DEVELOPMENT OF A TRAINING COURSE FOR ROAD SAFETY AUDITORS IN GREECE

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ABSTRACT

Road Safety Audit (RSA) is one of the actions of the Strategic Plan to improve road safety in Greece 2011-2020 and is considered mandatory for the Trans European road Network (TEN-T) according to Greek Presidential Decree 104/2011 regarding road infrastructure safety management and in accordance with European Directive 2008/96/EC. This paper presents preliminary results from a project concerning the development of a training course and training material for candidate Road Safety Auditors in Greece, aiming to adequately prepare them for conducting RSAs. In particular, the analysis of a questionnaire survey for RSA training and certification practices in European countries and Australia is presented, along with the principles upon which the RSA training course is based. Furthermore, the proposed framework of the curriculum is presented, both for the initial training course and for follow-up courses of auditors. The training course that leads to the certification of competency of the candidate auditors takes into consideration recent developments in road safety as well as the local conditions and needs in terms of road safety level, road design guidelines and road safety practices. Evaluation of the training course by trainees and trainers is proposed after an initial period of implementation. On the basis of candidate auditors' and trainers' feedback, certain aspects of the program can be improved. Furthermore, both courses are expected to be reviewed regularly in the light of recent research and developments and also from experience and challenges related to RSA implementation in the country.

Keywords: Road Safety Audit, training program, training curriculum, survey, learning outcomes, human factors, highway safety

INTRODUCTION

A key requirement in order to substantially upgrade road infrastructure safety is the implementation of a comprehensive program in terms of road safety, as applies in a number of developed countries and institutionalized at European level by Directive 2008/96/EC (*1*). Presidential Decree 104/2011 (*2*) adapted Greek legislation to the European Directive on road infrastructure safety management, whose implementation is planned for the Trans-European Road Network of Greece.

Integrated road infrastructure safety management concerns the obligations of those responsible for road infrastructure and traffic to conduct road safety audits [RSA] (during the design and construction phase), road safety inspections (during the operating phase), management of high risk sites and road impact assessments. These comprise the four core methodologies for identifying road safety concerns and their countermeasures in all stages of design, construction and operation of the infrastructure, both proactively and correctively.

For the implementation of the integrated road infrastructure safety management, specific procedures are defined which are related to the training and the responsibilities of auditors, the data which are collected and utilized, as well as the relevant good practices that should be used to tackle the road safety issues that have been identified.

For the successful implementation of the RSA procedure and in accordance with ministerial decision approving the guidelines for road infrastructure safety management (*3*), training and follow-up courses are planned for road safety auditors. Therefore, it is essential to develop a specific training curriculum as well as training material for the candidate road safety auditors.

Under this framework, the Greek Ministry of Infrastructure, Transport and Networks assigned the Hellenic Institute of Transport (HIT) of the Center for Research and Technology Hellas (CERTH) the elaboration of the project entitled: "Development of Training Curriculum and Training Material for Candidate Road Safety Auditors".

In the framework of this project, an extensive questionnaire survey was addressed to relevant agencies and services in Member States and Australia, in order to collect worldwide data on road safety auditor training curricula, the utilized training material and certification procedures. The results of the questionnaire survey were utilized during the development of the Greek training course with the aim to provide a course and the related syllabus that build on good practice from countries that have already adopted Directive 96/2008/EC (*1*), as well as other leading countries in terms of RSA.

The present paper aims to describe some results of the project, which is currently in progress. Specifically the paper presents (i) the main results of an extensive questionnaire survey that was addressed to EU countries that have adopted Directive 96/2008/EC, and to Australia; (ii) the principles for the development of the training course; and (iii) the proposal for the framework of the training course regarding both the initial and periodic training of auditors. Furthermore, the paper presents the definition of RSA and how it relates to the application of design standards and the learning outcomes of the course, including the key features of a meaningful/successful/efficient RSA. The paper also discusses key topics of the course such as the Safe System approach, and consideration of local conditions and needs in terms of road design guidelines and road safety practices.

