VIUS Summary Statistics Report

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About This Report

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Rolf R. Schmitt, *Deputy Director, Office of the Director*

Publication Management Official

Ramond Robinson, *Director, Office of Transportation Analysis*

Project Manager

Jina Mahmoudi, Ph.D., P.E., *VIUS Project Manager, Office of Data Development and Standards*

Major Contributors

Stacey Bricka, Ph.D., PMP®*; Christopher Rick, Ph.D.*; Novin Ghaffari, Ph.D.; and Jina Mahmoudi, Ph.D., P.E.
Ramond Robinson

Editor

Mikki Stacey*

Visual Information Specialists

Christopher Rick, Ph.D.*, and Justina Beard*

Other Contributors

Joseph McGill; Cha-Chi Fan, Ph.D.; and Ryan Grube

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Title

VIUS Summary Statistics Report

Performing Organization*

MacroSys, LLC
522 21st Street NW, Suite 120A
Washington, DC 20006

Abstract

This report describes the 179 million vehicles represented in the 2021 Vehicle Inventory and Use Survey. Chapter 1 provides a high-level look at Public Use File (PUF) data on the fleet. Chapter 2 discusses the Bureau of Transportation Statistics' analysis of general vehicle characteristics in the PUF data. Chapter 3 highlights vehicle changes and the increased

adoption of new technology features by examining the prevalence of specific safety and connectivity technologies across model years.

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Introduction

The Bureau of Transportation Statistics (BTS), an agency within the U.S. Department of Transportation, is an objective supplier of statistically sound baseline, contextual, and trend information that is intended to inform transportation policy and investment decisions across the United States. BTS is responsible for providing timely, accurate, and reliable information on U.S. passenger and freight transportation systems and their impacts on the economy, society, and the environment.

The Vehicle Inventory and Use Survey (VIUS) is conducted by the Census Bureau in partnership with BTS to collect, on the physical and operational characteristics of the truck population in the United States. The latest iteration of VIUS was conducted in 2022 and asked respondents about the characteristics and operation of their vehicles in 2021. Respondents were owners of vehicles in the truck fleet, which comprises vehicles with gross vehicle weight ratings (GVWRs) between classes 1–8 that were classified by their manufacturers as pickup trucks, straight trucks, truck tractors, minivans, light vans, or sport utility vehicles (SUVs).[1] For the 2021 VIUS, a total of 150,000 vehicles were sampled, and almost 68,000 completed surveys were returned. Prior to 2021, the last VIUS was conducted in 2002. Additional details regarding the VIUS program can be found in *Differences and Contrasts Between 2002 VIUS and 2021 VIUS* [BTS 2025] and *Design Changes That Affect the Comparability of the 2002 and 2021 VIUS Estimates* [BTS 2024c].

The 2021 VIUS sample reflects the 179 million vehicles in the truck fleet in terms of characteristics such as fuel efficiency and how many miles those vehicles were driven. These data are a rich resource to inform decisions regarding investments in transportation infrastructure, vehicle technologies and parts, safety, energy consumption, and more. The following statistics from the 2021 VIUS were recently published in BTS' *Transportation Statistics Annual Report* (TSAR) to Congress [2024b]:

> Whether for personal or commercial use, 93.4 million sport utility vehicles (SUVs) traveled on average 10,700 miles in 2021, 53.8 million pickups averaged 9,500 miles, and minivans averaged 10,100 miles. The 2021 VIUS shows that 2.9 million truck tractors traveled on average 48,500 miles in 2021, and 1.6 million other heavy trucks averaged 14,000 miles each. Some key data points from both the 2002 and 2021 VIUS datasets include the following:
>
> - In 2021, the total number of trucks operated on U.S. roadways was 169.8 million[2], versus 85.1 million in 2002.
> - The annual number of miles driven by these trucks was 1.9 trillion miles, a 70 percent increase from 1.1 trillion miles in 2002.
> - Light-duty trucks, which have a GVWR of less than 10,000 pounds, had a fuel efficiency of 19.5 miles per gallon (MPG) in 2021, compared to 17.4 MPG in 2002. In 2021, the average annual VMT [vehicle miles traveled] was 9,800 per truck, versus 12,200 in 2002.

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1 Refer to https://www.census.gov/programs-surveys/vius/technical-documentation/methodology.html for more details about the GVWR classification scheme used in the 2021 VIUS.

2 Estimates from TSAR may differ from those in the VIUS Tabulation Tool on the BTS website due to timing of differences in data versions.

- Heavy-duty trucks, which have a GVWR heavier than 26,000 pounds, had a fuel efficiency of 6.34 MPG in 2021, versus 6.23 MPG in 2002. In 2021, the average annual VMT for these trucks was 36,000 per truck, versus 41,000 in 2002.

The purpose of this summary statistics report is to provide a digestible overview of the 179 million vehicles represented in the 2021 VIUS Public Use File (PUF). Chapter 1 provides a high-level look at PUF data on the fleet. Chapter 2 discusses BTS' analysis of general vehicle characteristics in the PUF data. Chapter 3 highlights vehicle changes and the increased adoption of new technology features by examining the prevalence of specific safety and connectivity technologies across model years (MYs).

For a more in-depth view of the data, refer to TSAR [BTS 2024b] or the BTS VIUS website for the full suite of products, including the VIUS PUF [BTS 2024a, BTS and Census 2023].

1. Overview

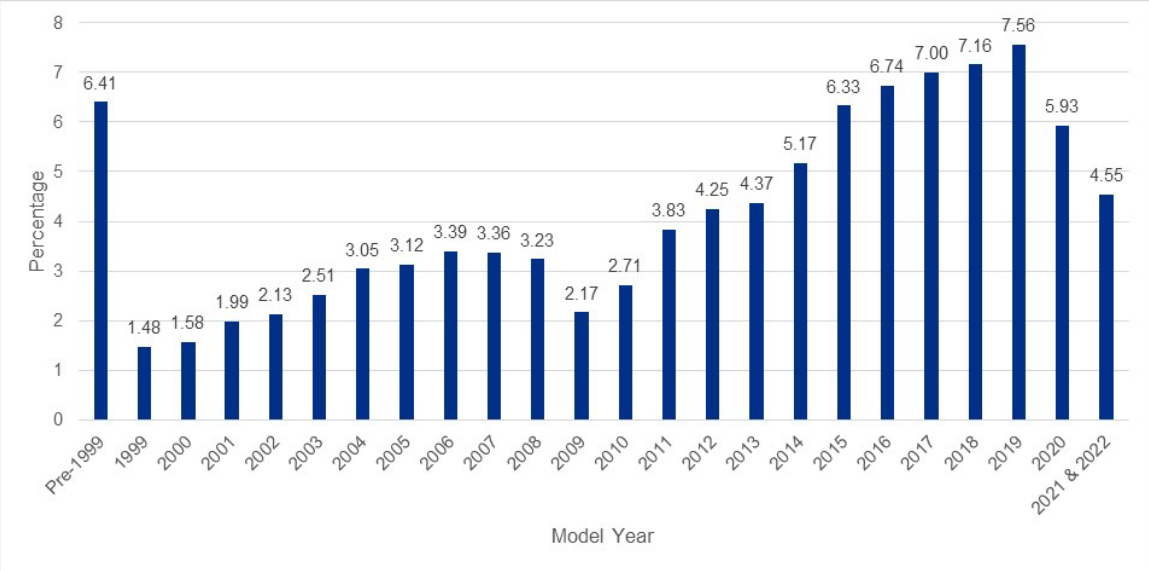
This chapter summarizes results for key data fields from the 2021 VIUS about the overall truck fleet. Key fields include the following:

- Total vehicles in the fleet by MY
- VMT
- Average miles traveled
- Geography

1.1. TOTAL VEHICLES IN THE FLEET BY MODEL YEAR

BTS analyzed the 68,000 completed 2021 VIUS responses to better understand the 179 million vehicles in the U.S. truck fleet. Based on these data, the truck fleet can be organized by MY as shown in Figure 1. In 2021, 4.55 percent of vehicles driven on U.S. roadways were MY 2021 or 2022, and 6.41 percent of vehicles were from MY 1998 or earlier. At 2.17 percent, MY 2009 vehicles made up the lowest share of vehicles over the nearly 20-year gap between the 2002 and the 2021 VIUS, while MY 2019 vehicles made up the highest share at 7.56 percent.

Figure 1. Percentage of Model Years in the Fleet

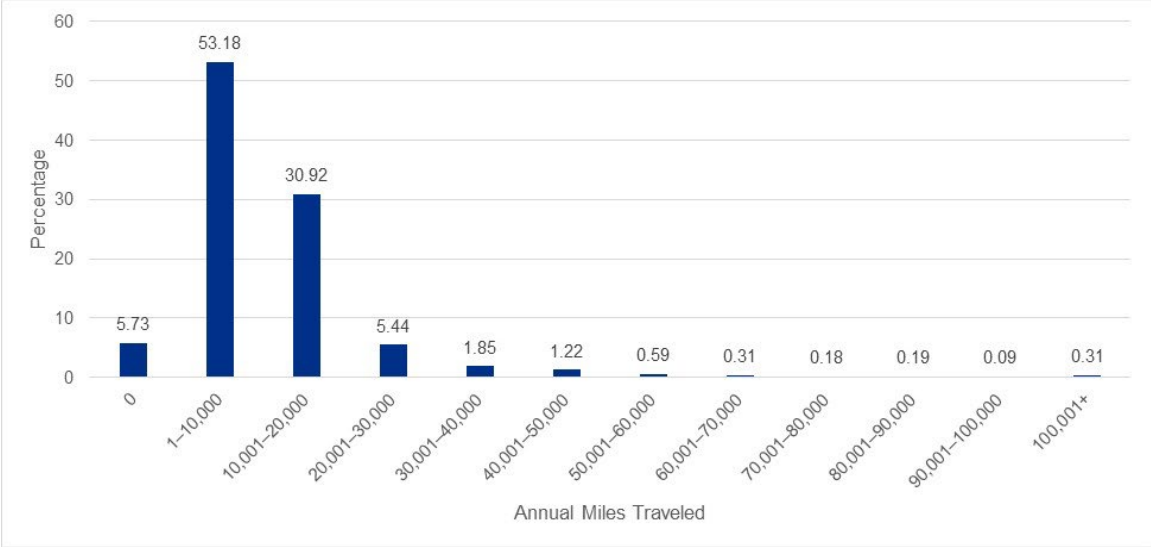


Source: BTS.
Note: Data are from VIUS PUF using the variable MODELYEAR.

1.2. VEHICLE MILES TRAVELED

VMT is another key datapoint of interest. Figure 2 shows annual VMT in 2021. In summary, 53.18 percent of vehicles were driven for 1–10,000 miles, 30.92 percent of vehicles were driven 10,001–20,000 miles, 8.51 percent of vehicles were driven 20,000–50,000 miles, 1.36 percent of vehicles were driven 50,000–100,000 miles, and 0.31 percent of vehicles were driven at least 100,001 miles. The 5.73 percent of vehicles that reported 0 miles in 2021 were not in use**.** Vehicle miles are annualized to represent usage for the vehicle in all of 2021, regardless of owner.

Figure 2. Percentage of Annual Vehicle Miles Traveled in 2021

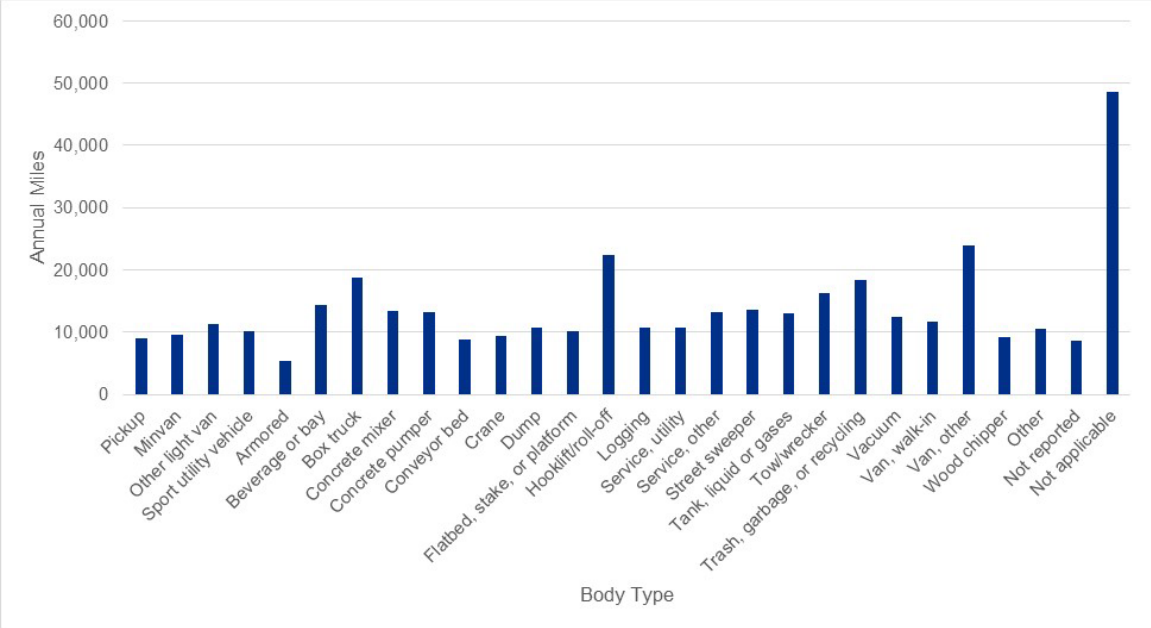


Source: BTS.
Note: Data are from VIUS PUF using the variable MILESANNL. The description for the "MILESANNL" data field in the 2021 VIUS PUF (which represents the annual VMT) indicates when a respondent had partial year ownership of the vehicle, lifetime miles were adjusted to reflect miles traveled in 2021 when not owned by the respondent".

1.3. AVERAGE ANNUAL MILES

Building on VMT, Figure 3 Illustrates average annual miles traveled in 2021 by body type. Vans were driven the most (23,921 miles), followed by hooklift and roll-off trucks (22,303 miles) and box trucks (18,839 miles). The average SUV was driven 10,222 miles, and the average pickup was driven 8,933 miles. At 5,440 miles, armored trucks were driven the least of any body type. Tractor-trailers comprise the "not applicable" category and were driven 48,532 miles.

Figure 3. Average Annual Miles by Body Type



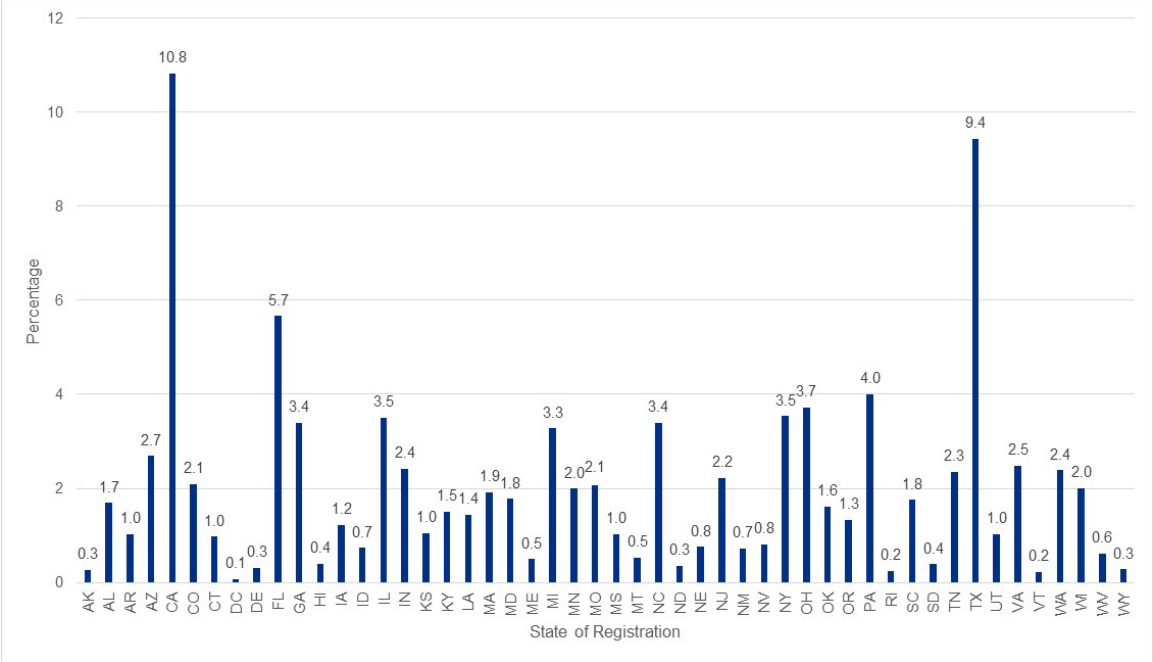
Source: BTS.
Note: Data are from VIUS PUF using the variables MILESANNL and BTYPE.

1.4. GEOGRAPHY

This section describes where the 2021 VIUS vehicles were registered and vehicle mileage by location.

Vehicle registrations by state (Figure 4) largely mirror state-level population data. Nearly 11 percent of vehicles were registered in California, which accounted for about 11.79 percent of the U.S. population in 2021 [Census 2024]. Texas was second in both vehicle registrations (9.44 percent) and population (8.90 percent). An exception to this pattern was New York, which accounted for 5.98 percent of the U.S. population in 2021 [Census 2024] but just 3.53 percent of vehicle registrations. Additional 2021 population data are available in Appendix A.

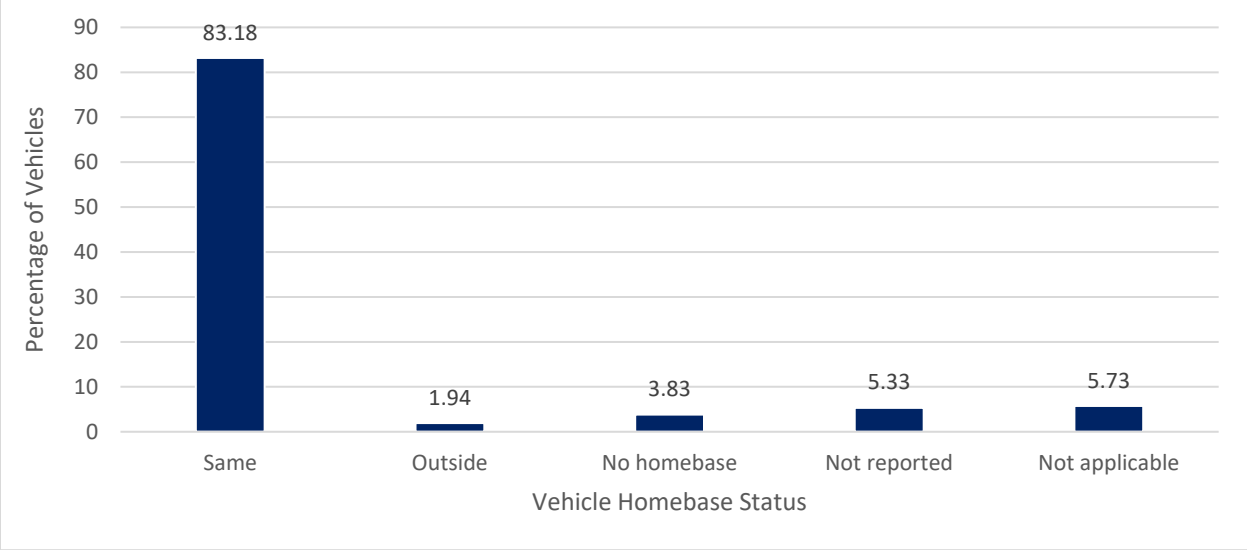
Figure 4. Percentage of Vehicle Registration by State



Source: BTS.
Note: Data are from VIUS PUF using the variable REGSTATE.

Figure 5 illustrates the relationship between in vehicles' homebases (i.e., the locations where the vehicles were usually parked when not on the road) and their state of registration. Based on the 2021 VIUS data, 83.18 percent of vehicles had their homebase in the same state in which they were registered. Only 1.94 percent of vehicles had a homebase outside their registration state, and roughly twice as many vehicles (3.83 percent) had no home base.

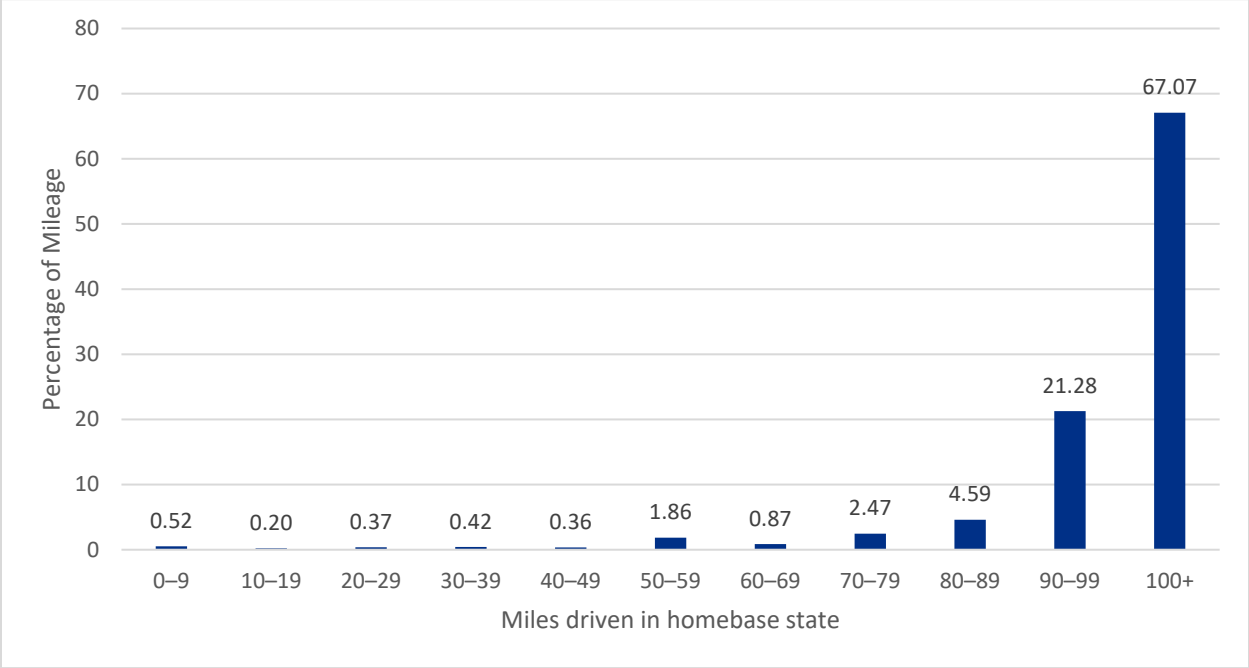
Figure 5. Vehicle Homebase



Source: BTS.
Note: Data are from VIUS PUF using the variable HBSTATE.

Figure 6 shows the share of vehicles that drive 0–50 percent, 50–99 percent, and 100 percent of their mileage within their homebase states.

