THEORY OF FORCES DYNAMICLY INFLUENCED ON QUARRY TRUCKS

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Annotation. *The article presents a mathematical development that allows determining the optimal ratio of construction and operational parameters of dump trucks, ensuring the stability of its movement when passing through uneven, deep areas of highways. The theory and results of experimental studies on the damage of truck transmissions as a result of the influence of road defects on the movement of a dump truck on unsuitable quarry roads are presented.*

Keywords. *Quarry dump trucks, mathematical development, Generalized coordinate, dynamic forces, mechanism cylinders, brackets are welded to the ends of the third transverse metal.*

Introduction

Quarry dump trucks are used to transport useful rock or loose rock to the dump or receiving bunkers. When a dump truck transports rock, the loaded rock creates significant dynamic stress on the supporting structures, even when at rest. Over 200.000 dynamic forces are applied to the support structure of the new dump trucks in the quarry and about 50.000 dynamic forces during unloading.

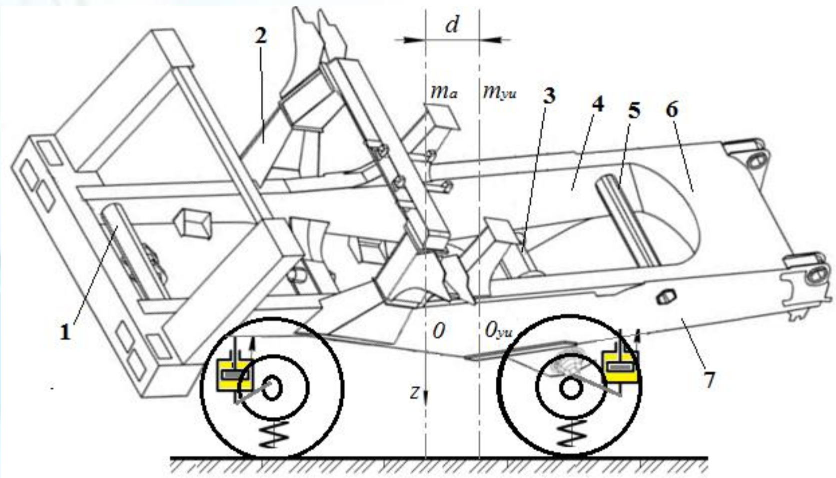

FIGURE 1. Generalized coordinate calculation scheme

The sleepers have a box-shaped section of variable height along the length of the frame. The first transverse metal 1 is made of a pipe with a diameter of 245x45 mm and is attached to the central joint of the front axle using a stud. The second transverse metal 2 is attached to the front suspension frame by means of brackets from the lower transverse metal connecting the side parts of the frame. The front suspension cross member is attached to the lower cross member. The third transverse metal is welded to the 3 side spears, which strengthens the middle part of the frame. The central arm of the rear bridge is attached to the third cross metal. Lower supports of tilt mechanism cylinders, brackets are welded to the ends of the third transverse metal. It consists of two cast pipe supports with a diameter of 325x36 mm. Pipes and cross elements are made of 10HSND GOST19281-89 alloy steel. The frame made of 10XSND alloy steel has the following mechanical properties: tensile strength sV= 540 MPa, yield strength sT= 400 MPa, impact strength aN=30 N.m/sm^2 at minus 70 oS. The platform is made of high-quality, corrosion-resistant alloy steel 18XGNMFR, its mechanical properties are as follows: tensile strength sV= 1100 MPa, yield strength sT= 1000 MPa, impact force at minus 40 ^{o}S is equal to aN=30 N.m/sm^2.

The differential equations and the formation of oscillations around the horizontal axis passing through the center of mass of the truck, that is, the frame, are presented in the form of a generalized coordinate calculation scheme in Fig. 1. Since the truck is oscillating in its vertical longitudinal plane, the system has two degrees of freedom. For generalized coordinates, the vertical displacement ***Z*** of the center of mass of the dump truck ***0*** and its angle of rotation n are taken around the axis parallel to the axes of the truck. As a result of moving the loads in the body to a certain distance from the center during the movement of the truck, the front and rear wheels vibrate relative to the center. Since this oscillating process is complex, the solution was analyzed using the Lagrange function.

$$\frac{d}{dt}\left(\frac{\partial L}{\partial q}\right)-\frac{\partial L}{\partial q}=0 \quad (1)$$

here; L - the Lagrangian function, $L=E_k-E_p$ E_k, E_p - kinetic and potential energy of the car

(Joule), q - generalized coordinate system, after loading the car body, the following kinetic energies are generated.

$$E_k = \frac{m\upsilon^2}{2} + \frac{j\omega^2}{2} = \frac{Q}{2g}\left(x^2 + \rho^2\varphi^2\right) \qquad (2)$$

Potential energies; $E_p = E_{p1} + E_{p2}$, E_{p1} - potential energy of truck gravity (Joule), E_{p2} - potential energy of truck suspension (Joule).

$$E_{p1} = -Qx \qquad (3)$$

$$E_{p21} = \frac{k_1}{2}(x_0 + x - l\varphi)^2 \qquad E_{p22} = \frac{k_2}{2}(x_0 + x + l\varphi)^2 \qquad (4)$$

Due to the loading mass of dump trucks in the normal state, the amplitude fluctuations caused by the inertia force and traction forces during the movement increased by 36% of the nominal force at the higher frequency and decreased by 24% at the lower frequency, the difference of the upper and lower frequencies of the total amplitude was 60%.

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