



#538



ADAS & Autonomy

# ADAS & Autonomy Forecast

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Interest in ADAS is growing at a rapid rate. OEMs today are integrating more features into their vehicles and announcing conceptual autonomous vehicles with the intent to produce them. This interest extends to a range of suppliers and technology companies who have announced the development of technologies for these vehicles.

Despite these advances, L4 autonomy faces many obstacles before becoming a commercial reality. Among these are the guidelines, legislation and regulations surrounding autonomous vehicles alongside the consumer trust needed to roll them out on a wide scale. These factors have caused OEMs to shift their focus from achieving the highest levels of vehicle autonomy to expanding the availability of lower levels and the capability of their own ADAS systems.

The ADAS L0 - L3 Forecast assesses and analyzes how features operating at lower levels of autonomy are expected to grow. Examining the offerings featured in passenger vehicles, the forecast works to highlight the regional differences in the penetration of different ADAS types. The technologies that facilitate them are also accounted for - including Adaptive Cruise Control, Driver Monitoring, and Rear Cross Traffic Alert systems. This report is updated quarterly, with regional versions covering the ADAS markets for China, Europe, and the U.S.

## RELATED SBD REPORTS

### 534 - Autonomous & Autonomy Guide

SBD's regional ADAS & Autonomy Database helps customers to understand which ADAS features are being offered by each vehicle manufacturer.

The database is built at model level and covers: ACC, PD, FCW, CA, NV/PD, TSR, LDP, BSM, RCTA, DM, AHD, SAPA, FAPA, RP, TA and SVC.

### COVERAGE



### FREQUENCY



### PUBLICATION FORMAT



### PAGES



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# Key questions answered

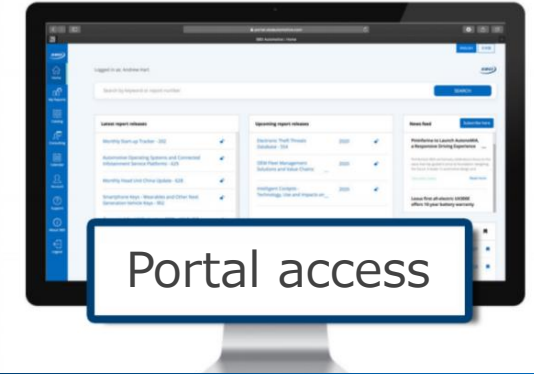
- > How will ADAS deployments vary per region?
- > What impact will regional regulations play?
- > How aggressively are different OEMs expected to ramp-up fitment of L1, L2, L2+, and L3 features in the coming years?
- > How widely adopted will LiDAR, camera, radar and other types of sensors become?

# This research supports

-  PRODUCT PLANNERS
-  C-SUITE
-  MARKETING
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December 2023  
**ADAS & AUTONOMY FORECAST**



## Introduction

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# Chapter Introduction

Some early Advanced Driver Assistance Systems (ADAS) were introduced during the 1990s. After being in the market for over two decades, ADAS has started to witness some noticeable market penetration. Key driving factors include competitive pressures, legislation, incentives by safety groups and lower cost of sensors.

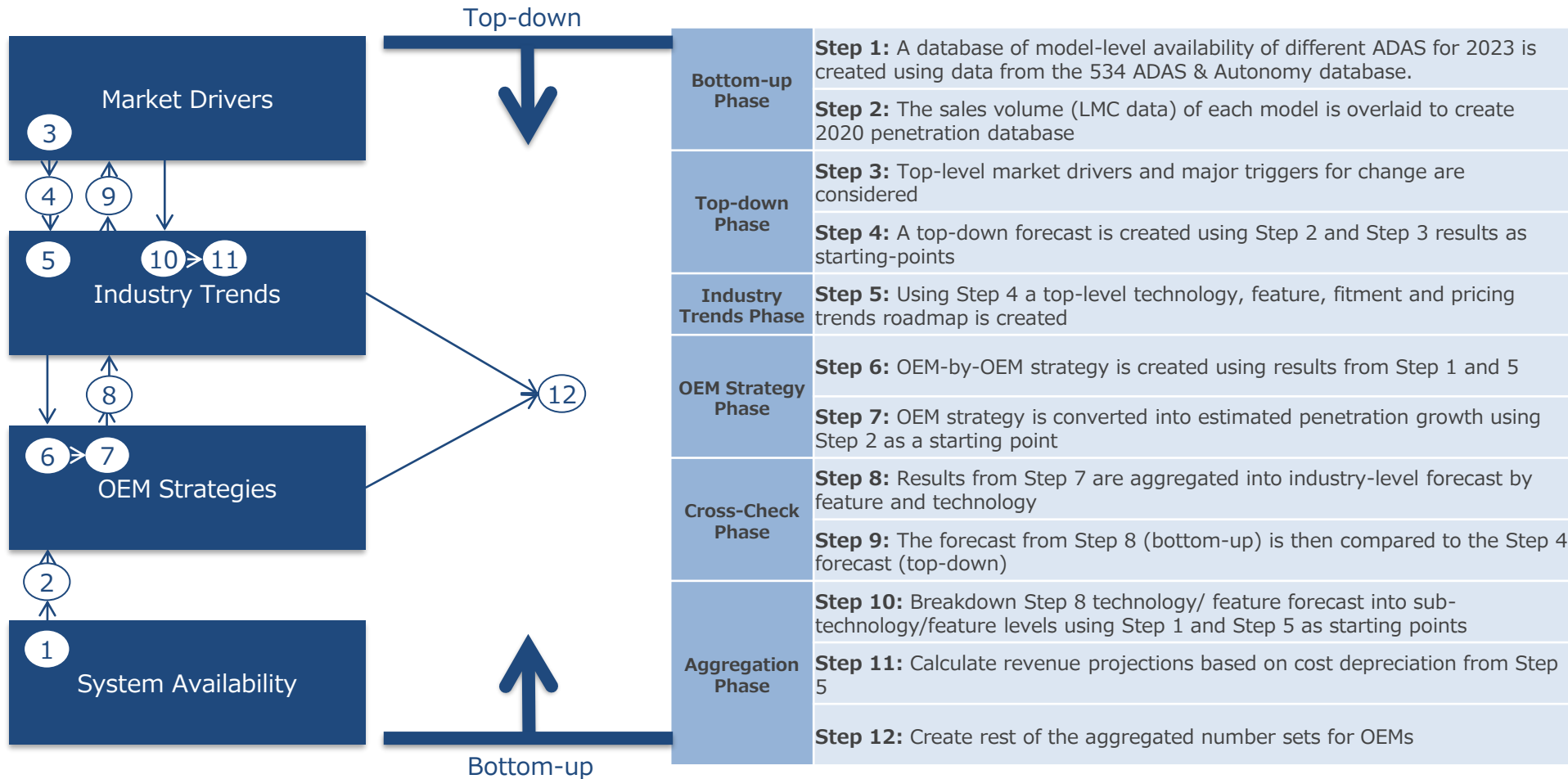
SBD has therefore prepared this report to understand at a regional level (Europe) the differences in penetration for various types of ADAS and the technologies supporting these features on personal vehicles. This report provides a deeper understanding by estimating the technology and feature penetrations on personal vehicles at an OEM level.

