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Final Report on Education, Training and Dissemination: Results and Recommendations for the Future Network

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Authors

Name	Company
Nick Hounsell and Birendra Shrestha	UoS
Ioannis Papamichail and Markos Papageorgiou	TUC
Pierre-Yves Gilliéron	EPFL
Juliette Renaud	ERT
Nour Eddin	IFFSTAR

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List of abbreviations

AP	Associate Partner
ATIS	Advanced Traveller Information Systems
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
DIS	Driver Information Systems
DLR	Deutsches Zentrum für Luft- und Raumfahrt
DoW	Description of Work
DTM	Dynamic Traffic Management
E&T	Education and Training
EC	European Commission
ECTS	European Credit Transfer and Accumulation System
EPFL	Ecole Polytechnique Fédérale de Lausanne
ERT	Europe Recherche Transport
GIS	Geographical Information System
GPS	Global Positioning System
ICL	Imperial College London
ICT	Information and Communication Technology
IFFSTAR	Institut français des sciences et technologies des transports, de l'aménagement et des réseaux
ITS	Intelligent Transport Systems
L&T	Learning and Teaching
MoU	Memorandum of Understandings
MSc	Master of Science
NEARCTIS	Network of Excellence for Advanced Road Cooperative Traffic management in the Information Society
NoE	Network of Excellence
PG	Postgraduate
RTPI	Real Time Passenger Information
SCOOT	Split Cycle Offset Optimisation Tool
TM	Traffic Management
TC	Traffic Control
TRANSYT	Traffic Network Study Tool
TUC	Technical University of Crete
TUD	Technical University of Delft

UCL	University College London
UG	Undergraduate
UoS	University of Southampton
UTC	Urban Traffic Control
VLE	Virtual Learning Environment
VCE	Virtual Centre of Excellence

1. Introduction

NEARCTIS (Network of Excellence for Advanced Road Cooperative Traffic management in the Information Society) is an academic network gathering teams working in the field of traffic management and optimisation, with a particular focus on cooperative systems for road traffic optimisation. This document is the final report of Workpackage 3 of the project which focuses on new networking developments to support improved education and training (E&T) in the area of co-operative traffic management systems. This covers all levels (student, postgraduate, young professional, etc), including the involvement of Associate Partners from all relevant employment sectors. An additional core task of WP3 concerns dissemination of all NEARCTIS activities on a regular basis using the most effective media. The following specific objectives of this task have been achieved:

1. Developing an effective networking process for education and training.
2. Developing a network of associate partners from industry, government and academia to integrate with and support the core academic network.
3. Developing proposals for education tools and courses at the European level related to NEARCTIS, based on an analysis of user needs and current provision.
4. Developing proposals for the training of young/senior professionals based on a market study and business model.
5. Developing programmes for the mobility and training of young/senior researchers within the network, including implementation and evaluation.
6. Developing and implementing the NEARCTIS dissemination plan, including (i) a regularly updated Web-site, (ii) leaflets, posters and electronic newsletters, (iii) organisation and participation in workshops and conferences and (iv) production of papers for refereed academic journals.

This final report focuses on overall findings from WP3 and present recommendations for the way forward for education and training in co-operative traffic management at the European level. The following chapters are presented on a task-by-task basis, covering:

Chapter 2: Education Tools and Courses (Task 3.1) authored by Nick Hounsell and Birendra Shrestha (UoS)

Chapter 3: Young/Senior Professionals Training (Task 3.2) authored by Ioannis Papamichail and Markos Papageorgiou (TUC)

Chapter 4: Young/Senior Researchers Mobility and Training (Task 3.3) authored by Pierre-Yves Gilliéron (EPFL)

Chapter 5: Associate Partner Activities (Task 3.4) authored by Juliette Renaud (ERT)

Chapter 6: Dissemination of Research Results (Task 3.5) authored by Nour Eddin (IFFSTAR)

Chapter 7: Summary of Next Steps

Readers should note that whilst NEARCTIS involves co-operative traffic management systems, the phrase ‘traffic management’, or the symbols TM are often used in this report for brevity.

2. Education Tools and Courses

2.1. Requirements

This task was concerned with two activities: education and training in co-operative traffic management systems for students and a review of learning and teaching (L&T) methods in universities. The two activities set out in the Description of Work (DoW) for Task 3.1 were:

Activity 3.1.1: Current education and training: Reviews and recommendations

This activity started with a review of existing education and training (E&T) in traffic management and co-operative systems worldwide. A starting point was a more general review of Education and Training (E&T) in Intelligent Transport Systems (ITS) produced by the recent EC-funded ETNITE project. From here, more detailed information on topics specific to NEARCTIS was gathered by direct communication with the providers. The review identified the variations in quality and quantity of provision across European member states, with recommendations concerning syllabus requirements and raising the E&T provision to a more common standard across Europe.

Activity 3.1.2: Learning and Teaching methods: Reviews and recommendations

A second activity in this task concerned a review of Learning and Teaching (L&T) methods. This highlighted innovative techniques including problem and case-based learning, the use of Information and Communications Technology (ICT), such as e-learning, real time interactive simulations and so on. The network will then enable examples of best practice to percolate across Europe, benefiting from the shared resources offered by network members.

A literature search of Education and Training activities and provision worldwide in traffic management and co-operative systems was reported in Deliverable D9 (The mid-term Report). This was preceded by an initial review of modern/innovative learning and teaching methods undertaken on a generic basis as reported in Deliverable D2 (Preliminary Report). This final report builds on those reports and expands to recommending future requirements of a course in the area of co-operative traffic management.

2.2. Summary of review of university courses and methods

2.2.1. University courses

The traditional model for university education has been for students to attend specific courses/Programmes on a full-time basis of length according to the level of the qualification (e.g. Undergraduate (UG) or Postgraduate (PG) course). The review of university courses available across Europe (Appendix I) highlighted that there is some dedicated university training specifically on traffic management systems, but naturally little yet on co-operative traffic management because this is a relatively new development. Even in the area of traffic management, course availability is very limited at undergraduate level both in Europe and elsewhere in the World. At the taught postgraduate level, many transport-related courses have maintained a relatively broad focus (e.g. Transport Planning, Engineering, Operations and/or Management). However, the increasing emphasis in transport networks in developed countries is in making the best use of the asset/infrastructure, through improved management and operations of the transport network. This is giving increasing impetus to traffic management, sometimes within a broader-based ITS programme. It was also apparent that the

extent of traffic management education and training varies considerably between countries, universities and courses.

There are currently no Master of Science (MSc) courses in Europe devoted entirely to cooperative traffic management. Most of the masters courses available cover a range of transport initiatives and tools including a thorough education in transport policy, planning, engineering, management, etc. Co-operative traffic management systems have therefore been generally integrated into such courses rather than offered as a stand-alone subject.

Based on the range of the courses available at European level and discussion within the network, it was concluded that a Masters level course is most appropriate for such a specialised field of co-operative traffic management. However, it was considered that the market is not there yet for a full course totally dedicated towards this one specific field. However, there is a demand for broader ITS course with a focus on co-operative traffic management. Hence in NEARCTIS we have designed a Masters course in Intelligent Transport Systems (ITS) with a focus on Cooperative Traffic Management System, as summarised in Section 2.3.

2.2.2. Delivery methods

The review of courses available to university students in the Europe and elsewhere (Appendix II) showed that the majority of the courses are taught at the Institution – full-time or part-time. The review concluded that among the various teaching and learning methods, conventional "Face-to-face learning" supplemented and supported by various ICT-based channels to deliver materials remains as the best method for University courses. This covers a large range of teaching practices including lecture, tutorial, group work, project, group discussion, seminar, conferences and other.

The delivery of such courses needs to be supported by information and communication technology (ICT) to enhance effectiveness. ICT can be used to distribute learning content, tailored to specific trainees (according to their knowledge and need). It allows interactive tutorials, subjects explained at different levels (for different target audience) etc. As reviewed in D2, some of the ICT-based channels to deliver education/learning materials include: web-based tutorials, web-streaming of media files, web blogging and web conference. In addition, teaching and learning processes can be streamlined with the use of Virtual Learning Environment (VLE) systems (Blackboard, Moodle, eChalk, etc.). This enhances the communication between the teacher and students with a facility to communicate easily regarding syllabus information, grading policies and deadlines. A fuller coverage of teaching and learning methods is given in Appendix II.

2.3. Example course on ITS and co-operative traffic management systems

Due to the complex nature of the proposed course area, the course proposed here covers various aspects of transportation, computer science, telecommunication, detection technology, human-machine interfaces and transport economics. Hence the course modules need expertise from various disciplines in addition to transportation. In terms of the administration of the course, the course could be run by an individual institution or by a group of Institutions jointly. For example NEARCTIS partners could jointly run a course among themselves or in association with another association such as ITS-EduNet (www.its-edunet.org). Another model of running such a course could be similar to the CITE consortium (www.citeconsortium.org) where each member institution contributes modules which are free to use by all consortium members, according to their specific needs. The members are

allowed to choose the modules according to their focus, set the course fee and the corresponding provision of facility. They are allowed to handle their income in their own way except the fact that they will provide a nominal yearly charge for administration of the consortium. Such a model reduces the workload of Universities by removing duplication of effort and gives financial freedom to the members. The proposed Virtual Centre of Excellence (VCE) could provide an ideal opportunity to form such consortium to run the course. An option of student exchange to study some part of the courses in other institutes within the consortium could also be embedded in the system.

2.3.1. Course structure

The structure of Masters Courses in transportation varies considerably between the UK and elsewhere in Europe. Most of the Masters Courses in UK universities on Transportation tend to be one year full-time courses equivalent to 90 ECTS. However, the Masters courses in Europe in Transportation tend to be 1.5 to 2 year courses equivalent to 120 ECTS (European credit Transfer and Accumulation System). Given that the European model is more predominant and 'Bologna compliant' (which the current UK courses may or may not be), this model is taken forward here (in Section 2.3.1 to 2.3.4).

In addition, there are considerable variations in the focus and expertise in different universities within Europe. So, even for courses with similar titles, the modules covered could be different from university to university. Hence, the course structure proposed below includes a range of optional modules so that an Institution could choose according to their focus in addition to the core modules.

To complete the proposed MSc in ITS and Cooperative Traffic Management Degree program, candidates would have to take sixteen modules. Eleven compulsory modules (A1 to A11) along with five of the B module options (B1 to B8) amounting to the total of 120 ECTS credits. All the modules except the dissertation are worth 6 ECTS. The research project is worth 30 ECTS. The module descriptions given below are drawn from a number of sources including the University of Southampton's MSc course in Transportation Planning and Engineering (www.soton.ac.uk), European MSc in ITS (www.em-its.eu), CITE consortium (www.citeconsortium.org) and Technical University of Munich (www.tum.de) and Technical University of Delft (www.tudelft.nl).

It is proposed that this course and/or variants of it, will be discussed by NEARCTIS partners for potential implementation, as we move towards our Virtual Centre of Excellence (VCE).

2.3.2. Core modules:

A1. Transportation Systems

This module would provide knowledge on Transportation Systems for the various modes of transport. This covers the transportation of people as well as of goods. The module would comprise assessment and economic evaluation of transport systems, set against the often conflicting background of local and national political objectives. Quality management in transport systems, as well as safety and security requirements are emphasised.

A2. Data analysis and techniques for Transportation Processes

This module is designed to provide knowledge of the basic data analysis techniques necessary for understanding and analysing transportation related datasets. This includes identification of suitable analysis methods, applications/calculations of appropriate techniques and models

(including with the use of statistical analysis software), interpretation of model and statistical test results and presentation of conclusions.

A3. Traffic Flow and Traffic Signal Control

This module would provide a detailed knowledge of traffic flow and traffic signal control with its numerous facets, coherencies and interdependencies. The module would cover: variables of traffic flow, fundamental diagram, kinematic waves, stationary and momentary observations and distributions for the modelling of delay and queuing processes. The traffic signal control part covers: basic concepts and system structures, general approach to signal control, design of signal plans, design of progressive signal systems and application of control engineering methods.

A4. Introduction to Intelligent Transport Systems

This module would provide knowledge on Intelligent Transport Systems (ITS) and the ITS infrastructure. The module illustrates the ITS systems with examples from Europe and elsewhere. The module discusses various systems including: traffic management and control, traveller information, driver assistance, public transport management, toll collection etc. Institutional and technical issues involved in deploying ITS infrastructure are also presented. Topics covered include: planning, design, architecture, standards, procurement, installation and construction, operation and maintenance, and funding of ITS systems.

A5. ITS for Traffic Operation and Control

This module would provide an overview of ITS applications for traffic operation and control in an urban and inter-urban context. It introduces the principles of different systems, their technical approaches and analysis of ITS applications in urban (e.g. UTC) , inter-urban (e.g. VMS, ramp metering) and integrated systems. The module explains the objectives, measures, methods and algorithms of implementing ITS systems. In addition, exercises covering a wide selection of real-life situations would be provided throughout the course.

A6. Transportation Management

This module would introduce the principles and current practice of Traffic and Transport Management related to Transportation Engineering on both urban and interurban roads. The aim is to gain knowledge and understanding of the range of traffic management and supporting Intelligent Transport Systems (ITS) applications available for improved efficiency and safety of road traffic, and design/evaluation skills relating to the these applications and their integration.

A7. Introduction to Cooperative Traffic Management

This module would provide an overview of Cooperative Traffic Management systems. Starting from the basic concept of cooperation, the module illustrates different architectures (vehicle to vehicle, vehicle to infrastructure), infrastructure components and various technologies involved with examples of systems deployed around the world. The module also details the benefits from the use of the cooperative concept along with the institutional and technical issues involved in deploying cooperative traffic management system. Topics covered include: introduction, architecture, technologies, standards, design, installation, operation, maintenance and funding of cooperative systems.

A8. Cooperative Traffic Management – Recent developments

This module builds on the “Introduction to Cooperative Traffic Management” module with the aim of making students aware of continuous development in the field. To fulfil this aim,

the module would provide an overview of research and developments in this area. Starting from the general area of cooperative traffic management applications the module gives details of applications that are currently researched. This will cover various EC funded research programs giving details of their research area, research outcome and field demonstration (if applicable). Topics covered include: introduction, general applications (urban, inter-urban, freight, etc), research programs within Europe, case studies and future prospects.

B9. Telecommunications Technology for ITS Applications

This module would provide knowledge in telecommunication technologies which are the backbone of all ITS applications. The module focuses on how to plan and implement telecommunications networks to support an ITS application. The module would start with the fundamentals of voice, data, and video transmission. The module would then focus mainly on mobile telecommunication and emerging communication systems and include: introduction to the concept of wireless communication, issues with wireless and mobile communication, design and performance of wireless systems, and overview of existing systems. The module would also deal with communication protocols, networks and systems,.

A10. Transport Economics

This module would introduce the principles of transport economics and how these principles are applied in practice in transport studies and in scheme appraisals. From an introduction of micro-economic theory, the module would then cover economic analysis in practice, including demand and cost forecasting, cost benefit analysis in both developed and developing countries and road pricing. The course would also examine the links between transport and the wider economy.

A11. Research Project (30 ECTS)

The Research project would provide an opportunity to undertake independent, original and critical research on a cooperative traffic management topic. This enables the student to take ownership of their learning and would help foster the deeper, project based learning necessary to gain a true understanding of the concepts in practice. The student would need to communicate the research objectives, methodology, analysis, results and conclusions effectively both orally and through the production of a Dissertation.

2.3.3. Optional modules

B1. Public Transport Planning, Management and Operations

This module would give an introduction to public transport planning, management and operations. The module would start with a discussion about the advantages/disadvantages and the functional characteristics of public transport modes and their capacity. This would be followed by the characteristics of public transport lines/networks and their design. The module would also cover public transport scheduling, management and operations with and without the use of modern Automatic Vehicle Location (AVL) systems.

B2. Traffic modelling

This module would introduce an applied approach covering the state-of-the-art in transport modelling. The module would be divided into three intermixed strands: 'Macroscopic Models' for predicting overall travel patterns; 'Microscopic Models' for predicting individual road junctions; and 'Behavioural Models' for predicting individual traveller responses. Within these strands, the module would cover wide ranging topics including: macroscopic traffic flow theory, optimisation methods, car-following and lane-changing behaviour, calibration and

validation of models. The overall aim would be to develop an understanding of the different approaches to modelling the consequences of transport engineering and policy decisions.

B3. Positioning and Navigation systems

This module would cover theory, principles and technologies for positioning, navigation and identification of both vehicles and goods. The module details: positioning technologies (e.g. GPS), detection technologies (e.g. sensor and transponder) and Wireless Identification Systems (RFID, ZigBee). The module would also cover Geographic Information Systems (GIS) including data structures, cartography and database technology. The module would cover various applications including: Automatic Vehicle Location (AVL), location based services, route guidance and navigation, Automatic Vehicle Identification (AVI), fleet management and tracking of goods.

B4. Systems Engineering for ITS applications

This module would cover a broad set of topics in systems engineering and system integration. It would provide an overview of the principles of systems engineering and its application to ITS projects. The module would also detail the techniques of regional system integration including: principles of systems engineering, benefits of alternative architectures, principles of system reliability, maintainability and availability.

B5. Innovations in Dynamic Traffic Management

This module would primarily focus on the ITS applications which are (directly or indirectly) used as a means to tackle congestion problems in road traffic networks. The module would focus on the effect of ITS on traffic processes (that is on collective human drive and travel behaviour) and on the tools and methods with which these effects can be simulated and evaluated. In terms of application examples, the scope includes ITS for road transport which affects traffic operations, that is, which are targeted at managing traffic streams (and individual drivers). Topics covered include: system response to ITS, methodological framework, ITS control system, data assimilation techniques (e.g. Kalman filtering), data fusion, traffic state prediction and examples such applications.

B6. Automatic Data Collection and Processing

This module would focus on automatic data collection from ITS and processing the information. It introduces the front end of the information flow chain for an ITS. Starting with sensor technology and elementary sensor systems, the module would then introduce embedded systems and data structures which enable to gain an insight into the underlying principles and to realise the necessity of data pre-processing. The module would also cover: the principles of data compression, real time data processing, digital signal processors, sensor technology and implementation.

B7. ITS Management skills

This module would provide knowledge in other important aspects including: law, disciplinary and grievance skills, motivation, quality assurance, project planning and controlling. The module would also cover how to organise and manage research and development projects in industrial as well as academic setups. The practice and development of oral and written communication skills needed to manage ITS projects would also be included in the module.

B8. Transport and the Environment

This module would introduce key concepts in the study of transport, energy and the environment, including sustainability. It would cover the principles and practice of monitoring and assessing the energy and environmental impacts of transport schemes, with particular reference to the Europe. It would also provide detailed coverage of the analysis of transport related noise, air pollution and carbon consumption.

An example of a course module is given in the next section.

2.3.4. Example Module: ITS for Traffic Operation and Control

Objectives

This course aims to improve the understanding of the general approach of traffic control and intelligent transportation systems in an urban and motorway context; it introduces the principles of different systems, their technical approaches and analysis of ITS applications in urban, extra-urban and integrated systems. It explains the objectives, measures, methods and algorithms of implementing ITS systems. In addition, exercises covering a wide selection of real-life situations will be provided throughout the course.

Teaching and Learning Methods

Contact hours	40
Private study hours	60
Total	*100*

Teaching methods include: Lectures, tutorial classes, seminars, simulation demonstrations, audio-visual presentations, small group teaching on computers

Learning activities include: Literature review/analysis, use of software, directed reading, student directed learning, individual tutorial work

Assessment: Examination 80% + Tutorial work 20%

The examination will assess the knowledge and understanding of transportation engineering of students and their abilities of analysis and problem solving. The other learning outcomes should be achieved through the tutorial exercise.

Learning Outcomes

Knowledge and understanding of the following

1. ITS system architecture for different control applications
2. Traffic signal types, layouts and control systems
3. ITS application on UTC, public transport and motorway
4. European ITS applications.

Intellectual skills

1. Design traffic signal junction according to requirements/specifications
2. Propose and evaluate alternative designs and options
3. Identify /recall the key issues in transportation engineering analysis and design
4. Evaluating economic benefits of ITS scheme

Key skills

- Collating and synthesising/prioritising information
- Learning and studying/researching independently

- Managing time
- Manipulating and analyse data
- Reporting work effectively
- Using creativity and innovation in problem solving

Contents

Introduction and Conceptual Framework

Definitions, Theory of Traffic Control (TC), Traffic Management Approach, Mobility Management versus Traffic Management, ITS concept, Quality Management, History of TC,

System Architecture

ITS technologies (TEC) system architectures, traffic/environment detection, signs, controllers, communication

Traffic signal design

Introduction, signal aspects, phases, stages, cycle, intergreen times, effective green time, saturation flows, capacity, queues, delays, design of signal timings, examples of optimisation methods, classification of signal control strategies (fixed-time signal, vehicle actuated signal, coordinated signal)

Urban Traffic Control (UTC)

Basic Structure, objectives, network/section/node, strategic/tactical/operational level, local actuation Network oriented signal control methods (plan selection, adaptive systems), Co-ordination need, benefits, platooning, linking systems, linking methods, fixed time models (e.g. TRANSYT (Vincent et al, 1980)), online model (e.g. SCOOT (Hunt et al, 1981)), working of coordinated traffic signals, traffic management using coordinated traffic signals, Forecast Methods in Traffic Control Network oriented signal control methods (plan selection, adaptive systems)

Public Transport Operations

Present trend of ITS applications in public transport, AVL system, bus priority, real time passenger information (RTPI), dynamic fleet management, enforcement, electronic ticketing, smart bus, general remarks on new applications and future trends.

Motorway Control Systems

Objectives, structure, types (net, line, node, other), algorithms, incident detection, ramp-metering, example (parameter setting, congestion warning, etc.)

Integrated Urban Traffic Management

Data fusion, strategy management, networking of systems, parking, tolling, mobility/road pricing,

Evaluation and Assessment of schemes

Evaluation need, objectives, evaluation steps, methods (simulation, field data), data analysis, statistics, example of evaluation

ITS for Public Transport Priority

Background, need for public transport priority, bus priority at traffic signals, detection methods, priority architectures, priority methods, theoretical analysis, technological requirements

Case studies of ITS applications

Case studies of ITS applications (initiatives, system, architecture, deployment and results) in different European cities including London and Munich.

Assignments

Written reports on Traffic signal design and evaluation of bus signal priority

Recommended Textbooks

- Kerner B. S. (2004). The Physics of Traffic: Empirical Freeway Pattern Features, Engineering Applications and Theory. Springer, ISBN 3540207163
- May A.D. (1990). Traffic Flow Fundamentals. Prentice Hall, US, ISBN 0-13-926072-2
- Salter, R.J and Hounsell, N.B. (1996) Highway Traffic Analysis and Design. Palgrave ISBN 0-333-60903-4

2.4. Summary

This chapter summarised the current situation in University-related courses in ITS and co-operative traffic management in Europe and worldwide, with details given in Appendix I. General recommendations on teaching and learning methods have then been followed by the specification of a new course in ITS and co-operative traffic management which is believed to be needed. As the expertise and the focus of traffic management education training varies considerably between European countries, a flexible approach has been taken here. It allows an individual university to design their own course using the optional modules related to their focus and expertise. The course could be run by an individual Institution or by a group of Institutions jointly. The course could be run by an association of few institutions with option of students studying at different institutions during the course period (e.g. using ERASMUS MUNDUS model). It also could be delivered by a model similar to CITE consortium (www.citeconsortium.org) where each member institution contributes modules which are free to use by all consortium members. Such a model reduces the workload of universities by removing duplication of effort. The proposed Virtual Centre of Excellence (VCE) could provide an ideal opportunity to form such consortium to run the course. An option of student exchange to study some part of the courses in other institutes within the consortium could also be embedded in the system. Organisation of such courses as a consortium brings NEARCTIS members more closely to fulfil one of the main aims of NEARCTIS to provide education and training opportunity in the field of co-operative traffic management.

2.5. References

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CITE, 2011. CITE Web-based Transportation Courses. CITE consortium, Available from www.citeconsortium.org

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Vincent R.A., Mitchell A.I. and Robertson D.I., 1980. TRANSYT Version 8 User Guide. Transport Research Laboratory, TRRL Report LR666

UoS - University of Southampton, 2011. MSc in Transportation Planning and Engineering. Available from www.
http://www.soton.ac.uk/engineering/postgraduate/taught_courses/msc_transportation_planning_and_engineering.page

FTW - Fachhochschule Technikum Wien, 2011. European Masters in Intelligent Transport Systems. Fachhochschule Technikum Wien, Available from *www.em-its.eu/*

3. Young/Senior Professional Training

3.1. Requirements

The area of Traffic Management is characterised by a rapid and multifaceted evolution in diverse fields such as:

- methodologies, approaches and paradigms for the design of intelligent systems (modelling, simulation, optimisation and control);
- implementation technologies: new sensors, advanced communications (including wireless), satellite systems, fast computing, human-machine interfaces etc.;
- traffic engineering and management systems (existing and evolving); and
- emerging technologies and inventions enabling innovative cooperative systems.

These evolutions call for increasingly interdisciplinary efforts towards the planning, design and operation of a new generation of co-operative Traffic Management and ITS implementations. The disciplines required range from traditional Civil Engineering to various sub-areas of Electrical Engineering, Computer Science, Physics and Mathematics. On the other hand, professionals usually have a strong education in just one of these disciplines. This situation calls for the organisation of suitable training tools and courses that will enable both young and senior professionals to face successfully the challenges of current and emerging ITS and Traffic Management applications. The specification of new training tools and courses has been the main concern of Task 3.2 of NEARCTIS. Before specifying new training tools and courses, a review of existing material and related needs was completed.

3.2. Summary of review of existing training courses for professionals

Training opportunities for professionals already working in the traffic management sector include conferences, workshops, seminars, field visits, trainings and short courses provided by various institutions. Attendance at these short courses, conferences and seminars is often supported by professional institutions[1]. The providers of such courses are categorised in different groups below:

- Academics and/or Universities
- Specialist organisations
- Private consultancies
- Software developers
- Conference organisers

These various course providers and the details of the courses they provide in the field of traffic management reported in D9 are given in Appendix III. The details have been extracted from information within the NEARCTIS partnership as well as material published on the web. These wide ranging courses available in traffic management for professionals have been reviewed to identify related needs and to specify new courses accordingly in subsequent sub-sections.

[1] For the UK, for example, these include the Institution of Civil Engineers (ICE), the Chartered Institution of Highways and Transportation (CIHT), the Chartered Institute of Logistics and Transport (CILT) and the Transport Planning Society (TPS).

3.3. Identification of Related Needs

This part of the report attempts to identify the training needs of current and future professionals in view of the rapid methodological and technological advances in the area.

3.3.1. Summary of Current Situation

3.3.1.1. Classification by Course Subjects

The review of Section 3.2 was structured according to the institutions offering courses for professionals, i.e. Universities, specialist organisations, private consultancies, software developers and conferences. A different classification of available courses may be undertaken on the basis of their addressed subjects or areas as follows:

(i) Courses addressing a specific tool: These courses usually present a subset of issues related to a specific (software or hardware) tool. Such issues may include the tool's methodological background, detailed (basic or advanced) presentation of its features, basic or advanced usage of the tool, interpretation of its delivered results and case studies. The intention of these courses is to train professionals to the usage of the respective tools and, thereby, to maximise their usefulness for their users. Examples of such courses are Introduction to SATURN, Introduction to MOVA, several courses by transportation software developers etc.

(ii) Courses addressing a specific area: These are courses focusing on a single specific area within Transportation. The areas addressed are usually relatively recent, i.e. based on recent research; as a consequence, there are (or were) hardly any related ordinary university courses available, which means that current professionals did not have a chance to receive the corresponding knowledge at the time of their studies. In other cases, the area is usually not covered in sufficient detail in university courses or involves significant updates in the related methods, regulations or state-of-practice. To attract a sufficient audience, the addressed area, although recent, must be of significant importance for the professionals' work, either in research or in consulting services or in development of systems. Examples of such courses are Dynamic Traffic Assignment, Introduction to Micro-Simulation Modelling, Planning & Design of Roundabouts etc.

(iii) Courses addressing a broader area: These are courses addressing a broader area or a multitude of interrelated subjects within Transportation. These courses may take several full days of lectures to cover their respective substances and are typically offered to professionals wishing to receive a broader overview and understand recent advances in the concerned areas. Examples of such courses are Dynamic Traffic Flow Modelling and Control, Modelling and Simulation of Transportation Networks, Intelligent Transport Systems etc.

(iv) Methodological or technological background courses: Transportation and traffic management are evolving from purely Civil Engineering sectors to multidisciplinary areas, involving various aspects of communications, computing, optimisation, statistics, control and more. As it is not possible for Transportation professionals to have a solid educational background in all these areas, the courses in this category intend to provide appropriate background knowledge to enable a deeper understanding and creative application of the addressed subjects. Surprisingly, very few courses of Section 3.2 seem to belong to this category, e.g. Discrete Choice Analysis.

3.3.1.2. Classification by Course Audience

Yet another classification of available courses may be based on their intended or factual audience. Courses may be more research oriented or more practice oriented. The former are addressing researchers and consultancy or administration employees with research-like activities, while the latter deliver the necessary knowledge and skills for immediate practical application.

On a different level, some of the courses of Section 3.2 are mainly addressing a local or national audience while others are intended for an international audience.

3.3.2. Potential new Professional Courses

A final outcome of NEARCTIS work within Task 3.2 has been the specification of new professional courses (Section 3.4). Clearly, the intention is not to replace available courses for professionals, but, by contrasting the review of Section 3.2 with the identification of needs in this section, it has been possible to identify possible gaps and to design new professional courses so as to fill the gaps. In so doing, it is reasonable to limit the scope of the related NEARCTIS work by excluding some categories of courses that are deemed less appropriate for a European Network of Excellence on Cooperative Traffic Management.

To start with, the main scope of NEARCTIS is Traffic Management on roads and highways, with an emphasis on recent and emerging cooperative systems. Therefore, the needs and specifications within WP3 should be limited to areas that are relevant for the design of better traffic management systems for road and highway networks.

In addition, the NEARCTIS work should address the European or international dimension of traffic management, leaving out of consideration any specific national issues with little relevance at the European level.

Furthermore, NEARCTIS is looking at the most advanced or emerging developments in traffic management rather than well-established practical tools. Thus, the focus of NEARCTIS within WP3 is on developments and needs related to more efficient research but also on recent research methods and products that have undergone successful field pilot tests or are considered promising for practical implementation.

A solid methodological or technological background is essential for successful traffic management developments and has therefore also been considered within NEARCTIS WP3.

Finally, needs and new course specifications have addressed specific or broader areas of traffic management but excluding training in the usage of individual tools as dedicated course subjects.

3.3.3. Areas and Needs

This section specifies specific needs and areas that are deemed significant for the development of enhanced traffic management tools and practices and should therefore be considered in the specification of new professional courses.

3.3.3.1. Methodological background areas

As mentioned earlier, there are several methodological background areas that are indispensable for the development of efficient traffic management tools, in particular of real-time traffic control strategies. The need for professional training in these areas is deemed necessary, either because many transportation professionals do not have the corresponding

educational background or because there are significant recent advances within these areas that may be exploited in traffic management applications. Clearly, related dedicated courses or course parts should focus on methods that appear to be most suitable for traffic management applications and should deliver successful application examples. Possible significant background methodologies include:

- Optimisation methods with available or potential applications to traffic management. This includes optimisation basics, nonlinear programming methods and tools, combinatorial optimisation, multi-objective optimisation, meta-heuristics etc.
- Control engineering methods with available or potential applications to traffic management. This includes classical feedback design methods, discrete-time control, multivariable control, optimal control etc.
- Fluid and particle flow methods with available or potential applications to traffic flow modelling.
- Estimation methods (Kalman filter, particle filter) and their application in traffic management.

3.3.3.2. Technological background areas

The practical application of traffic management tools is enabled by advanced technologies that cover the areas of monitoring, communications, computing and localisation. Possible significant background technologies include:

- Overview and basics of monitoring and localisation devices for road traffic management (sensors of various types, GPS, digital cameras etc.)
- Communications, computing and system architecture issues and tools for road traffic management.

Of particular importance in view of the rapid related developments are cooperative systems:

- Cooperative systems: achievements, features, capabilities and existing or potential applications for a new era of road traffic management.

3.3.3.3. Traffic Management application areas

Training needs for professionals address various areas of road traffic management that must be explicitly addressed by training courses. These areas include:

- Modelling and simulation concepts and tools (microscopic modelling including car-following and lane-changing behaviour, macroscopic traffic flow theory, model validation using real traffic data, case studies).
- Monitoring and estimation concepts and tools for traffic management.
- Driver information systems, dynamic traffic assignment methods and tools and route guidance in traffic networks.
- Traffic signal control in urban networks with emphasis on saturated traffic conditions.
- Public transport systems including public transport priority methods and tools.
- Motorway traffic control methods and tools (ramp metering, link control, variable speed limits, emergency lane usage, incident management).
- Road pricing methods, tools and impact.
- Fleet management and door-to-door travel.

3.4. Specifications for New Professional Courses

Based on the results of the above reviews, the final activity within NEARCTIS Task 3.2 was the specification of new professional courses at a European level for Cooperative Traffic Management. This includes a detailed description of the required subjects and contents.

As agreed between the NEARCTIS partners, the following five short professional courses were specified:

- Driver information systems (Michael G.H. Bell and Ioannis Kaparias, ICL)
- Traffic signal control and public transport priority (Nick Hounsell and Birendra Shrestha, UoS)
- Motorway traffic control methods and tools (Markos Papamichail and Ioannis Papamichail, TUC)
- Microscopic modeling and simulation (Peter Wagner, DLR)
- Traffic state estimation and data fusion methods (Hans van Lint, TUD)

Of course, this is only a subset of the courses that could be specified based on the specific needs and areas that are deemed significant for the development of enhanced traffic management tools and practices and that were analysed in section 3.3.3. The first four courses are covering Traffic Management Application areas while the last course is covering a Methodological area. In the following, these short professional courses are presented in more detail.

3.4.1. Course 1: Driver Information Systems

This is a short course that has been proposed by Prof. Michael G.H. Bell and Dr. Ioannis Kaparias, Imperial College London, London, U.K.

Scope: In the last two decades, the field of Intelligent Transportation Systems (ITS) has experienced a spectacular growth with emerging technologies being increasingly implemented in transport applications. ITS have been developed for areas such as traffic and public transport management, traveller information, safety and security, and freight and logistics. As an integral part of ITS, and more specifically of Advanced Traveller Information Systems (ATIS), Driver Information Systems (DIS) were initially treated as luxury goods and were only offered as premium accessories on high-priced cars. This has now changed and driver information has now become an everyday consumer good, as technological advances in ICT have resulted in a wide range of devices and applications becoming available at affordable prices. The purpose of this intensive course is to cover all aspects and tools necessary for the efficient design and evaluation of DIS. The course spreads over two days and consists of two parts: Systems and Methodologies. Part I (0.5 days) gives an introduction to the field of DIS and an overview of the systems and technologies available, as well as their evolution throughout the years, finishing with an insight into the future. Part II (1.5 days) then deals with the methodologies employed in DIS, which are presented in detail and supported by a number of exercises to consolidate the knowledge.

Who Should Attend: Technology developers, researchers, engineers, consultants, government officials, students, and generally whoever has an interest to gain in-depth knowledge about the field of DIS and how it fits within the general context of transport engineering and ITS.

Course contents

Part I – Systems

Context and definitions

General context of traveller information and DIS within ITS and transport; Usefulness and advantages

Historical overview

From 1960s until now: evolution of traveller information and needs; Technological advances; evolution of DIS systems and market

Overview of technologies

State-of-the-art of technologies: hardware and software; Communication; User interfaces

Overview of systems

In-vehicle and off-vehicle; Autonomous and centralised; Application categories; Traditional and ITS

Deployment, policy framework and future

Current state-of-play of DIS in various regions; Relation to the existing policy framework around the world (e.g. ITS EC Directive); Future opportunities

Examples

Part II – Methodologies

Principles

Properties of road networks and representation; Basics of optimisation in transport; Principles of transport modelling; macroscopic and microscopic traffic simulation

Uncertainty and reliability

Causes and effects of uncertainty; Time-dependence; Network reliability; Deterministic and stochastic modelling; Travel time and network state estimation

Route finding

Problem formulation and solution algorithms – exact and heuristic – for: basic shortest path; multiple routes; Multiple objectives; Constraints; Time-dependence; Stochastic variations

Traffic assignment

System- and user-optimum; Static assignment; Dynamic assignment; Reactive-proactive-anticipatory approaches

User behaviour

Market penetration rate and impacts; User preferences; Route choice models

Exercises

3.4.2. Course 2: Traffic Signal Control and Public Transport Priority

This is a short course that has been proposed by Dr. Nick Hounsell and Dr. Birendra Shrestha, Transportation Research Group, University of Southampton, Southampton, U.K.

Scope: Traffic Signal control has always been in the forefront of controlling and managing traffic in urban areas. With the availability of more affordable detection and communication technologies, the scope of utilising traffic signal control for management aspects has increased. This has led to traffic signal control becoming the key pillar of various Intelligent Transportation Systems (ITS) applications in the urban areas. The purpose of this two-day course is to cover the theoretical and practical aspects necessary for efficient design and evaluation of traffic signal control systems including public transport priority. The course begins with basic terminology and concepts used in traffic signal control. It then goes into the details of traffic signal design covering theoretical as well as practical aspects. The importance of linking traffic signals, linking methods, online and offline models such as SCOOT and TRANSYT are then covered. The second part of the course deals with the public transport priority at traffic signals with particular emphasis on buses. It starts with the need for bus priority in present context and then goes into the various ways of giving bus priority at traffic signals. Evaluation of bus priority implementation will also be covered in the lecture along with a tutorial.

Who Should Attend: Graduate students, engineers, researchers, consultants, and government employees who are interested in improving their understanding of traffic signal control and public transport priority.

