Journal of the Society of Automotive Engineers Malaysia
Volume 3, Issue 3, pp 333-340, September 2019
e-ISSN 2550-2239 & ISSN 2600-8092

Parametric Study of a Blind Spot Zone: Case Studies of Perodua Viva, Perodua Myvi and Proton Suprima

M. S. Muhamad Azmi*[1,2], A. H. Ismail[1,2], M. S. M. Hashim[1,2], M. S. Azizizol[1,2], S. Abu Bakar[1,2], N. S. Kamarrudin[1,2], I. I. Ibrahim[1,2], M. R. Zuradzman[1,2], A. Harun[1,3], I. Ibrahim[1,2], M. K. Faizi[1,2], M. A. M. Saad[1,2], M. F. H. Rani[1,2], M. A. Rojan[1,2] and M. H. Md Isa[4]

[1]Motorsports Technology Research Unit (MoTECH), Universiti Malaysia Perlis, Pauh Putra Campus, 02600 Arau, Perlis, Malaysia
[2]School of Mechatronic Engineering, Universiti Malaysia Perlis, Pauh Putra Campus, 02600 Arau, Perlis, Malaysia
[3]School of Microelectronic Engineering, Universiti Malaysia Perlis, Pauh Putra Campus, 02600 Arau, Perlis, Malaysia
[4]Malaysian Institute of Road Safety Research (MIROS, 43000 Kajang, Malaysia

*Corresponding author: safwanazmi@unimap.edu.my

ORIGINAL ARTICLE — Open Access

Article History:

Received
20 Oct 2018

Received in revised form
3 Aug 2019

Accepted
4 Aug 2019

Available online
1 Sep 2019

Abstract – *The initial works on Blind Spot Zone (BSZ) identification presents the importance of the blind spot towards the everyday drive. The alarming collision rate in the blind spot zone especially when changing lanes has triggered the necessity of BSZ detection and warning system, focusing on a daily-used and affordable car segment. Such technologies are recently available at top variant cars. Therefore, a low cost yet facilitative BSZ detection and warning system is required. This paper presents the continuity experimental result of identification of the BSZ of three different car segments, i.e. Perodua Viva in a compact A-segment car, Perodua Myvi in a compact B-segment and Proton Suprima in a C-segment hatchback. Instead of using volunteered persons, this paper presents a dedicated platform with adjustable heights and camera to replace the human. The results show that the blind spot area and angle is affected by types of car model and driver heights. Also, the relationship between the blind spot area and angle with driver height can be shown in a straight line.*

Keywords: Blind Spot Zone (BSZ), grid-based modeling, passenger cars, blind spot technology

Journal homepage: www.jsaem.saemalaysia.org.my

1.0 INTRODUCTION

The New Car Assessment Program for Southeast Asian Countries (ASEAN NCAP) prior to 2017-2020 protocols presents the necessity of Blind Spot Technology (BST), which also referred to as Side Assist, Active Blind Spot Assist, or Rear Vehicle Monitoring System in modern cars (Md Isa, 2016). It was first introduced by Volvo in its S80 Sedan as Blind Spot Information System (BLIS), later followed by Ford Inc. in their models such as Focus and Mondeo. The statistical data from the National Highway Traffic Safety Administration (NHTSA) showed that more than 800,000 accidents occur in the blind spot zone each year in the United States (Yi et al., 2016). In Malaysia, the fatality rate increases by the average of 2% yearly typically caused by the car-motorcycle crash in different accident angles, mostly concentrated in the blind spot zone (Roslan et al., 2011a; Roslan et al., 2011b). Therefore, the Blind Spot Zone (BSZ) can be depicted as a notable issue in the automotive industry.

The market penetration of such technologies, for instance in developing countries is slightly higher compared to developed countries in terms of both economic feasibility and attitudes. It is estimated that only 3% of vehicle sales in Malaysia are equipped with BST, with always available mostly in high-end or premium variants based on the top 100 sales data in 2014 (MAA, 2015). Indeed, the necessity for cars in Malaysia, and ASEAN, in general, to be equipped with BST as the trend of road accidents is at an alarming rate. These blind spot related crashes are somewhat preventable and must be regarded as major injury concerns. The BST development however requires a suitable method to firstly identified the blind spot zone for a specific car's segment.

