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ANALYSIS OF SAFETY SYSTEMS DAMAGE IN PUBLIC TRANSPORT VEHICLES ON THE EXAMPLE OF THE MUNICIPAL TRANSPORT COMPANY IN LUBLIN

The article presents the statistical analyzes associated with the repair of selected vehicle safety systems of public transport vehicles. These include steering systems, brakes and suspension. The data were obtained from the Municipal Transport Company in Lublin in the period of one year (2011r.). The test vehicles were a group of public transport buses, such as: Neoplan N4020, Ikarus 280.26, Jelcz, Solaris Urbino 12, Mercedes-Benz 0405N, Mercedes Benz 628 Conecto G i Mercedes Benz 628 Conecto 628 FL. The aim of this study was to determine how often the buses are subject to the above-mentioned systems failure.

Key words: bus, safety, communication

Introduction

Public transport plays an increasingly important role in the mobility of society, especially the developed countries, as an effective remedy for the increasing rate of motorization, perpetually crowded streets of towns and urban road networks. Regarded as a road that has a significant impact on road safety and communication. Key areas of integration activities in the development of road safety, public transport is: security management, monitoring, educational activities and activities for the development of infrastructure. One of the major problems that affect today Poland is a very low level of road safety for other European countries [2].

This article presents the an analysis of failures safety systems rolling stock Municipal Transport Company in Lublin. The first part includes a comparison of the number of failures between 2010 and 2011. In the studied group of vehicles in brake systems, steering and suspension. While the second part presents a summary of systems security divided into investigated by buses.

Types of failures of safety systems

The detailed requirements specified in the regulations [3] relate this m.in.: braking system, tires, seats and seat belts. Types of damage to safety systems have been selected from the group failures that occurred in a period of one year in public transport vehicles. These systems are divided into three groups:

1. braking system, which is divided into:
 - drums, brake pads, brake discs and brake;
 - main brake valve;
 - brake actuator bridge;
 - valve handbrake;
 - ABS
2. The steering system, which consists of:
 - steering column;
 - steering pump
 - longitudinal rod steering;
 - tip rod steering;
 - filter steering.
3. The suspension which includes:
 - shock absorbers;
 - bolt shock absorber bridge;
 - hanger stabilizer;
 - stabilizer bar [1].

Analysis of the number of failures of safety systems

We analyzed the number of failures safety systems on selected brands of buses between 2010 and 2011. The study group of vehicles consists of: Ikarus 280.26 - 5 pieces, Jelcz M121M - 12 pieces, Neoplan N4020 - 11 pieces, Solaris Urbino 12 - 12 pieces, Mercedes Benz 628 Conecto LF - 11 pieces and Mercedes Benz 628 Conecto G - 5 pieces.

In Figures 1 to 6 are graphs showing the number of failures attributable to the individual safety system for the bus model.

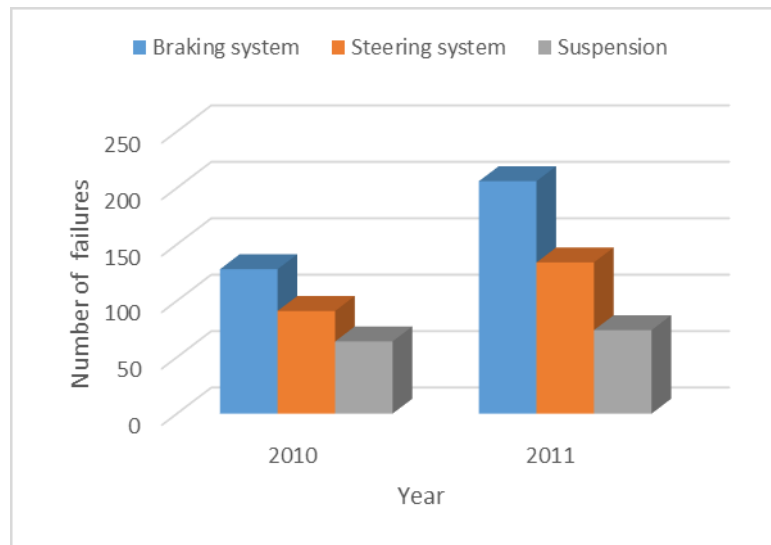


Fig. 1. Summary failures safety system bus Ikarus 280.26 [1].

