

## Driving Instructors' Perceptions of Truck Crash Factors

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### ABSTRACT

Driving instructors are stakeholders who provide theoretical and applied training that aim to develop drivers' driving abilities either regular or commercial vehicles. The high number of truck crashes attract serious attention within the transportation stakeholder, especially among driving instructors from the enforcement department. This is due to lack of studies related to the perspective of driving instructors' especially crashes caused by heavy vehicles such as trucks. Thus, this study aims to determine the contributing factors of truck crashes from driving instructors' perspectives. A quantitative method was adopted using survey questionnaires to obtain insight views from the respondents. Purposive sampling was used to select the respondents who were 63 officers involved in the enforcement and training of the truck drivers at the driving institute. A simple descriptive analysis based on percentage frequency was used to analyse the feedback data. The majority of the respondents reported that factors contributing to truck crashes are the human behaviour factor due to driver's attitude. This is followed by the vehicle factors related to technical problems such as brake malfunction and bald tyre, whereas road infrastructure factors are due to weather (heavy rain) and poor road conditions. This study will serve as a reference and awareness to the truck companies from the security management perspective to prevent truck crashes from occurring inside and outside the company. Security managers may use the finding as a guideline to provide awareness and issue instructions to their employees to ensure they abide by the company rules and regulations.

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### 1. Introduction

Globally, road traffic injuries are a significant cause of deaths, with about 1.2 million deaths and total injuries could reach 50 million worldwide annually (Uddin & Huynh, 2018). Every year more than 6,000 people are killed in road crashes in Malaysia. Road traffic crashes are the eighth leading cause of death worldwide and also the leading cause of death for young people between the ages of 15 and 29 as reported by the global status report on road safety (WHO, 2004).

Heavy vehicle transport such as trucks is essential in Malaysia's transportation and logistics services. However, heavy vehicle crashes, risk of injuries and deaths still remain high (Hyun et al., 2019). Commercial vehicles also play an essential role as the backbone of transportation and logistics industries. Statistics reveal that 42,005 of road crashes involved trucks and buses (Ministry of Transport Malaysia, 2019).

Generally, road crashes associated with trucks resulted in death and severe injury rather than collisions between two passenger cars only. Truck crashes gained significant attention and concern from various stakeholders. There are many effects and consequences behind road incidents. Common injuries suffered by drivers and the other road

users involved in truck crashes are back and neck injuries; spinal cord injuries; head and brain injuries; burns, amputation and disfigurement; internal injuries, cuts, bruises, broken bones, and lacerations; and fatality (Peng et al., 2018).

According to the Department of Town and Country Planning Peninsular Malaysia, Ministry of Housing and Local Government (2012), in their guideline entitled "Guideline for the Heavy Vehicle Terminal Planning" defined heavy vehicles as a commercial vehicle or goods vehicle with weights in payload "Berat dalam muatan" (BDM) excess of 5,000 kilograms (5 tonnes). Heavy vehicle types were distinguished by the axle and load type goods that can be transported either liquid or non-liquid. By referring to the heavy restriction order of the "Federal Roads" amendment in 2003, Act 333, a heavy vehicle shall consist of two (2) categories: rigid body and articulated body. Summarise categories of heavy vehicles in Malaysia are shown in Table 1.

In Malaysia, the driving license classes depend on vehicles type and capacity. There are over 10 classes of vehicles as specified by the Road Transport Department of Malaysia. Truck drivers are required to have a class E and good driving license (GDL), a vocational license with a work-out in the event of driving a trailer. Table 2 explained the

list of driving license classes set by the Malaysian Road Transport Department for class E license.

**Table 1:** Categories of heavy vehicles (Source: Road Transport Department, 2019).

Type	Characteristics
Rigid body vehicle	<ul style="list-style-type: none"> <li>• Less than 1.5 tons of gross vehicle mass (GVW)</li> <li>• Exceed 1.5 tons of gross vehicle mass (GVW)</li> </ul>
Articulated vehicle	<ul style="list-style-type: none"> <li>• Minimum 3 axles (box trailer)</li> <li>• Minimum 3 axles (container trailers e.g. oil trailers, cement, wheat flour etc)</li> <li>• Minimum 3 axles (container on the frame)</li> </ul>

**Table 2:** List of driving license classes set by the Malaysian Road Transport Department for class E license (Source: Road Transport Department, 2019).

