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ScienceDirect

Transportation Research Procedia 45 (2020) 258–265

Transportation Research Procedia

www.elsevier.com/locate/procedia

AIIT 2nd International Congress on Transport Infrastructure and Systems in a changing world (TIS ROMA 2019), 23rd-24th September 2019, Rome, Italy

Road Safety Capacity Building in Belarus through the development of Road Safety Master Courses

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Abstract

The risk of traffic fatalities varies significantly across high, medium and low-income countries. Among the reasons for this in the latter ones, there is often a lack of road safety knowledge and political will. Road safety is a multidisciplinary topic and requires trained professionals able to identify and implement efficient measures in the areas of engineering, enforcement, education and emergency services, taking into consideration social and economic aspects as well. However, in some Eastern Europe Countries there are potential barriers to train adequately professionals, generally due to a lack of specialised training and training standardization. Such an example can be seen in Belarus where, although road safety is a key issue, it is not managed on an evidence-based approach and there seems to be insufficient funding for related research. An initiative towards increasing knowledge capacity is the Be-Safe project (EC Tempus), a joint effort between three EU Universities and four Belarusian Universities. The objective of this paper is to describe the methodology carried out in Be-Safe to develop and test for two years two 1st level Road Safety Master Courses (60 ECTS) in Belarus according to the Bologna process requirements. Initially, a User Needs Analysis was carried out to understand local conditions and needs in terms of teaching and research on road safety. The analysis highlighted a lack of research due to insufficient funding, linguistic barriers and inadequate international relationships. This isolation led to a need of updating contents and methods of courses for students as well as research topics. Then, expected learning outcomes and Masters' curricula, one for the Technical Universities and one for the Economics Universities, were defined and developed respectively. Finally, Masters' courses in four Belarusian Universities were tested. Quality results were ensured through a Quality Board and assessment tools to monitor the Masters' process as a whole.

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Peer-review under responsibility of the scientific committee of the Transport Infrastructure and Systems (TIS ROMA 2019).

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10.1016/j.trpro.2020.03.015

Keywords: Traffic Safety; Capacity Building; Education/Training; Higher education; Masters Courses.

1. Introduction

Worldwide, road safety remains an issue of general concern with major societal and economic impacts. In many Countries road accidents have become one of the major causes of death and road safety is regarded as an issue of public health. Although the number of deaths and seriously injured people worldwide is decreasing, the improvement rate is subject to the effectiveness of the measures applied.

In current road safety practice, a number of reference documents, such as the AASHTO Highway Safety Manual (2010) , the Austroads Guide to Road Safety (2009a, 2009b), and the PIARC Road Safety Manual (2014) are being released aiming to provide sound road safety decisions and concurrently warrant the optimal use of the limited funds available. Since road safety is a multidisciplinary and multivariate scientific field, every proposed action and measure should be developed and supported through strategies in the areas of engineering, enforcement, education and emergency medical services taking into consideration social and economic aspects as well. In terms of training professionals, a robust educational curriculum is the key factor to communicate the necessary insights and knowledge within the constantly evolving environment of road safety. An example of such an initiative is the "Belarusian Road Safety Network" project (Be-Safe) of the Tempus Program of the European Commission.

The Be-Safe project was a joint effort between three EU universities (“Sapienza” University of Rome, Loughborough University and National Technical University of Athens) and four Belarusian Universities (Belarusian National Technical University, Brest State Technical University, Belarusian State University of Transport and Belarusian State University of Economics). The key objective of the Be-Safe project was to develop and test for two years two Masters' Curricula in road safety according to the Bologna process standards in Belarus; one for the Technical Universities and one for the Economics University. The objective of this paper is to describe the methodology carried out in Be-Safe to develop and test two 1st level Road Safety Master Courses (60 ECTS) in Belarus according to the Bologna process requirements (European Credit Transfer Systems user Guide, 2009).

2. Road Safety in Belarus since 2006

In 2006 in Belarus, 1,726 people died as a result of road accidents. Ever since, there is a continuous effort at State level aiming to reduce the number of fatalities in road accidents. During the same year (2006), a national road safety action plan titled "The Concept of Road Safety of the Republic of Belarus for the period 2006 - 2015" was released. One of its primary goals was to reduce the number of fatalities in road accidents in 2015 by at least 500 people compared to 2005 (1,673 fatalities). Concerning the European situation, in 2010, the European Union renewed its commitment to improve road safety by setting a target of further reducing road fatalities by 2020 by 50% compared to 2010, thus retaining the level of ambition regarding the priority and importance in addressing this major concern.

