City Bus Inter-City and Inter-Provincial Traveller Safety Analysis in Jakarta until Solo Province

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ABSTRACT

Safety is one of the main goals in reducing and minimizing traffic accident victims. The factors that cause accidents are humans, vehicles, and the environment/nature. Buses, which have their own prestige, play a role in moving from the place of origin to the destination. This study is decisive in analyzing travel safety for bus users, especially on inter-city buses between provinces with the route Jakarta - Solo. The approach used in this research was quantitative by collecting data using a closed questionnaire which was distributed to 92 respondents using the Jakarta - Solo buses, observing and interviewing respondents using Inter-City Inter-Provincial (AKAP) buses traveling from Jakarta to Solo. The distribution of questionnaires was carried out at the Pondok Cabe Type A Terminal, where later the data was processed using Structural Equation Modeling or SEM. In this research, it was used as a data analysis technique with the SPSS and AMOS 24.00 programs to determine the determinants of safety behavior. Data processing resulting from the goodness of fit test output functions to process and analyze data that has statistical analysis capabilities as well as a data management system with a graphical environment. Apart from that, the benefit of testing AMOS SEM data is to see the relationship between variables simultaneously and take into account direct and indirect effects between variables and this test explains the significant influence on safety behavior. Implementation of a ramp check within the fleet departure time has an important factor in determining travel safety which originates from vehicle factors. Handling accidents in order to minimize casualties by checking and handling (maintaining) vehicles, getting adequate rest for drivers, providing adequate space and equipment if passengers have an accident, and the need to establish related agency skills by providing education to passengers and buses, as well as accident handlers.

Keywords: Bus user, Structural equation modeling, Travel safety.

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1. INTRODUCTION

Buses are a mode of land transportation that many people choose to travel short, medium and long distances. Currently, the popularity of buses as a mode of transportation seems to be fading. In line with increasingly affordable air transportation rates, many people prefer to travel by plane rather than bus. Improving services is very necessary and important to implement in improving the quality of public transportation services so that it can reduce current transportation problems.

The accidents that result cause the highest number of deaths where accident factors can be caused by humans, vehicles, the environment and nature. Based on data from the Republic of Indonesia Police, it is recorded that the number of accidents is increasing from year to year. Compiled from investigative data by the KNKT Ministry of Transportation of the Republic of Indonesia in 2019 – 2022 there were no less than 6 accidents involving buses.

Vehicle inspection is very necessary to minimize the number of accidents that occur. Each vehicle is inspected one by one for the administrative and technical completeness of motorized vehicle roadworthiness. Vehicle checking (rampcheck) aims to ensure the condition of the vehicle in anticipation of an accident. Vehicles that have been ramp checked will be given a sticker if they meet the technical and administrative criteria for roadworthiness. Apart from that, the implementation of ramp checks also determines the safety facilities available on inter-city buses between provinces, especially on the Jakarta - Solo route

2. LITERATURE SURVEY

2.1 Human Management Factors

Human Management Factors are needed to create positive safety behavior in the workplace through methods used by management to create a work environment that supports the creation of positive safety behavior with consideration of workers' psychological problems. The indicators of Human Management Factors are:

a. Management safety commitment

b. Social support

c. Production pressure

d. Safety motivation

e. Safety knowledge

2.2 Technological Factors

Relating to operational activities, knowledge, control, maintenance, use of machines and equipment, as well as other technical activities related to safety. Indicators of Technological Factors:

a. Safety qualification test

b. Rules, conditions, constraints

c. Safe system

d. Safety targets

e. Correct functional operation

2.3 Traffic accident

A traffic accident is an incident in road traffic that involves at least one vehicle which causes injury or damage or loss to the owner/victim (WHO, 1984). The high number of traffic accidents and the large cost of losses resulting from the many problems faced in improving traffic safety and road transportation which need serious treatment, so one way to reduce the number of accidents is with a Road Safety Audit or RSA for short. .