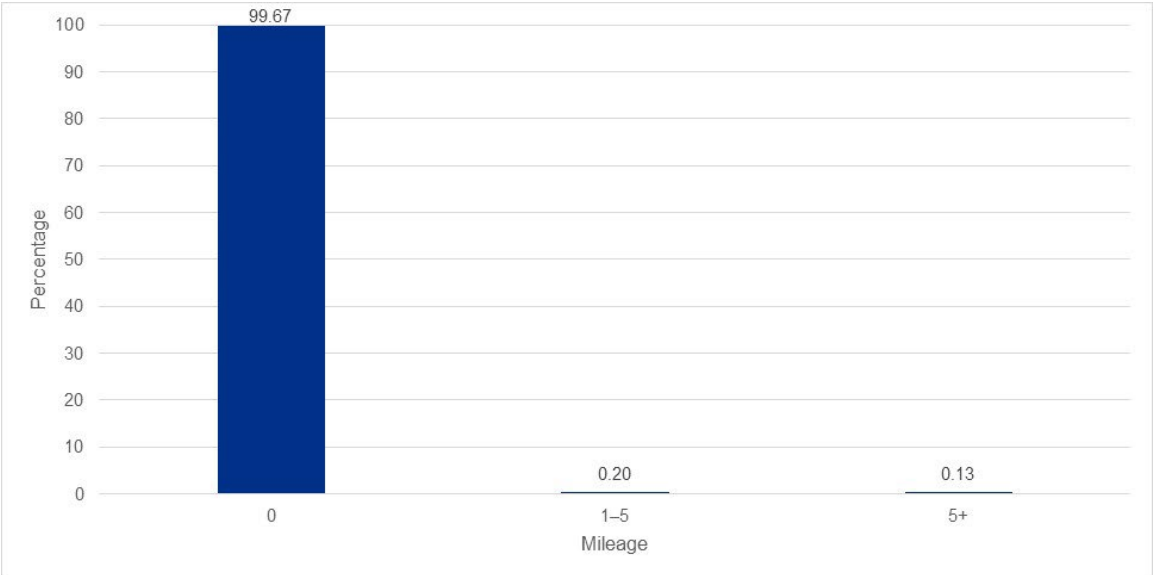
Figure 6. Percentage of Mileage Within Homebase State



Source: BTS.
Note: Data are from VIUS PUF using the variables REGSTATE and JU_HOMEBASE.

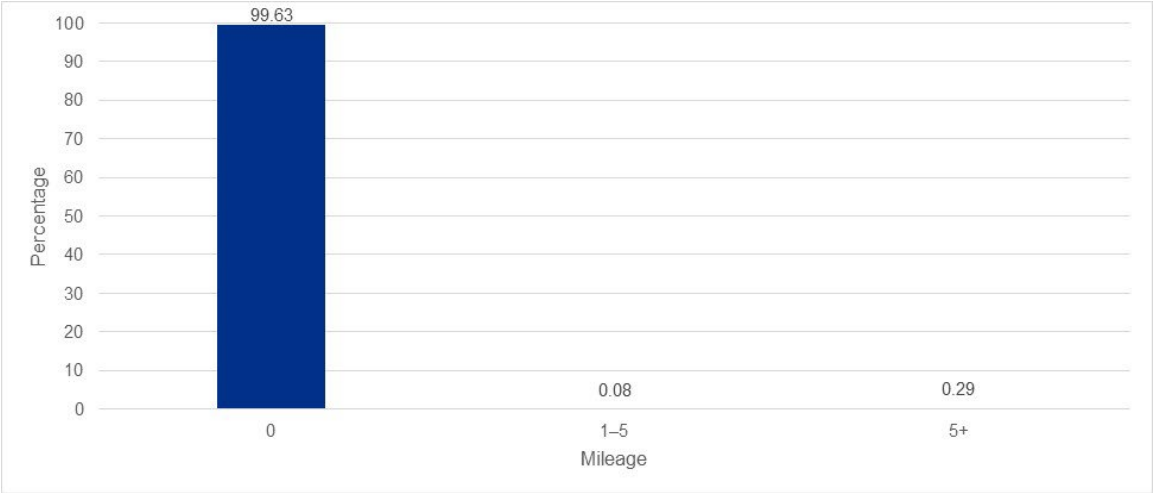
Figure 7 and Figure 8 show virtually all trucks captured by the 2021 VIUS were driven exclusively in the United States. Just 0.33 percent of vehicles were driven in Canada, and only 0.37 percent were driven in Mexico.

Figure 7. Percentage of Mileage Within Canada



Source: BTS.
Note: Data are from VIUS PUF using the variable JU_CANADA.

Figure 8. Percentage of Mileage Within Mexico



Source: BTS.
Note: Data are from VIUS PUF using the variable JU_MEXICO.

2. General Vehicle Characteristics

This section describes the characteristics of vehicles within the 2021 VIUS fleet. The VIUS vehicle characteristic data are critical to understanding the attributes of the U.S. vehicle fleet. TSAR, for example, highlights the increasing age of the vehicle fleet as follows [BTS 2024b]:

> The average age of the Nation's light vehicles (which includes passenger cars and light trucks) continues to increase steadily over time, up from 10.6 years in 2010 to 11.7 years in 2018. The pandemic-induced drop in vehicle sales increased the average vehicle age even further, reaching 12.5 years in 2023. Vehicle condition usually declines with use and age. Some additional key data points from the 2021 VIUS datasets include the following:
>
> - 41 percent of VIUS vehicles below 10,000 pounds were more than 10 years old and averaged 7,100 miles per year, while newer light-duty vehicles averaged more than 10,000 miles per year.
> - 47 percent of trucks heavier than 26,000 pounds were more than 10 years old and averaged 20,000 miles per year.
> - 10 percent of trucks heavier than 26,000 pounds were from model years 2020 and 2021 and averaged more than 75,000 miles per year.
>
> Various factors have been offered to explain the increasing age of the vehicle fleet: longer vehicle life due to improvements in vehicle manufacturing, an increase in the number of vehicles per household (e.g., older vehicles passed on to children of driving age when parents get a new car), changes in driving habits, and deferring vehicle purchases during economic recessions. As to the latter, the average age increase in the light-duty vehicle fleet was 12 percent between 2008 and 2013, a period of economic recession and recovery, compared with average age increases during the non-recession periods immediately before and after the recession of about 4 percent between 2002 and 2007 and 3 percent between 2015 and 2019. In comparison, the vehicle fleet has aged 6.8 percent from 2018 to 2023, which spans the COVID-19 pandemic years.

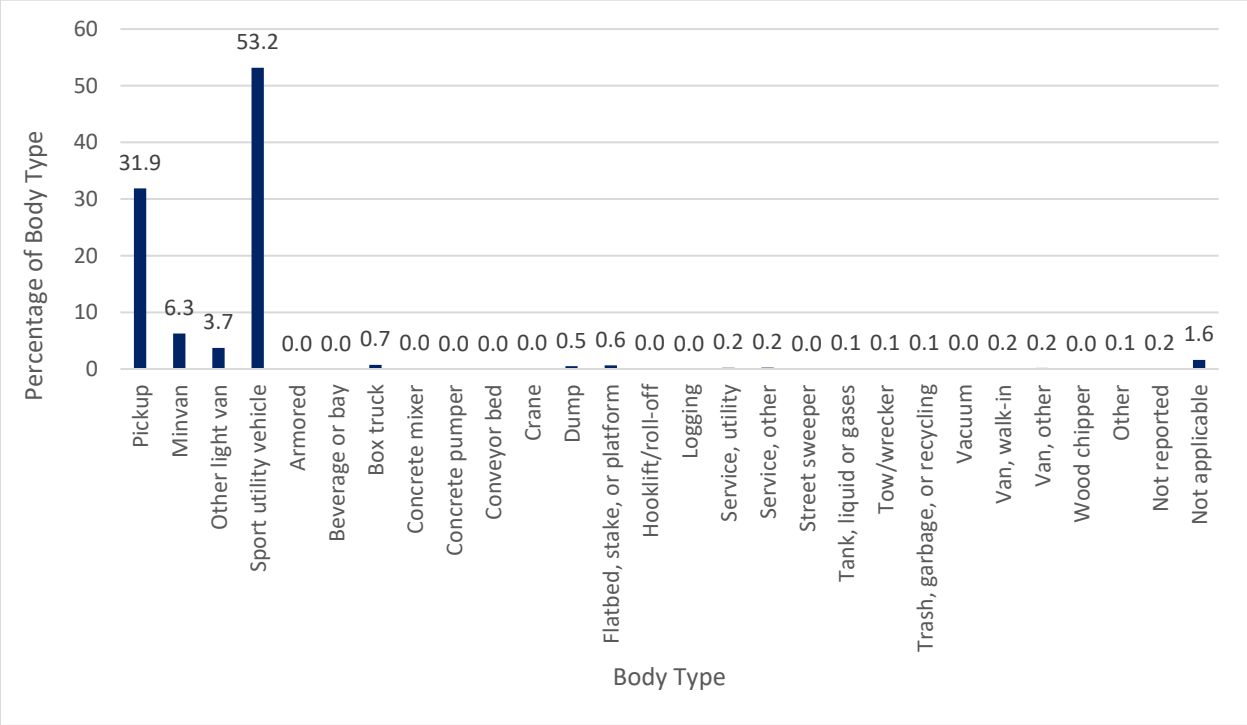
Characteristics covered in this chapter include vehicle-build information, categorization, usage, and features, among others.

2.1. VEHICLE-BUILD INFORMATION

Figure 9–Figure 14 summarize information about the physical characteristics of vehicles in the fleet, including body type, transmission type, number of axles, number of cylinders, and tow capacity.

Figure 9 Illustrates the fleet by percentage of each body type. SUVs comprise the majority (53.17 percent) of vehicles in the fleet. Pickup trucks are the second most common body type (31.87 percent). Minivans round out the top three (6.27 percent) vehicle body types. The only other body type comprising more than 1 percent of the vehicle fleet is other light vans. Box trucks account for 0.73 percent of all vehicles, followed by flatbed and dump trucks, accounting for 0.63 and 0.49 percent, respectively.

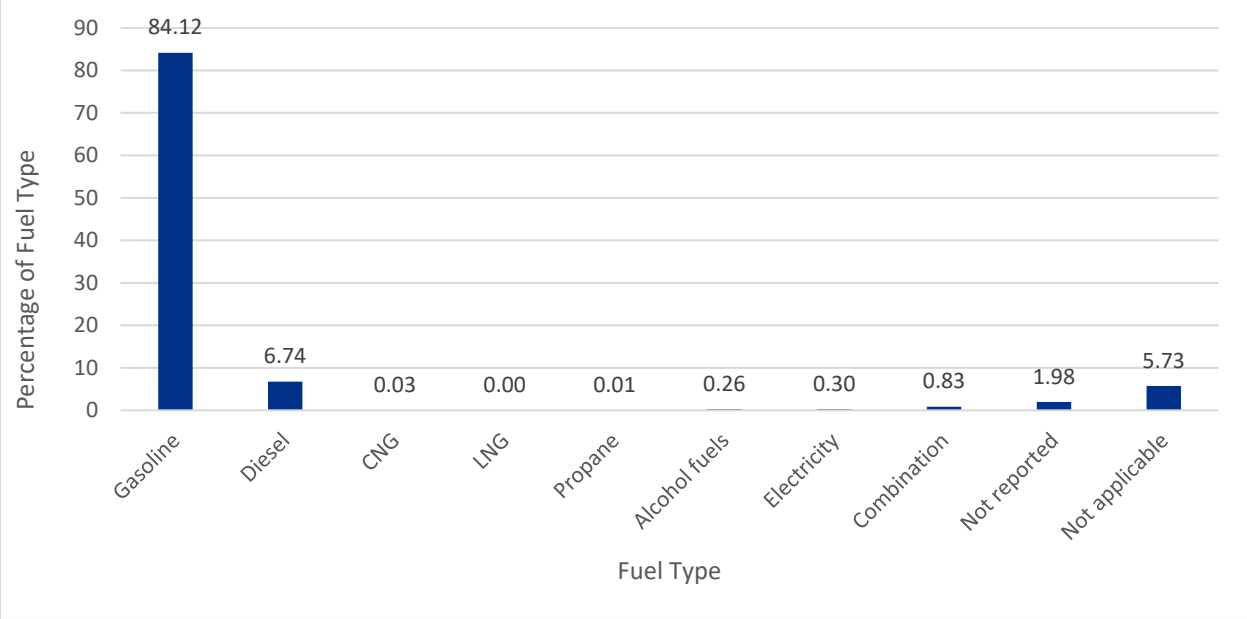
Figure 9. Body Type



Source: BTS.
Note: Data are from VIUS PUF using the variable BTYPE.

Figure 10 illustrates the fleet by percentage using each fuel type. The majority (84.12 percent) of vehicles used gasoline. At 6.74 percent of the fleet, diesel was the next most common fuel type. Vehicles using compressed natural gas (CNG), liquid natural gas (LNG), electricity, propane, alcohol fuels, or a combination of fuels accounted for 1.43 percent of all vehicles.

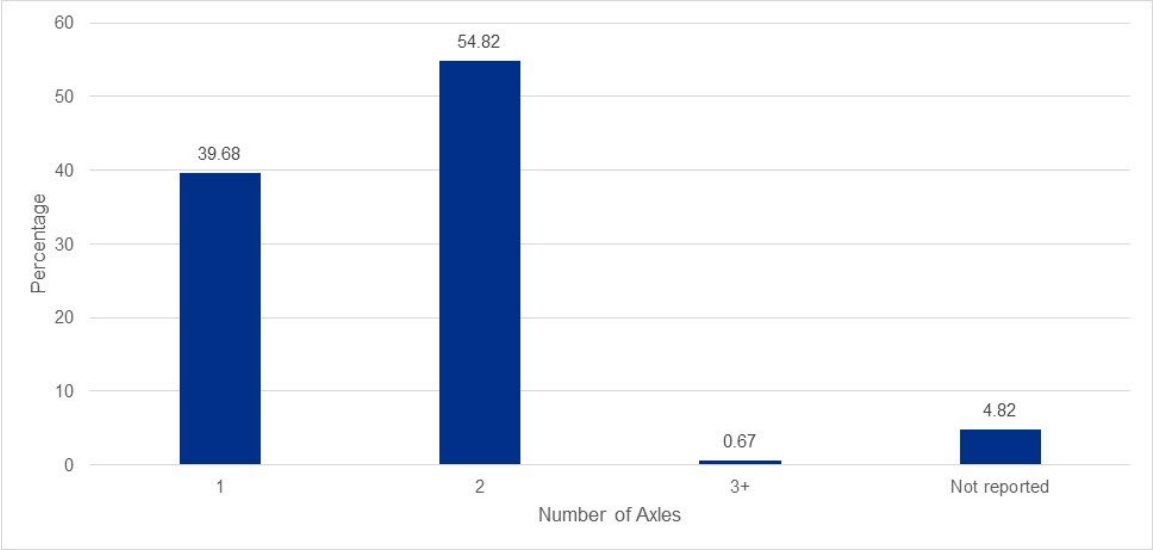
Figure 10. Fuel Type



Source: BTS.
Note: Data are from VIUS PUF using the variable FUELTYPE.

Figure 11 indicates 54.82 percent of vehicles had two axles on the drivetrain, while 39.68 percent of vehicles had one powered axle. Further, 0.67 percent of vehicles had more than two powered axles, and 4.82 percent did not report.

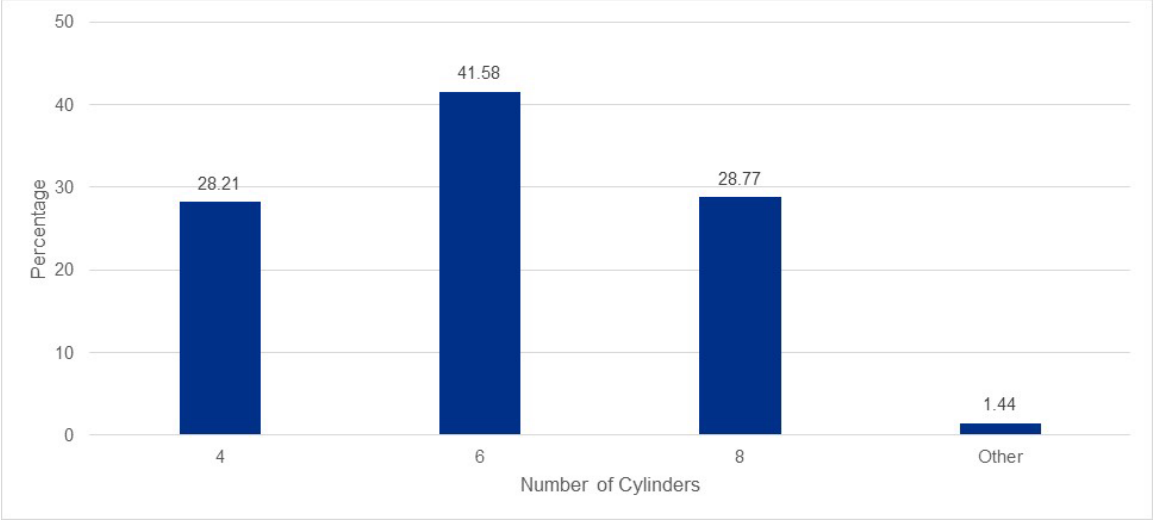
Figure 11. Percentage of Number of Axles



Source: BTS.
Note: Data are from VIUS PUF using the variable DRIVEAXLES.

Vehicles with six cylinders accounted for 41.58 percent of vehicles, with nearly equal shares of four- (28.21 percent) and eight-cylinder (28.77 percent) vehicles (Figure 12).

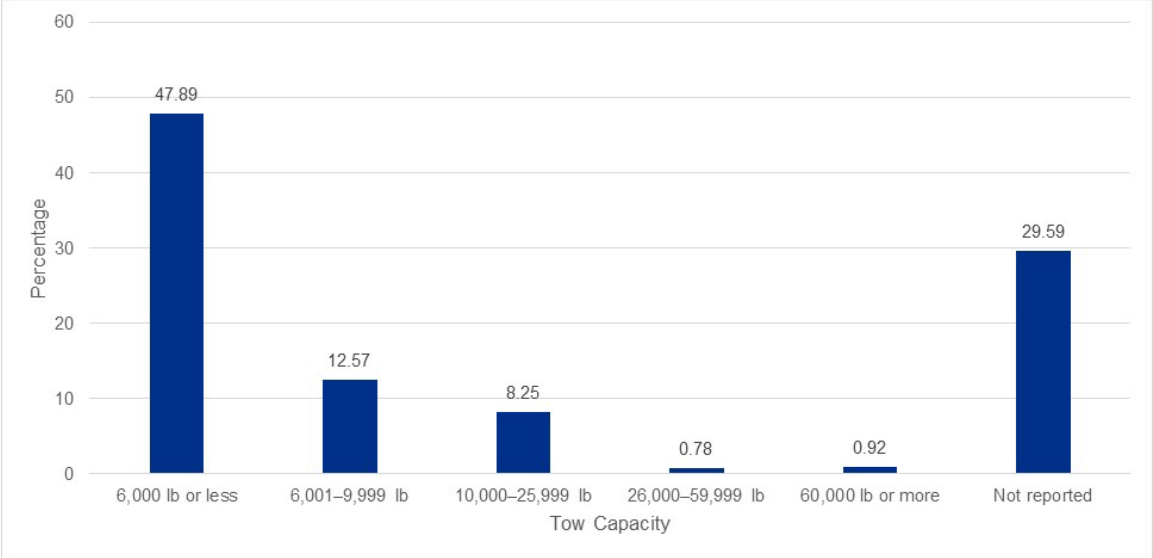
Figure 12. Percentage of Number of Cylinders



Source: BTS.
Note: Data are from VIUS PUF using the variable CYL.

Figure 13 shows that nearly half (47.89 percent) of all vehicles had a tow capacity of 6,000 pounds or fewer, while 12.57 percent of vehicles could tow 6,001–9,999 pounds. In addition, 8.25 percent of vehicles had a tow capacity of 10,000–25,999 pounds, while 1.7 percent of vehicles could tow more than 26,000 pounds. Figure 13 shows that 29.59 percent of vehicles did not report a tow capacity.

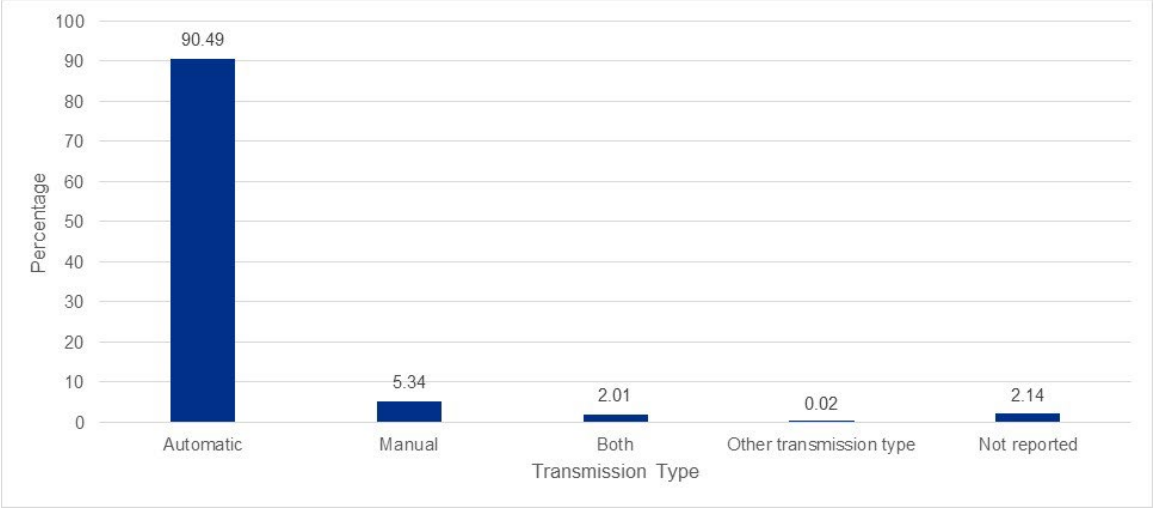
Figure 13. Percentage of Tow Capacity



Source: BTS.
Note: Data are from VIUS PUF using the variable TOWCAPACITY.

Figure 14 shows 90.49 percent of vehicles had an automatic transmission, 5.34 percent had a manual transmission, while 2.01 percent of vehicles had both transmission types.

Figure 14. Percentage of Transmission Type

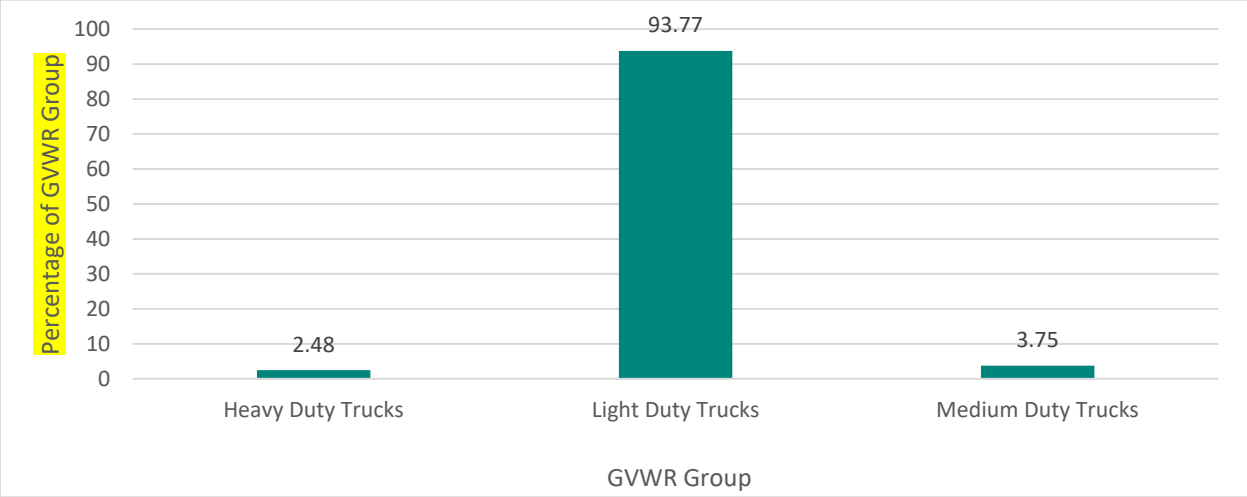


Source: BTS.
Note: Data are from VIUS PUF using the variable TRANSMISSION.

