



Scan Team Report
NCHRP Project 20 68A, Scan 09 04

Leading Practices for Motorcyclist Safety

Supported by the
National Cooperative Highway Research Program

September 2011

The information contained in this report was prepared as part of NCHRP Project 20 68A U.S. Domestic Scan, National Cooperative Highway Research Program.

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Acknowledgments

The work described in this document was conducted as part of NCHRP Project 20-68A, the U.S. Domestic Scan program. This program was requested by the American Association of State Highway and Transportation Officials (AASHTO), with funding provided through the National Cooperative Highway Research Program (NCHRP). The NCHRP is supported by annual voluntary contributions from the state departments of transportation. Additional support for selected scans is provided by the U.S. Federal Highway Administration and other agencies.

The purpose of each scan and of Project 20-68A as a whole is to accelerate beneficial innovation by facilitating information sharing and technology exchange among the states and other transportation agencies, and identifying actionable items of common interest. Experience has shown that personal contact with new ideas and their application is a particularly valuable means for such sharing and exchange. A scan entails peer-to-peer discussions between practitioners who have implemented new practices and others who are able to disseminate knowledge of these new practices and their possible benefits to a broad audience of other users. Each scan addresses a single technical topic selected by AASHTO and the NCHRP 20-68A Project Panel. Further information on the NCHRP 20-68A U.S. Domestic Scan program is available at

<http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=1570>.

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Disclaimer

The information in this document was taken directly from the submission of the authors. The opinions and conclusions expressed or implied are those of the scan team and are not necessarily those of the Transportation Research Board, the National Research Council, or the program sponsors. This document has not been edited by the Transportation Research Board.



Scan 09-04 Leading Practices for Motorcyclist Safety

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Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ABATE	American Bikers Aimed Toward Education
AMA	American Motorcyclist Association
CUTR	Center for Urban Transportation Research (Florida)
DOT	Department of Transportation
EMS	Emergency Medical Services
FHWA	Federal Highway Administration
MIC	Motorcycle Industry Council
MRF	Motorcycle Riders Foundation
MSC	Motorcycle Safety Coalition
MSF	Motorcycle Safety Foundation
MSSP	Motorcycle Strategic Safety Plan
MUTCD	Manual on Uniform Traffic Control Devices
NHTSA	National Highway Traffic Safety Administration
PE	Professional Engineer
PTOE	Professional Traffic Operations Engineer
NCHRP	National Cooperative Highway Research Program
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
VMT	Vehicle Miles Traveled

Executive Summary

In March and April 2011, a team of transportation professionals with expertise in highway design, maintenance, data collection and analysis, and motorcyclist safety issues held discussions with representatives from five states, four motorcycle rider advocacy groups, and one manufacturer on infrastructure issues relating to enhancing motorcyclist safety. The scan team focused on infrastructure, event management and travel planning, data collection and analysis, and communication and coordination as topics for discussion. The scan team chose specific states and organizations because of their innovative approaches to enhancing motorcyclist safety and their unique circumstances in hosting major riding events. The team invited motorcycle rider advocacy groups to participate because of their unique interests in promoting rider safety.

The scan team traveled to Florida, Maryland, and Wisconsin. In addition to officials from various organizations in these states, the team met with representatives from South Dakota, Idaho, and the American Motorcyclist Association, the Motorcycle Safety Foundation, the Motorcycle Industry Council, and the Motorcycle Riders Foundation, as well as with individuals from Harley-Davidson USA, and American Bikers Aimed Toward Education (ABATE) of Florida Inc.

Summary of Findings

The scan team gathered information on a broad array of topics and identified some effective practices that could be adopted at the state, city, and county levels. The team reviewed specific approaches to planning, design, operations, maintenance, and communications. These approaches are described in this report.

The team strongly endorses the concept of a motorcycle safety coalition in each state, with a membership representative of all stakeholders in the state. The coalitions provide perspective on the unique riding and handling characteristics of motorized two- and three-wheeled vehicles that are affected by roadway design, construction, and maintenance practices. The most effective coalitions serve as advisory bodies to heads of transportation departments. Formal business plans and frequent, regularly scheduled meetings provide opportunities for timely feedback on current and emerging safety issues. These advisory groups are effective in raising awareness of motorcycling issues among transportation officials, engineering and maintenance personnel, and the traveling public.

The states included in this domestic scan have adopted practices and protocols for highway design, construction, operations, and maintenance that are intended to enhance motorcycling safety. In addition, some of the states have created targeted programs to promote safety at large-scale annual rallies and at popular, but challenging, riding locations. The impetus for many of these programs was the growing awareness of the rising number of motorcyclist fatalities. Riding enthusiasts have increased the awareness of transportation professionals

and other stakeholders of the motorcycle's unique operating parameters.

Discussions with motorcycle rider advocacy groups reinforced the importance of addressing specific infrastructure conditions and standard practices. The advocates represented those who may be significantly affected by roadway design and conditions.

The scan team organized its inquiries around a list of amplifying questions that focused on infrastructure, travel planning and event management, data collection, and communication and outreach, but also touched on behavioral, safety, and legal issues. The topic headings in this report reflect these amplifying questions, and a summary of findings for each area is provided.

This information provided in this report's appendices is as follows:

- Appendix A: Amplifying Questions
- Appendix B: Scan Team Contact Information
- Appendix C: Scan Team Biographical Sketches
- Appendix D: Itinerary and Meeting Schedule
- Appendix E: Host Agency Key Contacts
- Appendix F: Colorado Milling Specification
- Appendix G: References and Additional Internet Resources

Background

Introduction

The National Cooperative Highway Research Program¹ (NCHRP) sponsored a domestic scan of state agencies that have implemented strategies to promote motorcyclist safety. The impetus for this scan is the rising number of riders and passengers who have died on the nation's roadways during the past 15 years.

As can be seen in Table 1.1, motorcyclist fatalities more than doubled from 1996 to 2008. Modest declines in 2009 and 2010 are a welcome reversal of this trend; however, the changing demographics to an older rider population and the increasing popularity of both high-powered motorcycles and low-powered scooters demand focused research to better develop effective safety measures.

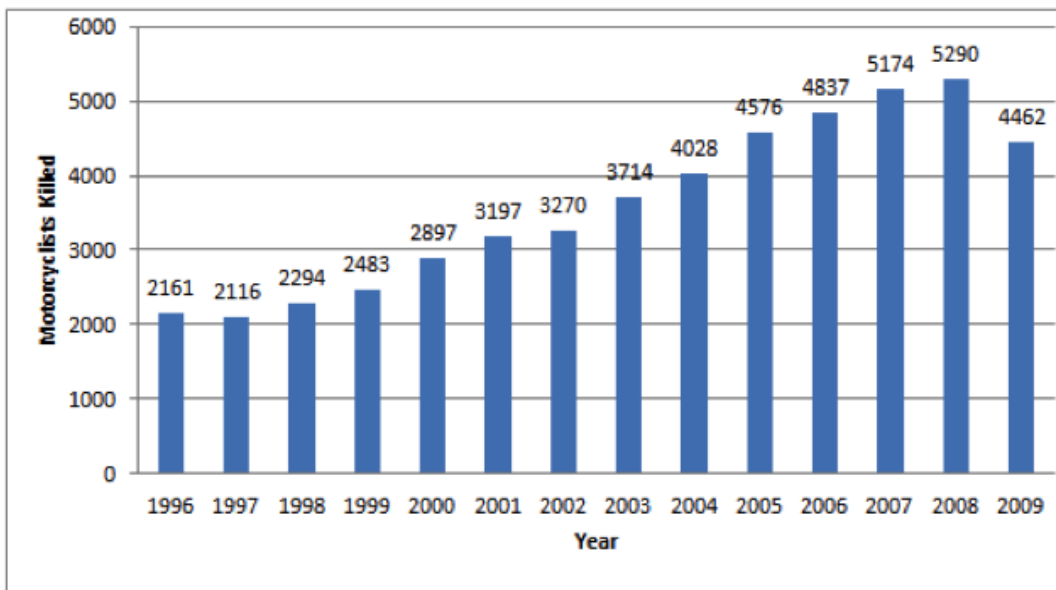


Table 1.1 Motorcyclists killed in crashes over the last 14 years

The design of motorcycles renders them more susceptible to control problems caused by road surface conditions and treatments than are vehicles with more than three wheels. The lack of an occupant enclosure often means that relatively minor control problems can lead to crashes with serious or fatal results. These factors support the need for an examination of highway infrastructure practices and conditions that can affect the occurrence and severity

¹ National Cooperative Highway Research Program, <http://www.trb.org/NCHRP/Public/NCHRP.aspx>

of motorcycle crashes. Practices and protocols adopted by state agencies that have resulted in enhanced motorcyclist safety need to be shared with other state and local organizations to continue the reduction in the number, rate, and severity of motorcycle crashes.

In March and April of 2011, a team of seven transportation safety and engineering experts met with representatives from five states, motorcycle rider advocacy groups, and manufacturers to discuss successful strategies in infrastructure design, construction, maintenance, and operations that enhance motorcyclist safety. The team met with state government transportation officials, university research center staff, and motorcycle industry association staff members and manufacturer representatives interested in promoting the safety of motorcyclists.

The team selected states based on the results of a desk scan that examined state highway strategic plans, conference proceedings, state Web sites, and other sources. States indicating that they employed measures other than rider training to address motorcycle crash factors were identified for consideration. The scan team reviewed the results of the desk scan and selected states for the team to visit to collect information about their programs. Members of motorcycle rider advocacy groups were also targeted to better understand the perspective of this unique segment of the driving public.

The information obtained during the scan team's trip identified several design, maintenance, and operational practices that can improve the safety of motorcyclists.

Purpose

The focus of the scan was on the planning and implementation of infrastructure improvements to improve motorcyclist safety. The scan team also reviewed design, construction, and maintenance policies and initiatives regarding roadside safety devices, traffic operations, work zone practices, and safety data as they relate to motorcyclists. Motorcyclist safety has received increasing attention from state government agencies, rider's groups, manufacturers, associations, and researchers. Some states have benefited from this attention by creating motorcyclist safety coalitions to address mutual concerns.

Making infrastructure improvements is but one part of the overall approach that the federal government has taken in recent years. Both the National Highway Traffic Safety Administration² (NHTSA) and the Federal Highway Administration³ (FHWA) have undertaken studies of motorcycle crashes^{4,5}. A Motorcyclist Advisory Council to the FHWA⁶ (MAC-FHWA) was chartered to provide guidance on improving highway infrastructure design, construction, and maintenance practices. Strategic plans, state assessments, and planning documents have also been developed to reduce the toll of motorcycle crashes in the U.S.

² National Highway Traffic Safety Administration, <http://www.nhtsa.gov/>

³ Federal Highway Administration, <http://www.fhwa.dot.gov/>

⁴ NHTSA Motorcycle Crash Causation Pilot Study, <http://www.nhtsa.gov/staticfiles/nti/pdf/811280.pdf>

⁵ FHWA Motorcycle Crash Causation Study, http://safety.fhwa.dot.gov/safetealu/fact_sheets/docs/ftsht5511.pdf

⁶ Motorcyclist Advisory Council to the FHWA, <http://safety.fhwa.dot.gov/mac/>

Report Organization

This scan report is organized by topic, rather than by itinerary. This organization mirrors the structure of the amplifying questions (see Appendix A), which the team developed to prioritize its goals. The report concludes with recommendations for implementation by federal and state agencies and national organizations.

