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RESEARCH INTO SAFE TRAFFIC OF LITHUANIAN RAILWAY LINES

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Abstract. The European Union directions pay a specific focus on traffic safety. Safety of railway transport traffic is among priority fields which has a direct effect on the quality of life of the population. It is most convenient to consider the number of breaks and accidents per year as the indicator of traffic safety. Reasons of traffic accidents can be very different. Most accidents occur due to poor technical condition of rolling-stock and infrastructure, the human factor and the deficient organization of traffic. Stock Company „Lithuanian railways" can not assure safe traffic yet. The number of traffic incidents decreased in a few preserves only. Considering that, it is necessary to prepare a strategy for traffic safety and the program for its implementation. In 2002 specialists started preparing a study for safe traffic. The study is important for the preparation and implementation of the mentioned program. First results obtained from the research have already approved the importance of the influence of infrastructure, rolling-stock and a human factor on traffic safety. The research carried out indicates positive changes in the situation of traffic safety of Lithuanian railways.

Keywords: Traffic safety, accident, breakdown, rolling-stock, locomotive, infrastructure, human factor, engine drivers.

1. Introduction

In the Regulations of the European Union life quality improvement is accented. Especial attention in the EU directives is paid to safe traffic [1, 2]. Traffic safety of railways is one of the prior spheres, having direct influence on life quality [3–10].

At the moment the length of Lithuanian railway lines is 1997.2 km [11], whereof 822 km are international railway transport corridors and branches needed for the whole Europe. Safe passenger train speed on these lines must be 160 km/h. In the sections Kena – Klaipėda and Kaišiadorys – Kybartai the mentioned speed will be realized to 2013. Besides, the amount of loads and passengers increases every year. In ten years it should increase 1.5 times.

AB "Lietuvos geležinkeliai" (SC "Lithuanian railways") can not assure safe traffic yet. The number of traffic incidents decreased in a few preserves only. Considering that, it is necessary to prepare a strategy for traffic safety and the program for its implementation. The contents of the traffic safety program could be as follows:

To analyse the situation of traffic safety in AB "Lietuvos geležinkeliai" in separate preserves evaluating the present situation of the traffic safety and strategy prepared for the years 2002–2015 by the Communication Ministry;

To prepare safety prevention means for the years 2004 – 2015. They must be implemented realizing traffic safety improvement strategy;

To project approximate financing necessary for the implementation of means for traffic safety. To plan scientific research and standards for the sphere of traffic safety.

In 2002 science and practice specialists started preparing a study for safe traffic. The study is important for the preparation and implementation of the mentioned program. Practical sense of the study is not felt yet because most of the suggested means require huge investments. Some of the recommended prevention means especially the ones associated with the human factor require a lot of time for making reforms in the system of specialist training and improvement of their qualification.

First results obtained from the research have already approved the importance of the influence of infrastructure, rolling-stock and human factor on traffic safety. The research gives information for the further formation of the study programs [12].

2. Present situation

During 1998–2003 7 train accidents and 674 breakdowns happened. 5 accidents occurred because of the road technical condition, 1 because of dissatisfactory condition of rolling-stock and one was caused by railway workers [12]. The research data for the period 1998–2003 is shown in Fig 1.

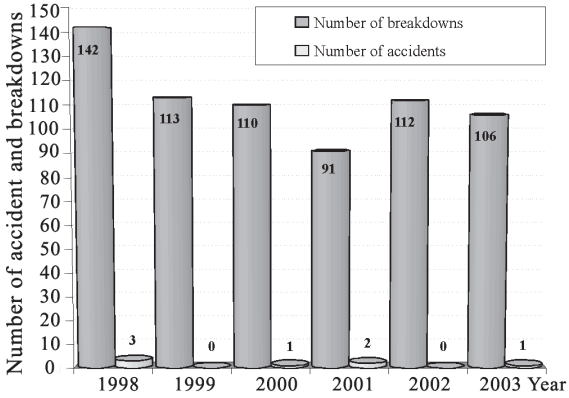

Fig 1. Distribution of accidents during the last 6 years

More than 60 % of breakdowns happened because of the technical condition of the rolling-stock. The main reason is ageing of the park because more than 50 % of the locomotives are utilized after expiry of their planned service period. Also about 30 % of rolling-stock breakdowns happen because of the human factor. 143 breakdowns happened because of the defects in the infrastructure. Most of them were caused by the delayed major repairs or regarding insufficient service of the intensively used railway road sections. Distribution of breakdowns according to different services during the years 1998–2003 is presented in Fig 2.

