

Perspectives on Different Interlocks and Reminders to Promote Seat Belt Utilization among ASEAN Drivers

J. Karjanto^{*1,2}, N. J. Amran¹, L. H. Che Hussein¹, M. F. Ahmad^{1,2}, M. Z. Baharom³, A. F. H. Zulkifli⁴, M. A. Azizul^{1,2}, A. H. Ariffin⁵, M. S. Abdul Khalid⁵ and N. Borhan⁵

¹ Faculty of Mechanical Technology and Engineering, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

² Centre for Advanced Research on Energy, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

³ Faculty of Mechanical & Automotive Engineering Technology, Universiti Malaysia Pahang Al-Sultan Abdullah, 26600 Pekan, Pahang, Malaysia

⁴ Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia, 84600 Panchor, Johor, Malaysia

⁵ Malaysian Institute of Road Safety Research (MIROS), 43000 Kajang, Selangor, Malaysia

*Corresponding author: juffrizal@utem.edu.my

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ABSTRACT – This study examines drivers' views on various interlocks and seat belt reminders, intending to increase compliance and awareness in the ASEAN New Car Assessment Programme (NCAP). Questionnaires were distributed to a total of 1394 drivers from Malaysia (n=502), Indonesia (n=505), and Thailand (n=387). In total, five different extreme interlocks and six types of reminders were proposed, and the respondents' responses were analyzed. Key findings showed that Malaysians favored the interlock that prevents a vehicle from exceeding 25 km/h (32.5%), while Indonesians (49.1%) and Thais (36.4%) preferred the interlock that prevents the car from starting (switching on). Regarding the seat belt reminders, all three countries (Malaysia, Indonesia, and Thailand) agree (43.4%, 37.2%, and 30.7%) that a buzzer or chime is the most effective seat belt reminder to use in vehicles. This study highlights the importance of customized strategies to improve seat belt use, offering insights for policymakers and automotive manufacturers to address safety challenges specific to ASEAN drivers.

KEYWORDS: ASEAN, driver, interlock, seat belt reminder, types of reminders

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1. INTRODUCTION

Road traffic injuries are a major cause of death and serious injury worldwide, especially in ASEAN (Association of Southeast Asian Nations) countries. An estimated 1.19 million deaths occur annually, making traffic accidents one of the world's leading causes of mortality (Antona-Makoshi et al., 2023). Although many accidents and deaths happen, many drivers and passengers in ASEAN countries still do not consistently wear seatbelts (Isa et al., 2017; Kassim, 2020; Santosa et al., 2020).

Today's vehicles are increasingly incorporating advanced technologies designed to promote and ensure seatbelt use, such as automatic reminders and auditory alerts. These systems are now standard in many new car models, where they emit alarms or vibrate until the driver and passengers have fastened their seatbelts (Mohd Zaki et al., 2021). Kidd and O'Malley (2023) highlighted that persistent seatbelt reminder systems, especially those with continuous and long-lasting audible signals, can significantly increase seatbelt usage and potentially save lives by improving compliance rates. There is still limited understanding of how drivers in ASEAN countries feel about these safety features, particularly considering the unique cultural and economic backgrounds of these countries. The issue of seatbelt use remains a major concern in road safety, as many drivers continue to neglect this critical safety measure. Factors contributing to this neglect include overconfidence in driving abilities, discomfort associated with wearing seatbelts, and simple forgetfulness (Usman & Adebosin, 2024).

Research shows that these behaviors greatly increase the risk of serious injury or death in the event of an accident. For example, a study found that a significant percentage of drivers reported not wearing seatbelts because they lacked awareness of the severe consequences of unfastened seatbelts, highlighting a disconnect between knowledge and behavior (Topal et al., 2024).

