise. Track facilities are the largest consumer of material resources - 44.93% (1,990,287 thousandUAH a year). In addition, the material resource and TIF maintenance cost planning in the modern conditions is complicated by the constant increase in their market value and the variable quality of their production.

The following TIE performance criterion is the level of innovative development. It manifests itself in the degree of mastering the modern TIF management technologiesat TIE. It results in reduced costs and time for maintenance of both existing and new TIF constructions.

The additional criteria include the following: the total weight of the metal consumed by TIE for TIF maintenance as the most expensive resource. Likewise, taking into account the weight of TIF structural elements and the TIE mechanization level,they include the engine power of technical meansin relation to the performance level.

Railway track consists of two parts: track structure and substructure.

When working under temporary load the rolling stock causes the track stress conditionwith elastic and permanent deformations. A characteristic feature of elastic deformations is that they disappear completely after removal of the load. They should be small and nearly the same in all track sections under the same regulatory load.

Permanent deformation resulting from the impact of the rolling stock and the negative environmental factors (wear of rails, sleepers, ballast material particle destruction, plastic deformation of the ballast and subgrade, leaching, erosion of ballast and raveling of slabs or monolith) should be minimal. They occur slowly over time and appear uniformly throughout the length of the track.

These provisions are the guidelines for the construction of the new reproduction system and the effective operation of the track infrastructure.

To ensure continuity, securityand smooth movement of trains with the set maximum speed, the trackmust be always in good condition and comply with the requirements of the Technical Operation Rules. Therefore, the basics of track facilities are maintenance and timely repair of infrastructure [6].

The current maintenance of atrack is its continuous monitoring, keeping it in good condition, preventing malfunctions and ensuring the long life of all track elements. The current track maintenance measures are not able to prevent from the permanent deformation completely. To eliminate the permanent deformations thetrack repair is conducted. It turns out that the need for periodic track maintenance and changes of its elements is not caused by track malfunction, but the wear of its elements or requirements for strengthening due to changes in track operating conditions and the development of high-speed traffic.

Track facilities of Ukrzaliznytsiaare one of the main branches of railway transport. About half of all the money spent on the overhaul of the railway sector is meant for the track facilities.

There are being improved (optimized) the organizational forms of exploitation of track facilities, the technology and organization of repair and track works on the basis of the widespread introduction of comprehensive mechanization and automation of labor-intensive processes and modernization of the existing fleet of machines and mechanisms. The origin of the track facility management system is considered to be the realization of the need for adjustment of track works ofTsarskoselskaya Railway put into operation in 1837 [6].

Track facility management strategy should be seen as a concept to adapt the structural components in railway operation terms, which are constantly changing [4] (See Table 1 below).

Table 1

Dynamics of indicators of economic and operational condition of the track infrastructure (Source: [4] with the author's completion)

№	Indicators	Years							
		1930	1940	1950	1960	1980	1990	2011	2013
1	Rail weight, kg	33,2	35,7	38,4	45,6	57,5	62,3	62,3	62,3
2	Number ofcross-sleepers (diagram), pcs. / km	1406	1502	1599	1684	1824	1839	1840	1840
3	Continuousweldedrail mileage, %	-	-	-	0,5	24,7	31,0	73,3	75,0
4	Average gross-load intensity, mln. t. gross load	1,2	4,3	8,1	18,9	34,6	38,3	50,0	52,4
5	Operating speed of goods train, km/h.	21,1	33,1	33,8	40,4	43,6	43,8	44,5	45,3
6	Service speedof goods train, km/h.	14,1	20,3	20,1	28,3	30,6	33,0	38,6	39,7
7	Average weightof goods train, gross, t	817	1301	1430	2099	2819	3070	3412	3423

Due to the tightening of maintenance conditions thetrack facility management system was transformed into a complex multilevel structure []. Today the components of this structure must be subject to a single track facility management strategy.

It is necessary to develop the integrated program for simultaneous development of all system components; strategy of track using is determined by a combination of regulations governing its operation mode with the appropriate level of speeds to ensure the safety of trains, as well as providing the necessary breaks for maintenance in a single process with transportation and achieving high efficiency of the whole railway transportsystem; strategy of trackmaintenance is determined by the set of admissible parameters of its state, technological standards and monitoring regulations with the adoption of decisions as to the rate and timing of the works, based on the information of the actual technical state of facilities providing the minor general transportationtasks.

V. *Based on the above-stated principles of the existing track management system [] and the current Provision on conducting regular preventive repair and track works on the railways of Ukraine, the CP 0113 [], the track facility management system formed under the influence of aggregate economic and operational factors must include the following componentscombined into a single set: track classification - a basic element for the entire structure designed to meet the operating conditions; track structure typificationestablishing its power by using new or old materials depending on the class, provides the necessary bearing capacity; systematization of track works with the division into two main groups - repair and maintenance of track; formalization of repair schemes depending on the track class, causes the execution of certain works, their periodicity determined on the basis of regulatory runningbypassed tonnage or in years, or on the basis of the actual track condition in accordance with the efficiencyevaluation criteria of its individual elements; standardization of repair work methods due to the possibilities of application of technical means and duration of regulatedinterruptions in the movement of trains; the adoption of common organizationprinciples for the current maintenance of track infrastructureelements, determined by the track stabilitylevel, the effective ratio to renovation works, modes of conducting works and opportunities for their performance under the train movement conditions; track condition monitoring; organizational structure of the trackmanagement in the conditions of reforming; system of material support, built on the principles of logistics;social and staffing support of the management structure elements of track facilities.*

REFERENCES

1. *Петренко Е. А. Реформирование железнодорожного транспорта – теория и мировой опыт : монография / Е. А. Петренко. – Донецк : Юго-Восток, 2010. – 413 с.*
2. *Широкова О. М. Аналіз роботи залізничного транспорту як передумова проведення реформування / О. М. Широкова // Економіка. Фінанси. Право. – 2008. – № 4. – С. 10–12.*
3. *Міщенко М.І. Економіко-організаційні основи функціонування підприємств колійної інфраструктури: монографія/ М.І. Міщенко. – Одеса: ІПРЕЕД НАН України, 2013. – 489 с.*
4. *Лапидус Б. М. Совершенствование структуры управления на этапе перехода к рынку / Б. М. Лапидус // Железнодорожный транспорт. – 1996. – № 4. – С. 50–51.*
5. *Інструкція зі складання місячних технічних норм експлуатаційної роботи залізниць України. – К. : Транспорт України, 2008. – 29 с.*
6. *Георгиевский П. И. Развитие путей сообщения в XIX веке / П. И. Георгиевский. // Труды преподавателей и материалы для институтских курсов : сб. / Ин-т путей сообщения. – СПб., 1893. – Вып. XXIV. – С. 1–96.*
7. *Положення про проведення планово-запобіжних ремонтно-колійних робіт на залізницях України : ЦП-0113 : затв. наказом Укрзалізниці від 10.08.2004 р. № 630-ЦЗ / Міністерство транспорту та зв'язку України, Державна адміністрація залізничного транспорту, Головне управління колійного господарства. – К., 2004. – 37 с.*