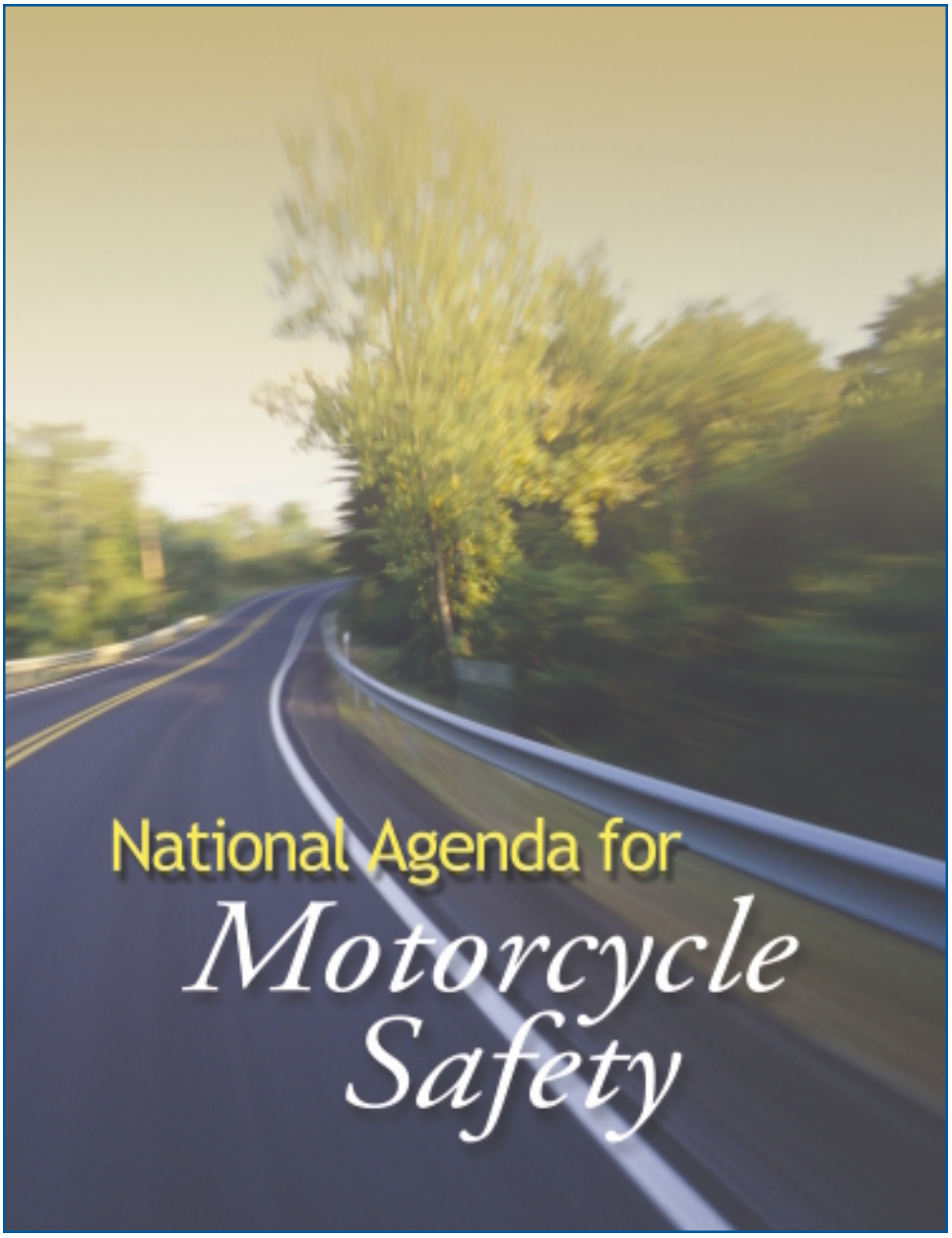

U.S. Department
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**National Highway
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www.nhtsa.dot.gov

MSF
MOTORCYCLE
SAFETY FOUNDATION

www.msf-usa.org

Research in Motorcycle Crashes

There are varying levels of depth for motorcycle crash investigations. The least detailed crash investigation is the retrospective extraction of data from police reports. This process occurs after the fact and simply selects available data from police investigation reports that may be of interest in motorcycle safety (rider age, license qualification, motorcycle size, insurance coverage, etc. Police traffic collision reporting varies significantly between jurisdictions, which is a formidable obstacle to meaningful state-to-state comparison (*Winn*, 1997, 1999).

The most detailed level of investigation is the multidisciplinary, on-scene, in-depth investigation (OSIDI) such as the 1981 study of 900 motorcycle crashes entitled, *Motorcycle Accident Cause Factors and Identification of Countermeasures* (*Hurt Report*). This study was sponsored by the U.S. Department of Transportation, National Highway Traffic Safety Administration (**DOT**-NHTSA), and conducted in Los Angeles by Harry Hurt of the University of Southern California (USC). The *Hurt Report* has been used both nationally and internationally as the best source of detailed motorcycle crash data in the development of training, countermeasures, and related questions. Such studies are rare, particularly for the broad spectrum of injury levels possible in motorcycle crashes. On-scene, in-depth investigation provides a level of detailed crash analysis far more valuable than less comprehensive investigations. The data variables that are collected are summarized in Appendix B.

ISSUE STATEMENT

Devising effective countermeasures requires comprehensive research into current causes of motorcycle crashes and defining the motorcycle population at risk.

WHERE WE ARE

Motorcycle crash investigations have been carried out not only in the United States (*Hurt*, 1981) but also in the United Kingdom (*Pedder*, 1979), Canada (*Newman*, 1974), Germany, and other

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Bold text denotes a glossary term. Double-click on it to view its definition in a separate "pop-up" window."

Red text denotes another section within the document. Click on it to go directly to that specific section.

Blue text indicates a reference. Click on it to navigate to the References section of the document, where you can view the reference in its entirety.

The Motorcycle Safety Foundation (MSF) and its funding member companies, BMW of North America, Inc., Ducati North America, Inc., Harley-Davidson Motor Co., Inc., American Honda Motor Co., Inc., Kawasaki Motors Corp. USA, American Suzuki Motor Corp. and Yamaha Motor Corp., USA are pleased to be supporters of the *National Agenda for Motorcycle Safety*, a project that provides an accurate road map of the most pressing motorcycle safety issues for the coming decade and beyond while offering the greatest occasion in recent history for improved motorcycling safety.

We would like to acknowledge the exceptional efforts of the Technical Working Group in creating this blueprint for motorcycle safety in the United States (U.S.). This group of well-respected experts in the fields of emergency medicine, enthusiast press, government affairs, insurance, law enforcement, motorcyclist groups, research, and rider education and training came to serve as representatives of the variety of stakeholders with an interest in motorcycle safety. Meeting over a two-year period, the diversity within the group ensured that the strategic vision for the future of motorcycle safety would be an accurate reflection of opinion as it is found in the entire motorcycle community.

The MSF Board of Trustees has directed MSF staff to take its vision of a "Worldview with a U.S. Focus" further than just curriculum and training matters. While MSF does and will continue to play a key role in rider education and training, motorcycle safety, as the name implies, is the core of what the Foundation is about. By working with all stakeholders involved in making motorcycling safe and enjoyable for U.S. riders, MSF has assumed a wider degree of responsibility for keeping the big picture/overall safety issues that concern U.S. motorcyclists at the forefront of our efforts and projects.

Today's motorcycle marketplace is dynamic and all indications suggest the existence of an increasing number of motorcycles in the traffic mix in the U.S. According to the Motorcycle Industry Council's *1998 Motorcycle Owner Survey*, in 1998, there were 6.6 million motorcycles and scooters estimated to be in use (a 29.8% increase from 1990), while during the same year, the average (mean) annual miles traveled by all motorcycles and scooters used on-highway was 2,613 miles (for a total of 13 billion on-street miles!) representing an increase of 11% from the average of 2,361 miles reported in 1990.

By June 2000, new unit sales of motorcycles had increased 26% over the previous year and an estimated 124% since 1990. With more and more people buying motorcycles and riding, the number of people taking advantage of rider education and training programs is also increasing. The number of riders trained in 1999 was 192,122, an 18.9% increase over 1998, and over one-third of course graduates were women.

Due to this dynamic increase in motorcycling, there is a need to use an approach to motorcycle safety that complements the energy in the marketplace. As these numbers grow, motorcyclists can be thankful that the *National Agenda for Motorcycle Safety* seeks to provide a comprehensive approach to motorcycle safety by addressing it on a variety of fronts that consider the viewpoints of all stakeholders, thereby meeting the needs of all riders. We believe that through following the recommendations found in the *National Agenda for Motorcycle Safety*, the safety needs of all riders can be better served. As a partner and stakeholder in motorcycle safety, we urge you to consider and act upon these very important recommendations.

Finally, MSF would like to recognize also its valued partner, the National Highway Traffic Safety Administration, and the firm of Albert Hydeman Associates as project facilitator, in the development of the *National Agenda for Motorcycle Safety*, as both were instrumental in making this important opportunity to increase the safety of motorcyclists across the U.S. a reality.

Tim Buche

Tim Buche, *President*

MOTORCYCLE SAFETY FOUNDATION • National Resource Office • 2 Jenner Street, Suite 150 • Irvine, CA 92618-3806 • (949) 727-3227 • Fax (949) 727-4217

U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

Administrator

400 Seventh Street, S.W.
Washington,D.C.20590

The National Highway Traffic Safety Administration is proud to partner with motorcyclists across the United States to present the *National Agenda for Motorcycle Safety*. The *National Agenda* provides a snapshot of motorcycle safety today and a blueprint for the future. The report addresses where we are in motorcycling today, looks to where we want to be in the future, and provides insights on how to get there.

Developing this comprehensive, strategic vision for the future was challenging. Over the past 24 months a Technical Working Group of highly respected, knowledgeable individuals collected data, listened to motorcyclists about their experiences, and crafted the *National Agenda for Motorcycle Safety*. The Technical Working Group's efforts provide guiding principles for enhancing motorcycle safety at the national and local levels.

From the beginning, the *National Agenda for Motorcycle Safety* was never intended to be a consensus document. Given the diverse opinions among the many stakeholders, it would be unrealistic to expect everyone to agree with all aspects of the *National Agenda*. While there is agreement on the need to improve motorcycle safety, there is disagreement on the best way to achieve the goal of fewer crashes, injuries, and deaths involving motorcyclists.

The *National Agenda for Motorcycle Safety* holds the promise of a new beginning in motorcycle safety. We must all rededicate ourselves to making motorcycling safer. The National Highway Traffic Safety Administration reaffirms its commitment to motorcycle safety and encourages others to make a similar commitment. My challenge to you, the motorcycling and traffic safety communities, is to take action on those parts of the *National Agenda* that you can support so the recommendations become reality and motorcycle safety is enhanced. I believe there is something in the *National Agenda for Motorcycle Safety* for everyone to work toward. The motorcycling and traffic safety communities must give it life.

In closing, I extend my appreciation to the members of the Technical Working Group for the long hours of hard work they devoted to this effort. While some discussions were intense, the results speak for themselves: a blueprint for future motorcycle safety efforts that each member can be proud to have crafted. Finally, I want to acknowledge the contributions of our partner, the Motorcycle Safety Foundation, for its leadeership, and the firm of Albert Hydeman Associates for its support, in producing the *National Agenda for Motorcycle Safety*.

Dr. Sue Bailey

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Appendices

Introduction

"Safety is not the equivalent of risk-free."
— United States Supreme Court, 1972

The mission of the *National Agenda for Motorcycle Safety* is to point the way to the most promising avenues for future motorcycling safety efforts in the United States (U.S.). It seeks to do so by incorporating information and ideas from a broad, multidisciplinary spectrum of stakeholders. This document was created to provide guidance to those seeking to enhance motorcycling safety at the national, state, and local levels. The authors sought to apply the most objective data available in formulating recommendations. The group that created this agenda drew from a wide cross section of interests and areas of expertise.

In an effort to maintain harmony among all groups holding a stake in **motorcycle safety**, this document has consciously omitted specific legislative recommendations. This exclusion should not be interpreted as support for or opposition to legislative initiatives.

The goal of the *National Agenda for Motorcycle Safety* is to enhance and improve motorcycle safety. The *National Agenda* simply attempts to answer the question, "What are the most important issues in improving motorcycle safety?" Unfortunately, the answers to this question are not at all clear. A lack of research, caused by a paucity of mechanisms and funding devoted to studies of motorcycle safety, has created a shortage of information about why motorcycles are crashing at the turn of the millennium.

Despite an upturn in motorcycle sales during the last decade, motorcycle crashes and fatalities steadily declined during most of that period, but then increased again in 1998 and 1999 (*NHTSA Fatality Analysis Reporting System*, 1999; see following page). The motorcycling community has invested considerable time and effort to improve its safety record through initiatives such as increased rider training and licensing campaigns. To the outside observer, this positive change may seem improbable, since motorcycles themselves have not fundamentally changed. Motorcycles continue to offer no significant protection to their users in a crash, a fact that horrifies some people used to being enclosed in a steel cage and cushioned by airbags. The very fact that a motorcycle at rest won't remain upright without its rider or some external method of support seems ominous to some.

Attempts to alter the perceived shortcomings of motorcycles with passive restraints, an enclosure for the rider, or an additional wheel create problems of their own. Although such approaches might bear fruit at some point in the future, successful efforts to continue improving motorcycling's safety record appear most likely to be those that focus on more established approaches, such as skills training, incremental technological advances, rider behavior, and personal protective equipment.

However, that doesn't mean that the motorcycling community is the only party capable of or responsible for brightening the motorcycling safety picture. Some of the most promising avenues to this goal exist outside of the motorcycling sector. The larger traffic safety community, highway designers, law enforcement, the medical community, designers of other vehicles, government, researchers working in related areas, insurers, and all road users can accomplish much more toward improving motorcycle safety. The working group who prepared this agenda drew from many of those communities to consider available methods of improving motorcycling safety. Small contributions in all these areas and others appear to offer significant reductions in motorcycle crashes, injuries, and deaths.

In addition, the pursuit of motorcycle safety can assist personnel in other areas charged with stemming crashes, injuries, or deaths caused by specific problems. An agency seeking to reduce drug- and alcohol-related crashes, for example, may find that programs targeting impaired riders can be very effective.

The motorcycling community continues to have substantial opportunities to contribute. Motorcycle rider training programs have been widely implemented to help reduce crash frequency, but they are still underutilized and often lack support from the larger traffic safety community. A broader educational approach, which provides motorcyclists with practical information outside of a formal training setting, can also aid both new and experienced riders. Finally, the motorcycling community can further improve its safety record simply by creating awareness of and interest in issues surrounding the subject, both among motorcycle riders and the wider community.

The Technical Working Group (TWG) offers the *National Agenda for Motorcycle Safety* as a first step along that road.

Motorcyclist Fatalities and Injuries and Fatality and Injury Rates, 1988-1998

Year	Fatalities	Registered Vehicles	Fatality Rate *	Vehicle Miles Traveled (millions)	Fatality Rate **
1988	3,662	4,584,284	8.0	10,024	36.5
1989	3,141	4,420,420	7.1	10,371	30.3
1990	3,244	4,259,462	7.6	9,557	33.9
1991	2,806	4,177,365	6.7	9,178	30.6
1992	2,395	4,065,118	5.9	9,557	25.1
1993	2,449	3,977,856	6.2	9,906	24.7
1994	2,320	3,756,555	6.2	10,240	22.7
1995	2,227	3,897,191	5.7	9,797	22.7
1996	2,161	3,871,599	5.6	9,920	21.8
1997	2,116	3,826,373	5.5	10,076	21.0
1998	2,284	3,879,450	5.9	10,260	22.4

Year	Injuries	Registered Vehicles	Injury Rate *	Vehicle Miles Traveled (millions)	Injury Rate **
1988	105,000	4,584,284	229	10,024	1,064
1989	83,000	4,420,420	189	10,371	805
1990	84,000	4,259,462	198	9,557	882
1991	80,000	4,177,365	193	9,178	876
1992	65,000	4,065,118	160	9,557	681
1993	59,000	3,977,856	149	9,906	600
1994	57,000	3,756,555	153	10,240	561
1995	57,000	3,897,191	147	9,797	587
1996	55,000	3,871,599	143	9,920	557
1997	53,000	3,826,373	137	10,076	522
1998	49,000	3,879,450	126	10,260	478

* Rate per 10,000 registered vehicles.
** Rate per 100 million vehicle miles traveled.
-- = not available.
Sources: Vehicle miles traveled and registered vehicles — Federal Highway Administration. Traffic deaths — Fatality Analysis Reporting System (FARS), NHTSA. Traffic injuries — General Estimates System (GES), NHTSA.

About the Organization of this Document

The TWG used the Haddon Matrix to organize the multitude of topics relevant to motorcycle safety. The topics were divided into the four factor areas. In those instances where a topic fell into more than one category, it was included where it was most relevant.

The Haddon Matrix allows categorization of the Pre-Crash, Crash, and Post-Crash groupings with Human, Vehicle, Environmental, and Social factors as illustrated in the table below:

	Pre-Crash	Crash	Post-Crash
Human Factors	Braking Licensing Education/Training Crash Avoidance Skills Attitude Toward Safety Motorist Physical Impairment Alcohol/Substance Impairment Telecommunication Distractions Rider Risk Recognition & Judgment Concurrent Exposure Data Collection	Personal Protective Equipment	Crash Research Education/Training Evaluation
Vehicle Factors	Horns Braking Intelligent Transportation Systems/ Intelligent Vehicle Initiative Conspicuity Vehicle Design Passenger/Loads Vehicle Equipment Vehicle Modifications Motorcycle Performance Vehicle Safety Equipment	Vehicle Safety Equipment Personal Protective Equipment	Automated Collison Notification (ACN) System Crash Research
Environmental Factors	Intelligent Transportation Systems Regulation Enforcement Road Hazards Natural Hazards Driver Distractions Other Vehicle Design Lane Position/Sharing Road Design and Maintenance	Road "Furniture" Other Vehicle Design	EMS Response
Social Factors	Enforcement Rider Peer Pressure Motorist Awareness Insurance Incentives Motorcycle Retail Advertising Transportation Safety Community Attitude		Transportation Safety Community Attitude Medical Community Attitude

Terms in bold type, throughout this document, are defined in the glossary.

A Brief History of Motorcycling

1885 —— First motorcycle
1903 —— Harley-Davidson Motor Company founded
1912 —— First white lines on roads
1914 —— First stop signal
1928 —— First front-wheel brakes on Harley-Davidson motorcycles met with skepticism
1939 —— First flashing turn signals
1940 —— First sealed-beam headlights
1945 —— 198,000 motorcycles registered in the U.S.
1949 —— Harley-Davidson fits hydraulic **front suspension**
1949 —— Honda builds its first motorcycle
1952 —— First hydraulic brakes on motorcycles
1953 —— Patent for protective helmet issued to University of Southern California (USC) Professor C. F. "Red" Lombard for energy-absorbing liner separate from the comfort padding
1953 —— Movie *The Wild One* released
1955 —— 450,000 motorcycles registered in the U.S.
1957 —— Snell Memorial Foundation established to create helmet performance standards
1958 —— California Highway Patrol motorcycle officers begin using helmets
1958 —— Harley-Davidson introduces rear suspension
1958 —— Over 500,000 motorcycles registered in the U.S.
1959 —— First Japanese motorcycle manufacturer (Yamaha), enters U.S. market
1962 —— 646,000 motorcycles registered in the U.S.
1962 —— "You meet the nicest people on a Honda" campaign launched
1965 —— 1.4 million motorcycles registered in the U.S.
1966 —— First ANSI Z90.1 performance standard for motorcycle helmets
1966 —— Law directing the issuance of Federal Motor Vehicle Safety Standards (FMVSS) enacted
1967 —— Bell Helmets introduces the first full-facial-coverage helmet
1969 —— 660,000 motorcycles sold in the U.S.
1969 —— Stock motorcycles run quarter-mile in less than 13 seconds
1970 —— Movie *Easy Rider* released
1970 —— 1.1 million motorcycles sold in the U.S.
1970 —— 2.8 million motorcycles registered in the U.S.
1972 —— FMVSS 123 standardizes motorcycle controls
1973 —— MSF created
1974 —— **FMVSS 218**, *Motorcycle Helmets* promulgated
1974 —— 55-mph speed limit established nationwide
1975 —— 5 million motorcycles registered in the U.S.
1975 —— U.S. traffic fatalities: motorcycle occupants–3,265; passenger car occupants–37,897
1976 —— Harry Hurt begins study of motorcycle crashes at USC with NHTSA funding
1977 —— NHTSA funds rear-wheel-steering motorcycle project
1978 —— Stock motorcycles run quarter-mile in less than 12 seconds
1980 —— U.S. traffic fatalities peak: motorcycle occupants–5,144; passenger car occupants–27,449
1980 —— First International Motorcycle Safety Conference sponsored by MSF
1981 —— *Motorcycle Accident Cause Factors and Identification of Countermeasures*, (referred to as the ***Hurt Report***) released
1983 —— Stock motorcycles run quarter-mile in less than 11 seconds

1985 —— U.S. traffic fatalities: motorcycle occupants–4,564; passenger car occupants–23,212
1985 —— 5.4 million motorcycles registered and 700,000 sold in the United States
1986 —— Superbike ban proposed and defeated
1990 —— U.S. traffic fatalities: motorcycle occupants–3,244; passenger car occupants–24,092
1990 —— Second International Motorcycle Safety Conference sponsored by MSF
1991 —— First antilock brakes on motorcycles
1995 —— U.S. traffic fatalities: motorcycle occupants–2,227; passenger car occupants–22,423
1997 —— USC Head Protection Research Laboratory conducts feasibility study of updating FMVSS 218
1997 —— U.S. traffic fatalities: motorcycle occupants–2,116; passenger car occupants–22,199
1997 —— Organization for Economic Cooperation and Development/Road Safety Committee 9 (OECD/RS 9) Technical Experts Group formed to develop common international methodology for in-depth motorcycle crash investigation
1997 —— MSF and NHTSA sponsor development of the *National Agenda for Motorcycle Safety*
1998 —— Stock motorcycles run quarter-mile in less than 10 seconds
1998 —— OECD common methodology first used in Bangkok, Thailand
1999 —— U.S. traffic fatalities: motorcycle occupants–2,472; passenger car occupants–20,818

The Need For Research

ISSUE STATEMENT

Research using a common methodology to define the crash-involved and at-risk population is the basis for safety countermeasures. The research that forms the foundation of current countermeasures is based on a study more than 25 years old.

WHERE WE ARE

The effectiveness of the concepts discussed in this document requires a foundation of viable and current research in most areas pertaining to motorcycle safety. While there is a substantial body of work relating to motorcycle safety in the United States and abroad, few of these studies, research projects, or statistical reports were done in coordination with one another. This renders an incomplete picture of motorcycle safety. However, budgetary constraints appear to make such smaller-scope studies the most likely source of information in the near future.

Beginning in 1976 and completed in 1981, *Motorcycle Accident Cause Factors and Identification of Countermeasures* (*Hurt*, 1981) is the benchmark of motorcycle crash research. The findings of this research provided a comprehensive research base for many aspects of motorcycle safety.

There was a continuous decline in motorcycle crash fatalities from the mid-1980s through 1997. The rates then turned up again in 1998 and 1999 (*FARS*, 1999). However, without research to investigate the causes of these trends, we are unable to identify which specific countermeasures are effective or meaningful and which ones are not.

From the first meeting of the Technical Working Group that prepared this document, it was apparent that our effectiveness would be limited by a consistent lack of viable, current research in most subjects related to motorcycling safety. Wide-ranging changes in motorcycling and related factors have altered the motorcycling landscape since the publication of *Motorcycle Accident Cause Factors and Identification of Countermeasures* (referred to as the *Hurt Report*) so thoroughly that it is impossible to determine if the findings of past studies are still valid.

There are few contemporary or timely crash facts, and there are few validations for existing countermeasures that demonstrate what motorcyclists are and are not doing safely. Major events that have affected motorcycling safety since the *Hurt Report* (see Appendix A) include:

- Motorcycle design has evolved so that motorcycle types—sportbikes and cruisers—that did not exist in the '70s are now the majority of those seen on the streets.
- Motorcycles have increased in cost, engine size, and power; suspension systems have changed drastically, fuel tank design has changed, there are new **brake** systems, and lights come on automatically when the engine is running.
- Motorcyclists have changed: Currently, the average motorcyclist is 38 years old. In 1980, the average age was 24. Also, more women are riding motorcycles than ever before.
- Mandatory helmet use laws, often with significantly different requirements, have been enacted, repealed—or both—in many states.
- State motorcycle-operator licensing requirements and operator training are generally more stringent and rigorous.
- The motor vehicle population has changed significantly. New vehicle types such as sport utility vehicles (SUVs) that are larger and higher than most automobiles are now commonplace.

WHERE WE WANT TO BE

The critical questions that need to be answered include:

- Among the many changes affecting motorcycle safety, what factors are responsible for the reduced injuries and fatalities during the late 1980s and early 1990s?

