

LEVELS OF ORGANIZATIONAL RELIABILITY OF SYSTEMS

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ABSTRACT

The reliability of the transportation process, as well as the railway infrastructure capacity are provided by the organizational and technical complex. The objective of the authors is to review levels of organizational reliability of the transportation process in Russia regarding railways, to study different dependences, management levels and algorithms of the work of employees as a result of the deep reforming of the sector, using economic evaluation, general scientific methods, comparison. Reliability of transportation depends on a set of technical requirements, inherent to railways, but also on other parameters, which ensure satisfaction of customers. Customers are regarded as passengers, consignors, freight forwarders, and the owners of rolling stock.

Keywords: railway, organizational and technical system, interaction of objects, reliable operation, infrastructure, transportation process, algorithm.

Background. The complexity and size of the railway infrastructure in the country is explained by the fact that it accounts for about 43% of cargo turnover, and if we exclude pipeline transport for over 85% of freight turnover, and almost for 40% of passenger turnover throughout the Russian Federation [1]. Transportation of this volume of goods and passengers by rail is provided by organizational and technical complex, which includes railway cars and coaches, traction rolling stock, and infrastructure facilities. The interaction of so tightly coupled systems is provided by the reliability and safety of the transportation process.

Sharing the same infrastructure for passenger and freight movements links and makes virtually equivalent requirements for safety and reliability of the carriage of goods and passengers. However, knowing this interdependence, we should not confuse the concepts. Safety is a state of the railway system, when in the process of implementation of transport activities human life and health, nature and the environment are not endangered. Reliability of the organizational and technical structure of the rail transport is characterized by the preservation of wealth, technical complexes, cargo, rolling stock, infrastructure, sufficient financial resources.

Reliability of transportation, however, depends on other parameters, which ensure satisfaction of transport services customers. Customers are regarded as passengers, consignors, freight forwarders, and the owners of rolling stock. Actions of such contractors must comply with the rules established and adopted by market participants, which focus primarily on maintenance of the transportation process.

Since the railway infrastructure refers to technical systems, the requirements for its reliability are formulated accordingly, and include the ability to smoothly work with the same specifications for a specified period of time or under certain conditions [2]. When applied to the transportation process, at its infrastructure level reliability should be understood as the harmonious interaction of all structural divisions and qualitative and timely execution of their functions.

The basic functions are productive, technological and organizational functions. Production functions

Actions of such contractors must comply with the rules established and adopted by market participants, which focus primarily on maintenance of the transportation process. Reliability is also provided by manufacturing plants that manufacture rolling stock. The article contains examples of new forms of interaction at macro- and micro- (local) of the actors of the rail industry. The authors state that as a result of structural changes rail transport has become a highly competitive environment that links together the various institutions of society and simultaneously adjusts the contradictions between the major sectors of the economy. Given the increasing role of rail traffic in the global economy increase in the reliability of organizational and technical systems at all levels will strengthen the competitive advantages of the national transport system.

are directly linked to the operation, maintenance and repair of infrastructure facilities, all types of rolling stock and other technical means of railways. Technological functions ensure provision of services for performance of productive activities of all parts of the system. Organizational functions refer to the management area, the greater part of them is assigned to monitor compliance with the requirements of the legislation of the Russian Federation, normative legal acts of the Government, regulations of Ministry of Transport of Russia and JSC «Russian Railways» [3].

