Motorcycle Safety and Accidents in Europe

a summary report

There are an estimated 23 million motorcycles in Europe

Half of the motorcycle accidents are one-sided; the other half are collisions with a car

Quality and maintenance of road surface is of utmost importance for motorcycle safety

The technical condition of motorcycles is not a significant factor in accident causation

1. Introduction

In recent years, about 25,000 motorcyclists (m/f) have participated in surveys about motorcycle safety and accidents commissioned by FEMA and its Dutch member organization MAG. Subjects include: how dangerous is it to ride a motorcycle in the various individual European countries? What are motorcycle riders' attitudes towards safety innovations? And what safety precautions do they take for themselves? Conclusion: motorcycle safety and accidents vary between individual countries. This summary report shows which motorcycle dangers, in which countries, motorcyclists need to be especially on the alert for. The objective: safer international motorcycle riding for all.

2. Cross-border riding

Riding a motorcycle requires optimal use of all senses to monitor the ever vast-changing road environment behind, next to and in front of the rider in order to be able to react defensively before it is too late. To ride safely and prevent becoming a victim of an accident, it helps to be aware of the most important and most frequently occurring risks motorcycle riders encounter. Not only in one's own country but also in other European countries: these days so many riders take their bikes cross-border on long range tours. To the high passes in the Alps. To the curvy roads in the hills of Sauerland or the Eifel. To the sunny coastal areas all along the Mediterranean. To the vast emptiness of the Scandinavian countries. To the ever more popular destinations in the eastern European countries and the Baltic states. How easy it is to assume that riding conditions in your own country also apply to other countries Not so!

3. Cross-border risks

Truly reliable and credible 'rider-be-aware' advice comes from fellow-riders speaking from their own experiences. In recent years, rider survey data and motorcycle statistics have become available for almost 20 European countries about the dangers riders face in the various European countries. These dangers are often different from what one is used to in his/her own country. Being aware of these differences is indispensable knowledge when planning to ride cross-border. FEMA has conducted three Pan-European surveys among motorcycle riders, the results of which have been published in a report entitled RIDERSCAN, European Scanning Tour for Motorcycle Safety (RIDERSCAN, FEMA, Brussels, September 2015; www.riderscan.eu). The Motorcycling Survey was conducted among more than 17,000 riders from 18 countries. The ITS User Survey collected data from more than 4,500 riders in 18 countries. And the more limited Training, Testing and Licensing User Survey measured the opinion of more than 400 riders from 17 countries. This reports summarizes the most important motorcycle safety issues in the various European countries.

4. Dutch details

About simultaneously with the FEMA surveys, the Dutch FEMA member MAG Netherlands conducted its own very detailed survey among almost 4,000 Dutch riders with special focus on causes and impact of motorcycle accidents. About 50% of these riders reported having been victim of a motorcycle accident at least once during the riding lifetime. Based on detailed descriptions of these almost 2,000 accident reports, the survey identified about 100 separate motorcycle accident causes. Of these, 13 causes are responsible for more than half of all accidents. The Dutch data may not necessarily be fully representative for other European countries. Nevertheless, disregarding the order in the top 13, it is likely that

most of the causes in the Dutch top 13 are also the most important causes in other European countries. Therefore, this report summarizes these top 13 as indication of the top risks European riders need to be especially aware of anywhere in Europe.

5. Motorcycle continent Europe

There are an estimated 23.000.000 motorcycles in 31 European countries according to 2013 figures from the European Association of Motorcycle Manufacturers ACEM. Seven countries have more than one million motorcycles, Italy holding the absolute top position.

Country	# motorcycles
Italy	6,500,000
Germany	3,800,000
Spain	2,900,000
France	1,700,000
Greece	1,600,000
Poland	1,200,000
Great Britain	1,100,000

> *There are an estimated 23 million motorcycles in Europe*

On average, two-thirds of the European motorcycle riders own one motorcycle and one-third two or more motorcycles. Just over half of the motorcycles have a 700 cc or larger engine. Honda is market leader across Europe followed by BMW, Yamaha and Suzuki each with about a similar market share. About half of the European motorcycle riders use their motorcycles for leisure only; about one-third also for commuting to work.