- Why have motorcycle fatalities increased during 1998 and 1999?
- Which problems identified by the *Hurt Report* still exist, and which are less significant?
- What are the commonalities of successful (i.e., non-crash involved) riders?
- What are the root causes for an automobile driver's violation of a motorcyclist's right-of-way?
- Why does alcohol continue to be a significant factor in fatal motorcycle crashes?
- What is the effect of motorcyclist education and training?
- How does highway infrastructure affect motorcycle safety?

Research in Motorcycle Crashes

There are varying levels of depth for motorcycle crash investigations. The least detailed crash investigation is the retrospective extraction of data from police reports. This process occurs after the fact and simply selects available data from police investigation reports that may be of interest in motorcycle safety: rider age, license qualification, motorcycle size, insurance coverage, etc. Police traffic collision reporting varies significantly between jurisdictions, which is a formidable obstacle to meaningful state-to-state comparison (*Winn*, 1997, 1999).

The most detailed level of investigation is the multidisciplinary, on-scene, in-depth investigation (OSIDI) such as the 1981 study of 900 motorcycle crashes entitled, *Motorcycle Accident Cause Factors and Identification of Countermeasures* (*Hurt Report*). This study was sponsored by the U.S. Department of Transportation, National Highway Traffic Safety Administration (**DOT**-NHTSA), and conducted in Los Angeles by Harry Hurt of the University of Southern California (USC). The *Hurt Report* has been used both nationally and internationally as the best source of detailed motorcycle crash data in the development of training, countermeasures, and related questions. Such studies are rare, particularly for the broad spectrum of injury levels possible in motorcycle crashes. On-scene, in-depth investigation provides a level of detailed crash analysis far more valuable than less comprehensive investigations. The data variables that are collected are summarized in Appendix B.

ISSUE STATEMENT

Devising effective countermeasures requires comprehensive research into current causes of motorcycle crashes and defining the motorcycle population at risk.

WHERE WE ARE

Motorcycle crash investigations have been carried out not only in the United States (*Hurt*, 1981) but also in the United Kingdom (*Pedder*, 1979), Canada (*Newman*, 1974), Germany, and other countries in Europe (*Otte*, 1998). While these studies provided useful information, the lack of a common methodology prevents direct comparison between them. For example, *Pedder* studied fatal crashes exclusively while others looked at different injury levels as well. Injury coding systems differ greatly due to a lack of standardization and differing levels of detail, thus making direct comparisons difficult.

WHERE WE WANT TO BE

To continue to make progress in motorcycling safety, the motorcycling community must be in a position to know what has happened to affect motorcycle safety and why. The motorcycle safety community needs to know facts about the motorcycle crash situation in current time. What have we done right? Which safety countermeasures have been effective? Which countermeasures are cost-effective, and which have not been utilized that should have?

HOW TO GET THERE

Defining the Population-at-Risk: Concurrent Exposure Data Collection

How do crash-involved motorcycles and riders compare with those not involved in crashes? The most effective way to know is through the collection of population-at-risk exposure data. Large-scale data sources, such as departments of motor vehicles, can be surveyed and compared with the population-at-risk identified through concurrent exposure data collection. However, exclusive reliance on registration or sales data sources will not define the on-road population-at-risk, due to variability between registrations and actual on-road use.

A comparison group should be motorcycles and riders exposed to the same risk but not involved in a crash. Population-at-risk exposure data were collected as part of the *Hurt Report* methodology. Those comparisons of crash population and population-at-risk allowed specific analysis of over- and

under-representation, and provided the basis for development of countermeasures.

Other studies that attempted to draw conclusions about representation in crashes without collecting exposure data (*Kraus*, 1988) have been strongly criticized. Others have surveyed the population-at-risk without detailed study of crashes (*Kraus*, 1994, 1995). It is the collection of both crash data and concurrent exposure data that provides the most meaningful method of analysis and development of countermeasures.

Common Methodology for In-Depth Motorcycle Crash Investigations

An important recent development is the creation of *Motorcycles: Common International Methodology for In-Depth Motorcycle Accident Investigation* (OECD Common Methodology). This methodology is based on that developed by Hurt and colleagues at USC for the 1981 DOT-NHTSA study. An international Technical Experts Group was organized in 1997 under the International Coordinating Committee of the Organization for Economic Cooperation and Development (OECD). The objectives of the OECD Common Methodology are to collect on-scene, in-depth data to provide detailed knowledge about all aspects of motorcycle crashes. A detailed listing of objectives is found in Appendix C.

The OECD Common Methodology requires observation of the population-at-risk to coincide with the investigation of the crash population.

The OECD Common Methodology allows flexibility in exposure data collection methods ranging from remote observation to personal interviews with at-risk motorcyclists (see Motorcyclist Attitudes, page 15).

The objectives for exposure data collection are to define:

- Population-at-risk
- Traffic characteristics
- Land use characteristics
- Vehicle characteristics
- Historical perspectives
- Data requirements
- National representation
- Application of countermeasures
- International correlation

The OECD Common Methodology is used in Europe in the Motorcycle Accident In-Depth Study (MAIDS) project which covers five areas in five European countries: France, Germany, Italy, Spain, and the Netherlands. The total number of collected crashes should be around 980, and the schedule completion date is the end of 2001. The OECD Common Methodology is also being used in Thailand.

Limited-Scope Studies

Although such large-scale research is the only way to determine many basic factors, there are opportunities to explore certain critical areas of motorcycle safety with smaller-scale studies.

Examples of topics that could be addressed with such studies are how motorcyclists form their attitudes, why other motorists fail to see motorcyclists, what motorcyclists can do to counter this, and which rider training regimens are most effective.

On a wider but less detailed level, development of a standardized police crash report would greatly facilitate data analysis and comparison between states.

Both government and industry have interests in the study of motorcycle safety. The appropriate state and federal government agencies, as well as the motorcycle industry, should share support and leadership for motorcycle safety.

RECOMMENDATIONS

- Immediate action should be taken by government and industry to address the critical questions in motorcycle safety through comprehensive, in-depth studies as well as studies focused on specific topics.
- To better utilize data collected by law enforcement personnel, a uniform traffic crash report for police officers should be developed and deployed. A similar format should also be developed for emergency medical services reports. This will permit meaningful comparisons among jurisdictions. All concerned parties should share the resulting information.
- Mechanisms for building academic and funding capacity for ongoing and future motorcycle safety research should be explored.

Conveying Research Information to Users

ISSUE STATEMENT

In addition to acquiring information about motorcycle crashes and safety, there is a need to disseminate information to those who need it most: motorcyclists and those who influence motorcycle safety.

WHERE WE ARE

There is often misinformation passed around among motorcyclists as myths, old wives' tales and anecdotes. There are few methods of countering this or conveying factual information or new findings.

- A commonly used method of conveying information is the MSF *Riding Tips* booklet included with new motorcycles.
- A few motorcycle enthusiast magazines offer editorial material addressing safety-oriented subjects, but their readers are a minority of the motorcycling population.
- MSF and related rider training organizations reach only participating riders (see Rider Education & Training, page 17).
- Some rider organizations hold seminars and training sessions for members, but these are not widely attended.
- Motorcycle safety information is widely dispersed on the Internet.

WHERE WE WANT TO BE

- We want to find methods of conveying motorcycling safety information more widely and rapidly.
- We would like more motorcyclists to avail themselves of seminars and other sources of information about motorcycle safety.

HOW TO GET THERE

- Urge established motorcycle information sources—such as enthusiast magazines, Internet sites and cable-TV programs—to routinely include safety information.
- Encourage the general media to provide motorcycle safety information to motorcyclists and motorcyclist awareness tips to other motorists.
- Create new avenues of conveying this information.
- Create a specific awareness goals: what every motorcyclist should know.
- Create standard public service announcements (PSAs) style guide information series for use by motorcycle clubs, groups, and rallies.
- Support current sources of safety information.
- Create a motorcycle safety information Internet site to provide quick, easy access to research and other relevant information for all motorcyclists. It would include relevant findings from studies determined to be credible by academic peer review, and present practical advice for motorcyclists and information for the general media.
- Provide practical information to the general media to be used for motorcycling safety features and motorcycle awareness pieces.
- Encourage the motorcycle enthusiast media to give greater attention to safety issues, especially practical information.

RECOMMENDATIONS

- Create a clearinghouse to distribute current, practical information about motorcycle safety based on recent research.
- Develop research-based safety information that can be used easily by the consumer media and in rider education and training systems.
- Explore public service announcements, advertising in enthusiast and near-enthusiast media, and any other viable avenues for distributing safety information.

Motorcyclist Attitudes

ISSUE STATEMENT

The safety of motorcyclists is affected by their attitudes toward skill development, their ability to practice **risk management**, and the influence of their riding peers regarding such issues as protective apparel and riding while impaired.

WHERE WE ARE

The attitudes of motorcyclists toward safety vary greatly. Some motorcyclists emphasize safety in motorcycling activities while others give it little thought.

Many riders appear to believe in the efficacy of rider training programs to enhance their skill development and increase their safety while riding. The prevalent rider training program in the United States teaches skill development, risk management, the use of protective apparel, and the danger of riding while impaired. However, many riders remain untrained and therefore may miss important safety messages.

Recent work in Australia has addressed the issues of motorcyclists' hazard perception and risk recognition (*Hazard Perception for Motorcycle Riders Conference*, 1999). However, there is little in-depth information that specifically addresses the effects of peer pressure, attitudes toward safety, and the individual rider's ability to recognize risk and react appropriately.

Knowledge of rider peer pressure and motorcyclists' attitudes toward safety appears to be primarily anecdotal. Peer pressure has been studied extensively regarding teenagers and drug/tobacco/alcohol use. The National Highway Traffic Safety Administration (NHTSA) has conducted focus groups directed at alcohol-involved riders that may provide insight into rider behavior and one component of risk recognition (*Syner*, 2000).

WHERE WE WANT TO BE

We want to know how to provide motorcyclists with resources that help them form more positive attitudes. To do so, we need to know how they form their attitudes about safety-related issues.

- What sources of information and opinion have the most influence on motorcyclists? How can we harness them to help provide a more effective safety message to positively influence behavior?
- How can we prevent inaccurate information from becoming widely distributed and repeated?
- What are the best methods of providing ready access to accurate, practical information about safety-related issues and encouraging safer behavior?

HOW TO GET THERE

Understanding how motorcyclists develop their attitudes about safety issues requires research.

- We want to know how motorcyclists form certain attitudes and why they may reject relevant information.
- The most likely methods for learning about motorcyclists' attitudes concerning safety are focus groups, crash research and surveys. Such tools should be designed to explore motorcyclists' attitudes and decision-making processes concerning safety and related issues. This research should include crash-involved riders and representative cross sections of motorcyclists to define attitudes among the population-at-risk.
- The most prevalent sources of influence should be used to help motorcyclists make informed decisions regarding safety issues and to encourage safe behavior. As we identify the most influential sources of positive, accurate information and influence, they should be given additional support.

RECOMMENDATIONS

- Study factors that affect and shape motorcyclists' attitudes and behavior and how they affect crash involvement.
- Using information about how motorcyclists form attitudes about safety issues, create programs that reduce dangerous behavior and reinforce safe behavior.

Rider Education & Training

ISSUE STATEMENT

Motorcycle rider education and training comprise the centerpiece of a comprehensive motorcycle safety program. The challenges are to get motorcyclists to take training and to keep quality rider training affordable and accessible to all interested parties.

WHERE WE ARE

Rider training is an effective crash countermeasure for riders for the first six months following training (*Billheimer*, 1996).

Currently, there are 47 state-legislated rider training programs in the United States. The remaining three states (Alaska, Arkansas, and Mississippi) have privately operated rider training sites. Financing comes from different funding sources and appropriations at the state level. An outline of a typical legislation scheme is in Appendix D. The total appropriation for 1998 for these programs nationwide was approximately $16 million (*SMSA*, 1998). To assess rider training and education programming, NHTSA promotes and facilitates Motorcycle Safety Program Assessments, which evaluate a state's motorcycle safety efforts using a peer-review program assessment team concept. The areas of assessment are detailed in Appendix E.

Since 1973, more than 2 million riders have been trained. In 1999, a total of 192,529 riders were trained. Estimates are that this represents just 20 to 50 percent of total annual demand. The curriculum most commonly used in all 50 states is MSF's Motorcycle *RiderCourse:Riding and Street Skills*® (MRC:RSS) for beginners and the Experienced *RiderCourse*® (ERC) for advanced skills training. Instructors and RiderCoaches℠ are trained and employed by individual state programs and certified through the MSF. These courses are conducted exclusively off-street. Most rider training programs in the United States do not utilize on-street training, which is widely accepted in other parts of the world. Private specialty training programs exist in some areas, including sidecar, trike, trailer, off-highway, on-highway, and track experience. Motorcycle simulator technology is generally not employed but is being studied.

Many motorcycle manufacturers and distributors based in the United States support rider education and training through their membership in the MSF and their participation in the MSF Motorcycle Loan Program. MSF is currently sponsored by the United States manufacturers and distributors of BMW, Ducati, Harley-Davidson, Honda, Kawasaki, Suzuki and Yamaha motorcycles. These companies also offer training incentives to new motorcycle purchasers either directly or through their affiliated owners' clubs. In addition, Honda extends use of its training centers in California, Georgia, Ohio, and Texas to the respective state programs for use as training sites. In 2000, Harley-Davidson began offering rider training directly through some of its dealers.

The state level rider training programs are part of an overall effort to encourage motorcyclists to get properly trained and obtain their motorcycle endorsement on their license. Most states provide allowances for the waiver of some portion of state licensing test for graduates of a state recognized rider training program. Some states require training for riders less than the ages of 16, 18 or 21 (see Appendix G for a list of each state's licensing and training requirements). These courses are generally affordable. The average tuition is $66.06 for the MRC:RSS and $40.75 for the ERC (*SMSA* 1998). In some states, training courses are free.

Some state programs lack components for program evaluation. Among those programs that do have evaluation components, methods of data collection are not standardized with other programs for adequate comparison. There is also no centralized repository that permits the exchange of such information for programs to benefit from one another's operation or training experiences. The National Association of State Motorcycle Safety Administrators (SMSA), an organization of state program administrators, surveys state programs annually for general training results and other statistical information.

There is no evaluation of rider education and training effectiveness or measures to determine if program effectiveness has been compromised due to the lack of resources. It is assumed, yet unknown, that the current programs are teaching necessary skills to survive in traffic.

WHERE WE WANT TO BE

We want all states to offer useful, available, and affordable motorcycle safety programs capable of providing quality rider education and training for all interested riders, new riders, and potential riders. Creating a program with sufficient resources will require the following:

- A government agency to provide program administration and oversight
- A funding source and ongoing appropriation to support training, marketing, and evaluation (see Appendix D)
- A uniform, educationally sound curricula (see Appendix F) that reflects current crash and training research as well as the differing demands of various riders and environments
- An effective delivery system to provide education and training where and when demand exists

Uniform data collection, data sharing methods, and training effectiveness measures should be instituted nationwide for evaluation of state rider training and other education programs. The possible advantages of on-street training should be explored.

There should be increased use of Motorcycle Safety Program Assessments, facilitated by NHTSA, to ensure that a team of peers periodically assesses all states.

Motorcycle awareness programs and materials should be components of other transportation programs (see Motorist Awareness, page 31).

Rider education and training and licensing functions should be merged to form one-stop operations (see Licensing, page 21).

HOW TO GET THERE

All states should provide and promote rider education and training programs capable of accommodating all riders who need or seek training. States currently without state authorized programs should create them.

All state programs need assistance in their funding request approaches to legislatures; in determining more viable ways to achieve necessary funding outside of fees levied on motorcyclists; and in how to allocate resources to increase program efficiencies and expand training capacity.

Other areas of concern include maintaining sufficient resources for operation and administration of the program and continued and recurrent program assessments to maintain program quality.

State motor vehicle departments and the motorcycle and insurance industries should continue to provide incentives for riders to obtain initial and recurrent training and proper licensure.

RECOMMENDATIONS

- Expand motorcycle safety programs to accommodate all who need or seek training.
- Conduct uniform follow-up research into the effectiveness and impact of rider education and training.
- Merge rider education and training and licensing functions to form one-stop operations.
- Increase the number of states conducting Motorcycle Safety Program Assessments.
- Establish benchmarks for rider education and training effectiveness and program operation excellence.
- Explore the effectiveness of on-street training.

Licensing

ISSUE STATEMENT

Comprehensive, fair, and effective motorcycle operator testing and licensing systems are necessary to measure the readiness of riders to ride safely.

WHERE WE ARE

The training and experience required to earn a motorcycle operator's license equips motorcyclists to perform better on the road. In 1998, 32 percent of motorcycle operators involved in fatal crashes were unlicensed or improperly licensed compared to 10.8 percent of car drivers (*FARS* data, 1998).

Special motorcycle operator license classifications and requirements for testing exist in all 50 states and the District of Columbia. The licensing components commonly in use are:

- Motorcycle operator manual
- Motorcycle license knowledge test
- Motorcycle license skill tests (on-street or off-street)
- Motorcycle learner's permit
- Intermediate motorcycle license or endorsement
- Full motorcycle license or endorsement
- Waiver of examination, or portions thereof, for completion of state-approved motorcycle rider training course
- Mandatory rider training for certain ages
- Motorcycle license renewal requirements
- Counseling and violator training

Graduated Driver Licensing (GDL), accepted for autos in many jurisdictions, appears unsuitable for motorcycles given that at least two important elements, supervised operation and parental involvement, are problematic in a motorcycle GDL scheme (see Appendix H).

Although used in other countries, **tiered licensing** has not been widely accepted in the United States. Studies have not shown a crash countermeasure benefit (*Mayhew*, 1989).

Forty-four state jurisdictions have adopted and/or modified the MSF *Motorcycle Operator Manual*. The American Association of Motor Vehicle Administrators (AAMVA), NHTSA, and MSF cooperatively developed many of the motorcycle licensing schemes in use in the United States. Sixteen jurisdictions use locally designed off-street tests. Motorcycle-specific products in use include a motorcycle knowledge test, the Alternate Motorcycle Operator Skills Test (Alternate MOST), the Motorcycle Licensing Skills Test (MLST), and the Motorcyclist in Traffic Test (MIT).

All jurisdictions waive knowledge and/or skill tests for eligible applicants who hold licenses from another jurisdiction that maintains licensing standards acceptable to the current jurisdiction. Most jurisdictions waive licensing examinations for graduates of state-approved rider training programs. Reports indicate that this practice is successful in drawing students to training.

See Appendix G for a complete state-by-state breakdown of testing procedures and waivers.

WHERE WE WANT TO BE

All motorcyclists should take the necessary steps to earn a motorcycle license or endorsement.

We want to better understand the characteristics of unlicensed riders, and find ways to ensure they obtain proper licensure.

HOW TO GET THERE

Methods of obtaining a motorcycle operator's license should be heavily promoted. Barriers to obtaining a license should be identified and methods sought to remove them.

- State licensing and rider education and training agencies should partner to create one-stop training and licensing programs, where riders who successfully complete the training course are immediately awarded their motorcycle operator license.
- Motorcycle dealers and other motorcycle community sources should promote proper licensing. Dealers should inform customers that a special endorsement is required and that rider education and training is a good route to this endorsement.
- Testing agencies should increase testing locations and hours to facilitate the licensing process.
- Licensing procedures should include current, sound, and effective materials and testing for skills and knowledge.
- All licensing agencies should provide training for their licensing employees to ensure that tests provide for applicant and examiner safety, are administered objectively, and are scored accurately and impartially. Licensing agencies should also consider participating in recognition programs such as the AAMVA Certified Driver Examiner and Certified Motorcycle Examiner programs.
- The penalties for operating a motorcycle without proper license should be well publicized.
- Studies should be commissioned to ensure that licensing tests measure skills and behaviors absent in crash-involved riders.
- To evaluate motorcycle GDL schemes, a model should be developed using the current best thinking and deployed in a few key jurisdictions. An evaluation protocol should be created to evaluate the system's effectiveness, and policy should be developed based on the outcomes.

RECOMMENDATIONS

- Commission studies to ensure that licensing tests measure skills and behaviors required for crash avoidance.
- Identify and remove barriers to obtaining a motorcycle endorsement.
- Develop and implement programs to allow all state motorcycle safety programs to issue motorcycle endorsements immediately upon successful completion of rider training courses.
- Enforce penalties for operating a motorcycle without a proper endorsement.
- Encourage states and jurisdictions to provide motorcycle specific training to license examiners administering testing for motorcyclists.
- Develop an enhanced motorcycle licensing model using appropriate GDL concepts and evaluate its effectiveness.

Crash Avoidance Skills

ISSUE STATEMENT

The *Hurt Report* identified prevalent skills absent among crash-involved riders as braking, **cornering**, and **swerving**. It is unknown if the lack of the skills for effective braking, cornering, and swerving continues to be over-represented in crash data, or if other deficiencies or behaviors play larger roles in today's crashes.

WHERE WE ARE

While there has been research on individual safety concerns, no other comparable, extensive crash study has been conducted since the *Hurt Report* (see The Need for Research, page 7). No national data exist concerning the effect of rider training (see Rider Education & Training, page 17) and other changes that might affect rider crash avoidance skills. Motorcycle design and performance have changed and improved significantly (see Motorcycle Design, see page 43). These changes may affect crash avoidance. No data exist to determine if engineering improvements are effective at reducing crashes.

Rider training programs focus on developing high-priority skills: braking, cornering, and swerving. Post-training testing is conducted to measure the acceptable application of these skills at speeds from 12 to 20 mph. Most state licensing examinations test for these skills using similar testing instruments and methods. Current rider training programs also focus on developing mental strategies for anticipating and dealing with hazards.

WHERE WE WANT TO BE

Identify the critical skills for avoiding motorcycle crashes and how those skills are acquired.

Focus training programs and licensing systems on high priority crash avoidance skills and adapt as safety needs and issues arise.

Increase the portion of riders taking advantage of training opportunities to learn crash avoidance skills and continue to enhance those skills through practice.

HOW TO GET THERE

Safety countermeasures in effect today need to be evaluated for effectiveness. Research should investigate various aspects of the crash avoidance skills picture to determine if new countermeasures are needed and the effects of technological changes. In addition, certain technologies or configurations may be shown to be superior for crash avoidance and should be used more widely.

Motorcycle safety programs should be evaluated to determine how effectively they teach critical crash avoidance skills and strategies. In addition, the programs should be responsive to the changing needs of the rider.

Evaluation of crash avoidance skills training should include the following elements:

- Braking effectiveness in real-world traffic situations with the various existing and future braking systems
- Cornering skills and strategies on the road
- Swerving effectiveness on the road
- Development of essential mental strategies for safe riding judgment, including visual directional control and an active hazard search, and anticipation process
- Other crash avoidance skills as identified by research

To determine if further countermeasures are needed, a study should be conducted on the feasibility, effectiveness, and practicality of using motorcycle simulators to develop crash avoidance skills and strategies (*Awane*, 1999).

RECOMMENDATIONS

- Conduct research to determine which rider crash avoidance skills are most important.
- Develop countermeasures in training, license testing, and motorcycle technology to address any current crash avoidance deficiencies.
- Evaluate effectiveness of rider education and training in developing crash avoidance skills.
- Evaluate the need for motorcycle simulator skills training.
- Examine technological approaches such as pre-crash warning and avoidance systems to enhance crash prevention.

Motorcyclist Alcohol & Other Impairment

ISSUE STATEMENT

Alcohol continues to be a prominent factor in serious motorcycle crashes. Other substances and causes of impairment, including prescription drugs, over-the-counter drugs, illegal recreational drugs, environmental factors, and drowsiness, are unknown factors in motorcycle crashes.

WHERE WE ARE

Alcohol and other substances have been found to be major risk factors in all types of motor vehicle crashes. These factors appear to weigh more heavily in motorcycle crashes than in crashes of other vehicle types based on the following:

- In 1998, intoxication (BAC ≥ 0.10 percent) rates for vehicle operators involved in fatal crashes were 36 percent for motorcycles, 29 percent for light trucks, 25 percent for passenger cars, and 3.0 percent for large trucks. An additional 9.0 percent of motorcycle operator fatalities had a BAC of 0.01 to 0.09 percent (*Traffic Safety Facts*, 1998).
- Forty-five percent of motorcycle operators killed in single vehicle crashes, and 62 percent killed in weekend-night, single vehicle crashes, were intoxicated (*Traffic Safety Facts*, 1998).
- Helmet use rates for intoxicated motorcyclists are lower than for those who are sober. Impaired motorcyclists involved in crashes are more likely to be speeding than those not drinking (*Traffic Safety Facts*, 1998).

Alcoholic beverages are frequently available and promoted where motorcycles are ridden and at events targeted to motorcyclists. Public information programs and training programs currently include information on the dangers of alcohol and motorcycling. The effects of alcohol on judgment and vehicle operation skills have been studied and quantified (*Moskowitz*, 1988). The number of skills needed to operate a motorcycle is known to be higher than for other motor vehicles (*MSF*, 1974). It is unknown at precisely what levels motorcycle-specific judgment and skills are impaired.

