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The Influence of Traffic Congestion in Jalan Raya Kopo on Motorcyclists' Aggressive Driving

Pengaruh Kemacetan di Jalan Raya Kopo terhadap Perilaku Agresif Pengendara Motor

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ABSTRACT

Bandung has become Indonesia's most congested city, based on a survey from the Asia Development Bank in October 2019. Traffic congestion can affect a person's physical and psychological condition. This situation encourages a driver to behave aggressively to quickly reach their destination. This study aims to analyze the effect of traffic congestion on Jalan Raya Kopo on the motorcyclists' aggressive behavior. The method used is quantitative- descriptive. Data was collected through a questionnaire distributed to 100 respondents with the criteria of motorcyclists who frequently passes Jalan Raya Kopo, aged 17-35 years. The researcher tested the classical assumptions, which included tests for normality, multicollinearity, and heteroscedasticity. Then an analysis with a simple regression analysis in the form of F test, t test, and R2 is used to analyze the effect of congestion on aggressive driving. The results showed that congestion influenced aggressive driving behavior by 28.9%, while the other 71.1% were influenced by other variables outside the test in this study.

INFO ARTIKEL

Kata kunci:
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ABSTRAK

Berdasarkan hasil survel Asia Development Bank pada Oktober 2019 Kota Bandung berada pada urutan pertama kota termacet se-Indonesia. Situasi kemacetan dapat memengaruhi kondisi fisik dan psikologis seseorang. Situasi tersebut mendorong seorang pengendara untuk berperilaku agresif agar cepat sampai ke tempat tujuan. Penelitian ini bertujuan untuk menganalisis pengaruh kemacetan di Jalan Raya Kopo terhadap perilaku agresif pengendara motor. Metode yang digunakan yaitu deskriptif kuantitatif. Data dikumpulkan melalui kuesioner yang disebar kepada 100 yang berusia 17-35 tahun berdasarkan kriteria seorang pengendara motor dengan frekuensi sering melewati Jalan Raya Kopo. Peneliti melakukan pengujian asumsi klasik yang mencakup uji normalitas, multikolinearitas, dan heteroskedastisitas. Kemudian, dilakukan analisis regresi sederhana berupa uji F, uji t, dan R2 untuk menganalisis pengaruh kemacetan terhadap perilaku agresif pengendara. Hasil penelitian menunjukkan kemacetan berpengaruh terhadap perilaku agresif sebesar 28,9%, sementara 71,1% lainnya dipengaruhi variabel lain di luar pengujian dalam penelitian ini.

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Introduction

Bandung City has a cool and humid climate because it is surrounded by mountains and has an average rainfall of 204.11 mm and an average amount of rain of 18 days per month (Krimayanti et al., 2019). Based on data from the Indonesian Central Bureau of Statistics (BPS), in 2018, Bandung City had an area of 16.7 km^2, with a population of 2,503,708 people, an average growth rate of 0.47%, and a population density of 14,932 people per km^2. BPS also noted that out of a total of 2.50 million people, 1.11 million worked and 237.26 thousand attended school. Based on this number, as many as 53.75% of Bandung residents have a high level of mobility on weekdays.

Every year, the population in Bandung is increasing, as it can be seen from the birth rate and population movement that has various goals. The increase in urbanization flows has had an impact on the emergence of new problems in the city of Bandung, such as waste, education, transportation, socioeconomics, natural disasters, and health. In terms of transportation, Bandung is ranked 14th most congested city in Asia and 1st in Indonesia based on a survey reviewed by the Asia Development Bank (ADB) in October 2019 (Asian Development Bank, 2019). Bandung has a high growth rate of motor vehicles. Data from the Bandung City Transportation Agency (DISHUB) in 2021 shows that two-wheeled private vehicles in Bandung totalled 1,116,779 units (Bandung, 2021). Bandung has congestion-prone points at several points, including: Jalan Sukajadi (Amellia et al., 2023); Pasteur Toll Road (Hermawan &; Haryatiningsih, 2022); Jalan Cihampelas (Fisu et al., 2019; Jalan Jakarta (Harahap et al., 2022); Jalan Soekarno Hatta-Ibrahim Adjie (Fotramanag, 2022); Jalan Pahlawan (Bimaputra et al., 2017); Jalan Raya Kopo (Prasetya, 2021); and other points.