20 % out of all registered breakdowns during the period from 1998 to 2003 were caused by the fault of Infrastructure service department; 74 % (5 out of 7) accidents happened because of the road technical condition. In the automation, communication and electricity supply economy, technical condition of more than 34 % of energy equipment is hardly satisfactory because their maintenance time is over 20 years. Maintenance of 56 % of signalisation equipment exceeds 20 years as well. Communication equipment is worn most of all because 75 % of the equipment is used for almost 20 years and when it is used for 25 years, it is in emergency condition. Breakdown percentage distribution according to the reasons during the period 1998–2003 is presented in Fig 3.

Most of the breakdowns during the years 1998–2003 are registered in the rolling stock economy. They make 66,4 % out of the total number of breakdowns.

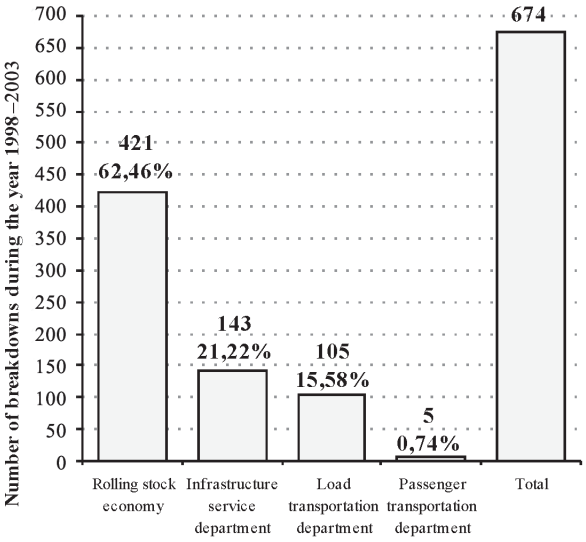

Fig 2. Number of breakdowns according to separate services during the years 1998–2003

The main reasons are: breakdown of locomotives when carrying the train (~ 59 %), passing the forbidden light (~ 9 %), collision (~ 5 %), rolling away the rails (~ 5 %) and other reasons (~ 22 %).

Breakdowns of the locomotives are mostly caused by poor repair quality. Disturbances happen because of the fault of the locomotive crew (too long working hours). Service time of more than 58 % locomotives is over. This caused increment of the breakdowns during the years 1998–2003 by 37 %. The largest amount of the breakdown reasons (40 %) is caused by internal-combustion engine damage. Among them most of the breakdowns happen in heat-locomotives because they make the largest part of the rolling stock. Besides, the age of 7 heat-locomotives (40 %) TEP 60 series is more than 30 years. There are 306 locomotives in Lithuanian railways rolling stock park. The maintenance of 179 of them is already over. Break-

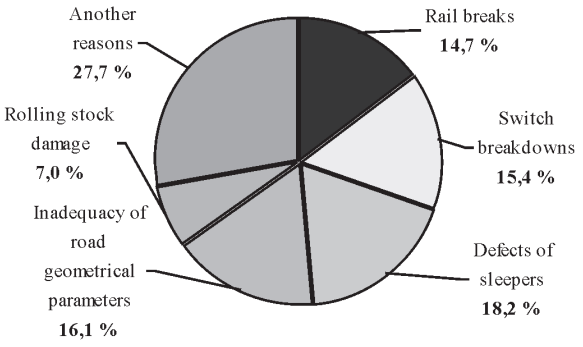

Fig 3. Distribution of breakdowns in the infrastructure service department according to the reasons during the period 1998–2003

down percentage distribution according to the reasons of technical conditions of the rolling stock and locomotive park during the years 1998–2003 is shown in Fig 4.

From the graphs shown above it is seen that during the research period as an average 1 accident and 100 breakdowns occur and it is not more than in the rest countries of Europe. However, following the dynamics of breakdowns a tendency to decrease is noticed. During the last six years breakdowns decreased from 142 to 106 (20 %). Most of the breakdowns happened because of the technical problems, i.e. park ageing and infrastructure technical level amortization (delayed major repairs of road). In both spheres of low reliability traffic clear reasons exist. In the road economy most of the breakdowns (48 %) are caused by the upper road construction (rails, sleepers, switches etc.) deformation. Many damages happen in the aged traffic regulation and electricity supply system. In the rolling stock economy breakdowns are mostly caused by the damage of the aged locomotive internal-combustion engines. They make 40 % out of the total balance. Locomotive repairs are carried out, unfortunately, regarding the lack of high quality repair basis, park shortcoming remains.

