



ASSESSMENT OF THE EFFECTIVENESS OF THE ROAD TRAFFIC SAFETY PROGRAMME 2007–2013 IN LATVIA

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Abstract. Since Latvia joined the European Union, the nature of traffic has changed very rapidly. In 2008 motorisation level reached 412 cars per 1000 inhabitants. Traffic flow is now more dense, but the development of road network was not so quick. The Road Traffic Safety Programme is one of the most important national documents setting the main goals in road traffic safety work. The First *Road Traffic Safety Programme 2000–2006* in Latvia was adopted by the Cabinet of Ministers in 2000. The following article analyzes the results of the *Road Traffic Safety Programme 2007–2013* implementation within the time period of 2007–2012 and gives a detailed look at the most effective measures under the circumstances of Latvia. The Cost-Benefit Ratio of *Road Traffic Safety Programme 2007–2013* implementation was calculated for the time period under research and it is good, i.e., the numerical value is 6.35.

Keywords: road traffic safety, accidents, traffic safety improvement, *Road Traffic Safety Programme 2007–2013*, effectiveness.

1. Introduction

In Latvia the highest number of killed in road accidents was registered in 1991. This reason and the fast development of relationship between Latvia and other European countries activated the problem of ensuring the road traffic safety in Latvia on the European level. The first Road Traffic Safety Action Plan was created in 1994 as a part of Latvian Transport Development Programme (Naudzuns *et al.* 1996). The implemented measures of *Road Traffic Safety Action Plan* in 1998 allowed to decrease the number of killed by 1.47 times in comparison with the year 1991. Generally, the targets of the first *Road Traffic Safety Action Plan* were accomplished at the beginning of 1999. The rapid growth of vehicle fleet as well as the desire of Latvia to join the European Union (EU) created new targets for road traffic safety. The next safety action plan “*The 2000–2006 National Road Traffic Safety Programme*” was approved by the Cabinet of Ministers on January 25, 2000. Nowadays, Latvia is implementing the *Road Traffic Safety Programme 2007–2013*.

In recent years traffic on the streets and roads of Latvia in particular and of the EU in general has become much safer. Road traffic safety programmes play a major role in the improvement of the situation. When preparing such a document the precise development of programme structure is crucial as stated by Kallberg (1996) and Kryztek

(1996) in their research work. As the examples a number of programmes may be named, e.g., the EU common *Brussels 2.6.2003 COM(2003) 311 Final – European Road Safety Action Programme. Halving the Number of Road Accident Victims in the European Union by 2010: a Shared Responsibility* as well as, specific road traffic safety programmes, such as, *Austrian Road Safety Programme 2011–2020*. In each of the mentioned documents targets to be achieved, ways forward, as well as time period in which the programme is to be implemented are defined. Analysis of the determination of numerical values of targets to be achieved has been researched by Elvik (2001, 2003) and Wittenberg *et al.* (2013). For a better choice of different measures to be implemented with the scope of the programme, the European Union has prepared a handbook on *Road Safety and Environmental Benefit-Cost and Cost-Effectiveness Analysis for Use in Decision-Making* in 2005. As mentioned in *2010 Road Safety Target Outcome: 100 000 Fewer Deaths since 2001. 5th Road Safety PIN Report*, Latvia is one of the few countries that has achieved the targets set by the EU in traffic safety area until the year 2010. At present a new EU traffic safety programme “*Road Safety as a Right and Responsibility for All*” a *Blueprint for the EU’s 4th Road Safety Action Programme 2010–2020* of 2008 is under preparation and it will cover the time period until 2020. Road traffic safety as stated by Evans 2004 is not merely a technical

Table 1. Relative increase of number and mileage of vehicles permitted for traffic

Year/year	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
Changes of the number of vehicles in good technical condition in comparison with the previous year, %	8.5	8.7	13.6	12.2	-1.0	-5.1	-0.4	2.3
Changes of vehicle mileage in comparison with the previous year, %	9.6	7.1	18.4	16.6	-8.1	-14.1	-2.1	-2.0

problem and it may not be guaranteed only with engineering measures as described both by Elvik, Vaa (2004) in their *Handbook of Road Safety Measures* and in the final report of the project SUPREME (2007). Analysis of psychological aspects has also to be dealt with as stated by Shinar (2007), Dewar, Olson (2007), Elvik (2010). Evaluation of road safety improvement effectiveness in low- and middle- income countries is done by Hyder *et al.* (2013).

2. Evaluation of road traffic safety level

Summary of Vehicle Statistics in Latvia of 2013 shows that the number and mileage of vehicles in good technical condition dramatically increased until 2008 (Table 1). Since 2008 both the number of vehicles in good technical condition and their total mileage has decreased. Despite this fact the number of vehicles in good technical condition has increased by 1.33 times, and their total mileage – by 1.12 times since 2004.