Class	Type of Vehicle
E	• Weightless motor (BTM) weights over 7,500 kg
E1	• Weightless motor (BTM) weights 7,500 kg
E2	• Weightless motor (BTM) weights more than 7,500 kg

The Road Safety Statistics Book published in 2019 stated that fatality involving truck crashes in Malaysia are 192 out of 6,284 cases (Road Transport Department, 2019). According to the book, about 1,000 cases from the fatality statistics were car occupants and motorcyclists involved in crashes with trucks. Large dimensions and heavy mass of heavy vehicles contribute to the different severity levels of impact towards other vehicles. Besides, heavy vehicles often move at a slower speed compared to other vehicles, therefore the speed difference between heavy vehicles and other vehicles can potentially cause rear-end collision.

Driving a larger vehicles like truck and commercial vehicle require knowledge, skill and ability to handle the manoeuvre of the large vehicles in a mix traffic condition. Driving lesson and training to handle the large vehicle for the drivers were first be taught by the driving instructors. Despite knowing that the driving instructor is among important resource in logistics system, study to consider view from driving instructor in identifying the factors contributing to truck crashes is still limited.

Thus, this research aims to determine the contributing factors of truck crashes from the driving instructors' perspectives to help driving instructors from the enforcement department develop drivers' driving abilities handling either regular or commercial vehicles. This study may help transport and logistics companies prevent truck crashes from occurring inside and outside of the companies.

## 2. Theoretical Framework: Factors Contributing to Trucks Crashes

### 2.1. Human Behaviour Factors

According to Zhou and Zhang (2019), the highest estimated factors caused by car, truck and motorcycle were by the careless driver behaviour. National Transportation Safety Board (NTSB) listed that safety factors identified concerning human behaviour were fatigue; driving under the influence of drugs and alcohol; and driver under medical fitness observation (Elshamly et al., 2017).

Furthermore, the impacts of driver behaviour on the severity of the trucks crashes are driver distraction, and emotional aspects was found to be associated with higher severity crashes (Zhu & Srinivasan, 2011). These factors can be mitigated by the self-awareness of the truck and truck drivers. Employers need to be more effective and strict in handy attitude issues related to truck drivers. Truck companies need to be more rigorous in truck drivers on the road. Employers should ensure that their employees received adequate rest during the working hour and employees are free from any dangerous medical conditions such as sleep apnea (Landay et al., 2020). Driver's mental and health condition are also contributing factor in truck crashes. A study by Elshamly et al. (2017) reviewed that more empathetic

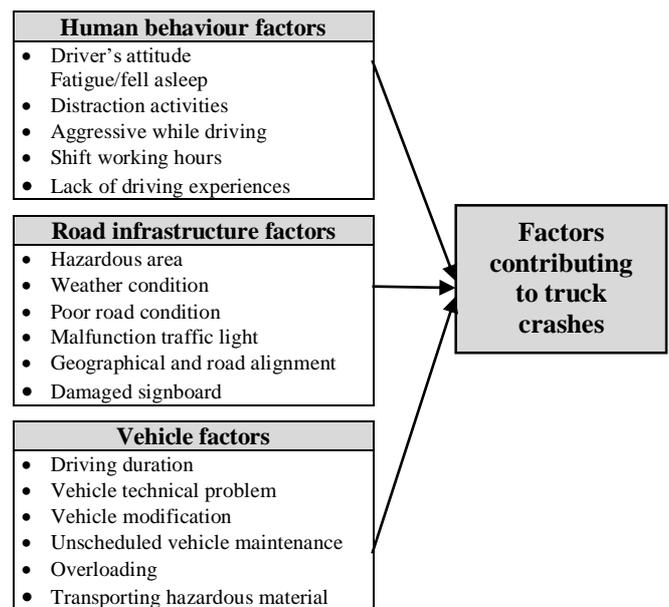
individual had lower rates of crash involvement rather than more anxious, guilt-prone, exhibitionistic, and risk-taking individuals.

