Shot lot transportation by road transport

R N Egorov, Yu S Korotkikh, O V Vinogradov and V G Ryabchikova

Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Federal State Educational Institution of Higher Education, 49, Timiryazev st, 127550, Moscow, Russia

E-mail: roman.egorov75@rambler.ru, skt.at@yandex.ru

Abstract. In the cargo turn-over of our country, the most important place is taken by transportation of perishable products and shot lots. Specific peculiarities of perishable products transportation make them one of the most critical ones and impose higher requirements to technical means of mobile refrigeration. The main task for mobile refrigeration is improvement of quality of transportation of perishable goods, productivity of work, capital productivity, reduction of current material costs per unit of transported cargo, more effective use of available and more rapid development of new economically efficient engineering tools.

1. Introduction

Comprehensive control of the carrying equipment is an important prerequisite for effective use and a guarantee of competitiveness. The provision of real-time information is of paramount importance. Advanced technologies, such as GPS (GLONASS), as well as mobile data, allow to determine the location of the vehicle, control loading, etc. Collection of information and processing it in computer databases, maintenance and evaluation of these data web-resource unmistakably and quickly will allow to influence the situation. This is the basis for the indispensability of telematics systems even today.

In the transport system of the Russian Federation, these telematics resources are not used by all companies. Consequently, the supply of the needs of the national economy, as well as the needs of the population for transportation and the creation of conditions for the development of a common economic space on the entire available territory is being hindered. Telematics include the system of data review, including key data on the vehicle for the purpose of planning and optimization in real time. In the process of monitoring the carrying equipment, current information is included, namely the temperature indicator, which specifies the conditions of vehicles transporting frozen or refrigerated goods, ensuring IFS and HACCP standards in the industry.

The efficiency of the carrying equipment or fleet is achieved by transmitting data from CAN/FMS (truck) as well as EBS (trailer/semi-trailer). These are primarily information about fuel consumption, temperature inside the isothermal van, tire condition monitoring and many other indicators. This provides the potential to reduce operating costs. Transmission of the information to the customers’ parallel IT systems and similarly prevents loss of data [1].

Confirmation of the safety of the goods transported (control of door opening, locking). Possibilities of equipment and degree of use of corresponding systems in carrying equipment will depend on the set tasks in logistics and forwarding of enterprise, and begin from elementary determination of location of automobile transport resources to the maximum amount of information and its integration into the...
following calculations or optimization of the route. The formation of information resources implies a systematic approach.

2. Materials and methods
To ensure the required efficiency in management, information resources must be integrated in the first and second directions.

As for the first direction, the task is to ensure the consistency of the planned systems and the executive systems. Under the second direction, the task is integration of complex forming the requirements for the executive corresponding systems.

Information systems, belonging to different groups, have differences as functional subsystems, and sustaining subsystems. Functional subsystems differ in the list of tasks to be solved.

3. Results
Sustaining subsystems will entirely differ by their elements, in particular information, technical, as well as mathematical. There is a specificity of some information systems.

Planning systems. These information systems are formed at the management level and are intended for the implementation of decisions of long-term mainly strategic direction. This possibility undoubtedly increases the quality of transportation, in particular the preservation of cargo in terms of quantity.

Goods transported in isothermal vans are pre-cooled or preheated; they can also be thermally untreated. Mandatory temperature regime during transport is maintained by the following factors:

- Thermal insulation materials and special construction in the vehicle and the surfaces themselves;
- Controllable ventilation systems;
- Controllable direct cooling/heating system.

For the fleet of semi-trailers, trailers in transport, the role of telematics trailers and their requirements is increasing. The most important solution is temperature monitoring for refrigerated transports, real time monitoring of unaccompanied freight by all possible modes of transport. At the moment, information support in small shipments works according to the scheme shown in figure 1.