In accordance with *Latvian State Roads Yearbook* of 2011, around 50% of paved roads, 39% of gravel roads and 56% of bridges were in poor and very poor technical condition. The road quality during the first four years of the *Road Traffic Safety Programme 2007–2013* has not improved, in fact, the quality of paved roads has even decreased (41% of paved roads were in poor and very poor condition in 2007).

Financial resources did not allow more active improvements in traffic safety. The total financing for state roads has decreased by 50% – from 194.43 EUR (136.1 million LVL) in 2007 to 97.14 EUR (68 million LVL) in 2011. The EU co-financing for road projects has decreased even more – by 57.2% from 106,71 EUR (74.7 million LVL) in 2007 to 45.71 EUR (32.0 million LVL) in 2010. The main attention is paid to the road maintenance at the present level. In 2010 the most important maintenance task – to ensure continuous traffic on state roads – was achieved.

In the scope of *Road Traffic Safety Programme 2007–2013* the following activities were implemented in the period of 2007–2012:

- evaluation of road traffic safety level;
- analysis of defined goals and tasks;
- evaluation of task preparation and implementation;
- evaluation of achievements, benefits and efficiency.

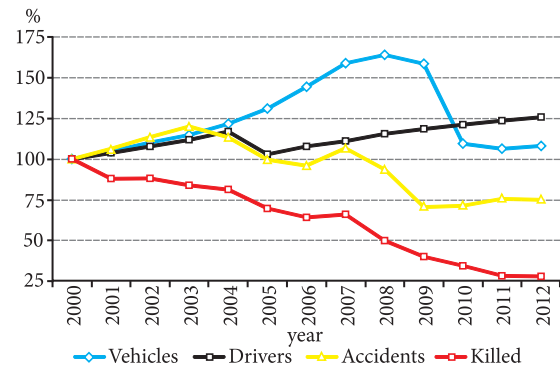


Fig. 1. Road traffic indices in Latvia (2001 year = 100%) in 2001–2012

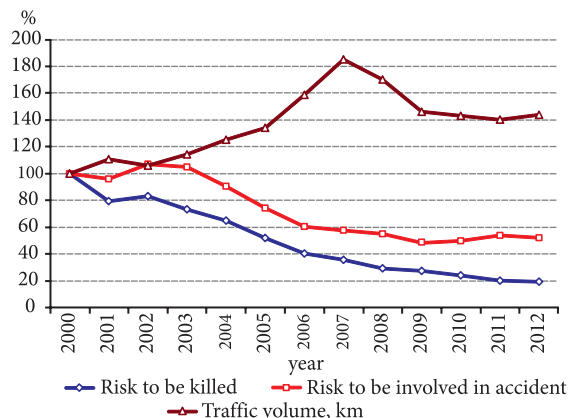


Fig. 2. Traffic volume, risk to be involved in accident and risk to be killed (2000 year = 100%) in 2000–2012

2.1. Changes in road traffic safety level

In the recent ten years the mileage of vehicles has increased by 1.3 times, the number of vehicles in good technical condition – by 1.6 times. Development of road and street infrastructure has fallen behind the increase of traffic volume and the road condition continues to deteriorate. Despite this fact, the improvement of traffic safety level may be observed in the last few years (Fig. 1) – the number of killed has decreased by 3.1 times and the number of road accidents with killed/injured has decreased by 1.4 times.

One of the most accurate indices of road traffic safety is the number of killed or the number of accidents with killed/injured related to vehicle mileage which provides

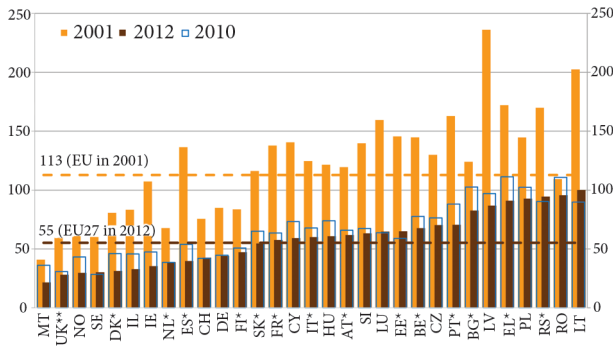


Fig. 3. Number of killed per 1 million inhabitants in the EU member states in 2001 and 2012 (Source: Back on Track to Reach the EU 2020 Road Safety Target? 7th Road Safety PIN Report, 2013)

