LANE SHARING AS A MOTORCYCLE RIDER SAFETY PRACTICE; A FURTHER EVALUATION

By Steve Guderian

INTRODUCTION

In August of 2011, a paper titled, *Lane Sharing: A Global Solution for Motorcycle Safety* was released and was subsequently published in the October 2011 issue of *Motorcycle Consumer News*. This article took the position that motorcycle lane sharing is a sound motorcycle rider safety practice. This paper compared rear-end motorcycle crashes in California with those in three other states, each with similar riding seasons and conditions. Those states were Arizona, Texas, and Florida. That paper concluded that California, where lane sharing is practiced, had a smaller percentage of fatal rear-end motorcycle crashes than the comparison states. It also showed that lane sharing is an accepted practice in many other industrialized countries and is involved in a small percentage of crashes in those countries. Also discussed were the serious effects of even a low speed rear-end motorcycle crash on the motorcycle rider while a lane sharing crash represented an avoidable or minor crash to a motorcyclist. The general conclusion from this information was that lane sharing has the potential to be an effective safety practice for motorcycle riders in the United States.

This paper will further discuss the potential safety measure of lane sharing for motorcycle riders. It will provide information related to crash avoidance, look at the results of a recently released California lane sharing survey, and do a data comparison with current motorcycle rider safety practices.

DISCUSSION

The evaluation of lane sharing in the United States can only be accomplished through the study of the practice in the state of California, the only state where the practice is allowed[1]. However, there is no formal recognition of lane sharing by any agency, public or private, within the state. Similarly there are no specific traffic laws designed to address any legal or illegal actions associated with the practice. Instead, general laws in the California Vehicle Code covering speeding, lane changing, etc; are discretionarily used by law enforcement officers for controlling lane sharing motorcycles in the state[2]. The lack of any form of recognition of the practice has in essence resulted in unrestricted actions by motorcycle riders, non-specific enforcement actions by law enforcement, and no information or data about the practice as it relates to the roadway environment. Furthermore, there is no educational safety information for motorcycle

riders, vehicle drivers, or any other roadway users about the practice of motorcycle lane sharing.

In May of 2012, the California Office of Traffic Safety released a report titled *Motorcycle Lane Share Study Among California Motorcyclists and Drivers 2012*. This was the first specific data in California about the lane sharing practice by motorcycle riders. It was a survey of both motorcycle riders and vehicle drivers regarding their knowledge of the practice of lane sharing and actions associated with a lane sharing motorcycle rider. The survey was done in 12 different counties within the state that represent 70% of the licensed motorcyclists and 77% of licensed vehicle drivers. The following is a sample of the information obtained.

Motorcycle Riders

78% of the riders surveyed practice lane sharing on freeways.
64% of the riders surveyed practice lane sharing on urban multi-lane roadways.
50% of the riders don't always lane share.
84% if the riders have never had any interaction with a car while lane sharing. Where contact did occur, the majority of the contacts were with a mirror or a scraping of the vehicle being passed. (Motorcycle mirrors are the same general height as many vehicle mirrors, so a mirror contact as referred to here is generally a non-damage producing contact between the vehicle mirror and the motorcycle mirror.)
Only a small percentage of lane sharing riders were involved in injury producing contact.
99% of lane sharing motorcycle riders had not been cited by law enforcement.

Vehicle Drivers

47% of the drivers surveyed did not know lane sharing was legal.
7% of the drivers surveyed admitted to trying to block a lane sharing motorcycle.
95% of drivers had not had any contact event with a lane sharing motorcycle.
Of the 5% of drivers that had experienced a contact event, 86% reported the contact was a mirror contact or a minor scraping to their vehicle.
63% of the surveyed vehicle drivers disapprove of the practice of lane sharing for the following reasons:

- 77% think it is unsafe.
- 20% are afraid the motorcycle might crash.
- 13% are afraid the motorcycle might cause them to crash.

