U.S. Department of Transportation
National Highway Traffic Safety Administration

TRAFFIC SAFETY FACTS
Research Note

NHTSA

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Overview of the 2017 Crash Investigation Sampling System

Summary

In 2017, there were an estimated 2,775,608 police-reported motor vehicle crashes in which at least one passenger vehicle (i.e., a passenger car or a light truck) was towed from the crash scene in the United States, which resulted in an estimated 1,686,240 known passenger vehicle occupant injuries. Among these crashes, 2.9 percent (81,443) resulted in crashes with serious injury levels or above, 35.9 percent (995,898) resulted in crashes with moderate or minor injury levels, and 45.1 percent (1,252,388) resulted in crashes with no injury level.

Introduction

The National Highway Traffic Safety Administration is releasing data from the newly modernized Crash Investigation Sampling System (CISS) – a replacement of the National Automotive Sampling System Crashworthiness Data System (NASS CDS). NHTSA designed CISS to select a more efficient and flexible sample using updated traffic and demographic information and optimizing the sample to better meet data users' needs. (For more information, see the Technical Report, *Crash Investigation Sampling System: Sample Design and Weighting*.) In 2017, motor vehicle traffic crashes that each involved at least one passenger vehicle towed from the scene of the crash were sampled, investigated, and coded at 24 newly selected sites across the nation. Weighting procedures were applied to generate nationally representative estimates of such crashes. This Research Note presents an overall summary of key estimates of crashes in 2017 and provides background on CISS. (For a more detailed explanation of the sample design, estimation protocols, and guidance on how to analyze the new data, please refer to the *Crash Investigation Sampling System: Design Overview, Analytic Guidance and FAQs*.) In addition to sample design and weighting enhancements, several improvements were made to the information technology infrastructure and operational protocols of CISS to gather more relevant, accurate, and nationally representative data. Some of these improvements are detailed in the Improvements section of this Note.

Results

Crashes

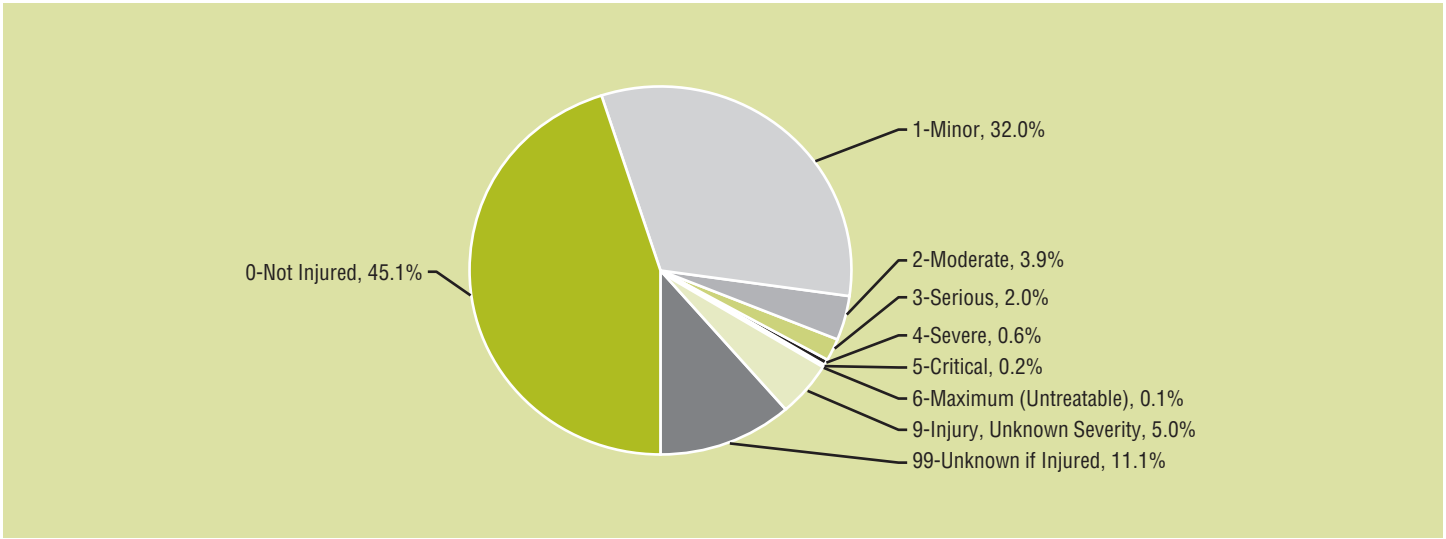
As shown in Table 1 and Figure 1, there were an estimated 2,775,608 police-reported crashes in 2017 where at least one passenger vehicle in each was towed from the scene. The maximum Crash Abbreviated Injury Scale (CAIS) severity is the basis of Table 1 and Figure 1. The maximum CAIS severity is the most severe injury level among the occupants of a CISS applicable vehicle involved in a crash. There were an estimated 81,443 [55,575+17,952+4,316+3,600] crashes with injury levels of serious or above. Of the estimated 81,443 crashes, 3,600 were maximum (untreatable) injury level crashes. An estimated 995,898 [887,016+108,882] crashes were moderate or minor injury level crashes, and 1.252 million estimated crashes were no injury level crashes.

