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16. Abstract

In 2005 there were 4,553 motorcycle rider fatalities, of which 2,021 (44%) were from single-vehicle crashes and 2,532 (56%) were from multivehicle motorcycle crashes. Of the 2,532 fatalities from multivehicle motorcycle crashes, 2,260 (89%) were from two-vehicle motorcycle crashes. More than 85 percent of the 2,260 motorcycle riders killed in two-vehicle crashes were in crashes involving passenger vehicles. Among the fatalities in two-vehicle crashes involving motorcycles and passenger vehicles, 98 percent of the fatalities were motorcycle riders and only 2 percent of the fatalities were passenger vehicle occupants. With such a high proportion of motorcycle rider fatalities in two-vehicle motorcycle crashes, this report was written to provide insight into the possible factors in these crashes. The analysis is based on 2001-2005 data from the Fatality Analysis Reporting System (FARS).

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1. EXECUTIVE SUMMARY

In 2005 there were 4,553 motorcycle rider fatalities, of which 2,021 (44%) were from single-vehicle crashes and 2,532 (56%) were from multivehicle motorcycle crashes. Two-vehicle crashes accounted for the vast majority of fatalities from multivehicle motorcycle crashes (2,260 or 89%). An overwhelming majority of motorcycle riders killed in two-vehicle crashes (more than 85%) were in crashes involving passenger vehicles. Among the fatalities in two-vehicle crashes involving motorcycles and passenger vehicles, 98 percent of the fatalities were motorcycle riders and only 2 percent of fatalities were passenger vehicle occupants. With such a high proportion of motorcycle rider fatalities in two-vehicle motorcycle crashes, this report was written to provide an understanding of the factors in these two-vehicle crashes.

Nearly 62,000 motorcycle riders died in multivehicle motorcycle crashes between 1975 and 2005. Of these, 56,000 were killed in two-vehicle motorcycle crashes. Motorcycle rider fatalities in two-vehicle crashes reached a peak of 2,740 in 1980 and a low of 1,063 in 1997. However, between 1997 and 2005 motorcycle rider fatalities in two-vehicle motorcycle crashes increased to 2,260, an increase of 113 percent. Similar increasing trend between 1997 and 2005 has also been observed among motorcycle rider fatalities in single-vehicle crashes (116%). The increase in the number of fatal motorcycle crashes between 1997 and 2005 to some extent can be attributed to the increased exposure in number of registered motorcycles and vehicle miles traveled (VMT).

1.1 Purpose

The purpose of this report is to:

- Analyze fatal two-vehicle motorcycle crashes for trends and crash characteristics using FARS (Fatality Analysis Reporting System) data;
- Identify possible factors relating to the drivers/operators in these crashes.

1.2 Methodology

The analytical approach involved several steps. First, a review of the data source was conducted to determine the crash data elements relevant to these fatal two-vehicle motorcycle crashes within FARS. The data elements were then analyzed for identifying possible factors within the crash and for identifying the role of the vehicles and driver/operator actions at the time of the crash. Data trends in two-vehicle motorcycle crashes for the past five years (2001-2005) were analyzed. Since the focus is to understand the factors in these two-vehicle motorcycle crashes in which the motorcycle operator was killed, data from the most recent year (2005) was analyzed for crash characteristics, vehicle, and driver/operator role.

1.3 Findings

Findings from the analysis of FARS data provide possible reasons and understanding behind the two-vehicle motorcycle crashes and could aid in the design of crash prevention programs. Findings in this section are divided into two categories: (1) findings from five-year two-vehicle motorcycle crash trend data and (2) findings based on characteristics of two-vehicle motorcycle crashes from the most recent year (2005):

(1) Findings based on two-vehicle motorcycle crash trend (2001-2005) data:

- Among fatal motorcycle crashes, nearly 55 percent of the crashes were multivehicle crashes -- crashes involving a motorcycle and another vehicle (one or more).

- Of the motorcycle rider fatalities from multivehicle crashes about 90 percent were from two-vehicle crashes, involving a motorcycle and another vehicle.

- An overwhelming majority (more than 85%) of the motorcycle riders killed in two-vehicle crashes were crashes involving passenger vehicles.

- Among the fatalities in two-vehicle crashes involving motorcycles and passenger vehicles, 90 percent were operators of motorcycles, 8 percent were the passengers of motorcycles and the remaining 2 percent were occupants of passenger vehicles.

(2) Findings based on characteristics of two-vehicle motorcycle crashes in which the motorcycle operator was killed from 2005:

- In nearly three-fourths of these crashes, the role of the motorcycle was recorded as the striking vehicle.

- Alcohol involvement among motorcycle operators killed was almost 2.5 times the alcohol involvement of the passenger vehicle drivers involved in these crashes.

- Nearly one-fourth (24%) of the motorcycle operators killed in two-vehicle crashes involving passenger vehicles, had an invalid license at the time of the crash compared to 8 percent of the passenger vehicle drivers.

- Of the motorcycle operators who were killed in these crashes, 27 percent were speeding at the time of the crash compared to 4 percent of the passenger vehicle drivers.

- Of the front-to-side crashes involving motorcycles and passenger vehicles, where one vehicle collided with the other at right angles, in 78 percent of the crashes the role of the motorcycle was recorded as the striking vehicle.

- In 55 percent of the head-on two-vehicle crashes involving motorcycles and passenger vehicles, the role of the motorcycle was recorded as the striking vehicle.

- In 68 percent of the rear-end crashes involving motorcycles and passenger vehicles, the role of the motorcycle was recorded as the striking vehicle.

- Of the motorcycle operators killed in two-vehicle crashes involving passenger vehicles, 49 percent had a previous driving violation recorded on their license at the time of the crash.

- For the passenger vehicle drivers involved in two-vehicle motorcycle crashes, 35 percent of the driver-related factor was failure to yield right-of-way compared to only 4 percent for motorcycle operators.

- There were 1.5 times as many two-vehicle motorcycle crashes involving passenger vehicles in 2005 during weekends than during weekdays.

- More than 90 percent of the two-vehicle motorcycle crashes involving passenger vehicles occurred on non-interstate roadways (in both urban and rural areas).

- Of the two-vehicle motorcycle crashes involving passenger vehicles, nearly 6 out of 10 occurred on urban roadways.

- More than 70 percent of these crashes occurred from May to October, which correlates to the peak motorcycle riding season.

- In 13 percent of the two-vehicle motorcycle crashes involving passenger vehicles, braking was reported as a crash avoidance maneuver by the motorcycle operators.

- Twenty-eight percent of the motorcycle operators killed in two-vehicle motorcycle crashes involving passenger vehicles were in the 20 to 29 age group, followed by 21 percent for the 40 to 49 age group and 20 percent for the 30 to 39 age group.

- Of the motorcycle operators killed in these crashes, 97 percent were males and 3 percent were females.

2. INTRODUCTION

In 2005, motorcycles made up 2.5 percent of all registered vehicles in the United States and accounted for only 0.4 percent of all vehicle miles traveled (VMT). However, in the same year, motorcyclists accounted for 10.5 percent of total traffic fatalities. Per 100,000 registered vehicles, the fatality rate for motorcyclists (73.12) in 2005 was 5.4 times the fatality rate for passenger car occupants (13.64). Per vehicle mile traveled in 2005, motorcyclists (42.27) were about 37 times as likely as passenger car occupants (1.14) to die in motor vehicle traffic crashes.

Nearly 62,000 motorcycle riders died in **multivehicle motorcycle crashes** between 1975 and 2005. Of these, 56,000 (90%) motorcycle riders died in two-vehicle crashes. Only two-vehicle motorcycle crashes involving a motorcycle and another vehicle were chosen for analysis since it is easier to understand the role/interaction of the vehicles and the drivers in these crashes. This report focuses on vehicle and driver interaction factors in fatal two-vehicle motorcycle crashes from 2001-2005 in order to understand possible causes for these crashes.

The purpose of this report is to:

- Examine motorcycle rider fatality data from NHTSA's FARS databases;
- Analyze two-vehicle motorcycle crash data within specific areas by looking for possible causes; and,
- Identify areas that may explain the possible vehicle and driver factors in fatal two-vehicle motorcycle crashes.

The following sections describe the data elements used in the analysis; analyze five-year (2001-2005) trend data in two-vehicle motorcycle crashes; delve more into the most current data (2005) for characteristics and role of the motorcycle operator, and the other driver in two-vehicle motorcycle crashes; highlight the findings; and summarize the implications for crash prevention programs.