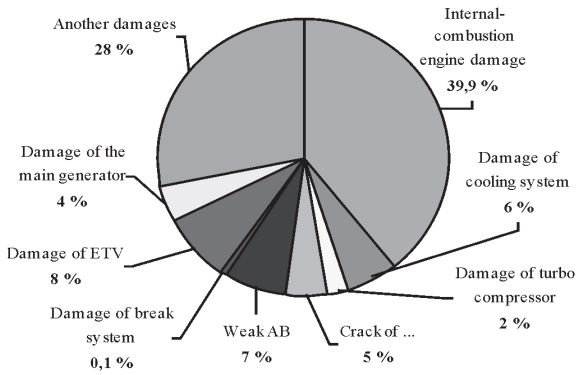

Fig 4. Percentage distribution of the breakdowns according to the reasons of technical condition of the rolling stock and locomotive park from 1998 to 2003

These technical reasons of breakdowns are known and they are under control. Generally, train speed is decreased and other restrains are brought, however this method is economically ineffective. Railway road and rolling stock technical level can be effectively improved only by huge investments to the modernization of the mentioned economy [2, 6, 8].

Only few accidents happen in the department of passenger transportation. The main reason is very low passenger train traffic and very strict regulation of train speed. Problems in this sphere of economy exist only in the wagon park structure. Most of the passenger train wagons (about 50 %) are maintained for less than 15 years and electric train wagons haven't overcome their maintenance limit yet. In this sphere of economy serious traffic safety problems don't arise as passenger train speed is not markedly increasing.

The amount of accidents and breakdowns is mostly influenced by the amount of transportation. The amount of loads requires utilizing more rolling stock, doing more switching and increasing run of rolling stock.

In the load transportation department the amount of breakdowns during 1998–2003 decreased from 23 to 14, meanwhile load transportation during the same period increased from 30 912 thousand tons to 43 477 thousand tons. The amount of breakdowns for 1 million tons of loads during the same period decreased from 0,74 to 0,32. In Fig 5 the amount of breakdowns for 1 million tons of transported loads and the dynamics of transported loads amount (thousand tons) during the same period are presented.

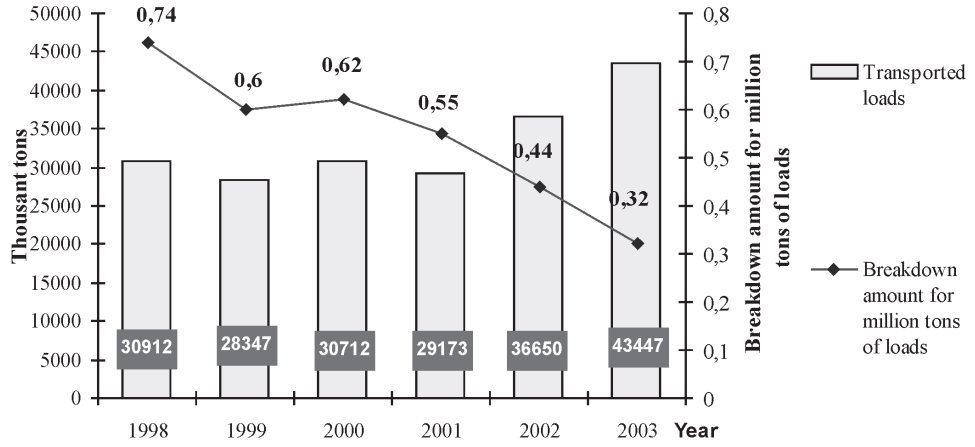

Fig 5. The amount of breakdowns for 1 million tons of transported loads and the dynamics of transported loads (thousand tons) during 1998–2003

In the graph it is obviously seen that during the research period the quantity of transportation increased by more than 12 thousand tons and the amount of breakdowns for 1 million transported tons of loads decreased twice. The main reasons of improved traffic safety are recently implemented organizational and technical means [11–13].

This dynamics may change as train speed increment is planned; however this problem is already being solved together with railway infrastructure and rolling stock park technical progress.

3. Human factor and traffic safety

The amount of breakdowns mostly depends on engine-drivers and their assistants work quality, therefore only this work will be analyzed in details [14].

