

INDIANA 2010 TRAFFIC SAFETY FACTS

IMPROVING THE LOCATIONAL CLASSIFICATIONS OF INDIANA MOTOR VEHICLE COLLISIONS

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Since 2007, the Center for Criminal Justice Research (CCJR) at the IU Public Policy Institute (PPI) has served as a research partner to the Indiana Criminal Justice Institute (ICJI) for analysis of Indiana motor vehicle collision data maintained by the Indiana State Police (ISP) in the Automated Reporting and Information Exchange System (ARIES). In this role, CCJR analyzes collision data elements as they exist in the Indiana Officer's Standard Crash Report and introduces new elements of analytical importance as needed.

The purpose of this note is to introduce a new element, *Census Locality*, that CCJR developed in response to discussions with the Indiana Traffic Records Coordinating Committee (TRCC). CCJR intends to incorporate the new element in 2011 collision analyses. The new 4-category (urban, suburban, exurban, rural) locality element improves upon the existing ARIES 2-category (urban, rural) locality element by providing a more informative characterization of the location of collisions. Locality is of particular importance in planning traffic safety initiatives and reducing motor vehicle collisions and resulting injuries and deaths. Following definitions of the existing (i.e., ARIES) and new (i.e., Census) locale elements, comparative maps and statistics are provided with concluding comments ending the note.

Locale relevance

Challenges

Rural locales are a perennial point of emphasis for traffic safety officials due to more serious collision outcomes in these areas relative to urban locales. The following metrics highlight these disparities:

- Nationally, rural motor vehicle fatality rates have been more than twice that of urban areas (NHTSA, 2010).
- In 2008, 23 percent of the U.S. population lived in rural areas, yet 56 percent of traffic fatalities occurred in rural areas (NHTSA, 2010).
- In 2009, the national average response time from motor vehicle accident to EMS arrival in rural areas was 16.51 minutes, seven minutes greater than in urban areas and well beyond the "Golden Ten Minutes" goal for pre-hospital immediate care (NHTSA, 2011).

Researchers have identified a number of factors that might explain observed differences between rural and urban motor vehicle fatality rates (Table 1) (for a complete list of sources, see Zwerling et al., 2005). These

Table 1. Factors contributing to elevated motor vehicle fatality rates in rural areas

Factor	Category	Timing
Rural drivers drive more miles than urban drivers	Driver	Pre
Rural drivers may be less likely to take safety measures, such as wearing seat belts	Driver	Pre
Alcohol use may be higher among rural drivers	Driver	Pre
Rural roads may be less safe	Environment	Pre
Rural crashes may be more severe due to higher speed limits and different road conditions	Environment	Pre
Rural vehicles may be less safe	Vehicle	Pre
The distance to emergency medical facilities may be longer in rural as opposed to urban areas	Response	Post
Rural crash victims may not receive medical attention as quickly as urban victims	Response	Post
The quality of medical response may be less in rural areas	Response	Post

Source: Zwerling, C., Peek-Asa, C., Whitten, P., Choi, S., Sprince, N., & Jones, M. (2005).



factors can be classified as pre (occurring before the collision) and post (occurring after the collision) contributing factors and broadly grouped into four categories: *driver, environment, vehicle, and response.*

Rural areas face particular challenges in mitigating response-related contributing factors. As noted in a 2008 NHTSA study of state emergency medical services (EMS) systems, "Rural jurisdictions often must rely on volunteers, have longer response times, face high personnel turnover and service coverage issues, lack quality medical direction, and may lack advanced pre-hospital care" (NHTSA, 2008, p. 5). Stewart (1990, p. 24) describes the importance of response time, stating:

Trauma is a time-dependent disease. 'The Golden Hour' of trauma care is a concept that emphasizes this time dependency. That is in polytrauma (typically serious crash victims suffer multiple injuries) patients, the first hour of care is crucial, and the patient must come under restorative care during that first hour. ... Pre-hospital immediate care seeks to apply supportive measures, and it must do so quickly, within what has been called the 'Golden Ten Minutes.'

