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The Implementation Analysis of the Electronic Road Pricing (ERP) System on Fatmawati Road (Ketimun 1 Intersection – TB Simatupang Intersection)

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ABSTRACT: Traffic congestion on Fatmawati Road has resulted in longer travel times, increased air pollution, and economic losses. To address this issue, this study evaluates the implementation of the Electronic Road Pricing (ERP) system as an effort to reduce vehicle volume and promote public transportation use. The research adopts a quantitative approach with a case study on Fatmawati Road, specifically between the Ketimun 1 Intersection and the TB Simatupang Intersection. Data was collected through road user surveys, road volume and capacity measurements, and analysis of the degree of saturation. The data analysis technique used is binary logistic regression to assess the potential shift in transportation modes and road users' preferences regarding ERP pricing implementation.

The study findings indicate that implementing ERP on Fatmawati Road can reduce traffic volume during peak hours by 15%, increase the average vehicle speed by up to 12%, and significantly decrease the degree of saturation. Although some road users are willing to pay the ERP rate, most of the public opposes this policy. Implementing ERP on Fatmawati Road has effectively reduced congestion and improved traffic performance. However, the success of this policy requires broader public support. Therefore, an effective communication strategy and the development of transportation infrastructure are necessary to ensure the success of this policy.

KEYWORDS: Congestion, Vehicle Volume, Degree of Saturation, Public Transportation, Electronic Road Pricing

I. INTRODUCTION

Traffic congestion occurs when vehicle movement is unexpectedly obstructed or halted, leading to slow or stationary traffic flow. Population growth and increasing motor vehicles in urban areas often result in severe traffic congestion. When the number of vehicles exceeds road capacity, congestion becomes inevitable. High-density residential areas and the proximity of offices and shopping centers to housing areas contribute to surges in vehicle volume during peak hours (Reynaldo & Widyaningsih, 2024).

In Indonesia, particularly Jakarta, congestion is primarily caused by the widespread use of private vehicles rather than public transportation. People prefer private vehicles over public transport due to affordability and convenience (Pangestu & Najid, 2023).

The main factor driving increased public and private transportation use is the population's rising mobility. Jakarta is one of the cities with high transportation demand. According to the Directorate of Traffic Security of Greater Jakarta Metropolitan Police, the number of registered motor vehicles in Jakarta has reached 18,006,404 units, increasing by 5.35% annually (Senapati & Najid, 2020).

The Jakarta government has implemented various measures to reduce congestion caused by population growth and the increasing number of private vehicles, leading to other negative effects, such as air pollution due to high fuel consumption. Previous policies included motor vehicle traffic restrictions, such as the three-in-one and odd-even license plate systems. However, these were deemed impractical, leading to the development of the **Electronic Road Pricing (ERP)** system. ERP is a road pricing system that charges vehicles using specific roads at designated times. This scheme aims to reduce congestion by imposing tariff on private car users during peak hours (Putri & Suryani, 2023).

ERP is one of the traffic control methods that requires payment for using certain road segments at specific times. The primary objective of ERP implementation is to alleviate congestion during peak hours, ensuring smoother vehicle flow (Nomleni, 2019).

The high activity level on Fatmawati Road has led to excessive vehicle use beyond the road's capacity, especially during rush hours in the morning and evening. This problem affects traffic conditions and congestion levels in the area. **ERP is considered a potential solution to this issue.** Therefore, analyzing the effectiveness of the ERP system on Fatmawati Road is crucial.

This study is expected to help reduce traffic congestion during peak hours, improve mobility, increase government revenue, and encourage sustainable public transportation.

Additionally, it will serve as an economic feasibility assessment for ERP implementation on Fatmawati Road and provide useful insights for future research.

II. RESEARCH METHODOLOGY

This research systematically addresses traffic congestion issues by collecting data and analyzing relevant literature or field observations by research and writing guidelines. The study follows several work phases and methodologies, which are presented in the flowchart in Figure 1.