## What are the key questions answered in the 2023 Europe ADAS Forecast?

- How aggressively are different OEMs expected to deploy SAE L0, L1, L2 and L3 features in the coming years?
- What sensors will OEMs use to support their ADAS?
- What are the barriers and drivers of ADAS deployment in the region?

Section	Content
<b>Executive Summary</b>	Introduction to the forecast and presents key highlights and conclusions from the report.
<b>What's New?</b>	Identifies trends within the forecast which are new to the 2022 forecast.
<b>Feature Trends</b>	Analysis of feature trends identified in the forecast, including the drivers and barriers of deployment.
<b>OEM Trends</b>	Overview of each OEM's offerings in terms of autonomy and supporting sensors.
<b>Regional trends</b>	Overview of key trends which are specific to the European market.
<b>Go Deeper</b>	Can SBD help you with any unanswered questions?

# Forecast Methodology



**Note:** The model level availability data (Step 1) for the forecast is obtained by researching the feature availability and feature fitment by various OEMs in the European market.

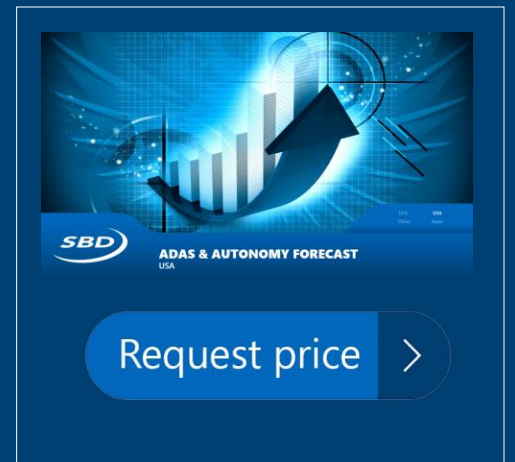


LMC Automotive is the premier automotive forecasting company and has an exclusive focus on the industry and an understanding of the dynamics that drive it. With offices in Oxford, Detroit, Shanghai, Bangkok and Frankfurt and representation in Brazil, Japan and Korea, they combine 30 years of experience in macroeconomics and demand analysis, with a global network of ground-level, intelligence gathering expert analysts to create unique perspectives and insights.

LMC Automotive provides the vehicle history and forecasts which power SBD's forecasting services.



