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An Analysis of Accident Claims for Cars with Blind Spot Detection (BSD) Technology in Malaysia

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Abstract – *Traumatic injuries sustained by motorcyclists are the leading cause of death in all vehicular accidents in Malaysia. In view of this situation, the New Car Assessment Programme for Southeast Asian Countries (ASEAN NCAP) has proactively announced its New Roadmap 2021-2025 with a more inclusive assessment protocol, whereby a Motorcyclist Safety Pillar has been added. Items in the pillar include Blind Spot Detection and Blind Spot Visualisation (BSD/BSV). However, apart from a few existing studies, the evaluation of BSD technology in real-world crashes in Malaysia is still inconclusive. Therefore, the goal of the current study is to analyse the insurance claims in road accidents and crash distribution for cars equipped with BSD technology. In this study, the BSD technology is evaluated by the most popular car models on Malaysian roads for the selected years from 2017 to 2018. The total number of accident claims recorded was 259,033 involving several notable brands. Frontal crashes accounted for 51% of the cases with 133,121 claims and made up the highest number of accident claims, rear crashes made up 24% of cases with 62,106 claims, and side crashes registered only 5% with 12,885 claims. The number of side crashes showed about 11% reduction on average in the following year for all the makes-models selected. This analysis could become a future benchmark for the overall effectiveness of the BSD system in a road crashes involving the side crash. The finding of this study has consolidated ASEAN NCAP's plans and initiatives to take the lead by implementing the use of the BSD technology in passenger cars to increase road safety.*

Keywords: Blind spot, collision claim, ASEAN NCAP, Blind Spot Detection (BSD) technology

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1.0 INTRODUCTION

The motorcycle has emerged as a predominant vehicle type in Southeast Asia, or the ASEAN region. This is due to its size, ease of use and affordable price. Being the largest group, motorcyclists represent 80% of the total number of Southeast Asian road users. Unfortunately, over the last decade, it has also become a major contributor to road traffic fatalities in the region (Solah et al., 2019). For instance, traumatic injuries sustained by motorcyclists are the leading cause of death in all vehicular accidents in Malaysia (Solah et al., 2019). The outcome of these deaths has incurred an estimated loss of RM8.58 billion which represents a significant financial blow to the local economy (Lip et al., 2019). Hence, the issue of safety of powered two-wheelers must not be overlooked. Moreover, investigation data revealed that nearly 90% of motorcycle crashes involved cars as the crash partner. A study conducted in the USA by the National Highway Traffic Safety Administration (NHTSA) also found that car passengers were highly involved in crashes with motorcycles, which was similar to the scenario in Malaysia (Zainal Abidin et al., 2018).

In view of this situation, the New Car Assessment Programme for Southeast Asian Countries (ASEAN NCAP) is committed to ensure the safety of motorcyclists in the ASEAN region. ASEAN NCAP has announced its New Roadmap 2021–2025 with a more inclusive assessment protocol whereby a Motorcyclist Safety Pillar has been added (Abu Kassim et al., 2019). Items in the pillar include Blind Spot Detection and Blind Spot Visualisation (BSD/BSV), advanced rear view mirror, auto high beam, pedestrian protection, and advanced motorcyclist safety technology (ASEAN NCAP, 2018; Prasetijo et al., 2018; Said et al., 2020). Both BSD and BSV would help in providing early detection/image to avoid collisions with motorcycles. It is expected that 37% of collisions can be avoided if all cars were equipped with such a technology (ASEAN NCAP, 2018). Car drivers depend on the rear view mirror and two side mirrors to see vehicles behind them. However, vehicles or other objects on either side and slightly behind a car may be in an area that is outside the field of view of these mirrors. This region is called the vehicle's blind spot area (Figure 1). Because of the blind spot in a vehicle, especially in the rear area where the driver has an impaired vision, a traffic accident easily occurs when the driver changes lanes.

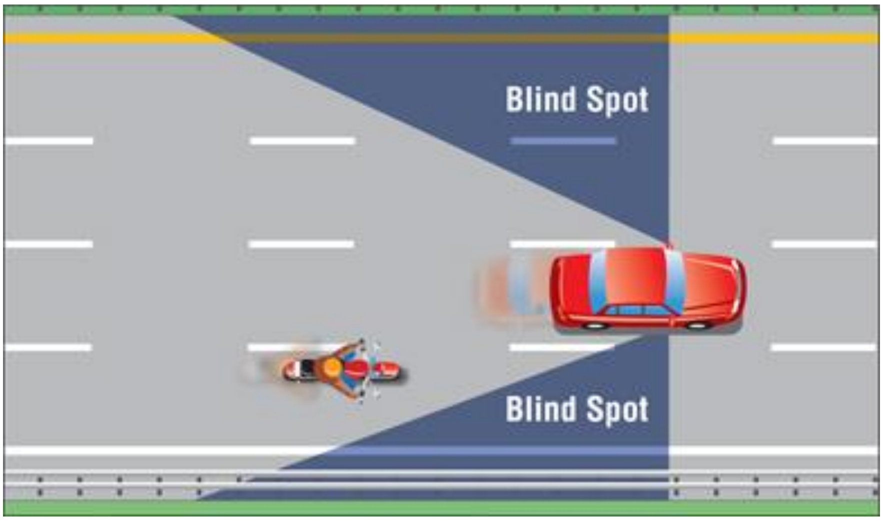

Figure 1: Blind spot area (www.careta.my)

