TRANSPORT CHALLENGE IN HORIZON 2020

ECTRI SUGGESTIONS FOR THE THIRD WORK PROGRAMME (2018-2020) *in the field of* "TRANSPORT SAFETY"

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The European Conference of Transport Research Institutes (ECTRI) is an international non-profit association that was officially founded in April 2003. It is the first attempt to unite the forces of the foremost multimodal transport research centres across Europe and to thereby promote the excellence of European transport research.
Today, it includes 28 major transport research institutes or universities from 21 European countries. Together, they account for more than 4,000 European scientific and research staff in the field of transport. ECTRI as the leading European research association for sustainable and multimodal mobility is committed to provide the scientifically based competence, knowledge and advice to move towards a green, safe, efficient, and inclusive transport for people and goods.

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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 supporting EC policies and programmes, to increase successful participation in EU projects and to provide a platform for networking and scientific exchanges. The group consists of 33 experts from 20 Transport Research Institutes and Universities representing 17 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, BME, CDV, DEUSTO, Fraunhofer, HIT, IFSTTAR, ITS, KTI, LNEC, TØI, TRL, TTI, UNEW, UNIZA, UPM, UVEG, VTI, VTT and WVL.

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, 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 are seen as are highly relevant for the Horizon 2020 programmes. 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.

The suggested research topics are reflected in the form of research priorities, aiming to highlight their significance for inclusion in the upcoming calls of Horizon 2020, and in particular to the Challenge aiming to achieve “better mobility, less congestion, more safety and security”. Those topics are seen as important transport issues, aiming to reduce accident rates and fatal causalities; they well complete those other topics which relate to the key drivers for supporting the achievement of low carbon mobility as suggested by ECTRI in its recent position paper[1]: 1. Systemic approach; 2. Resilience; 3. Human factors; 4. Policy-making.

2. Suggested research topics

TG-SAFETY is proposing seven research topics based on our conviction that increased knowledge will be important for improving transport safety across all transport modes.

Those seven topics are:

[1] ECTRI position paper on the third Transport Work programme “Towards low carbon mobility”, July 2016

1

Suggested title of the research topic	Response and adaptation to new transport technologies and automation
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail	
Specific challenge	
How operators and users of the transport system utilize the new technologies available and the interplay between new and "old" technologies. Safety may be harmed because new and old technologies are poorly integrated, because new technical assistance systems can lead to suboptimal behavioural adaptations or because safe and advanced safety transport systems face fierce competition from cheap transport suppliers with old, poor and unsafe equipment. There is also a risk that some users chose not use the new technologies.	
Scope	
Motivation: 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. Although the term "behavioural adaptation" is typically used to denote road users' tendency to "compensate" for road safety measures, the mechanisms are also identified in other transport modes as "lack of situation awareness" or "complacency" (aviation), "ATC-behaviour" (rail), "radar-assisted accidents" (sea). The rapid development and introduction of new advanced technological driver assist systems can be victim to behavioural adaptation in the classic sense but perhaps mostly manifested as reduced vigilance Another important safety challenge concerns the adaptation and interplay of new and old technologies; navigation systems may guide drivers of heavy vehicles onto unsafe roads; modern cars and drivers with automated responses may act differently than for example older drivers in traditional cars etc. A particular future challenge will be how traditional road users adapt and interact with automated vehicles. There is a need to understand the mechanisms of BA to new and old technologies and the associated interplay challenges between the modern and traditional drivers and vehicles. Research needs are: a) Identify mechanisms and examples of adaptation to technological changes in all transport modes and identify any common characters. Understand differences in relation to both technological levels and differences between subgroups (age, gender etc.). b) Investigate what determines user's attitudes to new technical systems and automated vehicles to understand why some road users tend not to adapt to the new technology. c) 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. d) 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. e) Develop an integrative human modeling approach (by coupling perceptive, cognitive and biomechanical features) to simulate future activities of operators/ users in a virtual environment (vehicle/infrastructures).	
Expected impacts	
Better understanding of how road users adapt to and utilize new transport technologies will provide the authorities, the motor vehicle industry etc. with vital knowledge about what instruments and safety measures that actually will work as intended (correct prediction of human responses) and those that will be victim of behavioural adaptation and thus not to the same extent be able to contribute to increased safety. Furthermore, better knowledge in this area can help authorities and industry with guidance about how new technologies ought to be introduced in order to avoid safety critical mismatch with existing technologies and undesirable behavioural adaptations.	

