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**National Highway
Traffic Safety
Administration**

Recent Trends In
Fatal Motorcycle Crashes

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16. Abstract

Motorcyclist fatalities decreased each year from 1993 to 1997, reaching a historic low of 2,116 in 1997. In 1998 and again in 1999 this trend was reversed with increases to 2,294 (8.7%) in 1998 and to 2,472 (7.8%) in 1999. The overall increase in motorcyclist fatalities from 1997 to 1999 was 356 (16.8%). This reversal in the fatality trend prompted and analysis into the possible reasons for the surge in fatalities in recent years.

The objective of this study is to analyze the combined motor vehicle crash data from the Fatality Analysis Reporting System (FARS) with the Motorcycle Industry Council (MIC), Federal Highway Administration (FHWA) and the US Census Bureau for the recent increases in motorcyclist fatalities. The combined data is then used to calculate rates and identify possible causes for the recent increases in motorcyclist fatalities for developing crash prevention programs.

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1. EXECUTIVE SUMMARY

This report was written to provide insight into the recent increases in motorcyclist fatalities. The analysis was based on 1990-1999 data from the Fatality Analysis Reporting System (FARS), a census of all fatal motor vehicle crashes; Motorcycle Industry Council (MIC), sales and market distribution data; Federal Highway Administration (FHWA), motorcycle registration and vehicle miles traveled (VMT) data; and the United States Census Bureau, general population data.

Motorcyclist fatalities decreased each year from 1993 to 1997, reaching a historic low of 2,116 in 1997. In 1998 and again in 1999 this trend was reversed with increases to 2,294 (8.4%) in 1998 and to 2,472 (7.8%) in 1999. The overall increase in motorcyclist fatalities from 1997 to 1999 was 356 (16.8%). This reversal in the fatality trend prompted an analysis into the possible reasons for this surge in fatalities in recent years.

This report does not analyze all variables within the FARS database and other data sources. Also, this analysis does not examine injury data from the General Estimates System (GES), which reports injuries resulting from motor vehicle crashes. Further analyses need to be undertaken by examining other variables within FARS and GES that may provide additional information describing other factors associated with motorcycle crashes. The National Highway Traffic Safety Administration (NHTSA) plans to conduct these analyses and report the findings.

1.1 Purpose

The purpose of this report is to:

- Use FARS data to analyze motorcycle crashes;

- Use exposure data such as ownership from MIC, vehicle registration and vehicle miles traveled (VMT) from FHWA, and resident population from the US Census Bureau;

- Combine the FARS data with the exposure data to calculate rates; and,

- Identify possible causes for the recent increase in motorcyclist fatalities.

The analytical approach involved several steps. First, a review of the data sources was conducted to determine the appropriate data elements to be examined within FARS, and to determine whether exposure data by age groups were available. Motorcycle registration data and VMT data by age groups were not available from FHWA. Ownership data by age groups for four different years were available from MIC and were used in some sections of the calculations, rates, trends and analyses. Resident population data from the U.S. Census Bureau were also used for analysis based on age groups. Motorcycle registration and VMT data were used to calculate rates over the ten-year period from 1990 to 1999 to identify trends.

1.2   Conclusions

The findings from the analysis described in this report identify a variety of trends from FARS data, available exposure data and calculated rates. Analyses from all data sources support FARS data about greater involvement of riders in the over 40 age group and 1,001-1,500 cc engine motorcycles in fatal crashes.

Findings from FARS, MIC, FHWA and US Census Bureau data provide insight into possible reasons for the increase in motorcyclist fatalities in recent years and could aid in the design of crash prevention programs:

1.2.1   Exposure data show more motorcycles on the road with more vehicle miles traveled;

1.2.2   More people over age 40 are operating motorcycles;

1.2.3   Larger engine motorcycles are being bought and operated;

1.2.4   There are more motorcyclist fatalities on rural roadways in recent years;

1.2.5   Undivided roadways account for a majority of motorcyclist fatalities particularly on rural roadways;

1.2.6   Speeding is still one of the major factors in motorcycle crashes especially among riders under the age of 30;

1.2.7   High BAC levels continues to be a major problem among motorcycle operators;

1.2.8   Helmet use is only slightly above 50 percent among motorcyclists killed with a 10 percent increase from 1990 (43 percent) to 1999 (53 percent); and

1.2.9   Motorcycle operators, especially in the under 20 and 20-29 age groups, are often improperly licensed to operate motorcycles.

2.   INTRODUCTION

More than 100,000 motorcyclists have died in traffic crashes since the enactment of the Highway Safety Act of 1966 and The National Traffic and Motor Vehicle Safety Act of 1966.

This report examines on motorcyclist fatalities from 1990-1999. In 1998, motorcycles made up less than 2 percent of all registered vehicles in the United States and accounted for only 0.4 percent of all vehicle miles traveled. However, in the same year motorcyclists accounted for 5.5 percent of total traffic fatalities, and in 1999, 5.9 percent of total traffic fatalities. Per 100,000 registered vehicles, fatality rate for motorcyclists (59.53) in 1999 was 3.6 times the fatality rate for passenger car occupants (16.41). Per vehicle mile traveled in 1999, motorcyclists (23.4) were about 18 times as likely as passenger car occupants (1.3) to die in motor vehicle traffic crash.

The purpose of this report is to:

- Combine NHTSA's motor vehicle crash data from FARS with data from the Motorcycle Industry Council (MIC), the Federal Highway Administration (FHWA) and the US Census Bureau;

- Analyze combined data within specific problem areas by looking for trends and calculating rates; and,

- Identify areas that may explain the possible causes for the recent increase in fatalities.

In order to better understand the reasons for the increase in fatalities, FARS data can be analyzed in various cross tabulations of more than 100 data elements. These analyses among the different variables provide better insight into the specific problem areas relating to the increase in fatalities. This analysis and report is based on FARS data elements (compared with MIC data) in various cross tabulations either individual or combined.

The following sections detail data used in the analysis, describe the methodology to analyze crash and exposure data, 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 the data sources, FARS, MIC, FHWA and US Census Bureau, to determine the data elements of interest in FARS and how these data sources could be combined with data from the other three sources;

- Formulating hypotheses about factors in fatal motorcycle crashes that may vary with different data elements and from year to year;

- Calculating percentages and rates to analyze 10 years of trend data and within specific data elements; and,

- Summarizing data that focus on increases in motorcyclist fatalities.

3.1 Data Sources

Four data sources were used in this analysis:

- Fatality Analysis Reporting System (FARS) relating to fatal traffic crashes;

- 2000 Motorcycle Statistical Annual from Motorcycle Industry Council (MIC) relating to ownership, retail sales, and motorcycle population;

- Federal Highway Administration (FHWA) relating to registration and vehicle miles traveled (VMT); and,

- US Census Bureau relating to resident population.

3.2 Historical Comparisons

The following sections provide some historical comparisons from the four data sources that have been used in this analysis. More information relating to the data sources is included in Appendix B.

3.2.1 Fatality Analysis Reporting System (FARS) Data

A review of FARS data from 1975 through 1999 shows motorcyclist fatalities reached an all time high of 5,144 fatalities in 1980, which was 10 percent of the 51,091 fatalities from all motor vehicle crashes. Eleven years later (1990), the number of motorcyclist fatalities was 3,244, only 63 percent of the high for motorcyclist fatalities reached in 1980. In 1999, there were 2,472 fatalities, only 76 percent of the motorcyclist fatalities in 1990. In fact, the motorcyclist fatality count in 1999 was just 48 percent of the count in 1980. Table 1 shows the fatalities from motor vehicle crashes from 1975 to 1999.

Table 1: Fatalities from Motor Vehicle Crashes by Year and Person Type

| Year | Person Type | | | Non Motorists | Total Fatalities |
| | Occupants by Vehicle Type | | | | |
	Passenger Cars	Motorcycles	Others/ Unknown (1)		
1975	25,929	3,189	6,807	8,600	44,525
1976	26,166	3,312	7,624	8,421	45,523
1977	26,782	4,104	8,264	8,728	47,878
1978	28,153	4,577	8,803	8,798	50,331
1979	27,808	4,894	9,228	9,163	51,093
1980	27,449	5,144	9,334	9,164	51,091
1981	26,645	4,906	8,873	8,877	49,301
1982	23,330	4,453	7,863	8,299	43,945
1983	22,979	4,265	7,599	7,746	42,589
1984	23,620	4,608	8,263	7,793	44,257
1985	23,212	4,564	8,267	7,782	43,825
1986	24,944	4,566	8,724	7,853	46,087
1987	25,132	4,036	9,397	7,825	46,390
1988	25,808	3,662	9,700	7,917	47,087
1989	25,063	3,141	9,883	7,495	45,582
1990	24,092	3,244	9,798	7,465	44,599
1991	22,385	2,806	9,549	6,768	41,508
1992	21,387	2,395	9,098	6,370	39,250
1993	21,566	2,449	9,559	6,576	40,150
1994	21,997	2,320	10,001	6,398	40,716
1995	22,423	2,227	10,641	6,526	41,817
1996	22,505	2,161	11,031	6,368	42,065
1997	22,199	2,116	11,410	6,288	42,013
1998	21,194	2,294	11,894	6,119	41,501
1999	20,818	2,472	12,516	5,805	41,611

Note:

(1) Others/Unknown vehicle type includes light trucks, vans, pickups, utility vehicles, large trucks, buses and other type of vehicles and unknown type of vehicle.

The number of occupant fatalities of passenger cars fell from 22,199 in 1997 to 21,194 in 1998 and further decreased to 20,818 in 1999. The overall fatalities from motor vehicle crashes would have declined further in 1998 and 1999, if motorcyclist fatalities had also decreased in 1998 and 1999.

The fatality rate for motorcyclists per 100,000 registered vehicle reached an all time high of 94.02 in 1978 compared to 59.53 in 1999. Similarly, the fatality rate for motorcyclists per 100 million VMT reached an all time high of 64.6 in 1977 compared to 23.4 in 1999. Motorcyclist fatalities and fatality rates from 1975 to 1999 are shown in Table 2. Review of motorcyclist fatalities and fatality rates from 1975 to 1999 show a reduction in the number of motorcyclist fatalities since 1975. This may be due to the decline in the number of registered motorcycles, reduced VMT, speed changes, and economic trends along with the corrective steps taken to reduce fatalities in motor vehicle crashes.

Table 2: Motorcyclist Fatalities and Fatality Rates by Year and per Registered Vehicle and Vehicle Miles of Travel

Year	Registered Motorcycles	Vehicle Miles Traveled (Millions)	Motorcyclist Fatalities	Fatality Rate per 100,000 Registered Motorcycles	Fatality Rate per 100 Million VMT
1975	4,964,070	5,629	3,189	64.24	56.7
1976	4,933,332	6,003	3,312	67.14	55.2
1977	4,933,256	6,349	4,104	83.19	64.6
1978	4,867,855	7,158	4,577	94.02	63.9
1979	5,422,132	8,637	4,894	90.26	56.7
1980	5,693,940	10,214	5,144	90.34	50.4
1981	5,831,132	10,690	4,906	84.13	45.9
1982	5,753,858	9,910	4,453	77.39	44.9
1983	5,585,112	8,760	4,265	76.36	48.7
1984	5,479,822	8,784	4,608	84.09	52.5
1985	5,444,404	9,086	4,564	83.83	50.2
1986	5,198,993	9,397	4,566	87.82	48.6
1987	4,885,772	9,506	4,036	82.61	42.5
1988	4,584,284	10,024	3,662	79.88	36.5
1989	4,420,420	10,371	3,141	71.06	30.3
1990	4,259,462	9,557	3,244	76.16	33.9
1991	4,177,365	9,178	2,806	67.17	30.6
1992	4,065,118	9,557	2,395	58.92	25.1
1993	3,977,856	9,906	2,449	61.57	24.7
1994	3,756,555	10,240	2,320	61.76	22.7
1995	3,897,191	9,797	2,227	57.14	22.7
1996	3,871,599	9,920	2,161	55.82	21.8
1997	3,826,373	10,081	2,116	55.30	21.0
1998	3,879,450	10,283	2,294	59.13	22.3
1999	4,152,433	10,584	2,472	59.53	23.4

Chart 1: Motorcyclist Fatalities by Year
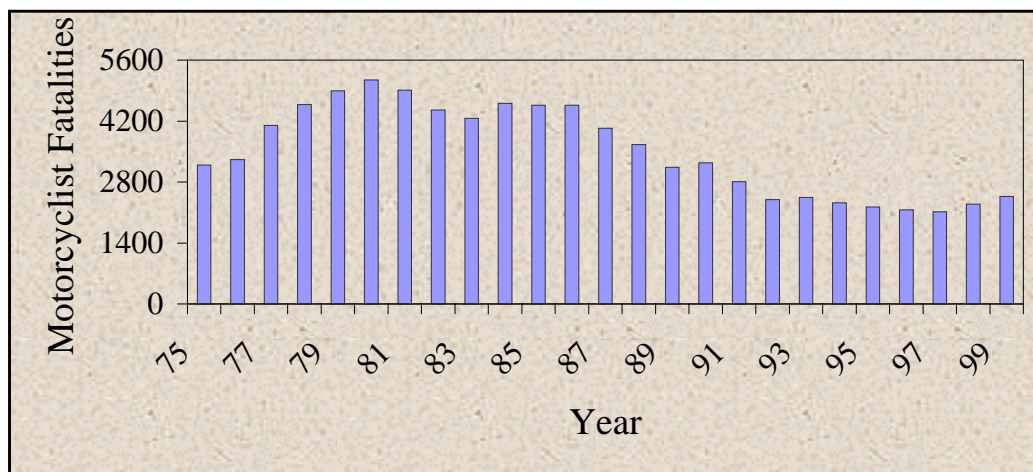
Further review of FARS data shows, on the other hand, that the number of motorcyclist fatalities has increased by 16.8 percent between 1997 and 1999 after reaching a historic low of 2,116 in 1997. Table 3 shows the number of motorcyclist fatalities from 1990 to 1999 by age group. As seen in the table the number of motorcyclist fatalities among age 40 and over has been increasing, especially from 1997 to 1999. The number of motorcyclist fatalities among age 40 and over has increased from 699 in 1997 to 968 in 1999, an increase of 38 percent. Motorcyclist fatalities has increased between 1990 and 1999 only in the 40-49 and over 49 age groups whereas the number of fatalities has decreased for all other age groups. The fatalities in 40-49 age group has increased from 278 in 1990 to 576 in 1999 and in the over 49 age group from 188 in 1990 to 401 in 1999. Still 20-29 age group has the most number of motorcyclist fatalities from 1990 to 1999 for any age group.

Table 3: Motorcyclist Fatalities by Year and Age Group

| Year | Motorcyclist Age Group | | | | | | Total |
	< 20	20-29	30-39	40-49	> 49	Unknown	
1990	504	1,457	816	278	188	1	3,244
1991	411	1,219	728	296	151	1	2,806
1992	318	981	652	280	164	0	2,395
1993	262	1,005	666	338	176	2	2,449
1994	260	910	608	346	195	1	2,320
1995	195	909	576	359	188	0	2,227
1996	202	763	555	420	221	0	2,161
1997	166	694	556	405	294	1	2,116
1998	201	720	612	475	285	1	2,294
1999	136	758	610	567	401	0	2,472

Chart 2: Motorcyclist Fatalities by Age Group and Year
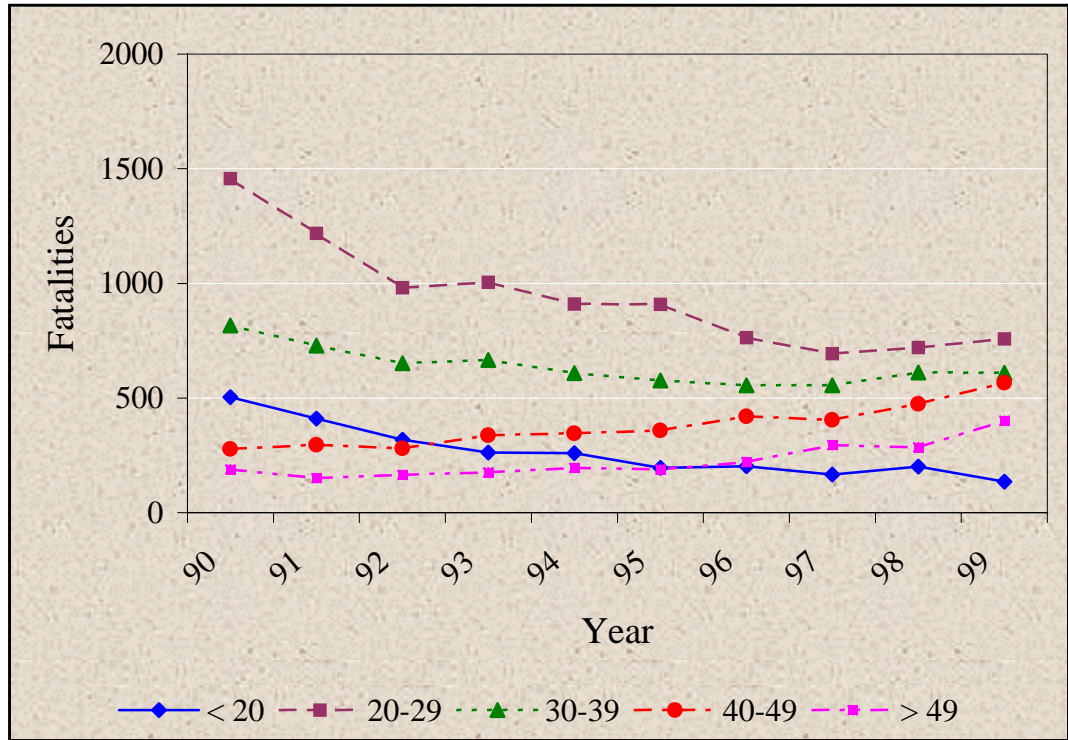
3.2.2 Motorcycle Industry Council (MIC) Data

According to the *2000 Motorcycle Industry Council Statistics*, motorcycle registrations accounted for 2 percent of all motor vehicles registered for use in 1999. There were 2.5 motorcycles in use for every 100 persons living in U.S. in 1998. California, Florida, Texas, New York and Ohio represented over one-third (34 percent) of the motorcycles in use in 1998. By region, the South had the highest motorcycle population in 1998 with 28 percent of the total motorcycles in use. The West showed the highest motorcycle penetration, at 2.8 vehicles per 100 persons. The Midwest had 2.7 motorcycles per 100 persons, East had 2.4 motorcycles per 100 persons and South had the least motorcycle penetration compared to all the regions with 2.1 motorcycles per 100 persons.

An estimated 4,809,000 "on-highway" motorcycles were in use in 1998 compared to 3,650,000 motorcycles in 1990, an increase of 32 percent between 1990 and 1998. Table 4 shows the distribution of motorcycles by engine size in cubic centimeters (cc) for these years. Two thirds (66 percent) of the motorcycles in 1998 had an engine displacement of over 749 cc compared to 40 percent in 1990. The percentage of motorcycles for all other engine sizes has decreased from 1990 to 1998. These data indicate that motorcycles with engines over 749 cc are becoming more prevalent.

Table 4: On-highway Motorcycles by Engine Displacement in cc

Engine Displacement	1990		1998	
Under 125 cc	430,700	11.8%	202,000	4.2%
125-349 cc	328,500	9.0%	240,400	5.0%
350-449 cc	197,100	5.4%	187,600	3.9%
450-749 cc	1,215,500	33.3%	995,500	20.7%
Over 749 cc	1,478,200	40.5%	3,183,500	66.2%
Total	3,650,000	100.0%	4,809,000	100.0%

Chart 3: Engine Size Percentage by Year
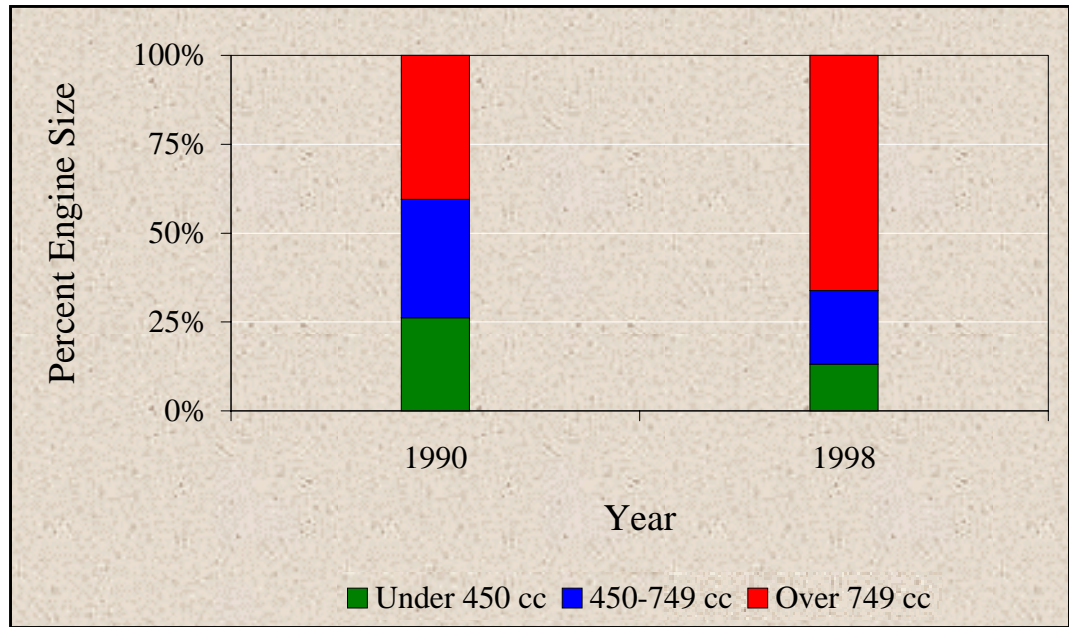
Table 5 shows the number of new on-highway motorcycle units sold between 1990-1999. There has been an increase each year in the number of units sold starting in 1993. The cumulative increase in the number of units sold is almost 65 percent between 1990 and 1999 with most of the increases occurring in 1998 and 1999. An estimated 372,000 new on-highway motorcycle units were sold in 1999, almost 21 percent over the previous year and an increase of over 50 percent from the 247,000 units sold in 1997. The average number of units sold between 1990 and 1999 was 235,400 units per year

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Table 5: New On-Highway Motorcycle Units Sold by Year and Percent and
Cumulative Increases

Year	Units Sold	Percent Increase from Previous Year	Cumulative Increase
1990	208,000	N/A	N/A
1991	190,000	-8.7	-8.7
1992	186,000	-2.1	-10.8
1993	201,000	+8.1	-2.7
1994	210,000	+4.5	+1.8
1995	214,000	+1.9	+3.7
1996	228,000	+6.5	+10.2
1997	247,000	+9.2	+19.4
1998	298,000	+20.6	+40.0
1999	372,000	+24.8	+64.8

Chart 4: New On-Highway Motorcycle Units Sold by Year
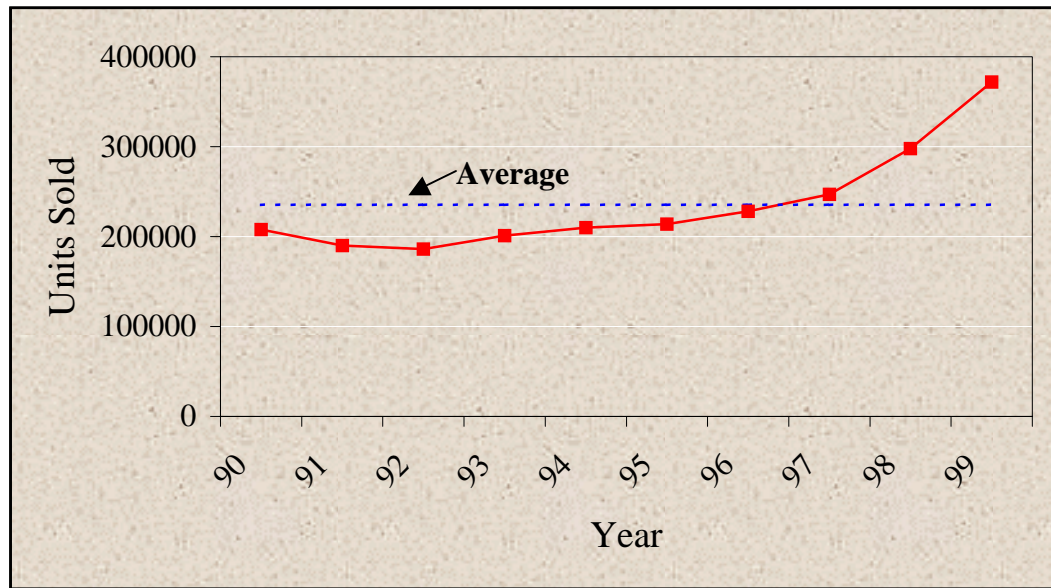
The mean age of a motorcycle owner in 1998 was 38.1 years compared to 33.1 years in 1990, 28.5 years in 1985 and 26.9 years in 1980. Table 6 shows the percent of ownership of motorcycles by age groups for four individual years. The percent of ownership for those age 50 years and over in 1998 was 19.1 percent compared to 10.1 percent in 1990, 8.1 percent in 1985 and 5.7 percent in 1980. Similar increases are also seen in the 35-39 and 40-49 age groups. Under 18, 18-24 and 25-29 age groups showed corresponding decreases. The largest decrease was in the under 18-age group and the greatest increase was in the 40-49 age group.

