ANALYSIS OF FREIGHT DRIVER BEHAVIOR ON TRAFFIC SAFETY IN SOUTH SULAWESI

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ABSTRACT
South Sulawesi faces a critical road safety challenge due to high traffic accident rates involving freight drivers, primarily linked to behavioral factors. Despite rising concerns about driving discipline, skills, and emotional regulation in this sector, the mediating role of safety knowledge remains underexplored. This study investigates the direct and indirect effects of freight driver behavior (driving discipline, driving skills, and emotional regulation) on traffic safety outcomes, with safety knowledge as a mediator. A quantitative approach was employed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 4. Data from 300 randomly selected freight drivers in South Sulawesi were collected through validated questionnaires (Cronbach's Alpha >0.85). Analysis included 500-bootstrap resampling to test path significance. Driver behavior (discipline/skills/emotional regulation) directly explained 92% of traffic safety variance ($\beta = 0.92$, $p<0.001$). Safety knowledge mediated indirect effects but had weaker direct impact (28.7% variance explained). Emotional regulation emerged as the strongest behavioral predictor. Freight accidents are predominantly driven by behavioral factors rather than knowledge gaps. Interventions targeting driving discipline and emotional regulation—supplemented by safety training—are critical for reducing accidents. Establishes a hierarchical relationship between driver behavior and safety knowledge, challenging assumptions of knowledge as the primary safety driver.

Keywords: Logistics transportation, Driving Behavior, Traffic Safety, South Sulawesi, Sem-Pls

INTRODUCTION
Safety in freight transportation in South Sulawesi is a critical issue, particularly in relation to driver behavior and cargo supervision (Dhista Ayunia et al., 2020; Patimah & Nurfauzan, 2022). Traffic safety is a multidimensional issue with serious implications for public safety, community welfare, and sustainable development (Syahriza, 2019). This issue is becoming increasingly critical in areas with high traffic accident rates, one of which is South Sulawesi Province (Fisu, 2019). Data shows that this region frequently ranks at the top in national accident statistics, resulting in fatalities, injuries (Widiyanti, 2016), significant material losses, and disruptions to the logistics chain (Nugroho et al., 2024; Nisumanti, 2018; Suryadarmawan et al., 2022).

In this context, several research questions arise: (1) What are the behavioral factors of freight transport drivers that influence traffic safety? (2) Truck drivers face various challenges and risks in their work, including operating heavy vehicles with a high potential for accidents, especially on certain routes in major cities (Rithoma et al., 2022). Factors influencing driver safety include the role of supervisors, driving training, work experience, and knowledge (Alfian Munawar et al., 2024). For hazardous goods transportation, additional factors such as packaging, vehicle condition, and compliance with regulations also play a significant role (Ramli & Pawelloi, 2021; Hutabarat, 2020).

The urgency of this research lies in the need for efforts to improve safety through education and training on safety systems, including driving procedures and understanding the characteristics of goods transportation (Sulistyo et al., 2021). By considering these factors, it is hoped that accident risks can be reduced and safety in the goods transportation industry can be improved (Hakzah et al., 2023). The Theory of Planned Behavior (TPB) has been applied in various contexts to predict behavioral intentions and actual behavior. Research shows that attitudes, subjective norms, and perceived behavioral control significantly influence the intention to comply with government regulations (Nadhira Afdalia et al., 2014), participating in reporting

violations (Ariwan Perdana et al., 2018), complying with tax obligations (Aini Indrijawati et al., 2022), and seeking medical care (Ady Irawan et al., 2023). This study aims to analyze the direct and indirect effects of freight driver behavior on traffic safety, with safety knowledge as a mediator, using a quantitative approach and Partial Least Squares Structural Equation Modeling (SEM-PLS) techniques. It is hoped that this study will provide significant contributions to understanding the factors influencing traffic safety in South Sulawesi, as well as recommendations for improving driving safety among freight transport drivers.

METHOD

The study used random sampling techniques with 300 respondents who were freight drivers at two motor vehicle inspection units (UPPKB), namely UPPKB Data'e and UPPKB Maccopa, located in South Sulawesi. The data analysis technique used in this study was PLS (Partial Least Squares) with structural equation modeling (SEM) using a numerical scale in the smart PLS version 4.0 application. The dimensions of the variables used were driving discipline (X1), fatigue (X2), driving skills (X3), and emotional regulation (X4) in relation to traffic safety (Z) and knowledge as a mediator (X). The measurement models tested were: (1) measurement model (outer model), namely convergent validity and discriminant validity composite reliability; (2) inner model analysis, namely model fit test, coefficient of determination (R2), and (3) hypothesis testing. Based on theoretical descriptions and previous research related to the influence of behavior on traffic safety. Therefore, this study is necessary to analyze the direct and indirect contributions of freight transport drivers' behavior to traffic safety, mediated by driving knowledge, and can be described within the conceptual framework of the study (Figure 1) and research hypotheses.

