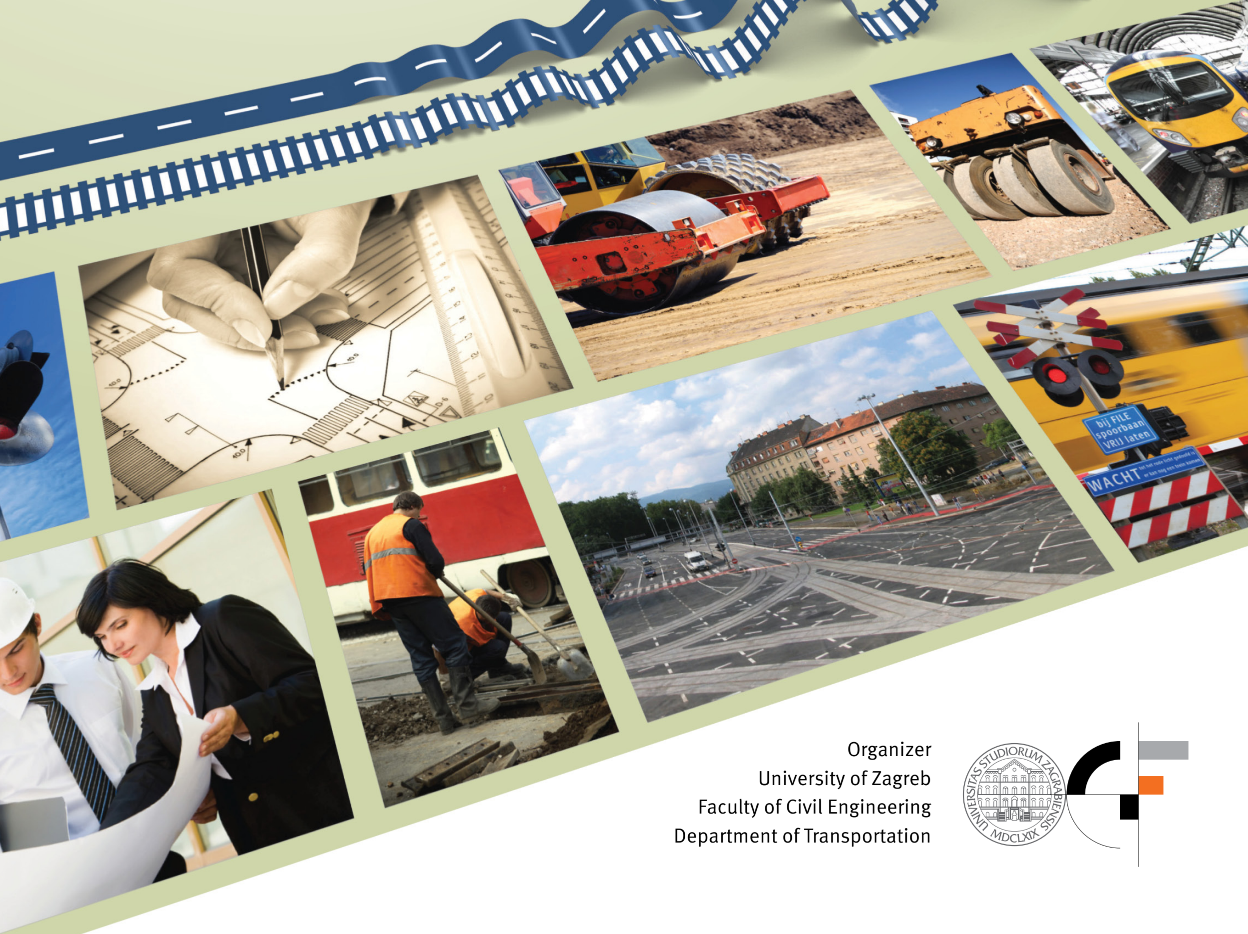
CETRA 2012

2nd International Conference on Road and Rail Infrastructure

7–9 May 2012, Dubrovnik, Croatia

Road and Rail Infrastructure II

Stjepan Lakušić – EDITOR



Organizer
University of Zagreb
Faculty of Civil Engineering
Department of Transportation

CETRA^{2012}
2nd International Conference on Road and Rail Infrastructure
7–9 May 2012, Dubrovnik, Croatia

