INDIANA TRAFFIC SAFETY FACTS 2008

May 2008

Designing and implementing effective traffic safety policies requires data-driven analysis of traffic accidents. To help in the policy-making process, the Indiana University Center for Criminal Justice Research is collaborating with the Indiana Criminal Justice Institute to analyze 2007 vehicle crash data from the Automated Reporting Information Exchange System (ARIES), formally the Vehicle Crash Reporting System (VCRS), maintained by the Indiana State Police. Research findings will be summarized in a series of Fact Sheets on various aspects of traffic collisions, including alcohol-related crashes, light and large trucks, dangerous driving, children, motorcycles, occupant protection, and drivers. An additional publication will provide information on county and municipality data and the final publication will be the annual Indiana Crash Fact Book. These publications serve as the analytical foundation of traffic safety program planning and design in Indiana.

Indiana collision data are obtained from Indiana Crash Reports, as completed by police officers. As of January 1, 2008, approximately 95 percent of all collisions are entered electronically through the ARIES. Trends in collisions incidence as reported in these publications could incorporate the effects of changes to data elements on the Crash Report, agency-specific enforcement policy changes, re-engineered roadways, driver safety education programs and other unspecified effects. If you have questions regarding trends or unexpected results, please contact the Indiana Criminal Justice Institute, Traffic Safety Division for more information.

INDIANA CRIMINAL JUSTICE INSTITUTE

CENTER FOR CRIMINAL JUSTICE RESEARCH

MOTORCYCLES 2007

Indiana motorcycle collisions are on the rise and can be deadly—as shown in the following example. On Saturday, June 9, 2007, between 3 and 4 pm, four motorcycles and a car collided on a straight and level two-lane state road (SR350E) in Dearborn County in southeastern Indiana. Weather conditions were clear. There was no junction or intersection involved. A passenger car, driven by an 18-year old male, drifted into the oncoming lane, colliding head-on with three of the motorcycles, one with a male operator and a female passenger and two with male operators only. The fourth motorcycle held a male operator and female passenger, and collided with something other than the car. The two riders on one motorcycle and one other motorcyclist were killed. Both dead motorcycle operators tested positive for alcohol (0.03 and 0.11 g/dL BAC), and one also tested positive for drugs. All drivers had proper licenses. The remaining three motorcyclists and the car's driver reported non-incapacitating injuries. All the motorcyclists were between the ages of 40 and 50; none wore a helmet. The 18-year old driver of the car was cited for an infraction. The toll for this single crash: three fatalities and four non-incapacitating injuries. In 2007, motorcycles and mopeds in Indiana were involved in 116 fatal collisions.

Overall, crashes involving motorcycles or mopeds[1] in Indiana in 2007 produced 124 fatalities consisting of 112 motorcycle operators, nine motorcycle passengers, one driver of another (non-motorcycle) vehicle, and two passengers in other vehicles. This fact sheet examines motorcycle collisions within Indiana, including fatality and injury rates among riders, alcohol-related collisions, helmet use, licensing statistics, primary factors in motorcycle collisions, and the geography of motorcycle collisions in the state. Data specific to Indiana are drawn from the Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.

Overview of Indiana motorcycle crashes

In reviewing the last fourteen years of motorcycle collisions, the number of persons killed in motorcycle crashes in Indiana reached a new high in 2007 (see Table 1). This also translated into a new high for the percent of total Indiana traffic fatalities generated by motorcycle crashes—13.8 percent. This statistic can be placed in context by considering that in Indiana, motorcycles accounted for only about 3 percent of all registered road vehicles. Overall, total motorcycle collisions increased substantially as well from 2006 to 2007. The increased number of motorcycle crashes explains why, despite a 13.7 percent rise in the number of registered motorcycles, Indiana motorcycle collisions per 10,000 registered

[1]In the 2006 Indiana motorcycle factsheet, mopeds were excluded. However, NHTSA includes mopeds in its analyses of motorcycle crashes. Therefore, for this factsheet, the term "motorcycles" as used will include mopeds, except as otherwise noted in selected exhibits or narratives. Data for the 2003 through 2006 periods were updated to include mopeds.

Table 1: Overview of Indiana motorcycle collisions, 1994-2007

			Fatal motorcycle collisions				Per 10,000 registered motorcycles				
Year	Motorcycle collisions	Motorcycles involved in fatal collisions	Persons killed	Single vehicle	Multiple vehicle	Registered motorcycles	Indiana collisions	Indiana fatalities	U.S. fatalities	Indiana traffic fatalities	Motorcycle percentage of total fatalities
1994	2,410	66	64	29	37	97,017	248.4	6.6	6.2	971	6.6%
1995	2,251	68	65	23	45	96,394	233.5	6.7	5.7	960	6.8%
1996	1,844	59	62	25	34	96,710	190.7	6.4	5.6	984	6.3%
1997	1,899	47	48	18	29	98,252	193.3	4.9	5.5	935	5.1%
1998	2,063	71	69	32	39	104,106	198.2	6.6	5.9	982	7.0%
1999	2,149	67	67	36	31	108,716	197.7	6.2	6.0	1,020	6.6%
2000	2,279	73	73	29	44	118,796	191.8	6.1	6.7	886	8.2%
2001	na	85	75	29	56	128,130	na	5.9	6.5	909	8.3%
2002	na	89	88	46	43	134,881	na	6.5	6.5	792	11.1%
2003	2,442	78	78	27	49	145,948	167.3	5.3	6.9	833	9.4%
2004	2,873	105	109	38	62	154,739	185.7	7.0	7.0	947	11.5%
2005	2,906	114	113	48	65	164,423	176.7	6.9	7.3	938	12.0%
2006	3,098	113	109	42	62	162,683	190.4	6.7	7.4	899	12.1%
2007	3,555	120	124	51	65	185,048	192.1	6.7	na	896	13.8%

Sources:
1) Collision Data: Fatality Analysis Reporting System, National Highway Traffic Safety Administration, as of April 15, 2008.
Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008
2000 *Crash Factbook*, Purdue Center for the Advancement of Transportation Safety (CATS)
2) Registration Data: Indiana Bureau of Motor Vehicles, as of March 5, 2008
2000 *Crash Factbook*, CATS
3) U.S. rate per 10,000 Motorcycles - *Traffic Safety Facts, 2005*, NHTSA
Note: 'persons killed' in 2007 includes three non-motorcyclist fatalities resulting from motorcycle collisions.
na = not available

motorcycles still increased slightly over the 2006 to 2007 period, from 190.4 to 192.1. Further, the fatality rate per 10,000 motorcycles remained the same (6.7) from 2006 to 2007.

