

Motorcycle Anti-lock Braking System (ABS): Feasibility Study Towards Mandatory Installation in Malaysia

M. S. A. Khalid*, K. A. A. Kassim, Z. M. Jawi, A. N. S. Z. Abidin, A. Hamzah, A. Roslan, M. H. Johari, M. S. Solah, S. A. S. M. Rahim and Z. H. Zulkipli

Malaysia Institute of Road Safety Research (MIROS), Taman Kajang Sentral, Kajang, Selangor, Malaysia

*Corresponding author: muhamadsyukri@miros.gov.my

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ABSTRACT – In 2020, there were more than 4,000 traffic fatalities in Malaysia, with motorcycle riders accounting for more than 65% of those deaths. Among the causes of motorcycle collisions include single-vehicle wrecks, inability to avoid other cars, bad braking, and inability to control the motorbike while braking. ABS is one of the more current safety devices that might prevent these types of collisions. Therefore, this study aims to explore the feasibility of mandating Motorcycle ABS as a standard fitment for all motorcycles in Malaysia. The research methods include a literature analysis of previous studies, a comparison of countries that have controlled the installation, and a poll of Malaysian motorcycle riders regarding their perception of motorcycle ABS. According to previous research, motorcycle ABS might potentially save lives and reduce injuries by 26% to 39%, depending on the type of collision. With similar efficiency, it is predicted that over 1000 lives can be saved and over 100,000 injuries can be prevented in Malaysia. Small-engine motorcycles (below 250cc) are the most popular among Malaysian users; yet, the majority of small-engine motorcycles are not equipped with good motorcycle safety technology, especially ABS, when compared to large-engine motorcycles (250cc above). In addition, survey results indicate that most motorcyclists in Malaysia are knowledgeable about ABS and agree with its functionality and efficiency. Furthermore, most respondents agreed that Malaysia wanted to mandate the installation of ABS on all motorcycles, with 90% of respondents wanting it to be mandated immediately. Concerns were also raised that the regulation would not significantly affect the market price. In light of the effectiveness of anti-lock braking systems (ABS) in saving lives and preventing injuries, user awareness, understanding, and demand for ABS, as well as market readiness, it may be determined that Malaysia is able and prepared to regulate motorcycle ABS as a mandatory fitment to all motorcycle.

KEYWORDS: Motorcycle, Anti-lock Braking System (ABS), motorcycle ABS, motorcycle safety, road safety

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1. INTRODUCTION

Generally, vulnerable road users include pedestrians, cyclists, and those riding two- or three-wheeled motorized vehicles, i.e., motorcyclists. These categories of road users lack a protective “shell” and, as a result, are more vulnerable than those in automobiles. Due to its compact size and low cost, the motorcycle has become the most popular vehicle on Malaysian roads over the past few decades. Malaysia, with a population of 31 million, is one of the leading ASEAN nations in terms of automotive travel, including motorcycle travel (Manan et al., 2020). From 2015 to 2019, the cumulative number of registered automobiles in Malaysia increased from 26 million to 31 million (an increase of around 16%). Figure 1 shows that motorbikes accounted for 45% of all registered vehicles, except in 2018 when that percentage rose to 48.1%.

In terms of crash involvement, over 31,000 vehicles were involved in motor vehicle collisions in 2015, a number that increased to over 34,000 in 2017 and then steadily decreased to 27,822 in 2019. From 2015 to 2019, the lowest percentage of motorcycles involved in traffic accidents in Malaysia was 35.4% (12,232 motorcycles) in 2017, while the highest rate was 48.2% in 2019 (13,421 motorcycles). According to the annual national crash statistics report published by the Royal Malaysian Police (RMP) Traffic Department, Malaysia recorded an average of 6,609 fatalities in road traffic crashes between 2015 and 2019. 2016 was the year with the highest number of traffic-related fatalities, with 7,152. Additionally, 2016 was the year with the largest number of severe injuries (4,506) and the second-highest number of minor injuries.

Motorcycle fatalities contributed between 62.7% and 65.7% of all road traffic fatalities for the five-year period, with the highest number reported in 2018 (Alias et al., 2020). From 2015 through 2018, there was an increasing trend in motorcycle fatalities, which declined in 2019. Moreover, the number of critically wounded motorcyclists decreased in 2017 but surged from 2018 to 2019. However, there has been no significant improvement in motorcycle fatalities in Malaysia (Kassim et al., 2021).

TABLE 1: Motorcyclist fatalities in Malaysia

Year	Overall Fatalities	Motorcyclist
2015	6,706	4,203 (62.7%)
2016	7,152	4,485 (62.7%)
2017	6,740	4,348 (64.5%)
2018	6,284	4,128 (65.7%)
2019	6,167	3,959 (64.2%)