Course contents

Introduction

Course aims; Topics covered; Tutorials

Traffic Signal Control

Introduction

Background; Types of junction control; Classification of signal control strategies (fixed-time signal, vehicle actuated signal, coordinated signal); Signal design software

Traffic signal timing and optimisation methods

Introduction; Signal aspects; Phases; Stages; Cycle; Intergreen times; Effective green time; Saturation flows; Capacity; Queues; Delays; Design of signal timings; Examples of optimisation methods around Europe

Linking traffic signals

Co-ordination need; Benefits; Platooning; Linking systems; Linking methods; Combination method, Fixed time models (e.g. TRANSYT); Online model (e.g. SCOOT); Working of coordinated traffic signals; Traffic management using coordinated traffic signals

Tutorial

Traffic signal design exercise (with software support)

Public Transport Priority

ITS in public transport

Present trend of ITS applications in public transport; AVL system; Bus priority; RTPI, Fleet management; Enforcement; Ticketing; Smart bus; General remarks on new applications and future trends

Introduction to PTP

Background; Need for public transport priority; Bus priority at traffic signals; Detection methods; Priority architectures

Bus priority methods

Introduction; Extensions; Recalls; Stage skipping; Stage insertion; Rolling horizon methods; Advantages/Disadvantages of various methods

Case study

London's bus network; Bus priority initiatives in London; Recent initiatives; iBus system; London's bus priority architecture; Deployment; Results

Evaluation of bus priority projects

Evaluation need; Objectives; Evaluation steps; Methods (simulation, field data); Data analysis; Statistics; Example of evaluation

Tutorial

Evaluation of BSP (bus signal priority)

3.4.3. Course 3: Motorway Traffic Control Methods and Tools

This is a short course proposed by Prof. Markos Papageorgiou and Ioannis Papamichail, Dynamic Systems and Simulation Laboratory, Technical University of Crete, Chania, Greece.

Scope: The design, analysis, and evaluation of Intelligent Transportation Systems (ITS) requires a good knowledge of traffic flow modelling and control techniques. The purpose of this intensive two-day course is to cover the basic theory and tools necessary for efficient design and evaluation of control methods and tools on motorway networks. The course will begin with traffic flow modelling that includes coverage of the various traffic flow models, the modelling of traffic networks, and simulation tools. The state-of-the art techniques on motorway control via application of modern optimisation and control techniques, together with several case studies will be presented.

Who Should Attend: Graduate students, engineers, researchers, consultants, and government employees who are interested in improving their understanding of advanced traffic control methods and tools and in becoming familiar with their application in ITS.

Course contents

Introduction

Some basic notions

Definitions; Control-loop elements; Mathematical models; Open-loop vs. closed-loop control

The regulation problem

Set values; Performance criteria; P, I, PI regulators

Optimal control strategies

Problem formulation; Solution alternatives; Hierarchical structures; Rolling horizon

Introduction to motorway traffic control

Control measures; Basic problems

Traffic Flow Modelling

Macroscopic traffic flow models

Definitions; Speed-flow relationship and Fundamental Diagram; Conservation equation; Kinematic waves and shock waves; LWR model; Drivers' anticipation; Second-order models; Model limitations; Modelling of on-ramp flow; Modelling of incidents; Testing control strategies via simulation; Fuel consumption models

Modelling of traffic networks

Macroscopic node interfaces; Turning rates; Urban junction modelling; Platoon dispersion; Saturation flow

Dynamic network models

METANET/METACOR, CONTRAM/MCONTRM, INTEGRATION, DYNAMIT

Exercises

Motorway Traffic Control

Ramp Metering

Why ramp metering; Implementation issues; Fixed-time ramp metering using Linear and Quadratic Programming; Local ramp metering strategies; ALINEA; Coordinated feedback ramp metering using LQ-control; METALINE; Field results from Paris, Amsterdam, Glasgow; Corridor impact of ramp metering; Nonlinear optimal ramp metering and applications; AMOC; HERO; Limitations and impact on demand

Link Control

Variable speed limitation; Warning messages; Reversable flow; Impact on traffic flow; Implementation examples

Integrated Freeway Network Traffic Control

Optimal integrated motorway network control; AMOC; Simulation examples

Merging Traffic Control

Basic concept; Control Algorithms; Applications to motorway work zones and toll plazas; Microscopic simulations testing

Exercises

3.4.4. Course 4: Microscopic Modelling and Simulation

This is a short course by Dr. Peter Wagner, German Aerospace Centre, DLR.

Scope: This three-day course starts with a description of empirically known facts about traffic flow, which is important for microscopic traffic flow models. It introduces the family tree of traffic flow models from macroscopic to microscopic ones. Into more detail, typical representatives of microscopic traffic flow models are introduced (cellular automata, safety-based models, models described by differential equations, psycho-physical models). The most

commonly used commercial traffic flow simulators and their implemented traffic flow models are described briefly, so that attendees learn about what these models can provide.

In the second part, not only the immediate car-following issues are discussed, but also the higher-order levels of tactical driving will be introduced and discussed. The most important of those is the lane-changing process, ranging from lane-changing on motorways to lane-changing on urban roads, from discretionary to forced lane-changing.

One of the most important topics is the calibration and validation of those traffic flow models. Since this is an issue with all traffic flow models, is had become especially important with the microscopic traffic flow models. Therefore, this part describes how to calibrate and validate traffic flow models, and gives advice to how this can be accomplished in reality.

Some exercises will be used for consolidation of the provided knowledge. Depending on available resources, they can be done with the open source simulator SUMO on real applications to provide a more in-depth understanding of the material. Extensive written materials, including all transparency copies, will be handed out.

Who Should Attend: Graduate students, engineers, researchers, consultants, and government employees who are interested in improving their understanding of microscopic traffic flow modelling and simulation and in becoming familiar with their application in all kinds of traffic management, especially in ITS and cooperative traffic management applications.

Course contents

Traffic Flow Modelling

Empirical facts

From macro to micro

Detailed Microscopic Models:

Cellular automata

Time-discrete models

Time-continuous models

Stochastic models

Psycho-physical models

Simulation tools / commercially available models

Tactical Driving

Lane changing on motorways

Discretionary; Forced

Lane changing on urban roads

Discretionary; Forced

Overtaking on rural roads

Intersection modelling

Calibration and Validation

Basic statistics behind

Non-linear optimization

How to do it even with commercially available simulation programs

Pitfalls

3.4.5. Course 5: Traffic State Estimation and Data Fusion Methods

This is a short course by Dr. Hans van Lint, Transport & Planning Department, Civil Engineering, Delft University of Technology, Delft, The Netherlands.

Scope: For traffic management applications reliable and accurate (archival and/or real-time) data are essential. In most practical cases, there exists a considerable gap between the information that is ideally needed and the data that is actually available. Data in practice come from different sensors with different characteristics and spatiotemporal coverage and semantics, and are typically sparse, noisy and biased. Moreover, some important traffic variables (e.g. density), can typically not be measured directly with regular sensors and need to be estimated from whatever data is available. In this course we outline the basic ingredients needed for traffic state estimation and data fusion. Besides data, we need models that implement our assumptions about these state variables and their relation to the available data, and data assimilation techniques that combine both into reliable estimates.

Who Should Attend: Graduate students, engineers, researchers, consultants, and government employees who are interested in improving their understanding of traffic state estimation and data fusion tools and in becoming familiar with their application in ITS.

Course contents

Introduction

Some basic notions

Place and role of state estimation in traffic management and control

Ingredients of traffic state estimation and data fusion

Data; Models (theory & assumptions); Data assimilation techniques

Brief overview of dynamic traffic phenomena

Congestion patterns in practice

Data and Models (Crash Course Traffic Flow Theory)

Basic variables and relationships – What can we measure and how?

Headway/Flow; Speed; Spacing/Density; Travel time; Time vs space mean; Edie's generalized variables; The continuity equation; The fundamental diagram (and what it means: average drive behaviour: theory vs empirics (what we measure), and causes for the differences: errors, traffic heterogeneity, hysteresis

Basic traffic dynamics

Shockwave & kinematic wave theory; Analytical and numerical solutions

Other (more advanced) modelling approaches

Some qualitative notes in relation to state estimation & data fusion

Critical Discussion

Limitations, What models do we need for state estimation, Which phenomena from 1.3 can we reconstruct with what type of models (if at all)

Exercises

Data Assimilation Techniques (1)

Heuristics

Interpolation; Smoothing and simple imputation

The adaptive smoothing method (ASM) and extensions

Spatiotemporal data smoothing and repairing; Fusing multiple data sources; Computational aspects

Interpolation and ASM application: travel time estimation methods

Comparison of well-known methods used in practice

Data-data consistency methods for data fusion

Parsimonious data fusion methods using simple relationships and multiple data sources

Exercises

Data Assimilation Techniques (2)

The Kalman filter (KF)

Brief tutorial with an application to bicycle tracking

The extended Kalman filter (EKF)

Assumptions; Implications; Application to traffic state estimation; Brief notes on alternatives (Unscented KF, Particle filtering)

EKF traffic state estimation

RENAISSANCE, Fileradar and other CTM; Alternative approaches; Discussion about convergence; Assumptions; Noise parameters; Computational aspects

Other applications and wider perspective in ITS

Location tracking; Object identification; Control

Exercises

Traffic State Estimation Cases & Exercises

Participants can apply (and play with) the techniques discussed using real data and networks from the regiolab-delft.nl traffic database

3.5. Summary

This chapter has set out a structure of five new professional courses at a European level for Co-operative Traffic Management. These courses have been proposed on the basis of the review of current situation in relation to the areas and needs within the scope of NEARCTIS. The courses included are: driver information systems; traffic signal and public transport priority; motorway traffic control methods and tools; microscopic modelling and simulation; and traffic state estimation and data fusion methods. These courses cover methodological area as well as traffic management application areas. These short courses could be included as

yearly events of the proposed Virtual Centre of Excellence (VCE). A possibility for running such courses could be in collaboration with ITS EduNet, which has already been established as a virtual network for training and education in ITS. Such joint organisation could reduce the resource burden and fulfil the aims of both organisations in terms of training opportunities in the field of co-operative traffic management.

4. Young/Senior Researchers' Mobility and Training

4.1. Introduction

This task promotes the mobility and training of the early stage researchers (less than 10 years of research experience) within the NEARCTIS NoE. The three main pillars of this action are:

- PhD research grants
- Mobility: visits between partners
- Training: summer school

A PhD committee was created (**[Table 4.1**]) in order to assess the proposals and to select the candidates to be accepted. This committee consists of one representative each from the NEARCTIS core institutions. The chair of the PhD committee is undertaken by EPFL which is in charge of the task 3.3. Pierre-Yves Gilliéron is leading this task and is in charge of its operational implementation.

The PhD committee has also been involved in the review of the PhD research work. Each PhD student has submitted a yearly report which was evaluated by some committee members.

[Table 4.1] List of the PhD committee members

EPFL (Chair)	André-Gilles Dumont
DLR	Peter Wagner
INRETS	Christine Buisson
UCL	Francesca Medda
TUC	Markos Papageorgiou
TU Delft	Serge Hoogendoorn
ICL	Michael G H, Bell
U.SOUTHAMPTON	Ben Waterson

NEARCTIS also co-hosted a second summer school on 'Traffic modelling for traffic management and cooperative systems". This event was jointly organised by NEARCTIS, COST action TU0903 MULTITUDE and the Dutch Research School TRAIL and held in Delft from 2-4 May 2011.

The mobility and training programmes have been well established by NEARCTIS and play a major role in the scientific exchange within the core network and also with some associate partners. This fundamental component will certainly play a key role in the future centre of excellence.

4.2. NEARCTIS PhD programme

Five PhD students were selected for the NEARCTIS PhD programme. The recruitment phase and the selection process were conducted carefully according the guidelines described in the D2. This resulted in some delays that necessitated an extension of the project to mid-2013. Thanks to this extended deadline all PhD research should be accomplished in 2013 as they were initialised in 2010.

The full budget of 360,000€ has been allocated, within the NEARCTIS incentive budget, for funding PhD research within the NoE. Part of the budget has also been devoted to the mobility of PhD students who must spend 6 months in a NEARCTIS institution.

4.2.1. Achievements and activities

All the PhD research works were started in 2010 and they have submitted their progress report after the 1st year of activity in June 2011 (Appendix IV). The Report (3 to 5 pages) is composed of the following sections: Research goals and objectives, Literature Review, Work achieved in past year, Current state of work, Calendar of upcoming work, Scientific publications, presentations and conferences held by the candidate and visits between partner institute(s). All the reports have been assessed by PhD committee members who provided some comments and advice to students. A specific form was developed for the evaluation of work progress reports (Appendix V). **[Table 4.2**] summarizes the status of each PhD research activity with his/her mobility plan.

[Table 4.2] NEARCTIS PhD details

PhD, Institute	Project Title/budget	Reviewer 2011	Mobility Plan
Mr Riccardo **Scarinci** UCL	Management of motorway roads € 79,918	DLR, Peter Wagner	- Hosting Inst.: TU Delft - Contact: Andreas Hegyi - Starting: Feb. 2012
Mr Scott **Cruickshanks** U.SOUTH-AMPTON	Privacy Barriers to the Uptake of Collaborative Transport Technology € 70,500	TU Delft, Serge Hoogendoorn	- Hosting Inst.: TUC, TU Delft, TU Graz (Ass. Part.) - Contact: I. Papamichail, S. Hoogendoorn, M. Fellendorf - Starting: Oct. 2011 - Comment: will spend 2 months in each institution
Mr Mehdi Keyvan **Ekbatani** TUC	Real-time Urban Traffic Signal Control under Saturated Conditions € 68,400	UCL, Francesca Medda	- Hosting Inst.: EPFL, USo - Contact: N. Geroliminis (EPFL), N. Hounsell - Starting: Jan. 2012 - 2 visits of 1 to 3 months each
Mr Thomas **Monamy** ENTPE / IFSTTAR	Modeling the capacity drop phenomenon € 100,000	ICL, Michael Bell	- Hosting Inst.: TUC - Contact: M. Papageorgiou - Starting: tbd
Miss Huiying **Wang** ICL	Co-operative alternative to traffic signals at intersections € 41,182 Part. funding	TUC, Markos Papageorgiou	- Hosting Inst.: EPFL - Contact: P.-Y. Gilliéron - Starting: mid 2012

The goal of the work progress report is to ensure that ongoing research is progressing according to expectations. At this stage of the research the committee members are checking that the research content is matching the goal of the NEARCTIS network and that the collaboration with partners is on-going or planned.

The assessment of the progress report was based on the following criteria associated with the following questions:

- Has the research been making satisfactory progress (Excellent/Good/Fair/Poor)?
- Is there evidence that the research has/will produce significant scientific and technical contribution?
- Is the calendar of the upcoming work achievable within the time and resources available?
- Is the collaboration with other NEARCITS partner(s) or stakeholders suitably involved?
- Is the mobility plan (stay of 6 months) reasonable?
- Comments to the PhD student.

The ongoing research work is progressing well with some promising preliminary results. All students have actively participated to NEARCTIS events (workshops, summer school) and have been included in some specific tasks of NEARCTIS (e.g. review).

4.2.2. Planned action

As mentioned in **[Table 4.2**], PhD students will spend some months in another NEARCTIS Institution (or more than one). This stay will certainly have a positive impact on the NoE with some joint research activity and publications. The 2012 progress report will focus on this point (**[Table 4.3**]).

[Table 4.3] NEARCTIS PhD planned actions

Responsibility	Task	Deadline
PhD candidate	Organise & perform mobility	2012
PhD candidate	Progress report	Yearly report (end of June)
PhD candidate	Oral presentation during NEARCTIS workshop	Mid 2012
PhD committee	Evaluation of the candidates' yearly progress report.	Within one month of the yearly report submission

In 2012 PhD students will contribute to the animation of a specific session during the next NEARCTIS workshop. It will be a good opportunity for the dissemination of preliminary results and making their research more visible.

According to the extended deadline for PhD research work, the PhD committee will keep an active role in the evaluation of the progress of PhD students. A particular effort will be made in the final evaluation of research activities with a deep involvement of NEARCTIS members.

4.3. Visits between partners

NEARCTIS encourages the mobility between partners and launched a call for mobility in spring 2011 in order to increase the number of visits. Apart from the PhD programme, mobility between partners is an added value for the realisation of the NoE.

4.3.1. Achievements and activities

Until end of year 2011, NEARCTIS has supported six young researcher mobility programmes:

1. Mahdi Zargayouna (INRETS) had an exchange at the TU Delft from March 2009 to August 2009.
2. Femke Van Wageningen-Kessels (TU Delft) had an exchange visit at INRETS/ LICIT between 07/09/2009 to 25/09/2009.
3. Yun-Pang Wang (DLR) had an exchange visit at EPFL/TRANSP-OR between 19/08/2010 to 24/09/2010
   Topic: Route choice calibration with traffic measurements
4. Olga Huibregtse (TU Delft) had an exchange visit at EPFL/TRANSP-OR between March to June 2011
   Topic: Efficient optimization of route advice considering compliance behavior
5. Andy Chow (UCL) had an exchange visit at EPFL/LUTS between 26/09/2011 to 30/09/2011
   Topic: Macroscopic fundamental diagram of motorway, a case study of M25 motorway, UK
6. Bani Anvari (ICL) had an exchange at the TU Delft in November 2011.
   Topic: Simulating ITS applications in future shared space environments

Reports on visits are available on the web site of NEARCTIS and an interview of Dr Yun-Pang Wang has been done for promoting the mobility of researchers within the NoE (see 0Appendix VI).

4.3.2. Planned action

The Steering committee has approved two more long-term visits between partners for spring 2012: F.M. Marczak (ENTPE, IFSTTAR) to University of Southampton, M. H. Pham (EPFL, LAVOC) to TU Delft.

The mobility programme was originally available for NEARCTIS core members only. The steering committee has since decided to open the mobility programme to associate partners. Thus they have the opportunity to visit NEARCTIS partners for a short or long-term stay.

4.4. Summer school

The organisation of summer schools is one of the key actions for promoting the human resources of the NoE within the scientific community in traffic management. The first NEARCTIS summer school was organised by EPFL in Lausanne in June 2010 (Appendix VII). This first joint school with COST action TU0702 was successful with a participation of 37 students and 6 lecturers. The joint school also increased the exposure to the wider European community.

The organisation of summer schools is still a priority for the steering committee and we would like to have such training schools on a regular basis (yearly) and jointly organised with

partners who have similar interest for tackling the congestion, safety and environmental challenges from the transportation domain.

4.4.1. NEARCTIS-COST TU0903 joint summer school

Some NEACTIS core institutions are also members of EU COST Action TU0903 (MULTITUDE)). COST Action TU0903 has a yearly budget for the organization of summer schools. The summer school in 2011 was organised by Winnie Daamen from the Delft University of Technology and it has been sponsored by NEARCTIS, COST action TU0903 and the Dutch Research School TRAIL. It took place in Delft from 2-4 May 2011 and was entitled 'Traffic modelling for traffic management and cooperative systems" Web site: *http://www.summerschool2011delft.org/*

The main objective of this summer school was to get the participants acquainted with the principles of the use of traffic models for ITS, including calibration and validation, how these models can be applied for ex-ante evaluation of dynamic traffic management (DTM) measures, which traffic phenomena should be covered by the models and to let them get hands-on experience with different types of models. The following topics were covered in the lectures (The full program is provided in Appendix VIII):

- Models in relation to ITS and cooperative systems
- Traffic flow phenomena
- Microscopic simulation models
- Car-following models
- Route choice and departure time choice

The lectures were delivered by the following well known instructors ([Table 4-4]).

[Table 4-4] Overview of lecturers of the summer school

Lecturer	Affiliation
Robert Bertini	Deputy Administrator of the Research and Innovative Technology Administration [RITA] at the U.S. Department of Transportation Portland State University
Serge Hoogendoorn	Delft University of Technology
Michael Bell	Imperial College London
Jaume Barcelo	Technical University of Catalonia
Eddie Wilson	University of Southampton
Christine Buisson	IFSTTAR, ENTPE
Tomer Toledo	Technion Israel Institute of Technology
Emma Frejinger	KTH Royal Institute of Technology
Peter Wagner	DLR
Vincenzo Punzo	University of Naples Federico

The school was open for all and participants within NEARCTIS and COST-TU0903 consortium were provided a travel grant to attend the course.

4.4.2. Achievements and activities

In total, 44 persons participated in the summer school. The participants were affiliated to fifteen institutes in nine different countries. Figure **1** gives the distribution of the participants over the institutes.

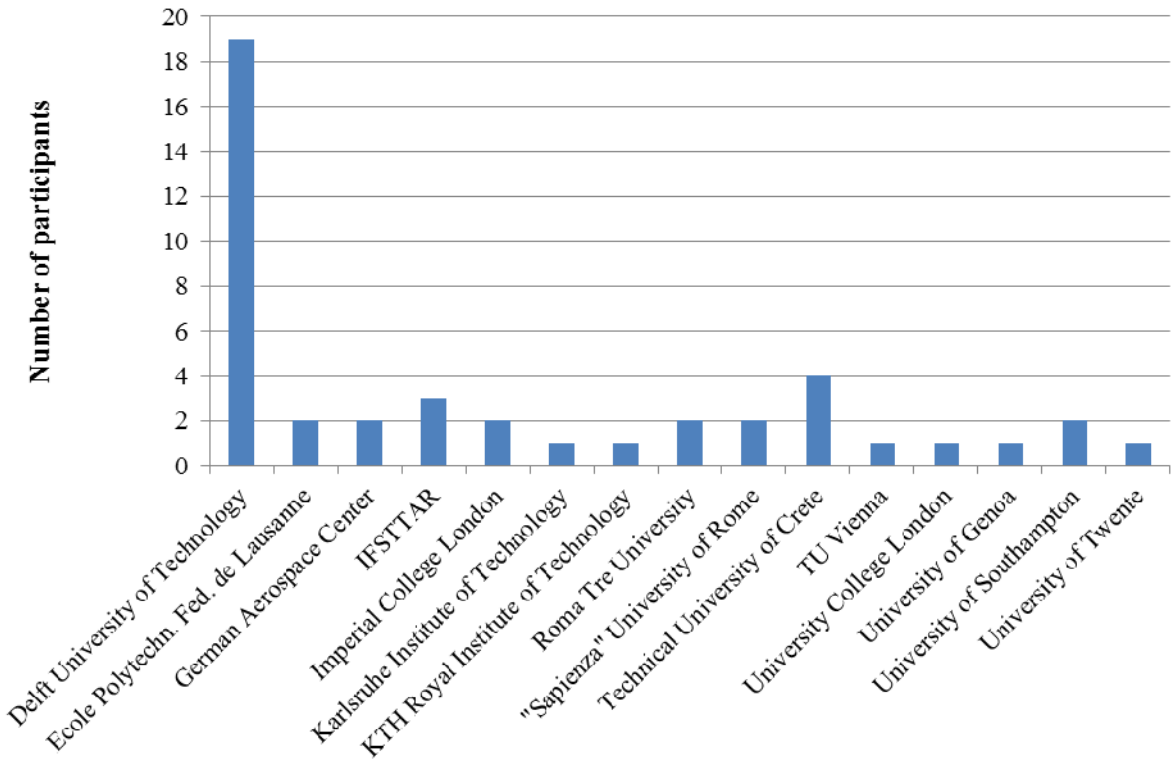

Figure 1: Overview of home institutes of participants

Figure 2 shows an overview of the connections to the different sponsors of the institutes the participants are affiliated with. Some institutes are affiliated with more sponsors, so the total does not add up to the total number of participants.

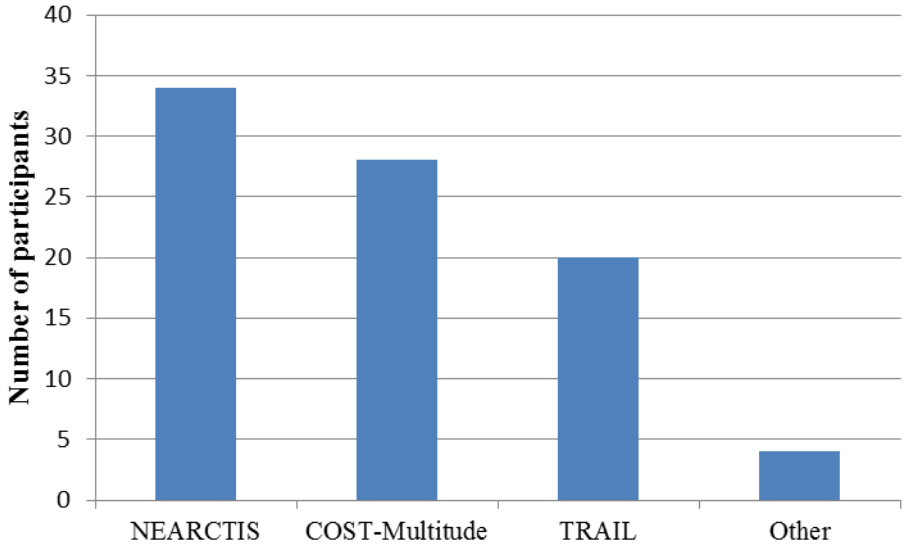

Figure 2: Overview of sponsors' affiliations of the participants' institutes

4.4.3. Evaluation – Lausanne 2010 and Delft 2011

One specific task of WP3 has been the evaluation of mobility and training programmes. During both summer schools (2010 in Lausanne, 2011 in Delft) the participants were asked to fill in an evaluation form (see Appendix IX). This evaluation form consisted of three types of questions, related to the general evaluation of the summer school, the evaluation of the lecturers and additional remarks. Most of the students (more than 75%) have filled the form which is a good score and acceptable for statistical analysis.

Lausanne 2010

First of all, **Figure 3** shows the evaluation of the overall quality of the summer school. All participants indicated that the quality was sufficient or higher, with an average score of 5.0 (good).

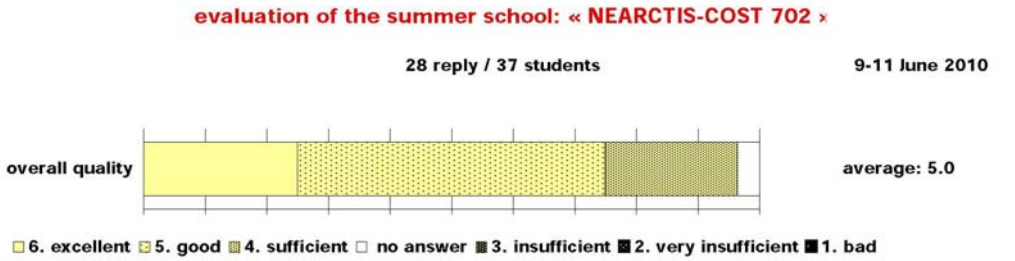

Figure 3: Evaluation of the overall quality of the summer school (Lausanne 2010)

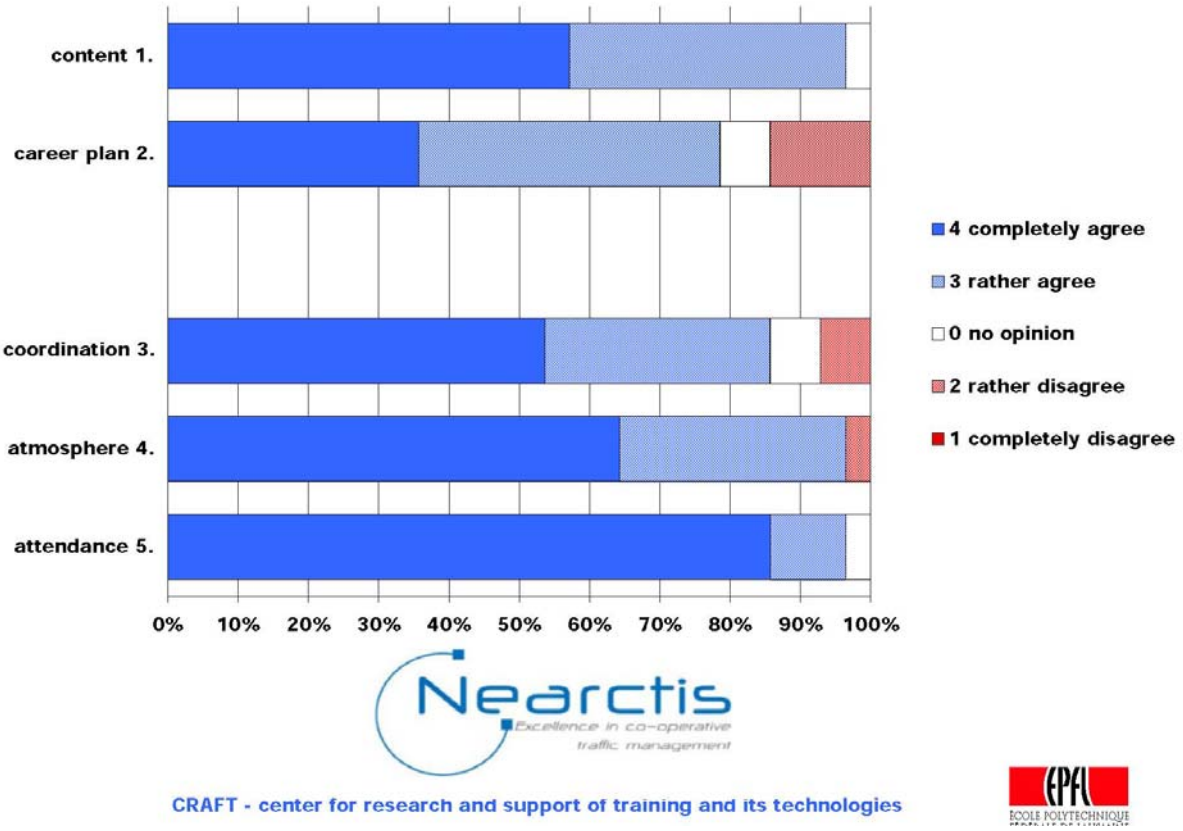

Figure 4: General evaluation of the summer school (Lausanne 2010)

Figure 4 shows the general evaluation of the summer school. The aspects covered are:

1. The content is rich and interesting.
2. The summer school fits well in your career plan.
3. The coordination between teachers is good.
4. The course atmosphere enables a good participation.
5. I attended the lectures.

The general evaluation also presents very positive results according the different aspects. However some students (15%) do not completely agree that the content of the summer school is matching with their career plan. Some students also have noticed that the coordination between instructors was not optimal.

Delft 2011

First of all, **Figure 5** shows the evaluation of the overall quality of the summer school. All participants indicated that the quality was sufficient or higher, with an average score of 4.8.

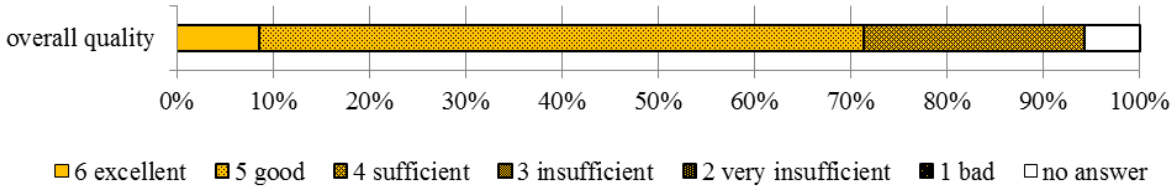

Figure 5: Evaluation of the overall quality of the summer school (Delft 2011)

Figure 6 shows the general evaluation of the summer school. The aspects covered are:

1. The content is rich and interesting.
2. The summer school fits well in your career plan.
3. The coordination between teachers is good.
4. The course atmosphere enables a good participation.
5. I attended the lectures.
6. I attended the exercises.
7. The (logistic) organisation of the course is good.

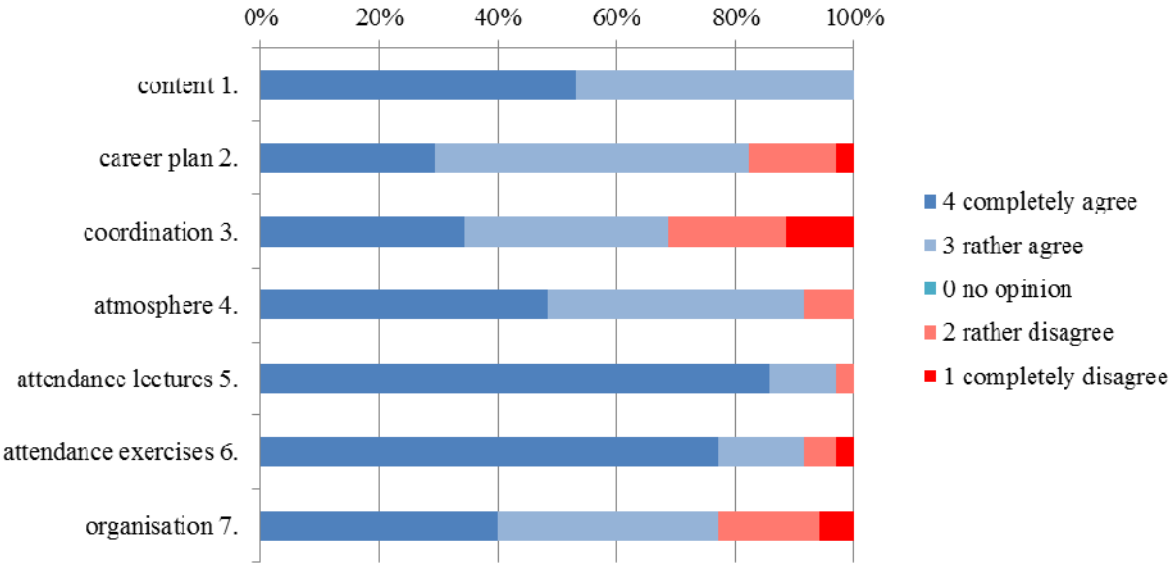

Figure 6: General evaluation of the summer school (Delft 2011).

First of all, it can be seen that all participants viewed the content as interesting, and more than 80% of the participants considered that the summer school fitted well in their career plan. The coordination between instructors is still the critical aspect: 30% of students are rather unsatisfied with this point.

Final remarks

The results of evaluation with a collection of remarks from the students are a valuable material for the organisation of future NEARCTIS summer schools. We already know that the coordination between instructors needs to be improved in order to avoid some repetitions and global introduction of topics. A better focus on specific concepts and algorithms is required for future courses.

4.4.4. Planned action

The next NEARCTIS summer school is planned at Ispra (EC Joint Research Centre in Italy) in spring 2012 with the collaboration of the COST action 0903 MULTITUDE.

The organisation of summer schools is one of the key aspects of NEARCTIS and is part of the perpetuation of the network. At this stage of the project there is coordination with the future plan of the NEARCTIS research centre and the role of training activities. Thanks to the high quality of NEARCTIS resources (databases, use cases, repository), the idea of organising a NEARCTIS summer school on a sustainable way is planned.

4.5. Summary of the planned actions

The following actions are planned for the continuation of Task 3.3 within NEARCTIS:

1. Monitoring the progress of the PhD research by the PhD committee with a special focus on the mobility programme of students
2. Participation of PhD students to a specific session during the next NEARCTIS workshop
3. Follow-up of the mobility programme and publication of reports of visits
4. Organisation of the NEARCTIS summer school 2012 in Ispra
5. Plan for future summer school within the NEARCTIS Research Centre.

4.6. Guidelines for future mobility and training

Task 3.3 has provided a collection of forms, rules and best practice for the implementation of mobility and training programmes (**[Table 4.5**]). At this phase of the project there are still on-going activities and it is not sensible to write now new guidelines for mobility and training. However the definition of the future research centre will take into account all these experiences in order to propose consolidated guidelines for mobility and training. This on-going task will be coordinated with WP5.

[Table 4.5] Overview of available guidelines and documents for mobility and training

Type of activity	Document	Publication
PhD programme	Guidelines for the submission of research project	D2
PhD programme	Instructions for PhD committee and for PhD candidate	D2
PhD programme	Evaluation for PhD grant	D9
PhD programme	Evaluation form for work progress report	D17
Mobility	Guidelines for mobility proposal	D2
Mobility	Evaluation form for mobility funding proposal	D9
Training	Teaching evaluation form (summer school)	D9, D17
Training	Programme of summer school	D9, D17

4.7. Summary

The mobility and training of early stage researchers within the NEARCTIS NoE has been an important part of the project. Five PhD researchers are currently undertaking research relating to co-operative traffic management in five different Institutions within NEARCTIS. Each researcher also has mobility plans to link with one or more NEARCTIS partner Institutions for a significant period of time. NEARCTIS has also supported six young researcher mobility programmes. In addition to these activities, NEARCTIS has organised two very successful summer schools in Lausanne (2010) and Delft (2011) jointly with EU COST action TU0702 and TU0903. A third is scheduled for Ispra, Italy in 2012. The oversubscription of these events shows that there is a demand for such training courses in the field of cooperative traffic management. This activity should be an important component for the future perpetuation of the network.

5. Associate Partners

Associate Partners are stakeholders who participate on a voluntary basis to the activities of NEARCTIS on the basis of Memorandum of Understandings (MoU). An example MoU (for industrial partners) is given in Appendix X. A document "Guide to the Associate Partners" (see Appendix XI) was produced to give Associate Partners more details about their role within NEARCTIS. Their diversity helps the consortium to get full insights of the challenges facing traffic management. They are also potential members for the future NEARCTIS association.

5.1. Evolution of the recruitment of Associate Partners:

Most of the recruitment of Associate Partners (APs) was done during the first two years of the project. Our first move was to broadly advertise for membership and since potential Associate Partners had already been contacted during the drafting of the NEARCTIS proposal, we had no difficulty with candidacies. The Associate Partners represent stakeholders from all over the world. Some of the partners are academic, some others road operators, some industrial partners. They are listed below.

