RIDERSCAN

European Scanning Tour for Motorcycle Safety

Safer Motorcycling in Europe now !

How can we tackle motorcycle safety challenges for the next decade ?

riderscan.eu

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Introduction

In 2008, hosted by the Norwegian Ministry of Transport, the first international workshop on PTW safety (Lillehammer, 2008) took place. Following 2 days of discussions with one hundred safety and PTW experts, the workshop came up with a top-20 list of recommendations to improve PTW safety[1], *inter alia* the critical need to work together (priority n°20).

In 2010, following the Lillehammer conclusions, the Federation of European Motorcyclists' Associations (FEMA) launched the European Motorcyclists' Forum (Brussels, 2010) with the objective of enhancing communications between EU authorities and PTW stakeholders..

In the meantime, the European Commission has finalized its Communication *Towards a European Road Safety area: Policy Orientations on road safety 2011-2020* following a preparatory consultative phase *the 4th EU RSAP 2011-2020 (2009)*; and the United Nations has adopted its *Declaration for a Decade of Action for Road Safety 2011-2020* (Moscow, 2009). The European Parliament has also joined in, publishing its own initiative *Road Safety Report*. All of these documents only partially address the 20 priority actions identified by PTW safety experts in Lillehammer.

The international efforts were rounded off by several national initiatives tackling some of the issues at stake to improve PTW safety.

In this context, FEMA considered it was high time to compile, review and structure available expertise and initiatives. With the support of the European Commission (EC), the Motorcycle Industry (ACEM) and the Mutuelle des Motards (AMDM), it launched the *European Scanning Tour for Motorcycle Safety* (RIDERSCAN) in 2011.

For three and a half years (November 2011 – April 2015), the project collected existing information on motorcycle safety in Europe, identified needs for action and established a cross-border knowledge-based network, thereby creating a lasting European framework for communicating and collecting data on PTW safety.

Table 1 **PTW Safety - Political priorities for the last decade**

Riderscan work focus

	The OECD/ITF Lillehammer Workshop on Motorcycle Safety	The EU Communication Towards a European Road Safety area: policy orientations on road safety 2011-2020	The European Parliament Road Safety Report	Preparation of the 4th EU RSAP 2011-2020. Public Consultation results
Improving **education and training programmes** for riders and drivers	✓	✓	✓	✓
Improve **awareness**: Getting safety messages across to riders and improving other road users' awareness of PTW riders	✓	✓	✓	✓
Transport **and road infrastructure policy**: roadway design for PTWs (including crash barriers)	✓	✓	✓	✓

1 http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html

Research, evaluation, technical developments				
Promoting the use of **modern technology** (active and passive safety, ITS) including brake systems				
Standards for personal protective equipment	✓	✓		
Enforcing speed limits, drink-and-drive laws, helmet use, combating PTW tampering and riding without licence		✓	✓	
Extending existing EU roadworthiness testing legislation to PTWs		✓		✓
Improving indicators and data				
Enhancing policy dialogue				
Improving emergency and post-injury services		✓		

The project reports on areas for European action (legislation, standardization, research and political needs), but also disseminates conclusions to relevant stakeholders at national level. In so doing, the project expects to create a new momentum among road safety stakeholders by upgrading knowledge, enhancing communication and improving cooperation between the various areas related to motorcycle safety.

Objectives

The main objectives of the project included the *identification and comparison of national initiatives on PTWs*, and the *identification of best practices*. Another important objective was to *collect and structure existing knowledge* at European level in order to *identify critical gaps* for future efforts to focus on. Finally, the project aimed at identifying the critical *needs for policy action*, whether at European or national level, with a view to disseminating them to a wide range of relevant stakeholders in Europe in the coming years.

Activities

The project activities with regard to the 8 safety areas aimed at gaining a better understanding of the topics, collecting knowledge and best practices, and comparing EU countries and their national approach to PTW-specific issues.

Table 2 **RIDERSCAN project activities**

• Gaining a clearer picture of 3DLD implementation, good practices and issues related to its implementation • Identifying priority areas for action and putting forward recommendations to improve the 3rd Driving Licence Directive (3DLD) and prepare the future 4th Driving Licence Directive (4DLD)	Deliverable 1
• Identifying missing data at European level • Making recommendations on data collection harmonisation	Deliverable 2
• Gaining a clearer picture of common infrastructure problems for PTWs in Europe • Identifying priority areas for action through standardization and other targeted activities	Deliverable 3
• Collecting and comparing police accident reports in Europe • Crossing the analysis with data collection and statistical needs (D2) • Making recommendations and identifying needs for harmonized accident reporting	Deliverable 4
• Compiling an overview of EU research work related to PTW safety • Identifying major research gaps that would require a focus in coming years	Deliverable 5
• Setting the scene for ITS with and for motorcycling (definitions, framework) • Gaining a clearer picture of existing ITS for motorcycling and existing systems/functions classifications • Improving understanding of riders' perception of ITS • Identifying specific PTW aspects with regard to ITS developments • Reporting on existing traffic management best practices for motorcycling	Deliverable 6
• Compiling an overview of and evaluating existing European awareness campaigns focused on road safety, including those that relate specifically to PTW riders • Making recommendations on ways and means of addressing specific safety messages to the motorcycling community	Deliverable 7
• Comparing existing national road safety strategies and/or national motorcycle strategy/action plans in Europe where they exist • Reporting on national best practices	Deliverable 8

With the objective of gathering as much expertise as possible, the project collected feedback and information from many different sources, and in many different ways.

Literature review

The project went through a detailed literature review of European documentation, including EU and EU stakeholders' policy papers, EU research project outcomes, and the proceedings of stakeholder meetings and other forums. The total number of documents collected currently exceeds 920, available in the project database.

Literature review of the main related policy documents

With the objective of gaining a preliminary overview of the key safety aspects to be considered in the PTW safety debate, and of the project safety areas in particular, the project team undertook a detailed comparison of the PTW safety policies of key PTW/road safety stakeholders. This overview is summarized in Annex 14.

EU research outcomes

Part of the work consisted of identifying and summarising the main outcomes of EU co-financed projects of relevance to the 8 safety areas covered by the project. This extensive reviewing work is available in Annex 21, and includes reviews of the outcomes of the following projects:

2-BE-SAFE	MAIDS	ROSYPE	SUNFLOWER+6
APROSYS	MOSAFIM	SAFERIDER	SUPREME
CAST	MOTORIST	SAFERWHEEL	TRACE
DaCoTA	MYMOSA	SAFETYNET	TRAIN-ALL
eSum	PILOT4SAFETY	SARTRE 1-4	TRAINER
EURORAP I and II	PISA	SIM	VRUITS
IN-SAFETY	PROMISING	Smart RRS	WATCH-OVER
IRT	ROSA	STAIRS	WHITEROADS

Stakeholders' feedback and priorities

The project then worked at collecting as much expertise as possible and integrating the views and priority areas for action of many different PTW safety stakeholders. The project collected input from many different perspectives. Contributors included: the European Commission, Member States' National Authorities, Road Safety Agencies and Research Institutes, the Motorcycling Community (industry/users), and Pan-European stakeholders. The number of interviewed experts totalled 112.

This feedback collection took several forms, depending on stakeholders' accessibility and availability, and included the following activities:

Amplifying Questions

After a first analysis of needs, a set of amplifying questions was prepared to further explore national situations for each safety topic. A questionnaire (Amplifying Questions) was designed to survey the different categories of stakeholders directly involved in policymaking (Member States, the European Union, Motorcycling Community representatives, EU stakeholders).

This questionnaire was reviewed by the following experts from the Expert Group members:

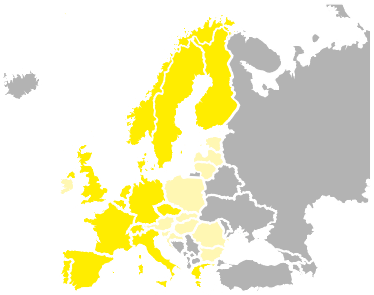
- Marcellus Kaup from CIECA for Deliverable 1 on training, testing and licencing.
- Kris Redant, Peter Saleh and Xavier Cocu from FEHRL for Deliverable 3 on infrastructure
- Bertrand Nelva-Pasqual from Mutuelle des Motards for Deliverable 4 on accident reporting
- Pierre van Elslande from IFSTTAR for Deliverable 5 on research
- Gabrielle Cross from MIRA for Deliverable 6 on traffic management and ITS (replaced by Aki Lumiaho in the course of the project)
- Andy Mayo from Local Transport Projects UK for Deliverable 7 on awareness campaigns
- Robbert Verweij from the Dutch Ministry for Infrastructure and the Environment for Deliverable 8 on national strategies.

Answers to the questionnaire were collected via phone interviews, written answers, or face-to-face meetings, summarized in Annex 4/ Annex 5/ Annex 6/ Annex 7

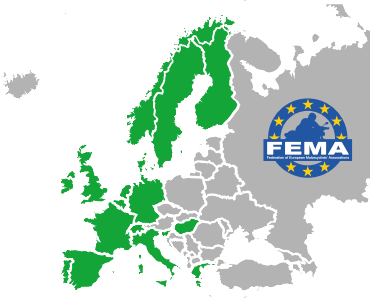
European Motorcyclist Surveys

In addition to these semi-structured interviews, the project also undertook 3 pan-European surveys to collect the views of riders themselves in the fields of licencing and training (Training survey), Intelligent Transport Systems (ITS Survey), mobility and safety habits (Motorcycling survey):

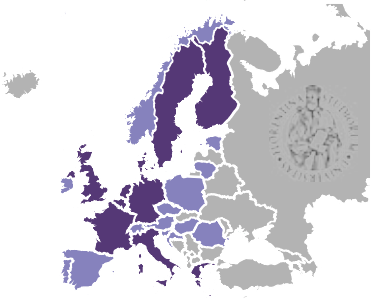
- The *Motorcycling Survey*. A survey targeting European riders was designed to collect information on the motorcycling community around Europe and gain a better overview of similarities and differences in terms of riding, attitudes and safety needs.
  The Pan-European survey was disseminated at national level via riders' groups and the motorcycling press in addition to being disseminated via Internet.
  It collected over 17,000 usable answers from 18 European countries. More details on the survey in Annex 1.



- The *Training, Testing and Licencing User Survey*. This public survey, which collected 442 answers, aimed at gaining a concrete understanding of the issues riders face in terms of training, testing and recent administrative and licencing changes, including the new rules contained in the 3rd Driving Licence Directive since 2013. See Annex 2.



- The *ITS User Survey*. This aimed to capture riders' attitudes towards safety systems at large. The Pan-European survey was disseminated at national level via riders' groups and the motorcycling press in addition to being disseminated via Internet. It collected over 4,500 usable answers from 18 European countries.
  Survey findings can be read in Annex 3.



These surveys were disseminated using the European network of PTW magazines, newly constituted in the context of the project. The total number of motorcyclists surveyed exceeded 31,000. The surveys were kindly analysed by the University of Firenze (ITS Survey), Mutuelle des Motards (Motorcycling survey) and FEMA (Training survey).

Participation in policy debates

Input from public workshops and other public events related to the topics covered were also collected and included in the overall analytical process. Attended events included:

Table 3 **Event participation**

Event	Place	Date
European Motorcyclists Forum	Köln (DE)	3/10/2012
DaCoTA Conference	Athens (GR)	22-23/11/2012
FEMA Committee Meeting	Stockholm (SE)	1/06/2013
FEMA Committee Meeting	Brussels (BE)	5/10/2013
Slovenian Road Safety Authorities Meeting	Ljubljana (SLO)	13-16/10/2013
IFSTTAR Journées scientifiques Deux-roues motorisés	Paris (FR)	15-16/10/2013
EC DG MOVE Workshop on National Road Safety Strategies and Action Plans	Brussels (BE)	25/11/2013
FOTNet 10th Stakeholder workshop on Naturalistic Driving Studies	Brussels (BE)	26/11/2013
2013 Annual POLIS Conference - Innovation in Transport for sustainable cities and regions	Brussels (BE)	4-5/12/2013
Forum for Automobile & Society on Road Safety	Brussels (BE)	21/02/2014
FIA Workshop Road Safety & Connected Mobility	Brussels (BE)	21/02/2014
European Motorcyclists Forum	Brussels (BE)	5-6/03/2014
ITS Advisory Group	Helsinki (FIN)	16/06/2014
ITS EU Congress	Helsinki (FIN)	18-19/06/2014
FEMA Committee Meeting	Reykjavik (ISL)	31/05/2014
EC Infrastructure Meeting	Brussels (BE)	13/06/2014
iMobility Forum VRU WG ERTICO	Brussels (BE)	23/04/2014
ifZ Conference	Köln (DE)	29-30/09/2014
TRB Meeting	Brussels (BE)	5/11/2014
iMobility Forum Research & Innovation WG Workshop	Brussels (BE)	27/01/2015
5th iMobility Forum Plenary Meeting	Brussels (BE)	28/01/2015
European Motorcyclists Forum	Brussels (BE)	2-3/02/2015
3rd EU-US Transportation Research Symposium on "Road Vehicle Automation"	Washington (USA)	14-15/04/2015

Project workshops

To discuss the project outcomes with a whole range of European stakeholders and collect any additional relevant inputs, the project organized 3 *European Motorcyclists Forums* (EMF), each comprised of a series of workshops.

Complete reports from project workshops: Annex 11, Annex 12 and Annex 13.

Pan-European stakeholders' feedback

The project also collected the views of pan-European stakeholders and discussed deliverable key findings. The former included ACEM, BAST, FERSI, CAST, CIECA, ERF, EURORAP and iGLAD.

Internal review and analysis

Parallel to these 360° collection and review processes, the project team also conducted several internal analyses and comparisons to complete the overall safety picture.

Table 4 **RIDERSCAN project analyses**

A comparison of PTW safety policies and stakeholders' priorities	D1, D2, D3, D4, D5, D6, D7, D8 Annex 14
A detailed analysis of main EU research outcomes regarding PTW safety	D1, D2, D3, D4, D5, D6, D7, D8, D9 Annex 21
A detailed comparison of today's licence access schemes in Member States including minimum age, training and testing requirements)	Deliverable 1 Annex 19
A qualitative analysis of the answers provided by riders on the new Riding Licencing scheme	Deliverable 1 Annex 2
A summary of the findings of in-depth PTW accident causation studies	Deliverable 2 Annex 17
An overview of variables collected per country in public motorcycling statistics and the identification of missing data or needs for harmonizing data	Deliverable 2
A review of the CARE initiative and related CADaS protocol	Deliverable 2 Deliverable 4 Annex 20
A comparison of national PTW safety guidelines for road design	Deliverable 3 Annex 8
The design of a black spot report form to be used by the PTW riding community	Deliverable 3 Annex 16
A comparison of 9 accident report forms from 9 Member States	Deliverable 4 Annex 20
An overview of the EU policy and research framework on ITS and transportation	Deliverable 6
An overview and classification of ITS developments for motorcycling	Deliverable 6

An analysis of close to 200 descriptions of the difference between riding and driving with regard to ITS development and training aspects	Deliverable 6 Annex 15
A comparison and structuring of ITS research priorities for PTW safety identified by different expert discussion platforms	Deliverable 6
An analysis of EU riders' priority rating of ITS systems/functions for PTWs	Deliverable 6 Annex 3
An analysis of the motorcycling community's subjective evaluation of a representative sample of national awareness campaigns aiming at tackling motorcycle safety issues	Deliverable 7
A compilation of PTW-safety-related awareness campaigns in Europe	Deliverable 7 Annex 10
A comparison of existing national strategies with regard to PTW safety	Deliverable 8 Annex 9
A preliminary perspective on PTW safety relevance of existing Safety Performance Indicators	Deliverable 8 Annex 18
Overall analysis of Member States' feedback	Annex 4
Overall analysis of the motorcycling community's feedback	Annex 5
Overall analysis of EU stakeholders' feedback	Annex 6

Drawing conclusions & recommendations

Finally, the information collected was compiled, reviewed and structured according to Europe's main levers for action, namely Research, Legislation, Standardization or Specific Actions.

Based on this input, the project concludes with a report on Key Challenges and Conclusions for each safety areas, accompanied by a list of Recommendations and priority actions for European and national levels.

Outcomes

All in all, the project activities have enabled the following outcomes:

Table 5 **RIDERSCAN project outcomes**

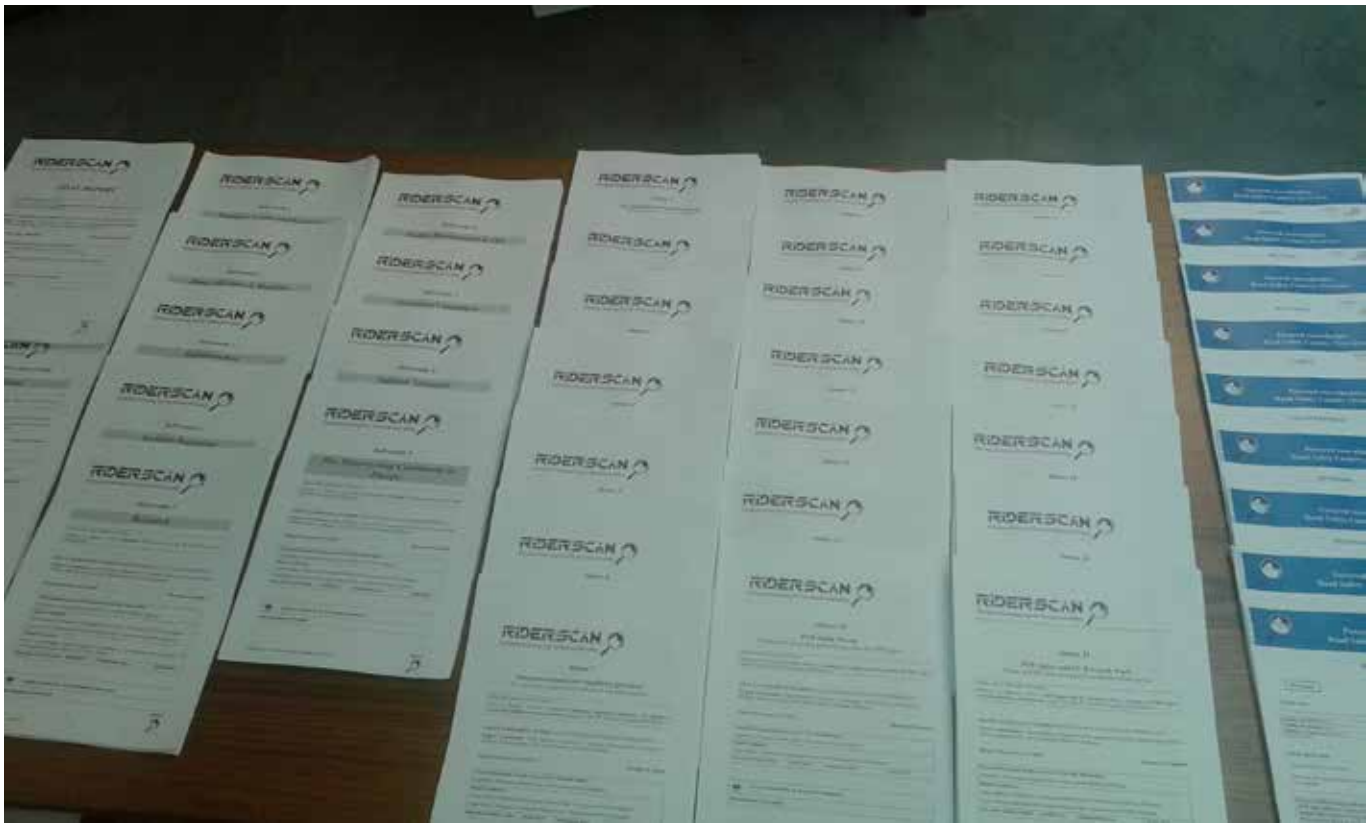
A summary of **EU research work** and **main conclusions** for the past decade related to the 8 safety fields	Annex 21
An EU **comparison of 3DLD implementation** and motorcycle access schemes	Annex 19
A picture of **EU riders' licences and the main geographical differences** in post-licence training	Annex 1
An **assessment of the 3rd Driving Licence Directive** in terms of training, testing and administrative and licencing changes by riders	Annex 2
Driving licence improvements, problems and best practices according to Member States, testing authorities, and the motorcycling community	Annex 4 Annex 5

An overview of the **main accident causation factors** based on 7 EU/national Powered Two Wheelers (PTW) in-depth accident studies	Annex 17
An overview of **variables collected per country** in public statistics reports on motorcycling	Deliverable 2
A table of variables recommended by the **CADaS protocol**	Deliverable 4
Recommendations for the use of the **CADaS protocol** and harmonization needs	Annex 20
A summary of **accessible data on motorcycle accidents** in the EU	Deliverable 2
A summary of **missing data in the EU** and recommendations on needs for harmonization	Deliverable 2
Comparison of **police accident report forms** and recommendations	Annex 20
A picture of EU riders' **problems with infrastructure** and the main geographical differences	Annex 1
A detailed review of existing **PTW/Infrastructure guidelines**, a list of **common problems** throughout Europe and **EU standards to be reviewed** to address priority issues	Annex 8
An overview of **Best Practices** throughout Member States (use of guidelines, PTW users as VRUs, black spot monitoring, "Vision Zero Roads" for PTWs)	Deliverable 3
A **Pan-European Black/White Spot Report Form** for use with ICT and involving the motorcycling community	Annex 16
A dedicated **infrastructure website** http://www.mc-infrastructure.eu/ addressing PTWs and infrastructure problems, along with a dedicated sub-**website on guardrails**, specifically focusing on roadside barriers http://www.mc-roadsidebarriers.eu/, including a **Motorcyclist Protection System Database, and Guidelines for road restraint systems**	Deliverable 3
Identification of **needs for PTW research** at national and European level	Deliverable 5
An overview of **ITS political context, legal frameworks and initiatives**	
An overview and **classification of ITS systems/functions for PTWs** in PTW-related safety areas	Deliverable 6
A European map of **rider acceptance of ITS** for PTWs	Annex 3
A primary description of the **specificities of the *riding tasks*** and their **impact on ITS development**	Annex 15
A picture of **EU riders' perceptions of national campaigns**	Annex 1
Motorcycling community **evaluation of PTW safety awareness campaigns** in Europe	Annex 10
Designing safety messages targeting the motorcycling community: common principles and rider-specific interventions	Annex 6 Annex 13
Dissemination channels and means to reach the motorcycling community: RIDERSCAN pan-European surveys lessons	Annex 1 Annex 2 Annex 3
A comparison of **national overall road safety strategies** and **national motorcycling safety strategies**	Annex 9
A first review of the literature on **Safety Performance Indicators** and a preliminary analysis of PTW specificities	Annex 18
A summary of key **stakeholders' recommendations for action** to improve • data collection and statistics for PTW safety; • access to PTWs; • PTWs' surrounding environment (infrastructure, ITS, traffic management) • communication with the riding community • action plans to tackle the main PTW safety issues	Annex 4 Annex 5 Annex 6 Annex 12 Annex 13 Annex 14

Deliverables

These outcomes were used to address and discuss the 8 safety areas covered by the project in 9 deliverables, the content of which was reviewed by the project experts.

1. **Training, testing and licencing**: Report on existing schemes, problems encountered, good practices, 3rd Driving Licence Directive (DLD) implementation, recommendations for 4th DLD (Deliverable 1)
2. **Data collection and statistics**: Report on available and missing data, proposals for harmonizing data collection related to motorcycling (Deliverable 2)
3. **Infrastructure**: Report on problems, existing solutions and standardization needs, recommendations for the development of a European road safety assessment programme for motorcycling (Deliverable 3)
4. **Accident reporting**: Report on accident reporting methods, recommendations for harmonizing police reporting (Deliverable 4)
5. **Research**: Overview of national and EU research on motorcycle safety, identification of duplication and gaps related to the 8 safety areas (Deliverable 5)
6. **Traffic management**: Report on existing and best practices (Deliverable 6)
7. **Awareness campaigns**: Report on means to address rider and driver behaviour, past and current campaigns, best practices and recommendations, overview of the motorcycle press and motorcyclist groups (Deliverable 7)
8. **National strategies**: Overview and analysis of existing national strategies in Member States, implementation and results and recommendations, recommendations for the development of a European Motorcycle Safety Performance Index (Deliverable 8)
9. **Motorcycling Community**: Report on motorcycling use and safety characteristics, the motorcycling population and ways of reaching it (Deliverable 9)



Supervisory group

The project report structure and content were subjected to a final review by the **project Expert Group**, made up of representatives from:

- CIECA for Deliverable 1 on *training, testing and licencing*;
- NTUA for Deliverable 2 on *data collection, statistics*;
- FEHRL for Deliverable 3 on *infrastructure*;
- Mutuelle des Motards for Deliverable 4 on *accident reporting*;
- IFSTTAR for Deliverable 5 on *research*:
- VTT for Deliverable 6 on *traffic management and ITS*;
- Local Transport Projects UK for Deliverable 7 on *awareness campaigns*;
- The Dutch Ministry for Infrastructure and the Environment for Deliverable 8 on *national strategies*.

Powered two wheeler safety today - What do we know?

Powered two-wheelers (PTWs) are a popular form of transport providing mobility to millions of people worldwide. However, unlike for other forms of motorised transport, PTW users, as with cyclists, remain more vulnerable on the roads due to the intrinsic characteristics of the vehicle.

Supporting road safety decision-making requires having quantitative information on road users' attitudes and behaviour, on road safety measures implemented, rules and programmes (including enforcement), and on their social costs and benefits.

Over the past decade, collision records highlighted a substantial decrease in PTW casualties (motorcycles and mopeds). This decrease, albeit less pronounced than for other means of transport, is taking place against a substantial increase in the number of PTWs.

However, acquisition of additional and better data on PTW accidents, mobility and other issues should therefore receive top priority at European level because more comparable data is needed to understand the causes of accidents and find appropriate countermeasures..

With the aim of contributing to the effort to improve data collection and knowledge on PTW safety in Europe, the RIDERSCAN project focused on:

- Compiling an overview of EU research work related to PTW safety
- Identifying missing data at European level
- Making recommendations on data collection harmonisation
- Identifying major research gaps that would require a focus in coming years.

Lillehammer priorities

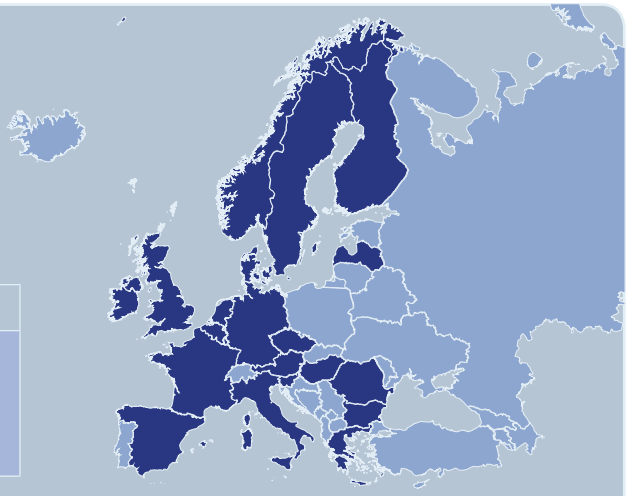
Priority n°3: Research and evaluation: Countermeasures need to be based on scientific research into driver and rider behaviour and before-and-after evaluations should be conducted.

Priority n° 16: Innovation: Where proposed countermeasures are not based on objective research, but are supported by all stakeholders, policymakers should test and evaluate the proposal in a pilot scheme.

RIDERSCAN outcomes (Deliverables 2, 4, 5)

- EU Research main data and statistics
- Comparison of 7 EU/National PTW accident in-depth studies on main causation factors
- Overview of variables collected per country in public statistics on motorcycles
- Data collection priorities according to the Motorcycling Community and Member States
- Comparison of police accident report forms
- Recommendations for improvements to the CARE database and CADaS protocol
- Summary of missing data in the EU and identification of data harmonisation needs
- Overview of EU Research main outcomes on PTW safety for the last decade
- Identification of needs for PTW research at national and European level
- Identification of Key Research priorities to improve PTW safety

Input received from...



EU stakeholders
DG MOVE, Dir. C Innovative and Sustainable Mobility, Unit 4 Road safety
BAST/FERSI - PROS
iGLAD Consortium
ACEM

	Member States	The Motorcycling Community	the Research Community
Austria	Statistics Austria		KFV (Austrian Road Safety Board)
Belgium		FEBIAC; MAG Belgium	BIVV-IBSR
Bulgaria	Trafficpol		
Czech Republic			Transport Research Centre
Denmark		MCTC	
Finland	TRAFI		
France	Conseil National de Sécurité Routière, Délégation à la sécurité et à la circulation routières (DSCR)	FFMC	IFSTTAR
Germany		BMW; IVM; IFZ; BU; BVDM	Federal Highway Research Institute (BASt)
Greece		AMVIR	National Technical University of Athens
Hungary	Hungarian Central Statistical Office		GRSP Hungary Association
Ireland	Road Safety Authority; National Roads Authority	MAG Ireland	
Italy	Italian Automobil Club, statistical department; ISTAT	ANCMA; Ducati; FMI	Centre for Transport and Logistics
Latvia	Road Traffic Safety Directorate		
Luxembourg	Statec, Police Grand-Ducale, Ministère du Développement durable et des Infrastructures	LMI	
Netherlands	Department of Road Safety, Ministry of Infrastructure and Environment	Kawasaki; Yamaha; MAG NL	SWOV Institute for Road Safety Research
Norway	Norwegian Public Roads Administration	NMCU	
Romania	Romanian Traffic Police Directorate		
Slovenia	Slovenian Traffic Safety Agency		
Spain			
Sweden	Swedish Transport Administration	SMC	Folksam, Road Safety Research department
United Kingdom	Road User Licensing, Insurance and Safety	BMF	

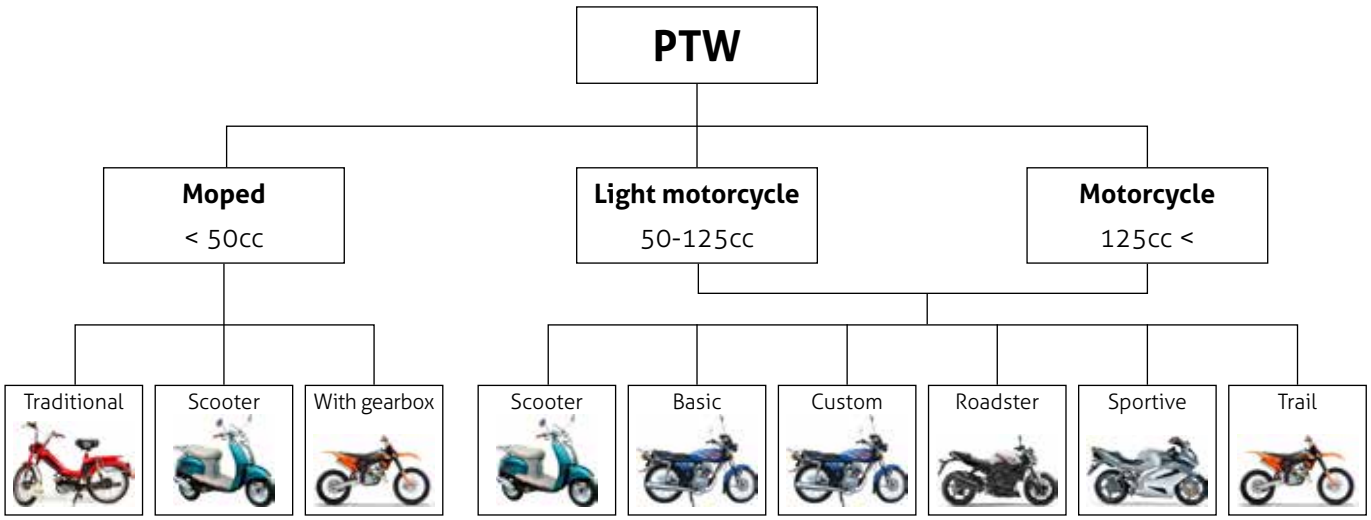
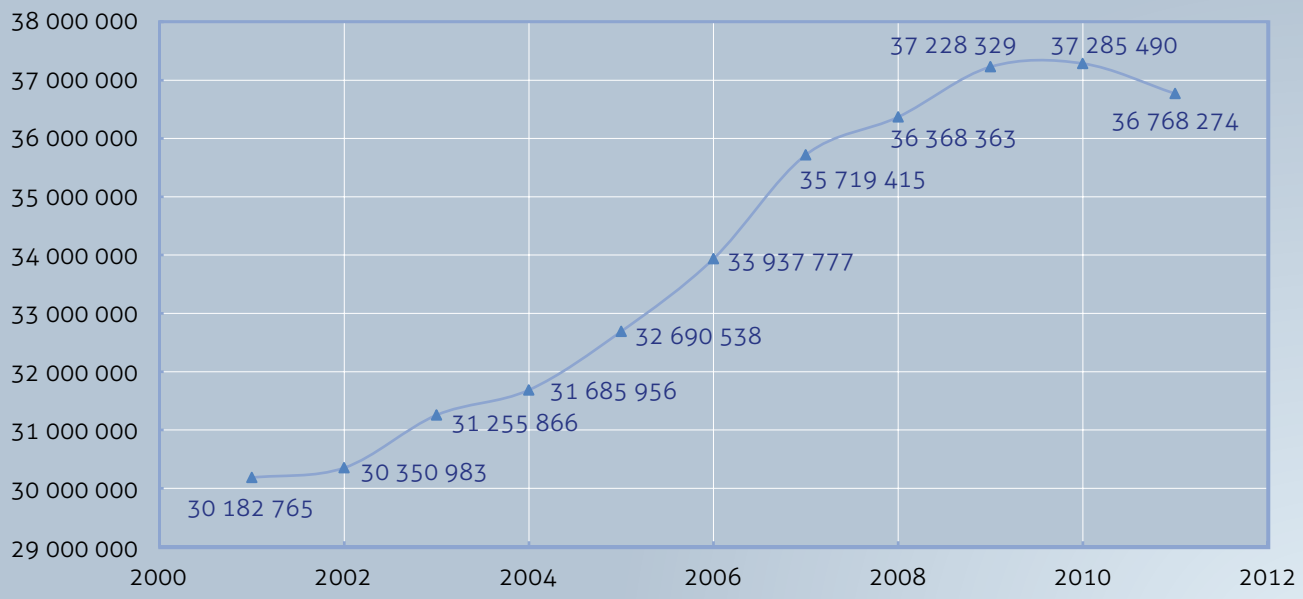


Figure 1 **PTWs variety park** (Source: OECD/ITF report on motorcycle safety, 2015 - to be published)

Figure 2 **PTWs circulating park** (Source: ACEM)

Figure 3 **PTWs circulating park (Source: ACEM)**



* European Union + Norway + Switzerland

EU POLICY AND DOCUMENTATION REVIEW

Data collection and research are not safety measures in themselves, but serve to study the need for and the effects of such measures.

As underlined by 2BESAFE, accident research incorporates the study of macro and micro accident databases / studies with respect to the casualty population. Macro studies record and investigate road accidents at a national and international level, whereas micro studies utilize in-depth and forensic investigation techniques to examine a much smaller number of crashes, but at a much greater level of detail. With police gathering data on injury collisions, there is a reasonable amount of recorded data across Europe at macro level, but there is very little in-depth or micro data collected.

All in all EU safety experts recognize data and statistics as being a critical element for improving PTW safety. **There is a lack of comprehensive data and research evidence about PTWs from a road safety perspective and as a sustainable form of transport**. This ranges from limitations in crash data reporting and collection, to the uncertainty about the effectiveness of a range of safety-related activities.

EUROPEAN STATISTICS

While the DACOTA project acknowledges that over the last two decades systematic efforts to gather and harmonise road accident data at a European level have led to a significant upgrading and enhancement of the CARE database, now providing very useful results as regards exposure data and safety performance indicators, it unfortunately concludes that PTW riders have only benefited marginally from these efforts and altogether, the availability, completeness and level of harmonization of this data vary significantly.

This opinion is shared by the European and International Road Federation (ERF/IRF), which suggests the development and use of a new statistical tool specifically aimed at gathering information on PTW accidents to ascertain the different factors which play a role in real-life conditions.

Table 1 **Estimated numbers of PTWs on the roads in Europe in 2013 (Source: ACEM)**

	Mopeds	Motorcycles
Austria	**300 000**	**456 000**
Belgium	200 000	451 000
Bulgaria		
Croatia	96 000	58 000
Cyprus		40 000
Czech Republic	**482 000**	**513 000**
Denmark	48 000	150 000
Estonia	14 000	25 000
Finland	300 000	250 000
France (2012)	**1 415 000**	**1 674 000**
Germany	**2 025 000**	**3 852 000**
Greece	**210 000**	**1 569 000**
Hungary		157 000
Ireland (2012)		35 000
Italy	**2 050 000**	**6 482 000**
Latvia		19 000
Lithuania (2012)	21 000	44 000
Luxembourg	9 000	17 000
Malta		17 000
Netherlands	**521 000**	**714 000**
Norway	176 000	162 000
Poland	**1 163 000**	**1 153 000**
Portugal	277 000	231 000
Romania		
Slovakia		74 000
Slovenia	41 000	52 000
Spain	**2 107 000**	**2 891 000**
Sweden	73 000	285 000
Switzerland	**175 000**	**688 000**
United Kingdom	**111 000**	**1 109 000**

Table 2 **PTW fatality rates (Source: CARE 10-10-2014)**

	Moped fatalities	Motorcycle fatalities	PTW fatalities	PTW rider fatalities as a percentage of the total number of road accident fatalities (2010)
Austria	**19**	**68**	**87**	
Belgium (2011)	20	127	147	15%
Bulgaria				
Croatia	16	62	78	
Cyprus	3	11	14	
Czech Republic	**7**	**86**	**93**	**12%**
Denmark	14	10	24	13 %
Estonia (2009)	3	2	5	5 %
Finland	7	21	28	10 %
France	**179**	**692**	**871**	**25 %**
Germany	**93**	**586**	**679**	**19 %**
Greece	**35**	**282**	**317**	**32 %**
Hungary	25	39	64	9 %
Iceland (2010)		1		13 %
Ireland		19		8 %
Italy	122	822	944	28 %
Latvia	3	7	10	6 %
Lithuania				
Luxembourg	0	5	5	3%
Malta (2010)		3		23 %
Netherlands	53	40	93	18 %
Norway				
Poland	82	621	343	9 %
Portugal	57	104	161	18 %
Romania	99	62	161	7 %
Slovakia (2010)		27		7 %
Slovenia	3	18	21	
Spain	63	293	356	20 %
Sweden (2010)	8	37	45	16 %
Switzerland (2010)	4	68	72	22 %
United Kingdom	12	320	332	21 %

EU RESEARCH WORK

In terms of available data, the review of these projects provides information related to the *market, motorcycle types, engine sizes, riding frequency, rider location, gender and age, education, family status, motivations to ride and profiles, fatality rates, road types and configurations, accident/vehicle types, weather conditions, accident causation factors, vehicle control, common accident types, risk factors, infrastructure, interaction between the rider/drivers/infrastructure, traffic management, accident scenarios, single vehicle accidents, impact and injuries, crash test scenarios, protective equipment, and design implication.*

However, most of the information available relates to analyses made on the basis of the CARE database. As noted by researchers from the 2BESAFE and VRUITs projects, it is important to stress the limits of CARE, and most of the national data, as all the information in these databases is mainly based on police reports. Moreover, the safety characteristics of mopeds and scooters bear a resemblance to both motorcyclists and cyclists. There are significant differences as well, justifying a separate category. Mopeds, scooters and motorcycles are often combined into a single category: 'powered two-wheeler' (PTW's)

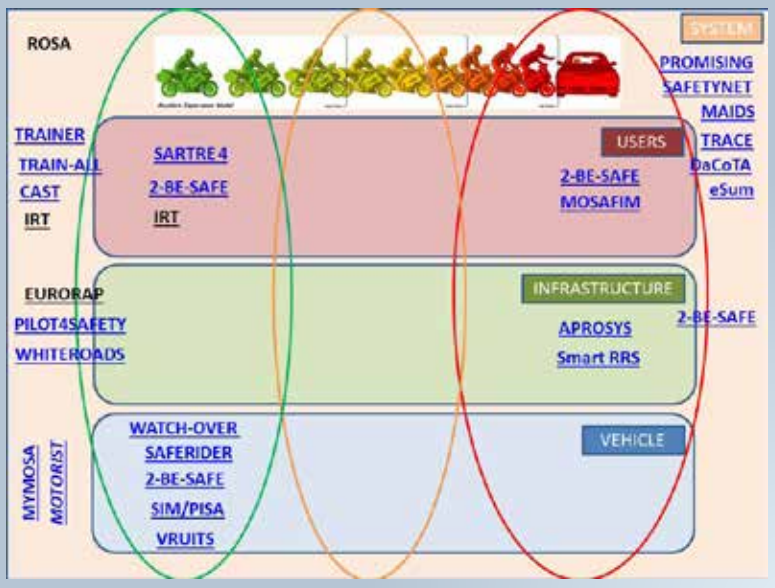
Additional data and related information sources have been established at EU level, including in-depth data, behaviour/attitude data, data on programmes and measures, social cost data etc., mainly within the context of European research projects. However, these data sources are still not of sufficiently comparable quality, are still not sufficiently linked, and the aggregate data are not always accessible. Finally, a high amount of national data remains unexploited at European level.

Of the 153 projects listed on the ERSO website (last consulted 18/04/15), only 25 projects relate to PTW safety, of which three-quarters date back to 2007 - 2012. Currently, the only dedicated project, SAFERWHEELS, has just started and will be investigating in-depth accident data. UDRIVE is expected to provide some naturalistic information, while VRUITS will propose an assessment of ITS for PTWs based on the FESTA methodology designed for cars.

Classifying EU research work according to the motorcycle accident sequence enables us to highlight the lack of focus on PTW *safety-critical events*, the *relationship between vehicle/users/infrastructure*, and the *related measures* needed.

The reason for this is clear: the lack of appropriate data and knowledge about conditions leading to accidents. For a more detailed overview of EU research projects reviewed, see "Overview of EU research projects on PTWs" (p. 183).

Figure 4 **EU research projects addressing the motorcycle accident sequence**



Stakeholders' views

Harmonising data collection processes throughout Europe is a difficult subject to tackle. All safety experts, and in particular those focusing on PTW safety, will agree that this is a critical issue when addressing PTW safety.

Behavioural knowledge

- There are a lot of differences between countries on PTW behavioural knowledge and MS differ in their focus on PTWs. What is clear is that, in European projects, there is a major lack of **behavioural knowledge** on PTWs. (BAST/FERSI)

Accident reporting

Any solution allowing more comparable data on PTW accidents to be gained at European level begins with the improvement of accident reporting across Europe. If harmonisation is too complex, we can at least *start by finding a way to make reports less different.*

- There is a huge need to improve accident reports. For example, in Germany, with the introduction of eBikes, there was a need to gain objective information on accidents involving them. This took 4 years to achieve. (*BAST/FERSI*)
- The CADAS protocol could contain more PTW data, but it needs to be pre-formulated by someone from CARE. (*BAST/FERSI*)
- According to FIM, police accident report forms provide us with an enormous potential, but great difficulties. Education of the police force is essential to convey the importance of gathering accident data. The quality of completed reports is often poor. A UN Working Party is looking at this issue. (*Workshops comments – European Motorcyclists' Forum 2012, 2014 and 2015*)
- In France, IFSTTAR has been collecting in-depth accident data for several years, working in cooperation with police services. The police frequently said that statistics was not their job, which is to protect people. They completed forms as a secondary task, and frequently entered "unknown" or made confusing statements. Progress has been made since then, notably with the introduction of control and correction steps, but every government still has to be persuaded to convey the importance of this task to their police. Notably when dealing with PTW crashes, insofar as their specific features require specific competences. (*Workshops comments – European Motorcyclists' Forum 2012, 2014 and 2015*)
- With regard to police accident reports: the police fill in a report, which is more or less the same throughout the EU. These reports provide a lot of information about accident conditions, but not about accident causation. It would be interesting to have distinct information collected on the road type (motorway, trunk road, secondary road or urban area); to have more information on accident conditions; and on social and societal factors (traffic, mileage, usage data and weather conditions). Certain other data cannot be exchanged at EU level due to data protection legislation. (*European Commission*)
- One solution regarding fatal accidents would be to have in-depth reports with much more information collected to be able to establish accident causation. But it is expensive and difficult to make them mandatory. (*European Commission*)

New technologies - ITS

- There is a lack of a PTW perspective, for example in ITS development. While one talks about Car2Car communication, C2I communication, one never refers to C2PTW, even though cars share large responsibility in PTW accidents. (*BAST/FERSI*)
- According to GDV, further research is needed on the expected benefits of ITS, and it is essential to develop a PTW-specific impact assessment methodology. (*Workshops comments – European Motorcyclists' Forum 2012, 2014 and 2015*)

- For GDV, conventional accident data was insufficient to come up with suitable designs for intelligent systems. The GDV representative stressed that new tools were needed and that naturalistic riding was one of the tools in the toolbox. Other necessary tools included simulator studies, in-depth accident research, all of which needed to be put together. The delegate added that the wheel did not need to be re-invented. Interesting research had already been done for cars and planes, and some issues were similar. The rider is still a human being, meaning that one could learn from these other research studies. (*Workshops comments – European Motorcyclists' Forum 2012, 2014 and 2015*)

Injury data

- A good point would be also to cross information about injuries (following the AIS structure) with hospital data. (*European Commission*)
- In the UK we have never been able to match up hospital data with accident data. For example, it's difficult to compare the severity of an injury as classified by the police to that classified by the medical team. In Sweden, from 1 January 2015, all hospitals report injuries from traffic accidents. It's been a law for the police forces for 10-15 years but they are not medically trained. Now we can get the correct information from the hospital. (*Workshops comments – European Motorcyclists' Forum 2012, 2014 and 2015*)
- A good point would be also to cross information about injuries (following the AIS structure) with hospital data. (*European Commission*)

Care database

- Member States are free to use or not use the CADAS structure. Generally speaking, national police accidents reports have adopted more or less the same structure. And it's up to the European Commission to organise the information gathered in a homogeneous way to allow comparison. (*European Commission*)

Table 3 **Data collection - Member State priorities**

At EU level	
✓	Exchange comparable data at EU level (vehicle fleet, personal injuries, age categories, mileage, safety equipment, alcohol and drug)
✓	Exchange the results of in-depth studies between EU countries
✓	Exchange non-statistical information between EU countries: on infrastructure, roadside barriers, final position of the vehicle after an accident
✓	Exchange hospital data with injury diagnosis between EU countries

Table 4 **Data collection - Motorcycling Community priorities**

At national level	
✓	Conduct more in-depth studies on a more regular basis / collect more detailed data on accidents involving PTWs
✓	Improve the collection of vehicle fleet data
✓	Collect more specific data on the L-category
✓	Collect data on PTW mileage
At EU level	
✓	Improve accident statistics comparability across the EU / Have more consistent data collection standards to gain comparable data across Europe
✓	Improve the collection of vehicle fleet data
✓	Collect and exchange more specific data on the L-category
✓	Harmonise alcohol and drugs tests at EU level

Comparisons & analysis

Research needs are so acute that what is needed is a strategic approach to PTW safety research. Without such a strategic plan, there is a high risk that public money will be spent on already investigated areas, while overlooking critical fundamental aspects or other specific research needs.

PTW in-depth studies review

Few countries undertook national in-depth accident causation studies aside from EU research projects (see table 5), underlining the role of EU research work in collecting essential data.

Table 5 **Availability of national in-depth studies**

Austria	**Yes: IDAF** **Within VRUITS**
Belgium	**No**
Bulgaria	Not known
Czech Republic	**No**
Denmark	Not known
Estonia	Not known
Finland	**Within 2-BE-SAFE** **Within VRUITS**
France	**Yes: 2RM Rapport** **Within MAIDS** **Within 2-BE-SAFE**
Germany	**Within APROSYS**
Greece	**Within 2-BE-SAFE**
Hungary	Not known
Ireland	Partly: see RSA national strategy technical report
Italy	**Within APROSYS** **Within MAIDS** **Within 2-BE-SAFE**
Latvia	Not known
Lithuania	Not known
Luxembourg	**No**
Malta	Not known
Netherlands	**Within APROSYS** **Within MAIDS**
Norway	**Yes: Norway fatal motorcycle accidents 2005-2009 report**
Poland	Not known
Portugal	Not known
Romania	Not known
Slovakia	Not known
Slovenia	**No**
Spain	**Within APROSYS** **Within MAIDS** **Within VRUITS**
Sweden	**Yes: The risk of injury to motorcyclists** **Within VRUITS**
Switzerland	Not known
UK	**Yes: In Depth Study of Motorcycle Accidents** **Within 2-BE-SAFE** **Within VRUITS**

In 2002, the OECD Road Transport Research Programme developed a common methodology to collect in-depth accident data. Unfortunately, as underlined by numerous research projects investigating EU and national accident databases, in-depth data collection methodologies still vary widely from one country to another.