In terms of *driver* contributing factors, Ward (2007, p. 2) notes that a distinct socio-cultural makeup in rural areas gives rise to a different safety culture, "that fosters attitudes and driving behaviors that increase the risk of fatal crashes." As a result, rural traffic safety improvement strategies must address differences in human factors as well as those related to vehicles and the environment.

Responding to locality-specific challenges

The traffic safety challenges posed by rural locales have not gone unnoticed by traffic safety officials. Though not comprehensive, Table 2 lists some of the programs developed at the national level to address rural traffic safety. These programs generally focus on helping states develop programs to improve rural road conditions and seat belt use on rural roads.

Locale descriptions and definitions

Thus, national and state traffic safety policies clearly recognize the disproportionate driving dangers and risks embedded in rural areas. However, the broad definition of *rural* versus *urban* locales masks a great deal of geospatial and demographic variation in areas classified as rural. Disentangling the finer aspects of this variation can improve our understanding of where motor vehicle collisions occur relative to the distribution of population, law enforcement, first responders, emergency medical facilities, and emergency transportation.

ARIES locality classification scheme

As outlined by the Model Minimum Uniform Crash Criteria (MMUCC, Third Edition, 2008), "The classification of rural and urban is determined by state and local officials in cooperation with each other and approved by the Federal Highway Administration, U.S. Department of Transportation" (NHTSA & GHSA, 2008). In Indiana, the adopted (ARIES) definition relies on collision location relative to the corporate limits of the state's towns and cities:

ARIES Locality: 'Urban' is defined as areas inside a city/town corporate limits and 'Rural' is defined as areas outside of a city/town corporate limits.

This classification scheme provides simplicity but has inherent shortcomings. Most notably, it is not normalized to account for relative differences in population (i.e., population density). As a result, very different areas are classified as urban (or rural). For example, Alton, a town in Crawford County in southern Indiana with a population of 52, and Fort Wayne, a city in Allen County in northeast Indiana with a population of 226,000, are both classified as urban locales.¹ This appears to be an obvious discrepancy which highlights a more general shortcoming of the ARIES

Table 2. Traffic programs targeting rural areas

Agency/Program	Description	Appropriation
FHWA, Local and Rural Road Safety Program	Provides national leadership in identifying, developing, and delivering safety programs and products to local officials and governments to improve highway safety on local and rural roads	Agency support only, no appropriations
FHWA, Local and Rural Roads Safety Peer-to-Peer Program	Experts with knowledge in various local and rural road safety issues volunteer their time to provide assistance to their peers requesting help	Agency support only, no appropriations
FHWA, High Risk Rural Roads Program	A component and set-aside of the Highway Safety Improvement Program (HSIP) that supports road safety program efforts through the implementation of construction and operational improvements on high risk rural roads	\$90M/year through FY 2009; up for renewal thereafter
U.S. DOT, Rural Safety Initiative	Highlights available options to help reduce highway fatalities and injuries on the nation's rural roads	One-time \$14.7M in FY 2009
NHTSA, Rural Seat Belt Project	Increases seat belt use among vehicle occupants in rural areas with high-visibility enforcement	\$4.5M+ since 2005

classification scheme: it mischaracterizes rural and urban locales, creating opportunities for misleading conclusions, and in turn, complicating efforts to tailor traffic safety initiatives to specific locales. Further, a specific location can be more or less rural—that is, a collision would be considered rural if it occurred less than a mile outside of a city's corporate limits, but would also be considered rural if it were 15 miles from the nearest town. In the first case, first responders would be expected to appear much faster than in the second case, and thus a better understanding of where a crash falls on this spatial continuum can shape our expectations and assessments of responses to rural collisions.

Census-based locality classification scheme

To overcome the shortcomings related to the ARIES locality classification scheme and capture more of the spatial variation associated with Indiana collisions, a new locale classification scheme was developed that includes two additional locale categories:

Census-based locality: 'Urban' is defined as Census 2000 Urban Areas, 'Suburban' as areas within 2.5 miles of urban boundaries, 'Exurban' as areas within 2.5 miles of suburban boundaries, and 'Rural' as areas beyond exurban boundaries (i.e., everything else).

