THE TEMPUS PROJECT HMCURF

ALFONSO MONTELLA

Summary: *In recent years, there is a growing transport demand in all the countries with developing economies. A modernization and growth in the road network aimed at improving mobility and reducing road fatalities must be accompanied with a substantial and effective training of new professionals in highway design and management. To contribute to the development of new Master degree programs on highway design and management in countries with developing economies according to an international perspective, this paper presents the framework and the main achievements of the Project HDMCuRF – Highway Design and Management: Curricular Reform for Russian Federation Design and Implementation of Higher Education Master Courses in Russia funded by the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Commission within the framework of the TEMPUS IV program. The project supports the transfer of EU higher education best practices in Highway Design and Management to develop advanced university courses to train competent resources. The project makes available to Russian Universities knowledge, management approaches, modeling and assessment techniques which are adapted and taken over by the Russian higher education system. Those best practices are based on the principles of the European Credit Transfer System and the recognition of the university degree. The EU participants share best practices, training management and quality assurance approaches according to the Bologna principles to support the development and diffusion of an innovative experience in technical higher education in Russian institutions supporting the capacity and knowledge building in highway and traffic engineering.*

Keywords*: master courses, learning outcomes, European Higher Education Area, TEMPUS program, Russian Federation.*

INTRODUCTION

In recent years, there is a growing transport demand in several countries where the transport system is facing a substantial development phase, thus becoming a strategic factor for socioeconomic development. However, several issues compromise the effectiveness of the road network, whose standards and operations are generally far from the standards of the countries with the most advanced transportation systems. A key issue is that the safety situation is challenging and the traffic increase will produce dramatic effects in the next years in terms of fatalities in traffic crashes if effective actions will not be carried out.

Alfonso Montella, Ph.D., P.Eng., Associate Professor;
Department of Civil, Architectural and Environmental Engineering; University of Naples Federico II
Via Claudio 21, 80125 Naples, Italy; E-mail: alfonso.montella@unina.it

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H. Gao, J. Guo, Y. Zhang andZ. Zha are with the School of Information Science and Technology, Southwest Jiaotong University, Chengdu 610031, China (e-mail: swjtu_gh@163.com). Corresponding author: Y. Zhang (ydzhang@home.swjtu.edu.cn).

A modernization and growth in the road network aimed at improving mobility and reducing road fatalities must be accompanied with a substantial and effective training of new professionals in highway design and management. Therefore, it is essential to update the higher education training systems to provide qualified professional resources capable of sustaining and managing the huge effort of road infrastructure development. At this aim, efforts of international collaboration have the potential to provide significant benefits.

In 2011, Russian universities launched a programme of transition to a tiered system of Higher education for the majority of technical professions. The reform of educational programs corresponds to the national scope of upgrading engineering education in accordance to a structure with three cycles of Higher education and the introduction of the European Credit Transfer and Accumulation System. The development of new Bachelor and Master degree programs, which are respectively the first and the second cycle in the Framework for Qualifications of the European Higher Education Area, requires harmonization of the structure and the contents of the educational curricula within the framework of Bologna requirements and international standards to introduce the programs in the academic mobility system. To contribute to the development of new Master degree programs on highway design and management in Russian Federation according to an international perspective, this paper presents the framework and the main achievements of the Project HDMCuRF – Highway Design and Management: Curricular Reform for Russian Federation Design and Implementation of Higher Education Master Courses in Russia funded by the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Commission within the framework of the TEMPUS IV program. The project started on 15th October 2011 and will finish on 14th October 2014.