Indiana motorcycle collisions, units, and individuals involved

In 2007, there were 3,555 collisions involving motorcycles in Indiana, a 14.8 percent increase from 2006 (see Table 2). Single vehicle crashes accounted for 46.2 percent of all collisions, a proportion that has remained roughly constant since 2003. There were 116 fatal collisions (44 percent were single-vehicle). Single motorcycle fatal collisions had the highest average annual growth rate (19 percent) from 2003 to 2007. In 2007, the probability that a given collision resulted in one or more fatalities was 3.3 percent.

Altogether in 2007, 3,655 motorcycles collided with 1,935 other vehicles and 34 pedestrians and pedalcyclists. Table 3 classifies the vehicles by unit severity, meaning the most serious

Table 2: Total collisions involving motorcycles and mopeds, by collision severity, 2003-2007

Collision severity	2003	2004	2005	2006	2007	Average Annual Change
All collisions	**2,442**	**2,873**	**2,906**	**3,098**	**3,555**	**10.0%**
Fatal	76	100	113	104	116	12.0%
Incapacitating	328	399	379	440	525	13.0%
Non-Incapacitating	1,260	1,611	1,604	1,713	1,969	12.3%
Property Damage Only	778	763	810	841	945	5.1%
Single vehicle collisions	**1,109**	**1,319**	**1,341**	**1,463**	**1,644**	**10.5%**
Fatal	27	38	48	42	51	19.0%
Incapacitating	168	174	193	243	285	14.4%
Non-Incapacitating	654	866	839	932	1,041	13.0%
Property Damage Only	260	241	261	246	267	0.9%
Multi-vehicle collisions	**1,333**	**1,554**	**1,565**	**1,635**	**1,911**	**9.7%**
Fatal	49	62	65	62	65	7.9%
Incapacitating	160	225	186	197	240	12.8%
Non-Incapacitating	606	745	765	781	928	11.6%
Property Damage Only	518	522	549	595	678	7.1%
Probability of fatal collision						
All collisions	3.1%	3.5%	3.9%	3.4%	3.3%	1.8%
Single-vehicle collisions	2.4%	2.9%	3.6%	2.9%	3.1%	7.7%
Multiple-vehicle collisions	3.7%	4.0%	4.2%	3.8%	3.4%	-1.6%

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Note: Non-incapacitating includes 'possible' injuries.

Table 3: Units involved in motorcycle collisions and unit injury severity, by unit type, 2003-2007

Unit type/ unit injury severity	2003	2004	2005	2006	2007	Average Annual Change
Motorcycle + Moped	**2,504**	**2,938**	**2,965**	**3,163**	**3,655**	**10.1%**
Fatal	75	101	112	104	117	12.7%
Incapacitating	322	399	378	437	523	13.5%
Non-Incapacitating	1,260	1,619	1,606	1,720	1,973	12.4%
Property Damage Only	847	819	869	902	1,042	5.5%
Other units	**1,368**	**1,616**	**1,645**	**1,696**	**1,969**	**9.8%**
Fatal	1	-	1	1	3	--
Incapacitating	13	6	6	11	11	7.4%
Non-Incapacitating	83	111	107	113	125	11.6%
Property Damage Only	1,271	1,499	1,531	1,571	1,830	9.8%
Grand Total	**3,872**	**4,554**	**4,610**	**4,859**	**5,624**	**10.0%**

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Note: 'Other units' category includes 34 pedestrians and pedalcyclists.
Non-incapacitating includes 'possible' injuries.

injury sustained by a unit's occupant(s). Therefore, among all vehicles, 120 had one or more fatalities on board. Overall, the number of motorcycles involved in crashes annually has grown at an average rate of 10.1 percent, about the same as non-motorcycle units. However, fatal and incapacitating injuries sustained by motorcycle riders have increased annually, on average, about 13 percent from 2003 to 2007.

There were 3,802 individuals on motorcycles involved in collisions in 2007, and 121 of these individuals were killed (see Table 4). Annual motorcycle fatalities since 2003 have declined in only one year, from 2005 to 2006, whereas the number of individuals killed on motorcycles has increased at an average annual rate of 13 percent. When collisions occur, the probability among individual motorcyclists of a fatal injury during the last two years has remained at 3.2 percent. The probability of incapacitating injuries has increased each year since 2003, and was nearly 15 percent in 2007. During the 2003 to 2007 period, when Indiana motorcycle crashes occurred, from two-thirds to three-quarters of all motorcycle riders suffered some form of injury.

Age of motorcyclists

The Insurance Institute for Highway Safety has shown that older motorcyclists have contributed disproportionately to increased motorcycle fatalities since at least 1999.[2] This was largely true in Indiana during 2003 to 2007 as well (see Figure 1). Since 2004 in Indiana, the modal (most frequent) age of motorcyclists receiving fatal or incapacitating injuries has been in the range of 40 to 49 years. Motorcycle riders between the ages of 40 and 49 have accounted for more than one-quarter of total fatalities and incapacitating injuries; the 50 to 59 year old category contributed an additional 19 percent of incapacitating and fatal injuries in both 2006 and 2007. The highest average annual growth rates in fatal and incapacitating injuries were all in age groups over 40. This age-injury bubble is moving into the 60 years and older group, where the 2003-2007 average annual increase was nearly 40 percent.

Table 4: Individuals on motorcycles and mopeds, by person type and injury status, 2003-2007

Person type & individual injury severity	2003	2004	2005	2006	2007	Average Annual Change
Driver	**2,389**	**2,821**	**2,813**	**3,008**	**3,467**	**10.0%**
Fatal	68	95	110	97	112	14.8%
Incapacitating	303	374	345	407	498	14.0%
Non-Incapacitating	1,214	1,587	1,578	1,698	1,938	13.0%
Unknown	804	765	780	806	919	3.6%
Injured occupant	**321**	**318**	**283**	**319**	**335**	**1.4%**
Fatal	9	13	2	11	9	97.9%
Incapacitating	42	53	51	63	70	14.3%
Non-Incapacitating	208	243	216	237	238	4.0%
Unknown	62	9	14	8	18	13.1%
All motorcyclists	**2,710**	**3,139**	**3,096**	**3,327**	**3,802**	**9.0%**
Fatal	77	108	112	108	121	13.1%
Incapacitating	345	427	396	470	568	14.0%
Non-Incapacitating	1,422	1,830	1,794	1,935	2,176	11.8%
Unknown	866	774	794	814	937	2.4%
Percent without reported injury	**32.0%**	**24.7%**	**25.6%**	**24.5%**	**24.6%**	
Probability of injury status						
Fatal	2.8%	3.4%	3.6%	3.2%	3.2%	
Incapacitating	12.7%	13.6%	12.8%	14.1%	14.9%	

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Note: 'Unknown' category includes blanks, unknown, refused, not reported, and multiple entries.
Non-incapacitating includes 'possible' injuries.

