The Planning of the Jakarta – Cikampek II South Toll Gate

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ARTICLE INFO

Article Information
Article Received: 2021-03-05
Article Revised: 2022-10-31
Article Accepted:

Keywords
Planning of Toll Gates, Jakarta-Cikampek II South Toll Gate, Optimum Toll Gate.

ABSTRACT

Toll roads have a significant impact on the movement of goods and services, but oftentimes toll roads, which are supposed to be barrier-free roads, do not serve their intended purpose. This is due to queue congestion at toll gates. This thesis discusses the "planning of Jakarta-Cikampek II South toll gate" using the Multi Channel Single Phase method as the basic structure for queuing processes with First In First Out (FIFO) queue discipline. In this thesis, toll gate planning is designed for the years 2020, 2025, and 2030, taking into account automatic toll booths and on-board toll booths. The result of the planning calculation for Jakarta-Cikampek II South toll gate in 2020 is that there are 5 ATG (Automatic Toll Gate) and 5 Exclusive ATGs for class I vehicles, and 1 On-Board Unit (OBU) toll booth for both entry and exit directions at Jati Asih toll gate. At Bantar Gebang toll gate, there are 8 ATG and 9 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Setu toll gate has 7 ATG and 8 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Sukaragam toll gate has 8 ATG and 9 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Taman Mekar toll gate has 8 ATG and 9 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Kutanegara toll gate has 6 ATG and 6 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Sadang toll gate has 2 ATG and 3 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. In 2025, Jati Asih toll gate has 6 ATG and 7 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Bantar Gebang toll gate has 9 ATG and 10 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Setu toll gate has 8 ATG and 9 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Sukaragam toll gate has 9 ATG and 10 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Taman Mekar toll gate has 9 ATG and 10 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Kutanegara toll gate has 7 ATG and 9 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Sadang toll gate has 3 ATG and 3 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. In 2030, Jati Asih toll gate has 6 ATG and 7 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Bantar Gebang toll gate has 10 ATG and 12 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Setu toll gate has 10 ATG and 11 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Sukaragam toll gate has 10 ATG and 12 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Taman Mekar toll gate has 10 ATG and 12 Exclusive ATGs for class I vehicles, and 1 OBU toll booth. Kutanegara toll gate has 7 regular toll booths, 9 special toll booths for class I vehicles, and 1 OBU toll booth. Sadang toll gate has 3 regular toll booths, 3 special toll booths for class I vehicles, and 1 OBU toll booth.

INTRODUCTION

Infrastructure is one of the important aspects in the economic development of a region because it greatly influences the flow of goods and services, in addition to being an important aspect in equalizing development and welfare. Therefore, the Indonesian government is currently aggressively developing infrastructure, one of which is toll roads.

Toll roads are unobstructed public roads that are part of the national road network system that is dedicated to vehicles with four or more wheels. The construction of toll roads aims to facilitate traffic flow, thus speeding up travel time for vehicles. In the past five years, 1,387 km of toll roads have been operational, serving routes throughout Indonesia. However, in practice, traffic congestion still occurs on toll roads, which is contrary to their purpose of facilitating traffic flow. This congestion is influenced by the accumulation of queues at toll gates due to the imbalance between the number of toll gates operated and the level of vehicle arrivals and departures through toll gates [1]. Therefore, good planning is needed.

The city of Jakarta, with an area of 661.5 km2, is the largest city in Indonesia and its population increases every year. Jakarta is also the largest economic center in Indonesia. With the numerous industrial sectors and the increasing population of Jakarta who travel to West Java, Central Java, and East Java, transportation facilities that can support commuters are highly needed. The needed transportation facility is a toll road. In 2019, the government will construct the Jakarta-Cikampek II South Toll Road. This toll road has a length of 62 km and connects the JORR II Toll Road with the Cipularang Toll Road. The Jakarta-Cikampek II South Toll Road is managed by PT Jasamarga Japek Selatan, which is a business group of PT Jasa Marga (Persero) Tbk. The Jakarta-Cikampek II South Toll Road is divided into three packages, namely package 1 from Jati Asih to Setu, package 2 from Setu to Taman Mekar, and package 3 from Taman Mekar to Sadang.