This new classification scheme differs from the ARIES classification scheme in several ways. First, it uses Census-defined Urban Areas to define urban locales, rather than city and town corporate limits. Remaining locale categories, including rural, suburban, and exurban, are defined based on distance from Urban Areas (Figure 1). Additionally,

because this classification scheme is being introduced outside of normal collision reporting, locale classifications must be assigned retroactively—that is, a collision must be mapped using the coordinates associated with the collision to determine its location and corresponding locale. As discussed below, this can be problematic because not all collisions have valid coordinates.

Census Urban Areas include both Urbanized Areas and Urban Clusters as defined by the U.S. Census Bureau (*Federal Register, 2000*):

Urbanized Area: Consists of contiguous, densely settled census block groups (BGs) and census blocks that meet minimum population density requirements, along with adjacent densely settled census blocks that together encompass a population of at least 50,000 people.

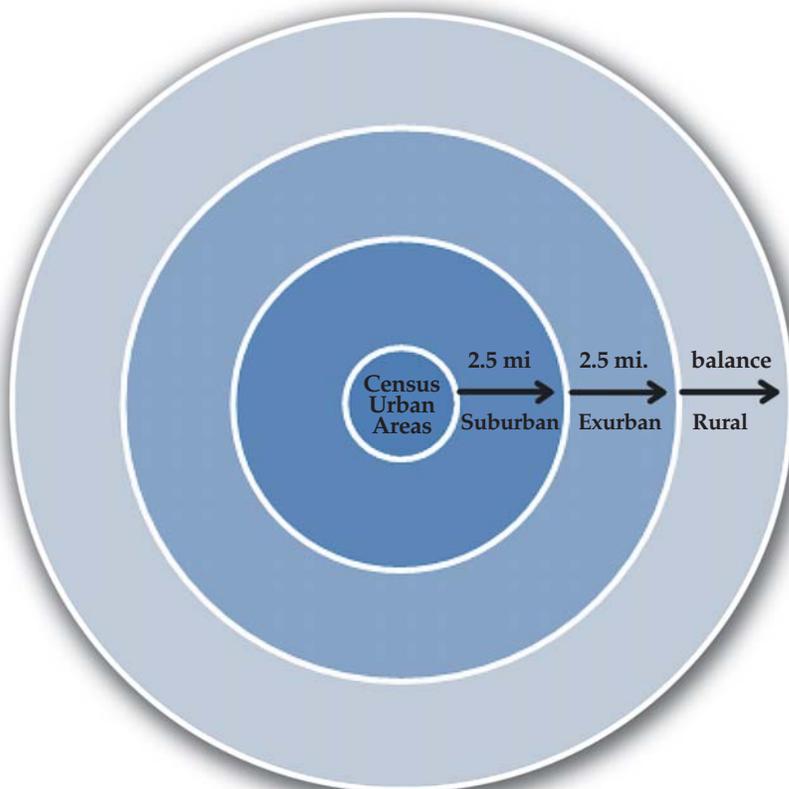
Urbanized Cluster: Consists of contiguous, densely settled census BGs and census blocks that meet minimum population density requirements, along with adjacent densely settled census blocks that together encompass a population of at least 2,500 people, but fewer than 50,000 people.

This classification scheme has several advantages over the ARIES classification scheme. First, it leverages the expertise of the U.S. Census Bureau in defining locales and relies on a normalized measure (i.e., population density) and minimum population sizes to identify urban areas, rather than including all incorporated places which vary greatly in population size and density. Second, this definition should more closely approximate the driving conditions of rural and urban locales while also accounting

for different driving conditions in areas between these locales (e.g., suburban and exurban). Finally, this definition should eliminate error associated with officer locale misclassification, as locale classification is based on the reported geographic coordinates of the collision, as opposed to the simple urban/rural checkbox selected by officers on the crash report.

