SAFETY ASPECTS IN THE ROAD INFRASTRUCTURE MANAGEMENT

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Abstract: *It is well-known fact that road safety is significantly less developed than that of rail, water and air transport. The average individual risk of being a fatality in relation to the distance covered is thirty times higher in road transport that in the other modes. This is mainly because the different modes have a different approach to safety management and to the use of risk management methods and tools.*

This was the main reason why the UN Road Safety Collaboration has developed and adopted a Global Plan for the Decade of Action for Road Safety 2011-2020, which provides a general framework for activities that may take place in the context of the Decade. The categories or "pillars" of activities are: building road safety management capacity; improving the safety of road infrastructure and broader transport networks; further developing the safety of vehicles; enhancing the behaviour of road users; and improving post-crash response.

Road safety infrastructure management is the first and fundamental pillar of the Decade with the objective to ensure that safety risks can be systematically identified, assessed, removed and mitigated during planning, designing, construction and use of new, upgraded and renewed roads. In this view all countries should consider adopting the long-term Safe System approach within the road transport system which is built around the premise that death and injury are unacceptable and are avoidable. The implementation of ISO 39001 should be an important milestone towards the achievement of road safety targets.

Keywords: *Road safety, Safe System, ISO 39001:2012*

INTRODUCTION

Road safety is a collective responsibility that requires the involvement of government, civil society as well as businesses from both the public and private sector. It requires a well-planned strategy and an associated plan. However, despite the impact of poor road safety on societies and economies around the world resulting in an annual loss of Gross Domestic Product (GDP) in the order of 2%–5%, only a limited number of countries follow coordinated approaches to road safety management.

Road safety is generally significantly less developed than that of rail, water and air transport. The average individual risk of being a fatality in relation to the distance covered is thirty times higher in road transport that in the other modes /1/. For such a situation, there are many different reasons, but in our opinion, the first and the basic is that 90% of drivers on streets and roads are amateurs. It means that the road safety depends largely on the individual driving skills and mood of the drivers. On the contrary the rail and the aviation systems are designed from a safety perspective, and even well-trained professionals, like train operators and pilots, are only allowed to operate under rather strict conditions. Second reason might be the lack of coordination between a long list of stakeholders responsible for the road traffic safety. Other reasons, no matter how important seem to us, are in the shadow of the aforementioned.

In order to minimize the risks of injuries in road traffic, a global long-term activity has been launched. The ultimate goal is to achieve in the long-term a road system with zero deaths and serious injuries. Action under the name “The Global Plan for the Decade of Action for Road Safety 2011–2020” was developed by the United Nations Road Safety Collaboration (UNRSC) and stakeholders from around the world. To achieve its goals, the Global Plan features five categories or “pillars” of activities /2/, and at the national level each country should have to adopt appropriately indicators to measure progress in each of these areas such as /3/ and /4/. First of all, it refers to high level outcome measures such as: number of road deaths; number of road crashes resulting in deaths; number of deaths per 100,000 population; number of deaths per 100 million vehicle-kilometres travelled and number of deaths per 10,000 registered vehicles.

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Second, (seven) problem areas in road safety in Europe were identified as very important for the development of safety performance indicators (SPIs). These areas are: alcohol and drug-use; speeds; protective systems; daytime running lights; vehicles (passive safety); roads (infrastructure) and the after-crash trauma management system.

In this view all countries, when forming road management system, should consider adopting the long-term Safe System approach within the road transport system which is built around the premise that death and injury are unacceptable and are avoidable. The Safe System approach to road safety (also known as Vision Zero or Towards Zero) was pioneered in Sweden and acknowledges the physiological and psychological limitations of humans and puts ultimate responsibility on the designers and operators of the system to accommodate these human limitations. This approach is derived from an understanding that people make mistakes, and from an ethical standpoint no-one should be killed or seriously injured on roads. The focus is on adapting the road system to humans, rather than human behavior to the roads.

The implementation of the UN plan has stalled in 2014. Year 2016 was the third consecutive poor year for road safety in Europe and in Republic of Serbia too. These figures required an urgent political action that would speed up the progress in the road safety in Serbia. During 2015, the National Strategy on Road Traffic Safety on the roads of the Republic of Serbia for the period from 2015 to 2020 years was adopted.

The strategy recognizes key areas of action as well as target-risk groups that need attention, taking into account the institutional management functions which are critical determinants of the capacity of a country to achieve set goals /5/: result focus, coordination of the key stakeholders, effective legislation, adequate funding, road safety promotion, robust and systematic monitoring and proactive research, development and knowledge transfer.

Planning, designing, building, operation and decommission of the state road network are in general under the authority of the PERS. From among these parts of road life cycle, four are critical to how road infrastructure safety is managed: planning, design, build and operation. As a support in prevention and mitigation of future road accidents road authorities (including the PERS) will be required to implement ISO 39001: 2012 - Road traffic safety (RTS) management systems standard, which implies application of Road (Infrastructure) Safety Management –RISM system, a set of ten different management procedures /6/ which are in accordance with the Safe System approach. By adopting the ISO standard 39001, Serbian road authorities will demonstrate its commitment to road safety and will be pioneer of the adoption of this standard in the region, and one of the few roads agencies world-wide.

