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Belarus Road Safety Network (BeSafe). 5.3. Review of Masters Curricula

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D5.3: Review of Masters Curricula

eSafe
Belorussian Road Safety Network

Project Acronym:	**Be-Safe**
Duration:	**01/12/2013 - 31/08/2017**
Project Coordinator:	**CTL (Italy)**
Proposal full title:	**Belarusian Road Safety Network**
Project number:	**544181-TEMPUS-1-2013-1-IT-TEMPUS-JPCR**
Document Title:	Review of Masters Curricula
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Summary: Deliverable 5.3 is the review of the Masters curricula of the two 1st level University Masters (60 ECTS) by the Quality Board. The Masters were developed for the Belarusian Universities according to the Bologna process standards within the Be-Safe project. The Deliverable reports the assessment of the initial curricula by the International Quality Board experts.

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1 Introduction

The European Association for Quality Assurance in Higher Education (ENQA) published an agreed set of standard, procedures and guidelines on quality assurance[1] requested by the Ministers of the Bologna Process signatory states in 2003. This document was considered the first step in the quality assurance process and has been adapted and expanded upon in the work of the Quality Assurance Agency (QAA). Within the QAA is the Framework for Higher Education (FHEQ[2]) whose fundamental premise is that qualifications should be awarded on the basis of achievement of outcomes and attainment rather than the number of years of study. The FHEQ is aligned to the Framework for Qualifications of the European Higher Education Area (FQ-EHEA) both having evolved and developed out of the Bologna Declaration and therefore. There are interchanging terms that are considered equivalent between European Countries and include a Master's degree qualification and a 'Cycle 2' qualification. These qualifications are aligned to a set of learning descriptors that a student is expected to have achieved at the end of a cycle 2 qualification and are set at Level 7 (Appendix 1).

The overall aim of the Masters course in Road Safety is to provide students with a range of coherent learning experiences to attain the knowledge at level 7. Thus the higher education providers are required to demonstrate their courses are at the appropriate level and will provide the opportunity for the knowledge acquisition required. In general terms the programmes should have clear direction and be able to demonstrate that the;

- Design of the curriculum and assessments will provide the learning experience to achieve the learning outcomes
- Is the institute able to provide the learning experience
- Intended learning outcomes of the programme are well thought out
- Assessments demonstrate the achievement of the intended learning outcomes

The FHEQ also provides a framework for externally assessing higher education programmes in their Code of Practice, Section 7[3] (www.qaa.ac.uk/academicinfrastructure). In particular (QAA[4]) auditors and reviewers look at how institutions align the academic standards of their awards with the levels referred to in the FHEQ. This Quality Code of Practice exposes the expectations of 'what institutions

[1] Standards and Guidelines for Quality Assurance in the European Higher Education Area; European Association for Quality assurance in Higher Education, 2007, Helsinki

[2] FHEQ The Framework for Higher Education Qualifications in England, Wales and Northern Ireland

[3] Code of practice for the assurance of academic quality and standards in higher education, Section 7: Programme design, approval, monitoring and review

[4] Assurance Agency for Higher Education (QAA) www.qaa.ac.uk/academicinfrastructure

are required to do, what they can expect of each other, and what the general public can expect of all higher education providers'.

Within the framework of the Tempus programme the Belarusian Road Safety Network project (Be-Safe project in the following) has been selected for funding. The project started in December 2013 and will end in August 2017.

The consortium is composed of three EU universities and four Belarusian Universities. The EU Universities are: Research Centre on Transport and Logistics of "Sapienza" University of Rome who are the project coordinators, the Transport Safety Research Centre from Loughborough University and the Department of Transportation Planning and Engineering of National Technical University of Athens. The Four Belarusian Universities are: Belarusian National Technical University, the Brest State Technical University, the Belarusian State University of Transport and the Belarusian State University of Economics. The Belarus Universities are defined as "Local Universities" for the purposes of the report.

The Be-Safe project aimed to transfer 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 through developing and testing in Belarus two 1st level University Masters (60 ECTS) according to the Bologna process standards.

The curriculum for the Masters programmes were iteratively development based on local user needs analysis, experience and review by EU partner Universities and an International Quality Review Board. Furthermore the development of the modules and lesson materials were developed in collaboration between the EU partners and Local Universities. This report progresses the development of the lesson materials in the second year based on the feedback from the Quality Board following the 1st year review (internal report).

With regard to the structure of the Masters, according to the Bologna process new Masters Programme will be defined accordingly as a one-year 60 credit 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).

- To meet these needs, the Masters curricula was based on the most recent and more effective training courses on road safety existing worldwide or on research projects carried out world wide in the last years.

In particular since both Economics and Technical Masters graduates had different needs the Economic University Masters curriculum focussed mostly on Road Safety Impact Assessment (RSIA) and Network Safety Ranking (RNS) while the Master curriculum of Technical Universities focussed on all the 4 tools defined in the European Directive 2008/96/EC.

In conclusion the international review of road safety courses has highlighted that attention must be paid to the definition of the target user of the Belarusian road safety Masters curricula. In short the profile of Masters Graduates should be clearly defined.

2 Quality Board

The role of the Quality Board in the Be-Safe project is pivotal in maintaining comparable standards between European higher education institutions and the Belarusian Universities. In keeping with the Bologna Process the Quality Board is ensuring that a culture of enhancement permeates all aspects of taught provision. Deliverable 5.1 was to set up the Quality Board (QB) which comprised of an academic from each of the three EU partner Universities, four Belarusian Universities as well as four International Experts in the field of Road Safety.

The external project reviews were reliant on the four International Experts to provide valuable insight and experience to the content of the masters programmes. The membership comprised the following;

Professor Evangelos Bekkiaris

Professor Fred Wegman

Professor Rune Elvik

Professor Shalom Hakkert

The Quality Plan was developed and circulated to the Quality Board for review as deliverable 5.2 (appendix) and used to facilitate the quality board reviews at the following time points;

Review of masters curricula (deliverable 5.3 / 1.3)

Review of masters material (deliverable 5.4)

Monitoring and review of the masters 1st year (deliverable 5.5)

Monitoring and review of the masters 2nd year (deliverable 5.6)

3 Technical Universities

3.1 Master objectives and profile of the Master graduates

The Masters for the technical universities, naturally, needs to focus on specific aspects related with engineering and management aspects. In particular, the Masters objective is to create road safety professionals 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 the road safety strategies for the short, medium and long term.

3.2 Master Curriculum

Based on results of the User Need Analysis and on discussions with Belarusian experts a set of "core competencies" for technical road safety professionals was identified. These competencies are intended to provide a broad framework for educating new safety professionals. They represent a fundamental set of knowledge, skills, and abilities needed to effectively function as a professional in road safety.