# Example slides from the report





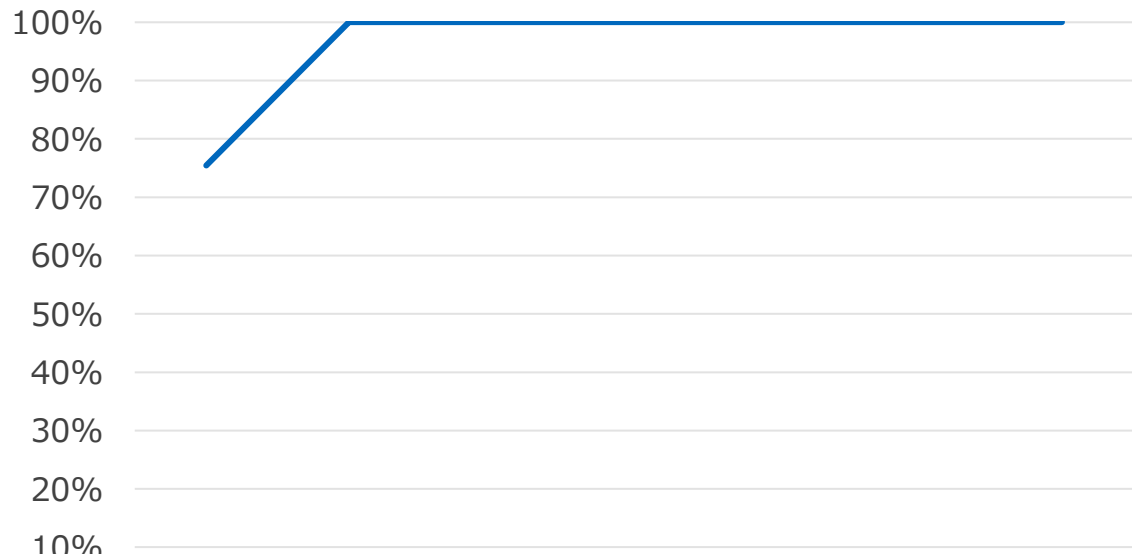
# Driver Monitoring

## Overview

Driver Monitoring systems already has a high deployment in the European market and thanks to the mandate in Europe it is expected to reach 100% penetration in 2024.

Low-cost solutions adopted mostly by volume OEMs use driving data or other on-board sensors to detect drowsy and distracted driving, while premium ones are based on a driver-facing camera and some support SAE L2 Piloted Driving.

### Driver Monitoring penetration



	2023	2024	2025	2026	2027	2028	2029
DM	75.4%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

## Highlights

Piloted driving is currently the main driver for Driver Monitoring systems growth featuring cameras.

In Europe, the systems featuring a **driver-facing camera either as standard or optional account for 12%** of the total and are mostly found in premium brands.

The OEMs below offer Driver Monitoring systems based on driver-facing cameras in Europe:





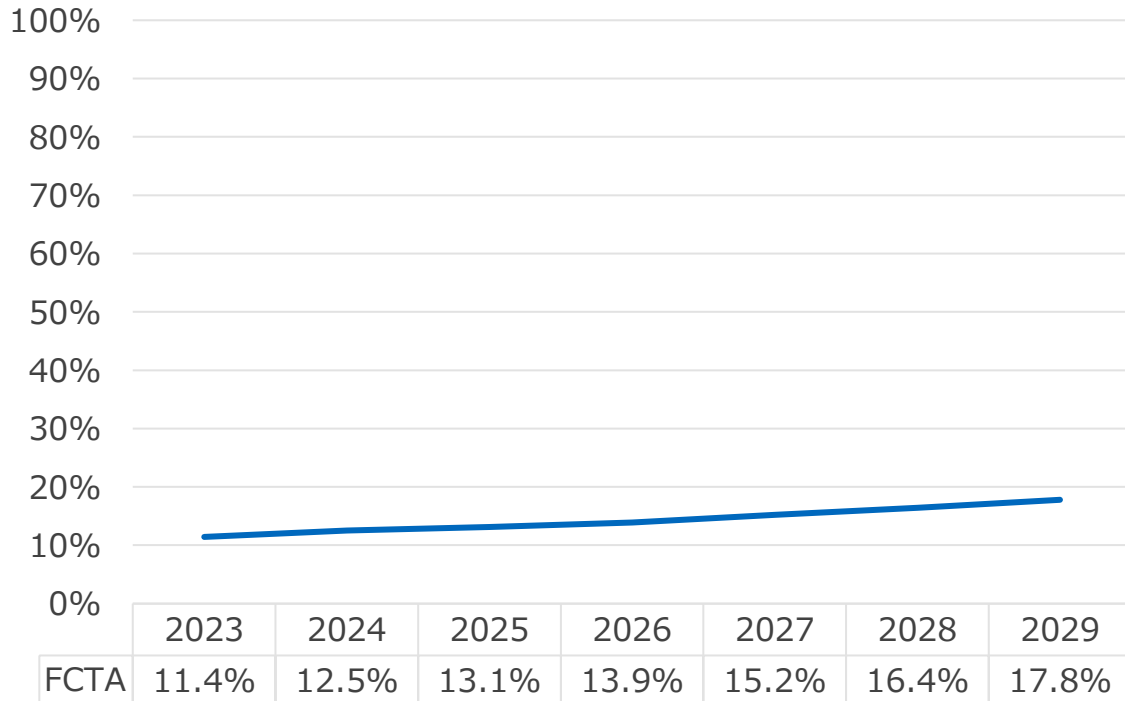


# Front Cross Traffic Alert

## Overview

Front Cross Traffic Alert deployment is quite limited despite an expected gradual growth over the next years over the forecasting period. The feature is typically a high-end offering among premium OEMs with a few exceptions from both European and non-European volume OEMs such as VW, Mazda. The main driver for the deployment of FCTA is competitive pressure.