THE GLOBAL PLAN FOR THE DECADE OF ACTION FOR ROAD SAFETY 2011–2020

General Assembly resolution 64/255 1 of March 2010 proclaimed 2011–2020 the Decade of Action for road safety, with a global goal of stabilizing and then reducing the forecasted level of global road fatalities by increasing activities conducted at national, regional and global levels. Resolution 64/255, requested the World Health Organization and the United Nations regional commissions, in cooperation with the United Nations Road Safety Collaboration and other stakeholders, to prepare a Plan of Action for the Decade as a guiding document to support the implementation of its objectives. The main reason for this was the size of the problems and increasing trends in the road safety. Each year nearly 1.3 million people die as a result of a road traffic collision. That is more than 3,000 deaths each day, and more than half of these people are not travelling in a car. Twenty to fifty million more people sustain non-fatal injuries from a collision, and these injuries are an important cause of disability worldwide. The economic consequences of motor vehicle crashes have been estimated between 1% and 3% of the respective GNP of the world countries, reaching a total over $500 billion. Reducing road casualties and fatalities will reduce suffering, unlock growth and free resources for more productive use.

The overall goal of the Decade will be to stabilize and then reduce the forecast level of road deaths around the world by 2020. Activities over the Decade should take place at local, national, regional and global levels, but the focus will primarily be on national and local level actions. Within the legal constructs of national

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and local governments, countries are encouraged to implement activities according to five pillars. This pillar focuses on the need to strengthen institutional capacity to further national road safety efforts:

- Road safety management - Encourage the creation of multi-sectoral partnerships and designation of lead agencies with the capacity to develop and lead the delivery of national road safety strategies, plans and targets, underpinned by the data collection and evidential research to assess countermeasure design and monitor implementation and effectiveness.
- Safer roads and mobility - Highlights the need to improve the safety of road networks for the benefit of all road users, especially the most vulnerable: pedestrians, bicyclists and motorcyclists;
- Safer vehicles - This pillar addresses the need for improved vehicle safety by encouraging harmonization of relevant global standards and mechanisms to accelerate the uptake of new technologies which impact on safety;
- Safer road users - This pillar focuses on developing comprehensive programmes to improve road user behaviour;
- Post-crash response - Promotion of the improvement of health and other systems to provide appropriate emergency treatment and longer-term rehabilitation for crash victims.

Progress towards achievement of the Decade goal will be through:

- monitoring of indicators;
- tracking milestones linked to the Decade; and
- mid-term and end-term evaluation of the Decade.

Relevant global and safety performance indicators have to be set up to monitor and analyse changes in road safety on the roads at the international and national level.

SAFETY PERFORMANCE INDICATORS (SPIs)

Road safety can be assessed in terms of the social costs of crashes and injuries. However, the numbers of crashes and people killed or seriously injured are small and do not provide all the necessary information about the level of road safety. Indicators like seat belt usage rates, speeds, and alcohol usage rates provide more accurate information about underlying causes of crashes. These indicators can assist in assessing the current safety conditions of a road traffic system and in monitoring their progress. Furthermore, they can be used to compare the safety performance of countries or regions and to measure the impact of various safety interventions. SPIs are developed, within SafeNet project , for the following areas: alcohol and drug-use, speeds, protection systems, daytime running lights, vehicles (passive safety), roads, and trauma management. More details about the SPIs are presented and described in /7/ and /8/ and discuss best practice that can be used as examples for countries that are willing to apply the SPIs.

Each country should have to adopt appropriately indicators such as /9/ and /10/ to measure progress in each of these areas:

- High level outcome measures: number of deaths resulting from road; number of road crashes resulting in deaths; number of deaths per 100,000 population; number of deaths per 100 million vehicle-kilometres travelled; number of deaths per 10,000 registered vehicles;
- Safety performance indicators, which include:
  - Safe roads: number of deaths from head-on crashes; number of deaths from single-vehicle crashes; number of deaths from intersection crashes; number of deaths from crashes on state roads; number of deaths from crashes on municipal roads; number of deaths from crashes on unclassified roads.
  - Safe speeds: number of deaths from crashes where speed was a contributory factor; mean free speeds at designated sites across the network; percentage of vehicles speeding by vehicle type and offence category.

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- Safe vehicles: average age of the national vehicle fleet (years); average age of passenger vehicles; percentage of new light vehicles sold with a 5-star ANCAP rating; percentage of new vehicles sold with key safety features.
- Safe people - responsible road use: number of young driver and motorcycle rider deaths (aged 17–25 years); number of deaths from crashes involving a young driver or motorcycle rider (aged 17–25 years); number of older driver and motorcycle rider deaths (aged 65+ years); number of deaths from crashes involving an older driver or motorcycle rider (aged 65+ years); number of motorcyclist deaths; number of cyclist deaths; number of pedestrian deaths, number of deaths from crashes involving a heavy vehicle.
- Safe people—irresponsible road use: number of drivers and motorcycle riders killed with a blood alcohol concentration (BAC) above the legal limit; number of deaths from crashes involving a driver or motorcycle rider with a blood alcohol concentration (BAC) above the legal; number of deaths from crashes involving an unlicensed driver or motorcycle; number of vehicle occupants killed who were not wearing a restraint; number of drivers and motorcycle riders killed who had an illegal drug in their system; number of deaths from crashes involving a driver or motorcycle rider who had an illegal drug in their system.

In the following text we will keep on the SPIs relating to the road network.

ROADS NETWORK SPIs

The safety performance of the road transport system depends on the functionality of the network, homogeneity, and predictability of the road environment and the traffic involved. In order to develop suitable SPIs, quantitative relations between the road network, road design elements and road safety have to be known sufficiently well. Knowledge about these relations, however, is still lacking, although it is known that conflicts and related crashes can be prevented by choosing the right elements or facilities in the road network or individual roads. Based on these considerations, two SPIs were developed /11/:

- the road network SPIs, and
- the road design SPIs.

