

Effectiveness of Seatbelts in Reducing Injuries and Deaths Among Express Bus**Passengers****Muhammad Bukhari Karia^a, Ahmad Khushairy Makhtar^{a, b}**^a Malaysia Institute of Transport (MITRANS), Universiti Teknologi MARA,
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Abstract: Passenger safety in express bus is an urgent concern in Malaysia as accidents continue to cause severe injuries and deaths. Seatbelts, long proven to reduce accident severity, are now required on all express bus following regulations introduced in July 2025. However, passenger compliance remains low despite the availability of seatbelts. This study examines the effectiveness of seatbelt use in reducing injuries and fatalities among express bus passengers. Using passenger questionnaires, on board observations, the research evaluates both safety outcomes and passenger behaviour. Findings reveal that wearing seatbelts significantly lowers the risk of serious injury or death, yet low awareness, comfort issues, and weak enforcement limit consistent use. The study underscores the need for targeted awareness campaigns, stricter regulation, and improved seatbelt design to enhance safety and save lives.

Keywords: *Express bus safety, Seatbelt effectiveness, Passenger compliance, Road accident prevention, Malaysia*

1. Introduction

Passenger safety on express bus has become an urgent issue in Malaysia as accidents involving long distance buses continue to cause serious injuries and fatalities. One of the main factors behind these outcomes is the lack of effective safety measures, particularly the limited use of seatbelts. Although seatbelts are widely recognized as one of the most effective devices for reducing injury and saving lives, their use in Malaysia has historically been emphasized only in private vehicles. Since the 1990s, seatbelt use in cars has been made compulsory, supported by enforcement and awareness campaigns that significantly improved compliance.

In contrast, express bus present a different picture. Despite many buses being equipped with seatbelts, most passengers do not use them, raising questions about the adequacy of current regulations. To strengthen safety, the Ministry of Transport Malaysia introduced a regulation effective July 1, 2025, requiring every express bus seat to be equipped with a seatbelt. This initiative is expected to lower the severity of injuries and fatalities in crashes and to raise overall confidence in public transport safety.

The purpose of this study is twofold: first, to assess the effectiveness of seatbelts in reducing injuries and deaths among express bus passengers; and second, to examine the reasons behind passengers' decisions to wear or not wear seatbelts. By analysing accident records, passenger surveys, and direct observations, this study contributes to a clearer understanding of passenger safety on express bus. Its findings will help identify areas where regulations, design improvements, and awareness strategies can be strengthened to reduce risks and promote safer travel.

2. Literature review**2.1 Introduction**

On 8 June 2025, a Universiti Pendidikan Sultan Idris (UPSI) student bus overturned in Gerik, Perak, resulting in 15 deaths and 30 injuries. This incident underscored the urgent need for improved bus passenger safety measures and highlighted the consequences of weak

compliance with seatbelt use in Malaysia. Malaysian research has shown consistently low compliance with rear seat seatbelt regulations and weak safety culture in public transport (Mohamed et al., 2011; Ng, Law, Wong, & Kulanthayan, 2013). Studies focusing on express bus further highlight low awareness of seatbelt design and limited passenger willingness to use available restraints (Ibrahim & Abdul Majid, 2020). Passenger perspectives reinforce concerns about safety standards in express bus services, pointing to systemic shortcomings in enforcement and operator level monitoring (Abdullah, Ali, & Wahab, 2020). This review synthesizes Malaysia-based studies to establish the foundation for assessing the effectiveness of seatbelts in reducing injuries among express bus passengers.

2.2 Effectiveness of Seatbelts in Reducing Injuries and Deaths (Malaysia evidence)

Direct Malaysian crash-effectiveness studies quantifying seatbelt injury reductions in buses are limited. However, national safety research establishes that seatbelts are critical to reducing occupant ejection and secondary impact injuries. A MIROS study documented that rear seatbelt availability and use are key to mitigating injury severity in crashes, though compliance remains low (MIROS, 2007). Ibrahim and Abdul Majid (2020) further argue that improved belt design and greater awareness in intercity buses would translate into measurable safety benefits. Collectively, Malaysian literature stresses the importance of seatbelt provision and compliance, while highlighting a lack of localized crash-outcome data for express buses.