In Russian Federation, the highway safety situation is serious and challenging and deserves of continuing high priority in national, regional and local governance. In the year 2010, 26,567 road fatalities occurred in Russian Federation (RF). When compared internationally, fatality rates in crashes on Russian roads are till seven times as high as experienced in the global best performing nations in road safety. As an example, in the Russian Federation there are 62.8 fatalities per 100,000 vehicles whereas the same fatality rate is equal to 8.5 in Australia and 10.0 in EU27 (*1-3*). In other words, if the RF ratio fatalities/vehicles in year 2010 was equal to the EU27 ratio then the number of fatalities was equal to 4,261, i.e. a reduction of 22,306 fatalities compared to the actual 26,567 fatalities. Moreover, Russian Federation is a huge country with an inadequate road network density of only 6 km roads/100 km^2 land compared for example to 67 km/100 km^2 of US, 180 km/100 km^2 of Germany or 40 km/100 km^2 of China etc., that cannot serve the economy and social needs of its population. Conscious of this reality the Russian Federation has developed its strategies to develop the road network of the country in the years to come (*5-10*). According to this strategic plan construction of more than 7000 km of freeways at international standards is planned in Russia until 2030. Design and construction of these highways require specialists and experts with high qualification at different levels in highway design and construction to be involved, and harmonization of educational programs for

training of such specialists and experts based on international standards.

The project objective was to design, develop and implement new master programs in Highway Design and Management in a joint effort between EU and Russian Universities in line with Bologna requirements. The project supports the transfer of EU higher education best practices in Highway Design and Management to develop advanced university courses to train competent resources. The project makes available to Russian Universities knowledge, management approaches, modelling and assessment techniques which are adapted and taken over by the Russian higher education system. Those best practices are based on the principles of the European Credit Transfer System and the recognition of the university degree. The EU participants share best practices, training management and quality assurance approaches according to the Bologna principles to support the development and diffusion of an innovative experience in technical higher education in Russian institutions supporting the capacity and knowledge building in highway and traffic engineering.

EU partners are University of Naples Federico II (UniNA, Italy, coordinating institution), National Technical University of Athens (NTUA, Greece), Royal Institute of Technology (KTH, Sweden), and FORMIT Foundation (Italy). Russian partners are Orenburg State University (OSU), Moscow State Automobile and Road University (MADI), Altai State Technical University (ASTU), and International Association for Automotive and Road Engineering Education (IAAREE).

PROJECT MANAGEMENT

The project consists in five Work Packages (WPs): (1) Project Management; (2) Development of a Master Programme in Highway Design and Management; (3) Quality assurance process; (4) Dissemination strategy; and (5) Sustainability strategy. The project management structure (see Figure 1) includes a Project Management Board (PMB), the Project Manager (PM) alias the Grant Applicant representative or the coordinator, the Quality Manager (QM) and the Work Package Leaders (WPLs). The PMB is formed by one representative of each consortium member, including the PM, the QM, the WPLs and others not involved in the mentioned roles, in a number of one representative from each participants, in order to guarantee successful development of the project.

The PMB is responsible for: decision making on project activities including corrections of activities time-table; conflict resolution mechanism for any issue may arise; quality control management including special committees establishment; continuous communication on running project's activities; revision of deliverables of the project. All project results and changes in activity plan are approved by the PMB.

Six management meetings have been organized during the project implementation for coordination and reporting. Inception meeting was carried out in Moscow (November 2011). Then, five PMB meetings have been carried out in Naples (June 2012), Athens (December

2012), Barnaul (July 2013), Stockholm (April 2014), and Orenburg (October 2014).

All partners have contributed to the management activities and twenty-four skype calls were carried out with delivery of to dos list before the calls, participation of all partners, and delivery of the minutes within one week from the call. Moreover, for managing the review process of the teaching material, a Review Board has been established.

