UDK 001

Usmanov Ilhomjon Ikromjanovich
Tashkent State Transport University
Assistant of the Department of Transport Power Equipment

METHODS FOR DETERMINATION OF DIESEL FUEL CONSUMPTION OF MINE DRIVERS

Annotation: The article discusses the methodology for calculating diesel fuel consumption rates for horizontal and vertical movement of mining dump trucks and developed recommendations for improving the calculation methodology in order to reduce diesel fuel consumption.

Key words: mining, dump truck, horizontal-vertical movement, diesel fuel consumption.

The energy intensity of open pit mining is mainly determined by the energy costs of transporting the rock mass (50-90%), which tends to increase with increasing depth of development. The most commonly used type of rock haulage is mining vehicles. However, it is one of the most expensive modes of transportation, both in terms of capital investment and operating costs.

Theoretical aspects of the use of mining dump trucks, heavy-duty mining vehicles have been studied in detail by scientists from the CIS countries. Including V.P. Smirnov's textbook "Theory of heavy-duty mining vehicles" [6] describes the theoretical and practical aspects of fuel consumption of dump trucks used in the mining industry. Russian scientist prof. In the research of St. Petersburg Mining University under the direction of AA Kuleshov [1; 2; 3;] allowed the organization of fuel consumption by mining dump trucks depending on many factors on mining and other conditions, which allows to determine fuel consumption with sufficient accuracy for operating conditions ”. According to the methodology developed by them, the specific fuel consumption of the truck per unit of transport is calculated using the following formula

$$Q_{m.yd}^{mp} = \frac{Q_m^{yd}}{3600\rho_m \eta_{mp}},$$

Here $Q_{т.уд}^{тр}$ - specific energy consumption (unit specific fuel consumption for transport works), l / (t * km); $Q_т^{уд}$ specific fuel consumption by the dump truck engine at rated power, (determined by engine characteristics), g / (kW); $\rho_т$ - diesel fuel density ; $\eta_{тр}$ - КПД- transmission efficiency.

Fuel consumption when moving a loaded truck horizontally over a distance of 100 km

$$Q_т^{горизг} = [100k_{сх}(2k_т + 1)G_{гр}]Q_{т.уд}^{тр},$$

Here $Q_т^{гориз}$ specific energy consumption when the dump truck moves horizontally, l / 100 km; $k_{сх}$ - vibration resistance coefficient; $k_т$ - the coefficient of gravity of the dump truck; $G_{гр}$ - load capacity of the dump truck, t.

Fuel consumption when moving a loaded truck vertically

$$Q_т^{верт} = \frac{100H(k_т + 1)}{1000} G_{гр} Q_{т.уд}^{тр} = 0{,}1H(k_т + 1)G_{гр}Q_{т.уд}^{тр},$$

Here $Q_т^{верт}$, л/100 км; ;

H is the vertical movement height of the loaded dump truck, m.

Fuel consumption (total fuel consumption) to overcome the horizontal and vertical sections of the route

$$Q_т^{сум} = Q_т^{горизг} + Q_т^{верт}.$$

It does not take into account the amount of fuel when performing loading and unloading operations, including shunting movements and idling of the engine. In this method, these values are taken into account by increasing the total fuel consumption by 20%. In this case, the total operating fuel consumption will be equal

$$Q_т = 1.2Q_т^{сум}, \text{ л/100 км.}$$

The engine power of a specific, consumable, overloaded dump truck is proportional to the effective engine power, ie

$$P_c^{уд} = \frac{P_e}{G_c},$$

Here $P_c^{уд}$ - specific labor force, kWh; P_e - effective power of dump truck engine, kW; G_c - weight of the loaded dump truck, t.

The maximum speed of the loaded dump truck (km / h) is calculated using the formula:

$$v_{cp}^{max} = 0.2838 \frac{P_c^{уд}}{k_{сц} + i},$$

Where i is the longitudinal slope of the mining road,%.

Depending on the longitudinal slope and the specific work force, the movement speed and specific fuel consumption are determined according to the table, Figure 1 [78]. The average speed of the dump truck in the direction of work

$$v_{cp} = \frac{v_{cp}^{max} + v_{пор}^{max}}{2},$$

Here - $v_{пор}^{max}$ Maximum specific speed of an empty dump truck:

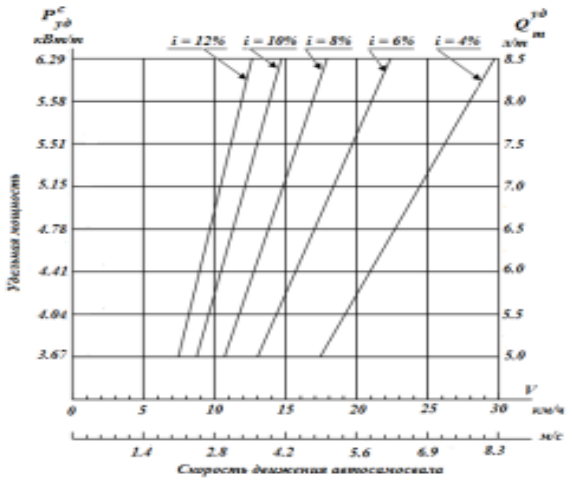

Figure 1. Vehicle speed [4]