Core Competencies:

- Basic concepts of road safety.
- Road safety management.
- Collection and Analysis of crash data.
- Contributing crash factors, countermeasure selection and evaluation.
- Road safety policies and plans.
- Road Infrastructure Safety Management

3.3 Programme structure

Each core competency included in the so-called "University component" of the curriculum, represents a module of the course. The structure of the Belarusian Masters curricula has been divided into the following components:

- State component. This component includes modules commons to all the Belarusian Masters belonging to a specific category approved by the Ministry of Education of The Republic of Belarus.

- University component where the theoretical background of the core competences on the road safety related topics will be provided. This component has a total of 30 ECTS[5] and 750 hours. Of these hours 50% are of lessons and 50% are of self-studying.
- Research activities & small thesis. This component will be used by the Master students for research activities on a given topic defined by the academics. It will include drafting a small thesis. This component has a total of 12 ECTS and 300 hours. These hours will be mostly of self-studying with tutoring from Local academics.
- Practical activities. These activities include all on-site, laboratory and practical activities. More 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.

The Be-Safe Masters for technical universities will delivered as a variation of the Belarusian Master's Degree Program in "Intelligent technologies in management of technical systems".

Table 2 shows the Master's components and its ECTS, divided in State and University Components, Research activities and practical activities.

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**

3.3.1 Basic concepts of road safety

This Masters module aims at providing the students with a better understanding of the road safety problems. It introduces fundamental concepts of science-based research that are necessary to

[5] 1 ECTS is about 25 hours of work load.

correctly assess road safety performance and to understand the road safety management techniques.

On completion of this module students should be able to:

- Describe highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes.
- Understand, value, and utilize science-based highway safety research and its application as fundamental to achieving further improvements in highway safety.
- Describe the demographic trends underlying the need for comprehensive and integrated highway safety management (e.g. social, cultural, age, gender).
- Understand the historical figures, benchmarks, and decisions underlying highway safety.
- Describe the classification of highway crash and injury severity factors and their relationship to the crash event (i.e. pre-crash, crash, and post-crash) by using models such as the Haddon Matrix.
- Explain the "Four E's" of traffic safety: engineering, education, enforcement and emergency medical services.
- Being able to explain the difference between random and systematic variation in the number of accidents
- Being able to give a concise definition of the expected number of accidents
- Explain how one can identify the contribution of random and systematic variation in the number of accidents in a population at risk
- Define what regression-to-the-mean means, explain how it can be detected and explain how it can be controlled for statistically
- List the most important theoretical probability distributions that have been proposed for accidents (Poisson, Negative binomial, Poisson lognormal, etc) and explain how one can determine which of these best fits the distribution of accidents in a population
- Explain the concept of exposure and various indicators for it.

The specific topics that will be addressed are:

- The magnitude of the problem (objective and subjective road safety, casualties due to road crashes, road accident costs, differences between countries, transport modes…).
- Science-based research and multidisciplinary approach(the involvement and expertise of individuals from multiple disciplines and multiple modes of transportation, importance of science-based methods used by both engineers and public health professionals; terminology, the

relationship between science and data; and the relationship between data driven approaches and positive crash outcomes, basic concepts of accident statistics and accident theory …).

- Factors affecting exposure, accident rate and injury severity(examples of how road design, land use, and vehicle design may have positive and negative safety consequences for driver decision-making. relationships between road safety and demographic, cultural, and social trends…).

Example references for this module are:

- Elvik, R., Høye, A., Vaa, T., Sørensen, M. (2009). The Handbook of Road Safety Measures, (Chapter 3 and Chapter 4).
- AASHTO, (2010). Highway Safety Manual (Chapter 3).

3.3.2 Road Safety Management

The objective of this component is to provide in-depth knowledge about the Road Safety Management structure (at national and local level) and on how it can be improved.

On completion of this module students should be able to:

- Identify the safety aspects of major transportation legislation.
- List and describe the goals of interest groups with a stake in safety-related policy, legislation, and investment decisions.
- Describe the institutional roles and responsibilities within which safety is managed (e.g., local, regional, state, and federal government, transportation modes and the private sector).
- Explain the importance of establishing a mechanism for co-ordination and commitment to clearly defined responsibilities for road safety measures
- Explain the role of a national forum for regular follow-up of road safety policy, involving an as broad spectrum of stakeholders as possible
- Explain the role of quantified road safety targets as part of management system and describe a process for setting targets that have an optimal level of ambition

This component will focus on (for example):

- Functions composing the road safety management system.
- Foundation for Road Safety Management policy.
- Safety management roles and responsibilities.
- Funding sources, requirements, and opportunities.

Example references for this module are:

- Koornstra, M. et al (2002) “SUNflower: a comparative study of the development of road safety in Sweden, the United Kingdom, and the Netherlands” Leidschendam, Dutch Institute for Road Safety Research.

- European Transport Safety Council (2012) “A challenging start towards the EU 2020 Road Safety Target” 6th Road Safety PIN Report.
- Land Transport Safety Authority (2000) “Road Safety Strategy 2010: A Consultation Document” National Road Safety Committee, Land Transport Safety Authority, Wellington.
- Dupont, E. et al (2010) “Deliverable 1.1/4.1 Consultation of a panel of experts on the needs for data and technical tools in road safety policy-making” EC-funded project DaCoTa – www.dacota-project.eu.
- Muhlrad, N, Gitelman V, Buttler I. (2011) “Deliverable 1.2 Road safety management investigation model and questionnaire” EC-funded project DaCoTa – http://www.dacota-project.eu.
- Bliss, T., Breen, J. (2009) “Country guidelines for the conduct of Road Safety Management Capacity Reviews and the Specification of Lead Agency Reforms, Investment Strategies and Safe System Projects”, Word Bank.
- Piarc (2007), “Road accident investigation guidelines for road engineers”.

3.3.3 Collection and Analysis of crash data

The aim of this component is to highlight the complexity of road accident records in terms of collecting, grouping and analysing accident data. Methods for data collection and types of data will be explored in the context of best practice EU guidelines and how they are used regarding the Accident Management structure at international and local level.

- Specific objectives are to understand the principles and approaches used for collecting accident data at state and local level.
- Evaluate the types of data recognising strengths and weaknesses for each method.
- Interpret crash data and understand how it can be used to develop road safety management strategies.

On completion of this module, students should be able to:

- Describe state and local information systems and data elements that can be used for safety management (e.g., crash, roadway inventory, driver/vehicle registration, citation, hospital/EMS, surveys, operations data, etc.).
- Describe the specialized national databases available for safety management and how they address deficiencies in the systems above.
- Describe the process by which crash data are collected, including constraints associated with accurate, reliable field data.
- Understand the types of accident data and how it is collected and their strengths and weaknesses.