2.2. TRUCK CATEGORIZATION

Truck Classification, a type of truck categorization, is based on a combination of weight and body type. The following are the three GVWR Group of Heavy-duty trucks, Light-duty trucks, and Medium-duty trucks, with a total count in 2021 VIUS (Figure 15):

Figure 15. GVWR Group

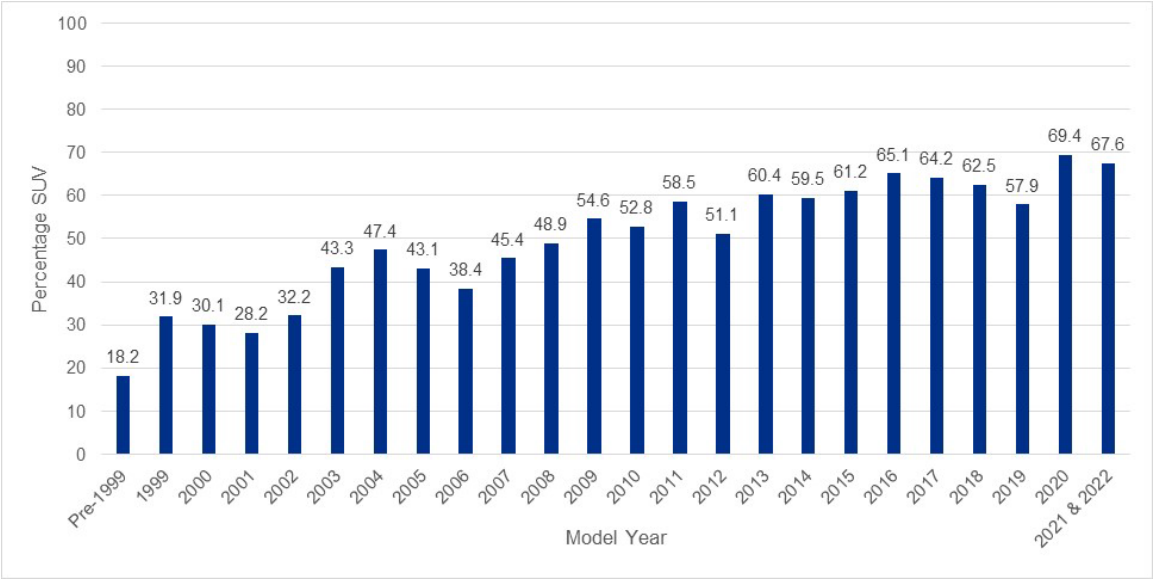


Source: BTS.
Note: Data are using the variable GVWR_CLASS. Refer to Table 3 of the VIUS Methodology document, https://www.census.gov/programs-surveys/vius/technical-documentation/methodology.html for more details about the GVWR classification scheme used in the 2021 VIUS.

Figure 15 shows that 93.77 percent of 2021 VIUS vehicles were Light-duty Trucks. Medium-duty trucks were just 3.75 percent, and heavy-duty trucks were 2.48 percent.

The share of 2021 VIUS vehicles that were SUVs dramatically increased in later MYs (Figure 16). Less than 20 percent of MY 1998 or older vehicles were SUVs. For all MYs since 2015, excluding MY 2019, SUVs made up more than 60 percent of each individual MY's vehicles.

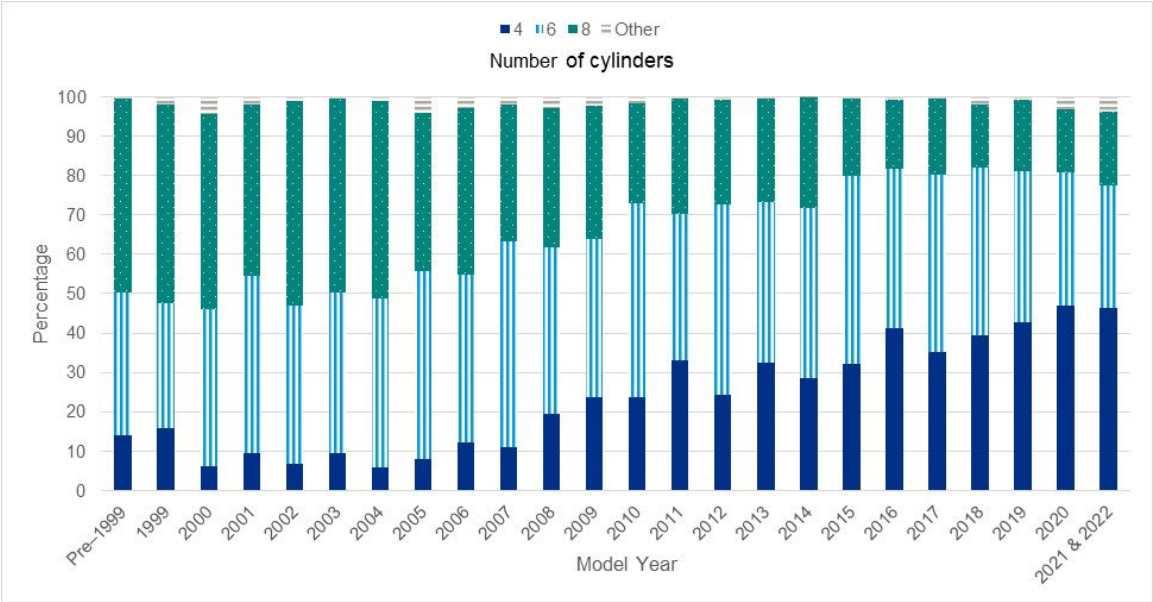
Figure 16. Sport Utility Vehicles as a Percentage of All Vehicles by Model Year



Source: BTS.
Note: Data are from VIUS PUF using the variables BTYPE and MODELYEAR.

Despite the shift to SUVs, the share of four-cylinder vehicles increased in recent MYs. Figure 17 shows 46.52 percent of MY 2021 and 2022 vehicles were four cylinders, compared with just 14.08 percent of MY 1998 or older vehicles. The share of six-cylinder vehicles ranged from a low of 30.86 percent for MYs 2021 and 2022 to a high of 52.27 percent for MY 2007 vehicles. Figure 17 shows 49.70 percent of all MY 1998 or older vehicles on the road had eight cylinders, compared to just 18.82 percent of MY 2021 and 2022 vehicles.

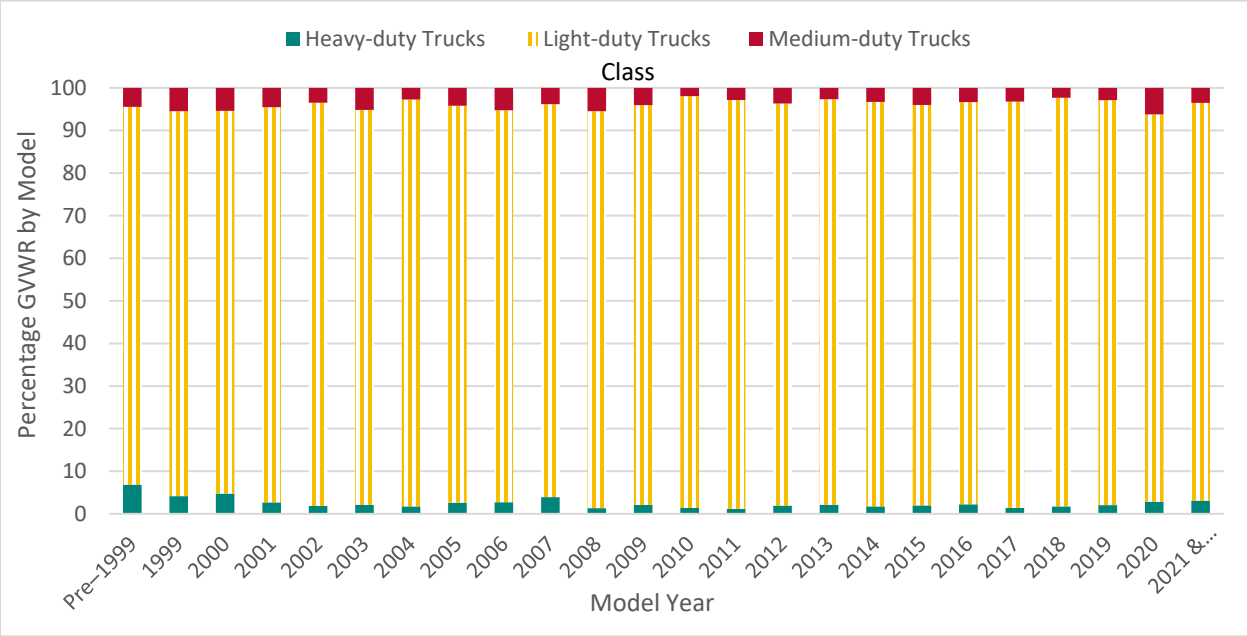
Figure 17. Percentage of Cylinders by Model Year



Source: BTS.
Note: Data are from VIUS PUF using the variables CYL and MODELYEAR.

Consistent with the increase in share of four-cylinder vehicles (Figure 17), fewer MY 2021 and 2022 vehicles were in medium and heavy-duty trucks (Figure 18). Light-duty trucks made up 93.38 percent of MY 2021 and 2022 vehicles, compared to just 88.65 percent of MY 1998 or older vehicles.

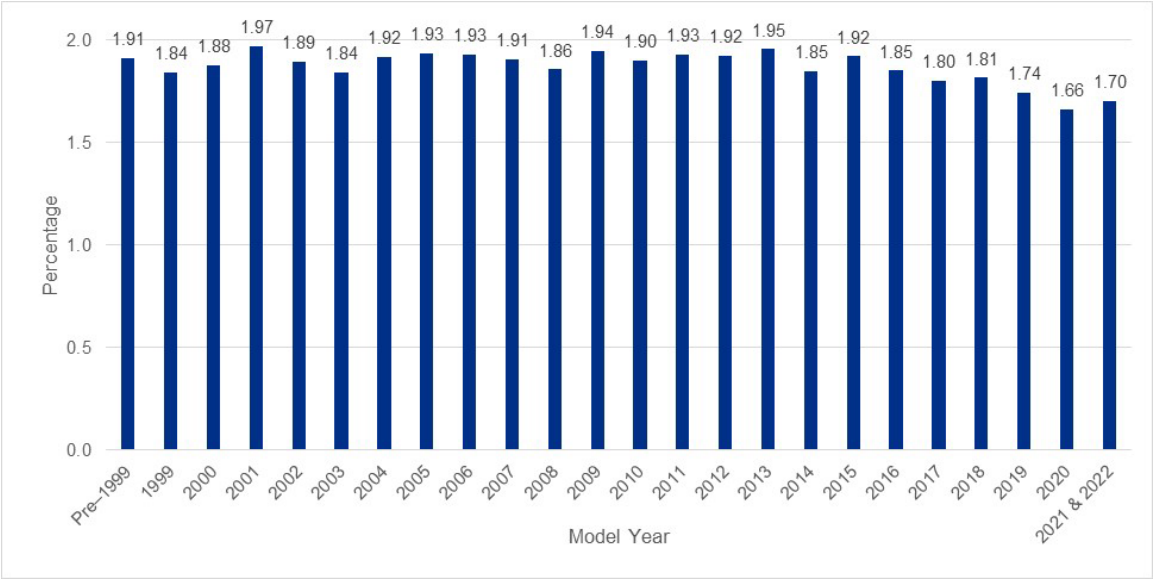
Figure 18. GVWR MY by Model Year



Source: BTS.
Note: Data are from VIUS PUF using the variables GVWR_CLASS and MODELYEAR. Refer to Table 3 of the VIUS Methodology document, https://www.census.gov/programs-surveys/vius/technical-documentation/methodology.html, for more details about the GVWR classification scheme used in the 2021 VIUS.

Figure 19 shows that hybrid electric vehicles comprised 1.70–1.97 percent of all vehicles for over 20 years.

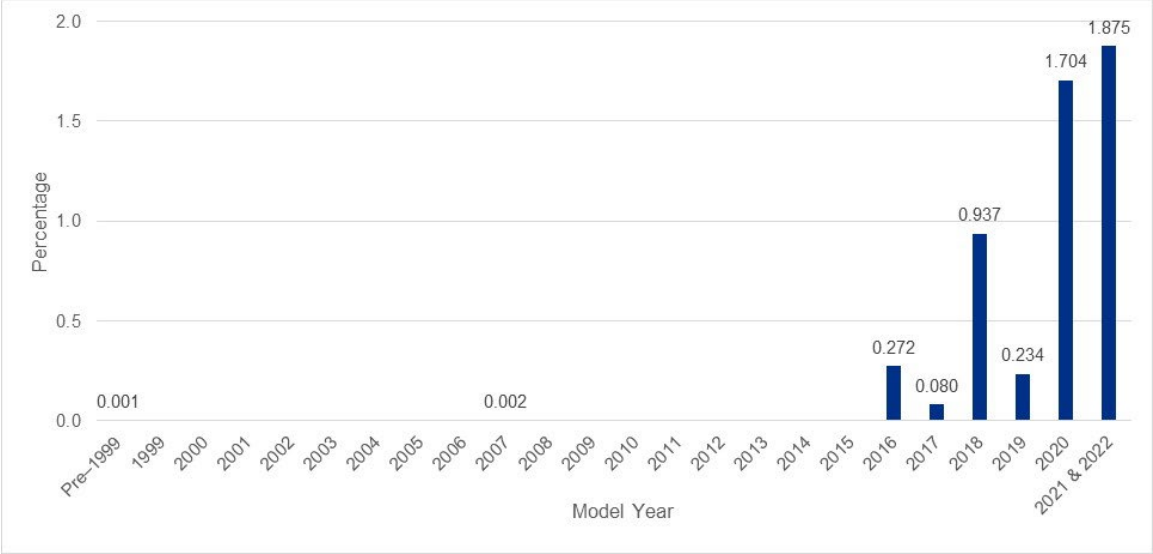
Figure 19. Percent Hybrid Vehicles by Model Year



Source: BTS.
Note: Data are from VIUS PUF using the variables FE_HYBDRIVENP and MODELYEAR.

Figure 20 indicates that electric vehicles accounted for nearly 2 percent of MY 2021 and 2022 vehicles in the 2021 VIUS. Despite the existence of electric vehicles in earlier years, few electric vehicles were captured prior to MY 2016.

Figure 20. Percent Electric Vehicles by Model Year

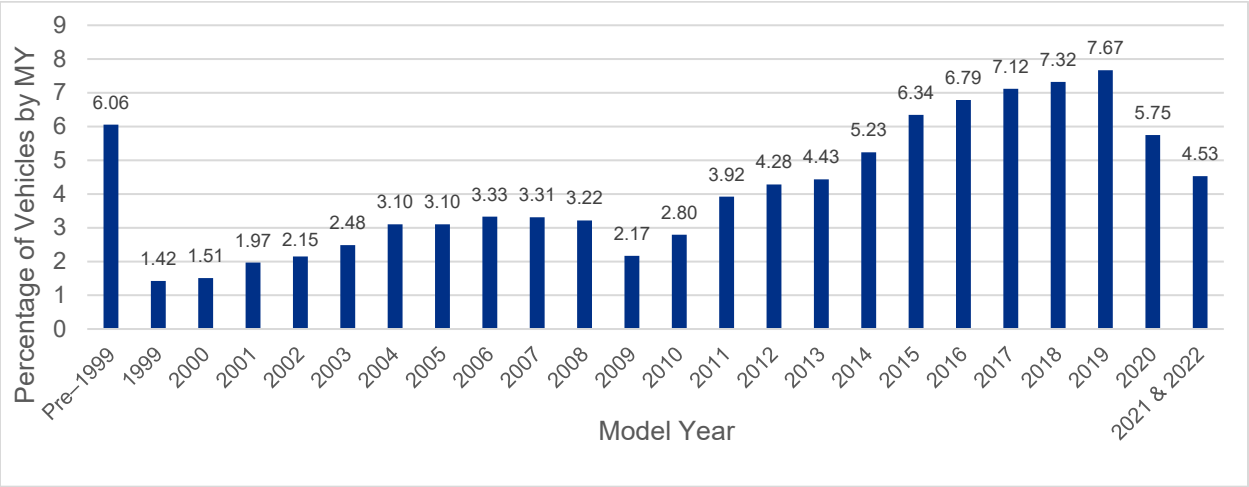


Source: BTS.
Note: Data are from VIUS PUF using the variables FUELTYPE and MODELYEAR.

2.3. LIGHT-DUTY VEHICLES

Broadly, the share of light-duty vehicles by MY (Figure 21) is similar to the MY results for all vehicles (Figure 1). This circumstance is unsurprising given the large share of all vehicles in the 2021 VIUS that were light-duty vehicles.

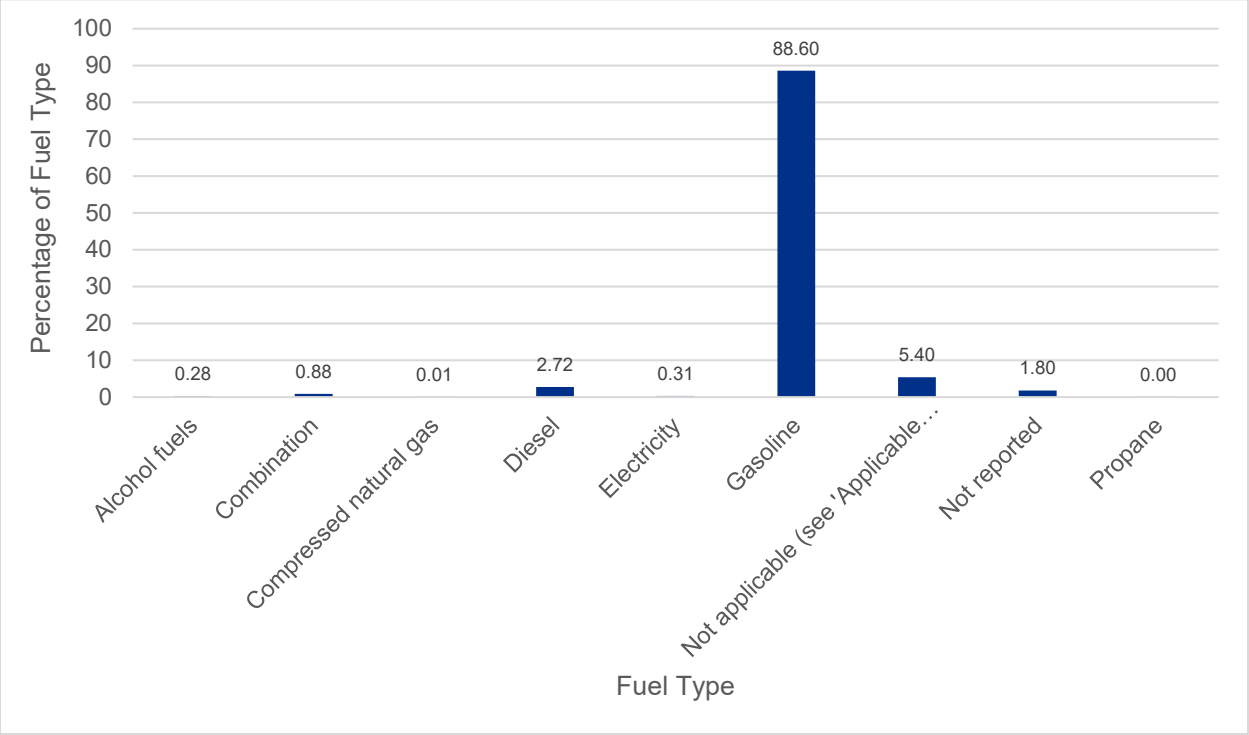
Figure 21. Light-duty Vehicles by Model Year



Source: BTS.
Note: Data are from VIUS PUF using the variables GVWR_CLASS and MODELYEAR.

Per Figure 22, 88.60 percent of light-duty vehicles used gasoline, and 2.72 percent used diesel.

Figure 22. Light-duty Vehicles by Fuel Type



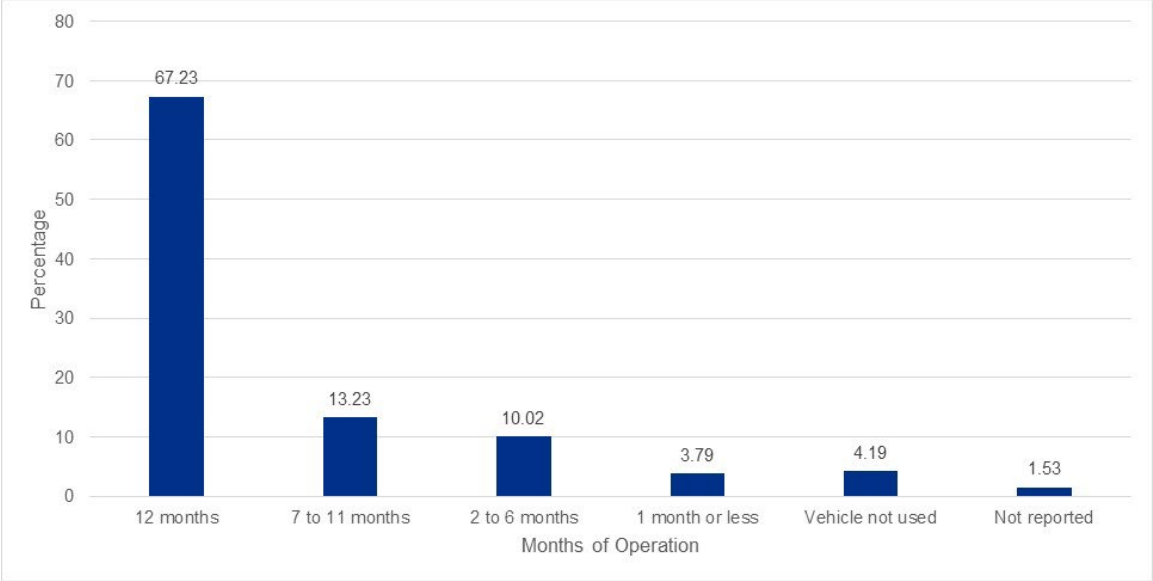
Source: BTS.
Note: Data are from VIUS PUF using the variables FUELTYPE and MODELYEAR.

2.4. VEHICLE USAGE

As shown in Figure 23, roughly two-thirds (67.23 percent) of all vehicles were in operation all 12 months in 2021, 13.23 percent of vehicles were in operation for 7–11 months, 10.02 percent

were in operation for 2–6 months, 3.79 percent were in operation for 1 month or less, and 4.19 percent were not used.