The road network SPIs assesses whether the “right road” is in the “right place”. The concept is based on the German guidelines for road categories /12/. In line with these recommendations, the division of the road network in Serbia was also carried out /13/. The idea behind this concept is that the function and traffic volume of a road determine the minimal requirements that have to be met by that road in order to guarantee an acceptable level of safety, where the requirements are related to (preventing) different types of conflicts. Practically, in a country or region, the connections between selected urban centres are assessed by comparing the theoretically needed road category with the actual road category. The road network SPI is the percentage of appropriate actual road category length per theoretical road category, summarized by connections in the network considered. For more information on the calculation of this SPIs /14/.

The road design SPIs determine the level of safety of the existing roads. This SPIs are based on the EuroRAP Road Protection Score (RPS). The RPS is a measure for the protection that is provided in relation to three main accident types: run<off road, head<on impacts and severe impacts at intersections. EuroRAP designed a method to calculate the RPS for each road segment or route, expressed in one to four stars, depending on a number of road characteristics. For more information see EuroRAP RPS /15/. The road design SPIs proposed within SafetyNet project is the distribution of the RPS scores for each road category /7/.

THE SAFE SYSTEM APPROACH

A Safe System approach within the road transport system is built around the premise that death and injury are unacceptable and are avoidable. This approach seeks to ensure that no road user is subject to kinetic energy exchange in a crash that will result in death or serious long-term disabling injury. OECD endorses the

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Safe System approach and notes that Safe System principles represent a fundamental shift from traditional road safety thinking, reframing the way in which traffic safety is viewed and managed.It overturns the fatalistic view that road traffic injury is the price to be paid for achieving mobility. It sets a goal of eliminating road crash fatalities and serious injuries in the long-term, with interim targets to be set in the years towards road death and serious injury elimination. This elimination requires road management system reconfiguration and recognition that the road network must eventually be forgiving of routine human (road user) errors. It is important to recognise the fundamental change that road safety agencies, including road authorities, will face in embracing and implementing this Safe System aspiration and in implementing Safe System treatments across their networks.

The overarching scientific safety principles for a Safe System include recognition that /17, 24/:

- humans have limitations and are fallible (i.e. they make mistakes);
- there are known physical limits for energy exchange in crashes, beyond which the human body is seriously injured;
- a well-designed system can ensure that the physical limits of the human body are not exceeded in a crash;
- the focus is on the long-term elimination of fatalities and serious injury;
- there is a shared responsibility for safe travel outcomes between “system designers” (those who influence the level of safety experienced on the road network) and the road user.

The last point is absolutely innovative and important. It means that it is no longer acceptable to expect the road user to carry all responsibility for avoiding serious crashes. The system will ultimately need to protect all road users, including those who act illegally, from death and serious injury.

As noted above, as well as road user behaviour, road – and vehicle-related safety factors play a substantial part in fatal injury crashes. Progressive movement towards a Safe System requires all key stakeholders to accept their responsibilities to provide for safe overall operation of the network. This is in addition to the responsibilities that individual road users bear. This concept of “shared responsibility” is at the core of the shift in traditional thinking about road crash contributing factors that a Safe System requires (Picture 1).

Picture 1. –The Safe System model (source: Australian National Road Safety Strategy /17/)

The Safe System approach looks to infrastructure design, speed limits and vehicle safety features that individually (and together) minimise violent crash forces. It relies upon adequate education, legislation and enforcement efforts to gain high levels of road user compliance with road rules; effective licensing regimes to control the safety of drivers using the system (particularly novice drivers and riders); and the cancellation of licences when serious offences are committed. A good standard of emergency post-crash care is also needed.

This fundamental shift away from a “blame the road user” focus, to an approach that compels system providers or designers to provide an intrinsically safe traffic environment, is recognised as the key to achieving ambitious road safety outcomes. While individual road users are expected to be alert and to comply with all road rules, the “system providers", including the road authorities, have a primary responsibility to provide a safe operating environment for road users.

Safe System in road design differ from traditional road design approaches. In traditional road design, crashes are the starting point and road users are generally seen as the cause of crashes. The focus is on reducing

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crashes and creating roads that have more space for cars, wider lanes and roads, straighter roads /18/. Traditional road design accepts a trade-off between safety, cost and mobility, with expectations that some people will inevitably die in crashes /19/.

THE STANDARD ISO 39001:2012

The standard ISO 39001:2012 (Road Traffic Safety – RTS - management systems) provides a management tool to ensure the best possible results from the endeavours within the Safe System approach. The standard ISO 39001 is designed to assist organisations in integrating road safety as a core objective into their management systems, as well as aligning with country road safety goals and strategies. The standard is aimed at both small and large organisations, as well as the public and private sector.

The ISO 39001 standard links to other ISO management systems standards and sets out specific and wide-ranging top management responsibilities and key management functions. The standard introduction work should begin a review of organization current road traffic safety performance; makes an assessment of the context for the organisation's activity; and considers specified, measurable road traffic safety performance factors known to reduce the risk of fatal and serious injury within the organisation's sphere of influence. The organisation has to select the road traffic safety performance factors to work on and then analyse what it can achieve over time. When establishing its targets, the organisation is required to consider the management capacity required to achieve them, as well as monitoring results and reviewing its road safety management system towards continual improvement.