The dependence of the specific power and the specific consumption of fuel on the speed of movement of the dump truck for different longitudinal slopes of the mining road. The average running time of the dump truck is calculated in addition to the maximum running time of the engine, including the time of loading and unloading of the truck, acceleration and braking, as well as the time of passing dangerous areas at low speeds. Statistics show that this time consumption is about

50% of the time spent at maximum speed; it is assumed that the total time spent in motion at maximum speed is increased by 1.5 times, ie

$$t = \frac{100}{v_{cp}} + 0{,}5\frac{100}{v_{cp}} = 1{,}5\frac{100}{v_{cp}},$$

Where - t - transport cycle time, hours

As a result, we have a comparable hourly consumption of fuel.

$$Q_m^ч = \frac{Q_m}{t} \text{ ,л/ч.}$$

The main factors determining fuel consumption are the length of the vehicle and the height of the rock mass, road surface quality, transmission efficiency, diesel engine fuel efficiency, vehicle driving modes, load weight, vehicle self-weight, road complexity, maneuvering schemes at endpoints, climatic conditions and altitude above sea level. Mathematical models of fuel consumption by general-purpose dump trucks use basic theoretical relationships from engine theory and empirical load characteristics for a particular engine.

The method considered is based on the use of the classical theory of movement of dump trucks and differs little from each other. Loading and unloading operations, including shunting movements and engine shutdown, as well as correction factors for fuel consumption when driving in horizontal sections and ascents to account for fuel consumption on the slopes of mining roads. Both methods are based on net fuel consumption, which is determined by efficiency (calculations use “nominal” fuel consumption). ”) The power of a dump truck engine, the value of which is determined from the load characteristics of the engine.

An analysis of the state of research and operation of mining vehicles in the open jar mine shows that much attention is being paid to this problem. The main goal of most of the work is to reduce the energy consumption of mining trucks. Currently, the specific consumption of diesel fuel for the main part of the open pit deposit is from 100 to 150 g / tkm, the reduction of which depends on the combination of many technological and technical parameters that characterize the

transport process in a particular mining enterprise. There are two main methods used in the study of high-speed modes of movement of dump trucks:

- mainly considering the required safe speed of the dump truck, the theoretical method of establishing a functional relationship between the forces of resistance to movement, speed of movement and power consumption leads to low results.

- an experimental method based on a series of experimental data obtained during direct measurements to processing enterprises using mathematical statistics and regression analysis methods.

- a complex method that combines both theoretical and experimental approaches in determining the speed modes of mining dump trucks. This method combines the shortcomings of the first and second methods of determining the speed of movement. On the one hand, there is not enough accuracy, and on the other - there is a great need for source data. In conclusion, it is necessary to take into account the effective energy parameters of the engines and to develop a calculation method to reduce diesel fuel consumption based on the optimization of high-speed driving modes and to substantiate practical recommendations. To achieve this goal, you need to solve the following tasks:

1. Analysis of available methods for calculating the specific consumption of diesel fuel in the transportation of rock mass by trucks along mining roads.

2. Development of a mathematical model for the specific energy intensity of the transport process based on the reasonable speed of the Kon dump truck and the balance of effective engine power and resistance to the movement of the Kon dump truck on routes of different lengths and longitudinal slopes at the lowest value of diesel fuel.

3. It is expedient to check the adequacy of the calculation methods based on the results of industrial activities of mining trucks to the actual values of energy parameters.

References:

1. Kuleshov, A. A. Design and operation of mining vehicles: Manual Part 2. / A. A. Kuleshov. - St. Petersburg, 1995. - 203 pages.

2. Kuleshov, A.A. Selection of the optimal type of structure of the excavator-vehicle complex in certain mining conditions: Textbook. / A. A. Kuleshov. - L .:, 1989 LGI. - 70 pages.

3. Kuleshov, A. A. Computation of railway and road transport activities using computers: textbook / A. Kuleshov, S. N. Reznikov L. ed. , 1986 LGI. - 45 pages.

4. Handbook of operational characteristics of BELAZ. - Minsk, 2008.

5. Kruglov V. V. Single logic and artificial neural networks: Textbook / V. V. Kruglov, M.I. Dli, R. Yu. Golunov. - M .: Publishing House of Physical and Mathematical Literature, 2001. - 224 pages.

6. Smirnov, V. P. Theory of heavy-duty mining vehicles / B. P. Smirnov, Yu. I. Lel. - Ekaterinburg: IGD Uro RAS, 2002. - 355 pages.