FRI-2.203-1-TMS-01

CALCULATION METHODOLOGY OF ECONOMIC EFFICIENCY IN MACHINES' BRAKE SYSTEM REGULATED REPAIR WORK [1]

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Abstract: *In the article is elaborated the method of calculating the economic efficiency of regulated repair of brake system of machines with the help of which the increase in the balance of profit was regulated under regulated repairing conditions, it made about 8.6 million AMD (18 thousand $) for 100 units minibuses per year, and profitability increased by 0.12%.*

Keywords:.*Brake axle, reliability, critical machine parts, profit, profitability*

INTRODUCTION

GAZelle brand minibus operational reliability investigation and assessment through machine parts resource indicators [2] shows that from the point of view of reliability the critical components, such as the shoe-beams of the brake mechanisms of the front and rear axles, have limited but definite value. By technical service and current repair operating statutes is envisaged technological operation by which is checked and if necessary, change the worn-out brake shoe. The execution of this operation is foreseen in the TS-2 name list. Studies and analyzes show that the borderline worn-out of shoe-beams of brake mechanism appears more frequently in the case of arbitrary cost of running, which does not coincide with the periodicity of the work of the TS-2. Naturally, there is need for current repair, which envisages removing minibus from the order causing work break with its economic negative consequences.

Based on the results of the scientific-experimental research [2], was substantiated and proved the fact that the improvement of safety of microbus traffic from the standpoint of brake system reliability in the conditions of standardization of resource indices of critical machine parts and 6.6% risk assessment criteria would significantly increase the safety of the minibus. The proposed solution for researched problem is dominant factor from the point of view of traffic safety.

However technical or technological solution of any problem must be justified from the point of view of economic efficiency as there is fact of not full use of machine parts' resources in the form of regulatory and normally performed works.

EXPOSITION

Let's consider the main components of the economic analysis [1].

Material costs: The normalized resource of braking' shoe-beams is smaller than their average resource, for both the front and the rear axle let us appoint

For front axle

R_a- average resource of shoe-beam (thousand/km)

R_n- normalized resource of shoe-beam (thousand/km)

g_a- unit cost of average resource of shoes (AMD/thousand/km)

g_n- unit cost of normalized resource of shoes (AMD/thousand/km), as

[1] Presented a plenary report of October 26, 2019 with the original title: CALCULATION METHODOLOGY OF ECONOMIC EFFICIENCY IN MACHINES' BRAKE SYSTEM REGULATED REPAIR WORK

g_n and g_a differ a little from each other, we accept $g_n = g_a = g$ (AMD/thousand/km)

for rear axle

R_a^1- average resource of shoe-beam (thousand/km)

R_n^1- normalized resource of shoe-beam (thousand/km)

g_a^1- unit cost of average resource of shoes (AMD/thousand/km)

g_n^1- unit cost of normalized resource of shoes (AMD/thousand/km) the same way $g_a^1 = g_n^1 = g^1$(AMD/thousand/km)

loss of shoe of front axle for one minibus

ΔR_f for one year will be

$$\Delta R_f = (R_a - R_n)\left(\frac{L}{R_a} + \frac{L}{R_n}\right) \quad (1)$$

where

L is the annual minibus run (thousand/km).

loss of shoe resource of rear axle for one minibus ΔR_r for one year will be

$$\Delta R_r = (R_a^1 - R_a^1)\left(\frac{L}{R_a^1} + \frac{L}{R_n^1}\right) \quad (2)$$

Average loss of shoe-beam resource of front axle and rear axle brakes will be

$$\Sigma\Delta R = \Delta R_f + \Delta R_r = (R_a - R_{\text{ü}})\left(\frac{L}{R_a} + \frac{L}{R_n}\right) + (R_a^1 - R_n^1)\left(\frac{L}{R_a^1} + \frac{L}{R_n^1}\right) \quad (3)$$

Material costs C_n because of loss of shoes resource during one year of operation of one minibus for front axle' shoes will be C_n

$$C_n = g \cdot \Delta R_f = g(R_a - R_n)\left(\frac{L}{R_a} + \frac{L}{R_n}\right) \quad \text{(AMD)} \quad (4)$$

for shoes of rear axle will be C_n^1

$$C_n^1 = g^1 \cdot \Delta R_r = g^1(R_a^1 + R_n^1)\left(\frac{L}{R_a^1} + \frac{L}{R_n^1}\right) \quad (5)$$

