



The relationship between the travelling speed and motorcycle styles in urban settings: A case study in Belgrade



Vladimir Jevtić^{a,*}, Milan Vujanić^b, Krsto Lipovac^b, Dragan Jovanović^c, Dalibor Pešić^b

^a Secretariat for Transport, Department for Traffic Safety, 27. Marta 43–45, Belgrade, Serbia

^b University of Belgrade–Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade, Serbia

^c University of Novi Sad, Faculty of Technical Sciences, Department of Transport Engineering, Trg Dositeja Obradovića 6, Novi Sad, Serbia

ARTICLE INFO

Article history:

Received 3 March 2014

Received in revised form 16 October 2014

Accepted 11 November 2014

Available online xxx

Keywords:

Motorcycles
Motorcycle styles
Speeding
Sport motorcycles
Safety

ABSTRACT

This report examines the difference in the distribution of the speeds of different motorcycle styles and the difference in the distribution of speeds of particular motorcycle styles and cars. The relationship between the speed of motorcycles that possess and those that do not possess vehicle registration plates was also explored. The speed was measured at six different locations on main roads in the city of Belgrade, Serbia. The study confirmed that, on average, motorcyclists drive faster than drivers of cars, but extreme speeding is recorded 2.3 times more often by motorcyclists than by car drivers. In this research, the styles of motorcycles were divided into three different groups according to their average speeds. The first group consists of sport motorcycles, which were faster than the other styles. The second group consists of scooter motorcycles, which were slower. The third group consists of conventional, touring, enduro, and chopper motorcycles with speeds that were statistically not significantly different. According to the differences of the mean speed of motorcyclists who use and do not use vehicle registration plates, the use of the registration plates can be considered a significant indicator of traffic safety. By classifying motorcycles in the three different groups, the issue of “generalizing” motorcyclists as a unique group is avoided and can be taken into consideration for future studies of motorcyclist safety.

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1. Introduction

Traffic accidents with fatal consequences involving two-wheelers account for approximately 15% of total fatalities in the EU–24 in 2010 (ERSO, 2012). The risk of death and serious body injury for drivers of two-wheelers is significantly higher than for drivers of cars (DACOTA, 2013). The current definition of the term “two-wheelers” includes different motorcycle styles (mopeds, tricycles, and four-wheelers) (ACEM, 2012). This definition raises the question of the substantial differences between these categories in terms of risk. Namely, motorcyclists belong to the category of road users that are particularly exposed to the risk of injuries, notably death (Clabaux et al., 2012). Additionally, motorcyclists belong to the only means of transport in the EU–20 for which the recorded number of traffic accidents increased over the period of 2001–2010. The risk of death or accident with serious injuries in Europe for motorcyclists is 5–25 times higher per kilometer than that of car drivers (Phan et al., 2010).

The Republic of Serbia is a developing country with the potential of joining European Union. Together with this development, the number of registered motorcycles has grown quickly. In 2011, that number was more than three times greater than in 2003. Concurrently, Serbian traffic police and law enforcement were not trained to address this specific group of traffic participants.

According to the Serbian Road Traffic Safety Agency (ABS, 2013), speeding is the key factor in accidents of motorcycles. Speeding is even more applicable to the group of sport motorcycles. According to Antov et al. (2010), the percentage of sport motorcycles in Serbia is the highest in Europe. In their publication, the authors report that 66% of Serbian motorcycle drivers indicated speed enjoyment as an important motive for driving motorcycles. Generally; in Serbia, a significant number of drivers do not respect speed limitations, and according to a WHO report (2011), speed enforcement in Serbia is below the average. Additionally, the percentage of motorcyclists who complete advanced motorcycle courses in Serbia is the lowest among all European countries (5.6% versus Sweden, 55.1%).

The report by the Road Traffic Safety Agency (2012) stated that in the city of Belgrade, the capital of the Republic of Serbia, motorcyclists fall into a group with a high public and traffic

* Corresponding author. Tel.: +381 64 8597 940; fax: +381 11 2754 636.

E-mail address: jevtic.vlada@gmail.com (V. Jevtić).

accident risk with fatal consequences. In Belgrade, from 2006 to 2011, 108 deaths of and 1847 injuries to motorcyclists were recorded. In 2011, the number of motorcycle-related fatalities accounted for approximately 15.4% of the total fatalities, or 7.4% of the total casualties.

An indicator of traffic safety is a quantifiable metric that affects the level of transportation safety. The purpose of traffic safety indicators is to assess traffic safety in certain area under certain conditions and to identify potential safety hazards in their early stage before they result in accidents (Thomas et al., 2005). Chapter 3 of the dissertation by Al Haji (2007) provides a survey of theoretical frameworks for selecting traffic safety indicators. Recent studies recognized speed as an important indicator of traffic safety for motorcyclists (Yannis and Evgenikos 2007). In several papers (Vlahogianni et al., 2012; Walton and Buchanan, 2012; Blackman and Haworth, 2013; Haque et al., 2009; Mannering and Grodsky, 1995; Phan et al., 2010; Hurt et al., 1981), speeds notably exceeding the speed limit are emphasized as key risk factors for accidents involving motorcyclists. Unsafe and inappropriate speed is a major traffic safety problem in many countries (OECD, 2006) and is an often discussed topic (Bjørnskau et al., 2012).

