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United States Department of Transportation

UNITED STATES GOVERNMENT STATUS REPORT

There were 37,133 people killed in motor vehicle traffic crashes on U.S. roadways during 2017, a 1.8-percent decrease from 37,806 people killed in 2016. The 2017 increase followed two yearly consecutive increases in 2015 and 2016.

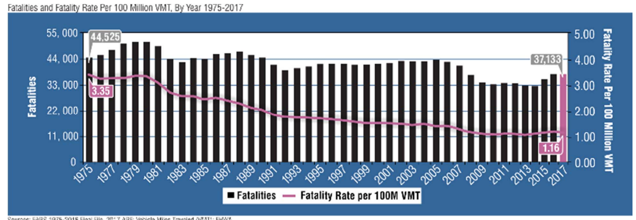
> **10.8-percent decrease from 37,806 806 people killed in 2016**

TRENDS IN ROADWAY FATALITIES

Over the past 40 years, there has been a general downward trend in traffic fatalities. Safety programs such as those increasing seat belt use and reducing impaired driving have substantially lowered the traffic fatalities over the years. Vehicle improvements such as air bags and electronic stability control have also contributed to the reduction of traffic fatalities.

Beginning in 2015, the long-term decline in fatalities on U.S. roadways began to shift, raising questions about the general decline in deaths and whether a new pattern was emerging. The 37,133 motor vehicle traffic fatalities in 2017 are 673 fewer fatalities than the 37,806 that occurred in 2016. The 1.8-percent decrease compares to the 6.5-percent increase from 2015 to 2016 and the 8.4-percent increase from 2014 to 2015. NHTSA has been closely monitoring the yearly changes in fatality data and the constructs and characteristics of those fatal incidents.

Fatalities and Fatality Rate Per 100 Million VMT, By Year 1975-2017

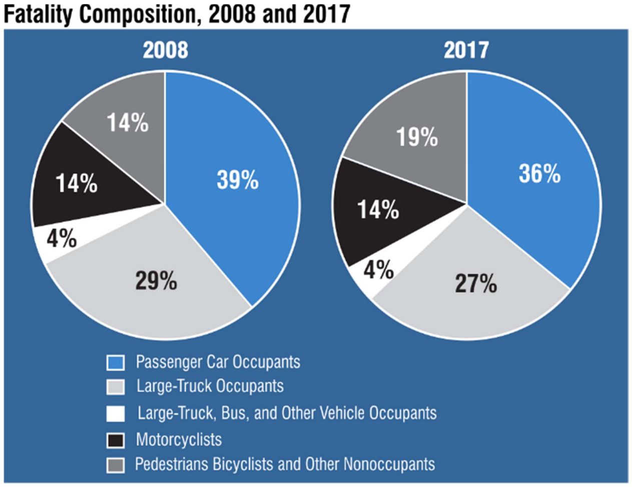


Sources: FARS 1975-2016 Final File, 2017 ARF; Vehicle Miles Traveled (VMT): FHWA

The fatality rate per 100 million vehicle miles travelled (VMT) decreased by 2.5 percent from 1.19 in 2016 to 1.16 in 2017. The 2017 rates are based on VMT estimates from the Federal Highway Administration's (FHWA) May 2018 Traffic Volume Trends (TVT). Overall, 2017 VMT increased by 1.2 percent from 2016 VMT – from 3,174 billion to 3,213 billion. This 2017 VMT increase of 1.2 percent is less than the increase of 2.6 percent from 2015 to 2016.

Looking at a 10-year change in fatalities based on the type of vehicle the occupant was in or if the person was outside a vehicle shows the major shifts over this time. The fatality compositions for 2008 and 2017 are shown in the figure. The biggest change is the proportion of nonoccupant fatalities, which increased from 14 percent to 19 percent from 2008 to 2017. During this same decade, the percentage of passenger car occupant fatalities decreased from 39 percent of the fatalities to 36 percent. The percentage of light-truck occupant fatalities decreased from 29 percent in 2008 to 27 percent in 2017. The proportion of motorcyclist fatalities stayed the same, at 14 percent.

Fatality Composition, 2008 and 2017



Source: FARS 2008 Final File, 2017 ARF
Note: Sum of individual slices may not add up to 100 percent due to rounding.