### 2.2. Road Infrastructure Factors

Road infrastructure factors seem very much related to risk and impact the truck driver differently. Gothié (2006), discussed that most heavy good vehicle (HGV) crashes that caused fatalities and injuries appear on major local roads and motorways. This information was supported by Yuan et al., 2021, where the majority of crashes involving HGVs did not occur at junctions but occur on country roads. This situation is probably due to vehicles' speed when travelling on the expressway, compared to other road types (Hamidun et al., 2019). When travelling at a higher speed, HGVs with heavy mass would create big momentum. Thus, momentum energy will transform into a big impact if the HGVs collide with another vehicle, resulting in higher fatality occurrence. Other than that, environmental factors such as weather conditions affected the road surface e.g. snowing weather (Chen & Chen, 2011). Dark surrounding may also affect heavy vehicle crash where the rear-end collision usually happens at night- time (Zhu & Srinivasan, 2011).

### 2.3. Vehicle Factors

Based on a study conducted by Hasrat et al., (2018), most of the HGVs were manufactured in compliance with safety standard. However, there must be unavoidable mechanical damage involved which will cause crashes. One of the common mechanical system malfunctions is tyre braking system failure. This problem is one of the most common types of problems involving tyre explosions and worn-out tyres. Most investigations carried out on HGVs show that failure in maintaining tyre condition is a frequent cause of crashes. Tyre blowouts occur due to many reasons such as obsolete, low or too high tyres adjustment and punctured tyres by debris on the road. Tyre explosions can drastically reduce the ability to control heavy vehicles and resulting in crashes (Zhang et al., 2014). Moreover, worn-out tyres can lead to many problems as it will affect the tyre' grips, mainly on slippery roads, which will cause vehicles to skid and inertia (Behnood & Mannering, 2019). The theoretical framework applied in this research was illustrated in Figure 1 as follows:



**Figure 1:** Adapted theoretical framework from Hasrat et al., (2018), Hamidun et al., (2019), and Gray et al., (2020).

### 3. Research Methodology

#### 3.1. Research Methodology Framework

The flowchart of research methodology for this research is explained in Figure 2 as follows:

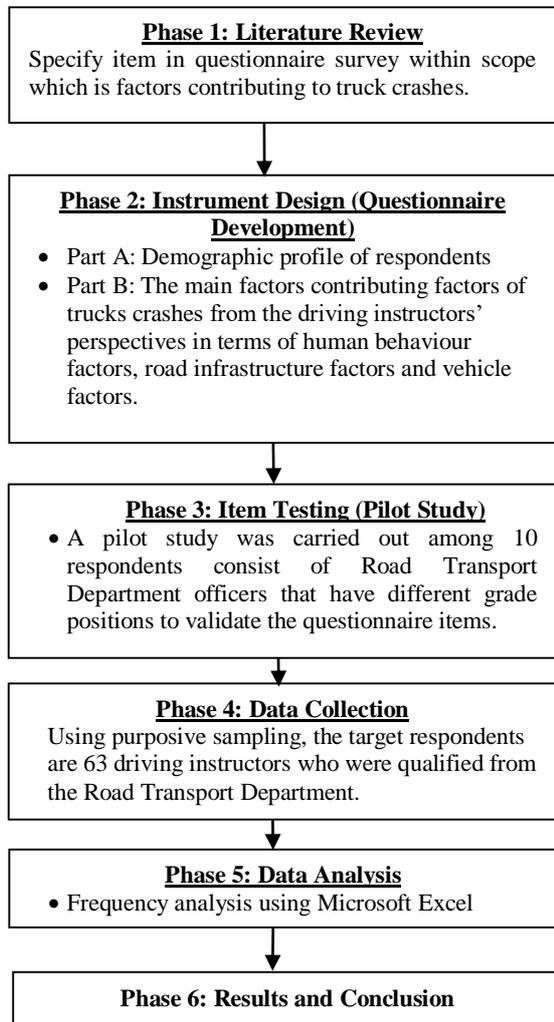


Figure 2: Research methodology framework.

