Case study

Analysis Factor of Noise, Bus Conditions, and Unsafe Actions on Accident Incidents at Mangkang and Pengaron Terminal, Semarang-IndonesiaCase study : Analysis of Noise Level, Vehicle Condition and Unsafe Action on Accident Incidents of Bus Drivers at the Bus Station in Semarang City – Indonesia

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ABSTRACT

Objective and Background:- aA traffic accident is an unexpected incident on the highway involving a vehicle with or without other road users that results in casualties or property loss. the bus station is a place to regulate the arrival and departure of inter-city and inter-provincial routes. The purpose of this study was to analyze the additional workload, vehicle conditions, and unsafe actions in the event of an accident. **Methods**: This type of research used a quantitative approach with a cross sectional study design. The population in this study were inter-city inter-provincial (AKDP) and inter-city within the province (AKDP) bus drivers with a study sample of 64 respondents in Mangkang and Penggaron bus station. The sampling technique uses accidental sampling. The research instrument was a questionnaire and it was processed using the Spearman rank test. **Results:** the results showed that there was no relationship between psychological conditions (p = 0.695), ergonomics (p = 0.994) with the incidence of bus driver accidents. However, there is a relationship between noise levels (p = 0.43), vehicle conditions (p = 0.002), unsafe actions (p = 0.025) and the incidence of bus driver accidents. **Conclusion**: Buses that enter Mangkang and Penggaron bus station, are required to follow the occupational safety and health (K3) regulations stipulated by local transportation regulations. Especially for economy class bus drivers, they must continue to carry passengers according to the capacity of their bus, so they can avoid dangerous incidents.

Keywords: Noise level, Vehicle condition, Unsafe action, Bus driver accident

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Traffic safety is an issue that has not received the attention it deserves and it is indeed our one great opportunity to save lives around the world. The Global Status Report on Road Safety states that road traffic accidents are now the eighth leading cause of death in the world. The number of road traffic fatalities has continued to increase, reaching 1.35 million in 2016. (1)

The Traffic accidents and deaths that occur in Indonesia have become serious problems, an average of 3 (three) people die every hour, due to road accidents. The data stated that a large number of accidents was caused by several things, including 61% of accidents caused by human factors, namely related to the ability and character of the driver, 9% due to vehicle factors (related to meeting roadworthy vehicle requirements) and 30% caused, by infrastructure and environmental factors . (2). Bus drivers with intercity, interprovincial and intercity within province routes play a very important role in terms of passenger safety, often drivers drive more than 4 hours or have busy, high-intensity routes and are at risk of traffic accidents.~~Inter-city, inter-provincial (AKAP) and inter-city within province (AKDP) bus drivers play a very important role in terms of passenger safety, often drivers drive more than 4 hours or have busy and high-intensity routes so they are at risk of experiencing a traffic accident.~~ (3) (4). Bus drivers with intercity routes play a very important role in terms of passenger safety, therefore bus drivers must always be in good stamina, often drivers drive more than 4 hours or have long, congested, high-intensity routes so they are at risk of of traffic accidents. (5).

Traffic noise factor has become one of the environmental issues in urban areas, bus noise intensity is 95.3–121.0 dB, trucks 110–117.6 dB, mini trucks 101.6–110.1 dB, motorbikes 99.8–107.3 dB, taxi 94.8–102.4 dB, minibus 90-100.5 dB, cars 85–92.3 dB, Jeeps 87.6–91.2 dB. Long-term exposure to noise intensity to drivers can cause physical and psychological discomfort which can result in traffic accidents (6). The noise level on the road can reach 70–80 dB, the train line 90 dB, and along the aircraft take-off line, it can reach 110 dB. Health problems caused by noise, namely disorders of the hearing and digestive systems, stress, headaches, increased blood pressure and decreased work performance (7). The human error factor has the potential to cause work accidents. unsafe behavior is violations committed by workers while carrying out their work, resulting in a situation that supports the occurrence of work accidents (8). The bus condition factor is a factor that has an influence on the occurrence of traffic accidents. Bus that undergo regular maintenance will

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create a sense of security and comfort for the driver and passengers. The physical condition and the bus engine which includes brakes, tires, rearview mirrors, main lights, sign lights, and so on will also affect the occurrence of traffic accidents. (9)

Initial observations made by researchers, at Penggaron Terminal there are 96 buses operating, while at Mangkang Terminal there are 80 buses and there are still many intercity and inter-provincial bus drivers detected, including Semarang-Surabaya, Semarang-Solo, Semarang-Jogjakarta, and other bus majors. , doing unsafe actions such as not using seat belts, using cellphones when driving the bus, carrying loads and passengers exceeding the limit, buses traveling at high speed, not equipping them with safety equipment such as light fire extinguishers, and the wrong position of the bus driver while driving.

