



# Overview of the 2021 Crash Investigation Sampling System

## Summary

Data from the 2021 Crash Investigation Sampling System (CISS) show that there were an estimated 2,698,338 police-reported motor vehicle crashes nationwide where at least one passenger vehicle (i.e., passenger car, light truck or van<sup>1</sup> 10,000 lbs or less) was towed from the crash scene, which resulted in an estimated 1,052,099 injured occupants of in-transport towed passenger vehicles. Among these crashes, 2.4 percent (64,386) were crashes with highest injury levels of serious or above, 18.5 percent (498,767) were crashes with moderate or minor injury levels, and 59.3 percent (1,599,291) were crashes with no injury. In 2021 CISS selected 3,806 police-reported crashes. Of the 3,806 selected crashes, 3,331 were eligible for investigation.

## Introduction

The National Highway Traffic Safety Administration is releasing the fourth year of data from the recently modernized 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 compared to CDS using updated traffic and demographic information and optimizing the sample to better meet data users' needs. For more information see *Crash Investigation Sampling System: Sample Design and Weighting* (Zhang et al., 2019a). In 2021 motor vehicle traffic crashes that involved at least one passenger

vehicle towed from the scene of the crash were sampled, investigated, and coded at 32 selected sites across the Nation. Statistical weighting procedures generated nationally representative estimates of relevant crashes. This research note presents a summary of key estimates of crashes in 2021.<sup>2</sup> For a more detailed explanation of the sample design, estimation protocols, and guidance on how to analyze the new data, please refer to *Crash Investigation Sampling Design: Design Overview, Analytic Guidance and FAQs* (Zhang et al., 2019b). In addition to sample design and weighting enhancements, several improvements were made to information technology infrastructure and operational protocols of CISS to gather more relevant, accurate, and nationally representative data.

## Results

**Crashes:** For 2021 CISS, 3,331 police-reported crashes were investigated where at least one passenger vehicle was towed from the scene. This represents an estimated 2,698,338 police-reported crashes (Table 1 and Figure 1). The Crash Abbreviated Injury Scale<sup>3</sup> (CAIS) is the basis of Table 1 and Figure 1. CAIS is the most severe injury level among the occupants of towed in-transport CISS-applicable vehicles involved in a crash. There were an estimated 64,386 (52,265 serious; 6,077 severe; 4,459 critical; 1,585 maximum) crashes with injury levels of serious or above. An estimated 498,767 (416,327+82,440) crashes had minor or moderate injury levels, and an estimated 1,599,021 crashes were no-injury crashes.

<sup>1</sup> Lights trucks or vans include pickups, vans, and SUVs.

<sup>2</sup> This research note does not include comparisons to 2020 CISS. For more information on CISS 2020 refer to National Center for Statistics and Analysis. (2022, February). *Overview of the 2020 Crash Investigation Sampling System* (Traffic Safety Facts Research Note. Report No. DOT HS 813 255). National Highway Traffic Safety Administration. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813255>

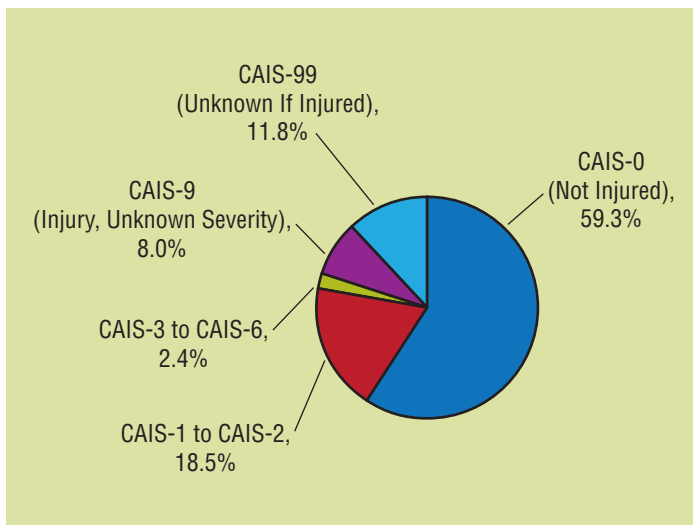
<sup>3</sup> For more information see [www.aaam.org/abbreviated-injury-scale-ais/](http://www.aaam.org/abbreviated-injury-scale-ais/)

