

Analysis of the safety of land transportation in the logistics industry

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ABSTRACT

The growing rate of the number of land transport vehicles is quite rapid in Indonesia (8.19% per year), with trucks being the third largest category of vehicles. In Indonesia, 4140 traffic accidents involved trucks in 2013. This study analysed the factors that influence land transportation safety in one of the logistics companies in Jakarta, the capital of Indonesia. This was a qualitative research study with analytic descriptive design, using the Haddon matrix to consider the driver, vehicle, physical environment and social environment factors in the pre-accident phase. The results of this study indicated that the safety of land transportation in Jakarta is influenced by four complex factors: fatigue in drivers, crime, other vehicles, and the driver's departure system. Interaction between these factors increased the risk of accidents in Jakarta.

Keywords: Transportation safety, land transportation, Haddon Matrix, logistics company

Introduction

More than 1.25 million people die from traffic accidents each year, and between 20 and 50 million suffer severe injuries and disability caused by traffic accidents [1]. In 2004, traffic accidents resulting in injury and death became the third highest cause of burden of disease for both men and women, after HIV/AIDS and unipolar depression. WHO predicted that traffic accidents would be the third highest disease burden to reduce the quality of human life by 2030 [2].

In 2016, the number of motorized land transportation vehicles in Indonesia accounted for 129,281,079 units, with an annual growth rate of 8.19%. Trucks are the third largest category of vehicle in Indonesia (as many as 7,063,433 units), after private motorbikes and cars [3]. In 2013, 4140 traffic accidents involved trucks [4], especially long-distance truck drivers. In the United

States, long-distance truck drivers have a risk of death twelve times greater and a risk of injury three times greater than workers in general [5].

Based on the Haddon matrix, four factors influencing transportation safety include the driver, vehicle, physical environmental and social environmental factors. First, drivers themselves are the most important factor in transportation safety because the driver can both cause and receive the impact of transportation accidents. Some driver factors that cause transportation accidents include fatigue, driving ability, driving knowledge and physical condition [6-8]. Also, driver behavior can cause accidents, including violations of driving regulations, speeding when conditions are unfit and consuming alcohol and illegal drugs, among others [9]. Cognition is one of the human factors that influence transportation safety. The other factors, such as driving knowledge, driving perception and the perception of compliance with driving rules are important in driving [7].

Second, vehicle factors are important in transportation safety. According to the Ireland Road Safety Authority, some elements that must be inspected for safety include steering, brakes, front and rear lights, electrical systems, clutches, mirrors, seat belts, speedometers, tires, windscreen, wipers and horns [10].

Third, physical environment factors affect safety, including road conditions. According to the Federal Highway Administration,

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road conditions are a contributing factor in 34% of traffic accidents. Road-related matters such as travel lanes, road shoulders, roadside slopes, horizontal arches, and vertical arches affect safety ^[11].

Finally, congestion is also a contributing factor that leads to improper driving behavior. Traffic density affects the stress level of drivers, contributing a social environmental factor to safety. Wickens explained that at a higher level of traffic congestion, higher levels of stress will be produced ^[12].

The logistics industry is important as mobilization is increased in the industrial world. The mobilization of goods from one place to another comes with safety and security risks that need attention. As transportation companies recognize these risks, management can reduce the risk of accidents by providing training or increasing the drivers' capacity to drive safely and efficiently ^[13]. Therefore, the purpose of this study is to look for factors that affect transportation safety in logistics companies, including the driver, vehicle, physical environmental and social environmental factors in the pre-accident phase.

Methods

This descriptive analytic study described the factors that influence the safety of transportation, especially in trucks, and analyzed the interactions between factors that cause accidents. The study used a qualitative approach. The research was conducted at the pool customer in one of the logistics companies in Jakarta and examined the shipping routes from Karawang to Surabaya. The sample of this study was a Jakarta driver from a driver supplier who served the route from Karawang to Surabaya.

Data collection was conducted by interviewing truck drivers using questions based on the variables, including the ability to drive, knowledge, physical condition, personality, and behavior. Interviews were conducted with source triangulation by interviewing three drivers who worked fewer than five years, three drivers who worked five or more years and three drivers who had experienced an accident. Among the 40 respondents who participated in this study, the average age was 40 years, with a range of 22 to 55 years. The respondents had an average work experience of eight years, with a range of one to fourteen years. Table 1 below shows the characteristics of the 40 respondents who participated in this study.