2.3 Injuries and Deaths in Express Bus Accidents (Malaysia)

Studies of express bus safety in Malaysia emphasize the consequences of poor seatbelt use. Ibrahim and Abdul Majid (2020) found that many passengers perceive belts as uncomfortable or unnecessary, reducing actual use in practice. Passenger perspectives from express bus operations also reveal that safety incidents are linked to both driver behavior and lack of restraint use, compounding risks of serious injury in crashes (Abdullah et al., 2020). Without widespread compliance, injuries in bus crashes remain preventable but frequent.

2.4 Laws, Mandates, and Enforcement (Malaysia)

Enforcement is a consistent theme in Malaysian seatbelt literature. Mohamed et al. (2011) showed that perceptions of being monitored or fined strongly influenced wearing among rear passengers. Ng et al. (2013) similarly identified enforcement visibility and social context as predictors of compliance. Ridzuan, Ismail, Ismail, and Mat (2018) compared Malaysia's rear seatbelt policy to the United Kingdom's, showing that weak enforcement explains the country's lower compliance levels despite similar regulations. These findings suggest that for express bus, new legislative requirements must be matched with robust enforcement mechanisms to be effective.

2.5 Factors Influencing Seatbelt Use Among Passengers (Malaysia)

Malaysian studies consistently identify a mix of demographic, behavioral, and perceptual factors. Mohamed et al. (2011) found that younger males and those with lower education levels were less likely to wear belts, especially when they perceived enforcement as weak. Ng et al. (2013) reported that social norms (such as whether others around were belted) shaped usage behavior, while Ibrahim and Abdul Majid (2020) noted that comfort and belt design are particularly influential in express bus. Together, these studies highlight that cultural attitudes and usability issues, not just legislation, are central to compliance.

Table 1. Summary of Key Malaysian Studies on Seatbelt Use and Passenger Safety

Variable / Study focus	Operational definition / Key findings	Source
Seatbelt compliance among rear passengers	Compliance with seatbelt use is strongly influenced by enforcement visibility, perceived penalties, and perceived crash risk among Malaysian passengers.	Mohamed et al. (2011)
Social and behavioural influences on seatbelt use	Passenger behaviour is significantly affected by social norms and the behaviour of surrounding passengers, which shape individual willingness to comply.	Ng et al. (2013)
Seatbelt design awareness in express buses	Comfort, accessibility, and seatbelt design quality significantly influence passengers' willingness to use seatbelts during express bus journeys.	Ibrahim & Abdul Majid (2020)
Passenger safety perceptions in express bus operations	Weak operator monitoring and limited enforcement contribute to unsafe conditions and low safety compliance from the passengers' perspective.	Abdullah et al. (2020)
Rear seatbelt availability and injury severity	Availability and accessibility of rear seatbelts are directly associated with reduced injury severity during crashes in Malaysia.	MIROS (2007)
Policy enforcement comparison: Malaysia vs UK	Malaysia demonstrates significantly lower compliance with rear seatbelt laws compared to the UK due to weaker enforcement despite similar regulations.	Ridzuan et al. (2018)

Table 1 summarises key Malaysian studies related to seatbelt use, passenger behaviour, and express bus safety. The synthesis highlights consistent themes across the literature, particularly the roles of enforcement, social norms, seatbelt design, and operator practices in shaping passenger compliance. This review strengthens the theoretical foundation of the present study and clarifies how previous research informs the analysis and discussion.

3. Research Method

3.1 Research Design

The study employed a quantitative research design, combining survey questionnaires with direct observational data. The questionnaires captured passengers' self-reported seatbelt use and attitudes toward safety, while the observations provided real time compliance data on actual seatbelt usage during journeys.

