MOTORCYCLE LANE-SHARING

Literature Review

Oregon Department of Transportation

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by

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16. Abstract This report examines the use of lane-sharing (also sometimes referred to as lane-splitting and filtering) nationally and internationally and includes discussions on motorcycle and driver (auto) safety, and the potential benefits of lane-sharing.		
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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3
	NOTE: Volumes greater than 1000 L shall be shown in m^3.			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit	(F-32)/1.8	Celsius	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
m^2	meters squared	1.196	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
ml	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius	1.8C+32	Fahrenheit	°F

*SI is the symbol for the International System of Measurement

MOTORCYCLE LANE-SHARING

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1.0 INTRODUCTION

In the past decade, the United States has experienced a large increase in motorcycle endorsements and registrations. This influx, coupled with growing concerns over traffic congestion and limited resources, has created interest in the potential use of motorcycle lane-sharing. While mostly prohibited in the United States, with the exception of California, motorcycle lane-sharing, also known as lane-splitting or filtering, is a common practice in many countries around the world. Lane-sharing allows motorcycles to take advantage of parts of the road not being utilized by allowing them to pass between lanes of stopped or slower-moving vehicles.

Allowing motorcycles to move more freely through traffic could help reduce overall congestion, and potentially reduce some types of motorcycle crashes. In some cases, it may also reduce motorcycle riders' travel times and create an incentive for people to switch travel modes. This switch could be environmentally beneficial as motorcycles have much greater fuel efficiency than automobiles, emit less greenhouse gasses, and also contribute less wear to the roads and infrastructure.

There are, however, significant safety concerns regarding motorcycle lane-sharing. A motorcycle traveling between rows of moving vehicles in the same lane is vulnerable to different threats, such as vehicles suddenly changing lanes or opening doors (*California DMV 2009*). Lane-sharing motorcycles also travel over road surface that is not designed for prolonged traffic, including painted lines, road seams, and reflective markers (*Aiello 2008*). Additionally, lane-sharing riders have encountered vehicles that intentionally maneuver to block them from advancing in an effort to have them "wait their turn." Vehicle passenger safety is also of concern as lane-sharing may reduce an operator's ability to predict, and therefore, react to traffic movement around them.

This report examines the use of lane-sharing nationally and internationally and includes discussions on motorcycle and driver (auto) safety, and the potential benefits of lane-sharing.

1.1 DEFINING LANE-SHARING

Lane-sharing refers to passing between lanes of stopped or slower moving vehicles on a motorcycle (*NHTSA 2000*). In some cases, the term "filtering" has been used to specify moving between stationary traffic, while the term "lane-splitting" has been reserved for moving between traffic in motion (*FEMA 2010*).

For the purposes of this report, the terms lane-sharing, lane-splitting, and filtering will refer to the general practice of moving between either stopped or moving traffic unless specifically stated otherwise.

2.0 EXPERIENCES WITH LANE-SHARING

Experiences with lane-sharing are limited in the United States, where the practice is prohibited in all states except California. California's allowance of lane-sharing is unique in that the state does not have a code accepting the practice, but rather has no code or regulation banning it. Similarly, California does not have any laws against lane-sharing, and thus there is no formal enforcement protocol. Standard enforcement practice takes into account the context and advocates for safe operating speeds. Within California, data relative to lane-sharing is limited, as motorcycle accident reports do not evaluate lane-sharing as a potential causation factor.