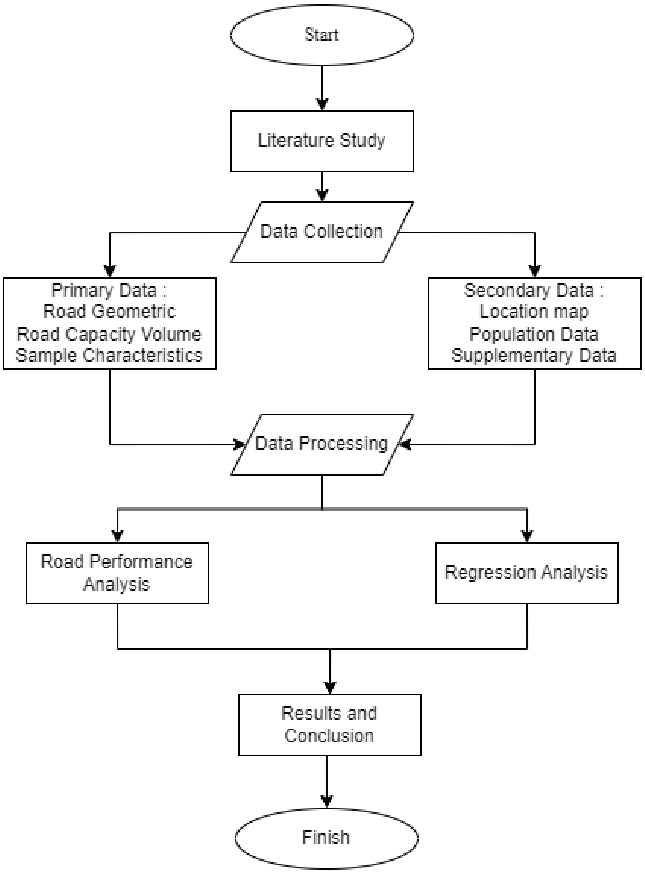

Figure 1. Research Flowchart
(**Source:** Processed by researcher, 2024)

This research was conducted on Fatmawati Road, covering the segment from the Ketimun 1 Intersection to the TB Simatupang Intersection. The road consists of two lanes, each with two sub-lanes.

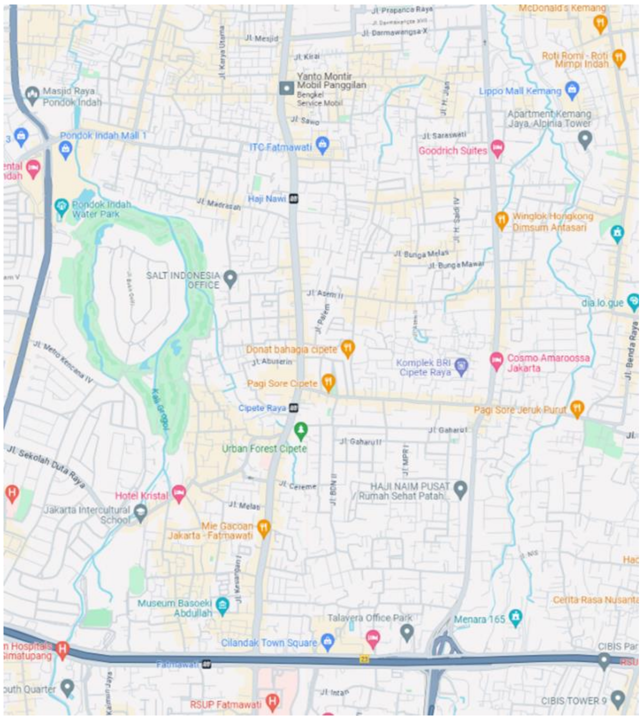

Figure 2 Research Location Map
(**Source:** Google Maps, 2024)

This road stretches 3.9 km from Ketimun 1 Road, Kebayoran Baru, South Jakarta, to TB Simatupang Road, Cilandak, South Jakarta. It has two lanes, with two sub-lanes on each lane. Public transportation services, including TransJakarta and the Light Rail Transit (LRT), operate along Fatmawati Road. However, increased mobility has led to transportation issues. Congestion caused by excessive private vehicle usage, especially during peak hours, negatively impacts the local economy, leads to fuel wastage, and contributes to air pollution from vehicle emissions, which poses serious health risks.