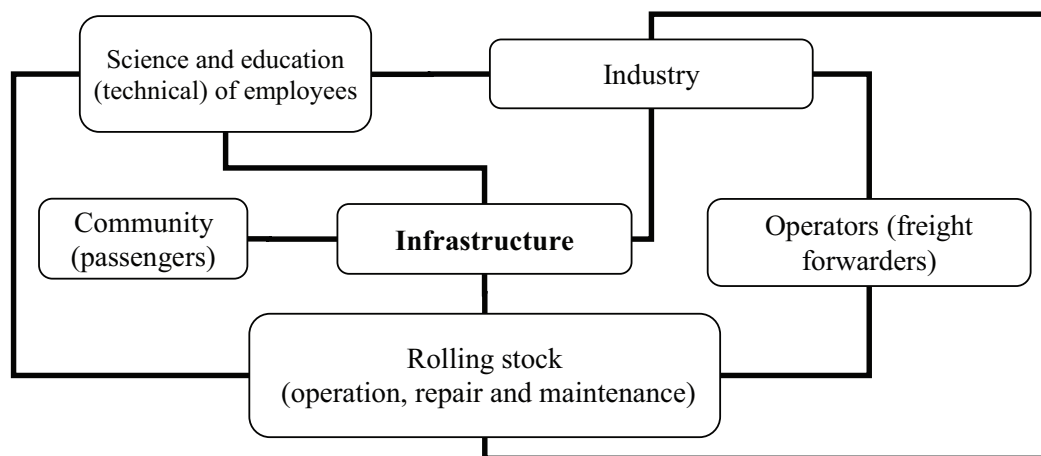
The major production functions are qualitative repairs and maintenance of freight and passenger cars. They are tasks for the enterprises of cars repair works of both the holding company «Russian Railways» and private organizations [3].

Of course, the reliability of transportation depends not only on infrastructure enterprises, it is also provided by manufacturing plants that manufacture rolling stock. Cars of various manufacturers and designs are used, and operation and maintenance of such vehicles in the global economy gain added significance because not only the safety of passengers and employees of the transport sector dominates, but also the readiness of new equipment to compete on international routes, providing the economic efficiency of transportation.

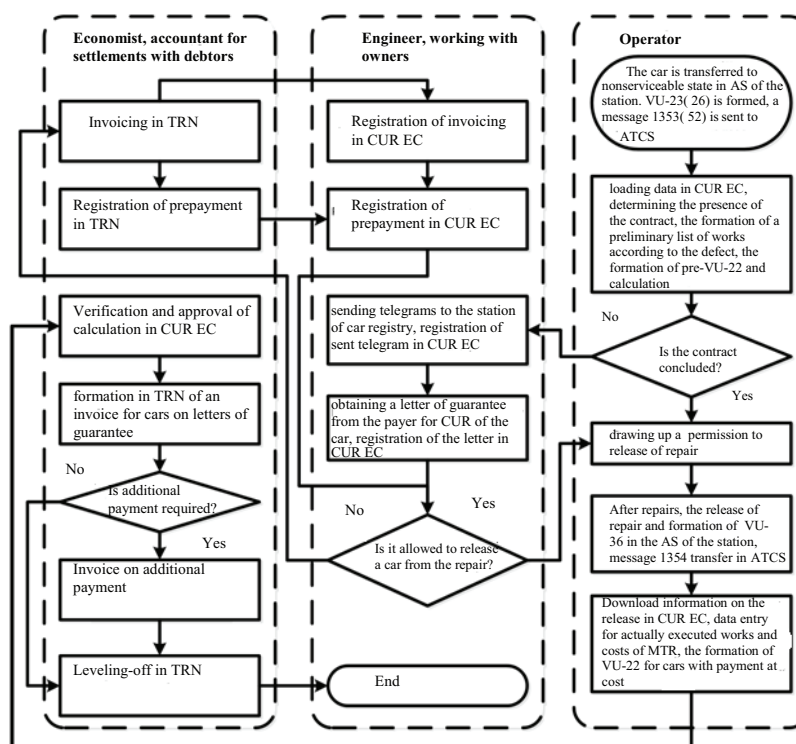
Objective. The objective of the authors is to investigate levels of organizational reliability of the transportation process, different dependences, management levels and algorithms of the work of employees.

Methods. The authors use analysis, economic evaluation, general scientific methods, comparison.