In Malaysia, it is mandatory for everyone in a vehicle, including both drivers and passengers, to wear a seatbelt at all times (Ghaffari et al., 2020). One of Malaysia's main pillars of its road safety efforts has been the mandatory seatbelt regulation, which was first implemented in the 1970s. The rule, which initially applied only to front-seat passengers, was eventually extended to rear passengers in 2009. The country enforces a primary seatbelt law, meaning that law enforcement officers have the authority to stop vehicles and issue fines specifically if they notice that the driver or any passenger is not wearing a seatbelt (Ibrahim et al., 2021). This law is designed to ensure that seatbelt use is taken seriously, as it plays a crucial role in reducing the risk of injury or death in the event of an accident. Similarly, Indonesia enforces a primary seatbelt law that requires all occupants in a vehicle, including both drivers and passengers, to always wear seatbelts while the vehicle is in motion (Ghaffari et al., 2020). The prevailing law that governs road traffic regarding mandatory seatbelt use was enacted in 2009, where only the driver and the passenger in the front row are required to wear seatbelts during the road journey (Ariyanto et al., 2024). The primary seatbelt law reflects Indonesia's commitment to improving road safety and reducing the risk of serious injuries or fatalities in traffic accidents. By making seatbelt use a legal obligation for everyone in the vehicle, the law aims to instill safer habits among drivers and passengers, contributing to overall public awareness of the importance of seatbelts in preventing injuries during collisions. In Thailand, seatbelt usage has been mandatory for all vehicle occupants in front seats since 1979 under Section 123 (Sirikasemchai, 2020). However, the enforcement of this law has been less emphasized, especially in areas outside of major cities (Woldegebriel et al., 2019). Strengthening enforcement, particularly in areas with lower compliance, could help improve seatbelt usage in Thailand. In terms of fine structure or penalty, Malaysia enforces a higher compound fine compared to Indonesia and Thailand, with a fine of MYR 300 ($\approx$ USD 70) for failure to wear a seatbelt, and has been increased to MYR 2,000 and/or imprisonment of up to 1 year ($\sim$ USD 473) since 2009 (Ridzuan & Abd Rahman, 2018). In Indonesia, a fine up to Rp 250,000 ($\approx$ USD 16) or 1-month imprisonment is enforced, whereas in Thailand, a fine up to THB 2,000 ($\approx$ USD 55), is enforced for those who do not wear a seat belt as a driver or a front passenger (Sutanto et al., 2022).

To ensure compliance remains high, vehicle safety must be tested to gain the user's trust. The New Car Assessment Programme (NCAP) is one of the programs that tests new vehicles launched by the manufacturer to ensure their safety level meets the specific requirements. This study explores ASEAN drivers' views on in-car seatbelt technologies and intends to explore factors that influence their willingness to use these systems (Antona-Makoshi et al., 2023). By looking into these perspectives, the study aims to evaluate the best in-vehicle technologies for encouraging belt usage among ASEAN drivers. The findings could offer valuable insights on how to adapt these safety tools to meet ASEAN drivers' needs and encourage more people to use seatbelts, also helping reduce the number of serious injuries on the road.

2. METHODOLOGY

The methodology involves conducting a questionnaire based on those used in the previous study in the USA (Kidd et al., 2014). The questionnaire focuses on five types of interlock systems that act as preventive measures in vehicles, such as preventing the car from: 1. Cannot be switched on; 2. Gear is locked; 3. Prevent traveling > 25 km/h; 4. Prevent the use of the radio; 5. Gas throttle is difficult to push/use. The respondents chose whether they agreed or not with the approach. In addition, six (6) types of reminders were proposed: 1. Buzzer or chime; 2. Vibration feel to body; 3. Voice message; 4. Continuously lit light; 5. Text display; 6. Illuminated seat belt buckle. The respondents chose whether they agreed or not with the approach. Questionnaires were administered to a total of 1394 drivers from Malaysia ($n=502$), Indonesia ($n=505$), and Thailand ($n=387$). The questionnaires were available in English, Malaysian, Indonesian, and Thai languages to accommodate the different backgrounds of the respondents.

The chi-square test was used to check if the preferences for interlocks and reminders are significantly associated or not with countries. The null hypothesis is: There is no significant difference in public agreement/disagreement with the seat belt interlock system across the three countries, while the

alternative hypothesis is: Attitudes toward the interlock system vary by country, and country is a significant factor in the likelihood of agreement or disagreement. If any significant difference was found, the post-hoc analysis, in the form of pairwise comparison with Bonferroni correction ($\alpha/3 \approx 0.017$), was performed to further identify which specific countries contributed to the differences. Then, frequency analyses were conducted to identify which types of systems are most supported by the respondents from Malaysia, Indonesia, and Thailand.