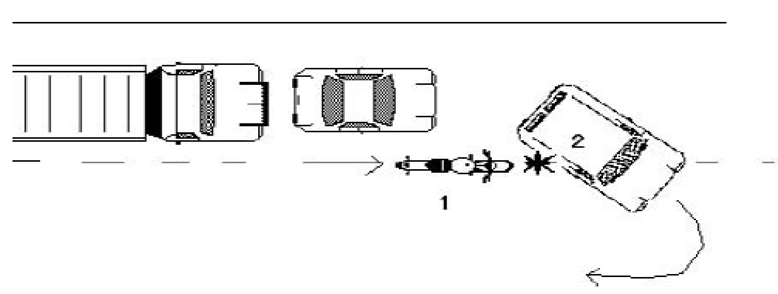
In contrast to the United States, locations such as the United Kingdom (UK) have allowed lane-sharing for some time and reports have been produced which have evaluated lane-sharing among other motorcycle safety factors. In general, results from the UK show that the predominant safety issue with lane-sharing is the violation of "driver expectation," where drivers of automobiles do not expect motorcycles to pass them in stopped or slow-moving traffic, and as a result, often turn into motorcycles (*Sexton, Fletcher and Hamilton 2004*; *Clarke et al. 2004*; *Crundall et al. 2008*). An example of such an incident was presented in a 2004 UK report (*Clarke et al.*), which is shown in Figure 2.1.

Figure 8: An example of a driver causing an accident by failing to take into account possible motorcycle riding strategies in heavy traffic

Story:

It was dark on a fine December evening. It was not raining but the road was damp. The rider (M,47) of a Honda CBR600 motorcycle (1) was passing a queue of stationary traffic on a single carriageway A class road with a 60 mph limit when the driver (M,56) of a Vauxhall Astra Van (2) pulled out of the line of traffic with the intention of making a U-turn and collided with the motorcyclist who was knocked from his bike and sustained an black eye, bruised nose and sprained shoulder. Driver 2 admitted to not seeing the motorcycle and not looking properly after assuming that the vehicles behind were stationary, he had clearly not considered the possibility of a motorcycle passing the traffic. Several witnesses clearly put the blame with driver 2 who was charged with driving without due care and attention. One witness however thought the motorcyclist was travelling a little fast but there is no evidence to support this.

Diagram:



Source: *Clarke et al. 2004, p. 25*

Figure 2.1: Example storyboard of a lane-sharing/filtering accident.

A summary of potential benefits of lane-sharing as well as safety considerations is included at the end of this section.

2.1 UNITED STATES

Lane-sharing is mostly prohibited in the United States, and there are no national studies on the topic. However, one of the most comprehensive motorcycle studies, known as the "Hurt Report" (*Hurt et al. 1981*), touched on motorcycle safety as a whole and represents one of the most in-depth studies to date.

The benchmark study led by researcher Harry Hurt, *Motorcycle Accident Cause Factors and Identification of Countermeasures,* was completed in 1981. The researchers completed 900 in-depth on-site accident investigations in Los Angeles, California, providing a comprehensive look at variables affecting motorcycle safety, including: accident characteristics, vehicle factors, injuries, and protection systems. This study has been cited for finding that lane-sharing may have safety benefits. The National Highway Traffic Safety Administration (NHTSA) in its *National Agenda for Motorcycle Safety* (*2000*) states that "there is evidence (*Hurt*, 1981) that traveling between lanes of stopped or slow-moving cars (i.e., lane-splitting) on multiple-lane roads (such as interstate highways) slightly reduces crash frequency compared with staying within the lane and moving with other traffic". However, an article summarizing an interview with Hurt in 1999 stated that Hurt "pointed out that the research from the late 1970s only hinted that lane-splitting didn't show up as a significant factor in accidents" (*Hough*).

Findings from the Hurt Report include the following (*Hurt 1981*):

- The failure of motorists to detect and recognize motorcycles in traffic is the predominating cause of motorcycle accidents. The driver of the other vehicle involved in collision with the motorcycle did not see the motorcycle before the collision, of [sic] did not see the motorcycle until too late to avoid the collision (*p. 416*).
- Approximately two-thirds of the accidents occurred at intersections (*p.54*).
- Moderate or heavy traffic was the situation at 59.2% of the accidents. The congestion associated with this traffic underlies the importance of obstacles to vision and the role of motorcycle conspicuity (*p. 57*).