[2]Highway Loss Data Institute. (2008). *Fatality Facts 2006: Motorcycles*. Insurance Institute for Highway Safety. Available at http://www.iihs.org/research/fatality_facts_2006/motorcycles.html, accessed April 13, 2008.

Figure 1: Fatal and incapacitating injuries of motorcycle and moped riders by age, 2003-2007

Growth rates, total individuals with fatal or incapacitating injuries

Age group	16-20	21-29	30-39	40-49	50-59	60+
Average Annual Change, 2003-2007	6.0%	11.9%	8.8%	19.0%	18.5%	39.1%

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Note: Riders of motorcycles and mopeds, where age is known. N for all years = 2,648.

Drivers license status of motorcycle operators in Indiana collisions

The NHTSA National Center for Statistics and Analysis has noted that on average from 2002 to 2006,"one-fourth (25%) of motorcycle operators fatally injured in fatal crashes were operating their motorcycles with invalid licenses (either did not have the license or did not have an endorsement) compared to about 15 percent for fatally injured passenger vehicle drivers."[3] At the Indiana state level, invalid licensing of motorcycle operators continues to be a problem in many motorcycle crashes (see Table 5).

Indiana law requires motorcycle operators to have either a motorcycle learner permit, a motorcycle endorsement to the

Table 5: Drivers license status of Indiana motorcycle and moped operators involved in collisions, 2003-2007

Count of motorcycle operators (where license status is known)	2003	2004	2005	2006	2007	Average Annual Change
All crashes	**2,174**	**2,578**	**2,656**	**2,822**	**3,393**	**12.0%**
Other licenses	1,737	1,692	1,601	1,417	1,400	-5.2%
Motorcycle licenses	407	747	876	1,151	1,638	43.6%
Probation, learner, no license	30	139	179	254	355	118.4%
Fatal crashes	**71**	**101**	**109**	**97**	**116**	**14.7%**
Other licenses	51	57	68	51	50	1.0%
Motorcycle licenses	18	38	36	42	59	40.7%
Probation, learner, no license	2	6	5	4	7	59.6%
Motorcycle licenses as percent of total						
All crashes	18.7%	29.0%	33.0%	40.8%	48.3%	
Fatal crashes	25.4%	37.6%	33.0%	43.3%	50.9%	

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Includes cases where license status is known.
'Motorcycle licenses' category includes motorcycle licenses, motorcycle endorsements, and motorcycle learner permits.

[3]National Center for Statistics and Analysis. 2008. *Fatally Injured Motorcycle Operators by License Status,* (DOT HS 810 892). National Highway Traffic Safety Administration. Washington, D.C. January, p. 1.

Table 6: Percentage motorcycle licenses reported for motorcycle-moped operators involved in collisions, 2003-2007

Age category	2003	2004	2005	2006	2007	Average Annual Change
16-20	15.5%	20.1%	23.8%	26.8%	27.5%	15.9%
21-29	14.5%	26.0%	29.6%	36.2%	42.7%	33.3%
30-39	16.7%	27.1%	30.1%	41.8%	48.6%	32.0%
40-49	24.1%	33.0%	35.7%	43.8%	54.1%	22.8%
50-59	22.5%	35.2%	41.9%	50.8%	60.4%	28.9%
60 or older	18.3%	37.2%	47.6%	49.5%	62.1%	40.3%
Grand Total	**18.8%**	**29.4%**	**33.7%**	**41.9%**	**49.6%**	**28.4%**
N	2,155	2,521	2,580	2,743	3,297	

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
N reflects count of all motorcycle or moped operators involved in collisions, where age and license status were known.

operator's license, or a motorcycle license (IC 9-24-1-5).[4] Nonetheless, despite major improvements in the proportion of properly licensed motorcycle operators involved in collisions, in 2007 less than one-half of operators in crashes were correctly licensed. This percentage was only slightly better for operators involved in fatal crashes (50.9 percent). As shown in Table 6, Indiana data suggest a direct relationship between operator age and the likelihood of proper licensing. The younger the operator, the less likely it is for proper licensing to be in place. In 2007, slightly more than one-fourth of 16 to 20 year old operators in crashes had valid motorcycle permits, whereas more than half of operators 40 years of age and older had proper licenses.

Use of helmets in motorcycle collisions

Motorcycle helmet use is related to injury severity in motorcycle crashes. Helmets are widely acknowledged to reduce head injuries from motorcycle crashes.[5] Nationally, motorcycle helmet use has dropped from 63 percent in 1994 to 51 percent in 2006, with helmet use in the Midwest estimated to be about 50 percent.[6] Among the six Great Lakes states, only Michigan requires all riders to wear helmets. Indiana, Wisconsin, Ohio, and Minnesota require only riders under age 18 to wear helmets, and Illinois has no helmet requirements at all.[7]

The proportion of collision-involved motorcyclists wearing helmets has not changed substantially in Indiana during the 2003-2007 period (see Table 7). More than two-thirds of motorcycle riders involved in and nearly three-fourths of riders killed in Indiana crashes in 2007 did not wear a helmet. Overall, helmet use is associated with lower probabilities of death or

Table 7: Injury status of individuals on motorcycles (excluding mopeds) by helmet use and injury status, 2003-2007