TITLE
Road and Rail Infrastructure II, Proceedings of the Conference CETRA 2012

EDITED BY
Stjepan Lakušić

ISBN
978-953-6272-50-1

PUBLISHED BY
Department of Transportation
Faculty of Civil Engineering
University of Zagreb
Kačićeva 26, 10000 Zagreb, Croatia

DESIGN, LAYOUT & COVER PAGE
minimum d.o.o.
Katarina Zlatec · Matej Korlaet

COPIES
600

A CIP catalogue record for this e–book is available from the National and University Library in Zagreb under 805372

Proceedings of the
2nd International Conference on Road and Rail Infrastructures – CETRA 2012
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ACCIDENTS AT THE LEVEL CROSSINGS IN LITHUANIAN RAILWAYS

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Abstract

It was discovered that in Lithuania the traffic safety indicators of railway level crossings rank among the worst in Europe, and Lithuania's indicator of the risk for the users of level crossings is twice higher than in most European countries. 178 events have occurred in the Lithuanian railway level crossings during the last ten years. 72 people were killed and 57 people were seriously injured in these accidents. This article analyzes disadvantages of the largest projects that are related to traffic safety improvements at level crossings. It also analyzes the traffic safety situation in the Lithuanian railway level crossings and considers instruments which increase the traffic safety and efficiency. This article presents the study that has examined the condition of 15 level crossings, and introduces the results and conclusions.

Keywords: accident, level crossings, public education, traffic safety.

1 Introduction

Undoubtedly the most effective way to ensure the safety at the intersections is to close the level crossings. However, level crossings do exist, and closing them is not an easy task. First of all, their number is large, and the costs of closing them are very high considering that two–level intersections should be constructed in their place. Therefore, the issue remains permanently relevant. Because of fast–growing road traffic intensity in Lithuania and the objective to increase the speed of trains it becomes ever more difficult to intersect two traffic infrastructures. Therefore a number of models have been developed to assess the safety at level crossings, which calculates the expected annual number of accidents at a crossing on the basis of the number of crossing variables (Gitelman et al. 2006). However, in the countries where a speedy progress occurs, it is because there is a national and funded programme backed by political will to effect change (Australia, USA, Spain, Portugal) (Nelson 2009).
After the country joined the EU, the Lithuanian Railways have carried out some large–scale projects in the railway infrastructure modernization and improvement of the technical conditions. But the problems of level crossings are not being considered in principle, and therefore traffic safety conditions at the level crossings remain largely unchanged. The aims of this article are as follows: to analyze the statistics of traffic accidents and trends in the Lithuanian railway level crossings; to examine what has been carried out in Lithuanian railways to improve traffic safety; to discuss several important projects which dealt with the issue of traffic safety at level crossings and their main problems. Furthermore, the article presents the results of a study, which together with the overview of literature and problems allowed formulating conclusions and recommendations.

2 The traffic safety situation in the Lithuanian railway level crossings

At present JSC 'Lithuanian Railways' owns 523 railway level crossings of which 384 ones are controllable, and 139 are not controllable. 48 out of 523 level crossings are onlooked and 475 not onlooked. The number of casualties at level crossings makes up 20% of total rail accident casualties. (Gailienė et al. 2011). A comparison of the distances (in kilometers) between railway level crossings with the other 24 EU countries and Norway showed that in Lithuania there is a level crossing in every 4.17 kilometer of the railway track. The highest density of railway level crossings is in Norway – every 1.02 km, and lowest in Latvia – every 7.38 km. However, although the density of level crossings seems to be not a big problem in the Lithuanian railways, the level of traffic safety at level crossings in Lithuania ranks among the poorest among the countries concerned.

Figure 1 shows the change in the amounts of accidents, fatally injured and wounded people in 2004–2010, and Figure 2 shows how Lithuania looks in the context of other countries according to these indicators. Considering Figures 2 and 3, it may be concluded that although the numbers in absolute values are not high, but comparing the situation in Lithuania and in other countries it is obvious that there is a need to investigate and determine what measures would improve the traffic safety, and effective measures and their correct use are in order. In Lithuania, unlike in the UK for example, all traffic accidents occur due to road irregularities. The UK declares that 63% of the accidents are the results of driving mistakes, 21% of non–compliance with road traffic regulations, 16% of car breakdowns, weather conditions, mistakes of the locomotive driver or duty

operators of level crossings, signaling malfunctions of level crossings (M. Knutton, 2004). However, Evans observes that railway operators tend to have a poor view of road users behavior at level crossings, and this is backed up by some well–known video footage of very dangerous behavior of the road users. Nevertheless, it is not clear whether road user behavior is worse on level crossings than on the roads generally (Evans, 2011).