Table [6.1] List of Associate Partners of NEARCTIS

European Union			
Organisation	**Representative**	**Sector**	**Location**
Graz, University of Technology, institute of highway engineering and highway planning	Martin Fellendorf	Research	Austria
KUL-CIB\ Traffic & Infrastructure, Department of Mechanical Engineering , University of Leuven	Chris Tampère	Research	Belgium
Motor Transport Institute (Instytut Transportu Samochodowego – ITS)	Andrzej Wojciechowski	Research	Poland
University of Artois	Hassane Abouaissa	Research	France
Centre d'études techniques de l'équipement du Sud Ouest/ ZELT (CETE SO : ZELT)	Marie-Reine Bakry	Research	France
TRL	Alan Stevens	Research	UK
University of Versailles Saint – Quentin en Yvelines	Samir Tohmé	Research	France
DVS	Gerben Bootsma	Operator	Nederland
TNO	Eline Jonkers	Research	Nederland
Traffic First	Mathieu Treutenaere	Industry	France
CITILOG	Miguel Pintado	Industry	France
T. U. of Munich	M. Spangler	Research	Germany

EGIS mobilité	J-M. Morin	Industry	France
Technische Universität of Braunschweig	B. Friedrich, O. Bley	Research	Germany
CERTU	Tiphaine Bretin	Operator	France
CERTH/HIT	A. Bekiaris	Research	Greece
LCPC	N. Hautière	Research	France
MOVEO cluster	S. Sellam	Operator	France
POLIS	S. Hoadley	Operator	EU
ECTRI	C. Almeras	Operator	EU
ETRA	Marques	Industry	Spain
ITS Hellas	V. Mizaras	Research	Greece
ITS Germany	M. Droste	Research	Germany
ITS-EduNet e.V	D. Monninger	Research	EU
TELENAVIS HELLAS S.A.	K. Haniotis	Industry	Greece
SODIT	N. Etienne	Industry	France
Link technology SA	I. Damianos	Industry	Greece
IOMI	Mark Brakstone	Consultant (research)	UK
Europe			
Organisation	**Representative**	**Sector**	**Location**
Ford Otomotiv Sanayi A.S.,	Murat Yildirim	Industry	Turkey
Istambul Technical University	Hande Demirel	Research	Turkey
Pamukkale University	Halil Kumsar	Research	Turkey
İSBAK A.Ş	Yeliz Tozlu	Industry	Turkey
Ideal Technology	Hasan Sutcuoglu	Industry	Turkey
Rest of the world			
Organisation	**Representative**	**Sector**	**Location**
University of Auckland	Avi Ceder	Research	New Zealand
VicRoads	Andrew Wall	Operator	Australia
California PATH, University of California, Berkeley	Alexander Skabardonis	Research	USA
The Open University of Israel	Dr. Yuval Chen	Research	Israël

University of Tokyo / Institute of Industrial Science	Marc Miska	Research	Japan
Construction & transportation Unit, Hong Kong Polytechnic University	William H.K. Lam	Research	Hong Kong
Federal University of Catarina	Eduardo Camponogara	Research	Brazil
KOTI	Young-in KWON	Operator	Korea
Klein and Associates	Larry Klein	Consultant (research)	USA

Some researchers are very involved in the activities of the Network, but their administration hasn't formally signed a MoU yet: This is the case of ENTPE (European engineer school), who have been hosting NEARCTIS meetings, of the University of Napoli (Vincenzo Punto is involved in the summer school 2012). In essence, we can safely say that we have 44 Associate Partners.

Already in year 2, following the remarks of the reviewers, we narrowed the recruitment in order to achieve a more balanced geographic representativeness, as well as to correct the fact that the APs are too often academics. We decided to focus more on recruiting national ITS organizations, as they would be representative of the industry and operators, important categories currently under-represented with the AP cohort.

Recruitment continued in year 3, focused only on industrial/ consulting partners. We followed the remarks of the reviewers to focus on southern European partners, who were also under-represented in the consortium.

Lately, we have been including in our activities any motivated researcher, actually involved in one of our actions, even if their administration hasn't signed the MoU yet, as we prefer to encourage enthusiasm rather than be formal.

5.2. Assessment of the collaboration with the Associate Partners:

Collaboration with APs has been mainly focused on the collection of data for the Deliverables, and participation to the events.

5.2.1. Communicating with the APs

We started with issuing formal newsletters every 6 months but soon found out that it was more effective to send short emails, at more regular intervals with information on the project's highlights. On top of those general emails, WP and Tasks leaders are directly contacting APs who have recorded an interest for their activities to communicate when needed. The communication isn't just "top-down" as APs are also sometimes circulating news from their organizations (conferences, job openings…).

5.2.2. Getting inputs from APs

We had made, at the beginning of the project, a "matrix of interest" summarizing themes which might be of interests for participation. When they sign up for the role of Associate Partners, they are asked to make their areas of interest known so as to be integrated in the matrix. Tasks leaders use the matrix to contact APs interested in their subject and ask for inputs. However, few of them (no more than 2-3) are really participating in the drafting of the deliverables. We then decided to ask them for validation on the documents, rather than

directly on inputs. This has worked well for Deliverables D6 and D7. A selection of the most relevant (and involved) APs were also invited to assess Deliverable D14 at the occasion of the "round table" event in London in order to produce D18.

5.2.3. Participation to events

We have had APs participating to our workshops regularly, typically around 5 to 9 depending on the event. This is a figure we are satisfied with, considering the fact that they are not getting any funding for the trips.

5.3. Improvements with collaboration in year 3

In the light of our experience of the previous years, special attention has been taken in year 3 to increase collaboration with the APs.

5.3.1. Participation in the researcher mobility programme

Some of the networking activities have been opened to APs, such as the exchange mobility programme. This programme is financed by the Incentive budget of NEARCTIS. Its aim is to allow researchers to visit other institutes belonging to the Network. An allowance of a maximum of 4000 euros can be attributed by the Steering Committee upon positive validation by the PhD committee of NEARCTIS of the proposal.

5.3.2. More active participation in the making of strategic Deliverables

As usual, APs are sent draft documents of Deliverables for inputs and reactions. This year, they will be more actively involved in the process. Working with APs has allowed us to identify partners that are specially interested in the project, and eager to be involved.

5.4. Integrating the Associate Partners in the Network:

As expected, of the 42 Associate Partners who signed a MoU, few are really active in NEARCTIS, since they don't get any financial support for their efforts. However, we've seen in the past year the emergence of collaborations that are going beyond what is planned in the DoW of NEARCTIS. Those actions are a helping us setting an agenda for the activities of the future NEARCTIS association that can be sustainable. APs are essential in the validation process of our future business plan, and it will be crucial for the project in the coming years to see if they express an interest for becoming paying members of the future NoE.

5.4.1. Promoting mobility of researchers

NEARCTIS is sponsoring 5 PhD through its PhD programme. The main characteristic of the PhD programme is that the students are expected to do part of their degree at another partner's. In the case of one of our PhD student, the exchange will be made with one of our Associate Partners, TU Graz.

Young PhD students from the Network have also found further career opportunities with some of our APs. This is the case for Chen Cai, a graduate from UCL who has been hired in 2011 by NICTA.

Partners of NEARCTIS have been lecturing at APs institutions: in November 2011, Winnie Daamen, from TU Delft has been a guest lecturer at ENTPE for three weeks. Her stay was so fruitful that she is now involved in a local project with ENTPE and KEOLIS (a local public transport provider).

Nick Hounsell (UoS) has been lecturing for TUM; Markos Papageorgiou and Ioannis Papamichail (TUC) have been guest lecturer for several months at the University of Berkeley in 2011.

Partners of NEARCTIS (EPFL and IFSTTAR) and prospective Associate Partner QUT have started (in September 2011) a Marie Curie action.

5.4.2. Participating in the perpetuation scenarios:

One of the perpetuation scenarios for the future NoE is that there will be a NEARCTIS summer school every year. Technical University of Munich, one of our APs, has a strong experience of organizing sustainable summer schools. They have proposed their expertise to help us design a self-sustainable package for this activity. Regarding the summer school activity, we have always had a politic of collaboration with partners external to the Network. For example, we have collaborated with the University of Napoli in 2011 and in 2012. The 2013 edition of the summer school will most probably be organized jointly with the Technical University of Barcelona, a prospective Associate Partner.

We have also received support in finalizing the perpetuation scenarios possible by some of our APs: indeed, both TU Leuven and ECTRI have proposed solutions for the perpetuation of the Network. ECTRI by proposing to host the secretariat of the association and TU Leuven by putting us in contact with another "umbrella" organization that could be able to handle the administrative part of the network.

5.4.3. Further integration of Associate Partners

A survey was launched in the autumn of 2011 to try and see what kind of collaboration and activities was interesting to pursue in the future NoE. The main challenge of the future Network will be to maintain activities with no EC funding. APs activities have helped us select organizations that are important in our field, interested by our thematic, and willing to involve themselves. They are our future members and knowing exactly, at the end of the project, what is their vision of sustainability will help in building a successful Network.

5.5. Summary

NEARCTIS has been successful in recruiting a large number of Associate Partners (AP) across the world. However, with the large numbers of APs with diverse expertise and interest, the integration has not been up to the level desired. One of the shortcomings could be the lack funding available to integrate APs in various NEARCTIS events. Given this situation, it may be preferable to have fewer, but more committed APs included in the future perpetuation of the network.

6. Dissemination of Research Results

6.1. Introduction

The aim of this task has been to prepare and support the dissemination of the results of the project to relevant recipients. These include decision-making bodies, the private sector, the wider academic community and the general public. Dissemination activities have been organised according to the intended target audience, namely (i) research peers (ii) other EU projects, NoE and the Commission, (iii) the general public and (iv) media relations.

6.2. Activities Task 3.5

Annual workshops and summer/spring schools are now a tradition in the dissemination activities for NEARCTIS.

6.2.1. NEARCTIS Workshops

NEARCTIS workshops have been an important medium of networking within NEARCTIS. These workshops have provided NEARCTIS project partners an opportunity to meet and network in the traffic management field. The main objectives these workshops were to initiate a debate on future key research topics related to the deployment of co-operative systems within the context of scientific challenges and mobility issues. The structure of the workshops has been: a plenary session with one or two keynote speaker(s) on topics within the scope of the network; technical and posters' sessions; and a participative session (e.g. questions and answers panels in the 3rd workshop). Four NEARCTIS workshops (see Appendix XII) organised so far are as follows:

- The first workshop held in Lyon on the 9th December 2008 within the EU French Presidency event.
- The second workshop was held on the 13th November 2009 at University College London (UCL)
- The third workshop was held in Lausanne (Switzerland) on the 11th June 2010 entitled "*Towards new research areas in co-operative traffic management*"
- The fourth workshop was held in Lyon (France) on the 10th June 2011 entitled "*Towards an integrated European community in advanced road cooperative traffic management*"

The 4th NEARCTIS workshop was held in Lyon in June 2011 as a side event of 8th ITS European Congress, 6 - 9 June 2011 - Lyon. The main objective of the workshop was to disseminate the work completed so far by the network as well as to initialize the process towards the harmonisation of the research agenda for setting up a Virtual Centre of Excellence (VCE) as part of the perpetuation of the network. This event was focused on how to move forward an integrated European community in advanced road cooperative traffic management.

This workshop was an excellent opportunity to meet the active community working in traffic modeling and management area and to inform and discuss the latest progress of research activities. This event has served as a platform for sharing experiences and for discussing the future of traffic management.

The workshop was divided into 3 main sequences:

- Harmonised research agenda

- Targeted presentations linked to NEARCTIS activities with participation of associate partners
- Interactive poster session presented by early stage researchers

6.2.2. Special sessions

A NEARCTIS team was invited to participate and present the network vision on traffic management during the Fully Connected Car workshop 2011 within the session on Road Operators.

The NEARCTIS network organized a special session at the 8th ITS European Congress, 6 - 9 June 2011 - Lyon on "Training to ITS". The purpose of this session was to make a short presentation of various European experiences of training on ITS, mainly at the Master level, but also on short courses or other training opportunities. An important topic discussed was on the possibilities for international training on ITS subjects. Beside session coordination and organization, the contributors were mainly from the NEARCTIS Network.

A request for organizing another special session has been made to the ITS World Congress organizers for next October 2012, in Vienna.

6.2.3. Summer School

The second NEARCTIS Summer school was held May 2-4, 2011 - Delft - The Netherlands2. The main objective of this well attended school was to get the participants acquainted to the principles, the calibration and traffic models and to get hands–on experience with different types of traffic models, especially in relation to cooperative systems and ITS.

The next training school will be organized jointly with the COST action Multitude (*www.multitude-project.eu*) on 6-8 June 2012 on assessment of ITS solutions. More precisely, this edition will target evaluation of Intelligent Transportation Systems measures, including the core methodologies for the quantification of the impacts, the multi-criteria analysis and the management of uncertainty.

6.2.4. Website

The fully operational network website (www.nearctis.org) has been revamped and regularly updated (Figure 7). As part of this effort, new functionalities were integrated in a new release of the website to enable better access to the shareable resources identified in WP4 using a dedicated Wiki, resource desk, Website search functionality and statistics.

This task will continue for the whole project duration to disseminate project achievements and other NEARCTIS events such workshops and conferences. Besides, the next release will target new functionalities for Network perpetuation.

[2] http://www.nearctis.org/home/events/training-schools/may-2011-summer-school/

Figure 7: NEARCTIS website

6.2.5. Liaisons with others projects and initiatives

NEARCTIS is pursuing an effort of liaising with other projects, networks and initiatives dealing with cooperative systems, traffic management or more broadly ICT/ITS. As an illustration of this effort cross connections were established with EC projects dealing with cooperative systems (such as SafeTRIP, Eco-move, Coopers, COSMO) and institutions (e.g. Joint Research Centre, Institute for Energy and Transport Sustainable Transport Unit). Besides, NEARCTIS has a close connection with different networks: COST actions (TrafMet and Multitude), ECTRI, ERCTICO and the Transportation Research Board.

As a result of liaising with other networks, NEARCTIS has held its first training school jointly with the COST action TU0702 (*www.cost-TU0702.org*) on "Real-Time Road Traffic Monitoring and Control" (9th -10th June 2010). This training school was well attended and gathered more that 25 of early stage researchers. As already mentioned, the next training school will be organized jointly with the COST action Multitude (*www.multitude-project.eu*) on 6-8 June 2012 (see Appendix XIII).

Liaison also occurs through NEARCTIS members involvement in other EC projects. Examples include: Marie Curie IRSES OPTIMUM, the support action ECOSTAND and the support action SATIE.

A joint call for papers is also in preparation with a join sponsorship of NEARCTIS and two technical committees of Transportation Research Board (Traffic Flow Theory and ITS).

6.3. Dissemination events

As regards to dissemination, leaflets on NEARCTIS were distributed during the following events:

- Fully Connected Cars Workshop, Geneva, January 2011
- ITS Europe, Lyon, June 2011
- 5th Energy ITS Workshop in Vienna, June 2011
- International Workshop on Traffic Data Collection & its Standardisation, Australia, September 2011
- TRB Annual Meeting, USA, January 2011 and 2012

6.4. Summary

The research results have been disseminated through various channels including NEARCTIS workshops, summer school, leaflets and NEARCTIS website. The participation in these workshops and summer schools has been very encouraging. The awareness about NEARCTIS has also been raised by distribution of leaflets at various international conferences. However, during the course of the time, it was felt that the website needs to be updated more frequently than at present. The successes and lessons learned here will be included in the next phase of discussions into the virtual Centre of Excellence.

7. Conclusions and recommendations

7.1. Conclusions

This workpackage 3 of NEARCTIS has focused on new networking developments to support improved education and training (E&T) in the area of co-operative traffic management systems. This covered various groups (student, postgraduate and young professional), including the involvement of Associate Partners. An additional core task of WP3 concerned dissemination of all NEARCTIS activities on a regular basis using the most effective media. During the period, the objectives of the workpackage have been addressed by carrying out various tasks given below:

- The review of university courses available across the Europe highlighted that there are some dedicated university trainings specifically on traffic management systems, but naturally little yet on co-operative traffic management because this is a relatively new development. To address this issue, a new MSc course on ITS, with a focus on cooperative traffic management, has been specified, Which could involve a number of NEARCTIS Institutes working collaboratively. This will be taken forward for further discussion in the context of the proposed VCE.
- The review of short courses available across the Europe showed a need for new professional courses at a European level for Cooperative Traffic Management. The specifications for five new professional courses at a European level covering different aspects of Cooperative Traffic Management have been prepared. Such courses could be included in the yearly events of the proposed VCE or run jointly with other organisation such as ITS EduNet.
- The mobility and training of the early stage researchers within the NEARCTIS NoE was an important part of the project. Five PhD students are undertaking research at five different institutions within NEARCTIS, With periods of time also spent at partner Institutes. NEARCTIS has also supported six young researcher mobility programmes. In addition, two summer schools were organised in Lausanne (2010) and Delft (2011). These summer schools were very successful in attracting a large number of participants and oversubscribed. On the basis of such popularity, such events should definitely be annual events within the proposed VCE.
- To integrate with and support the core academic network within NEARCTIS, a network of associate partners from industry, government and academia were recruited. NEARCTIS was successful in recruiting a large number of Associate Partners (AP) across the world. However, there were shortcomings in terms of the integration which could be due, in part, to the lack of funding available to integrate APs in various NEARCTIS events. Learning the lessons from this process, fewer but more committed APs should be included in the future perpetuation of the network
- The project results have been disseminated through various channels available including NEARCTIS workshops, summer schools, leaflets and NEARCTIS website. The participation in NEARCTIS events such as workshops and summer schools has been very encouraging. Nevertheless, the Website, being one of the key dissemination tools, needs more frequent update to capture all recent events to generate user interest into it.

7.2. Recommendations

Education and training activities within NEARCTIS have been successfully carried out. These activities have facilitated greater interactions amongst partners and strengthened the networking of the group. Looking at the achievements with the network in terms of education and training in the field of Cooperative Traffic Management, it is recommended that such a network should continue, to advance the progress made so far.

NEARCTIS brought various institutes from different backgrounds and countries together to discuss the issue of cooperative traffic management. After completion of NEARCTIS, it is important that the network is still retained (in the form of virtual centre/network of excellence (VCE)). As the funding is not there, there is a limit to the activities that could be carried out through such a virtual network. However, the VCE should continue the successful events achieved by NEARCTIS, address the (few)_areas of shortcomings experienced, and analyse potential business models and funding opportunities to take the VCE forward effectively.

The organisation of the VCE, including the programme of activities, will be specified in Deliverable D16: Plan for Integration and Sustainability. From the work in WP3, it is recommended that the VCE should consider inclusion of the following education and training activities:

- **A yearly summer school program with contribution from NEARCTIS partners**
  Summer schools are the most successful events organised by NEARCTIS. After the two very successful summer schools in Lausanne (2010) and Delft (2011) jointly with EU COST action TU0702 and TU0903, another is planned for 2012. Even with much reduced funding from NEARCTIS, the event is remains oversubscribed and this clearly shows the demand for it. Hence continuation of an annual summer school is recommended, seeking sponsorship as far as possible.

- **A yearly workshop on co-operative traffic management applications and research and development requirements**

- **Joint professional courses on different aspects of co-operative traffic management**
  The specifications for five new professional courses at a European level for Cooperative Traffic Management have been prepared as the review highlighted a need for new professional courses at a European level for Cooperative Traffic Management. Such courses could be run jointly in association with other organisations such as ITS-EduNet. Such joint organisation reduces the resource burden and fulfils the aims of both organisation in terms of the education and training opportunity in the field of co-operative traffic management.

- **A new Masters level course on ITS and co-operative traffic management, run on a collaborative basis**.
  The review of university courses available across the Europe highlighted that there are no dedicated university trainings specifically on co-operative traffic management because this is a relatively new development. To address this issue, a new MSc course on ITS with a focus on cooperative traffic management has been specified. Such a course could be run by a consortium of members within the VCE. The consortium arrangement could be similar to CITE consortium (www.citeconsortium.org) where each member institution contributes modules which are free to use by all consortium members, according to their specific needs. The members are allowed to choose the modules according to their focus, set the course fee and the corresponding provision of

facility. They are allowed to handle their income in their own way except the fact that they will provide a nominal yearly charge for administration of the consortium. Such a model reduces the workload of Universities by removing duplication of effort and gives financial freedom to the members.

- **Continuation of collaborative PhD research in this area**
- **Continuation of the NEARCTIS website**
  A website is the face of the VCE in this digital world and hence need to be continued with VCE. However, learning the lesson from NEARCTIS, more frequent update of the website is needed to keep with the pace of all ongoing events and to generate user interest into the website.

Appendix I: University Courses

The review of education and training for students at graduate and postgraduate levels in universities across Europe reported in this Appendix is extracted from the earlier NEARCTIS Deliverable D9. It has therefore to be noted that the information summarises education and training provision as existing in 2009, and is therefore a snapshot of the situation at that time.

The list of countries and respective NEARCTIS partners who provided the information on co-operative traffic management systems courses in respective countries were as follows:

- Austria (Y.-P. Wang, DLR)
- Czech Republic (ETNITE, 2007)
- France (S. Sellam, INRETS)
- Greece (I. Papamichail, TUC)
- Germany (Y.-P. Wang, DLR)
- Italy (ETNITE, 2007)
- Sweden (ETNITE, 2007)
- Switzerland (A. Bhaskar and P. Y. Gilliéron, EPFL)
- Turkey (H. Demirel, ITU)
- UK (B. Shrestha and N. Hounsell, UoS)

A. Co-operative traffic management systems courses in Austria

In Austria, the Fachhochschule Technikum Wien (FHTW) provides a range of specific co-operative traffic management systems courses in the study field of co-operative traffic management systems. As Vienna's first University of Applied Sciences, FHTW has been a pioneer in the relatively new system of the Fachhochschulen in Austria. Currently it provides two co-operative traffic management systems related education programmes: a Bachelors and a Masters programme both called "Intelligent Transport Systems". These programmes aim at graduating engineers whose competence and knowledge profile enables them to quickly understand specific problems and, thanks to their interdisciplinary background, to transfer complex interrelations onto questions concerning traffic and transport and to develop suitable solutions. Focus of the education is the technological aspect on the level of innovative components and systems closely linked to information services in transport, traffic, traffic surveillance and control as well as influential mechanisms of intelligent transport systems on the mobility behaviour of people and goods. The studies are structured along a 3-year/6-semester program for the Bachelors degree and a 2-year/4-semester program for the Masters degree. Every semester consists of 15 weeks (One teaching unit is 45 minutes.). It also runs an interdisciplinary master program, which is jointly offered by FHTW, the Linköping University (LiU) in Sweden as well as the Czech Technical University (CTU) in Prague. This joint Master program is called European Master of Science in Intelligent Transport Systems and is designed both for beginners and professionals. All courses are taught in English.

Besides the courses at the FH Technikum Wien, there are two other co-operative traffic management systems related study programmes – Urban Technologies at the University of Applied Sciences FH Joanneum in Kapfenberg (Styria), a full time programme and the part time professional MSc in ITS Management at the Danube University in Krems (Lower

Austria). The traffic management related subjects and modules offered at those programmes are listed in Table 2.1.

[Table A1.1] Co-operative traffic management systems related programmes in Austria

University *programme*	Traffic management related courses
FH TECHNIKUM Wien *Bachelor in Intelligent Transport Systems* 3-year full time (including 12 weeks internship during the 5th and 6th semesters)	Information and telecommunication engineering ITS-telematics projects Traffic fundamentals Traffic telematics infrastructure, traffic information systems, toll systems Driver support systems
FH TECHNIKUM Wien *Master in Intelligent Transport Systems* 2-year full time (including big ITS-Project during the 3rd semester) *European Master of Science in Intelligent Transport Systems* Duration: 4 semesters (jointly organised with Linköping University (LiU) Sweden and Czech technical University (CTU) Prague)	ITS system architecture Cooperative systems Advanced Driver Assistance Systems Public Transport Logistics and Fleet Management Mobile communication and Identification systems ITS Basics Specialisation in ITS 1,2,3, 4 GIS, Positioning, navigation and identification systems Traffic modelling and simulation
FH Joanneum *Diploma Programme in Urban Technologies* 4-year (including 15 weeks internship during the 7th semester)	Transport Engineering Transport Systems Transportation Planning Transport Telematics
Danube University Krems *Professional MSc ITS (Intelligent Transport Systems) Management* 2-year (4 semester) Part time organized in weekly blocks	Traffic Management Traffic Telematics Systems Management

B. Co-operative traffic management systems courses in the Czech Republic

There are two universities in the Czech Republic focused on transport sciences:

- Czech Technical University (CTU), Faculty of Transportation Sciences in Prague ;
- University of Pardubice, Jan Perner Transport Faculty.

The CTU, Faculty of Transportation Sciences has in its study program one study branch specialized in ITS. The Jan Perner Transport Faculty at University of Pardubice has its study program oriented in operative aspects of transportation and has several co-operative traffic management systems courses (duration 1 semester). Other Czech universities are not specialized in transportation and have only some courses related to the transportation problem, but with no emphasis on co-operative traffic management systems. A summary of co-operative traffic management systems Education in the Czech Republic is given in Table 2.2.

Table [A1.2] Courses with co-operative traffic management systems coverage in Czech Republic

University *programme*	Traffic management related courses
Czech technical University, Faculty of Transportation Sciences *Bachelor program Technology in Transportation and Telecommunications* 4 years study program	Introduction to Transport Engineering Orientation in vehicle technology Introduction to Safety and Telecommunication technique
Czech technical University, Faculty of Transportation Sciences *Master program Transportation Engineering and Communications* 2 years study program *PhD program Technology in Transportation and Telecommunications* 3 years study program	Intelligent Transport Systems Telematics Systems Reliability in Transportation Signals and codes Transport Processes Methods Intelligent Transportation Systems Advanced Vehicle Dynamics
University of Pardubice, Jan Perner Transport Faculty *Bachelor program Traffic Engineering and Telecommunications* 3 years study program *Master program* 2 years study program	Communication and Safety Technologies Logistic in transportation Integrated traffic systems International Transportation Intermodal transportation Transportation Theory Safety Systems

C. Co-operative traffic management systems courses in France

Transport training in France is mainly delivered through the Grandes Ecoles system. Two main post-graduated schools are specialised in transport and mobility. The Ecole des Ponts Paris Tech is specialized in Transport training in France, providing various Master programmes: transport and mobility, transport and environment, transport and sustainable development. The Transport and Mobility programme is intended to provide engineers and managers with tools and high level knowledge in the field. The courses within the Transport and Mobility Master include different parts like Traffic Engineering and Telematics, Traffic Modelling, Project Assessment and Management. A 6-month internship in enterprise after 2 semester's studies concludes the Master. This training provides both theoretical and practical environment for young students or transport practitioners.

The ENTPE (École Nationale des Travaux Publics de l'État) is the twin post-graduated school which trains engineers for careers in land-use planning and land development - civil engineering, environment, transportation and urban planning. It counts 6 research centres in geomaterials, building sciences, transport economics, traffic engineering, environmental sciences, and interdisciplinary environment and society.

The ENTPE can be seen as multi-disciplinary in its field, seeking to cover a wide range of subjects through 8 in-depth programmes offered in the third year: Civil engineering, Environment and Hydraulics, Transport planning and traffic modelling and management, Construction, Information technology, Urban planning and management, and Marine and waterway engineering. The transport-related program targets transportation economics, traffic modelling and more generally transportation engineering and ITS issues.

Other ITS related trainings can be obtained in France in some specialized French Ecole d'ingénieurs; like Ecole des Ingénieurs de la Ville de Paris (EIVP), ECE or ESTACA, whose courses cover some parts of ITS issues. Similarly, some technical universities like Université de Technologie de Compiègne (UTC) specialized in science and technology delivers a specialised master in ITS. The following table summarises the current Transport Programmes in France.

Table [A1.3] Courses with traffic management & co-operative systems coverage in France

University *programme*	ITS related courses
ParisTech (ENPC, ENSG, ENST) *MSc. Transport & Mobility* 1 year + 6 months internship	Traffic Engineering in the ITS Context Traffic Modelling Safety of Transport Systems Project assessment
ParisTech (ENPC, Ecole Polytechnique, ENSMP) *MSc. TRADD (Transport and sustainable development)* 1 year + 6 months internship	Transport telematics Traffic engineering Management of road networks Managing urban transport networks with intermodality and multimodality concepts
ENPC ParisTech **2nd and 3rd year**	Transport and satellite based positioning
ECE (Ecole Centrale d'Electronique) *Engineering of on-board systems, automobile, intelligent systems*	Intelligent vehicles Intelligent ground transport Urban public transport Automatic driving European wide ITS programmes
ESTACA *Mastère spécialisé* Education in the analysis, planning, and operation of all modes of transportation (air, rail, road, marine and Aerospace)	Engineering Project Management Human Factors, Ergonomics Applied Mathematics and Operational Research Safety of Road Transportation
ENTPE *Civil engineer degree* master degree programme	ITS architectures, cooperative systems ITS and safety for road transport Traffic engineering
EIVP *Civil engineer degree*	ITS Traffic Engineering Traffic Modelling
Ecole Centrale de Lyon Engineer training in Transport and Traffic	Traffic Modelling

D. Co-operative traffic management systems courses in Greece

Table 2.4 provides information regarding the university courses available in Greece in the field of co-operative traffic management systems.

Table [A1.4] Courses with co-operative traffic management systems coverage in Greece

University *programme*	Traffic management related courses
National Technical University of Athens School of Civil Engineering	Urban Road Networks Traffic Management and Road Safety Special Topics in Traffic Engineering Quantitative Methods in Transportation
National Technical University of Athens School of Rural and Surveying Engineering	Transportation systems Highway engineering II (traffic flow) Highway engineering III (Intersetion design and operation)
Aristotle University of Thessaloniki Department of Civil Engineering	Traffic control Traffic engineering
Aristotle University of Thessaloniki Department of Rural and Surveying Engineering	Transportation engineering Design of urban transport infrastructure and mass transportation systems Design of transportation projects using computers
University of Patras Department of Civil Engineering	Traffic engineering Urban traffic design
University of Thessaly Department of Civil Engineering	Traffic Flow Improvement &Environmental Friendly Transportation Mean Special Topics in Highway Engineering
Technical University of Crete Department of Production Engineering and Management	Advanced Telematics in Road Transportation (Postgraduate course)

E. Co-operative traffic management systems courses in Germany

Technological advances in telecommunication and informatics are increasing the number of corresponding applications in transport systems. Therefore, many related courses have been offered during the last years. Co-operative traffic management systems are mainly subject to IT-equipped transportation systems and are still based on fundamental knowledge and developments in transport science and engineering. Thus most co-operative traffic management systems study courses are provided by conventional transportation-related departments as advanced teaching materials. In Germany there are few study courses that are explicitly dedicated to ITS, such as the Master study at the institute of Economic-Logistic-

Transport of the Fachhochschule Erfurt (Erfurt University of Applied Sciences). Most ITS-related courses are offered in the field of civil engineering at the German universities and some others are offered in the field of telematics at some universities of applied sciences.

The most extensive and specialised ITS-related study courses are provided by the department of transportation science at the Dresden University of Technology ("Technische Universität Dresden"), where students can choose a major field of study called "traffic telematics". The graduates receive a German Diploma degree. Apart from this one, there are, as aforementioned, many study courses in civil engineering all over Germany, but mostly with Bachelor and Master Degrees due to the restructuring of the university and college system since 2007/2008. It is planned that this restructuring should be completed at the end of 2010. Principally, students with their studies enrolled during the "Diploma" system, still obtain a Diploma degree after fulfilling the corresponding requirements. Traffic engineering in many of civil engineering departments is an optional major study. Most transport-related departments focus on road transport, some concentrate on public and railway transport, and a few subject groups centre on maritime and air transport. Most of these study courses include ITS-modules even though the scope of these modules is very different and variegated. In any case, ITS-modules are predominantly offered in the area of road transport.

Table 2.5 summarises the current courses study durations and completion degrees offered by universities and colleges with a significant focus on transportation researches. Some ITS-courses at the University of Stuttgart and at the technical University of Munich are offered in English. All other courses are offered in German.

Table [A1.5] Courses with Co-operative traffic management systems coverage in Germany

University programme	Traffic management related courses
Technische Universität Dresden *Diploma degree in transport engineering* Duration: 6 semesters with additional 4 semesters for fundamental courses	Traffic control engineering Traffic Management Systems and Computerized Operational Control systems Transportation system engineering Intermodal transportation system engineering Information engineering of traffic systems Adaptive and intelligent system Special problems of traffic control automation and of traffic system technology
Technische Universität Berlin *Bachelor and Master degree in Transport and Mechanical Systems* Duration: 6 and 4 semesters for Bachelor and Master degree	Networking of traffic systems Information systems in public transport Methods of transport telematics Basic principles of transport systems planning and transport informatics Transport modelling and simulation Applications of traffic telematics

Fachhochschule Bochum *Bachelor and Master degree in civil engineering* Duration: 6 and 4 semesters for Bachelor and Master degree	Transportation systems and concepts Traffic control Traffic management Traffic control – latest topics Control and information systems
Technische Universität Braunschweig *Bachelor and Master degree in civil engineering or in mobility and transport* Duration: 6 and 4 semesters for Bachelor and Master degree	Microscopic traffic flow simulation and its applications Traffic management on motorways Traffic engineering Traffic information systems
Technische Universität Darmstadt *Bachelor degree in civil engineering and Geodesy* *Master degree in civil engineering or in traffic and transport* Duration: 6 and 4 semesters for Bachelor and Master degree	Seminar of traffic planning and traffic technologies Modern traffic control technologies and traffic demand modelling Transport planning and technology Planning and management of public transport
Hochschule Darmstadt *Bachelor and Master degree in civil engineering* Duration: 6 and 4 semesters for Bachelor and Master degree	Traffic engineering Telematics in traffic and transport
Fachhochschule Erfurt *Master degree in "Intelligente Verkehrssysteme und Mobilitätsmanagement"* Duration: 4 semesters	Transport telematics Traffic control Traffic modelling and simulation Road traffic engineering Intelligent transportation systems
Technische Universität München *Bachelor and Master in civil and surveying engineering* Duration: 6 semesters for Bachelor degree and 4 semesters for Master degree	Traffic control and management Intelligent Vehicles / Navigation Systems ITS-System Architecture Traffic Operation and Control

Universität Stuttgart *Bachelor and Diploma* degree in civil and environmental engineering* Duration: 6 semesters for Bachelor degree and 10 semesters for Diploma degree	Transportation engineering and traffic control systems Road traffic control systems Case studies of traffic control systems Microscopic traffic simulation Computer aided transportation planning and traffic engineering

* Master degree with the duration of 4 semesters from 2011/2012 on (expected)

In addition to the aforementioned institutions many other German universities and colleges also provide various transport-related courses, but with less emphasis on co-operative traffic management systems issues. These institutions include:

> Rheinisch Westfälische Hochschule Aachen, Fachhochschule Braunschweig/Wolfenbüttel, Ruhruniversität Bochum, Technische Universität Cottbus, Universität Dortmund, Technische Universität Hamburg-Harburg, Universität Kassel, Universität Magdeburg, Bauhaus-Universität Weimar, Bergische Universität Wuppertal.

Moreover, the co-operative traffic management systems related research institutions, such as the institute of transportation systems at the German Aerospace Centre (DLR) and the Fraunhofer institut for Transportation and Infrastructure Systems (IVI) do not offer co-operative traffic management systems courses currently.

F. Co-operative traffic management systems courses in Italy

The Universities that currently have in their formative teaching supply regarding co-operative traffic management systems are few, among these (geographical order, from the North): the Politecnico di Torino, the University of Genoa, the University of Florence, Faculties of Engineering of the University of Rome *Roma Tre*, and the University of Reggio Calabria.

At the Politecnico di Torino, the co-operative traffic management systems and related architecture for their design and development have been introduced in 2003 within the course of *Design and practice of transport systems*; a specific module (4 credits) on *Innovation Technology and ITS* is included in the Master (II level) kept at COREP-Politecnico di Torino and titled *Transport: Systems, Networks and Infomobility*, at its sixth edition in 2005-2006. Recently, the course is developed to deliver in the e-learning platform, a cutting-edge multimedia platform designed specifically to meet distance learning requirements.

The Faculty of Engineering of the University of "Roma Tre" for the academic year 2004/2005 has been activated a II level Master in *Complex Systems for sustainable metropolitan mobility* in partnership with ATAC local public transport Company of Rome, and Ministry of infrastructures and Transport by the academic year 2005/2006. In particular, the Master aims to form professional figures in the technological and organizational area of transport enterprise, to introduce basic instruments and methods for planning, realization and management of complex systems and ITS; to supply instruments for the analysis and evaluation on the main modifications of operational, decisional and informative processes of managers, generated from the application of new systems and computer and telematic technologies with high technological content.

F. Co-operative traffic management systems courses in Sweden

There are two main universities which offer courses with co-operative traffic management systems coverage in Sweden. *Communication and transport system* is a M.Sc. programme offered at Linköping University which includes the highest amounts of courses in co-operative traffic management systems related subjects. Other co-operative traffic management systems related courses can be found at KTH providing one MSc in Traffic Engineering in 4th year curriculum. These co-operative traffic management systems modules are concerning, for example, needs and visions regarding ITS, types of co-operative traffic management systems actors and services, co-operative traffic management systems and the road traffic process, overview of Road Traffic Management and its applications and intelligent vehicles, etc. Table 2.6 provides further details.

Table [A1.6] Co-operative traffic management systems programmes in Sweden

University *programme*	Traffic management related courses
Linköping Uiversity *MSc. in Communication and Transport Systems* Relative to 3 engineering degree programmes	Overview in the area of communications and transportation Transport telematics Quantitative logistics Traffic modelling
KTH *MSc in Traffic Engineering* ITS specific courses in 4th year of programme	Needs and visions concerning ITS Types of ITS actors and services ITS and the road traffic process Overview of Road Traffic Management and its applications Intelligent vehicles

G. Co-operative traffic management systems courses in Switzerland

In Switzerland, there are no specific undergraduate programme in traffic management and transport planning. Most of the courses are included in the civil engineering programmes which offer specialization in the transportation domain. Table 2.7 provides a list of transportation courses at two leading Swiss Federal Institutes at Lausanne and Zurich: *Ecole Polytechnique Fédérale de Lausanne* (EPFL) and *Eldenössische Technische Hochschule Zürich* (ETHZ). There are also some similar programmes at the university of applied sciences (HES: Hautes Ecoles Spécialisées, FH: Fachhochschule).