This research involved collecting primary data through field surveys. The primary data includes traffic volume counts, survey data, and questionnaire responses. The collected data was then processed and analyzed. The data types used in this study include:

1. Road Geometric Data
2. Road Volume and Capacity Data
3. Road Capacity Data
4. Degree of Saturation Data
5. Side Friction Data
6. Respondent Characteristics Data
7. Stated Preference Data
8. Revealed Preference Data
9. Sample Size Data
10. Regression Analysis Data
11. Short Interview Data

Once collected, the data was categorized based on problem identification, allowing for an effective and targeted problem-solving analysis. The analysis consists of several parts: road user movement probability analysis and traffic performance analysis. Based on the increased mobility on Fatmawati Road, the standard of living of individuals in Jakarta has risen, leading to higher private vehicle ownership. However, the road characteristics have not accommodated the increasing number of vehicles.

III.RESULTS AND DISCUSSION

A field survey was conducted at two observation points along Fatmawati Road, covering both the northbound and southbound directions. The collected data was then analyzed. The traffic performance analysis was assessed based on the degree of saturation (DS) value, calculated by dividing the traffic volume (Q) by the existing road capacity (C) on Fatmawati Road. The traffic volume data used was taken from the peak-hour condition. Additionally, several adjustment factors were considered when determining road capacity.

A. Road Condition Data

Technical data regarding the existing road condition is required to analyze traffic performance. This data is essential for determining the existing road capacity (C). The general road data for Fatmawati Road is as follows:

1. Location : Fatmawati Road, Jakarta
2. Area : 324 km^2
3. Population : 3,285 million
4. Road Function : Urban road
5. Road Length : 3.9 km
6. Road Width : 12 m
7. Road Type : 4-lane, 2-way divided
8. Side Friction : High

B. Road Capacity

For a 2/2TT road type, capacity (C) is determined for total two-way traffic flow. Flow is determined separately for each direction for 4/2T, 6/2T, and 8/2T road types, and capacity is calculated per lane. The formula for calculating road capacity, based on the Indonesian Road Capacity Guidelines (Ministry of Public Works), is as follows:

$C = C_O \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$

Where:

C = Road capacity

C_O = Basic road capacity

FC_{LJ} = Capacity adjustment factor due to lane width

FC_{PA} = Capacity adjustment factor due to directional separator

FC_{HS} = Capacity adjustment factor due to side friction

FC_{UK} = Capacity adjustment factor due to city size

Below are the basic capacity and adjustment factors for Fatmawati Road (for one direction) to calculate the road capacity (C)

C_O = 1,700 x 2 lanes= 3,400 SMP/hour

FC_{LJ} = 0.92 (width per lane 3 meters)

FC_{PA} = 1

FC_{HS} = 0.95 (high side friction, shoulder width 1.5 meters)

FC_{UK} = 1 (population 3.285 million)

Thus, the road capacity (C) of Fatmawati Road can be calculated using the formula:

C = 3,400 x 0.92 x 1 x 0.95 x 1
= 2,971.6 SMP/hour

C. Traffic Volume

Traffic volume measurement is a direct method to count the number of vehicles passing through a specific point on the observed road segment. The collected vehicle count data is converted into Passenger Car Units (PCU) by multiplying the vehicle count with an appropriate weight factor for each vehicle type. The following table provides the Passenger Car Unit (PCU) equivalent values used for Fatmawati Road, which operates as a 4/2T road type with a vehicle flow rate exceeding 1,050 vehicles per hour.

