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# METHODOLOGY OF SELECTION OF EFFICIENT MOVING STRUCTURE FOR TRANSPORTATION OF FAST DESTRUCTIVE LOADS

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**ABSTRACT**
Successful storage of perishable goods can only be achieved by maintaining a special temperature regime that is necessary to maintain quality at all stages of the product life cycle from production to consumption (including transportation).
The main criterion in the selection of rolling stock for the transport of perishable goods is to ensure the safety of the cargo. To do this, take into account the nature of the route, the number of unloading points on the distribution route, the type of cooling device of the car-refrigerator.
This paper is based on the basic steps of an effective rolling stock selection methodology for transporting perishable goods.

**Keywords:** Perishable goods, transportation, transportation, rolling stock, refrigeration, efficiency, operation.

## INTRODUCTION

Successful storage of perishable goods can only be achieved by maintaining a special temperature regime required to maintain quality at all stages of the product life cycle from production to consumption (including transportation).
During the transport of perishable goods, it is necessary to protect the cargo from the temperature and pressure of the surrounding environment, which is one of the uncontrollable weather factors.
Heat flux compensation may be required to maintain the quality of perishable goods during transportation, which calls for the use of specialized rolling stock with isothermal bodies equipped with or without special equipment, temporary or permanent cooling source, designed for transporting perishable goods [1].
The same requirements apply to vans-refrigerators specializing in the transportation of commercial, catering and household goods, as well as additional requirements determined by the specific characteristics of the transported goods arising from the specific characteristics of these cargoes and the turnover process [2]:

- Prevention of loss of goods during transportation, which means not only a reduction in their quantity for one reason or another, but also the preservation of their consumer properties and appearance;
- Actively promote the minimization of both direct shipping costs and other associated costs;
- Actively promote the elimination of manual labor in loading and unloading operations;
- Timely delivery of goods to the consumer

In choosing the type of rolling stock and its load capacity, it is necessary to take into account the characteristics and nature of the goods, the size of the shipment, the season and the temperature of the environment, the urgency of delivery of goods to the trade network.

Selection of rolling stock is one of the main issues to be addressed in the substantiation of transport-technological schemes of cargo transportation [3].

It is closely connected with the methods and means of transport equipment, loading and unloading and other work used in the technology of packaging, transportation and preparation of goods for consumption. [4].

Observations show that the selection of rolling stock in the conditions of operational transport is based on the intuition and practical experience of those responsible for transportation.

In this case, the carrier must pay special attention to the characteristics of the cargo and the requirements for its protection from external factors. There were cases of stagnation of rolling stock during loading and unloading, damage or failure of perishable goods, incomplete or overloading of vehicles, non-fulfillment or incomplete fulfillment of the order for transportation. [5].

Rational selection of rolling stock will depend on the timeliness of delivery and storage of cargo, fulfillment of the transportation plan, reduction of transportation costs and increase of profitability of the enterprise. A rolling stock that performs a given volume of traffic in a specified period of time with minimal material and labor costs can be said to be a more efficient operating component.

Taking into account the actual traffic volume and the structure of the fleet in the specific operating conditions, the problem of selecting a more efficient content can be solved by comparing and contrasting the performance of rolling stock of different types and models under the same transport conditions.

This takes into account not only the volume and distance of traffic, but also the size (batch) of shipments, methods and means of loading and unloading, condition of the road network, type of pavement, maximum allowable loads, capacity of roads and man-made structures [4].

The choice of the type of rolling stock will also require an assessment of its operational qualities in relation to the existing operating conditions, which are conditioned by different combinations of transport, road and climatic factors..

The optimal make and model of the vehicle is determined on the basis of economic calculations. Analysis of the results of scientific research allows us to confirm that as a criterion for optimality in solving the problem of vehicle selection, many authors accept the efficiency of vehicles, minimal costs, as well as the cost of delivery.

Vehicle productivity can be used as a criterion for choosing the type of rolling stock of the same brand and the same load-bearing class, if the type of body affects the productivity of rolling stock and does not affect price indicators, especially storage costs.

There is an opinion [5] that it is necessary to take the indicator of transportation costs as a criterion for a comparative assessment of the efficiency of vehicles, which includes the ratio of the sum of annual costs of operating costs and capital investment per unit of transport work.:

$$Zp = Se + (En\,(K - Tsl)) / W \qquad (1)$$

Бу ерда $Zp$ – incurred costs, conditional currency;

Se – operating costs for transportation, conditional currency / t • km;

En – normative efficiency ratio;

K – capital investments for the use of the car, conventional currency;

Tsl – liquid value of the vehicle, conditional currency;

W – average annual productivity of the car, t • km.