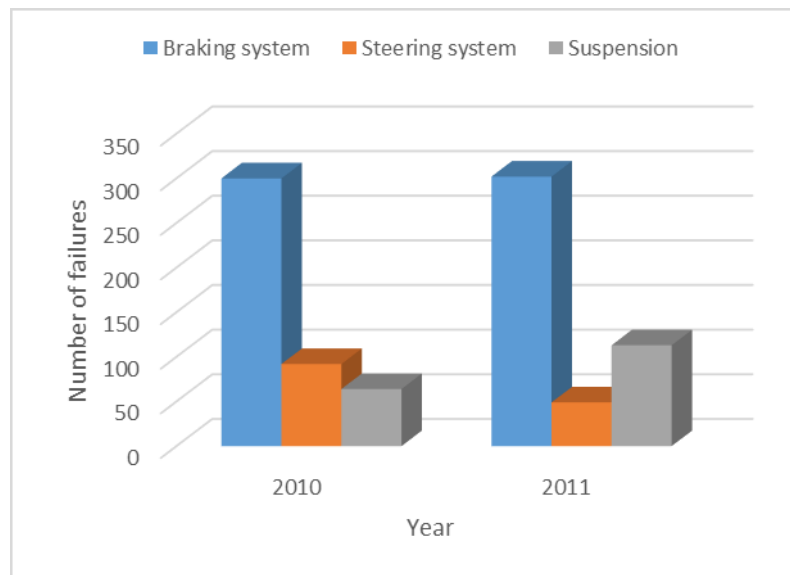


Fig. 1. Summary failures safety system bus Jelcz M121 [1].

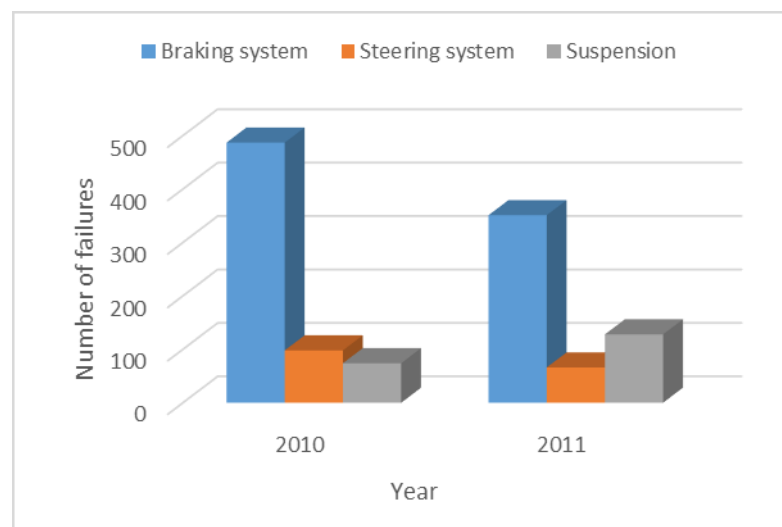


Fig. 3. Summary failures safety system bus Neoplan N4020 [1].

