Road Traffic Safety in Latvia

J Smirnovs¹ and A Lāma²

¹ Department of Roads and Bridges, Transportation Engineering Institute, Riga Technical University, 6A Kipsalas Street, LV-1048 Riga, Latvia
² Road Traffic Safety Directorate, LV-1079 Riga, Latvia

juris.smirnovs@rtu.lv

Abstract. The article discusses development trends in road traffic safety indicators in Latvia. Changes in society and vehicle fleet after the regain of independence created new situation on the roads. More dynamic vehicle fleet allowed achieving higher average speed of the traffic flow. Reduction in the service level of public transport resulted in much higher use of cars which in turn led to increased traffic flow density. Currently the use of cars in Latvia and in particular in the rural areas has become an integral part of everyday life. It is obvious, that road traffic safety improvement is a complex and complicated task. Despite some achievements during past years, general road traffic safety situation in comparison to other EU countries has still relatively big improvement potential. The article is thus aimed at showing the influence of automobilization increase on road traffic safety level and discussing the reasons for improving road traffic safety level.

1. Introduction

Road traffic is one of the most important traffic modes today. EU statistics [1] show, that in 2015 within EU, 28 passenger cars accounted for 83.1% of inland passenger transport with motor coaches, buses and trolleybuses (9.2%) (measured by the number of inland passenger kilometres travelled by each mode). Situation with freight transport is similar. In 2016 road transport had the largest share of EU freight transport performance - 76.4% on the total inland freight transport (based on tonne-kilometres performed) [2]. The evolved situation shows that road transport will have an important impact on the sustainable development of the society in the future as well. Another evidence is the fact that the UN Resolution “Transforming our world: the 2030 Agenda for Sustainable Development” adopted by the General Assembly on 25 September 2015 [3] set special goals dedicated to road transport and especially to road traffic safety. Namely:

- Goal 3. Ensure healthy lives and promote well-being for all at all ages. 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents.
- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable. 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

Road traffic safety nowadays has the top priority and also topic within sustainable transport system. Road traffic safety engineering has to find answers to serious challenges. First of them is the
problem of economic loss caused by road traffic accidents. It has to be emphasized, that the total costs of accidents among EU countries vary between 0.4% and 4.1% of the gross domestic product (GDP) [4]. The next challenge is connected to the aging of the population. Elderly people are the world’s fastest growing age group and share of people aged 60 or above is expected to reach 21% of the world population by 2050 [5].

Road traffic safety issue is topical in Latvia. Road traffic safety in Latvia is co-ordinated and supervised by the Road Traffic Safety Council. The loss to the national economy in 2016 was 262 million Euros due to road traffic accidents [6]. Until the regain of independence in the 1990s, no international comparison of road traffic data was carried out in Latvia, as many types of data in the former Soviet Union were considered confidential. When some information on the existing situation in Latvia was for the first time presented during international conference in Berlin in 1992 [7], the experts in debates expressed their doubts concerning the accuracy of the data. Unfortunately the data was correct and corresponded to the reality [8].

The aim of this paper is to present development in road traffic safety improvement in Latvia, where the usage of public transport compared to the situation 30 years ago has decreased several times, but car usage within the past ten years has increased dramatically.

2. Used data and methods
The analysis used data on vehicle numbers and road traffic accidents since 1968 which in the past was collected by the former militia and at present by the Road Traffic Safety Directorate [9]. Data on mileage was acquired also from the Road Traffic Safety Directorate and data on inhabitants was acquired from the Central Bureau of Statistics [10].

The paper does not deal with traffic safety level in urban areas and outside urban areas separately, but provides an overview of the general situation in the country.

2.1. Exposure data
Road traffic safety studies use the following types of data as exposure data: number of vehicles, number of inhabitants, information about road network and traffic volume.

2.1.1. Automobilization and vehicle fleet.
The first information on the number of vehicles comes already from 1923, when 422 vehicles were registered in Latvia. However, the number at that time was low and automobilization did not reach even 1 vehicle per 1,000 inhabitants. An overview of the development of automobilization is presented in Figure 1.

![Development of automobilization in Latvia](image)

**Figure 1.** Development of automobilization in Latvia.

As we may see, the period before the regain of independence was considered “Childhood” with automobilization level under 100 cars/1,000 inhabitants and the period from 1990 to 2005 was
a period of fast development. Since the beginning of 2005 it is possible to believe that Latvia has reached a certain saturation level of automobilization.

In respect to vehicle pool we may note that during the years of independence its structure has changed with considerable increase in the proportion of cars. The proportion of vehicles produced in the former Soviet Union has decreased dramatically. Congestions, in particular in the centres of the biggest cities, e.g. Riga, have been recorded since 1997 [8].