Scan Team Members

The members of the scan team included transportation agency personnel from four states, FHWA, NHTSA, and a private research corporation. The team members, shown in Figure 1.1, were:

- Richard Schaffer (FHWA Co-Chair), Motorcycle Roadway Infrastructure Safety Program manager, FHWA, Washington DC
- Dennis W. Heuer (AASHTO Co-Chair), administrator, Hampton Roads District, Virginia Department of Transportation (DOT)
- Frances D. Bents (subject matter expert), associate director, Transportation and Safety Research Group, Westat
- Joseph A. Foglietta III, PE, director of Regional Affairs, New York State DOT
- David C. Wieder, PE, Maintenance and Operations Branch manager, Colorado DOT
- Michael J. Jordan, program analyst, Office of Safety Programs, NHTSA
- Pradeep Tiwari, PE, PTOE, assistant director, Roadway Inventory Multimodal Planning Division, Arizona DOT



Figure 1.1 Scan team members (left to right): Narendra Khambhati (Arora and Associates), Pradeep Tiwari, Dick Schaffer, Joseph Foglietta, David Wieder, Fran Bents, and Michael Jordan (not shown: Dennis Heuer)

Scan team contact information is provided in Appendix B; biographical sketches are provided in Appendix C.

Issues of Interest

The purpose of this scan was to visit selected states to collect information with the potential to improve roadway safety for motorcyclists. Prior to the trip, the team conducted a desk scan, searching state strategic highway safety plans and researching the literature and federal and state government agency Web sites for information on motorcycle safety infrastructure planning and improvement. The selected states have practices and policies focused on or contributing to mitigating the occurrence of roadway motorcycling hazards.

The complete list of amplifying questions, which was shared with the focal states, manufacturers' representatives, and motorcycle rider advocacy groups to aid in agenda planning, is presented in Appendix A. Major issues of interest included these items:

- Infrastructure issues relating to motorcycle safety
 - Roadway design, construction, operation, and maintenance practices
 - Pavement treatments
 - Low-cost countermeasures
 - Work zones
 - Training for engineers and maintenance staff
 - Signage
 - Roadside barriers and terminals
 - Traffic controls
- Enforcement issues
 - Law enforcement training in motorcycle-related topics
 - Licensing, registration, and vehicle definition
 - Targeted enforcement
- Travel planning
 - Changing demographics
 - Planning for motorcycle travel
 - Inclusion of motorcyclist safety issues in driver education materials

- Data
 - Collection of motorcycle volumes
 - Details of motorcycle factors in police crash reports
 - Data analysis and usage
- Motorcycle advocacy
 - Design, construction, and maintenance issues
 - Improved data
 - Roadway hazards and cues
 - Engagement with state agencies

Travel Itinerary

During the two one-week trips, the team visited representatives from Florida, South Dakota, Idaho, Maryland, and Wisconsin; South Dakota and Idaho representatives met with the team in Florida. In addition, the team met with representatives from:

- Harley-Davidson Motor Company⁷ (Harley-Davidson)
- American Motorcyclist Association⁸ (AMA)
- Motorcycle Safety Foundation⁹ (MSF)
- Motorcycle Industry Council¹⁰ (MIC)
- Motorcycle Riders Foundation¹¹ (MRF)
- American Bikers Aimed Toward Education (ABATE) of Florida Inc¹²

The team's full itinerary and meeting schedule are provided in Appendix D.

Host Delegations

During the team's two, one-week trips, it met with representatives from the various state transportation agencies, universities, manufacturers' representatives, and motorcycle rider advocacy groups. Host agency key contact information is provided in Appendix E.

⁷ Harley-Davidson Motor Company, http://www.harley-davidson.com/en_US/Content/Pages/home.html

⁸ American Motorcyclist Association, <http://www.americanmotorcyclist.com/>

⁹ Motorcycle Safety Foundation, <http://online2.msf-usa.org/msf/Default.aspx>

¹⁰ Motorcycle Industry Council, <http://www.mic.org/>

¹¹ Motorcycle Riders Foundation, <http://www.mrf.org/>

¹² ABATE of Florida Inc., <http://www.abateflorida.com/>

Infrastructure Improvements

The planning and implementation of infrastructure improvements to enhance motorcyclist safety is the main focus of this domestic scan. How roads and intersections are striped, signed, and maintained, how congestion is handled during large motorcycle events, and how infrastructure is designed for motorcycle travelers each play definitive roles in motorcyclist safety.

A watch phrase the AMA uses for infrastructure safety as it pertains to motorcyclists is:

“Making a mistake on a motorcycle should not result in a fatality.”

Simple mistakes while operating a motorcycle can lead to a fatality for riders, while the same mistake in a car or truck yields few or no consequences. Thus, we must be especially sensitive to the vulnerability of motorcyclists and make our infrastructure design, construction, and maintenance practices more accommodating and forgiving for riders.

South Dakota sequences its construction efforts around the Sturgis Motorcycle Rally¹³ and with motorcycle traffic in mind. For several years, the state has done this in preparation for the rally in the western district, and the practice has expanded to other areas around the state.

Idaho’s Strategic Highway Safety Plan¹⁴ (2nd edition, 2010) has a separate focus area for motorcycles, with the goal of reducing fatalities to 24 or fewer by 2012. This plan includes chapters on engineering, enforcement, education, emergency response, and public policy. The engineering issues identified by the Idaho Infrastructure Advisory Council address all 21 safety infrastructure issues addressed by the governor’s appointed Motorcycle Safety Advisory Council, which was established by the governor’s Executive Order 2005-02¹⁵.

Infrastructure Issues and Mitigation Approaches

Drainage and Shoulders

Rural roads, which are often preferred by motorcyclists, present design and construction challenges for engineers. Narrow rights-of-way available for the roadway, shoulders, and proper drainage features are often present in rural areas. Roadway crowns, while great for drainage, present unique challenges to motorcyclists when they are stopping, turning,

¹³ Sturgis Motorcycle Rally, <http://www.sturgismotorcyclerrally.com/>

¹⁴ Idaho’s Strategic Highway Safety Plan, <http://itd.idaho.gov/ohs/SHSP.htm>

¹⁵ Idaho Executive Order No. 2005-02, <http://www.abateofnorthidaho.org/Documents/Motorcycle%20Safety%20EO6%202005.pdf>

or slowing down. This uneven and unlevel road surface can catch the rider off-guard. Consequently, a rider’s loss of footing may cause him or her to lose control of the motorcycle.

Additionally, many rural roads have narrow, unimproved, or no shoulders. This lack of a recovery area often contributes to motorcycle crashes when a motorcycle leaves the roadway pavement. Maryland has recognized these challenges and is attempting to address them within its roadway network. States should consider adding to or creating shoulders along roadways where limited recovery areas exist.

Communication of Road Conditions

As has been noted, certain physical constraints dictate roadway design. However, communicating these constraints to the rider mitigates the potential for adverse traveling results. Increased signage of potential hazards and the use of motorcycle-specific placards as allowed by the Manual on Uniform Traffic Control Devices¹⁶ (MUTCD) are best practices worth emulating. Advance warning to riders that roads present a steep crown, no shoulder, or other hazard provides riders with useful knowledge to heighten their awareness of road conditions and allow them to adjust their riding behavior.

Harley-Davidson supports the communication of road conditions to the rider. The physics of motorcycling dictates concerns with edge drop-offs, curbs, slick pavement markings (and paint), and the placement, condition, and protection of roadside furniture (e.g., poles for signs or lights). Balancing pavement marking reflectivity with traction is a constant challenge requiring continued vigilance. Additionally, Harley-Davidson is supportive of supplemental warning signage on roadway sections where high motorcycle use has shown large numbers of crashes and rider fatalities.

Similarly, motorcycle-specific signing in construction zones alerts motorcyclists to conditions that otherwise might be unexpected (see Figure 2.1). The South Dakota DOT and the Highway Safety Office are considering using the MUTCD-approved motorcycle placard (W8 15P) to increase messaging that is specific to motorcyclists (see Figure 2.2).



Figure 2.1 Advance notice of changed conditions. This message alternates with “BE PREPARED TO STOP” (photo courtesy of Doug Kinniburgh)

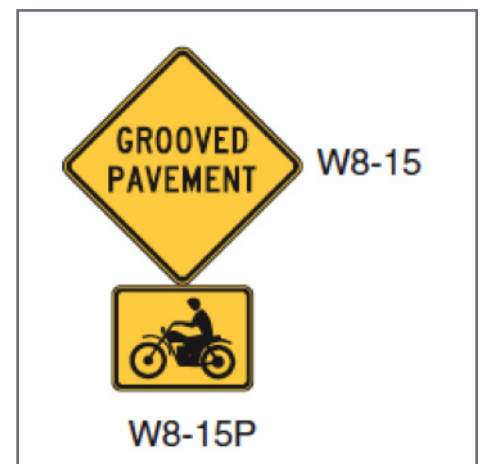


Figure 2.2 MUTCD-approved motorcycle placard

¹⁶ Manual on Uniform Traffic Control Devices for Streets and Highways, <http://mutcd.fhwa.dot.gov/pdfs/2009/mutcd2009edition.pdf>

Portable message boards and dynamic speed display reminders are used in problem areas to help riders comply with safe operating speeds. South Dakota uses portable traffic signals during the Sturgis rally, where traffic must be controlled at certain locations due to dramatically increased volume (see Figure 2.3).



Figure 2.3 Portable traffic signals in Sturgis, South Dakota
(photo courtesy of Doug Kinniburgh)

Pavement Conditions

Milling

Many conditions that are challenging or threatening to motorcyclists may not normally be so intimidating to motorists. The milling of pavement as part of resurfacing operations is one such example. The irregular surface created by the milling of old pavement does not present a vehicle-handling challenge to motorists. However, the irregular and grooved surface, coupled with roadway scaling and loose material, are particularly hazardous to motorcyclists. This is further exacerbated in cases where only one lane is milled and the adjacent lane is in the original condition. This differential pavement height is most critical when a motorcyclist must go from the milled lane (low side) to the original roadway (high side).

Maryland established a mill and pave standard that specifies that a milled lane must be repaved within 24 hours of milling. Additionally, it states that if the height differential is 2½ inches or less, the lane must be signed. In cases where the differential is greater than 2½ inches, Maryland closes the lane. Florida requires that milling and repaving occur during the same day to minimize the impact on motorcyclists. See Appendix F for a discussion of Colorado's milling specification.

Steel Plates

Another infrastructure challenge is the use of steel plates to cover open excavations or similar roadway irregularities. These plates provide little traction to motorcycles, and their thickness presents a hump on the roadway. Maryland has recognized this potential hazard and, when employing steel plates, it recesses them to match the roadway surface, minimizing the speed bump characteristic for nonrecessed use.

Sealants

An important maintenance issue is the practice of sealing roadway cracks to preclude moisture from entering the roadway and the resultant undermining of the roadway pavement and supporting structure. A common practice is to apply hot tar to these cracks. Excess tar can create humps, bumps, and slick surfaces that are hazardous to riders. Without proper control, these “tar snakes” (see Figure 2.4) present opportunities for motorcycle tires to lose traction with the road surface and can result in unintended consequences, including loss of control.



