



ECTRI POSITION PAPER

“Research Needs in the field of Transport Safety in a Cross Modal Setting”

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1. Introduction

ECTRI launched its Thematic Groups in September 2007 as a means to facilitate exchanges among its researchers interested in similar research fields and in order to promote joint initiatives and positions. One of the groups is the Thematic Group on Transport Safety (TG-Safety). The main objectives of this group are to define research topics of interest for influencing EC policies and programmes, to create consortia for EU projects and to provide a platform for networking and scientific knowledge. The group consists of 25 experts from 15 Transport Research Institutes and Universities representing 15 countries. Most of the institutes are working in the field of road safety, railway safety, nautical safety, safety management and safety culture and some are also involved in aviation safety. Members are: AIT, CDV, CERTH, DVS, Fraunhofer, LNEC, IFSTTAR, ITS, KTI, TØI, TRL, UPM, UVEG, VTI and VTT.

TG-SAFETY wants to play an active role in the development of validated and innovative knowledge of transport safety by bringing in their expertise on safety issues in different European countries, their scientific knowledge of integrated safety policies and research issues and their experience in safety research for the different transport modes: roads, waterways, railways and aviation. We acknowledge the work of other platforms such as ERTRAC, EARPA, and FERSI and also the current PROS project regarding road safety research priorities, but believe that TG-SAFETY has an added value by addressing integrated transport safety policy issues and the development of cross modal evaluation tools and strategies.

TG-SAFETY has identified several research topics that are of general interest to the group and that we believe are highly relevant for the EC Framework Programme 8 (aka Horizon 2020). The topics are those where we believe we can gain new insights and knowledge by applying a cross modal perspective, i.e. to study how theories and methods on safety issues can be fruitfully exchanged between modalities. ECTRI thinks that given their importance, these aspects should be identified as research themes in future programme of "Horizon 2020".

2. Suggested research areas

We are proposing seven areas of research based on our conviction that increased knowledge will be important for improving transport safety across all transport modes.

2.1 Behavioural adaptation to transport safety measures

Behavioural adaptation (BA) has been a key issue in road safety research for many years. It implies that drivers tend to take advantage of new safety measures in other ways than just to increase safety. Typically drivers increase speed or reduce vigilance and hence reduce the potential safety impact of the measure. This is particularly the case for measures such as those that improve road friction, sight, stopping distance and so on.

Although the term "behavioural adaptation" is typically used to denote road users' tendency to "compensate" for road safety measures, and as such the phenomenon is often called "risk compensation", it is in fact a more general mechanism and the term is also used to describe

the tendency for drivers to adapt behavior in response to changes in the driving environment.

The term “behavioural adaptation”, or in particular “risk compensation”, is more or less exclusively used in road safety research. However, the mechanisms at work are general and also identified in other transport modes as “lack of situation awareness” or “complacency” (aviation), “ATC-behaviour” (rail), “radar-assisted accidents” (sea).

Traditionally, in highway engineering research, the main observation has been that drivers tend to take advantage of safety measures by driving faster. With new cars being equipped with advanced driver assistance systems, behavioural adaptation manifested as reduced vigilance might be more likely, and as such the resemblance with other transport modes is apparent. In addition, with advanced driver assistance systems an alternative BA may be an increased use of communication devices. There is a need to understand the mechanisms by which all forms of BA occur and how one may deal with the problem in a cross-modal setting. This involves not only analyzing driving data and getting performance statistics but also looking for different solutions that promote beneficial behavioural change, such as insight based education, incentive based reward systems, technical solutions and so on.

Research issues:

- Identify mechanisms and examples of behavioural adaptation in all transport modes and identify any common characters. Understand differences in relation to fitness to drive and differences between subgroups such as older/younger drivers, males/females etc.
- BA of vulnerable road users (VRUs) in relation to infrastructure changes.
- BA in relation to new technologies and advanced driver assistance systems such as intelligent speed adaptation (ISA), automatic train control, adaptive cruise control, adaptive front light systems, navigation systems, smart phones etc.
- Naturalistic driving/riding observation studies with the aim to increase knowledge about BA in situations where the vehicles have several support systems and there is a risk for overload of information compared to a situation-related process of information.
- BA in relation to training and education in the different transport modes.