Table 6: Ownership of Motorcycles by Age Group

Age	Year			
	1980	1985	1990	1998
Under 18	24.6%	14.9%	8.3%	4.1%
18 – 24	24.3%	20.7%	15.5%	10.6%
25 – 29	14.2%	18.7%	17.1%	10.9%
30 – 34	10.2%	13.8%	16.4%	11.5%
35 – 39	8.8%	8.7%	14.3%	16.0%
40 – 49	9.4%	13.2%	16.3%	24.6%
50 and Over	5.7%	8.1%	10.1%	19.1%
Not Stated	2.8%	1.9%	2.0%	3.2%
Median Age	24.0 Years	27.1 Years	32.0 Years	38.0 Years
Mean Age	26.9 Years	28.5 Years	33.1 Years	38.1 Years

Chart 5: Motorcycle Ownership Percentage by Age Group and Year
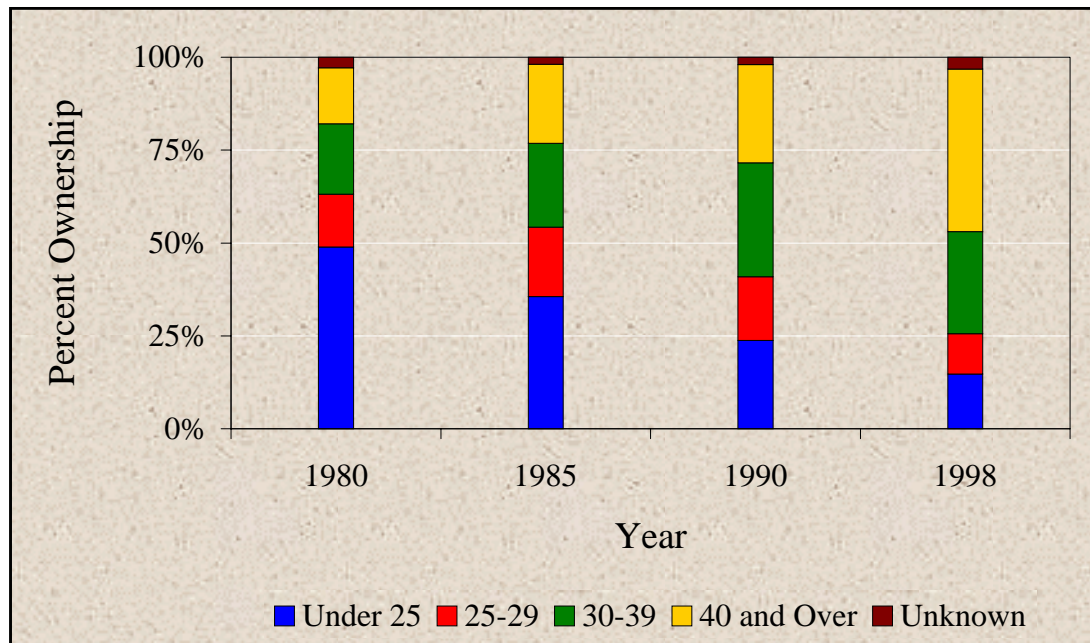
3.2.3 Federal Highway Administration (FHWA) Data

Table 7 shows motorcycle registrations and vehicle miles traveled (VMT) from 1990 to 1999. The data show that motorcycle registrations have increased from 1997 to 1999 by 8.5 percent while the 1999 VMT for motorcycles shows an increase of 8.0 percent since 1995. The data indicate increased exposure in terms of both motorcycle registrations from 1997 to 1999 and vehicle miles traveled from 1995 to 1999.

Table 7: Motorcycle Registrations and Vehicle Miles Traveled (VMT) by Year

Year	Motorcycle Registrations	VMT (Millions)
1990	4,259,462	9,557
1991	4,177,365	9.178
1992	4,065,118	9,557
1993	3,977,856	9,906
1994	3,756,555	10,240
1995	3,897,191	9,797
1996	3,871,599	9,920
1997	3,826,373	10,081
1998	3,879,450	10,283
1999	4,152,433	10,584

Chart 6: Registered Motorcycles and VMT by Year
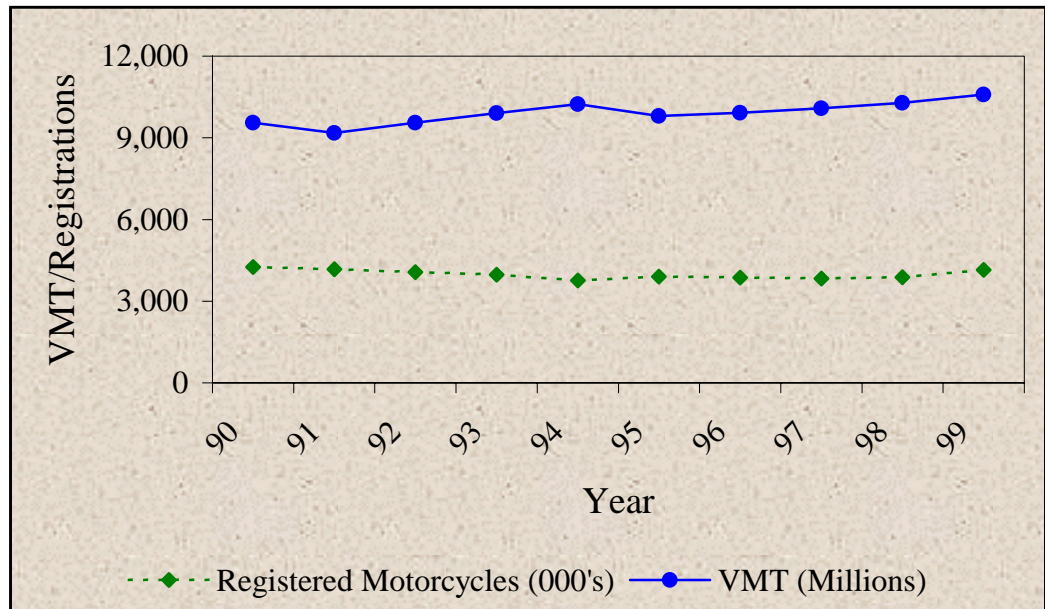
3.2.4 US Census Bureau Data

The US population increased from 249,464,000 in 1990 to 272,691,000 in 1999, or 9.3 percent as per the estimates released by the Census Bureau on October 1, 2000. Table 8 shows the population estimates from 1990 to 1999 by age group.

The population of age group 20-29 has been steadily decreasing each year from 1990 to 1999 and the 30-39 age group has been decreasing each year since 1995. All other age groups have shown a steady increase in population each of the years since 1990. The greatest increase in population has been in the 40-49 and over 49 age groups. The population of 40-49 age group has increased by 31.6 percent

from 1990 to 1999 and over 49 age group increased by 16.7 percent. The increase for under 20 and 30-39 age group for the same years are 8.8 percent and 0.9 percent respectively.

Table 8: Estimate of US Resident Population (100,000) by Year and Age Group

Year	Resident Population Age Group					Total
	< 20	20-29	30-39	40-49	> 49	
1990	718.8	403.7	418.9	316.2	637.0	2,494.7
1991	723.1	398.7	426.9	328.6	644.3	2,521.5
1992	730.7	391.9	433.4	341.7	652.7	2,550.3
1993	740.0	383.6	438.3	351.4	664.6	2,577.8
1994	749.1	375.0	441.1	363.9	674.1	2,603.3
1995	756.8	368.9	441.2	377.2	683.9	2,628.0
1996	764.4	364.4	438.7	392.4	692.4	2,652.3
1997	771.0	363.1	433.8	398.5	711.6	2,677.8
1998	777.0	362.5	427.8	407.4	727.8	2,702.5
1999	781.9	362.4	422.7	416.2	743.7	2,726.9

Chart 7: US Resident Population by Age group and Year

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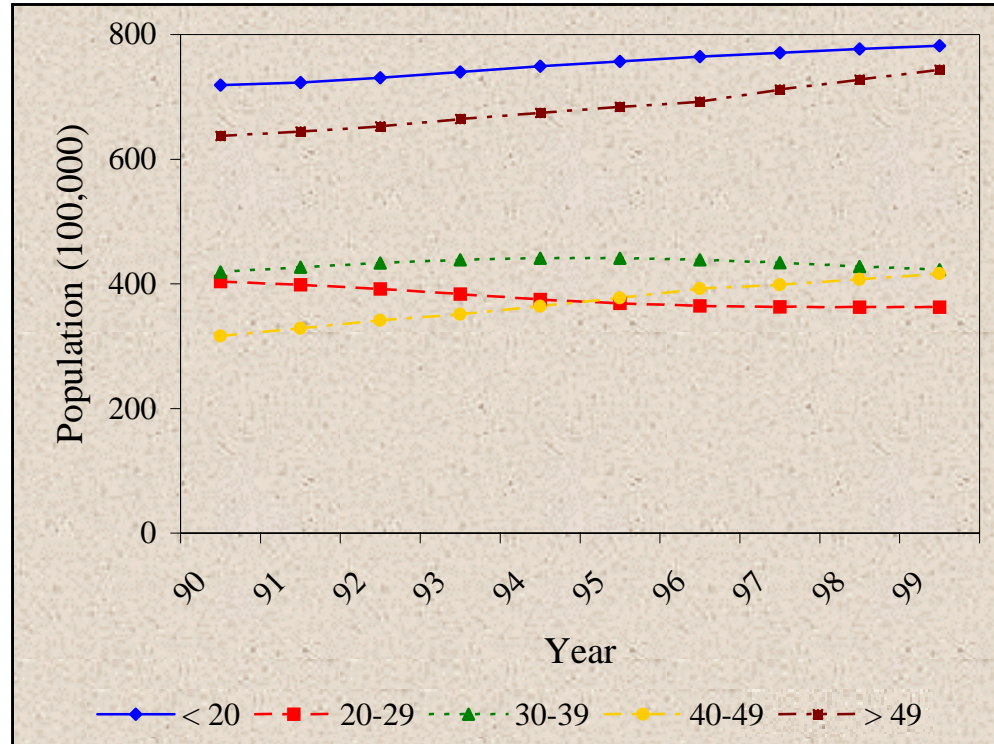
3.3   Fatal Motorcycle Crash Facts

Data from the Fatality Analysis Reporting System and the *Traffic Safety Facts 1999: Motorcycles* provided the following information that served as a basis for the formulation of the hypotheses shown on the next page:

- Almost half (42 percent) of all motorcyclist fatalities in 1999 resulted from crashes in seven states: 236 in California, 182 in Texas, 177 in Florida, 120 in Ohio, 111 in Pennsylvania, 107 in New York, and 106 in North Carolina;

- In 1999, 41 percent of all motorcyclists involved in fatal crashes were speeding, approximately twice the rate for drivers of passenger cars or light trucks.

- In 1999, the percentage of alcohol involvement was more than 50 percent higher for motorcyclists than for drivers of passenger vehicles;

- Almost half of the motorcycle operators who died in single-vehicle crashes in 1999 were intoxicated;

- Intoxication rates for drivers in fatal crashes in 1999 were highest for motorcycle operators (28 percent) compared to drivers of large trucks (1 percent), light trucks (20 percent) and passenger cars (17 percent);

- More than 5 percent of the motorcycle operators involved in fatal crashes in 1999 had at least one previous conviction for driving while intoxicated on their driver records, compared to less than 4 percent for passenger car drivers;

- Nearly one out of six motorcycle operators (15 percent) involved in fatal crashes in 1999 were operating the vehicle with an invalid license (license suspended, revoked, expired, canceled or denied) at the time of the collision, while fewer (11 percent) drivers of passenger vehicles in fatal crashes did not have a valid license;

- Motorcycle operators involved in fatal traffic crashes were more than 1.5 times as likely as passenger vehicle drivers to have a previous license suspension or revocation (20 percent and 13 percent respectively);

- More than one half of all motorcycles involved in fatal crashes in 1999 collided with another motor vehicle in transport. In two-vehicle crashes, 76 percent of motorcycles involved were impacted in the front. Only 3 percent were struck in the rear;

- In 1999 and 1998 more motorcyclists were killed on rural roads than urban roads reversing the trend from 1990 to 1997;

- Per vehicle mile, motorcyclists were about 16 times as likely as passenger car occupants to die in a traffic crash in 1998;

- Motorcycles are more likely to be involved in a fatal collision with a fixed object than are other vehicles. In 1999, 27 percent of the motorcycles involved in fatal crashes collided with a fixed object, compared to 17 percent for passenger cars, 11 percent for light trucks, and 3 percent for large trucks;

- Occupant fatality rates for motorcycles are much higher than those for passenger cars and light trucks. Table 9 gives the occupant fatality rates by vehicle type for 1988 and 1998 and percent change between 1988 and 1998.

Table 9: Occupant Fatality Rates by Vehicle Type 1988 and 1998

Fatality Rate	Motorcycles	Passenger Cars	Light Trucks
1988			
Per 10,000 Registered Vehicles	8.0	2.1	1.9
Per 100 Million VMT	36.5	1.9	1.7
1998			
Per 10,000 Registered Vehicles	5.9	1.7	1.5
Per 100 Million VMT	22.4	1.4	1.2
Percent Change, 1988-1998			
Per 10,000 Registered Vehicles	-26%	-19%	-21%
Per 100 Million VMT	-39%	-26%	-29%

Based on the data from FARS, MIC, Federal Highway, US Census Bureau and *Traffic Safety Facts 1999: Motorcycle*, the following hypotheses were formulated for testing in further analysis of fatal motorcycle crashes:

- Alcohol involvement among operators is a major factor;

- Over 40 age groups are more frequently involved;

- Motorcycle with larger engines will be involved;

- More crashes are now occurring on rural roadways;

- Speeding is a factor;

- Drivers involved are less likely to wear helmets; and,

- License status is still a concern for motorcycle operators.

3.4   Analytical Tools

Review of the data from FARS, MIC, FHWA and the US Census Bureau indicate that further in-depth analysis is required using either data individually or by combining data to calculate rates and look for trends. This report focuses on the following three major areas:

- Age groups among motorcyclists;

- Motorcycle engine displacement in Cubic Centimeters (cc) in fatal crashes; and,

- Land use in motorcyclist fatalities (rural/urban).

Several data variables have been used in the analysis relating to the above three areas either individually or as a combination. The data variables used are:

- Alcohol involvement among operators (drivers);

- License status with license compliance among operators;

- Helmet use among occupants (motorcyclists, which includes operator and passenger);

- Speeding as a factor in crashes;

- Crash type (single vehicle/multiple vehicle); and,

- Roadway type (undivided/divided).

Fatality rates have been calculated using FARS data in conjunction with MIC, FHWA, and US Census Bureau data. Also, individual data from MIC, FHWA and Census Bureau have been analyzed for trends in the use of motorcycles, resident population, motorcycle registrations, and vehicle miles traveled:

- Motorcyclist fatality rate per 100,000 registered vehicles by year;

- Motorcyclist fatality rate per 100 million VMT by year;

- Motorcyclist fatality rate per 100,000 US resident population by age group; and,

- Ratio of fatality percentage (numerator) to ownership percentage (denominator) by age group.

4. FINDINGS

Detailed results are presented based on ownership, number of fatalities, resident population, motorcycle registrations and vehicle miles traveled. Additional data used in the analysis, but not shown in the findings, are given in Appendix A.

4.1 Motorcyclist Fatalities by Person Type

Motorcyclist fatalities reached a historic low of 2,116 in 1997, and had been declining since 1990. However, fatalities increased by 16.8 percent between 1997 and 1999. Table 10 shows motorcyclist fatalities from 1990 to 1999. The numbers indicate that operators account for about 90 percent of the fatalities while passengers account for the remaining 10 percent.

Table 10: Motorcyclist Fatalities by Year and Person Type

Year	Operator (Driver)		Passenger		Total
	Number	Percent	Number	Percent	
1990	2,896	89	348	11	3,244
1991	2,497	89	309	11	2,806
1992	2,172	91	223	9	2,395
1993	2,216	90	233	10	2,449
1994	2,095	90	225	10	2,320
1995	2,020	91	207	9	2,227
1996	1,962	91	199	9	2,161
1997	1,937	92	179	8	2,116
1998	2,089	91	205	9	2,294
1999	2,276	92	196	8	2,472

Chart 8: Motorcyclist Fatalities by Person Type and Year

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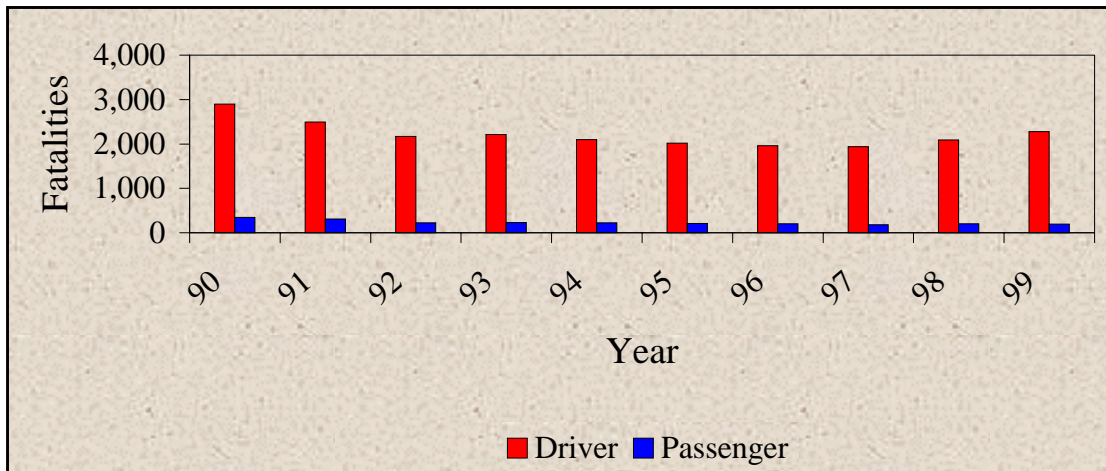
Table 11 shows motorcyclist fatalities by sex from 1990 to 1999. The data show that for the past ten years over 90 percent of the motorcyclists killed were males.

Table 11: Motorcyclist Fatalities by Year and Sex

Year	Motorcyclist Sex						Total
	Male		Female		Unknown		
	Number	Percent	Number	Percent	Number	Percent	
1990	2,988	92	256	8	0	0	3,244
1991	2,579	92	227	8	0	0	2,806
1992	2,211	92	183	8	1	0	2,395
1993	2,238	91	211	9	0	0	2,449
1994	2,111	91	209	9	0	0	2,320
1995	2,024	91	203	9	0	0	2,227
1996	1,966	91	195	9	0	0	2,161
1997	1,926	91	190	9	0	0	2,116
1998	2,088	91	206	9	0	0	2,294
1999	2,247	91	224	9	1	0	2,472

4.2   Motorcyclist Fatalities by Age Groups (percent)

Even though motorcyclist fatalities declined between 1990 and 1997, there have been two consecutive years in which the trend reversed itself with a 8.4 percent increase in fatalities between 1997 and 1998 and a 7.8 percent increase between 1998 and 1999. This increase has been observed for the most part, in the over 40-age group. The number of under 20 and 20-29 age group fatalities has declined considerably between 1990 and 1999 and the 30-39 age group has maintained the same percentage of fatalities. But the 40-49 and over 49 age groups showed a steady increase each year between 1990 and 1999. The percentage of fatalities in the 40-49 age group has increased from 8.6 percent in 1990 to 22.9 percent, a factor of 2.7. The over 49 age group fatality percentage for the same years has increased from 5.8 in 1990 to 16.2 in 1999, by a factor of 2.8. Table 12 shows the percent of motorcyclist fatalities by age groups for the last 10 years.

However, examining Table 12 shows, there are still proportionally more fatalities in the 20-29 year age group than in the under 20, 30-39, 40-49, and over 49 age groups from 1990 to 1999. This indicates that 20-29 age group is still the leading age group in terms of the number of motorcyclist fatalities among all age groups.

Table 12: Motorcyclist Fatalities as Percent by Year and Age Group

Year	Motorcyclist Age Group by Percent				
	< 20	20-29	30-39	40-49	> 49
1990	15.5	44.9	25.2	8.6	5.8
1991	14.7	43.5	26.0	10.6	5.4
1992	13.3	41.0	27.2	11.7	6.8
1993	10.7	41.1	27.2	13.8	7.2
1994	11.2	39.2	26.2	14.9	8.4
1995	8.8	40.8	25.9	16.1	8.4
1996	9.3	35.3	25.7	19.4	10.2
1997	7.8	32.8	26.3	19.1	13.9
1998	8.8	31.4	26.7	20.7	12.4
1999	5.5	30.7	24.7	22.9	16.2

Chart 9: Motorcyclist Fatality Percentage by Year and Age Group
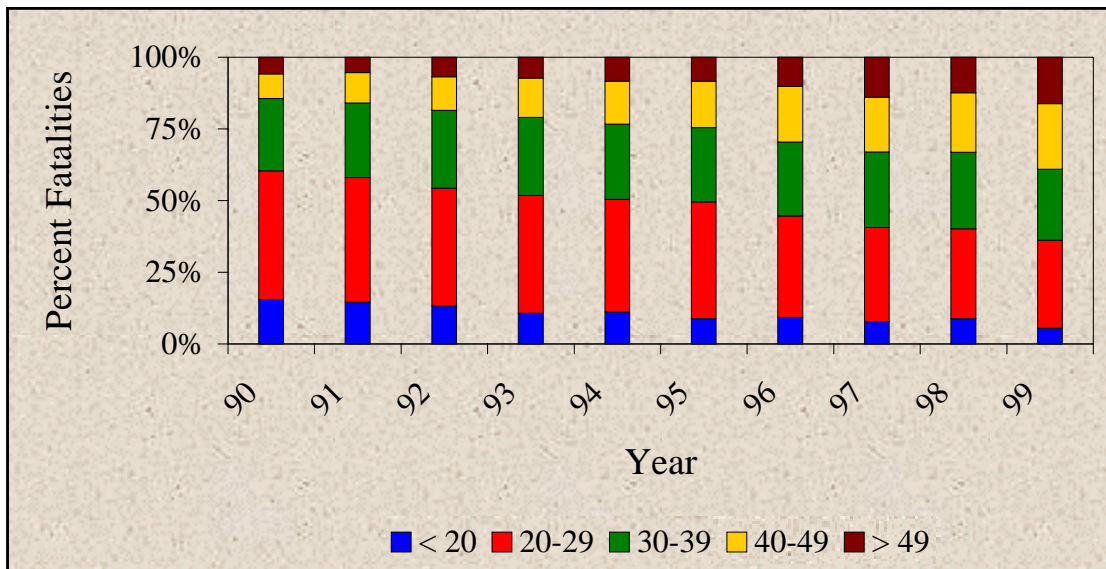
4.3 Motorcyclist Fatalities by Land Use

Between 1990 and 1997 the majority of motorcyclist fatalities occurred on urban roadways but it was generally decreasing. This trend has changed in the past two years with more fatalities occurring on rural roadways. Motorcyclist fatalities on rural roadways increased from 44.5 percent in 1990 to 51.7 percent in 1999 an increase of 7.2 percent. In 1997, 1,047 motorcyclists were killed on rural roadways compared to 1,278 in 1999, an increase of 22.1 percent. The increase in motorcyclist fatalities for the same years on urban roadways was 9.8 percent. Table 13 shows the breakdown of the fatalities by land use for the years 1990 through 1999.