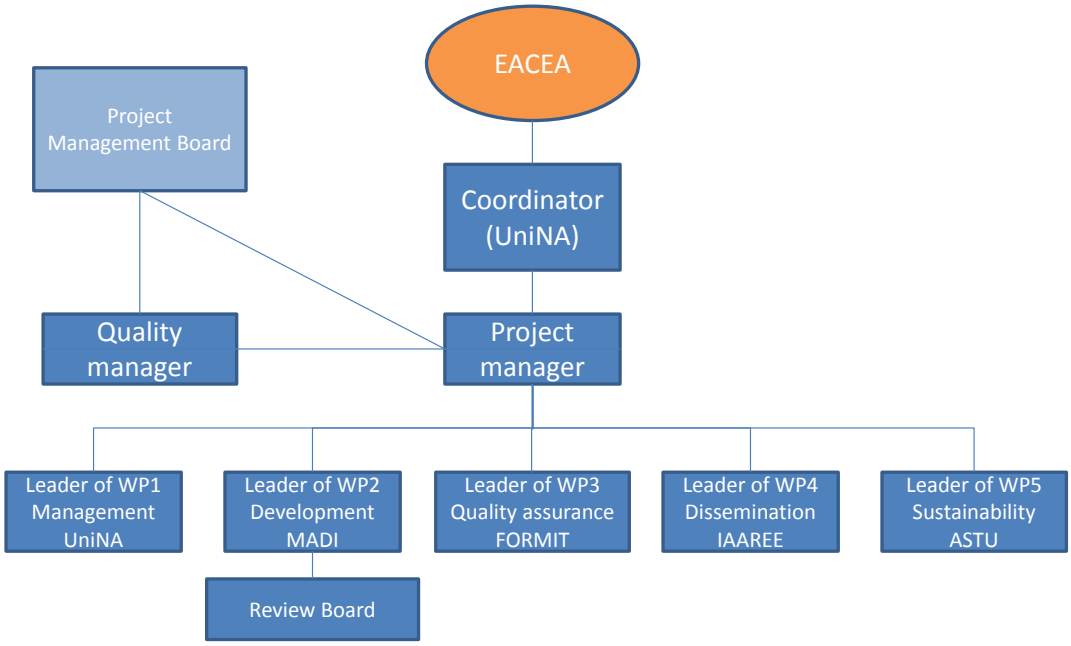

Figure 1. *Project management organisation.*

MASTER COURSE DEVELOPMENT AND IMPLEMENTATION

In 2005, the European Ministers Responsible for Higher Education (*4*, *7*) have adopted the overarching framework for qualifications in the European Higher Education Area (EHEA), comprising three cycles (bachelor, master of science and doctorate of philosophy), generic descriptors for each cycle based on learning outcomes and competences, and credit ranges in the first and second cycles (*8*). The European Ministers have pointed out that the European Higher Education Area must be open and should be attractive to other parts of the world.

The master course in Highway Design and Maintenance (HDM) corresponds to a second cycle in the Framework for Qualifications of the EHEA. The course duration is 2 years, which are equivalent to 120 European Credit Transfer and Accumulation System (ECTS) (*9*). ECTS was originally set up in 1989 as a pilot scheme within the framework of the Erasmus program in order to facilitate the recognition of study periods undertaken abroad by mobile students. ECTS is a learner-centred system for credit accumulation and transfer based on the transparency of learning outcomes and learning processes. It aims to facilitate planning, delivery, evaluation, recognition and validation of qualifications and units of learning as well as student mobility. It is used in the European Higher Education Area, involving all countries engaged in the Bologna Process. Most Bologna countries have adopted ECTS by law for their higher education systems.

ECTS credits are based on the workload students need in order to achieve expected learning outcomes. Workload indicates the time students typically need to complete all learning activities (such as lectures, seminars, projects, practical work, self-study and examinations) required to achieve the expected learning outcomes. 60 ECTS credits correspond to the workload of a fulltime year of formal learning (academic year). Credits are allocated to the entire study program as well as to his educational components (such as modules, internship, and thesis). The number of credits ascribed to each component is based on its weight in terms of the workload students need in order to achieve the learning outcomes.

Learning Outcomes

The HDM course is based on the learning outcome approach and learning outcomes have been defined for each module (see Table 1). Learning outcomes describe what a learner is expected to know, understand and be able to do after successful completion of a learning process and are defined in terms of knowledge, skills and competence (*10*).

Knowledge means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual.

Skills mean the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

Competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.

Qualifications that signify completion of the second cycle are awarded to students who have:

1) Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research critical awareness of knowledge issues in a field and at the interface between different fields;

2) Specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields;

3) Competence to manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams.