Table 1
CISS Applicable Police-Reported Motor Vehicle Crashes in 2017, by Crash AIS Severity

Maximum Crash AIS (CAIS) Severity	Estimates [Standard Error]	Percentage of Total Crashes
0-Not Injured	1,252,388 [112,344]	45.1%
1-Minor	887,016 [81,343]	32.0%
2-Moderate	108,882 [8,658]	3.9%
Subtotal CAIS-(1) to CAIS-(2)	**995,898**	**35.9%**
3-Serious	55,575 [7,701]	2.0%
4-Severe	17,952[5,793]	0.6%
5-Critical	4,316 [1,228]	0.2%
6-Maximum (Untreatable)	3,600 [692]	0.1%
Subtotal CAIS-(3) to CAIS-(6)	**81,443**	**2.9%**
9-Injury, Unknown Severity	138,400 [51,849]	5.0%
Subtotal CAIS-(1) to CAIS-(9)	**1,215,740**	**43.8%**
99-Unknown if Injured	307,480 [44,588]	11.1%
Total	**2,775,608 [108,648]**	**100%**

Source: 2017 CISS. Some components may not add to subtotals or totals due to independent rounding.

Figure 1
CISS Applicable Police-Reported Motor Vehicle Crashes in 2017, by Crash AIS Severity



Vehicles Involved

As shown in Table 2, there were an estimated 5.066 million vehicles involved in police-reported motor vehicle crashes where at least one passenger vehicle in each was towed in 2017. Of the 5.066 million vehicles, 2.855 million vehicles were passenger cars (56.4%) and 2.026 million vehicles were light trucks (40.0%).

Table 2
Passenger Vehicles Involved in CISS Applicable Crashes in 2017, by Vehicle Type

Vehicle Type	Estimates [Standard Error]	Percentage of Total Vehicles
Passenger Cars	2,854,560 [166,592]	56.4%
Light Trucks	2,026,403 [85,147]	40.0%
Subtotal	**4,880,963**	**96.4%**
Total*	**5,065,616 [220,594]**	**100.0%**

Source: 2017 CISS. Some components may not add to subtotals or totals due to independent rounding.
*Total includes non-passenger vehicles (i.e., large trucks, motorcycles, buses, other, and unknown vehicle types). The results are not displayed because minimal information is collected in CISS on non-passenger vehicles.

Occupants Involved

Table 3 shows the maximum AIS (MAIS) severity of vehicle occupants involved in crashes where at least one passenger vehicle in each crash was towed. In 2017, an estimated 4,987,669 passenger vehicle occupants were involved in CISS crashes. Of the 4,987,669 occupants, 4,665 (0.1%) had maximum (untreatable) injuries, 5,056 (0.1%) had critical injuries, 18,534 (0.4%) had severe injuries, 64,000 (1.3%) had serious injuries, 152,853 (3.1%) had moderate injuries, 1,246,238 (25.0%) had minor injuries, and 2,834,298 (56.8%) had no injury.

Table 3
Occupants Involved in CISS Crashes in 2017, by Maximum AIS

Maximum AIS (MAIS) Severity	Estimates [Standard Error]	Percentage of Total Occupants
0-Not Injured	2,834,298 [165,527]	56.8%
1-Minor	1,246,238 [128,554]	25.0%
2-Moderate	152,853 [13,151]	3.1%
Subtotal MAIS- (1) to MAIS-(2)	**1,399,091**	**28.1%**
3-Serious	64,000 [7,877]	1.3%
4-Severe	18,534 [5,730]	0.4%
5-Critical	5,056 [1,033]	0.1%
6-Maximum (Untreatable)	4,665 [982]	0.1%
Subtotal MAIS-(3) to MAIS-(6)	**92,255**	**1.9%**
9-Injury, Unknown Severity	194,894 [75,382]	3.9%
Subtotal MAIS-(1) to MAIS-(9)	**1,686,240**	**33.8%**
99-Unknown if Injured	467,131 [82,880]	9.4%
Total	**4,987,669 [193,195]**	**100.0%**

Source: 2017 CISS. Some components may not add to subtotals or totals due to independent rounding.

