PARTS: Market Penetration of Advanced Driver Assistance Systems (ADAS)

September 2024 Report

Last Version: December 2021

PARTS
PARTNERSHIP FOR ANALYTICS RESEARCH IN TRAFFIC SAFETY

To learn more about our work, visit us at
NHTSA.gov/PARTS

ADAS Penetration Rates

Sections

I. Overview

The Partnership for Analytics Research in Traffic Safety (PARTS) is a partnership between automobile manufacturers and the U.S. Department of Transportation's National Highway Traffic Safety Administration in which participants voluntarily share applicable safety-related data for collaborative safety analysis.

The goal of this government-industry initiative, operated by an independent third party, is to improve traffic safety through an enduring data-sharing partnership. By generating novel insights about the effectiveness and safety benefits of advanced driver assistance systems (ADAS) features, the partnership aims to improve traffic safety.

As of December 2023, participating automobile manufacturers have submitted vehicle equipment data for approximately 98 million passenger vehicles sold in the United States—representing 168 different models from model years 2015–2023 and covering 10 vehicle segments. Vehicle equipment data allows for the identification of various ADAS features that were present on the vehicle at the time of manufacture. The nine participating automobile manufacturers who have provided vehicle data are Ford, General Motors, Honda, Hyundai, Mazda, Mitsubishi, Stellantis, Subaru, and Toyota. Because PARTS industry partners account for approximately 80% of the U.S. automobile market, PARTS vehicle data can provide an improved understanding of how quickly ADAS systems are penetrating the U.S. car market.

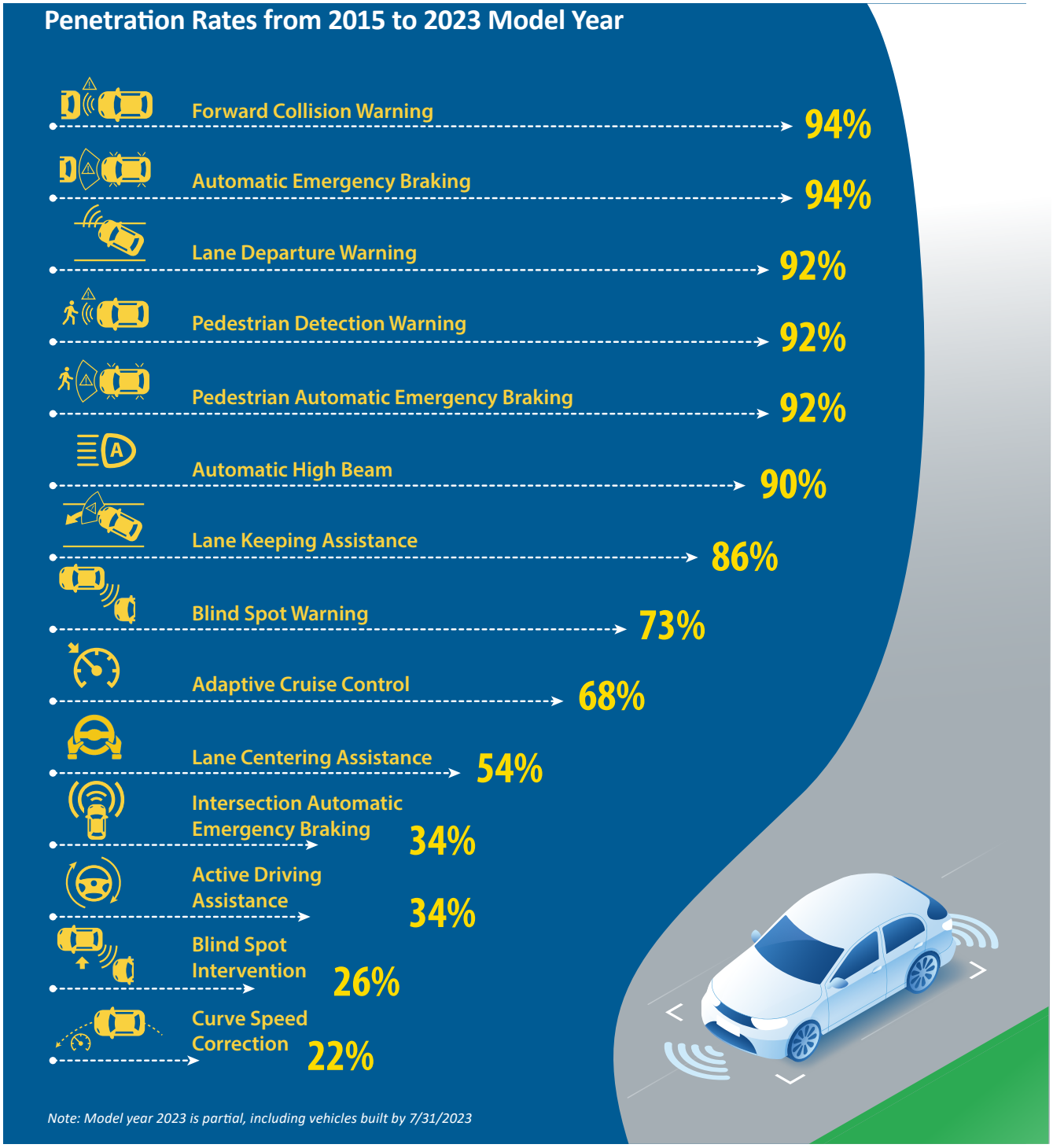
Penetration rates are reported for the following ADAS features:

Forward Collision Warning & Automatic Emergency Braking Systems	SAE Level[1,2]
Forward Collision Warning. Detects potential collisions with a vehicle ahead and alerts the driver. Some systems also provide alerts for pedestrians or other objects.	0
Automatic Emergency Braking. Detects potential collisions with a vehicle ahead, provides warnings, and automatically brakes to help avoid a collision or lessen the severity of impact.	0
Pedestrian Detection Warning. Detects potential collisions with pedestrians or other non-motorists ahead and alerts the driver.	0
Pedestrian Automatic Emergency Braking. Detects potential collisions with pedestrians and other non-motorists ahead and automatically brakes to help avoid a collision or lessen the severity of impact.	0
Intersection Automatic Emergency Braking. Detects potential collisions at intersections including left turning and cross traffic. Provides alerts and automatically brakes to help avoid a collision or lessen the severity of impact.	0
Other Collision Warning & Intervention Systems	
Blind Spot Warning. Detects and notifies the driver of vehicles in the blind spot. Some systems provide an additional warning if the driver activates the turn signal.	0
Blind Spot Intervention. Applies braking or momentary steering assistance if a driver attempts changing lanes when the vehicle's blind spot is detected to be occupied.	0
Lane Departure Warning. Monitors the vehicle's position within the driving lane and alerts the driver as the vehicle approaches or crosses lane markers.	0
Lane Keeping Assistance. Provides momentary steering support to help keep the vehicle in the lane when the vehicle approaches or crosses a lane line or road edge.	0
Driving Control Assistance Systems	
Lane Centering Assistance. Provides sustained steering support to assist the driver in continuously maintaining the vehicle at or near the center of the lane.	1
Curve Speed Correction. Detects curves in the road and adjusts vehicle speed accordingly under certain circumstances.	1
Adaptive Cruise Control. Cruise control that also assists with acceleration and/or braking to maintain a driver-selected gap to the vehicle in front. Some systems can come to a stop and continue.	1
Active Driving Assistance. Provides sustained steering, acceleration, and braking assistance when design conditions are met. The driver must constantly supervise this support feature and maintain responsibility for driving. It may or may not require driver hands on the wheel.	2
Advanced Lighting Systems	
Automatic High Beam. Switches the high beams on and off automatically based on detected lighting conditions.	0

[1] SAE International Surface Vehicle Information Report, "Active Safety Systems Terms and Definitions," SAE Standard J3063, Rev. Mar. 2021.
[2] SAE International Surface Vehicle Recommended Practice, "Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles," SAE Standard J3016, Rev. Apr. 2021.

2. Key Findings

The penetration of ADAS has expanded to 14 features in the PARTS study set, covering model years 2015 through 2023. This report marks growth in the 5 features included in the previous report and introduces a first look at 9 new features. As of the 2023 model year, penetration rates for these features range between 22% and 94%, with 10 out of the 14 features surpassing 50% market penetration. These substantial increases reflect the industry's proactive and voluntary commitment to integrating driver assistance technologies into vehicles. Participation in collaborative initiatives like PARTS further underscores the industry's commitment to enhancing vehicle safety and to understand the real-world effectiveness of these new technologies.

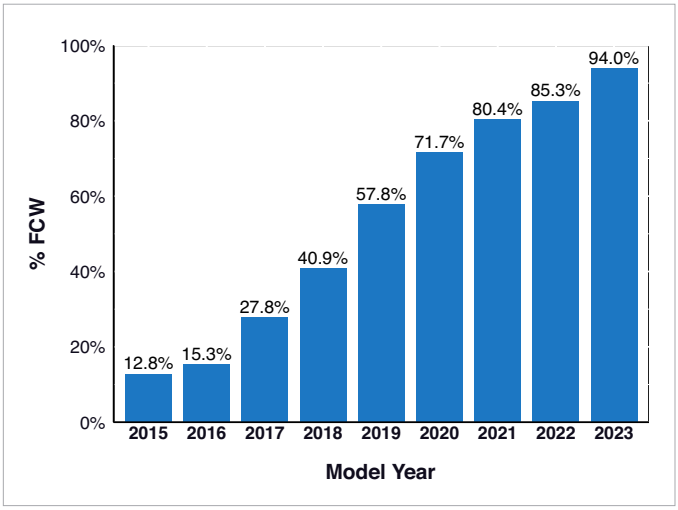


III. Forward Collision Warning & Automatic Emergency Braking Systems

Forward Collision Warning

Among makes and models in the PARTS study set, Forward Collision Warning (FCW) penetration increased from 12.8% in model year 2015 to 94% in model year 2023. Warning-only collision avoidance systems were among the first to enter the market, but these systems have since been integrated into emergency braking systems, namely AEB.

