GROWTH OF EFFICIENCY OF TRUCK OPERATIONS ON THE BASIS OF TRANSPORT AND LOGISTICS INTERACTION

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ABSTRACT

The author examines approaches to improvement of the efficiency of trucks' operations on the basis of a concept of transition of a road carrier from pure physical movement of cargo to the system of transport and logistics services. The author proposes methods for structuring transport and logistics processes and suggests trends and directions of organization of their interaction.

Keywords: transport, car, service, logistics, cycle, need, interaction, ranking, cyclogram, matrix.

Background. *For the organization of efficient transport services system it is necessary to understand transport technology, its physical structure, regularities of the functioning of interacting elements in it [1].*

Applying the concept of transition from pure transportation to provision of transport and logistics services requires from a road carrier a clear understanding of all processes, their interrelationships and interdependence: car's mechanical work, service, transport products, transport process, transportation process.

The knowledge of specialized technology of a customer organization by the road carrier, at least at the junction of its activities and motor production will act consciously and more effectively in not only carrier's interests, but first and foremost for the benefit of the enterprises of the whole supply chain. It will improve the competitiveness of the system and will result in growing demand for transport and logistics services of a road carrier. Thus, in the transport service of production, generating traffic flows, a carrier during loading maintains control over the compliance of the shipment to real needs of a consignee. This makes the logistic support of cargo and timeliness of delivery mutually beneficial. Moreover, the majority of cargo has a maximum permissible length of transportation and their transportation is an integral part of cooperation process, provided by agreements. In this regard, the importance of organization of transport and logistics cooperation increases [2].

Such interaction is that:

– Firstly, a road carrier is obliged with qualitative transport service to ensure efficiency of the specialized production of consumers of its services;

– Secondly, a consumer of transport services shall organize its main production with a possibility for a road carrier to use transportation schemes of work, which are the most efficient for both parties, which help to reduce transportation costs and size of transport tariffs. This «counter-movement» in the system will allow achieving a synergistic effect, reducing transport capacity of transported goods, thereby increasing its competitiveness and affordability for customers.

Objective. *The objective of the author is to investigate ways to improve efficiency in the functioning of road carriers in the transport and logistics cooperation.*

Methods. *The author uses general scientific methods, analysis and simulation.*

Results. *Any process that needs transport services can be viewed in transport and temporal characteristics: total duration of k-th transport and logistics process ($T_к$), duration of the i-th cycle of this process ($T_к^i$), as well as the level of transport demand at every stage. Therefore, for the organization of transport and logistics cooperation all processes requiring transport services by certain types of transport and a number of vehicles within a certain time can be conveniently represented in the form of a matrix shown in Pic. 1.*

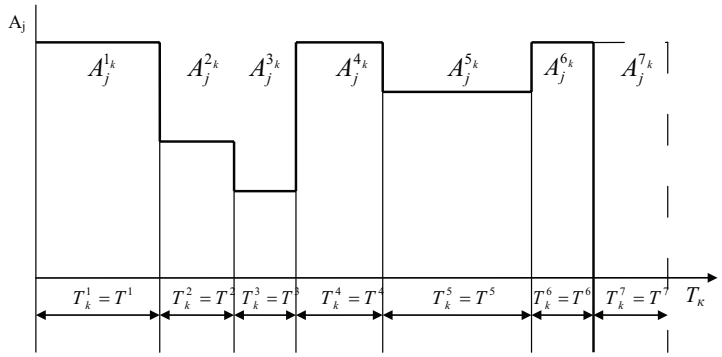
The condition for demand of transport and logistics processes (hereinafter – TLP) of motor carriers in vehicles is described by an algorithm:

$$\sum_{n=1}^{k}\sum_{i=1}^{r_k}(A_j^{i_k}\cdot T_k^{\,i})\le\sum_{j=1}^{m}A_j\cdot T\ .$$

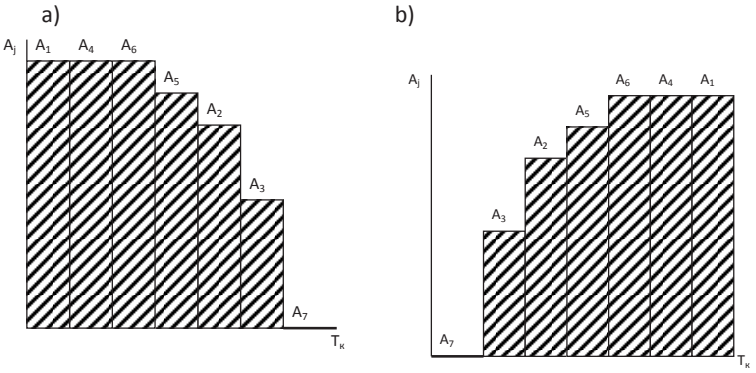
This matrix covers all parameters of transport and logistics processes (TLP):