An evaluation of the survey information for vehicle drivers shows they have a large misunderstanding about the practice of lane sharing by motorcyclist. For example, 95% of drivers say they have had no interaction with a lane sharing motorcycle. However, drivers still question the safety of the practice due to different fears about the practice. An overall conflict in the driver data such as this shows the need for driver education of the practice. Education about the practice could also be beneficial to motorcycle riders, however the survey data is not conclusive in this respect.

The lack of formal traffic data on lane sharing in the state restricts the ability to conclusively evaluate effectiveness of the practice in California. However, the lane sharing survey done by the state shows that its low motorcycle rear end collision fatality rate was achieved with 47% of the vehicle drivers not knowing that the practice of lane sharing was allowed. How much lower could this rate be if all California vehicle drivers were made aware that the practice was allowed? Similarly, how much lower could this rate be if the motorcycle riders were educated on the practice and the rider actions were regulated? Any state that chooses to allow lane sharing as a rider safety practice has the opportunity to do so with driver and rider education programs and enactment of regulatory provisions for the practice. This represents the best rider safety potential for the practice, and it would allow for an accurate evaluation of the safety of the practice.

COLLISION AVOIDANCE

The previous lane sharing paper had a discussion about the dynamics of a lane sharing collision when compared to a rear-end impact to a motorcycle by a trailing vehicle. The conclusion was that a lane sharing contact was not only less severe than a rear-end impact, but it was also possible for a motorcyclist to recover from a lane sharing contact, which was highly unlikely when impacted directly from the rear. Further research shows that it is much more likely that a motorcycle rider can avoid a lane sharing contact, while it is unlikely that they can avoid being impacted from the rear.

Reports have indicated that it takes about 1.2 seconds for a motorcycle to swerve 1 meter, and another 1.2 seconds to straighten out[3]. This is a total time of 2.4 seconds for a motorcycle rider to move out of the path of a potential collision to the motorcycle rear-end. This is only the movement time and does not include rider perception and response time. In an attempt to provide a more refined estimate for motorcycle movement time, this author has done some preliminary rider testing.

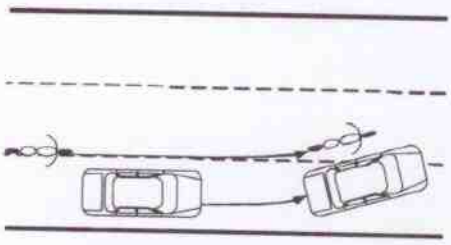
Riders were tested as to how long it took the motorcycle rider to move out from behind and then just past the rear end of a stopped or stopping vehicle ahead in the same lane. This testing found an average movement time from a stopped position to a position past

the rear of a vehicle of 3 seconds. The difference between the times in the two studies is that the average time obtained by the author also includes the time necessary to start and accelerate from a stopped position, as compared to swerving when the motorcycle is already moving.

Due to the number of associated variables, the perception and response time for a stopped motorcyclist about to be struck from the rear is difficult to estimate. In order to respond to a pending crash situation, the motorcycle rider must first have the opportunity to detect the immediate hazard approaching from the rear. This immediate hazard detection must be accomplished through the use of rear-view mirror(s) that give a limited and distorted perspective. Additionally, the motorcyclists' ability for immediate or even timely hazard detection can vary depending on the circumstances of each situation.

Considering the optimum circumstances, which include the rider already scanning in rear-view mirrors for approaching traffic, a reasonable best approximation for the rider perception and response time would be about 1.25 seconds. Combining the movement time for the motorcycle with the rider perception and response time gives a best case average of 4.25 seconds for a rider to move the motorcycle out of the path of a pending rear-end contact by a vehicle.