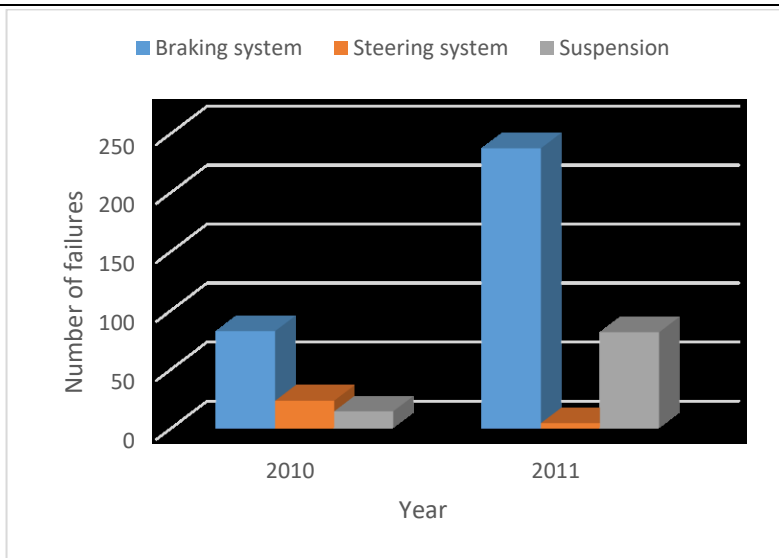


Fig. 4. Summary failures safety system bus Solaris Urbino 12 [1].

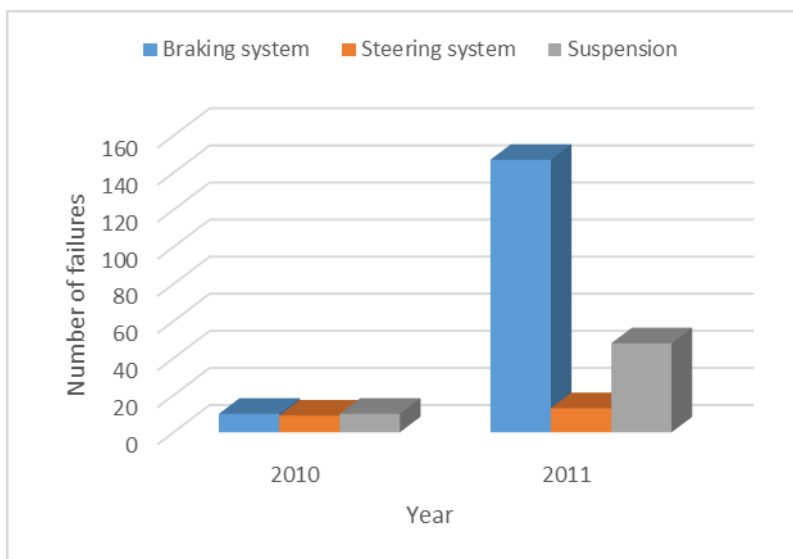


Fig. 5. Summary failures safety system bus Mercedes Benz 628 Conecto LF [1].

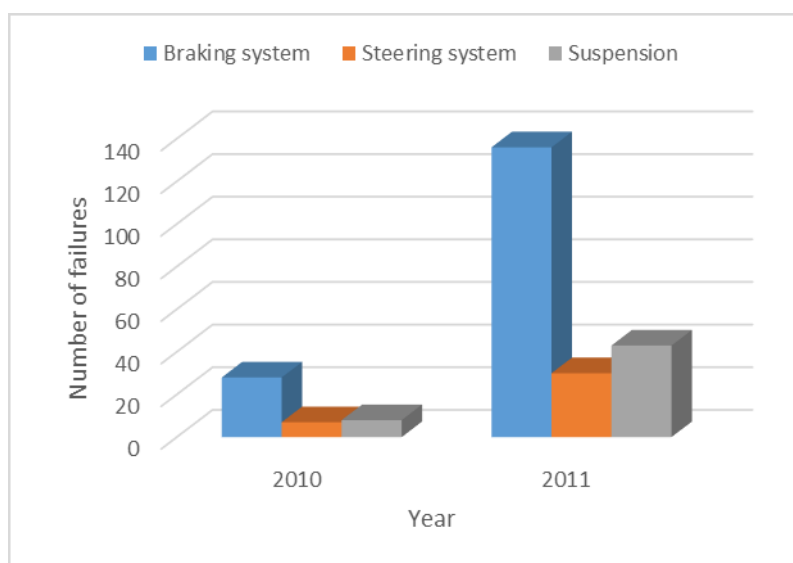


Fig. 6. Summary failures safety system bus Mercedes Benz 628 Conecto G [1].