QUESTIONNAIRE SURVEY

General

The survey was addressed to EU countries that have adopted Directive 96/2008/EC, and to Australia, where RSAs have been successfully implemented for over twenty years. The questionnaire was sent to experts on road safety in agencies and organizations involved in road safety and transport infrastructure who have knowledge of Road Safety Audit practice in their countries. The questionnaire included the following main sections:

- Part A: Adoption and implementation of Directive 2008/96/EC.
- Part B: Implementation of RSAs, in terms of the existence and utilization of relevant standards and guidelines.
- Part C: Initial training and certification for RSAs, with reference to issues such as the content of officially institutionalized training curricula, their duration, the existence of relevant guidelines, the role of various agencies and organizations, the qualifications of candidate auditors, the examination and certification procedure, how long certification is valid for, etc.
- Part D: Periodic training and maintaining competence of auditors, concerning the requirements for maintaining competence, the contents of any periodic training curricula, their duration, etc.

A total of 11 completed questionnaires were received from 10 different countries: Australia, Sweden, the Czech Republic, Hungary, Slovenia, Portugal, Italy, Switzerland, the Netherlands and Germany. The following paragraphs outline interesting data obtained through this survey. Selected questionnaire items are presented in Table 1.

TABLE 1 Selected Questionnaire items

	QUESTIONNAIRE ITEM
Q1	Has Directive 2008/96/EC been incorporated into national legislation in your country? When were these national laws issued?
Q2	Has the scope of Directive 2008/96/EC been extended to other roads in the national network, besides TEN-roads? To which type of roads?
Q3	When were RSA training and certification procedures first applied in your country, or (if not yet applied) when is the planned implementation date?
Q4	Is there any standard or guideline for training and certifying Road Safety Auditors in your country? Please provide the relevant reference(s)
Q5	Are there officially approved current Road Safety Audit Guidelines or Manuals in your country? If yes, please provide the relevant reference(s) e.g., website addresses, in your reply and the date of their official approval.

Q6	Are there any other Road Safety Audit Guidelines or Manuals in use? Please provide relevant references:
Q7	Could you please provide a brief description of the officially approved curriculum of the RSA training courses in your country? Please provide the relevant reference(s)?
Q8	What is the total duration of the RSA training courses in your country?
Q9	Could you please describe how successful completion of the training course is assessed?
Q10	Which are the minimum requirements for awarding a certification for Road Safety Auditing?
Q11	Which organisation or institutes are RSA training course providers?
Q12	Which organisation/authority is responsible for approving RSA training courses?
Q13	Which organisations or institutes award a Certificate of Competence?
Q14	Which organisation/authority is responsible for reviewing and approving the assessment and certification process?
Q15	What is the validity period of the Certificate of Competence?
Q16	Which are the requirements for Road Safety Auditors that hold certificate awarded in another country?
Q17	What are the formal requirements in your country (if any) for certified Road Safety Auditors to maintain their competence?
Q18	What is the duration of the RSA follow-up training courses in your country?
Q19	Could you please briefly describe the curriculum of the RSA follow-up training courses in your country?
Q20	Could you please describe how the successful completion of the follow-up training course is assessed?

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Adoption and Implementation of Directive 2008/96/EC

According to the survey, the provisions of the European Directive have been incorporated into national law in all the European countries that replied to the questionnaire, except for Germany, where the Directive is implemented through existing guidelines in the federal states (Q1). In most cases (60% of responses), the implementation of the Directive has been extended to other roads in the national road network as well, and in the Netherlands and Switzerland to the entire national road network (Q2).

Regarding statutory training and certification procedures, these have begun to be implemented in all countries that participated in the survey (Q3). With the exception of Italy and the Netherlands, standards or guidelines are used for training and certification in the European countries participating in the survey. In Australia, the larger states (Victoria, New South Wales, Queensland, Western Australia and South Australia) have developed their own programs and accreditation procedures on which, those of the smaller ones (Tasmania, the Northern Territory and the Australian Capital Territory - Canberra), are based (Q4).

Implementation of RSA – Existence and Use of Guidelines

With the sole exception of Sweden, all European countries and Australia use approved and current guidelines and manuals on Road Safety Audits (Q5), while in Switzerland, the Netherlands, the Czech Republic and Germany, additional guidelines and manuals are also used for the RSA process (Q6).

Initial Training and Certification for RSA

As part of the questionnaire survey, information regarding the content of the training program for candidate road safety auditors was collected in the aforementioned countries (Q7). The longest programs in terms of duration (Q8), with a relatively broad range of issues, are provided in Germany, Italy and Hungary.

