

Motorcycle Crashes and its Implications to Local Roads

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Agenda

- Overview of Puerto Rico
- Road safety fundamentals
- Motorcycle research methodology
- Trends in motorcycle registrations and fatalities in Puerto Rico
- Comparison of motorcycle-related crash elements in California and Puerto Rico
- Relevant motorcycle crashes statistics in US Southeast Region and Puerto Rico
- Contributory factors of motorcycle crashes in local roads
- Safety countermeasures and recommendations



An Overview of Puerto Rico

- 3,500 sq. mi.
- 2.3 million licensed drivers
- 115,000 registered motorcycles
- 504 road fatalities
- 3.84 million inhabitants
- 2.8 million registered motor vehicles
- 26,647 kilometers of roads

Puerto Rico's Highway System



80% urban roads

77% local roads

OUR MISSION

plan, design, operate, and maintain
streets and highways

provide a balanced system for the movement of
people and goods

safe, rapid, comfortable, convenient,
economical, and environmentally compatible



When does a road can be considered
SAFE for motorcycle riders

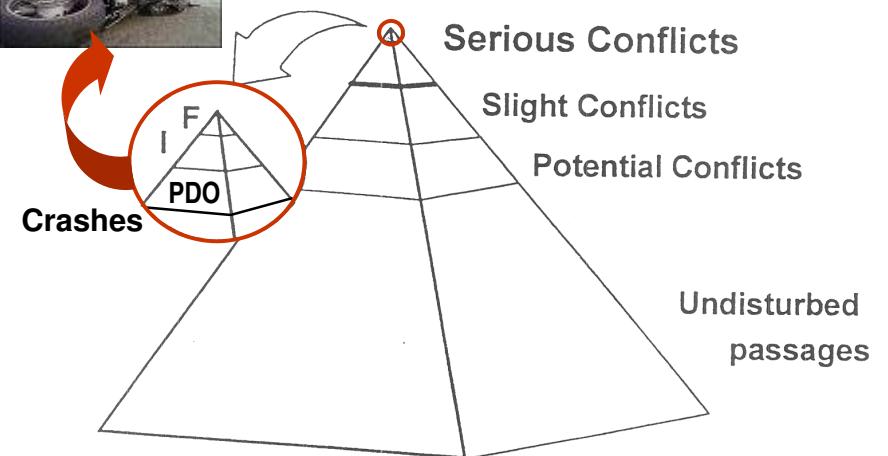


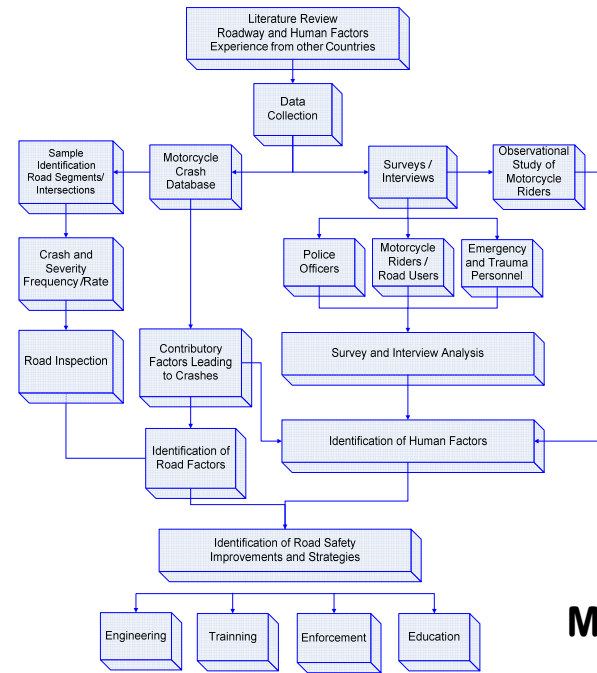
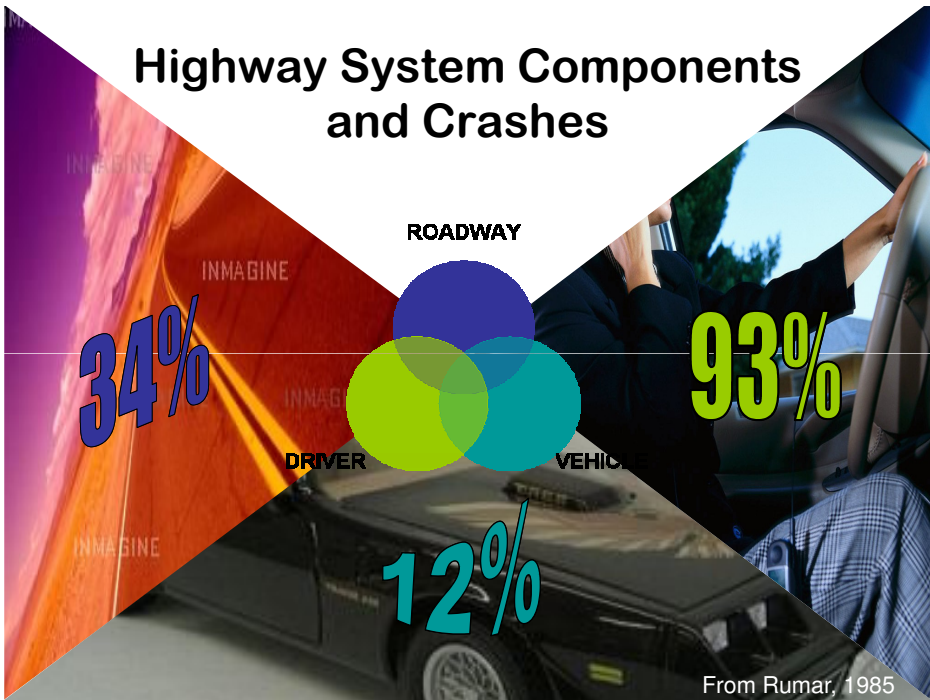
How to Measure Road Safety