Thus, material losses of shoe-beams of brake mechanisms under normalized resource investment conditions will be

$$\Sigma C = g(R_a - R_n)\left(\frac{L}{R_a} + \frac{L}{R_n}\right) + g^1(R_a^1 + R_n^1)\left(\frac{L}{R_a^1} + \frac{L}{R_n^1}\right) \quad (6)$$

Now, let's calculate the **working costs.**

The changing technology of shoes' brake mechanism of GAZelle brand minibus envisaged dismantle of tires and only after it technological operation of shoes changing. Taking into account the high responsibility of the work done in terms of safe traffic, as a rule it carries out the fourth or fifth grade locksmith/machine-fitter.

Let's calculate the number of changing of brake shoes for one minibus per year П.

for the front axle

$$\Pi = \frac{L}{R} \quad (7)$$

where $\bar{R}$ is the average arithmetic of the normalized resource

for rear axle Π^1

$$\Pi^1 = \frac{L_1}{\bar{R}} \quad (8)$$

The shoe changing laborious of the front axle brake mechanism is normalized 0,4m hour, for rear axle 0,65m hour. General work t will be

$$t = n \cdot 0{,}4 + n^1 \cdot 0{,}65 = 0{,}4\frac{L}{R} + 0{,}65 \cdot \frac{L}{R^1} \quad \text{(man hour)} \quad (9)$$

Having a 4th grade machine-fitter payment fee T you can easily calculate labor costs

$$C_f = t \cdot T = \left(0{,}4\frac{L}{\bar{R}} + 0{,}65\frac{L}{\bar{R}^1}\right)t \quad \text{(AMD)} \quad (10)$$

In order to calculate **income, profit, and profitability**, it is necessary to detect the change of coefficients of exhaust curve in the case of changing with the brake beams average resources and normalized values. As mentioned above, the minibus is removed from the order under the condition of the average resources of brake beams so it is normal that the income D_{day} (thousand.AMD) does not work.

In the case of a normal resource realization, the minibus isn't taken out from order and the shoes changing operation is done during the out of shift.

Let's consider the number of cases of changing shoes of the brake in one year in case of changing their average resource run (N)

$$N = \left(\frac{L}{R_a} + \frac{L}{R_a^1}\right) \qquad \text{(machine, day)} \tag{11}$$

It goes to show that the number of days of the minibus routes decreases

$N_{machine,\ day}$

in that case, if we accept the number of working days 302 days a year, so in the case of shoes changing with the average resource the number of days when the microbuses work in order will be N_o.

$$N_o = 302 - N \tag{12}$$

The change in the cost of the minibuses technical readiness coefficient will be ΔN_p

$$\Delta N_p = \frac{302}{365} - \frac{302-N}{365} \tag{13}$$

lack of income ΔD due to the decrease in technical readiness coefficient will be

$$\Delta D = N \cdot D_{day} \tag{14}$$

where D_{day} is the amount of income per shift (AMD)

Thus, in the conditions of normalized resources of shoe-beams of brake system of GAZelle brand minibus current repair makes it possible to have economical incomes from the cost of shoe-beams resource ΣC and the loss of labor costs C_f and the loss of income due to the removal of the minibus from order ΔD.

As a result we will get the balance of income and expenses as follows:

$$B = \Delta D - \Sigma C - C_f = N \cdot \Delta D - g(R_a - R_n)\left(\frac{L}{R_a} + \frac{L}{R_n}\right) + g^1(R_a^1 - R_n^1)\left(\frac{L}{R_a^1} + \frac{L}{R_n^1}\right) - \left(0{,}4\frac{L}{\bar{R}} + 0{,}65\frac{L}{\bar{R}^1}\right)t \qquad \text{(AMD)} \tag{15}$$

In the course of the scientific-experimental research, following the dynamics of market price changes and the company's payment and other normative rates, the increase in the balance of profit was regulated under regulated repairing conditions, it made about 8.6 million AMD (18 thousand $) for 100 units minibuses per year, and profitability increased by 0.12%

CONCLUSION

Based on the methodology for calculating the economic efficiency of regulated repair of brake system regulated repair of car brake pads with standardized resource indicators can generate about 8.6 million AMD(18 thousand $) profit growth.

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