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Research paper



Logistic Quality Management of Transport Process in Construction

Halyna Zelinska[1], Lyudmyla Boldyrieva[2]*, Iryna Amelina[3]

[1] *Ivano-Frankivsk National Technical University Of Oil And Gas, Ukraine*
[2]*Poltava National Technical Yuri Kondrayuk University, Ukraine*
[3]*Poltava National Technical Yuri Kondrayuk University, Ukraine*
**Corresponding Author E-Mail: Boldyrewaljuda@Ukr.Net*

Abstract

The article presents the key problems of the logistics management of the quality of the transport process in the construction industry. Characterized by the influence transport services quality on the efficiency of production and commercial activate enterprise. The main indicators of quality of transportation are summarized: qualitative indicators; indicators assessing the effect of transportation of construction materials in due time; indicators characterizing loss of product during transportation. The technological scheme of goods transportation by the means of transport (with quality control of the transport process) is presented. The directions of quality assurance of transport provision are offered: formation of material and technical basis of transport; creation of preconditions for efficient use of transport; improvement of organizational and economic mechanism of transport-logistic systems functioning. The allowed limits of different types use transport on the criterion of productivity or cost of transportation are offered. It was established that the essential reserve for improving the efficiency of transport and technological processes in construction (along with increasing the throughput and improving the quality of machines operation) is to: improve transport equipment of transport complexes; application of the newest technologies of transport processes; the use of effective ways to manage transport robots. The basic reserve of reduction of specific energy consumption on motor transport is determined. The main ways of reducing specific fuel consumption during transportation are given. The main directions of rolling stock fuel economy are increase formulated. The measures of loading and unloading works of labor-intensity execution reduction are substantiated.

Keywords: *construction, logistics, management, process, quality, transport, transport service.*

1. Introduction

Future development of the construction process requires the global harmonization of transport and technological processes with the implementation of construction and installation work to minimize energy costs, costs, environmental impact on the environment. An important role in this structure can play logistics as a science of rational organization, management and technical and technological support of processes in the field of construction in order to maximize demand and minimize overall costs.

2. Main Body

Fei Ying, John Tookey, Johannes Roberti (2014) believe that the intention is to gain detailed understanding of the practice and obstacles in efficient construction logistics and thus identify interventions to improve logistics efficiency, especially using the numbers of vehicle movements to the construction site as an indicator [1]. Viktoria Sundquist (2018) in this research reflected logistics reorganizing can contribute to improved performance in the construction industry. In this paper, the opportunities for such reorganizing are investigated by focusing on the connection between logistics operations at the construction site and operations undertaken before building materials land at sites [2]. Kovács G. (2016) argues that during the construction processes, many problems might arise, at present the symptomatic treatment is the common practice. Besides, the literature offers a wide choice of business process description languages. This paper presents the modern principles and the description languages are used in the construction's logistics processes [3]. The works of Gyimesi A. and Bohács (2015) present the development of a new construction logistics model with a new point of view: we want to integrate related experiences from the practice of other industries with the specialties of construction logistics processes [4]. R. Zeng (2016) accentuates that for the high-risks of construction logistics, a reasonable transportation route is able to reduce the risk effectively and ensure that the materials can reach the construction site successfully. Based on the features of construction logistics and the complex network theory, influence factors in the process of transportation have been converted into the weights of the edge [5].

The problems of logistics quality management of the transport process in construction are key in view of the need to ensure competitiveness. In our opinion, the concept of "competitiveness of transport services " implies:

- adequacy of technical and technological level of transport service with the achievement of scientific and technological progress in the field of transport;
- conformity of quality of transport service quality of services provided by carriers-competitors;

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- the ability of the service to meet the needs of certain categories of consumers;
- the level of consumer expenses for the purchase of transport services (price of consumption);
- level of transport-logistic service, including quality assurance of delivery, cargo insurance (building materials), etc.

It is logical to assert that the quality of transport services is a measure of their responsibility to the requirements and expectations of consumers regarding the timeliness of delivery of goods (building materials), their quantity, absence of losses, damage, etc. Important goals of transport are reducing costs and improving the quality of the transport process. Improving quality control helps simultaneously reduce the costs of transporting building materials and increase the profitability of the enterprise (Fig. 1).