The initial works on blind spot identification have been presented in the authors' previous work (Hashim et al., 2018), mainly for the compact car segment where Perodua Viva was used. In this early works, six drivers were volunteered, with their heights ranging from 165 to 172 cm. The driver was instructed to adjust the seat according to their preference and to adjust the side mirror so that he was able to see a quarter of the car body in the mirror. An assistant is moving from one grid to another and the driver visibility was recorded. A grid-based technique was proposed in order to identify the blind spot zones. Based on this initial works, the conclusion that has been made i.e. blind spot area for the left side of the car is larger than the right side and the angle of the left side is smaller than the right side. Continuity works are conducted motivated by these prior works.

In this paper, a new approach was taken. Instead of using volunteers to record their target visibility in the BSZ, a platform with adjustable heights and camera are developed. As we humans tend to liken things to our preferences, machines on the other hand are not. This is due to the fact that many factors are influencing human favourite, often judged by instinct and psychological (Pan et al., 2007). Based on the initial works, we observed that some volunteers adjusted the side mirrors as they wished, and some are just following their peers. This situation may cause multiple uncontrollable variables that lead to improper and invalidated results. Therefore, the platform usage could be able to eliminate this factor.

2.0 EXPERIMENTAL METHODS

Figure 1 depicted a grid assignment that was used to determine the blind spot zone (BSZ) area (Hashim et al., 2018). The shaded area indicates the BSZ and θ is the computed angle of BSZ. Each grid was set to 500 mm × 500 mm. The area covered is 3500 mm × 4500 mm for each side of the vehicle, which is sufficient to determine the targeted zone and a typical size of a Malaysian road.

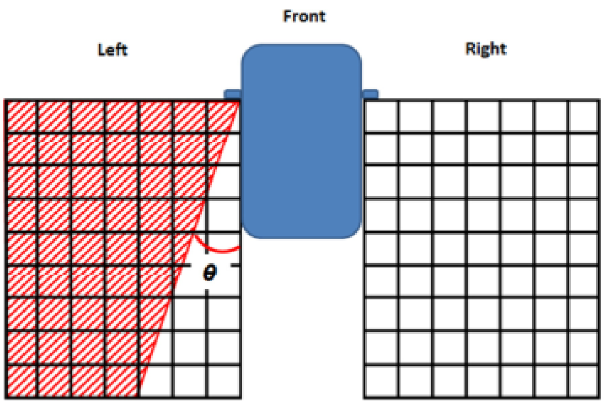


Figure 1: Identification of blind spot zones using the grid-based technique

Figure 2 shows the simple and elegant developed platform. Figure 3, on the other hand, shows the placement of the developed platform in one of the vehicles i.e. the Proton Suprima. Examples of images taken from the camera are shown in Figure 4. The platform was adjusted according to the anthropometric data from Md Isa et al. (2016) and again used to set the ideal condition for seating of a driver in terms of distance from the seat to steering with respect to driver's height. Then a target is moved from grids with the camera recording from the driver's seat. This BSZ identification works were offline, for which the determination of target visibility was conducted inside the laboratory. Each grid is marked when the target is visible.

