



U.S. MARKET INSIGHTS **AUTOMATIC EMERGENCY** **BRAKING (AEB)**

Analysis completed: June 2016

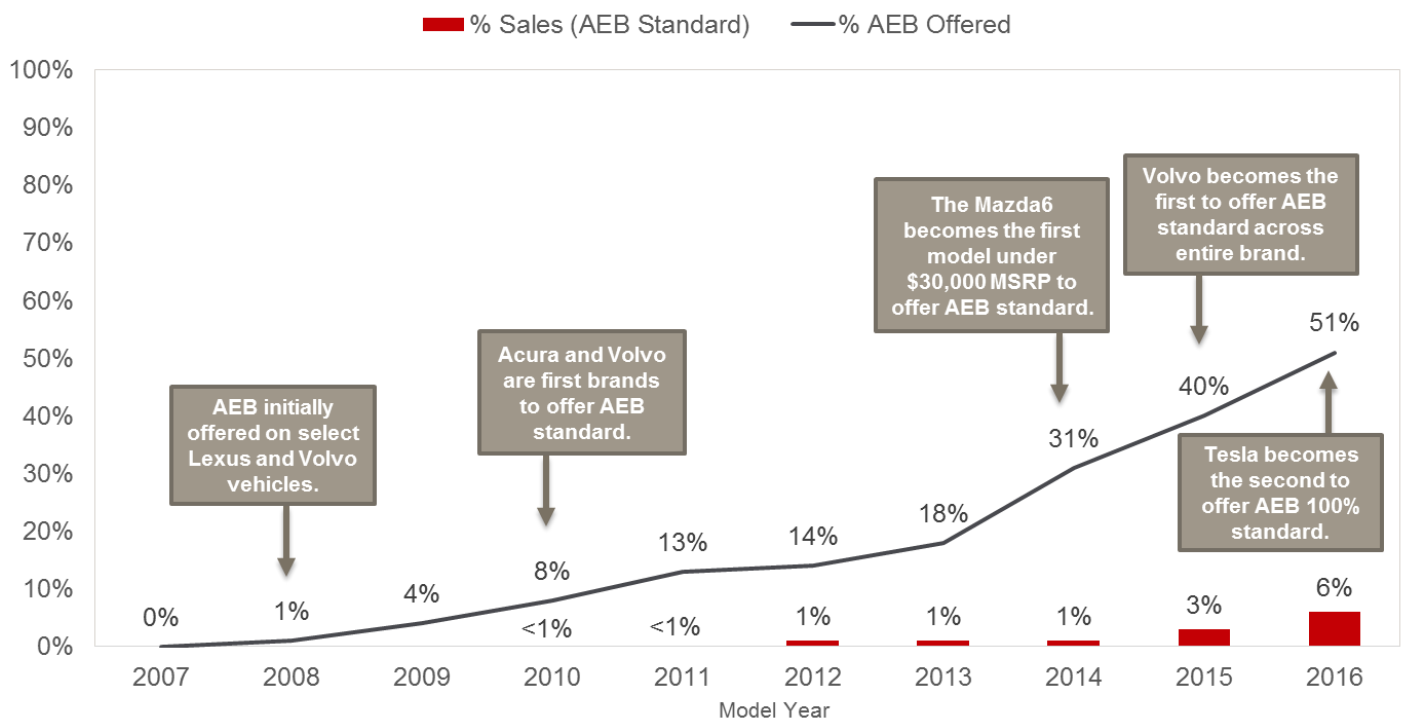
U.S. MARKET INSIGHTS

AUTOMATIC EMERGENCY BRAKING (AEB)