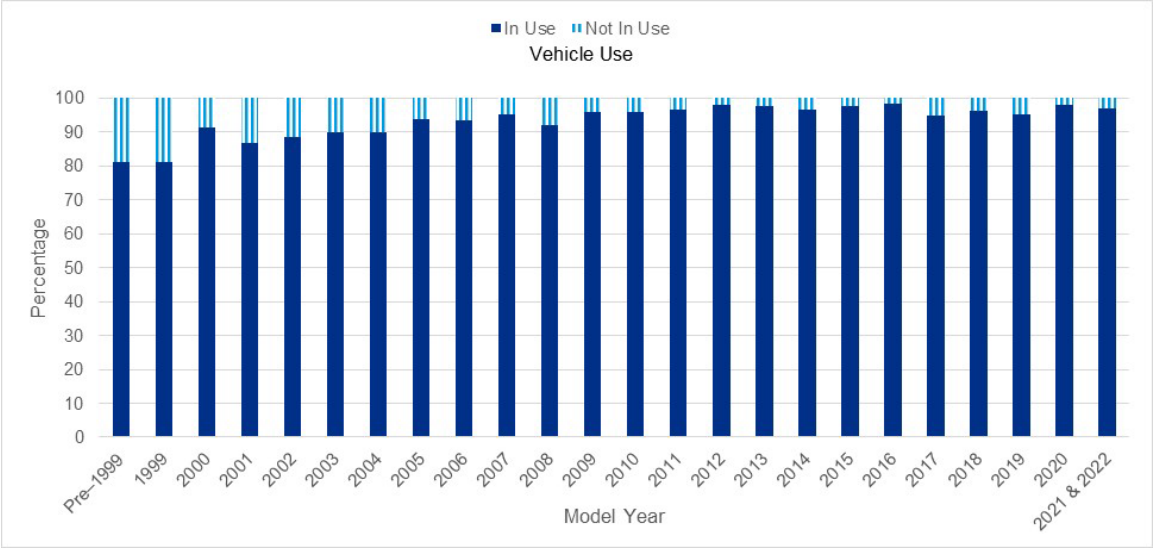
Figure 23. Percentage of Months of Operation in 2021



Source: BTS.
Note: Data are from VIUS PUF using the variable MONTHOPERATE.

Figure 24 shows that 97 percent of vehicles in the MY 2021 and 2022 category were in operation during 2021, while just 81 percent of vehicles with MYs 1999 or pre-1999 were in operation.

Figure 24. Percentage of In-Use Vehicles by Model Year

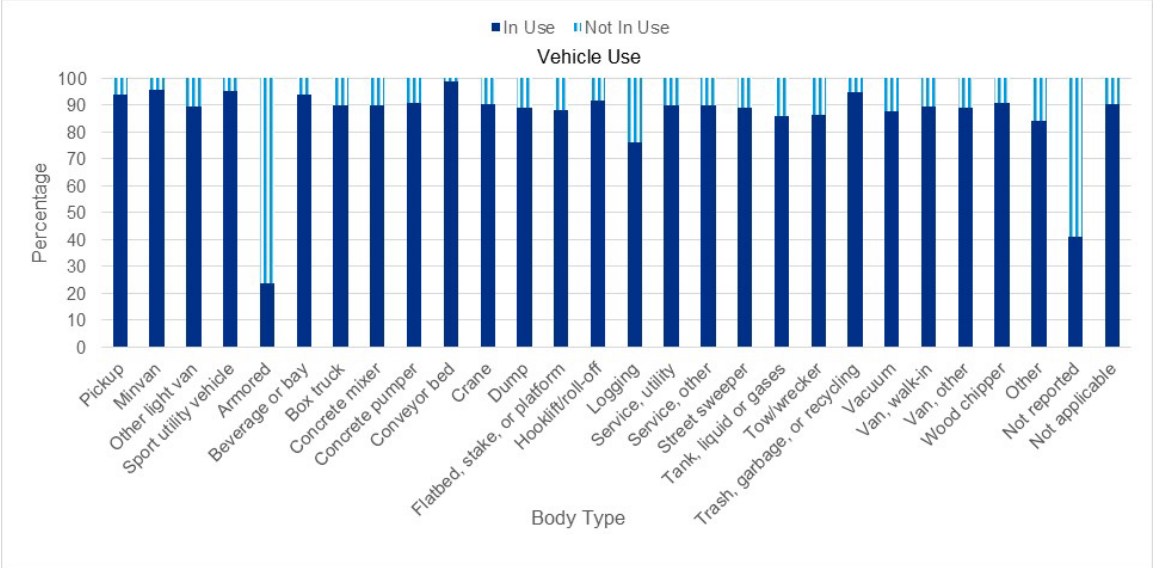


Source: BTS.
Note: Data are from VIUS PUF using the variables MONTHOPERATE and MODELYEAR.

Figure 25 indicates 24 percent of armored vehicles were reported in-use, which is by far the lowest of any body type. The next lowest in-use body type was logging vehicles, with 76 percent

in use. Among the highest in-use body types were pickups (94 percent), SUVs (95 percent), and minivans (96 percent).

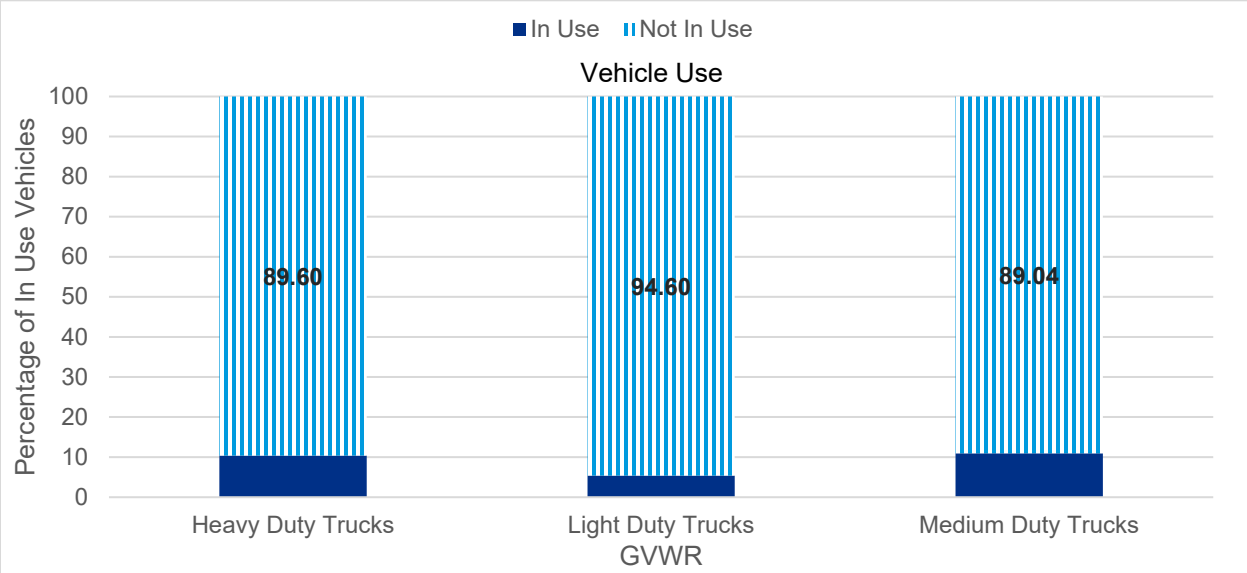
Figure 25. Percentage of In-Use Vehicles by Body Type



Source: BTS.
Note: Data are from VIUS PUF using the variables MONTHOPERATE and BTYPE.

Figure 26 illustrates vehicles in use by weight class. Light-duty trucks had the highest in-use rates (94.60 percent), followed by Heavy-duty trucks with (89.60 percent) and medium-duty trucks with (89.04 percent).

Figure 26. In-Use Vehicles by GVWR_CLASS

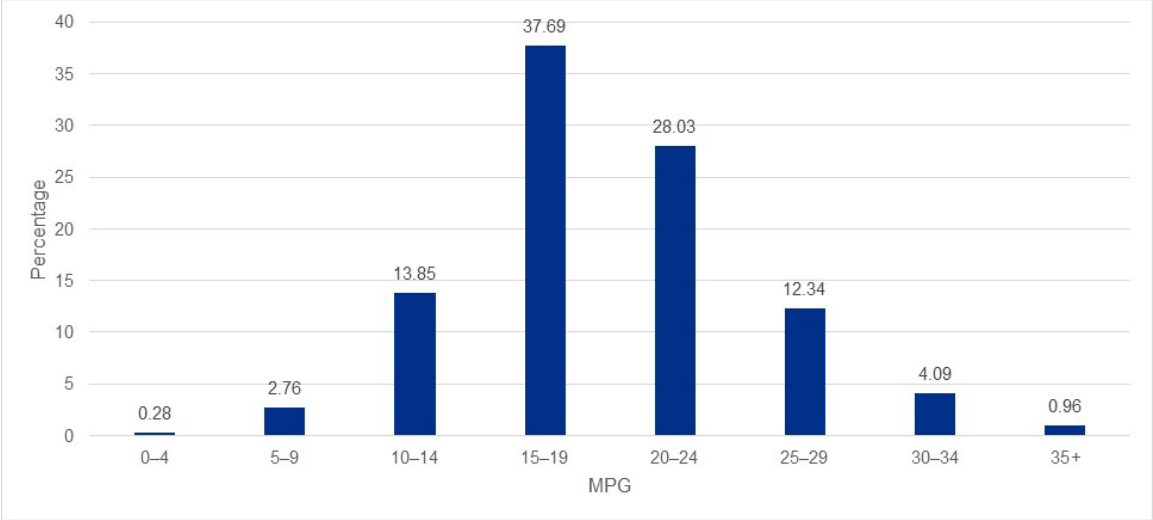


Source: BTS.

Note: Data are from VIUS PUF using the variables MONTHOPERATE and GVWR_CLASS. Refer to Table 3 of the VIUS Methodology document, https://www.census.gov/programs-surveys/vius/technical-documentation/methodology.html for more details about the GVWR classification scheme used in the 2021 VIUS.

Figure 27 illustrates the 2021 VIUS fleet in terms of fuel efficiency. Most vehicles (37.69 percent) had a fuel efficiency of 15–20 miles per gallon, 28.03 percent of vehicles had a fuel efficiency of 20–25 miles per gallon, 13.85 percent of vehicles had a fuel efficiency of 10–15 miles per gallon, and about 0.96 percent of vehicles had a fuel efficiency above 35 miles per gallon.

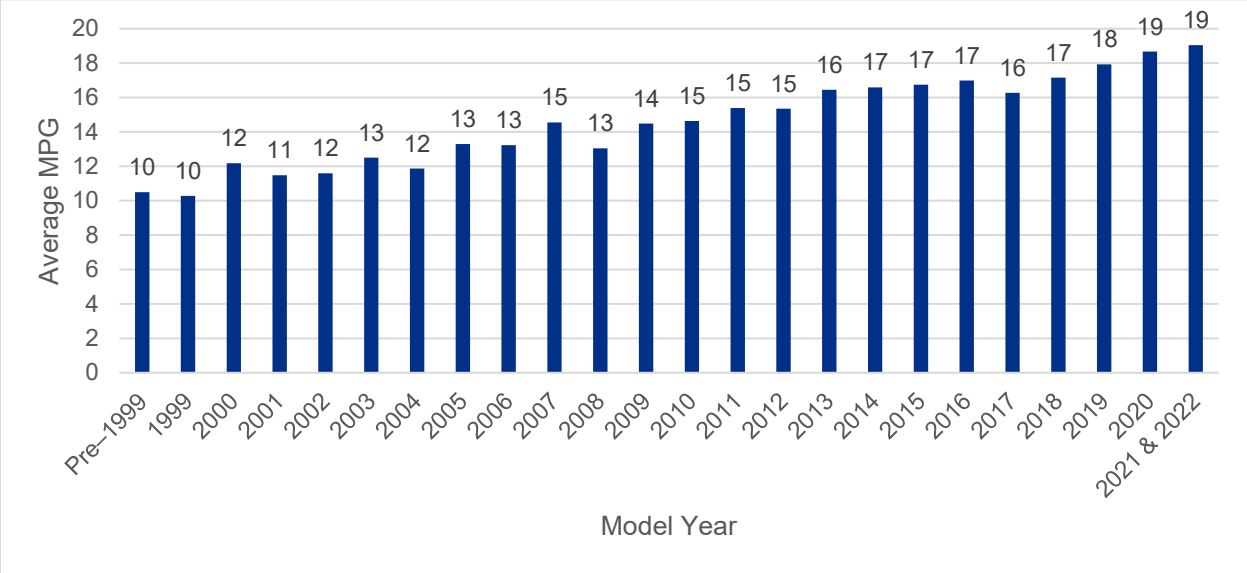
Figure 27. Percentage of Fuel Efficiency (in Miles per Gallon)



Source: BTS.
Note: Data are from VIUS PUF using the variable MPG.

For Light-duty vehicles, the average MY 2021 or 2022 vehicle had a fuel efficiency of nearly 19 miles per gallon (Figure 28), compared with just 10 miles per gallon for MY 1998 or older vehicles. The increase in fuel efficiency was reasonably constant over time. Considering the increased share of four-cylinder vehicles (Figure 17), the increase in fuel efficiency (Figure 28) is an interesting insight offered by the 2021 VIUS data.

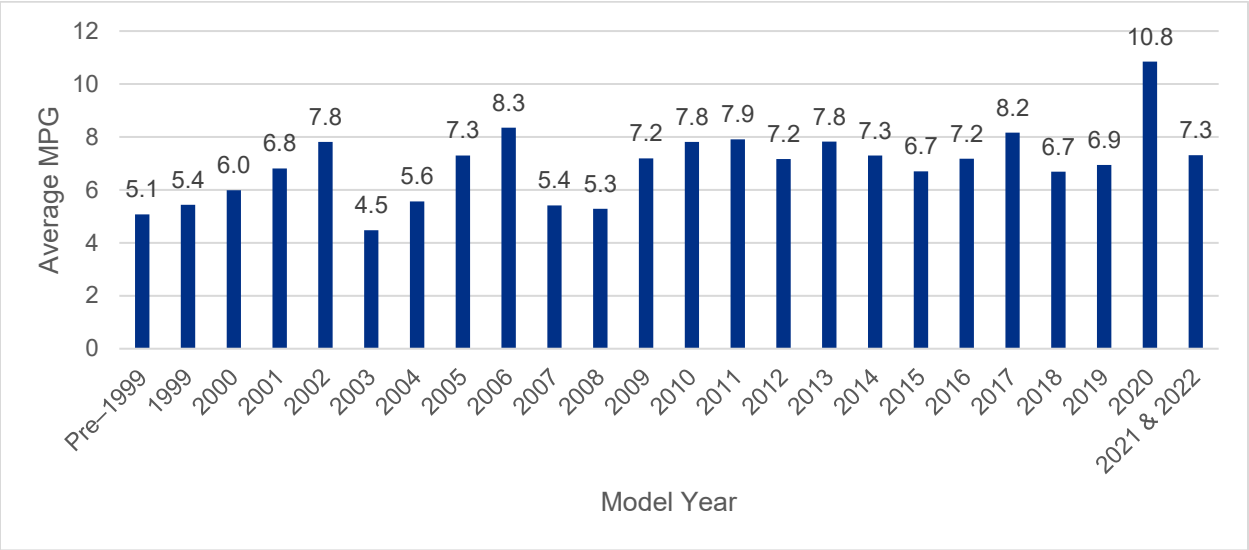
Figure 28. Average Miles per Gallon by Light- duty Vehicles



Source: BTS.
Note: Data are from VIUS PUF using the variables MPG and GVWR_CLASS. Refer to Table 3 of the VIUS Methodology document, https://www.census.gov/programs-surveys/vius/technical-documentation/methodology.html for more details about the GVWR classification scheme used in the 2021 VIUS.

Figure 28 and Figure 29 indicate that medium-duty vehicles did not have the same increase in fuel efficiency as similarly light-duty vehicles. Large-duty vehicles' fuel efficiency has hovered at 7–9 miles per gallon for all MYs.

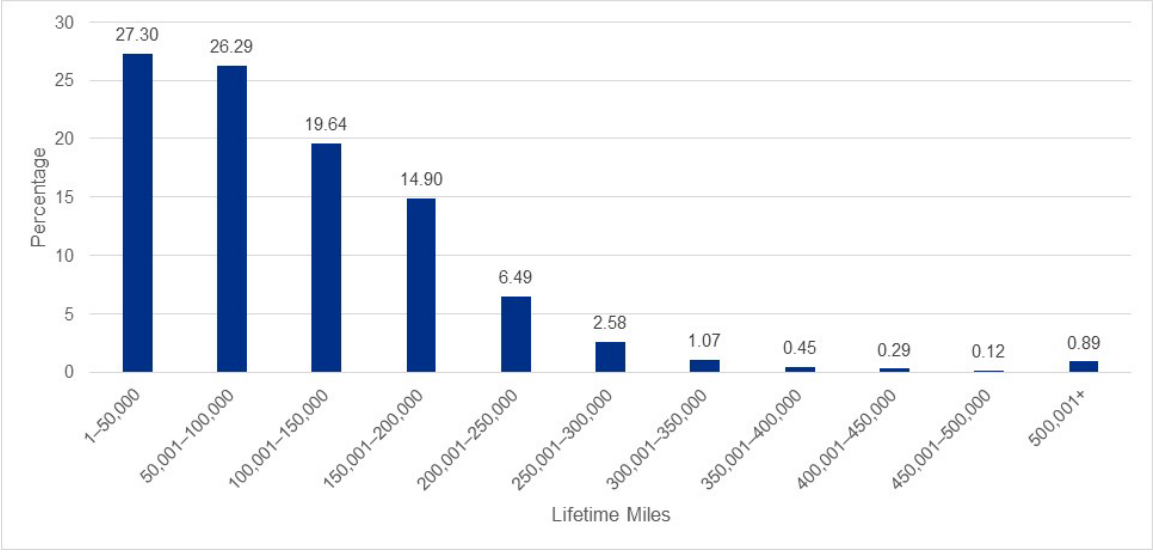
Figure 29. Average Miles per Gallon by Model Year—Medium and Heavy-duty Vehicles



Source: BTS.
Note: Data are from VIUS PUF using the variables MPG and GVWR_CLASS. Refer to Table 3 of the VIUS Methodology document, https://www.census.gov/programs-surveys/vius/technical-documentation/methodology.html for more details about the GVWR classification scheme used in the 2021 VIUS.

Figure 30 shows 27.30 percent of vehicles in 2021 VIUS had lifetime miles of 50,000 or fewer, while 26.29 and 19.64 percent had lifetime miles between 50,001–100,000 and 100,001–150,000 miles, respectively. Nearly 1 percent (0.89 percent) had over 500,000 lifetime miles.

Figure 30. Percentage of Lifetime Miles



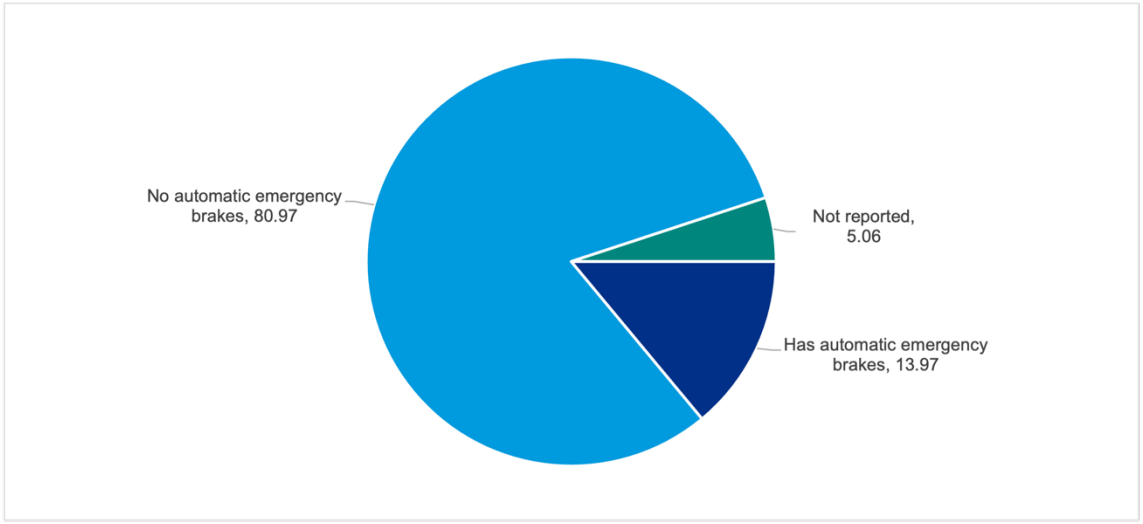
Source: BTS.
Note: Data are from VIUS PUF using the variable MILESLIFE.

2.5. VEHICLE SAFETY FEATURES

The 2021 VIUS gathered data on vehicles' safety features, including presence of emergency braking and steering, cameras, and air bags.

Figure 31 shows that nearly 14 percent of vehicles had automatic emergency braking.

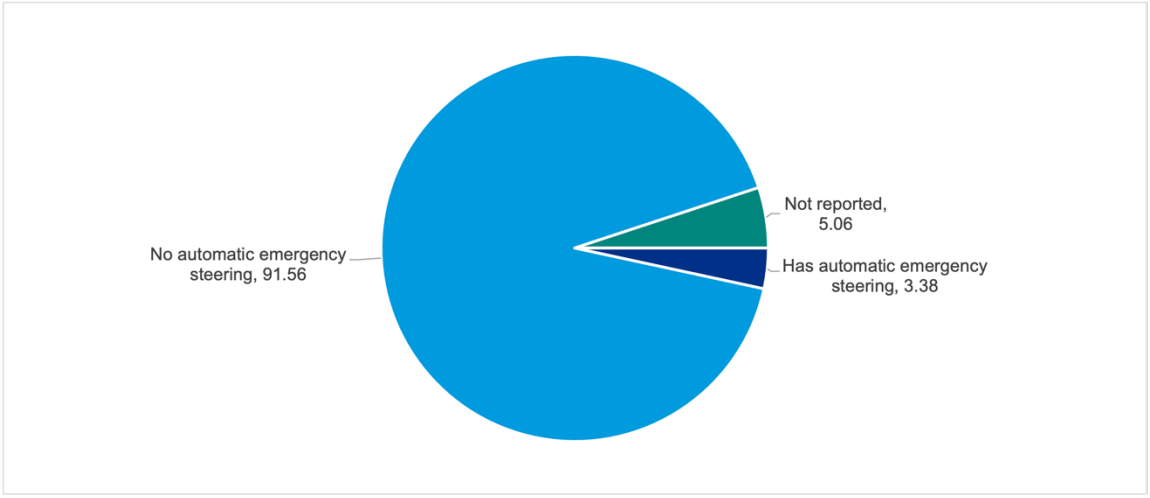
Figure 31 Safety—Automatic Emergency Brakes



Source: BTS.
Note: Data are from VIUS PUF using the variable CI_AUTOEBRAKE.

Figure 32 shows that 3.38 percent of vehicles had automatic emergency steering.