3. ANALYTICAL APPROACH

The analytical approach for the report involved the following steps:

- Reviewing FARS data to determine the data elements of interest in two-vehicle motorcycle crashes and how these data elements could be combined;
- Formulating hypotheses about possible factors in fatal **two-vehicle motorcycle crashes**;
- Summarizing data that focuses on possible causes for motorcycle rider fatalities in two-vehicle motorcycle crashes;
- Analyzing data trends in the past five years (2001-2005) in two-vehicle motorcycle crashes; and
- In-depth analysis of two-vehicle motorcycle crash characteristics using the most recent 2005 data.

3.1 Trends

The focus of this report is to identify possible causes and the driver/operator interactions in fatal two-vehicle motorcycle crashes. To better understand fatal two-vehicle motorcycle crashes, we need to look at data trends of these crashes and data variables that can explain the role of the vehicles involved and the people involved in these crashes. This section looks at five-year trend data pertaining to two-vehicle motorcycle crashes.

3.1.1 Fatal Motorcycle Crashes by Crash Type

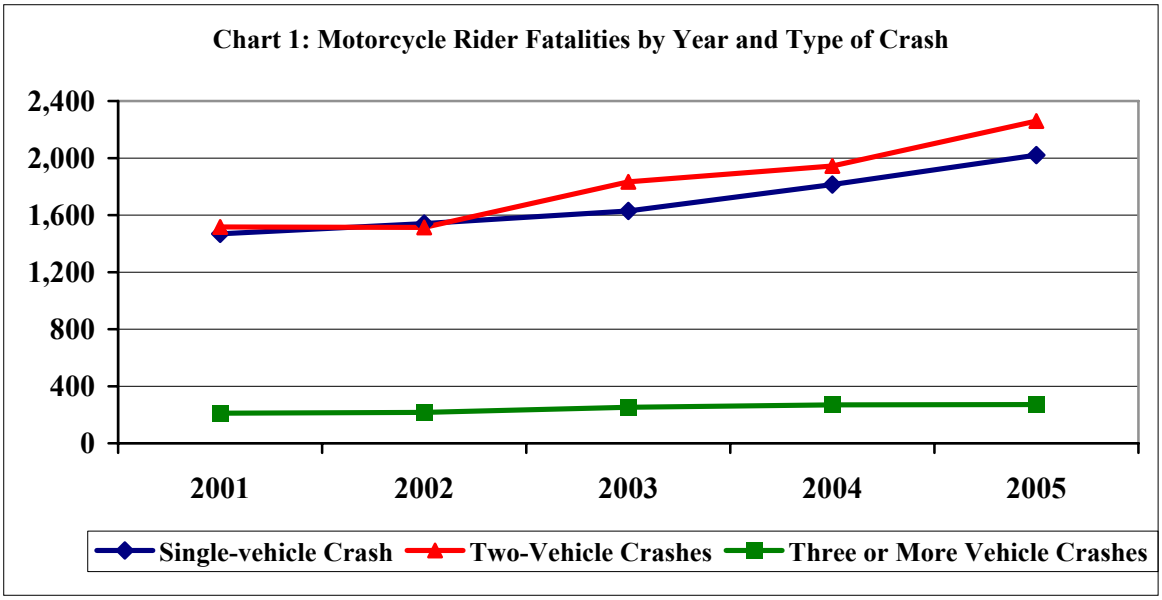
Among the fatal motorcycle crashes from 2001-2005, an average 46 percent of the crashes were single-vehicle crashes and the remaining 54 percent multivehicle crashes. Of the 54 percent multivehicle crashes, 48 percent of the crashes were two-vehicle motorcycle crashes and 6 percent were crashes involving three or more vehicles. In the past five years (2001-2005), single-vehicle motorcycle crashes have increased by 38 percent from 1,460 crashes in 2001 to 2,015 crashes in 2005, two-vehicle motorcycle crashes have increased by 49 percent from 1,479 crashes in 2001 to 2,207 crashes in 2005 and crashes involving three or more vehicles has increased by 28 percent from 208 crashes in 2001 to 267 crashes in 2005. However, the proportion of single-vehicle, two-vehicle, and three-or-more vehicle motorcycle crashes during this time period has remained steady. The increase in motorcycle crashes in recent years can be attributed to some extent to the increased exposure. Table 1 shows the number and percent of fatal motorcycle crashes by year and type of crash. The data shows that among multivehicle crashes a majority are two-vehicle crashes involving a motorcycle and another vehicle.

Table 1 Fatal Motorcycle Crashes by Year and Type of Crash									
Year	Crash Type							Total	
	Single-Vehicle Crash		Multivehicle Crash						
			Two Vehicles		Three or More Vehicles		Total		
	#	%	#	%	#	%		#	%
2001	1,460	46	1,479	47	208	7	1,687	3,147	100
2002	1,535	48	1,481	46	208	6	1,689	3,224	100
2003	1,608	44	1,771	49	242	7	2,013	3,621	100
2004	1,802	46	1,886	48	261	7	2,147	3,949	100
2005	2,015	45	2,207	49	267	6	2,474	4,489	100
Source: NCSA, FARS 2001-2004 (Final), 2005 (ARF)									

3.1.2 Fatalities in Motorcycle Crashes by Crash Type

A review of motorcycle rider fatalities from 2001-2005 shows that, the proportions of fatalities from single-vehicle and multivehicle crashes has remained almost the same. In all the years majority of motorcycle rider fatalities have been in two-vehicle crashes, with the exception of 2002. Of the 2,532 motorcycle rider fatalities in 2005 from multivehicle crashes, 2,260 (about 90 percent) were from two-vehicle crashes involving a motorcycle and another vehicle. Table 2 shows the number and percent of motorcycle rider fatalities by year and type of crash. Chart 1 shows the motorcycle rider fatality trend in the past 5 years by type of crash.

Table 2 Motorcycle Rider Fatalities by Year and Type of Crash									
Year	Crash Type							Total	
	Single-Vehicle Crash		Multivehicle Crash						
			Two Vehicles		Three or More Vehicles		Sub Total		
	#	%	#	%	#	%		#	%
2001	1,469	46	1,517	47	211	7	1,728	3,197	100
2002	1,540	47	1,514	46	216	7	1,730	3,270	100
2003	1,629	44	1,833	49	252	7	2,085	3,714	100
2004	1,814	45	1,945	48	269	7	2,214	4,028	100
2005	2,021	44	2,260	50	272	6	2,532	4,553	100
Source: NCSA, FARS 2001-2004 (Final), 2005 (ARF)									



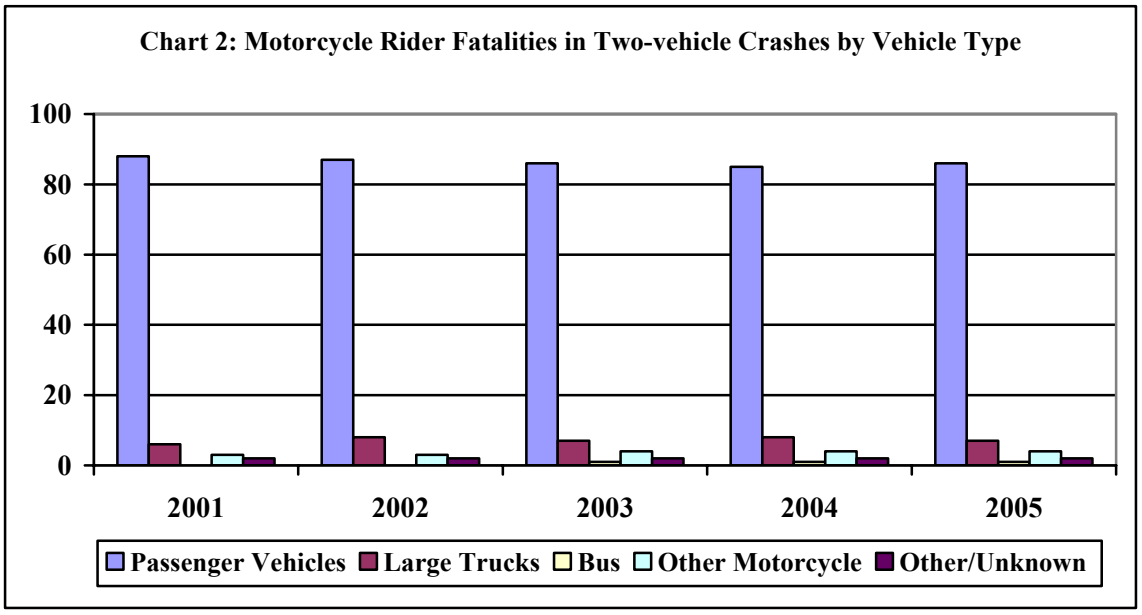
3.1.3 Motorcycle Rider Fatalities in Two-Vehicle Crashes by Vehicle Type

Among the motorcycle rider fatalities in two-vehicle motorcycle crashes, an overwhelming majority (more than 85%) were in crashes involving passenger vehicles (passenger cars and light trucks). Table 3 shows the number and percent of motorcycle rider fatalities in two-vehicle crashes by year and vehicle type of the other vehicle involved in the crash. The proportion of motorcycle rider fatalities involving passenger vehicles in two-vehicle motorcycle crashes has remained almost the same in the last 5 years (2001-2005).