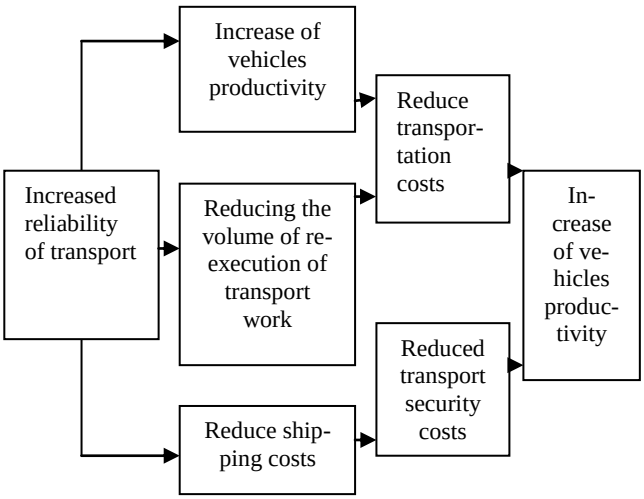


Fig. 1. Impact of transport services quality on the efficiency of production and commercial activity of the enterprise

Improving the quality of transportation provides cost savings in the following ways:
the productivity of vehicles increases, since it does not take time for one-off transfers, the quality of the cargo does not deteriorate during its stay on the road . Such savings lead to a direct reduction of transport costs per unit of output;
improving the quality of transportation means reducing the volume of re-execution of transport work that arises when necessary to carry out additional flights of vehicles for the carriage of cargo instead of lost or damaged during past travel.
The level of transport provision largely determines the effectiveness of trade, which is manifested in the price of goods as a transport component. After all, the quality of transport products (transport services), characterized by the speed and regularity of delivery, the preservation of cargo, the reliability of transport, affects the formation of the price of goods moving. This price may increase at a high level of transport equipment or vice versa - decrease at its low quality.
Important indicator is the delivery of construction materials in the appropriate time and without loss of transportation services quality. The qualitative indicators characterizing transportation of building materials in the appropriate terms include:
- the specific weight of goods transported to order in a timely manner;
- time of idle machines while waiting for technological transport;
- the time delay between the receipt of building materials and the export of them to the place of storage or processing .

Indicators that assess the effect of transportation of construction materials within the set time limits may be:
- saving of customer's funds and resources due to transportation of goods in due time;
- saving of resources and resources at the expense of reduction of losses as a result of reduction of downtime in expectation of technological transport.

Indicators characterizing loss of product during transportation are:
- the proportion of goods lost during transportation and loading;
- the share of construction materials , the quality of which deteriorated during their delivery.

Accordingly, indicators for assessing the effect of improving transportation conditions are: saving costs and resources from reducing traffic and load losses.
In general, the permissible limits for the use of different types of transport (road, tractor) in construction should be determined by two criteria: productivity and cost of transportation. Therefore, it is important to find acceptable limits for the use of different types of transport on the criterion of performance or cost of transportation.
The first approach involves comparison of technical and operational parameters of vehicles, which are factors of their productivity. Thus, the performance of a vehicle with a trailer (W_t) can be determined by the formula:

$$W_t = Q_t \cdot V_t, \quad (1)$$

where Q_t - load carrying capacity of a transport trailer, t;
V_t - operating speed of the transport train, km / h.

The second approach involves comparing the economic parameters of transport aggregates, in particular, the cost of transport work. Thus, the cost of transporting a vehicle with a trailer (V_t):

$$V_t = C_t \cdot T_t, \quad (2)$$

where C_t - cost of one hour of the vehicle with a trailer, UAH / hour;
T_t - duration of the vehicle with a trailer during the working day, hour.

The cost of one hour of a vehicle with a trailer can be determined by the formula:

$$C_t = S + S_1 + S_2 + S_3 + S_4, \quad (3)$$

de S - payment for one hour of driver's work, UAH;
S_1 - the cost of used fuel and lubricants, UAH;
S_2 - depreciation deductions for a vehicle and a trailer for one hour of work, UAH;
S_3 - expenses for repair and maintenance of a vehicle and a trailer for one hour of their work, UAH;
S_4 - overhead costs per hour of work of a vehicle with a trailer, UAH.

The technology for controlling the quality of the transport process involves control at all nine stages of cargo transportation, from checking the quality of vehicle preparation to traffic to quality control of building materials during its storage.
Table 1 provides media control functions, specified persons are inspectors. When controlling the quality of the transport process, no additional staffing posts are envisaged to perform control functions, since TQM approaches provide that overall quality control is carried out by direct performers.

Table 1: Quality control in the implementation of the transport process in construction

Stages of the transport process	Content of control functions	Performer
1	2	3
Preparing a vehicle for traffic	Vehicle body overview	The driver
Preparation of cargo for transportation	Overview of containers, pallets, other cargo equipment	Person who releases cargo
Load spare	Review of cargo condition	Person who releases cargo
Weighing-1	Review of cargo condition	Responsible person, driver
1	2	3

Transportation of cargo	Monitoring of cargo status	The driver
Weighing-2	Review of cargo condition	The driver, the receiver of the cargo
Unloading spare	Review of cargo condition	Review of cargo condition
Warehousing	Review of cargo condition	Warehouse manager

Transport and technological processes play an important role in the construction, sometimes defining the pace of construction and installation work. There are different views on the place of transport and technological processes, their structure, etc. In particular, transport operations are divided into cargo transportation operations, cargo handling operations, distribution operations.

One of the industrial principles of construction of transport and technological processes is the leading role of vehicles in organizing the rhythm of the machines during the execution of construction and installation work.