The comparison of accident causation factors identified within national in-depth studies, illustrated in the table below, underlines the critical need to define/use common methodology to guarantee that the public money spent on such expensive research activities benefits more than one research project. This also underlines the role played by EU funding in expensive research activities.

Table 6 **Overview of PTW accident causation factors - In-depth studies comparison**

PTW accident causation factors	**MAIDS** *	**2BESAFE** **	**VRUITS** ***	**AT** ****	**ES**	**FR**	**NO** ****	**SE** ****	**UK**
OV* driver responsibility	X					X			X
Traffic scan errors	X	X		X		X	X		X
Perception failure by the OV*	X	X				X	X		X
Riders' lack of experience		X		X			X	X	X
Speed and extreme behaviour	X	X		X			X		
Road environment and infrastructure	X				X		X		
Technical fault and vehicle failure	X						X		

* MAIDS = France, Germany, Italy, The Netherlands, Spain
** 2BESAFE = Finland, France, Greece, Italy, UK
*** VRUITS = Austria, Finland, Spain, Sweden, UK
**** For Austria, Norway and Sweden, only fatal PTW accidents were studied

*OV = Other Vehicle

The private iGLAD initiative is an interesting way forward to be considered. Similarly, IRTAD harmonization work is to be included in the overall effort to guarantee a sustainable approach to data collection in the field of road safety.

Accident reporting & police accident report forms

The way the police accident report is filled in also differs from one country to another.

Table 7 **Accident reporting procedures**

Austria	An electronic police accident report is currently being tested. It displays a number of specific questions when the police officer checks the box "PTW". In the case of an injury accident, further data is collected. Included in the police report are some basic facts on the environment: type of road, road condition, weather, road design (curve, straight line). The cause of the accident can be assessed at a later date. The new electronic form contains one question on the cause of the accident. The answer is an educated guess by the responsible police officer.
Belgium	Accidents on motorways are recorded by the federal police and all other ones by the local police. There are a number of questions concerning cycle paths for cyclists and moped riders. But there is no specific section on other PTWs.
Bulgaria	The investigator has to fill in another report, a registration card (used for statistics only), and in this there are questions on the infrastructure (bridge, etc.). When the accident call comes to the police, they first have to secure the scene. The traffic unit (an auxiliary unit within the police) arrive at the scene of the accident once it has been secured to fill in the accident report and the registration card used for statistics. They may subsequently summon a more specialized investigation unit to collect information for the court case. This is only done in the case of injuries or fatalities.
Finland	The forms are computerized and the police have a connection to Trafi's vehicle database. Accident location coordinates come from the police car's GPS.
France	Even if there is no special section on PTWs, there are a number of PTW-specific questions: type of vehicle, brand and whether a helmet was worn. The police accident report can be initially filled in on the spot just after the accident, though information is missing and the police have to come back to the spot some days later to complete the report. One of the major problems of accident reporting is that the person who intervened at the moment of the accident and the person who completes the report are not the same (different ministries, different services, etc.).
Germany	The accident is registered by the police on site when they are summoned to the accident. Accident details are registered in the computer system later on at the police station. But it is also possible for an accident to be registered with the police some time after it occurred.
Greece	There are a couple of questions specific to PTWs (wearing a helmet, seat position).
Ireland	The police accident report is in electronic form. There are different investigations in the case of collision. If the collision is minor, the police just fill in the standard collision report at the scene of the accident to try to reconstitute the crash. If there is a fatality, a forensic expertise is compiled. Alongside the police report and the forensic expertise (with information about the vehicle, driver, i.e. a very detailed report), the National Road Authority (within 7 days) will also compile a report, this time more on the road structure itself.

Netherlands	For some crashes the police are present and have to complete an electronic form collecting all information. This is then passed on to the government. In certain cases, insurance companies will also conduct further investigations. And in the case of any lawsuit, there may be more investigations done, but, as the data is not collected by the police, the government does not receive it. There is however a second data source: when a person is injured and goes to hospital, the hospital collects data on his injuries and the vehicle involved. However, no data on the weather, infrastructure, location, etc. is collected. The two sets of data are merged by the government.
Romania	The same procedure applies for all accidents. First, at the scene of an accident, the police officer writes down a report with all data which might otherwise be lost (road and weather conditions, etc.). After that, a technical examination of the PTW will follow (all data and details are written in the report). Finally the, personal data of the accident victims, passengers and witnesses are included in the report, as well as initial conclusions on the cause of the accident. A few days may be needed to get all the data.

Today, no European country has a PTW-specific police accident report. In almost every case, there is only one such report per country, which is used for all road categories and for all vehicles. The one exception is Italy where there is no harmonised police accident report and where the local police can use a specific form for themselves.

Besides having a specific PTW accident report form, another option would be to improve the existing report by:

- adding a dedicated section for PTWs (in the case of an electronic form for example);
- adding questions regarding the different MAIDS variables included in the police accident report;
- making a clear distinction between the causes and consequences of the accident, along with including third-party perspectives even if not "involved" in the accident (a PTW accident can be caused by a dangerous manoeuvre of a motorist without the PTW actually making contact with the car);
- identify the dynamics of the accident in order to quickly establish a plausible cause and responsibility

Other stakeholders recommend to at least consult an experienced Garda (Police) motorcyclist for every PTW accident.

Infrastructure issues

Infrastructural issues are not taken into account in every police accident report. Demands vary from one country to another, as does the scope of details collected.

In Austria, Finland, Greece, Luxembourg and Slovenia, the police accident report does not take into account infrastructural problems. In Austria, if there is a request regarding the infrastructure (for example on road friction), the information is collected at a later date by another ministry.

In the Czech Republic, Hungary, Ireland, Romania and Spain, reporting on infrastructural problems is part of the police accident report. For example, the infrastructure section in the Spanish report is quite detailed (information on road type, road designation and kilometre, type of junction, state of the road surface, road lighting, visibility, speed limit, number of carriageways, number of lanes, lane width, shoulder width, number and type of safety barriers, road markings, road margins, etc.). In Ireland and Romania, information related to infrastructure issues is shared with the competent authority in order to remedy them.

Turning to Belgium, Bulgaria, France, Germany, Latvia, the Netherlands and the United Kingdom, infrastructural issues are taken into account as general accident causes. But this will greatly depend on the police officer's evaluation of the situation, meaning that the quality of the police accident report can vary. In France, there is a list of different road characteristics but without any detailed explanations. For example, there are check-boxes for "crash-barrier" or "tree" but only to be checked in the case of a collision with another vehicle. If the rider crashed into the tree because he fell off his motorcycle, it won't be reported.

CARE DATABASE AND THE CADaS PROTOCOL

Improving PTW safety not only requires having comparable data at European level through the use of common headings in police accident reports. It also involves having **identical value ranges** in all countries. Due to differences in the collected data variables and values, their definitions, the differences of the accident data collection forms structures and the relevant data formats among the existing national databases, both accident data quality and availability are affected. Consequently, lack of accident data uniformity among and within EU countries hinders the exploitation of CARE potential and limits data analyses and comparisons at EU level.

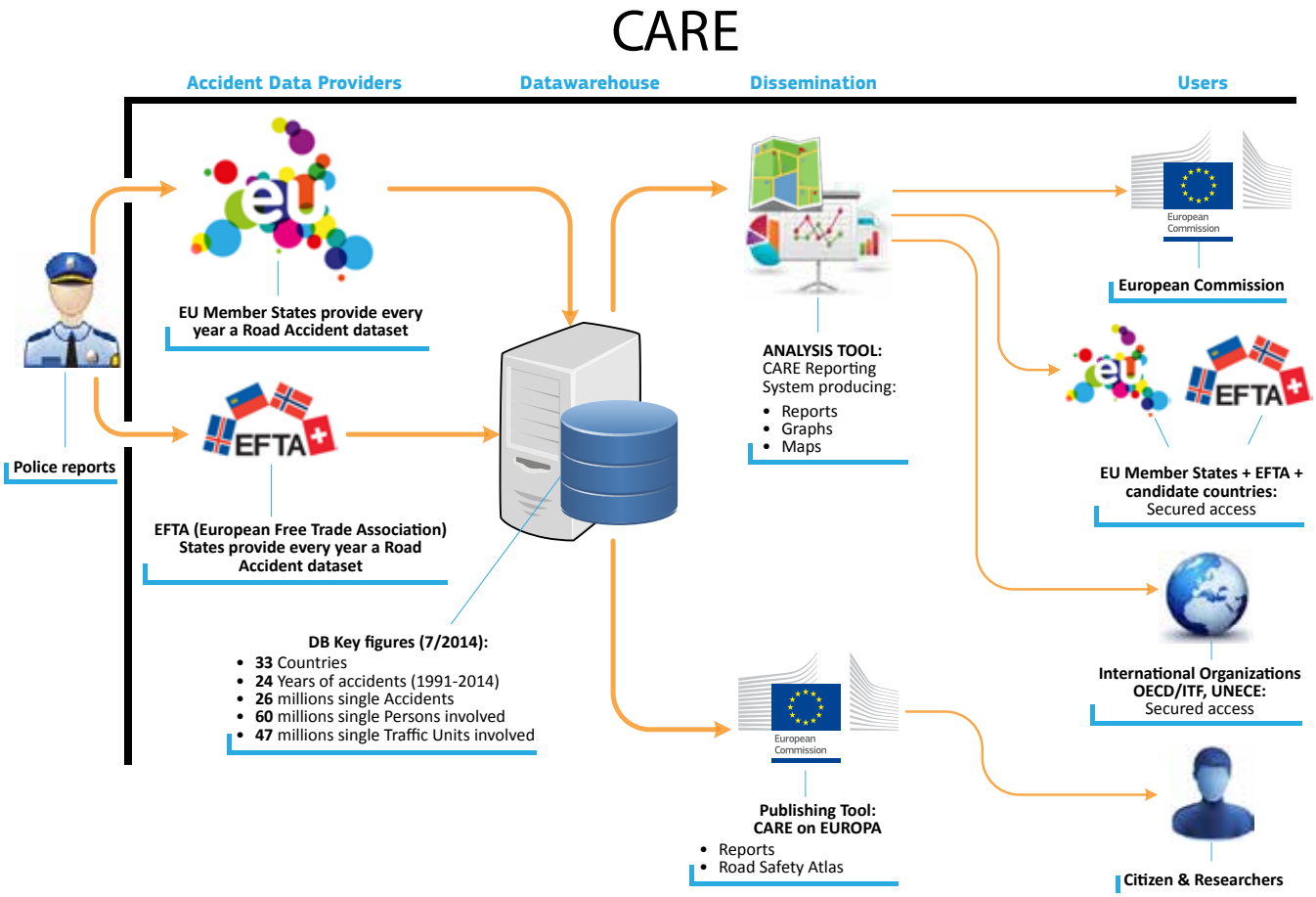


Figure 5 **Care database, using CADaS protocol**

The Mutuelle des Motards (project partner) made a comparative analysis of 9 police accident reports (Denmark, France, Italy, Portugal, Scotland, Slovenia, Spain, Switzerland and the United Kingdom).

Mutuelle des Motards' comparative work revealed differences in the variables found in the data collected, their values, their definitions, as well as structural differences in the accident report forms and in the formats of the relevant data in existing national databases. This can make it very difficult to compare data. The lack of harmonised accident data between and within EU Member States represents an obstacle to exploiting such data and limits EU-level comparisons.

Accident
Accident ID
Accident date
Accident time
Nuts
Lau
Weather conditions
Light condition
Accidents with pedestrians
Accidents with parked vehicles
Single vehicle accidents
At least 2 vehicles: no turning
At least 2 vehicles: turning or crossing

Road
Accident ID
Latitude
Longitude
E-road
E-road kilometer
Func. Class 1st road
Func. Class 2nd road
Speed limit 1st road
Speed limit 2nd road
Motorway
Urban area
Junction
Related to junction / intersection
Junction control
Surface conditions
Obstacles
Carriageway type
Number of lanes
Emergency lane
Markings
Tunnel
Bridge
Work zone related
Road curve
Road segment grade

Traffic unit
Accident ID
Traffic unit ID
Traffic unit type
Vehicle special function
Trailer
Engine power
Active safety equipment
Vehicle drive
Make
Model
Registration year
Traffic unit maneuver
First point of impact
First object hit in
First object hit off
Insurance
Hit and run
Registration country

Person
Accident ID
Traffic unit ID
Person ID
Year of birth
Gender
Nationality
Injury type
Road user type
Alcotest
Alcotest sample type
Alcotest result
Alcohol level
Drug test
Driving license issue date
Driving license validity
Safety equipment
Position in/on vehicle
Distracted by device
Psycophys. Phys. Imp.
Trip / journey purpose

Figure 6 **Variables recommended by the CADaS protocol**

The following findings and recommendations have been gathered.

Headings

74 different headings were found within the various accident reports forms studied.

Example: Spain uses 34 headings while France has 56.

Recommendation 1: Harmonise the format of accident report forms at European level

Headings content

Accident reports' heading content also differs from country to country, making it almost impossible to perform any comparison.

Example: description of the road: state of the road surface, curve or straight road, upward/downward slope, etc.

Recommendation 2: Harmonise the content of the individual headings at European level

Vehicle details

In identifying the vehicle(s) involved, the vast majority of accident reports only list their make and/or model. Within their national accident report forms, a number of countries list the type of vehicle when a PTW is involved. However, as this heading is not mandatory, any data is collected in a non-harmonised manner. It would be a good idea to be able to at least find details of the engine size and/or the type of vehicle (sports, basic, off-road, custom, etc.).

Recommendation 3: Put forward a proposal for the harmonised classification of the vehicles involved

Accident location

The place where the accident happened is not listed in a uniform and precise manner from one country to the next. For instance, when an accident happens in a built-up area, it would be no problem to list the name of the street and the nearest street number. By contrast, this is much more difficult when the accident occurs in the open countryside.

Recommendation 4: Have the police list the GPS coordinates of the place of accident

Vehicle damage

There are different ways of listing the damage to the vehicles in the accident reports. This is a further factor making it difficult to compare countries.

Recommendation 5: For each vehicle involved, list the following:

- Point of impact (front left, front right, etc.)
- Angle of impact (0°, 45°, 90°, 135°...360°)
- Impact severity (light, medium, hard)

Recommendation 6: Make it mandatory to take a photo of the damage to each vehicle involved

Vehicle use

With a view to gaining a better understanding of the accidentology of PTW riders, it is seen as a good idea to be able to access such data as how often the vehicle is used or what the purpose of the last trip was, as is possible in France and Belgium.

Recommendation 7: Put forward a proposal for European harmonisation of data on vehicle use frequency

Recommendation 8: Put forward a proposal at European level for gathering data on the purpose of the last trip

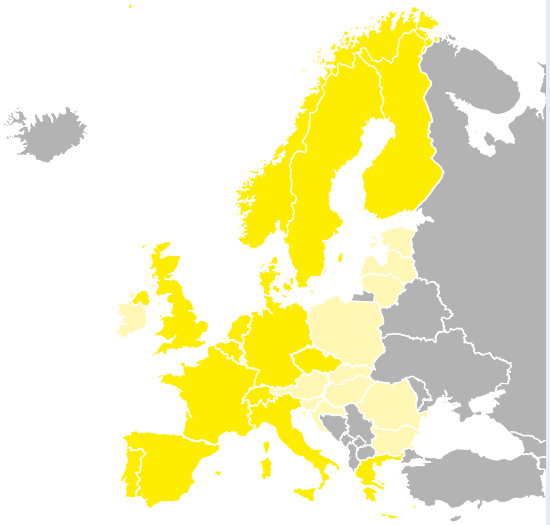
Though police reports constitute a great potential, they are of poor data quality and/or only partially filled out. In all cases, the police's primary concern at the scene of an accident is to secure the area to prevent any further accident happening!

Each state must be made aware of the fact that the quality of the data collected is dependent on the extent to which the police are involved in accomplishing this task.

To conclude, given the specific features of each Member State, there is little point in having a harmonised police accident report form at European level. Were we to have such, i.e. taking the specific features of each country into account, we would end up with a long and tedious data collection process. The proposal is therefore to **have certain headings made mandatory, with these being harmonised for all EU Member States**. This would allow us to gain a much better picture of the accidentology of PTW riders (bikers and trikers) as well as improving our knowledge of the traumatology of riders and their passengers.

Project surveys outcomes

Motorcycle use in Europe - The RIDERSCAN pan-European Motorcycling Survey

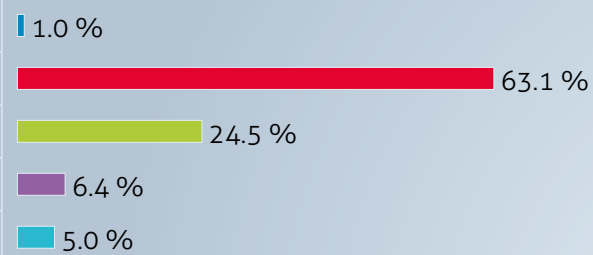


A survey targeting European riders was designed to collect information on the motorcycling community around Europe and gain a better overview of similarities and differences in terms of riding, attitudes and safety needs. The survey gathered 17,556 answers from 31 countries (more details p. 175). The number and diversity of answers enables to collect the following information:

On vehicle use - number of motorcycle(s) by rider: The European dataset shows that the vast majority of riders own just one powered two-wheeler. However, geographical differences can be observed. Motorcyclists from Southern European countries tend to own just one PTW, as seen in France (68.6%), Spain (68.1%) and Portugal (67.9%). By contrast, riders from Northern European countries tend to own several bikes. Riders from Norway, Sweden and Switzerland owned the highest number, with 9.2%, 9.6% and 9.6% of them respectively owning more than 3 powered two-wheelers.

Figure 7 **Number of powered two-wheeler vehicles owned by the respondent (EU dataset)**

	No.	% cit.
None	**180**	**1.0 %**
1	**10 965**	**63.1 %**
2	**4 263**	**24.5 %**
3	**1 112**	**6.4 %**
More than 3	**870**	**5.0 %**
Total	**17 388**	**100.0 %**

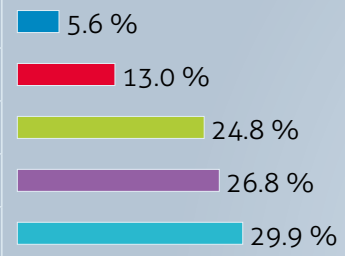


Engine size: The European dataset shows that the majority of bikes owned have engine sizes exceeding 400 cm3, with a reasonably equal share between bikes above 400 cm3, above 700 cm3, and above 1000 cm3. However, the analysis of the national datasets shows that:

- The Czech Republic is the country with the largest number of PTWs with an engine size below 125 cm3 (16.8%). This smallest engine size is least represented in Switzerland, where such PTWs constitute just 2% of all PTWs owned by respondents.
- Greece has the highest number of 125-400 cm3 PTWs (representing 29.2% of all PTWs).
- 401-700 cm3 is the most popular engine size in the Czech Republic, France, Greece, Portugal and Spain. In Portugal, 37.4% of PTWs have this engine size.
- 701-1000 cm3 is the most popular engine size in Germany, Italy, though the Netherlands has the highest percentage of this engine size (32.2% of PTWs).
- Finally, motorcycles exceeding 1000 cm3 are the most popular in Belgium, Denmark, Finland, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom. In Belgium, motorcycles exceeding 1000 cm3 represent 45.3% of all PTWs.

Figure 8 **Engine size breakdown of PTWs owned in Europe (Merged answers) (EU dataset)**

	% cit.
Below 125cm³	**5.6 %**
125-400 cm³	**13.0 %**
Above 1000 cm³	**24.8 %**
701-1000 cm³	**26.8 %**
401-700 cm³	**29.9 %**
Total	**100.0 %**



Type of vehicle: The preferred type of vehicle varies greatly from one country to another without any real geographical trend:

- Standard motorcycles are the most popular type of PTW in the Czech Republic, France (33.3%), Germany, Italy, Portugal and Switzerland.
- Sport Touring motorcycles are the most popular type in Denmark, the Netherlands, Norway, Spain and the United Kingdom. In Denmark, they account for 32.7% of all PTWs.
- On/off road bikes are the most popular type in Greece and Sweden. In Greece, they represent 30.7% of all PTWs.
- Touring bikes are the most popular type in Belgium, representing 24.1% of PTWs.
- Custom bikes are the most popular type in Finland, representing 21.1% of PTWs.
- Greece has the highest rate of scooters (27.7%) and electric (0.5%) PTWs declared by survey respondents.

Figure 9 **Breakdown by vehicle type in Europe (Merged answers) (EU dataset)**

	% cit.
Electric	**0.2 %**
Trial	**1.0 %**
Supermotard	**2.8 %**
Enduro/Cross	**4.5 %**
Custom	**6.7 %**
Touring	**9.3 %**
Scooter	**10.4 %**
Supersport	**10.6 %**
On/off road	**15.3 %**
Sport Touring	**17.6 %**
Standard	**21.6 %**
Total	**100.0 %**

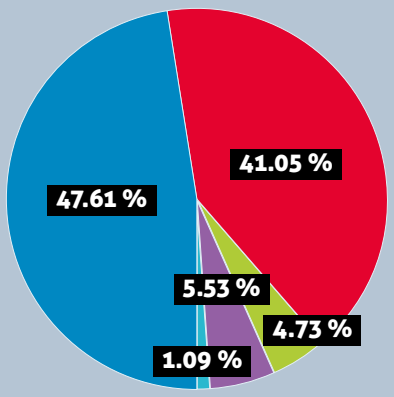
Brand: Listed below are the top 5 brands in most surveyed countries (Belgium, the Czech Republic, Denmark, France, Germany, the Netherlands, Norway, Portugal, Spain and Sweden). Harley Davidson enters the top 5 in Finland (10.5% of PTWs owned by respondents) and Switzerland (7.6%). In Greece, Piaggio accounts for 6.5% of PTWs, as can be expected when we recall that 27.7% of Greek respondents are scooter owners. Italian and UK riders show a certain national preference in their choices: in Italy, Ducati is the third most popular brand (11.2%), while in the United Kingdom, Triumph is the fourth brand (12.7%). This preference for national brands is also confirmed in the German answers, with BMW taking top place (18.1%).

Figure 10 **Top 5 brands owned in Europe (Merged answers) (EU dataset)**

	No.	% cit.
Honda	**4 331**	**19.5 %**
BMW	**3 226**	**14.5 %**
Yamaha	**2 956**	**13.3 %**
Suzuki	**2 890**	**13.0 %**
Kawasaki	**1 788**	**8.1 %**
Total	**22 196**	**100.0 %**

Transport use – preferred means of transport: The EU sample of answers shows a fairly balanced share between cars and PTWs; both are declared by over 40% of respondents as the most used means of transport. Car and PTW usage is more or less balanced in Belgium, France, Italy, the Netherlands, Portugal, Spain and the United Kingdom. In the Czech Republic, Denmark, Finland, Germany, Norway, Sweden and Switzerland car usage is higher than PTW use, while in Greece, the reverse is true, with car usage at 26.7% and PTW usage at 66.4%. Cleary, a geographical trend can be seen, with the proportion of PTW usage dropping in Northern European countries where the weather makes riding throughout the year more difficult.

Figure 11 **Car and PTW usage (EU dataset)**



	% cit.
Car	**47.61 %**
Powered two-wheeler	**41.05 %**
Bicycle	**4.73 %**
Public transport	**5.53 %**
Other	**1.09 %**
Total	**100.0 %**

Car use (mileage): The EU sample shows that half of the respondents clock up over 10,000km/year by car, and close to 30% over 15,000km. However, a country comparison shows that this proportion is quite similar in every country selected except Greece, Spain and Sweden where respondents drive less than in other European countries: In Greece, more than 50% of respondents drive less than 5,000 km per year by car. In Sweden, more than 50% of the respondents drive less than 7,000 km per year by car. In Spain, more than 53% of the respondents drive more than 7,000 km per year by car, though less than 38% drive more than 10,000 km.

Table 8 **Approximate annual mileage by car (answer per countries)**

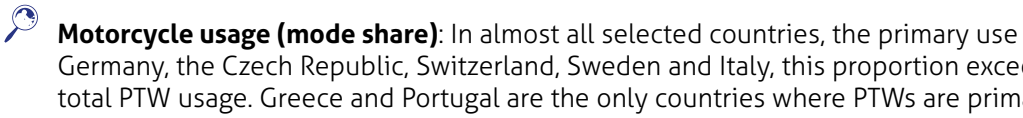
	Drive more than 10,000km/year	Drive more than 15,000km/year
Belgium	55,8%	36%
Czech Republic	50,3%	32.3%
Denmark	68.2%	46.2%
Finland	68.5%	48.5%
France	50.9%	30.1%
Germany	56.2%	34.9%
Greece	21.4%	10.4%
Italy	49.5%	29.1%
Netherlands	50%	34.3%
Norway	63.9%	33.9%
Portugal	43.7%	28.3%
Spain	37.4%	19.8%
Sweden	39.4%	24.8%
Switzerland	51.8%	28.5%
United Kingdom	46.4%	21.6%

PTW use (mileage): the EU sample shows that average mileage by PTW is generally between 3,000 and 10,000km/year. A country comparison shows no specific geographical trend:

- in Sweden, the largest group of riders (24.3% of our respondents) rides between 1,000 to 3,000km a year;
- the largest group of riders in the Czech Republic (26.6% of respondents), Germany (22.6%), Portugal (19.9%) and the United Kingdom (22.3%) ride between 3,001 and 5,000km a year;
- the largest group of riders in Denmark (20.3% of respondents), Finland (20.8%), Greece (23.1%), Italy (20.6%), Spain (20.1%) and Switzerland (22.1%) ride between 7,001 and 10,000km a year;
- the largest group of riders in Belgium (23.1% of respondents), France (20.7%) and Norway (21.1%) ride between 10,001 and 15,000km a year;
- in the Netherlands, the largest group of riders (22.3% of respondents) rides more than 15,000km a year.

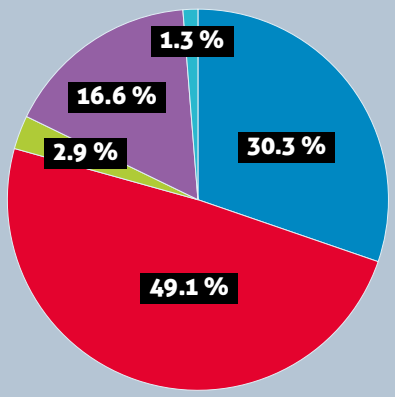
Figure 12 **Approximate annual mileage on a motorcycle (EU dataset)**

	% cit.
Less than 1000km/600mi	**2.3 %**
1000 to 3000km/601 to 1800mi	**11.2 %**
3001 to 5000km/1801 to 3000mi	**19.2 %**
5001 to 7000km/3001 to 4500mi	**17.7 %**
7001 to 10000km/4501 to 6000mi	**19.9 %**
10001 to 15000km/6001 to 10000mi	**17.7 %**
More than 15000km/10000mi	**12.1 %**
Total	**100.0 %**



Motorcycle usage (mode share): In almost all selected countries, the primary use of a PTW is for leisure. In Germany, the Czech Republic, Switzerland, Sweden and Italy, this proportion exceeds 50% of respondents' total PTW usage. Greece and Portugal are the only countries where PTWs are primarily used for commuting.

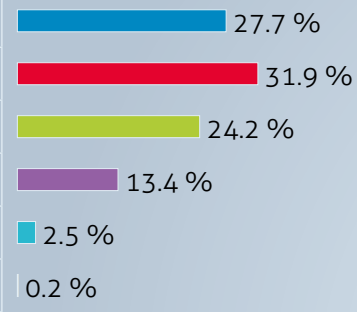
Figure 13 **PTW usage (EU dataset)**



	% cit.
Going to work/school/university (commuting)	**30.3 %**
Leisure/hobby/sport (short rides)	**49.1 %**
Professional use	**2.9 %**
Long distance travelling	**16.6 %**
Other	**1.3 %**
Total	**100.0 %**

Figure 14 **Frequency of PTW use (EU dataset)**

	% cit.
Everyday	**27.7 %**
During the summer season	**31.9 %**
A few times a week	**24.2 %**
A few times a month	**13.4 %**
A few times a year	**2.5 %**
Never	**0.2 %**
Total	**100.0 %**



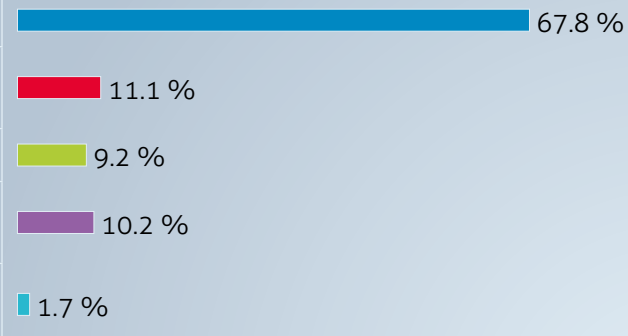
A national comparison tells us that the countries where riders use their PTW every day - Greece (73.4%), Spain (37.4%), Portugal (37.2%) and Italy (32.1%) - are all Southern European countries where weather conditions are mild enough to allow riding throughout the year. This is also in line with the fact that Greece, Portugal and Spain have the highest rates of PTW commuting. It should also be noted that Greece has the highest percentage of scooters – a typical urban vehicle – among the PTWs owned by respondents.

Countries where riders use their PTW only during the summer - Norway (80.2%), Denmark (73.0%), Sweden (70.4%) and Finland (69.1%) - are logically Nordic countries where weather conditions make riding difficult outside summer.

Riding habits: The vast majority of riders in Europe generally ride alone (67.8%), while a tiny minority rides in groups of over 10 riders (1.7%). A country analysis further illustrates that group (>10) riding is more common in Denmark where 6.6% of riders ride most of the time with many other motorcyclists, followed by Belgium at 4.1%. For the other selected countries, this proportion drops below 3%.

Figure 15 **Riding habits and group riding (EU dataset)**

	% cit.
Alone	**67.8 %**
With a pillion passenger / as a passenger	**11.1 %**
With another motorcyclist	**9.2 %**
With a few others motorcyclists (< 10)	**10.2 %**
With many other motorcyclists (groups/clubs/organized rides >10)	**1.7 %**
Total	**100.0 %**

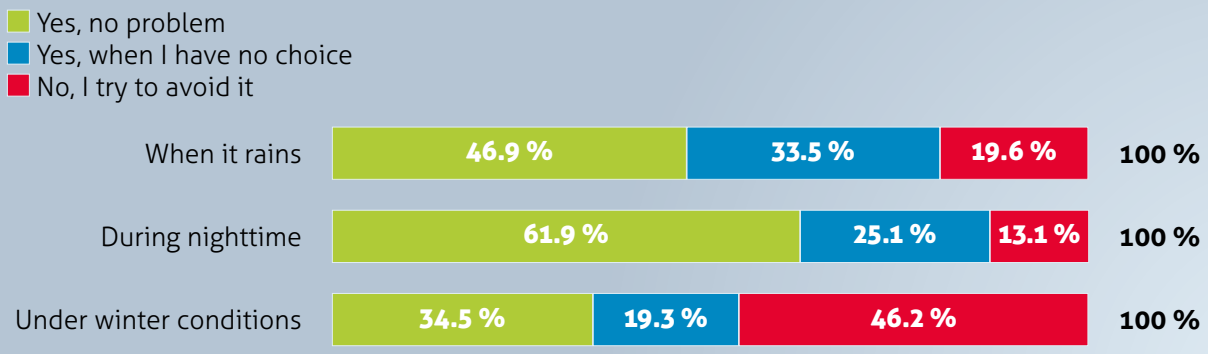


Not surprisingly, answers about riding in specific weather conditions were strongly influenced by the respondent's country.

Riders have no problem riding in the rain in the Netherlands (65.1%), the United Kingdom (62.2%) and Norway (61.5%). Conversely, 25.6% of riders in Italy, Portugal (24.9%), in Czech Republic (24.5%) and Greece (24.5%) avoid riding in the rain. This difference is certainly linked with a country's rain frequency and whether or not people are used to dealing with rain.

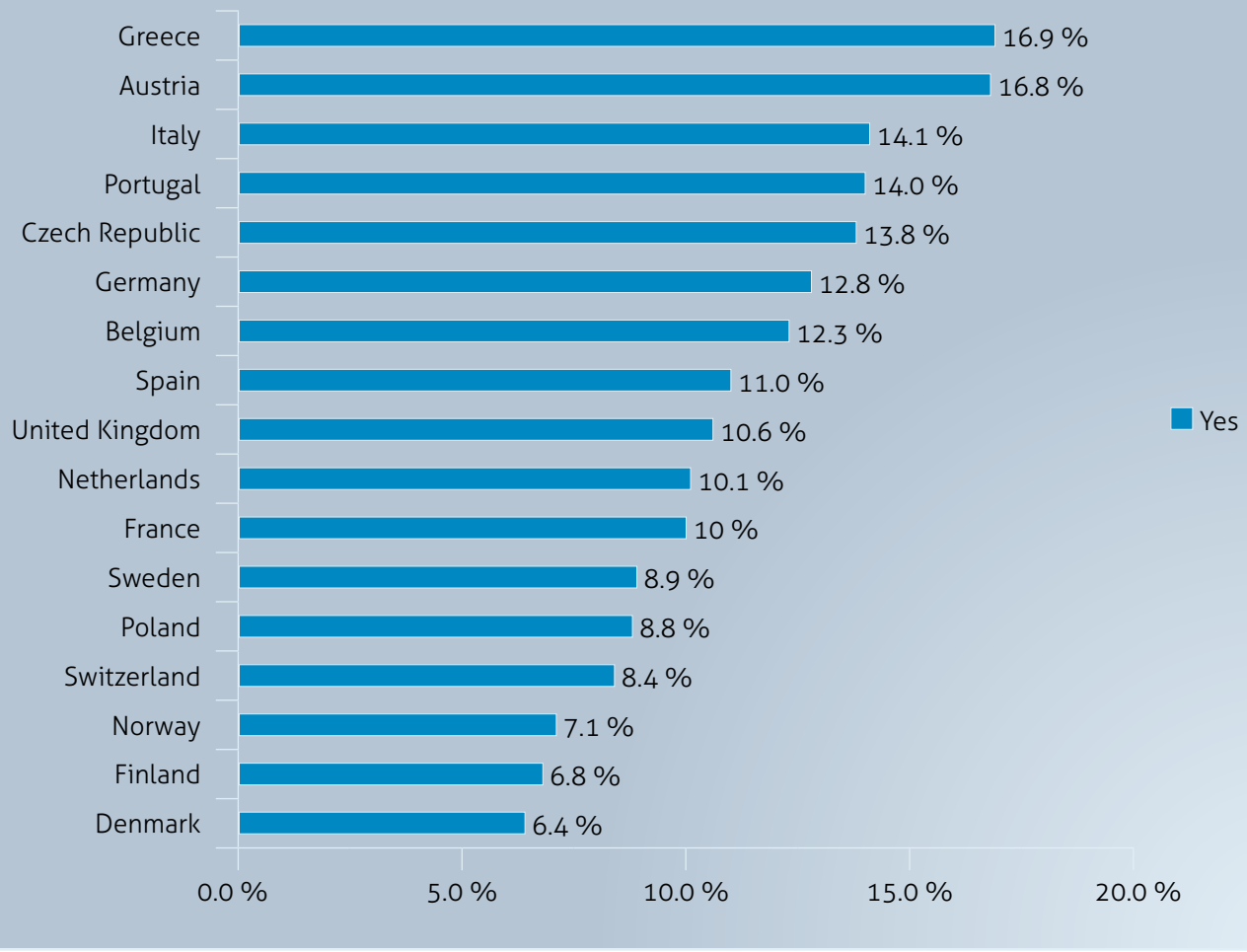
Moreover, 68.7% of Greek riders and 62.1% of Portuguese riders have no problem riding in wintry conditions and only 13.1% of Greeks and 16.3% of Portuguese try to avoid it. By contrast, in Norway 87% of riders try to avoid riding in wintry conditions, in Finland 86.7% of riders, in Denmark 84.9% of riders, and in Sweden 82% of riders. It is easy to see that this is linked to the fact that "wintry conditions" in Southern European countries are less harsh for motorcyclists than in the Nordics.

Figure 16 **Riding and weather conditions (EU dataset)**



Accidents - accident involvment: The vast majority of riders in Europe stated not having been involved in any kind of accident in the twelve months preceding the survey (87.1% of the respondents). A national analysis of answers shows that there are regional patterns to be considered.

Figure 17 **Have you been involved in an accident in any form during the last twelve months? (Merged answers) (Answer per country)**



Accident type (merged) Of the 12.4% of respondents stating they had had an accident in the last twelve months, somewhat more than 10% declared having had more than one accident.

Crossing these results with the age of the respondents, we can conclude that young riders are more involved in accidents that older ones. The two age groups more involved in accidents are the under-25s and the 25-34 age group. In every country, under-25s constitute the group most involved in accidents, except in Belgium, the Netherlands and Spain. The record was held by Portugal where 43.8% of under-25 riders had been involved in an accident during the last 12 months, followed by the United Kingdom (43.5%) and Switzerland (37.5%). The lowest numbers were for Belgium (16.7%), the Netherlands (12.5%) and Spain (10%), countries in which the 25-34 age group had a higher percentage of riders involved in an accident (22.9% for Belgium, 18.5% for the Netherlands and 18.4 for Spain).

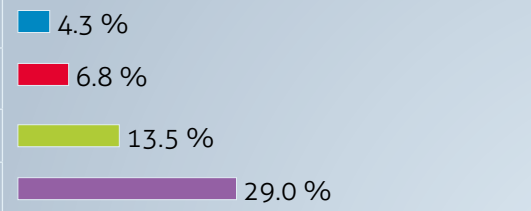
In almost every country, the most common type of accident stated was a *collision with another vehicle* (54.9%), followed by a single accident (29%). Finland was the exception, with the order being reversed: of the 109 accidents declared (during the twelve last months), 44% were single accidents and 33.9% involved a collision with another vehicle.

Greece in turn had the highest rate of collisions with another vehicle (72.8%).

The highest rates of collisions with road infrastructure are to be found in Finland (19.3%), Spain (12.3%) and Belgium (11.8%). By contrast, Danish riders declared no accidents with road infrastructure.

Figure 18 **Accident type (merged answers) (EU dataset)**

	% obs.
Tilting standing still	**4.3 %**
Collision with road infrastructure	**6.8 %**
Tilting/cornering slow speed	**13.5 %**
Single	**29.0 %**
Collision with another vehicle	**54.9 %**
Total	**100.0 %**

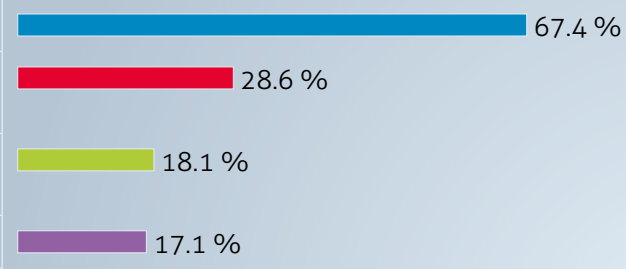


To be noted: respondents were allowed to tick more than one answer (for example "tilting standing still" is considered as a single accident; therefore, both cases could be ticked without being inconsistent).

Guilty party (merged) : The EU sample of those having been involved in an accident in the last twelve months comes up with the other road user being responsible for the accident (45.4%), followed by own fault (34.1%). 63.8% of accidents resulted in some form of physical harm with or without hospital treatment.

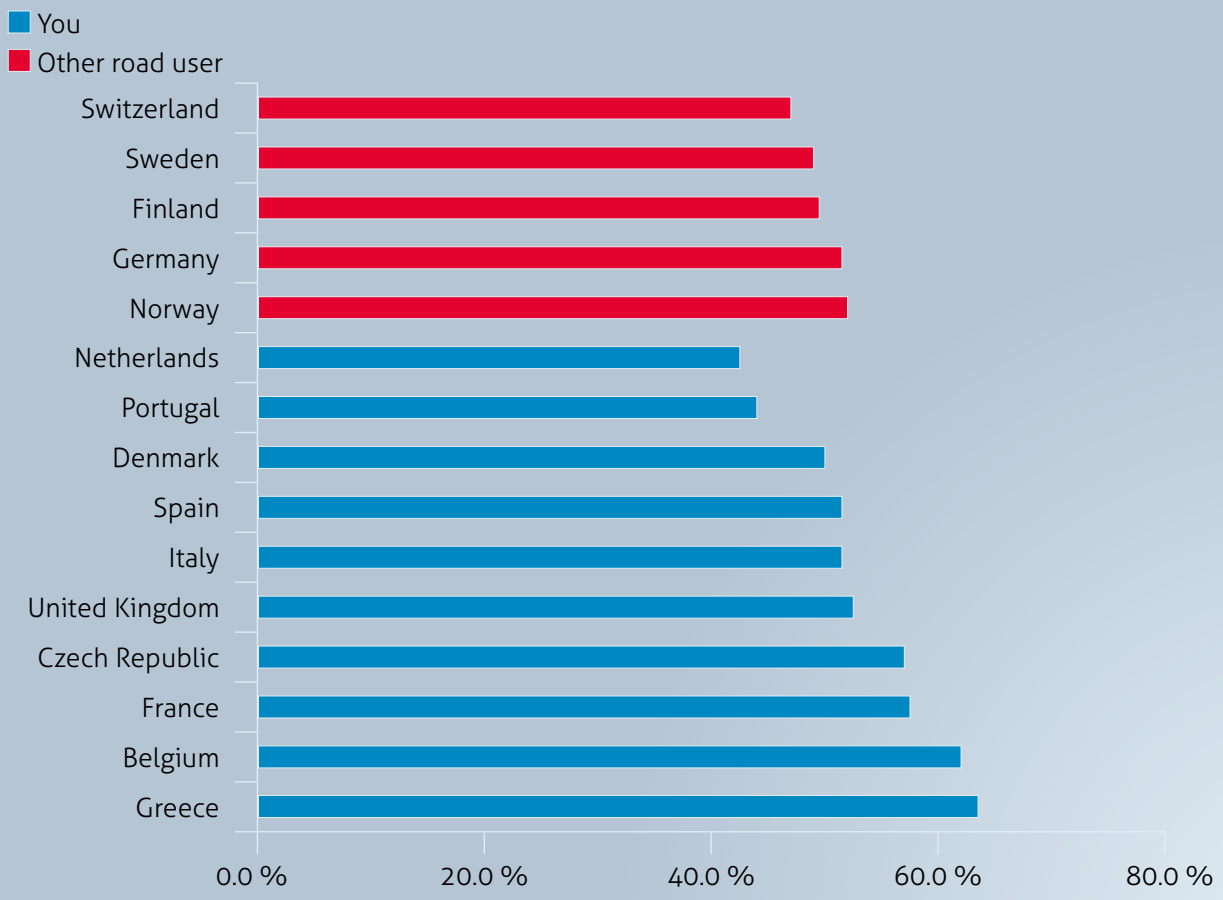
Figure 19 **Consequences of the accidents (merged answers) (EU dataset)**

	No.	% obs.
Tilting standing still	**1 422**	**67.4 %**
Collision with road infrastructure	**604**	**28.6 %**
Tilting/cornering slow speed	**382**	**18.1 %**
Single	**360**	**17.1 %**
Total	**2768**	**100.0 %**



A comparison of national answers showed that the party most likely to be responsible for the accident is the other road user in Greece, Belgium, France, the Czech Republic, the United Kingdom, Italy, Spain, Denmark, Portugal and the Netherlands; while in Norway, Germany, Finland, Sweden and Switzerland it is the rider himself.

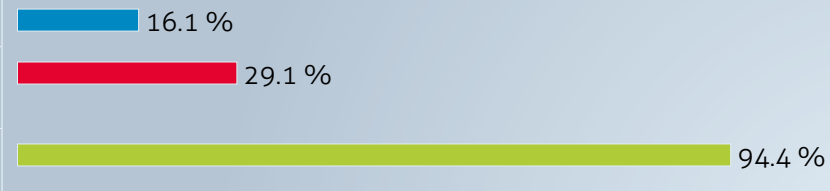
Figure 20 **Party responsible for the accident per country (answer per countries)**



Near-misses: When asked about near-misses, 27.9% of the EU sample stated not having experienced a near collision. All others stated having had at least one, due in the vast majority of cases (94.4%) to another driver's error.

Figure 21 **What was the (most frequent) causation factor(s) of your near-miss accident(s)? (Merged answers) (EU dataset)**

	% cit.
Own error(s)	**16.1 %**
Infrastructure problems	**29.1 %**
Other driver's error(s)	**94.4 %**
Total	**100.0 %**



Infrastructure issues are particularly prevalent in Greece, Spain, Belgium, Italy and France, cited as causing more than 30% of the near-miss accidents experienced by our respondents.

Figure 22 **Proportion of infrastructure problems in causing near-miss accidents (answer per country)**

Greece	40.9%
Spain	38.6%
Belgium	37.7%
Italy	36.9%
France	36.5%
Finland	28.4%
Czech Republic	21.5%
Sweden	18.3%
Switzerland	17.6%
Portugal	15.7%
Germany	13.8%
Norway	12.9%
Netherlands	11.7%
UK	8.9%
Denmark	6.2%

Identified needs

As highlighted by DACOTA, **aggregate road safety data** concern **road accident data, risk exposure data** and **road safety performance indicators**, but also causation indicators (such as those resulting from in-depth data) and **health indicators** (such as those resulting from epidemiological data). These indicators, combined with additional information on other important road safety aspects such as those related to behavioural, social and political aspects, enable work on an integrated approach.

Supporting road safety decision-making requires having quantitative information on **road users' attitudes and behaviour**, on **road safety measures** implemented, **rules and programmes** (including enforcement), and on their **social costs and benefits**.

As regards PTW use and safety aspects, none of these data and other statistical elements have yet been properly designed and accepted at international level to enable proper benchmarking between countries.

Based on the input collected during the project on r*esearch, data collection & statistics* and *accident reporting*, the project recommendations include the following:

Research needs

- Exposure studies:
  - develop a **methodology** to collect and analyse mobility data harmonised at EU level
  - mobility data (annual mileage for PTWs) to separate impact of exposure, intrinsic risk and compensatory behaviour of riders.
- Development of PTW accident **prediction models** by means of accident simulations and vehicle dynamics to see which state of the road has which effect on the braking system, the tyres and the rider behaviour, what are the reactions of different vehicles on the same section of road, at the same speed? Etc.
- Mobility research: understanding PTW use, riding models, etc.
- Naturalistic/simulation studies to identify:
  - skills, attitudes & behaviours; how to influence different types of riders to take safer decisions when riding;
  - riding models, risk patterns and the role of risk awareness
  - safety critical events
  - which and how information is processed by the rider
  - mental failures
- Road conflict investigations
- Accident data collection (pre-during-post collision) and reconstruction of accident dynamics
- More in-depth investigations will allow a better understanding of fatal and serious injury crash patterns and causes
- Assessment of injuries linked with crash types (link between crash data and hospital data);
- Improvement of crash simulation and crash dummies (taking into account their particular postures to understand their specific injuries) to better understand
  - the consequences of an accident
  - how injuries occur and how to prevent them;
- Research into the relationship between weather and accidents should be continued, including more data allowing additional factors to be considered.
- PTW conspicuity and other perception problems
- Speed: comparative study on speed differences on comparable road types within Europe.

- Effectiveness of safety activities / cost-benefit analyses
- Design a PTW-specific impact assessment methodology
- Compile and expand key existing studies for PTW use.
- Development and introduction of safety equipment adapted to countries with hot weather

Standardization

- Need to develop and apply relevant methods, tools and indicators to measure PTWs in traffic flows and analyse their mobility and behaviour (exposure data).
- Standardize the definition of "seriously injured".
- Harmonize accident (macro/micro) reporting methodologies

Legislation

- Prepare a legislative proposal which sets up the right framework for data collection in Member States, defining a common data collection strategy which includes improving accident reporting
  - harmonise formats and headings;
  - harmonised classification of vehicles involved in an accident
  - include GPS coordinates for accident location
  - include the following information for each vehicle involved in the accident:
    - Point of impact (front left, front right, etc.)
    - Angle of impact (0°, 45°, 90°, 135°...360°)
    - Impact severity (light, medium, hard)
  - include pictures of the scene and damage to each vehicle involved.

  and propose
  - a harmonised way to measure the vehicle fleet
  - common categories for the type/frequency /motivation of use for vehicles

Specific actions

- Promote the use of the CADaS protocol at national level to have comparable data across Europe
- propose and include in CADaS
  - common age categories;
  - a common classification of the types of PTWs
- complement the CADaS protocol with specific data of relevance to accidents with PTWs, such as environmental aspects or vehicle details
- Cross information on injuries between Member States
- Enhance exposure and mobility data collection work between Member States
- Cross/compare existing knowledge between different EU countries
- Set up a strategic approach to PTW research needs
- Use iGLAD as the basis to set up a common European in-depth accident causation database.

Accessing PTWs: training testing and licensing

The 3rd Driving Licence Directive was implemented by Member States in very diverse ways with regard to progressive access requirements (age, testing, training, direct access). A comparison of these schemes highlights several common patterns and differences between Member States with regard to minimum age requirements and training and testing requirements with or without progressive access.