Further analyses of data in the report will focus on two-vehicle fatal motorcycle crashes where one vehicle was a motorcycle and the other vehicle was a passenger vehicle. NHTSA defines passenger vehicles as comprising passenger cars and light trucks, with the light trucks consisting of pickups, sport utility vehicles and vans. Chart 2 shows 5-year trend data of motorcycle rider fatalities in two-vehicle motorcycle crashes by vehicle type.

Chart 5 shows the breakdown of motorcycle crashes and motorcycle rider fatalities in 2005, by the type of crash (single-vehicle/multivehicle). The flowchart categorizes crashes and fatalities starting with the overall numbers and splits it further, by the types of vehicles involved in two-vehicle motorcycle crashes.

Table 3 Motorcycle Rider Fatalities in Two-Vehicle Crashes by Year and Second Vehicle Type											
Year	Passenger Vehicles		Large Truck		Bus		Other Motorcycle		Other/ Unknown		Total
	#	%	#	%	#	%	#	%	#	%	
2001	1,340	88	90	6	6	0	45	3	36	2	1,517
2002	1,321	87	115	8	3	0	52	3	23	2	1,514
2003	1,583	86	130	7	13	1	76	4	31	2	1,833
2004	1,653	85	159	8	13	1	86	4	34	2	1,945
2005	1,935	86	166	7	18	1	88	4	53	2	2,260
Source: NCSA, FARS 2001-2004 (Final), 2005 (ARF)											



3.1.4 Motorcycle Rider Fatalities in Two-Vehicle Crashes by Passenger Vehicle Type

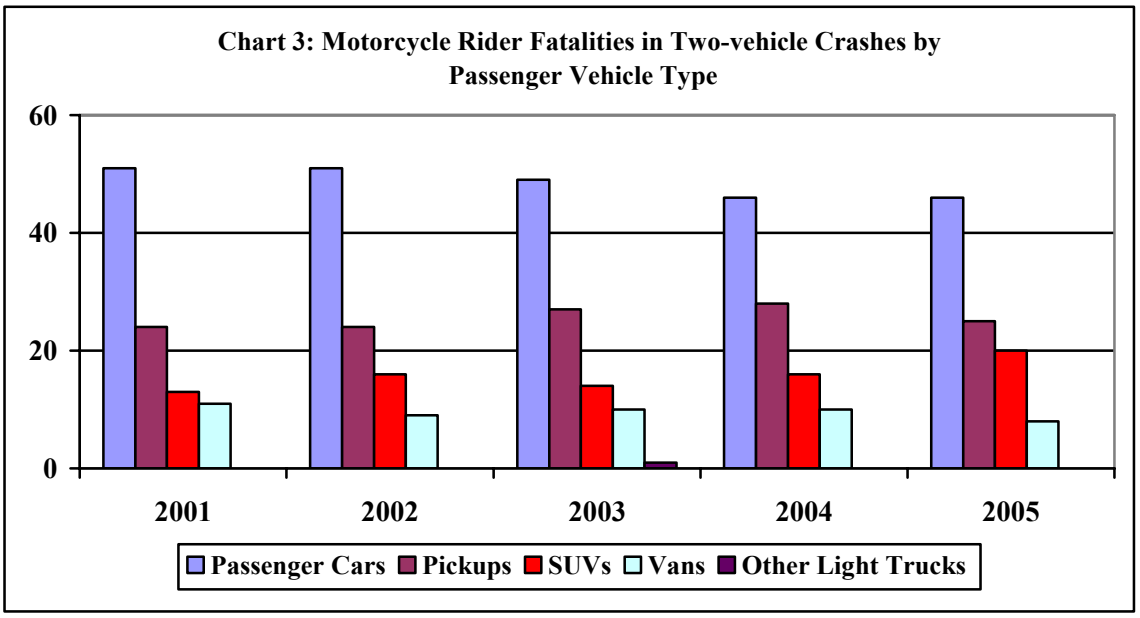
The number and percent of passenger vehicles involved in two-vehicle crashes with a motorcycle, by the type of passenger vehicle and year is shown in Table 4. About 50 percent of the motorcycle rider fatalities in two-vehicle motorcycle crashes involved passenger cars, followed by about 25 percent involving pickup trucks and about 25 percent involving vans and SUVs. The percentage of motorcycle rider fatalities involving passenger cars has decreased from 51 percent in 2001 to 46 percent in 2005, the percentage of motorcycle rider fatalities involving pickup trucks and vans has remained almost the same; however, the percentage of motorcycle rider fatalities involving SUVs has increased by 7 percentage points from 13 percent in 2001 to 20 percent in 2005. This could be due to the increase in SUV registrations in the past years. SUV registrations have in-

creased by 51 percent from 2001-2005. Chart 3 shows 5-year trend of motorcycle rider fatalities in two-vehicle motorcycle crashes by passenger vehicle type.

Table 4
Motorcycle Rider Fatalities in Two-Vehicle Crashes by Year and Second Vehicle Type Where the Second Vehicle Was a Passenger Vehicle

Year	Passenger Cars		Pickups		SUVs		Vans		Other Light Trucks		Total
	#	%	#	%	#	%	#	%	#	%	
2001	689	51	324	24	176	13	146	11	5	0	1,340
2002	671	51	322	24	208	16	117	9	3	0	1,321
2003	772	49	424	27	220	14	159	10	8	1	1,583
2004	755	46	459	28	262	16	172	10	5	0	1,653
2005	897	46	478	25	389	20	163	8	8	0	1,935

Source: NCSA, FARS 2001-2004 (Final), 2005 (ARF)



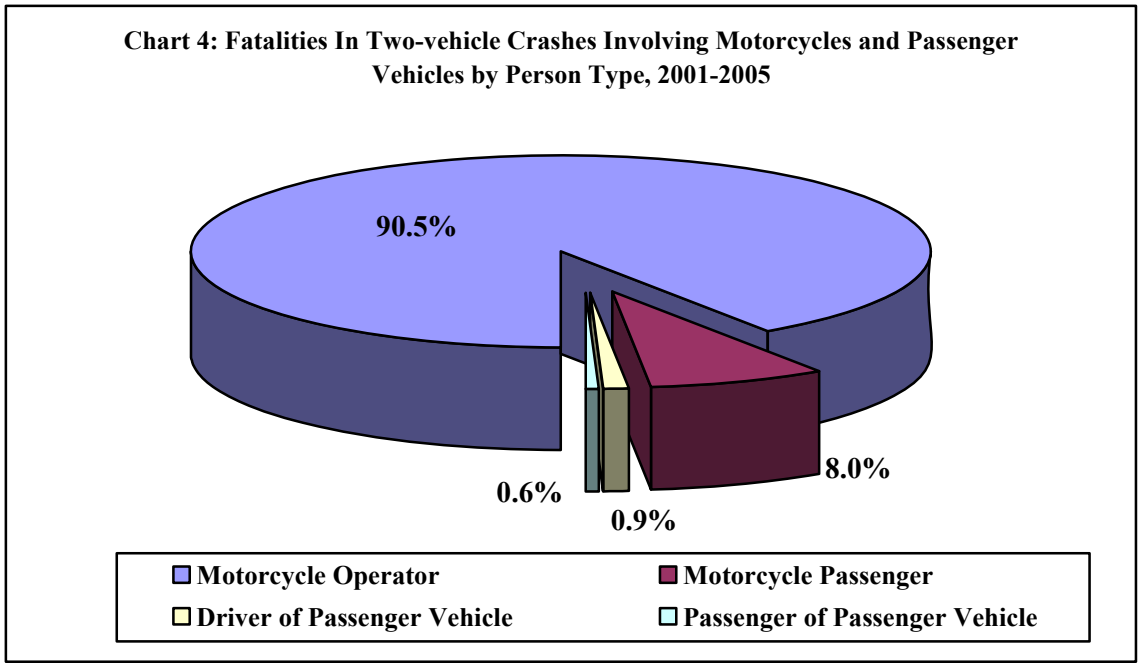
3.1.5 Fatalities in Crashes Between a Motorcycle and a Passenger Vehicle by Person Type

Data for the past five years show that among the fatalities in two-vehicle crashes involving motorcycles and passenger vehicles, 98 percent of the fatalities were motorcycle riders and only 2 percent of the fatalities were passenger vehicle occupants. Of the motorcycle rider fatalities in these crashes more than 90 percent were the motorcycle operators and nearly 10 percent were passengers. Table 5 shows motorcycle riders and passenger vehicle occupants killed in two-vehicle crashes involving a motorcycle and a passenger vehicle by year and person type. Chart 4 shows proportion of fatalities by person type, in two-vehicle motorcycle crashes involving passenger vehicles for five years combined (2001-2005).