H1 = Driving discipline is thought to have a direct effect on traffic safety.
H2 = Driving discipline is thought to have a direct effect on driving knowledge.
H3 = Driving fatigue is thought to have a direct effect on traffic safety.
H4 = Driving fatigue is thought to have a direct effect on driving knowledge.
H5 = Driving skills directly influence driving knowledge.
H6 = Driving skills directly influence traffic safety.
H7 = Emotional behavior is thought to have a direct effect on traffic safety.
H8 = Emotional behavior is thought to have a direct effect on driving knowledge.
H9 = Driving knowledge is thought to have a direct effect on traffic safety
H10= Driving discipline is thought to have an indirect effect on traffic safety through driving knowledge
H11= Driving fatigue is thought to have an indirect effect on traffic safety through driving knowledge
H12= Driving skills are suspected to have an indirect effect on traffic safety through driving knowledge
H13= Emotional behavior is suspected to have an indirect effect on traffic safety through driving knowledge

RESULT AND DISCUSSION

1. Outer Model (Measurement Model)

Convergent Validity

Convergent validity is a measure used to ensure that items accurately reflect the construct being measured (M. Purnamasari, 2023). Convergent validity is often assessed alongside discriminant validity using structural equation modeling (SEM) techniques (Cheung & Wang, 2017). Convergent validity was evaluated to determine the effectiveness of the measuring instruments to ensure that the instruments measuring the variables of fatigue, driving skills, emotional regulation, driving knowledge, and driving safety accurately captured the intended constructs and provided the following results in Table 1.

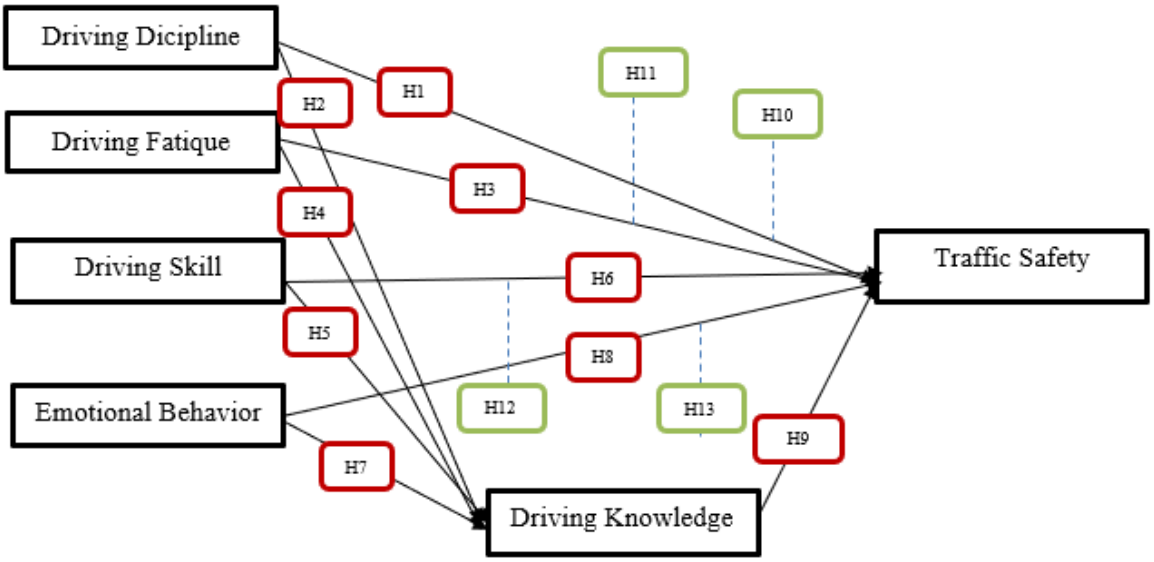

Figure 1 Conceptual Framework

Table 1.
Measurement Model

	Driving Dicipline	Driving Fatique	Driving Skill	Emotional Behavior	Traffic Safety	Driving Knowledge
X1.1	0.926					
X1.2	0.750					
X1.3	0.884					
X2.1		0.775				
X2.2		0.975				
X2.3		0.789				
X3.1			0.881			
X3.2			0.889			
X3.3			0.894			
X4.1				0.929		
X4.2				0.958		
X4.3				0.919		
Y1.1					0.944	
Y1.2					0.943	
Y1.3					0.960	
Y2.1					0.953	
Y2.2					0.852	
Y2.3					0.938	
Y2.4					0.864	
Z1.1						0.886
Z1.2						0.809
Z1.3						0.932