Table 13: Motorcyclist Fatalities by Year and Land Use

| Year | Land Use | | | | | | Total |
| | Rural | | Urban | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
1990	1,445	44.5	1,798	55.4	1	0.0	3,244
1991	1,337	47.6	1,465	52.2	4	0.1	2,806
1992	1,091	45.6	1,285	53.7	19	0.8	2,395
1993	1,177	48.1	1,256	51.3	16	0.7	2,449
1994	1,070	46.1	1,244	53.6	6	0.3	2,320
1995	1,070	48.0	1,144	51.4	13	0.6	2,227
1996	1,027	47.5	1,126	52.1	8	0.4	2,161
1997	1,047	49.5	1,064	50.3	5	0.2	2,116
1998	1,166	50.8	1,119	48.8	9	0.4	2,294
1999	1,278	51.7	1,168	47.2	26	0.1	2,472

Chart 10: Motorcyclist Fatalities by Year and Land Use
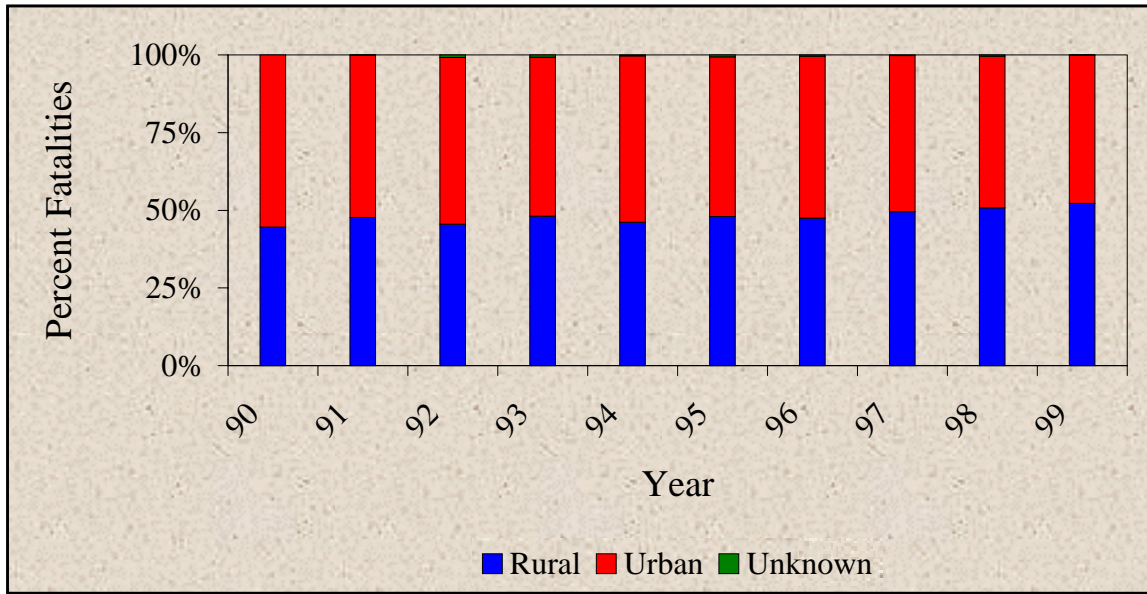
4.4   Motorcyclist Fatalities by Engine Displacement in Cubic Centimeters (cc)

In addition to the overall increase in motorcyclist fatalities in recent years, there has been a noticeable increase in motorcyclist fatalities within the 1,001-1,500 cc engine size category. The number of motorcyclist fatalities in the 1,001-1,500 cc engine group rose from 702 in 1990 to 817 in 1999, an increase of 16.4 percent the only group to show an increase of fatalities between 1990 and 1999. The largest number of motorcyclist fatalities is still in the 501-1,000 cc engine group. However, the fatality count among motorcyclists in the 1,001-1,500 cc group is fast approaching the 501-1,000 cc level.

Motorcyclist fatalities in the 500 cc and less engine group declined by 71 percent between 1990 and 1999. Similarly fatalities in the 501-1,000 cc group have declined by 35 percent during the same time period. Starting in 1996, a very small number of all motorcyclist fatalities are reported involving motorcycles with engine displacements greater than 1,500 cc. Table 14 shows fatalities from 1990 to 1999 by engine displacement.

Table 14: Motorcyclist Fatalities by Year and Engine Displacement in Cubic Centimeters

Year	Engine Displacement in Cubic Centimeters										Total
	Up to 500		501-1,000		1,001-1,500		> 1,500		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	
1990	639	19.7	1,526	47.0	702	21.6	0	0.0	377	11.6	3,244
1991	497	17.7	1,365	48.6	654	23.3	0	0.0	290	10.3	2,806
1992	411	17.2	1,107	46.2	590	24.6	0	0.0	287	12.0	2,395
1993	388	15.8	1,111	45.4	683	27.9	0	0.0	267	10.9	2,449
1994	311	13.4	1,038	44.7	633	27.3	0	0.0	338	14.6	2,320
1995	310	13.9	1,009	45.3	666	29.9	0	0.0	242	10.9	2,227
1996	243	11.2	1,001	46.3	654	30.3	8	0.4	255	11.8	2,161
1997	194	9.2	957	45.2	729	34.5	11	0.5	225	10.6	2,116
1998	213	9.3	1,040	45.3	781	34.0	16	0.7	244	10.6	2,294
1999	184	7.4	993	40.2	817	33.1	23	0.9	455	18.4	2,472

Chart 11: Motorcyclist Fatalities by Year and Engine Displacement in cc

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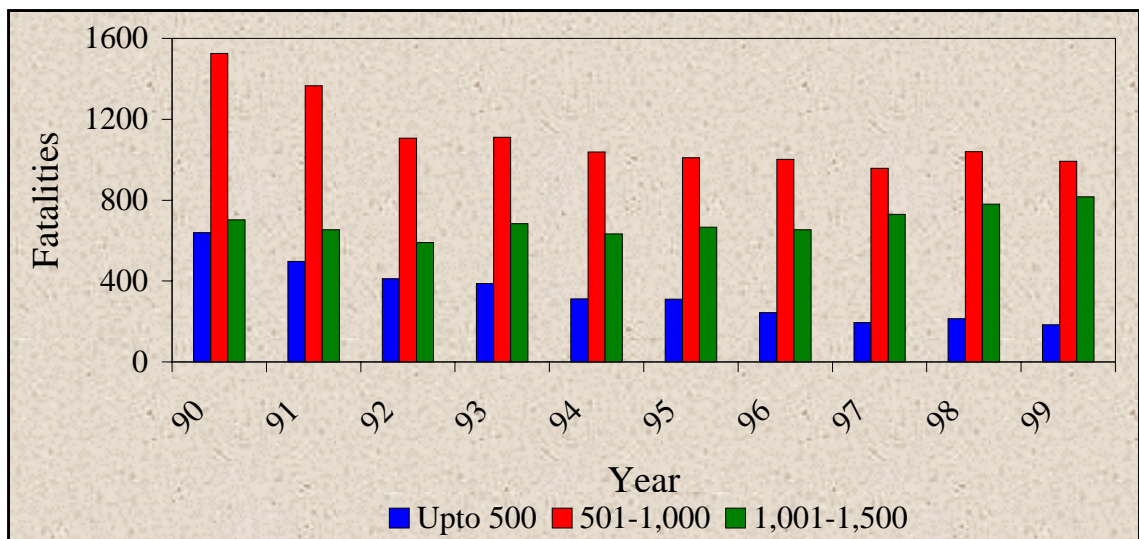
4.5   Motorcyclist Fatalities in 1,001-1,500 cc Engine Size by Year and Age Group

Review of data from Table 14 above showed that the increase in motorcyclist fatalities is only in the 1,001-1,500 cc engine size group between 1990 and 1999. Analysis of data from Table 15 shows number of motorcyclist fatalities in the 1,001-1,500 cc engine size category has increased only in 40-49 and over 49 age groups between 1990 and 1999. The motorcyclist fatalities in 40-49 age group have been steadily increasing each year since 1992. Similarly motorcyclist fatalities in over 49-age group have been steadily increasing each year since 1993.

The motorcyclist fatalities in over 40-age group in the 1,001-1,500 cc engine size have been increasing even though overall motorcyclist fatalities have reduced from 1990 to 1997. The number of motorcyclist fatalities in 40-49 age group has increased by 2.5 times between 1990 and 1999. Similarly motorcyclist fatalities in over 49-age group have increased by 3.4 times between 1990 and 1999. These numbers indicate the involvement of larger motorcycles like 1,001-1,500 cc engine size group by age groups over 40 in fatal crashes. Additional numbers for motorcyclist fatalities by engine size by age group for each year are given in Appendix A.

The percentage of motorcyclist fatalities in over 40-age group has increased from 27 percent in 1990 to 65 percent in 1999 in the 1,001-1,500 cc engine size. Almost two thirds (65 percent) of the motorcyclist fatalities in 1999 were in over 40-age group and the rest one third in under 40-age group. In 1990, three fourths (74 percent) of motorcyclist fatalities were in under 40-age group compared to 27 percent in over 40-age group.

Table 15: Motorcyclist Fatalities in 1,001-1,500 cc Engine Size by Year and Age Group

Year	Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
1990	22	3	236	34	258	37	116	17	70	10	0	0	702
1991	19	3	202	31	246	38	126	19	60	9	1	0	654
1992	17	3	146	25	231	39	125	21	71	12	0	0	590
1993	13	2	191	28	253	37	167	24	59	9	0	0	683
1994	12	2	137	22	215	34	176	28	93	15	0	0	633
1995	12	2	135	20	233	35	182	27	104	16	0	0	666
1996	15	2	119	18	211	32	198	30	111	17	0	0	654
1997	8	1	99	14	232	32	225	31	165	23	0	0	729
1998	17	2	91	12	252	32	267	34	153	20	1	0	781
1999	3	0	79	10	206	25	293	36	236	29	0	0	817

Chart 12: Motorcyclist Fatalities in 1,001-1,500 cc Engine Size by Year and Age Group
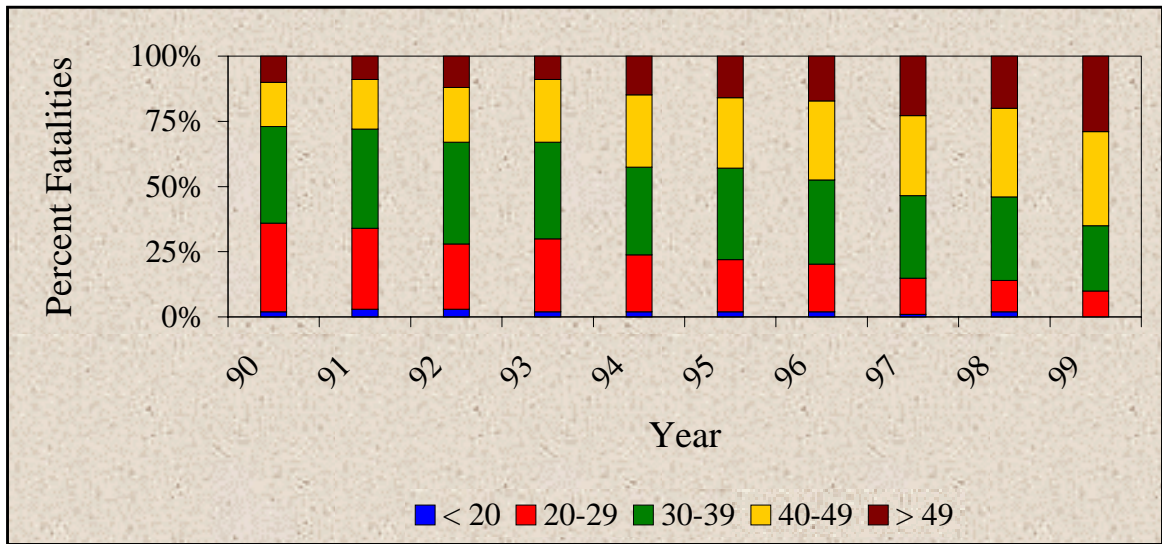
4.6 Mean Age of Motorcyclist Killed and Mean Engine Displacement in Fatal Crash

From 1990 to 1999 the average age of motorcyclists killed increased each year. The mean age of the motorcyclist killed in 1990 was 29.3 years. It increased to 36.5 years in 1999, an increase of 24.6 percent. Similarly the mean engine displacement of the motorcycles involved in fatal crashes has increased from 769 cc in 1990 to 922 cc in 1999, an increase of 19.9 percent. The analysis indicates a rise in the average age of motorcyclist killed and greater involvement of motorcycles with larger engines in fatal crashes. Table 16 shows the mean age of motorcyclist killed and mean engine displacement in fatal crash from 1990 to 1999.

Table 16: Mean Age of Motorcyclist Fatality and Mean Engine Displacement in cc
Involved in Fatal Crash by Year

Year	Mean Age of Motorcyclist Killed (Years) (1)	Mean Engine Displacement Involved in Fatal Crash (cc) (2)
1990	29.3	769
1991	29.6	786
1992	30.5	799
1993	31.3	820
1994	31.8	837
1995	32.1	842
1996	33.4	865
1997	34.8	899
1998	34.6	904
1999	36.5	922

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Chart 13: Mean Age of Motorcyclist Fatality by Year
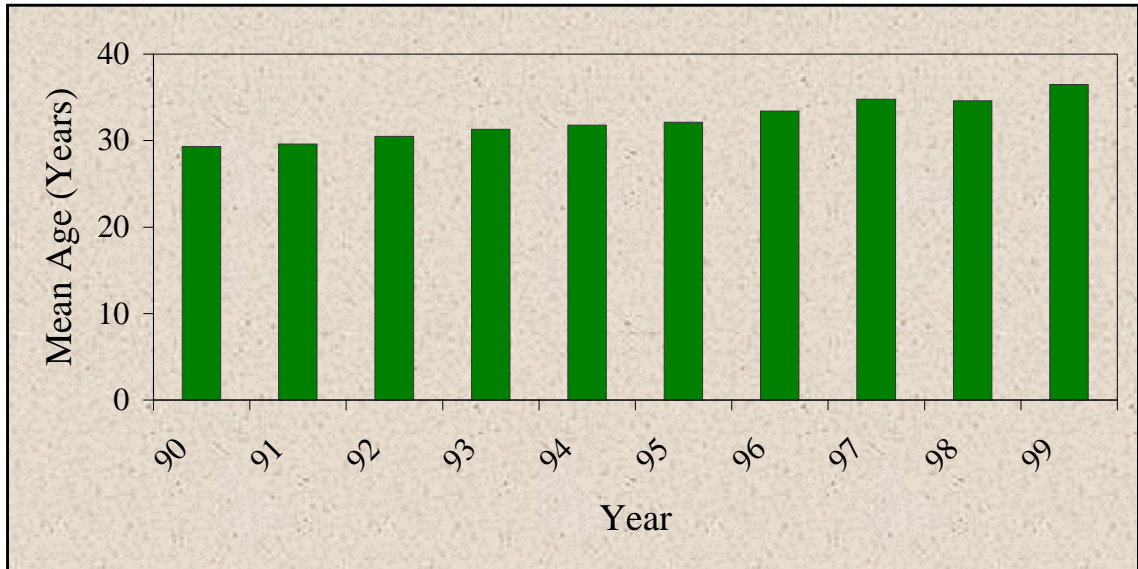
Chart 14: Mean Engine Displacement in cc in Fatal Crash by Year
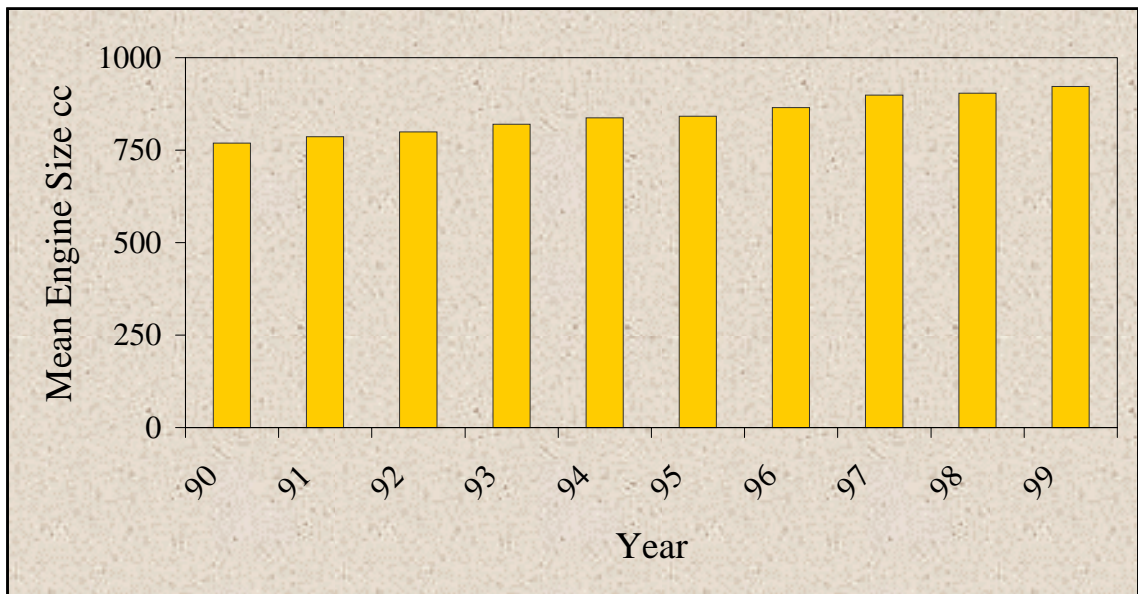
4.7   Motorcyclist Fatalities by Crash Type

Table 17 shows the number and percentage of fatalities for each year by crash type. The numbers do not indicate any significant variation over the ten-year period. However, further analysis of fatalities as shown in the following sections indicate significant trends and reveal information regarding speeding, alcohol use, age groups, engine displacement, and helmet use.

Table 17: Motorcyclist Fatalities by Year and Crash Type

| Year | Single Vehicle Crash | | Multiple Vehicle Crash | | Total |
	Number	Percent	Number	Percent	
1990	1,469	45	1,775	55	3,244
1991	1,285	46	1,521	54	2,806
1992	1,114	47	1,281	53	2,395
1993	1,069	44	1,380	56	2,449
1994	1,010	44	1,310	56	2,320
1995	960	43	1,267	57	2,227
1996	937	43	1,224	57	2,161
1997	937	44	1,179	56	2,116
1998	1,042	45	1,252	55	2,294
1999	1,134	46	1,338	54	2,472

4.8   Motorcyclist Fatalities by Helmet Use

Helmet use in fatal crashes among motorcyclist fatalities has shown a slow but steady increase from 43 percent in 1990 to 53 percent in 1999, a 10 percent increase. At the same time 44 percent of the motorcyclists who were killed in 1999 did not wear a helmet while riding a motorcycle compared to 51 percent in 1990. Table 18 shows the number and percent of the motorcyclist fatalities by helmet use from 1990 to 1999.

Table 18: Motorcyclist Fatalities by Year and Helmet Use

| Year | Helmet Use | | | | | | Total |
| | Not Used | | Used | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
1990	1,650	51	1,384	43	210	6	3,244
1991	1,400	50	1,236	44	170	6	2,806
1992	958	40	1,303	54	134	6	2,395
1993	986	40	1,330	54	133	5	2,449
1994	1,001	43	1,228	53	91	4	2,320
1995	940	42	1,197	54	90	4	2,227
1996	925	43	1,162	54	74	3	2,161
1997	879	42	1,145	54	92	4	2,116
1998	1,021	45	1,182	52	91	4	2,294
1999	1,082	44	1,300	53	90	4	2,472

Chart 15: Motorcyclist Fatalities by Year and Helmet Use
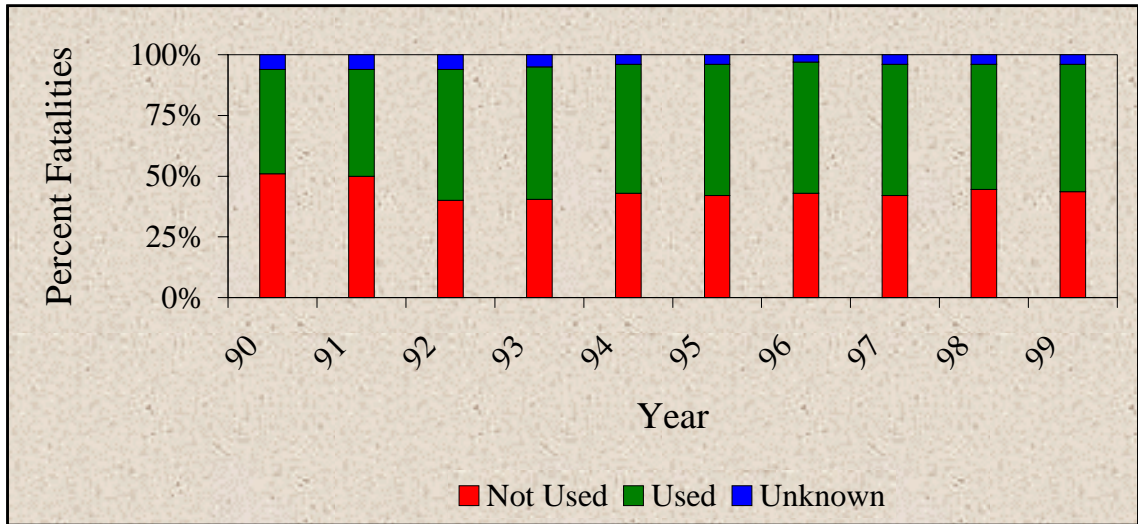
4.9   Motorcyclist Fatalities by Roadway Type

Seventy percent of the motorcyclist fatalities occur on undivided roadways, another 20 percent are on roadways that have a median with no median barrier. Data from 1990 to 1999 indicate that there are not many changes in the percentage of the fatalities occurring on different types of roadways. Table 19 shows the number and percentage of fatalities on different roadways. Further data analysis on undivided roadways is provided in the following sections.

Table 19: Motorcyclist Fatalities by Year and Roadway Type

| Year | Roadway Type | | | | | | | | | | Total |
| | Not Divided | | Median-No Barrier | | Median w/Barrier | | One Way Traffic | | Unknown | | |
	No.	%	No.	%	No.	%	No.	%	No.	%	
1990	2,244	69	629	19	213	7	83	3	75	2	3,244
1991	1,984	71	506	18	193	7	62	2	61	2	2,806
1992	1,762	74	371	15	172	7	42	2	48	2	2,395
1993	1,798	73	389	16	161	7	65	3	36	1	2,449
1994	1,631	70	468	20	157	7	39	2	25	1	2,320
1995	1,586	71	431	19	145	7	31	1	34	2	2,227
1996	1,531	71	411	19	168	8	21	1	30	1	2,161
1997	1,484	70	437	21	146	7	16	1	33	2	2,116
1998	1,662	72	405	18	176	8	23	1	28	1	2,294
1999	1,737	70	486	20	161	7	41	2	47	2	2,472

Chart 16: Motorcyclist Occupant Fatality by Year and Roadway Type
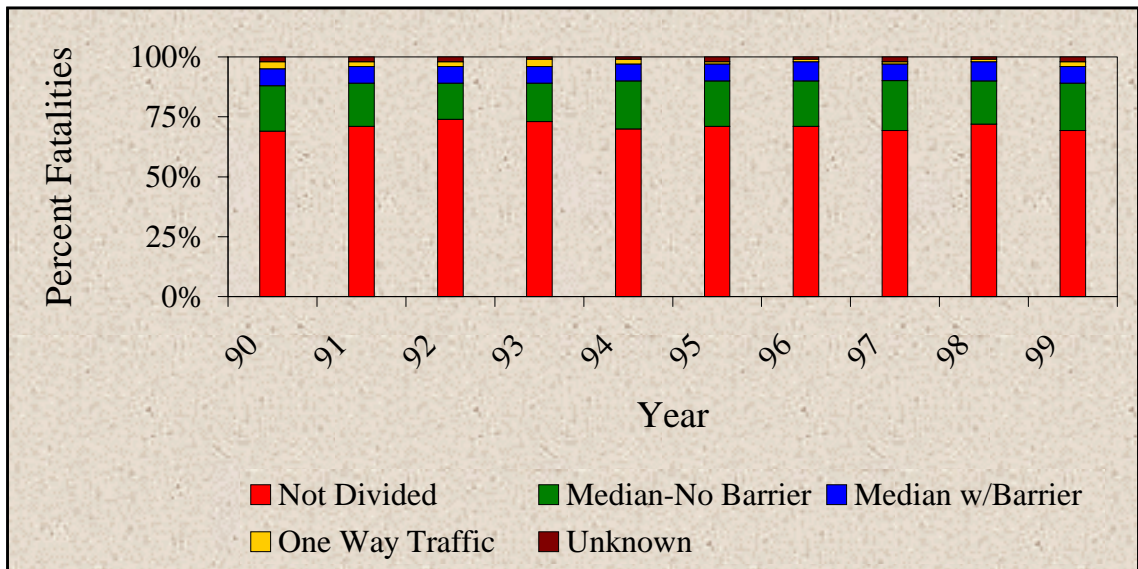
4.10   Motorcyclist Fatalities by Speeding

The percent of motorcyclist fatalities, where speeding was recorded as driver contributing factor remains about 42 percent and has not changed significantly in the past ten years. Further analysis of the data in the following sections reveals some important information relating to speeding and alcohol use by age groups. Table 20 shows the numbers and percentage of fatalities listed for each of the past ten years.

