UDC: 656.1/.5.081-049.5(497.7)
Professional paper

MODEL PROPOSAL REGARDING ROAD SAFETY AUDIT FOR THE REPUBLIC OF NORTH MACEDONIA - AS A PROACTIVE APPROACH TOWARDS PREVENTION OF TRAFFIC ACCIDENTS

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Abstract

In this paper, will be presented a RSA Model proposal, selected on the basis of a systematic engineering approach. The model includes analysis and synthesis of the existing documentation and experience of the developed countries where RSA is carried out in a quite formalized way. The model proposal corresponds to the Macedonian conditions, standards and practice. It presents the general characteristics of the proactive approach, which is at present applicable in the world, and it is based mostly on Danish experiences. RSA Model-proposal is intended and recommended for planning offices in the private and/or public sector, at national or local level, consultant firms, and road agencies and as a practical tool aimed to provide safer roads for all users. It is expected that a significant contribution will be made regarding traffic accidents prevention on the roads in the Republic of North Macedonia.

Keywords: Audit, model, project, procedures, road safety**.**

1 Introduction

The integration into the European traffic road network through the introduction of modern transport technologies, technical-technological and other achievements, as well as market adjustment, requires from the Macedonian traffic system and the road network a new quality, safety and high-speed services.

Road Safety Audit (RSA) is one of the most researched topics related to increasing of road safety levels.

Research on this topic in Macedonia is very modest; there are almost no studies and other documents at all. We are witnessing that in practice there are many illegal and other connections and access roads that endanger traffic safety. On the other hand, the legislation is not clear enough, and the inspectorate and the judiciary are not effective in preventing these connections (accesses). Based on the identification of the problem, the subject and purpose of the research was set - elaboration of a draft proposal for RSA, as the first comprehensive source of instructions for Road Safety Audit.

The RSA draft proposal should help "plan" potentially unsafe features when upgrading to new roads, traffic management projects, and maintenance of existing roads. There are certain cases where, shortly after the commissioning of a new road or a new traffic project, there is a need to change certain features in terms of road safety. A road safety audit will help reduce the need for such changes.

2 Introduction to road safety audit

Road Safety Audit (RSA) is a systematic and independent assessment of road safety parameters. Its goal is to make the new and reconstructed roads as safe as possible - before construction begins and before traffic accidents occur.

In the case of road safety audits, individual projects are examined through a "road safety prism". All elements that do not correspond to the project are revealed and suggestions for improvement are formulated.

The RSA process can best be described as a *proactive approach* to road safety. It is a completely different approach from traditional black spots, used to identify problematic places based on the frequency of traffic accidents. The fundamental feature of RSA is that it is most effective when taken during the early stages of project development and design.

In our road administration, RSA should be an independent stage of quality control and it can be applied to all road projects - construction of new roads, as well as reconstruction. The audit can also be applied to the exploitation and maintenance of existing roads, making an invaluable contribution to the efforts of the road manager to reduce the number of dead and injured people on the roads.

Key elements of RSA are:

- It is a formal examination with a structured process, not just a superficial examination;
- It is performed independently by professionals not participating in the audited project;
- It is performed by a team of qualified professionals, who are representatives of appropriate disciplines; and
- It is aimed exclusively at security issues.

Road Safety Audit must not jeopardize the justification of the project, but must clarify its implications for traffic safety and enable the project to be as safe as possible.

This is where the specific goals of the RSA come from:

- minimize the risk of traffic accidents on new or modified roads,
- avoiding opportunities for the project to lead to an increase in the number of traffic accidents on another part of the road network,
- increase the importance of road safety to all types of users of new or modified roads to be used as safely as possible, and
- reduce the cost of a lifetime of a project - unsatisfactory projects can be expensive to correct once they have been completed.

The main purpose of the security audit, it is “to ensure that all new traffic projects (solutions) function as safely as possible, throughout the entire preparation and construction process, within each project.

During the performance, the main goal of the safety audit is “to ensure that all new traffic projects (solutions) work as safely as possible, throughout the entire process of preparation and construction, within each project.

3 How to introduce road safety audit?

One of the main goals of the RSA is to research projects from a road safety perspective. In order to present RSA, each research must be performed competently, independently and systematically, in accordance with the agreed procedure.

Based on these fundamental principles, the set of guidelines for the implementation of the RSA is known as the general system. The general system consists of three parts:

1. Required organization (participants);

2. Basic procedure;

3. The standard description in the phase of the course of the project where the audit can be performed, i.e. audit phase.