Recent Crash-Related Statistics

Certain crash characteristics stand out for the 2017 year.

In 2016 and 2017, urban fatalities have overtaken rural fatalities with an emerging trend towards an increasing divide. The U.S., in general, has seen a resurgence in urban living in recent years which could contribute to this change in fatality location.

Notable in 2017 was that 6,988 nonoccupants were killed in motor vehicle crashes – this includes pedestrians, bicyclists and other nonoccupants. While there was a slight decrease in nonoccupant fatalities, the general trend for this group of individuals has been increasing since 2010.

In 2017, 10,874 people died on U.S. roadways in crashes involving an alcohol-impaired driver. An alcohol-impaired driving fatality is defined as a fatality in a crash involving a driver or motorcycle rider (operator) with a blood alcohol concentration of .08 grams per deciliter (g/dL) or greater. These deaths constitute 29 percent of all fatalities in the year. Most alarming of these fatality figures is the number of large truck drivers involved. Alcohol-impaired drivers of large trucks involved in fatal crashes had the largest percent increase of 61.1 percent from 2016 to 2017, and this is at a .08 g/dL. However, commercial drivers that often drive large trucks, have a lower threshold for legal intoxication than the general public which makes the data striking.

Alcohol-Impaired* Drivers Involved in Fatal Crashes by Vehicle Type, 2016 and 2017

Type	2016	2017	Change	% Change
Passenger Car	4,411	4,297	-114	-2.6%
Light Truck - Van	280	284	+4	+1.4%
Light Truck - Utility	1,632	1,721	+89	+5.5%
Light Truck - Pickup	2,030	1,932	+98	-4.8%
Motorcycle	1,425	1,454	+29	+2.0%
Large Truck	72	116	+44	+61.1%

Source: FARS 2016 Final File, 2017 ARF
*See definition in text.

Restraint use, measured by the National Occupant Protection Use Survey (NOPUS) in a roadside observational survey, in 2017 was 89.7 percent. This contrasts with only 53 percent restraint use for those occupants that died in passenger vehicles in crashes in 2017 as reported through the Fatality Analysis Reporting System.

DATA MODERNIZATION

NHTSA has collected crash data since the early 1970s to support its mission to reduce motor vehicle crashes, injuries, and deaths on our Nation’s highways. The Fatality Analysis Reporting

System (FARS) is a census of fatal crashes in the 50 States, the District of Columbia, and Puerto Rico (Puerto Rico is not included in the U.S. totals discussed above). This system has been in place since the 1970s and remains the data collection source for fatalities on U.S. roadways. However, NHTSA's National Center for Statistics and Analysis redesigned the nationally representative sample of police-reported traffic crashes, which enables NHTSA to estimate the number of police-reported injury and property-damage-only crashes in the United States. The new system, called the Crash Report Sampling System (CRSS), replaced National Automotive Sampling System (NASS) General Estimates System (GES) in 2016. The 2016 CRSS data was initially released in March 2018 and rereleased with corrections in May 2018. This is the latest year for which CRSS data is available.

In 2016, there were an estimated 7,277,000 police-reported traffic crashes, in which estimated 3,144,000 people were injured. There were an estimated 5,065,000 property-damage-only crashes in 2016. A direct comparison of the 2016 injury, and property-damage-only crash estimates cannot be made with any previous year, due to the change in data collection practices.

VEHICLE SAFETY RESEARCH

NHTSA's Office of Vehicle Safety Research executes short- and long-term research projects with the goal of providing a scientific basis to help inform future agency decisions. The research covers all phases of the crash scenario – advanced pre-crash and crash-avoidance warnings, technologies, and equipment; occupant protection and vehicle behavior during a crash; and post-crash vehicle integrity, egress, and notifications. Emerging technologies are a constant source of research activities which offer the opportunity to encourage the safety of the technologies, conduct assessments and develop performance criteria and test procedures when necessary.