Experiences from countries where this standard applies earlier suggests that in the case of middle income countries, like Serbia, early adoption of ISO 39001 by large corporations (involved in road safety) in the first instance could assist governments in meeting their serious road safety challenges. Main benefits arising from the implementation of the standards are as follows: reduction in global safety indicators, cost reductions related to traffic crashes, meet organizational safety and social responsibility targets, improved standardization of work and communications, identifying the way to improve efficiency through better management, cutting operating costs through improved efficiency, demonstration to stakeholders that you take these targets seriously.

THE STATUS OF ROAD SAFETY IN SERBIA

Characteristics of the road network in the Republic of Serbia

The road network in the Republic of Serbia is about 40,000 km long, and it is divided into a network of state roads, a network of municipal roads and streets and unclassified roads /13/. The division was made in accordance with the German guidelines for road categories /12/. The total length of state roads is 16,179,892 km, and their structure is as follows:

- I A category state roads (motorways) – 747.009 km (April 2017);
- I B category state roads – 4,481.702 km;
- II A category state roads – 7,781.703 km;
- II B category state roads – 3,169.478 km;

Other, up to 40,000 km, are municipal roads and streets.

The state roads network is the responsibility of PE "Roads of Serbia" and the municipal road network of local self-government.

The status of the state road network, where most of the traffic takes place, is as follows:

- An iRAP survey carried out in 2008 over 2,945 km, highlighted that one third of the road network was one - or two-stars rated, i.e. below the iRAP's minimum target of three, stars;

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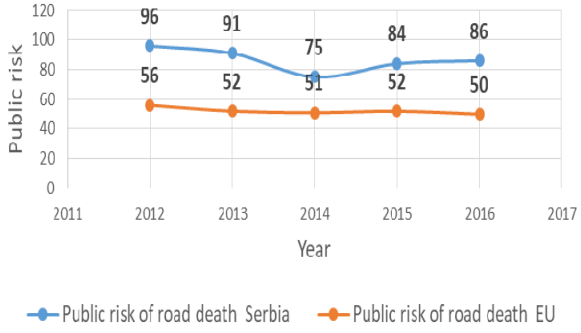
– On the national road network 262 dangerous places have been identified, of which 79 are places with priority I (30.1% of the total number of dangerous places), 106 with priority II (40.5%) and 77 places with priority III (29.4%).

Picture 2 shows the change in the level of public risk in the Republic of Serbia and the average of countries of the European Union (EU) in five years (2011 – 2016), for which there are official data . This relative indicator of traffic safety is very useful because it provides comparisons with other entities/territories, with which it would otherwise not be possible to make comparisons due to the difference in the number of inhabitants.

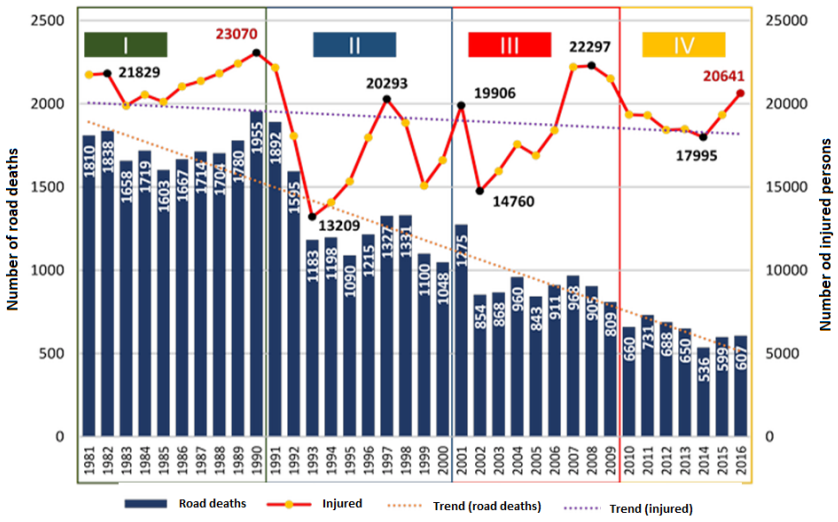


Picture 2. – Public risk of road deaths in Republic of Serbia and the average in the EU for period 2012-2016 (source: own calculation)

From the picture it can be seen that the public risk on the road network in the Republic of Serbia, and in the observed period, has a slightly declining trend but the annual values are significantly and constantly higher (about 40%), compared to the average of the EU.

Basic Road safety indicators on the road network of Republic of Serbia

Basic safety indicators in the Republic of Serbia, over the last thirty years, point out that the state's attitude towards road safety and road authorities practice has been different in different periods of time (see Picture 3).



Picture 2. –– Number of fatalities and injuries in the period from 1981 to 2016 (source: Statistical report on the state of traffic safety in the Republic of Serbia for the year 2016)

The above picture shows reference period, according to their characteristics, can be divided into four periods of time in which the levels and trends of road safety indicators were different:

– In the first period of time (1981-1990), it is characteristic that the increase in the number of vehicles was necessarily accompanied by an increase in the number of traffic crashes. This period is

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characterized by the introduction of some elements of a road safety system and the processes in the former Socialist Federal Republic of Yugoslavia;