3.1 *Required organization*

- ❖ *Role and responsibilities of the participants*: Each audit is performed by the interaction of different participants; whose roles are pre-defined at certain stages. RSA is based on the principle of independent audit (analogous to external review in the context of quality control). In addition, the fundamental idea is about issues that the designer and the auditor do not agree on, the decision not to be made by the designer, but by the client requesting services from the designer. Based on that, there are three participants in the road safety audit, i.e. *client, designer, auditor*.
- ▪ *The client* (road management) - is an organization that orders the project from the designer, who pays and owns the project. The Road Administration should: (1) approach road safety audits as a requirement within quality control, (2) review the project at an appropriate stage, (3) review a formal audit report, and act on the basis of recommendations when appropriate and feasible.

The client (or his representative) is responsible for the basic terms of the project and is tasked with cases where the designer and the auditor disagree. The discrepancy concerns the client who sends his decision in writing to the designer and the auditor. Roads management is responsible for: (1) selecting the audit team with appropriate training and experience, (2) providing project documentation, (3) ensuring that auditors meet the requirements contained in the defined conditions, (4) participation in initial and final meeting, (5) notification to the audit team of any changes to the project.

- ▪ *The project team* (project organization) or designer - is the contractor - responsible for planning, designing within the project under consideration. The designer should enable RSA to perform project information, project drawings, composition information and traffic characteristics, traffic accident report and all other documents related to the project. The project team / project manager initiates an audit when necessary, participates in the initial and final meeting and discusses issues highlighted in the audit report.

The designer must also take a position on the auditor's comments and present all his disagreements with it to the client for consideration and decision-making.

- ▪ *The audit team* - is an independent organization or individual whose primary role is to identify potential road safety issues; critically reviews and examines project material by reviewing project documentation and drawings and by performing field tours. He usually does not make changes to the project, nor does he make changes. The audit team can use an existing set of checklists to assist in performing the audit. These checklists are only a guide and should not be used as a substitute for experience. They are also a measure of continuity from one audit to another. The auditor lists all the circumstances that cast doubt on security, describes and explains the reasons for that suspicion.

The primary task of the auditor is not to check whether the project complies with road standards. Road standards are an important tool and vital recommendation for the auditor, but the auditor sometimes has to go beyond road standards. The basic assumption is that the designers themselves take a position on the norms, directions and guidelines of the road standards and that they inform the auditors in cases of non-compliance with the standards with an explanation of the reasons.

Road safety auditors work and have experience analyzing traffic accidents and reducing the number of road accidents. In addition, auditors must be familiar with road planning, their design, and construction. They must renew their knowledge.

In the long run, auditors should receive certificates through training offered as preparation for the certification process and pass final qualification exams.

3.2 *Basic procedure*

The procedure within the general system consists of three stages: *order, review* and *completion*.

- *Audit order*: The designer contacts the auditor and they agree on the audit. So, the designer is the one who takes the initiative, whether he chooses an auditor or the client decides. Reviews can be ordered using an existing template, while details are in the contract and can be verified on a special contract form. The designer collects all the drawings (sketches), gets all the necessary information, etc., and then gives them to the auditor. This review includes:

- short description of the project,

- explanation of the project conditions (project speed, curvature radii, slope, visibility criteria, etc.),

- reasons for possible deviations from the road standards,

- traffic density and traffic accident data,

- a set of drawings in 2 copies, and

- explanation for changes in the project after the previous audits.

- *Review:* The auditor reviews the project material. He uses certain checklists to help with this research. The project auditor (drawings) indicates all the obvious problems. The problems are then structured, formulated, reviewed and documented in the first draft of the audit report.

At this point in the process, the auditor contacts the designer to determine whether they share the opinion about the project and its status. Auditors' comments should be presented at two levels: problems and remarks.

- *Problems* are conditions that create an increased risk of traffic accidents. Problems must lead to changes in the project that will eliminate or significantly reduce the risk. The auditor makes suggestions for mitigating the problems. Designing changes is not the job of the auditor.
- *Remarks* refer to the conditions under which, based on the experience, it is necessary to pay attention to the continuation of the project, but in which it is not possible to document an increased risk for the participants in the traffic in the current phase of the audit.

The auditor then prepares proposals for possible guidelines and approaches to addressing these issues.