Table 5
Motorcycle Rider and Passenger Vehicle Occupant Fatalities in Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle, by Year and Person Type

Year	Motorcycle Rider Fatalities			Passenger Vehicle Occupant Fatalities			Total Occupant Fatalities
	Operators	Passengers	Total	Drivers	Passengers	Total	
2001	1,224	116	1,340	18	8	26	1,366
2002	1,219	102	1,321	12	10	22	1,343
2003	1,447	136	1,583	14	10	24	1,607
2004	1,515	138	1,653	13	11	24	1,677
2005	1,792	143	1,935	17	11	28	1,963

Source: NCSA, FARS 2001-2004 (Final), 2005 (ARF)



3.1.6 Fatalities in Crashes Between a Motorcycle and a Passenger Vehicle When a Motorcycle Operator Was Killed in the Crash, by Year and Person Type

When the motorcycle operator was killed in a two-vehicle crash involving a motorcycle and a passenger vehicle, only 5 percent of the fatalities were others and 95 percent were the motorcycle operators. Of these other fatalities (motorcycle passengers, passenger vehicle occupants), only about 1 percent were occupants of the passenger vehicle involved in the crash and the remaining nearly 4 percent were the passengers of the motorcycle.

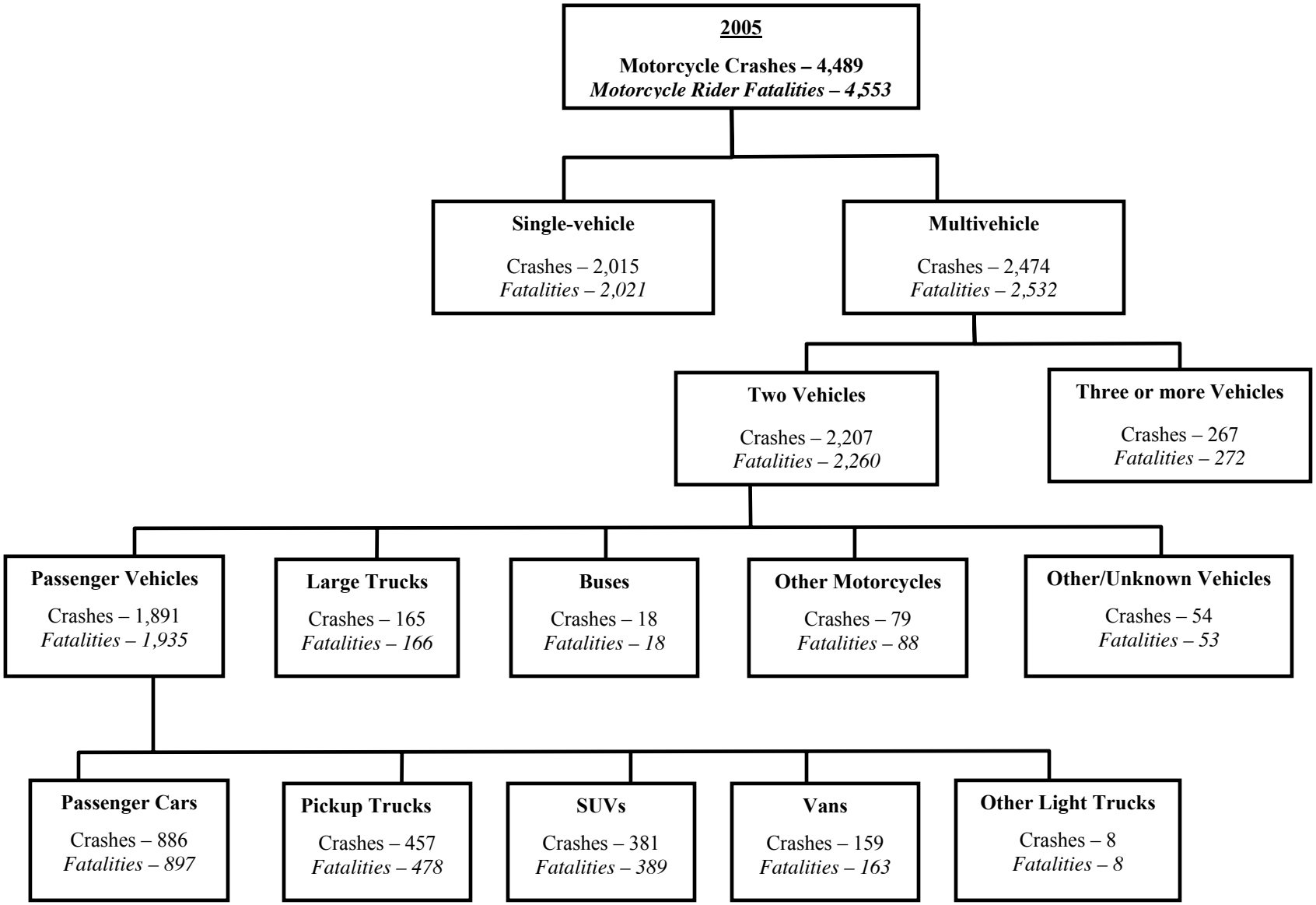
Table 6 shows fatalities in two-vehicle crashes involving a motorcycle and a passenger vehicle by year and person type, when the motorcycle operator was killed in the crash.

Table 6
Fatalities in Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle, When a Motorcycle Operator Was Killed in the Crash, by Year and Person Type

Year	Motorcycle Rider Fatalities			Passenger Vehicle Occupant Fatalities			Total Occupant Fatalities
	Operators	Passengers	Total	Drivers	Passengers	Total	
2001	1,224	49	1,273	8	5	13	1,286
2002	1,219	41	1,260	6	5	11	1,271
2003	1,447	57	1,504	12	9	21	1,525
2004	1,515	55	1,570	11	8	19	1,589
2005	1,792	57	1,849	11	4	15	1,864

Source: NCSA, FARS 2001-2004 (Final), 2005 (ARF)

Chart 5: Breakdown of Motorcycle Crashes and Motorcycle Rider Fatalities* in 2005 by Crash Type and Vehicle Type Involved



*Fatalities shown throughout this chart are only motorcycle rider fatalities.

Source: NCSA, FARS 2005 (ARF)

3.2 Crash Characteristics

Review of FARS data indicates further in-depth analysis is required using relevant data elements to identify possible causes in fatal two vehicle motorcycle crashes involving a passenger vehicle. Motorcycle rider fatality trend data (*DOT HS 810 606 'Recent Trends in Motorcycle Crashes – An Update'*) show that among motorcycle riders killed in motorcycle crashes, 90 percent of those killed were motorcycle operators. Also, data from the previous section indicate that among fatalities in two-vehicle crashes involving a motorcycle and a passenger vehicle, 90 percent of the people killed were motorcycle operators. Our focus in this section is to find the factors in two-vehicle motorcycle crashes that may better explain the circumstances in which the crash occurred, interaction between the two vehicles, role of the vehicles involved, role of the motorcycle operator and passenger vehicle driver in the crash, and other crash characteristics. Hence, two-vehicle motorcycle crashes from the most recent year (2005) were considered for further analysis. There were 1,891 two-vehicle fatal crashes involving motorcycles and passenger vehicles in 2005 (Chart 5) in which 1,935 people were killed. Of these crashes 1,792 had a motorcycle operator fatality and the remaining (99) had either a motorcycle passenger fatality or a passenger vehicle occupant fatality. The analysis in this following section is based on data from two-vehicle crashes involving a motorcycle and a passenger vehicle in 2005 in which a motorcycle operator was killed.

