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Modeling the Factors of Intercity–Interprovincial Bus Accidents as a Basis for Formulating Road Transport Safety Improvement Strategies (Case Study: Bus Drivers at Jatijajar Type a Terminal)

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ABSTRACT

The high frequency of traffic accidents in the land transportation sector, especially those involving intercity and interprovincial buses (AKAP), indicates that the safety aspect of passenger transportation is still a significant problem. This study aims to analyze the factors that contribute to the risk of accidents for AKAP bus drivers at the Jatijajar Type a Terminal, Depok. A quantitative approach is used with the Structural Equation Modeling (SEM) method to test the multidimensional relationship between driving behavior, drivers' mental and physical condition, company management, government regulations, environment and traffic, and vehicle factors to accident risk. The SEM-PLS analysis revealed that five factors significantly influenced the accident, collectively explaining 59.8% of the total variance in AKAP bus accidents. Mental and Physical Condition factors were the strongest predictors (coefficient = 0.302), followed by Risky Driving Behavior (0.273), Environment and Traffic (0.222), Company Management (-0.227), and Government Regulation (-0.194). Vehicle factors did not show a significant influence. Based on these findings, two priority strategies validated by experts were formulated: (1) Transformation of the driving profession through standardization of competencies and vocational education, and (2) Restructuring of wage and incentive systems to improve driver welfare and eliminate economic pressures that trigger risky behavior. This study provides a theoretical contribution by comprehensively modeling the factors of AKAP bus accidents and providing strategic recommendations that can be used as a reference for the government and bus operators in formulating more targeted policies to improve road transportation safety.

INTRODUCTION

The high demand for intercity bus services makes it an important role in an effective and efficient land transportation system in developing countries, especially in facilitating the movement of people, goods, and services that are essential to the national economy. In many developing countries, mass transportation infrastructure (such as trains or airplanes) is uneven or too expensive (Tschumi, 1996). Intercity and Inter-provincial (*AKAP*) buses fill this gap by providing a flexible and affordable land transportation solution for low-income segments. Based on data obtained from the Ministry of Transportation's Siasati 2025, in the last four years there has been an increase in the number of passengers and bus departures at Type A Terminals that serve intercity and interprovincial departures (Ding Zhang L. Xi J. Li Y. Zheng L. & Zhang K., 2023).

To support the security and safety of passengers, this has been regulated in the policy stated in the Law of the Republic of Indonesia Number 22 of 2009 concerning Road Traffic and Transportation.

However, the high demand for *AKAP* bus services is in line with the increasing number of bus accidents. *AKAP* bus accidents in Indonesia remains a critical issue with significant socio-economic impacts. Based on data from the National Police Pusiknas (Pusiknas), it was recorded that in the last 3 years there has been an increase in the number of accidents based on the type of bus vehicle, which consists of medium buses and standard buses. In 2022, 3,076 accident cases were recorded. This figure has increased dramatically by 160% in 2023 to 7,999 cases. This increasing trend will continue in 2024 with a total of 11,368 cases, or an increase of about 42% from the previous year.

The high frequency of traffic accidents involving intercity and interprovincial buses (*AKAP* remains a critical issue in the land transportation system in Indonesia. Data from the National Transportation Safety Committee (*KNKT*) for the January-September 2022 period recorded 827 cases of bus accidents, of which 15% involved drivers with a history of lack of rest and low driving competence (Fajri Lubis, 2024). The National Transportation Safety Committee's (*KNKT*) investigation report for 2024 noted a number of important incidents that highlighted various weaknesses in the technical aspects of the vehicle and human factors.

This is in line with research from (Dou Deng S. Yu H. Li T. Yu S. Zhang J., 2024), Driver's condition fluctuates due to the combined influence of physiological, psychological, and environmental dynamics, which can lead to complex and diverse driving hazards. This phenomenon suggests that despite efforts to improve safety, the accident rate is still high so more research needs to be done, especially related to the role of government, company responsibility, driver psychosocial factors, and traffic conditions.

Although numerous studies have addressed land transportation safety, a significant gap remains in the literature concerning *AKAP* bus drivers. Most studies focus on human factors, such as how safe and aggressive driving behaviors affect bus driver accident rates (Fadhil et al., 2022); Kanaila Bobihu P. Jusuf H. Mahdang P.A., 2024); driver fatigue due to long work durations (Zainy Pratama G.B. Kurnianto R.R. & Iridiastadi H., 2023); and vehicle technical factors, such as operational risks due to facility damage and traffic congestion (Ichsandi, 2024). The complexity of safety factors for *AKAP* bus drivers underscores the urgency of this research, given the influence of interrelated critical dimensions, including government regulations on driver competency certification (Fajri Lubis, 2024), company policies related to work shifts and rest facilities (Zuraida & Abbas, 2020), and psychosocial factors such as emotional intelligence and workload (Useche et al., 2018). Therefore, a comprehensive study is needed to address this gap through an in-depth identification of the determinants of *AKAP* bus accidents. This study includes an integrative analysis of driver behavior variables, drivers' mental and physical conditions, technical aspects of vehicle feasibility, road and traffic environmental conditions, and the strategic roles of company management and government regulations. Furthermore, this study aims to analyze the magnitude of influence of each factor by developing an empirically tested accident model as the basis for formulating applicable priority strategies.

This study focuses on intercity and interprovincial bus drivers (*AKAP*) departing from Jatijajar Type A Terminal, Depok City. This terminal serves diverse strategic routes operated by bus companies of various scales. The bus route departing from the Jatijajar Type A Terminal crosses a number of corridors that have proven to be prone to traffic accidents. These facts

show that AKAP bus drivers departing from Jatijajar Terminal face significant safety challenges in terms of road infrastructure, vehicle technicalities, and traffic dynamics, thus making this terminal relevant as a research location on land transportation safety.

Theoretically, this study contributes to enriching the transportation safety management literature through the development of an integrative model that tests various determinant variables of accidents simultaneously. Empirically, this study presents actual data on *AKAP* bus operations at the Jatijajar Type A Terminal as a valid database to formulate more precise policies and priority strategies. The results of this research are expected to be a strategic instrument for the government in designing effective regulations and for companies in implementing targeted safety programs. Through this comprehensive analysis, this study is projected to be able to increase driver operational awareness, reduce fatality rates, and have a positive impact on public safety and the sustainability of the national transportation industry as a whole.