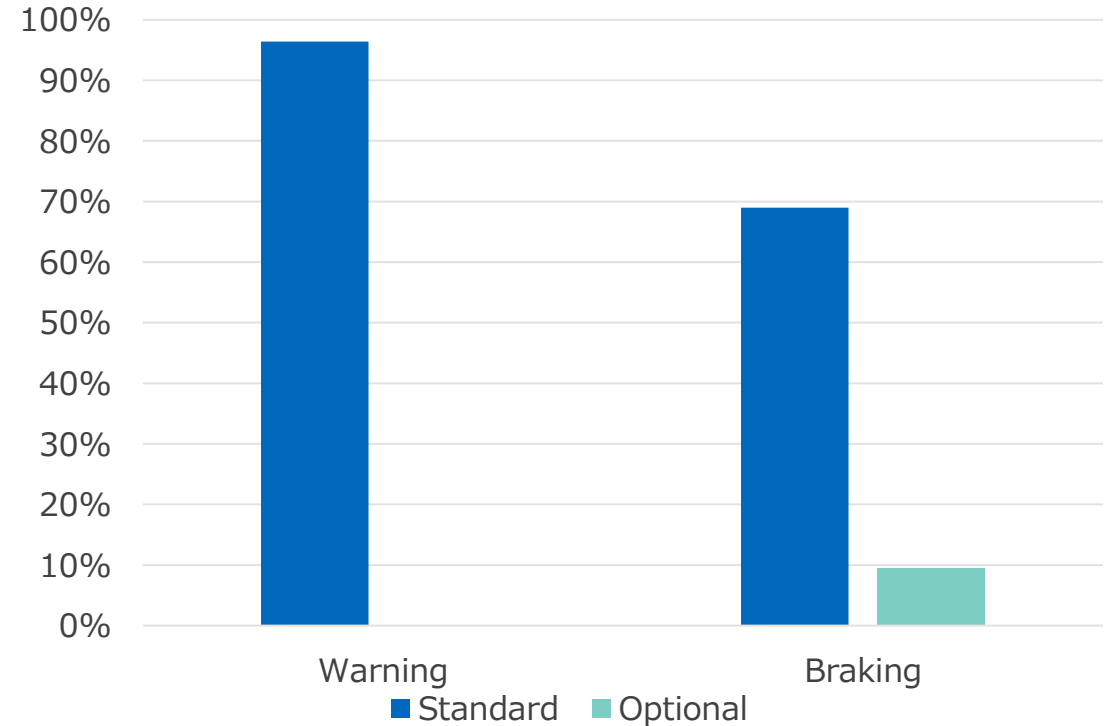
### Front Cross Traffic Alert penetration



## Highlights

The **warning function has the highest adoption** rate in Front Cross Traffic Alert and is always offered as standard. **Braking** is also becoming more common, and it is mostly **included as standard** by the OEMs offering the function with the sole exception of BMW that features it as optional on some selected models.

### FCTA Functions Penetration





# SAE Level 0

## Vision System

### Route 1

- The most basic implementation of vision system features a mono camera and generally basic functions under the Lane Departure Prevention (LDP), Traffic Sign Recognition (TSR), and Automatic Headlight Dipping (AHD). This system is featured in most vehicles, even volume brands' low trims.



- Fiat features mono camera headlight dipping, LDP warnings and haptic feedback, and speed plus other road signals for TSR all via mono camera provided as standard in most models.

### Route 2

- Some brands (mostly premium) feature vision systems via Stereo Cameras as standard or options and some optional additional functions for Lane Departure Prevention (LDP), Traffic Sign Recognition (TSR), and Automatic Headlight Dipping (AHD).



- Land Rover features stereo cameras as standard and optionally adds beam shaping for AHD, lane keeping in LDP with warning and haptic feedback, and speed adaptation according to TSR.

### Route 3

- The highest trim levels and generally premium brands provide vision systems implemented through trifocal cameras and offer also a higher level of functions like beam shaping for AHD.



- BMW uses trifocal cameras offered as standard in most models and includes services such as beam shaping for AHD, lane keeping along with warning and haptic feedback for LDP, and TSR with automatic speed adaptation according to speed signs and others.

## Rear Sensing

- The single Radar is the most common system for rear sensing in Blind Spot Monitoring (BSM) and Rear-Cross Traffic Alert (RCTA) respectively used in 83% and 59% of the vehicles respectively.



- Alfa Romeo uses radar for both BSM, with warning, haptic feedback and intervention, and RCTA including warning and braking assist.

- Different types of Cameras are adopted for rear sensing, like side cameras, and rearview cameras. They are generally not really common for this use and reach a maximum of 11% adoption in RCTA.



- Volkswagen features RCTA exclusively with rearview camera and providing warning and braking assist.

- Ultrasonic sensors are used in rare cases and almost always along either cameras or radars in both BSM and RCTA in a very limited number of cases, and mostly but not exclusively by premium OEMs. Only in 5% of cases for BSM Ultrasonic sensors are adopted alone.



TESLA

- Tesla is the only OEM that offers BSM through camera and ultrasonic sensors. The system is offered as standard in all its models and provide BSM warning and intervention.