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Table 20: Motorcyclist Fatalities by Year and Speeding Factor

| Year | Speeding Factor | | | | | | Total |
| | Speeding | | Not Speeding | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
1990	1,423	43.9	1,787	55.1	34	1.0	3,244
1991	1,315	46.9	1,465	52.2	26	0.9	2,806
1992	1,083	45.2	1,290	53.9	22	0.9	2,395
1993	1,067	43.6	1,348	55.0	34	1.4	2,449
1994	1,033	44.5	1,247	53.8	40	1.7	2,320
1995	961	43.2	1,213	54.5	53	2.4	2,227
1996	940	43.5	1,178	54.5	43	2.0	2,161
1997	882	41.7	1,205	56.9	29	1.4	2,116
1998	956	41.7	1,315	57.3	23	1.0	2,294
1999	1,027	41.5	1,410	57.0	35	1.4	2,472

4.11 Motorcycle Operator Fatalities by Driver Blood Alcohol Concentration (BAC)

The National Highway Traffic Safety Administration defines a fatal traffic crash as being alcohol-related if either a driver or a non-occupant (e.g., pedestrian) had a blood alcohol concentration (BAC) of 0.01 grams per deciliter (g/dl) or greater in a police reported traffic crash. Persons with a BAC of 0.10 g/dl or greater involved in fatal crashes are considered to be intoxicated. This is the legal limit of intoxication in many states. BAC values have been assigned to drivers involved in fatal crashes when alcohol test results are unknown. A complete description of the statistical procedures used for unknown alcohol test results in FARS can be found in a technical report available from the National Center for Statistics and Analysis (reference No. 6)

Alcohol involvement among motorcycle operators has been declining over the last ten years. The percent of fatally injured operators who had been drinking in 1999 was 38 percent compared with 52 percent in 1990. But a majority of operators killed who had been drinking were intoxicated with a BAC 0.10+. In 1999, there were 875 operators killed that had been drinking (BAC 0.01+) of which 644 (74 percent) operators killed were intoxicated (BAC 0.10+). These numbers indicate that even though the alcohol involvement among operators is declining, there is still an underlying problem because of the high proportion with BACs over 0.10+. Table 21 shows the numbers and percent of operators killed by their BAC from 1990 to 1999.

Table 21: Motorcycle Operator Fatalities by Year and Operator BAC

Year	BAC 0.00		BAC 0.01-0.09		BAC 0.10+		BAC 0.01+		Total
	No.	%	No.	%	No.	%	No.	%	
1990	1,378	48	359	12	1,158	40	1,518	52	2,896
1991	1,214	49	298	12	985	39	1,283	51	2,497
1992	1,110	51	262	12	799	37	1,062	49	2,172
1993	1,223	55	245	11	748	34	993	45	2,216
1994	1,246	59	229	11	621	30	849	41	2,095
1995	1,177	58	233	12	610	30	843	42	2,020
1996	1,123	57	232	12	607	31	839	43	1,962
1997	1,164	60	215	11	558	29	773	40	1,937
1998	1,241	59	190	9	659	32	848	41	2,089
1999	1,401	62	231	10	644	28	875	38	2,276

Chart 17: Motorcycle Operator Fatality by Year and Operator BAC
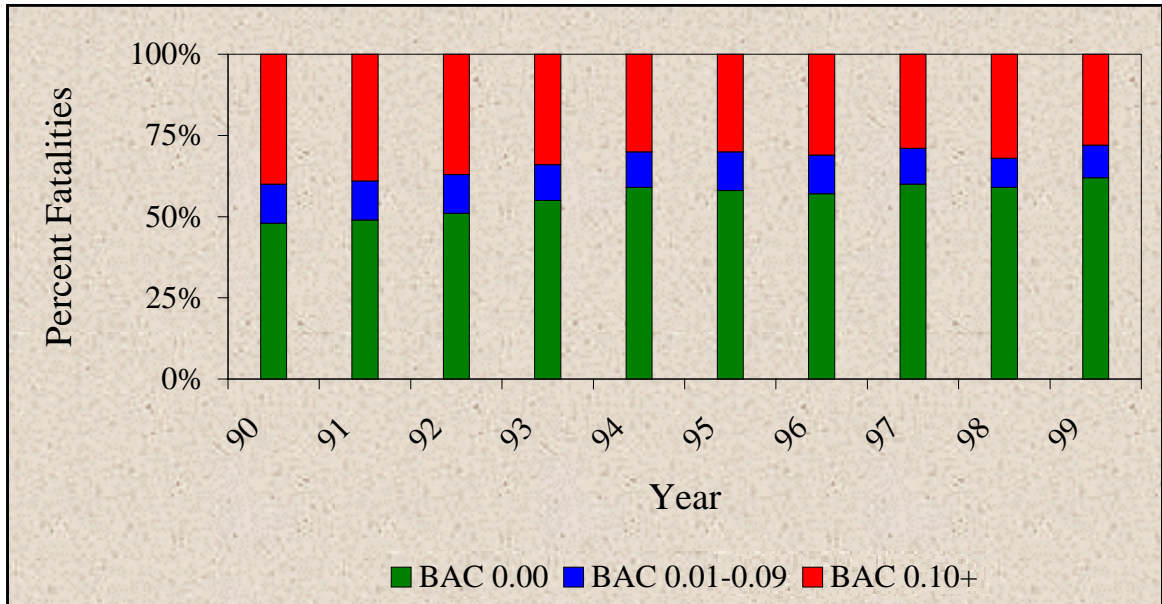
4.12   Motorcycle Operator Fatalities by License Status and License Compliance

The definitions of properly and improperly licensed terms used throughout this report are based on the following:

Properly Licensed – 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.

Improperly Licensed – not licensed, not licensed to operate a motorcycle, or a license that is suspended, revoked, expired, or canceled or denied.

From 1990 to 1999 a steadily increasing percent of fatally injured motorcycle operators were properly licensed. This number hit an all time high of 71 percent in 1999 compared to 55 percent in 1990. Still 28 percent of the operators killed in 1999 were riding a motorcycle with an improper license. Table 22 shows the number and percentage of operators killed by their license status for the past ten years.

Table 22: Motorcycle Drivers Killed by Year and License Status and License Compliance

| Year | License Status with License Compliance | | | | | | Total |
| | Properly Licensed | | Improperly Licensed | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
1990	1,579	55	1,265	44	52	2	2,896
1991	1,422	57	1,045	42	30	1	2,497
1992	1,249	58	890	41	33	2	2,172
1993	1,349	61	836	38	31	1	2,216
1994	1,294	62	777	37	24	1	2,095
1995	1,263	63	737	36	20	1	2,020
1996	1,274	65	666	34	22	1	1,962
1997	1,300	67	623	32	14	1	1,937
1998	1,405	67	665	32	19	1	2,089
1999	1,619	71	629	28	28	1	2,276

Chart 18: Motorcycle Operator Fatality by Year and License Status by License Compliance

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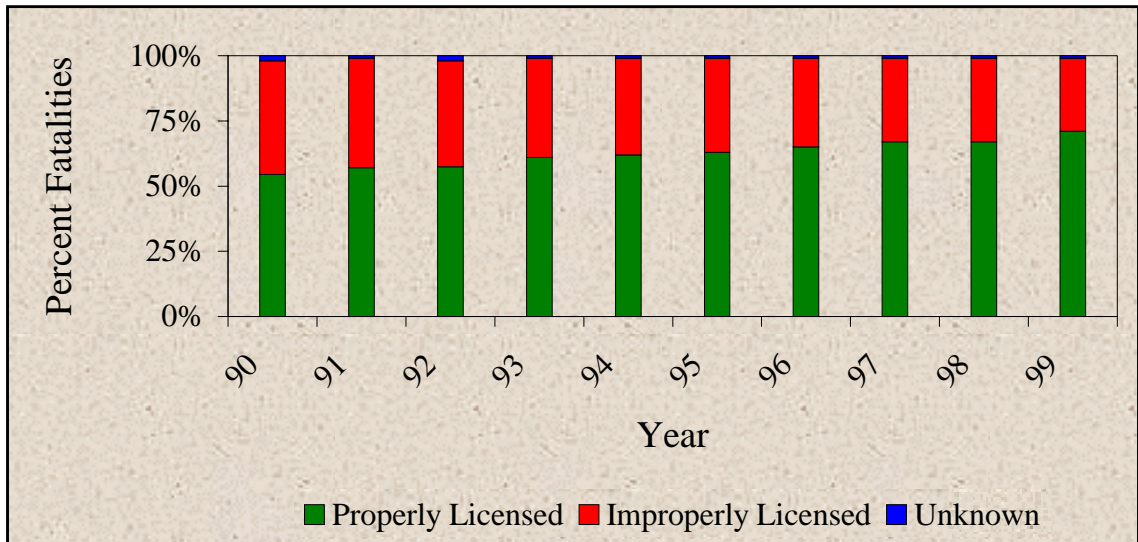
4.13   Motorcyclist Fatalities (Years 1980, 1985, 1990 and 1998)

In order to calculate fatality rates based on ownership, data were used from MIC's *2000 Motorcycle Statistical Annual*. These data were available for 1980, 1985, 1990, and 1998 and were given as percentage of ownership by age groups. Rates are calculated by dividing the fatality percentage (numerator) by ownership percentage (denominator) for the specific age group. Since actual numbers of owners by the age group were not available, this method of calculating the rates was used.

Table 23 shows the number of fatalities, their percentages, and mean age of all motorcyclist fatalities in that year. The data show that only fatalities in the 40 and over age group have increased (by 63 percent) between 1990 and 1998 whereas fatalities in the other age groups have declined over time. The number of fatalities in the 40 and over age group has overtaken all other age groups in 1998. The largest increase in the percentage of fatalities in any age group between 1990 and 1998 is in the 40 and over age group whereas the largest decline is in the under 25-age group. The decline in fatalities in the under 25-age group between 1980 and 1998 is 80 percent. The decline in fatalities for the 25-29 age group is 63 percent for the same period and for 30-39 age group 33 percent between 1980 and 1998.

Table 23: Motorcyclist Fatalities by Age Group and Year (1980, 1985, 1990, and 1998)

Age Group	1980		1985		1990		1998	
	Number	Pct	Number	Pct	Number	Pct	Number	Pct
Under 25	2,793	54	2,297	50	1,294	40	564	25
25-29	967	19	970	21	667	21	357	16
30-39	920	18	861	19	816	25	612	27
40 and Over	460	9	431	9	466	14	760	33
Unknown	4	0	5	0	1	0	1	0
Mean Age (Years)	26.2		26.8		29.3		34.6	

Chart 19: Motorcyclist Fatalities by Age Group and Year (1980, 1985, 1990 and 1998)
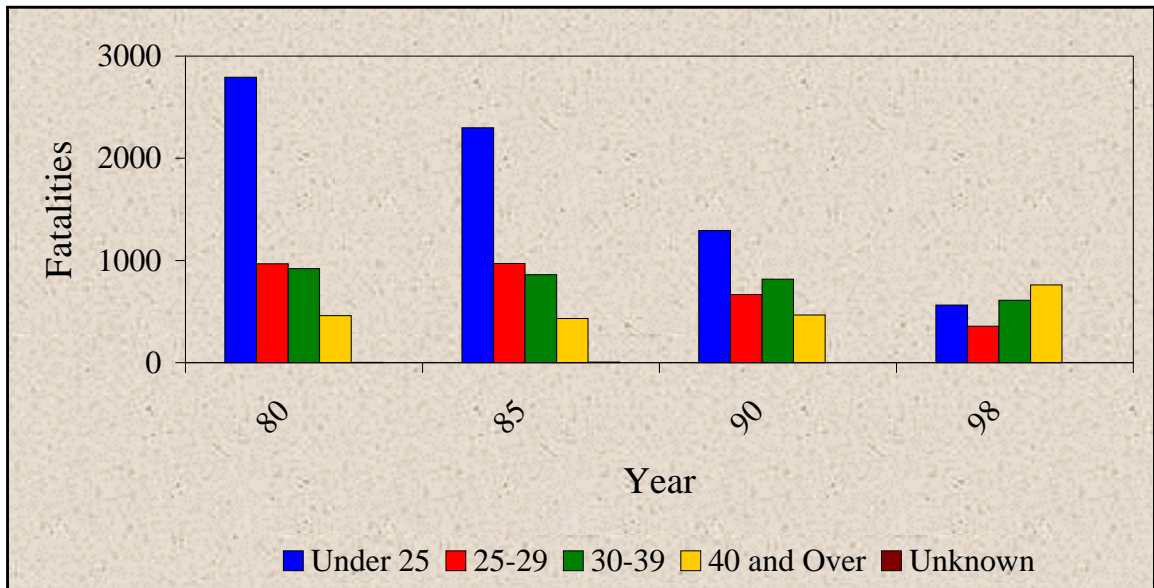
Chart 20: Motorcyclist Fatality Percentage by Age Group and Year (1980, 1985, 1990 and 1998)
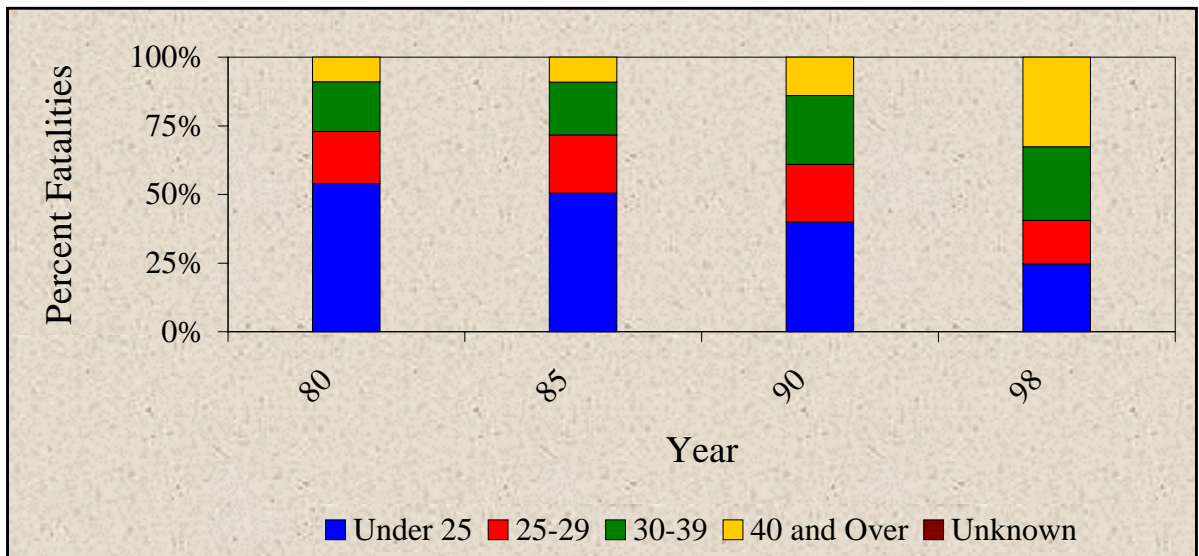
Table 24 below gives the rates based on the fatality percentage divided by the ownership percentage (refer to Table 6 in Section 3.2.2 above for Ownership data) for a particular age group when the data is read across the table by year. As seen in earlier tables, the rates for the 40 and over age group have increased during 1990, and 1998. This is due to the fact that there are more owners in this age group as a percentage (denominator) in recent years and correspondingly, also more fatalities as a percentage (numerator). In fact the highest increase in the ratio has been for the 40 and over age group when compared during 1990 and 1998 years.

Table 24: Ratio of Fatality Percentage to Ownership Percentage by Age Group and Year
(1980, 1985, 1990 and 1998)

Age Group	1980	1985	1990	1998
Under 25	1.1104	1.4138	1.6761	1.6728
25-29	1.3239	1.1364	1.2023	1.4275
30-39	0.9411	0.8387	0.8192	0.9702
40 and Over	0.5921	0.4432	0.5439	0.7581

Chart 21: Ratio of Occupant Fatality Percentage to Ownership Percentage by Age Group
and Year (1980, 1985, 1990 and 1998)
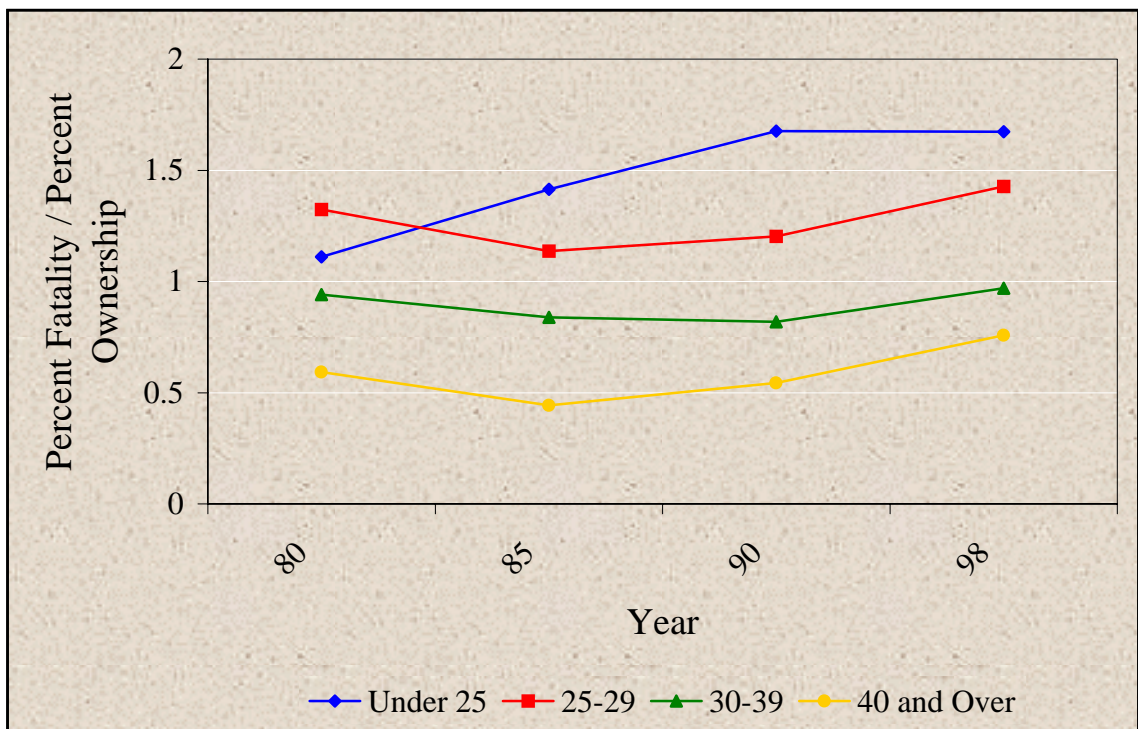
4.14 Motorcyclist Fatalities by Engine Size and Land Use

Table 25 shows the number and percentage of motorcyclist fatalities by rural/urban and engine size aggregated for ten years. The data indicate more fatalities on urban roads for those operating motorcycles below 1,000 cc engine size compared to more fatalities on rural roads for those operating motorcycles of 1,000-1,500 cc engine size. These numbers show greater involvement of motorcycles over 1,000 cc engine size on rural roads in fatal crashes.

Table 25: Motorcyclist Fatalities by Engine Size and Land Use (1990-1999)

| Engine Size cc | Land Use | | | | | | Total |
| | Rural | | Urban | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Up to 500	1,595	47.1	1,777	52.4	18	0.5	3,390
501-1,000	4,730	42.4	6,372	57.2	45	0.4	11,147
1,001-1,500	3,787	54.8	3,102	44.9	20	0.3	6,909
1,501 and Above	36	62.1	22	37.9	0	0.0	58
Unknown	1,560	52.3	1,396	46.8	24	0.8	2,980
Total	11,708	47.8	12,669	51.7	107	0.4	24,484

Chart 22: Motorcyclist Fatality by Engine Size in cc and Land Use (1990-1999)
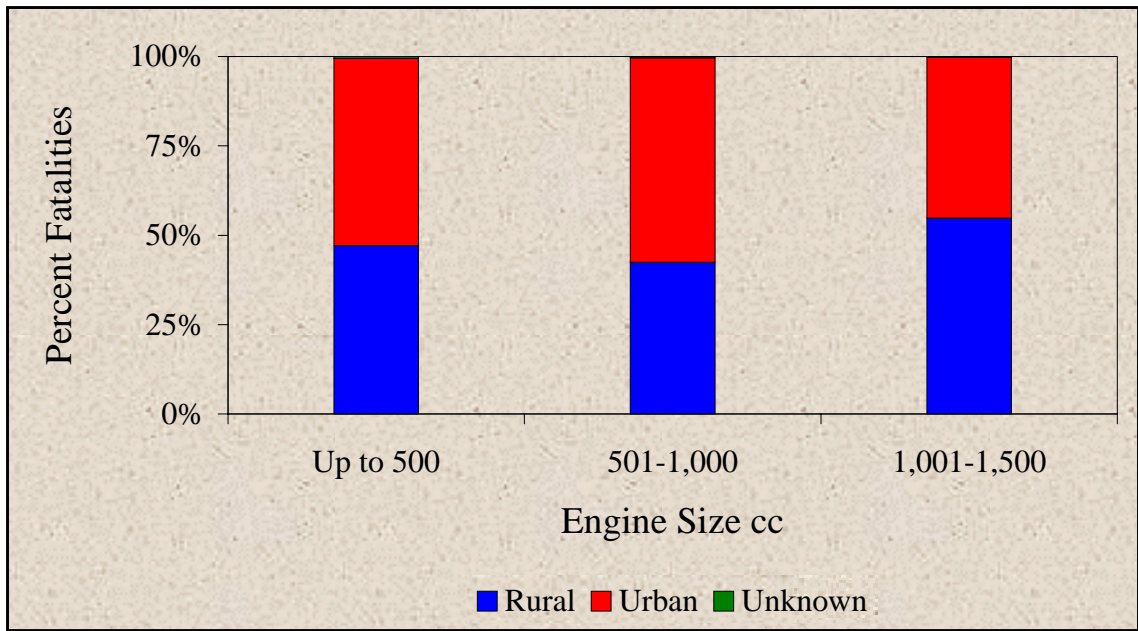
4.15 Motorcyclist Fatalities by Age Group and Land Use

Analysis of the data from Table 26 aggregated for ten years shows that motorcyclist fatalities for the Under 20 age and 30-39 age groups are almost evenly divided between urban and rural roads. The fatalities on the rural roads increase as age increases. In the 20-29 age group there are more fatalities on urban roads. These numbers show a division of motorcyclist fatalities under the age of 30 mainly on urban roads and motorcyclist fatalities over the age of 40 mainly on rural roads. The 30-39 age group fatalities are almost evenly divided between urban and rural roads.

Table 26: Motorcyclist Fatalities by Age Group and Land Use (1990-1999)

| Age Group | Land Use | | | | | | Total |
| | Rural | | Urban | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	1,315	49.5	1,316	49.6	24	0.9	2,655
20-29	3,801	40.4	5,574	59.2	41	0.4	9,416
30-39	3,093	48.5	3,262	51.1	24	0.4	6,379
40-49	2,095	55.7	1,657	44.0	12	0.3	3,764
Over 49	1,402	62.0	856	37.8	5	0.2	2,263
Unknown	2	28.6	4	57.1	1	14.3	7
Total	11,708	47.8	12,669	51.8	107	0.4	24,484

Chart 23: Motorcyclist Fatality by Age Group and Land Use (1990-1999)
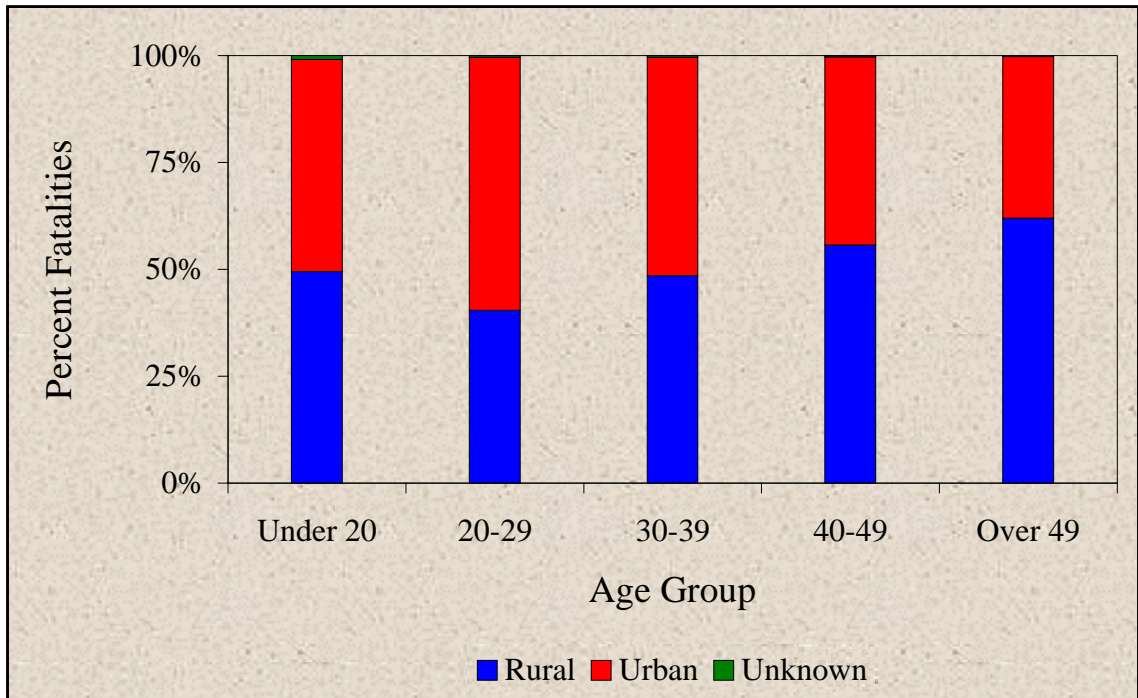
4.16 Motorcyclist Fatalities by Age Group and Speeding Factor

Fifty four percent of the 20-29 age group motorcyclist fatalities were related to speeding as a factor in the crash. The number of motorcyclist fatalities reduced where speeding was on the police accident report for operators over the age of 30 with just 19 percent of the over 49 age group fatalities related to speeding as a factor. These numbers indicate that speeding is a greater problem among motorcyclists under the age of 30. Table 27 shows the breakdown of fatalities and percentages by age group and speeding as a factor aggregated for ten years. Overall, 44 percent of motorcyclist fatalities were related to speeding, and 60 percent of those fatalities occurring among those under the age of 30.

