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Motorcycle/Donorcycle: Improving Motorcyclist Safety in Győr, Hungary †

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Abstract: Due to their high fatality rate, motorcycles, often referred to as "donorcycles" in the U.S., present unique safety challenges. In Hungary, motorcycle safety remains a critical issue despite a relatively low per capita rate of motor vehicle deaths, largely due to limited ownership and recognition. This study examines historical trends in motorcycle use in Hungary and the economic factors influencing their current prevalence. By emphasizing the crucial role of helmets and safety gear, road conditions, and environmental factors, this paper provides actionable recommendations to improve motorcycle safety in Győr and the surrounding regions. Implementing these recommendations stands to significantly reduce accidents and save lives, ensuring safer roads for all.

Keywords: motorcycle safety; traffic fatalities; helmet use; transportation infrastructure; Hungary traffic safety; Central European traffic safety

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1. Introduction

Motorcycles are significantly more dangerous than cars. In the U.S., motorcyclists are 27 times more likely to die in crashes than car drivers, earning motorcycles the grim nickname "donorcycles" due to the organ donations received from unhelmeted riders [1,2]. Hungary has fewer motor vehicle deaths per capita than the U.S. (7.4 vs. 12.8 per 100,000), but preventing two-wheeled vehicle-related deaths remains a challenge [3,4].

In Hungary, motorcycles make up only 4% of on-road vehicles, with an ownership rate of 19 per 1000 people, below that of many neighboring countries (e.g., Austria—60 per 1000). Only Romania (7 per 1000) has fewer motorcycles per capita, while Croatia and Hungary have nearly identical figures [5,6]. An extremely low rate of motorcycle ownership may lead to a lack of recognition of motorcyclists, and road users, policymakers, and law enforcement may not fully understand the challenges motorcyclists face, especially in conditions that pose unique risks to motorcyclists. This lack of understanding can lead to the construction of infrastructure not designed for motorcyclists, such as roads with inconsistent traction, inadequate signage for two-wheelers, or poor lighting that exacerbates visibility issues, especially in adverse weather conditions.

This paper explores these issues and others and proposes recommendations to improve motorcycle safety in Győr and other regions in Hungary.

2. Background and Historical Trends: Győr, Hungary, and the Global Context

Throughout the early to mid-Communist era (1949–1970s), most motorcycles in Hungary were produced locally by companies such as Csepel, Pannonia, and Danuvia. These were later replaced by Soviet-made motorcycles. Pannonia, which ceased production in 1974, produced about 700,000 motorcycles over two decades [7,8]. Motorcycles were more affordable than cars, making them accessible to less economically advantaged individuals [9]. However, they did not meet the technical standards of Western or Japanese motorcycles like the Honda Gold Wing, which was introduced in 1975 [10].

Although Hungary began to move away from central planning in 1968 with the New Economic Mechanism, access to Western goods remained limited until after the Communist

regime collapsed [11]. Post-Communism, Hungary saw increased access to global products, including motorcycles and cars. However, significant inflation in the early 1990s and import surcharges in 1995 limited consumer purchasing power [12]. Consequently, the adoption of motorcycles as recreational vehicles was delayed.

While for the balance of the last three decades, Hungary has not been prosperous enough to support a large community of recreational motorcyclists, it has become too wealthy for motorcycles to be a primary mode of transportation—as is the case in Thailand, where 87% of households have at least one motorcycle [13]. Thus, Hungary occupies an interesting middle ground, with motorcycle usage and ownership likely to remain at low to moderate levels for some time.

Globally, 28% of traffic fatalities involve powered two- or three-wheeled vehicles (PTWs), with a disproportionate number occurring in Southeast Asia (43% as of 2016). The European PTW death rates are relatively lower, and comparing these regions' death rates and causes can help reduce fatalities and improve safety in Hungary [14].

3. Safety Equipment: Costs and Benefits

Traffic, road conditions, and access to safety equipment are critical to PTW safety. Among safety equipment, helmets are paramount. Other equipment mainly improves visibility to prevent accidents rather than minimizing impact harm, although protective clothing can mitigate fall damage [15]. Methods for reducing accident likelihood and injury severity are worthy of consideration.

3.1. Helmets: Types, Recommendations, and Costs

The safety benefits of helmets for motorcyclists are extensively documented. In the U.S., motorcyclists without helmets are 40% more likely to incur fatal head injuries and 15% more likely to experience nonfatal injuries compared to those wearing helmets. A Crash Outcome Data Evaluation System (CODES) study revealed that helmets are 67% effective in preventing brain injuries and that motorcyclists without helmets are three times more likely to sustain brain injuries in crashes [16].

Helmet effectiveness varies based on accident type, fit, and design, with different standards used to assess their protective ability [17]. The DOT standard, developed by the U.S. Department of Transportation, specifies requirements for testing for drop, penetration, and impact resistance and retention systems to ensure helmets stay in place. DOT helmets are manufacturer-certified, which relies on self-policing and can sometimes lead to substandard helmets being sold [18].

More rigorous standards include SNELL and ECE 22.05/22.06, which are common in Europe. Official laboratories verify compliance with these and have stricter impact protection requirements. ECE 22.06 emphasizes protection from side impacts and the performance of accessories like face shields [19]. The SNELL standard, updated every five years and currently defined by M2020, focuses on motorsports performance and tolerating high collision energies [20,21].

The SHARP rating system assigns stars based on crash performance, providing additional information to helmet buyers. SHARP ratings are not standalone certifications and are only given to helmets already certified by other standards [22]. We will discuss each certification and rating system in the Recommendations section.