Table 1. *Learning Outcomes of the Module Highway Safety Analysis and Management*

Knowledge	– Highway safety fundamentals. – Crash data characteristics and limitations. – Predictive methods to support actions based on empirical evidence, science, and technology. – Procedures for highway safety management, including network screening, diagnosis, selection and prioritization of countermeasures. – Advanced safety management tools required by the EU Directive 2008/96/EC on road infrastructure safety management such as road safety impact assessment, road safety audits and road safety inspections.
Skills	– Identify required data to apply safety performance functions. – Use relevant safety performance functions for estimating expected average crash frequency (including by crash severity and crash types) of a network, facility, or individual site. – Evaluate and compare the expected average crash frequency of existing facilities, alternative designs for an existing facility, and designs for a new facility under future traffic volumes. – Calibrate safety performance functions to reflect local conditions. – Calculate expected crashes at a specific location using the safety performance functions (that represent an average crash for a type of facility) in conjunction with historic (observed) crash information unique to the site of interest by the empirical Bayes approach. – Use available resources and data-warehouses to identify appropriate crash modification factors for specific situations. – Develop their own crash modification factors, based on a number of study designs. – Apply crash modification factors to compare and select highway safety improvements. – Establish reference populations for network screening. – Perform network screening with the best approach in relation to the data availability. – Perform statistical tests to identify significant crash patterns. – Perform association between crash patterns and crash contributory factors. – Use different tools, such as factor matrix, condition diagram, and collision diagram, to identify possible crash contributory factors. – Conduct site inspections to identify crash contributory factors. – Identify countermeasures that can reduce the frequency and/or the severity of the significant crash patterns. – Estimate benefits and costs of the countermeasures. – Use different methods for prioritizing countermeasures and projects for implementation. – Evaluate safety effectiveness of the countermeasures. – Perform road safety impact assessment for infrastructure projects. – Perform road safety audits for simple infrastructure projects, as a member of a team. – Perform road safety inspections, as a member of a team.
Competence	– Participate in the data driven decision making in the highway safety management process of an highway authority. – Perform an active role in the in the highway safety management process of an highway authority.

Traditionally, higher education was relatively explicit about the knowledge to be achieved, or at least the knowledge covered by the curriculum. Main focus was on the contents of the program, which is a broad general statement of teaching intention and indicates what the teacher intends to cover in a block of learning. It was however somewhat less explicit on the skills or competences required for the award a given qualification. Competences, such as those of critical evaluation, were and are embedded or implicit in the assessment values and practices. It is becoming increasingly widespread practice that as wide a range of the outcomes as possible are specified. The "learning outcomes" approach shifts the emphasis from the duration of learning and the institution where it takes place to the actual learning and the knowledge, skills and competences that have been or should be acquired through the learning process. Despite the fact that it is considered to be relatively new, the "learning outcomes" approach has been applied in various countries, in various sectors and for various purposes.

Course Contents

The definition of the course contents is based on the Assessment study on Highway Design and Management curricula requirements in Russian Federation. Aim of the assessment study was to take into consideration any pre-existing master program and any pre-existing competences of Russian universities for the design of the new master program, to determine structure of modules of the new program according to the requirements of Russian economy in specialists for highway sector and to the preliminary design of the course contents carried out by the EU universities. As part of the assessment study, the following activities were performed:

- Analysis of strategic governmental documents of the Russian Federation in the field of education and transport and federal educational standards http://standart.edu.ru/
    - The Governmental Program "Transport Strategy of RF by 2030", http://www.mintrans.ru/documents/detail.php?ELEMENT_ID=13008;
    - The Federal Special Purpose Program "Development of transport system of Russia for the period from 2010 to 2015 year", http://fcp.economy.gov.ru/cgi-bin/cis/fcp.cgi/Fcp/ViewFcp/View/2012/264.
- Analysis of managing documents (missions and strategic programs of development) of Partner Countries universities.
- Expert evaluation study of existing educational programs in partner universities in the field of highway design, construction and management, as well as curricula, teaching plans and working programs of courses. Leaders of core departments and chairs were involved as the experts.
- Study of proposed curricula of European universities in the field of highway design, construction and management.
- Analysis of system of training and retraining of teachers on the basis of the experience and procedure of the Academic mobility Centre of MADI.