Congestion in Bandung is one of the government's focuses in achieving development goals. The Bandung City Transportation Agency (DISHUB), as an agency that takes care of transportation problems, strives to reduce congestion in Bandung. The performance pursued by the Bandung City Transportation Agency (DISHUB) to minimize congestion includes providing media for criticism and suggestions as well as public complaints; placing staff according to their ability to manage congestion; carrying out traffic engineering, such as in the Sukajadi area, which has proven successful in reducing congestion; and publishing accountability reports through national media broadcasts such as TVRI. Every achievement indicator has been met by the Bandung City Transportation Agency (DISHUB) except productivity. This can be seen from the 13 points that are still prone to congestion from the 32 points that have an impact on the level of community satisfaction (Dzahabyyah et al., 2021).

In dealing with congestion situations, a motorcyclist has the potential to engage in aggressive driving behavior. The behavior is influenced by various factors such as age, driving skills, gender, environment, lifestyle, and personality of the rider (Tasca, 1996). Based on research conducted by Handayani et al., (2017), in 360 high school students in Surakarta aged 14-20 years, aggressive behavior is shown by breaking through behavior and not giving opportunities to other riders to overtake, which has a percentage of 18.08%; driving roughly above the safe speed limit with a percentage of 16.93%; disobeying traffic signs with a percentage of 14.09%; driving on a zigzag path with a percentage of 10.97%; and turning without marking, like a turn signal light, with a percentage of 8.57%. According to Koentjaraningrat (cited in Soerjono, 2020), traffic violation conditions can be found in people who inhabit big cities in Indonesia and are manifested in slashing behavior and mentality in order to achieve goals in the fastest way possible without following applicable rules.

In this study, the research subjects focused on motorcyclists' ages, i.e., 17-35. The age is chosen based on the minimum age for having a driver's license (SIM), which is 17 years, and the maximum age in early adulthood, which is 35 years (Sukaesih, 2017). Then, the process of determining the location of the study was chosen based on congestion-prone points in the city of Bandung which based on research by Wulandari (2016), entitled "The Relationship Between Risk-Taking Behavior and Aggressive Driving in Motor Vehicle Drivers on Jalan Surapati Bandung City Early Adulthood". Meanwhile, this study will focus on congestion conditions on Jalan Raya Kopo to have a difference location from previous studies (Soerjono, 2020).

This background prompted researchers to analyze the effect of congestion on the Jalan Raya Kopo on the aggressive driving behavior of motorcyclists. This research was studied through the use of theory as the basis for the preparation of research instruments, including: congestion influence factors from the Cambridge Systematic Texas Transportation Institute (2006), as a measurement scale of congestion variables; aggressive driving behavior scale (ADBS), the Cambridge Systematic Texas Transportation Institute (2006); and anomic behavior from the Swiss Institute of Development (SID) by Robert K. Merton and Johan Galtung (Velásquez 2022) as a variable measurement scale of aggressive driving.

Method

Descriptive quantitative method was used in this research process. Data was collected through questionnaires distributed to the research location, namely Jalan Raya Kopo, Bandung, so that the object of the research included all motorcyclists at that location. The sampling technique using Wibisono (2003) formula (Riduwan & Akdon, 2020), was applied to this study because the study population had an uncountable number, so this study was addressed to 100 respondents as a sample. The criteria for respondents in this study include: 1) motorcyclists; 2) ages between 17-35 years; and 3) active road users with frequent passing of Jalan Raya Kopo.

Research instruments are arranged based on measurement scales based on theories and modifications from previous researchers. The congestion variable measuring instrument consists of 10 statements from 7 measurement indicators, and *the* aggressive driving variable consists of 15 statements from 2 measurement indicators. The initial questionnaire (*try-out*) was tested on 40 respondents and then tested through a validity test. After testing, the congestion variable measuring instrument changed to 9 statement points and the aggressive driving variable to 11 valid statement points ($r_{calculate} > r_{table}$ (0.312 with N = 40). Statements that have been proven valid are tested again to determine the consistency of the instrument through reliability tests so that reliable data results are obtained, namely *Cronbach Alpha* > 0.60.