To date, the Hurt Report is the most recent comprehensive motorcycle safety study in the United States. While parts of the Hurt Report may still be valid today, it was published nearly 30 years ago. Since 1981, much about motorcycles, motorcycle riders, and the roads upon which they operate have changed. The National Highway Traffic Safety Administration (NHTSA) describes some of these changes as follows (*NHTSA 2000*):

- Motorcycle design has evolved so that motorcycle types—sportbikes and cruisers—that did not exist in the '70s are now the majority of those seen on the streets.
- Motorcycles have increased in cost, engine size, and power; suspension systems have changed drastically, fuel tank design has changed, there are new brake systems, and lights come on automatically when the engine is running.
- Motorcyclists have changed: Currently, the average motorcyclist is 38 years old. In 1980, the average age was 24. Also, more women are riding motorcycles than ever before.

- Mandatory helmet use laws, often with significantly different requirements, have been enacted, repealed—or both—in many states.
- State motorcycle-operator licensing requirements and operator training are generally more stringent and rigorous.
- The motor vehicle population has changed significantly. New vehicle types such as sport utility vehicles (SUVs) that are larger and higher than most automobiles are now commonplace.

2.1.1 Future Research

In 2005, as part of the reauthorization of transportation legislation SAFETEA-LU, a motorcycle crash causation study was mandated. Originally, this study was expected to encompass approximately 900 cases, however because of funding challenges, the study has since been scaled down to 300 cases.

In preparation for the comprehensive study, a pilot study was conducted to evaluate the use of the Organization for Economic Cooperation and Development (OECD) methodology. It included 53 on-site crash investigations (completed in California). These cases are expected to be used as part of the 300 total cases. Through an exchange with Jessica Cicchino (*2010*), the study's project manager, the pilot study report is expected to be published by summer 2010. Jessica Cicchino, as well as the project manager for the comprehensive study, Dr. Carol Tan (*2010*), confirmed that the OECD variables relating to lane-sharing (i.e. filtering between lanes, lateral motion only; and filtering forward between lanes, both longitudinal and lateral motion) would be included in both the pilot and comprehensive study.

Having variables documenting filtering behaviors as part of in-depth accident investigations may help to provide information on the safety impacts of lane-sharing. Because the study is expected to only have one location, (*FHWA 2009*), it is unlikely that comparisons will be able to be made regarding places that allow lane-sharing, such as California, versus places that do not.

2.1.2 California

As stated in the introduction to this section, California represents the only location in the United States that currently allows motorcycle lane-sharing. Vehicle codes relevant to the practice and information on enforcement are presented below.

2.1.2.1 Vehicle Codes

While California has been recognized as the only location in the United States allowing lane-sharing, the practice is not specifically referenced in California's driving codes. The current California codes relating to lane-sharing are as follows (*California DMV 2010a)*:

> 22350. No person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and

> the surface and width of, the highway, and in no event at a speed which endangers the safety of persons or property.
>
> 21658. Whenever any roadway has been divided into two or more clearly marked lanes for traffic in one direction, the following rules apply:
>
>> (a) A vehicle shall be driven as nearly as practical entirely within a single lane and shall not be moved from the lane until such movement can be made with reasonable safety.
>>
>> (b) Official signs may be erected directing slow-moving traffic to use a designated lane or allocating specified lanes to traffic moving in the same direction, and drivers of vehicles shall obey the directions of the traffic device.
>
> 22107. No person shall turn a vehicle from a direct course or move right or left upon a roadway until such movement can be made with reasonable safety and then only after the giving of an appropriate signal in the manner provided in this chapter in the event any other vehicle may be affected by the movement.

This varies greatly from other states such as Oregon, for which there is a code specifically making lane-sharing illegal (see Oregon Code in Appendix A).

2.1.2.2 Practice and Enforcement

The *California Motorcycle Handbook* (*California DMV 2009*) states that "lane sharing is **not** safe" and that people should discourage lane-sharing by others. Recommendations are made to discourage lane-sharing by having drivers of other vehicles keep a center lane position, especially during heavy, bumper-to-bumper traffic. If lane-sharing is to be done, the Handbook suggests maintaining an adequate space cushion.

No research was found that evaluated the safety of lane-sharing in California. In March 2010 the California DMV was contacted and it was confirmed that no data was available (*California DMV 2010b*). Partially, data on lane-sharing is not available because the California Highway Patrol (CHP) does not list it as a factor in accident reports. The CHP considers factors such as excessive speed, unsafe lane changes, improper passing, and following too closely as being related to lane-sharing. In 1999, the CHP found these factors influenced 2,822 of the 7,163 motorcycle fatal and injury accidents in the state (*Squatriglia 2000*).