EXECUTIVE SUMMARY

- In March 2016, automakers representing more than 99% of overall United States (U.S.) vehicle sales, committed to equip virtually all new cars in the United States with automatic emergency braking (AEB) systems as a standard feature by no later than 2022 and on all new trucks by 2025.
- Automatic emergency braking detects and alerts the driver of impending forward crashes with other vehicles in time to avoid or mitigate the crash, taking corrective action if the driver's response is not sufficient.
- Through March 2016, 6% of all 2016 model year (MY) vehicles sold have AEB as a standard feature (across 20 different brands).
- Automatic emergency braking is offered on 51% of all 2016 model lines available in the United States through March 2016.
- Volvo and Tesla are the only two brands that currently equip AEB as a standard feature on their entire model lines, already satisfying the announced commitment.
- Every committed automaker currently offers automatic emergency braking on at least one model as either a standard or optional feature. In addition, within those automakers there are only three brands that do not offer AEB as a feature at all in its 2016 MY vehicles: Maserati, RAM, and smart.
- Potentially the largest challenge for OEMs to meet the 2022 pledge will be AEB implementation within light duty trucks and full sized vans as the feature is not a standard feature among these body styles.
- We expect automakers to not only fulfill their AEB commitment by 2022, but also to continue to advance further in automotive safety technology. Adding AEB to vehicles creates hardware infrastructure that can be improved upon with future software enhancements and breakthroughs.

Figure 1. U.S. Automatic Emergency Braking adoption by model year



Note: Contains sales data through March 2016

BACKGROUND

On March 17th, 2016, the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and the Insurance Institute for Highway Safety (IIHS) announced a commitment by automakers, representing more than 99 percent of U.S. automobile sale volume, to make automatic emergency braking (AEB) technology a standard feature on all new cars in the United States no later than 2022 and on all new trucks by 2025.

The technology is believed to be highly effective at reducing crashes and injuries based on various studies in the U.S. and around the world. According to NHTSA estimates, this voluntary commitment will push adoption of standard AEB systems up to three years faster than through a regulatory process. The two government entities believe this could prevent up to 28,000 crashes and 12,000 injuries along with improvements in productivity, such as the general reduction of traffic jams due to accidents. Additional details are as follows:

- AEB is expected to be standard on all light-duty cars and trucks with a gross vehicle weight of 8,500 lbs. or less beginning no later than Sept. 1, 2022 and on all trucks with a gross vehicle weight between 8,501 lbs. and 10,000 lbs. beginning no later than Sept. 1, 2025.
- The brands included in the pledge are: Acura, Audi, BMW, Buick, Cadillac, Chevrolet, Chrysler, Dodge, Ford, GMC, Honda, Hyundai, Infiniti, Jaguar, Jeep, Kia, Land Rover, Lexus, Lincoln, Maserati, Mazda, Mercedes-Benz, Mitsubishi, MINI, Nissan, Porsche, RAM, Scion, smart, Subaru, Tesla, Toyota, Volkswagen, Volvo.
- The NHTSA will begin to rate AEB systems and other advanced technologies under its 5-Star Safety Ratings beginning in model year 2018.
- Consumer Reports will assist the NHTSA and IIHS in monitoring automaker progress towards meeting the AEB commitment.

AUTOMATIC EMERGENCY BRAKING DEFINITION

Automatic emergency braking (AEB) systems detect an impending forward crash with another vehicle in time to avoid or mitigate the crash. There are two main types of AEB systems, Dynamic Brake Support and Crash Imminent Braking. These systems first alert the driver to take corrective action to avoid the crash before taking the following measures if the driver's response is not sufficient:



Dynamic Brake Support automatically supplements the driver's braking in an effort to avoid the crash if the driver brakes but not hard enough to avoid the crash.