Table 1. Respondent Characteristics

Respondent characteristics	Total	Percentage
Age		
< 35 years	7	17,5%
> 35 years	33	82,5%
Total	40	100%
Work period		
Less than 5 years	5	12,5%
More than 5 years	35	87,5%
Total	40	100%
Accident Experience		
Never	33	82,5%
Ever	7	17,5%
Total	40	100%

In addition to the interviews, the actual condition of the factors that affect transportation safety on one of the logistics company routes in Jakarta was observed. Variables observed were vehicles, road conditions, lighting, signs and driving behavior. For observing road conditions variables, this study used an inspection guide from the 2004 Federal Highway Administration Road Safety Fundamentals. Vehicle variables were analyzed using the Road Safety Authority's Rules of the Road inspection guide. The driver's behavior was also observed.

Results

Drivers with longer work experience had better driving skills. Of the interview respondents, 87.5% had more than 5 years' driving experience and were increasingly accustomed to driving trucks, with improved driving skills. However, driving safety training was still needed for drivers, especially those whose driving experience was under five years. For example, most drivers did not know about the ideal safety distance between vehicles at a certain speed, which could increase the risk of accidents. According to the research, knowledge of risks and perceptions of a reasonable speed contributed to accidents ^[15].

According to the interviews, training was not consistently provided to all drivers in the logistics company in Jakarta. In fact, some drivers did not receive any training and still required knowledge concerning traffic signs and vehicle maintenance. The driver's knowledge of driving safety matters was still poor, including knowledge of safe driving distance and load limitations. However, the drivers who had experienced an accident had better knowledge of driving safety. These drivers consistently obeyed traffic rules, even when no police were present.

Also, according to their responses, the drivers did not have a fixed driving schedule. Instead, they were assigned to jobs based on customer demand. Most of the drivers delivered cargo almost every day. The drivers were also capable to drive during the day and night. They are required to drive along with the cargo.

Some of the drivers complained of suffering dizziness and fatigue during driving. Along with these physical complaints, they often felt annoyed at the behavior of other drivers, especially

motorbikes. These annoyances affected stress levels while driving.

In addition to the interviews, two trucks belonging to a logistics company in Jakarta (with police numbers W 8547 UP and W 8590 UP) were inspected during loading and unloading in the pool. An inspection was performed on the tire, seat belt, brake, steering, clutch, lights, and horn. Additionally, brakes, steering, clutches, lights, and horns were routinely checked and maintained, according to the unit maintenance data recorded from January to May 2018.

These inspections found some issues in the condition of the tire, seat belt, brake, steering, clutch, lights, horn, and APAR. In one of the cars, some tires were missing a nut from a tire change. Also, some tires used vulcanizing techniques, where the tire is hotter faster. However, the use of re-treaded tires was still in accordance with Standard Operating Procedure (SOP) unit management. According to SOP unit management, only front tires must be original tires.

In one of the cars observed, the APAR, intended for use in an emergency, was located outside the vehicle, in the wing box. This locked position would make it difficult to use in an emergency. In other cars, the APAR was located under the driver's seat, which is also difficult to reach during an emergency. The logistics company had various regulations related to safety, health and the environment as outlined in the SOP, including SOP Competency, Training and Concern, Safety Driving SOP, Travel Management SOP, Fatigue Management SOP, and SOP Vehicle Maintenance Safety. However, as mentioned in the interviews, the company did not have a fixed schedule for drivers. Unit and driver departures were in accordance with customer orders; the driver's departure schedule was highly dependent on these orders. The only schedule that management arranged was the driver's holiday schedule. The management also implemented a system for every driver to be responsible for the same unit.

Further observations were made of road conditions from the pool in Karawang to Surabaya by reviewing a map the management of the logistics company made to help drivers. The map contained recommended routes, with resting points and danger points, through the north and south coasts of Java. On the north coast, several roads had a high risk of loss, such as the road between Pekalongan to Batang, where there were areas prone to accidents and stone-throwing by residents. There were also areas prone to accidents and congestion between Kudus and Rembang. In addition, on the north coast route between Tuban and Gresik, a major area was prone to accidents, stone-throwing, and robberies. On the south coast route, roads from Wonosari to Pacitan had accident-prone areas. The physical conditions of the road posed difficulties as well. They were uphill, with many sharp turns. Several low-wiring roads that risk getting stuck in the unit. Overall, the north coast route was more widely used and had fewer accident-prone points.