Source: processed data, smart-pls 4

The next step is to assess convergent validity through the AVE (Average Variance Extracted) value. Hair (2010) states that if a model has an AVE value above 0.6, then the model is categorized as having high convergent validity. After eliminating factor loadings below 0.6, the AVE values are shown in Table 2.

Table2.
Average Variance Extracted (AVE)

Variabel	Average variance extracted (AVE)
Driving Dicipline (X1)	0.734
Driving Fatique (X2)	0.724
Driving Skill (X3)	0.788
Emotional Behavior (X4)	0.875
traffic safety (Y)	0.852
Driving Knowledge (Z)	0.769

Source: Processed data, smart-pls 4 (2025)

Discriminant Validity

This test was conducted to ensure that the research model had good discriminant validity, so the Fornell-Larcker test was performed. the fornell larcker critarian are shown in Table 3.

Tabel 3.
Fornell Larcker Criterian

	X1.	X2.	X3.	X4.	Y	Z1.
X1.	0.872					
X2.	-0.030	0.940				
X3.	-0.028	-0.048	0.852			
X4.	-0.089	0.057	0.307	0.928		
Y	-0.049	0.127	0.214	0.228	0.962	
Z	0.266	-0.166	-0.116	-0.183	-0.035	0.864

Source: Processed data, smart-pls 4 (2025)

Based on Table 3, we can see that all variables have higher values when explaining the variable itself compared to other variables in the same column. Emotional regulation has a value of 0.928, which is higher than other variables in the same column. Similarly, driving skills have a value of 0.852, which is higher than fatigue. The table above suggests that the data model tested in this study meets the required criteria.

Composite Realibilty

The acceptable CR (Composite Reliability) value in this study ranges from 0.70 to 0.80. A construct can be said to have good reliability if its value is 0.70. The composite reliability value table is shown in Table 4.

Table 4.
Nilai Composite Realibilty

Variable	Composite reliability
Driving Dicipline (X1)	0.891
Driving Fatique (X2)	0.886
Driving Skill (X3)	0.918
Emotional Behavior (X4)	0.955
traffic safety (Y)	0.976
Driving Knowledge (Z)	0.909

Source: Processed data, smart-pls 4 (2025)

Table 4 shows that the CR (Composite Reliability) value is > 0.80, indicating that all variables in this research model are valid. From all stages of outer model testing, the variables in this study have good convergent validity, good discriminant validity, and good internal consistency reliability.

2. Structural Model Testing (inner model)

R-Square testing

Research data testing using a structural model (Inner Model) was conducted to determine the relationship between constructs, significance values, R-square, and research models. This model will be evaluated using R-square for the dependent construct T-test and the significance of the structural path parameter coefficients. The R-square values are presented in Table 5.

Table 5.
Nilai R-square

Variable	R-square
Traffic Safety	0.920
Driving Knowledge	0.490

Source: Processed data, smart-pls 4 (2025)

Table 5 shows the R-Square value for the traffic safety variable as 0.920. This result indicates that 92% of the traffic safety variable can be influenced by the variables of fatigue, driving skills, emotional regulation, and driving knowledge, while 8% is influenced by other variables outside the scope of this study. Meanwhile, driving knowledge obtained a value of 0.490. This result indicates that 49% of the driving knowledge variable can be influenced by the variables of fatigue, driving skills, and emotional regulation. Meanwhile, 51% is influenced by other variables outside the scope of this study.

