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Motorcycle Riding Safety

Karandeep Singh[1], Rajesh Mattoo[2]

[1]Student, Dronacharya College of Engineering, Gurgaon, Haryana, India.

[2]Assistant Professor, Dronacharya College of Engineering, Gurgaon, Haryana, India.

Corresponding Author: karansngh556@gmail.com

Abstract: - Statistics show that motorcyclists are more at risk per mile ridden than any other type of road user. In addition, although the number of road accident fatalities has decreased in recent years, the number of motorcyclist fatalities has risen and the distribution of casualties has changed. TRL Limited was commissioned by the then Department of the Environment, Transport and the Regions to undertake a scoping study of motorcycle safety. This included a review of literature and current research, with a view to identifying areas where further research was needed. The report of the study was produced in unpublished form in November 1999, but is now published to make the work available to a wider readership.

Key Words:— ***Safety injury, prevention health, psychology attitudes rider.***

I. INTRODUCTION

The Department of the Environment, Transport and the Regions (DETR) (now Department for Transport (DfT)) commissioned TRL Limited to undertake a scoping study of motorcycle safety. The objectives were: to review the relevant literature and research, to identify existing gaps in knowledge and to make recommendations for further research. The number of people killed in motorcycle crashes in the United States increased dramatically in the decades prior to 1980, reaching a peak of 5,097 fatalities in that year. In the last two decades of the century, the nationwide incidence of motorcycle fatalities has declined, dropping to 2,106 fatalities per year in 1997 (1), 62 percent below the 1980 peak. Some, but not all, of the drop can be attributed to a decline in riding. Between 1980 and 1997, the number of motorcycles registered in the United States fell by 35 percent, from a high of 5.7 million to 3.7 million. The fact that the decline in fatalities has far outstripped the decline in registrations, however, suggests that the widespread introduction of helmet laws, training programs, and public education campaigns during the last two decades has had a measurable impact on the number and severity of crashes. Even so, the National Highway Traffic Safety Administration (NHTSA) has estimated that at the turn of the century, the mileage-based death rate for motorcycle riders will be roughly 16 times greater than the overall motor-vehicle death rate. The more than 2,000 deaths per year represented by this rate provide a significant impetus for motorcycle safety research and the introduction of ongoing countermeasures at the federal, state, and local levels.

II. CHARACTERISTICS OF MOTORCYCLING

Motorcycles and motorcycling have a number of characteristics that make them qualitatively different from cars and car driving, and that are at least potential contributors to the high accident liability of motorcyclists**.**

A. Motorcycle stability, performance and handling:

Motorcycles tend to have much higher power-to-weight ratios than cars, and increasing numbers of motorcycles are capable of very high speeds and accelerations.

Being a ‘single track’ vehicle, a motorcycle can easily become unstable and capsize if braking, accelerating or a slippery road surface cause a wheel to lose adhesion. This is particularly critical if the machine is leaning to take a bend. Braking can also cause a motorcycle to change its line on a bend.

Such characteristics make motorcyclists particularly vulnerable if they take bends too fast to be able to stop in the distance they can see to be clear, and to sudden changes in road surface. The need to avoid wheel-locking also means that riders may find it difficult to make best use of the brakes in other emergency situations.

Longitudinal ridging or grooving of the road surface, and raised road markings, can produce steering instability.

B. Vulnerability of motorcycle and rider:

In addition to problems of instability, motorcycles and their riders are vulnerable in other ways – for example:

- Lack of crash protection
- Vulnerable to not being seen by car drivers.
- Vulnerable in impacts with crash barriers that have been designed for other types of vehicle

III. RIDER TRAINING

These programs are typically funded through motorcycle license or registration fees and are generally based on the curriculum of the Motorcycle Safety Foundation's (MSF) beginning rider education program—the Motorcycle Rider Course: Riding and Street Skills (MRC:RSS). This curriculum covers roughly 16 hours of training, 8 of which are spent on motorcycles on a controlled range. Eighteen states have made successful completion of the MRC:RSS course mandatory for young riders (under the age of 16, 18, or 21) seeking a motorcycle license, and Rhode Island requires training for all license applicants, regardless of age. MSF has also developed an 8-hour Experienced Rider Course for no beginners. In 1997 approximately 140,000 novice and experienced riders were formally trained in state and military programs.