AB "Lietuvos geležinkeliai" (Stock Company "Lithuanian railways") in 2003 had 523 engine-workers and 363 their assistants. Dividing engine drivers into age groups it is estimated that potentially unsafe drivers are the ones with the work experience from 21 to 30 years (1,36 out of the total number of breakdowns fall on one engine driver). This age for engine-drivers assistants is from 11 to 20 years (0,69 out of the total number of breakdowns fall on one assistant).

The distribution of the amount of breakdowns for one person according to engine drivers and their assistants work experience during the year 2003 is presented in Fig 6.

The results of the research do not allow concluding that engine drivers and their assistants work experience is a critical factor of work quality. However, the attention paid to this factor could be an assumption for the preparation and improvement of the qualification of such specialists and for the improvement of operating conditions.

It may be assumed that specialists having 21–30 years of work experience can easily solve professional questions, however in this complicated work facts of psychological (depression) and accelerated tiredness can occur.

Traffic safety largely depends on the amount and qualification of workers. Such analysis evaluating the number of workers and their qualification gives some answers to open questions.

In AB "Lietuvos geležinkeliai" the number of employees during the period 1994–2003 decreased from 18 323 to 12 614 (31,2 %). Regarding the reduction of the staff or according to the application of employees, 5 709 workers were fired during this period.

In common, traffic safety didn't get worse because in 2001 one breakdown fell on 896 workers and in 2003 it fell on 1802 workers. According to the results of the research is it estimated that the qualification of Lithuanian railway lines employees increases constantly and this influences the improvement of traffic safety. In 1994 only 6,9 % workers had university education and 14,8 % had technical education and in 2003 respectively 11,9 % and 26,4 %. Percentage dynamics of the Lithuanian railway lines employees having university and technical degree is presented in Fig 7.

The qualification of workers is not the main criterion of technical progress. The qualification or practical experience improvement is more important than percentage qualification evaluation [14].

Fig 8 shows the improvement and progressive dynamics of AB "Lietuvos geležinkeliai" specialists' qualification.