Consider the following scenario. A vehicle that is approaching the rear of a stopped motorcycle is traveling 35 mph, or 51 fps (feet per second). In an emergency stopping situation, the vehicle can stop in about 2 seconds. From the rider's perspective, this approaching 35 mph vehicle isn't recognized as an immediate hazard to the motorcycle and rider until it is about 2 seconds away. However, it is going to take the motorcyclist 4.25 seconds to move out of the path of the approaching vehicle. This means the vehicle will collide with the rear of the now moving motorcycle because the rider does not have enough time to move the motorcycle to a position to avoid the pending crash.



For comparison, in a pending lane sharing contact, the perception and response time for a rider who has detected the immediate hazard of a lane-changing vehicle in a cut-off situation, is about 1.25 seconds. It could be argued that the perception and response time could be closer to 1 second as in a lead vehicle situation[4]. The difference between the lane sharing contact avoidance motion and rear-end collision avoidance motion is that in the lane sharing situation the motorcycle avoidance motion away from the vehicle is close to a parallel path of travel with that of the cut-off vehicle (see the above diagram). That is, as

the vehicle is moving laterally into the motorcyclist's path of travel the motorcycle avoidance motion to avoid contact is also in the same lateral direction of travel. Furthermore, the side movement into an adjacent lane for the lane-changing motion of a vehicle is limited when compared to its forward motion. This gives the motorcycle rider time to perceive and react to the vehicle in order to avoid a contact with or from the vehicle.

LANE SHARING, SAFETY MEASURE COMPARISON

The National Highway Traffic Safety Administration (NHTSA) has four motorcycle rider safety practices that are rated on a scale of 1 to 5 for effectiveness,[5] with 1 being the least effective and 5 being the most effective. Two of the four safety measures have been rated at 1, one is rated as a 3 and one, a universal helmet law, is rated a 5 (a universal helmet law mandates approved helmet usage for all motorcycle riders).The latest motorcycle and vehicle traffic crash data from NHTSA is for 2009[6].This NHTSA report also shows that in 2009 twenty states and Washington, DC had universal helmet laws.

Using the 2009 NHTSA crash data, Table 1 on the next page shows the percentage of fatal motorcycle crashes for total vehicle fatal crashes and has been separated between the "Universal Helmet Law States" and the "No Helmet Law States." The data in this table shows that as a percentage of total crashes, fatal motorcycle crashes are 2.8% higher in "No Helmet Law States" as compared to "Universal Helmet Law States." If a universal helmet law were enacted in the 30 "No Helmet Law States" the expectation is that they would perform at the same level of percentage of fatal crashes as the "Universal Helmet Law States," or 11.7%. This would reduce the total number of fatal motorcycle crashes in the no helmet law states by 2.8% or save about 500 motorcyclists.

Due to the lack of specific data regarding lane sharing, lives saved and/or the number of crashes reduced has to be inferred from data from other areas. An additional qualification for data is that rear end crash and same direction crash dynamics for vehicles-motorcycle crashes is not the same as the dynamics of vehicle-vehicle collisions. That is, a rear-end crash into a motorcycle by another vehicle is far more severe for the motorcycle than a rear-end crash into a vehicle by another vehicle[7]. All vehicle collision data from NHTSA shows that four types of impacts total 85% of all collisions; rear end (28%), crossing path (25%), run off road (23%) and lane change (9%). This information shows that at 28%, a rear-end crash situation is the most common crash situation for all vehicles.

In 2009, there were 106,000 motorcycle collisions. 84,000 of these crashes were injury crashes[8] resulting in 90,000 injured riders and passengers[9]. In Europe, lane sharing was involved in 0.45 % of the crashes studied while in Great Britain it was 5%. And crashes where the motorcycle was stopped, like in a rear-end impact, were 2.8% of collisions studied[10]. If it is presumed from the all vehicle NHTSA collision data that 28% of the injury motorcycle collisions involved a rear-end impact; and it is further presumed that 28% rear-end impacts was reduced to 8%, 5% for lane sharing and 2.8% for rear-end collisions, that represents a 20% reduction in the total number of injury motorcycle collisions. This represents a potential reduction of over 18,000 injured motorcycle riders and passengers.