The rationale for this dual design was to allow triangulation: while surveys reveal passengers' perceptions and intentions, observations confirm actual behaviour. This strengthens the validity of findings and provides a holistic understanding of compliance with seatbelt laws on express bus.

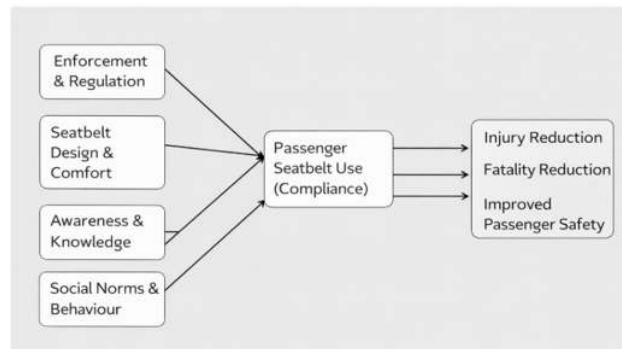


Figure 1. Conceptual framework of seatbelt compliance and passenger safety outcomes

3.2 Population and Sample

A total of 200 passengers were approached across multiple intercity routes at Terminal Amanjaya. Of these, 120 were eligible and consented to participate. Ultimately, 80 passengers completed questionnaires that were included in the final analysis (response rate: 66.7%).

Observational data were collected independently on five major operators: Nini Express, Sani Express, Stars Express, Kesatuan Express, and Aerobus. Routes covered included Ipoh–Kuala Lumpur, Ipoh–Alor Setar, Ipoh–Terengganu, and Ipoh–Johor Bahru, ensuring geographical diversity. Within each bus, front, middle, and back rows were observed to capture compliance variation. Special attention was given to children, elderly passengers, and pregnant women.

The population of the study comprised express bus passengers traveling across major intercity routes in Malaysia.

Survey sample: A total of approximately 80 passengers completed structured questionnaires, covering demographic details, frequency of travel, awareness of seatbelt laws, and willingness to comply.

Observation sample: Observations were conducted across different express bus operators including Nini Express, Stars Express, Aerobus, Kesatuan Express, and other major carriers. Journeys covered various routes such as Ipoh–Kuala Lumpur, Ipoh–Alor Setar, Ipoh–Terengganu, and Ipoh–Johor Bahru, ensuring geographical diversity.

Within each bus, different seating zones were included: front, middle, and back rows, to capture variations in compliance. Special attention was also paid to passenger categories such as children, elderly passengers, and pregnant women, since their compliance and safety concerns differ. This combination ensured a more representative dataset of passenger behaviour.

3.3 Research Instrument

3.3.1 Questionnaire

- i. Structured into sections on demographics, travel frequency, awareness of seatbelt laws, and compliance behavior.
- ii. Included both closed-ended questions and Likert-scale items.
- iii. Example: “How often do you fasten your seatbelt during an express bus journey?” (1 = Never, 5 = Always).

3.3.2 Observation Checklist

Observers recorded real-time passenger behavior before and during the journey using a standardized checklist. Checklist items included:

- i. Whether the seatbelt was visible and functional.
- ii. Seatbelt condition (clean, dirty, damaged, hidden under seat).
- iii. Whether signage or reminders were provided by the bus operator.
- iv. Passenger compliance by seat location (front, middle, back).
- v. Special categories (children sitting without belts, elderly, pregnant passengers).

The checklist also noted driver behavior, such as whether the driver wore a seatbelt and whether a safety announcement or reminder was given before departure.

3.4 Data Collection Procedures

Data were collected in two parallel streams:

Survey distribution: Questionnaires were distributed at major bus terminals and onboard journeys. Respondents were briefed about the study and confidentiality was assured.

Observation process: Trained enumerators boarded selected buses and silently recorded compliance using the Observation Checklist. Observations were conducted before departure and during the journey to capture both initial compliance and ongoing behaviour.