[Table A1.7] Co-operative traffic management systems programmes in Switzerland

University *programme*	Traffic management related courses
EPFL *BSc in Civil Engineering* 3 yr full-time *MSc in Civil Engineering* 2 yr full-time	Transport et télématique Fundamentals of Traffic Operations and Control Advanced Transport Phenomena Modélisation mathématique du comportement Optimization and simulation
ETHZ *BSc in Civil Engineering* 3 yr full-time *MSc in Civil Engineering* *MSc in Spatial Development and Infrastructure Systems* 2 yr full-time	Transport Planning Methods Transport Systems Evaluation Traffic Engineering and Management Systems

H. Co-operative traffic management systems courses in Turkey

In Turkey, there are no explicit Traffic Management and Cooperative Systems programs. However, several governmental and private universities offer undergraduate programs on Civil Engineering, where transportation engineering programs are generally offered at graduate level. Most departments deal with road transport, some are concentrated in public and railway transport, and a few subject groups are dealing with maritime and air transport. The main universities related to these issues are listed in Table 2.8.

Table [A1.8] Courses with Co-operative traffic management systems coverage in Turkey

University *programme*	Traffic Management related courses
Istanbul Technical University Department of Civil Engineering, *MSc and PhD degrees in Transportation Engineering*	Traffic Control Intelligent Transportation Systems Transportation Systems Analysis
Middle East Technical University Department of Civil Engineering, *MSc and PhD degrees in Civil Engineering*	Principles of Transportation and Traffic Engineering Traffic Engineering I &II

Boğaziçi University Department of Civil Engineering, *MSc and PhD degrees in Civil Engineering*	Transportation Modelling and Planning Advanced Traffic Engineering
Yildiz Technical University Department of Civil Engineering, *MSc and PhD degrees in Transportation Engineering*	Principles of Transportation and Traffic Engineering Transportation Planning

Besides these mentioned educational institutions, other well-known state and private Turkish universities introduce lectures on "traffic management" related subjects, predominantly associated to the study course "civil engineering".

I. Co-operative traffic management systems courses in UK

The following section summarises the latest situation concerning education courses in co-operative traffic management systems in the UK.

Undergraduate courses

Suitably qualified students enter UK Universities at age of about 18 and undertake either 3 year 'Bachelors' courses (BEng, BSc, etc) or 4 year Masters Courses (e.g. MEng). These are usually full-time courses, but some are organised on a 'sandwich' basis, including a period spent in industry. The academic requirements of some professional Institutions (e.g. the Institution of Civil Engineers) have resulted in a tendency for students wishing to become 'Chartered' to opt for 4 year courses. This trend is now reducing, and may reverse, given increasing levels of student debt. The tables, below show UK Universities offering transport related courses with some co-operative traffic management systems relations. The lists of courses given in the tables are listed on the basis of their course title without thorough investigations of their content.

From a survey of UK courses currently available, there appear to be no undergraduate courses devoted entirely to co-operative traffic management systems, although some courses do contain limited elements of them. Universities have some freedom in their syllabus for courses such as these, so the coverage of the topics is quite mixed. However, there are a number of undergraduate courses in transport, some of which include limited coverage of co-operative traffic management systems,as listed in Table 2.9.

Table [A1.9] Undergraduate courses with co-operative traffic management systems coverage in the UK

University *programme*	Traffic management related courses
Aston University *BSc courses in Transport Management and Logistics* 3 yr full-time/4 yr sandwich courses	Planning and Controlling Logistics European Transport Multimodal Transport Management Traffic and Transport Engineering

Cardiff University *BEng/MEng in Civil and Environmental Engineering* 3-4 yr full-time	Transport Engineering. Integrated Transport Engineering.
Imperial College London *MEng in Civil and Environmental Engineering* 4 yr full-time	Transport Transportation
University of Leeds *BEng/MEng in Civil and Environmental Engineering* 4 yr full-time	Transport engineering
Liverpool John Moores University *BSc in Management, Transport and Logistics* 3 yr full-time/4 yr sandwich courses	Transport and Logistics: Systems and Policy Movement of Goods Movement of People Road Transport Operations
Napier University *BEng in Civil* and *Transportation Engineering;* *BSc in Transport Management* 3yr/4yr full-time courses	Management of Passenger and Freight Operations Transport Control Transport Systems Network Management Traffic Models and Public Transport
Newcastle University *MEng in Civil Engineering* 4yr full-time courses	Design of Transport Infrastructure Transport Engineering
Swansea Institute of Higher Education *BSc in Transport Management* 3 yr full-time	Movement of Goods Movement of People Passenger Transport Operations Passenger Transport Infrastructure
University College London *BEng/MEng Civil Engineering* 3 yr/4 yr full-time courses	Transport studies

University of Loughborough *BSc courses in Transport and business management* 3 yr full-time/4 yr sandwich courses	Road Transport Technology Surface Transport Systems Logistics Strategy
University of Southampton *BEng/MEng Civil Engineering* 3 yr/4 yr full-time courses	Transportation Engineering
University of the West of England *BA courses in Transport and sustainability; Planning with Transport* 3 yr full-time/ 5 yr part-time	Transport Planning and Modelling Transport Systems and Logistics

Postgraduate courses

There are a number of well-established, strong postgraduate courses in Transport in UK Universities. Until recently, postgraduate courses were dominant, because of the multi-disciplinary nature of the topic requiring a range of skills more appropriate to this level. The most common type of course is the Masters Degree (MSc or MA). The MSc is most relevant to co-operative traffic management systems studies. These courses are usually taken as a 1 year full time option, although many Universities offer part-time attendance over a longer period. MSc courses usually involve a taught element of 6-9 months combined with an individual project for the remaining period. Most courses offer a Diploma alternative, which has a reduced content and/or a lower academic standard. Although there is substantial co-operative traffic management systems aspects coverage in many of the courses, there is currently no MSc course in the UK devoted entirely to the topics. Most of the MSc courses available cover a range of transport initiatives and tools and that a thorough education in transport policy, planning, engineering, management, etc. Co-operative traffic management systems have therefore been generally integrated into such courses rather than offered as a stand-alone subject. Table 2.10 provides an overview of postgraduate courses with some coverage of co-operative traffic management systems.

Table [A1.10] Postgraduate courses with co-operative traffic management systems coverage in the UK

University *programme*	Traffic management related courses
Aston University *MSc Traffic Engineering* *MSc Transport Planning* 2-5 yr Distance Learning	Traffic Engineering and Highway Design 1 Traffic Engineering and Highway Design 2 Junction capacities Intelligent Transport Systems Sustainable transportation Transport modelling
Cardiff University *MSc in Transport and Planning* 1 yr full-time	Public transport Transport management
London, Imperial College and University College *MSc in Transport;* *MSc in Transport with Business Management;* *MSc in Transport with Sustainable Development* 1 yr full-time/ 2 yr part-time	Advanced transport modelling Design of accessible transport systems Public transport Transport engineering and operations Transport demand and modelling Transport telematics
University of Leeds *MA Transport Economics;* *MSc Transport Planning ;* *MSc(Eng) Transport Planning and Engineering;* *MSc Transport Planning and Environment* 1 yr full-time/ 2-3 yr part-time	Principles of Transport Engineering Traffic Control Systems Traffic Management Essentials of Traffic Management Freight Transport Planning and Management Public Transport Planning and Management Transport in Development
University of Loughborough *MSc in Transport policy and business management* *MSc in Sustainable Transport and Travel Planning* 1 yr full-time/ up to 5 yr part-time	Transport and the Environment Transport Policy and Planning Transport Modelling Transport and the Environment Sustainable Cities and Transport

Napier University *MSc Transport Planning and Engineering* 1 yr full-time/ 3 yr part-time/ 3 yr distance learning	Transport and Traffic Models Public Transport and Terminal Design Traffic Management Traffic Engineering And Control
University of Newcastle upon Tyne *MSc Transport engineering & operations;* *MSc Transportation planning & policy;* *MSc Transport & the environment* 1 yr full-time	Transport management and operations Management and operation of public transport systems Intelligent transport systems and e-services Freight transport planning and management Management of urban transport in developing countries Traffic management techniques
University of Nottingham *Civil Engineering: Transportation Masters (MSc)*	Traffic engineering
Oxford Brookes University *MSc in Transport Planning* 1 yr full-time/ 2 yr part-time	Mobility Management Contemporary Issues in Transport Planning Practice Destination and Event Management
University of Salford *MSc in Transport Engineering and Planning* 1 yr full-time/ 2 yr part-time	Traffic engineering Transport systems design Transport planning Urban public transport
Sheffield Hallam University *MSc in Transport Planning and Management;* 1 yr full-time/ 2-3 yr part-time	Strategic land use and transport planning Geographical information systems (GIS) and transport
University of Southampton *MSc in Transportation Planning and Engineering* 1 yr full-time/ up to 4 yr part-time	Transportation engineering: analysis and design Transportation engineering: transport management Passenger and freight transport
University of Surrey *Transport Planning and Practice*	Transport Strategies and Interventions Developing Transport Solutions Design and Analysis of Transport Schemes

University of Westminster *MSc Logistics and Supply Chain Management;* *MSc Transport Planning and Management* 1 yr full-time/ 2 yr part-time	Public Passenger Transport Traffic in Urban Areas Freight Transport and Logistic Services Introduction to Logistics Management, Planning and Policy
University of the West of England *MSc in Transport Planning* 1-1.5 yr full-time/ 2-3 yr part-time *MA Built Environment Studies (Transport and Urban Design)* 1 yr full-time; 2.3 yr part-time	Travel Demand Analysis Traffic and Environmental Management Traffic Management and the Environment Design in Sensitive Urban Areas

These courses offer both full-time and part-time options, with modules organised for day-release, short-course attendance and/or 'distance learning'. Some courses include specific modules on Co-operative traffic management systems (e.g. at Newcastle and Leeds, whilst others incorporate Co-operative traffic management systems into modules wherever relevant. As an example, the Southampton MSc includes coverage of Co-operative traffic management systems in passenger transport, freight transport, traffic management and control.

Co-operative traffic management systems education can also be achieved through postgraduate research programmes. These include MPhil/PhD programmes, typically lasting 2-3 years if full time, and are offered by most of the Universities listed above. The Universities in the UTP have substantial Transport Research Groups, and support PhD activities with an increasing emphasis on co-operative traffic management systems in many cases. A recent initiative, supported by EPSRC, is the Engineering Doctorate (EngD). This is a 4-year programme involving 2 years of postgraduate courses followed by 2 years research in industry. The new EngD in Transport and Infrastructure Engineering at the University of Southampton is particularly relevant to Co-operative traffic management systems.

As seen above, transport teaching and research is multi-disciplinary and dispersed across a number of UK Universities. This led to the formation in the 1960s of the Universities Transport Study Group (UTSG) which is a focus for transport activity. It now has some 50 member Universities with activities which include an Annual Conference.

Appendix II: Learning and Teaching Methods

This Appendix summarises the review of modern/innovative learning and teaching methods extracted from earlier deliverable D2. This has been undertaken initially on a generic basis (i.e. not specific to NEARCTIS application areas), applicable to postgraduate education and professional training. This review, based partly on the findings from the ETNITE project, is presented in the following sections.

A. Education Methods and Practices

In the past, the teacher/lecturer was always in a central role of the process (Maier, 2000), delivering the knowledge on pre-defined time on the pre-defined place, which requested the participation of the students. This was recognized as an ideal technique for the transfer of the knowledge. Lectured and learning material was static, demanding a lot of student's attention. Today, instead of the lecturer, the focus of the process is on the student (trainee). The whole process of learning is directed towards the interactivity – active participation of the trainees, allowing them to comment and influence on the learning process.

With the rapid development of information and communication technologies (ICT), the computer based teaching techniques are constantly evolving. Institutions are offering as flexible times for learning as they can and in virtual training organizations on the internet learning is possible 24/7. Almost all of the institutions offer training material on the internet, most of the material is offered for public access. This includes 'classic' teaching material, audio/video files (courses, interesting TV shows, interactive ICT supported movies, etc.).

Various teaching and learning methods currently available can be broadly grouped into 3 main delivery methods depending on the interaction of instructor and the student/learner:

Face-to-face learning

This group of teaching/learning method requires a student/trainee to be physically present at the site of teaching/training. It covers a large range of teaching practices including lecture, tutorial, group work, project, group discussion, seminar, conferences and other. Face-to-face learning uses a rich mixture of speech, delivery, posture and other body language to convey meaning and emotion. With participants physically present at the site, the speakers can adjust what he is saying in response to feedback from the listeners. Participants have to 'think on their feet' as they develop their argument and responds to comments immediately. The presenter can employ various interactive discussion methods including: Turn-taking, Rounds, Buzz groups, Pyramids, Syndicates, Fishbowls, Brainstorms, Organised debates, etc.

Distance learning

In distance learning, a student/trainee does not need to be physically present at the site. The student/trainee learns from his own place at his own time with the help of the materials available in the internet, library etc. The trainer uses various forms of presentation including written text, video clips, puzzles, etc to make the learning process more interesting. However, trainer and trainee not being physically present, meaning/emotion can only be conveyed through presentation.

The main advantage of distance learning is that it allows participants to learn in their own time, pace and place. The course material can be carefully thought through and presented in way that it may not always be possible in face-to-face learning.

Examples include distance learning courses, web-seminars, and virtual communities.

Blended learning

Blended Learning is an approach to blend different learning methods, techniques and resources and apply and deliver them in an interactive meaningful learning environment. Such approach may apply face-to-face instruction with computer-mediated instruction. Learners should have easy access to different learning resources to apply the knowledge and skills they learn under the supervision and support of the teacher inside and /or outside the classroom. The terminal aim of blended learning is to provide realistic practical opportunities for learners and teacher to make learning independent, useful, sustainable and ever growing (Graham, 2005).

This approach amalgamates the flexibility of distance learning with the benefits of trainer/trainee interaction of face-to-face learning. It is getting popular to complement face-to-face learning as well distance learning approaches. A survey carried out the Rochester Institute of Technology Online Learning department reported that 75% of all students in the pilot project indicated that they like the blended learning format with less than 5% withdrawing or failing the course (Frankle, 2005).

Examples include instructor-led distance learning courses and course management system based teaching (e.g. using Blackboard, Moodle, eChalk). These systems and described in more details in the next section "ICT in Education".

All three methods of teaching and learning can be facilitated by a range of materials and learning resources designed according to the topic and intended learning outcomes. The following approaches can be particularly effective (ETNITE, 2007):

- **Case-based learning/reasoning**. Case-based learning is an ideal way to encapsulate experience and represent it in a 'story-like' manner. Cases should be selected that are: a) historically important, or b) unusual (the case that breaks the rule/law) or c) paradigmatic (represents a class of thing). Case-based learning helps students remember concepts, events and processes and provides a convenient mental 'label' for recalling these principles. Case studies are also used to encapsulate ideas and experiences that have been learnt. In engineering, for example, students can determine the underlying principles from the cases presented, and make the relevant decisions where the scenario calls for it. *Case-based learning is clearly highly relevant to the NEARCTIS domain, given the range of traffic management implementations in Europe.*
- **Problem-based learning**. Problem-based learning is 'learning by doing'. Problems are often contextualised within future workplace settings, roles or creative design. They allow students the freedom to progress through free enquiry and give them the experience of overcoming confusion and frustration (i.e. cognitive conflict that re-structures a students knowledge) prior to finding a solution.

  Again, problem-based learning is an ideal platform for traffic management, given the typical problems faced by decision-makers (e.g. what traffic management do I need?) and the large range of potential options.
- **Tutorial-based learning**. This is a standard didactic teaching method. The tutor prepares the material to be learnt in a controlled, step-by-step manner, with clear explanations and interactive exercises to encourage deep learning. Most computer-based learning packages use a tutorial style. Tutorial-based learning is excellent for the beginner and those wishing to get a basic grasp of essential principles. The more interactive the tutorial, the better it is for the learner.

B. ICT in Education

Information and Communication Technology (ICT) applications can be central to many of these methods for independent learning. There are at least 3 distinct uses for computers in education, as summarised in Table 2.2 below (ETNITE, 2007):

1. Tools	**2. Communication**	**3. Resources**
Word-processor	e-mail	Learning materials
Spreadsheet	Mailing lists	Websites
Database	Discussion forums	CD Roms/DVD's
Presentation graphics	Chat rooms	Online journals
Statistical analysis	Video-conferencing	Online abstracts
Programming Languages	Instant messaging	Online citation indexes
Computer Aided Design	MOO, WEBLOG, SKYPE, PODCAST, Wiki	Online datasets
Etc		Etc

Table 2.2: Computers in education

In addition to these, information and communication technology is progressively used in delivering course materials more effectively. Apart from extensive use in distance learning, computers are also widely used to deliver courses in face-to-face, as well as blended learning methods. There are various ICT-based techniques used in creating, delivering and managing courses. The education and learning practice supported by ICT where the medium of instruction is through computer technology is commonly known as E- Learning (*http://en.wikipedia.org/wiki/E_learning*). It offers a possibility of a real-time distribution of learning content, tailored to specific trainee (according to its knowledge and need). A key benefit of e-learning is "just-in-time" support, allowing the interested parties to search for information and learn only and just when it is needed. It also allows rapid adaptation to changes and innovations which classic material cannot follow. It would allow interactive tutorials, subjects, explained on different levels (for different target audience) etc.

Some of the key benefits of ICT technologies for *innovative* learning and teaching are:

- Interactive nature of the learning environment motivates trainees, allows them to actively participate, to dig deeper into the subject. It also helps trainers to explain difficult themes on the basis of the targeted audience.
- It facilitates trainees to watch the desired lecture multiple times from any place, allowing them to possibly clarify the overlooked data.
- It provides possibility to simulate real phenomena, for example to work on imaginary projects, to simulate real working processes.
- It provides option to use different types of the material: audio, video, presentations, documents, etc.

There are various ICT-based channels to deliver education/learning materials. Some of the common channels are described below.

Web-based course

Web-based course is a common mode of course delivery technique used in distance learning environment. Nowadays, there is a growing use of such technology in the classroom and thus promoting blended learning. Websites can be utilized within the class for those students who do not have internet access and can give other students the opportunity to expand knowledge if access is available privately. Interactive websites have elements within in them that allow people to act on or influence particular items on a particular page and making learning more interesting and interactive.

There is clearly tremendous scope for web-based ITS courses, with examples from CITE (Section 6.4 and at the Politechnico di Torino (Section 6.3) showing some early developments.

Web streaming of media files

Web-streaming of media files is in effect an internet-based radio or TV broadcast. This provides an opportunity for delivering remote real-time education, where a lecturer in one location 'lectures' to students elsewhere, each with their own computer (with the visual image and audio) and facilities to ask questions/discuss on-line. Potential applications of such technique include lectures by invited experts and reports from conferences or other events and locations. The main disadvantage of this technique is the high level of technology needed, including special server software.

BLOG (Weblog)

A blog (a contraction of the term *weblog*) is a type of website, usually maintained by an individual with regular entries of commentary, descriptions of events, or other material such as graphics or video (*http://en.wikipedia.org/wiki/BLOG*). Entries are commonly displayed in reverse-chronological order. Blogs provide commentary or news on a particular subject using a combination of text, images, and links to other blogs, web pages and other related media. Most blogs are primarily textual although some focus on photographs (photoblog), sketchblog, videos (vlog) or audio (podcasting), and are part of a wider network of social media.

It is not difficult to conceive how this idea could be used for discussion groups, etc on ITS topics for education and training.

Virtual communities

ICT offers the possibility of establishing virtual communities of people with similar interest. It allows a virtual relationship between trainers and trainees. Benefits are mutual – trainees have a chance of clarifying the possible misinterpreted terms, they have a feeling that they have a connection with their trainer and are more interested and efficient, and on the other side, there are trainers who have an instant feedback on training course and learning material and can through the comments and questions which arise during the course modify the material or even the lecture. Those communities are the ideal place for sharing the information, knowledge, and probably most importantly, the experience. Examples of such communities are: Virtual classes, Chat room, E-mail, Forum and Frequently Asked Questions.

Web conference

Web conference is used to conduct live meetings or presentations via the Internet. In a web conference, each participant sits at his or her own computer and is connected to other participants via the internet. A webinar (**WEB**-based sem**INAR**) is a term to describe a specific type of web conference delivering a workshop or lecture over the web (*http://www.pcmag.com/encyclopedia_term/0,2542,t=Webinar&i=54380,00.asp*). It may be

one-way webcast, or there may be interaction between the audience and the presenters. In some cases, the presenter may speak over a standard telephone line, pointing out information being presented on screen and the audience can respond over their own telephones, preferably a speaker phone. A web-conference could utilise various form of presentation including: slide show presentations, live or streaming video, VoIP (Real time audio communication using Internet), Web tours, Text chat, etc.

The potential application of such technique is in delivering a lecture from expert from a remote place.

Virtual field trip

Field trip is a common method of blending learning and teaching methods. With the rapid development ICT, there is an opportunity to experience field trips without leaving the place. Virtual field trips can also be used for post-field trip activity (for evaluation purpose) as well as pre-field trip activity (to provide pre-trip information). Pre-trip activity gives insight and knowledge that might be missed during their visit in addition to a greater appreciation of the trip for what they will be seeing upon their arrival. With the ability to go on a virtual fieldtrip, the places students can go are nearly endless – can cover every continent on earth.

This technique could be used for demonstration ITS applications around the world as a part ITS education and training.

In addition, there are dedicated systems for managing the learning environment. The systems are known as Course Management System (CMS) or Learning Management System (LMS) or Virtual Learning Environment (VLE). These systems assist a teacher to communicate and administer classroom activities as well as assess student work, share course content and help develop a community among the teacher, students, and parents (Wikibooks, 2009). Such systems enhance communication between the teacher and students with a facility to post announcements to the entire class or send an individual email. In addition, syllabus information, grading policies and deadlines can be clearly communicated. From a variety of Course Management Systems available, three main CMS examples (Blackboard, Moodle, and eChalk) are described below.

Blackboard: Blackboard (*http://www.blackboard.com/*) provides software solutions that help manage online academic environments. Blackboard's Course & Portal Solutions for example, provides online course management, academic communities and administrative services. Blackboard Learning System allows students to take courses online or supplement face-to-face learning" through the "Virtual Classroom/Collaboration feature". Blackboard also has an "Assignments" feature, allowing students to receive feedback from the teacher after submitting an assignment through Blackboard.

Moodle: "Moodle (*http://moodle.org/*) is a course management system (CMS) also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a Free web application that educators can use to create effective online learning sites. Moodle is used in a variety of settings by a variety of institutions, such as universities, schools, companies, and teachers, throughout the world. Moodle does not require the installation of any particular software; it can be created, edited, and used solely online. The creation and editing system is user-friendly and seems to have been designed with the novice user in mind. Templates encourage clear organization of assignments and resources, and forums are also simple to create.

eChalk: eChalk (*http://www.echalk.com/*) provides K-12 schools and educational environments with the necessary tools for students, parents, and teachers. eChalk allows the

teachers to alter their class pages according to the learning style of the class. The teacher can lead the students every step of the way by posting many assignments and communicating constantly (this is an example of cooperative learning) or simply posting a subject matter and leaving the students to learn and explore on their own (this is an example of collaborative learning). These two learning styles are available to the students round the clock as a result of internet based system.

C. User needs of ITS courses

ITS course needs of different user groups (students, professionals in industry, public sector, etc) are different, both in 'content' and 'delivery'. 'Content' will be addressed in Deliverable D9. The following section therefore focuses on 'delivery', through an analysis of opportunities and prospects for the separate, distinct user categories identified in ETNITE (2007).

University Students

The traditional model for University education has been for students to attend specific courses/Programmes on a full-time basis of length according to the level of the qualification (e.g. Undergraduate (UG) or Postgraduate (PG) course). Students usually attend their National/local University, although 'overseas' study can be significant, particularly for PG students or where co-operative arrangements exist (e.g. SOCRATES/ERASMUS).

Concerning traffic management, course availability is very limited at Undergraduate level both in Europe and elsewhere in the World. This appears to be because traffic engineering and management is not a traditional discipline leading to a 'profession', but is often seen as a part of a broader subject area (e.g. Transport or ITS) which, being multi-disciplinary, is more appropriate for postgraduate study.

At the taught Postgraduate level (e.g. Masters), many Transport-related courses have maintained a relatively broad focus (e.g. Transport Planning, Engineering, Operations and/or Management). However, the increasing emphasis in transport networks in developed countries is in making the best use of the asset/infrastructure, through improved management and operations of the transport network. This is giving increasing impetus to traffic management, sometimes within a broader-based ITS programme. For example, a pan-European Masters course in ITS has been started recently by a consortium of three Institutions within the ETNITE project. (ETNITE, 2007).

Professionals

Appropriate training methods for professionals working in the traffic management (TM) sector clearly differ from those for students undertaking University courses. Full-time University attendance is normally not possible for professionals, so more suitable training options are:

1. **University-provided modules** on a day-release basis (e.g. if working locally to the University) or on a short residential basis (e.g. of 1 or 2 weeks). There is evidence that both of these options can be popular, but there is an under-provision of such options in the University sector
2. **Distance Learning** Programmes. The CITE initiative in the USA (*http://www.citeconsortium.org/*) indicates that this can be a popular model for professionals, depending on the availability/quality of courses, their accreditation and the possibility to study for an academic award. There is no equivalent initiative solely on TM in Europe at present.

3. **Short courses** (e.g. 1 day to 1 week) on specific topics run on a commercial or cost-neutral basis. Such courses exist for a range of transport topics, although coverage of TM is more 'opportunistic' than structured. For example, a short course in 'ITS and traffic management' generated in ETNITE was held in Southampton in 2007 with a number of innovative features.
4. **National/international conferences** (e.g. the annual World Congress on ITS). Such conferences offer advantages of networking and breadth of topic coverage, but do not offer structured training. (The onus is on the participant to make best use of the Conference for his/her needs).
5. **Workplace training**. This involves training on specific topics in the workplace, either by internal staff or by external experts. This already takes place to varying degrees in organizations according to commercial/development needs (e.g. employer-based graduate training schemes).

Policy/Decision Makers

Policy/decision makers here refer to Senior Government officials (European, national, regional, local) who are interested in the extent to which TM can support transport policy implementation. Interest is therefore mainly in the broad categories of ITS (information, pricing, management, etc) and their potential/likely impacts, particularly costs and benefits. Training needs therefore differ from many of the ITS/TM 'professionals' who may have specific technological training requirements. However, the training *methods* are similar to the ITS Professional, as both are constrained by time restrictions caused by their employment. For this aspect, therefore, the training options generally fall within options 1 to 5 above.

Appendix III: Details of training courses for professionals

This Appendix details the courses in the field of traffic management offered by various providers. The content is extracted from earlier deliverable D9. The courses are grouped in terms of the category of the provider: academics and/or universities, specialist organisations, private consultancies, software developers and conference organisers.

A. Academics and/or Universities

There are a few courses provided by academics that are usually hosted by their affiliated university. These are presented here below first. On the other hand, there are some universities that host quite a long list of professional development courses relevant to Traffic Management which are presented next.

Dynamic Traffic Flow Modelling and Control

This is a short course that is offered periodically by Prof. Markos Papageorgiou, Dynamic Systems and Simulation Laboratory at the Technical University of Crete, Chania, Greece.

The design, analysis, and evaluation of ITS require a good knowledge of traffic flow modelling and control techniques as well as of powerful methodologies from the areas of optimisation, control, networks and dynamic systems. The purpose of this intensive 5-day course is to cover the basic theory and tools necessary for efficient design and evaluation of ITS on road and freeway networks. The course begins with traffic flow modelling and validation that includes coverage of the various traffic flow models, the modelling of traffic networks, and simulation tools. Measurement devices and estimation problems in traffic networks, that include automatic incident detection and O-D estimation, are presented and discussed. The state-of-the art techniques on freeway traffic control, road traffic control, and integrated control employing ramp metering, signal control, and route guidance via application of modern optimisation, control, and estimation techniques, together with several case studies are presented. Some 50 exercises are used for consolidation of the provided knowledge. Extensive written materials, including all transparency copies, are handed out.

The course is designed for graduate students, engineers, researchers, consultants, and government employees who are interested in improving their understanding of advanced traffic flow modelling and control tools and in becoming familiar with their application in ITS.

In more detail, the topics covered during the course address the following subjects: introduction (some basic notions, the regulation problem, optimal control strategies, optimisation theory, heuristics, automatic control application procedures, overview of comparable domains); traffic flow modelling (microscopic models, macroscopic models, model validation, critical discussion); modelling of traffic networks (fixed-routing modelling, traffic assignment: basic notions, dynamic traffic assignment; dynamic network models); measurements and estimation (measurement devices and data processing, estimation of traffic variables, automatic incident detection, origin-destination matrix estimation); freeway traffic control (introduction, ramp metering, link control, route information and guidance, case studies, integrated freeway network traffic control, merging traffic control); road traffic control (introduction, isolated intersection control, fixed-time coordinated control, coordinated real-time strategies, public transport priority, parking control systems, integrated urban-freeway traffic control, a case study).

Modelling and Simulation of Transportation Networks

This is a summer course that is offered yearly by Prof. Moshe E. Ben-Akiva (and visiting lecturers), Intelligent Transportation Systems Program at the Massachusetts Institute of Technology, Massachusetts, USA.

Modelling and simulation methods are essential elements in the design, evaluation, and operation of transportation systems. Congestion problems in cities worldwide have prompted at all levels of government and industry a proliferation of interest in Intelligent Transportation Systems (ITS) that include advanced supply and demand management techniques. Such techniques include real-time traffic control measures, and real-time traveller information and guidance systems whose purpose is to assist travellers in making departure time, mode and route choice decisions.

Transportation researchers have developed models and simulators for use in the planning, design and operations of such systems. This course draws heavily on the results of recent research and is sponsored by the Intelligent Transportation Systems Laboratory of the Massachusetts Institute of Technology.

The course studies theories and applications of transportation network demand and supply models and simulation techniques. It provides an in-depth study of the world's most sophisticated traffic simulation models, demand modelling methods, and related analytical techniques, including discrete choice models and their application to travel choices and driving behaviour; origin-destination estimation; prediction of traffic congestion; traffic flow models and simulation methods (microscopic, mesoscopic and macroscopic); and alternative dynamic traffic assignment methods.

The learning objectives of this course are:

1. Understand transportation network demand and supply models.
2. Distinguish among alternative approaches to dynamic traffic assignment and traffic simulation.
3. Assess the advantages and disadvantages of alternative network modelling and simulation methods.

This program is intended for analysts, engineers, managers and planners, as well as industry, government and academic researchers who seek to understand, analyze and predict performance of transportation systems. Participants with backgrounds in diverse areas such as traffic engineering, systems engineering, transportation planning, operations management, operations research and control systems are welcome.

The course consists of a series of lectures, including software demonstrations and case studies that develop the concepts and techniques and demonstrate their applications. The following lecture topics may be addressed as part of the course: introduction to transportation network models; traffic flow theory and simulation approaches; microscopic, mesoscopic and macroscopic traffic simulation models; network supply models: static and dynamic; behaviour in networks; discrete choice analysis; route and departure time choice; estimation methods of origin to destination flows from traffic counts; prediction of origin to destination flows; microsimulation of users' behaviours; users' response to ITS; supply/demand interactions, day-to-day adjustment processes and equilibrium models; application for real-time systems; simulation-based dynamic traffic assignment algorithms; evaluation of dynamic traffic assignment models; multimodal networks with scheduled services; application of modelling and simulation to traffic management, calibration and validation of traffic simulation models.

Discrete Choice Analysis: Predicting Demand and Market Shares

This course has been designed by Prof. Moshe E. Ben-Akiva who is offering it every summer at the Massachusetts Institute of Technology, USA. It is also organized yearly in Europe by Prof. Michel Bierlaire, as an EPFL Advanced Continuing Education Course by the Transport and Mobility Laboratory at EPFL, Switzerland.

Accurate predictions of the demand and market shares are critical for a wide variety of businesses and public organizations. Examples of applications include: predicting demand for a new product under alternative pricing strategies; designing a business plan for a new technology; analyzing the impact of a merger on market shares; forecasting the ridership on a new metropolitan transit service; and analyzing competitive scenarios for introducing a new telecommunication service. To accomplish these tasks, discrete choice analysis provides powerful methodological tools. Based on the modelling of individual behaviour, it is used to model in detail the structure of a market, and to predict the impact of various scenarios.

This one-week program undertakes an in-depth study of discrete choice models and their applications. It provides participants with the practical tools necessary for applying new discrete choice techniques. By examining actual case studies of discrete choice methods students will be familiarized with problems of data collection, model formulation, testing, and forecasting and will gain hands-on application experience by using readily available software to estimate and test discrete choice models from real databases. The course emphasises applications of discrete choice methods to strategic and tactical marketing and to policy-related problems.

The course is designed for professionals (from industry and public authorities) and academic researchers (professors, researchers, PhD students), interested in understanding and predicting consumer choices, demand and market share, such as marketing analysts, managers, planners, economists, engineers, operations researchers.

The course covers the following topics: fundamental methodology, e.g. the foundations of individual choice modelling, random utility models, discrete choice models (binary, multinomial, nested, cross-nested logit models, GEV models, probit models, and hybrid choice models such as logit kernel and mixed logit); data collection issues, e.g. choice-based samples, enriched samples, stated preferences surveys, conjoint analysis, panel data; model design issues, e.g. specification of utility functions, generic and alternative specific variables, joint discrete/continuous models, dynamic choice models; model estimation issues, e.g. statistical estimation, testing procedures, software packages, estimation with individual and grouped data; forecasting techniques, e.g. aggregate predictions, sample enumeration, micro-simulation, elasticities, pivot-point predictions and transferability of parameters; examples and case studies, including marketing (e.g., brand choice), housing (e.g., residential location), telecommunications (e.g., choice of residential telephone service), energy (e.g., appliance type), transportation (e.g., mode of travel).

Advanced Modelling and Simulation of Transportation Networks

This is a short course organised by Prof. Moshe E. Ben-Akiva, Massachusetts Institute of Technology, USA; Prof. Ennio Cascetta, "Federico II" University of Naples, Italy; and Prof. Agostino Nuzzolo, "Tor Vergata" University of Rome, Italy. It was hosted in Sorrento, Italy, May 17-21, 2010.

Increasing levels of traffic congestion, the complexity of transportation services and regulations and the introduction of innovative technologies necessitate the application of

advanced modelling and simulation tools. Applications include long range planning, design and operations. The tools used by transportation researchers and professionals for demand analysis and network assignment have been extended to include more realistic behavioural representations and dynamic settings. The course is intended to present these advances in: networks; demand; traffic assignment; and transit systems.

The course is designed for professionals (from industry, government and academia) interested in planning, design and management of transportation networks. Knowledge of basic transportation analysis tools and mathematical modelling methods is required.

A tentative course schedule has been announced as following: supply and traffic performances (static and dynamic networks, macroscopic models, flow-based (mesoscopic) models, microscopic and simulation methods); demand models (overview of discrete choice analysis, path and departure time choice, activity based models, land-use/transport Interaction models); traffic assignment (framework for demand/supply performances interactions, equilibrium and day-to-day dynamic models, OD estimation, models for real-time prediction); Transit systems (general framework and models for low frequency services, general framework and models for high frequency services); Pricing and Revenue forecasting (theory and models, case studies); Freight models (economic activity, logistic chain and mode choice, city logistics).

Intelligent Transport Systems

This course was given by Dr. C. Michael Walton, University of Texas at Austin, USA; Pierre Pretorius, Kimley-Horn & Associates; William W. Millar, American Public Transportation Association; Dr. Johann Andersen, Techso; Prof Arnold van Zyl, Stellenbosch University, South Africa; Dr. Gert-Jan van Rooyen, Stellenbosch University, South Africa; and Dr. Riaan Wolhuter, Stellenbosch University, South Africa. It was organised (September 7-11, 2009) by the Institute for Transport Technology, Stellenbosch University and the ITS South Africa.

The purpose of this course was to provide a working knowledge of ITS in general (including technology and communication options and principles) and more detailed knowledge in certain application areas (including freeway management systems and public transport applications).

The course was designed for officials of implementing authorities, consultants, service providers and Transportation Engineering post-graduate students.

The course covered the following topics: basic ITS elements, ITS objectives, ITS measures, ITS toolbox, benefits, economic evaluation, ITS architecture, ITS standards; policy for ITS, financing, institutional and legal aspects, implementation guidelines; fundamentals of systems engineering for ITS projects; ITS technology and communications: design principles, communication options, field device requirements, communication protocol; freeway management systems: planning, components, design principles & implementation; public transport systems: planning, components, design principles & implementation; transportation management centre business planning; traveller information state of the practice; ITS systems maintenance; ITS in developing counties; case studies & practical exercises.

- ***TRAIL***

TRAIL is the Netherlands Research School on Transport, Infrastructure and Logistics based in Delft, The Netherlands. TRAIL trains Ph.D. candidates and performs scientific and applied scientific research in the fields of mobility, transport, logistics, traffic, infrastructure and

transport systems. TRAIL is a collaborative initiative of five Dutch universities, and is accredited as research school since 1997. TRAIL's educational curriculum is designed to fit the individual needs of the Ph.D. candidates and includes a program of seminars. The interested reader can find a complete list of courses at *http://www.rstrail.nl/website_nieuw/pages/agenda/agenda_textframe.html*. A few examples are given here below.

Behavioural Aspects in Transport

This course was given recently by Prof. dr. E.M. (Linda) Steg, University of Groningen; and Prof. dr. K.A. (Karel) Brookhuis, Delft University of Technology, University of Groningen. The basic objectives of this course were: to get a coherent behaviour scientific perspective on mobility, traffic and transport. To obtain knowledge of the basis theory and methodology of behaviour scientific traffic research. To learn about important results of research on mobility growth, transport mode choice, safety in traffic and environmental impact of traffic. To get a better insight in which behaviour factors predict the success and failure of mobility and traffic and transport policy. To learn about the need for diagnosis, intervention and evaluation in order to effectively solve policy problems.

The course was divided into two parts. The first part went into detail about the adaptation of human behaviour to recent developments in telematics, in particular to automated systems that support the driver in the traffic task (cruise control, speed limitation). It as also discussed why people choose for certain ways of transportation (how, when, why), and how people evaluate policies aimed at reducing transport policies. In the second part, students were assigned to a real life problem ("pay as you drive"), and work in small groups on solutions for problems in the development of this controversial measure.

Dynamic Traffic Assignment

This course was given recently by Henk van Zuylen, Michael Mahut (INRO), Maaike Snelders (TNO/TRAIL) and Dr. Michiel Bliemer (Goudappel/TRAIL).