Liu and co-workers (2017) revealed that BSD and a warning system based on a millimetre wave radar can detect targets which come into the rear warning area and effectively give early alarm to the driver in various urban road environments. Results of an experiment involving a BSD camera-assisted car on a highway in Taiwan in both nighttime and daytime conditions showed that the proposed Blind Spot Warning (BSW) system is useful in detecting vehicle and preventing collision (Wu et al., 2013). The invention of the BSD technology is also proven to reduce road accidents where in the United States of America, the technology has helped reduce the number of road accidents (Cicchino, 2018). The use of BSD technology has decreased the rate of lane-change crashes by 14% and the rate of injuries by 23%. If all passenger vehicles were equipped with the system, it would prevent 50,000 police-reported crashes a year in the USA (Cicchino, 2018).

The New Car Assessment Programme (NCAP) as part of the consumer movement will award a good rating to a tested car, which is equipped with BSD technology. Nevertheless, research is needed to determine the performance of this technology in real-world crashes especially in the ASEAN region including Malaysia. It is of the utmost importance that a clear distinction is drawn between the concept of accident proneness and the heterogeneity shown based on observations of insurance claim frequencies. Therefore, the main objective of this paper is to analyse the number of insurance claims for road crashes involving vehicles with BSD technology in Malaysia. It is believed that by emphasising the impact of this crash avoidance technology in terms of crash rate and crash distribution, industry players' and end users' awareness of BSD technology would be increased.

2.0 METHODOLOGY

2.1 Source of Data

Data for the study on Blind Spot Detection (BSD) technology were extracted from Motordata Research Consortium Sdn. Bhd.'s (MRC) Business Intelligence Tools (BI Tools). The BI Tools system is a comprehensive reporting database structure. It utilises the claim database in a structured reporting system to allow ease of customised reporting in the claim report. The system also simplifies the analysis by identifying the name of vehicle manufacturers, models of vehicles and date of claim.

Accident claim data will be parked in MRC's Automotive Database and automatically updated 24 hours daily (live) for recent claim submission. This will ensure that the data are accurate and up to date for reporting purposes and can be used by MRC's clients. For this study, the period of data collection was from January 2017 to December 2018 for the selected models and vehicle manufacturers.

2.2 Selection of Vehicle Manufacturer

The current research on BSD encompasses the most popular car models in Malaysia which are equipped with BSD technology. The vehicle manufacturers for this study were continental brands i.e. Mercedes-Benz, BMW, and Peugeot; Japanese makes, i.e. Toyota, Honda, Mazda, and Lexus; and South Korea's Hyundai and Kia. The vehicle manufacturers were selected based on the availability of BSD technology in their models in the selected years.

2.3 Selection of Accident Claims

Accident claims were selected from road crashes involving frontal crashes, rear crashes, and side impact crashes only. The study primarily focused on the blind spot area of each vehicle involved in the crash. The blind spot area included in the selection criteria for the crash area extended from the fender/front wing to the quarter panel or rear wing of the vehicle. Indirect components other than the main components were excluded from this study.

The areas and components included in this study are as disclosed in Figure 2. Details of the main components or parts replacement selection are tabulated in Table 1. The component replacement for frontal crashes consisted of the front bumper cover, grille, and headlamp. Meanwhile, rear crashes were defined by replacement of the rear bumper cover, boot lid, tailgate, and rear lamp assembly. The side crash area was defined by replacement of the wing/fender, door mirror, front door, rear door, rear wing/quarter panel, and side sill. Parts besides those listed above fell under "Others".

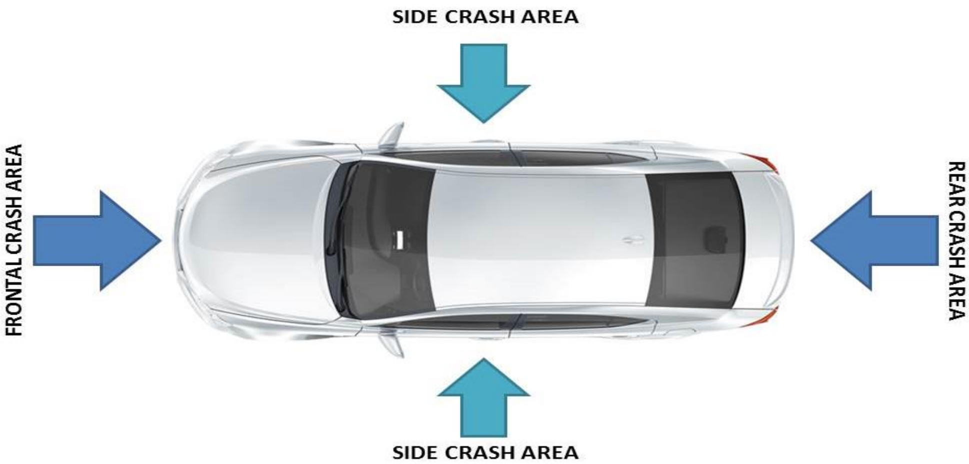

Figure 2: Selection of crash areas (MRC, 2019)