Of importance is the fact that the training/licencing topic is the only safety area for which the project team found a significant difference between answers from the motorcycling community (industry/users) and those from Member States' experts, with the exception of Ireland and France where all stakeholders seemed to be in agreement over the benefits of the new access scheme resulting from 3DLD implementation.

As the need to improve motorcycle training and licencing is now recognized among the road safety community, the RIDERSCAN project focused on:

- Gaining a clearer picture of 3DLD implementation, good practices and issues related to its implementation.
- Identifying priority areas for action and recommendations to improve the 3rd Driving Licence Directive (3DLD) and prepare the future 4th Driving Licence Directive (4DLD).

Lillehammer priorities

Priority n°1: Training programmes: Countries have different training needs, based on their vehicle fleet and training resources. Motorcycle training should therefore build on existing standards, focus on risk awareness and risk avoidance, and develop an understanding of the rider/motorcycle capacities and limitations.

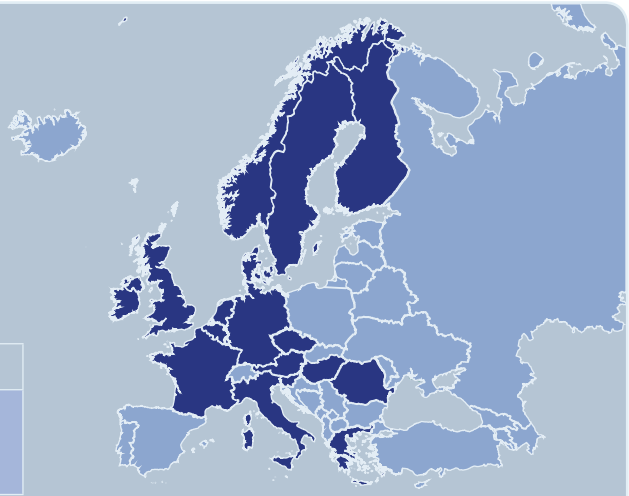
EU Road Safety Communication

"Towards a European Road Safety area: policy orientations on road safety 2011-2020": Strategic objectives: Improve education and training of road users

RIDERSCAN outcomes

- A literature review of the main policy documents (Annex 14)
- A summary of EU research work and main conclusions for the past decade (Annex 21)
- Comparison of 3DLD implementation and motorcycle access schemes in Europe (Annex 19)
- A picture of main geographical differences with regard to EU riders (Annex 1
- Assessment of the 3rd Driving Licence Directive in terms of training, testing and administrative and licencing changes by riders (Annex 2)
- Improvements, issues and best practices (throughout Member States, evaluation of the Motorcycling Community and CIECA members) (Annex 4, Annex 5)
- A summary of Recommendations for Action gathered from PTW safety policy priorities - main references (Annex 14), Amplifying Questions Member States (Annex 4), Motorcycling Community (Annex 5), EU Stakeholders (Annex 6), EMF2015 discussions (Annex 13)

Input received from...



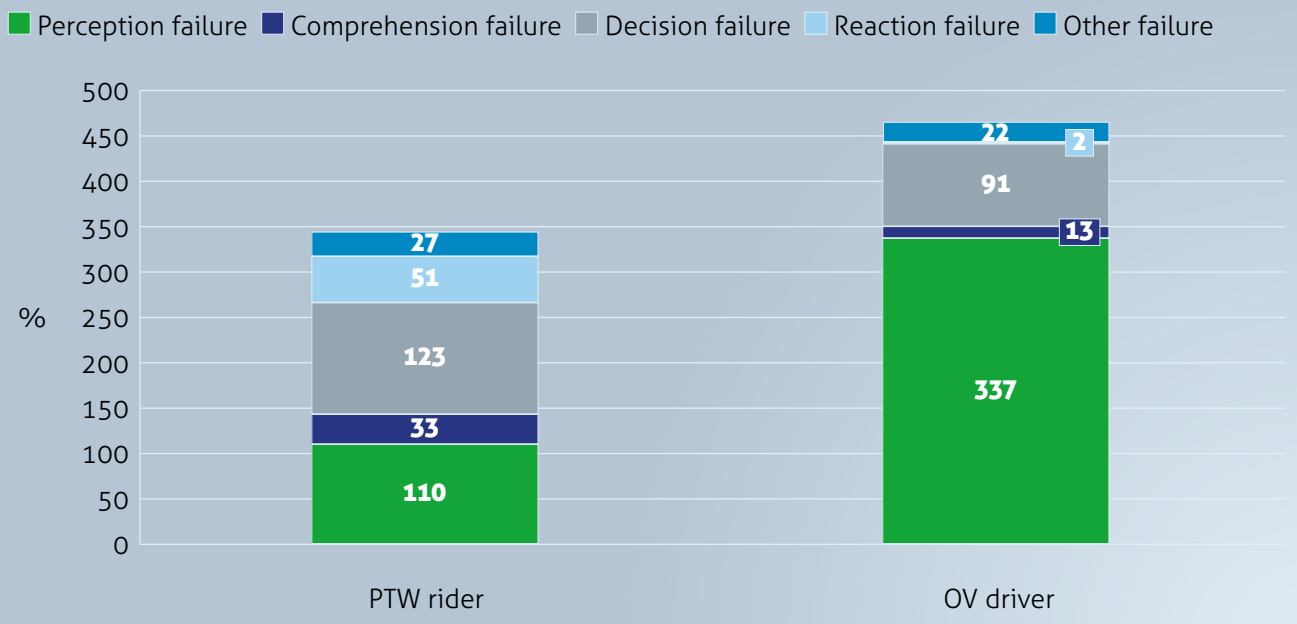
EU stakeholders
European Commission: DG MOVE, Dir. C Innovative and Sustainable Mobility, Unit 4 Road safety. CIECA (reviewer of the deliverable)

	Member States	The Motorcycling Community	the Research Community
Austria	Federal Ministry for Transport, Innovation and Technology, Department of Transport		KFV (Austrian Road Safety Board)
Belgium	SPF mobilité et transports, DG Transport Routier et Sécurité Routière	FEBIAC; MAG Belgium	
Czech Republic			Division of Road Safety and Traffic Engineering, Transport Research Centre
Denmark		MCTC	
Finland	TRAFI, department Permits and Approvals		
France	Conseil National de Sécurité Routière	FFMC	IFSTTAR
Germany		BMW; IVM; IFZ; BU; BVDM	Federal Highway Research Institute (BASt); TÜV
Greece	Ministry of Infrastructure, Transport and Networks	AMVIR	
Hungary			
Ireland	Road Safety Authority	MAG Ireland	
Italy		ANCMA; Ducati; FMI	
Luxembourg	Société Nationale de Circulation Automobile	LMI	
Netherlands	Department of Road Safety, Ministry of Infrastructure and Environment	Kawasaki; Yamaha; MAG NL	SWOV Institute for Road Safety Research
Norway	Norwegian Public Roads Administration	NMCU	
Romania	Ministry of Internal Affairs, Driving Licencing and Vehicles Registration Directorate		
Slovenia	Slovenian Traffic Safety Agency		
Sweden	Swedish Transport Agency	SMC	
United Kingdom	Road User Licencing, Insurance and Safety; Driver and Safety Standards Agency	BMF	

EU POLICY AND DOCUMENTATION REVIEW

In 2004, the MAIDS study[1], following the US Hurt report, highlighted *human factors* as the key PTW accident causation factor to be considered and addressed. According to this in-depth study of over 900 accidents in 5 EU countries, *human factors* represented the primary accident contributing factor in approximately 88% of all cases (PTW riders/ OV drivers), among which *perception failure* on the part of the other vehicle (OV) driver reached 50.5%.

Figure 23 **Human failures (MAIDS)**



This need to focus on rider and driver training has been underlined by all key stakeholders for the last decade. These safety experts have been urging the European Commission and Member States to expand driving licence work to address training content and set up an adequate training framework.

Table 9 **Key policy documents – identified priorities**

D1 – Training, Testing, Licencing	ETSC	Lillehm.	FEMA	EC	ACEM	ITF
Train every novice rider	✓	✓	✓	-	-	✓
Moped safety included in school education	✓	-	-	-	-	-
Training content to focus on hazard awareness/ assessment and collision avoidance strategies	✓	✓	✓	✓	-	-
Training to focus on rider/motorcycle capacities and limitations, along with attitudes towards safety	-	✓	-	✓	✓	✓
Driver training to include a component on PTW awareness and acceptance, including perception failures (speed/behaviour) and traffic scanning strategies	✓	✓	✓	✓	✓	✓

1 http://www.maids-study.eu/

Comparison of the implementation of 3DLD and motorcycle access schemes in Europe

Minimum age requirements

Table 10 **3DLD Minimum age requirements**

Two major trends

Access to PTWs at a younger age		
AM 15 or 16 years old	Austria Croatia Estonia France Lithuania Romania Spain	Bulgaria Czech Republic Finland Germany Luxembourg Slovenia Sweden
A1 16 years old		
A2 18 years old		
A 20 years old with 2 years' possession of A2 or 24 years old in direct access		

Access to PTWs at a older age		
AM 16 years old	Belgium Ireland Malta	Greece Netherlands Norway
A1 18 years old		
A2 20 years old		
A 22 years old with 2 years' possession of A2 or 24 years old in direct access		

... with some national specificities

AM from 14 years old	France
A1 from 17 years old; **A2** from 19 years old	UK Northern Ireland
AM from 18 years old	Malta

Training and testing requirements

The 3rd Driving Licence Directive introduced a new concept called Progressive Access to a PTW licence, with the announced objective to invite candidates to progressively access high- powered vehicles. In practice, Progressive Access means that it is only possible to gain an A2 licence when the rider already has an A1 licence. Similarly, to gain an A licence a rider must already have an A2 licence. When this is not the case, the rider would have to take the full test to gain the licence.

Table 11 **3DLD Training & Testing requirements**

Where *Progressive Access* is applied: 3 major trends can be found

Training option	Finland	Ireland	Luxembourg
Testing option	Estonia Lithuania	Germany Netherlands	Northern Ireland Sweden
Training and testing	Belgium Romania	Bulgaria United Kingdom	Croatia

Without *Progressive Access*:

AM	A1	A2	A
• Theory courses • Practical training courses • Theoretical test	• Theory courses • Practical training courses • Theoretical test • Practical test	• Theory courses • Practical training courses • Theoretical test • Practical test	• Theory courses • Practical training courses • Theoretical test • Practical test

... though with some national specificities

Access to an A2 licence is possible after holding an A1 licence for at least 2 years (and the A licence after holding an A2 licence for at least 2 years) and there is the possibility to choose between a 7-hour training module or to take a practical test.	Austria
The graduate option is possible only once. If this option was taken for the A2 licence, it is no longer possible for the A licence. In this case a training module and a practical test must be taken.	Ireland
There is no direct access to the A licence at 24. To gain an A licence, the rider must have held an A2 licence for at least 2 years and have completed its training module.	Luxembourg Spain
Access to an A2 licence is possible after holding an A1 licence for at least 2 years and after passing a theoretical and practical test. Access to an A licence is possible after holding an A1 licence for at least 2 years and after completion of a 9-hour training module.	Spain

EU RESEARCH WORK

EU research work on training and behavioural aspects of PTW training is quite extensive and covers all essential elements needed to further improve access schemes.

Several EU research projects have investigated a number of human factor aspects and their potential relation to training and licencing. This includes the work undertaken within the 2BESAFE[1] project (2011) which describes the *requirements of the riding task every rider has to tackle, in particular, risk awareness*, and concludes that *there is a need to improve motorcycling training, with more specific targeting of new (or returning) leisure riders, but there is also potential for improving the training of car drivers or developing campaigns that focus on the responsibility of the driver to actively search for motorcyclists.*

Projects such as 2BESAFE, IRT or PROMISING provide very useful insights into risk factors, rider segmentation and hazard perception. There is a need to start working on a common PTW rider/driver training framework.

For more details on the EU research projects scanned, see the section "Overview of EU research projects on PTWs" (p. 183).

1 http://www.2besafe.eu/

Assessment of the 3DLD: issues to be solved and recommendations

Based on the interviews held with Member State experts, motorcycling community representatives and CIECA members, the RIDERSCAN project was able to list the major improvements achieved through the 3rd Driving Licence Directive and the issues still needing to be solved, either at EU or national level.

To be noted: Training/Licencing is the only safety area for which the project team found a significant difference between answers from the motorcycling community (industry/users) and those from Member State experts, with the exception of Ireland and France where all stakeholders seemed to be in agreement on the benefits of the new access scheme resulting from 3DLD implementation.

Identified improvements

Table 12 **3DLD Identified improvements**

Motorcycling Community (industry/users)	Member State experts
The increase of power for A2	The new system of progressive access with testing or training is an improvement / Consolidation of the progressive part of the licence
Direct access to the A licence at 24 is a good thing	Direct access to the A licence at 24 is a good thing
Improved training and/or testing in some countries (Belgium, Ireland, Italy, Greece)	No improvement observed yet (Germany, Luxembourg and the Netherlands)

In the opinion of motorcycling community representatives

One of the main improvements brought about by the 3DLD is the increase of power for A2 motorcycles. The raised engine power to a comfortable 35 kW for motorcycles is seen as an incentive for novice riders.

The possibility of direct access to the A licence at 24 was also seen as a good aspect of the directive, particularly for Germany where direct access was previously possible at 25 and for Ireland which did not have any direct access before.

Moreover, the 3DLD was also an occasion for upgrading training and/or testing in some countries (Belgium, Ireland, Greece).

Nevertheless, some countries (Belgium, Netherlands, the UK) do not see any improvement through the 3DLD compared to their previous licence scheme.

In the opinion of Member State experts

The main improvement observed concerned the new system of progressive access involving additional testing and/or training or the consolidation of this progressive part of the licence. However this aspect of the directive is clearly not seen as an improvement by the motorcycling community (see above).

For Member State experts, the system of progressive access is seen as a boost to road safety, while the possibility of direct access to the A licence at 24 is also seen as a good measure.

Several Member States (Belgium, Estonia, Austria, Finland) and Norway also highlighted the fact that they had used the 3DLD as an opportunity to upgrade their training (students' training, instructors' training, or the introduction of training for certain categories).

Identified problems

Table 13 **3DLD Identified problems**

Motorcycling Community (industry/users)	Member State experts
The licence scheme is too complex, too expensive for riders	The licence scheme is too complex, too expensive for riders
No incentive for young riders: they will wait until 24 and then go for the full A licence	Access to 3-wheelers with an A licence instead of a B licence is illogical
The minimum ages for the licence grades are too high	

In the opinion of motorcycling community representatives

The main issue with 3DLD implementation is the system's complexity, which has led to an increase in the cost of gaining a licence for applicants. On the one hand, with 3DLD implementation, a lot of countries experienced an increase in the number of mandatory training courses needed before taking the test. This has led to an increase in the total cost of the licence for applicants in Belgium, Finland, France, Greece, Norway and Romania. On the other hand, with 3DLD implementation, to get a full A-licence going through each step of the graduate licence, an applicant will have to take more training modules and more tests, resulting in an increase in the total cost in Germany, Luxembourg, the Netherlands, Sweden, Portugal and the United Kingdom. However, in Austria, Ireland, Malta and Denmark no changes or even licence cost reductions were found, proving that cost increase was not a non-avoidable collateral impact.

The motorcycling community representatives also highlight the fact that there is no incentive for "young riders" to start motorcycling at an early stage and gain experience. On the contrary, the cost and length of the licencing scheme encourages young riders to wait until 24 to gain direct access to the full A licence instead of going through the different steps to gain experience with regard to vehicle handling, but also hazard and safety awareness. The motorcycling community also expresses concerns about the minimum age for the first licence step being too high and not harmonised at European level.

All interviewed Member State experts underlined issues with training and testing requirements and called for improvements in this area.

Several Member State experts (Austria, Belgium, Germany and Greece) also complained about the issue of access to 3-wheelers with an A licence instead of a B licence. This is seen as illogical as their physical behaviour and construction are more like that of a four-wheel car than a powered two-wheeler. Access to trikes with a B licence seems more logical if it comes along with special training.

Recommendations

Table 14 **3DLD Recommendations**

Motorcycling Community (industry/users)	Member State experts
The priority would be to focus on training. Rider training should be more oriented towards risk awareness, with risk prevention and defensive riding courses offered. This kind of training should integrate all initial rider training steps	Priority should be given to further harmonising training by implementing a common framework for the training of the instructors, inspectors and testers, along with a definition of minimum standards for the training
Lowering the minimum age for each licence step and harmonising it throughout the EU	The licence scheme should not be changed again and/or an evaluation of 3DLD should be done before starting work on a 4DLD
Avoid test repetition between stages	Greater involvement of stakeholders in the development of legislation relative to the licence scheme

Additional feedback

Workshops comments - European Motorcyclists' Forum 2012, 2014 and 2015

- Representatives from Norway and Sweden underlined the need for driving licence and training schemes to be based on precise accident knowledge. In Norway, for instance, in-depth accident investigation has led to a revision of the training curriculum to better match riders' needs. This revision led to a review of the licencing access scheme.
- Sweden emphasised the gender issue inherent to the motorcycle licence. The test bike and test itself make it difficult for women riders to take the test, and this will get worse after 2019 when the test bike will have 50 kW and weigh around 180 kg.
- Several participants also raised the issue that more or improved training would be a good way of enhancing motorcycle safety. An interesting research project from the Netherlands proved that more training had a positive impact on riders but that when people thought they were better drivers, they tended to take more risks, thereby negating the training outcome.



ACEM

- Through its wise transposition into Member States' national legislation, the 3DLD could contribute to encouraging progressive access and developing training, hence further boosting the mobility contribution of PTWs, while at the same time improving the safety of the users. Unfortunately, some Member States have decided to include both training and testing for progressive access, while other Member States have left this open: testing or training.
- On training, ACEM recommends that Member States introduce mandatory pre-licence training for all novice riders; training for progressive access riders; training for riders making use of equivalence options between various licence categories.
- ACEM also see a need to harmonise training curricula across Europe. The requirements and content of such training are neither harmonised nor legislated by the European Union, as this is a national competence and responsibility, hence the diversity.

FEMA/FIM

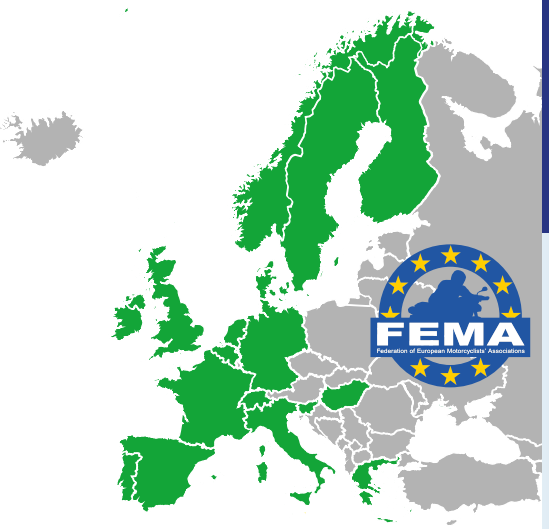
- Riding a PTW requires technical skills. Novice riders, whatever the kind of PTW, should be trained. Training should not only focus on basic manoeuvring skills and mastering traffic situations, but also address attitudes towards safety, putting a special emphasis on hazard perception and defensive riding.
- It is, however, worth noting that a very restrictive and complicated motorcycle licencing system can result in illegal behaviour by some riders through unnecessarily complicating the process.

- The curricula for the training and education of drivers in all other vehicle categories should also focus on risk awareness when dealing with PTWs, their vulnerability and crash patterns.
- An instructor's competence and attitude towards road safety are critical. There should be minimum competence requirements for instructors according to the training they provide. The requirements could relate to the instructors' own riding competence, and their pedagogical competence e.g. competence in coaching. It is important for driving instructors' education to be developed so that they can fulfil the intentions of the curriculum.

Comparisons & analysis

Project survey outcomes

The training, testing and Licencing User Survey: A view in Initial rider training



A survey targeting European riders was designed to collect information for understanding the issues riders face in terms of training and testing and recent administrative and licencing changes, including the new rules contained in the 3rd Driving Licence Directive as of 2013. The survey gathered 442 detailed answers (more details p. 176). The answers received revealed the following problems:

- **Licence cost / time**

Among the problems raised by respondents about the new driving licence scheme, those of the cost and the time it takes to gain a full licence were often cited. Indeed, it appears that if someone wants to get a full licence going through all the stages, he will have to take several courses and tests. Logically, a side effect of this new system could be that people will just wait until 24 to gain direct access to the A licence, avoiding the interim steps, in which case the directive's objective to have experienced riders riding powerful motorcycles will not be achieved. Even worse, the directive could prevent young people from riding a motorcycle at an early age, representing a loss of experience as people wait until they are 24 to take their licence.

- **Licence complexity**

Another problem raised was the complexity of the new driving licence scheme. The lack of clarity concerning age limits across Europe and the power limitation associated with a licence type make the new scheme much more difficult to understand.

- **Driving test format**

Another criticism of the new driving licence scheme is about the format of the driving test itself. For 6% of our respondents, training should be more focused on practice and should allow more hours riding on the road in traffic situations.

- **Discrimination**

These problems lead to another important issue: the discriminatory aspect of the 3rd Driving Licence Directive. A lot of respondents just did not understand why the authorities consider PTW riders and car drivers in different ways. The logic of going through different stages to gain experience and confidence before being allowed to ride a powerful vehicle are understandable and defendable; but the fact that inexperienced car drivers are not submitted to the same process is much more difficult to apprehend for survey respondents.

Table 15 **Survey top-10 comments**

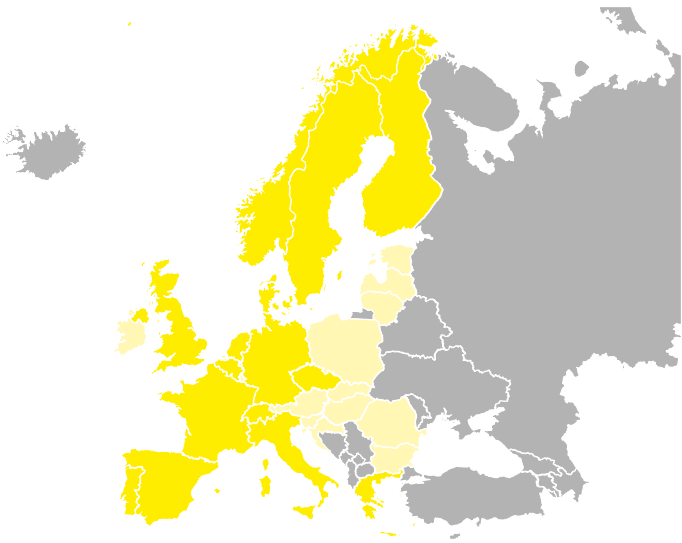
N°	Answer	Number of occurrences
1	Too expensive to gain a full licence	40
2	Too complex to gain a full licence	33
3	The new driving licence scheme is better, good, excellent, the system of stages before acquiring a full licence is a good idea	23
4	The system of stages is a good idea but ... (too many stages, too expensive, etc.)	23
5	This new scheme is discriminatory compared to the car driving licence	20
6	This driving licence scheme is catastrophic, useless, ridiculous, etc.	20
7	Too long to gain a full licence	19
8	There is a lack of choice of motorcycle for the A2 licence; there is/will be a problem with the market for second-hand motorcycles	13
9	There are problems in the exam (e.g.: not enough training on traffic situations, education of car drivers, etc.)	11
10	The age limit for each licence type should be harmonized throughout Europe / the age limit for each licence type is too strict	11

Comment: *the 10 responses with the most occurrences among a total of 177 answers. A lot of respondents expressed more than one opinion in their answer.*

Legend: **In green** positive opinion on the new driving licence scheme
In red negative opinion on the new driving licence scheme

The RIDERSCAN pan-European Motorcycling Survey - A view on post-licence training

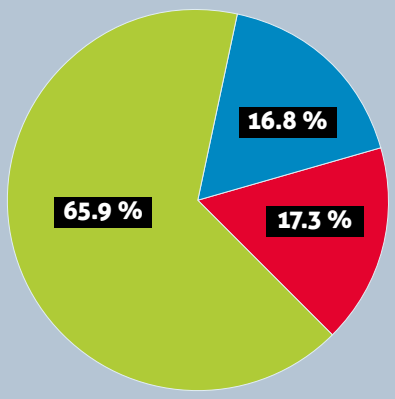
A survey targeting European riders was designed to collect information on the motorcycling community around Europe and gain a better overview of similarities and differences in terms of riding, attitudes and safety needs. The survey gathered 17,556 answers from 31 countries (more details p 175). The number and diversity of answers enabled us to gain the following information:



Geographical trends

The European dataset shows that only a minority of riders have undertaken post-licence training courses once or more often. A national comparison of the answers shows great national differences. Among the countries with at least 100 answers, Switzerland (69.5%), Austria (66.1%) and the United Kingdom (57.4%) have the highest rate of respondents who have at least participated once in voluntary advanced training. Switzerland (47.9%), Austria (43.8%) and Sweden (43.6%) also have the highest rate of respondents stating having taken advanced training more than once.

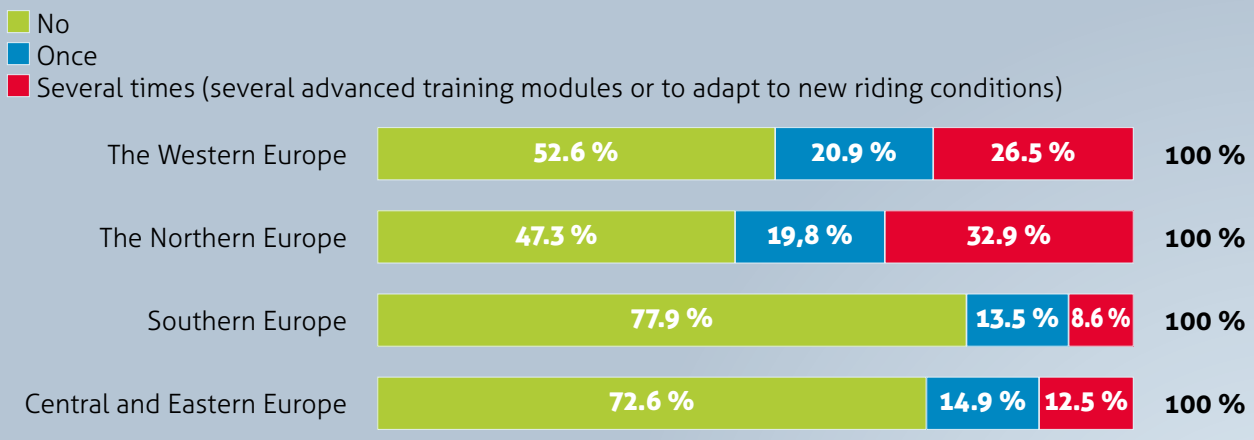
Figure 24 **Participation in voluntary advanced training (post-licence training) in Europe (EU dataset)**



	% cit.
Once	**16.8 %**
Several times (several advanced training modules or to adapt to new riding conditions)	**17.3 %**
No	**65.9 %**
Total	**100.0 %**

There is a clear geographical trend to be observed with regard to participation in voluntary advanced training, with the highest participation rates found in Western and Northern Europe.

Figure 25 **Participation in voluntary advanced training (post-licence training) in area of Europe**

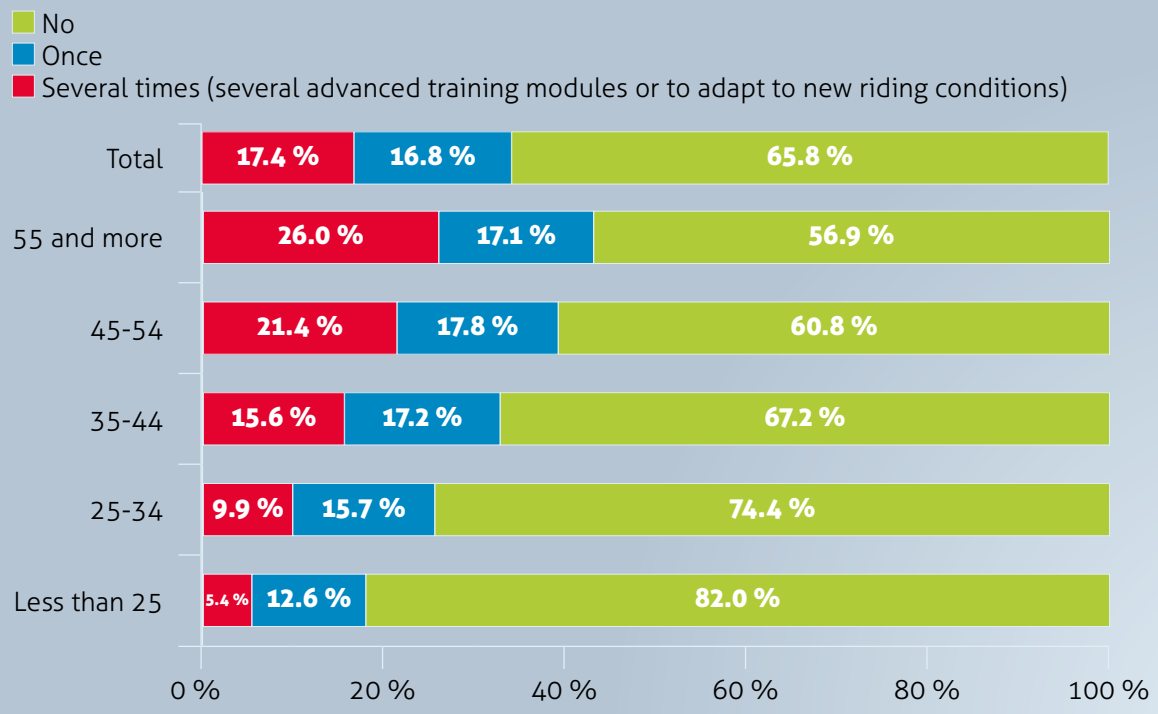


Western Europe: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerlands
Northern Europe: Denmark, Finland, Ireland, Iceland, Norway, Sweden, United Kingdom
Central and Eastern Europe: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia
Southern Europe: Cyprus, Greece, Italy, Malta, Portugal, Spain

Age influence

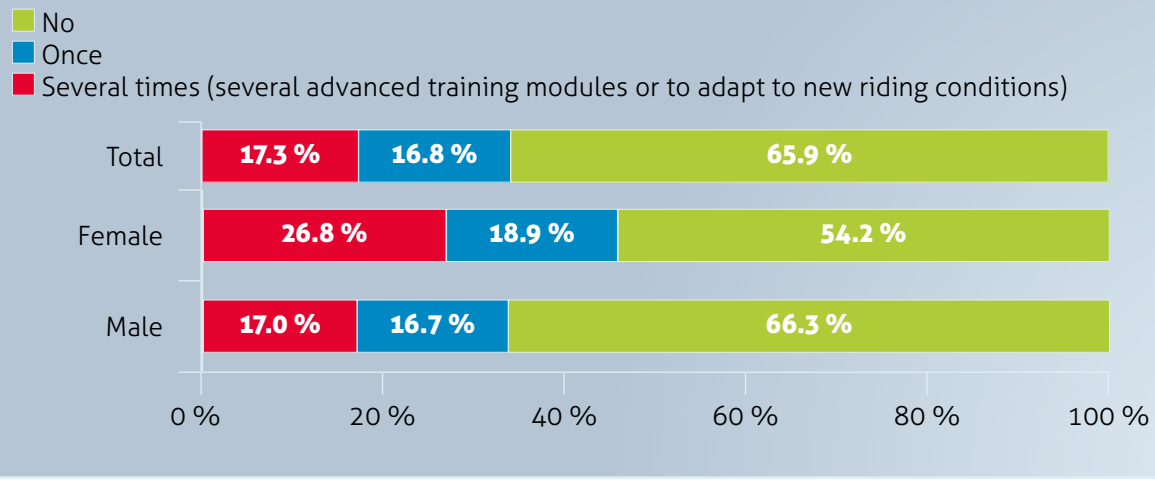
While no clear age influence could be identified amongst those stating having taken a voluntary advanced training course once, the proportion steadily increases with age for those declaring having taken such courses more than once, most likely illustrating the influence of risk awareness and/or purchasing power. 43.1% of respondents aged 55 or older have taken at least one advance training course, against 18% of our under-25 respondents.

Figure 26 **Participation in advanced training by age (EU dataset)**



Interesting to note is the proportion of female riders having taken advanced training courses once or more: 45.8% of female respondents had taken a post-licence training course at least once, against 33.7% of male respondents.

Figure 27 **Participation in advanced training by gender (EU dataset)**



Rider profiles

Crossing advanced training courses information with national rider profiles shows some interesting similarities.

Specifically comparing France, Italy and the United Kingdom, the following can be underlined:

- Answers show that there is a correlation between professional activity and advanced training participation. We see that among business owners or self-employed professionals there is a higher rate of riders taking advanced training courses more than once than in the overall national sample. Nevertheless, the correlation seems less distinct in Italy, where the rate of riders having taken several advanced training courses is lower than in France or the United Kingdom.
- There seems to be a correlation between a rider's level of education and advanced training participation. We see that it is the three highest levels of education (master, doctorate and post-doctorate) that have the highest rate of riders having taken advanced training courses more than once in the total national sample. Nevertheless, the correlation seems less distinct in Italy, where the rate of riders having taken several advanced training courses is lower than in France or the United Kingdom.
- There is no clear correlation between a rider's family situation and advanced training participation. The rate of participation is more or less the same throughout the sample. The influence of having children or not seems to have no influence on any decision to undertake advanced training courses.
- There is a correlation between a rider's level of income and advanced training participation. A high level of income is linked with a higher participation rate than the overall national sample. Not surprisingly, the cost of advanced training courses is a critical factor influencing riders to take such courses.
- There is a clear correlation between membership of a national motorcyclist association and advanced training participation. The same trend can be observed between members of a motorcycling/motoring club and non-members. Associations and clubs thus play an important role in raising awareness among their members.
- There is a correlation between the annual PTW mileage and advanced training participation, with those riders with the highest mileage per year having the highest participation rates.
- There is a correlation between the type of PTW usage and advanced training participation. Riders having taken several advanced training courses tend to use their PTWs mainly for leisure and hobby.
- No correlation could to be found between the safety attitude "Motorcycling will never be made risk-free" and advance training course participation. In France, the highest participation rate can be found among riders who totally agreed with the statement, while this rate applies to riders who totally disagreed with it in the United Kingdom.

Table 16 **Respondents' profiles in France, Italy and the United Kingdom**

	Members of a national motorcyclists association	Member of a motorcycling/ Motoring club	Readers of motorcycle magazines	Respondents took several voluntary advanced training
France	31.3%	17.8%	76.9%	7.8%
Italy	7.4%	26.8%	78.0%	5%
United Kingdom	25.4%	36.5%	91.1%	34.2%

Table 17 **Participation rate in several advanced training courses for members and non-members of a national motorcyclist association**

	Member of national motorcyclists association	Not a member of national motorcyclists association	Readers of motorcycle magazines	Respondents took several voluntary advanced training
France	11.6% of riders members of national motorcyclists association took voluntary advanced training several time	5.5%	76.9%	7.8%
Italy	9%	4.6%	78.0%	5%
United Kingdom	58.8%	24.7%	91.1%	34.2%

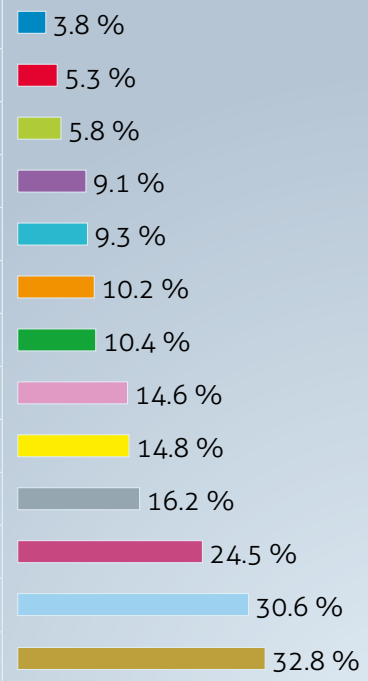
Table 18 **PTW annual mileage and participation rate in several advanced training courses**

France	13.6% of riders riding more than 15,000km a year took voluntary advanced training several times
Italy	7.8%
United Kingdom	52.8%

Safety information sources

Figure 28 **What are your safety information sources? Answer ranked as most important (EU sample)**

	% cit.
Motorcycle dealers	**3.8 %**
The National Transport Administration	**5.3 %**
Motorcycle manufacturers	**5.8 %**
Friends or family	**9.1 %**
Information from Road Safety agencies	**9.3 %**
Motorcycle clubs	**10.2 %**
Other	**10.4 %**
Rider education in traffic schools	**14.6 %**
License training before the motorcycle license	**14.8 %**
Your national motorcyclists' organization in your country	**16.2 %**
Motorcycling friends	**24.5 %**
Articles in motorcycle magazines	**30.6 %**
Advanced training	**32.8 %**
Total	**100.0 %**



- Advanced training, licence training and education in driving schools are well rated when it comes to rider information. It seems that advanced training courses are the most important source of safety information, confirming the benefits of such training for enhancing motorcycle safety.
- Advanced training is the top answer in Belgium, the Czech Republic, Denmark, Greece, Norway, Portugal, Switzerland and the United Kingdom.
- The national sample analysis shows that for riders in France, Italy and the United Kingdom who have taken at least one advanced training course, the most important source of information on motorcycle safety is such a course. In France, the most important source for riders who have never taken any advance training is motorcycle dealers (89.2%), while in Italy it is the licence training before the motorcycle licence (86.1%), and friends or family in the United Kingdom (63.5%).
- In Finland, the most important source of information is motorcycling friends (27.6% against 17.9% for advanced training).
- In France, the national motorcyclist organization (36.5%), motorcycling friends (28.6%), articles in motorcycle magazines (28.3%) and rider education in driving schools (23.2%) came before advanced training (23.0%).
- Articles in motorcycle magazine are a more important source of information than advanced training in Germany (33.9% against 31.8% for advanced training) and Italy (37.9% against 28.1%). 79.6% of German respondents are readers of motorcycle magazines, as are 78% of Italian respondents.
- National motorcyclist organizations are considered as a more important source of information than advanced training in the Netherlands (35.5% against 32.0%), Spain (29.9% against 26.8%) and Sweden (31.6% against 30.1%). 62.6% of Dutch respondents are members of a national motorcyclist association, 54.3% of Spanish ones and 88.1% of Swedish ones.

Identified needs

The pre-licence training curriculum should aim at teaching the necessary knowledge, skills and mental attitude to ride defensively, in full awareness of risk exposure and accident causation factors, and not simply at passing the licencing test.

The licence test should instead be a quality assurance of the candidate's competence – i.e. the minimum skills, knowledge and attitude needed to safely operate a motorcycle on public roads. To this end, Category A training instructors and examiners should be experienced riders accredited by national certification programmes.

Today's EU regulatory framework only briefly describes the content of testing. Finding an adequate system enabling access to PTWs, while ensuring that novice riders & drivers have the skills, knowledge and attitudes needed to safely operate the vehicle chosen on public roads, is one of the critical issues needing to be addressed by Europe today.

Based on the input collected during the project on *training, testing and licencing* throughout Europe, the project recommendations include the following:

Research needs

- **Effects of the various age limits on progressive access**
  - EU harmonisation: cross-EU evaluation of the effects of the various age limits to ride a class I moped
  - In what way is learning to ride a moped different from learning to ride a motorcycle; or learning to ride a low-performance motorcycle different from learning to ride a high-performance one?
  - Risk awareness: motorcycling experience effect (including training, type of riding licence, number of year of practice and frequency of motorbike use) on motorcyclists' risk awareness.
- **Training**
  - the content and effectiveness of training (including post-licence training) with the aim of improving the behaviour and safety of both drivers and riders
  - further research should identify specific training needs according to experience and vehicle
  - young riders: search for effective ways to improve training for young riders/drivers
  - rider training: which skills and how should they be trained during training (e.g. manoeuvring skills, braking skills, noticing risk situations) at driving schools; and how do the skills learned work in real traffic situations? How can these be learned effectively and efficiently, in how much time and in which sequence?
- **New technologies**
  - The development of new simulation techniques offers new opportunities for training programs (risk definition, risk identification, hazard awareness programmes, simulation tools, etc.)

Standardization

- **Standardizing minimum training curriculum requirements** and linking driving licence tests to this standard would significantly improve the quality of rider training programmes (need for a "quality seal")
- Standardise EU rider/instructor training curricula

Legislation

- Address training content / instructor skills in a legislative framework as an essential complement to the 3rd Driving Licence Directive (for PTWs), addressing:
  - Initial rider training
  - Instructor training
  - Advanced riding courses
  - Use of driving simulators
  - Special training and education for returning bikers
- Harmonize and lower the minimum age
- Harmonize licencing requirements to a greater extent

Specific actions

- The type of bike chosen by riders provides a clear indication of their motives, the experience they seek and their concept of riding (when they can choose the bike). One implication is that persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour.
- Train PTW users in the proper use of ABS and promote its widespread uptake: the necessity of knowing how the Anti-lock Braking System (ABS) works; training in ABS operation; initial rider training, websites, post-licence training programmes.
- Benchmark and exchange best practices on training methods, content, and instructor skills.

Road environment

Riding defensively, scanning traffic precisely and anticipating risk situations are of vital importance for motorcyclists. Riders need to concentrate on the traffic rather than on road surface quality and properties.

However, infrastructure deficits are often the primary or at least a contributing factor in motorcycle accidents. Road design, maintenance and construction are most often dictated by the needs of multi-track vehicles, with road standards and guidelines hardly taking the specific needs of PTWs into consideration.

Basic PTW design needs include:

- Consistent adhesion/grip/skid resistance in all weather conditions,
- Clear signs that riders can see and understand,
- Good mutual visibility,
- Minimum risk of colliding with obstacles.

The road environment has a significant influence on the risk of crashes involving PTWs. Contributing factors include *road surface defects* (such as unevenness, potholes or debris on the road); the presence of *slippery material* (water, oil) on the road; *road markings* with insufficient *skid resistance* or the use of raised pavement markers; poor *road alignment*; the presence of *obstacles*, *roadside hazards* and safety barriers, and interaction with other road users (including heavy goods vehicles, cars, cyclists, pedestrians and other PTWs).

The road layout has an important impact on the harmony and efficiency of interactions between road users, specifically between cars and PTW riders. More particularly, it can condition the capacity of car drivers to detect a PTW, and favour a driving speed conducive to safety, both elements recognized as critical in crashes involving PTWs.

It is sometimes more effective to act indirectly on road infrastructure than directly on road users. Human behaviour is partly the product of the environment in which humans operate. The road layout will thus have a decisive influence on their activity, whether behavioural or cognitive (psychological).

Consequently, the quality of the road layout and proper traffic management play an important role in helping riders to control their vehicles, preventing loss of control, and influencing interactions with other road users. Infrastructure determines the way road users interact.

Road maintenance requires the relevant authorities, road engineers and road safety experts to be properly trained or briefed in PTW-specific requirements. *Road Safety Audit/ Inspection Curricula* and *Road Assessment Programmes* are key elements to be considered, while motorcyclist groups and ICT-based contributory processes (e.g. for identifying high-risk sites a.k.a. black spots) are coming up with interesting innovative solutions needing to be considered.

As the need to further improve infrastructure is now recognized among the road safety community and as advanced technology, especially intelligent transport systems, is now promoted for both active safety (accident prevention) and passive safety (accident protection) by a vast majority of stakeholders and is part of the road environment faced by powered two wheeler users, the RIDERSCAN project focused on:

- Gaining a clearer picture of the common infrastructure problems;
- Identifying priority areas for action through standardization and other targeted activities.
- Setting the scene for ITS with and for motorcycling (definitions, framework)
- Gaining a clearer picture of existing ITS for motorcycling and existing systems/functions classifications
- Improving understanding of riders' perceptions of ITS
- Identifying specific PTW aspects with regard to ITS developments
- Reporting on existing traffic management best practices for motorcycling
- EU policy and documentation review

Lillehammer priorities

Priority n°2: Transport and infrastructure policy: It is a fundamental motorcycle safety requirement that, by default, PTWs should have a place in overall transport policy and infrastructure policy/management.

Priority n°4: General driver training: A component on awareness and acceptance of motorcyclists should be included in the general training for all drivers, with a particular emphasis on the need for appropriate traffic scanning strategies.

Priority n° 15: Motorcycles in ITS: Enhanced awareness of motorcycles should be incorporated into the development of all vehicle ITS projects.

Priority n°8: Guidelines for the development of road infrastructure: Each level of government should include in their infrastructure guidelines measures for accommodating PTWs, developed with input from relevant stakeholders. The guidelines should be relevant to the needs of the jurisdiction concerned and coordinated with other jurisdictions and levels of government. An international transfer of best practices is also recommended.

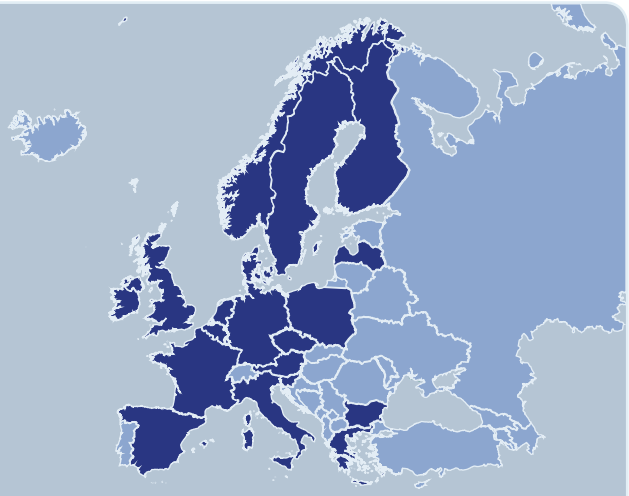
Priority n°11: Training for road designers: The needs of PTWs should be included in the basic training for road designers, highway and traffic engineers

Priority n°14: Roadway design: Identification and resolution of roadway design problems (e.g. accident black spots & "corridor" analysis of a sequence in the road structure) should include input from rider organizations & relevant experts.

RIDERSCAN outcomes

- EU research main conclusions on infrastructure and on ITS for PTWs
- Common PTW infrastructure problems in Europe
- Overview of best practices throughout Member States (use of guidelines, black spots, PTW users as VRUs)
- List of EU standards to be reviewed
- Pan-European Black/White Spot Report Form to be used
- A dedicated infrastructure website
- Dedicated sub-website on guardrails
- A Motorcyclist Protection System Database
- Guidelines for road restraint systems
- Overview of ITS political context, legal frameworks and initiatives
- Overview and classification of ITS systems/functions for PTWs in PTW-related safety areas
- A European map of rider acceptance of ITS for PTWs
- A primary description of the specificities of the riding tasks and their impact on ITS development
- PTW/ITS deployment challenges

Input received from...



EU stakeholders
ERF
FEHRL
CEDR

	Member States	The Motorcycling Community	the Research Community
Austria			KFV (Austrian Road Safety Board)
Belgium	Department of Mobility	FEBIAC; MAG Belgium	IBSR, BRRC
Bulgaria	Road Infrastructure Agency		
Czech Republic			Transport Research Centre
Denmark		MCTC	
Finland	TRAFI		
France	Conseil National de Sécurité Routière	FFMC	IFSTTAR
Germany		BMW; IVM; IFZ; BU; BVDM	Federal Highway Research Institute (BASt)
Greece		AMVIR	National Technical University of Athens
Ireland	National Roads Authority	MAG Ireland	
Italy		ANCMA; Ducati; FMI	
Latvia	Latvian State roads		
Luxembourg	Ministère du Développement durable et des Infrastructures, administration des ponts et chaussées	LMI	
Netherlands	Department of Road Safety, Ministry of Infrastructure and Environment	Kawasaki; Yamaha; MAG NL	
Norway	Norwegian Public Roads Administration	NMCU	
Poland	General Directorate of National Roads and Motorways		
Slovenia	Slovenian Traffic Safety Agency		
Spain	Directorate General for Traffic (DGT), Ministry of Interior		
Sweden	Swedish Transport Administration	SMC	
United Kingdom	Road User Licencing, Insurance and Safety	BMF	

EU POLICY AND DOCUMENTATION REVIEW

Technology is seen by all major stakeholders as an important, if not essential, component of Europe's competitiveness in the global economy. Transporting people, goods and information in the most efficient way is definitely a critical element of this economic angle.

From a citizen perspective, technology is expected to provide more freedom (mobility/time) and a better standard of living (safety/environment).

The deployment of new technologies, in particular on European roads, has become one of the hottest topics on the agenda of the European institutions, closely related to mobility, safety and greening issues. They increasingly belong to riders' traffic environment. Similarly, road infrastructure solutions are set to increasingly integrate ICT, as illustrated by the new European research funding programme *Horizon 2020*. Automated vehicles could, according to optimistic sources, come as early as 2018. More realistic sources talk of 2020, but in all cases, automation is coming, and the only question remaining is *when*?