3.2.1 Day of the Week and Time of Day When the Crashes Occurred

Among the two-vehicle crashes in 2005 involving a motorcycle and a passenger vehicle, a higher percentage occurred during daytime than during nighttime, 1,027 (57%) compared to 764 (43%). Of the 1,027 crashes that occurred during daytime, 438 (43%) were on Saturday and Sunday, and of the 764 crashes which occurred during night time, 418 (55%) were on Friday night, Saturday night, and Sunday night. The definition for daytime/nighttime is shown below. Based on the definition, daytime for any day of the week would be from 6 a.m. to 5:59 p.m. and nighttime would be from 6 p.m. to 12 a.m. and extending into the early hours (5:59 a.m.) of the next day. For example Sunday nighttime would be from 6 p.m. Sunday to 5:59 a.m. on Monday. Table 7 shows two-vehicle crashes involving a motorcycle and a passenger vehicle by time of the day and the day of the week the crash occurred. The highest number of crashes during any one day was on Saturday, both day and night.

Daytime: 6 a.m. to 5:59 p.m.
Nighttime: 6 p.m. to 5:59 a.m.

Table 7 Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle, By Day of the Week and Time of Day								
Day of the Week	Time of Day						Total	
	Daytime		Nighttime		Unknown			
	#	%	#	%	#	%	#	%
Sunday	201	11	127	7	1	0	329	18
Monday	115	6	90	5	0	0	205	11
Tuesday	121	7	81	5	0	0	202	11
Wednesday	109	6	85	5	0	0	194	11
Thursday	103	6	90	5	0	0	193	11
Friday	141	8	132	7	0	0	273	15
Saturday	237	13	159	9	0	0	396	22
Total	1,027	57	764	43	1	0	1,792	100
Source: NCSA, FARS 2005 (ARF)								

3.2.2 Time of Day and Day of the Week When the Crashes Occurred

In 2005, of the 1,792 two-vehicle crashes involving a motorcycle and a passenger vehicle, 938 (52%) occurred during weekdays and 854 (48%) occurred during weekends. The following are the definitions used for weekdays and weekends:

Weekday: 6 a.m. Monday through 5:59 p.m. Friday.
Weekend: 6 p.m. Friday through 5:59 a.m. Monday.

Based on the definition above, the number of hours during a weekend is 60 (2½ days) and during weekdays is 108 (4½ days). The total number of weekend days during a year is 130 (52 weeks x 2½ days) and the total number of weekdays during a year is 234 (52 weeks x 4½ days). Based on the number of hours (when normalized for hours) during weekdays and weekends, there were 1.6 times as many crashes during weekend compared to weekdays. Based on the daytime/nighttime definition from section 3.2.1, daytime for weekdays would be 6 a.m. thru 5:59 p.m. and nighttime for weekdays would be from 6 p.m. thru 5:59 a.m. Monday-Friday. For weekends, daytime would be from 6 a.m. thru 5:59 p.m. Saturday and Sunday, and nighttime would be from 6 p.m. thru 5:59 a.m. (next day) on Friday, Saturday, and Sunday. Table 8 shows two-vehicle crashes involving a motorcycle and a passenger vehicle in 2005 by time of day and day of week.

Table 8 Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle By Time of Day and Day of Week						
Time of Day	Day of Week					
	Weekday		Weekend		Total	
	#	%	#	%	#	%
Daytime	589	33	438	24	1,027	57
Nighttime	349	19	415	23	764	43
Unknown	0	0	1	0	1	0
Total	938	52	854	48	1,792	100
Source: NCSA, FARS 2005 (ARF)						

3.2.3 Month When the Crash Occurred

Among the 1,792 two-vehicle crashes in 2005 involving a motorcycle and a passenger vehicle, a higher proportion (71%) of crashes occurred during the months from May to October (corresponds to prime riding months in all States) and the remaining 29 percent were during the months from November to April (normally riding months in some southern states). In all the months February had the lowest number of such crashes and July had the highest. Table 9 shows number and percentage of two-vehicle crashes between a motorcycle and a passenger vehicle by month.

Table 9 Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle by Month		
Month	2005	
	#	%
January	59	3
February	44	2
March	90	5
April	155	9
May	171	10
June	215	12
July	231	13
August	211	12
September	220	12
October	214	12
November	118	7
December	64	4
Total	1,792	100
Source: NCSA, FARS 2005 (ARF)		

3.2.4 Type of Roadway and Relation to Junction Where the Crash Occurred

Of the 1,792 two-vehicle crashes in 2005, involving a motorcycle and a passenger vehicle, an overwhelming proportion (1,639 or 91%) were on non-interstate roadways. Of these 1,639 non-interstate crashes, 841 (51%) were intersection crashes and 797 (49%) were non-intersection crashes. Overall, among the 1,792 crashes 888 (50%) were intersection crashes and 903 (50%) were non-intersection crashes. Table 10 shows two-vehicle crashes involving a motorcycle and a passenger vehicle by type of roadway and relation to junction. The type of roadways that define interstate and non-interstate are shown below.

Interstate: Principal arterial-interstate, rural principal arterial-interstate, urban principal arterial-interstate.
Non-Interstate: Rural principal arterial - other, Rural minor arterial, Rural major arterial, Rural major collector, Rural minor collector, Rural local road or street, Urban principal arterial - other freeways or expressways, Urban minor arterial, Urban collector, Urban local road or street.

Table 10
Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle
By Type of Roadway and Relation to Junction

Type of Roadway	Relationship to Junction						Total	
	Intersection		Non-Intersection		Unknown			
	#	%	#	%	#	%	#	%
Interstate	8	0	70	4	0	0	78	4
Non-Interstate	841	47	797	44	1	0	1,639	91
Unknown	39	2	36	2	0	0	75	4
Total	888	50	903	50	1	0	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.5 Land Use (Rural/Urban) Where the Crash Occurred

Of the 1,792 two-vehicle crashes in 2005 involving a motorcycle and a passenger vehicle, 723 (40%) occurred on rural roadways and 1,002 (56%) occurred on urban roadways. This indicates that nearly 6 out of every 10 two-vehicle crashes between a motorcycle and a passenger vehicle occur on urban roadways. Table 11 shows the number and proportion of two-vehicle crashes involving a motorcycle and a passenger vehicle by land use. The definition of rural/urban roadways in FARS data are based on Census data and adopted by the Federal Highway Administration.

Table 11 Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle by Land Use		
Land Use	Fatal Crashes	
	#	%
Rural	723	40
Urban	1,002	56
Unknown	67	4
Total	1,792	100
Source: NCSA, FARS 2005 (ARF)		

3.2.6 Vehicle Role When the Crash Occurred

In two-vehicle crashes between a motorcycle and a passenger vehicle in 2005, in 1,334 (74%) of the crashes the motorcycle was recorded as the striking vehicle, compared to 470 (26%) of crashes where the passenger vehicle was recorded as the striking vehicle. This indicates that of the two-vehicle crash between a motorcycle and a passenger vehicle, nearly three-fourths of the time the motorcycle is the striking vehicle. Table 12 shows role of the motorcycle and the passenger vehicle in the crash.

Note: *"Striking" in the above paragraph does not imply fault but only describes the relationship of the vehicles in the crash as recorded by police*.

Table 12 Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle By Vehicle Role												
Motorcycle Role	Other Vehicle Role										Total	
	Non-Collision		Striking		Struck		Both		Unknown			
	#	%	#	%	#	%	#	%	#	%	#	%
Non-Collision	1	0	1	0	0	0	1	0	0	0	3	0
Striking	1	0	45	3	1,275	71	13	1	0	0	1,334	74
Struck	1	0	412	23	16	1	0	0	0	0	429	24
Both	0	0	12	1	4	0	6	0	0	0	22	1
Unknown	0	0	0	0	0	0	0	0	4	0	4	0
Total	3	0	470	26	1,295	72	20	1	4	0	1,792	100
Source: NCSA, FARS 2005 (ARF)												

3.2.7 Crash Avoidance Maneuver at the Time When the Crash Occurred

In more than one-third (37%) of the crashes neither the passenger vehicle driver nor the motorcycle operator took any action (no maneuver) in the crash. Overall, motorcycle operators took some kind of crash avoidance maneuver more often than the other driver – 56 percent versus 42 percent. In 24 percent of the crashes there was some type of a crash avoidance maneuver by the motorcycle operator and in 13 percent of the crashes there was some type of a crash avoidance maneuver by the driver of the passenger vehicle. Braking as a crash avoidance maneuver by the motorcycle operator was reported in 299 (17%) of the crashes compared to 77 (4%) by the driver of the passenger vehicle. Steering as a crash avoidance maneuver by the driver of the passenger vehicle was reported in 135 (8%) of the crashes compared to 111 (6%) by the motorcycle operator. Table 13 shows crash avoidance maneuver by the motorcycle operator and the driver of the passenger vehicle.