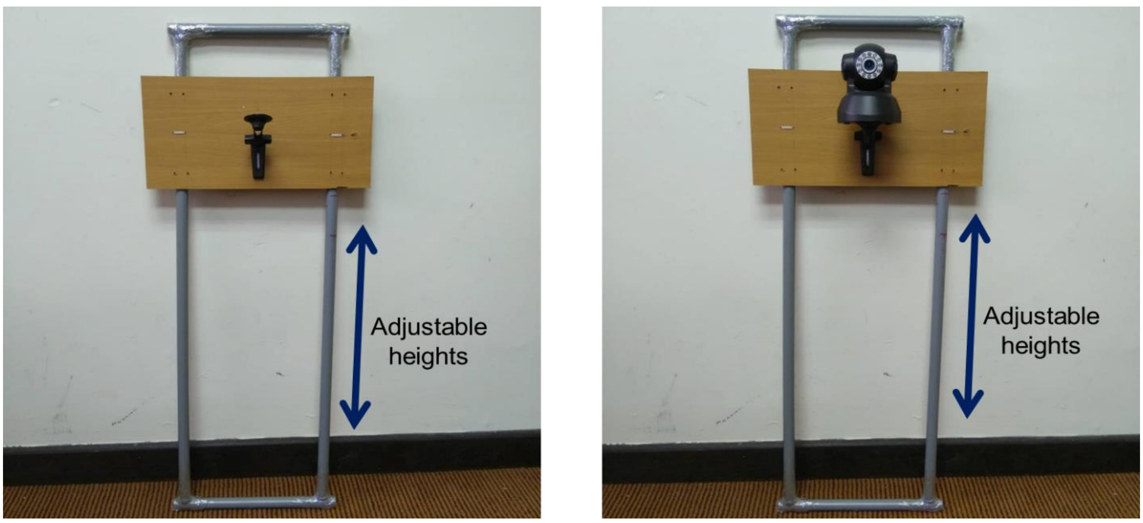


Figure 2: The developed platform for blind spot data collection – without a camera (left), with a camera (right)

Figure 3: Platform position in Proton Suprima – outside view (left), inside view (right)

Figure 4: Images were taken from the camera of the platform – the target is visible (left), the target is not visible (right)

In this study, a platform as shown previously in Figure 2 was developed to replace the human driver for the data collection of the blind spot area. A camera was installed to capture the image from the side mirrors while an assistant was moved from one grid to another in order to measure the visibility. The anthropometric data from Md Isa et al. (2016) were used for the platform adjustment on the driver's seat to represent the preferred position for the driver while driving. Furthermore, the camera can be adjusted vertically which can represent the human driver's height in the range between 140 to 180 cm. The results were compared with Hashim et al. (2018) to see the effectiveness of the current proposed method for blind spot data collection. In order to compare the result, the data were taken from the same car model (Perodua Viva). Then, blind spot area data for Perodua Myvi and Proton Suprima were also taken using the current proposed data collection method.

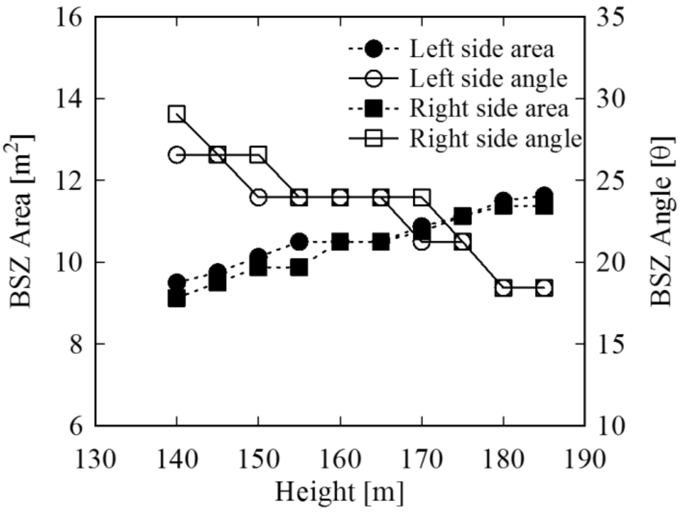
As stated above, there are three car models used to determine BSZ using current proposed data collection method. The specification of the selected cars is tabulated in Table 1.

Table 1: Specification of cars used in the experiment

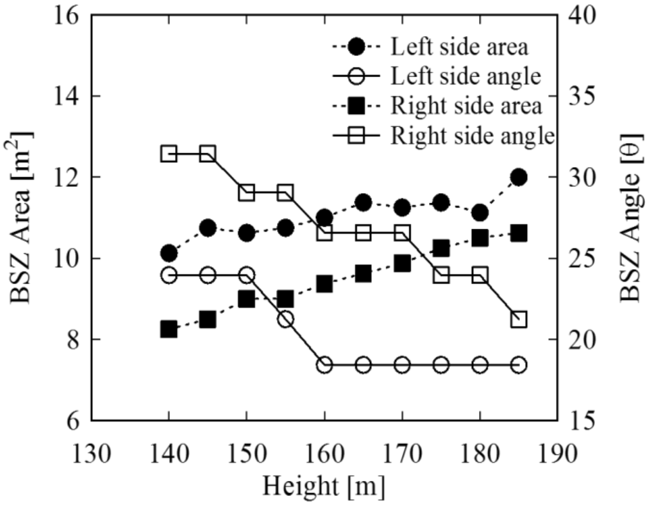
No.	Items	Car 1	Car 2	Car 3
1.	Model	Perodua Viva	Perodua Myvi	Proton Suprima
2.	Length	3,575 mm	3,697 mm	4,436 mm
3.	Weight	1,475 mm	1,665 mm	1,786 mm
4.	Height	1,530 mm	1,570 mm	1,524 mm
5.	Curb weight	790 kg	960 kg	1,365 kg