The vast majority of these programs deal with the institutional framework (EU and national legislation) (Italy, the Chech Republic, Portugal, the Netherlands, Germany, Sweden), human factors (Slovenia, Hungary, the Netherlands, the Chech Republic, Germany), road infrastructure safety management (the Chech Republic, Slovenia, Hungary, Italy, Sweden) as well as road safety impact assessment (Slovenia, Hungary). Furthermore, contemporary approaches to addressing road safety are also covered, namely the safe system and self-explaining roads (*4*) (the Netherlands, the Chech Republic, Sweden, Portugal, Slovenia, Hungary), as well as accident analysis (the Chech Republic, Sweden, Hungary, Germany).

Cost-benefit analysis is found in Hungary and Sweden. In Italy the program covers road design and tunnel safety, while the program of Hungary apart from RSA includes specific issues such as the role of speed in road safety and road hierarchy. In Australia there is no national training or accreditation program. Each of the main states has an independent system, but they are all are similar. In all programs there is the practical part which includes conducting RSAs, while in most of them the test procedure is clearly indicated. Key topics covered in RSA training courses of European countries according to the survey responses are presented in Table 2.

TABLE 2 Key topics covered in RSA training courses in European countries participating in the survey

	DE	NL	IT	PT	SI	HU	CZ	SE
Road Safety Audit process	▪	▪	▪	▪	▪	▪	▪	▪
Safety Management and Regulatory Framework	▪	▪	▪	▪	▪	▪	▪	▪
Human factors in road design	▪	▪			▪	▪	▪	▪
Safe System Approach		▪		▪	▪	▪	▪	▪
Road design / Design standards	▪		▪			▪	▪	
Accident analysis Countermeasures	▪		▪		▪	▪	▪	▪

Regarding the duration of the programs (Q8), significant variation can be found. In most cases, the length ranges from 3 to 8 days, or 24 to 48 hours, except in Italy, where the training program lasts 180 hours. In Germany, the duration is 7-11 days in classes plus extra hours of individual preparation depending on the theme. In Hungary, the training hours are spread over a three-month period, while in Slovenia the test is performed two weeks after completion of the program. Australian training programs have a duration of 2-3 days.

Most countries (Germany, the Netherlands, Hungary, Sweden and Italy) state clearly that the successful completion of the RSA training procedure is usually evaluated through written exams (Q9). Reference is also made to practical exercises (Portugal, Australia and Hungary), oral examination (Italy), as well as examination on RSA issues at the final stage of road design. In Australia, depending on the state, the evaluation varies between exercises during the program and presentation of inspection findings in a group of participants, or a combination of the two.

The minimum requirements for certification to conduct RSA in the examined European countries are (Q10):

- Qualifications: Civil engineers or traffic engineers or those with a background in technical or natural sciences (Sweden) with expertise in road safety and design. In Portugal, auditors must be registered with a professional chamber.
- Experience: Mainly in road design, road safety engineering and accident analysis. In most countries the minimum period is five years, with the exception of Slovenia (10 years) and Portugal (3 years).
- Successful completion of the training program.

The first two requirements are usually a precondition for participating in a training program.

In Australia all accredited road safety auditors need to have successfully completed a RSA training course, generally have had a pre-set number of years of professional

experience (although some states may not have this requirement), and have been part of a RSA team for a specified number of audits.

The training bodies vary (Q11). Often they are universities (Italy), research institutes (Portugal, Hungary, the Czech Republic), professional organizations (Switzerland, Hungary) or private firms (the Netherlands, Sweden). In Australia, depending on the state, RSA training is offered by members of the competent authority, universities, research institutes (e.g. ARRB) or recognized consultancy firms. In every case, the competent authorities (ministries) in European countries and Australia are responsible for approving the training programs (Q12). Ministries are training providers in Italy, Switzerland, Slovenia and the Netherlands.

Regarding the roles and responsibilities of bodies involved in the training and certification of candidate auditors, in most cases (70%) training bodies also provide certificates of competence (Germany), in collaboration (Switzerland) or after authorization by the competent authority/ministry (Australia, Italy) (Q13). The competent authorities are responsible for the inspection/supervision and approval of the evaluation and certification process (Q14). In Portugal, Sweden and the Netherlands the certificate is given by the competent ministry/authority.