Operators and passengers	2003	2004	2005	2006	2007	Average Annual Change
Helmet use indicated	**808**	**1,012**	**866**	**967**	**995**	**6.3%**
Fatal	20	27	20	19	30	15.5%
Incapacitating	79	110	103	119	113	10.8%
Non-Incapacitating	451	606	498	583	590	8.7%
Unknown	258	269	245	246	262	0.6%
No helmet use indicated	**1,886**	**1,799**	**1,871**	**1,827**	**2,175**	**4.0%**
Fatal	56	70	83	77	84	11.4%
Incapacitating	266	280	254	289	374	9.8%
Non-Incapacitating	957	1,012	1,059	994	1,174	5.6%
Unknown	607	437	475	467	543	-1.2%
Grand total	**2,694**	**2,811**	**2,737**	**2,794**	**3,170**	
Percentage of:						
All crashes, no helmet indicated	70.0%	64.0%	68.4%	65.4%	68.6%	
Fatal crashes, no helmet indicated	73.7%	72.2%	80.6%	80.2%	73.7%	
Non-helmet risk factor						
Fatal	1.20	1.46	1.92	2.14	1.28	
Incapacitating	1.44	1.43	1.14	1.29	1.51	

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Non-helmet risk factor = ratio of (fatal or incapacitating percentage of subtotal without helmets) to (fatal or incapacitating percentage of subtotal with helmets). For example, in 2007, if helmet use was not indicated, the risk of fatal injury status was 1.28 times greater than when helmet use in the crash was indicated.
Mopeds are excluded from this analysis.
'Unknown' category includes blanks, unknown, refused, not reported, and multiple entries.
Non-incapacitating includes 'possible' injuries

[4]In general, Indiana requires a motorcycle license or endorsement for the operator of any motorized two wheel vehicle that can be driven on public roadways at 25 miles per hour or more (see IC 9-21-11-12). ARIES data do not include information relative to the potential speed of mopeds, so this factsheet assumes all moped operators involved in collisions should have a license.

[5]See Sosin, D.M., Sacks, J.J.,and Holmgreen, P. (1990). Head injury—associated deaths from motorcycle crashes, relationship to helmet use laws. *Journal of the American Medical Association* 264(18) November ; and Norvell, D.C., and Cummings, P. (2002), Association of helmet use with death in motorcycle crashes: a matched-pair cohort study. *American Journal of Epidemiology* 156(5): 483-487. Also, repeal of helmet laws is associated with increased injuries and injury severity. See Muller, A. (2004). Florida's motorcycle helmet law repeal and fatality rates. *American Journal of Public Health* 94(4): 556-558, April; and Bledsoe, G.H., and Li, G. (2005). Trends in Arkansas motorcycle trauma after helmet law repeal. *Southern Medical Journal* 98(4): 401-02.

[6]Glassbrenner, D., and Ye, J. (2006). Motorcycle helmet use in 2006—overall results. *Traffic Safety Facts—Research Note.* (DOT HS 810 678). National Center for Statistics and Analysis. National Highway Traffic Safety Administration. Washington, D.C. November.

[7]American Motorcycle Association. (2007). *State Motorcycle Laws.* Available at http://www.amadirectlink.com/legisltn/laws.asp, accessed March 11, 2007.

Table 8: Primary factor reported for single and multiple-unit collisions of motorcycles and mopeds only, 2003-2007

Primary factor reported for motorcycles and mopeds only	2003	2004	2005	2006	2007	Average Annual Change
Two or more vehicles	**1,345**	**1,603**	**1,604**	**1,691**	**2,001**	**10.8%**
Driver	1,241	1,545	1,551	1,613	1,903	11.7%
Environment	77	37	28	41	54	0.5%
Vehicle	27	21	25	37	44	15.9%
Single vehicle crashes only	**1,041**	**1,310**	**1,325**	**1,458**	**1,638**	**12.3%**
Driver	756	1,004	983	1,084	1,209	13.1%
Environment	233	251	282	305	356	11.2%
Vehicle	52	55	60	69	73	8.9%
'Driver factor' as percent of total						
Two or more vehicles	**92.3%**	**96.4%**	**96.7%**	**95.4%**	**95.1%**	**0.8%**
Single vehicle crashes	**72.6%**	**76.6%**	**74.2%**	**74.3%**	**73.8%**	**0.5%**

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Notes: Includes units reporting a primary factor group (excludes 'NULL').
Excludes all units other than motorcycles and mopeds.

Table 9: Units for which 'Driver as a Primary Factor' was reported for single and multiple-unit motorcycle collisions, 2003-2007

Multi-Vehicle Collisions	2003	2004	2005	2006	2007
Motorcycle and moped only	**1,241**	**1,545**	**1,551**	**1,613**	**1,903**
Distracted driving	4	44	39	62	83
Driver not a factor	1	6	4	12	3
Errant/Risky driving	1,073	1,230	1,244	1,266	1,528
Impaired driving	46	47	38	49	53
Other driving condition	117	218	226	224	236
Percent errant/risky	**86.5%**	**79.6%**	**80.2%**	**78.5%**	**80.3%**
All other vehicles/units	**1,228**	**1,531**	**1,566**	**1,605**	**1,853**
Distracted driving	2	52	38	60	82
Driver not a factor	1	6	4	10	1
Errant/Risky driving	1,065	1,228	1,261	1,256	1,515
Impaired driving	44	46	41	54	46
Other driving condition	116	199	222	225	209
Percent errant/risky	**86.7%**	**80.2%**	**80.5%**	**78.3%**	**81.8%**
Single Vehicle Collisions					
Motorcycle and mopeds only	**756**	**1,004**	**983**	**1,084**	**1,209**
Distracted driving	5	21	31	39	40
Driver not a factor	7	15	18	26	1
Errant/Risky driving	513	620	571	632	764
Impaired driving	72	98	92	96	109
Other driving condition	159	250	271	291	295
Percent errant/risky	**67.9%**	**61.8%**	**58.1%**	**58.3%**	**63.2%**

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Note: Includes units reporting a Driver primary factor group (excludes 'NULL').

incapacitating injury in Indiana motorcycle collisions. When collisions occurred in 2007, motorcycle riders without helmets were about 1.3 times more likely to experience a fatal crash than riders who wore a helmet. Further, motorcyclists without helmets were 1.5 times more likely to suffer incapacitating injuries in collisions than those with helmets.