3.0 RESULTS AND DISCUSSION

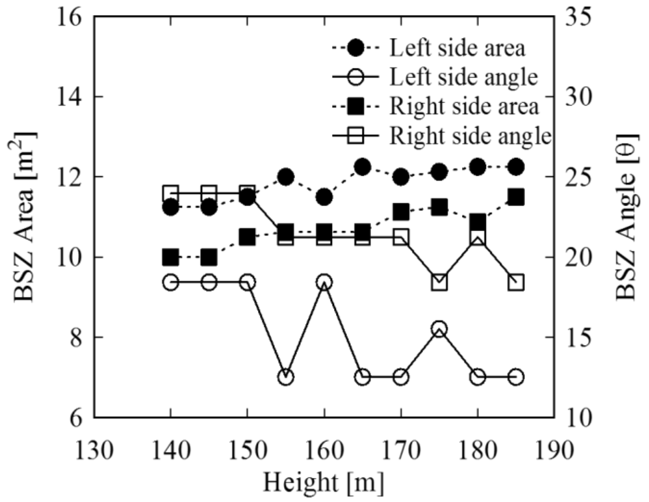
Figure 5 (a), (b) and (c) show the area and angle of blind spot for three car models which are Perodua Viva, Perodua Myvi and Proton Suprima, respectively. From the results, it can be concluded that the blind spot area for the left side of the cars is larger than the right side and the angle of the left side is smaller than the right side. This result agreed well with finding by Hashim et al. (2018). Furthermore, the blind spot area will increase with the increase of driver heights, while the blind spot angle will decrease for all car models.



(a) Perodua Viva



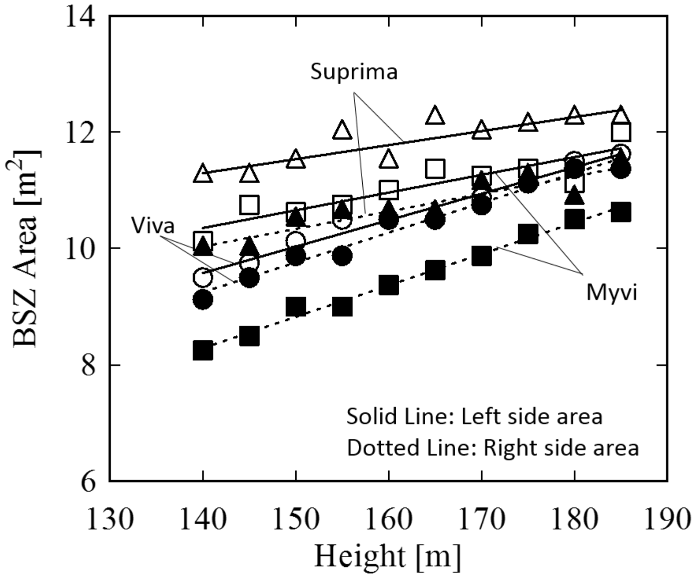
(b) Perodua Myvi



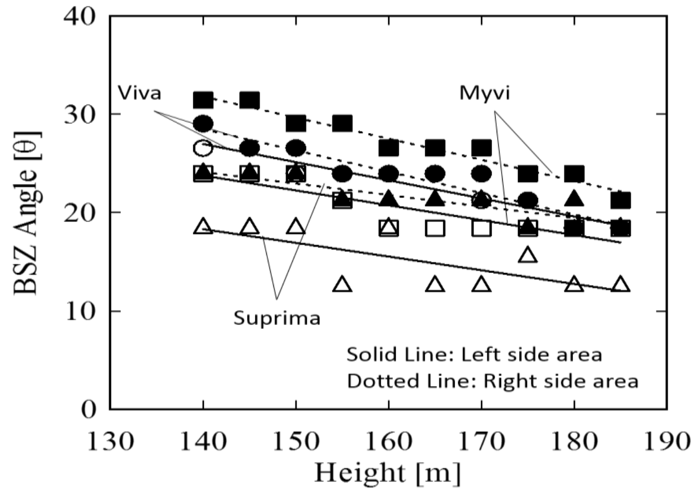
(c) Proton Suprima

Figure 5: Area and angle of blind spot for three car models – (a) Perodua Viva; (b) Perodua Myvi; (c) Proton Suprima