6. Motorcycle fatalities

Are some European countries more dangerous for motorcycle riders than others? A first indication is obtained by relating the number of motorcycles to the number of fatal motorcycle accidents in a country. Official European Commission statistics (CARE 2012) report about 4,500 fatal motorcycle accidents. The danger rank of each country is based on calculating the number of registered motorcycles per fatal accident. The more motorcycles per fatal accident, the safer the country is; the fewer motorcycles per fatal accident, the more dangerous the country is. Countries can then be classified in two categories as relatively safe or relatively dangerous compared to the European average. The number listed for each country is its danger rank: 1 is the safest country, 25 is the most dangerous country. The European average is 5,000 motorcycles per fatality. The calculations, then, show that Croatia is the most dangerous and Denmark is the least dangerous country. (For countries not categorized the required data are not available.)

# Motorcycles/fatality	Country
Relatively dangerous	
1,000 – 2,000	25 Croatia, 24 Ireland, 23 Poland
2,000 – 3,000	22 Portugal, 21 France, 20 Latvia, 19 Slovakia, 18 Slovenia
3,000 – 5,000	17 Luxembourg, 16 Great Britain, 15 Belgium, 14 Hungary, 13 Estonia
Relatively safe	
5,000 – 7,000	12 Greece, 11 Malta, 10 Czech Republic, 9 Germany, 8 Austria
7,000 – 10,000	7 Sweden, 6 Italy, 5 Finland, 4 Spain
10,000+	3 Switzerland, 2 Netherlands, 1 Denmark

Please note: this danger ranking is independent of the causes of fatal accidents. Countries differ in climate conditions, in average riding kilometers per year, in quality of road infrastructure, in driving license training and in general car driver behavior etcetera. This ranking serves as a serious warning signal when riding cross-border. Motorcycle riders living in relatively safe countries should be aware of potentially more riding hazards when traveling to more dangerous countries.

7. Motorcycle accidents

> *Half of the motorcycle accidents are one-sided; the other half are collisions with a car*

A rather similar country ranking shows up when analyzing data from FEMA's Motorcycling Survey among 17,000 European motorcycle riders. These 17,000 riders reported whether they had been involved in a motorcycle accident of any nature during the past 12 months – both one-sided accidents as well as collisions. Comparing the various country response results in three danger categories based on the percentage of accident incidences in each country. Greek motorcycle riders reported the highest percentage of accident incidences and Denmark the lowest percentage. (For countries not categorized the required data are not available.)

Accident incidence	Country
Highest incidence	17 Greece, 16 Austria, 15 Italy, 14 Portugal, 13 Czech Republic
Intermediate	12 Germany, 11 Belgium, 10 Spain, 9 Great Britain, 8 Netherlands, 7 France
Lowest incidence	6 Sweden, 5 Poland, 4 Switzerland, 3 Norway, 2 Finland, 1 Denmark

Scandinavia has the lowest accident incidence. For Poland, it appears that accident incidences are limited but if an accident occurs that it is relatively often fatal. A possible explanation for the difference between Scandinavian and southern European countries could be that because of the long winter the riding season in Scandinavia is relatively short: more than 80% of Scandinavian riders avoid riding during the winter months. However, available RIDERSCAN country data about kilometer riding averages per year indicate that differences in average riding kilometers per year do not explain the differences between northern and southern European countries in accident incidences. On average, about half of the European motorcycle accidents are one- sided; the other half are collisions, almost always with a car. In almost all countries motorcycle riders under 35 years of age report relatively high accident involvement.

8. Top 13 accident risks

Taking into account the limitations mentioned in section IV above, the most likely top-13 European motorcycle accident risk situations are listed below. The listing distinguishes single accidents risks in which only a motorcycle is involved (4) from collisions (9). This top-13 can be considered to be responsible for over 50% of all motorcycle accidents.

Each category is listed in the order of personal physical injury risk for the rider as a result of the accident: the score is based on the reply of the riders themselves to the survey question whether they had suffered physical injury because of the accident they had been involved in.

The list items are in alphanumerical order and not in numerical order to indicate that the frequency percentages within the list may vary from country to country.
The physical injury risks are grouped three Hi – Me – Lo categories as the actual Dutch percentages should be treated as only indicative of the European situation.

