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Eco-driving methods and training: issues and perspectives

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Abbreviations

Abbreviation	Meaning
ECTRI	European Conference of Transport Research Institutes
FEHRL	Forum of European National Highway Research Laboratories
FERSI	Forum of the European Road Safety Research Institutes
FOT	Field Operational Test
ITS	Intelligent Transportation Systems
OEM	Original Equipment Manufacturers
PTW	Powered Two-Wheelers

List of participants

Surname	First name	Association
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Agenda

<p style="text-align: center;">Seminar on Eco-driving methods and training</p> <p style="text-align: center;">Thursday, December 1, 2011</p> <p style="text-align: center;">CERTH/HIT premises - Thessaloniki, Greece</p>		
Timing	Topic	Speaker
09:00-09:30	Welcome Coffee	
09:30-09:55	Overview of DECOMOBIL project	<i>J.P. Medevielle, IFSTTAR</i>
09:55-10:20	Eco-Driving: Definition and State of the Art	<i>D. Margaritis, CERTH/HIT</i>
10:20-10:45	Eco-Driving ITS and EU initiatives	<i>E. Bekiaris, CERTH/HIT</i>
10:45-11:15	Coffee Break	
11:15-11:40	Using mobile technology for on-board and off-board Eco-Driving schemes	<i>R. Montanari, RELAB</i>
11:40-12:05	Training methodologies and interactive tools in Eco-Driving. Research priorities stemming from DETRA.	<i>S. Nikolaou, CERTH/HIT</i>
12:05-12:30	Evaluation of truck Eco-Driver training delivered through simulation	<i>A. Stevens, TRL</i>
12:30-12:55	Acceptability of Eco-driving functionality by bus drivers	<i>A. Pauzie, IFSTTAR</i>
12:55-14:10	Lunch Break	
14:10-16:10	Interactive discussion on future research in Eco-Driving methods, emerging technologies and training	<i>Chaired by E. Bekiaris, CERTH/HIT</i>
16:10-16:30	Coffee Break	
16:30-17:00	Workshop Conclusions	<i>E. Bekiaris, CERTH/HIT</i>

1 Overview

The Seminar aimed to identify the background research on Eco-Driving and how the use of existing studies, tools and ITS systems can be further researched, adapted and extended to result to concrete methods and training initiatives in this sector.

Furthermore, it provided the opportunity to discuss and interact with the attendants on the future research steps that should be followed, as well as on the actors to be involved on the diffusion and application of the results of Ecodriving training.



Figure 1: General seminar photos

2 Presentations

2.1 Welcome and overview of DECOMOBIL project (J.P. Medevielle)

Jean-Pierre Medevielle, President of HUMANIST, welcomed the participants and gave an introduction to the DECOMOBIL project scope and activities.



The relevant presentation follows in **Annex 1**.

The following questions were raised by the audience:

- How the DECOMOBIL network is expected to be sustained?

The presenter responded that DECOMOBIL network will be supported by the HUMANIST VCE and its members, as well as through its close joint cooperation with other Associations (FERSI, ECTRI, FEHRL, ...). There is an initial plan towards the maintenance and sustainability of the network that will be adopted and finalised during the life of the project.

- What is the Focused Joint Research Initiative (JRI) and which the mechanism behind it?

The presenter responded that this is the real innovation of the DECOMOBIL project, which aims to exploit the Lyon and Lund declarations and create a frontier or anticipatory research into relevant focused scientific knowledge. This new type of programme proposes measures promoting interaction with various stakeholders with the purpose to improve the cohesion of thematic scientific programmes and therefore promotes standardization, interoperability, policy or evaluation making and regulation or rule making between the involved parties.

2.2 Eco-Driving: Definition and State of the Art (D. Margaritis)

Dimitris Margaritis, Researcher in CERTH/HIT, gave an introduction to the definition and relevant state-of-the art of Eco-Driving.



The need, characteristics and benefits of Eco-driving have been raised during the presentation, whereas the technologies and best practices currently available were highlighted. The relevant presentation is available in **Annex 2**.

During the discussion the following questions were raised:

- Except driving style, it is important to train the driver to use efficiently (in terms of eco-friendliness) high in-car energy consumers like air-conditioning.

