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SLOVENIAN INFRASTRUCTURE GUIDELINES FOR POWERED TWO-WHEELERS

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Abstract: In last few years the total number of traffic accidents in Slovenia has decreased whilst the number of accidents involving powered two-wheelers (PTWs) has increased. In 2017, 104 people died in road accidents in Slovenia, the lowest number recorded in the last 60 years. In contrast, during the same year there was a noticeable increase in the number of PTW rider fatalities. By the end of 2017, there were 29 fatalities among PTW riders, which, in comparison to the previous year (2016, 24 fatalities), represents an increase of 21%. In 2017, the proportion of PTW fatalities was 24% out of all road accident fatalities, which is the worst figure since records began in Slovenia. In addition, the proportion of PTW riders who were seriously injured or killed in comparison to the overall number that were seriously injured or killed in all traffic accidents was significantly higher than the proportion of PTW riders in the traffic structure.

Numerous promotional campaigns have been carried out in Slovenia over the last ten years, and a number of measures have been introduced to improve the road safety of PTWs. The Faculty of Civil Engineering, Transportation Engineering and Architecture at the University of Maribor is more or less satisfied with these measures. However, because there is great interest in upgrading the level of road safety of PTWs, the authors of this report decided to create their own infrastructure guidelines for ensuring the road safety of PTWs in the equipping and road maintenance phases.

Keywords: powered two-wheelers, guidelines, infrastructure

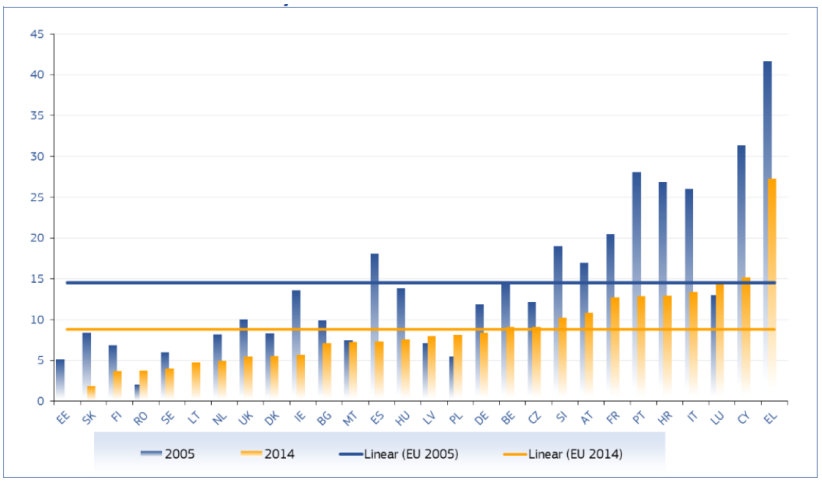
1. INTRODUCTION

Powered two-wheelers (PTWs) is a term in the motorcycle industry, which includes motorcycles, mopeds and scooters. PTWs represent an economical means of transport, offering increased mobility in traffic congestion, which is popular in urban commuting. In addition, riding a PTW provides a special sensation which is attractive for many riders. However, PTW riders can also be considered as a vulnerable group of road users.

The vulnerability of PTWs has been established with the large number of road accidents and poor safety statistics in many European and world countries. PTW riders in the European Union are one of the most vulnerable groups of road users (Šraml et al., 2012). They are quite often involved in road traffic accidents and, unfortunately, in many cases can be seriously injured or even killed. Some studies of PTW accidents have reported that approximately 96% of riders of PTWs involved in traffic accidents are at great risk of suffering certain injuries (Hurt et al., 1981). Moreover, other studies show that even in 50% of such accidents, serious injuries or even death of the rider occurred (Diamantopoulou et al., 1995).