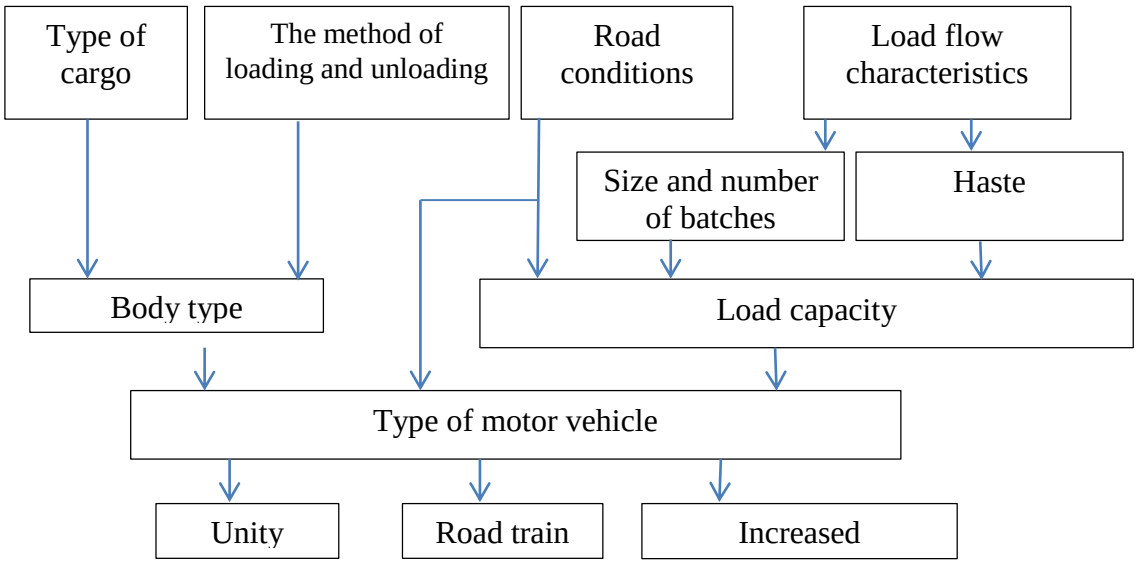


Figure 1. Moving content selection scheme.

The competitiveness of the carrier can be increased by reducing the cost of transportation. Reducing the cost of transportation can be achieved by concentrating them, enlarging the consignments of cargo transported at the same time and using vehicles with large load capacity, provided that this does not harm the consignor and consignee [6].

In most cases, a comparative assessment of the cost of transportation may be sufficient to select the most rational type of vehicle from the series of vehicles, if the cost includes the cost of loading and unloading the vehicle, as well as the cost of maintenance and repair of roads. [7].

The main criterion in the selection of rolling stock for the transport of perishable goods is to ensure the safety of the cargo. To do this, take into account the nature of the route, the number of unloading points on the distribution route, the type of cooling device of the car-refrigerator.

For example, in international transport, autonomous cooling devices, mainly mounted on cars and semi-trailers, are used, which allow to maintain a given temperature regime, regardless of whether the car's engine is running or not..

In urban and suburban transportation, the refrigeration unit compressor uses cooling devices driven by the car’s engine or an external power source.

In general, a more efficient rolling stock selection methodology for transporting perishable goods includes the following key steps.

1. Selection of the criterion of optimality. As mentioned above, the main indicators that measure the efficiency of cargo transportation are vehicle efficiency, value indicators (transportation costs, cost, profit) and energy consumption of transport (specific fuel consumption). Productivity should be as high as possible, and the value and energy consumption of transportation should be minimal.

2. Determining the stiffness limits of operating conditions.

Determining the approximate parameters of the routes of delivery and distribution of perishable goods; determine the required storage temperature; determination of the average monthly air temperature at the place where transportation is required; determination of stiffness limits of operating conditions.

3. Check that the operating conditions of the selected vehicles are capable of maintaining the load within the given hardness limits.

This will be based on the requirement to ensure that the costs associated with the delivery of goods, directly or indirectly, are kept to a minimum and take into account:

the costs of loading and unloading and road construction; possible quantitative and qualitative losses of cargo during delivery;

working capital and costs associated with the storage of goods;

warehousing costs in preparation of goods for transportation to consumers;

the cost of using auxiliary means of transport (containers, trays, multi-purpose containers, etc.);

rolling stock, loading and unloading vehicles, garages, capital investments in warehousing, etc.