METHOD

This research strategy was used to answer three research objectives, namely

1. Research Question 1 (RQ1): identify and validate the factors influencing the occurrence of Intercity and Inter-provincial (AKAP) bus accidents. The research strategy for RQ1 uses literature review and expert validation using the Delphi Method.
2. Research Question 2 (RQ2) = Analyze the magnitude of the influence between the factors causing the accident through the development and testing of the AKAP bus accident model. The research strategy for RQ2 used a questionnaire survey and Structural Equation Modeling (SEM) analysis based on Partial Least Squares (PLS)
3. Research Question 3 (RQ3) = Formulate a priority strategy to improve road transportation safety based on the dominant factors identified as modeling results. The research strategy for RQ3 uses SWOT (Strengths, Weaknesses, Opportunities, Threats) TOWS (Threats, Opportunities, Weaknesses, Strengths) analysis and expert validation using the USG (Urgency, Seriousness, Growth) method,

The aforementioned research questions provide the framework for the literature review to determine research variables and indicators. To ensure its validity, the two-round Delphi method is used, which is a gradual process involving a series of questionnaires and systematic feedback to filter the consensus of experts (J. Skulmoski T. Hartman F. & Krahn J., 2007). In an effort to answer the first research question (RQ1), a consensus was set with a minimum threshold of 70% involving five experts in the field of transportation safety.

The research strategy to answer the second research question (RQ2) uses a quantitative approach that focuses on Intercity Interprovincial (AKAP) bus drivers at Jatijajar Type A Terminal, Depok. The application of the non-probability sampling technique with the purposive sampling method is due to a dynamic population without a definite sample framework (infinite population). The study utilized a purposive sampling technique to select 100 respondents. This sample size fulfills the minimum

The sample size was set at 100 respondents, which surpassed the minimum statistical requirements for Structural Equation Modeling (SEM) analysis, providing sufficient statistical power for the hypothesized model (Hair Ringle C.M. & Sarstedt M., 2011). This sample size

ensures adequate statistical power and representativeness of cross-sectional studies in accurately describing variations in demographic characteristics and driver behavior. The primary data collection process began with a pilot study of 10 drivers to validate the instruments, followed by a main survey through structured questionnaire interviews. . The questionnaire consists of two parts, namely the demographic details of the respondents, including education, age, work experience, driver's license ownership, travel distance, average travel time, and remuneration scheme. The second part consists of a statement about the constructed chosen in the form of an assessment scale using the Likert scale ranging between strongly disagree (indicated by the number 1) and strongly agree (indicated by the number 5). Data analysis was carried out simultaneously using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with the help of SmartPLS 4.0. This method was chosen for its effectiveness in estimating complex hierarchical models with latent plural variables, as well as its flexibility to the assumption of multivariate normality distributions.

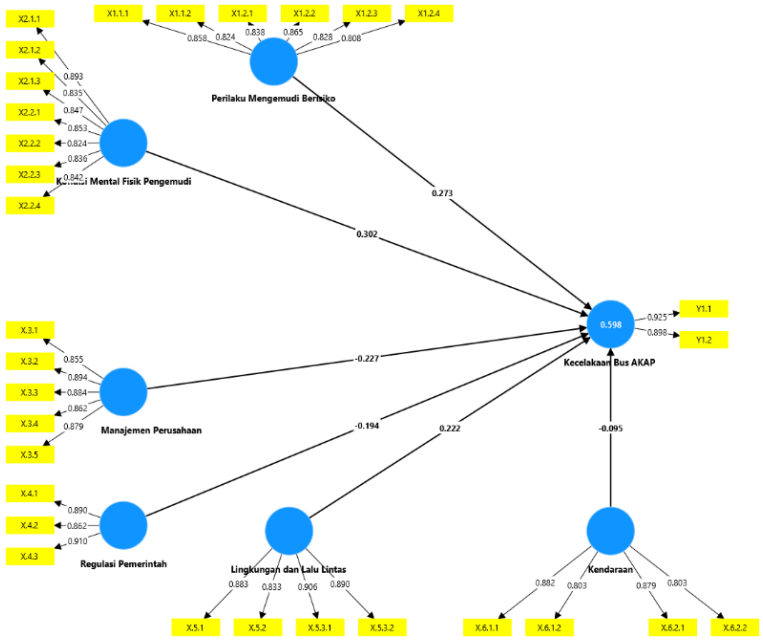
The research strategy for RQ3 integrates the results of the SEM analysis with a study of the literature classified through SWOT analysis to compile a list of relevant strengths, weaknesses, opportunities, and threats. The identified internal and external factors were then formulated into alternative applicative strategies using the TOWS matrix. To set priorities, the strategy recommendations are reviewed and validated by experts through the USG (Urgency, Seriousness, Growth), Growth method, so that the most appropriate strategic steps are obtained in improving the safety of AKAP buses.

RESULT AND DISCUSSION

Research question 1 aimed to validate variables and indicators that had been compiled based on literature studies, and two rounds of validation were carried out by transportation experts. After the advice of several experts to improve and complete the redaction of the indicators, it was agreed that the variables of Risky Driving Behavior (X1) with 6 indicators, the physical and mental condition of the driver (X2) with 9 indicators, company management (X3) with 5 indicators, government regulations (X4) with 3 indicators, environment and traffic (X5) with 4 indicators, and vehicles (X6) with 5 indicators, on AKAP bus accidents (Y), measured by 2 indicators. The results of the validation are the basis for the preparation of respondent survey questionnaires at the next stage.

The results of Research question 2 were processed from the data of respondents' questionnaires to 100 *AKAP* bus driver respondents. In this study, data analysis was carried out using the SEM-PLS approach method for validity test, reliability test, and structural research model.

With the fulfillment of the outer model requirements, namely the convergent validity test and the reliability test for each variable with an outer loading value above 0.7, an average variance extracted (AVE) value of > 0.5, a composite reliability value > 0.7, and Cronbach's alpha value of > 0.7. The next stage is to test the structural model



Based on the results of the analysis *of Structural Equation Modeling - Partial Least Squares* (SEM-PLS) showed that the research model involving six factors (X1 Risky Driving Behavior, X2 Mental Physical Condition, X3 Company Management, X4 Government Regulation, X5 Environment and Traffic, and X6 Vehicles) was able to explain 59.8% of the variance in the AKAP Bus Accident variable (R Square value = 0.598). This shows that the factors studied collectively have moderate to strong predictive capabilities for the occurrence of accidents. Mental, Physical, and Driving Behavior are the strongest driving factors for accidents, while Company Management and Government Regulation play a protective role. Environmental and Traffic Conditions also significantly increased the risk, while the Vehicle factor was not significant in this study.