Compared failures safety system bus Ikarus 280.26 (Fig. 1) can be seen that the number of failures in 2010 is much lower than is the case in 2011. The greatest number of failures in both cases the braking system

(respectively 128 and 206). In steering the 2011 number of failure compared to 2010 increased by 43 failures, while the suspension has increased by only 10. In the case of Jelcz M121M (Fig. 2) in the brake system is the number of failures at the same level (2010 r. - 300, 2011. - 302). The number of failures in the suspension of relief doubled compared with 2010 but the situation is different in the steering system where the number of failures in 2011. Is smaller. In the brake system and steering system of the vehicle the brand Neoplan N4020 (Fig. 3) The number of failures increased during the year by 136 for the brake system and 32 faults in the steering system, and in case of suspension of the number of failures is higher in 2011 at 54. Figure 4 in the statement

of safety systems in the bus Solaris Urbino 12 the number of failures in the brake system and suspension is much higher in comparison with 2010 (an increase of 155 malfunctions in the brake system and 67 suspended). The steering in 2011, failure of the system is minimal (4 breakdowns). Failure safety system buses Mercedes Benz 628 Conecto LF and Mercedes Benz 628 Conecto G (Fig. 5 and 6) as compared to 2010 deteriorated significantly, where the brake increase was about 137 and 108 failures in the steering of 4 and 23 failures and the suspension of 38 and 35 failures.

Analysis of safety systems

Analyzed the failure of safety systems, that took place in 2011 in the public transport buses in Lublin. The test group of vehicles is: 280.26 Ikarus, Jelcz M121M, Neoplan N4020, Solaris Urbino 12 Mercedes Benz 628 Conecto LF and Mercedes Benz 628 Conecto G. The engine test results.

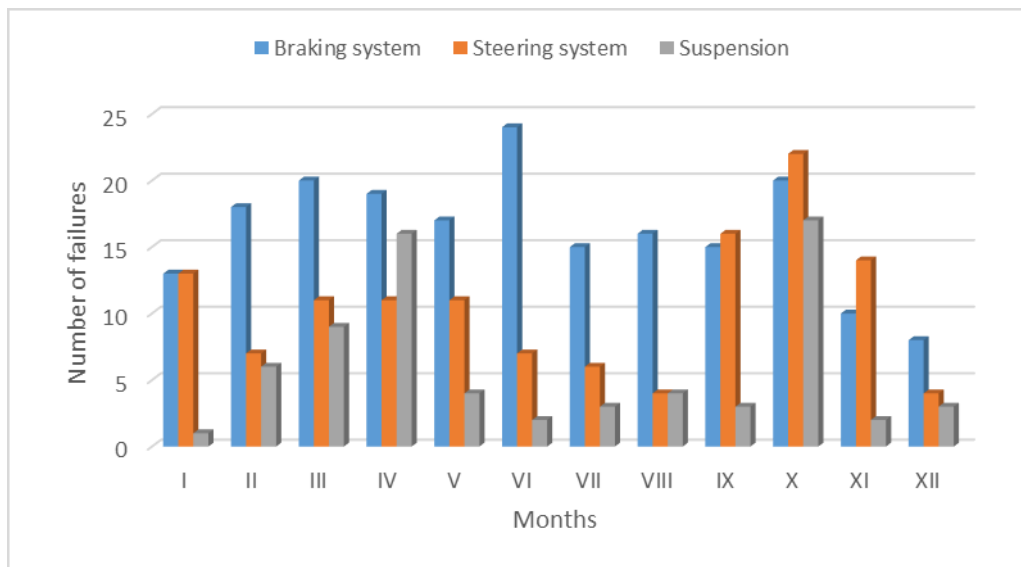


Fig. 7. Summary safety system bus Ikarus 280.26 [1]