The Jakarta-Cikampek II South Toll Road is built to reduce the burden on the Jakarta-Cikampek Toll Road. Based on the current condition, the Jakarta-Cikampek Toll Road experiences traffic congestion every day, which takes a lot of time to pass through. Therefore, the government is constructing the Jakarta-Cikampek II Elevated Toll Road and the Jakarta-Cikampek II South Toll Road.

In practice, toll roads should be free of traffic jams, but in reality, congestion often occurs on toll roads. This is due to the long queue at toll gates and the lack of balance between the operated toll gates and the number of vehicles entering the toll road [1]. To reduce congestion at toll gates, good planning is needed.

From the above discussion, this final project aims to create an optimal toll gate planning design needed for the Jakarta-Cikampek II South Toll Road toll gate planning.

A. *Objectives*

The objectives to be discussed are as follows:

1. To determine the estimated number of vehicles that will pass through the Jakarta-Cikampek II South toll gate in 2020, 2025, and 2030.
2. To determine the number of toll booths needed for Jakarta-Cikampek II South toll gate based on the estimated number of vehicles passing through if the toll gate is planned with ATG (Automatic Toll Gate) and OBU (On-Board Unit) systems in 2020, 2025, and 2030.
3. To determine the length of the queue at the toll gate in 2020, 2025, and 2030.

B. *Study Location*

The location to be reviewed in this final project is located on the Jakarta-Cikampek II South toll road, which is planned for seven toll gates whose locations can be seen in Figure 1.

Figure 1. Calculation Flowchart

RESEARCH DESCRIPTION

A. *Problem Identification*

In problem identification, a review of the main issues in the case study is conducted, which will be formulated into a problem statement and will then serve as the basis for the problem in the preparation of this final project. In this case, a direct review of the Jakarta-Cikampek II South toll road is conducted, which does not have toll gates, thus requiring planning for toll gates that meet established standards.

B. *Literature Review*

Searching and studying materials related to the writing of the final project on the Planning of Jakarta-Cikampek II South Toll Gate. This can be in the form of books, journals, and previous final project papers.

C. *Data Collection*

The data collected in the preparation of this final project is entirely secondary data obtained from relevant parties or institutions that already exist, including:

1) Planned Toll Road Traffic Volume

The planned traffic volume of the Jakarta-Cikampek II South toll road is obtained from PT. Jasa Marga, which is the relevant institution involved in the construction of the toll road.

2) Service Time and Queue Length

Service time and queue length were obtained from the results of a previous final project survey [2] conducted at the Cililitan toll gate on February 28, 2019. Service time for automatic toll gates is calculated when a car stops and attaches an e-toll card for payment until the car leaves the gate and the gate barrier is closed again. Meanwhile, for on-board unit toll gates, it is calculated when a car slows down so that the infrared signal can be read for toll payment until the car leaves the gate and the gate barrier is closed again. The queue length is calculated precisely when a vehicle is in front of the gate to conduct transactions.

D. *Data Analysis*

Data processing is the next step after collecting the data, which will be used to answer the problem statements.

1. *Origin-Destination Matrix*

Table 1. Origin-Destination Matrix for Class 1

	JA*	BG*	Se*	Su*	TM*	KN*	Sa*
Jt Asih	0	27828	219	4	1	1	1
Btr Gebang	27828	0	18985	300	5	1	1
Setu	219	18985	0	23308	319	4	1
Sukaragam	4	300	23308	0	24153	255	2
Taman Mekar	1	5	319	24153	0	22486	116
Kutanegara	1	1	4	255	22486	0	11700
Sadang	1	1	1	2	116	11700	0

Table 2. Origin-Destination Matrix for Peak Hour Traffic of Class I

	JA*	BG*	Se*	Su*	TM*	KN*	Sa*
Jt Asih	0	3695	30	1	1	1	1
Btr Gebang	3695	0	2508	40	1	1	1
Setu	30	2508	0	3111	43	1	1
Sukaragam	1	40	3111	0	3205	34	1
Taman Mekar	1	1	43	3205	0	2985	16
Kutanegara	1	1	1	34	2985	0	1554
Sadang	1	1	1	1	16	1554	0

Determining the origin-destination matrix for each traffic class using the Furness method and sum of square error based on the daily traffic data obtained.