The effects of prescription, over-the-counter, and illegal drugs are also unknown as they relate to motorcycle crashes. In addition, motorcyclists are subjected to more direct effects of the environment such as heat and cold, and it is unknown whether these play a role in motorcycle crashes. Other sources of impairment, such as drowsiness, allergies, etc., could also play a role, but these have not been studied.

WHERE WE WANT TO BE

To achieve this goal of reducing motorcycle crashes where alcohol and other drugs are factors, we need a better understanding of:

- Why alcohol continues to play a role in motorcycle crashes more frequently than in those of other vehicles.
- Alcohol use and substance abuse patterns of motorcyclists.
- The role of alcohol and substance abuse, including over-the-counter medications, in motorcycle crashes.
- How alcohol, drug, and other substances and conditions impair judgment and skill.
- The role, if any, that other sources of impairment play in motorcycling.

HOW TO GET THERE

Reducing the role of alcohol and other impairing substances in motorcycle crashes requires additional information and programs from a variety of sources. These should include:

- Increased research on the alcohol and other drug use patterns of motorcyclists and the incidence of alcohol and drug involvement in motorcycle crashes.

- Increased partnerships with groups already involved in alcohol/substance abuse issues and encouragement of new programs and approaches.
- Studying the effects of alcohol and other substances on motorcycle operating skills.
- Increased health care community involvement in detecting and counseling regarding alcohol/substance abuse.
- Encouraging the alcoholic beverage industry to promote responsible use of alcohol and provide non-alcoholic beverages at motorcycle events.
- Working with law enforcement to enforce current laws and helping them recognize motorcyclists' alcohol/substance abuse behavior.

We need to know if and how other potential forms of impairment figure into the motorcycle safety picture and whether they should be addressed with programs. In the interim, motorcyclists should be educated that impairment does not necessarily or exclusively derive from chemical sources.

RECOMMENDATIONS

- Study how alcohol, drugs and other substances, including over-the-counter medications, can affect a motorcyclist's operating skills.
- Study the alcohol, drug and other substance use patterns of motorcyclists.
- Continue to discourage mixing alcohol and other drugs with motorcycling.
- Educate law enforcement about unique alcohol-related behavior of motorcyclists.
- Encourage partnerships with groups already involved in alcohol/substance abuse issues related to motor vehicle crashes, e.g., Mothers Against Drunk Driving (MADD), Students Against Destructive Decisions (SADD).

Personal Protective Equipment

ISSUE STATEMENT

The protective apparel worn by a motorcyclist provides the only defense against injury in a crash. This apparel includes a **Federal Motor Vehicle Safety Standard (FMVSS) 218 compliant helmet**, heavy-duty jacket and pants, boots, gloves, and eye protection. Because of changes in technology and use of protective equipment, additional research in this area is needed.

WHERE WE ARE

Motorcyclists usually separate from the motorcycle at some time during a crash. It stands to reason that protective apparel is far more likely to be effective than protective equipment attached to the motorcycle (*Ouellet*, 1990). In the event of a crash, no existing strategy or safety equipment offers protection comparable to a FMVSS 218 compliant helmet. There are no compelling medical arguments against helmet use. Detailed analysis of 900 crashes found that "helmeted riders show significantly lower injury frequency in all types of lesions" (*Hurt*, 1981). A recent analysis from the Crash Outcomes Data Evaluation Systems (CODES) from six states demonstrated that helmets were 35 percent effective in preventing death and 67 percent effective in preventing brain injuries (NHTSA, 1996, 1998). In other words, unhelmeted injured motorcyclists are three times as likely to suffer a brain injury compared to helmeted injured motorcyclists. Motorcyclists who do sustain fatal injuries while wearing FMVSS 218 compliant helmets typically have one or more additional fatal injuries, so that the limit of the helmet to protect them is rarely an issue (*Ouellet*, 1990). Head impacts that would otherwise cause death or permanent injury can often be attenuated with little or no injury to a motorcyclist wearing an FMVSS 218 compliant helmet.

FMVSS 218 compliant helmets do not contribute to crash causation (*Hurt*, 1981). However, it is proven by research (*Hurt*, 1981) that increased coverage, particularly increased coverage of the expanded polystyrene liner, increases protection from injury. Helmet use has not been shown to increase the risk of spinal injuries (*Orsay*, 1994, *Thom*, 1995).

Mandatory helmet-use laws have proven an effective strategy in increasing helmet use (*Peek-Asa*, 1999, *Kraus*, 1995), and in reducing head injuries and fatalities (*McSwain*, 1984, *Kraus*, 1994). However, mandatory helmet-use laws are controversial with some motorcyclists. Research shows the number of motorcyclists wearing non-compliant helmets is increasing in states with mandatory helmet use laws (*Peek-Asa*, 1999). Recent research has found that as many as 40 percent of motorcyclists in Florida, which at the time the research was conducted had a mandatory helmet-use law for all riders, wore non-compliant helmets (*Turner*, 2000).

Recently, a number of states have modified helmet laws to permit motorcyclists to ride without a helmet if they carry specific health insurance coverage or pass a rider training course (see Appendix I). Other "partial" helmet-use laws, such as those requiring only certain age groups to use helmets, have unknown effectiveness because of enforcement issues. These approaches dilute the original reasons for the law and may raise confusion about the usefulness and role of helmets.

FMVSS 218, also called "the DOT standard" was promulgated in 1974 and was revised in 1980 and 1988. Helmets sold for motorcycle use in the United States are required by law to meet the minimum performance requirements set forth in FMVSS 218. Helmets qualified to other standards, such as the Snell Memorial Foundation or American National Standards Institute must also meet FMVSS 218. NHTSA is evaluating several issues including:

- Increased test impact velocity to improve impact absorption of FMVSS 218 compliant helmets
- Retention system positional stability tests to ensure helmet retention in crashes
- Improved labeling so motorcyclists will know more about the qualification and care of their helmets and so law enforcement can identify non-compliant helmets

- Revised pass/fail test criteria for harmonization with international helmet standards
- Chin bar test performance qualification for full-facial coverage helmets
- Eye protection test qualification for helmets so equipped

Eye protection plays a dual role: first, eye protection significantly reduces crash involvement (*Hurt, 1981a, 1984*) because it prevents vision degradation caused by wind blast and foreign objects in the eyes. Eye protection also reduces eye injury, both while riding and in crashes (*Hurt, 1984*). The Vehicle Equipment Safety Standard No. 8 (VESC-8) for motorcyclist eye protection is widely referenced and applied by the 36 states with motorcyclist eye protection-use laws (see Appendix I).

Research and new technologies are continually bringing new types of protective gear to the user, although their actual capabilities need to be researched. The environmental extremes confronted by motorcyclists are also addressed by protective apparel, making riding more comfortable in extreme temperatures and inclement weather. There is a variety of apparel offering various degrees of protection for motorcyclists involved in a crash.

The most frequent injury to the crash-involved motorcyclist is abrasion. A wide range of apparel provides proven protection from abrasion (*Hurt, 1981a*). Leather, used in garments to cover virtually all of a motorcyclist's body, can prevent abrasion including serious deep abrasions, has a traditional appeal to many motorcyclists and is currently fashionable. A variety of leather grades, construction, and styles is available, and many leather garments offer extensive features to accommodate motorcyclists' needs. Not all leather garments, even all of those styled in a manner that suggests motorcycle use, are sturdy enough to provide significant abrasion protection (*Woods, 1994a, 1994b*). Various types of effective synthetic materials have been offered in recent years.

A variety of approaches is being taken to provide motorcyclists with impact protection for body areas besides the head. These involve some type of impact resistant material, or **armor**, incorporated into jackets, suits and even gloves and boots. Armor is being designed in an attempt to protect the motorcyclist from everything from bruising and fractures of the extremities, to averting life-threatening injuries to the torso, and reducing spinal injuries. The European Union has devised testing standards: CE EN1621-1 for elbow, shoulder and knee armor and CE EN 1621-2 for spinal armor. No such standards exist in the United States, and there are no armor standards for the torso area, which is critical for protection from life-threatening injuries.

WHERE WE WANT TO BE

All motorcyclists should choose to wear protective apparel because they understand that such apparel can reduce injuries in a crash. All motorcyclists should want to wear FMVSS 218 compliant helmets while riding to reduce head trauma resulting from a crash. Motorcyclists should understand the critical nature of apparel and how it provides comfort, in addition to protection, while riding. Their choices in apparel should be based on promotion from all motorcycle safety organizations, groups, clubs, other stakeholders, and the motorcycle industry. In states where there are helmet laws, law enforcement personnel should know how to identify FMVSS 218 compliant helmets.

HOW TO GET THERE

A wide-reaching platform or forum is needed from which motorcyclists can be informed about the benefits of protective gear and provided with information about various available technologies (see Conveying Research Information to Users, page 13). At these forums, motorcyclists would gather information about new technologies and their effectiveness to aid in making informed apparel choices. This is an area where the technology is changing rapidly.

The motorcycle community and other stakeholders need to create more education programs for motorcyclists to understand the benefits of

FMVSS 218 compliant helmets. This information should also include facts to repudiate misinformation about unfounded dangers of helmet use. Stakeholders should find ways to more effectively communicate the benefits of helmet use and work toward making voluntary use of FMVSS 218 compliant helmets more widely accepted. The dangers of non-compliant helmets should also be communicated by similar means.

Mandatory helmet-use laws should specify the use of FMVSS 218 compliant helmets. Motorcyclists and traffic law enforcement officials should be educated in how to determine if a helmet meets FMVSS 218. Revisions to FMVSS 218 should aid in identification of FMVSS 218 compliant helmets and elimination of non-compliant helmets.

Additional research is needed into all of these issues. Standards should be developed based on research to help consumers make informed choices. The effectiveness of personal protective equipment would be investigated as part of any crash research.

RECOMMENDATIONS

- Use effective strategies to increase the use of FMVSS 218 compliant helmets.
- Educate motorcyclists about the value of protective apparel by providing an information source on related research and a forum for the exchange of information.
- Find ways to more effectively communicate the benefits of helmet use and work toward making voluntary use of FMVSS 218 compliant helmets more widely accepted.
- Use effective strategies to ensure that all helmets in use meet FMVSS 218.
- Revise FMVSS 218.
- Conduct research regarding protective apparel effectiveness, and consider development or adoption of existing standards, if research justifies.

NOTE:

As noted in the Introduction to the *National Agenda*, in order to maintain harmony between the groups interested in motorcycle safety, the *National Agenda for Motorcycle Safety* has consciously refrained from making any legislative recommendations, including any regarding mandatory helmet-use laws. This exclusion should not be interpreted as support for, or opposition to legislative initiatives.

Motorist Awareness

ISSUE STATEMENT

When motorcycles and other vehicles collide, it is usually the other (non-motorcycle) driver who violates the motorcyclist's right-of-way (*NHTSA, 1998*). There is a continuing need to help other motorists "think motorcycles" and to educate motorcyclists to be aware of this problem.

WHERE WE ARE

Several factors combine to cause drivers of other vehicles to overlook motorcyclists and subsequently violate their right-of-way:

- Motorcycles and their riders are a relatively small component of the total traffic mix. Therefore, their visual recognition is reduced.
- Many drivers do not anticipate routine encounters with motorcyclists in traffic.
- Motorcycles are smaller visual targets and are more likely to be obscured.

Research shows drivers who also ride motorcycles and those with family members or close friends who ride are more likely to observe motorcyclists and less likely to collide with them (*Brooks, 1990*). This indicates that drivers can see motorcyclists, whom they might otherwise overlook, if they mentally train themselves to do so. The visual problem is compounded by a variety of visual limitations confronting drivers:

- Automobiles have obstructions and blind spots that can obscure or hide a motorcycle and rider. These include door pillars, passengers' heads, and areas not visible in the mirrors.
- Other conditions affecting the vehicle—such as precipitation, glare, and cargo—can further impair a driver's view and obscure motorcyclists.
- Objects and environmental factors beyond the vehicle, including other vehicles, roadside objects, and light patterns can make it more difficult for drivers to identify motorcyclists in traffic.

Traditional driver distractions, such as passengers, eating, smoking, reading, shaving, applying make-up, and managing audio systems, continue to be a problem and may be increasing as new distractions emerge. Portable phones and other communication devices, and features such as in-vehicle navigation systems, which divert more attention inside the car, may be increasingly distracting drivers.

WHERE WE WANT TO BE

Motorists should be aware of motorcycles and take special care to identify and acknowledge their presence. Motorists should avoid distractions and compensate for visual obstructions.

Motorcyclists should compensate for unaware motorists by increasing their conspicuity (see Conspicuity, page 49), lane position, riding with headlights on during daytime, and wearing brightly colored and retro-reflective protective apparel.

HOW TO GET THERE

Both drivers and motorcyclists need to become more aware of the visibility problem. Educating drivers to become more aware of motorcycles and to consistently consider their presence would appear to be a very promising strategy for improvement in this crucial area. Getting drivers to consider the possible presence of motorcycles and the need to look for motorcyclists, situations where motorcycles may be obscured, and techniques for detecting motorcyclists, would be useful in reducing right-of-way violations by other vehicles.

This problem must be addressed on a number of fronts:

- Further research into why motorists fail to see motorcyclists could supply information on how to educate drivers to expect motorcycles to be present and to detect them.
- Mature driver programs that teach older drivers how to deal with their changing abilities should emphasize that motorcyclists may require an additional effort to detect.

- Rider education and training efforts need to continue to emphasize this problem and stress that the rider must assume the responsibility of avoiding a crash situation caused by another motorist. Initial and recurring rider education and training should continue to emphasize that motorists will frequently fail to observe motorcyclists, even though the motorcyclist is in plain view.
- Rider education and training must continue to include training on strategies and techniques for coping with this conspicuity problem.
- All driver education and training (mature driver programs, high schools, remedial programs) should include a component on motorcycle awareness.
- Expand avenues to promote motorists' awareness of motorcyclists through billboards, visitor centers, media, motor vehicle departments, bill statements, banks, grocery stores, gas pumps, etc., where there are "captive audiences."

RECOMMENDATIONS

- Educate operators of other vehicles to be more conscious of the presence of motorcyclists.
- Remind motorcyclists that they may be overlooked and provide defensive strategies for overcoming this situation.
- Include questions regarding motorcyclists on driver's license tests and include information in driving manuals.
- Include the completion of a motorcyclist awareness class in sanctions against motorists found guilty of violating a motorcyclist's right-of-way.
- Adequate funding needs to be devoted to the development and implementation of motorist awareness issues.

Insurance Industry Involvement

ISSUE STATEMENT

Insurers can provide incentives to encourage and enhance motorcycle safety and can provide information about motorcycle loss data to help determine where future safety measures are needed.

WHERE WE ARE

Insurers employ limited avenues to enhance and encourage motorcycle safety.

- Some insurance companies offer premium discounts for motorcyclists who have taken an MSF-recognized rider training course (see Rider Education & Training, page 17). Some states also require such incentives (see Appendix J).
- An inordinate number of motorcycle crashes occur when unlicensed riders are operating the motorcycle. However, not all insurers verify that all operators have a motorcycle license, endorsement, or make a valid endorsement a requirement for the policy to be effective (see Licensing, page 21).

Motorcycle insurers are not currently required to provide motorcycle-specific loss data for analysis or use in a safety-related database as they are, for example, with automobiles.

WHERE WE WANT TO BE

Insurers could further motorcycling safety efforts and reduce their own losses by supporting certain responsible riding practices with incentives.

- Specify that all users of insured motorcycles must possess a valid motorcycle operator's license for coverage to be effective.
- Provide premium discounts to motorcyclists who have received a certificate of completion or equivalent from an appropriate (i.e., basic or experienced) MSF-recognized rider-training course.

Insurers could help devise safety countermeasures by providing loss information to motorcycle safety and traffic safety organizations.

HOW TO GET THERE

The insurance industry should work with the motorcycling community and other entities concerned with motorcycle safety to understand the loss patterns of motorcycling and reward safe motorcyclists with incentives. Insurers should:

- Offer incentives for rider training.
- Encourage proper licensing for motorcycle operators of insured vehicles and discourage use by improperly licensed operators.
- Create a system for collecting loss data that can be used to devise safety countermeasures.
- Offer insurance discounts for remaining crash-free.

RECOMMENDATIONS

- Insurers should write policies that stipulate that coverage or certain portions of coverage are not valid if the owner permits an unlicensed or improperly licensed operator to use the motorcycle.
- Collect, organize, analyze, and distribute motorcycle-specific loss data from insurers to better understand safety issues, and to educate riders and other motorists on motorcycling safety issues.
- Develop guidelines for insurers to tie approved training, licensing, and safe-riding practices to premium reductions.

Enforcement & Adjudication

ISSUE STATEMENT

Law enforcement is responsible for ensuring compliance with laws and regulations intended to promote and maintain highway safety, and is an integral component of motorcycle safety.

WHERE WE ARE

Some law enforcement agencies do not make motorcycle safety a priority and take a traditional approach toward law enforcement relating to motorcycles. For example, because motorcyclists are a small part of the motoring public, few programs are funded that proactively target motorcycles for compliance and safety programs.

Many prosecutors and judges are unaware of the factors that contribute to motorcyclists' injuries and fatalities. Even though violations, such as riding without a motorcycle operator's license, are associated with a significant increase in crashes and injury (*FARS*, 1998), there is little perceived threat for the motorcycle rider of being caught, and even less fear of the consequences.

WHERE WE WANT TO BE

Law enforcement agencies and the courts should recognize the importance of motorcycle safety. Agencies should participate in statewide Motorcycle Safety Program Assessments to maintain comprehensive enforcement and public education programs to enhance motorcycle safety. Enforcement programs should address specific problems related to motorcycles. Prosecutors and judges should be equitable when dealing with motorists who cause motorcycle crashes.

Technical expertise in motorcycle safety and crash investigation should be available to crash investigators. Motorcycle-specific crash investigation training should be more widely available to law enforcement investigative personnel.

HOW TO GET THERE

Judicial and law enforcement agencies and associations should work together to promote motorcycle safety. Law enforcement agencies should involve themselves at all levels of state motorcycle safety programs to better understand the needs and aims of those programs. By coordinating with motorcycle safety organizations and working with other traffic safety groups that already work on motorcycle safety (e.g., AAMVA, MSF, NAGHSR, NHTSA, SMSA), law enforcement and judicial groups could become more aware of and involved in relevant motorcycle safety issues.

There should be a concerted effort to inform and educate law enforcement officers and administrators about other programs designed to address motorcycle safety. Areas to cover include:

- Existing materials—such as NHTSA cue cards with indicators for detecting impaired motorcyclists that differ from those of other impaired motorists—should be widely distributed and utilized.
- Law enforcement officers need the proper tools to fairly and effectively enforce helmet-use laws where applicable (see Personal Protective Equipment, page 27), such as information on how to differentiate FMVSS 218 compliant helmets from non-compliant helmets.
- Motorists who violate motorcyclists' right-of-way should face legal consequences at least as great as if they had violated an automobile operator's right-of-way. The public should be educated about the danger of overlooking a motorcyclist and the serious legal penalties for doing so.
- Motorcycle crash experts should be available as a resource for police crash investigators to aid in accurate analysis of motorcycle crashes (see Conveying Research Information to Users, page 13).

RECOMMENDATIONS

- Educate law enforcement and judicial officials about unique motorcycle safety issues and resources.
- Encourage inclusion of law enforcement officials in Motorcycle Safety Program Assessments.
- Develop and implement standardized data gathering and reporting for motorcycle crashes.
- Include motorcycle crash investigation procedures in the basic course given to crash investigators.
- Appropriate sanctions should be applied to those found guilty of contributing to motorcycle crashes. The sanctions, such as mandatory attendance at a motorcycle awareness course, would be designed to expand knowledge of motorcycle issues.

Traffic Safety Community Attitude

ISSUE STATEMENT

Highway safety organizations throughout the United States, public and private, place less emphasis on motorcycle safety when compared with other modes of transportation.

WHERE WE ARE

Little attention is paid at any level to the impact overall traffic safety has on motorcycle safety.

- The emphasis on motorcycle safety is placed on helmet usage and laws.
- Funding for other motorcycle safety issues is very limited.
- Highway safety publications and public education campaigns rarely focus on motorcycle safety issues.

WHERE WE WANT TO BE

Greater emphasis on motorcycle safety by United States highway safety organizations can advance motorcycle safety efforts in a number of key ways:

- Funding for motorcycle safety programs should be increased.
- Motorcycle safety programs should be more widely publicized and promoted.

HOW TO GET THERE

To give motorcycle safety efforts a new legitimacy and urgency, key leaders in the traffic safety community must be well informed about pertinent issues to help those involved in promoting motorcycle safety receive greater support.

Key leaders in the traffic safety community and the motorcycle community can champion motorcycle safety efforts by working with the appropriate highway safety decision-makers. These efforts should lead to a comprehensive application to promote motorcycle safety that can be applied nationwide.

Develop cooperative arrangements between motorcycle safety advocates and the media to increase publicity surrounding the issue of motorcycle safety and increase public awareness of drivers' responsibility to detect and avoid motorcycles (see Motorist Awareness, page 31).

RECOMMENDATIONS

- Traffic safety organizations outside of the motorcycling community can better influence motorcycle safety issues by becoming more educated about motorcycle safety issues and adopt them where applicable.
- Increase funding for motorcycle safety programs by elevating their importance to state highway safety offices.
- Representatives of the motorcycle safety community should be integrated into the larger highway safety community to improve cooperative efforts.

Introduction to Motorcycles

NOTE:
This section is intended as an informational and introductory piece and does not include recommendations.

Background: Motorcycle Types & Characteristics

Until the 1950s, there was just one kind of motorcycle available. This all-purpose type of machine was designed for street use and was modified for more specialized applications. As motorcycles became more popular, new configurations were created to address certain interests and needs. Initially, special models were designed for off-highway riding. However, the range and variety of models has grown as manufacturers identified and addressed new market niches. By the 1980s, several distinct types of street-legal motorcycles had emerged. The characteristics and capabilities of current street motorcycles vary with their style. Different categories have different strengths and weaknesses, which may be helpful to recognize. Although some machines blur the distinctions, in general, current street-legal motorcycles fit into the following categories:

Traditional

Traditional motorcycles designed as practical transportation, with few styling frills or amenities. This category falls in the middle of the spectrum in most areas of ergonomics and performance, including power, handling response, and braking. Although they were once almost universal, traditional-style motorcycles have declined in popularity as more specialized types have become available.

Cruiser

Currently the most popular category of the market, centered on traditional or classic American styling. Once dominated almost exclusively by Harley-Davidson, the cruiser category has attracted competition from all major manufacturers and is the entry category for new American manufacturers. The profile is long with a low saddle height. The emphasis in the cruiser category is on appearance, style, and sound, with less emphasis on performance. Owners frequently customize these machines.

Sportbike

Styled and constructed in the manner of road-racing motorcycles with streamlined bodywork, front-end weight bias, and forward-leaning riding positions, the emphasis is on handling, acceleration, top speed, braking, and cornering prowess. Performance handling and braking systems are the rule on sportbikes, which tend to be lighter and more technologically advanced than other types of motorcycles. Often less comfortable than other types, they are favored for riding on twisting roads.

Touring

Large motorcycles with luggage, wind protection and other amenities (stereo, two-way communication, cruise control, etc.) designed to transport rider and passenger in comfort. Touring bikes are heavy with moderate power outputs. Their intended purpose is comfortable, long-distance travel.

Sport-Touring

These motorcycles combine the comfort and some of the luggage capacity of touring motorcycles with the responsive handling of sportbikes. Usually powerful with relatively responsive handling, and high-performance brakes, sport-touring motorcycles offer fewer amenities than touring bikes. The ideal mission of a sport-touring machine is medium- and long-distance travel via curving roads.

Dual-Purpose

Machines designed to be used both on- and off-road. They are typically lightweight, tall and narrow with single-cylinder engines, long suspension travel and tires suitable for on- and off-highway use.

Scooters

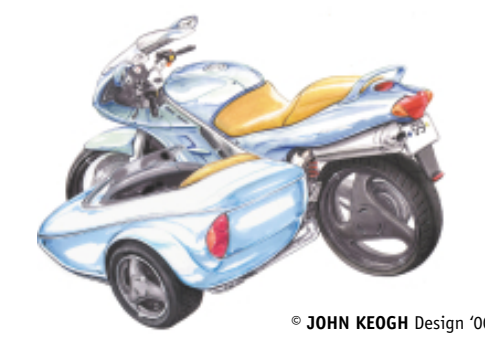
These two-wheeled vehicles are small, mostly low-power designs with small-diameter wheels suitable primarily for use at low and medium speeds on surface streets in urban environments. Their appearance differs significantly from motorcycles' because of their bodywork and the "step-through" frame design. Most are not suitable or legal for use on high-speed or controlled-access roadways, though some do have sufficient power and other capabilities to allow such use.

Mopeds and Nopeds

Lightweight, very low-power two-wheelers designed for cheap urban transportation. Their bicycle-like design, slow acceleration, and limited top speed (30 miles per hour) make them unsuitable for use on high-speed roadways and create unique traffic issues for their users.