The results of this analysis confirm that risky driving behavior has a significant effect on accidents, where unsafe *acts* within the framework of the Human Factors Analysis and Classification System (HFACS) (Shappell & Wiegmann D.A., 2000) are the final manifestation of systemic failure. These findings highlight that senior driver profiles (60% of experience >15 years) tend to be caught up in *overconfidence* and *normalization of deviance*, where repeated offenses such as speeding or using a mobile phone are considered normal practices due to the absence of negative consequences. Manifestations of this behavior appear in two forms: *errors* in complex conditions and deliberate violations (*violations*) for the sake of operational targets, both of which empirically increase the risk of incidents. These results reinforce the study by (Kanaila Bobihu P. Jusuf H. Mahdang P.A., 2024) on aggressive behavior, the classification of safety violations by (Ding Yin H. Li Z. He X. Zheng L. & Xi J., 2024) which contributed 27.9% to accidents, as well as the findings of (Alkaabi, 2023) regarding the strong correlation of non-compliance with traffic rules with involvement in accidents.

Mental and physical conditions were identified as the most significant predictors of *AKAP* bus accidents, which in the framework of *HFACS* represents *the Preconditions for Unsafe Acts* through *Adverse Mental* and *Physiological States*. These findings are empirically triggered by extreme workloads, where 62% of respondents drive 10–16 hours with a range of

600–900 km, which accumulates physical fatigue and the risk of *microsleep*. This condition is exacerbated by financial pressures due to the trip based guarantessn (93% of respondents) which forces drivers to ignore the quality of rest in favor of economic targets. According to (Dawson & McCulloch K., 2005) risk model, the determinant factor of fatigue is not just the duration of work, but the quality of sleep obtained, which if inadequate will trigger a decline in cognitive function and situational alertness. Psychosocially, work pressure and family conflicts drain drivers' mental resources, creating a "hidden pandemic" that triggers *decision errors*. These results corroborate the study of (Zainy Pratama G.B. Kurnianto R.R. & Iridiastadi H., 2023) on the correlation of driving duration with fatigue, as well as the research of (Amoadu Ansah E.W. & Sarfo J.O., 2024; and (Peters Grogan H. Henderson G.M. Gómez M.A.L. Maldonado M.M. Sanhueza I.S. & Dennerlein J.T., 2021) which confirmed that psychosocial workload and low job satisfaction have a fatal impact on land transportation safety.

Confirming that company management serves as a significant inhibitory factor; the stronger the protective layer of the company's management, the lower the probability of accident occurrences. However, field findings suggest this protective function is undermined by the dominant business model, where 93% of respondents operate under a trip based compensation system that creates delivery targets and prioritizing economic incentives over safety protocols. In addition, there are inequalities in the training aspect; Management tends to exclude experienced drivers due to incorrect competency assumptions, thus triggering *complacency* and *overconfidence*. Another weakness was found in health monitoring that is still merely symbolic and seasonal, such as inspections only during the 2) Major Holiday peak travel season, so that it fails to function as an active defense system that ensures the physical condition of drivers on a regular basis. The results of this study empirically reinforce the importance of organizational safety culture which is emphasized by (Mokarami et al., 2019), the vital role of driving safety training as revealed by (Lucidi et al., 2019), the influence of fair incentive policies in shaping safe behavior as found (Škerlič & Erčulj, 2021). Thus, confirming that the stronger the protective layer of the company's management, the less chance of accidents occurring.

The government is a significant protective factor that in the framework of *HFACS* functions as *organizational influences* or the outer safety net of the transportation system. The implementation of this regulation is reflected in the competency aspect, where the majority of drivers (67%) already have a B2 driver's license as the initial filter for technical qualifications. However, field findings show that the effectiveness of these regulations is often undermined by law enforcement inconsistencies, such as buses that remain operational even though *ramp checks* have not met safety standards. This condition indicates that administrative regulations have not been fully operationally controlled. Safety optimization can be achieved if law enforcement is carried out consistently through innovations such as electronic tickets (E-Tickets) and more rigid *ramp check supervision* at Type A Terminals. These findings support the argument of (Cameron, 2023) regarding the urgency of legal strictness to ensure compliance, as well as the study by (Crizzle Toxopeus R. & Malkin J., 2020) which emphasizes the importance of rest facility regulation as a preventive effort against driver fatigue.

Environmental and traffic factors have been shown to have a positive and significant effect on the increased risk of accidents on *AKAP* buses, a finding that fundamentally supports

the (Haddon, 1972) which places "Environment" as the main pillar of cause of accidents alongside humans and vehicles. The significance of this factor is crucial considering that the majority of respondents (60%) are senior drivers with more than 15 years of experience; The fact that experienced drivers still consider this factor a serious threat underscores the severity of external challenges on the ground, such as damaged infrastructure, minimal road markings, sharp curves, and extreme weather. In addition to the physical condition of the road, the complexity of traffic flow (*mixed traffic*) and routine congestion are additional burdens that increase the probability of incidents in real terms. These findings are in line with the study of Law et al. (2017) and (Pembuain Priyanto S. & Suparma L.B., 2019) on the contribution of poor infrastructure to bus accidents, as well as research by (Sekaryadi Setiawan D. & Nurhalim I., 2019) and (Made Kariyana Hayataning Pamungkas T. & Ayu Anggraini T., 2024) which confirmed that the density and heterogeneity of vehicles on the highway have a strong correlation with the frequency of accidents in the land transportation sector.

The vehicle is not the main determinant of the accident in this model. This finding is driven by the homogeneity of the data due to the strict regulation of Mandatory Periodic Technical Inspection (*KIR*) at the Type A Terminal which neutralizes the variability of physical conditions between fleets. However, from a methodological perspective, this insignificance reveals a gap between the driver's subjective perception and technical reality. The phenomenon of Normalization of Deviance and Illusion of Control emerged, where senior drivers feel that they have mastered the technical aspects of the bus through daily experience without doing systematic self-checks like flight protocols. As a result, latent breakdowns are often overlooked because drivers tend to entrust the mechanical aspects entirely to the company.

Field findings and *KNKT* reports (Wildan, 2023) reinforce that fatal incidents such as brake failures are often not pure mechanical failures, but brake fade errors due to a deep lack of understanding of vehicle dynamics in extreme situations. This confirms that technical risks are often reduced by the dominance of human factors and management, consistent with the findings of (Syahliantina, 2025) and a study in Norway by Christensen & Elvik (2007) which showed that routine inspections do not necessarily reduce the number of accidents if they are not accompanied by driver competence. The study of (Zeng Qiang Y. Zhang N. Yang X. Zhao Z. & Wang X., 2024) in China also confirmed that the influence weight of vehicles is much smaller than that of human and road factors. Theoretically, these results emphasize the need to integrate perceptual data with objective technical inspections in the Safe System approach, to ensure that the safety of *AKAP* buses does not only rely on administrative compliance, but also on comprehensive operational mastery.