Table 1  
**CISS-Applicable Police-Reported Motor Vehicle Crashes in 2021, by Crash AIS**

Crash AIS (CAIS)	Estimates (Standard Error)	Percent of Total Crashes
<b>0-Not Injured</b>	<b>1,599,291 (84,153)</b>	<b>59.3%</b>
1-Minor	416,327 (40,796)	15.4%
2-Moderate	82,440 (11,619)	3.1%
<b>Subtotal (CAIS-1 to CAIS-2)</b>	<b>498,767</b>	<b>18.5%</b>
3-Serious	52,265 (5,428)	1.9%
4-Severe	6,077 (1,080)	0.2%
5-Critical	4,459 (1,118)	0.2%
6-Maximum (Untreatable)	1,585 (458)	0.1%
<b>Subtotal (CAIS-3 to CAIS-6)</b>	<b>64,386</b>	<b>2.4%</b>
9-Injury, Unknown Severity	216,591 (58,670)	8.0%
<b>Subtotal (CAIS-1 to CAIS-9)</b>	<b>779,744</b>	<b>28.9%</b>
99-Unknown If Injured	319,302 (41,304)	11.8%
<b>Total</b>	<b>2,698,338 (128,561)</b>	<b>100.0%</b>

Source: 2021 CISS. Some components may not add to subtotals or totals due to independent rounding.

Figure 1  
**CISS Applicable Police-Reported Motor Vehicle Crashes in 2021, by Crash AIS**



Source: 2021 CISS

*Vehicles Involved:* In the 3,331 investigated police-reported crashes in 2021, 5,935 vehicles were involved. Table 2 shows an estimated 4,708,759 passenger vehicles<sup>4</sup> in 2021 were involved in police-reported motor vehicle crashes where at least one passenger vehicle was towed. Of the 4,708,759 light passenger vehicles, 2,232,534 vehicles were passenger cars (45.1%) and 2,403,594 vehicles were light trucks or vans (48.5%).

Table 2  
**Vehicles in CISS-Applicable Crashes in 2021, by Vehicle Type**

Vehicle Type	Estimates (Standard Error)	Percent of Total Vehicles
Passenger Cars	2,232,534 (171,966)	45.1%
Light Trucks or Vans (SUVs, Vans, and Pickup Trucks)	2,403,594 (150,849)	48.5%
Unknown Type of Passenger Vehicles*	72,631 (13,192)	1.5%
<b>Subtotal</b>	<b>4,708,759</b>	<b>95.0%</b>
<b>Total**</b>	<b>4,954,323 (282,893)</b>	<b>100.0%</b>

Source: 2021 CISS. Some components may not add to subtotals or totals due to independent rounding.

\*These vehicles were identified as light passenger vehicles, but the vehicle type is unknown based on vPIC.

\*\*Total includes large trucks, motorcycles, buses, other, and unknown vehicle types. The results are not displayed because minimal information is collected on those vehicles.

*Occupants Involved:* There were 6,487 occupants of towed in-transport passenger vehicles in CISS-applicable crashes in 2021. Table 3 shows the maximum AIS (MAIS) of estimated occupants of towed in-transport passenger vehicles involved in crashes where at least one passenger vehicle was towed. MAIS is the maximum AIS severity for an occupant of a towed in-transport passenger vehicle. In 2021 an estimated 4,737,021 occupants of towed in-transport passenger vehicles were involved in CISS crashes. Of the 4,737,021 occupants, 1,887 (<0.1%) had a maximum (untreatable) injury, 4,773 (0.1%) had a critical injury, 6,959 (0.1%) had a severe injury, 56,206 (1.2%) had a serious injury, 104,727 (2.2%) had a moderate injury, 559,095 (11.8%) had a minor injury, and 3,152,719 (66.6%) had no injury.