![Figure 1. Applicable scheme of information support for shot lots transportation.](image)

The implementation of temperature control will ensure a high level of competitiveness of transportation, in particular, the preservation of cargo quality.
In order to maintain the quality of perishable commercially transported goods, it is necessary to impose requirements on isothermal vehicles:

- Maintaining the required temperature and appropriate humidity inside the isothermal van when loaded, regardless of influencing factors;
- Maintaining the movement of isothermal rolling stock at the maximum permitted speeds and at the same time ensuring smooth running, in order to reduce damage to the cargo being transported;
- Automating the operation of climatic installations and monitoring temperature and humidity, the reliability and simplicity of these installations, both in repair and maintenance.

Isothermal vehicles are classified depending on the type of cargo transported into universal and specialized.

Isothermal vehicles differ in the way they cool or heat cargo:

- Refrigerators due to steam or refrigeration compressor units, cool autonomously;
- Iceboxes contain containers for stacking ice or a formed mixture of salt and ice;
- Thermoses are insulated with no cooling or heating structures.

Perishable goods are transported by rail, water, as well as by road and in shot lots by air. The most mass transportation is conducted by road, mostly in small quantities. This is where there is little control over the temperature, which means a low level of cargo quality safety and big losses [2].

Necessary list of measures to be implemented to improve the quality of transportation of perishable goods in small batches:

- Equipping the vehicle used with modern refrigeration and isothermal equipment;
- Introduction of temperature, pressure and vibration monitoring sensors in the means of transportation;
- Reduction of non-productive downtime of vehicles due to more coordinated work with shippers and consignees due to implementation of a number of Automatic Control Systems (hereinafter ACS) and Automation of Product Delivery and Freight Planning;
- Construction of a specialized terminal or equipment for the reception, dispatch and storage of perishable goods with the provision of a car parking space.
The National State Standard provides for the implementation of heat calculation when planning the transportation of perishable goods, as well as the calculation of ventilation [3, 4].

For the purpose of continuous monitoring, it is proposed to equip vehicles and warehouses with a temperature and humidity recorder, which is a compact device similar in function to the familiar thermometer, which will be able to ensure:

- Microclimate monitoring;
- Safety of the cargo in terms of quality ensuring competitiveness, i.e., if the driver periodically turns off, the climate system that activates saving fuel or electricity and it will be reflected in the information of the web resource and unmistakably allows operator to influence the situation. In the same way, deviations will be recorded for timely management decisions.

The temperature sensor is located directly in the frozen locker. The information is available in the driver’s cab, on the body shell, on the server and can also be duplicated. Thus, control is carried out not only on the cargo route, but also in the places of loading and unloading [5].

If a spare vehicle is available, it is possible to deliver shot lots to external customers. In particular, from the logistics center to the proposed compensator warehouse for short-term storage with the following services: unloading from the isothermal van; storage within the compensator warehouse; formation of the required batch; loading the required batch in the isothermal van of the vehicle; delivery to the destination, followed by unloading at the premises of the customer. Distribution to several consignees, if necessary, ensuring that each consignee is unloaded from the isothermal van of the vehicle, should also be a compulsory service [6, 7].

4. Discussion
The key aspect of this interaction with the recipients of perishable cargo is a real-time delivery schedule with the possibility of adjustments. The schedules will form transport contours, in view of the existing network of roads and their load and intensity.

The transport contours will be designed to serve the participants of shot lots transportation in a timely and high-quality manner. Their advantages are in the formation of transport links, both horizontal and vertical, and between the regional logistics center and consumers. Stable transport links will have to meet the conditions of infrastructure functioning in the shot lots transportation. In real time, this allows to optimize the total costs associated with the delivery of goods to customers and consumers.

5. Conclusion
Based on the research, it follows that in order to reduce non-productive downtime, it is necessary to implement a number of measures when creating a specialized terminal or equipped room:

- Grouping of cargoes organizationally, namely to bring large ones at the end of the accumulation to the composition, and small ones at the beginning of the accumulation;
- For the most coordinated action within the existing enterprise, it is proposed to implement an ACS, such as Cargo Express, this will help to predict and plan the cargo operations, which will help to reduce non-productive downtime while waiting for cargo operations;
- Improvement of technical facilities at the customers themselves for unloading and loading of perishable goods to increase productivity.

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