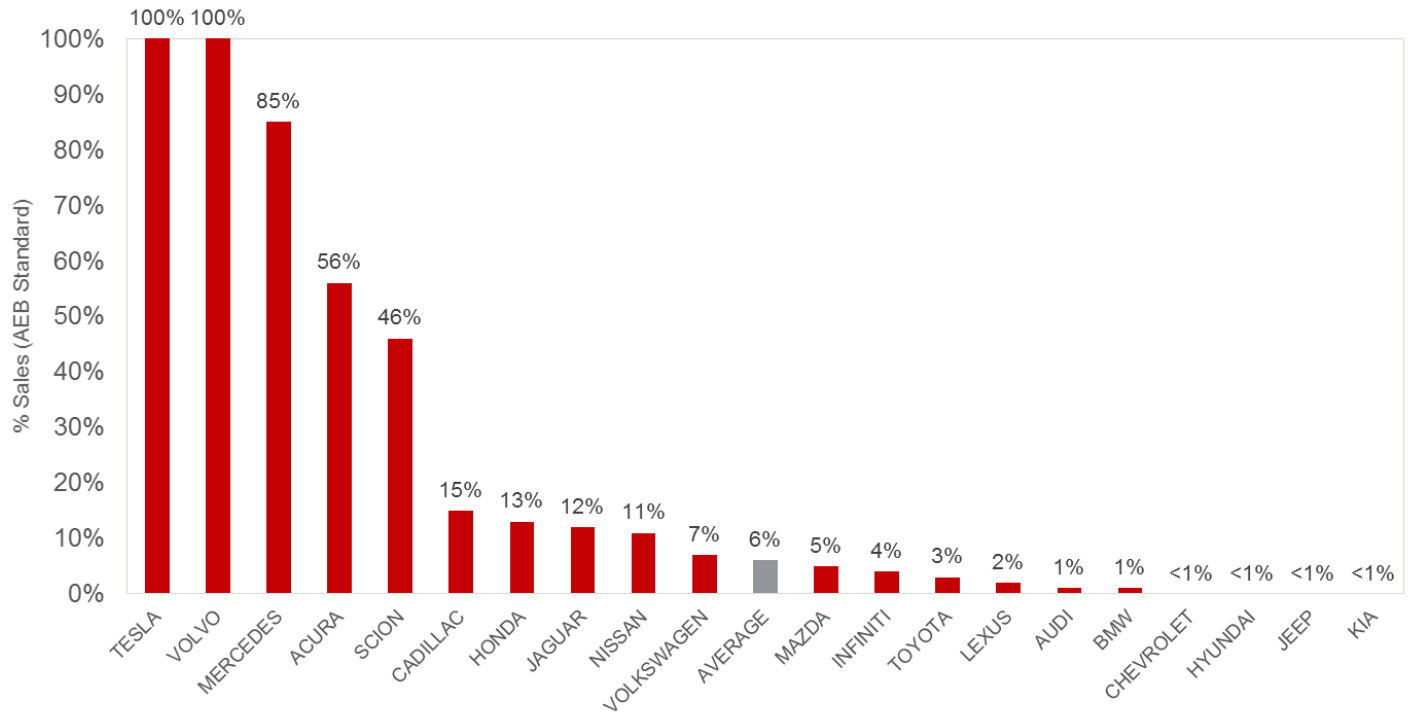
Crash Imminent Braking automatically applies the vehicle's brakes to slow or stop the car, reducing the severity of the crash when the driver does not take any action to avoid a crash.

2016 CURRENT ADOPTION

As previously mentioned in Figure 1, 6% of all 2016 Model Year vehicle sales in the United States have automatic emergency braking as a standard feature. While the OEM commitment for standard AEB is over six years away, the NHTSA will be adding automatic standard braking, among other advanced safety technologies, as a part of their 5-star safety ratings in less than two years. Safety ratings will be impacted if vehicles are not equipped with AEB and these findings, when exposed to consumers, could have ramifications for automakers. Every automaker is in a different position to achieve AEB adoption – some are well-placed, while others will need to make significant investments.

- Volvo and Tesla are the clear leaders of automatic emergency braking as they are the only two brands that currently provide the feature standard throughout their entire model lines.
- Mercedes-Benz is not far behind Volvo and Tesla. In 2016 model year, the German brand has sold AEB as a standard feature on 85% of their vehicles.
- Due to the sales of the Scion iA, Scion leads all mass market brands in terms of proportional sales for AEB standard vehicles. Starting next year, Scion will cease being a brand with their current model lines being re-branded under the Toyota nameplate.
- Even though premium brands such as Infiniti, Lexus, Audi, and BMW are on the forefront of AEB, each brand will have to significantly ramp up their efforts to equip automatic emergency braking from select models to the rest of their vehicle line.