High (H) > 50% chance of physical injury
Medium (M) 25-50 % chance of physical injury
Low (L) <25% chance of physical injury

	Accident condition	Physical injury risk
	Single	
A	Emergency stop to avoid accident (mostly with cars)	H
B	Oil or fuel on road	M
C	Steering error especially in curves	M
D	Braking error and blocking brakes	M
	Collision	
E	Car coming sideways not yielding right of way on intersection	H
F	Car coming onto road from parking area, outlet, gas station etc.	H
G	Car oncoming from opposite direction and turning left in front of motorcycle	H
H	Car oncoming from opposite direction driving in wrong lane	H
I	Car moving in same direction changing lanes (overtaking, making left/right turn, parking)	M
J	Car moving in same direction hitting motorcycle from behind stopped for traffic light, yielding etc.	M
K	Car moving in same direction changing lanes in traffic jam	M
L	Car moving in same direction hitting riding motorcycle from behind	M
M	Motorcycle not keeping enough distance to car in front moving in same direction	L

Traffic safety measures and innovations should give priority to improvements that help prevent these top 13 accident causes.

9. Technical motorcycle condition

Motorcycle riders know that the technical condition and maintenance of their motorcycle are critical to their personal safety. In-depth analyses of motorcycle accident causes over the past 10 years in various European countries have consistently concluded that technical faults of the motorcycle are rarely the cause of fatal and non-fatal accidents. The 2009 MAIDS-study by ACEM in cooperation with i.a. the European Commission covered > 900 motorcycle accidents in France, Germany, Italy The Netherlands, Spain – countries considered to together offer a 'representative view of the PTW accident scene'. It found that less than 5% of the accidents were caused by a vehicle failure, in most cases a tyre blow-out or other failure. Post-accident technical inspections found a technical problem in less than < 2% of the motorcycles but these 'often had no relationship to accident causation'. Similar findings have been reported by the Norwegian Public Roads Administration (Staten Vegvesen, Special Report 2011) and by the Swedish Transport Administration (Motorcycle Vision 2.0, Sveriges MotorCykliter 2014): technical motorcycle faults are to blame in about 1-2% of the fatal accidents investigated over the past years. The Dutch study of almost 2.000 accidents also found that a technical failure was the cause of no more than 2% of the accidents, mostly a brake failure of some kind (MAG NL 2015). All available data show: the technical condition of motorcycles is not a significant factor in accident causation.

10. European road infrastructure

Quality of road surface and maintenance is of utmost importance for motorcycle safety. The FEMA survey among 17.000 European motorcycle riders reveals to what extent road infrastructure problems lead to near-accidents. A between-country comparison shows that according to the motorcycle riders themselves the most dangerous road infrastructure exists in Greece and the least dangerous in Denmark. Countries can be classified into three categories as to the quality of their road infrastructure. (For countries not categorized the required survey data are not available.)

Road infrastructure quality	Country
Lowest quality:	15 Greece, 14 Belgium, 13 Spain,12 Italy, 11 France
Intermediate:	10 Finland, 9 Czech Republic, 8 Sweden, 7 Switzerland, 6 Portugal
Highest quality:	5 Germany, 4 Norway, 3 Netherlands, 2 Great Britain, 1 Denmark

It is worth noting that the top 3 of road infrastructure problems is identical for all countries. The difference between countries is the extent to which they occur.

This is the top 3 of road infrastructure problems:

1. Poor maintenance: potholes, fillings etc.
2. Road surface itself: top layer material (slippery, repair patches, bitumen fillings etc.)
3. Markings on road surface (painted or patched-on): signs, lines, warnings, arrows etc.

Road maintenance problems occur in all countries to about the same extent. However, more than in western and northern European countries, motorcycle riders have to be on extra alert in central and southern countries on issues with road surface tarmac, curve layout and usage of paint and patched-on markings on the road. Mediterranean countries have higher motorcycle risks due to all kinds of markings on the road, roadside equipment, urban furniture including road signs, absence of warnings for upcoming road dangers and absence of warnings for upcoming road work going on.

> *Quality and maintenance of road surface is of utmost importance for motorcycle safety*

11. Safety innovations

Motorcycle safety depends on a rider's own riding style, on road infrastructure, on technical condition of the motorcycle and on behavior of other road users especially car drivers. Technology has the potential to help increase motorcycle safety. All kinds of organizations and companies focus their activities on designing, testing and promoting technological innovations aimed at improving traffic safety: politicians, public servants, engineers, manufacturers, universities etc. By far the most of these innovations are being developed from the perspective of car driving safety. Often, motorcycles are not taken into account. That is the conclusion to be drawn from FEMA's survey data regarding European motorcycle riders' opinion about no fewer than 53 separate innovations. Some of these innovations are already becoming a common feature, others are in their prototype stage and again others have barely left the drawing board. How do motorcycle riders rate these innovations as to being useful or dangerous for motorcycle riding?