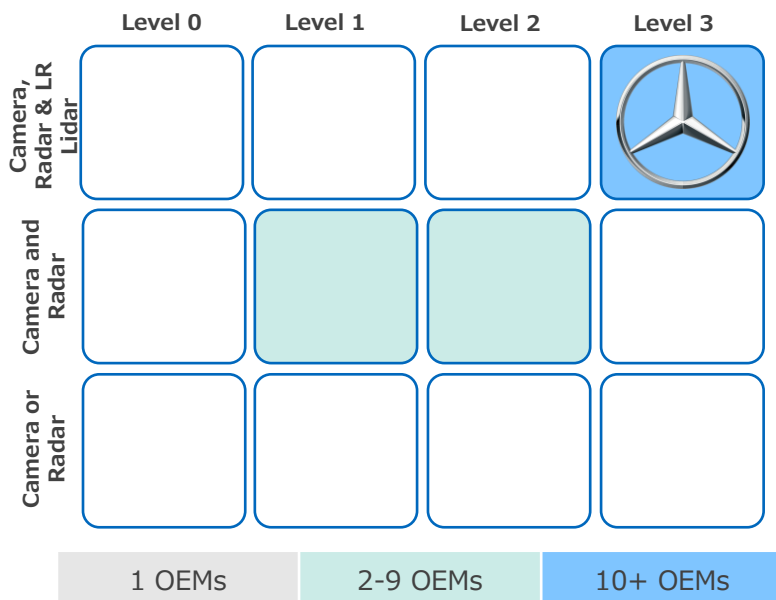


# Mercedes-Benz Group

## Overview

Mercedes-Benz is a leader in ADAS technology thanks to its SAE Level 3 PD+ offering achieved via long range lidar that is still extremely rare in the industry. Smart does not reach SAE level 3 but has a good offering including Level 2 ADAS.

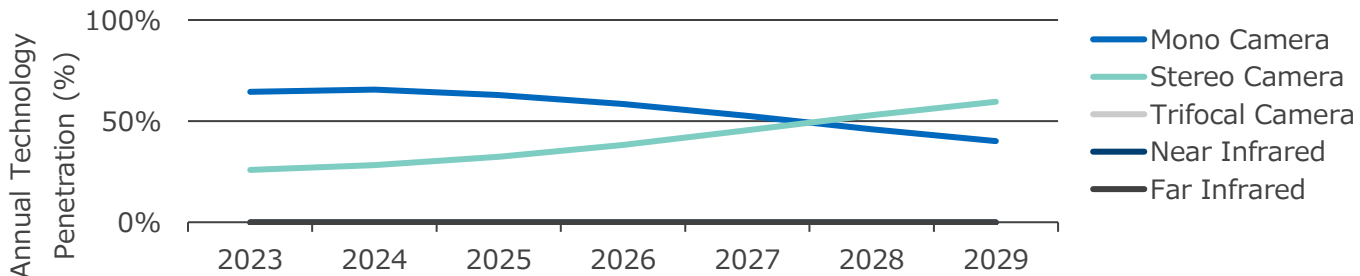
### 2029 Technology position



	2023	2026	2029
SAE Level 0	98%	100%	100%
SAE Level 1	84%	92%	92%
SAE Level 2	31%	43%	67%
SAE Level 3	0.3%	1.6%	3.3%



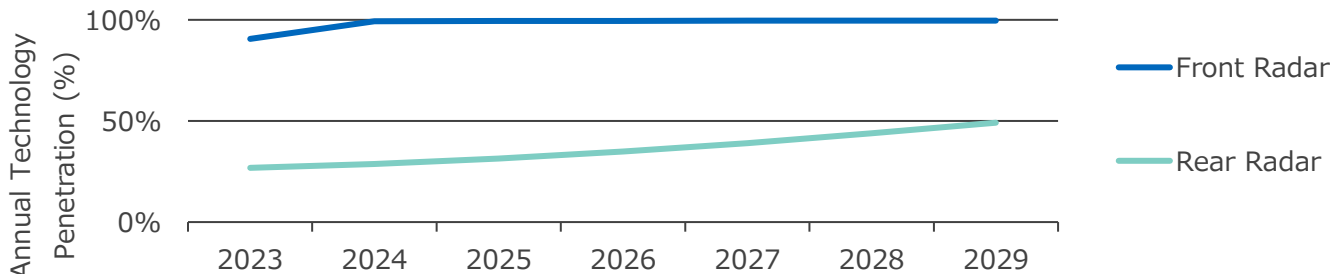
### Camera



Mono camera has already 100% adoption in Smart, but the decrease is driven by Mercedes gradual substitution with stereo cameras.



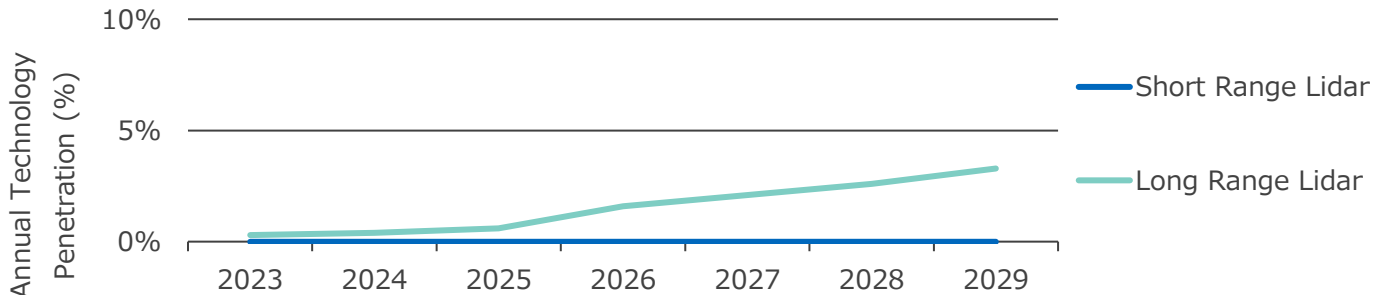
### Radar



Front radar is already approaching 100% and expected to continue, while rear radar, will more than double its adoption rate over the forecasting period reaching over 54%



### Lidar



Long range lidar is adopted by Mercedes-Benz as it leads the industry with Level 3 autonomy.