The certificate of competence (in most of the countries that responded to the relevant question) is valid (Q15) for a certain time period, namely: 3 years in the Netherlands, Portugal, Slovenia, Italy and the Czech Republic, 5 years in Hungary and 1 year in Australia. In Switzerland, the relevant validity period is indefinite and Sweden has not set a specific time period. It should also be noted that in four countries (Netherlands, Germany, the Czech Republic and Australia) the certificates of competence to conduct RSAs issued in other states are not valid (Q16). By contrast, in Slovenia these certificates are valid, while in Portugal and Sweden specific additional conditions are set related to the profession and experience of the Auditor.

Periodic Training and Maintenance of Competence for RSA

In European Directive 96/2008/EC it is stated that road safety auditors, after being awarded the certificate of competence, should participate in further periodic training courses (e.g. participation in shorter educational courses). The conditions for maintaining the competence to conduct RSAs vary in the countries that took part in the questionnaire survey. In general, this is associated with periodic training. In the Netherlands and Germany, an additional requirement in order to maintain competence is the conducting of RSA. Specifically, in the Netherlands, during the three-year validity period the auditor must conduct at least two RSAs, participate in a one-day training course each year and be subject to evaluation by the “Quality Institute”. In Switzerland no fixed requirements have been set, but an auditor meeting is held every two years on problems often encountered in projects. In Hungary, the auditors have to attend a continuous training course lasting 16 hours every 5 years and in Portugal (3-years certificate validity) the auditors must regularly bring their knowledge up to date via an 8-hour course offered by a certified training organization or through other training initiatives recognized by the certifying authority (Q18). In Sweden the auditors have to attend a periodic course of one day per year, while Slovenia provides periodic training of two days (16 hours) every three years. Similarly, in Italy, every three years the auditor should attend an upgraded program lasting 30 hours and in the Czech Republic the periodic training course lasts two days (also every three years).

In Germany, 3 RSAs are to be assigned to auditors in a 3-year period, along with participation in two one-day training courses. Finally, Australia does not provide regular training courses.

Regarding the content of periodic training courses (Q19), the survey revealed that in all countries that took part, emphasis is placed on new advances in the institutional framework, in regulations and in road design. Furthermore, innovations in RSA, road safety management (Italy, Slovenia) and road safety measures (Italy) are presented, as well as relevant experience from European states (Slovenia), national and European directives and guidelines (Slovenia), special issues and specific design cases, e.g. roundabouts, pedestrian safety (Hungary), case studies prepared by the participants (Hungary), examples of road safety improvement measures (Slovenia) and workshops (Hungary and Slovenia)). A key element of training is the exchange of experiences, as well as the interactive training process with the involvement of auditors in discussions and workshops (the Netherlands, Germany, Hungary, Slovenia). In Hungary there is RSA "simulation": a role playing game where the auditor, the client and the designer express all their arguments regarding the RSA proposals.

Of the six countries in which periodic training courses are carried out (Germany, the Netherlands, Hungary, Sweden, Italy and the Czech Republic), in four of them (Germany, the Netherlands, Sweden and the Czech Republic) there is no auditor examination requirement on completion of the training process.

PRINCIPLES FOR THE DEVELOPMENT OF A TRAINING COURSE

The proposed training course was formed on the basis of (a) the definition, principles and scope of RSAs and duties of road safety auditors, (b) the area of expertise and the knowledge framework of the auditors, in accordance with international practice and research, (c) assessments of the relevant institutional framework regarding the qualifications and prerequisites and training of road safety auditors and (d) good practice from leading countries in terms of RSA.

Road Safety Audit

Road Safety Audit is defined as the formal process by which an independent team, holding the necessary skills, investigates the eventuality of road accidents and road safety level for all users on a future road or traffic project or an existing road (e.g. *4*, *5*). It must be stressed that in accordance with modern textbooks worldwide, the term "Road Safety Audit" also includes "Road Safety Inspection", i.e. a Road Safety Audit on existing roads.

Road Safety Audit is based on the principles of the Safe System Approach to road safety applying them proactively. The implementation of Road Safety Audit from the initial stages of road design is an opportunity to support safe user behavior through design. Road Safety Audit aims at improving safety for all road users, in particular the vulnerable. Road Safety Audit ensures the design of a safer, predictable road environment without surprises for road users, with controlled and repetitive provision of information in order to identify risks, which is "forgiving" in terms of road user errors.