2

Suggested title of the research topic	**Innovative use and understanding of MAIS3+ and big data to estimate risk of whole travel chain**
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail/sea	
Specific challenge	
To maintain and improve transport safety levels is particularly challenging as new "soft mode" travel patterns in city areas are encouraged throughout Europe. The risk levels of cycling and walking are often poorly covered due to both lack of sufficient accident and injury reporting and to insufficient exposure data. The promotion of cross-modal travel particularly in urban areas, poses additional challenges with respect to mapping the risks and injury costs involved. The integration of hospital data of road accidents and injuries with traditional police records, like the Swedish STRADA-register, can provide more complete accident and injury figures. The EC and Member states have agreed to use the MAIS3+ definition to assess the number of serious injuries within the EU. However, because of methodological heterogeneity and differences in data collected between countries, it is still difficult to use and estimate the total number of serious injuries in Europe. New technologies, e.g. apps, can map whole travel chains and may be a valuable tool for providing exposure data. The combined utilization of new technologies to map exposure with possibilities for injury data, can provide better and more complete risk figures and thereby also accident and injury cost estimates for different road user groups and for whole travel chains.	
Scope	
Traditionally, accident data and information on the consequences (fatalities, slight/severe injuries, property damage only) are collected separately and evaluated differently for different transport modes by country and year and published by EuroStat. In road safety research there have been only a few studies looking into the risks of whole travel chains and investigating the safety effects of transferring traffic between road user groups. The potential to use hospital data and MAIS3+ to acquire good injury data regardless of where the accidents happened has for many years been looked upon as a promising possibility. Hospital data provides a more detailed insight into e.g. the number of pedestrian and bicycle accidents, which are largely underreported in official road accident statistics, but also admits the possibility to evaluate and study the risks for permanent medical impairment. It will also provide an opportunity to study the risks involved in transport chains including the accidents on board a transport carrier as well as accidents and injuries between carriers at bus stops, pavements and so on. Research needs / aspects to consider a) Insurance data / hospital data/ police data: Methods on how to merge different data sources in order to obtain an improved source of information on a European level should be investigated. Different bodies/agencies collect most of the times the 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 b) Since 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, the distribution of seriously injured according to MAIS3+ for different transport modes needs to be investigated. c) Research on single-pedestrian-accidents and relevant exposure data is necessary to obtain a high safety level from a "door-to-door" perspective and here hospital data is crucial. d) Develop methodologies to use newly developed techniques such as Drice Cam, mobile devices and navigation systems to explore accident and exposure data, through statistical	

methods that enhance in-depth accident investigation results combining data so obtained with macroscopic data. In-depth data collection should complement macroscopic data by means of thematic focus data gathering (e.g. pedestrian, bicyclist accidents etc.) 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.
Expected impacts
The utilization of hospital data will improve our knowledge of the consequences of accidents and provide better opportunities to select effective safety measures to achieve the EU's 2020 target for serious injuries. The utilization of hospital data combined with more complete exposure data can reveal the true risks involved of whole travel chains in addition to the risks for single road user groups. Furthermore, the utilization of hospital data could also be linked to treatment and cost data, giving the opportunity to obtain better basis to calculate real public costs of accidents. Such costs would be of great importance for the authorities in decisions about financing transport safety measures, asset management and the development of treatment facilities.

