ROAD INFRASTRUCTURE SAFETY MANAGEMENT AS A PART OF THE ROAD TRAFFIC SAFETY PROTECTIVE SYSTEM

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Abstract: Road infrastructure has been identified as one of the pillars of traffic safety policies that should significantly contribute to the reduction of road traffic injuries. Directive 2008/96/EC on road infrastructure safety management. The Directive prescribes the implementation of procedures in the field of road infrastructure safety improvement, which have the highest degree of effectiveness, and which are mandatory for the trans-European road network, and are recommended for use on other roads. Apart from the prescribed, there is a possibility of applying other procedures. The following procedures are in use: RIA (Road Safety Impact Assessment); RSA (Road Safety Audit); EuroRAP (Europe Road Assessment Program) i iRAP (International Road Assessment Program); RSI (Road Safety Inspection) (as a proactive measures); and BSM (Black Spot Management); IDSA (In Depth Study of Accident); and NSM (Network Safety Management) (as a reactive measure). The first two procedures (RIA and RSA) are applied in the design phase of the roads, before construction, as well as in the case of reconstruction of roads that are already in operation while others (ERAP and iRAP; RSI; BSM; IDS and NSM) are applied on the existing roads in exploitation. The amending of Directive 2008/96/EC is underway, and it is based on the proposed road safety framework that follows safe system approach, i.e. it assumes that human beings can and will continue to make mistakes and that it is up to all actors to ensure that road accidents do not lead to serious or fatal injuries (shared responsibility). The paper presents the history and basic characteristics of certain procedures, as well as the field of their application.

Keywords: road safety, road infrastructure safety improvement, procedures, hazardous areas/black spots, proactive measures, reactive measures.

INTRODUCTION

The number of road traffic deaths has reached 1.35 million in 2016. Road traffic injury has become the leading cause of death for children and young adults

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aged 5–29 years (World Health Organization, 2018: XI). Road safety is becoming the greatest risk in our lives.

One of the pillars of the Global Plan for the Decade of Action for Road Safety 2011-2020 is "**Safer roads and mobility"** (WHO). This pillar strongly emphasises the role of road infrastructure in road traffic safety improvement. In order to achieve good results, effective tools should be used. A set of such tools has been introduced with a Directive 2008/96/EC of the European Parliament and of the Council of 19 November 2008 on road infrastructure safety management. The Directive prescribes the implementation of procedures in the field of road infrastructure safety improvement, which have the highest degree of effectiveness, and which are mandatory for the trans-European road network, and are recommended for use on other roads.

Road Traffic Safety Law of the Republic of Serbia (RTSL, Official Gazette of Republic of Serbia, No. 41/2009, 53/2010, 101/2011, 32/2013 – decision of the Constitutional Court, 55/2014, 96/2015 – other Law, 9/2016 – decision of the Constitutional Court, 24/2018, 41/2018, 41/2018 – other Law and 87/2018) sets a framework for road safety management (Nešić & Lipovac, 2017), and sets obligations for major stakeholders. Thus, for the road authorities it is required by RTSL (article 4) that: "*An enterprise, another legal entity or an entrepreneur who designs, constructs, reconstructs, maintains and manages the roads is obliged to do so in a manner that enables safe traffic.*" Financing is provided within State budget for State Roads Authority and as a part of Road Traffic Safety Fines (15%) for the Local Government Road Authorities (Nešić & Lipovac, 2017).

On the other hand, Law on Roads (LR, Official Gazette of Republic of Serbia, No. 41/2018 and 95/2018 – other Law) sets a framework for a Road Infrastructure Safety Management. It is required from road authorities by LR (article 78) to plan, design and build public roads in accordance with road traffic safety requirements, and also to conduct Road Safety Impact Assessment (RIA) and Road Safety Audit (RSA).

X SPECIAL CONDITIONS FOR CONSTRUCTION AND RECONSTRUCTION OF PUBLIC ROADS

(LR, Official Gazette of Republic of Serbia, No. 41/2018 and 95/2018 – other Law)

Planning, design and construction of public roads

Article 78

Public roads are planned, designed and constructed so that the planning and technical solutions are aligned with the latest knowledge in the design and construction of public roads with traffic safety requirements, demographic and economic needs, economic principles and criteria for assessing the justification of their construction, regulations on the protection of life environment and regulations governing agricultural land.