<sup>4</sup> In 2021 NHTSA began using vPIC Body Class as the source for vehicle classification. However, passenger vehicles are identified using Body Type. For more information on vPIC, refer to National Center for Statistics and Analysis. (2022, January). *Product information catalog and vehicle listing (vPIC) analytical user's manual*, 2020 (Report No. DOT HS 813 252). National Highway Traffic Safety Administration. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813252>

Table 3

**Occupants of Towed In-Transport Passenger Vehicles Involved in CISS Crashes in 2021, by Maximum AIS**

Maximum AIS (MAIS)	Estimates (Standard Error)	Percent of Total Occupants
<b>0-Not Injured</b>	<b>3,152,719 (177,371)</b>	<b>66.6%</b>
1-Minor	559,095 (59,910)	11.8%
2-Moderate	104,727 (14,922)	2.2%
<b>Subtotal (MAIS-1 to MAIS-2)</b>	<b>663,822</b>	<b>14.0%</b>
3-Serious	56,206 (5,918)	1.2%
4-Severe	6,959 (1,407)	0.1%
5-Critical	4,773 (1,160)	0.1%
6-Maximum (Untreatable)	1,887 (605)	<0.1%
<b>Subtotal (MAIS-3 to MAIS-6)</b>	<b>69,825</b>	<b>1.5%</b>
9-Injury, Unknown Severity	318,452 (73,836)	6.7%
<b>Subtotal (MAIS-1 to MAIS-9)</b>	<b>1,052,099</b>	<b>22.2%</b>
99-Unknown If Injured	532,203 (80,119)	11.2%
<b>Total</b>	<b>4,737,021 (244,475)</b>	<b>100.0%</b>

Source: 2021 CISS. Some components may not add to subtotals or totals due to independent rounding.

Table 4 shows the mortality of occupants of towed in-transport passenger vehicles and the injury status of non-fatally injured occupants.<sup>5</sup> Of the estimated 4,737,021 occupants, 18,113 (0.4%) died within 30 days of the motor vehicle crash and 1,032,635 (21.8%) were non-fatally injured.

Table 5

**Injured Occupants of Towed In-Transport Passenger Vehicles in CISS Crashes in 2021, by Age Group and MAIS**

MAIS	Age Group					
	Percentage					
	<16	16–24	25–44	45–64	65+	Total*
MAIS-1 to MAIS-2	52.3%	61.4%	65.3%	57.9%	77.1%	63.1%
MAIS-3 to MAIS-6	2.7%	3.3%	6.0%	12.5%	8.2%	6.6%
MAIS-9 (Injury, Unknown Severity)	45.0%	35.4%	28.7%	29.6%	14.7%	30.3%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: 2021 CISS. Some components may not add to subtotals or totals due to independent rounding.

\*Includes unknown age

Table 4

**Occupants of Towed In-Transport Passenger Vehicles Involved in CISS Crashes in 2021, by Mortality and Injured Status**

Mortality	Injured Status	Estimates (Standard Error)	Percent of Total Occupants
Fatal		18,113(1,468)	0.4%
Non-Fatal	Not Injured	3,152,699(177,373)	66.6%
	Injured*	1,032,635(111,537)	21.8%
	Unknown if Injured	532,203(80,119)	11.2%
	<b>Subtotal (Non-Fatal)</b>	<b>4,717,537(244,258)</b>	<b>99.6%</b>
<b>Total**</b>		<b>4,737,021(244,475)</b>	<b>100.0%</b>

Source: 2021 CISS. Some components may not add to subtotals or totals due to independent rounding.