Results. After the implementation of structural reforms contradictions in the economic interests of subjects of the complex began to emerge. For example, attempts to change the requirements for the technical condition of the fleet of cars, such as the prohibition of life extension of the old rolling stock [4, 5], are designed to improve the quality and volume of production of the new car equipment. However, these requirements may have an impact on some industries. Mass types of cars are produced in sufficient quantities, but no enterprise produce new refrigerators and



Pic. 1. The high-level structure of organizations providing reliability of the transportation process.



Pic. 2. The work algorithm of the employees of operational car depot with AS «CUR EC» at the primary level of transportation process.

cars for transportation of chemicals. About half of refrigerator cars were manufactures more than 25 years ago, almost 70% of chemical tanks have been operated for more than 18 years [6]. Under these conditions, a ban on extending the service life of cars in these segments can result in large losses for both consignors and consumers.

Facts convince: the reliability of the transportation process depends not only on infrastructure enterprises, but also on a wider range of organizations. Pic. 1 shows a diagram of the structure of the railway

transport and economic links of the industry after the structural reform. The scheme fixes the division into separate economic entities of previously existing single organizational establishment – Ministry of railways. Instead of administrative ways of management bilateral interaction of economic nature arose between the actors.

Transport infrastructure is a key and central element of the reformed system. It satisfies the needs of the community directly, providing transportation of passengers, as well as being a customer of the prod-



ucts of the industry. In addition, together with other actors the movement of vehicles with goods (industrial products and raw materials) is ensured. The specialists who have undergone training and professional development in railways educational institutions got jobs at divers industrial and maintenance enterprises. Rail transport is a constant consumer of high-tech products and collaborative research.

Industrial production is being tested in scientific institutions that provide appropriate conclusions about its suitability. Science, infrastructure and industry work in close conjunction, as any used product must comply with the standards adopted by infrastructure companies, being integrators of various technical systems. Freight forwarding companies indirectly interact with rail infrastructure via the industry that supplies rolling stock, as well as through the enterprises, engaged in repair and maintenance of privately owned cars.

At the primary level of organizational and technical provision of reliability individual employees act at their workstations. One can cite an example of a cars' operation depot, that uses automated system (AS) for control of current uncoupling repair on the basis of economic criteria «CUR EC», which implements a specific representation (model) of a business process flowing during repair [7].

The algorithm of works of depot employees in this automated system is shown in Pic. 2. According to the established order for each private wagon, undergoing CUR, it is necessary to check the existence of a contract with the owner, and in its absence to give a notifying telegram, to obtain a letter of guarantee, to draw up an invoice for payment of services, and then to start repairing. Upon completion of repair the employees edit the calculation or expense and damage report, which reflects all the work performed and the materials used.

These schemes give an idea of the different levels of the system called to ensure the reliability of the

transportation process, but do not reflect the complexity of the interaction of employees within the depot and their relations with the various AS, as well as interaction of operating companies of the freight car fleet with operating and maintenance depots, which largely affect reliability and safety of freight transportation.

Thus, the largest operational wagon depot Vkhodnaya daily releases 130 cars after current repairs cars and plans to further increase the volume of work. In this case, for each repaired car a package of report documents is drawn up, which becomes the basis for payment of repairs. The number and type of documents varies depending on the type and cause of the malfunction, the volume of work performed, as well as contractual relations with the owner of the car and the conditions of the long term contract. During preparation a package of the documents of the owner passes through the hands of employees of depot departments, road directorate, accounting department of the regional common service center, which complement the package or control and double-check the correctness of the documents. At any stage an error may occur, and streamlined procedure for interaction will be broken, reducing the reliability of the whole system.

Conclusions. To summarize, it can be stated that as a result of structural changes rail transport has become a highly competitive environment that links together the various institutions of society and simultaneously adjusts the contradictions between the major sectors of the economy. However, conditions exist that complicate pre-existing organizational and technical system of transportation process, which in turn affects the performance of its reliability. Given the increasing role of rail traffic in the global economy increase in the reliability of organizational and technical systems at all levels will strengthen the competitive advantages of the national transport system.

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