

HOW TO IMPROVE ROAD INFRASTRUCTURE THROUGH USER-DRIVEN POLICIES: THE CASE OF MOTORCYCLIST-FRIENDLY ROAD RESTRAINT SYSTEMS

Author: *Aline Delhaye, General Secretary of the Federation of European Motorcyclists' Associations (FEMA), phone +32 2 736 90 47, fax +32 2 736 94 01, general.secretary@fema-online.eu*

Abstract:

The presentation looks at how users can take action to improve infrastructure for better safety, through awareness campaigns, product development, standardization and identification of black spots.

Road restraint systems, including guardrails, represent a source of injury for motorcyclists falling off a bike and hitting elements such as support posts, which present a narrow profile and no energy absorption properties. Current guardrail standards do not mandate protection for motorcyclists.

The presentation features an overview of the European motorcyclists' campaign leading to the approval of provisional standard prEN1317-8 by CEN Technical Committee 226, Working Group 1 in 2010, achieved through FEMA's liaison status at CEN since 2007.

The campaign includes awareness projects with national authorities, the research community, the industry and the general public, as well as grassroots campaigns and multilingual user surveys aimed at gathering missing data on guardrail-related accidents.

Supporting publications include the final report of the "Motorcyclists and Crash Barriers" project (2000), featuring recommendations to road authorities on guardrail installation, and "The Road to Success" (2005) publication on guardrail policies.

Related work undertaken in research projects will also be featured: the Advanced Protection Systems project (APROSYS), designing protective equipment for motorcyclists; and the Smart Road Restraint Systems project (SMARTRRS), improving primary, secondary and tertiary safety with an integrated system: a new guardrail profile offering increased protection to motorcyclists, hazard-detecting sensors and accident localisation capabilities.

Paper:

Whenever talking about road safety in general, and motorcycle safety in particular, infrastructure design and maintenance play an essential role. Making infrastructure safer for road users seems to follow a logical path: (1) public awareness, (2) product development, (3) research (4) standardization, (5) road assessment, and finally (6) public investment. However, the timeframe can be excessively long due to competition issues between those stakeholders who expect financial benefit out of the discussion and those who have to spend public money with the best cost/efficiency ratio.

When coming to road infrastructure design, the case of Road Restraint Systems is an excellent example to illustrate the above, and the complex difficulty to work on improving road safety within a reasonable timeframe. Integrating the impacted road users (and therefore civil society) in the discussion contributes to preventing competing corporations from taking the leadership at the expense of common interest. The organisation representing European motorcyclists, the Federation of European Motorcyclists' Associations, FEMA, has worked over the past 25 years at improving motorcyclists' safety through infrastructure improvement, with drawbacks and successes, opening the path to a more structured contribution of civil society in the standardization process.