The California Highway Patrol's enforcement of lane-sharing is based on officer judgment of whether the lane-sharing was done in a safe and prudent manner (*CHP 2010*). In a *San Francisco Chronicle* article, CHP Officer Cliff Kroeger states that "the issue that we look at is the speed at which it occurs…" and "the question is, 'at what speed does it become unsafe?' That's up to the individual officer to decide. It depends how fast traffic is going at the time" (*Squatriglia 2000*). The article goes on to say that, "not everyone follows it, but the general rule of thumb among motorcyclists is to stick to the No. 1 and No. 2 lanes and go no more than 10 or 15 mph faster than traffic when lane splitting."

2.2 EUROPE

In 2009 Europe completed the Motorcycle Accident In-Depth Study (MAIDS). The study included 921 in-depth investigations in five sampling areas located in France, Germany, Italy, the Netherlands and Spain. The research examined collision dynamics including pre-crash motions prior to the crash (Table 2.1). Included in these motions were the lane-sharing behaviors of filtering forward between lanes longitudinally, as well as filtering forward between lanes both longitudinally and laterally (see shaded rows). Out of the 921 crashes investigated, 4 (0.4%) were engaged in filtering as the pre-crash motion. Comparatively, 26 (2.8%) accidents occurred while the motorcycle[1] (referred to as the powered two-wheeler (PTW)) was stopped in traffic with a speed of zero, and 452 (49.1%) occurred with the PTW moving in a straight line with constant speed.

Table 2.1: Motorcycle/PTW Pre-crash Motion Prior to Precipitating Event

	Frequency	Percent
Stopped in traffic, speed is zero	26	2.8
Moving in a straight line, constant speed	452	49.1
Moving in a straight line, throttle off	39	4.2
Moving in a straight line, braking	22	2.4
Moving in a straight line, accelerating	108	11.7
Turning right, constant speed	7	0.8
Turning right, throttle off	1	0.1
Turning right, accelerating	1	0.1
Turning left, constant speed	6	0.7
Turning left, throttle off	3	0.3
Turning left, braking	3	0.3
Turning left, accelerating	2	0.2
Stopped at roadside, or parked	1	0.1
Making Y-turn left	1	0.1
Changing lanes to left	9	1.0
Changing lanes to right	10	1.1
Merging to left	1	0.1
Entering traffic from right shoulder, median, or parked	2	0.2
Passing maneuver, passing on right	3	0.3
Passing maneuver, passing on left	53	5.8
Travelling wrong way, against opposing traffic	8	0.9
Stripe-riding, filtering forward between lanes, longitudinal motion	1	0.1
Filtering forward between lanes, both longitudinal and lateral motion	3	0.3
Collision avoidance maneuver to avoid a different collision	7	0.8

[1] It should be noted that the term "motorcycle" or "powered two-wheeler" in Europe may refer to a broader group of vehicles than the U.S., including: motorbikes, sport bikes, mopeds, and scooters.

	Frequency	Percent
Negotiating a bend, constant speed	111	12.1
Negotiating a bend, throttle off	10	1.1
Negotiating a bend, braking	12	1.3
Negotiating a bend, accelerating	14	1.5
Other	5	0.5
Total	921	100.0

Source: *MAIDS 2009*

After the precipitating event leading to the crash, motorcyclists may attempt a collision-avoidance maneuver or continue on their path. Table 2.2 displays the post-event, pre-crash, movement of the PTW. In this case filtering behaviors after the event accounted for 0.5% (n=5), while 63.7% (n=586) moved in a straight line.