Table 27: Motorcyclist Fatalities by Age Group and Speeding (1990-1999)

| Age Group | Speeding Factor | | | | | | Total |
| | Speeding | | Not Speeding | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	1,285	48.4	1,336	50.3	34	1.3	2,655
20-29	5,077	53.9	4,223	44.8	116	1.2	9,416
30-39	2,681	42.0	3,610	56.6	88	1.4	6,379
40-49	1,210	32.1	2,495	66.3	59	1.6	3,764
Over 49	432	19.1	1,789	79.1	42	1.9	2,263
Unknown	2	28.6	5	71.4	0	0.0	7
Total	10,687	43.6	13,458	55.0	339	1.4	24,484

Chart 24: Motorcyclist Fatality by Age group and Speeding (1990-1999)
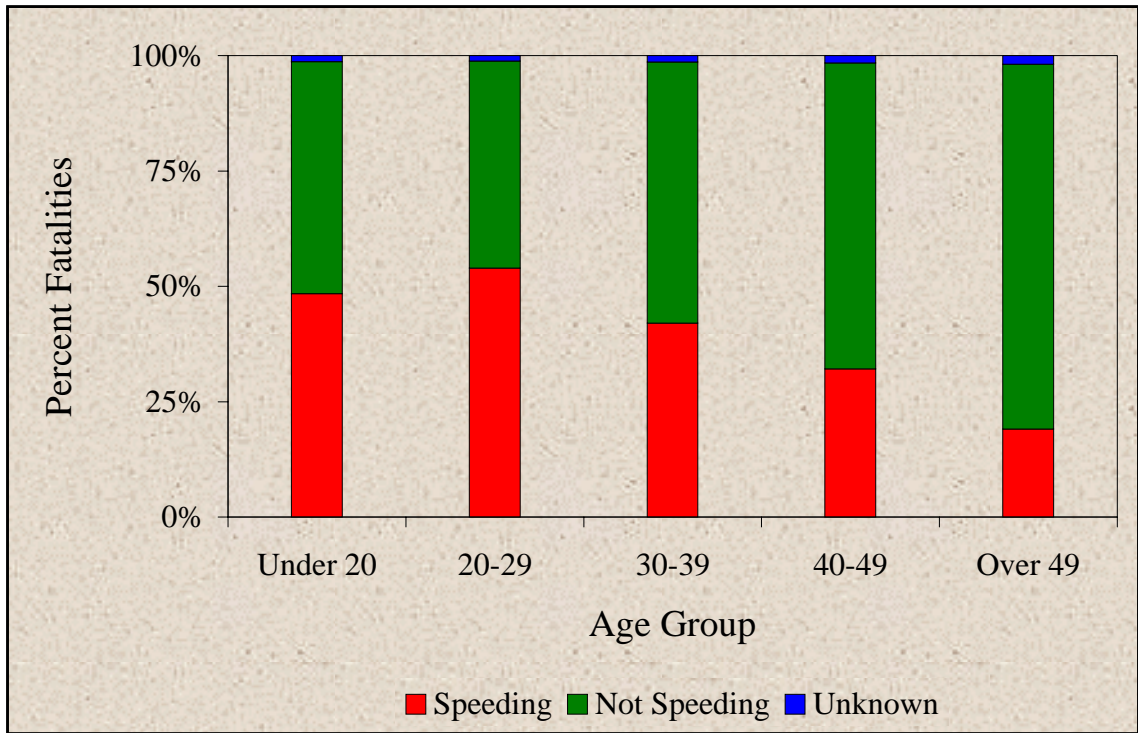
4.17 Motorcyclist Fatalities by Engine Size and Speeding Factor

Table 28 shows the numbers and percentages of the motorcyclist fatality breakdown by engine displacement and speeding factor aggregated for ten years. More than half (52 percent) of all motorcyclist fatalities occurred riding motorcycles in the 501-1,000 cc engine size category were related to speeding as a driver related factor in the crash compared to 36 percent riding motorcycles under 500 cc engine size and 39 percent in 1,001-1,500 cc category.

Table 28: Motorcyclist Fatalities by Engine Size and Speeding Factor (1990-1999)

| Engine Size Cc | Speeding Factor | | | | | | Total |
| | Speeding | | Not Speeding | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Up to 500	1,202	36	2,147	63	41	1	3,390
501-1,000	5,792	52	5,212	47	143	1	11,147
1,001-1,500	2,662	39	4,137	60	110	1	6,909
1,501 and Above	14	24	44	76	0	0	58
Unknown	1,017	34	1,918	64	45	2	2,980
Total	10,687	44.	13,458	55	339	1	24,484

Chart 25: Motorcyclist Fatality by Engine Size and Speeding Factor (1990-1999)
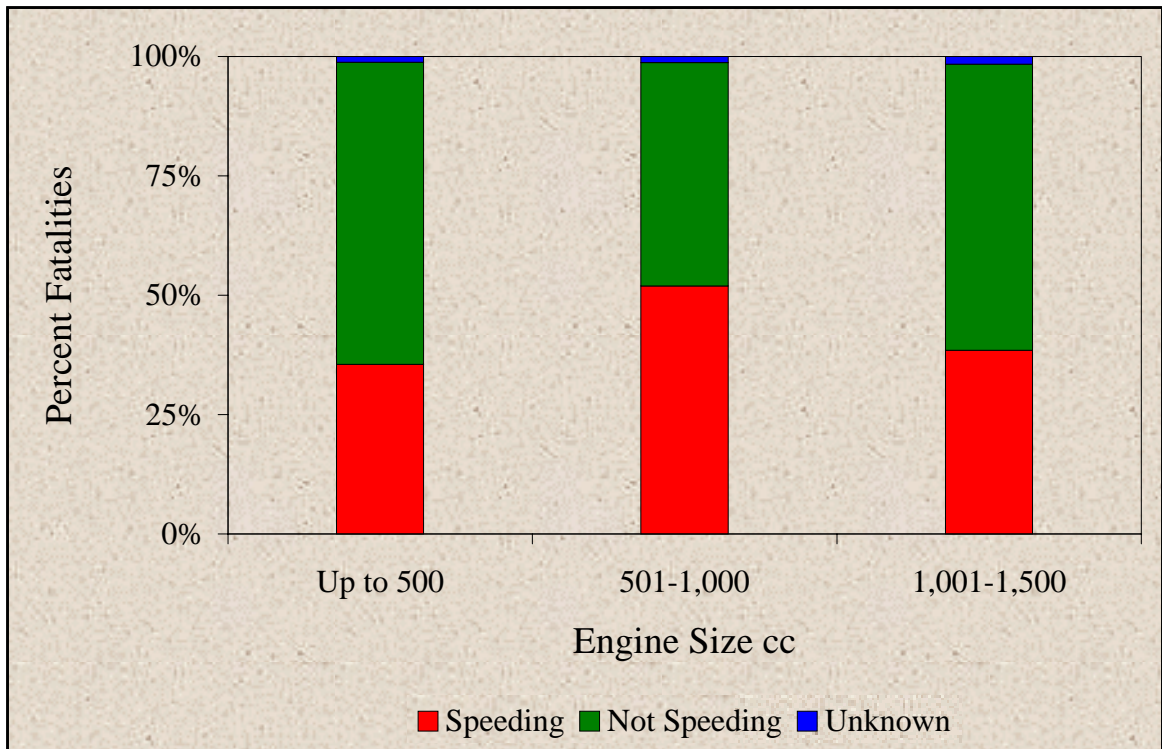
4.18   Motorcyclist Fatalities by Land Use and Roadway Type

Seventy-one percent of all motorcyclist fatalities are on undivided roadways with another 19 percent on roadways with no median barrier. Eighty seven percent of motorcyclist fatalities in rural areas occur on undivided roadways and another 9 percent occur on rural roadways with no median barrier. In fact, 42 percent of all motorcyclist fatalities occur on rural, undivided roadways.   These numbers indicate a very high percentage of fatalities occurring on undivided roadways. Further analysis of this issue appears in the

following sections.   Table 29 shows the 10-year aggregated breakdown of the motorcyclist fatalities by type of roadway and land use.

Table 29: Motorcyclist Fatalities by Land Use and Roadway Type (1990-1999)

Land Use	Roadway Type										Total
	Not Divided		Median-No Barrier		Median w/Barrier		One Way Traffic		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	
Rural	10,169	87	1,075	9	252	2	108	1	104	1	11,708
Urban	7,180	57	3,443	27	1,439	11	313	2	294	2	12,669
Unknown	70	65	15	14	1	1	2	2	19	18	107
Total	17,419	71	4,533	19	1,692	7	423	2	417	2	24,484

Chart 26: Motorcyclist Fatality by Roadway Type and Land Use (1990-1999)
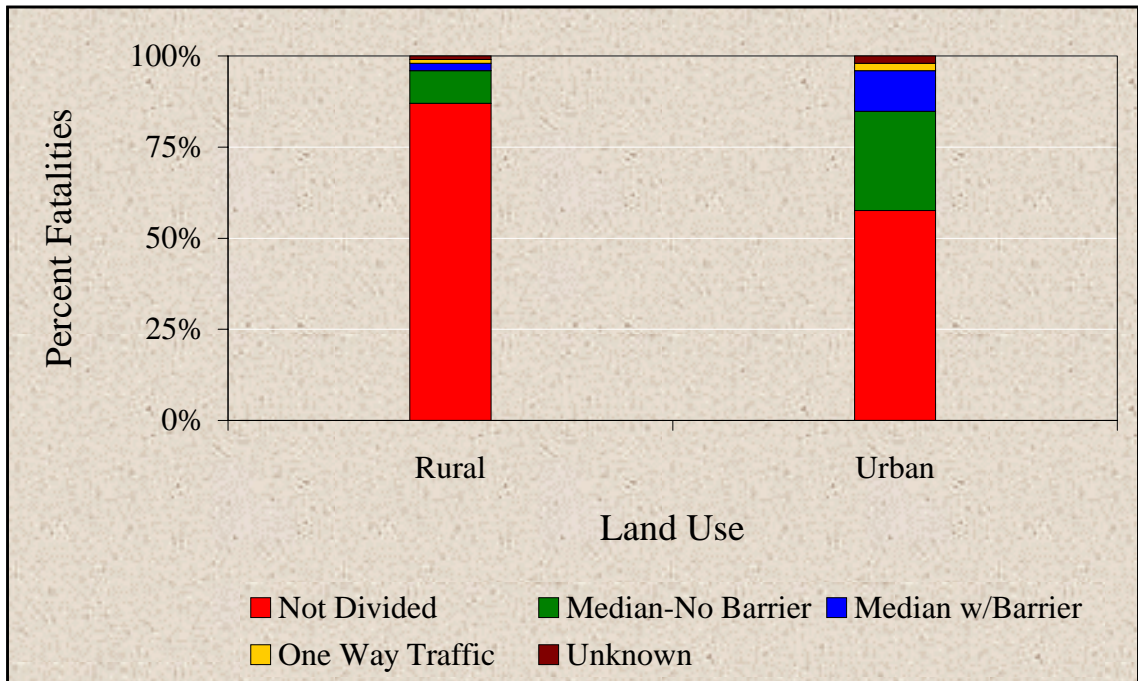
4.19   Motorcycle Operator Fatalities by Age Group and License Status by License Compliance

Analysis of the data in Table 30 aggregated over ten-year period shows that properly licensed status becomes more usual with the increasing age of the operator. The under 20 group has the lowest percentage of all fatally injured operators with proper motorcycle licenses and the highest percentage occurs in the over 49 group. This may show a

tendency of motorcycle operators under the age of 20 to overlook the importance of having a proper license.

Table 30: Motorcycle Operator Fatalities by Age Group and License Status by License Compliance (1990-1999)

| Age Group | License Status by License Compliance | | | | | | Total |
| | Properly Licensed | | Improperly Licensed | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	961	44	1,155	53	45	2	2,161
20-29	4,609	54	3,861	45	112	1	8,582
30-39	3,742	64	2,059	35	48	1	5,849
40-49	2,694	78	711	21	39	1	3,444
Over 49	1,747	82	345	16	28	1	2,120
Unknown	1	25	2	50	1	25	4
Total	13,754	62	8,133	37	273	1	22,160

Chart 27: Motorcycle Operator Fatality by Age Group and License Status by License Compliance (1990-1999)

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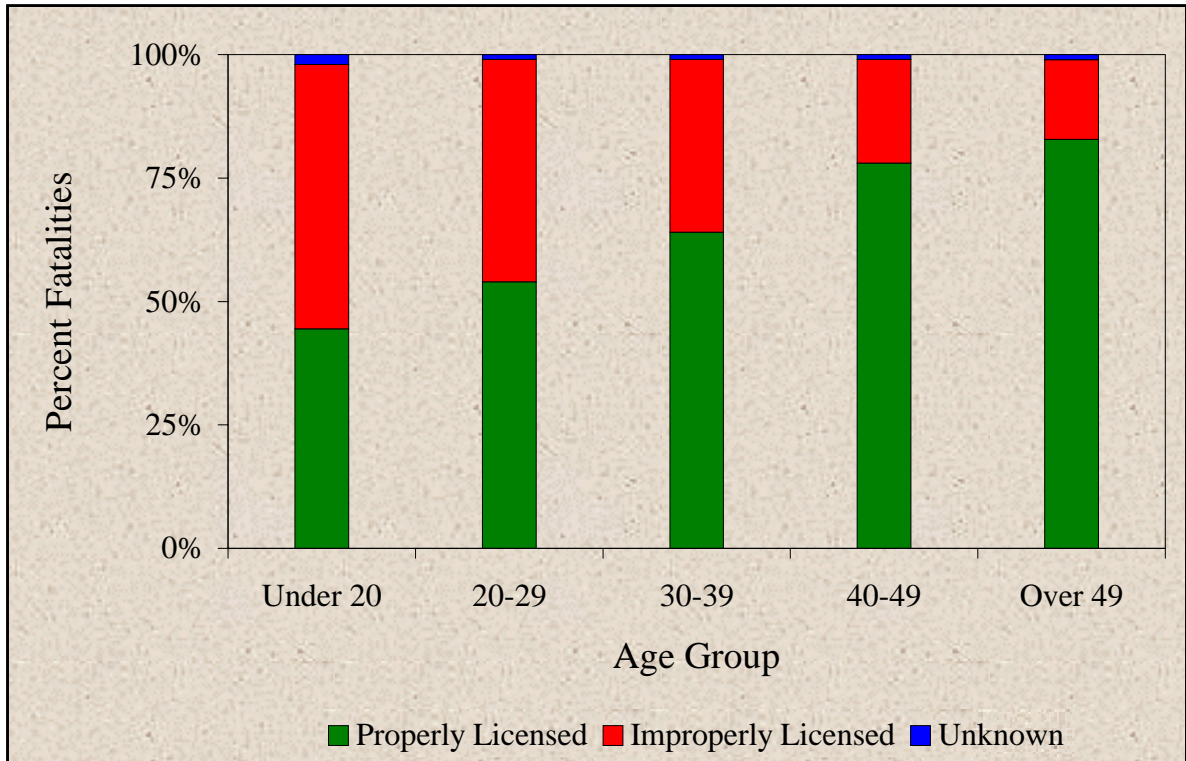
4.20   Motorcycle Operator Fatalities by License Status by License Compliance and Engine Size

The larger the motorcycle engine size more likely the operator is to have a proper license. This is shown in the statistics for fatally injured motorcycle operators. Proper license status for operator fatalities in the 1,001-1,500 cc engine displacement category is 1.7 times higher than the engine displacement category up to 500 cc and 1.3 times higher than the 501-1,000 cc engine displacement group. These numbers fall in line with Table 30 showing proper license status by age group where over 40 age groups had highest percentages of proper licenses. This reflects the use of motorcycles with larger engine by operators over the age of 40. Over half (51 percent) of fatally injured operators in the engine displacement category up to 500 cc were improperly licensed. Table 31 shows the aggregated 10-year breakdown of operator license status by engine displacement.

Table 31: Operator Fatalities by License Status by License Compliance and Engine Displacement (1990-1999)

| Engine Size Cc | License Status by License Compliance | | | | | | Total |
| | Properly Licensed | | Improperly Licensed | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Up to 500	1,474	47	1,600	51	55	2	3,129
501-1,000	6,038	59	4,048	40	107	1	10,193
1,001-1,500	4,694	77	1,348	22	53	1	6,095
1,501 and Above	46	90	4	8	1	2	51
Unknown	1,502	56	1,133	42	57	2	2,692
Total	13,754	62	8,133	37	273	1	22,160

Chart 28: Motorcycle Operator Fatality by Engine Size and License Status by License
Compliance (1990-1999)
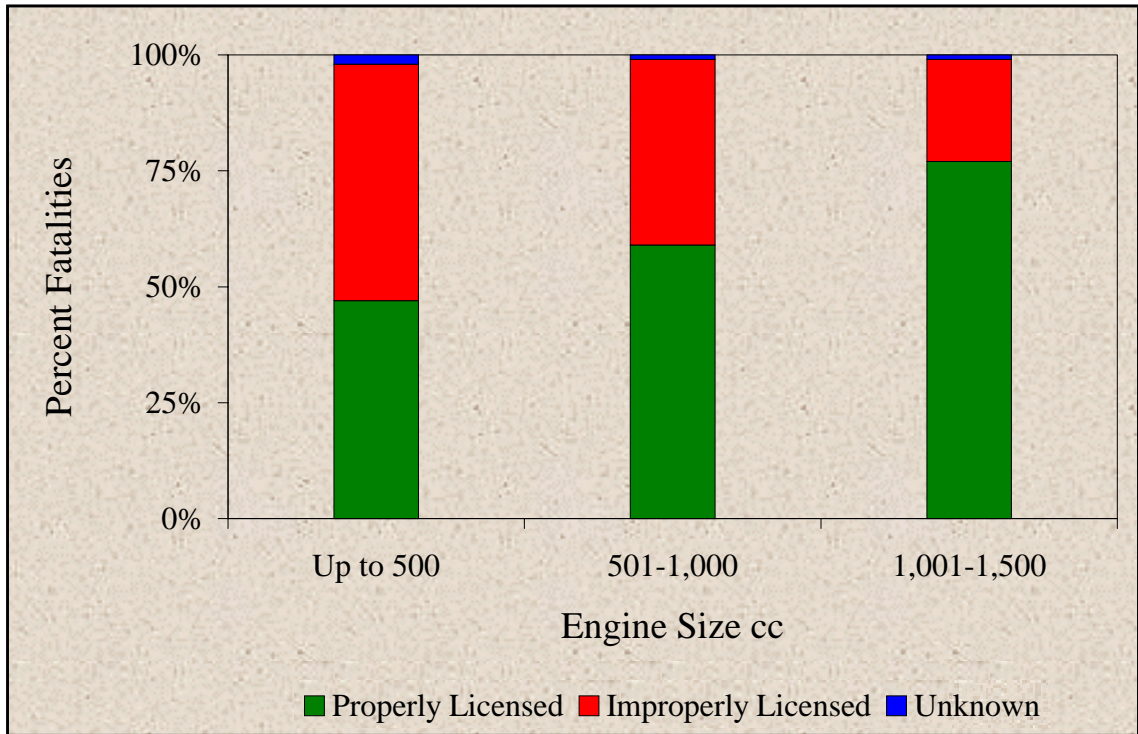
4.21 Motorcycle Operator Fatalities by License Status by License Compliance and Land Use

Analysis of the data for properly and improperly licensed status by land use shows a higher percentage of fatally injured motorcycle operators with a proper license in rural areas compared to urban areas. However, still more than a third (37 percent) of all operators killed were improperly licensed in both urban and rural roadways. Table 32 shows the license status by license compliance of operators killed by land use aggregated for ten-year period.

Table 32: Motorcycle Operator Fatalities by License Status by License Compliance and
Land Use (1990-1999)

| Land Use | License Status with License Compliance | | | | | | Total |
| | Properly Licensed | | Improperly Licensed | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Rural	7,021	67	3,373	32	115	1	10,509
Urban	6,672	58	4,728	41	155	1	11,555
Unknown	61	64	32	33	3	3	96
Total	13,754	62	8,133	37	273	1	22,160
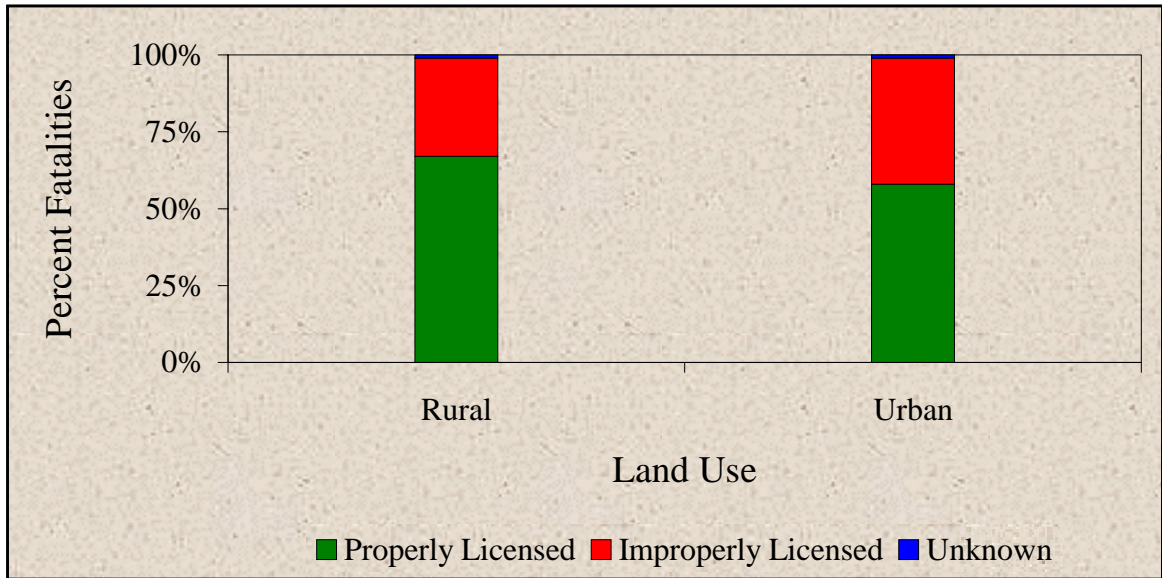
4.22 Motorcycle Operator Fatalities by Age Group and Operator BAC

Fifty-eight percent of operator fatalities in the 30-39 age group were related to alcohol, which was the highest percent among any age group. Out of those operators killed who had been drinking (682+2,682=3,364), 80 percent (2,682) were intoxicated with a BAC 0.10+. Forty-nine percent of the operator fatalities in the 40-49 age group were alcohol related. Out of the operators in the 40-49 age group who had been drinking (366+1,297=1,663) 78 percent (1,297) were intoxicated with a BAC 0.10+. These high numbers indicate a problem of high alcohol use among operators of motorcycles that were killed. Table 33 gives the 10-year aggregated breakdown of the results by operator alcohol use and age group.