Table 1 EMP value of 4/2-T type public road segment

Road type	Traffic volume per lane (vehicles/hour)	EMP	
		KS	SM
4/2-T or 2/1	<1050	1.3	0.4
	>1050	1.2	0.25
6/2-T or 3/1 8/2-T or 4/1	<1100	1.3	0.4
	>1100	1.2	0.25

(**Source:** (PKJI, 2023)

Note:
KS = Medium Vehicle
SM = Motorcycle

The following are the results of the traffic volume survey and its calculations:

Table 2 Traffic Volume of Fatmawati Road (North-South)

Time	SM	Car	Truck	Bus	SMP/ 15 minutes	SMP/ hour
6.00-6.15	652	231	4	2	401.2	1549.9
6.15-6.30	678	212	2	3	387.5	
6.30-6.45	742	153	8	2	350.5	
6.45-7.00	821	197	6	1	410.7	
7.00-7.15	912	201	4	1	435.0	1681.4
7.15-7.30	865	212	4	3	436.7	
7.30-7.45	731	207	3	1	394.6	
7.45-8.00	832	194	9	2	415.2	
8.00-8.15	831	172	2	2	384.6	1493.1
8.15-8.30	732	191	5	1	381.2	
8.30-8.45	764	180	4	2	378.2	
8.45-9.00	754	151	7	1	349.1	
9.00-9.15	739	179	6	3	374.6	1368.1
9.15-9.30	765	182	2	2	378.1	
9.30-9.45	660	129	4	1	300.0	
9.45-10.00	638	150	2	3	315.5	
16.00-16.15	1000	235	11	2	500.6	2240.8
16.15-16.30	922	221	3	3	458.7	
16.30-16.45	1226	287	4	1	599.5	
16.45-17.00	1432	306	11	4	682.0	
17.00-17.15	1296	305	4	2	636.2	2721.4
17.15-17.30	1539	328	13	2	730.8	
17.30-17.45	1494	307	12	3	698.5	
17.45-18.00	1371	300	8	3	656.0	
18.00-18.15	1303	314	2	1	643.4	2642.6
18.15-18.30	1296	325	4	2	656.2	
18.30-18.45	1214	421	7	1	734.1	
18.45-19.00	1235	287	7	4	609.0	
19.00-19.15	1209	343	3	1	650.1	2404.9
19.15-19.30	1171	332	3	4	633.2	
19.30-19.45	1037	302	4	3	569.7	
19.45-20.00	1072	278	3	2	552.0	

(**Source:** Researcher's Process)

Table 3 Traffic Volume on Fatmawati Road (South-North)

Time	SM	Car	Truck	Bus	SMP/ 15 minutes	SMP/ hour
6.00-6.15	907	232	8	1	469.6	2223.9
6.15-6.30	1021	216	4	2	478.5	
6.30-6.45	1343	276	7	2	622.6	
6.45-7.00	1359	298	10	3	653.4	
7.00-7.15	1421	315	4	2	677.5	2824.5
7.15-7.30	1416	354	6	4	720.0	
7.30-7.45	1434	371	8	3	742.7	
7.45-8.00	1327	343	6	2	684.4	
8.00-8.15	1332	402	3	1	739.8	2684.6
8.15-8.30	1304	372	5	2	706.4	
8.30-8.45	1265	419	11	2	750.9	
8.45-9.00	1323	146	5	4	487.6	
9.00-9.15	1276	243	6	2	571.6	2223.0
9.15-9.30	1113	321	8	4	613.7	
9.30-9.45	1037	276	4	1	541.3	
9.45-10.00	1005	232	9	2	496.5	
16.00-16.15	742	221	7	2	417.3	1664.4
16.15-16.30	661	249	3	4	422.7	
16.30-16.45	754	187	4	1	381.5	
16.45-17.00	863	208	13	3	443.0	
17.00-17.15	936	196	4	1	436.0	1682.6
17.15-17.30	903	206	9	3	446.2	
17.30-17.45	788	183	4	0	384.8	
17.45-18.00	856	186	12	1	415.6	
18.00-18.15	831	179	2	2	391.6	1507.5
18.15-18.30	780	183	3	1	382.8	
18.30-18.45	768	179	6	2	380.6	
18.45-19.00	770	148	9	1	352.5	
19.00-19.15	747	173	6	1	368.2	1348.5
19.15-19.30	672	194	3	3	369.2	
19.30-19.45	662	130	4	1	301.5	
19.45-20.00	636	141	5	3	309.6	

(**Source:** Researcher's Process)

So, use the equivalence figure for road type 4/2D with a traffic flow per lane of ≥2,150 vehicles per hour, namely:

1. Truck and bus coefficients (KS) = 1.2
2. Car coefficient (MP) = 1
3. Motorcycle coefficient (SM) = 0.25

The following is an example of calculating the traffic volume on Fatmawati Road in the South-North direction at 17.00-17.15

= (936 x koef.SM) + (196 x koef.MP) + (4 x koef.KB) + (1 x koef.KB))

= (936 x 0.25) + (196 x 1) + (4 x 1.2) + (1 x 1,2))

= 436

Then calculate Q per hour by adding the EMP per 15 minutes

= 417.3+422.7+381. 5+443.0

= 1,664.4 SMP/hor

D. Road Saturation Degree

The calculation of the saturation degree is a method used to measure the effectiveness of the analyzed traffic performance. The saturation degree value ranges between 0 and 1. A value close to zero indicates an unsaturated flow, creating a smooth traffic condition where the presence of other vehicles does not affect each other (PKJI, 2023).

The formula for calculating road capacity is based on the Indonesian Road Capacity Guidelines from the Ministry of Public Works, using the following formula:

DJ = Q / C

With :

DJ = Saturation Degree

Q = Traffic volume (SMP/hour)

C = Road capacity (SMP/hour)

The following is a calculation of the degree of saturation value on Fatmawati Road:

Q = 2,824.5 SMP/hour

C = 2,971.6 SMP/hour

DJ = Q / C

= 2,824.5 / 2,971.6

= 0.95

A road segment with a saturation degree (DJ) value greater than 0.85 indicates poor traffic performance. In such cases, it is necessary to consider increasing road capacity or implementing policy changes for that segment (PKJI, 2023).

E. Questionnaire Data

The traffic volume data is used to determine the required number of respondents. To calculate the number of respondents or sample size, the Slovin formula is applied to determine the minimum required sample size. The data collected from the questionnaire will be processed to analyze the characteristics of road users.

The formula needed to determine the minimum number of samples required is the Slovin formula.

$N = N/(1+N\alpha^2)$

With :

n = desired sample size

N = population size

Travel purposes :
109 responses

gin of error

sample size on Fatma

follows.

Work
Education
Entertaiment
Event
Others

$n = N/(1+N\alpha^2)$

$n = 2{,}824.5/(1+2{,}824.5(10\%)^2)$

$n = 96.58 \approx 97$ sample

The following research findings present the characteristics of the respondents that were collected.

Gender :
109 responses

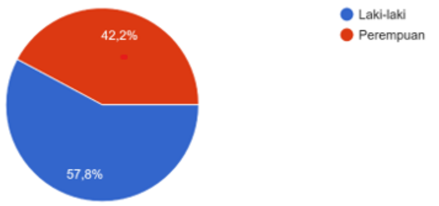

Figure 3 Respondent Characteristics by Gender
(**Source:** Google form questionnaire results)

Based on the results of the questionnaire, the characteristics of respondents are known by gender. 57.8% are male, and 42.2% are female from 109 respondents.

Occupation :
109 responses

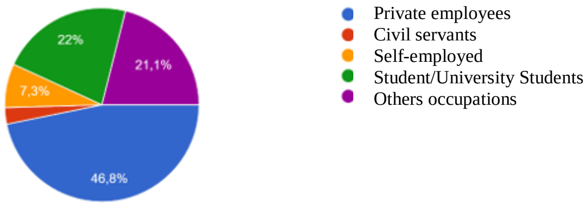

Figure 4 Respondent Characteristics by Occupation
(**Source:** Google form questionnaire results)

Based on the questionnaire results, respondents' characteristics are known by their occupations. 46.8% are private employees, 2.8% are civil servants/state-owned employees, 7.3% are self-employed, 22% are students/university students, and 21.1% have other occupations from 109 respondents.