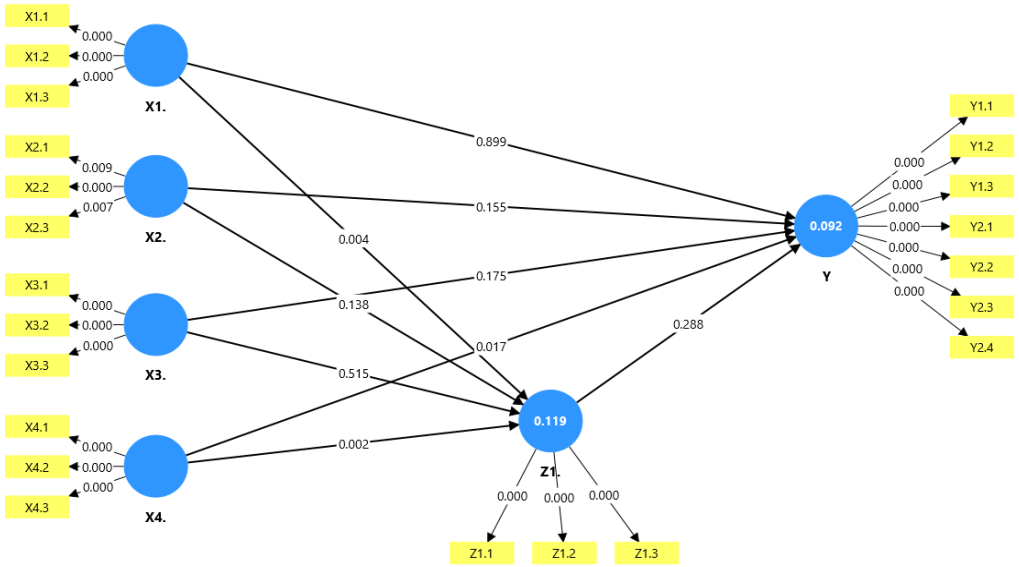

Figure 2. Path Model

3. Hypothesis Testing

Hypothesis testing uses the T-statistic value interval and p-value (Z. Zuhdi et al., 2016). The data from the hypothesis testing are presented in Tables 6 and 7.

Table 6.
Direct effect hypothesis test

Path	Original sample	T-values	P-values	Hypothesis
Driving Dicipline → traffic safety	-0.006	0.127	0.899	Invalid
Driving Dicipline → Driving Knowledge	0.290	2.867	0.004	Valid
Driving Fatique → traffic safety	0.149	1.421	0.155	Invalid
Driving Fatique → Driving Knowledge	-0.095	1.482	0.138	Invalid
Driving Skill → traffic safety	0.091	1.357	0.175	Invalid
Driving Skill → Driving Knowledge	-0.039	0.651	0.515	Invalid
Emotional Behavior → traffic safety	0.206	2.390	0.017	Valid
Emotional Behavior → Driving Knowledge	-0.097	3.090	0.002	Valid
Driving knowledge → traffic safety	0.049	1.063	0.288	Invalid

Source: Processed data, smart-pls 4 (2025)

Table 7.
Testing the hypothesis of indirect influence

Path	Original sample	T-values	P-values	Hipotesis
Driving Dicipline → Driving knowledge→ traffic safety	0.014	0.982	0.326	Invalid
Driving Fatique →Driving knowledge → traffic safety	-0.005	0.655	0.512	Invalid
Driving Skill→Driving knowledge→ traffic safety	-0.002	0.371	0.711	Invalid
Emotional Behavior →Driving knowledge → traffic safety	-0.005	1.062	0.288	Invalid

Source: Processed data, smart-pls 4 (2025)

Driving discipline has a direct impact on traffic safety
In some cases, studies have found that driving discipline affects traffic safety. However, the author's research shows that there is no significant influence between driving discipline and traffic safety. This may be due to other factors such as poor road conditions (Lee, n.d.), inadequate lighting (Vivoli et al., 2006), or weak enforcement of traffic laws, which play a more significant role in determining safety levels (Udhayanto et al., 2024) (Chen et al., 2016) (Yan et al., 2010). Thus, even if drivers are disciplined, the risk of accidents remains high due to these external factors.

Driving discipline has a direct impact on driving knowledge
The research findings on the influence of driving discipline on driving knowledge indicate a significant influence between driving discipline and driving knowledge. This explains that the disciplined driving behavior of freight transport drivers in South Sulawesi is influenced by driving knowledge factors (Nurhadi & Rahimudin, 2024).

Fatigue while driving has a direct impact on traffic safety.
The results of the study on the effect of fatigue on traffic safety show that there is no effect of driving fatigue on traffic safety. Several studies have shown that there is not always a significant relationship between fatigue and traffic safety (Hakkanen, 2000) (Sullivan & Nieuwenhuys, 2021), depending on the population studied (Jackson et al., 2011).