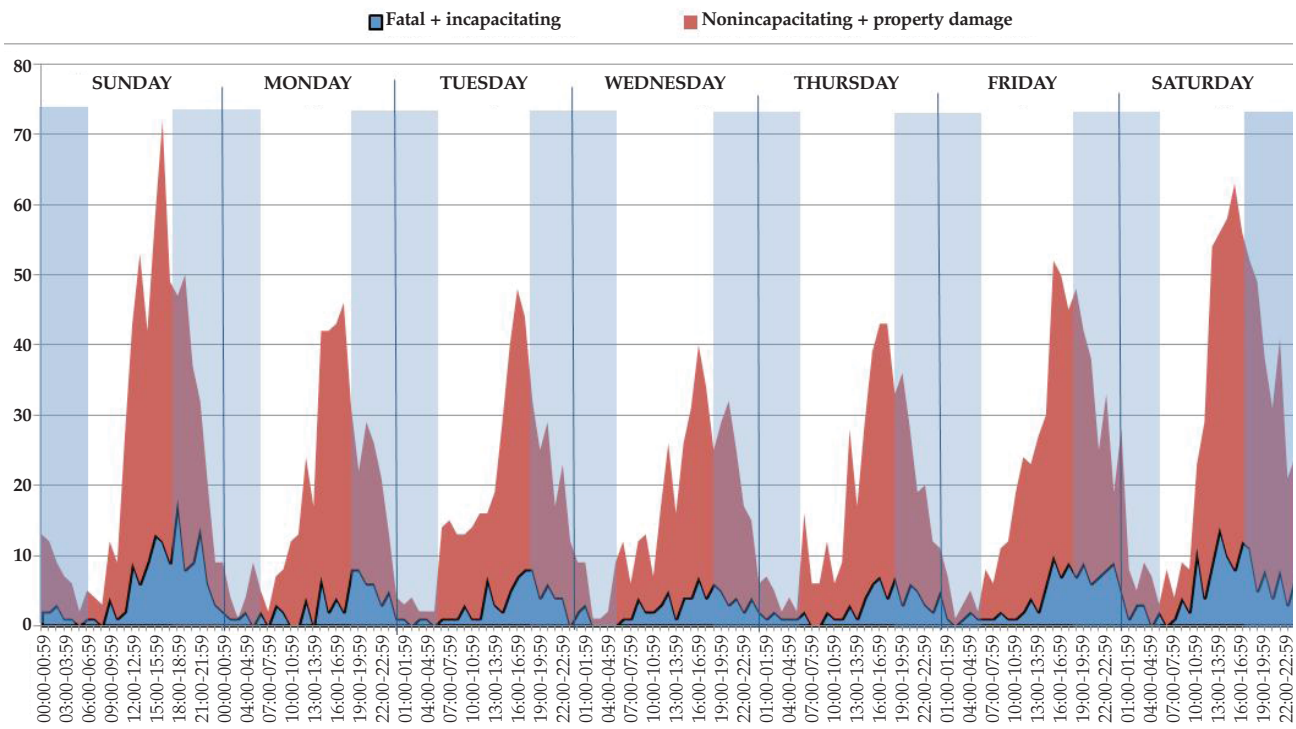
Primary factors identified in motorcycle collisions

The *Indiana Officers Standard Crash Report* requires investigating officers to indicate the "primary cause" of a collision, which includes 48 possible causes classified as contributing circumstances attached to the driver, the vehicle, or the environment. Of the three groups of primary factors—driver, environment, or vehicle—that can be identified as contributing to the incidence of motorcycle collisions, factors associated with the driver are most frequently indicated in Indiana crash reports (see Table 8). However, the identification of "driver factors" as the primary group varies depending on whether the collision involves only a single motorcycle or other vehicles. When two or more vehicles are involved, behavioral characteristics of the driver are identified as a primary factor in the collision more than nine out of every ten instances (i.e., the investigating officer assigned some aspect of driver behavior as the primary factor for 95.1 percent of the motorcycles involved in multi-vehicle collisions). But when the collision involves only a single motorcycle, the role of environmental and vehicular factors become more important, typically accounting for about one-fourth of motorcycles crashes during 2003 to 2007.

When the driver is considered the primary factor in a collision, more detailed behavioral characteristics are identified in crash reports. As shown in Table 9, this typically refers to a group of behaviors classified as errant/risky driving.[8] For example, considering only

[8]This includes the following actions: Disregard Signal or Sign, Failure to Yield Right of Way, Following Too Closely, Improper Lane Usage, Improper Passing, Improper Turning, Jackknifing, Left of Center, Overcorrecting/Oversteering, Ran Off Road Left, Ran Off Road Right, Speed Too Fast for Weather Conditions, Unsafe Backing, Unsafe Speed, Wrong Way on One Way.

Figure 2: Motorcycle and moped collisions by day of week and time of day, 2007



Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Vertical lines = midnight
Shaded areas = approximate periods of darkness, 1800-0600 each day.

multi-vehicle collisions involving motorcycles, when the driver is considered the primary factor in the crash, both the motorcycle and the other vehicle involved were engaged in errant/risky driving approximately 80 percent of the time. When focusing only on single-vehicle motorcycle crashes, the rate of errant/risky driving drops to about two-thirds of the motorcycles involved. Also, it should be noted that the rate of driver impairment is substantially different in multiple versus single vehicle motorcycle crashes: driver impairment is a factor in about ten percent of single motorcycle crashes, but only about three percent in multi-vehicle crashes (calculated from Table 9).

The number of persons killed in motorcycle crashes in Indiana reached a new high in 2007.

Timing and incidence of motorcycle collisions

The frequencies of motorcycle crashes fluctuate at certain times on certain days. In the 2006 Indiana motorcycle factsheet, the pattern of Indiana motorcycle crashes aggregated from 2003 to 2006 showed a typical cyclical pattern: high peaks during rush hour periods, low valleys during early morning periods, and weekend peaks. In 2007, the same pattern occurred. Figure 2 shows the crash frequencies each hour of the day for each day of the week, divided between fatal plus incapacitating and all other crashes; the vertical lines represent midnight and the shaded bands indicate the approximate periods of darkness (6 pm to 6 am). Motorcycle crashes exhibit a characteristic time-day pattern through the week. Motorcycle crashes occur disproportionately during morning rush hour, lunchtime, and evening rush hour, with both fatal and non-fatal collisions peaking typically in the late afternoon or early evening on Fridays, Saturdays, and Sundays. The worst two hours of the week clearly peak at 6-7pm Saturday and 6-7 pm Sunday. The time pattern of fatal collisions is more varied and less predictable, but generally follows the larger crash pattern.