Transportation mode :
109 responses

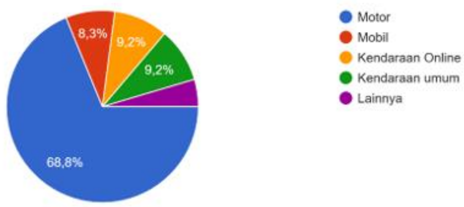

Figure 5 Respondent Characteristics by Transportation Mode
(**Source:** Google form questionnaire results)

Based on the results of the questionnaire, it is known that the characteristics of respondents are by transportation modes. There are 68.8% motorcycles, 8.3% cars, 9.2% online vehicles, 9.2% public vehicles, and 4.6% others from 109 respondents.

Tujuan perjalanan :
109 jawaban

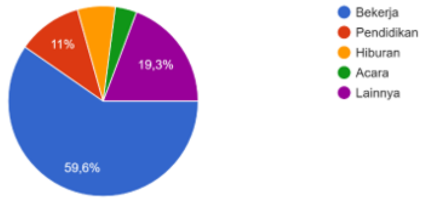

Figure 6 Respondent Characteristics by Travel Purposes
(**Source:** Google form questionnaire results)

Based on the questionnaire results, Male ents' characteristics are known by travel purposes Female vork, 11% education, 6.4% entertainment, 3.7% events, and 19.3% other purposes from 109 respondents.

F. Binary Logistic Regression Analysis

Binary logistic regression analysis is a statistical technique used to understand the relationship between one or more independent variables and a binary dependent variable. This approach is commonly applied when the dependent variable has two possible outcomes (success/failure, presence/absence, yes/no, etc.). The objective of the binary logistic regression analysis in this study is to identify factors influencing the willingness of road users on Fatmawati Road to switch to public transportation, use alternative routes, or choose to pay the ERP (Electronic Road Pricing) rate to pass through Fatmawati Road. This analysis consists of several sections:

1. **Analysis of Public Transport Mode Shift**

   Data processing uses IBM SPSS Statistics to determine the number of road users switching to public transportation based on the input variables.

   According to the SPSS output, the significant variable is Transport Mode (1) or private cars. The binary logit analysis confirms that this variable meets the significance threshold. The next step is to determine the logit function to calculate the probability of mode shift. The logit function is as follows:

   Logit (p) = -1.236 (Transport Mode(1)) + 0.032

   Motorcycle
   Car
   Online vehicles
   Public vehicles
   Others

   Thus,

   The probability function:

   $$\pi(\chi) = \frac{\exp(-1{,}236\chi1+0{,}032)}{1+\exp(-1{,}236\chi1+0{,}032)}$$

2. **Analysis of Shift to Alternative Roads**

Data processing will be conducted using **IBM SPSS Statistics** software to determine the number of road users switching to alternative routes based on the input variables in the table.

According to the SPSS output, the significant variable is Transport Mode (1) or private cars. The binary logit analysis confirms that this variable meets the established significance threshold. The next step is to determine the logit function to calculate the probability percentage of the shift. The logit function is as follows:

Logit (p) = 0 (Transport Mode) – 2.221 (Transport Mode(1)) + 2.691

Thus,

The probability function:

$$\pi(\chi) = \frac{\exp(0(trans\ mode))\chi 1 - 2.221(\text{trans mode } 1)\chi 1 + 2.691)}{1 + \exp(0(trans\ mode))\chi 1 - 2.221(\text{trans mode } 1)\chi 1 + 2.691)}$$

3. Analysis of Road Users Choosing to Pay ERP

Data processing will be conducted using IBM SPSS Statistics software to analyze road users who choose to pay Electronic Road Pricing (ERP) to pass through Fatmawati Road based on the input variables in the table.

According to the SPSS output, the significant variable is Transport Mode (2). The binary logit analysis confirms that this variable meets the established significance threshold. The next step is to determine the logit function to calculate the probability percentage of the shift. The logit function is as follows:

Logit (p) = 2.134 (Transport Mode(2)) – 0.184

Thus,

The probability function :

$$\pi(\chi) = \frac{\exp(2{,}134\chi 1 - 0{,}184)}{1 + \exp(2{,}134\chi 1 - 0{,}184)}$$

G. G. Traffic Performance Analysis after Implementation

The following traffic performance analysis is an estimate or prediction of traffic conditions after the implementation of Electronic Road Pricing (ERP) on Fatmawati Road, considering:

1. Number of Transport Mode Shifts

This study examines three variables namely, Shift to public transportation, Shift to alternative roads, and willingness to pay ERP on Fatmawati Road during peak hours, such as in the morning and evening.