2.1.2. Road network
Total length of Latvia road and street network is 70,244 km, out of them 15,158 km are with bitumen surface, 53,349 km with crushed stone and gravel surface and 1,737 km of forest roads have no adjusted surface [11]. Unfortunately the quality of roads is not the best one. It is mentioned, that “Ratings for Latvia’s transport infrastructure are close to the EU average, except for its roads, which are rated poorly” [12]. It has to be emphasized, that in accordance with the EU information, Latvia does not have motorways [13]. Average state road network density is 0.311 km per km², but total road network density is 1.131 km per km² [14].

2.1.3. Traffic intensity and mileage
Traffic intensity on Latvian roads continues to increase and in 2017 the average annual traffic density in Latvia reached 5,985 veh./24h, which is only a little above the historical maximum recorded in 2007 – 5,830 veh./24 h. [15]. In 2017 the highest density in particular was recorded on the road section Rīga – Žurkava, where AADT reached 45,238 veh./24h. Though the automobilization level in Latvia has continuously been increasing, in general, the total vehicle mileage has not always been proportional to the changes in the automobilization level. In the beginning of 1990s, the level of car use sharply decreased due to the lack of fuel. However, the level of automobilisation was quickly increasing (see Figure 2).

2.1.4. Inhabitants
Number of inhabitants in Latvia continues to decrease. Over the past seven years (since the beginning of 2010), the population has decreased by 186 thousand and at the beginning of 2018 it was 1 million 934 thousand (see Figure 3). The population growth rate in 2017 was 1.04%, compared to 2.16% in 2010. In 2018 population density in Latvia was 30 persons per 1 km² (in 1990–1992 – 41 persons) [16]. Similarly to many European Union countries, the population of Latvia is aging. At the beginning of 2017, 22.2% were 65 years of age and older [17].
2.2. Accident rate
One of the oldest road traffic safety indicators widely used worldwide is accident rate [18]. In the current research, accident rate is calculated annually for the whole road and street network in Latvia with the use of Formula (1). Total recorded number of accidents was used for calculations.

\[ AR = \frac{RTA \times 10^6}{365 \times TV} \]  

(1)

with AR – accident rate, accidents per million veh./km;
RTA – number of road traffic accidents;
TV – annual road traffic mileage, veh./km.

3. Analysis of changes in the traffic safety level
Analysis of traffic safety level uses both relative and absolute indicators such as the number of road accidents, the number of fatalities and injuries, the amount of loss to national economy. One of the widely used indicators of traffic safety level is the number of fatalities in accidents. In Latvia, the highest number of fatalities was recorded in 1991 (see Figure 4). This mentioned indicator is frequently used when setting targets for road traffic safety improvement programmes [19].

When analysing the absolute indicator of traffic safety level – the number of fatalities in road traffic accidents (Figure 4), the following periods may be distinguished.
• The first period from 1968 to 1969 when the number of fatalities in accidents sharply increased.
• The second period lasted from 1970 to 1983 and it was a period of certain stability.
• Since 1983 a trend of decrease in the number of fatalities could be noted, but it unfortunately lasted only until 1986.
• The period of 1986 – 1991 was the worst period in the history of Latvian traffic safety, when the number of fatalities doubled in five years. In this period the level of automobilization in Latvia reached 100 veh./1,000 inhabitants and the first breezes of independence could be felt. This created the situation when traffic safety in the whole country was regarded as of less importance.
• Since the regain of independence and preparation and implementation of traffic safety programmes [20–23] the situation improved and in 2017 the lowest number of fatalities was registered in the history of Latvia – 136.

The most dangerous period for traffic safety in Latvia was the period when the level of automobilization was 90 – 140 veh./1,000 inh. (see Figure 5).

![Figure 5. Automobilization and fatalities.](image)

The analysis of fatalities in 2017 by age group (see Figure 6) shows that in general the data coincides with the EU average indicators [24]. Small difference may be seen in the number of senior fatalities (above 64 years): whereas the average value in the EU is 26% [25], the share of senior fatalities in 2017 in Latvia was 21%.

![Figure 6. Accident fatality distribution by age group.](image)
Loss inflicted by road traffic accidents is one of indicators widely used for evaluation of the traffic safety level. Volume of loss is usually expressed as a percentage of the GDP. In 2016 this loss in Latvia amounted 1% of the GDP and in absolute figures it reached EUR 262.0 million (see Figure 7).

![Economical losses caused by road traffic accidents](image)

Figure 7. Economic loss caused by road traffic accidents.

When analysing the impact of GDP on traffic safety level in Latvia, it was found out that in the period from 1995 to 2017 a clear trend of the decrease in the fatality number was recorded (see Figure 8). This contradicts the data of Dadgar I and Norström T (2017) [26] study which analysed the data from 18 OECD countries and showed that the increase in the GDP leads to an immediate increase in traffic fatalities.

![Fatalities and GDP](image)

Figure 8. Fatalities and GDP.

The increase in the GDP leads to a trend in the increase of traffic accident numbers, and in the case of Latvia it shows certain trend of stabilisation of the number of traffic accidents (see Figure 9).

![Accidents and GDP](image)

Figure 9. Accidents and GDP.