- The second period of time (1991 – 2000), the average number of killed persons was reduced to 1,311, while the average number of injured in traffic crashes reduced to 17,629 persons. Characteristic of the second period (1991-2000) are the war events on the territory of the former SFRY and the bombing of Serbia in 1999, when the standard of living, and consequently the number of registered motor vehicles, their use and number of road death were reduced. This period of time is characterized by the degradation of the traffic safety system, including the road network.
- The third period of time (2001-2009) is characterized by the stabilization of the economic condition and the improvement of the living standard of the population. It began the restoration and rehabilitation of the road network with the help of the international community (EBRD, WB, etc.). This influenced the road safety situation and the number of casualties was reduced. However, in 2006, the number of casualties started to rise again. At the end of 2009 in National Assembly of Republic of Serbia the Law on Traffic Safety was adopted. The Law created all legal conditions for the establishment of a traffic safety management system in Serbia and influenced the positive changes that are still ongoing.
- In 2010 the UN renewed their commitment to improve road safety by setting a target of reducing road deaths by 50% by 2020, compared to 2010 levels. This target followed an earlier target set in 2001 to halve road deaths by 2010.

  In the last time period (after 2010) the situation in Serbia is as follows: in the period from 2012 to 2017, 5,050 persons were killed in traffic crashes, 28,214 persons were seriously injured, and while 126,604 persons suffered slight injuries (see Table 1).

Table 1 - Basic indicators of traffic safety in the Republic of Serbia, period 2012-2016
(source: Statistical report on the state of traffic safety in the Republic of Serbia for the year 2017)

Year	Road crashes with					Casualties				
	Road deaths	Injuries	Casualties	Material damage only	Total road crashes	Road deaths	Severe injuries	Light injuries	Injuries	Total road casualties
2010	593	13,586	14,179	33,609	47,806	660	3,883	15,463	19,346	20,006
2011	659	13,460	14,123	28,330	42,453	731	3,777	15,539	19,316	20,047
2012	619	12,742	13,361	24,253	37,614	688	3,544	14,891	18,435	19,123
2013	594	12,932	13,526	23,636	37,162	650	3,422	15,053	18,475	19,125
2014	476	12,568	13,044	21,969	35,013	536	3,275	14,720	17,995	18,531
2015	548	13,108	13,656	20,515	34,171	599	3,448	15,902	19,350	19,949
2016	551	13,850	14,401	21,570	35,971	607	3,363	17,278	20,641	21,248
2017	525	14,169	14,748	21,721	36,469	579	3,502	17,758	21,260	21,839
Total	**4,565**	**106,415**	**111,038**	**195,603**	**306,659**	**5,050**	**28,214**	**126,604**	**154,818**	**159,868**

In the same period here were a total of 306,659 traffic crashes, of which 4,619 traffic crashes with road deaths, 106,415 traffic crashes with injured persons and 195,603 traffic crashes with material damage only. It should be taken into account that the number of traffic crashes with only material damage is incomplete due to the fact that a certain number of collisions, with minor material damage, were registered by insurance companies, but it's not included in the Statistical Report.

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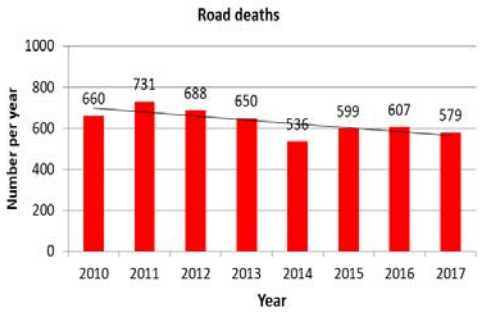
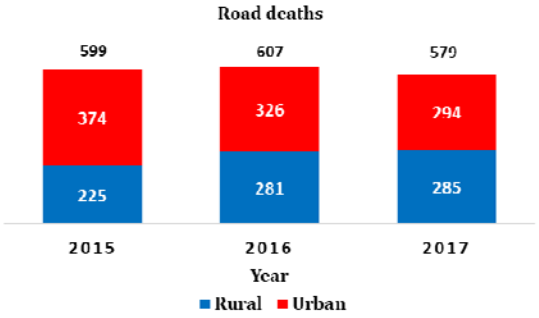
Picture 4 shows the change in the number of road deaths in the Republic of Serbia in the period 2010-2017.



Picture 4 - Number of road deaths in the period from 2010 to 2017
(source: Statistical report on the state of traffic safety in the Republic of Serbia for the year 2017)

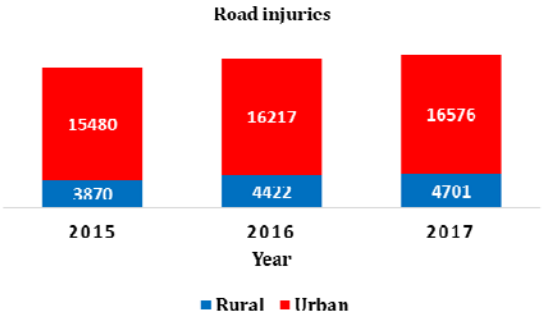
From the picture above, it can be seen that there are some fluctuations in the number of road deaths in the observed period, but with the tendency of declining.

The collisions can be divided according to the place where they happened. In our case, the division was made on crashes that originated in inhabited parts (urban) and out of settlements (rural). Motor vehicle crash fatality rates are different in rural areas than in urban areas. However, the explanations for these differences are less clear /25/. The picture 5 presents the total number of dead, the number of dead and urban areas and the number of dead and rural areas in last three years.