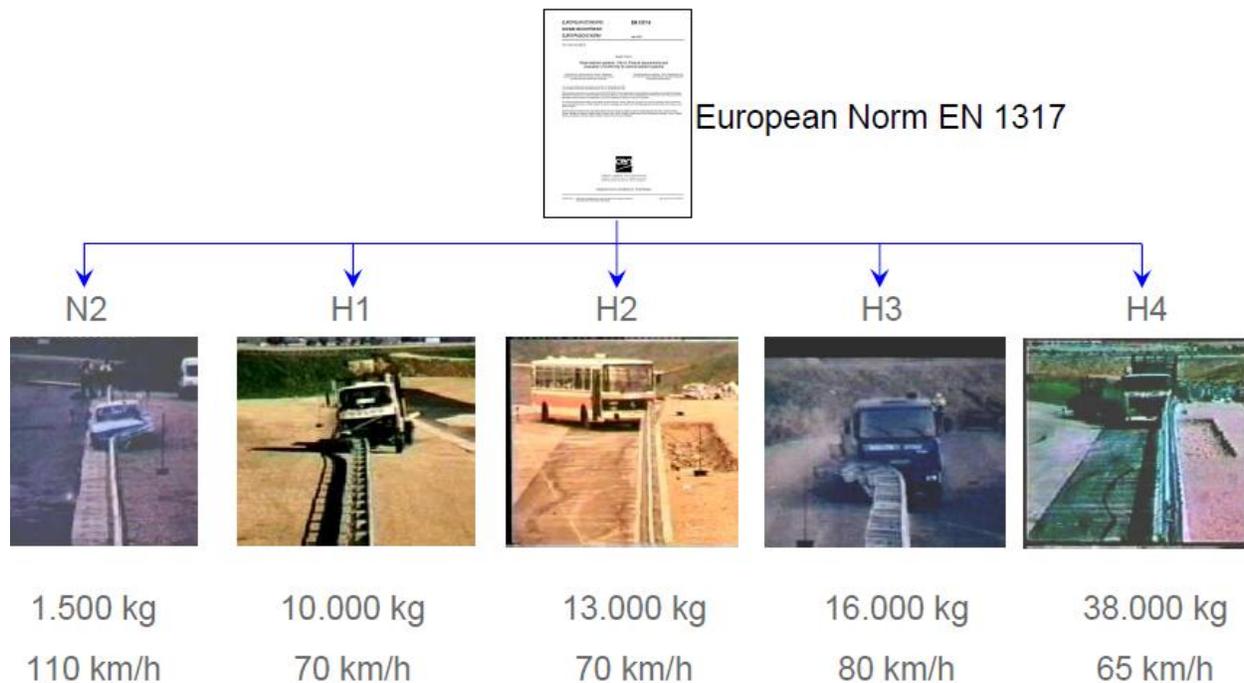
The case of road restraint systems¹

The prime objective of *road restraint systems* are to help the driver turn a critical loss of vehicle control into a benign controlled event, absorbing impact energy and reducing injury severity. Also called "crash barriers", these systems have been typically designed to guide and restrain errant vehicles, ranging from small cars to heavy goods vehicles.

However, when a motorcyclist impacts one, collides with it or simply slides on a road, road restraint systems turn into major additional hazards. In France, in the year 1993, 1994, 1995, accidents against crash barriers were involved in 8% of all motorcycle fatalities, in addition to 342 'seriously' injured and 385 'slightly' injured (Bradley, 1998), In Germany, the proportion rises up to 11% of fatalities and 25% of motorcycle accidents in one year involving metal crash barriers (Ellmers, 1997).

Motorcyclists are particularly at risk of collision on bends and curves, where acceleration and deceleration occurs and the stability of the vehicle can be compromised. Published research has shown that riders are 15 times more likely to be killed than car occupants in this type of collision (Williams, 2004), and the nature of impacts with barriers is such that riders are more likely to suffer injuries to lower extremities, and vital regions of the body, such as the spine, head and thorax (MAIDS, 2004, APROSYS, 2007).

¹ http://www.eurorap.org/library/pdfs/20081202_Bikers.pdf and <http://www.fema-online.eu/uploads/documents/guardrails/crashbarrier2005.PDF>



This situation was not improved but rather reinforced with the development of a European standard providing full-scale impact test requirements within the EN1317 (1&2) Standard (1998), a procedure whereby national regulations across the European Union are harmonized in a common approach. The norm, which identifies systems according to the type of vehicle they are able to restrain, includes performance indicators (containment, impact severity and deformation levels) used by road authorities to select the restraint systems needed on different types of roads.

Although the standard only includes specific provisions for cars and heavy vehicles - and is therefore inadequate for motorcyclists - EU Member States rigorously apply it.

Raising awareness technically and politically

From the introduction of the standard, riders' organisations started raising awareness about their situation, calling for barriers to be adapted, and more generally for the needs of motorcyclists to be integrated in the processes of road design and maintenance.

In 2000, FEMA produced the '*Final report of the motorcyclists and crash barriers project*²', which provided recommendations to road authorities for reducing injuries to motorcyclists caused by collision with crash barriers. The project was supported by the transport directorate of the European Commission and became a reference in the debate on guardrails worldwide.

² http://www.fema-online.eu/uploads/documents/guardrails/Motorcyclists_and_crash_barriers.pdf

Following the report's publication, several national FEMA member organizations and other safety stakeholders such as the Association of European Motorcycle Manufacturers³, the UK's Institute of Highway Incorporated Engineers⁴, and The European Road Federation⁵, have been working at providing information and guidelines for road authorities, leading the way in educating transport stakeholders and delivering a safer road environment. An overview of successful national projects was compiled by FEMA⁶ in 2005, in which FEMA members also describe the difficulties encountered in the absence of clear (European) regulations, as they were indeed dependent on the good will of national, regional, local authorities to acknowledge the needs of motorcyclists and offer more protective roadside barriers.