Based on the description, a study was conducted with the title "Analysis of Noise Levels, Vehicle Conditions and Unsafe Actions Against Bus Driver Accidents at the Semarang-Indonesia City Bus Terminal.~~Based on the description above, a research was conducted with the title "Analysis of Additional Workload, Vehicle Conditions, and Unsafe Actions in Work Accidents on Bus Drivers at the Bus Terminal in Semarang City~~",

RESEARCH METHODS

The type of research used is descriptive research, which is to explain the actual conditions under study. The method used in this study is an analytic observational method with a cross-sectional approach, namely the data obtained directly during the study. (12) (13) The population taken in this study were the Inter-City, Inter-Provincial (AKAP) and Inter-City Within Province (AKDP) bus drivers in Mangkang and Penggaron Terminal (Bus Station). The technique used in data collection is accidental sampling, ~~accidental sampling~~. The samples used in this study were 64 bus drivers.

RESULTS AND DISCUSSION

Based on the transportation sector, the city of Semarang is a strategic location because it is located between West Java province and East Java province and is at the midpoint of the northern coastline of the island of Java from Jakarta to Surabaya. Semarang city is also located on the main connecting line node between the north coast route and the south coast route, namely the Semarang and Yogyakarta/Surakarta routes. The advantage of this location means that the city of Semarang will continue to develop in the field of services and

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distribution as well as become a gateway to other areas on the island of Java. This needs to be supported by a good transportation system. Semarang city currently has 2 main bus terminals, namely the Mangkang terminal and the Penggaron terminal. Each terminal has a different number of passengers and bus capacity. Mangkang Terminal is a bus terminal that serves city transportation routes, border transportation, Trans Semarang, Trans Java Central, and inter-city transportation (14) while the Penggaron terminal is a bus terminal located at the western end of Semarang city bordering Demak regency, more precisely located in Penggaron Kidul. Pedurungan, Semarang. Penggaron terminal serves city transportation routes, border transportation, Trans Semarang, and inter-city transportation (15). The two terminals are the largest terminals owned by the Central Java Provincial Government and are strategic bus terminals in regulating the entry and exit of bus traffic to the city of Semarang. The independent variables used in this study were noise, psychological factors, vehicle conditions, and unsafe actions, while the dependent variable used in this study was traffic accidents. This is because according to the domino theory the biggest cause of accidents is due to unsafe actions, then unsafe conditions and the rest is caused by unexpected factors, including noise and bad bus conditions, therefore it needs to be corrected. (16)

Based on the research results, the following data were obtained:

1. The Relationship Between Noise Level and Accidents

Table 1. The Accident Distribution Based on Noise Level

No	Noise Level	Bus driver accident				Total		R	P-*value*
		Low		High					
		N	%	N	%	N	%		
1	Low	10	34,5	19	65,5	29	45,3		
2	High	21	60	14	40	35	54,7	-0,254	0,043
	Total	31	48,4	33	51,6	64	100		

The results of the analysis using the Spearman rank test show that the relationship between noise levels and the incidence of bus driver accidents in this study obtained a p-value of 0.043 with a value of R -0.254, meaning that there is a relationship between noise levels and bus driver accidents and the higher the noise level, then the likelihood of having an accident risk will increase - 0.254 times compared to a low noise level (the risk of accidents is getting worse)

Noise is sound whose presence is undesirable that comes from production process tools or work tools which at a certain level can cause hearing loss. (17). Noise in occupational health is defined as sound that can reduce hearing both quantitatively (increased