This study began with collecting literature reviews for the theoretical framework constructs related to the significant factors contributing to truck crashes factors studied by other researchers, as shown in Table 3.

Table 3: Studies by other researchers

Factors contributing to truck crashes	Authors (s)
Human behaviour factors	Gray et al., (2020)
Road infrastructure factors	Hamidun et al., (2019)
Vehicle factors	Hasrat et al., (2018)

Secondary data were obtained by reviewing the literature review to adapt the theoretical framework in this study. This stage involves filtering the similarities and differences of the keywords, concepts, variables, elements, and factors in the area of heavy good vehicle safety to identify the research gaps in the past 5 years back literature (Baker, 2000). Literature review keywords search e.g. truck crashes factors, heavy good vehicle driver behaviour, heavy good vehicle roadways crashes, awareness of heavy good vehicle road safety, heavy

good vehicle road safety concept, public perceptions towards heavy good vehicle road safety were used in this research context.

#### 3.2. Target Respondents and Sampling Design

According to the National Transport Policy (2019 - 2030), policies will significantly impact a sustainable transport sector (Ministry of Transport, 2019). Policies will accelerate economic growth and supports the nation's well-being in line with an advanced nation status at the economic competitiveness, social elements, and environmental protection (Paradowska, 2019). There are three (3) principles of the policy vision, namely (i) Ensuring inclusivity and accessibility of transport services, (ii) Improving safety and security of transport services and (iii) Involving public participation or stakeholders engagement in the development of transport initiatives.

This research chooses driving instructors as the respondents due to data limitations in the Driving Licensing Division, Road Transport Department, Muar Branch, Malaysia, by referring to these policies. Results are expected to generate more discussion and action plans towards truck driver's safety in the department. The department can utilise it to improve and enhance the current situation of truck safety in the state.

Using purposive sampling, the total targeted respondents were 63 driving instructors who were qualified from the Road Transport Department. Purposive sampling was chosen in this research because of the driving instructor's expertise in planning and delivering lessons related to driving skills. Prior to administering the online questionnaire survey to the targeted respondents, a pilot study was carried out among 10 respondents of road transport department officers that have different grade positions to validate the questionnaire items. This sample size was calculated using the Raosoft sample size calculator using 5% of margin error and 95% confidence level. The equation of sample size is given as follows:

Equations

$$x = Z(c/100)2r(100-r) \tag{1}$$

$$n = N x / ((N-1)E^2 + x) \tag{2}$$

$$E = \text{Sqrt}[(N - n)x/n(N-1)] \tag{3}$$

Where N is the population size, r is the fraction of responses that research is interested to, and Z(c/100) is the critical value for the confidence level c. The sample size required for this study is only 62, and this study received 63 usable and completed questionnaires from the respondents.

#### 3.3. Instrument Design

A quantitative research approach using a survey was carried out using Google Form as a platform. The questionnaire design for this study was separated into two sections. Part A of the questionnaire section gathered the demographic profiles of respondents. In contrast, Part B asked respondents about the main factors of truck crashes from the driving instructors' perspectives regarding human behaviour, road infrastructure, and vehicle factors. The following shows main factors and sub-factors influencing truck crashes and descriptive codes in the questionnaire survey:

#### 3.4. Data Collection and Analysis

The theoretical framework constructs adapted in this research were obtained by reviewing the relevant literature review. A quantitative method using survey questionnaires administered to the respondents through an online platform using respondents' email address. Frequency analysis was used to determine the percentages based on the respondent's feedbacks for the given items. The result for each factor will be ranked from high to low percentage.

### 4. Results and Analysis

This section presents the analysis of results based on 63 respondents, their profiles and various factors contributing to truck crashes such as human behaviour, road infrastructure, and vehicle factors.