Table 1: Component or Parts Replacement Grouping (MRC, 2019)

Crash Area	Main Components or Parts Replacement Selection
Frontal Crash	Front Bumper Cover, Grille, Headlamp
Rear Crash	Rear Bumper Cover, Boot Lid, Tailgate, Rear Lamp Assembly
Side Crash	Wing/Fender, Door Mirror, Front Door, Rear Door, Rear Quarter Panel, Side Sill
Others	Other than the parts listed above

The filtered claims data were matched with the parts database list to ensure the selected list in the crash area criteria was divided according to the respective classification of crash areas as illustrated in Figure 3. The claim estimate number was the unique identification number used in claim reporting as the reference number.

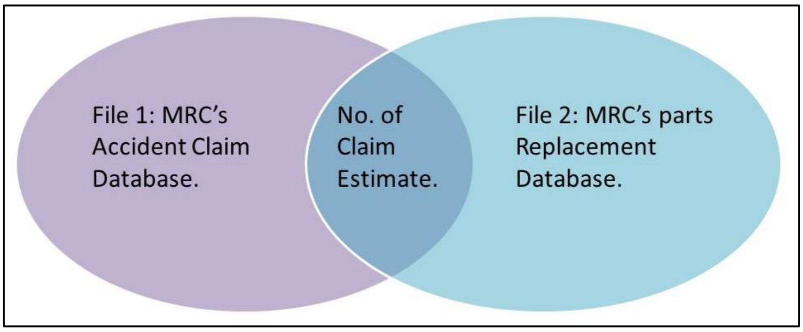

Figure 3: Number of claim estimates

3.0 RESULTS AND DISCUSSION

3.1 Vehicles Equipped with BSD Technology in Malaysia

BSD technology first entered the Malaysian market in 2017. The number of both local and foreign vehicle manufacturers and models equipped with BSD technology has grown greatly as tabulated in Appendix I. Table 2 shows the number of sales for vehicles equipped with BSD and without BSD from 2017 to 2018. The vehicles were categorised into four groups (passenger car, MPV, SUV, and pickup). The total number of sales for vehicles with BSD was 75,125 for both years, with 22,921 sold in 2017 and 52,204 vehicles sold in 2018. However, these numbers cannot be interpreted as an increment for the consecutive years because vehicles with BSD technology were only introduced in the Malaysian market towards the end of 2017.

In this study, the BSD technology was evaluated by the most popular models in Malaysia in the selected years of 2017 and 2018. The accident claims data for local vehicle manufacturers i.e. Proton and Perodua, were excluded. For Proton model, the X70 is equipped with the BSD system and the model was launched at the end of 2018 (Jonathan Lee, 2018). Thus, the accident claims data for the model were insufficient to be evaluated in this study. For Perodua, no BSD system has been installed in their vehicles. Thus, no accident claims data could be evaluated for the Perodua models.

Table 2: Sales of vehicles equipped with BSD in Malaysia (2017-2018)

<table>
<tr><th rowspan="2">Vehicle Category with BSD</th><th colspan="2">2017</th><th colspan="2">2018</th><th rowspan="7">Total for Both Years = 75,125</th></tr>
<tr><th>No. of Models-Variants</th><th>No. of Sales</th><th>No. of Models-Variants</th><th>No. of Sales</th></tr>
<tr><td>SUV</td><td>46</td><td>13,630</td><td>55</td><td>35,675</td></tr>
<tr><td>Passenger Car</td><td>65</td><td>9,134</td><td>91</td><td>15,149</td></tr>
<tr><td>MPV</td><td>3</td><td>116</td><td>4</td><td>1,380</td></tr>
<tr><td>Pickup</td><td>1</td><td>41</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>115</td><td>22,921</td><td>150</td><td>52,204</td></tr>
</table>

3.2 Accident Claims for Cars Equipped with BSD Technology (2017 to 2018)

Table 3 shows the number of accident claims for the most popular car models in Malaysia which are equipped with the BSD system. The total number of claims recorded was 259,033 involving cars from Honda, Hyundai, Lexus, Mazda, Mercedes-Benz, Peugeot, BMW, and Toyota. Toyota vehicles topped the ranking with 126,173 accidents followed by Honda with 86,981 accident claims in 2017–2018. BMW, M-Benz, Mazda, and Hyundai accounted for less than 35,000 claims. The high number of Toyota and Honda cars was because these two were the most popular manufacturers or car brands in Malaysia and their sales were related to their vehicle quality and safety standards. According to Jawi et al. (2012), Toyota and Honda were considered "The Big Three" foreign makes, together with Nissan, based on their annual Total Industry Volume (TIV).