The results of the Belarusian road safety action plan for the period 2006-2015, can be seen during the current decade during which the road fatality trends in Belarus show a remarkable improvement and place the country among the best performing European countries. For example, in 2014, the number of road fatalities, though still a major issue, decreased to 757, a figure which is far beyond the expectations set in 2006. Figure 1 provides the relevant comparison regarding EU members and Belarus for 2010 and 2014 respectively. It can be seen that, although in 2010 the country performed worse than all EU members, a significant improvement is noticed four years after 2014. Specifically, road fatalities in 2014 decreased by more than 36% in comparison to 2010. It is clear that road safety in this Country remains a key issue. However, according to the Local Academics, efforts towards stronger road safety improvements are hindered by certain barriers such as:

- Road safety is not managed on an evidence base and there seems to be insufficient funding for related research.
- No funding is available for the implementation of the Plan on the Concept of road safety.
- There is not a clear administration in charge of road safety. The Belarusian Police is partially involved, since the responsibility is dispersed amongst a number of ministries and agencies.

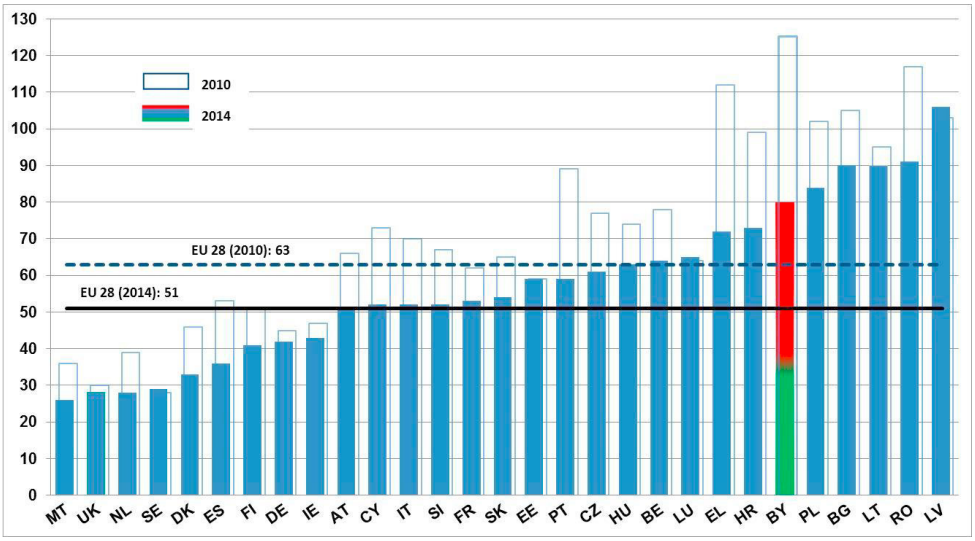

Fig. 1. Road fatalities per million of inhabitants in EU and in Belarus in 2010 and 2014

It it is obvious that current road safety performance in Belarus is improving rather slowly and requires further effort from all road safety authorities and other stakeholders. Moreover, the notable road safety improvement during the second decade of 2000 should be further organized and monitored.

3. Identification of User needs requirements

During the first steps of the Be-Safe project, an analysis carried out in cooperation with Belarusian Universities and stakeholders highlighted the need to strengthen the role of research and start managing road safety policy on an evidence-base in Belarus. Aiming to deliver efficient and comprehensive master's curricula, certain issues were thoroughly examined at the project's opening stage. At the outset, there was a necessity to review and analyse the most relevant and recent experiences and tools in the field of road safety available at international level. However, the most important aspect was to clearly understand local conditions and needs in terms of both research and teaching at the field of road safety. The relevant analysis highlighted several important findings which are briefly stated below. A curricula review was carried out intending to stress the type of available post-graduate courses related to road safety at international level by Universities and other training and educational centers. The goal was to understand whether these courses meet the Belarusian demands for road safety professionals both in public and private sectors. The review specifically focused on:

- Identifying course objectives and intended users
- Identifying the main course contents, learning objectives and competencies
- Identifying duration and effort required (in term of ECTS credits)