2. Arrival Rate Analysis

The arrival rate analysis is obtained by multiplying the origin-destination matrix by the peak hour factor according to the 2014 PKJI (Indonesian Road Capacity Manual).

$$q_{JP} = ADT \text{ x k} \tag{1}$$

Where:
qjp = traffic flow for planning purposes (vehicles/hour)
k = conversion factor from average daily traffic to peak hour traffic (0.11/ Indonesian Road Capacity Manual 2014 no. 3)
ADT = Average daily traffic

3. Vehicle Distribution Analysis

Vehicle distribution analysis at each toll gate is obtained by adding the results of the vehicle arrival rate analysis.

4. Service Time Analysis

Service time analysis uses data on the service time of each vehicle passing through based on its class. The analysis will produce the service level of each vehicle class.

5. Traffic Intensity Analysis

Traffic intensity analysis is the value of the comparison between the arrival rate and the service level.

$$\rho = \frac{\lambda / N}{\mu} < 1 \tag{2}$$

6. Queue Analysis

Queue analysis at the Jakarta-Cikampek II South toll gate is conducted using the FIFO (First In First Out) queue analysis method. The aim of this analysis is to determine the length of the queue and the time required to wait in the toll gate.

The calculation of the queue analysis uses the FIFO queue method with the following formula [3]:

$$n = \frac{\lambda}{\mu - \lambda} = \frac{\rho}{1 - \rho} \tag{3}$$

$$q = \frac{\lambda^2}{\mu(\mu - \lambda)} = \frac{\rho^2}{1 - \rho} \tag{4}$$

$$d = \frac{1}{(\mu - \lambda)} \tag{5}$$

$$w = \frac{\lambda}{\mu(\mu - \lambda)} = d - \frac{1}{\mu} \tag{6}$$

Where:
n = the average number of vehicles in the system
q = the average number of vehicles in the queue
d = the average time a vehicle spends in the system
w = the average time a vehicle spends in the queue
λ = arrival rate
μ = service rate
ρ = comparison between arrival rate and service rate

ANALYSIS AND DISCUSSION

A. Origin-Destination Matrix

To determine the level of traffic load at each toll gate, an origin-destination matrix analysis is conducted. The sum of square error and Furness methods will be used in the analysis of the origin-destination matrix.

The sum of the square method is used to obtain the difference between the predetermined volume and the matrix volume by comparing the total volume difference.

The result of the origin-destination matrix analysis for Class I is presented in Table 2:

a. JA – Jati Asih
b. TM – Taman Mekar
c. BG – Bantar Gebang
d. KN –Kutanegara
e. Se – Setu
f. Sa – Sadang
g. Su – Sukaragam

B. Arrival Rate Analysis

The previously obtained origin-destination matrix is still in the form of average daily traffic. To convert this matrix into peak hour traffic, it needs to be multiplied by a conversion factor k, which is the factor to convert ADT (Average Daily Traffic) into peak hour traffic [4].

The following is an example calculation to obtain the peak hour traffic and the resulting origin-destination matrix for peak hour traffic presented in Table 3.

qjp = k x ADT
qjp = 0,11 x 27828 vehicle/day
qjp = 3695 vehicle/hour

C. Vehicle Distribution Analysis

After obtaining the peak hour traffic matrix, the next step is to perform a vehicle distribution analysis for the vehicles entering and exiting the Jakarta-Cikampek II South toll gate. The vehicle distribution is obtained by adding up the origin-destination matrix that was previously obtained.