Table 33: Operator Fatalities by Age group and Operator BAC (1990-1999)

| Age Group | Operator BAC | | | | | | Total |
| | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	1,695	78	191	9	274	13	2,161
20-29	4,784	56	1,062	12	2,736	32	8,582
30-39	2,485	42	682	12	2,682	46	5,849
40-49	1,781	52	366	11	1,297	38	3,444
Over 49	1,531	72	193	9	396	19	2,120
Unknown	2	41	0	5	2	54	4
Total	12,277	55	2,495	11	7,388	33	22,160

Chart 30: Motorcycle Operator Fatality by Age Group and Operator BAC (1990-1999)
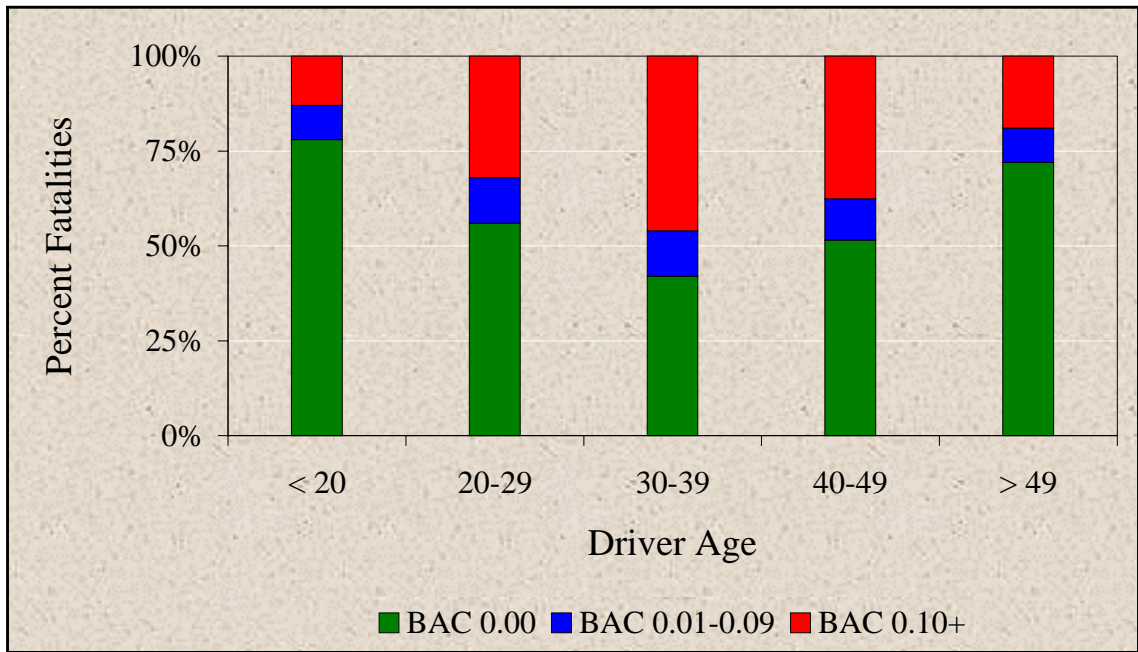
4.23 Motorcycle Operator Fatalities by Engine Size and Operator BAC

The number of operator fatalities by engine size and operator BAC indicate that operators of 1,001-1,500 cc engine displacement motorcycle category had the highest percentage (50 percent) who were drinking and the highest percentage who were intoxicated with a BAC 0.10+ (39 percent). The highest number of operator fatalities with alcohol (1,167+3,192=4,359) was associated in the 501-1,000 cc engine displacement category. Table 34 shows the numbers and percentage of operator fatalities by their BAC and engine size for an aggregated ten-year period.

Table 34: Motorcycle Operator Fatalities by Engine Size and Operator BAC (1990-1999)

| Engine Size Cc | Operator BAC | | | | | | Total |
| | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | |
	Number	Percent	Number	Percent	Number	Percent	
Up to 500	1,928	62	336	11	865	28	3,129
501-1,000	5,834	57	1,167	11	3,192	31	10,193
1,001-1,500	3,014	49	685	11	2,396	39	6,095
1,501 and Above	33	65	2	4	16	31	51
Unknown	1,468	54	306	11	919	34	2,692
Total	12,277	55	2,495	11	7,388	33	22,160

Chart 31: Motorcycle Operator Fatality by Engine Size and Operator BAC (1990-1999)
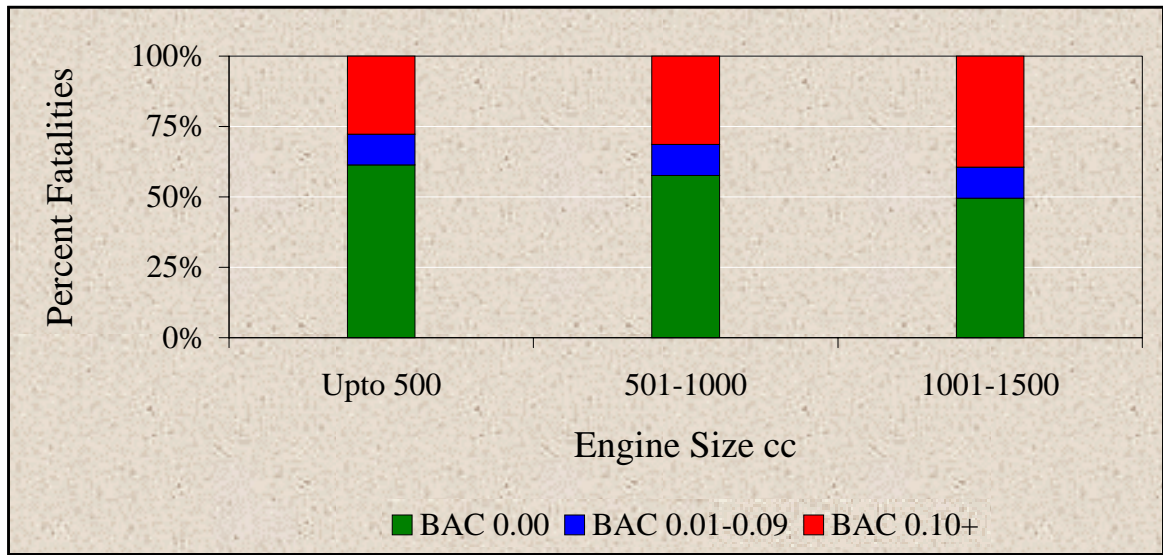
4.24 Motorcycle Operator Fatalities on Undivided Roadway by Age Group and Operator BAC

On undivided roadways overall 59 percent of the operators killed in the 30-39 age group were drinking. Among the 30-39 age group operators killed who had alcohol (487+1,892=2,379), 80 percent (1,892) were intoxicated. Similarly overall 50 percent of the 40-49 age group operators killed were drinking. Among the 40-49 age group operators killed with alcohol (270+964=1,234), 78 percent (964) were intoxicated. These numbers indicate a high use of alcohol by operators over the age of 30 on undivided roadways. Overall, 45 percent of the operators killed on undivided roadways were using alcohol with 34 percent intoxicated with BAC 0.10+. Table 35 shows the BAC breakdown among operator fatalities by age group for an aggregated ten-year period.

Table 35: Motorcycle Operator Fatalities on Undivided Roadways by Age Group and Operator BAC (1990-1999)

Age Group	Operator BAC						Total
	BAC 0.00		**BAC 0.01-0.09**		**BAC 0.10+**		
	Number	Percent	Number	Percent	Number	Percent	
Under 20	1,331	79	148	9	213	13	1,692
20-29	3,314	55	753	13	1,957	32	6,024
30-39	1,679	41	487	12	1,892	47	4,058
40-49	1,228	50	270	11	964	39	2,462
Over 49	1,093	72	132	9	283	19	1,508
Unknown	0	0	0	0	1	100	1
Total	8,644	55	1,790	11	5,310	34	15,745

Chart 32: Motorcycle Operator Fatality on Undivided Roadways by Age Group and
Operator BAC (1990-1999)
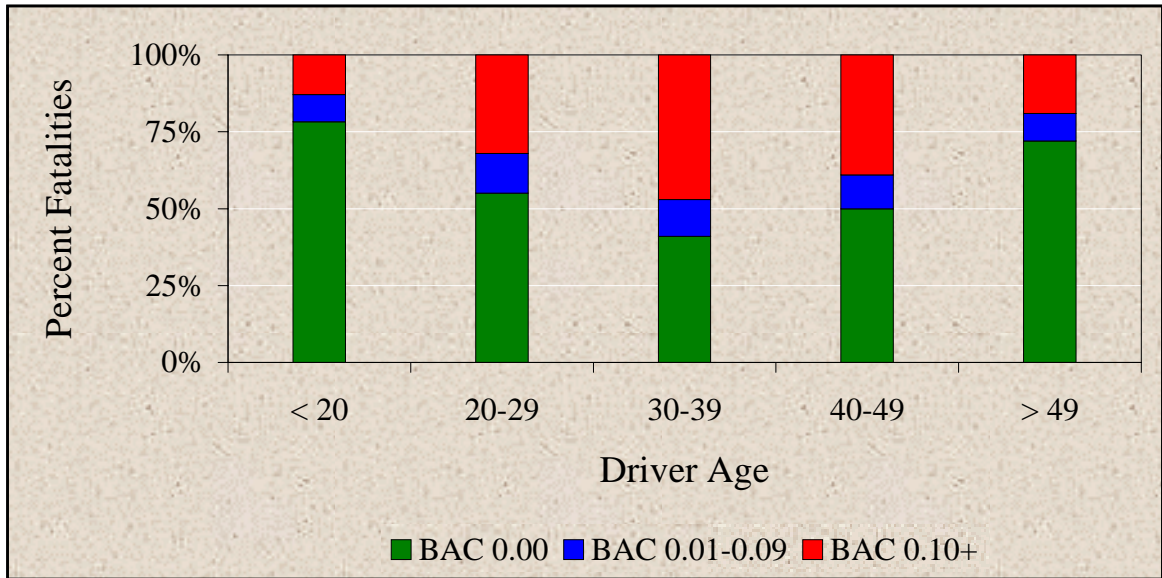
**4.25   Motorcycle Operator Fatalities on Undivided Roadways by Crash Type and
Operator BAC**

Table 36 shows the distribution of motorcycle operator fatalities on undivided roadways
by type of crash and operator BAC for an aggregated ten-year period. Sixty one percent
of the operators killed in single vehicle crashes were alcohol involved.   Among the
operators killed in single vehicle crashes who had been drinking (857+3,584=4,441), 81
percent (3,584) were intoxicated.   Alcohol use by fatally injured operators in single
vehicle crashes was almost twice as high as in multiple vehicle crashes. Alcohol use in
the intoxicated category (BAC 0.10+) for operators killed in single vehicle crashes was
almost 2.5 times as high for those in multiple vehicle crashes. This shows high alcohol
use among operators killed in single vehicle crashes.

Table 36: Motorcycle Operator Fatalities on Undivided Roadways by Crash Type and
Operator BAC (1990-1999)

| Crash Type | Operator BAC | | | | | | Total |
| | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | |
	Number	Percent	Number	Percent	Number	Percent	
Single Vehicle (SV) Crash	2,941	40	857	12	3,584	49	7,382
Multiple Vehicle (MV) Crash	5,703	68	933	11	1,727	21	8,363
Total	8,644	55	1,790	11	5,310	34	15,745

Chart 33: Motorcycle Operator Fatality on Undivided Roadways by Crash Type and
Operator BAC (1990-1999)
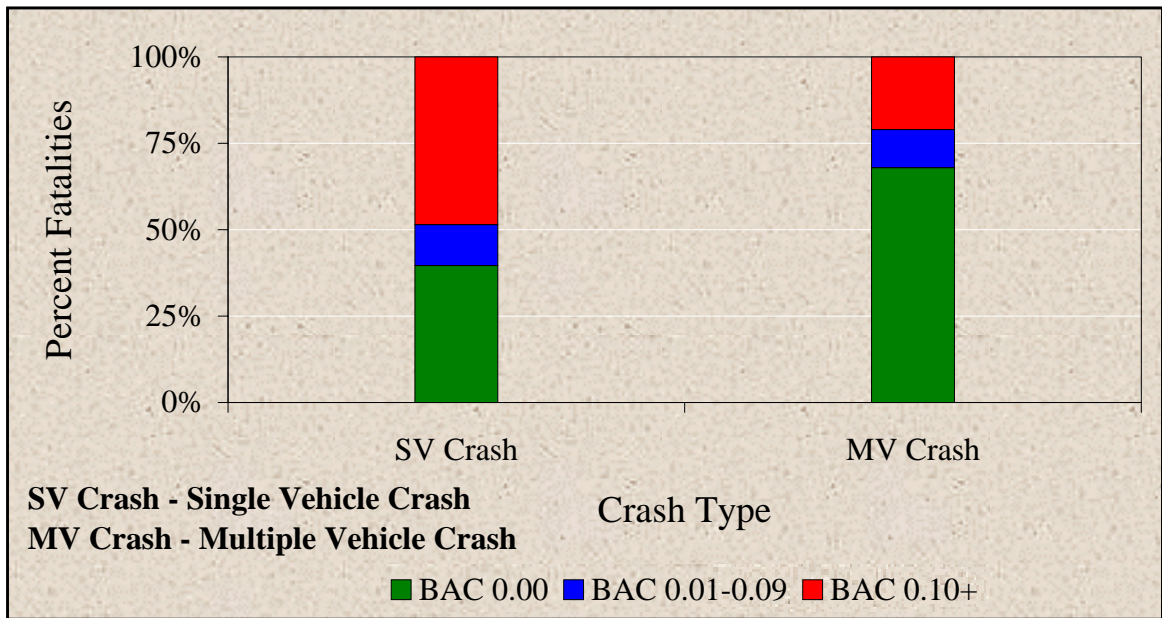
4.26 Motorcycle Operator Fatalities on Undivided Roadway Single Vehicle Crash by Age Group and Operator BAC

Operators in the 30-39 age group killed on undivided roadway in single vehicle crashes had the highest rate of alcohol involvement compared to any age group with 73 percent drinking and 62 percent intoxicated with a BAC 0.10+. Similar high alcohol involvement among fatally injured operators in the 20-29 and 40-49 age group is also evident with 60 percent in the 20-29 age group drinking with 47 percent intoxicated, and 66 percent in the 40-49 age group with 55 percent intoxicated. The striking fact is the very high percentage of the operators who were intoxicated (BAC 0.10+) in these single vehicle crashes on undivided roadways. The numbers once again show that even though alcohol rate among operators generally has declined as an overall number, there is still an underlying problem of high alcohol involvement among motorcycle operators killed in this type of crash. Table 37 shows the BAC levels for fatally injured operators by age group for an aggregated ten-year period.

Among the fatally injured operators in the 30-39 age group who were drinking (229+1,257=1,486), 85 percent (1,257) were intoxicated. Similarly among fatally injured operators in the 40-49 age group who were drinking (126+641=767), 84 percent (641) were intoxicated. Of the fatally injured operators in the 20-29 age group that were drinking (372+1,351=1,723), 78 percent (1,351) were intoxicated. These numbers are also very high even among fatally injured operators in the over 49-age group with 78 percent intoxicated (191/(191+55)). There were more operators killed who were drinking in the 20-29, 30-39 and 40-49 age groups than operators killed who were not drinking. For the 30-39 age group the ratio was 2.8 times more alcohol fatalities.

Table 37: Motorcycle Operator Fatalities on Undivided Roadway Single Vehicle Crash
by Age Group and Operator BAC (1990-1999)

| Age Group | Operator BAC | | | | | | Total |
| | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	455	68	75	11	143	21	674
20-29	1,162	40	372	13	1,351	47	2,885
30-39	538	27	229	11	1,257	62	2,024
40-49	389	34	126	11	641	55	1,156
Over 49	397	62	55	9	191	30	643
Unknown	0	0	0	0	1	100	
Total	2,941	40	857	12	3,584	49	7,382

Chart 34: Motorcycle Operator Fatality on Undivided Roadway Single Vehicle Crash by
Age Group and Operator BAC (1990-1999)
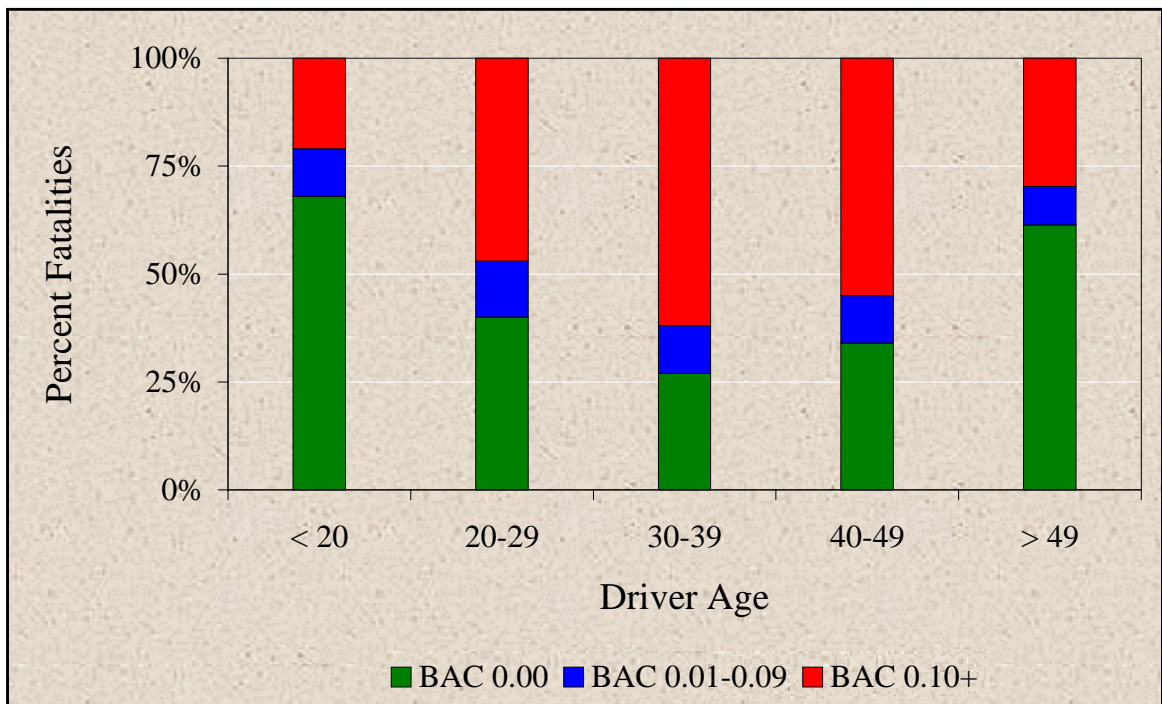
4.27 Motorcycle Operator Fatalities Speeding on Undivided Roadways by Age Group and Operator BAC

Table 38 shows fatally injured motorcycle operators who were speeding on undivided roadways by age group and operator BAC levels for an aggregated ten-year period. Once again the 30-39 age group has the highest percentage (67 percent) of drinking operator fatalities among all age groups. The 40-49 age group follows closely with 64 percent. Of

the fatally injured operators in the 30-39 age group who were drinking (209+976=1,185), 82 percent (976) were intoxicated. Percentages were roughly the same for the 40-49 age group. There were more drinking fatally injured operators than not drinking for age groups 30-39 and 40-49. These numbers again point to the risks involved when speed and alcohol are combined on undivided roadways for motorcycle operators.

Table 38: Motorcycle Operator Fatalities Speeding on Undivided Roadways by Age Group and Operator BAC (1990-1999)

| Age Group | Operator BAC | | | | | | Total |
| | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	605	73	79	10	140	17	825
20-29	1,691	52	430	13	1,153	35	3,273
30-39	575	33	209	12	976	55	1,760
40-49	293	35	103	12	436	52	832
Over 49	172	58	27	9	98	33	296
Unknown	0	0	0	0	1	100	1
Total	3,336	48	848	12	2,803	40	6,986

Chart 35: Motorcycle Operator Fatality Speeding on Undivided Roadways by Age Group and Operator BAC (1990-1999)
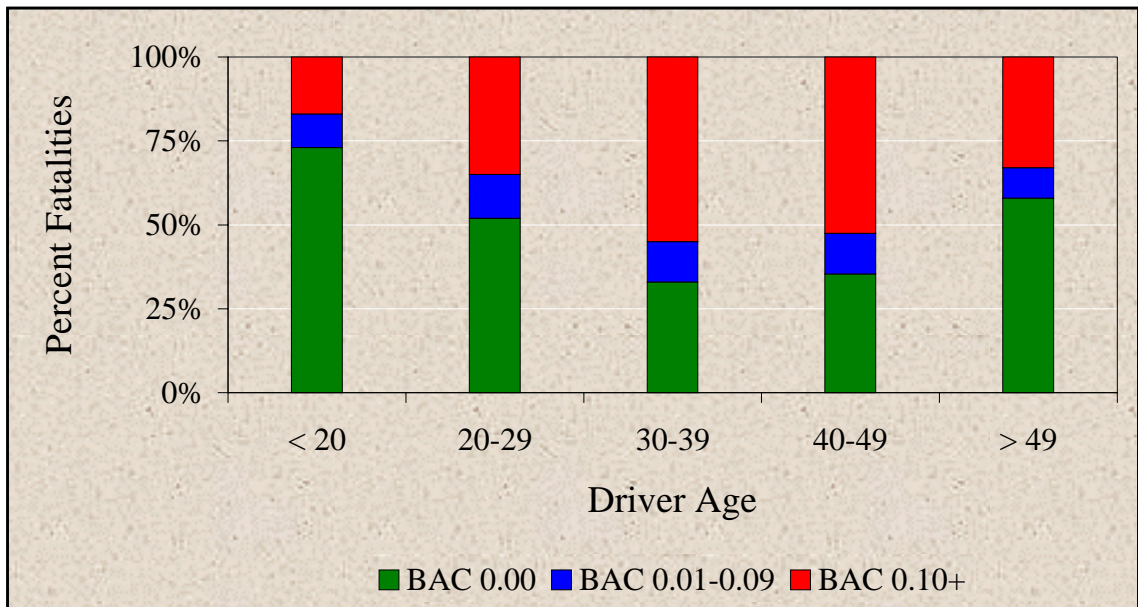
4.28 **Motorcycle Operator Fatalities Speeding on Undivided Roadway Single Vehicle Crash by Age Group and Operator BAC**

There were more fatalities among operators in single vehicle crashes who were drinking in the 20-29, 30-39 and 40-49 age groups than those who did not have any alcohol. Table 39 provides the breakdown of operator fatalities for those speeding on undivided roadways in single vehicle crashes by age group and operator BAC for an aggregated ten-year period. As can be seen from the numbers, alcohol use among those in the over 30-age groups is higher than among those in the under 30-age groups (with the exception of the over 49 age group). Seventy-four percent of those operators who died in the 30-39 age group were drinking. Operators in this age group were almost 3 times as likely to be drinking in these crashes as not.

Table 39: Motorcycle Operator Fatalities Speeding on Undivided Roadway Single Vehicle Crash by Age Group and Operator BAC (1990-1999)

| Age Group | Operator BAC | | | | | | Total |
| | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | |
	Number	Percent	Number	Percent	Number	Percent	
Under 20	312	66	54	12	105	22	471
20-29	786	41	249	13	881	46	1,917
30-39	302	26	128	11	727	63	1,157
40-49	161	28	71	12	338	59	569
Over 49	113	55	16	8	77	37	206
Unknown	0	0	0	0	0	0	0
Total	1,674	39	519	12	2128	49	4,320

Chart 36: Motorcycle Operator Fatality Speeding on undivided Roadway Single Vehicle Crash by Age Group and Operator BAC (1990-1999)

51
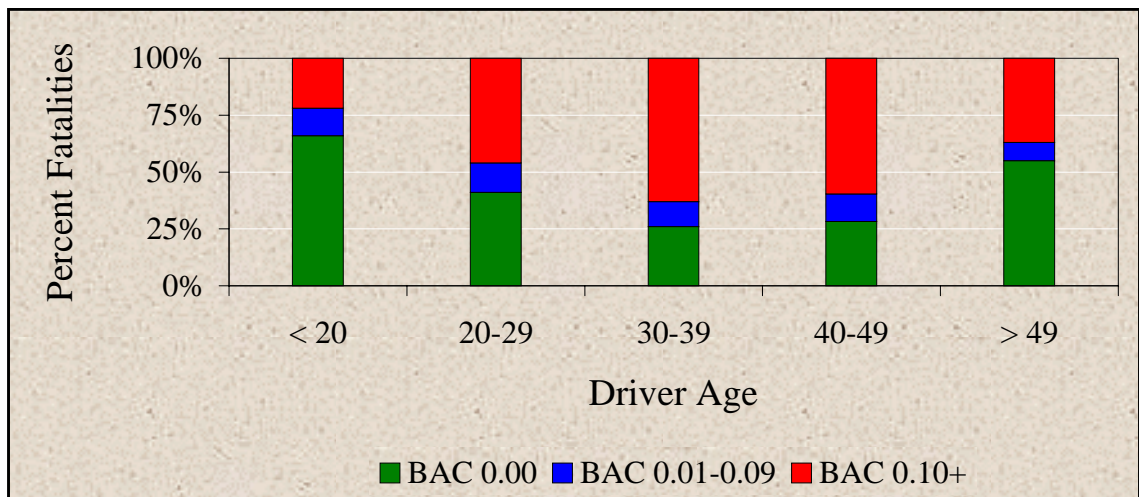
4.29 Motorcyclist Fatality Rate by Registered Motorcycles and VMT

Fatality rates for motorcyclists declined between 1990 and 1997 both when measured per 100,000 registered motorcycles and when measured per 100 million motorcycle VMT. However, in 1998 and 1999 fatality rates increased by 7.6 percent per 100,000 registered motorcycles and by 11.4 percent per 100 million VMT. The number of fatalities has increased more sharply for these years than the increase in the VMT in 1998 and 1999. Table 40 gives the fatality rates for registered motorcycles and motorcycle VMT from 1990 to 1999.