- Be able to interpret the information in accident databases in the correct context.
- Understand the role of quantitative and qualitative analysis of accident data and appropriate use of such data.
- Design an appropriate research approach for a specific problem.
- Identify available data for use in road safety management.
- Select suitable data and analytical approaches for particular road safety problems.
- Understand how to initiate new data collection system to address road safety challenges.
- Critically evaluate the current local road safety problems.
- Formulate analytical solutions to current road safety problems.
- Apply knowledge to future road safety challenges.
- Explain how the level of reporting in official accident statistics can be determined and suggest measures to improve the level of reporting
- Suggest how best to form populations of roadway elements in order to describe the distribution of accidents and form the basis for analyses
- Explain how hazardous road locations can be identified in terms of the long-term expected number of accidents and explain how to minimise the number of false positives and false negatives.

The specific topics that will be addressed are

- Road Safety Data Collection (accidents, exposure, performance indicators).
- Databases and data processing.
- Accident Classification (inside – outside urban areas, age, gender, road user etc.).
- Macroscopic Level Analysis.
- In-Depth Accident Investigation.
- Crash Modification Factors.
- Review of state and local information systems and data elements that can be used for safety management (e.g., crash, roadway inventory, driver/vehicle registration, citation, hospital/EMS, surveys, operations data, etc.).

Example references for this module are:

- Cuerden, R., Pittman, M., Dodson, E. & Hill, J. (2008). The UK On The Spot Accident Data Collection Study – Phase II Report: Road Safety Research Report No. 73. Department for Transport: London.
- http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme5/onthespotaccident.pdf.

- Department for Transport (2004). Instructions for the Completion of Road Accident Reports (STATS20): With effect from 1 January 2005. Department for Transport: London.
- http://www2.dft.gov.uk/pgr/statistics/datatablespublications/accidents/casualtiesgbar/s20instructionsforthecom5094.pdf.
- Hill J.R, Fagerlind H (2012) The DaCoTA On-line manual for In-depth Road Accident Investigators. http://dacota-investigation-manual.eu/.
- Wheat, A (2005) Accident Investigation. ISBN 1-4018-6939-4. Thomson Delmar Learning New York.

3.3.4 Contributing crash factors, countermeasure selection and evaluation

The objective of this component is to provide the student with a comprehensive understanding of crash prevention through the evaluation of:

- Factors that can contribute to crashes – human factors, road infrastructure, and road design, environmental factors, driving behaviour (alcohol, speeding) etc.
- Interpreting the contributory problems and apply suitable countermeasures to reduce crashes – infrastructure, policy, education, enforcement, vehicle design, systems approach, speed management, designing safe road sides.
- Evaluating the application of countermeasures – through pre-and post-assessment measures e.g. injury / casualty statistics, speed assessments.

On completion of this module students should be able to:

- Identify current and potential highway safety problems using suitable scientific methods (e.g., those controlling for regression-to-the-mean).
- Identify the linkages among human factors and behaviour, vehicle design, roadway design, and the environment and their interactions with respect to identified crash problems.
- Identify effective countermeasures that address specific crash factors.
- Establish priorities for alternative interventions/countermeasures based upon their expected cost and effectiveness and select countermeasures to implement (e.g., utilizing current science-based research methods such as NCHRP Report 500 series and NHTSA/FHWA Highway Safety Guidelines).
- Evaluate the effectiveness of the implemented intervention/countermeasure using appropriate statistical techniques in safety management (e.g., use of Empirical Bayes (EB) and/or case-control designs).
- Understand the importance of calculating the expected safety cost/benefit associated with implementing a countermeasure based on numbers of crashes expected to occur if a countermeasure were not implemented.

- Knowledge of the most relevant measures to improve road safety included innovative ITS solutions
- Explain potentially confounding factors in before-and-after studies and how to use the Empirical Bayes method in evaluation studies
- Develop a model for selecting sites for safety treatment on the road network
- Perform a cost-benefit analysis in order to help support priority setting between safety measures.

The specific topics that will be addressed are:

- Cost Effectiveness/Benefit Analysis for countermeasure implementation and evaluation of the effectiveness of the implemented countermeasure using appropriate statistical techniques in safety management [e.g., use of Empirical Bayes (EB) and/or case-control designs].
- Methodologies to explore human factor contributions to crashes to include Human Functional Failure (TRACE), DREAM as well as exploring cognitive psychology and human and driver error.
- Systems approach to crash causation.
- Use case studies to review accident causation and countermeasures.
- Establishing priorities for countermeasure implementation based on current science-based research methods such as NCHRP Report 500 series and NHTSA/FHWA Highway Safety Guidelines.

Example references for this module are:

- NOYES, Janet M., 2001. Designing for humans. Psychology.
- SKYTTNER, Lars., 1996. General systems theory: an introduction. Basingstoke : Macmillan Press.
- Note: 2nd (2005) edition also available.
- SKYTTNER, Lars., 2001. General systems theory: ideas & applications. World Scientific.
- SKYTTNER, Lars., 2005. General systems theory: problems, perspectives, practice. World Scientific.
- DIETRICH, Rainer., 2004. Teaming up: components of safety under high risk. Ashgate.
- BANBURY, Simon., 2004. A Cognitive approach to situation awareness: theory and application. Ashgate.
- HOLLNAGEL, Erik., 2004. Barriers and accident prevention. Ashgate.
- STRAUCH, B., 2004. Investigating human error: incidents, accidents and complex systems. Ashgate.
- ELVIK R., HOYE A, VAA T., SORENSEN M (2009) The Handbook of Road Safety Measures. Emerald Group Publishing.

- Roadside infrastructure for safer European roads: D06 European best practice for roadside design: guidelines for roadside infrastructure on new and existing roads (2006). THOMSON et al. Project RISER, European Community. http://hdl.handle.net/2134/2205.
- RISER consortium (2006) Critical Vehicle and Infrastructure Interactions. Deliverable 3.
- EuroRAP (2009) Star rating for road safety. The EuroRAP methodology. www.eurorap.org.
- Bekiaris, E., Wiethoff, M., Gaitanidou, E., (Eds), "Infrastructure and Safety in a Collaborative World", Springer [ISBN: 978-3-642-18371-3(hardcover) – ISBN: 978-3-642-18372-0 (online)], 2011
- Martinez, M. L., Portouli, E., Nikolaou, S., "Curricula, Tools and Scenarios for driver training related to ITS. HUMANIST, Report of F.3 Task Force F, April 2007
- Papamathaiakis, A., Nikolaou, S., "Multimedia software tool for drivers training in the user of new ITS". HUMANIST, Deliverable F.4, April 2008
- Winkelbauer, M. , Nussbaumer, C., Gaitanidou, E., Bekiaris, E., Road Operators training schemes and tools, In-Safety Deliverable 3.3, March 2008
- Supreme (2007), "Best practices in road safety handbook for measures"
- Piarc (2003), *The World Road Association* "Road safety manual"
- Piarc (2007), *The World Road Association* "Road safety inspection guidelines"
- Piarc (2007), *The World Road Association* "Road safety audit guidelines"

3.3.5 Road safety policies and plans

This component aims to provide the student with key knowledge to analyse EU road safety policies in the context of Belarusian road safety priorities. Using 'best practice' methods and reviews of successful road safety polices they will develop local road safety strategies.