Sidecars

A third wheel can be added to the side of a motorcycle to create a motorcycle/sidecar combination. These devices attach to the frame of the host motorcycle and provide additional passenger or cargo capacity. These accessories strongly affect all aspects of handling and control by essentially creating an entirely different kind of vehicle, which in some ways is more like an automobile than a motorcycle.



Trike

These machines are created by either grafting the front of a motorcycle to the back of an automobile or adding an automobile-type rear axle to the rear of a motorcycle to create a three-wheeled vehicle. Although they are usually licensed as motorcycles, these vehicles are dramatically different in many ways and do not handle or steer like motorcycles.

Motorcycle Design

ISSUE STATEMENT

The design of motorcycles has made them increasingly more capable and specialized, and generally reflects a greater emphasis on safety.

WHERE WE ARE

In general, motorcycle design has yielded steady safety improvements. The motorcycles of today are better in virtually every significant safety area than those of just two decades ago.

Current motorcycles have better brakes, greater stability, more responsive steering, more effective controls, improved ergonomics for better control and reduced fatigue, and improved reliability in all systems than those of even a decade ago.

The acceleration and top speed of the most powerful models (mostly sportbikes) have increased continually. The effect of these performance increases on safety is currently unknown.

Tires, which are particularly crucial components on a two-wheeled vehicle, have advanced significantly and have contributed much to vehicle performance, reliability, and safety. Modern tires are more durable, offer better traction for turning and stopping, and have contributed to significantly improving stability compared with their counterparts of the 1970s.

Some motorcycles have hand and foot controls that can be adjusted to accommodate various riders with larger or smaller than average hands and feet, thereby increasing the riders' control of these motorcycles.

Brakes are often significantly more powerful and can have an antilock braking system and/or linked front and rear application.

Lack of rider protection is a characteristic of all motorcycles. Research into devices to reduce rider injuries in crashes is ongoing. Because of the lack of coupling between motorcycle and rider (which would create an additional hazard), motorcycle-mounted rider protection systems have significant limitations (*Ouellet*, 1990; see Personal Protective Equipment, page 27).

- Leg protectors have been devised and studied in the United States and internationally, but the results have been mixed thus far. There is no widespread agreement that they provide additional protection, and they may pose safety drawbacks.
- Motorcycle airbags have been under study for 30 years both as vehicle equipment and as a part of the rider's apparel. At this time, the benefits and risks, such as undesired deployment, are still under investigation (*Iijima*, 1998).

The evolution and specialization of street motorcycles to meet specific requirements of the market have created some design features that raise safety issues and suggest further research.

- Studies of earlier types of machines have shown that fuel tanks that rise abruptly from the saddle immediately in front of the rider contribute to severe pelvic injuries in frontal impacts (*Ouellet*, 1981). Most current sportbike tanks have a similar style and are likely to present a similar injury mechanism.
- Some cruiser and touring motorcycles place components, such as instruments and controls, atop the fuel tank. These designs may increase uro-genital injuries during crashes.
- Motorcyclists complain that windshields that extend through a rider's line of sight impede vision under certain conditions, including rain and nighttime.
- Although **tubeless tires** significantly reduce the likelihood of a blowout and resulting loss of control, **tube-type tires** are still fitted to many cruiser models in order to use wire-spoke wheels for appearance reasons. However, alternative wire-spoke wheel designs exist that may be used with tubeless tires. Wire wheels may also be sealed for use with tubeless tires. The *Hurt Report* listed puncture flats as the primary motorcycle vehicle failure leading to crashes.

- Emphasis on styling simplicity, the search for weight reduction, and lack of space often dictates a single-bulb taillight. The failure of either the taillight or brake-light filament can leave the motorcyclist without rear lighting.

WHERE WE WANT TO BE

We want to understand the effects of current motorcycle design on safety. Specific issues that must be addressed include:

- The effects of rapid acceleration and high top speeds
- The run-flat performance of motorcycle tires
- Injury mechanisms of current designs

As with other vehicles, fashion is a significant factor in motorcycle design. However, there may be some safety consequences that are not desirable. Safety should not be sacrificed for the sake of fashion.

More motorcycles should offer control adjustments to accommodate riders who are larger or smaller than average.

HOW TO GET THERE

Research is needed to learn about the effects of current motorcycle design and performance on safety.

Although some issues raised here concerning motorcycle design await research and technology for solutions, others—such as vision restrictions and tube-type tires—can be addressed with current technology as research results dictate.

RECOMMENDATIONS

- Conduct research to determine how current motorcycle designs affect crash and injury causation.
- Implement the use of available tire and wheel technology and explore technology, such as run-flat tires, to reduce frequency of loss-of-control crashes caused by puncture flats.

Braking

ISSUE STATEMENT

Although motorcycles have sufficient braking power and traction to enable them to stop in as short a distance as a typical car, **panic-braking** a motorcycle poses unique hazards and requires greater operator skill than stopping a car in panic situations or in a skid.

WHERE WE ARE

The vast majority of motorcycles use an independent system for the front and rear wheels, with a lever on the right handlebar controlling the front brake and foot pedal controlling the rear brake. A small number of motorcycles link the controls and an even smaller number have a handlebar lever to control the rear brake. We know of no current research that indicates which if any of these is more effective.

Braking seems to be one of the most difficult skills for a motorcyclist to master. It is also one of the most critical. It is difficult because most motorcycles have two separate brake-control systems, one for the front wheel and one for the rear wheel. As the front brake is applied, weight transfers to the front tire, which causes available traction to vary as weight shifts, requiring the rider to adjust pressure on each brake control in a maximum-performance stop. As found in the *Hurt Report*, in a situation the motorcyclist typically **overbrakes** the rear and **underbrakes** the front, even though weight transfer means the front brake must do the majority of the braking. Overbraking can either cause loss of steering control or total loss of control. If the rear wheel is locked, the rider typically loses directional control. If the front wheel locks, the rider is likely to crash due to loss of stability.

Rider training courses, available for the last two decades, have sought to develop improved motorcyclist braking skills. Greater emphasis has been focused on proper braking technique and the importance of the front brake. There seems to be a greater recognition of the importance of front brake use than there was 20 years ago when the *Hurt Report* was conducted. Failure to brake effectively and loss of control during panic-braking continue to play a role in motorcycle crashes.

Continued rider training and practice are key elements in assuring maximum rider performance in a panic situation. This allows riders to learn brake control during a maximum-braking stop, internalize the process of a hard stop so they react automatically in a panic situation, and deal with events such as rear-wheel lock-up. However, even panic-braking *practice* involves risk, because locking the front wheel can cause an immediate loss of control and a fall. This makes it difficult for rider training organizations to train riders to use the front brake to its full capability.

Motorcycle braking systems have steadily improved in terms of power, control, and reliability and continue to do so. Virtually all street motorcycles now have hydraulically actuated disc brakes, at least on the front wheel. Most motorcycles use this type of brake—which is self-adjusting for wear and more resistant to fade and wet conditions than drum-type brakes—on the rear wheel as well. Many street motorcycles also have powerful dual disc brakes on the front wheel, which provide more stopping power where it is needed most. This is particularly true for sportbikes and touring motorcycles. Cruisers, despite weights that are normally heavier than other styles except touring motorcycles, often have just a single disc brake in front, although this seems to be changing.

Two technical developments have sought to simplify braking control and provide more effective braking. **Linked braking** slows both wheels with a single control. **Antilock braking systems (ABS)** allow the rider to apply maximum braking force without fear of wheel lock-up and the resulting loss of control, providing the bike is not leaned over. Under many pavement conditions, antilock brake systems allow the rider to stop a motorcycle more rapidly while maintaining steering control even during situations of extreme, panic braking.

Although incidental and first-hand experience indicates either of these systems can be effective in countering the problems faced by a motorcyclist in a panic stop, we know of no research that shows how they perform in the field com-

pared with similar bikes fitted with standard brake systems. The added costs (particularly for ABS) and reluctance to accept them by some experienced motorcyclists have limited the adoption of these potentially effective systems.

WHERE WE WANT TO BE

We want motorcyclists to possess the skills to use their brakes fully while maintaining control under all riding conditions, thus avoiding some crashes.

We would like developments in brake systems, which offer better, safer panic-stopping capability for motorcyclists, to continue and be more widely adapted to all classes of motorcycles.

HOW TO GET THERE

Assuring that motorcyclists get maximum braking performance requires training, research, and deployment of equipment that can provide maximum-performance braking while minimizing the danger of a braking-induced crash. To obtain the level of braking that is available even on current machines, both experienced and inexperienced motorcyclists need recurrent training (see Rider Education & Training, page 17).

Several braking issues invite further study:

- The new technologies seem to promise shorter stopping distances and overall safer stopping for motorcyclists. ABS in particular can do much to eliminate the dangers of overbraking in a straight line.
- Studies of how effectively linked-braking systems perform in the field would tell whether they should be employed more widely.
- The effectiveness of braking systems that combine ABS with a linked control should be explored.

RECOMMENDATIONS

- Study the effectiveness of linked and antilock braking in the field. If these technologies prove valuable, deploy them more widely.
- Use information from research to implement other braking-related countermeasures.
- Provide additional training and education on proper braking and panic-braking techniques.

Vehicle Modifications

ISSUE STATEMENT

A motorcycle's relatively simple design and availability of replacement or accessory components make it easy, inexpensive and popular to modify with unknown safety consequences.

WHERE WE ARE

Virtually every part of a motorcycle can be modified, and many modifications can affect the safety of the vehicle. Modifications aimed at improving or changing the way the machine works include those directed at engine performance, comfort, handling, braking, or cargo capacity. Some changes are made to personalize and customize the appearance. Even seemingly simple, routine changes—such as fitting new tires—can change a motorcycle's handling.

Some changes (such as upgrading suspension components, tires, or brake components) can be purely beneficial, while others can be mostly detrimental from a functional standpoint. Many involve trade-offs. For example, a motorcycle that is lowered to give the rider a more surefooted stance at a stop gives up some cornering ground clearance and suspension travel. Some changes, such as major frame modifications or use of an aftermarket frame, can change the entire character of the motorcycle. Installation of a sidecar or a three-wheeled "trike" kit creates an entirely different class of vehicle that no longer handles or responds like a two-wheeled motorcycle.

Although trailers towed behind motorcycles have become more popular, we know of no data that indicate their effect on motorcycle behavior. Most motorcycle manufacturers warn against their use, however.

Users may install aftermarket components or make modifications that their motorcycles were not designed for or tested with. They may combine modifications that were not designed to be together and when combined have unforeseen effects on the performance of the vehicle. Riders may also fail to understand all the consequences of a change. Some changes also lend themselves to misuse. Adding a cargo compartment or a luggage rack at the rear of the motorcycle, for example, may allow the user to place too much weight there despite labels warning against it. A change in weight distribution can significantly alter how a motorcycle handles.

The *Hurt Report* showed that modified vehicles were over-represented in crashes. However, the types of vehicles created by the modifications specified in that study—known then as **semi-choppers**—now constitute the two largest subcategories of original equipment street motorcycle: sportbikes and cruisers. Because a motorcycle created by an aftermarket or user-created modification is much different than one built by a manufacturer, the current situation has changed too much for that aspect of the study to be relevant. The *Hurt Report* also found street motorcycles with modified exhaust systems were over-represented in crashes.

As with original equipment, the quality and safety of most aftermarket components have steadily improved, although seemingly they haven't reached the levels of original equipment components yet. Users have access to more information of such products from manufacturers than in the past, and the user is likely to be better informed of the possible drawbacks to the modification. The liability climate has also made suppliers and installers more cautious about modifying motorcycles.

Some of the most questionable modifications that were popular during the era the *Hurt Report* was conducted, such as removing the front brake, have fallen out of style. It is not clear, therefore, if modifications are still a significant factor in motorcycle crashes.

The modifications favored by motorcyclists change with technology, fashion, and other factors, which makes most specific regulations unfeasible. Some countries, such as Germany, require that prior to any sale of a motorcycle, any of its modifications must be tested and certified. Although this may prevent some crashes, it may also cause some by limiting the riders' access to superior tires, brakes, suspension, and other components.

WHERE WE WANT TO BE

The current role of vehicle modifications in motorcycle crashes should be better understood.

All aftermarket vendors should make safety a priority in the development of motorcycle accessories.

HOW TO GET THERE

Any future studies of crash causation should certainly examine the role of modifications to motorcycles, particularly major changes such as chassis modifications, sidecars, and trailers. Since some alterations may be under-represented in motorcycle crashes, that issue should also be addressed. Education of riders may be a better approach to dealing with modification-related problems than regulations.

RECOMMENDATIONS

- Study the role of modifications in current motorcycle crashes.
- Educate users about how modifications and loads can change the operating characteristics of their motorcycles.

Conspicuity

ISSUE STATEMENT

Motorcyclists who are conspicuous are underrepresented in crashes.

WHERE WE ARE

A common complaint of street riders is that other motorists fail to observe them. Motorists who violate motorcyclists' right-of-way frequently state, "I didn't see him," or "He came out of nowhere" (*Hurt*, 1981).

The problem of other motorists failing to observe motorcyclists apparently exists on several levels (see Motorist Awareness, page 31). An important *Hurt Report* finding was that conspicuous motorcycles and riders were less likely to have their right-of-way violated by other vehicles.

A variety of recognized tactics exists to make motorcycles and their riders more conspicuous: lighting, surface color and size, and rider traffic strategy.

Lighting factors include:

- Since 1979, most motorcycles sold in the United States have been equipped with **automatic-on headlamps** to meet some state requirements. This seems to have been an effective method of making them more conspicuous and reducing right-of-way violations. Currently, 86 percent of motorcycles on the road have their headlights on during daytime (*Turner*, 2000).
- Using the high beam of a motorcycle's headlight during the day also helps to prevent violations of the motorcyclist's right-of-way (*Hurt*, 1981).
- In the cruising and touring categories, auxiliary headlights, usually of reduced wattage, are gaining popularity. Many sportbikes are equipped with dual headlights.
- Recently, some automobiles have started using **daytime running lamps** (DRL), which may reduce the effectiveness of motorcycle automatic-on headlamps.
- Headlight modulators, which cause the light to alternate between a higher and a lower intensity during the day, also increase conspicuity (*Hurt*, 1981). Headlight modulators are federally regulated lighting devices and as such, all state laws governing them are preempted. Motorcycle headlight modulators have not been studied to determine their effects on other motorists.
- Many modern street bikes are equipped with **position lamps** in their front turn signals. This may help other motorists to identify the vehicle as a motorcycle and to better judge its distance and speed.
- Few motorcycles have more than single-point rear lighting, though multiple lights at the rear would seem to offer similar benefits and also provide redundancy for the single taillight.

The color of and equipment on a motorcycle can play a significant conspicuity role.

- Motorcycles equipped with additional frontal bodywork (**fairings** which protect the rider from wind and weather) were found to be under-represented in crashes where motorists violated the motorcyclist's right-of-way. The larger the fairing and the brighter the color, the more effective it seemed to be in preventing other vehicles' right-of-way violations (*Hurt*, 1981).
- During the period of study for the *Hurt Report*, most fairings were aftermarket accessories added to motorcycles for touring comfort. By the late 1980s, most manufacturers offered some motorcycles with fairings as original equipment. In addition, most sportbikes have smaller, more aerodynamic fairings, that tend to be more brightly colored and often have elaborate graphic designs. Whether the newer sport-style fairings have a significant effect on conspicuity is not known.
- One of the easiest and most effective ways for a motorcyclist to be seen by other motorists is by wearing brightly colored, upper-torso clothing and/or retro-reflective material. However,

only a minority of motorcyclists choose such brightly colored apparel, whether for fashion or other reasons.

- Social and fashion pressures are apparently a powerful reason for not wearing brightly colored clothing. Although sportbike riders, who imitate racers, have largely accepted bright colors, the larger cruiser category chooses apparel in almost nothing but inconspicuous black. Other categories often choose other hard-to-see colors such as gray, beige, and other neutral colors. The olive-drab and camouflage apparel that the *Hurt Report* found over-represented in the typical right-of-way-violation crash is still worn.
- Manufacturers and distributors of helmets confirm that more than half of the motorcycle helmets sold for street use in the United States are black, which seems to be chosen primarily for fashion.

Rider traffic strategy strongly affects visibility (see Rider Education & Training, page 17 and Lane Use, page 51).

WHERE WE WANT TO BE

We want motorcyclists to be aware of how conspicuity issues affect their safety and prepare accordingly.

We would like states to reconsider regulations that prohibit proven and safe conspicuity-enhancing modifications to lighting systems.

HOW TO GET THERE

Education of motorcyclists to overcome their resistance to employing conspicuity strategies is needed. Protective apparel manufacturers can help by promoting conspicuity in their advertising and in their apparel designs. Efforts that focus on peer acceptance of conspicuous colors are also suggested.

Research is needed into the matters of conspicuity and why motorcyclists are overlooked by other motorists. Programs should be implemented based on the findings to correct this.

- Research that explores the reasons why drivers fail to observe motorcyclists despite attempts to be more visible should be a high priority.
- Information about specific high-conspicuity colors and the uniqueness of applying them to specific locations on the bike or rider would be useful to riders seeking greater conspicuity.
- DRL usage on cars may influences the environment and effectiveness of motorcycle automatic-on headlamps and warrants investigation.
- Motorcycle lighting should be studied to find safe ways to increase conspicuity and enhance recognition during the day and at night.

RECOMMENDATIONS

- Conduct research to determine why other motorists fail to see and identify motorcyclists and implement countermeasures.
- Encourage motorcyclists to enhance their conspicuity.
- Encourage manufacturers to make motorcycle apparel and parts conspicuous.
- Reconsider state requirements that prohibit safe conspicuity-enhancing modifications, including safe modification to lighting systems.
- Conduct research on the effect of automobile DRL on motorcycle safety.

Lane Use

ISSUE STATEMENT

Motorcyclists, who have significant room to maneuver while riding within a traffic lane, can use this margin to position themselves for maximum visibility to other motorists while maintaining safety and control of the traffic situation.

WHERE WE ARE

The relatively narrow width of a motorcycle on the road allows its rider to employ many strategies not available to drivers of other vehicles.

- Motorcyclists can choose their position within their lane to avoid road surface hazards, other vehicles, pedestrians or other mobile hazards, intrusions, or potential intrusions into their right-of-way.
- Motorcyclists may seek positions where they are in view of other drivers and pedestrians.
- Motorcyclists may select a position that maximizes their view of the road and traffic ahead.

All states permit motorcycles to use high occupancy vehicle (HOV) lanes with a single rider on the motorcycle. Limited studies evaluating this practice have shown no traffic or safety problems (*Jernigan*, 1995).

A motorcycle's narrow width can allow it to pass between lanes of stopped or slow-moving cars on roadways where the lanes are wide enough to offer an adequate gap. This option can provide an escape route for motorcyclists who would otherwise be trapped or struck from behind. There is evidence (*Hurt*, 1981) that traveling between lanes of stopped or slow-moving cars (i.e., **lane splitting**) on multiple-lane roads (such as interstate highways) slightly reduces crash frequency compared with staying within the lane and moving with other traffic. Although lane splitting is allowed in just a few areas of the United States, notably California, it appears to be worthy of further study because it offers a means of reducing congestion in addition to possible safety benefits. It is widely used in many other countries.

WHERE WE WANT TO BE

All motorcyclists should be aware of the value of lane positioning to maximize their visibility to other motorists and better manage traffic situations.

We would like to have additional research to provide information about the safety or dangers of lane splitting.

HOW TO GET THERE

A well conceived lane-position strategy can greatly increase the safety of a motorcyclist, particularly in traffic. More motorcyclists and other motorists need to be apprised of such strategies through rider training and safety messages in the media and methods such as registration renewal flyers.

More research is needed to verify the benefits or hazards of lane splitting.

RECOMMENDATIONS

- Study the safety implications of lane splitting.
- Educate motorcyclists about lane-use strategies, including HOV lane usage.

Roadway Characteristics

ISSUE STATEMENT

Roadway design, maintenance, and construction are generally directed toward the needs of multi-wheel vehicles, with the needs of motorcycles often addressed as an afterthought.

WHERE WE ARE

Poor road design and maintenance contribute to motorcycle crashes, injuries, and fatalities. A variety of common road conditions and design factors can pose hazards to motorcyclists. Debris on the road can also cause a motorcycle to crash. In addition, roadside objects may create an injury mechanism for a motorcyclist.

- Current highway standards permit pavement ridges of up to 1.5 inches without tapering, which pose a significant hazard to motorcycles.
- Potholes are a hazard that can cause motorcycle crashes.
- Slick materials that interfere with traction are applied to road surfaces with increasing frequency. A motorcycle's traction can be seriously compromised by bituminous rubberized **asphalt sealer** used for crack repair and plasticized adhesive pavement-marking tape.
- Fluid spills can cause loss of traction and a resulting crash.
- Roadway debris poses a greater hazard to motorcycles than to larger vehicles. Debris can deflect a motorcycle's wheel when it is struck.
- Metal road surface components, either temporary or permanent, offer almost no traction, and when wet, may also be the most difficult to see.
- Many roadside barriers designed to retain cars and reduce injuries to automobile occupants are deadly to motorcyclists who collide with them. Wire-rope barriers are one example, but a motorcycle or the body of a fallen motorcyclist can also strike portions of other barrier designs in ways that an automobile cannot, causing severe injuries. Other roadside fixtures, such as signage, which may yield when struck by a car, can injure a motorcyclist who hits them. Even curbs can be deadly to a fallen rider who slides into them.
- Current work-zone signage practices may not adequately address the safety needs of motorcyclists.

WHERE WE WANT TO BE

We would like road design, construction, and maintenance procedures to accommodate the safety needs of motorcyclists.

Motorcyclists should have the skills necessary to detect and avoid roadway hazards (see Crash Avoidance Skills, page 23).

HOW TO GET THERE

Roadway engineers and other traffic designers need to elevate the placement of motorcycle safety dynamics as a consideration in design, construction, and maintenance of roadways at all levels of oversight—federal, state, county, and local. This may also benefit the safety of other vehicles.

RECOMMENDATIONS

- Identify and prioritize roadway hazards to motorcycle operation.
- Develop and revise highway standards on all levels—federal, state, county, and local—to reflect the needs of motorcyclists and encourage motorcycle-friendly design, construction, and maintenance procedures.
- Create a working group to recommend changes to highway standards to increase motorcycle safety.
- Post specific warnings for motorcyclists where unavoidable hazards exist.
- Revise the ***Manual on Uniform Traffic Control Devices*** **(MUTCD)** so that signage better communicates roadway or construction conditions that present hazards to motorcyclists.
- Educate motorcyclists about the hazards created by common roadway defects and maintenance methods. Emphasize riding skills required to negotiate these hazards through education and training.
- Take steps to remove slippery sealants and repair substances applied to road surfaces.
- Educate road design and maintenance personnel about conditions that pose hazards to motorcyclists.
- Reduce roadway debris such as that resulting from uncovered loads and shorn retreads.

Other Vehicle Design

ISSUE STATEMENT

The design of other vehicles plays a role in motorcycle safety. For example, mirror design may compromise visibility. Vehicle height may obscure a motorcyclist's ability to survey the surrounding traffic environment.

DRL on automobiles may reduce the effectiveness of operating motorcycles' headlights during the day as a conspicuity measure.

The spray from vehicles, especially heavy trucks, on wet roads may adversely affect a motorcyclist's vision.

WHERE WE ARE

There is little effort to design or test other vehicles to increase motorcyclist safety.

There are increasing numbers of tall vehicles on the road. Tall vehicles obscure a motorcyclist's view of the environment and surrounding traffic. They also obscure other drivers' views of motorcycles. In a collision with a tall vehicle, a motorcyclist is less likely to vault over the vehicle after the collision than in a collision with a lower vehicle.

Blind spots on automobiles and trucks make it harder for drivers to see motorcyclists. Mirror design may compromise the ability of drivers to detect motorcycles.

The design of other vehicles as it pertains to injury agents also affects motorcycles when a crash occurs.

WHERE WE WANT TO BE

We want consideration for motorcycles to be incorporated into the design of other vehicles.

We would like motorcyclists to be aware of how other vehicle design may affect their safety and adjust riding strategies accordingly.

HOW TO GET THERE

Undertake crash investigation research to determine which elements of other vehicle design adversely affect motorcycle safety.

Encourage other vehicle designers to research and consider how a specific vehicle design may affect motorcycles and their riders.

RECOMMENDATIONS

- Educate motorcyclists about strategies to overcome the challenges that the designs of other vehicles create in the traffic environment.
- Emphasize motorcycle safety issues as a consideration in the design of other vehicles.
- Investigate how the designs of other vehicles affect motorcycle safety.

First Response

ISSUE STATEMENT

Despite the efforts to prevent motorcycle crashes, they still occur. Providing rapid and appropriate emergency medical response is vital to limit deaths and disability resulting from these crashes.

WHERE WE ARE

Motorcyclists have predictable injury patterns that emergency medical personnel may not always recognize.