Table 40: Motorcyclist Fatality Rates by Year and Registered Motorcycles and VMT

Year	Fatality Rate per 100,000 Registered Motorcycles	Fatality Rate per 100 million VMT
1990	76.16	33.9
1991	67.17	30.6
1992	58.92	25.1
1993	61.57	24.7
1994	61.76	22.7
1995	57.14	22.7
1996	55.82	21.8
1997	55.30	21.0
1998	59.13	22.3
1999	59.53	23.4

Chart 37: Motorcyclist Fatality Rate by Year and Registered Motorcycles and VMT

52
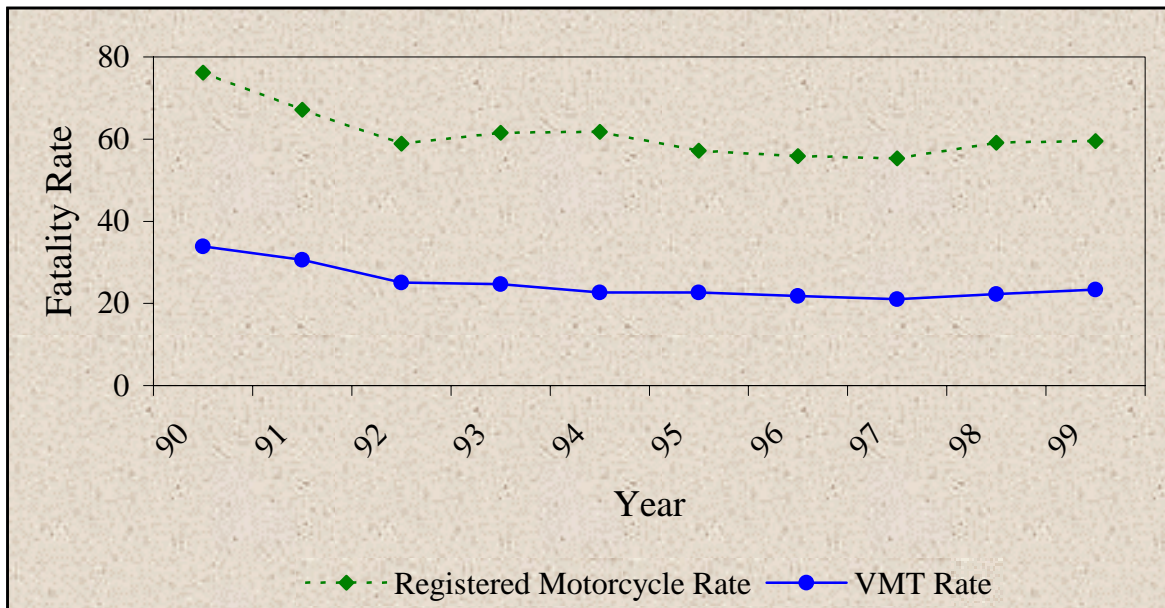
4.30 Motorcyclist Fatality Rate per 100,000 US Resident Population

Even though the population of 40-49 and over 49 age groups grew between 1990 and 1999, the increase in motorcyclist fatality for these two groups have outpaced the increase in population as evident from the increase in the fatality rates. Table 41 gives the motorcyclist fatality rates per 100,000 US resident population. The greatest rate increase is seen for the over 49-age group with the rate jumping from 0.30 in 1990 to 0.54 in 1999. Similarly the fatality rate for the 40-49 age group has risen from 0.88 in 1990 to 1.36 in 1999. The rates for other age groups have decreased over the same period of time with the largest decrease occurring in the under 20 age group. These rates underscore the increase in motorcyclist fatalities in the over 40 age groups seen in previous sections.

Table 41: Motorcyclist Fatality Rate by Year and per 100,000 US Resident Population

Year	Occupant Age Group					Total
	Under 20	20-29	30-39	40-49	Over 49	
1990	0.70	3.61	1.95	0.88	0.30	1.30
1991	0.57	3.06	1.71	0.90	0.23	1.11
1992	0.44	2.50	1.50	0.82	0.25	0.94
1993	0.35	2.62	1.52	0.96	0.26	0.95
1994	0.35	2.43	1.38	0.95	0.29	0.89
1995	0.26	2.46	1.31	0.95	0.27	0.85
1996	0.26	2.09	1.27	1.07	0.32	0.81
1997	0.22	1.91	1.28	1.02	0.41	0.79
1998	0.26	1.99	1.43	1.17	0.39	0.85
1999	0.17	2.09	1.44	1.36	0.54	0.91

Chart 38: Motorcyclist Fatality Rate by Year and per 100,000 US Resident Population
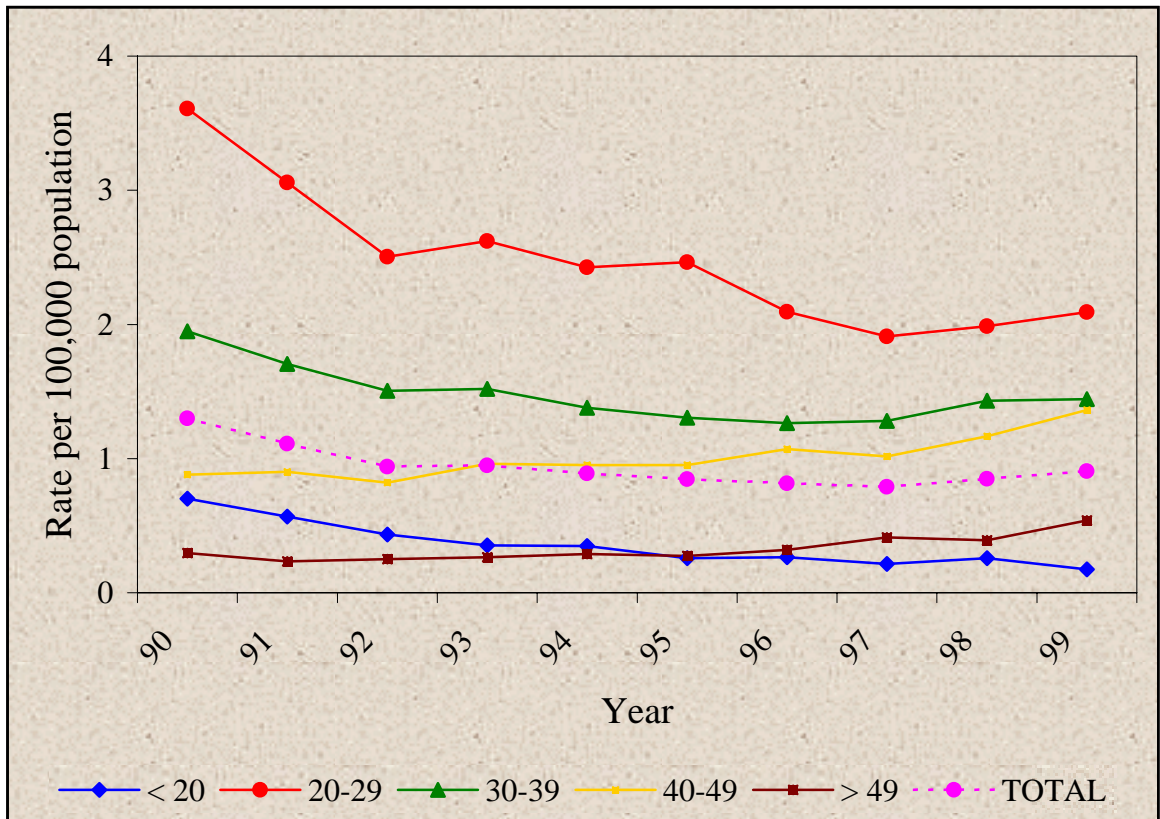
5. CONCLUSIONS

The analysis described in this report supports a variety of conclusions about the targets for motorcycle crash prevention programs and could aid in the design of countermeasure programs. The analysis also demonstrates the utility of using different data sources to cross verify the results from one data source with another. Since one of the major foci of this report and analysis is based on age groups and engine size, use of the FARS data in conjunction with MIC data along with US Census Bureau data permitted conclusions that could not have been drawn by using FARS data alone. The use of MIC data supports the observations of the FARS data relative to the involvement of 40 and over age groups and motorcycles with engine sizes of 1,001-1,500 cc in recent years in fatal motorcycle crashes.

This report does not analyze all variables within the FARS database and other data sources. Also, this analysis does not examine injury data from the General Estimates System (GES), which reports injuries resulting from motor vehicle crashes. Further analyses need to be undertaken by examining other variables within FARS and GES that may provide additional information describing other factors associated with motorcycle crashes. The National Highway Traffic Safety Administration (NHTSA) plans to conduct these analyses and report the findings.

5.1 Motorcyclist Fatalities by Person Type

In view of the fact that 90 percent of all fatally injured motorcyclists are operators rather than passengers, it is imperative that safety programs, education, training and enforcement be geared towards motorcycle operators. Also, since more than 90 percent of the fatally injured motorcyclists are males, safety messages should be directed mostly towards the male audience.

5.2 Motorcycle Exposure Rates

Data from FHWA relating to registered motorcycles and motorcycle VMT show an increase in the number of registered motorcycles in the past two years and also an increase in VMT in the past five years. MIC data show that number of new on-highway motorcycle units sold has increased each year since 1992 with most of the increase seen between 1997 and 1999. The motorcyclist fatality rates based on registered motorcycles and VMT have also increased between 1997 and 1999. These exposure data indicate more motorcycles on the roads with more vehicle miles traveled in the recent years.

5.3 Motorcyclist Age

Results from 1990-1999 FARS data show that there is an increase in the number of motorcyclist fatalities in over 40-age group. MIC data also suggests more over 40-age people are buying and riding motorcycles increasing their exposure. Review of US Census Bureau data from 1990-1999 indicates an increase in over 40-age population. If these patterns continue as seen from the combination of data sources, there is the

likelihood that there will continue to be an increase in the number of over 40-age motorcyclists involved in fatal crashes.

5.4   Motorcycle Engine Displacement in Cubic Centimeters

Analysis of FARS and MIC data shows that there is an increase in the average engine size of motorcycles involved in fatal crashes. Data from FARS indicates that more over 40-age group motorcyclists are getting killed on motorcycles with 1,001-1,500 cc engines. This leads to the supposition that there may be a corresponding increase in the number of larger motorcycles involved in fatal crashes.

5.5   Motorcycle Operator Fatalities by Operator BAC

Forty-five percent of all motorcycle operator fatalities between 1990 and 1999 were associated with operator BAC of 0.01+, and 33 percent were in the intoxicated category (BAC 0.10+). Although the percentage of drinking-operator fatalities has decreased from 52 percent in 1990 to 38 percent in 1999, alcohol is still a major problem, especially among motorcyclists over the age of 30 and among motorcyclists operating motorcycles with larger engines. This poses a great risk for all motorcycle operators, particularly when riding on rural undivided roadways. Alcohol use among motorcycle operators should become an important topic of any safety initiatives developed by NHTSA and its partners.

5.6   Motorcyclist Helmet Use

Helmet use among occupants killed has increased from 43 percent in 1990 to 53 percent 1999. Still almost half of the motorcyclists killed were not a wearing a helmet. Increasing the number of states with helmet laws covering all riders, more education, and stronger enforcement of existing helmet use laws are required to reduce the risks of fatal injury.

Only 20 states, the District of Columbia and Puerto Rico require helmet use for all riders. Twenty-seven states require use for a specific segment of riders and 3 states do not require any helmet use while riding a motorcycle (reference 7). Detailed information relating to the helmet use requirements is provided in Appendix C.

5.7   Motorcycle Operator License Status by License Compliance

Almost one third (28 percent) of the motorcycle operators killed in 1999 did not have a proper license compared to more than half in 1990. Having a proper license is more usual among operators over the age of 30 than among operators under the age of 30. These numbers indicate the need for stronger relationships between rider training and licensing programs. The numbers also suggest a need for better enforcement of motorcycle licensing.

5.8   Motorcyclist Fatalities by Speeding Factor

With more than 40 percent of all motorcyclist fatalities associated with speeding as a contributing factor, safety messages relating to the risk of motorcycles speeding has to be communicated along with necessary education programs. This is particularly important in the under 30 population since more than half (60 percent) of all fatally injured motorcyclist with speeding as a factor in the crash were under the age of 30.

5.9   Motorcyclist Fatalities by Crash Type (Single/Multiple)

There has not been any significant change in the distribution of motorcyclist fatalities between single and multiple vehicle crashes in the past ten years. But a closer look at the data reveals differences with respect to alcohol use, speeding, age group, land use, engine size and other factors between the two types of crashes. Motorcycle operators in single vehicle crashes were more often drinking than those in multiple vehicle crashes and more often intoxicated. Operators in 30-39 age groups on rural undivided roadways were found to have some of the highest percentages of fatalities with alcohol use in single vehicle crashes. A greater effort is needed for propagating the safety messages through appropriate prevention programs to motorcyclists about their risks of being involved in single vehicle crash. Law enforcement efforts should address impaired riding issues as part of a comprehensive impaired driving program. Also, state and local impaired driving programs should include activities and messages that focus on reducing impaired riding.

5.10   Motorcyclist Fatalities by Land Use (Urban/Rural)

Even though the shift of motorcyclist fatalities is very gradual from urban roadways to rural roadways, it is possible that this trend will continue. This is important since 42 percent of all motorcyclist fatalities occur on rural undivided roadways. Also, helmet use, license status, alcohol use and speeding vary between urban and rural roadways. Hence more attention should be focused towards rural roadways for better education, enforcement, communication and other safety messages.

5.11   Motorcyclist Fatalities by Roadway Type

Over 70 percent of all fatalities occur on undivided roadways with 42 percent of all fatalities occurring on rural undivided roadways. Alcohol use among operators on undivided roadways was found to be one of the highest and particularly among the over 30 age groups. A major effort is needed to send out a message designed to focus attention on the risks involved in operating motorcycles on undivided roadways. The safety message should also include the risks attached to speeding and alcohol use on undivided roadways.

6. APPENDIX A: Additional Data

The following sections provide additional data that were used in the analysis but not shown in the previous sections.

Table A-1: Motorcyclist Fatalities by Crash Type and Land Use (1990-1999)

| Crash Type | Land Use | | | | | | Total |
| | Rural | | Urban | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Single Vehicle	5,861	53	5,053	46	43	0	10,597
Multiple Vehicle	5,847	43	7,616	56	64	0	13,527
Total	11,708	48	12,669	52	107	0	24,484

Table A-2: Motorcyclist Fatalities by Crash Type and Age Group (1990-1999)

| Age Group | Crash Type | | | | Total |
| | Single Vehicle Crash | | Multiple Vehicle Crash | | |
	Number	Percent	Number	Percent	
< 20	1,040	39	1,615	61	2,655
20-29	4,279	45	5,137	55	9,416
30-39	3,005	47	3,374	53	6,379
40-49	1,707	45	5,057	55	3,764
> 49	923	41	1,340	59	2,263
Unknown	3	43	4	57	7
Total	10,957	45	13,527	55	24,484

Table A-3: Motorcyclist Fatalities by Crash Type and Engine Size (1990-1999)

| Engine Size cc | Crash Type | | | | Total |
| | Single Vehicle Crash | | Multiple Vehicle Crash | | |
	Number	Percent	Number	Percent	
Up to 500	1,326	39	2,064	61	3.390
501-1,000	5,186	47	5,961	53	11.147
1,001-1,500	3,214	47	3,695	53	6,909
> 1,500	28	48	30	52	58
Unknown	1,203	40	1,777	60	2,980
Total	10,957	45	13,527	55	24,484

Table A-4: Motorcyclist Fatalities by Helmet Use and Land Use (1990-1999)

| Helmet Use | Land Use | | | | | | Total |
| | Rural | | Urban | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Not Used	5,294	49	5,486	51	62	1	10,842
Used	5,991	48	6,435	52	41	0	12,467
Unknown	423	36	748	64	4	0	1,175
Total	11,708	48	12,669	52	107	0	24,484

Table A-5: Motorcyclist Fatalities by Helmet Use and Age Group (1990-1999)

| Age Group | Helmet Use | | | | | | Total |
| | Not Used | | Used | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
< 20	1,309	49	1,231	46	115	4	2,655
20-29	4,077	43	4,838	51	501	5	9,416
30-39	2,934	46	3,111	49	334	5	6,379
40-49	1,674	44	1,948	52	142	4	3,764
> 49	845	37	1,336	59	82	4	2,263
Unknown	3	43	3	43	1	14	7
Total	10,842	44	12,467	51	1,175	5	24,484

Table A-6: Motorcyclist Fatalities by Helmet Use and Engine Size (1990-1999)

| Engine Size cc | Helmet Use | | | | | | Total |
| | Not Used | | Used | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Up to 500	1,603	47	1,648	49	139	4	3,390
501-1,000	4,463	40	6,129	55	555	5	11,147
1,001-1,500	3,085	45	3,486	50	338	5	6,909
> 1,500	21	36	37	64	0	0	58
Unknown	1,670	56	1,167	39	143	5	2,980
Total	10,842	44	12,467	51	1,175	5	24,484

Table A-7: Motorcyclist Fatalities by Helmet Use and Crash Type (1990-1999)

| Crash Type | Helmet Use | | | | | | Total |
| | Not Used | | Used | | Unknown | | |
	Number	Percent	Number	Percent	Number	Percent	
Single Vehicle	5,302	48	5,138	47	517	5	10,597
Multiple Vehicle	5,540	41	7,329	54	658	5	13,527
Total	10,842	44	12,467	51	1,175	5	24,484

Table A-8: Motorcycle Operator Fatalities by Land Use and Operator BAC (1990-1999)

| Land Use | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | Total |
	Number	Percent	Number	Percent	Number	Percent	
Rural	5,804	55	1,149	11	3,555	34	10,509
Urban	6,410	55	1,340	12	3,805	33	11,555
Unknown	63	66	5	5	28	29	96
Total	12,277	55	2,495	11	7,388	33	22,160

Table A-9: Motorcyclist Fatalities by Roadway Type and Age Group (1990-1999)

| Age Group | Roadway Type | | | | | | | | | | Total |
| | Undivided | | Median-no Barrier | | Median w/Barrier | | One Way Traffic | | Unknown | | |
	No.	%	No.	%	No.	%	No.	%	No.	%	
< 20	2,088	79	368	14	97	4	29	1	73	3	2,655
20-29	6,606	70	1,709	18	717	8	206	2	478	2	9,416
30-39	4,428	69	1,264	20	466	7	119	2	102	2	6,379
40-49	2,692	72	715	19	270	7	43	1	44	1	3,764
> 49	1,602	71	475	21	142	6	25	1	19	1	2,263
Unknown	3	43	2	29	0	0	1	14	1	14	7
Total	17,419	71	4,533	19	1,692	7	423	2	417	2	24,484

Table A-10: Motorcyclist Fatalities by Roadway Type and Engine Size (1990-1999)

| Engine Size cc | Roadway Type | | | | | | | | | | Total |
| | Undivided | | Median no Barrier | | Median w/Barrier | | One Way Traffic | | Unknown | | |
	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	2,510	74	600	18	178	5	56	2	46	1	3,390
501-1,000	7,817	70	2,056	18	849	8	218	2	207	2	11,147
1,001-1,500	4,814	70	1,396	20	518	7	97	1	84	1	6,909
> 1,500	45	78	12	21	1	2	0	0	0	0	58
Unknown	2,233	74	469	16	146	5	52	2	80	3	2,980
Total	17,419	71	4,433	19	1,692	7	423	2	417	2	24,484

Table A-11: Motorcycle Operator Fatalities by Roadway Type and Operator BAC (1990-1999)

| Roadway Type | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | Total |
	Number	Percent	Number	Percent	Number	Percent	
Undivided	8,644	55	1,790	11	5,310	34	15,745
Median no Barrier	2,383	58	441	11	1,287	31	4,111
Median w/Barrier	836	54	162	11	539	35	1,538
One Way Traffic	200	51	54	14	136	35	390
Unknown	214	57	47	12	116	31	376
Total	12,277	55	2,495	11	7,388	33	22,160

Table A-12: Motorcycle Operator Fatalities on Undivided Roadway Multiple Vehicle Crash by Age Group and Operator BAC (1990-1999)

| Age Group | BAC 0.00 | | BAC 0.01-0.09 | | BAC 0.10+ | | Total |
	Number	Percent	Number	Percent	Number	Percent	
< 20	875	86	73	7	70	7	1,018
20-29	2,151	69	382	12	606	19	3,139
30-39	1,141	56	257	13	636	31	2,034
40-49	840	64	144	11	323	25	1,306
> 49	696	80	77	9	92	11	865
Unknown	0	0	0	0	1	100	1
Total	5,703	68	933	11	1,727	21	8,363

Table A-13: Motorcycle Operator Fatalities on Undivided Roadway Single Vehicle Crash by Land Use and Operator BAC (1990-1999)

Land Use	BAC 0.00		BAC 0.01-0.09		BAC 0.10+		Total
	Number	Percent	Number	Percent	Number	Percent	
Rural	1,956	41	528	11	2,231	47	4,715
Urban	975	37	326	12	1,340	51	2,641
Unknown	10	38	3	12	13	50	26
Total	2,941	40	857	12	3,584	49	7,382

Table A-14: Motorcycle Operator Fatalities on Undivided Roadway Multiple Vehicle Crash by Land Use and Operator BAC (1990-1999)

Land Use	BAC 0.00		BAC 0.01-0.09		BAC 0.10+		Total
	Number	Percent	Number	Percent	Number	Percent	
Rural	3,049	69	487	11	904	20	4,439
Urban	2,622	68	446	11	816	21	3,884
Unknown	33	82	1	2	7	17	40
Total	5,703	68	933	11	1,727	21	8,363

Table A-15: Motorcycle Operator Fatalities Speeding on Undivided Roadway Multiple-Vehicle Crash by Age Group and Operator BAC (1990-1999)

Age Group	BAC 0.00		BAC 0.01-0.09		BAC 0.10+		Total
	Number	Percent	Number	Percent	Number	Percent	
< 20	294	83	25	7	36	10	354
20-29	904	67	180	13	272	20	1,356
30-39	273	45	81	13	249	41	603
40-49	132	50	33	12	98	37	263
> 49	59	66	11	12	20	23	90
Total	1,662	62	329	12	675	25	2,666

Table A-16: Motorcycle Operator Fatalities Not Speeding on Undivided Roadways by
Age Group and Operator BAC (1990-1999)

Age Group	BAC 0.00		BAC 0.01-0.09		BAC 0.10+		Total
	Number	Percent	Number	Percent	Number	Percent	
< 20	714	84	67	8	70	8	851
20-29	1,578	59	317	12	782	29	2,677
30-39	1,082	48	270	12	898	40	2,251
40-49	914	57	163	10	518	32	1,595
> 49	905	76	102	9	181	15	1,188
Unknown	0	0	0	0	1	100	1
Total	5,192	61	920	11	2,450	29	8,563

Table A-17: Motorcycle Operator Fatalities Speeding on Undivided Roadways by Land
Use, Crash Type and Operator BAC (1990-1999)

Land Use	Crash Type	BAC 0.00		BAC 0.01-0.09		BAC 0.10+		Total
		Number	Percent	Number	Percent	Number	Percent	
Rural	Single Vehicle	1,082	40	305	11	1,335	49	2,722
	Multiple Vehicle	791	62	150	12	337	26	1,278
	Total	1,873	47	455	11	1,672	42	4,000
Urban	Single Vehicle	585	37	213	13	786	50	1,583
	Multiple Vehicle	856	62	179	13	337	25	1,372
	Total	1,441	49	392	13	1,122	38	2,955
Unknown	Single Vehicle	7	46	1	7	7	47	15
	Multiple Vehicle	15	92	0	0	1	7	16
	Total	22	70	1	4	8	26	31
Total	Single Vehicle	1,674	39	519	12	2,128	49	4,320
	Multiple Vehicle	1,662	62	329	12	675	25	2,666
	Total	3,336	48	848	12	2,803	40	6,986

Table A-18: Motorcyclist Fatalities by Year, Engine Size and Age Group

Engine Size cc	Year 1990 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	176	28	272	43	107	17	27	4	57	9	0	0	639
501-1,000	229	15	824	54	327	21	104	7	42	3	0	0	1,526
1,001-1,500	22	3	236	34	258	37	116	17	70	10	0	0	702
Unknown	77	21	125	33	124	33	31	8	19	5	1	0	377
Total	504	16	1,457	45	816	25	278	9	188	6	1	0	3,244

Engine Size cc	Year 1991 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	139	28	222	45	73	15	32	6	31	6	0	0	497
501-1,000	204	15	698	51	314	23	108	8	41	3	0	0	1,365
1,001-1,500	19	3	202	31	246	38	126	19	60	9	1	0	654
Unknown	49	17	97	33	95	33	30	10	19	7	0	0	290
Total	411	15	1,219	43	728	26	296	11	151	5	1	0	2,806

Engine Size cc	Year 1992 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	101	25	181	44	73	18	32	8	24	6	0	0	411
501-1,000	154	14	562	51	252	23	92	8	47	4	0	0	1,107
1,001-1,500	17	3	146	25	231	39	125	21	71	12	0	0	590
Unknown	46	16	92	32	96	34	31	11	22	8	0	0	287
Total	318	13	981	41	652	27	280	12	164	7	0	0	2,395

Engine Size cc	Year 1993- Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	97	25	148	28	71	18	33	9	39	10	0	0	388
501-1,000	119	11	596	54	255	23	95	9	45	4	1	0	1,111
1,001-1,500	13	2	191	28	253	37	167	24	59	9	0	0	683
Unknown	33	12	70	26	87	33	43	16	33	12	1	0	267
Total	262	11	1,005	41	666	27	338	14	176	7	2	0	2,449

Engine Size cc	Year 1994 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	75	24	133	43	55	18	18	6	30	10	0	0	311
501-1,000	121	12	534	51	230	22	109	11	43	4	1	0	1,038
1,001-1,500	12	2	137	22	215	34	176	28	93	15	0	0	633
Unknown	52	15	106	31	108	32	43	13	29	9	0	0	338
Total	260	11	910	39	608	28	346	15	195	8	1	0	2,320

Engine Size cc	Year 1995 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	69	22	126	41	58	19	33	11	24	8	0	0	310
501-1,000	80	8	571	57	220	22	101	10	37	4	0	0	1,009
1,001-1,500	12	2	135	20	233	35	182	27	104	16	0	0	666
Unknown	34	14	77	32	65	27	43	18	23	9	0	0	242
Total	195	9	909	41	576	26	359	16	188	8	0	0	2,227

Engine Size cc	Year 1996 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	58	24	87	36	50	21	20	8	28	12	0	0	243
501-1,000	98	10	495	49	224	22	137	14	47	5	0	0	1,001
1,001-1,500	15	2	119	18	211	32	198	30	111	17	0	0	654
> 1,500	0	0	0	0	1	13	2	25	5	63	0	0	8
Unknown	31	12	62	24	69	27	63	25	30	12	0	0	255
Total	202	9	763	35	555	26	420	19	221	10	0	0	2,161

Engine Size cc	Year 1997 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	42	22	61	31	37	19	24	12	29	15	1	1	194
501-1,000	76	8	480	50	231	24	103	11	67	7	0	0	957
1,001-1,500	8	1	99	14	232	32	225	31	165	23	0	0	729
> 1,500	0	0	1	9	1	9	3	27	6	55	0	0	11
Unknown	40	18	53	24	55	24	50	22	27	12	0	0	225
Total	166	8	694	33	556	26	405	19	294	14	0	0	2,116

Engine Size cc	Year 1998 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	54	25	67	31	47	22	19	9	26	12	0	0	213
501-1,000	92	9	503	48	246	24	130	13	69	7	0	0	1,040
1,001-1,500	17	2	91	12	252	32	267	34	153	20	1	0	781
> 1,500	0	0	1	6	3	19	6	38	6	38	0	0	16
Unknown	38	16	58	24	64	26	53	22	31	13	0	0	244
Total	201	9	720	31	612	27	475	21	285	12	1	0	2,294

Engine Size cc	Year 1999 - Motorcyclist Age Group												Total
	< 20		20-29		30-39		40-49		> 49		Unknown		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Up to 500	30	16	61	33	45	24	25	14	23	13	0	0	184
501-1,000	76	8	534	54	226	23	104	10	53	5	0	0	993
1,001-1,500	3	0	79	10	206	25	293	36	236	29	0	0	817
> 1,500	0	0	1	4	2	9	12	52	8	35	0	0	23
Unknown	27	6	83	18	131	29	133	29	81	18	0	0	455
Total	136	6	758	31	610	25	567	23	401	16	0	0	2,472

7. APPENDIX B: Data Sources

The following sections give information relating to the four data sources used in the analysis.