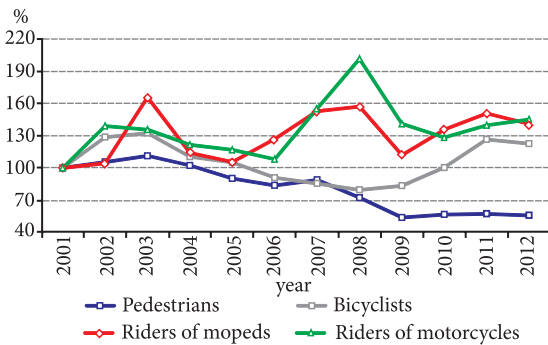


Fig. 4. Percentage changes of accidents in 2011–2012

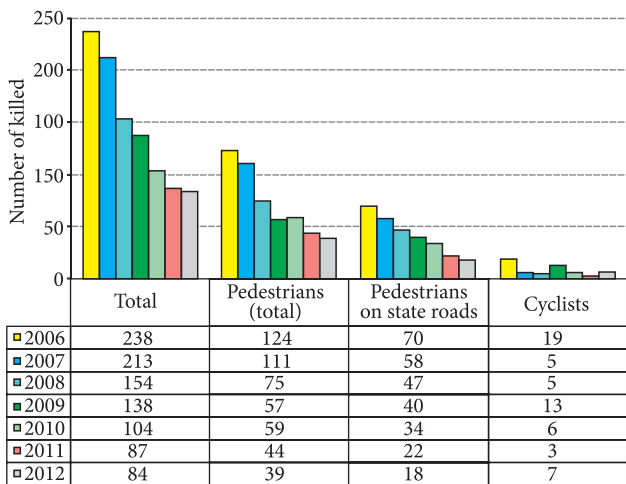


Fig. 5. Number of killed in darkness and twilight in 2006–2012

the characteristics of the risk to be killed or to be involved in road traffic accident.

The risk to be killed in road traffic accident has decreased twice from 0.034 in 2006 to 0.016 in 2012 and the risk to be involved in road traffic accident with injured has decreased by 13.8% – from 0.357 in 2009 to 0.308 in 2012 (Fig. 2).

Despite considerable achievements, Latvia is still one of the countries where the number of killed in accidents per 1 million inhabitants is one of the biggest – 87 in comparison with 55 which is the average value for the EU member states. Worse indices are only in Greece, Poland, Serbia, Romania and Lithuania (Fig. 3).

Latvia’s achievements in the recent years were highly evaluated by the EU. On June 22, 2009 in the 3rd Conference on Road Traffic Safety Quality Indices of the European Transport Safety Council (ETSC) in Brussels Latvia and Spain were awarded the Road Safety Award 2009 for continuous and successful strategy to reduce the number of killed in accidents.

2.2. Main road traffic safety problems in Latvia

177 persons were killed and 4179 injured in 3358 road traffic accidents in 2012. One of the greatest problems is the ensuring of safety of vulnerable road users (pedestrians, cyclists, riders and passengers of mopeds, motorcycles and quadric-cycles), especially in urban areas.

1733 accidents with killed/injured (51.6% from the total number of accidents) were registered in 2012 in which vulnerable road users were involved. 91 persons (51.4% from the total number) were killed and 1721 persons (41.2% from the total number) were injured in these accidents.

Fig. 4 shows the dynamics of road accidents with killed/injured over the last 10 years.

It should be noted that the number of motorcycles and mopeds in good technical condition increases (by 2.5 times and 2.4 times since 2006, respectively). However, the number of accidents with killed/injured where motorcycles are involved has increased by 34.2%, and the number of accidents where moped riders are involved – by 9.3% since 2006.

47.5% of all killed are registered in the dark hours of the day. It should be noted that the number of killed in the dark hours of the day since 2006 has decreased for 2.9 times, and the number of pedestrians and cyclists – by 3.3 times and 2.7 times, respectively (Fig. 5).

In total, the numbers of killed in the dark hours of the day in 2012 are the following:

- 38 pedestrians (62.3% from the total);
- 7 cyclists (38.9% from the total).

One of the main causes of accidents is the exceeding or inappropriate choice of driving speed. In 2012 because of the speed 23 persons (13.1% from the total number) were killed and 531 persons (12.7% from the total number) were injured.

One of the factors that negatively influences traffic safety is the exceeding of max speed limits defined in *Road Traffic Regulations*. Exceeding of speed limit on Latvian roads occurs very frequently. The statistics compiled by *SJSC Latvian State Roads* indicate that – the permitted speed limit of 90 km/h is exceeded in average by 55% of the total traffic volume (Fig. 6).

Approx 25% of drivers from the total traffic volume on state main roads have exceeded the speed limit by more than 10 km/h, i.e., they drove faster than 100 km/h.

Data of the State Police 2010–2012 shows that the exceeding or inappropriate choice of driving speed is still one of the main causes of road traffic accidents in 34.2% of all registered violations of *Road Traffic Regulations*.

In 2012 drivers under the influence of alcohol and drugs (except moped riders and cyclists) have caused 170 (5.1% from the total number) road traffic accidents with killed/injured. 23 persons (13.3% from the total number) were killed and 268 persons (6.4% from the total number) were injured in these accidents. Compared to 2006, the number of such accidents has decreased by 2.6 times, the number of killed in these accidents – 3.7 times and the number of injured – 2.4 times. The percentage of accidents with killed/injured caused by drivers under the influence of alcohol has been decreasing year by year (Fig. 6).