According to Abubakar (1996), in Mayuna (2011) in general the grouping of accidents based on the process of occurrence is:

1. Single accident (KT), namely a single accident experienced by one vehicle.
2. Pedestrian accidents (KPK), namely single accidents involving pedestrians.
3. Two-vehicle turning accident (KMDK), namely an accident when making a turning movement and only two vehicles turning.
4. Accident turning more than two vehicles (KMLDK), namely an accident when making a turning movement and more than two vehicles are involved.
5. Accident without any turning movement between two vehicles (KDK), namely an accident when walking straight or an accident without any movement and only two vehicles are involved.
6. Accidents without turning more than two vehicles (KLDK), namely accidents when walking straight or accidents that occur without turning and more than two vehicles are involved.

In general, the characteristics of accidents according to collisions can be classified on a uniform basis (Fachrurozy, 1986, in Mayuna, 2011):

1. Rear-angle (ra), a collision between vehicles moving in different directions, not in opposite directions, except at right angles.
2. Rear-end (re), a vehicle hits from behind another vehicle moving in the same direction, except in the same lane.
3. Sideswipe (ss), a vehicle that hits another vehicle from the side when traveling in the same direction, or in the opposite direction, unless on a different lane.
4. Head on (ho), a collision between vehicles traveling in opposite directions.
5. Backing, collision backwards.

Based on the type of victim, according to ADB (1996) traffic accident victims are grouped into:

1. Death Victims are victims who died at the scene of the incident or within a few days, or no later than 30 days after the incident as a result of a traffic accident.
2. Seriously Injured Victims are victims who require hospital treatment for at least one night.
3. Minor Injury Victims are victims who require medical treatment but do not have to stay overnight in hospital.

2.4 Safety

Road safety is an effort to reduce road accidents by paying attention to the factors that cause accidents, such as infrastructure, surrounding factors, facilities, people and signs or regulations. Road safety is an inseparable part of the concept of sustainable transportation which emphasizes the principles of transportation that is safe, comfortable, fast, clean (reducing pollution/air pollution) and accessible to all people and groups, including people with disabilities, children ± children, mothers and the elderly (Soejachmoen, 2004).

2.5 External Factors

External factors are activities carried out within the organization, such as difficult conditions that occur outside normal conditions such as natural disasters and unexpected events caused by nature. If these difficult conditions occur, all activities carried out should still pay attention to safety. Indicators of External Factors:

a. Illegal action
b. Substandard Climate
c. Emergency condition

2.6 Passenger / User

Passengers are an important element of all activities carried out at the company. The safety of passengers as customers needs to always be maintained. Indicators from users:

a. Passenger safety consciousness

   Efforts are needed from company management to increase commuter train passengers' awareness of safety.

b. Environment and equipment

   The company management carries out efforts related to passenger safety by providing facilities and infrastructure that support this.

c. Management safety propaganda

   Safety propaganda is an active way for company management to maintain passenger safety. This safety propaganda can be carried out through: TV, media, bulletins, forums, internet, etc

2.7 Terminal

The terminal is a node point for various modes of transportation, as a transfer point for passengers from one mode to another or from various modes to one mode, and also as a destination and final point for people after getting off and continuing to walk to work, home or market.

2.8 SEM (Structural Equation Modeling)

The data analysis technique uses Structural Equation Modeling (SEM), carried out to thoroughly explain the relationship between the variables in the research. SEM is used not to design a theory, but rather to examine and justify a model.

SEM is a stronger analytical technique because it considers interaction modeling, nonlinearity, correlated independent variables, measurement errors, correlated error terms, multiple latent independent variables where each is measured using multiple indicators, and one or two latent dependent variables are also each measured using multiple indicators.