The classical assumption test is carried out to analyze data through normality tests to find out normally distributed data as a condition for regression testing, multicollinearity to determine symptoms that have the potential to interfere with the testing process, and heteroscedasticity to determine the difference in variance from the residual value tested (Sari et al., 2017). The test continued with a simple linear regression analysis with 3 test processes, namely the simultaneous significance test (F_{test}), the individual parameter significance test (t_{test}), and the R-square test (R^2). The research decision is determined based on the hypothesis assumed by the study, namely:

1. H_0 = Congestion on Jalan Raya Kopo, Bandung does not affect the aggressive driving behavior of motorcyclists.
2. H_a = Congestion on Jalan Raya Kopo, Bandung affects the aggressive driving behavior of motorcyclists.

Result and Discussion

Based on field data obtained through the distribution of questionnaires to 100 respondents, the motorcyclists who participated in this study were dominated by 22-year-old women with a frequency of riding motorcycles on Jalan Raya Kopo every 1-3 times per week, so that respondents in this study had met the following sample criteria.

Respondent Criteria

Data shows that every motorcyclist often faces traffic congestion on the Jalan Raya Kopo every day (morning, afternoon, evening, and night). This is supported by data from research (Lazuardi, 2020), which states that the service level of Jalan Kopo-Soreang has an E (bad) value precisely every holiday, namely Sunday afternoon and Monday morning when people return to their original routine. On Monday afternoon, and afternoon the data showed a C grade (quite good), as well as an A grade (very good) on Sunday morning and evening.

Classical Assumption Test

This test was carried out as a fulfilment of the requirements of simple regression analysis, including that the data has normal distribution values and does not experience symptoms of multicollinearity, heteroscedasticity, or autocorrelation (Ghozali & Ratmono, 2017). However, this study only focused on normality, multicollinearity, and heteroscedasticity tests. Testing for autocorrelation is not carried out because research data in the form of cross-sections is carried out simultaneously at one time which is not time series data based on a series of time and is very dependent on observations in previous studies (Basuki & Prawoto, 2017). In addition, before the classical assumption test, the data is first transformed from ordinal form to intervals to meet the test requirements (Lubis, 2021).

Normality Test

Tests were carried out with parametric statistics *of Kolmogorov Smirnov* based on residual values. As for the basis of decision making based on hypotheses:

1. H_0: Sig. value < 0.05, the data has an abnormal distribution value.
2. H_a: Sig. value > 0.05, the data has a normal distribution value.

Table I Normality Test
1-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		100
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	4.23127114
Most Extreme Differences	Absolute	.087
	Positive	.087
	Negative	-.072
Test Statistic		.087
Asymp. Sig. (2-tailed)		**.060**[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

Source: SPSS 23 version data processing

After a *substantial negative skewness transformation* with the LG10 (k-x) formula, the normality test shows a sig. value of 0.60 (> 0.05), so the data has a normal distribution value.

Multicollinearity Test

The multicollinearity test aims to ensure that the data does not have symptoms of multicollinearity. The symptoms of multicollinearity can cause problems in the regression analysis process. The decision-making is based on the following hypotheses.

1. H_0: If the tolerance values < 0.10 and *VIF* > 10, then the data have symptoms of multicollinearity.
2. H_a: If the tolerance values > 0.10 and *VIF* < 10, then the data does not have symptoms of multicollinearity.

Table II Multicollinearity Test
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Itself.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	BRIGHT
1	(*Constant*)	28.983	4.125		7.027	.000		
	CONGESTION	7,715E-05	.000	.078	.785	.434	**.960**	**1.042**
	ACCIDENT RISK PERCEPTION	-.345	.127	-.271	-2.711	.008	**.960**	**1.042**

a. Dependent Variable: AGGRESSIVE DRIVING

Source: SPSS 23 version data processing

Based on the multicollinearity test, the tolerance value showed results of 0.960 (> 0.10) and VIF 1.042 (< 10), so the data does not have symptoms of multicollinearity.