Severity of road traffic accidents with killed/injured may be characterised by the number of killed per 100 road traffic accidents with killed/injured. Despite the fact that since 2006 this value has decreased to 5.2 (killed per 100 accident) (2012) (Fig. 7), it still is bigger than in the Northern countries (3.5 killed per 100 accidents). The value describing the severity of road traffic accidents with killed/injured on state roads (14.8 killed per 100 accidents) is approximately four times bigger than in urban areas (3.7 killed per 100 accidents).

As the research shows (Lama 2011), the use of safety measures has increased in the last years. From 2006 to 2010 the following indices increased:

- the use of seat belts in front seats of cars – 77%–86%;
- the use of seat belts in rear seats of cars – 21%–40%;
- the use of helmets of riders and passengers of motorcycles – 93%–98%;
- the use of helmets of riders and passengers of mopeds – 67%–90%.

Unfortunately, the above mentioned achievements are not yet satisfactory, since they are beyond the objectives to achieve the level where over 98% of all occupants of cars use the seat belts, over 99% of all riders and passengers of the Power Two Wheelers (PTW) use helmets until 2010.

2.3. Evaluation of the implementation of Road Traffic Safety Programme 2007–2013

In accordance with the target (Section 2) of *Road Traffic Safety Programme 2007–2013* the number of killed in 2012 should not exceed 200 persons (Fig. 8). 177 persons were killed in 2012, i.e. 11.5% less than the set target for 2012.

2.3.1. Ensuring of safety of vulnerable road users

According to the quantitative indices of *Road Traffic Safety Programme 2007–2013* the number of vulnerable road users killed in 2012 should not exceed 98 persons (Fig. 9). 91 persons were killed in 2012, i.e. 7.1% less than the target set for 2012.

According to the quantitative indices of *Road Traffic Safety Programme 2007–2013* the number of pedestrians killed in 2012 should not exceed 80 persons (Fig. 10). 62 persons were killed in 2012, i.e. 22.5% less than the target set for 2012.

2.3.2. Increasing of safety level for children in road traffic

According to the quantitative indices of *Road Traffic Safety Programme 2007–2013* the number of children killed and

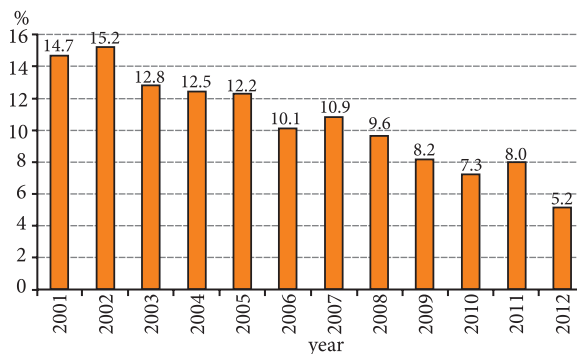


Fig. 6. Distribution of accidents caused by drivers under the influence of alcohol in 2001–2012

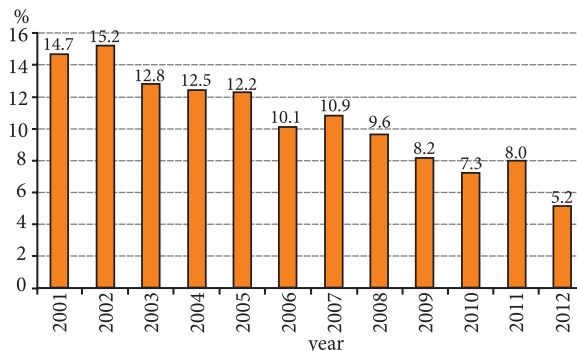


Fig. 7. Number of killed per 100 accidents in 2001–2012

injured in road traffic accidents in 2012 should not exceed 220 children (Fig. 11). In 2012, unfortunately, 450 children were killed and injured in accidents and this is almost twice higher than the target set for 2012.

2.3.3. Ensuring of safe driving speed of vehicles

According to the quantitative indices of *Road Traffic Safety Programme 2007–2013* the number of the killed because of violation of permitted speed limits in 2012 should not exceed 65 persons (Fig. 12). 23 persons were killed in such accidents in 2012, i.e. 64.6% less than the target set for 2010.

2.3.4. Elimination of driving under the influence of alcohol

According to the quantitative indices of *Road Traffic Safety Programme 2007–2013* the number of the killed in accidents caused by driving under the influence of alcohol in 2012 should not exceed 36 persons (Fig. 13). 25 persons were killed in such accidents in 2012, i.e. 30.6% less than the target set for 2012.

As the task to increase traffic monitoring and control level set in the *Road Traffic Safety Programme 2007–2013* is being implemented, the number of road traffic accidents caused by drivers under the influence of alcohol in the recent years has decreased by 4 times from 701 accidents in 2001 to 174 in 2012, and the number of the killed in such accidents has decreased by 4.4 times from 111 persons in 2001 to 25 persons in 2012.