The comparison of the blind spot area and the angle between three car models is shown in Figure 6. Proton Suprima has the highest blind spot area between all models while Perodua Myvi shows the lowest blind spot area regardless of driver heights. Moreover, the relationship between blind spot area and driver heights can be represented in a linear relationship as can be seen in Figure 6(a). On the other hand, between all three models, Perodua Myvi shows the largest blind spot angle while the smallest blind spot angle was shown by Proton Suprima regardless of driver heights. Additionally, the blind spot angle of all car models also can be shown in a linear relationship as in Figure 6(b).



(a) Area



(b) Angle

Figure 6: Comparison of blind spot area and angle between three car models

4.0 CONCLUSION

In this study, a new data collection method has been proposed using an adjustable platform instead of some volunteers. The results from the currently proposed method agreed well with previous work (Hashim et al., 2018), which shows that the left side of the BSZ area is larger than the right side and the left side of the BSZ angle is smaller than the right side. Also, BSZ of three different car models, i.e. Perodua Viva, Perodua Myvi and Proton Suprima have been identified. The conclusions are as follows:

a) With the increasing driver height, the blind spot area will also increase but the blind spot angle will decrease for all types of car.

b) Proton Suprima has the highest blind spot area and the smallest blind spot angle while Perodua Myvi has the lowest blind spot area and the largest blind spot angle regardless of driver heights.
c) The relationship between blind spot area and angle with driver height can be shown in a linear relationship.

ACKNOWLEDGEMENTS

The authors would like to express gratitude and appreciation for the financial support from ASEAN NCAP, under the grant of the ASEAN NCAP Collaboration Holistic Research (ANCHOR).

REFERENCES

Hashim, M.S.M., Ismail, A.H., Bakar, S.A., Azmi, M.M., Razlan, Z.M., Harun, A., Kamarrudin, N.S., Ibrahim, I., Faizi, M.K., Saad, M.A.M., Rani, M.F.H., Mahayadin, A.R., Rojan, M.A., Azizizol, M. S.& Md Isa, M.H. (2018). Identifying blind spot zone for passenger cars using grid-based technique. *Journal of the Society of Automotive Engineers Malaysia, 2*(3), 245-251.

MAA (2015). *Press Release: Market Review for 2014 and Outlook for 2015*. Malaysian Automotive Association (MAA).

Md Isa, M.H. (2016). *Blind Spot Technology Must Be Seen*. The Sun, 15th April 2016.

Md Isa, M.H., Deros, B.M., Jawi, Z.M., & Abu Kassim, K.A. (2016). An anthropometric comparison of current Anthropometric Test Devices (ATDs) with Malaysian adults. *Malaysian Journal of Public Health Medicine*. *Special Volume, 1*, 15-21.

Pan, X., Han, C.S., Dauber, K., & Law, K.H. (2007). A multi-agent based framework for the simulation of human and social behaviors during emergency evacuations. *AI & Society, 22*(2), 113-132.

Roslan, A., Sarani, R., Hashim, H.H., & Saniran, N. (2011a). *ADSA Motorcycle Fact Sheet, Vol. 1*. Malaysian Institute of Road Safety Research (MIROS). Retrieved from http://www.miros.gov.my

Roslan, A., Sarani, R., Hashim, H.H., & Saniran, N. (2011b). *ADSA Motorcycle Fact Sheet, Vol. 2*. Malaysian Institute of Road Safety Research (MIROS). Retrieved from http://www.miros.gov.my

Yi, K., Kim, D., & Jung, K.H. (2016). Real-time line marker detection for night-time Blind Spot Monitoring system in suburb area. In *Advanced Multimedia and Ubiquitous Engineering* (pp. 561-568). Springer, Singapore.