In parallel, riders started approaching policy-makers asking for support. Countries such as Portugal or, more recently, the Netherlands voted laws mandating the use of motorcyclists protective guardrails. In 2001, in an own initiative report, the European Parliament called for barriers to "*meet the specific safety requirements of motorcyclists*". Members of Parliament such as Korien Wortmann-Kool (The Netherlands), Bernd Lange (Germany), Liz Lynne (United Kingdom) and Ines Ayala-Sender (Spain) have been particularly active in petitioning the Commission and supporting riders' awareness campaigns at European level, ensuring that the guardrail issue remains mentioned in all documents related to road safety and infrastructure. These publications include the *European Road Safety report 2011-2020*, which points out that "*the standard guard rails used on European roads are death traps for motorcyclists and [calls] on the Member States to take prompt action to refit dangerous stretches of road with rails with upper and lower elements [...]*"⁷

Raising awareness was not limited to Europe. At the OECD level, the message is no different. In 2008, following the *Lillehammer workshop on motorcycle safety*, a list of 20 priorities was agreed on by over 100 motorcycle safety experts, among which road infrastructure comes as priority n°2⁸.

Launching the standardization process: Spanish success story

Alongside the technical and political work, motorcyclists also organized major protests in several countries, which increase public awareness and willingness from road authorities to tackle the problem. In Spain, for example, in view of the rise in motorcycle accidents, the road sector started working on their own standard to evaluate safety barriers.

Today, various existing protocols to test *Motorcyclist Protection Systems* (MPS) are very similar, simulating a sliding motorcyclist impacting the tested system, head first,

³ <http://www.acem.eu/publiq/PTWsaferoaddesigninEurope-final.pdf>

⁴ <http://www.motorcycleguidelines.org.uk/home.htm>

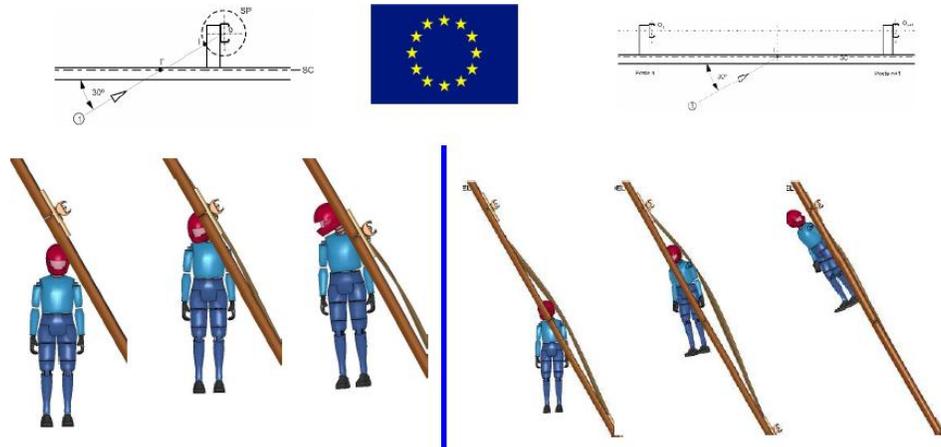
⁵ http://www.erf.be/media/position_papers/PTW%20Discusssion%20Paper_Final_IF.pdf

⁶ <http://www.fema-online.eu/uploads/documents/guardrails/crashbarrier2005.PDF>

⁷ http://www.europarl.europa.eu/meetdocs/2009_2014/documents/tran/pr/855/855504/855504en.pdf

⁸ <http://www.internationaltransportforum.org/jtrc/safety/Lillehammer2008/lillehammer08.html>

without the motorcycle. A dummy is launched at a given speed and a given entrance angle, and is made to collide against the MPS, on the post or between two posts. The main differences between tests protocols include criteria such as impact speed, impact point, entrance angle and the part of the dummy which hits the MPS first.