Discussion

The driver had an important influence on transportation safety, as drivers could cause accidents. For example, driver behavior in the logistics company in Jakarta often violated traffic rules and regulations from company management, such as using a cell phone while driving. Cell phones were used because the drivers received calls from dispatchers to provide travel-related information and special instructions. However, using a cell phone causes significant distractions and lower driver concentration, which can increase the risk of accidents^[8].

Another behavior that needed consideration was the consumption of drugs. Among the three drivers, no one took drugs while driving. However, two other drivers often consumed herbal supplements to increase stamina. Also, drivers sometimes consumed herbal supplements at home or in herbal supplement stalls.

Drivers also violated regulations regarding fatigue management (Law Number 22 of 2009 concerning Road Traffic and Transportation, Article 90). According to this article, a driver may drive for a maximum of twelve hours a day, including at least a one-hour rest period. Drivers are also required to rest for at least thirty minutes after driving for four hours. But many drivers in the logistics company violated this rule by driving for six or seven hours without taking a break. This is because the drivers are chased time to unload goods that are requested by the customer. Additionally, the SOP explained that units with two drivers are required to change drivers every four hours. However, drivers violated these rules and chose to keep driving until the driver was tired. According to the results of the interview, drivers rarely changed with other drivers at the specified time and showed no resting behavior when management recommended rest. Instead, drivers passed specified resting points to pursue the loading and unloading time targeted by the customer. According to research, driver fatigue is dangerous because symptoms of fatigue while driving, such as sleepiness and exhaustion, can cause errors with deadly impacts^[14]. This resulted in a decrease in the physical condition of the driver due to driving over the prescribed time limit.

The physical condition of the drivers also declined due to fatigue from a demanding delivery schedule. Even when unloading was occurring, orders for other deliveries were already being received. This quick turn-around did not give the driver the opportunity to rest.

Drivers could drive units during both the day and night. They considered driving during the day more difficult than driving at night due to the level of congestion during the daytime. Since the drivers were used to driving at night, they were still capable of driving in the dark. They have also been skilled in carrying trucks with heavy loads even with considerable risks.

The seat belt, brakes, steering, clutch, horn, and lights were in prime condition due to periodic checks. Unit checks were carried out at the beginning of the unit usage, and unit maintenance was once a month or every 2000 KM. In addition, if the driver had a complaint about the condition of the unit being carried, they

could make a request for inspection. The condition and safety system of the vehicle must be considered as they are closely related to the seriousness of the accident ^[15].

The travel hazard map made by the OHSE division of a logistics company explained areas prone to accidents, congestion, stone-throwing, and robbery. Each of these impacted driving safety. For example, higher levels of congestion increased the stress levels of drivers, triggering unsafe behaviour in driving ^[12]. Another danger, robbery, was the most threatening, according to the drivers, because they carried cargo with high value. According to the interviews, drivers had to be aware of their contents because they are vulnerable to robberies.

The company could implement OSH by making several SOPs related to OSH operations. The driving safety SOP regulated the driver's behavior and physical condition. It should also regulate speed limits, safe driving distance, rest periods, resting places, travel routes and more. The driving safety SOP referring to Law Number 22 of 2009 explained limitations to cell phone use while driving. In this SOP, the dispatcher responsible for the unit's trip was arranged. However, the communication mechanism between the dispatcher and the driver was not regulated; the driver had to use a cell phone while driving to respond to dispatcher calls.

Additionally, fatigue management was regulated by rest time, which was prescribed for every four hours of driving, but drivers exceeded the driving time limit because they chased the loading and unloading time. The SOP on travel management was arranged so that the driver stopped at checkpoints determined by management. Unfortunately, drivers did not stop at the checkpoint due to violations. In general, the regulations of the logistics company covered all aspects of land transportation safety. However, management must supervise the implementation of these regulations in the field to reduce the risk of accidents.

Conclusion

According to the findings of this study, land transportation safety is influenced by four complex factors that impact each other. Two of the main factors are driver behavior and company management regulations. In addition, inconsistencies were found in several units related to unit condition checks. Physical environmental factors were identified as areas prone to congestion and crime around the route. Also, the study identified social environmental factors that affect transportation safety such as the absence of a good departure schedule for drivers and the presence of a binding system between the driver and the unit.

Conflict of Interest: NIL

Ethical Clearance:

The study was approved by the Ethical Committee of Faculty of Public Health, Universitas Indonesia, Indonesia, the approval number is 294/UN2.F10/PPM.00.02/2018

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