The auditor reviews the report from the point of view of his quality control system, corrects it, signs it (if several auditors participated in the audit, only one of the signs - a person responsible for the audit).

The diagram illustrates how the arbitration procedure (modification of the project in accordance with the proposal of the auditor or the designer) can be linked to the audit process.

- **Conclusion:** The auditor sends the audit report to the designer and the client. The designer formulates his opinion on every problem mentioned in the report, stating whether the auditor's recommendations will

be adopted; the designer can also prepare alternative proposals for change. The auditor determines whether agreement has been reached on the issues. The auditor may orally present his reports to the designer.

In case of discrepancies regarding the problems or solutions, the designer should inform the client in writing and at the same time send a copy to the auditor, requesting his decision.

The client notifies the designer of his decision in writing and sends a copy to the auditor.

When the audit is completed, either by agreement or with the intervention of the client, the auditor makes a written statement to that effect. Thus, the auditor - not the designer, formally announces that the audit is completed.

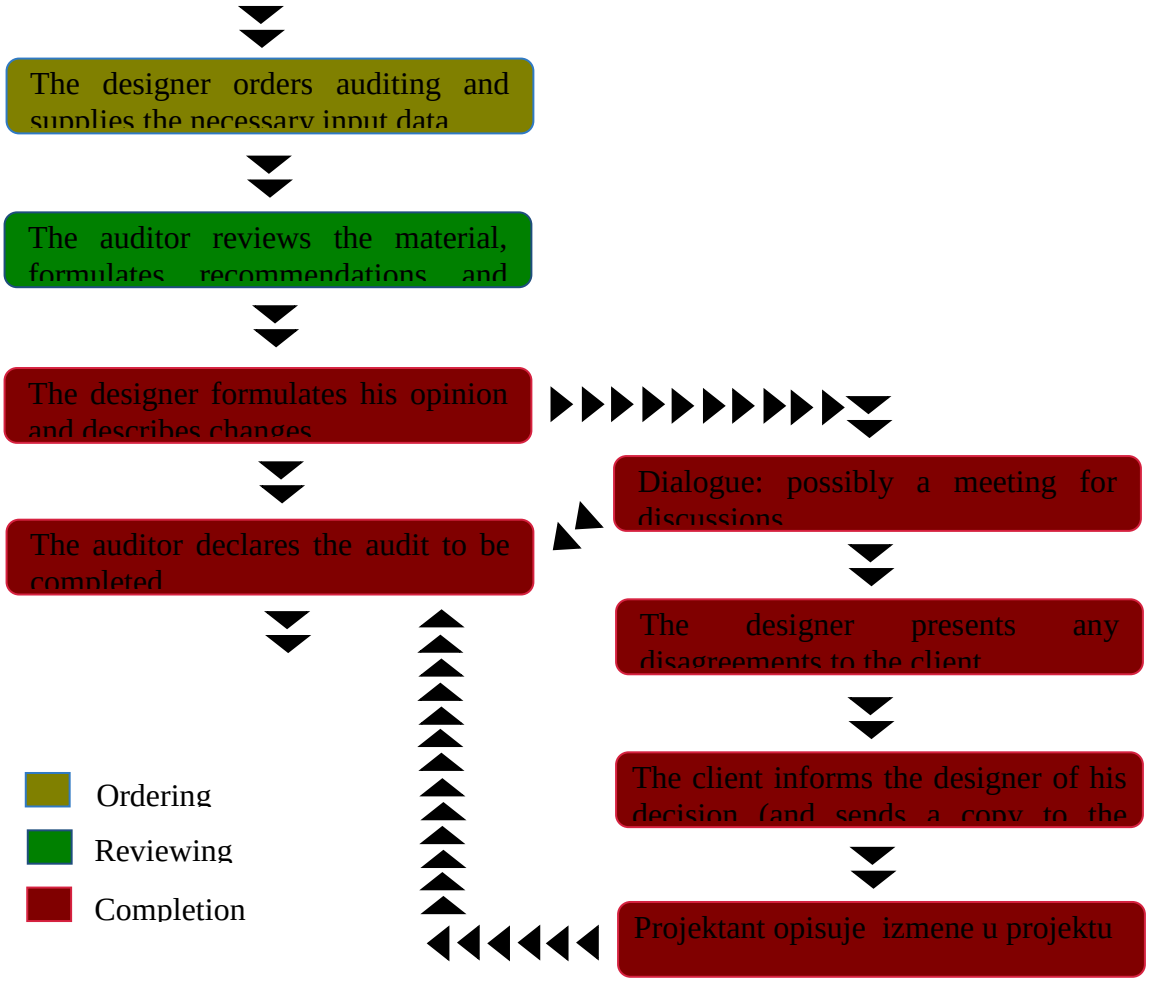

Diagram: Procedure of the audit process

3.3 *Audit phases*

Performing audits several times during the project phases is almost always useful, especially in the case of very small or unusual projects. In the construction of new roads, an important step is to assess the impact of the planned locations and types of intersections on traffic safety, before the detailed design and revision of those intersections. The complexity and level of effort invested in the audit process changes at every stage.

Road safety review is best to be done in five phases of new road projects:

Phase 1: *(Planning)***Initial project***(General)* or feasibility phase. During this phase, the nature and scope of the project are assessed, the starting points for specific design are determined, such as the different variants of the road extension, the important design standards, the connection to the existing road network,

the number and type of intersections, the control of access, locations and types of junctions, the impact of existing infrastructure, and whether the new road should be open to all types of traffic.

Some of these elements are also taken into account during the review at other stages of the project. When more details are available on the project, security considerations become more concentrated. The auditors should concentrate on how the facility will affect the continuity of the adjacent road network and identify the needs of all road users (pedestrians, cyclists, motorcyclists and others). Auditors can be particularly cost-effective because of the low cost of implementation.

Phase 2: *(Conceptual)* **General** (preliminary) project. The audit can be performed after the completion of the general plans of the project. The primary purpose is to assess the relative safety of intersections or junctions, horizontal and vertical longitudinal profiles, cross-section for visibility, width of stop lanes, overall slope and pedestrian capacity, including children, the elderly, the disabled, cyclists and other standards for designing, as well as the layout of the intersection before project acceptance and expropriation. The audit at this stage should be prior to the purchase of the land, in order to avoid complications in case of significant changes in the road profile.