- **Nominal safety** – determined by compliance with design guidelines and standards
- **Objective safety**
 - Measured with crashes
 - Likelihood of crash on the road for a particular driver
- **Subjective / perceived safety**
 - Safety as perceived and interpreted by drivers
 - Driver behavior / speed selection

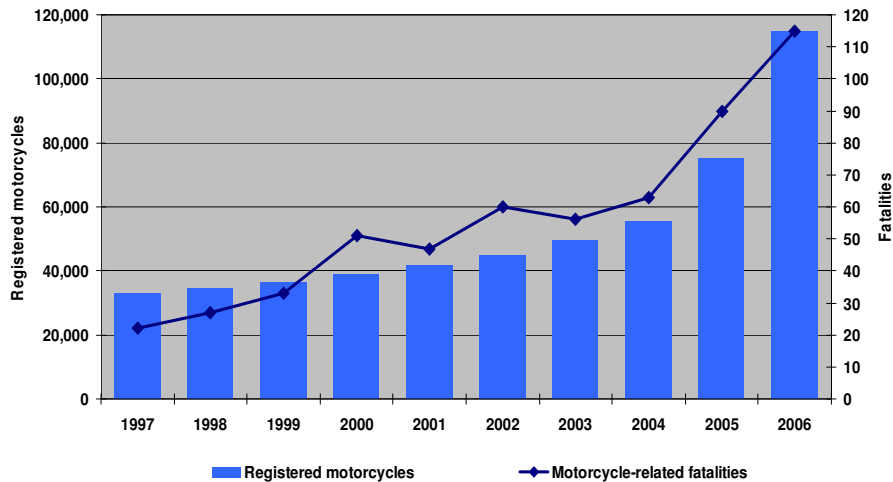
Pyramid of Highway Traffic Events





Motorcycle Research Methodology

Trends in Motorcycle Registrations and Fatalities in Puerto Rico (1997-2006)