Table 4 Number of Users Willing to Pay ERP (Transport Mode Variable 2)

Total responden	109 person
The number of respondents who chose to pay for ERP (Transport Mode 2)	6 person
Probability of displacement	6/109 x 0.87 = 4.7 %
Fatmawati road vehicle volume	2,824.5 SMP/hour
Number of people switching to public transport	4.7% x 2,824.5 = 133 SMP/hour

(**Source:** Processed by Researcher)

Table 5 Recapitulation of Comparative Road User Mobility

Recapitulation	Respondents switch to public transportation	Respondents turn to alternative routes	Respondents switch to public transportation
Number of respondents	6 people	66 + 8 people	6 people
Probability	1.2%	47% + 2.2%	4.7%
Volume (SMP/hour)	34 SMP/hour	1,389 SMP/hour	133 SMP/hour

(**Source:** Processed by Researcher)

2. Traffic Volume after Implementation

The traffic volume on Fatmawati Road during peak hours is considered heavy, reaching 2,824.5 PCU/hour. Previously, three probabilities were calculated namely: Road users switching to public transportation: 34 PCU/hour, Road users switching to an alternative route: 1,389 PCU/hour, and Road users who are willing to pass through Fatmawati Road during peak hours: 133 PCU/hour. Thus, the total volume on Fatmawati Road decreases to 2,824.5 – 1,389 – 34 = 1,401.5 PCU/hour.

3. Degree of Saturation (DS)

The degree of saturation (DS) on Fatmawati Road was previously 0.95. After analyzing traffic performance post-implementation, DS is calculated by dividing the post-implementation traffic volume by the road capacity previously determined.

The calculation for DS on Fatmawati Road is as follows.

Q = 1,401.5 SMP/hour
C = 2,971.6 SMP/hour
D_J = Q / C
= 1,401.5 / 2,971.6
= 0.47

H. Respondents' Opinions on ERP Pricing

In planning ERP implementation on Fatmawati Road, an appropriate tariff will be set for private vehicle users. This study primarily focuses on traffic volume but briefly examines road users' responses to the proposed tariff. The following data from a questionnaire shows the percentage of respondents who agree or disagree with the car tariff that will

If you use a motorcycle, would you be willing to pay the Electronic Road Pricing (ERP) of Rp3,000 to use Fatmawati Road?
109 Answer

If you use a car, would you be willing to pay the Electronic Road Pricing (ERP) of Rp6,000 to use Fatmawati Road?
109 Answer

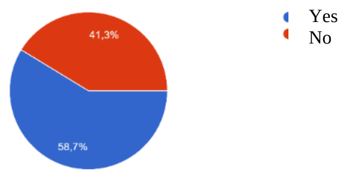

Figure 7 Respondents' Opinions on Car Tariff (Option 1)

(Source: Processed by Researcher)

58.7% of road users agree with a car tariff of Rp 6,000 for using 3.9 km of Fatmawati Road.

If you use a car, would you be willing to pay the Electronic Road Pricing (ERP) of Rp10,000 to use Fatmawati Road?
109 Answer

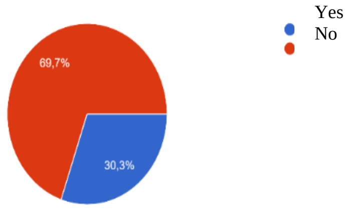

Figure 8 Respondents' Opinions on Car Tariff (Option 2)

(**Source:** Processed by Researcher)

69.7% of road users disagree with a car tariff of Rp 10,000 for using 3.9 km of Fatmawati Road.

