FACT SHEET NO.: 7 / 4 **PERFORMED BY: PRO**

A GENERAL INFORMATION

A 1	**Category**	**Research and Innovation**
A 2	**Subcategory**	**Framework - Transport safety**
A 3	**Transport policy measure (TPM)**	**Compulsory safety standards in road vehicles (Driver assistance systems, seat belt reminder, eCall, vehicle-infrastructure interface etc.)**
A 4	**Description of TPM**	In 2009, more than 35.000 people died on the roads of the European Union and about 1.5 million persons have been injured. Road safety is a major societal issue and causes huge costs (approximately 130 billion EU in 2009) for society. Although significant improvements concerning road safety have been made, there still has to be done much more to reach the European 'zero vision' target (zero fatalities on European roads by 2050). [3] Technology is expected to contribute substantially to reach the 'zero vision' target for road transport. Road safety technologies are: - advanced driver assistance systems - (smart) speed limiters - seat belt reminders - 'eCall'. This is a device which alerts rescue services automatically when a road crash occurs. - cooperative systems such as congestion warning systems and travel time prognoses based on current traffic and road conditions. - vehicle - infrastructure interfaces and - improved roadworthiness tests = vehicle inspection (including for alternative propulsion systems) [1][2]. This TPM focusses on technical safety systems, with special regard to: driver assistance systems and vehicle-infrastructure interface. - Advanced driver assistance systems (ADAS) are designed to support the driver in the driving process by taking over some vehicle control responsibilities. Prior to full automation there will be a stage of partial automation where technology will take over some vehicle control tasks. This means the driver is still responsible for driving, but some tasks will be managed by the ADAS. Examples are: lane departure warning, anti collision warning or pedestrian recognition systems.[4] - Vehicle-infrastructure interface (V2I = Vehicle-to-infrastructure) is a technology designed to directly linking road vehicles to their physical surroundings (infrastructure). Through a wireless exchange of safety and operational data between vehicles and (road) infrastructure the system is intended primarily to avoid or mitigate motor vehicle crashes. Furthermore, it will also lead to a wide range of other safety, mobility, and environmental benefits. Examples are: speed advice for green wave at traffic lights, routing to avoid congestion and area wide traffic information provision.[5]
A 5	**Implementation examples**	Applicable implementation examples of ADAS [9]: - Fuel efficiency advisor - Lane departure warning system - In-vehicle navigation system with typically GPS and TMC for providing up-to-date traffic information. - Adaptive cruise control (ACC) - Collision avoidance system (Precrash system) - Intelligent speed adaptation or intelligent speed advice (ISA) - Night Vision - Adaptive light control - Automatic parking - Traffic sign recognition Examples of V2I [8]: - Speed warnings in relation to curves, school zones and work zones, poor weather conditions - Pedestrian protection system
A 6	**Objectives of TPM**	Road accidents cause huge economic and human costs to society. Reducing the number of fatalities and injuries is one of the priority actions of the European Commission [1]. Furthermore, technical safety systems can help optimising traffic flows and reduce the risk of congestion.
A 7	**Key changes concerning:**	
A 7.1	- Choice of transport mode / Multimodality:	No key changes
A 7.2	- Origin and/or destination of trip:	No key changes
A 7.3	- Trip frequency:	No key changes
A 7.4	- Choice of route:	V2I systems provide real time traffic information which will lead to different choices of routes adjusted to congestion, accidents, avalaible parking and other traffic information [6].
A 7.5	- Timing (day, hour):	No key changes
A 7.6	- Occupancy rate / Loading factor:	No key changes
A 7.7	- Energy efficiency / Energy usage:	Slightly more energy efficient driving can be expected, but is no key change concerning fuel consumption.
A 8	**Main source**	[1]

B IMPACTS

B 1 OVERVIEW ON IMPACTS

		AFFECTED SEGMENTS: Passengers: Road	Rail	Air	Public transport	Slow modes	Transport operators: Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	Geographical level: 1st level	2nd level	Source: Source of assessment	Spatial level of source
B 1.1	**Summary**	→					→											R	N	S	I

- In general, ADAS and V2I systems have the potential to deliver major positive impacts on road users, residents and society. But before these systems can be successfully implemented it will be essential to improve acceptance under private vehicle users. Currently, privacy issues and the feeling of losing control of driving restrains ADAS and V2I systems from being totally embraced by private vehicle users [6].
- There are clear benefits for slow modes, residents near motorways and society. Most vehicle technology systems (including ADAS and V2I systems) will improve road safety for all road users, shorten travel time and reduce traffic pollution and emissions [1][3].
- Public bodies will be responsible for the construction of the needed physical infrastructure, its maintenance, and operating costs. This will lead to substantial financial burdens on public bodies over a long period of time [6].