3

Suggested title of the research topic	**Fitness to operate and distraction**
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail/air/sea	
Specific challenge	
How to design the transportation system to take into account all forms of human limitations, both physical and cognitive etc. This will be particularly relevant in the future with increasing elderly population and with an increasing number of people with disabilities participating in normal life as well as for identified high risk groups such as young men.	
Scope	
Motivation: Fitness to drive or operate in the transport system can be viewed in both long-term and short-term perspectives. In a long-term perspective fitness is a result of training and education providing the system participants the necessary qualifications to operate safely. In a short-term perspective, fitness to operate is concerned with daily fitness, which may be impaired by lack of sleep, sickness, stress, ageing, disabilities, fatigue or intoxication. Accidents due to drivers and transport operators falling asleep is an important risk factor. Research shows that operators 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 the operators' 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 tasks involved. 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. Research needs are: a) Investigate the possibility of mutual learning between transport modes about fatigue management. b) 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. c) 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. d) Further research is needed to estimate the risk conferred by different distracting activities and the circumstances during which activities pose greatest risk. e) Better understanding of reasons for risky driving among young problematic drivers and related preventive actions such as rehabilitation programs and better education.	
Expected impacts	
Distraction is an important cause of crashes and the expected impact of an increased knowledge of these issues is that it results in fever distracted transport operators. Solutions to reduce the prevalence of driving and operating under sleepiness will save lives and severe injuries. Advanced technical solutions to detect, warn and help drivers and operators to avoid critical situations due to sleepiness needs to be innovative and based on unobtrusive techniques were the transport industry but also small companies' expertise is needed. The impact of this will in the long run be improved technical knowledge based on sensor development and human monitoring. Concepts for Fatigue management combining new technology with education and control may improve the companies' situation taking into account learning between transport modes is important and contribute to a	

healthier situation for especially the professional drivers. In the future systems that support automated driving will contribute to a safer journey, save fuel, contribute to less crashes and to a more effective way of using the time.
A better understanding of and effective preventive actions for high risk young drivers will lead to increased safety and fewer crashes in the transport system.

4

Suggested title of the research topic	**Planning for the ageing society and senior centred design of autonomous vehicles**
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail/air/sea	
Specific challenge	
How to design the transportation system to take into account all forms of human limitations, both physical and cognitive. Process toward partial and full automation in transport (personal vehicle, autonomous car-sharing) has to be carefully conducted in order not to exclude part of the population, especially seniors. Indeed, elderly people are fragile and their ratio in the population is going to expand in the future, so a dedicated concern has to be devoted to their specific needs and requirements.	
Scope	
A lot of heterogeneity exists in the older population, related to health and cognitive status, and also experiences, behaviour and expectations. It is crucial to study how factors such as gender, socioeconomic status, educational level, social support, and personality influence older people's habits concerning mobility and accessibility. The number of older car drivers is increasing, and the extent to which older people manage to drive and to handle new vehicle technology is an important question. In this framework, autonomous vehicles can be a great opportunity in terms of safety and mobility for this population by reducing drastically fatal traffic casualties. However, it is as pedestrians (and increasingly as bicyclists) that older people are most at risk in road traffic. Also, their knowledge about public transport services is often lacking, which may result in them travelling less than they might have done or shying away completely from using public transport. Sometimes the problem is not lack of information but too much of it or the wrong kind. Accessibility of the transport system is also a function of urban planning, land use, perceptions of security, facility provision and location. Research needs are: a) How do factors such as gender, socio-economic status, educational level, social support etc. influence subgroups of older people's habits concerning mobility and accessibility? b) Development of models providing a better understanding of 'the whole journey' from end to end, and of the public environment c) Countermeasures to allow for continued driving in safety (including Advanced Driver Assistance Systems and autonomous vehicles) d) How can a new generation of public transport systems and ways of providing information using the latest technology be found to meet the needs of older people? e) How can technical solutions in combination with information campaigns and training activities help develop bicycling and walking?	
Expected impacts	
Better understanding of the characteristics of the older population will increase the older people's mobility through appropriate and supported modes. This will include advanced assistance system designed according to their needs, expectations and public transport systems and automated vehicles. Investigations on acceptance and usability requirements for seniors will provide data to set up optimized cooperative intelligent transport system. Senior centred design will allow the development of adapted cooperative vehicles and their Human Machine Interaction, identifying recommendations and guidelines supporting developers and manufacturers in addition to public authority. The work will also facilitate modal shift of older people from the private car, and the participation and inclusion of older people in Europe's society. Another related and important impact will be the reduction of the number of injuries and severity experienced by older road users.	