Table 3. The Number of Vehicles Entering and Exiting the Toll Gate

Class	The Number of Vehicles Entering and Exiting the Toll Gate						
	JA	BG	Se	Su	TM	KN	Sa
I	3729	6246	5694	6392	6251	4576	1574
II	530	885	804	902	889	650	226
III	188	312	283	315	312	230	82
IV	82	134	121	135	133	99	38
V	60	96	87	98	96	71	28
Total	4589	7673	6989	7842	7681	5626	1948

For example, the number of vehicles from Jati Asih to Bantar Gebang is 3695, which means that the number of vehicles entering Jati Asih and exiting at Bantar Gebang is 3695. This vehicle distribution analysis is performed for all types of vehicle categories.

The next calculation is to determine the number of vehicles entering and exiting each planned toll gate by adding up the vehicles entering and exiting each toll gate in the vehicle distribution table. For example, the calculation for Class I vehicles entering and exiting the Jati Asih toll gate is 3729 vehicles, obtained by vertically adding up the peak hour traffic calculation, where the vehicles entering and exiting the Jati Asih toll gate are 3695 + 30 + 1 + 1 + 1 + 1 = 3729 vehicles. The calculation of the number of vehicles entering and exiting each planned toll gate is done for each vehicle class, resulting in the calculation of vehicles at each toll gate as presented in the table.

D. Service Time Analysis

Analysis of Service Time using the frequency of vehicles passing, resulting in the cumulative frequency and percentage for each second. The data used is secondary data taken from the previous final task survey. The service time survey was conducted at the exit toll gate, and the service time for entrance toll gate is assumed to be the same. The graph of service time for class I vehicles is shown in Figure 3.

From the graph shown in Figure 3, it can be seen that the most frequent service time for class 1 vehicles occurs at second 7, while the lowest service time frequency is at second 11. The explanation of Figure 4 for the service time of class I vehicles is as follows:

Avarage : 8,32
Median : 8
Mode : 7
Cumulative Percentage : 50% = 7.6
: 75% = 8.7
Service Time : 8 second

To determine the service time for each vehicle class, it is based on the mean value, 50% cumulative percentage, and 80% cumulative percentage. The median and mode values are also checked to determine which value is closer to the median and mode. Therefore, after analyzing the service time for each vehicle class, it is 8 seconds for class I, 10 seconds for class II, 11 seconds for class III, 12 seconds for class IV, 16 seconds for class V, and 4 seconds for class I at the On Board Unit gate.

E. Service Level Analysis

The analysis of the level of service of this toll gate is conducted on two types of toll gates, namely automatic toll gates and on-board unit toll gates.

The level of service is the toll booth's ability to serve vehicles within a certain unit of time, in this case, within one hour.

The survey results indicate that 64% of Class 1 vehicles use the special Class 1 automatic toll gate, while 26% use the automatic toll gate and 10% use the on-board unit toll gate.

Here is an example of calculating the level of service for the Jati Asih toll gate on the ATG that can be used by each vehicle class in 2020.

Service Time :

1. Class I = 8 second
   = 450 vehicle/hour
2. Class II = 10 second
   = 360 vehicle/hour
3. Class III = 11 second
   = 327.27 vehicle/hour
4. Class IV = 12 second
   = 300 vehicle/hour
5. Class V = 16 second
   = 222.22 vehicle/hour

Arrival rate:

1. Class I = 3091 x 26%
   = 803.66 vehicle/hour
2. Class II = 440 vehicle/hour
3. Class III = 157 vehicle/hour
4. Class IV = 69 vehicle/hour
5. Class V = 51 vehicle/hour
6. Class V = 7 vehicle/hour

Here is an example of the service level calculation at the automatic toll booth in the Jati Asih toll gate:

$$\mu = \frac{(803.66\ x\ 450) + (440\ x\ 360) + (157\ x\ 327.27) + (69\ x\ 300) + (51\ x\ 222.22)}{803.66 + 440 + 157 + 69 + 51}$$

F. Toll Gate Intensity Analysis

Intensity analysis is necessary to determine the comparison between the arrival rate (λ) and the service