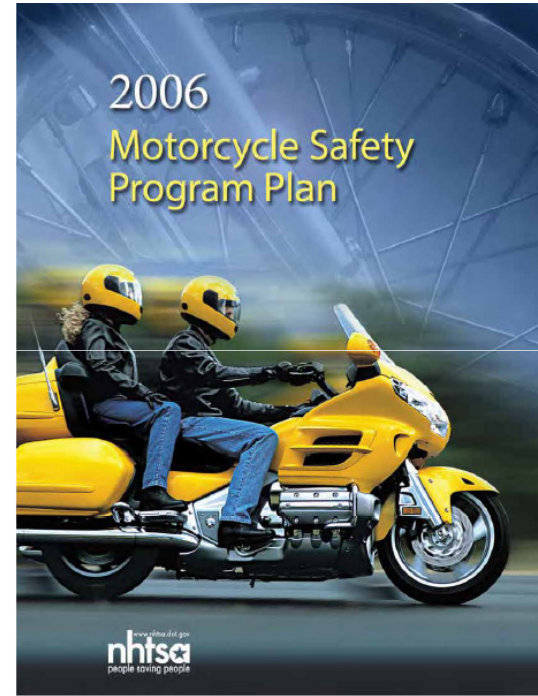
Crash-related Elements	Hurt Report, California (1981)	Puerto Rico (2002-04)
Crash type	2.6% property damage only (PDO) 97.4% injury or fatal	40.1% property damage only (PDO) 59.9% injury or fatal
Area type	9.4% occurred in a rural area	18.5% occurred in a rural area
Road classification	55.9% occurred on arterial highways	29.7% occurred on arterial highways
Crash location	59.7% occurred in roadway segments	75.2% occurred in roadway segments
Roadway alignment	81.3% on straight and level segment	75.7% on straight and level segment
Maneuver type	29.5% right angle crashes	17.5% side crashes in same direction
Traffic control type	25.5% in signalized intersections	8.9% in signalized intersections
Roadway defects	2.0% were caused by roadway defects	3.0% were caused by roadway defects
Gender of riders	97% of motorcycle riders were men	95% of motorcycle riders were men
Age of riders	62.6% between 17-26 years old	35.6% between 26-35 years old
Fatality rate (2006)	6.90	19.83

Relevant Motorcycle Crash Statistics

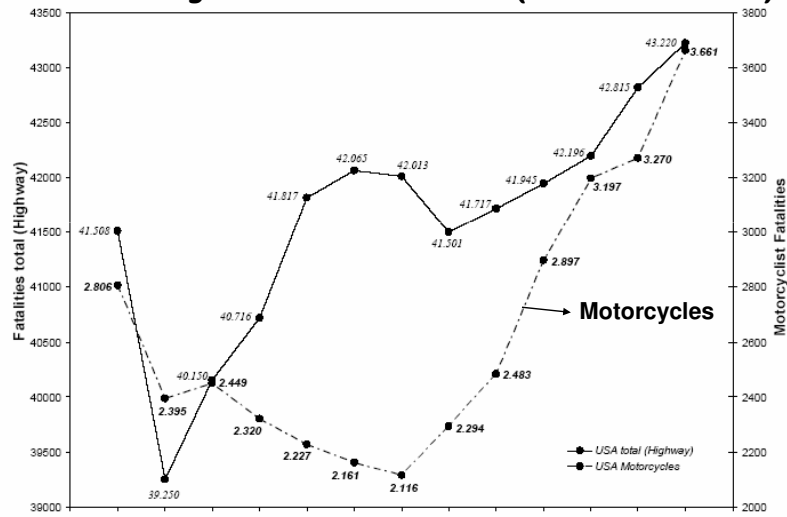
Southeastern Region of U.S. and Puerto Rico



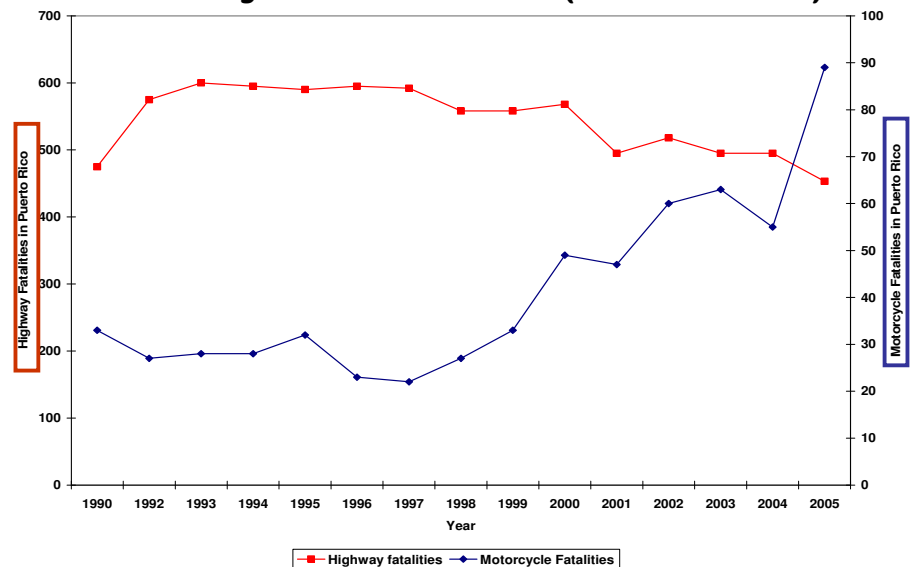
Source: NHTSA, 2006. Motorcycle Safety Plan