On completion of this module, students should be able to:

- Evaluate the implementation of road safety measures based on in-depth understanding of road safety issues and utilizing evidence-based planning approach
- Realize the importance of monitoring road safety interventions and utilize tools for road safety accountability
- Evaluate the combined effects of several road safety measures through the implementation of pilot studies, cost benefit – cost effective analyses as well as post implementation monitoring
- Utilize scientific management techniques in planning, implementing, and evaluating highway safety programs.
- Identify strategies to integrate and amplify safety in transportation planning processes.

- Explain the need to provide leadership and funding for ongoing service/support enhancements such as professional development, staff education and training, upgraded computer hardware and software and more.
- Establish multidisciplinary relationships necessary to support effective highway safety initiatives.
- Evaluate and adopt international trends in current needs and culture.
- Develop preliminary road safety policies.
- Set up intermediate quantitative targets.
- Distribute monitoring and implementation responsibilities to various authorities.
- Develop in draft form campaigns and promote public participation and support.

The key to road safety policy is having appropriate tools for collecting and analysing accidents to improve monitoring of road safety progress and provide accurate data for developing new road safety measures. The importance of having accurate data will be considered in the context of road safety policy to:

- Identify the problem of social and economic burden of road crashes and injury.
- Understand crash and injury trends.
- Decision making to target resources for effective interventions.
- Identify road crash indicators.
- Set road safety targets and assess performance.

Other topics to be addressed are (indicative):

- Identification, analysis and assessment of critical risk factors.
- Analysis and forecasting procedures and techniques in setting targets.
- Evidence based decision making.
- Legislative issues.
- Speed impact.
- Social cost.
- Cost effectiveness assessment of road safety infrastructure investments.

The use of publications and web-based tools will be used for the purposes of this component mainly from international initiatives such as SAFETYNET, DaCoTA, EuroRAP, IRAP, PIARC, the World Bank and OECD.

3.3.6 Road Infrastructure Safety Management

The present component aims to point out current trends and procedures assessed worldwide and focused on the improvement of road safety performance of the concerned infrastructure.

On completion of this module students should be able to:

- Identify the safety impact in human capacity of certain infrastructure components and design elements
- Get acquainted with the methodologies promoting road safety outlined in Directive 2008/96/EC in order to adapt their efficiency in local conditions
- Perform basic aspects of Road Safety Auditing and Inspection on predefined checklist.
- Justify the implementation of a certain Network Safety Ranking methodology by evaluating different approaches
- Suggest road element combinations to be evaluated not necessarily imposed from design guidelines.
- Define, evaluate and assess through cost-benefit analysis road safety issues that promote selection of proposed solution.

Other topics to be addressed are (indicative):

- Evaluation and improvement of prearranged checklist.
- Utilize multi criteria analysis for decision making.
- Prioritization of criteria to be assessed based on design stage during RSA.
- Fundamentals of traffic impact analysis.
- Inspection scheme management.
- Definition and identification of road sections with high accident concentration.
- Detailed accident analysis and risk factors contributing to accidents.
- Treatment suggestions as well as their implementation and post evaluation.

Certain issues dealing with the above should be analyzed further including: road accident and exposure data collection, processing and analysis at both macroscopic level (police data) and through in-depth investigation (multi-disciplinary specialist teams) aiming to identify accident and injury causation, appropriate countermeasures through uniform cost-benefit/effectiveness analysis.

Example references for this module are:

- European Directive 2008/96/EC.
- The Handbook of Road Safety Measures.
- AASHTO, (2011).
- RAA (2008). Guidelines for the design of motorways
- AASHTO, (2010). Highway Safety Manual (Chapter 3).
- Piarc (2003), The World Road Association “Road safety manual”
- DACOTA. http://www.dacota-project.eu/deliverables.html
- EuroRAP. http://www.eurorap.org/

3.4 Equipment and material

Table 3, Table 4 and Table 5 identify useful equipment and material to support students and academics in teaching and research activities with reference to:

- Publications.
- Software tools.
- Hardware/Other equipment (e.g. computers, peripheral devices, accessories supporting data collection).

Some of the suggested equipment/material is freely available online the other will be bought considering also the budget availability pf the project.

Table 2 Suggested Publications

Title	Authors	Availability
The Handbook of Road Safety Measures	Elvik R., A. Høye, M. Sørensen, T. Vaa	Payment Required
The Highway Safety Manual	American Association of State Highway and Transportation Officials, AASHTO	Payment Required
ISO 39001 "Road Traffic Safety Management"	ISO standards	Payment Required
Practical road safety auditing	Martin Belcher, Steve Proctor and Phil Cook	Payment Required
Infrastructure and Safety in a Collaborative World"	Bekiaris, E., Wiethoff, M., Gaitanidou, E.	Payment Required

Table 3 Suggested Software and tools

Title	Description	Availability
Pc-Crash 10.0 Academic version	PC-Crash™ is a Windows™ collision and trajectory simulation tool that enables the accurate analysis of a wide variety of motor vehicle collisions and other incidents.	Payment Required
TransCAD Transportation Planning Software	TransCAD is a Geographic Information System (GIS) designed specifically for use by transportation professionals to store, display, manage, and analyze transportation data.	Payment Required
R	R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS.	Freely available

Table 4 Other useful equipment

Title	Availability
Pc Workstation desktop or laptop (15)	Payment Required
Laser printer	Payment Required
Traffic count camera	Payment Required
Digital camera	Payment Required

4 Economic Universities

4.1 Master objectives and profile of the Master graduates

The Masters for the economic universities, naturally, needs to focus on specific aspects related with macro- and micro-economics and econometrics. In particular, the Masters objective is to create road safety professionals able to:

- Define Road Safety policies.
- Data collections 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 economic universities will, thus, deal with topics such as prediction models, estimation of social costs of road accidents, assessment of impacts, company safety management, policies definition, etc.

The main ambition of this Masters is to license 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 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. BS ISO 39001).
- Consultants, able to provide high level independent expertise to Administrations and Companies on road safety issues related with economic aspects.

4.2 Master Curriculum

Based on results of the User Need Analysis and on discussions with Belarusian experts, a set of “core competencies” for economic road safety professionals have been identified. These competencies are intended to provide a broad framework for educating new safety professionals. They represent the fundamental set of knowledge, skills, and abilities needed to effectively function as a professional in road safety. Core Competencies are as follows:

- Basic concepts of road safety.
- Road Safety Management.
- Road safety policies and plans.
- Econometric models for policy impacts evaluation and forecasting.
- Economic evaluation and efficiency assessment tools.