During the evaluation of a road design or an inspection of an existing road, the Road Safety Auditor should address the following issues (*6*):

- Who can be injured in an accident of the specific section of the road, and why? How can this happen?
- What types of accidents / collisions may occur?
- How can the likelihood of an accident be reduced or its consequences mitigated?

These questions should be answered by professionals that have careers developed through experience in road safety engineering and collision investigation and good background knowledge of highway and traffic engineering (*4*), (*6*).

RSA vs Design Guidelines

In general, road safety on new roads is pursued through proper design and construction, taking relevant guidelines into account, and on existing roads through systematic maintenance. However, the implementation of design guidelines does not always ensure a high road safety level for the project (*4)*, (*7*). It must be stressed that Road Safety Audit is not a check of compliance with the design guidelines and it is not a substitute for design check. In Road Safety Audit emphasis is placed on proactive assessment of hazards or hazardous situations that might lead to accident occurrence if they are left untreated (*6)*, (*8*).

Road Safety Auditor Skills

As already discussed, the role of the road safety auditor during the evaluation of a road design or the inspection of an existing road, can be summarized as considering who might be injured in an accident on the specific section of the road, how this might happen and how the likelihood of an accident might be reduced or its consequences mitigated. The road safety auditor is a trained professional engineer who evaluates the design of the road (conducted by another engineer) with main criterion of safety for all road users.

For the development of the training course, the following requirements related to road safety auditors (*4*), (*6*), (*8*), (*9*) have been taken into account:

1) Professional experience and knowledge in the area of road safety engineering and accident analysis

a. Knowledge in the field of road safety engineering and accident analysis. They must have an understanding of safety principles. In addition, they must have an understanding of how best-practice highway design can benefit road safety in order to be able to identify risks associated with relevant design elements and therefore contribute to proposals for appropriate and sustainable solutions.

b. Professional knowledge and experience in RSA

The auditor needs to have knowledge and experience regarding the RSA process for both the type and stage of the project - especially when acting as the coordinator of the auditors' team. In addition, auditors need to have up-to-date knowledge and maintain their experience in other areas of road safety engineering as well.

c. Road safety culture

Auditors must be characterized by self-criticism and positive road safety attitudes that determine their behavior and ability to investigate the road project in depth and detail. As the Road Safety Audit is part of the safe system approach and sustainable safety, auditors need to understand and assimilate these principles.

2) Independence

Auditors cannot conduct RSAs on designs in which they have participated.

3) Training

Road safety auditors need training that contributes to the development of the desired knowledge and skills. Training should complement experience in road safety engineering and RSA, and should contribute to the development of knowledge and skills and knowledge of the latest innovative road safety research. In addition, periodic re-training is essential in order for auditors to stay up to date with modern practices in accident investigation and recent research in road safety engineering, including issues from the driver-behavior point of view as well as the latest technological developments in addressing the resulting risks to road users.

4) Other skills

Road safety auditors should have good knowledge of the design guidelines and control data, and also be capable of:

- preparing clear concise reports,
- forming a clear picture of the on-site project from the design drawings and from the point of view of all road users,
- understanding complex layouts and paying attention to details,
- assessing the likely frequency and severity of crashes and errors resulting from localized risk factors,
- discussing and defending their point of view in a constructive and consensus-seeking way, without being arrogant, overbearing or intolerant,
- examining innovative solutions.

Directions for Training as Laid Down in the Institutional Framework

In the European (*1*) and Greek institutional framework (*2*), (*3*), directions are provided for the training and certification of Road Safety Auditors. As stated in the EU Directive (*1*), the initial training should ensure "…*that practitioners get the necessary up-to-date knowledge.",* and *"… that where road safety auditors carry out functions under this Directive, they undergo an initial training resulting in the award of a certificate of competence, and take part in periodic further training courses.*"

From the above provisions, but also based on the emphasis that should be given to RSA in accordance with relevant manuals and guidelines (e.g. *4*, *6*, *8*, *9*), one basic dimension in terms of auditor education and training is to provide new and up-to-date knowledge. The auditors should keep abreast of the latest developments in road safety research, road design, and issues concerning the human factor. The EU Directive provides further guidance in the exchange of best practices and in this respect consistency of the Member States' training curricula is desirable. To this end, findings from the present questionnaire survey were utilized during the development of the Greek training course.