Advanced Driver Assistance Systems – Current crash avoidance systems rely on sensors such as radar, lidar, camera, ultrasonic, and others to detect potential collisions with other vehicles, pedestrians, or objects and then warn the driver to take appropriate action, as well as technologies that automatically intervene by applying brakes or providing steering inputs to avoid or mitigate a crash if the driver's actions are delayed or insufficient. Advanced driver assistance systems (ADAS) provide the driver with added convenience, safety or functionality during "normal" driving scenarios, but still require the driver to be fully engaged in the driving task. The overall objective of NHTSA's ADAS research program is to provide automotive industry stakeholders with information, analyses, and tools to help evaluate and advance the safe development and deployment of these crash avoidance systems. When appropriate, the program also facilitates (e.g. by developing more technologically neutral performance criteria and test procedures) the removal of unnecessary regulatory barriers that may prevent introduction of these systems.

Automated Driving Systems – Vehicle Safety Research's focus on Automated Driving Systems (ADS) aims to establish a safety assessment framework, contribute to the body of knowledge, and provide leadership that advances the safe testing and deployment of ADSs such that their benefits are optimized and risks appropriately mitigated. Current and upcoming efforts address the technical challenges associated with safe testing and deployment of SAE automation levels 3 through 5 – conditional, high, and full – driving automation. NHTSA's ADS research follows *Automated Driving Systems 2.0: A Vision for Safety*, the Secretary's strategic goals, *Preparing for the Future of Transportation: Automated Vehicles 3.0*, and involves efforts with stakeholders, other DOT modal administrations, States and other federal agencies. While interests of the different types of stakeholders vary widely, the main goal of the NHTSA ADS research is to support the development of safety criteria, metrics, and assessment methods for ADSs. This is a challenge of considerable breadth and depth that the agency is still in the early stages of addressing.

Crashworthiness – This research program focuses on understanding causes of human injury in motor vehicle crashes and vehicle safety countermeasures that can reduce their severity and frequency of occurrence. This program is responsible for developing and upgrading test procedures for evaluating motor vehicle crash safety and developing associated test tools, such as crash test dummies and injury metrics. Crashworthiness research encompasses new and improved vehicle design, biomechanics and injury causation, field data collection and analysis of serious injury cases, and safety countermeasures and vehicle equipment to enhance safety for all road users. Current and upcoming research includes evaluating the safety of occupants in vehicles with Automated Driving Systems (ADS – SAE International Automation Levels 3-5) due to potential non-traditional occupant compartment designs and seating conditions. Additional research is ongoing related to the safety of alternative fuel vehicles safety including electric and hydrogen vehicles.

Human Factors – The effectiveness of many crash avoidance technologies available on motor vehicles relies in part on the way the (human) driver interfaces with the system – ranging from simply whether (or not) they engage the system (i.e., controls), to how warnings are conveyed (i.e., driver-vehicle interface). Other factors include a driver's ability to regain situational awareness and make and execute a correct decision quickly enough. In addition, more advanced driving automation systems (that are anything short of "fully automated") also rely on the driver's ability to properly understand the capabilities, constraints, and control settings of driving automation – including the circumstances and way the human driver takes-over or "partners" with the automated systems to complete the driving task. Even fully automated systems may need some degree of user engagement to ensure safe operation. Efforts within Vehicle Safety Research aim to: establish a basis for efficient and objective methods for evaluating driver-vehicle interfaces; use such methods to profile effective interface design approaches; understand how driver readiness (or "state") may impact the efficacy of such designs and engagement methods; and, determine if and how drivers may adapt to such technologies, thereby also impacting effectiveness (either positively or negatively).

Vehicle Cybersecurity – Digital electronics that include many new safety, mobility, and efficiency features commonly are included in modern vehicles today. These software-intensive functions, and wired and wireless data exchange interfaces, introduce cybersecurity challenges and potential safety concerns. While cybersecurity is germane to data security, intellectual property, and privacy, NHTSA is primarily focused on the safety implications of vehicle cybersecurity. NHTSA's Research activities include research tracks that identify risks, defensive methods, test tools, and ecosystem factors impacting vehicle security; lifecycle cybersecurity risk management; processes that manage associated safety and security risks; and efforts to identify emerging research opportunities that have the potential to facilitate continuous improvement in the cybersecurity of motor vehicles.