The course introduced the practical use of this technique, using Dynameq, a program for DTA developed by Mike Florian of INRO in Montreal. The course had a practical character where the participants had the chance to get hands-on experience with the use of DTA program.

A series of hands-on exercises covered software inputs and outputs and demonstrate simulation basics, data validation, results interpretation, model calibration, post-DTA analysis and generating sub-areas and dynamic traversal matrices.

Reliability of Transport

The course was given by Prof. dr. Henk van Zuylez, emeritus professor Dynamic Traffic Management at Delft University of Technology, and professor at Hunan University (Changsha, China); and Fangfang Zheng (DUT, CEG) Frank Zuurbier (DUT, CEG)

The reliability of transportation systems has become an increasingly important issue both for passenger and freight transport. Dutch policy has specific targets with respect to travel time reliability. For a good analysis of the reliability and the robustness of a transportation system, a good theory is necessary. Such theoretical frameworks was presented at the course. The students learned about the latest developments in the field of the reliability of transport networks.

University of Leeds

The Institute for Transport Studies at the University of Leeds, UK, has been providing a variety of specialist short courses for many years. These courses deal with specialist topics and are designed for people who already have some experience of working in the transport field. The courses are recognised by professional bodies (e.g. ICE) as contributing to the attendees' professional development. For professional progression, it is possible to accumulate credits towards a "Certificate in Transport Studies". The list of the short courses relevant to NEARCTIS offered by the institute this year is given below as an illustration.

Freight Transport Planning and Management

This is a two-day course designed to help planners, policymakers and consultants to develop a better understanding of freight operations and its specific needs. The course has two core elements. The first covers the broader context of freight operations including a thorough understanding of the key issues in national and international freight transport policy, together with the factors affecting the logistics decisions of individual organisations. The second provides an introduction to various quantitative techniques for managing freight movements, in order to promote understanding of how the industry makes use of modern management techniques.

Introduction to SATURN

This 3-day course provides wide coverage of the latest features available in SATURN. The course is suitable for those who have little familiarity with or no formal training in SATURN. It is also appropriate for anyone wishing to understand the basic principles underlying congested network assignment models. The course has been developed in conjunction with experienced practitioners from the Greater Manchester Transportation Unit. It covers the theoretical principles underlying the model; the mechanics of network building, running the programs and analysing the outputs; the issues of calibration and validation; forecasting and appraisal for new developments and road schemes; and presents evidence from real life studies. A significant proportion of the time available is devoted to practical exercises incorporating hands-on experience of the latest SATURN software.

Other short courses offered in the transport field include:

- Passenger Demand Forecasting Handbook (PDFH)
- Monitoring Traffic Pollution
- Modelling Traffic Pollution
- Advanced SATURN Workshop

Aston University

The School of Engineering & Applied Science at the Aston University, UK, offers a programme of seminars and conferences, intended to contribute towards professional training and the Continuing Professional Development (CPD) requirements of the relevant professional institutions. The university also allows Post Experience Certificates to be used to lead to its two distance-learning MSc courses in Transport Planning and Traffic Engineering. The list below gives the overview of the one-day short courses related to traffic engineering and management offered this year. These courses are run in Birmingham.

Introduction to micro-simulation modelling for transportation & planning professionals

This one-day course introduces micro-simulation modelling which is widely recognised as a valuable tool for assessing the impacts of land use changes, transportation schemes and new infrastructure proposals. Micro-simulation modelling, taking account of the road networks and road user behaviour, allows planners and engineers to test ideas and support innovative thinking with graphically displayed results. This course provides those new to modelling, project managers and clients with a fit-for-purpose understanding of techniques, software and interpretation of results. The topics include: overview of micro-simulation; preparation for micro simulation; organising micro-simulation study; interpreting results; and micro-simulation for incident management.

Introduction to MOVA Traffic Signal Control: Practical Guidance for Designers & Auditors

This is a one-day course on Microprocessor Optimised Vehicle Actuation (MOVA) software that can help to improve the performance of a stand-alone traffic signal by identifying excessive demand and reducing delay by optimising timings. This practical and informative course provides an introduction to signal optimisation techniques, guidance on site selection and the application of MOVA software and advice about the benefits to be gained and the pitfalls to be avoided in using the technique as part of a modern traffic control system. The course covers topics such as: principles and practice of MOVA control; junction data; design of MOVA control; and assessment of the performance.

Planning & Design of Pedestrian Crossing Facilities

This course brings together good practice guidance and understanding of the core factors to enable delegates to plan and design safe and sustainable crossing locations on a wide variety of routes. The course is designed for traffic engineers and designers involved in planning and design of pedestrian crossing facilities. The course deals with formal crossing demand and assessment techniques, evaluation of impacts, key geometric factors and provides guidance on crossing selection and operation. The course could lead to the award (optional), a certificate of competence in pedestrian crossing planning and design.

Major/Minor Junction Design: Competence Training for Roads & Traffic Engineers

This course deals with the most common form of intersection on British roads – major/minor junction. Such junction can comprise simple layouts on single carriageways with low flows up to high capacity intersections with channelisation. This one-day course is aimed at traffic engineers, roads designers and road safety auditors working in infrastructure design, development control and collision reduction fields. The course aims to provide concise and robust training in junction design, leading to an optional certificate of competence in junction design. The topics covered in the course include: overview of major/minor junctions; good junction design; geometric factors; and operational factors.

Planning & Design of Roundabouts: Good Practice & TD16/07

This course looks at all aspects of roundabout design, from fundamental principles to the factors that affect both capacity and safety, highlighting elements of good design drawn from international sources. Incorporating international guidance & innovative practice and building on the UK Highways Agency's 3-year study to update the Roundabout Design Standard TD16, this course will be of benefit to design engineers, traffic planners and development control officers as well as road safety auditors and those involved in collision reduction and

prevention schemes. The topics include: policy and planning considerations; design for operation and safety; good geometric design; and case study.

Mini-Roundabouts Planning & Design: Good Practice & TD54/07

This course covers all aspects of mini-roundabout design, from sitting and safety to the geometric factors that affect both capacity and operational performance including the new guidance contained in TD54. This course is designed for design engineers, traffic planners and development control officers as well as road safety auditors and those involved in collision prevention and reduction schemes. The topics covered are: policy and planning considerations; design for operation and safety; good geometric design; and case study.

An introduction to traffic engineering and highway design

This course is aimed to provide an introductory level to technical knowledge for transport planners and traffic engineers including traffic engineering and highway design matters. Current methods and applications widely used for Local Highway Authorities and Trunk Road Network are introduced. The topics, in addition to highway design aspects, include various traffic engineering tools and methods such as: link/junction/network capacity; Intelligent Transport Systems; Route Management; VMS, MOVA, SCOOT, Ramp Meeting, etc.; and emerging methods (active traffic management and Congestion Charging).

Understanding traffic engineering and its applications

This course is aimed to provide technical knowledge for transport planners, traffic engineers and civil engineers in assessing the capacity of transport network, software packages, techniques and guidance available in traditional and advanced techniques. Emerging aspects such as Active Traffic Management, red routes and Intelligent Systems (Signals) will also be covered. A series of lectures uses real examples, to provide delegates with a good understanding. The topics include: concepts of traffic engineering; level of assessment; traffic analysis techniques; and advanced traffic engineering techniques (active traffic management, congestion charging, intelligent transport systems).

An introduction to pedestrian modelling

This course, run in association with Steer Davies Gleave, covers different aspects of modelling pedestrian experience. As the designs of new developments and infrastructure are increasingly focussed towards maximising the pedestrian experience, the practises involved in modelling and quantifying that experience have become increasingly complex. The topics included are: overview of pedestrian modelling; static pedestrian modelling; dynamic station and transport interchange modelling; stadia crowd flow modelling.

Traffic Management & The Art of ITS: Part 1

This course has been prepared to provide guidance to the successful implementation of ITS solutions from meeting policy and strategy requirements through to delivering ITS on the street. A number of case studies are used as reference points to demonstrate how theory is turned into practice and the lessons to be learnt from this process.

Traffic Management & The Art of ITS: Part 2

This course has been prepared to provide guidance to the successful implementation of ITS solutions on the street. This approach tackles the use of legacy systems, the technologies

required and the opportunities that can be realised. We also provide a view, and guidance, on emerging and future technologies and the implications to ITS implementation.

Junction analysis for transport studies and transport assessments

This course is aimed to provide basic knowledge for transport planners and traffic engineers on the principles of junction assessment and design. The course covers current methods and applications widely used as a part of local highway work and development planning. Basic principles of junction assessment, various methods for baseline data collection, use of type of junction modelling, principles of junction models (ARCADY, LINSIG, etc.), forecasting and growth in traffic (NRTF, TEMPRO), interpreting model outputs and consideration of remedial measures.

Transport modelling: an introduction

This course provides an introduction to transportation modelling with up to date examples of modelling studies across the country. The course aims to provide general concepts and theories, though not in detail, to enable the transport planners, traffic engineers and modellers to understand the suitability of models for their daily applications, judge selection of the right package for the right job and input and output requirements. The course covers: transport modelling basics; available models; use of models and advanced concepts of modelling.

ITS in a Sustainable Society

This topical and practical one day course, examines real world traffic and transport schemes and strategies, and the technologies employed. The continuing impact of technological change on policy decisions and behaviour is analysed, linking ITS applications to issues that are central to our social and economic well being. The topics include: introduction to ITS; traffic problem; costs and benefits; applying ITS.

Newcastle University

The School of Civil Engineering and Geosciences at the Newcastle University, UK, offers a range of courses for study by transport professionals. Taught by leading research-active academics and professionals from the various industries, the courses offer up-to-date and industrially relevant curricula in short, intensive programmes. Many of the courses address serious skills shortages in the disciplines. The courses vary in length from two days to five days which we feel is an achievable length of time for engineers and scientists to study away from their workplace. Each course is designed to make the most of the study time available providing the attendees with increased knowledge and up to date skills which will give them a competitive advantage in the workplace and in the employment market. The list of short courses related to traffic management offered this year is given below.

Design of Transport Infrastructure

This 5-day course provides information on many of the key state of the art ITS and e-services being adopted by transport industry, providing understanding of the philosophy of why technology has been developed to support the management and control of the transport sector and how the systems and services have an influence on transport policy development. Delegates will gain awareness of the basic techniques used in the delivery of ITS systems and services. The course also introduces delegates to international research on Intelligent Transport Systems (ITS), and how this technology may be used globally. Moreover, the course introduces the political implications for ITS. Key areas considered are charging and

payment systems, traffic management systems, and the provision of information. The course also covers the development of appropriate business cases and financial plans for ITS and e-services investment.

Traffic and Environment Management for Sustainability

This course introduces the concept of traffic and environment management for sustainability. On completion, participants will have a better understanding of sustainability issues surrounding traffic and the environment. The participants will discuss the scale of local and global air pollution problems; and learn about the policies and reports with a strong bearing on local and global air pollution and sustainability. They will be introduced to the concept of the nested approach to modelling traffic, emission and air quality at micro and macro scales. This module will also discuss and demonstrate the role of intelligent transport systems (ITS) in delivering sustainability (keeping environmental, economic and health objectives in mind). Participants will also learn the use of traffic micro-simulation, emission and dispersion models to estimate air pollution in response to strategic and tactical initiatives. They will have the fundamental understandings to be able to deliver more effective management of traffic for sustainability.

Other short courses offered in the field of traffic engineering include:

- Air Pollution - 5 days
- Road Safety 1: Road Safety Policy 2 days
- Road Safety 2: Accident Investigation and Prevention 2 days
- Road Safety 3: Road Safety Audits 2 days
- Road Safety 4: Advanced Road Safety Audits 2 days
- Transport Policy in Practice 5 days
- Travel Demand Forecasting 1: Evolution and Objectives 1.5 days
- Travel Demand Forecasting 2: Forecasting and Models 1.5 days
- Travel Demand Forecasting 3: Traffic Assignment and Practical Applications 1.5 days

Politecnico of Turin, Italy

The Department for Transport of the Politecnico of Turin, TTS Italia ordinary member, organises in collaboration with TTS Italia an innovative training course on ITS. The course started on 12 April at the Politecnico of Turin and after that date the course will continue for the next three months by distance thanks to a multimodal and interactive online tool developed by the Politecnico with the support of the Italian Ministry for Infrastructure and Transport. The course is based on several online lessons with sequential levels that the user will be able to manage as he prefers. However, the user has to pass each level to access the next one. The course ends on the 15th of July with the issue of the certificates to participants.

B. Specialist Organisations

TRB

The mission of the Transportation Research Board (TRB) in U.S.A. is to promote innovation and progress in transportation through research. In an objective and interdisciplinary setting, TRB facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote

technical excellence; provide expert advice on transportation policy and programs; and disseminates research results broadly and encouraged their implementation.

TRB conducts web briefings or "webinars" on various subjects[3]. Some of these webinars that are relevant to traffic management and have been conducted recently are:

- New Managed Lane Provisions in the 2009 Manual on Uniform Traffic Control Devices (MUTCD)
- Pedestrian and Bicyclist Safety and Mobility in Europe Scan: Findings and Recommendations
- International Scan on Reducing Congestion and Funding Transportation Using Variable Road Pricing: Findings and Recommendations

POLIS

Polis is a network of European cities and regions from across Europe, which promotes, supports and advocates innovation in local transport. Within the framework of the European research project CVIS (Cooperative Vehicle Infrastructure Systems), co-ordinated by ERTICO – ITS Europe, Polis organised recently (September 10-11, 2009) the following summer school.

Cooperative Systems – Concept, Benefits and Deployment of "Talking" Cars and Roadside Infrastructure

This two-day programme was part of the longer summer school entitled "The city of the future" which was organised by the universities, high schools and public transport provider of Clermont-Ferrand in France. The summer school aimed at providing participants with a solid grounding in the basic concepts and current research & development related to cooperative systems as well as introducing the potential of this technology to address transport challenges at urban, regional and national levels.

This interactive programme was designed for young transport engineers from all over Europe interested in tools for planning the transport of tomorrow. The programme was organised around plenary and working group sessions. In the plenary sessions, information was provided about the concepts, benefits and possible uses of cooperative systems. In the working groups, participants worked on developing potential applications to make road transport greener, safer and more comfortable. As well as discussions about cooperative systems, there were also demonstrations, including mini-trucks and short films.

CITE

The Consortium for ITS Training and Education (CITE) is an organization of universities and industry associations, focused on providing comprehensive advanced transportation training and education that is flexible and convenient for its students. Most of CITE's partners are based in USA. CITE offers over thirty interactive web-based courses for transportation technicians, professionals and college students. More information can be found on *http://www.citeconsortium.org/index.html.*

[3] A Webinar (WEB-based semINAR) is a workshop or lecture delivered over the web. Webinars may be a one-way Webcast, or there may be interaction between the audience and the presenters.

PTRC

Planning and Transport, Research and Computation (PTRC) is an independent, international organisation based in London, UK, which specialises in the training of transport, highways and planning professionals. PTRC has over 30 years experience in training professionals at all levels, working with consultants, local authorities, government bodies and universities. PTRC designs and delivers training courses, seminars, workshops and conferences on a wide variety of transport and related topics. Recently, PTRC has introduced an Evening Lecture Series in Traffic and Transportation, which are held at various locations throughout the UK. Apart from regular events, PTRC also offer in-house training and tailor courses to the precise needs of a particular organisation. The conferences and courses offered this year are listed below as examples.

The European Transport Conference

The European Transport Conference (run by the Association for European Transport) is an annual 3-day event for academics and practitioners working in the field of transport. The conference covers various aspect of transport industry, from passenger transport to freight. The conference is generally organised in October.

Transport Practitioners Meeting (TPM)

This annual event is aimed at transport planners, engineers and urban transport designers from the UK and Ireland. The conference presentations covers various projects, such as Transport Governance, to detailed presentations on the implementation of bus priority, urban realm and way-finding schemes.

Scottish Transport Applications & Research (STAR) Conference

This one day annual conference provides the chance to attend suitable professional development conferences for Scottish based transport practitioners. STAR 2010 provides an excellent opportunity in a cost and time efficient way. The aim of conference is "To disseminate current transport research and practice that is relevant and applicable to the transport agenda within Scotland".

Sharing the Street - Annual National Conference

This one day annual conference (first in its series) explores many of the key issues around sharing the street. The conference adds to the debate around shared streets, spaces and surfaces that continues nationally with the desire by many local authorities and developers to create more creative, enjoyable and safe streets, sometimes challenged by stakeholders and user groups.

Traffic Management Conference (Incorporating Bus Priority Conference)

This is an annual 2-day conference organised by PTRC, which is targeted for practitioners involved in the bus priority and general traffic management projects. The two-day event encompasses all aspects of traffic engineering and management, including bus priority ideas and techniques.

An Introduction to Traffic & Transport: A 20-Week Evening Seminar Programme

This is a 20 week long programme of evening seminars providing an introduction to the different components of transport planning and traffic engineering. This is aimed to improve

training and development for transport practitioners, particularly those new to the profession and recent entrants from non-traditional backgrounds. The course covers the wide range of topics to gain skills necessary to become a well rounded practitioner. These topics include transport planning, surveys, traffic management and transport modelling. The course runs in 4 cities: London, Manchester, Glasgow and Dublin.

Two-day Training course on Transport Modelling

This two-day course is designed to familiarise transport engineers and planners with the basic techniques currently used in traffic and transport forecasting. The course is planned for March this year.

Some of the technical visits organised by PTRC in 2009 were:

- Seminar and Technical Visit - Ashford Inner Ring Road Shared Space Project
- Portsmouth – Britain's First 20 mph City (Conference and Technical Visit – PTRC in partnership with Portsmouth City Council), Portsmouth
- Seminar and Technical Visit to Swansea Metro Bus Rapid Transit Project – October

Some of the short courses and seminars organised by PTRC in 2009 were:

- One-day seminar on Integrated Transport & Land Use Planning
- Special seminar for transport modellers – "Providing the scientific evidence base for transport planning decisions"
- ACT TravelWise Training Course – Introduction to Workplace Travel planning - Introductory Self Study Pack and One Day Workshop
- Two-day Training Course – Designing for Cycle Users

innovITS

innovITS is a UK ITS Centre of Excellence for Transport Telematics and Technology for Sustainable Mobility. This ITS Centre of Excellence will seek out inventive telematics technology to integrate on a realistic scale and validate that it delivers value to travellers and transport operators. As a result, it will act as a catalyst for subsequent deployment and commercial exploitation. The centre organises various seminars and workshops in a themed topic on intelligent transport systems. Some of the examples of the workshops organised in 2009 include:

- Intelligent Transport Systems – Future Vision
- Simulation Showcase
- Informed Logistics - Information and consortium-building day
- The Informed Traveller
- Creating Effective, efficient transport systems
- Transport Technology and Climate Change - Building a greener Scotland

- ***UTMC***

Launched in 1997, the Urban Traffic Management and Control (UTMC) initiative, funded and led by the UK Department for Transport, developed and trialled an open and modular approach to the design and implementation of Intelligent Transport Systems (ITS). In 2003, UTMC Development Group (UDG) was set up to facilitate the development and implementation of UTMC systems. It works with organisations which include RTIG, ITS(UK), TIH, ITSO and innovITS. It also organises yearly the UTMC conference and other workshops on the topics related to UTMC area. Examples from past years are listed below:

- Workshop on "Specifying for Delivery", December 2009
- Workshop on "Designing for Impact and Performance Measurement", December 2009
- Workshop on Urban-Interurban Integration, December 2008
- Workshop on Novel Traffic Management Techniques, December 2008
- 12th UTMC Conference, Bristol, December 2009
- 11th UTMC Conference, Leeds, December 2008

IET

The Institution of Engineering and Technology (IET) is one of the world's leading professional societies for the engineering and technology community. It regularly organises conference on Road Transport Information and Control (RTIC). This conference reviews the latest and most innovative traffic management and public transport systems advances on the road network, through the application of Intelligent Transport Systems (ITS).

- ***RTIG***

Real Time Information Group (RTIG) was established in 2000 to provide a focus for all those involved in UK bus Real Time Information (RTI). Now it has merged with INFORM (working in the field of public transport telematics) to form RTIG-INFORM. RTIG-INFORM has a wide membership drawn from UK local authorities, bus operators and system suppliers, with representatives from Government and other key industry groups. It regularly organises workshops for members to discuss their concerns and to share their experiences. Some of the examples are:

- Annual Conference: Achieving Customer Focus, Liverpool (9-10 November 2009)
- Integrating bus and road network management, Maidstone (13 January 2010)
- Spring Meeting and RTIG-INFORM AGM, London (March 2010)

C. Private Consultancies

- ***JCT Consultancy***

JCT Consultancy, UK, offers an extensive range of courses in traffic engineering. These include training in traffic signals methodology, traffic engineering software, traffic signal controllers, traffic signal management, junction design and junction audit. These courses are offered for a range of levels from introductory through to advanced methodology and accordingly, are directed at complete beginners through to experienced professionals. All the courses are accredited by the Institute of Highway Engineers (IHE) for equivalent number of days of the course. The examples of courses offered by JCT consultancy this year in the field of traffic management are listed below.

Introduction to Traffic Signals

This course is suitable for anyone recent or new in the traffic signal/control field. In addition, senior managers who find that they are responsible for traffic signal control teams and their background experience hitherto has been in other specialist areas such as highway design, transportation planning etc. The course is aimed at providing an insight into the traffic signals field, covering a number of design related subjects at an introductory level including: Pedestrian and Cyclist Traffic Provisions, Traffic Signal control strategies, intelligent Transport Systems and Bus/Tram Priority, Traffic Signal Theory and Calculations, Overview

of Geometric Design and Traffic Signals in Modelling. The course duration is 2 days and has an IHE accreditation of two days. The course runs in various places in the UK.

Advanced Traffic Signal Design

This 4-day course is intended for anyone who is involved with traffic signal design at a basic level and would like to further their skills in this area. This course looks at the more intricate design procedures available to engineers. The course will highlight the design techniques available to squeeze extra capacity and efficiency from junctions using signalling methods and geometric configurations. The course covers signalised roundabout and various aspects of phase based traffic signal design. The course has an IHE accreditation of four days.

MOVA - Design and Implementation

This course is primarily a three-day course, intended to introduce, explain, and give confidence in MOVA design, implementation and operation. However, delegates who would like a basic understanding and overview only of MOVA without the technical detail can choose to attend the first day only. All aspects of MOVA design including dataset specification, implementation and operation including problem solving, and (weather permitting) experience on site. The course has an IHE accreditation equivalent to the number of days.

Pedestrian Crossings - Assessment, Design and Implementation

This is a one day course for those who are involved in the design & installation of Pelican, Puffin and Toucan mid-block crossings. The course covers the topics including: assessment of potential pedestrian crossings ("Pelican"/"Puffin" and "Toucan" crossings); elements of law, regulations and codes of practice; design requirements; and crossing under various control types (VA, UTC, Cable-less Linking Facility -CLF and Microprocessor Optimised Vehicle Actuation - MOVA). The course has an IHE accreditation of 1 day.

TR2500 Controller Specifications

This course is intended to provide delegates with an appreciation and understanding of the Highway Agency's specification TR2500 for microprocessor traffic controllers. Delegates will be given an introduction to the specification followed by an in depth examination of the appendices including a brief revision of related topics such as VA, CLF, UTC and MOVA. The course will benefit those involved in the detailed specification of traffic controllers and those wishing to know more about the current specification and the facilities available. The course duration is one day and has an IHE accreditation of 1 day.

Traffic Signal Management

The course is designed for those who have responsibilities for traffic signal and control functions, and are involved in leading the work of experts in individual areas of activity. In covering a wide range of topics at an introductory overview level, it is ideal for unit managers, or others who require a wide ranging overview of traffic signal related activities. The course covers eight key topics as follows: Traffic Signal Maintenance and Renewal; Highway Authority Roles; How Traffic Signals Work; Superimposed Control Strategies; Concept Design and Special Provision; Traffic Signals in Modelling; Scrutiny of Traffic Signal Proposals; and Implementation and Follow-up Work. The standard course duration is two days and is accredited by IHE.

TRANSYT V13 Computer Workshop

The course is aimed at those whose work involves co-ordination of traffic signals and would like to learn the methodology behind TRANSYT 13 as a tool for modelling networks. The course provides a two-day "hands-on" workshop teaching the use, interpretation and application of the TRL TRANSYT/13 program to model linked signal networks. The topics covered include: Program Overview; Input/output; Model and Optimiser, modeling Pedestrian Facilities and Fixed Times; Model Calibration and Validation. The course duration is two days and is accredited by IHE for two days.

Arcady 7 and Picady 5 Essentials

This one-day course provides a full understanding of the input data requirements, input data measurement, data entry, and output data interpretation of the ARCADY and PICADY computer programs. The aim of this course is to provide confidence in measuring the input data geometric parameters, to teach the methodology required to properly apply this software in traffic impact design for TA submissions, and to provide guidance on how to properly evaluate and/or check ARCADY PICADY design /TA submissions. Following a demonstration on how to input data for provided examples into ARCADY and PICADY , delegates are given the opportunity to gain confidence using the programs using actual consultancy practice examples. This course is primarily aimed at persons who have to provide, or, are in receipt of, Traffic Impact evaluations that involve the use of the ARCADY and PICADY computer programs. The course has an IHE accreditation of one day.

Linked MOVA Design and Applications

This is a more specialised course on design and examples of Linked MOVA systems. This is aimed at experienced MOVA designers who have experience in the design and operating principles of MOVA applied to free standing junctions and to develop their MOVA skills wish to extend their knowledge into the Linked MOVA systems. This one day course covers all aspects of Linked MOVA design including dataset specification, implementation and operation including problem solving. More specific topics include: working of Linked MOVA; design; additional detection required; method of control; controller configuration; implementation; and applications (by example). The course has an IHE accreditation of one day.

LinSig V3 Computer Workshop

This three day workshop is designed as a key training to produce efficient and accurate modelling as part of traffic signal design, transport assessments or network studies. This is designed for anyone whose work involves the precise modelling of traffic signal junctions, individually or in networks. The workshop is equally aimed at people with experience in transport modelling, traffic signals, or earlier versions of LinSig, who wish to hone their existing skills, ensure correct applications, and be well placed to authorise or audit other people's work. Delegates are expected to have a basic understanding of how traffic signals work and know what is meant by terms such as phase, stage, intergreen, saturation flow and capacity. The standard course duration is three days, or two days for the shorter option, with 3 or 2 days accreditation as appropriate. The course runs across various cities in the UK.

LinSig V3 Signalled Roundabout Design

This one-day course deals with the geometric design and the traffic modelling of signalised roundabouts using LinSig. The geometric design of signalised roundabouts requires a rigorous

process of lane flow analysis to identify combinations of lanes and signalisation which will work properly from the outset. Traffic modelling is then used to optimise signal timings for coordination and capacity, and to predict overall performance. This course details the method of combining both processes using LinSig within modelling using iterative methods to give rapid results. The course is aimed at all those involved in the geometric design, traffic modelling and signal optimisation of signalled roundabouts. Delegates require a good understanding and hands-on experience of LinSig modelling of stand-alone junctions. The course has an IHE accreditation of one day.

TMS Consultancy

TMS Consultancy, UK, presents training courses and seminars for Local Authorities and Consultancies as well as for organisations such as RoSPA, PTRC, IHIE and LARSOA. The modules and short courses are designed to provide structured training for individuals with all levels of ability. Mainly from people that are new to, or, wishing to broaden their understanding of a subject, to those with practical and managerial experience wishing to keep up-to-date with the latest developments. The list of the courses, related to traffic management, offered this year is given below.

Introduction to Traffic Management

This is a three-day module designed to give an introduction to a wide range of traffic management measures and processes. The aim is to make delegate able to understand many of the statutory processes and design issues surrounding this work area and will be able to undertake traffic management work with more confidence. The course offers an ideal starting point for those new to traffic management or needing to gain an insight into the areas of junction design and traffic regulation orders. The topics include: traffic signs, traffic signals, pedestrian facilities, cycling facilities, public transport facilities, junction design and traffic regulation orders.

Introduction to Traffic Signals and Pedestrian/Cycle Crossings

This three-day course provides an introduction to the issues involved in the design and implementation of traffic signals and pedestrian/cycle crossings. This module is aimed at road safety, traffic management and development control professionals seeking to learn or improve their skills in the design of traffic signals and pedestrian/cycle crossing. The course covers various topics in traffic signals and signalized pedestrian crossing including: design of pedestrian crossings (zebra, Puffin, Pelican and Toucan Crossings); other design issues (staggered crossings, guard rail, lighting); traffic signal design (layout, detection systems, phases and stages, capacity and modeling) and control strategies(UTC, bus priority, gating etc).

Introduction to Roundabout Design

This two-day module covers the design of roundabouts, including mini-roundabouts. This module is aimed at Traffic Management and Development Control Professionals seeking to improve their skills in roundabout design. The course covers: the principles of roundabout design; geometric design issues; capacity issues including ARCADY 6; pedestrian and cyclist facilities; and mini-roundabout.

Introduction to Junction Design

This is a three-day course designed to provide an understanding of the principles and practice of designing a variety of junctions. This module is aimed at a broad range of professionals who are involved in designing or assessing the adequacy of junctions. The main topics included are: general principles of junction design, priority junctions (layouts, principles of Design, capacity issues including PICADY 5); traffic signal design (capacity issues including modelling programs, designing for pedestrians and cyclists) and roundabout (geometric design, mini-roundabouts, capacity issues and modelling programs, pedestrians and cyclists).

Temporary Traffic Management on Urban and Local Roads

This two-day course is targeted at all levels of Management, Client Officers, Technicians and anyone not actually involved in installing Temporary Traffic Management (TTM), but who require a knowledge of basic TTM practice on urban and rural roads. The course aims to provide delegates with the necessary underpinning knowledge of temporary traffic management and the design procedures used. This provides Highway Authorities, Contractors, and other organisations who require a knowledge of current basic practice, with minimum legal requirements where they apply. On completion of this course all delegates will be required to undertake a written examination which carries a 75% pass mark. Lantra Awards (the national awarding body) will issue a certificate to successful candidates.

- ***SunCam***

SunCam, Inc. is a popular source of continuing education training for engineers, architects contractors and project managers (*http://www.suncam.com*). The Traffic Engineering courses offered include the following:

- Traffic Control Plans
- Access Management
- Intersection Safety
- Lighting Design
- Traffic Signal Supports, Indications and Signing
- Traffic Signals, Designing
- Traffic Signals, Introduction to
- Traffic Signals, Planning for

D. Transportation Software Developers

- ***TRL***

The Transport Research Laboratory (TRL), UK, runs training courses and hands-on workshops for ARCADY/PICADY, OSCADY PRO, TRANSYT, MOVA, PCMOVA, SCOOT, MAAP and HDM-4, as the producer of these software products. Training courses are comprised of a mixture of presentations from TRL staff and practical sessions where delegates can gain hands-on experience of using the latest versions of the programs. Presentations include explanations and advice relating to the underlying traffic engineering principles, accident reduction considerations and the use of the software itself. All the courses are Institute of Highway Incorporated Engineers (IHIE) approved CPD training courses. These are usually run on TRL's premises in Crowthrone, UK. Some of the short courses offered recently are listed below.

TRANSYT Training (one-day UPGRADE to TRANSYT 13)

This comprehensive one-day course is aimed at existing users of TRANSYT who would like to learn about the new version of the software and the new features it offers. The course presents in detail the essentials of how to use the new software and will include extensive hands-on sessions. The course is ideal for both those who are planning to upgrade to TRANSYT 13 and for those who will have already done so.

TRANSYT Training (two-day foundation course)

This two-day course is aimed at those involved in the design and operation of traffic management and control in urban areas. It is also suitable to anyone evaluating designs of linked traffic signals, such as those at signalised roundabouts. The aim of the course is to provide delegates with grounding in how to use TRANSYT by explaining all of the main features of the program through a sensible mix of presentations, demonstrations and practical sessions. The course is suitable for beginners, although familiarity with basic traffic engineering terms and ideas is assumed. Experienced users can also benefit from the course, since they provide an opportunity to try out new features in the software.

ARCADY/PICADY Training (two-day foundation course)

Covering both ARCADY 6 and PICADY 5, this two-day course aims to give delegates a comprehensive grounding in how to use the programs and how to interpret the results. The course also gives delegates practical experience on using the software. The course is for anyone involved with the design of roundabouts and priority junctions, (rather than policy makers) who has no knowledge or limited knowledge of ARCADY and PICADY. The course is also of use to anyone examining submissions involving ARCADY or PICADY.

ARCADY/PICADY Training (one-day concise course)

This one-day course aims to give delegates a comprehensive grounding in how to use both ARCADY 6 and PICADY 5 programs and how to interpret the results. The course also gives delegates practical experience on using the software. The course is a sensible mix of presentations (from TRL staff), practical sessions and demonstrations. The course is for anyone involved with the design of roundabouts and priority junctions, (rather than policy makers) who has no knowledge or limited knowledge of ARCADY and PICADY. The course is also of use to anyone examining submissions involving ARCADY or PICADY.

MOVA Seminar and MOVA Engineers Training Course

This is a three-day course aimed at covering virtually every aspect of MOVA operation. The course is suitable for both beginners as well as experienced users. Day 1 is in Seminar format and is designed for those responsible for the road network and traffic engineers who need an introduction to MOVA. The day covers the basic principles of MOVA operation, how effective it is in comparison with other systems, where it is most suited, and the future of MOVA. Days 2 and 3 (the Engineers' course) is a mixture of practical and theory and delves into much of the detail on how to design, commission and validate a MOVA controlled junction. Exercises include the measurement of saturation flow and speed, and use of MOVA Comm and the new forthcoming MOVA Setup for Windows.

OSCADY PRO Training (one-day foundation course)

This one-day introductory course aims to give delegates a basic grounding in how to use the program and how to interpret the results. The course is a sensible mix of presentations, practical sessions and demonstrations, but with the main emphasis on the practical sessions. The course is for anyone involved with the design of signalised junctions who has no knowledge or limited knowledge of OSCADY PRO. The course is also of use to anyone examining submissions involving OSCADY PRO.

OSCADY 5 CLASSIC Training (two-day foundation course)

The course uses OSCADY 5 and includes a demonstration of its features such as graph generation and multiple demand sets. It gives delegates an appreciation of the traffic mechanisms behind the programs and practical experience in their use. The course is for anyone involved with the design of signalised junctions (rather than policy makers), who has no knowledge or limited knowledge of OSCADY.

SCOOT Training

The objective of the course is to help traffic engineers and technicians to understand and apply SCOOT and to supplement the information given in the SCOOT literature. The course is aimed at candidates who have, or will have, a direct involvement in the implementation and operation of SCOOT. The topics covered include: introduction to SCOOT; setting up a SCOOT; SCOOT output; SCOOT facilities and current research.

SIAS limited

SIAS, UK is the developer of S-paramics transportation simulation software. SIAS provides S-paramics training courses backed by its extensive audit and consultancy service. Courses are conducted by transportation engineers with considerable S-Paramics experience drawn from the large number of SIAS's micro-simulation commissions. Courses are designed to show how to properly apply S-Paramics software to a transportation project. The courses run regularly by SIAS are the following.

Model Development for absolute beginners to micro-simulation

This course covers the fundamentals of model development from inception to analysis, It enables attendees to build a wide variety of S-Paramics models. The course is hands-on, with one PC per trainee and a maximum of six trainees per course. This course is designed for new and inexperienced S-Paramics users. This three-day course is held in Edinburgh each month.

3 Day Calibration and Advanced Modelling Techniques

This is a three day course for S-Paramics micro-simulation modellers who are already familiar with the topics covered in the Model Development course. It goes into greater depth on the calibration techniques available in S-Paramics, and shows how to check for model operation from various forms of output data produced by the Data Analysis Tool (DAT). It covers the writing VA traffic signal plans and using the S-Paramics Matrix Estimation Module. The three-day course covers some of the fundamental principles behind micro-simulation modelling and techniques for undertaking analysis and scheme comparisons. It is normally held in Edinburgh.

2 Day Advanced Signal Control

This two day course is aimed to enable traffic modellers to apply dynamic traffic control to a running simulation using the S-Paramics Advanced Control Interface (ACI). Information from the vehicle detectors within the S-Paramics model is transmitted via the interface to control software that allows a modeller to control signal stage orders and timings, give route choice information via broadcast media, or modify lane restrictions or speed limits via roadside variable message signs. Course attendees should be experienced in the use of S-Paramics micro-simulation in addition to the knowledge of Visual Basic. The course introduces S-Paramics ACI and demonstrates how to use SIAS's PController software module and Visual Basic to build traffic controller systems and interface these to an S-Paramics model.

1 Day S-Paramics Managers' Overview Seminar

This concentrated one day seminar is aimed at transportation planning managers with no hands-on experience of S-Paramics micro-simulation and little time to spare. It aims to cover topics from the perspective of the client or manager, such as scoping, inception, data collection, an overview of simulation methodology, calibration, validation, analysis and reporting.

SIAS also provides a series of trainings concentrated on more advanced and specific model development techniques and applications using S-Paramics. Each module contains practical examples and most are suitable for modellers with some experience. These include:

- Economic Assessment
- Advanced Assignment Considerations
- Motorway and Dual-Carriageway Modelling
- Emissions Modelling techniques

- ***TSS***

Transport Simulation Systems (TSS) has a singular focus on developing and marketing transport modelling software for traffic engineering, management and operations. TSS is currently servicing over 1,500 users in 55 countries and is rapidly expanding into decision support for real-time traffic management with Aimsun Online.

TSS offers standard and customised Aimsun training, ranging from basic use to advanced programming for research. Most of TSS' European courses are delivered in Barcelona. Depending on the audience, the course is taught in English, French or Spanish. However, on-site training can be scheduled with customised course content to suit particular needs. Outside of Europe, TSS works with distributors to support training needs; so far TSS has run well-attended courses in Australia, Chile, China, Japan and South Africa. There are two standard courses aimed at new and advanced users, respectively, which are presented below.

Aimsun Foundation Course

This four-day course is for new Aimsun users who want to build models for project work. It covers the following topics: the Aimsun environment and modelling objects; data inputs and network editing; micro-simulation; dynamic traffic assignment; outputs; network auditing and calibration; 3D modelling and visualisation; traffic management; mesoscopic simulation; macroscopic modelling; integration of macro, meso and micro.