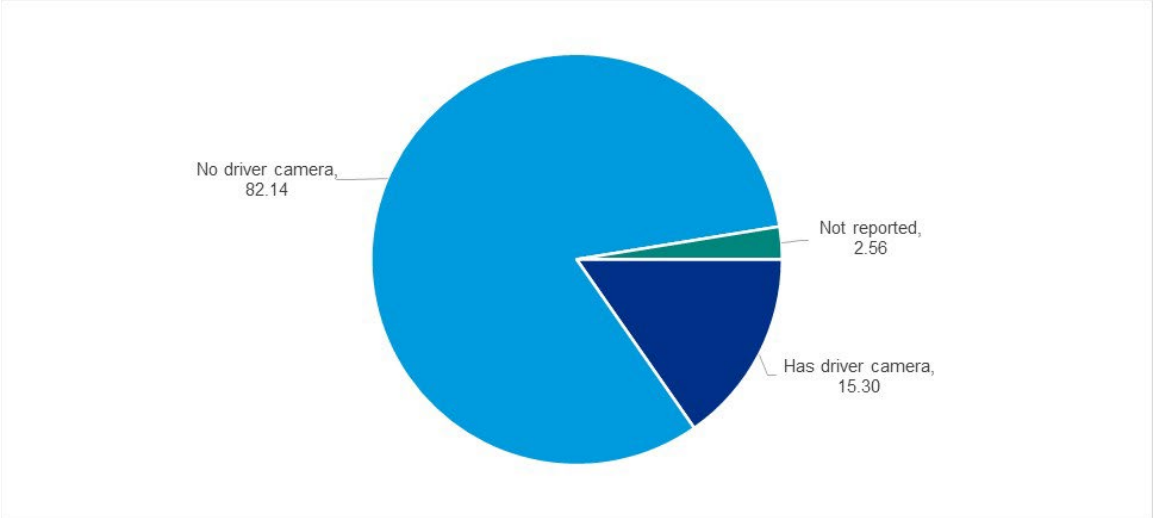
Figure 32. Safety—Automatic Emergency Steering



Source: BTS.
Note: Data are from VIUS PUF using the variable CI_AUTOESTEER.

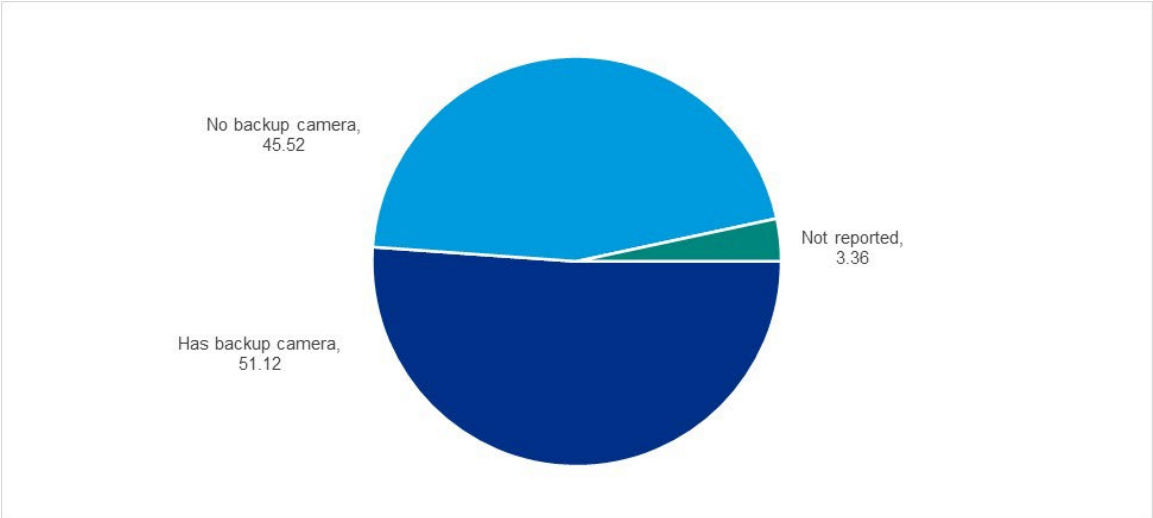
Figure 33 shows 15.30 percent of vehicles had driver-facing cameras, Figure 34 shows 51.12 percent of vehicles had backup cameras, and Figure 35 shows 6.43 percent had surround-view cameras.

Figure 33. Safety—Driver-Facing Camera



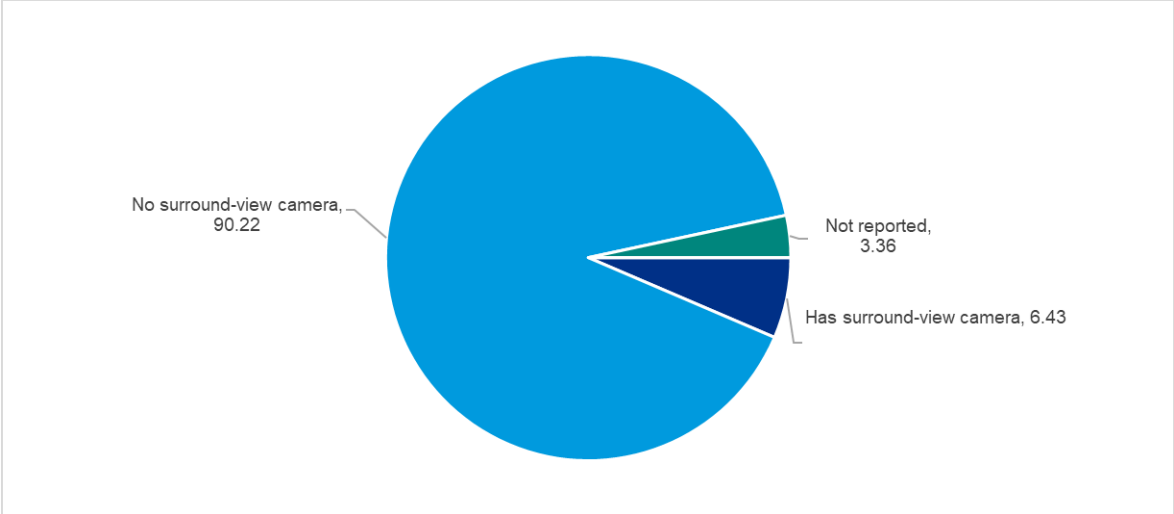
Source: BTS.
Note: Data are from VIUS PUF using the variable ST_DRIVERCAM.

Figure 34. Safety—Backup Camera



Source: BTS.
Note: Data are from VIUS PUF using the variable OD_BACKUPCAM.

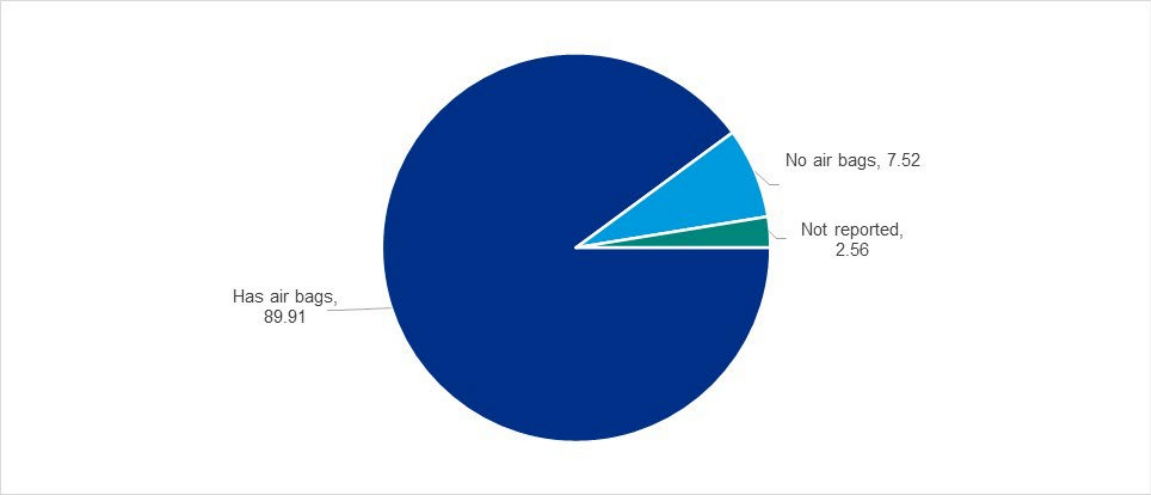
Figure 35. Safety—Surround-View Camera



Source: BTS.
Note: Data are from VIUS PUF using the variable OD_SVCAM.

Airbags were the most common safety feature for vehicles included in 2021 VIUS, with 89.91 percent of vehicles reporting their presence (Figure 36).

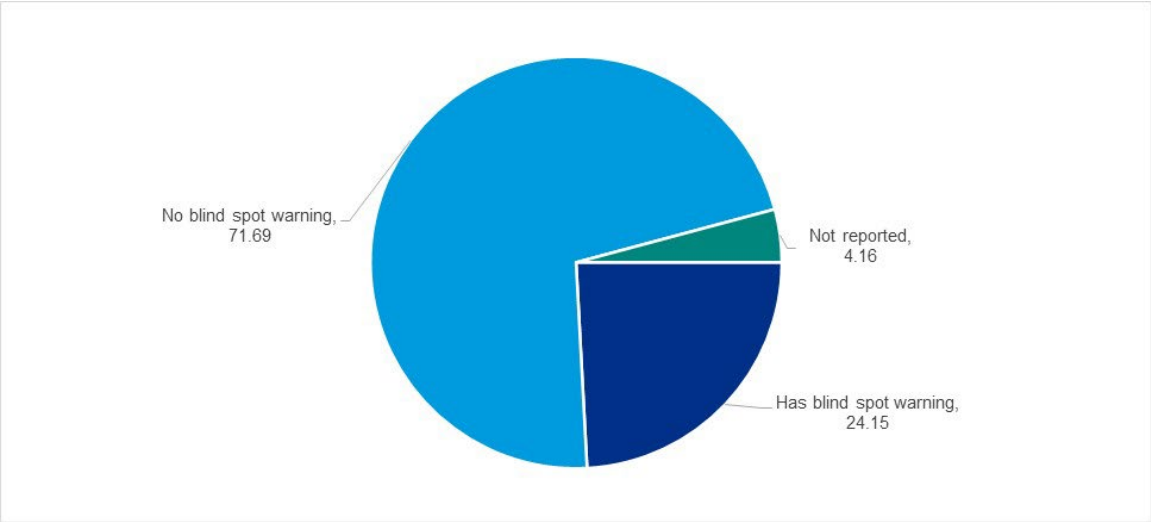
Figure 36. Safety—Air Bags



Source: BTS.
Note: Data are from VIUS PUF using the variable ST_AIRBAG.

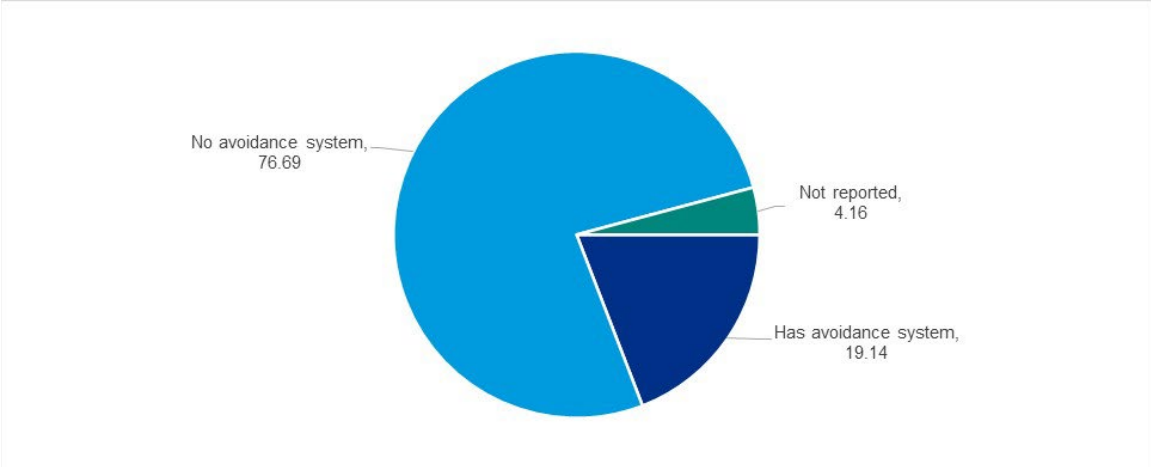
Less common safety features are illustrated in Figure 37–Figure 42. Figure 37 shows 24.15 percent of vehicles had blind spot warning features. Figure 38 shows 19.14 percent of vehicles had forward collision avoidance warning systems. Figure 39 shows 17.38 percent had lane departure warnings. Figure 40 shows 16.69 percent had lane-keeping assistance. Figure 41 shows 19.54 percent had parking obstruction warning features. Figure 42 shows 16.32 percent had rear cross traffic warning.

Figure 37. Safety—Blind Spot Warning



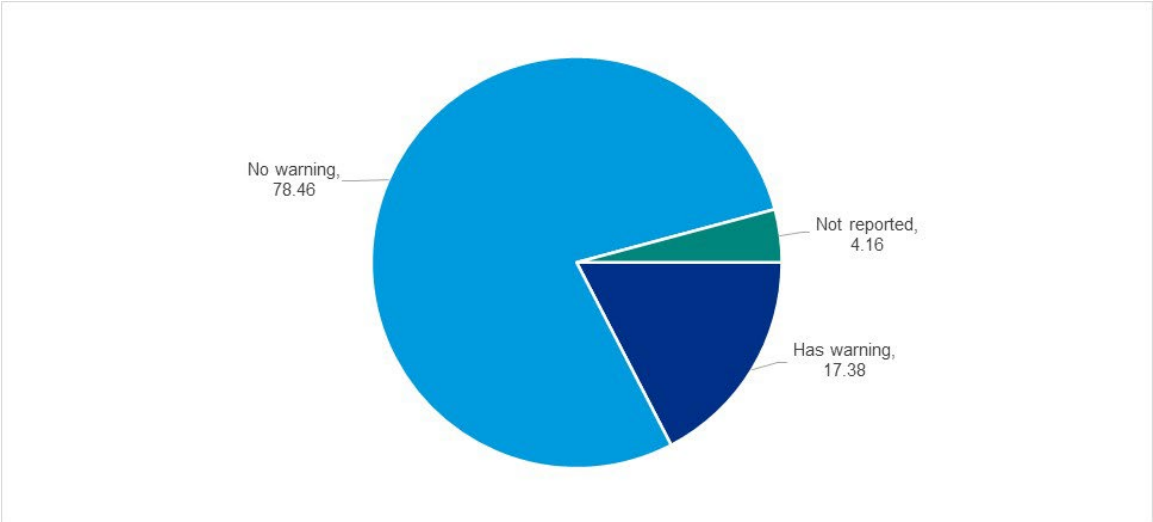
Source: BTS.
Note: Data are from VIUS PUF using the variable CW_BLINDSPOT.

Figure 38. Safety—Crash and Collision Avoidance Warning



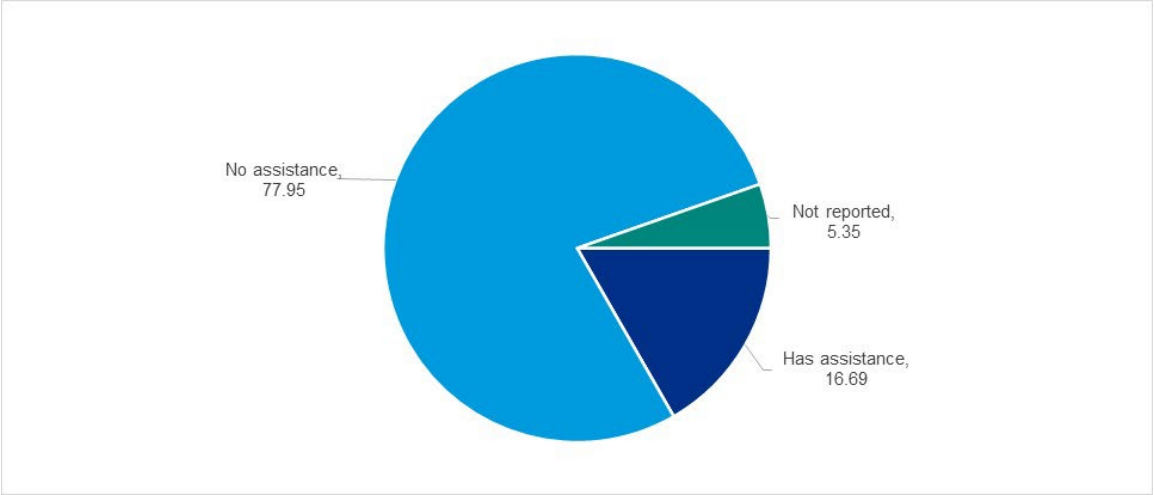
Source: BTS.
Note: Data are from VIUS PUF using the variable CW_FWDCOLL.

Figure 39. Safety—Lane Departure Warning



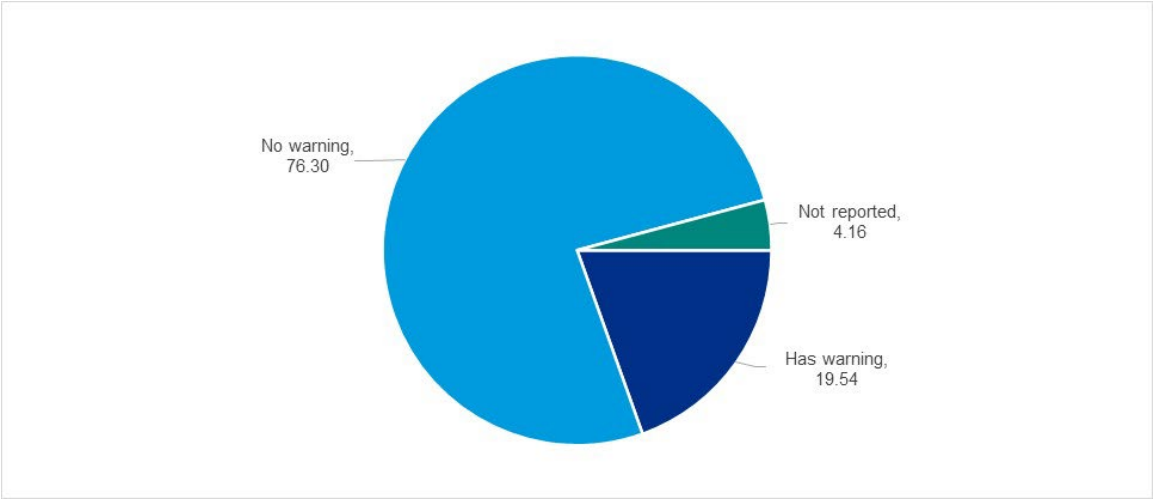
Source: BTS.
Note: Data are from VIUS PUF using the variable CW_LANEDEPART.

Figure 40. Safety—Lane-Keeping Assistance



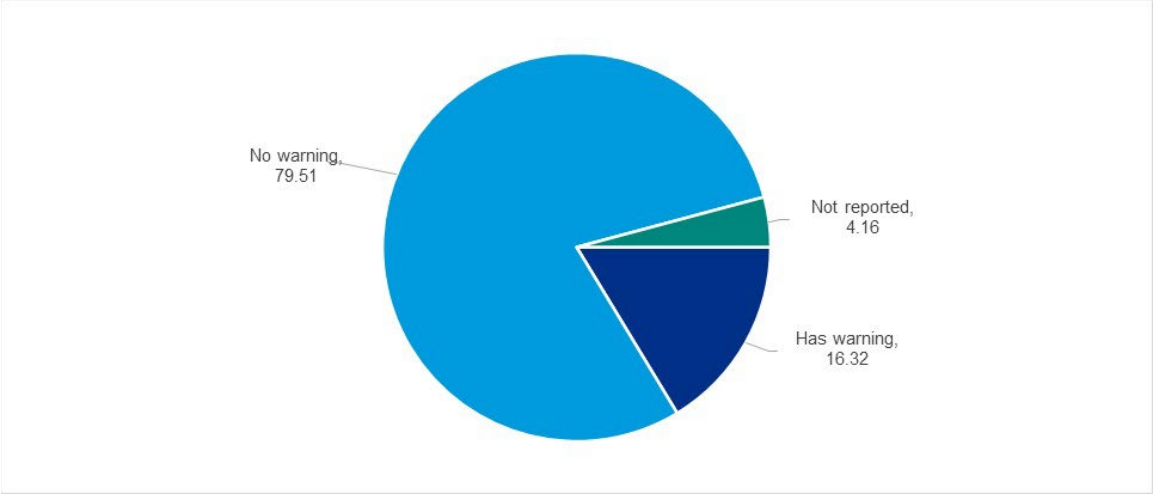
Source: BTS.
Note: Data are from VIUS PUF using the variable DC_LANEASST.

Figure 41. Safety—Parking Obstruction Warning



Source: BTS.
Note: Data are from VIUS PUF using the variable CW_PARKOBST.

Figure 42. Safety—Rear-Cross Traffic Warning



Source: BTS.
Note: Data are from VIUS PUF using the variable CW_RCROSSTRAF.

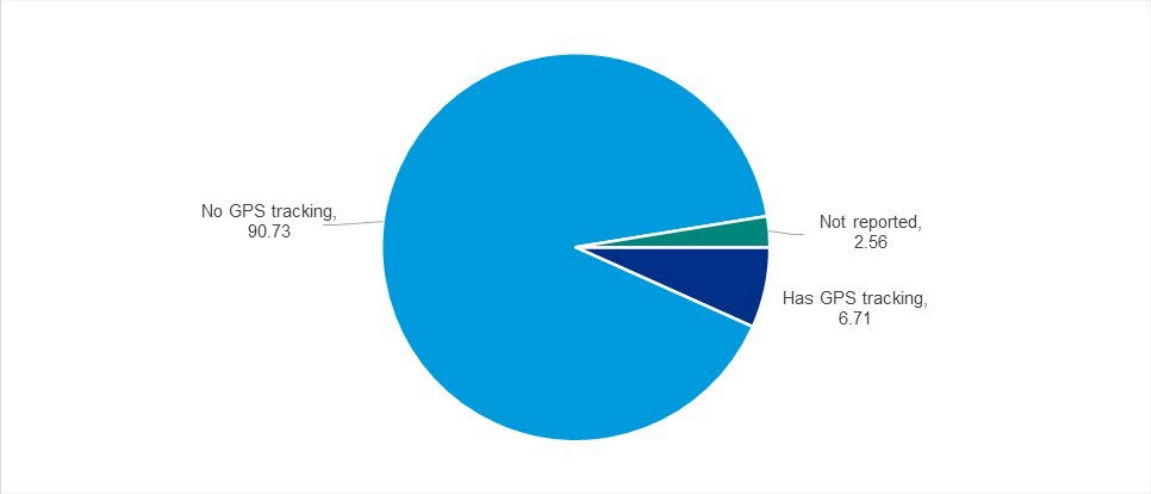
2.6. VEHICLE CONNECTIVITY FEATURES

Vehicle connectivity features explored in the 2021 VIUS include Global Positioning System (GPS) tracking, GPS navigation systems, internet access, platooning capabilities[3], telematics[4], and vehicle fleet tracking.

[3] Platooning capabilities are systems that allow vehicles to communicate with other vehicles and coordinate movements.
[4] Telematics track driving characteristics, including mileage and speed.