#### 4.1. Demographic Profiles of Respondents

There are limitations of study due to movement control order (MCO) in Malaysia during the data collection. Figure 3 shows that the majority of respondents (97%) for this study are male officers, and only a minority of female respondents (3%) responded to this survey. The profile of respondents based on working state department from various states in Malaysia is shown in Figure 4.

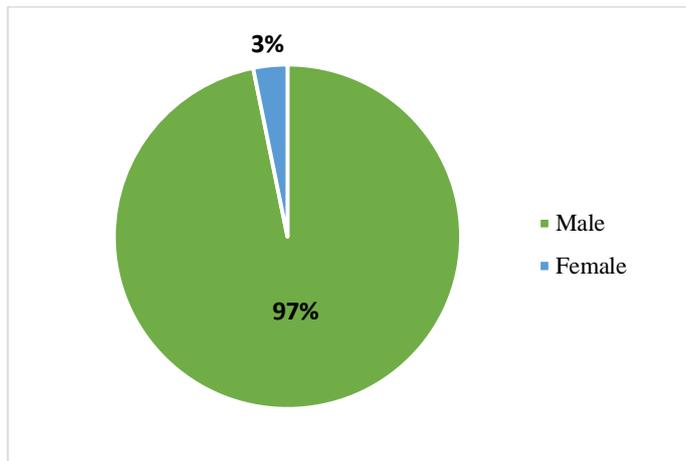


Figure 3: Profile of respondents based on gender.

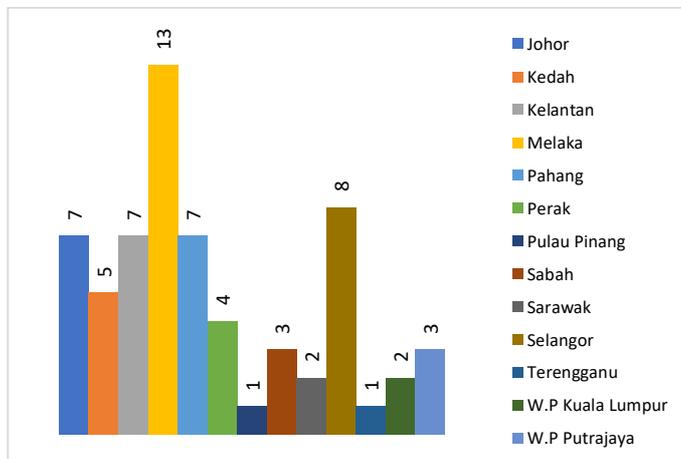


Figure 4: Profile of respondents based on working state department.

Figure 5 shows that almost half of respondents (49%) are road transport officers with a grade position of KP19 to KP28. Most of them are officers from the Driving Licensing Division, Road Transport Department in Malaysia.

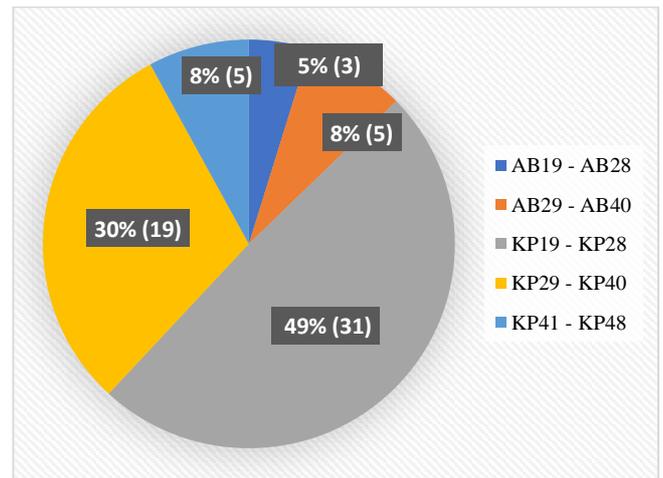


Figure 5: Profile of respondents based on grades.