Formulation of Priority Strategy Recommendations to improve road transportation safety based on the dominant factors identified as a result of modeling

Research Question 3 (RQ3) is focused on the formulation and prioritization of recommendation strategies based on the identification of dominant factors in RQ2, namely Mental Condition, Physical Condition, and Driving Behavior. The data analysis stage begins with a SWOT-TOWS Analysis to map the internal strengths and weaknesses of the empirical findings, as well as external opportunities and threats to produce comprehensive alternative intervention strategies. Furthermore, the strategy was prioritized quantitatively by experts

using the USG (Urgency, Seriousness, Growth) method. This structured approach ensures that the resulting recommendations are not only theoretical, but are firmly rooted in field evidence to systematically address the root cause of *AKAP* bus accidents, as detailed in the following table:

Table 1 SWOT Matrix

	INTERNAL		OUTSIDE
	STRENGTH (S)		**OPPORTUNITY (O)**
S1	High Formal Qualifications of Drivers.	**O1**	Surveillance and Assistance Technology Innovation
S2	Operational Experience That Requires Large Capital	**O2**	Adaptation of Global Well-Being Models
S3	The Existence of Vehicle Operational Feasibility Standards	**O3**	Strengthening the Regulatory Framework
S4	Perception of Vehicle Readiness	**O4**	Potential for Stricter Law Enforcement
S5	Understanding of Safety Technology.		
WEAKNESS (W)		**THREAT (T)**	
W1	Vulnerability of Driver's Mental Condition	**T1**	Risky Road Infrastructure Conditions
W2	High Prevalence of Physical Fatigue	**T2**	Complex and Congested Traffic Environment
W3	Poorly monitored health conditions	**T3**	Limitations of Safety Support Facilities
W4	Risky Driving Behavior	**Q4**	Gaps in Regulatory Implementation and Oversight
W5	Failure to Self-Regulate in Critical Situations	**Q5**	Bad weather conditions.
W6	Business Models That Encourage Unsafe Practices		
W7	Suboptimal Company Safety Management		

As a follow-up to the mapping of factors in the SWOT analysis, the following matrix presents the formulation of the strategy formulated through the TOWS analysis framework. Each strategy formulated in this matrix serves as a basis for the preparation of priority recommendations to be submitted for validation.

Table 2 TOWS Matrix

	S	**W**
O	*Strengths and Opportunities* **of SO1 (S1, S2+O3): Standardization of National Competency Training and Certification** . Utilize the driver's qualifications and experience as the basis of a professional certification program that must be updated regularly. **SO2 (S3 + O1): Digitization and Transparency of Vehicle Inspection Processes** . Utilizing the feasibility standards that are already running with digital technology (QR Codes) to increase the transparency and accountability of the results of the inspections at the terminal.	*Weaknesses and Opportunities* **WO1 (W6,W7 + O3): Reform of the Wage and Incentive System.** Using a regulatory framework to drive the transformation of the wage system from "per trip" to base salary plus measurable safety performancebased incentives. **WO2 (W2 + O1): Digitization of Working Hours Supervision (ELD/Tachograph).** Addressing fatigue issues by mandating the use of ELD technology to ensure compliance with working hours regulations. **WO3 (W4, W5 + O1): Mandatory Implementation of ADAS & DMS Technology.** Address risky behaviors (W4) and self-regulation failures (W5) with the help of

			early warning technology and *real-time monitoring (O1).* **WO4 (W1, W3+O2): Development of the Driver Mental Health Program (EAP).** Addressing unmonitored health issues (W1) and physical health issues by adopting a proven global EAP (O2) model.
	T	*Threat Power* **ST1 (S2 + T1): Driver Participation-Based Infrastructure Reporting System.** Leverage the driver's extensive experience (S2) to proactively map and report infrastructure vulnerabilities (T1) to authorities. **ST2 (S1, S3 + T4): Strengthening Integrated and Data-Driven Law Enforcement.** Using driver qualifications and vehicle eligibility as non-negotiable minimum standards in law enforcement to close oversight gaps.	*Threat Weaknesses* **WT1 (W2 + T3): Standardization of Rest Facilities on Fatigue-Prone Tracks.** Formulate measures to prevent fatigue (W2) by establishing or standardizing *a decent rest area* (T3) on a strategic route with minimal facilities. **WT2 (W6+T4): Public Safety Rating System for Bus Operators.** Creating an external accountability system (rating) to suppress business models that drive risk (W6), especially amid regulatory oversight gaps (T4).
			WT3 (W5+T1, T2, T5): Advanced defensive driving training. Develop specialized training modules to overcome driving difficulties (W5) in the face of external threats such as poor infrastructure (T1), complex traffic (T2), and bad weather (T5).

Based on the results of the TOWS matrix, the next step is to prioritize the most effective and relevant interventions. The following table presents 11 extracted strategy recommendations, complete with their reference codes and key objectives, for further validation and refinement by experts.

The determination of priority order was carried out through quantitative analysis using the USG (Urgency, Seriousness, and Growth) method. In this stage, five experts (Member 1 to Member 5) provide an assessment of each strategy. Scores from all experts are then accumulated to produce a total value that is the basis for ranking priority strategies. The results of the analysis are as follows:

Table 3 Recommendation Strategy

NO.	TOWS CODE	RECOMMENDATION STRATEGY	MAIN OBJECTIVES	TOTAL	RANK
1.	WO1	**Wage & Incentive System Restructuring:** Replacing the trip based compensation with a monthly base salary (above UMP/MSE) plus safety performance based incentives (record zero accidents, telematics score).	Eliminate economic pressure as a major driver of risky and tiring driving behavior. Focus of Intervention: • Risky Driving Behavior • Mental and Physical Conditions • Company Management	69	2
2.	WO3	**Mandatory Application of ADAS & DMS Technology:** Requires the installation of *ADAS (*Advanced Driver	Provide real-time early warning and technological interventions to prevent	58	9