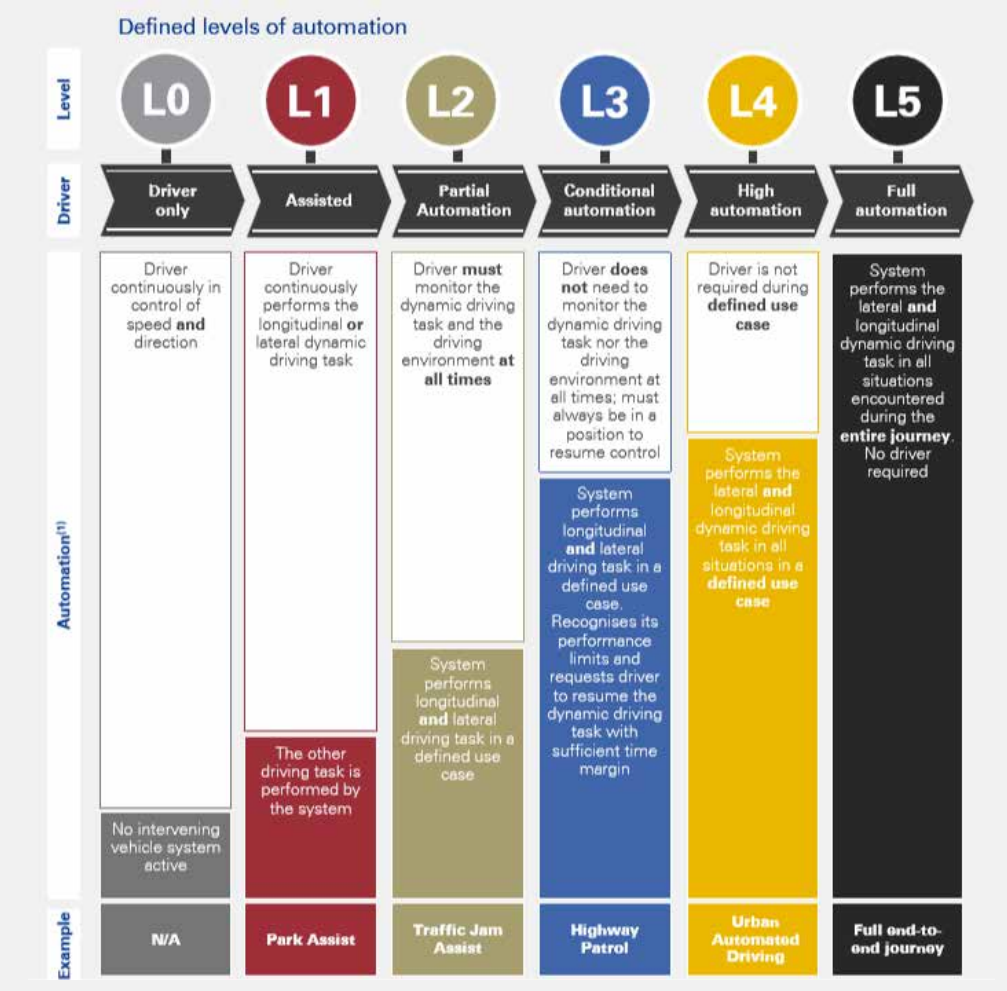


Figure 29 **Rollout of automated technology (Source - ACEA)**

Assistive and cooperative systems are expected to have a significant impact on the safety of motorcyclists, influencing car drivers' perception and decision-making. With the deployment of ITS solutions, the impact of other vehicles, human behaviour, and training must therefore be studied and integrated into a specific impact assessment of intelligent transport systems with regard to PTWs.

As underlined by the European Commission[1], available solutions as well as ongoing R&D have focused on cars and trucks, with only limited applicability to motorcycles, light PTWs, bicycles and pedestrians – in that order. This has to do primarily with technical and practical limitations, notably with regard to the user interface, available space to install equipment without hindrance to the user, exposure to outside environmental conditions and the lack of a high-quality power source. There are also economic factors: if the bill is to be paid by the road user, the cost of the ITS equipment has to be small compared to the cost of the transport means itself. Manufacturers of motorcycles, light PTW's and bicycles do not have R&D budgets anywhere near those of car manufacturers. As a result, few ITS solutions have been developed that target traffic participants other than car or truck drivers as the primary user.

EU RESEARCH WORK

The road performance characteristics of motorcycles are very different to those of other types of vehicles. Certain manoeuvres and road conditions carry a higher risk for motorcyclists than for drivers. The road environment has a significant influence on the risk of crashes involving motorcyclists. Contributing factors include:

- Interaction with larger vehicles (cars, trucks)
- Road surface issues (such as roughness, potholes or debris on the road)
- Water, oil or moisture on the road
- Excessive line marking or use of raised pavement markers (a.k.a structured road markings assemblies or rumble strips in EN 1871)
- Poor road alignment
- Presence of roadside hazards and unprotected safety barriers
- Number of vehicles and other motorcyclists using the route. (EURORAP)

Road infrastructure should be designed taking account of the same injury tolerance criteria as those developed for vehicle occupant protection and pedestrian impacts, so that roads and vehicles together provide an effective safety system; (DACOTA)

Making the road infrastructure "motorcycle friendly", self-explaining and forgiving requires an in-depth understanding of vehicle-road interaction and its dynamics. Detailed analysis with simulation tools (vehicle-infrastructure interaction simulation), as well as the incorporation of data gathered in naturalistic riding studies, should take place in coming PTW-related research projects. (2BESAFE)

The current ITS state-of-the art has not been subjected to any dedicated impact assessment with regard to its positive or negative consequences for other road users, and accident causation risks are not fully known or understood, in particular with regard to PTW use. Their specific characteristics, including limitations, capabilities, profiles and vulnerabilities, require the development of a specific assessment methodology based on a careful identification of the existing differences to car use.

Lack of data on VRU-specific accidents: in order to be able to assess the current situation in traffic especially with regard to certain road user groups (pedestrians, cyclists, older road users), there is a need to overcome the significant lack of data. This in turn is needed to develop specifically adapted solutions at different levels. Knowledge of real-life critical situations is needed for sustainable improvement. (VRUITS)

1 ITS ACTION PLAN / framework contract TREN/G4/FV-2008/475/01
http://ec.europa.eu/transport/themes/its/studies/its_en.htm

As a consequence, projects targeting VRUs, such as VRUITS, have no choice but to use the only existing assessment methodology developed by eIMPACT[1] to assess ITS systems. The methodology focuses on the 9 safety mechanisms described below and is based on car use, again highly different from PTW ergonomics and dynamics:

- direct in-car modification of the driving task;
- direct influence by roadside systems
- indirect modification of user behaviour
- indirect modification of non-user behaviour
- modification of interaction btween users and non-users
- modification of road user exposure;
- modification of modal choice;
- modification of route choice;
- modification of accident consequences

A better understanding of the riding activity (tasks, modelling, patterns) and the actual needs and constraints of PTW users is a prerequisite for improving the road environment for PTW users in the future.

For more details on the EU research projects scanned, see the section "Overview of EU research projects on PTWs" (p. 183).

1 http://www.eimpact.eu/

Stakeholders views

Member State experts	Motorcycling Community (industry/users)
Revision of EU standards:	Integration of PTW-specific needs:
• EU standards on crash barriers (EN 1317)	• Improve communication on the implementation of PTW-specific infrastructure guidelines through setting up a roundtable for PTW safety
• EU road surface standards (road quality (friction, evenness) for PTWs)	• Find a way to motivate road engineers to use PTW infrastructure guidelines
Need for harmonisation:	• The EU directive on infrastructure should include road inspections for secondary roads
• Harmonisation in road construction	• The crash barrier test (EN1317) should include PTW specificities
• Harmonisation of road inspections for secondary roads	• Improve the periodic maintenance of roads
• Formal exchange of knowledge between similar countries	• Improve traffic signalisation on roads dangerous for motorcycles
• Use of safety gear/clothing	
• A uniform policy towards the use of bus lanes, road verges, hard shoulders, filtering	

Riders' rating of ITS developments for motorcycling

Consolidating the ITS systems/functions gathered in the Monash review[1] **(in blue)** and the Saferider User Survey[2] (in black), the project team came up with the following categorization **(in orange)** of existing ITS devices for powered two-wheelers.

The majority of systems/applications/functions referred to in the next pages are far from being available on the market. Many of them are only at prototype phase. Some are indeed being investigated by the PTW industry, with some examples of implementation, but for a limited number of vehicles and with limited use. Several others have not been researched by industry, but come from researchers trying to improve road safety.

1 Bayly, M., Regan, M., Hosking, S., Intelligent Transport Systems and Motorcycle Safety, Monash University Accident Research Centre, 2006, http://www.monash.edu.au/miri/research/reports/muarc260.html

2 SAFERIDER project, D1.2. Use Cases report, 2008, http://www.fema-online.eu/riderscan/IMG/doc/saferider_certh_wp2_v3_d1.2_extract_ridersneedsandwants-2.doc

Rider warnings and information

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p.173)
Advanced Rider Assistance	Reduce rider workload	Prevent loss-of-control crashes (indirect safety benefits)	
Black spot warnings	A system able to warn the rider that he is riding in a place with a high risk of crashing or where a high number of crashes have occurred, aka a black spot	Prevent loss-of-control crashes (indirect safety benefits)	
Curve speed warning	A function able to warn the rider that he/she is negotiating a bend at a speed too fast for its curvature; Information or warnings regarding the speed or geometry of a curve ahead is delivered by an on-board unit and GPS system		Top 10 most dangerous and most useless system
Following distance warning	Alerts user when distance to vehicle ahead is too short		
Forward collision warning	Alerts user when an object has been detected ahead on the roadway that is slower than the user's vehicle → Prevent motorcycle striking objects / vehicle in path	Reduction of frontal impact crashes (indirect safety benefits)	
Heads-up display	Projects a display of vehicle information onto the windshield		Top 10 most dangerous system
Helmet-mounted display	Projects a display of vehicle information onto the helmet visor → Minimize need for riders to take eyes off road	Loss-of-control crashes and potentially speed-related crashes (indirect safety benefits)	Top 10 most dangerous system
In-vehicle tutoring systems	Provide feedback to the user regarding vehicle performance		
Navigation systems	Deliver information regarding vehicle position and intended path via a GPS or satellite system and on-board unit → Reduce rider workload	Prevent loss-of-control crashes (indirect safety benefits)	
Object detection systems	Detect and alert the user to objects on the roadway (animals, pedestrians, etc.) → Warn driver of objects in his path	Prevent collisions with objects on roadway (indirect safety benefits)	
Reverse collision warning system	Detect and alert the user to the proximity of objects directly behind the vehicle when reversing		
Road surface condition monitoring	Monitor the road surface ahead and alert the user to abnormalities, material or fluids on the road surface → Warns riders of road surface abnormalities	Reduce running-off-road crashes (direct safety benefits)	
Speed alert/warning	Alert the user when a pre-set limit is exceeded		Top 10 most useless system
Traffic warnings	A system that informs the rider about traffic conditions		
Weather warnings	A system that informs the rider about weather conditions on the road he/she is riding on or planning to travel on		

Maintenance and diagnostic

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Tyre pressure monitoring	Monitors the temperature and pressure of the tyres and alerts user to potential problems		Top 10 best safety systems
Vehicle Diagnostics	A function that can electronically diagnose mechanical factors of the PTW → Warn the driver of vehicle system problems	Prevent loss-of-control crashes (indirect safety benefits)	Top 10 best safety systems

Lighting and visibility

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Adaptive front lightning	Improve illumination of the vehicle path in curves by altering the direction of the light beam → Improve road visibility when cornering	Crashes occurring in curves at night or in poor visibility conditions (indirect safety benefits)	Top 10 best safety systems
Blind spot assistance system	A system that can support the rider in a situation when a rider is invisible to a vehicle that is driving/approaching slightly from behind (mainly)		
Continuous strobe lighting	Provide a continuous flashing light making the vehicle visible to other road users		Top 10 most dangerous and most useless system
Daytime running lights	Low-luminance front-mounted lights, automatically activated when headlights are not turned on → Increase motorcycle conspicuity	All multiple vehicle crashes during daytime (direct safety benefits)	
Emergency brake advisory systems	Activate rear brake lights when the accelerator is rapidly released		
Rear-view display / Rear-view helmet	Displays real-time images of the road environment direction behind → Increase riders' field of view	Prevent side-swipe and rear-end crashes (indirect safety benefits)	Top 10 most dangerous system
Vision enhancement	Provide a high contrast image of the road and road environment in poor visibility conditions		Top 10 best safety systems
Visibility improving helmet	Prevent fogging of the motorcycle helmet visor through heating or dehumidifying systems		Top 10 best safety systems

Braking

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Anti-lock braking systems	Provide smooth and even braking pressure to all wheels, and prevent them from locking → Prevent brakes locking	Most relevant to frontal and object collision crashes (direct safety benefits)	Top 10 best safety systems
Brake assist	Applies maximum braking pressure in emergency stops → Reduce stopping distance in emergency braking	Most relevant to frontal and object collision crashes (direct safety benefits)	Top 10 best safety systems
Linked braking systems	Apply braking pressure to both wheels even when only one brake is engaged by the user → Maximize braking force	Prevent frontal collisions and running off-road crashes (direct safety benefits)	Top 10 best safety systems

Stability and balance

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Automatic Stability Control	ASC: prevents the rear wheel from spinning uncontrolled and lift-off detection of front wheel		Top 10 best safety systems
Electronic stability program	Detects loss of control of vehicle and intervenes on each wheel to maintain trajectory → Maintain traction of the vehicle	Loss-of-control crashes, and off-path-in-curve crashes (direct safety benefits)	
Roll stability	→ Warn riders if tilt of motorcycle is too great	Off-path-in-curve crashes which account for 17% of all motorcycle crashes (direct safety benefits)	Top 10 most dangerous and most useless system
Traction control	A system that gives optimal grip to the wheel while accelerating; Provides greater control when accelerating by applying braking pressure or altering the fuel or power supply		

Rider fitness

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Alcohol detection and interlock	Disable vehicle's ignition if alcohol is detected in the breath of the user → Prevent drunken riding	Any type of crash involving alcohol. 25% of fatal motorcycle crashes involve a BAC over .05 (direct safety benefits)	Top 10 most useless system
Animal detection systems	Detect and alert the user to animals on the roadway		
Driver vigilance monitoring	Monitor vehicle/user behaviour and/or physiology and provide alerts or intervene if the user is fatigued or inattentive → Monitor alertness and fatigue in rider	Prevent loss-of-control crashes (indirect safety benefits)	
Drowsiness relieving system	Provide alerts such as warning tones, haptic feedback or fragrance if users is fatigued or inattentive		
Electronic licencing / Smart cards	Disable ignition unless licenced user is identified → Prevent unlicenced riding	Should reduce alcohol- and speed-related crashes (direct safety benefits)	Top 10 most useless system
Helmet reminder and interlock	Detects the presence of helmet and disables the ignition if helmet is not properly fixed		Top 10 most useless system

Passive systems (post-crash)

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Airbag jackets	Airbags within the jacket inflate when the rider is thrown from the vehicle → Minimise injury to the rider when thrown from the vehicle	Relevant to any single or multiple vehicle crash where the rider is thrown from the vehicle (direct safety benefits)	
e-call/ Automatic Crash Notification	Automatically inform emergency services of vehicle's location in the event of a crash	Reduce emergency response times (direct safety benefits)	
Emergency lighting systems	Illuminate the vehicle after a crash has occurred	Reduce emergency response times (indirect safety benefits)	
External airbags	Airbags mounted externally to the front bumper and bonnet inflate upon collision with a pedestrian → Cushion impact of rider with other vehicle	Minimize injury in vulnerable road user collisions	
Impact sensing cut-off systems	Disable electrical and/or fuel systems post-crash → Prevent electrical and fuel systems igniting in a crash	Prevent minor injury crashes becoming serious or fatal (indirect safety benefits)	Top 10 best safety systems
Motorcycle airbag	Deploy upon detection of crash that exceeds a predetermined intensity level → Prevent the rider being thrown from the vehicle in front-impact crashes	Frontal impact crashes with other vehicles and objects (direct safety benefits)	
Pop-up bonnet systems	→ Cushion impact of upper body with car bonnet	Minimize injury in vulnerable road user collisions	

Vehicle to Vehicle (V2V) communication

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Adaptive cruise control	A system that can automatically maintain a constant distance, selected by the rider, to the vehicle in front and can also maintain a constant speed		Top 10 most dangerous system
Intersection collision avoidance	Vehicles approaching an intersection communicate their speed and direction to roadside beacons, which alert other vehicles of their position		Top 10 most dangerous system
Inter-vehicle communication systems	Vehicles communicate their speed, direction, location and vehicle type. This information is then displayed to the user → Prevent other driver failure-to-see crashes	Off-path-in-curve crashes, which account for 17% of all MC crashes (direct safety benefits)	
Motorcycle detection system	Motorcycles transmit their speed and location to other vehicles, alerting other drivers when motorcycles are in close proximity		

Vehicle to Infrastructure (V2I) communication

System	Description	PTW safety benefits	Riders evaluation (cf. ITS Survey results p. 173)
Intelligent speed adaptation	Alert and/or limit the speed of the vehicle according to the posted speed limit, using roadside beacons or GPS systems to determine this speed → Prevent the vehicle from exceeding the speed limit	Prevent speed-related crashes (direct safety benefits)	Top 10 most dangerous and most useless system
Lane changing collision avoidance	Monitor the vehicle's blind spot and provide alerts when vehicles are located in this area		
Lane departure warning / Lane keeping assistance	Monitor the vehicle's lateral position, and either alert or intervene when the vehicle deviates from the lane		Top 10 most dangerous and most useless system
Speed limiting systems	Alert the user and inhibit further acceleration when a pre-set limit is exceeded		Top 10 most dangerous and most useless system

Motorcyclists: *Powered* Vulnerable Road Users

At this stage, it is important to note that the PTW domain is very different from pedestrian and bicycle safety domains. From an ITS development perspective, it appears that these three communities of road users have very little in common with regard to hardware or software platforms supporting mobility needs, as PTWs are the only ones with on-board electricity. Besides, requirements related to usability, licencing, manoeuvrability, the environment and travelling (among many others) differ tremendously depending on which category of VRUs one is focusing on.

Due to the specific nature of uses, PTW users require a wider geographical service area and a level of service than everyday pedestrians and cyclists. While bicycles and pedestrians will most likely need to rely mainly on smartphone platforms, this is no solution for PTWs.

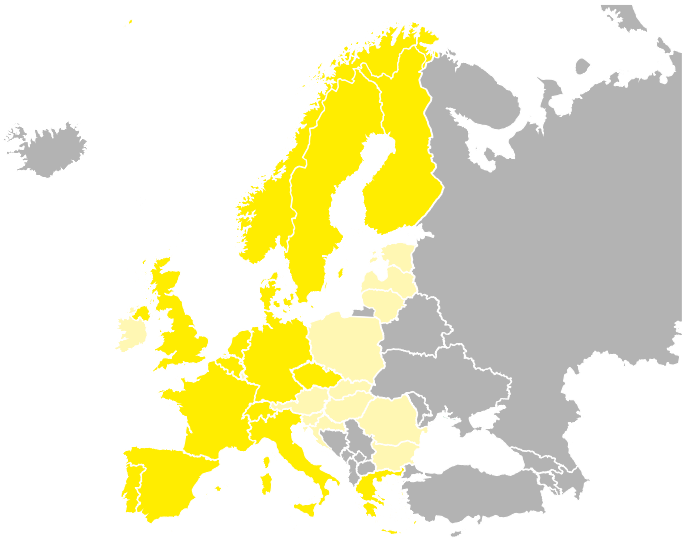
The bill-of-materials (BOM) – a highly scrutinized aspect at all development phases of any technical solution – does not impact bicycle and pedestrian solutions in the same way. Besides, on this specific aspect, PTW riders are perhaps the users most highly impacted by any added costs due to the relative cheap vehicle price (compared with cars).

The requirements for road structures also differ between these 3 groups. PTW riders are likely to suffer/benefit more from different factors and structures than pedestrians and cyclists.

Hence, it is highly likely that applicable solutions answering PTW safety needs will not only differ in design but may also not be applicable to pedestrians and cyclists - and vice-versa. The three categories have very limited fields of possible synergies regarding the design, specification and implementation of efficient safety measures.

Project survey outcomes

Everyday riders' view on infrastructure - The RIDERSCAN pan-European Motorcycle Survey



A survey targeting European riders was designed to collect information on the motorcycling community around Europe and gain a better overview of similarities and differences in terms of riding, attitudes, and safety needs. The survey gathered 17,556 answers from 31 countries. (more details p. 175). The number and diversity of answers enabled the following information to be collected:

Infrastructure problems

With the exception of France and Norway, the infrastructure priority in all countries is *road maintenance* (i.e. potholes, asphalt seals, etc.)

Road surface (pavement, rutting, manholes, slab joints, tram tracks, skid resistance) was always the second most important issue for riders, except for France and Norway where this issue came in front of *road maintenance*.

Figure 30 **Main infrastructure problems faced by motorcyclists (EU sample)**

	No.	% cit.
Road works	**2 373**	**13.5 %**
Hazard signaling (black spot management)	**3 037**	**17.3 %**
Road structure and design (geometry, curve design)	**3 591**	**20.5 %**
Road signs, roadside equipment, urban furniture	**5 063**	**28.8 %**
Road markings (paintings)	**6 795**	**38.7 %**
Road surface (pavement, rutting, manholes, slabs joints, track trams, skid resistance)	**13 966**	**79.6 %**
Road maintenance (potholes, bituminous asphalt sealer, longitudinal roadway ridges, manhole covers, roadway debris)	**15 537**	**88.5 %**
Total	**17 556**	**100.0 %**

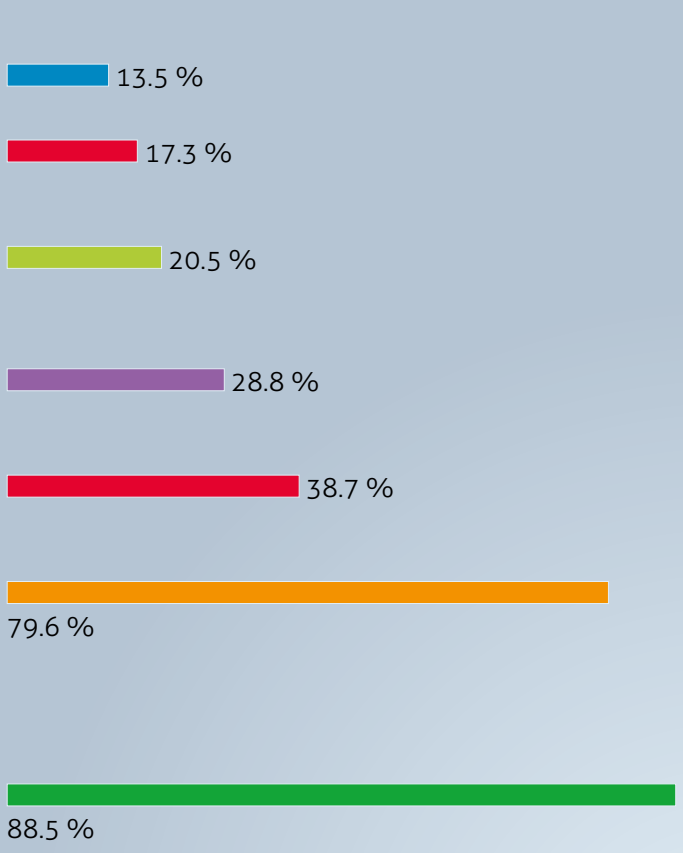
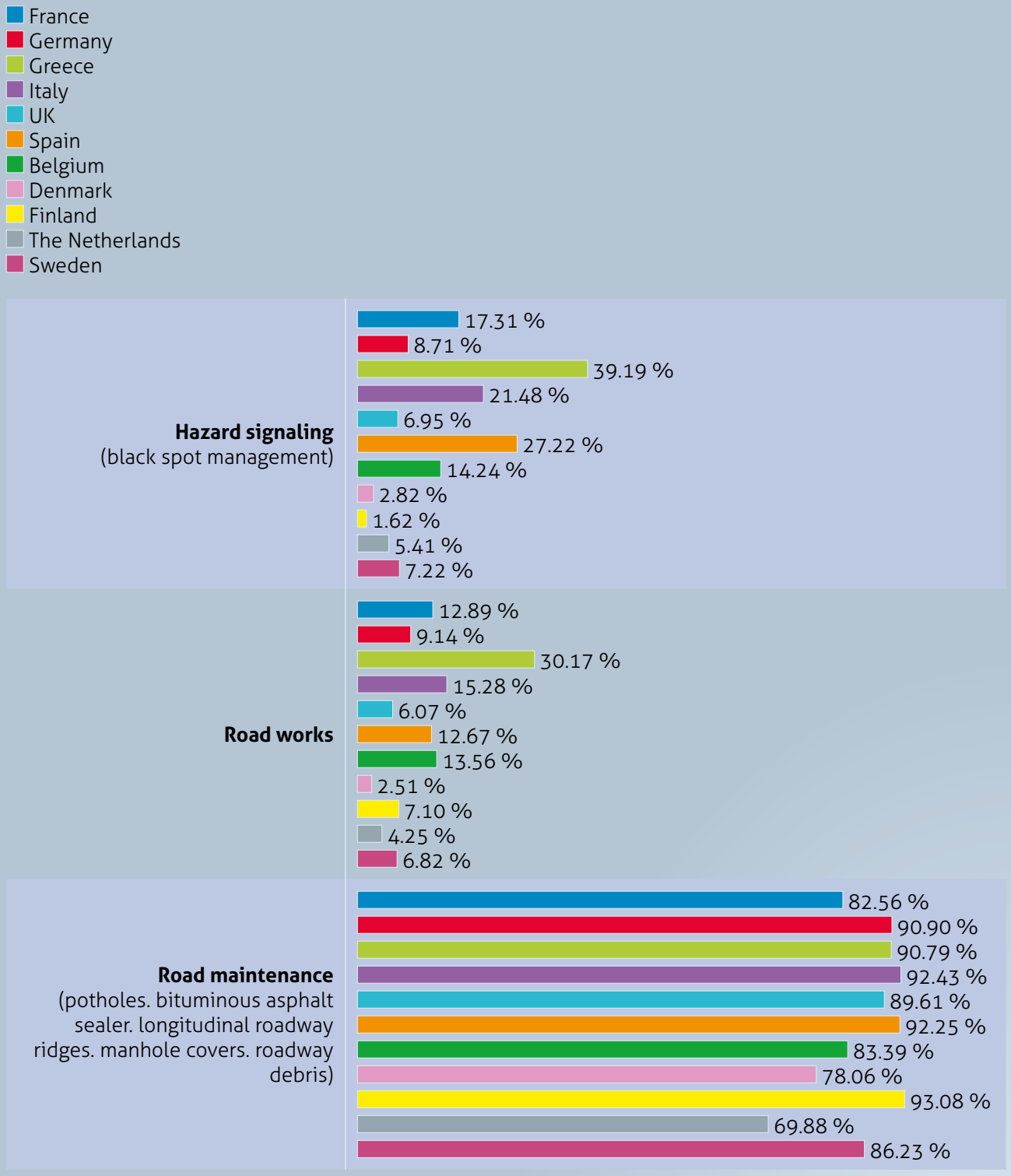
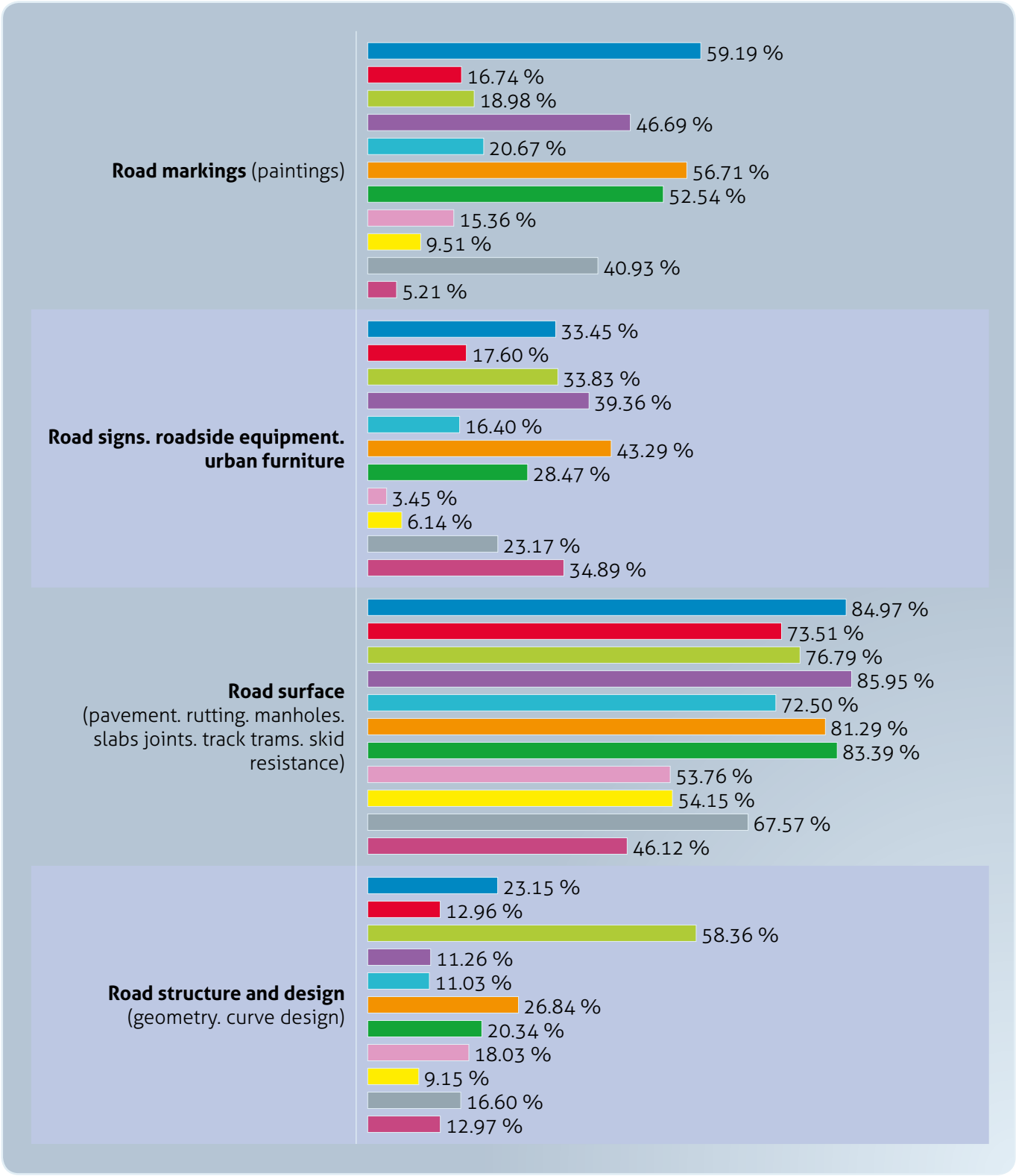


Figure 31 **Main infrastructure problems faced by motorcyclists (Answer per country)**





A less problematic issue appears to be *roadworks*, especially for Austria (only 0.9% of the respondents selected *roadworks* as one of the main infrastructure problems), Denmark (2.5%), the Netherlands (4.2%) and Switzerland (4.8%). By contrast, in Greece and Poland *roadworks* were selected by 30.2% and 23.0% respectively of riders as one of the main infrastructure problems for riders.

Some specific national features:

- in Denmark, unlike the rest of Europe, 3 issues were chosen by less than 4% of the riders as main infrastructure problems for PTWs: Road signs, roadside equipment, urban furniture (3.4% in Denmark against the European average of 28.8%), hazard signalling (3.4% in Denmark against 17.3% in Europe) and roadworks (3.4% in Denmark against in Europe 13.5%);

- only 1.6% of Finnish riders choose hazard signalling as an important infrastructure issue for riders, while the average for Europe is 17.3%.
- the issue of road markings is a particular problem in France (59.2% of riders) and Spain (56.7%);
- Road signs, roadside equipment, urban furniture is one of the main problems in Italy for 39.4% of riders and in Spain for 43.3% of them;
- 58.4% of Greek riders and 34.0% of Norwegian riders selected road structure and design as one of the main infrastructure problems faced by PTW users;
- Hazard signalling is a problem in Greece (39.2%) and Portugal (29.2%);
- Greece seems to have the greatest problems with infrastructure, with 6 out of 7 issues getting more than 30% of the riders' votes. Only road markings scored less (19%), while these seem to be a problem for the rest of European riders (38.7% - EU sample).

Infrastructure and accidents

The highest rate of collisions with road infrastructure can be found in Finland (19.3%), Spain (12.3%) and Belgium (11.8%). In Denmark, of the 36 accidents declared, none involved a collision with road infrastructure.

Figure 32 **Accident type (all accidents declared merged) (EU sample)**

	No.	% obs.
Tilting standing still	**91**	**4.3 %**
Collision with road infrastructure	**143**	**6.8 %**
Tilting/cornering slow speed	**284**	**13.5 %**
Single	**611**	**29.0 %**
Collision with another vehicle	**1 159**	**54.9 %**
Total	**2 110**	**100.0 %**

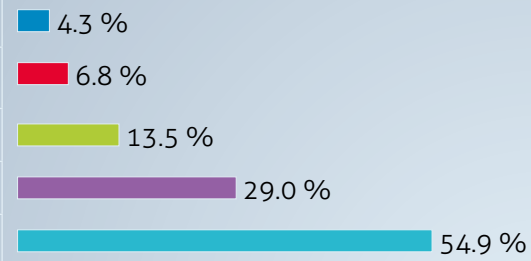
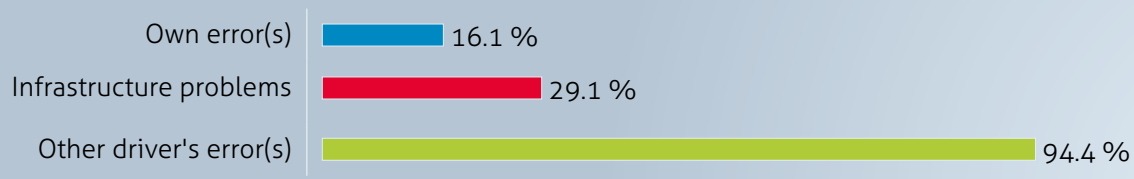


Figure 33 **What was the most frequent factor causing your near-miss accidents? (EU dataset)**



Infrastructure issues are particularly striking in Greece, Spain, Belgium, Italy and France, where infrastructure problems were behind more than 30% of the near-miss accidents experienced by our respondents.

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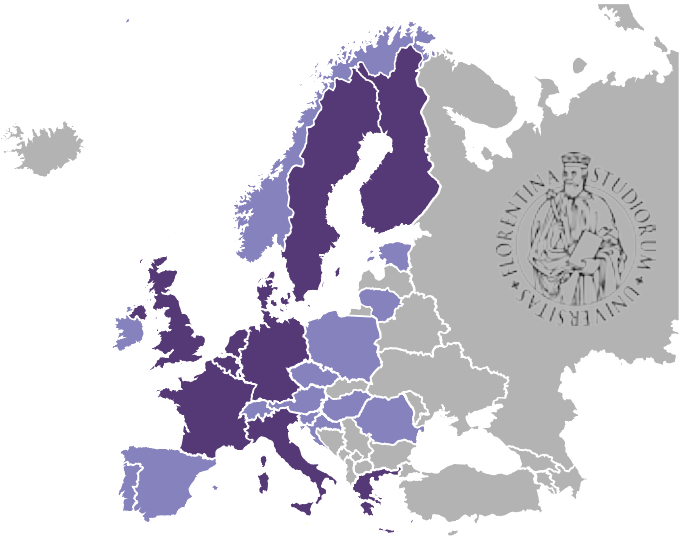
Table 19 **Rate of infrastructure problems in causing near-miss accidents (answer per country)**

Greece	40.9 %
Spain	38.6 %
Belgium	37.7 %
Italy	36.9 %
France	36.5 %
Finland	28.4 %
Czech Republic	21.5 %
Sweden	18.3 %
Switzerland	17.6 %
Portugal	15.7 %
Germany	13.8 %
Norway	12.9 %
Netherlands	11.7 %
UK	8.9 %
Denmark	6.2 %

Riders ITS awareness and acceptance - The ITS user survey

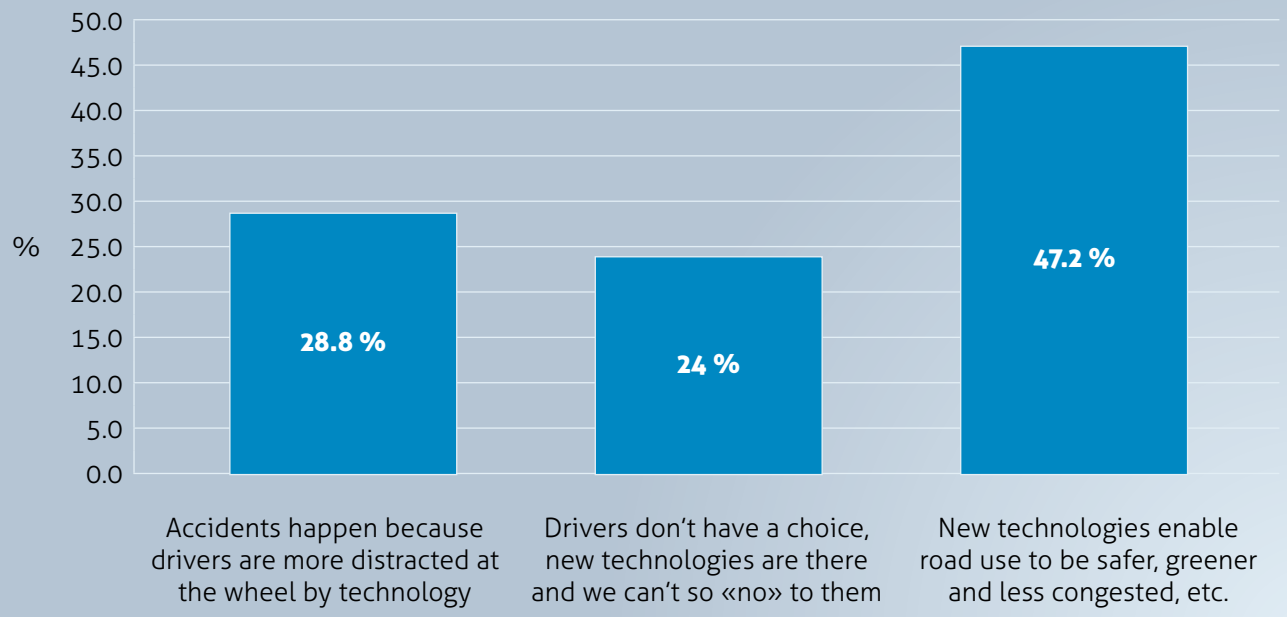
A survey targeting European riders was designed to capture riders' attitudes towards safety systems at large. Specific interest was directed at identifying: rider subgroups with different attitudes towards safety and safety systems/devices; national differences within Europe with reference to an average European sample; systems/functions appreciated by riders and systems/functions considered dangerous and/or useless by riders. The survey gathered 4,845 detailed answers (more details p. 177).
The information gained is summarised below:



Attitudes toward technologies

First, riders were asked to express their opinion on new technologies and their perceived relationship to safety. The largest group of riders stated that new technologies have the potential to improve road use (47.2%), though the second largest user group (28.8%) holds the opposite opinion (i.e. technology decreases safety as road users are distracted by technology.

Figure 34 **Distribution of the «safety statement» (European dataset)**



There is a clear correlation between the attitude towards technology and riding experience: the higher their experience is, the less the riders tend to have a positive attitude towards technology.

Figure 35 **Safety statement vs riding experience (European dataset)**

The same trend is visible in the correlation with annual PTW mileage: except for the unexplained dip in annual mileages between 1,000 and 3,000 km/year, the positive attitude towards technology decreases with increasing mileage and the group of sceptical riders increases. For those clocking up more than 15,000 km/year, the latter group becomes the largest one.

Figure 36 **Safety statement vs riding mileage (European dataset)**

By contrast no clear relationship could be found with PTW usage. For example, Greece and Italy have a similar level of technology acceptance (68.6% for Greece and 61% for Italy), yet have very different PTW usage levels. In Greece, more than 65% of respondents used their car for commuting while more than 55% of Italian riders used their motorcycle for leisure.

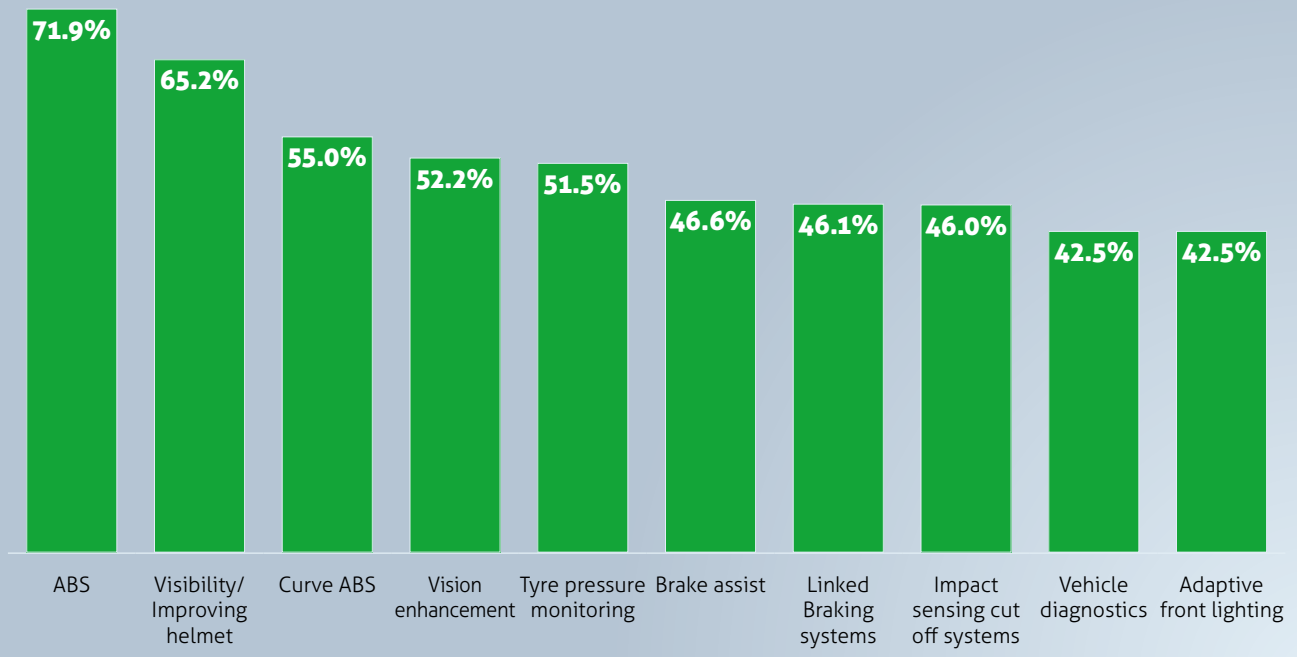
The 10 best-rated safety systems

Riders were then asked to rate a list of safety systems (identified by the Monash University review and surveyed in the SAFERIDER project).

In terms of safety systems, the best-rated one is ABS, the only real safety device available on the market. A more general analysis in terms of typology shows that:

- 4 of the 10 systems are related to *braking*;
- 3 of the 10 systems are related to *lighting and visibility*;
- 2 of the 10 systems allow improved PTW *maintenance*;
- 1 of the 10 systems belongs to the *post-crash* group.

Figure 37 **10 best safety systems/devices in decreasing order of relevance (European dataset)**



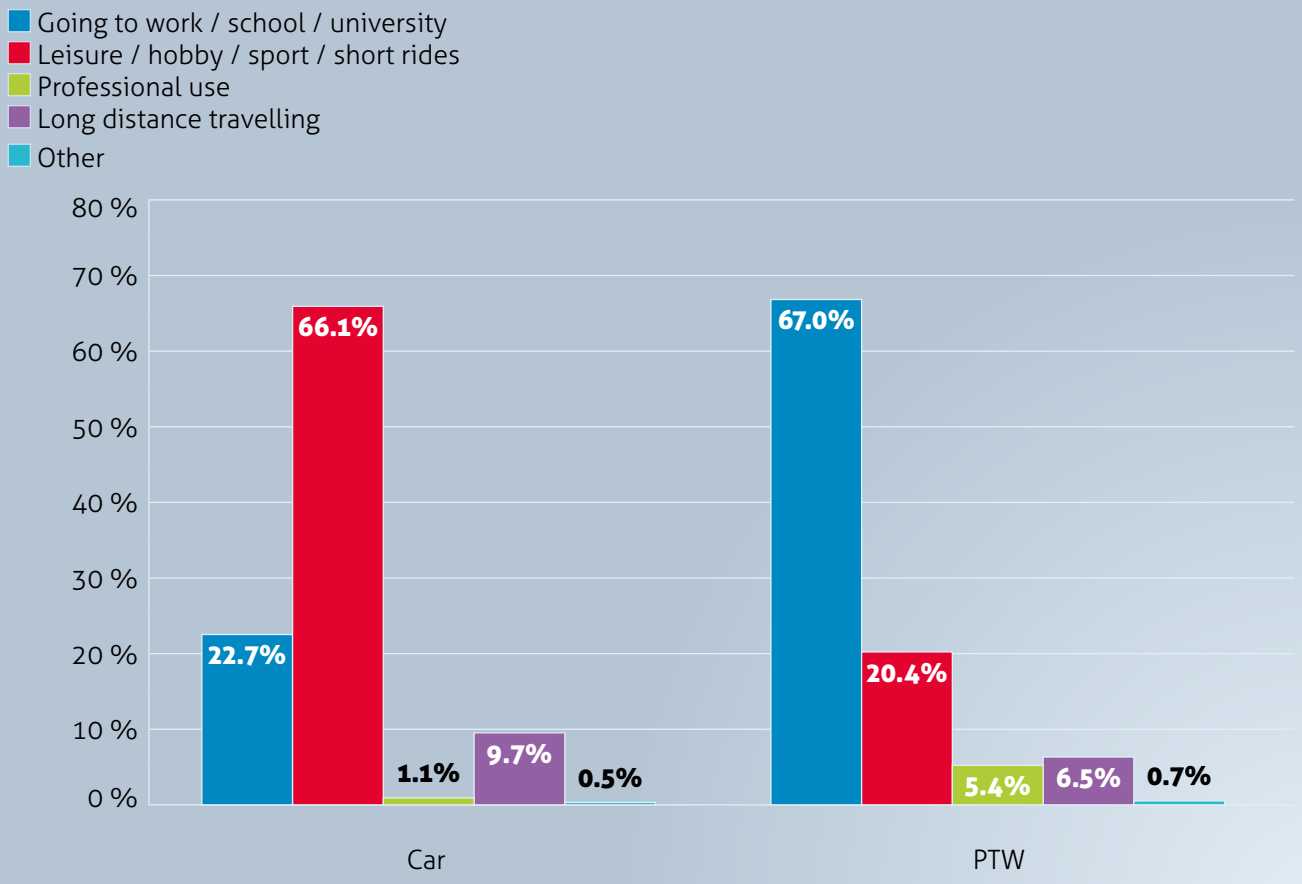
A comparison of these 10 systems with the 10 systems rated best by "technology negative" (sceptical) riders, shows that 9 out of 10 systems are identical. This result represents a strong statement of rider expectations, independent of their attitude towards technology.

Table 20 **Comparison of top 10 best safety systems - full European dataset vs sceptic riders**

Description	All	Sceptic
ABS		
Visibility/Improving helmet		
Curve ABS		
Vision enhancement		
Tyre pressure monitoring		
Brake assist		
Linked Braking systems		
Impact sensing cut off systems		
Vehicle diagnostics		
Adaptive front lighting		
Automatic crash notification		

Motivations should be investigated more broadly, since other data points to a highly fragmented scenario based on different usage patterns: in fact 67% of riders who use their PTW as their main means of transport are commuters, while leisure riders represent 66% of riders who use their car as their main means of transport. Most probably these two subgroups have different safety requirements and also different expectations in terms of safety systems.