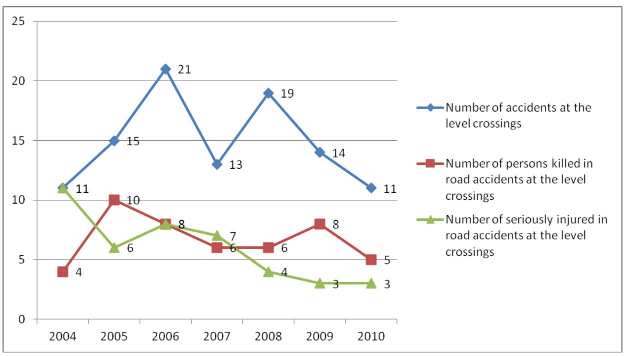

Figure 1 Safety indicators in level crossings of Lithuania in 2004–2010

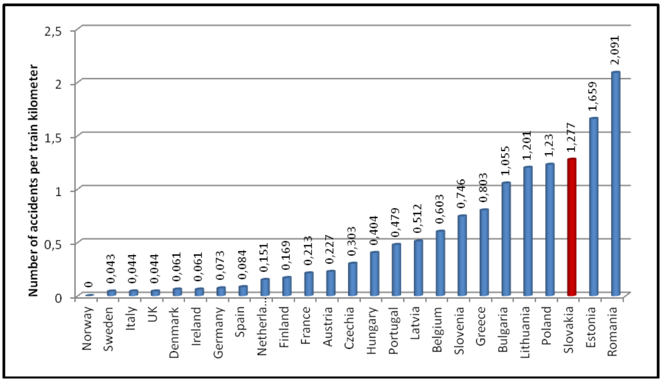

Figure 2 Number of accidents in relation to annual distance of the trains (in millions of km)

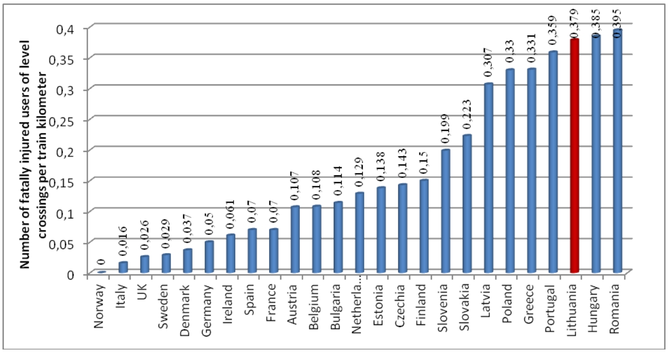

Figure 3 Number of fatally injured users of level crossings in relation to annual distance of the trains (in millions of km)

3 The measures improving traffic safety at level crossings and their implementation

The issue of traffic safety in level crossings is discussed and analyzed very often. It is examined on several levels: social, technical, economical, etc. Level crossing safety professionals argue that safety is improved by actions characterized as the three E's: engineering, education and enforcement. The strong effects of engineering solutions such as installing active warning devises and improving the visibility of trains are evident and substantiated in literature. Quantifying and evaluating enforcement activities, such as placing police offers at crossings to issue citations, or installing camera enforcement, is more difficult and has engendered a much smaller pool of literature (Savage 2006). However, engineering solutions alone will not remove the risk arising at level crossings, therefore an equal emphasis on education of users and the taking of punitive action against those who abuse level crossings is necessary (Nelson, 2009). Educational activities have a measurable effect on modifying driver behavior and improving safety (Savage 2006; Koppel 2009; Mok and Savage 2005). A good example is Operation Lifesaver – international organization continuing a public education program first established in 1972 (State Idaho, USA). This operation spread across the USA during the late 1970's and early 1980's when the level of risk was very high. Ian Savage estimates that the initial implementation of Operation Lifesaver prevented 1,455 annual incidents and 164