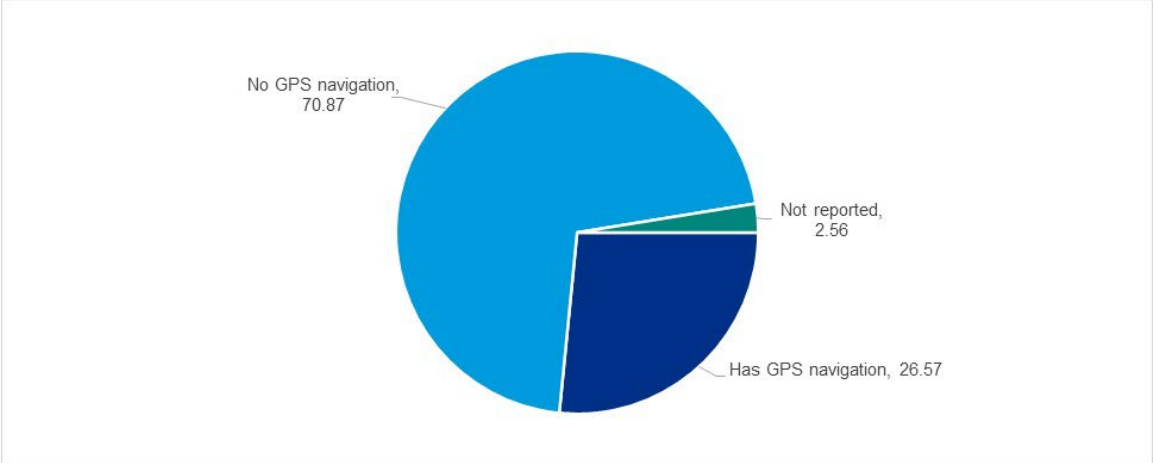
Figure 43 and Figure 44 indicate 6.71 percent of vehicles in the 2021 VIUS were equipped with GPS tracking for fleet transponder use only (no navigation aid), whereas 26.57 percent of vehicles had GPS navigation. Further, 11.75 percent of vehicles had internet access (Figure 45).

Figure 43. Connectivity—Global Positioning System Tracking



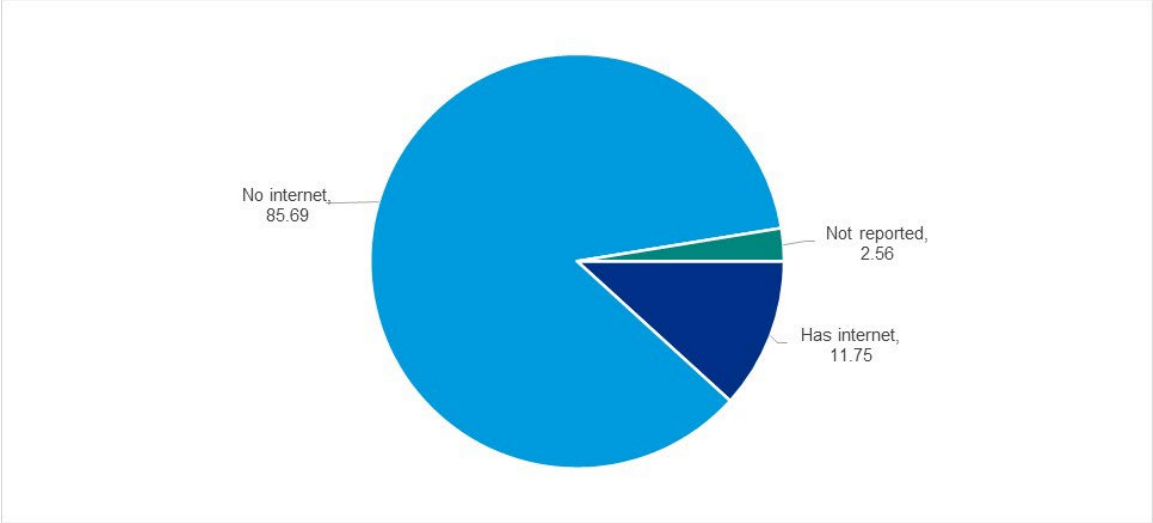
Source: BTS.
Note: Data are from VIUS PUF using the variable ST_GPS.

Figure 44. Connectivity—Global Positioning System Navigation



Source: BTS.
Note: Data are from VIUS PUF using the variable ST_GPSNAV.

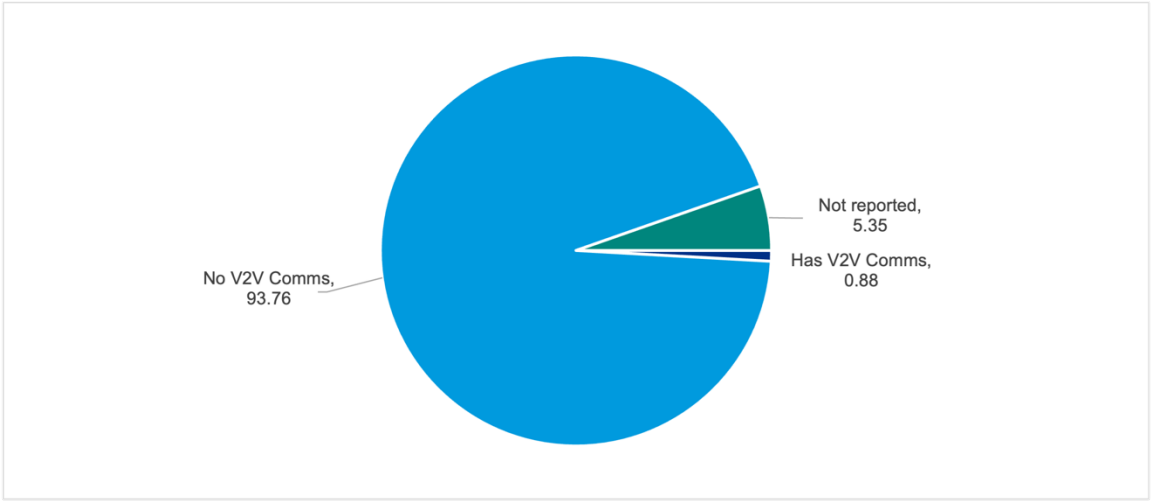
Figure 45. Connectivity—Internet



Source: BTS.
Note: Data are from VIUS PUF using the variable ST_INTERNET.

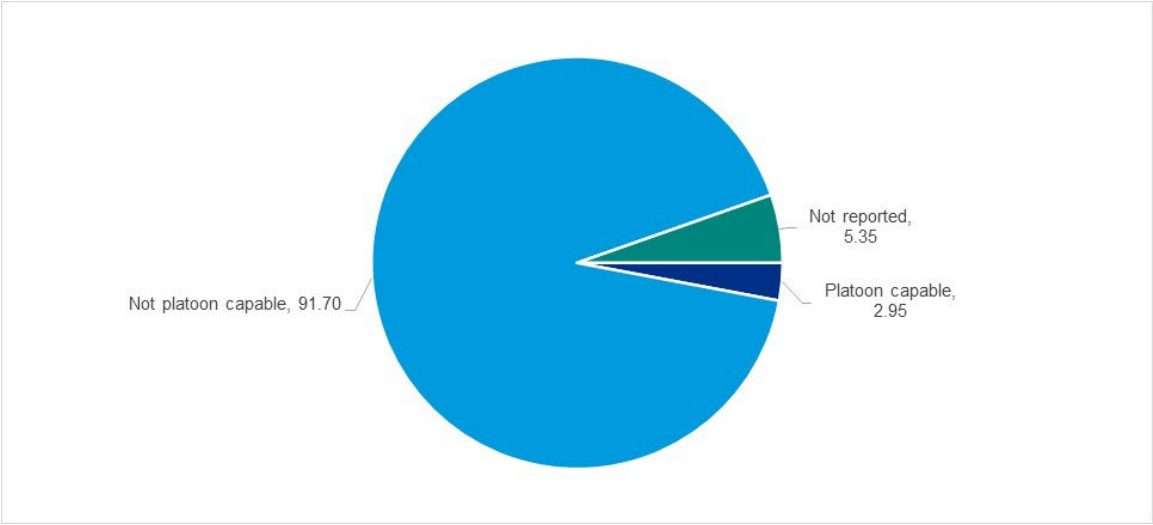
Figure 46 and Figure 47 show 2.95 percent of vehicles were capable of platooning, while 0.88 percent of vehicles had telematics. Further, 0.9 percent of vehicles were capable of vehicle-to-vehicle (V2V), vehicle-to-infrastructure, and vehicle-to-everything communications (Figure 48).

Figure 46. Connectivity—Vehicle Communication



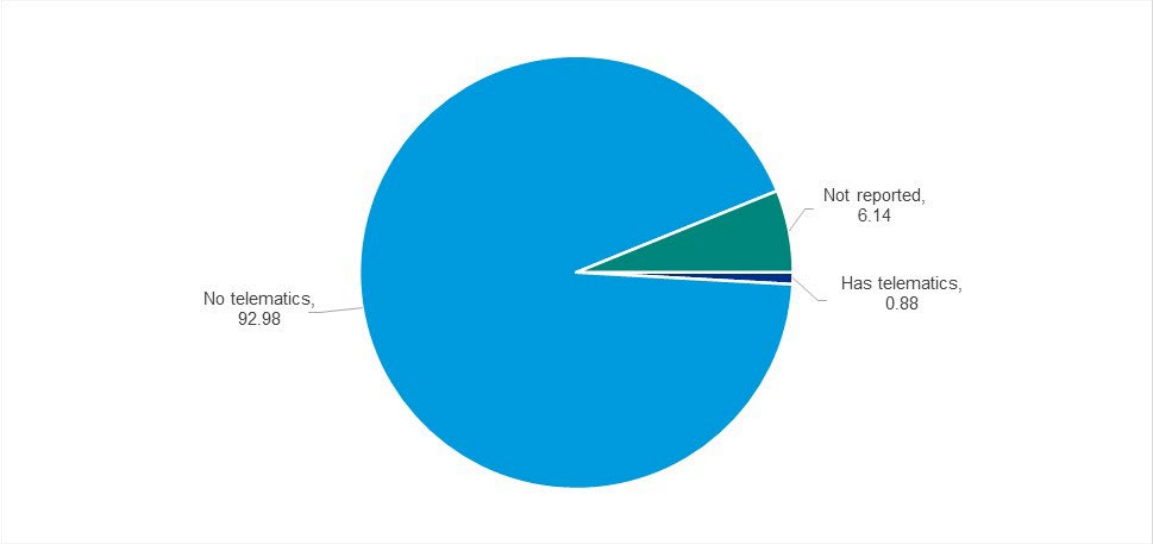
Source: BTS.
Note: Data are from VIUS PUF using the variable DC_VTVCOMM.

Figure 47. Connectivity—Platoon



Source: BTS.
Note: Data are from VIUS PUF using the variable DC_PLATOON.

Figure 48. Connectivity—Telematics

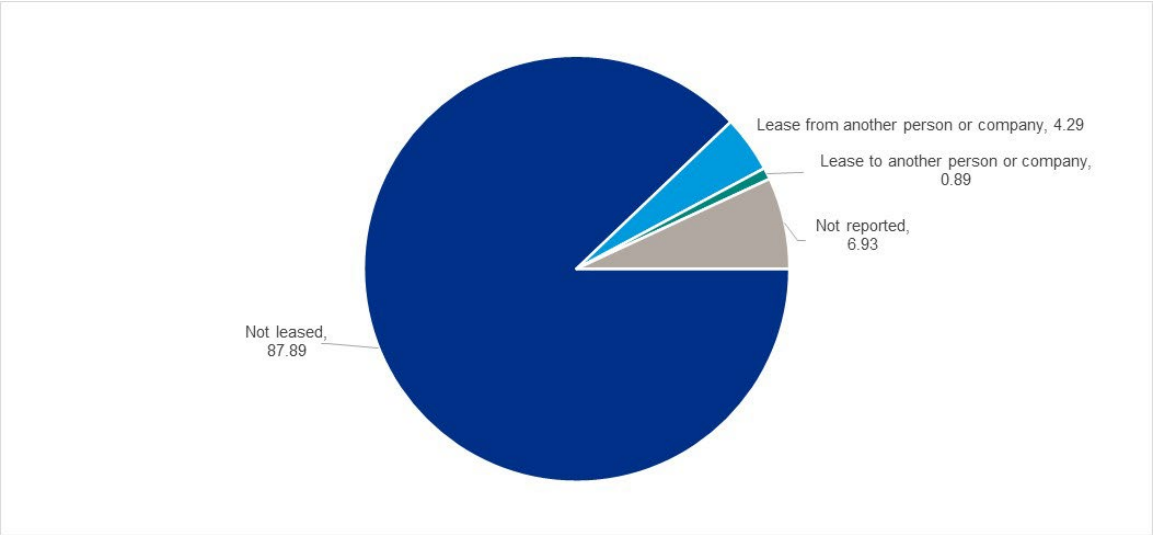


Source: BTS.
Note: Data are from VIUS PUF using the variable OF_TELEMATICS.

2.7. LEASING

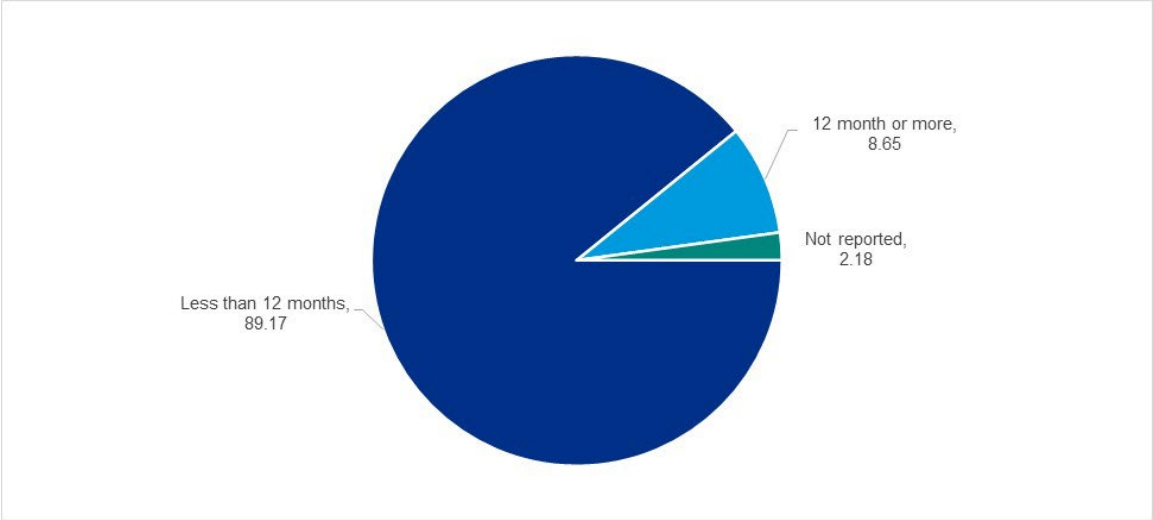
Figure 49 shows 4.29 percent of vehicles were leased by the vehicle user, 0.89 percent of vehicles were leased to another user, and 87.89 percent of vehicles were not leased. Among leased vehicles, 89.17 percent were leased for less than 12 months, whereas 8.65 percent were leased for 12 months or more (Figure 50). Further, 91.6 percent of leased vehicles were leased under the vehicle-only leasing agreement term, while 6.65 percent of vehicles were leased under the vehicle-with-driver leasing agreement term (Figure 51).

Figure 49. Lease Terms—Arrangement



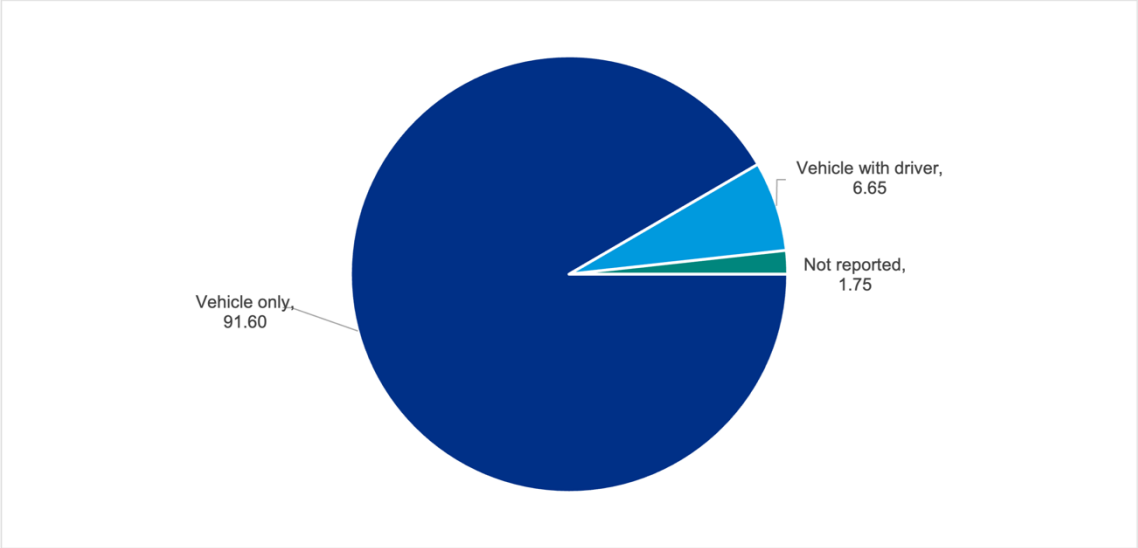
Source: BTS.
Note: Data are from VIUS PUF using the variable LEASE_STAT.

Figure 50. Lease Terms—Length



Source: BTS.
Note: Data are from VIUS PUF using the variable LEASELENGTH.

Figure 51. Lease Terms—Driver Arrangement

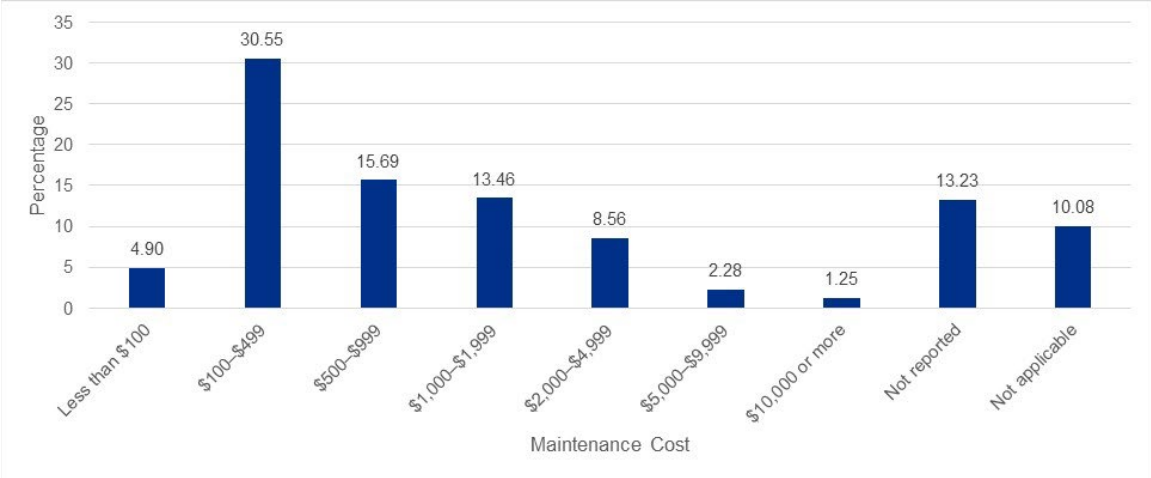


Source: BTS.
Note: Data are from VIUS PUF using the variable LEASECHAR.

2.8. MAINTENANCE AND REPAIRS

Figure 52 shows 30.55 percent of vehicles incurred general maintenance expenses of $100–$499, 15.69 percent and 13.46 percent of vehicles incurred maintenance expenses of $500–$999 and $1,000–$1,999, respectively. Further, 12.09 percent had expenses exceeding $2,000, with 1.25 percent incurring expenses of at least $10,000.

Figure 52. Percentage of General Maintenance

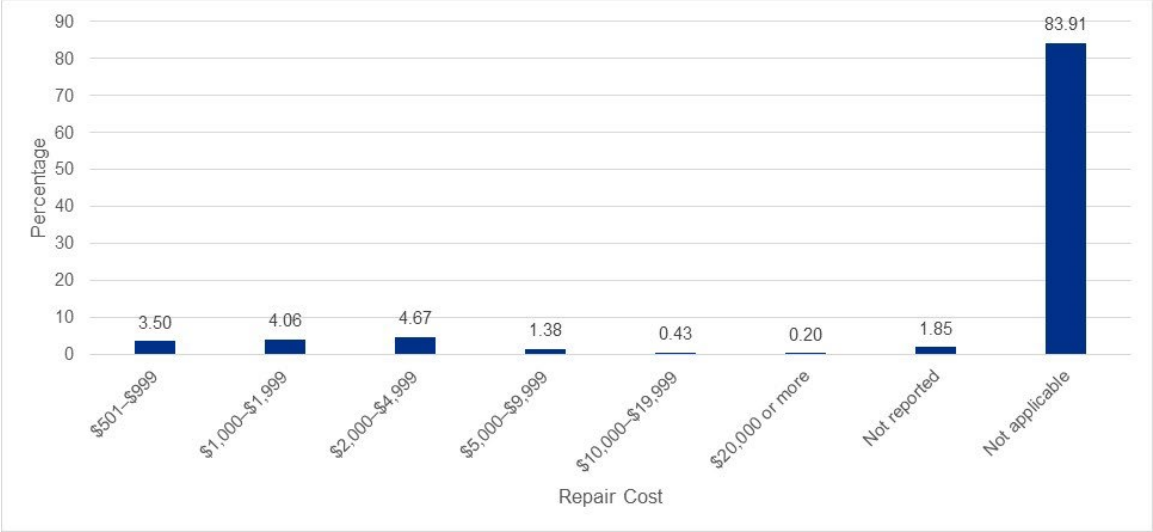


Source: BTS.
Note: Data are from VIUS PUF using the variable GM_COST.

With respect to the total cost of extensive repairs, Figure 53 shows that 83.91 percent of vehicles in the 2021 VIUS fell into the not applicable category (which means either the vehicle was not in use or did not have extensive repairs). The shares of vehicles with extensive-repair expenses of $501–$999, $1,000–$1,999, and $2,000–$4,999 were 3.50 percent, 4.06 percent,

and 4.67 percent, respectively. Additionally, 2.01 percent of vehicles had extensive repairs of at least $5,000.

Figure 53. Percentage of Extensive Repairs

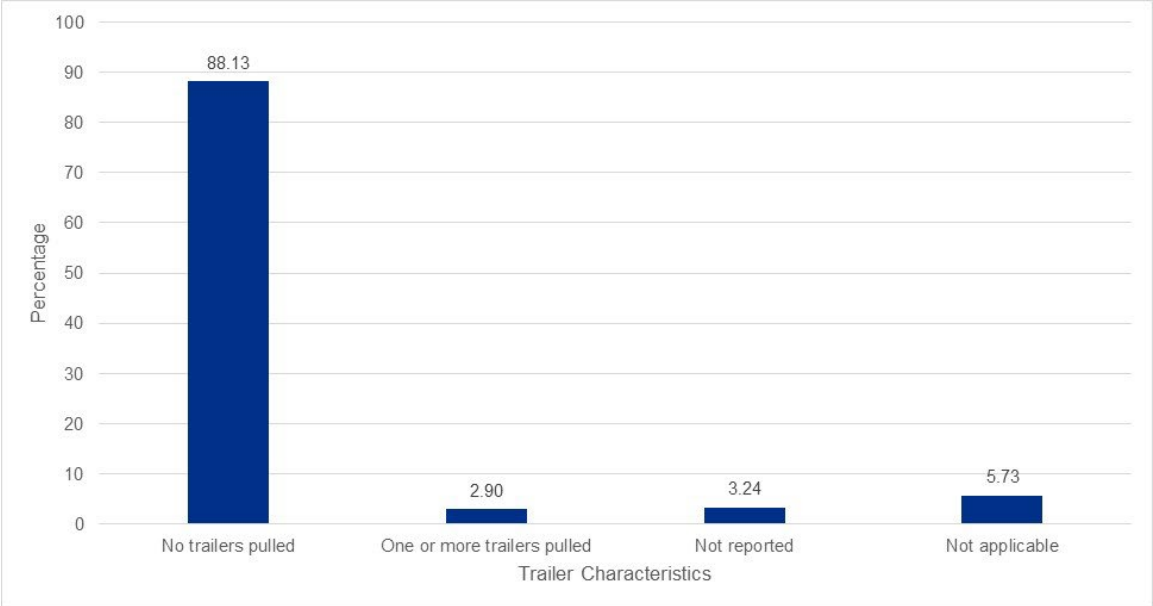


Source: BTS.
Note: Data are from VIUS PUF using the variable ER_COST.