2.2 Safety climate – work related safety

Safety climate and safety culture are concepts adopted within organizational settings to denote the level of safety awareness in the organization. Safety climate/culture has been a key issue in order to maintain safety as a top priority in particular within complex and dangerous production activities, like oil drilling and nuclear power plants. Safety climate/culture has also been a focus in aviation, whereas in road transport it is largely absent. Thus there would be ample opportunities to improve safety in different transport modalities by implementing safety climate/culture principles from other areas/transport modes.

Such opportunities seem obvious for professional car and truck drivers, often being within an organizational setting, but less so for the vast majority of private drivers. Nevertheless, it would be potentially fruitful to investigate the possibilities of adapting safety climate/culture principles for private actors in transport, such as private car drivers.

Research issues:

- Investigation of possible relationship between safety climate, safety culture and accidents. Although safety culture is increasingly highlighted in safety management in the transport industry, the relationship with accidents is not very well documented.
- Defining methods for implementing available knowledge and develop companies CRS's (Corporate Social Responsibility).
- Implementation of and research about effects of the new international standard for road safety, ISO39001. This specifies requirements for a road traffic safety (RTS) management system to enable an organization that interacts with the road traffic system to reduce death and serious injuries related to road traffic crashes which it can influence.
- Investigation of the possibilities of adapting safety climate/culture principles to private actors in the transport system.

2.3 Fitness to drive and distraction

Fitness to drive can be viewed in both long-term and short-term perspectives. In a long-term perspective fitness to drive is a result of driver training and driving tests giving the driver the necessary qualifications to drive safely. In a short-term perspective, fitness to drive is concerned with daily fitness, which may be impaired by lack of sleep, sickness, stress, ageing, disabilities, fatigue or intoxication.

In the long-term perspective fitness to drive is a natural concern in all transport modalities with specific requirements of the type and amount of training necessary and the content of the driving tests. However, despite the fact that a lot of research on driver training and licensing has been conducted, the effects on accident involvement are unclear. For private car training, results vary and often no significant safety effect can be found. In all transport modes, accidents are rare, and thus the safety effect of training is difficult to measure.

In the short-term perspective lack of fitness to drive is also a major concern in all transport modes, and the problem seems to be increasing. Accidents due to drivers falling asleep are an important risk factor. Research shows that drivers often lack the knowledge of when their reduced vigilance state becomes dangerous. Among professional drivers sleepiness is a major problem and there are numerous examples of incidents and accidents where pilots, train, bus and truck drivers have severe sleepiness or have fallen asleep. Such problems have many different causes, related both to how work hours and schedules are organised and to drivers' free time, amount and quality of their sleep. In addition, sleepiness and fatigue may result from cognitive underload, resulting from the increasing automatization of the driver task.

Fatigue management programmes have been adopted in order to help solve the problems. The contents and effects of these programmes vary, and the ways such problems are met differ between transport modes. For example, there seems to be better opportunities for airplane pilots to claim 'not fit for flight', than for professional drivers in road transport. The possibility of mutual learning between transport modes about fatigue management should be investigated taking as a base all existing related statistics. In line with a holistic approach

it is important to both have the possibility to detect and to inform/warn on an operational, tactical and strategic level

Distracting activities while driving are common for the transport modes and can result in errors. Driver distraction is an important cause of crashes and can result from factors both inside and outside the vehicle.