Table 3: Number of accident claims for cars with BSD technology (2017–2018)

	Number of Claims				
Manufacturer	**Frontal Crash**	**Rear Crash**	**Side Crash**	**Others**	**TOTAL**
Toyota	71,149	30,124	6,261	18,639	126,173
Honda	43,293	21,436	3,141	19,111	86,981
M-Benz	5,478	3,107	663	4,101	13,349
Mazda	4,910	3,116	785	1,880	10,691
BMW	2,438	1,696	1,054	5,424	10,612
Hyundai	3,018	1,337	557	1,169	6,081
Peugeot	1,939	723	304	395	3,361
Lexus	896	567	120	202	1,785
TOTAL	133,121	62,106	12,885	50,921	259,033

Figure 4 shows the distribution of crash areas of vehicles equipped with BSD for 2017–2018. Frontal crashes comprised 51% of the cases with 133,121 claims, making it the highest accident claims for all vehicle manufacturers under study. Rear crashes contributed 24% to the cases with 62,106 claims and side crashes comprised only 5% with 12,885 claims. Other crash areas formed the remaining 20% of accident claims. Details of crash contribution according to makes can be referred to in Appendix II.

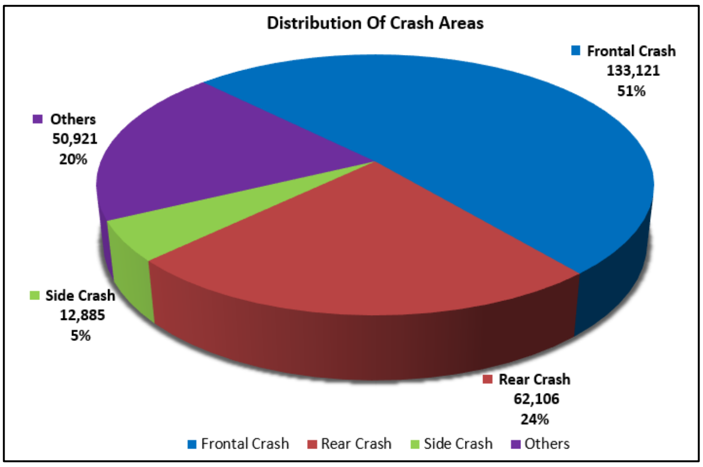

Figure 4: Distribution of crash areas for cars equipped with BSD (2017–2018)

3.3 Trends of Crash

Figure 5 shows the overall claims for both 2017 and 2018. An increment in total claims was observed for frontal and rear crashes for almost all selected vehicle manufacturers. The accident claims increased by 10,193 and 2,780 cases for frontal crashes and rear crashes, respectively. Figure 6 and Figure 7 present the detailed cumulative claims for 2017–2018 for each vehicle manufacturer involved in this study. Based on the accident claims data, the number of frontal crashers for the biggest population was increased only about 13% on the following year for both Toyota and Honda with 4,471 and 2,595 cases, respectively.