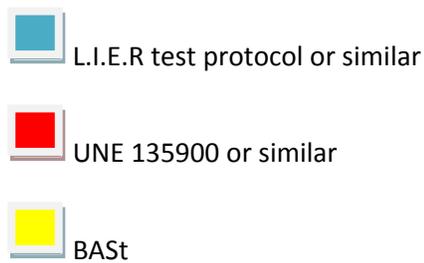
Concrete results started to arise as from 2008, when Spanish Standardization body AENOR adopted the UNE135900:2008 standard. Following massive public pressure, including calls for installation of motorcycle protective systems by Spanish motorsport celebrities, public authorities announced important investments for the installation of protective systems. The national motorcycle safety action plan includes the installation of hundreds of kilometers of protection systems, and further investments were made in product research for improvements in impact absorption and barrier design. SMART RRS⁹, an EU co-funded research project coordinated by the University of Zaragoza, illustrates the new national dynamic created by the adoption of the Spanish standard.

According to CIDAUT, one of the Spanish government accredited test houses, no fatal or seriously injured accidents involving motorcyclists have been recorded since the installation of approved protective guardrails.

The European standardization process

From an industrial perspective, the lack of a European standard for product approval was seen as an obstacle to a European market for motorcyclists' protective road restraint systems. For those who had products to protect motorcyclists, having harmonized requirements was the next obvious step. This explains the support FEMA started to receive from guardrail manufacturers.

⁹ <http://smarrts.unizar.es/content.php?seccion=16&elemento=319>



Regulations in Europe

From a rider's perspective, a European standard was the only way to get over national resistance to the development of a national standard. As the Spanish example illustrated, things really started moving politically when a standard was being discussed to test the available products.

In 2006, FEMA approached the Centre Européen de Normalisation (CEN)¹⁰, the European standardization body and asked for liaison status with the Technical Committee in charge of road equipment (TC226). In 2007, the Committee "*accept[ed] in principle to work on the protection of motorcyclists in respect of road restraint systems, and ask[ed] the Chairman, the Secretary and the convenor of WG 1, in consultation with FEMA, to prepare the Scope for a new work item based on the existing standards, regulations and technical specifications in the CEN member countries*". In June 2008, the same Committee adopted Resolution 319 calling for the preparation of a part 8 to EN1317 for the "*development of a European Standard which reduces the impact severity of motorcyclist collisions with safety barriers considering the existing national standards and the possibilities of present day technology*".

Despite the workload and the costs involved, FEMA members decided to follow the technical work and for the next 3 years actively participated to the related working and task groups, providing the available expertise, including expertise from Spain (once again) where additional real world tests had been performed against concrete barriers.

In 2011, the proposal for part 8 of the standard on guardrails was technically ready, validated by all task and working groups, after an internal enquiry for comments and positive evaluation for adoption. Despite all green indicators, the proposal for a standard was rejected by a majority of CEN members at a vote in June, and transformed into a "Technical Specification" - a non-binding specification, without any provision for European harmonization.

¹⁰ <http://www.cen.eu/>

A complex lobby work

How can we explain the negative outcome at the CEN/TC226 meeting on June 15, 2011?

Despite the enthusiasm displayed by motorcyclists, the preparation of a European standard was not seen as positive by all stakeholders. Some manufacturers worried about their products not complying with the new standard or being tied to the new standard for motorcyclists, and arguments over statistics, test criteria, configurations, and performance classes, were among the topics put on the table at every occasion. Road authorities in turn were worried about the increase of product prices because of additional tests to be performed. They were also worried about having to retest existing systems, hence discussions about the number of tests to be performed and the possibilities offered by simulation tests. As for the few test houses equipped to test traditional road restraint systems (about a dozen in Europe), worries headed towards reproducibility issues and related prerogatives regarding product testing. Although everyone agreed to work at *“improving the safety of motorcyclists”*, every word of the resolution, every step of the process was carefully considered by all parties, and technical comments included every possible issue. The wording of the title itself was discussed at length to finally end with a standard aiming at *“reducing the impact severity after a collision with guardrails”* instead of *“motorcyclists protective guardrails”*.