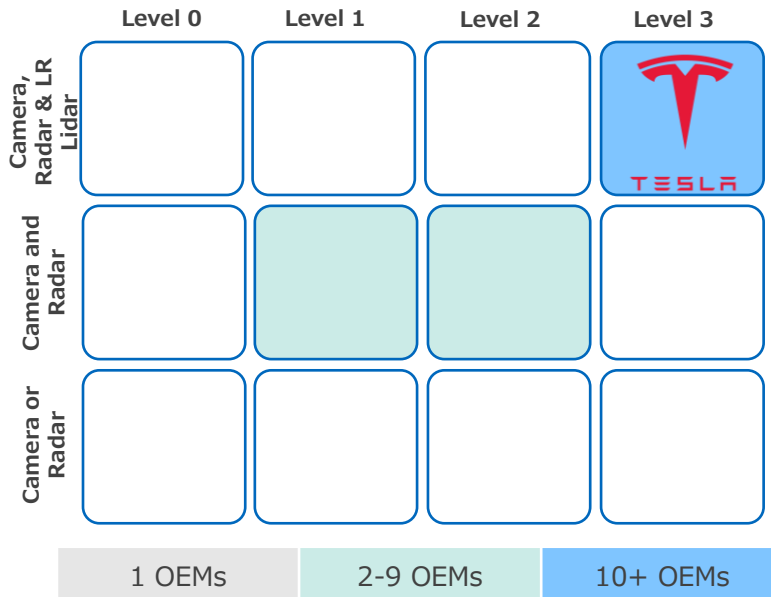


# Tesla Motors

## Overview

Tesla features the same offering on all its vehicles, featuring every ADAS for SAE level 0 and 1, and also fully-automatic parking assist and remote parking functions along with piloted driving for SAE level 2. SAE Level 3 is expected to be introduced by 2026.

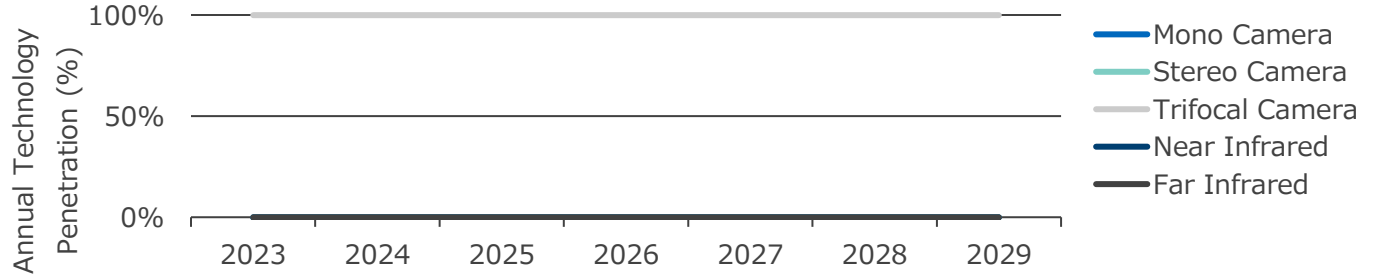
### 2029 Technology position



	2023	2026	2029
SAE Level 0	100%	100%	100%
SAE Level 1	100%	100%	100%
SAE Level 2	100%	100%	100%
SAE Level 3	0%	2.2%	7.5%



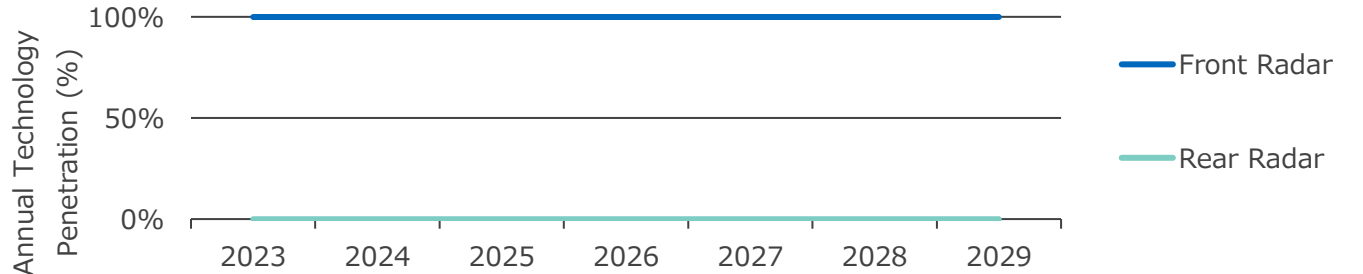
### Camera



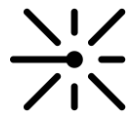
Tesla adopts only trifocal cameras featured in all its vehicles.