Research issues:

- Investigate the possibility of mutual learning between transport modes about fatigue management (see above).
- Research on similarities and differences in driver education between transport modes, and the possibility to adopting well documented learning models from one mode to another.
- Research about the user of the transport system as an active participant. Issues like motivation and conscious choices based on the user's expertise, experience, attitudes and risk awareness in conjunction with the standards and norms that exist in society and in the immediate social group.
- Research about how driver vigilance is affected in situations with autonomous driving. How to make sure that the driver has the ability to take back control when required (as stated in the Vienna convention).
- Further research is needed to estimate the risk conferred by different distracting activities and the circumstances during which activities pose greatest risk.

2.4 Evaluation of change/policy initiatives

A cross-modal safety policy involving the coordinated development of safety measures and common evaluation tools can benefit the transport sector and help reduce those unforeseen consequences inherent in traditional sector focused policies. Safety (and security) measures developed with an intra-modal focus, while intended to prevent accidents and potential incidents, may merely result in the migration of both risk factors and traffic to other modes (e.g. prohibiting dangerous goods on boats might increase road transport, that has higher risks). Vulnerability to new and old risks, cross-modal dependencies, and the challenges associated with New Public Management¹ are further arguments for the cross-modal management of safety and security.

There seems to be a growing tendency in Europe for countries to reorganise their transport sectors and to bring together the different transport bodies into large general organisations. For example, in The Netherlands, Sweden and Finland the different transport bodies (road, rail, sea, air) have been reorganised into a common transport body. Also the accident investigation boards have become intermodal in many European countries. The organisation also includes direct links with safety/security bodies such as police, fire service, and civil safety.

Different transport modes have separated standards and such reorganisations may facilitate mutual learning between transport modes and a more common perspective on safety issues. Safety problems, safety management principles and safety measures may become more

¹A new way to produce public services where traditional public production is outsourced to subcontractors.

common in a joint organisational setting. However, there is also the risk that such merging processes are both time and energy consuming (including all previous technical processes such as the creation of a common database or data exchange among different entities) so that the actual safety work is lacking.

Research issues:

- Identification of specific safety policy initiatives and safety outcomes of the different ways the transport sector is organised in different countries. A particular interesting point for investigation could be whether and to what extent a more cross-modal approach in safety management is revealed in countries where the different transport sectors have been reorganised into a common transport body.
- Research and evaluation methods should be developed and research focused on isolating the effects of policy initiatives.
- Analysis of safety differences between countries and related factors behind them would increase knowledge on effects of main characteristics as: total number of person kilometres, modal split of the person kilometres, accident risks on different road categories and share of vehicle kilometres among those road categories as well as severity of accidents (fatalities per injury accidents). These kinds of analyses would be highly beneficial while evaluating the safety potential related to policy initiatives.
- Investigation of possible risk migration (from a mode to another mode) due to cross modal policy in Europe.

2.5 Ageing society

All over Europe the number of older people is growing, and it is important to acquire knowledge concerning older people's everyday mobility in the transport system and its impact on their welfare, well-being and quality of life. The number of older car drivers is in particular increasing, putting new demands on the road infrastructure concerning lighting, signposts and so on. Modern cars and road traffic are equipped with advanced driver assistance systems. To what degree older people manage to handle such systems is an important question, probably heavily dependent on how user-friendly these systems are designed and further on the familiarity of older people with modern technologies.

Although safety devices on board vehicles are improving and ever more present, older drivers are more at risk to be killed than middle aged drivers in any particular accident scenario. Their mortality is much higher because of their physical vulnerability. Thus the growth in the number of older road users could seriously increase the number of them among victims of transport accidents. However it is as pedestrians (and increasingly as bicyclists) that older people are most at risk in road traffic. Possible countermeasures to avoid a major accident increase in the ageing society could be to allow for continued driving among older people but with certain restrictions, for example allow for continued driving in the local community where they are familiar with the traffic system. Other possible measures could be to have additional driver training for older people, to help older drivers to correctly evaluate their driving ability. Public transport of high quality is obviously very important to secure mobility among the older population, but the large-scale automation in public transport may deter older people from using it. Accessibility of the transport system is

also a function of urban planning, local land use, perceptions of security, facility provision and location.