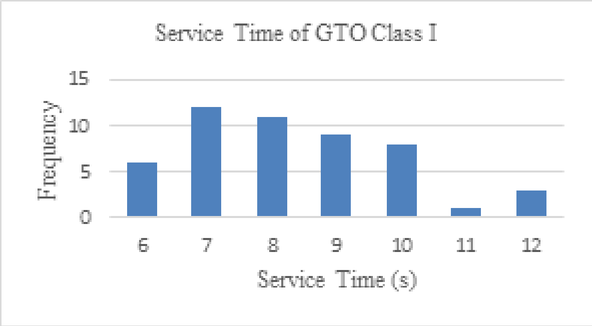

Figure 2. Service Time of Class

rate (μ). The value of the intensity for each toll gate must be less than 1, where if the intensity value $\rho > 1$, it can be ensured that the arrival rate is greater than the service rate, resulting in a continuously increasing queue. The assumption of the number of planned toll booths needs to be made to calculate the traffic intensity, and this assumption will be controlled by traffic intensity.

The planning of toll gate intensity for class I vehicles uses the proportion of those who enter the automatic toll gate, the special automatic toll gate, and the on-board unit toll gate, while for class II to class V vehicles, all enter the automatic toll system. Here is an example of traffic intensity analysis at Jati Asih toll gate in 2020:

<u>Entrance and Exit Toll Gates</u>

Number of ATGs Special Class I = 5
Number of automatic toll booths = 5
Number of OBU booths = 1
$\lambda 1$ ATG of Special Class I = 3091x64%
= 1979
$\lambda 2$ automatic toll booths = (3091x24%)+440+157+69+51
= 1521
$\lambda 3$ On Board Unit booths = 3091 x 10%
= 309
μ1 ATG of Special Class I = 450 vehicle/hour
μ2 automatic toll booths = 398 vehicle/hour
μ3 On Board Unit booths = 900 vehicle/hour

1. Special Automatic Toll Gate:

$$\rho 1 = \frac{\lambda 1 / N1}{\mu 1} = \frac{1979/5}{450} = 0.879 < 1\ (Ok)$$

2. Automatic Toll Gate:

$$\rho 2 = \frac{\lambda 2 / N2}{\mu 2} = \frac{1521/5}{397} = 0.766 < 1\ (Ok)$$

3. On Board Unit Toll Booth:

$$\rho 3 = \frac{\lambda 3 / N3}{\mu 3} = \frac{309/1}{900} = 0.343 < 1\ (Ok)$$

After conducted the analysis, it was found that the values of ρ1, ρ2, and ρ3 are <1, which means that the intensity at the entrance gate of Jati Asih toll road is safe and the assumption of the number of toll gates can be used in planning. The same thing is done for other toll gates.

G. Toll Gate Queues Analysis

The queue analysis at the Jakarta-Cikampek II South toll gate aims to determine the number of queues and waiting time under the same conditions as the previous traffic intensity analysis data. The method used is the First in First Out (FIFO) method, where the first arrivals will be served first.

Here is an example of traffic queue analysis at the Jati Asih toll gate in 2020:

Number of ATGs Special Class I = 5
Number of automatic toll booths = 5
Number of OBU booths = 1
$\lambda 1$ ATG of Special Class I = 1979
$\lambda 2$ automatic toll booths = 1521
$\lambda 3$ On Board Unit booths = 309
μ1 Exclusive ATG Gol. I = 450 vehicle/hour
μ2 automatic toll booths = 398 vehicle/hour
μ3 On Board Unit booths = 900 vehicle/hour
$\rho 1$ = 0.879
$\rho 2$ = 0.766
$\rho 3$ = 0.343