		Assistance Systems*) and DMS (*Driver Monitoring System*)* systems on the entire AKAP bus fleet.(Pizzicori et al., 2025; Scholliers et al., 2020; Xu et al., 2021)	accidents due to concentration disorders, drowsiness, and failure to anticipate. Focus of Intervention: • Risky Driving Behavior • Mental and Physical Conditions		
3.	WO2	**Digitization of Working Hours Monitoring (ELD/Tachograph):** Requires the use of certified ELDs (*Electronic Logging Devices*) on all fleets to accurately monitor/track working hours, breaks, and speeds.(Electronic Logging Devices | FMCSA, n.d.;	Ensure compliance with working hours regulations and systematically address driver fatigue. Focus of Intervention: • Mental and Physical Conditions • Company Management	59	8
4.	WO4	**Development of a Digital-Based Driver Mental Health (EAP) Program:** Developed a standardised national EAP, adopting *a best practice model* such as Australia's "Healthy Heads in Sheds & Trucks" (HHTS) initiative . The program provides a digital platform (website & app) that provides easy access for drivers to conduct mental health checkups, access educational materials (articles, videos), relaxation exercises, and a directory of professional assistance services.(Healthy Heads - Supporting Mental Health in Trucking and Logistics , n.d.)	Managing stress and unmonitored health conditions as major risk factors for accidents. Focus of Intervention: • Mental and Physical Conditions	53	11
5.	SO1	**National Standardization of Competency Training & Certification:** Creates a Professional Driver Competency Certification that must be updated regularly, covering *defensive driving* , risk management, and mastery of safety technology.	Improve and equalize the standards of driver skills, by utilizing existing qualifications and experience as basic capital. Focus of Intervention: • Risky Driving Behavior	73	1
6.	ST2	**Strengthen Integrated and Data-Driven Law Enforcement:** Integrate surveillance data from multiple sources (ELD, DMS, ETLE, Digital *Ramp Inspection* Report) to conduct targeted and consistent law enforcement against violations.	Increase effectiveness and create a deterrent effect, as law enforcement is based on objective digital evidence. Focus of Intervention: • Risky Driving Behavior • Government Regulations	65	5

7.	WT2	**Public Safety Rating System for Bus Operators:** Creates a *Safety Rating* System (e.g. 1-5 Stars) for each PO issued, assessed based on the number of accidents, compliance, and inspection results.	Encourage healthy competition between operators in terms of safety and provide information to passengers. Focus of Intervention: • Company Management • Government Regulations	68	3
8.	ST1	**Driver Participation-Based Infrastructure Reporting System:** Create an integrated digital platform for drivers to report accident-prone points (*black spots*), damaged roads, or minimal traffic signs to the Ministry of PUPR & Dishub.	Leveraging the experience of thousands of drivers as "sensors in the field" to accelerate the identification and mitigation of infrastructure risks. Focus of Intervention: • Environment and Traffic	55	10
9.	WT1	**Standardization of Rest Facilities on Fatigue-Prone Routes:** Identify corridors or routes with the highest fatigue levels and build/improve the quality of *rest areas specifically* for commercial vehicle drivers.	Provide a safe and decent rest area to support the driver's physical and mental recovery. Focus of Intervention: • Risky Driving Behavior • Government Regulations • Traffic and Environment	61	7
10.	SO2	**Digitization and Transparency of Vehicle Inspection Process: Implement** *a digital ramp inspection system* where the results are recorded in a national database and can be verified through QR Codes on buses. Sanctions are in the form of freezing operating licenses for companies that repeatedly violate eligibility requirements. Indonesian Regulation: PM of Transportation 27/2021. Benchmark: A strict annual commercial vehicle inspection system (such as MOT in the UK or TÜV in Germany). Sudden inspections in the bus parking area, not just in the terminal.	Prevent the practice of "roadless buses remain in operation" and improve the accountability of the inspection process at the terminal. Focus of Intervention: • Company Management • Government Regulations	62	6
11.	WT3	**Advanced defensive driving training**. Develop specialized training modules to overcome driving difficulties in the face of external threats such as poor	Develop drivers who are able to proactively anticipate, manage, and mitigate the risk of external threats, not just react. Focus of Intervention:	66	4

	infrastructure, complex traffic, and bad weather.	• Risky Driving Behavior • Company Management • Traffic and Environment

Based on the results of the assessment using the Urgency, Seriousness, and Growth (USG) method for the 11 recommended strategies, two main priorities were obtained. The Standardization of National Competency Training and Certification ranks first, followed by the Restructuring of the Wage and Incentive System in second place, so both are chosen as priority focuses. Following up on these results, experts provided a number of strategic inputs and suggestions to improve these two priority recommendations, namely experts providing strategic input related to the development of National Competency Training and Certification Standardization, namely by first designating drivers as official professions such as pilots. Furthermore, it is necessary to prepare a clear level of position to support professionalization. Thus, the Standardization of National Competency Training and Certification can be directed to the Transformation of the Driver Profession: Towards the Standardization of Competency and Vocational Education. This transformation emphasizes that drivers are not only seen as operational workers, but as professions that have measurable competence, tiered qualifications, and access to continuous Vocational education. This approach is expected to be able to improve the quality of safety, welfare, and competitiveness of drivers in the national transportation system.

1. Recommended Strategy 1

The implementation of the National Competency Training and Certification Standardization strategy requires planned collaborative action from regulators and industry players. The following are the details of the proposed recommendations for each party:

a. Formalizing Profession Status

This recommendation is specifically addressed to the Ministry of Manpower (Kemnaker) as the authorized institution to set national standards and classifications of positions. This proposal focuses on refining the Indonesian Standard Occupational Classification sector(KBJI) to provide formal recognition and a strong legal basis for enhancing the professionalism and welfare of intercity and interprovincial bus drivers (AKAP). This practice refers to a model that has been successfully implemented in the European Union, where every commercial vehicle driver is required to have a Certificate of Professional Competence (CPC). This certification ensures that the driving profession is formally recognised and that its competencies are standardised through mandatory periodic training (Directive (EU) 2022/2561 Of The European Parliament And Of The Council, 2022) (2022/2561, 2022).

Concretely, the proposed policy intervention is to add a new, more specific occupational code in the 8331 Bus and Tram Driver group, namely 8331.04 - Road Transport Professional Bus Driver (Licensed), with a job description "Driving and operating scheduled public transport buses (Inter-Provincial Inter-City/AKAP and Inter-Provincial City/AKDP) in accordance with specified safety standards, schedules, and routes. The main qualification for this position is to have a valid Professional License from the National Professional Certification Board (BNSP) and to have attended SKKNI-based education/training."