CEN decision process for EN1317-8		
Member:	"Possible acceptance as a European Standard"? (source: public enquiry)	Vote in TC226 on June 15 2011
Austria (ASI)	No	Not present
Belgium (NBN)	No	Yes
Bulgaria (BDS)	Yes	Not present
Croatia (HZN)	Yes	Not present
Cyprus (CYS)	Abstains	Not present
Czech Republic (UNMZ)	Yes	No
Denmark (DS)	Yes	Not present
Estonia (EVS)	Yes	Not present
Finland (SFS)	No	No
France (AFNOR)	Yes	Yes
Germany (DIN)	Yes	No
Greece (ELOT)	Yes	Not present
Hungary (MSZT)	-	Not present
Iceland (IST)	Yes	Not present
Ireland (NSAI)	Abstains	No
Italy (UNI)	Yes	Yes
Latvia (LVS)	Yes	Not present
Lithuania (LST)	Yes	Not present
Luxembourg (ILNAS)	-	Not present
Malta (MSA)	Yes	Not present
Netherlands (NEN)	No	No
Norway (SN)	No	Yes
Poland (PKN)	Abstains	Not present
Portugal (IPQ)	No	Yes
Romania (ASRO)	Yes	Not present
Slovakia (SUTN)	Abstains	Not present
Slovenia (SIST)	Yes	Not present
Spain (AENOR)	Yes	Yes
Sweden (SIS)	No	No
Switzerland (SNV)	Yes	Not present
United Kingdom (BSI)	No	No

These discussions considerably delayed the process. Though understandable from an economic perspective, they made little sense for the motorcycling community and from a road safety perspective. FEMA tried by all means to keep the debate focused on the victims behind accident statistics or test protocols.

In 2009, in an attempt to re-focus the debate, FEMA launched a pan-European *Call for Testimonies* gathering personal stories and reports of motorcyclists injured in crash barrier collisions. These personal testimonies underlined the trauma suffered by victims, by their families and friends, and in some cases by witnessing police officers, medical personnel or simple passer-bys. This collection of personal stories, though offering a valuable look at the situation faced everyday by millions of motorcyclists, illustrating the risk of death and serious injury posed by ill-adapted restraint systems, unfortunately had little impact because of the lack of statistical relevance.

For the opponents of the standard, questioning every single aspect of the proposed draft became a lobbying strategy, which in the end resulted in a fruitful outcome for them as the draft was not put for formal vote, and instead turned into a non-binding “technical specification”. Battle won. What were the deciding factors? An efficient lobby for some, an excess of perfectionism for some others; lack of awareness of the safety problem faced by motorcyclists in real life; a conjunction of all the reasons above for sure. But most critical of all was the absence of road users at the final stage of the decision making process.

The need for better data and research

In a similar attempt to learn more about guardrail issues, FEMA became involved in various projects to gather additional expertise and collect reliable data related to protective guardrails.

In 2008, the *European Road Assessment Programme (EURORAP)*, an international not-for profit association whose members are motoring organizations and national and regional road authorities, produced a review titled ‘Barriers to Change’¹¹ which provides an analysis of the issues and a series of recommendations for improvements to barrier design. The paper shows that motorcycle crashes cost the European economy billions annually, and argues that the response is not proportionate to the scale of the problem. It examines crash barriers that routinely save the lives of car occupants but can cause traumatic death to motorcyclists, recommends that engineers be provided with clear guidance on the design of barriers and the locations where they should be used. FEMA was part of the panel.

APROSYS (2004 -2009)¹², with its Sub Project 4 on motorcycles, focused on passive safety devices for motorcyclists, including forgiving infrastructure. From the accident data available in the MAIDS, DEKRA, DIANA and COST327 databases, detailed information about motorcyclist road accidents (the causes of the accidents and the most

¹¹ http://www.eurorap.org/library/pdfs/20081202_Bikers.pdf

¹² <http://www.aprosys.com/Documents/deliverables/FinalDeliverables/Final%20SP4%20report%20AP-90-0004.pdf>

frequent riders' injuries patterns) was compiled and compared with the findings of earlier works in this field (in particular the ISO activities). An optimum number of representative accident scenarios were selected, and impacts with road infrastructure were evaluated. Methods to evaluate and validate infrastructure protective devices for motorcyclist have also been developed. The evaluation of the existing protective devices for motorcyclists was carried out as well. A proposal for a test procedure to evaluate and validate infrastructure protective devices for motorcyclists were developed, and the feasibility of this test procedure was demonstrated. This information, though available publicly, was not used during the preparation process of the CEN draft standard.