RESEARCH AREA ACTIVITIES

Crashworthiness

The crashworthiness research program is responsible for developing and upgrading test procedures for evaluating motor vehicle safety and developing the test devices and appropriate injury metrics. The purpose of the program is to investigate the problems of vehicle crash safety and associated factors that contribute to serious injuries and fatalities. Ongoing research includes:

- Biomechanics research to develop publicly available data, tools, performance measures, and procedures;
- Work with trauma centers to understand the detailed nature of occupant injuries;
- Completing biofidelity testing and development of associated requirements for tools to be used in the assessment of potential alternative seating arrangements that are forecasted for ADS-equipped vehicles;
- Safety Systems research to utilize the tools developed through Biomechanics and begin development strategies for enhancing occupant safety for alternative seating arrangements;
- Completion of technical documents for the THOR 5th percentile female;
- Evaluation of potential crash interaction between current vehicles and commercial ADS-equipped vehicles designed to carry cargo without occupants.

Crash Avoidance

Given that more than seven million police-reported crashes occur every year in the U.S., NHTSA sees an increased emphasis on crash avoidance and driver assistance technologies. These technologies have the potential to reduce fatalities and injuries by preventing the crash from occurring, or reducing the severity of crashes by providing timely warnings to the driver to take appropriate action. NHTSA's continued research activities in crash avoidance include:

- ADAS research, which includes SAE level 0-2 vehicles, to develop objective test procedures and performance evaluation methods;
- Evaluation of system reliability, unintended consequences, and potential safety benefits of new emerging ADAS technologies;

- Understanding performance characteristics and operational envelope of crash avoidance technology and systems;
- Assisting the agency in developing approaches to addressing potential regulatory barriers for emerging driver assistance systems;
- Human Factors research to help develop the community's understanding around the safety impacts of human-machine interface approaches as well as potential longer term behavioral changes related to ADAS uses and how they might impact safety outcomes.

Alternative Fuel Safety

Recently introduced vehicle engine technologies, including hydrogen and advanced lithium ion battery vehicles, are being introduced to the market at a fast rate. This research will examine the safety issues and promote research to enhance industry best practices. NHTSA will continue to perform research activities such as:

- Continuing fleet safety validation testing of high voltage traction battery systems;
- Conducting thermal propagation testing at the pack- and full-vehicle level to assess test procedure suitability and evaluate performance criteria;
- Assessing battery management system. functionality, including all levels of charging.
- Developing and evaluating lithium ion battery diagnostics that can detect damage prior to battery fire initiation;
- Evaluating the safety of the fiber-wrapped pressure vessels used for storing high pressure hydrogen and compressed natural gas in vehicle systems. Refine, demonstrate, and document safety best practices for laboratory testing.

Vehicle Electronic and Emerging Technology

This program advances NHTSA's expertise in vehicle electronics to address the safety and security of emerging electronics and software technologies, and their implications to the safety of vehicle occupants and other road users. NHTSA will continue to pursue the following activities:

- Perform cybersecurity research to facilitate cyber-resilient vehicle designs that mitigate safety risks. This includes a focus on developing test and validation approaches to vehicle software, application of the NIST framework to automotive architectures, and assessing wireless interface vulnerabilities.
- Expand functional safety research to include emerging subsystems used to support advanced technology vehicle designs including perception/sensor systems and decision-support software.

Automated Driving Systems

Preliminary research indicates that there is the potential for significant safety enhancement associated with Automated Driving Systems (ADS), which includes SAE level 3-5 vehicles. The main goal of the ADS research program is to assure that ADS are being designed, operated, and used safely within their given operational design domain. NHTSA activities include:

- Research to support policy decisions on potential changes to federal safety standards to facilitate continued safe innovation in ADS technologies;

- Perform research with key stakeholders, including the automotive industry, standards setting organizations, academia, and other safety organizations to refine safety principles for ADS, and develop test procedures and performance criteria;
- Complete critical human factors research including research on "takeover-ready driver" attributes and governing factors for SAE L3 systems as well as research on how ADS can communicate their intent with other road users (drivers, pedestrians, and cyclists);
- Initiate new research on the ADS design needs for disabled and vulnerable populations;
- Perform crashworthiness research to develop test tools to support safety testing of future ADS vehicle designs with non-traditional seating (as outlined above in the *crashworthiness* activities area).