This is achieved with the help of appropriate legislation, campaigns and intensive police enforcement. Despite wide advertisement campaigns and police enforcement the number of registered drivers under the influence of alcohol is still relatively high:

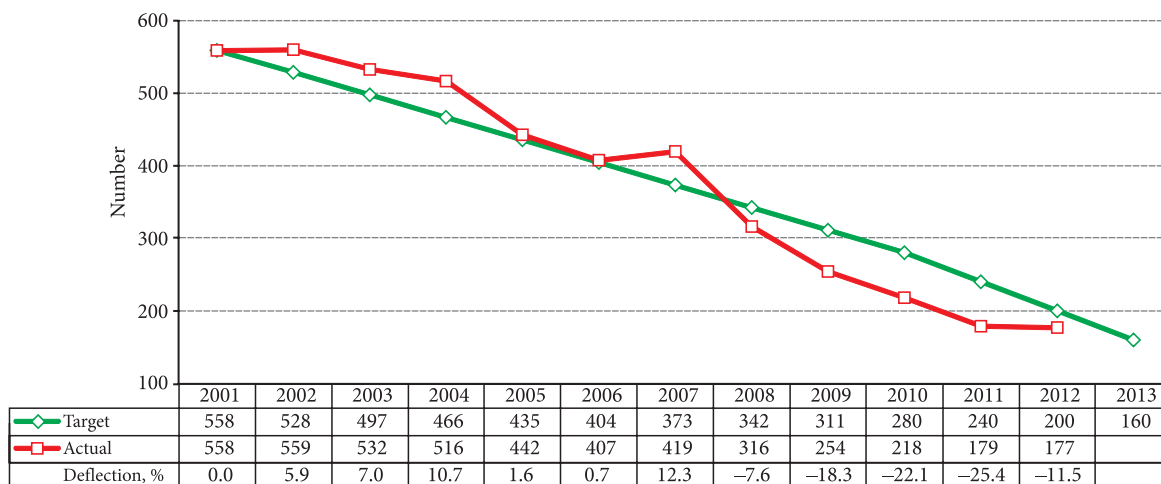


Fig. 8. Number of killed and the target in 2001–2012

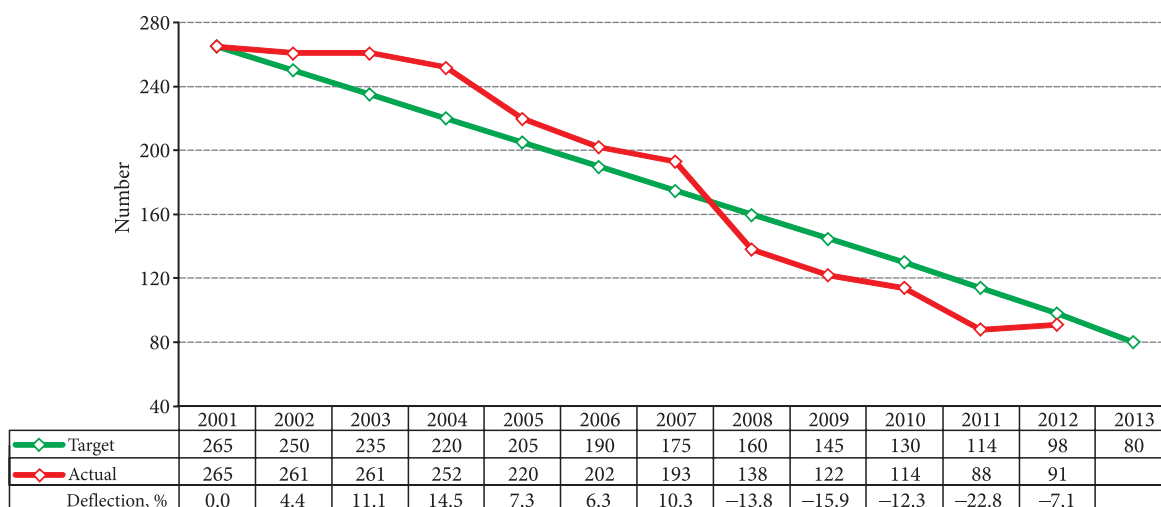


Fig. 9. Number of vulnerable road users killed and the target for 2001–2012

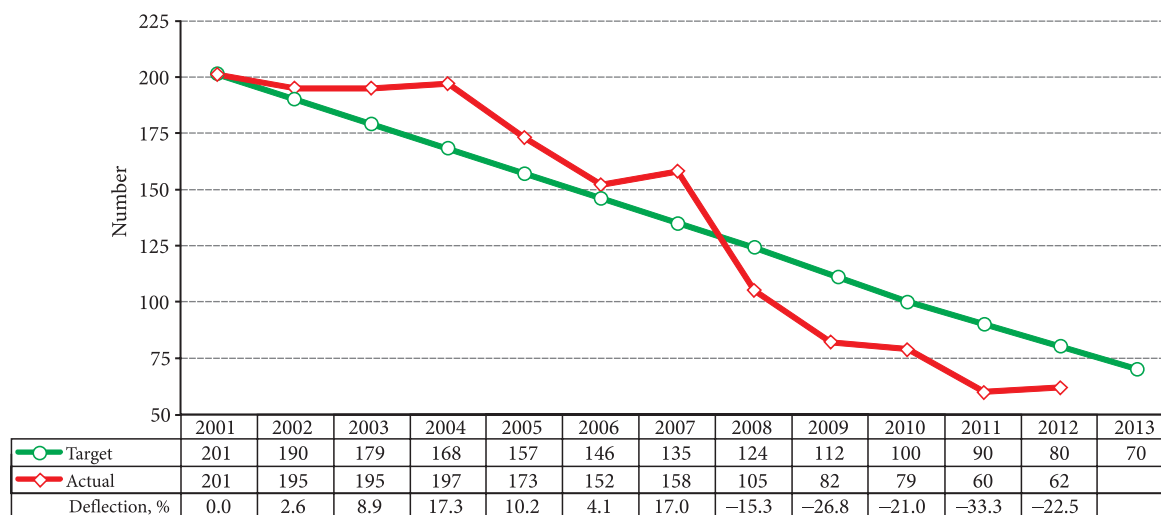


Fig. 10. Number of pedestrians killed and the target for 2001–2012