Key Justifications and Arguments:

1) The structural consistency, i.e. the addition of the 8331.04 code, will be consistent with the existing numbering logic (following .01, .02, and .03) and fill in the gaps of the most important categories.
2) If a tour bus driver (8331.01) is considered to be specific enough to have its own code, then AKAP bus drivers who objectively have a higher level of fatigue, a greater risk of fatal accidents, and a greater responsibility for public safety should have a special classification of their own.
3) The Special Advanced Policy Unlock Code 8331.04, this will be an administrative "key" for:
    a) Setting a Statutory Sectoral Minimum Wage (UMS) that is fair and in accordance with the level of risk and expertise.
    b) Implement strict and supervised working hours rules.
    c) Provide professional recognition and dignity on par with other high-risk professions.

The relevance of this research is further strengthened by the momentum of the latest national policy focusing on the formalization of the driving profession, which is marked by an agreement between the Ministry of Transportation and the Ministry of Manpower as well as the active role of *BNSP*. This momentum is reflected in the July 2025 edition of the National Jobs Map for the Transport and Logistics Sector, which has accommodated the bus driver profession but shows that the definition of career paths and qualifications still requires refinement to the job map and the formulation of derivative regulations from the *SKKNI* framework for drivers.

b. Developing a National Certification Framework

The institutionalization of the competency certification framework for professional drivers must be based on the Indonesian National Work Competency Standard (*SKKNI*) system which has been established through the Decree of the Minister of Manpower and Transmigration Number 269 of 2014 in the field of Drivers, and strengthened by the Regulation of the Minister of Transportation Number PM 7 of 2018 Roadmap for Competency Development of *SKKNI* in the Transportation Sector. This regulation affirms that driving is a formally qualified profession that includes aspects of knowledge, skills, and work attitudes, as implemented by the Commercial Driver's License (CDL) in the United States. However, the implementation of *SKKNI* on *AKAP* buses is still lagging behind special freight transportation (PM 13/2023) which requires competency certification as an absolute requirement for an operating permit. Currently, *AKAP* buses only require annual training without a formal certification mandate in the route licensing process. Therefore, cross-sectoral policy intervention is needed through Government Regulations or Ministerial Regulations to integrate competency certification as a prerequisite for licensing *PO* Bus routes. This ensures that the certification policy is not just administrative, but becomes a binding legal instrument in the licensing and operational supervision system to ensure the safety of road transportation.

The logical implication of this policy is the need to prepare derivative regulations in the form of Government Regulations (*PP*) or Ministerial Regulations across sectors that

specifically regulate "Professional Standards and Competency Certification of Public Transportation Drivers". This instrument must include:

1) The multi-level qualification structure is in accordance with the Indonesian National Qualifications Framework (*KKNI*);
2) validity and recertification mechanisms;
3) institutional attribution for *BNSP, LSP*, and educational/training institutions; and
4) Formulation of effective sanctions for non-compliant operators.

Analogously, the driver position grading system can mimic other standardized professional models, such as pilots in the aviation sector. In Ministry of Transportation Regulation No. 7 of 2018, the level of pilot positions is formulated in stages starting from First Officer, Senior First Officer, to Captain, with a strict certification and recertification mechanism based on flight hours. This layered pattern can be adapted in the design of the *AKAP* bus driver profession, for example the Main Driver, Intermediate Driver, Main Driver or Driver Instructor levels so that it can build a clear career path, and ensure the quality of competence.

Thus, the standardization of the driving profession will evolve from a monolithic model (Level 3 *KKNI*) to a progressively layered system, which not only ensures mandatory certification and periodic renewal, but also opens up career development pathways and provides formal recognition of the improvement of professional drivers' skills and experience. The certification system is designed in stages to create a clear career path and recognition of the following skill levels.

Table 4 Recommendations for Driver Positions

NO.	Level	Certification Name	Target Participants	Main Focus of Competence
1.	KKNI Level 3	Professional Driver – Junior Level	New drivers or those who are already employed but do not yet have a certification. Become a minimum mandatory standard.	Fundamental Operations & Safety: Masters 16 units of basic competencies of KKNI 269 3.3.1, including *Defensive Driving* , introduction to ADAS & DMS, basic Fatigue Management, and professional ethics.
2.	KKNI Level 4	Professional Driver - Intermediate Level	Experienced driver (minimum 5-10 years at Level 3) with a good safety track record.	Advanced Skills & Efficiency: Advanced Defensive Driving (e.g., maneuvering in difficult conditions), *Proactive Travel Risk Management, Economical Driving Strategies, Light technical problem-solving* , and mentoring skills.
3.	KKNI Level 5	Professional Driver – Master/Instructor	Senior drivers (minimum 5 years at Level 4) who are projected to be Instructor Supervisors.	Managerial, Analytical, & Instructional: Telematics data analysis, basic incident investigation, development of training materials, and the ability to become an Internal Competency Assessor.

In the long-term context, the existence of this structured and multi-level national certification framework can be the main foundation for encouraging cross-border recognition or mutual recognition for the public transport driver profession in Indonesia. The model of mutual recognition of driver certification has been effectively implemented in various regions, such as the European Union which integrates professional driving licenses between its member

states through the harmonization of training standards, working hours, and competency tests (Directive 2006/126/EC Of The European Parliament And Of The Council, 2006) (2006/126/Ec, 2006). Thus, Indonesian drivers who have obtained a Professional Competency Certificate (SKP) at a certain level under the Indonesian National Qualifications Framework (*KKNI*) have the potential to obtain formal recognition in partner countries, especially within the framework of ASEAN regional cooperation related to cross-border transportation facilitation. This recognition not only increases the competitiveness of Indonesia's transportation workforce, but also strengthens safety standards in cross-border public transportation services.

c. Transforming the Driver Education System through Vocational Education and Training (*VET*)

In response to the lack of formal educational institutions for the bus driver profession, a systemic transformation from a short-term course model to a structured Vocational Education and Training (*VET*) (*VET*) is recommended. This step is essential to ensure a sustainable supply of competent labor and improve the status of the profession. The implementation of this transformation is outlined as follows:

1) Establishment of a Pilot Project

Existing educational institutions can be appointed as pioneers to open new study programs such as the Department of Highway Transportation Engineering (Professional Driver Concentration) at the Vocational level, or the D1/D2 Highway Transportation Operations Management Program for higher education levels.

2) SKKNI-Based Curriculum Standardization

The national curriculum must be set compulsorily, with a composition of 70% practice and 30% theory, referring to the National Work Competency Standards (*SKKNI*) for Drivers (2014) and updated according to industry needs. This three-year vocational education program integrates modern technology competencies, human factors, and risk management through apprenticeship schemes in bus companies and theory in vocational schools. To ensure effectiveness, graduates of this accredited program automatically obtain a Level 3 Professional Competency Certificate (*SKP*) without retesting. Its implementation requires regulatory intervention through the formalization of the profession in the Indonesian Standard Position Classification (*KBJI*) as well as institutional collaboration between the Ministry of Transportation, the Ministry of Education, and industry. Although strategic, the main challenge lies in the need to invest in facilities, develop relevant curriculum, and build a credible and accessible Professional Certification Body (*LSP*) for all prospective drivers.