- Needs analysis in training of qualified teachers for realization of HDM-curricula in partner universities.
- Expert assessment of the requirements of the national labour market for graduates of HDM-course on the basis of IAAREE experience and procedure. IAAREE members were involved as the experts.
- Usage of databases of IAAREE for forming of a list of potential employers for graduators of HDM-course.

For the harmonization of HDM-curricula with the traditional structure of Russian post-graduate programs for masters of science, two modules (Up-to-date scientific and technical problems in construction; The fundamentals of research methods in construction) were developed by MADI.

The master course consists of twelve modules (Tables 2 and 3), an internship and a final thesis. Course modules are complementary and must be seen as the single parts needed to train qualified professional resources capable of sustaining and managing the huge effort of road infrastructure development and improvement.

Main contents relate to basic scientific methods, highway design and construction, and traffic analysis with a specific focus on highway safety. Scientific methods are taught in the modules Statistical methods for transportation data analysis, Fundamentals of research methods in construction, and English for engineering. In the latter module, the students will carry out language practice activities related to their future professional career and will be further oriented and stimulated versus the international scientific knowledge. Highway design is the focus of four modules (Highway design; Pavement analysis, design, and maintenance; Special issues in highway design; and Environment preservation), which provide both the fundamentals of design, as well as advanced knowledge related also to detailed design issues and to the mitigation of highway environmental impacts. The modules Applications of Information Technology on highway design and construction and Up-to-date scientific and technical problems in construction deal with highway construction. The modules Traffic flow theory and simulation and Advanced traffic management systems concern traffic analysis. After successful completion of these modules students will know fundamentals of traffic flow theory and its application for capacity analysis, design, management, operation and control of segments and intersections. Students will also acquire fundamental knowledge on the principles, characteristics, and application of traffic simulation models, active traffic management, traffic flow metering, and a wide range of intelligent transport systems technologies.

Highway safety and management is not an isolated module since previous modules are safety related. Given the international focus of the course, highway design criteria are handled going beyond the standards and introducing the concept of safety based design. According to the standards safety is nominal, i.e. any design is safe if parameters comply with defined thresholds and is not safe if parameters do not satisfy these threshold. However, highway safety changes with continuity in relation to the design parameters and the relationships between crash

frequency and severity and design parameters are clearly examined in the highway safety module. A special focus is given to design highways that fulfil drivers' expectations. This concept is the focus of the sub-modules design consistency and context sensitive based design. Another critical highway design and safety related parameter is the concept of speed. An extensive discussion of this concept is included in the master course, aiming at providing all background information for the speed parameter, its various types, uses, interpretations or even misinterpretations. Intersections geometric design and functional analysis is the subject of several sub-modules since intersections constitute only a small part of the overall highway system but intersection-related crashes constitute more than 50 percent of all crashes in urban areas and over 30 percent in rural areas. Furthermore, very important safety issues are provided in the module special issues in highway design: design criteria for vulnerable road users such as pedestrians, bicyclists, older drivers and people with disabilities; concepts, tools and techniques that will lead to a corresponding safe driving condition at reduced speed levels when needed; design changes that have to accommodate a roadway in its transition from a rural to an urban environment; adaptation to unusual and restrictive roadway contexts and application of special design techniques and concepts that promote safety and serve the road and the non-road users alike; access management; traffic control devices to regulate traffic, warn drivers of hazards or regulatory controls ahead, and correctly guide motorists; lighting techniques and device to improve perception and visibility of pedestrians and potential hazards, mutual sighting of vehicles, and nighttime perception of the road environment; and roadside safety design.

The second year of the second semester is dedicated to the internship (18 ECTS) and to the master thesis. The internship is aimed at performing a work project, which will be part of the master thesis. Three students from each Russian University performed a one month internship in the UniNA Road Safety Laboratory, NTUA Laboratory of Transportation Engineering, and KTH Transportation Laboratory. The other students performed the internship in the Russian transportation industry or in the Russian universities labs.