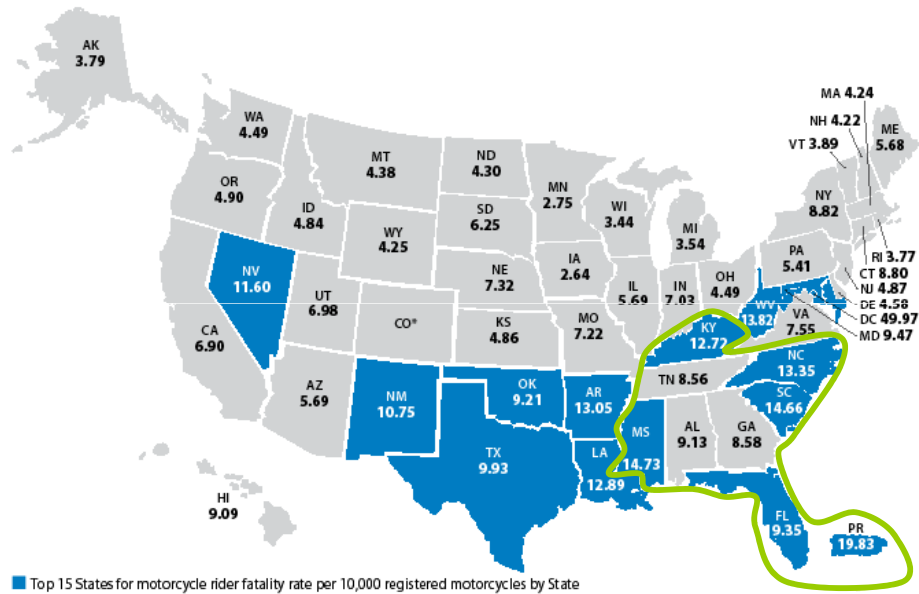
Comparison of US Highway and Motorcycle Fatalities (1991-2003)



Comparison of PR Highway and Motorcycle Fatalities (1991-2005)



Motorcycle Rider Fatality Rate Per 10,000 Registered Motorcycles by State

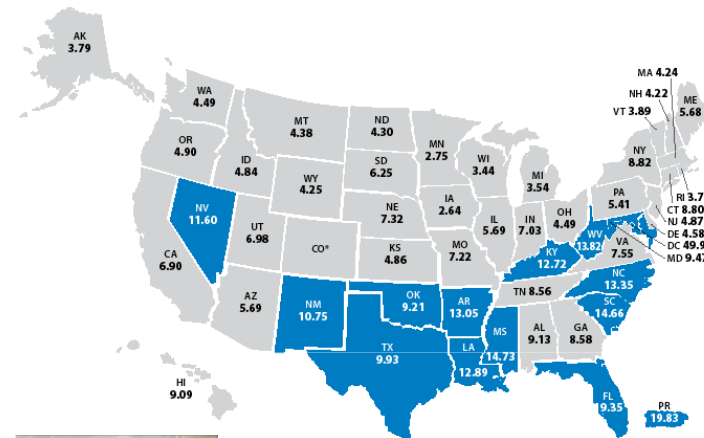


Source: NHTSA, 2006. Motorcycle Safety Plan

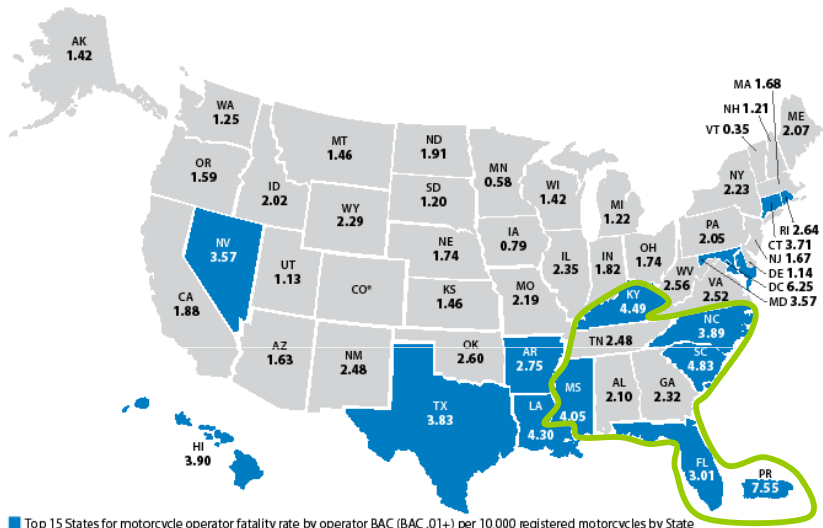
Rank	State / U.S. Territory	Motorcycle Fatalities
1	California	432
2	Florida	432
3	Texas	285
4	Pennsylvania	158
5	Illinois	157
6	New York	150
7	North Carolina	134
8	Ohio	134
9	Arizona	119
10	Puerto Rico (2006 update)	115
11	Georgia	111