Heteroscedasticity Test

Testing is carried out to determine data deviations, namely differences in variance from the resulting residual value. The decision was taken based on the way the glacier hypothesized it.

1. H_0: If the sig. value < 0.05, then the data have symptoms of heteroscedasticity.
2. H_a: If the sig. value > 0.05, then the data does not have symptoms of heteroscedasticity.

Table III Heteroscedasticity Test
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Itself.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	BRIGHT
1	(Constant)	1.734	2.325		.746	**.458**		
	CONGESTION	- 1,152E-05	.000	-.021	-.208	**.836**	.960	1.042
	ACCIDENT RISK PERCEPTION	.064	.072	.092	.891	**.375**	.960	1.042

a. Dependent Variable: ABSRES

(Source: SPSS 23 version data processing)

The data in Table III show the sig. value of the efficacy of the independent variable (X), namely congestion, and the perception of accident risk to the dependent variable (Y), namely aggressive driving, showing sig. value congestion 0.836 (> 0.05) and sig. value accident risk perception 0.375 (> 0.05), so it can be concluded that the data does not have symptoms of heteroscedasticity.

Simple Regression Analysis Test

A simple regression analysis test was conducted to test the influence contained in the independent variable (X), namely congestion, on the dependent variable (Y), namely aggressive driving, and the strength of influence exerted by the perception of accident risk as the moderator variable (Z).

In testing the effect of traffic congestion on aggressive driving of motorcyclists', the basis for decision-making in this study is based on hypotheses as follows.

1. H_0: If the value of F_{counts}, t_{counts}, < F_{tables}, t_{tables}, then traffic congestion does not affect aggressive driving.
2. H_a: If the value of F_{counts}, t_{counts}, > F_{tables}, t_{tables}, then traffic congestion affects aggressive driving.

In addition, decision making is also based on a significance value of 5% with a hypothesis as follows.

1. H_0: Sig. value > 0.05, congestion does not affect aggressive driving.
2. H_a: Sig. value < 0.05, congestion has an effect on aggressive driving.

Table IV Simultaneous Significance Test (Statistical Test F)

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Itself.
1	Regression	551532361.464	**1**	551532361.464	**39.777**	**.000[b]**
	Residual	1358825616.726	**98**	13865567.518		
	Total	1910357978.190	99			

a. Dependent Variable: Y
b. Predictors: (Constant), X

Source: SPSS 23.0 version data processing

The data in Table IV shows that the calculated F_{value} is 39.777. While the F_{value} of the F_{table} can be known based on the value of df_1 as the numerator and df_2 as the denominator, F_{table} where df_1 is 1, and df_2 is 98 is 2,700. Thus, it can be concluded that H_0 is rejected, and H_a is accepted, assuming F_{count} (39.777) > F_{table} (2.700), and sig. value 0.00 (< 0.05), which means congestion (X) affects aggressive driving (Y).

Table V Individual Parameter Significance Test (Statistical t Test)

Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Itself.
		B	Std. Error	Beta		
1	(Constant)	8462.263	1854.556		4.563	.000
	X	.529	.084	.537	6.307	.000

a. Dependent Variable: Y

Source: SPSS 23.0 version data processing

The data in table V shows that the calculated bottleneck t_{value} (X) is 6.307. While the t_{table} with a significance of 5% for 100 respondents is 1.98379. Thus, it can be concluded that H_0 is rejected, and H_a is accepted assuming t_{count} (6.307) > t_{table} (1.983) and the value of sig. 0.00 (< 0.05), which means congestion (X) affects aggressive driving (Y).

The regression model on the effect of congestion (X) on aggressive driving (Y) is Y= 8462.263+ 0.529X, with the interpretation of the regression model as follows.

1. α= 8462,263. This means that if congestion (X) is 0, then aggressive driving (Y) has a value of 8462.263 with a significant value at alpha 5%.
2. β= 0,529. This means that assuming every increase in congestion (X) by 1 unit will increase aggressive driving (Y) by 0.529 with a significant value result at alpha 5% of the t-test results.