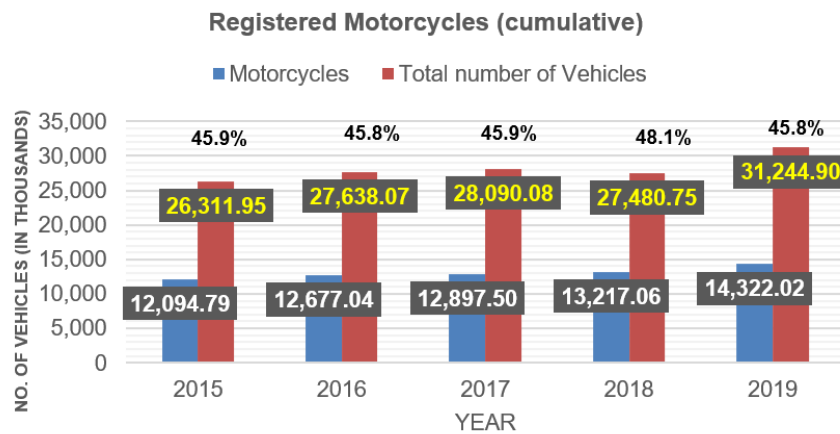


FIGURE 1: Registered motorcycles in Malaysia

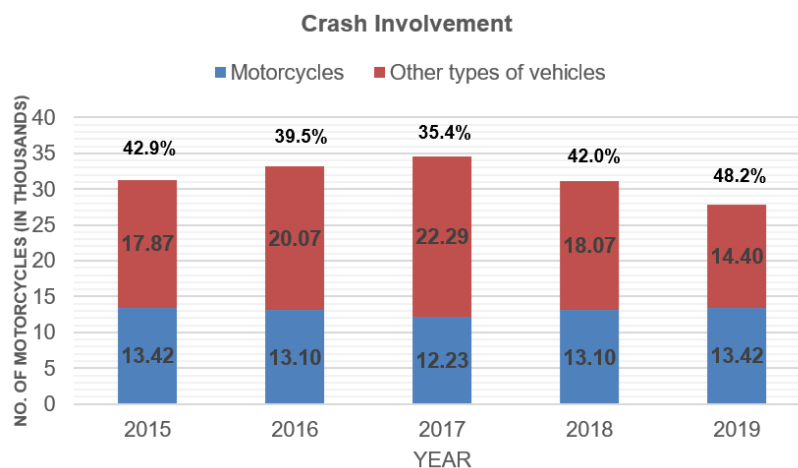


FIGURE 2: Motorcycles crash involvement in Malaysia

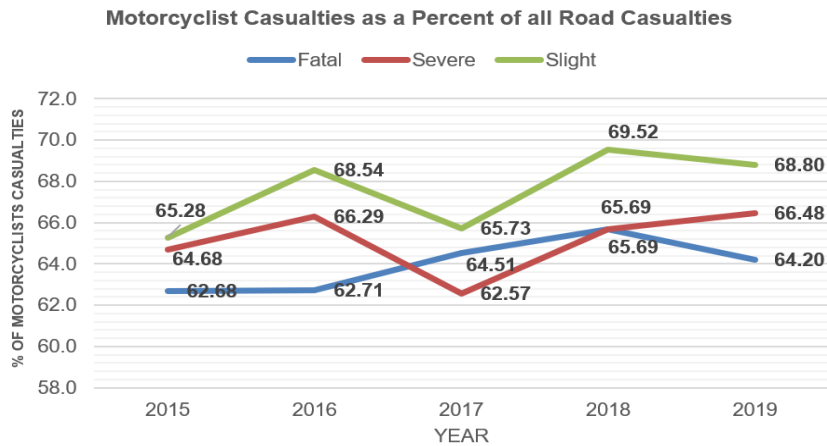


FIGURE 3: Registered motorcycles in Malaysia

2. SMALL ENGINE CAPACITY MOTORCYCLE: THE MAIN CONTRIBUTOR TO MOTORCYCLIST DEATHS IN ASEAN AND MALAYSIA

There are an estimated 313 million motorcycles in use worldwide, with Asia accounting for 80%, Latin America for 5%, and North America for 2%. (Wanna, 2019). Figure 4 illustrates the global distribution of motorbike ownership. The ASEAN area has seen the most increase in motorbike ownership of any region in the globe. Small-engine capacity (less than 250cc) motorcycles, including the underbone or moped, and scooter varieties, are the most popular in the ASEAN region and especially in Malaysia. According to the statistics, these sorts of motorcycles hold a dominant market share in the majority of ASEAN nations, particularly in Malaysia, where they make up more than 90 percent of the market. This, in turn, contributes to a larger number of deaths among them too (Khalid et al., 2021; WHO, 2020; Manan et al., 2018).

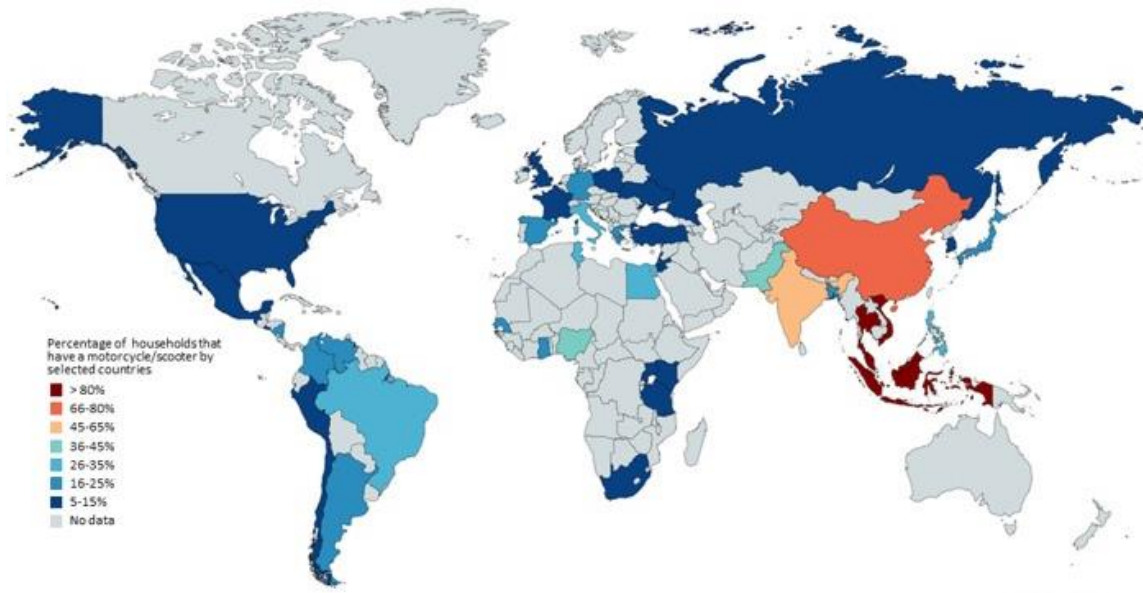


FIGURE 4: Percentage of motorcycle ownership in the world (Source: Statista, Krungsri Research)