Picture 5 - The division of road deaths by place where they occurred
(source: The integrated database of characteristics of traffic safety – Agency of Road Safety Republic of Serbia)

In 2015, rural road deaths accounted for 37.6%, and in 2017 approximately 50% of total road deaths in the same year, but the available data, for only three years, are insufficient to predict the future trend. It can only be said that the number of deaths does not decrease, as would be expected in accordance with the UN commitment to improve road safety.



Picture 6 - The division of injuries by place where they occurred
(source: The integrated database of characteristics of traffic safety – Agency of Road Safety Republic of Serbia)

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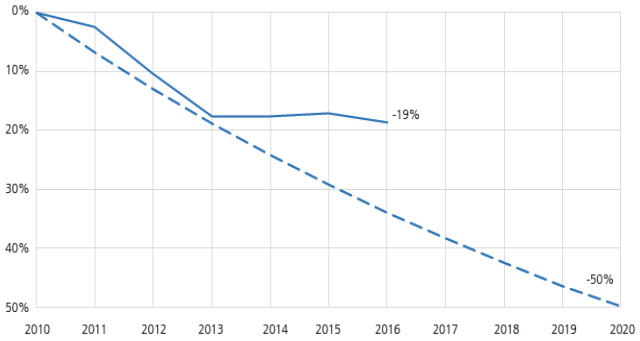
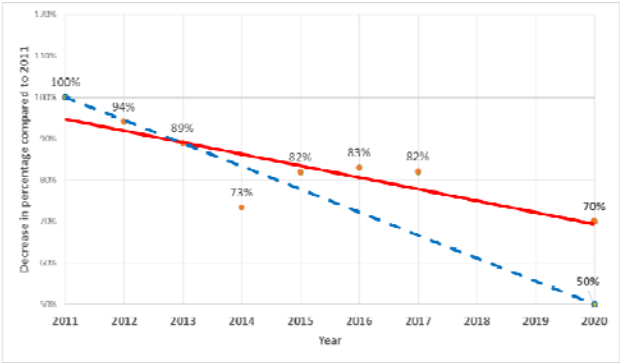
When looking at data related to the number of injured persons, the situation is even worse. The total number of injuries in road crashes in the last three years is increasing in urban as well as rural areas, but their mutual relationship has not changed (80% rural and 20% rural).

The problem arose when analyses showed that since 2014, progress has virtually ground to a halt. 2016 was the third consecutive poor year for road safety in whole EU (see Picture 7). Out of the 32 countries monitored by the PIN Programme only 15 countries registered a drop in the number of road deaths in 2016. A similar trend was observed in the Republic of Serbia for the period 2010-2017 (Figure 8).



Picture 7 - Reduction in the number of road deaths in EU since 2010 (blue line) plotted against the EU target for 2020 (blue dashed line)
(source: Ranking EU Progress on Road Safety, 11th Road Safety Performance Index Report, June 2016)



Picure 8 - Reduction in the number of road deaths in Republic of Serbia since 2010 (red line) plotted against the EU target for 2020 (blue dashed line)
(source: Statistical report on the state of traffic safety in the Republic of Serbia for the year 2017)

Looking at Picture 2, it can be noticed that the smallest number of road deaths were in 2014 (536 persons), which is the smallest number since the statistics on traffic crashes are statistically monitored and analysed in the Republic of Serbia. After this year the number of fatalities has ceased to decline and even began to grow somewhat. If this trend continues, the decrease in the number of road deaths for the period 2010-2020 will be, at best, -30% instead of the proclaimed -50%.

These figures required an urgent political action that would speed up the progress in traffic safety in Serbia. The National Strategy for Road Transport Safety on the Roads of the Republic of Serbia for the period from 2015 to 2020 (adopted in 2015) recognizes the key areas of activities, as well as the target groups of risks that need the greatest attention. In order to facilitate the implementation of the Strategy, an appropriate Road Safety Action Plan has been adopted.

CAPACITY BUILDING ON ROAD SAFETY MANAGEMENT

The Republic of Serbia in 2009 initiated the establishment of new institutions of the Road Safety System as well as stable sources of traffic safety financing. In 2014, the Government adopted the document “Charter of Responsibility and Safe Behaviour in Traffic” and the baseline for the adoption of the National Strategy on Road Traffic Safety of the Republic of Serbia for the period from 2015 to 2020 years.

In doing so, taking into account that the following seven institutional management functions are critical determinants of the capacity of a country to achieve results /5/:

- Results focus – a strategic focus that links the delivery of interventions with subsequent intermediate and final outcomes. This requires government to designate a lead agency to work with other agencies to:
  - Develop management capacity to understand a country’s road safety issues;
  - Provide a comprehensive strategy with intermediate and outcome targets;
  - Deliver interventions and target achievements;
  - Review performance.