Source: NHTSA, 2006. Motorcycle Safety Plan

Rank	State / U.S. Territory	Fatalities	Fatality Rate 10K registered motorcycles
1	Wash DC	8	49.97
2	Puerto Rico (2006 update)	115	19.83
3	Florida	432	19.35
4	Mississippi	40	14.73
5	South Carolina	88	14.66
6	West Virginia	27	13.82
7	North Carolina	134	13.35
8	Arkansas	57	13.05
9	Louisiana	72	12.89
10	Kentucky	68	12.72
11	Nevada	52	11.6
12	New Mexico	39	10.75
13	Texas	285	9.93
14	Maryland	69	9.47
15	Oklahoma	78	9.21
16	Alabama	74	9.13
17	Hawaii	21	9.09
18	New York	150	8.82
19	Connecticut	57	8.8
20	Georgia	111	8.58
21	Tennessee	93	8.56



Nine (9) of the top 21 states with highest motorcycle fatality rate are located in the southeastern states of U.S. (43%)



Six (6) of the top 15 states with highest motorcycle fatality rate by operator BAC > 0.01 are located in the southeastern states of U.S. (38%)

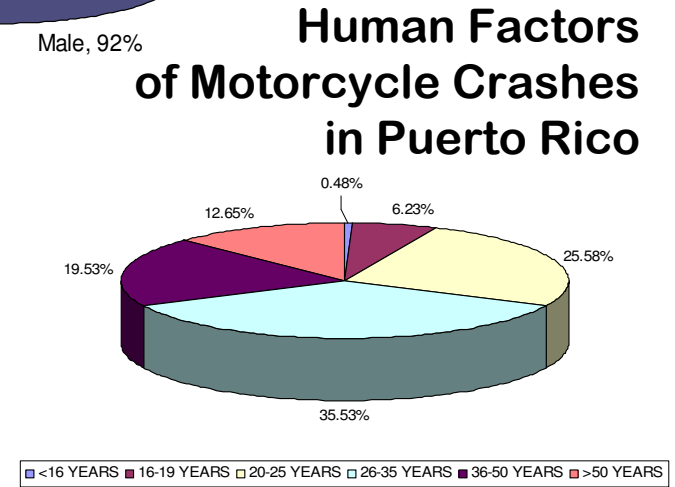
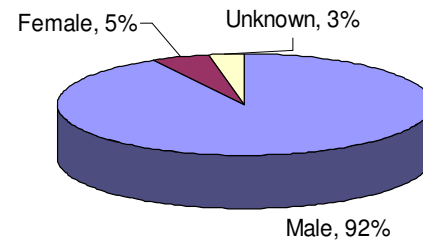
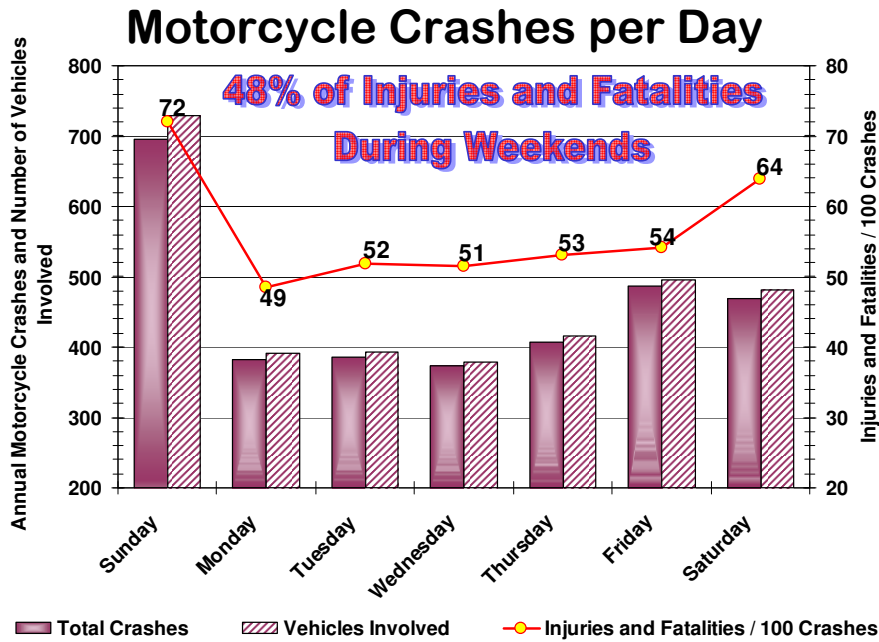