A regression model of the effect of the independent variable on the dependent variable is Y = 8462.263 + 0.529X, with an interpretation of the value of α = 8462.263. It means that if congestion (X) is 0, then aggressive driving (Y) has a value of 8462.263, with a significant value result at alpha 5%, and β = 0.529, assuming every increase in congestion (X) by 1 unit will increase aggressive driving (Y) by 0.529, with a significant value result at alpha 5% of the t test result.

Table VI R-square (R^2)

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.537a	.289	.281	3723.650

a. Predictors: (Constant), X

Source: data SPSS 23.0 version

The data in Table VI shows that the value of R is 0.537, so $R^2 = (0.537)^2$ is 0.289 or R^2 x 100% = 28.9%. Thus, the effect of congestion on aggressive driving has an influence of 28.9%, while another 71.1% influences other variables outside of testing in this study.

Traffic Jam on Jalan Raya Kopo

Congestion on Jalan Raya Kopo can be measured through congestion influence factors from the Cambridge Systematic and Texas Transportation Institute (2006). Based on the results of data processing related to respondents' experiences during the traffic jam on Jalan Raya Kopo, the factors causing congestion are due to the large number of vehicles that exceed the width of the road, the increasing flow of vehicles during the hours of entry and return from school, and traffic control lights having a duration that is too short on such a high road flow. In addition, sometimes congestion occurs due to inadequate road layout, decreased road width due to construction activities, and the holding of special events that are not accompanied by adequate parking areas that take up road sections and are held at busy road times, causing traffic congestion. Meanwhile, what respondents never experienced was congestion that occurred due to road closures or lane diversions due to traffic accidents or the number of motorists who stopped to watch it.

Road width capacity indicates traffic performance can run according to its functions, which include vehicle volume capacity and road service level (Morlok, 1991). One method for measuring congestion indicators on Jalan Raya Kopo is the level of road service, with a value of A to F. Jalan Raya Kopo has the lowest value of E (0.93<1), which occurs on Kopo-Soreang Road on Sunday afternoon and Monday morning (ITB, 2017). The E value indicates unstable road flow with the volume of vehicles having reached the capacity of low-speed road width, which is less than 40 km/h. Meanwhile, the highest value for the performance of Jalan Raya Kopo section is an A (<0.60) value precisely on the Kopo-Peta Road on Sunday morning and afternoon with free flow, low vehicle volume, and high driving speed.

Motorcyclists' Aggressive Driving

Aggressive driving behavior is sometimes carried out by drivers when facing traffic jam by honking when other drivers do something inappropriate, swearing while driving, accelerating the speed of the vehicle when the traffic light turns from yellow to red, and driving above the safe speed limit (> 80 km/h). However, motorists on Jalan Raya Kopo never engage in aggressive driving behaviors such as making warning movements to other motorists, braking suddenly when the traffic light turns from green to yellow without looking at the rearview mirror, overtaking into traffic lines even though other motorists try to close gaps, deliberately closing gaps when other motorists try to overtake, making sudden turns without signalling other drivers, bringing the driving distance closer to other drivers in a row while talking, or accelerating to overtake vehicles that are about to turn.

Research by Sya'bani (2012) examines the volume of vehicles and traffic noise on the Kopo Canal Road that interfere with activities at SD Angkasa V Lanud Sulaiman. The results showed that vehicles passing through the road had a considerable volume, namely 3322.35 junior high school/hour in the morning, 2596.7 junior high school/hour during the day, and 2864.9 junior high school/hour in the afternoon. The volume of vehicles encourages traffic noise with a total noise pollution of 78.50–80.80 dB (A) from the ideal traffic noise in educational locations of 55 dB (A) (State Ministry of the Environment, 1996). The noise on the road not only comes from the large number of oncoming vehicles, but it is also driven by the behavior of motorists who honk when the traffic situation is smooth, triggering other motorists to return similar horns, drivers who swear at each other, and other aggressive driving behaviors.