- every 13th accident involved drivers under the influence of alcohol (except moped riders and cyclists);
- every 10th person killed is registered in accidents involving drivers under the influence of alcohol (except moped riders and cyclists);

- every 12th person injured is registered in accidents involving drivers under the influence of alcohol (except moped riders and cyclists).

It shows that despite the achievements of the recent years the driving under the influence of alcohol is still a

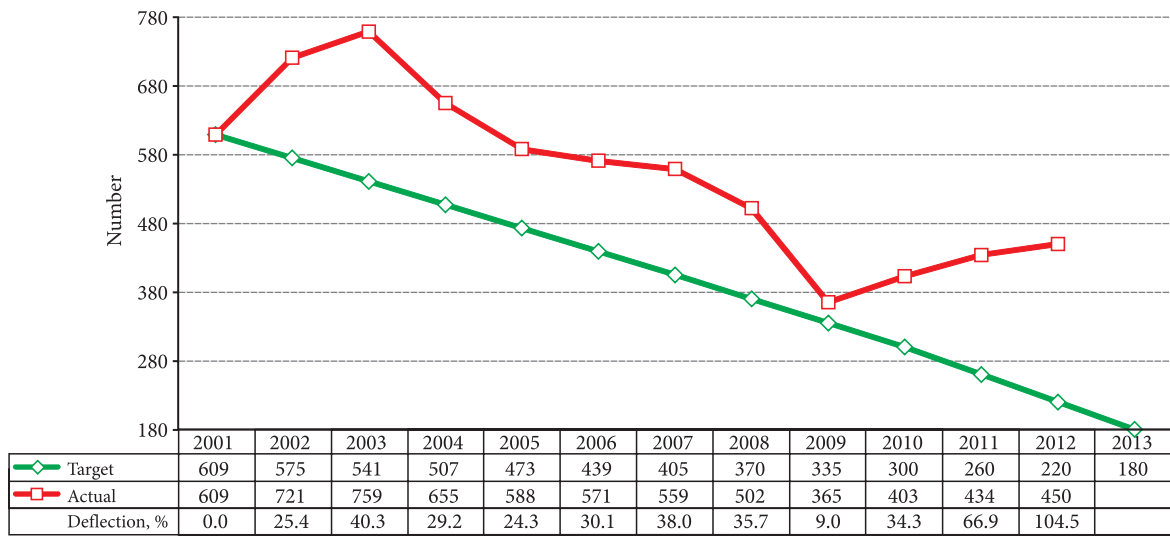


Fig. 11. Number of children killed and injured in road traffic accidents and the target for 2001–2012