Numerous studies have exhaustively described the features of these small-engine motorcycles (Grava, 2003; ACEM, 2004). The small-engine variety of motorbike is widely used because of its convenience, portability, and ease of operation in congested urban environments. However, the machine's lack of stability compared to a four-wheeled vehicle, its small size, and the lack of crash protection for riders are all major safety concerns (Faudzi & Zulkipli, 2020). They can reach high speeds and present a braking challenge, just like more powerful motorcycles (Nguyen, 2013; APEC, 2010). Despite their

popularity, this type of motorcycle has not yet been equipped with modern safety features (Jawi et al., 2021). Therefore, the purpose of this research is to determine whether or not it would be possible for Malaysia to make motorcycle Anti-lock Braking Systems (ABS) mandatory for all motorcycles, especially those with smaller engine capacities, thus improving motorcycle safety and decreasing the number of motorcycle-related accidents and fatalities.

3. MOTORCYCLE ANTI-LOCK BRAKING SYSTEM (ABS)

3.1 Capabilities to Reduce Motorcycle Crashes and Death

The ABS is a safety feature that prevents the vehicle's wheels from locking while in motion. The technology provides the stability of the motorcycle while the driver maintains control of the vehicle. As long as the wheels continue to revolve, the automobile can move in whichever direction the driver steers. Since 2007, all new passenger cars sold in the European Union (EU) must be equipped with ABS, which the introduction in 1978 was for high-end automobiles.

Similarly, ABS was introduced for motorcycles in the late 1980s. Now that the technology has sufficiently evolved, the cost to install ABS has drastically decreased. Numerous nations throughout the globe have enforced the use of ABS due to the effectiveness in reducing collisions and preventing road fatalities, with estimated advantages ranging from 26% to 42% in reducing motorcycle collisions (Rizzi et al., 2015; Lich et al., 2016; Kumaresh et al., 2017; WHO, 2020).

3.2 Technical Comparison of Effectiveness of Motorcycle ABS And Motorcycle Combined Braking System (CBS)

In terms of technical effectiveness, Koetnuyom et al. (2021) found that a motorbike equipped with ABS would give superior braking performance on low-friction surfaces compared to non-ABS and CBS motorcycles. In addition, during the braking maneuver testing, a motorcycle equipped with ABS revealed that the rider could avoid obstacles without losing control. In contrast, riders of non-ABS and CBS motorcycles failed the braking maneuver due to the loss of lateral force at the front wheel caused by wheel lockup.

As ABS motorcycles demonstrated superior braking capability and enhanced stability, this should help reduce injuries resulting from human mistakes and behavior, particularly when riding on a wet surface and in tough riding conditions (WHO, 2017). ABS for motorcycles might assist in addressing the common inappropriate braking that contributes to motorcycle accidents. Although some believe that ABS is unneeded for small-engine motorcycles, the research mentioned above suggests that such motorcycles are driven at high speeds and present the same braking problems that lead to collisions and injuries as bigger motorcycles. Thus, ABS is appropriate for any motorcycle capable of exceeding 50 km/h.

3.3 Projected Number of Fatalities and Serious Injuries That Can Be Avoided with Motorcycle ABS

Past research is summarized in this part, including estimates for the number of lives saved and the percentage of motorcycle-related deaths and injuries that could have been avoided if anti-lock brakes had been standard equipment. A large number of studies have been conducted on the advantages of ABS, and their results are summarized in Table 2, which is organized into subheadings based on the studies' objectives, data sources, and conclusions of the study.

The majority of research employed national crash data to assess the effectiveness of motorcycle ABS in reducing fatal crashes, total crashes, and injuries, as summarized in Table 2. Although research utilized national crash data, the data were unique to crashes in various configurations, excluding head-on, overtaking, U-turning, entering and exiting a parking space, contact with a stationary object, and cutting in collisions. There was only one study that mapped crash data to evaluate the efficacy of ABS. In conclusion, the ABS study in Germany, India, and Indonesia demonstrated that the motorbike ABS might help prevent crashes by 26, 33, and 26%, respectively.