Table 13
Two-Vehicle Crashes Involving a Motorcycle and a Passenger Vehicle
By Crash Avoidance Maneuver

Motorcycle Operator Crash Avoidance Maneuver	Passenger Vehicle Driver Crash Avoidance Maneuver										Total	
	No Maneuver		Braking		Steering		Other		Not Reported/ Unknown			
	#	%	#	%	#	%	#	%	#	%	#	%
No Maneuver	657	37	35	2	59	3	2	0	27	2	780	44
Braking	182	10	21	1	20	1	6	0	70	4	299	17
Steering	64	4	10	1	16	1	2	0	19	1	111	6
Other	12	1	0	0	1	0	1	0	4	0	18	1
Not Reported/ Unknown	116	6	11	1	39	2	4	0	414	23	584	33
Total	1,031	58	77	4	135	8	15	1	534	30	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.8 Age of the Motorcycle Operator and Driver of the Passenger Vehicle

In 2005, among the 1,792 motorcycle operator fatalities in two-vehicle crashes involving a motorcycle and a passenger vehicle, 501 (28%) were in the age group of 20 to 29. Among the drivers of the passenger vehicles involved, 373 (21%) were in the 20-to-29 age group. Table 14 shows age groups of the motorcycle operator killed and passenger vehicle driver involved in 2005. The 20-to-29 age group stands out as the highest age group among all motorcycle operator age groups among operator fatalities. However, there seems to be an even distribution among passenger vehicle drivers.

Table 14
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved in Two-Vehicle Crashes by Age

Motorcycle Operator Age	Passenger Vehicle Driver Age												Total	
	< 20		20-29		30-39		40-49		50-59		> 59			
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
< 20	11	1	32	2	23	1	16	1	18	1	14	1	116	6
20-29	54	3	96	5	95	5	98	5	62	3	87	5	501	28
30-39	39	2	80	4	72	4	63	4	50	3	54	3	363	20
40-49	45	3	77	4	78	4	71	4	51	3	49	3	373	21
50-59	38	2	58	3	43	2	62	3	38	2	49	3	294	16
> 59	17	1	30	2	23	1	26	1	19	1	29	2	145	8
Total*	204	11	373	21	334	19	336	19	238	13	282	16	1,792	100

Source: NCSA, FARS 2005 (ARF) *Includes passenger vehicle drivers with unknown age

3.2.9 Sex of the Motorcycle Operator and Driver of the Passenger Vehicle

Among the motorcycle operators killed in two-vehicle crashes involving a passenger vehicle, 1,730 (97%) were males and 62 (3%) were females. Among the passenger vehicle drivers involved in these crashes, 1,134 (63%) were males, 637 (36%) were females and 21 (1%) were unknown. Table 15 shows sex of motorcycle operators killed and passenger vehicle drivers involved in two-vehicle crashes in 2005. The proportion of male to female motorcycle operators killed in two-vehicle crashes is similar to the proportion of male to female motorcycle operators killed in all motorcycle crashes.

Table 15
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved in Two-Vehicle Crashes by Sex

Motorcycle Operator Sex	Passenger Vehicle Driver Sex						Total	
	Male		Female		Unknown			
	#	%	#	%	#	%	#	%
Male	1,097	61	613	34	20	1	1,730	97
Female	37	2	24	1	1	0	62	3
Total	1,134	63	637	36	21	1	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.10 Licensing of the Motorcycle Operator and Driver of the Passenger Vehicle

In 2005, 32 percent of the operators/drivers involved in 1,792 two-vehicle crashes involving a motorcycle and a passenger vehicle, were operating their vehicles with an invalid license at the time of the crash. Of these, 429 (24%) were motorcycle operators, who

were killed while operating the motorcycle with an invalid license and 152 (8%) were drivers of the passenger vehicles involved in these crashes with an invalid license. Table 16 shows license status of motorcycle operators and drivers of passenger vehicles involved in two-vehicle crashes. The definitions for the terms valid and invalid, used in this report are based on the following:

For passenger vehicle driver
Valid – the driver was properly licensed for the class of vehicle driven at the time of the crash.
Invalid – the driver was improperly licensed for the class of vehicle driven at the time of the crash.

For motorcycle operator
Valid – a valid driver license with a motorcycle endorsement, a motorcycle only license, learner's permit; and a temporary license; or no license required for operating a motorcycle type vehicle like mopeds.
Invalid – not licensed, not licensed to operate a motorcycle, or a license that is suspended, revoked, expired, canceled, or denied.

Table 16
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved in Two-Vehicle Crashes by License Status

Motorcycle Operator License Status	Passenger Vehicle Driver License Status						Total	
	Valid		Invalid		Unknown			
	#	%	#	%	#	%	#	%
Valid	1,223	68	106	6	20	1	1,349	75
Invalid	370	21	46	3	13	1	429	24
Unknown	14	1	0	0	0	0	14	1
Total	1,607	90	152	8	33	2	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.11 Alcohol Level of Motorcycle Operator and Driver of the Passenger Vehicle

In 2005, 30 percent of the two-vehicle crashes involving motorcycles and passenger vehicles, in which the motorcycle operator was killed, were alcohol-related (BAC .01 g/dL or higher). Of the motorcycle operators who were killed in these crashes, 422 (24%) had a BAC of .01 g/dL or higher with 292 (16%) at BAC of .08 or higher. Of the alcohol involved (BAC ≥ .01) motorcycle operators killed, 69 percent had BAC of .08 or higher which is above the illegal limit in all states. Among the drivers of the passenger vehicles involved in these crashes, 175 (10%) had a BAC of .01 or higher with 134 (7%) at BAC of .08 or higher. BAC levels of motorcycle operators in two-vehicle crashes were more than twice that of drivers of passenger vehicles. Table 17 shows alcohol involvement of motorcycle operators killed and passenger vehicle drivers involved in two-vehicle crashes in 2005. The combined total of motorcycle operators/ passenger vehicle drivers who had

BAC levels of .01 g/dL or higher shown in table 17 is 34 percent (motorcycle operators at 24% and passenger vehicle drivers at 10%). This does not match with the 30 percent mentioned earlier in this paragraph because the 30 percent represents crashes where at least one operator/driver had a BAC level greater than or equal to .01g/dL; and there were crashes in which both the motorcycle operator and the passenger vehicle driver had alcohol, a total of 34 percent.

Table 17
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved In Two-Vehicle Crashes by Their Alcohol Involvement

Motorcycle Operator Alcohol Involvement	Passenger Vehicle Driver Alcohol Involvement						Total	
	BAC = .00		BAC = .01-.07		BAC ≥ .08			
	#	%	#	%	#	%	#	%
BAC = .00	1,251	70	25	1	94	5	1,370	76
BAC = .01-.07	112	6	3	0	15	1	130	7
BAC ≥ .08	254	14	13	1	25	1	292	16
Total	1,617	90	41	2	134	7	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.12 Speeding as a Factor in the Crash

Speeding as a factor was cited nearly 7 times more for motorcycle operators than for the driver of the passenger vehicle in two-vehicle crashes (27% versus 4%). Among the 1,792 two-vehicle crashes in 2005 involving a motorcycle and a passenger vehicle, 476 (27%) of the motorcycle operators killed were speeding at the time of the crash compared to 63 (4%) of the drivers of the passenger vehicles who were speeding. Table 18 shows motorcycle operators killed and passenger vehicle drivers involved in two-vehicle crashes by speeding.

Table 18
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved in Two-Vehicle Crashes by Speeding

Motorcycle Operator Speeding	Passenger Vehicle Driver Speeding				Total	
	Speeding		Not Speeding			
	#	%	#	%	#	%
Speeding	4	0	472	26	476	27
Not Speeding	59	3	1,257	70	1,316	73
Total	63	4	1,729	96	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.13 Manner of Collision and Vehicle Role of the Motorcycle and Passenger Vehicle

Of the 1,792 two-vehicle crashes between motorcycles and a passenger vehicles in 2005, 146 (8%) were crashes where the manner of collision was not collision with a motor vehicle in transport. This means the first harmful event (the event that causes the unstabilized situation in the crash) was not the collision between the motorcycle and the passenger vehicle. However, the most harmful event (the event that leads to the injury/fatality in the crash) occurred during the collision between the motorcycle and the passenger vehicle. Of the other crashes where the first harmful event recorded in the crash was collision between the motorcycle and passenger vehicle; 640 (36%) were front-to-side crashes where one vehicle hit the other vehicle at a right angle; 319 (18%) were head-on crashes; 276 (15%) were front-to-side crashes in which the vehicles were moving in the opposite direction; 204 (11%) were rear-end crashes; 82 (5%) were sideswipe crashes and 63 (4%) were front-to-side crashes in which both the vehicles were moving in the same direction.