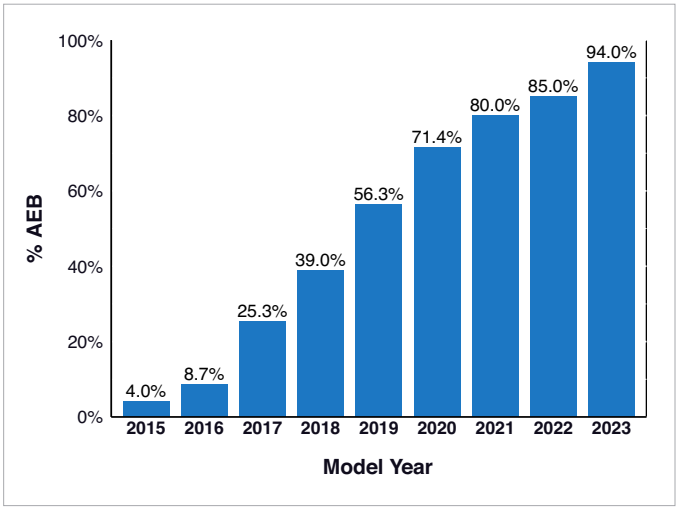
Model Year	Vehicle Count	FCW Count	Percentage
2015	11,636,941	1,484,901	12.8%
2016	11,503,458	1,763,814	15.3%
2017	12,240,521	3,405,611	27.8%
2018	12,079,329	4,943,688	40.9%
2019	12,157,501	7,025,356	57.8%
2020	10,651,727	7,638,194	71.7%
2021	10,584,082	8,508,790	80.4%
2022	9,974,715	8,504,144	85.3%
2023	7,127,816	6,702,321	94.0%



Automatic Emergency Braking

Among makes and models in the PARTS study set, Automatic Emergency Braking (AEB) penetration increased from 4% in model year 2015 to 94% in model year 2023. The industry voluntary agreement[3] in 2016 spearheaded by NHTSA, the Insurance Institute for Highway Safety, and automobile manufacturers was instrumental in the quick rise of AEB.

Model Year	Vehicle Count	AEB Count	Percentage
2015	11,636,941	465,748	4.0%
2016	11,503,458	1,004,234	8.7%
2017	12,240,521	3,093,136	25.3%
2018	12,079,329	4,713,064	39.0%
2019	12,157,501	6,838,888	56.3%
2020	10,651,727	7,605,288	71.4%
2021	10,584,082	8,470,879	80.0%
2022	9,974,715	8,480,323	85.0%
2023	7,127,816	6,697,332	94.0%

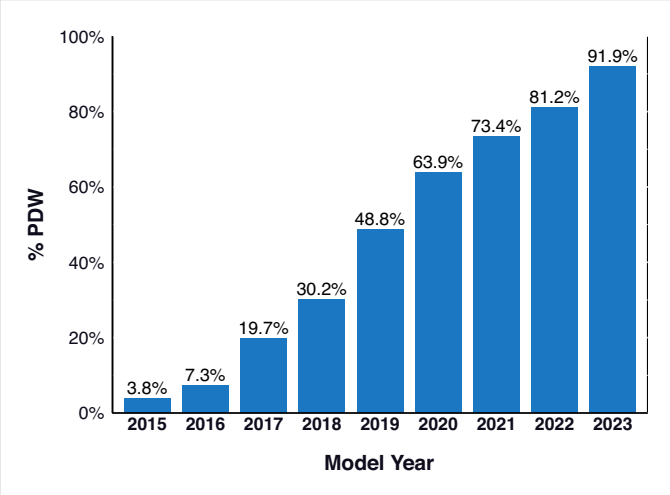


[3] https://www.nhtsa.gov/press-releases/us-dot-and-iihs-announce-historic-commitment-20-automakers-make-automatic-emergency.

Pedestrian Detection Warning

Among makes and models in the PARTS study set, Pedestrian Detection Warning (PDW) penetration increased from 3.8% in model year 2015 to 91.9% in model year 2023. Similar to FCW systems, PDW was first to enter the market and has since been integrated into the emergency braking systems, namely PAEB.