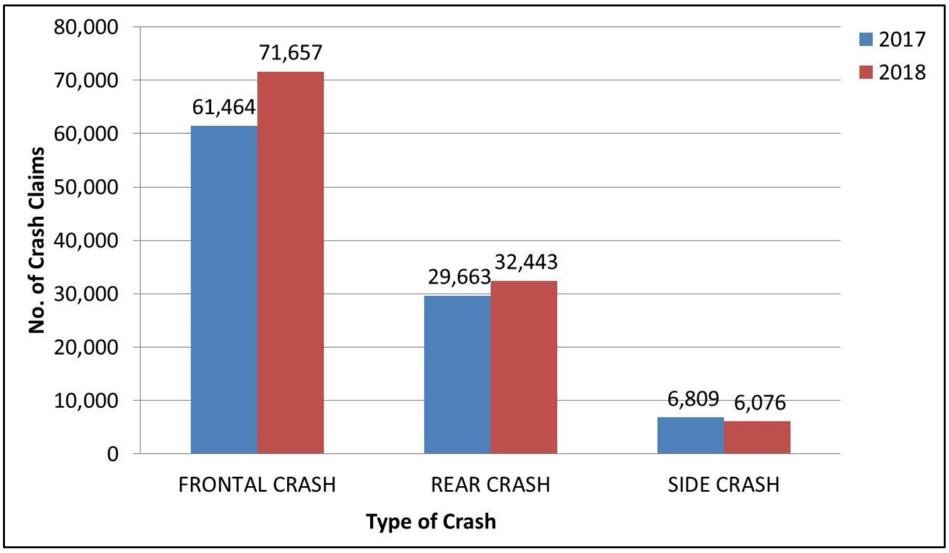

Figure 5: Overall number of claims for 2017 -2018

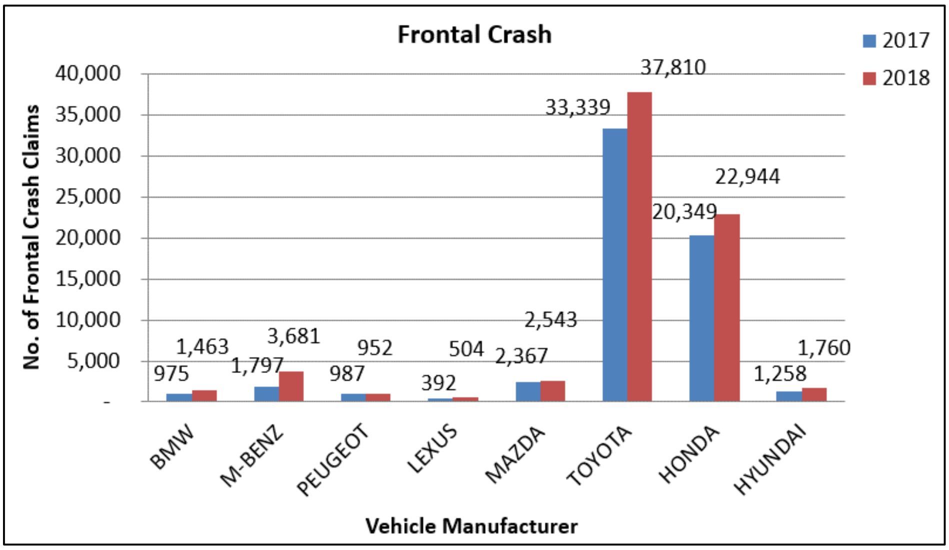

Figure 6: Trends of frontal crashes for cars with BSD according to makes

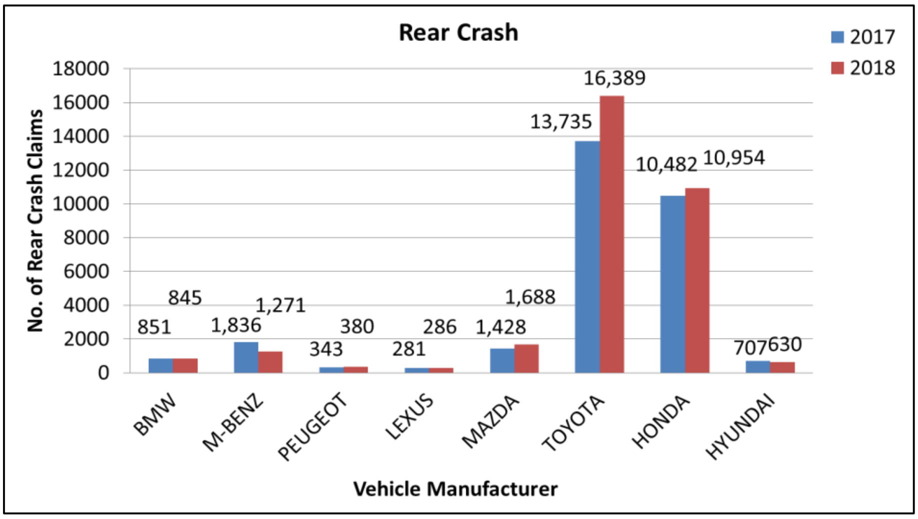

Figure 7: Trends of rear crashes for cars with BSD according to makes

The Blind Spot Detection (BSD) technology is used to detect vehicles in adjacent lanes that may not be directly observed by the driver. BSD alerts the driver to the presence of another vehicle and to use caution when planning a lane change. Therefore, the performance of a BSD system should be evaluated based on probable sideswipe crashes or same direction crashes that have been avoided through the use of BSD (Cicchino, 2018). In the study, an interesting situation was identified for side crashes. The total accident claims were reduced by about 733 between 2017 to 2018 (Figure 8). Figure 8 shows the trend of side crashes for cars equipped with a BSD system based on vehicle manufacturers. Based on the accident claims data, the number of side crashes was reduced by 11% on average in the following year for all vehicle manufacturers selected. It can be assumed that side crashes on Malaysia's roads have been reduced for vehicles equipped with the BSD system. Statistically, it has been tabulated that the BSD system can reduce blind spot accidents. This analysis could become a future benchmark for the overall effectiveness of BSD technology in preventing road accidents involving side crashes.