Enumerators avoided influencing passengers by remaining discreet.

In cases where permission was granted, photographic evidence was collected to document seatbelt conditions.

Observations were carried out across multiple dates and routes to reduce bias and capture variation across operators.

Table 2. Summary of Survey Questions and Reasoning

<i>Category</i>	<i>Example Questions</i>	<i>Purpose / Reasoning</i>
Travel Characteristics	Destination, trip duration, frequency of use, seat location	To identify how travel patterns may influence seatbelt use.
Seatbelt Use and Behaviour	Do you wear seatbelts during bus travel? How often? Reasons for non-use?	To measure compliance rates and understand barriers to usage.
Perceptions and Attitudes	Do you feel safer when wearing seatbelts? Is it easy to use?	To capture beliefs about effectiveness and usability.
Influencing Factors	Would stricter enforcement or reminders increase usage?	To assess external factors that could improve compliance.

3.5 Research Ethics

Ethical standards were strictly followed throughout the study. Respondents were informed about the purpose of the research, assured that participation was voluntary, and reminded that they could withdraw at any time without consequence. Consent was obtained prior to participation. Confidentiality was maintained by anonymizing all responses, and no personal identifying information was disclosed. The data collected were used exclusively for research purposes.

4. Results and Discussion

The study combined survey questionnaires from 80 passengers with direct observations of express bus departing from Ipoh to various destinations. This dual method approach provided a more comprehensive picture of compliance patterns. The surveys offered insights into passenger attitudes, self-reported practices, and motivations, while the observations revealed the reality of on-board behaviour. This combination allowed for meaningful comparisons between intention and practice, highlighting gaps that a single method might not capture. The alignment of both sets of data enhances the credibility of the findings.

4.1 Survey Results Overview

From the questionnaires, 45 % of passengers reported that they regularly used seatbelts during express bus journeys, while 55 % admitted to inconsistent use or no use at all. Although awareness levels were high—more than 80 % of respondents agreed with statements affirming that seatbelts reduce the risk of injury and death—this knowledge did not consistently translate into practice.



Figure 2 (Q9): Do you wear a seatbelt during bus travel



Figure 3 (Q10): Seatbelts Usage Frequency

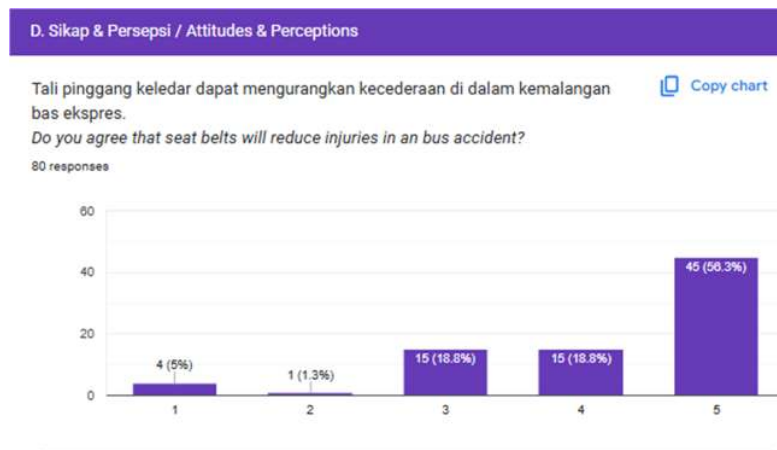


Figure 4 (Q16): Seatbelts reduce risk of injury



Figure 5 (Q17): Seatbelts are not necessary for short trips



Figure 6 (Q18): Seatbelts are important for passenger safety



Figure 7 (Q19): Seatbelts reduce risk of fatal injury

Table 3. Main reasons for non-use of seatbelts among express bus passengers (n=44 non-users)