Table 2.2: PTW pre-crash motion after precipitating event

	Frequency	Percent
Stopped in traffic, speed is zero	6	0.7
Moving in a straight line, constant speed	289	31.4
Moving in a straight line, throttle off	41	4.5
Moving in a straight line, braking	175	19.0
Moving in a straight line, accelerating	81	8.8
Turning right, constant speed	6	0.7
Turning right, throttle off	7	0.8
Turning right, braking	5	0.5
Turning right, accelerating	1	0.1
Turning left, constant speed	14	1.5
Turning left, throttle off	5	0.5
Turning left, braking	14	1.5
Turning left, accelerating	16	1.7
Stopped at roadside, or parked	1	0.1
Making U-turn left	1	0.1
Changing lanes to left	8	0.9
Changing lanes to right	13	1.4
Merging to left	2	0.2
Merging to right	2	0.2
Leaving traffic, turn out to right	2	0.2
Passing maneuver, passing on right	6	0.7
Passing maneuver, passing on left	56	6.1
Crossing opposing lanes of traffic	5	0.5
Travelling wrong way, against opposing traffic	9	1.0
Stripe-riding, filtering forward between lanes, longitudinal motion	1	0.1
Filtering between lanes, lateral motion, only	1	0.1
Filtering forward between lanes, both longitudinal and lateral motion	3	0.3
Collision avoidance manoeuvre to avoid a different accident	8	0.9
Negotiating a bend, constant speed	54	5.9
Negotiating a bend, throttle off	22	2.4
Negotiating a bend, braking	29	3.1

	Frequency	Percent
Negotiating a bend, accelerating	9	1.0
Other	28	3.0
Unknown	1	0.1
Total	921	100.0

Source: *MAIDS 2009*

In addition to the findings relating to lane-sharing, MAIDS primary findings include the following (*Maids 2009, p.69*):

- More than 60% of the PTWs and 55% of [Other Vehicles] OVs were traveling in a straight line prior to the precipitating event and 64% continued in a straight line up to impact.
- PTW accidents occur in a wide variety of different impact configurations (i.e., many different relative heading angles).
- 90% of all OVs were to the front of the PTW rider and 60% of the PTWs were to the front of the OV, at the time of the precipitating event.
- In multiple vehicle crashes, 71.2% of the PTW operators attempted some sort of collision avoidance maneuver (49.3% by braking, 16.2% by swerving). 64.9% of the OV drivers attempted no collision avoidance maneuver.

These findings suggest that despite the legality of lane-sharing in the study areas of MAIDS, crashes with lane-sharing related behaviors make up a relatively small percentage of total crashes. The majority of motorcyclists in the study were traveling straight with 90% of the vehicles they crash with being in front of them.

2.2.1 United Kingdom

As of 2008, motorcycles accounted for 1% of all traffic in the UK (*DfT 2009*). Since 1997, fatalities have risen, increasing at a proportionately greater rate than registrations and vehicle miles traveled (VMT) (*DfT 2009*).

In the UK lane-sharing is most commonly referred to as filtering. For several locations in the UK, filtering is explicitly investigated as a causation factor in motorcycle accidents.

Some of the most recent analysis of crashes (1997-2008 data) found that overtaking/filtering[2] was a factor in 19% of multi-vehicle motorcycle accidents, and when three or more vehicles were involved that percent increased to 33% (*Dtf Transport 2009*).

More specific to filtering, a study by Clarke et al. (*2004*) found that:

- Filtering was a factor in a total of 5% of the motorcycle accidents studied.
  - The person at fault for these accidents was more than twice as likely to be the other driver.

[2] Where crash statistics are cited for “overtaking/filtering” the categories were combined.

- The greatest frequency of overtaking/filtering accidents occurred on weekdays and during peak travel times.

- Nearly half (48.9%) of motorcycles involved in an overtaking/filtering accident had engine capabilities above 600cc.

- Motorcycles categorized as "sports tourer" were significantly overrepresented in overtaking/filtering accidents. (Other bike categories included: tradition, supersport, moped, and scooter.)

Similar to the Clarke et al. (*2004*) finding that drivers tend to be at fault in accidents where filtering is a factor, a separate study in Scotland found that "drivers on built-up road are more likely to cause the accident than the motorcyclist. Drivers do not expect, see, or register that motorcycles may be alongside them when they are stationary or waiting to join (or leave the queue of traffic)" (*Sexton, Fletcher and Hamilton 2004*, p. 3). The Scotland study recommended that both drivers and motorcyclists need to be made aware of the dangers of filtering.