	21 Universal Helmet Law States & DC	30 No Helmet Law State	Total All states
Total Fatal Crashes	15957	17851	33808
Total Fatal Motorcycle Crashes	1868	2594	4462
% Motorcycle Crashes of Total Crashes	11.7%	14.5%	13.2%

Table 1 2009 Crash Data from NHTSA separated by Universal Helmet Law States & No Helmet Law States

The NHTSA data shows that 5% of all fatal vehicle crashes involve a rear-end collision, or about 223 fatal motorcycle crashes. If this number were reduced to 1-2.8% to correspond with the European numbers, this would be a reduction of 98-178 fatal motorcycle crashes in the United States.

> *It should be noted that given the differences in crash dynamics between a vehicle into the rear of a motorcycle, as compared to a vehicle into the rear of another vehicle, it would be possible to see a motorcycle crash reduction percentage greater than 5% for fatal rear-end motorcycle crashes. This in turn would correspond with a greater number of motorcycle rider lives saved.*

Lane sharing also has the potential to reduce rear-end crashes by a motorcycle colliding with the rear of a vehicle ahead. A rider who has lane sharing experience should be mentally prepared to use the escape route represented by the path along the side of or between two vehicles. In other words, a rider approaching the rear of stopped or suddenly stopping traffic should have the option and the ability to use the roadway space beside a vehicle to avoid a rear-end collision with that vehicle or from traffic approaching from behind. Without the experience of lane sharing, there is a high potential for riders not to use the escape space next to vehicles.

CONCLUSIONS

The use of human factors of perception and response to immediate hazards discussed in this paper shows why lane sharing works as a motorcycle rider safety practice. Specifically, it is highly unlikely that a motorcycle rider would be able to avoid a pending contact to the rear of their motorcycle. For comparison, a lane sharing motorcycle has a good chance of avoiding a collision altogether. Lane sharing effectively removes the motorcycle rider from a high probability collision situation and places the rider in a low probability collision situation. This represents an effective collision reduction motorcycle rider safety practice.

This paper primarily looked at the crash reduction of a motorcycle being rear-ended by a trailing vehicle. But lane sharing also has the potential to reduce rear-end crashes by a motorcycle colliding with the rear of a vehicle ahead. Furthermore, a rider who has lane sharing experience should be mentally prepared to use the escape route represented by the path along the side of or between two vehicles. In other words, a rider approaching the rear of stopped or suddenly stopping traffic should have the option and the ability to use the roadway space beside a vehicle to avoid a rear-end collision. Without the experience of lane sharing, there is a high potential for riders not to use the escape space between two vehicles.

Looking at the available data for the United States and relating it to the practice of lane sharing by motorcycle riders gives strong evidence that lane sharing could save the lives of a significant number of motorcyclists in the United States. Furthermore, the NHTSA data indicates that the most effective rider safety practice is mandatory Universal Helmet Laws in all states. The NHTSA data also shows that 19 states and Washington, DC have mandatory universal helmet laws. Regarding the 19 Universal Helmet Law states, the question becomes what is the next motorcycle rider safety practice that can be implemented in these states? Lane sharing represents a possible next step in motorcycle rider safety for these states.

With the current data a universal lane sharing law in the United States could be up to 35% as effective as a universal helmet law in the United States for fatal motorcycle crashes under the prevailing riding conditions. Due to the lack of specific information for lane sharing, there is a high possibility for a greater percentage of effectiveness when lane sharing is compared to helmet usage. A higher percentage of effectiveness also means the estimated 98-178 motorcycle rider lives saved and 18,000 fewer motorcycle rider injury numbers would also increase.

Final note, some of the injury and fatal data used for this paper is general overall crash data rather than specific motorcycle crash data. Therefore, some of the conclusions are best estimates for the information available.

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