

# Predicting Car Drivers' Speeding Behavior in Surabaya, Indonesia

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**Abstract**

This study examines the influence of demographic, psychological, and situational factors on car drivers' speeding intentions and behaviors in Surabaya, Indonesia, to inform targeted road safety interventions. An online questionnaire yielded 322 valid responses from licensed car drivers with at least six months of driving experience. Data were analyzed using partial least squares structural equation modeling (PLS-SEM) to assess the relationships between driver characteristics, situational factors, speeding intentions, and actual speeding behavior. Favorable road conditions and situational constraints significantly increased speeding intentions, whereas marital status and self-efficacy significantly reduced them. Self-efficacy also directly decreased speeding behavior, and speeding intentions strongly predicted actual speeding. The model explained 36.1% of the variance in speeding intentions and 24.9% in speeding behavior. These findings highlight the need for integrated interventions—combining education, awareness campaigns, and strict enforcement—to address both attitudinal and situational drivers of speeding.

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## INTRODUCTION

Traffic accidents in Indonesia, including Surabaya, the capital city of East Java province, have tended to increase every year [1,2]. It is widely accepted that speeding is the most common traffic violation and a significant cause of accidents [3-5]. Speeding can also increase the fatality rate of accidents by up to 2.3 times [6]. Since March 23, 2021, Electronic Traffic Law Enforcement (ETLE) cameras have been implemented in Indonesia to monitor traffic violations, as shown in Figure 1. In Surabaya, ETLE cameras have been installed at 39 locations [7].



**Figure 1.** ETLE System Example: Camera and Speeding Ticket Process

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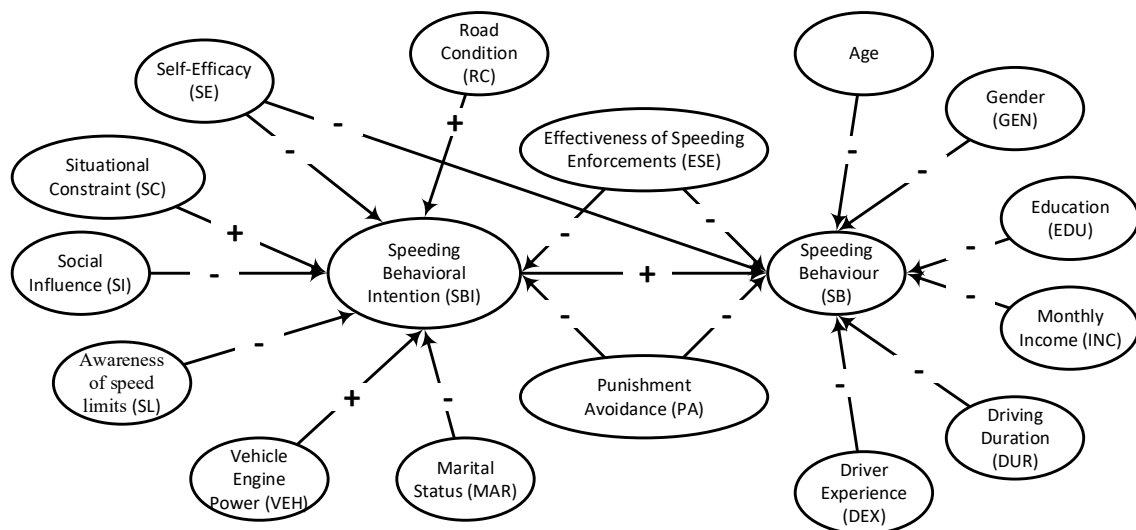
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It is interesting to examine whether the implementation of ETLE cameras is an effective form of speeding enforcement. Several studies have investigated the link between speeding behavior, driver traits, and other factors that may influence speeding behavior, as shown in Table 1.

**Table 1.** Factors Influencing Speeding Behavior

Factors\Reference	[9]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[8]	[5]	[18]	[19]
Gender	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓
Age	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Income	✓	✓			✓					✓	✓	
Education			✓		✓					✓	✓	
Marital status		✓	✓									
Speeding enforcement		✓							✓			
Driver experience	✓	✓	✓						✓			
Driving duration	✓		✓						✓			
Vehicle engine power		✓										
Road condition								✓				
Self-efficacy				✓								
Situational constraints		✓										
Social influence		✓		✓								
Awareness of speed limits											✓	
Effectiveness of speeding enforcement		✓										
Punishment avoidance										✓		

This study aims to investigate factors that affect car drivers speeding behaviour. The variables related to drivers' characteristics include age, gender, education, income, marital status, driving duration, and driving experience [12,14-16,19]. Other factors that might hypothetically influence speeding behavior, as suggested by previous studies, include vehicle engine power [11], road conditions [17], self-efficacy [18], social influence [13], punishment avoidance [18], awareness of speed limits, and the perceived effectiveness of speeding enforcement [10], as shown in Table 1. Figure 2 illustrates the theoretical framework and assumptions of the study, based on the effects of various factors identified in prior research.