Figure 2. U.S. Automatic Emergency Braking adoption by Brand – Sales (2016 Model Year)



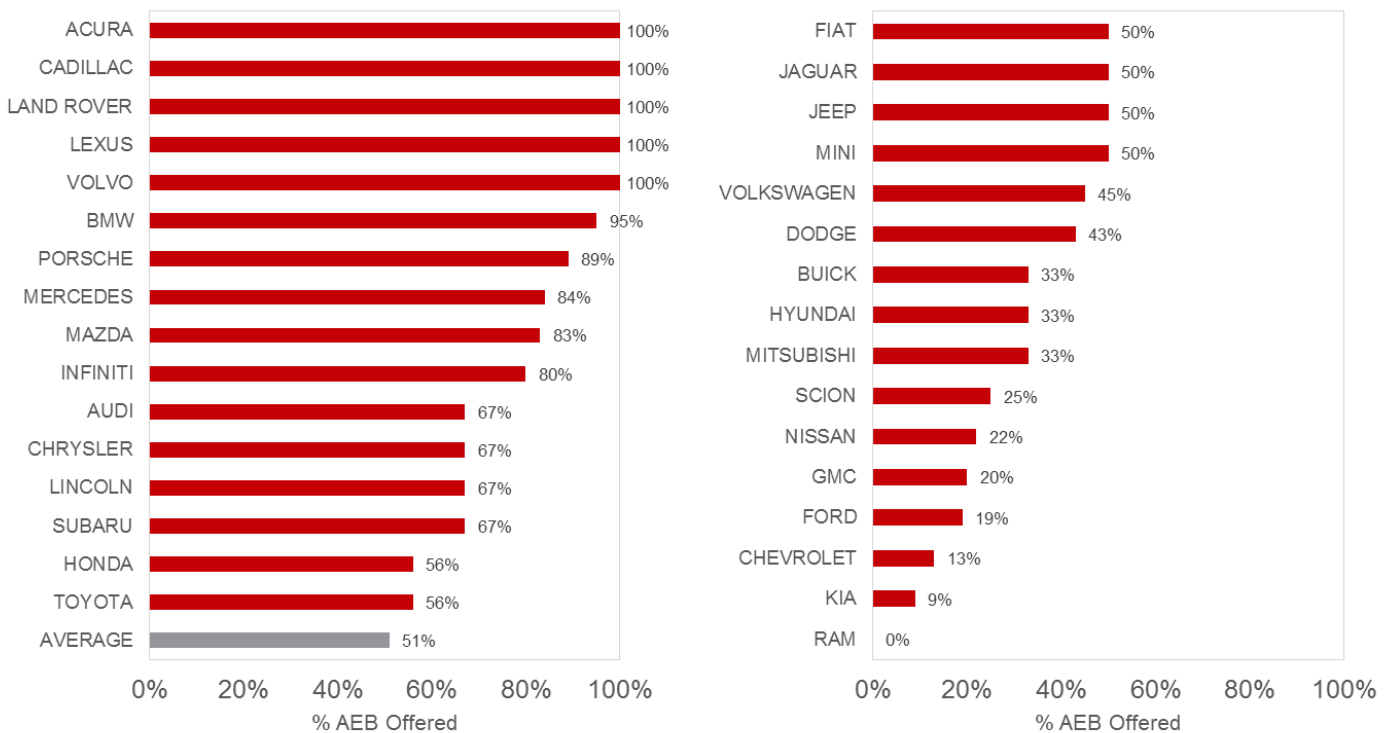
Note: Contains sales data through March 2016; Chart only shows brands that have sold vehicles with AEB as a standard feature during the 2016 model year.