An integral part of the project documentation of the projects for the construction and reconstruction of public roads are the reports on the assessment of the impact of the road on traffic safety and the reports on the audit of projects in terms of road safety characteristics, in accordance with Art. 88 and 89 of this Law.

In LR, there is also a whole chapter (XI) which contains special requirements that public road must fulfil regarding Road Traffic Safety. The Chapter prescribes the use of certain procedures used worldwide to improve Road Traffic Safety through actions by road authorities.

These provisions are the basis for the Road Infrastructure Safety Management system in Republic Serbia, which is explained in this paper.

ROAD INFRASTRUCTURE SAFETY MANAGEMENT IN EUROPE

Road Infrastructure Safety Management (RISM) refers to a set of procedures that support a road authority in decision making related to the improvement of safety on a road network (Persia et. al., 2016).

Procedures regarding Road Infrastructure Safety Management that are in operation across Europe (and worldwide) are: Road Safety Impact Assessment (RIA); Road Safety Audit (RSA); Europe Road Assessment Program (EuroRAP) and International Road Assessment Program (iRAP); Road Safety Inspection (RSI); Black Spot Management (BSM); In Depth Study of Accident (IDSA); Network Safety Management (NSM) (Nešić, Lipovac and Jovanović, 2012).

Those procedures can be of proactive and of reactive nature. Proactive ones are used in early stages of a project's life-cycle, whereas reactive ones are used on the existing infrastructure. First four procedures are of preventive nature. The others are reactive.

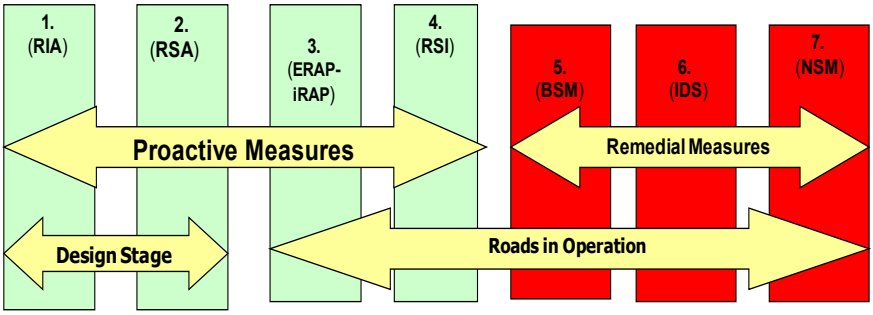

Figure 1: *Schematic view of RISM procedures (Nešić, Lipovac and Jovanović, 2012).*

Directive 2008/96/EC of the European Parliament and of the Council of 19 November 2008 on road infrastructure safety management prescribes most of

the above procedures on the roads which are part of the trans-European road network, whether they are at the design stage, under construction or in operation (article 1). Directive 2008/96/EC required from member states to establish and implement procedures relating to Road Safety Impact Assessments (article 3) and Road Safety Audits (article 4) for infrastructure projects, and Safety Ranking and Management (article 5), and Safety Inspections (article 6) of the road network in operation. The implementation date was set to 19 December 2010 (article 14). Directive 2008/96/EC also allows usage of these procedures as a set of good practices, to national road transport infrastructure, not included in the trans-European road network, that was constructed using Community funding in whole or in part (article 1). In order to provide successful implementation, provisions regarding the adoption of guidelines were also prescribed (article 8). The same applied to training curricula for road safety auditors and a certificate of competence for auditors (article 9). The procedures are defined as (article 2):

- "road safety impact assessment" means a strategic comparative analysis of the impact of a new road or a substantial modification to the existing network on the safety performance of the road network;
- "road safety audit" means 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;
- "ranking of high accident concentration sections" means 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;
- "network safety ranking" means a method for identifying, analysing and classifying parts of the existing road network according to their potential for safety development and accident cost savings;
- "safety inspection" means an ordinary periodical verification of the characteristics and defects that require maintenance work for reasons of safety.