**Figure 2.** Theoretical Model Framework

Hypothetically, road conditions, situational constraints, and vehicle engine power will positively influence speeding behavioral intention, while social influence, awareness of speed limits, and marital status will negatively influence it. All driver characteristics are expected to negatively influence speeding behavior, and self-efficacy, the effectiveness of speeding enforcement, and punishment avoidance are hypothesized to negatively influence both speeding behavioral intention and speeding behavior.

**METHODS**

This study focused on drivers' perceptions of speeding behavior. Data were collected via an online questionnaire randomly distributed to car drivers with at least six months of driving experience in Surabaya city. A total of 355

responses was retrieved. However, after identifying multivariate outliers, 33 responses were classified as outliers and removed, leaving 322 valid questionnaires for further analysis. The descriptive statistics of the respondents are presented in Table 2.

**Table 2.** Descriptive Statistics Results

Item	Category	N	%
Gender (GEN)	Male	204	63.4
	Female	118	36.6
Age (AGE)	Youth (17-35 years)	217	67.4
	Middle-aged & Elderly (36-60 years)	105	32.6
Education (EDU)	High school	100	31.1
	Undergraduate	153	47.5
	Postgraduate	69	21.4
Monthly income (INC)	< 3 million IDR	72	22.4
	3–6 million IDR	83	25.8
	6–9 million IDR	51	15.8
	9–12 million IDR	47	14.6
	> 12 million IDR	69	21.4
Driving hours per day (DUR)	< 1 hour	73	22.7
	1 – 4 hours	231	71.7
	> 4 hours	18	5.6
Driving experience (DEX)	< 1 year	19	5.9
	1 – 3 years	30	9.3
	> 3 years	273	84.8
Marital status (MAR)	Single	218	67.9
	Married	104	32.4
Vehicle engine power (VEH)	< 100 PS*	141	43.8
	100-125 PS	168	52.2
	> 125 PS	13	4.0
Awareness of speed limits (SL)	Yes	233	72.4
	No	89	27.6

\*pferdestarke = 0.9863200706 horsepower

The questionnaires designed for the study include 25 measuring items modified from previous relevant studies. Particularly, seven measurement items were respondents' characteristics such as: age, gender, education, monthly income, driving duration, driving experience, and marital status, and twenty measurement items were vehicle engine power (1 item), awareness of speed limits (1 item), social influence (1 item), effectiveness of speeding enforcements (1 item), punishment avoidance (1 item), road condition (3 items), self-efficacy (2 items), situational constraint (3 items), speeding behavioural intention (3 items), and speeding behaviour (2 items). Respondents were requested to indicate their responses to various issues on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). PLS-SEM was employed to analyze the data.

## RESULTS AND DISCUSSION

Table 3 shows that the reliability of all individual items is greater than 0.7. The internal consistency reliability of all constructs, as measured by Cronbach's alpha and Construct Reliability (CR), ranged from 0.757 to 0.861 and from 0.862 to 0.929, respectively. Therefore, all constructs met or exceeded the acceptable dependability criterion of 0.7. As a result, the internal consistency of the items was confirmed. The loadings for all constructs ranged from 0.676 to 0.868, exceeded the recommended cut-off value of 0.5, suggesting the acceptable convergent validity.

The examination of the distinction between a construct and its peers is done using three discriminant validity criteria. The squared correlations of the other components are less than the squared correlations of the AVE, which ranged from 0.822 to 0.932, as demonstrated in Table 4.

The model achieves discriminant validity as Table 5 shows that all other cross-loadings are less than all measurement element loadings. Table 6 shows that all the HTMT values are below the permitted level (0.85). Consequently, the discriminant validity of all constructs has been proved. This study revealed that all model measurements met the requirements for reliability and validity.