Improvements in CISS

Several modernizations were undertaken in the areas of sample design/estimation, IT infrastructure, and operational protocols/technology to better align sites and data with emerging data needs. This resulted in an up-to-date, relevant sample that is scalable and flexible. It was built upon a modern IT infrastructure and uses state-of-the art data collection technology.

Sample Design Improvements

The CISS sites were selected to provide optimal data collection sites with data needs, statistical precision, and budget in mind. One of the key sampling enhancements in CISS was the incorporation of a framework to provide a replacement sample in situations where the vehicle or vehicles in the original sampled case were not available. This resulted in significant improvements in vehicle acquisition rates, i.e., information collected on vehicles and occupants. Towed vehicle inspection acquisition rates in 2017 were 88 percent, about 15 percent more than historical NASS CDS rates. Another sample design enhancement includes the scalability and flexibility of the sample for the CISS sites and police jurisdictions. The scalable and flexible samples allow NHTSA to adjust the sample size to accommodate potential budget fluctuations with minimal operational effects. Also, CISS is independent of any other NHTSA survey. More information on sample design enhancements can be found in the technical report *Crash Investigation Sampling System: Sample Design and Weighting*.

Information Technology Enhancements

The CISS program consists of an operational component as well as a robust information technology platform. A new platform was completely rebuilt, including consolidation of all system resources into a centralized web-based system to simplify management and improve overall change control. The coding interface was also fully consolidated from a distributed server model that was previously spread across multiple data centers throughout the country.

The most significant change within the CISS IT is the consolidation of all supporting records for initiating a case to create a set of tools that act as an authoritative library for all teams to base their operations on. Included in the library of tools is a platform where source crash reports could be uploaded and used within multiple studies at the same time, which fully replaced a manual decentralized paper-based process. This pro-

cess is further supported by a consolidated application platform that allows for listing, selection, and quality control checks. Following selection and initiation of a case, a baseline shell is created in the coding platform automatically to initiate work on the coding interface. This significant improvement led to a reduction in labor as well as improvements in addressing quality and performance concerns quickly.

Additional improvements include supporting the field data collection that uses modern technologies to prevent unintentional damage and data loss, modernizing the public platform to support current browser and internet requirements, delivering data in a variety of formats such as common delimited text format, and developing a set of data marts to separate the production data from the final data to eliminate impact on the following year's production needs.

Data Collection Protocols and Technology Improvements

To address the users' needs for more precise scene and vehicle data, NHTSA made three significant improvements in the CISS program: (1) provide more comprehensive crash scene documentation and scaled diagrams; (2) increase the number and precision of vehicle crush measurements; and (3) make the raw measurements collected at the scene available to the public in a format that can be used in most reconstruction and mapping software.

In CISS, scene and vehicle measurements are collected electronically with Nikon Total Stations replacing the manual measurement techniques used in its predecessor, NASS CDS. The scene measurements are processed using FARO Blitz diagramming software and scaled diagrams are produced. Scene files are made available to the public in common file formats that can be used in most computer-aided design or mapping software.

Another improvement was to generate vehicle crush by changing the method of measuring crush points from a manual measurement method to an electronic measurement method using the total station. Principles for obtaining crush points are similar to the previous manual measurement method, in that the damaged vehicle is compared to its undeformed state. However, the efficiency and accuracy by which this is done now is a considerable upgrade from the earlier systems. Additional detail describing scene and vehicle documentation in CISS is described in ESV paper 17-0174, *Improved Field Measurements in NHTSA's CISS Program*.

To provide more detailed injury information, NHTSA improved the level of injury detail available in CISS by: (1) adding ten data elements to describe injury causation scenarios for seriously injured occupants; (2) using Visual Anatomical Injury Descriptor (VisualAid) software developed by the Department of Defense Army Research Laboratory to enter and present injury data; and (3) adopting the most recent version of the Abbreviated Injury Scale, AIS 2015, produced by the Association for the Advancement of Automotive Medicine. Additional detail is described in ESV paper 17-0173, *Documenting Injuries in NHTSA's CISS Program*.

Comparisons of 2017 CISS with CDS, FARS, and CRSS

Comparisons of 2017 CISS estimates with CDS estimates should be performed with caution because they are two completely independent sample surveys designed more than 30 years apart. CISS and CDS have different target populations. CISS targets crashes where at least one passenger vehicle is towed from the scene (for any reason), whereas CDS targets crashes where at least one passenger vehicle is towed *due to damage*. Since CDS is a subpopulation of CISS, it is possible to combine both data systems. For more information on combining CDS and CISS, refer to the *Crash Investigation Sampling System: Design Overview, Analytic Guidance and FAQs*.