An example of an effort to raise awareness towards filtering is in Surrey County, near London. The county has developed posters warning drivers that filtering may occur. The poster reads "WARNING // FILTERING" (*Surrey County Council 2010*) (Figure 2.2).

Source: *Surrey County Council 2010*

Figure 2.2: Filtering Warning Poster.

2.3 POTENTIAL BENEFITS OF LANE-SHARING

The interest in lane-sharing originates from the concept of keeping the motorcycle in motion. One of the early benefits recognized for lane-sharing was to help keep air-cooled motorcycle engines from overheating (*Aiello 2008*). When kept in motion, the engines are cooled by the air flowing over the fins, but when stopped there is no mechanism for cooling. However, advances in motorcycle technology and the greater proliferation of water-cooled engines have made the overheating issue relatively mute, allowing motorcycles to operate in hot temperatures and slow-moving traffic.

More recent commonly mentioned benefits of lane-sharing include: congestion reduction, reduced motorcycle travel times and increased reliability, modal shift, emission reduction, etc. While these benefits are frequently cited, their value has rarely been quantified.

The degree to which a motorcycle impacts congestion, relative to a car, is not well measured, especially when lane-sharing is practiced. The article *Motorcycles as a Full Mode of Transportation* assumes that the relationship is not equal, as evidenced by research showing motorcycles as a 0.5 equivalent to car capacity in free-flowing freeway conditions and when lane-sharing at stoplights (leaving the stopline six or more seconds after a green light) (*Wigan*

2002). The capacity difference is recognized in London, where motorcycles are exempt from the Central Area London Congestion Charge.

In addition to contributing to congestion reduction by the capacity/size differential, motorcycles help to free additional space when lane-sharing. When motorcycles move from the travel lane to the center line space is created. Because the capacity savings are influenced by the volume of lane-sharing and vehicle mix, the benefit varies.

Relative to the motorcyclist themselves, benefits of lane-sharing include reduced travel time and increased travel time reliability. These benefits are achieved by keeping the motorcycle in motion and passing stopped or slow-moving traffic. The Wigan report cites research from Melbourne, Australia (a location where lane-sharing is allowed), which shows that between the modes of bicycle, car, train, bus, motorcycle, and train, the highest average speeds and third-shortest trip times were for motorcycles (*2002*).

According to survey results from the UK, the potential for reduced travel time and increased travel time reliability have made the practice of lane-sharing more attractive. The study found that "wide lanes are highly valued by motorcyclists who can use the additional width to filter through congested areas and reduce their travel time variability" (*DfT 2004, p. 75*). The results were confirmed by a study by Burge et al. (*2007*) which utilized a preference survey to examine the policy choice of widening lanes to allow for lane-sharing versus not widening lanes. Results from the survey of motorcycle owners found that "a positive coefficient was seen for wide lanes that allow motorcyclists to filter, indicating both that motorcycles become a more attractive proposition when the road layout makes this possible and that motorcyclists are reluctant to filter when space is inadequate" (*Burge et al. 2007, p. 67*). While the study only sampled the preferences of motorcycle owners, it was suggested that the results could be calibrated in some way to relate to the entire population and show the relationship of lane-sharing to mode shift (car to motorcycle).

Another benefit of lane-sharing comes from the perspective of law enforcement, who can take advantage of filtering by sending motorcycles through congested traffic in order to better respond to incidents. The California Highway Patrol was quoted in a San Francisco newspaper as "embrac[ing] lane splitting because it allows a quicker response to emergencies" (*Squatruglia 2000*).

2.4 LANE-SHARING SAFETY CONSIDERATIONS

Lane-sharing presents unique safety considerations due to the fact that motorcycles are allowed in spaces not designed for such traffic and where movement is not expected. Accidents pose a risk for property damage and injury, where the seriousness of injury is greatest for motorcyclists.