Figure 2.4 Excess sealant (“tar snakes”) reduces surface friction (photo courtesy of Fran Bents)

Maryland has adopted a specification that crack sealants cannot exceed 1/16 inch above the surface of the roadway, thereby reducing these hazards. Florida generally does not use joint sealant or fill cracks since its climate does not include periods of severe freezing. Idaho does the proper preparation, milling, and filling of tar on roadway cracks and uses the Colorado Crack Filling Specification in this application (see Appendix F).

Loose Material

Loose material, such as gravel and sand, also presents hazards to motorcycle riders by interrupting the traction between the motorcycle tires and the roadway. While often annoying to motorists, this loss of traction can be catastrophic to the rider.

As a maintenance practice, sweeping to remove loose sand and gravel is important. It is especially important as winter transitions to spring. The residual sand used during the winter months to enhance traction during snow and ice events becomes a hazard to motorcyclists in the spring and the beginning of a new riding season.

No statewide plan to sweep and clean away abrasives used for winter operations was evident among the states visited during the scan. At best, it is left to the discretion of local highway officials when or even if sweeping operations are conducted. Many states rely on rain to clean the roadways after winter operations. Idaho extends aprons to the right-of-way line to avoid gravel on shoulders and exits and performs aggressive sweeping in the Boise metropolitan area for air quality and motorcycle safety purposes. In South Dakota, pen-face brooms and pick-up brooms are used to sweep all bridge decks in the spring and are centrally located in the western region.

Traffic Control Devices

Traffic control devices can present additional challenges to the rider. In many instances, motorcycle riders are forced to sit through repeated traffic light cycles because the motorcycle does not trip the detector; this is often a function of the loop detectors on the roadway.

Maryland has found that painting cues to guide riders to have their motorcycles straddle the loop detector cut helps trigger the signal; Idaho is also trying this. In those instances where

this technique is ineffective, states are considering replacing the loops with video detection systems to trigger the signal.

Curves

An interesting approach employed in Wisconsin is to sign curves with advisory signs even if the curve can be navigated at the posted speed limit. The thought is that advance warning to motorcyclists (and motorists) alerts them to the challenge ahead. Similarly, Wisconsin is installing chevron signing in curves in areas popular with motorcycle riders. The state is also using specific signage in construction zones to warn of uneven pavement.

Roundabouts

The emerging use of roundabouts presents a common challenge for all motorists, who have to learn the protocols for navigating them. Roundabouts present a unique challenge to motorcyclists. The many pavement markings create a hazard to riders because of the reduced traction on the roadway's markings. Wisconsin is selectively applying pavement markings with a higher skid resistance to address this concern (see Figure 2.5).

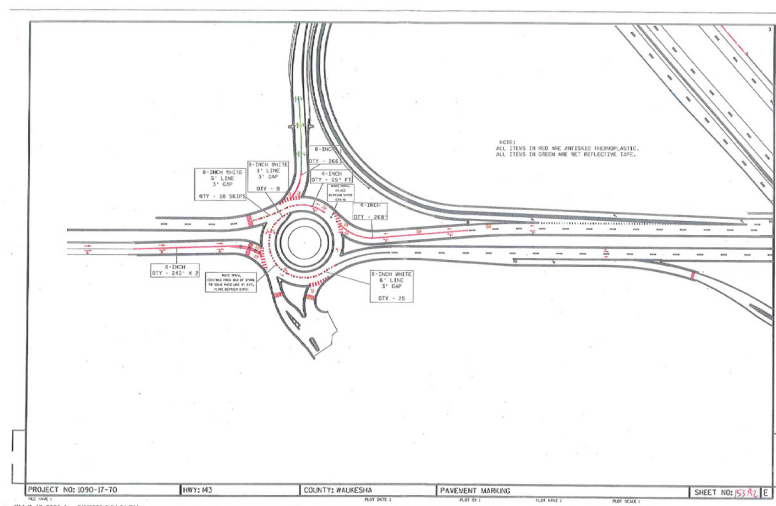


Figure 2.5 Application of high-friction materials in a Wisconsin roundabout

Safety Edge

Another maintenance consideration for mitigating run-off-the-road accidents is the employment of the safety edge. This is a shoe placed on pavers, which produces a wedge-shaped (i.e., triangular) edge to the pavement as asphalt is placed. The intended purpose is to produce a wedged versus a vertical edge of pavement at the shoulder. Should a motorcyclist leave the pavement and ride on the shoulder, the transition back to the roadway pavement is more gradual than navigating a vertical “asphalt wall”, similar to that discussed above during resurfacing operations with milled and existing pavements (see Pavement Conditions Milling). Wisconsin is piloting the use of safety edge on state roads¹⁷.

¹⁷ Safety EdgeSM Introduction, FHWA, <http://www.fhwa.dot.gov/everydaycounts/technology/safetyedge/intro.cfm>

Road Maintenance Crew Training

Training road maintenance crews to be aware of motorcyclist safety issues can be another effective tool. As with any maintenance practice, initial training and follow-up reinforcement is a sustainable method for fostering positive action.

Maryland requires that, within 12 months of hire, all maintenance staff attend a Maintenance Training Academy, which includes awareness of motorcyclist safety issues. The state also reinforces its expectations annually regarding crack sealing, pothole repairs, and sweeping. This simple attention to motorcycle-specific challenges is encouraging.

Idaho, Florida, and South Dakota train staff to be aware of motorcycle infrastructure needs in roadway operations, maintenance, and design. Florida coordinates roadway development and improvement projects with law enforcement, emergency services, and the Motorcycle Safety Advisory Committee to ensure that motorcycle riders' safety concerns are taken into consideration.

Motorcycle Rider Advocacy Group Concerns

The AMA has expressed some concerns regarding common construction and maintenance practices and their potential negative impacts on motorcyclists. For example, when concrete pavements are tined or grooved, signing should indicate such treatments to alert the motorcycle rider to the differences in the motorcycle's handling and traction.

In cases of pavement milling, the milling should follow the road's curves, especially on exit ramps. Oftentimes the milling runs parallel to the direction of travel and fails to follow the ramp, which directs the rider into the shoulder and off the roadway. Milling and other maintenance areas should have an adequate number of signs with enough information to alert the rider to upcoming conditions.

Similar to milling and its effect of serving as a directional indicator is the issue of eradication of old pavement markings. Incomplete eradication presents a distinct challenge to riders, who may be unsure if the pavement markings are merely fading or are no longer valid. Complete eradication of old markings in construction areas is necessary for motorcyclist safety.

Other issues concerning safety and maintenance practices are to:

- Ensure that debris is removed from roadways promptly.
- Repair ruts in the traveled way. This is especially noticeable and hazardous at bus stops, where rutting creates irregular and slick spots (from leaking fluids), which can lead to loss of motorcycle control or overturn of the motorcycle due to irregular and/or slick footing.
- Be aware that detours during construction and weather emergencies may take motorcyclists along gravel roads.

Event and Travel Planning

Motorcycling is unique in that it is the one mode of transportation that annually attracts the riding community to many venues throughout the country. Some of these venues are local, some are regional, and others are of national renown. While some of these events attract attendees in the hundreds, others attract tens of thousands, and it is the combination of the size, scope, and overall logistics of these events that warrants attention from state and local agencies.

Florida

Florida’s climate, ocean beaches, and scenic roadways make it a popular place for the motorcycling community. The state also hosts two nationally known motorcycle rallies, Daytona Bike Week¹⁸ in the spring and Biketoberfest¹⁹ in the fall, with each event attracting over 100,000 attendees.

Florida has also seen an increase in the number of motorcycle registrations over the past two decades. As can be seen in Table 3.1, current motorcycle registrations in Florida are nearly 3.5 times those in 1991; over the same time, national rate just about doubled. Table 3.2 shows that, from the year 2000 and on, motorcycle fatalities, injuries, and crashes kept increasing, with both injuries and crashes peaking in 2008.

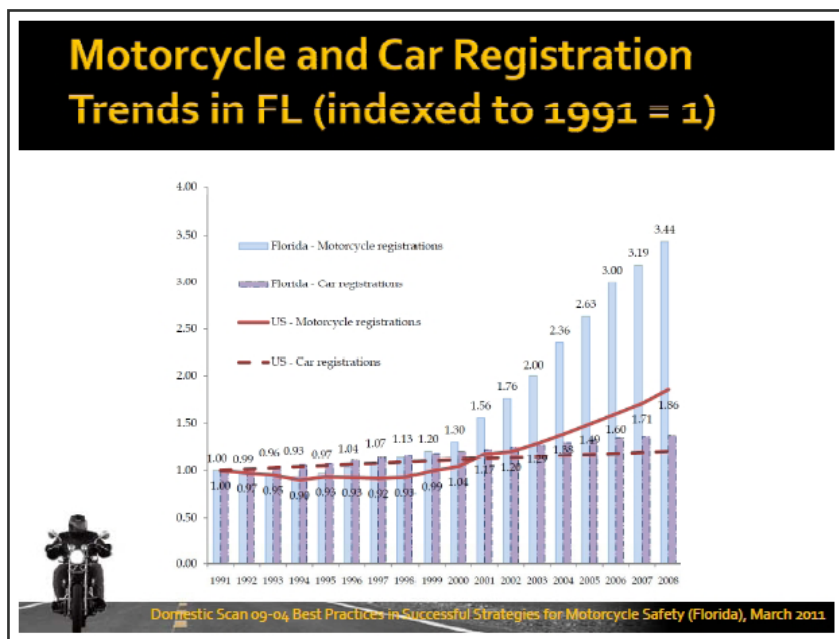


Table 3.1 Florida motorcycle and car registration trends (indexed to 1991 = 1)