The international review of road safety courses revealed a total of 3 Masters of Science in road safety and several road safety post-graduate (non-degree) courses. Both Masters' contents and road safety post-graduate course contents vary a lot according to the targeted users. Some international courses/masters are designed for low- and medium-income Countries. These Countries are experiencing a rapid motorization and the number of road fatalities is growing. Therefore, strong emphasis should be given to capacities such as the ability to make a Road Safety Plan and to support the development of programs in the area of education, enforcement and engineering. A similar scenario is replicated in Belarus, and therefore, a thorough review of the contents and the learning objectives of these courses was performed before developing the Belarusian road safety Master curricula. Furthermore, the

requirements of the Bologna process were considered in the development of the Masters programs in Belarus to ensure transparency and recognition of the individual courses. It was decided that the new Masters program will be set-up accordingly, as a 1 year – 60 European Credit Transfer System (ECTS) credit taught Masters with transparent quality assured content that will allow the course to be recognised within the Lisbon Convention and on par with the European Area of Higher Education (EAHE). The Masters incorporate the following five elements which represent the minimum requirement for consideration when developing a Masters' program and this should ensure a program that is then comparable to other higher education institutions in Europe (Lokhoff et al.,2010).

- **Level**: the Masters program provides a holistic course combining the required skill set through individual modules.
- **Workload**: The workload comprises taught lectures, self-study, coursework and a short dissertation thesis. Credits are assigned to individual modules assessed by the achievement of the learning outcomes through examinations, coursework and the dissertation.
- **Quality**: quality is considered in three stages namely the internal assessment of students academic achievement, fit for purpose of the Master program against set criteria to review the course content, academic rigor and institutional support and ranking of the establishment (university, school or department) at national or international level.
- **Profile**: the profile of the Masters describes in detail general and specific descriptions of purpose, content and student development to map the qualification to future work or study requirements
- **Learning outcomes**: the Masters program have clearly stated learning outcomes to identify what the student is expected to know understand and demonstrate after completion of the course.

In order to understand local background conditions, taking into consideration the current administrative and academic structure of local Universities, a User Needs Analysis (UNA) was carried out by delivering a questionnaire to the local academics where the following objectives were addressed:

- thorough understanding of the background conditions in terms of current Masters' availability and students' earlier preparation
- thorough understanding of the local situation in terms of contents and equipment currently available for the Masters
- thorough understanding of the local needs in terms of Masters' contents on road safety
- thorough understanding of the local needs in terms of new equipment to be provided for the Masters' skills needed to be provided in the Masters' Curricula in order to improve the employment opportunities of Masters' graduates.

The local University educational system revealed an adequate level of designing, managing and analysing road safety. Figures regarding foreign students show that the Belarusian University educational system attracts students from the former Soviet Union Republics as well as China and Turkey. Moreover, local Technical Universities often support local administrations on road safety related projects and are also involved in projects in the former Soviet Union Republics. Regarding road safety research activities in Belarus, there seems to be a problem of isolation from the international research world. This isolation is due to: insufficient funding, linguistic problems and inadequate international relationships. This isolation leads to a necessity of updating contents and methods of courses for students, followed by a need to update research topics in the field of road safety. Another highlighted issue was the low level of technical equipment in the current laboratories. Moreover, the requirements of the Directive 2008/96/EC concerning the establishment and implementation of certain procedures for the management of road infrastructure safety such as Road Safety Impact Assessment (RSIA), Road SafetyAudits (RSA), Management of Road Network Safety (RNS) and road safety inspections (RSI) were taken into consideration. These procedures constitute essential tools for evaluating certain criteria at the initial planning phase, detecting road safety issues, hierarchizing the potential technical-socio-economic impacts, analysing scenarios, proposing interventions and finally controlling their implementation and effectiveness. Therefore, it was very important to include those procedures in the Masters curricula. In addition, different needs for a road safety expert with an Economics

background compared to one with a Technical background were identified. For this reason, the Economics University Master curriculum focuses mostly on RSIA and RNS while the Master curriculum for Technical Universities focuses on all the four tools defined in the Directive 2008/96/EC.