2.9. INDUSTRIAL AND SERVICE EQUIPMENT

Figure 54 shows only 2.90 percent of vehicles pulled one or more trailers.

Figure 54. Percentage of Industrial and Service Equipment—Trailer Characteristics

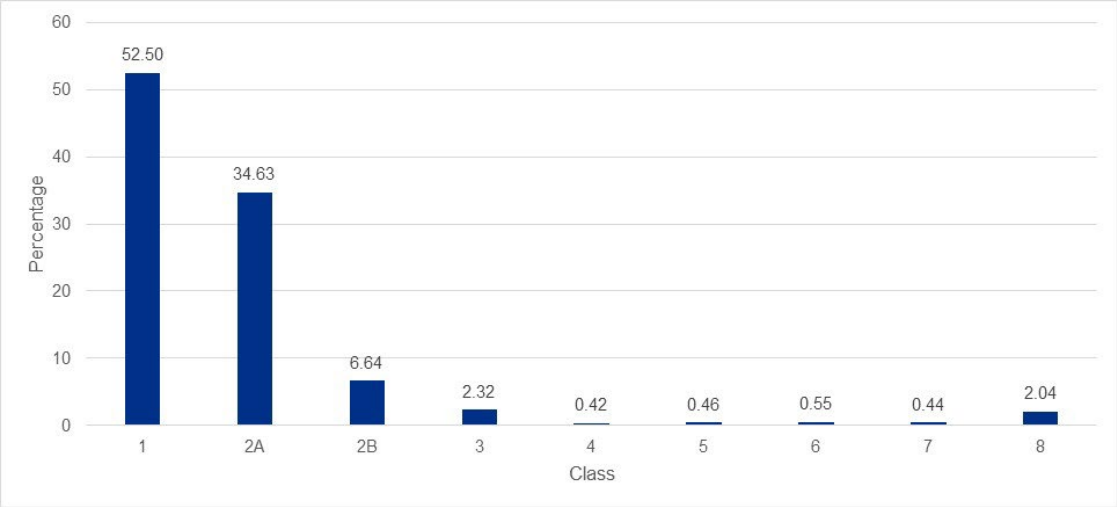


Source: BTS.
Note: Data are from VIUS PUF using the variable TCONFIG.

2.10. WEIGHT

Figure 55 illustrates GVWRs for vehicles in the 2021 VIUS. Most vehicles (52.50 percent) were Class 1 vehicles (light duty) with a weight limit of 6,000 pounds, and 41.27 percent were Class 2 vehicles (i.e., 2A and 2B) with a weight limit of 6,000–10,000 pounds. Class 3–Class 6 (medium duty) vehicles had weight limits of 10,000–26,000 pounds and accounted for 3.75 percent of all vehicles. Class 7 and Class 8 (heavy-duty) vehicles, for which the weight limit exceeds 26,000 pounds, accounted for 2.48 percent of all vehicles in 2021 VIUS.

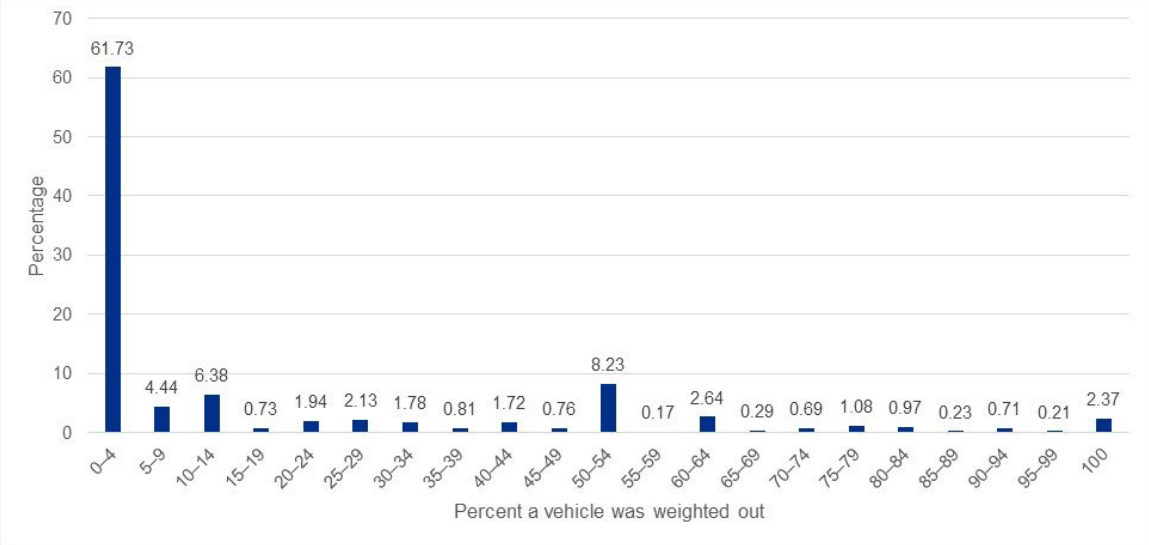
Figure 55. Percentage of Weight—Gross Vehicle Weight Ratings



Source: BTS.
Note: Data are from VIUS PUF using the variable GVWR_CLASS.

Figure 56 illustrates the fleet by weighout share.

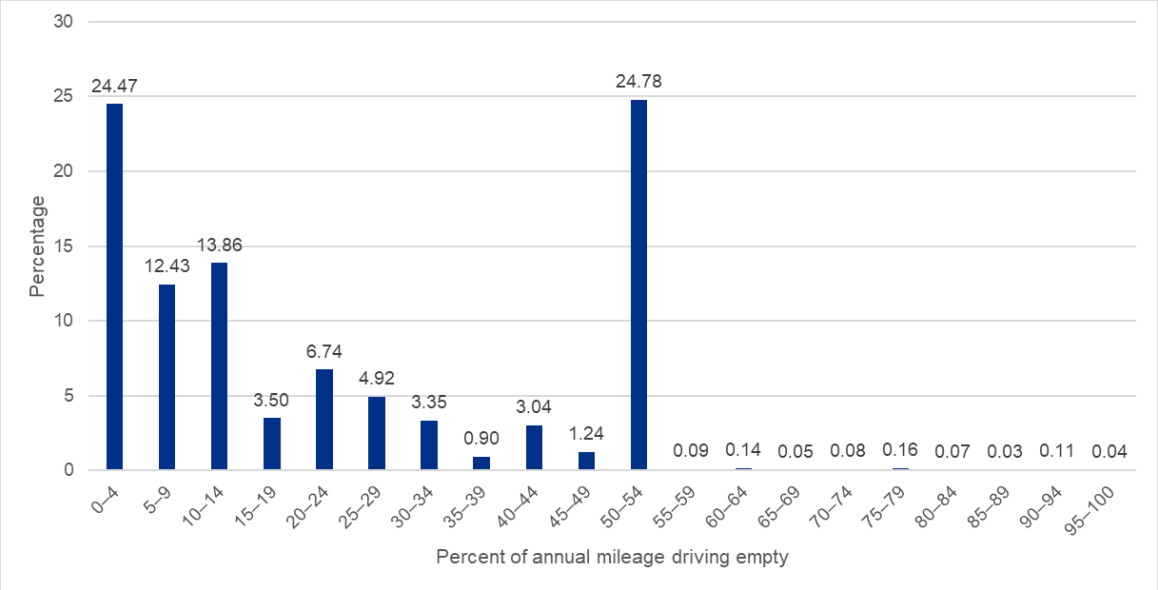
Figure 56. Percentage of Weight—Weighout Share



Source: BTS.
Note: Data are from VIUS PUF using the variable WEIGHOUTPCT.

Figure 56 shows weight out, which is the percent of 2021 annual mileage that the vehicle was filled to the weight limit (weighed out). The percentage identifies commodity-carrying vehicles. The figure shows only 2.58 percent of vehicles were operated at maximum weight capacity for at least 95 percent of their annual miles. On the other hand, 61.73 percent of vehicles operated at maximum capacity for less than 5 percent of their annual miles. Further, Figure 57 shows 24.78 percent of vehicles were driven empty (deadheading) for 50–54 percent of their total miles. Another 24.47 percent of vehicles were driven empty, less than 5 percent of their total miles. Very few vehicles (0.77 percent) were driven empty for more than 55 percent of their total miles.

Figure 57. Percentage of Weight—Deadhead Share



Source: BTS.
Note: Data are from VIUS PUF using the variable HEADHEADPCT.

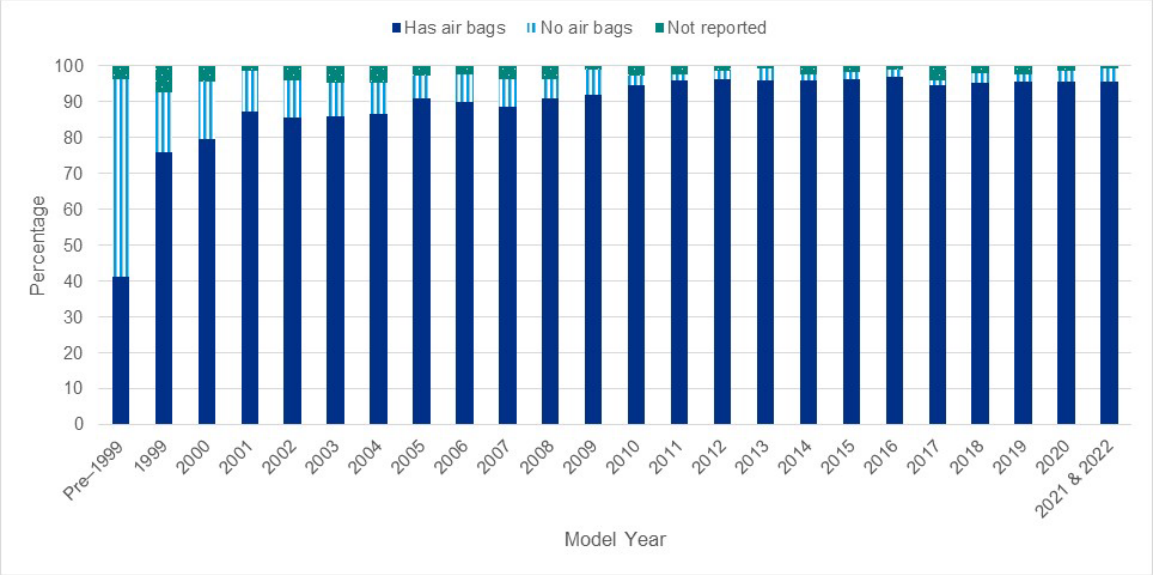
3. Vehicle Changes and New Technology Adoption Across Model Years

In addition to changes in general vehicle characteristics over time (Chapter 2), the adoption of new technologies, such as particular vehicle safety and connectivity features, has increased as described in this chapter.

3.1. CHANGES IN VEHICLE SAFETY FEATURES

Airbags have been required for light trucks and passenger vehicles built after September 1998 (Figure 58) [NHTSA 1999]. For vehicles MY 1998 or older, only 41.13 percent of vehicles had airbags. For 1999–2001, the number of vehicles with airbags increased as follows: 75.99 percent of MY 1999, 79.39 percent of MY 2000, and 87.17 percent of MY 2001 vehicles. Over 95 percent of vehicles in recent MYs (since 2011, excluding 2017) had airbags.

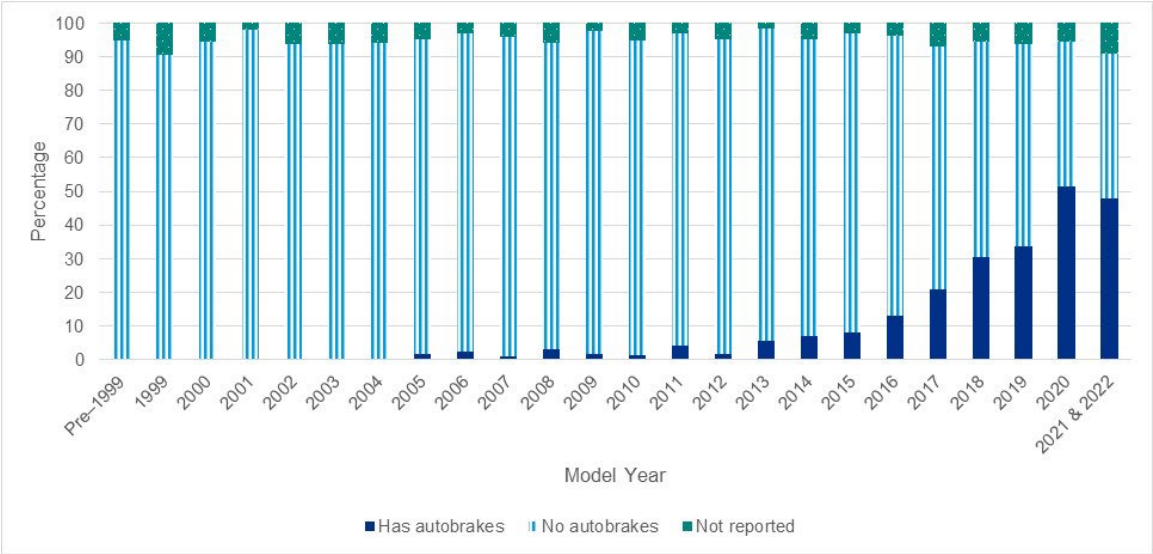
Figure 58. Percentage of Safety—Airbags



Source: BTS.
Note: Data are from VIUS PUF using the variables STAIRBAG and MODELYEAR.

In the 2021 VIUS, autobrakes first appear in MY 2005 vehicles; 1.71 percent of vehicles from that year had autobrakes (Figure 59). The percentage of vehicles with autobrakes increased quickly in recent years—from under 10 percent for MY 2015, to 30.35 percent for MY 2018, to 47.78 percent for MYs 2021 and 2022.

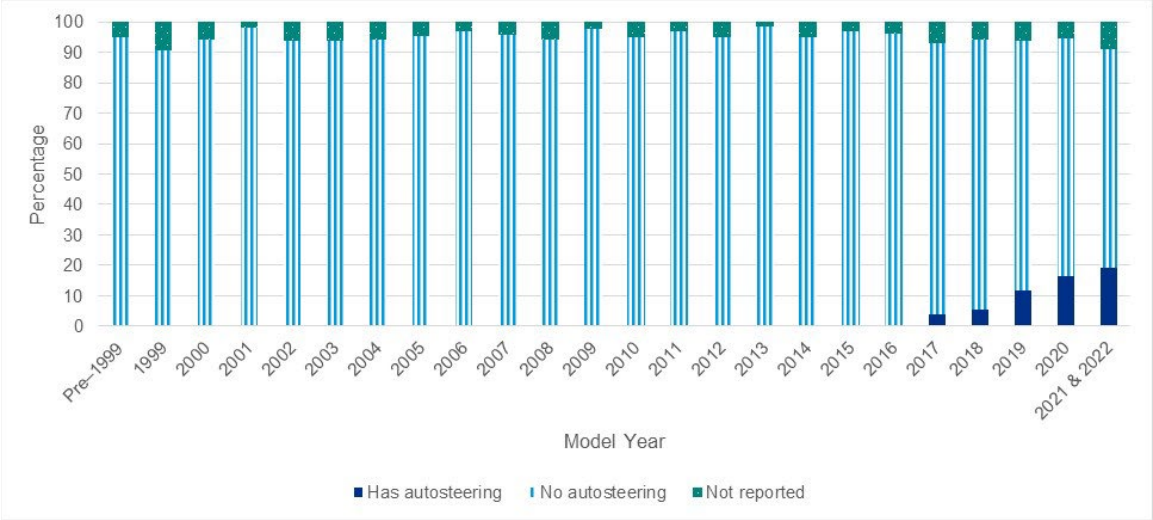
Figure 59. Percentage Safety—Autobrakes



Source: BTS.
Note: Data are from VIUS PUF using the variables CI_AUTOEBRAKE and MODELYEAR.

Autosteering is another recent safety feature. It first shows up in MY 2017 vehicles. Figure 60 shows 3.95 percent of MY 2017 vehicles had an autosteering feature. Like other new technologies, adoption of autosteering has been slowly increasing as 19.13 percent of MY 2021 and 2022 vehicles were equipped with an autosteering feature.

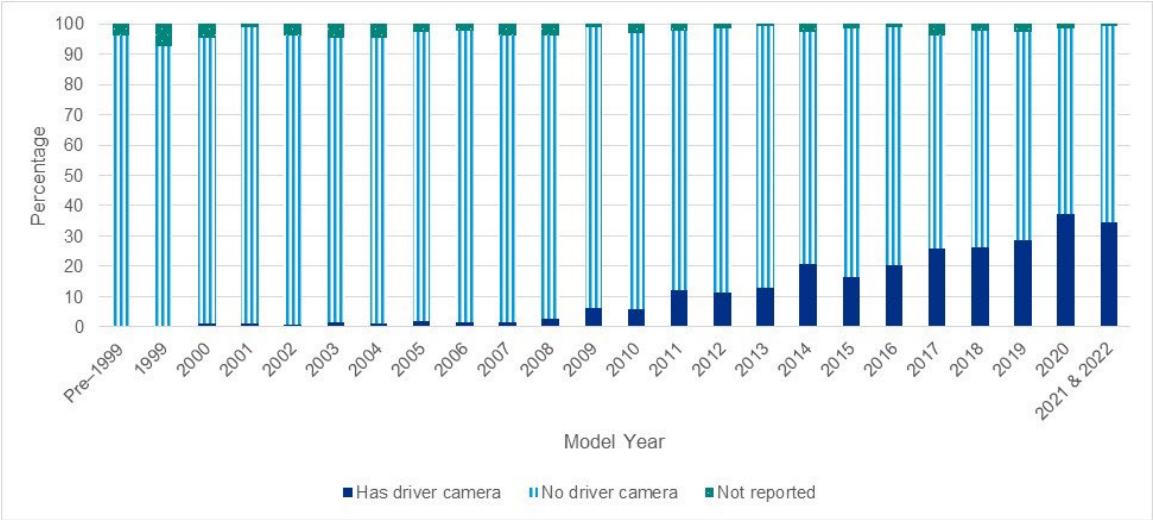
Figure 60. Percentage of Safety—Autosteering



Source: BTS.
Note: Data are from VIUS PUF using the variables CI_AUTOESTEER and MODELYEAR.

Cameras were another common safety feature in 2021 VIUS vehicles. Driver-facing cameras were installed on 0.14 percent of MY 1998 or older vehicles. The share of vehicles with driver cameras by MY hovered below 10 percent until 2011. Figure 61 shows 34.65 percent of MY 2021 and 2022 vehicles had driver cameras.

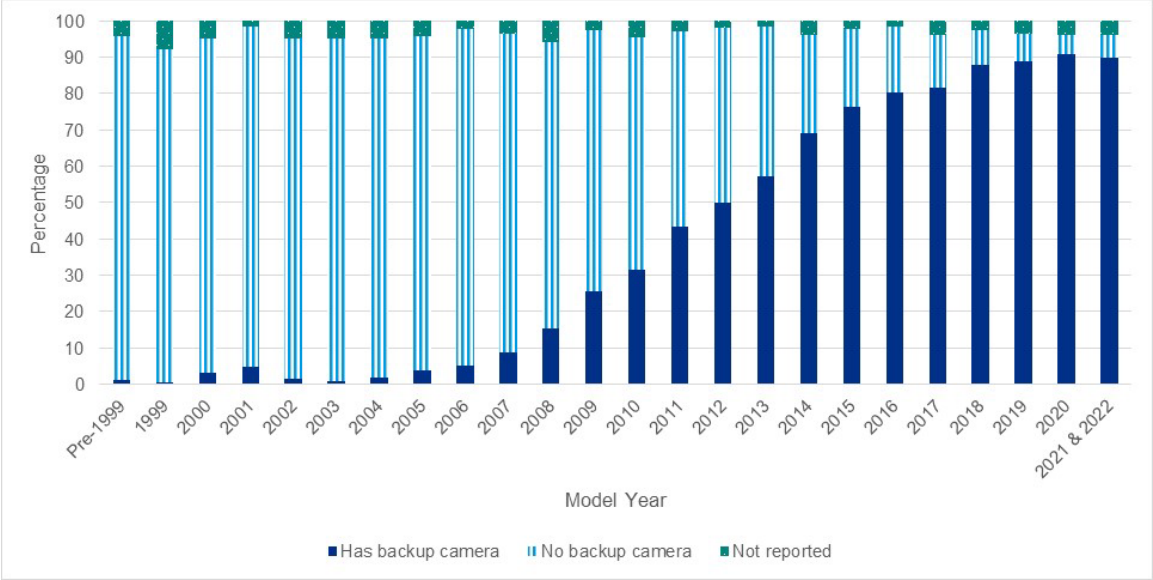
Figure 61. Percentage of Safety—Driver-Facing Camera



Source: BTS.
Note: Data are from VIUS PUF using the variables ST_DRIVERCAM and MODELYEAR.

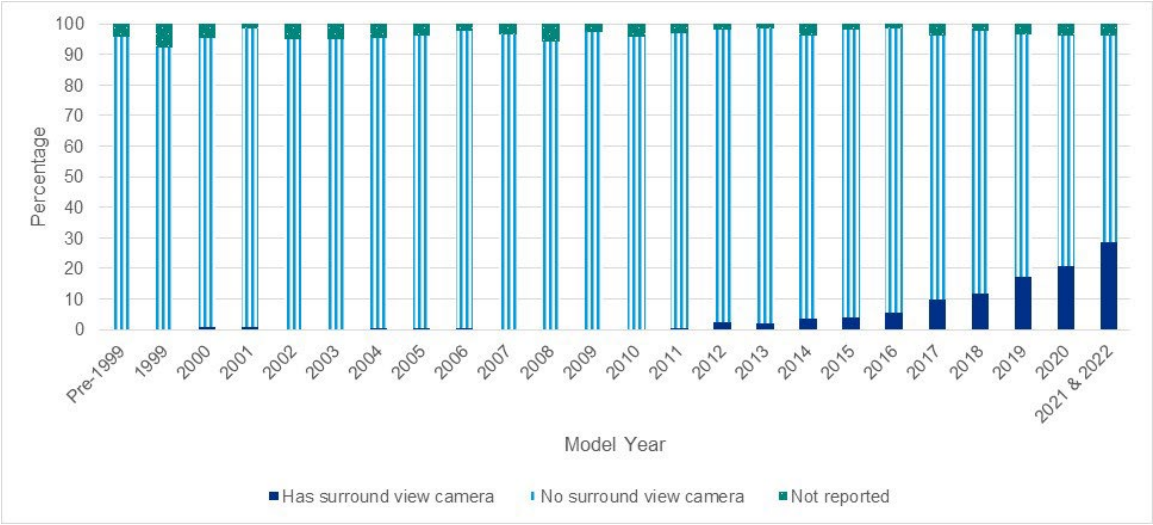
Backup cameras have seen more widespread adoption following a 2014 National Highway Traffic Safety Administration rule requiring all automobiles sold in May 2018 to have backup cameras [NHTSA 2014]. Figure 62 shows 90.03 percent of MY 2021 and 2022 vehicles had backup cameras. As evidenced by this VIUS PUF data, surround-view cameras were available before 1999, but their popularity has grown in recent years. As shown in Figure 63, just 2.31 percent of MY 2012 vehicles had surround-view cameras, compared to 28.50 percent of MY 2021 and 2022 vehicles.