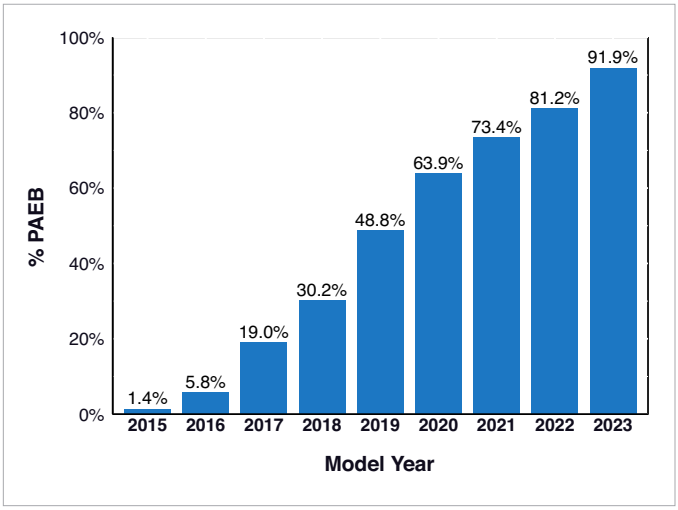
Model Year	Vehicle Count	PDW Count	Percentage
2015	11,636,941	439,931	3.8%
2016	11,503,458	842,753	7.3%
2017	12,240,521	2,415,322	19.7%
2018	12,079,329	3,653,582	30.2%
2019	12,157,501	5,935,170	48.8%
2020	10,651,727	6,807,395	63.9%
2021	10,584,082	7,767,771	73.4%
2022	9,974,715	8,103,330	81.2%
2023	7,127,816	6,550,884	91.9%



Pedestrian AEB

Among makes and models in the PARTS study set, Pedestrian AEB (PAEB) penetration increased from 1.4% in model year 2015 to 91.9% in model year 2023, highlighting a clear trend toward the widespread deployment of pedestrian detection and emergency braking technology in the automotive industry.

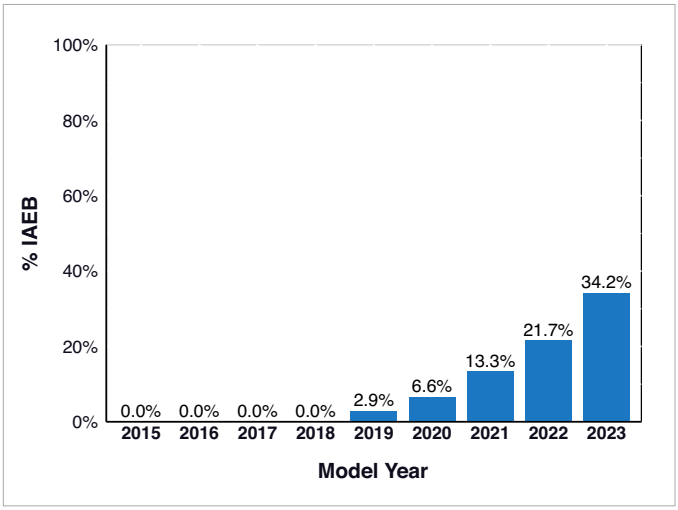
Model Year	Vehicle Count	PAEB Count	Percentage
2015	11,636,941	157,507	1.4%
2016	11,503,458	667,388	5.8%
2017	12,240,521	2,330,728	19.0%
2018	12,079,329	3,653,582	30.2%
2019	12,157,501	5,935,170	48.8%
2020	10,651,727	6,807,395	63.9%
2021	10,584,082	7,767,771	73.4%
2022	9,974,715	8,103,330	81.2%
2023	7,127,816	6,550,884	91.9%



Intersection AEB

Among makes and models in the PARTS study set, Intersection AEB (IAEB) penetration increased from 0% between model years 2015-2018 to 34.2% in model year 2023. Newer and more advanced emergency braking systems continue to evolve and are on pace with other maturing ADAS features.

Model Year	Vehicle Count	IAEB Count	Percentage
2015	11,636,941	0	0.0%
2016	11,503,458	0	0.0%
2017	12,240,521	0	0.0%
2018	12,079,329	0	0.0%
2019	12,157,501	352,747	2.9%
2020	10,651,727	703,193	6.6%
2021	10,584,082	1,404,392	13.3%
2022	9,974,715	2,163,924	21.7%
2023	7,127,816	2,439,754	34.2%

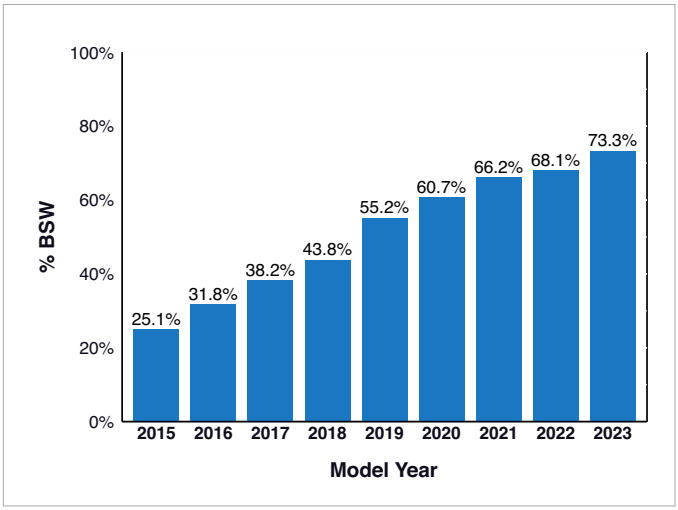


IV. Other Collision Warning & Intervention Systems

Blind Spot Warning

Among makes and models in the PARTS study set, Blind Spot Warning (BSW) penetration increased from 25.1% in model year 2015 to 73.3% in model year 2023. BSW led ADAS deployments as the most common system in 2015 yet now lags behind traditional AEB and PAEB systems.