Of the 640 front-to-side crashes between motorcycles and passenger vehicles where the vehicles crashed into each other at right angles, 501 (78%) crashes, the role of the motorcycle in the crash was recorded as striking the passenger vehicle and in 122 (19%) crashes, the role of the passenger vehicle was recorded as striking the motorcycle.

Among the 319 head-on crashes between motorcycles and passenger vehicles, in 176 (55%) crashes, the role of the motorcycle in the crash was recorded as striking the passenger vehicle, in 103 (32%) crashes, the role of the passenger vehicle was recorded as striking the motorcycle and in 34 (11%) crashes the role for both the vehicles in the crash was recorded as striking the other vehicle.

Of the 276 front-to-side crashes between motorcycles and passenger vehicles where the vehicles crashed in the opposite direction, in 219 (79%) crashes the role of the motorcycle in the crash was recorded as striking the passenger vehicle, and in 48 (17%) crashes the role of the passenger vehicle was recorded as striking the motorcycle.

Of the 204 rear-end crashes between motorcycles and passenger vehicles, in 139 (68%) crashes the role of the motorcycle in the crash was recorded as striking the passenger vehicle, and in 59 (29%) crashes the role of the passenger vehicle was recorded as striking the motorcycle. Table 19 shows motorcycle operators killed and passenger vehicle drivers involved in two-vehicle crashes in 2005 by manner of collision and vehicle role.

Table 19
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved in Two-Vehicle Crashes in 2005, by Manner of Collision and Vehicle Role

Manner of Collision and Motorcycle Role		Other Vehicle Role										Total*	
		Non-Collision		Striking		Struck		Both		Unknown			
		#	%	#	%	#	%	#	%	#	%	#	%
Not applicable	Non Collision	1	0.7	1	0.7	0	0.0	1	0.7	0	0.0	3	2.1
	Striking	1	0.7	9	6.2	97	66.4	1	0.7	0	0.0	108	74.0
	Struck	1	0.7	28	19.2	1	0.7	0	0.0	0	0.0	30	20.5
	Both	0	0.0	4	2.7	1	0.7	0	0.0	0	0.0	5	3.4
	Total	3	2.1	42	28.8	99	67.8	2	1.4	0	0.0	146	100.0
Rear-End	Striking	0	0.0	0	0.0	139	68.1	1	0.5	0	0.0	140	68.6
	Struck	0	0.0	59	28.9	2	1.0	0	0.0	0	0.0	61	29.9
	Both	0	0.0	2	1.0	0	0.0	1	0.5	0	0.0	3	1.5
	Total	0	0.0	61	29.9	141	69.1	2	1.0	0	0.0	204	100.0
Head-On	Striking	0	0.0	34	10.7	176	55.2	0	0.0	0	0.0	210	65.8
	Struck	0	0.0	103	32.3	3	0.9	0	0.0	0	0.0	106	33.2
	Both	0	0.0	1	0.3	0	0.0	2	0.6	0	0.0	3	0.9
	Total	0	0.0	138	43.3	179	56.1	2	0.6	0	0.0	319	100.0
Front-to-Side: Same Direction	Striking	0	0.0	0	0.0	49	77.8	1	1.6	0	0.0	50	79.4
	Struck	0	0.0	12	19.0	1	1.6	0	0.0	0	0.0	13	20.6
	Total	0	0.0	12	19.0	50	79.4	1	1.6	0	0.0	63	100.0
Front-to-Side: Opposite Direction	Striking	0	0.0	0	0.0	219	79.3	3	1.1	0	0.0	222	80.4
	Struck	0	0.0	48	17.4	4	1.4	0	0.0	0	0.0	52	18.8
	Both	0	0.0	1	0.4	0	0.0	1	0.4	0	0.0	2	0.7
	Total	0	0.0	49	17.8	223	80.8	4	1.4	0	0.0	276	100.0
Front-to-Side: Right Angle	Striking	0	0.0	2	0.3	501	78.3	5	0.8	0	0.0	508	79.4
	Struck	0	0.0	122	19.1	4	0.6	0	0.0	0	0.0	126	19.7
	Both	0	0.0	1	0.2	3	0.5	2	0.3	0	0.0	6	0.9
	Total	0	0.0	125	19.5	508	79.4	7	1.1	0	0.0	640	100.0
Front-to-Side: Unknown Direction	Striking	0	0.0	0	0.0	40	85.1	0	0.0	0	0.0	40	85.1
	Struck	0	0.0	5	10.6	0	0.0	0	0.0	0	0.0	5	10.6
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0	2	4.3	2	4.3
	Total	0	0.0	5	10.6	40	85.1	0	0.0	2	4.3	47	100.0
Sideswipe: Same Direction	Striking	0	0.0	0	0.0	17	39.5	2	4.7	0	0.0	19	44.2
	Struck	0	0.0	19	44.2	1	2.3	0	0.0	0	0.0	20	46.5
	Both	0	0.0	3	7.0	0	0.0	0	0.0	0	0.0	3	7.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0	1	2.3	1	2.3
	Total	0	0.0	22	51.2	18	41.9	2	4.7	1	2.3	43	100.0
Sideswipe: Opposite Direction	Striking	0	0.0	0	0.0	28	71.8	0	0.0	0	0.0	28	71.8
	Struck	0	0.0	11	28.2	0	0.0	0	0.0	0	0.0	11	28.2
	Total	0	0.0	11	28.2	28	71.8	0	0.0	0	0.0	39	100.0
Rear-to-Side	Striking	0	0.0	0	0.0	4	66.7	0	0.0	0	0.0	4	66.7
	Struck	0	0.0	2	33.3	0	0.0	0	0.0	0	0.0	2	33.3
	Total	0	0.0	2	33.3	4	66.7	0	0.0	0	0.0	6	100.0
Rear-to-Rear	Struck	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	1	100.0
	Total	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	1	100.0
Total*	Non Collision	1	0.1	1	0.1	0	0.0	1	0.1	0	0.0	3	0.2
	Striking	1	0.1	45	2.5	1,275	71.1	13	0.7	0	0.0	1,334	74.4
	Struck	1	0.1	412	23.0	16	0.9	0	0.0	0	0.0	429	23.9
	Both	0	0.0	12	0.7	4	0.2	6	0.3	0	0.0	22	1.2
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0	4	0.2	4	0.2
	Total	3	0.2	470	26.2	1,295	72.3	20	1.1	4	0.2	1,792	100.0

Source: NCSA, FARS 2005 (ARF)

* Includes Unknown and Other Manner of Collisions

3.2.14 Previous Driving Records for the Motorcycle Operator and Passenger Vehicle Driver

Among the 1,792 motorcycle operators and passenger vehicle drivers involved in two-vehicle crashes, 885 (49%) of the motorcycle operators had a previous driving record (crash, suspension or revocation, DWI convictions, speeding conviction, other harmful convictions) in the 3 years prior to the crash. Among the passenger vehicle drivers involved in these crashes 603 (34%) had a previous driving record. In 314 (18%) of the crashes both the motorcycle operator and the other driver had previous violations. Table 20 shows motorcycle operators and passenger vehicle drivers by their previous driving record.

Table 20
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved in Two-Vehicle Crashes by Previous Driving Record

Motorcycle Operator Previous Driving Record	Passenger Vehicle Driver Previous Driving Record				Total	
	Yes		No			
	#	%	#	%	#	%
Yes	314	18	571	32	885	49
No	289	16	618	34	907	51
Total	603	34	1,189	66	1,792	100

Source: NCSA, FARS 2005 (ARF)

3.2.15 Violations Charged in the Crash

In 2005, among the passenger vehicle drivers involved in two-vehicle motorcycle crashes, there were violations reported in the crash for 30 percent of the passenger vehicle drivers. The analysis in this section does not cover motorcycle operators due to the fact that violations are not charged for fatally injured motorcycle operators in the crash. For the passenger vehicle drivers involved, nearly 15 percent had violations of rules-of-the-road charged (like turning, yielding, signaling); about 9 percent had violations charged for offenses like reckless driving, careless driving, and hit-and-run; 5 percent of them had license and registration violations charged; and 4 percent of the drivers were charged with impairment offenses. Table 21 shows violations charged to passenger vehicle drivers involved in two-vehicle motorcycle crashes.