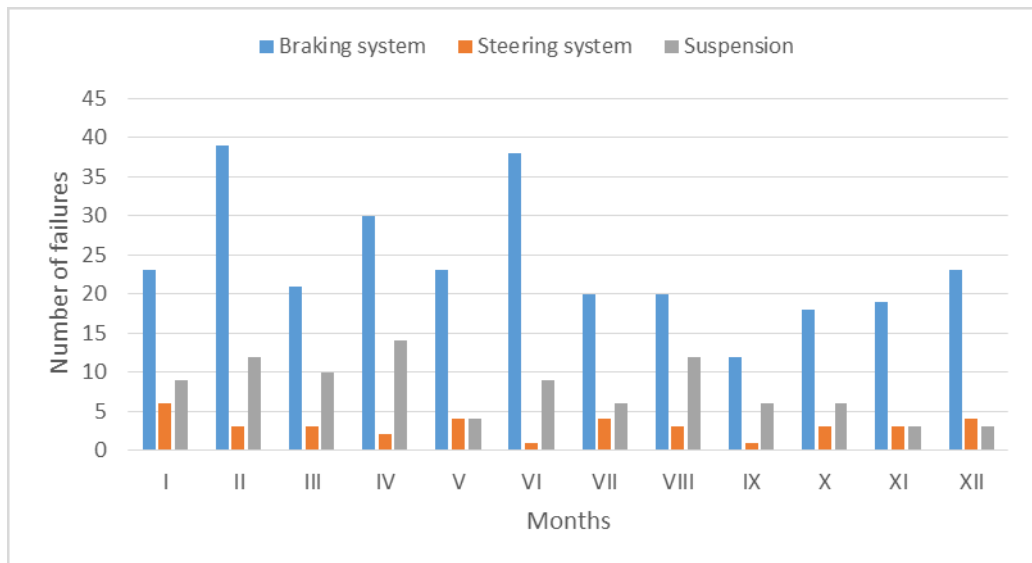


Fig. 8. Summary safety system bus Jelcz M121M [1]

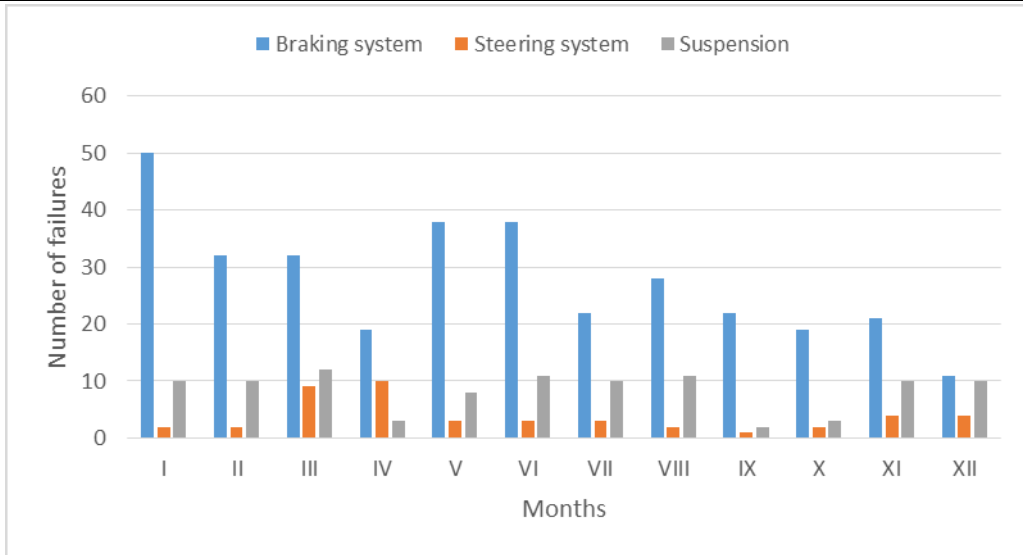


Fig. 9. Summary safety system bus Neoplan N4020 [1]