TABLE 2: Summary of findings from published paper related to ABS effectiveness

Author	Objective	Method	Findings
Fildes et al. (2015) <i>Evaluation of the effectiveness of Anti-lock Braking Systems on motorcycle safety in Australia</i>	To accomplish a variety of goals concerning the installation of the ABS technology as a mandatory safety feature on bikes that fall under the LC category and have an engine size that is higher than 125cc. To identify future trends of motorbike and ABS installation growth, the predicted advantages in terms of future injury reductions, and the anticipated economic cost of the technology.	A statistical analysis of national road accident data as well as sales and ABS fitment trends for motorbikes. It was expected that ABS would be effective in a variety of accident scenarios, excluding head-on, passing, U-turning, entering and exiting a parking space, collision with a fixed object, and cutting in crashes.	ABS technology on LC>125 motorcycles (no scooters) resulted in - a 33% reduction in all injury crash severities and - a 39% reduction in severe injury crashes for sensitive crashes - 31% benefits across all motorcycle crashes in Australia When ABS and CBS were combined, the efficiency slightly increased to 44%.
Teoh (2013) <i>Effects of Antilock Braking Systems on motorcycle fatal crash rates: An update</i>	The objective of this study was to update Teoh (2011) with the most recent information.	Motorcycle drivers involved in fatal crashes per 10,000 registered vehicle years between 2003 and 2011 were analyzed for 13 ABS-equipped motorcycle models. The fatal crash rates of ABS-equipped motorcycles were compared to those of identical models without ABS.	The number of fatal motorcycle crashes per 100,00 vehicle years registered decreased by 31% after ABS was installed. A 95% confidence interval for this efficiency estimate was (9 percent, 48 percent). Due in significant part to the increased precision given by the bigger sample size, both the revised estimate and its confidence interval fall inside the confidence interval of the 2003-08 estimate.
Rizzi et al. (2015) <i>Effectiveness of motorcycle Anti-lock Braking Systems (ABS) in reducing crashes, the first cross-national study</i>	The purpose of this study was to determine whether or not antilock braking systems (ABS) for motorcycles are effective in lowering the number of real-life crashes.	Using police reports from Spain (2006-2009), Italy (2009), and Sweden (2003-2012), this study analyzed a variety of motorcycles, including scooters, and compared nations with distinct motorcycling practices. The statistical analysis employed odds ratio calculations based on an induced exposure methodology.	The effectiveness of motorcycle ABS in reducing injury crashes: <ul style="list-style-type: none"> Italy: from 24% (95% confidence interval [CI], 12-36) Spain: in 29% (95% CI, 20-38) Sweden: 34% (95% CI, 16-52) The reductions in severe and fatal crashes: <ul style="list-style-type: none"> Spain: 34% (95% CI, 24-44) Sweden: 42% (95% CI, 23-61) The overall reductions of crashes involving ABS-equipped scooters (at least 250 cc) were: <ul style="list-style-type: none"> Italy: 27% (95% CI, 12-42) Spain 22% (95% CI, 2-42). ABS on scooters with at least a 250-cc engine reduced severe and fatal crashes by 31% (95% CI, 12-50), based on Spanish data alone.

<p>Lich et al. (2016)</p> <p>Motorcycle Stability Control – The next generation of motorcycle safety and riding dynamics</p>	<p>This research intended to evaluate the accident-avoidance potential of Motorcycle Stability Control (MSC). As part of this, the advantages of ABS for Germany were explained.</p>	<p>The study utilized the GIDAS accident database (German-In Depth Accident Study). Data considers crashes involving injuries.</p>	<p>The estimated avoidance potential for motorcycle ABS in Germany is 26% of all powered-two-wheeler crashes involving personal injury involving 125cc engine size (assuming a 100% installation rate).</p>
<p>Lich et al. (2015)</p> <p>Benefit estimation of Anti-lock Braking System for powered two-wheeler on Indian highways</p>	<p>The Road Accident Sampling System for India (RASSI) database was used for this study. Data includes personal injury crashes.</p>	<p>The Road Accident Sampling System for India (RASSI) database was used for this study. Data includes personal injury crashes.</p>	<p>One estimation is that every third accident involving a biker on Indian roadways can be avoided by a powered two-wheeler ABS (assuming a 100% installation rate of such a device).</p>

4. PREPAREDNESS TOWARD SAFER MOTORCYCLES

4.1 Current Status of The Introduction of Motorcycle ABS Regulation

Many countries have enforced the adoption of ABS because of its effectiveness in reducing motorcycle crashes. In January 2016, the 27-member European Union (EU) was the first to implement such a regulation. Since then, ABS installation on motorcycles has expanded dramatically. Using police reports from a variety of European nations, including Spain, Italy, and Sweden, a wide range of motorbike sizes in connection to ABS usage has been verified (Rizzi et al., 2015).

Currently, the European Union, Russia, Japan, Turkey, Ukraine, Australia, and the United Kingdom adhere to UN Regulation No. 78 on the brakes of vehicles in categories L1, L2, L3, L4, and L5 (tricycles). Motorcycle Brake is the third regulatory subject included in the Global Technical Regulations (GTR) of the 1998 Agreement (UNECE, 2021). Much of the information contained in the regulations pertain to motorcycle ABS. The GTR No. 3 has been applied for by the United States, Canada, the European Union, Japan, and Russia.

The successful implementation of the law in the EU has persuaded many other nations, particularly WP29 signatories, to join this trend. Before deciding to establish such legislation, many nations have likewise conducted substantial research. Japan, Taiwan, India, Brazil, China, South Korea, Australia, and New Zealand are among the nations whose motorcycles comply with the ABS legislation.

In a review report for 2020 (WHO, 2020), it was determined that a fundamental shift was necessary to reduce road-related trauma in Thailand. With the backing of the government, Thailand has become the first ASEAN nation to declare the 2024 implementation of the motorcycle ABS rule (Galang, 2021). The document was signed by the Department of Land Transport after the Government decided on 9 April 2021, based on the recommendations of the National Motorcycle Working Group comprised of stakeholders from the private and public sectors, NGOs, and academia, that all new motorcycles with a capacity greater than 125 cc (or 11 kW) must be equipped with ABS by 2024. Starting on January 1, 2026, OEMs will no longer be permitted to sell previous models that are not equipped with ABS.