#### 4.2. Factors Contributing to Truck Crashes

Table 4 shows the respondents' perspectives on the factors contributing to truck crashes. These factors are ranked based on the percentages of agreement level from the respondents (Yes answer) from high to low order sequence.

Table 4: Ranking of factors contributing to truck crashes.

Factor	Sub-factors	Yes	No	Rank
Human	Driver's attitude	100%	0%	1
	Lack of sleep/sleep while driving	90.5%	9.5%	2
	Distraction activities (eat while driving, smoking, mobile phone, DVD, talking, radio)	93.7%	6.3%	3
	Aggressive driving (speeding, self-overconfidence, drug used traffic offense)	93.7%	6.3%	4
	Working hours (shift pattern, overtime)	87.3%	12.7%	5
	Lack of training/driving experiences	85.7%	14.3%	6
Vehicle	Vehicle (brake and tyre technical problem)	96.8%	3.2%	1
	Over loading	96.8%	3.2%	2
	Lack of vehicle maintenance	95.2%	4.8%	3
	Driving duration (more than 4 hours)	93.7%	6.3%	4
	Transporting hazardous material	82.5%	17.5%	5
	Vehicle modifications without permission	65.1%	34.9%	6
Road	Hazardous area (road construction)	88.9%	11.1%	1
	Weather condition (heavy rain)	95.2%	4.8%	2
	Road condition (damaged roads)	93.7%	6.3%	3
	Malfunction traffic light	66.7%	33.3%	4
	Geographical factors (cross wind area)	63.5%	36.5%	5
	Damaged sign board	57.1%	42.9%	6

The result shows that human factors rank the highest contributing factor to truck crashes. Hundred percent (100%) of respondents agreed that driver's attitude is the main issue leading to truck accidents. The sequence of sub-factors that influence the truck crashes for human factors are (i) driver's attitude, (ii) distraction activities (eat while driving, smoking, mobile phone, DVD, talking, radio) and aggressive driving (speeding, self-overconfidence, drug used traffic offense) (93.7%), (iii) lack of sleep/sleep while driving (90.5%), (iv) working hours (shift pattern, overtime) (87.3%) and (v) lack of training/driving experiences (85%).

According to the respondents, the most agreed vehicle sub-factors from the perspective of road transport officer's are (i) vehicle technical problems (brake malfunction/bald tyre) and overloading (98.2%), (ii) lack of vehicle maintenance (95.2%), (iii) driving duration of more than 4 hours (93.7%), (iv) transporting hazardous material (82%), (v) vehicle modification without permission based on 100% tinted (65.1%).

While for the road infrastructure sub-factors, respondents indicated that (i) weather condition (heavy rain) (95.2%), (ii) road condition (damaged roads) (93.7%), (iii) hazardous area due to road construction (88.9%), (iv) malfunction of traffic light (66.7%), (v) geographical factors due to crosswind area (63.5%) and finally (vi) damaged signboard (57.1%) as the main sub-factors contributing to truck crashes.

#### 4.5. Respondents' Point of View

Figure 6 shows the respondents' point of view on reducing truck crashes. The majority of the respondents indicate that law enforcement must be carried out, followed by effective training. The enforcement and training are crucial to improve the driver/personal attitudes to reduce crashes involving heavy vehicles.

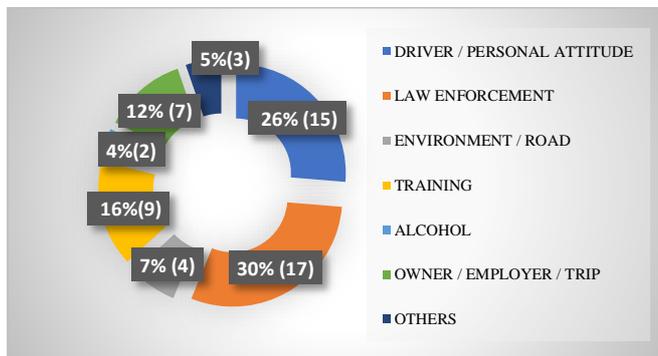


Figure 6: Respondent point of views.