A motorist with a high perception of accident risk will drive in an orderly manner and be alert to the possibility of traffic accidents. The results showed that the riders had a fairly high perception of accident risk, as evidenced by 8 out of 10 statements considered often experienced by riders, such as driving in a healthy body condition, using complete equipment when driving such as helmets, jackets, and so on, being more careful when passing roads that have never been travelled, having a perception that uncontrolled riders have a higher risk of accidents, be more careful when going through accident-prone locations, be careful when carrying children, and sometimes have trauma from traffic accidents so that they are more vigilant in driving and have controls to avoid accidents. However, in two other statements, motorists still often drive using cell phones and pass through roads in the opposite direction to get to their destination quickly.

The Effect of Congestion on Jalan Raya Kopo on Aggressive Driving Behavior.

The influence of congestion conditions on the aggressive driving behavior of motorcyclists' shows that transportation governance needs to be improved even better. Based on the regression model of the influence contained in the independent variable (X) on the dependent variable (Y), aggressive driving behavior will continue to increase if the value of the influence of congestion increases. In addition, a similar study conducted by Lusiana (2020) states that drivers in a state of stress due to traffic have an influence of 9.7% on aggressive driving behavior. Then, according to research from Daryamah (2019), Bandung City has a high level of congestion. The cause of this is the high volume of vehicles without balancing efforts such as road infrastructure capacity development. This study found that drivers kept their distance from drivers who showed aggressive attitudes during traffic situations.

The average speed of motorists on Jalan Raya Kopo ranges below 50 km/h (36.00–51.50 km/h) and continues to decrease during traffic jam. However, congestion situations with a long duration can cause stress and conflict behavior between riders. Motorists tend to behave aggressively by increasing the speed by 20 km/h above the safe driving limit (80 km/h) when the traffic flow runs smoothly after a traffic jam.

Conclusion

Bandung City ranks first as the most congested city in Indonesia based on a survey from the Asia Development Bank (ADB) in October 2019. One of the congestion-prone points in Bandung City is Jalan Raya Kopo, which has quite high road usage activities dominated by industrial activities, residential land use, as well as trade and services. Congestion situations can encourage a motorist to behave aggressively while driving. This condition was termed anomy by Emile Durkheim in Marks (1974), which is the emergence of an unstable state due to fading values and norms. Bandung City has a high level of congestion. The cause of this is the high volume of vehicles without balancing efforts such as road infrastructure capacity development.

Researchers can conclude that this study was compiled based on field data obtained through the distribution of questionnaires to 100 motorcyclists dominated by women aged 22 years with a frequency of riding every 1-3 times per week. Therefore, respondents in this study can be said to have met the sample criteria. The results showed that the hypothesis of H_0 was rejected, and Ha was accepted, assuming that there was an influence of congestion on Jalan Raya Kopo, Bandung, on the aggressive driving behavior of motorcyclists with an influence of 28.9%, while the other 71.1% was influenced by other variables outside the test in this study. A regression model of the influence of the independent variable on the dependent variable, namely Y = 8462.263 + 0.529X, which means that if congestion (X) is 0, then aggressive driving (Y) has a value of 8462.263 with a significant value result at alpha 5%. In addition, every increase in the congestion value (X) by 1 unit will increase aggressive driving (Y) by 0.529, with a significant value result at alpha 5% of the test result t.

Based on the results of data processing related to respondents' experiences during traffic jam on Jalan Raya Kopo, the factors causing congestion are often experienced due to the large number of vehicles that exceed the width of the road, the flow of vehicles increasing during the hours of entry and return to school, and traffic control lights having a duration that is too short on high road flow. The average speed of motorists on Jalan Raya Kopo ranges below 50 km/h (36.00–51.50 km/h) and continues to decrease during traffic jam. However, drivers behave aggressively when facing traffic situations for a long duration, starting from the onset of stress accompanied by other conflict behaviors between riders.

As for suggestions for future researchers, research can be done by testing other factors that can affect aggressive driving behavior, such as internal factors of motorcyclists, namely stress, irregular sleep patterns, or time management skills. In addition, research can be carried out on other congestion locations in Bandung, such as Jalan Sukajadi, Pasteur Toll Road, Jalan Cihampelas, Jalan Jakarta, Jalan Soekarno Hatta-Ibrahim Adjie, Jalan Pahlawan, and other points based on the processed data of related parties who are authorized to regulate traffic, such as Polrestabes, DISHUB, and other parties.

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