In Malaysia, the overall number of road deaths reduced by 2% from 6,617 in 2018 to 6,287 in 2019. (Ministry of Transport Malaysia, 2021). Nevertheless, the number of accidents in 2019 increased to 567,516. Nearly two-thirds of road fatalities were attributable to motorcyclists, who accounted for the biggest proportion of road users involved in collisions. Although there has been a substantial gain in vehicle safety in Malaysia, the majority of adjustments have been made to passenger cars. In addition to VTA requirements, ASEAN NCAP has brought the safety of passenger vehicles in the country up to international standards. However, there is still a significant gap in motorcycle safety.

On March 16, 2021, MIROS announced the launch of the Malaysian Motorcycle Assessment Program or MyMAP (Amir et al., 2021; MIROS, 2021). Together with the Malaysia Automotive Robotics and IoT Institute (MARii), this effort is based on The National Automotive Vision and The National Automotive Policy that the Malaysian government announced in 2020. MyMAP's objective is to serve as a starting point for increasing motorcycle safety, notably through technology means (Zulkipli et al., 2021). Clearly,

the motorcycle ABS regulation is one of the primary goals of MyMAP. MyMAP, like NCAP, is not a rule-making organization. Therefore, comprehensive deployment of the motorbike ABS in the nation will not be possible in the near future. Nonetheless, it is hoped that the introduction of MyMAP will motivate manufacturers to include additional active safety systems, particularly ABS, on their motorcycles, so making it easier for the responsible parties to make the necessary regulation.

4.2 Penetration of Motorcycle ABS in the Current Fleet

Yamaha, Honda, Kawasaki, and Suzuki are just a few of the leading manufacturers who have adopted the system. Yet only a small percentage of motorcycles with engines smaller than 250cc have ABS installed. Taking a closer look at the Malaysian motorcycle market, it becomes clear that most purchasers can only afford cheaper models with smaller engines. Therefore, this group accounts for far over 90% of Malaysia's motorbike riders.

ABS is not standard on many smaller motorcycles, especially the cub (underbone) type, often known as the "kapcai." The scooter category has the majority of ABS-equipped vehicles. Several years ago, a certain motorcycle manufacturer, MFORCE, rewrote the rules by fitting its cub-style bikes with ABS. More recently, in December 2021, Honda debuted their new model, the Honda RSX, which is equipped with ABS. Considering this tendency, Malaysia will certainly have more cub-style motorcycles equipped with ABS within the next year or two.

4.3 Supply and Manufacture of the ABS Module and System

ABS was sourced from several countries, primarily Europe, Japan, and China. However, the majority of ABS suppliers produced their goods in Thailand. According to ABS providers, all of their factories in Thailand have begun producing motorcycle ABS in accordance with Thailand's 2024 ABS legislation announcement. In addition to providing their own countries, Thailand's ABS production is also supplied or exported to Japan, China, India, Taiwan, and many others. According to the leading supplier, their Thai factories are more than capable of producing and supplying motorcycle ABS modules to all ASEAN nations, including Malaysia.

Regarding supply and demand, it is anticipated that the mandated installation of ABS on all types of motorbikes in Malaysia will not pose a significant problem. In fact, if the resolution on motorcycle ABS is adopted in the near future, countries such as Indonesia, Thailand, and Malaysia are more than prepared.

5. HOW WOULD MALAYSIA BENEFIT FROM MOTORCYCLE ABS IMPLEMENTATION?

5.1 Life Benefits

Multiple studies have demonstrated that ABS has an estimated efficiency of 26-39% in minimizing motorcycle crashes, injuries, and fatalities. Several disaster scenarios, including motorcycle skidding, side impact, junction collision, braking error, rear-ending another vehicle, and hitting a pedestrian, present opportunities to prevent rider fatalities. Therefore, with an estimated efficacy of 26-39%, implementation of the ABS motorcycle rule in Malaysia might save up to 1,000 motorcyclists' lives annually and prevent 100,000 injuries.

5.2 Economics Benefits

In tandem with the number of lives saved and the decrease in serious injuries among road users, the introduction of motorcycle ABS legislation can generate economic gains. Based on the value of statistical life (VOSL) of RM3.12 million in Malaysia as estimated by MIROS (MIROS, 2018), with the reduction of road deaths, the country can save approximately RM 2 billion annually, not including savings due to the reduction of injuries that will eventually mitigate the economic impact of road crashes on the country.

6. CONSUMER AWARENESS AND DEMAND

6.1 Level of Consumer Awareness and Demand for Motorcycle ABS

This research was conducted through an online survey. It utilized convenience sampling in which survey respondents were contacted via multiple social media channels. The inclusion criterion required respondents to be motorcycle riders. This study was conducted over the course of three months (from September to November 2021). The questionnaires had a variety of information, including socio-demographic information, motorcycle ownership, motorcycle technology, and the most important component, which was motorcycle ABS knowledge, comprehension, opinion, and demand.

6.1.1 Respondents Demographics

Approximately 406 motorcyclists participated in the online survey. The remainder of the respondents' distribution is shown in Table 3 below. Most motorcyclists were male (96.1%), employed in the private sector (47%), had a higher education background (86.4%), and resided in urban areas (42.3%).

More than 99 percent of respondents had a motorcycle. The details of the respondent's motorcycle are presented in Table 4. The majority of responders (69.2%) utilized either a regular or underbone-style motorcycle. This is likely because the majority of these motorcycle types are readily available and affordably priced. In the poll, the majority of respondents claimed that their motorcycle was between 101 and 125cc (39.4%) or 126 and 150cc (35.7%), indicating that the majority of motorcyclists in Malaysia utilized motorcycles with small engine capacities. The investigation also discovered that 96.6 percent of them are licensed. As motorcycles are smaller than other cars, simple to maintain, and dependable, they were utilized as the primary form of transportation (55.1%) and for everyday commutes (64.5%).