7.1 Fatality Analysis Reporting System (FARS)

The National Center for Statistics and Analysis (NCSA) collects and analyzes data, conducts research, and disseminates statistical information to support efforts by NHTSA and the highway safety community aimed at reducing deaths, injuries and economic losses resulting from motor vehicle crashes.

NCSA designed and developed the Fatality Analysis Reporting System (FARS) database, a national census of police-reported motor vehicle crashes resulting in fatal injuries. FARS compiles data from various sources on the location and circumstances of the crash, types of vehicles, and people involved. This system generates overall measures of highway safety, helps identify traffic safety problems, and provides a basis to evaluate the effectiveness of motor vehicle safety standards and highway safety programs.

FARS system became operational in 1975. It contains a census of fatal motor vehicle traffic crashes within the 50 states and the District of Columbia and Puerto Rico.

A motor vehicle crash is a transport incident that involves a motor vehicle in transport, is not an aircraft incident or water craft incident, and does not include any harmful event involving a railway train in transport prior to involvement of a motor vehicle in transport.

To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public, and result in the death of a person (either an occupant of a vehicle or a non-motorist) within 30 days of the crash. Data elements contain specific information including the age of the person, license status of the driver, roadway type, motorcycle engine size, and land use (urban/rural). These data elements can be used in determining trends relating to fatal crashes. Thus, the FARS system provides a basis to evaluate the effectiveness of motor vehicle safety standards and highway safety programs.

NHTSA has contracted with an agency in each state to provide information on fatal crashes. Data on fatal motor vehicle traffic crashes are gathered from the state's own source documents and are coded on standard FARS forms. The analyst or analysts from the contract agency in each state obtain documents needed to complete the FARS forms, which generally include some or all of the following:

Police Accident Reports (PARS);
State vehicle registration files;
State driver-licensing files;
State Highway Department data;
Vital Statistics;

Death certificates;
Coroner/medical examiner reports;
Hospital medical records; and,
Emergency medical services reports.

The FARS file contains descriptions of each fatal crash reported. Each crash has more than 100 coded data elements that characterize the crash, the vehicles, and the people involved. The specific data elements may be modified slightly at times, in response to users' needs and highway safety emphasis areas.

All data elements are reported on one of the following forms:

The Accident Form: This form records information about the time and location of the crash, the first harmful event in the crash, whether it is a hit-and-run crash, whether a school bus was involved, and the number of vehicles and people involved. Information on the weather conditions, roadway surface conditions, geometric profiles of the highways, the geographic location of the crash including the route information as well as the presence of the traffic control devices is also recorded in this form. Roadway information such as the functional classification, route, National Highway System (NHS) relation, land use, the number of lanes, and the flow of traffic at the site of the crash is recorded on this form.

The Vehicle and Driver Form: These forms include the data for each vehicle and driver involved in the fatal crash. The data include the vehicle type, the initial and principal points of impact, the most harmful event, and the driver's license status.

The Person Form: This form contains data on each person involved in the fatal crash. The data include the age, gender, role (driver, passenger, non-motorist), the severity of the injuries sustained, and the restraint usage characteristics.

FARS data can be used to answer a myriad of questions on the safety of vehicles, drivers, pedestrians, traffic situations, roadways and environmental conditions. But the data cannot by themselves be used to calculate the rates to find trends over a period of time based on exposure data. For example, FARS data can be used in evaluating the following:

Speed limit as a factor in fatal crashes;
Fatalities by zip code, region, county, or state;
Fatal crashes by land use categories (urban or rural);
Fatalities by type of roadway;
Pedestrian fatalities by zip code, region, county or state;
Fatalities by vehicle type (passenger car or motorcycle);
Fatalities by age group; and,
Fatalities in various weather or road surface conditions.

NCSA has developed a variety of reports and fact sheets using the information from FARS. Some are produced annually. Examples of the fact sheets and reports include:

Traffic Safety Facts: An annual compilation of data on motor vehicle crashes;

Motor Vehicle Traffic Crashes as a leading cause of death in the US, 1997: A report examining the status of fatalities in motor vehicle crashes compared to the other causes of death;

Traffic Safety Facts – Motorcycles: An annual compilation of motorcycle crash data; and,

Traffic Safety Facts – Alcohol: An annual compilation of data on the effects and involvement of alcohol in motor vehicle crashes.

Additional information on traffic safety facts, FARS and other publications can be obtained from the NHTSA's website at:

www.nhtsa.dot.gov

7.2   Motorcycle Industry Council (MIC)

The Motorcycle Industry Council (MIC) is a nonprofit, national trade association representing the motorcycle industry. The MIC's purpose is to preserve and promote motorcycling and the motorcycle industry. This is accomplished through activities in government relations, statistics, communications, technical and aftermarket programs. MIC has two offices, Executive Office in Irvine, California and Government Relations Office in the Washington, D.C. area.

More than 300 members represent manufacturers and distributors of motorcycles, scooters, parts and accessories, and members of allied trades, such as publishing companies, advertising agencies, insurance companies, and consultants. While dealers, clubs and individuals are not eligible for membership, MIC works with these groups on issues of mutual interest.

7.3   Federal Highway Administration (FHWA)

FHWA is part of the U.S. Department of Transportation and is headquartered in Washington, D.C., with field offices across the United States. FHWA performs its mission through these main programs:

The Federal Highway Program provides federal financial assistance to States to construct and improve the National Highway System, urban and rural roads, and bridges. The program provides funds for general improvements and development of safe highways and roads.

The Federal Lands Highway Program provides access to and within national forests, national parks, Indian reservations and other public lands by preparing plans, letting

contracts, supervising construction facilities, and conducting bridge inspections and surveys.

To support all of these program areas, FHWA conducts and manages a comprehensive research, development, and technology program.

Each year FHWA brings together annual series of selected statistical tabulations relating to highway transportation in three major areas:

- Highway Use – the ownership and operation of motor vehicles;

- Highway Finance – the receipts and expenditures for highways by public agencies; and,

- The Highway Plant – the extent, characteristics, and performance of the public roadways, roads, and streets in the U.S.

7.4   US Census Bureau

US Census Bureau is part of the Department of Commerce and located in Washington, DC. One of the missions of the Census Bureau is to collect census data every ten years and update the data each year. The sole purpose of the census is to secure general statistical information and compile the population by state, race, age groups, and several other categories.

8. APPENDIX C: Status of State Motorcycle Helmet Use Requirements

Twenty states, the District of Columbia and Puerto Rico require helmet use for all riders. Twenty-seven states require use of helmet for a specific segment of riders, usually under 18. Helmet use is not required in three states. The table below with the notes gives the details of the state helmet use requirements.

| Helmet Use Required for all Riders	Helmet Use for A Specific Segment of Riders (Usually Under 18)	Helmet Use Not Required
Alabama	Alaska	Colorado
California	Arizona	Illinois
District of Columbia	Arkansas	Iowa
Georgia	Connecticut	
Maryland	Delaware (1)	
Massachusetts	Florida (2)	
Michigan	Hawaii	
Mississippi	Idaho	
Missouri	Indiana	
Nebraska	Kansas	
Nevada	Kentucky (3)	
New Jersey	Louisiana (4)	
New York	Maine (5)	
North Carolina	Minnesota	
Oregon	Montana	
Pennsylvania	New Hampshire	
Puerto Rico	New Mexico	
Tennessee	North Dakota	
Vermont	Ohio (6)	
Virginia	Oklahoma	
Washington	Rhode Island (7)	
West Virginia	South Carolina	
	South Dakota	
	Texas (8)	
	Utah	
	Wisconsin	
	Wyoming	

1.   Riders under 19 must wear helmets and helmets must be in the possession of other riders, even though use is not required.

2.   Required for riders under age 21 and for those without $10,000 of medical insurance that will cover injuries resulting from a motorcycle crash.

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3. Required for riders under age 21, riders operating a motorcycle with an instruction permit, riders with less than one-year experience, and/or riders who do not provide proof of health insurance to county clerk. (Insurance provision repealed effective July 15, 2000.)

4. Required for riders under age 18 and those who do not have a health insurance policy with medical benefits of at least $10,000. Proof of policy must be shown to law enforcement officer upon request.

5. Required only under 15 years of age, novices, and holders of learner's permits.

6. Riders under 18 and first year novices are also required to wear helmets.

7. Riders under 21 and first operators must wear helmets.

8. Riders 20 and under and those who have not completed a rider training course or who do not have $10,000 medical insurance coverage.

9.   APPENDIX D: ADDITIONAL CHARTS

The following six charts show the motorcyclist fatalities and resident population comparison for each age group and all ages combined.

Age < 20

Age 20-29

Age 30-39

Age 40-49
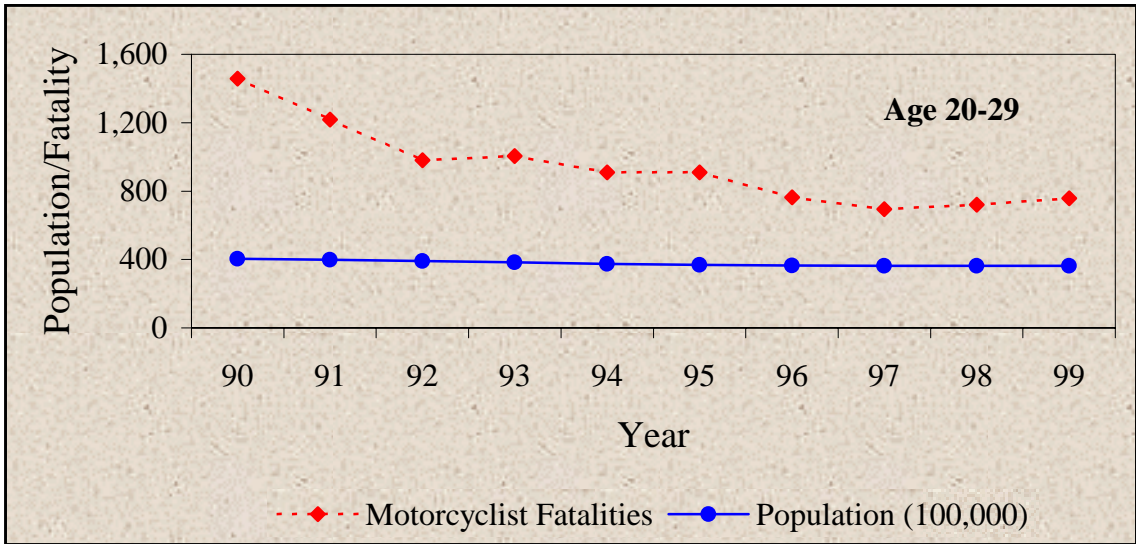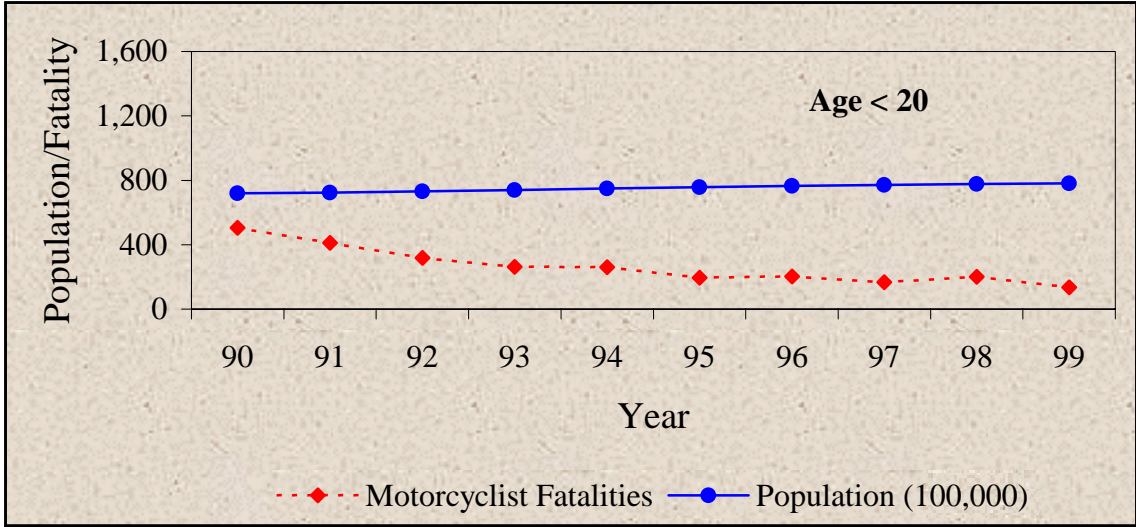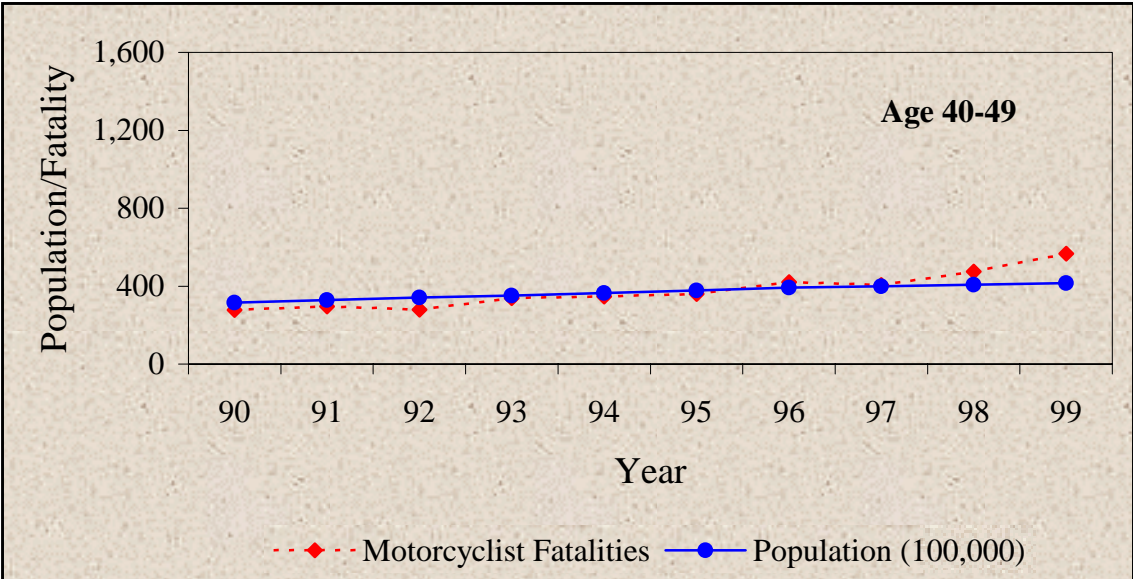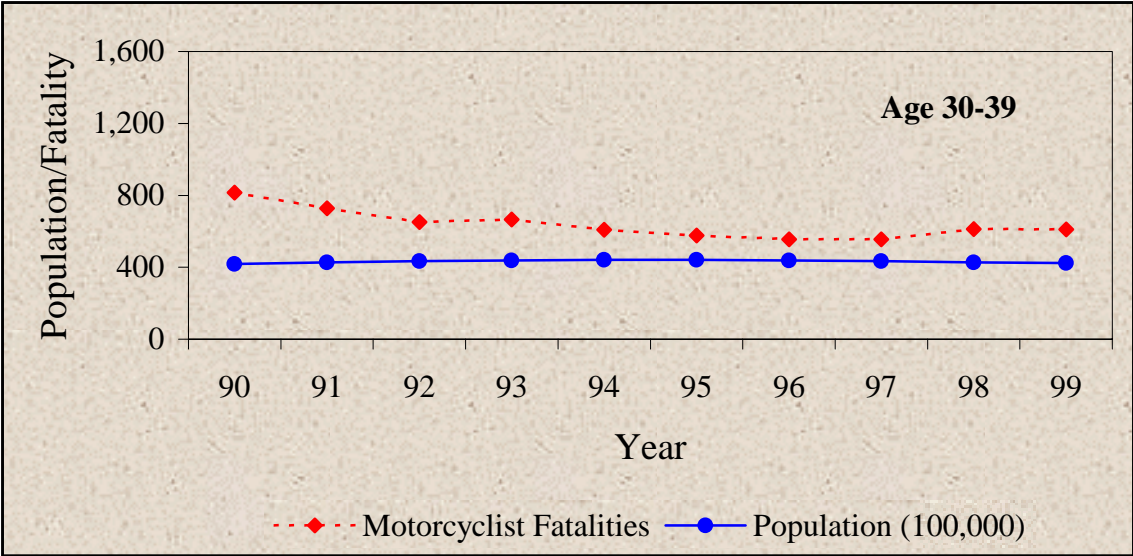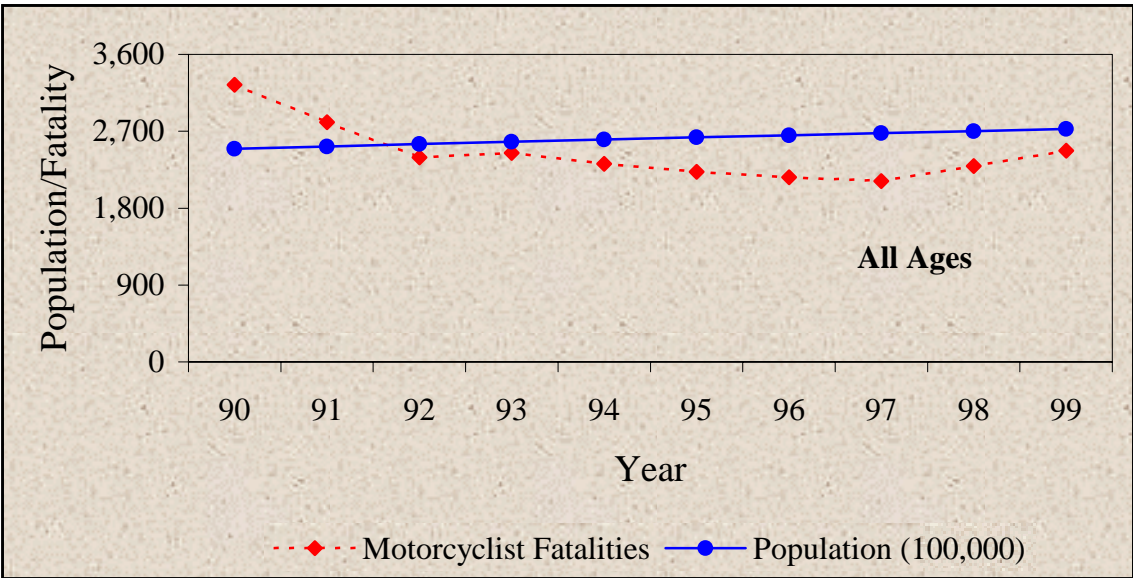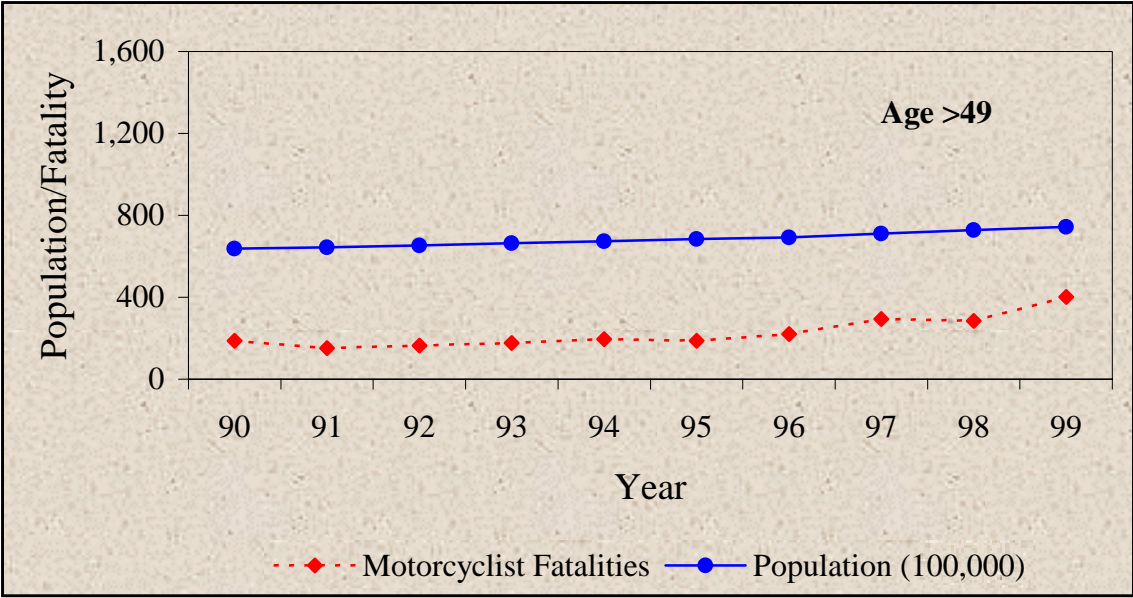
10. REFERENCES

10.1   Department of Transportation, National Highway Traffic Safety Administration, "*Traffic Safety Facts 1999: Motorcycle*".

10.2   Motorcycle Industry Council, "*2000 Motorcycle Statistical Annual*".

10.3   United States Census Bureau, Population Division, Population Estimates Program, "*Resident population Estimates of the United States by Age and Sex: April 1, 1990 to July 1, 1999, with Short-Term Projection to October 1, 2000*".

10.4   Department of Transportation, Federal Highway Administration, "*Motorcycle Vehicle Miles Traveled – 1975-1999*".

10.5   Department of Transportation, Federal Highway Administration, "*Registered Motorcycles – 1975-1999*".

10.6   Department of Transportation, National Highway Traffic Safety Administration, "*A Method of Estimating Posterior BAC Distributions for Persons Involved in Fatal Traffic Accidents (DOT HS 807 094)*".

10.7   Department of Transportation, National Highway Traffic Safety Administration, "*State Legislative Fact Sheet, Motorcycle Helmet Use Laws, January 2001*".