2. Recommended Strategy 2

The second strategy recommendation is the restructuring of the remuneration system. This restructuring was carried out because the system which was originally in the form of a performance based variable compensation scheme tied to trip frequency that created income uncertainty, was changed to a stable and predictable monthly fixed wage structure. This change is accompanied by the implementation of the Position Allowance as an instrument of compensation differentiation that reflects career paths. Here are the details of the restructuring components:

a. Fixed Remuneration Structure (Monthly Wage)

The gross amount of all components below may refer to the honorarium limit set forth in the Input Cost Standard (*SBM*). (Reference: PMK No. 32 of 2025).

1) Basic Salary: Basic remuneration with a minimum amount of 75% of the total basic salary plus fixed allowances in accordance with Government Regulation Number 36 of 2021 concerning Wages.
2) Position Allowance: A fixed allowance given based on the driver's career level or level (e.g., Junior, Intermediate, Senior/Master) as a reflection of his or her responsibilities. The amount is determined in accordance with the Company's Internal Policy based on the Wage Structure & Scale.
3) Risk/Safety Allowance: Fixed compensation provided for potential risks on the job and as an incentive to maintain a track record of driving safety. The amount is set to be adjusted. The Company's Internal Policy analyzes the risk of the position.
4) Other Benefits: Other fixed benefits such as transportation or communication assistance that are paid periodically. The amount is prepared in accordance with the Company's Internal Policy.

b. Components of Non-Fixed and Non-Wage Income

These components are budgeted and paid separately, exempt from the monthly expenditure ceilings set by the Standard Input Cost (*SBM*).

1) Overtime: Financial compensation paid for working hours that exceed the predetermined standard time, in accordance with Government Regulation Number 35 of 2021.
2) Religious Holiday Allowancera (*THR*): Annual non-wage income that must be paid by the employer ahead of religious holidays. In accordance with the regulation of Ministry of Manpower Regulation No. 6 of 2016.

c. Statutory Payroll Deduction

Deductions imposed on the employee's gross income are in accordance with applicable laws and regulations.

1) National Employment Insurance Contribution (BPJS Employment)
2) National Health Insurance Contribution (BPJS Health)
3) Individual Income Tax (Article 21 on Income Tax)

The restructuring of the wage system is a crucial step to mitigate risky driving behaviors triggered by economic pressures. It is suggested to transition from trip based compensation to a fixed basic salary structure with tiered allowances (Junior, Intermediate, Senior) and safety-based incentives. This strategy requires regulatory intervention from the Ministry of Manpower and the Ministry of Transportation to establish mandatory salary structure standards for bus companies. Despite the challenges of potential resistance from conventional trip-frequency business models and the need to invest in telematics technology for performance monitoring, gradual implementation through pilot projects is a pragmatic solution. This pattern is projected not only to provide income and welfare certainty for drivers, but also fundamentally eliminate dependence on Target based Revenue Sharing System and motivation to maximize trip frequency (ritase), thereby creating a fairer and more sustainable transportation safety culture in Indonesia.

CONCLUSION

The study concluded that *AKAP* bus accidents were influenced by six main factors, namely risky driving behavior, drivers' mental and physical condition, company management, government regulations, environment and traffic, and vehicles, which were then broken down into 34 relevant indicators. The results of the SEM-PLS analysis showed five factors that had a significant effect on accidents, with the driver's mental and physical condition as the most dominant factors, followed by risky driving behavior, company management, and government regulations acting as protective factors, while vehicle factors were insignificant due to strict feasibility standards. Based on the analysis of *SWOT TOWS* and *USG*, two priority strategies were determined to improve safety, namely the transformation of the driver's profession through the standardization of competencies and vocational education, and the restructuring of the wage system from a trip based compensation to a fixed salary with safety-based incentives to improve welfare and reduce risky behavior.

REFERENCES

2006/126/Ec, D. (2006). Directive of the European Parliament and Council on driving licenses. *Official Journal of the European Union*, *N/A*. https://doi.org/N/A

2022/2561, D. (Eu). (2022). Directive on the initial qualification and periodic training of drivers. *Official Journal of the European Union*, *N/A*. https://doi.org/N/A

Alkaabi, K. (2023). Identification of hotspot areas for traffic accidents and analyzing drivers' behaviors and road accidents. *Transportation Research Interdisciplinary Perspectives*, *22*. https://doi.org/https://doi.org/10.1016/j.trip.2023.100929

Amoadu Ansah E.W. & Sarfo J.O., M. (2024). Psychosocial work conditions and traffic safety among minibus and long-bus drivers. *Journal of Occupational Health*, *66(1)*. https://doi.org/https://doi.org/10.1093/joccuh/uiad019

Cameron, M. (2023). The role and strategies for traffic policing in road safety. *N/A*, *N/A*. https://doi.org/N/A

Crizzle Toxopeus R. & Malkin J., A. M. (2020). Impact of limited rest areas on truck driver crashes in Saskatchewan: A mixed-methods approach. *BMC Public Health*, *20(1)*. https://doi.org/https://doi.org/10.1186/s12889-020-09120-7

Dawson & McCulloch K., D. (2005). Managing fatigue: It's about sleep. *Sleep Medicine Reviews*, *9(5)*. https://doi.org/https://doi.org/10.1016/j.smrv.2005.03.002

Ding Yin H. Li Z. He X. Zheng L. & Xi J., T. (2024). Analysis of Risk Bus Driver Characteristics and Research on Risk Level Evaluation Methods for Bus Drivers. *IEEE Access*, *N/A*. https://doi.org/https://doi.org/10.1109/ACCESS.2024.3498936

Ding Zhang L. Xi J. Li Y. Zheng L. & Zhang K., T. (2023). Bus Fleet Accident Prediction Based on Violation Data: Considering the Binding Nature of Safety Violations and Service Violations. *Sustainability*, *15(4)*. https://doi.org/https://doi.org/10.3390/su15043520

Dou Deng S. Yu H. Li T. Yu S. Zhang J., Y. (2024). Research on the Optimization Method of Bus Travel Safety Considering Drivers' Risk Characteristics. *Applied Sciences*, *14(20)*. https://doi.org/https://doi.org/10.3390/app14209598

Electronic Logging Devices | FMCSA. (n.d.). Retrieved July 17, 2025, from https://www.fmcsa.dot.gov/hours-service/elds/electronic-logging-devices

Electronic Logging Devices and Hours of Service Supporting Documents. (15 C.E.). http://www.regulations.gov.