TABLE 3: Respondents' demographic

Variables	N (%)
Gender	
Male	390 (96.1)
Female	16 (3.9)
Occupation	
Government	121 (29.8)
Private	191 (47.0)
Self-employed	34 (8.4)
Student	50 (12.3)
Retiree	2 (0.5)
Not working	8 (2.0)
Education Background	
Higher education	351 (86.4)
Secondary	47 (11.6)
Primary	5 (1.2)
None	3 (0.7)
Locality	
Urban	112 (35.2)
City	235 (42.3)
Rural	59 (22.4)

6.1.2 Motorcyclists' Awareness of Safety Technology

Diverse types of motorcycle safety features have been developed to facilitate riding and control. The purpose of this section is to assess respondents' understanding of motorcycle safety. The study asked, "Are you aware of or familiar with motorbike safety features?" The survey featured a number of questions for which the responses were "Yes, No, or Uncertain". Figure 5 depicts a listing of responses about motorbike safety characteristics. The majority of respondents were aware of the ABS, traction control (TC), low-pressure tire indicator, combination brake (CB), and motorbike electronic stability control, as indicated by the results (ESC).

TABLE 4: Motorcycle ownership

Variables	N (%)
Motorcycle Ownership	
Yes	403 (99.3)
No	3 (0.7)
Types	
Standard/Underbone	281 (69.2)
Scooter	68 (16.7)
Big Bike (touring/naked/sport)	50 (12.3)
Others	7 (1.7)
Engine capacity (cc)	
<100cc	17 (4.2)
100 – 125cc	160 (39.4)
126 – 150cc	145 (35.7)
151- 250cc	51 (12.6)
>250cc	33 (8.1)
License status	
Full license	392 (96.6)
Unlicensed	14 (3.4)
Use of motorcycle	
Main mode of transport	224 (55.1)
Leisure & recreation	135 (33.3)
For working (delivery goods or food)	43 (10.6)
Others	4 (0.9)
Frequency of use	
Everyday	262 (64.5)
2-3 days per week	83 (20.4)
One a week	27 (6.7)
Others	34 (8.3)

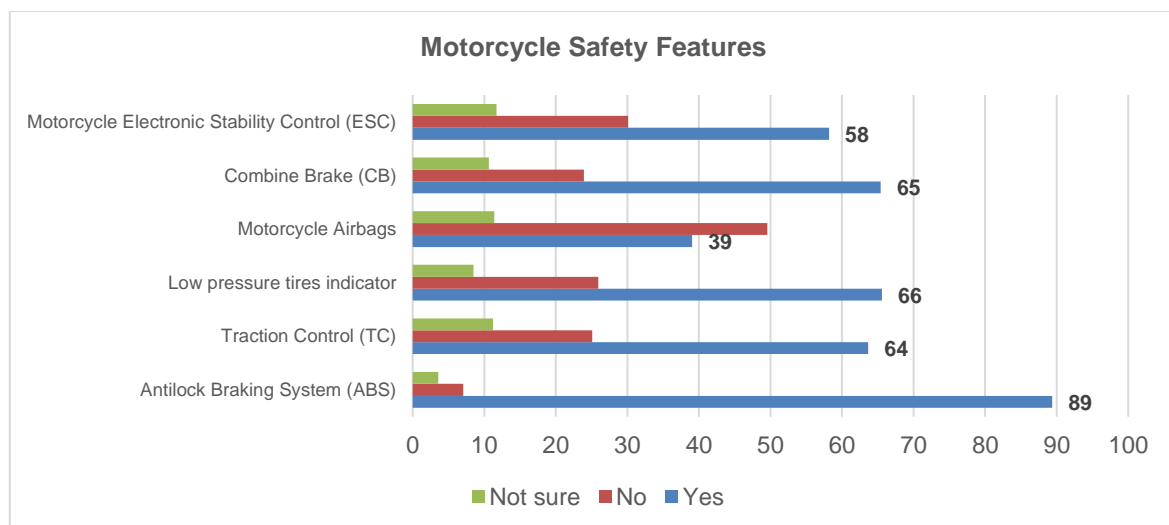


FIGURE 5: Respondents' knowledge of motorcycle safety features

6.1.3 Rider Opinion on Motorcycle ABS Technology

This section will cover the opinions of respondents on ABS technology for motorcycles in Malaysia. Multiple questions in the survey required a “Yes, No, or Uncertain” response. The data indicated that 75.4% of respondents did not have ABS on their motorcycles. In addition, when asked if they had experience with ABS braking while riding, the majority did not have any.

Eighty-two percent of respondents agreed that all motorcycles must be fitted with anti-lock braking systems (ABS). The majority of respondents (84.70%) also claimed to understand how ABS works. The majority of respondents also stated that ABS might minimize the danger of road accidents (85.2%), lower the risk of injuries or death in road accidents (77.8%), prevent the motorcycle from skidding (80.8%), prevent accidents (59.1%), and prevent the wheels from locking (86.6%). Nonetheless, they predicted that the installation of ABS would increase the cost of motorcycles by 83.5%. In response to the survey question, “Does your country have any ABS regulations?”, respondents determined that Malaysia had no ABS regulations. This study also found that most motorcyclists in Malaysia (94.3%) supported the introduction of the motorcycle ABS rule.