Among the drawbacks of the Census-based locality classification scheme, not all collisions have valid coordinates and some coordinates that may be considered valid are not entirely accurate. This prevents mapping and ultimately locale classification. For example, in 2009, 88 percent of Indiana collisions had valid coordinates—that is, coordinates that mapped inside the state. The remaining 12 percent were either missing or had invalid coordinate information, which means that these collisions would not receive a locale classification using the Census-based classification scheme. The new "point and click" mapping feature in ARIES, scheduled to be rolled out in the summer of 2011, will likely result in significant improvements in both the quantity and accuracy of coordinate data reporting. Additionally, as with incorporated places, US Census-defined Urban Areas are subject to change. Unlike incorporated places, which are updated annually through the Census Boundary and Annexation Survey (BAS), Urban Areas are delineated only during decennial or contracted inter-decennial censuses, making their boundaries and associated attributes more dated than incorporated places. The Census-based locality classification scheme will be adjusted to reflect the revised Census 2010 Urban Area delineations once the data are released.

Figure 1. Census-based locality categories



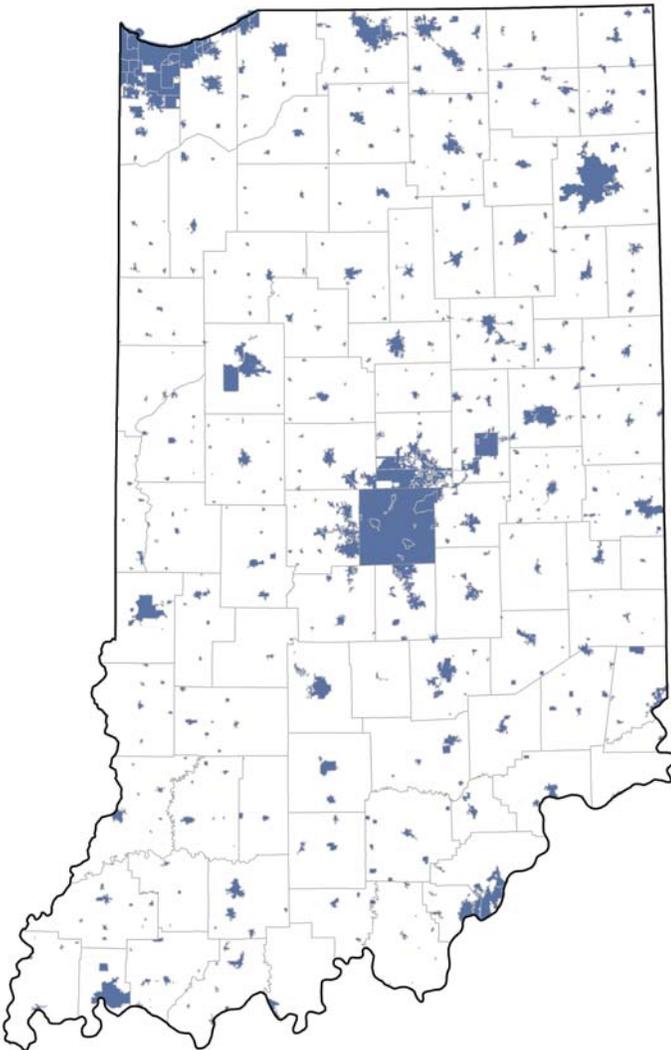
Source: Locale categories derived from Census 2000 Urban Areas.