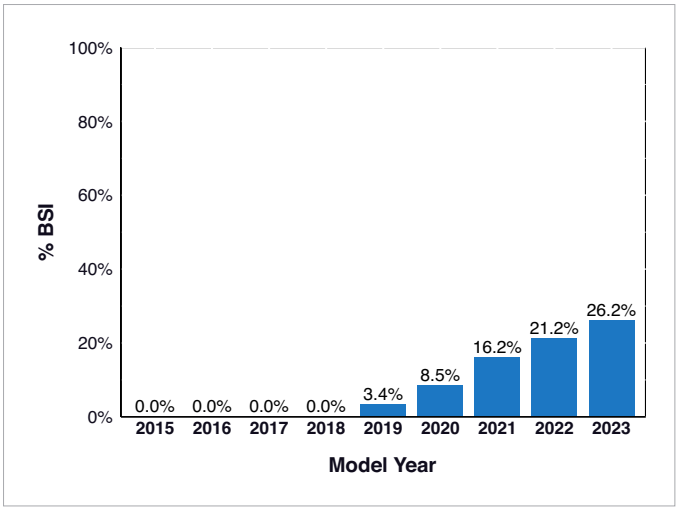
Model Year	Vehicle Count	BSW Count	Percentage
2015	11,636,941	2,917,685	25.1%
2016	11,503,458	3,654,503	31.8%
2017	12,240,521	4,676,041	38.2%
2018	12,079,329	5,289,200	43.8%
2019	12,157,501	6,714,527	55.2%
2020	10,651,727	6,464,171	60.7%
2021	10,584,082	7,009,642	66.2%
2022	9,974,715	6,793,985	68.1%
2023	7,127,816	5,223,019	73.3%



Blind Spot Intervention

Among makes and models in the PARTS study set, Blind Spot Intervention (BSI) penetration increased from 0% between model years 2015-2018 to 26.2% in model year 2023. Blind spot functionality with steering intervention is newer and on the rise.

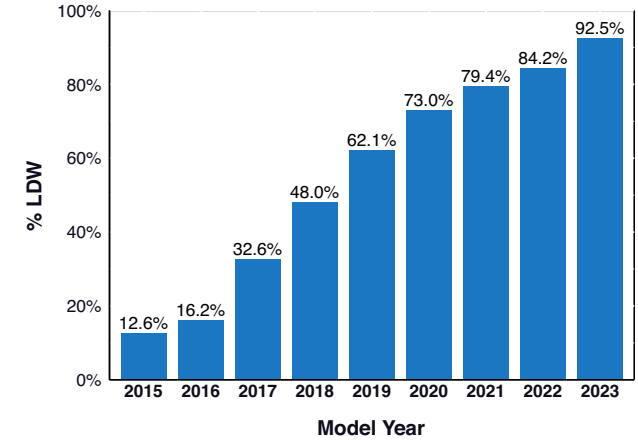
Model Year	Vehicle Count	BSI Count	Percentage
2015	11,636,941	0	0.0%
2016	11,503,458	0	0.0%
2017	12,240,521	0	0.0%
2018	12,079,329	0	0.0%
2019	12,157,501	411,206	3.4%
2020	10,651,727	909,475	8.5%
2021	10,584,082	1,715,786	16.2%
2022	9,974,715	2,110,719	21.2%
2023	7,127,816	1,864,779	26.2%



Lane Departure Warning

Among makes and models in the PARTS study set, Lane Departure Warning (LDW) penetration increased from 12.6% in model year 2015 to 92.5% in model year 2023. As with FCW and PDW, the deployment of warning-only lane departure systems had an earlier start and have now mostly been incorporated into lane keeping systems, although a few warning-only systems still exist.

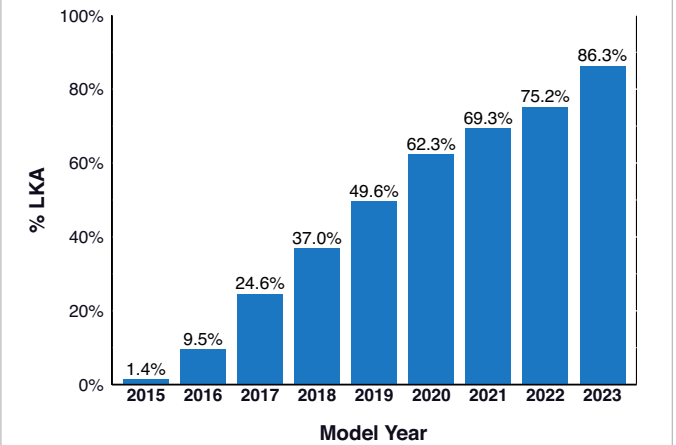
Model Year	Vehicle Count	LDW Count	Percentage
2015	11,636,941	1,469,663	12.6%
2016	11,503,458	1,860,838	16.2%
2017	12,240,521	3,991,661	32.6%
2018	12,079,329	5,796,092	48.0%
2019	12,157,501	7,550,148	62.1%
2020	10,651,727	7,775,326	73.0%
2021	10,584,082	8,403,161	79.4%
2022	9,974,715	8,394,860	84.2%
2023	7,127,816	6,595,743	92.5%