- ISO 39001 “Road Traffic Safety Management”.

Each core competency, included in the so-called “University component” of the curriculum, represents a module of the course. Expected learning outcomes[6], derived from for each module are reported in Table 6.

Table 5 Core Competencies and Learning Outcomes.

Core competencies	Learning Outcomes
Basic concepts of road safety	Describe highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes.
	Understand, value, and utilize science-based highway safety research and its application as fundamental to achieving further improvements in highway safety.
	Describe the classification of highway crash and injury severity factors and their relationship to the crash event (i.e., pre-crash, crash, and post-crash) by using models such as the Haddon Matrix.
	Explain the “Four E’s” of traffic safety: engineering, education, enforcement and emergency medical services.
	Describe the demographic trends underlying the need for comprehensive and integrated highway safety management (e.g. social, cultural, age, gender).
	Understand the historical figures, benchmarks, and decisions underlying highway safety.
	Being able to explain the difference between random and systematic variation in the number of accidents
	Being able to give a concise definition of the expected number of accidents
	Explain how one can identify the contribution of random and systematic variation in the number of accidents in a population at risk
	Define what regression-to-the-mean means, explain how it can

[6] Derived from: TRB. 2006. NCHRP Research Results Digest 302: Core Competencies for Highway Safety Professionals. National Academies, Washington, D.C.

	be detected and explain how it can be controlled for statistically
	List the most important theoretical probability distributions that have been proposed for accidents (Poisson, Negative binomial, Poisson lognormal, etc) and explain how one can determine which of these best fits the distribution of accidents in a population
	Explain the concept of exposure and various indicators for it
Road Safety Management	Identify the safety aspects of major transportation legislation.
	List and describe the goals of interest groups with a stake in safety-related policy, legislation, and investment decisions.
	Describe the institutional roles and responsibilities within which safety is managed (e.g., local, regional, state, and federal government, transportation modes and the private sector).
	Explain the importance of establishing a mechanism for co-ordination and commitment to clearly defined responsibilities for road safety measures
	Explain the role of a national forum for regular follow-up of road safety policy, involving an as broad spectrum of stakeholders as possible
	Explain the role of quantified road safety targets as part of management system and describe a process for setting targets that have an optimal level of ambition.
Economic evaluation and efficiency assessment tools	Recognise and interpret the key factors that contribute to crashes (human ,vehicle, road)
	Identify suitable countermeasures to reduce accidents using a combination approach incorporating engineering, enforcement and education
	Evaluate proposed countermeasures and extrapolate the expected benefits of implementing a countermeasure versus not implementing it
	Assess the effectiveness of countermeasures through using different Efficiency Assessment Tools and interpret the evaluations in the correct context; e.g. life saves

	Apply Cost Benefit Analysis into Road Safety applications and measures, including key parametres selection such as discount rates, ROI, Pay Back period targets, etc.
	Apply Cost Effetiveness Analysis from the point of view of different stakeholders.
	Apply review multi-criteria analysis for the evaluation of Road Safety measures (a priori and a posteriori).
	Estimate economic impacts of specific measures (both primary and secondary)
	Find analogies and success case studies to transder to local conditions.
	Derive business modesl for selected measures and implementations
	Perform full life syscle assessment and sustainability analysis of proposed measures
	Recognise the differences in the EATs used and the type of data required to undertake evaluations
	Design an appropriate study to determine the effectiveness of accident countermeasures
	Select and apply suitable analytical approaches to evaluate countermeasures
	Be able to undertake specific EATs using the correct method and interpret the results
	Interpret findings from countermeasure evaluations
	Establish priorities for countermeasure implementation to reduce road accidents
	Understand the basic concepts of a systems approach to crash causation and road safety
	Establish priorities for alternative interventions/countermeasures based upon their expected cost and effectiveness and select countermeasures to implement
Road safety policies and plans	Utilize scientific management techniques in planning, implementing, and evaluating highway safety programs.

	Identify strategies to integrate and amplify safety in transportation planning processes.
	Explain the need to provide leadership and funding for ongoing service/support enhancements such as professional development, staff education and training, upgraded computer hardware and software and more.
	Establish multidisciplinary relationships necessary to support effective highway safety initiatives.
	Evaluate and adopt international trends in current needs and culture
	Develop preliminary road safety policies
	Set up intermediate quantitative targets
	Distribute monitoring and implementation responsibilities to various authorities
	Develop in draft form campaigns and promote public participation and support
Econometric models for policy impacts evaluation and forecasting	Perform road safety data collection, storage and processing
	Perform accident data analysis
	Develop statistical models for time series analysis and prediction
	Evaluate effectiveness of policies and programmes
Commuters and professional drivers road safety	Describe the size and nature of the problem
	Identify the key concepts of ISO 39001 Road Traffic Safety Management
	Set, measure and monitor RTS performance
	Review organizational RTS performances and determine the risks and opportunities.
	Set appropriate RST objectives and targets to achieve them.
General skill	Apply skills in analysis (including statistical analysis) and problem formulation to areas of general debate other than road safety
	Enhance skills in oral presentation of reports on group work, subject to deadlines.

	Present word-processed written reports using structure, paragraphing and citation, appropriate to professional and academic standards in road safety
	Construct tables of statistical data, interpret such data, and carry out statistical hypothesis testing.
	Explain the distinction between random and systematic variation in the number of accidents

4.3 Programme structure

Each core competency included in the so-called "University component" of the curriculum, represents a module of the course. The structure of the Belarusian Masters curricula has been divided into the following components:

Considering the Belarusian Masters structure the Master curricula has been divided in the following components:

- State component. This component includes modules commons to all the Belarusian Masters belonging to a specific category 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[7] and 750 hours. Of these hours 50% are of lessons and 50% are of self-studying.
- Research activities & small thesis. This component will be used by the Master students for research activities, on a given topic defined by the academics. It will include the drafting of a small thesis. This component has a total of 12 ECTS and 300 hours. These hours will be mostly of self-studying with tutoring of Local academics.
- Practical activities. These activities include all in site, lab and practical activities. More 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 of self-studying.

Be-Safe Master for economic universities will delivered as a variation of the Belarusian Master's Degree Program in "Logistics and Road Traffic Safety".

The Table 7 shows the master's components and its ECTS, divided into State and University Components, Research activities and practical activities.

Table 6 Components of the "Be-Safe master for economic universities".

[7] 1 ECTS is about 25 hours of work load.

Curriculum components		Hours	ECTS
	State component	*350*	*14*
	University component	*750*	*30*
E1	Basic concepts of road safety	125	5
E2	Road Safety Management	100	5
E3	Road safety policies and plans	100	4
E4	Econometric models for policy impacts evaluation and forecasting	125	6
E5	Economic evaluation and efficiency assessment tools	175	6
E6	Commuters and professional drivers road safety	75	4
E7	*Research activities*	*300*	*12*
E8	*Practical training*	*100*	*4*
Total		**1500**	**60**

4.3.1 Basic concepts of road safety

This Masters module aims at providing to the students a better understanding of the road safety problems. It introduces fundamental concepts of science-based research that are necessary to correctly assess road safety performance and to understand the road safety management techniques.