According to the legal framework (*2*) and guidelines for road infrastructure safety management in Greece, candidate auditors must have the necessary qualifications in terms of formal education and experience, i.e. they must be Civil Engineers or Rural and Surveying Engineers (disciplines related to the qualifications requirement for background and experience in road safety engineering) with at least five years experience in design, road safety engineering and accident analysis. After successfully completing an

appropriate training course and examination, such candidate auditors will be able to conduct RSAs.

FRAMEWORK OF TRAINING COURSE

Structure

Road Safety Auditors (as defined internationally) are trained professional engineers specializing in road safety engineering issues who understand the mechanisms of road accidents, know how to deal with them, and are thus able to carry out road safety audits. The proposed training course is designed so that an experienced engineer can be brought up to date with the latest developments in road safety research, road design and human factor concerns. During the process of its configuration, good training practices found in EU Member States are also considered.

The proposed training course consists of two parts: theory and practice. The theoretical part includes three main sections: road safety policy and the institutional framework (Section 1), road safety audit issues (Section 2), and road safety engineering (Section 3). The practical part involves RSA training and examination. A successful performance in the examination results in the acquisition of a certificate of competence.

Since the successful performance in the examination of the candidate auditor with the prerequisite qualifications in terms of formal education and experience lead to the certificate of competence, applicants will be tested on their technical ability to apply knowledge and skills in conducting RSAs.

A key feature of the training process is its dynamic character, since besides the lectures and presentations of the different topics by trainers; provision is also made for the active participation of trainees in the course in terms of collaboration, discussion, exchange of knowledge and experiences, etc.

The safety principles considered in the development of the training curriculum and materials result from the modern international scientific literature and practice in the field of road safety engineering. Road safety engineering aims at creating a road and traffic environment that informs, guides, warns and controls road users and at the same time is "forgiving" of their errors. It should be noted that there is no substitute for the application of sound road safety engineering experience and judgment which form the basis for the formulation of these principles (*10)*, (*11*).

The design of the road and the road environment in accordance with these safety principles is different to a design that just follows the formal design guidelines (e.g. design according to AASHTO design guidelines (*12*) or flexible design according to AASHTO Guide for achieving Flexibility in Highways (*13*)) and in most cases merely involves compliance with the control design values (*7*), (*10*), (*14*). It is widely accepted (*4*), (*6*), (*7*) that a road design which is based exclusively on the design guidelines is not necessarily safe. On the other hand, if the selected values of certain minor design elements do not fall under the suggested control values the road is not necessarily unsafe.

The project aims to deliver original material, appropriate to train professionals with an advanced level of expertise taking also into consideration the local conditions and needs in terms of road design and road safety practices, and road safety level. The training curriculum is expected to be completed before the end of 2015, addressing specific

learning outcomes in terms of knowledge, skills and competence of the candidate road safet auditor.

Learning Outcomes

A set of learning outcomes have been specified for each section/subsection. These learning outcomes represent the knowledge, skills and competences that candidates with a sound road safety engineering experience should acquire through their participation in the training course for the award of a certificate of competence. During the course, candidates will be presented with examples of RSA implementation in all design stages as well as on existing roads using real scheme examples. In the practical part, the course will include case studies and site visit(s) where the participants will have the chance to be trained in the field, and apply in practice what they have been taught in the classroom. The certification of competence is awarded to candidates who prove their knowledge, understanding and ability to undertake a Road Safety Audit at any stage.

Section 1: Road Safety Policy and Institutional Framework

Candidates will become aware of issues of strategic road safety planning and regulatory framework for road safety management; they will also have an understanding of the Safe System approach to road safety and the principles of sustainable safety.

Section 2: Road Safety Audit Issues

Candidates will understand what is a Road Safety Audit and the benefits associated with the RSAs. They will have an understanding of the requirements associated with the road safety audit procedures (phases); they will understand RSA process (steps), objectives and tasks, and will be able to apply processes associated with the road safety audit at any design stage of a project. They will understand auditing principles, roles and responsibilities; the relationship of road safety audit and design standard; how to identify safety problems; the use of checklists; and how to structure an RSA report. Candidates are expected to understand the benefits of conducting audits in early design stages of a project. Candidates are also expected to understand the essential difference of inspection as part of regular maintenance practice and road safety audit of an existing road; the differences and complexities of auditing project(s) at different design stages or of different types, which in turn influence/guide/advise the selection of the audit team members (in terms of expertise and/or experience); and the importance of the audit brief for an effective audit (project scope, details and history). Finally, they will be expected to know how to make realistic and constructive recommendations

Section 3: Road Safety Engineering

Identification and Improvement of Hazardous Locations. Candidates will understand and apply various methods for accident analysis and investigation techniques; they will know how to select appropriate road safety remedial measures and monitor the effectiveness of measures. They will be aware of a method for applying Road Safety Impact Assessment and the use of Crash Modification Factors.