\*Includes Injured, details unknown

\*\*Includes Fatal – ruled disease

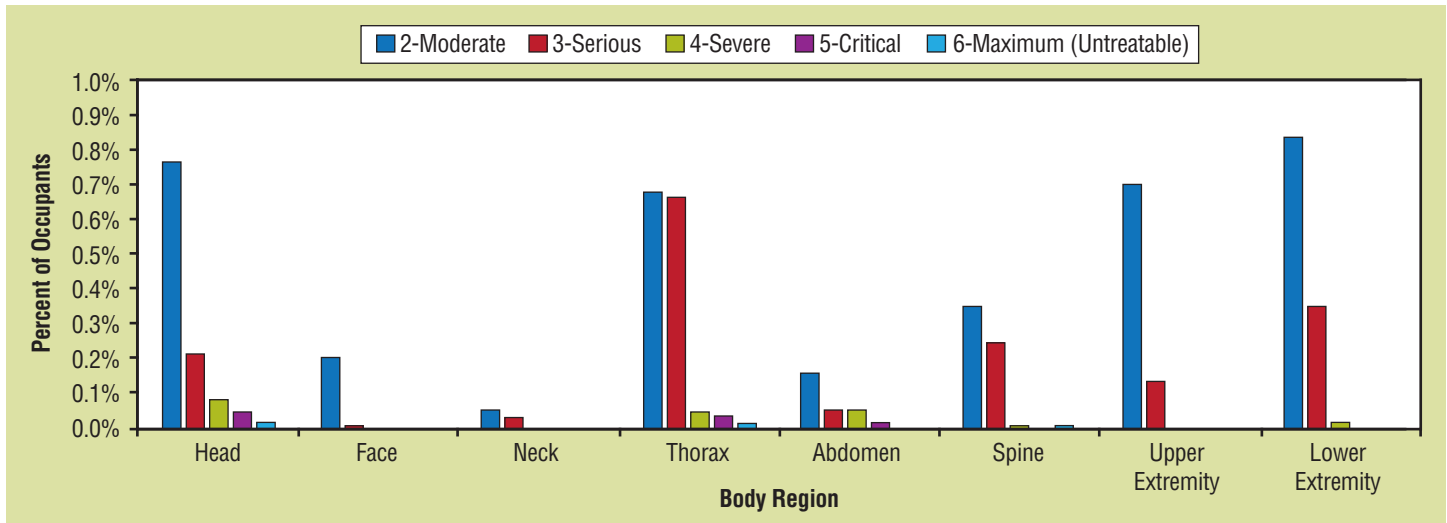
Table 5 shows the percentage of injured occupants of towed in-transport passenger vehicles in CISS crashes by age group and MAIS. For injured occupants under age 16, a little over 52 percent had minor or moderate injury and almost 3 percent had a serious injury or above. Sixty-one percent of injured occupants age 16 to 24 had a minor or moderate injury and 3 percent had a serious injury or above. For injured occupants from age 25 to 44, there were 65 percent who had minor or moderate injury and 6 percent had serious injury or above. Approximately 58 percent of injured occupants age 45 to 64 had minor or moderate injury and almost 13 percent had serious injury or above. For occupants over age 65, about 77 percent had minor or moderate injury and 8 percent had serious injury or above.

<sup>5</sup> It is important to note the fatal estimate presented in Table 5 is different from the Fatality Analysis Reporting System (FARS). FARS includes all passenger vehicle occupants (regardless of tow status), other vehicle occupants, and nonoccupant fatalities.

Figure 2 shows the percentage of occupants with injury of AIS-2 or above by body region. The body regions that most frequently sustained an injury of AIS 2 or higher were the

head, thorax, and lower extremities. The same body regions most frequently sustained an injury of AIS 3 or higher.

Figure 2  
Percentage of Occupants in CISS Crashes With AIS 2+ by Body Region



Source: 2021 CISS. The results shown are not mutually exclusive between body regions.