¹⁸ Daytona Bike Week <http://www.officialbikeweek.com/>

¹⁹ Biketoberfest, <http://www.biketoberfest.org/>

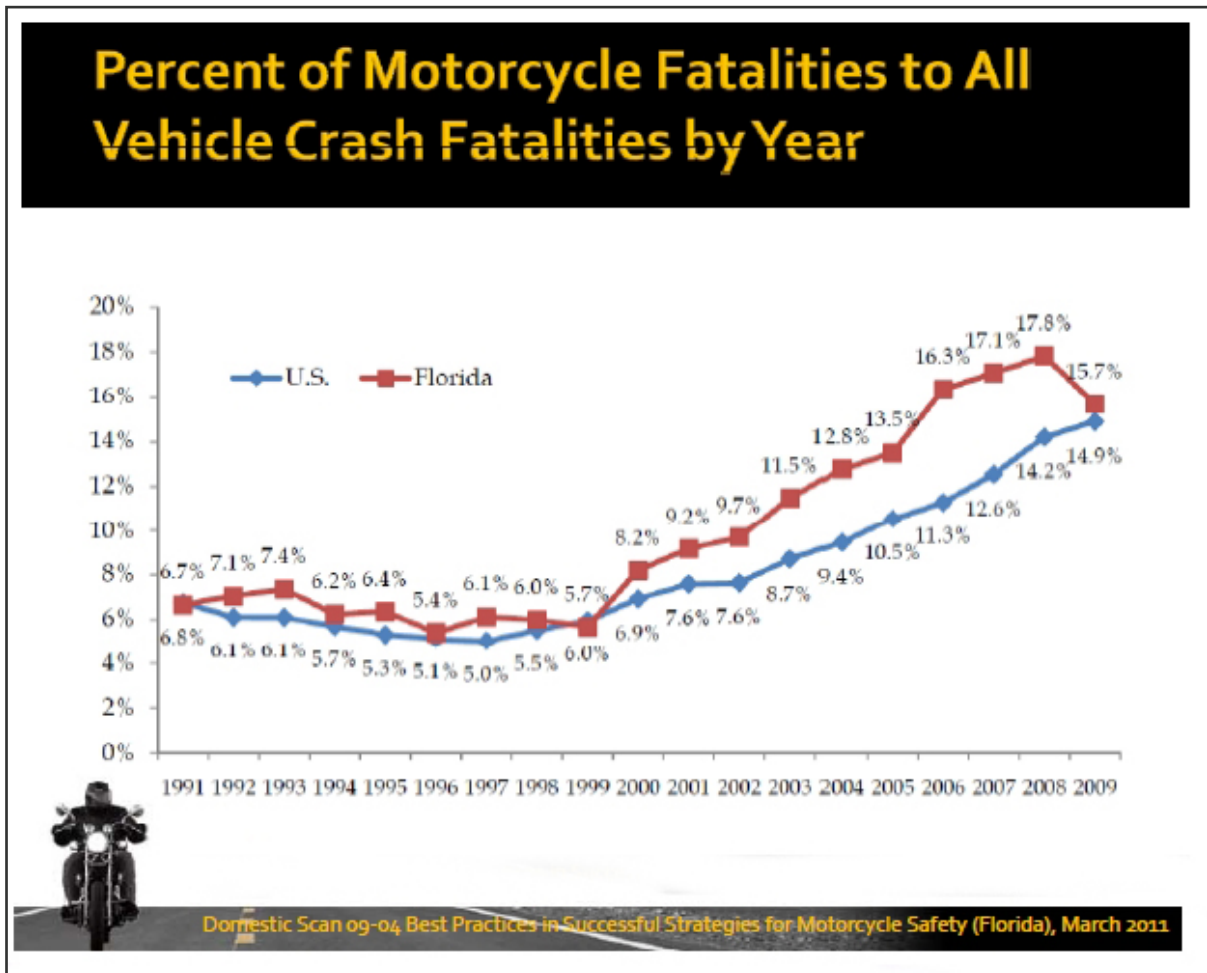


Table 3.2 Percent of motorcycle fatalities to all vehicle crash fatalities by year

Since 2000, this annual increase in motorcycle-related crashes, combined with increased attendance at the two Florida bike rallies, focused media attention on the number of motorcycle crashes, injuries, and fatalities. To address these increasing trends, in 2008 the Florida DOT Safety Office, along with other Florida state and regional agencies, invested their efforts over nine months to develop a five-year Motorcycle Strategic Safety Plan (MSSP)²⁰. This plan sets the vision and goals for motorcycle safety throughout Florida over a five-year period.

One of the more notable developments was the creation of the Motorcycle Safety Coalition (MSC) to help implement the strategies and action steps set forth in the MSSP. The coalition includes representatives from the Florida DOT, the Department of Highway Safety and Motor Vehicles, the Department of Health, state and local law enforcement,

²⁰ Florida Motorcycle Strategic Safety Plan, <http://www.dot.state.fl.us/safety/HighwaySafetyGrantProgram/hsgp/PDF/FloridaMotorcycleSafetyStrategicPlanFinalVersion.pdf>

emergency management, motorcycle safety interest groups, and motorcycle dealers. The MSC assisted with prioritizing the action steps in the MSSP.

In addition to advancing the goals and action steps in the MSSP, the coalition has played an important role in coordinating the state, regional, and local efforts that are needed twice each year for the two Florida bike rallies. These activities span the weeks before and after both events and include an awareness campaign, law enforcement strategies, traffic management, emergency medical services (EMS) deployment, and crowd control. The state, regional, and local representative members credit the coalition with markedly improving the effectiveness of their combined resources and activities.

Florida's MSC members determined after a review of Daytona Bike Week crash statistics that almost 60% of those crashes were the fault of, or caused by, the motorists, not the riders. This resulted in a campaign that is now used to remind motorists to be aware of motorcyclists prior to upcoming bike week rallies. Prior to the two bike weeks, the sign shown in Figure 3.1 is installed throughout the Daytona area along highways, at bus stops, and on large commercial billboards to remind motorists to look for motorcycles.

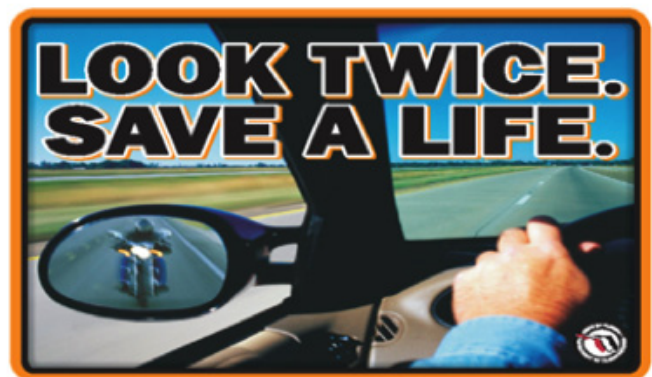


Figure 3.1 Exemplar safety poster developed by Florida's Motorcycle Safety Coalition

Over the years, the size of the Florida rallies has grown. The rally organizers, in coordination with Florida's state and regional oversight agencies, have moved to a more distributed venue system to help manage traffic and crowds. Originally, all events were held in downtown Daytona; however, as attendance at each bike week grew, other organizational strategies were deployed. Daytona Bike Week and Biketoberfest have changed to a multivenue format, where rally events are now held at several locations around the greater Daytona area. This change has resulted in more distributed traffic, less congestion, and better traffic flow.

South Dakota

Like Florida, South Dakota is home to a rally of national renown: the Black Hills Motor Classic (also known as the Sturgis Motorcycle Rally), which has been held every year, usually in August, since 1940. Although this started as a rally for a few hundred motorcyclists, it has grown to a two-week event that sees anywhere from 357,000 to more than 605,000 (see Table 3.3) vehicles, mainly motorcycles, a week entering and leaving Sturgis, a city with a year-round population of 6,600.

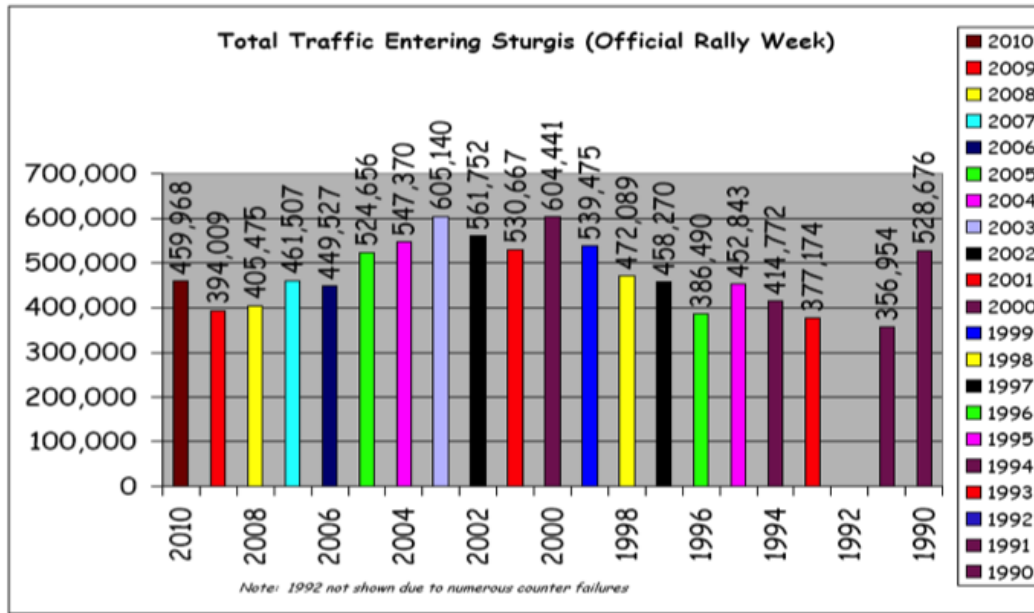


Table 3.3 Traffic counts for Sturgis Rally week

This rally, unlike the two Daytona rallies, occurs in a very rural area. The South Dakota Highway Patrol coordinates the rally with all involved parties (e.g., city and county leaders, Emergency Management Services, and business leaders), who meet to prepare and schedule resources.

The South Dakota DOT begins deploying and installing the traffic management and control equipment about three weeks before the rally. The agency also sequences and sometimes suspends highway construction activities on most roadways leading to Sturgis. This suspension occurs several days before and after the official rally, as well as during the week of the rally.

Since most of the rally attendees are from out of state and are unfamiliar with the area and the roadways, the South Dakota DOT makes extensive use of variable and dynamic message signs to alert and inform motorcyclists (see Figure 3.2, Figure 3.3, and Figure 3.4).



Figure 3.2 Speed reminders



Figure 3.3 This message alternates with “TIGHT CURVES AHEAD”



Figure 3.4 *Approaching multiple venues. This message alternates with “ROCK N REV LEFT AT NEXT LIGHT”*

To keep traffic flowing smoothly, entrances and exits to local rally venues must sometimes be eliminated or restricted during the week of the rally (see Figure 3.5).



Figure 3.5 *Temporary “candlestick” entrance control and lane delineation for a Sturgis motorcycle venue (photo courtesy of Doug Kinniburgh)*

In addition, portable and temporary traffic signals are required to actively manage the tremendous increase in traffic volumes (see Figure 3.6).



Figure 3.6 *Temporary traffic signals in Sturgis, South Dakota (photo courtesy of Doug Kinniburgh)*

Wisconsin

Milwaukee, Wisconsin, is home to Harley-Davidson. Each summer, Harley-Davidson holds the Milwaukee Rally²¹ in downtown Milwaukee and the surrounding suburbs. While this rally is well attended by many riders from across the country, it is the special anniversary rallies (e.g., the 100th, 105th, and the upcoming 110th) that attract the largest crowds and the most venues (see Figure 3.7).



Figure 3.7 *An aerial view of a beach music venue at a recent Milwaukee Rally*

Milwaukee is located on Lake Michigan and, like Sturgis in South Dakota, is very close to Interstate 90. Similarly to Sturgis, the Milwaukee Rally's events are primarily managed by the state highway patrol, with coordination and outreach from the Harley-Davidson community, local law enforcement, EMS, and community leaders.

The rally events also make extensive use of signing in and around the surrounding area (see Figure 3.8, Figure 3.9, and Figure 3.10).



Figure 3.8 *Temporary venue destination signs trail blaze for out-of-state riders*



Figure 3.9 *Permanent variable message signs alert riders to expected destinations*



Figure 3.10 *Temporary variable message signs are strategically placed to direct specific riders to the correct exit*

²¹ Milwaukee Rally, <http://www.milwaukeeerally.com/>

As is the case in Daytona and Sturgis, the Milwaukee motorcycle events employ a distributed venue deployment so that traffic is dispersed around the main location but does not all head for one location at the same time. These venues are typically several miles apart; this separation provides traffic movement and storage on the local roadway system, effectively spreading out and diluting traffic congestion as much as possible (see Figure 3.11). As these events approach 100,000 plus in attendance, this venue separation strategy is critical.