On completion of this module students should be able to:

- Describe highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes.
- Understand, value, and utilize science-based highway safety research and its application as fundamental to achieving further improvements in highway safety.
- Describe the classification of highway crash and injury severity factors and their relationship to the crash event (i.e., pre-crash, crash, and post-crash) by using models such as the Haddon Matrix.
- Explain the “Four E’s” of traffic safety: engineering, education, enforcement and emergency medical services.
- Describe the demographic trends underlying the need for comprehensive and integrated highway safety management (e.g. social, cultural, age, gender).
- Understand the historical figures, benchmarks, and decisions underlying highway safety.
- Being able to explain the difference between random and systematic variation in the number of accidents
- Being able to give a concise definition of the expected number of accidents

- Explain how one can identify the contribution of random and systematic variation in the number of accidents in a population at risk
- Define what regression-to-the-mean means, explain how it can be detected and explain how it can be controlled for statistically
- List the most important theoretical probability distributions that have been proposed for accidents (Poisson, Negative binomial, Poisson lognormal, etc) and explain how one can determine which of these best fits the distribution of accidents in a population
- Explain the concept of exposure and various indicators for it.

The specific topics that will be addressed are:

- The magnitude of the problem (objective and subjective road safety, casualties due to road crashes, road accident costs, differences between countries, transport modes…).
- Science-based research and multidisciplinary approach (the involvement and expertise of individuals from multiple disciplines and multiple modes of transportation, importance of science-based methods used by both engineers and public health professionals; terminology, the relationship between science and data; and the relationship between data driven approaches and positive crash outcomes, basic concepts of accident statistics and accident theory …).
- Factors affecting exposure, accident rate and injury severity(examples of how road design, land use, and vehicle design may have positive and negative safety consequences for driver decision-making. relationships between road safety and demographic, cultural, and social trends…).

Example references for this module are:

- Elvik, R., Høye, A., Vaa, T., Sørensen, M. (2009). The Handbook of Road Safety Measures, (Chapter 3 and Chapter 4).
- AASHTO, (2010). Highway Safety Manual (Chapter 3).

4.3.2 Road Safety Management

The objective of this component is to provide in-depth knowledge about the Road Safety Management structure (at national and local level) and on how it can be improved.

On completion of this module students should be able to:

- Identify the safety aspects of major transportation legislation.
- List and describe the goals of interest groups with a stake in safety-related policy, legislation, and investment decisions.
- Describe the institutional roles and responsibilities within which safety is managed (e.g., local, regional, state, and federal government, transportation modes and the private sector).
- Explain the importance of establishing a mechanism for co-ordination and commitment to clearly defined responsibilities for road safety measures

- Explain the role of a national forum for regular follow-up of road safety policy, involving an as broad spectrum of stakeholders as possible
- Explain the role of quantified road safety targets as part of management system and describe a process for setting targets that have an optimal level of ambition.

This component will focus on (for example):

- Functions composing the road safety management system.
- Foundation for Road Safety Management policy.
- Safety management roles and responsibilities.
- Funding sources, requirements, and opportunities.

Example references for this module are:

- Koornstra, M. et al (2002) "SUNflower: a comparative study of the development of road safety in Sweden, the United Kingdom, and the Netherlands" Leidschendam, Dutch Institute for Road Safety Research.
- European Transport Safety Council (2012) "A challenging start towards the EU 2020 Road Safety Target" 6th Road Safety PIN Report.
- Land Transport Safety Authority (2000) "Road Safety Strategy 2010: A Consultation Document" National Road Safety Committee, Land Transport Safety Authority, Wellington.
- Dupont, E. et al (2010) "Deliverable 1.1/4.1 Consultation of a panel of experts on the needs for data and technical tools in road safety policy-making" EC-funded project DaCoTa – www.dacota-project.eu.
- Muhlrad, N, Gitelman V, Buttler I. (2011) "Deliverable 1.2 Road safety management investigation model and questionnaire" EC-funded project DaCoTa – www.dacota-project.eu.
- Bliss, T., Breen, J. (2009) "Country guidelines for the conduct of Road Safety Management Capacity Reviews and the Specification of Lead Agency Reforms, Investment Strategies and Safe System Projects", Word Bank.

4.3.3 Road safety policies and plans

This component aims to provide the student with key knowledge to analyse EU road safety policies in the context of Belarusian road safety priorities. Using 'best practice' methods and reviews of successful road safety polices they will develop local road safety strategies.

On completion of this module students should be able to:

- Evaluate and adopt international trends in current needs and culture.
- Develop preliminary road safety policies.
- Set up intermediate quantitative targets.

- Distribute monitoring and implementation responsibilities to various authorities.
- Utilize scientific management techniques in planning, implementing, and evaluating highway safety programs.
- Identify strategies to integrate and amplify safety in transportation planning processes.
- Explain the need to provide leadership and funding for ongoing service/support enhancements such as professional development, staff education and training, upgraded computer hardware and software and more.
- Establish multidisciplinary relationships necessary to support effective highway safety initiatives.
- Evaluate and adopt international trends in current needs and culture.
- Develop preliminary road safety policies.
- Set up intermediate quantitative targets.
- Distribute monitoring and implementation responsibilities to various authorities.
- Develop in draft form campaigns and promote public participation and support.

The key to road safety policy is having appropriate tools for collecting and analysing accidents to improve monitoring of road safety progress and provide accurate data for developing new road safety measures. The importance of having accurate data will be considered in the context of road safety policy to:

- Identify the problem of social and economic burden of road crashes and injury.
- Decision making to target resources for effective interventions.
- Identify road crash indicators.
- Set road safety targets and assess performance.

Other topics to be addressed are (indicative):

- Identification, analysis and assessment of critical risk factors.
- Analysis and forecasting procedures and techniques in setting targets.
- Evidence based decision making.
- Legislative issues.
- Social cost.
- Cost effectiveness assessment of road safety infrastructure investments.

The use of publications and web-based tools will be used for the purposes of this component mainly from international initiatives such as SAFETYNET, DaCOTA, EuroRAP, IRAP, the World Bank and OECD.

4.3.4 Econometric models for policy impacts evaluation and forecasting

This component covers statistical analysis and modeling of accident data, more specifically it will focus on the development and use of econometric models in the field of transportation with particular attention to road safety.

Competencies from this component are how to predict future developments in road safety of a country and how to set efficient priorities for road safety measures.

On completion of this module students should be able to:

- Perform road safety data collection, storage and processing
- Perform accident data analysis.
- Develop statistical models for time series analysis.
- Evaluate effectiveness of policies and programmes.

