ABSTRACT

The purpose of the study is to increase the use of the resource of brake pads of motor vehicles through the development of new science-based technical solutions. The experimental study is based on the brake pads of a production car with the introduction of a conductive layer into the friction lining with the output of the light and sound alarm to the driver. The article presents the results of experimental studies on the process of limiting wear of the friction linings of brake pads. During the development of practical recommendations for the technical diagnosis of vehicles, it was confirmed that for monitoring the technical condition of vehicles, it was proposed to use a device to inform the driver about the wear of the brake lining, the use of which increases the utilization of the brake lining resource by up to 98%. The use of this device in the future will allow tracking the dynamics of changes in the thickness of the brake lining, which will facilitate the control of wear and ensure timely repair of the brake system with low costs of materials and tools.

Keywords: brakes, brake system, wear, brake lining, driver.

INTRODUCTION

The development of the technical exploitation system (TE) is carried out on the basis of the planning-precautionary principle of repair and maintenance work. The information base for increasing the use of a motor vehicle resource are indicators of the durability of structural and non-structural elements of machines and the results of their diagnosis [2]. The use of these data allows to study the patterns of formation of costs for ensuring the operability of vehicles and to build effective resource-saving processes of its fuel cells.

However, to fully implement the above direction in relation to vehicles in ordinary operation is not possible due to the need to determine the technical condition (TC) of a large number of their elements [3, 4]. Therefore, the purpose of repair and maintenance effects is justified only for individual diagnosed elements of vehicles. The determination of the frequency of maintenance (TM) and repair (R) of vehicles is carried out on their basis on the basis of general patterns of changes in operating and repair costs [1]. This approach does not allow, in principle, to predict the magnitude of the frequency and repair costs for different conditions. As a result, there is no possibility of developing a fuel system by controlling the timing and volume of repair and servicing impacts [9].

An analysis of the organization of production processes, the composition and distribution of the labor resources of the TE system of motor transport showed that its organizational and production structure does not sufficiently take into account the possible scope and scope of work for the maintenance and repair of the entire range of units.

In order to maintain vehicles in readiness for their intended use, timely and quality maintenance of their maintenance and repair, it is necessary to increase the level of control over the condition of vehicles at all stages of operation, which will undoubtedly increase the efficiency of the vehicle TE system [5, 10].

MATERIALS AND METHODS

The main tasks of technical diagnostics are determined by GOST 20911-89, one of which in particular is the control of the technical condition of the elements of motor vehicles.

The transition to maintenance and repair according to the actual technical condition is possible if there is a developed diagnostic system based on the development of devices that allow the process of using the equipment to its intended purpose, monitor the technical condition (monitoring the technical condition) of the main components and systems, in particular systems ensuring road safety movement.

One of the main systems ensuring road safety is the brake system.

As an example, consider the device informing the driver about the wear of the brake lining [6, 7, 8], which allows for a further transition to the maintenance and repair of vehicles on the actual condition, which will significantly reduce costs.

For the manufacture of brake pads adopted the following approximate manufacturing technology:

a. According to a special catalog, 2 layers of a friction lining (Figure-1) of the required length and thickness are made (the lining itself passes the test for...
resistance to shear of the material, strength of setting with the counter-body due to corrosion, the degree of compressibility of the applied forces, etc.)

b. At the next stage, the residual layer of the friction lining is connected to the frame with high-temperature glue BC-10T (heat-resistant glue, shoe glue according to GOST 22345-77). The operation takes place in three stages with glue applied to both surfaces with intermediate hourly drying of each layer, the connection occurs in a special device (clamp) with a specific pressure of 2.7 kgf / cm square with heating (180-200 °C) and holding the connected parts in a muffle oven for an hour.

c. For the working part of the lining, the operation is repeated with the installation of a current collector and spraying of nano-material.

d. In conclusion, a control test on the strength of the lining connection with the pad is carried out. The entire manufacturing procedure takes 24 hours.

RESULTS AND DISCUSSIONS

Tests of the device informing the driver about the limiting wear of the brake lining were carried out in accordance with GOST 25478-91 ("Motor vehicles. Requirements for the technical condition of traffic safety conditions. Test methods").

Bench tests were carried out at the STS-3-SP-11 stand, road tests were carried out with the EFFECT-02 device (M 016.000.00 TU) - Measuring the effectiveness of automobile brake systems.

Three samples were tested (in comparison with regular brake pads) with imitation of limiting wear. Road tests were carried out after the bench.

As can be seen from the test results (Tables 1, 2), the experimental sample meets the requirements of road safety in the Russian Federation.

Table 1. Results of bench tests of the device informing the driver about the maximum wear of the brake lining.

<table>
<thead>
<tr>
<th>No</th>
<th>The value of the specific braking force on the wheel with the device informing the driver about the limiting wear of the brake lining, %</th>
<th>The value of the specific brake force on the wheel equipped with a standard brake shoe, %</th>
<th>Sound alarm</th>
<th>Light alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>0.85</td>
<td>0.85</td>
<td>0.86</td>
<td>0.87</td>
</tr>
<tr>
<td>2</td>
<td>0.84</td>
<td>0.85</td>
<td>0.86</td>
<td>0.86</td>
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<tr>
<td>3</td>
<td>0.85</td>
<td>0.86</td>
<td>0.86</td>
<td>0.86</td>
</tr>
</tbody>
</table>

The completeness of the use of the brake lining resource is shown in Figure-2.
It is recommended to apply the developed prototype on the road and agricultural equipment equipped with drum-type brake mechanisms.

Table-2. Results of road tests of the device informing the driver about the wear limit of the brake lining.

<table>
<thead>
<tr>
<th>No</th>
<th>Initial speed, km/h</th>
<th>Braking distance, m</th>
<th>Vehicle lead outside the corridor</th>
<th>Standard value of stopping distance for the tested vehicle, m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>11</td>
<td>11.2</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
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<td>11.1</td>
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<td>-</td>
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<tr>
<td>3</td>
<td></td>
<td>10.9</td>
<td>11</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure-2. Full use of the brake lining resource.

The developed prototype allows implementing the last 2 variants of operation.

A patent of the Russian Federation for invention No. 2452880 has been received for the indicated sample, bulletin No. 16 of June 10 [8] was published.

CONCLUSIONS
During the development of practical recommendations for the technical diagnosis of vehicles, it was confirmed that for monitoring the technical condition of vehicles, it was proposed to use a device to inform the driver about the wear of the brake lining, the use of which increases the utilization of the brake lining resource by up to 98%. The use of this device in the future will allow you to track the dynamics of changes in the thickness of the brake lining, which will facilitate the control of wear and ensure timely repair of the brake system with low costs of materials and tools.

REFERENCES