4. Masters' program

As stated, road safety experts with an Economics background compared to those with a Technical background were found to have different needs. Therefore, two master curricula were structured; one for Engineering Faculties and one for the Economics Faculty. The key components of the Master for both the Technical and Economics Faculties are as follows:

- State component which includes modules common to all the Belarusian Masters belonging to a specific category and approved by the Ministry of Education of the Republic of Belarus.
- University component where the theoretical background of the core competencies on the road safety related topics, will be provided. This component has a total of 30 ECTS and 750 hours. Of these hours 50% are of lessons and 50% are of self-studying.
- Research activities & small thesis on a given topic defined by the academics. It includes the drafting of a small thesis. This component has a total of 12 ECTS and 300 hours. These hours are mostly of self-studying with tutoring from local academics.
- Practical activities including on-site, laboratory and practical activities. Specifically, for each core competence excluding "Basic concepts of road safety", 20 hours have been allocated as practical activities for a total of 100 hours and 4 ECTS. Of these hours 50% are for practical activities with academics and 50% are self-studying.

4.1. Master Program for Technical Universities

The Master for the Technical Universities focuses on specific issues related to engineering and management aspects. In particular, the objective of this Master is to create road safety professionals, in accordance with the core competencies for Highway Safety Professionals (NCHRP, 2006), able to:

- define Road Safety management processes
- deal with collection, aggregation and analysis of traffic accident data
- thoroughly analyze accidents and select the most effective countermeasures perform the basic aspects of road safety audits and inspections, and concurrently evolve their experience and expertise on a continual basis relying on the provided theoretical background plan road safety strategies for the short, medium and long term.

Thus, the Master Curriculum for technical universities deals with topics such as road safety management, analysis of road safety data (crash data, safety performance indicators, exposure data, background data), selection of countermeasures (e.g. for infrastructure, vehicles, education and enforcement, etc.), definition of plans, etc. The main ambition of this Master is to license road safety professionals able to work as:

- Experts for Public Administrations, mainly focusing on designing road safety strategies, designing road safety action plans, including selection of road safety interventions and road safety management
- Experts for transport companies, mainly dealing with internal road safety management, in-depth analysis, road safety audits and inspections
- Consultants, able to provide high level independent expertise to Administrations and Companies on road safety issues related with technical aspects
- Researchers.

Table 1 shows the Master components followed by the ECTS, divided in State and University components, Research Activities and Practical Activities respectively. Each core competency included in the so-called "University component" of the curriculum, represents a module of the course.

Table 1. Components of the "Be-Safe master for technical universities"

	Curriculum components	Hours	ECTS
	State component	*350*	*14*
	University component	*750*	*30*
T1	Basic concepts of road safety	125	5
T2	Road Safety Management	100	4
T3	Collection and Analysis of crash data	100	4
T4	Contributing crash factors, countermeasure selection and evaluation	125	5
T5	Road safety policies and plans	150	6
T6	Road Infrastructure Safety Management	150	6
T7	*Research activities& small thesis*	*300*	*12*
T8	*Practical activities*	*100*	*4*
	Total	**1500**	**60**

4.2. Master Program for Economic Universities

The Masters for the Economics University emphasizes specific aspects related to macro and micro-economics as well as econometrics. In particular, the Master aims in forming road safety professionals able to:

- define Road Safety policies
- utilize data collection processes and methodologies
- predict or assess the results (impacts) of these policies
- define strategies to improve the safety of (public and private) company workers.

The Master Curriculum for the Economics University should, therefore, focus on topics such as prediction models, estimation of social costs of road accidents, assessment of impacts, company safety management, policies definition, etc. The main goal of this Master is to authorize road safety professionals able to work as:

- Experts for Public Administrations, mainly focusing on definition of road safety policies and assessment (e.g. through econometrics models) of road safety inter interventions.
- Experts for Companies, mainly dealing with risk assessment of vehicle fleets and drivers workers, mobility management, and specification of the minimum requirements for a Road Traffic Safety Management System (e.g. ISO 39001).
- Consultants, able to provide high level independent expertise to Administrations and Companies on road safety issues related to economic aspects.

Table 2 illustrates the Economics' University Master's modules followed by the ECTS, separated once again in the State and University components, Research Activities and Practical Activities.

Table 2. Components of the "Be-Safe master for economic universities"

Curriculum components	Hours	ECTS
State component	*350*	*14*

	University component	*750*	*30*
T1	Basic concepts of road safety	125	5
T2	Road Safety Management	100	5
T3	Road safety policies and plans	100	4
T4	Econometric models for policy impacts evaluation and forecasting	125	6
T5	Economic evaluation and efficiency assessment tools	175	6
T6	Commuters and professional drivers road safety	75	4
T7	*Research activities& small thesis*	*300*	*12*
T8	*Practical activities*	*100*	*4*
	Total	**1500**	**60**

The Masters were tested in the four Belarusian Universities for two years. Other complementary activities such as the establishment of a road safety laboratory in each local University and study visits at EU Partners Universities were carried out during the project.

