BULLETIN of Armenian National Agrarian University

International Scientific Journal

ISSN 1829-0000
Reg. № 211.200.00169

Journal homepage: https://www.anau.am/en/teghekagir

UDC: 629.343

Reliability Assessment of the Brake System in Gazelle Minibus Through Resource Indicators of the Limiting Machine Parts

H.V. Vardanyan, N.A. Bazikyan, V.A. Vardanyan
Armenian National Agrarian University
henrik1993@inbox.ru

ARTICLE INFO

Keywords:
resource,
gamma-percentile resource,
limiting reliability,
critical in reliability

ABSTRACT

The resource indicators of the machine parts limiting the brake system reliability in the minibuses of GAZelle series are introduced in the current article. Based on these indices the critical machine parts from the perspective of reliability have been identified. The experimental researches refer to the 3 m 600 thousand km of total run for 20 units of minibuses as a result of which the durability indices have been developed.

Introduction

In order to study the reliability of the brake system in the minibus of GAZelle series, scientific experimental researches have been carried out upon the example of the minibuses of GAZelle series exploited in the seven intra-urban passenger routes in Yerevan. In the transportation company the controlled technical exploitation of the minibuses' brake system is moderated in consistent with the statutes approved by the RA government in 2007.

Materials and methods

The total run of the 20 minibuses under control has made over 3 m 600 thousand km throughout 3 years. In conditions of such running rate, activities of technical service number 2 (TS-2) 307 and technical service number 1 (TS-1) for the minibuses have been carried out 1228 times. Current repair (CR) works have been implemented to eliminate the malfunctions of the brake system 603 times, out of which in 336 cases the works have coincided with those carried out at TS-2 and for the rest 267 cases work performance requests have been submitted. The expense on the spare parts during the Current Repair works was mainly for the change of the shoe-beams of the working brake mechanism in the front axle with 316 kits and 87 kits for the change of the shoe-beams of the drum brake mechanism in the rear axle. It should be mentioned that the shoe-beams of the brake mechanisms in the front axle are replaced with the new ones but the rear axle shoes mainly stay the same; for each minibus they are renewed through merely nailing the beams onto the shoes. The mentioned repairing technology is accepted by the companies exploiting GAZelle minibuses both in the RA and abroad. In the table introduced below the number of the machine parts used during the TS and CR works for the brake system of 20 unit of minibuses of GAZelle series under control is introduced. The machine parts limit the exploitation reliability (GOST 27002-89, 2002) of the minibus brake system.

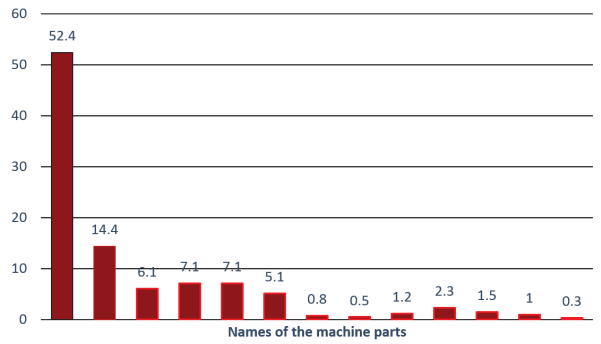
It should be mentioned that for the rest machine parts of the minibus brake system of GAZelle series, such as pipelines, chamber adapters, brake pedal spring, axis, pedal, etc., hardly any repairing work has been implemented or if so, it has been carried out once or twice, which has been ignored due to the goal of the issue. Meanwhile, it should be mentioned that in the company where the investigations are being carried out, the current repairing works of the vacuum booster in the brake system are being implemented through the aggregate-link changing method and the mentioned link is changed in a collective way but not through replacing the machine parts.

Results and discussions

For the visual comparative evaluation of the repairing works of the machine parts in the brake system of GAZelle series the specific weight of the machine parts according to the name list of the table is introduced in the figure. The aim of the figure is to show the name list of the machine parts which limit the exploitation reliability and resource indicators (Lukomsky, 1961) of the brake system in minibus brake system.

Table Machine parts expenses during the TS and CR

N	Name of the machine part	The cost amount of the machine parts	The machine part replaced upon the CR claim	The machine part replaced during the TS-2	The average run of the machine part, thousand/km
1	Front axle brake shoe 3105-3501216	316 sets	137	179	12.3
2	Rear axle brake shoe 3302-3501090	87 sets	41	46	40.0
3	Support guide pin 3105-3501214	37 sets	14	23	97.84
4	Front axle hydro-cylinder piston 3105-3501186	43 sets	32	11	87.3
5	Front axle hydro-cylinder collar 3105-3501194	43 sets	32	11	83.3
6	Front axle brake mechanism disk	31 sets	-	31	110.0
7	Clamp	5	-	5	Selection volume is not sufficient
8	Support	3	-	3	-"-
9	Hydro-cylinder	7	-	7	-"-
10	Brake fluid rubber pipe/tube	14	2	12	-"-
11	Rear axle hydro-cylinder collar	9	7	2	-"-
12	Rear axle hydro-cylinder piston	6	-	6	-"-
13	Vacuum booster	2	2	-	-"-
		603	267	336	



Fg. The specific amount of the Current Repair machine parts (names according to the table) for the minibus of GAZelle series

As it is shown in the introduced diagram figure the names of the machine parts in the brake system needed to be repaired is divided into three main groups:

a) with high specific weight-14.4÷52.4%,
b) average specific weight-5.1÷7.1% and
c) low specific weight- 0.2÷2.3%.

Conclusion

Thus, in exploitation conditions of minibuses of GAZelle series in the intra-urban route of Yerevan, the shoe-beams of the front axle disk-type brake mechanism and partially the beams of rear axle brake drum-like mechanism can be assessed as critical from the perspective of the brake system reliability. This means that the conducted research experiments will enable to find the real resources of those machine parts, as non-renewable machine parts, to find out the resource distribution regularity, to estimate the gamma percentile resource and to develop the possibility of uninterrupted work.

Then it will be possible to find the distribution principles: mathematical expectation value - X, mean-squared departure/ deviation - σ, dispersion - D, dispersion ranges or the variation correlation - V.

References

GOST 27002-89.(2002).Reliability in basic concepts of engineering. Terms and definitions. Issue-Standard, -p. 176.

Lukomsky, YA. I.(1961). The theory of correlation and its application to the production analysis. Moscow. Gosstatizdat, -p. 345. (in Russian).