Figure 38 **Most often used means of transport vs PTW usage (European dataset)**

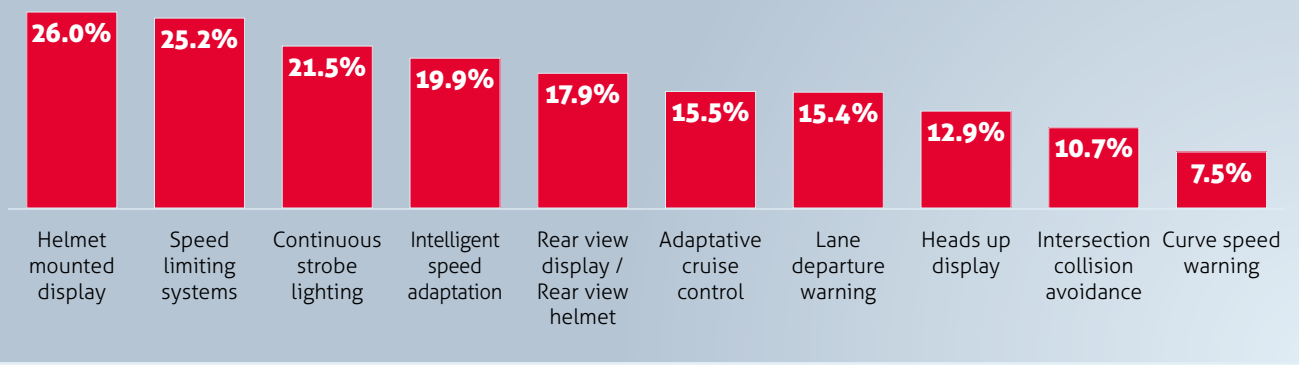


The 10 systems rated as most dangerous

The analysis of the top 10 dangerous systems came to the following results:

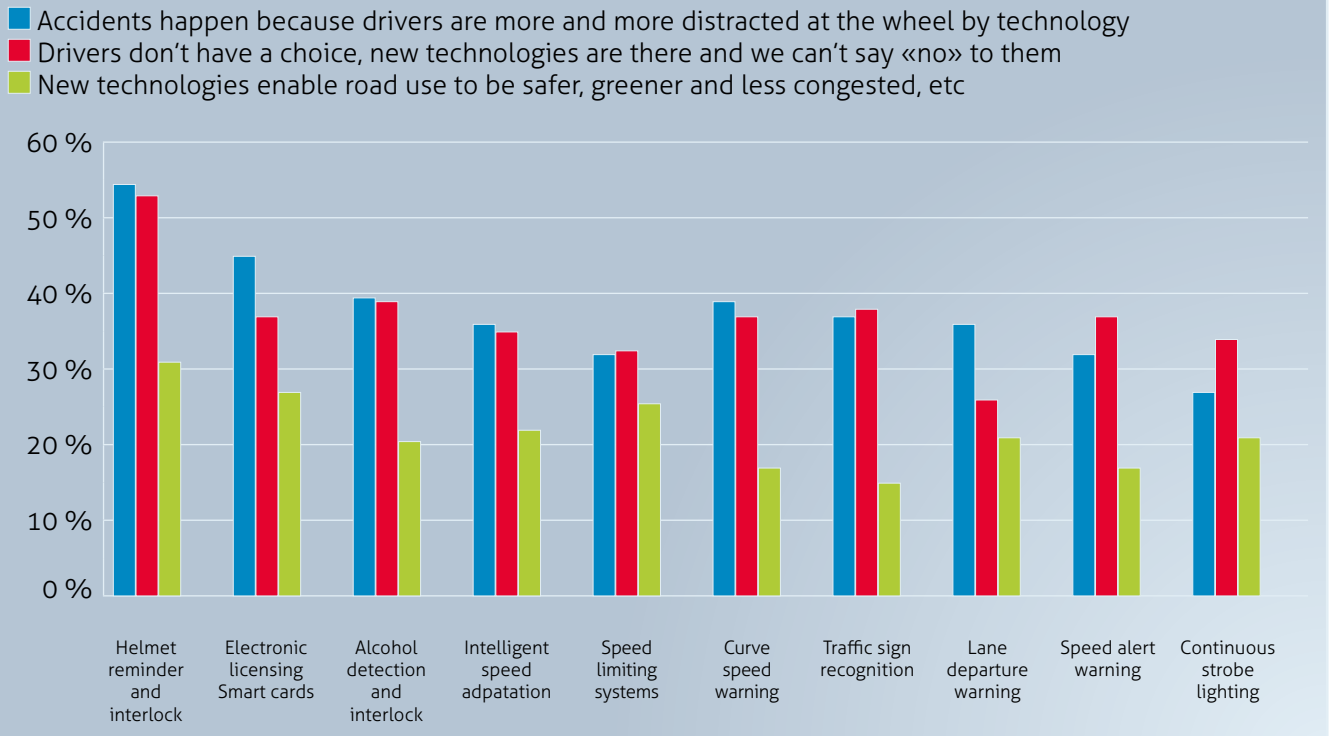
- 3 of the 10 systems rated as most dangerous provide *warning and information* systems;
- 3 of the 10 systems rated as most dangerous represent the *communication between vehicles and infrastructure* (*V2I*) group;
- 2 of the 10 systems rated as most dangerous are related to *lighting and visibility*;
- 2 of the 10 systems rated as most dangerous belong to the *communication between vehicles* (*V2V*) group.

Figure 39 **10 most dangerous systems/devices for safety in decreasing order of relevance (European dataset)**



The 10 systems rated as *useless*

Figure 40 **10 most useless systems/devices for safety vs the safety statement (systems are in decreasing order of relevance; European dataset)**



The five systems common to both the useless and dangerous groups share some common traits:

- They are active during riding;
- They require an interaction with the rider and thus have the potential to cause a sensorial overload, especially in dangerous situations.

Table 21 **Comparison of top 10 dangerous and useless safety systems (European dataset)**

Description	Dangerous	Useless
Helmet reminder and interlock		
Speed limiting systems		
Continuous strobe lighting		
Intelligent speed adpatation		
Rear view display / Rear view helmet		
Adaptative cruise control		
Lane departure warning		
Heads up display		
Intersection collision avoidance		
Curve speed warning		
Helmet reminder and interlock		
Electronic licensing Smart cards		
Alcohol detection and interlock		
Traffic sign recognition		
Speed alert warning		

In the assessment of useless systems, the first three systems (i.e. *helmet reminder and interlock, electronic licencing smart cards, alcohol detection and interlock*) show major national differences ranging up to 45%. These differences tend to decrease as the degree of uselessness decreases.

National perspective

The national analyses highlight different opinions and attitudes, with the breakdown of riders' attitudes towards safety summarized in the so-called "safety statement". Results show that in all countries except France and the United Kingdom the largest subgroup is that of technology-positive riders. Moreover, apart from Germany, this subgroup represents at least 50% of riders (result valid for Belgium, Greece, Italy, the Netherlands, the Nordics and the United Kingdom).

A further comment on the ranking of best/useless/dangerous systems involves the national differences within European countries. Regarding the 10 best devices for safety:

- Southern European countries (i.e. Greece and Italy) have usually high and very similar ratings
- Germany, Netherlands, Sweden, and United Kingdom are always the countries with lower percentages (exceptions on specific devices are ABS and curve ABS, which received appreciation in Sweden)
- Belgium, Denmark, and France are more selective, with a changing grading on a per system basis

The analysis of safety systems considered either definitely useful or essential for safety highlights a common feeling of riders in different countries. The most relevant findings are:

- the most commonly represented groups of systems are: *maintenance* and *diagnostics* and *braking*, since all systems in these groups were at least considered once as useful for safety. Similarly, the lighting and visibility group contains many systems considered relevant for safety;

Figure 41 **10 best safety systems/devices with detail of country rating (systems are in decreasing order of relevance; European dataset)**

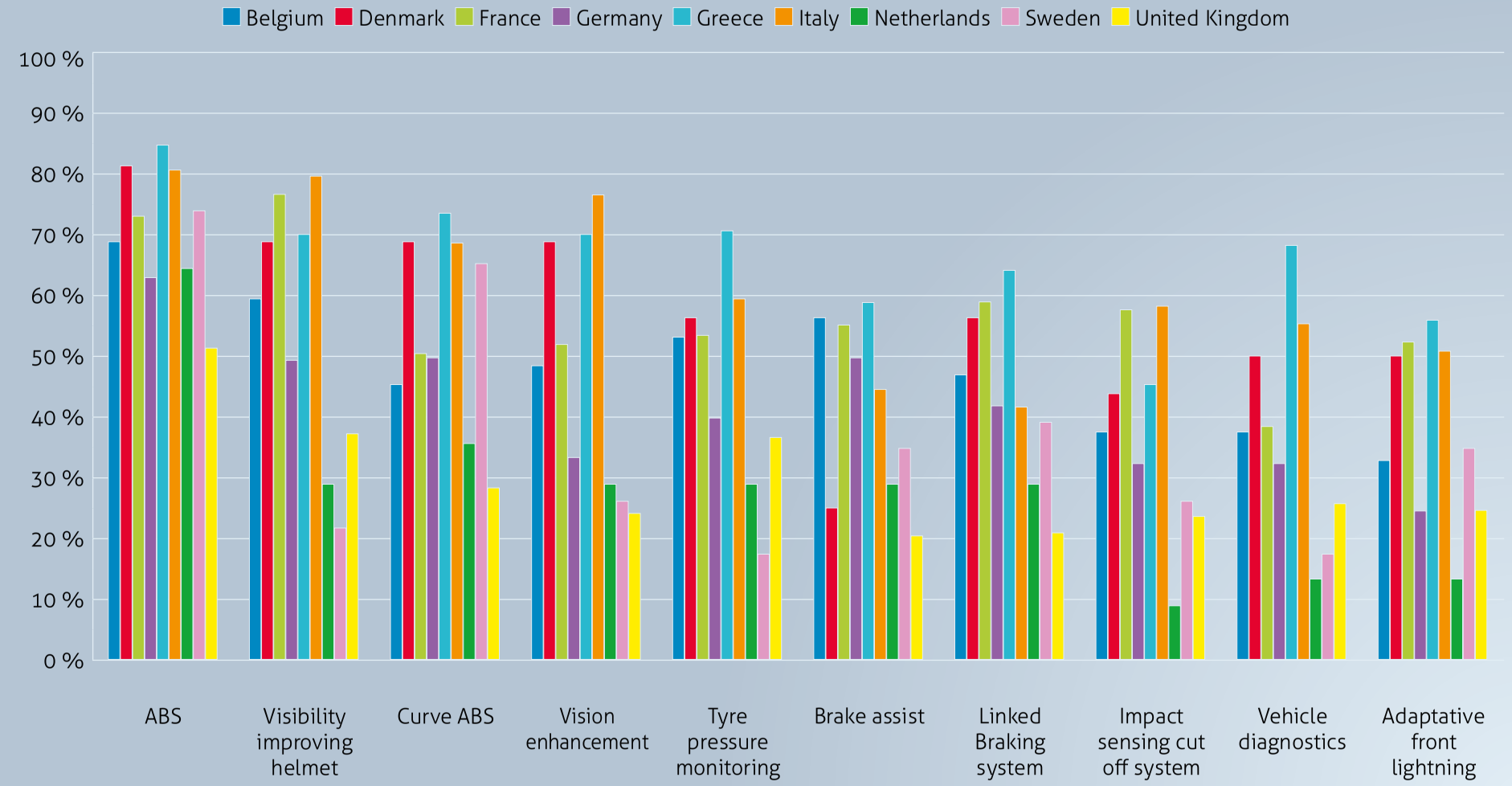
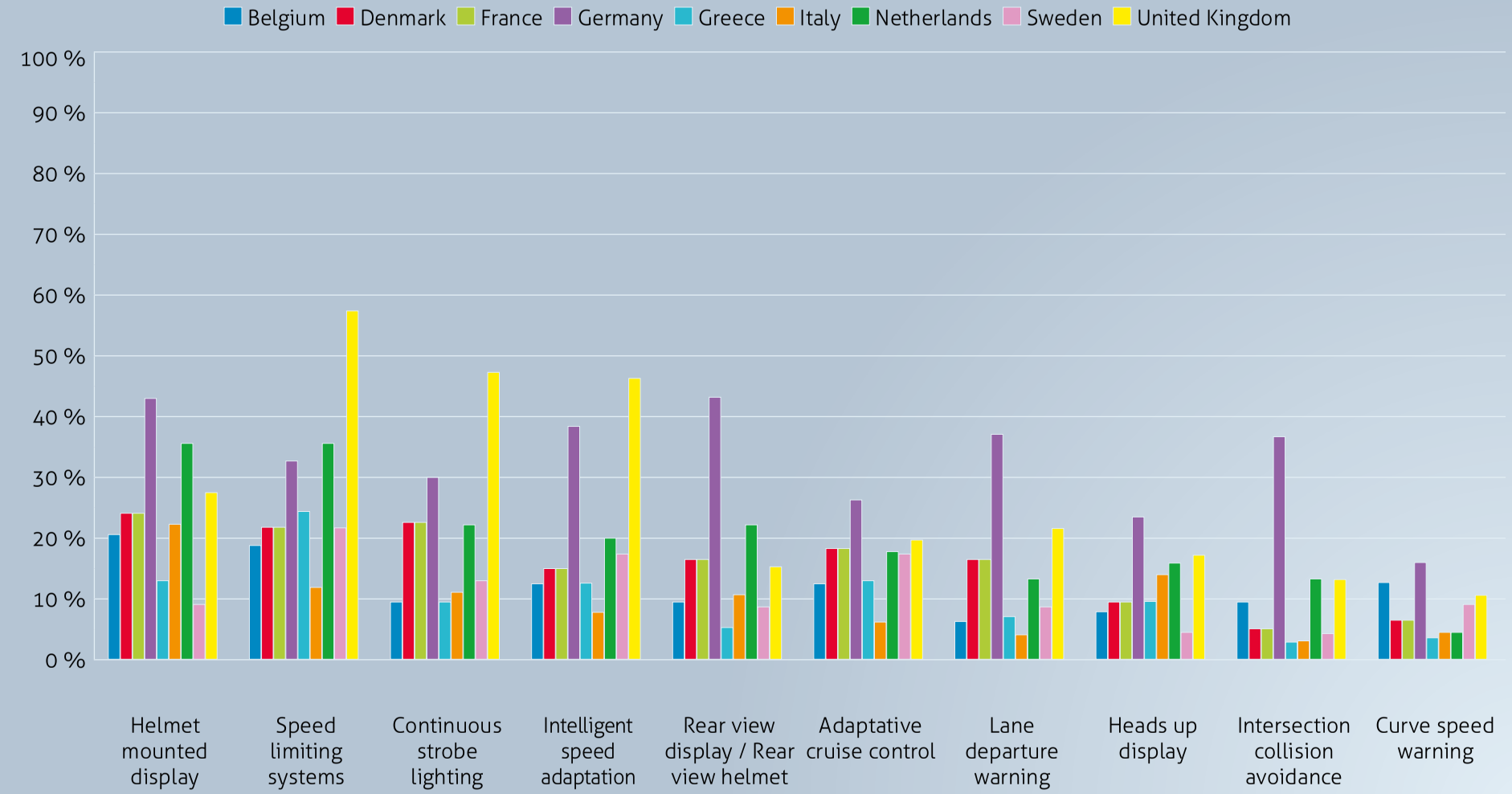


Figure 42 **10 most dangerous systems/devices with detail of country rating (systems are in decreasing order of relevance; European dataset)**



- *communication between vehicles and infrastructure* (*V2I*) was the only group never perceived as useful for safety. On the contrary, its systems were often ranked among those systems considered as being of least use or dangerous;
- although different attitudes towards technology were recorded, a number of safety systems were considered useful for safety by all riders in all countries:
  - tyre pressure monitoring;
  - visibility improving helmet;
  - ABS;
  - curve ABS;
- generally speaking, safety systems related to braking were considered useful in most of the countries.

In the case of the systems rated as dangerous, Germany and the United Kingdom show high negative ratings. The United Kingdom is the most critical country with regard to continuous strobe lighting, speed limiting systems and intelligent speed adaptation, while Germany is the most critical with regard to the remaining 7 systems. An explanation could be linked to national campaigns against Daytime Running Lights (DRL) and/or Intelligent Speed Adaptation (ISA) in these countries, highlighting in turn the role of the media and rider community campaigns for riders' acceptance.

Observed in the details for each country, 9 systems were ranked as dangerous and useless by the respondents in all countries.

3 systems were ranked as dangerous and useless in 6 different countries: *Speed limiting systems*, *intelligent speed adaptation* and *lane departure warning*. *Rear view display / rear view helmet* and *continuous strobe lighting* were badly ranked respectively in 4 and 3 countries. *Adaptive cruise control*, *curve speed warning*, *electronic licencing smart cards* and *in-vehicle tutoring system* were ranked dangerous and useless in 2 countries.

France and the Nordics were the most severe, ranking 6 systems each as useless and dangerous, while British riders only ranked 2 systems as useless and dangerous.

System installation option

A summary of the preferred installation option for systems considered as essential for safety shows that there is no relation to attitudes towards technology. In fact more than 60% of riders in all countries apart from Greece and Italy were in favour of a safety system available as an option. By contrast, in Greece and Italy respectively 58.9% and 69.2% of riders were in favour of them being standard features.

Workshops comments - European Motorcyclists' Forum 2012, 2014 and 2015

- We need to think about PTWs right from the beginning. Once something is implemented, it is too late and too complex to change.
- There are a lot of basic issues out there on the streets which are still not being addressed. It's not rocket science to solve problems like pot-holes, diesel spill and gravel on the road, which are killing a number of riders each year and creating a lot of traffic accidents.
- We have to be aware that some vehicles will be equipped with ITS; some not. And it's difficult and unsafe not to know which one is equipped and which is **not** – for example when following a vehicle that is braking on a curve
- For FIA and FEMA, key challenges to user acceptance of ITS include liability issues, driver distraction, awareness and training, safety, vulnerable road users and pan-European solutions.
- Visual conspicuity: ACEM emphasized that cooperative ITS is definitely not a short- or mid-term replacement for any conventional technology deployed today. In this respect, in the visual conspicuity area improvements are possible, allowing riders to be seen. But there is still the issue of 'Look but fail to see', i.e. it's not just about conspicuity, but also about people seeing yet not reacting because they are distracted, for example by talking on a mobile phone.
- Penetration rate: there is an important issue on cooperative systems: if you don't get a signal, this can mean one of two things. Either there is no motorcyclist, or there is but he doesn't have this device fitted. How can you make sure that the penetration rate reaches a level so that, if you don't hear a signal, that means there is no danger ahead? For ACEM, this is a challenge for cooperative ITS in general and one that they are working on addressing. One possibility is to combine communication technologies, adding cellular communication for instance, to speed up the penetration rate.
- Rider & driver training: ITS goes hand-in-hand with proper training. ABS and CBS can support drivers in braking, help maintain motorcycle stability and reduce braking distance. Riders need to practice and learn the use of new braking technology to make the most of the capabilities of their braking systems. And it's also important to consider and know what technology can NOT do. This is just as important as knowing what it CAN do. Interpretation of signals is important: if you get a warning of an approaching motorcycle, what does the driver do? Accelerate, brake, turn in the opposite direction? This is something we have to take into consideration as a training issue – how to react if a driver gets certain information.
- New technologies to better measure friction are urgently needed to ensure that roads meet friction standards. Loss of grip causes one-third or even more of accidents.

Infrastructure key stakeholders

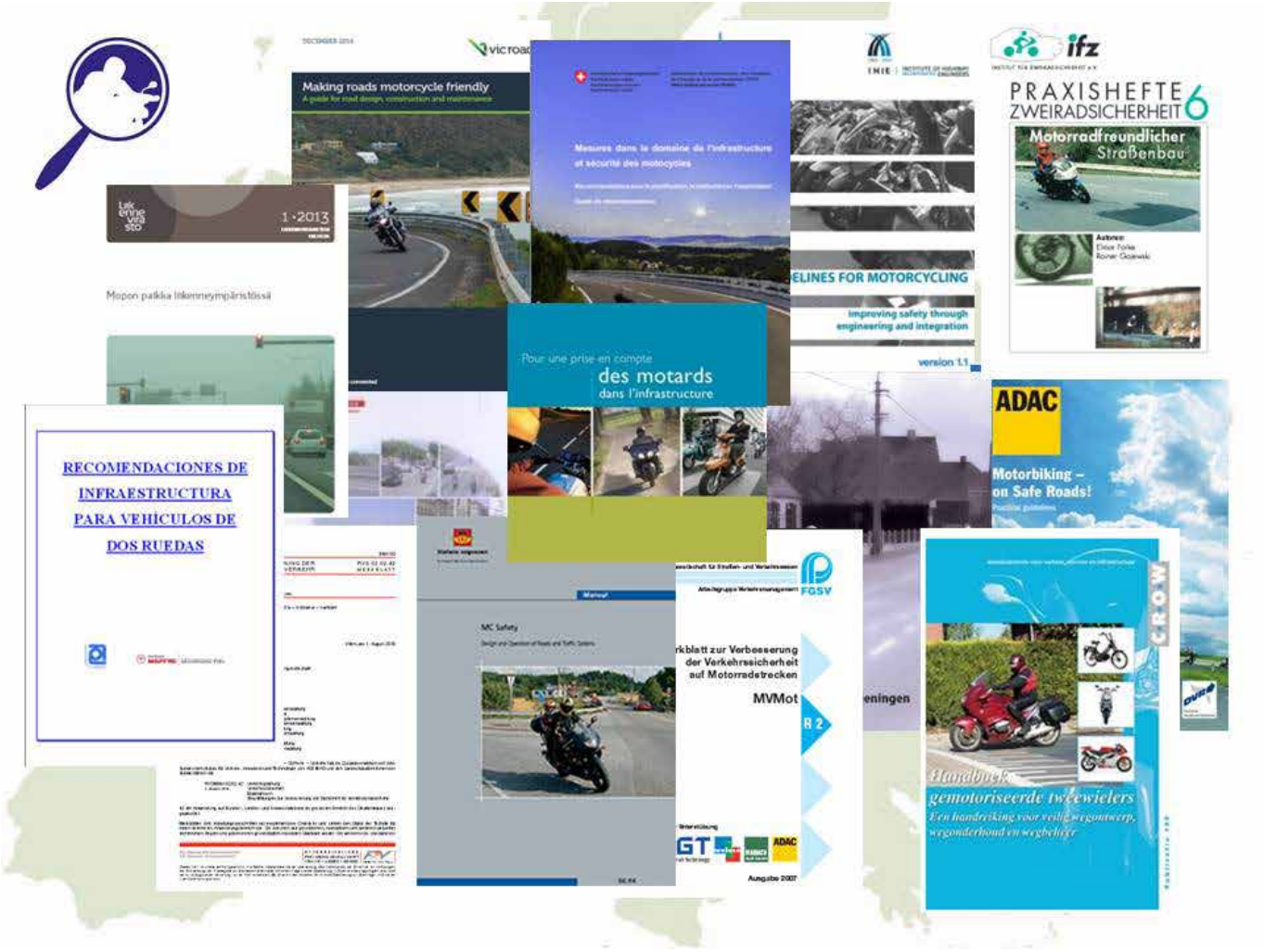
- Possible actions for the European Union would be to promote the use of minimum safety requirements (barriers, markings, passive support structures EN 12767) but this could be done in cooperation with the CEDR (*ERF*).
- As things stand, CEDR members are already cooperating on the development of asset management practices at a European level. The voluntary cooperation between the member countries demonstrates the value thereof. This work has already delivered a common core system for asset management to be deployed by national road administrations: it includes recommendations and a guide for implementing the core system in each national road administration, as well as common items and remaining asset management disparities between national road administrations. CEDR cannot compel Member States to follow its guidelines, but the process of consensus-building between the respective national road directors encourages voluntary adoption while respecting specific national conditions (*CEDR*).
- **Standards**: This is not a really popular issue because different solutions already exist. You don't need a "harmonised standard" to have a solution deployed at national level; the same goes for other standards (e.g. manhole covers) for which solutions already exist (*ERF*).
- **Skid resistance**: different sorts of marking exist (e.g. painting, tape, etc). It would be interesting to have studies to understand what kind of marking constitutes a problem for motorcycles. One suggestion would be to update the standards to make sure that requirements take the specific features of motorcycling into account (*ERF*).
- **Signposting**: Forgiving posts exist. But once again, testing is done with cars. What needs to be done here is to adapt posts and tests to motorcycles. And this would be really interesting as, when you have forgiving obstacles, in most cases you no longer need roadside barriers (*ERF*).
- **Tests simulating motorcycle accidents**: it would be good to arrive at a consensus on testing basic road safety equipment for motorcycles as well, but also feasible from an industry point of view. At present, the testing methods for motorcycle equipment would require huge investment on the part of manufacturers, but the demand from Member States is not there to justify this investment. Solutions must be affordable and feasible in a practical way (*ERF*).
- EuroRAP and iRAP possess a shared methodology that already provides a star rating for PTW safety. The methodology used by EuroRAP to rate roads is a drive-through methodology. For each 100-meter stretch of road, 52 elements possibly leading to an incident are recorded. One point of possible interest to motorcyclists is to identify infrastructure elements related to PTW accidents. The Star Rating and Safer Roads Investment Plan components of the RAP protocols could be used to complement any Road Safety Audit/Inspection (*EURORAP*).

Users' key stakeholders

- PTW-friendly road design, maintenance and infrastructure generally benefit all road users. The aim is to ensure that the safety of PTW riders is considered in the design and maintenance of roads and the implementation of traffic management plans (*FIM/FEMA*).
- A consistent road and road environment invite road users to adopt appropriate behaviour. A self-explaining road allows road users to anticipate changes in the local road context (*FIM/FEMA*).
- When potentially aggressive obstacles in the safety zone cannot be avoided, the last option is to isolate road users from these obstacles by the installation of vehicle restraint systems. However, some of these installations can be extremely dangerous for PTW riders. For instance, crash barriers with unprotected posts are a real danger for motorcyclists (*FIM/FEMA*).
- Allowing PTWs to use bus lanes is not necessarily a measure to improve safety, but rather to improve traffic flow. It has safety implications, however. Traffic management measures can have a dual purpose, both facilitating PTW traffic and increasing safety (*FIM/FEMA*).
- Engineers, road designers and providers, local authorities, road safety auditors and inspectors should be trained to consider PTWs in the design, construction, maintenance and operation of roads, and be provided with the necessary risk assessment tools to make the right decisions (*FIM/FEMA*).

Common Infrastructure problems in Europe

The RIDERSCAN project collected and reviewed in details 10 sets of PTW infrastructure guidelines, identifying common recurrent problems and criticalities for PTW users, and the related standards that would require revision to enhance PTW safety by including PTW-specific requirements.



For consistency with other work in this field, the OECD classification was chosen to report on the common problems:

Road design, condition and maintenance

- **Manholes and metal surfaces**

  A manhole in the middle of road can represents a change or loss of grip for a PTW

- **Pedestrian crossing markings**

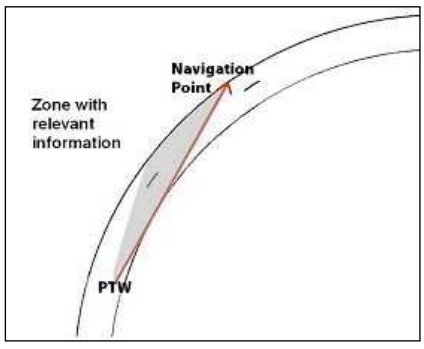
  (in curves) and direction arrows etc.) can be an additional hazard on the road, especially in wet conditions because of their potentially reduced skid resistance

- **Road markings**

  The larger the painted area is, the more dangerous it is for motorcyclists. When they cannot avoid riding over it, they can lose grip on both wheels at the same time

- **Roundabouts**

  A too high entry angle can lead to excessive speed on approach, while a too low entry angle and central objects can hide a PTW from the view of other drivers



- **Variable radius curves**

  Because of the changing position of the PTW in the curve the navigation point changes constantly.

- **Traffic calming schemes and speed bumps**

  The location of traffic calming measures and the height of the raised section can be a great problem for PTWs

Road surface quality

Poor-quality road surfaces involve repeated changes of grip for motorcyclists and are difficult to avoid and to anticipate

- **Slippery surfaces**

  Patched surfaces, unevenness, re-texturing

- **Potholes and fissures**

- **Debris, pollution and fallen loads/spillage on the road surface**

  Gravel, dirt, sand, debris, oil spills: road surface contamination is an obstacle that a PTW will try to avoid. At the same time it increases the likelihood of skidding, especially in curves or in zones with frequent acceleration or braking.

Roadside

- **Crash barriers**

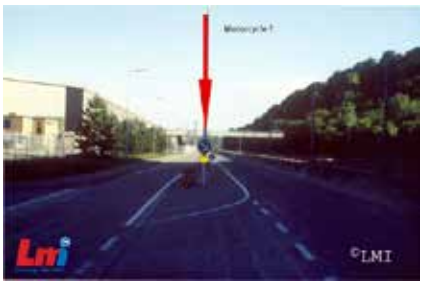
  Unprotected posts and barriers without under-ride protection constitute dangers for PTWs. Road restraint systems installed too close to the side of the road are more likely to be hit by PTWs, possibly with severe consequences.

- **Obstacles**

  Obstacles alongside and on the road represent major hazards for motorcyclists

- **Road signs and posts**

  They can cause injury if a motorcyclist hits them, and they can also reduce visibility



- **Hedges/vegetation**

  In a curve or when not well maintained, they can obstruct visibility

CEN STANDARDS REVISION NEEDS

Using this list, the RIDERSCAN experts for Deliverable No 3, Kris Redant (Belgian Road Research Center - BRRC) and Peter Saleh (Federation of European Highway Research Laboratories – FEHRL/AIT), identified the relevant CEN standards that need revision and/or amending.

Overall, several standards already contain provisions relevant to PTWs. It is important that Road Assessment Audits/Inspections define threshold values that are appropriate and relevant for all road users (including PTWs)

ROAD DESIGN, CONDITIONS AND MAINTENANCE

▶ Manholes: EN 124 (TC 165): very vague about skid resistance

Technical note: the revised version of EN 124 (different parts) was approved (transposition to national standards still pending) very recently. The new version stipulates that concrete surfaces or surfaces with a certain pattern (described in prEN 124-1:2015) should have sufficient skid resistance. For other designs, a pendulum test (giving a Pendulum Test Value or PTV) is required

▶ Road markings: road painting and pavement marking

→ Road marking materials:
- EN 1423 (Drop on materials)
- EN 1871 (Physical properties): would need harmonisation
- EN 1790 (Preformed road markings): would need harmonisation

→ Performance:
- EN 1436 (Performance requirements) = road marking performance for road users: skid resistance (friction coefficient) and visual performance (daytime and night-time visibility and colour)

→ Test: A single durability test method is needed
- EN 13197 (Indoor Wear Simulator test)
- EN 1824 (Road test)

ROAD SURFACE QUALITY AS A % OF LOSS OF GRIP ACCIDENTS

▶ Surface treatment (a maintenance technique to improve road surface characteristics for a limited period of time)

→ EN 12271 (Surface Dressings) → EN 12272-2: Visual assessment of defects

→ EN 12273 (Slurry Surfacing) → EN 12274-8: Visual assessment of defects

Technical note: EN 12271 and EN 12273 are relevant for two maintenance techniques. Supporting standards for these two product standards include characteristics that could be relevant for PTWs and for which a closer look on how PTW interests are integrated would be interesting

→ EN 13108-1 (Asphalt concrete)

Technical note: EN 13108 parts 1 - 8 (and in the near future also part 9) are product standards currently containing mainly empirical specifications (properties for the mix and constituents). Future versions should slowly move to a more fundamental (performance-based) approach and could include characteristics relevant to PTWs. More or less comparable to what applies for MPS, it will become important to convince RA to take these special characteristics into account (or better: make sure that the characteristics that are beneficial for PTW are relevant for all road users)

→ EN 13036 series - Parts 1 - 8: Surface skid resistance, unevenness, measurement techniques

Technical note: EN 13036-x (and also CEN/TS 15901-x) concerns measuring methods. Simplification (avoiding one MM/country) and - again - requirements that are appropriate for PTWs are needed

The pendulum test is the most common test method for determining local skid resistance, though more dynamic methods allowing larger scale assessments are slowly being introduced. It seems unclear however what the relationship is between the results of these test methods and the slipperiness of a surface as experienced by a PTW rider.

Roadside

- Crash barriers posts
  - → CEN/TS 1317-8: currently reviewed and harmonized standard is now being implemented
- Crash barriers too close to the road
  - → There are no standards on the installation of Road Restraint Systems. Each country or even road authority can individually decide whether and how to install RRS
- Obstacle
  - → CEN/TC226 (road equipment): work on characteristics relevant for the safety of road users and evaluate 'performance under impact'
  - → EN 12767 (safety under impact): passive safety of support structures for road equipment. The test assesses the impact of a small vehicle (900 kg) against certain road equipment. Possibility discussed to integrate PTWs in this assessment
  - → There are no standards on the installation of obstacles or how to handle existing obstacles
- Signposting
  - → EN 12899-1 (Vertical signs): this standard consists mainly of characteristics concerning visual performance and stability.
  - → For 'safety under impact' it refers to EN 12767.
  - → CEN/TC50: EN 40 (Lighting columns)

    Technical note: the product standards EN 40, EN 12899 and certain others currently refer to EN 12767 when it comes to performance under impact. If PTWs are to be taken into account it will mainly be in EN 12767 where something needs to be done
  - → EN 12966 (Variable message signs): this standard consists mainly of characteristics concerning visual performance and certain other characteristics of relevance to the electrical components.
  - → EN 12368 (Traffic control equipment)

Best practices in EU Member States

EU Directive on Road Infrastructure and Safety Management[1]

The EU directive on road safety management establishes procedures relating to road safety impact assessments, road safety audits and safety inspections for the TEN-T network. For the first time, PTWs were included in the audit requirements as VRUs. The project investigated whether this directive had improved motorcycle safety.

Table 22 **EU Directive on road infrastructure and safety management**

The infrastructure directive improved motorcyclist safety	The infrastructure directive did not improve motorcyclist safety
Austria	Finland (already high standards)
Germany	France (crash barriers are too rare)
Ireland	Luxembourg (already safe roads)
The Netherlands	UK (already high standards)

1 European Directive 2008/96/EC

Mandatory use of PTW infrastructure guidelines

From the interviews held with Member State experts and the motorcycling community representatives, the project found out that several countries have infrastructure guidelines for PTWs, though most of them are not mandatory, with the exception of Norway and Ireland.

Table 23 **Mandatory use of PTW use of PTW infrastructure guidelines**

No guidelines	PTW-specific guidelines	Infrastructure guidelines for all road users, including PTWs
Bulgaria Czech Republic Greece Latvia Luxembourg Poland	Austria (M) Belgium Finland France Germany (M) Norway (M) Spain (M) Switzerland UK	Ireland (M) Netherlands Sweden (M) (M) mandatory (M) partly mandatory

Austria and Germany have made the use of the guidelines on the TEN-T network mandatory and recommend their use on other roads.

Austria identified a lack of dissemination to local authorities, while the UK and France admit different levels of use throughout the country. The Netherlands is seen as the country with the lowest level of guideline adherence.

Black Spot Monitoring

Several countries have already introduced specific black-spot monitoring systems which include PTWs (Austria, France, Ireland, Luxemburg, the Netherlands, Poland, Spain, Sweden, and the UK), while others have but without specific consideration of PTWs (Belgium, Latvia). Several countries still have no specific black-spot monitoring programmes (Czech Republic, Finland, Germany, Greece).

Moreover, while roads are designed and regularly assessed, no specific assessment for PTWs is foreseen.

Table 24 **Black Spot Monitoring**

Collection of infrastructure problems / high risk sites	Collection of infrastructure problems / high-risk sites in general = but NOT for PTWs	No collection of infrastructure problems
Austria France Ireland Luxembourg Netherlands Poland Spain Sweden UK	Belgium Latvia	Czech Republic Finland Germany Greece

PTW users as VRUs

Only a few countries consider PTW users as Vulnerable Road Users (VRUs) in a legal sense, with a corresponding impact on transport policies (Austria, Czech Republic, Germany, Ireland, Luxemburg, Norway and Sweden); conversely, the Netherlands and Belgium do not recognize them as VRUs at all. Finland, France and the UK have decided on an intermediate status, accepting their vulnerability from a safety perspective, but not a legal one.

Table 25 **PTW users as VRUs**

Riders/passengers on PTWs are legally considered as VRUs on all road	Riders/passengers on PTWs are sometimes included as VRUs. But not from a legal perspective	Riders/passengers on PTWs are NOT considered as VRUs
Austria	Finland	Belgium
Czech Republic	France (court decision)	The Netherlands
Germany	UK (from a safety point of view only)	
Ireland		
Luxembourg		
Norway		
Sweden		

Debris, pollution and fallen loads/spillage on the road surface

In May 2008 Norway opened what it described as the 'Vision Zero Motorcycle Road'. On an approximately 15km-long stretch of road, measures were introduced to demonstrate the feasibility of producing a 'motorcycle-friendly' road at reasonable cost. Measures included:

- Extensive modifications to crash barriers to include an under-run rail and 'soft' ends to protect motorcyclists.
- Lamp columns were moved away from the highway edge and placed behind the barrier wherever possible.
- Sign posts were replaced with 'lattice' type forgiving constructions.
- Large stones were moved away from the highway edge, run-off areas were created and un-surfaced side roads were asphalted at junctions to restrict gravel wash-off, etc.

While some of the measures used (crash barrier under-run rails, surfacing of tracks joining the highway) are not applicable in an urban setting, the principle of reviewing road safety characteristics for PTW users is extremely relevant and cost-efficient.

Inclusion of PTWs in traffic management activities

The answers to the Amplifying Questions for Member State representatives were similar, with very few examples of proper or specific integration of PTWs into intelligent transport management system.

PTW specificities with regard to ITS developments:

Riding is not driving

Based on a group discussion launched on LinkedIn which gathered 180 posts from all over the world, and a one-day workshop on PTWs and ITS organised by the iMobility VRU WG early 2015, the project team was able to extract the key factors which make riding a motorcycle different from driving a car, and to identify specific fields for ITS development. According to the answers of experienced riders, the greatest differences between riding a bike and driving a car can be found in the following areas:

- Motivation
- Risk acceptance
- Perspective/ field of view
- Biomechanical activity
- External stimuli / information*
- Brain activity (thought processes)
- Effort (psychomotor/cognitive)
- Physical/Cognitive impairment (distraction)
- Safety Critical Events (SCE)
- Perception /reaction time
- Mental processes:
  - road scanning
  - risk assessment
  - operation/manoeuvres
- Task prioritization
- Concentration span
- Skill set

Identified needs

Improve infrastructure

PTWs have some special features which, according to the research community, directly or indirectly impact road transport research outcomes, whether for the safety of PTW users or for road safety in general. Dedicated consideration is required to gain a better understanding of PTW dynamics and interaction with traffic, and more specifically of accident causation factors, allowing risk domains and risk contributing factors to be identified.

With specific regard to road infrastructure, the fact that PTWs are single-track vehicles, without any bodywork, means that riders can have certain difficulty handling tasks while controlling the vehicle, in particular when cornering or braking and even more so in emergency situations, to mitigate or avoid incidents. Even with excellent brakes and tyres, controlling the vehicle in all kinds of situations requires special training and experience or specific riding assistance systems on board the PTW. The single-track character also implies that riders have greater difficulty coping with imperfect road surfaces and obstacles on the road.

Based on the input collected during the project on infrastructure throughout Europe, the project recommendations include the following:

Research needs

- **Better understanding of PTW/infrastructure interactions**

- Improve data collection
- Gain an in-depth understanding of the vehicle-road interaction and its dynamics, including detailed analysis with simulation tools (vehicle-infrastructure interaction simulation)
- Research accident scenarios and biomechanics
- Incorporate data collected in naturalistic riding studies
- Study the interaction between motorcycle tyres and road surface conditions
- Make road design safer
- Understand the effects of the road environment on road users
- Provide a more forgiving road environment
- Make roads self-explaining for PTWs
- Improve the environment to enhance reciprocal perception of riders and drivers
- Conduct "friction measuring" research
- Re-evaluate speed-reducing measures (such as humps or lane narrowing) from the point of view of PTW rider safety
- Design roadside equipment to provide better protection for PTW riders who may collide with them

- **Road maintenance**

- Develop more durable roads that are easier to maintain in a good state
- Develop a "holistic solution for asset management"; with the aim of making work zones safer

- **Black spot management**

- Research local accidents and appropriate countermeasures

- **Testing methodologies**

- Define a testing methodology for roadside and other infrastructure equipment which remains practicable for road equipment manufacturers

Standardization

- Review standards for 'PTW- friendly' road infrastructure and design

Legislation

- Improve the periodic maintenance of roads => The EU directive on infrastructure needs to include provisions on road inspections for secondary roads.
- Infrastructure Directive: The Directive for Infrastructure and Safety Management is currently being revised, including how to cater for the needs of PTWs. A good step forward would be for any EU money given to motorways to include specific provisions for motorcycles. This would act as a good example for secondary roads.
- Black spot monitoring would benefit from harmonisation throughout the EU (via legislation or other means).

Specific actions

- Need to find a way to motivate road engineers to use the infrastructure guidelines or make them mandatory.
- *Motorcyclist Protection System Database*: further political support and dissemination activities are required to encourage MPS manufacturers to feed the database and road authorities to make use of it. http://www.mc-roadsidebarriers.eu/search-for-mps/
- A civil engineering handbook would be a practical instrument for improving road safety for PTWs. It would emphasize the engineering items to be considered during the design and maintenance of infrastructure
- Monitoring high-risk sites (black spots):
  - Involvement of the rider community
  - Use of smart applications
- Use of the pan-European Road Hazard report form for PTWs
- Promote the use of minimum safety requirements (barriers, markings, passive support structures EN 12767). This could be done in cooperation with CEDR.
- Exchange best practices on self-explaining roads
- Disseminate the guidelines on roadside barriers for motorcyclists
- Promote the PTW infrastructure website

ITS deployment

As a number of interesting European projects have indicated, ITS and cooperative rider support systems have great potential for increasing riding safety and traffic safety at large. However, again, these are assumptions not based on actual data and will need to be properly researched and assessed in order to guarantee user acceptability, market deployment, hence PTW industry investments.

Similarly, the proper inclusion of PTWs in *intelligent* traffic management activities would help reduce PTW risks within traffic flow and post-crash support in the case of an accident involving a PTW. Recognition and adequate integration of PTW characteristics into ITS deployment activities, both as *vulnerable* and *powered* users of the transport system, will significantly contribute to an increased awareness by all stakeholders of the specificities of this means of transport.

Based on the input collected during the project on *traffic management and ITS*, the project recommendations include the following:

Research needs

- Further research is needed regarding the expected costs/benefits of ITS on riding activity:
  - Understanding issues of automation for PTW use;
  - Interaction of PTWs with automated and non-automated vehicles
  - User acceptance
  - ITS efficiency (estimate of the relative damage reductions associated with deploying ITS in motorcycles; the effectiveness of ITS technologies can be established through collecting and evaluating crash data, field testing and the analytical modelling of risks
  - Assess the benefits of both assistive systems and rider training, especially in direct comparison to each other
  - Prioritization of ITS for PTW safety
- Fundamental:
  - Data collection design and implementation, together with data analysis tools
  - Effects on rider performance and behaviour of human-machine interaction with new technologies, covering such issues as distraction, cognitive workload, over-reliance on technology, training requirements, situational awareness, etc.
  - Extensive on-road research examining the effects of using assistive systems on PTWs.
  - Incident, near-miss and pre-crash data
  - Modelling (riding tasks, motivation for action, accident causation factors, identification of safety-critical events)
  - Specific PTW features, applications and services and their interaction with other road users
  - Perception research[1] (reliable object recognition and tracking, situation awareness, accurate road representation, detection of free space, perception architecture, etc.)
  - Development of methodologies, including PTW-specific impact assessments based on eIMPACT and its 9 safety mechanisms[2]
    - direct in-car modification of the driving task;
    - direct influence by roadside systems
    - indirect modification of user behaviour
    - indirect modification of non-user behaviour
    - modification of interaction between users and non-users
    - modification of road user exposure;
    - modification of modal choice;
    - modification of route choice;
    - modification of accident consequences
- Research on vehicle technology for two-wheeler safety, including interaction of other vehicles' technology with PTWs:
  - Large-scale Field Operational Tests (FOTs) related to naturalistic driving conditions to capture VRU-related behaviour and ITS requirements
  - Advanced intelligent sensing
  - V2X communication platform for cooperative ITS applications
  - The 112 Pan-European eCall for PTWs (drafting the minimum technical and functional specifications with identified interfaces for additional features, triggering design, tests, verification, validation, short-listed solutions, demonstrations)
  - Active and passive systems (incl. conspicuity technology)
  - Interaction of other vehicles' technology with PTWs

1 iMobility Forum Workshop on Automation; Angelos Admitis – ECCS - .ppt
2 http://www.eimpact.eu/

- The interaction of an automated vehicle with its environment and other (non-automated) road users: develop technology and equipment on board other vehicles (cars and trucks) that can contribute to improving motorcycle safety (blind spot)
- Post-deployment field operational tests in a real traffic environment, with a full set of analyses including rider acceptance and willingness to pay

- In-depth identification of accident causation factors and Safety Critical Events, and prioritization of motorcycle safety problems that are amenable to ITS intervention
  - *Naturalistic riding studies* (INRS and NRS): baseline data collection with instrumented PTWs to define current practices, capabilities and issues
    - Identify PTW-specific driving tasks, patterns and styles
    - Understand riders' motivation for action
  - *Field operational tests and perception research to*
    - Validate interpretation of rider intentions
    - Define triggering patterns
- Rider (and instructor) training and testing needs (e.g. future *e-mirrors*)
  - Effects on rider performance and behaviour of human-machine interaction with new technologies that deal with issues such as distraction, cognitive workload, over-reliance on technology, training requirements, situational awareness, etc.
  - Instructor training scheme to promote knowledge of ITS

Standardization

- PTW tools for road safety management
- Integration of PTWs in automated traffic control systems
- Define a test protocol through which the behaviour of motorcycles (from a safety point of view) can be rated. The process would be similar to that for cars and the gaining of "stars" through crash tests defined in such test protocols as "EuroNCAP"

Legislation

- Traffic management for PTW road safety.
- The EU should encourage and support the introduction of ITS, taking specific account of PTWs (e.g. on-board collision avoidance technology in cars, vans and lorries which detect riders – V2V/V2I systems).
- Effective integration of VRUs into traffic management systems, including black spot management, incident management, ITS integration, road infrastructure design

Specific actions

- It is important to spread knowledge of these new systems to stimulate demand for them.
- PTW users need to be trained properly in the use of ABS. Widespread adoption of ABS needs to be promoted: the necessity to know how ABS works; training in ABS operation (initial rider training, websites, post-licence training programmes).
- Define a test protocol through which the behaviour of motorcycles (from a safety point of view) can be rated. The process would be similar to that for cars and the gaining of "stars" through crash tests defined in test protocols such as "EuroNCAP" (ROSA)

Conveying safety messages to riders

Significant differences exists between sub-groups of riders regarding both their motivations for riding a motorbike, their motorcycling practices and their respective attitudes towards risk and risk-taking while on their bikes.

Potential measures for increasing road safety for motorcyclists (in terms of awareness campaigns, training, riding licences or traffic laws, for example) should take into account these sub-group characteristics and their respective differences.

In 2008, the Lillehammer Workshop[1] highlighted the need to *develop integrated campaigns which portray responsible riding, develop an awareness of PTWs and mutual respect between road users.*

Since then, several EU research projects have addressed the awareness issue through campaigns and education, all of them underlining the need to pay particular attention to the acceptance issue, and recommending the involvement of the riding community in identifying the safety messages.

With the aim to contribute to a common understanding among governments, riders, other road users and road safety professionals, the RIDERSCAN project focused on:

- Compiling an overview of and evaluating existing European awareness campaigns focusing on road safety, including those that relate specifically to PTW riders.
- Making recommendations on ways and means of addressing specific safety messages to the motorcycling community.

Lillehammer priorities

Priority n°6: Getting safety messages to the riders: Safety messages to riders should be developed *in partnership with rider groups*, in order to use the effectiveness of peer advice in communicating key issues to riders on issues that will impact their communities.

Priority °7: Integrated awareness campaigns: There should be r*egular, targeted campaigns addressing both motorcyclists and other road users*, where necessary *supported by other action* e.g. enforcement, on safety-related subjects that include, mutual respect, protective equipment, speed, alcohol and drug issues.

Priority n°9: Portrayal of responsible riding: Codes of practice should be developed in order to *promote and market motorcycling responsibly*; the motorcycling press and rider organisations should also promote responsible behaviour codes.

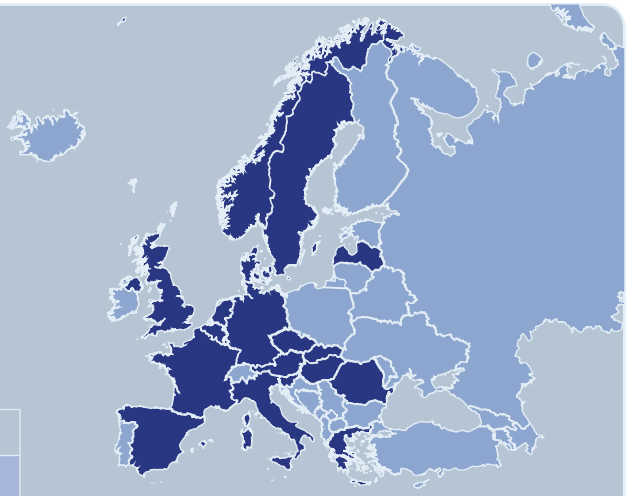
Priority n°10: Other Vehicle Driver awareness: To develop *an awareness of PTWs and mutual respect between road users*, education activities and campaigns should be set up *from childhood*, to emphasize that "road safety means road sharing".