## 5. Discussions

The respondents' background indicates that the majority were male, which is a common situation in the Malaysian setting where they are directly involved in the training and operations related to the truck drivers. They are responsible for conducting enforcement operations, preparing records and reports of operations and prosecutions, engaging with prosecutions witnesses cases from various states in Malaysia. Thus, based on their profiles, experience and job scope, their feedbacks are relevant and meaningful to achieve the objective of this study.

Overall, this study shows that the truck crashes main factors were human behaviour, precisely human attitude, distraction activities and aggressive driving, sleep deprivation, shift pattern, and lack of training and driving experiences. The previous study shows that the highest estimated factors caused by trucks were careless drivers (Zhou & Zhang, 2019). In addition, Zhu and Srinivasan (2011) highlighted that the driver behaviour factors such as driver distraction and emotional related aspects were associated with higher severity crashes of a truck. The second-ranking factor corresponds to technical issues such as

brake malfunction/bald tyre, overloading and lack of maintenance. A previous study by Hasrat et al., (2018) has shown that the common mechanical system malfunctions are tyre braking system failure in maintaining tyre conditions resulted in tyre explosions and worn-out tyres, consequently contributed mainly to the cause of truck crashes. The following high factors are road infrastructure and external factors related to the weather condition, damaged road, road construction, traffic light malfunction, and crosswind. This is in line with the previous studies that show environmental factors such as weather conditions affect the road surface and conditions (Chen & Chen, 2011).

Finally, this study provides the suggestion by the respondents to reduce the truck crashes in Malaysia, where the majority of them indicate that stricter law enforcement must be carried out in conjunction with effective training. The enforcement and training are crucial to improve the driver's personal attitudes and reduce the crash statistics involving heavy vehicles.

## 6. Conclusion and Recommendations

In summary, this study was carried out using an online survey to determine the factors contributing to truck crashes based on the insight views from 63 driving instructors involved in the enforcement and training of the drivers at the driving institute. Findings indicate that the human factor due to the driver's attitude contribute to the truck crashes in Malaysia. Second is the vehicle or technical factors such as brake malfunction/bald tyre, vehicle overloading followed by the infrastructure, or external factors such as damaged road and weather conditions. Respondents suggested that stricter law enforcement and effective training must be in place to improve the driver/personal attitudes to reduce truck crashes. This study is practical and has a significant contribution to serve as a reference to the truck companies from the security management point of view to prevent truck crashes occurring inside and outside of the company.

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## References

- Baker, M. J. (2000). Writing a literature review. *The Marketing Review*, 1, 219–247. Retrieved from <https://doi.org/10.1362/1469347002529189>
- Behnood, A., & Mannering, F. (2019). Time-of-day variations and temporal instability of factors affecting injury severities in large-truck crashes. *Analytic Methods in Accident Research*, 23, 100102. Retrieved from <https://doi.org/10.1016/j.amar.2019.100102>
- Chen, F., & Chen, S. (2011). Injury severities of truck drivers in single- and multi-vehicle accidents on rural highways. *Accident Analysis and Prevention*, 43(5), 1677–1688. Retrieved from <https://doi.org/10.1016/j.aap.2011.03.026>
- Ministry of Housing and Local Government. (2012). *Guideline for the heavy vehicle terminal planning*.
- Elshamly, A. F., El-Hakim, R. A., & Afify, H. A. (2017). Factors Affecting accidents risks among truck drivers in Egypt. *MATEC Web of Conferences*, 124, 10–14. Retrieved from <https://doi.org/10.1051/mateconf/201712404009>
- Gothié, M. (2006). *Heavy vehicle accident factors*. France: Laboratoire Régional de Lyon, CETE de Lyon.
- Gray, Ritter & Graham, P.C (2020) "Human Factors and Serious Truck Accidents" Retrieved from <https://www.grgpc.com/human-factors-serious-truck-accidents/> retrieved on 30 November 2020