Motorcycle Riding Behavior in Puerto Rico



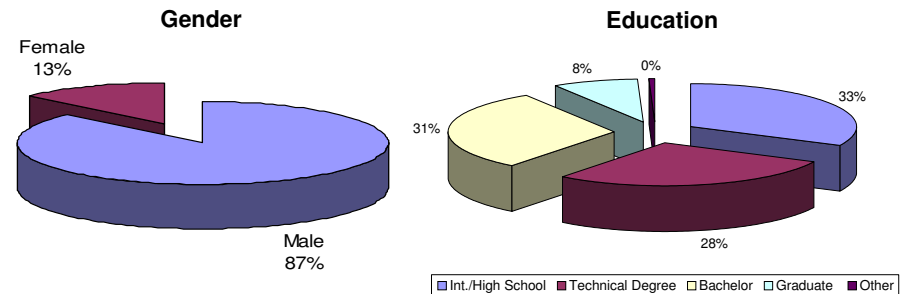
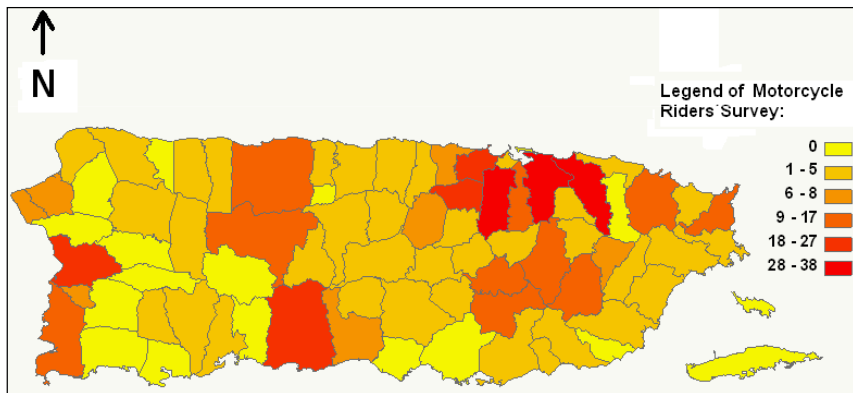
Motorcycle Riding Behavior in Puerto Rico

Contributory Factors	Percentage of Contributory Factors in Highway Fatalities by Year				
	2001	2002	2003	2004	2005
Motorcycle riders	9	12	11	13	20
Alcohol-related	52	47	47	51	48
Speeding	48	49	47	48	47
Roadway departure	45	51	50	53	58
Single vehicle	68	68	66	66	66
Pedestrians	34	34	30	33	29
Total Road Fatalities	495	518	495	495	453

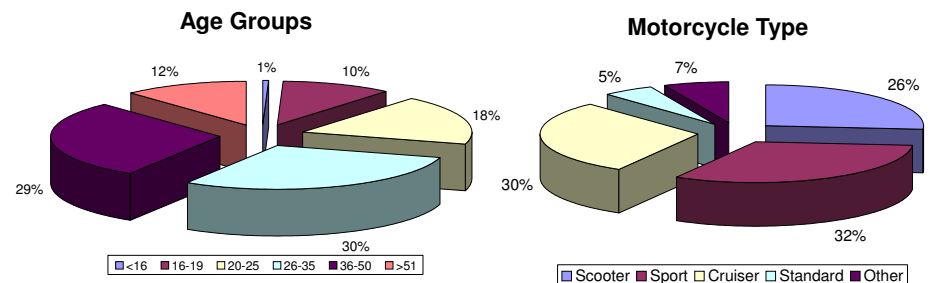


Survey of Motorcycle Riders

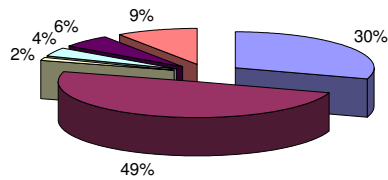
- 500 motorcycle riders surveyed
- 78% of municipalities