*Drivers Involved:* As shown in Table 6 and Figure 3, among the estimated 3,507,753 drivers 16 and older of towed in-transport passenger vehicles involved in CISS crashes, 1,978,969 (56.4%) were male and 1,464,624 (41.8%) were female. The corresponding estimates of drivers were 1,098,490 (56.9%) male and 814,274 (42.2%) female in no injury crashes; 649,946 (56.7%) male and 489,262 (42.7%) female in injury crashes. Crashes with injury

levels of serious or above (CAIS-3 to CAIS-6) involved 53,806 (57.0%) male drivers (16 and older) of towed in-transport passenger vehicles compared to 40,413 female drivers (42.8%). Figure 3 shows that the percentage of male drivers is highest in critical injury crashes (70.6%) followed by severe injury crashes (66.1%).

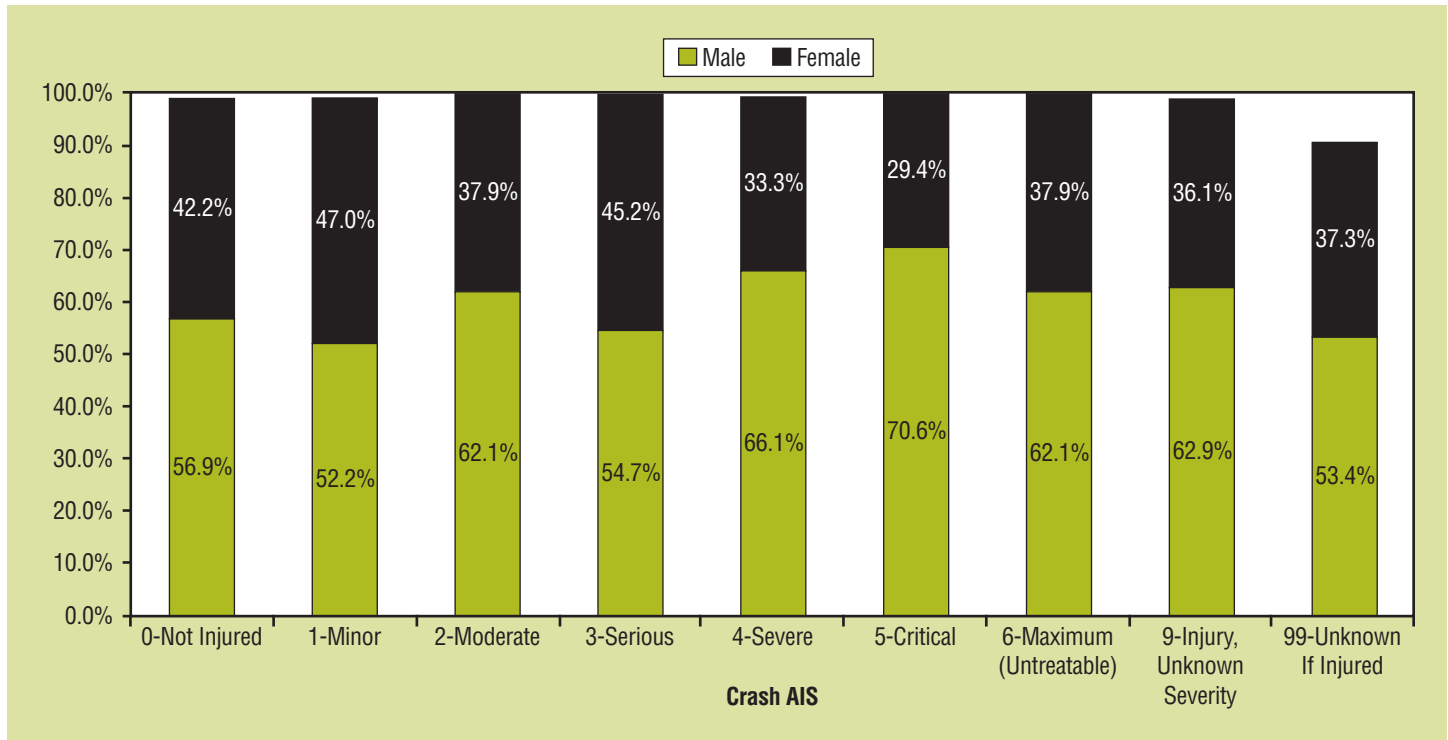
Table 6  
Drivers (≥ 16 Years Old) of Towed In-Transport Passenger Vehicles Involved in CISS Crashes in 2021, by Sex and Crash AIS