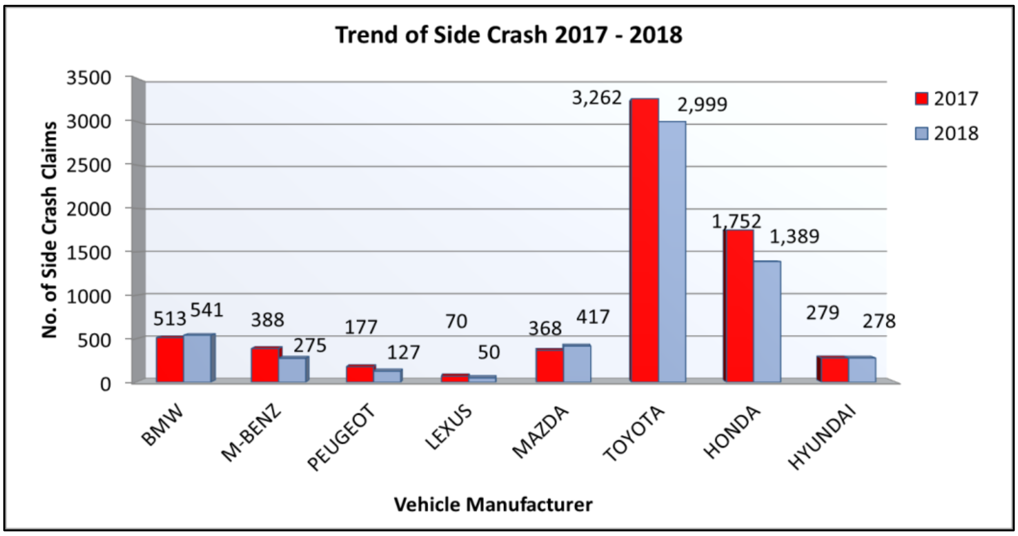

Figure 8: Trends of side crashes for cars with BSD according to makes

5.0 CONCLUSION

The total number of accident claims recorded was 259,033 involving popular and high-end makes-models in the MRC database between 2017 and 2018. Frontal crashes accounted for the highest accident claims (51%) for all vehicle manufacturers under study, while side crashes recorded the lowest number of claims (5%) between 2017–2018. The trend of crashes for consecutive years also showed an increment in accident claims for frontal crashes and rear crashes among BSD-equipped models. Nevertheless, an apparent downtrend in claims was discovered for side crashes – and this stage it can be arguably said that side collisions have been reduced for BSD-equipped models, whereby the system is design to prevent blind-spot-related collisions. As BSD technology is still new to the Malaysian market and the number of sales for vehicles equipped with the BSD technology is still limited, it is recommended that this analysis be conducted again in the near future once the number of car sales with the BSD system has increased further. A bigger database will likely increase the accuracy and perspectives of the results.

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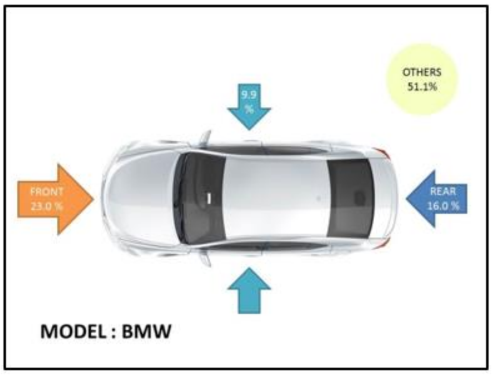
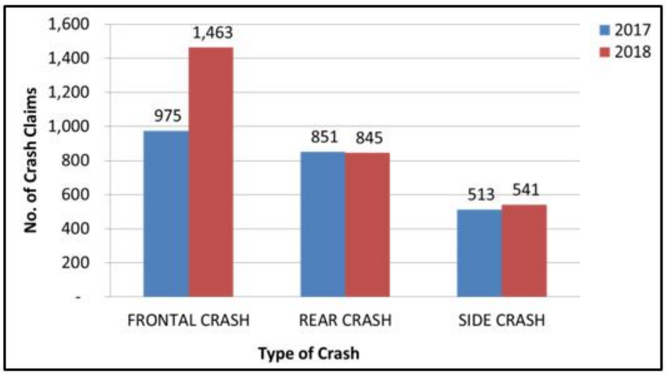
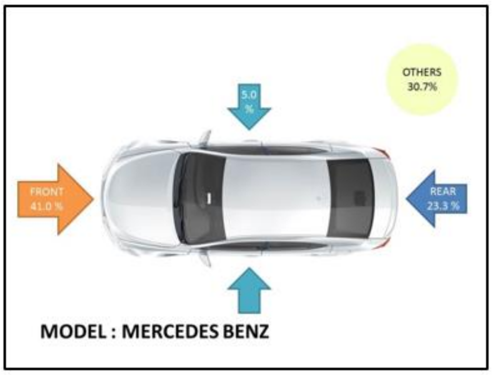
Appendix I. Available Vehicles Equipped with BSD Technology in Malaysia