Characteristics of Survey Sample



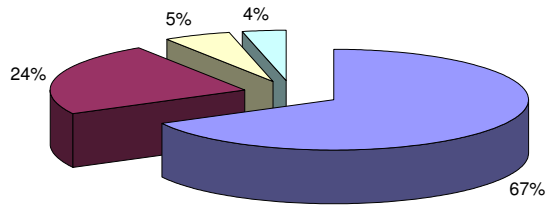
Preferred Day for Using Motorcycle



Stated Motorcycle Use

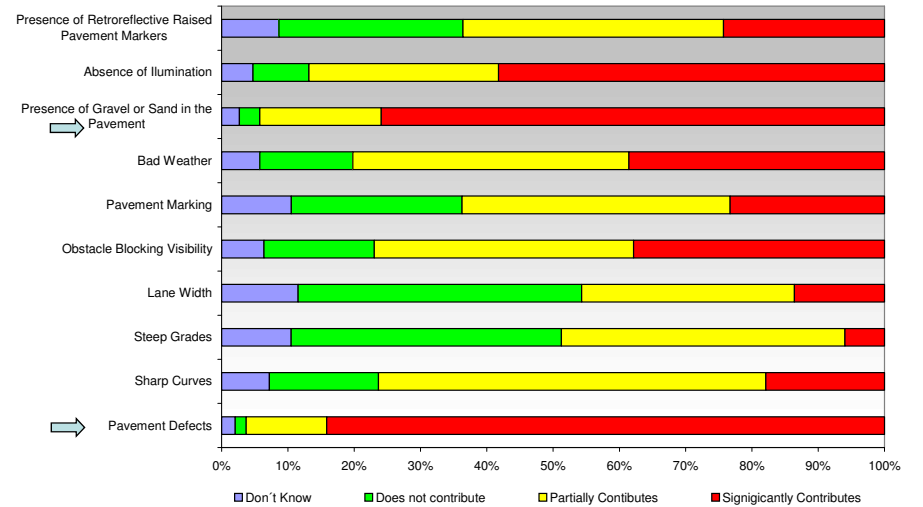
■ All days ■ Weekend ■ Holidays ■ Monday to Friday ■ Other ■ Weekend & Holidays

Primary Motorcycle Use

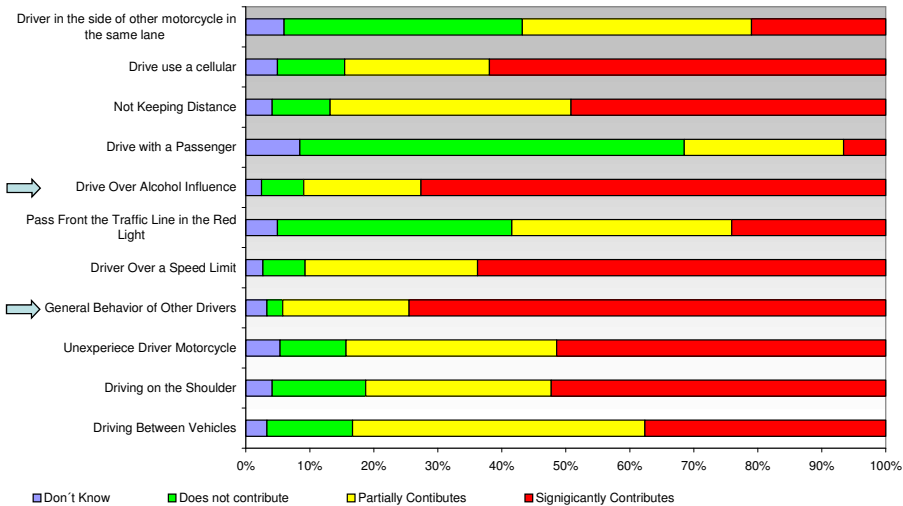


■ Recreation ■ Go to School or Work ■ To Work ■ Other

Perception of Contributing Road Factor to Motorcycle Crashes

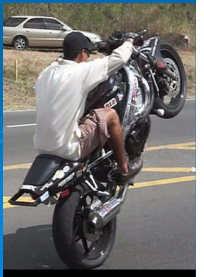


Perception of Contributing Factor of Human Behavior in Motorcycle Crashes



Twelve Contributory Factors to Motorcycle-related Crashes

1. Untrained and inexperienced riders
2. Risk acceptance (speed differential, etc.)
3. Driving under the influence - DUI (alcohol, drugs, etc.)
4. Lack of safety garment (severity-related)
5. Highway geometry (sharp curvature)
6. Hidden driveways and sight distance restrictions
7. Pavement markings at crosswalks and stop bars approaching an intersection
8. Pavement conditions
9. Climatic conditions
10. Inadequate nighttime illumination
11. Inadequate transition tapers at work zones
12. Inadequate road signage