<i>Reason</i>	<i>Description</i>	<i>% of non-users</i>
<i>Discomfort</i>	Wearing a seatbelt for several hours during long-distance travel felt restrictive; passengers reported difficulty reclining or sleeping.	60%
<i>Lack of enforcement</i>	Drivers/staff rarely reminded passengers to fasten seatbelts, and no follow-up occurred if passengers ignored signs.	50%
<i>Misconceptions</i>	Belief that seatbelts are unnecessary for short trips, or that bus size/weight makes them inherently safe.	40%

Table 2 summarises the main reasons reported by passengers for not wearing seatbelts during express bus journeys. Among the 44 respondents identified as non-users, the most common barrier was discomfort, with approximately 60% explaining that wearing a seatbelt for several hours during long-distance travel felt restrictive. Many noted that it limited their ability to recline or sleep, which are typical behaviours on overnight journeys. Lack of enforcement was the second most frequently cited factor, mentioned by about half of non-users. Passengers observed that while signage was present, drivers and bus staff rarely issued reminders and did not follow up when passengers failed to comply, which reinforced the perception that seatbelt use was optional rather than mandatory. Misconceptions also played an important role, with around 40% of respondents expressing the belief that seatbelts were unnecessary for short trips or assuming that the size and weight of buses made them inherently safer. This reflects a persistent knowledge gap, as unrestrained passengers remain at significant risk of injury even when the vehicle structure remains intact. Together, these findings suggest that non-use of seatbelts is driven not only by behavioural and attitudinal factors but also by structural issues such as comfort and weak enforcement practices.

4.2 Observation Findings

The observations on Nini Express, operating the Ipoh–Terengganu route, showed clear differences depending on seating location. All five passengers seated in the front rows were observed wearing seatbelts, but compliance dropped sharply toward the rear of the bus, where only one passenger remained buckled. This suggests that visibility near the driver encourages higher usage, while those seated further back feel less pressure to comply.



Figure 8: Nini Express observations images

On Stars Express, patterns varied by route. On the Ipoh–Alor Setar trip, four of the five passengers in the front rows were buckled, yet compliance fell in the middle section where only three of seven passengers wore seatbelts. The Ipoh–Kuala Lumpur service recorded the lowest overall usage: just one of six passengers in the front, two of ten in the middle, and one of eight at the back. These results indicate that on this route in particular, non-compliance was widespread across the bus, even in the most visible seating zones.



Figure 9: Nini Express observations images

Aerobus, serving the Ipoh–TBS–Shah Alam–Klang corridor, recorded the highest compliance among all operators. Every passenger observed in the front rows (10/10) and middle rows (8/8) wore seatbelts, although usage again fell at the rear, where only one of nine passengers complied. This pattern shows that while Aerobus passengers were generally more responsive to safety rules, rear-seat passengers still lagged behind.



Figure 10: Aerobus observations images

For Kesatuan Express, operating the Ipoh–Kuala Terengganu route, the picture was more mixed. Only one of three passengers in the front rows wore a seatbelt, yet compliance at the back was perfect, with all five passengers buckled. However, this appeared to result from active monitoring by bus staff rather than voluntary behaviour. The case illustrates how direct supervision can temporarily increase compliance, though it may not reflect genuine passenger attitudes.



Figure 11: Kesatuan Express observations images

Taken together, these findings demonstrate that seatbelt use is consistently higher in the front rows, declines in the middle, and is lowest at the back. They also highlight that operator practices, supervision, and social visibility strongly influence whether passengers choose to comply.

5. Conclusion

This study set out to examine the effectiveness of seatbelt use in reducing injuries and fatalities among express bus passengers in Malaysia, with a particular focus on the Terminal Amanjaya Express Bus Terminal in Ipoh. Drawing on evidence from the literature, accident records, survey responses from 80 passengers, and observational data collected from several bus operators, the findings reaffirm that seatbelts are among the most effective safety devices available for preventing severe outcomes in road accidents. Passengers who use seatbelts face a markedly lower risk of being ejected from their seats or sustaining critical injuries when collisions occur, even at moderate speeds.