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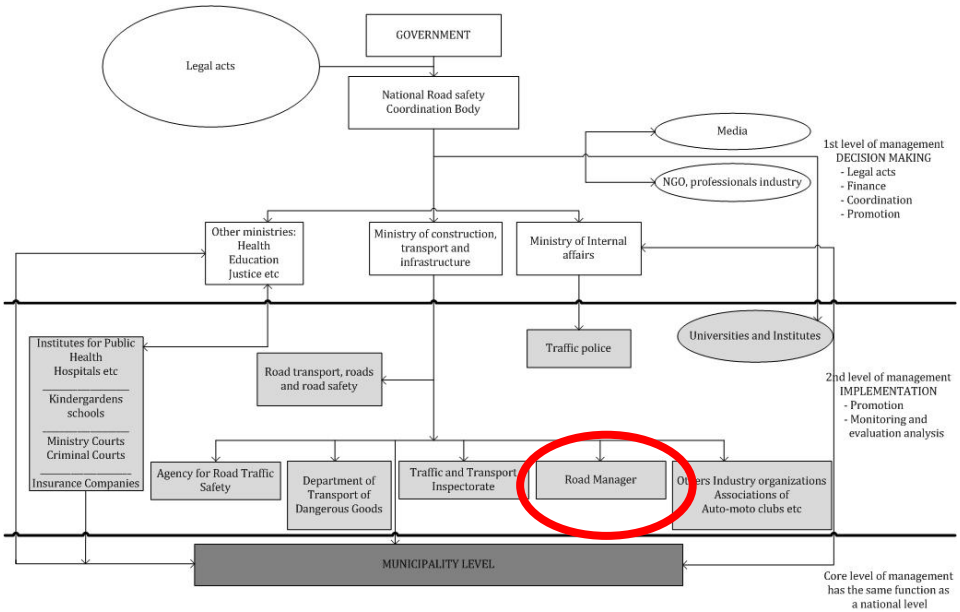
- Coordination of the key agencies to develop and deliver road safety policy and strategy.
- Effective legislation to enable desired results to be delivered.
- Adequate funding and well targeted resource allocation for interventions and related institutional management functions.
- Promotion of road safety within government and the broader community.
- Robust and systematic monitoring and evaluation to measure progress.
- Proactive research and development and knowledge transfer programmes which actively influence improvement in interventions, institutional management functions and performance monitoring.

By adopting the Strategy in 2015, it has been made an essential step for a strategic approach to road traffic safety: the Government directs itself and undertakes activities to solve the problem of traffic safety, fully responsible and systematically, aware that traffic safety is a very important problem in the sphere of social, political, health and economic life of the state. In order to achieve cooperation and harmonized performance in the function of improving the road safety, as well as initiating and monitoring preventive and other activities in the field of road safety, in 2014 the Government established the Road Safety Coordination Body /19/, as a government coordination body, comprised of ministers in charge of transport, internal affairs, health, labour, justice, education and trade and services... (Picture



Picture 9 - Organization of road safety in Serbia
(source: "Regional Road Safety Workshop, Belgrade - October 15-16, 2014")

Capacity building on road safety management in the Republic of Serbia focuses on the adoption of an integral road safety approach. It goes beyond the insertion of safety improvements into the road rehabilitation design to cover also the preparation of CSR based road safety campaign and the adoption of better management practices. That includes the adoption of ISO 39001 standard by Public Enterprise "Roads of Serbia" (PERS).

The material basis for this project is provided through a loan granted by The European Bank for Reconstruction and Development (EBRD), with parallel financing provided by the World Bank, the European Investment Bank and the Government of Serbia, to rehabilitate a large number of individual sections of roads (a total length of 1,125 km) across the country.

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During 2015, the National Strategy on Road Traffic Safety on the roads of the Republic of Serbia for the period from 2015 to 2020 years was adopted, which defines the mission and vision to achieve set goals by 2020. These goals are:

- No dead children in traffic in 2020;
- To halve the annual number of seriously injured children, compared to 2011;
- To halve the annual number of road deaths in 2020, compared to 2011;
- To halve the annual the number of seriously injured persons in 2020, compared to 2011;
- To halve the overall, annual socio-economic costs of traffic accidents in 2020, compared to 2011.

Road safety performance levels particularly, in countries with lower levels of road safety performance, can be improved in the short term by implementing a battery of proven measures and overcome main risks. The key measures to address these risks were identified as follows:

- Speed management: enforcement of existing speed limits can provide immediate safety benefits, perhaps more quickly than any other single safety measure. Effective speed management also requires that speed limits are appropriate for the standard of the road, the roadside risks, road design, traffic volumes and mix and presence of vulnerable road users. Public support for reduced speed limits needs to be fostered, as there is generally little understanding that small decrements in speed produce substantial reductions in trauma. Other essential components of speed management are infrastructure improvement and the use of new technologies, such as intelligent speed adaptation, to modify behaviour.
- Reduced drink-driving: based on best practice experiences, highly visible enforcement using random breath testing is needed to enforce blood-alcohol limits that should not exceed 0.5g/l for the general population. Enforcement is most effective when backed by extensive publicity, with tough sanctions for repeat offenders. Alcohol interlocks fitted to all vehicles are a future option, subject to successfully increasing public acceptance.
- Seatbelt use: legislation with firm police enforcement backed by intensive mass-media programmes and penalties is the most effective strategy to improve seatbelt wearing. Technologies such as seatbelt reminder systems and seatbelt ignition interlocks could almost completely counter the non-wearing of seatbelts if introduced universally but would require community and vehicle industry acceptance.
- **Safer roads and roadsides**: at least for the short term, appropriate measures include targeted road improvements that identify and treat the highest crash locations with specific treatments such as audible edge-lining, shoulder sealing, clearing of roadside vegetation and the construction of passing lanes. For longer term, a systematic, proactive approach to road infrastructure design and renewal is needed.
- Enhanced vehicle safety: the safety of vehicles has increased significantly in recent years, due to technological development of passive (crash protection) and active (crash avoidance) systems. In particular, Electronic Stability Control systems represent a major recent advance in active safety, with collision avoidance and lane departure warning systems examples of other promising technologies.
- Reduced young driver risk: graduated licensing schemes in tandem with extended training during the learner period have been effective in reducing deaths among young drivers. Components of a graduated licensing can include night-driving and peer-passenger restrictions, graduated demerit points while on probation, zero blood-alcohol content tolerance and extended learning periods while under supervision to provide for driving in a variety of road and weather conditions.