3. PROBLEM DEFINITION OR EXPERIMENTAL WORK

a. Location and time of research

Data collection at Terminal Type A Pondok Cabe, South Tangerang, Indonesia with research time July – August 2022

b. Data collection technique

Data collection techniques (Figure 1) by carrying out interviews and questionnaires to visitors who use AKAP facilities to determine the level of travel safety in order to obtain primary data, while secondary data is obtained from the Police and KNKT to determine the number of accidents that occur.

c. Data processing

Data processing was carried out after distributing the questionnaire. The initial step is to record all questionnaire data in Microsoft Excel. Then, from the data recap, the average of each indicator is found. Then the average results were processed again with SPSS software and SEM AMOS software.

d. Data analysis

Data analysis in this research is Structural Equation Modeling (SEM) with the help of the Analysis of Moment Structure (AMOS) 24.00 program. The SEM stages in this research consist of Confirmatory Factor Analysis (CFA) for the construct to meet the Good of Fit Index (GOFI) criteria.

4. RESULTS AND DISCUSSION

4.1 General description

Pondok Cabe Type A Terminal is one of the terminals belonging to the Ministry of Transportation, Jabodetabek Type A Class III Transportation Management Agency which is located in Pondok Cabe Udik, Pamulang, South Tangerang City, Banten. Inaugurated in December 2018, the Ministry of Transportation and the South Tangerang City Government are committed to and working to improve mass transportation services in the Jabodetabek area.

Pondok Cabe Type A Terminal has an area of 25,995 square meters. Consisting of a main building covering an area of 2,550 square meters, an intra-city transport terminal covering an area of 1,125 square meters, an inter-city bus terminal (settlement zone) covering an area of 2,500 square meters plus 2,870 square meters, and 1,800 square meters for terminal land.

Pondok Cabe Type A Passenger Terminal serves 33 Inter-City Inter-Provincial Bus POs (AKAP) with a fleet of 64 units. At the Type A Passenger Terminal, Pondok Cabe also serves 1 airport transport PO with a fleet of 4 fleets per day. With 23 facilities available at Terminal Type A Pondok Cabe.

4.2 Research result

Based on data collection: interviews and questionnaires for visitors who use AKAP facilities to determine the level of travel safety in order to obtain primary data, while secondary data is obtained from the Police and KNKT to determine the number of accidents that occur.

Road traffic accidents are estimated to be the 5th leading cause of death in the world after heart disease, stroke, lung and respiratory tract infections. Due to concerns about current conditions, the United Nations (UN) launched the Decade of Action for Road Safety and Indonesia strongly supports this UN step. The second Decade of Road Safety Action (DAKJ), which has a time span of 10 years (2021-2030), has five pillars, namely road safety management, infrastructure, vehicles that better ensure health, road user behavior and post-accident handling. The material losses suffered from these various accidents reached IDR 246 billion. The value increased 24.24% from 2020 which was IDR 198 billion.

Based on data from the Indonesian National Police, in August 2022 the number of traffic accidents reached 6059 cases with the number of deaths due to traffic accidents reaching 882 people. Of this number, the victims were in the productive age range of 35 - 60 years.

DKI Jakarta is the province with the most congested traffic in Indonesia but the death rate due to traffic accidents is very high in East Java. According to data from the Republic of Indonesia Police Traffic Corps in 2022 in its daily report, of the 31,234 victims who died as a result of traffic accidents in Indonesia, more than 20 victims died in East Java. West Java Province is the second region with the highest death rate of around 7 fatalities, followed by Central Java Province with around 4 fatalities. In fourth place is Banten with almost 2 fatalities per day.

There were 6 accidents involving buses in 2020 which were investigated by the KNKT with information about 3 collisions, 2 caught fire and 1 rolled over. Meanwhile, in 2021, 7 incidents were recorded with information about 4 collisions, 1 burning and 1 rolling over. In 2022 until June, 6 incidents were recorded with 6 collisions.