If you use a car, would you be willing to pay the Electronic Road Pricing (ERP) of Rp15,000 to use Fatmawati Road?
109 Answer

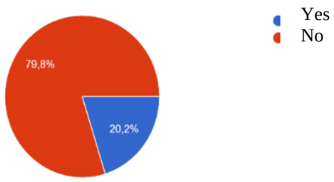

Figure 9 Respondents' Opinions on Car Tariff (Option 3)

(Source: Processed by Researcher)

79.8% of road users disagree with a car tariff of Rp 15,000 for using 3.9 km of Fatmawati Road. Thus, it can be concluded that many car users prefer tariff (Option 1). It is also observed that as the tariff increases, the level of rejection also increases. Next, the questionnaire data presents respondents' opinions on the motorcycle tariff that will be implemented under the Electronic Road Pricing system on Fatmawati Road.

Figure 10 Respondents' Opinions on Motorcycle Tariff (Option 1)

(**Source:** Processed by Researcher)

It can be observed from the above graph that 61.5% of road users agree with the implementation of the motorcycle tariff (Option 1) of Rp 3,000 for using Fatmawati Road over a distance of 3.9 KM.

If you use a motorcycle, would you be willing to pay the Electronic Road Pricing (ERP) of Rp5,000 to use Fatmawati Road?
109 Answer

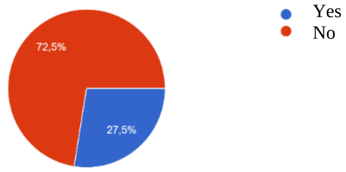

Figure 11 Respondents' Opinions to Motorcycle Tariff (Option 2)

(**Source:** Processed by Researcher)

It can be observed from the above graph that 72.5% of road users do not agree with the implementation of the motorcycle tariff (Option 2) of Rp 5,000 for using Fatmawati Road over a distance of 3.9 KM.

If you use a motorcycle, would you be willing to pay the Electronic Road Pricing (ERP) of Rp10,000 to use Fatmawati Road?
109 Answer

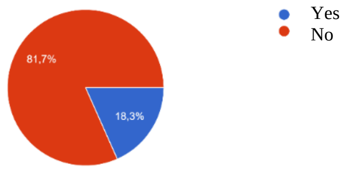

Figure 12 Respondents' Opinions to Motorcycle Tariff (Option 3)

(Source: Processed by Researcher)

It can be observed that 81.7% of road users do not agree with implementing the motorcycle tariff (Option 3) of Rp 10,000 for using Fatmawati Road over a distance of 3.9 KM. Thus, it can be concluded that many motorcycle users prefer tariffs (Option 1). It is also evident that as the tariff increases, the level of rejection also increases.

IV. CLOSING

CONCLUSION

Based on the analysis conducted on Fatmawati Road, further research is required to examine the impact of ERP implementation on alternative roads that may be affected. The conclusions from this analysis are as follows:

1. The probability of road users shifting due to the planned ERP implementation is as follows:
   a. The probability of road users switching to public transportation is 1.2% of the total vehicle volume during peak hours.
   b. The probability of road users switching to alternative roads is 47% for motorcycles and 2.2% for cars based on the total vehicle volume during peak hour.
   c. The probability of road users willing to pay the ERP rate on Fatmawati Road is 4.7% of the total vehicle volume during peak hours.
2. From the analysis conducted, the estimated performance and condition of Fatmawati Road after ERP implementation are as follows:
   a. Traffic volume during peak hours decreases from 2,824.5 SMP/hour to 1,401.5 SMP/hour
   b. The saturation degree decreases from 0.95 to 0.47, indicating that congestion is expected to reduce significantly after ERP implementation.
3. Based on the survey results, the respondents' opinions on the proposed ERP rate can be summarized as follows: For car users, 58.7% agree with a tariff of Rp 6,000 and For motorcycle users, 61.5% agree with a tariff of Rp 3,000.

RECOMMENDATION

From the conclusion obtained from the analysis of the ERP implementation research on Fatmawati Road, the author, tries to provide input and suggestions, including the following:

1. Conduct awareness campaigns and educate road users before implementing ERP to ensure a smooth transition.
2. Since the probability of road users switching to public transportation is low, it is essential to improve the quality and accessibility of public transport services.
3. Future studies should analyze the impact on alternative roads and expand research by incorporating more extensive literature studies on ERP implementation.

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