Human factors and safe road design. Candidates will understand the requirements for the implementation of safety principles of Safe System Approach and Sustainable Safety principles in relation to roads, vehicles and road users. They will understand how to apply human factors principles in designing roadway elements (curves, intersections, interchanges, workzones, rural-urban transitions) and traffic engineering elements (signing, markings); how to apply positive guidance principles in road safety audit. They will have an understanding of the driving task, the needs, capabilities, and limitations of road users and how they operate in the driving environment. They will understand how the design influences driving behavior and how the environment contributes to driver errors and collisions; how to apply task analysis method and the effects of demands imposed on drivers by the driving environment; individual differences such as age; how to consider the needs of vulnerable road users in design; and, how design consistency affects driver expectations, which in turn influence driving behavior (including speed selection).

Road safety, road design and design guidelines. Candidates will become aware of the current road design principles and guidelines; they will have an understanding of road design elements and important issues of road design (sight distance, horizontal alignment, cross section, vertical alignment, 3-D road design, road surface operational characteristics such as friction and evenness; they will understand and apply safety principles in road design. They will also be aware of issues regarding functionality and categorization of roads; they will know how to identify and deal with problems associated with transit through roads in built up areas.

Road safety and signing. Candidates will be aware of key elements in signing. They will understand and apply safety principles in signing including workzone signing.

Road safety and vehicle restraint systems. Candidates will be acquainted with key terminology of EN1317 standard, i.e. containment level, impact severity, working width, and performance classes; they will be aware of issues resulting from the mandatory application of EN1317; they will understand which parameters are the basis for decision making on the use of road restraint systems and on which properties/performance parameters of road restraint systems the choice of the appropriate system is based.

Theoretical Part

According to the learning outcomes, the proposed theoretical part of the training course that is 30 hours' duration includes the following sections and subsections:

Section 1: Road Safety Policy and Institutional Framework

Subsection 1.1: Road Safety Policy in Greece and worldwide

Subsection 1.2: Institutional Framework for Road Safety Management in Greece

Subsection 1.3: Good European practices for Road Safety Management

Section 2: Road Safety Audit Issues

- Road Safety Audit Process
- Preparation of a Road Safety Audit report
- RSA roles and responsibilities
- RSA team composition
- Differentiating Road Safety Audits (audit in design stages, on existing roads, on work zones, related to particular road user groups)

Section 3: Road Safety Engineering

Subsection 3.1: Identification and Improvement of Hazardous Locations

Subsection 3.2: Safety by Design

- Definition and analysis of the Safe System Approach
- Human factors and safe road design
- Road safety, road design and review of existing design and safety guidelines
- Road safety and road signing
- Road safety and vehicle restraint systems

Subsection 3.3: RSA Examples

Practical Part

The practical part of the training course includes RSA applications and the examination process. The applications relate to the following:

- RSA case studies at various stages of the project (preliminary design, detailed design, pre-operation) and road safety inspection on an existing road. At this point, organizational issues related to RSA are also tackled (discussion, individual preparation)
- On-site visits and study of material (individual preparation)
- RSA findings and writing of report (individual participation)
- Individual/group presentation of RSA findings.

The above applications cover the RSA procedure from its start up to the presentation of the findings and will contribute to the assimilation of theoretical knowledge and the acquisition of initial experience in conducting RSA. There is provision for emphasis on the specific characteristics of the Greek road network (e.g. low-maintenance level, coexistence of different operational characteristics, poor speed management, etc.) and their importance in the success of RSA.

During the examination process, the performance of the candidates will be taken into account in terms of the following:

- Knowledge of the curriculum
- Conducting RSAs

The proposed duration of the RSA applications and Knowledge test is 12 hours (the hours of individual preparation are not included).

A Road Safety Audit on a project at design stage and an RSA on an existing road section or intersection/interchange are used as an examination.