Crash AIS	Sex		
	Male	Female	Total*
	Estimates (Standard Error)	Estimates (Standard Error)	Estimates (Standard Error)
<b>0-Not Injured</b>	<b>1,098,490(96,413)</b>	<b>814,274(69,153)</b>	<b>1,929,048(121,427)</b>
1-Minor	317,109(31,161)	285,582(27,045)	607,416(54,772)
2-Moderate	85,488(19,331)	52,195(4,321)	137,700(20,486)
<b>Subtotal (CAIS-1 to CAIS-2)</b>	<b>402,597</b>	<b>337,777</b>	<b>745,116</b>
3-Serious	41,728(6,236)	34,425(3,392)	76,243(6,539)
4-Severe	6,468(1,595)	3,262(724)	9,786(2,155)
5-Critical	3,602(1,128)	1,503(357)	5,105(1,159)
6-Maximum (Untreatable)	2,008(862)	1,223(656)	3,231(1,477)
<b>Subtotal (CAIS-3 to CAIS-6)</b>	<b>53,806</b>	<b>40,413</b>	<b>94,365</b>
9-Injury, Unknown Severity	193,543(57,956)	111,072(23,797)	307,508(79,361)
<b>Subtotal (CAIS-1 to CAIS-9)</b>	<b>649,946</b>	<b>489,262</b>	<b>1,146,989</b>
99-Unknown If Injured	230,533(43,254)	161,088(33,894)	431,716(68,947)
<b>Total</b>	<b>1,978,969(118,616)</b>	<b>1,464,624(83,735)</b>	<b>3,507,753(178,721)</b>

Source: 2021 CISS. Some components may not add to subtotals or totals due to independent rounding.

\*Total includes unknown sex.

Figure 3  
**Drivers (≥ 16 Years Old) of Towed In-Transport Passenger Vehicles Involved CISS Crashes in 2021, by Sex and Crash AIS**



Source: CISS 2021. Note: Percentages may not add to 100 percent due to unknown sex.

## Comparisons of CISS with CDS, FARS, and CRSS

Comparisons of 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 slightly different target populations. The CISS target population represents crashes where at least one passenger vehicle is towed from the scene (for any reason), whereas the CDS target population represented crashes where at least one passenger vehicle is towed *due to disabling damage*. Also, CISS case selection is based on newer vehicles with higher severity injuries, whereas, CDS case selection was first based on injury severity, then the model year of the vehicle. 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 *Crash Investigation*

*Sampling Design: Design Overview, Analytic Guidance and FAQs* (Zhang et al., 2019b).