There is an ongoing activity by the European Commission to change Directive 2008/96/EC. On 17 May 2018, the Commission adopted a proposal for a Directive amending Directive 2008/96/EC on road infrastructure safety management[2]. The proposed revision extends the application of procedures outside the trans-European transport network (TEN-T) to motorways and primary roads. It also proposes replacement of "ranking of high accident concentration sections" and the "network safety ranking" with a "network-wide road assessment" to map the risks of accidents, and introduces provisions regarding protection of vulnerable road users to be applied in all road safety management procedures. "Network-wide road assessment" would be defined as *an assessment of the safety of the road network within the scope of this Directive in order to benchmark accident and impact severity risk* (article 2c). "Road safety inspection" would change definition

2 http://www.europarl.europa.eu/legislative-train/theme-resilient-energy-union-with-a-climate-change-policy/file-road-infrastructure-safety-management, accessed on 23.03.2019.

to: *a targeted on-site inspection of an existing road or section of road to identify hazardous conditions, faults and deficiencies that increase the risk of accidents and injuries* (article 2c). So, if the proposal should be adopted, there would be 4 procedures, as follows: "road safety impact assessment", "road safety audit", "road safety inspection" and "network-wide road assessment"

ROAD INFRASTRUCTURE SAFETY MANAGEMENT IN SERBIA

Law on Roads (LR, Official Gazette of Republic of Serbia, No. 41/2018 and 95/2018 – other Law) brings a provisions with special road traffic safety requirements that public road must fulfil. The provisions include the following six (6): Road Infrastructure Safety Management (RISM) procedures: Road Safety Impact Assessment (RIA); Road Safety Audit (RSA); Road Safety Inspection (RSI); Risk Mapping (RM); Black Spot Management (BSM); In Depth Study of Accident (IDSA).

XI SPECIAL REQUIREMENTS WHICH THE PUBLIC ROAD MUST FULFIL FROM TRAFFIC SAFETY ASPECT

(LR, Official Gazette of Republic of Serbia, No. 41/2018 and 95/2018 – other Law)

Road Safety Impact Assessment

Article 88

„When designing for the construction of a new, or reconstruction of the existing state road of 1st order, the state road authority must provide an assessment of impact of that road on the traffic safety on the network of public roads (hereinafter: Assessment).

The report of Assessment referred to in paragraph 1 of this Article shall be drawn up.

The state road authority shall act upon accepted recommendations from the report referred to in paragraph 2 of this Article no later than the beginning of the next phase of design.

In case of inability to act upon the recommendations from the report referred to in paragraph 2 of this Article, the state road authority has, within 30 days from the receipt of the report, to explain the possible non-submission to the authority competent for traffic affairs.

The authority competent for traffic affairs shall give a final opinion on the explanation of the state road authority referred to in paragraph 3 of this Article.

The state road authority is obliged to act upon the final opinion of the authority competent for traffic affairs.

The Minister shall prescribe the method for the implementation of the Assessment and the content of the Assessment Report."

Road Safety Impact Assessment (RIA) is defined as: *strategic comparative analysis of the impact of variants of a new or reconstructed road on traffic safety on the road network (LR, a. 2, p. 1, pt. 67).* It is required for making a decision to build a new State Road of 1st order, or to reconstruct the existing one, which is aligned with 2008/96/EC provisions which require carrying it out at the initial planning stage, before the infrastructure project is approved, for all infrastructure projects.

Audit and inspection
(LR, Official Gazette of Republic of Serbia,
No. 41/2018 and 95/2018 – other Law)

Article 89

The state road authority has to provide for the Road Safety Audit of a state road of 1st order from the aspect of the road safety features (hereinafter: Audit) for all new road construction projects and reconstruction projects of the existing road, at all design stages, immediately before the road is put into operation and at latest six months after the release of the road into exploitation.

The public road authority has to provide for the Road Safety Inspection (hereinafter: Inspection):

1) periodical inspection of state road of 1st order at least once in a five years period;

2) targeted Inspections for public roads sections with the highest risk, according to risk map of roads and streets.