Potentially Hazardous Pavement Surfaces Deficiencies for Motorcycles



Ten Contributory Factors to Motorcycle- related Crashes at Local Roads

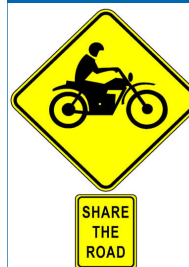
1. Transition from high-speed to low-speed roads
2. Abrupt changes in geometry
3. Limited sight distances
4. Hidden driveways
5. Vegetation / Lack of roadside maintenance
6. Obsolete roadside safety features
7. Loose gravel on pavement surface and intersections
8. Pavement conditions (rutting, shoving, polished aggregate, lane shoulder drop-offs)
9. First-time drivers at tourism and recreational areas
10. Inadequate advanced warning signs



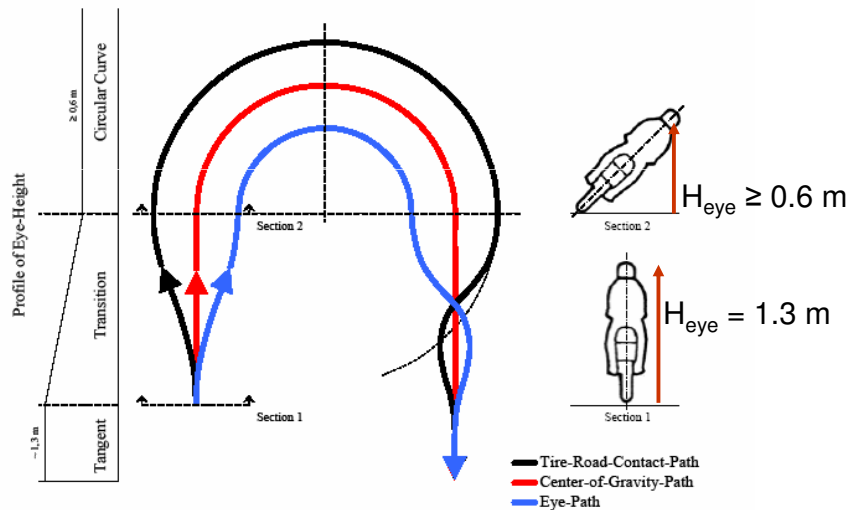
Maintenance Issues

1. General Safety Countermeasures

- Exclusive motorcycle lanes
- Advanced stop bars
- Improve road signage
- Pavement maintenance
- Forgiving roadside



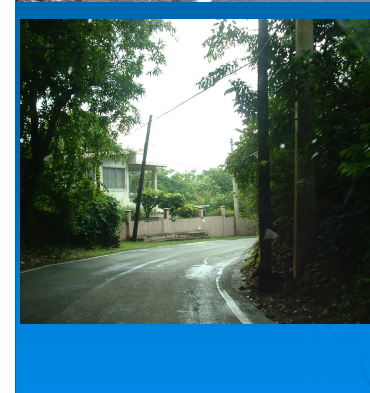
2. Recommended Motorcycle Training for Riding on Horizontal Curves



Curve warning sign



3. Improve warning signs to address local prevailing conditions



Grooved shoulder warning sign



3. Improve warning signs to address local prevailing conditions



4. Recommended Advanced Markings at Intersections



4. Experimental Motorcycle Advanced Stop Line at Intersections



5. Enforcement, Education, Training, Engineering, and Administrative-related Recommendations

Thrust Areas	Short (S), Medium (M) and Long (L) Term Recommendations to Reduce Motorcycle Crash Potential
Enforcement	Increase fines of motorcycle traffic-related violations (S)
Education	Education campaign on helmet and safety clothing, increasing risk perception, crash consequences that results in impairment that affects your future quality of life, etc. (M-L)
Training	Implement a motorcycle training and riding test for motorcycle licensing (S-M)
Engineering	Provide effective and preventive maintenance to highways (M-L)
Administrative	Legislative action to establish 18-years old as minimum age to obtain a motorcycle license (S) Include specifications for motorcycles in roadway and roadside design manuals and Manual of Uniform Traffic Control Devices (MUTCD)

Thank you for the opportunity!

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