Apart from that, at Pondok Cabe Type A Terminal, joint safety inspections are often held by several stakeholders to support traffic safety. Based on the National General Plan for Road Safety (RUNK 2011-2035) and has been followed up with the Instruction of the President of the Republic of Indonesia Number 4 of 2013 concerning the road safety action decade program with the target of realizing the 5 (Five) Pillars of Road Safety Action.

Table 1 Accidents Data on LLAJ by KNKTinvestigated

No	Years	Investigations	Type of Accidents			Fatalities	
			Collision	Rollover	Burning	Death	Injuries
1	2020	12	7	2	3	47	124
2	2021	18	12	4	2	75	118
3	2022	12	12	0	0	95	208
Total		42	31	6	5	217	450

Source : KNKT Investigation Data

Based on accident data from the KNKT Investigation on October 27 2020, an AKAP bus with the route Jakarta - Solo had an accident on the Jagorawi toll road KM 15+ 800 and was in the fire category. Therefore, at the Pondok Cabe Terminal, joint safety inspections are implemented by several stakeholders to support traffic safety. Based on the National General Plan for Road Safety (RUNK 2011-2035) and has been followed up with the Instruction of the President of the Republic of Indonesia Number 4 of 2013 concerning the road safety action decade program.

4.3 Discussion

To determine the number of samples used in this research is the Slovin formula. The Slovin formula is a formula used to calculate the minimum sample size for a finite population survey, where the main objective of the survey is to estimate population proportions. The Slovin formula used to determine the sample size is (Sugiyono, 2017):

$$n = \frac{N}{1 + N(e)^2}$$

Where :

n = Number of samples

N = Number of Population

e = Constant (% standard error rate that can be tolerated for a sampling, in this case using an error rate of 5%)

$$n = \frac{120}{1 + 120(0.05)^2}$$

$$n = 92$$

Next, input data in SPSS and produce several required outputs including Normality Test, Validity Test, Reliability Test and continued with testing using AMOS SEM and Goodness of Fit Index (GOFI) testing.
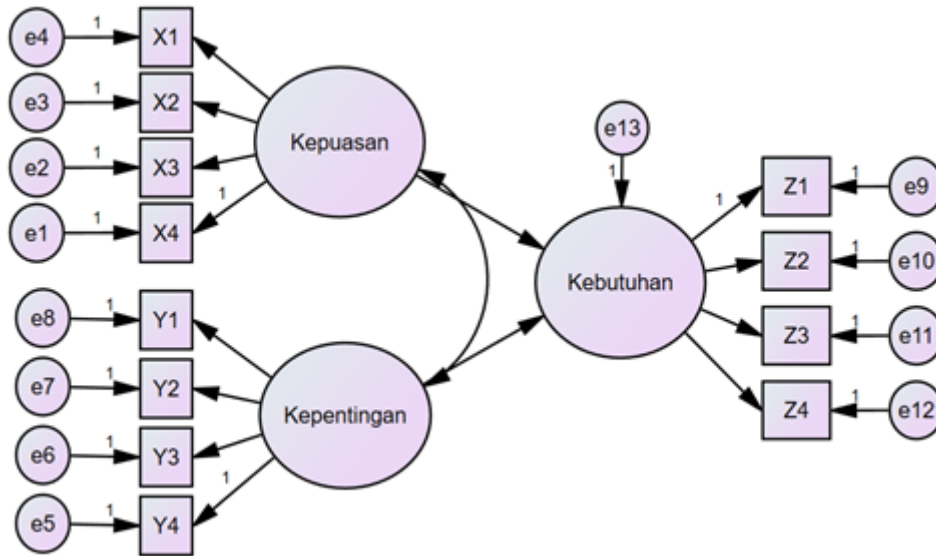
Figure 2 AMOS SEM Diagram Design