Lane Keeping Assistance

Among makes and models in the PARTS study set, Lane Keeping Assistance (LKA) penetration increased from 1.4% in model year 2015 to 86.3% in model year 2023. The deployment of LKA has been steadily increasing, though it remains slightly less prevalent than frontal collision avoidance systems like AEB.

Model Year	Vehicle Count	LKA Count	Percentage
2015	11,636,941	166,978	1.4%
2016	11,503,458	1,095,003	9.5%
2017	12,240,521	3,014,907	24.6%
2018	12,079,329	4,472,605	37.0%
2019	12,157,501	6,032,401	49.6%
2020	10,651,727	6,637,299	62.3%
2021	10,584,082	7,335,414	69.3%
2022	9,974,715	7,496,047	75.2%
2023	7,127,816	6,150,111	86.3%

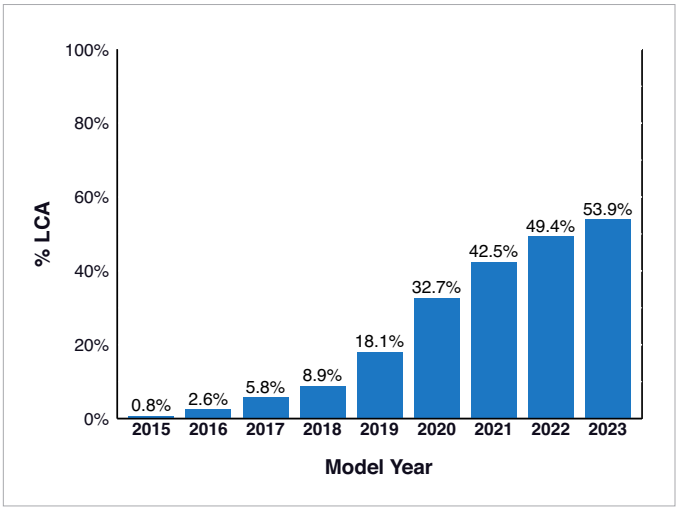


V. Driving Control Assistance Systems

Lane Centering Assistance

Among makes and models in the PARTS study set, Lane Centering Assistance[4] (LCA) penetration increased from 0.8% in model year 2015 to 53.9% in model year 2023. As a relatively new technology within driving control assistance systems, LCA is now available in a little over half of new vehicle models.

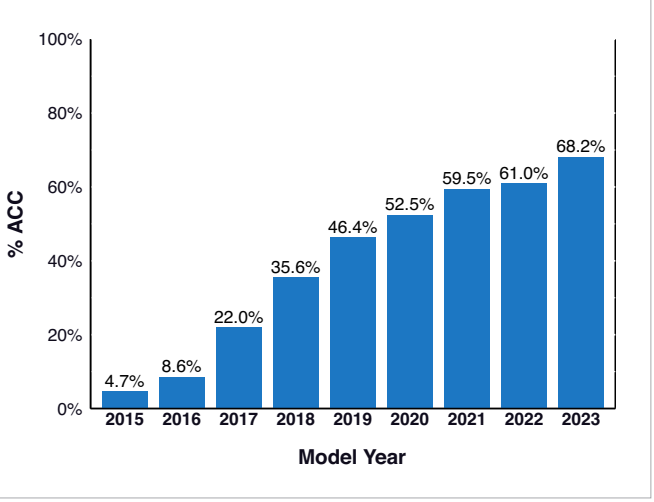
Model Year	Vehicle Count	LCA Count	Percentage
2015	11,636,941	87,607	0.8%
2016	11,503,458	302,987	2.6%
2017	12,240,521	710,991	5.8%
2018	12,079,329	1,080,461	8.9%
2019	12,157,501	2,204,809	18.1%
2020	10,651,727	3,479,728	32.7%
2021	10,584,082	4,500,432	42.5%
2022	9,974,715	4,931,013	49.4%
2023	7,127,816	3,843,263	53.9%



Adaptive Cruise Control

Among makes and models in the PARTS study set, Adaptive Cruise Control (ACC) penetration increased from 4.7% in model year 2015 to 68.2% in model year 2023. ACC was the first driving control assistance system deployed and remains slightly more prevalent than LCA in new vehicle models.