B 1.2	**Summary: Income groups**	No specific social groups are affected by the TPM.
B 1.3	**Summary: Age groups**	
B 1.4	**Summary: Disabled people**	
B 1.5	**Summary: Gender groups**	
B 1.6	**Summary: Ethnic groups**	

B 2 TRAFFIC IMPACTS

		AFFECTED SEGMENTS: Passengers: Road	Rail	Air	Public transport	Slow modes	Transport operators: Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	Geographical level: 1st level	2nd level	Source: Source of assessment	Spatial level of source
B 2.1	Travel or transport time	↘					↘											L	R	S	I
B 2.2	Risk of congestion	↘					↘											L	R	S	I
B 2.3	Vehicle mileage	→					→											L	R	S	I
B 2.4	Service and comfort	↗					↗											N		S	I

B 2.I	**Overall impacts on social groups**	
B 2.II	**Implementation phase**	
B 2.III	**Operation phase**	
B 2.IV	**Summary / comments concerning the main impacts**	- Travel time for road vehicle will decrease through V2I and ADAS. Mainly, because these technology systems will increase efficiency of road use [6]. - V2I and ADAS technology will not only be beneficial for road safety, but will also create a more homogeneous traffic flow. Besides, V2I will provide road users with real time traffic information which will enable drivers to adjust their routing and be able to avoid congestion [3]. - Vehicle mileage will be less consistent as it used to be. Road users will be able to adapt their routing based on real-time traffic information. This will lead to additional vehicle mileage when V2I systems suggest a longer route to avoid congestion or free parking spaces. But, this will not lead to substantial changes, because ADAS and V2I will reduce the risk of congestion and accidents. Which means, that alternative (longer) routing will be limited. Altogether, vehicle mileage will stay more or less the same [6]. - Service and comfort will increase through reduced congestion, predictable journey times and lower vehicle operation costs (due to more economical driving behaviour caused by ADAS and V2I) [9]. These clear benefits will go hand in hand with some minor disadvantages of the safety systems: First, privacy is a big issue for private car users. A systems which demands private car users to build a black box in their vehicle which saves data all the time will encouter heavy resistance from users. Second, public acceptance is currently low as drivers do not want to feel that they are losing control of their vehicle [6]. - Optimizing the road usage, e.g. by minimizing the distance to vehicles in front and minimizing brake actions that lead to sudden braking (causing accidents and congestion). This will lead to a more homogeneous traffic flow [7].
B 2.V	**Quantification of impacts**	

B 3	ECONOMIC IMPACTS	AFFECTED SEGMENTS																Geographical level		Source	
		Passengers					Transport operators														
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	**Employees in transport**	**Residents**	**Economy**	**Public bodies**	**Society**	1st level	2nd level	Source of assessment	Spatial level of source
B 3.1	Transport costs	➔					➔											**L**	**R**	**S**	**I**
B 3.2	Private income / commercial turn over																				
B 3.3	Revenues in the transport sector																				
B 3.4	Sectoral competitiveness																				
B 3.5	Spatial competitiveness																				
B 3.6	Housing expenditures																				
B 3.7	Insurance costs																				
B 3.8	Health service costs	↘				↘											↘	**N**		**S**	**I**
B 3.9	Public authorities & adm. burdens on businesses															↗		**N**	**L**	**S**	**I**
B 3.10	Public income (e.g.: taxes, charges)																				
B 3.11	Third countries and international relations																				
B 3.I	**Overall impacts on social groups**																				
B 3.II	**Implementation phase**																				
B 3.III	**Operation phase**																				
B 3.IV	**Summary / comments concerning the main impacts**	- Shorter travel and transport times will reduce transport costs. Furthermore, reduced maintenance and insurance costs will be flatten out by purchase costs of road safety technology systems (related to ADAS systems). The net effect is not clear at this moment. [6] - Health service costs will decline through decreasing number of fatalties and injuries through road accidents. [1] [3] - Public bodies will be faced with costs for the construction of needed infrastructure. Additionally, they will be responsible for maintenance and operating costs of technology systems (related to V2I systems). [6]																			
B 3.V	**Quantification of impacts**	For trucks, the use of ACC (adaptive cruise control) combined with FCW (forward collision warning) has a very positive benefit-cost ratio between 3.9 and 5.2. It is therfore clearly beneficial from the societal point of view. For cars, the attainable benefits are not sufficient to compensate for the costs. The benefit-cost ratio ranges between 0.5 and 0.7; the system is either too expensive or users on average drive too less km to pay off the "investment". The ACC+FCW system represents foremost a comfort system. These effects are however not subject of monetarisation in a transport-focused cost-benefit analysis. [10]																			