RIDERSCAN outcomes

- EU research main conclusions
- A picture of EU riders' perceptions of national campaigns
- Dissemination channels and ways of reaching the motorcycling community
- Identification of the key elements for the efficient design of PTW awareness campaigns

1 http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html

Input received from...



EU stakeholders
CAST project

	Member States	The Motorcycling Community	the Research Community
Austria			KFV (Austrian Road Safety Board)
Belgium			VSV ; BIVV-IBSR
Czech Republic			Division of Road Safety and Traffic Engineering, Transport Research Centre
Denmark		MCTC	
France	Conseil National de Sécurité Routière	FFMC	
Germany		IVM; IFZ; BU	
Greece		AMVIR	National Technical University of Athens
Hungary			GRSP Hungary Association
Italy		Ducati; FMI	Centre for Transport and Logistics
Latvia	Latvian state roads		
Luxembourg	Ministère du Développement durable et des Infrastructures	LMI	
Netherlands	Department of Road Safety, Ministry of Infrastructure and Environment		SWOV Institute for Road Safety Research
Norway	Norwegian Public Roads Administration	NMCU	
Romania	Romanian Traffic Police Directorate		
Slovakia	Ministry of Transport		
Slovenia	Slovenian Traffic Safety Agency		
Spain			
Sweden	Swedish Transport Agency	SMC	
United Kingdom	Department for Transport	BMF	

EU RESEARCH WORK

ROAD SAFETY CAMPAIGNS

- Road safety campaigns are powerful instruments for reducing road accidents, but they have only limited effectiveness over time. For this reason they are often combined with long-term education to shape people's thinking and convictions in childhood and adolescence. This approach fosters considerate and cautious drivers, who can sometimes be reminded of specific risks through road safety campaign. (2BESAFE)
- Road safety campaigns as a stand-alone measure generally don't have a large effect on road safety. However, campaigns are crucial as a support for other road safety measures such as legislation, engineering and enforcement. (SUPREME)
- Campaigns to improve the mutual understanding of all road users can be helpful in this regard and were mentioned several times by motorcyclists. These campaigns need to make both riders and car drivers aware of the vulnerability of PTW riders and to foster safe interactions between different road users. In addition, the media need to promote a positive attitude towards protective clothing and protection equipment. This can be achieved by promoting an attractive image of PTW riders. (2BESAFE)
- Development and implementation of measures to communicate the risks should be based on:
  - Specific knowledge about motorcyclists' expectations, attitudes, motivations and habits concerning drinking and riding, speeding, use of safety equipment and interactions with car drivers.
  - Knowledge about specific motivations for the use of powered two wheelers.
  - Age- and gender-specific differences. (SARTRE4)

AWARENESS TOPICS

- 5 key awareness topics in the area of European PTW research were identified (SARTRE4):
  - *Speeding*: Contrary to expectations, motorcycle riders, whatever the age group, received fewer speeding tickets than car drivers. However, this may mostly reflect the amount and type of 'exposure' and the degree of enforcement efficiency, not necessarily concluding that motorcyclists drive slower than car drivers. (SARTRE4)
  - *Alcohol*: Riding a motorcycle while impaired is known to be a very high-risk activity. The impact of alcohol on riding skills is even greater than on car driving skills. Motorcyclists seem to be aware of this and often decide not to ride to do ride when they have been drinking (Syner & Vegega, 2000). This point is important to mention because it shows that motorcyclists are already aware of the risk associated with drink-riding. Communicating this risk and informing motorcyclists about it would therefore seem to be a waste of effort. However, these findings need to take geographical considerations into account. Motorcycle use is very different among SARTRE countries due to both cultural and weather differences, especially between Northern and Southern European countries. The type of motorcycle, motorcyclist profiles, frequency of use and the size of the motorcyclist population differ widely between those European regions. (SARTRE4)
    Given that in most Mediterranean countries alcohol production and consumption have long been interwoven with the economy and culture, authorities should actively try to modify the behavioural culture of drink-driving among PTW users. It is evident that a shift in culture towards making drink-driving socially unacceptable requires not only intensive police controls supported by a severe penal system, but also large-scale awareness-raising campaigns over a sustained period of time, aimed at increasing perceived susceptibility to drink-driving fatalities. (eSUM)

- *Protective equipment*: The results of the survey revealed important differences between various groups of motorcyclists and also various countries in the usage of protective equipment (other than helmets). Besides the general level of safety awareness in individual countries, there are complex factors affecting wearing rates.
  The percentage of motorcyclists wearing a technical jacket is highest in Austria, Sweden and Estonia, and the lowest in Greece, Italy and Hungary. Back protection equipment is most often used in Sweden, Ireland and Austria, while the lowest rate is again found in Greece, Italy and Hungary. The use of technical shoes/ boots is most often found in the Netherlands, Sweden and Austria, while less often in Italy, Greece and Serbia. Finally, use of a phone system installed in the helmet is highest in Serbia, Israel and Austria, while the lowest usage is in France, Sweden and Slovenia. There is a relation to styles of motorcycling typical for individual countries, but also to weather conditions. (SARTRE4)

- *Helmet wearing*: According to respondents, their safety helmet wearing rate is high, with less than 2% reporting that they "never" or "rarely" wore a helmet. The type of road that the motorcyclist uses is one factor affecting helmet use, with the highest rate on motorways ("always" wear a helmet 91,4%) and the lowest one in built-up areas ("always" wear a helmet 84,6%). However, the proportion of riders always wearing a helmet is clearly below the ideal level of 100%.

  - *Gender*: The percentage of females "always" wearing a helmet is somewhat higher (consistently more than 2% higher) than that of males for each of the four road categories.

  - *Engine size*: The helmet-wearing rate is higher among drivers riding motorcycles with an engine size greater than 250 cc, consequently with higher performance and higher speed potential.

  - *Annual mileage*: The percentage "always" wearing a helmet is somewhat lower among those who drive more than 5,000 kilometres a year on a motorcycle compared to those who drive less than 5,000 kilometres a year. However the helmet wearing rate is significantly lower when motorcycle mileage exceeds 10,000 km/year

  - *Location*: A significant relationship between individual countries and helmet wearing was found for all road categories (e.g. less than 60% of motorcyclists always wear a helmet in Serbia; more than 97% motorcyclists always wear one in Estonia).

  - *Passenger helmet-wearing* rates are somewhat lower than those of the drivers, with 78.5% of motorcycle drivers "never" carrying a passenger without a helmet. The proportion of motorcycle riders who report "never" carrying passengers without a helmet is the lowest for the youngest age group (18-24 years of age); as age rises the proportion of those carrying passengers only with helmet increases. (SARTRE4)

- The city of Athens in particular should address the limited PTW helmet use there through massive publicity and more systematic police enforcement efforts. (eSUM)

- *Driver distraction*: Driver distraction is understood as a form of inattention and has been defined as "a diversion of attention away from activities critical for safe driving, toward a competing activity". Given the difficulty in removing the causes of distraction, such as the use of mobile phones, and in enforcing laws related to particular sources of distraction, the use of hard-hitting campaigns to promote risk awareness and change behaviour is a necessary part of any programme of countermeasures. Contrary to drink-driving, norms have not yet changed for driver distraction in spite of consistent results showing that risks are known. Research data supports the idea that car driver distraction is not connected to the lack of perceived risk but rather a disconnection between the norms underlying the behaviour and knowledge of risk. This data suggests that driver distraction campaigns cannot simply focus on risk-awareness strategies, but should instead use an approach that deals also with enforcement norms. (DACOTA)

- *Cell phone use*: One of the research-based recommendations for action to address the cell phone use issue is to inform, educate and train road users: Drivers need to be made more aware of the dangers of mobile phone use and of other various distracting activities and educated about the possible effects of distraction, their ability to compensate for it, as well as receiving practical advice on how to deal with telephones in vehicles. (DACOTA)

Motorcyclist profiles

- Significant differences exists between sub-groups of riders regarding both their motivations for riding a motorbike, their motorcycling practices and their respective attitudes towards risk and risk-taking while on their bikes. Potential measures to be implemented for increasing road safety for motorcyclists (in terms of awareness campaign, training, riding licences or traffic laws, for example) should take into account these sub-group characteristics and their respective differences, in order to be specifically tailored to each motorcyclist profile. Such dedicated profile-specific "targeted approaches" may be a more efficient way for fostering road safety than general measures covering all riders. (SARTRE4)
- There is a very clear distinction between Northern and Southern European motorcyclists. They differ greatly in their motivations (and thus profiles), use of safety equipment, attitudes towards drinking and driving, and their proportion of road deaths compared to other road user categories. We thus recommend a different approach to road safety communication in Northern and Southern European countries. (SARTRE4)
- Risk communication approaches should include internet-based dialogue-oriented strategies. Addressing safety topics in social networks seems to be a promising strategy to reach younger people. Enhanced risk communication should be part of the process of obtaining a motorcycle licence. (SARTRE4).

For more details on the EU research projects scanned, see the section "Overview of EU research projects on PTWs" (p. 183).

Key elements for the efficient design of awareness campaigns - CAST general elements

The CAST project recommends the following 6 steps when designing a road safety campaign:

Getting started

The very first step to do before launching a campaign is to clearly define why you need an awareness campaign. This means identifying the problem you want to address.

- Identify and define the problem, based on available data.
- Analyse the context: in which context does the problem addressed occur?
- Identify partners and stakeholders and getting them involved: the more stakeholders from the sector are involved, the better the message will be designed and accepted.
- Draft the budget: costs for research and evaluation should also be included.
- Bring the campaign partners together for a kick-off meeting: the general objective and the campaign strategy should be drafted between partners.
- Call for bids and setting up the campaign team: the bidders may include advertising, production, and media-buying agencies, public relations agencies, and researchers. Outside researchers are at least recommended to evaluate the campaign.

Analysing the situation

This process is fundamental to understanding in detail the problems targeted. The following steps, in this order, are needed:

- Thoroughly analyse the problem and possible solutions: analysis of in-depth studies, theoretical models, past campaigns, marketing studies on the target audience.
- Decide whether to segment the audience: it is often best to segment the audience in order to address the distinct needs and characteristics of particular subgroups. Several subgroups can be targeted.
- Determine how to act on main motivations and reach the audience: find out what factors contribute to the problem behaviour identified.
- Define the campaign's specific objectives: identifying the campaign's primary and secondary objectives.
- Gather information from evaluations of past campaigns and other actions: select an evaluation methodology appropriate to the campaign and its objective.

Designing the campaign and evaluation

The elements collected during steps 1 and 2 will be necessary to design the campaign. In parallel, complementary actions or programmes can be designed too.

- Develop the campaign strategy: try to answer these questions: What should we do? How should we do it?
  - Define the strategy: type of campaign, scale.
  - Develop the content of the message: context, structure and style of message. The message should be as clear as possible.
  - Choose campaign identifiers: spokespersons, logos, mascots, brands, etc.
  - Select the media and define the media plan: dependent on the budget, the target audience, etc.
  - Develop and pre-test the messages and slogans in their full context: message testing tells you more about the strengths and weaknesses of the message.
- Design the campaign evaluation: try to answer this question: How will we know whether the campaign is working or not?
  - Define the objectives of the evaluation: the minimum is to determine whether the campaign works or not, and whether or not it is cost effective.
  - Choose the evaluation design and sample: choose a sample and use a control group.
  - Develop evaluation measures: road-accident data, observed behaviours, self-reported data and cost data.
  - Define methods and tools for collecting data: qualitative or quantitative method.
  - Plan the evaluation

Conducting the ex-ante evaluation and implementing the campaign:

The ex-ante status should be used as a baseline for the other phases of the evaluation. You also need to produce the actual campaign materials and launch the campaign.

- Conduct the ex-ante evaluation
- Produce the campaign materials
- Roll out the campaign: the timing of the launch is very important since it creates unique opportunities to get free publicity for the campaign.
- Control the release of campaign materials and possibly feedback to previous steps: in case of implementation issues, corrective measures can be applied.

Completing the evaluation and drawing conclusions

This step is essential to determine whether the campaign was effective and achieved its goals.

- Implement the chosen evaluation method for the during- and/or after- campaign periods
- Process and analyse the evaluation data: comparison of the ex-ante data with that obtained in the during and/or after period(s).
- Collect cost and cost-effectiveness information
- Draw clear conclusions on the campaign: identification of successful elements and elements that did not work, and why.

Writing the final report

One of the main goals of writing the report is to provide important information and feedback not only to the partners involved in the campaign, but also to stakeholders, researchers and the general public. It is crucial to disseminate the results of the campaign, ensuring that the information is widely distributed and easily accessible. Indeed, any improvement in future campaigns depends on the availability of thorough and rigorous campaign evaluation reports.

Key elements for the efficient design of PTW awareness campaigns – PTW specificities

Views of the Motorcycling Community (industry/users)

According to answers received from the ***motorcycling community***, there are two important things to highlight in any awareness campaign for powered two-wheelers users or on PTWs:

	cast
▶ **To raise the awareness of other road users to the presence of riders**	*It depends on the nature of the problem*
▶ **To send a positive message to riders**	*Agree - If you start moralizing people, there is a kind of rejection of the message*

Member State experts and road safety and research institutes also made recommendations for the design of an awareness campaign for or on PTWs:

	cast
▶ **Focus the campaign on providing solutions: point out what the danger is and how to ride/drive safely, with concrete information for safe motorcycle riding. E.g.: how to change behaviour or give examples of dangerous situations and how to behave. It is more convincing if you show which behaviour should be preferred to avoid an accident.**	*Very important to give the audience specific feasible instruction on how to reduce the risk*
▶ **A lot of people to be reached by the message: widespread publication. The campaigns are more effective when they are broadcast on TV, reaching all motorcyclists. Campaigns in specialized magazines are less useful as they tend to reach motorcyclists already aware of road safety.**	*Important to have a general dissemination channel.* *Riders who read MC press are not always safety aware.*
▶ **Bring together all stakeholders, including riders.**	*Very important to have as many stakeholders from the motorcycling community as possible*
▶ **Proper identification of the problem: in order to realise a good campaign, we have to identify what the actual PTW problems are.**	*This is a necessary first step*
▶ **Talk to other road users: talk with car drivers and all road users and make them aware of PTW presence.**	*It depends on the nature of the problem*

▶ **Prepare the awareness campaign by prevention work in the field (practical workshops at the beginning of motorcycling season).**	*Campaigns that are combined with field activities have proved to be more effective than stand-alone campaigns*

Similarly on the negative aspects, the ***motorcycling community*** highlighted two important things to **avoid** in any awareness campaign for powered two-wheelers users or on PTWs:

	
▶ **Sending out a message stating that riders have sole responsibility for their accidents**	*It depends on the nature of the problem*
▶ **Giving the impression that "extreme riding" is the regular way of riding**	*Except if you want to target extreme behaviour as such*

The project also asked stakeholders to identify topics of relevance for future awareness campaigns to increase PTW safety:

	Countries
Car drivers, please pay attention to two-wheelers, especially when approaching crossroads.	*ACEM Italy* *FFMC France* *Biker Union Germany* *SMC Sweden*
Regarding single-vehicle accidents: Don't be over-confident! An exaggerated opinion of oneself is often the cause of an accident. One's own competence in taking curves in particular is often overestimated.	*ACEM Germany* *Biker Union Germany*
Road safety awareness in general	NMCU Norway SMC Sweden
Regarding multi-vehicle accidents: It's better to look twice! If PTW riders are aware of their risks, this knowledge can help avoid or reduce the dangers.	*ACEM Germany*
Always wear protection and the right clothes, even during a hot summer, as they can save lives.	*ACEM Italy*
Use your head and be careful: public roads are not a motor-racing circuit.	*ACEM Italy*
Target riders without a licence	*SMC Sweden*
Target distracted driving	*FMI Italy*

Views of member state representatives

According to ***Member State experts and road safety and research institutes***, elements that should be **avoided** are:

	cast
▶ **Sending out a too negative message is less convincing for users. We should not show the result of an accident (death, etc.). The use of shocking pictures or videos to provoke behavioural change is maybe not the right way to achieve a long-term effect on safe traffic behaviour.**	*Fear is not effective in the long term. But if you do use fear appeals, don't let them interfere with the change in attitude or behaviour you want to have.*
▶ **Stigmatizing riders. A stigmatizing message won't be accepted and won't work. You have to choose a message that the motorcycling community can support. Don't target a specific and extreme behaviour because it is not the "normal" behaviour of most riders.**	*If you start moralizing people, there is a kind of rejection of the message.*

Workshops comments - European Motorcyclists' Forum 2012, 2014 and 2015

- There is a need to segment awareness campaigns as riders do not form a homogenous group. If "the" motorcyclist does not exist, "the" rider safety campaign does not exist either.
- Awareness campaigns are an area where there is a need to have a common commitment from the sector as a whole, and requires all people to be involved.
- Evaluating a campaign is absolutely crucial, to know whether the campaign is working or not, and whether the money has been spent properly. How can you learn whether a campaign is effective or not if you don't get feedback and evaluation? The involvement of an academic institution can be beneficial.
- Overall, a number of campaigns analysed did have a certain impact on accidents, even small campaigns. But you need to distinguish between the effects on knowledge, the effects on road user attitudes, and the effects on behaviour or intended behaviour, as all three can influence accidents. This means that a campaign for getting or giving more knowledge or insight into a problem can be called effective if it is proven that the knowledge levels before and after the campaign are different, compared to a group not exposed to the campaign.

CAST Project

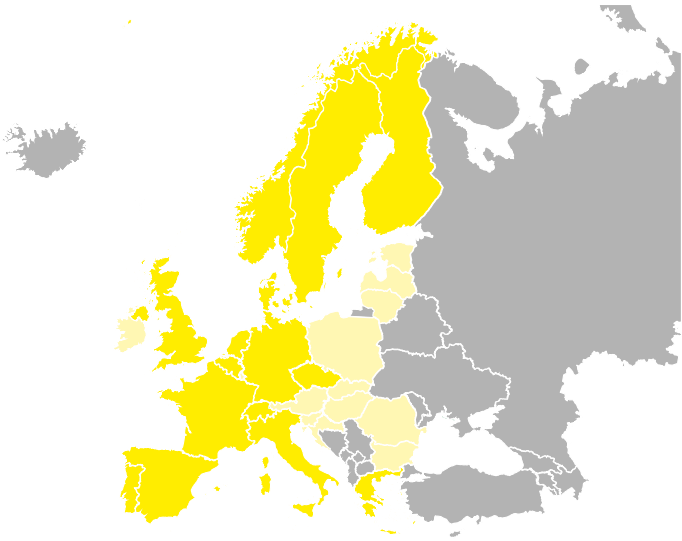
- What needs to be done is to analyse your problem, your audience, your media channel. It is important also to report on which elements you used, etc. And then evaluate what worked and what did not work, allowing best practices to be compared between countries.
- The most important things are to have a good analysis of the problem you want to address and of your audience, and to involve stakeholders.

- When a campaign is financed by the EU, it should be based on CAST principles. The CAST principles provide guidelines on designing and implementing a campaign, but above all on how to evaluate it. And it is crucial to evaluate the impact, thereby gaining input for the next campaign.
- An EU-wide campaign would not necessarily be effective and pertinent, as there are many differences between countries. To conduct an EU campaign, you would need an analysis of common accident patterns. If this is not available, national or regional campaigns are better. At present there is no room for a pan-EU campaign. What would make sense would be to have a general baseline for Europe, to be adapted depending on the country issue at stake.

Comparisons & analysis

Project surveys outcomes

Everyday riders' view on safety and safety campaigns - The RIDERSCAN pan-European Motorcycling Survey



A survey targeting European riders was designed to collect information on the motorcycling community around Europe and gain a better overview of similarities and differences in terms of riding, attitudes and safety needs. The survey gathered 17558 answers from 31 countries. (more details p. 175). The number and diversity of answers enabled the following information to be collected:

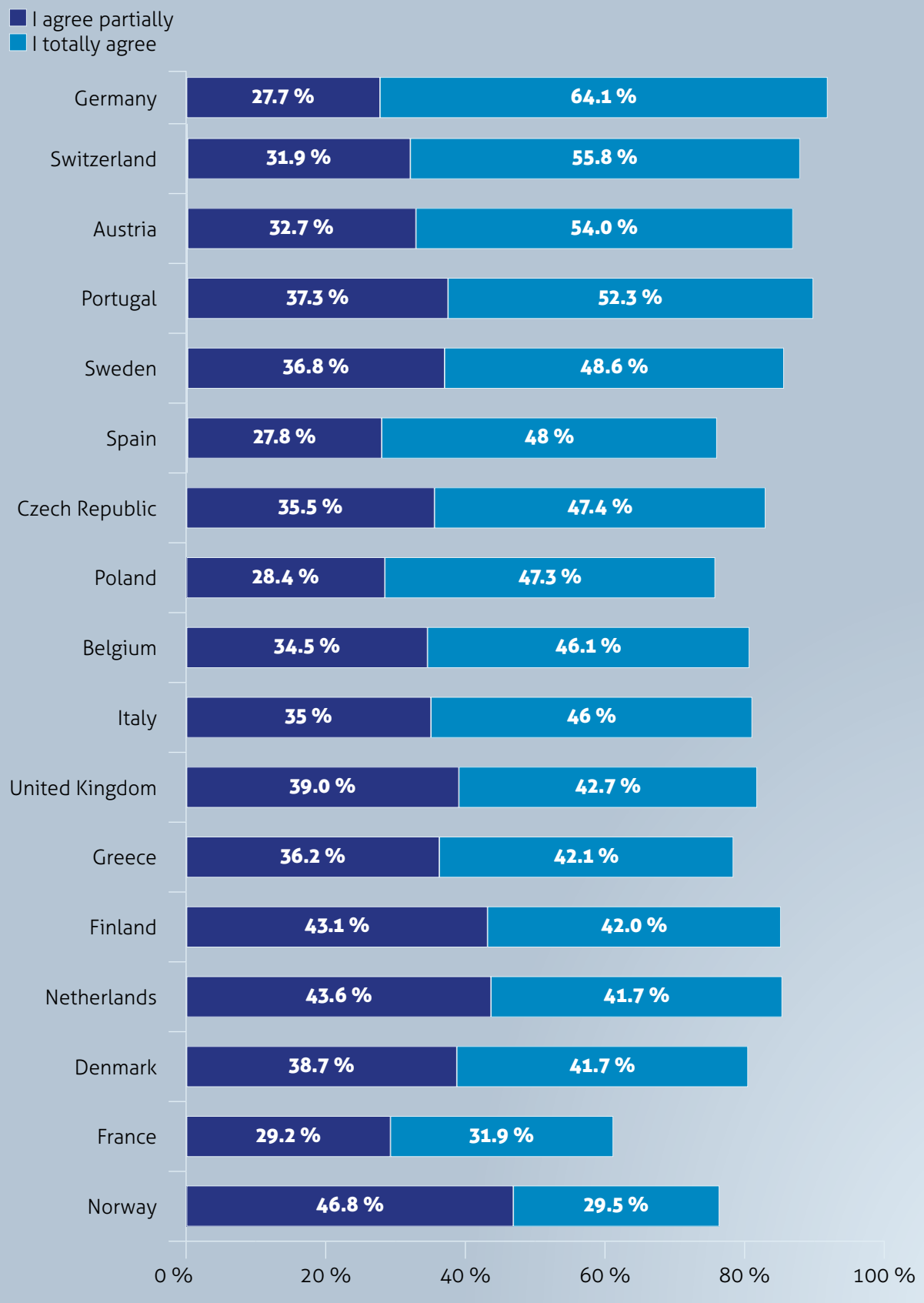
Safety attitude

The vast majority of EU riders tend to agree that risk will remain an inherent element of riding a PTW, and that riding a PTW will always be more dangerous than driving a car . The statement "Motorcycling will never be made risk-free" gained a large consensus throughout Europe, with at least 70% of the riders in each selected country totally or partially agreeing with it. We found the highest level of agreement (totally and partially combined) in the Netherlands (96.5%) and the lower level in Greece (77%). Riders totally agreeing with the statement were to be found most in Sweden (77.3%) and again the fewest in Greece (39.7%).

Figure 43 **Breakdown of answers for the following statement 'Motorcycling will never be made risk-free' (EU dataset)**

	No.	% cit.
I totally disagree	**809**	**4.6 %**
This is not quite true	**1 282**	**7.3 %**
I agree partialy	**4 384**	**25.0 %**
I totally agree	**11 046**	**63.0 %**
Total	**17 521**	**100 %**

Figure 44 **Country breakdown of positive answers for the safety statement 'Riding a motorcycle involves taking a higher risk than driving a car' (answer per country)**



Similarly, the statement "Riding a motorcycle involves taking a higher risk than driving a car" was unanimously accepted in Europe (80.6%) with at least a 60% level of agreement (totally or partially combined) in every selected country. The highest level of agreement was found in Germany (91.8%) and the lowest level in France (61.1%).

Figure 45 **Breakdown of answers for the safety statement 'Riding a motorcycle involves taking a higher risk than driving a car' in Europe (EU dataset)**

	No.	% cit.
I totally disagree	**1 135**	**6.5 %**
This is not quite true	**2 256**	**12.9 %**
I agree partialy	**5 659**	**32.3 %**
I totally agree	**8 470**	**48.3 %**
Total	**17 520**	**100 %**

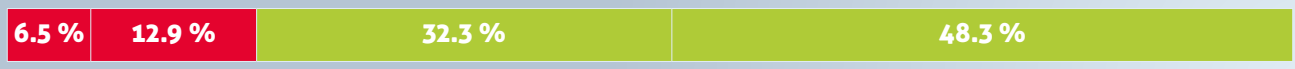


Figure 46 **Which statement best defines motorcycle safety? (EU dataset)**

	No.	% obs.	
Riding is not more dangerous than other modes of transportation, it is mainly about the right attitude and behaviour, and everyone sharing the road properly	**8 990**	**51.5 %**	51.5 %
Motorcycling is dangerous and one should be extremely well trained before getting on the road with a bike	**4 225**	**24.2 %**	24.2 %
To make motorcycling safer, it is the job of road authorities to improve riding conditions (road infrastructure, tax cuttings on motorcycling protective equipment, etc)	**2 740**	**15.7 %**	15.7 %
Motorcycle safety, it's all about car drivers' training and awareness	**1 492**	**8.6 %**	8.6 %
Total	**17 447**	**100.0 %**	

The statement "*Riding is not more dangerous than other modes of transportation, it is mainly about the right attitude and behaviour, and everyone sharing the road properly*" was chosen by the majority of the riders in all surveyed countries.

At least 50% of respondents considered that this sentence best defined motorcycle safety in Finland, the Czech Republic, the United Kingdom, Sweden, Portugal, Norway, the Netherlands, Switzerland, Italy and Germany.

France was the country least in agreement with this statement, with just 40.2% of respondents choosing this answer. The second statement preferred by French riders is "*To make motorcycling safer, it is the job of road authorities to improve riding conditions (road infrastructure, tax cuts on motorcycling protective equipment, etc)*", chosen by 25.1% of French respondents.

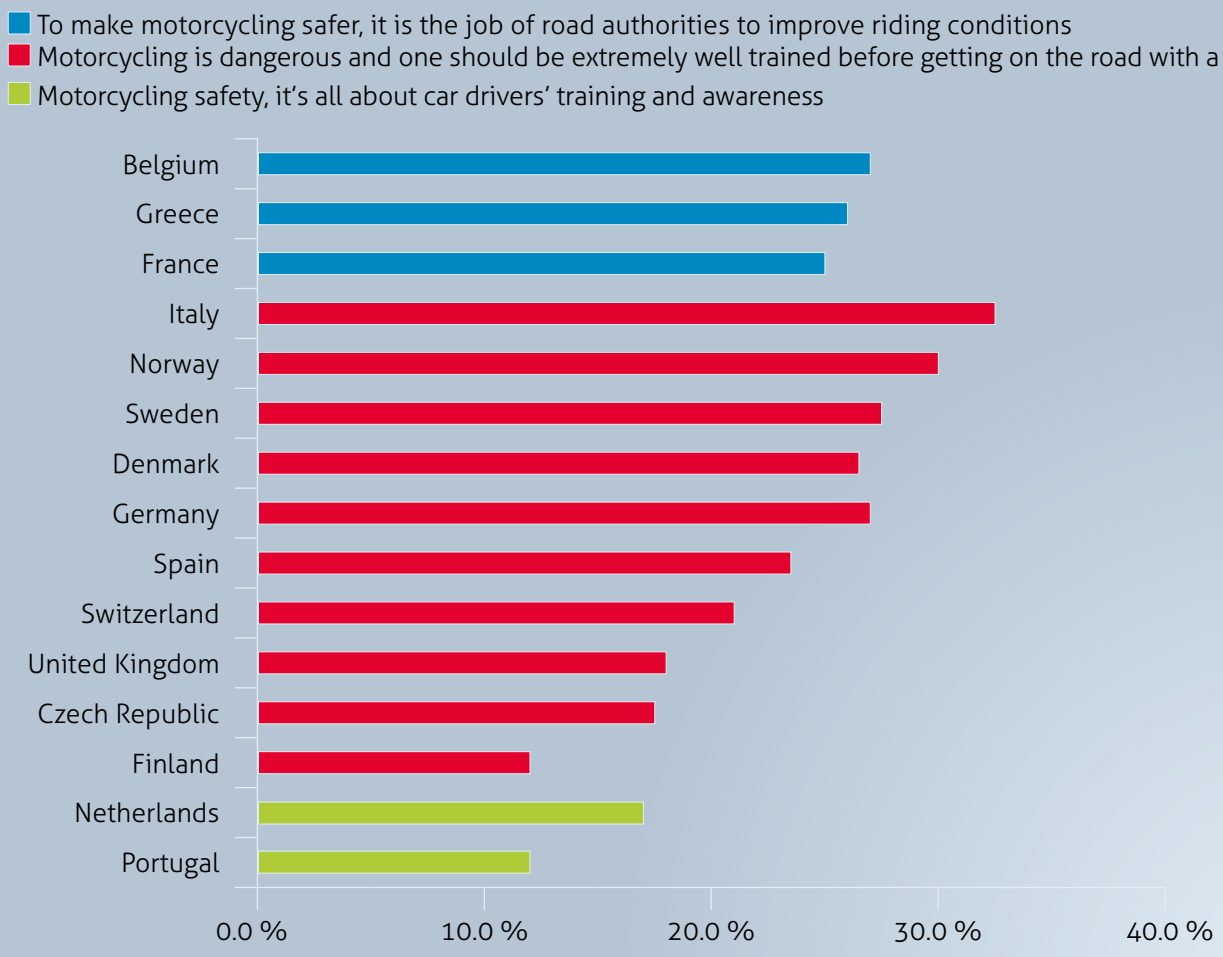
Table 26 **Country breakdown of answers (national rates)**

	Riding is not more dangerous than other modes of transportation, it is mainly about the right attitude and behaviour, and everyone sharing the road properly	To make motorcycling safer, it is the job of road authorities to improve riding conditions	Motorcycling is dangerous and one should be extremely well trained before getting on the road with a bike	Motorcycle safety, it's all about car drivers' training and awareness
Finland	**78,9%**	**6.1%**	**11.5%**	**3.5%**
Czech Republic	**68,1%**	**11.9%**	**17.2%**	**2.8%**
United Kingdom	**67,7%**	**6.3%**	**17.7%**	**8.3%**
Sweden	**65,4%**	**4.3%**	**27.2%**	**3.1%**
Portugal	**63,9%**	**8.1%**	**16.3%**	**11.7%**
Norway	**61,7%**	**3.8%**	**30.1%**	**4.4%**
Netherlands	**60,3%**	**8.6%**	**14.4%**	**16.7%**
Switzerland	**56,6%**	**16.2%**	**21.0%**	**6.3%**
Italy	**51,2%**	**13.2%**	**32.4%**	**3.2%**
Germany	**50%**	**19.2%**	**26.3%**	**4.5%**
Greece	**48,2%**	**26.0%**	**22.0%**	**3.8%**
Spain	**47,8%**	**13.4%**	**23.3%**	**15.5%**
Belgium	**44,5%**	**27.1%**	**15.8%**	**12.7%**
Denmark	**43,9%**	**4.9%**	**26.4%**	**24.8%**
France	**40,2%**	**25.1%**	**22.6%**	**22.6%**

While the first statement chosen to best define motorcycle safety was the same in all surveyed countries, the second most chosen answer varied. To enhance motorcycle safety, 3 solutions can be considered:

- Road authorities' responsibility: improving riding conditions: Belgium, Greece and France.
- Motorcyclists' responsibility: improving training: Italy, Norway, Sweden, Denmark, Germany, Spain, Switzerland, the United Kingdom, the Czech Republic and Finland.
- Other road users' responsibility: car driver training and awareness: the Netherlands, Portugal.

Figure 47 **Second most chosen answer per country to the question « Which sentence best defines motorcycle safety?» (national rates)**



Safety campaigns

Answers to the question "*Which sentence best defines your perception of official road safety campaigns*" vary greatly from country to country without any correlation with membership or readership rates. This means that riders' perceptions of an official road safety campaign are directly influenced by their own personal assessment of the quality of the road safety campaign.

Table 27 **Breakdown of answers on riders' perceptions of official road safety campaigns in Europe (EU dataset)**

	No.	% obs.
Public road safety campaigns do not address the right issues.	**4 134**	**23.8 %**
I am not aware of public road safety campaigns.	**3 990**	**22.9 %**
Public road safety campaigns give a bad image of motorcyclists and motorcycling.	**3 867**	**22.2 %**
Public road safety campaigns address the right issues and use language and images drivers and riders understand.	**3 319**	**19.1 %**
Public road safety campaigns address the right issues, but language and images are difficult to understand, inappropriate or offensive.	**1 294**	**7.4 %**
Public road safety campaigns send the wrong messages.	**787**	**4.5 %**
Total	**17 391**	**100.0 %**

Table 28 **Top answers per country % perception of official road safety campaigns (answers per country)**

	Public road safety campaigns address the right issues and use language and images drivers and riders understand	Public road safety Campaigns address the right issues, but language and images are difficult to understand, inappropriate or offensive	Public road safety campaigns do not address the right issue	Public road safety campaigns give a bad image of motorcyclists and motorcycling	Public road safety campaigns send the wrong messages	I am not aware of public road safety campaigns
Austria			**14.4%**			**34.2%**
Belgium	**34.8%**					
Czech Republic	**44.5%**					
Finland			**25.2%**			**30.4%**
France				**37.8%**		
Germany				**31.1%**		**31.7%**
Greece			**24.5%**			**36.0%**
Italy		**32.3%**				**32.2%**
Netherlands	**25.3%**					
Norway				**27.3%**		**26.7%**
Poland	**26.0%**					
Portugal				**16.8%**		**46.0%**
Spain				**28.1%**		
Sweden				**28.5%**		**34.6%**
Switzerland				**38.4%**		
United Kingdom	**36.2%**					

Riders from Belgium, the Czech Republic, the Netherlands, Poland and the United Kingdom have a good perception of the awareness campaigns conducted by their national authorities, as seen by the top selected answer "*Public road safety campaigns address the right issues and use language and images drivers and riders understand*".

For France, Italy, Spain and Switzerland, riders seem to think that official awareness campaigns can be offensive and put over a negative image of motorcycling and motorcyclists.

In Austria, Finland, Germany, Greece, Norway, Portugal and Sweden, the top answer chosen by riders is "*I am not aware of public road safety campaigns*". Amplifying questions directed at Member States and EU Road Safety Authorities and the motorcycling community confirmed that public authorities do not conduct any campaigns in Greece, Norway and Sweden, and that they are very rare in Austria. In Germany this result is quite surprising, given the various campaigns launched by public authorities such as Runter vom Gas.

In Austria, Finland and Greece, the second most frequent answer is "*Public road safety campaigns do not address the right issue*". In Germany, Norway, Portugal and Sweden the second most frequent answer is "*Public road safety campaigns give a bad image of motorcyclists and motorcycling*". This means that, even when there is no public awareness campaign in their country, riders there tend to have a negative image of official road safety campaigns.

Identified needs

PTW accident investigation work has highlighted the relevance of human factors, including individual behaviour, in accident causation. Awareness campaigns, broadly speaking, have the capacity to play an important role in tackling some of these factors.

This is confirmed by the OECD/ITF Motorcycle Safety Report (2015, to be published) which underlines that, although it is acknowledged that there is *little research evidence on communication campaign effectiveness, it is assumed that the media can*

- *positively influence attitudes and behaviours;*
- *provide information*
- *increase the acceptability of safety measures*

Based on the input collected during the project on Awareness Campaigns, the project recommendations include the following:

Research needs

- **Risk definition, identification, awareness** and **assessment** considering different mobility patterns and riding styles in Europe (focusing on specific rider groups at greater risk such as novice or returning riders) would enhance knowledge not only for the design of robust awareness campaigns, but also for hazard perception training purposes and ITS development;
  Such a study would also investigate the influence of cultural differences between European countries on road safety: behaviour, perceptions, attitudes, beliefs of road users. It would also help understand the link between different social factors (age, alcohol, riding in groups) and behaviour.
- Study the specific risks of novice riders and design effective measures to increase their safety
- **Other Vehicle drivers**: investigate perception failures and road user distraction, and ways to increase VRU awareness (including PTWs)
- **Behaviour in traffic**: gain a better understanding of all road users' behavioural patterns and their interaction (with and without technology involved); testing of / long-term analysis of rider behaviour in traffic; measures to improve the behaviour of all road users
- **Extreme behaviour**: understand the causes of extreme behaviour and design effective measures to reduce it; identify the specific group of motorcyclists behaving in an extreme manner and find ways of reaching them.
- **Protective equipment**: develop and test personal safety equipment

Specific actions

- Campaigns aiming at **increasing mutual recognition and acceptance** of road traffic systems
- **Reaching riders in PTW dealerships**, as the type of bike chosen by riders provides clear information on their motives, the experience they seek and their concept of riding (when they can choose the bike). Persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour;

Setting up a PTW safety strategy

Road safety work needs to be based on a thorough analysis of existing safety problems, on a clear strategic view of what problems need to be tackled and by which types of measures, preferably on the basis of a vision of the long-term aims and the role of the various components of the traffic system.

Since the 2008 Lillehammer Workshop [1], several Member States have designed strategy/action plans with the objective of tackling PTW casualties, some as part of overall national safety strategies, others with specifically designed action plans.

As the need to address PTW safety is now recognized among the road safety community, the RIDERSCAN project focused on:

- Comparing existing national road safety strategies and/or national motorcycle strategy/action plans in Europe where they exist.
- Reporting on best practices.

Lillehammer priorities

Priority n°2: Transport and infrastructure policy: It is a fundamental motorcycle safety requirement that, by default, PTWs should have a place in overall transport policy and infrastructure policy/management.

Priority n°3: Research and evaluation: Counter measures need to be based on scientific research into driver and rider behaviour and before-and-after evaluations should be conducted.

Priority n°13: Policy dialogue: To enable communication and build mutual confidence, meetings between motorcycle stakeholders and policy makers\road authorities (e.g. forums, councils,) should be established, in order to exchange views, discuss needs and secure the necessary financing\resources for safety counter measures.

1 http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html

EU Road Safety Communication

The Communication from the Commission, currently under mid-term review, has identified 7 areas for actions:

- Improving education, training
- Safer road infrastructure
- Improve emergency and post-injury services
- Protect VRUs (incl. motorcyclists)
- Increase enforcement (by means of vehicle technology)
- Harmonisation and strengthening of roadworthiness testing (+ roadside checks)
- Promote the use of modern technology (active and passive safety, ITS)

With a number of specific PTW measures:

- Improving the perception of PTW riders by other road users.
- Enforcement on speed, drink-driving, helmet use, tampering and riding without a licence
- Encouraging research and technical developments
- Standards for personal protective equipment
- Use of relevant ITS applications (e.g. eCall)
- Airbags
- Appropriate anti-tampering measures
- Extending existing EU legislation on roadworthiness testing to PTWs
- Better adapting the road infrastructure to PTWs (e.g. safer crash barriers)

Interestingly, the following points were made by stakeholders during the consultation phase:

- Most problematic: novice drivers and PTW users
- Safer crash barriers for PTWs
- Safety Impact Assessment of land use planning and road infrastructure
- Campaigns, training, instructors
- Lack of accident definitions, integration of safety into other fields, lack of data and research

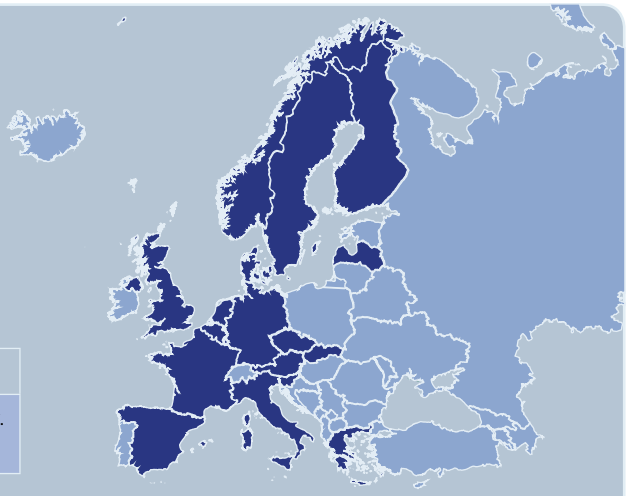
To which the European Parliament's Motion further added the following demands related to PTW safety:

- Improving indicators and data;
- Giving greater attention to PTWs/visibility in car driving lessons;
- Designing road infrastructure and equipment with PTWs in mind;
- Replacing existing dangerous crash barriers for motorcyclists

RIDERSCAN outcomes

- A comparison of national overall road safety strategies and national motorcycling safety strategies
- A first review of the literature on Safety Performance Indicators and a preliminary analysis of PTW specificities
- A summary of key stakeholders' recommendations for action

Input received from...



EU stakeholders
DG MOVE, Dir. C Innovative and Sustainable Mobility, Unit 4 Road safety.
ACEM

	Member States	The Motorcycling Community	the Research Community
Austria	Austrian Ministry for Transport		
Belgium		FEBIAC; MAG Belgium	
Czech Republic			Transport Research Centre
Denmark		MCTC	
Finland	Finnish Transport Safety Agency		
France	Conseil National de Sécurité Routière	FFMC	
Germany		BMW; IVM; IFZ; BU; BVDM	Federal Highway Research Institute (BASt)
Greece		AMVIR	National Technical University of Athens
Italy		ANCMA; Ducati; FMI	
Latvia	Road Traffic Safety Directorate		
Luxembourg	Ministère du Développement durable et des Infrastructures		
Netherlands	Department of Road Safety, Ministry of Infrastructure and Environment	MAG NL	
Norway	Norwegian Public Roads Administration	NMCU	
Slovakia	Ministry of Transport		
Slovenia	Slovenian Traffic Safety Agency		
Spain	Directorate General for Traffic, Ministry of Interior		
Sweden	Swedish Transport Agency	SMC	
United Kingdom	Road User Licencing, Insurance and Safety	BMF	

EU POLICY AND DOCUMENTATION

EU RECOMMENDATIONS

A non-paper from the European Commission on road safety planning[1] lists a few recommendations and best practices for designing and implementing a road safety strategy:

- *Strategy period: long-term planning provides the basis for long-term efforts.* As road safety is by nature a long-term effort, a strategy for achieving targets and focusing on the main activity areas over a longer time span would be more effective than just short-term planning.
- *Applying the Safe System approach.* According to the SUPREME project, "a sustainable safe road system aims to prevent crashes and, if they still occur, to minimise their consequences. It is based on the idea that people make mistakes and are physically vulnerable".
- *Using lessons learned to sharpen the action plan from one strategy period to the next.*
- *The link between problem analysis and action priorities to do the right things.* Priority areas should be evidence-based and target current issues.
- *Scientific choice of measures gives legitimacy.* Concrete measures should be based on scientific studies and cost effectiveness considerations.
- *Using prognoses and risk assessments to prepare for «worst case scenarios».*
- *Strategic objectives motivate stakeholders*
- *Operational objectives help to focus the work.* Quantitative, measurable and specific operational objectives.
- *Output targets add transparency.* An output target is formulated as the quantified direct output expected from an action. These output targets enable citizens and stakeholders to track progress and know what to expect from the road safety work.
- *Clear assignment of responsibility and clear deadlines facilitate implementation*
- *Assessment of costs and defined sources of funding make actions realistic.* Define a clear budget and resources not only for the strategy, but also for each concrete measure.
- *Monitoring and evaluation mechanisms are tools for accountability.* Specific evaluation, monitoring mechanisms and performance indicators should be designed before the implementation of the strategy in order to evaluate the effect of measures.
- *Inclusive approach to mobilise stakeholders.* Different actors should be involved in the road safety plan, such as agencies, authorities, administrations, NGOs, users, etc.
- *Transparency for accountability and citizen participation.*

EU RESEARCH WORK

- Road safety work needs to be based on a thorough analysis of existing safety problems, on a clear strategic view of what problems need to be tackled and by which types of measures, preferably on the basis of a vision about the long-term aims and the role of the various components of the traffic system. (SUPREME)

1 European Commission, Road safety planning. Good practice examples from national road safety strategies in the EU. Non-paper as food for thought and discussions, version 13.10.2014

http://ec.europa.eu/transport/road_safety/pdf/national-road-safety-strategies_en.pdf

- Looking at the use of motorcycles and the riding behaviour and the accident risk of motorcyclists from an EU perspective, there are many differences between the European countries. Therefore safety measures for motorcyclists should be developed in accordance with country-specific circumstances. (SARTRE4)
- In view of the high PTW accident rate, this should not only include technical and non-restrictive measures. Policymakers need to recognise the role of mopeds and motorcycles as road users and the need for measures to improve their safety. (PROMISING)
- PTW safety is a complex undertaking, as improvements in the field require an integrated 'safe system' approach and rely on adoption of measures by all participating disciplines and behavioural modifications by the public at large. (eSUM)
- Simple methodology for designing and implementing a PTW casualty reduction programme. Essentially there are 6 stages:

1. Gather data required for analysing PTW casualties: at least collision data and contextual data (background data on PTW use)
2. Analyse data
3. Identify casualty issues: From the analysis it should be possible to identify common causation factors to assist in selecting appropriate countermeasures.
4. Develop targets and select countermeasures: align the latter with the problems identified in the data analysis.
5. Implement the countermeasures and monitor them: A robust monitoring framework should be established in order to accurately evaluate the effectiveness of any measures implemented.
6. Evaluate effectiveness: a named individual should be responsible for managing the project's implementation; measures selected should be suitably modified to ensure that they are appropriate to national/city conditions; sufficient resources should be available (eSUM).

- The 2BESAFE project recommends (supported by observation data and a statement in the Focus Group) working on 5 areas:
  - *Infrastructure*:
    - Use of anti-slip materials for road surfaces;
    - Separate lanes for PTWs;
    - Use of bus or emergency lanes has been considered as a safety and comfort enhancement for riders.
  - *Vehicle*:
    - Improvements to PTW lighting;
    - Raised awareness of riders for assistive technologies
  - *Interaction between road users and individual characteristics*:
    - Awareness training (training for PTW riders which enhances riding skills)
    - Research into traffic conflicts has to take into consideration that addressing certain groups of road users is not an isolated issue. The observation data and the experience obtained in the data analyses repeatedly showed that conflicts and errors by motorcycle riders are to a certain degree the fault of other road users. Therefore, the focus in future traffic research must lie on the interplay of different road user groups.
  - *Society (legal requirements, media)*:
    - It is crucial to adapt the regulatory framework in order for it to meet the specific fears, needs and

wishes of PTW riders. In this regard MC riders often mentioned the imbalance in the traffic system with its main focus on car drivers. A large proportion of the mentioned behaviour of PTW riders is not legal but still considered as "typical behaviour" and already socially accepted. This aspect needs to be considered in the process of reviewing and amending traffic legislation. Campaigns to improve the mutual understanding of all road users can be helpful in this regard and have been mentioned several times by motorcycle riders.

- *Individual*:
  - PTW training needs to focus more on riders' vulnerability and the fact that fast acceleration, speeding and braking abruptly as a consequence of inappropriate speed are particularly risky.
  - Refresher training for riders who haven't been riding a motorcycle for a long time need to be advocated.
  - The design of the motorcycle protective clothing should be adapted to different riding tasks. For motorcyclists who use their PTW for riding to work or for short trips, protective clothing suitable for the office or daily use is needed. The cost of protective clothing in general needs to be low enough for it not to be "exclusive" but for daily use. In addition, there should be a standard level of security for safety equipment in order to ensure quality. Legal requirements should therefore focus on adequate protective clothing for different riding tasks. (2BESAFE)

- Acceptance of a measure is much greater if the target group has been involved in the development and introduction of the measure. Motorcyclists in many countries have some degree of organisation, which makes it easier to discuss measures with motorcyclist representatives. For moped riders there are no special organisations representing their views and needs, although tourist organisations and the industry may offer to represent them. (PROMISING)

For more details on the EU research projects scanned, see the section "Overview of EU research projects on PTWs" (p. 183).