At the same time, the study highlights the ongoing challenge of ensuring consistent compliance. Regulation by itself is insufficient. Although Malaysia introduced a regulation in July 2025 mandating seatbelts on all express bus seats, the impact of this measure remains limited by enforcement gaps, operator practices, and passenger behavior. Surveys and observations showed that many passengers continue to neglect seatbelt use due to reasons such as discomfort during long trips, the perception that buses are inherently safe because of their size, or simple complacency on familiar routes. These findings illustrate that legislation must be complemented by stronger enforcement mechanisms, public education, and cultural change to achieve widespread compliance.

Equally important are design and usability issues. Observational checklists revealed that in many cases seatbelts were hidden, twisted, or poorly maintained, making them inconvenient or unappealing to use. Passengers who wished to comply sometimes found it difficult to do so because of dirty or damaged equipment. This shows that safety cannot be achieved by

regulation alone it must also be supported by operator accountability, regular inspections, and technological improvements such as seatbelt reminder systems or improved ergonomics.

The findings carry broader implications for Malaysia's transport safety agenda. First, enforcement must shift from seasonal campaigns to sustained, visible monitoring at major terminals like Terminal Amanjaya in Ipoh. Second, operators must assume responsibility by conducting safety briefings, ensuring equipment functionality, and training drivers to reinforce compliance. Third, passenger education campaigns should emphasize that accidents can happen on both short and long trips, and that large vehicles are not automatically safe. Fourth, cultural norms must evolve so that wearing a seatbelt is seen not only as an individual precaution but also as a shared social responsibility.

Finally, the study demonstrates that improving seatbelt compliance among express bus passengers aligns with Malaysia's wider commitments under the National Road Safety Plan and the Sustainable Development Goals (SDGs). In particular, it contributes directly to SDG 3 (Good Health and Well-being) by reducing injuries and fatalities, and to SDG 11 (Sustainable Cities and Communities) by promoting safer, more sustainable transport systems.

In conclusion, the evidence presented here underscores the urgent need for a multi-pronged approach that combines legislation, enforcement, education, operator accountability, and design innovation. By addressing both behavioural and structural barriers, Malaysia can reduce preventable injuries, save lives, and strengthen public trust in its express bus system. If effectively implemented, these measures could position Malaysia as a regional example of how integrated strategies can transform road safety outcomes in the public transport sector.

6. Implications

The combined results underline that Malaysia's challenge is both structural and behavioural. Both surveyed intentions and observed practices point to systemic gaps that need to be addressed comprehensively.

6.1 Policy and Enforcement

Observations confirmed that even when safety signs were present, audio announcements and reminders were rare. Without consistent enforcement at Ipoh's Terminal Amanjaya and other hubs, passengers treat seatbelt laws as optional. Authorities must:

- i. Conduct random inspections onboard before departure.
- ii. Enforce penalties for non-functional seatbelts during PUSPAKOM checks.
- iii. Extend enforcement campaigns from seasonal operations into routine checks.

6.1.1 Operator Responsibility

Operators such as Nini Express, Sani Express, and Stars Express showed low compliance compared to Aerobus, which had nearly universal front and middle row use. This suggests that operator practices such as clean belts, reminders, and functional equipment directly influence compliance. Policies must require operators to:

- i. Maintain and repair buckles regularly.
- ii. Ensure belts are visible and accessible.
- iii. Train drivers to announce reminders before departure.

6.2 Passenger Behavior and Social Norms

Both surveys and observations confirmed that many passengers do not buckle up simply because others do not. To shift this norm, campaigns in Ipoh universities, terminals, and social media should emphasize that wearing a seatbelt is a shared responsibility, not just an individual choice.

6.3 Public Health and Safety Impact

The implications are stark: non-use of seatbelts, especially in the middle and back rows, leaves passengers at significantly higher risk of injury. Improving compliance could reduce fatalities by 30–40% in bus accidents, translating into dozens of lives saved annually. The presence of unrestrained children, elderly passengers, and pregnant women underscores the urgency.