5. Quality Monitoring

In accordance with the standard of the European Association for Quality Assurance in Higher Education (ENQA, 2005), the quality of the Masters was monitored and reviewed by a Quality Board comprising of one academic from each Belarusian Universities, three from the EU Universities and four external well known road safety experts.

A Quality Plan was written to ensure standardization of the reviews and to provide the Quality Board with detailed guidelines on how to conduct the overall assessment in line with the expected standards a Master course should obtain in line with the Bologna Process. The Quality Board reviewed:

- the Master curricula whereby recommendations for inclusions were made and incorporated into the Master programs;
- Masters material at the end of the 1st year and 2nd year's delivery;
- students and staff feedbacks trough questionnaires;
- students' final examination and small theses.

Finally, Quality Board's recommendations were produced to improve the integrity of the course. After two years of Masters' testing, the Quality assessment showed that the lesson materials were excellent quality and provided students with an excellent learning opportunity; the student feedback of the Master programs were satisfactory as well as the quality of the small theses. In comparison with other courses in Europe known to the quality board panel, the level of these Masters was considered to be comparable in contents. Thus, it was considered that the students would be well equipped for future jobs in road safety work and research if they were to absorb the knowledge in this one-year program. However, one of the concerns expressed from the review was the experience of the academics to teach road safety in a breadth and depth as the Master courses cover. It was highlighted that their experience related mainly to transport safety rather than a larger road safety perspective and recommended bringing in experts to teach particular aspects for example, road safety audit or human factors. Overall it was recognized by the Quality Board that the development of the Master programs in the project life time was really the beginning of road safety education in Belarus and it was hoped that opportunities will be sought to continue developing this area with partners in Europe and, also, relevant organizations in Belarus itself. In order to enhance the outcomes of the Masters' programs and, also, ensure that the students learning is on par with other European Countries, a list of recommendations was provided below to future proof the teaching of road safety in Belarus:

- Involve other disciplines in teaching of road safety (such as psychologists addressing human behavior and highways engineers to the more technical aspects). This would enable a bridge between current academic knowledge and new academics with road safety as a specialty.

- Encourage the Masters' students towards an academic career in Road Safety to forward this knowledge area in Belarus. Emphasis for their research could be focussed on current gaps in knowledge in Belarus such as social costs, human factors, road safety audit and autonomous vehicles.
- Academics need to publish in International Journals to ensure expertise in road safety is recognized and present at conferences outside of Russian speaking Countries.
- Encourage and nurture young academics to develop the science of road safety in Belarus in order to bridge the gap between old knowledge and the development of a new field; thus,in time, academics would become experts in this field.

6. Impact

Since 2014 there weren't existing Masters in road safety worldwide. The establishment of two first level road safety masters (60 ECTS), according to the Bologna Process standard, was considered a very positive change for Belarus as well as for the EU project Partners Countries (Italy, UK and Greece) whose academics contributed to set up Masters' curricula, contents and material. Moreover, the Masters have been formally approved by the Belarusian Ministry of Education; this means that all the Belarusian Engineering and Economic faculties of Engineering and economics are currently able to set up a first level Master in road safety; the Masters degree is also officially recognized in the European Union since Belarus has become a member of the Bologna process standard. The Masters currently contribute to create new road safety experts to be likely allocated in the public and private transport sector as well as further training professionals already working in this field such as Local Police Officers and traffic management technicians.

7. Conclusions

A robust educational curriculum is essential to communicate to road safety professionals the necessary insights and knowledge gained within the constantly evolving environment of road safety. Based on this, the "Belarusian Road Safety Network" project (Be-Safe) of the Tempus Program of the European Commission aimed to develop and test in Belarus two 1st level University Masters (60 ECTS) according to the Bologna process standards, for Engineering and Economics Faculties. The objectives concerned transferring to Belarus the most recent knowledge and good practices developed in the European Union in the field of road safety and local Universities were the key actors to start this process. After two years of Masters' testing, the overall quality of the Masters were satisfactory, although the experience of the academics were related mostly to transport safety rather than a larger road safety perspective. The Masters have contributed to create new road safety professionals and strengthen the role of road safety research in Local Universities. Moreover, the Masters were formally approved by the Belarus Ministry of Education and the Masters degree officially recognized in the European Union.

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