Issues, such as proper helmet removal technique, are still misunderstood and may be incorrectly handled by those who are first to aid an injured motorcyclist.

While there are motorcycle-specific training programs for first responders and Emergency Medical Technicians, these are not widely used and have not been integrated with local trauma systems.

WHERE WE WANT TO BE

Emergency medical personnel training must include information specific to the medical needs of injured motorcyclists.

We want motorcyclists and others to have available and take advantage of motorcycle-specific first response training programs.

HOW TO GET THERE

Support the *Emergency Medical Systems* (EMS) *Agenda for the Future* (NHTSA, 1996) and identify opportunities to integrate principles of motorcycle safety with its core content.

The motorcycle community should also work with national Emergency Medical Services, emergency medicine, and trauma groups to disseminate information and aid in developing training on the initial care of injured motorcyclists to likely first responders. This training should include issues such as helmet removal and other life-support techniques for injured motorcyclists.

RECOMMENDATIONS

- Integrate a motorcyclist treatment component in emergency medical personnel training.
- Integrate a motorcyclist treatment component in first-aid/bystander care training and encourage motorcyclists to obtain this training.
- Identify opportunities to utilize the *EMS Agenda for the Future* to promote motorcycle safety.

Intelligent Transportation Systems

ISSUE STATEMENT

The deployment of Intelligent Traffic Systems (ITS) within traffic is rapidly increasing. Current ITS and Intelligent Vehicle Initiative (IVI) development efforts have generally ignored the presence of motorcycles and their riders.

WHERE WE ARE

- Motorcycle safety has received little, if any, consideration in the development and deployment of ITS technologies.
- The plan to accelerate deployment of vehicle-based ITS technologies, via DOT's Intelligent Vehicle Initiative, raises concerns that these systems have not been adequately tested to perform reliably in a mixed traffic environment that includes motorcycles.
- Research and development of ITS technologies have been directed only toward the improvement of automobile safety. No research has been directed toward the improvement of motorcycle safety.
- Motorist awareness of motorcycles remains a pervasive safety issue (see Motorist Awareness, page 31) and ITS technologies are essentially awareness-enhancement tools for the motorist. Therefore, a tremendous opportunity exists to apply these technologies toward the improvement of motorcycling safety through technology-enhanced motorist awareness. This opportunity is being ignored.

WHERE WE WANT TO BE

We want to ensure that motorcycling safety is enhanced—or at the least not compromised—by deployment of ITS/IVI technologies. By considering motorcycles and motorcyclists in the design and deployment of ITS technologies, it should be possible to enhance motorcycling safety in various ways.

- Design ITS to increase motorist awareness of motorcycles.
- Use ITS technologies to reduce violations of motorcyclists' right-of-way.
- Employ ITS to reduce EMS response times to motorcycle crash scenes.

HOW TO GET THERE

The agencies and organizations responsible for developing ITS technologies should ensure that motorcycles are considered in design, evaluations, and assessments prior to the deployment of these technologies within the private and commercial vehicle fleets.

- Emphasis should be given to the reliable detection of motorcycles by Automated Collision Warning Systems (ACWS) and Automated/Adaptive Cruise Control. Coordinating participants should include the DOT Joint Program Office on Intelligent Transportation Systems, ITS America, NHTSA, ITS industry, motorcycle industry, and motorcycle-user organizations.
- Identify and prioritize motorcycle safety issues that may be addressed through the application of ITS technologies. Conduct research to determine the impact these technologies may have toward improving motorcycle safety. Foster development and deployment of those technologies that have a positive impact on motorcycle safety. Suggested topics for further research include:

1. Application of ACWS toward the mitigation of multivehicle collisions involving motorcycles; more specifically the reduction of the left-hand turn in front of an approaching motorcycle. According to NHTSA (*FARS*, 1998) nearly half of all motorcycle fatality crashes are multivehicle; 36 percent of these are left-hand turns in front of an approaching motorcycle.

2. Study the feasibility and benefits of equipping motorcycles with automated collision notification systems for the purpose of reducing EMS response time in the case of a motorcycle crash. Participants should include the DOT Joint Program Office on Intelligent Transportation Systems, ITS America, NHTSA, ITS industry, the motorcycle industry, and motorcycle rider organizations.

RECOMMENDATION

- Include motorcycles in the design and deployment of Intelligent Transportation Systems.

Summary of Recommendations

The *National Agenda for Motorcycle Safety* recommends the following:

URGENT Recommendations

Research in Motorcycle Crashes (page 9)

- Immediate action should be taken by government and industry to address the critical questions in motorcycle safety through comprehensive, in-depth studies as well as studies focused on specific topics.

Motorcyclist Alcohol & Other Impairment (page 25)

- Continue to discourage mixing alcohol and other drugs with motorcycling.

Personal Protective Equipment (page 27)

- Use effective strategies to increase the use of FMVSS 218 compliant helmets.

Motorist Awareness (page 31)

- Educate operators of other vehicles to be more conscious of the presence of motorcyclists.

ESSENTIAL Recommendations

Research in Motorcycle Crashes (page 9)

- To better utilize data collected by law enforcement personnel, a uniform traffic crash report for police officers should be developed and deployed. A similar format should also be developed for emergency medical services reports. This will permit meaningful comparisons among jurisdictions. All concerned parties should share the resulting information.
- Mechanisms for building academic and funding capacity for ongoing and future motorcycle safety research should be explored.

Motorcyclist Attitudes (page 15)

- Study factors that affect and shape motorcyclists' attitudes and behavior and how they affect crash involvement.
- Using information about how motorcyclists form attitudes about safety issues, create programs that reduce dangerous behavior and reinforce safe behavior.

Rider Education & Training (page 17)

- Expand motorcycle safety programs to accommodate all who need or seek training.
- Conduct uniform follow-up research into the effectiveness and impact of rider education and training.
- Merge rider education and training and licensing functions to form one-stop operations.

ESSENTIAL Recommendations (continued)

Licensing (page 21)

- Commission studies to ensure that licensing tests measure skills and behaviors required for crash avoidance.
- Identify and remove barriers to obtaining a motorcycle endorsement.
- Develop and implement programs to allow all state motorcycle safety programs to issue motorcycle endorsements immediately upon successful completion of rider training courses.
- Enforce penalties for operating a motorcycle without a proper endorsement.
- Encourage states and jurisdictions to provide motorcycle specific training to license examiners administering testing for motorcyclists.

Crash Avoidance Skills (page 23)

- Conduct research to determine which rider crash avoidance skills are most important.
- Develop countermeasures in training, license testing, and motorcycle technology to address any current crash avoidance deficiencies.
- Evaluate effectiveness of rider education and training in developing crash avoidance skills.

Motorcyclist Alcohol & Other Impairment (page 25)

- Study how alcohol, drugs and other substances, including over-the-counter medications, can affect a motorcyclist's operating skills.
- Study the alcohol, drug and other substance use patterns of motorcyclists.
- Educate law enforcement about unique alcohol-related behavior of motorcyclists.
- Encourage partnerships with groups already involved in alcohol/substance abuse issues related to motor vehicle crashes, e.g., Mothers Against Drunk Driving (MADD), Students Against Destructive Decisions (SADD).

Personal Protective Equipment (page 27)

- Educate motorcyclists about the value of protective apparel by providing an information source on related research and a forum for the exchange of information.
- Find ways to more effectively communicate the benefits of helmet use and work toward making voluntary use of FMVSS 218 compliant helmets more widely accepted.
- Use effective strategies to ensure that all helmets in use meet FMVSS 218.
- Revise FMVSS 218.

ESSENTIAL Recommendations (continued)

Motorist Awareness (page 31)

- Remind motorcyclists that they may be overlooked and provide defensive strategies for overcoming this situation.
- Include questions regarding motorcyclists on driver's license tests and include information in driving manuals.
- Include the completion of a motorcyclist awareness class in sanctions against motorists found guilty of violating a motorcyclist's right-of-way.
- Adequate funding needs to be devoted to the development and implementation of motorist awareness issues.

Insurance Industry Involvement (page 33)

- Insurers should write policies that stipulate that coverage or certain portions of coverage are not valid if the owner permits an unlicensed or improperly licensed operator to use the motorcycle.

Enforcement & Adjudication (page 35)

- Educate law enforcement and judicial officials about unique motorcycle safety issues and resources.
- Encourage inclusion of law enforcement officials in Motorcycle Safety Program Assessments.
- Develop and implement standardized data gathering and reporting for motorcycle crashes.
- Include motorcycle crash investigation procedures in the basic course given to crash investigators.
- Appropriate sanctions should be applied to those found guilty of contributing to motorcycle crashes. The sanctions, such as mandatory attendance at a motorcycle awareness course, would be designed to expand knowledge of motorcycle issues.

Traffic Safety Community Attitude (page 37)

- Traffic safety organizations outside of the motorcycling community can better influence motorcycle safety issues by becoming more educated about motorcycle safety issues and adopt them where applicable.
- Increase funding for motorcycle safety programs by elevating their importance to state highway safety offices.
- Representatives of the motorcycle safety community should be integrated into the larger highway safety community to improve cooperative efforts.

ESSENTIAL Recommendations (continued)

Motorcycle Design (page 43)

- Conduct research to determine how current motorcycle designs affect crash and injury causation.
- Implement the use of available tire and wheel technology and explore technology, such as run-flat tires, to reduce frequency of loss-of-control crashes caused by puncture flats.

Braking (page 45)

- Study the effectiveness of linked and antilock braking in the field. If these technologies prove valuable, deploy them more widely.

Conspicuity (page 49)

- Conduct research to determine why other motorists fail to see and identify motorcyclists and implement countermeasures.
- Encourage motorcyclists to enhance their conspicuity.
- Encourage manufacturers to make motorcycle apparel and parts conspicuous.
- Reconsider state requirements that prohibit safe conspicuity-enhancing modifications, including safe modification to lighting systems.

Lane Use (page 51)

- Study the safety implications of lane splitting.

Roadway Characteristics (page 53)

- Identify and prioritize roadway hazards to motorcycle operation.
- Develop and revise highway standards on all levels—federal, state, county, and local—to reflect the needs of motorcyclists and encourage motorcycle-friendly design, construction, and maintenance procedures.
- Create a working group to recommend changes to highway standards to increase motorcycle safety.
- Post specific warnings for motorcyclists where unavoidable hazards exist.
- Revise the *Manual on Uniform Traffic Control Devices (MUTCD)* so that signage better communicates roadway or construction conditions that present hazards to motorcyclists.
- Educate motorcyclists about the hazards created by common roadway defects and maintenance methods. Emphasize riding skills required to negotiate these hazards through education and training.
- Take steps to remove slippery sealants and repair substances applied to road surfaces.
- Educate road design and maintenance personnel about conditions that pose hazards to motorcyclists.

ESSENTIAL Recommendations (continued)

Other Vehicle Design (page 55)

- Educate motorcyclists about strategies to overcome the challenges that the designs of other vehicles create in the traffic environment.

First Response (page 57)

- Integrate a motorcyclist treatment component in emergency medical personnel training.
- Integrate a motorcyclist treatment component in first-aid/bystander care training and encourage motorcyclists to obtain this training.

Intelligent Transportation Systems (page 59)

- Include motorcycles in the design and deployment of Intelligent Transportation Systems.

NECESSARY Recommendations

Conveying Research Information to Users (page 13)

- Create a clearinghouse to distribute current, practical information about motorcycle safety based on recent research.
- Develop research-based safety information that can be used easily by the consumer media and in rider education and training systems.
- Explore public service announcements, advertising in enthusiast and near-enthusiast media, and any other viable avenues for distributing safety information.

Rider Education & Training (page 17)

- Increase the number of states conducting Motorcycle Safety Program Assessments.
- Establish benchmarks for rider education and training effectiveness and program operation excellence.
- Explore the effectiveness of on-street training.

Licensing (page 21)

- Develop an enhanced motorcycle licensing model using appropriate GDL concepts and evaluate its effectiveness.

Crash Avoidance Skills (page 23)

- Evaluate the need for motorcycle simulator skills training.
- Examine technological approaches such as pre-crash warning and avoidance systems to enhance crash prevention.

NECESSARY Recommendations (continued)

Personal Protective Equipment (page 27)

- Conduct research regarding protective apparel effectiveness, and consider development or adoption of existing standards, if research justifies.

Insurance Industry Involvement (page 33)

- Collect, organize, analyze, and distribute motorcycle-specific loss data from insurers to better understand safety issues, and to educate riders and other motorists on motorcycling safety issues.
- Develop guidelines for insurers to tie approved training, licensing, and safe-riding practices to premium reductions.

Braking (page 45)

- Use information from research to implement other braking-related countermeasures.
- Provide additional training and education on proper braking and panic-braking techniques.

Vehicle Modifications (page 47)

- Study the role of modifications in current motorcycle crashes.
- Educate users about how modifications and loads can change the operating characteristics of their motorcycles.

Conspicuity (page 49)

- Conduct research on the effect of automobile DRL on motorcycle safety.

Lane Use (page 51)

- Educate motorcyclists about lane-use strategies, including HOV lane usage.

Roadway Characteristics (page 53)

- Reduce roadway debris such as that resulting from uncovered loads and shorn retreads.

Other Vehicle Design (page 55)

- Emphasize motorcycle safety issues as a consideration in the design of other vehicles.
- Investigate how the designs of other vehicles affect motorcycle safety.

First Response (page 57)

- Identify opportunities to utilize the *EMS Agenda for the Future* to promote motorcycle safety.

Members of the Technical Working Group

Art Friedman

Editor, *Motorcycle Cruiser* magazine
Emap USA, Inc. Publishing

Art Friedman has been riding motorcycles for more than 35 years, amassing more than 1.5 million miles of street riding. He also spent 14 years roadracing motorcycles semi-professionally. He rides a motorcycle daily.

After graduating Beloit College in 1971, he started his career as a motorcycle journalist in 1972 at *Cycle News,* a weekly newspaper. In 1974, he moved to *Cycle Guide* magazine. In 1978, he was hired at Petersen Publishing Company (now Emap USA, Inc.) first on the editorial staff of *Motorcyclist*, which during his tenure became the largest U.S. magazine devoted exclusively to street motorcycles. In 1993 he oversaw the launch of *Sport Rider* magazine. After 13 years as *Motorcyclist*'s editor-in-chief, he started a companion title, *Motorcycle Cruiser,* where he currently serves as editor.

As editor of *Motorcyclist,* Friedman made riding skills and safety features a standard component of that magazine's format, and motorcycle safety continues to be a regular part of *Motorcycle Cruiser*.

Steve Garets

Director
Team Oregon Motorcycle Safety Program

Steve Garets has been an active year-round motorcycle rider since 1963. He came into motorcycle safety in 1981 as an advocate for education and training. His involvement has included rider and instructor training, motor officer training, curricula development, community and state rider training program development and administration, licensing system development, license examiner training, state rider training program assessment, and all-terrain vehicle (ATV) rider, instructor and chief instructor training.

Garets is a member of the Transportation Research Board subcommittee on motorcycles and a past Executive Committee member and Chairman of the National Association of State Motorcycle Safety Administrators (SMSA). He is also a past member of the Oregon Governor's Motorcycle Safety Advisory Committee.

Kathleen N. Jensen

Insurance Services Counsel
National Association of Independent Insurers

Kathleen Jensen has worked in the property/casualty insurance industry for more than 15 years. She is currently Insurance Services Counsel for the National Association of Independent Insurers (NAII) and is the staff liasion for the NAII Motorcycle Insurance Committee. The NAII is a national insurance trade association representing more than 675 property and casualty insurance companies across the country. NAII member companies range from large national companies to regional companies to companies writing in a single state. The association was created to promote the economic, legislative and public standing of its members and the insurance industry, to provide a forum for discussion of problems which are of common concern to its members, to keep members informed of regulatory and legislative developments, and to serve the public interest through appropriate activities, including the promotion of safety and security of persons and property. The member companies of the association include more than 50 of the property casualty insurance companies that write motorcycle insurance in the U.S.

Prior to joining the NAII, Jensen worked for CNA Insurance in Chicago, Illinois and Zurich Insurance in Schaumburg, Illinois.

Sean Maher

Legislative Affairs Specialist
American Motorcyclist Association

Sean Maher has been with the staff of the American Motorcyclist Association's (AMA) Government Relations Department since 1995. As a Legislative Affairs Specialist, his primary focus is on street motorcycling issues and policies. Maher is the AMA representative to the Intelligent Transportation Society of America (ITS America) and is active on both the Safety and Human Factors Committee, and Advanced Vehicle Control and Safety Systems Committee.

Maher holds a Bachelor of Arts degree in Political Science from Ohio State University.

Ralph Martin

Captain
Colorado State Patrol

Ralph Martin has been a member of the Colorado State Patrol since 1970. He has a degree in the Administration of Justice and in 1981 graduated from the Traffic Police Administration Training Program at the Northwestern University Traffic Institute.

Captain Martin has served as a field troop commander and is currently Officer In Charge of the Patrol's Operational Development Section at State Patrol Headquarters. He is also coordinator of the Patrol's Drug Recognition Expert (DRE) Program.

Robert L. Muelleman

Chief, Section of Emergency
Nebraska Health Systems

Robert L. Muelleman, M.D., FACEP, is Medical Director for Emergency Medical Services for Nebraska Health Systems and Professor and Section Chief of Emergency Medicine for University of Nebraska Medical Center. He has been involved in motorcycle safety and rural motor vehicle research and most recently has worked on the Safe Communities program with NHTSA Region VII.

Robert Rasor

Vice President, Government Relations
American Motorcyclist Association

Robert Rasor is the Vice President of Government Relations for the American Motorcyclist Association (AMA). He has been with the association for 26 years and has played an important role in promoting safe motorcycling and providing strong representation and advocacy for the AMA's 264,000 members. He also serves as the President of the Commission for Mobility, Transport, Road Safety, Industry and Public Affairs for the *Fédération International de Motocyclisme* (FIM), the world governing body for motorcycle sport.

He has a Bachelor of Science degree in Business Administration, Economics and Sociology from Morehead State University. In his more than 35 years of motorcycling involvement, he has been an amateur motocross racer and toured extensively in the U.S., Canada, and Mexico.

David Thom

Senior Program Manager
Head Protection Research Laboratory

David Thom has been riding motorcycles, both on- and off-highway since 1970, when a friend introduced him to what would become a lifelong pursuit. He is a believer in rider training and has taken the MSF Experienced *RiderCourse* several times.

Professor Harry Hurt recruited Thom from a motorcycle dealership for the research team doing the *Hurt Report* at the University of Southern California in 1977. This began his career in the study of motorcycle safety, injury mechanisms and protective gear that continues today at the Head Protection Research Laboratory. While at USC, he earned a Bachelor and Master of Science in Safety Science.

His research over the years includes studies of rider braking performance, motorcycle conspicuity, car driver attention, helmet crash performance, retention system design, testing and standards, and how people get hurt in motorcycle crashes.

Lonnie J. Westphal

Chief
Colorado State Patrol

Lonnie Westphal joined the Colorado State Patrol in 1974. He was promoted to Sergeant in 1978, Lieutenant in 1981, Captain in 1983, Major in 1991 and Lieutenant Colonel in 1992. He was given his current appointment, to the rank of Colonel, and position of Chief of the Colorado State Patrol in 1995.

Colonel Westphal holds a Master of Arts degree in Public Administration from the University of Denver. He is a former board member for the State Patrol Protective Association, a former member of the board of officers for the Colorado Council of Law Enforcement Associations, an active member of the International Association of Chiefs of Police, a former International Chair of the Police Traffic Services Committee of the American Association of Motor Vehicle Administrators, a graduate of the National Executive Institute of the Federal Bureau of Investigation, and graduate of the John F. Kennedy school of Government for Senior Executives at Harvard University.

Steve Zimmer

Motorcyclist-Rights Activist

Steve Zimmer began riding street motorcycles while serving in the U.S. Navy. Riding for recreation and transportation, he has covered 23 states and gone from coast to coast and border to border. He holds a Bachelor of Arts in Psychology and Sociology from the University of Missouri.

Zimmer has been active in the motorcyclist-rights movement since early 1983 when he joined Freedom of Road Riders of Missouri (FORR). He served as State Newsletter Editor for FORR and held several local positions including Vice President and Central Committee Representative. At the end of 1989, he assumed the vacated position of State Legislative Coordinator and began lobbying in the Missouri State Capitol for FORR.

At the end of 1997, Zimmer was named Vice President of Government Relations for the Motorcycle Riders Foundation in Washington, D.C., serving in that capacity until June of 2000.

He currently enjoys riding in the Mid-Atlantic region and plans to continue working for the advancement and protection of motorcycling and motorcyclists.

Glossary

Antilock braking system (ABS): A braking system that prevents wheels from locking during braking.

Armor: Padding, hard-shelled material or other impact-absorbing material fitted to a motorcyclist's apparel. Performance standards exist in Europe for such materials.

Asphalt sealer: Material used to fill and repair cracks in asphalt paving. Materials currently used often create a slick surface that can cause a motorcycle to lose traction.

Automatic-on headlamp: A motorcycle headlamp that is automatically illuminated when the engine is started—also known as daytime running lamp. Required by regulation in many states since 1973 and consequently installed on virtually all street bikes sold in the U.S.

Brake: To stop or slow a motorcycle using the brakes. See also Panic-brake.

Café-racer: Customized motorcycle built in the style currently categorized as a sportbike; popular in the 1970s and early 1980s.

Corner (or **cornering**): To negotiate a turn in the road. A motorcycle must lean to do so.

Daytime running lamps (DRL): Frontal lighting used to enhance daytime conspicuity of motor vehicles including motorcycles.

DOT: U.S. Department of Transportation

Fairing: Frontal bodywork on a motorcycle intended to make the vehicle more aerodynamic and/or reduce wind pressure on the rider.

FMVSS 218: U.S. Department of Transportation Federal Motor Vehicle Safety Standard No. 218 *Motorcycle Helmets*.

FMVSS 218 compliant helmet: A motorcycle helmet that complies with U.S. Department of Transportation Federal Motor Vehicle Safety Standard No. 218 (FMVSS 218) for motorcycle helmets.

Front suspension: Often called the "fork" or "forks" because most motorcycles use designs with two parallel legs.

Hurt Report: A study of 900 motorcycle crashes titled *Motorcycle Accident Cause Factors and Identification of Countermeasures*, authored by H.H. Hurt et al., in 1981. Conducted in the late 1970s, it is considered the most comprehensive study of motorcycle crash causation to date.

Lane splitting: Passing between lanes of stopped or slower-moving vehicles on a motorcycle. Not permitted in most of the U.S., it is allowed in many other countries and may provide a safety benefit. Also called "lane sharing."

Linked braking: Motorcycle braking systems that use a single control to operate both front and rear brakes.

Manual on Uniform Traffic Control Devices **(MUTCD)**: Contains all national design, application, and placement standards for traffic control devices, including signs, signals, and pavement markings. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.

Motorcycle safety: Reducing motorcycling crashes, injuries and fatalities through risk management and countermeasures.

Overbrake: Applying too much force to a brake during a stop, which causes a wheel to stop turning. This can result in loss of directional control (particularly if the rear wheel stops rolling) or upset the motorcycle and cause a crash (a common result of overbraking the front wheel).

Panic-brake: An emergency stop, requiring hard, effective controlled brake application, so called because it is often conducted during a moment of panic.

Position lamps: Additional filaments in a motorcycle's front turn-signal assemblies that act as full-time running lights to increase conspicuity, distance perception by other drivers, and awareness.

Risk management: The practice of planning for and reducing risk.

Semi-chopper: A motorcycle customized in the style currently categorized as cruiser. In the 1970s, such machines frequently included lengthened front suspension.

Swerve (or **swerving**): To rapidly change direction, normally employed to avoid an obstacle.

Tiered licensing: A licensing system that provides for operating restrictions based upon motorcycle engine displacement.

Tubeless tire: A tire that retains air without an inner tube. An inner tube (used on a tube-type tire) is necessary to retain air pressure when the wheel design or the tire cannot do so. However, an inner tube typically deflates rapidly when punctured, and this sudden deflation can cause a quick reduction of control on a motorcycle. A tubeless tire typically deflates much more slowly, providing a motorcyclist with warning before control is reduced significantly. Whether a tube-type or tubeless tire is chosen normally depends on the kind of wheel to which it is fitted.

Tube-type tire: See **Tubeless tire.**

Underbrake: Failure to apply the brakes to their full capability, resulting in a longer than needed stopping distance. This is usually caused by fear of the results of overbraking.

Resources

American Association of Motor Vehicle Administrators (AAMVA)

4301 Wilson Blvd.
Suite 400
Arlington, VA 22203
Phone: (703) 522-4200
Fax: (703) 522-1553
www.aamva.org

Founded in 1933, the American Association of Motor Vehicle Administrators is a voluntary association of public-service executives responsible for motor vehicle administration, driver-licensing issues and the enforcement of state and national laws that govern the use of vehicles on the roads in the U.S. and Canada. The association seeks to improve the administration of motor vehicle and law enforcement agencies by providing educational forums for its jurisdictional members to exchange ideas; to more effectively serve the driving public by encouraging jurisdictions to implement uniform laws and regulations; and to foster excellence in service to its diverse customer base by providing jurisdictional service delivery best practices.