Phase 3: Main project (detailed). All the elements of the main design should already exist during the detailed phase of the project. During this phase, the audit team reviews the characteristics of the final geometric project, traffic signs and road markings, lighting plans, landscaping, intersection and junction elements, acceleration and deceleration lane lengths and turning radius. The team is also considering elements for special groups of traffic participants, such as elderly pedestrians, children, the disabled and cyclists, then drainage, protective fences and other roadside objects, as well as the possibility of construction.

Phase 4: *Opening*, Examining the complete project just *before* or *after opening*. Immediately before the opening of the facility, the audit team should make a field tour, in order to consider whether the safety needs of all traffic participants are adequately met. The audit team should undertake day and night driving during the inspection, and, if possible, inspect at different times. This type of audit determines whether there are any risk conditions that have not been identified during previous audits.

Phase 5: *Monitoring.After* **opening** or existing roads put into use. The road safety audit can be performed immediately after the opening of the new facility. Insight into the work and problems that were not easily visible before opening the facility can be achieved by reviewing. Corrective measures, although more expensive to take at this stage, can still be cost effective. It is possible to assess whether it is used in the intended way and whether some other design changes are needed, based on the actual behavior of the participants in the traffic. Road safety audits also apply to a section of an existing road network to identify safety vulnerabilities. Accident reporting information is an important component of these audits; however, in addition to traditional black spots analysis, they should be supplemented by estimates of the potential for even more traffic accidents.

The first three phases take place while the project is on paper. The last two phases are performed after the project is completed.

The number of phases of the audit will depend on the type of project, and the audit during all five phases will be performed usually in the case of major new projects. In the case of small buildings or reconstruction projects, special audits are rarely performed in the first three stages; these three revisions are merged into one audit, depending on the nature of the design process and the scope of the project.

4 Execution of road safety audit

When a road manager makes a decision to perform an RSA, in the case of establishing a local system, the following approach is recommended.

1. Appointment of the project leader

It is recommended that the project leader be appointed prior to the introduction of the RSA. He will be responsible for advancing the project, preparing the budget, scheduling the time, and so on, and will be in charge of informing the employees. It is recommended that the project leader work closely with road managers who have already introduced the RSA.

2. Defining the phases and types of projects

The types of projects that are important to the road manager and the stages in which the audit of individual types of projects will be carried out should be defined. The management should approve the types of projects and the phases in which the audit will be performed.