TABLE 5: Rider opinion on ABS technology

Statement	Yes	No	Not Sure
1. Does your motorcycle have Antilock Braking System technology (ABS)?	72 (17.7)	306 (75.4)	28 (6.9)
2. Have you experienced ABS while riding?	134 (33.0)	236 (58.1)	36 (8.9)
3. Do you know how ABS works?	344 (84.7)	33 (8.1)	29 (7.1)
4. Do you feel all motorcycles need to have ABS?	333 (82.0)	46 (11.3)	27 (6.7)
5. Do you feel the use of ABS can reduce the risk of road crashes?	346 (85.2)	29 (7.1)	31 (7.6)
6. Do you think the use of ABS is able to reduce the risk of injuries or death caused by road crashes?	316 (77.8)	44 (10.8)	46 (11.3)
7. ABS can prevent from skidding?	328 (80.8)	26 (6.4)	52 (12.8)
8. ABS can prevent from crash?	240 (59.1)	100 (24.6)	66 (16.3)
9. ABS is to prevent the wheels from locking?	353 (86.9)	18 (4.4)	35 (8.6)
10. Fitment of ABS will increase the price of motorcycle?	339 (83.5)	20 (4.9)	47 (11.6)
11. Does your country have any regulations on ABS?	19 (4.6)	352 (86.7)	35 (8.6)
12. Agree to regulate ABS?	383 (94.3)	17 (4.2)	6 (1.5)

As a first step in implementing the motorcycle ABS regulation in Malaysia, this study suggests posing the “4W” questions: who, what, when, and why. All motorcycle segments should be fitted with ABS if such a rule were to be enacted in the respondents’ nation. Figure 6 demonstrates that, on average, more than 75% of respondents felt that all motorcycles should be equipped with ABS.

The majority of respondents (83%) believe that the motorcycle ABS legislation should be adopted immediately or during the next five years, as shown in Figure 7. 2% of respondents believe that the regulation should be adopted within the next five to ten years. 15% of respondents were unsure as to when the motorbike ABS rule should be implemented in Malaysia.

When a new technology comes, the price of a motorcycle will undoubtedly be affected financially. The respondents were questioned regarding their readiness to pay for a newer motorcycle technology. Figure 8 demonstrates that 72 percent of respondents are ready to pay less than RM400 for the installation of ABS on a motorcycle.

The respondents also considered that motorcycles without ABS posed a greater risk in road crashes than those with ABS (Figure 9). Therefore, motorcycles should be equipped with ABS for this reason.