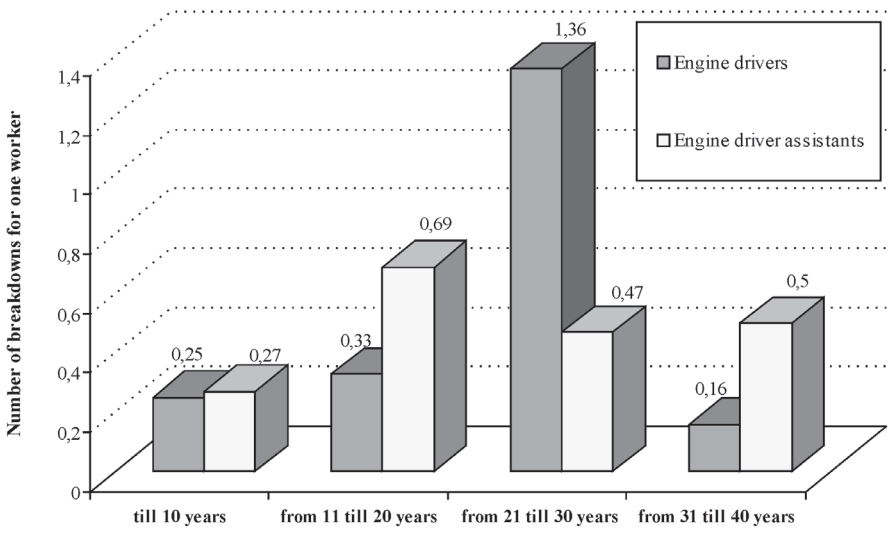

Fig 6. Distribution of breakdowns according to work experience during 2003

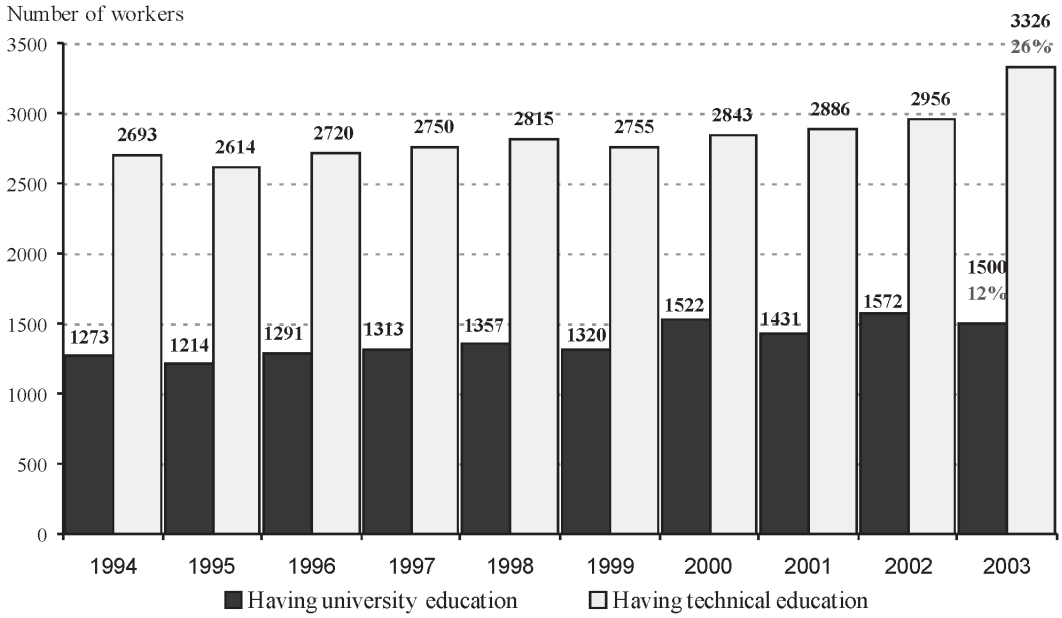

Fig 7. Dynamics of workers having university and technical degree during 1994–2003

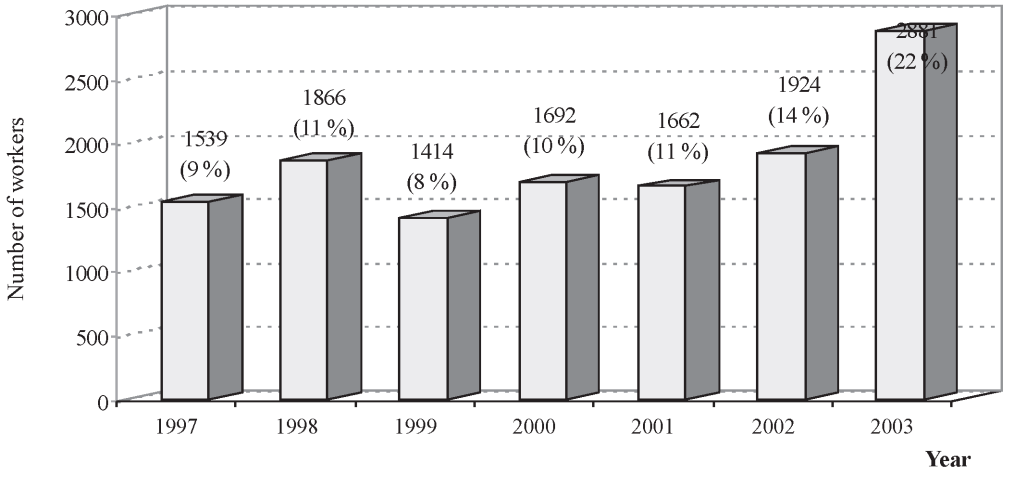

Fig 8. Dynamics of workers who improved qualification from 1997 to 2003

4. Conclusions

1. The number of breakdowns decreases every year; since 1998 to 2003 breakdowns decreased from 142 to 106 per year. However 1 accident and over 100 breakdowns happen every year. Most of the breakdowns (to 60 %) are caused by ageing of rolling stock park and infrastructure technical condition (21 %).

2. Human factor influence on traffic safety is mostly represented by engine drivers and their assistants. Evaluating them according to danger, assistants with work experience from 11 to 20 years are excluded. The most dangerous engine drivers group is workers with work experience from 21 to 30 years.

3. Decrement of workers is not the main traffic safety problem because the number of breakdowns falling on the number of workers increases continuously and in 2003 it reached 1802, meanwhile three years ago, 896 workers fell on one breakdown. Increased educational background of workers influences the improvement of traffic safety. The amount of workers having high or higher education has increased from 21,6 % in 1994 to 38 % in 2003.

4. During the last 6 years the number of break-

downs falling on 1 million tons of freights has decreased from 0,74 to 0,32. Whereas freights during the same period have increased from 30 912 thousand tons to 43 447 thousand tons.

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