Alcohol-related motorcycle collisions

Alcohol use is a frequent factor in motorcycle collisions. It should be emphasized here that "alcohol-related" does not necessarily mean alcohol caused the crash, but that alcohol was one of the (possibly several) factors contributing to the collision. Considering all collisions involving motorcycles in Indiana,

Table 10: Alcohol-related collisions involving motorcycles or mopeds, 2003-2007

Motorcycle or moped collisions	2003	2004	2005	2006	2007	Average Annual Change
Single vehicle	**1,109**	**1,319**	**1,341**	**1,463**	**1,644**	**10.5%**
Alcohol-related individual involved	176	218	203	223	263	11.2%
Percent alcohol-related	15.9%	16.5%	15.1%	15.2%	16.0%	0.3%
Multiple vehicle	**1,333**	**1,554**	**1,565**	**1,635**	**1,911**	**9.7%**
Alcohol-related individual involved	156	143	146	152	140	-2.5%
Percent alcohol-related	11.7%	9.2%	9.3%	9.3%	7.3%	-10.4%
All collisions	**2,442**	**2,873**	**2,906**	**3,098**	**3,555**	**10.0%**
Alcohol-related individual involved	332	361	349	375	403	5.1%
Percent alcohol-related	13.6%	12.6%	12.0%	12.1%	11.3%	-4.4%
Mopeds only (all collisions)	**15**	**309**	**321**	**523**	**608**	**27.7%**
Alcohol-related individual involved	3	46	54	85	94	28.5%
Percent alcohol-related	20.0%	14.9%	16.8%	16.3%	15.5%	-5.2%
Fatal collisions involving motorcycle or moped						
Single vehicle	**27**	**38**	**48**	**42**	**51**	**19.0%**
Alcohol-related individual involved	11	19	22	21	24	24.6%
Percent alcohol-related	40.7%	50.0%	45.8%	50.0%	47.1%	4.4%
Multiple vehicle	**49**	**62**	**65**	**62**	**65**	**7.9%**
Alcohol-related individual involved	20	15	24	22	17	1.0%
Percent alcohol-related	40.8%	24.2%	36.9%	35.5%	26.2%	-4.6%
All fatal collisions	**76**	**100**	**113**	**104**	**116**	**12.0%**
Alcohol-related individual involved	31	34	46	43	41	8.4%
Percent alcohol-related	40.8%	34.0%	40.7%	41.3%	35.3%	-2.5%

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.
Average annual growth for mopeds calculated for 2004-07 only, excludes 2003.

about 11 percent in 2007 were linked to alcohol (see Table 10).[9] Alcohol is a factor in single-vehicle motorcycle crashes more than twice as frequently as multiple vehicle collisions. Considering only fatal motorcycle collisions in Indiana, about 35 percent were alcohol-related in 2007, down slightly from the 41 percent rate in 2006. Again, the rate of alcohol involvement for single vehicle motorcycle fatalities in 2007 is much higher than for multiple vehicle fatalities (47.1 percent compared to 26.2 percent).

In 2007, of the 112 fatalities among Indiana motorcycle operators, 40 (35.7 percent) were alcohol-related. Eighteen percent of all incapacitating injuries were linked to alcohol (see Table 11). Alcohol-related motorcycle crashes were more dangerous than non-alcohol crashes, generating higher proportions of fatal and incapacitating injuries. The percent of individuals with fatal or incapacitating injuries was typically twice as high in alcohol-related motorcycle crashes compared to non-alcohol collisions (the "alcohol lethality ratio") from 2003 to 2007. In 2007, the 11.7 percent of motorcycle operators classified as alcohol-related accounted for 39 percent of all motorcycle operator fatalities.

NHTSA's 2006 estimates of alcohol-related fatal motorcycle crashes nationally indicated about 34 percent of fatally injured motorcycle operators had blood alcohol content (BAC) levels greater than 0.01 grams per deciliter (g/dL).[10] Indiana ARIES data also produce reported BAC levels for motorcycle operators involved in crashes, although these estimates are subsequently re-calculated by NHTSA using imputation models, and ARIES fatality counts by BAC level are thus typically less than later federal estimates.[11] Table 12 shows the BAC ranges for Indiana motorcycle operators involved in all crashes, and those involved in only fatal crashes for the 2003-2007 period. In 2007, a quarter of motorcycle operator fatalities had reported BAC levels of 0.08 g/dL or greater. This is compared to 2.4 percent of motorcycle operators involved in other non-fatal collisions.

[9]For purposes of the Indiana ARIES data supporting this analysis, "alcohol-related crashes" are defined based on information from the *Indiana Officer's Standard Crash Report* input to ARIES. A record is alcohol-related if:
1. Primary factor = "Alcoholic beverages" OR
2. Contributing circumstance = "Alcoholic beverages" OR
3. BAC test result > 0 for driver or non-motorist OR
4. Apparent physical condition = "Had been drinking" for driver or non-motorist OR
5. OWI (operating while intoxicated) citation issued to driver.

[10]National Center for Statistics and Analysis. Motorcycles, *Traffic Safety Facts: 2006 Data* (DOT HS 810 806). National Highway Traffic Safety Administration. Washington, D.C.

[11]NHTSA performs imputation routines to re-estimate state level alcohol involvement, which increases the federal estimates of the percentage of alcohol-related motorcycle fatalities. Information reported here is based only on non-imputed alcohol data included in the ARIES data extract as of March 16, 2008.

Table 11: Motorcycle and moped operators by injury status, alcohol and non-alcohol related, 2003-2007

Operators by injury status	2003	2004	2005	2006	2007	Average Annual Change
Not alcohol-related individual	**2,060**	**2,460**	**2,476**	**2,635**	**3,062**	**10.7%**
Fatal	39	62	66	57	72	19.5%
Incapacitating	233	304	282	336	409	16.0%
Non-Incapacitating	1,066	1,389	1,402	1,493	1,722	13.3%
Unknown	722	705	726	749	859	4.6%
Fatal + incap percentage	**13.2%**	**14.9%**	**14.1%**	**14.9%**	**15.7%**	**4.6%**
Alcohol-related individuals	**329**	**361**	**337**	**373**	**405**	**5.6%**
Fatal	29	33	44	40	40	9.5%
Incapacitating	70	70	63	71	89	7.0%
Non-Incapacitating	148	198	176	205	216	11.1%
Unknown	82	60	54	57	60	-6.5%
Fatal + incap percentage	**30.1%**	**28.5%**	**31.8%**	**29.8%**	**31.9%**	**1.7%**
Percent classified as alcohol-related						
All motorcycle and moped operators	13.8%	12.8%	12.0%	12.4%	11.7%	-3.9%
Fatalities	42.6%	34.7%	40.0%	41.2%	35.7%	-3.4%
Incapacitating	23.1%	18.7%	18.3%	17.4%	17.9%	-5.9%
Alcohol lethality ratio	**2.28**	**1.92**	**2.26**	**2.00**	**2.03**	

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008

Alcohol lethality ratio calculated as the ratio of the alcohol-related fatal + incap percentage to the non-alcohol related fatal + incap percentage.