Research issues

- Apply an integrated, holistic approach to cover all the needs a transport system must meet to safeguard mobility among older people.
- Older people are a very heterogeneous group. Research should focus on different subgroups defined by age, gender, financial resources (affects use of transport mode and safety standard of vehicles), geography (urban/rural), cognitive abilities, self-awareness and social, ethnic and cultural factors.

2.6 Injury data – cost of treatment

Traditionally, accident data and their consequences (deaths, injuries, material damage) have been collected for every transport mode per country on a yearly base and some aggregated data are published through EuroStat. In road safety research there have been a few studies that have looked at the safety effects of transferring traffic between road user groups. However, safety effects of transferring transport between transport modes have not been studied extensively, possibly because accident reporting varies between transport modes.

The potential to use hospital data to acquire good injury data regardless of where the accidents happen has for many years been looked upon as a promising possibility. During recent years several European countries have established accident databases for collecting such hospital data. These databases give opportunities to acquire a full picture of for example the number of pedestrian and bicycle accidents, which are largely underreported in official road accident statistics. Such data will also give the opportunity to study the risks involved in transport chains including both the accidents on board a transport carrier as well as accidents and injuries between carriers at bus stops, pavements and so on.

Furthermore, hospital data may possibly be linked to treatment and cost data, giving the opportunity to calculate real public costs of accidents. Such costs will be of great importance for the authorities in decisions about financing transport safety measures, asset management and the development of treatment facilities.

Research issues:

- Insurance data / hospital data/ police data: there is room for more. Methods on how to merge different data sources together in order to obtain an optimal source of information on a European level should be investigated. Different bodies/agencies collect most of the times same data with different definitions for the same accident. Establishing a common methodology for accident investigation and data collection is of main interest (SafetyNet and DaCoTA project). However this methodology is under development and most importantly needs real-life testing on a large scale before a Europe wide application.
- If MAIS3+ is adopted as a common definition of serious injuries within Europe, research about these injuries are required to identify areas with large potential to reduce the number of seriously injured to reach the EU-goal for 2020. In a cross-modal setting it should be important to compare the distribution of seriously injured according to MAIS3+ for different transport modes.

- Research about single-pedestrian-accidents and relevant exposure is necessary to obtain a high safety level from a “door-to-door” perspective.
- Apply smarter ways to utilize statistical methods and data. In-depth data collection should complement macroscopic data by means of thematic focus data gathering (e.g. pedestrian, bicyclists’ accidents), depending on the topics that should be addressed and considered as high priority per time period. Large-scale thematic data collection will assure large samples that can provide statistically powerful results representing the whole of Europe.
- Develop better accident prediction models for quantifying safety risks.

2.7 Transport infrastructure

The planning and coordination of transport infrastructure development has major consequences for the provision of transport and the modal split. From a safety perspective the modal split is rarely optimal; more goods could for instance be transported by rail or sea. As mentioned under topic four, an optimal modal split relies heavily on the organization and coordination of the transport modalities. Today both the quality of the infrastructure, the transport costs and the different regulations may produce a suboptimal modal split. For instance, a consequence of strict regulations on the transport of dangerous goods on ferries is that dangerous goods are transported over long distances by car and truck, increasing the overall exposure to risk of society.

Safety (and security) regulations with an intra-modal focus, while intended to prevent accidents and potential incidents, may merely result in the migration of both risk factors and traffic to other modes. Similarly, inadequate infrastructure may result in similar migration problems. ITS and ICT deployed over the considered infrastructure eases the analysis.

Research issues:

- Research into the influence of infrastructure and linkage to other factors, with the aim to develop applicable solutions in practice.
- Influence of urban planning on road safety. Development on road safety impact assessment (RIA) tool, and also other tools from directive 2008/96 ES.
- Difference of safety level of road infrastructure in EU countries (the differences are important not only for investment, application directive 2008/96 ES, user safety).
- Development of science-based evaluation tools to tackle the need for safety evaluations set in the road infrastructure safety directive.

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