Locale comparisons

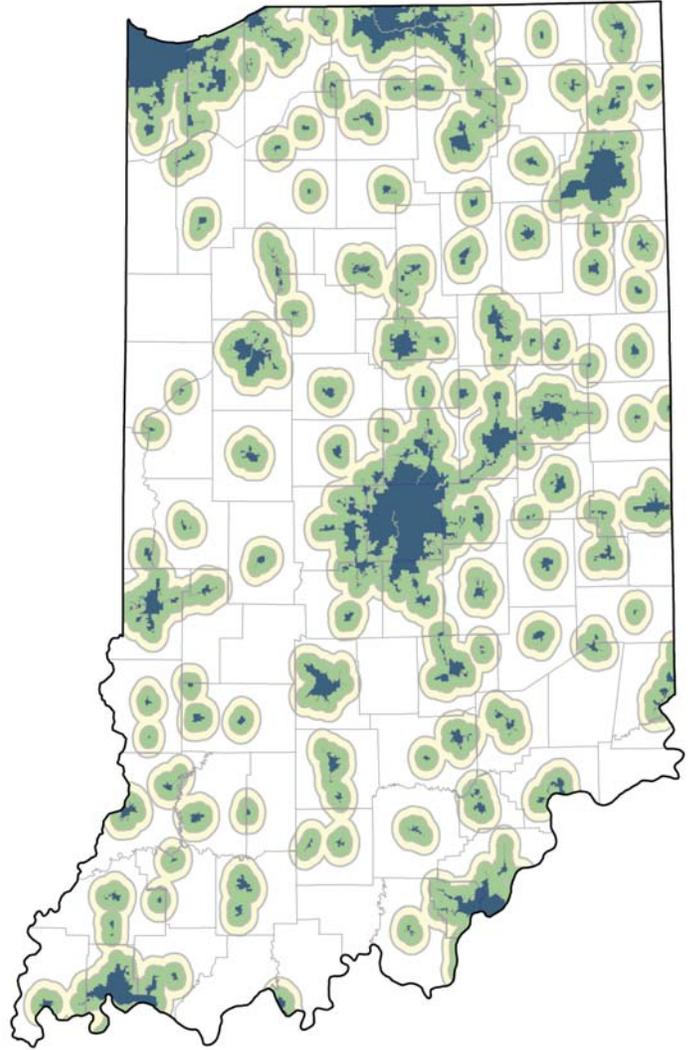
The areas encompassing each locale under the ARIES and Census-based classification schemes are shown in Maps 1 and 2. While many of the same areas are classified as urban, many of the smaller incorporated places classified as urban under the ARIES classification scheme are not classified as urban using the Census-based classification scheme. This is expected because these areas do not meet the minimum population size and density requirements established for Census Urban Areas. Another notable difference is apparent for rural areas: using the ARIES classification scheme, 93 percent of the state is classified as rural, compared to only 46 percent using the Census-based classification scheme, a difference largely due to the reclassification of formerly rural locales as suburban or exurban. Additional comparisons, including how counts of collisions change in the Census locale classification scheme, are shown in Table 3.

With the exception of population, the reclassification of locales using the Census-based classification scheme results in reductions in various urban attributes, due to the spatial redefinitions into the more informative categories of suburban, exurban, and rural. Using the Census-based classification scheme, urban locales are smaller in area, have fewer street miles, and fewer collisions. A greater population is estimated, however, because Census Urban Areas include only the most densely populated Census blocks and block groups. With respect to changes in the locational classification of Indiana motor vehicle collisions from 2009, there is a substantial reduction in the number of collisions classified as rural using the Census-based classification scheme. In fact, only 12,684 collisions are classified as rural using the Census-based classification scheme, compared to 50,363 using the ARIES classification scheme, a difference of 37,679. The majority of this difference (76 percent) is attributed to reclassification of collisions into the suburban category, indicating that many collisions formerly classified as rural under the ARIES classification scheme occurred in close proximity (within 2.5 miles) to urban locales.

Map 1. Incorporated Places (ARIES)



Map 2. Urban Areas (Census)



Urban Suburban Exurban Rural

Table 3. Locale comparisons, ARIES versus Census-based classification scheme

Attribute	Incorporated Places (ARIES)		Urban Areas (Census-based)				Difference, UA-urban v. IP-urban
	Urban	Rural	Urban	Suburban	Exurban	Rural	
Area (sq. mi.)	2,416	33,728	2,222	8,226	9,129	16,567	-194
Street miles	27,584	84,065	25,755	23,026	21,669	41,198	-1,829
Estimated population (09)	3,523,923	2,893,360	3,792,484	1,376,927	535,864	712,009	268,561
Total collisions (09)	116,619	50,363	114,623	28,695	10,980	12,684	-1,996
Fatal	220	388	211	183	92	122	-9
Incapacitating	1,504	1,149	1,488	547	282	336	-16
Non-incapacitating	19,939	9,883	19,736	5,589	2,122	2,375	-203
Property damage	94,956	38,943	93,188	22,376	8,484	9,851	-1,768