By the end of the course, trainees have a sound understanding of the most important features of Aimsun Advanced and are able to plan and carry out projects.

Aimsun Advanced Course

This two-day course is for more experienced Aimsun users who want to deepen their knowledge and get the most out of our software. By the end of the course, trainees have an excellent understanding of these advanced topics and are able to harness the power of Aimsun and build high quality models.

- ***PTV***

The PTV Group provides cutting-edge software technology and consulting to enable customers to meet their mobility needs. It helps people plan and manage traffic and transportation, provides them with the latest traffic reports and assists them in optimising their long-term resource allocation. Since 1979, PTV Group has been a leading provider of products and solutions for travel, traffic and transportation planning. In the Traffic Software, Traffic Consulting and Logistics Software business fields, PTV technology forms the foundation of a host of brand-name products and its own leading map&guide and PTV Vision product lines.

Training offered by PTV on its software suite for transportation planning and operations analyses include: users group meetings; individual training; and training courses (*http://www.vissim.de/software/transportation-planning-traffic-engineering/trainingevents*).

- ***Citilabs***

Citilabs is a software development firm that develops, markets and supports software products for a broad group of professionals involved in transportation planning, modelling, traffic engineering, GIS and urban planning. Citilabs offers courses designed for all types of Citilabs software users. Training can be received in a variety of formats, including public training events, private training services, and web-based training (*http://www.citilabs.com/training.html*).

E. Conference Organisers

There are various conference organisers who organise seminars and conferences on various transport related topics. Most of these events are focussed on policy issues rather than practice. However, some of the events are well suited for transport professionals to get deeper understanding of the issues from different prospective. Some of the companies involved in organising transport related seminars and conferences in the UK are:

- Waterfront Conference Company
- Holyrood Events, Edinburgh
- Local Transport Today conferences

In addition, there are courses, workshops and tutorials that have been hosted by Conferences. Some of these courses hosted by the IEEE Intelligent Transportation Systems Conferences are presented here below.

Applications of Dynamic Traffic Assignment Methods to Traffic Management and Evacuation Planning

This is a short course by Dr. Hani S. Mahmassani that was hosted by the 9th International IEEE Intelligent Transportation Systems Conference (ITSC 2006), Toronto, Canada, September 17-20, 2006.

This short course reviewed developments in simulation-based dynamic traffic assignment techniques, including recent software capabilities, and describe their application for operational planning and evaluation of ITS strategies in corridor and metropolitan area networks. In addition to describing the underlying methodological aspects of mesoscopic simulation, dynamic micro-assignment and associated network algorithms, the course discussed how to get started in terms of building a network and obtaining the necessary input data. Applications included incident and work zone management through information supply measures, e.g. variable message signs, diversion and traffic control; evaluation of managed lanes and pricing schemes; network contingency analyses and emergency evacuation planning; development and evaluation of integrated corridor management schemes.

The Role of Control Theory and Artificial Intelligence in Integrated Traffic Management: Fundamentals, Advances and Applications

This is a short course by Prof. Markos Papageorgiou and Dr. Baher Abdulhai that was hosted by the 9th International IEEE Intelligent Transportation Systems Conference (ITSC 2006), Toronto, Canada, September 17-20, 2006.

Traffic management on road and freeway networks employs a number of real-time control measures, such as signal control, route guidance, driver information, ramp metering, variable speed limits, and link control. In most cases the related systems and control strategies address one control measure at a time; however, several simulation studies as well as limited field investigations indicate that an additional amelioration of traffic conditions may be achievable as a result of appropriate integration of various control measures and systems. It was the aim of this workshop to discuss issues related to the integration of traffic management strategies along with the potential contribution of control theory as well as related artificial intelligence in this endeavour. This short course was divided into two parts. The first part focused on control theory applications while the second part focused on applications based on reinforcement learning from Artificial Intelligence. The presentation will address integration levels, suggested integrated control strategies and case studies.

Microscopic Traffic Simulation Modeling and Analysis Using VISSIM

This is a tutorial by Dr. Yinhai Wang that was hosted by the 10th International IEEE Intelligent Transportation Systems Conference (ITSC' 07), Seattle, Washington, September 30 - October 3, 2007.

Many traffic operational issues, such as traffic signal timing and dynamic toll rate determination for High Occupancy Toll (HOT) lane operations, require uses of microscopic traffic simulation models for system evaluation and optimization. Microscopic traffic simulation tools, such as VISSIM, Paramics, and Aimsun, have gained popularity over the past several years. However, attention must be paid to use of microscopic simulation models because their results could be misleading if the models are not properly configured and calibrated.

The objective of this tutorial was to introduce microscopic traffic simulation concepts and modelling procedures using VISSIM as an example. With instructions and in-class exercises, participants in this short course were expected to develop fundamental skills for microscopic traffic simulation modelling and simulation data analysis using VISSIM.

Major topics included: microscopic traffic simulation concept; VISSIM introduction; simulation modelling; model calibration; simulation data analysis; and advanced traffic simulation issues.

Emergent Cooperative Technologies in Intelligent Transportation Systems

This a workshop by Miguel Angel Sotelo, Urbano Nunes and Ljubo Vlacic to be hosted by the 13th International IEEE Conference on Intelligent Transportation Systems (ITSC 2010), Madeira Island, Portugal, September 19-22, 2010.

Transport accounts for 30% of total energy consumption in western countries. While some governments are currently negotiating with the automotive industry on how to reach an average CO2 emission of 120g/km for the new cars fleet by 2012, ITS technologies offer a new, complementary way of reducing CO2 emissions and increasing safety of the whole transportation system. This includes dynamic transport management and control strategies involving multiple interactions with vehicles. The objective of this workshop is to disseminate the best research results from cross-disciplinary researchers working on Emergent Cooperative Technologies in Intelligent Transportation Systems.

Traffic Behaviour, Modelling and Optimization

This is a workshop by Manuel J. Galán Moreno and Javier J. Sánchez Medina to be hosted by the 13th International IEEE Conference on Intelligent Transportation Systems (ITSC 2010), Madeira Island, Portugal, September 19-22, 2010.

Traffic management has become a key quality of life issue for national, state and local authorities across the world. The energy, environmental and economic crises that many of our citizens are experiencing is motivating the scientific community to engage in research aimed at addressing the negative impacts of traffic congestion towards achieving sustainable mobility goals. In addition, roads safety is also a priority issue. Every year thousands die in the roads, and there are many public institutions funding research projects in order to reduce that numbers. In this context multiple research groups are exploring different approaches aiming at a better understanding of driver behaviour, the resulting traffic dynamics, and on strategies to improve the efficiency of the roadway infrastructure for all its users, be it drivers, pedestrians, bicyclists or transit riders. The objective of this workshop is to bring together researchers, mainly from academia, in an open and informal environment, in order to share results, to discuss solutions and to plan for and be aware of future research initiatives.

Artificial Transportation Systems and Simulation (ATSS'2010)

The ATSS Workshop series are organized by Rosaldo Rossetti, Henry Liu and Shuming Tang and this year will be hosted by the 13th International IEEE Conference on Intelligent Transportation Systems (ITSC 2010), Madeira Island, Portugal, September 19-22, 2010.

The aim of this workshop is to foster the discussion on issues concerning the development of Artificial Transportation Systems and Simulation as a means to devise, test and validate ITS-based technologies. With the ability to integrate different transportation models and solutions in a virtual environment, ATSS serve as an aid to support decisions made by engineers and practitioners in a controlled and safe manner. They also provide a natural ground where new approaches can be experimented while avoiding natural drawbacks of dealing directly with real critical domains, such as ITS. On the basis of theories and methodologies borrowed from a wide spectrum of disciplines, such as the Social Sciences, Distributed Computing, Artificial Intelligence and Multi-agent Systems, Virtual Reality and many others, many important issues arise which challenge and motivate many researchers and practitioners from multidisciplinary fields, as well as different technical and scientific communities.

Appendix IV: PhD student progress reports

Annul PhD Research Report - First year

Ramp metering for the management of motorway roads

Candidate: Riccardo Scarinci

Host institute: University College London - UCL

Partner institute: Technical University of Delft – TUD

Thesis supervisor: Benjamin Heydecker

Thesis co-supervisor: Andy Chow (UCL), Andreas Hegyi (TUD)

Date of start of thesis: 1 July 2010

Date of report submission: 30 June 2011

Email ID of Candidate: riccardo.scarinci.09@ucl.ac.uk

Report

Research goals and objectives

The focus of this research is to explore the purpose of Ramp Metering, identify specific objectives, analyse and develop the different RM control policies. This research aim to give answers to three fundamental questions:

1. Which is the *best* control policy?

Since the first implementation of the Ramp Metering system, the choice of the best control policy has been an important task. Nowadays several strategies are present, from static control policies not depending on the traffic condition (e.g. static control, fixed-time control), to dynamic control policies related to the state of the traffic on the motorway (e.g. demand/capacity, percent/occupancy, ALINEA, ANCONA). Each of these control policy bring along the second question:

2. Which is the *best* system configuration?

This question will lead to the analysis of physical geometry, detector, solid-line and other system components configuration. Finally, considering the previous questions, a definition of *best* is essential, therefore an additional research question is necessary:

3.What is *best*? What are the objectives of the RM system?

Possible objectives of the RM system could be minimise the journey travel time, minimise the fuel consumption or maximise the stability of the traffic. These three research question will be analysed and evaluated for both single and a network of synchronised junctions.

Literature Review

Three main topics have been covered in the literature review so far: simulation model, RM development and its control policies. The current state of art in microscopic simulation model for traffic in motorway has been review, with particular attention to: car following model, lane changing model and merging model in motorway. The temporal and spatial development of ramp metering system in UK has been stated. Finally the state of art of Ramp Metering control policy, theory, implementation and field results have been investigated.

Although the main research topics have been covered, more exhaustive review of the state of art will be necessary during the next two years.

Work achieved in past year

Beside the literature review, a complete analysis and update of the micro simulation model has been done during the past year. Even if suitable software were already present, this process would have been necessary for three principal reasons. First of all, extra logic was introduced to simulate properly the merging of traffic in motorway junctions. Furthermore new functionalities were developed to simulate specific feature of Ramp Metering system. Moreover, some unexpected outputs have shown the necessity of an extensive debugging procedure to ensure the correct working of the software when modelling the relevant traffic conditions.

In conclusion an extensive literary review and the implementation of the micro simulation model have been completed during the last year.

Current state of work

The current stage of the research project is the identification of a suitable case study. After the analysis of the RM development in UK, the subset of possible case studies was

reduced at the 87 sites where the RM system has been already installed. The streak of the motorway M6 from junction 19 to junction 16 has been chosen as case study for its demand and supply characteristics, data availability and the stakeholders' interest. Currently the network characteristics are being coded in the micro simulation software and the procedure to access the site dataset has been started.

Calendar of upcoming work

Once completed the stages of case study coding and site data access, the important phases of calibration and validation of the model are next in the agenda. Using the MIDAS database (record of detective loops on the motorways) the simulation model parameters will be calibrated according to the case study characteristics; subsequently, the quality of the model will be evaluated in the validation phase. Different implementations of current control policies will be evaluated and optimized with different scenarios. Then, new control strategies will be studied starting from a single intersection and ending with more complex scenarios of multiple synchronised junctions.

Figure 1 shows the general schedule for the research project main tasks completed and to be completed within 2 years.

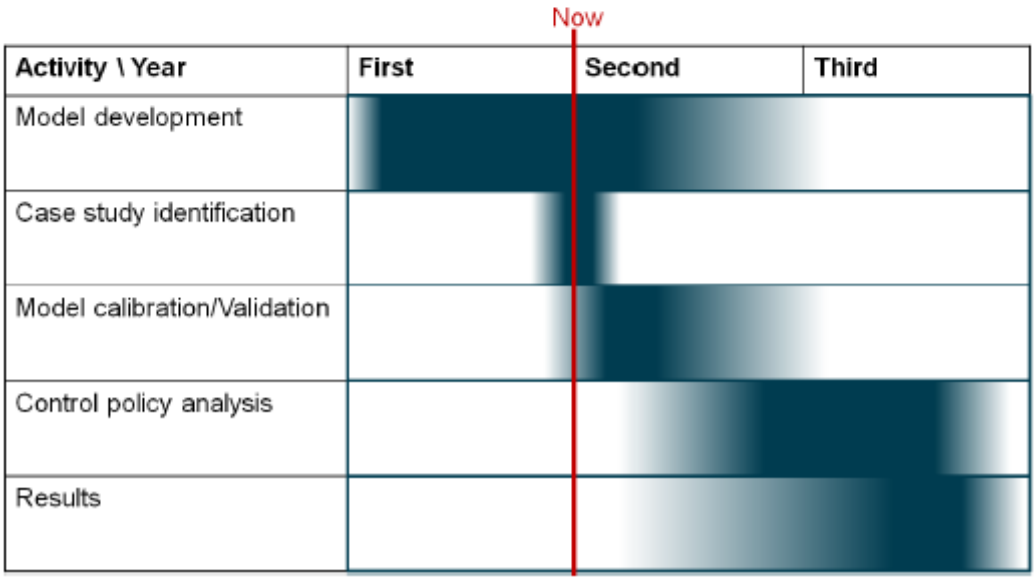

Figure 1 general research schedule

Scientific publications

Although no official publications have been produced during the first years of research, several working document have been created. Following is the list of these documents and a brief description:

- November 2010 Scarinci, *Ramp Metering for the management of motorway roads* [Poster]. Poster presented during the Civil Environmental and Geomatic Engineering Department Open House – UCL, London, UK.
- December 2010 Heydecker, *Review of the state of knowledge and capability in relevant technologies Deliverable 6 NEARCTIS*. Contribution on the final review of the document.
- December 2010 Scarinci, *SIGSIM Guide 2010*. Theory, user and programmer guide of the simulation software SIGSIM. Update and revision of the previous manuals.
- June 2011 Scarinci, *Ramp Metering for the management of motorway roads* [Poster]. Poster presented during the 4th NEARCITS workshop – IFSTTAR, Lyon, France.
- June 2011 Scarinci, *Ramp Metering for the management of motorway roads* [Presentation]. The research project has been presented during the following event:
  - Visit from NICTA (National ICT Australia). – UCL, London, UK.
  - Visit to ENTPE (Ecole Nationale des Travaux Publics de l'Etat – Accueil) – ENTPE, Lyon, France.
  - EUREKA Seminar – UCL, London, UK.

Presentation, conference, seminar

Following is the list of events attended as member of audience:

- June 2010, NEARCTIS summer school – EPFL, Lausanne, Suisse.
- July 2010 – June 2011, Centre for Transport Study seminars. Weekly series of seminar held by University College London and Imperial College London.
- January 2011, UTSG 43rd Annual Conference – The Open University, Milton Keynes, UK.

- May 2011, NEARCTIS summer school – Delft University of Technology, Delft, The Netherlands.

Following is the list of events attended as presenter:

- June 2011, [UCL internal seminar] Visit from NICAT (National ICT Australia). – UCL, London, UK.
- June 2011, 4th NEARCITS workshop – IFSTTAR, Lyon, France [Poster]
- June 2011, [ENTPE internal seminar] Visit to ENTPE (Ecole Nationale des Travaux Publics de l'Etat – Accueil) – ENTPE, Lyon, France.
- June 2011, [UCL internal seminar] EUREKA Seminar – UCL, London, UK.

Visit between partner institutes

The following visits have been done during the last year:

- 18 March 2011, Imperial College – London, UK. Informal meeting with PhD student Huiying Wang. Topic: comparison of research projects and identification of common area.
- 9 June 2011, ENTPE– Lyon, France. Internal seminar with professor, researcher and PhD students. Topic: presentation of research project and identification of common areas.

The following visits are being organized and will be carried out in the next year[1]:

- July 2011, University of Southampton. Duration: one day. Topic: presentation of research project and identification of common areas.
- September 2011 Technical University of Crete. Duration: one week (short technical visit). Topic: presentation of research, exchange of expertise in Ramp Metering control policies.
- February 2012, Delft University of Technology. Duration: 6 month (long technical visit). Topic: exchange of expertise in traffic simulation model, software implementation, dynamic traffic management and Ramp Metering control policies.

[1] The dates reported here are only indicative.

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UNIVERSITY OF Southampton
School of Civil Engineering and the Environment

Annul PhD Research Report 2011

Privacy Barriers to the Uptake of Cooperative Transport Technology

Candidate: Scott Cruickshanks
Host institute: University of Southampton
Partner institute:
Thesis supervisor: Dr Ben Waterson
Thesis co-supervisor: Dr Nick Hounsell
Date of start of thesis: Feb 2010

Date of report submission: 7th June 2011
Email ID of Candidate: **s.m.cruickshanks@soton.ac.uk**

Introduction

This annual PhD research report outlines the aims and objectives of my research. It then goes on to discuss the progress I have made since my last report and outlines the plans for the remainder of the PhD.

Research Aims

The two main aims of my research are firstly; to draw clear and concise conclusions about whether privacy concerns associated with Cooperative Transport Systems will prevent the successful uptake of these technologies across the European Union. Secondly, it will aim to identify the best methods for reducing the 'privacy' impact of Cooperative Transport Systems.

Objectives

A review of existing literature on privacy has shown that cooperative transport systems (CTS) are likely to create privacy concerns to some degree. However, no existing research has looked specifically into whether these fears associated with CTS will be substantial enough for the rewards on offer to be outweighed by the privacy concerns. To fill this hole in knowledge and in order to achieve the aims of this research, the research has been broken down further into six main objectives and their subsequent tasks.

Objective 1

Understand 'Privacy' and come up with a way of measuring 'Privacy' invasions.

Completed Tasks:

An understanding of 'Privacy' has been developed through a thorough literature review. The literature review suggests that before a user carries out any action, be it driving their car, using an internet search engine or making a phone call, he/she will carry out a simple privacy risk-reward calculation. On most occasions, this will be done subconsciously. This calculation takes into account the likelihood of their personal data being abused and the actual consequence of the abuse if it occurs. This is then weighed up against the reward for completing the action.

Invasion Factor = (Risk of Data Abuse x Consequence of Data Abuse) ÷ Reward

In this equation, the risk of data abuse incorporates the user's perception of the likelihood that a data abuse will take place and will take into account factors such as who the data processors are, the method of transfer and whether they are covered by any legal frameworks. Their perception of the consequence of a data abuse taking place will rely heavily on the type of data being traded and the users weighting of factors, such as embarrassment, inconvenience and a loss of safety. Similarly, the user's perception of the value of the reward will rely on the user's personal circumstance. For example, a £10 reward may seem large to some people, but small to others.

Therefore analysis of the Invasion Factor equation can be used to measure the 'Privacy Invasions' associated with a transport system.

Remaining Tasks:

- Update and the 'Privacy' literature review

Objective 2

Compare the different co-operative transport system technologies, their benefits and the level of 'Privacy Invasion' they require.

Remaining Tasks:

- Research co-operative transport systems and compile a list of real and hypothetical technologies
- For each technology define the potential benefits and the information about the user they require to operate.

Objective 3

Understand the point at which the personal information required by a technology becomes unacceptable in public opinion terms.

Completed Tasks:

A survey has been created, piloted and currently being conducted in the UK (See next section) which measures people's perceptions about various privacy scenarios, and weightings of certain rewards and privacy variables in order to come up with a range of doubt for the 'Invasion Formula'.

Remaining Tasks:

- Analyse the results of the UK survey.
- Conduct the survey in other EU countries.

Objective 4

Understand whether views on the acceptable level of intrusion changes from person to person and nation to nation throughout the European Union member states.

Remaining Tasks:

- Ensure that the survey samples a true representation of the people who live and travel throughout the European Union.

Objective 5

Draw conclusions about whether different co-operative system technologies in their current and hypothetical forms will be deemed acceptable in 'Privacy' terms.

Remaining Tasks:

- Survey the public's opinion on both the benefits and privacy losses associated with the various co-operative transport system technologies
- Apply the results of the survey to the 'Invasion Formula' for each individual co-operative transport system technology to see whether they are acceptable or not

Objective 6

For technologies that are deemed unacceptable improvements will be suggested.

Remaining Tasks:

- Evaluate how the technologies could be improved to meet the public's demands
- Conclude whether with/without improvements 'Privacy' could prevent co-operative transport systems from being implemented.

The Survey

In order to achieve objectives 3, 4 and 5 a broad web-based survey and a targeted mail survey will be conducted. The main purpose of the web-based survey will be to sample a high volume of people from all around the world. The web-based survey will be promoted via several forms of media and it is hoped that once someone has completed the survey they will forward it on to their friends and family. This is facilitated by a feature of the survey that will prompt the participant to enter the email addresses of their friends and family, which will send out an automated email linking the friends and family to the survey.

Due to the self-selection biases that will be present in the web-based survey it is important to balance the volume of responses received by the web survey with a targeted mail survey. The purpose of the mail survey is to target a sample which covers the range of demographics and cultures present across the European Union to see what impact these factors could have on people's privacy concerns.

To ensure that the privacy views of the full range cultures present in the European Union is measured four separate countries will be surveyed. These countries will represent the four extreme cultural corners of Europe which allowing for appropriate partners in each country/region will be; UK, Scandinavia, Greece and Slovakia. These corners were calculated using Hofstede's cultural dimensions (Hofstede 2001).

In each country census data (or equivalent) will be used to identify a random sample that closely resembles that typical demographic makeup of the country as a whole. For example in the UK the region that best matched the overall national average profile for education levels, distance travelled to work, employment status, mode of travel to work, ethnicity and social grade was identified to be the Metropolitan District of Sefton.

Therefore it is fair to conclude that a survey that targets a large random sample of Sefton will represent the typical view of the UK as a whole to an acceptable level of accuracy. To create a random sample from Sefton as a whole the edited electoral roll will be used to generate a random list of names and addresses for the survey to be sent to. To take into consideration the fact that people with strong views on information privacy are unlikely to be present on the edited electoral register a proportion of the surveys will be sent to the occupiers of properties whose residents are not on the electoral register, even though the names of the residents will be unknown.

The web survey is currently live and can be found at www.internationalprivacysurvey.com

Progress Over the Last Year

- **Privacy Literature Review** – A side from keeping update on a rapidly changing area the major bulk of the privacy literature review is now complete.
- **Designed and Piloted Survey** – A survey that explores people's privacy views was designed and trialled on a sample of 134 people.
- **Analysed Pilot Survey and Made Appropriate Changes** – The results of the pilot survey were analysed and while the survey showed promising results a few changes were made to make it more user friendly and to ensure no space was wasted.
- **Created Website and Put the Survey Live Online** – www.internationalprivacysurvey.com was created and was used for the pilot survey and has since been updated with the final survey.
- **Conducted UK Mail Survey** – A sample of 2000 paper versions of the survey has been sent out to a target population and the responses are currently coming in.

Work Still to be done

- **Plan European Surveys / NEARCTIS Mobility** – The most critical activity going forward is organising the European Surveys. It is hoped that surveys will be conducted in Greece, Scandinavia and Slovakia. However at present I have only got contacts (other NEARCTIS partners) in Greece so as a matter of urgency I need to make some contacts in Scandinavia and Slovakia or consider changing the survey countries.
- **Analyse UK Survey Results** - The results of the UK survey need to be analysed before the survey can be rolled out across Europe.
- **Conduct European Survey / NEARCTIS Mobility** – Spend six months with other NEARCTIS partners conducting the survey across Europe.
- **Analyse European Results** – Analyse the results of the European surveys and write up thesis.

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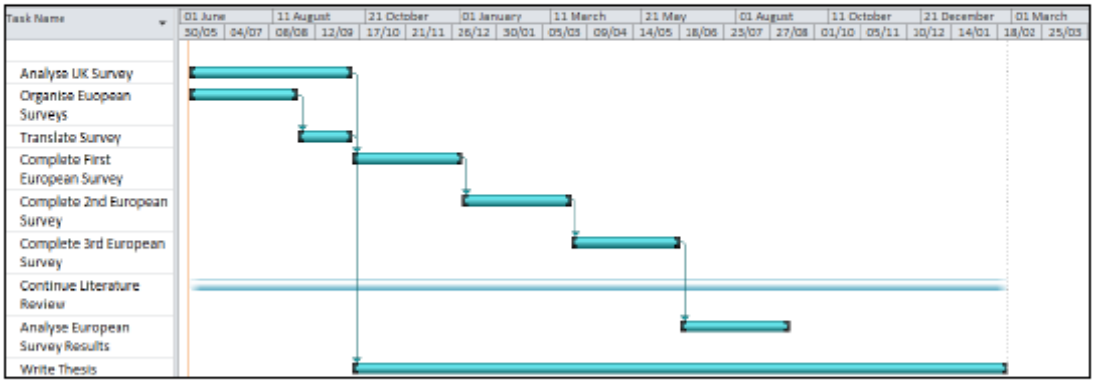
Gantt Chart



Papers

Cruickshanks S, Waterson B (2011) "Are Privacy Fears Associated With Intelligent Transport Systems Justified" 44th Annual UTSG Conference, Milton Keynes.

Annual PhD Research Report [Year1]

Real-time Urban Traffic Control under Saturated Conditions

Candidate: MEHDI KEYVAN EKBATANI
Host institute: Technical University of Crete
Partner institute:
Thesis supervisor: Prof. Markos Papageorgiou
Thesis co-supervisor: Dr. Ioannis Papamichail
Date of start of thesis: 22.06.2010

Date of report submission: 29.06.2011
Email ID of Candidate: m_ekbatani@dssl.tuc.gr

1) Introduction

Traffic congestion is reported to be steadily increasing in urban areas. Among other possible measures, a better utilization of the existing infrastructure (e.g. via improved traffic management) is deemed to be a possible way to mitigate congestion and improve urban mobility.

The development of practicable and efficient real-time signal control strategies for urban road networks under saturated traffic conditions is a major challenge with significant scientific and practical relevance. The scientific relevance stems from the recently increased interest in the specific problem as well as recent, potentially valuable, models and insights that may contribute to improved signal control methods. The practical relevance stems from the congestion, degradation and gridlock problems encountered increasingly in modern urban road networks that could benefit highly from improved signal control under saturated traffic conditions.

Traffic signal control for urban road networks has been an area of intensive research efforts for several decades, and various algorithms and tools have been developed, proposed or implemented to increase the network traffic flow efficiency. Despite the continuous advances in the field of traffic control under saturated conditions, novel and promising developments of simple concepts in this area remains a significant objective, because some reported approaches that are based on various meta-heuristic optimization algorithms can hardly be used in a real-time environment.

To address this problem, the recently developed notion of network fundamental diagram, e.g. for urban networks, is exploited to improve mobility in saturated traffic conditions via application of gating measures, based on an appropriate feedback control structure. As a case study, the proposed methodology is applied at the urban network of Chania, Greece, using AIMSUN microscopic simulation.

2) Literature Review

UTC systems constitute a scientific field with long-lasting and extensive research and development activities. Many methodologies have been proposed so far, but there is still space for new developments, particularly for saturated traffic conditions. In fact, widely used strategies like SCOOT (P. B. Hunt, D. I. Robertson, R. D. Bretherton, and M. C. Royle, 1982) and SCATS (P. R. Lowrie, 1982), although applicable to large-scale networks, are deemed less performant under saturated traffic conditions.

On the other hand, more advanced traffic-responsive strategies like OPAC (N. H. Gartner, 1983), PRODYN (J. L. Farges, J. J. Henry, and J. Tufal, 1983), and RHODES (P. Mirchandani and L. Head, 1998) use algorithms with exponential complexity, which do not permit a straightforward central network-wide application. As a consequence, they use heuristic, hierarchically superior control levels with the aim of network-wide coordination. Thus, most available strategies face modeling limitations when it comes to saturated traffic conditions that are frequently observed in modern metropolitan areas. On the other hand, TUC (Traffic-responsive Urban Control) (C. Diakaki, V. Dinopoulou, K. Aboudolas, and M. Papageorgiou, 2002) has been developed to provide coordinated, network-wide, traffic-responsive control in large-scale urban networks even in cases of saturated traffic conditions.

The notion of a fundamental diagram for a road location was recently found to apply to two-dimensional urban road networks as well (Geroliminis and Daganzo, 2008). The derived fundamental diagram of the urban network can be exploited for better signal control under saturated conditions.

3) Work achieved in past year

This research is trying to control the congestion via feedback gating by applying the notion of a network fundamental diagram of an urban network that needs to be protected from the detrimental effects of oversaturation. The general scheme of gating and protecting the congested area during the peak is displayed by the Figure 1. As a demonstration example for the concept under development, the congested zone in the peak period of the Chania urban network is considered as protected network (PN) via 8 gating points.

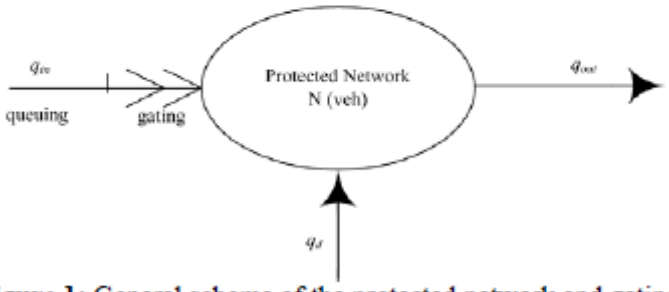


Figure 1: General scheme of the protected network and gating

The Chania urban network is modelled in the AIMSUN microscopic simulation environment. The PN is separated from the whole network by the red border in Figure 2. The PN consists of 165 links,

and the 8 traffic lights applied for the gating, are at the borders of the PN (indicated by arrows in Figure 2). In the middle of every link inside the red border line, a loop detector is installed. The measurements are collected every cycle (in this case 90 seconds). The NFD of the PN (obtained via a 4 hours simulation scenario with realistic O-D demands and dynamic traffic assignment based routing) is displayed in Figure 3.

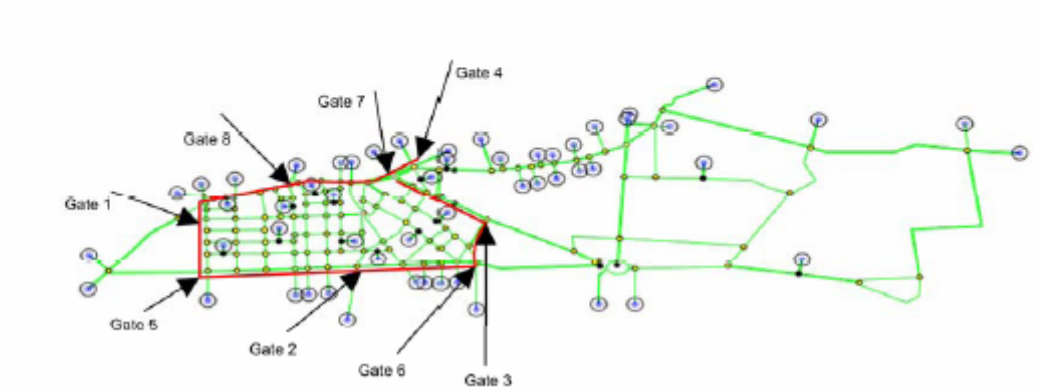


Figure 2: Chania urban network modelled in AIMSUN

3.1) Fundamental Diagram of the PN (TTD vs. TTS)

Figure 3 displays the MFD for the PN, where the y-axis reflects the Total Travelled Distance (TTD in veh·km), while the x-axis reflects the Total Travel Spent (TTS in veh·h). The TTD and TTS is obtained by the following equations:

$$X_z(k) = L_z a_z O_z(k)$$

where Z is the link where measurement is collected, O is Occupancy (in %), L is length of the link (in m), $k = 0, 1, 2,\ldots$ is a discrete time index reflecting corresponding cycles and

$$a_z = \frac{\mu_z}{100\lambda}$$

where μz is the number of lanes of link z and λ is the average vehicle length (in m).

$$TTS = \sum_{z \in s} T(k) X(k)$$

where $T(k)$ *is* cycle time applied during cycle k.

$$TTD = \sum_{z \in s} T(k) q(k) L_z$$

where q_z is flow in the link z.

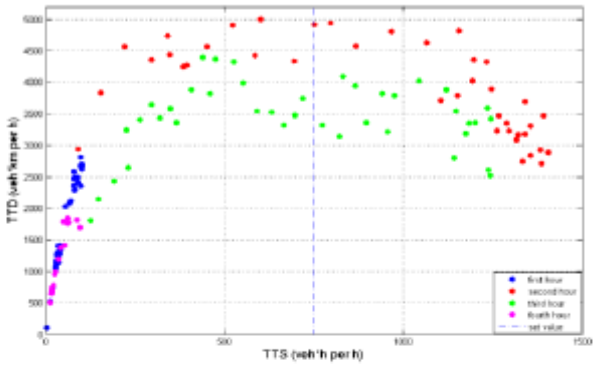


Figure 3: MFD of the PN

3.2) Modelling of the System for Feedback Control Design

The dynamics of the urban network based on the notion of the network fundamental diagram is shown in Figure 4.

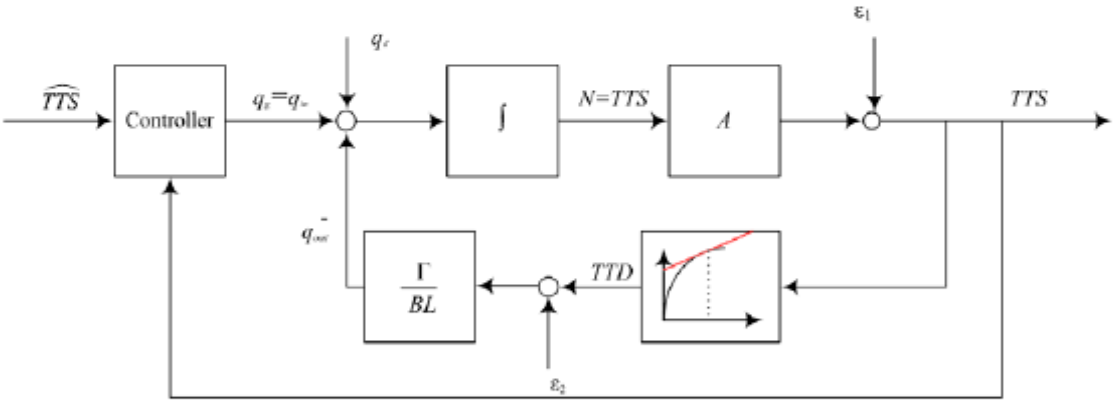


Figure 4: Block diagram of the system and the feedback controller

The dynamic state equation of the protected network (using the conservation equation and the NFD) in discrete time is given by the equation below:

$$\Delta TTS(k+1) = \mu \Delta TTS + \left[\frac{(1-\mu)}{C}\right]\left[\Delta q_{in}(k) + \Delta q_d(k)\right]$$

$$C = \frac{\Gamma \overline{F}'}{BL}$$

$$\mu = e^{(-CTA)}$$

where L is the average link length of the PN, Γ portion of the total flow that exits the network, $\overline{F'}$ is the slope of the MFD around the critical value ($\widehat{TTS}$), shown by the red line in Figure 4, T is the cycle (90 seconds), A is the portion of the PN's TTS that appears in the measured sub network (MSN), in this case 100%, and B portion of the PN's TTD that appears in the MSN, 100% in this case.

3.3) Controller

To avoid congestion-caused degradation (i.e. a TTD decrease), the critical value in the MFD is considered as the set value for the controller. The target is to keep the traffic state of the PN around the set value, so that the network does not enter the oversaturation area in the NFD in Figure 3. To this end, the following PI feedback controller is introduced:

$$q_{in}(k) = q_{in}(k-1) - K_p\left[TTS(k-1) - TTS(k-2)\right] + K_I\left[\widehat{TTS} - TTS(k-1)\right]$$

The Kp and KI values are obtained by the tuning of the regulator. The preliminary results are shown in Figure 5 and Figure 6 for the no-control and control cases.

3.4) Results

no control

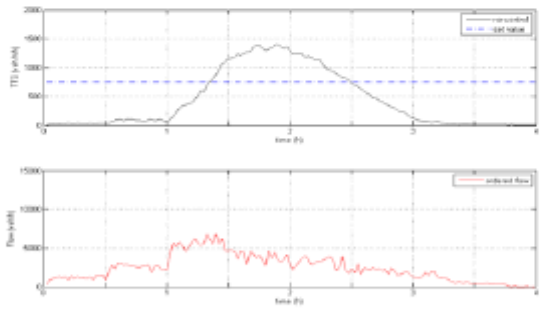


Figure 5: TTS vs. time, actual flow

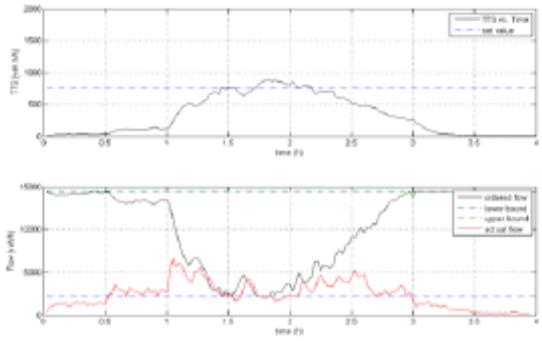


Figure 6: TTS vs. time, actual & ordered flow

Mean speed and delay time of the entire network are considered as the performance indices. Mean speed in the no-control case is 9.01 (km/h) and in the controlled case is 10.01 and the total delays are 351 and 308 seconds respectively.

4) Calendar of upcoming work

Table 1: calendar of upcoming work

	phases	2011		2012				2013			
		Qrt3	Qrt4	Qrt1	Qrt2	Qrt3	Qrt4	Qrt1	Qrt2	Qrt3	Qrt4
1	Split										
2	Cycle & Offset										
3	Architecture										
4	Simulation										
5	Field test (if possible)										

5) Presentation and conference

Recently this work was presented at the NEARCTIS Workshop in Lyon. Also, an Abstract was sent to the TRA Conference (2012).

6) Visit between partner institute(s)

The first discussions are done with Prof. Nick Hounsell from Southampton University and Prof. Nikolaos Geroliminis from EPFL for respective visits (1 to 3 months each). Both professors showed a great interest to cooperate within the NEARCTIS mobility program. The estimated date to visit EPFL is Feb. 2012 and summer 2012 for University of Southampton.