2016 CURRENT ADOPTION (CONTINUED)

Even though standard AEB consists of 6% of all U.S. sales in the 2016 model year, the 2022 commitment doesn't look as daunting when it is viewed from the perspective of model offerings. Every automaker who has made the commitment currently offers automatic emergency braking on at least one model. In addition, within those automakers, there are only three brands that do not offer AEB as a feature in the 2016 MY: Maserati, RAM, and smart.

- While not readily implementing AEB as a standard feature, premium brands such as Cadillac, Land Rover and Lexus offer automatic emergency braking as an option on vehicles through all of their model lines.
- AEB has been historically dominated by premium brands, however mass-market brands such as Mazda, Chrysler, and Subaru also have a strong number of AEB offerings in the 2016 model year. Each brand offers AEB on at least 67% of their model lines.
- There are some premium brands with ground to make up in the coming years, such as Jaguar and Buick (50% and 33%, respectively).
- The brands with the most work ahead of them are RAM, Kia, Chevrolet, Ford, and GMC. Not only do these brands have less than 1% of sales attributed to vehicles with standard AEB, but these brands do not offer AEB on a majority of their model lines.

Figure 3. U.S. Automatic Emergency Braking adoption by Brand – Offerings (2016 Model Year)



Note: Chart does not show brands with less than 0.10% market share; Tesla (not shown) has 100% standard coverage