In response, the presenter underlined that indeed, drivers tend to constantly switch on the air-condition/clima, especially in south European countries. Although, not using the air-condition will save fuel, but driving with the windows open, at a high-speed, will also cause excessive fuel consumption. DECOMOBIL should promote the cautious use of energy consumers in a car (such as air-condition, audio, etc.).

- Traffic management can assist eco-driving.

The presenter responded that this is a true case and this first DECOMOBIL workshop has taken this aspect into account. The next presentation will discuss the latest technologies on this topic, as well as the related (already running) research projects in Europe and in the US.

2.3 Eco-Driving ITS and EU initiatives (E. Bekiaris)

Evangelos Bekiaris, Research Director at CERTH/HIT, presented the upcoming policies of the European Commission towards Eco-Driving, the relevant current and near-future initiatives, as well as the available ITS systems (marketed or prototyped) that either support the driver on-line to drive in an eco-friendly way, or train him/her to do so off-line (i.e. not while driving). The relevant presentation follows in **Annex 3**.



The following questions were raised by the audience:

- How are these technologies evaluated in terms of their actual impact?

The presenter responded that the current Field Operational Test (FOT) studies constitute a strong tool towards the evaluation of the available technologies and the assessment of their impact. Since these technologies are at prototype level or currently emerging at the market, their applicability and benefit will be measured in a medium-term horizon and depends strongly on the priorities of the industry and the market penetration electric vehicles.

- How could individual ITS technologies be exploited to support Eco-driving?

The presenter responded that cooperative systems can create the framework for supporting Eco-driving in the future. Furthermore, the use of mobile technologies as the link between the infrastructure-driver-vehicle may result to integrated services that can significantly contribute in a short-term horizon.

2.4 Using mobile technology for on-board and off-board Eco-Driving schemes (R. Montanari)

Roberto Montanari, Head of the Human-Machine Interaction department of Re:LAB, presented the results of a mobile-based industrial application for on and off-board Eco-driving schemes. Moreover, a short video on the use of this application was presented to the attendants to demonstrate the use and benefits. The relevant presentation includes confidential industrial material and therefore is not included in this public document.



The following issues were raised by the audience:

- The relevant platform would be good to be tested in FOT's involving buses and trucks to evaluate its impact and added-value.

The presenter responded that the development team created this application on demand for human-factors based industrial need, not being aware of further potential use in research. However, it is possible to be used for research purposes as well.

- Equipping a fleet of vehicles with this application should be easy and of low cost, since there is no need of equipping the vehicles with special technologies.

The presenter responded that the application supports use through any nomadic system in the vehicle, managed by central server.

- When the system is expected to be available?

The presenter responded that the system is ready and licenses are available for marketing. What is not yet ready at industrialised level is the server that provides the data. However, the application is ready as a product to be used for research initiatives.

2.5 Training methodologies and interactive tools in Eco-Driving (S. Nikolaou)

Stella Nikolaou, Researcher in the Driver & Vehicle Sector of CERTH/HIT, presented the available training methodologies and tools used for drivers' and professionals' (i.e. driving schools instructors) training and how they could be further adapted to Eco-Driving. Since the technologies and services that support Eco-driving have just been launched, there aren't yet enough concrete results to develop training curricula for Eco-Driving. However training is always a pre-requisite of safe and beneficial use of emerging technologies in vehicles and therefore there is a demanding need that this issue will be of high importance in the near future. The relevant presentation follows in **Annex 4**.



The following question was raised by the audience:

- How can Eco-driving training be optimally provided in driving schools?

The presenter responded that there should be two types of training; theoretical and practical. Theoretical training can be provided for specific functions and based upon best practices on Eco-Driving (latter already included in the Greek driver's license training programme) and should be based on training books and multimedia applications, with user-friendly environment and content that can be easily comprehended by the different driver types. Practical training should be provided for those functions and systems where theoretical training is evaluated to be not complete enough and could be based on the use of driving simulators through specific scenarios and for even more demanding systems on on-road training scenarios.

2.6 Evaluation of truck Eco-Driver training delivered through simulation (A. Stevens)

Alan Stevens, Researcher at TRL, presented the findings of a study that used the SAFED truck simulator on eco-driving training and validated the impacts when the drivers return to their fleet. The relevant presentation follows in **Annex 5**.



The following issues were raised by the audience:

- The use of driving simulators for bus/truck drivers to evaluate the training effect after a period of i.e. 6 months (maybe with the use of a mobile application, such as that of Re:LAB) could provide valuable research results.