American Association of State Highway and Transportation Officials (AASHTO)

444 North Capitol St. NW
Suite 249
Washington, DC 20001
Phone: (202) 624-5800
Fax: (202) 624-5806
www.aashto.org

AASHTO is a nonprofit, nonpartisan association representing highway and transportation departments in 50 states, the District of Columbia, and Puerto Rico. It is the only national public sector association that represents all five transportation modes: air, highway, public transportation, rail, and water. Its primary goal is to foster the development, operation, and maintenance of an integrated national transportation system.

AASHTO develops voluntary standards and guidelines which are widely used in the design, construction, maintenance, and operation of national highway and transportation facilities.

AASHTO publishes more than 100 manuals and specification guides covering such areas as transportation, administration, safety, design, construction, and maintenance.

American Motorcyclist Association (AMA)

13515 Yarmouth Dr.
Pickerington, OH 43147
Phone: (614) 856-1900
Fax: (614) 856-1920
www.amadirectlink.com

The American Motorcyclist Association is a non-profit organization with a membership of more than 265,000 motorcycle enthusiasts. Established in 1924, the Association's purpose is to pursue, protect and promote the interests of motorcyclists, while serving the needs of its members.

Federal Highway Administration (FHWA)

400 7th St. SW
Washington, DC 20590
Phone: (202) 366-0660
www.fhwa.dot.gov

FHWA is a part of the Department of Transportation and is headquartered in Washington, D.C., with field offices across the U.S. Its mission is to create the best transportation system in the world for the American people through proactive leadership, innovation, and excellence in service. FHWA provides expertise, resources, and information to continually improve the quality of our nation's highway system and its intermodal connections. The FHWA performs its mission through these main programs:

- The *Federal-Aid Highway Program* provides federal financial assistance to the 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.

Head Protection Research Laboratory (HPRL)

6409 Alondra Blvd.
Paramount, CA 90723
Phone: (562) 529-3295
Fax: (562) 529-3297
www.hprl.org

The Head Protection Research Laboratory is a non-profit, public-benefit research organization. HPRL was originally within the University of Southern California in Los Angeles. HPRL faculty and staff conducted the 1981 DOT-NHTSA sponsored study of 900 motorcycle accidents in Los Angeles, and continue to study motorcycle crashes and protective equipment in the U.S. and internationally.

International Association of Chiefs of Police (IACP)

515 N. Washington St.
Alexandria, VA 22314
Phone: (703) 836-6767 or (800) THE-IACP
Fax: (703) 836-4543
www.theiacp.org

The International Association of Chiefs of Police is the world's oldest and largest non-profit membership organization of police executives, with over 17,000 members in more than 100 different countries. IACP's leadership consists of the operating chief executives of international, federal, state, and local agencies of all sizes.

Motorcycle Safety Foundation (MSF)

2 Jenner St.
Suite 150
Irvine, CA 92618-3806
Phone: (949) 727-3227
Fax: (949) 727-4217
www.msf-usa.org

Since March 1973, the Motorcycle Safety Foundation (MSF) has set internationally recognized standards of excellence in motorcycle safety. The MSF works with the National Highway Traffic Safety Administration, state governments, and other organizations such as the American Association of Motor Vehicle Administrators, the International Association of Chiefs of Police, and the National Association of State Motorcycle Safety Administrators to improve motorcyclist education and operator licensing. The Motorcycle Safety Foundation is a national, non-profit organization sponsored by the U.S. manufacturers and distributors of BMW, Ducati, Harley-Davidson, Honda, Kawasaki, Suzuki and Yamaha motorcycles.

National Association of Governors' Highway Safety Representatives (NAGHSR)

750 First St. NE
Suite 720
Washington, D.C. 20002-4241
Phone: (202) 789-0942
Fax: (202) 789-0946
www.naghsr.org

NAGHSR is the voice of the states in highway safety. This 501(c)(3) non-profit association represents the highway safety programs of states and territories on the "human factors" of highway safety. Such areas include occupant protection, impaired driving, speed enforcement, and motor carrier, school bus, pedestrian, and bicycle safety. NAGHSR's mission is to provide leadership in the development of national policy to ensure effective highway safety programs.

National Highway Traffic Safety Administration (NHTSA)

400 Seventh St. SW
Washington, D.C. 20590
Phone: (888) 327-4236
www.nhtsa.dot.gov

NHTSA was established under the U.S. Department of Transportation by the Highway Safety Act of 1970, as the successor to the National Highway Safety Bureau, to carry out safety programs under the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966. The Vehicle Safety Act has subsequently been recodified under Title 49 of the U.S. Code in Chapter 301, Motor Vehicle Safety. NHTSA also carries out consumer programs established by the Motor Vehicle Information and Cost Savings Act of 1972, which has been recodified in various chapters under Title 49.

NHTSA is responsible for reducing deaths, injuries and economic losses resulting from motor vehicle crashes. This is accomplished by setting and enforcing safety performance standards for motor vehicles and motor vehicle equipment, and through grants to state and local governments to enable them to conduct effective local highway safety programs.

NHTSA investigates safety defects in motor vehicles, sets and enforces fuel economy standards, helps states and local communities reduce the threat of drunk drivers, promotes the use of safety belts, child safety seats and air bags, investigates odometer fraud, establishes and enforces vehicle antitheft regulations and provides consumer information on motor vehicle safety topics.

NHTSA also conducts research on driver behavior and traffic safety, to develop the most efficient and effective means of bringing about safety improvements.

State Motorcycle Safety Administrators (SMSA)

8251 Main St. NE
Suite 102
Fridley, MN 55432
Phone: (763) 785-9242
Fax: (763) 784-1660
www.smsa.org

The National Association of State Motorcycle Safety Administrators (SMSA) was established by MSF in 1984 as a forum for the exchange of information among state-sponsored motorcycle-education programs. The SMSA works to foster and promote state-administered motorcycle safety programs and to represent concerns related to motorcycle safety by working cooperatively with those individuals and organizations with an interest in motorcycle safety.

References

Awane, T. (January 1999). *Integrating Simulators in Motorcycle Safety Education*: Journal of International Association of Traffic and Safety Sciences.

Billheimer, J.W. (August 1996). *California Motorcyclist Safety Program, Program Effectiveness: Accident Evaluation*; California Highway Patrol; Systan, Inc., Los Altos, CA.

Brooks, P. & Guppy, A. (1990). *Driver Awareness and Motorcycle Accidents*. *Proceedings of the International Motorcycle Safety Conference*, II, 10-27-10-56.

Federal Motor Vehicle Safety Standard No. 218, Motorcycle Helmets (1974, 1980, 1988). United States Code, part 571; S 218-1.

Hazard Perception for Motorcycle Riders Conference, Monash University, Australia, 1999.

Hurt, H.H., Jr. (1984). *Motorcyclist Protection, Biomechanics of Impact Trauma*, American Association of Automotive Medicine and International Research Council on the Biomechanics of Trauma.

Hurt, H.H., Jr., Ouellet J.V. & Wagar I.J. (1981a). *Effectiveness of Motorcycle Safety Helmets and Protective Clothing*, Proceedings of the American Association for Automotive Medicine.

Hurt, H.H. Jr., Ouellet, J.V. & Thom D.R. (1981b). *Motorcycle Accident Cause Factors and Identification of Countermeasures*. (DOT HS 805 862). Washington, DC: National Highway Traffic Safety Administration.

Iijima, S., Hosono, S., Ota, A. & Yamamoto, T. (1998). *Exploratory Study of an Airbag Concept for a Large Touring Motorcycle*. Paper Number 98-S10-O-14, Sixteenth ESV.

Jernigan, J.D. & Lynn, C.W. (1995). *The Effect of Motorcycle Travel on the Safety and Operations of HOV Facilities in Virginia,* Virginia Transportation Research Council.

Kraus, J.F., Peek, C., McArthur, D.L. & Williams, A. (1994). *The Effect of the 1992 California Motorcycle Helmet Use Law on Motorcycle Crash Fatalities and Injuries*, Journal of the American Medical Association: 272 (19), pp. 1506-1511.

Kraus, J.F., Peek, C. & Williams, A. (1995). *Compliance with the 1992 California Motorcycle Helmet Use Law*, American Journal of Public Health: 85, pp. 96-98.

Kraus, J.F., Zador, P., Arzemanian, S. & Anderson, C. (1988). *Motorcycle Design and Crash Injuries in California*, Bulletin, New York Academy of Medicine, 64:788-803.

Mayhew, D.R. & Simpson, H.M. (1989). *Motorcycle Engine Size and Traffic Safety,* Traffic Injury Research Foundation of Canada, Ottawa, Ontario.

McSwain, N.E. & Willey, A.B. (December 1984). *Impact of the Reenactment of the Motorcycle Helmet Law in Louisiana*. (DOT HS 806 760). Washington, DC: U.S. Department of Transportation.

Moskowitz, H. & Robinson, C.D. (July 1988). *Effects of Low Doses of Alcohol on Driving-Related Skills: A Review of the Evidence*. (DOT-HS-807-280). Washington, DC: U.S. Department of Transportation.

Motorcycle Safety Foundation. (1974). *Motorcycle Task Analysis*. Irvine, CA.

National Highway Traffic Safety Administration. (August 1996). *Emergency Medical Services Agenda for the Future*. (DOT HS 808 441). Washington, DC: U.S. Department of Transportation.

National Highway Traffic Safety Administration. Fatality Analysis Reporting System (FARS) data (1997, 1998, 1999).

National Highway Traffic Safety Administration. (February 1996). Report to Congress: *Benefits of Safety Belts and Motorcycle Helmets*. (DOT HS 808 347). Washington, DC: U.S. Deparment of Transportation.

National Highway Traffic Safety Administration. (January 1998). Research Note: *Further Analysis of Motorcycle Helmet Effectiveness using CODES Linked Data*. Washington, DC: U.S. Department of Transportation.

National Highway Traffic Safety Administration. Traffic Safety Facts 1998. (DOT HS 808 953). Washington, DC: U.S. Department of Transportation.

Newman, J.A. & Webster, G.D. (1974). *The Mechanics of Motorcycle Accidents*, Proceedings, 18th American Association for Automotive Medicine, pp. 265-302.

Orsay, E.M., Muelleman, R.L., Peterson, T.D., Jurisic, D.H., Kosasih, J.B. & Levy, P. (April 1994). *Motorcycle Helmets and Spinal Injuries: Dispelling the Myth*, Annals of Emergency Medicine Vol. 23 No. 4.

Otte, D., Willeke, H., Chinn, B., Doyle, D. & Shuller, E. (1998). *Impact Mechanisms of Helmet Protected Heads in Motorcycle Accidents—Accidental Study of COST 327*, Proceedings, 1998 International Motorcycle Conference.

Ouellet, J.V. (1990). Appropriate and Inappropriate Strategies for Injury Reduction in Motorcycle Accidents, Society of Automotive Engineers Congress, SAE Paper 900747.

Ouellet, J.V. & Hurt, H.H., Jr. (1981). *Groin Injuries in Motorcycle Accidents*, Proceedings of American Association for Automotive Medicine.

Pedder, J.B., Hurt, H.H., Jr. & Otte, D. (June 1979). *Motorcycle Accident Impact Conditions as a Basis for Motorcycle Crash Tests*, Proceedings of the 12th NATO conference on Experimental Safety Vehicles.

Peek-Asa, C., McArthur, D.L. & Kraus, J.F. (1999). *The Prevalence of Non-Standard Helmet Use and Head Injuries Among Motorcycle Riders*, Accident Analysis and Prevention 31.

State Motorcycle Safety Administrators. (December 1999). *1998 State Motorcycle Program Survey*. Fridley, MN.

Syner, J. & Vegega, M. (November 2000). *Impaired Motorcycle Riding: What Motorcyclists Think About Alcohol and Motorcycling*. Paper presented at the annual meeting of the American Public Health Association, Boston.

Thom, D.R., Hurt, H.H., Jr., Smith, T.A. & Ouellet, J.V. (September 1997). *Feasibility Study of Upgrading FMVSS No. 218, Motorcycle Helmets*. National Highway Traffic Safety Administration, DTNH22-87-P-02001.

Thom, D.R., Hurt, H.H. Jr., Smith, T.A. & Rehman, I.R. (1995). *Atlas and Axis Injuries in Fatal Motorcycle Collisions*, 39th Proceedings of the Association for the Advancement of Automotive Medicine.

Turner, P.A. & Hagelin, C.A. (January 2000). *Novelty Helmet Use by Motorcycle Riders in Florida*, presented at the 79th Annual Meeting of the Transportation Research Board.

Winn, G.L. & Bucy, D.S. (1997). *Technology vs. Culture: Improving the Efficiency of Traffic Crash Data Collection in West Virginia*, Seventh International Conference: Traffic Safety on Two Continents.

Winn, G.L., Carr, M. & Bucy, D.S. (January 1999). *State Crash Report Data Elements for Motorcycles*, presented at the 80th Annual Meeting of the Transportation Research Board.

Woods, R.I. (1994a). *Specification of Motorcyclists Protective Clothing Designed to Reduce Road Surface Impact Injuries, Performance of Protective Clothing*. Fifth Volume, ASTM STP 1237, American Society for Testing and Materials.

Woods, R.I. (1994b). *Testing of Protective Clothing for Motorcyclists: Validation of Laboratory Tests by Results from a Simulated Accident, and by Results from Crash-Damaged Clothing Performance of Protective Clothing*. Fifth Volume, ASTM STP 1237, American Society for Testing and Materials.

Appendix A

Factors That Have Changed Since the *Hurt Report*

Since the data for the *Hurt Report* were collected, many components of the motorcycling and traffic environment have changed. The following is a partial listing.

I. **Motorcycle engineering changes**
- A. Frame design and construction
- B. New types of motorcycle (e.g., sportbikes) sold as original equipment
- C. Suspension design
  1. Front fork strength, stiffness, and geometry
  2. Rear suspension change from two to one shock systems
- D. Fuel tank design
- E. Handlebar design and construction
- F. Engine performance increases
- G. Tire and wheel improvements
- H. Brake efficiency improvements
  1. Disc brakes more common
  2. Interconnection of front and rear brake systems
  3. Antilock braking system (ABS)
  4. Hydraulic brakes
  5. Linked brakes
- I. Emissions systems introduced
- J. Lighting changes
  1. Daytime running lamps (DRL) since 1973
  2. Integrated front parking lights
  3. Higher performance headlamps

II. **User population changes**
- A. Fewer total riders, higher percentage licensed
- B. Maturing of motorcycle riding population
- C. More females riding motorcycles
- D. More widely available training
- E. Changes in helmet use
- F. Use of fake helmets in helmet law states
- G. Fewer motorcycles registered
- H. Changes in available protective apparel
- I. Changes in use of protective apparel
- J. Riders have information from *Hurt Report* available

III. **Automobile engineering changes**
- A. Daytime running lamps (DRL)
- B. Improved bumpers
- C. More aerodynamic exteriors
- D. ABS
- E. Changing vehicle types, e.g., sport utility vehicles (SUV)

IV. **Roadway Environmental changes**
- A. Roadside sound barriers
- B. Animal diversion barriers
- C. Rumble strips

Appendix B
In-Depth Investigation of Motorcycle Crashes

Data Collected On-Scene:

Vehicle data

- Vehicle Identification Number (VIN), manufacturer, model, and cubic displacement
- Mechanical factors data, motorcycle and other vehicles
- Crash or injury related cause factors
- Motorcycle pre-crash motions
- Other vehicle pre-crash motions
- Motorcycle crash motions
- Other vehicle crash motions
- Motorcycle post-crash motions
- Associate vehicle injury sources
- Contribution of design or maintenance defects to crash or injury causation
- Vehicle speed for motorcycle and other vehicle
- Motorcycle lighting; headlamps, running lights, etc.
- Crash fire causes and burn injuries

Crash scene, environment

- Crash scene data
- Roadway motorcycle was traveling
- Roadway other vehicle was traveling
- Traffic and controls
- Verify crash configuration
- Preview crash cause factors
- Collision contribution of weather, view obstructions
- Collision contribution of roadway conditions and defects

Human factors, injury causation

- Rider background data
- Rider training and licensing
- Rider motorcycle experience, street and off-highway
- Collision avoidance performance
- Other vehicle driver background data
- Passenger contribution to crash causation
- Alcohol and drug involvement
- Detailed helmet analysis

Appendix C

Objectives of the *Common Methodology*

The objectives of the international *Common Methodology for In-Depth Motorcycle Crash Investigations* are to conduct motorcycle crash investigations that are:

1. On-scene, at or near the time of the accident
2. In-depth investigation and analysis
3. Multi-disciplinary: engineering, medical, motorcycle-qualified investigators
4. Multi-level
5. Include crash causation as well as injury causation factors
6. Include human, vehicle, and environmental factors and all possible interactions
7. Include identification of countermeasures
8. Applicable to all powered two-wheel vehicle crashes
9. Recommended to use sample sizes of at least 100 crashes per sample area per year
10. Include collection of concurrent exposure data
11. Specify a minimum level and type of academic qualification, motorcycle riding experience, and special investigation team training
12. Able to provide and audit path between the raw data and the final results
13. Reproducible from team to team
14. Based on unbiased sampling, results, and interpretations
15. Useful for comparison between sample areas and countries
16. Based on a census of qualified motorcycle crashes meeting sampling criteria
17. Are from a sampling period covering 24 hours per day, 365 days per year
18. Require standardized, minimum statistical analysis
19. Result in final databases that have a common structure and format

The Organization for Economic Cooperation and Development (OECD) Common Methodology also requires analysis of the population-at-risk to coincide with investigation of the crash population. Large-scale data sources such as departments of motor vehicles can be surveyed and compared to the population-at-risk identified through concurrent exposure data collection. However, exclusive reliance on these data sources will not define the true population-at-risk.

The objectives for exposure data collection are to precisely define:

- Population-at-risk
- Traffic characteristics
- Land use characteristics
- Vehicle characteristics
- Historical perspectives
- Data requirements
- National representation
- Countermeasures applications
- International correlation

Appendix D

Scope of Services Typically Provided for in Legislation Authorizing Motorcycle Safety Programs

Most state legislation that creates motorcycle safety programs typically includes the administration and implementation of programs or systems to facilitate:

A. Sponsor/site identification and preparation

B. Equipment acquisition, maintenance, and repair

C. Instructor and/or RiderCoach℠ identification, training, and continuing education

D. Instructor-trainer and/or RiderCoach℠ identification, training, and continuing education

E. Motorcycle operator training

F. Course delivery

G. Program evaluation and quality assurance

H. Promotion and public information

I. Additional requirements may include:

   1. Provisions for mandatory training for riders younger than 16, 18, or 21

   2. Formation of citizen and/or government advocacy committees to provide oversight and a public forum to hear motorcyclists' safety issues and concerns

   3. Motorcycle operator licensing training and testing

Appendix E

State Motorcycle Safety Program Assessments

The Motorcycle Safety Program Assessment is a technical assistance tool that the National Highway Traffic Safety Administration (NHTSA) offers to states to allow management to review the motorcycle safety program, note the program's strengths and accomplishments, and note where improvements can be made. The assessment can be used as a management tool for planning purposes and for making decisions about how to best use available resources. The Motorcycle Safety Program Assessment process provides an organized approach for meeting these objectives.

The Motorcycle Safety Program Assessment is a cooperative effort among NHTSA, the state motorcycle program office, the state highway safety office, and other agencies or offices, such as the Department of Motor Vehicles, Department of Public Safety, Department of Transportation, and/or Department of Education, which contribute to the state's motorcycle safety program efforts. The Motorcycle Safety Program Assessment follows the format and procedures utilized by other highway safety and emergency medical services program assessments.

The Motorcycle Safety Program Assessment is based on the recommendations in NHTSA's Highway Safety Guidelines and Program Advisories. *Motorcycle Safety Program Guideline Number 3: Motorcycle Safety* is used as the basis against which each state program is assessed. The Motorcycle Safety Program Assessment examines the following components of a comprehensive motorcycle safety program:

- Program management including
  a. Legislation, regulation, and policy
  b. Evaluation and research
- Motorcycle personal protective gear
- Motorcycle operator licensing
- Motorcycle rider education and training
- Motorcycle operation under the influence of alcohol or other drugs
- Motorcycle conspicuity and motorist awareness programs
- Public information and education efforts

Appendix F

Examples of Rider Education & Training Curricula

Basic training

1. Curricula designed for the beginning rider
2. Entry qualifications: minimum age to qualify for state's motorcycle endorsement
3. Knowledge and skill testing
4. Licensing examinations waived for course graduates

Intermediate training

1. Curricula designed for rider with at least six months' or 20,000 miles experience
2. Entry qualifications: possess motorcycle permit
3. Skill testing
4. Licensing skills test waived for course graduates

Experienced rider training

1. Curricula designed for rider with at least three years of experience and 10,000 miles
2. Entry qualifications: possess motorcycle endorsement
3. Skill and knowledge testing optional
4. License examinations not waived

Optional special needs training

1. Passenger
2. On-street

Appendix G

State Operator Licensing Requirements

CYCLE SAFETY INFORMATION

MSF MOTORCYCLE SAFETY FOUNDATION

National Resource Office

2 Jenner Street • Suite 150 • Irvine CA 92618-3806

(949) 727-3227

STATE MOTORCYCLE OPERATOR LICENSING – 2000

This is the 24th annual Cycle Safety Information Sheet reporting state motorcyclist-licensing procedures and standards. This information is the result of surveying licensing authorities in the nation's 51 licensing jurisdictions.

Program Services staff of the Motorcycle Safety Foundation provides technical, material and examiner-training assistance at low or no cost upon request.