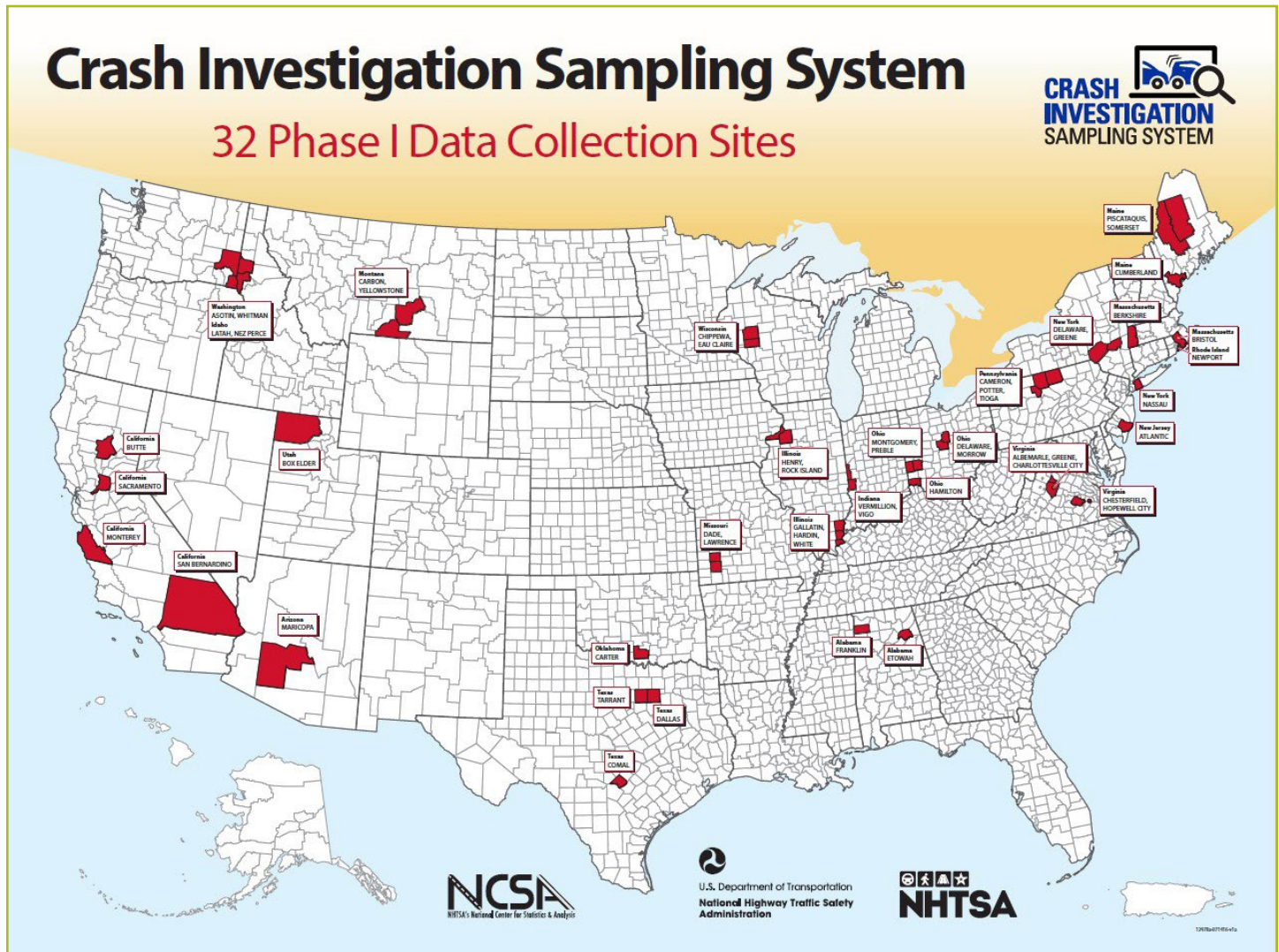
Additionally, CISS target population is a sub-population of the Crash Report Sampling System (CRSS) target population. CRSS targets police-reported crashes on a trafficway in the United States. Estimates of total crashes from CISS are similar to the estimates of total crashes from the corresponding CRSS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

FARS is a national census of fatal crashes. CISS in-scope fatal crashes are also a sub-population of FARS. However, CISS data is normally collected within 1 or 2 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 2021 CISS Sample

The map below shows the 32 data collection sites selected for CISS.

Figure 4  
CISS Data Collection Sites



In 2021 CISS selected 3,806 police-reported crashes from 227 police jurisdictions in 32 sites across the country. Each police-reported crash is categorized into 10 analysis domains which 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 2021 CISS. The distribution of the 2021 CISS sampled cases is consistent with target sample allocation distribution. Among the 3,806 crashes, 3,331 crashes<sup>6</sup> were eligible to be investigated and included in the final analytic files for estimation.

<sup>6</sup> Out-of-scope cases and replaced sample cases are not investigated or included in the final analytic files.