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hearing threshold) and qualitatively (hearing spectrum narrowing) which is related to a certain intensity, frequency, duration, and time patterns. (18), (25). Noise is a problem that until now has not been handled properly because it is one of the neglected factors in the work environment so that it can become a serious threat to bus drivers which can cause various disturbances, such as physiological, psychological, and communication disorders and can increase the risk of accidents.(19). Research on symptoms of nervous system-related disorders in workers exposed to work noise and vibration in Korea shows that job exposure to vibration and noise is related to Nervous System Related Symptoms (NSRS) and these symptoms can lead to the risk of work accidents. (20). The ergonomic work analysis of bus drivers in the private collective transport sector shows that the largest number of complaints related to noise can cause work accidents (21). Noise factors that are exposed for long periods of time to bus drivers cause risky psychological impacts, which can affect overall road safety.(22)

Noise above 80 dB can cause restlessness, malaise, tiredness of hearing, stomach pain, and circulatory problems. Excessive and prolonged noise is detrimental to the efficiency and concentration of bus drivers.(23)

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2. The relationship between the psychological condition of the bus driver and the accident

Table 2. The relationship between the psychological condition of the bus driver and the accident

No	Psychological Conditions	Bus driver accident				Total		R	P-*value*
		Low		High					
		N	%	N	%	N	%		
1	Low	8	44,4	10	55,6	18	28,1		
2	High	23	50	23	50	46	71,9	-0,05	0,695
	Total	31	48,4	33	51,6	64	100		

The results of the analysis using the Spearman rank test show that the relationship between psychological conditions and bus driver accidents in this study obtained p-value = 0.695 with a value of R = -0.050, meaning that there is no relationship between psychological conditions and bus driver accidents and the better the psychological condition bus drivers, then the possibility of experiencing an accident risk will be reduced

Bus accidents can be caused due to the bad psychological condition of the bus driver, resulting in a loss of concentration while driving. Psychological disorders of bus drivers cause

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aggressive behavior while driving, this is because aggressive driving behavior is behavior that manifests itself as an action that is disturbing and directed towards others. (24). These behaviors can be unsettling because they can also put other drivers at risk, such as excessive speed, getting in and out of lanes, and walking past red lights, all of which are at risk of causing traffic accidents. (25)

This study shows that there is no relationship between psychological conditions and accidents, this is because the bus driver respondent has a good psychological condition. Emotionally mature bus drivers tend to behave less deviantly, one of which is driving aggressively, the more mature the bus driver's psychological condition, the lower the aggressiveness. When the psychological condition of a bus driver is mature, he can control himself, his behavior will also be in accordance with the existing norms and rules so that the level of driving aggressiveness can be suppressed. (26)

3. The relationship between ergonomics and accidents

Table 3. Distribution of accidents by ergonomics

No	Ergonomics	Bus driver accident				Total		R	P-*value*
		Low		High					
		N	%	N	%	N	%		
1	Low	15	48,4	16	51,6	31	48,4		
2	High	16	48,5	17	51,5	33	51,6	-0,001	0,994
Total		31	48,4	33	51,6	64	100		

The results of the analysis using the Spearman rank test which shows the relationship between ergonomic conditions and the incidence of bus driver accidents obtained a p-value of 0.994 with an R value of -0.001 meaning that there is no relationship between ergonomic conditions and the incidence of bus driver accidents. The better the ergonomic conditions, the risk of accidents will be reduced -0.001 times compared to less ergonomic conditions.

~~The results of the analysis using the Spearman rank test which shows the relationship between ergonomic conditions and the incidence of bus driver accidents obtained a p-value of 0.994 with an R value of -0.001 meaning that there is no relationship. between ergonomic conditions and the incidence of bus driver accidents.~~ This is because the bus driver has been able to adjust to the ergonomic conditions so that the risk of accidents can be controlled.