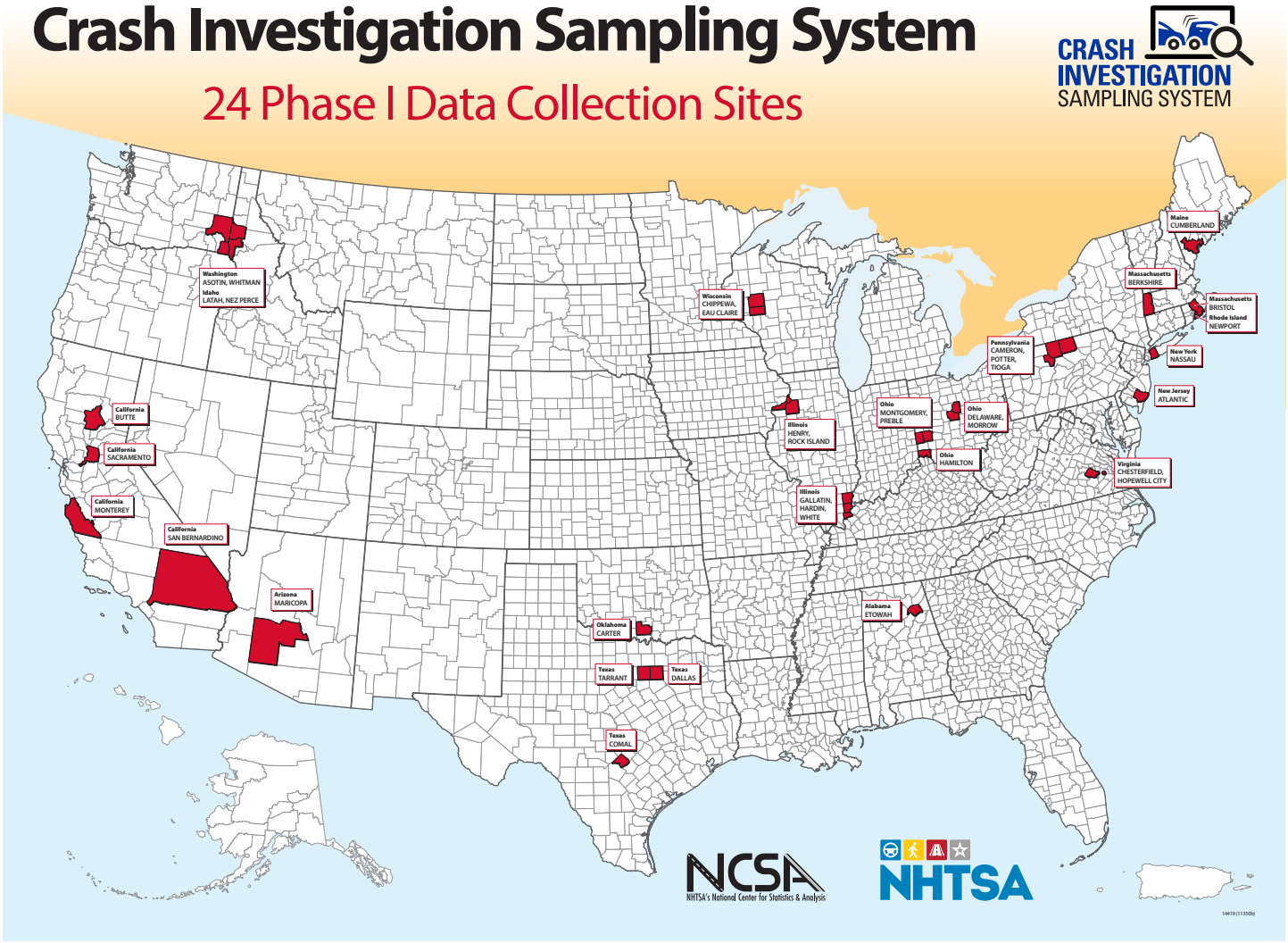
Additionally, CISS target population is a sub-population of the Crash Report Sampling System (CRSS) target population. CRSS targets police-reported crashes on a traffic way in the United States. Estimates of total crashes from CISS are similar to the estimates of total crashes from the corresponding CRSS sub-population.