Table 21 Passenger Vehicle Drivers Involved in Two-Vehicle Motorcycle Crashes By Violations Charged		
Violations Charged	**Passenger Vehicle Driver**	
	#	**%**
Speed-Related Offenses	6	0.3
Non-Moving - License and Registration Violations	90	5.0
Reckless/ Careless/ Hit-and-Run-Type Offenses	158	8.8
Rules of the Road (total)	275	15.3
Rules of the Road - Turning, Yielding, and Signaling	206	11.5
Rules of the Road - Traffic Sign and Signals	38	2.1
Rules of the Road - Wrong Side, Passing, and Following	21	1.2
Rules of the Road - Lane Usage	10	0.6
Equipment	6	0.3
Impairment Offenses	71	4.0
Other Violations	2	0.1
None Reported	1,261	70.4
Unknown	90	5.0
Total Drivers	1,792	100
Source: NCSA, FARS 2005 (ARF) Note: *The sums of the numbers and percentages are greater than the total drivers as each driver may be coded with more than one violation*		

3.2.16 Driver-Related Factors

Among the motorcycle operators and passenger vehicle drivers involved in two-vehicle crashes in 2005, 27 percent of the driver related factors in the crash for the motorcycle operator was driving too fast for conditions or in excess of posted speed limit, compared to 3 percent for the passenger vehicle driver. Fifteen percent of the driver related factors for the motorcycle operators were failure to keep in proper lane or running off road compared to 9 percent for passenger vehicle drivers. Driving under the influence of alcohol, drugs, or medication was a related factor in the crash for 9 percent of the motorcycle operators, compared to 7 percent for passenger vehicle drivers. Operating the vehicle in an erratic or reckless manner was a related factor in the crash for 5 percent of the motorcycle operators, compared to 2 percent for the passenger vehicle driver. Failure to yield right of way was a related factor in the crash for 4 percent of the motorcycle operators compared to 35 percent for passenger vehicle drivers in the crash. This indicates that in two-vehicle crashes involving a motorcycle and a passenger vehicle, more than one-third of the related factors for the passenger vehicle driver were not yielding right-of-way to the motorcycle operator. Table 22 shows related factors in the crash for motorcycle operators and passenger vehicle drivers involved these crashes.

Table 22
Motorcycle Operators Killed and Passenger Vehicle Drivers Involved In Two-Vehicle Crashes by Driver Related Factors

Driver Related Factors	Motorcycle Operator		Passenger Vehicle Driver	
	#	%	#	%
Driving too fast for conditions or in excess of posted limit or racing	482	26.9	61	3.4
Failure to keep in proper lane or running off road	271	15.1	161	9.0
*Operating vehicle in erratic, reckless, ...	84	4.7	33	1.8
Failure to obey traffic signs, signals, or officer	77	4.3	55	3.1
Failure to yield right-of-way	64	3.6	630	35.2
Inattentive (talking, eating, etc.)	58	3.2	90	5.0
Vision obscured (rain, snow, glare, lights, building, trees, etc.)	35	2.0	53	3.0
Driving wrong way on one-way traffic or wrong side of road	35	2.0	20	1.1
**Swerving or avoiding due to wind, slippery surface, …	17	0.9	9	0.5
Making improper turn	17	0.9	84	4.7
Overcorrecting/oversteering	12	0.7	10	0.6
Drowsy, asleep, fatigued, ill, or blackout	1	0.1	8	0.4
Under the influence of alcohol, drugs, or medication	159	8.9	127	7.1
Other factors	293	16.4	293	16.4
None reported	813	45.4	711	39.7
Unknown	38	2.1	26	1.5
Total Drivers	1,792	100	1,792	100

Source: NCSA, FARS 2005 (ARF)
Note: *The sums of the numbers and percents are greater than the total drivers as each driver may be coded with more than one factor*

* Operating the Vehicle in an - Erratic, Reckless, Careless, or Negligent Manner or Operating at Erratic or Suddenly Changing Speeds.
** Swerving or avoiding due to - Severe Crosswind, Wind From Passing Truck, Slippery or Loose Surface, Tire Blow-Out or Flat, Debris or Objects in Road, Ruts, Holes, Bumps in Road, Live Animals in Road, Vehicle in Road, Phantom Vehicle, Pedestrian, Pedalcyclist, or Other Nonmotorist in Road, Ice, Water, Snow, Slush, Sand, Dirt, Oil, Wet Leaves on Road.

4. FINDINGS

Findings from the analyses based on fatal two-vehicle motorcycle crashes involving passenger vehicles in 2005 are shown below.

- In nearly three-fourths of the two-vehicle motorcycle crashes involving passenger vehicles, the role of the motorcycle was recorded as the striking vehicle.

- Alcohol involvement among motorcycle operators killed was almost 2.5 times the alcohol involvement of the passenger vehicle drivers involved in these crashes. Of the alcohol involved (BAC .01+) motorcycle operators killed in these crashes 69 percent had BACs of .08+, which is above the illegal limit in all States.

- Twenty-four percent of the motorcycle operators killed in two-vehicle crashes involving passenger vehicles in 2005 had an invalid license compared to 8 percent of the passenger vehicle drivers involved in these crashes.

- Of the motorcycle operators who were killed in two-vehicle motorcycle crashes involving passenger vehicles 27 percent were speeding at the time of the crash compared to 4 percent of the passenger vehicle drivers who were involved in these crashes.

- Among the front-to-side crashes, 36 percent of the crashes were one vehicle colliding with the other at right angles. Of these crashes (front-to-side at right angles), in 78 percent of the crashes the role of the motorcycle was recorded as the striking vehicle.

- In 55 percent of the head-on two-vehicle crashes involving motorcycles and passenger vehicles, the role of the motorcycle was recorded as the striking vehicle and in 68 percent of the rear-end crashes the role of the motorcycle was recorded as the striking vehicle.

- Of the motorcycle operators killed in two-vehicle crashes, 49 percent had previous driving records compared to 34 percent for the passenger vehicle drivers involved in these crashes.

- Twenty-seven percent of the related factors for the motorcycle operators killed in two-vehicle motorcycle crashes involving passenger vehicles were driving too fast for conditions or in excess of posted speed limit, 15 percent were failure to keep in proper lane or running off the road, and 5 percent were operating vehicles in an erratic or reckless manner. For the passenger vehicle drivers involved in these crashes 35 percent of the driver-related factors were failure to yield right-of-way, 9 percent were failure to keep in proper lane or running off the road, and 7 percent were driving under the influence of alcohol, drugs, or other medication.

- There were 1.5 times as many two-vehicle motorcycle crashes in 2005 during weekends than during weekdays. Of the two-vehicle motorcycle crashes that occurred dur-

ing daytime, 43 percent were on Saturdays and Sundays and of the crashes that occurred during nighttime 55 percent were on Friday, Saturday, and Sunday.

- Of the two-vehicle crashes involving motorcycles and passenger vehicles in 2005, 91 percent occurred on non-interstate roadways and of these half were crashes at intersections and the other half were non-intersection crashes.

- In 2005, nearly 6 out of 10 two-vehicle motorcycle crashes involving passenger vehicles occurred on urban roadways.

- Seventy-one percent of the two-vehicle motorcycle crashes involving passenger vehicles occurred from May to October. This is similar to the general pattern seen among motorcycle rider fatalities every year, indicating prime riding season for motorcycles in all the states.

- Braking was reported as a crash avoidance maneuver by motorcycle operators in 13 percent of the crashes and by passenger vehicle drivers in 4 percent of the crashes. Steering was reported as crash avoidance maneuver by passenger vehicle drivers in 8 percent of the crashes and by motorcycle operators in 6 percent of the crashes.

- Twenty-eight percent of the motorcycle operators killed in two-vehicle motorcycle crashes involving passenger vehicles were in the 20 to 29 age group, followed by 21 percent for the 40 to 49 age group and 20 percent for the 30 to 39 age group. Among motorcycle rider fatalities every year the 20 to 29 age group has the highest fatalities.

- Of the motorcycle operators killed in two-vehicle crashes involving a motorcycle and a passenger vehicle, 97 percent were males and 3 percent were females.

- Of the 1,792 two-vehicle motorcycle crashes involving passenger vehicles, 57 percent were crashes in which the vehicles crashed front-to-side, 18 percent were crashes in which the vehicles crashed into each other head on, 11 percent of the crashes were rear-end crashes and 5 percent were sideswipe crashes.

- In two-vehicle motorcycle crashes in 2005, 30 percent of passenger vehicle drivers involved were charged with driving violations. Violations were not charged for motorcycle operators in these crashes due to the fact that violations are not charged for fatally injured people.

5. REFERENCES

1. Klein, T.M. A Method of Estimating Posterior BAC Distributions for Persons Involved in Fatal Traffic Accidents: Final Report. 1986. DOT-HS-807-094. Washington, DC: National Highway Traffic Safety Administration.

2. Shankar, Umesh, & Varghese, Cherian. Recent Trends in Fatal Motorcycle Crashes: An Update. June 2006. DOT HS 810 606. Washington, DC: National Highway Traffic Safety Administration.

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