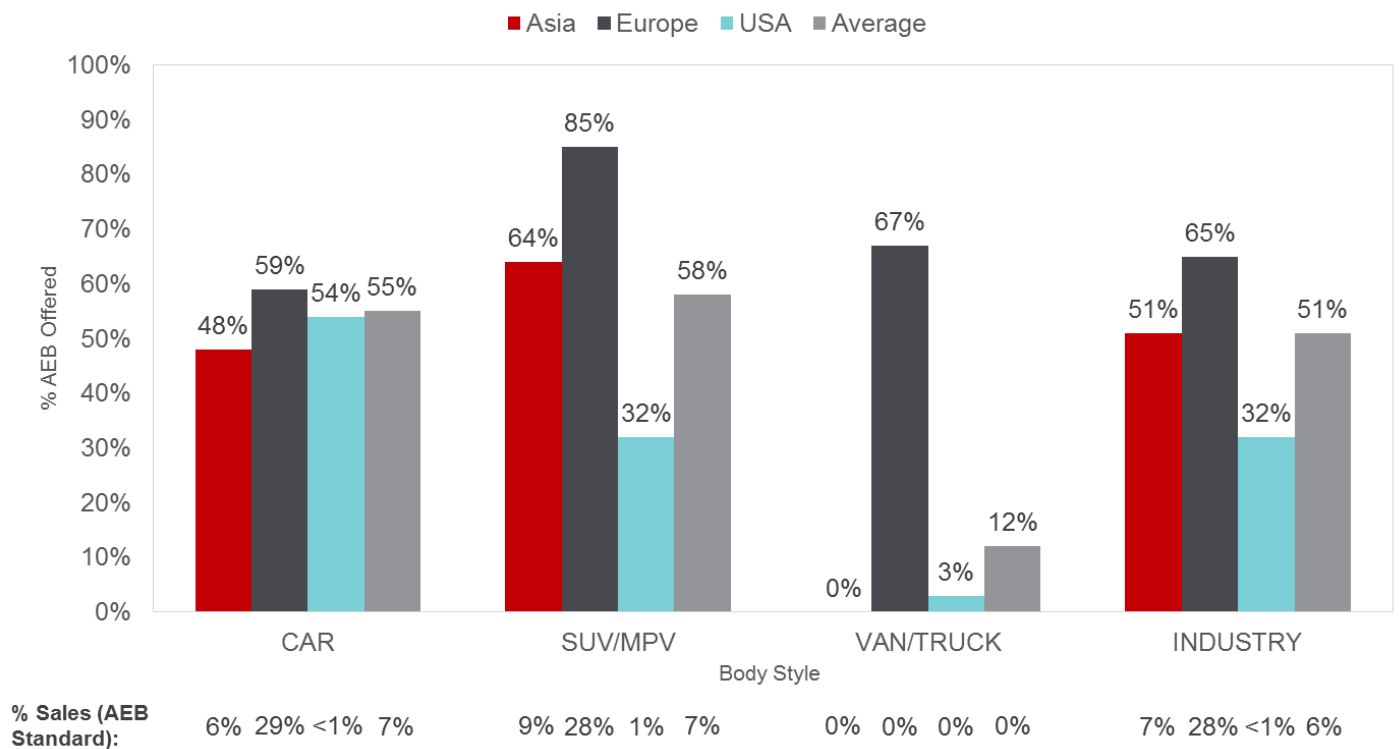
AEB ADOPTION BY BRAND ORIGIN

Due to the way that automatic emergency braking systems' hardware and software operate, size, weight, and body type, among others, all play important factors when it comes to calibration and implementation. This can make it potentially harder for companies with larger varieties of body styles to implement AEB in comparison with brands that focus on only one or two. In addition to physical features, there are social aspects that play into the development and implementation of features like automatic emergency braking. This includes the culture of the brand and their local competitors as well as the customer's perceptions of those brands.

Going forward, OEMs must be active in achieving the AEB commitment or face the possibility of brand erosion due to being behind in safety advances. In particular, AEB being incorporated into U.S. government safety ratings may alter consumer perception one way or another. However, this was not the case before the pledge as automakers put different levels of importance to AEB systems.

- European brands have the highest rates both in terms of offerings and sales across all body styles. This is due to strong support from AEB leaders such as Volvo, Mercedes-Benz, BMW, and Porsche.
- To meet the pledge by 2022, Domestic and Asian brands will need to focus on adding AEB throughout their trucks and full-sized vans as only the Ford F-150 has AEB as an offering. In addition, the entire industry will need to step up to the challenge across this body style group as AEB is not currently offered as a standard feature.
- While Asian brands such as Lexus and Subaru are among the leaders in terms of automatic emergency braking, there are also a number of brands that are below the curve. The Korean nameplates, Hyundai and Kia will need to invest heavily in AEB technology through all body styles.

Figure 4. U.S. Automatic Emergency Braking adoption by Brand Origin (2016 Model Year)



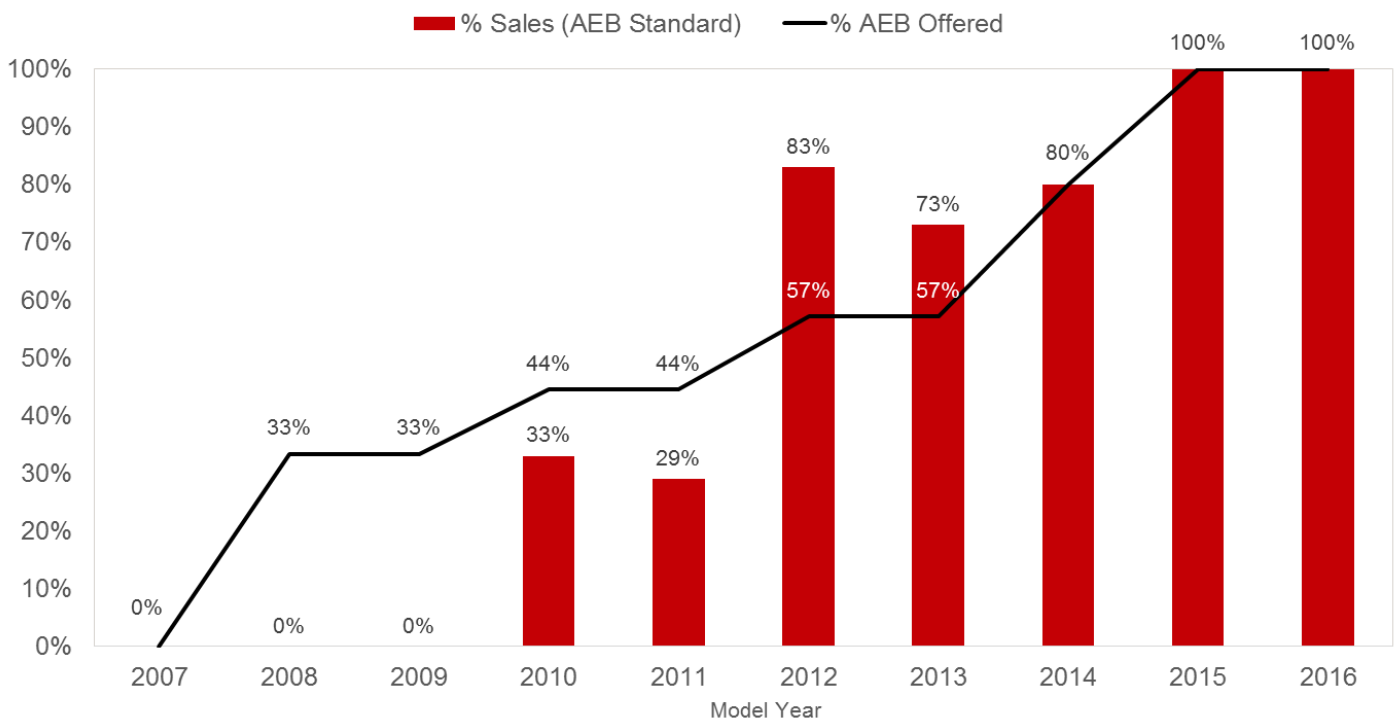
Note: Contains sales data through March 2016