Sources:

Urban Areas: U.S. Census Bureau, 2000 TIGER Line Files (most recent)

Incorporated Places: U.S. Census Bureau, 2009 TIGER Line Files

Streets: U.S. Census Bureau, 2000 TIGER Line Files

Population: U.S. Census Bureau, American Community Survey, 2005-2009 5-year estimates

Collisions: Indiana State Police Automated Reporting and Information Exchange System (ARIES), 2009

Note:

Populations were estimated from block group populations.

SUMMARY

The way in which rural (and other) locales are defined is of particular importance to traffic safety officials due to more serious collision outcomes in rural locales and widely recognized challenges associated with traffic safety in rural areas. This note introduces a new locale element whose definition is based on Census Urban Areas rather than incorporated town/city limits. The new element overcomes the principal limitations of the existing locale element, relying on minimum population size and density requirements set by the U.S. Census Bureau and incorporating two additional locale categories. These adjustments are expected to yield more accurate approximations of driving conditions experienced by Indiana drivers.

The Census-based classification scheme reclassifies a large number of collisions into the suburban category, resulting in a substantial reduction in the number of rural collisions.

Endnotes:

¹Population figures based on U.S. Census Bureau 2009 population estimates for incorporated places and minor civil divisions.

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This publication was prepared on behalf of the Indiana Criminal Justice Institute (ICJI) 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 ICJI and the National Highway Traffic Safety Administration.

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

Traffic Safety Project

A collision produces three levels of data: collision, unit (vehicles), and individual. For this reason, readers should pay particular attention to the wording of statements about the data to avoid misinterpretations.

Designing and implementing effective traffic safety policies requires data-driven analysis of traffic collisions. 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 2010 vehicle crash data from the Automated Reporting Information Exchange System (ARIES), maintained by the Indiana State Police. This marks the fifth year of this partnership. 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 law enforcement officers. As of December 31, 2010, approximately 99 percent of all collisions are entered electronically through 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.

The Indiana Criminal Justice Institute

Guided by a Board of Trustees representing all components of Indiana's criminal and juvenile justice systems, the Indiana Criminal Justice Institute serves as the state's planning agency for criminal justice, juvenile justice, traffic safety, and victim services. ICJI develops long-range strategies for the effective administration of Indiana's criminal and juvenile justice systems and administers federal and state funds to carry out these strategies.

The Governor's Council on Impaired & Dangerous Driving

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.

Indiana University Public Policy Institute

The Indiana University (IU) Public Policy Institute is a collaborative, multidisciplinary research institute within the Indiana University School of Public and Environmental Affairs (SPEA), Indianapolis. The Institute serves as an umbrella organization for research centers affiliated with SPEA, including the Center for Urban Policy and the Environment and the Center for Criminal Justice Research. The Institute also supports the Office of International Community Development and the Indiana Advisory Commission on Intergovernmental Relations (IACIR).

The Center for Criminal Justice Research

The Center for Criminal Justice Research, one of two applied research centers currently affiliated with the Indiana University Public Policy Institute, works with public safety agencies and social services organizations to provide impartial applied research on criminal justice and public safety issues. CCJR provides analysis, evaluation, and assistance to criminal justice agencies; and community information and education on public safety questions. CCJR research topics include traffic safety, crime prevention, criminal justice systems, drugs and alcohol, policing, violence and victimization, and youth.

The National Highway Traffic Safety Administration (NHTSA)

NHTSA provides leadership to the motor vehicle and highway safety community through the development of innovative approaches to reducing motor vehicle crashes and injuries. The mission of NHTSA is to save lives, prevent injuries and reduce economic costs due to road traffic crashes, through education, research, safety standards and enforcement activity.

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