B 4	SOCIAL IMPACTS	AFFECTED SEGMENTS																Geographical level		Source	
		Passengers					Transport operators														
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	**Employees in transport**	**Residents**	**Economy**	**Public bodies**	**Society**	1st level	2nd level	Source of assessment	Spatial level of source
B 4.1	Health (incl. well-being)	➔				↗	➔							↗			↗	**N**		**S**	**I**
B 4.2	Safety	↗				↗	↗							↗			↗	**N**		**S**	**I**
B 4.3	Crime, terrorism and security																				
B 4.4	Accessibility of transport systems																				
B 4.5	Social inclusion, equality & opportunities																				
B 4.6	Standards and rights (related to job quality)																				
B 4.7	Employment and labour markets																				
B 4.8	Cultural heritage / culture																				
B 4.I	**Overall impacts on social groups**																				
B 4.II	**Implementation phase**																				
B 4.III	**Operation phase**																				
B 4.IV	**Summary / comments concerning the main impacts**	- Well-being for residents and society will benefit from vehicle technology systems like ADAS and V2I. Mainly because of environmental benefits for residents living near heavy congested motorways and societal benefits because of less fatalties through road accidents. - A clear negative impact on well-being is caused by the poor acceptance of vehicle technogolies among private vehicle users. Primarily private vehicle users are sceptical when it comes to privacy issues and the fact that they will lose some driving tasks to technology which they do not completely trust [6]. - The contribution of technology to the improvement of the safety record of road transport is undoubtable. Technologies like ADAS and V2I systems will decrease the number of accidents because they can interfere at times and point were drivers lose concentration or fail to see dangerous situations [3].																			
B 4.V	**Quantification of impacts**																				

B 5	ENVIRONMENTAL IMPACTS	AFFECTED SEGMENTS																Geographical level		Source	
		Passengers					Transport operators														
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	**Employees in transport**	**Residents**	**Economy**	**Public bodies**	**Society**	1st level	2nd level	Source of assessment	Spatial level of source
B 5.1	Air pollutants													↘			↘	**L**	**N**	**S**	**I**
B 5.2	Noise emissions													↘			↘	**L**	**N**	**S**	**I**
B 5.3	Visual quality of the landscape																				
B 5.4	Land use																				
B 5.5	Climate																↘	**N**	**I**	**S**	**I**
B 5.6	Renewable or non-renewable resources																				
B 5.I	**Overall impacts on social groups**																				
B 5.II	**Implementation phase**																				
B 5.III	**Operation phase**																				
B 5.IV	**Summary / comments concerning the main impacts**	- Innovative ADAS and V2I systems will encourage changes to more sustainable driving styles and behaviour which enhance sustainability and will help reduce traffic pollution emissions (NOx, PM and CO2) [7].																			
B 5.V	**Quantification of impacts**																				

C REFERENCES

C 1	**Other TPMs of this subcategory**	There are several transport policy measures related to safety, but none of them particuliar refering to ADAS or V2I. Selected vehicle safety standards are: - EU Directive 1991/671/EEC relating to the compulsory use of seat belts on front seats in vehicles of less than 3.5 tonnes. - EU Directive 2005/39/EC addresses the need for making the wearing of safety belts compulsory for all passengers, including children, except in public service vehicles. - EU Directive 2005/40/EC refers to roadworthiness tests for motor vehicles and their trailers. To guarantee road-safety, environmental protection and fair competition it is vital to ensure that road vehicles in operation are well maintained and tested. This way, it will maintain its performance as guaranteed by type-approval, without excessive degradation, throughout its life-time.
C 2	**References**	**International** [1] European Commission (2011): Commission Staff Working document . Accompanying the White Paper - Roadmap to a single European transport area. SEC(2011)391. Brussels [2] European Transport Safety Council (2011): Towards a Vision Zero for Road Safety in Europe, News Release, Brussels: ECTS [3] European Commission (2010): Towards a European road safety area: policy orientations on road safety 2011-2020. COM(2010) 389 final. Brussels [4] International Harmonized Research Activities (2010): Design Principles for Advanced Driver Assistance Systems - Keeping Drivers In-the-Loop, Working Group on ITS [6] CVIS - Cooperative vehicle-infrastructure systems (2010): Exploring the possibilities offered by next generation infrastructure vehicle communications in tackling urban transport challenges, Brussels [7] European Commission (2010): Definition of necessary vehicle and infrastructure systems for Automated Driving, SMART 2010/0064, Brussels: DG Information Society and Media [8] Federal Highway Administration (2011). Research for V2I Communication and Safety Applications. 2011 ITE Technical Conference, Orlando, Florida. http://www.its.dot.gov/presentations/V2I_Safety2011_ITE_Technical_Final_files/frame.htm [9] euroFOT (2012). European Large-Scale Field Operational Tests on In-Vehicle Systems. Final deliverable. 7th Framework programme. http://www.eurofot-ip.eu/download/library/deliverables/eurofotsp120121212v11dld113_final_report.pdf [10] euroFOT (2012). European Large-Scale Field Operational Tests on In-Vehicle Systems. Overall cost-benefit study. http://www.eurofot-ip.eu/download/library/deliverables/eurofotsp620121130v11dld67_overall_costbenefit_study.pdf **National** [5] U.S. Department of Transport (2010): Roadway Geometry and Inventory - Trade Study for IntelliDrive Applications, Georgetown Pike: Turner-Fairbank Highway Research Center