annual fatalities. Operation Lifesaver is primarily a volunteer organization and operates on a shoestring budget (Mok and Savage 2005). Today the organization has branches in Canada, Mexico, UK, Argentina. The first OL subsidiary in Europe called Operation Lifesaver Estonia (OLE) was founded in 2004 by Estonian railways and two private persons. In 2007 Operation Lifesaver Europe was founded (Koppel 2009). And currently the United States have a decreasing number of accidents at level crossings (2009 in comparison to 2008 – 14.2%) due to education, implementation of new road traffic rules and dealing with the issues of closing the level crossings (A.Cotey, 2009).
Otherwise, the measures applicable to improving traffic safety at level crossings can be divided to: the essential technical (closing of level crossings and the construction of two–level intersections considering the changes in traffic conditions), maintenance technical (affording visibility, installation of cameras, road markings), socio–educational (drivers' education, increasing the fines, public education). The essential technical tools will be further reviewed in the next section. Maintenance measures are improving the visibility (in Lithuania about half of all level crossings do not comply to the visibility requirements), installation of video cameras, modernization of turnstiles, installation of various measures to draw the driver's attention (installation of more and brighter road signs, speed reduction belts). In Lithuania these issues are poorly dealt with, although different studies easily demonstrate the importance of these measures. Social–educational measures are education of people, wider education, courses, explanations, enforcing and increasing administrative penalties. These measures are particularly needed in Lithuania and not only at level crossings. In Lithuania an attitude that crossing the railway line is possible where it is needed and at any given moment for a particular person is widespread. People still do not understand and are very surprised to learn that walking by rail or crossing it is forbidden for outsiders, they are punished, but do not consider that an offence. Public education in Lithuania has been launched but still remains limited and without any substantial results.

4 Improving traffic safety in Lithuanian railways

'The safety of railway transport and environmental protection' is one of the main areas of the European Union structural assistance in the transport, communications and developing of informational society in 2014–2020. One of this priority's objectives is the implementation of railway transport traffic safety measures by closing single–level railway crossings, fencing the railway network with security fences and so on. At the moment it is difficult to say how this will be carried out. Presently the largest train speed in Lithuanian railway lines is 120 km/h. The existing norms allow the level crossings to be operated where the speed limit is up to 160 km/h. As mentioned, an ongoing project is being carried out on the railway line Vilnius–Kaunas in order to upgrade the speed to 160 km/h. This project is implemented in four phases: designing, modernization of the railway, construction of the second railway line, modernization of the signaling systems. However, the implementation of this project inevitably raises the question of liquidation of level crossings. Whereas at the time the solution of this issue is not possible economically and in point of time, the decision has been made to examine intersections between transport nodes in separate local projects, without connecting them to the current project. Elimination of level crossings has to be solved comprehensively, because this concerns not only the railway infrastructure, but also the municipality's master plans and Road Administration's development plans. Therefore, the projects require a totally different coordination, bringing together several institutions, and a new funding system. Therefore, in accordance with the normative requirements it has been resolved after the modernization of the Vilnius–Kaunas railway line for the speed limit of 160 km/h to maintain the operational speed at railway level crossings limited to 120 km/h until the decision on the issues of installation of two–level intersections will be made. However, the question is, when this will be done.

The largest project implemented by JSC 'Lithuanian Railways' was 'Assuring traffic safety by reconstructing level crossings' (2008). The original plan was to reconstruct 50 level crossings in different territories of Lithuania, however only 36 out of them have been reconstructed because of lack of funds. In the reconstructed level crossings car speed has increased from 10/30 km/h to 50/90 km/h (in town/in outskirts). Following the Requirements for maintenance of level crossings 10 m of road in both sides of the level crossing has been reconstructed as well as the flooring and upper railroad construction of the level crossing. During the project it has been observed that typical technical requirements have been prepared for all the crossings. These requirements include replacement of the upper rail road construction with new one in the level crossing and 25 m in the approach to the crossing. Replacement of the flooring, asphalt works of the road in 10 meters distance to both sides of the crossing, water outlet from the flooring, installation of abutments, renewal or installation of new traffic signs were planned as well. While implementing the project it has not been considered that in some of the level crossings longitudinal inclination of the road does not meet the requirements. This causes poor visibility and driving conditions. In some level crossings intersection angle of railway and road does not meet the requirements of installation of the level crossings, however this issue has not been considered during the reconstruction. This problem has not been solved because of long bureaucracy procedures concerning earth, road rearrangement and similar issues. Reconstruction of intersection angle has not been performed because of lack of funds and time as well. Traffic intensity has not been considered when replacing asphalt. Typical asphalt layer construction has been designed. Taking this project as an example it can be concluded that it is necessary to analyze each level crossing thoroughly evaluating more criterions to estimate the extent of reconstruction and plan for the budget and time necessary for reconstruction before preparing technical requirements (Gailiene et al, 2011).