The extent of injuries grows with excessive driving speed (WHO, 2008; Lin et al., 2003). Speed is monitored in most of the EU countries (Hakkert and Gitelman (2007)), and the speed of motorcyclists is significantly different compared to the other participants in accidents (DACOTA, 2013). In a previous study (Haque et al., 2012), the largest number of accidents was noted to occur between motorcycles and other vehicles. Speed differentials between vehicles and motorcycles have a great influence on the crash risks. Another study (ACEM, 2008) noted that in 61.6% of accidents with other vehicles, the collision speed of motorcycles was under 50 km/h. The study also noted that in 9.4% of accidents, the collision speed of motorcycles was greater than 100 km/h; whereas, the collision speed of cars exceeded 100 km/h in only 2.3% of accidents.

With the increase in the number of motorcycles and the number of accidents, an increasing need for identifying differences in the distribution of the speed between the motorcycles and other forms of transportation has arisen. Most of the published studies focused on identifying differences in the distribution of the speed between the means of transport, i.e., the difference between motorcyclists and other road users. These studies did not detail categorizations within the group of motorcyclists. A survey regarding speeds in Israel states that compared to the other participants, motorcyclists usually drive over the speed limit on both rural and urban roads during both day and night conditions (Gitelman et al., 2010). According to the report by the Department for Transport (DfT, 2006), the average speed of motorcyclists is generally higher than the average speed of cars on an identical road. In a project conducted in Australia, monitoring sections over which the speed limit is 100 km/h descriptively showed that motorcyclists ride faster than car drivers. The percentage of motorcyclists who drove 10 km/h and above over the speed limit was approximately 3.3 times higher compared to car drivers (Baldock et al., 2010).

Observing motorcycles as a unique group does not disclose the actual situation about the distribution of speeds because of the significantly different categories of motorcycles. Authors often use two or three categories of motorcycles, grouping them by different criteria (power, capacity, legal categorization, etc.), such as in Chen and Chen (2011). However, a smaller number of studies in which a more detailed categorization of motorcycles was performed to determine the connection between speed and certain categories of motorcycles. One of the methods to divide motorcycles is by style. By style we refer to a group of motorcycles with similar

performance, appearance, and purpose, similar to previous research (Antov et al., 2010). Table 4 given in the Appendix A, shows the division of motorcycles by style and their characteristics based on the European Commission project SARTRE 4. In some studies (Teoh and Campell, 2010), instead of the term “style”, the term “type” was used. However, by the type of motorcycle we refer to a specific brand of motorcycle, similar to other studies (Kraus et al., 1988). Teoh and Campell (2010) analyzed accidents and indicated that motorcycles are significantly different with respect to style and design, particularly in terms of size, weight, and performance (top speed, acceleration, power, maximum angle “overthrow” in the curve, etc.), and the results are analyzed in relation to the six styles of motorcycles. The existing studies mainly focused on sport motorcycles.

Sport motorcycle accidents are mentioned as a specific problem (Van Elslande and Elvik, 2012). Speeding by drivers of sport motorcycles is most commonly reported (Elliott et al., 2003; Phan et al., 2010). Sport motorcycles are considerably more at risk of being involved in accidents with serious consequences compared to other styles of motorcycles (Bjørnskau et al., 2012). The rate of casualties of sport motorcycle drivers is four times higher than of drivers of touring motorcycles (Kraus et al., 1985). Nine out of ten drivers who drive at high speeds are street racers on replicas of racing motorcycles (Strandroth and Person, 2005). In the state of Serbia, 33% of registered motorcycles are sport motorcycles; however, sport motorcycles were involved in 49% of fatal traffic accidents (ABS, 2013).

On the streets of Belgrade, motorcyclists often ride vehicles with registration plates that are intentionally placed so that they cannot be clearly seen or they do not have registration plates at all. Our subjective estimation was that these riders drive faster and more “aggressively” than those who have regular registration plates. We included in our analysis the parameter “having proper registration plates”, expecting to detect differences in the distribution of speed between motorcyclists who have registration plates and motorcyclists who do not have registration plates. The potential benefit of this analysis could be that the use of the registration plates on motorcycles, depending on the style, can be regarded as a significant indicator of traffic safety.

The key questions to be answered about motorcycle styles are the following: What is the extent of differences between styles of motorcycles considering the distribution of speed? Can the style of motorcycles be systematically related to the distribution of the speed? The answers to these questions would enhance further research in terms of better determining the difference between motorcycles and other modes of transport and within the group of motorcycles.

A significant number of studies used methods to determine the distribution of speeds between different modes of transportation and different styles of motorcycles that were based on questionnaires (motives and attitudes) and an analysis of collision speed (from accident data). In this paper, a significantly different approach was used. All data were collected by direct observation and speed recording on streets.

The present study examines the statistical significance of differences in the distribution of speeds between six styles of motorcycles and between motorcycles and cars. This study also examines the relationship between the speed distribution of motorcycle styles and the possession of vehicle registration plates on motorcycles.

2. The research method

According to Serbian Traffic Safety Law which is in accordance with laws in European Union countries, driving 50 km/h faster than the official speed limit within urban areas is considered to be a

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