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## STATISTIC ANALYSIS OF DATA FROM RENOVATIONS OF FREIGHT WAGONS

**Abstract:** Analysis of data from protocols that are filled during the process of qualification for renovation of freight wagons can be very useful in the process of freight wagons development and modernization in order to obtain better exploitation properties and extend periods between repairs. In this paper results for freight wagon types EAOS 1415 A2 and A3 as well as BDZE, CFRE, CSDE, 401W, 408W, 412W are presented. 298 qualification protocols from years 2012 up to 2014 were analysed. The acquired data were analysed in order to specify the percentage of repairs of individual wagons elements. Obtained results were presented on charts. It was concluded that at this moment there is no any part of the freight wagons body shell that may be indicated as the most exposed to damage during standard exploitation of the freight wagons.

### 1. Introduction

Introduction of modern technology helps eliminate or reduce nuisance problems associated with the implementation of any kind of transport or the operation of the used technical means. Rail transport is a very important part of the modern economy, one of the components determining its dynamic development. It is therefore important to conduct research and taking action aimed at the development and refinement of this branch of industry. Such actions directly translate into an increase in its effectiveness, safety, reduction of burden on the environment and society. Nowadays numerous studies are conducted, aimed at introducing new technologies and solutions, both in terms of railway infrastructure and logistics management systems, as well as in traction vehicles themselves [1-3]. This paper contains a report on the part of works conducted in the research and development project. This project is realized within the Program of Applied Research by Institute of Engineering Processes Automation and Integrated Manufacturing Systems of Silesian University of Technology together with consortium partners: company DB Schenker Rail Polska SA and Germaz. The main objective of the project is to develop a technology of modernization of freight wagons for the transport of coal and aggregates, through the use of innovative materials and technologies to repair this type of wagons during periodic repairs. Actions which have been

undertaken within the project are to improve the operating conditions considered types of wagons by [1-3]:

- better corrosion protection of the wagon elements,
- easier unloading of the wagon in winter conditions (no freezing of the cargo to the sides and floor of the wagon),
- reduction of the weight of the wagon while its load increases,
- easier management of freight cars during exploitation.

Data obtained from the process of freight wagons repairing can be very important and could have strong influence on the process of their development. The work was done in order to obtain precise information about the process of damage of individual elements of the freight wagons body shell during their exploitation and to verify if there is any part that may be indicated as the most exposed to damage during standard exploitation.

## 2. The qualifying protocol

At this moment the qualifying protocol that is used in the DB Schenker Rail Polska SA Company in order to decide which elements of the freight wagon should be repaired or replaced by the new ones includes such data as:

- the type of the analysed freight wagon;
- the drawings of the analysed type of wagons including views of all side walls and the floor;
- the identification number of the wagon;
- the date and type of the previous repair and the date and type of the actual renovation;
- the table with listed elements of the wagon with the possibility to mark whether the item is suitable for repair, replacement, or whether it is in good technical condition;
- the signatures of the responsible people and the place for other notes.

In presented work 298 qualifying protocols were analysed from repairs conducted from 2012 up to 2014. Protocols were scanned and sorted taking into account types of freight wagons. Data from protocols were analysed in order to specify the percentage of repairs of individual wagons elements. Obtained results were presented on charts.

In order to analyse data from protocols elements of the freight car's box were named and marked on the scheme of the freight wagon. In Fig. 1 names of the EAOS 1415 A2 and A3 wagon's elements designations are presented.

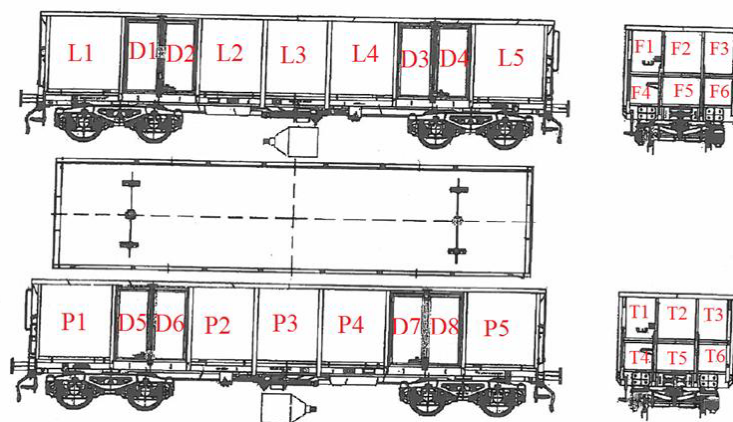


Fig.1. Designation of EAOS 1415 A2 and A3 wagon's elements

The most important, taking into account assumption of modernization of the freight wagons using composite panels mounted to the wagon's shell of the body, is the information about the damage of its elements. Percentage of repairs of individual elements of the shell of the body is presented in Fig. 2.

