UDK 629.351

CALCULATION OF OPTIMUM NUMBER OF VEHICLES FOR GRAIN TRANSPORTATION

Dmytro Yeriutin

National Aviation University, Kyiv

Scientific supervisor - Iryna Klyus, PhD in physics and mathematics, associate professor

Keywords: logistics of vehicles, grain transportation, combine harvester, car loading capacity.

Increasing the efficiency of transportation and loading and unloading operations is one of the existing reserves for reducing the cost of agricultural products and increasing the profitability of enterprises of the agro-industrial complex. To achieve this goal, an algorithm for solving the problem is considered to justify the necessary number of vehicles for the transportation of grain crops from the field to granaries.

The main tasks of road transport used in harvesting grain crops are: timely transportation of grain crops to granaries; creation of conditions for rational use of collection equipment, reduction of downtime in the process of loading and unloading vehicles; creating conditions for the implementation of advanced methods of organizing the work of the collection and transportation processes and reducing costs.

In order to ensure the smooth collection and transportation process by means of vehicles, the methodology takes into account the grain yield, the area of the area to be harvested, the distance from the field to the granary, the number and technical characteristics of each combine harvester, as well as the carrying capacity of all vehicles involved in grain logistics.

Determining the required number of cars for grain transportation must be carried out taking into account the productivity of the technological machine, therefore, in the methodology, we calculate the time of the clean cycle of the grain harvester(t^{c}_{TM}). It is also necessary to calculate the return trip time (t^{c}_{v}), which is carried out by a field vehicle to the grain receiving point and back.

As a result, two different states of the cleaning and transport process are derived. In the first case, $t^{c}_{v} < t^{c}_{TM}$, for each particular combine there will be one vehicle with the corresponding volume of the body and carrying capacity.

In the second one, $t^{u}_{a} > t^{u}_{TM}$, the required number of vehicles is taken from the calculation of the volume of threshed grain, taking into account the time of the round trip of the car:

$$V_{tg} = t^{c}_{v} \times 3,6 \times q_{tg} \times k_{q} / (\gamma \times \eta_{b} \times (1+d)),$$

where q_{tg} - capacity of combine, kg/s; k_{q} - harvester capacity utilization factor, η_{b} - harvester capacity usage factor, d - the ratio of straw mass to grain mass.

When transporting grain from a combine harvester, the estimated number of vehicles is determined based on the equality of the total productivity of combines and the carrying capacity of road transport involved in grain logistics. At the same time, the diverse composition of vehicles and technological machines, their different load capacities and volumes of bunkers are taken into account.

$$m_1 \times x_1 + m_2 \times x_2 + \ldots + m_n \times x_n + m_k,$$

x_1, x_2, x_n - number of vehicles of certain model; m_1, m_2, m_n - the carrying capacity of the car of the certain model, *t;* m_k - mass of threshed grain by all combines in the field, *t.*

Therefore, we calculate the required number of vehicles using the formula:

$$x_i = m_i \times m_k /(m_1^2 + m_2^2 + \ldots + m_n^2)$$

Thus, the number of vehicles, serving a group of harvesters, is directly dependent on the cycle time of the round trip. When transporting grain, the carrying capacity of the vehicle is important

Conclusions:

The developed method allows us to achieve the set goals by finding the necessary rationally justified number of vehicles, when transporting grain crops from the field to granaries. At the same time, the carrying capacity of each model is taken into account, and not the average for the entire rolling stock, as well as the number of combines used for threshing grain crops, with the technical characteristics of each. As a result, we get the minimum number of vehicles of each model with the maximum useful load.

References:

1. Esin K.S. Logistika perevozok zerna: programmnoe obespechenie rascheta optimal'nogo kolichestva transportnyh sredstv / K.S. Esin, A.L. Sevost'janov // Vestnik TOGU, - №1(32) 2014. - S. 117-124.
2. Esin K.S. Metodika vybora podvizhnogo sostava pri uborke zernovykh kul`tur [Tekst] / K. S. Esin, A. L. Sevost`yanov // Mir transporta i tekhnologicheskikh mashin. - Orel. - №2(41). - 2013. - S. 95-102.