Other topics to be addressed are (indicative):

- Count data models (Poisson and Negative Binomial Regression models).
- Discrete response models.
- Multivariate models.
- Time-Series Analysis.
- Hazard / Duration models
- Cluster and factor analysis
- Policy impact assessment, example of applications in road safety.

Example references for this module are:

- Washington, S., M. Karlaftis and F. Mannering. “Statistical and Econometric Methods for Transportation Data Analysis”. CRC Press, 2003.
- Dacota WP4 Time Series Analyses.Dacota WP1 Road Safety Management.

4.3.5 Economic evaluation and efficiency assessment tools

The aim of this module is to understand the approaches taken for decision making at the highest level using Efficiency Assessment Tools (EATs). The most common EATs are Cost Benefit Analysis and Cost Effectiveness Analysis from which policy decision making can be based that will give the highest return on investments. To enable the application of EATs this module will review the systems approach to crash causation and consider potential countermeasures that would mitigate crashes and injury.

On completion of this module students should be able to:

- Recognise and interpret the key factors that contribute to crashes (human, vehicle, and road).
- Identify suitable countermeasures to reduce accidents using a combination approach incorporating engineering, enforcement and education.
- Evaluate proposed countermeasures and extrapolate the expected benefits of implementing a countermeasure versus not implementing it.
- Assess the effectiveness of countermeasures through using different Efficiency Assessment Tools and interpret the evaluations in the correct context; e.g. numbers of lives saves.

- Recognise the differences in the EATs used and the type of data required to undertake evaluations.
- Design an appropriate study to determine the effectiveness of accident countermeasures.
- Select and apply suitable analytical approaches to evaluate countermeasures.
- Be able to undertake specific EATs using the correct method and interpret the results.
- Interpret findings from countermeasure evaluations.
- Establish priorities for countermeasure implementation to reduce road accidents.
- Understand the basic concepts of a systems approach to road safety and crash prevention.
- Establish priorities for alternative interventions/countermeasures based upon their expected cost and effectiveness and select countermeasures to implement.
- Apply Cost Benefit Analysis into Road Safety applications and measures, including key parameters selection such as discount rates, ROI, Pay Back period targets, etc.
- Apply Cost Effetiveness Analysis from the point of view of different stakeholders.
- Apply review multi-criteria analysis for the evaluation of Road Safety measures (a priori and a posteriori).
- Put monetary values to intagible benefits.
- Estimate economic impacts of specific measures (both primary and secondary)
- Find analogies and success case studies to transfer to local conditions.
- Derive business models for selected measures and implementations
- Perform full life cycle assessment and sustainability analysis of proposed measures.

This module will, for instance, focus on:

- Cost Effectiveness/Benefit Analysis for countermeasure implementation and evaluation of the effectiveness of the implemented countermeasure using appropriate statistical techniques in safety management [e.g., use of Empirical Bayes (EB) and/or case-control designs].
- Methodologies to explore human factor contributions to crashes to include Human Functional Failure (TRACE), DREAM as well as exploring cognitive psychology and human and driver error.
- Systems approach to crash causation.
- Use case studies to review accident causation and countermeasures.
- Establishing priorities for countermeasure implementation based on current science-based research methods such as NCHRP Report 500 series and NHTSA/FHWA Highway Safety Guidelines.
- Framework of economic evaluation of Traffic safety measures
- Evaluation techniques and methodologies for CBA, CEA and MCA.
- Case studies and best practices.

- Methodologies for assessing the impact of Safety measures to the overall economy and society.
- Issuing policy recommendations based upon quantified assessment results.

Example references for this module are:

- Road Safety and Environmental Benefit-Cost and Cost-Effectiveness Analysis for Use in Decision-Making Examples of assessed road safety measures - a short handbook - July 2006 (European Commission).
- Baum, H., Höhnscheid, K.-J. (2001) Economic Evaluation of Road Traffic Safety Measures: Germany, in: ECMT, Round Table 117, Paris 2001; P. 5 – 40. Elvik R. (2001a).
- Elvik. R (2003) Cost-benefit analysis of road safety measures: applicability and controversies. Accident Analysis and Prevention 33, 9-17.
- Elvik. R (2003) How would setting policy priorities according to cost-benefit analyses affect the provision of road safety?. Accident Analysis and Prevention 35, (557-570).
- ECMT (2001) Economic evaluation of road traffic safety measures. Report of the 117 round table on transport economics; Paris, October 2000. European Conference of Ministers of Transport.
- Frindstom, L. (1998) TRULS: an econometric model of road use, accidents and their severity. 8th WCTR, Antwerp, July.
- The use of efficiency assessment tools: solutions to barriers; Work package 3 of the European research project ROSEBUD R-2005-2 Shalom Hakkert & Paul Wesemann (eds.) Leidschendam, 2005 SWOV Institute for Road Safety Research, The Netherlands.
- NOYES, Janet M., 2001. Designing for humans. Psychology, Book.
- SKYTTNER, Lars. 1996. General systems theory: an introduction. Basingstoke: Macmillan Press. Note: 2nd (2005) edition also available.
- DIETRICH, Rainer. 2004. Teaming up: components of safety under high risk. Ashgate.
- BANBURY, Simon. 2004. A Cognitive approach to situation awareness: theory and application. Ashgate.
- HOLLNAGEL, Erik. 2004. Barriers and accident prevention. Ashgate.
- STRAUCH, B., 2004. Investigating human error: incidents, accidents and complex systems. Ashgate. Book.
- ELVIK R., HOYE A, VAA T., SORENSEN M (2009) The Handbook of Road Safety Measures. Emerald Group Publishing.
- Roadside infrastructure for safer European roads: D06 European best practice for roadside design: guidelines for roadside infrastructure on new and existing roads (2006). THOMSON et al. Project RISER, European Community. http://hdl.handle.net/2134/2205.
- RISER consortium (2006) Critical Vehicle and Infrastructure Interactions. Deliverable 3.

- EuroRAP (2009) Star rating for road safety. The EuroRAP methodology. www.eurorap.org
- Bekiaris, E., & Nakanishi, Y. J. (Eds.). (2004). "Economic impacts of intelligent transportation systems: innovations and case studies" (Vol. 8). Elsevier, ISBN 0-7623-0978-4, ISSN: 0739-8859 (Series).
- De Brucker, K. & Wiethoff, M., "Implementation scenarios and concepts towards self explaining roads", In-Safety D2.1, October 2006.

4.3.6 Commuters and professional drivers road safety

This component aims to provide the student with key knowledge and skills to implement and maintain an effective Road Traffic Safety Management system according to ISO 39001 standards.

Students should be able to:

- Describe the size and nature of the problem
- Identify the key concepts of ISO 39001 Road Traffic Safety Management
- Set, measure and monitor RTS performance
- Review organizational RTS performances and determine the risks and opportunities.
- Set appropriate RST objectives and targets to achieve them.