If, under the given operating conditions, the specific components of the specific costs are equal, then they may be disregarded [7].

4. Comparison of selected cars on the criteria of optimality.

Comparison of vehicles can be carried out graphically by means of diagrams on the criteria of minimizing the cost of transportation in the stiffness intervals of operating conditions.

5. Based on the results of the graphic comparison, the final decision is made on the selection of a vehicle for transportation in a specific range of rigidity of the conditions of operation of a specific perishable load.

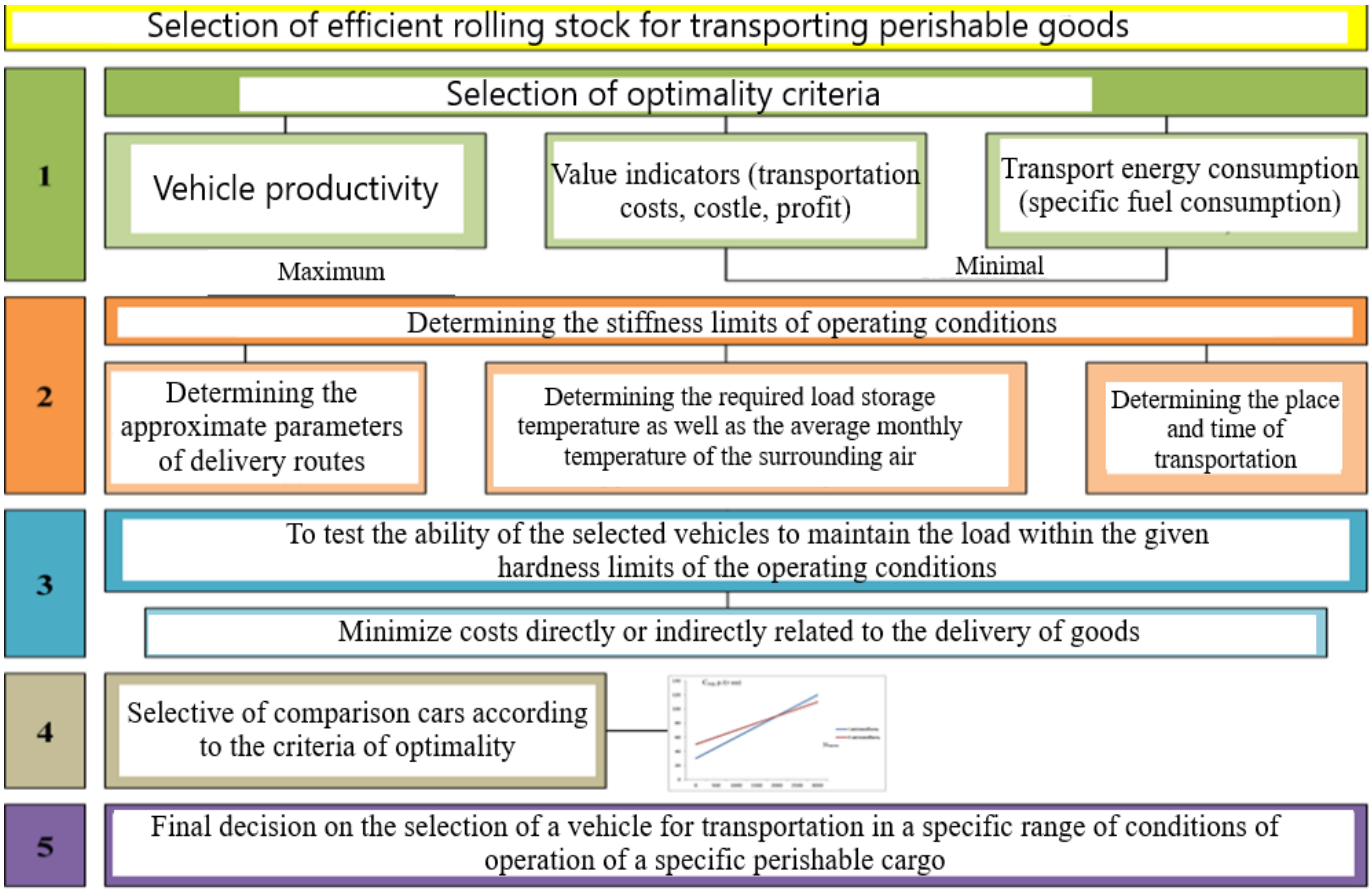


Figure 2. An effective rolling stock selection methodology for transporting perishable goods.

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