In the EU the number of fatalities per 100,000 registered motorcycles is twice as high for motorcycle riders as the number of fatalities for car passengers per 100,000 registered cars (European Commission, 2015). In 2014 alone, approximately 26,000 people were killed in road accidents across the EU and PTWs accounted for 17% of those fatalities (compared to 16% in 2005). In 2014, at least 3,841 PTWs riders (drivers and passengers) of motorcycles were killed in the EU in road accidents (European Commission, 2016). Fig. 1. shows that between 2005 and 2014 the road traffic fatality rate of PTWs decreased in most EU countries. Significant decreases were recorded in Italy, Portugal and Cyprus, whereas the fatality rate increased in Romania and Poland (European Commission, 2016).

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Sources: CARE database (EUROSTAT for population data), data available in May 2016

Figure 1. *PTW rider fatalities per million population in the EU, 2005 and 2014 or latest available year (European Commission, 2016)*

Some European countries are 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 (Fig. 2). Official European Commission statistics report about 4,500 fatal motorcycle accidents for 2012. 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 into 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. For countries not categorised the required data is 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 The Czech Republic, 9 Germany, 8 Austria
7,000 – 10,000	7 Sweden, 6 Italy, 5 Finland, 4 Spain
10,000 +	3 Switzerland, 2 The Netherlands, 1 Denmark

Figure 2. *The danger rank of countries*

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, with Italy holding the absolute top position (Fig. 3).

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

Figure 3. *Estimated number of motorcycles (FEMA, 2016)*

In the last few years the total number of traffic accidents in Slovenia has decreased whilst the number of accidents involving PTWs has increased. In 2017, 104 people died in all road accidents in Slovenia, the lowest number recorded in the last 60 years. In contrast, during the same year there was a noticeable increase in the number of PTW rider fatalities. By the end of 2017, there were 29 fatalities among PTW riders, which, in

comparison to the previous year (2016, 24 fatalities) represents an increase of 21%. In 2017 the proportion of PTW fatalities was 24% out of all road accident fatalities, which is the worst figure since records began. In addition, the proportion of PTW riders that were seriously injured or killed in comparison to the overall number that were seriously injured or killed in all traffic accidents was significantly higher than the proportion of PTW riders in the traffic structure.

Due to all of the above-mentioned factors, it is clear that there is significant interest in Slovenia in understanding the relations between motorcyclists and road infrastructure, and finding some new approaches to designing, equipping and maintaining roads.

2. PAST CAMPAIGNS AND IMPLEMENTED MEASURES FOR PTWS IN SLOVENIA

For several years Slovenia has been implementing various campaigns and introducing various measures in order to become a motorcycle-friendly country. Until now, several preventive awareness campaigns and additional educational campaigns have been carried out, whilst various measures have also been implemented that aim to lessen the consequences of road accidents involving motorcyclists.

In the past Slovenia tried to improve the low-level of traffic safety of PTWs in various ways; the following measures were generally used:

- preventive campaigns and additional education
- additional non-traffic signs and road markings
- improved road/roadside safety conditions

Preventive awareness campaigns and additional education are considered a ‘long-term investment’, as the positive consequences are only visible after an extended period. This measure includes the production and distribution of promotional flyers, brochures and posters (Fig. 4.) containing precautionary contents in order to promote better traffic safety.



Figure 4. *An example of a Slovenian prevention billboard for 2018 (Source: Agency Yin + Young, Slovenia)*

Implementation of additional traffic/non-traffic signs and road markings is a less widespread approach for improving PTW traffic safety. The following measures have generally been used in Slovenia:

- preventive non-traffic signs, which are not a part of the Slovenian regulation (Fig. 5)
- additional road markings, which are not a part of the Slovenian regulation



Figure 5. *One of eight preventative information boards that are not included in the Slovenian Traffic Signalling Rulebook (Source: K. Korenjak and Society MzM)*

Improved road/roadside safety conditions can be accomplished through the implementation of physical measures. The aim of such physical elements is to achieve a higher level of safety on the road and particularly in areas directly next to roads (roadside). These measures are also called infrastructure safety improvements; motorcycle-friendly roadside barriers (Fig. 6.) represent just one of these measures.