HDM master's thesis requirements (12 ECTS) have been defined taking into account both the EU and the Russian universities existing procedures. The thesis is developed by the student with original contribution under the guidance of one or more supervisors. The thesis and internship comprise reviewing literature, developing theory and methods, collecting appropriate data and analysing results. The thesis is aimed at developing the student's capability to work independently and to engage in a new subject, define and analyse a problem, develop alternative solution and evaluate them. Furthermore, the goal is that the student should train working on applied engineering solutions but with a sound scientific basis. Minimum contents of the thesis have been identified as follows: (1) Abstract; (2) Background and problem statements; (3) Goal and scope statements; (4) Literature review; (5) Description of the methodologies; (6) Description of the results; (7) Discussion of the results; and (8) Conclusion statements, which highlight the significance of the results in the context of highway and traffic engineering practice and/or research. Master's thesis is discussed by oral presentation with a commission appointed by the university academic body.

Table 2. *Modules Structure (First year)*

Module #	Module title	ECTS	Year	Semester
1	Highway design 1.1 Contemporary road design approach 1.2 The speed parameter 1.3 Design consistency 1.4 3-D design controls 1.5 Aesthetic road design criteria 1.6 Design for heavy vehicles and powered two wheelers 1.7 At grade un-signalized intersections 1.8 Roundabouts 1.9 Interchanges	9	1	1
2	Traffic flow theory and simulation 2.1 Traffic flow characteristics 2.2 Traffic flow models 2.3 Highway capacity and level of service 2.4 Traffic flow simulation	9	1	1
3	Pavement analysis, design, and maintenance 3.1 Introduction to pavement design 3.2 The sub-grade 3.3 Material characterization 3.4 Pavement design 3.5 Pavement performance	6	1	1
4	Statistical methods for transportation data analysis 4.1 Data management and data editing 4.2 Descriptive and exploratory statistics 4.3 Probability models and statistical inference 4.4 Multivariate statistics 4.5 Discrete choice statistical models	6	1	1
5	Special issues in highway design 5.1 Design for vulnerable road users 5.2 Traffic calming 5.3 Transition between rural and urban areas 5.4 Road design in difficult environmental conditions 5.5 Access management 5.6 Signs, markings, and lighting 5.7 Road restraint systems	9	1	2
6	Advanced traffic management systems 6.1 Introduction to Intelligent Transportation Systems 6.2 Traffic surveillance methods 6.3 Automatic vehicle identification systems 6.4 Advanced traveller information systems 6.5 Active traffic management 6.6 Traffic flow-metering 6.7 Incident management 6.8 Case studies	15	1	2
7	Applications of Information Technology on highway design and construction 7.1 GIS technologies 7.2 GIS applications in highway design and maintenance 7.3 Automation in construction	3	1	2
8	Up-to-date scientific and technical problems in construction 8.1 Methods for solving scientific and technical problems in construction 8.2 Fundamentals of the theory of highway reliability 8.3 Highway construction in special conditions 8.4 Special sections of higher mathematics 8.5 Mathematical simulation	3	1	2

Table 3. *Modules Structure (Second year)*

Module #	Module title	ECTS	Year	Semester
9	Highway safety analysis and management 9.1 The role of the driver-vehicle-road-environment system in the highway safety 9.2 Crash data 9.3 Safety performance functions 9.4 Empirical Bayes methodology 9.5 Crash modification factors 9.6 Network screening 9.7 Diagnosis 9.8 Selection of countermeasures 9.9 Economic appraisal and prioritization 9.10 Fundamentals of road infrastructure safety management 9.10.1 Road safety impact assessment 9.10.2 Road safety audits 9.10.3 Road safety inspections	15	2	1
10	Environment preservation 10.1 Environmental assessment 10.2 Impact evaluation 10.3 Case study	5	2	1
11	Fundamentals of research methods in construction 11.1 Philosophical problems of science and technology 11.2 Social aspects of science and technology 11.3 Methodology of scientific researches 11.4 Project management	5	2	1
12	English for engineering 12.1 English for special purposes vs. English for general purposes 12.2 A technical syllabus for Engineering: descriptive skills 12.3 A technical syllabus for Engineering: explaining and discussing 12.4 A technical syllabus for Engineering: viewpoints and solutions	5	2	1
13	Internship	18	2	2
14	Master's thesis	12	2	2