Table 2 Goodness of Fit Index / GOFI Test Results

Goodness of Fit Index	Cut- off value	Analysis Results
Chi square statistic	Expected to be small	228.070
Significance probability	≥ 0.05	0.000
RMSEA / The Root mean square error of approximation	≤ 0.08	0.427
CMIN/DF	≤ 2.00	4.472
GFI / Goodness of index	≥ 0.90	0.370
AGFI /Adjusted goodness fit index	≥ 0.90	0.036
TLI/ Tucker lewis index	≥ 0.95	0.618
CFI /Comparative fit index	≥ 0.95	0.705

Figure 3 Model fit after modification

Table 3 Goodness of Fit Index / GOFI Test Results after Modification

Goodness of Fit Index	Cut- off value	Analysis Results
Chi square statistic	Expected to be small	177.229
Significance probability	≥ 0.05	0.01
RMSEA / The Root mean square error of approximation	≤ 0.08	0.04
CMIN/DF	≤ 2.00	1.664
GFI / Goodness of index	≥ 0.90	0.902
AGFI /Adjusted goodness fit index	≥ 0.90	0.922
TLI/ Tucker lewis index	≥ 0.95	0.592
CFI /Comparative fit index	≥ 0.95	0.978

4.4 Hypothesis Results

Based on the results of research and testing with SPSS 22, the normality test obtained. The significance value (p) in the Shapiro-Wilk test is listed as group Reading with Shapiro-Wilk because data is <100 respondents. Validity testing obtained a calculated R value > than the r table, namely 0.444. Reliability test obtained Cronbach alpha's r count, namely $0.147 >$ r table.

Testing with SEM AMOS 24.00 on respondents obtained a t-value with a significance level of 5%. Chi square is 177.229 and the probability value P ≤ 0.05 means the research hypothesis is accepted (H0 is rejected) (Haryono, 2016). The AMOS 24.00 C.R value calculation results are based on the fit model in table 4.10. The output results of the goodness of fit test function to process and analyze data that has statistical analysis capabilities as well as a data management system with a graphical environment. Apart from that, the benefit of testing AMOS SEM data is to see the relationship between variables simultaneously and take into account direct and indirect effects between variables. These results explain that safety behavior has a significant influence on safety behavior.

5. CONCLUSIONS AND RECOMMENDATIONS
5.1 Conclusion

1. Safety facilities have an important role in minimizing accidents.

These safety facilities have been equipped on the inter-city, inter-provincial bus fleet for the Jakarta - Solo route at Terminal Type A Pondok Cabe. These facilities are available in the fleet and at the Pondok Cabe Terminal, such as safety equipment on the fleet, skills of the bus crew and inspection of the fleet before departure.

2. Factors that influence accidents can be caused by driver factors, where the driver is less agile in understanding the terrain. Apart from that, vehicle factors also play an important role in accidents, so Pondok Cabe Terminal Type A carries out vehicle checks (rampchecks) on the fleet. Other factors are the environment and weather.

3. Handling accidents in order to minimize casualties, namely by checking and handling (maintenance) on vehicles, adequate rest for drivers, the availability of adequate space and equipment if passengers have an accident, and the need to establish related agency skills by providing education to passengers and buses, as well as accident handler.

4. Institutions that play a role in reducing the number of accidents, especially on buses, are:

    a. Road Safety Management by Bappenas / Bappeda
    b. Safe Roads by the Ministry of Public Works / PUPR Department
    c. Safe Vehicles by the Ministry of Transportation / Transportation Department
    d. Safe Road User Behavior by the Police
    e. Pre and Post Accident Handling by the Ministry of Health / Health Office

5.2 Recommendations

1. The implementation of safety behavior for operators, drivers and users of AKAP buses in the Jakarta - Solo route is emphasized again, in order to minimize the number of accidents. This can also be implemented by terminal officers to provide advice and routinely check vehicles that will travel.

2. Further consideration is needed regarding the indicators for each variable by adding and subtracting these variables. It is hoped that the advantages and disadvantages shown in the model modification will become a benchmark for further research development

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