Operator Populations		Registrations			State Licensing Agencies			
Auto Operators	Motorcycle Operators	CDL	Motorcycles	State	Knowledge Testing Agency	Skill Testing Agency	License Issuance Agency	M/C Lic. Legislation
3,336,230	2,150	126,140	40,977	AL	Dept. of Public Safety	same	same	1991
474,376	27,320	31,403	13,695	AK	Motor Vehicle Division	same	same	1979
3,639,064	190,217	105,939	70,081	AZ	Motor Vehicle Division	same	same	1968
1,931,174	111,719	86,340	21,151	AR	State Police	same	Driver Services	1987
19,675,748	832,732	600,752	414,493	CA	Dept. of Motor Vehicles	same	same	1968
2,304,950	344,030	83,320	97,717	CO	Dept. of Motor Vehicles	same	same	1963
2,325,128	139,754	52,172	51,000	CT	Dept. of Motor Vehicles	same	same	1967
551,784	33,683	26,205	9,997	DE	Dept. of Motor Vehicles	same	same	1974
346,600 *	16,500 *		2,400 *	DC	Motor Vehicle Services	same	same	1963
13,012,132	497,081	502,784	218,632	FL	Hwy. Safety & MV	same	same	1984
4,489,709	210,504		82,248	GA	Dept. of Public Safety	same	same	1974
746,329	31,397	24,586	16,936	HI	Differs by County (Island)	same	same	1965
811,636	5,404	59,351	34,529	ID	Driver Services	same	same	1994
8,538,638	573,103	368,819	203,935	IL	Secretary of State	same	same	1969
4,855,101	220,746	258,736	102,000	IN	Bureau of Motor Vehicles	same	same	1960
2,091,774	214,938	138,177	124,201	IA	DOT Driver Services	same	same	1968
1,800,000	200,000	110,000	42,186	KS	Dept. of Rec.Veh. Div.	same	same	1974
2,867,000	111,184	136,721	35,628	KY	State Police	same	Circ. Court Clerks	1992
2,176,935	57,176	96,860	61,372	LA	Dept. of Public Safety	same	same	1968
838,685	102,098	61,580	31,757	ME	Secretary of State	same	same	1987
3,338,708	186,468	127,440	48,195	MD	Motor Vehicle Admin.	same	same	1967
4,216,057	232,730	96,296	91,872	MA	Registry of Motor Veh.	State Police	Registry of Motor Vehicles	1968
6,911,750	438,305	253,092	138,243	MI	Secretary of State	same	same	1970
3,196,984	298,863	200,193	118,275	MN	Dept. of Public Safety	same	same	1968
2,048,731	54,804		19,000	MS	Highway Patrol	same	same	1985
3,202,300	268,900	217,694	62,701	MO	Highway Patrol	same	Driver License Bureau	1968
690,000	70,000		17,981	MT	Motor Vehicle Division	same	same	1976
1,202,541	40,483	62,460	19,621	NE	Dept. of Motor Vehicles	same	same	1967
1,250,925	64,673	41,009	26,808	NV	Dept. of Motor Vehicles	same	same	1971
866,198	120,987	49,159	44,362	NH	Dept. of Safety	same	same	1968
5,292,092	264,100	189,620	96,000	NJ	Div. of Motor Vehicles	same	same	1921
1,106,570	58,400	44,000	31,341	NM	Motor Vehicle Division	same	same	1966
10,529,798	502,453	482,152	180,880	NY	Dept. of Motor Vehicles	same	same	1977
4,805,390	233,112	258,648	88,213	NC	Motor Vehicle Division	same	same	1978
412,127	36,087	36,323	15,480	ND	Driver License Division	same	same	1968
7,772,757	594,106	299,519	229,279	OH	State Highway Patrol	same	Bureau of Motor Vehicles	1968
2,334,096	123,923	119,581	52,971	OK	Dept. of Public Safety	same	same	1967
2,535,753	164,898	108,673	62,029	OR	Dr. & Motor Veh. Serv.	same	same	1966
8,283,391	748,315	333,731	185,990	PA	Dept. of Transportation	same	same	1968
687,872	59,593	26,451	20,516	RI	Comm. College of RI	same	Registry of Motor Vehicles	1967
2,498,154	94,888	109,289	45,003	SC	Dept. of Public Safety	same	same	1975
510,436	52,641	44,674	25,735	SD	Dept. of Comm. & Reg.	same	same	1968
3,877,658	196,641		72,567	TN	Dept. of Safety	same	same	1972
14,221,990	606,839		372,229	TX	Dept. of Public Safety	same	same	1967
1,071,731	102,579	52,641	25,275	UT	Driver License Division	same	same	1967
501,110	50,108	26,590	14,462	VT	Dept. of Motor Vehicles	same	same	1968
4,771,570	223,050		70,320	VA	Dept. of Motor Vehicles	same	same	1969
3,562,030	264,450		96,926	WA	Dept. of Licensing	same	same	1967
1,300,000	76,709	57,486	21,871	WV	State Police	same	Motor Vehicle Division	1992
3,709,957	375,741	240,746	168,113	WI	Dept. of Transportation	same	same	1968
358,848	40,064	31,517	14,648	WY	Dept. of Transportation	same	same	1968

* DC numbers are from 1999 report

		Motorcyclist Learner Permits				
Vehicles Registered as Motorcycles	State	Issuance Fee	Issuance Tests	Duration	Renewal Fee	Restrictions
2,3,4,8,9,10,11	AL	NO LEARNER PERMIT SYSTEM				
2,3,4,8,9,10,11	AK	$5.00	V,K	2 years	$5.00	S,H
3,4,9,10,12	AZ	$7.00	V,K	6 months	$7.00	R,T
2,4,8,9,10,13	AR	NO LEARNER PERMIT SYSTEM				
1,2,3,4,7,8,9,10,11,12	CA	$12.00	V,K	1 year	$12.00	B*,H,P,R,T
8,9,10	CO	$10.00	V,K,Sk	8 months	$10.00	S
2,8,9,10,12	CT	$5.50	V,K	60 days	$5.50	H,P,T,D,R
12	DE	$8.00	V,K,Sk	60 days	$5.00	H,P,R,T,C
4,8,9,10,11,13	DC	$10.00	V,K	60 days	$10.00	S,H
4,8,9,10	FL	0	V,K	60 days	0	P,H
2,3,4,8,9,10	GA	$10.00	V,K	6 months	$10.00	H,P,R,T
4,8,9,10	HI	$5.00	V,K	180 days	$5.00	P,T
1,3,4,7,8,13	ID	$11.50	V,K	6 months	$11.50	H*,P,R,T
8,11	IL	$10.00	V,K	1 year	$10.00	S,B,T,C,E
2,3,4,9,10,13	IN	$5.00	V,K	1 year	$5.00	S*H,P,T
8,9,10	IA	$6.00	V,K	2 years	$6.00	S
1,5,8,9,10,13	KS	$4.00	V,K	1 year	$4.00	S,P
4,9,10,11,13	KY	$6.00	V,K	6 months	$6.00	H
1,2,4,8,11,12	LA	NO LEARNER PERMIT SYSTEM				
9,10	ME	$10.00	V,K,🎓	1 year	$10.00	H,P,T
8,9,10,13	MD	$30.00	V,K	180 days	$30.00	S,H,P,T
1,4,13	MA	$15.00	V,K	1 year	N/A	H,P,T,E
4,8,9,10	MI	$13.50	V,K	150 days	$13.50	S,H,P,T,E
8,9,10,12	MN	$21.00	V,K	1 year	$21.00	H,P,R,T,E
9,10,11,13	MS	$1.00	V,K,Sk	1 year	$1.00	S,H
4,9,10,12,13	MO	$1.00	V,K,✓	6 months	$1.00	H,P,T,D,C
1,2,3,4,5,7,8,9,10,12	MT	$.50	V,K	6 months	$.50	S,H*
4,8,9,10	NE	$3.00	V,K	1 year	$3.00	S,H
9,10	NV	$19.50	V,K	8 months	$19.50	S,H,P,R,T
3,8,9,13	NH	$28.00	none	1 year	$28.00	H*,T,P
2,3,4,9,10	NJ	$5.00	V,K	90 days	$5.00	S,H,E
2,8,9,10,11,13	NM	$2.00	V,K	6 months	$2.00	P,C
8,9,10,12	NY	$52.00 max.✓	V,K	1-5 years, ✓	$33.00	S,H,P✥,R,T,E
3,5,11	NC	$10.00	V,K,▲	18 months	0	P
3,8,9,10,11	ND	$10.00	V,K	6 months	$8.00	H,P,C,T
3,4,8,9	OH	$6.00	V,K	1 year	$6.00	H,P,R,T,E
4,9	OK	$23.00	V,K,Sk	4 years	$19.00	S,T*,C*
3,4,8,9,10,13	OR	$13.00	V,K,✓	1 year	N/A	S,H,P,T
4	PA	$7.00	✎	120 days	$7.00	S,P,T
4,9,10	RI	$2.00	V,K,Sk	90 days	N/A	S,R,P,E
3,4,12	SC	$2.50	V,K	1 year	$2.50	H*
3,4,7	SD	$8.00	V,K,Sk	30 days	$18.00	S,H*,P
2,4,9,10,11	TN	$6.50	V,K,Sk	1 year	0	H,P,R,T,C*
4,9,11	TX	$16.00,✓	V,K	6 years,✓	$32.00,✓	S,C*
4,9,10,11,12	UT	$7.50	V,K	6 months	N/A	H*,P,R,T
3,8,9,10,12	VT	$7.00	K	120 days	$7.00	P,T,D
4,8,11	VA	$3.00	V,K	1 year	$3.00	S,H,P,R,T
9,11	WA	$3.50	none	90 days	$3.50	H,P
2	WV	$5.00	V,K,Sk	90 days	$5.00	B,H,P,T,E
8,9,10	WI	$22.00	V,K	6 months	$22.00	S,H,P,E,B,♿
3,4,7,13	WY	$20.00	V,K	90 days	$20.00	H*

Vehicles Registered as Motorcycles

1 • 3-wheel, All-Terrain Vehicle
2 • Nopeds (small displacement 3-wheel)
3 • Minibikes
4 • Motorbikes
5 • Golf Carts
6 • Snowmobiles
7 • All-Terrain w/ more than 3 wheels
8 • 3-wheel, service vehicle
9 • Modified 3-wheel (straddle seat)
10 • Modified 3-wheel (bench seat)
11 • Mopeds
12 • Off-Road Motorcycles
13 • Contact local DMV

Learner Permit Restrictions

S • Supervision
H • Helmets
R • Restricted Roadways
T • Times of Day
B • .00 BAC
P • No Passengers
D • Restricted Distances
C • Cycle Size Restrictions
E • Eye Protection

Footnotes

V • Vision
K • Knowledge
Sk • Skill
* • Certain age groups only
✥ • No passengers except supervisor
✎ • If no DL must pass V & K
🎓 • Must complete 8-hour classroom training
♿ • If under 18 years of age, must be enrolled in *RiderCourse*® before obtaining permit.
✓ • Fee, duration depends on age at application. Fee includes license fee.
▲ • Road sign identification test.

Motorcyclist Learner Permits

S • 23 jurisdictions require supervision

H • 35 jurisdictions require helmet usage

R • 14 jurisdictions restrict learners to certain roadways

T • 28 jurisdictions restrict times of day for operation

B • 4 jurisdictions restrict BAC levels - CA, IL, WV, WI

P • 33 jurisdictions restrict learners from riding with passengers

D • 3 jurisdictions restrict learners to riding within the state or shorter distances - CT, VT, MO

C • 8 jurisdictions restrict cycle size of learners' motorcycles

E • 10 jurisdictions restrict learners to wearing eye protection

48 jurisdictions that provide motorcyclist licenses and/or endorsements make motorcyclist learner permits available. 3 jurisdictions do not.

NH and WA report that they do not require knowledge or skill tests to obtain a learner permit.

PA applicants must take vision and knowledge tests if they do not hold a driver license.

WI applicants under 18 must be enrolled in *RiderCourse* before obtaining permit.

			General Licensing Information									
License/ Endorsement Codes	License/ Endorsement Fees	Duration in Years	State	Total Operator Testing Sites	Sites Provide M/C Tests	Sites Provide CDL Tests	Total State Examiners	# Exam. Who Test M/C Lists	3rd Party Testers Used	Age w/out Rider Ed.	Age with Rider Ed.	Rider Training Required For:
M	$0⇨K	4	AL	82	82	10	167C,32L	N/A	CDL	14	14	N/A
M1,M2	$15.00⇨Sk	5	AK	30	30	26	35C&L	35	Yes	16	16	N/A
M	$7.00	✪	AZ	104	57	9	838	597	CDL/car/MC	18	16	N/A
M,MD/M	$14.00-$5.00	4	AR	98	98	98	39	39	No	16	16	N/A
M1,M2	$12.00	4	CA	187	174	58	533	546	MC/CDL	21	16	under 21
M	$16.00	5	CO	87	87	10	144C	144	MC/CDL/car	16	16	N/A
M,1M,2M, ●	$0-$37.00 ⇨ K	4	CT	11	10	5	100L	50	MC	18	16	under 18
M	$8.00	5	DE	4	3	3	26	13	MC	18	16	under18
M	$20.00	4	DC	1			8C	8	CDL	16	16	N/A
MTCY Only,Also	$5.00	4,6	FL	181	50	7	1692C	450	MC/CDL	21	16	under 21
MR,MJ,MX	$15.00	4	GA	57	40	3	250C	110	MC/CDL	16	16	N/A
2	$9-$18.00 ⇨ K,Sk	⋈	HI	22	16	8	56C,12L	34	CDL	15	15	N/A
M	$11.50	4	ID	55	25	93	163C,210L	31	MC/CDL/car	21	15	under 21
L,M	$10.00	4	IL	104	104	95	750C	750	MC/CDL	18	16	under 18
MC	$6-$10.00 ⇨ Sk	4	IN	167	30	18	75 + 32C	121	MC/CDL	16	16	N/A
M,8	$1.00 / year	2-4	IA	133	133	89	122	122	No	18	16	under 18
D,M	$6.50 ⇨ K,Sk	4	KS	46	46	8	150C	150	MC/CDL	16	15	N/A
M	$12.00	4	KY	120	120	120	73C,37L	87	MC/CDL	16	16	N/A
M,7	$8.00	4	LA		80	35	482	482	MC/CDL	16	16	N/A
I,J	$0 ⇨ K,Sk	6	ME	28	28	22	36C	36	MC	N/A	16	all ages
MD	$30.00	5	MD	12	25	12	121C	40	No	18	16	under 18 ⇨
M	$15.00 ⇨ K,Sk	5	MA	37	42	9	64L	114	MC	17	16.5	N/A
CY	$13.50 ⇨ Sk ✧	4	MI	475	124	212	600C	277	MC/CDL	18	16	under 18 and ✓
M	$0	4	MN	84	93	73	105C	105	MC/CDL	18	16	under 18
E	$5.00	4	MS	60	60	9	36C,15L	51	CDL	16	16	N/A
M	$7.50-$40.00	6	MO	147	125	14	197C	197	CDL	16	15.5	N/A
M	$2.00-$4.00 ■	8,4	MT	57	56	56	33C	31	MC	16	15	N/A
M	$18.75	5	NE	99	96	89	83	60	CDL	16	16	N/A
M,MX,MZ,MU	$5.00	4	NV	37	9	7	44C	38	MC/CDL	16	16	N/A
MC	$37.00	4	NH	14	14			23	MC	18	16	N/A
M,E	$15.00-$13.00	4	NJ	19	10	15	162C	73	MC	17	17	N/A
M,W,Z	$11.50	4	NM	68	68	68	60C	68	MD/CDL	16	13	under 18
M,MJ	$52.00 max, ✧	5	NY	138	96	64	158C	152	No	16	16	N/A
M	$1.25 ⇨ K,Sk	5	NC	89	89	89		406	MC	18	16	N/A
M	$8.00 ⇨ K,Sk	4	ND	43	43	43	36C	36	No	16	14	under 16
M,R,M-1,M-3	$6.50	4	OH	96	96	96	210C	96	MC	18	15.5	under 18
M	$4.00 ⇨ K	4	OK	86	86	18	83	83	No	14	14	N/A
M	$30.00	4	OR	61	99	22	195C	170	MC/CDL	19	16	under 21
M,V ✧	$2.00	4	PA	72	68	36	193C	121	MC/CDL	16	16	N/A
H	$1.00	5	RI	6	2	1	10	23	MC/CDL	N/A	16	all applicants
M,4	$12.50 ⇨ K	5	SC	59	59	36	160C	160	CDL	15	15	N/A
2,3	$8.00	5	SD	53	53		47C	47	MC/CDL	14	14	N/A
M,MP	$17.50	3-7 ✖	TN	102	102	8	243C	243	MC/CDL	16	16	N/A
M	$15-$32.00 ⇨	4	TX	243	243		370C,121L	599	No	18	15	under 18
M,O,U	$7.50	5	UT	37	37	12	67C	80	MC/CDL	N/A	16	N/A
M	$1.00 / year	2,4	VT	12	6	5	10C	10	MC/car	16	16	N/A
M	$2.00 / year	5	VA	78	18	65	217C	197	MC	18	15.8	N/A
M1,M2,M3	$6-$14.00 ⇨ K	4	WA	63	63	63	295C	295	CDL	18	16	under 18
F	$5.00	4 ✖	WV	55	55	55	16L,36C	16L	MC/CDL	16	16	N/A
M	$8-$12.00 ⇨ Sk	4-8	WI	126	126	126	165C	165	MC/CDL	18	16	✧
M	$23.00	4	WY	30	30	13	55C	55	MC/CDL	16	16	N/A

C • Civilian Examiners
L • Law Enforcement Examiners
CDL • Commercial Drivers License

K • Knowledge Test
Sk • Skill Test

Footnotes:

Blank spaces indicate information was not provided.

⇨ • Additional fees for application processing, knowledge and/or skill testing.

✓ • Applicants who fail two skill tests.

✖ • In transition to a 5-year license. Renewals last until next birthday divisible by 5.

✧ • Restricted to motor-driven cycle.

✪ • AZ D/L is good to age 60, then must be renewed every 5 years.

⋈ • $13.50 motorcycle endorsement fee is not collected if learner permit was previously issued at $13.50.

⋈ • HI 4 yr = 15 - 17 yrs; 6 yr = 18 - 71 yrs; 2 yrs = 72+

■ • Depending on age.

✧ • New drivers receive a multi-year permit that includes the license fee.

⇨ • If not previously licensed in the U.S., must complete 3 - hour drug & alcohol awareness course.

✧ • If under 18; or before 3rd skill test; or before renewing learners permit the 4th time.

● • The older codes 104 - 107, 204 - 207 will be replaced with M, 1M & 2M when licenses are renewed.

MC ONLY fees not included on this page.
Waivers for any portion of MC test equals 3rd party testing.

Examiner Profiles

24 jurisdictions used state-approved contractors to conduct M/C and CDL skill tests.

7 contracted CDL testing outside of the state agency.

11 contracted M/C testing outside of the state agency.

Motorcyclist Licensing Systems

Standard • Identity, vision, health and previous operating experience is screened to determine applicant eligibility.

Appropriate licensing tests assess minimum safe operating knowledge and skill standards. Intervention occurs as needed for all operators.

Tiered • Licensees of some or all age groups are restricted to operating on specific motorcycle sizes.

Graduated • Individual assessment of applicant age, experience and operating record, if any, determines operating privileges for first-time licensees of some or all age groups during a provisional period.

Additional monitoring and early intervention occurs as in the Provisional System.

Operating privileges increase as experience, maturity and skills increase until full privileges are earned (6 months - 2 years).

Jurisdictions with Motorcycle Tiered - Licensing Programs

- **AL** • under 16 restricted to 150cc
- **OK** • under 16 restricted to 250cc or less
- **TX** • under 16 restricted to under 250cc
- **IL** • under 18 restricted to under 150cc unless completed rider training
- **MO** • 15.5 to 16 restricted to 250cc or less
- **NM** • under 15 restricted to 100cc or less
- **ND** • under 16 restricted to 250cc
- **TN** • under 16 restricted to 650cc or less - under 15 restricted to 125cc or less

Motorcyclist Knowledge Testing			State	Motorcyclist Skill Testing					
Handbook Used	Knowledge Tests	Auto Test		Primary Skill Test	Secondary Skill Test	Rider-Ed Waiver	Reciprocal Lic. Waivers	3-Wheel/Sidecar Testing	3Wh/SC Oper. Restricted to
Local	Local	No	AL	None	None	No	Yes	none	None
MOM	MSF	Yes	AK	Alt. MOST	Local off-street	Yes	Yes	mod m/c skill test	full m/c priv
MOM	Mod. MSF	No	AZ	Alt. MOST	None	Sk,K	Yes	mod m/c skill test	sidecar, 3-wh
Local	Local	No	AR	Local on-street	Local on-street	No	Yes	mod m/c skill test	full m/c priv.
Mod. MOM	Local	Yes	CA	Local off-street	Local off-street	Sk	Yes	mod m/c skill test	sidecar, 3-wh
Mod. MOM	MSF	No	CO	Alt. MOST	Local off-street	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	Yes	CT	Alt. MOST	None	Sk	Yes	car skill test	sidecar, 3-wh
MOM	MSF	No	DE	Alt. MOST	Alt. MOST	Sk,K	Yes	car skill test	full DL priv.
Local	Local	No	DC	Alt. MOST	Local off-street	No	Yes	car skill test	full m/c priv.
MOM	MSF	Yes	FL	Alt. MOST	None	Sk,K	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	GA	MLST	MLST	Sk,K	Yes	car skill test	sidecar 3-wh
MOM	MSF	No	HI	Alt. MOST	Alt. MOST	Yes	Yes	mod m/c skill test	sidecar, 3-wh
Mod. MOM	Mod. MSF	Yes	ID	Alt. MOST	Alt. MOST	Yes	Yes	mod m/c skill test	sidecar, 3-wh
Mod. MOM	Local	No	IL	Alt. MOST	Local on-street	Sk,K	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	IN	Alt. MOST	Alt. MOST	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	Yes	IA	Local off-street	Local off-street	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	KS	Alt. MOST	Alt. MOST	Sk,K	Yes	mod m/c skill test	full m/c priv
Local	Local	Yes	KY	Local off-street	Local off-street	Sk	Yes	mod m/c skill test	full m/c priv
Mod. MOM	MSF	No	LA	Local off-street	Local off-street	Sk	Yes	none	full m/c priv
Mod. MOM	Local	No	ME	Local on-street	Local on-street	K	Yes	car skill test	full m/c priv
Mod. MOM	MSF	Yes	MD	Local off-street	Local off-street	No	Yes	car skill test	multi-purp. veh.
Local	Local	Yes	MA	Local off-street	Local off-street	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	MI	Alt. MOST	Alt. MOST	Sk	Yes	mod m/c skill test	sidecar, 3-wh
Mod. MOM	Local	Yes	MN	Alt. MOST	Alt. MOST	Sk	Yes	mod m/c skill test	3-wh
MOM	Local	No	MS	M/C In-Traffic	Local on-street	No	Yes	car skill test	sidecar, 3-wh
MOM	Mod. MSF	No	MO	Local off-street	Local off-street	Yes	Yes	mod m/c skill test	3-wh
MOM	MSF	No	MT	Alt. MOST	Local on-street	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	NE	Alt. MOST	M/C In-Traffic	Sk,K	Yes	car skill test	full m/c priv
MOM	MSF	Yes	NV	MLST	Alt. MOST	Sk,K	Yes	car skill test	sidecar, 3-wh
Local	Local	No	NH	Alt. MOST	Alt. MOST	Sk	Yes	car skill test	full m/c priv
Mod. MOM	Local	Yes	NJ	Alt. MOST	Alt. MOST	Sk	No	mod m/c skill test	sidecar, 3-wh
MOM	MSF, Local	No	NM	Alt. MOST	Local on-street	Sk,K	Yes	mod m/c skill test	full m/c priv
MOM	Local	No	NY	Local on-street	Local on-street	Yes	Yes	mod m/c skill test	full m/c priv
MOM	Local	No	NC	Local off-street	Local off-street	Sk	Yes	none	full m/c priv
MOM	MSF	Yes	ND	Alt. MOST	Local off-street	No	Yes	mod m/c skill test	sidecar, 3-wh
MOM	Local	No	OH	Alt. MOST	Alt. MOST	Sk	Yes	mod m/c skill test	sidecar, 3-wh
Local & MSF	Local	No	OK	M/C In-Traffic	Local on-street	Sk	Yes	none	full m/c priv
MOM	MSF	Yes	OR	Alt. MOST	Alt. MOST	Sk,K	Yes	mod m/c skill test	sidecar, 3 wh
Mod. MOM	MSF	Yes	PA	Local off-street	Local off-street	Sk,K	Yes	mod m/c skill test	full m/c priv
Local	Local	No	RI	Local off-street	Alt. MOST	Sk,K	Yes	m/c RE course	full m/c priv
Mod. MOM	Mod. MSF	Yes	SC	Local off-street	Local off-street	No	Yes	m/c skill test	sidecar, 3-wh
MOM	MSF	No	SD	M/C In-Traffic	Local on-street	Sk,K	Yes	car skill test	full m/c priv
MOM	Mod. MSF	Yes	TN	Local on-street	Local on-street	Sk,K	Yes	car skill test	full m/c priv
Mod. MOM	Local	Yes	TX	Local on-street	Local on-street	Sk*	Yes	m/c skill test	full m/c priv
MOM	Local	No	UT	Alt. MOST	Local off-street	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	VT	Alt. MOST	Alt. MOST	Sk	Yes	none	sidecar, 3-wh
MOM	MSF	No	VA	Local on-street	Mod. Alt. MOST	Sk	Yes	no info	full m/c priv
Mod. MOM	MSF	No	WA	Alt. MOST	Alt. MOST	Yes	Yes	car skill test	sidecar, 3-wh
MOM	MSF	No	WV	Alt. MOST	Alt. MOST	Sk,K	Yes	no info	no info
MOM	Local	No	WI	M/C In-Traffic	M/C In-Traffic	Sk	Yes	mod m/c skill test	sidecar, 3-wh
MOM	MSF	No	WY	Alt. MOST	Alt. MOST	Sk	Yes	mod m/c skill test	full m/c priv

Footnotes

Auto Test • Automated Testing available.

Primary • Tests used in most or all urban locations and/or where the majority of motorcyclists are tested.

Secondary • Test used in rural sites or locations unable to accommodate the primary test.

Rider-Ed Waivers • Issued to eligible applicants who successfully complete rider-education requirements acceptable for licensing standards.

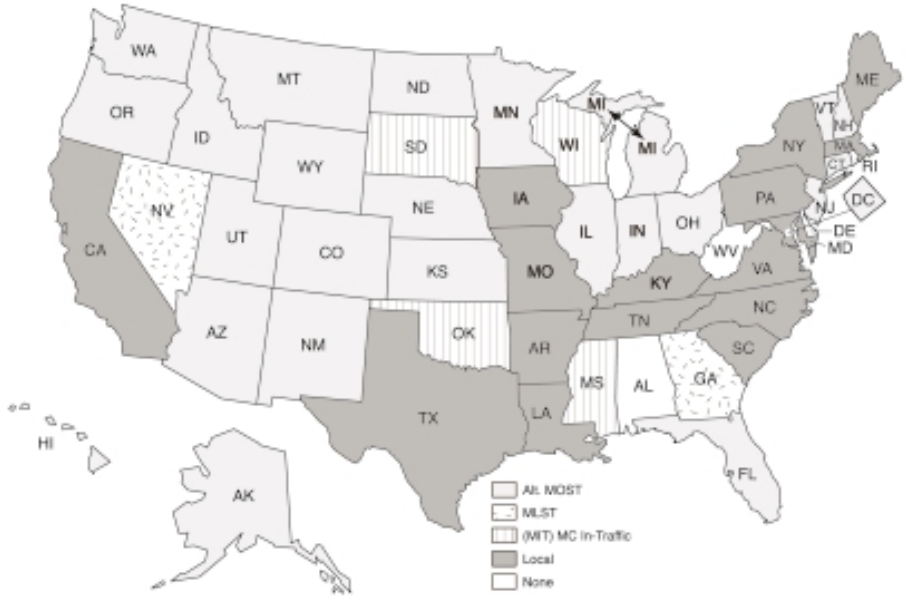
Out-of-State Transfer • (Reciprocal) Waivers - Issued to eligible applicants who were tested and licensed in a previous jurisdiction and maintain acceptable standards for current jurisdiction.

