

## Are Electric Cars Safe? A Descriptive Analysis of the first collisions reported in Spain

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### I. INTRODUCTION

In January 2018, 5,993 hybrid vehicles and 922 full electric vehicles were registered in Spain. This accounts for 6.5% of all vehicles registered that month and is a 52% increase compared to January 2017 [1]. The data reflect a trend that has been growing exponentially over the last seven years in Spain (Fig. 1). Nevertheless, PEV (plug-in vehicles, including both hybrid PHEV and battery BEV) represented only 0.6% of the market share of all passenger cars in Spain in 2017, well behind other European countries, such as Sweden, Belgium, Finland or The Netherlands, where PEV passenger cars account for more than 1.5% of the market share. In the whole of the EU, the percentage of PEV passenger car registrations was 1.4% and, similar to Spain, there is a growing trend of the registration of these vehicles in the 28 EU Member States [2].

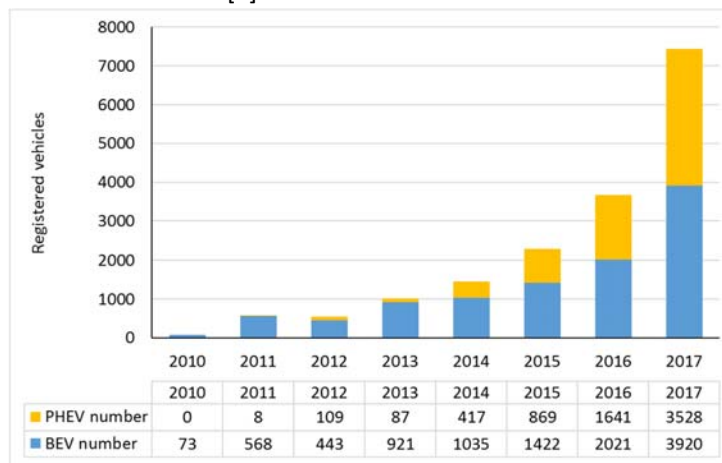


Fig. 1. Registration of electric vehicles in Spain (2010–2017). PHEV: plug-in hybrid electric vehicle; BEV: battery electric vehicle [3].

While the main difference between internal combustion engine (ICE) vehicles and PEVs is the reduction in contaminating emissions, the structural design of BEV, with an increased weight and a different distribution of load-bearing structures, and the potential behavioural differences in driving styles of BEV owners, together with a more dedicated use of BEV in urban areas will likely mean that the crash experience of BEV occupants differs from that of ICE occupants. This study shows preliminary data on crashes involving BEV in Spain from an injury prevention and crashworthiness perspective.

### II. METHODS

Counts of BEV crashes and corresponding injured occupants were obtained from the Spanish General Directorate of Traffic (DGT). The data are maintained as a census of police-reported casualties. This study includes data from all Spanish roads in which a crash involving at least one injured BEV passenger car occupant, either in a frontal or lateral impact, was reported to the police within the last three years, and with available data (2014–2016). Make and model of cars involved in crashes were not registered in Spain before 2014, therefore even if there was a collision involving a BEV, it cannot be identified.

### III. INITIAL FINDINGS

Paralleling the market penetration of BEV shown in Fig. 1, the number of crashes involving BEV has increased over the last three years from two cases in 2014, to six cases in 2015, to 46 cases in 2016. The rate of involvement of BEV in crashes has grown steadily: 0.06% (2014), 0.13% (2015) and 0.51% (2016). All these BEV were registered in 2012 or later. Unfortunately, for almost 75% of the BEV crashes reported in 2016, there is missing data that precludes drawing information from the victims involved in those crashes.

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TABLE I  
CRASHES INVOLVING BEV IN SPAIN 2014–2016

Year	Total no. of crashes	Crashes with vehicle information	BEV crashes	BEV crashes with complete information	Killed in BEV crashes	Seriously injured in BEV crashes	Slightly injured in BEV crashes
2014	91,570	53,101	2	1	0	1	20
2015	97,756	58,210	6	4	0	0	4
2016	102,362	102,362	46	12	0	0	1

Although the majority of BEV crashes occurred in urban areas, 25% of BEV crashes took place in conventional roads outside of cities. There was one pedestrian collision in each of the three analysed years. Most BEV crashes were head-on crashes, although there was also a significant number of rear-end collisions. The distribution of crash configuration is shown in Fig. 2.

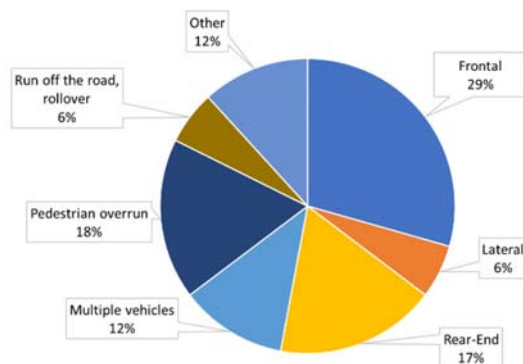


Fig. 2. Distribution of crash configuration for BEV in Spain, 2014–2016.

#### IV. DISCUSSION

The available data clearly show that the number of crashes involving BEV increased significantly in 2016. This increase coincides with the doubling of BEV use compared to 2014, and given the current trend this is likely to continue growing in the coming years. Car sharing in large cities will play a major role in the occurrence of BEV crashes, as it was found that the car model most frequently involved in crashes was the car used by one car sharing company. Frontal impacts and pedestrian collisions were the most common types of crash in the analysed sample.

This preliminary study includes only descriptive statistics, and consequently no attempt was made to estimate crash or injury risks associated with BEV. Spanish official crash statistics have been updated in recent years, and the complete census (including information about vehicle type) of crash data is available only for 2016. Data from 2014 and 2015 are incomplete, and approximately 40% of the crashes recorded do not include whether the vehicle was ICE or PEV. In any case, the figures included here are a conservative estimate of BEV-related crash statistics.

#### V. REFERENCES

[1] ANFAC, Nota de prensa, 2018.  
 [2] EAFO, [http://www.eafo.eu/eu#eu\\_fleet\\_pev\\_block\\_anchor](http://www.eafo.eu/eu#eu_fleet_pev_block_anchor), 2018.  
 [3] OVEMS, <https://evobservatory.iit.comillas.edu/noticias-y-publicaciones/publicaciones>, 2018.