Measures related to safer state roads and roadsides are under the authority of the PERS. The PERS takes care about road safety through the elimination of dangerous locations as well as about environment

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protection through the elimination or mitigation of harmful effects of roads and traffic on the environment, obeying all due procedures pursuant to the valid legislation.

Each phase of an engineering structure's life cycle (road network) has its unique operational characteristics from when it was planned until it is decommissioned. Deming /20/ identifies four separate parts of the life cycle: **Plan – Do – Act – Check** but in practice complex engineering projects, including road networks, are divided into five parts: **Plan (initial concept) – Design – Build – Operate – Decommission**.

- Planning. Planning involves the designation of road corridors in the area under analysis. From the safety management perspective this stage has two important phases: developing a draft concept of the selected road and developing the area's land use plan (city, municipality), a process which happens a few or more than ten years before the road is built. The location of the road (especially of roads of a high technical standard) is key to understanding the traffic flows on the road itself and within its catchment area. The higher the standard of the road, the bigger its range which affects safety in the area quite significantly.
- Design. This stage consists of two phases that have important safety implications: the draft design that must be submitted to obtain a siting decision and is made a few years before the actual construction and a detailed design required for the building permission and made not long before the start of construction. The particular elements of the design (draft design, detailed road design with the traffic layout and temporary traffic layout during the construction phase) should be verified and corrected accordingly.
- Build. This stage includes two critical phases: construction and commissioning. The first phase should ensure the safety of traffic during construction and how it affects road safety. When preparing the project for commissioning it is important to check whether design requirements have been met and test the location of traffic and traffic safety equipment in real life conditions. As a result of these checks improvements are made to the project to increase safety before it is turned over for use.
- Operate. This stage has two important phases: short-term and long-term operation of the road. In the first phase it is important to evaluate how the new road and its elements influence road user behaviour after it has been in use for a short period of time. The second phase involves systematic and periodical road reviews with the aim to identify any risks that may appear on the particular road and remove any defects and shortcomings that may cause risks to road traffic. This is to ensure safety or better safety.
- Decommission (upgrading/renewal). At this stage roads are assessed to establish whether they can still be used following improvements or whether they should be closed altogether. When roads are decommissioned the risk to road users is minor which is why the analysis will not cover this phase.

From among these parts of road life cycle, four are critical to how road infrastructure safety is managed: planning, design, build and operation.

As a support in prevention and mitigation of future road accidents road authorities use Road (Infrastructure) Safety Management –RISM, a set of different management procedures /21/. These procedures are defined in /22/ as "the analytic tools that help road authorities detect emerging safety problems early, that help in locating the most hazardous parts of the road system, that identify the most important factors contributing to road accidents and injuries and that help to estimate the likely effects of specific road safety measures or a road safety programme consisting of several measures". A total of ten procedures have been identified, these are:

- Road Safety Impact Assessment (RIA) – which is being implemented at the initial planning stage before the infrastructure project is approved. The purpose is to demonstrate the implications on road safety of different planning alternatives of an infrastructure project and they should play an important role when routes are being selected;
- Efficiency assessment tools (EAT) - Budget for road investment in general and for road safety in particular should be spent as optimally as possible. Efficiency assessment tools (e.g. cost-benefits

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analysis) determine the effects for society of a given investment, for instance in road safety, in order to prioritize investment alternatives;
- Road Safety Audit (RSA) - An independent detailed systematic and technical safety check relating to the design characteristics of a road infrastructure project and covering all stages, from planning to early operation, as to identify, in a detailed way, unsafe features of a road infrastructure project;
- Network Operation (NO) - It relates to daily management of the infrastructure of a road network, with particular reference to maintaining road serviceability and safety;
- Road Infrastructure Safety Performance Indicators (SPI) - Safety performance indicators (SPIs) are seen as any measurement that is causally related to crashes or injuries and is used in addition to the figures of accidents or injuries, in order to indicate safety performance or understand the process that leads to accidents. Road Infrastructure Safety Performance Indicators aim to assess the safety hazards by infrastructure layout and design (e.g. percentage of road network not satisfying safety design standards);
- Network Safety Ranking (NSR) - A method for identifying, analysing and classifying parts of the existing road network according to their potential for safety development and accident cost savings;
- Road Assessment Programs (RAP) - These methods involve the collection of road characteristics data which are then used to identify safety deficits or determine, how well the road environment protects the user from death or disabling injury when a crash occurs;
- Road safety inspection (RSI) - A preventive tool consisting of a regular, systematic, on-site inspection of existing roads, covering the whole road network carried out by trained safety expert teams, resulting in a formal report on detected road hazards and safety issues, requiring a formal response by the relevant road authority;
- High Risk Sites (HRS) - A method to identify, analyse and rank sections of the road network which have been in operation for more than three years and upon which a large number of fatal accidents in proportion to the traffic flow have occurred;
- In-depth Investigation - In-depth Investigation is the acquisition of all relevant information and the identification of one or several of the following: the cause or causes of the accident, injuries, injury mechanisms and injury outcomes, how the accident and injuries could have been prevented.

Mentioned procedures are made according to in accordance with the Safe System Approach and ISO 39001: 2012. By adopting the ISO standard 39001, Serbian road authorities will demonstrate its commitment to road safety and will be pioneer of the adoption of this standard in the region, and one of the few roads agencies world-wide.

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