Fadhil, A., Anggraini, R., & Sugiarto, S. (2022). ANALISIS HUBUNGAN KESALAHAN, PEYIMPANGAN DAN PELANGGARAN PENGGUNA RODA DUA TERHADAP KESELAMATAN BERKENDARA. *Jurnal Arsip Rekayasa Sipil Dan Perencanaan*, *5*(1), 16–25. https://doi.org/10.24815/jarsp.v5i1.24681

Haddon, W. (1972). A Logical Framework For Categorizing Highway Safety Phenomena And Activity. *N/A*, *N/A*. https://doi.org/N/A

Hair Ringle C.M. & Sarstedt M., J. F. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19(2)*. https://doi.org/https://doi.org/10.2753/MTP1069-6679190202

Healthy Heads - Supporting Mental Health in Trucking and Logistics. (n.d.). Retrieved July 17, 2025, from https://www.healthyheads.org.au/

J. Skulmoski T. Hartman F. & Krahn J., G. (2007). The Delphi Method for Graduate Research. *Journal of Information Technology Education: Research*, *6*. https://doi.org/https://doi.org/10.28945/199

Kanaila Bobihu P. Jusuf H. Mahdang P.A., F. (2024). Hubungan Aggressive Driving Behavior Dengan Kejadian Kecelakaan Lalu Lintas Pada Pengemudi Bus AKAP dan AKDP di Terminal Kota Gorontalo. *Jurnal Kolaboratif Sains*, *7(7)*. https://doi.org/https://doi.org/10.56338/jks.v7i7.5597

Lucidi, F., Girelli, L., Chirico, A., Alivernini, F., Cozzolino, M., Violani, C., & Mallia, L. (2019). Personality traits and attitudes toward traffic safety predict risky behavior across young, adult, and older drivers. *Frontiers in Psychology*, *10*(MAR). https://doi.org/10.3389/fpsyg.2019.00536

Made Kariyana Hayataning Pamungkas T. & Ayu Anggraini T., I. (2024). Model Pengaruh Komposisi Jumlah Kendaraan Terhadap Tingkat Kecelakaan Pada Provinsi Bali. *N/A*, *7(1)*. https://doi.org/N/A

Mokarami, H., Alizadeh, S. S., Rahimi Pordanjani, T., & Varmazyar, S. (2019). The relationship between organizational safety culture and unsafe behaviors, and accidents among public transport bus drivers using structural equation modeling. *Transportation Research Part F: Traffic Psychology and Behaviour*, *65*, 46–55. https://doi.org/10.1016/j.trf.2019.07.008

Pembuain Priyanto S. & Suparma L.B., A. (2019). The Effect of Road Infrastructure on Traffic Accidents. *11th Asia Pacific Transportation and the Environment Conference*, *N/A*. https://doi.org/N/A

Peters Grogan H. Henderson G.M. Gómez M.A.L. Maldonado M.M. Sanhueza I.S. & Dennerlein J.T., S. E. (2021). Working conditions influencing drivers' safety and well-being in the transportation industry. *International Journal of Environmental Research and Public Health*, *18(19)*. https://doi.org/https://doi.org/10.3390/ijerph181910173

Pizzicori, M., Piantini, S., Lucci, C., Cordellieri, P., Pierini, M., & Savino, G. (2025). Retrofitting ADAS for Enhanced Truck Safety: Analysis Through Systematic Review, Cost–Benefit Assessment, and Pilot Field Testing. *Sustainability (Switzerland)*, *17*(11). https://doi.org/10.3390/su17114928

Scholliers, Johan., Tarkiainen, Mikko., Silla, Anne., Modijefsky, Michiel., Janse, Rick., & Born, G. van den. (2020). *Study on the feasibility, costs and benefits of retrofitting advanced driver assistance to improve road safety : final report*. Publications Office of the European Union.

Sekaryadi Setiawan D. & Nurhalim I., Y. (2019). Kajian korelasi kecelakaan dengan kepadatan lalu lintas di ruas jalan Cianjur-Sukabumi. *Jurnal Momen*, *02(2)*. https://doi.org/N/A

Shappell & Wiegmann D.A., S. (2000). The Human Factors Analysis and Classification System-HFACS. *N/A*, *N/A*. https://doi.org/https://www.researchgate.net/publication/247897525

Škerlič, S., & Erčulj, V. (2021). The impact of financial and non-financial work incentives on the safety behavior of heavy truck drivers. *International Journal of Environmental Research and Public Health*, *18*(5), 1–15. https://doi.org/10.3390/ijerph18052759

Fajri Lubis. (2024). Pemimpin Berperan Besar dalam Peningkatan Kinerja Keselamatan di Perusahaan Angkutan Umum. *Jurnal Penelitian Kesehatan "SUARA FORIKES" (Journal of Health Research "Forikes Voice")*. https://doi.org/10.33846/sf15235

Syahliantina, A. (2025). Kajian Faktor-Faktor Yang Mempengaruhi Terjadinya Kecelakaan Sebagai Dasar Mitigasi Kecelakaan Bus Antarkota Antarprovinsi (Akap). *N/A*, *N/A*. https://doi.org/N/A

Tschumi, B. (1996). *Architecture and Disjunction*. MIT Press.

Wildan, A. (2023). Kajian Teknis Rem Blong pada Bus dan Truk. *Diva Press*, *N/A*. https://doi.org/N/A

Xu, Y., Ye, Z., & Wang, C. (2021). Modeling commercial vehicle drivers' acceptance of advanced driving assistance system (ADAS). *Journal of Intelligent and Connected Vehicles*, *4*(3), 125–135. https://doi.org/10.1108/JICV-07-2021-0011

Zainy Pratama G.B. Kurnianto R.R. & Iridiastadi H., M. L. S. (2023). Fatigue Among Indonesian Commercial Vehicle Drivers: A Study Examining Changes in Subjective Responses and Ocular Indicators. *International Journal of Technology*, *14(5)*. https://doi.org/https://doi.org/10.14716/ijtech.v14i5.4856

Zeng Qiang Y. Zhang N. Yang X. Zhao Z. & Wang X., Y. (2024). An Influencing Factors Analysis of Road Traffic Accidents Based on the Analytic Hierarchy Process and the Minimum Discrimination Information Principle. *Sustainability*, *16(16)*. https://doi.org/https://doi.org/10.3390/su16166767