Model Year	Vehicle Count	ACC Count	Percentage
2015	11,636,941	542,017	4.7%
2016	11,503,458	991,541	8.6%
2017	12,240,521	2,687,398	22.0%
2018	12,079,329	4,295,366	35.6%
2019	12,157,501	5,643,893	46.4%
2020	10,651,727	5,587,383	52.5%
2021	10,584,082	6,302,461	59.5%
2022	9,974,715	6,086,837	61.0%
2023	7,127,816	4,863,056	68.2%

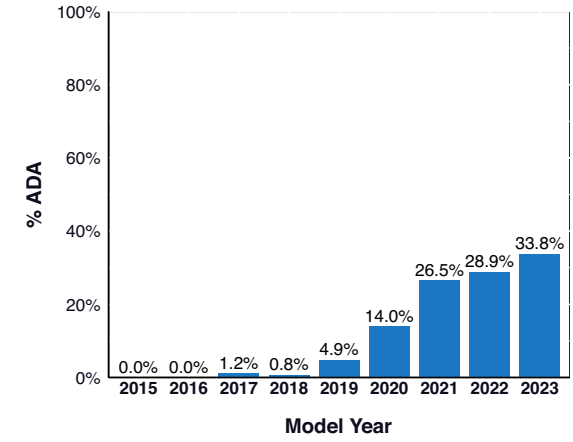


[4] The Lane Centering Assistance feature of some vehicle models is implemented as an independent feature while other models implement it as a part of the Active Driving Assistance system.

Active Driving Assistance

Among makes and models in the PARTS study set, Active Driving Assistance[5] (ADA) penetration increased from 0% between model years 2015-2016 to 33.8% in model year 2023. ADA, which combines the functionalities of LCA and ACC, represents a new level of driver assistance technology. The system is now available in more than one-third of all new vehicle models.

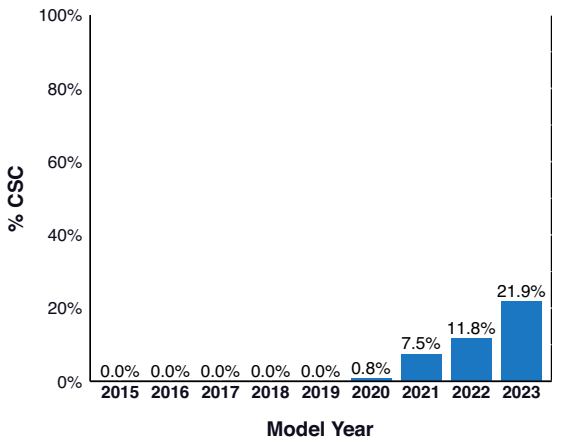
Model Year	Vehicle Count	ADA Count	Percentage
2015	11,636,941	0	0.0%
2016	11,503,458	0	0.0%
2017	12,240,521	146,223	1.2%
2018	12,079,329	98,739	0.8%
2019	12,157,501	589,743	4.9%
2020	10,651,727	1,494,245	14.0%
2021	10,584,082	2,805,023	26.5%
2022	9,974,715	2,887,535	28.9%
2023	7,127,816	2,410,658	33.8%



Curve Speed Correction

Among makes and models in the PARTS study set, Curve Speed Correction (CSC) penetration increased from 0% between model years 2015-2019 to 21.9% in model year 2023. CSC, introduced to the market in 2020, is on the rise.

Model Year	Vehicle Count	CSC Count	Percentage
2015	11,636,941	0	0.0%
2016	11,503,458	0	0.0%
2017	12,240,521	0	0.0%
2018	12,079,329	0	0.0%
2019	12,157,501	0	0.0%
2020	10,651,727	85,291	0.8%
2021	10,584,082	792,958	7.5%
2022	9,974,715	1,181,508	11.8%
2023	7,127,816	1,563,294	21.9%



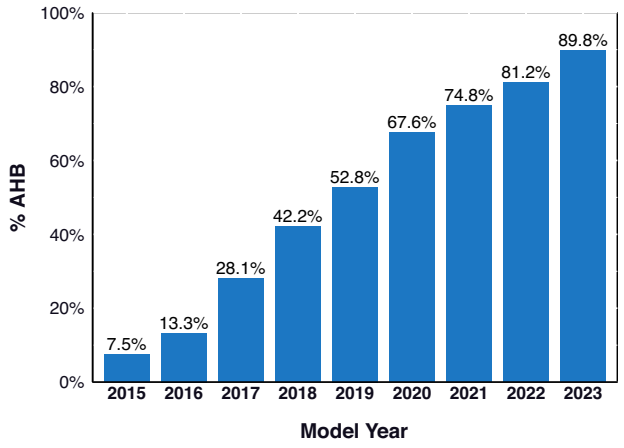
[5] To meet the minimum requirements for Active Driving Assistance, based on PARTS definition, a system must simultaneously include both Adaptive Cruise Control and Lane Centering Assistance.