Relative indicators are used to compare international data and one of the most frequently used is the number of fatalities per 100,000 inhabitants as well as the number of fatalities per million vehicle kilometres (see Figure 10). Though both these indicators improved greatly in the course of time and in 2017 reached 9.7 fatalities per million veh./km and 7.0 fatalities per 100,000 inhabitants Latvia is still
far above the average indicators of the EU which in 2015 was respectively 5.8 fatalities per 100,000 inhabitants. [25].

4. Discussion
Each of the indicators of traffic safety level mentioned in this article – accident rate, number of fatalities, accidents, economical loss caused by road traffic accidents, fatalities per million vehicle kilometres, fatalities per 100,000 inhabitants – are used both for characterising traffic safety level in each separate country and for carrying out international comparisons [27–28].

Improvement in traffic safety level is a complex process involving measures undertaken by different authorities. Researchers from different countries work for a number of years in order to
create an integral indicator of traffic safety level [29–30]. One of the most successful solutions created so far is the Road Safety Index DaCoTA [31], which is calculated on the basis of the traffic safety data of the European countries and Israel. According to such calculations, Latvia together with Romania, Poland and Italy is within the group of countries with the lowest traffic safety level. During the implementation of DaCoTA project, a methodology for forecasting potential trends in changes of traffic safety level was worked out on the basis of the number of fatalities in traffic accidents (see Figure 12). The data recorded in Latvia until now shows that we have succeeded to stay within the limits of foreseen interval of the data spread.

A number of reasons led to comparatively poor traffic safety level. Some of the reasons are connected to the quality of roads and the absence of motorways.

![DaCoTA forecast and real data](image)

**Figure 12.** DaCoTA forecast and real data.

As already mentioned above, Latvia does not have motorways. EU statistics show that fatality rates are high in the regions with low motorway density, such as most regions in Romania, Hungary and the Czech Republic, except their capital regions, all Bulgarian and Polish regions, the Baltic States, and many rural areas in France and Spain. This data suggests that the high proportion of road traffic using motorways is an important factor behind the low number of road fatalities in many regions [32]. Road junctions are considered as locations with high concentration of road traffic accidents. In 2015 the percentage of fatalities on road junctions in Latvia was 12% from the total number of accidents and the mayor part – 52% were pedestrians [33]. Several studies [34] show that the absence of roundabouts may be considered the cause for the decrease in the traffic safety level. At present there are more than 130 roundabouts in Latvia [35] and the situation in this aspect has been improving.

Next criterion influencing the traffic safety level is the vehicle fleet. In comparison with the end of the 20th century, the structure of the vehicle fleet has changed completely. At present the most common vehicle brand in Latvia is VW (17%), followed by AUDI (11%), Volvo (7%) and Opel (7%). Unfortunately the average age of registered vehicles on January 1, 2018 was 14.02 years which is higher than the average EU indicator – 11.0 years (2016) [36].

Nevertheless, the experience and the behaviour of drivers are the factors that influence traffic safety level most of all. On January 1, 2018 there were 854,988 driver licences issued in Latvia and 57.9% of licences were issued to men. The share of female drivers has been increasing rapidly in the past years which increased from 29.3% to 42.1% in the period from January 1, 2000, to January 1, 2018, [37]. Similarly to the general society, the drivers are aging, as well. This means that road and street design in the future will have to be based on the principles of forgiving road design, and road signs and markings will have to have better reflection capacity. Despite the higher statistical risk of injuries of senior drivers [38], the share of injured senior drivers is substantially lower than the share of young injured drivers [39].

At the beginning of the 21st century, the share of heavy road traffic accidents was significant – 15.2% of accidents in 2002 were caused by drunk driving. Thanks to different traffic safety
campaigns, police enforcement activities and changes in the lifestyle, the share of such accidents decreased to 4.2% in 2017. The share of heavy accidents caused by speeding on the other hand practically did not change: in 2002 it was 10.8% and after 15 years in 2017 it was almost the same – 9.4% [40]. At the beginning of August 2018, road traffic in Latvia was controlled by 84 stationary speed cameras and their number will reach 100 till the end of 2018. As it can be seen not only in Latvia but also in countries with excellent level of traffic safety, some traffic safety problems can be solved successfully while other problems persist. This phenomenon was already mentioned by Rune Elvik [41].

5. Conclusion
Despite the improvement in the traffic safety in recent years in Latvia, still much has to be done to reach the level of Western European countries. However, it has to be noted that since 1993 both absolute and relative traffic safety indicators have been continuously improving.

Latvian experience shows the following:
- At the beginning of 1990s, Latvia experienced the turning point in road traffic safety field which in Sweden and the Netherlands was experienced already in the 1970s [42].
- Under certain economic conditions, the increase of automobilization level has not resulted in the increase of vehicle mileage;
- Level of road traffic safety dramatically deteriorated during the change of political regime (1987 – 1991);
- Implementation of road traffic safety programmes has considerably contributed to the improvement of traffic safety in Latvia.

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