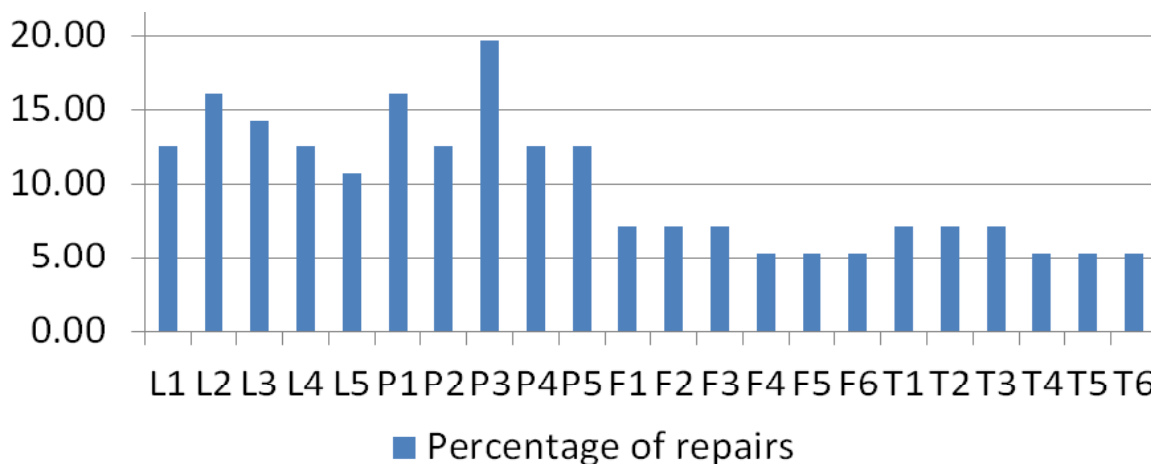


Fig.2. Percentage of repairs of individual elements of the shell of the body of freight wagon EAOS 1415

In Fig. 3 assigned names of elements of the freight wagons marked BDŽE, CFRE, CSDE, 401W, 408W, 412W are presented. Such kind of freight wagons have very similar structure of the shell of the body and 221 qualifying protocols of those wagon types were analysed. Obtained results are presented in Fig. 4.

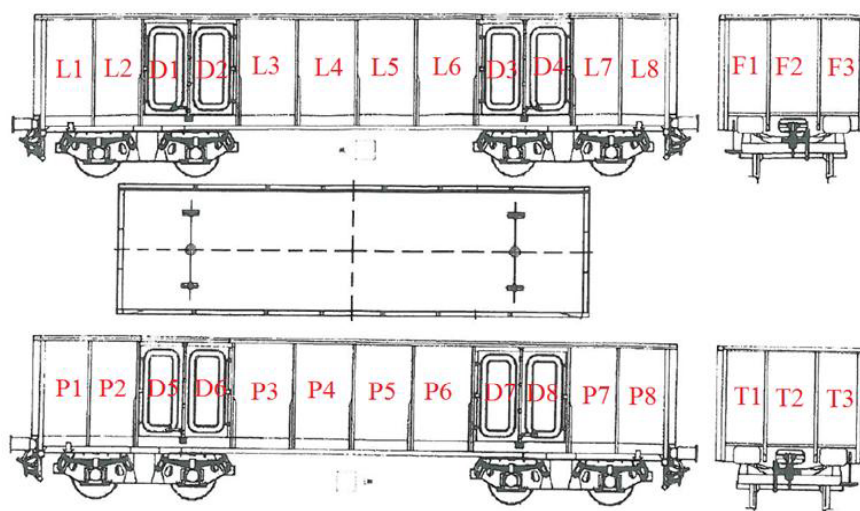


Fig.3. Designation of BDŽE, CFRE, CSDE, 401W, 408W, 412W wagon's elements

In case of all analysed qualifying protocols they were prepared before the standard periodical renovation of freight wagons that takes place every three years of their exploitation.

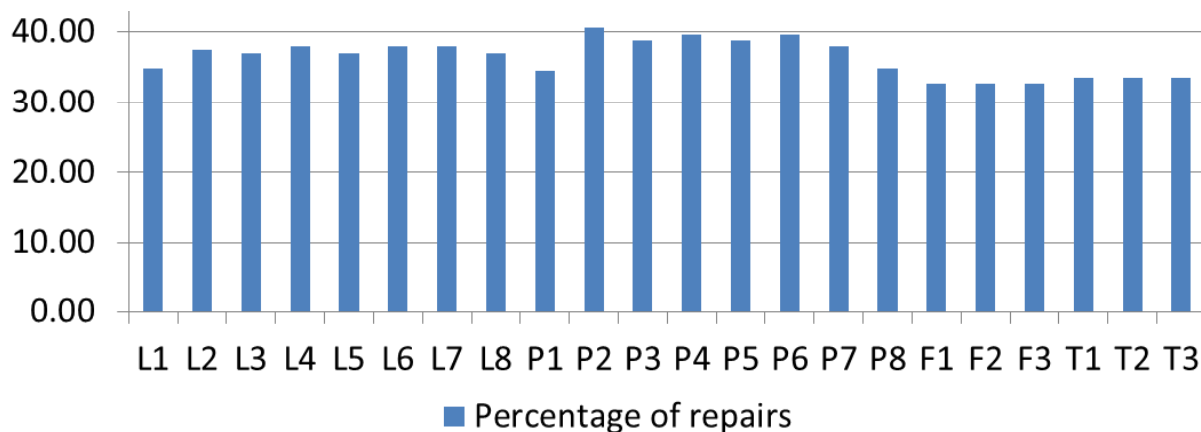


Fig.4. Percentage of repairs of individual elements of the shell of the body of freight wagon BDZE, CFRE, CSDE, 401W, 408W, 412W

### 3. Conclusions

Presented results of qualifying protocols analysis shows that there is no any part of the freight wagons body shell that may be indicated as the most exposed to damage during standard exploitation of the freight wagons. In case of type EAOS 1415 freight wagons it can be noticed that elements of the side walls were repaired more often than elements of front walls but it must be noticed that in this case only 56 qualifying protocols were analysed. In the second case of the freight wagons with very similar structure of the shell of the body such as BDZE, CFRE, CSDE, 401W, 408W, 412W where 221 qualifying protocols were analysed the distribution of the percentage of repairs of individual elements is much more uniform. It should be mentioned that in order to obtain more precise information about the process of damage of individual elements of the freight wagons body shell during their exploitation it is necessary to carry out a more accurate operational documentation starting from the production of wagons, which will take into account operating conditions of carriage, such as the type of transported cargo, as well as all carried out repairs. Results of the implementation of the improved qualifying protocols will be presented in the future publications.

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