'Unknown' category includes blanks, unknown, refused, not reported, and multiple entries.

Non-incapacitating includes 'possible' injuries

Table 12: Motorcycle and moped operators by blood alcohol content (BAC) range, in grams/deciliter (g/dL), 2003-2007

BAC (g/dL) range	2003	2004	2005	2006	2007
Injury status = Non-fatal	**2,321**	**2,726**	**2,703**	**2,911**	**3,355**
Not reported or no test	2,158	2,546	2,584	2,757	3,224
0.00	28	36	26	41	32
> 0.00 < 0.08	22	25	21	28	18
0.08 < 0.15	36	33	26	31	30
0.15 < 0.60	68	61	46	54	51
0.60 and greater	9	25	0	0	0
Percent 0.08 and greater	**4.9%**	**4.4%**	**2.7%**	**2.9%**	**2.4%**
Percent greater than 0.00	**5.8%**	**5.3%**	**3.4%**	**3.9%**	**3.0%**
Injury status = Fatal	**68**	**95**	**110**	**97**	**112**
Not reported or no test	38	33	37	48	46
0.00	11	43	40	21	33
> 0.00 < 0.08	2	5	7	5	5
0.08 < 0.15	7	4	9	7	10
0.15 < 0.60	8	9	17	16	18
0.60 and greater	2	1	0	0	0
Percent 0.08 and greater	**25.0%**	**14.7%**	**23.6%**	**23.7%**	**25.0%**
Percent greater than 0.00	**27.9%**	**20.0%**	**30.0%**	**28.9%**	**29.5%**

Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008.

Geography of motorcycle collisions

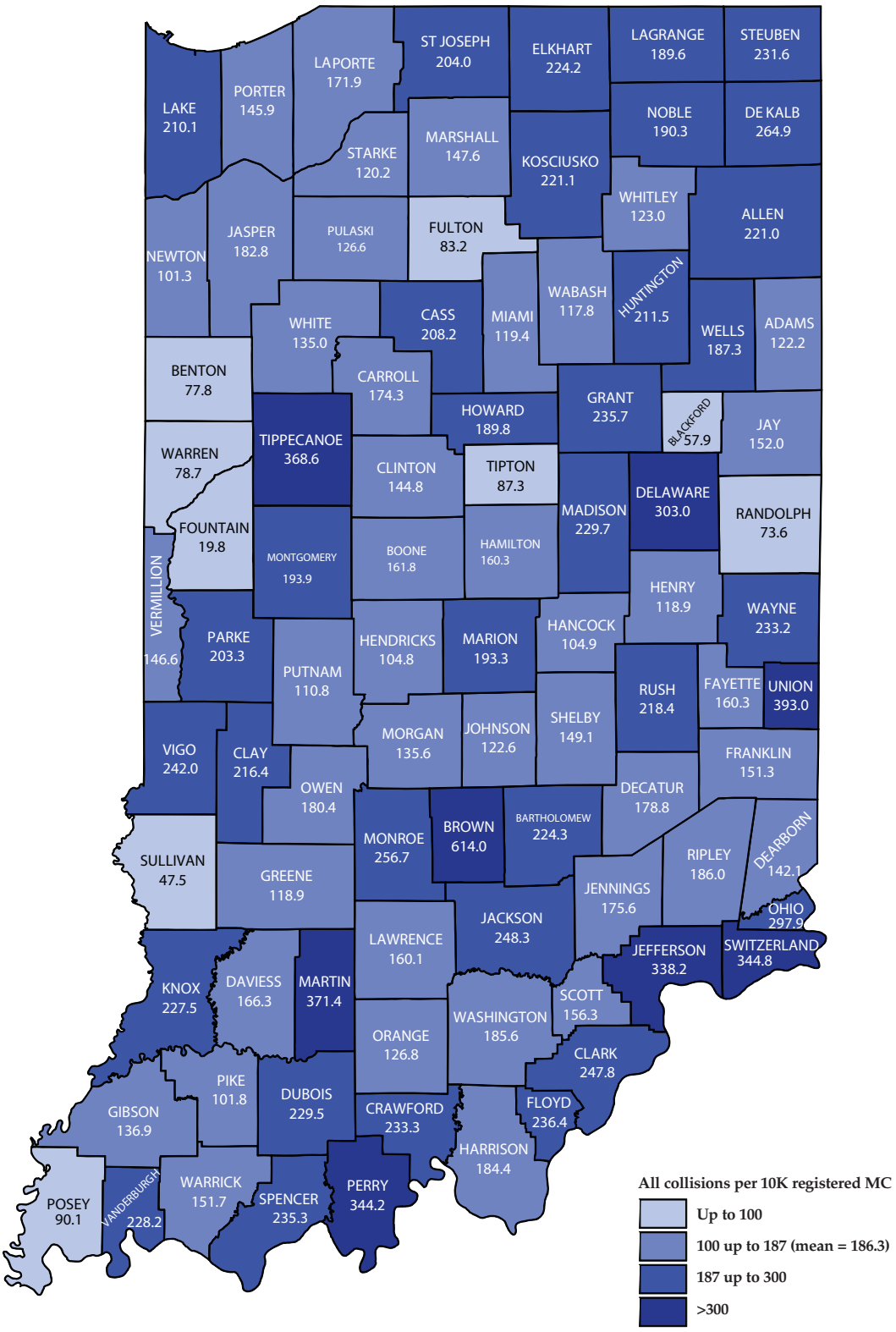
Motorcycle crashes cluster in certain areas of the state. Map 1 classifies Indiana counties by the number of collisions per 10,000 registered motorcycles in each county in 2007. In 2006, the average rate per county was 165.5 crashes per 10,000 registered motorcycles; the county average climbed to 186.3 in 2007. Counties that attract more motorcyclists reflect higher rates, so that, for example, scenic counties such as Brown, Martin, and Perry reflected some of the highest collision rates in 2007. In general, two Indiana regions stand out in Map 1: the Ohio River valley area and far north-eastern Indiana. Motorcyclist fatalities were also concentrated in several areas, as shown in Map 2, which illustrates the point location of motorcyclist collisions that resulted in fatal or incapacitating injuries.[12] Two predominately urban counties in particular—Lake and Marion—show high fatality concentrations in 2007, but a spattering of the most serious motorcycle collisions can also be seen in various rural areas across the state as well.