From the above it is clear that an effective performance in the examination process of a candidate with the necessary qualifications in terms of formal education and experience leads to a certificate of competence. Candidates are then examined on their technical ability to perform as road safety auditors. Once this last process has been completed successfully, the candidate becomes a certified auditor.

Periodic Training Course

Continuing education of Road Safety Auditors aims at the exchange of knowledge and experience in addressing road safety concerns (whether common, more particular, or exceptional cases), as well as procedural issues (collaboration with main contractor, the competent authorities and designers). Furthermore, the above benefits result in delivering improved designs as well as updating the design guidelines.
The one day periodic training course is proposed to cover the following issues:

- New developments in design guidelines (Functionality of road network-Recognizability of roads-Design classes)
- Roundabouts
- RSA on urban roads
- RSA on motorways at design stages
- RSA on workzones
- Specific issues - Experience exchange (organized)

SUMMARY

The training course presented in the present paper, which involves both initial and periodic training of road safety auditors, is the first comprehensive attempt in Greece, in line with the guidelines set by the European and national legal framework. At the present time, the project is in the phase of development of educational material.

The results of the questionnaire survey for RSA training and certification practices in European countries and Australia were utilized during the development of the Greek training course with the aim to provide a course and the related syllabus that build on good practice from countries that have already adopted Directive 96/2008/EC (*1*), as well as other leading countries in terms of RSA. The training course that leads to the certification of competency of the candidate auditors takes into consideration recent developments in road safety as well as the local conditions and needs in terms of road safety level, road design guidelines and road safety practices. Upon completion of the course, candidates are expected to be able to apply accident investigation techniques, human factors and safety principles in road design, to undertake a road safety audit, and to identify the potential for collisions or a safety problem and propose appropriate remedial measures.

The topic covering the Safe System approach is central to the training curriculum. Safe System approach is a road safety strategy based on human factors principles and is already applied in Sweden, the Netherlands (the Dutch Sustainable Safety vision similarly constitutes a state-of-the-art Safe System approach), Australia and several states in the

USA (*15*), (*16*), (*11*). A Safe System approach is one of the only ways to achieve the vision of zero road fatalities and serious injuries and requires that the road system be designed to expect and accommodate human error (*16*). Managing the inter-relationship of travel speed, road infrastructure design, human tolerance and vehicle safety is central to the Safe System approach. In a Safe System, road safety problems are dealt with by considering how several components of the road transport system interact rather than by implementing individual countermeasures in relative isolation (*11*). Candidates are expected to understand the basic principles of sustainable safety, i.e. the importance of designing roads and vehicles according to human capabilities in order to protect and assist the road users; and also the importance of information, education and awareness of road users as well as the role of regulations and enforcement in a sustainably safe traffic system.

Other qualities of the course include human factor considerations in road design; positive guidance principles and approach; a critical analysis of road safety practices and design guidelines in Greece; discussion of challenges to providing positive guidance as identified in workzones in operation; and recommendations to mitigate these challenges. The course is expected to be delivered by professionals experienced in RSA implementation in Greece and educational experience. Emphasis will be placed on key features of successful implementation of RSA and lessons learned from the implementation of RSA so far, i.e., problems identified and the challenges that have been identified in implementing RSA recommendations (*17*).

Following an initial period of implementation, the training course will be evaluated by candidate auditors and trainers to assess whether the program meets their needs in terms of the requirements of the RSA, and whether it provides them with new knowledge. Following evaluation, the program can be improved by taking into account the views of candidate auditors and trainers. A key objective of the course is to develop updating knowledge, meaning that the course is expected to be reviewed regularly in the light of recent research and developments and also on the basis of experience in road safety audit implementation and challenges related to Road Safety Audits undertaken by certified auditors.

Road safety audits could be a catalyst for improving other design projects and design standards and importantly for developing a safety culture among road designers (*4*), (*11*), (*18*). By developing the concept of Road Safety Culture, safety is made inherent to the decision making process, thus affecting the road system in all phases of design, construction and operation. As far as Road Safety (especially RSA) is concerned, engineering knowledge alone is not enough. Further assets are necessary, such as the ability to exercise self-criticism, independent evaluation, in-depth investigation and great attention to every detail in order to define hazards that might have been ignored or not noticed. The training process for candidate auditors must be communicated so as to strengthen the belief that road safety is everyone's responsibility and the common duty is to ensure that safety is an integral part of all choices/decisions that affect the road infrastructure system.

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