A report is made on the performed Audit referred to in paragraph 1 of this Article.

The public road authority shall act upon the accepted recommendations from the report referred to in paragraph 3 of this Article no later than the beginning of the next stage of design.

A report is made on the performed Inspection referred to in paragraph 2 of this Article.

The public road authority shall initiate a procedure for remedying the deficiencies according to accepted recommendations from the report referred to in paragraph 5 of this Article within 90 days from the date of receipt of the report.

In case of inability to act upon the recommendations from the report referred to in paragraph 3 and 5 of this Article, the public road authority has, within 30 days from the receipt of the report, to explain the possible non-submission to the authority competent for traffic affairs.

The authority competent for traffic affairs shall give a final opinion on the explanation of the public road authority referred to in paragraph 3 and 5 of this Article.

The public road authority is obliged to act upon the final opinion of the authority competent for traffic affairs.

The Minister shall prescribe the method for the implementation of the Audit and Inspection and the content of the Audit and Inspection Report.

Audit and Inspection referred to in Article 88 of this Law may also be implemented on other public roads designated by the Government.

Road Safety Audit (RSA) is defined as: *Road safety audit of safety features of road projects is an independent, formal and systematic check of the road project from the aspect of traffic safety (LR, a. 2, p. 1, pt. 68)*. It has to be carried out on the design characteristic of a project for a new State Road of 1st order, or the existing one to be reconstructed, in all phases of designing before opening a road and six months after opening. 2008/96/EC basically covers the same requiring RSA to form an integral part of the design process of the infrastructure project at the stage of draft design, detailed design, pre-opening and early operation.

Road Safety Inspection (RSI) is defined as: *independent, formal and systematic road traffic safety inspection of existing road elements (LR, a. 2, p. 1, pt. 69)*. Road Authority must provide RSI on a new State Road of 1st order (at least once in five years), and on highest risk road sections, identified as a result of risk mapping. Similarly, Directive 2008/96/EC requires that periodic road safety inspections are undertaken in respect of the roads in operation in order to identify the road safety related features and prevent accidents. Covering highest risk road sections (for other roads) is just a bonus to a provision basically aligned with 2008/96/EC.

Risk mapping, dangerous location identification and ranking

(LR, Official Gazette of Republic of Serbia,
No. 41/2018 and 95/2018 – other Law)

Article 90

„The state road authority has to, at least once in three years, provide for projects of risk mapping for determining the sections of highest risk (hereinafter: Risk Mapping), i.e. projects of identification and ranking of dangerous locations (black spots).

The municipality roads and streets authority has, at least once in five years, to provide for projects of risk mapping, i.e. projects of identification and ranking of dangerous locations (black spots) on the roads under their authority.

For highest risk road locations and sections the public road authority referred to in paragraph 1 and 2 of this Article shall examine in detail the problems of road traffic safety and take measures to eliminate risks.

The Minister shall prescribe the manner of determining the sections of the highest risk and the identification and ranking of dangerous locations (black spots).

Risk Mapping (RM) is defined as: *an objective method of evaluating road safety based on actual unwanted events on the observed road network (LR, a. 2, p. 1, pt. 70)*. In order to identify highest risk road sections and/or highest risk road locations, State Roads Authority must conduct RM procedure at least once in three years, and Municipality Roads Manager at least once in five years. Black Spot Management (BSM) is provided as an alternative or addition to RM. Provisions regarding RM are similar to those prescribed within Directive 2008/96/EC regarding the use of "ranking of high accident concentration sections" and maybe

even "network safety ranking". Exact application of RM has not been clearly defined, but it will be further developed by the rulebook of the respective ministry.

Independent assessment of the impact of road infrastructure on traffic accidents with dead persons (IARAD) is defined as: *independent assessment of the contribution of the public road to the occurrence, or the consequences of a traffic accident*. Assessment should be done based on accident police report (police are obliged to send an accident report to road authorities within 60 days), within 30 days from reception, and remedial measures (if any) should be applied within next 60 days. Inspiration for this procedure has been found in "In Depth Study of Accident" (IDSA).