VI. Advanced Lighting Systems

Automatic High Beam

Among makes and models in the PARTS study set, Automatic High Beam (AHB) penetration increased from 7.5% in model year 2015 to 89.8% in model year 2023. This growth in advanced lighting technology reflects its importance in enhancing nighttime driving safety.

Model Year	Vehicle Count	AHB Count	Percentage
2015	11,636,941	875,044	7.5%
2016	11,503,458	1,532,048	13.3%
2017	12,240,521	3,434,155	28.1%
2018	12,079,329	5,091,766	42.2%
2019	12,157,501	6,413,355	52.8%
2020	10,651,727	7,202,347	67.6%
2021	10,584,082	7,920,593	74.8%
2022	9,974,715	8,099,272	81.2%
2023	7,127,816	6,397,958	89.8%



Notes

- Reported ADAS penetration rates represent a partial view of the U.S. automobile market, both in terms of manufacturers and models. Vehicles in the PARTS study set may not be representative of the entire market but do represent the majority at approximately 80%.
- Data for model year 2023 is partial, including vehicles built by 7/31/2023.
- Not all models are available in all model years.
- Manufacturers identified the vehicles that met the ADAS definitions; specific performance criteria were not applied.
- Vehicles include passenger vehicles in the following 10 segments: small cars, midsize cars, large cars, small SUVs, midsize SUVs, large SUVs, medium pickups, light duty pickups, heavy duty pickups, and minivans.
- Makes and models included in the study set include:

  Ford: Aviator, Bronco, Bronco Sport, Continental, Corsair, EcoSport, Edge, Escape, Expedition, Explorer, F-150, F-150 Lightning (EV), F-250, Fiesta, Focus, Fusion, Maverick, MKC, MKS, MKZ, Mustang, Mustang Mach-E (EV), Nautilus, Navigator, Ranger, Taurus

  General Motors: Acadia, ATS, Blazer, Bolt (EV), Canyon, Colorado, Cruze. CT4, CT5, CT6, CTS, Enclave, Encore, Encore GX, Envision, Equinox, Escalade, Hummer (EV), Impala, LaCrosse, Lyriq (EV), Malibu, Regal, Sierra HD, Sierra LD, Silverado HD, Silverado LD, Sonic, Spark, SRX, Suburban, Tahoe, Terrain, Trailblazer, TRAX, Traverse, Verano, Volt, XT4, XT5, XT6, XTS, Yukon, Yukon XL

  Honda: Accord, Civic, CR-V, Fit, HR-V, ILX (Integra), Insight, MDX, Odyssey, Passport, Pilot, RDX, Ridgeline, TLX

  Hyundai: Accent, Elantra, G70, G80, G90, GV60, GV70, GV80, Ioniq, Ioniq 5, Ioniq 6, Kona, Palisade, Santa Cruz, Sante Fe, Sonata, Tucson, Venue, Veloster

  Mazda: CX-3, CX-30, CX-5, CX-50, CX-9, Mazda3 Hatchback, Mazda3 Sedan, Mazda6, MX-30 (EV)

  Mitsubishi: Eclipse Cross, Mirage, Mirage G4, Outlander, Outlander PHEV, Outlander Sport

  Stellantis: 200, 300, Challenger, Charger, Cherokee, Compass, Durango, Gladiator, Giulia, Grand Cherokee, Pacifica, Ram 1500, Ram 2500, Renegade, Stelvio, Wagoneer/Grand Wagoneer, Wrangler 2DR, Wrangler 4DR

  Subaru: Ascent, BRZ /86, Crosstrek, Forester, Impreza, Legacy, Outback, WRX

  Toyota: 4Runner, Avalon, bZ4X/Solterra (EV), Camry, CH-R, Corolla 4DR, Corolla Cross, Corolla HB, Crown, ES, GX, Highlander, IS, LS, NX, Prius, RAV4, RX, Sequoia, Sienna, Tacoma, Tundra, UX, Venza
- See the table below for the SAE International Surface Vehicle Recommended Practice, Taxonomy and Definitions for Driving Automation Systems levels corresponding to the ADAS features included in this report.

SAE Level	Definition	Narrative Definition	Sustained Lateral & Longitudinal Vehicle Motion Control	Object and Event Detection and Response (OEDR)	Dynamic Driving Task (DDT) Fallback	Operational Design Domain (ODD)
	Driver Performs Part or All of the DDT					
0	No Driving Automation	The performance of the driver in carrying out the driving task, even when enhanced by active safety systems.	*Driver*	*Driver*	*Driver*	*n/a*
1	Driver Assistance	The sustained execution by a driving automation system of either lateral or longitudinal vehicle motion control (but not simultaneously) with the expectation that the driver performs other driving tasks.	*Driver & System*	*Driver*	*Driver*	*Limited*
2	Partial Driving Automation	The sustained execution by a driving automation system of both lateral and longitudinal vehicle motion control with the expectation that the driver continues monitoring and responding to conflicts and supervises the driving automation system.	*System*	*Driver*	*Driver*	*Limited*