1. Special Automatic Toll Gate:

$$n = \frac{\rho}{1-\rho} = \frac{0.879}{1-0.879} = 7.27 \approx 8$$

$$q = \frac{0.879^2}{1-0.879} = 6.4 \approx 7$$

$$d = \frac{1}{(\mu - \lambda/N)} = \frac{1}{(450 - 1978/5)} x\, 3600 = 66.2 \text{ second}$$

$$w = d - \frac{1}{\mu} = 66.2 - \frac{1}{450} x\, 3600 = 58.2 \text{ second}$$

2. Automatic Toll Gate:

$$n = \frac{\rho}{1-\rho} = \frac{0.766}{1-0.766} = 3.28 \approx 4$$

$$q = \frac{0.766^2}{1-0.766} = 2.5 \approx 3$$

$$d = \frac{1}{\left(\mu - \frac{\lambda}{N}\right)} = \frac{1}{\left(398 - \frac{1521}{5}\right)} x\, 3600 = 38.8 \text{ second}$$

$$w = d - \frac{1}{\mu} = 38.8 - \frac{1}{398} x\, 3600 = 29.7 \text{ second}$$

3. On Board Unit Toll Booth:

$$n = \frac{\rho}{1-\rho} = \frac{0.343}{1-0.343} = 0.52 \approx 1$$

$$q = \frac{0.343^2}{1-0.343} = 0.17 \approx 1$$

$$d = \frac{1}{(\mu - \lambda/N)} = \frac{1}{(900 - 309/1)} x\, 3600 = 6.1 \text{ second}$$

$$w = d - \frac{1}{\mu} = 6.09 - \frac{1}{900} x\, 3600 = 2.1 \text{ second}$$

After conducted the analysis, it was found that the number of queues at the planned toll gate is <10 vehicles, so it is declared safe and the number of planned toll booths can be used. [5]

H. The planning of Jakarta-Cikampek II South Toll Gate in 2025 & 2030

The planning of the Jakarta-Cikampek II South toll gate in 2025 & 2030 aims to determine the toll gate's ability to serve the increasing volume of vehicles passing through compared to the data in 2020. The calculation uses the same method as the previous calculation, but the data used is the volume of vehicles in each year of 2025 & 2030 obtained from PT. Jasa Marga as the relevant instance.

CONCLUSION

A. Toll Gate Queues Analysis

1) Number of Vehicles

a. The number of vehicles that exit and enter each toll gate of Jakarta-Cikampek II South in 2020:

a) Jati Asih toll gate, with 3808 vehicles/hour.
b) Bantar Gebang toll gate, with 6373 vehicles/hour.
c) Setu toll gate, with 5793 vehicles/hour.
d) Sukaragam toll gate, with 6491 vehicles/hour.
e) e)Taman Mekar toll gate, with 6368 vehicles/hour.
f) Kutanegara toll gate, with 4668 vehicles/our.
g) Sadang toll gate, with 1617 vehicles/hour.

b. The number of vehicles that exit and enter each toll gate of Jakarta-Cikampek II South in 2025:

a) Jati Asih toll gate, with 4589 vehicles/hour.
b) Bantar Gebang toll gate, with 7673 vehicles/hour.
c) Setu toll gate, with 6989 vehicles/hour.
d) Sukaragam toll gate, with 7842 vehicles/hour.
e) Taman Mekar toll gate, with 7681 vehicles/hour.
f) Kutanegara toll gate, with 5626 vehicles/hour.
g) Sadang toll gate, with 1948 vehicles/hour.

c. The number of vehicles that exit and enter each toll gate of Jakarta-Cikampek II South in 2030:

a) Jati Asih toll gate, with 5272 vehicles/hour.
b) Bantar Gebang toll gate, with 8852 vehicles/hour.
c) Setu toll gate, with 8024 vehicles/hour.
d) Sukaragam toll gate, with 8994 vehicles/hour.
e) Taman Mekar toll gate, with 8839 vehicles/hour.
f) Kutanegara toll gate, with 6460 vehicles/hour.
g) Sadang toll gate, with 2235 vehicles/hour.