The provision of ergonomic facilities for bus drivers is deemed necessary so that drivers can adjust their needs while driving. There needs to be a commitment to improve occupational safety and health for drivers related to ergonomic risks. Proper stretching and strengthening exercises and implementing a progressive aerobic program to improve overall

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fitness. (27) Management of bus transportation services must have baseline data about diseases of all drivers, as well as carry out medical check-ups that are specific to ergonomic hazards as biomonitoring and personal control as well as preventive measures. (28)

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4. Relationship between vehicle conditions and accident incidents

Table 4. Accident Distribution Based on Bus Conditions

No	Bus condition	Bus driver accident				Total		R	P-*value*
		Low		High					
		N	%	N	%	N	%		
1	Low	9	29	22	71	31	48,4		
2	High	22	66,7	11	33,3	33	51,6	-0,376	0,002
Total		31	48,4	33	51,6	64	100		

The results of the analysis using the rank spearman test showed that the relationship between vehicle conditions and the incidence of bus driver accidents in this study obtained a p-value of 0.002 (p-value 0.000 <0.05) with a value of R = -0.376, which means that there is a relationship between vehicle conditions and bus driver accidents. with inadequate bus conditions, the risk of accidents will increase -0.376 times

The better the bus condition, the less the number of accidents caused by the vehicle (bus) factor. The biggest influence lies in the maintenance of the vehicle (bus), which is the responsibility of the owner and the driver of the vehicle which is obliged to test in reducing the level of accidents caused by vehicle factors. (29). The government needs to make strict safety regulations, especially on the appropriateness of the condition of the vehicle so that there are no accidents.(30)

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5. The Relationship Between Unsafe Action and the Bus Driver Accident

Table 5. Distribution of Accidents by Unsafe Action

No	Unsafe Action	Bus driver accident				Total		R	P-value
		Low		High					
		N	%	N	%	N	%		
1	Low	12	35,3	22	64,7	34	53,1		
2	High	19	63,3	11	36,7	30	46,9	-0,28	0,025
Total		31	48,4	33	51,6	64	100		

The results of the analysis used the Spearman rank test which shows the relationship between unsafe actions and the incidence of bus driver accidents with a p-value of 0.025 (p-

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value 0.000 <0.05) and an R-value of -0.280, meaning that there is a relationship between vehicle conditions and accidents driver and unsafe actions by bus drivers increase the risk of accidents - 0.280 times

The biggest cause of traffic accidents is the human factor through unsafe driver actions, therefore, the importance of driving safety education so that road users, especially vehicle drivers, are able to take safe actions in making decisions, identify and assess risks and strategies to minimize risks. One of the ways that can be done to increase the safe behavior of drivers is by educating them about driving safety. The unsafe behavior of drivers has a direct impact on the number of work accidents. The more often unsafe actions are carried out by the driver, the more risk of a work accident that can cause harm to the driver or other people. (31),

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The government and several agencies engaged in the transportation sector continue to increase efforts to reduce the number of traffic accidents. One of them is the national driving safety campaign and driving safety training that have been carried out by both the traffic police and several private agencies. Driving safety is the basis of advanced driving training that pays more attention to driver and passenger safety. Driving safety is designed to increase driver awareness of all the possibilities that occur while driving (32)

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CONCLUSION

Based on the results of research on 64 respondents with the category of not having frequent accidents as many as 31 people (48.4%), while accidents with frequent accidents were 33 people (51.6%). There is a significant relationship between the noise level and the incidence of bus driver accidents at the bus terminal in Semarang City (p-value = 0.043). There is no significant relationship between psychological conditions and the incidence of bus driver accidents at the bus terminal in Semarang City (p-value = 0.695). There is no significant relationship between ergonomics and the incidence of bus driver accidents at the bus terminal in Semarang City (p-value = 0.994). There is a significant relationship between vehicle conditions and the incidence of bus driver accidents at the bus terminal in Semarang City (p-value = 0.002). There is a significant relationship between unsafe action and the incidence of bus driver accidents at the bus terminal in Semarang City (p-value = 0.025).

SUGGESTION

The terminal management needs to improve again regarding safety information while driving. Support from the management of each terminal is the most important element in changing

unsafe behavior which is still often done by bus drivers. Supervision can be improved because drivers or passengers become more reluctant to comply with the prevailing regulations. Drivers are advised to be more obedient in checking the condition of their respective vehicles before operating.

DATA AVAILABILITY

All relevant data has been registered on paper along with supporting information files. All relevant data has been imposed onto the paper along with a supporting information file. This study will help researchers to reveal critical areas regarding the analysis of the relationship between noise factors, vehicle conditions and unsafe actions against bus driver accidents at Semarang City - Indonesia Bus Terminal so that traffic accidents can be reduced.

CONSENT AND ETHICAL APPROVAL

The written consent of the respondent has been collected and preserved by the author(s).

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