CLEAR LEADER: VOLVO

During the 2015 model year, Volvo became the first automaker to make automatic emergency braking standard on their entire vehicle line, a trend that has continued in 2016. They have been one of the industry leaders when it comes to this feature since its inception, being one of the first brands to offer AEB to customers along with Lexus during the 2008 model year.

- Volvo was one of the pioneers of AEB, offering the feature as an option on all 2008 V70 and XC70s and select S80s. The AEB feature would become fully optional for the S80 during the following model year.
- For the 2010 model year, Volvo debuted the XC60, the first vehicle in the U.S. market to have AEB as a standard feature across the entire model line.
- The S60 debuted in the 2011 model year, Volvo's second model line to have AEB as a standard feature. Volvo's AEB proportional sales decreased during the model year, however, due to an increase of sales from models without AEB such as the C30, C70, and XC90.
- In 2012, AEB became standard on the XC70 and S80, marking the final time automatic emergency braking would be just an option on Volvos.
- Volvo completed the transition to 100% AEB being a standard feature through attrition as the models without automatic emergency braking (C30, C70, and XC90) ended their production cycles. The XC90 has returned to the market after a one year hiatus, this time with AEB as a standard feature.

Figure 5. U.S. Automatic Emergency Braking History: Volvo



Note: Contains sales data through March 2016

CONCLUSION

While standard automatic emergency braking (AEB) systems currently only make up 6% of 2016 sales within the United States, the pledge made in March 2016 looks achievable as all major automotive companies offer the technology on at least one of their models. This thought becomes more tangible when considering that before the public pledge took place, AEB offerings increased by an average of about 10-percentage points each year since the 2014 model year.

To make this goal, the biggest challenge will be for Domestic and Korean brands as they ramp up implementation. Domestic brands need to focus specifically on their larger body styles such as full sized vans and trucks, while Hyundai and Kia will need to develop the technology across their entire brand.

That said, there is a high probability that all companies will not only fulfill their AEB commitment by 2022, but also go further in automotive safety technology. By committing to installing AEB systems on their vehicle lines, OEMs are creating an infrastructure that can be built upon with future software enhancements and breakthroughs. It would be expected that these improvements would be even more agile than what the automotive industry has normally been accustomed to. Instead of thinking of time in vehicle generations and model years, these software updates could be implemented in months or weeks after the technology has been developed and tested.