* • Must remove sidecar.

K • Knowledge

Sk • Skill

Primary Motorcyclist Skill Tests



Alabama administers a general rules-of-the-road knowledge test only.

31 jurisdictions report using a single skill test statewide. This may or may not imply that a single skill test, of consistent standards and procedures, is offered in these states.

27 jurisdictions report using the Alternate MOST as their primary skill test.

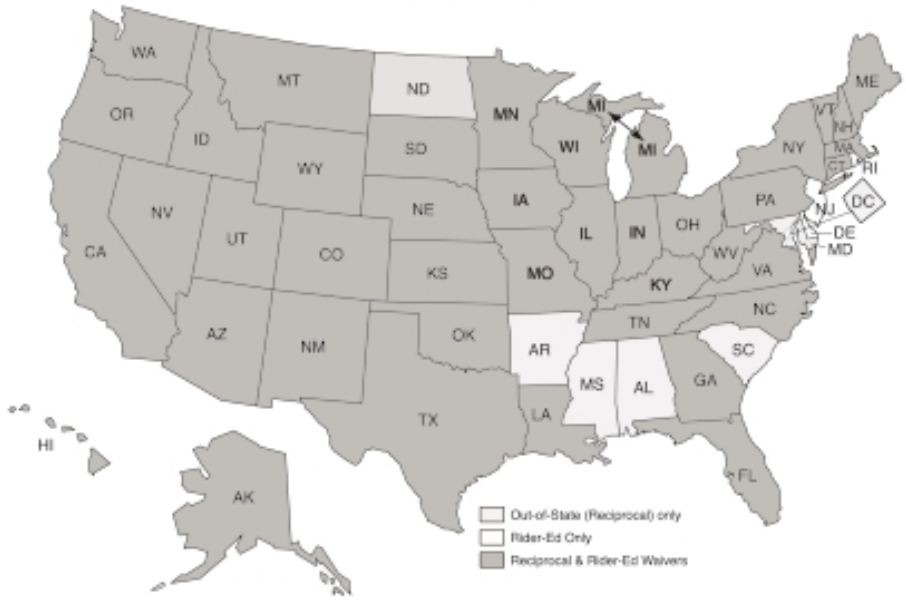
2 jurisdictions report using the MLST as their primary skill test.

4 jurisdictions report using the Motorcyclist In-Traffic (MIT) test as their primary skill test.

6 jurisdictions report using an on-street test of local design.

11 jurisdictions report using an off-street test of local design.

Available Waivers For Rider-Ed Completion and Out-of-State (Reciprocal) Transfers



43 jurisdictions report waiving knowledge and/or skill tests for eligible motorcycle operator applicants who successfully complete state-approved rider education.

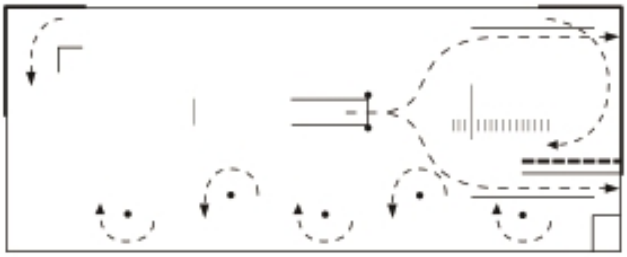
All jurisdictions, except New Jersey, report waiving knowledge and/or skill tests for eligible applicants who have previously tested in another jurisdiction and maintain licensing standards acceptable to the current jurisdiction.

MSF OFF-STREET TESTS

The Alternate Motorcycle Operator Skill Test (Alternate MOST) requires:

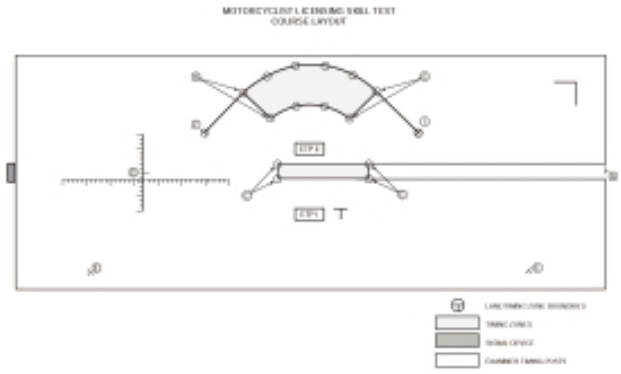
- Applicant performance of five basic vehicle-control exercises (Stalling, Sharp Turn, Normal Stop, Cone Weave, and U-Turn).
- Applicant performance of two collision-avoidance exercises (Quick Stop and Swerve).
- No electronic equipment costs or maintenance.
- Least amount of testing space needed for off-street testing (125x30 ft with 10 ft additional unobstructed area).

An Alternate Most Examiner Training Video and Guide is available, 42 minutes in length. It details how to administer the Alternate MOST and challenges examiners with practice scoring exercises.



The Motorcycist Licensing Skill Test (MLST) requires:

- Performance of one basic vehicle-control exercise (Straight Path and Sharp Turn).
- Performance of two collision-avoidance exercises (Riding Curves and Quick Stop/Swerve).
- Repetition of collision-avoidance exercises that allows more opportunity to assess turning, stopping and swerving skills.
- Automatic or manually-operated electronic equipment that converts speed traveled through a timing zone to a score.



MSF ON-STREET TEST

The Motorcyclist In-Traffic Test (MIT):

- Requires applicant performance of 8-11 riding behaviors determined to be important to safer riding.
- Allows assessment of rider judgment in actual traffic situations.
- Does not require off-street test facility.

All of these tests employ objective scoring criteria, are easy to conduct in approximately 10 minutes, and examiners do not need to be riders to administer them. However, motorcyclist examiners who have completed a rider-training course or are riders enjoy more credibility with applicants they test. AAMVA guidelines recommend that applicants receive uniformly administered tests statewide.

MSF will provide states the loan of printer's negatives for any of the following materials. Knowledge Test slides for states using automated testing are also available.

Motorcycle Operator Manual and Knowledge Tests

The Motorcycle Operator Manual includes information on motorcycle riding preparations, protective gear and defensive operating. Each of the five Knowledge Tests (that include 25 multiple-choice questions) are based on MOM information. Tests emphasize areas critical to safe riding. The MOM is also available on computer disk as a PageMaker file.

The Motorcycle Skill Test Practice Guide

The Motorcycle Skill Test Practice Guide provides motorcycle license applicants with exercises that they can practice before taking their skill test. These exercises do not replace a rider-education course.

Sharing the Road with Motorcycles

Studies show that most two-vehicle collisions involving motorcyclists are caused by drivers of other vehicles. *Sharing the Road with Motorcycles* offers information to make drivers aware of conditions and situations commonly faced by motorcyclists.

The Motorcycle Safety Foundation (MSF) is a national, nonprofit organization dedicated to promoting safe and responsible motorcycling. We have programs in rider training, operator licensing and public information. MSF is supported by the U.S. distributors of BMW, Ducati, Harley-Davidson, Honda, Kawasaki, Suzuki and Yamaha motorcycles.

Appendix H

Elements of a Typical Graduated License System for Motorcyclists

Stage 1 - Learner's permit

General applicants who satisfy application prerequisites are screened for vision and tested on rules of the road and subjects specific to motorcycling. Upon successful completion of the tests, applicants are granted a learner's permit authorizing restricted, on-street riding privileges.

Conditions of permit include:

a. 90-day permit period
b. Supervision by older rider/driver
c. Parental participation
d. No passengers
e. Mandatory helmet and eye protection use
f. Zero BAC tolerance
g. High-visibility clothing
h. No interstate-highway riding
i. Daylight hours only

Stage 2 - Intermediate, provisional or restricted license

General applicants who have satisfied application requirements are given a motorcycle knowledge and performance test. Applicants may take the test as many as three times. Where required, proof of rider education must be presented before taking the test a second time. Upon successful completion of testing, applicants are granted an intermediate license.

License conditions include:

a. Restricted hours
b. No passengers
c. Mandatory helmet and protective clothing
d. Zero tolerance BAC for riders under 21
e. License revocation for alcohol-related offense
f. Parental participation for riders under age 18
g. Special limitation of speed or road types (freeways, etc.)
h. Early intervention for violations or at-fault crashes

Stage 3 - Full or unrestricted license

General applicants who successfully complete the intermediate license stage and meet any minimum age (and/or time) requirements are given a second-level knowledge and on-road driving skills test. Upon successful completion of the test, applicants are granted a full unrestricted license. If it is not feasible to have second-level knowledge and on-highway driving skill tests because of the costs, jurisdictions should require a clean driving record as a condition for obtaining a full or unrestricted license.

License conditions include:

a. Successfully complete intermediate license stage
b. Meet any minimum age requirement
c. Successfully complete advanced rider education
d. Pass on-highway skills test

Appendix I

State Motorcycle Equipment Requirements

STATE ON-HIGHWAY MOTORCYCLE EQUIPMENT REQUIREMENTS

Motorcycle Industry Council

JULY 2000

	Safety Helmet	Eye Protection	Rearview Mirror	Brakes	Handlebar Height	Passenger Seat*	Passenger Footrests*	Passenger Handhold*	Headphones Prohibited	Turn Signals	Speedometer/ Odometer	Daytime Headlight Use	Periodic Inspection
Alabama	•		•	•-13	•-17	•	•						
Alaska	•-p	•-k	•-11	•-13	•-17	•	•	•	•	•-#			•-25
Arizona	•-4	•-j	•	•-12	•-17	•	•	•					•-23
Arkansas	•-6	•	•	•-12		•	•	•				•	•
California	•		•	•-13	•-19	•	•		•-n	•-b		•-i	•-25
Colorado		•	•	•-12		•	•		•-o				•-25
Connecticut	•-4	•-j	•	•-13g	•-17	•	•			•	•-22a	•-e	•-25
Delaware	•-1,7	•	•	•-12	•-17	•	•			•			•
Dist. of Col.	•	•-j	•	•-13	•-17#	•	•	•			•-20		•
Florida	•-v	•	•	•-13	•-17	•	•		•-o			•	
Georgia	•	•-j	•	•-13g	•-17	•	•		•-9	•-d		•	
Hawaii	•-4	•-j		•-12	•-17	•	•			•-#			•
Idaho	•-4		•	•-12		•	•						
Illinois		•	•	•-12	•-19	•	•		•-o			•	
Indiana	•-4,m	•-4		•-13	•-17	•	•					•	
Iowa			•	•-12	•-17	•	•				•	•-h	
Kansas	•-4	•-j	•-10	•	•-19	•	•			•-b		•-21	•-25
Kentucky	•-r	•	•	•-12		•	•						
Louisiana	•-t	•-j	•-10	•-12	•-17	•	•		•-n, o				•
Maine	•-3		•	•-13	•-19	•	•					•	•
Maryland	•	•-j	•-11	•-13	•-17	•	•	•-#	•-n		•-#		•-24
Massachusetts	•	•-j	•	•-13	•-17	•	•		•	•-b			•
Michigan	•	•-2j	•	•-13	•-17	•	•						•-25
Minnesota	•-4,m	•	•	•-12	•-19	•	•		•-n			•	•-25
Mississippi	•		•	•-12	•-14#						•-20#		•
Missouri	•			•-12	•-17#								•
Montana	•-4		•	•-13		•	•			•		•	
Nebraska	•			•-12	•-16	•	•						
Nevada	•	•-j	•-11	•-13	•-19	•	•			•			
New Hampshire	•-4	•-j	•	•-12	•-17	•	•	•-#		•-b	•-#		•
New Jersey	•-1	•-j	•	•-12, (13g#)	•-19	•	•						•
New Mexico	•-4	•-j	•	•-13	•-17	•	•						•-25
New York	•	•	•	•-13	•-17	•			•-n	•-s	•-20f	•	•
North Carolina	•		•	•-12		•	•				•-20	•	•
North Dakota	•-1,4		•	•-13	•-17	•	•				•		
Ohio	•-4,8	•-j	•	•-12	•-17	•	•		•-n, o	•-w			•-25
Oklahoma	•-4	•-j	•-11	•-13	•-15	•	•				•-20	•	•
Oregon	•		•	•-12		•	•			•-b		•	•-25
Pennsylvania	•	•	•	•-13#	•-19	•	•	•	•-9		•-a#		•
Rhode Island	•-5	•	•-(10#)	•-12	•-17	•	•	•	•		•-20a#		•
South Carolina	•-1,6	•-6j	•	•-13	•-17	•	•					•	
South Dakota	•-4	•-j	•	•-13	•-19	•	•						
Tennessee	•	•-j	•	•-12	•-17	•	•					•	
Texas	•-q		•	•-13	•-17#	•						•-u	•
Utah	•-4		•-10	•-12	•-19, (17#)	•	•	•-#		•-a#	•-22		•
Vermont	•-1	•-j	•-#	•-12	•-17	•	•						•
Virginia	•	•-j	•	•-13c	•-17	•	•		•-n, o				•
Washington	•	•-j	•-11	•-13a	•-18	•	•		•-o			•	•-25
West Virginia	•	•	•	•-12	•-17	•	•					•	•
Wisconsin	•-4,m	•-k	•	•-12	•-18	•	•				•	•	•-25
Wyoming	•-4		•-10	•-12	•-19	•	•					•	

- • Requirement in law
- ◦ If carrying a passenger
1. Reflectorization
2. Where speeds exceed 35 mph
3. With learner's permit; for 1 yr. after obtaining license; & passengers under15 yrs.
4. Under 18 years
5. Operators under 21 yrs.; for 1yr. after obtaining license; & all passengers
6. Under 21 years
7. Possession by all; wear under 19 yrs. & by instruction permit holders
8. Novice license holders
9. Prohibited except for communication
10. Left side
11. Left and right side
12. One wheel
13. Both wheels
14. Maximum of 10" above listen point
15. Maximum of 12" above listen point
16. Maximum of 15" above listen point
17. Maximum of 15" above seat
18. Maximum of 30" above seat
19. Handgrips below shoulder height
20. Speedometer
21. For motorcycle manufactured after 1/1/78
22. Odometer
23. Annual emissions inspection
24. Upon transfer of title
25. Random
- a. If originally equipped by manufacturer
- b. For motorcycle manufactured after 1/1/73
- c. For motorcycle manufactured after 7/1/74
- d. For motorcycle manufactured after 1/1/72
- e. For motorcycle manufactured after 1/1/80
- f. For motorcycle manufactured after 9/1/80
- g. For 1974 or later model year motorcycle
- h. For 1977 or later model year motorcycle
- i. Manufacturer requirement for motorcycle manufactured after 1/1/78
- j. Except if equipped with windscreen
- k. Except if equipped with windscreen 15" or higher
- m. Instructional permit holders
- n. Prohibited in both ears simultaneously
- o. Except helmets with speakers
- p. Operators under 18 yrs.; all passengers
- q. Except for 21 yrs. & over with rider ed or with health insurance with $10,000 medical benefits for motorcycle related injuries
- r. Under 21 yrs., operators with instruction permit, or those having held motorcycle license less than 1 yr.
- s. For 1985 or later model year motorcycle
- t. Except for 18 yrs. & over with health insurance with $10,000 medical benefits for bodily injuries
- u. For 1975 or later model year motorcycle
- v. Except for 21 yrs. & over with health insurance with $10,000 medical benefits for injuries
- w. For motorcycle manufactured after 1/1/68
- # Required by inspection regulations

Many state inspection regulations require that any equipment installed on a motorcycle must function properly even though the equipment is not required by law.

This information is provided by the Motorcycle Industry Council Government Relations Office. The chart will be updated annually as State Legislatures continue to pass and/or amend motorcycle equipment requirements. Please contact the Motorcycle Industry Council offices for additional information concerning motorcycle equipment requirements. Although this chart represents information from the most authoritative sources available as of the date shown above, the Motorcycle Industry Council is not responsible for accuracy or completeness.

Information concerning equipment requirements in Canada can be obtained from the Motorcycle & Moped Industry Council (MMIC) at 3780 14th Ave., Suite 211, Markham, Ontario, Canada L3R 9Y5; Phone/Fax: (905) 470-6123.

Government Relations Office • 1235 Jefferson Davis Highway, Suite 600 • Arlington, Virginia 22202-3261 • (703) 416-044
Executive Office • 2 Jenner Street, Suite 150 • Irvine, California 92618-3806 • (949) 727-4211

Motorcycle Industry Council

GOVERNMENT RELATIONS BULLETIN

August 22, 2000 GRB 00-007

Contact: Kathy Van Kleeck
Tina Hildebrand

State Insurance Requirements for Motorcycles
August 2000

The following chart is a summary of state insurance requirements pertaining to motorcycles.

There are 40 states plus the District of Columbia which require all motorcyclists to carry liability insurance. In addition, New Hampshire requires persons under 18 to show proof of insurance when applying for a driver's license. The remaining states all have financial responsibility requirements for motorcyclists which mandate the deposit of security and the furnishing of proof of financial responsibility for the future after accident involvement. The liability or financial responsibility limits mandated by state insurance statutes are indicated on the chart in parentheses and are in thousands of dollars.

There are 21 states which prohibit insured motorcyclists from rejecting uninsured motorist coverage.

The chart shows those states which have no-fault first party benefit reparation provisions of some sort and how those provisions apply to motorcycles. It also indicates which states have laws addressing insurance discounts for motorcyclists who have completed a rider education course.

1235 Jefferson Davis Highway, Suite 600, Arlington, Virginia 22202 PH: (703) 416-0444 FAX: (703) 416-2269

GRB 00-007

State Insurance Requirements for Motorcycles				
STATE	**COMPULSORY LIABILITY (Minimum Limits)**	**MAY REJECT UNINSURED MOTORIST COVERAGE**	**PROVISIONS FOR NO-FAULT REPARATIONS**	**REMARKS**
Alabama	Yes (20/40/10)	Yes	None	
Alaska	Yes (50/100/25)	Yes	None	
Arizona	Yes (15/30/10)	Yes	None	
Arkansas	Yes (25/50/15)	Yes	No-fault add-on; no limitation on tort rights. Motorcycles not included. Coverage may be rejected in writing by all.	
California	*[1] (15/30/5)	Yes	None	[1]A driver involved in an accident who fails to prove existence of financial responsibility at time of accident shall have driver's license suspended for 1 year.
Colorado	Yes (25/50/15)	Yes	Motorcycles excluded by definition of motor vehicle.	
Connecticut	Yes (20/40/10)	No	No-fault law repealed, effective 1/1/94.	10% insurance discount for graduates of motorcycle rider education program.
Delaware	Yes (15/30/10)	Yes	No-fault add-on; no limitation on tort rights. All registered motor vehicles; certain coverage may be excluded for motorcycles and written subject to certain deductibles, waiting periods, sublimits and reductions.	Insurance discount available for 3 years following completion of rider education program.
DC	Yes (25/50/10)	No	Mandatory no-fault law repealed in 1985. No-fault add-on; no limitation on tort rights. Motorcycles excluded by definition of motor vehicle.	
Florida	* (10/20/10)	Yes	Motorcycles excluded by definition of motor vehicle.	Premium discount required for vehicles with antilock brakes or antitheft devices.
Georgia	Yes (15/30/10)	Yes	None	

State Insurance Requirements for Motorcycles				
STATE	**COMPULSORY LIABILITY (Minimum Limits)**	**MAY REJECT UNINSURED MOTORIST COVERAGE**	**PROVISIONS FOR NO-FAULT REPARATIONS**	**REMARKS**
Hawaii	Yes (20/40/10)	Yes	No-fault add-on. Motorcycles excluded.	15% insurance discount for graduates of rider education program.
Idaho	Yes (25/50/15)	Yes	None	
Illinois	Yes (20/40/15)	No	None	
Indiana	Yes (25/50/10)	Yes	None	
Iowa	* (20/40/15)	Yes	None	
Kansas	Yes (25/50/10)	No	Motorcycle owners may reject coverage.	
Kentucky	Yes (25/50/10 or $60,000 single limit)	Yes	Coverage may be rejected in writing by all. Motorcycles excluded, however insurer must offer for purchase as part of every motorcycle insurance policy the option of basic reparation benefits, added reparation benefits, & uninsured & underinsured motorist coverage. Motorcycle passengers are not bound by tort limitations and retain their right to sue.	
Louisiana	Yes (10/20/10)	Yes	None	
Maine	Yes (50/100/25 & $1,000/person for medical payments)	No	None	
Maryland	Yes (20/40/10)	No	No-fault add-on; no limitation on tort rights. All registered motor vehicles; motorcycles may be excluded from coverage.	
Massachusetts	Yes (20/40/1)	No	All registered motor vehicles; maximum $8000 deductible provided for all vehicles.	10% insurance discount for graduates of rider education program.
Michigan	Yes (20/40/10)	Yes	Motorcycles excluded by definition of motor vehicle; however certain coverage must be offered to motorcyclists at their option.	

State Insurance Requirements for Motorcycles				
STATE	COMPULSORY LIABILITY (Minimum Limits)	MAY REJECT UNINSURED MOTORIST COVERAGE	PROVISIONS FOR NO-FAULT REPARATIONS	REMARKS
Minnesota	Yes (30/60/10)	No	Motorcycles excluded by definition of motor vehicle.	
Mississippi	* (10/20/5)	Yes	None	
Missouri	Yes (25/50/10)	No	None	
Montana	* (25/50/10)	Yes	None	
Nebraska	Yes (25/50/25)	Yes	None	
Nevada	Yes (15/30/10)	Yes	None	
New Hampshire	*[1] (25/50/25)	No	No-fault add-on; no limitation on tort rights. Motorcycles excluded.	[1]Persons under 18 must show proof of insurance when applying for driver's license. Rules may be adopted requiring 10% insurance discount for rider education course graduates.
New Jersey	Yes (15/30/5)	No	Motorcycles excluded by definition of motor vehicle.	
New Mexico	Yes (25/50/10)	Yes	None	
New York	Yes (25/50/10)[1]	No	Motorcycles excluded by definition of motor vehicle.	[1]Minimum limits where death results are 50/100.
North Carolina	Yes (30/60/25)	Yes	None	Insurance companies may apply to Insurance Bureau for insurance discount for rider education course graduates.
North Dakota	Yes (25/50/25)	No	Motorcycles excluded by definition of motor vehicle.	
Ohio	Yes (12.5/25/7.5)	Yes	None	

State Insurance Requirements for Motorcycles				
STATE	**COMPULSORY LIABILITY (Minimum Limits)**	**MAY REJECT UNINSURED MOTORIST COVERAGE**	**PROVISIONS FOR NO-FAULT REPARATIONS**	**REMARKS**
Oklahoma	Yes (10/20/10)	Yes	None	Insurance discount available for 3 years following completion of motorcycle accident prevention course. Excludes graduates attending pursuant to a court order.
Oregon	Yes (25/50/10)	No	No-fault add-on; no limitation on tort rights. Motorcycles exempt.	
Pennsylvania	Yes (15/30/5)	Yes	No-fault law repealed effective 7/1/84. Motor vehicle liability insurance policies must include certain first-party coverages payable without regard to fault. Motorcycles specifically excluded.	
Rhode Island	Yes (25/50/25 or $75,000 single limit)	No	None	
South Carolina	Yes (15/30/10)	No	No-fault add-on; no limitation on tort rights. Coverage optional for all motor vehicles. Motorcyclists may exclude first-party benefits, or choose deductibles, options, or specific exclusions.	Graduates of rider education program may apply for reduction in motorcycle insurance rates.
South Dakota	Yes (25/50/25)	No	No-fault add-on; no limitation on tort rights. Motorcycles excluded by definition of motor vehicle. Coverage may be rejected by all.	
Tennessee	* (25/50/10 or $60,000 single limit)	Yes	None	10% insurance discount effective for 3 years following completion of rider education program.
Texas	Yes (20/40/15)	Yes	No-fault add-on; no limitation on tort rights. Coverage for all vehicles may be rejected in writing.	

State Insurance Requirements for Motorcycles				
STATE	COMPULSORY LIABILITY (Minimum Limits)	MAY REJECT UNINSURED MOTORIST COVERAGE	PROVISIONS FOR NO-FAULT REPARATIONS	REMARKS
Utah	Yes (25/50/15 or $65,000 single limit)	Yes	Motorcycles exempt.	
Vermont	Yes (20/50/10)	No	None	
Virginia	+ (25/50/20)	No	No-fault add-on; no limitation on tort rights. Coverage for all vehicles optional at request of insured.	
Washington	* (25/50/10)	Yes	No-fault add-on; no limitation on tort rights. Motorcycles specifically excluded. Coverage may be rejected in writing.	
West Virginia	Yes (20/40/10)	No	None	
Wisconsin	* (25/50/10)	No	No-fault add-on; no limitation on tort rights. Motorcycles specifically excluded. Coverage may be rejected by all.	
Wyoming	Yes (25/50/20)	Yes	None	

+Insurance or $400 uninsured motor vehicle fee required
*Financial responsibility required