**Table 3.** Results of Reliability and Validity Tests

Constructs	Items	Loadings	Cronbach's $\alpha$	CR	AVE
Road Condition (RC)	RC1	0.860	0.760	0.862	0.676
	RC2	0.810			
	RC3	0.795			
Self-Efficacy (SE)	SE1	0.885	0.757	0.892	0.804
	SE3	0.909			
Situational Constraint (SC)	SC1	0.910	0.808	0.884	0.718
	SC2	0.815			
	SC3	0.814			
Speeding Behavioural Intention (SBI)	BI1	0.882	0.861	0.915	0.782
	BI2	0.905			
	BI3	0.866			
Speeding Behaviour (SB)	AB1	0.926	0.848	0.929	0.868
	AB2	0.937			

**Table 4.** Discriminant Validity Criteria: Fornell-Larcker

Items	SB	SBI	RC	SC	SE
<b>SB</b>	<b>0.932</b>				
<b>SBI</b>	0.451	<b>0.884</b>			
<b>RC</b>	0.570	0.403	<b>0.822</b>		
<b>SC</b>	0.476	0.340	0.508	<b>0.847</b>	
<b>SE</b>	-0.307	-0.400	-0.202	-0.071	<b>0.897</b>

**Table 5.** Discriminant Validity Criteria: Cross-loading

Items	SB	SBI	RC	SC	SE
<b>SBI</b>	<b>0.926</b>	0.402	0.512	0.454	-0.259
<b>SB2</b>	<b>0.937</b>	0.436	0.549	0.434	-0.311
<b>SBI1</b>	0.371	<b>0.882</b>	0.369	0.274	-0.384
<b>SBI2</b>	0.407	<b>0.905</b>	0.341	0.283	-0.350
<b>SBI3</b>	0.417	<b>0.866</b>	0.359	0.345	-0.328
<b>RC1</b>	0.543	0.344	<b>0.860</b>	0.447	-0.212
<b>RC2</b>	0.452	0.344	<b>0.810</b>	0.375	-0.164
<b>RC3</b>	0.404	0.303	<b>0.795</b>	0.434	-0.115
<b>SC1</b>	0.480	0.365	0.508	<b>0.910</b>	-0.087
<b>SC2</b>	0.374	0.233	0.340	<b>0.815</b>	-0.007
<b>SC3</b>	0.327	0.233	0.416	<b>0.814</b>	-0.073
<b>SE1</b>	-0.249	-0.347	-0.181	-0.046	<b>0.885</b>
<b>SE3</b>	-0.300	-0.370	-0.181	-0.080	<b>0.909</b>

**Table 6.** Discriminant Validity Criteria: HTMT

Items	SB	SBI	RC	SC
<b>SBI</b>	0.527			
<b>RC</b>	0.706	0.497		
<b>SC</b>	0.561	0.391	0.635	
<b>SE</b>	0.380	0.495	0.263	0.084

The structural model is examined to determine how independent variables affect the dependent variable. This study includes fifteen independent variables (AGE, GEN, EDU, INC, DUR, DEX, RC, SC, SI, SL, VEH, MAR, SE, ESE, and PA) and two dependent variables (SBI and SB). Figure 3 shows the results of the structural model.

The coefficient of determination ( $R^2$ ) for SBI (0.361) and SB (0.249) is considered moderate and acceptable. This implies that the nine sets of independent variables (ESE, RC, SE, SC, SI, SL, VEH, MAR, and PA) collectively explained 36.1% of the variance in speeding behavioral intention (SBI), while the nine sets of independent variables (AGE, GEN, EDU, INC, DUR, DEX, SE, ESE, and PA) collectively explained 24.9% of the variance in speeding behavior (SB).

The structural model was predicted to have Goodness of Fit and  $Q^2$  of 0.482 and 0.515, respectively, using  $R^2$  values of 0.25 and 0.35, and AVE values of 0.676, 0.804, 0.718, 0.782, and 0.868. Therefore, the model has predictive relevance and is considered acceptable [20].