Not only will updates become faster, but the scope will be increased as well. Updates will be not only be implemented on the current vehicle line, but also on previous model years that have the appropriate hardware. A perfect example of this can be seen with Tesla when they added semi-autonomous driving to their vehicles in late 2015 through an over-the-air update. However, with the benefits of speed and agility of software development also comes the risks. The fail fast method of programming works well in a gaming/app environment, however adaptation to the automotive industry will most likely require additional testing because human lives are at stake. Moving forward, it will be the companies that understand the integration of heavier loads on hardware through higher complexity software that will become the clear winners in automatic emergency braking and safety technology as a whole.

METHODOLOGY

The U.S. Market Insights Automatic Emergency Braking (AEB) report was created using information from JATO's Model Mix and Vehicle Specification databases.

Automatic Emergency Braking (AEB): For the purposes of this report, automatic emergency braking is classified as the sub-feature “includes automatic braking” by JATO. This sub feature is a part of “Collision Warning System,” which in turn is a part of the subject “Safety” in JATO's Vehicle Specification database.

% Sales (AEB Standard): This metric is the percentage of vehicles sold with AEB as a standard feature. It was created by merging AEB information from the Vehicle Specification database with vehicle sales data from the Model Mix database. The report contains vehicle sales data up until March 2016 and has been aggregated at the vehicle version level which sets below each Vehicle's trim.

% AEB Offered: This metric is the percentage of models that offer AEB as either a standard or optional feature and/or either standard and optional. A model is considered to have offered AEB if any version of the model has the feature within the model line. In addition, models that have more than one body style (i.e. sedan, hatchback, wagon, etc.) are considered as if they are different models. For example if Brand A has three models, but model B has both a sedan and wagon, then, for this metric, we would treat Brand A as if they offered four separate models.

Brand Origin: Brand Origin is a reorganization of automotive brands based on the national origin of the nameplate (as opposed to the origin of the corporation each brand belongs to). For example, even though they are now owned by the Indian-based organization, Tata, the Jaguar and Land Rover brands are assigned to Europe for purposes of this study. In the same vein, brands like Chrysler and Dodge are considered being a part of the USA group despite being owned by FCA.

Brand Origin Definition		
Asia	Europe	USA
<ul style="list-style-type: none"> ▪ Acura ▪ Honda ▪ Hyundai ▪ Infiniti ▪ Kia ▪ Lexus ▪ Mazda ▪ Mitsubishi ▪ Nissan ▪ Scion ▪ Subaru ▪ Toyota 	<ul style="list-style-type: none"> ▪ Aston Martin ▪ Audi ▪ Bentley ▪ BMW ▪ Fiat ▪ Jaguar ▪ Lamborghini ▪ Land Rover ▪ Maserati ▪ McLaren ▪ Mercedes-Benz ▪ MINI ▪ Porsche ▪ Rolls-Royce ▪ smart ▪ Volkswagen ▪ Volvo 	<ul style="list-style-type: none"> ▪ Buick ▪ Cadillac ▪ Chevrolet ▪ Chrysler ▪ Dodge ▪ Ford ▪ GMC ▪ Jeep ▪ Lincoln ▪ RAM ▪ Tesla

Body Style: Body Style is a reorganization of the JATO variable “Body Type,” grouping the types into three distinct body styles: Car, SUV/MPV, and Van/Truck.

Body Style Definition		
Car	SUV/MPV	Van/Truck
<ul style="list-style-type: none"> ▪ Convertible ▪ Coupe ▪ Hatchback ▪ Micro Car ▪ Sedan ▪ Targa ▪ Wagon 	<ul style="list-style-type: none"> ▪ Car Van ▪ Mini MPV ▪ Minivan ▪ Sport Utility Vehicle 	<ul style="list-style-type: none"> ▪ Cargo Van ▪ Chassis Cab ▪ Chassis Cowl ▪ Combi ▪ Cutaway ▪ Passenger Van ▪ Pickup



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