3.2. Reflective Gear (Passive Visibility Systems)

While helmets are the most significant type of rider safety equipment, reflective gear can reduce accident risk. Reflective clothing drastically decreases accident risk for PTW operators in poor visibility conditions. It can include retroreflective materials, fluorescent dyes, and phosphorescent coatings [23]. Despite research on the benefits of high-visibility clothing, dark apparel remains common in motorcycle gear [17,24].

4. Infrastructure and Conditions

4.1. Roads: Design, Traction, and Markings

As important as rider behavior, protective gear use, and conduct are, even the most responsible PTW operators cannot completely compensate for environmental conditions. While weather may be beyond the control of the operator and road designers and builders, the latter can work to mitigate risks.

This paper will focus on three critical components of safe roads for PTW operators:

1. Paved shoulders;
2. Good traction;
3. Clear signage, markers, and lighting.

Each of these plays a critical role in reducing the chance of serious accidents.

Paved shoulders better a motorcyclist's experience by providing a safe stopping place for those who are tired or facing mechanical issues. Paved shoulders and dedicated motorcycle lanes through intersections also reduce traffic conflicts and collisions [25].

Good traction, essential for safe motorcycle operation, results from the interaction of pavement materials, roughness, and surface conditions [26]. Traction control systems prevent excessive wheel slip, while antilock braking systems (ABSs) maintain proper traction during braking, reducing fatal motorcycle accidents by 22% [27].

Finally, clear signage, markers, and lighting are crucial for PTW operator safety, helping riders quickly identify hazards, navigate roads, and maneuver through complex intersections with higher accident risks [28]. Effective signage is particularly important due to the challenges of using electronic devices on motorcycles, which can be physically and cognitively demanding for the operator and can degrade, if not outright destroy, electronics in cases of extreme temperatures, water exposure, or vibration [17,29,30].

4.2. Weather, Traffic, and Variable Conditions

Weather can have a significant effect on the probability and significance of accidents. A study conducted in Spain found a positive relationship between higher wind speeds and the likelihood of collisions on roads [31]. Rain and ice are dangerous to motorcyclists (although relatively few accidents occur on icy roads, likely due to motorcyclists avoiding them) [32]. Gravel, oil, and other temporary hazards—often from vehicle residue, spills, or construction—also negatively impact motorcyclist safety, certainly if the rider is not expecting them [17,26].

Of significant benefit to motorcyclists and other PTW operators is Hungary's relatively mild weather. While summers can be hot, winters are rarely extreme. Snow and ice accumulation is moderate compared to that in less temperate locations like the Northeastern United States. For comparison, the average January snowfall in Győr is usually less than 16.2 cm, whereas in Syracuse, New York (United States), it is 86.4 cm [33,34].

Thus, while weather (rain most of all) should not be dismissed as a potential risk to motorcyclists, Hungary, in general, and Győr, in particular, offer favorable riding conditions relative to much of the world.

5. Recommendations

While specific traffic and accident datasets for Győr were not available at the time of writing, a generalized series of recommendations can be offered within the context of Hungary's legal, economic, and environmental conditions and general motorcycle and PTW safety.

A review of the research suggests that recommendations can be broken into three categories:

1. Enhancing public awareness and education;
2. Improving infrastructure for motorcyclists;
3. Encouraging the use of high-quality safety equipment.

5.1. Enhancing Public Awareness and Education

Three simple measures can support public awareness of motorcycles and how to safely operate them (and operate a vehicle around them).

Rider education programs: Hungary already has a licensing program for motorcyclists, but new technologies like virtual reality simulators could improve training. Vehicle simulators have proven effective for car and train drivers [35–37]. Additionally, adapting existing games to training could provide a cost-effective training model for inexperienced motorcyclists.

Driver vigilance: Through billboards and social media campaigns, the government should encourage drivers to be vigilant about motorcycles.

High school safety courses: The government should introduce a basic motorcycle/PTW safety course at a high school in Győr. Offering training on AM (50cc-class) mopeds or scooters could provide young riders with essential PTW operation skills. Such programs have been shown to reduce serious accidents [38].

5.2. Improving Infrastructure for Motorcyclists

A visual inspection of the roads in and around Győr reveals (at least to the untrained eye) most to be in good condition. However, motorcycle safety could easily be improved by the addition of enhanced road markers and signage.

Reflective road and lane markers can reduce the risk of accidents from veering out of a lane or off road. These markers can be applied wet using advanced paint, are durable, and require little new or specialized equipment [39,40]. In addition to improved lane marking, dedicated signage could enhance the safety of motorcyclists and other PTW operators. Such dedicated signage should address gravel, oil, uneven pavement, and sharp or unpredictable turns—all of which imperil motorcyclists far more than four-wheel vehicle operators [24,26,41].

5.3. Encouraging the Use of High-Quality Safety Equipment

A high-quality SNELL-approved helmet can cost over 300 USD (approximately 100,000 HUF as of July 2024) [42,43]. Thus, less affluent PTW operators have a strong financial incentive to choose helmets of a lower cost (and quality). Given the sometimes debilitating nature of a serious head injury, this stands to be a case of poor economics. Győr could save lives and medical resources by offering a helmet subsidy program to low-income riders. Additionally, the city could offer free- or low-cost access to retroreflective tape and markers that could be applied to PTWs to increase PTW and rider visibility and decrease the odds of cars crashing into them.

6. Summary

Regardless of their size or speed, PTWs (motorcycles included) offer riders much that four-wheeled vehicles cannot. Freedom, agility, a sensory experience more demanding and engaging than being in a car, and membership in a brotherhood of riders make motorcycling worthwhile. However, riding *any* PTW presents notable challenges that riding in a car or truck does not. If applied consistently, the recommendations in this paper should reduce many of these without degrading the riding experience.

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