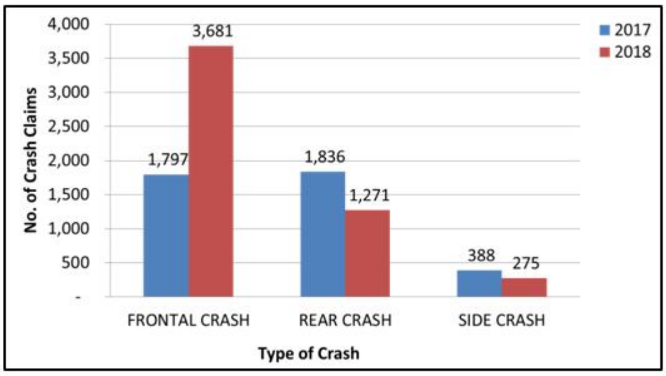
Manufacturer	Model		Year
Proton	X70 1.8 TGDi Premium 2WD		2018
Mercedes-Benz	C200 Coupe AMG Line E 200 SportsStyle Avantgarde E 300 Exclusive Line E 350 AMG Line GLC 300 4Matic Coupe AMG Line GLE 450 4Matic AMG Line C300 Coupe AMG Line C200 Avantgarde C300 AMG Line C Class (W205) AMG C43 4 Matic CKD	E Class (W213) E 250 Exclusive CKD E 63 S 4MATIC+ AMG GLC 63 S 4 Matic Coupe AMG G 63 GLE 43 4mATIC Coupe GLE 400 4 Matic Coupe AMG Line GLS 400 4Matic AMG Line S 450 L AMG line	2018
BMW	M850i x Drive Coupe 5 Series 530e Sport 5 Series 530i M Sport	6 Series GT 630i M Sport 740 Le x Drive	2018
Peugeot	3008 SUV 1.6 THP 5008 SUV 1.6 THP 508 GT	408 e-THP 508	2016–2018
Honda	Accord 2.4 VTI-L Advance Accord 2.0 VTI-L CR-V 1.5 TC Premium 2WD	CR-V 1.5 TC 4WD CR-V 1.8 TC 2WD Odyssey 2.4 EXV	2018
Lexus	ES 250 Luxury ES 300h IS 300 Luxury 300 F Sport IS 300h GS F LS 500 Luxury LS 500 Executive LS 500h Executive NX 300 Premium NX 300 F Sport NX 300h	RX 300 Premium RX 300 Luxury RX 300 F Sport RX 350 F Sport RX 350L RX 450h LX 570 LC 500 ES 250 Luxury ES 300h ES 250 Luxury ES 300h	2018
Mazda	3 Hatchback 2.0 Skyactiv High 3 Sedan 2.0 Skyactiv High 6 2.5 Skyactiv-G with G Vectoring cntrl 6 2.2 Skyactiv-D with G-Vectoring cntrl 6 2.5 Skyactiv-G with G Grand Touring CX3 2.0 Skyactiv-G 2WD with G	CX5 2.2 CX9 2.5 4WD CX9 2.5 2WD CX-9 Vectoring cntrl CX5 2.0 CX5 2.5	2018
Toyota	Camry 2.5 Hybrid New 2019 Vios E/G New 2019 Yaris E/G Alphard 3.5 Vellfire 2.5	Rush 1.5 S C-HR 1.8L (Malaysia) C-HR 1.2t (Euro NCAP) AUS/NZ Camry 2.5 Hybrid	2018
Hyundai	Ioniq HEV Plus Elantra 1.6 Turbo Genesis 3.8 GDI	Ioniq Genesis 3.8 GDI	2018
Kia	Stinger 2.0 TGDi Stinger 3.3 V6 GT	Stinger 3.3 V6 GT	2018