The motorcyclists' top 10 of useful-for-motorcycles technological innovations is:

1. (Curve) ABS (anti-lock braking system)
2. Visibility improving helmet (prevention of visor fogging-up through heating or de-humidification)
3. Monitoring of tire pressure and temperature
4. Vision enhancement (contrast reinforcement in bad-sight weather conditions)
5. Brake assist (applying maximum braking pressure in emergency situations)
6. Linked braking systems (engaging both front and rear brakes also when only one is activated)
7. Impact-sensing cut-off systems
8. Motorcycle diagnosis (mechanical and technical problems)
9. Adaptive front lighting (light beam projecting into curves)
10. Automatic stability control (preventing rear wheel spin and front wheel lift-off)

The motorcyclists' top 10 of dangerous-for-motorcycles technological innovations is:

1. Helmet-mounted display of motorcycle information on helmet visor
2. Intelligent speed limitation (alert and/or intervene when posted speed limit is exceeded; prevent acceleration over posted speed limit)
3. Warning and automatic intervention when set cruise control speed is exceeded
4. Continuous on/off flashing strobe lights for visibility
5. Real-time rear-view display on helmet visor or windshield
6. Adaptive cruise control (maintaining a fixed distance to vehicle in front)
7. Lane departure warning (when changing lanes)
8. Heads-up display of vehicle information on windshield
9. Intersection collision avoidance (through vehicles transmitting speed, location and riding direction to roadside beacons)
10. Curve speed warning (GPS-based warning for too much tilt / speed in upcoming curve)

The main reason motorcyclists give for considering technological innovation as dangerous is that during riding they require active interaction. This may lead to information overload and distraction. And distraction is about the most dangerous thing during riding.
Overall, in most countries riders expect positive safety advantages from new technological developments. Primarily from technical diagnosis for maintenance (especially brake systems and tires) and from systems that improve visibility and sight.
Motorcyclists consider as most dangerous communication systems between their motorcycle and road infrastructure intended to automatically intervene with riding (such as speed) without the rider having any control.

12. Personal safety measures

The vast majority of European motorcyclists agree that riding a motorcycle will always involve a certain risk and that it is riskier than driving a car. About half of the riders expect that new technology will make traffic safer and greener. About one-third fear for technology that will distract riders too much from their riding environment.

"Most riders expect positive safety advantages from new technological developments."

The vast majority of European motorcyclists – therefore – take their own safety precautions. The top 3 is:

1. Motorcycle gloves
2. Motorcycle helmet (fluorescent not so much yet)
3. Motorcycle jacket with protectors

Most riders also use:

4. Motorcycle boots
5. Motorcycle trousers with protectors

Worth noting is that there are almost no between-country differences in taking these personal top-5 safety precautions.

13. Motorcycle driving license

European regulations determine what kind of driving license can be obtained for what type of motorcycle at what age. FEMA survey data show an understanding amongst motorcycle that step-by- step motorcycle training could result into safer riding style. However, the actual operationalization meets with considerable objections in all countries. First and foremost, motorcycle riders feel that obtaining the full license is too complex, takes too long and is far too expensive: it discourages people from obtaining a motorcycle license at all. Secondly, motorcycle riders feel that the process is discriminatory compared to getting a car driving license: a starting 18-year-old new car driver does not first have to drive for years in a Trabant before (s)he may start driving a Ford Focus and then only after years is allowed to hit the road with a Ferrari. The latter, this new 18-year-old car driver may do from the very first day (s)he has a car drivers license. All in all, European motorcycle riders are not convinced that the step-by-step motorcycle license requirement really benefits motorcycle riding safety.

14. Safety and awareness

Riders Motorcycle safety and accident risks in Europe vary from country to country. A rider cannot take for granted that the riding conditions (s)he is used to domestically also apply when traveling cross- border.

ITS Technological innovations should give priority to what riders feel as most useful for them and should thoroughly test ITS systems that motorcycle riders consider dangerous before receiving formal European approval for usage in European traffic.

FEMA This FEMA summary report is intended to improve a) awareness of riders' potential cross-border motorcycle risks and as well as b) awareness of ITS-parties regarding motorcyclists' attitudes towards motorcycle-safe and motorcycle-dangerous technological innovations.

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