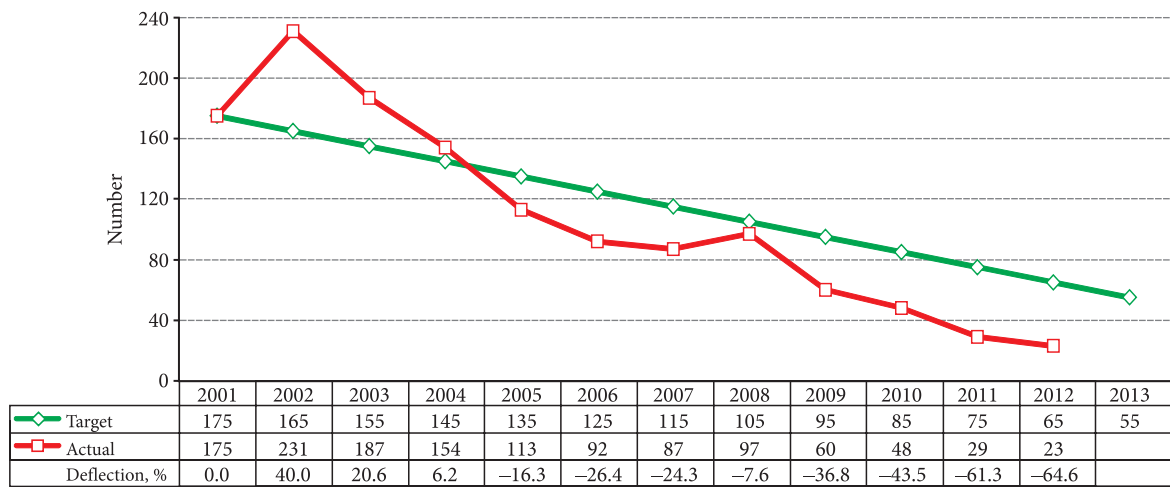


Fig. 12. Number of killed because of violation of permitted speed limits and the target for 2001–2012

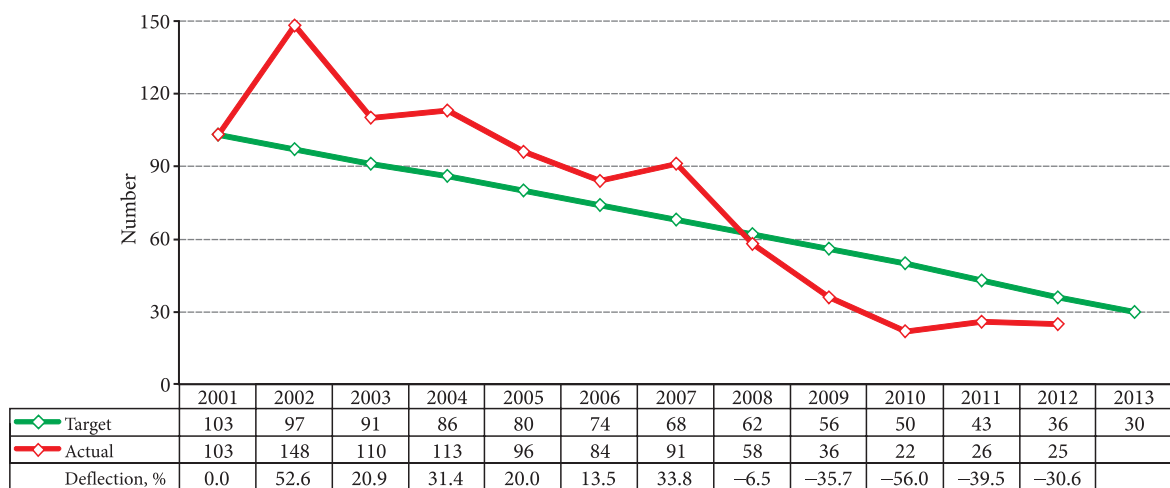


Fig. 13. Number of the killed in accidents caused by driving under the influence of alcohol and the target for 2001–2012

Table 2. Benefits of the implementation of the Road Traffic Safety Programme 2007–2013

Years	Killed				Injured				Accidents				Total benefits, million EUR
	Average of 2004–2006	Actual data	TZ _b , EUR	Benefits, EUR	Average of 2004–2006	Actual data	TZ _i , EUR	Benefits, EUR	Average of 2004–2006	Actual data	TZ _m , EUR	Benefits, EUR	
2007	455	419	408 124	14 692 446	5 807	6 088	7 259	–2 042 253	4 616	4 781	2 605	–429 019	12.22
2008	455	316	481 850	66 977 163	5 807	5 408	6 126	2 442 204	4 616	4 196	3 302	1 387 913	70.81
2009	455	254	439 317	88 302 730	5 807	3 930	4 320	8 107 087	4 616	3 160	3 466	5 047 078	101.46
2010	455	218	439 437	104 146 548	5 807	4 023	5 835	10 406 829	4 616	3 193	3 383	4 815 539	119.37
2011	455	179	501 730	138 477 617	5 807	4 224	6 066	9 599 985	4 616	3 386	3 404	4 187 451	152.27
2012	455	177	505 008	140 392 333	5 807	4 179	6 155	10 019 085	4 616	3 358	3 458	4 351 108	154.76
Total benefits in 2007–2012													610.88

topical problem, especially in weekends from Friday to Sunday.

3. Efficiency of Road Traffic Safety Programme 2007–2013

Cost-benefit analysis (CBA) evaluated the results of financing of implementation of safety measures of the Road Traffic Safety Programme 2007–2013. Cost-Benefit Ratio (CBR) was used for the estimation:

$$CBR = \frac{\text{Benefits}}{\text{Costs}}, \quad (1)$$

- if $CBR < 1$, the measure is ranked as poor;
- if CBR is from 1 to 3, the measure is ranked as acceptable;
- if $CBR > 3$, the measure is ranked as excellent.