Figure 6. *Motorcycle-friendly roadside barriers (Source: www.zurnal24.si)*

The best results were obtained in Slovenia through the use of additional non-traffic signs and motorcycle-friendly roadside barriers.

However, all these measures mentioned above are of a reactive nature and were only installed after it was discovered that some locations are dangerous for PTW riders. Logically, there was a demand to do something proactive in terms of road design, and the equipment and maintenance phases before traffic accidents involving PTW riders occurred.

3. SLOVENIAN INFRASTRUCTURE GUIDELINES FOR PTWS

3.1. Foreign experience

Firstly, it needs to be pointed out that Slovenia will not be the first country with infrastructure guidelines for PTWs. From the interviews held with experts from member states and representatives of the motorcycling community, the project RIDERSCAN, European Scanning Tour for Motorcycle Safety (Delhaye & Marot, 2015)

found that several countries have infrastructure guidelines for PTWs, though most of them are not mandatory, with the exception of Norway and Ireland.

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

Figure 7. *The status of infrastructure guidelines for PTWs in different countries*

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.

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 although without specific consideration of PTWs (Belgium, Latvia). Several countries still have no specific black-spot monitoring programmes (the Czech Republic, Finland, Germany, and Greece).

Only a few countries consider PTW users as Vulnerable Road Users (VRUs) in a legal sense, with a corresponding impact on transport policies (Austria, the Czech Republic, Germany, Ireland, Luxembourg, Norway, and Sweden). Conversely, the Netherlands and Belgium do not recognise 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.

3.2. Proposal for Slovenian guidelines

Due to the different competencies in issuing by-laws in Slovenia, it was decided that these guidelines will not contain a chapter about road design from the PTWs point of view (which is a bad solution). The Slovenian infrastructure guidelines for PTWs will contain two main chapters:

- measures to improve PTW safety in the road equipment phase
- measures to improve PTW safety in the road maintenance phase

The Slovenian infrastructure guidelines for PTWs in the road equipment phase will contain:

- new conditions and installation methods of motorcycle-friendly roadside barriers
- motorcycle collision shock absorbers (mounted on guardrails posts)
- rumble strips and optical brakes in front of dangerous bends to enforce reasonable speeds
- passive-safe posts for marking the course of bends and marking connections (reflective flexible bollards or ‘balisette' bollards instead of rigid road signage)
- installation of closely-spaced flexible guidance posts



Figure 8. *Some of the measures provided in the Slovenian specification in the road equipment phase; from upper-left: flexible bollards, flexible 'balisette' bollards, motorcycle collision shock absorbers and a reinforced shoulder between the pavement and the slope of the embankment*

In the Slovenian infrastructure guidelines for PTWs in the road maintenance phase the following situations/locations/elements are defined as dangerous and need to be eliminated as soon as possible:

- altitude difference between carriageway and shoulder
- damaged pavements
- guardrails with no underrun protection in dangerous bends
- slippery pavements
- road patches
- obstructed visibility in bends
- dangerous patchwork
- serious flaws in the road pavement: patches of varying grip, lane ruts and patchwork repairs

4. CONCLUSION

The vulnerability of PTWs has been established with the large number of road accidents and poor safety statistics in many European and world countries. PTW riders in the European Union are one of the most vulnerable groups of road users. They are quite often involved in road accidents and, unfortunately, in many cases can be seriously injured or even killed.

Preventive awareness campaigns, additional education and training, additional non-traffic signs and road markings, physical measures to mitigate the effects of road accidents involving motorcyclists, various EU projects aimed at detecting and solving motorcycle traffic safety issues, the introduction of additional information boards and markings are only a part of the efforts to provide motorcyclists safe participation in traffic.

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