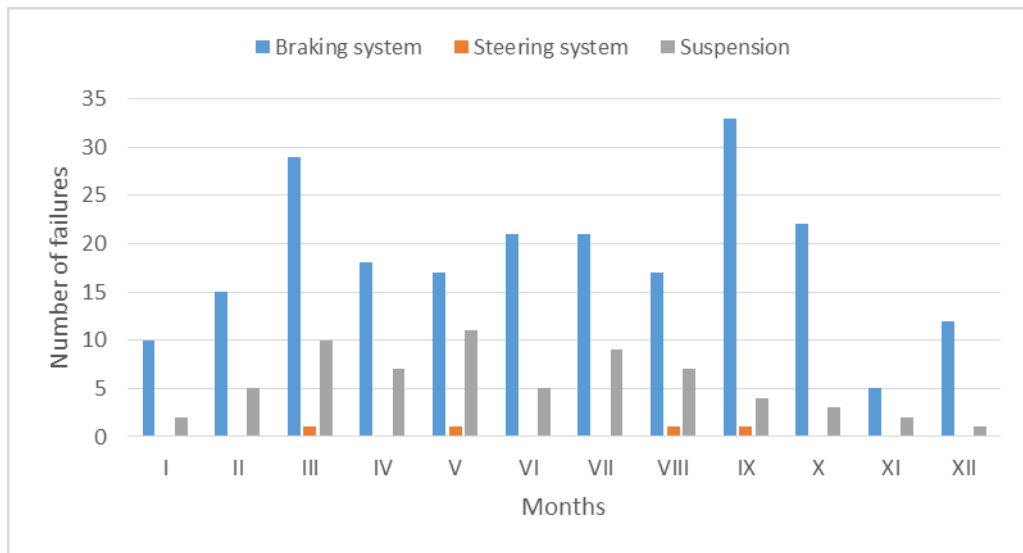


Fig. 10. Summary safety system bus Solaris Urbino 12 [1]

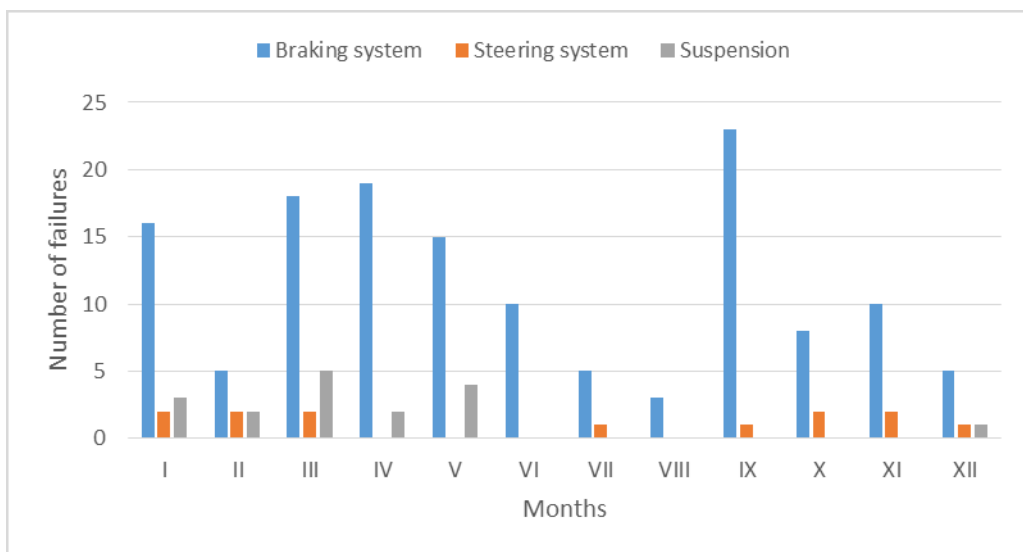


Fig. 11. Summary safety system bus Mercedes Benz 628 Conecto LF [1]