SMART RRS (2008 – 2012)¹³: The project investigated available studies on guardrails and statistics and found out that motorcyclists impacting fixed objects occurred in 4% of the cases in urban areas, while it was between 10% and 20% in rural areas, with a fatal outcome 2 to 5 times higher than in other types of accidents. It also discovered that the best solution seems to be the addition of a lower rail to the most common single beam design, as it provides better energy absorption than concrete solutions or wire rope safety barriers. Wire rope safety barriers are viewed by motorcyclists as the most aggressive form of restraint systems. This view is supported by computer simulations and tests, which indicate that injuries will be severe if a rider hits the cables or the support due to the smaller impact surface offered by the cable compared to other designs. This information, though available publicly, was not used during the preparation process of the CEN draft standard. *SMART RRS* is now developing a smart road restraint system providing better shock absorption features and offering the opportunity to alert motorists and emergency services to an accident happening.

PILOT4SAFETY: in 2008, the European Parliament and Council issued Directive 2008/96/CE on road infrastructure safety management, which foresees a series of safety checks, as well as training and certification of road safety auditors. The Directive focuses specifically on the safety of vulnerable road users, which includes motorcyclists. When the directive is adopted by the Member States, it will apply to the TEN-T road network (covering only a part of the EU highway network), while the highest number of fatalities occurs on the so-called "secondary roads". To overcome this barrier, the *PILOT4SAFETY*¹⁴ project is aiming at applying the Directive's approaches related to training and certification of Road Safety Experts for the application of Road Safety Audit and Road Safety Inspection procedures to selected secondary roads, in the EU Regions represented in the project. FEMA is part of the advisory board.

Similarly, evaluation studies providing pre-installation and post-installation data are missing as well. France has launched a study to analyze the number of accidents involving motorcyclists before and after the installation of protective guardrails. Results of the study are expected in the next few years. Unfortunately, as far as we know, this is also one of the few, if not the only, ongoing post-installation studies on guardrails and motorcyclists.

¹³ <http://smarrts.unizar.es/>

¹⁴ <http://pilot4safety.fehrl.org/>

Finally, the cost of road construction work over its service life is a function of design, quality of construction, maintenance strategies and maintenance operations, but all these elements are rarely taken into account in the decision making process. Designers often neglect a very important aspect, which is the possibility to perform future maintenance activities. The focus is mainly on other aspects such as investment costs, traffic safety, aesthetic appearance, regional development and environmental effects. Hawzhen Karim's PhD thesis "*Road Design for Future Maintenance – Life-cycle Costs Analyses for Road Barriers*"¹⁵ underlines that road authorities have often focused on eliminating costs after they are incurred (i.e. reactive cost management) instead of eliminating costs in the commitment stages (i.e. proactive cost management), leading to impaired maintenance standards and low product quality. In almost all efforts towards efficient maintenance, says Hawzhen, road authorities have ignored improvement potential that exists during the planning and design phase, the underlying causes and consequences of which have not been studied adequately. Hawzhen's study reveals a complex combination of problems which result in inadequate consideration of maintenance aspects.

Obviously, this information, though available publicly, was not used during the preparation process of the standard. A first attempt to link the standardization work with the research work has been made with an invitation made by SMART RRS Consortium to the CEN/TC226/Working Group 1 in March 2012, upon the initiative of FEMA. At this occasion, CEN standardization experts will have the opportunity to see in real life the crash test according to the technical specification EN1317 part 8 and hopefully discuss aspects in relation with the standard to re-launch the standardization process for EN1317-8.

The role of road users: keeping the balance between road safety and competition

When looking at the overall process, it becomes obvious that major drawbacks or delays have been the result of the lack of data and/or statistics. As reminded by one of the working group conveners, CEN's prime objective is not road safety, but rather market support and enhancement. If a standard then happens to improve road safety, all the better, but this is only secondary goal.

In the road safety discussion, convincing public authorities becomes the cornerstone of the lobbying process, and to this end, it is crucial to collect the information that will put forward public interest as the main goal of the standardization process. As illustrated by FEMA's work in the guardrail discussion, representatives of civil society have a key role to play to make sure that road safety, and therefore the interests of the citizens, have the highest priority in the mind of road authorities at the time of decision.

¹⁵ <http://kth.diva-portal.org/smash/record.jsf?pid=diva2:37798>