Table 7  
**CISS Sample Allocation Versus 2021 CISS Sampled Cases**

CISS Analysis Domains	Description	Target Percentage of Sample Allocation	2021 Percentage of Sampled Cases
1	At least one occupant of towed passenger vehicle is killed	4.5%	5.5%
2	Crashes not in Stratum 1 involving: <ul style="list-style-type: none"> <li>• A recent model year passenger vehicle in which at least one occupant is incapacitated</li> </ul>	8.0%	9.4%
3	Crashes not in Stratum 1 or 2 involving: <ul style="list-style-type: none"> <li>• A recent model year passenger vehicle in which at least one occupant is non-incapacitated, possibly injured, or injured but severity is unknown.</li> </ul>	22.0%	19.4%
4	Crashes not in Stratum 1-3 involving: <ul style="list-style-type: none"> <li>• A recent model year passenger vehicle in which all occupants are not injured</li> </ul>	15.5%	14.5%
5	Crashes not in Stratum 1-4 involving: A mid-model year passenger vehicle in which at least one occupant is incapacitated	6.0%	7.5%
6	Crashes not in Stratum 1-5 involving: <ul style="list-style-type: none"> <li>• A mid-model year passenger vehicle in which at least one occupant is non-incapacitated, possibly injured or injured but severity is unknown</li> </ul>	12.0%	13.0%
7	Crashes not in Stratum 1-6 involving: <ul style="list-style-type: none"> <li>• A mid-model year passenger vehicle in which all occupants are not injured</li> </ul>	10.0%	10.6%
8	Crashes not in Stratum 1-7 involving: <ul style="list-style-type: none"> <li>• An older model year passenger vehicle in which at least one occupant is incapacitated</li> </ul>	6.0%	4.9%
9	Crashes not in Stratum 1-8 involving: <ul style="list-style-type: none"> <li>• An older model year passenger vehicle in which at least one occupant is non-incapacitated, possibly injured or injured but severity is unknown.</li> </ul>	10.0%	9.2%
10	Crashes not in Stratum 1-9 involving: <ul style="list-style-type: none"> <li>• An older model year passenger vehicle in which all occupants are not injured</li> </ul>	6.0%	6.0%
<b>Total</b>		<b>100%</b>	<b>100%</b>

Source: 2021 CISS. Components may not add to 100 percent due to independent rounding.  
Recent model year (or late model year): vehicles that are 4 years old or newer (i.e., any model year of 2017-2022)  
Mid-model year: 5- to 9-year-old vehicles (i.e., any model year of 2012-2016)  
Older model year: vehicles that are 10 years old or older (i.e., any model year up to 2011)

## Downloading and Analyzing 2020 and 2021 CISS Data

The 2020 CISS can be downloaded here: [www.nhtsa.gov/file-downloads?p=nhtsa/downloads/CISS/2020/](http://www.nhtsa.gov/file-downloads?p=nhtsa/downloads/CISS/2020/)

The 2021 CISS can be downloaded here: [www.nhtsa.gov/file-downloads?p=nhtsa/downloads/CISS/2021/](http://www.nhtsa.gov/file-downloads?p=nhtsa/downloads/CISS/2021/)

The analytic user's manual can be found here: <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813398>

The CISS coding and editing manual can be found here: <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813388>

The CISS crash viewer can be found here: <https://crashviewer.nhtsa.dot.gov/CISS/SearchIndex>

*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>

The databook application providing weighted and unweighted univariate distributions of the variables in CISS can be found at: <https://cdan.dot.gov/DataBook/DataBook.htm>

## References

Zhang, F., Noh, E. Y., Subramanian, R., & Chen, C.-L. (2019a, September). *Crash Investigation Sampling System: Sample design and weighting* (Report No. DOT HS 812 804). National Highway Traffic Safety Administration. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812804>

Zhang, F., Subramanian, R., Chen, C.-L., & Young Noh, E. Y. (2019b, September). *Crash Investigation Sampling System: Design overview, analytic guidance, and FAQs* (Report No. DOT HS 812 801). National Highway Traffic Safety Administration. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812801>

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