3. RESULTS AND DISCUSSION

In terms of gender distribution, for Malaysian data, 76% of the respondents are male ($n=384$), while 24% are female ($n=118$). Whereas, for Indonesia, 71% of the respondents are male ($n=360$), while 29% of the respondents are female ($n=145$). For Thailand, 63% of respondents are male ($n=242$), while 37% are female ($n=145$). In terms of age distribution, the age groups are divided into three (3) groups: 18-29 as teenagers, 30-49 as middle-aged adults, and 50 years and above as the eldest. In the 18-29 age group, the highest number of respondents came from Indonesia ($n=415$), followed by Malaysia at 362. Thailand had the lowest number in this age range, with only ($n=92$). This shows that most of the younger participants in the survey are from Malaysia and Indonesia. In the 30-49 age group, Thailand recorded the highest number of respondents at 233, which is more than double the number from Malaysia ($n=98$) and much higher than Indonesia, which had only 53. This suggests that the middle-aged group in Thailand was more active in participating in the survey compared to the other two countries. For the 50 years and above group, the number of respondents is smaller in all countries, but again, Thailand had the highest ($n=61$), followed by Malaysia ($n=42$), and Indonesia with the lowest ($n=36$). The chart shows that Malaysia and Indonesia had a younger group of respondents, while Thailand had more participation from middle-aged and older individuals.

For all the proposed interlocks, the chi-square tests found that there were statistically significant differences in the distributions between the three countries ($p < 0.05$) (see Table 1). Therefore, the null hypothesis can be rejected. Further post-hoc analyses reveal that only Interlock 3 ($p = 0.23$) and 5 ($p = 0.74$) show no significant difference between Malaysian and Indonesian respondents. This means that Malaysian and Indonesian responses on interlocks 3 and 5 do not vary by country.

Frequency analyses were then used to determine which interlocks are more acceptable and practical for implementation in each country (see Figure 1).

TABLE 1: Chi-square test of homogeneity followed by pairwise comparison with Bonferroni correction for different types of interlocks

Type of Interlock	Chi-Square Test	Pairwise Comparison with Bonferroni Correction
1. Cannot be switched on	$\chi^2 = 112.77, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 43.04, p < 0.001$ Malaysia vs Thailand: $\chi^2 = 96.27, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 18.39, p < 0.001$
2. Gear is locked	$\chi^2 = 34.28, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 6.96, p < 0.001$ Malaysia vs Thailand: $\chi^2 = 33.06, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 11.43, p < 0.001$
3. Prevent traveling > 25 km/h	$\chi^2 = 28.04, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 1.44, p = 0.230^*$ Malaysia vs Thailand: $\chi^2 = 16.81, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 27.01, p < 0.001$
4. Prevent the use of radio	$\chi^2 = 173.78, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 25.61, p < 0.001$ Malaysia vs Thailand: $\chi^2 = 173.46, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 81.81, p < 0.001$
5. Gas throttle difficult to push/use	$\chi^2 = 67.90, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 0.11, p = 0.740^*$ Malaysia vs Thailand: $\chi^2 = 59.28, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 54.24, p < 0.001$

*Indicates NO significant difference

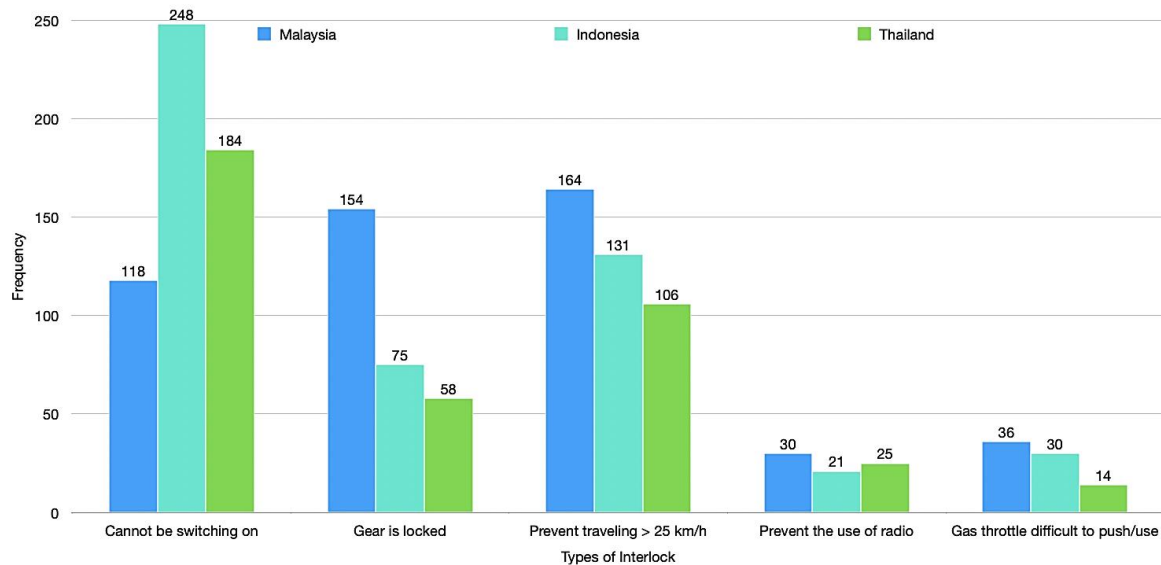


FIGURE 1: Frequency analyses for the five proposed interlocks for Malaysia, Indonesia and Thailand