Serial number of cycle / Serial number of TLP	1	2	3	...	i	r = 1,2...i
k n = 1,2... k	$A_j^{1_k}$	$A_j^{2_k}$	$A_j^{3_k}$	...	$A_j^{i_k}$	$\sum_{i=1}^{r_k}(A_j^{i_k}\cdot T_k^{\,i})$
.....	...	...	...	...	...	...
2	$A_j^{1_2}$	$A_j^{2_2}$	$A_j^{3_2}$	...	$A_j^{i_2}$	$\sum_{i=1}^{r_2}(A_j^{i_2}\cdot T_2^{\,i})$
1	$A_j^{1_1}$	$A_j^{2_1}$	$A_j^{3_1}$	...	$A_j^{i_1}$	$\sum_{i=1}^{r_1}(A_j^{i_1}\cdot T_1^{\,i})$

Pic. 1. Matrix of demand for different types of vehicles in the transport and logistics process.



Pic. 2. Cyclogram of transport and logistics process and its transport demand: T is duration of the k-th transport and logistics process and D_k^i of single i-th cycles, days; $A_j^{i_k}$ is a number of vehicles of the j-th type, in demand in the i-th cycle of the k-th transport and logistics process, units; - - - is duration of transport service-2, days.



Pic. 3. Option cyclogram of the transport and logistics process of transport demand: a – on decrease; b – on increase.

– k is serial number of transport and logistics process;

– $T_к$ is duration of the k-th TLP, days;

– $i_к$ is serial number of a cycle of the k-th TLP;

– $T_к^i$ is duration of a single $i_к$- th cycle of the k-th TLP, days;

– n is a number of the k-th TLP;

– T is duration of the period under review, days;

– A_j is a number of vehicles of the j-th type, units;

– m is a number of j-th types of vehicles;

– $A_j^{i_k}$ is a number of vehicles of the j-th type, demanded in the i-th cycle of the k-th TLP, units;

– r_k is a number of cycles (i) of the k-th type of TLP.

Any k-th transport and logistics process with duration $T_к$ can be represented as a cyclogram, shown in Pic. 2.

The cyclogram shows the unevenness in demand for transport services in different cycles of the process, because of its technological aspect. The uneven demand leads to unproductive downtime of vehicles during its decline and inability to use these vehicles in other types of transportation or enterprises even within a short demand.

To reduce such losses of a road carrier it is necessary to rank all i-th cycles of each k-th transport and logistics processes to reduce or increase the demand for transport services. This will help regulate the demand and allow using the released part of vehicles in other TLP. This regrouping of individual stages of transport services within a single cycle in certain types of road transportation will enhance not only possibilities of the car fleet, but also make the entire transport and logistics system more flexible [3].

Ranking of shown in Pic. 2 cyclogram on demand for vehicles of the j-th type (A_j) and the duration of the individual i-th cycles of the transport and logistics process ($T_к$) will help optimize the sequence of stages to reduce the level of fluctuations in demand for vehicles of this type.

From ranking of all cycles of the cyclogram two inequations follow:

– Decrease in demand for cars:

$$A_1=A_4=A_6>A_5>A_2>A_3>A_7; \quad (1)$$

– Changes in the order of individual cycles of the transport and logistics process:

$$T_к^5 > T_к^1 > T_к^4 > T_к^2 > T_к^7 > T_к^3 > T_к^6, \quad (2)$$

which can be ranked in accordance with the increase in their demand:

$$A_7<A_3<A_2<A_5<A_6=A_4=A_1; \quad (3)$$

$$T_к^6 < T_к^3 < T_к^7 < T_к^2 < T_к^4 < T_к^1 < T_к^5. \quad (4)$$

The regrouping of cycles of auto services consumers' work and their transport services in accordance with ranking becomes real only in case of changes in cycling, which is not always possible. The process of regrouping of individual cycles of TLP, showing demand for road transport services, is just an example of «counter movement» of a consumer of auto services and a road carrier, when mutual respect for economic interests of the other party increases the efficiency of their joint action: unproductive downtime of cars reduces or eliminates completely and a recoil effect increases.

The cyclogram (Pic. 2), taking into account previously given ranking by the level of demand for transport, can be shown as decreasing demand (Pic. 3a) and increasing demand (Pic. 3b) for vehicles of the j-th type.

In the presence of flexible technologies of processes requiring transport services, repetitive cycles can go on changing principles of alignment – if it is allowed by the technological process of the main production of the enterprise. Then, the maximum period of lack of demand for transport services increases by 2 times, which stimulates a motor carrier to use its road rolling stock to service other processes (types of road transportation) of the same or other enterprises.

Conclusions. *The given ranking method reduces unproductive downtime of cars, increases efficiency of a road carrier and reduces transport capacity of products of enterprises, generating traffic flows.*

In each case, the economic justification for the alignment of transport and logistics process must be performed taking into account the costs of its restructuring. Restructuring of the transport and logistics process aimed at reducing transport capacity of generated traffic flows, is viable when the cost of changes will be less than loss of profit a road carrier.

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