Annual PhD Research Report [2011]

(The modeling of capacity drop phenomena)

Candidate: Thomas Monamy
Host institute: IFSTTAR
Partner institute:
Thesis supervisor: Habib Haj-Salem
Thesis co-supervisor: Jean-Patrick Lebacque
Date of start of thesis: 12/2009

Date of report submission: 5th July 2011
Email ID of Candidate: tmonymy@gmail.com

Report (3 to 5 pages)
Research goals and objectives

In the Highway Capacity Manual, the highway capacity is defined as the maximum achievable flow rate under repeatable conditions; which is close to the maximum achievable flow at traffic equilibrium. This means that the capacity is only a function of the characteristics at the location. Empirical macroscopic observations indicate the existence of a critical density such as the equilibrium flow is maximal. One would name it the "capacity flow". Under the critical density, the flow is quite proportional to the density. Once the density exceeds the critical density the capacity flow is surprisingly not reachable anymore. The density has to fall down under the critical value and then to re-increase to the critical value to recover a capacity flow: there is an hysteretic relation between density (headway in a microscopic scale) and flow (velocity) in the description of traffic dynamics.
This phenomenon is known as capacity drop. The objective is to analyze this phenomena using real data measurement and to develop a microscopic model that reproduces this capacity drop and then to identify the main origins of this phenomenon.
If this phenomenon has been well-known for the last thirty years, it has not been sharply modeled and so its origins are not precisely identified. However, lane changes, bounded acceleration of vehicles, and the reaction time for drivers seem to be factors contributing to it according to several authors.

Literature Review

The field of study for road traffic dynamics was completely new in the 30's, when Greenshields made the first studies about traffic vehicles. Since the 50's, the field is becoming more and more important, for a very simple reason: As the number of vehicles has increased until the network is congested, it has become quite necessary to understand the underlying dynamics and to develop a mathematic traffic model. Nowadays, the danger of vehicles pollutants emissions is a new topic of interest for traffic modeling, as well as the cost of congestions increasing with the number of vehicles on the roads, due to the limitation of the construction of the new infrastructure.

As in fluid dynamics, two main approaches have been considered by the researchers, the macroscopic one to describe the evolution of a network, and the microscopic one, which main target is to explain time-space individual driver behaviors considering the interactions between a driver and its neighborhood. Most of the microscopic models are nevertheless car following models, essentially modeling the evolution of a follower in reaction to its leader trajectory.

Among the car-following models, it is possible to distinguish three kinds of models: safe-distance models, stimulus-response models, and psycho spacing models.

For the safe-distance models, the principle is to know at every moment which distance keeps a follower safe considering that the leader might have a completely unexpected behavior. Although the model is static and only gives information about steady state traffic, it remains pretty interesting because the safe distance respect is one of the main points in the drivers' formation program. Besides, it gives pretty good results considering the simplicity of the model.

The stimulus-response models are more interesting for several reasons. The notion of sensitivity is introduced in traffic theory, but more important, the first delayed model appears in 1958 by Chandler, generalized in the following form:

$$\frac{dv_t(t+\Delta t)}{dt} = \frac{1}{T}[v_t(t) - v_{t-1}(t)] \qquad (1)$$

The delay is quite an obligatory a feature for a serious microscopic model because the main difficulty in vehicular traffic modeling is certainly the human factor, and the time reaction is part of it.

The psycho-distance models are based on the danger notion:

- For large inter-vehicles distances the driver is not influenced by its neighborhood and the velocity differences.
- There is a distance-threshold such as the danger is perceived. Under this distance, the driver decelerates until he does not perceive the relative velocity to the leader anymore.

This kind of models is interesting for two reasons: first of all, it defines two traffic phases: the free phase and the interaction/forced phase, and then it describes that drivers are often looking for a steady state while driving in interaction with other drivers.

Another model that is really interesting is the Optimal Velocity Model developed by Bando & *al.* [BHNSS95] [BHNN98]. The principle is to explicit an Optimal Velocity Function that gives the targeted equilibrium velocity for a driver in function of the net headway. In the first version [BHNSS95], the acceleration is a function of the difference between the current speed and the equilibrium speed given by the optimal velocity function, and should allow to keep a reasonable velocity at any time. The second version [BHNN98] includes a reaction time τ as a delay for the acceleration.

$$\ddot{x}_n(t+\tau) = a\left[V\left(x_{n-1}(t) - x_n(t)\right) - \dot{x}_n(t)\right] \qquad (2)$$

$$V(\Delta x) = 16.8\left[\tanh\left(0.0860(\Delta x - 25)\right) + 0.913\right] \qquad (3)$$

An interesting remark about microscopic models is that they often produce a symmetric behavior in acceleration and deceleration. In the reality, breaking amplitude is much stronger than acceleration amplitude. One can find this kind of ideas in Lebacque.

Work achieved in past year

A large study of NGSIM data has been realised in order to get information on time reaction and the small velocities driver's behaviours, which concluded that from the follower's point of view, a restart is very often delayed. The large scattering of data on the restart time (time gap between a leader's and its follower's restarts) seems to indicates 2 causes for this phenomena: (i) there is a strictly positive reaction time and (ii) there might not be an equilibrium speed for too small headways.

The OV model was considered interesting to study because its OV function provides a base to describe the driver's behaviours around their equilibrium. An improved OV model has been proposed to make it asymmetric in acceleration and deceleration, according to the following rules:

- Each driver desires its travel to be the less expensive possible. If the duration of the travel is part of the travel cost, it is obvious that a collision is much more expensive than losing 30 minutes in congestion. Each driver's objective is to have the shortest travel possible, while assuring at any time his safety.
- According to the last point, we will assume that there exists for each driver a function called Optimal Velocity Function such as a driver knows at any time which is the maximal speed he might reach while keeping its travel safe. We assume that this function is simply a function of the net headway. The Y-term compares the optimal velocity to the current velocity to give part of the needed acceleration.
- Each action is the consequence of traffic conditions evolution, and is delayed by a reaction time. At every moment, a driver watches, then analyses, decides, and corrects its acceleration after a reaction time.
- Generally drivers anticipate breaking when there is an obstacle on the way. This idea is developed in [YS09], where the authors show that part of hysteretic phenomena was linked with human errors, i.e. anticipation and overreaction. This is the interest of the Z-term.
- One can drive at the speed limit if there is no leader, and we should not drive faster than the speed limit even if the leader is doing so.
- Vehicles are limited by Newtonian physics: the accelerating and breaking amplitudes are bounded. This feature is major to describe a vehicle in a transient state. (Equations 5-6)

- Anticipation abilities are not taken into account in the sense of reacting to a further leader, and the model's main parameter is the headway to the direct leader.

We can write the following equations:

$$a_i^*(t+T_R) = Y\left(OVF\left(h_i(t)\right) - v_i(t)\right) + Z\frac{\dot{h}_i(t)}{h_i(t)+L_i} \quad (4)$$

$$a_i(t+T_R) = \min(a_i^*(t+T_R); A_{max}) \; if \; a_i^*(t+T_R) > 0 \quad (5)$$
$$a_i(t+T_R) = \max(a_i^*(t+T_R); B_{max}) \; if \; a_i^*(t+T_R) < 0 \quad (6)$$

With:
A_{max} The bound for acceleration
B_{max} The bound for deceleration
T_R The reaction time
$a_i^*(t+T_R)$ The desired acceleration for i^{th} driver at time $t+T_R$.
$a_i(t+T_R)$ The real acceleration for i^{th} driver at time $t+T_R$.
L_i The length for i^{th} vehicle,
$h_i(t)$ The net headway for i^{th} vehicle at time t,
$\dot{h}_i(t)$ The time derivative headway for i^{th} vehicle at time t.
$v_i(t)$ The velocity for i^{th} vehicle at time t.
Y, Z Constants to be calibrated

And the associated OV function is given by :

$$OVF(h) = 0 \; for \; h < h_{min} \quad (7)$$
$$OVF(h) = 2.505 * h^{0.6} \; for \; h \in [h_{min}; h_{max}], h_{max} = 2 * V_{max} \quad (8)$$
$$OVF(h) = V_{max} \; for \; h > h_{max} \quad (9)$$

The model produces interesting results in terms of shockwaves, hourly flow, and without calibration. Simulations confirm the impact of reaction time, bounded acceleration, and equilibrium headway once congestion is formed.

Current state of work

Contacts have been established with the LCPC-Nantes which developed a solution to track vehicles on a video and extract trajectories. The point is to find an interesting spot where it's possible to make an interesting movie. It seems pretty difficult to find a place with (i) enough height to have a large picture, (ii) a bottleneck. DIRIF (Road management) is able to provide us videos with their supervising cameras and we are looking for the best solution.
The target is to get a new dataset in order to calibrate the model's parameters.
In the same time, a special attention would be given to the lane changing field, where capacity drop is also likely to find its origins. This topic has not really been investigated yet for this work.

Calendar of upcoming work

Once conclusions would have been drawn from the microscopic part of the work, the aspect of macroscopic expression of capacity drop is to be examined in order to try to get closer from an operational solution for road managers. The problematic of access control will be examined after all.

	July-Sept '11	October-December '11	January-March '12	April-June '12
▪ Lane changing investigations				
▪ New video data acquisition				
▪ Macroscopic aspects				
▪ Access control				
▪ Visit to LICIT			1 week	
▪ Visit to TUC			3 to 6 months?	

Scientific publications

An article entitled *Experimental Analysis of Trajectories for the Modeling of Capacity Drop* is currently on submission for EWGT2011.

Presentation, conference, seminar held by the candidate

Some work was presented on both Nearctis workshops in Lausanne and Bron during poster sessions:
-The modelling of capacity drop phenomena using NGSIM databases in Lausanne, 11th June 2010
- Experimental Analysis of Trajectories for the Modeling of Capacity Drop in Bron, 10th June 2011

Visit between partner institute(s)

The partner institute I should visit for my long stay is probably the TUC. There is no date defined yet, but this will certainly happen when there will be the time to work on access control. A short visit will also happen certainly at the beginning of 2012 at IFSTTAR-LICIT to work on data from the MOCOPO Project, with Christine Buisson.

Annual PhD Research Report [2011]

The Cooperative Alternative to Traffic Signals at Intersections

Candidate: Huiying Wang
Host institute: Imperial College London
Partner institute: EPFL
Thesis supervisor: Prof Michael G. H. Bell
Thesis co-supervisor: Pierre-Yves Gilliéron
Date of start of thesis: 4 May 2010

Date of report submission: 30 June 2011
Email ID of Candidate: huiying.wang08@imperial.ac.uk

Research goals and objectives

Cooperative driving, which is based on communications and information sharing between vehicles and infrastructures, aims at enhancing driver comfort and road safety, delivering reliable journey times, increasing traffic efficiency and reducing environmental impacts. Cooperative-ITS becomes one of the main research focuses in many projects, e.g., European projects eSafety, SAFESPOT, CVIS, COOPER, Connected Vehicle; the U.S. project IntelliDrive^{SM}. However, the potential of cooperative driving to increase urban road and intersection capacity by smarter traffic management has received less attention. This NEARCTIS project, investigates the potential for V2V and V2I communication and cooperative driving to achieve non-signalised traffic control at intersections. Thus, the objectives are:

(1) Establish a microscopic simulation model based on a real network in London which the vehicle positioning and communication modules will be developed and different level of automated driving will be tested on.

(2) Develop a vehicle positioning module with high precision. As the high requirement of safety and real-time traffic management, a more accurate V2V relative positioning and V2I absolute positioning will be generated by combing GPS and wireless positioning techniques.

(3) Develop a vehicle communication module with different levels of latency (e.g. data exchange, signal processing, and vehicles response to accelerate or decelerate) for non-signalised junction control.

(4) Conduct simulation experiments to establish junction performance for different levels of positional accuracy and latency.

(5) Conduct simulation experiments to explore the feasibility of applying cooperative traffic control with different levels of automated driving.

(6) Take non-motorised and non-automated modes into account to test junction performance.

(7) Evaluate the potential efficiency, environmental and social benefits of the cooperatialternative to signalised junction control.

Literature Review

Cooperative driving has been studied on automated highway systems (AHS) and cooperative vehicle highway systems (CVHS) over the years since 1960s. As an advanced form of the autonomous vehicles (Kato et al. 2002) which only based on inputs from its own borne sensors, a cooperative vehicle communicates and exchanges information dynamically with other surrounding vehicles and the roadside infrastructure (Kato et al. 2002; The DfT 2004; Shladover 2005; van Arem et al. 2006), which are known as Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communications. The 5.9 GHz dedicated short range communication (DSRC) wireless protocol on IEEE 802.11a allows high-speed V2V and V2I communications within a range of up to 1,000 meters with low weather dependence. With DSRC, each individual vehicle is both a transmitter and receiver of information. The data exchanged between vehicles conveys speed, position, acceleration, deceleration, heading and other vehicle kinematics (additionally with destination, priority, occupancy, road conditions information if cruise control function is available). The message is broadcasted to all neighbours within a specified communication range. Roadside infrastructures transmit traffic condition ahead, speed recommendation, hazards and incident alert, accidents information to vehicles in order to control traffic flow and improve safety.

A proper concept of platooning (i.e. a group of consecutive vehicles maintain minimal separation and are controlled by a special vehicle-follower control system) was formalized by Shladover (1978), who also indicated the requirement of V2V communications between the leading vehicle and the rest of the platoon. With intelligent cooperative systems, shorter headways between vehicles are achievable by mitigating or eliminating reacting distance needed for human reaction. Closer inter-vehicle distance within the same platoon in AHS / CVHS is demonstrated as an efficient strategy to improve traffic capacity without compromising safety levels in several studies (Shladover 1978, 1991; Sheikholeslam 1993; Yanakiev 1996; Ioannou 1998; Canudas de Wit 1999; Alvarez 1999; Kato et al. 2002; van Arem 2006; Gonzalez-Villasenor 2007). The California PATH program of the University of California developed a "platoon / vehicle-follower" approach for full CVHS (Shladover 1991 and Ioannou 1998). Kato et al. (2002) showed a flexible automated platooning technology in the Demo 2000 cooperative driving in Japan. Few researches are found on forming vehicles into platoons to pass through intersections to increase traffic capacity and efficiency.

Work achieved in past year

1. Communication mechanism

The first focus on this project is the V2V and V2I communication mechanism. We assume that each cooperative vehicle is equipped with a GPS device, communication units and in-vehicle sensors (such as radar or lidar that offer information about the motion of vehicles). Furthermore, there is Road Side Unit (RSU) on every approach of the researched intersection, which is equipped with DSRC transceiver and connected to monitoring centre. All the messages transmit from vehicles to RSU then go to monitoring centre for proceeding, calculation, optimisation, platoon formation and discharge sequence. Then RSU communicates with vehicles with appropriate commands (braking, acceleration and deceleration) after the optimisation forward back to it. To simply the problem, at the first stage of this project, assume each cooperative vehicles and RSU has timely access to the information.

In order to achieve efficient information / message transmission, communication protocol is established. To avoid broadcast storm (Wisitpongphan et al., 2007) blocks communication channel, messages are classified according to emergency levels and assigned with different priorities. Additionally, different level of cooperation for individual vehicles depends on platoons (Michael et al., 1998). For instance, high cooperation is applied within the same platoon - vehicle continuously exchange state information such as speed and acceleration, in addition to maneuver coordination messages and emergency warnings; while low cooperation is defined between different platoons - vehicles communicate only during maneuvers and emergencies (e.g., hard braking).

2. Platoon formation and dispersion logic

Sheikholeslam and Desoer (1990, 1992) presented a full communication case for a platoon of vehicles on a highway system. However, that is the ideal state of cooperative ITS, and the deployment of cooperative driving may take decades due to expenses, privacy protection, driver acceptance, and government regulation and policy. Thus, one of the focuses on this research project is to investigate the relationship between the cooperative systems equipped vehicles and unequipped ones, which is also the key for platoon formation and dispersion at intersections. The significance of researching on automated and manual mixed traffic is to bridge the gap between the current completely human driving to future completely cooperative control.

In order to realise basic functions of platoon formation and dispersion first, V2V and V2I communication, and vehicle positioning is considered to be under ideal circumstances, i.e., latency, accuracy and errors are believed can be adjusted and compensated combining with other technologies. A four-arm intersection with one-lane on each approach as the base background was established in micro-simulation tool VISSIM. To simplify signal groups, only straight movements were considered at the first stage.

A platoon consists of any combinations of cooperative and manual vehicles (i.e., it can be led and ended by whether a cooperative or manual vehicle). Platoon variable include platoon size, platoon headway, platoon speed and inter-arrival between consecutive platoons (Jiang and Li, 2003). A platoon consists of at least one vehicle. However, according to drivers' patience for waiting to pass through an intersection, there should be a maximum waiting time for conflicting movements, i.e., there is a maximum platoon size. There are few researches on the platoon length and gap acceptance content. Referring to signal timing controlled junctions, in which drivers' patience for waiting is considered, maximum acceptable durations often falls in the range 120-200 seconds in Britain. Normally, cycle time is greater than 60s and no more than 120s. Thus, the platoon size here is defined as the platoon length or the number of vehicles in a platoon which would pass through an intersection within 120s. 120s is also as the maximum inter-platoon time spacing, which is sufficiently large to allow conflicting movements to pass through without waiting too long for other movements. Platoon headway is defined as the average value of headways within a platoon in Jiang and Li (2003). For intra-platoon vehicles, the inter-vehicle distance is within the range between safe following headway and critical headway. VanderWerf and Shladover (2001) research shows the mean desired time gaps for manual driving, autonomous adaptive cruise control (AACC) and cooperative adaptive cruise control (CACC) in highway traffic. Critical headway is essential for determining whether a vehicle belongs to a platoon. To serve the purpose of an effective traffic control in terms of vehicles platoons, an appropriate value of the critical headway should be neither too high nor too low. 3.0 seconds is adopted here as empirical data from signal timing.

Platoon dispersion logic adheres to FIFO generally, except circumstances as giving priority to emergency vehicles. To meet the need of locating manual vehicles and be sure all vehicles within a

platoon has passed through the intersection, inductive loop detectors and distance measuring sensors are used to monitor vehicle locations and headways. Sheikholeslam and Desoer (1993) show a longitudinal control law for a platoon of vehicles without any communication of lead vehicle information.

Current state of work

The current work is focusing on fulfil, evaluate and adjust my communication mechanism, platoon formation and dispersion logic through a micro-simulation way in VISSIM. Programming applications mentioned above in Visual C++ and access to model data and simulations in VISSIM through a COM interface is in process. At the meanwhile, longitudinal control of a platoon is being researched. Platoon control laws in the events of loss of communication between the lead vehicle and the other vehicles in the platoon, and between the lead vehicle and roadside infrastructure is being investigated.

Calender of upcoming work

No.	Task	Start	End
1	Fulfil platoon formation and dispersion logic via Visual C++ in base model	07/2011	10/2011
2	Extend the model to 2-lane road intersection with lateral control of platoons	11/2011	02/2012
3	Visit EPFL, investigate issues of vehicle positioning, simulate different positioning accuracy	03/2012	05/2012
4	Research on communication failure and latency, enhance model stability	06/2012	08/2012
5	Conduct junction performance tests	09/2012	11/2012
6	Assess efficiency, environmental and social benefits	10/2012	12/2012
7	Writing up	12/2012	04/2013

Visit between partner institute(s)

The academic visit is being planned to EPFL from March to August 2012, under the guidance of Pierre-Yves Gilliéron. The main task which will be done there is to research on positioning technologies, analyse potential issues which may affect the performance of the intersection and cause safety problems, and investigate techniques to mitigate the impacts. V2V and V2I communications latency, loss and failure will also be analysed and backup plans will be explored.

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Appendix V: Review of PhD work progress report template

NEARCTIS PhD: annual work progress report

1. REVIEWER

Name		Reviewed date	

2. PhD work

PhD student	…
Research title	…

3. REVIEWER'S EVALUATION

Please answer the following questions and amplify any negative answers on the space provided. The authors should have sufficient information to understand the basis for your recommendation.

CONTENT:

A. Has the research been making satisfactory progress?

☐Yes ☐No

B. Is there evidence that the research will produce significant scientific contribution?

☐Yes ☐No

C. Is the calendar of the upcoming work achievable?

☐Yes ☐No

D. Is the collaboration with other NEARCTIS partner or associate partners suitably involved?

☐Yes ☐No

E. Is the plan for mobility (stay of 6 months) reasonable?

☐Yes ☐No

5. COMMENTS TO PhD student

6. COMMENTS TO PhD committee

Page 1 of 1

EPFL- PY Gilliéron

Appendix VI: Mobility of researcher: interview of Yun-Pang Wang

Nearctis
Excellence in co-operative traffic management

Interview on the mobility of researcher

Pierre-Yves Gilliéron	Yun-Pang Wang
Research and teaching associate, EPFL Lausanne, Switzerland	Research associate, DLR, Berlin, Germany
NEARCTIS: task leader young researcher mobility and training	NEARCTIS: task leader of "Identification of Synergetic Possibilities"

Pierre-Yves> Can you briefly introduce yourself and your background in traffic management?

Yun-Pang> I have obtained my master degree and my PhD degree working on problems in transportation planning and traffic modelling within the field of civil engineering. I have been working at DLR as a research associate since 2007. My active research interests include demand modelling, traffic simulation and calibration for traffic management.

Pierre-Yves> What was your motivation for visiting a NEARCTIS partner and taking part to the mobility programme?

Yun-Pang> The main motivation is that the Transport Mobility Laboratory at EPFL works on calibration of traffic models, which is also one of our main topics. Besides, it is a very good opportunity to become more acquainted with the other NEARCTIS partners, to learn about their expertise and research activities, particularly with regard to possible collaboration in the future.

NEARCTIS – Mobility of researchers – April 2011 http://www.nearctis.org

Pierre-Yves> What kind of work did you carried out during your visit at EPFL?

Yun-Pang> As aforementioned, both our institute and the Transport Mobility Laboratory at EPFL work on the topic of traffic model calibration. Therefore, the visit aimed at work on the route choice calibration problem and the respective analysis with empirical data.

Furthermore, I also took the opportunity to attend the discrete route choice workshop, held at the Transport and Mobility Laboratory at EPFL, and the Swiss Transport Research Conference (STRC) to learn more about route choice problems and the current transportation research topics in Switzerland, respectively.

Pierre-Yves> Have you achieved concrete results for your research at DLR and have you planned some publications?

Yun-Pang> Yes, we have successfully coupled the traffic simulation tool SUMO from DLR and the calibration tool Cadyts from EPFL with promising results from different experiments. In addition, we have also proposed a calibration approach with use of multi-point vehicle stream measurements. The proposed approach has been examined with a synthetic network and works well. The respective extended abstract has been submitted to the MT-ITS 2011 conference and it is currently under review.

Pierre-Yves> In summary what are the most excited part of your visit and what would be the benefit for NEARCTIS?

Yun-Pang> In addition to the calibration work, I have been made acquainted with some research associates and PhD candidates at EPFL, at the workshop and at the STRC conference. Such networking activities and the expected collaboration in the future would be a benefit for NEARCTIS.

Pierre-Yves> What can say to young NEARCTIS researchers about this opportunity of mobility?

Yun-Pang> I think it is a very good opportunity to become acquainted with the other partners' experts and learn about their research activities. Moreover, it is always better to work "together" instead of only via "emails", since the sharing of ideas and the discussion of the challenges are much more effective this way. Of course, it is also an excellent opportunity to experience the different life style and culture.

You are PhD student or young researcher of NEARCTIS core institutions. You have great interest in the NEARCTIS mobility programme, please contact

pierre-yves.gillieron@epfl.ch or visit our web site: *http://www.nearctis.org/*

NEARCTIS – Mobility of researchers – April 2011

Appendix VII: NEARCTIS Summer School 2010 in Lausanne

Fifty percent of the NEARCTIS core institutions are also members of EU COST Action TU0702 (Real time monitoring, surveillance and control of road networks under adverse weather conditions). COST Action TU0702 has a yearly budget of 12,000€ for the organization of summer school. Both NEARCTIS and COST TU0702 have similar interests in tackling congestion, safety and environmental challenges from transportation systems. Therefore, in order to smartly utilize the resources and minimize the total cost it was decided to organize a joint training school between NEARCTIS and COST TU0702. Moreover, the joint school also increased the exposure to the wider European community.

The main objective of this training school was to provide an opportunity for young researchers and professionals to acquire knowledge on the basics of road network state estimation, modelling and control and to allow trainees to get an insight on possible implications of these basics in their own research and application field.

The course was titled “Real time traffic monitoring and control” and was organised by EPFL at Lausanne, Switzerland from 9-11 June 2010. The school offered full two-days of lectures and a one day workshop. Participants to the lectures also attended the 3rd NEARCTIS Workshop organised at the same venue. Following topics were covered in the lectures:

- Network state estimation
- Traffic modelling and control
- Data fusion
- Travel demand modelling

The lectures were delivered by the following well known instructors:

- ***Prof Hans van Lint:*** Technical University of Delft, The Netherlands
- ***Prof. Lawrence A. Klein:*** Consultant, US (Author, *Sensor Technologies and Data Requirements for ITS*)
- ***Prof. Markos Papageorgiou:*** Technical University of Crete, Greece.
- ***Prof Michael Bell:*** Imperial College London, UK
- ***Dr Mila Mihaylova:*** Lancaster University, UK
- ***Dr Nick Hounsell:*** University of Southampton, UK

The program of the summer school is given below.

Real-Time Road Traffic Monitoring and Control

Objectives:

The objectives of this summer school are :

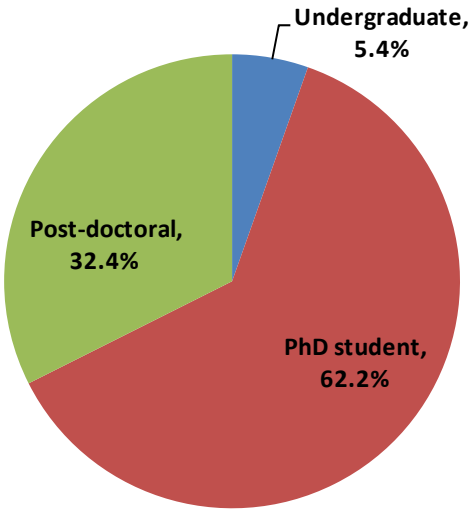
- to provide an opportunity for young researchers and professionals to acquire knowledge on the basics of road network state estimation, modelling and control and
- to allow trainees to get insight on possible implications of these basics in their own research and application field

Date	Time		Lecturer	Lecture Title
9th June	8:15-8:30	Welcome		
	8:30-9:15	Lecture 1	Hans van Lint	Framework
	9:15-9:30	Break		
	9:30-10:15	Lecture 2		Traffic state estimation (using kalman filtering)
	10:15-10:30	Break		
	10:30-11:15	Lecture 3		
	11:15-11:30	Break		
	11:30-12:15	Lecture 4		
	12:15-14:00	Lunch break		
	14:00-14:45	Lecture 5	Mila Mihaylova	Traffic state estimation (particle filter)
	14:45-15:00	Break		
	15:00-15:45	Lecture 6		
	15:45-16:00	Break		
	16:00-16:45	Lecture 7	Nick Hounsell	Urban traffic control and bus priority
	16:45-17:00	Break		
	17:00-17:45	Lecture 8		
10th June	8:30-9:15	Lecture 9	Michael Bell	Traffic and transit assignment
	9:15-9:30	Break		
	9:30-10:15	Lecture 10		
	10:15-10:30	Break		
	10:30-11:15	Lecture 11	Lawarence A. Klein	Data fusion
	11:15-11:30	Break		
	11:30-12:15	Lecture 12		
	12:15-14:30	Lunch break		
	14:30-15:15	Lecture 13	Markos Papageorgiou	Freeway traffic control
	15:15-15:30	Break		
	15:30-16:15	Lecture 14		
	16:15-16:30	Break		
	16:30-17:15	Lecture 15		
	17:15-17:30	Break		
	17:30-18:00	Answer to students questions		
11th June	9:00-16:00	Workshop "Towards new research area in co-operative traffic management"		

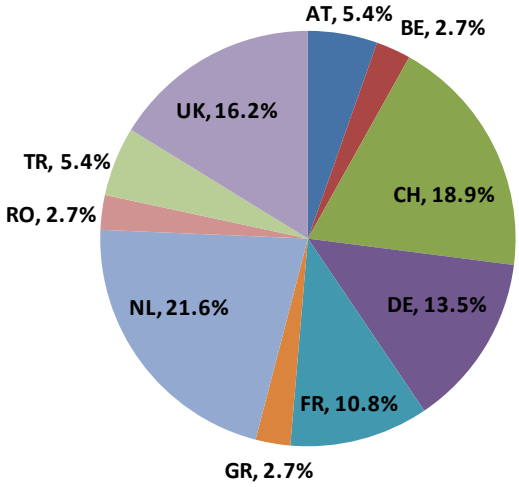
The school was open for all. Participants within NEARCTIS and COST TU0702 consortium were provided travel grant to attend the course.

[Figure 4.7] NEARCTIS-COST TU0702 joint training school, EPFL, Lausanne Switzerland (June 9-11, 2010) (Hans van Lint (upper left), Miha Mihaylova (upper right))

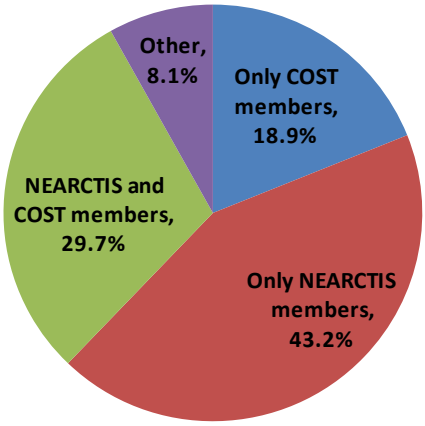
The school was a big success and in total, 37 students benefited from this joint training course. Most of the students were PhD students (≈62%) (Figure 4.3). Participants to the school were from 10 different European countries (Figure 4.4.). 73% of the participants were affliated with the NEARCTIS core group (Figure 4.5). The participants for the school were from fifteen different European Institutes (Figure 4.6).



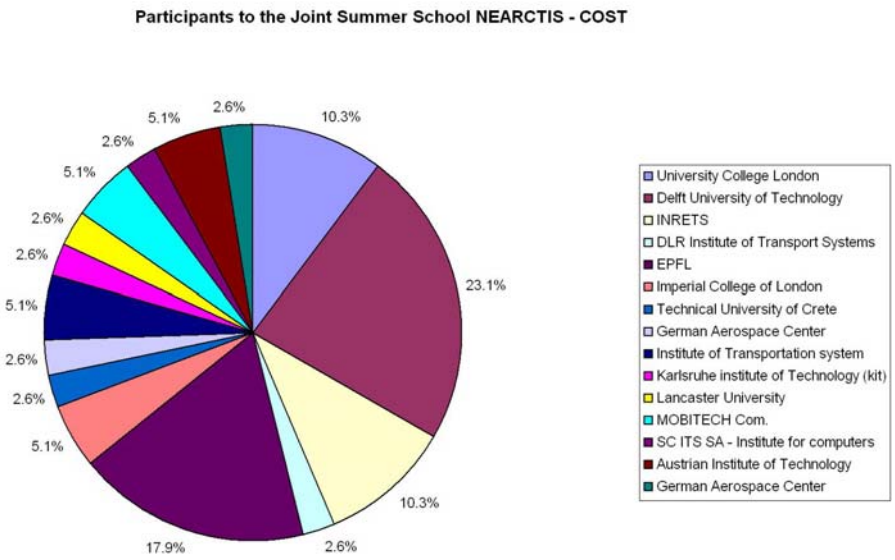
[Figure 4.8]: Participants educational background



[Figure 4.9.]: Participants' affiliation with different European countries



[Figure 4.10.]: Participants' affiliation with NEARCTIS and COST TU0702



[Figure 4.11]: Representation from different institutes to the joint training school

Overall we have received a positive feedback. The participants were requested to provide an annonomous feedback to the quality of the lectures, teaching materials and organisation by filling an "evaluation form".

Appendix VIII: NEARCTIS Summer School Program jointly with COST Action TU-0903

Monday 2 May 2011

When	What	Who
9:00	Introduction on summer school	Winnie Daamen
9:05	Introduction to the use of models in relation to ITS and cooperative systems	Robert Bertini
9:45	Traffic flow phenomena and their importance to modelling	Serge Hoogendoorn
10:45	Break	
11:15	Model system	Michael Bell
12:00	Microscopic simulation models	Jaume Barcelo
12:45	Parametrisation of car-following models: qualitative features and mathematical analysis	Eddie Wilson
13:30	Lunch	
14:30	Assessment of freeway bottlenecks using the microsimulation tool FOSIM (exercise)	Serge Hoogendoorn
18:00	Diner	Participants / Lecturers

Tuesday 3 May 2011

When	What	Who
9:00	Data and principles for calibration	Christine Buisson
10:30	Break	
11:30	OD estimation	Tomer Toledo
13:00	Lunch	
14:00	OD table estimation (exercise)	Hans van Lint and Tamara Djukic
18:00	Diner	Participants / Lecturers

Wednesday 4 May 2011

When	What	Who
9:00	Route choice and departure time choice	Emma Frejinger
10:30	Break	
11:30	Calibration using macroscopic and microscopic data	Peter Wagner
12:15	Sensitivity analyses of model parameters	Vincenzo Punzo
13:15	Lunch	
14:00	Car following model calibration and parameter sensitivity analysis (exercise)	Peter Wagner and Vincenzo Punzo
17:30	Closure	Winnie Daamen

Appendix IX: Teaching evaluation form

TEACHING EVALUATION QUESTIONNAIRE

NEARCTIS-COST MULTITUDE Joint Summer School
Traffic modelling for traffic management
and cooperative systems
2-4 May, 2011

Your answers will allow the teachers to find out how the students have appreciated their teaching. Give your personal opinion. This questionnaire is anonymous.
Tick the box that best corresponds to your reaction to each statement:

completely agree 4, rather agree 3, rather disagree 2, completely disagree 1, no opinion 0.

global appreciation:	4	3	2	1	0
1. The content is rich and interesting.	○	○	○	○	○
2. The course fits well in your career plan.	○	○	○	○	○

Appreciation for each teacher:
question I. The teacher's presentation is **clear** and well structured.
question II. The **balance** between theory, examples and applications is adequate.
question III. The **pace** is appropriate and allows time to follow through and understand.
question IV. The teacher's **oral expression** is good (clear, expressive, speed, ...).
question V. The **visual aids** are good (blackboard, slides, projection...).
question VI. Support **documents** are adequate and well referenced.

teacher:	clear I 4 3 2 1 0	balance II 4 3 2 1 0	pace III 4 3 2 1 0	oral exp. IV 4 3 2 1 0	visual aids V 4 3 2 1 0	documents VI 4 3 2 1 0
Robert Bertini	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Serge Hoogendoorn	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Michael Bell	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Jaume Barcelo	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Eddie Wilson	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Christine Buisson	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Tomer Toledo	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Emma Frejinger	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Peter Wagner	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○
Vincenzo Punzo	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○	○○○○ ○

3.	The coordination between teachers is good.	○	○	○	○
4.	The course atmosphere enables a good participation.	○	○	○	○
5.	I attend the lectures.	○	○	○	○
6.	I attend the exercises.	○	○	○	○
7.	The (logistic) organisation of the course is good.	○	○	○	○

Transport & Planning

TU Delft

TEACHING EVALUATION QUESTIONNAIRE

Overall, I rate the course as:
excellent 6 ❍, good 5 ❍, sufficient 4 ❍, insufficient 3 ❍, very insufficient 2 ❍, bad1 ❍.

For the main following reasons:
Strengths of the course: .....

Weaknesses: .....

Your suggestions: .....

Thank you for your cooperation!!!

Transport & Planning

TU Delft

Appendix X: Example of Memorandum of Understanding

NEARCTIS Network of Excellence

Memorandum of understanding

Class I (Industry) Associate partner

agreed between :

Europe Recherche Transport, coordinator of the NEARCTIS project, acting on behalf of NEARCTIS partners and represented by Ms Claire Niclause, hereafter referred to as "NEARCTIS"

and

xxx

Hereafter referred to as "The associate partner"

ARTICLE 1 – MUTUAL INTEREST FOR COOPERATION

NEARCTIS and the associate partner acknowledge their interest for mutual cooperation.

NEARCTIS main objective is to develop a virtual research institute in the field of traffic management; this means developing:

- An harmonized research programme
- A set of common resources
- A training and dissemination policy

For this purpose, NEARCTIS needs to develop strong connections with several communities:

- The international academic community concerned with the research topics studied in the network
- The scientific community concerned with related topics not directly addressed inside NEARCTIS: human factors, economics, road safety…
- The professional community concerned by traffic optimisation: car manufacturers, traffic systems manufacturers, consultants
- The Traffic management authorities: local authorities, motorways operators…

These connections are necessary to have a better knowledge of the international state of the art and users needs for research and training. They are also necessary to implement an efficient dissemination policy.

The associate partner is interested in joining the network to get an easier access to information concerning the field of traffic management, through common data bases, newsletters, participation in networking activities (working groups, conferences or workshops), specific access to some of the resources shared by the network such as databases, software etc. It is also an opportunity to participate in the definition of research programmes and to initiate research collaborations.

It is thus an opportunity to participate in the specification of research programs proposed in common with the network partners: The NoE project itself does not fund research, but is a platform for building common proposals to research calls.

For Associated Partners involved recently in traffic management, participating may also be a way of getting experience and training.

ARTICLE 2 - ASSOCIATE PARTNER PARTICIPATION IN NEARCTIS ACTIVITIES

The main contribution of associate partners is their participation in thematic or application working groups of the networks. These groups are in charge of building research programs or application projects on specific scientific fields or applications.

Associate partners also participate in relevant networking actions of the NoE such as conferences, training actions etc.

Furthermore, “Class I” partners are specifically invited to contribute to the Work Packages of NEARCTIS as follows:

WP1 (Research Programmes): In elaborating research programmes, expression of interest for specific developments, or identification of research needs to feed new system developments are expected; Class I partners may also contribute to developing a common view on the state of the art.