Interlock 1 (Cannot be switched on) has been chosen as the preferred interlock among respondents in Indonesia and Thailand. It can be linked to rising awareness of seatbelt safety and the effectiveness of preventive enforcement to change risky behaviors. These countries have seen low seatbelt usage in rear seats and high rates of traffic injuries, making strict interlock systems appealing to enforce compliance and save lives (Sutanto et al., 2022). In contrast, the Malaysian preference for Interlock 3 (Prevent traveling > 25 km/h) indicates that Malaysians prefer a method that is not extreme enough compared to Indonesia and Thailand. This choice reflects a higher concern for enforcement during movement rather than at vehicle start, possibly influenced by local policies and public perceptions of when risky behaviour is most likely to occur (Dong et al., 2025).

For all the proposed types of reminders, the chi-square tests found that there were statistically significant differences in the distributions between the three countries ($p < 0.05$) (see Table 2). Therefore, the null hypothesis can be rejected. Further post-hoc analyses reveal that only Reminder 2 ($p = 0.790$), Reminder 4 ($p = 0.600$), Reminder 5 ($p = 0.540$), and Reminder 6 ($p = 0.071$), show no significant difference between Malaysian and Indonesian respondents. This means that Malaysian and Indonesian responses to these types of reminders do not vary by country.

Frequency analysis was carried out to understand the most preferred types of seat belt reminders among respondents from Malaysia, Indonesia, and Thailand (see Figure 2). The results show that a loud sound, such as a buzzer or chime, is the most popular reminder type for all three countries. It was selected by 43.4% of Malaysian respondents ($n=219$), 37.2% of Indonesian respondents ($n=188$), and 30.7% of Thai respondents ($n=155$). In Malaysia, Indonesia, and Thailand, the respondent chooses a buzzer or chime as their majority agreement, among other strategies. This may be linked to the strong emphasis on practical and non-intrusive reminders that are commonly integrated into existing systems, such as home alarms and school bells, reflecting a preference for sensory alerts that are effective (Asisi et al., 2022). The second most favored reminder type was a voice message, especially in Indonesia, where 35.6% ($n=180$) preferred this option. It was also supported by 24.8% ($n=125$) in Thailand and 22.6% ($n=114$) in Malaysia. This indicates a strong interest in voice-based alerts as an alternative or addition to basic sound cues. Other reminder types, such as vibrations, flashing lights, text displays, and illuminated seat belt buckles, were less popular across all countries. For example, physical vibrations were chosen by only 14.1% in Malaysia, 11.9% in Indonesia, and 10.3% in Thailand. The least preferred options were text displays and illuminated buckles, both receiving less than 5% support in each country.

Although the acoustic buzzer or chime is often described by respondents as “non-intrusive,” this interpretation appears somewhat paradoxical given that such signals are purposely designed to be persistent and attention-grabbing. Prior studies have shown that continuous or escalating auditory cues are among the most effective forms of seat belt reminders because they are difficult to ignore and

immediately demand the driver's attention (Fildes et al., 2003; Regan et al., 2008). However, the driver's preference for this type of reminder does not necessarily stem from its pleasantness or subtlety. Rather, it may reflect an acknowledgment of its effectiveness – that the buzzer/chime is a familiar, quick, and unmistakable signal that successfully prompts compliance without ambiguity. Unlike voice prompts, which may be perceived as intrusive or patronizing, or vibration feedback, which can be ambiguous or associated with system malfunction, the acoustic signal communicates urgency in a neutral and universally understood manner. In this sense, “non-intrusive” may be interpreted not as “quiet,” but as situationally acceptable – annoying enough to be effective, yet transient and easily silenced through compliance.