Figure 3.11 Local roads are closed or made “motorcycle only” to facilitate the flow of rally goers and viewers

Data Collection and Analysis

Collection of accurate and adequate safety data is a critical prerequisite to making the right decisions and taking the appropriate corrective measures for motorcycle safety. With the growing focus on motorcycle safety, the U.S. DOT, FHWA, and AASHTO have developed new scientific tools for safety analysis to help state agencies identify safety problems and address them in a systematic manner. These tools have introduced additional requirements for site-specific crash, traffic volume, and geometric data. Section 148²² of the national highway bill SAFETEA-LU²³ has created a new safety infrastructure grant program that places added emphasis on data improvement and requires state agencies to be data driven in developing their safety programs and priorities.

The scan team visited Florida, Maryland, and Wisconsin to get an insight into their ability to collect and analyze motorcycle data. Motorcycle stakeholders from Idaho and South Dakota also participated in the discussion with the team while it was in Florida. As part of the amplifying questions, these states and stakeholders were asked to enlighten the team on:

- How they collect the exposure data (vehicle miles traveled [VMT])
- Which agency is responsible for collecting safety data
- What elements/attributes were related to motorcycles on the crash form
- How motorcycle usage is tracked

Most of the states in the scan collect motorcycle crash data; however, varying degrees of data attributes were captured, depending on the crash form.

Most of the states found it difficult to estimate VMT for motorcycles. VMT is a measure of exposure data, key information that is required to obtain stratified crash rates and carry out a meaningful comparison of motorcycle crashes with other types of crashes. Exposure data



Figure 4.1 Motorcycle crash data are collected in varying degrees of detail

²² SAFETEA-LU vs TEA-21 – Highway Safety Improvement Program, <http://safety.fhwa.dot.gov/safetealu/docs/sidebyside.pdf>

²³ Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users, <http://www.fhwa.dot.gov/safetealu/>

is required in the identification of risk factors in traffic crashes, as this data represents the at-risk population. This allows the analysis of over- or under-representation of motorcycle crashes in the crash population and helps in the identification of risk factors.

Due to their size, metal content, and position within the lane, motorcycles are not detected well by the traditional traffic data classifiers. In addition, most of the seasonal counts undertaken by the transportation agencies are plain volume counts and typically are done on weekdays, when motorcycle usage is lower as compared to weekends.

Florida

Florida is virtually 100% electronic in reporting crash data, which ensures timely availability of data. Florida is fortunate to have the Center for Urban Transportation Research²⁴ (CUTR), a research unit that works hand-in-hand with the Florida DOT's motorcycle safety section and provides detailed trend analyses of crash data. CUTR examines the following sources of data:

- Florida crash data (Florida Department of Highway Safety and Motor Vehicles²⁵)
- Traffic citation data (Florida Highway Patrol²⁶)
- Motorcycle registration data
- Motorcycle endorsement data
- Florida Agency for Health Care Administration²⁷ data
- Observational survey
- Motorcycle program Evaluation and Data Collection
- Event survey

The Florida crash data show an interesting trend: motorcycle injuries are over-represented in the higher age group (>35), although the speeds are lower. The analysis also indicates that a higher percentage of motorists are at fault in motorcycle crashes than are riders.

Florida reports motorcycle travel on a matrix of required vehicle classification categories for FHWA's Highway Performance Monitoring System²⁸. Although Idaho and South Dakota do not collect VMT data, Idaho does track motorcycle usage through registration and endorsement information.

²⁴ Center for Urban Transportation Research, <http://www.cutr.us/programs/ttat/projects.shtml>

²⁵ Florida Department of Highway Safety and Motor Vehicles, <http://www.flhsmv.gov/>

²⁶ Florida Highway Patrol, <http://www.flhsmv.gov/fhp/>

²⁷ Florida Agency for Health Care Administration, <http://ahca.myflorida.com/>

²⁸ Highway Performance Monitoring System, <http://www.fhwa.dot.gov/policyinformation/hpms/states.cfm>

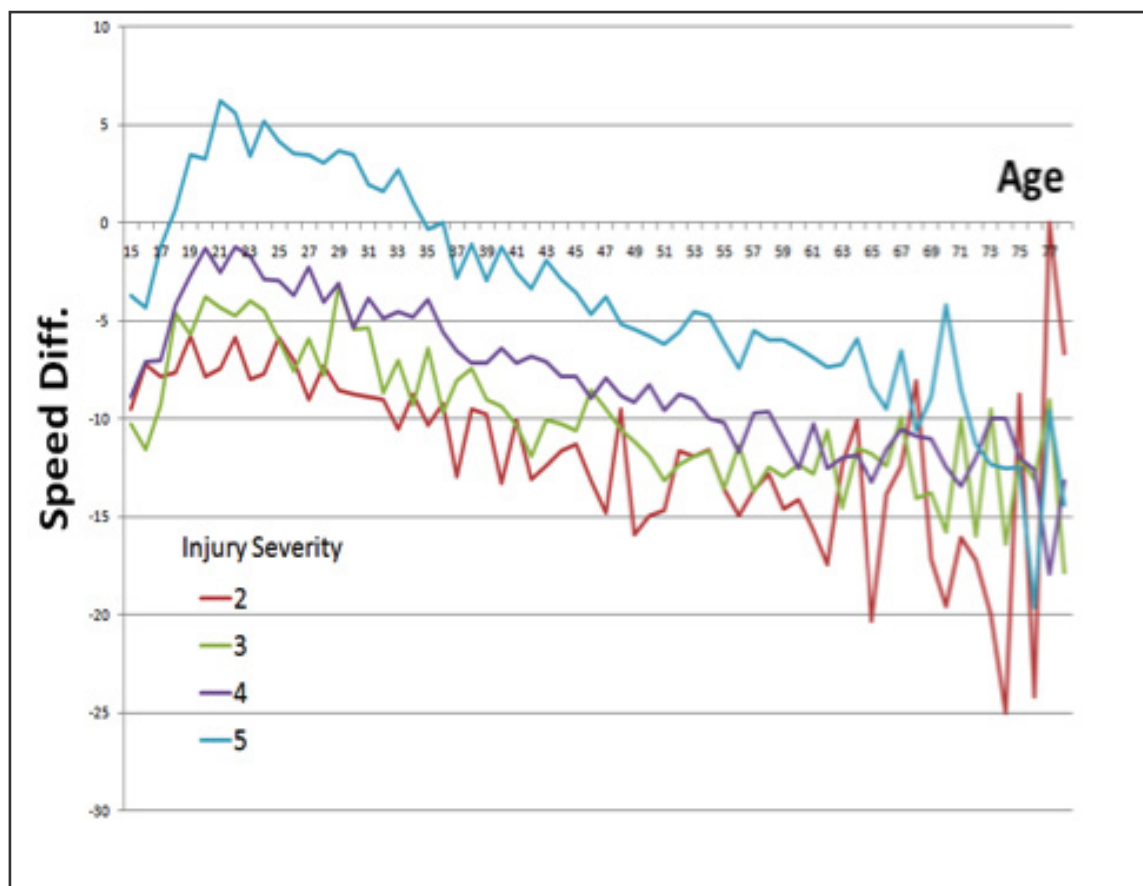


Table 4.1 Speed difference (average) versus injury severity in Florida motorcycle-involved crashes, 2002-2008

Maryland

The Maryland Highway Safety Office conducts extensive data collection and analysis for motorcycle crashes in the state. The reported motorcycle crash record indicates that, when compared with all crashes for all vehicle types, a disproportionate number of crashes are single-vehicle crashes. More than 82% of all motorcycle crashes involve an injury or a fatality. Motorcycle crashes peak during the warm weather riding season (i.e., May through September), with the highest occurrence in July and August. Motorcycle crashes are also more frequent during weekends.

Motorcycle crashes in Maryland are over-represented for riders aged 21 to 49, which is an entirely different observation from what the team found in Florida, where riders over 35 are more pronounced in the motorcycle crash database.

Motorcycle registration and motorcycle-endorsed licensure remain the only available proxy measures in Maryland for motorcycle exposure. Motorcycle registrations were reported to have increased by 75% from 2001 to 2008. However, the aforementioned limitations of technology continue to impair the state’s ability to get an accurate estimate of exposure data.

CHAPTER 5

Coordination and Outreach

A common theme among all states that participated in this domestic scan was the importance of communication and collaboration. The greater the willingness to collaborate and focus on a common issue, the higher the degree of success achieved. The simple act of engaging groups and individuals who might have something to contribute is a powerful gesture that often mitigates future impediments. This section discusses coordination and outreach in the context of three areas: events, infrastructure, and behavior.

Events

Major successful events (e.g., Bike Week and Biketoberfest in Daytona, the Sturgis Motorcycle Rally in South Dakota, Harley-Davidson's Milwaukee Rally, and Delmarva Bike Week²⁹ in Maryland) are examples of effective coordination and outreach. Without providing safe riding experiences and well-planned and well-executed events, riders will not return for future events. The amount of outreach appears proportional to the relative size of the event. Command posts are employed to varying degrees within states hosting large motorcycle events.

South Dakota

In the run up to major events, outreach to the community is important. South Dakota conducts outreach to and coordination with the construction community. Because weather limits the state's prime construction season, South Dakota's robust statewide outreach to engage the construction industry, state transportation officials, and the event planners results in a win-win situation for riders attending the Sturgis Rally, while allowing infrastructure construction improvements to progress.

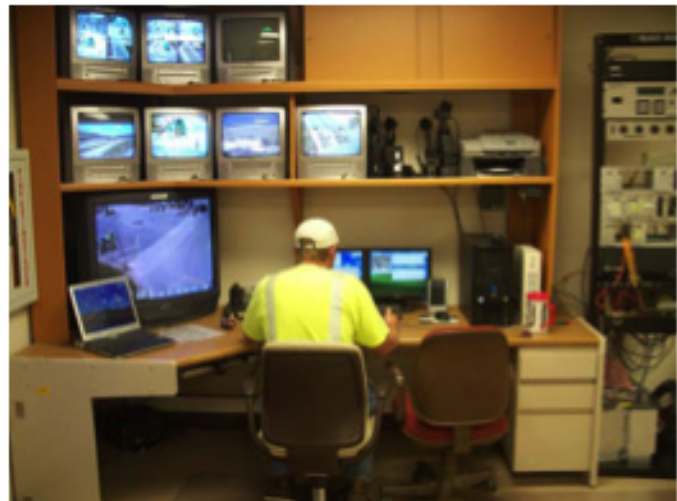


Figure 5.1 Sturgis, South Dakota, command center

²⁹ Delmarva Bike Week, <http://www.delmarvabikeweek.com/>

Coordination and outreach works in South Dakota, especially in the western portion of the state, where the rally is held. Rally leaders conduct daily “ground zero” meetings to analyze intelligence received and hold daily press conferences to disseminate relevant information to the participants.

Florida

In Florida, where the hosting county is the lead, strategic partnerships are utilized to conduct pre-event planning, which transitions to ongoing communication throughout the events. Coordination with various outlets (e.g., AAA Auto Club South³⁰, *Full Throttle*³¹ magazine, and law enforcement) reach down to the local citizens to prepare them for the influx of riders. Instruments such as simple yard signs have proven effective for Daytona Bike Week and Biketoberfest.