Research on the safety impacts of lane-sharing is the U.S. is nearly non-existent, where the most frequently cited study is the 1981 Hurt Report. The report did not directly discuss lane-sharing, but has been interpreted as providing evidence that lane-sharing is not a significant factor in motorcycle accidents.

A greater volume of research is available for Europe, where many studies have evaluated motorcycle accidents explicitly looking at lane-sharing as a causation factor. Findings have varied as to the percentage of motorcycle accidents which can be directly attributed to lane-sharing maneuvers. For example, a study by Clarke et al. (*2004*) found that lane-sharing was a factor in 5% of the motorcycle accidents studied; where as an in-depth study of motorcycle accidents in parts of Europe, the 2009 MAIDS study, attributed a total of 0.45% of all motorcycle accidents to lane-sharing maneuvers.

Not surprisingly research has shown that the safety risks for lane-sharing are higher during congested conditions, such as during weekdays and at peak hours—conditions when lane-sharing is typically practiced.

Overall, of accidents involving lane-sharing, the greatest issue is driver expectation, where a driver of a car in stopped or slow-moving traffic does not expect to be passed by an object traveling between lanes. This expectation has resulted in a predominance of sideswipe and turn-into-path accidents for lane-sharing related crashes.

Conversely to safety concerns with lane-sharing, a potential safety benefit is increased visibility for the motorcyclist. Splitting lanes allows the motorcyclist to see what the traffic is doing ahead and be able to proactively maneuver.

3.0 CONCLUSION

Lane-sharing, often referred to as lane-splitting or filtering, is the movement of motorcycles between lanes of stopped or slow-moving traffic. While the practice is allowed in California, it is prohibited in other parts of the United States. Experiences with lane-sharing in Europe and elsewhere have led to an interest of the practice in other areas of the U.S. In line with that interest, this report explored the use of lane-sharing nationally and internationally and discussed the potential benefits of lane-sharing along with safety concerns.

A review of literature relevant to lane-sharing revealed that research on the topic is limited. No studies were found that primarily focused on the benefits or safety concerns of the practice. Benefits were often cited in motorcyclist advocacy publications and enthusiast articles. Quantitative data were limited and more generally related to capacity and emission benefits of motorcycles relative to cars.

Relevant to the safety implications of lane-sharing, motorcycle crash causation studies provided the most direct information on lane-sharing. Studies, such as the 1981 Hurt report and the 2009 MAIDS report, considered lane-sharing as a causation factor. Statistics from these and other publications showed that lane-sharing was a factor in <1% to 5% of motorcycle accidents. Because studies incorporating lane-sharing as a potential causation factor are limited, the range presented above should be considered with caution.

From the review of literature it is clear that additional research on lane-sharing is needed. Little information currently exists; most of which is part of large crash studies where lane-sharing is not the primary focus. One of the limiting factors for these studies is that crash investigations are expensive, often requiring an on-call team of experts. The in-progress Crash Causation Pilot Study (*forthcoming*) estimates a cost of $7,500 per crash investigation (*FHWA 2009*). Other options for researching lane-sharing include pilot test studies and incorporating a lane-sharing variable into accident reporting. For locations newly allowing lane-sharing, methods for collecting benefit and safety data should be considered so that the understanding of the impacts of lane-sharing may be more fully considered in the future.

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APPENDIX A:
OREGON VEHICLE CODE PROHIBITING LANE-SHARING

Oregon Code

The Oregon code relevant to lane-sharing is as follows (*Oregon DMV 2007*):

> 814.240 Motorcycle or moped unlawful passing; penalty.
>
> > (1) A motorcycle operator or moped operator commits the offense of motorcycle or moped unlawful passing in a lane with a vehicle if the operator does any of the following:
> >
> > > (a) Overtakes and passes in the same lane occupied by the vehicle the operator is overtaking, unless the vehicle being passed is a motorcycle or a moped.
> > >
> > > (b) Operates a moped or motorcycle between lanes of traffic or between adjacent lines or rows of vehicles.
> >
> > (2) This section does not apply to a police officer in the performance of official duties.
> >
> > (3) The offense described in this section, motorcycle or moped unlawful passing in a lane with a vehicle, is a Class B traffic violation.