Stakeholders' views

Recommendations from Member State experts and Motorcycling Community representatives

Member States	Motorcycling Community (Industry/users)
• *Increase knowledge*: promotion of in-depth investigation of accidents involving PTWs; new definition of 'seriously injured'.	• *Knowledge*: the EU could improve PTW safety by financing better and more in-depth studies. EU expertise on road safety issues adding to available data from Member States will contribute positively to complex legislation on road safety.
• *Training and education*: procedures to obtain driving licences; awareness-raising campaigns; risk perception and risk assessment, advanced riding courses; use of driving simulators; special training and education for older bikers.	• *Better relationship with the motorcycling community*: the EU should work in synergy with and get feedback from European manufacturers and motorcyclist associations about the actions to be implemented. Only a close relationship with users and manufacturer representatives can improve PTW safety and make EU institutions aware of the needs of PTW users.
• *Sharing best practices and benchmarking*: comparison between the work done by the different countries on the Policy Orientations on Road Safety (see below).	• *Harmonisation*: the EU can support greater harmonisation of Member State policies through establishing a framework for national safety strategies and providing collections of best practices.

• *ITS and above all ABS*: regulations for mandatory equipment such as ABS (at least for bikes > 125cc), airbags, cooperative systems, e-call.	• *ITS*: the EU should encourage and support the introduction of ITS for PTWs: on-board collision avoidance technology in cars, vans and lorries which detect riders.
• *European awareness campaigns*: based on shared values and topics and easily adaptable at national level; forbid campaigns based on speed; increase communication between authorities and riders.	
• *User safety*: protective clothing (research, promotion, European standards on protective clothing) and conspicuity.	
• *Infrastructure safety*: road shoulders and intersections; best practices in urban areas; standards for 'PTW-friendly' safety barriers; PTW-specific road safety management tools.	
• *Enforcement*: technological innovations; controls for driving under the influence of drugs; cooperation among Member States; measures to prevent the tampering of new mopeds; speed support systems.	

Comparisons & analysis

National Road Safety Strategies – Comparison of strategic approaches

With the objective of identifying best practices, the project team compared national road safety strategies, action plans available in English (most of them) and identified 2 clear strategic approaches:

Overall road safety strategies

A dedicated section for powered two-wheelers

Even for countries without a motorcycle safety strategy, it is nevertheless possible to dedicate a section to powered two-wheelers. This is the case with Portugal, Slovakia, Germany and Austria. However, even with a specific section on PTWs, different variables are possible:

In Portugal, there is a specific section on motorcycles as they are considered as the top risk group. But there are no specific measures for PTWs as their needs are considered within general measures.

In Slovakia, there is a specific chapter on vulnerable road users, and a subsection on motorcyclists with 3 specific measures for motorcyclist safety.

In Germany, there are subsections on motorcyclists within 3 main sections: the human factors action area and the automotive engineering action area, while there are specific measures on a motorcycle-friendly infrastructure within the infrastructure action area.

In Austria, there is a dedicated section on motorcycles and another on mopeds.

In Bulgaria, Croatia and Greece, there are small subsections on motorcycles and mopeds, though generally included within more general topics:

In Bulgaria, there is a section on target groups and a subsection on motorcycles and mopeds. In this section, the strategy explains the different measures involving PTWs.

In Croatia, there is a section on the most vulnerable road users within a section targeting improving road user behaviour.

In Greece, there is a subsection on improving the safety of motorcyclists within the section on Safe Road Users.

Integrating powered two-wheelers safety within all sections

In the Norwegian strategy, there is no particular section on motorcycles. nevertheless motorcycle measures can be found within 8 different subsections, including licencing, road maintenance, ITS, etc.

To a lesser extent, in Switzerland and Northern Ireland there is no section on motorcyclists and measures targeting motorcyclists are integrated within general measures and can be found within other sections and subsections.

Scheduling & evaluation

To actually achieve concrete improvements, a road safety strategy cannot only be a declaration of goodwill. Measures planned must be implemented and evaluated.

Slovakia can be seen as a good example of a well-planned road safety strategy. Its road safety strategy considered 9 clear general objectives, with clear sub-objectives. They also planned to evaluate the success of the different motorcycle measures via predefined indicators: the numbers of slightly / severely injured and killed motorcyclists; the number of implemented campaigns with an emphasis on their evaluation.

In Austria, the periods for launching each measure in each field have already been scheduled. Evaluation is planned in the form of a cost-benefit analysis. However specific indicators and schedules are not indicated within the strategy.

Specific Motorcycle safety strategies

Integrating the specific needs of motorcyclists within a general strategy to ensure that they are not left out can also be a smart strategy, as it allows motorcyclists to be taken into account in every aspect of road safety and to integrate their needs when talking about other roads users. But this can only work when the measures designed for PTWs take the specificities of motorcycles and motorcyclists into account, and when the measures promoted are effectively implemented.

Approaches: Strengths & Weaknesses

Particular needs of motorcycles considered

Unlike general road safety strategies, the strength of PTW-specific strategies is that the particular needs of motorcycles and PTW users are taken into account. The solutions recommended and measures planned are specifically designed to solve PTW issues.

Lack of integrated approach

A weakness we can highlight is that these approaches do not consider motorcyclists together with other road users. These strategies are designed specially for PTW issues and measures, meaning that the needs of other road users are taken into account in separate plans. The idea of having different plans/strategies can be a weakness because if the road authorities or the road designers don't consult these particular plans, they might totally ignore the section on motorcyclists.

	Strengths	Weaknesses
Overall approach: national road safety plans	Possibility to mainstream motorcycling as part of the overall safety strategies	Lack of specific consideration of PTW characteristics in most cases
	Takes advantage of the overall assessment process and action plan	Lack of specific measures targeting PTW-specific needs
		Number of specific measures is limited
		Overrepresentation of enforcement measures
		PTWs often not considered as VRUs
Specific approach: motorcycle safety plans	Particular needs of motorcycles are considered	Lack of a broad approach

Lack of specific measures

A problem we observed with overall road safety strategies is that there is a lack of specific measures targeting powered two-wheelers, meaning that their specific needs are not integrated.

In Poland, the document analysed was only a short summary of their road safety strategy, but in it, there was no reference at all to powered two-wheelers, not even within the section on vulnerable road users.

In Estonia, there was no specific section on vulnerable road users or on PTWs. But for each measure, target groups were specified and organised by vehicle (motorcycle, moped), by traffic environment, and by road users (motorcycle and moped). PTWs are included within some measures but there are only 2 specific measures targeting PTWs: one on enforcement and one on research.

In Hungary, there are no specific measures for powered two-wheelers. The authorities are aware they must take measures to improve PTW safety, but they have not yet identified the specific measures.

In Finland, there is no specific section on vulnerable road users or on PTWs. Though there is a subsection on moped safety within the "Traffic behaviour" section, there is no reference to motorcycles.

Overrepresentation of enforcement measures

In Eastern European countries, we can observe that a lot of measures concerning powered two-wheelers are enforcement measures.

In Hungary, at present, the only measures identified concern enforcement.

In Latvia, PTWs are not really considered as vulnerable road users on a par with cyclists and pedestrians. Latvia has

not planned any specific measures for motorcyclist safety, except for enforcement measures.

In Lithuania, PTW-specific needs are not considered, while the only measures envisaged are enforcement solutions.

Identified best practices

→ Organisation of the road safety strategy:
- Plan a (mid-term) evaluation
- Plan a deadline for the strategy and for each action

→ Human factors
- Advanced training or training courses for motorists on PTWs

→ Vehicle factors
- Research and measures to improve PTW visibility

→ Environmental factors:
- Research into the possibility of PTWs using bus lanes

→ Social factors:
- Collect accident data from hospitals, trauma centres, police departments
- Reduce emergency reaction times
- Implement smart accident reports, using smart software to analyse accidents in detail, including contributory factors.

Identified needs

Based on the input collected during the project on National Strategies, the project recommendations include the following:

Research needs

- Fundamental research leading to proposals for PTW road safety measures:
  - Investigation of road conflicts
  - Identification of accident black spots
  - Riders' needs, their characteristics (riding behaviour, cognitive performance, mentality, acceptance, motives, mobility needs, etc.)
  - Riders' interaction with the elements making up the road network (other road users, the road environment and their PTWs)
  - Riders' behaviour: comparison at EU level; study of young riders; means to improve road user behaviour in general and of PTW users in particular.
- In-depth accident and naturalistic studies to better understand accidents that happened on the road and to design effective and coherent measures to tackle the different safety issues
  - PTW accident reconstruction
- Risk perception and risk assessment work
- Develop road safety management tools designed for PTW safety
- Common impact assessment and cost-benefit analysis methodologies to evaluate the impact of safety concepts (design better evaluation and better cost-benefit analyses of safety measures and their effects)
- Identify relevant safety performance indicators based on an understanding of PTW riding models, risk patterns and accident causation factors
- Mobility research and design of a holistic approach to PTW safety: understanding PTW use and the motorcyclist community

Standardization

- PTW tools for road safety management
- New definition of "seriously injured"
- Protective clothing (research, promotion, European standards on protective clothing)

Legislation

- Harmonize on-board collision avoidance technology for cars, vans and lorries
- Review existing transport legislation framework to integrate PTW safety elements
- Include PTWs in existing EU transport policy papers (e.g. White Paper on Transport policy, ITS directive, etc...)

Specific actions

- European awareness campaigns based on shared values aiming at **increasing mutual recognition and acceptance** of road traffic systems

- The identification of a **general baseline for European awareness campaigns for PTWs**, to be further adapted in line with national/regional/local PTW safety patterns;
- **Reaching riders in PTW dealerships**, as the type of bike chosen by riders provides clear information on their motives, the experience they seek and their concept of riding (when they can choose the bike). Persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour
- **Enhance stakeholders' dialogue**; increase communication between authorities and riders; the European Union could provide added value by stimulating positive national debates on PTW safety, fostering dialogue between the motorcycling community and national road authorities
- **Sharing best practices and benchmarking** national strategies and specific road safety actions targeting PTW safety
- Develop awareness-raising campaigns based on shared values and topics easily adaptable at national level
- Develop in-depth expertise on EU PTW safety issues
- Promote the use of efficient technology
- Encourage technological developments for PTW safety
- Support standardization work and efforts that properly integrate PTW needs (infrastructure, definition of injuries, protective clothing, conspicuity, safety management)

Findings and conclusions

Following this 360° collection and review process and having provided an overall picture of PTW safety, the project concludes with the identification of *Key Challenges and Recommendations for PTW Safety*. These are addressed to road authorities and safety stakeholders.

Key Challenges

Improving PTW Safety Knowledge

In its upcoming report on PTW safety due for release in 2015[1], the OECD/ITF states: *Additional research is needed to better understand current challenges related to PTW mobility and safety problems. Operational research and development is needed to achieve a traffic system which better integrates and protects PTWs in a cost efficient manner. A co-ordinated and concerted cooperation between a variety of disciplines (e.g. civil and mechanical engineers, economists, educationalists, psychologists, transport planners, lawyers etc.) is key to the development of a consistent set of measures to address real issues regarding the safety of PTW riders.*

This backs up the priorities identified in 2008, when the first international workshop on PTW safety[2] concluded that

- *Counter-measures need to be based on scientific research into driver and rider behaviour and before-and-after evaluations should be conducted.*
- *Where proposed counter-measures are not based on objective research, but are supported by all stakeholders, policy makers should test and evaluate the proposal in a pilot scheme*
- *Enhanced awareness of motorcycles should be incorporated into the development of all vehicle ITS projects.*

Collecting relevant data for improving PTW safety

As highlighted by DACOTA, **aggregate road safety data** concerns **road accident data**, **risk exposure data** and **road safety performance indicators**, but also **causation indicators** (as those resulting from in-depth data) and **health indicators** (as those resulting from epidemiological data). These indicators, combined with additional information on other important road safety aspects such as those related to behavioural, social and political aspects, facilitate work on an integrated approach.

Supporting road safety decision-making requires having quantitative information on **road users' attitudes and behaviour**, on the **road safety measures** implemented, **rules and programmes** (including enforcement), and on their **social costs and benefits**.

As regards PTW use and safety aspects,

- None of this data or other statistical elements have yet been properly designed and accepted at international level to enable proper benchmarking between countries.
- Since the first pan-European in-depth study on PTW accidents (MAIDS, 2004), data collection has expanded and several countries have undertaken in-depth studies to gain a better understanding of PTW accident causation factors. However, often due to the **lack of exposure data and methodological differences**, the information collected is difficult to use for policymaking and further research.
- The analysis of **fatality or injury numbers**, though indicative of trends, is not sufficient to understand **accident causation factors** and **relative risk levels**. Collecting and analysing reliable exposure data is indispensable.

1 IMPROVED SAFETY FOR MOTORCYCLES, SCOOTERS AND MOPEDS © OECD 2014 (to be published)
2 http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html

In 2015, the OECD/ITF Motorcycle safety report[1] further highlights the need *to develop and apply relevant methods, tools and indicators to measure PTWs in traffic flows and analyse their mobility and behaviour (exposure data)*, complementing this recommendation with the statement that *more in-depth investigations will allow a better understanding of fatal and serious injury crash patterns and causes.*

Aware of the need for more reliable data in general, the European Commission has already financed several projects and taken the initiative to address this issue. With the preparation of the new Work Programme 2016-2017 under H2020, key research activities identified by RIDERSCAN could be addressed and answered within a reasonable space of time.

In 2002, the OECD Road Transport Research Programme developed a common methodology to collect detailed on-the-scene data from motorcycle accidents. Unfortunately, as underlined by numerous research projects investigating EU and national accident databases, in-depth data collection methodologies still vary widely from one country to another.

The private iGLAD initiative is also an interesting way forward to be considered. IRTAD work is of course to be included in the overall effort to guarantee a sustainable approach to data collection in the field of road safety.

Reporting on PTW accidents

It appears quite clear that, while everyone agrees that accident details are key to gaining a better understanding of accident causation factors and designing adequate countermeasures, the overall challenge remains to find acceptable ways to harmonize the information-collecting process, not least because the primary task of those in charge of filling in accident reports, i.e. police officers, is to first manage the accident consequences and protect human lives.

Nevertheless, several things can be done to progressively harmonize accident data collection, enable European comparisons, and define sound road safety strategies for the different transport modes. These include

- **fostering the use of the CADaS protocol at national level** to have comparable data throughout Europe,
- proposing **harmonized age brackets**.

For PTW-specific accident reporting, there is a need to

- complement the CADaS protocol with specific **data related to accidents involving PTWs**, such as environmental aspects or vehicle details;
- propose and include a **common PTW typology**;
- identify the (obvious) **share of responsibility** per road user involved in an accident.

In order to evaluate the correct exposure rate to in turn identify accident-related risk factors, it is also necessary to

- propose a harmonised way of measuring the **number of PTWs on the road**;
- identify and propose common typology for the **type/frequency/motivation of vehicle use**;

More specifically on *accident report forms*, it is advisable to:

- harmonise **formats** and **headings**;
- propose a harmonised **classification of vehicles involved in an accident**
- include **GPS coordinates** for the accident location
- include the following information for each vehicle involved in the accident:
  - Point of impact (front left, front right, etc.)
  - Angle of impact (0°, 45°, 90°, 135°...360°)
  - Impact severity (light, medium, hard)
- include **pictures** of the **scene** and the **damage to each vehicle** involved.

1 IMPROVED SAFETY FOR MOTORCYCLES, SCOOTERS AND MOPEDS © OECD 2014 (to be published)

Dedicated research tackling PTW safety challenges

Today, research needs are so acute that what is needed is a strategic approach to PTW safety research. Without such a strategic plan, there is a high risk that public money will be spent on already investigated areas, while forgetting critical fundamental aspects or other specific research needs.

As stated in the OECD/ITF Report on Motorcycle Safety (2015, to be published)[1], a safe system approach needs to be adopted, aimed at preventing accidents and mitigating them when they happen. With this in mind, Rijnaerts and van der Valk's accident sequence model[2] is a very appropriate model to base a strategic approach on:

Looking at the model, the key research focuses are clear:

1. to find ways of keeping riders (all types, all vehicles) outside the **orange** and **red** phases, and to find solutions to help them remain in the **green** phase;
2. train the rider to anticipate the **orange** and **red** phases;
3. protect the rider and passenger when the **red** phase unfortunately happens.

To this end:

- Fundamental research is needed to define riding models and understand the related risk patterns and the role of risk awareness and anticipation in avoiding road conflicts potentially leading to accidents;
  - More in-depth investigations and naturalistic riding studies will allow a better understanding of fatal and serious injury crash patterns and causes.
  - Rider visibility and other perception problems deserve further study in order to identify key contributing factors and effective countermeasures
- Active safety work is needed as emergency manoeuvres, which take place in the **orange** phase, should enable riders to reach a perfect emergency stop or swerve. In-depth accident data show that these manoeuvres are often poorly performed. The model's authors believe that there are 3 groups of causes for this failure:
  - primitive reaction of fear which prevents riders from taking action; this survival reflex takes command of the riders' thinking and action.
  - the dynamic properties of the single track vehicle and its relation with the surrounding environment;
  - the level of vehicle control of the average PTW rider.

  Priority research action would therefore include
  - the understanding and identification of PTW safety critical events
  - which and how information is processed by the rider,
  - identification of mental failures, in order to find appropriate measures to address these risks.
- Passive safety work: once in the **red** phase, PTW riders suffer relatively severe injuries or worse, because of the lack of passive safety features;

  Priority research work should focus on
  - developing passive systems which mitigate the consequences of an accident
  - developing and implementing safety equipment adapted to countries with hot weather
- Finally, research work will require accurate exposure data, for which relevant methods, tools and indicators need to be developed and used to measure PTWs in traffic flows and analyse their mobility and behaviour

1 IMPROVED SAFETY FOR MOTORCYCLES, SCOOTERS AND MOPEDS © OECD 2014 (to be published)
2 Safety Aspects of Powered Two Wheelers, Problems – Solutions - Van Der Valk, K., Rijnaerts, W.

Improving access to PTWs

Answering EU citizens' day-to-day mobility needs is one of Europe's key objectives. Based on EU equality principles, in times where alternative mobility and co-modality solutions are being greatly encouraged to ease congestion on European roads, priority should be given to allowing every citizen to choose his/her form of transport based on his/her mobility needs.

Due to the intrinsic characteristics of PTWs, designing an acceptable access scheme promoting the development of experience is a prerequisite for improving PTW safety. To this end, it is important that PTW training and licencing schemes be economically accessible (in comparison with other individual forms of road transport) and provide the necessary training content for minimizing risk exposure once on the road.

Several EU research projects have investigated a number of human factor aspects and their potential relation to training and licencing, including the work undertaken within the 2BESAFE[1] project (2011) which describes the *requirements of the riding task every rider has to tackle – in particular risk awareness – and concludes that there is a need to improve motorcycling training, with more specific targeting of new (or returning) leisure riders, but there is also potential for improving the training of car drivers or developing campaigns that focus on the responsibility of the driver to actively search for motorcyclists.*

Giving sense to progressive access

The "3rd Driving Licence Directive" was adopted by Europe in 2006. However, due to the freedom left to Member States to set up their own access schemes, the Directive has made PTW access in Europe more expensive and more complex in the vast majority of EU Member States, while leaving aside the critical issue of training content. This has created a real schism between the motorcycling community and road authorities.

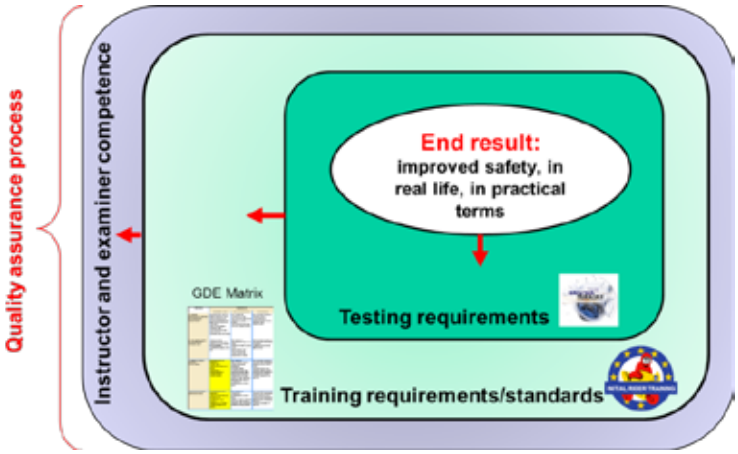
According to ACEM, the minimum requirements for training are not justified and are counter-productive. Another point is that while the Directive seeks to encourage progressive access, the way it is implemented by Member States leads to the opposite effect and to additional cost, with the result that people wait much longer to take a test, and maybe start with a much bigger motorbike, which is not what was intended. It would be a good idea to look at this in a more pragmatic way.

The testing paradigm & instructors' training

The pre-licence training curriculum (PLTC) should aim at teaching the necessary knowledge, skills and mental attitude to ride defensively, in full awareness of risk exposure and accident causation factors, and not simply at passing the licencing test.

The licence test should instead be a quality assurance of the candidate's competence, i.e. the minimum skills, knowledge and attitude needed to safely operate a motorcycle on public roads. To this end, Category A training instructors and examiners should be experienced riders accredited by national certification programmes.

Figure 48 **PTW/Infrastructure basic needs**



In 2008, the first international workshop on PTW safety was held in Lillehammer, hosted by the Norwegian Ministry of Transport. This identified the need for training to focus on risk awareness as the top priority for improving PTW safety. Acknowledging the variety of training programmes based on *countries' vehicle fleet and training resources, workshop participants concluded that motorcycle training should therefore build on existing standards, focus on risk awareness and risk avoidance, and develop an understanding of the rider/motorcycle capacities and limitations.*

1 http://www.2besafe.eu/

This is confirmed by the OECD/ITF Motorcycle Safety Report (2015, to be published) which underlines the need for training to *not only focus on basic manoeuvring skills and mastering traffic situations, but also address attitudes towards safety*. The report also highlights the need for *other road users [to] be made aware of the specific risks associated with PTWs vulnerability and crash patterns*.

Today's EU regulatory framework only briefly describes the content of testing. Finding an adequate system enabling access to PTWs, while ensuring that novice riders & drivers have the skills, knowledge and attitudes needed to safely operate the vehicle chosen on public roads, is one of the critical issues needing to be addressed by Europe today.

Training content

The EU co-financed Initial Rider Training project came up with the first complete initial rider training programme in 2007 designed from a European perspective. Highly experienced instructors, supported by academics, designed a training programme applicable in a modular way (to better match 3DLD requirements). This included the design of tailored courses, such as those for so-called *returning riders*. However, apart from Ireland, it has not yet been used as a reference for shaping national training curricula.

- With the objective of reducing novice/returning riders' risk exposure, there is a need to:
  - **make use of new technologies** to develop new simulation techniques and open up new opportunities for training programmes;
  - **standardize minimum training curriculum requirements**: linking driving licence tests to this standard would significantly improve the quality of rider training programmes (need for a "quality seal");
  - **encourage safe riding behaviour**: the type of bike chosen by riders provides a clear indication of their motives, the experience they seek and their concept of riding (when they can choose the bike). One implication is that **persuasive communication material**, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour.
- With the objective of encouraging progressive access, there is a need to:
  - **evaluate the effects of the various age limits on progressive access**
  - **research** how the skills trained in riding schools (e.g. manoeuvring skills, braking skills, being aware of high-risk situations) are effectively learned and used in real traffic situations. This would help find effective ways to improve young riders/drivers training programmes, and identify specific training needs according to experience and vehicle;
  - **address training content / instructors' competence in a legislative framework**. This is an essential complement to the 3rd Driving Licence Directive (for PTWs).

Ensuring a safer road environment

Infrastructure

PTW riders are more sensitive to road design and maintenance than car drivers. The design of roadway elements influences how a road user interacts with the roadway. These elements include bends, junctions, the road surface and the roadside. The general influence of road and surrounding traffic on the driving speed, level of vigilance, attention paid, accident severity is a well-known fact. Whereas an infrastructure problem can be managed by a car driver, it can be a real challenge for a PTW rider.

Since the first pan-European in-depth study on PTW accidents (MAIDS, 2004), several important milestones have been reached as regards PTWs and infrastructure needs:

- A number of guidelines on how to design and maintain roads with PTWs in mind have been published.

However, most of them remain just good intentions and are hardly used by local authorities and road engineers.

- The "Infrastructure Directive"[1] has been adopted by Europe;

However, the Directive has hardly been used by road authorities to improve PTW safety and does not apply to the road network responsible for the largest number of PTW accidents, namely secondary roads.

- EuroRAP has included some PTW features in its star-rating system.

But not all EU countries use either the EURORAP star-rating system or other road assessment programmes

- The CEN/TC226 has adopted a technical specification for Motorcycle Protective Systems

However, the CEN/TS1317-8 is still only a non-binding technical specification, despite years of campaigning. TS1317-8 should fully integrate EN1317, the European standard applied by all Member States in their national standards, and be included in their national road design guidelines.

The first international workshop on PTW safety[2] in 2008 concluded that:

- *It was a fundamental safety requirement that motorcycles should have a place in overall transport policy and infrastructure policy/management.*
- *Each level of government should include measures in their infrastructure guidelines for accommodating motorcycles, developed with input from relevant stakeholders. The guidelines should be relevant to the needs of the jurisdiction concerned, and coordinated with other jurisdictions and levels of government. An international transfer of best practices was also recommended.*
- *The needs of motorcyclists should be included in the basic training for road designers as well as highway and traffic engineers.*
- *Identification and resolution of roadway design problems (e.g. accident black spots & "corridor" analysis) should include input from rider organizations & relevant experts.*

Today, one can say that, with regard to infrastructure and PTW safety, all necessary preliminary steps have been taken, and all relevant experts agree on the need to better integrate PTW needs into road design, maintenance, and auditing/inspection. The necessary information and expertise is available in Europe. It is now a question of putting it all together, starting with the information collected within the project.

1 European Directive 2008/96/EC
2 http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html

In 2015, the OECD/ITF Motorcycle safety report[1] (to be published) further underlines that:

- *Infrastructure is essentially thought for cars*
- *Infrastructure should be improved to better integrate PTWs, taking into consideration the wide variety of users and the large speed differential at intersections;*
- *There is a clear problem of infrastructure maintenance (potholes, debris ..), to which PTWs are very sensitive*
- *Self-explaining roads and appropriate traffic calming measures and PTW friendly equipment ("forgiving" roads) need to be developed*
- *In some cases, the use of dedicated lanes should be considered*

The need for political commitment

Without a clear political commitment to tackle infrastructure issues, market competition will play a delaying role deterring improvements. The example of EN1317 on roadside barriers (guardrails) and protection for PTWs is illustrative of the necessary time it takes for a standard to evolve without the involvement of public authorities.

Disseminating the information

Disseminating correct information, making road authorities, planners and engineers aware of the problems on the one hand and existing solutions on the other hand, is another challenge that Europe should consider tackling.

Using rider communities to identify road hazards (black spots)

Several initiatives, including the actual writing of PTW/Infrastructure guidelines in some cases, have directly leveraged rider community expertise. These initiatives have been praised on several occasions by road authorities as they enable them to increase the efficiency of their actions. Examples of such initiatives can be found here:

- Cross-sectorial collaboration in Germany
- Taking into account powered two-wheelers in road infrastructure design in France

New technologies and smart applications are providing new opportunities to involve the rider community in identifying black spots in support of local road authorities' efforts to improve the road network.

To this end, the project worked at designing a ***pan-European road hazard report*** form which could support local initiatives while at the same time contributing to a common understanding of road hazard problems. The questionnaire targets everyday riders.

Infrastructure research needs

PTWs have certain special characteristics which, according to the research community, directly or indirectly impact road transport research outcomes, whether for the safety of PTW users or road safety in general.

Dedicated consideration is required to gain a better understanding of PTW dynamics and interaction with traffic, and of specific accident causation factors, enabling us to identify risk domains and risk-contributing factors.

With specific regard to the infrastructure, the fact that PTWs are single-track vehicles, without an encapsulating protective shell, means that a rider may have difficulty handling tasks while controlling the vehicle, in particular when cornering or braking and even more so in emergency situations, to mitigate or avoid an accident. Even with excellent brakes and tyres, vehicle control in all kinds of situations requires special training and experience or specific riding assistance systems on board the PTW. The single-track character also implies that riders have more difficulty coping with imperfect road surfaces and obstacles on the road.

One of the main strategic objectives of the European Commission Road Safety plans is to better adapt road infrastructure to PTWs. The mid-term review of the EC Communication on Road Safety 2011-2020 is thus an opportunity to address the challenge, making use of the recommendations drawn up by the various experts, including the need to review existing EN standards to better include PTW requirements.

1 IMPROVED SAFETY FOR MOTORCYCLES, SCOOTERS AND MOPEDS © OECD 2015 (to be published)

Automation of the transport system

ITS and cooperative rider support systems have a good potential to increase riding safety and traffic safety at large, as indicated by a number of interesting European projects. The standalone systems have led and will lead the way – ABS, combined ABS, airbags, radars, scanners etc., and they may be excellent systems in the event of a crash and just before.

With regard to ITS, the first international workshop on PTW safety[1] concluded that

- *it was a fundamental motorcycle safety requirement that, by default, PTWs should have a place in overall transport policy and infrastructure policy/management;*
- *Enhanced awareness of motorcycles should be incorporated in the development of all vehicle ITS projects*

This is confirmed by the OECD report on Motorcycle Safety[2] which states: *While Intelligent Transport Systems (ITS) offer opportunities to improve the safety of drivers as well as riders, they require more R&D on their capacity to prevent PTW crashes, as ITS applications for cars are not directly transferable to PTWs. Any ITS application which removes, or interferes with, the longitudinal or lateral control of the vehicle could have adverse effects.*

PTW Intelligent Vehicle Systems have the potential to improve riders' safety. Indeed, compared to other VRU categories such as pedestrians and cyclists, PTWs are the only category with a permanent on-board electricity supply for powering additional safety functions, applications, features, services and devices. Hence, PTW users can benefit from far more advanced Intelligent Transport Systems (ITS) solutions, applications and services than other VRUs.

However, there are a number of obstacles that will likely lead to a lower coverage and slower uptake compared to passenger cars. Most new PTW safety functions will require major research and developments due to interference issues. The PTW Human Machine Interface (HMI) will require specific design, specification and development in order not to cause/produce any disruptive, endangering, imminent, and multiple media messages, warnings, alarms and/or requests for immediate interaction or reactions while the PTW user is riding and scanning traffic.

Available solutions as well as ongoing R&D have focused on cars and trucks, with only limited applicability to motorcycles, light PTWs, bicycles and pedestrians – in that order. This has to do primarily with technical and practical limitations, notably with regard to the user interface, available space to install equipment without hindrance to the user, exposure to outside environmental conditions and the lack of a high-quality power source. There are also economic factors: if the bill is to be paid by the road user, the cost of the ITS equipment has to be small compared to the cost of the vehicle itself. Manufacturers of motorcycles, light PTW's and bicycles do not have R&D budgets anywhere near those of car manufacturers. As a result, few ITS solutions have been developed that target traffic participants other than car or truck drivers.[3]

A better understanding of the riding activity (tasks, modelling, patterns) and the actual needs and constraints of PTW users is a prerequisite for

- the design of PTW ITS and/or efficient adaptation of car ITS to PTWs;
- the evaluation of their safety impact based on real road practices;
- rider acceptance, and in turn market and industry investment.

Indeed, the most important issue with advanced rider assistance systems (ARAS) in a PTW environment is the HMI; which is much more than just how and where the SatNav device is attached to the PTW.

The technological challenges are numerous. All these issues are directly related to the very different **riding dynamics and handling** of a PTW compared to a 4-wheeled vehicle. Indeed, the 7 contact points between the rider and the bike - footrests, saddle, tank sides and handlebars – are not all suitable for warning strategies. The clocks (rev & speed) with the traditional (non-time-critical) warning light panels are not suitable either since they are out of the line of sight.

1 http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html
2 IMPROVED SAFETY FOR MOTORCYCLES, SCOOTERS AND MOPEDS © OECD 2014 (to be published)
3 ITS ACTION PLAN / framework contract TREN/G4/FV-2008/475/01 http://ec.europa.eu/transport/themes/its/studies/its_en.htm

The **timing of warnings** (audio, visual, haptic, tactile) is critical not only due to the desired impact of the warnings but also riding dynamics: (semi-)automatically slowing down a bike in the middle of a curve may cause a non-desired manoeuvre that the rider is unable to control; in a hazardous situation in a curve the safest action instead of decelerating might be to accelerate the bike!

All in all, riders are accustomed to listen to the satnav guidance in the earphones and monitor the oil pressure warning light on the panel. When it comes to a warning via haptic/tactile means this is all new and riders need to be considered as novices. How, when, by which means and by which of those seven contact points the warning should be delivered based on the riding situation is totally vague, whether for the administration or for the industry.

As regards the PTW industry, many OEMs are well prepared for the ARAS challenge (e.g. BMW, Honda, Yamaha; Piaggio – though only in R&D) but several OEMs have a model range that does not support the introduction of ARAS systems and functionalities; ABS is just not enough. However, in view of the difficult economic context, with a decline in the PTW market in the range of 47% since 2008[1], but also poor research investment in this transport mode, ITS systems development has not taken off as much as in the car segment. **User awareness and acceptance** are poor and the willingness to engage in a path seen to be led by car industry researchers and designers does not support rider commitment, contrary to what is witnessed among automobile clubs (e.g. FIA).

Developing ITS for PTWs will require the coordination and support of different stakeholders: authorities, researchers, manufacturers and users. Generally speaking, riders are very safety-minded and want safer infrastructures, safer vehicles and fewer accidents. In view of that, they will adopt new technologies when they are seen to improve the situation for riders and other road users. To this end, rider acceptance will be a key element to consider.

While riders recognise the incredible possibilities of improving road safety, they are probably not ready to accept anything for the sake of novelty. Road safety is a real concern for motorcyclists but ITS raises a number of questions. Key challenges for user acceptance of ITS include liability issues, driver distraction, awareness and training, safety, vulnerable road users and pan-European solutions. Nevertheless, motorcyclists are interested in new technologies – especially the younger generation. But they also like the freedom to choose the new motorcycles with features like super advanced ABS systems. Choice remains the key.

Research needs with regard to ADAS/IVIS

When looking at accident factors, the data available indicates that the most common type of accident involving motorcyclists is a collision with a passenger car, and in the majority of such cases, the car driver is at fault[2]. With the deployment of ITS solutions, the impact of other vehicles, human behaviour, and training must therefore be studied and integrated into a specific impact assessment of intelligent transport systems.

Moreover, as highlighted by the report on «Safety and comfort of the Vulnerable Road User» [3] commissioned by DG MOVE, assistive and cooperative systems are expected to have a significant impact on the safety of motorcyclists, influencing both PTW and car drivers' perception and decision-making. Hence the safety potential and impact of new cooperative and informative applications for accident avoidance and mitigation needs to be further developed.

The current state-of-the art in ITS has not been subjected to any dedicated impact assessment with regard to its positive or negative consequences for other road users, and accident causation risks are not fully known or understood, in particular with regard to PTW use. Their specific characteristics, including limitations, capabilities, profiles and vulnerabilities, require the development of a specific assessment methodology based on a careful identification of the existing differences to car use.

1 "A Global Vision for the Powered Two-Wheeler Market" – ACEM conference 29/01/2014
2 MAIDS study, ACEM, 2005
3 Framework Service Contract TREN/G4/FV-2008/475/01
http://ec.europa.eu/transport/themes/its/studies/doc/2011_05-safety-and-comfort-vulnerable-road-user.pdf

2 Stakeholders meeting on the deployment of ITS and vehicle technologies to improve road safety – Brussels 8/3/2013
http://ec.europa.eu/transport/road_safety/pdf/stake_8_3_2013/session_2_thomas_lich_and_dr_peter_e_rieth.pdf

Assistive and cooperative systems are expected to have a significant impact on the safety of motorcyclists, influencing car drivers' perception and decision-making. With the deployment of ITS solutions, the impact of other vehicles, human behaviour, and training must therefore be studied and integrated into a specific impact assessment of intelligent transport systems with regards to PTWs.

Based on the functional logic of Advanced Driver Assistance Systems (ADAS) from CLEPA, it can easily be understood how distant PTW research is from the car sector.

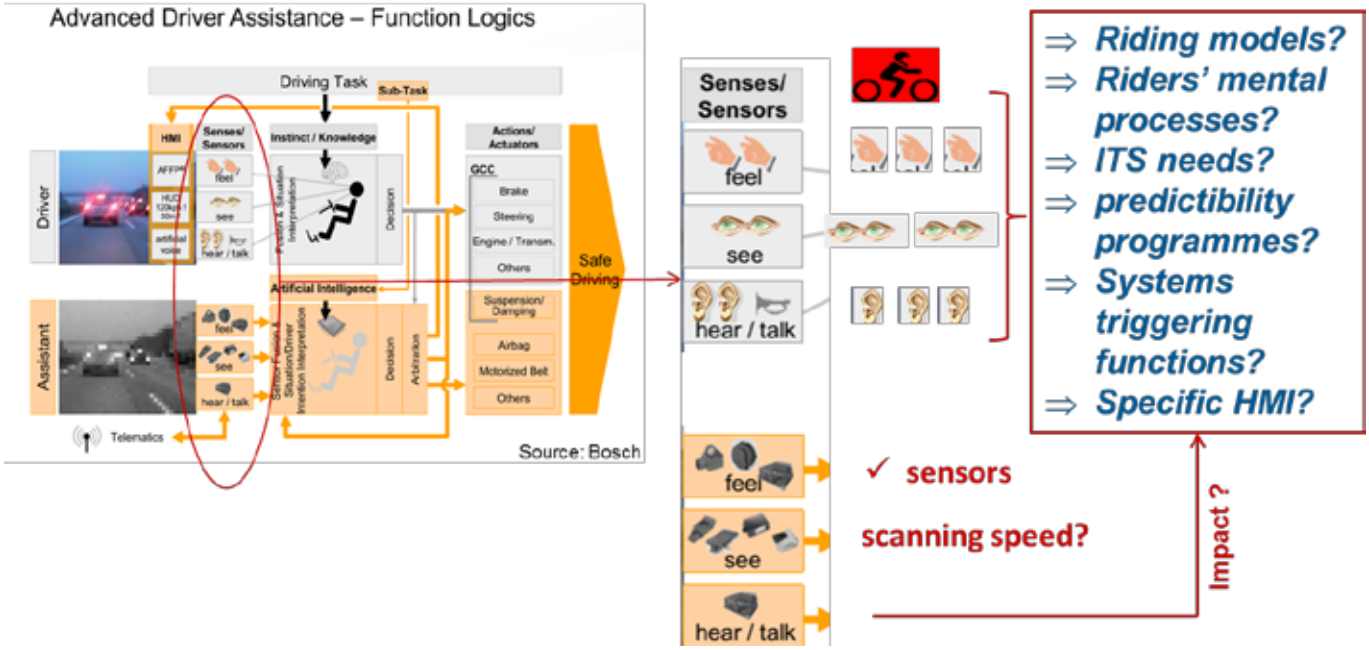


Figure 49 **Advanced Driver Assistance - functional logic**[2]

Efficient PTW safety awareness campaigns

PTW accident investigation work has highlighted the relevance of human factors, including individual behaviour, in accident causation. Awareness campaigns, broadly speaking, have the capacity to play an important role in tackling some of these factors.

One of the main strategic objectives of the European Commission Road Safety plans is to *improve awareness of PTW riders by other road users*. The mid-term review of the EC Communication on Road Safety 2011-2020 is therefore an opportunity to address the challenge, making use of the recommendations issued by the various experts, one of which is the need to include representatives of the PTW community in the design and development of comprehensive and efficient awareness campaigns tackling PTW safety issues.

As safety awareness can take different forms and involve different stakeholders, work heading in the right direction can already be started. This includes:

- Campaigns aimed at **increasing mutual recognition and acceptance** on the road.
- The identification of a **general baseline for European awareness campaigns for PTWs**, to be further adapted in line with national/regional/local PTW safety patterns;
- **Reaching riders in PTW dealerships**, as the type of bike chosen by riders provides clear information on their motives, the experience they seek and their concept of riding (when they can choose the bike). Persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour;
- Further research on **risk definition, identification, awareness** and **assessment** considering different mobility patterns and riding styles in Europe (focusing on specific rider groups at greater risk such as novice or returning riders) would enhance knowledge not only for the design of robust awareness campaigns, but also for hazard perception training purposes and ITS development;

- Such a study would also investigate the influence of cultural differences between European countries on road safety: behaviour, perceptions, attitudes, beliefs of road users, and develop an understanding of the link between different social factors (age, alcohol, riding in groups) and behaviour.
- Complementary studies should include research on:
  - **Other Vehicle drivers' perception failures**, road user distraction, and ways to increase VRU awareness (including PTWs);
  - **Behaviour in traffic**: to better understand all road users' behavioural patterns and their interaction (with and without technology involved): this would involve a long-term analysis of rider behaviour in traffic, resulting in measures to improve the behaviour of all road users;
  - **Extreme behaviour**: understand the causes of extreme behaviour and design effective measures to reduce it: this involves identifying the specific group of motorcyclists showing extreme behaviour and finding ways of reaching them;
  - **Protective equipment**: develop and test personal safety equipment.

Designing a safe system also for PTWs

As PTW riders have specificities not shared by other road users, it is essential to know these in order to take them into account. Specific measures are necessary to enhance PTW riders' safety. Moreover, measures designed for other road users should also consider the specific characteristics and vulnerability of PTWs and their riders.

Several approaches to PTW safety can be considered when drafting road safety strategies:

- *Designing a specific approach* → PTW Safety Action Plans/Strategies. PTW users' specific needs are well considered. But there is a possible side effect: the effectiveness of any such PTW-specific plan is reduced by the existence of multiple non-aligned safety plans for other road users.
- *Including a specific section on motorcyclists and moped riders within the overall road safety strategy.* The specificities of PTW riders are recognised and measures can be specifically designed. But it is essential to not lose track of these when designing measures for other road users.
- *Integrating PTW users' needs within all sections.* This method has the advantage of comprehensively including PTW users in the mobility scheme and keeping their presence on the road in mind. Nevertheless, attention must be paid to not ignore the fact that PTW riders are a particular group of road users with their own vulnerability and needs.

Regarding the content of the strategy itself, actions and measures should be chosen and designed depending on the road safety issues identified nationally/regionally/locally. There is no one-size-fits-all solution, and the problems faced by Member States will greatly depend on cultural and mobility patterns.

While the majority of the measures will require a strategy tailored to national circumstances, there are some areas where Europe has a role to play:

- Design appropriate **frameworks** (e.g. licencing, training, awareness campaigns) that can be then tailored to national circumstances;
- Make sure PTWs are fully and adequately **integrated in all European transport policy papers** (e.g. White Paper on Transport Policy, ITS directive, etc...);
- Support **standardization work** and efforts (e.g. infrastructure) that rightly integrate PTW needs and requirements:
  - infrastructure
  - definitions of injuries;
  - protective clothes
  - conspicuity
  - safety management
  - etc.

- **Increase knowledge**:
  - Fundamental research leading to proposals for potentially successful PTW road safety measures: riders' needs, their characteristics (riding behaviour, cognitive performance, mentality, acceptance, motives, mobility needs, etc), their interaction with the elements making up the road network (other road users, the road environment and their PTWs);
  - In-depth accident and naturalistic studies to better understand accidents that happened on the road and to design effective and coherent measures to tackle the different safety issues;
  - Risk perception and risk assessment work
- Develop road safety management tools designed for PTW safety:
  - Common **impact assessment** and **cost-benefit analysis methodologies** to evaluate the impact of safety concepts (design better evaluation and better cost-benefit analyses of safety measures and their effects)
  - Identify **relevant safety performance indicators** based on an understanding of PTW riding models, risk patterns, and accident causation factors;
- **Enhance stakeholders' dialogue**; the European Union could provide added value by stimulating positive national debates on PTW safety, fostering dialogue between the motorcycling community and national road authorities;
- **Benchmark** national strategies and specific road safety actions targeting PTW safety; **sharing of best practices**;
- Develop awareness-raising campaigns based on shared values and topics easily adaptable at national level.

Recommendations for action

Based on the input collected during the project on *training, testing and licencing* (D1), *data collection & statistics* (D2), *infrastructure* (D3) *accident reporting* (D4), *research* (D5), *traffic management & ITS* (D6), *awareness campaigns* (D7), and *national strategies* (D8), the project recommendations include the following:

Research Needs

To improve PTW safety knowledge

- Exposure studies:
  - develop a **methodology** to collect and analyse mobility data harmonised at EU level
  - mobility data (annual mileage for PTWs) to separate impact of exposure, intrinsic risk and compensatory behaviour of riders.
- Development of PTW accident prediction models by means of accident simulations and vehicle dynamics to see which state of the road has which effect on the braking system, the tyres, rider behaviour; what are the reactions of different vehicles on the same section of road, at the same speed? Etc.
- Mobility research: understanding PTW use, riding models, etc.
- Naturalistic/simulation studies to identify:
  - skills, attitudes & behaviours; how to influence different types of riders to take safer decisions when riding
  - riding models, risk patterns and the role of risk awareness
  - safety critical events
  - which and how information is processed by the rider
  - mental failures
- Road conflict investigations
- Accident data collection (pre-during-post collision) and reconstruction of accident dynamics
- More in-depth investigations will allow a better understanding of fatal and serious injury crash patterns and causes
- Assessment of injuries linked with crash types (link between crash data and hospital data);
- Improvements in crash simulation and crash dummies (taking into account their particular postures to understand their specific injuries) to better understand
  - the consequences of an accident
  - how injuries work and how to prevent them
- Research into the relationship between weather and accidents should be continued by including more data allowing additional factors to be considered.
- PTW conspicuity and other perception problems
- Speed: comparative study on speed differences on comparable road types within Europe.
- Effectiveness of safety activities / cost-benefit analyses
- Design a PTW-specific impact assessment methodology
- Compile and expand key existing studies for PTW use.
- Develop and introduce safety equipment adapted to countries with hot weather

To improve access to PTWs

- **Effects of the various age limits on progressive access;**
  - EU harmonisation: evaluation of the effects of the various age limits to ride a class I moped between EU countries;
  - In what way is learning to ride a moped different from learning to ride a motorcycle; or learning to ride a low-performance motorcycle different from learning to ride a high-performance one?
  - Risk awareness: motorcycling experience effect (including training, type of riding licence, number of years of practice and frequency of motorbike use) on motorcyclists' risk awareness.
- **Training:**
  - the content and effectiveness of training (including post-licence training) with the aim of improving the behaviour and safety of both drivers and riders;
  - further research should identify specific training needs according to experience and vehicle
  - young riders: search for effective ways to improve training for young riders/drivers
  - rider training: which skills and how should they be trained during training (e.g. manoeuvring skills, braking skills, noticing risk situations) at driving schools; and how do the skills learned work in real traffic situations? How can these be learned effectively and efficiently, in how much time and in which sequence?
- **New technologies:**
  - The development of new simulation techniques offers new opportunities for training programs.