Maryland

For Delmarva Bike Week, the Maryland State Highway Administration uses media outlets in advance of the event to make the populace aware that this event will make the event’s beach location somewhat noisier than normal. Law enforcement presence moderates expectations between visitors desiring a peaceful beach experience and those visitors seeking the excitement of mingling with fellow motorcycle riders who converge on this vacation destination. Annual planning events engage the business community and ensure awareness campaigns are held in the weeks leading up to Bike Week.

Wisconsin

In Wisconsin, a multijurisdictional command post is employed for such events as Harley-Davidson’s The Ride Home³² and anniversary events such as The Ride Home’s 90th, 95th, 100th, and 105th anniversaries. Advance planning results in publication of an operations plan, a useful reference for all leaders that is a direct product of inclusive interagency coordination. The command post is located away from the event, enabling leaders to have a higher-level view of the event, which encourages more global decision making and coordination of resources and responses. The state traffic operations center provides a liaison link to the command post in addition to providing input gleaned from the highway cameras. Interestingly, there was no lead project manager/command post commander; however, the system was successful. Mission debriefings and lessons learned from previous plans contributed to this successful strategy.

As in other states, coordination with construction contractors, through the Wisconsin highway department, addresses strategic project shutdowns or accelerations to minimize impact to major motorcycle events. Variable message signs are employed as part of the outreach.

The Harley-Davidson Motor Company participates in mission briefings and provides staff for interagency coordination for major Harley-Davidson events in Milwaukee. Temporary signage and event leaders conducting pre-event route reconnaissance contribute to the success of large events centered on Harley-Davidson in Milwaukee.

³⁰ AAA Auto Club South, <http://www.aaasouth.com/>

³¹ Full Throttle magazine (Florida), <http://floridafullthrottle.com/>

³² The Ride Home, http://www.harley-davidson.com/wcm/Content/Pages/Events/105th_Coverage/ride_home.jsp?locale=en_US

Infrastructure

Wisconsin

Wisconsin's statewide Motorcycle Safety Advisory Council³³ meets quarterly and includes rider advocates, law enforcement, governmental agencies, riders, motorcycle manufacturers, and dealerships in its membership. This council provides a forum for coordination and open discussion regarding motorcycle issues. Agendas are published and minutes are recorded. According to the council, more than half of all crashes involve solely the motorcyclist; the council is currently discussing what actions to take.

Publications that highlight safe motorcycle routes are available. In Wisconsin, advance planning involves Harley-Davidson, which conducts route reconnaissance for many of the larger events. This helps identify road furniture and infrastructure shortcomings from a rider's perspective. It also alerts local jurisdictions of potentially large numbers of motorcyclists visiting their municipalities. Any methods that foster communication, collaboration, and outreach are encouraged.

Florida

Florida sponsors a 28-member MSC³⁴, whose members include law enforcement, trainers, EMS, motorcycle groups, motorcycle rider advocacy groups, and insurance industry representatives. The coalition was launched in 2008 and has implemented a working group structure to develop issue-based strategies and actions regarding motorcycle safety. The Florida MSSP (see Figure 5.2) was published in 2009.

Maryland

Maryland encourages the reporting of road hazards through the local district offices; many states designate a bike and pedestrian coordinator. Similarly, states are beginning to recognize the benefit of a single point advocate for motorcycle-related issues, from maintenance activities to event planning. Identification of a state motorcycle advocate to programmatically coordinate motorcycle-specific issues is employed to varying levels among the states visited.

In Maryland, a safety coordinator's responsibilities include motorcycles, along with bicycles and pedestrians. The focus is predominantly on overall safety and not on technical aspects, such as roadway design and traffic engineering. AASHTO has supported a focus on bike and pedestrian components of transportation; however, it has not yet adopted the same focus on motorcycle-related aspects of transportation.

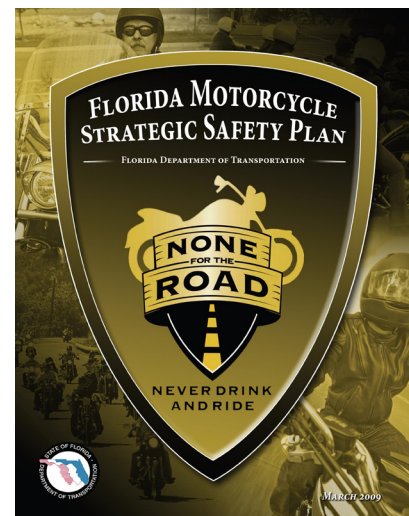


Figure 5.2 Florida Motorcycle Strategic Safety Plan

³³ Wisconsin Motorcycle Safety Advisory Council, <http://www.dot.wisconsin.gov/safety/vehicle/motorcycle/mosac.htm>

³⁴ Ride Smart Florida, <http://www.ridesmartflorida.com/>

Behavior

Wisconsin

Wisconsin uses each interaction between law enforcement and the public as an opportunity to conduct outreach. Whether at a checkpoint or during a traffic stop, the focus is on education. Officers give out business cards at each stop and encourage people to find safe rides homes. Electronic billboards, media releases, and the 511 network are used to notify motorcyclists that traffic laws will be enforced and improper behavior, riding and alcohol/drug consumption, speeding, and reckless behavior, will not be tolerated. Additionally, reminders about the impacts from riding and fatigue, riding and weather (e.g., heat and precipitation), and distractions along the road are broadcast to reach riders so that they can make informed decisions.

Maryland

Maryland's Maintenance Training Academy is an example of outreach beginning with state employees. The academy includes discussions to raise awareness of the effect of maintenance practices on the safe operation of motorcycles. This strategy for outreach educates the maintenance forces and facilitates statewide coverage.

Wisconsin

Training offered through Harley-Davidson, the MSF, and state agencies presents opportunities for outreach and education. Whether mandatory or voluntary, any opportunity to share information with motorcycle riders to improve their ability to recognize, analyze, and properly react to potentially hazardous situations is an effective outreach opportunity.

Harley-Davidson strictly regulates its advertising outreach to present a positive image of motorcycle riding and safety. This outreach encourages the use of proper riding attire, delinks alcohol consumption with riding, and takes a stand of no tolerance for unsafe riding behaviors.

Major motorcycle events also offer opportunities for personal contact with riders. Wisconsin employs THE REF³⁵ (Transportable High-End Rider Education Facility) (see Figure 5.3). This mobile classroom is dedicated to providing training, education, and information to motorcycle riders and the motoring public. Among its functions, two motorcycle simulators are available to demonstrate safe motorcycling techniques and awareness.



Figure 5.3 Wisconsin's THE REF mobile motorcycle training center

³⁵ THE REF, <http://www.zeroinwisconsin.gov/TheREF/>

CHAPTER 6

Advocacy

The scan team surveyed motorcycle rider advocacy groups (e.G., Ama, msf, mrf, and mic), state abate chapters (abate of florida, inc., State legislative trustee), and representatives from harley-davidson. These advocates suggested that state-maintained roads are generally better designed, more efficiently operated, better signed, and better maintained for motorcycle riding than are city and county roads. It is unclear whether initiatives developed by the state agencies and guidance from the federal government are shared routinely with local jurisdictions.



Figure 6.1 Riders traveling to planned events (photo courtesy of Doug Kinnibaugh)

Wide shoulders benefit riders by providing broader riding surfaces, especially on curves, and safer breakdown refuge areas. The advocates endorsed the use of wider shoulders, whenever possible. They also noted that research is needed to explore the safety benefits of various types of guardrails and road furniture. Some riders believe that cable barrier systems are especially dangerous for motorcyclists; however, crash data do not support this conclusion. Impacts with concrete barriers may be more harmful than sliding under the more widely spaced cable barrier systems. The potential of lower rails attached to w-beam units for mitigating rider injuries is as yet untested.

In work zones, it is helpful when outdated lane lines are removed with the least amount of damage to the pavement surface. These outdated markings can be confusing when lanes shift but the old markings are still present. Varying road surfaces and areas where milling is not parallel with the travel path can also present unexpected challenges. These issues can be addressed with improved signage and improved planning.

In Florida, advocates commented that community-based traffic safety teams funded by NHTSA 402 grants³⁶ are very responsive to motorcyclists' concerns. Motorcycle rider advocacy groups view the work of local agencies to address local challenges as beneficial.

Advocates also strongly support law enforcement efforts to remove speeders and intoxicated or impaired drivers/riders from the roads. Pulling dangerous operators from the road benefits all motorists.

³⁶ Section 402 Highway Safety Funds, <http://safety.fhwa.dot.gov/policy/section402/>

Recommendations and Implementation Plan

Based on the information collected during the scan, the team developed recommendations that reflect successful strategies employed by various agencies. These recommendations will be brought to the attention of federal, state, and local highway agencies through a series of outreach activities described below.

Recommendations

Create Motorcycle Safety Coalitions

Each state should create an AASHTO-sponsored MSC of stakeholders, including highway engineering, construction, maintenance, operations, rider training, researchers, police agencies, motorcycle rider advocacy groups, trauma care, EMS, local community leaders, and media outlets. Each coalition should create a mission statement and a specific business plan so that it can measure its progress.

Communicate Roadway Condition Information

Publish all roadway construction, maintenance, and hazardous location information on state DOT Web sites, on social networking media outlets (e.g., Facebook and Twitter), and send the information directly to motorcycle rider advocacy groups. Allow riders and motorists to report hazardous conditions to a state Web site using a 511 network, social media, or similar approach.

Improve Data Collection Technologies and Practices

Improve motorcycle safety data collection technologies and practices to better define safety risks and identify “hot spots” associated with motorcycle safety (e.g., geocode crash locations). Identify and implement sound methodologies for the collection and estimation of motorcycle VMT. Review the crash reports for these locations and send highway maintenance and design staff to visit the sites to determine the need for additional signage, improved friction, wider shoulders, or modification of traffic controls. Have projects be data driven whenever possible.

Share Successful State Strategies with Local Agencies

State agencies should share successful strategies with city and county engineering, maintenance, and traffic operations staff. Information on maintenance and operational improvements

available to the states should be routinely transmitted to departments in local jurisdictions. Motorcyclists often prefer to ride on smaller, rural roads that may not be maintained to the same standards as major highways.

Share Safety Practices and Materials

Share motorcycle-related safety practices and materials available from other states, and the federal government. Two examples are the “Look Twice” video originally produced by the Idaho DOT and modified for use in Florida and Maryland, and “Share the Road” materials from the Florida MSC. The MSF also has extensive safety and education materials available at minimal or no cost.

Establish Standards to Improve Traction on Slippery Surfaces

Conduct research to establish standards to improve traction on slippery surfaces, such as crossbars at intersections and toll plazas, lane striping, and large painted in-road lettering and directional signs, cattle guards, and steel plate surfaces.

Revise the MUTCD to Recommend Motorcycle Placard Use

Encourage the National Committee on Uniform Traffic Control Devices to change the MUTCD guideline for motorcycle placard use from “may” (a suggestion) to “should” (a recommendation). Ensure that the new motorcycle placard is used in work zones and in other locations that present riding challenges, such as sharp curves and areas of frequent high winds.