Fatality Analysis Report System (FARS) is a national census of fatal crashes. CISS in-scope fatal crashes are also a sub-population of FARS. However, CISS data are normally collected within one or two weeks after the crash while FARS has much longer time to identify and collect fatal crash data. Due to the nature of serious crashes and injury outcomes, CISS fatal crash counts and FARS may not be comparable.

The 2017 CISS Sample

The map below shows the 24 data collection sites selected for CISS. For 2018 and subsequent data collection years, 32 data collection sites were selected.

Figure 2
CISS Data Collection Sites



In 2017, CISS selected 2,331 police-reported crashes from 169 police jurisdictions in 24 sites across the country. Each police-reported crash is categorized into 10 analysis domains that were created based on internal and external data needs. Table 4 shows the target sample allocation for each analysis domain compared to the actual sampled cases for 2017 CISS. The distribution of the 2017 sampled CISS cases is consistent with target sample allocation distribution. Among the 2,331 crashes, 2,035 crashes were eligible to be investigated and included in the final analytic files for estimation.

Table 4
CISS Sample Allocation Versus 2017 CISS Sampled Cases

CISS Analysis Domains	Description	Target Percentage of Sample Allocation	2017 Sampled Cases
1	At least one occupant of towed passenger vehicle is killed	5%	4.2%
2	Crashes not in Stratum 1 involving: • A recent model year passenger vehicle in which at least one occupant is incapacitated.	10%	10.3%
3	Crashes not in Stratum 1 or 2 involving: • A recent model year passenger vehicle in which at least one occupant is non-incapacitated, possibly injured, or injured but severity is unknown.	20%	23.0%
4	Crashes not in Stratum 1-3 involving: • A recent model year passenger vehicle in which all occupants are not injured.	15%	15.0%
5	Crashes not in Stratum 1-4 involving: • A mid-model year passenger vehicle in which at least one occupant is incapacitated.	6%	5.5%
6	Crashes not in Stratum 1-5 involving: • A mid-model year passenger vehicle in which at least one occupant is non-incapacitated, possibly injured, or injured but severity is unknown.	12%	11.6%
7	Crashes not in Stratum 1-6 involving: • A mid-model year passenger vehicle in which all occupants are not injured.	10%	10.6%
8	Crashes not in Stratum 1-7 involving: • An older model year passenger vehicle in which at least one occupant is incapacitated.	6%	4.7%
9	Crashes not in Stratum 1-8 involving: • An older model year passenger vehicle in which at least one occupant is non-incapacitated, possibly injured, or injured but severity is unknown.	10%	9.6%
10	Crashes not in Stratum 1-9 involving: • An older model year passenger vehicle in which all occupants are not injured.	6%	5.6%
Total		**100%**	**100%**

Source: 2017 CISS. Components may not add to 100 percent due to independent rounding.

Downloading and Analyzing 2017 CISS Data

The 2017 CISS can be downloaded at: ftp://ftp.nhtsa.dot.gov/ciss/2017

The analytic user's manual can be found at: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812803

Crash Investigation Sampling System: Design Overview, Analytic Guidance, and FAQs can be found at: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812801

Crash Investigation Sampling System: Sample Design and Weighting can be found at: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812804

A databook providing weighted and unweighted univariate distributions of the variables in CISS can be found at: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812802

References

Mynatt, M., Rudd, R., Alpert, N., Loftis, K., & Kulaga, A. (2017). *Documenting Injuries in NHTSA's CISS Program.* Paper presented at 25th Enhanced Vehicle Safety Conference, June 5-8, 2017, Detroit, MI. Available at www-esv.nhtsa.dot.gov/Proceedings/25/25ESV-000173.pdf.

Mynatt, M., & Brophy, J. (2017). *Improved Field Measurements in NHTSA's CISS Program.* Paper presented at 25th Enhanced Vehicle Safety Conference, June 5-8, 2017, Detroit, MI. Available at www-esv.nhtsa.dot.gov/Proceedings/25/25ESV-000174.pdf.

Zhang, F., Subramanian, R., Chen, C.-L., & Noh, E. Y. (2019, September). *Crash Investigation Sampling System: Design overview, analytic guidance, and FAQs*. Washington, DC: National Highway Traffic Safety Administration. Available at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812801

Zhang, F., Noh, E. Y., Subramanian, R., Chen, C.-L. (2019, September). *Crash Investigation Sampling System: Sample design and weighting*. Washington, DC: National Highway Traffic Safety Administration. Available at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812804

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For questions regarding the information presented in this report, please contact NCSARequests@dot.gov. Access this Crash•Stats and other general information on traffic safety at https://crashstats.nhtsa.dot.gov/.

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