5 Analysis of traffic safety of selected road sections before and after the railway level crossing

The objective of the analysis is to carry out the inspection of selected road sections before (after) the railway level crossings, to evaluate how the elements of the road correspond to the legislations, to determine the existing shortcomings. The task is to analyze the information about road section (maps, drawings, etc.); traffic in the road section (car traffic volumes, traffic composition, operating speed, etc.); railway level crossing (category, permissible train speed, train traffic volumes, signaling systems of the level crossings, etc.); weaknesses at the road section (vertical and horizontal road markings, road surface, visibility, etc.); weaknesses at the railway section (floorings of the level crossings, signaling systems, drainage gutters, etc.); other weaknesses.
15 level crossings that intersect with state roads were selected for the analysis. The analysis of the level crossings was carried out by a targeted survey. It started with analysis of drawings, photographs, descriptions of traffic accidents and other available materials. After the inspections, it was discovered that there are 85 irregularities at the inspected level crossings. Figure 4 shows the percentage distribution of the detected irregularities at road sections.

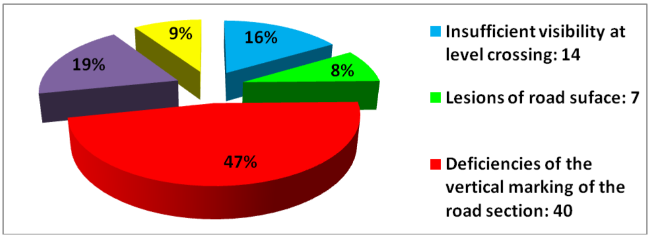

Figure 4 Percentage distribution of the detected irregularities at road sections

It is obvious that almost half of the irregularities (47%) are deficiencies of the vertical marking of the road section. These deficiencies have a significant impact on the organization of safe traffic and they are usually quickly and easily removed.
19% are the deficiencies of level crossing infrastructure. These problems also have a significant impact on the organization of safe traffic but solving them is more complicated than solving marking problems. Some level crossings need minor repairs of floorings and drainage gutters, and others need greater repairs of these elements. 16% consists of visibility problems at level crossings. After the inspection, it was found that only one level crossing fulfilled the conditions of visibility requirements. Provided that Lithuania has a lot of undisciplined drivers who constantly break traffic rules, it is proposed to install speed humps before level crossings as an additional tool to improve road safety.
Analysis showed that in the majority of level crossings road and railway intersect in less than a 90° angle, in part of level crossings the oblique angle of intersections does not satisfy the requirements (minimal oblique angle of road and railway intersection is 60°).
Research results, as expected, have shown that the categories of level crossings do not match actual traffic conditions. This happens because the automobile and train traffic volumes are increasing. The categories of five level crossings should be changed to higher because transport (trains and automobiles) traffic volumes in those crossings are higher than permitted in relevant categories. Category IV should be changed to category III at three level crossings. Such change of level crossing categories does not mean much, because there is no need to improve infrastructure of the level crossings.
One more level crossing should have the category changed from IV to I, and the other – from III to I. As the level crossing of category I should be watched, such level crossing category change requires substantial changes in the infrastructure of the level crossing. Installation of watched level crossing requires substantial investments not only because of changes in the infrastructure, but also because of creating the workplace for the crossing duty operator.

6 Conclusions

After the analysis, it has been discovered that the traffic safety conditions at level crossings of Lithuanian railway lines are bad and worse than in most countries of the European Union. This is due to the lack of attention paid to engineering, enforcement and education measures. However, the large–scale reconstruction and modernization projects concerning the issues of improving traffic safety at level crossings are dealt with superficially or the solutions are postponed.
The inspections on traffic safety of road sections before (after) railway level crossing were carried out. During these inspections 85 irregularities were identified in road sections. Deficiencies were mainly found in the vertical marking of road section, and they accounted for 47% of the irregularities. Weaknesses were also identified in the installations of level crossing infrastructure, pavement, visibility and other. It was settled that categories of five level crossings should be higher than they are currently accredited.

In order to ensure traffic safety at level crossings, where the lack of visibility was found out, humps can be installed before railway level crossings to reduce the speed. The installation of speed humps would reduce the number of drivers who do not stop before a railway crossing. In order to identify the effectiveness of engineering measures, investigations on the efficiency of humps (to reduce the speed) are proposed.

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