In our view, transport and technological processes in construction consist of a certain set of technological (basic) processes that determine the operation mode and timing of loading and unloading and transport operations as separate completed parts of the transport technological process.

In turn, the mechanization of construction and erection works on a construction site are carried out using buffer machines, equipment and means of small mechanization, and also carried out taking into account:

individual properties of the object and conditions of its construction;

terms of construction of the object;

providing of integrated security of construction;

organizational and technical capabilities of the contractor [6, p. 14].

Place of quality control transport as the process in the construction is shown in the diagram (Fig. 2).

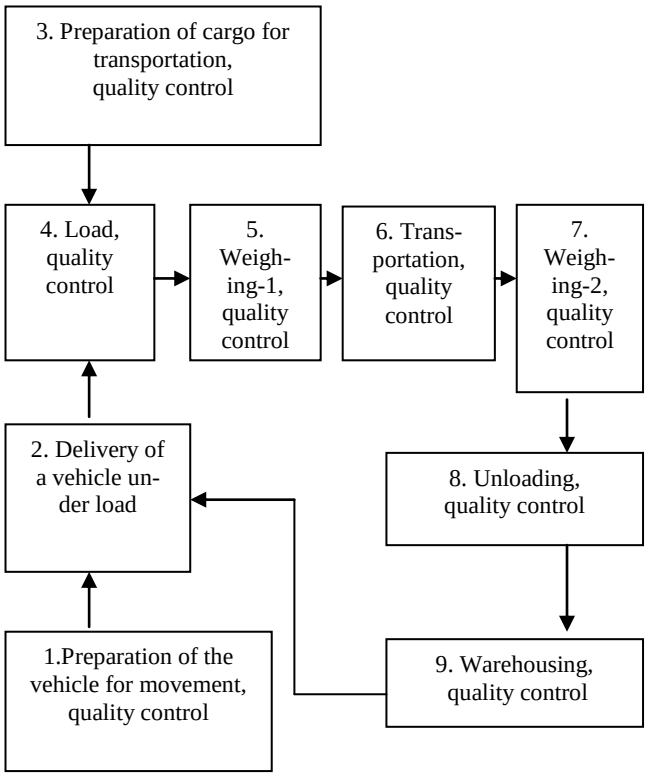


Fig. 2. Technological scheme of cargo transportation by a means of transport (with quality control of the transport process) [7, c. 46].

It is important that the programs of quality assurance for the transport process are developed at the enterprises. The basis of such programs can be assigned the following main areas provide a transport security (Table 2) [7, c .47].

Table 2: Directions provide quality transportation services

Directions provide quality transportation services	
1. Formation of transport material and technical basis	1.1. Providing of enterprises by transport, loading and unloading, weighting.
	1.2. Creation of repair and service base of transport, etc.
2. Creating prerequisites for efficient use of transport.	2.1. Provision of highly skilled personnel
	2.2. Development of the roads network/
	2.3. Increase of cargoes transportability
	2.4. Optimization of freight flows through the efficient placement of load-carrying and cargo-receiving items, etc.
3. Improvement of the organizational and economic mechanism of the operation of transport-logistic systems	3.1. Improvement of organizational structure and management structure of transport departments.
	3.2. Improvement of personnel motivation system.
	3.3. Improving the organization of transport processes, etc.

It has been established that the essential reserve for increasing the efficiency of transport and technological processes in construction (along with increasing the throughput and improving the quality of machines) is:

- improvement of transport equipment of transport complexes;
- application of the newest technologies of transport processes;
- the use of effective ways to manage transport robots.

Efficient use of rolling stock is possible in the presence of the necessary repair and maintenance base, because simple cars in construction for technical reasons make up about 25% of total time expenditures and are mainly due to low level of technical readiness. The renovation of the rolling stock should be done taking into account the requirements for construction vehicles and trends in its development, in particular, energy saving.

In the conditions of rising fuel and lubricant materials, the rational use of them is all the more urgent. Features of transport energy consumption are as follows:

The total amount of energy consumed in the construction sector, 35-40% is attributed to loading and unloading operations and cargo transportation;

Trucks with gasoline carburetors are becoming more and more expensive to operate, especially compared to vehicles equipped with diesel engines that use diesel fuel. On the main transportation of goods, the cost of fuel per 1 tkm of transport work cars average load (4-5 tons) with a diesel engine 25-30% less than in similar cars with a carburetor engine of the same power.

3. Conclusion

The main reserve for reducing the specific energy consumption of motor vehicles is the increase in the productivity of rolling stock of motor vehicles, primarily due to the increase and rational use of payload, reducing to a minimum the idle mileage of cars.

The main ways of reducing specific fuel consumption during transportation are optimization of transportation routes, diesel transportation of motor vehicles, use of heavy tankers with trailers.

Acknowledgement

Taking into account the situation of the energy crisis, the following research should be continued in the sphere of efficient energy consumption in transport.

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