3.1. Benefits of the Road Traffic Safety Programme 2007–2013

Benefits of implementation of the Road Traffic Safety Programme 2007–2013 were calculated by using the deviation of actual data of road safety indices from the pessimistic scenario. For the calculation of benefits, data of losses of the killed person, injured person and accident was used (Table 2):

$$TZ = TZ_b n_b + TZ_i n_i + TZ_m n_m, \quad (2)$$

where TZ_b , TZ_i , TZ_m – the average losses of killed person, injured person and losses of an accident, respectively, EUR; n_b , n_i , n_m – number of the killed, number of the injured and number of accidents, respectively.

Total benefits of implementing the Road Traffic Safety Programme 2007–2013 in 2007–2012 are 610.88 million EUR.

3.2. The implementation costs of the Road Traffic Safety Programme 2007–2013

Each year certain financing from the state budget is allocated to all the ministries involved in solving the road traffic safety problems in order to ensure the principles that

guarantee traffic safety. However, this financing is insufficient to achieve the defined target which is to reduce the number of killed twice. Therefore, to implement the tasks of Road Traffic Safety Programme 2007–2013 in 2007–2012 additional financing in the amount of 175.16 million EUR (in prices of 2006) was allocated for different measures.

Additional necessary financing for road traffic safety improvements was acquired from the state and municipal budgets, international funds and other financial sources.

In 2007–2012 approx 96.0 million EUR were allocated from different financial sources what made approx 55% from the planned additional financing. Despite the overall crisis and reduction of funding for different sectors, the financing for road traffic safety was not significantly reduced.

3.3. Effectiveness of the Road Traffic Safety Programme 2007–2013

For the evaluation of CBR, data estimated in the above mentioned paragraphs was used (Table 3).

Table 3. Effectiveness of implementation of the Road Traffic Safety Programme 2007–2013

Total benefits, million EUR	610.88
Total additional expenses for road traffic safety, million EUR	96.0
CBR = Cost – Benefit Ratio	6.35

As the $CBR > 3$, the effectiveness of the Road Traffic Safety Programme 2007–2013 is good. In addition to that, the road safety situation significantly improved after the introduction of penalty point system. The CBR of introducing the penalty point system is excellent, as well as the results of the campaigns combined with intensive enforcement against drinking and driving.

4. Conclusions and recommendations

1. Despite the fact that the level of motorisation has reached a certain level of saturation and the condition of the road network continues to deteriorate and does not meet safety

requirements in many locations, the level of road traffic safety has improved. In comparison with 2006, both the number of road traffic accidents and the numbers of the killed and injured have decreased.

2. Relative indices characterising road traffic safety are still one of the worst in the EU member states, despite the fact that the rate of traffic safety improvement in Latvia is one of the best in the EU.

3. Disregarding the fact that the severity of road traffic accidents has decreased, its value is still higher than that in the Nordic countries.

4. Already in 2009 it was possible not only to achieve the reduction of the number of the killed in accordance with the defined quantitative indices but also to achieve the target set by the EU to reduce the number of the killed twice. In 2012 the number of the killed continued to decrease.

5. Analysing the implementation of the *Road Traffic Safety Programme 2007–2013* it could be noted that a lot of measures have been implemented to achieve the set targets, however:

- as the main share of losses is caused by road traffic accidents with pedestrians in the conditions of limited visibility, intensive measures have to be continued to physically separate different groups of road users;
- control of road users has to be developed with special attention paid to the control of exceeding speed limits on roads, especially with a more intensive use of speed cameras;
- it is very important to continue the formation of public opinion towards safe driving in road traffic, however, it may not fully replace engineering measures in the road network or control of the road users;
- further development of facilities of the rescue services has to be continued that would allow to save more persons involved in road traffic accidents, e-Call system has to be introduced that would allow to save even more lives.

6. Cost-Benefit Ratio of the *Road Traffic Safety Programme 2007–2013* implementation is 6.35. In comparison with the average values of 2004–2006, the total benefits amount to 610.88 million EUR and the implementation of the *Road Traffic Safety Programme 2007–2013* in the first four years may be regarded as good, though the *Road Traffic Safety Programme 2007–2013* was not implemented in full scale:

- due to insufficient financing the improvement of traffic organisation schemes from road traffic safety point of view is insufficient;
- the best achievements may be observed in forming the consciousness of the road users and the control of the road users.

7. To achieve the defined target, road traffic safety has to be a governmental priority and active work has to be continued to achieve the set targets by using and adapting the best practices from other EU member states.

8. As one of the most effective measures under the circumstances of Latvia is penalty point system. The CBR of introducing the penalty point system is excellent.

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