WP2 (Cases Studies): Class I partners may provide inputs from their knowledge of field experiments; they may also participate in proposing new types of systems to be implemented through case studies.

WP3 (Training and Dissemination) Associated partners participation in WP3 is not mandatory. However Class I partners may provide some requirements for young professional training, or for dissemination of research results. They themselves participate in this dissemination.

WP4 (Common resources): Associate partners participation to WP4 is not mandatory, but it can be interesting that they share some resources with other partners, using procedures similar to those used inside the consortium: test tracks or sites, software. Doing this they may in turn

get access to the network shared resources. This can result in a wider range of resources made available to a wider community.

WP 5 (Management): this WP is of lesser interest for class I associate partners for it is mainly devoted to the project management.

On this basis, the associate partner will participate in NEARCTIS activities in the way described in annex 1.

ARTICLE 3 – SERVICES PROVIDED BY NEARCTIS TO THE ASSOCIATE PARTNER

The associate partner gets access to the following services provided by NEARCTIS:

- Free attendance of NEARCTIS workshops and events
- Free subscription to NEARCTIS newsletter
- Specific access at fair and reasonable conditions to NEARCTIS common resources
- Access to internal information restricted to associate partners, mainly through the restricted area of the NEARCTIS website (*www.nearctis.org*)
- Access to the results of the tasks he is involved in.

ARTICLE 4 - DURATION, EFFECTIVE DATE, EXPIRATION, TERMINATION OF THE MEMORANDUM OF UNDERSTANDING

The MoU covers the whole duration of the NEARCTIS project, which is planned to end in July 2012.

The MoU signed by the Coordinator and prospective Associate Partner is submitted to the Steering Committee for approval.

Should the Associate Partner fail to respect the commitment described in this document, the decision to terminate the collaboration between NEARCTIS and the associated partner can be made by the Steering Committee.

The Associate Partner can resign from its participation at every anniversary of the signing of this MoU, provided a three month notice send to NEARCTIS coordinator.

ARTICLE 5- FINANCIAL ASPECTS

No fee is requested from associate partners.

There is no specific funding in the NEARCTIS project for associate partners activity. Associate Partners are therefore normally expected to fund their own participation in NEARCTIS activities. However, some expenses for networking activities (e.g. travel) may be partly funded by NEARCTIS.

ARTICLE 6 - INTELLECTUAL PROPERTY

Access Rights to Foreground if Needed for Use of a Party's own Foreground shall be granted on fair and reasonable conditions.

No commercial exploitation of the Foreground is possible unless a licence contract is signed between partners.

ARTICLE 7 - CONFIDENTIALITY

All information and documents exchanged between both the parties related to this agreement shall remain confidential and shall not be disclosed without the consent of both parties. The parties shall consult each other for any publication arising out of this agreement.

This memorandum of Understanding is written in two original documents in English language.

For NEARCTIS: For XXX

Associate partner participation form

NEARCTIS associate partner participation form	
Organisation name :	
Division/dept:	
Organisation type : (Academic, local authority, operator, Industry, Consultant, international non profit…)	
Contact name :	
Position	
Electronic address :	
Website :	
Global estimation of the possible effort to be devoted to NEARCTIS activities over the project duration (4 years) :	… person x month

Participation in tasks	Commitment		contact for the task	e_mail
	Active participation (tick at least one !)	Interested by task results		
WP1 RESEARCH PROGRAMS: DEFINITION AND COORDINATION				
T.1.1. Modelling				
T.1.2. Optimization and Control				
T.1.3. Positioning Tracking and Communication				
T.1.4. Deployment and implementation issues				
WP2 CASES STUDIES : IDENTIFICATION AND ASSESSMENT				
T.2.1 Global Services				
T.2.2.Large highway corridors				
T2.3 Dense urban networks				
T.2.4 Local freeway network				
T 2.5 Shared Multi-modal/multiuser networks				
WP3 EDUCATION, TRAINING AND DISSEMINATION				
T3.1 Education tools and courses				
T3.2 Young/senior professional training				
T3.3 Young/senior researchers mobility and training				
T3.4 Associate partner network management				
T3.5 Dissemination of research results				
WP4 CAPITALISATION AND SHARED				

RESOURCES					
T4.1 Identification of shared resources within the NoE					
T4.2 Specification and Implementation of data-base for remote access to resources					
T4.3 Identification of synergetic possibilities					
Workshops and events	every time	Occasionally	never		
We consider attending NEARCTIS events:					

Appendix XI: Associate Partner Participation Guide

NEARCTIS
Associate Partner
Participation Guide

July 2008

The NEARCTIS project

Introduction

NEARCTIS (Network of Excellence: Advanced Road Cooperative Traffic management in the Information Society) is an academic network involving several of the main teams working on the field of traffic management and optimisation, with a particular focus on cooperative systems. Full partners in the project are listed in Section B

Within the field of ICT for mobility, the project deals more specifically with the question of cooperative systems for road traffic optimisation, but it covers a wider scope as it appears that cooperative systems have to be integrated into the whole traffic management system. The need is to develop systems able to cope with what are the main problems at stake: safety, energy consumption, environmental impacts and congestion as an obstacle to mobility.

The main objective of the project is to constitute what could be considered as a virtual research institute. This means elaborating the main elements of this research institute: building a consistent research program, defining a set of shared resources (data, experimental means, bibliographical databases), organising the spreading of knowledge and research results.

To reach these objectives, the project will include a harmonisation of the research program of all the partners on the various topics addressed, specification of case studies to be made in common, and the elaboration of a dissemination and training program for researchers and professionals. A focus is made on spreading excellence towards the scientific community of the field, particularly for the European Union newcomers.

The project is designed as a first step towards constituting a permanent virtual institute ensuring consistency between research programs and good mutualisation of resources. Tight relationships with the international scientific community, but also with the main stakeholders of the field (traffic operators, local authorities, consultants or manufacturers) are ensured through a network of associated partners who are involved into all the main activities of the project.

Section A: The Joint programme of activities

As explained above, NEARCTIS is organised as a building process for a virtual research institute (VRI), which could then be implemented as a virtual centre of excellence (VCE). The implementation of the Joint Programme of Activities (JPA) is organised along this line, and thus process orientated.

The goals of the JPA are to define the relevant activities that will be successfully implemented in the VRI. The activities of the JPA are therefore processes that allow the shape of the VRI to be specified, and finally its implementation into a VCE prepared.

Based on these statements the Joint Programme of activities has been developed with the perspective to create a research Institute. This involves the need to:

- Define a research programme
- Plan applications of research results
- Promote common training programmes and researchers mobility among partners
- Disseminate research results
- Develop and manage common research infrastructures

Strategy of the JPA: developing an integrated and multidisciplinary research program with applications perspectives

Building an integrated research programme is the core of the NEARCTIS project and is also its most complex task. It involves multiple scientific fields, each of them deserving specific research, but has also to include some application perspectives

The global scope of NEARCTIS is traffic management, envisaged as the optimisation of road infrastructure use, with an emphasis on the application of cooperative systems.

Basically, what is to be done in elaborating the program is:

- Developing a common view on the state of the art on each research field
- Identifying exploitable research results and research gaps. For this purpose, case studies will be proposed to integrate research results from several research fields into the definition of traffic management systems, and using this definition to point out research or knowledge gaps
- Sharing this work with a wide research and user community to validate it (as explained further on, this will be one of the roles of associate partners)
- Combining all this into an integrated research program.

For this purpose, the project is structured along two different lines corresponding to research field on the one hand and to applications on the other:

The first line is thus based on the main types of research fields involved in the project. This is strongly connected to scientific disciplines, and gives an idea of the variety of disciplines involved: applied mathematics, optimisation, control, computer science, communication, positioning, signal processing, data analysis… The scientific fields considered are the following:

- Modelling,
- Optimisation and control
- Communication and positioning

- Deployment and implementation issues
- Assessment

The first three of these are the main components of a traffic management system: Inside the management system, the **model** and the **optimisation and control** processes constitute together the control loop: the optimisation process produces control scenarios, which are evaluated by the model in order to determine the optimal one, which is applied to the field through the **Communication process.** The positioning and communication process also provides the management system with field data which make the model able to make an estimation of the system variables.

The last two scientific fields (which will be grouped together) deal with the implementation process of a management system: Deployment, implementation and assessment issues.

The second structure line includes the various types of traffic management systems and strategies, taking account of the various geographic scales and environments on which management systems may be implemented. For example, they could be grouped as follows:

- Global services, which include systems designed for a wide area: Information broadcasting, European-wide on-board guidance, etc.
- Motorway corridors, which are long distance (perhaps several hundred kilometres) motorway systems and the associate road systems
- Dense urban networks which are typically defined at a city scale, including various types of roads (freeway, arterials, etc) and transport modes;
- Local main road systems such as urban freeways, which may deserve specific types of traffic management (managed lanes, ramp metering, etc), and associated arterials.
- Shared multimodal / multi-user networks which are mainly urban situations with conflicting use of the same public area by several categories of users or modes.

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The idea in implementing those two structures is to ensure transversality between disciplines and research fields, by studying applications of several research fields to a technical system. This is what is called “case studies” in the sequel.

This organisation may be summed up in the following table:

Research fields, disciplines / Applications	Modelling	Optimization and control,	Communication, positioning and tracking	Deployment and implementation issues	Assessment
Global services					
Motorway corridors					
Dense urban networks					

Local main road networks			Application of vehicles positioning on local freeway systems		
Shared multimodal / multi-user networks					

As an example, the intersection of the grey row and column shows that 'Application of vehicles positioning on local freeway systems' could be a topic where research results could be applied or research gaps identified.

The organisation of the JPA is based upon this double structure, with a close coordination of both, ensured through a specific task: a review of the research field will identify exploitable research results, which can be applied through case studies. On the other hand, defining a case study may result in identifying some specific research gaps or needs which have to be integrated into the research program.

Organisation of the JPA

A **first work package** is devoted to the **constitution of an integrated research program**. This work package is divided into tasks corresponding to the various research fields mentioned above. The activities conducted in parallel in each task (described in detail in the WP description) aim at constituting a common, consistent research program. This involves:

- Developing a common view on the state of the art of the different applications, technologies and supporting research, analysing the position of the NEARCTIS group relative to international research.
- Identifying users research needs
- Determining research priorities, identifying scientific challenges
- Evaluating necessary resources for research and the need for co-operation
- Defining the role of each partner in a way consistent with their own priorities and constraints

A second work package is devoted to the **identification and development of specifications and the pre-assessment of illustrative case studies to be potentially conducted.** Selected case studies should fulfil a number of criteria:

- They should represent real complex problems that are likely to benefit from the application of innovative research techniques (e.g. those identified in work package 1).
- They should be representative for similar problems and approaches appearing in several traffic networks around Europe.
- They should involve new research challenges.

A third work package is devoted to **Education, training and dissemination actions**. This will be a very important task in NEARCTIS as it is a way of strengthening the links between

the core group and the professional community. The activities of this WP will be strongly oriented to make NEARCTIS a world-class reference in its domain and to offer the most significant knowledge base in traffic management and cooperative systems field. Within this WP a specific task is dedicated to the management and relationships with Associate Partners.

Beside these specific actions towards stakeholders through the association of partners outside the Network, there will be a particular emphasis on the training of young professionals, considering that enhanced skills will be needed in the coming years to exploit advanced traffic management opportunities to best effect.

The fourth workpackage deals with the constitution of a set of **common resources** for the network: it is a constitutive part of the centre of Excellence which is the global objective of the project. The idea is:

- To identify resources owned by each partner and which could be useful as a common resource,
- To develop agreements for sharing these resources with respect to costs, intellectual property rights, etc
- To organise the use of common resources
- To specify and develop additional resources as necessary for the future Centre of Excellence.

Common resources can be of various forms:

- Data sets are certainly the most valuable resources to be shared. The interest is to make it possible to compare the results obtained by various researchers on the same data; it is also to share the costs of gathering data and elaborating the metadata necessary for their use
- Experimental resources are also useful to share: test tracks, equipped test vehicles, traffic test beds which belong to one of the network partners may be made available to others or even in some cases be managed in common
- Software (simulation, data processing, etc) may also be shared, with various possibilities : open access, proprietary software usable by all partners etc
- Bibliographic data may also be shared in various ways : free access to databases, or constitution of common bibliographic databases
- Training material, such as courses, training software, exercises, etc

.**The fifth (and last) work package** is devoted to **Network management** and to the definition of a final solution to implement the – hopefully successful - **Virtual Research Institute** into a **Virtual Centre of Excellence**.

The workpackages 1, 2, 3 and 4, which are the ones interesting associate partners, and the tasks they include, are described in Appendix X. (Note: These are extracts from the Description of Work: They are not included in this Deliverable for the sake of brevity).

Appendix XII: NEARCTIS Workshop Programmes

First NEARCTIS workshop, Lyon 2008

AGENDA FOR 1st NEARCTIS WORKSHOP

December 9, 2008
Lyon, France

- **Local Organizer:**
  J. Renaud (ERT) Phone: +33 (0) 472 142 585
  N.-E. El Faouzi, (INRETS) Phone: +33 (0) 472 142 543
- **Venue:**
  Amphi CETE – 25, avenue F. Mitterrand, F-69500 Bron.
- **How to get there:**
  http://www.inrets.fr/infos/centres/Acces_anglais.html

- **9h30-9h50: Arrival**
- **9h50 - 10h00 : Welcome speech –** M. Bernard CAMBOU, Scientific Director of INRETS

10h00 – 12h00: Plenary Opening

Facilitator: Juliette RENAUD, NEARCTIS Coordinator, ERT – SAS.

1. *10h00-10h30*: Ms. Irmgard HEIBER, DG. INFSO. "ICT in Europe: Trends, Innovations and Issues".
2. *10h30-11h00*: M. J.-B. LESORT, NEARCTIS Scientific Moderator. "General structure and objectives of NEARCTIS"

11h00-11h20: Coffee/Tea Break

3. *11h20-11h40*: M. Reinhard PFLIEGEL, Austria Tech. "Co-operative Systems for Intelligent Road Safety – COOPERS" Project
4. *11h40-12h00*: M. Matthias MANN, PTV. "Adaptive and Co-operative Technologies for Intelligent Transport – AKTIV" Project

12h00 – 12h50: WPs' leaders and Associate Partners Cross-Cutting Session

- The idea here is to give a unique opportunity to Associate partners to discuss directly with WPs' leaders about their involvement in an informal way.

12h50-14h00: Lunch

14h00 – 17h30: Technical Sessions

1. **Session 1:** Modelling, control and technology for Network Optimisation
2. **Session 2:** Data needs, implementation deployment and case studies
3. **Session 3:** Education, Training and dissemination

14h00 – 15h00: Modelling, Control and Technology for Network Optimisation

Facilitators: Benjamin Heydeker (UCL) and Pierre-Yves Gillieron (EPFL)

- **Tasks involved:**
  - **WP1 – T.1.1, T.1.2 and T.1.3**

15h00 – 16h00: Data Needs, Implementation, Deployment Assessment and Case Studies

Facilitators: Markos Papageorgiou (TUC) and Serge Hoogendoorn (Delft Univ.)

- **Tasks involved:**
  - **WP1 – T.1.4,T.1.5,**
  - **WP2 – T.2.1,T.2.2.,T.2.3,T.2.4,T.2.5**
  - **WP4 – T.4.1,T.4.2.,T.4.3**

16h00-16h20: Coffee/Tea Break

16h20 – 17h20: Education, Training and Dissemination

Facilitators: Nick Hounsell (Univ. of Southampton) and Edward Chung (EPFL)

- **Tasks involved:**
  - **WP3 – T.3.1, T.3.2, T.3.3, T.3.4, T.3.5**
  - **WP4 – T.4.1,T.4.2.,T.4.3**

17h20 – 18h00: Closing Session

Facilitator: Jean-Baptiste LESORT (INRETS)

- Sessions' report
- Actions' summary

Last Update: 02 December '08

Second NEARCTIS workshop, London 2009

Imperial College London UCL Nearctis

Network of Excellence for Advanced Road Cooperative Traffic management in the Information Society (NEARCTIS)

2nd Workshop Programme

13 November 2009

Venue:
Jeremy Bentham Room, Wilkins Building
Bloomsbury Campus, University College London
Gower Street, London WC1E 6BT

08.30 – 09.00	Coffee	
09.00 – 09.45	**Welcome plenary – Keynote speech**	
09.45 – 11.15	**Session A:** WP1 and WP2 updates: Research programmes and case studies	
11.15 – 11.30	Coffee break	**Session C:** Partners' posters
11.30 – 13.30	**Session B1:** Partners' presentations	
13.30 – 14.15	Lunch break	
14.15 – 15.45	**Session B2:** Partners' presentations	
15.45 – 16.00	Coffee break	
16.00 – 17.30	**Session B3:** Partners' presentations	
17.30 – 18.00	**Closure**	

Welcome plenary
Introduction by Jean-Baptiste Lesort (NEARCTIS president) and keynote speech by André Vits (NEARCTIS advisory committee).

Session A (Chair: J.B. Lesort)

B. Heydecker – UCL
WP 1 Update: Review of the state of knowledge and capability in relevant technologies

M. Papageorgiou – TU Crete
WP 2 Update: Review of available case studies and related scientific knowledge

Imperial College London UCL Nearctis

Sessions B (Oral presentations)

B1 (Chair: M.G.H. Bell)

J. Marais – INRETS
GNSS-based localisation systems: existing performances and works in progress

M. Miska, M. Kuwahara – University of Tokyo
International Traffic Database (ITDb)

A. Bhaskar, E. Chung, A.-G. Dumont – EPFL & Queensland University of Technology
Urban network travel time estimation by integrating multisource data

R. Krishnan, J. Polak – Imperial College London
Intelligent decision support for traffic management

B2 (Chair: F. Medda)

R.C. Carlson, I. Papamichail, M. Papageorgiou, A. Messmer – TU Crete
Optimal mainstream traffic flow control of large-scale motorway networks

D. Krajzewicz – DLR
iTETRIS: An integrated tool set for evaluation of large-scale traffic management application based on vehicular communication

A. Hegyi, S. Hoogendoorn – TU Delft
SPECIALIST: A dynamic speed limit control algorithm based on shock wave theory

B3 (Chair: B. Heydecker)

B. Shrestha – University of Southampton
Opportunities for new co-operative systems for buses in London

P. Addison – UCL
ICT: Who stands to benefit?

Related projects

H. van Lint (TU Delft):	*ATMO – Advanced Traffic Monitoring*
C. Almeras (ECTRI):	*YEAR2010 project & traffic management*
C. Buisson (ENTPE):	*COST Action TU0903: Supporting the use, calibration and validation of traffic simulation models*
I. Kaparias (Imperial):	*CONDUITS traffic management benchmarking*
N.-E. El Faouzi (INRETS):	*COST Action TU0702: Weather-responsive traffic management*

Imperial College London UCL Nearctis

Session C (Posters)

M. Aron, R. Seidowsky, S. Cohen – INRETS
The safety impact of hard shoulder use during congested traffic: The case of a managed lane operation on a French urban motorway

S. Bauer, R. Nippold, Y.-P. Wang – DLR
AIM - Application Platform Intelligent Mobility

A. Bousquet, N.-E. El Faouzi – INRETS
Tempus: Multimodal router prototype based on urban travel time estimation

S. Box – University of Southampton
Traffic signal control using vehicle position data

G. Flötteröd, Y.-P. Wang, M. Behrisch, P. Wagner – EPFL & DLR
Disaggregate route choice estimation for the SUMO traffic microsimulator with the Cadyts calibration tool for improved traffic management

A. Fonzone, M.G.H. Bell – Imperial College London
How much do we pay for our lack of hyper-rationality?

P.-Y. Gillieron, J. Marais – EPFL & INRETS
Role of the positioning and communication technologies in co-operative traffic management

A. Gning, L. Mihaylova, R. Boel– Lancaster University & Ghent University
An interval compositional model approach for road traffic systems

S. Haji Hosseinloo, M.G.H. Bell – Imperial College London
Finding time-dependent hyperpaths for traffic networks: Route choice under uncertainty

S. Hoogendoorn, M. Westerman, J. van Kooten, P. van Koningsbruggen, R. van Katwijk, S. Hoogendoor-Lanser – TU Delft
Design and implementation of integrated network management in the Netherlands

J. Hu, M.G.H. Bell – Imperial College London
Short-term congestion prediction for in-vehicle route guidance

I. Kaparias, M.G.H. Bell, H. Belzner – Imperial College London & BMW Group
Field testing of a reliable in-vehicle navigation algorithm

A. Kouvelas, E. Kosmatopoulos, M. Papageorgiou – TU Crete
Adaptive optimisation with satisfactory transient performance for large-scale traffic control systems

D. Krajzewicz, M. Behrisch, Y.-P. Wang – DLR
Microscopic road traffic simulation package „SUMO" for optimising traffic management

J. Leitloff, F. Kurz, D. Rosenbaum, U. Thomas, P. Reinartz – DLR
Traffic processor for a real time airborne monitoring system of disasters and major incidents

J. Ogawa – University of Southampton
Analysing new traffic management applications for UK motorways

M.-H. Pham, A. Bhaskar, E. Chung, A.-G. Dumont – EPFL
Towards a pro-active model for identifying traffic risks

J. Princeton – INRETS
Case study on a managed lane: Simulation of a dedicated lane on an urban motorway

V. Trozzi, M.G.H. Bell – Imperial College London
Passengers navigation in a public transport network: Supporting real-time route choices in a dynamic and stochastic multimodal network through a personal journey planner

F. van Wageningen-Kessels, L. Leclercq, K. Vuik, S. Hoogendoorn, H. van Lint – TU Delft & INRETS
Lagrangian traffic flow simulations: accuracy of numerical methods

M. Wang, W. Daamen, S. Hoogendoorn, B. van Arem – TU Delft
Sustainability perspectives of cooperative systems

M. Zargayouna, S. Hoogendoorn, A. Pel, O. Huibregtse – INRETS & TU Delft
Optimizing instructions for online evacuations control with multi-agent systems

Closure
Session chaired by Jean-Baptiste Lesort, summarising the outcomes of the workshop.

Third NEARCTIS workshop, Lausanne 2010

3rd workshop NEARCTIS		**11 June 2010**
Welcome, coffee		**09:00**
Welcome plenary – Keynote speech		**09:30**
EPFL Transportation Center	Prof. Michel Bierlaire	
Keynote speech	**Prof. Nikolas Geroliminis, EPFL**	
"The M^3 of traffic systems: Modeling, Monitoring and Management "		
Session 1: Research prospects: vision of research in traffic management		**10:15 - 11:15**
Chair: Jean-Baptiste Lesort, INRETS		
▪ Traffic management: state-of-practice, capabilities and needs	Markos Papageorgiou, TUC	
▪ Some priorities for future co-operative traffic management	Nick Hounsell, USo	
▪ Scenarios for traffic information and management in 2028	Serge Hoogendoorn, TUD	
▪ Towards a harmonised research agenda	Benjamin Heydecker, UCL	
Coffee break		**11:15 - 11:30**
Session 2: Flashlight presentations, overview of research activities		**11:30 - 12:30**
Chair: Prof. André-Gilles Dumont		
▪ Rodrigo Castelan Carlson, Ioannis Papamichail, Markos Papageorgiou, Local feedback-based mainstream traffic flow control on motorways using variable speed limits, Technical University Crete ▪ Ioannis Kaparias, Konstantinos Zavitsas, Michael Bell, CONDUITS: Benchmarking urban traffic management, Imperial College London ▪ Sylvain Lassarre, Michel Roussignol, Antoine Tordeux, Macroscopic characteristics in stationary state of a Markovian jump process modelling a traffic flow, INRETS-GRETIA and Paris-Est University ▪ Yun-Pang Wang, Peter Wagner, Towards a dynamic system optimum based on vehicular data obtained by microscopic simulation, DLR ▪ Andy H. F. Chow, A macroscopic tool for arterial traffic analysis, University College London		
Lunch break		**12:30 - 13:30**
Session 3: Panel discussion – Co-operative systems: today and tomorrow		**13:45 - 15:00**
Chair: Prof. Fritz Busch, TU München, member of the NEARCTIS advisory committee		
Panellists: representatives from industry, road operators, research institution ▪ Frédéric Riva, Siemens Schweiz AG (CH) ▪ Derek Renaud, Transport for London (UK) ▪ Cornelius Menig, AUDI (D) ▪ Eugenio Morello, CSST, Centro Studi sui Sistemi di Trasporto (I) ▪ Siebe Turksma, PEEK Traffic solutions (NL)		
Goal of the panel: ▪ to debate on future research activities in co-operative traffic management ▪ to share expertise and ideas for future research directions ▪ to reinforce the role of NEARCTIS within the context of a multidisciplinary research area		

Coffee break **15:00 - 15:15**

Session 4: Posters - Research activities of NEARCTIS partners **15:15 - 16:00**

Chair: Dr Ashish Bhaskar

This poster session will be interactive. The authors will be able to present theirs posters to the participants.

List of posters

- Minh Hai Pham, Ashish Bhaskar, André-Gilles Dumont, A Strategy for Developing Risk-Sensitive Active Traffic Management System, EPFL
- Julia Bendul , Wolfgang Stölzle, New Combined Transport Offers dealing with Supply Chain Concepts, University of St.Gallen
- Rodrigo Castelan Carlson, Ioannis Papamichail, Markos Papageorgiou, Local feedback-based mainstream traffic flow control on motorways using variable speed limits, TUC
- N.B. Hounsell , B.P. Shrestha, Differential Priority at Traffic Signals using iBus in London, University of Southampton
- Ben Waterson , Simon Box, Examining the impact of penetration rate on the performance of cooperative traffic management systems, University of Southampton
- Tibye Saumtally, Jean-Patrick Lebacque, Habib Haj-Salem, Side Constrained Traffic Assignment Problem in Dense Urban Area, INRETS
- Thomas Monamy , Jean-Patrick Lebacque, Habib Haj-Salem, Experimental Analysis of Trajectories for the Study of Capacity Drop, INRETS
- Victor Knoop, Christine Buisson, Bart van Arem, Avoiding the under-utilisation of the shoulder lane by ITS measures, TU Delft
- Ioannis Kaparias, Konstantinos Zavitsas, Michael Bell, CONDUITS: Benchmarking urban traffic management, ICL
- Framke van Wageningen-Kessels, Bas van't Hof, Serge Hoogendoorn, Multi-class traffic flow models: do they respect anisotropy?, TU Delft
- Ersan Ozturk, Hasan SEVIM, CIM-Tr: Cooperative Information Management for Traffic Flow, Istanbul Technical University KOSGEB R&D Center
- Gabriel Nowacki , Michał Niezgoda, Thomas Kallweit , National Automatic Toll Collection System Pilot in Poland, Motor Transport Institute; Warsaw
- Boyacı Burak, Geroliminis Nikolas, Exploring the Effect of Variability of Urban Systems Characteristics in the Network Capacity, EPFL
- Ji Yuxuan , Geroliminis Nikolas, Partitioning Urban Traffic Networks based on Spatial and Temporal Features of Congestion, EPFL
- Sylvain Lassarre, Michel Roussignol, Antoine Tordeux, Macroscopic characteristics in stationary state of a Markovian jump process modelling a traffic flow, INRETS-GRETIA and Paris-Est University
- Daniel Krajzewicz, Investigating Ecological Impacts on selected Traffic Management Methods, DLR
- Karsten Kozempel, Ralf Reulke, ARGOS Navigation Filter, DLR
- Wagner Peter, Nippold Ronald, Toledo Tomer, Calibration of microscopic traffic simulation models by acceleration or by trajectory (Run it!), DLR
- Thorsten Neumann, Potentials and Deficits of a recent Approach for urban Traffic Monitoring based on Floating Car Data, DLR
- Yun-Pang Wang, Peter Wagner, Michael Behrisch, Towards a dynamic system optimum based on vehicular data obtained by microscopic simulation, DLR
- Romain Billot, Florian de Vuyst, Nour-Eddin El Faouzi , Integrating the weather effects on traffic : empirical analyses, mathematical modeling and simulation, Ecole Centrale Paris
- Robert Oertel, Adaptive traffic signal control using vehicles' delay times, DLR
- JD (Puff) Addison, Changing variance of journey times with varying arrival and service rates, University College London
- Andy H. F. Chow, A macroscopic tool for arterial traffic analysis, University College London
- Mamy Fetiarison, A simulation framework for the evaluation of pedestrian data collection methods, EPFL

Closure **16:00 - 16:15**

Fourth NEARCTIS workshop, Lyon 2011

Skelton of the 4th workshop NEARCTIS — 10 June 2011

Welcome, coffee — 09:00

Welcome plenary – Keynote speech — 09:30

- Welcome Speech
  - CETE de Lyon — M. Yannick Mathieu, CETE de Lyon
  - IFSTTAR — M. Henri Van Damme, Scientific Director
- Keynote Speech — M. Bernard Basset, ITS France

  "ITS France: presentation, actions within ITS Directive including cooperative systems"

Session 1: Towards a Harmonised Research Agenda for a VCE — 10:15 - 11:15

Chair: Jean-Baptiste Lesort, ENTPE

- Elaboration Process of the Harmonised Research and Development Programme — Benjamin Heydecker, (UCL)
- Identified Research Topics Based on the Assimilation and Shared Resources — Peter Wagner, (DLR)
- Education Training and Dissemination Achievements and Recommendations for the Future Network — Nick Hounsell, (Univ. of Southampton)
-
- Perpetuation Process and Capitalisation of the Network — Christine Buisson, (IFSTTAR)

Coffee break — 11:15 - 11:30

Session 2: Benefits of Cooperative Systems to traffic Management and Related Initiatives — 11:30 - 12:30

Chair: Nick Hounsell, University of Southampton

- "ERTRAC Roadmap Towards an Integrated Urban Mobility System" — Sylvain Haon (POLIS)
- "Eco-traffic Management and Cooperative Systems: the eCoMove way" — Jean Charles Pandazis (ERTICO)
- "OPTIMUM - Optimised ITS-based Tools for Intelligent Urban Mobility : A Marie Curie Scheme for Research Staff Exchange" — Fabienne Janin (ERT)

Lunch break — 12:30 - 13:30

Session 3: EC strategy in cooperative systems and Assessment of ITS measures projects — 13:45 - 15:00

Chair: Glenn Geers, NICTA, Australia, member of the NEARCTIS Advisory Committee

- Emilio Davila (EC) : "European Strategy and Programmes"
- Paul Boulter (TRL) "ECOSTAND - Common assessment methodology for determining the impacts of ITS on energy efficiency and CO_2 emissions"
- R. Horiguchi (ITL, Japan): "The Energy ITS Project - the Modeling and the Validation of Traffic Simulation for the Assessment of CO_2 Reduction with ITS Measurement"
- M. Yonezawa (JARI, Japan): "The Energy ITS Project - the Meso-scale Harmonization of Traffic Simulation and CO_2 emission Model Considering Acceleration Behaviors"

Coffee break — 15:00 - 15:15

Session 4: Posters - Research activities of NEARCTIS partners **15:15 - 16:00**

Chair: Nour-Eddin El Faouzi, IFSTTAR

This poster session will be interactive. The authors will be able to present theirs posters to the participants.

List of Posters:

- Maurice Aron, Régine Seidowsky. Cooperative traffic data and risk indicators. IFSTTAR
- Thomas Courbon, Ludovic Leclercq. Cross-comparison of Macroscopic Fundamental Diagram estimation methods. ENTPE, IFSTTAR
- Scott Cruickshanks, B Waterson. Will Privacy Concerns Associated With Cooperative Transport Systems Restrict the Publics Freedom of Movement? University of Southampton
- Filmon G. Habtemichael, Luis Picado Santos. Improved Active Traffic Management Systems For Motorway Efficiency. University of Coimbra
- Olga Huibregtse, Gunnar Flötteröd, Michel Bierlaire, Andreas Hegyi, Serge. Optimization of evacuation instructions as a fixed-point problem. TU Delft & EPFL
- Günter Kuhns, Rüdiger Ebendt, Peter Wagner, Elmar Brockfeld, Alexander Sohr. Self-evaluation of Floating Car Data (FCD) based on travel times from real vehicle trajectories. German Aerospace Center (DLR)
- Florian-Martin Marczak, Christine Buisson. A new filtering technique based on I-splines. ENTPE, IFSTTAR
- Thomas Monamy, Habib Haj-Salem, Jean-Patrick Lebacque. Experimental Analysis of Trajectories for the modeling of Capacity Drop. IFSTTAR
- Minh-Hai Pham, André-Gilles Dumont. Risk-Sensitive Traffic Management System. EPFL
- Polyvios Polyviou, Nick Hounsell. How can Modelling of Traffic Incidents Support Intelligent Transport Systems and Reinforce Bus-based Public Transport? University of Southampton.
- Hartmut Runge, Steffen Suchandt, Fabrice Reclus, Nour-Eddin El Faouzi, Jean-Luc Ygnace, Mathieu Vérité. Verification of Traffic Information using Advanced Radar Satellites, DLR, CETE de Lyon, ENTPE, IFSTTAR
- Riccardo Scarinci. Ramp Metering for the management of motorway roads. University College London.
- Schakel W. J., B. van Arem. Localized traffic flow optimization using in-vehicle advice. TU Delft
- Jan Schulz, Yasin Walayat. Towards a traffic measuring surveillance system utilizing tire pressure monitoring systems (TPMS). German Aerospace Center (DLR)
- Meng Wang, Winnie Daamen, Serge Hoogendoorn, Bart van Arem. Investigating Environmental Impacts of Dynamic Speed Limits. TU Delft.

Closure **16:00 - 16:15**

Appendix XIII: MULTITUDE-NEARCTIS Summer School 2012

ITS Summer School 2012

The three day intensive school will provide attendants with a training on the evaluation of Intelligent Transportation Systems (ITS) measures, including the core methodologies for the quantification of the impacts, the multi-criteria analysis and the management of uncertainty.

Several case studies will be presented and a practicum will guide attendants through the application of the whole assessment process.

The school is targeted to graduate and PhD students, engineers, researchers, consultants and government employees who wish to improve their understanding of the assessment of ITS solutions.

Info and Deadlines

Maximum number of participants: 40

Acceptance: First-In First-Served

Registration opening: February 15th, 2012

Registration deadline: April 20th, 2012

Acceptance confirmation: May 1st, 2012

No fee is due

Organised by:

Joint Research Centre,
Institute for Energy and Transport
Sustainable Transport Unit
Ispra, Italy
www.iet.jrc.ec.europa.eu

JRC EUROPEAN COMMISSION

COST Action TU0903 - MULTITUDE.
Methods and tools for supporting the Use, caLibration and valdaTion of Traffic simUlation moDEls
www.multitude-project.eu

NEARCTIS - A Network of Excellence for Advanced Road Cooperative traffic management in the Information Society
www.nearctis.org

Organisation committee:

Christine Buisson (IFSTTAR)
Winnie Daamen (TU/Delft)
Vincenzo Punzo (EC-JRC)

MULTITUDE-NEARCTIS Summer School 2012

Assessment of ITS solutions

European Commission Joint Research Centre
Ispra (VA), Italy
6-8 June 2012

www.multitude-project.eu/its-school

Draft Programme - Day 1

Assessment framework

Wednesday June 6th, 2012

9:00	Welcome to participants *Panagiota Dilara (JRC) and Vincenzo Punzo (JRC)*
9:05	Assessment of Intelligent Transportation Systems (ITS) policies at EU and Regional levels *European Commission Representative*
9:30	Introduction to the Assessment of ITS Measures *Speaker from 2Decide project*
10:30	*Coffee break*
11:00	Assessment Methodology *To be decided*
12:00	The Management of Uncertainty in the Assessment Process *Andrea Saltelli (JRC)/ Stefano Tarantola (JRC)*
13:00	*Lunch*
14:30	Exercise. Introduction: Problem definition and assessment framework: data , actors , indicators, etc. *Winnie Daamen (TU Delft), Christine Buisson (IFSTTAR) and Biagio Ciuffo (JRC)*
16:00	*Coffee break*
16:30	Exercise. Definition of alternatives and scenarios, analysis of the base scenario *Winnie Daamen (TU Delft), Christine Buisson (IFSTTAR) and Biagio Ciuffo (JRC)*
18:00	End of Day 1

Draft Programme - Day 2

The role of modelling in the assessment of ITS solution impacts

Thursday June 7th, 2012

9:00	From data to the Measures of Effectiveness (MoE) *Christine Buisson (IFSTTAR)*
9:45	Automated Section Speed Enforcement Systems: impacts on traffic, pollutant emissions and road safety *Vincenzo Punzo (JRC)*
10:30	assessment of bus and taxi special lane on the A1 northern entrance of Paris *Simon Cohen (IFSTTAR)*
11:15	*Coffee break*

11:45	Urban case study *Robert Bertini (Portland State University)*
12:30	*Lunch*
14:00	Exercise. Definition of MoE and scenario implementation *Winnie Daamen (TU Delft), Christine Buisson (IFSTTAR) and Biagio Ciuffo (JRC)*
16:00	*Coffee break*
16:30	Exercise. Model calibration, output gathering and validation *Winnie Daamen (TU Delft), Christine Buisson (IFSTTAR) and Biagio Ciuffo (JRC)*
18:00	End of Day 2

Draft Programme - Day 3

Traffic simulation in impact assessment

Friday June 8th, 2012

9:00	OD matrix estimation methods *Costas Antoniou (NTUA)*
10:00	Key requirements for a successful assessment simulation study (part 1) I/ Ability of simulation tools to reproduce the physical phenomenon those are at play in regulations II/ Network representation and coding and definition of alternatives *Serge Hoogendoorn (TU Delft)*
11:00	*Coffee break*
11:45	Key requirements for a successful assessment simulation study (part 2) III/ Parameters, calibration, validation IV/ Stochasticity *Serge Hoogendoorn (TU Delft)*
12:30	*Lunch*

14:00	Exercise: Multi-criteria assessment *Winnie Daamen (TU Delft), Christine Buisson (IFSTTAR) and Biagio Ciuffo (JRC)*
15:30	*Coffee break*
16:00	Exercise: Uncertainty analysis of results *Winnie Daamen (TU Delft), Christine Buisson (IFSTTAR) and Biagio Ciuffo (JRC)*
17:30	End of Day 3