A. Effectiveness:

The ultimate measure of the effectiveness of any motorcycle training program is its impact on crash rates. During the 1980s several states and Canadian provinces attempted to assess

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the impact of motorcycle training on crashes, only to obtain decidedly mixed results. In the 1990s an extensive evaluation of the California Motorcyclist Safety Program (2) used trend analysis and matched-pair comparisons to isolate the impacts of a state-wide training program initiated in 1987. During the first 10 years of the program, motorcycle crashes in California dropped 72 percent, a decline far greater than that in the rest of the United States (55 percent) during the same period. A matched-pair analysis showed that the crash rates among untrained novice riders were more than double those among their trained counterparts for at least 6 months after the training, when riding experience begins to have a levelling effect on the differences between the two groups. In addition to lowering the crash rates among novice

riders, research shows that formal training classes advance the use of protective equipment and discourage unpromising riders from becoming motorcyclists.

B. Licensing:

Key Issues Most states require riders to obtain a special operator's license before driving a motorcycle on public streets and highways. There is, however, ample evidence that many motorcyclists ignore these requirements. NHTSA statistics show that, during a 10-year period ending in the mid-1990s, 42 percent of the motorcyclists involved in fatal accidents in the United States were either unlicensed or improperly licensed. Unlicensed riders circumvent the skill and knowledge tests that are a major part of most licensing programs. Not surprisingly, they are overrepresented in fatality statistics, since their ranks include such crash-prone, high-risk riding groups as the under aged, the under experienced, and the under suspension. As a group, unlicensed riders are 2 to 3 times more likely to be involved in a fatal crash than the typical licensed rider, and this figure rises to at least 20 times more likely among those whose licenses have been suspended.

Research Needs Research is needed to document the size of the population of unlicensed riders. In addition, research is needed to relate testing, restrictive licensing practices, proof-of-insurance requirements, mandatory training programs, and sanctions to the size of that population.

C. Motorcycle Helmets:

Motorcycle helmets have improved greatly in comfort and convenience since the first patent for the modern protective helmet was issued in 1953. Helmet milestones include the American National Safety Standard for Motorcycle Helmets in 1966, the first full-facial coverage helmet in 1967, Federal Motor Vehicle Safety Standard (FMVSS) No. 218 for motorcycle helmets in 1974, and increased use of energy-absorbing materials and integral eye protection beginning in the 1970s. Motorcycle helmets in the United States are regulated by FMVSS 218, which standardizes test procedures and equipment. The current version of FMVSS 218 was issued in 1988, and a major upgrade is currently in progress (5), designed to bring the regulation closer to the international state of the art. Even with this upgrade, however, FMVSS 218 will contain no requirements for protection outside a limited zone above the ears, ignoring the important chin portion of full-facial-coverage helmets.

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As the end of the 20th century approaches, 22 states have universal mandatory helmetuse laws, 25 have partial helmet-use laws, and 3 have no helmet-use requirement. Universal mandatory helmet laws result in almost 100 percent helmet use. Laws requiring helmets for certain age groups only are less effective and more difficult to enforce than those requiring universal use. In the United States, helmet laws that apply only to younger riders typically result in overall helmet use of 34 to 54 percent (1). The effectiveness of helmets in mandatory-use states is well documented; mandatory use has been associated with at least a 30 percent reduction in

fatalities (6). NHTSA estimates that helmets saved 486 motorcyclists' lives in 1997, and that 266 more could have been saved if all motorcyclists had worn helmets (1). A disturbing trend in states with mandatory helmet-use laws is the use of "helmets" that do not comply with FMVSS 218. Although these bogus helmets are sold as novelty items, they find their way into traffic use; in California, a mandatory helmet-use state (7), they represent 10 percent of all helmets worn. These unqualified helmets do not provide adequate head protection and undermine the effectiveness of mandatory helmet-use laws.

D. Road Markings:

Road markings can affect the riding dynamics of motorcycles considerably, depending on the quality of the markings and the weather conditions. Poorly designed or located markings can cause wobbling, 'crabbing' whereby the motorcycle longitudinal axis is at an angle to the direction of travel. Surface water results in a loss of road grip (Weidele and Breuer 1989). It is especially this loss of adhesion between the tyres and the road that causes problems for motorcycle riders. Thus the potential leaning angle of approximately 45°at a velocity of 40km/h in good weather and road conditions is reduced to 40° when crossing dry markings, and may deteriorate to as little as 25° when crossing wet road markings. In addition to that, the stopping distance doubles on wet road markings compared with that on dry unmarked roadways (tarmac). The crossing of profiled road markings causes strong steering impulses leading to deviations from the nominal track of about 100mm. In addition to this, profiled road markings cause one-track vehicles to weave, and at high speed they can even induce sustained weaving with little or no attenuation. Surface water may be retained by profiled markings, causing loss of adhesion or even aquaplaning. In conjunction with the influence of air resistance this may cause the front wheel to rise, losing friction between the front tyre and the road.

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