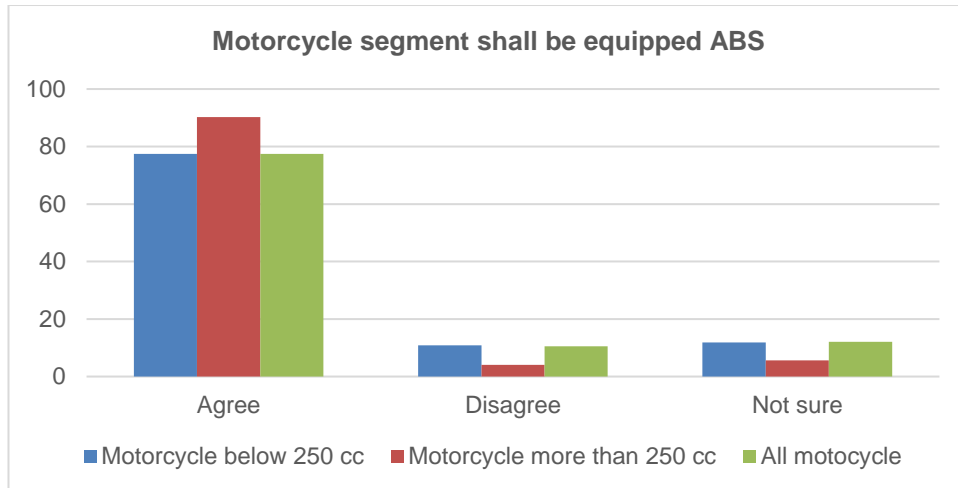


FIGURE 6: Where to implement ABS

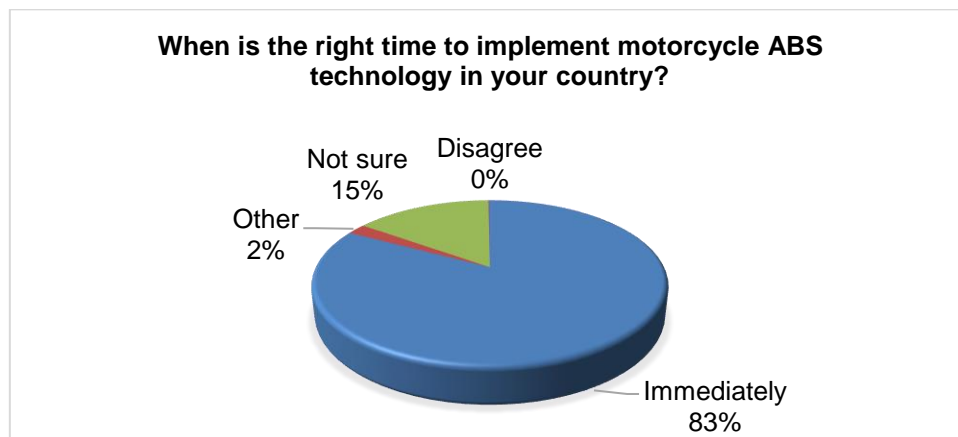


FIGURE 7: When to implement ABS



FIGURE 8: Price willing to pay

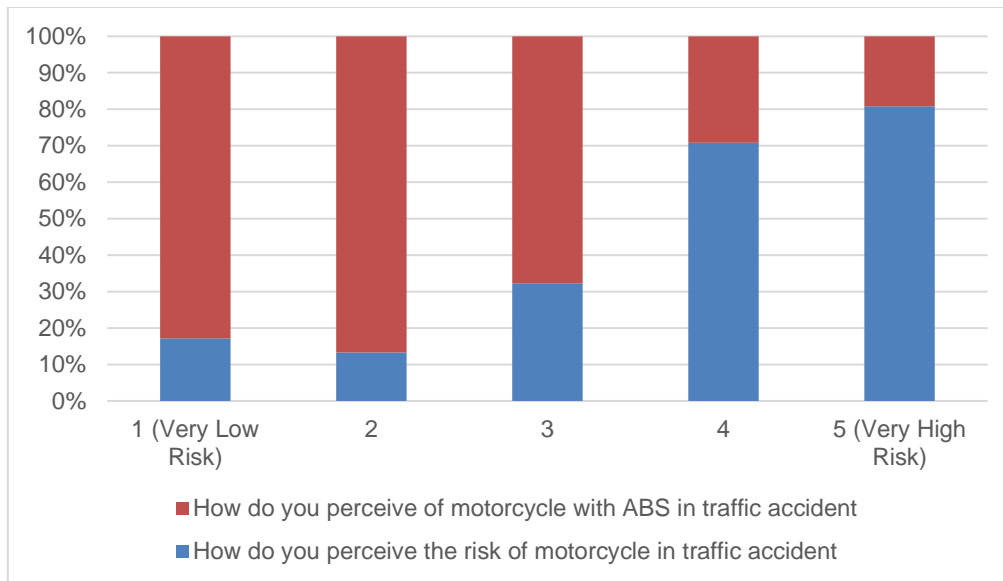


FIGURE 9: Respondents' perception of road crashes risk with and without ABS

6.2 Affordability – Cost of Motorcycle with ABS as Sold to Consumers

The typical consumer's budget motorcycle doesn't have nearly as many bells and whistles as a more expensive bike. Basic safety elements are thought to be necessary for all models, despite the fact that allowing differentiation between models and brands might increase the business aspect. In particular, the ABS has been identified as a potential problem. As a country with a wide range of climates, Malaysia is ideally suited to test the benefits of this technology.

It is acknowledged that extra expenses would be incurred for any vehicle that requires special equipment. MIROS did price comparison research of motorcycles with and without anti-lock braking systems (ABS) in several markets. Motorcycles with engine displacements of less than 200 cc were the focus of this research, and the outcomes are summarized in Table 6.

Based on the evidence provided, it appears that adding ABS by the manufacturer adds an extra 13%-22% to the price of a motorcycle. Whether or whether a consumer chooses to shell out the extra cash for the ABS model depends on their willingness and ability to do so, especially given the demographics of the market (in lower to middle-income countries). The question then becomes whether or not the price of these models with ABS can be further lowered to make them more accessible to people of varying financial levels. MIROS dug further, looking into how much it would cost to get the ABS module from the supplier to the motorcycle. It is displayed in Table 7 below.

According to a comprehensive investigation, the ABS module sold by the seller costs between MYR 300 and MYR 400, with an average of MYR 350 per unit. The motorcycle maker then purchases and integrates this into the vehicle's system. The final price would be between MYR 800 and MYR 1,500, with an average of MYR 1,150, or more than four times the original price sold by the vendor. It is acknowledged that the manufacturer incurs additional expenditures for assembly and labor upon purchase. Despite this, manufacturers have additional incentives, such as bulk purchase discounts, that could be explored to further reduce the price of the ABS model given. The price difference between when the module is purchased and when it is installed on a motorcycle has yet to be fully justified but given the importance of the ABS module in terms of road user safety, an agreement between manufacturers and regulatory bodies is highly recommended and best suited to help mandate this safety feature at an affordable price, which could reduce road user mortality in Malaysia.

TABLE 6: Cost comparison of motorcycles with and without ABS

Model	Price		Difference (RM)
	With ABS	Without ABS	
SYM VF3i 185cc	MYR 9,338	MYR 8,288	1,100
Yamaha NVX 155cc	MYR 10,998	MYR 8,998	2,000

TABLE 7: Cost difference of ABS module from the vendor to motorcycle fitted

	ABS Vendor	ABS Spare Part	Motorcycle Fitted (Reached Consumer)
Range	MYR 300 - 400	MYR 800 – 1,500	MYR 1,000 – 2,000
Average	MYR 350	MYR 1,150 (3 folds)	MYR 1,500 (4 folds)

7. CONCLUSION

The motorcycle market in the region is still expanding, and the demand for motorbikes in Malaysia is expected to remain high for the foreseeable future. The price aspect and size benefit of these motorcycles with modest engines mitigate the inherent dangers they represent. The ABS has been around for many years and is recognized for its ability to avoid motorcycle accidents. ABS-equipped motorcycles have been shown to reduce collisions by between 26-39%, according to previous research. Therefore, assuming the same effectiveness, it might save up to one thousand motorcyclists' lives in Malaysia.

The consumer demand study also revealed that awareness of ABS was the highest among respondents (90%) compared to other motorbike safety features. The respondents' knowledge, understanding, and confidence in ABS were positive, and over 80% of them supported mandating the use of motorcycle ABS in Malaysia. In addition, the majority want the regulation to be mandated as soon as possible.

On the other hand, MIROS and MARii have implemented the MyMAP program for all motorcycles in Malaysia, in the same spirit as ASEAN NCAP, with the intention that it will inspire manufacturers to incorporate additional safety aid technology into their motorcycles. In conclusion, based on the efficiency of ABS in preventing deaths and injuries, user awareness, understanding, and desire for ABS, as well as market readiness, Malaysia is able and prepared to mandate ABS for all bikes.

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