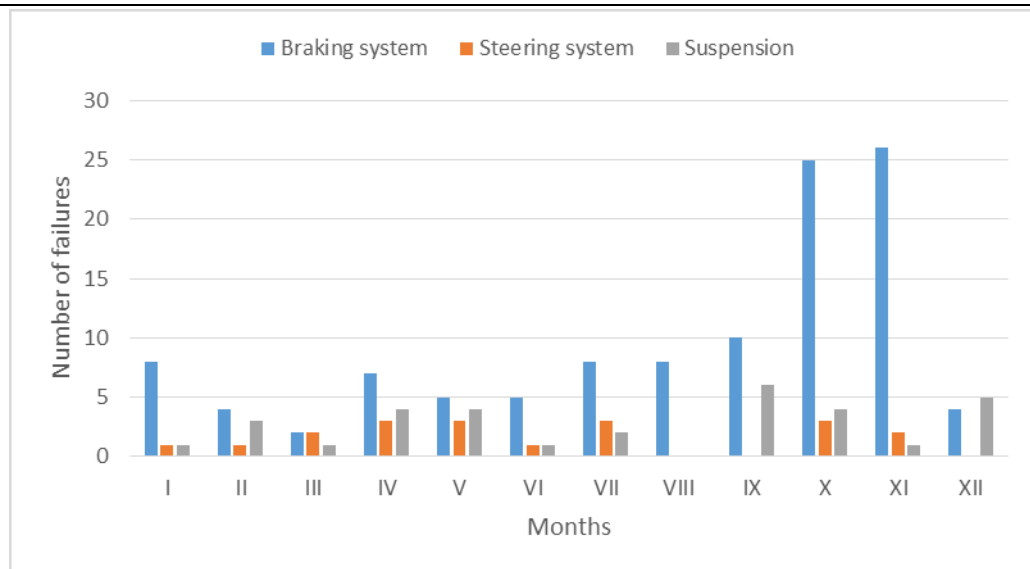


Fig. 12. Summary safety system bus Mercedes Benz 628 Conecto G [1]

Compared safety systems can observe the course of the failure models of buses operated in MPK in Lublin. In the case (fig. 7) Ikarus 280.26 failures are practically throughout the study period in all three systems. The greatest number of failures has demonstrated the brake system while the smallest number occurred in the suspension of decrease in failures during the holiday season. Summary table (Fig. 8 and 9) safety systems Jelcz M121M and Neoplan N4020 shows the failure rate within one year. You may notice that the course of failure in both cases is similar, where growth failures occurs in winter periods while a slight decrease from June to November. Faults in the steering (fig. 10, 11) in buses Solaris Urbino 12, Mercedes Benz 628 Conecto LF is very low. The Solaris Urbino 12 failure of the aforementioned system is minimal where during the year were literally 4 crashes after 1 failures in the month of March, May, August and September. A similar process occurs in a Mercedes Benz 628 Conecto LF where after two failures occurred and the beginning of the year (January - March) and at the end of the year (October - November), while in the summer months, there were no failures. In Figure 12 the brake system showed the highest number of failures in the autumn months. The steering and suspension in this model bus failures are rare.

Conclusions.

The article presents an analysis of failures safety systems in transport commuters. In the analysis, braking, steering and suspension fleet of vehicles used by the Municipal Transport Company in Lublin. The analysis shows that most failures occurs in the brake system of the vehicles the study. It should be noted that during one year of operation of city buses the number of failures increased significantly with compared to 2010 but in some cases the level of failures was comparable as well happen that the number of failures in 2011 was lower (eg. Steering). In the analysis of the results statement of safety systems, in the case of buses Ikarus 280.26, Jelcz M121M and Neoplan N4020 failures have occurred over the whole period of time. While failures in other vehicles (Solaris Urbino and Mercedes Benz Conecto 628), the youngest of the research group can be distinguished months with negligible as well as emergency work without these buses.

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