6.4 Economic Costs

Observation checklists revealed defective belts, meaning operators face liability risks if accidents occur. By investing in better maintenance and compliance systems, bus companies can reduce accident-related medical costs, lawsuits, and insurance claims.

6.5 Cultural and Technological Change

Aerobus strong compliance rates demonstrate that improvement is possible with better operator practices. To replicate this across Malaysia:

- i. Drivers should model compliance by wearing their own belts, as noted in observations.
- ii. Install seatbelt reminder systems to alert passengers.
- iii. Use visual campaigns in Ipoh Amanjaya Terminal to normalize usage.

By addressing both survey and observation findings, Malaysia strengthens its commitment to the National Road Safety Plan and global commitments under the Sustainable Development Goals (SDGs). Specifically:

6.6 Final Implications

In essence, the study shows that awareness is not the issue—behaviour is. Achieving change requires:

- i. Stronger and consistent enforcement.
- ii. Greater operator responsibility for safety.
- iii. Addressing comfort and accessibility issues in seatbelt design.
- iv. Promoting cultural and social change through education.
- v. Exploring technological interventions.

Only by integrating these approaches can Malaysia move toward a culture where seatbelt use on express buses is automatic, universal, and unquestioned.

7. Research limitations

First, the analysis relied partly on self-reported data from passenger questionnaires. Such responses are vulnerable to social desirability tendencies, where participants may overstate their compliance with seatbelt use in order to appear more responsible. While observational data were included to complement the surveys, these observations were limited to a selection of trips and operators. It is therefore possible that the results do not fully reflect the diversity of passenger behavior across all routes, times of day, or types of journeys. For example, compliance on long-haul overnight trips might differ substantially from compliance on shorter, daytime trips, but this was not systematically captured.

Second, the study focused specifically on express buses departing from the Terminal Amanjaya in Ipoh. This site was chosen because of its high passenger volume, central role in interstate travel, and accessibility for researchers. However, the findings may not be generalizable to all terminals in Malaysia. Passenger demographics, operator practices, and enforcement patterns could vary significantly in other hubs such as Kuala Lumpur's Terminal Bersepadu Selatan (TBS), Penang's Sungai Nibong Terminal, or Johor Bahru's Larkin Sentral.

Conducting a multi-terminal or nationwide study would help to capture these variations and provide a more representative understanding of national compliance levels.

Third, the scope of this study was largely concentrated on passenger behavior and regulatory frameworks. Other factors that could strongly influence outcomes such as driver practices, vehicle maintenance, seating design, and emergency response readiness were not explored in depth. For instance, the way drivers enforce or remind passengers of seatbelt rules, or the structural design of bus seats and belts, could affect compliance and safety outcomes. Likewise, the effectiveness of post-crash emergency systems, including evacuation procedures, might also interact with seatbelt use in determining injury severity.

Finally, the study's timeframe and resources limited the amount of data collection possible. Observations were conducted only at selected intervals, and survey participation was capped at 80 respondents. While sufficient for preliminary analysis, larger sample sizes across longer periods would strengthen the statistical power of findings and reduce the likelihood of sampling bias.

These limitations suggest several avenues for future research. A multi-terminal, nationwide study could examine regional variations in seatbelt compliance and effectiveness, providing a broader evidence base for policymaking. Long-term studies that track compliance and accident outcomes over time, particularly before and after policy changes, would help to assess the long-term impact of regulations such as the July 2025 mandate. In addition, qualitative interviews with passengers, drivers, and enforcement officers could provide richer insights into the social and cultural factors shaping compliance. Expanding the dataset to include vehicle condition, driver enforcement practices, and emergency response measures would also give a more holistic understanding of how seatbelt use interacts with the wider safety ecosystem in Malaysia's public transportation sector.

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