3. Defining the local organization

A description should be given within the department and units of local authorities that could play certain roles in the local organization. In doing so, analyze whether one or more employees in the road administration should be sent for training and qualifying examinations for auditors.

If road management hires its employees, it is necessary to emphasize when (for which types of projects and stages of audits), a particular auditor may be considered impartial.

4. Preparation of the audit team

A list of potential auditors needs to be compiled. This list can include people in charge of traffic safety in road administrations, with whom contracts can be concluded, preferably reciprocal.

It is convenient that road auditors should be independent from the project team to ensure their impartiality.

5. Development of the local RSA manual

The local system, its organization, project types, phases, etc. should be described.

6. Referral and training of all parties engaged

It is vital that all employees are fully informed about the audit system, including the basis, purpose and expected effects. In this regard, it is important to clarify all issues of competence (decision-making power).

5 Conclusions

The application of RSA in the Republic of North Macedonia is at its earliest stage. In our conditions, due to the poor condition of the roads and inadequate traffic signals and equipment, RSA would be very necessary in the phase of exploitation and maintenance of existing roads, and should be introduced in the designing phase of new roads.

Regarding the revision of security, in the Republic of North Macedonia should:

- Examine their own procedures for evaluating road infrastructure projects so that they could be more effective given the practice of other EU member states.
- systematic introduction of RSA is necessary - to introduce a mandatory requirement for all major projects on new roads to be subject to safety audit (these audits should be checked in scientific institutions - Faculties, to require the participation of foreign experts);
- over time, formal procedures should be extended to smaller projects, as well as to check the safety of existing roads;
- Public Enterprise “State Roads Agency” should ask the designer to provide an RSA carried out by traffic safety experts. At the very beginning, the audit teams should have engineers who have experience in analyzing traffic accidents and analyzing the state of traffic safety. In addition, a process of licensing of auditors who will perform the training in the authorized scientific institutions and continuous improvement should be introduced;

- basic training course can be attended in the Republic of North Macedonia, with the visit of leading experts from around the world, but advanced training course must be attended in the most developed countries, in their directorates and similar road administrations that successfully perform the RSA;
- preparation of a detailed manual for good practice that can be used together with the instructions;
    - In order to introduce the RSA in the Republic of North Macedonia, Public Enterprise "State Roads Agency" should provide special funds in the road budget, taking into account the relationship between costs and benefits that can be achieved.

References

[1.] Manual of road safety audit, Ministry of Transport, Denmark, 1997.

[2.] Guidelines for The Safety Audit of Highways, The Institution of Highways and Transportation Supported by the 1987 VOLVO Road Safety Award, London, 1990.

[3.] Road Safety Audit and Safety Impact Assessment, European Transport Safety Council, Brussels, 1997.

[4.] Road Safety Audits –A Synthesis of Highway Practice, Washington D.C, USA, 2004.

[5.] Road Safety Audit - Road Safety Audit Guidelines, Canada, 1999.

[6.] Sinani, F., Bombol, K., Prometni principi revizije sigurnosti cesta, Suvremeni promet, br. 1-2, 2008, ISSN 0351-1898. (Rad sa: XV International Scientific Symposium: Transport systems 2008, 17-18 april 2008, Opatia, Croatia) pp. 21-24.

[7.] Sinani, F., Bombol, K., Elementi predlog-modela za reviziju bezbednosti puteva u republici makedoniji, Naučno –stručni skup, 12-14novembar, Palić, - Vojvodina, pp. 33-40.

[8.] Sinani, F., Lindov O., Opći principi revizije sigurnosti cesta, Naućno- stručni časopis iz saobraćaja, transporta i komunikacija u Bosni i Hercegovini, TEC – Traffic Engineering & Communications, decembar, 2014, Sarajevo, BIH, ISSN broj za on-line verziju: 2303-5900, pp. 49 -56.

[9.] Синани Ф., "Проектирање на модел за ревизиони процедури во безбедноста на патната инфраструктура во Република Македонија", Магистерски труд, Технички факултет, Битола, 2007.

[10.] Lindov O.,Sinani, F., BSM- Black spot menagement as mothodology approach in increasing safety of road traffic, International Conference of Applied Sciences, 19-20 May 2017, University of Tetova and Northern Illinois University from USA, , pp. 124-131.

[11.] LindovO,."Sigurnost i zaštita u saobraćaju i transportu", Skripta predavanja, Fakultet za saobraćaj i komunikacije Sarajevo, BiH, 2013.