Figure 62. Percentage of Safety—Backup Camera



Source: BTS.
Note: Data are from VIUS PUF using the variables OD_BACKUPCAM and MODELYEAR.

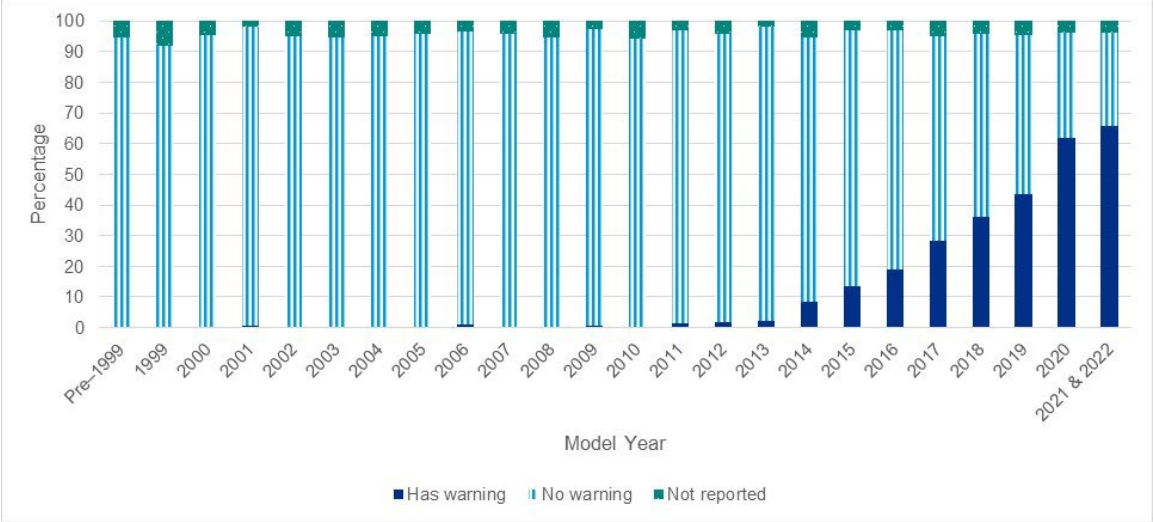
Figure 63. Percentage of Safety—Surround-View Camera



Source: BTS.
Note: Data are from VIUS PUF using the variables OD_SVCAM and MODELYEAR.

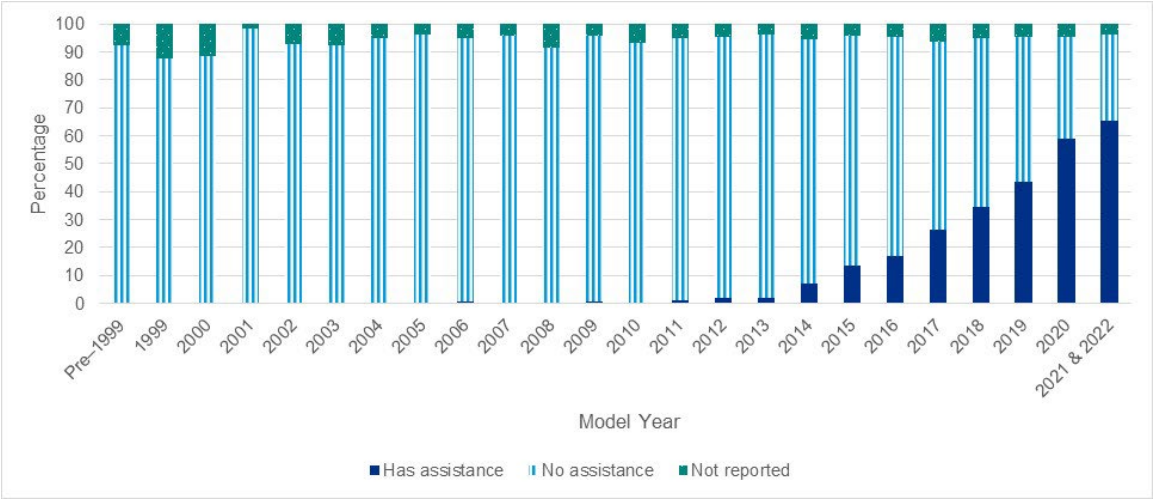
Lane departure warnings alert the driver if the vehicle is approaching a lane line. Lane assistance helps drivers keep within the lane lines. Figure 64 indicates just 1.33 percent of MY 2011 vehicles had lane departure warning systems, while 65.72 percent of MY 2021 and 2022 vehicles were equipped with this feature. Lane-keeping assistance systems increased at roughly the same pace—from 1.27 percent in MY 2011 to 65.33 percent for MY 2021 and 2022 vehicles (Figure 65).

Figure 64. Percentage of Safety—Lane Departure Warning



Source: BTS.
Note: Data are from VIUS PUF using the variables CW_LANEDEPART and MODELYEAR.

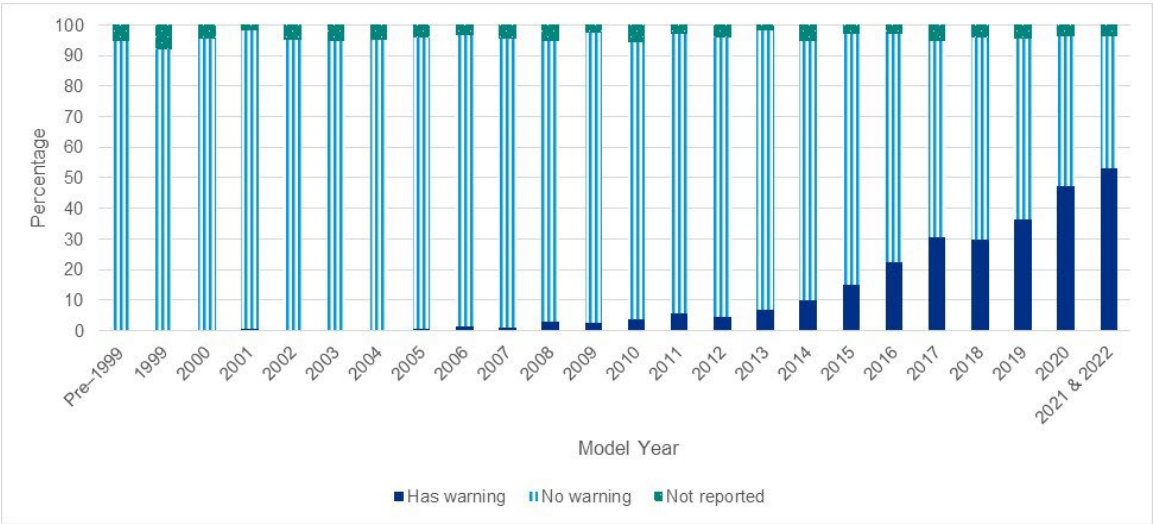
Figure 65. Percentage of Safety—Lane-Keeping Assistance



Source: BTS.
Note: Data are from VIUS PUF using the variables DC_LANEASST and MODELYEAR.

Figure 66 indicates rear-cross traffic warning systems were on 53.14 percent of MY 2021 and 2022 vehicles, more than doubling (in percentage points) the 22.40 percent for MY 2016 vehicles.

Figure 66. Percentage of Safety—Rear-Cross Traffic Warning

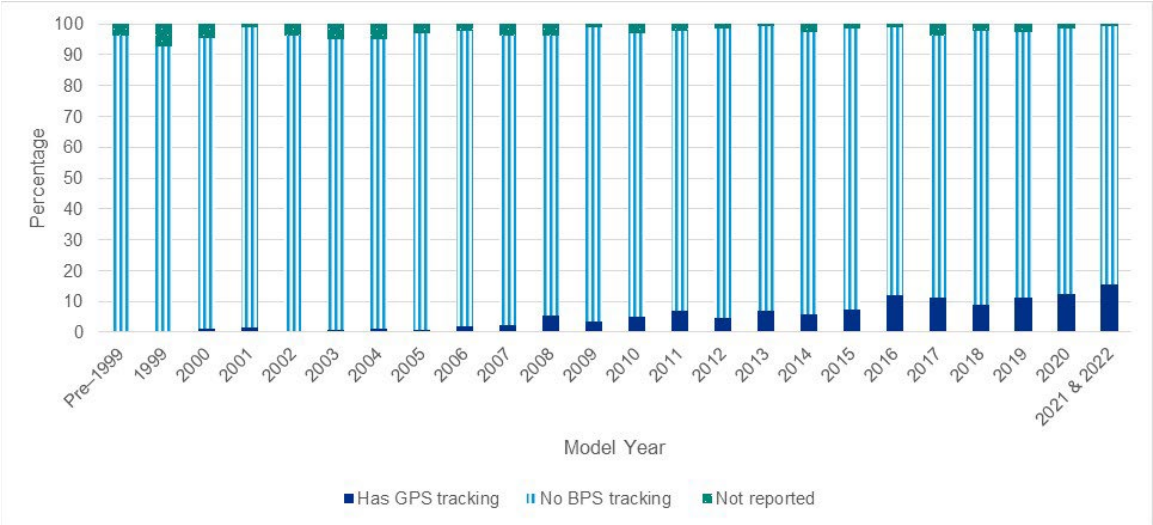


Source: BTS.
Note: Data are from VIUS PUF using the variables CW_RCROSSTRAF and MODELYEAR.

3.2. CHANGES IN VEHICLE CONNECTIVITY FEATURES

GPS tracking allows dispatchers or others to track a vehicle's movements, whereas GPS navigation systems provide routing for the driver. Figure 67 shows 15.59 percent of MY 2021 and 2022 vehicles had GPS tracking systems, a doubling (in percentage points) of the 7.32 percent for MY 2015 vehicles, and a nearly 10-fold increase (in percentage points) over the 1.92 percent for MY 2006 vehicles.

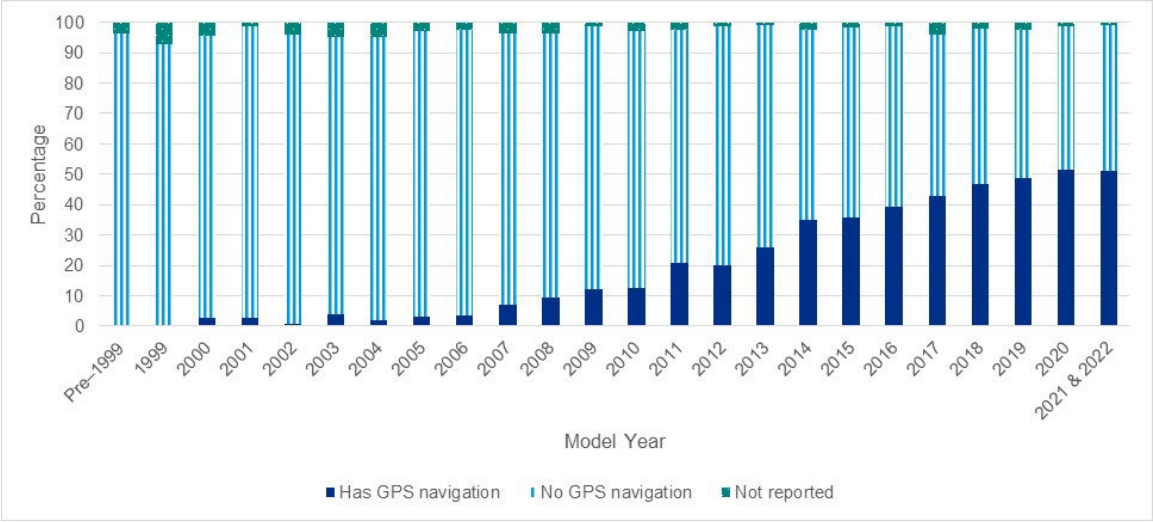
Figure 67. Percentage of Connectivity—Global Positioning System Tracking



Source: BTS.
Note: Data are from VIUS PUF using the variables ST_GPS and MODELYEAR.

As shown in Figure 68, GPS navigation systems were more widespread, being installed in 51.17 percent of MY 2021 and 2022 vehicles, a nearly 18-fold increase (in percentage points) over MY 2000 vehicles (2.85 percent).

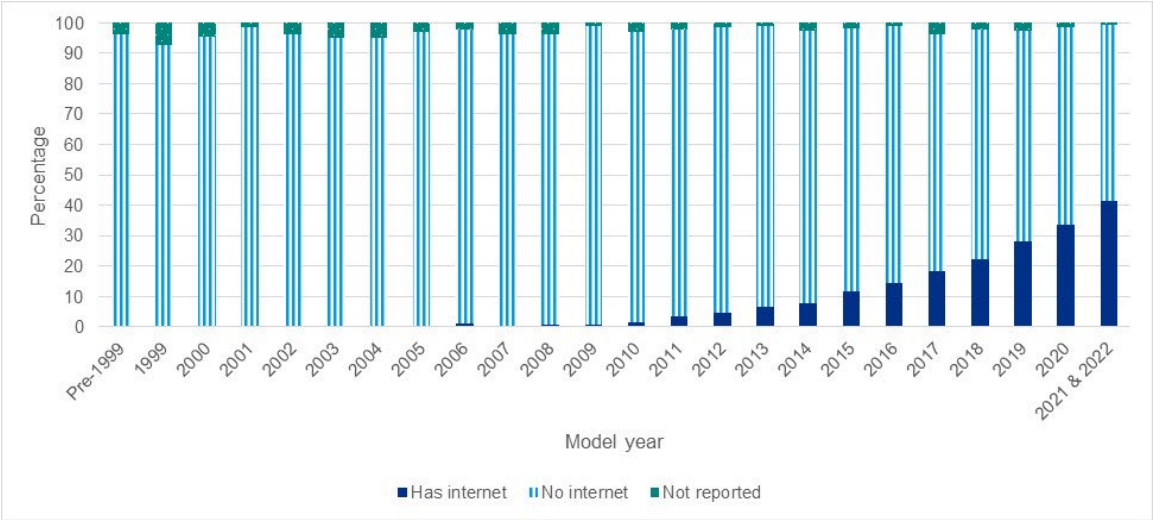
Figure 68. Percentage of Connectivity—Global Positioning System Navigation



Source: BTS.
Note: Data are from VIUS PUF using the variables ST_GPSNAV and MODELYEAR.

Figure 69 illustrates internet connectivity information for vehicles. According to the 2021 VIUS, 1.19 percent of vehicles in 2006 were equipped with internet connectivity, and adoption of that feature increased over time, reaching 41.44 percent for MY 2021 and 2022 vehicles.

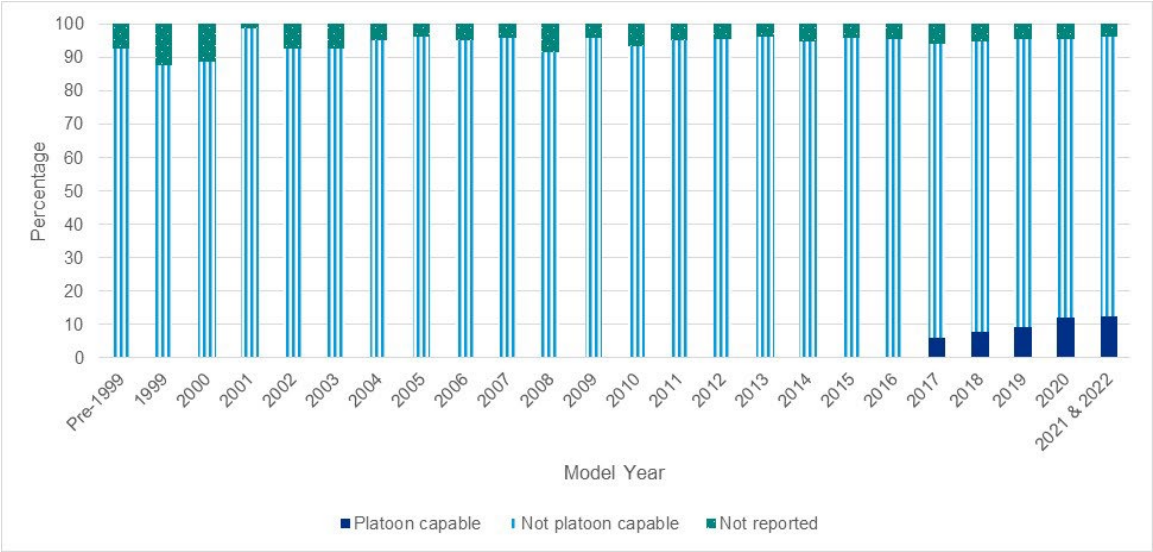
Figure 69. Percentage of Connectivity—Internet



Source: BTS.
Note: Data are from VIUS PUF using the variables ST_INTERNET and MODELYEAR.

Further, MY 2017 vehicles were the first to have platooning capabilities in the 2021 VIUS. Figure 70 shows 5.89 percent of MY 2017 vehicles had platooning capabilities, compared with 12.51 percent of MY 2021 and 2022 vehicles.

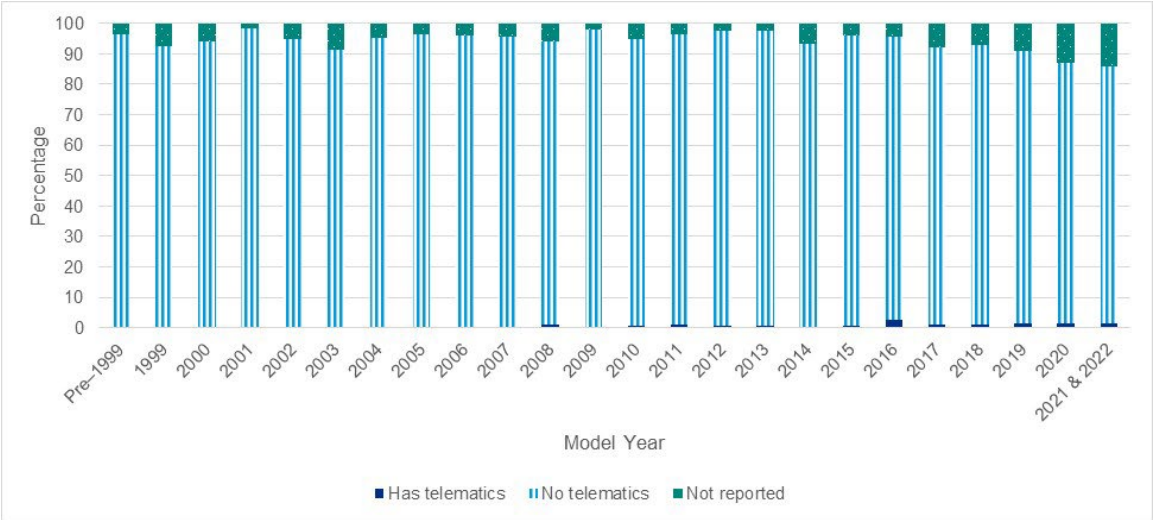
Figure 70. Percentage of Connectivity—Platooning



Source: BTS.
Note: Data are from VIUS PUF using the variables DC_PLATOON and MODELYEAR.

Despite being available since before 1999, telematics has not seen increased adoption. Just 1.54 percent of MY 2021 and 2022 vehicles in the 2021 VIUS had telematics capabilities, compared with 1.05 percent for MY 2008 vehicles (Figure 71).

Figure 71. Percentage of Connectivity—Telematics



Source: BTS.
Note: Data are from VIUS PUF using the variables OF_TELEMATICS and MODELYEAR.

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Appendix A. Population and Registered Vehicle Data

Section 1.4 of this report discusses geography. Truck registration by state is charted in Figure 4, and the truck registration by state is discussed in the context of each state's population for a few select states. Table 1 shows the percent of truck registrations for each state (as a percentage of all U.S. truck registrations) side-by-side with state population for all states (as a percentage of the U.S. population as whole).

Table 1. State Population, Percent of Population, and Percent of Registered Vehicles

State	Population	Percent of population	Percent of registered vehicles
Alabama	5,049,196	1.52	1.69
Alaska	734,420	0.22	0.27
Arizona	7,274,078	2.19	2.69
Arkansas	3,026,870	0.91	1.02
California	39,142,565	11.79	10.83
Colorado	5,814,036	1.75	2.09
Connecticut	3,606,607	1.09	0.97
Delaware	1,005,062	0.30	0.30
District of Columbia	669,256	0.20	0.08
Florida	21,831,949	6.57	5.67
Georgia	10,792,060	3.25	3.39
Hawaii	1,447,029	0.44	0.40
Idaho	1,904,848	0.57	0.73
Illinois	12,700,641	3.82	3.50
Indiana	6,815,907	2.05	2.42
Iowa	3,198,613	0.96	1.22
Kansas	2,938,338	0.88	1.05
Kentucky	4,507,583	1.36	1.51
Louisiana	4,627,971	1.39	1.44
Maine	1,378,931	0.42	0.50
Maryland	6,179,403	1.86	1.78
Massachusetts	7,000,474	2.11	1.91
Michigan	10,041,351	3.02	3.27
Minnesota	5,718,660	1.72	1.99
Mississippi	2,947,209	0.89	1.03
Missouri	6,171,374	1.86	2.07
Montana	1,106,522	0.33	0.52
Nebraska	1,964,537	0.59	0.75
Nevada	3,148,141	0.95	0.82
New Hampshire	1,387,677	0.42	NA
New Jersey	9,270,541	2.79	2.22
New Mexico	2,117,333	0.64	0.73
New York	19,848,276	5.98	3.53
North Carolina	10,564,320	3.18	3.40
North Dakota	777,966	0.23	0.35
Ohio	11,767,344	3.54	3.72
Oklahoma	3,992,238	1.20	1.62
Oregon	4,254,280	1.28	1.32
Pennsylvania	13,015,571	3.92	4.00
Rhode Island	1,097,246	0.33	0.24
South Carolina	5,194,274	1.56	1.75

State	Population	Percent of population	Percent of registered vehicles
South Dakota	896,492	0.27	0.39
Tennessee	6,965,740	2.10	2.35
Texas	29,570,351	8.90	9.44
Utah	3,339,738	1.01	1.02
Vermont	647,210	0.19	0.22
Virginia	8,658,910	2.61	2.48
Washington	7,743,760	2.33	2.38
West Virginia	1,785,618	0.54	0.62
Wisconsin	5,881,608	1.77	2.01
Wyoming	579,636	0.17	0.28

List of Abbreviations, Acronyms, and Initialisms

BTS	Bureau of Transportation Statistics
CNG	compressed natural gas
GPS	Global Positioning System
GVWR	gross vehicle weight rating
LNG	liquified natural gas
MY	model year
PUF	Public Use File
SUV	sport utility vehicle
TSAR	*Transportation Statistics Annual Report*
VIUS	Vehicle Inventory and Use Survey
V2V	vehicle-to-vehicle
VMT	vehicle miles traveled