Teaching Material

New and original teaching material has been developed. Teaching material consists of 12,500 slides, supplementary notes, and supporting material (videos, standards, guidelines, papers, and technical documents). A cloud-based solution (dropbox) was used to share all materials, so that they are constantly available to all partners. The slides have been developed according to a common framework and contain knowledge information, case studies, exercises, and detailed references. The teaching material has been developed in English language and has been translated by the Russian universities.

Training of the Russian Teaching Staff

Training of the Russian staff has been carried out in three two-week workshops aimed at improvement of their skills in teaching of HDM modules. Three teachers from each Russian University participated to each workshop.

The first workshop was held in Naples, Italy, at the premises of the University of Naples Federico II, Department of Transportation Engineering "Luigi Tocchetti", from June 11 to June 22, 2012; participants visited the UniNA Highway Safety Laboratory and drove the VERA (Virtual Environment for Road sAfety) high fidelity dynamic-driving simulator (*11-13*).

The second workshop was held in Stockholm, Sweden, at the premises of the Royal Institute of Technology, School of Architecture and the Built Environment, Department of Transport Science, division for Traffic and Logistics, from July 24 to August 5, 2012; participants visited the student computer lab rooms and some sights and streets in Stockholm city to see the implemented idea of Stockholm, a city for everyone.

The third workshop was held in Athens, Greece, at the premises of Athens, Greece, at the premises of the National Technical University of Athens, School of Rural and Surveying Engineering, Laboratory of Transportation Engineering, from December 3 to December 14, 2012. The participants also had the opportunity to visit the GeoInformatics Center/Software Lab of the School of Rural and Surveying Engineering of NTUA and the Operation Center of the Athens Toll Motorway ATTIKI ODOS S.A., where they had the opportunity to learn how the motorway traffic is managed and attended additional lectures on Motorway Traffic Management from the competent engineering staff of the Athens Toll Motorway ATTIKI ODOS S.A.

Courses Implementation

Master courses have been activated in all the three Russian partner universities and 31 students completed the experimental master programme: 12 in MADI, 10 in ASTU, and 9 in OSU. In ASU, 2 students are in maternity leave and will complete the program in 2015.

According to the students, teaching materials fully deliver the main issues in highway design and maintenance. The material reaches the students by illustration and demonstration of situation-related examples. The material allows students to be guided in work-related road design practice to increase traffic safety. State-of-the-art software in highway design and traffic simulation assists students in case laboratory sessions. On-going training is supported by the hand-out material. Overall, students are thankful to have the opportunity to get modern knowledge in accordance with Bologna principles and competence in highway design, traffic

safety and highway management has been considerably increased.

QUALITY ASSURANCE PROCESS

The quality level of the project and its results have been taken into a huge consideration both at internal and at external level. First, a dedicated work-package has been foreseen, WP3 "Quality assurance process" with three deliverables, D7 Quality Manual, D8 Quality Plan, and D9 Quality assurance monitoring, for organizing all quality monitoring activities in a proper way. The Quality Manual (D7), released by January 2012, sets out the organization, management, standards and procedures which are to be used in the project to ensure it meets its objectives. The procedures here described have been left generic on purpose and will be detailed for every single procedure. Quality guidelines have been collected from Russian and European Universities and the Quality Manual has been delivered. In details some indicators have been identified starting from the Logical Framework Matrix approach, together with the support from some partners with previous experience on TEMPUS projects.