In the interest of motorcyclist safety, the team recommends that AASHTO’s Standing Committee on Highways³⁷ improve the awareness and training opportunities and provisions in its roadway design guidelines for transportation professionals. For example:

- Establish policies that require milled surfaces to be paved during the same day
- Adopt other mitigating measures, such as transverse and longitudinal tapering and motorcycle-specific signage
- Rout the interior surfaces of pavement cracks before applying sealant during crack-sealing maintenance activities
- Remove all excess sealant to eliminate “tar snakes”

Implementation

The scan program is dedicated to disseminating the scan results to the broadest possible audience. Team members will implement an outreach phase that includes promoting the key findings through this final report, in related publications, by giving presentations, and by sharing ideas with colleagues. The benefits of the scan can only be realized if stakeholders adopt and implement the team’s recommendations.

³⁷ AASHTO Standing Committee on Highways, <http://highways.transportation.org/Pages/default.aspx>

Scan team members will serve as catalysts to encourage and promote broader awareness of motorcycling safety issues and adaptation of the successful practices identified through their efforts. Specific plans include the following:

- Conduct outreach to FHWA, AASHTO, TRB, ITE, MIC and other national organizations for support in improving motorcycle VMT estimates.

Plan: Develop a problem statement for submission to the NCHRP on the lack of valid and reliable motorcycle VMT data.

- Develop guidelines and materials to improve the awareness and training of transportation design, construction, maintenance, and operations staff. Provisions should be made in roadway design guidelines regarding motorcyclist safety.

Plan: Make presentations to appropriate AASHTO, SASHTO, WASHTO, NACTO, TRB, and ITE committees to encourage the FHWA to work with states to develop useful materials and guidelines.

- Implement outreach to encourage states to create MSCs.

Plan: Obtain details from Florida, Wisconsin, and Idaho on the development and operation of their coalitions. Request that Florida prepare a webinar on the topic. Team members will work within their own states to form coalitions, while also identifying other outreach opportunities. Coordinate with the international scan team, which is developing a toolbox on this topic.

- Develop an NCHRP Problem Statement to establish guidelines for pavement marking friction standards. Recommend that a synthesis be performed under NCHRP Project 20-5.

- Deliver Webinars to states and local jurisdictions on the following topics:

- Communication, that is, publish all roadway construction, maintenance, and hazardous location information on state DOT Web sites and social media outlets (e.g., Facebook and Twitter); send the information directly to motorcycle rider advocacy groups. Allow riders and motorists to report hazardous conditions to a state Web site using a 511 network, social media, or similar approach. Share and customize motorcycle safety outreach materials from other states and the federal government.
- Share information about successful strategies with city and county engineering, construction, maintenance, and traffic operations staff.

Plan: Create PowerPoint presentations, distribute the FHWA brochure, and invite the visited states to develop materials for topical Webinars.

- Create an e-document to enhance awareness of motorcycle safety-related issues in construction and maintenance practices.

Plan: Collect and highlight successful strategies in an easy-to-read document, then disseminate it electronically through the NCHRP newsletter, AASHTO newsletter, and FHWA Web site.

- Recommend to the AASHTO National Committee on Uniform Traffic Control Devices³⁸ that the use of the motorcycle placard language be changed from “may” to “should”. **Plan: Ask a statewide traffic engineer to make this recommendation.**

³⁸ National Committee on Uniform Traffic Control Devices, <http://www.ncutcd.org/execboard.shtml>

Appendix A:

Amplifying Questions

After selecting agencies and organizations, the scan team provided amplifying questions to them in advance of the trip. This appendix presents a consolidated list of these amplifying questions sorted into topic categories. The report facilitator created these categories after reviewing the individual team members' responses. During the trip, team members asked additional questions about safety coalitions and communication practices. The results of the law enforcement questions were of limited value, and that topic was incorporated into other responses for reporting purposes. The amplifying questions were organized into the following categories:

Infrastructure Issues Relating to Motorcycle Safety

1. Do you have specific approaches to roadway design, construction, and maintenance practices that consider motorcycling safety? What are the specific motorcycle-related design standards?
2. Do you give special consideration to motorcycles in placement of construction-related items (e.g. metal plates, gravel, channelizing devices, and other potential hazards)?
3. How do you adjust your pavement treatments to accommodate motorcycles?
4. What are your maintenance policies regarding cleanup of sand/chemicals used for winter maintenance, vehicle fluids at intersections, and highway debris? Are these practices statewide or local?
5. Have you employed any low-cost approaches to improving the infrastructure relative to motorcyclist safety? These might include improved traction on pavement markings, reducing tar snakes from crack sealants, rapidly removing roadway debris after weather or other events, applying friction products, and ramping the edges to steel plates.
6. Has your state developed specific guidelines for laying out work zones to accommodate motorcycle traffic?
7. Do you have training for your highway engineers and maintenance personnel relating to motorcycle safety issues? Issues could include spiral curves, roadway debris, and negative super-elevation.
8. What signage and other cues do you employ to help motorcycle riders "read" road conditions and features, such as curves? What guidance exists for state/local agencies on marking roads for motorcyclists? Is the guidance followed?
9. What do you do to notify motorcyclists of specific motorcycle safety hazards, such as edge drop-offs, bridge joints, and surface irregularities?
10. Do you modify roadways after analyzing crash data and frequent crash locations? How?
11. What safety countermeasures are most useful in situations where there is a higher volume of motorcycles? Do you employ specific signage? Do you pave shoulders and eliminate drop-offs in these areas?

12. What part do motorcycles play in the selection and placement of roadway barriers and terminals?
13. What types of detectors do you use for actuated signals at intersections? Have you adopted technologies that detect motorcycles? What are they?
14. Are you using any active traffic management techniques to dynamically allow use of motorcycles on shoulders or other flexible operations, such as queue jumping at intersections?

Enforcement Issues

1. Do you train your law enforcement officers on the cues for detecting impaired motorcyclists?
2. Are enforcement measures targeted at areas of high numbers of motorcycle crashes?
3. What is your state's definition of a motorcycle? Does it follow the Model Minimum Uniform Crash Criteria definition (V8): "It is a two- or three-wheeled motor vehicle designed to transport one or two people. Included are motor scooters, mini-bikes and mopeds"?
4. Have you seen an increase in scooter use (powered two wheelers, 50 cc or less)?
5. Do you require registration/licensing of all scooters and operators?
6. Are motorcycles allowed on High Occupancy Vehicle lanes?
7. Do you conduct motorcycle safety checkpoints? If yes, how do you determine when and where to conduct them?
8. How do you enforce compliance with the state motorcycle helmet use law?
9. What enforcement activities have occurred and/or are planned to address the use of noncompliant helmets?

Travel Planning

1. What kind of long-term planning are you doing for the changing demographics of the traveling public? Commuters? Increase in motorcycles and scooters?
2. Does your state's driver's licensing manual include information about sharing the roadways with motorcycles?
3. Do you have special approaches to infrastructure management for planned motorcycle events (e.g., temporary signage or shut down of work zones)?
4. What approaches do you/should you carry over to routine operations?
5. What are the most important motorcycle safety issues in travel planning?

6. Is motorcycle usage included in travel demand models? If not, why not?
7. Do you formally engage the motorcyclist community in your planning/outreach activities? If yes, how? Has it been beneficial?

Data

1. How do you collect motorcycle exposure data (VMT)?
2. What elements/attributes on your police crash report form are related to motorcycles and how do you use them? Is a barrier or other struck object specifically described in the crash report? What additional information would you like reported on a police crash report? Why?
3. What agency is responsible for collecting motorcycle safety data?
4. Is this data analyzed? If so, how is the data used?
5. How is motorcycle usage tracked?
6. Is vehicle registration the only data used?

Questions for Motorcycle Rider Advocacy Groups

1. Are there specific roadway design issues of concern to your membership? If so, what are they?
2. Are there specific roadway construction issues of concern to your membership? If so, what are they?
3. Are there specific roadway maintenance practices of concern to your membership? If so, what are they?
4. Are there specific cues on the roadway that help riders to “read” the road and anticipate features on the road ahead? What are they?
5. What low-cost modifications can be made to the infrastructure to promote riding safety?
6. What is your definition of a motorcycle?
7. What law enforcement activities do you think are effective in promoting riding safety?
8. How can improved motorcycle VMT data be obtained? What factors should be considered?
9. What are the primary motorcyclist safety issues concerning your members?
10. Do you formally engage state agencies in promoting motorcyclist safety? If so, how do you do so?
11. What activities do you sponsor to reduce impaired riding? Promote protective gear? Promote proper licensing?

Appendix B:

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Appendix C:

Scan Team Biographical Sketches

DENNIS W. HEUER (AASHTO Co-Chair) is the Hampton Roads District administrator for the Virginia DOT, located in Suffolk. He currently leads 1000 state employees delivering construction, engineering, maintenance, and operations services over 7400 lane miles of highways in southeastern Virginia. He also manages a ferry system, four bridge-tunnels, and a toll bridge with an annual district budget of over \$400 million. Prior to joining Virginia DOT, Heuer served as a program and project manager for Thompson Engineering in Mobile, Alabama, after retiring from the U.S. Army as a leader of engineer units. Heuer earned a bachelor's degree in aerospace engineering from the Polytechnic Institute of Brooklyn, New York, and a master's degree in civil engineering from the Pennsylvania State University. He is a registered professional engineer in 13 states, including Virginia. Professional memberships include ASCE, ASHE, and the Harley Owners Group (HOG), where he has merged his interest in road and bridges with motorcycle safety.

RICHARD SCHAFFER (FHWA Co-Chair) is the Motorcycle Roadway Infrastructure Safety Program manager for the FHWA's Office of Safety in Washington, D.C. In addition, he manages the Bicycle and Older Road User safety programs within the Office of Safety. He is a member or friend of many committees and task forces, including the TRB Motorcycle and MOPED, Bicycle Transportation, Pedestrian, and Federal Lands and National Parks Committees. Before joining the Office of Safety, Schaffer served as the Transportation Planning manager for Cochise County Arizona and as a transportation scholar with Saguaro National Park. He holds a bachelor's degree in geography and a master's degree in public administration from the University of Colorado in Boulder.

FRANCES D. BENTS (Subject Matter Expert) is an associate director with Westat. She manages the Evaluation Design for Motorcycle Countermeasures contract for the FHWA and was the facilitator for the Motorcyclists' Advisory Council to the FHWA (MAC-FHWA). Bents was the primary author of the Motorcyclist Safety White Paper for the Toward Zero Deaths initiative. She also developed and managed the pilot Motorcycle Crash Causation and Outcomes study for the NHTSA³⁹ and is the project director for the Motorcycle Crash Causation Study for the FHWA. Bents has been involved with traffic safety research since 1975, specializing in field data collection and crash investigation. She holds a bachelor of science degree with honors from Towson University. Professional affiliations include past officer of the Women's Transportation Seminar, instructor for the Society of Automotive Engineers, and treasurer and member of the Board of Directors of the Association for the Advancement of Automotive Medicine.

JOSEPH A. FOGLIETTA III is the director of the Office of Regional Affairs for the New York State DOT in Albany. In this position, Foglietta provides main office management oversight for the DOT's 11 regions and helps ensure consistent communication of department policies and initiatives. In 2006, he was appointed the regional design engineer in Region 9 Binghamton. Foglietta has worked for New York State DOT since 1977, when he started

³⁹ U.S. DOT FHWA Motorcycle Crash Causation Study, http://safety.fhwa.dot.gov/safetealu/fact_sheets/ftsht5511.cfm

his career in Region 8 Poughkeepsie as a junior engineer in the Construction Group. He has managed a variety of functions within the region, including the Parkway Design Unit and the Major Projects Design Group. He holds a bachelor's degree in civil engineering from the University of Colorado and is a registered professional engineer in the State of New York.