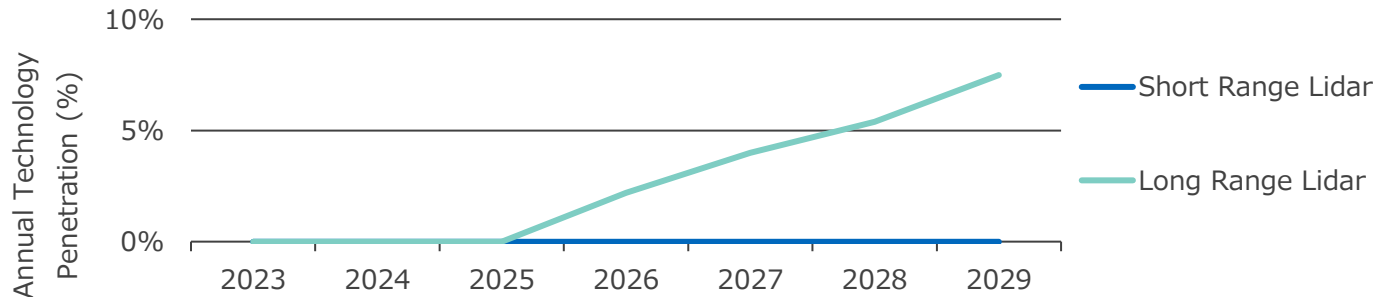
### Radar



Front radar for functions like collision avoidance has also a 100% adoption rate, while rear radar at Tesla is substituted by cameras for functions like BSM and RCTA.



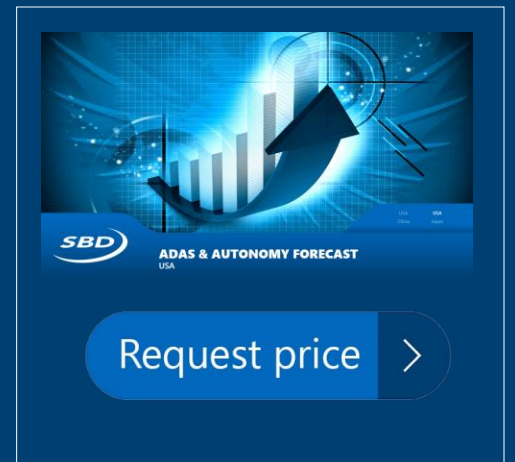
### Lidar



Tesla is expected to introduce long-range lidars by 2026 with relatively quick adoption through all its models.



# What the Excel Version Contains





# Excel Database Includes



538 - ADAS & Autonomy Forecast											
538EU-23		2023 - Europe			Europe Market						
By Feature	Annual Features Sales		Volume	Sub-cat	2023	2024	2025	2026	2027	2028	2029
	ACC	ACC	6,500,594	8,173,811	9,526,477	10,522,970	11,475,877	12,404,215	13,210,808		
	PD	PD	3,778,351	4,805,685	5,785,596	6,617,454	7,433,110	8,207,749	8,924,897		
	CA	CA	13,310,385	16,381,093	17,459,554	17,799,758	17,995,104	18,134,287	18,225,437		
	NV	NV	6,375	9,529	14,519	19,508	24,808	32,072	38,792		
	TSR	TSR	9,450,784	16,380,783	17,459,255	17,799,491	17,994,867	18,134,100	18,225,283		
	LDP	LDP	12,544,801	16,381,093	17,459,554	17,799,758	17,995,104	18,134,287	18,225,437		
	BSM	BSM	5,624,423	7,115,889	8,428,854	9,596,354	10,647,116	11,620,857	12,467,955		
	RCTA	RCTA	4,374,123	5,620,403	6,617,076	7,457,043	8,298,941	9,102,031	9,881,677		
	FCTA	FCTA	1,737,837	2,052,600	2,293,600	2,483,033	2,732,808	2,972,680	3,247,609		
	DM	DM	11,446,816	16,381,093	17,459,554	17,799,758	17,995,104	18,134,287	18,225,437		
	AHD	AHD	7,856,979	10,230,954	11,521,373	12,356,178	13,100,545	13,773,077	14,345,175		
	SAPA	SAPA	2,006,950	2,574,725	3,252,648	3,773,361	4,307,917	4,823,674	5,352,428		
	FAPA	FAPA	1,096,608	1,371,704	1,651,286	1,938,119	2,242,148	2,615,371	2,910,090		
RP	RP	669,516	803,756	966,061	1,135,992	1,295,093	1,465,187	1,572,687			
PD+	PD+	3,058	4,536	17,072	58,249	95,203	151,528	212,301			
Features Penetration (%)	Features Penetration (%)		Volume	Sub-cat	2023	2024	2025	2026	2027	2028	2029
	ACC	ACC	42.7%	49.9%	54.6%	59.1%	63.8%	68.4%	72.5%		
	PD	PD	24.8%	29.3%	33.1%	37.2%	41.3%	45.3%	49.0%		
	CA	CA	87.5%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
	NV	NV	0.042%	0.058%	0.083%	0.110%	0.138%	0.177%	0.213%		
	TSR	TSR	62.1%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
	LDP	LDP	82.5%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
	BSM	BSM	37.0%	43.4%	48.3%	53.9%	59.2%	64.1%	68.4%		
	RCTA	RCTA	28.8%	34.3%	37.9%	41.9%	46.1%	50.2%	54.2%		