Independent evaluation of road impact on road traffic accident with dead persons

(LR, Official Gazette of Republic of Serbia, No. 41/2018 and 95/2018 – other Law)

Article 91

In the event of a road traffic accident with at least one dead person, the ministry responsible for internal affairs shall submit a report on the road traffic accident to a competent public road authority, within 60 days from the date of occurrence of a traffic accident.

In the event of a road traffic accident referred to in paragraph 1 of this Article, the public road authority shall provide an independent evaluation of the contribution of the public road to the occurrence or consequences of a road traffic accident (hereinafter: Independent Evaluation) within 30 days from the date of receipt of the road traffic accident report referred to in paragraph 1 of this Article.

The public road authority is obliged to submit the Independent Evaluation to the Public Roads Inspection within 30 days from the date of its receipt.

Based on the Independent Evaluation, in which it was determined that the road contributed to the occurrence or consequences of a road traffic accident, the public road authority, within 60 days from the day of receipt of the Independent Evaluation, takes measures to improve road traffic safety and prevent the occurrence of road traffic accidents, or severe consequences of traffic accidents.

The Minister, with the consent of the Minister of the Interior, prescribes the contents of the report of traffic accidents.

The Minister prescribes precisely the content and method of implementation of the Independent Evaluation.

PROPOSAL FOR CHANGES TO DIRECTIVE 2008/96/EC

On 17 May 2018, the Commission adopted the proposal for a directive amending Directive 2008/96/EC on road infrastructure safety management (Proposal for a Directive of the European Parliament and of the Council amending Directive

2008/96/EC on road infrastructure safety management[3]). It proposes key changes to strengthen road infrastructure safety management procedures and extends the scope of the directive beyond the trans-European transport network (TEN-T). It is based on a proposal for a new road safety framework that follows "safe system approach" which assumes that human beings can and will continue to make mistakes and that it is up to all stakeholders to ensure that road accidents do not lead to serious or fatal injuries (shared responsibility), and in which the concept of "forgiving roads" can also reduce the severity of the accidents that happen.

The proposal replaces the existing provision on the reactive "*safety ranking and management of the road network in operation*" with a new risk-based and pro-active "*network-wide road assessment*" procedure. Such assessments shall be carried out on the entire road network covered by the directive and comprise, according to the proposal, a visual inspection, an analysis of traffic volumes and historic accident data and an assessment of crash and impact severity risk (Debyser, 2018).

Another key change to the existing legislation is the extension of the scope of the directive beyond the trans-European transport network (TEN-T) to motorways and primary roads outside the network as well as road infrastructure projects outside urban areas that are completed using EU funds in whole or in part (Debyser, 2018).

The proposal also establishes general performance requirements for road markings and road signs in order to facilitate the development of cooperative, connected and automated mobility systems. It also makes it mandatory to take vulnerable road users into account in all road safety management procedures (Debyser, 2018).

CONCLUSION AND RECOMMENDATIONS

Currently, Serbian Law on Roads requires almost all Road Infrastructure Safety Management Procedures prescribed by the Directive 2008/96/EC on Road Infrastructure Safety Management. RIA, RSA and RSI are fully aligned with 2008/96/EC provisions. Ranking of high accident concentration sections as per Directive is covered by Serbian Risk mapping. Network safety ranking is not clearly covered since rulebook for the application of Risk mapping has not yet been adopted.

Serbian Law goes even beyond Directive 2008/96/EC requirements, since there are two more procedures to implement: BSM and IDSA. BSM is a very old procedure, but still usable in Serbian conditions, considering road conditions. IDSA is very important to learn about accident causes.

3 European Commission. Brussels, 17.5.2018. COM(2018) 274 final. 2018/0129(COD). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018PC0274. Accessed on 24.03.2019.

Proposal for a directive amending Directive 2008/96/EC will also probably bring a "safe system approach" and concept of "forgiving roads", which are neither present nor planned for the near future in Serbian law.

Vulnerable road users have not been especially taken into account in Serbian Law, but they are included in Road Safety Strategy and probably will be a part of the new Road Safety Law.

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