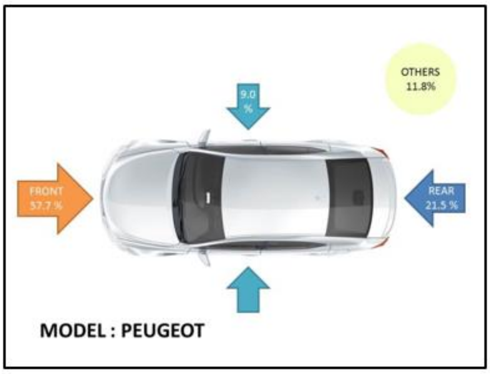
Appendix II. Distribution of Crash Area

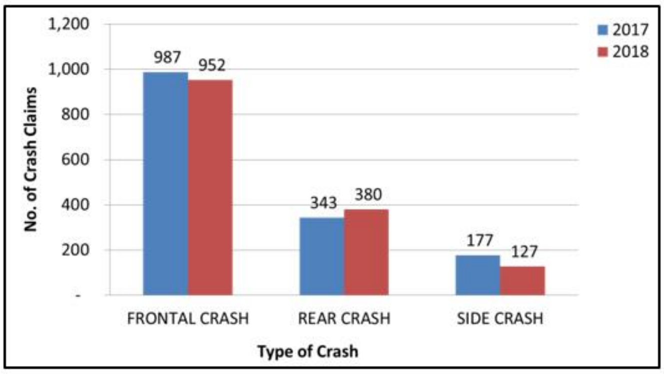


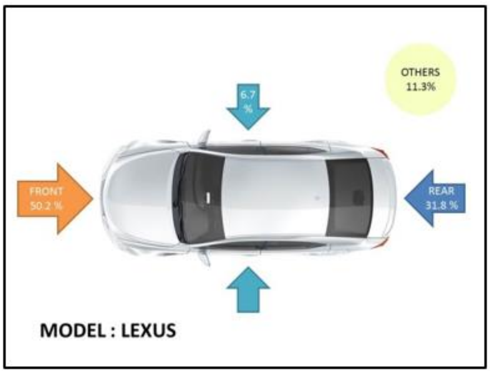


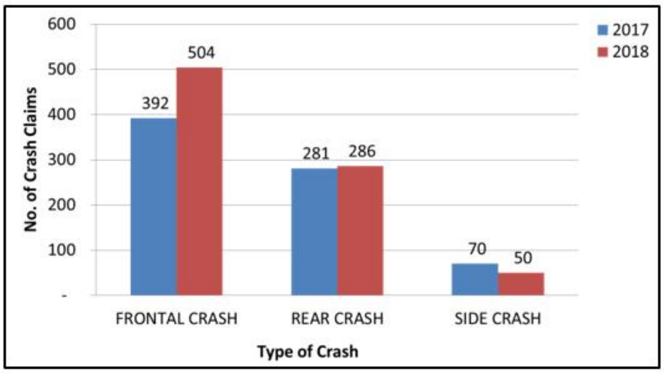


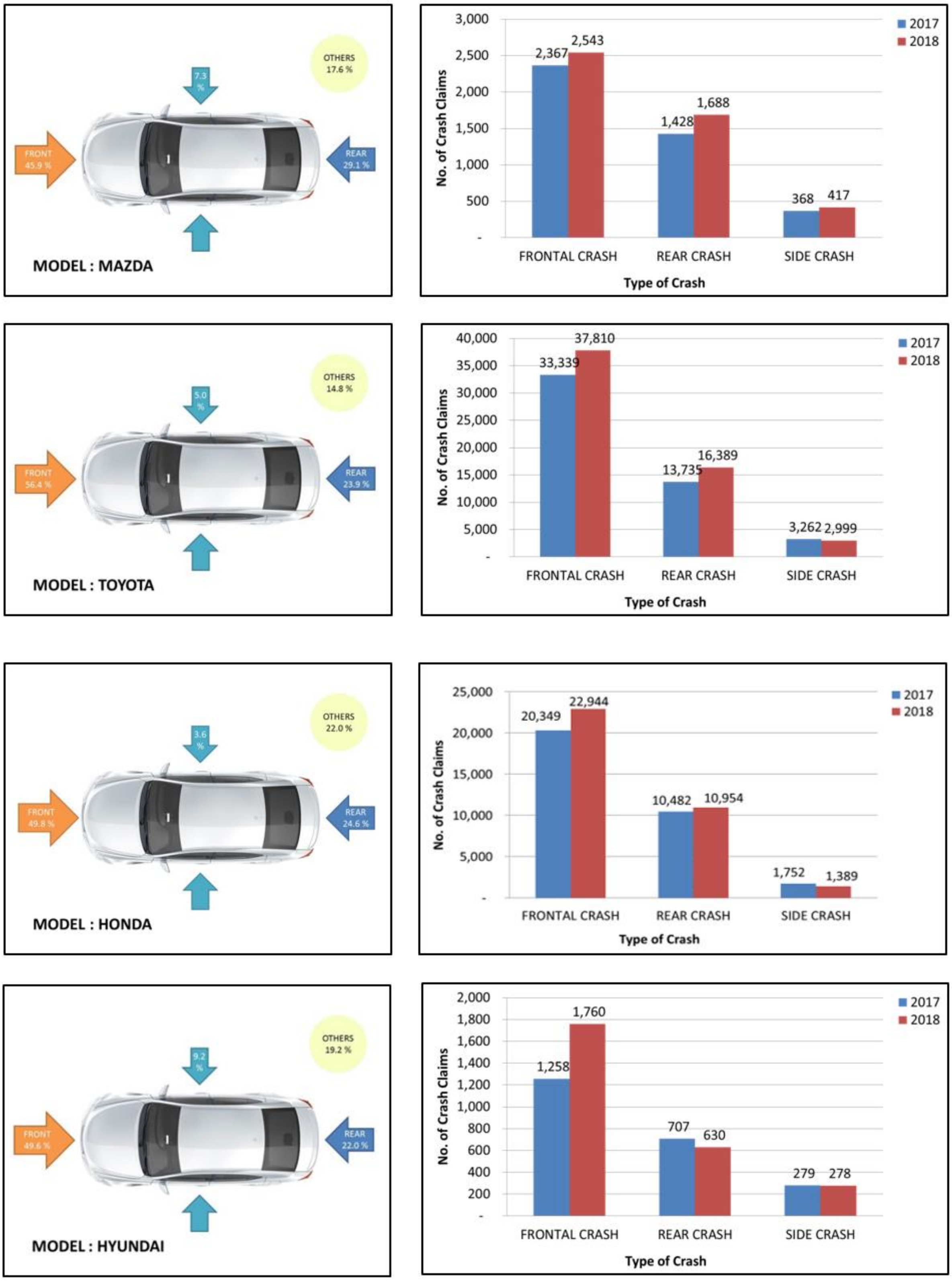











OTHERS 17.6 %
7.3 %
FRONT 45.9 %
REAR 29.1 %
MODEL : MAZDA
3,000
2,500
2,000
1,500
1,000
500
-
No. of Crash Claims
2017
2018
2,367
2,543
1,428
1,688
368
417
FRONTAL CRASH
REAR CRASH
SIDE CRASH
Type of Crash
OTHERS 14.8 %
5.0 %
FRONT 56.4 %
REAR 23.9 %
MODEL : TOYOTA
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
No. of Crash Claims
2017
2018
33,339
37,810
13,735
16,389
3,262
2,999
FRONTAL CRASH
REAR CRASH
SIDE CRASH
Type of Crash
OTHERS 22.0 %
3.6 %
FRONT 49.8 %
REAR 24.6 %
MODEL : HONDA
25,000
20,000
15,000
10,000
5,000
-
No. of Crash Claims
2017
2018
20,349
22,944
10,482
10,954
1,752
1,389
FRONTAL CRASH
REAR CRASH
SIDE CRASH
Type of Crash
OTHERS 19.2 %
9.2 %
FRONT 49.6 %
REAR 22.0 %
MODEL : HYUNDAI
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
-
No. of Crash Claims
2017
2018
1,258
1,760
707
630
279
278
FRONTAL CRASH
REAR CRASH
SIDE CRASH
Type of Crash