5

Suggested title of the research topic	**Adaptation and development of infrastructure**
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail	
Specific challenge	
How to ensure that the transportation system is coordinated and works efficiently and how to adapt the infrastructure to automated vehicles and new transport demands developing in European cities.	
Scope	
European cities grow, partly due to planned population increase in urban areas. The transport infrastructure and the transport system in urban areas face serious challenges of how to provide safe and high-quality transport in urban areas with limited space and increasing populations. An important challenge for city planners and authorities relates to how to adapt or reuse present infrastructure to meet the new transport demands characterized by more use of "soft modes", public transport as well as automated vehicles. Can existing road infrastructure be utilized to suit pedestrians and cyclists, like e.g. the old Spanish railways being transformed to cycle ways? Copenhagen have built a new cycle "highway" above street level to facilitate the increasing number of cyclists, which is an example of "radical" infrastructure design that can serve as example for other cities. The facilitation of soft modes/public transport with restrictions on motorized traffic and parking is often not welcomed by business and trade, as they believe they lose customers. Hence, to adopt and develop sufficient transport infrastructure to accommodate the planned growth in bicycling, walking and public transport, also poses political challenges in addition to those related to traditional use and limited space. Another important challenge is related to the integration of goods delivery in city areas when parking and motorized traffic is restricted as well as new demands due to a higher degree of automated vehicles. Research needs / aspects to consider a) Research on the relationship of infrastructure, safety and mobility with special consideration on integrating safety and mobility for pedestrians and cyclists in city areas. b) Consider how urban planning and city authorities can accommodate the change in urban transport that is politically wished for, i.e. to adopt and develop infrastructure and environmentally friendly transport policies in delicate ways to minimize resistance from important stakeholders. c) Determine the necessary adaptation of Transport Infrastructure due to a higher level of automation	
Expected impacts	
Transport infrastructure has a major impact on the modal split. The proposed research will provide important knowledge of how to develop and adapt transport infrastructure to meet the new transport demands in urban areas with increasing populations.	

6

Proposal for programming a H2020 research topic	
Suggested title of the research topic	**Safety climate – work related safety**
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail/air/sea	
Specific challenge	
How to ensure that operators and users of the transport system give safety considerations sufficient priority? This is important because the transport market in Europe is becoming more integrated with the increased competition where safety considerations may be harmed and because new technical assistance systems can provide suboptimal adaptations.	
Scope	
Motivation: 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, nuclear power plants etc. Safety climate/culture has also been focused in aviation and rail, whereas in road transport such a focus is largely absent. There are ample opportunities to improve safety in road 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 interesting and potentially fruitful to investigate into the possibilities of adopting safety climate/culture principles also to private actors in transport, such as private car drivers. Research needs are a) Investigation of possible relationship between safety climate, safety culture and accidents. b) Defining methods for implementing available knowledge and develop companies CRS's (Corporate Social Responsibility) including safety culture. c) Implementation of and research about effects of the new international standard for road safety, ISO39001[2]. d) Investigation of the possibilities of adopting safety climate/culture principles from aviation and rail to professional drivers on the road, like bus companies, haulage companies etc. e) Also the possibility to applying the principles of safety climate/culture to private actors in transport, such as private car drivers ought to be investigated.	
Expected impacts	
A growing number of publications document a positive association between safety climate/culture and actual safety both in general but also in the transport sector. Still, safety culture/climate has so far received little attention in road transport where the vast majority of transport accidents happen. There is thus a huge safety potential of the application of safety climate/culture principles to road transport.	

[2] ISO39001 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.

7

Suggested title of the research topic	**Evaluation of change/policy initiatives**
Programme	Transport
Timing/year Work Programme	2018/2019
Indication on "research area"	
Road/rail/air/sea	
Specific challenge	
How to ensure that the transportation system is coordinated and works efficiently? For example, to avoid that different levels of security requirements and infrastructures provides suboptimal traffic distribution or allocation of risk.	
Scope	
There is 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. Increased automation in all transport modes, including road, also contributes to bringing the different transport modes together and becoming more similar to each other. Traditionally different transport modes have had separated standards and such reorganisations and developments 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 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 needs are: a) 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. b) Research and evaluation methods for isolating the effects of policy initiatives c) Investigation of possible risk migration (from a mode to another mode) due to cross modal policy in Europe.	
Expected impacts	
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 Management are further arguments for the cross-modal management of safety and security.	

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