The Quality Plan (D8) contains all specific actions to be done to correctly develop project activities according to set high quality standards. Either internal and external quality monitoring procedures are here detailed. Consultation with all partners, via a conference call, has been done for agreeing on proposed quality procedures. Quality assurance monitoring (D9) has been organized in an external project monitoring procedure and in an internal survey. For the first year, the external monitoring has been realized through a web-based survey in which a feedback on TEMPUS programme and on the project has been asked. Addressees are University colleagues, both from the own university and from EU/non EU universities. The survey is on a voluntary base, no expenses have been generated. During the workshops for training the teaching staff, held in Naples, Stockholm, and Athens, internal surveys has been held in order to ascertain its effectiveness for the HDM Master future implementation. Target are Russian trainees participating at the three workshops. Questions are: (1) Are project objectives clear? (2) Are courses in line with project objectives? (3) Are courses contents sufficient for the future Master implementation? (4) Is courses duration sufficient for the future Master implementation? (5) Is training material, provided along the courses, sufficient for the future Master implementation? (6) Is training model transferable easily from EU to RU?

The second phase of the Quality monitoring developed, for the external monitoring, a procedure for ascertain the level of quality of the Master course, its modules and sub-modules, in compliance with the Quality Manual. Target of this survey were the students from Russian Universities, attending the Master course. The frequency of submission of the survey is every

six months.

Moreover, in the project management, the role of the Quality manager has been included in the Project Management Board, with the responsibility of coordinating the quality assurance procedures concerning the project's activities and the evaluation of project outputs and outcomes.

A quality review procedure, not foreseen in the original work plan, has been introduced for all delivered teaching materials. The review process was managed by the Review Board.

Review guidelines have been defined and sent to all reviewers. In the guidelines, it is clarified that the review is aimed at improving the learning outcomes of the course and is not aimed at ranking the teaching material. Thus, the Review Board asks an advice aimed at understanding the appropriateness of the teaching material, the shortcomings of the teaching material, and the possible actions to fix the identified issues.

In the review form, there are four questions: (1) Coverage of the topics declared in the program; (2) Adequacy and clarity of the material; (3) Adequacy of the exercises; and (4) Adequacy of the main references and the supporting material. For any question, reviewers are asked to provide rating and comments. The rating ranges from Excellent (5) to Poor (1). If a question is not applicable (e.g., exercises are not an important part of a sub-module), reviewers can rate as N/A. In the review form, it is clarified that comments are the most important part of the review and should provide: (1) a clear indication of the weakness of the material and (b) recommendations to improve the materials and to reach better outcomes.

All materials has been revised to satisfy reviewers' comments.

DISSEMINATION

The dissemination of HDMCuRF results has been planned to be carried out all along the duration of the project. It has been organized in the work-package WP4 "Dissemination strategy", coordinated by IAAREE with the involvement of all partners. The WP4 foresees 4 deliverables, the first one being the project website www.formit.it/hdmcurf. The website is structured both as a public space for disseminating general information, such as project facts, activities, partners, events, and so on but also as a private project repository for official documents, reports and work-in-progress materials to be shared among partners. The website

has been designed by FORMIT and put on line on May 2012. Using the same graphic of the website, a leaflet has been designed by FORMIT with the contribution of contents from all partners. Each partner was then responsible for printing it for each opportunity of dissemination the project and its results. Russian partners have been involved in dissemination activities also in participating to conferences and submitting publications.

CONCLUSIONS

Within the TEMPUS HDMCuRF Project a modern, intensive and probably unique worldwide until now Highway Design and Management course material has been developed, which is now available from the corresponding M.Sc. curricula of the three universities MADI, ASTU, and OSU in the Russian Federation.

The first HDM master courses have been successfully completed in the three Russian universities participating to the project. Graduates of the HDM courses from MADI, ASTU, and OSU have reached an advanced level of education for the exercise of a highly qualified activity in highway design and management and are fully acquainted with all contemporary issues of highway design and management, in which the world community of researchers and practitioners are currently involved and are practicing. Special focus was given on highway safety analysis and management and it is expected the HDM graduates will be in position to best serve the Russian Federation in improving road safety in the years to come for the benefit and profit of the Russian people.

Given the international focus of the course, highway design and management criteria are handled going beyond the national standards according to the principle of performance based design and management. Thus, results of the project can be used also outside Russian Federation.

New master courses are being carried out in the three Russian partner universities without the economic support of the European Commission. Thirty-three students were enrolled in 2014, thus showing the sustainability of the project.

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