The presenter responded that indeed re-training in 3, 6, 12 and 24 months should be applied and its effects should be evaluated.

- What is the cost of the training (use of driving simulator, etc.) and what is the benefit?

The presenter responded that a full cost/benefit analysis has not been performed on training. The study provided only some data on reduction of emissions and fuel use after the provision of the training.

2.7 Acceptability of Eco-driving functionality by bus drivers (A. Pautie)

Annie Pautie, Research Director at IFSTTAR/LESCOT, presented the results of a study focusing on the acceptability of an Eco-driving functionality by bus drivers, performed within the framework of the Safeway2School European project. The relevant presentation follows in **Annex 6**.



The following issues were raised by the audience:

- The study tested two types of truck drivers; owners and employers of trucks with evident differences in the acceptance ratio. How could these differences be balanced and a consensus reached for both types of truck drivers?

The presenter responded that campaigns and awareness activities constitute a top priority towards Eco-driving, especially related to the economic recession. An important issue is also how to safeguard the privacy of employees by promoting - and not demanding – the use of Eco-driving.

3 Open Discussion and Conclusions

Following the presentations, the Chairman, Dr. Evangelos Bekiaris, highlighted the main points for future research and policy actions:

- Traffic Management policies and algorithms and their potential towards improving eco-driving and CO₂ emissions reduction through practices or cooperative systems.
- Which are the effective ways to develop micro and macro simulation models to assess the effects of Eco-driving?
- Eco-driving and relation to PTWs?
- Incentives for Eco-driving promotion (for bus, truck, elderly drivers, ...).
- Convince/ involve the OEM's and relation/ convergence of EU policies?
- Clean car racing events organised under the auspices of FIA in member countries, providing accurate point-to-point fuel consumption. Could such actions increase the awareness of the public to Eco-driving?
- Which are the enablers and which are the limiters?
- Training costs? Acceptance issues? Legal issues especially those related to intervention actions?
- Eco-driving as a pre-requisite to the success of clean vehicles' market penetration, and especially electric ones.

The discussion resulted in the following conclusions:

Major stakeholders/ promoters:

- Energy providers (promoting energy saving to support their clients).
- OEM's of clean vehicles.
- European associations or agglomeration of transportation companies pushing the industry to have Eco-driving systems as standard options to their vehicles and highlighting their interest for specific functions.
- European Commission and politicians providing economic and non-economic incentives.
- International standardisation initiatives.

Eco-Driving Enablers:

- Need for range extension by OEM's of clean vehicles, thus need for less fuel consumption.
- New technologies on nomadic devices (i.e. iPhone gateway).
- Personal mobility ecological footprint algorithms and devices trend.
- Engine modification services for alternative fuels and need of driver behaviour adaptation.
- Economic crisis, leading to importance of any fuel savings.

Eco-Driving Limiters:

- Lack of standardisation.
- Cost of training or in-vehicle application.
- User acceptance because of legal implications.
- Safety of application, to avoid enhancing the driver workload.

Key areas for Market penetration

- Incentives that will focus more on identifying the state-of-the-art and test the available technologies in short and medium-term.
- ITS/cooperative systems and their relation to Eco-driving to be studied through implementation scenarios useful for any cooperative project of the future (i.e. macro level -> city level).
- Eco-driving training is an issue that needs further research funds to be standardised. The research should currently focus on validity, evaluation frequency and ways of monitoring Eco-driving. Training could be defined, through requirements stemming from such pilot studies.

Eco-Driving Training

Training for eco-driving can be at three different levels:

- information feedback to the driver (either real-time or post-drive);
- recommendations in real-time depending on driving conditions, etc;
- intervention between the driver and vehicle (according to pre-selected levels).

Future actions

- It was decided that a session on Eco-driving & ITS/ cooperative systems will be added to the HUMANIST VCE Conference due to be held in June 2012 in Valencia, Spain. New projects dealing with Eco-driving will be presented during this session along with demonstration of the iPhone application prototypes of Re:LAB, to further promote them for research use especial in FOT's.
- DECOMOBIL is not a research project and therefore cannot develop tools for Eco-driving. However, it can draw the main points for future research on this field and support at policy level the creation of future research initiatives considering the industrial and market trends (i.e. electric vehicles).