Conclusions

Indiana motorcycle crashes during 2007 can be characterized along several dimensions. Individuals involved in motorcycles are highly likely to be injured, with about a 3.2 percent (1-in-31) chance of a fatal injury outcome. Operators involved in crashes were improperly licensed more than half the time, and were not wearing a helmet two-thirds of the time. Motorcycle collisions followed the ebb and flow of rush hour and weekend traffic flows, but motorcyclist fatal and incapacitating injuries occurred disproportionately on Fridays, Saturdays, and Sundays. The potential for a fatal or incapacitating injury increases by a factor of two when a motorcycle collision was alcohol–related. Errant and risky driving by motorcyclists (and by the drivers of other vehicles with which they collide) is the most frequently cited primary factor in collisions.

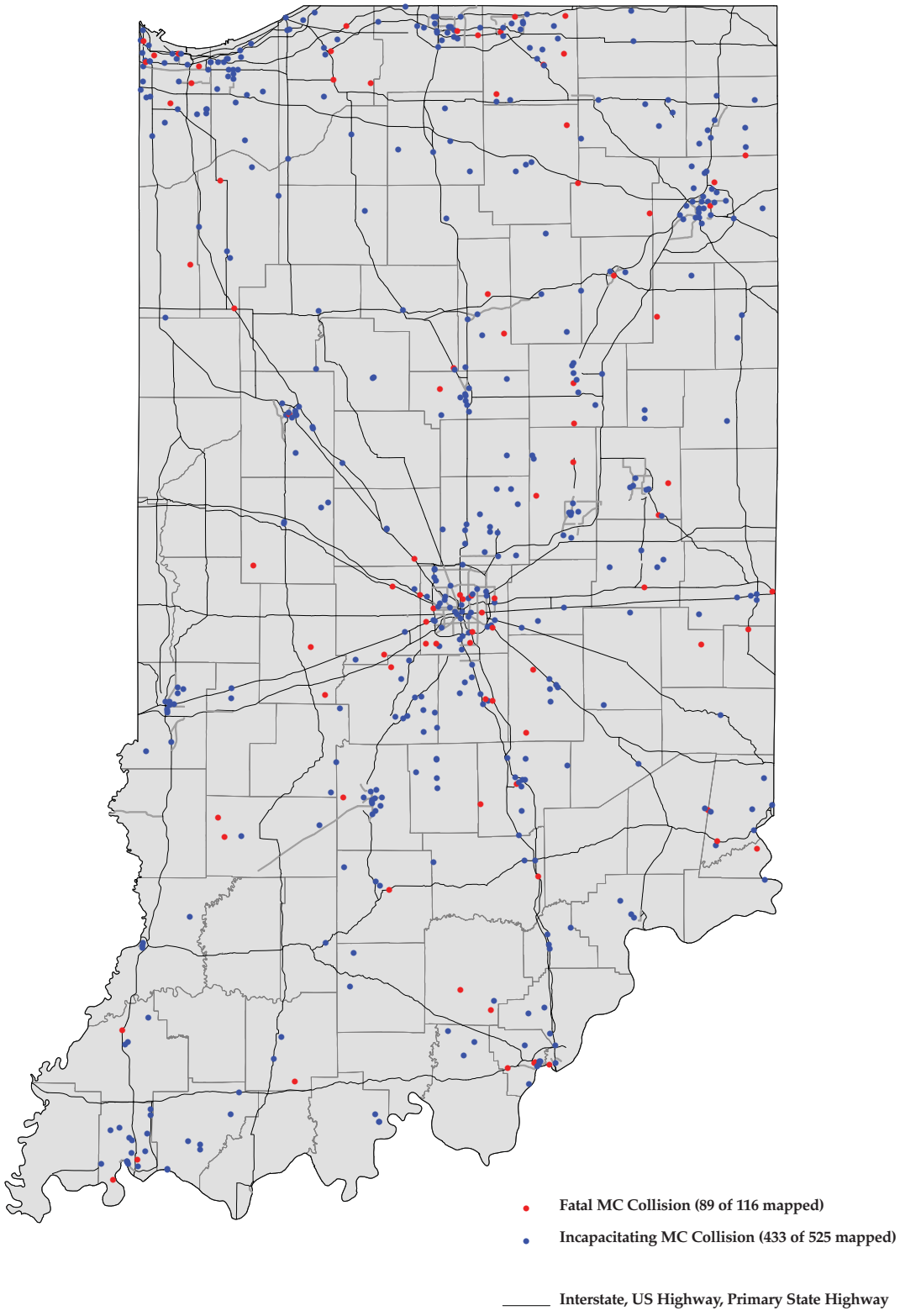
[12]Some motorcycle crash entries in ARIES do not include geographic coordinates. The geocoded file used to construct Map 2 consisted of approximately 81 percent of all reported 2007 motorcycle collisions for which fatal or incapacitating injuries were reported. Approximately 77 percent of fatal motorcycle collisions are included in the geocoded file.

Map 1: Indiana motorcycle collisions per 10,000 registered motorcycles, 2007



Data sources: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008 (crash data); Indiana Bureau of Motor Vehicles, as of January 10, 2008 (registration data)

Map 2: Indiana fatal and incapacitating motorcycle collisions, 2007



Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 16, 2008

2008 INDIANA TRAFFIC SAFETY FACTS

This publication was prepared on behalf of the Indiana Criminal Justice Institute by the Indiana University Center for Criminal Justice Research (CCJR). Please direct any questions concerning data in this document to ICJI at 317-232-1233.

This publication is one of a series of Fact Sheets that, along with the annual Indiana Crash Fact Book, form the analytical foundation of traffic safety program planning and design in the state of Indiana. Funding for these publications is provided by the Indiana Criminal Justice Institute and the National Highway Traffic Safety Administration.

An electronic copy of this document can be accessed via the CCJR website (www.criminaljustice.iupui.edu), the ICJI traffic safety website (www.in.gov/cji/traffic/), or you may contact the Center for Criminal Justice Research at 317-261-3000.

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The Governor's Council on Impaired & Dangerous Driving, a division of the Indiana Criminal Justice Institute, serves as the public opinion catalyst and the implementing body for statewide action to reduce death and injury on Indiana roadways. The Council provides grant funding, training, coordination and ongoing support to state and local traffic safety advocates.

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