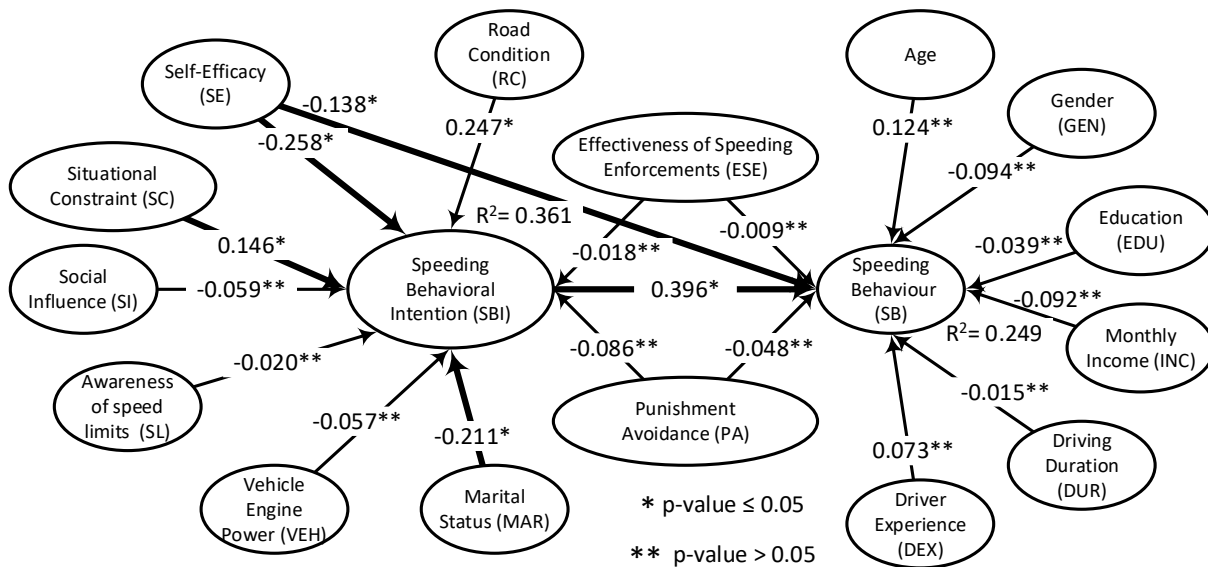


Figure 3. Structural Model of Car Drivers' Speeding Behaviour

Based on the findings, the path model and hypothesis testing shown in Figure 2 and Table 7 revealed that only six hypotheses were accepted, which are: (1) Speeding behavioral intention (SBI) is significantly influenced by road condition (RC) and situational constraint (SC), (2) marital status (MAR) and self-efficacy (SE) have a significant negative influence on speeding behavioral intention (SBI), (3) speeding behavior (SB) is significantly influenced by self-efficacy (SE), and (4) speeding behavioral intention (SBI) significantly influences speeding behavior (SB).

Table 7. Structural Model

Hypotheses	$\beta$	<i>p</i> -value	Hypotheses	$\beta$	<i>p</i> -value
RC → SBI	0.247	0	ESE → SB	-0.009	0.88
SC → SBI	0.146	0	PA → SB	-0.048	0.505
SI → SBI	-0.059	0.207	AGE → SB	0.124	0.122
SL → SBI	-0.02	0.673	GEN → SB	-0.094	0.113
VEH → SBI	-0.057	0.251	EDU → SB	-0.039	0.518
MAR → SBI	-0.211	0	INC → SB	-0.092	0.217
SE → SBI	-0.258	0	DUR → SB	-0.015	0.769
ESE → SBI	-0.018	0.736	DEX → SB	0.073	0.154
PA → SBI	-0.086	0.127	SBI → SB	0.396	0
SE → SB	-0.138	0			

The model accounts for around 36% of the variance in intentions to speeding and 25% of the variance in actual speeding behavior. Inexplicable variance will persist due to the unpredictable character of human behavior.

In future studies, to better understand the relationship with speeding behavior, more explanatory variables should be considered, including several social-psychological factors such as attitude, perceived behavioral control, personal norm, and habit.

### CONCLUSIONS

The speeding behavior of motorists can result in adverse outcomes, including injury and traffic collisions. Analyzing the speeding behavior of car driver yields valuable insights, from which targeted measures can be designed to mitigate traffic accidents.

The results suggest that the intentions of drivers to exceed speed limits are substantially influenced by their marital status, self-efficacy, and situational constraints. Speeding behavior is indirectly influenced by all of these attributes through the mediation of speeding behavioral intentions. Drivers' speeding behavior is directly influenced by their self-efficacy.

These data suggest that an unmarried or single motorist is more likely to exceed speed restrictions. Driver's self-efficacy refers to a driver's confidence in their capacity to manage their vehicle at high speed or maneuver through

traffic safely despite rapid speeds, whereas situational constraints encompass external factors that affect a driver's ability to regulate their speed, such as urgency due to an emergency or anxiety about tardiness. Both the driver's self-efficacy and situational constraints greatly influence their speeding behavior.

Traffic awareness can foster positive control beliefs and attitudes in drivers, aiding in the regulation of their speeding intentions and behaviors. Consequently, traffic education regulations must be established, emphasizing the importance of alerting drivers to the potential consequences of speeding. Based on these findings, traffic awareness and educational methods must be combined with traffic enforcement by imposing substantial fines for speeding infractions.

The conclusions are exclusively based on a sample of car drivers in Surabaya, which may not accurately represent the entire population of car drivers in the city. Consequently, the data that has been provided is subject to limitations regarding its relevance. Despite the limitations, the data that has been collected is scientifically relevant for the development of road safety legislation that is designed to reduce the number of accidents and injuries.

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