TABLE 2: Chi-square test of homogeneity followed by pairwise comparison with Bonferroni correction for different types of reminders

Type of Reminder	Chi-Square Test	Pairwise Comparison with Bonferroni Correction
1. Buzzer or chime	$\chi^2 = 66.98, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 6.77, p < 0.001$ Malaysia vs Thailand: $\chi^2 = 36.36, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 66.85, p < 0.001$
2. Vibration feel to body	$\chi^2 = 118.55, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 0.07, p = 0.790^*$ Malaysia vs Thailand: $\chi^2 = 102.16, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 96.73, p < 0.001$
3. Voice message	$\chi^2 = 28.04, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 10.81, p = 0.001$ Malaysia vs Thailand: $\chi^2 = 50.01, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 19.70, p < 0.001$
4. Continuously lit light	$\chi^2 = 173.78, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 0.28, p = 0.600^*$ Malaysia vs Thailand: $\chi^2 = 80.30, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 88.56, p < 0.001$
5. Text display	$\chi^2 = 67.90, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 0.38, p = 0.540^*$ Malaysia vs Thailand: $\chi^2 = 92.41, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 102.98, p < 0.001$
6. Illuminated seat belt buckle	$\chi^2 = 67.90, p < 0.001$	Malaysia vs Indonesia: $\chi^2 = 3.27, p = 0.071^*$ Malaysia vs Thailand: $\chi^2 = 113.92, p < 0.001$ Indonesia vs Thailand: $\chi^2 = 84.73, p < 0.001$

*Indicates NO significant difference

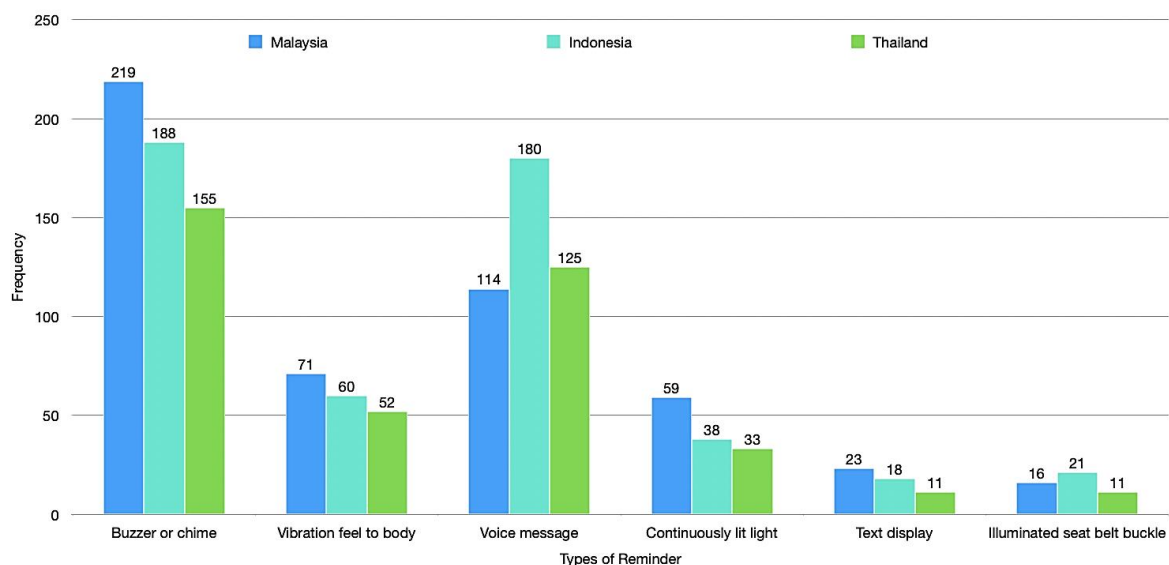


FIGURE 2: Frequency analyses for the six proposed reminders for Malaysia, Indonesia, and Thailand

4. CONCLUSION

The Seatbelt Reminder System (SBR) has been widely used in modern vehicles as a compulsory safety standard. It shows that among the three countries that have been studied, there is a significant difference in their perspective towards the safety system, especially the seat belt reminder system. There are a lot of prevention strategies that have been suggested to consumers. In addition, the NCAP program in various countries has developed very specific requirements for its assessment program. ASEAN drivers, especially in Malaysia, Indonesia, and Thailand, have shown various points of view regarding overly extreme prevention, types of seat belt reminders, and types of seat belt reminder strategies. By using chi-square statistical analysis, it is shown that people in the studied countries have different perspectives. Furthermore, based on the responses that have been gathered, it can be concluded that most of the respondents from Thailand and Indonesia choose Interlock 1 (prevent from switching on), and respondents from Malaysia choose Interlock 3 (prevent from travelling over 25 km/h). For types of seat belt reminders, all three countries chose buzzer or chime as their preference.

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