This module will, for instance, focus on:

- Work related road safety: Size and nature of the problem
- Work related road safety: Policy frameworks
- Organisation's road safety risks
- Principles and requirements of Road Traffic Safety Management Systems (ISO 39011)
- Audit techniques based on ISO 39011 and risk profiling
- Appropriate interventions to reduce risk and improve effectiveness
- Accident and incident reporting procedures

Example references for this module are:

- International Standard ISO 39001
- SafetyNet (2009). Work-related road safety. Available at: http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/work_related_road_safety.pdf
- Work-related road safety case studies: www.drivingforbetterbusiness.com/casestudies/default.aspx

4.4 Equipment and material

Table 8, Table 9 and Table 10 identify useful equipment and material to support students and academics in teaching and research activities with reference to:

- Publications.
- Software tools.
- Hardware/Other equipment (e.g. computers, peripheral devices, accessories supporting data collection).

Some of the suggested equipment/material is freely available online the other will be bought considering also the budget availability pf the project.

Table 7 Suggested Publications

Title	Authors	Availability
The Handbook of Road Safety Measures	Elvik R., A. Høye, M. Sørensen, T. Vaa	Payment Required
The Highway Safety Manual	American Association of State Highway and Transportation Officials, AASHTO	Payment Required
ISO 39001 "Road Traffic Safety Management"	ISO standards	Payment Required
Practical road safety auditing	Martin Belcher, Steve Proctor and Phil Cook	Payment Required
Economic impacts of intelligent transportation systems: innovations and case studies (Vol. 8)	Bekiaris, E., & Nakanishi, Y. J.	Payment Required

Table 8 Suggested Software and tools

Title	Description	Availability
Pc-Crash 10.0 Academic version	PC-Crash™ is a Windows™ collision and trajectory simulation tool that enables the accurate analysis of a wide variety of motor vehicle collisions and other incidents.	Payment Required
TransCAD Transportation Planning Software	TransCAD is a Geographic Information System (GIS) designed specifically for use by transportation professionals to store, display, manage, and analyze transportation data.	Payment Required
R	R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS.	Freely available

Table 9 Other useful equipment

Title	Availability
Pc Workstation desktop or laptop (15)	Payment Required
Laser printer	Payment Required
Traffic count camera	Payment Required
Digital camera	Payment Required

5 Conclusions

One of the main aims of the Be-Safe project is to develop and test in Belarus two 1st level University Masters (60 ECTS) according to the Bologna process standards, one for Engineering faculties and one for Economics faculties.

With reference to the definition of effective and useful Master curricula on road safety, two preconditions are required to reach these aims. On the one hand there is a need to clearly understand local conditions and needs both in terms of research and teaching on road safety. On the other hand, the need is to review and analyse the most relevant and recent experiences and tools in the field of road safety available at international level. This analysis was carried out and summarized in Deliverable 1.1 "Synthesis of UNA and international review results".

Starting from these results and considerations in this Deliverable (Deliverable 1.3) the Curricula developed for the two 1st level University Masters are reported.

The first step, in the Curricula, is the definition of the objectives that are defined in term of skills and activities that graduates should be able to carry out after the Masters. For Technical Universities the Masters objective is to create road safety professionals 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 the road safety strategies for the short, medium and long term.

While, for Economic Universities the objective is to create road safety professionals able to:

- Define Road Safety policies.
- Data collections processes and methodologies.
- Predict or assess the results (impacts) of these policies.
- Define strategies to improve the safety of (public and private) company workers.

Once the Masters objectives are clearly defined for each Curriculum the core competencies to be delivered are defined and synthesised in Table 11.

Table 10 Core competencies for Technical and Economical Universities.

Tecnical Universities	Economical Universities
Basic concepts of road safety.	Basic concepts of road safety
Road safety management.	Road Safety Management

Tecnical Universities	Economical Universities
Collection and Analysis of crash data.	Road safety policies and plans
Contributing crash factors, countermeasure selection and evaluation.	Econometric models for policy impacts evaluation and forecasting
Road safety policies and plans.	Economic evaluation and efficiency assessment tools
Road Infrastructure Safety Management	Commuters and professional drivers road safety

After the definition of the core competencies the structure of the Masters has been defined and organised in component, according to the Bologna process standards: one-year 60 credit Masters with transparent quality assured content that will allow the course to be recognised within the Lisbon Convention and on par with the EAHE.

The components, both for Technical and Economical Universities, are:

- State component. This component includes modules commons to all the Belarusian Masters belonging to a specific category approved by the Ministry of Education of The Republic of Belarus.
- University component where the theoretical background of the core competences on the road safety related topics will be provided. This component has a total of 30 ECTS[8] and 750 hours. Of these hours 50% are of lessons and 50% are of self-studying.
- Research activities & small thesis. This component will be used by the Master students for research activities on a given topic defined by the academics. It will include drafting a small thesis. This component has a total of 12 ECTS and 300 hours. These hours will be mostly of self-studying with tutoring from Local academics.
- Practical activities. These activities include all on-site, laboratory and practical activities. More 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.

The two Tables below show the Master's components and related ECTS, divided in State and University Components, Research activities and practical activities (Table 12 refers to Technical Universities while Table 13 refers to Economical Universities).

[8] 1 ECTS is about 25 hours of work load.

Table 11 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**

Table 12 Components of the "Be-Safe master for economical universities"

Curriculum components		Hours	ECTS
	State component	*350*	*14*
	University component	*750*	*30*
E1	Basic concepts of road safety	125	5
E2	Road Safety Management	100	5
E3	Road safety policies and plans	100	4
E4	Econometric models for policy impacts evaluation and forecasting	125	6
E5	Economic evaluation and efficiency assessment tools	175	6
E6	Commuters and professional drivers road safety	75	4
E7	*Research activities*	*300*	*12*
E8	*Practical training*	*100*	*4*
Total		**1500**	**60**

For each core competence, the Curricula provide:

- A general description,
- The learning outcomes expected defined in term of skills and activities that students should be able to carry out after the competition of the module on the core competency;

- The specific aspects the modules will focus on
- The list of possible references.

For each Curriculum is also defined the list of equipment and publications to be bought in order to set up an adequate Road Safety laboratory.

Concluding this Deliverable provides two high level Curricula the 1st level University Masters in line with the Be-Safe objectives. These two Curricula are the first step in order to develop and test in Belarus two 1st level University Masters (60 ECTS) according to the Bologna process standards, one for Engineering faculties and one for Economics faculties.

According to these two Curricula is now possible the definition of the materials for the Masters such as presentations and lessons (Deliverable 1.5 - Masters' material) and the setting up of the road safety laboratories in the Local Universities involved in the project (D 1.6 - Set up of road safety laboratories) the two preliminary steps in order to deliver the Masters in Belarus.