Excel Data Points:  
**10,000+**

Global OEMs Covered:  
**40+**

Excel Tabs:  
**4**





# Excel Database Includes

OEM	Feature	Sum of 2023	Sum of 2024	Sum of 2025	Sum of 2026	Sum of 2027	Sum of 2028	Sum of 2029
Alfa Romeo	ACC	66%	71%	76%	81%	85%	88%	91%
	AHD	100%	100%	100%	100%	100%	100%	100%
	BSM	35%	36%	37%	39%	41%	44%	47%
	CA	100%	100%	100%	100%	100%	100%	100%
	DM	74%	100%	100%	100%	100%	100%	100%
	FAPA	0%	0%	0%	0%	0%	0%	0%
	FCTA	0%	0%	0%	0%	0%	0%	0%
	LDW	100%	100%	100%	100%	100%	100%	100%
	NV	0%	0%	0%	0%	0%	0%	0%
	PD	17%	22%	28%	35%	42%	50%	58%
	PD+	0%	0%	0%	0%	0%	2%	8%
	RCTA	35%	36%	37%	39%	41%	44%	47%
	RP	0%	0%	0%	0%	0%	0%	0%
	SAPA	2%	3%	3%	8%	10%	14%	18%
TSR	74%	100%	100%	100%	100%	100%	100%	
Audi	ACC	26%	36%	45%	53%	60%	65%	69%
	AHD	30%	36%	43%	49%	56%	63%	70%
	BSM	19%	22%	26%	31%	36%	43%	50%
	CA	99%	100%	100%	100%	100%	100%	100%
	DM	82%	100%	100%	100%	100%	100%	100%
	FAPA	1%	2%	3%	4%	5%	7%	8%
	FCTA	3%	10%	13%	16%	20%	23%	27%
	LDW	99%	100%	100%	100%	100%	100%	100%
	NV	0%	0%	0%	0%	1%	1%	1%
	PD	26%	44%	52%	60%	66%	71%	74%
	PD+	0%	0%	0%	1%	2%	3%	4%
	RCTA	19%	22%	26%	31%	36%	43%	50%
	RP	1%	2%	3%	4%	5%	7%	8%
	SAPA	11%	14%	18%	23%	29%	35%	42%
TSR	48%	100%	100%	100%	100%	100%	100%	
BMW	ACC	12%	14%	17%	21%	25%	29%	33%

Excel Data Points:  
**10,000+**

Global OEMs Covered:  
**40+**

Excel Tabs:  
**4**



# Excel Database Includes



Hyundai	Far Infrared	0%	0%	0%	0%	0%	0%	0%
	Front Radar	100%	100%	100%	100%	100%	100%	100%
	Long Range Lidar	0%	0%	0%	0%	0%	0%	0%
	Mono Camera	100%	100%	100%	100%	100%	100%	100%
	Near Infrared	0%	0%	0%	0%	0%	0%	0%
	Rear Radar	47%	54%	61%	67%	73%	77%	82%
	Short Range Lidar	0%	0%	0%	0%	0%	0%	0%
	Stereo Camera	0%	0%	0%	0%	0%	0%	0%
	Trifocal Camera	0%	0%	0%	0%	0%	0%	0%
	Ultrasonic	7%	10%	13%	16%	20%	25%	29%
Jaguar	Far Infrared	0%	0%	0%	0%	0%	0%	0%
	Front Radar	82%	93%	93%	93%	93%	93%	93%
	Long Range Lidar	0%	0%	1%	2%	3%	4%	5%
	Mono Camera	0%	0%	0%	0%	0%	0%	0%
	Near Infrared	0%	0%	0%	0%	0%	0%	0%
	Rear Radar	62%	69%	75%	81%	85%	88%	91%
	Short Range Lidar	0%	0%	0%	0%	0%	0%	0%
	Stereo Camera	100%	100%	100%	100%	100%	100%	100%
	Trifocal Camera	0%	0%	0%	0%	0%	0%	0%
	Ultrasonic	23%	27%	32%	38%	43%	48%	54%
Jeep	Far Infrared	0%	0%	0%	0%	0%	0%	0%
	Front Radar	100%	100%	100%	100%	100%	100%	100%
	Long Range Lidar	0%	0%	0%	0%	0%	0%	0%
	Mono Camera	100%	100%	100%	100%	100%	100%	100%
	Near Infrared	0%	0%	0%	0%	0%	0%	0%
	Rear Radar	27%	34%	42%	49%	54%	59%	63%
	Short Range Lidar	0%	0%	0%	0%	0%	0%	0%
	Stereo Camera	0%	0%	0%	0%	0%	0%	0%
	Trifocal Camera	0%	0%	0%	0%	0%	0%	0%
	Ultrasonic	14%	17%	21%	26%	31%	36%	41%
Kia	Far Infrared	0%	0%	0%	0%	0%	0%	0%
Front Radar	100%	100%	100%	100%	100%	100%	100%	

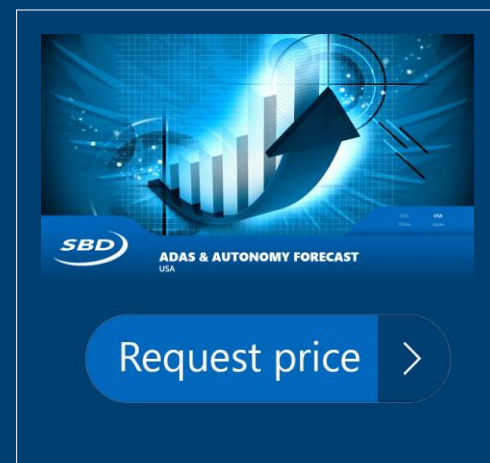
Excel Data Points:  
**10,000+**

Global OEMs Covered:  
**40+**

Excel Tabs:  
**4**



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