To ensure a safe road environment/infrastructure

- **Better understanding of PTW/infrastructure interactions**
  - Improve data collection
  - Gain an in-depth understanding of the vehicle-road interaction and its dynamics, including detailed analysis with simulation tools (vehicle-infrastructure interaction simulation)
  - Research accident scenarios and biomechanics
  - Incorporate data gathered in naturalistic riding studies
  - Study the interaction between motorcycle tyres and road surface condition
  - Safer road design:
  - Understand the effects of the road environment on road users
  - Provide a more forgiving road environment
  - Make roads self-explaining for PTWs
  - Improve the environment to enhance reciprocal perception of riders and drivers
  - "Friction measuring" research
  - Re-evaluate speed-reducing infrastructural measures (such as humps or lane narrowing) from the point of view of PTW rider safety
  - Design roadside obstacles to provide better protection for PTW riders who may collide with them
- **Road maintenance:**
  - Development more durable roads that are easier to maintain in a good state
  - Develop a "holistic solution for asset management"; with the aim of making work zones safer
- **Black spot management:**
  - Research local accidents and suitable counter-measures.
- **Testing methodologies:**
  - Define a testing methodology for roadside and other infrastructure equipment which remains practicable for road equipment manufacturers

To ensure a safe road environment - ITS

- Further research is needed regarding the expected costs/benefits of ITS on riding activity:
  - Understanding issues of automation for PTW use;
  - Interaction of PTWs with automated and non-automated vehicles
  - User acceptance
  - ITS efficiency (estimate of the relative damage reductions associated with deploying ITS in motorcycles; the effectiveness of ITS technologies can be established through the collection and evaluation of crash data, field testing and analytical modelling of risks
  - Assess the benefits of both assistive systems and rider training, especially in direct comparison to each other
  - Prioritization of ITS for PTW safety
- Fundamental:
  - Data acquisition design, implementation, and data analysis tools
  - Effects on rider performance and behaviour of human-machine interaction with new technologies covering such issues as distraction, cognitive workload, over-reliance on technology, training requirements, situational awareness, etc.
  - Extensive on-road research examining the effects of using assistive systems on PTWs.
  - Incident, near-miss and pre-crash data
  - Modelling (riding tasks, motivation for action, accident causation factors, identification of safety critical events)
  - Specific PTW features, applications and services and their interaction with other road users
  - Perception research[1] (reliable object recognition and tracking, situation awareness, accurate road representation, detection of free space, perception architecture, etc.)
  - Development of methodologies, including PTW-specific impact assessments based on eIMPACT's 9 safety mechanisms[2]
    - direct in-car modification of the driving task;
    - direct influence by roadside systems
    - indirect modification of user behaviour
    - indirect modification of non-user behaviour
    - modification of interaction btw users and non-users
    - modification of road user exposure;
    - modification of modal choice;
    - modification of route choice;
    - modification of accident consequences
- Research on vehicle technology for two-wheeler safety, including PTW interaction with other vehicles' technology
  - Large scale Field Operational Tests (FOTs) related to naturalistic driving conditions to capture VRU-related behaviour and ITS requirements
  - Advanced intelligent sensing
  - V2X communication platform for cooperative ITS applications
  - The 112 Pan-European eCall for PTWs (drafting the minimum technical and functional specifications with identified interfaces for additional features, triggering design, tests, verification, validation, short-listed solutions, demonstrations)
  - Active and passive systems (incl. conspicuity technology)
  - Interaction of other vehicles' technology with PTWs
  - Iinteraction of an automated vehicle with its environment and other (non-automated) road users; develop technology and equipment on board other vehicles (cars and trucks) that can contribute to improving motorcycle safety (blind spot)
  - post-deployment field operational tests in a real traffic environment with a full set of analyses, rider acceptance, willingness to pay

1 iMobility Forum Workshop on Automation; Angelos Admitis – ECCS - .ppt
2 http://www.eimpact.eu/

- In-depth identification of accident causation factors and Safety Critical Events, and prioritization of motorcycle safety problems that are amenable to ITS intervention
  - Naturalistic riding studies (INRS and NRS): baseline data collection with instrumented PTWs to define current practices, capabilities and issues
    - Identify PTW-specific driving tasks, patterns and styles
    - Understand riders' motivation for action
  - Field Operational Tests and perception research to
    - Validate interpretation of rider intentions
    - Define triggering patterns
- Rider (and instructor) training and testing needs (e.g. coming e-mirrors)
  - Effects on rider performance and behaviour of human-machine interaction with new technologies that deals with issues such as distraction, cognitive workload, over-reliance on technology, training requirements, situational awareness, and so on
  - Instructor training scheme to master ITS

To design an efficient PTW safety campaigns and convey Appropriate safety messages to riders

Further research on

- **risk definition, identification, awareness** and **assessment** considering different mobility patterns and riding styles in Europe (focusing on specific rider groups at greater risk such as novice or returning riders) would enhance knowledge not only for the design of robust awareness campaigns, but also for hazard perception training purposes and ITS development;

  Such a study would also investigate the influence of cultural differences between European countries on road safety: behaviour, perceptions, attitudes, beliefs of road users. It would also help understand the link between different social factors (age, alcohol, riding in groups) and behaviour.
- Study the specific risks of novice riders and design effective measure to increase their safety
- **Other Vehicle drivers' perception failures**, road user distraction, and ways to increase VRU awareness (including PTWs)
- **Behaviour in traffic**: better understand all road users' behavioural patterns and their interaction (with and without technology involved); testing of / long-term analysis of rider behaviour in traffic; measures to improve the behaviour of all road users
- **Extreme behaviour**: understand the causes of extreme behaviour and design effective measures to reduce it; identify the specific group of motorcyclists showing extreme behaviour and find ways of reaching them.
- **Protective equipment**: develop and test personal safety equipment

To design a safe system including PTWs

- Fundamental research leading to proposals for PTW road safety measures:
  - Investigation of road conflicts
  - Identification of accident black spots
  - Riders' needs, their characteristics (riding behaviour, cognitive performance, mentality, acceptance, motives, mobility needs, etc.)
  - Riders' interaction with the elements making up the road network (other road users, the road environment and their PTWs)
  - Riders' behaviour: comparison at EU level; study of young riders; means to improve the behaviour of road users in general and of PTW users in particular.
- In-depth accident and naturalistic studies to better understand accidents that happened on the road and to design effective and coherent measures to tackle the different safety issues;
  - PTW accident reconstruction
- Risk perception and risk assessment work
- Develop road safety management tools designed for PTW safety:
- Common impact assessment and cost-benefit analysis methodologies to evaluate the impact of safety concepts (design better evaluation and better cost-benefit analyses of safety measures and their effects)
- Identify relevant safety performance indicators based on an understanding of PTW riding models, risk patterns and accident causation factors;
- Mobility research and design of a holistic approach to PTW safety: understanding PTW use and the motorcyclist community.

Standardization needs

To improve PTW safety knowledge

- Need to develop and apply relevant methods, tools and indicators to measure PTWs in traffic flows and analyse their mobility and behaviour (exposure data).
- Standardize the definition of "seriously injured".
- Harmonize accident (macro/micro) reporting methodologies

To improve access to PTWs

- **Standardizing minimum training curriculum requirements** and linking driving licence tests to this standard would significantly improve the quality of rider training programmes (need for a "quality seal")
- Standardise EU rider/instructor training curricula

To ensure a safe road environment/infrastructure

- Review standards for 'PTW- friendly' road infrastructure and design

To ensure a safe road environment - ITS

- PTW tools for road safety management
- Integration of PTWs in automated traffic control systems
- Define a test protocol through which the behaviour of motorcycles (from a safety point of view) can be rated. The process would be similar to that for cars and the gaining of "stars" through crash tests defined in such test protocols as "EuroNCAP"

To design a safe system including PTWs

- PTW tools for road safety management
- New definition of "seriously injured"
- Protective clothing (research, promotion, European standards on protective clothing)

Legislation needs

To improve PTW safety knowledge

- Prepare a legislative proposal which sets up the right framework for data collection in Member States, defining a common data collection strategy which includes improved accident reporting
  - harmonise **formats** and **headings**;
  - harmonise **classification of vehicles involved in an accident**
  - include **GPS coordinates** for accident location
  - include the following information for each vehicle involved in the accident:
    - Point of impact (front left, front right, etc.)
    - Angle of impact (0°, 45°, 90°, 135°...360°)
    - Impact severity (light, medium, hard)
  - include pictures of the scene and damage to each vehicle involved.
  - and propose
    - a harmonised way to measure the vehicle fleet
    - common categories for the **type/frequency /motivation of use** for vehicles

To improve access to PTWs

- **Address training content / instructors' competence in a legislative framework** as an essential complement to the 3rd Driving Licence Directive (for PTWs). Subjects to be addressed:
  - Initial rider training
  - Instructor training
  - Advanced riding courses
  - Use of driving simulators
  - Special training and education for returning bikers
- Harmonize and lower the minimum age
- Harmonize licencing requirements to a greater extent

To ensure a safe road environment/infrastructure

- Improve the periodic maintenance of roads → The EU directive on infrastructure should include provisions on road inspections for secondary roads.
- Infrastructure Directive: The Directive for Infrastructure and Safety Management is currently being revised, including how to cater for the needs of PTWs. A good step forward would be for any EU money given to the motorways to include specific provisions for motorcycles. This would give a good example for secondary roads.
- Black spot monitoring would benefit from harmonisation throughout the EU (by means of legislation or other means).

To ensure a safe road environment - ITS

- Traffic management for PTW road safety.
- The EU should encourage and support the introduction of ITS taking specific account of PTWs (e.g. on-board collision avoidance technology in cars, vans and lorries which detect riders – V2V/V2I systems).
- Effective integration of vulnerable road users into traffic management systems: these include black spot management, incident management, ITS integration, road infrastructure design

To design a safe system including PTWs

- Harmonize on-board collision avoidance technology for cars, vans and lorries
- Review existing transport legislative framework to integrate PTW safety elements
- Include PTWs in existing EU transport policy papers (e.g. White Paper on Transport policy, ITS directive, etc...)

Needs for specific actions

To improve PTW safety knowledge

- Promote the use of the CADaS protocol at national level in order to have comparable data across Europe
- propose and include in CADaS
  - common age categories
  - common typology classification of the types of PTWs
- complement the CADaS protocol with specific data of relevance to accidents with PTWs, such as environmental aspects or vehicle details
- Cross information on injuries between Member States
- Enhance exposure and mobility data collection work between Member States
- Cross/compare existing knowledge between different EU countries
- Set up a strategic approach to PTW research needs
- Use iGLAD as the basis to set up a common European in-depth accident causation database.

To improve access to PTWs

- The type of bike chosen by riders provides a clear indication of their motives, the experience they seek and their concept of riding (when they can choose the bike). One implication is that persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour.
- To train PTW users properly in the use of ABS and promote the widespread use thereof: the necessity of knowing how ABS works: training in ABS operation: initial rider training, websites, post-licence training programmes.
- Benchmark and exchange best practices on training methods, content, and instructors' competence

To ensure a safe road environment/infrastructure

- Need to find a way to motivate road engineers to use the infrastructure guidelines or make them mandatory.
- Motorcyclist Protection System Database: further political support and dissemination activities would be required to encourage MPS manufacturers to feed the database and road authorities to make use of it.
- A civil engineering handbook would be a practical instrument for improving road safety for PTWs by emphasizing the engineering items to be considered during the design and maintenance of infrastructure
- Monitoring high-risk sites (black spots):
  - involvement of rider communities
  - use of smart applications
- Use of the pan-European Road Hazard report form for PTWs
- Promote the use of minimum safety requirements (barriers, markings, passive support structures EN 12767) though this could be done in cooperation with CEDR.
- Exchange best practices on self-explaining roads
- Disseminate the guidelines on roadside barriers for motorcyclists
- Promote the infrastructure/PTWs website

To ensure a safe road environment - ITS

- It is important to spread knowledge of these new systems to stimulate demand for them.
- PTW users need to be trained properly in the use of ABS. Widespread adoption of ABS needs to be promoted: the necessity of knowing how ABS works: training in ABS operation: initial rider training, websites, post-licence training programmes.
- Define a test protocol through which the behaviour of motorcycles (from a safety point of view) can be rated. The process would be similar to that for cars and the gaining of "stars" through crash tests defined in test protocols such as "EuroNCAP" (ROSA)

To design an efficient PTW safety campaigns and convey Appropriate safety messages to riders

- Campaigns aimed at **increasing mutual recognition and acceptance** of road traffic systems
- **Reaching riders in PTW dealerships**, as the type of bike chosen by riders provides clear information on their motives, the experience they seek and their concept of riding (when they can choose the bike). Persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour;
- Increasing mutual recognition and acceptance among road users

To design a safe system including PTWs

- European awareness campaigns based on shared values aimed at **increasing mutual recognition and acceptance** of road traffic systems
- The identification of a **general baseline for European awareness campaigns for PTWs**, to be further adapted in line with national/regional/local PTW safety patterns;
- **Reaching riders in PTW dealerships**, as the type of bike chosen by riders provides clear information on their motives, the experience they seek and their concept of riding (when they can choose the bike). Persuasive communication material, tailored to the motivational requirements of the average rider of each motorcycle type, could be provided when buying a motorcycle in an attempt to encourage safe riding behaviour;
- **Enhance stakeholders' dialogue**; increase communication between authorities and riders; the European Union could provide added value by stimulating positive national debates on PTW safety, fostering dialogue between the motorcycling community and national road authorities;
- **Sharing best practices and benchmarking** national strategies and specific road safety actions targeting PTW safety;
- Develop awareness-raising campaigns based on shared values and topics easily adaptable at national level;
- Develop in-depth expertise on EU PTW safety issues
- Promote the use of efficient technology
- Encourage research and technological developments for PTW safety
- Support standardization work and efforts that properly integrate PTW needs (infrastructure, definition of injuries, protective clothing, conspicuity, safety management, etc.)

List of figures and tables

FIGURES

TABLES

Glossary

2BESAFE	2-Wheeler Behaviour and Safety (research project)
3DLD	3rd Driving Licence Directive
4DLD	4th Driving Licence Directive
ABS	Anti-lock Braking System
ACC	Adaptive Cruise Control
ACEM	The Motorcycle Industry in Europe
ACN	Automatic crash notification
ADAS	Advanced Driver Assistance Systems
AEBS	Advanced Emergency Braking Systems
AHL	Adaptive Headlights
AIT	Austrian Institute of Technology (Austria)
AMVIR	Association of Motor Vehicles Importers Representatives (Greece) - Σύνδεσμος Εισαγωγέων Αντιπροσώπων Αυτοκινήτων
ANCMA	Associazione Nazionale Ciclo Motociclo Accessori (Italy)
APROSYS	Advanced Protection Systems (research project)
ARAS	Advanced Rider Assistance System
ASC	Automatic Stability Control
ASR	Anti-Slip Regulation
AT	Austria
AV	Automated Vehicle
BASt	The Federal Highway Research Institute (Germany) - Bundesanstalt für Straßenwesen
BE	Belgium
BG	Bulgaria
BIVV-IBSR	Belgian Road Safety Institute (Belgium) - Belgisch Instituut voor de Verkeersveiligheid-Institut Belge pour la Sécurité Routière
BMF	British Motorcyclists Federation (United Kingdom)
BOM	bill-of-materials
BRRC	Belgian Road Research Centre (Belgium)
BSD-T	Blind spot detection for trucks
BU	Biker Union (Germany)
BVDM	Bundesverband der Motorradfahrer (Germany)
C2I	Car-to-Infrastructure
C2PTW	Car-to-PTW
CADaS	Common Accident Data Set
CARE	Community database on road accidents resulting in death or injury
CAST	Campaigns and Awareness-raising Strategies in Traffic Safety (research project)
CBS	Combined braking system
cc or cm3	Centimetre cube
CEDR	Conference of European Directors of Roads

CEN	European Committee for Standardization
CH	Switzerland
CIECA	The International Commission for driver testing
C-ITS	Communication Information Technology Systems
COMeSafety	Communication for eSafety (research project)
DACOTA	Data Collection Transfer & Analysis (research project)
DDM	Driver Drowsiness Monitoring and Warning
DG CONNECT	Directorate-General Communications Networks, Content and Technology
DG ENTR	Directorate-General Enterprise and Industry
DG INFSO	Directorate-General Information Society & Media. Became DG CONNECT in 2012
DG MOVE	Directorate-General for Mobility and Transport
DoT	Department of Transportation
DRL	Daytime Running Lamps
EC	European Commission
ECOSTAND	Joint EU - Japan - US task force
EeIP	European eCall implementation platform
EMF	European Motorcyclists Forum
EN	European Standard
ERF	European Road Federation
ERSO	The European Road Safety Observatory
ES	Spain
ESC	Electronic Stability Control
eSUM	European Safer Urban Motorcycling (research project)
ETSC	European Transport Safety Council
EU	European Union
EuroNCAP	European New Car Assessment Program
FACTUM	Traffic and Social analysis (Austria) - Verkehrs und Sozialanalysen
FEBIAC	Fédération Belge de l'Automobile & du Cycle (Belgium)
FEHRL	Federation of European Highway Research Laboratories
FEMA	Federation of European Motorcyclist's Associations
FERSI	Forum of European Road Safety Research Institutes
FESTA	Field operational test support action (research project)
FFMC	Fédération Française des Motards en Colère (France)
FI	Finland
FIA	International Automobile Federation - Federation Internationale de l'Automobile
FIM	International Motorcycling Federation - Fédération Internationale de Motocyclisme
FMI	Federazione Motociclistica Italiana (Italy)
FOTNET	Field Operational Test Networking and Data Sharing Support (research project)
FOTs	Fields Operational Tests
FR	France
GADGET	Guarding Automobile Drivers through Guidance Education and Technology

GDV	The German Insurance Association (Germany) - Gesamtverband der Deutschen Versicherungswirtschaft
GIDAS	German In Depth Accident Study
GRSP	Global Road Safety Partnership
H2020	Horizon 2020
HMI	Human Machine Interfaces
I2V	Infrastructure-to-vehicles communication
IBSR	The Belgian Road Safety Institute (Belgium) - Institut Belge pour la Sécurité Routière
ICT	Information and communication technologies
IDAF	In-depth Analysis of accidents with fatalities (Austria)
IE	Ireland
IFSTTAR	The French institute of science and technology for transport, development and networks (France) - Institut français des sciences et technologies des transports, de l'aménagement et des réseaux
IFZ	Institut für Zweiradsicherheit (Germany)
iGLAD	Initiative for the global harmonisation of accident data
INS	Intersection Safety
iRAP	International Road Assessment Programme
IRF	International Road Federation
IRT	Initial Rider Training (research project)
ISA	Intelligent Speed Adaptation
ISTAT	The National Institute for Statistics (Italy)
IT	Italy
ITF	International Transport Forum
ITS	Intelligent Transport System
IVIS	In-Vehicle Information Systems
IVM	The German Motorcycle Industry Association (Germany) - Industrie-Verband Motorrad
IVSS	In-Vehicle Safety Systems
KFV	Austrian Road Safety Board (Austria) - Kuratorium für Verkehrssicherheit
LCA	Lane Change Assist
LDW	Lane Departure Warning
LDWS	Lane Departure Warning Systems
Lillehm.	Workshop on Motorcycling Safety, Lillehammer
LMI	Lëtzebuerger Moto-Initiativ (Luxembourg)
LU	Luxembourg
LV	Latvia
MAG Belgium	Motorcycle Action Group (Belgium)
MAG Ireland	Motorcyclists Action Group (Ireland)
MAG NL	Motorrijders Actie Groep (the Netherlands)
MAIDS	In-Depth investigation of motorcycle accidents (research project)
MC community	Motorcycling community
MCTC	MC Touring Club (Denmark)

MLIT	Japanese Ministry of Land, Infrastructure, Transport and Tourism
MoC	Memorandum of Cooperation
MPS	Motorcycle protection systems
MS	Member State
MSC	Motorcycle Stability Control
NGOs	Non-governmental organisation
NL	The Netherlands
NMCU	The Norwegian Motorcycle Union (Norway) - Norsk Motorcykkel Union
NO	Norway
NTUA	National Technical University of Athens (Greece)
OBIS	On-Bike Information Systems
OECD	Organisation for Economic Co-operation and Development
OEMs	Original equipment manufacturer
OV	Other vehicle
PCV	Pre-crash protection of VRU
PDS/ EBR	Pedestrian detection systems combined with automatic emergency braking
PILOT4SAFETY	Pilot project for common EU Curriculum for Road Safety experts: training and application on Secondary Roads (research project)
PISA	Powered Two Wheeler Integrated Safety (research project)
PLTC	Pre-licence training curriculum
PPE	Personal protective equipment
PROMISING	Promotion of mobility and safety of vulnerable road users (research project)
PROS	Priorities for Road Safety Research in Europe (research project)
PTW	Powered two-wheelers
R&D	Research and development
RITA	Research and Innovative Technology Administration
ROSA	European Handbook on Good Practices in Safety for Motorcyclists (research project)
ROWVs	Right of way violations
RSA	Road Safety Authority (Ireland)
RTTI	Real-time traffic and travel information
SAFERIDER	Advanced Telematics for enhancing the safety and comfort of motorcycle riders (research project)
SAFETYNET	SAFETYNET (research project)
SARTRE	Social Attitudes to Road Traffic Risk in Europe (research project)
SE	Sweden
SIM	Safety In Motion (research project)
SMART RRS	Smart Road Restraint Systems (research project)
SMC	Sveriges MotorCyklister (Sweden)
SPF	Service Public Fédéral (Belgium)
SPI	safety performance indicators
SUNFLOWER+6	A comparative study of the development of road safety in 9 European countries (research project)

SUPREME	Summary and publication of Best Practices in Road safety in the EU Member States (research project)
SWOV	Institute for Road Safety Research (the Netherlands) - Stichting Wetenschappelijk Onderzoek Verkeersveiligheid
TC	Technical Committee
TEN-T	Trans-European Transport Networks
TPMS	Tyre Pressure Monitoring Systems
TRACE	Traffic Accident Causation in Europe (research project)
Trafficpol	Traffic Police Department (Bulgaria)
TRAFI	Finnish Transport Safety Agency (Finland) - Liikenteen turvallisuusvirasto
TRAIN-ALL	Integrated System for driver Training and Assessment using Interactive education tools and New training curricula for all modes of road transport (research project)
TRB	Transport Research Board
TS	Technical Specification
TÜV	Technical Inspection Association (Germany) - Technischer Überwachungsverein
UDRIVE	European Naturalistic Driving Study (research project)
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
US	United States
USDOT	US Department for Transport
V2I	Vehicles-to-infrastructure communication
V2V	Vehicles-to-vehicle communication
VMS	Variable Message Signs
VRU	Vulnerable Road Users
VRUITs	Improving the safety and mobility of Vulnerable Road Users through ITS applications (research project)
VSV	Flemish Foundation for Traffic Knowledge (Belgium) - Vlaamse Stichting Verkeerskunde
VTT	Technical Research Centre of Finland (Finland) - Teknologian tutkimuskeskus
VTTI	Virginia Tech Transportation Institute (USA)
WATCHOVER	Vehicle-to-Vulnerable road user cooperative communication and sensing technologies to improve transport safety
WG	Working group
WP29	The World Forum for Harmonization of Vehicle Regulations

RIDERSCAN INTERVIEWS

European Commission
DG MOVE, Dir. C Innovative and Sustainable Mobility, Unit 4 Road safety

EU stakeholders	
ACEM	CIECA
BAST, FERSI	ERF
CAST	EURORAP
CEDR	iGLAD

	Member States	The Motorcycling Community	the Research Community
Austria	Austrian Ministry for Transport Statistics Austria		KFV (Austrian Road Safety Board) Austrian Institute of Technology
Belgium	SPF mobilité et transports Department of Mobility	FEBIAC (Fédération Belge de l'Automobile & du Cycle) MAG Belgium (Motorcycle Action Group)	BIVV-IBSR VSV
Bulgaria	Trafficpol Road Infrastructure Agency		
Czech Republic			Transport Research Centre
Denmark		MCTC (MC Touring Club)	
Finland	Finnish Transport Safety Agency (Trafi)		
France	Conseil National de Sécurité Routière	FFMC (Fédération Française des Motards en Colère)	IFSTTAR
Germany		BVDM (Bundesverband der Motorradfahrer) BU (Biker Union) ifz (Institut für Zweiradsicherheit) BMW IVM (Industrie-Verband Motorrad Deutschland)	Federal Highway Research Institute (BASt)
Greece	Ministry of Infrastructure, Transport and Networks	AMVIR (Association of Motor Vehicles Importers Representatives)	National Technical University of Athens
Hungary	Hungarian Central Statistical Office		GRSP Hungary Association
Ireland	National Roads Authority Road Safety Authority	MAG Ireland	
Italy	Italian Automobil Club ISTAT	Ducati Motor Holding ANCMA (Associazione Nazionale Ciclo Motociclo Accessori) FMI (Italian Federation of Motorcyclists)	Sapienza University of Rome
Latvia	Road Traffic Safety Directorate Latvian State roads		
Luxembourg	Ministère du Développement durable et des Infrastructures Police Grand-Ducale Société Nationale de Circulation Automobile (SNCA) Statec (statistical institute)	LMI (Lëtzebuerger Moto Initiativ)	
Netherlands	Ministry of Infrastructure and Environment	MAG NL (Motorrijders Actie Groep) Kawasaki Motors Europe Yamaha Motor Europe	SWOV Institute for Road Safety Research
Norway	Norwegian Public Roads Administration	NMCU (Norsk Motorcykkel Union)	
Poland	General Directorate of National Roads and Motorways		
Romania	Ministry of Home Affairs Ministry of Internal Affairs Romanian Traffic Police Directorate		
Slovakia	Ministry of Transport, Construction and Regional Development		
Slovenia	Slovenian Traffic Safety Agency		
Spain	Ministry of Interior, Directorate General for Traffic		
Sweden	Swedish Transport Agency The Swedish Transport Administration (Trafikverket)	SMC (Sveriges MotorCyklister)	Folksam, Road Safety Research department
United Kingdom	Road User Licencing, Insurance and Safety Driver and Safety Standards Agency Department for Transport	BMF (British Motorcyclist Federation)	

THE RIDERSCAN PAN-EUROPEAN MOTORCYCLING SURVEY

The European Motorcyclists Survey aimed at collecting information about the motorcycling community around Europe in order to have a better overview of similarities and differences in terms of riding and attitudes, and better identify the safety needs of the motorcycling community: motorcycle usage and transport habits; motorcycle equipment; accident and near-accident causation and consequences; assessment of safety-related statements on motorcycling and motorcyclists' information sources.

The European Motorcyclists Survey was organised as an open participation survey. This method was preferred to a controlled group of riders, since interest in the survey topic was a prerequisite. However, the *open participation* method can create a bias in the sample of respondents. This point will be discussed in greater detail below.

The survey consisted of 4 parts:

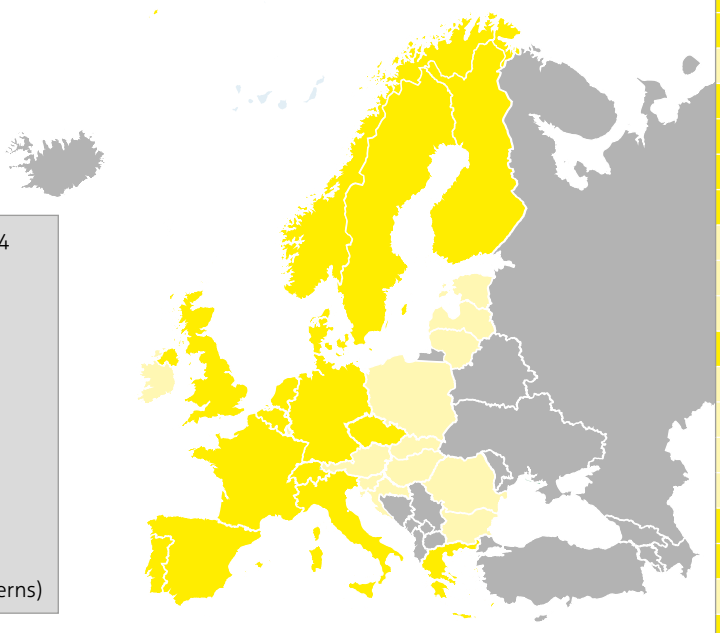
I. General information: this part of the survey aimed at segmenting motorcyclists per country according to basic socio-economic information.

II. Mobility habits: This part of the survey aimed at understanding what kind of journeys motorcyclists undertake in general and more specifically with their powered two wheelers.

III. Riding habits: This part of the survey aimed at gaining more details on riding habits.

IV. Safety habits: This part of the survey aimed at gaining more details on safety habits.

The survey was open to the general public in each participating country for a duration of 6 months. It was available in the following languages: Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Norwegian, Polish, Portuguese, Slovenian, Spanish and Swedish. Identification was required to participate, enabling respondents to complete the questionnaire in stages and preventing duplicate answers from the same subject. The survey was advertised through rider clubs and national



- → 30/10/2013 - 14/09/2014
- → 17558 analyzed answers
- → 15 studied countries
- → North/South comparison
- → East/West Comparison
- → EU/country trends
- → Country/country trends
- → Country analyses
- → Topic analysis (e.g. protective gear)
- → Cross-surveys analysis (ITS/mobility-cultural patterns)

Austria	0.6 %
Belgium	1.7 %
Bulgaria	0.0 %
Croatia	0.0 %
Cyprus	0.1 %
Czech Republic	9.7 %
Denmark	3.6 %
Estonia	0.2 %
Finland	9.5 %
France	12.8 %
Germany	16.0 %
Greece	6.1 %
Hungary	0.1 %
Iceland	0.0 %
Ireland	0.6 %
Italy	12.0 %
Latvia	0.0 %
Lithuania	0.0 %
Luxembourg	0.1 %
Malta	0.0 %
Netherlands	1.5 %
Norway	3.0 %
Poland	0.8 %
Portugal	2.3 %
Romania	0.1 %
Slovakia	0.3 %
Slovenia	0.1 %
Spain	3.0 %
Sweden	4.3 %
Switzerland	1.9 %
United Kingdom	9.8 %

At the end, the survey received 17,556 answers from riders all over Europe, though some European countries participated more than others. The data analysis was done by Mutuelle des Motards and SONECOM sprl.

In order to obtain European results reflecting the actual population and to gain a representative data set, the results have thus been weighted. The representativeness criterion was the number of motorcyclists counted by country (reference population N of which your sample n must be representative), and not the number of accidents (PTW) as this was found to be less representative.

The Training, Testing and Licencing User Survey

The Training, Testing and Licencing Survey aimed to fully understand the issues riders face in terms of training, testing and recent administrative and licencing changes, including the new rules contained in the 3rd Driving Licence Directive since 2013: Assessment of the rider training; assessment of the riding test; information about licence cost and identification of problems linked to the new licence structure.

The Training, Testing and Licencing User Survey was organised as an open participation survey. This method was preferred to a controlled group of riders, since interest in the survey topic was a prerequisite. However, the *open participation* method can create a bias in the sample of respondents. This point will be developed below.

The survey questionnaire consisted of 7 parts:

I. Respondent details: a series of questions defining the respondent's profile.

II. Vehicle details: the respondent was asked to describe his main vehicle.

III. Licence details: details on the respondent's licence and riding entitlement.

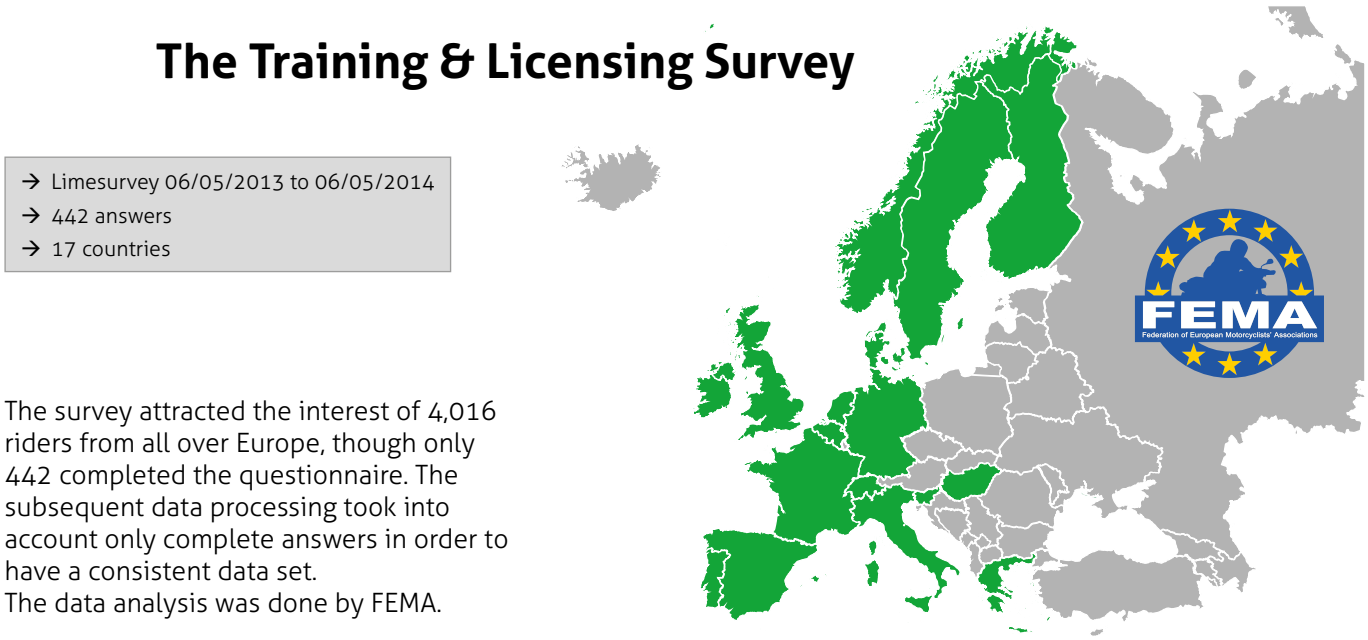
IV. Rider training: details and assessment of the training received by the respondent. The objective of this part was to compare motorcycle training across Europe.

V. Motorcycle test(s): details of test(s) taken by the respondent. The underlying objective was to establish an overview of the testing requirements throughout Europe.

VI. Costs: identification of the costs related to gaining a motorcycle licence.

VII. Problems encountered with the new driving licence rules: collection of problems and difficulties faced by the motorcycling community in relation to the new licencing rules as defined by the 3rd Driving Licence Directive implemented in all EU Member States as from 19 January 2013.

The survey was open to the general public, though identification was required to participate, enabling respondents to complete the survey in subsequent sessions and avoiding duplicate answers from the same subject. To facilitate the participation of riders, the survey was available in the following national languages: English, French, Italian, Dutch, Slovenian and Swedish. The survey was advertised through rider clubs and national press.



The survey attracted the interest of 4,016 riders from all over Europe, though only 442 completed the questionnaire. The subsequent data processing took into account only complete answers in order to have a consistent data set.
The data analysis was done by FEMA.

The ITS user survey

The ITS user survey aimed at capturing riders' attitudes towards safety systems at large. Specific interest was directed at identifying: rider subgroups with different attitudes towards safety and safety systems/devices; national differences within Europe with reference to an average European sample; systems/functions appreciated by riders and systems/functions considered dangerous and/or useless by riders.

The survey consisted of two parts:

I. A section on the characterization of the respondent in terms of demographic variables, riding experience and PTW usage, using the same questions as in the Motorcycling Survey and with a specific statement on technology/accidents aimed at interpreting riders' answers according to overall technology acceptance views.

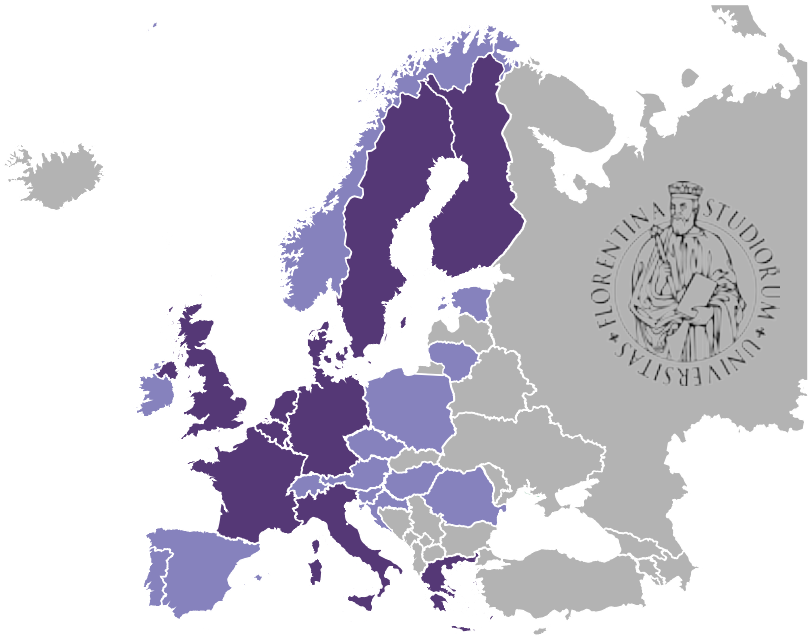
II. A section dedicated to safety systems/devices. The respondent was asked to rate each system/device on a 6-grade scale ranging from *dangerous* to *essential for safety*.

The list in the second section consisted of the systems/functions identified by the Monash University review[1] and those initially evaluated / surveyed in the SAFERIDER project[2]. A description of each system/function was provided for reference during the course of answering the questionnaire. The list was structured according to the functional/ kind of support purpose of the systems/functions to facilitate understanding. The following classification scheme was used: (1) rider warnings and information systems; (2) maintenance and diagnostic; (3) lighting and visibility; (4) braking; (5) stability and balance; (6) rider fitness; (7) passive (post-crash) systems; (8) communication between vehicles (V2V) and (9) communication between vehicles and infrastructure (V2I). Technically speaking, the list included both systems currently available on the market and systems not available for powered two-wheelers or even not available at all for road vehicles. The latter group includes systems currently being researched and thus only general features were available to describe their performance.

The survey was open to the general public, though identification was required to participate, allowing the questionnaire to be completed in stages and preventing the same respondent answering more than once. To facilitate participation, the questionnaire was available in the following national languages: Bulgarian, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Italian, Lithuanian, Norwegian, Polish, Portuguese, Rumanian, Slovakian, Slovenian, Spanish and Swedish. The survey was advertised at national level through FEMA member associations and partnerships with main national motorcycle magazines.

The ITS Survey

- → 28/01/2014 to 19/06/2014
- → 4484 answers
  BUT 1785 used % accident rates
- → 25 countries
  BUT 11 exploitable for statistic relevance



The survey attracted the interest of 7677 riders all over Europe, though only 4845 actually completed the questionnaire.

In order to obtain European results exactly reflect the actual population and to gain a representative data set, the results were weighted using the number of motorcyclists accidents by country. The data analysis was done by the University of Firenze (UNIFI).

1 Bayly, M., Regan, M., Hosking, S., Intelligent Transport Systems and Motorcycle Safety, Monash University Accident Research Centre, 2006, http://www.monash.edu.au/miri/research/reports/muarc260.html

2 SAFERIDER project, D1.2. Use Cases report, 2008, http://www.fema-online.eu/riderscan/IMG/doc/saferider_certh_wp2_v3_d1.2_extract_ridersneedsandwants-2.doc

RIDERSCAN DELIVERABLES

Detailed outcomes can be read in the following **deliverables**:

Deliverable 1 on *Training, Testing and Licencing*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable1_trainingtestinglicencing.pdf

Deliverable 2 on *Data Collection and Statistics*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable2_datacollection_statistics.pdf

Deliverable 3 on *Infrastructure*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable3_infrastructure.pdf

Deliverable 4 on *Accident Reporting*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable4_accidentreporting.pdf

Deliverable 5 on *Research*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable5_research.pdf

Deliverable 6 on *Traffic Management and ITS*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable6_trafficmanagement_its.pdf

Deliverable 7 on *Awareness Campaigns*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable7_awarenesscampaigns.pdf

Deliverable 8 on *National Strategies*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable8_nationalstrategies.pdf

Deliverable 9 on *the European Motorcycling Community in Europe*
http://www.fema-online.eu/riderscan/IMG/pdf/deliverable9_motocyclingcommunityineurope.pdf

Project **recommendations** are listed separately in the report on *Needs for Policy Action.*
http://www.fema-online.eu/riderscan/IMG/pdf/needsforpolicyactions.pdf

Detailed inputs can be read in the following **annexes**:

Annex 1: The European Motorcyclists Survey - A picture of Motorcycling in Europe
http://www.fema-online.eu/riderscan/IMG/pdf/annex_1.pdf

Annex 2: The training, testing and licencing User Survey - Feedback from European riders on the 3DLD implementation
http://www.fema-online.eu/riderscan/IMG/pdf/annex_2.pdf

Annex 3: Intelligent Transport System for PTWs User Survey - A user priority rating of ITS for motorcycling
http://www.fema-online.eu/riderscan/IMG/pdf/annex_3.pdf

Annex 4: Member States Amplifying Questions - EU Road Safety Authorities views and recommendations
http://www.fema-online.eu/riderscan/IMG/pdf/annex_4.pdf

Annex 5: Motorcycling Community Amplifying Questions - Riders and Industry Safety Experts views and recommendations
http://www.fema-online.eu/riderscan/IMG/pdf/annex_5.pdf

Annex 6: EU Stakeholders Amplifying Questions - Feedback on recommendations
http://www.fema-online.eu/riderscan/IMG/pdf/annex_6.pdf

Annex 7: European Commission Amplifying Questions - EU regulatory context and feedback on recommendations
http://www.fema-online.eu/riderscan/IMG/pdf/annex_7.pdf

Annex 8: PTW Infrastructure Priorities for Europe- Comparison of existing PTW infrastructure guidelines and other

relevant reports
http://www.fema-online.eu/riderscan/IMG/pdf/annex_8.pdf

Annex 9: National strategies analysis - Comparison of existing national road safety strategies
http://www.fema-online.eu/riderscan/IMG/pdf/annex_9.pdf

Annex 10: Awareness campaigns review - Overview of PTW safety awareness campaigns in Europe
http://www.fema-online.eu/riderscan/IMG/pdf/annex_10.pdf

Annex 11: EMF 2012 workshops – Report
http://www.fema-online.eu/riderscan/IMG/pdf/annex_11.pdf

Annex 12: EMF 2014 workshop - Memorandum of the discussions
http://www.fema-online.eu/riderscan/IMG/pdf/annex_12.pdf

Annex 13: EMF 2015 workshops - Memorandum of the discussions
http://www.fema-online.eu/riderscan/IMG/pdf/annex_13.pdf

Annex 14: PTW safety priorities - Comparison of existing political priorities for PTW safety
http://www.fema-online.eu/riderscan/IMG/pdf/annex_14.pdf

Annex 15: What makes Riding different driving - LinkedIn Threads
http://www.fema-online.eu/riderscan/IMG/pdf/annex_15.pdf

Annex 16: PTW Black/White Spots - Developing a Pan-European road hazard report form
http://www.fema-online.eu/riderscan/IMG/pdf/annex_16.pdf

Annex 17: PTW Accident Causation Factors - Comparison of PTW accidents in-depth studies main factors and conclusions
http://www.fema-online.eu/riderscan/IMG/pdf/annex_17.pdf

Annex 18: Safety Performance Indicators for PTW Safety - Preliminary perspective on PTW safety relevance of existing SPI
http://www.fema-online.eu/riderscan/IMG/pdf/annex_18.pdf

Annex 19: Access to PTWs in Europe - 3DLD implementation and motorcycle access schemes in Europe
http://www.fema-online.eu/riderscan/IMG/pdf/annex_19.pdf

Annex 20: PTW Accident reporting - Comparison of police accident report forms and recommendations
http://www.fema-online.eu/riderscan/IMG/pdf/annex_20.pdf

Annex 21: PTW Safety and EU Research Work - Review of PTW-related research work from ERSO portal
http://www.fema-online.eu/riderscan/IMG/pdf/annex_21.pdf

The project also collected relevant information from each EU country covered. **Country Fact Sheets** on PTW safety information are available for the following countries:


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_austria.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_belgium.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_bulgaria.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_cyprus.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_czech_republic.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_denmark.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_estonia.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_finland.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_france.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_germany.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_greece.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_hungary.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_ireland.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_italy.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_latvia.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_malta.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_netherlands.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_norway.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_poland.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_portugal.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_romania.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_slovakia.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_slovenia.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_spain.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_sweden.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_switzerland.pdf


http://www.fema-online.eu/riderscan/IMG/pdf/fact_sheet_-_united_kingdom.pdf

Overview of EU research projects on PTWs

Powered Two-Wheeler Safety Today – What do we know?

Project	Relevant Deliverables
2-BE-SAFE	D1.1 Rider/Driver behaviours and Road safety for PTW D1.3 Weather conditions and road safety for PTWs D6.4 Guidelines, policy recommendations and further research priorities
APROSYS	Motorcyclists: Accident National Data
DaCoTA	Motorcycle & Mopeds. Basic Fact Sheet 2012 Powered Two Wheeler report
eSum	MAIDS data on urban accidents Diagnosis of urban motorcycling safety
MAIDS	In-depth investigations of accidents involving powered two wheelers. Final Report 2.0
PISA	D2 Powered two wheeler Integrated Safety Review of current PTW accident data
PROMISING	D3 Integration of needs of moped and motorcycle riders into safety measures
SAFERWHEEL	
SAFETYNET	"Safety of PTWs" webpage "Accident characteristics" webpage "In-depth studies" webpage
SARTRE 1-4	Sartre 3 survey. European Drivers and Road Risk Sartre 4 survey. European road users' risk perception and mobility
SIM	In-depth Accident analysis
Smart RRS	D.2.1a Report on revision of regulation UNE135900
STAIRS	An Approach to the Standardisation of accident and injury registration systems in Europe
SUNFLOWER+6	A comparative study of the development of road safety in the SUNflower+6 countries. Final report
SUPREME	Best practices in road safety. Handbook for measures at the country level
TRACE	D1.3. Road Users and Accident Causation. Part 3: summary report D1.1 Road users and accident causation. Overview and General Statistics D1.2 Road users and accident causation. In-depth analysis D2.1 Accident causation and pre-accidental driving situations. Part 1: Overview and general statistics D2.2. Accident causation and pre-accidental driving situations. Part 2: In-depth analysis D2.3. Accident causation and pre-accidental driving situations. Summary report
VRUITS	D2.1 Technology potential of ITS addressing the needs of Vulnerable Road Users (not published)
WATCH-OVER	D2.1 Requirements and Use Cases

Accessing PTWs: Training, Testing and Licencing

Project	Relevant Deliverables
2-BE-SAFE	D3.1 Social, cognitive and behavioural differences of PTW riders with reference to their attitudes towards risk and safety D3.2 Risk Perception, its contextual parameters, and its influence on PTW rider choices and riding behaviour
DaCoTA	Powered Two Wheeler report
IRT	The Initial Rider Training Manual e-Coaching evaluation report Hazard perception, attitudes and behaviour in riding
MAIDS	MAIDS & Initial Rider Training
PROMISING	D3 Integration of needs of moped and motorcycle riders into safety measures
ROSA	European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: human factor European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: training
SAFETYNET	"Learning, Testing and Licencing" webpage
SIM	In-depth Accident analysis
SARTRE 1-4	Sartre 4 survey. European road users' risk perception and mobility
SUNFLOWER+6	A comparative study of the development of road safety in the SUNflower+6 countries. Final report
SUPREME	Best practices in road safety. Handbook for measures at the country level
TRAIN-ALL	D1.2 Training Needs, Scenario and Curricula Definition and Specification of Tools and Curricula D1.1 Benchmarking and classification of CBT tools for driver training D5.3 Impact analysis and towards an integrated training curriculum
TRAINER	D1 Survey of existing training methodologies and driving instructors' needs D2.1 Inventory of driver training needs and major gaps in the relevant training procedures

Road Environment

Project	Relevant Deliverables
2-BE-SAFE	D1.2 Road Infrastructure and Road Safety for PTWS D3.1 Social, cognitive and behavioural differences of PTW riders with reference to their attitudes towards risk and safety D3.3 Relationships between rider profiles and acceptance of Advanced Rider Assistance Systems
APROSYS	Final report for the work on 'Motorcyclist Accidents'
DaCoTA	Powered Two-Wheeler report Roads report Vehicle safety report

EURORAP I and II	Road Safety Toolkit
MAIDS	In-depth investigations of accidents involving powered two wheelers. Final Report 2.0
PILOT4SAFETY	New Curriculum for Road Safety Experts Safety Prevention Manual for secondary road
PROMISING	D3 Integration of needs of moped and motorcycle riders into safety measures Accident Causation Models eSafety report
RISER	
ROSA	European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: human factor European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: infrastructure European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: motorcyclists equipment European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: vehicle
SAFERIDER	Benchmarking Database
SAFETYNET	"Guardrails" webpage
SARTRE 1-4	Sartre 4 survey. European road users' risk perception and mobility
SIM	In-depth Accident analysis
Smart RRS	D1.3 Main findings of the State of the Art D.2.1a Report on revision of regulation UNE135900 D.2.1b Report on revision of regulation EQUS9910208C D.2.2 Report on revision of state of the art on Road Restraint Systems
SUNFLOWER+6	A comparative study of the development of road safety in the SUNflower+6 countries. Final report
SUPREME	Best practices in road safety. Handbook for measures at the country level
TRACE	D4.1.1 Review of crash effectiveness of Intelligent Transport Systems D4.1.3 A-priori evaluation of safety functions effectiveness -Methodologies D5.1 Analyzing 'human functional failures' in road accidents D6.1 Common database of existing safety functions
VRUITS	D2.1 Technology potential of ITS addressing the needs of Vulnerable Road Users (to be published)
WATCH-OVER	D2.1 Requirements and Use Cases
WHITEROADS	Comparative checklist for determining the characterists of WhiteRoads in the TEN-T

Conveying Safety Messages to the Riders

Project	Relevant Deliverables
2-BE-SAFE	D3.1 Social, cognitive and behavioural differences of PTW riders with reference to their attitudes towards risk and safety D5.1 Interaction processes of motorcycle riders with other road users
CAST	Manual for Designing, Implementing and Evaluating Road Safety Communication Campaigns
DaCoTA	Driver distraction report Cellphone Use while driving report Powered Two Wheeler report (ERSO)
eSum	Potential impacts for improving PTW safety
ROSA	European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: motorcyclists equipment European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: human factor European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: training
ROSYPE	Road Safety for Young People in Europe
SARTRE 1-4	Sartre 4 survey. European road users' risk perception and mobility
SUPREME	Best practices in road safety. Handbook for measures at the country level

Setting up a PTW Safety Strategy

Project	Relevant Deliverables
2-BE-SAFE	D5.1 Interaction processes of motorcycle riders with other road users D6.4 Guidelines, policy recommendations and further research priorities
APROSYS	Final report for the work on 'Motorcyclist Accidents'
DaCoTA	D1.2 Road safety management
eSum	D5.2 action pack - addressing urban PTW accident Potential impacts for improving PTW safety
PROMISING	D3 Integration of needs of moped and motorcycle riders into safety measures
ROSA	European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: enforcement policies European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: human factor European Handbook on Good Practices in Safety for Motorcyclists - Epigraph: training
SARTRE 1-4	Sartre 3 survey. European Drivers and Road Risk Sartre 4 survey. European road users' risk perception and mobility
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