DAVID C. WIEDER is the Maintenance and Operations branch manager for the Colorado DOT. In this role, he establishes the budget for the nine maintenance and six traffic sections throughout the state. He oversees the maintenance of the state's infrastructure, including pavement structures, bridges, minor structures, tunnels, sweeping, lighting, signing, signals, and striping. Also under his management is winter maintenance, including equipment, de-icers, and avalanche control and mitigation. Wieder is responsible for ensuring consistency in maintenance throughout the state by promulgating procedures and policies regarding maintenance of the infrastructure. For the 22 years he was with the Colorado DOT prior to assuming his current role, Wieder managed the design and construction of highways and bridges throughout the state as an engineering manager, a construction project engineer, and as a design project manager. Wieder holds dual degrees from the University of Colorado in geology and civil engineering, and is a licensed professional engineer in Colorado. He serves on the Clear Roads Technical Advisory Committee, the Pacific Northwest Snowfighters Pooled Fund Study, the Maintenance Decision Support System Pooled Fund Study, and the AASHTO and Western Association of State Highway and Transportation Officials (WASHTO) subcommittees on Maintenance.

MICHAEL JORDAN is a program analyst for the NHTSA, Office of Safety Programs, Safety Countermeasures Division. In this position, Jordan oversees the development and demonstration of safety countermeasure programs and initiatives to improve motorcyclist safety by affecting operator behavior. He is responsible for addressing multiple subject areas that relate to motorcycle safety, including alcohol- and drug-impaired riding, personal protective equipment, operator licensing, rider education and training, law enforcement and adjudication, speed management, legislation and regulation, data and evaluation, motorist awareness and rider conspicuity, program management, and highway engineering. Jordan received a bachelor of science degree from Shepherd University, Shepherdstown, West Virginia.

PRADEEP TIWARI is currently assistant director of the Roadway Inventory Management Section, Arizona DOT. The principal responsibility of this section is administering several FHWA programs, including the Highway Performance Monitoring System (HPMS) and the Traffic Monitoring Program. HPMS is the official federal government source of data on the extent, use, condition, performance, and operating characteristics of the nation's highways. From a national perspective, the FHWA's primary intent with this program is to provide Congress with a policy tool for major highway legislation and funding decisions. Tiwari has more than 30 years of experience in managing road and traffic engineering projects. He is

⁴⁰ SafetyAnalyst, <http://www.safetyanalyst.org/>

member of the AASHTO Task Force for deployment of SafetyAnalyst software⁴⁰ in the state DOTs and is a panel member for NCHRP Project 17-46 (FY 2010), “Comprehensive Analysis Framework for Safety Investment Decisions.” Tiwari is a professional engineer in Arizona and possesses a professional traffic operations engineer certification. Pradeep has a bachelor’s degree in civil engineering and a master’s degree in transportation systems engineering.

Appendix D:

Itinerary and Meeting Schedule

APPENDIX D : ITINERARY AND MEETING SCHEDULE

Date/city	Meeting topic/agency	Presenter
March 13, 2011 Orlando, FL	Team meeting	
March 14 ⁴¹ Orlando, FL	Welcome to Florida	Marianne Trussell, Chief Safety Officer, Florida DOT State Safety Office, Tallahassee, Florida
	Introductions of the Scan and Scan Team	Dick Schaffer, FHWA Scan Team Co-Chair, Office of Safety Integration, FHWA
	South Dakota Briefing: "Engineering Strategies for the Sturgis Motorcycle Rally"	Doug Kinniburgh, Region Traffic Engineering Supervisor, South Dakota DOT
	South Dakota Briefing: "Highway Safety Strategies for Sturgis and Statewide Motorcycle Safety"	Lee Axdahl, Office of Highway Safety, South Dakota Department of Public Safety
	Florida Briefing	Trenda McPherson, Florida DOT, Traffic Safety Specialist - Motorcycle Program Coordinator
	MSSP/Business Plan with Emphasis Areas	Trenda McPherson
March 15 Orlando, FL	Panel discussions with Florida Representatives in Reference to Amplifying Questions	
	Infrastructure	Fred Heery and Chester Henson
	Enforcement	Mark Welch and Dominick DeSiato
	Travel Planning	Chanyoung Lee and Trenda McPherson
	Data and Analysis	Aldo Fabregas and Michael Lo
	Motorcycle Rider Advocacy	Darrin Brooks and Michele Sullivan
	Florida Educational Tour	
	Turnpike's Turkey Lake TMC Tour	
	SMART Trainer Demonstration	Kip Bickford
	Static Trainer Demonstration	Michele Sullivan
March 16 Orlando, FL	Inspection Station	Dominick DeSiato
	Florida: Successful Implementations and Best Practices	
	EVAC Ambulance	Mark O'Keefe
	Trauma Project	Patricia Byers
	Data and Analysis	Chanyoung Lee
	Communications	Pei-Sung Lin and Mark Welch
	Motorcycle Safety Coalition	Trenda McPherson and Pei-Sung Lin
	Florida's Strategic Highway Safety Plan	Marianne Trussell
	Idaho Briefing	Brent Jennings, Idaho DOT, State Highway Operations and Safety Engineer
Team meeting		

Date/city	Meeting topic/agency	Presenter
April 4 Baltimore, MD	Team meeting	
	Best Practices in Maryland	Peter Moe, State Highway Administration, MSHO
	University-Based Motorcycle Data Analysis in Maryland	Dr. Patricia Dischinger and Cindy Burch, National Study Center for Trauma and Emergency Medical Services Systems
	University of Maryland Center for Advanced Technology Transfer	Dr. Michael Pack, CATT, UMD
April 5 Baltimore, MD	Roundtable I	Peter Moe, SHA Staff
	Maryland Motor Vehicle Administration	Phil Sause, Maryland MVA
	Motorcycle SMART Trainer Demo	Phil Sause, Maryland MVA
	A Comprehensive Review of Motorcycle Crashes in Maryland	Jean-Yves Pont du Jour, SHA
	Roundtable II	Dr. Mansureh Jehani, Morgan State University
April 6 Baltimore, MD	Roundtable II	Peter Moe, SHA Staff
	Presentations and discussions with motorcycle rider advocacy groups:	
	American Motorcyclist Association	Ed Moreland
	Motorcycle Riders Foundation	Jeff Hennie
	Motorcycle Safety Foundation	Tim Buche
	Motorcycle Industry Council	Kathy Van Kleeck
April 7 Milwaukee, WI	Travel to Wisconsin	
	Statewide Traffic Operations Center Event Planning	Tom Heydel and Scott Silverson
April 8 Milwaukee, WI	Roundtable discussion	
	Harley-Davidson presentations	Brook Smith and Nathan Boyd
April 9 Milwaukee, WI	Roundtable discussion	
	Final team meeting	
	Return home	

⁴¹ Links to some of the presentations given in Orlando can be found at <http://www.cutr.usf.edu/programs/its/domesticscan.shtml>

Appendix E:

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Appendix F:

Colorado Milling Specification

Colorado Specification for Milling

Roadway surfaces that have been milled for any reason present a unique challenge to the motorcyclist. The rough texture of the surface tends to destabilize the motorcycle, causing challenges to even the most experienced rider. Adding to this challenge is the effect of milling that is not parallel to the travel direction. The combination of surface texture and milling direction can redirect the motorcycle to the point of loss of control.

Several states have adopted diverse strategies to address this issue. Many states require the milled portion of the roadway to be closed to traffic until it has been repaved. Other states address smoothness specifications to mitigate the effects of the milled surface. For instance, Colorado specifies smoothness in this Project Special Provision.

The existing pavement shall be milled to the cross-slope as shown on the plans, and shall have a surface finish that does not vary longitudinally or transversely more than 3/8 inch from a 10 foot straightedge.

The milled surface shall have a macrotexture equal to or less than 0.170 inch for single-lift overlays and 0.215 inch for multiple-lift overlays as tested in accordance with CP 77. Milled surfaces that do not meet these criteria shall require corrective action in accordance with the QCP. The Contractor shall be responsible for testing the macrotexture of the milled surface at the location directed by the Engineer in accordance with CP 77 at a stratified random frequency of one test per 10,000 square yards or a minimum of once per work day.

Other challenges presented to the rider are the transverse and longitudinal vertical edges presented by milling. Again, various strategies are used to address this issue. Many states opt for closing the milled lane. Other states require it to be repaved the same day. Closing lanes can present a relative high user cost depending on the average daily traffic. Repaving the same day may add cost to the project. Some states opt to taper both transverse and longitudinal joints. Here is an excerpt from the same Project Special Provision from the Colorado DOT.

At the completion of each day's work, longitudinal vertical edges greater than 1 inch shall be tapered. No transverse vertical edges will be allowed. Longitudinal milled surface tie-ins to existing pavement shall be tapered to not less than a 3:1 slope, transverse milled surface tie-ins to existing pavement shall be tapered to not less than a 50:1 slope. Transverse tapered joints may be tapered with the planing machine, a temporary asphalt ramp, or other methods approved by the Engineer. No longitudinal joint between the milled and existing surfaces shall fall between 1 to 5 feet of any lane line.

Colorado Paving Specification

Paving presents the same challenges as milling and are addressed in the Colorado DOT's Plant Mix Pavements Standard Specification.

Where paving operations are on the present traveled roadway, the Contractor shall arrange paving operations so there will be no exposed longitudinal joints between adjacent travel lanes at the end of a day's run. With the approval of the Engineer, the Contractor may leave an exposed longitudinal joint conforming to the following:

- (1) When the thickness of the pavement course being placed is 1.5 inches or less a vertical exposed longitudinal joint may be constructed.
- (2) When the thickness of the pavement course being placed is greater than 1.5 inches the joint shall be constructed according to one of the following:
 - (i) The entire joint shall be tapered 3:1 or flatter. A taper steeper than 3:1 shall be considered vertical.
 - (ii) The top portion of the longitudinal joint may be vertical. The vertical portion shall be a maximum of 1.5 vertical inches. The remainder of the joint, below the vertical portion, shall be tapered 3:1 or flatter.

Colorado Crack Filling Specification

Immediately before applying hot poured joint and crack sealant, the cracks shall be cleaned of loose and foreign matter to a depth approximately twice the crack width. Cleaning shall be performed using a hot compressed air lance. This lance shall be used to dry and warm the adjacent asphalt immediately prior to sealing. Direct flame dryers shall not be used.

These cracks shall be filled with hot poured joint and crack sealant flush with the pavement surface. Immediately following the filling of the crack, excess sealant shall be leveled off at the wearing surface by squeegee, a shoe attached to the applicator wand, or other suitable means approved by the Engineer. The squeegeed material shall be centered on the cracks and shall not exceed 3 inches in width or 1/16 inch in depth.

Appendix G:

References and Additional Internet Resources

American Association of State Highway and Transportation Officials Communications Brief: State Departments of Transportation Lead the Way Using New Media, <http://AreWeThereYet.transportation.org>

MAIDS, Motorcycle Accidents In-Depth Study, Association of European Motorcycle Manufacturers, European Commission, April 2009. http://www.motorcyclesafetyinfo.com/motorcycle_accident_in_depth_study.html

National Cooperative Highway Research Program Project 08-81, Improving the Quality of Motorcycle Travel Data Collection, <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2956>

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