2) Number of toll booths

a. Number of toll booths in 2020:

a) Jati Asih Toll Gate: Exclusive ATG 5, ATG 5, OBU 1
b) Bantar Gebang Toll Gate, Sukaragam, Taman Mekar: Exclusive ATG 9, ATG 8, OBU 1
c) Setu Toll Gate: Exclusive ATG 8, ATG 7, OBU 1
d) Kutanegara Toll Gate: Exclusive ATG 6, ATG 6, OBU 1
e) Sadang Toll Gate: Exclusive ATG 3, ATG 2, OBU 1

b. Number of toll booths in 2025:

a) Jati Asih Toll Gate: Exclusive ATG 7, ATG 6, OBU 1
b) Bantar Gebang, Sukaragam, Taman Mekar Toll Gate: Exclusive ATG 10, ATG 9, OBU 1
c) Setu Toll Gate: Exclusive ATG 9, ATG 8, OBU 1
d) Kutanegara Toll Gate: Exclusive ATG 9, ATG 7, OBU 1
e) Sadang Toll Gate: Exclusive ATG 3, ATG 3, OBU 1

c. Number of toll booths in 2025:

a) Jati Asih Toll Gate: Exclusive ATG 7, ATG 6, OBU 1
b) Bantar Gebang, Sukaragam, Taman Mekar Toll Gate: Exclusive ATG 12, ATG 10, OBU 1
c) Setu Toll Gate: Exclusive ATG 11, ATG 10, OBU 1
d) Kutanegara Toll Gate: Exclusive ATG 9, ATG 7, OBU 1
e) Sadang Toll Gate: Exclusive ATG 3, ATG 3, OBU 1

3) Number of Toll Gate Queues

a. Number of toll gate vehicle queues in 2020:

a) Jati Asih Toll Gate: Exclusive ATG 6, ATG 3, OBU 0
b) Bantar Gebang Toll Gate: Exclusive ATG 4, ATG 3, OBU 1
c) Setu Toll Gate: Exclusive ATG 4, ATG 4, OBU 1
d) Gerbang tol Sukaragam: Exclusive ATG 4, ATG 3, OBU 1
e) Taman Mekar Toll Gate: Exclusive ATG 4, ATG 3, OBU 1
f) Kutanegara Toll Gate: Exclusive ATG 8, ATG 3, OBU 1
g) Sadang Toll Gate: Exclusive ATG 1, ATG 4, OBU 0

b. Number of toll gate vehicle queues in 2025:

a) Jati Asih Toll Gate: Exclusive ATG 2, ATG 3, OBU 1
b) Bantar Gebang Toll Gate: Exclusive ATG 7, ATG 5, OBU 2
c) Setu Toll Gate: Exclusive ATG 8, ATG 6, OBU 1
d) Sukaragam Toll Gate: Exclusive ATG 9, ATG 6, OBU 2
e) Taman Mekar Toll Gate: Exclusive ATG 7, ATG 5, OBU 2
f) Kutanegara Toll Gate: Exclusive ATG 2, ATG 3, OBU 1
g) Sadang Toll Gate: Exclusive ATG 2, ATG 1, OBU 0

c. Number of toll gate vehicle queues in 2030:

a) Jati Asih Toll Gate: Exclusive ATG 6, ATG 7, OBU 0
b) Bantar Gebang Toll Gate: Exclusive ATG 5, ATG 7, OBU 3
c) Setu Toll Gate: Exclusive ATG 5, ATG 3, OBU 2
d) Sukaragam Toll Gate: Exclusive ATG 6, ATG 8, OBU 4
e) Taman Mekar Toll Gate: Exclusive ATG 5, ATG 7, OBU

f) Kutanegara Toll Gate: Exclusive ATG 4, ATG 10, OBU 1
g) Sadang Toll Gate: Exclusive ATG 5, ATG 2, OBU 0

B. Suggestion

Based on the planning results, the following sugestions can be given by the writer to toll gate planners, toll road management agencies, or the government to achieve a great toll gate that meets minimum service standards:

1. Increase socialization regarding the use of On Board Unit tools.
2. Affordable purchase prices for On Board Unit tools.
3. The need for vehicles in class of 2 to 5 to start using On Board Unit tools.

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