- Hamidun, R., Wah Hoong, A. P., Roslan, A., Shabadin, A., & Jamil, H. (2019). Characteristics of heavy goods vehicles (HGV) accidents in Malaysia. *IOP Conference Series: Materials Science and Engineering*, 512(1). Retrieved from <https://doi.org/10.1088/1757-899X/512/1/012021>
- Hasrat, M., Adie, M., Ally, A., Balqis, N., Amalina, N., Hasrat, M.,... Muzlan, N. (n.d.). *Case study – Heavy vehicles accident in Malaysia*.
- Hyun, K. (Kate), Jeong, K., Tok, A., & Ritchie, S. G. (2019). Assessing crash risk considering vehicle interactions with trucks using point detector data. *Accident Analysis and Prevention*, 130(July 2016), 75–83. Retrieved from <https://doi.org/10.1016/j.aap.2018.03.002>
- Landay, K., Wood, D., Harms, P. D., Ferrell, B., & Nambisan, S. (2020). Relationships between personality facets and accident involvement among truck drivers. *Journal of Research in Personality*, 84, 103889. Retrieved from <https://doi.org/10.1016/j.jrp.2019.103889>
- Ministry of Transport. (2019). *National transport policy 2019 - 2030*. Retrieved from [https://www.pmo.gov.my/wp-content/uploads/2019/10/National-Transport-Policy2019\\_2030EN.pdf](https://www.pmo.gov.my/wp-content/uploads/2019/10/National-Transport-Policy2019_2030EN.pdf)
- Paradowska, M. (2019). Rivalry, excludability and positive transport externalities – Case study of a private university in Poland. *International Journal of Sustainability in Higher Education*, 20(7), 1290–1312. Retrieved from <https://doi.org/10.1108/IJSHE-10-2018-0187>
- Peng, Y., Wang, X., Peng, S., Huang, H., Tian, G., & Jia, H. (2018). Investigation on the injuries of drivers and copilots in rear-end crashes between trucks based on real world accident data in China. *Future Generation Computer Systems*, 86, 1251–1258. Retrieved from <https://doi.org/10.1016/j.future.2017.07.065>
- Road Transport Department. (2019). *Road safety statistics book*. Malaysia.
- Uddin, M., & Huynh, N. (2018). Factors influencing injury severity of crashes involving HAZMAT trucks. *International Journal of Transportation Science and Technology*, 7(1), 1–9. Retrieved from <https://doi.org/10.1016/j.ijst.2017.06.004>
- Yuan, Y., Yang, M., Guo, Y., Rasouli, S., Gan, Z., & Ren, Y. (2021). Risk factors associated with truck-involved fatal crash severity: Analyzing their impact for different groups of truck drivers. *Journal of Safety Research*, 76, 154–165. Retrieved from <https://doi.org/10.1016/j.jsr.2020.12.012>
- Zhang, M., Kecojovic, V., & Komljenovic, D. (2014). Investigation of haul truck-related fatal accidents in surface mining using fault tree analysis. *Safety Science*, 65, 106–117. Retrieved from <https://doi.org/10.1016/j.ssci.2014.01.005>
- Zhou, T., & Zhang, J. (2019). Analysis of commercial truck drivers' potentially dangerous driving behaviors based on 11-month digital tachograph data and multilevel modeling approach. *Accident, Analysis and Prevention*, 132(1), 105256. Retrieved from [https://www.researchgate.net/publication/335922377\\_Analysis\\_of\\_commercial\\_truck\\_drivers'\\_potentially\\_dangerous\\_driving\\_behaviors\\_based\\_on\\_11month\\_digital\\_tachograph\\_data\\_and\\_multilevel\\_modeling\\_approach](https://www.researchgate.net/publication/335922377_Analysis_of_commercial_truck_drivers'_potentially_dangerous_driving_behaviors_based_on_11month_digital_tachograph_data_and_multilevel_modeling_approach)
- Zhu, X., & Srinivasan, S. (2011). A comprehensive analysis of factors influencing the injury severity of large-truck crashes. *Accident Analysis and Prevention*, 43(1), 49–57. Retrieved from <https://doi.org/10.1016/j.aap.2010.07.007>