Driving fatigue has a direct impact on driving knowledge
The results of the study on the effect of fatigue on driving knowledge show that there is no effect of driving fatigue on driving knowledge. Another study proving that fatigue does not affect driving knowledge can be found in a study conducted on Go-Jek drivers in Malang City. The study analyzed the relationship between work fatigue, knowledge, attitudes, and safe riding behavior. The results showed that there was no significant relationship between work fatigue and driving knowledge ($p > 0.05$), while work fatigue significantly influenced safe riding behavior ($p = 0.000$) (Al-Mekhlafi et al., 2021).

Driving skill has a direct impact on traffic safety
The results of the study on the influence of driving skills on traffic safety show that there is no influence of driving skills on traffic safety. Other studies have also demonstrated that there is no significant relationship between driving skills and traffic safety (Fitzpatrick et al., 2019) (Yuxing et al., 2016), but rather that other factors such as attitude, perception, and compliance with traffic rules (Zhang et al., n.d.) often play a more significant role in determining safety than technical driving skills.

Driving skill has a direct impact on driving knowledge
The results of the study on the influence of driving skills on driving knowledge show that there is no influence of driving skills on driving knowledge. A study indicates that there is no significant relationship between driving skills and safe driving behavior, which implicitly suggests that technical skills are not always directly related to cognitive aspects such as driving knowledge ($p = 0.075$) (Effendi & Syadiah, 2018).

Emotional behavior has a direct impact on traffict safety
The results of research on the influence of emotional behavior on traffic safety show a significant influence between emotional behavior factors and traffic safety (Al-Mekhlafi et al., 2021). Various studies consistently show that emotional behavior, whether in the form of emotional stability, emotional maturity, or emotional intelligence, has a significant impact on traffic safety.

Emotional behavior has a direct impact driving knowledge
The results of research on the influence of emotional behavior on driving knowledge show that emotional behavior factors do influence driving knowledge. Other studies examining the relationship between emotional levels and driver behavior indicate that emotions, including how drivers manage anger and stress, influence driving behavior, including aspects of driving knowledge and awareness.

Driving knowledge has direct impact on traffic safety
The results of the study on the effect of driving knowledge on traffic safety show that there is no effect of driving knowledge on traffic safety. In another study using Structural Equation Modeling (SEM), it was found that while knowledge of traffic signs is important, its impact on traffic safety is not always directly significant (Adinugroho et al., 2014) (Dai, 2009) without being supported by other factors such as driver discipline and vehicle condition (Simmons et al., 2016).

Driving discipline indirectly affects traffic safety through driving knowledge.
The results obtained from the study on the effect of driving discipline on traffic safety mediated by driving knowledge show no effect.

Driving fatique indirectly affects traffic safety through driving knowledge
The results of the study on the effect of driving fatigue on traffic safety mediated by driving knowledge showed no effect. Another study states that work-related fatigue can indeed reduce concentration and alertness (Al-Mekhlafi et al., 2021), but the effect of fatigue on accidents can be moderated or mediated by other factors such as driving knowledge, rest time management, and driver experience, so the direct impact on safety is not significant.

Emotional behavior indirectly affects traffic safety through driving knowledge
The results of research on the effect of driving skills on traffic safety mediated by driving knowledge show no effect. Other studies also explain that emotional behavior does not significantly affect traffic safety, although driving knowledge has a significant effect (Legree et al., 2003). Emotional behavior alone is insufficient to ensure traffic safety without being supported by knowledge and proper attitudes (Zuraida & Russell, 2020) (Atmaja et al., 2024). The mediation of knowledge does not strengthen the influence of skills on safety (Zhang et al., n.d.) (Nerio & Nabe, 2024).

CONCLUSION

The conclusions of this study indicate that there are variations in the influence of certain factors on traffic safety and driving knowledge. Although driving discipline is expected to improve safety, this study found that there is no significant influence between driving discipline and traffic safety. However, driving discipline has been proven to have a positive influence on driving knowledge. The study shows that driving fatigue does not have a significant influence on traffic safety or driving knowledge. This suggests that other factors, such as rest time management and driver experience, may play a more significant role in determining safety. Driving skills do not have a significant effect on traffic safety or driving knowledge. This indicates that other aspects, such as attitude and compliance with traffic rules, are more decisive for safety. Emotional behavior has been proven to have a significant effect on traffic safety and driving knowledge. This suggests that emotional stability and stress management skills can contribute to safer driving behavior. This study also found that driving discipline, driving fatigue, and emotional behavior do not influence traffic safety when mediated by driving knowledge. This suggests that driving knowledge alone is insufficient to ensure safety without support from other factors.

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